APPENDIX F

RESPONSES TO REPORT OF AUGUST 21, 2006, BY EARTH CONSULTANTS INTERNATIONAL (ECI) ENTITLED "REVIEW OF BOREHOLE LOGS AND REPORTS FOR THE BRIGHTWATER REGIONAL WASTEWATER TREATMENT PLANT, SNOHOMISH COUNTY, WASHINGTON"

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This document contains responses to an August 21, 2006, letter and report by Earth Consultants International (ECI) entitled "Review of Borehole Logs and Reports for the Brightwater Regional Wastewater Treatment Plant, Snohomish County, Washington" which was submitted to the City of Woodinville, Washington by ECI. These responses were prepared jointly by representatives of MACTEC, CH2M Hill, and Shannon & Wilson. The following pages contain our responses to specific comments in the ECI report on a paragraph-by-paragraph basis.

General Discussion

Boring log information developed by King County's consultants was used by ECI to make a contour map of the elevation at which Standard Penetration Test (SPT) blow counts (N-values) were 100 or more. N≥100 was taken by ECI to represent the geologic contact of separating recessional outwash of the Vashon Stade of the Fraser glaciation (Vashon glaciation) from underlying advance outwash and till or diamict. The basis for ECI's geologic correlation is the compaction in deposits overridden by glacier ice and the lack of compaction in sediments deposited at the glacier was melting or after it had melted. The ECI geologists apparently believe that the N≥100-elevation surface was uniform immediately after deglaciation and that any non-uniformity in the N≥100-elevation surface is a post-glacial offset caused by a northwest-trending fault. ECI states that trenches excavated in 2006 by King County and its consultants did not answer the question of whether active faults exist beneath the two chemical buildings. ECI concludes that new trenches are needed in locations where post-glacial sediments can be dated by laboratory methods to evaluate the risk that active faults are present under the chemical buildings and everywhere else at the site.

We disagree with the premise, the interpretations, and the conclusions of the ECI letter and report. ECI's report indicates an incomplete understanding of glacial sediments of the Puget Lowland, and especially of subglacial deposits. ECI interprets differences in the N≥100-elevation surface (their definition of the top of glacially over consolidated materials) as offsets of the contact between recessional outwash and glacial till/advance outwash along active faults. The method used by ECI's geologists to develop the contours on their Figure 2 is not described; it seems that they might have been biased in developing a northwest trend to the contours to support their interpretation that any differences in elevation of the N≥100 surface were active faults parallel to traces of the Southern Whidbey Island fault (SWIF).

ECI states that the 2006 trenches excavated by King County and its consultants did not answer the question of whether active faults exist beneath the two chemical buildings, but ECI geologists have no direct basis to support this conclusion because they have not reviewed the data and reports generated from the trenching investigations. Samples from a few borings are described as having fractures or inclined layers. ECI claims these deformed samples indicate that active faults are present; however, ECI implies that samples without such notations on boring logs may mean that deformations were not noticed, or even worse, they were noticed but not reported.

Some of the sediments exposed in the trenches excavated for the south chemical building show deposits that pinch out, are truncated, slumped, and deformed over very short distances. Overlying and/or underlying continuous undeformed deposits confirm that the deformed units are not the result of seismic shearing or even secondary earthquake effects, but the product of subglacial action or subaerial fluvial erosion and deposition. Other sediments exposed in the trenches suggest that they were caused by secondary earthquake effects, primarily liquefaction. Still other deformations are consistent with melt-out of blocks or masses of glacial ice that became buried within the deposit. Any deformations that could be interpreted as faults were overlain by unfaulted and undeformed recessional outwash deposits of the Vashon glaciation, which are pre-Holocene in age, making all deformation inactive by the definition of active faults in the 2003 International Building Code.

ECI's report states that new trenches and age-dating by laboratory methods are required to answer the active-fault question. King County and its consultants have excavated trenches, submitted samples for radiocarbon analyses, and believe that the active-fault question has been answered. The samples returned ages of >37,500 years and 70±40 years B.P. The samples were obtained from deposits of the Vashon glaciation and recession which are well known regionally to be between 16,950 and 16,570 cal yr B.P. (Porter and Swanson, 1998). The >37,500 date probably came from coal fragments eroded from the lower Tertiary formation in the Maltby area (Minard, 1985) and the younger date came from modern roots penetrating the sample.

ECI references the Draft SEIS for the assumption made by King County and its consultants that a fault might lie anywhere on the site south of Lineament 4, and that such a hypothetical fault might have the potential for up to about six feet of surface displacement. The assumption of the hypothetical fault was for the worst-case scenario assessment only. King County and its consultants described characteristics of Lineament 4, identified a linear northwest-trending topographic feature west of the site that projects onto the south part of the site as Lineament X, and noted that no similar features existed on the landscape between Lineament 4 and Lineament X that would project through the plant site. Based on these descriptions, King County and its consultants stated that the assumption of a hypothetical fault on the plant site south of Lineament 4 was extremely conservative for worst-case scenario assessment only. ECI is now inappropriately using that conservatism falsely as an admission on the part of King County and its consultants that northwest-trending faults can lie everywhere on the site.

The remaining sections of this letter address specific comments as they appear in the ECI report dated August 21, 2006. Paragraphs are referenced by page and paragraph number. Page numbers correspond to the numbered pages in the ECI report, whereas the paragraph numbers are sequential from the first paragraph on page 1.

Page 1, Paragraph 1:

ECI states that their report to City of Woodinville, dated August 21, 2006, is a follow-up to their report to SKEA, dated December 23, 2003. ECI's stated objective was to use on-site borehole data to determine if any notable discontinuities exist in the age or character of sedimentary layering that might suggest faulting. ECI concept of 'layering' seems to be misguided in a glacial erosional and depositional environment where abrupt changes are common and the only deposits that have lateral continuity are the lacustrine units. Lacustrine units in the glacial environment commonly are limited in extent and irregular in plan view, facts that are not mentioned in ECI's report. Contrary to ECI's objectives of finding northwest-trending faults in the glacial stratigraphy at the site and validating the conclusions in its December 24, 2003, report, discontinuities in borehole samples and irregularities interpreted from contoured elevations of some parameter interpreted from borehole data are typical features of glacially deposited materials in the Puget Sound region. However, at the Brightwater site, ECI interprets these discontinuities and irregularities to be features of active strike-slip faults of the SWIF.

Page 1, Paragraph 2:

ECI's report specifically mentions the 12 borings by Aspect Consulting in 2004 and the 22 borings performed by CH2M Hill in 2004; the Aspect Consulting borings were drilled in support of the investigation of Lineament 4 and Trench 2A (Beef Barley), whereas the CH2M Hill borings were drilled for the final engineering design of the wastewater facility at locations of specific wastewater process structures. None of these borings indicated signs of shearing or fractures because such signs were not present, not because such signs were overlooked or disregarded. In our opinion, it is not possible to decipher tectonic folding of strata from borehole sampling in glacial soils in the Puget Lowland in contrast to syndepositionally and post-depositionally inclined strata caused by glacial and subglacial processes.

Not including subsurface information obtained during site grading in the summer of 2006, logs from 47 borings are available to describe conditions across the 75-acre plant site. This translates to an average borehole spacing of about 270 feet. Viewed in a north-trending zone across the major treatment facilities, the average spacing is closer to about 200 feet.

ECI is implying that variation in the trend line of the top of glacially overridden sediments on the order of 20 feet (in the case of "inferred fault B") or the presence of a geologic material not encountered elsewhere on the site (in the case of "inferred fault A") suggest faulting. The odds are probably low of finding over 100 acres of glacially deposited material anywhere in the Puget Sound region without an area with at least a 10 percent slope on glacial sediments or a change in geologic units.

Exploration data facts:

- 25 borings drilled by CH2M HILL during Feb, April, and May 2004. In addition,
- 6 PB-series from summer 2003,
- 5 SB-series from fall 2001,
- 6 1999 Nelson-Couvrette Stockpot borings (only 2 included in 2005 Data Report),
- 2 1999 Nelson-Couvrette borings in Parcel 3B (south of Stockpot),
- 3 CDM borings near the tunnel portal, and
- 12 August 2004 Aspect borings in the North Mitigation Area (NMA).
- 59 Total borings for both plant site and NMA.

Page 1, Paragraph 3:

ECI's geologists recognize the value of regional radiocarbon dates in defining the age of the Vashon glacial deposits in the Puget Lowland. Later in ECI's report, however, King County and its consultants are criticized for using the regionally determined ages of on-site glacial deposits and required to make independent laboratory assessments of deposit ages.

The functional definition of an active fault included in the SEIS (displaced glacial deposits) was based on the knowledge that much of the Brightwater site, and much of the Puget Lowland region, is a glacially scoured landscape without post-glacial deposits of late Pleistocene and/or Holocene age. In any case, the active fault definition controlling the Brightwater project is the one in the 2003 International Building Code (2003 IBC), which is a Holocene criterion (11,000 undefined years old). ECI's geologists misinterpret this active fault definition to mean a fault that displaces glacial deposits at any position in the glacial sequence, even if unfaulted glacial deposits are present stratigraphically above and/or below the faulted glacial deposits. King County and its consultants consistently apply the geologic principles of superposition and cross-cutting relations to conclude that faults or fault-like features that are buried by glacial deposits have ages of most recent movements that are older than the unfaulted glacial deposits, and are, therefore, pre-Holocene in age and not active by the 2003 IBC active fault definition.

ECI's geologists are confusing calibrated dates with radiocarbon dates in this paragraph. Figure 5 in Technical Appendix A of the SEIS and Figure 3 in the Chemical Building Seismic Trench report shows the relations among radiocarbon years before present, calibrated years before present, and calibrated calendar years. The real issue is whether or not deposits that are younger than the last glaciation (Holocene) are faulted. If Vashon glacial sediments – either overridden outwash, till or diamict, or normally consolidated recessional outwash – are faulted, but the overlying younger Vashon sediments are not, then the faulting event is not active. If Vashon glacial sediments – either overridden outwash, till or diamict, or normally consolidated recessional outwash – are faulted, and the overlying younger glacial and post-glacial sediments are also faulted, then the faulting event is active.

Page 2, Paragraph 4:

This paragraph describes the 2003 IBC active fault definition.

Page 2, Paragraph 5:

The 2004 FB- and TW- series borings were drilled primarily for engineering reasons. Although CH2M HILL field personnel occasionally make notes about the possible geologic origin in the comments column of their logs, it is their standard practice to put only uninterpreted data in the logs and data report. This allows an unbiased evaluation of all the data prior to developing a geologic interpretation.

The ECI report states erroneously that King County and its consultants moved the proposed plant facilities in response to two publications by the U.S. Geological Survey (USGS). Both publications pertain to the trenches excavated on the Brightwater site in the fall of 2004 (USGS Open-File Report 2005-1013, dated January 2005 and USGS Open-File Report 2005-1136, dated March 2005). No treatment plant facilities have ever been proposed north of Lineament 4 or south of the projection of Lineament X. No treatment plant facilities have ever been considered within the North Mitigation Area, which is defined as the portion of the site north of the northern boundary of the former Parcel 3 property line.

Page 2, Paragraph 6:

The ECI report misstates the extent of subsurface geology data at the site. In addition to the borehole logs, trenches, LiDAR, and aeromagnetic surveys of the site, geologic records also include 17 geotechnical test pits excavated in April 2004, 24 geotechnical test pits excavated for the Northshore School District in 2001 (AESI, 2001) on the NMA, and 3 large-scale test pits excavated under the direction of Hoffman Construction Company in August, 2005 (HWA, 2005). Six additional borings were drilled in July, 2006 by Kleinfelder as part of the installation of piezometers to monitor the performance of the dewatering system. Furthermore, King County and its consultants excavated trenches in the summer of 2006 to fulfill part of the requirements of the Development Agreement with Snohomish County. One trench and a supplemental pit were excavated approximately 240 feet southeast of the North Chemical Building. The South Chemical Building was investigated with trenches in three locations; one location was approximately 240 feet southeast of the South Chemical Building (four exposures were logged), one location was directly under the Chemical Building, and one location was less than 50 feet southeast of the Chemical Building.

Three plausible explanations besides faulting are available to explain variability in the arrangement and contour of subsurface layers. ECI is misleading the reader of their report to say that borehole data suggest faulting. On-site evidence of landslides, erosion, and excavation for past development is clear indication of changes to the surface of the land in recent history. Earthquake-shaking-induced liquefaction features were documented in the trench excavated across Lineament 4 in the North Mitigation Area, and liquefaction features have been found regionally throughout the Puget Lowland. The most likely explanation for variable arrangement of subsurface layers at the site is past landslide activity, erosion, glaciation, and secondary earthquake-shaking effects. Standing alone, this evidence does not completely rule out faulting as a possible cause, but it highlights more likely explanations of local variability in subsurface geology.

Page 2, Paragraph 7:

This paragraph describes the geologic units based on available data. A few mappable units could be added to the list (e.g., fill, wetland deposits, colluvial deposits, and landslide deposits).

Page 3, Paragraph 8:

The ECI geologists use Standard Penetration Test (SPT) blow counts (N-values) to differentiate deposits that have been overridden by ice, hence ‘over consolidated by compaction’, from deposits that have not been overridden, hence ‘normally consolidated’. We note that ECI’s report states that they “assigned ‘normally consolidated’ to deposits having a blow count ‘N’ value of less than 100, and ‘overly consolidated’ to deposits having blow counts in excess of 50 blows for 12 inches or less…”. We interpret this statement to mean they assigned “normally consolidated” to samples with N<100 and “over consolidated” to samples with N≥100, even though their statement indicates N≥50 was used to define “overly consolidated” samples. Later in ECI’s report, they refer to their contour map as showing elevations on the contact between Vashon glacial deposits and recessional deposits, which apparently they believe are post-Vashon in age. Troost et al. (2005) include recessional outwash as one of the units in the Vashon (younger glacial) deposits, as do we.

It is neither proper nor standard engineering geology practice in Puget Lowland soils to arbitrarily use N≥100 to distinguish over-consolidated from normally consolidated deposits. Gravel and cobble content and soil type greatly influences N-values. In some cases, high plasticity clay can have N≈30 still be overridden by glacial ice. In other cases, a normally consolidated granular soil can have blow counts in the 60s to 80s if the gravel content is high. A uniform sand deposit with a blow count of 50 or 60 may be glacially overridden, but geologic interpretations depend on the context with surrounding deposits. With the understanding that N≥100 is, at best, a gross approximation of the top of glacially overridden deposits, the two geologic profiles produced by ECI probably are a reasonable approximate depiction of the top of glacially overridden deposits at the Brightwater site. The degree of approximation, however, precludes the use of deviations in the N≥100 surface as an indicator of fault offsets.

The last sentence of this paragraph is a misleading and improper conclusion of the information discussed in the paragraph. In glacial deposits of the Puget Lowland, elevation differences of a geologic contact between boreholes are to be expected because of the glacial environment of erosion and deposition. Neglecting the most likely explanation of elevation differences in favor of an active-fault interpretation is unreasonable. Abrupt irregular and uneven contacts are common in glacial deposits, particularly in subglacial environments which are known to be present at the Brightwater site. To postulate faulting as the cause of irregularities in the surface of glacially overridden strata buried by younger non-overridden deposits would result in post-glacial, potentially active faults throughout the glaciated part of the Puget Sound region. King County and its consultants believe that faults of concern to engineered works are those that have displaced the glacially scoured upland ridges.

Technical Note: Although it may not significantly change the elevation of the contact lines drawn on ECI's Figure 3 or the point of ECI's argument, to be technically correct, it should be noted that most of the near-surface deposits in the eastern portion of the plant site are not normally consolidated. Normally consolidated sedimentary materials with only 10 or 20 feet of overburden and primarily composed of silty fine- to medium-grained sand would be expected to have $N<10$ rather than the N-values in the 20s, 30s, and 40s that are commonly reported in the boring logs, unless the N-values represent coarse gravels, cobbles, or boulders in the deposits. The higher SPT N-values measured in the eastern part of the plant site are indicative of previously higher effective stresses, which in post-glacial, primarily granular materials would be mainly caused by erosion of overburden or significant desiccation of the deposits. It is difficult to imagine erosion of tens of feet of sediment occurring uniformly across an area as large as the plant site.

The site has been extensively graded, so in some locations, only man-made fill deposits may be on top of deposits which have been over consolidated by glacial ice. Such appears to be the case at FB-13, shown on Section B of ECI's Figure 3, where site grading cut-and-fill would make the top of the $N\geq100$ surface lower on the south side of ECI's "Inferred Fault B" than on the north side.

Page 3, Paragraph 9:

The CH2M HILL 2005 Geotechnical Recommendations Report and 2006 Addendum interpretation of the silt and clay deposits found in the borings east of Stockpot Soup and in FB-19 and B-2B-99 (identified on ECI's Figure F-1) is that they were glacial lacustrine deposits; they could not have been overridden by the full depth of the Vashon glaciation because the blow counts were not above 50, as is commonly observed for Lawton Clay or Transitional Bed and older deposits of similar gradation in the region. This interpretation is consistent with explanations offered by Nelson-Couvrette (1999). The ECI report states that the fine-grained sediments in the Giles and Nelson-Couvrette reports are the same as those in the French Onion Trench. This is not correct. The silt and clay in the geotechnical reports are most likely Vashon recessional deposits, whereas the fine-grained deposits encountered in the French Onion Trench to the east were intensely sheared silt, clay and till that were subsequently compacted by overriding glacial ice, making them early Vashon age, at the youngest.

Although no radiocarbon dates have been obtained to verify the age of the clay[1] in the area of the Stockpot Soup building, the N-values and the laboratory data from Atterberg limits testing indicate that this deposit is likely to be Vashon recessional lacustrine soil that was deposited on the edge of the Little Bear Creek valley in the last stages of ice melting. This interpretation is consistent with explanations offered by Nelson-Couvrette (1999).

Page 4, Paragraph 10:

The discontinuity between geologic units on the northeast side of "Inferred Fault A" and the southwest side of "Inferred Fault A" amounts to a difference of 25 to 35 feet between FB-21 on the south, and FB-19 and B-2B-99 on the north side of the line, respectively. A vertical offset of this magnitude occurring along a fault in post-glacial time certainly would have created an impressive scarp across the glacially scoured upland ridges adjacent to the site. Examination of maps in Blakely et al. (2004) and Sherrod et al. (2005a) show continuity of glacial flutes (glacially scoured upland ridges) south of Lineament 4 and no LiDAR scarps between Lineament 4 and Lineament X that project onto the site (Figure F-1). A more likely scenario is that the Vashon diamict (Qvd) deposits were gouged out during movement of the Vashon ice sheet or scoured during glacial recession, and the resulting depression was filled with fine-grained sediments during glacial recession. It is highly speculative and unreasonable to conclude that the silt/clay deposit in borings FB-19 and B-2B-99 is the result of seismic displacement because it is a different material than encountered in nearby borings to the south. The silt/clay deposit is not present to the northwest in borings B-1-98, B-2-98, and all TB-series borings. The material is also absent in recent excavations to the west for the North Mitigation Area ponds. It is unreasonable to infer any particular orientation to the boundary separating the silt/clay deposit to the north and the granular deposits to the south based on the limited distribution of the deposit in a few borings. In other words, an assumption that a recessional lacustrine/glacial diamict contact is a fault that is "roughly parallel to the Lineament 4 Fault" is completely unfounded. The fundamental nature of glacial deposits is to display contacts that are irregular both horizontally and vertically.

ECI recognizes in the final sentence of this paragraph that their "inferred fault A" would miss proposed treatment plant buildings. ECI's "inferred fault A" projects southeastward into glacially scoured upland ridges adjacent to the site that show no evidence of deformation in LiDAR images (Figure F-1).

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[1] Samples of clay from this area were not examined for small amounts of organic material that might be suitable for radiocarbon age determinations. The radiometric age of the materials normally is not relevant for foundation engineering. Engineering geologic evaluation of the environment of deposition and its context to regional geologic formations normally is sufficient for engineering purposes.

Page 4, Paragraph 11:

In the ECI report, an elevation difference of a geologic contact between borings 200 feet apart is called “an offset”. Actually, ECI’s geologists are using the word “offset” to represent differences in elevation between borings of the N≥100 surface which, in many cases, is not even a geologic contact. Variability in the elevation of geologic contacts, especially those formed during glacial advance and recession, of 20 to 25 feet over 200 feet is not at all unusual in the Puget Sound region, as experienced by most construction companies in foundation excavations. If the elevation variation were caused by faulting, rather than normal glacial processes, then it seems unlikely that a 20 to 25 foot “offset”, as purported along Section B-B’, could become discontinuous at Section C-C’, only 400 feet to the west. In the first sentence, ECI implies that it is unusual to have Vashon recessional deposits in contact with Vashon till, and that a fault may be a likely explanation. A 20- to 25-foot vertical difference in the Qvr/Qvd contact over a distance of about 200 feet is not uncommon. That is a gradient of only 10 to 12½ percent which is not unusual for glacial deposits exposed in construction excavations in the Puget Sound region.

Page 4, Paragraph 12:

ECI’s contour map “reflects the drop across inferred “fault B” in the eastern part of the site”, as stated in the third sentence of this paragraph. Actually, what ECI’s contour map shows is simply a steeper slope in the N≥100 surface which they infer to be a northwest-trending fault.

Statements about contacts between recessional outwash and Vashon diamict generally sloping westward, with occasional westward trending gullies, is generally consistent with our observations. However, ECI’s contour map on Figure 2 should be viewed with caution because it is based on large distances between borings and the top of the glacially over-consolidated layer may have been altered by past site grading. Furthermore, a fundamental point about ECI’s contour map is that it is not the “top of the “overly consolidated” sediments: It is a contour map of the shallowest N≥100 value in widely spaced borings sampled at 5-foot intervals. At a minimum, the contour map should be viewed as having an accuracy of ±5 feet.

It is difficult to understand the significance of ECI’s argument regarding the westward sloping surface of the top of the diamict. Little Bear Creek is located to the west of the plant site and a glacially scoured upland ridge is located to the east. The glacially scoured landscape simply slopes to the west at the plant site, but it has complications associated with erosion and deposition processes of a subglacial environment. The gullies and swales in ECI’s contour map appear to be west-trending tributaries of Little Bear Creek, not northwest-trending offsets of the SWIF.

Page 5, Paragraph 13:

The ECI report states that determining depths to a geologic contact from SPT blow counts is misleading because of the influence of site grading. King County and its consultants believe that they have properly interpreted the relevant data and that ECI's conclusions are the result of its failure to accept the inherent variability of glacial erosional or depositional environments.

We concur with the ECI statements about the depth to glacially overconsolidated material, that the depth generally increases to the south and west, and that the depths can be misleading because of site grading.

Page 5, Paragraph 14:

The ECI report seems to imply that King County's consultants might have observed deformation features in samples recovered from the borings but failed to describe the features on the boring logs. The standard practice among geologists and geotechnical engineers is to describe what is observed, but not to add notes regarding what was not observed.

The B-1-99 and B-2-99 borings note thin silt and very fine sand partings at irregular angles or angles between 45 degrees and vertical within the upper 10 feet, within deposits of lacustrine material. These borings are at the toe of a landslide triggered during site grading (Nelson-Couvrette, 1999). The partings are within a geologic unit that is notorious for landsliding within the Puget Sound region, to the extent that all the local geologic hazard maps classify any deposit on a slope greater than 15 percent with interbedded silt/clay and sand to be a landslide hazard. The noted features could have been produced by the recent landsliding, by older landsliding particularly during the period shortly following deglaciation, or by deposition into a desiccation or stress-relief crack in the clay.

Tilted bedding and infilled fractures and slickensides were identified below a depth of 88 feet, in pre-Fraser (pre-Vashon) deposits in boring PB-12. Features such as those noted in the log are not uncommon for those deposits in this region and are commonly attributed to landsliding, lateral spreading, or glacial loading or unloading. The age of such movement is not possible to determine. A more complete picture would include descriptions of distorted partings, high angle partings, disturbed texture, and fissures in the pre-Fraser deposits in borings P46-01, P46-02, and P46-3, all three of which were sampled continuously by wireline coring or sonic coring techniques. As with the evidence of pre-Fraser disturbance in boring PB-12, these features are commonly found in similar deposits that are located elsewhere in the region but outside areas where fault zones are suspected.

Also not mentioned in the ECI report are the notes in the logs of trench borings TB-5, TB-9, TB-7, TB-11, and TB-12 such as "fractured at approximately 80 degrees from horizontal", "brown to gray contact across bedding", "wavy structure (possible glacial bedding shear)", "orange staining running at various angles irregularly through sample", and horizontal and subhorizontal platy fractures". These features can be attributed to a variety of processes, including subglacial and liquefaction. Similar features were not observed in the trench borings nearest to Lineament 4.

Technical Note: It is unremarkable that no features indicative of disturbance were noted in the logs of the shallower PB-series borings, the SB-series borings, or the FB-series borings. It should be noted that the recent GCCMOW-series borings [6 total] drilled by sonic coring also have no mention of deformation features. First, samples from these borings were taken at discrete intervals typically every 2.5 to 5 feet, making it difficult to track trends in bedding, unlike the deep PB-12 boring and the P46-series borings which were continuously sampled. Second, the borings typically did not extend by great depths into pre-Fraser lacustrine deposits, where deformation features are commonly seen. Finally, notes referring to "horizontal and sub-horizontal platy fractures" and similar features in the TB-borings are questionable in terms of whether they reflect disturbance beyond that caused by sampling. The TB- borings were drilled to assist with planning the seismic trench across Lineament 4; therefore, all features even remotely suggestive of disturbance were noted (e.g. "wavy structure"), whereas this kind of fine detail may not be noted specifically in logs of borings drilled for routine geotechnical purposes.

Page 5, Paragraph 15:

ECI's report describes limitations of borehole log for geologic interpretations, especially with driven samples taken at discrete intervals. They use this limitation to imply that geologic evidence of active faulting might exist in the areas where borings are drilled, but be missed in the sampling process. We do not dispute that borehole sampling protocol limitation as a possibility, but are compelled to note that ECI apparently has used an arbitrary $N \geq 100$ as a true representation of a geologic contact, drawn a contour map based on the arbitrary surface, apparently forced a northwest-trend to slopes in their contoured surface, and not mentioned accuracy and precision limitations in their procedures. Furthermore, ECI uses terms such as "offset" and "drop" to mean deviations from a uniform slope in their arbitrary contoured surface.

Page 5, Paragraph 16:

The ECI report notes that deformation was observed by the USGS in two trenches consisted of "a high-angle fault, folding, and liquefaction features in the southern trench…" We believe that the 'high-angle fault' mentioned is an injection feature caused by subglacially induced or possibly earthquake-induced liquefaction exposed in the eastern part of the trench (South Trench 1 and South Trench 1c in the MACTEC report). It has a variable, north-trending strike (not parallel to the SWIF) and dips to the west at a moderate angle (about 38°). Some inclined layers (possibly folding, but possibly primary sedimentary structure in subglacial environment) and liquefaction features were exposed in the lower part of South Trench 1. The inclined layers and liquefaction features were preserved in a sand deposit that is too dense to be susceptible to liquefaction processes currently; therefore, we use the density of these deposits to indicate that they have been overridden by glacial ice. A critically important detail is omitted from the ECI report: Unfaulted and undeformed glacially overridden deposits (Qvd or diamict) were exposed in Trench South 1a and Trench South 1b stratigraphically above the projections of the “high-angle fault, folding, and liquefaction features”. Consequently, the deformation features in the lower part of the trench are not active by the 2003 IBC definition because they are overlain by undeformed glacial deposits that are older than Holocene.

The ECI report notes that the USGS observed “crack oriented subparallel with Lineaments 4 and X in the northern trench”. Critically important details are omitted from the ECI report: Cracks in the Vashon diamict and till are common, as reported by Troost et al. (2005) for the Seattle Area Mapping Project, and the cracks had a variety of orientations, not just subparallel to the SWIF.

The ECI report notes that boreholes drilled near the chemical buildings trenches “do not record any deformation, yet considerable deformation was observed in the trenches.” We disagree with this conclusion. Local deformation was observed in the trenches. It is easy to understand how small-diameter samples from vertical boreholes would show undeformed glacial deposits; however, the ECI statement implies that samples from the boreholes should have captured deformation features, too.

The ECI report also comments about the lack of deformation recorded in borings drilled in the vicinity of the USGS Beef Barley trench (Trench 2a in Technical Appendix A of the SEIS) “although faulting in the vicinity of the borings was documented in the Beef Barley trench…” The faulting documented in the Beef Barley trench (Sherrod et al., 2005a) or in Trench 2a (SEIS Technical Appendix A) was very minor and localized. A monoclinal fold was the primary feature exposed in the trench to indicate that Lineament 4 was an active strand of the SWIF. It is not at all surprising that examination of samples obtained from the borings did not reveal evidence of deformation because deformation is localized.

Technical Note: The ECI report mentions boring FB-7 in third sentence. This is a typographical error; the boring is FB-17.

Page 6, Paragraph 17:

The ECI report concludes that new borehole data provide additional support for their inferred “fault A” and tenuous additional support for inferred “fault B”. We disagree. The borehole data are consistent with the distribution and character of sediments deposited in a subglacial and recessional environment. The difference in elevation of the top of the N≥100 surface at ECI’s inferred “fault A” appears to be a pocket, perhaps scoured or perhaps created by melt-out of a large mass of glacial ice, in the underlying diamict in which lacustrine silt/clay accumulated. The slope of the N≥100 surface is the only “tenuous” evidence to support ECI’s inferred “fault B”.

The third sentence in this paragraph of the ECI report refers to inferred “faults A and B” as “Lineaments A and B”. This change in terminology is very misleading because it implies that some features are aligned. Differences in elevation of the top of the N≥100 surface between widely spaced boreholes were interpreted by ECI geologists to have linear, northwest trends to support their inferred “fault A” and inferred “fault B”. These elevation differences do not produce an alignment of features that could possibly be considered to be “lineaments”.

The ECI report states that it would be “more difficult” to evaluate strike-slip movement [than dip-slip movement] with only borehole data. ECI geologists consistently disregard the complexity inherent in subglacial and recessional outwash stratigraphy in their evaluation of borehole data. The ECI report states that borehole analysis does not provide unambiguous evidence for the presence or absence of faulting, and refers to aeromagnetic and ground-magnetic data and LiDAR scarps in the same way. We believe that the absence of scarps in the LiDAR hillshade depiction of glacially scoured upland ridges south of Lineament 4 to the east and west of the Brightwater site is unambiguous evidence that no significant post-glacial displacement has occurred, as shown on Figure F-1. We believe that an adequate understanding of the geology of the site exists for the purposes of the plant facilities.

Page 6, Paragraph 18:

It is misleading for the ECI report to drop “inferred” from the inferred “fault A” and inferred “fault B”. Any or all of the “other explanations” for the chaotic arrangements of the glacial deposits are likely, and based on geologic experience in excavation exposures and interpretations of borehole data in other parts of the Puget Lowland, they are the most likely explanations for these features. The diamicts (both till and till-like deposits) are inter-mixed themselves and with recessional outwash deposits where the channels in the outwash environment cut into the diamicts and the outwash deposits filled in the channels.

The reference to Booth’s 1994 paper on glaciofluvial infilling and scour is misapplied to ECI’s discussion of glacial features at the Brightwater site. Booth’s 1994 paper discusses the overall filling of the Puget Lowland by advance outwash and the mechanism by which the large water-filled (present day) depressions were carved by subglacial meltwater. Its applicability to the Brightwater site is limited. More importantly, the subglacial features at the site are a product of a more localized geologic process described by Laprade (2003) as subglacially reworked till. In fact, the borehole information from the Brightwater site (and five other sites in the Puget Lowland) was used by Laprade in establishing the hypothesis of subglacial reworking of sediment on the lee sides of hills and ridges. Such processes have been documented elsewhere in glaciated regions of the world (Benn and Evans, 1998).

It is true that the overall shape of the Little Bear Creek drainage was caused by subglacial erosion oriented generally north-south, but the subglacial erosion and deposition at the Brightwater site on the slope to the east of the creek are not constrained to any particular orientation because of the complex subglacial environment in which high-pressure water flowing at the sole of the glacier and irregularities in the contact of the ice with the underlying geologic materials produces chaotic distribution of geologic materials with abrupt changes over small distances laterally and vertically. The large boulders (glacial erratics) encountered in Trench South 2b by themselves are easily understood examples of the complexity of the subglacial environment. Additional strength to support the chaotic character of subglacial deposits is the complex folding and glacial-faulting between and adjacent to the erratic boulders in Trench South 2b which are underlain and overlain by undeformed glacial deposits.

The last sentence of this paragraph in the ECI report is a baseless statement that is misleading in several areas. Their sentence is “However, these trends are north-south, whereas “fault A” and “fault B” trend northwest-southeast, parallel to the Southern Whidbey Island fault and its accompanying LiDAR and aeromagnetic lineations.” ECI’s reference to north-south pertains to the general trend of movement of the Vashon lobe ice sheet. ECI’s reference to faults without retaining the “inferred” adjective is a gross misstatement of facts which we believe is a baseless misinterpretation of borehole data. ECI’s reference to a northwest-southeast trend is important to their argument that significant active faults might be present at the site. Figure F-1 shows clearly that south-southeast-trending glacially scoured upland ridges (called glacial flutes by the USGS in Blakely et al., 2004) are continuous south of Lineament 4 and scarps in the LiDAR data are absent between Lineament 4 and Lineament X.

Page 6, Paragraph 19:

The ECI report gives an opinion that absence of faulting is not proved by absence of deformation features in samples collected from boreholes. They give a further opinion that interpretation of the cause of deformation features (glacial vs. tectonic) in borehole samples is difficult. King County and its consultants’ approach to understanding the geologic setting of the site is based on interpretation of data from a variety of sources, not just borehole samples. Our understanding of the geologic setting of the site starts with the chaotic subglacial environment of erosion and deposition combined with recognition of the continuity of glacially scoured upland ridges and the absence of scarps in LiDAR data (Figure F-1) and is supported by the exposures in the seismic trenches excavated at and near the two chemical buildings. All of the geologic data collected at the Brightwater site is consistent and supports our conclusion that active tectonic faults do not exist on the site where wastewater treatment facilities are planned.

Page 6, Paragraph 20:

The last sentence of this paragraph in the ECI report claims that the USGS team visiting the trenches “favored” a fault interpretation rather than a glacio-tectonic interpretation for the deformation features exposed in “the chemical-building trenches”. This statement in the ECI report mischaracterizes the USGS’s comments in the July 7, 2006 email report from Craig Weaver to Bob Peterson, which states that the southern trench “shows evidence of deformation and liquefaction in glacial deposits.” Weaver’s e-mail report further states “Although it may be possible to develop a defensible argument that all of the deformation is related to glacio-tectonics, an equally convincing argument could be constructed for some or all of the observed deformation resulting from regional seismotectonics.”

Weaver’s July 7, 2006, e-mail report states “A near vertical fault in glacial deposits in the northern half of trench 1 appeared to offset several strata and large-scale folds were observed.” This statement refers to what we believe is an injection feature exposed in Trench South 1 and Trench South 1c which strikes approximately north and dips at 55° to 38° to the west. The USGS did not take measurements of the feature’s orientation, but it is clear from their statement that they interpreted this particular feature to be a fault. The USGS report did not include statements regarding their observations in Trench South 1a or Trench South 1b, both of which were located within 40 to 50 feet northwest of and parallel to Trench South 1. Trenches South 1a and 1b were approximately 4 feet deep and exposed subglacial deposits that were unfaulted and undeformed across any conceivable projection of what the USGS called “a near vertical fault in glacial deposits”.

Important facts about the feature that the USGS called “a near vertical fault in glacial deposits” include:

- It is buried by unfaulted and undeformed glacial deposits that must have been compacted by glacial ice.
- The unfaulted and undeformed glacial deposits are older than Holocene.
- The feature that the USGS called “a near vertical fault” is not active by the 2003 IBC definition of an active fault.
- The strike of the feature is approximately north and does not project through either of the two chemical buildings planned for the Brightwater facility.

Page 7, Paragraph 21:

The ECI report states that “It is probable that this controversy [glacio-tectonic or fault interpretation of deformation features] could be resolved by more extensive trenching and analysis as recommended by the USGS (Weaver, 2006)…” We disagree with ECI’s interpretation of the Weaver report as recommending more extensive trenching and analysis. The USGS report states “Our informal suggestion to your group in the field was to deepen this [the northern chemical building] trench to better understand the nature of these cracks.” ECI’s statement falsely implies that the USGS recommended more extensive trenching at the site.

The chaotic character of subglacial and glacial outwash deposits that were exposed in the chemical building seismic trenches makes unambiguous resolution of the origin of deformation features challenging. However, deformation features observed in the seismic trenches excavated for the South Chemical Building clearly show that deposits of glacial origin, hence older than Holocene, at shallow depth are undeformed across the projections of deformation features at greater depth in older glacial deposits. Therefore, no active faults are present at the South Chemical Building. The geologic reasoning for the lack of active faults at the North Chemical Building relies on the nature of cracks observed in the North Trench and the continuous nature of the glacially scoured upland ridges and lack of LiDAR scarps on Figure F-1 on a northwest-southeast projection through the North Chemical Building.

ECI's report states that additional trenching would be necessary at locations where deposits younger than those containing faults or other deformation features would be encountered to determine if the faults are active by the 2003 IBC definition. Additional trenching for the South Chemical Building is unnecessary because unfaulted and undeformed deposits of glacial origin, hence glacial age (older than Holocene), are present across deformation features observed in deeper, hence older, glacial deposits. Additional trenching for the North Chemical Building is unnecessary because the cracks in the diamict deposit exposed in the North Trench have a variety of orientations, appear to be filled with uniformly compacted fine sand or fluidized silt and sand, and show continuity of glacially scoured upland ridges and lack of LiDAR scarps along a projection of the SWIF through the North Chemical Building location (Figure F-1).

The ECI report implies that active faults could be present anywhere on the site if active faults are found in trenches located near specific buildings that are not along the projection of a geologic lineament. Figure F-1 shows locations of glacially scoured upland ridge lines created by the Vashon ice sheet more than approximately 16,500 years ago. The USGS Beef Barley and French Onion trench locations were selected because of the position of Lineament 4 supplemented by ground-based observations. The absence of LiDAR scarps, aeromagnetic lineaments, and the consistency of glacially scoured upland ridges is consistent with our interpretation of the geologic features exposed in the chemical building seismic trenches that no active faults exist under or pass through the foundation of either chemical building.

Page 7, Paragraph 22:

The ECI report states that observations discussed in their report, "especially those made in the chemical building trenches, illustrate the uncertainty that is present with respect to ground rupture hazard to the plant facility." The ECI report contains no discussion of the unfaulted and undeformed glacial deposits exposed in South Trenches 1a and 1b over any conceivable projection of deformation features exposed in deeper glacial deposits which proves that no active faults are present at the South Chemical Building. Similarly, the ECI report contains no discussion of the continuity of glacially scoured upland ridges along the projection of the SWIF south of Lineament 4, or the lack of LiDAR scarps that project though the plant site south of Lineament 4, as can be seen on Figure F-1.

The ECI report contains a quotation from the DSEIS regarding the "prudence" of assuming that surface-fault hazards might exist on the site between Lineaments 4 and X. This assumption was made for worst-case-scenario analysis only, and was not the interpretation of the actual site condition by King County or its consultants. It was postulated in order to assess the effects of a highly unlikely seismic event. Our interpretation of all information supports a conclusion that active faults are absent from the site where treatment facilities are planned. Figure F-1 is part of that body of information which indicates lack of LiDAR scarps projecting onto the site and continuity of glacially scoured upland ridges.

The ECI report contains a quotation from the DEIS regarding the amount of displacement on any features meeting the definition of an active fault south of Lineament 4 being smaller than displacements on Lineament 4 associated with past earthquakes. The last sentence of this paragraph in the ECI report is misleading and false. ECI's report states "without further trench exploration, vertical ground deformation of six feet or more cannot be ruled out anywhere on the Route 9 site, according to the DSEIS." The postulated hypothetical deformation on an assumed fault for the worst-case scenario evaluation is less than that observed on Lineament 4. The oldest earthquake on Lineament 4 produced 3.3 to 6.5 feet of displacement, possibly more. However, the most recent earthquake on Lineament 4 produced less than 3 feet of deformation. It is clear from the continuity of glacially scoured upland ridges and the absence of LiDAR scarps projecting onto the site that no features of a scale similar to Lineament 4 project through or are present on the site south of Lineament 4.

Page 7, Paragraph 23:

The ECI report states that the plant is designed to withstand seismic shaking only and not fault rupture. All geologic information collected to date, including observations made in the seismic trenches near the chemical building locations, consistently indicated that no active faults are present on the site south of Lineament 4. ECI's report notes (page 4, paragraph 10) that their inferred "fault A" would miss proposed buildings. Their inferred "fault B" is required to have a unique strike-slip displacement on a sloping buried surface of $N \geq 100$ in order to have no elevation change across its projection in the center of the plant site. Our findings consistently support a conclusion that no active faults are present on the plant site south of Lineament 4.

Page 8, Paragraph 24:

The ECI report states that "Additional evidence is currently being sought by the USGS…" implying that they are conducting surveys on or adjacent to the Brightwater site. King County and its consultants are aware that the USGS is continuing its seismic hazard research on the SWIF and other geologic features in the Puget Sound region, but are unaware of any USGS-led research activities specifically at the Brightwater site. Neither King County nor its consultants are aware of any USGS plans to obtain additional seismic information at the Brightwater site.

Page 8, Paragraph 25:

This paragraph in the ECI report consists of ten bullet items. Our responses presented below pertain to each bullet item identified with by sub-letters.

Paragraph 25a:

The ECI report states that the site lies within the SWIF zone. The boundaries of the SWIF have not been clearly defined. The USGS diagrams shown on Figure F-1 imply that the SWIF zone is at least as far southwest as Woodinville and as far northeast as a point southwest of Maltby (note that the location of Maltby on the upper diagram on Figure F-1 is incorrect).

Paragraph 25b:

The ECI report contains a misleading statement regarding a functional definition of an active fault. The SEIS was prepared with recognition that post-glacial, pre-Holocene deposits would not be present over much of the site. For this reason, the SEIS definition of an active fault was one that displaced glacial deposits. The definition of an active fault was not intended to be ‘displacement within the last 15,000 years’. The 2003 IBC definition is the one that controls design of the Brightwater facilities.

Paragraph 25c:

The ECI report states that it is important to determine ages by radiocarbon dating and the origin of deformation in glacial sediments. We disagree that it is critical to determine ages of glacial deposits by radiocarbon analyses because the ages of advance and retreat of the Puget Lobe of the Cordilleran Ice Sheet are sufficiently well constrained (Porter and Swanson, 1998) that additional dates are unnecessary. All glacial, subglacial, and outwash deposits in the Puget Sound region are older than Holocene. Radiocarbon dates of post-glacial deposits would be needed so that pre-Holocene deposits could be distinguished from Holocene deposits.

We agree in part with ECI’s statement that it is critical to determine the origin of deformation in glacial sediments. In situations where the deformed glacial deposits are overlain by undeformed glacial deposits, the age of the deformation is approximately as old as the glacial deposits themselves; therefore, the deformation is not active by a Holocene definition and determining the cause of the deformation is not critical. We believe that geologic reasoning should be used to evaluate the significance of glacial-deposit deformation in situations where deformed glacial deposits are not overlain by undeformed glacial deposits. In the case of the Brightwater site, active faults of significance will be associated with the northwest-trending SWIF and also have a northwest trend. Glacially scoured upland ridges to the east and west of the site appear to be continuous and undeformed south of Lineament 4. Therefore, we do not expect active faults to be present on the site in the area of proposed treatment facilities. Our interpretation of the geology exposed in the seismic trenches is consistent with the continuous character of the glacially scoured upland ridges in positions where northwest-trending active fault traces would project.

Paragraph 25d:

The ECI report states that faulting is suggested by elevation of the contact between Vashon glacial sediments and recessional post-glacial sediments. Figure 2 in ECI's report shows elevation contours drawn on borings with two types of data: 1) geologic contact data and 2) SPT N-value data. Within the main plant site (excluding the North Mitigation Area), 6 borings have elevations in red indicating that they were based on geologic contact notation, whereas 29 borings have elevations in blue indicating that they were based on N-values. Variability in N-values can be caused by a variety of factors and we believe that it is not a reliable indicator of the contact between glacial deposits that have been overridden by ice and glacial outwash sediments deposited as the ice was melting. Further variability and bias may have been introduced because interpretations of the top of glacially over-consolidated material generally were based on samples obtained at 5 foot intervals (with the exception of PB-12, which had a continuous core below a depth of 20 feet), introducing an error in the interpreted elevation of the contact by ±5 feet at each location.

Extensive experience with glacial sediments in the Puget Lowland indicates that irregularities in the top of overridden glacial deposits are common. Till thickness varies significantly over short distances; Troost et al. (2005) indicate that the thickness of the Vashon till unit typically varies from 1 m to 10 m. Troost et al. (2005) also indicate that the thickness of the Vashon recessional outwash deposit unit varies from about 1 m to 6 m, typically in channels. We disagree with ECI's conclusion that comparison of elevations on a complex surface can suggest the presence of faulting at the site.

Trenches excavated in the summer of 2006 near the chemical buildings exposed glacial, subglacial, and outwash deposits that demonstrate the chaotic distribution of sediments deposited in the glacial environment. ECI's inferred "fault A" and inferred "fault B" do not project through the chemical building seismic trenches. Our interpretation of the contours shown on ECI's Figure 2 does not suggest faulting in general, and we disagree with the northwest orientations of the two projections inferred by ECI.

Paragraph 25e:

The ECI report states that faulting is suggested by differences in sediment types in boreholes. We disagree with ECI's conclusion for the reasons described above for Paragraph 25d.

Paragraph 25f:

The ECI report refers to the Draft SEIS for a statement that it is possible for active faults to exist on the site without proof to the contrary and the amount of ground deformation probably would be less than that exposed in the USGS Beef Barley trench. Again, this assumption was done for worst-case scenario analysis only. Continuity of glacially scoured upland ridges and lack of scarps in LiDAR images that might project onto the site strongly support our conclusion that active faults do not exist on the site south of Lineament 4.

Paragraph 25g:

The ECI report states that a fold in sediments exposed in the USGS Beef Barley trench had an amplitude of about 6 feet; therefore, the Draft SEIS indicates that as much as 6 feet of deformation could occur anywhere under the plant site. We agree that the deformation exposed in the USGS Beef Barley trench was a monoclinal fold. We refer to ECI's statement in Paragraph 25f that the amount of ground deformation probably would be less than that exposed in the USGS Beef Barley trench. The DEIS does not state that there could be as much as 6 feet of deformation anywhere under the proposed plant. The worst-case scenario analysis which is contained in the DEIS says that IF an undetected lineament of the SWIF were to rupture beneath the site most of the untreated effluent and chemicals would be contained within the site. Examining extreme events well beyond what we know could occur is common practice in engineering as a method of bounding problems. King County conducted a reasonable, good faith exercise in examining a scenario they thought could not happen, but would represent the outside limits of potential environmental impacts. It is improper to interpret putting an outside limit on the problem as admission of the real potential for ground rupture beneath the treatment plant facilities.

Paragraph 25h:

The ECI report states that design for ground rupture must be based on precise locations of faults and other data that can be acquired only from trenching. King County and its consultants have excavated trenches at or near the two chemical buildings and exposed geologic conditions that are consistent with continuous undeformed glacially scoured upland ridges and absence of scarps in LiDAR data to the east and west of the site that would project onto the site south of Lineament 4. Therefore, no design for fault rupture is needed.

Paragraph 25i:

The ECI report states that faulted and deformed sediments of probably Vashon age or younger were exposed in the chemical building trenches. The ECI report does not state that deformed glacial sediments in Trenches South 1 and 1c and Trenches South 2a and

2b were overlain by undeformed glacial sediments, making the age of any deformation the same as the glacial sediments older than Holocene. Exposures in Trenches South 1a and 1b were undeformed. The USGS-interpreted “near vertical fault” exposed in Trenches South 1 and 1c was overlain by an undeformed glacial gravel deposit. Therefore, no deformation in the south trenches is active.

The glacial till exposed in the North Trench was cracked but not faulted. The cracks have variable orientations, consistent with Troost et al. (2005) description that the Vashon till is commonly fractured. The till in the North Trench was buried only by deposits of site grading fill, so post-glacial deposits of pre-Holocene age are absent at this location. Our judgment that no active faults are exposed in the North Trench is based on the high density of fracture filling material, the tension-opening mode of most cracks, the continuity of glacially scoured upland ridges, and the lack of scarps in LiDAR data that project into the site south of Lineament 4.

We discount the validity of ECI’s contour on the top of N≥100 in general, but point out that the contours on ECI’s Figure 2 do not support the possible presence of northwest-trending faults through either chemical building.

Paragraph 25j:

The ECI report states that the chemical building trenches are limited in extent and are not adequate for evaluating the risk of ground rupture to the remainder of the plant facilities. King County excavated seismic trenches near the chemical building to satisfy one of the requirements of the Development Agreement with Snohomish County. King County and its consultants believe that the available geologic data, including the chemical building trenches, consistently support a conclusion that no active faults project through the site south of Lineament 4. No further evaluation of ground rupture risk is warranted.

Page 9, Paragraph 26:

The ECI report states an opinion that active fault hazards at the plant site have not been characterized adequately. The ECI report further states that “mitigation against surface fault rupture that has been proposed is not based on any data between the Lineament 4 active fault and Lineament X…” Two parts of this statement are false: 1) geologic data collected between Lineament 4 and Lineament X have been used by King County and its consultants to conclude that no active faults are located through the plant site, and 2) no mitigation is warranted against a hazard that is not present. Data collected between the two lineaments consists of trench exposures and evaluation of the glacially scoured upland ridges to the east and west of the site; these data consistently demonstrate that active faults are absent from the plant site.

The ECI report refers to the worst-case scenario analysis discussion in the SEIS to argue that King County’s consultants believe that “it must be assumed that an active fault could exist anywhere through the plant, and that fault should be assumed to have the potential for a six-foot surface displacement." The geologic studies and considerations leading up to selecting the locations for Trenches 2a and 2b (USGS's Beef Barley and French Onion trenches) support an interpretation that Lineament 4 had features suggestive of an active fault and was worth investigating. The continuity of glacially scoured upland ridges (called glacial flutes by the USGS in Open-File Report 2004-1204, see Figure F-1) is a reasonable indication that traces of the SWIF do not project through the site south of Lineament 4. King County decided that, for purposes of the SEIS, it would 'assume that an active fault could exist on the site' because its consultants suggested that it might not be possible to PROVE CONCLUSIVELY that active faults were absent with a reasonable cost. In fact, the seismic trenches excavated during the summer of 2006 near the two chemical buildings demonstrate two points: 1) the glacial geology at the site is complex and includes deformation caused by glacial and subglacial processes, and 2) all information consistently supports the conclusion that traces of the SWIF do not project through the site south of Lineament 4. The amount of displacement assumed on the hypothetical faults postulated for worst-case scenario purposes was less than Lineament 4 because any faults as significant as Lineament 4 should have been detected by evaluation of LiDAR data and aeromagnetic lineaments.

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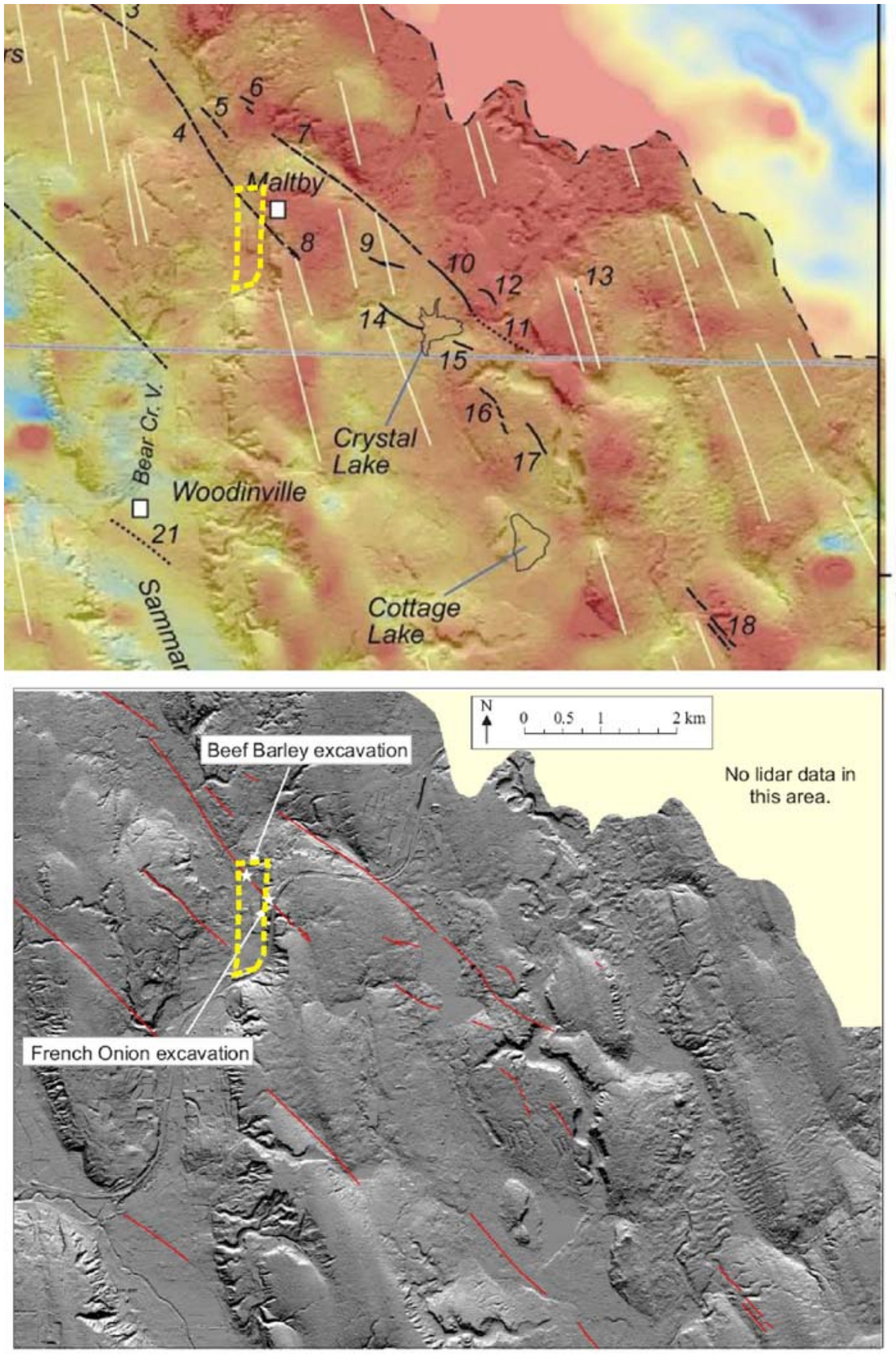

Lidar map showing the area around the excavations across the Southern Whidbey Island fault zone, with lineaments (dashed) and scarps (solid) shown by red lines and excavations shown by white stars.

Figure F-1. Upper diagram from Blakely et al. (2004): Colored aeromagnetic data draped on hillshade LiDAR image. Numbered black lines are scarps and lineaments. White lines show glacial flute directions. Lower diagram from Sherrod et al. (2005a): Hillshade LiDAR image showing locations of USGS Beef Barley and French Onion trenches. Red lines show scarps and lineaments. Approximate location of Brightwater site shown in yellow dashed line.