From: J Sevilla [qmakeda@chesapeake.net]
Sent: Friday, July 09, 2010 3:58 PM
To: CalvertCliffsCOLAEIS Resource; Quinn, Laura; woody.francis@USACE.ARMY.MIL; Steckel, James; Arora, Surinder
Cc: Peter Saar; Peter Vogt; Michael Mariotte; Allison Fisher; Paul Gunter; Bruce Gordon; Chris Bush; William Johnston; fabiada@yahoo.com; Timothy Flaherty; harold thornburg
Subject: June Sevilla submission to DEIS (DRAFT NUREG 1936) and FSAR - #1 of 3 emails
Attachments: June 26 2010 ltr-Kidwell-Sevilla-FSAR Rev 6 analysis.pdf

Importance: High

TO: NRC - NUREG 1936 DEIS Staff Reviewers
NRC - FSAR Staff
NRC- Geological and Geotechnical Staff
US Army Corps of Engineers - Woody Francis
Laura Quinn - NRC
James Steckel - NRC

From: June Sevilla in behalf of self and Southern Maryland CARES

This is the 1st of 3 emails submitted for consideration and ACTION, both on the DEIS and FSAR components of CCNPP Unit 3's application with NRC and USACE. This attachment also contains the enclosure of 2 of the 11 exhibits (Exhibit 4, 4a and 7) referred to in other documents forthcoming as part of this series of submissions (due to file size).

Attached is Dr. Susan Kidwell's scientific analysis of CCNPP Unit 3's FSAR Rev 6, in form of letter to me, June Sevilla, since she is my subject matter expert witness. Dr. Kidwell's scientific review and analysis of the latest revision of FSAR impacts decisions made in the DEIS because the conclusions drawn by NRC Staff and the US Army Corps of Engineers were based on geologic and geotechnical information which have been misrepresented by the Applicant in their FSAR, which also contains errors and omissions that affect not only the FSAR, but the DEIS likewise.

Please forward this information to all other NRC staff and US gov't agencies reviewing the DEIS and FSAR.

Thank you,

June Sevilla
301-351-3161
P.O. Box 354
Solomons, MD 20688

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Sent Date: 7/9/2010 3:58:10 PM
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From: J Sevilla

Created By: qmakeda@chesapeake.net

Recipients:
"Peter Saar" <peters@opc.state.md.us>
Tracking Status: None
"Peter Vogt" <ptr_vogt@yahoo.com>
Tracking Status: None
"Michael Mariotte" <nirsnet@nirs.org>
Tracking Status: None
"Allison Fisher" <afisher@citizen.org>
Tracking Status: None
"Paul Gunter" <paul@beyondnuclear.org>
Tracking Status: None
"Bruce Gordon" <iyp@dmv.com>
Tracking Status: None
"Chris Bush" <chris.bush@verizon.net>
Tracking Status: None
"William Johnston" <wj3@comcast.net>
Tracking Status: None
"fabiada@yahoo.com" <fabiada@yahoo.com>
Tracking Status: None
"Timothy Flaherty" <tsflaherty@hotmail.com>
Tracking Status: None
"harold thornburg" <mattt3@verizon.net>
Tracking Status: None
"CalvertCliffsCOLAEIS Resource" <CalvertCliffs.Resource@nrc.gov>
Tracking Status: None
"Quinn, Laura" <Laura.Quinn@nrc.gov>
Tracking Status: None
"woody.francis@USACE.ARMY.MIL" <woody.francis@USACE.ARMY.MIL>
Tracking Status: None
"Steckel, James" <James.Steckel@nrc.gov>
Tracking Status: None
"Arora, Surinder" <Surinder.Arora@nrc.gov>
Tracking Status: None

Post Office: x300jrs

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MESSAGE	1467	7/9/2010 4:05:22 PM
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5750 South Kenwood Avenue
Chicago, IL 60637

Ms. June Sevilla
Lusby, MD

June 26, 2010

RE: Comments on CCNPP Unit 3 FSAR Rev 6 Section 2.5 “Geology, Seismology, and Geotechnical Engineering”

Dear June,

I have now had a chance to read the full text of the relevant section (2.5) of the FSAR Rev.6, which your detailed instructions permitted me to find on the NRC website. The report clearly states that Lettis Associates did make two reconnaissance visits to the site, including an aerial reconnaissance by fixed-wing aircraft to look for relevant geomorphic features (p. 2-1051), and the FSAR includes an unpublished LiDAR-based slope map of the area (Fig. 2.5-26, p. 2-1390). The report conclusions are otherwise based on a (quite complete) review of the published literature on the immediate area and larger region. A large portion of material in the report apparently dates to an investigation commissioned by Bechtel during construction of the original plant in the 1970’s. There is no mention that Lettis Associates conducted any new field analyses such as boreholes, trenches, or seismic profiles to test any tectonic features that have been postulated in the literature, including the one at Moran Landing postulated in my 1997 JSR paper (Kidwell 1997). The detail of the current FSAR on other points suggests that any new original data like this would have been described in detail had it been generated by Lettis Associates or others.

<u>RE the postulated fault at Moran Landing and associated folding in the Conoy Cliffs:</u>

This fault is closer to the CCNPP than any others postulated and is thus of greatest concern. The FSAR authors (“they”) agree with my published work that the basal contact of Pliocene and Quaternary age gravels in the upper part of the Cliffs is variable in elevation because it is erosional in nature, and that this interval includes multiple erosional channel forms. They also acknowledge some variation in elevation of beds within the generally tabular Miocene-age strata per my 1997 cross-section, but think that those changes are not convincingly tectonic given changes of similar magnitude that I documented elsewhere in the Calvert Cliffs (Section 2.5.1.1.4.4.4.8, p. 2-1096; and again on p. 2-1118).

That is a fairly conservative interpretation of the field evidence and scientifically fine -- as you know, I didn't draw the postulated fault onto my diagram for reasons of similar scientific conservatism, even though my text is explicit that a fault is postulated in that location. I could not find evidence that the change in elevation of the entire stack of Miocene units across the Moran Landing valley and the dip reversal evident within Conoy Cliffs could be attributed to (paleo)erosion alone, unlike most other features in the Calvert Cliffs, where detailed examination revealed truncation of underlying beds, pinchout of infilling units, and/or biostratigraphic corroboration of a gap in the record. On the other hand, no fault plane is exposed in outcrop –it must be inferred, because the likely position of the fault plane lies where a modern valley intersects the Bay shoreline. My solution was to clearly postulate the fault in the text but simply leave a suggestive gap in the figured cross-section itself where the fault seemed to lie. I continue to believe now, as I did when writing the 1997 paper, that a definitive answer to the fault hypothesis for the Moran Landing/Camp Conoy features will require an explicit test using new analytic methods. It will not emerge if analysis is limited (as the FSAR is) to a reconsideration of existing evidence or a re-analysis of available outcrops, even by neotectonic specialists. Given the clearly erosional and thus irregular elevation of the base of the post-Miocene record, the evidence – pro or con – the extension of this fault up thru the Quaternary will likely remain ambiguous.

I was quite surprised that the FSAR would cite, as an argument against tectonic origin, the failure of workers from previous decades ever having observed these features (p. 2-1118). By that argument, there should be no scientific discoveries. It would disallow the physical reality of the erosional channels in the Plio-Quaternary part of the record – never reported in the literature until my 1997 paper, but which the FSAR authors accept– and would disallow the reality of lateral changes in dip (elevation) evident within the basically tabular Miocene record, which they also seem to accept (p. 2-1117-1118). The coarse stratigraphic resolution and wide spacing of control points (logs, boreholes) of other authors' figures reprinted in the FSAR would not allow detection of any but the largest magnitude offsets, and thus it should not be surprising that features as spatially fine as a fault plane and associated folds would not be detected. The Figures in general are difficult to follow as evidence – none have captions identifying the original source, which is not always clear in the text citation, several key cross-sections seem to be missing, and the numbering system is confused in cross-referencing figures. For example, the map Fig. 2.5-32 indicates the existence of four cross-sections relevant to evaluating the postulated Moran Landing fault. The longest is B-B', which the map key indicates is provided in Figs. 2.5-28, -29 and -30. Fig.2.5-30 is the cross-section from Fig. 2 of my 1997 JSR paper – it is incorrectly positioned on map Fig. 2.5-32 well inland from the cliff-faces where it was actually measured, and has also been modified by coloring and insertion of new location labels, which is not acknowledged. Fig. 2.5-28 is not a cross-section but a lithologic map key, and Fig. 2.5-29 is a map locating seismic reflection lines but does not present the actual (cross-sectional) seismic data (and these data do not seem to be provided in other figures). The cross-section in Fig. 2.5-39, which is labeled as E-E' and has quite dense spatial control, is not positioned on map Fig. 2.5-32 and so I am at a loss to evaluate it – other than pointing out that all of the stratigraphic contacts other than the base of the Upland Deposits are densely covered with ?- marks, indicating poor control on bed elevations. Fig. 2.5-43 presents a cross-section labeled as E-E', with the key sending the reader to map "Fig. 2.5-32 and -33" for its geographic location – but there is no E-E' trend provided on map fig. 2.5-32 and Fig. 2.5-33 is not a map, and so presumably they mean the map in Fig. 2.5-34! The cross-section itself (E-E' in fig. 2.5-43, running SE from CCNPP in Fig. 2.5-34) only extends halfway to Moran Landing, is constructed using only five shallow and widely spaced boreholes, and dashes in all stratigraphic contacts including the base of the Upland Deposits, acknowledging poor stratigraphic as well as spatial control on geologic anatomy. Cross-sections C-C' and D-D' on map Fig. 2.5-32 are presumably those in Figs. 2.5-41 and -42, but I am not sure. If so, based on their positioning in map Figure 2.5-32, they also do not extend sufficiently far south to intersect with the postulated Moran Fault unless the fault plane has a very shallow and northward dip (unlikely). I have not been able to locate the cross-sectional drawing denoted A-A' in map Fig. 2.5-32.

Thus, of the cross-sectional figures presented as evidence, only one (from my 1997 paper) has a map position, length, and spatial and stratigraphic control sufficient to test for faults and associated folds. The FSAR states (p. 2-1118) “Multiple key stratigraphic markers provide evidence for the *absence* of Miocene-Pliocene faulting and folding beneath the site.” (my stress). This statement would be difficult to support with the evidence provided. It is instead contradicted by the one cross-section they provide that has the stratigraphic resolution and density of control points required to test for faults and associated folds (the cross-section from my 1997 paper).

Concerning the apparent lack of other published observations on structural warping (p. 2-1118), Gernant (1970, Maryland Geological Survey, Report of Investigations No. 12) also detected the notable change in dip of Miocene strata within the Conoy Cliffs and also attributed it to folding (see Encl 1: Gernant’s Figure 4, p.10, included below). This is one published paper missed in the FSAR review, albeit directly relevant. [The one outcrop photograph provided in the FSAR (Fig. 2.5-44) is a highly oblique view of the same Conoy Cliffs, taken from a large distance, that will minimize the viewers ability to appreciate the feature. It concerns me that this might have been the only perspective FSAR authors had, other than perhaps a highly foreshortened view from the narrow beach at the base of the Conoy Cliffs.] Genant and I both recognized the involvement of folding in the creation of the reversed dip of Choptank Formation beds within the Conoy Cliffs, despite the erosional nature of the stratigraphic discontinuity surface(s) that define those beds. (Paleo)erosion is commonly localized in areas of relative uplift (regardless of whether uplift is antecedent/inherited, syn-depositional, or post-depositional). The erosional nature of some of the bed contacts that Gernant and I traced is thus not mutually exclusive with the existence of structural warping as a contributing – or even a primary – control on observed changes in bed elevation, contrary to the implication of the FSAR (e.g.. p. 2-1095, “undulations typically represent erosional features…”). My 1997 paper is explicit that, although some variation in elevation of beds (more precisely, discontinuity surfaces) within the larger Calvert Cliffs are entirely erosional in nature (representing incised channels), changes in elevation near the CCNPP and some others appear to instead be structural warps, at least in part (1997 JSR paper, p. 324). That assessment reflects an explicit rejection of the hypothesis of erosion. In fact the lack of any sedimentary response to the relative (paleo)high on the south side of Moran Landing– St Marys beds do not thin or become coarser over it -- argues that the offset in elevation here is post-depositional (notice the continuity of facies tracts within SM units that can be traced across the postulated fault plane in my 1997 cross-section). The FSAR authors seem to be broadly skeptical of changes in bed elevation as evidence of structural features (e.g., in also rejecting McCartan and others’ postulated monoclines, p. 2-1093, -1095, -1116, -1199, etc.) and to be unattuned to using sedimentologic/ stratigraphic evidence for growth faulting and folding. I, too, would not use it as definitive evidence. However, I would expect an explicit testing of faults hypothesized on this basis using more definitive methods (dedicated boreholes, trenches, seismic profiling) before rejecting it, especially when placement of a public facility was an issue.

<u>Re LiDAR evidence :</u>

Figure 2.5-26 (p. 2-1390) provides one new kind of data relevant to the existence of these features. However, the discussion of it in the FSAR is cursory and I disagree with their reading of it. The LiDAR shows several clear linear features of low slope running across the Calvert peninsula in ~NE orientations, including one extending directly SW from Moran Landing (such as might be expected on the up-thrown side of a fault plane or its propagated fold). That low-

slope lineament coincides with a linear topographc high, visible in conventional topographic maps. Moreover, even more so than on topographic maps, the LiDAR highlights the many suspiciously long linear segments of streams in three oriented sets (NE as the postulated fault, NW perpendicular to the postulated fault, and oblique; see below, Encl 2a and 2b, Sevilla's exhibit 4 from PSC 9218-Kidwell testimony). All of these features deserve a critical quantitative analysis by a tectonic geomorphologist, given the notably non-dendritic appearance of drainage locally and regionally.

<u>Recommendation:</u>

I would be the first to state that the stratigraphic anatomy of the outcropping MD Miocene is subtle and complex, as one might expect in such a thin record (only ~10 meters of sedimentary record per million years) – that is in fact the primary message of my 1997 JSR paper. All three Miocene formations (Calvert, Choptank, and St. Marys) include several erosional disconformities, regional dips are very low, and the unlithified nature of the sediments makes them poor candidates for capturing the kinds of ancillary structural evidence (like joints) that is usually available to evaluate tectonic deformation. In addition, the overlying Pliocene and Quaternary strata – whose deformation is critical to testing recent movement – are difficult-to-date gravels and sands arranged in intersecting channel forms, making folding and faulting especially difficult to detect. This is all the more reason that the "hard look" required by the NRC would seem in this case to require new dedicated analyses to test explicitly for the postulated structural features rather than rely on the patchwork of existing evidence. New analyses would include dedicated boreholes or trenches aimed to penetrate the postulated fault plane (vertical boreholes directly over the plane or slant boreholes, rather than vertical boreholes at some distance) and high-resolution seismic reflection profiles of nearby deposits of undoubted Quaternary age that would have been originally flat-lying (e.g., muds within the modern Chesapeake Bay). There is no evidence in the FSAR Rev. 6 that Lettis Associates or others have performed any of this new scientific work on the postulated Moran Landing fault.

For the record, I offer these opinions only as an interested citizen with past scientific experience in the Calvert Cliffs region. I have no current scientific interest in Maryland geology other than as an area of occasional student fieldtrips, and would decline any offer of becoming involved in new analyses because my scientific interests now lie elsewhere. New analyses also require a different set of skills and equipment.

All the best,

Susan M. Kidwell

William Rainey Harper Professor
Department of Geophysical Sciences
University of Chicago

(Enclosures)

Encl 1 – Gernant's Fig 4, page 10 of 1970 Maryland Geological Survey, Report of Investigations No. 12:

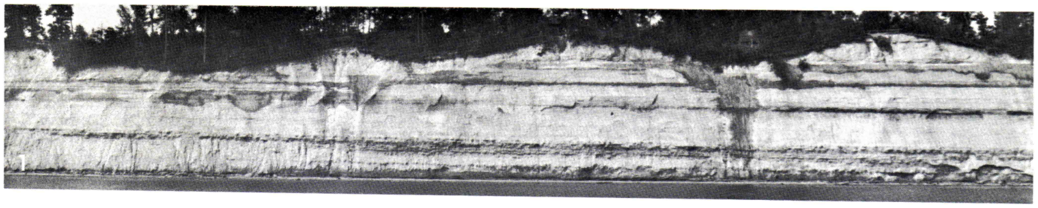


Figure 4: (Different perspectives of same cliff section.) Calvert Cliffs at Camp Conoy Y. M. C. A. Good view of unconformable relationships around Choptank-St. Marys boundary. Type area for Conoy Member. Double-headed arrow on right of lower photo shows thickness of St. Marys at north end of Conoy Cliff not present at south end of Conoy Cliff. Single-headed arrow at left marks Choptank-St. Marys unconformity.

Close examination of the formational contact at locality 67-71 (fig. 5) reveals this to be a surface of erosion. The upper Choptank member is abnormally thin, being only a little over 4 feet thick. Within 500 feet southeast this unit is 8 to 9 feet thick, as can be seen in figure 6. Figure 5 shows the broadly but deeply undulating formation boundary. It also shows the "basal sand" of the St. Marys filling lows in this undulating surface.

STRATIGRAPHIC NOMENCLATURE

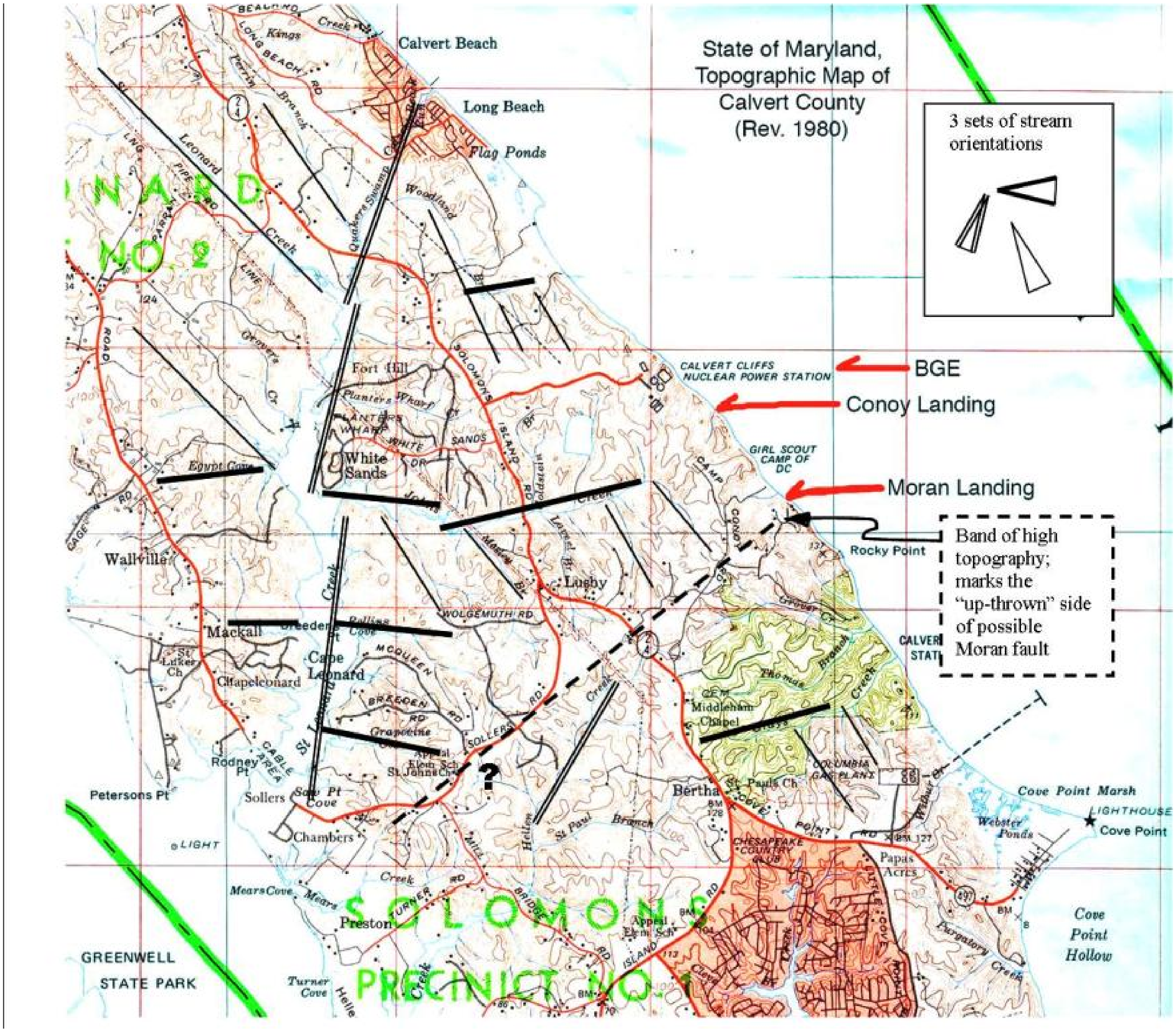
Within the Chesapeake Group of Maryland, Shattuck (1904, pp. *lxix-lxxxvi*) recognized and delineated 24 sub-divisions or "zones". The Choptank consists of "zones 16" through "zone 20". Each "zone" was defined on the basis of lithologic characteristics and the relative quantity of fossil shells, not by the occurrence of particular species. As such, each "zone" is a rock stratigraphic unit (Krumbein & Sloss, 1963, p. 625).

The five subdivisions of the Choptank as recognized by Shattuck are redefined, named, and given type sections in the discussion below.

SUBDIVISIONS OF THE CHOPTANK FORMATION

Calvert Beach Member.—This member corresponds to "zone 16" of Shattuck and lies at the base of the Choptank (fig. 6). The type section, here designated, is the low bluff in the Calvert Cliffs at Calvert Beach, Maryland ((fig. 7,8) ; also see locality 67-65 in Appendix I for detailed description of the type section). The sediments vary from dusky green to dusky blue, rarely yellowish-brown to dark brown, very muddy to slightly muddy, fine sand to very fine sand. The nature of the lower contact is not clear (see previous discussion) but can be described as subtle (fig. 2,3). The location of the upper contact is difficult to fix because of its gradational character. Inasmuch as the overlying bed is defined in part as a major shell bed, the contact has been placed at the base of the first major influx of shells (fig. 2). Sedimentary structures included in this member are small scour and fill structures (fig. 3), burrows (fig. 7,8), sand stringers and lenses (fig. 2), localized low-angle planar cross laminations, and irregular bedding laminations. In general, macro-

Encl 2a – Sevilla Exhibit # 4, PSC CPCN Case No. 9218 testimony – Kidwell:



Encl 2b – Sevilla Exhibit # 4, PSC CPCN Case No. 9218 testimony – Kidwell:

Using an existing topographic map of Calvert County, MD:

1. Many streams have suspiciously long straight stretches and make approximately right-angled turns, which is typical of terrains where there is an underlying structural (tectonic) control on drainage.
2. This contrasts with the "dendritic" (root-like) pattern that typifies terrains lacking any structural control on the weakness of the underlying rocks.

3. Tenured and experienced geologists Dr. Susan Kidwell, Dr. Peter Vogt, and Dr. Curt Larsen concur that in this part of Calvert County there is
   a. a set of stream segments with a basically East-West orientation (indicated by bold solid lines on map; for example, Johns Creek, which heads east toward the southern end of CCNPP property),
   b. a second set of stream segments having a South-Southwest orientation (doubled-lines; for example, St Leonard Creek and its overland extension to Long Beach), and
   c. a third set of mostly minor streams having a South-Southeast orientation (many fine solid lines).
4. The "overlaid stream line segments" on the topographical map have been positioned slightly east or north of the relevant stream so as not to obscure the trace of the stream on the map or the labels providing the stream names.
5. The bold dashed line on the map, running Northeast - Southwest, marks a band of topographically high land that extends from the Calvert Cliffs over to the Patuxent River:
   a. It begins under the Moran property and
   b. coincides with Sollers Road for a considerable stretch and in the direction of the mouth of Mears Cove on the Patuxent River.
   c. This dashed line does not mark the trace of the postulated Moran Fault, but rather the topographic high running land along the edge of the "up-thrown" block. The fault line would be located on the <u>north side</u> of this dashed line within the order of a quarter mile.
6. The location of the CCNPP Unit 3 Cooling Tower, when measured relative to the dashed line is about a half mile northwest of the dashed line; even lying closer to the postulated Moran Landing Fault (less than a half mile).
7. (**Sevilla Exhibit 7**) Dr. Robert Gernant, in the 1970 publication of the Maryland Geological survey, "Report of Investigations No, 12", page 10, Figure 4, published his picture of Calvert Cliffs at "Camp Conoy, YMCA" because he noticed the unusual tilt of the beds in that area of Calvert Cliffs. Dr Gernant's picture is the north cliff view of the same area labeled by Dr. Kidwell in her 1997 JSR study, page 324, Figure 2, as "Conoy Landing"(**Sevilla Exhibit**s **5 and 6**).
8. Dr. Gernant's publication in 1970 led Dr. Kidwell to examine very carefully Calvert Cliffs especially at the Conoy Landing area, because of the unusual tilt of the beds downwards towards the north. This tilt contrasts the usual tilt of beds downwards towards the south. The significance of this unusual northward tilt is that the beds have been arched slightly by deformation. Such "folding" of the beds is commonly associated with faults.
9. There are thus 3 kinds of evidence suggesting a plausible fault: a) contrast in elevation of beds between north and south sides of "Moran Landing" (underscored in Dr. Vogt's mark-up of Dr. Kidwell's 1997 Fig. 2; b) arching of beds at Conoy Cliff, as diagramed in Kidwell's Figure 2 and as evident in part of Dr. Gernant's Figure 4 in 1970; and c) unpublished 2010 observation by Drs. Kidwell and Vogt of the topographic features as suggested by the line of topographically high land and orientation of the streams as corroborated in part by Dr. Larsen (page 1 this Sevilla Exhibit 4).