FPL.

L-2014-284
10 CFR 52.3

October 3, 2014

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

Re: Florida Power & Light Company
Proposed Turkey Point Units 6 and 7
Docket Nos. 52-040 and 52-041
Voluntary Revised Response to NRC Request for Additional Information Letter No. 043 (eRAI 5875) SRP Section - 02.05.03 Surface Faulting

References:

1. FPL Letter L-2011-510 to NRC dated November 28, 2011, Response and Response Schedule to NRC Request for Additional Information Letter No. 043 (eRAI 5875) SRP Section - 02.05.03 Surface Faulting
2. FPL Letter L-2012-018 to NRC dated January 18, 2012, Response to NRC Request for Additional Information Letter No. 043 (eRAI 5875) SRP Section - 02.05.03 Surface Faulting
3. FPL Letter L-2013-306 to NRC dated December 4, 2013, Revised Response to NRC Request for Additional Information Letter No. 037 (eRAI 5896) SRP Section - 02.05.02 Vibratory Ground Motion
4. FPL Letter L-2014-152 to NRC dated June 18, 2014, Submittal of Part 2, Chapter 2, Section 2.5

FPL and NRC Staff have been engaged in interactions concerning the information provided in References 1 through 4.

As a result of these interactions Florida Power & Light Company (FPL) is providing, as attachments to this letter, revised responses for the Nuclear Regulatory Commission's (NRC) Requests for Additional Information (RAI) RAI 02.05.03-1 through 02.05.03-4. The attachments identify changes that will be made in a future revision of the Turkey Point Units 6 and 7 Combined License Application (if applicable). These revised RAI responses provide the current versions of each response and associated COLA change in order to facilitate the NRC Staff's review. These revisions reflect changes provided in earlier revisions of the RAI responses as well as any changes that resulted from the supplemental site investigations associated with FSAR Subsection 2.5.4.

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NRO

As stated, in Reference 3, FPL RAIs 02.05.03-1 and 02.05.03-3 were revised based on the supplemental site investigation.

If you have any questions, or need additional information, please contact me at 561-691-7490.

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

Executed on October 3, 2014.

Sincerely,

William Maher
Senior Licensing Director – New Nuclear Projects

WDM/RFB

Attachment 1: FPL Revised Response to NRC RAI No. 02.05.03-1 (eRAI 5875)
Attachment 2: FPL Revised Response to NRC RAI No. 02.05.03-2 (eRAI 5875)
Attachment 3: FPL Revised Response to NRC RAI No. 02.05.03-3 (eRAI 5875)
Attachment 4: FPL Revised Response to NRC RAI No. 02.05.03-4 (eRAI 5875)

cc:
PTN 6 & 7 Project Manager, AP1000 Projects Branch 1, USNRC DNRL/NRO
Regional Administrator, Region II, USNRC
Senior Resident Inspector, USNRC, Turkey Point Plant 3 & 4

NRC RAI Letter No. PTN-RAI-LTR-043

SRP Section: 02.05.03 – Surface Faulting

QUESTIONS from Geosciences and Geotechnical Engineering Branch 2 (RGS2)

NRC RAI Number: 02.05.03-1 (eRAI 5875)

FSAR Section 2.5.3.8.2.1 "Potential Sources of Non-Tectonic, Geologic Deformation" passage, concludes that shallow depressions preserved at the surface, recognized in the site vicinity, are formed by gradual top-down, subaerial dissolution and that they are unlikely to have underlying cavity voids with potential for rapid collapse. The staff notes the presence of similar-sized and -shaped features on the sea floor of Biscayne Bay within 3 km to the east of Units 6 and 7 in publically available satellite images such as presented by Google Earth software. In order for the staff to completely understand the geologic setting of the TPNPP site and in support of 10 CFR 100.23 please address the following:

a) Discuss how you evaluated the apparent semi-circular alignments of individual off-shore depressions. Discuss if the features may be consistent with incipient collapse into a larger underlying void, such as the cenotes of the Yucatan or the filled sink in nearby Key Largo Marine Sanctuary reported by Shinn et al., 1996, Ref 228.

b) Discuss a possible timeframe when such features could have formed and whether they could have formed at similar elevations below Units 6 and 7.

FPL RESPONSE:

Part a) of the RAI response presents a description of the vegetated patches in Biscayne Bay based on aerial photography interpretation and analysis of depression density. Published interpretations of geophysical data of buried paleokarst features in Biscayne Bay also were considered in evaluating the origin and subsurface extent of the vegetated patches. The characteristics of the features in Biscayne Bay are compared with subaerial, vegetated depressions in the area of the Turkey Point Units 6 & 7 site. These features are then compared with the sinkhole in the nearby Key Largo Marine Sanctuary as reported by Shinn et al. (FSAR 2.5.3 Reference 228) and the cenotes of the Yucatan to evaluate their origins. Part b) of the RAI response discusses the timeframe and the hydrogeochemical environments in which the vegetated patches in Biscayne Bay were formed and whether they could have formed at similar elevations below the Turkey Point Units 6 & 7 site.

a) Evaluation of Individual Offshore Vegetated Patches

The seafloor of Biscayne Bay east of the Turkey Point Units 6 & 7 site includes many dark, vegetated patches that appear to be similar to the dark, vegetated patches mapped subaerially at the site (FSAR Figure 2.5.3-202 and FSAR Figure 2.5AA-203). The subaerial vegetated patches at the site are generally wet or water-filled depressions that are generally less than one foot lower than the surrounding area (FSAR Subsection 2.5.3.8.2.1). Based on published literature (FSAR 2.5.1 Reference 264), the FSAR for Turkey Point Units 3 and 4 (FSAR 2.5.1 Reference 712, p. 2.9-3), geologic field reconnaissance and the results of a detailed site subsurface investigation (FSAR 2.5.1 References 708, 995, and 996) that included a multi-method surface geophysical survey, these features on the site are thought to be the result of a subaerial, epigenic, gradual, top-down process of carbonate dissolution caused by downward seepage of slightly acidic meteoric water following fractures, joints and bedding planes.

As discussed in FSAR Appendix 2.5AA, the locations of the vegetated depressions onsite correlate well with results of the geophysical surveys (FSAR Figures 2.5.4-223 and 2.5.4-228). The sampling indicates that the features are characterized by up to 11 feet of peat accumulated over soft zones of the Miami Limestone. Outside of the vegetated depressions, a surficial layer of muck generally 2 to 6 feet thick is present throughout the site. The areas of thicker surficial deposits, typically peat (FSAR 2.5.1 Reference 996), beneath the vegetated depressions likely represent zones of increased dissolution with possible small voids, dissolution-enlarged fractures and softer rock.

Occasional areas of linear patterns or alignment of the vegetated patches were identified by analysis of aerial photographs of the site area. This linear pattern is commonly noted throughout southern Florida, in particular the Everglades, and corresponds with subsurface fracture orientation, and tidal and/or surface water flow directions as discussed in FSAR Subsections 2.4.1.2, 2.5.1.2.3 and 2.5.3.2 and shown in FSAR Figures 2.4.1-206 and 2.5.3-202.

Analysis of the submarine vegetated patches included visual examination of Google Earth imagery (FSAR 2.5AA References 202, 203, 204, and 205) to identify features within a distance of 3 kilometers (1.9 miles) east of the site in Biscayne Bay (FSAR Figure 2.5.3-202 and FSAR Figure 2.5AA-203). Four circular areas with radii of 0.48 kilometers (0.3 miles) were evaluated for density of surficial depressions or vegetated patches. Two onshore circles were drawn, one just west of the site (circle 1) and one centered on the site (circle 2). Similarly, two offshore circles were drawn (circles 3 and 4), both east of the site (FSAR Figure 2.5AA-203). Subaerial depressions were interpreted from 1940 aerial photography (1:40,000 scale), and submarine vegetated patches were interpreted from 1986 aerial photography (1:40,000 scale). Detailed mapping was performed to a scale of about 1:2000 to define the location and extent of patches within and immediately surrounding each circular area. Density data for the patches from the two subaerial circular areas (circles 1 and 2 in FSAR Figure 2.5AA-203) and the two submarine circular areas (circles 3 and 4 in FSAR Figure 2.5AA-203) are shown in FSAR Table 2.5AA-201.

The average areas of the individual vegetated patches in the subaerial circles 1 and 2 are 780 and 540 square meters (8,396 and 5,812 square feet), respectively, and the average areas for the submarine patches in circles 3 and 4 are 180 and 320 square meters (1,938 and 3,444 square feet), respectively (FSAR Table 2.5AA-201). While the submarine patches have lower average areas, the average values for both locations (subaerial and submarine) are of the same order of magnitude. The size distribution of the patches in both the subaerial and submarine environments is variable, with high standard deviations for the patch areas, and a size range that varies from 20 square meters (215 square feet) to greater than 7,900 square meters (85,000 square feet). Very similar vegetated patch densities are calculated for subaerial and submarine areas (FSAR Table 2.5AA-201). The statistics for the subaerial circles are somewhat skewed by the presence of a few very large patches (especially in circle 1), reflected by the fact that the standard deviations of the patch areas in these circles are actually larger than the mean. These outliers may in fact consist of several smaller patches, which have been obscured by vegetation. Otherwise, the patches in all four circles display similar characteristics, with similar minimum patch sizes and population densities.

The larger average subaerial patch size relative to the average submarine patch size is consistent with their inferred origin (FSAR Subsection 2.5.3.2 and FSAR Appendix 2.5AA Section 2.2). As discussed in part b) of this revised response, the patches on the floor of Biscayne Bay likely formed during the Wisconsinan glacial advance, when sea level was approximately 328 feet (100 meters) lower than the modern ocean. At that time the floor of the bay and the area of the Turkey Point Units 6 & 7 site both were subject to subaerial weathering and surficial dissolution. At the beginning of the Holocene, sea level rose, flooded the area that is now Biscayne Bay and prevented further subaerial weathering and surficial dissolution in the bay. However, because it is at a higher elevation, the area of the site has remained subaerial since the Wisconsinan and has been subject to subaerial weathering and surficial dissolution for several thousand years longer than the floor of the bay.

The imagery available through Google Earth was reviewed specifically to look for possible semicircular alignments in the surficial depressions or vegetated patches located in Biscayne Bay. Two possible semicircular arrangements of vegetated patches are observed just east of the site in imagery from March 2011 (FSAR Figures 2.5AA-202 and 2.5AA-204). These arcs of vegetation have radii of roughly 480 meters (1,575 feet) and 368 meters (1,207.5 feet), (FSAR Figure 2.5AA-202 labels A and B, respectively). Hence, if these features were each a complete circle rather than a half-circle or arc, they would be similar in diameter to the Key Largo submarine paleosinkhole of Shinn et al. (FSAR 2.5.3 Reference 228). Shinn et al. (FSAR 2.5.3 Reference 228) (FSAR Figure 2.5AA-205) state the sinkhole is 600 meters in diameter with a depth likely to exceed 100 meters. The submarine paleosinkhole lies beneath 5 to 7 meters of water, and is bordered by Holocene reefs to the east and marine grass and carbonate sand to the west. Patches of marine grass grow on the carbonate sands within the circular feature, but corals are absent. The sediments as observed from the sediment cores consist of monotonous gray aragonite mud visually lacking in sedimentary laminations and fossils (FSAR 2.5.3 Reference 228).

The visual analysis found little to no similarities between the Key Largo submarine paleosinkhole in FSAR Figure 2.5AA-205 and the semicircular arrangement of vegetated patches in FSAR Figure 2.5AA-204. It is concluded that the two features are not of the same origin. The different morphology (a circle versus a semicircle) and differing vegetation patterns of the two features are apparent in FSAR Figures 2.5AA-204 and 2.5AA-205. In addition, an earlier air photo from 1994 (FSAR Figure 2.5AA-206) of the possible semicircular feature shows a less-well-defined arc of vegetation. The Key Largo submarine paleosinkhole and other submarine sinkholes reported on the Miami and Pourtales terraces are typically associated with a bathymetric relief on the order of 5 to 200 meters (16 to 656 feet) (FSAR 2.5.3 Reference 228 and FSAR 2.5.1 Reference 951). A 1-foot contour interval map of bathymetry data for Biscayne Bay adjacent to Turkey Point Units 6 & 7 (FSAR 2.5AA Reference 201) was evaluated to identify any potential depressions associated with the semi-circular vegetation patterns. Depressions associated with the semi-circular vegetated patches discussed in this revised response are not discernible at this resolution.

Cunningham and Walker (FSAR 2.5.1 References 958 and 989) conducted a study east of the Miami Terrace using high-resolution, multichannel seismic-reflection data (FSAR Figure

2.5.1-356). The data exhibit disturbances in parallel seismic reflections that correspond to the carbonate rocks of the Floridan Aquifer system and the lower part of the overlying intermediate confining unit (FSAR Figure 2.5.1-357). The disturbances in the seismic reflections are indicative of deformation in carbonate rocks of Eocene to middle Miocene age. This deformation is interpreted to be related to collapsed paleocaves or collapsed paleocave systems, and includes fractures, faults, and seismic-sag structural systems (FSAR Figure 2.5.1-358) (FSAR 2.5.1 References 958 and 989). The revised response to RAI 2.5.1-17 and FSAR Appendix 2.5AA provide further discussion of the interpreted origin of the deformation.

Regardless of the mechanism of formation, the geophysical data indicate the absence of deformation in rocks younger than middle Miocene (FSAR Figures 2.5.1-357, -358, and -359). This finding suggests that if the same mechanism had been active at the Turkey Point Units 6 & 7 site during the Eocene, none of the strata younger than middle Miocene would be deformed. These younger strata include the Miami Limestone, Key Largo Limestone, Fort Thompson Formation, Tamiami Formation and Peace River Formation. The total thickness of this section at the site is approximately 450 feet (137.2 meters) (FSAR Figure 2.5.1-332). Deformation of rocks below this depth is not likely to pose a threat of surface collapse at the site.

Shinn et al. (FSAR 2.5.3 Reference 228) postulate that the Key Largo sinkhole is a cenote that formed during the Pleistocene. Fluctuations in sea level related to advance and retreat of continental glaciers raised and lowered the fresh groundwater/seawater shoreline mixing zone in the area of the sinkhole and facilitated dissolution of carbonate rocks to a depth near the sea level low stand. As the Wisconsinan ice sheet began to retreat and sea level began to rise 15,000 years ago, the shelf off Key Largo was at least 100 meters above present sea level. The depositional environment at the bottom of the cenote during this time was that of a shallow freshwater lake and was likely the site of fresh groundwater discharge. The lake would have gradually deepened as the groundwater level adjusted to the rising sea level. Then, by 6,000 years ago, just before marine flooding of the shelf, the sinkhole would have been surrounded by wetlands. Infilling of the sinkhole most likely began with precipitated freshwater calcite mud (i.e., marl). The continuation of rising sea level would have caused fresh and brackish water to be replaced by saline waters. Marine sediment would have begun to settle into the sinkhole after it was inundated by the sea, at which time the sinkhole would have functioned like a giant sediment trap. The ^{14}C dates indicate that pulses of rapid sedimentation at 4.1 ka and 4.8 ka (thousand years before present) punctuated marine sedimentation. These pulses were likely the result of tropical hurricanes, which reworked and deposited the lime mud on the Florida reef tract. The lime mud sedimentation ceased and was replaced with sedimentation by skeletal carbonate sands about 3 ka. The eastern rim of the sinkhole is dominated by coral reefs, which are assumed to be the major source of the sands that cap the muddy sediment (FSAR 2.5.3 Reference 228).

The 179 feet (54.6 meters) of sediments cored in the Key Largo submarine paleokarst sinkhole investigated by Shinn et al. consist mostly of gray aragonite mud visually lacking sedimentary laminations and fossils except for a cap of carbonate sands (FSAR 2.5.3 Reference 228). This sequence of sediments has not been observed in the geotechnical borings drilled at the Turkey Point Units 6 & 7 site (FSAR 2.5.1 References 708, 995, and

996). This finding suggests that there are no sinks beneath the site similar to the one investigated by Shinn et al., and because the vegetated depressions on the site and the vegetated patches in nearby Biscayne Bay are believed to be of the same origin, the finding also suggests that the features on the floor of Biscayne Bay near the site do not indicate the presence of submarine paleokarst sinkholes such as the one investigated by Shinn et al.

Formation of the cenotes on the Yucatan Peninsula is directly related to current cave development and the position of the fresh groundwater/saltwater mixing zone relative to the caves. The caves near the coast are actively enlarging because of mixing of fresh and saline water (see revised response to RAI 02.05.01-1). However, according to Smart et al., (FSAR 2.5.1 Reference 965), many caves in the interior are above the present mixing zone and are characterized by collapse and infill with surface-derived clays, speleothem deposits, and calcite raft sands. Cave sediment fill, speleothem, and ceiling-level data indicate multiple phases of cave development. Due to the continued accretion of carbonate rocks along the coast during the Pleistocene, caves that are now located in the interior of the Yucatan Peninsula were nearer the coast during previous high sea-level stands and have gone through multiple phases of cave development related to fluctuations in eustatic sea level associated with advance and retreat of continental glaciation during the Pleistocene. Collapse of the cave roofs is extensive and ubiquitous, which results in the development of crown-collapse surface cenotes. Collapse is a result of the large roof spans caused by lateral expansion of passages at the level of the mixing zone, the low strength of the poorly cemented Pleistocene limestones, and the withdrawal of buoyant support during sea level low stands (FSAR 2.5.1 Reference 965). The greater topographic relief of the cenotes terrain of the Yucatan Peninsula provides a stark contrast with the flat topography at the Turkey Point Units 6 & 7 site and in the available bathymetric data for the near-site area of Biscayne Bay.

The apparent origin of the greater topographic relief and a much more developed karst regime within the cenotes terrain in the Yucatan Peninsula relative to the Turkey Point Units 6 & 7 site and its vicinity is the relatively high rate of fresh groundwater discharge from a large inland watershed in the Yucatan that produces a more robust mixing zone and more carbonate dissolution (FSAR 2.5.1 Reference 965). The fresh groundwater/saltwater interface at the site is located approximately 6 miles inland (FSAR Figure 2.4.12-207), groundwater at the site is saline (FSAR Tables 2.4.12-210 and 2.4.12-211), and mean sea level in the vicinity of the site is rising approximately 0.78 feet (0.2 meters) per century (FSAR 2.4.5 Reference 206). Therefore, a fresh groundwater/saltwater mixing zone that would promote dissolution of the limestone underlying the vegetated features on the floor of Biscayne Bay does not now exist at the site. The absence of a more developed karst topography or an active mixing zone near the site suggests that the process of carbonate dissolution that is instrumental in forming the cenotes of the Yucatan is not a mechanism that is likely to produce cavernous limestone with the potential for collapse at the site or beneath the vegetated patches on the floor of nearby Biscayne Bay.

b) Possible Timeframe When Such Features Could Have Formed and Whether They Could Have Formed at Similar Elevations below Units 6 and 7

The features on the floor of Biscayne Bay likely formed during the Wisconsinan glacial advance when sea level was approximately 100 meters lower than the modern ocean (see revised response to RAI 02.05.01-2 part b). During that time, the limestone on what is now the floor of Biscayne Bay was subject to subaerial weathering and dissolution. That same process of subaerial weathering and dissolution is currently active on the site and has formed the vegetated depressions identified there. As further discussed in FSAR Appendix 2.5AA, the origin of both the features on the floor of Biscayne Bay and the vegetated depressions onsite is thought to be surficial dissolution rather than collapse into a subsurface cavity.

Biscayne Bay has been modified and dredged and has an average water depth that ranges from 6 to 13 feet (1.8 to 4 meters) (FSAR 2.5.1 Reference 991). Assuming the water level in the bay is at 0 feet NAVD88, the floor of Biscayne Bay ranges in elevation from approximately –6 to –13 feet NAVD88. According to Reich et al. (FSAR 2.5.1 Reference 992), sediments overlying bedrock in the bay range in thickness from less than 6 inches to 30 feet. Using this information and the elevations of the bottom of the bay, it is concluded that the surface elevation of the bedrock over which the vegetated patches occur on the floor of the bay ranges from approximately –6.5 to –43 feet NAVD88. As discussed in FSAR Subsection 2.5.1.2.4 and the revised response to RAI 02.05.01-2 an upper zone of secondary porosity (referred to as the "Upper Higher Flow Zone" in FSAR Subsection 2.4.12.1.4) within the Biscayne Aquifer is located near the contact of the Miami Limestone and Key Largo Limestone at an approximate elevation of -28 feet NAVD88. A lower zone of secondary porosity (referred to as the "Lower Higher Flow Zone" in FSAR Subsection 2.4.12.1.4) is located within the Fort Thompson Formation at an approximate elevation of -65 feet NAVD88. Based on site stratigraphic data collected during the subsurface investigation (FSAR 2.5.1 References 708 and 995), the units are relatively flat and, therefore, it appears that the upper zone of secondary porosity at the site occurs within the stratigraphic interval of the limestone surface over which the vegetated patches occur on the floor of Biscayne Bay. The results of the site subsurface investigation described in FSAR Subsections 2.5.1.2 and 2.5.4.1.2.1 and the revised responses to RAIs 02.05.01-1, 02.05.01-2, and 02.05.04-1, as well as the results of a multi-method surface geophysical survey designed to detect subsurface cavities (within the limitations of the geophysical survey imposed by diminishing resolution with increasing depth, decreasing cavity size, and increasing offset from survey lines), demonstrate the absence of large solution features at this stratigraphic interval.

Although the upper zone of secondary porosity and the vegetated patches on the floor of Biscayne Bay may be in the same stratigraphic interval, the formation of these dissolution features is somewhat different. Dissolution features such as the vugs in the upper zone of secondary porosity are typically post-depositional and occur in a subsurface freshwater/saltwater mixing zone or in a freshwater phreatic system in which groundwater has filled open spaces and causes dissolution. The vegetated patches on the floor of the bay appear to be surficial paleo-dissolution features that formed during the Wisconsinan (most recent) glacial stage of the Pleistocene when sea level was approximately 100 meters (328 feet) lower than the modern ocean (FSAR 2.5.1 Reference 262) and at an elevation favorable for surficial dissolution by rainwater of subaerial limestone in what is now the bay.

Sinkholes formed by collapse of subsurface cavities are rare in the shallow stratigraphy of southern Florida (FSAR 2.5.3 References 224, 229, and 236). Furthermore, as discussed in the revised responses to RAI 2.5.1-1 and RAI 2.5.1-17 and in FSAR Appendix 2.5AA, the current position of the freshwater/saltwater interface is approximately 6 miles (9.6 kilometers) inland from the site (FSAR Figure 2.4.12-207), groundwater at the site is saline (FSAR Tables 2.4.12-210 and 2.4.12-211), mean sea level in the vicinity of the site is rising approximately 0.78 feet (0.2 meters) per century (FSAR 2.4.5 Reference 206), and there is no fresh groundwater shoreline flow near the site. Therefore, a freshwater/saltwater mixing zone that would promote carbonate dissolution and formation of cavernous limestone with the potential for collapse at the site does not now exist. Finally, results of the site subsurface investigation (FSAR 2.5.1 References 708 and 995) offer no evidence of the existence of large underground openings that would pose a sinkhole hazard or create foundation instability.

This response is PLANT SPECIFIC.

References:

None

ASSOCIATED COLA REVISIONS:

COLA revisions associated with this revised RAI response are presented in the revised response to RAI 2.5.1-17.

ASSOCIATED ENCLOSURES:

None

NRC RAI Letter No. PTN-RAI-LTR-043

SRP Section: 02.05.03 – Surface Faulting

QUESTIONS from Geosciences and Geotechnical Engineering Branch 2 (RGS2)

NRC RAI Number: 02.05.03-2 (eRAI 5875)

FSAR Section 2.5.3.7, the "Designation of Zones of Quaternary Deformation in the Site Region" passage states that "Within the site region, seismicity and potential Quaternary tectonic deformation are restricted to the Cuba areal source zone, approximately 160 miles south of the site." The staff notes that assessment of other tectonic features outside the Cuba Areal zone were not included in the FSAR. In order for the staff to determine the adequacy of the regional geologic characterization and in support of 10 CFR 100.23 please address the following:

a) Describe the presence of the Quaternary-active Walkers Cay fault, the Santaren Anticline, and the Straits of Florida normal faults within the site region but outside the Cuba Area Source Zone.

b) Provide a figure, centered on the site region, which reflects all potential Quaternary active features in the site region.

c) FSAR Section 2.5.3.7, states that the Cuba Area Source is 160 miles from the site. However FSAR Section 2.5.2.4.4.3.2.1, Cuba Areal Source Zone, states that the source zone is 140 miles from the site (p 2.5.2-60, rev 2). Please clarify the inconsistency.

FPL RESPONSE:

a) Describe the presence of the Quaternary-active Walkers Cay fault, the Santaren Anticline, and the Straits of Florida normal faults within the site region but outside the Cuba Area Source Zone.

The Walkers Cay fault, located northeast of the site just within the site region boundary (200-mile radius), is interpreted from seismic reflection data. Mullins and Van Buren (1981) (FSAR 2.5.1 Reference 474) postulated that faulting on the Walkers Cay fault may extend "possibly even to the seafloor" (p. 226), and a later seismic line (LBB-18) is interpreted with a fault extending to the seafloor (FSAR 2.5.1 Reference 785). Because the strata near the seafloor are likely Quaternary in age, the extension of the fault to the seafloor suggests that the Walkers Cay fault was active during the Quaternary. However, the nearest borehole (ODP Site 628) to the Walkers Cay fault strand interpreted as extending to the seafloor on seismic line LBB-18 revealed that the Quaternary section is only about 5 m thick (Reference 1), making it difficult to resolve Quaternary deformation. The response to RAI 02.05.01-14 further clarifies the available data regarding the Walkers Cay fault and provides FSAR revisions to reflect that it is considered a possible Quaternary active structure.

The Santaren anticline, located southeast of the site just within the site region boundary (200-mile radius), is also imaged in seismic reflection data. Masaferro et al. (2002) (FSAR 2.5.1 Reference 479) propose intermittent periods of tectonic growth on the Santaren anticline extending into the early Quaternary based on a model of the temporal variability in sedimentation and fold-growth rates since Late Oligocene time. Masaferro et al. (2002) calculate a fold uplift rate of 0.05 mm/yr for one early Quaternary bed (M2-M3), but they also show this bed to be preceded by a period of late Pliocene quiescence, and followed by a period of late Quaternary quiescence. According to Masaferro et al.'s (2002) Figure 3a, the period of late Quaternary quiescence lasted from approximately 1 Ma to the present. Furthermore, Masaferro et al. (2002) cannot constrain the errors associated with their calculated fold uplift rates. In other words, based on the information presented in Masaferro et al. (2002), it is not possible to assess whether these very low apparent fold uplift rates since the Late Miocene are distinguishable from zero. If the actual fold uplift rate in bed M2-M3 is zero, the most recent activity of the Santaren anticline would be late Pliocene. Masaferro et al.'s (2002) interpretation that relief in post-Miocene beds reflects fold uplift is discussed in more detail in FSAR Subsection 2.5.1.1.1.3.2.2 and RAI responses 02.05.01-3 and 02.05.01-15.

The Straits of Florida normal faults are overlain by undeformed Miocene and younger strata (Angstadt et al. (1985) (FSAR 2.5.1 Reference 482); Denny et al. (1994) (FSAR 2.5.1 Reference 221)). Uchupi (1966) (FSAR 2.5.1 Reference 790) postulated that post-Miocene faulting may have produced the Miami and Pourtales terraces, but more detailed seismic data have pointed to a non-fault origin for these geomorphic features. While some evidence exists for Miocene reactivation of these structures (FSAR 2.5.1 Reference 484), the Straits of Florida normal faults are not assessed to be Quaternary-active, as discussed in FSAR Subsection 2.5.1.1.1.3.2.2 and the FPL responses to RAIs 02.05.01-3 and 02.05.01-16.

The statement "Within the site region, seismicity and potential Quaternary deformation are restricted to the Cuba areal source zone" in FSAR Subsection 2.5.3.7 will be revised. In addition, during preparation of this response it was discovered that the citation for FSAR Section 2.5.1 Reference 790 shown in FSAR Subsection 2.5.1.3 is incorrect. The correct citation for this reference (Uchupi, 1966) is shown in the Associated COLA Revisions section.

b) Provide a figure, centered on the site region, which reflects all potential Quaternary active features in the site region.

As discussed in the FSAR (Subsection 2.5.3), FSAR Figure 2.5.3-201 depicts all known or suggested Quaternary faults in the central and eastern U.S. as compiled by Crone and Wheeler (2000) (FSAR 2.5.3 Reference 203). The Crone and Wheeler study did not extend far enough offshore to capture the Walkers Cay fault, the Santaren anticline, the Straits of Florida normal faults, or any faults in Cuba.

New FSAR Figure 2.5.3-205 will depict tectonic structures within the site region with potential Quaternary deformation, including the Walkers Cay fault, the Santaren anticline, and faults on Cuba within the site region. So as not to minimize hazard, the Walkers Cay fault has been assigned a Quaternary age, and some faults associated with Cuba may also be active in the Quaternary, although timing of specific structures is not established in published research. Although FPL questions Masaferro et al.'s (2002) (FSAR 2.5.1 Reference 479) assertion that the stratigraphic relationships indicate intermittent fold growth into the early Quaternary, the Santaren anticline will be shown as a potential Quaternary structure on FSAR Figure 2.5.3-205. Deformation on the Straits of Florida normal faults occurred in the late Tertiary, and thus, these faults are not included on FSAR Figure 2.5.3-205.

c) FSAR Section 2.5.3.7, states that the Cuba Area Source is 160 miles from the site. However FSAR Section 2.5.2.4.4.3.2.1, Cuba Areal Source Zone, states that the source zone is 140 miles from the site (p 2.5.2-60, rev 2). Please clarify the inconsistency.

At its nearest point, the Cuba areal source zone is located approximately 140 miles from the Units 6 & 7 site, as stated in FSAR Subsection 2.5.2.4.4.3.2.1. The text of FSAR Subsection 2.5.3.7 will be revised to indicate that this distance is approximately 140 miles, instead of approximately 160 miles.

This response is PLANT SPECIFIC.

References:

1. Austin, J. A., Jr., Schlager, W., Palmer, A. A., et al., 1986b, Proceedings of the Ocean Drilling Program, Initial Results (Part A), 101: 7, Site 628: Little Bahama Bank, pp. 213-217.

ASSOCIATED COLA REVISIONS:

Reference 790 in FSAR Subsection 2.5.1.3 will be revised as follows in a future COLA revision:

790. ~~Uchupi, E., The Atlantic Continental Shelf and Slope of the United States:*Topography*, Professional Paper 529, U.S. Geological Survey, 1968. C~~ **Uchupi, E., *Shallow structure of the Straits of Florida: Science*, Vol. 153, No. 3735, pp. 529-531, 1966.**

The second paragraph in FSAR Subsection 2.5.3.1.2 will be revised as follows in a future COLA revision:

In addition to the geologic mapping described above, the U.S. Geological Survey has published a compilation of all known or suggested Quaternary faults, liquefaction features, and possible tectonic features in the Central and Eastern United States (References 203 and 235) (Figure 2.5.3-201). **These compilations did not extend into the Bahamas or Cuba, and therefore do not depict faults in these regions. Within the boundaries of these compilations,** ~~These compilations do not identify any~~ **no** Quaternary tectonic faults or tectonic features **are identified** ~~with~~in the site region or site area. However, one potential Quaternary feature, Grossman's Hammock, is located approximately 20 miles northwest of the site, but a ground-penetrating radar study provides evidence that the feature has no tectonic offset (Reference 217)**;** Subsection 2.5.3.2 describes this feature in detail. The U.S. Geological Survey studies (References 203 and 235) classify Grossman's Hammock as a non-tectonic feature (Figure 2.5.3-201).

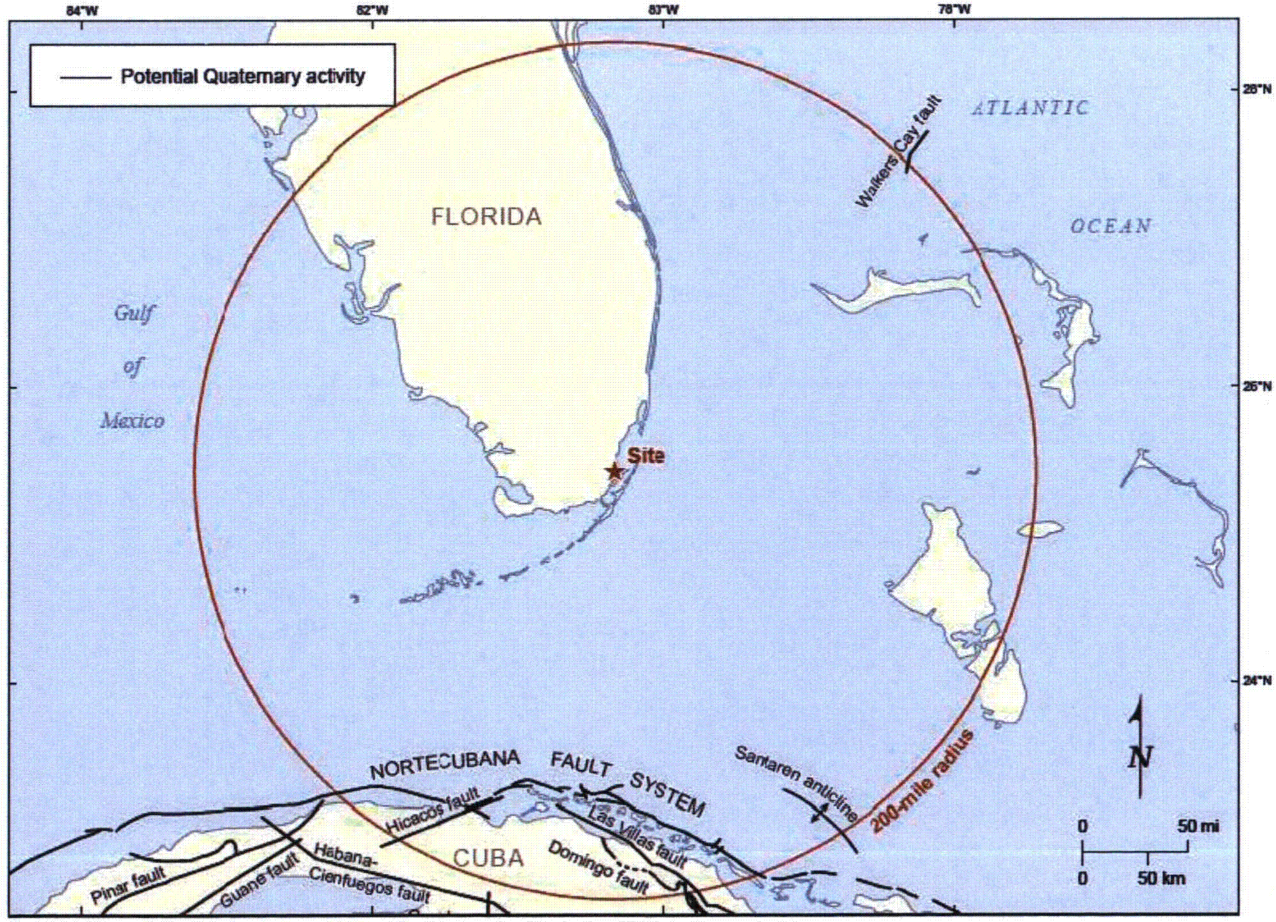
The text in FSAR Subsection 2.5.3.7 will be revised as follows in a future COLA revision:

2.5.3.7 Designation of Zones of Quaternary Deformation in the Site Region

Results of the subsurface exploration program at the site indicate continuous, horizontal stratigraphy that precludes the presence of Quaternary faults, folds, or structures related to tectonic deformation at the site (Figure 2.5.1-335). There are no zones of Quaternary deformation associated with tectonic faults requiring detailed investigation within the site area (Figure 2.5.1-335). Field reconnaissance, review, and interpretation of aerial photography, and review of published literature performed, do not reveal any evidence for Quaternary tectonic deformation, including paleoliquefaction, within the site, site area, or site vicinity. Within the site region, seismicity and potential Quaternary deformation are restricted to the **faults within the** Cuba areal source zone, approximately ~~160~~ **140** miles south of the site**, and possible deformation associated with the Walkers Cay fault and Santaren anticline (Figure 2.5.3-205).** No sand blows or paleoliquefaction features have been identified in the published literature for the site region. **Karstic dissolution of limestone is a source of non-tectonic Quaternary deformation found in Florida and the Bahamas within the site region (Subsection 2.5.3.8.2.1 and 2.5.4.4.5).**

FSAR Figure 2.5.3-205 “Potential Quaternary Tectonic Structures in the Site Region” will be added to Subsection 2.5.3 in a future COLA revision as indicated below:

Figure 2.5.3-205 Potential Quaternary Tectonic Structures in the Site Region



ASSOCIATED ENCLOSURES:

None

NRC RAI Letter No. PTN-RAI-LTR-043

SRP Section: 02.05.03 – Surface Faulting

Question from Geosciences and Geotechnical Engineering Branch 2 (RGS2)

NRC RAI Number: 02.05.03-3 (eRAI 5875)

FSAR Section 2.5.3.2, "Geological Evidence, or Absence of Evidence, for Surface Deformation", states that published geologic mapping at a range of scales show no bedrock faults mapped within the site vicinity (References 211, 213, 224, and 226). However, the staff note, that Figure 2.5.1-253 depicts a strike-slip fault within 25 miles of the site; this feature is also shown as a high-rank lineament on Figure 2.5.3-204.

In order for the staff to completely understand the geologic setting of the site and in support of 10 CFR 100.23 please discuss the high-rank lineament shown on Figure 2.5.3-204, and clarify it's relationship with the strike-slip fault north of TPNPP shown on Figure 2.5.1-253. Include a discussion regarding how these figures are in agreement with the FSAR Section 2.5.3.2 statement that no faults have been mapped in the site vicinity. Finally, please clarify this apparent disagreement between the text and figures in the appropriate FSAR section(s).

FPL RESPONSE:

Discuss the high-rank lineament shown on Figure 2.5.3-204

As described in FSAR Subsection 2.5.3.1.2, the United States Army Corps of Engineers (USACE) mapped a variety of lineaments in southern Florida (FSAR 2.5.3 Reference 232), including the high-rank lineament shown on FSAR Figure 2.5.3-204. The USACE study relied on Landsat imagery viewed at scales between 1: 1,000,000 and 1: 125,000 to identify lineaments and suggested it was possible that some lineaments could be related to fractures or faults. However, the study did not present evidence for tectonic displacement along the high rank lineament shown in Figure 1 (FSAR 2.5.3 Reference 232) and did not interpret this feature as a fault. The lineaments were generally not field checked by the USACE authors, who indicate that "a considerable number of the mapped lineaments may be dismissed after further investigation" (FSAR 2.5.3 Reference 232, p. 50). The northeast-trending 'highrank' lineament in question was not identified in previous lineament analyses that included southern Florida (FSAR 2.5.3 Reference 232). No field evidence or information about whether this lineament was field-checked was provided in FSAR 2.5.3 Reference 232.

In the methodology section of FSAR 2.5.3 Reference 232, it is pointed out that normally each lineament is assigned a "Low", "Medium" or "High" rank based on the number and types of features that are found along it (e.g., ponds, sinkholes, tonal changes), but that any lineament with a stream alignment on part of it was automatically assigned a "High" rank. The southwestern end of the high-rank lineament is located near the linear portion of the Shark River (discussed in FSAR Subsection 2.5.3-2), and because this represents a stream alignment, this appears to be the reason it was assigned a "High" rank by the USACE. There are several uncertainties associated with the assessment of a "High" rank to this lineament. For example, it is possible that only a stream alignment (and not multiple features) defines this lineament shown on FSAR Figure 2.5.3-204. In addition, the coarse nature of the lineament identification study dictated by the small scales at which the lineament analysis was conducted, and the lack of field evidence indicated by the USACE provide uncertainty in the existence, geometry, and tectonic implications of the high-rank lineament. Later field and air photo reconnaissance conducted to support this application found no positive evidence for faulting associated with the linear portion of the Shark River; the influence of tides contributes to its linear expression, as discussed in FSAR Subsection 2.5.3.2.

According to the lineament analysis conducted as part of the supplemental field investigation(Response to NRC RAI Number 02.05.04-01), three main lineament orientations and two subsidiary orientations are identified in the site. Main lineament orientations are east-west, northeast-southwest, and northwest-southeast; the two subsidiary orientations are east-northeast-west-southwest and north-northeast-south-southeast. Field reconnaissance, a review and interpretation of aerial photography, a review of published literature, and an analysis of the results of the subsurface exploration (FSAR 2.5.2 References 708, 995, and 996) reveal no geomorphic evidence to suggest differential uplift across any of the lineaments or any structural or stratigraphic evidence to suggest lateral displacement across any of the lineaments. These lineaments do not correlate with any potential folds, faults, or other structures within the site area (see description in FSAR Subsection 2.5.3.2 and FSAR Figures 2.5.1-335, 2.5.1-334, 2.5.1-337, 2.5.1-338, 2.5.1-339, 2.5.1-340, 2.5.1-341, and 2.5.1-342).

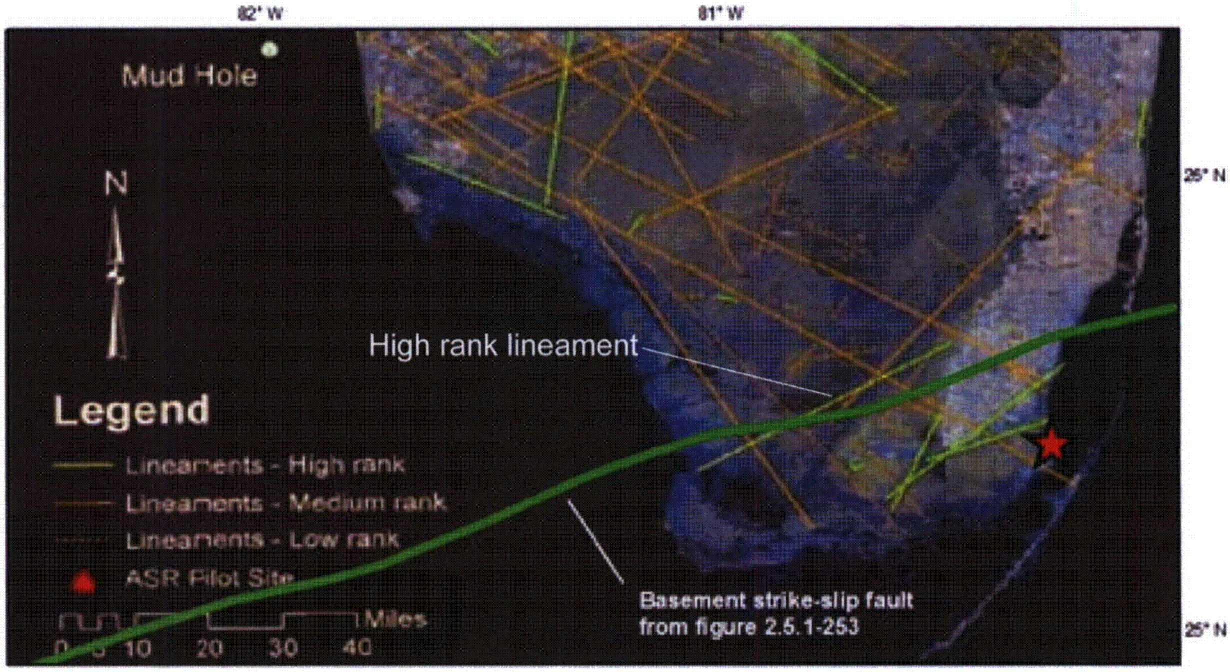
Clarify the high-rank lineament's relationship with the strike-slip fault north of TPNPP

As described in FSAR Subsection 2.5.1.1.1.3.2.1, the postulated basement faults shown on FSAR Figure 2.5.1-253 are drawn to accommodate potential misfits in plate tectonic reconstruction models or differences in lithology from widely separated boreholes, and thus, little evidence directly indicates actual displacement has occurred on these postulated structures. The northeast-striking basement fault near the site is drawn by Barnett (1975) (FSAR 2.5.1 Reference 458) in order to align magnetic anomalies on Andros Island in the Bahamas with the Peninsular Arch. Barnett (1975, p. 130) (FSAR 2.5.1 Reference 458) states "The evidence for the actual presence of major shear faults in the basement of the Florida-Bahama Platform is interpretative, necessarily. These faults must have been inactive since the end of the Jurassic Period, except for more or less localizing younger depositional flexures. If these faults really had an active part in the development of the Gulf of Mexico region, then the evidence is circumstantial, in the final analysis". It is worth noting that most of the faults from Barnett (1975) (FSAR 2.5.1 Reference 458) (in particular, this southern-most, northeast-striking one) do not appear in later publications concerning the lithology and geophysics of the Florida basement (e.g., FSAR 2.5.1 References 212, 463, 513, 849, and 856), and maps or cross-sections using younger stratigraphy do not indicate that these postulated basement faults extend upward towards the surface (e.g., FSAR 2.5.1 References 373 and 393; FSAR Figures 2.5.1-230, 261, and 263).

There is no clear relationship between the postulated buried strike-slip basement fault depicted in FSAR Figure 2.5.1-253 and the high-rank lineament on FSAR Figure 2.5.3-204. As shown in Figure 1, the two features are both northeast-striking, but have different geometries, extents, and locations. The high-rank lineament is more north-striking, completely straight and mapped onshore, terminating at the Atlantic coastal ridge, while the postulated basement fault strikes more easterly, has a variable strike, and extends tens of kilometers offshore both to the east and west. Where the high-rank lineament is most well defined (at its southwest end, near the mouth of the Shark river), the basement fault is located more than 5 km to the north (Figure 1). No geologic evidence of faulting is reported to support a tectonic origin for the lineaments identified in the USACE study, and no evidence links the postulated basement faults at depth to any lineament at the surface (FSAR 2.5.3 Reference 232). The original study by Barnett (1975) (FSAR 2.5.1 Reference 458) did not interpret geomorphic expression of any of the postulated basement faults depicted in FSAR Figure 2.5.1-253. FPL interprets the similarity in general location (southern Florida) and strike (northeast) of the high-rank lineament and postulated basement fault to be coincidental. Because the high-rank lineament in FSAR Figure 2.5.3-204 is not associated with faulting, this figure provides no conflict with FSAR statements regarding faulting within the site vicinity.

Discuss the high-rank lineament and basement strike-slip fault relative to statements made in the FSAR

The FSAR currently states that there are no faults within the site vicinity, while FSAR Figure 2.5.1-253 shows a basement fault within the site vicinity. The postulated buried basement fault on FSAR Figure 2.5.1-253 represents an old (Pre-Cretaceous) fault (see also discussion in FSAR Subsection 2.5.1.1.1.3.2.1). Because of the fault's age and burial depth, it does not represent a possible source of surface deformation. As discussed above, the high-rank lineament near the postulated basement fault (FSAR Figure 2.5.3-204) is not associated with faulting. This distinction between an older (Pre-Cretaceous) fault at depth and a fault that could deform the surface will be clarified in the FSAR statement, thus correcting any potential disagreement between the figure and the text.



Source: FSAR 2.5.3 Reference 232 and FSAR 2.5.1 Reference 458

Figure 1 Illustration from USACE Lineament Study and Barnett (1975) Strike-slip Fault

This response is PLANT SPECIFIC.

References:

None

ASSOCIATED COLA REVISIONS:

The first paragraph in FSAR Subsection 2.5.3.2 will be revised as follows in a future FSAR revision:

Field reconnaissance, review and interpretation of aerial photography**,** and review of published literature did not reveal any evidence for **active** tectonic deformation within the site vicinity or site area. No **active** faults or geomorphic features **relating to active faulting have been mapped in the site vicinity, site area, or the site** (Figures 2.5.1-334, 2.5.1-336, 2.5.1-337, 2.5.1-338, 2.5.1-339, 2.5.1-340, 2.5.1-341, and 2.5.1-342) ~~in the site vicinity, site area, or the site~~. **Although a basement fault has been interpreted to exist within the site vicinity (Figure 2.5.1-253), there is no evidence to suggest that this buried pre-Cretaceous fault is active or represents a surface faulting hazard (Figures 2.5.1-261 and 2.5.1-263) (Subsection 2.5.1.1.1.3.2.1). Therefore, no capable faults are known to exist within the site vicinity.** In addition, no seismic activity has been reported within the site vicinity (Subsection 2.5.2), and bedding is horizontal and undisturbed (Subsection 2.5.1.2.3). No salt domes, Quaternary volcanic features, or glacial sources of deformation occur in the site vicinity (Figures 2.5.1-201 and 2.5.1-237) (Subsections 2.5.3.8.2.1, 2.5.1.1.2.1.1, 2.5.1.1.1.2.1.1, 2.5.1.2.4, and 2.5.1.2.3). Non-tectonic deformation features in the site area are interpreted to be "potholes" caused by surficial dissolution (Subsections 2.5.1.2.4 and 2.5.4.4.5).

ASSOCIATED ENCLOSURES:

None

NRC RAI Letter No. PTN-RAI-LTR-043

SRP Section: 02.05.03 – Surface Faulting

Question from Geosciences and Geotechnical Engineering Branch 2 (RGS2)

NRC RAI Number: 02.05.03-4 (eRAI 5875)

FSAR Section 2.5.3.2, states in the "Geological Evidence, or Absence of Evidence, for Surface Deformation passage", that "the second feature beyond the site vicinity investigated as part of geologic field reconnaissance includes possible faults identified from borehole data in the McGregor Isles area near Ft. Myers, 120 miles northwest of the site. Based on gamma-ray logs from several wells, Sproul et al. (Reference 230) interpret faulting of pre-upper Hawthorn (Miocene) strata. In spite of their interpretation that overlying upper Hawthorn and younger strata are unfaulted, Sproul et al. (Reference 230) suggest possible geomorphic indicators of faulting." The staff notes that possible geomorphic indicators of faulting appear to be inconsistent with the finding that upper Hawthorn and younger strata are unfaulted at the McGregor Isles are.

In order for the staff to understand evidence for or against tectonic deformation in Florida Platform specific geology and in support of 10 CFR 100.23, please clarify the apparent inconsistent conclusions that Sproul et al (Reference 230) drew regarding these possible faults. Describe the geomorphic features that Sproul et al referred to and provide more details of your field reconnaissance examination of this area completed for this application.

FPL RESPONSE:

<u>Clarify the apparent inconsistent conclusions from Sproul et al. (Reference 230)</u>

The faults discussed in FSAR Subsection 2.5.3.2 were interpreted by Sproul et al. (1972) (FSAR 2.5.3 Reference 230) on the basis of variation in elevation of a distinctive peak in the gamma-ray logs which is interpreted as a correlation horizon in several boreholes at depth beneath portions of Ft. Myers, Florida. The correlation horizon, within the Miocene Hawthorn strata, occurs at elevations which vary from -390 to -205 feet NAVD 88. The apparent vertical offsets range from 50 to 110 feet across the interpreted faults (FSAR 2.5.3 Reference 230). Sproul et al. (1972) (FSAR 2.5.3 Reference 230), state, "The available data seem to indicate that most, but not all, of the displacement occurred after the unit represented by the gamma-ray correlation marker was deposited, and prior to the deposition of the upper part of the Hawthorn Formation." The authors also state that displacement of the beds above the gamma-ray correlation marker (the upper horizons of the Hawthorn Formation) "is not so obvious from an examination of the logs" (FSAR 2.5.3 Reference 230) (see Figures 1 and 2). These statements and the relationships in Figure 2 provide the only direct information regarding the timing of potential fault movements. The 'possible geomorphic indicators of faulting' are not specifically correlated with post-Miocene fault activity (FSAR 2.5.3 Reference 230). If the geomorphic features noted by Sproul et al. were clearly tied to fault activity, it would indeed be inconsistent with the timing of faulting indicated by the borehole data. Given the apparent inconsistency between interpreted geomorphology and borehole data, FPL interprets only the borehole data to have actual bearing on the ages of these proposed faults.

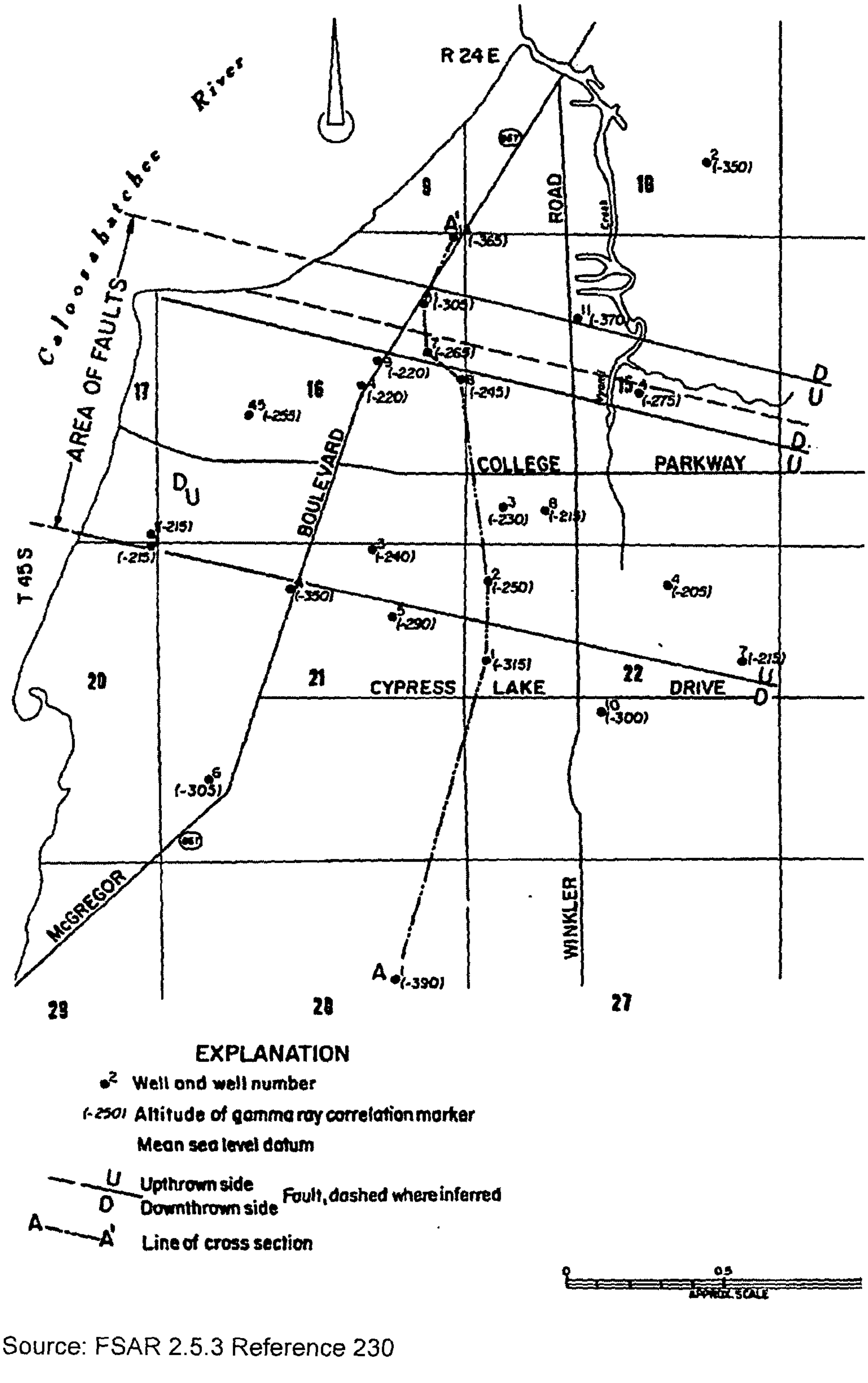
Describe the geomorphic features that Sproul et al. referred to

Sproul et al. (1972) (FSAR 2.5.3 Reference 230) suggest that the "configuration of the Caloosahatchee River shoreline in the vicinity of the northeast corner of section 17 (in Figure 1), and the alignment of a tributary to Whiskey Creek near the center of section 15 are suggestive of fault controlled features" (p. 12 of FSAR 2.5.3 Reference 230) (see Figure 1). The shoreline throughout the northwest corner of section 16 and the southwest corner of section 17 is not aligned with the faults, but a bend in the shoreline does occur near the northern group of 3 faults (see Figure 1). However, the fault located at the apex of the bend is dashed and listed as "inferred". If the shoreline bend had resulted from Quaternary faulting, the geometry of the bend would indicate apparent dextral slip, not dip-slip as interpreted based on stratigraphic displacement of the marker bed. Surficial strata in this area are mapped as unfaulted Tertiary-Quaternary shell units (Reference 1).

Although the short tributary to Whiskey Creek is subparallel to the proposed faults, the orientation of the main creek drainage in section 15 is at high angles to the trace of the mapped faults, with no apparent offset or deflection along the proposed structures (See Figure 1). A comprehensive geologic mapping effort in Lee County and the Caloosahatchee Basin utilizing well cuttings, cores, quarry pits and the limited natural outcrops does not indicate any surficial faulting in the area (e.g., Reference 1).

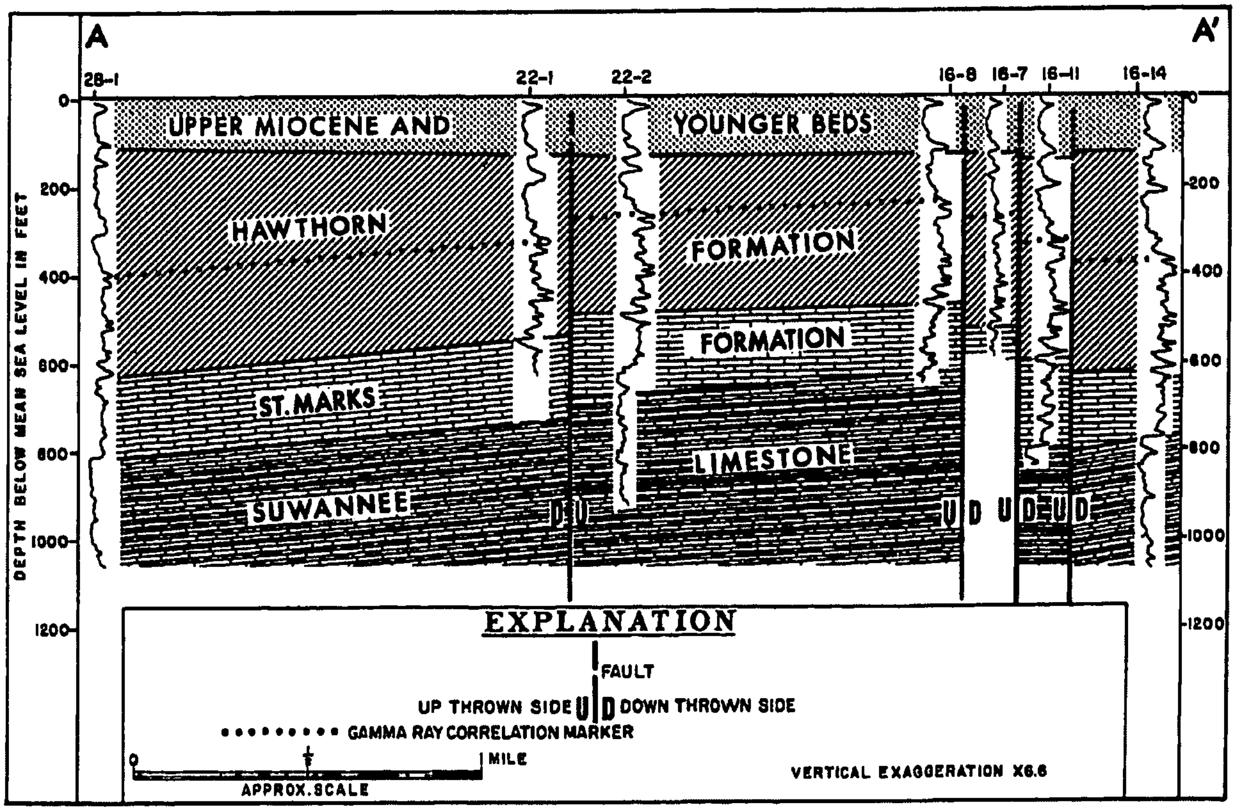
Provide more details of your field reconnaissance

A brief field reconnaissance consisted of driving along roads in the area and walking along available sidewalks that crossed the proposed faults. A map of this work is shown as Figure 3. Heavy modification of the landscape through suburban development left few natural exposures useful to assessing the pre-development geomorphology. No fault scarps or topographic features suggested a fault-controlled influence on the geomorphology.



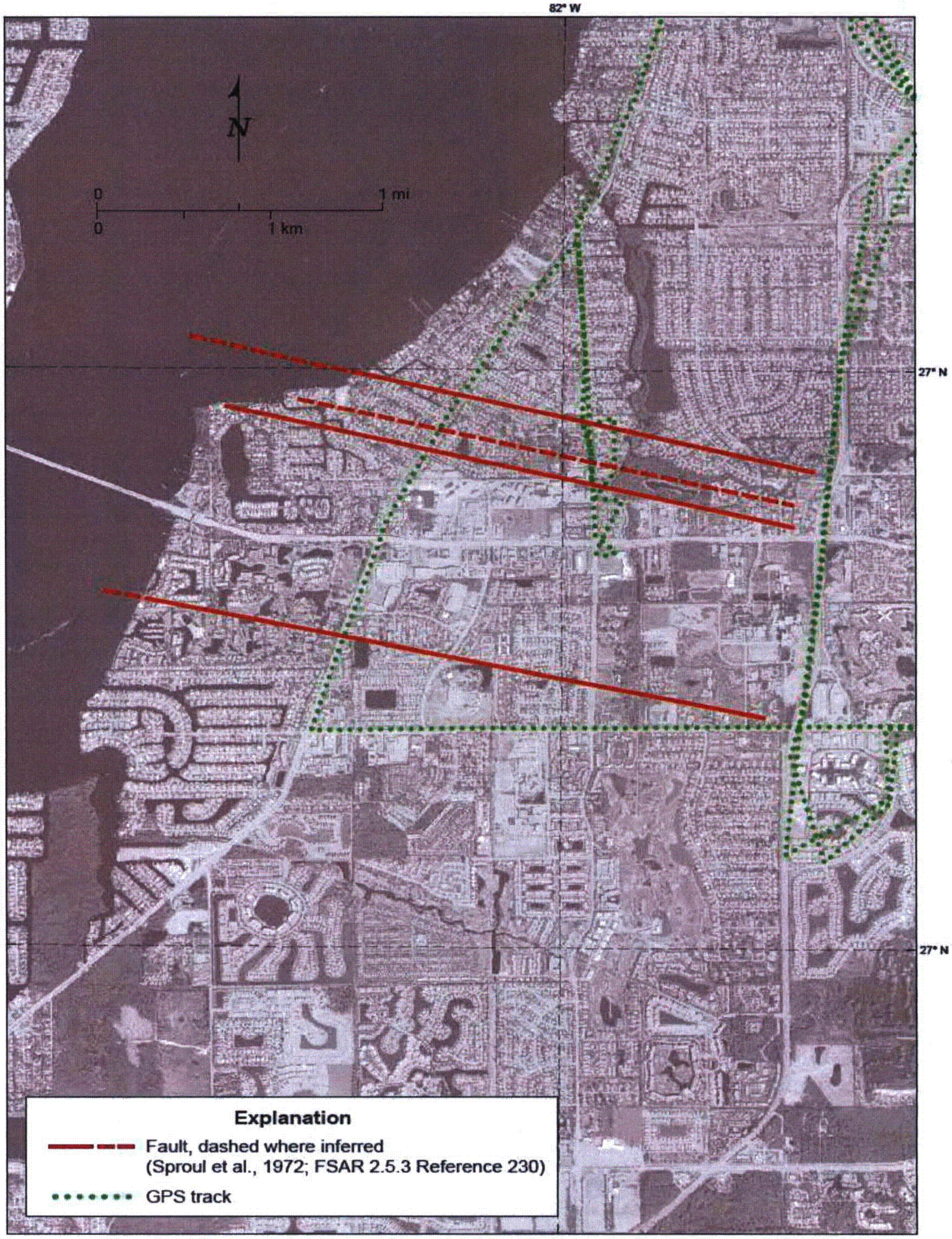
Source: FSAR 2.5.3 Reference 230

Figure 1 Map of McGregor Isles Area



Source: FSAR 2.5.3 Reference 230

Figure 2 Interpreted Borehole Section from Sproul et al.



Source: FSAR 2.5.3 Reference 230

Figure 3 Field reconnaissance near the McGregor Isles faults

This response is PLANT SPECIFIC.

References:

1. Scott, T. M., and Missimer, T. M., *The Surficial Geology of Lee County and the Caloosahatchee Basin*, Florida Geological Survey Special Publication, Issue 49, p. 17-20, 2001.

ASSOCIATED COLA REVISIONS:

The last paragraph of Subsection 2.5.3.2 will be revised as follows in a future version of the FSAR.

The second feature beyond the site vicinity investigated as part of geologic field reconnaissance includes possible faults identified from borehole data in the McGregor Isles area near Ft. Myers, 120 miles northwest of the site. Based on gamma-ray logs from several wells, Sproul et al. (Reference 230) interpret faulting of pre-upper Hawthorn (Miocene) strata. In spite of their interpretation that overlying upper Hawthorn and younger strata are unfaulted, Sproul et al. (Reference 230) suggest possible geomorphic indicators of faulting. **Sproul et al. (Reference 230) noted a bend in the coastline near the westward projection of a few of the subsurface faults and that a stream between two of the faults is aligned subparallel to the faults.** However, despite the landscape being heavily modified by urban development, field reconnaissance and inspection of aerial photography reveal no evidence for faulting at the surface, **and published studies identified no surficial faulting in the area (Reference 240).**

A new reference will be added to Subsection 2.5.3.9 in a future version of the FSAR.

240. Scott, T. and T. Missimer, *The Surficial Geology of Lee County and the Caloosahatchee Basin*, Florida Geological Survey, Special Publication, Issue 49, pp. 17-20, 2001.

ASSOCIATED ENCLOSURES:

None