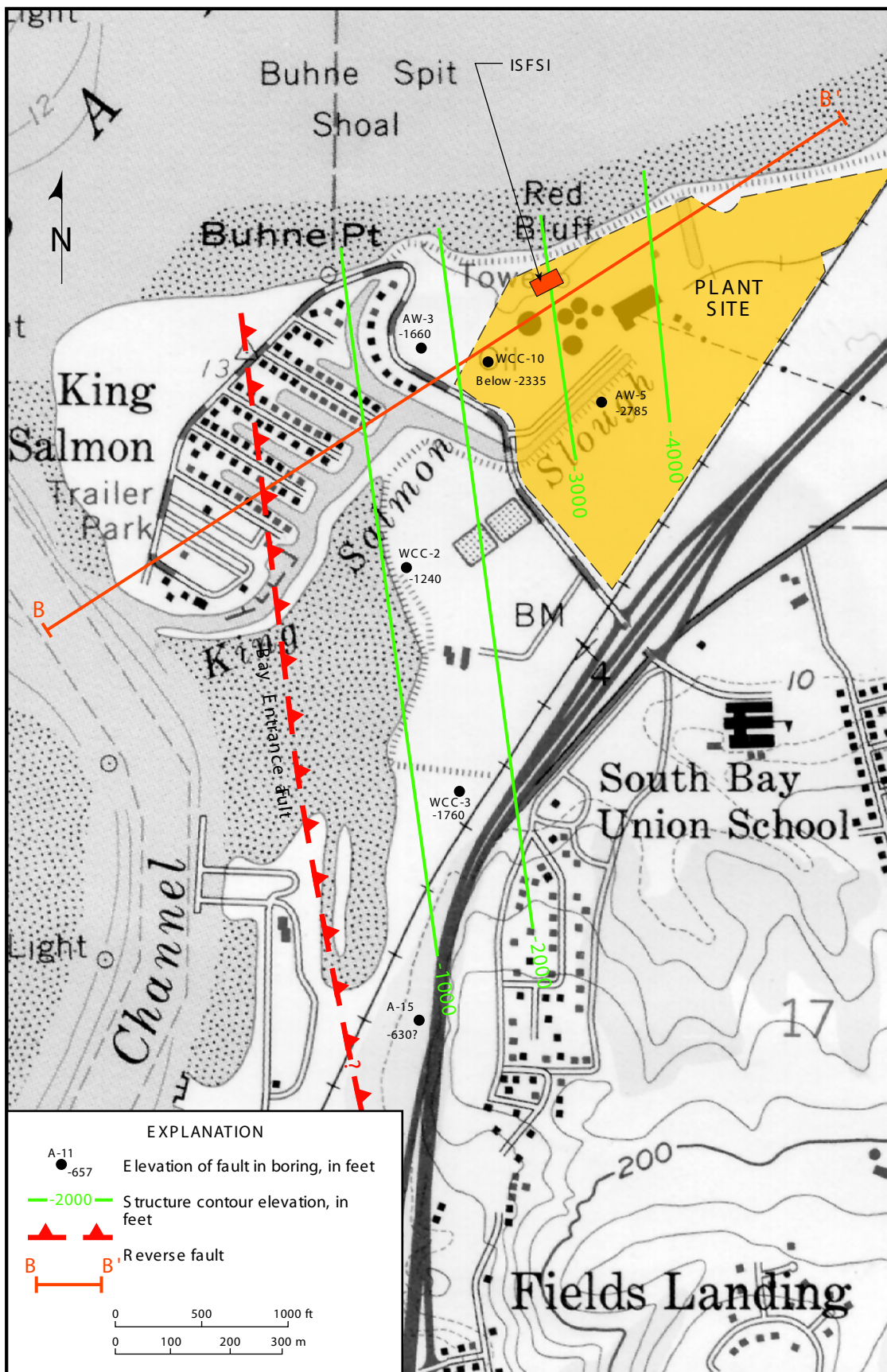




Cross section B-B' is shown on Figure 2.6-50.
(modified from Woodward-Clyde Consultants,
1980, Figure C-18).

FSAR UPDATE

HUMBOLDT BAY ISFSI

**FIGURE 2.6-47
STRUCTURE CONTOUR MAP OF
THE BAY ENTRANCE FAULT**

Revision 0 January 2006

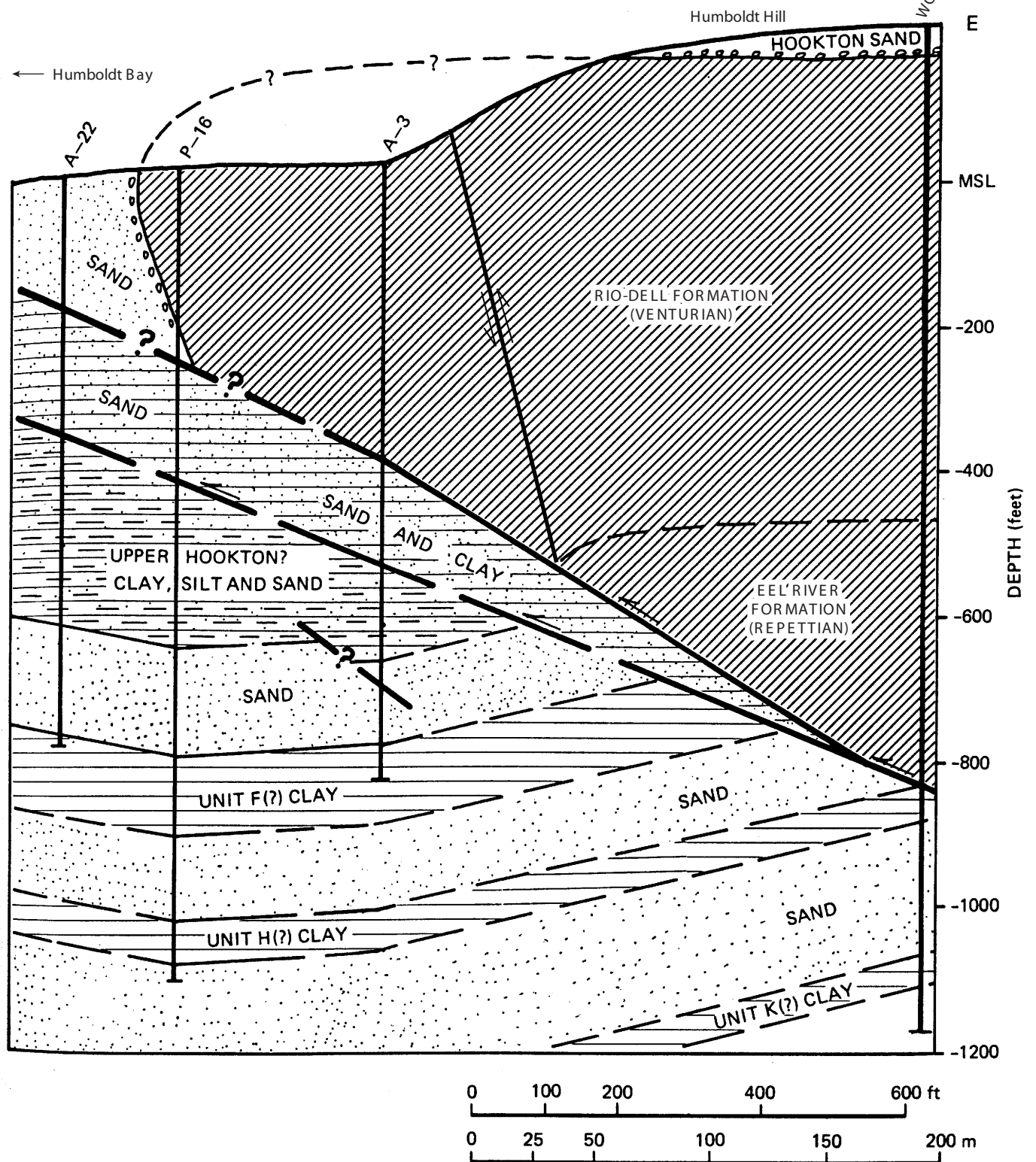


**FSAR UPDATE
HUMBOLDT BAY ISFSI
FIGURE 2.6-48**

Structure contour map of the Buhne Point fault (reinterpretation of data presented on Woodward-Clyde Consultants, 1980, Figure C-25). Cross section B-B' is shown on Figure 2.6-50.

A

A'

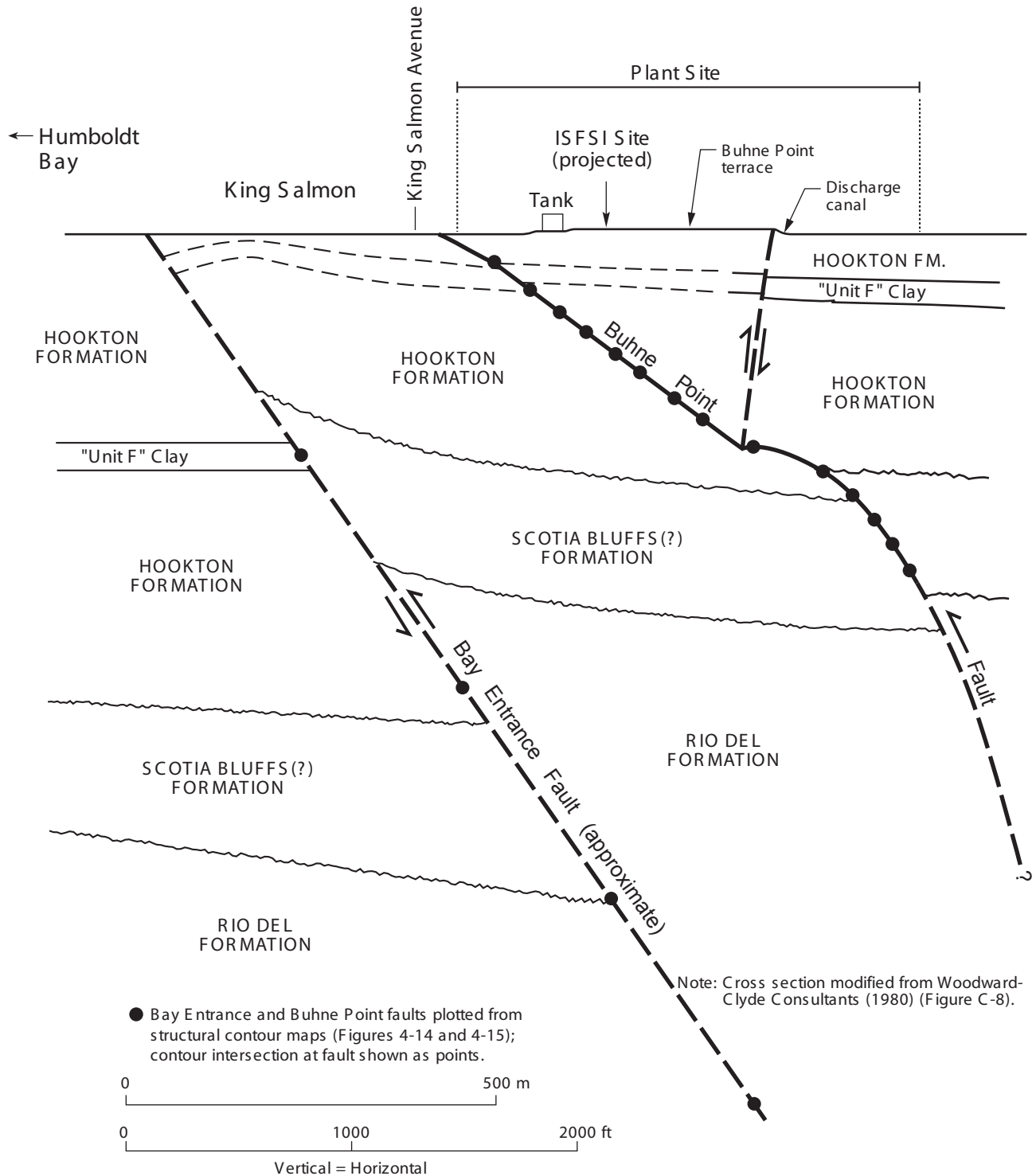


FSAR UPDATE
HUMBOLDT BAY ISFSI
FIGURE 2.6-49

□ Cross section A-A' across the Little Salmon fault zone at Humboldt Hill (modified from Woodward-Clyde Consultants, 1980, Figure C-15). Location of cross section A-A' is shown on Figures 2.6-30 and 2.6-46.

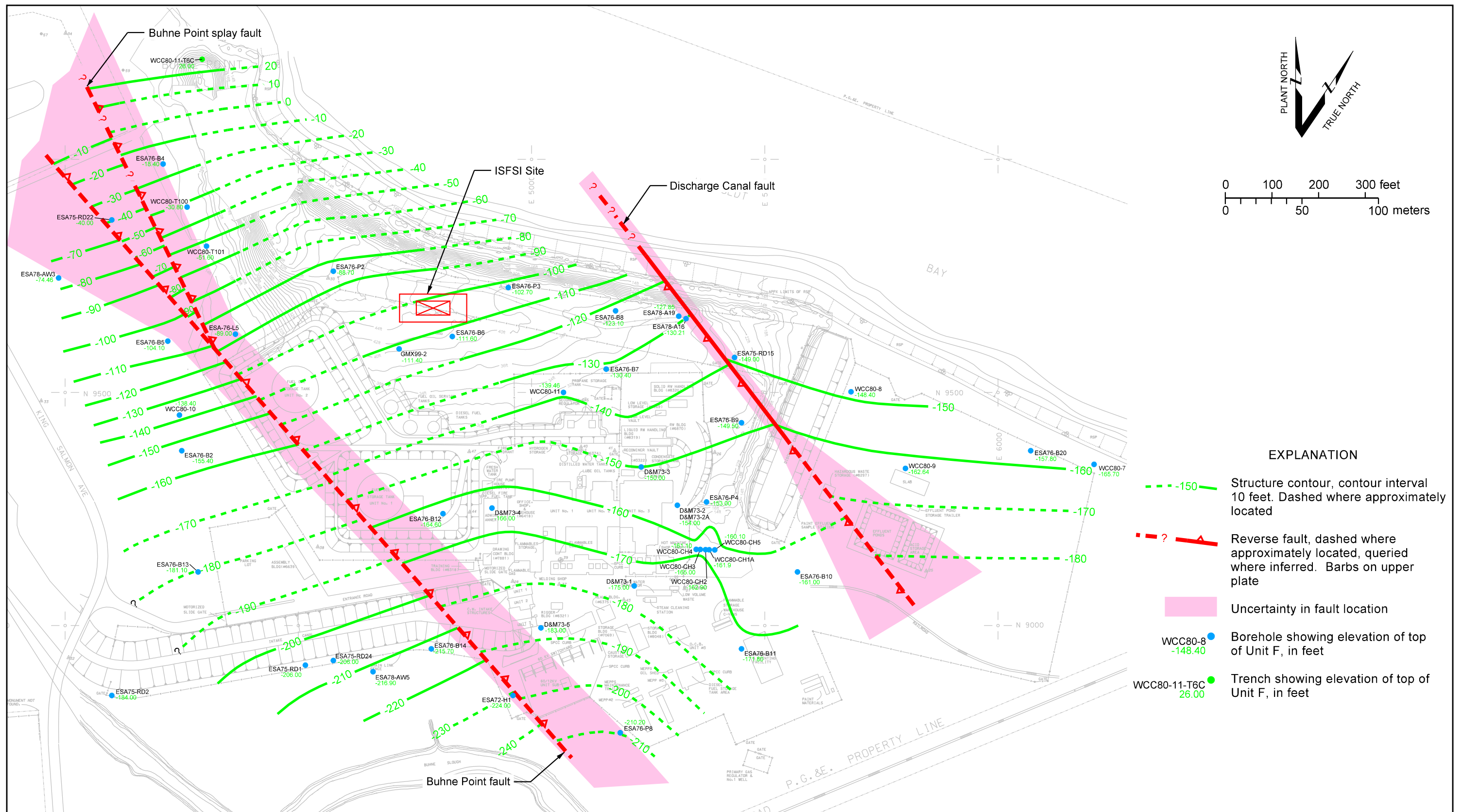
B

B'

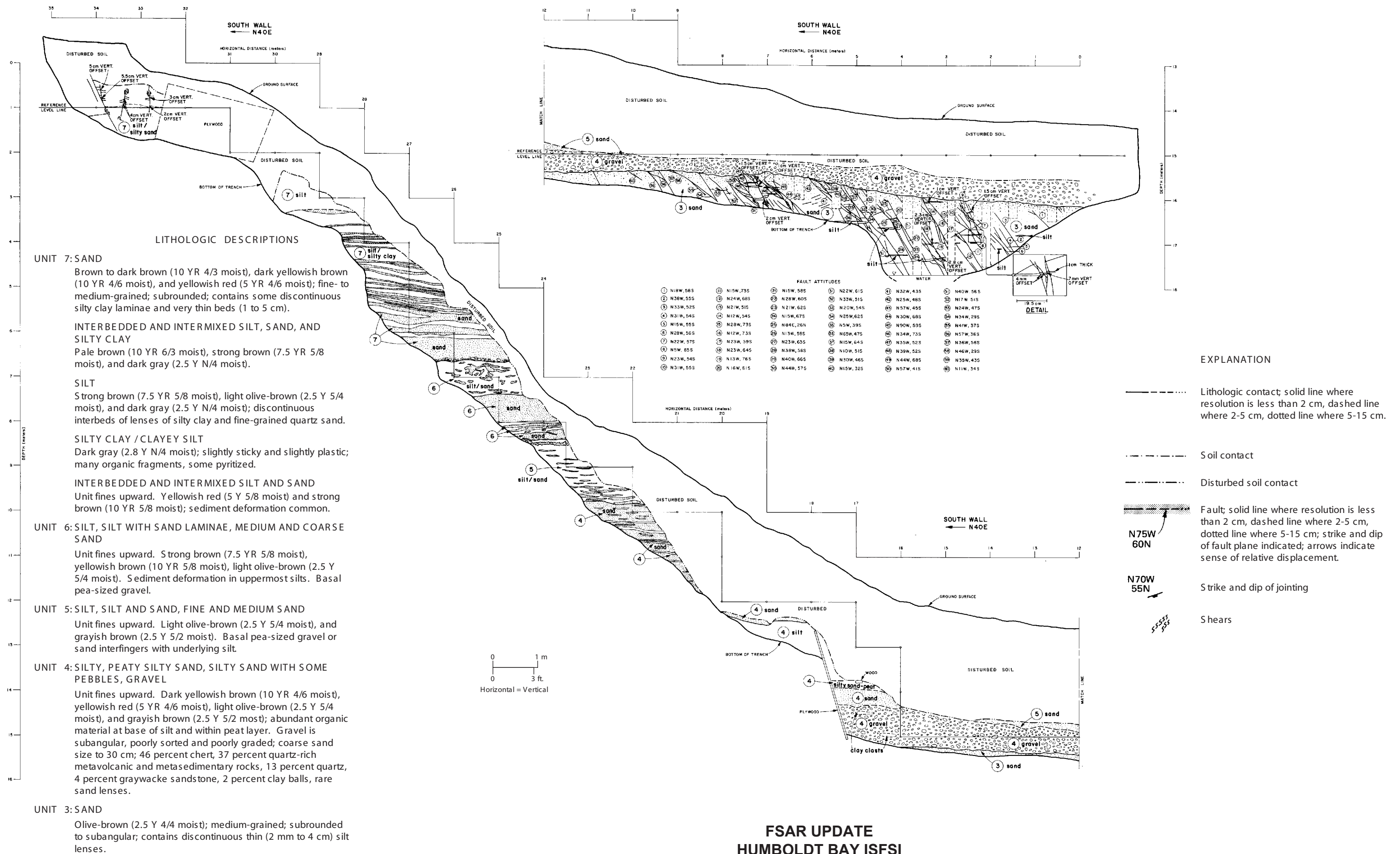


**FSAR UPDATE
HUMBOLDT BAY ISFSI'
FIGURE 2.6-50**

Cross section B-B' across the Bay Entrance and Buhne Point faults. Location of cross section is shown on Figures 2.6-30 and 2.6-47.

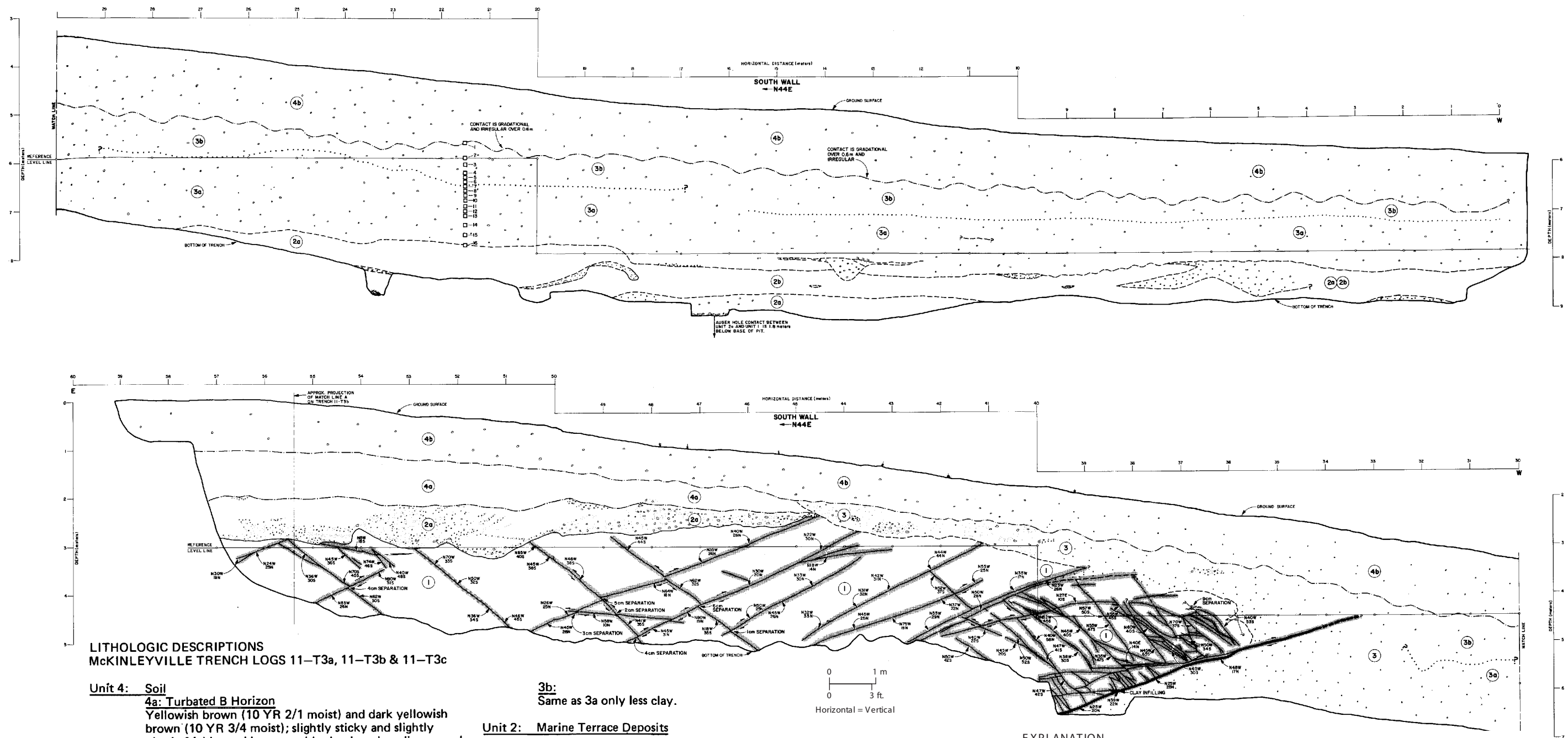


FSAR UPDATE
HUMBOLDT BAY ISFSI
FIGURE 2.6-51 STRUCTURE CONTOUR MAP OF TOP OF UNIT F

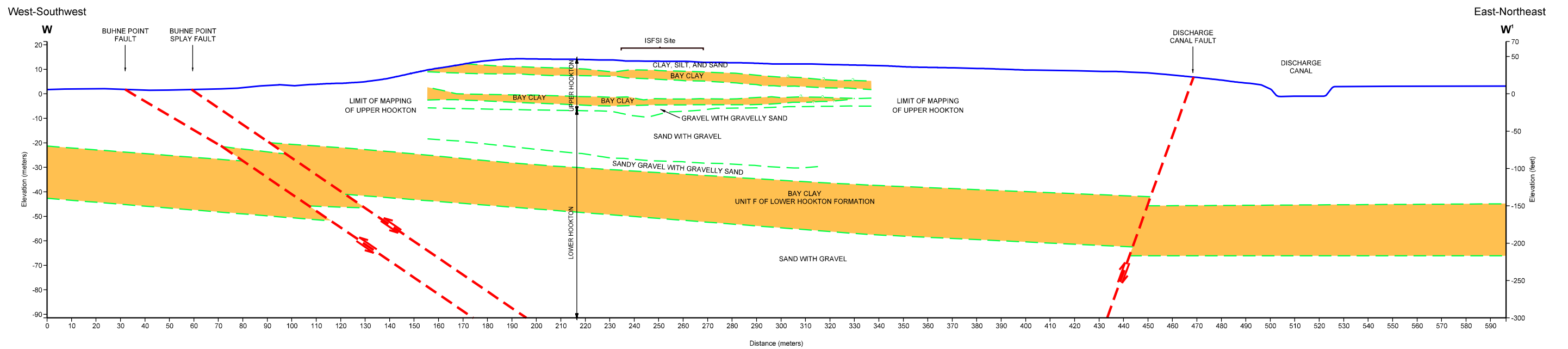


**FSAR UPDATE
HUMBOLDT BAY ISFSI
FIGURE 2.6-52**

Log of trench 11-T6b showing small faults of the Buhne Point fault in the lower Hookton Formation (from Woodward-Clyde Consultants, 1980, Figure C-35). Location of trench is shown on Figure 2.6-31.



FSAR UPDATE
HUMBOLDT BAY ISFSI
FIGURE 2.6-54
McKINLEYVILLE TRENCH (FROM
WOODWARD-CLYDE CONSULTANTS,
1980, FIGURE B-19a). LOCATION OF
TRENCH SHOWN ON FIGURE 2.6-13.



-  Fault, dashed where inferred, arrows show sense of displacement.
-  Lithologic contact, dashed where approximate, queried where inferred.

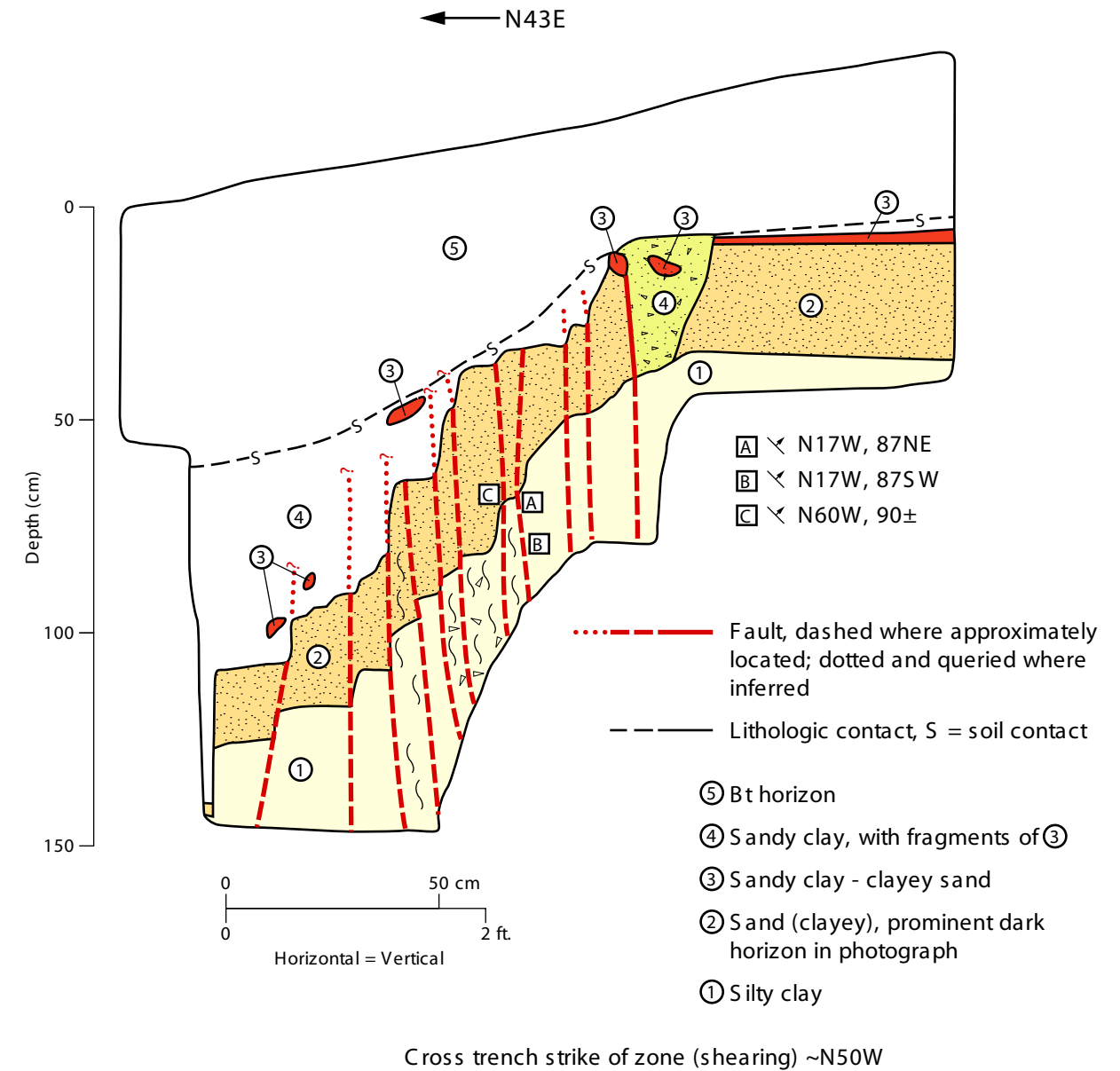
Note: Location of cross section is shown on Figure 2.6-31. Unit F location based on structure contour map (Figure 2.6-51). Stratigraphy above Unit F based on correlation of boreholes (ESA76-P2, GMX99-2, ESA76-6 through -8) and trenches. See Figure 2.6-31 for locations of boreholes.

FSAR UPDATE

HUMBOLDT BAY ISFSI

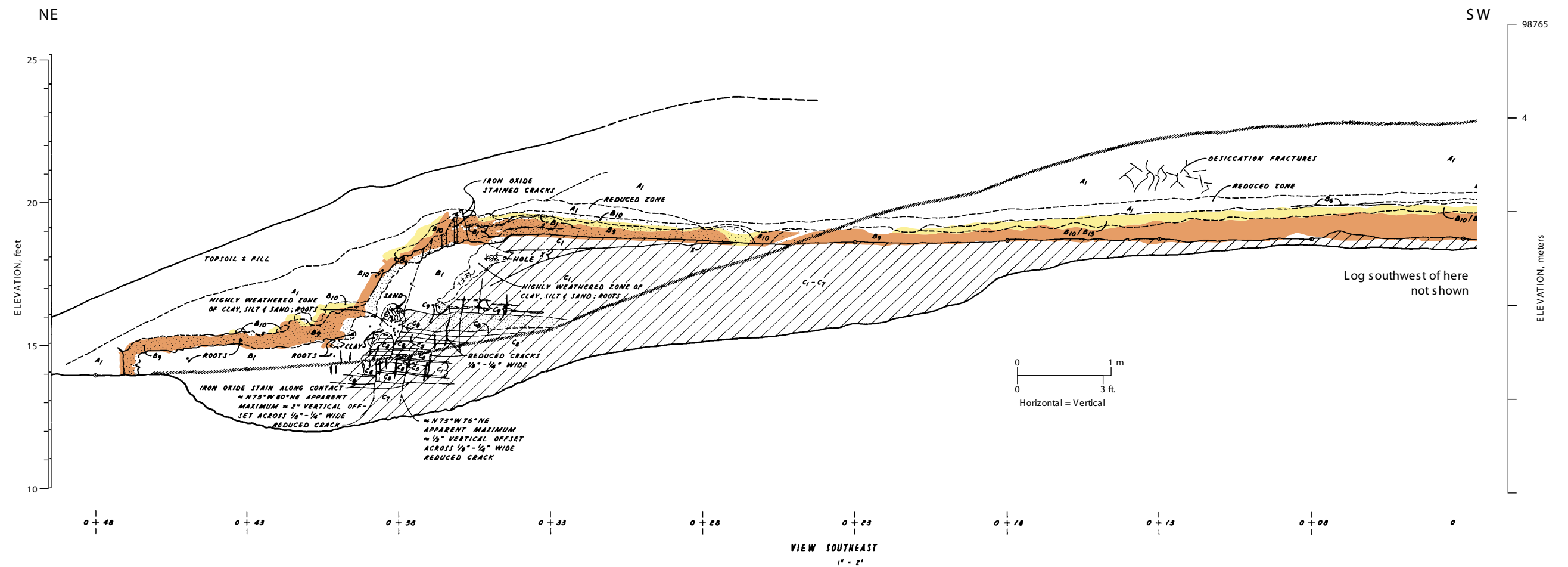
FIGURE 2.6-55
GEOLOGIC
CROSS SECTION W-W' ¹

Revision 0 January 2006



**FSAR UPDATE
HUMBOLDT BAY ISFSI
FIGURE 2.6-56**

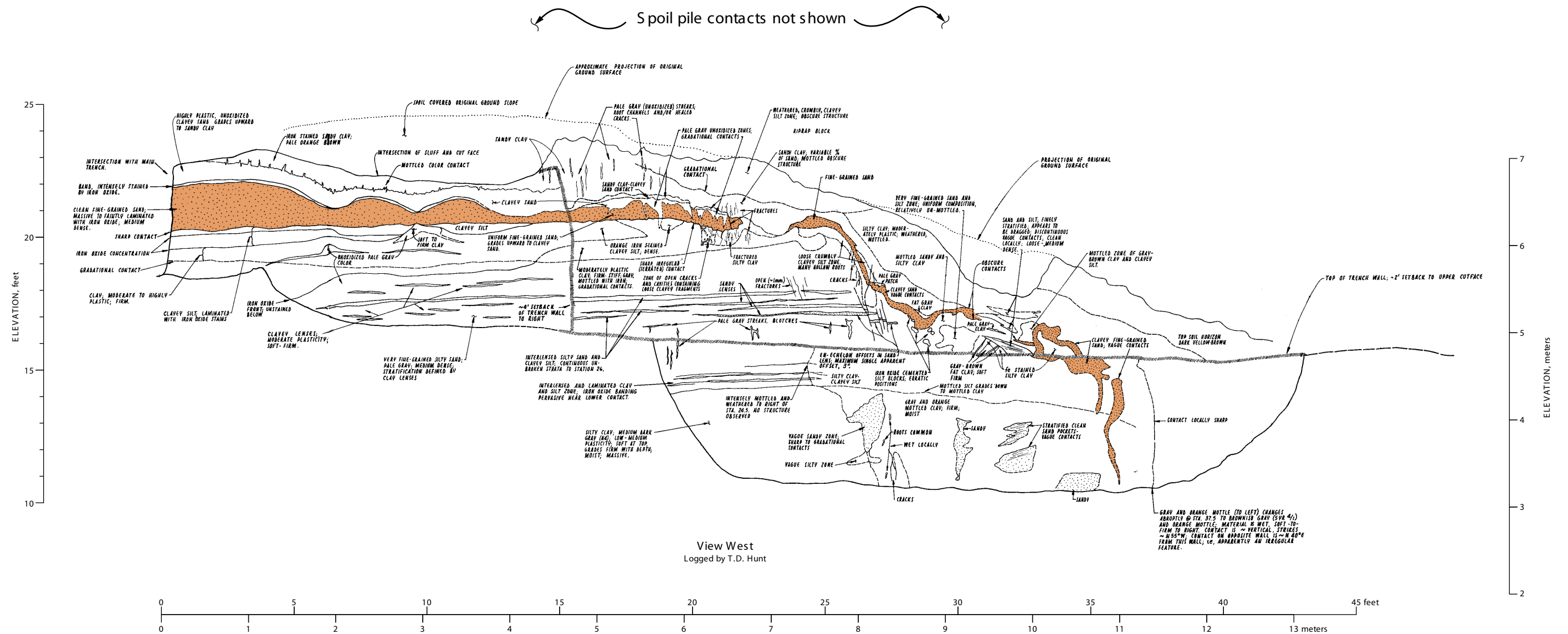
Exposure of Discharge Canal fault in sea cliff west of Discharge Canal. The vertical string line in the middle of the photograph is 100 cm long. (Photographs JW-3-23 and 24; taken on March 21, 2000). Location of exposure is shown as outcrop JW-7 on Figure 2.6-31.



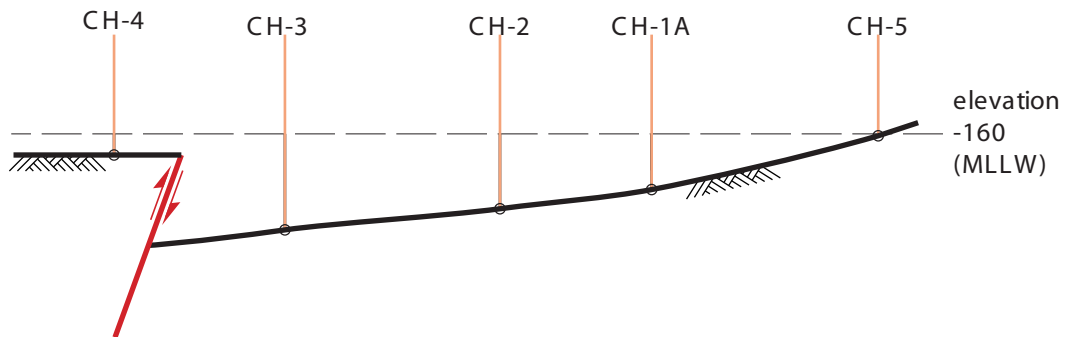
Log of northeastern part of trench BP-2 (from Earth Sciences Associates, 1977, Figure C37 [colors added for emphasis]). Station numbers are in feet. Location of trench is shown on Figure 2.6-31.

FSAR UPDATE
HUMBOLDT BAY ISFSI
FIGURE 2.6-57 LOG OF ESA (1977) TRENCH BP-2

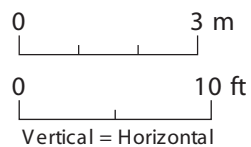
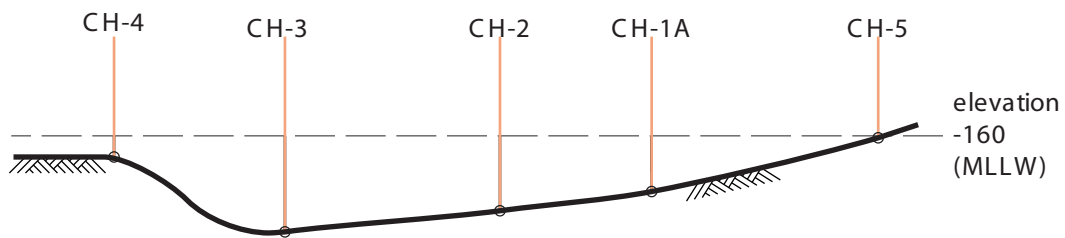
Revision 0 January 2006



(a) Fault



(b) Cut-and-Fill Channel



**FSAR UPDATE
HUMBOLDT BAY ISFSI
FIGURE 2.6-59**

Alternative interpretations of the irregularities in the top of the Unit F clay between boreholes WCC80-CH4 and WCC80-CH5. Locations of boreholes shown on Figure 2.6-31.



**FSAR UPDATE
HUMBOLDT BY ISFSI
FIGURE 2.6-60**

Trench GMX-T1, view east-southeast. View along trench with Humboldt Bay Power Plant in the background. Part of trench GMX-T2 is in the foreground. (Photograph FHS-00/8-1 #29 taken August 1, 2000.)



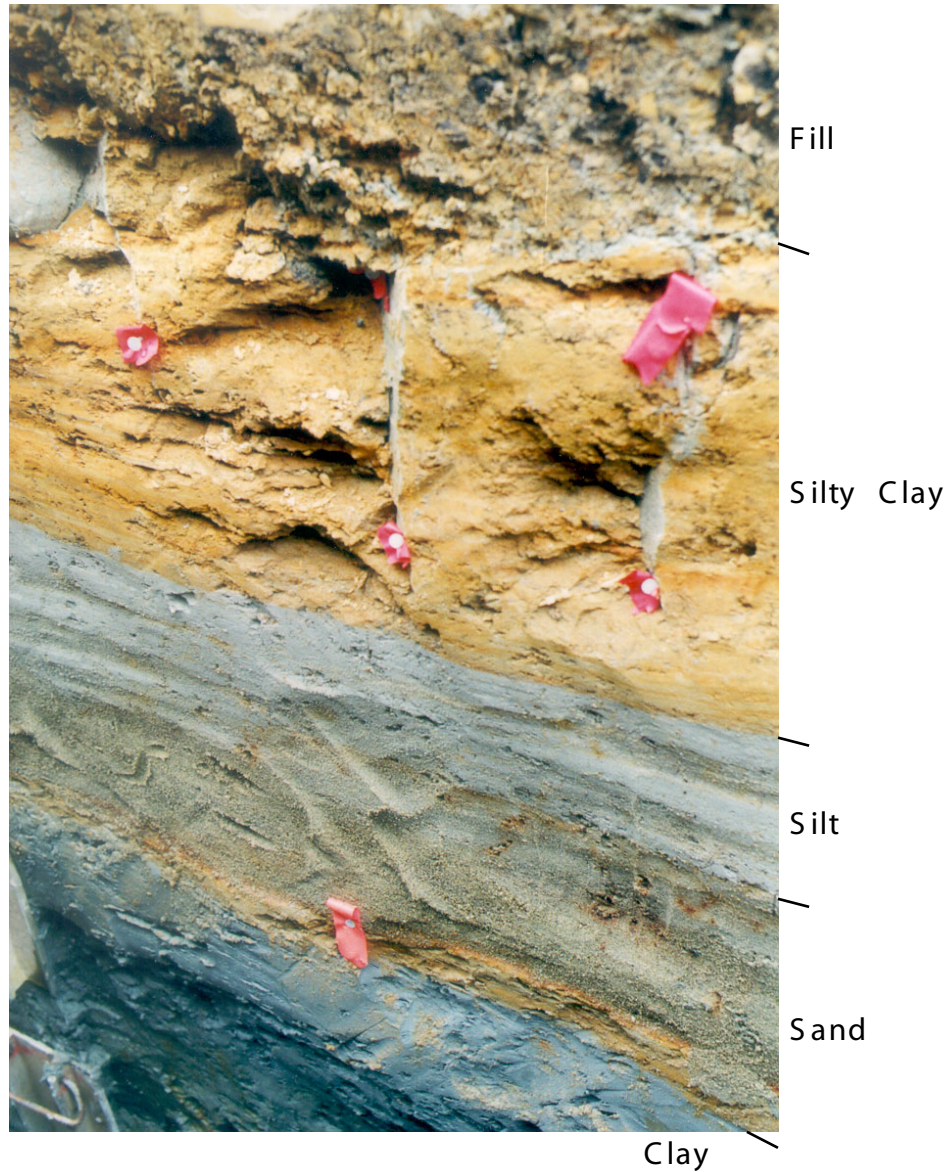
FSAR UPDATE
HUMBOLDT BAY ISFSI
FIGURE 2.6-61 SURVEYING GEOLOGIC CONTACTS IN TRENCH GMX-T2. VIEW IS TOWARD THE SOUTH. (PHOTOGRAPH FHS-00/7-4 #9 TAKEN AUGUST 1, 2000.)

Revision 0 January 2006



**SAFETY ANALYSIS REPORT
HUMBOLDT BAY ISFSI
FIGURE 2.6-62**

Artificial fill overlying sand and silt layers of the upper Hookton Formation in northwest wall of trench GMX-T2 between station 36 ft. and station 44 ft. (Photograph FHS-00/7-4 #19 taken August 1, 2000.)



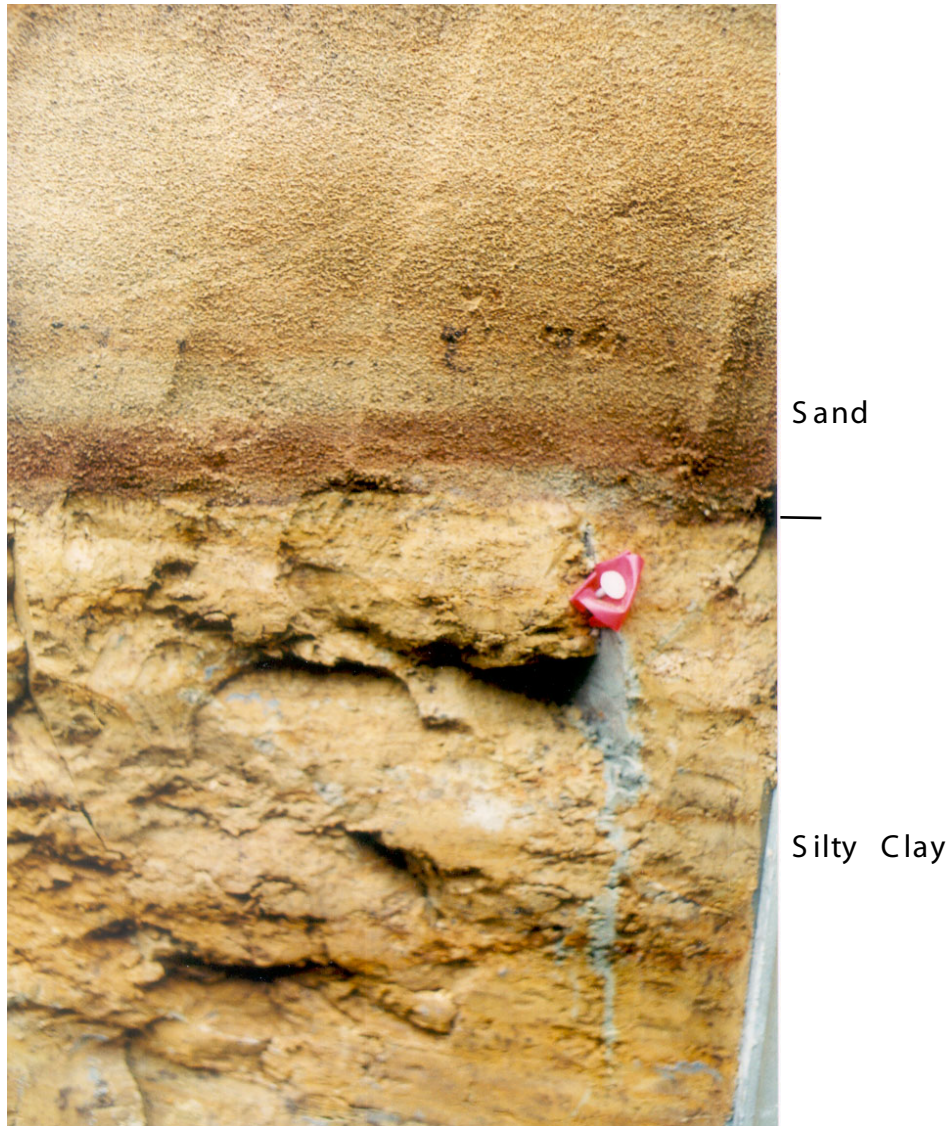
**FSAR UPDATE
HUMBOLDT BAY ISFSI
FIGURE 2.6-63**

Clay fractures in upper Hookton Formation in trench GMX-T2. Fractures are at station ~25 ft., depth ~5 ft. Note continuous bedding across fractures below where they have been bleached in the weathered silty clay. (Photograph FHS-00/8-3 #32 taken August 3, 2000.)



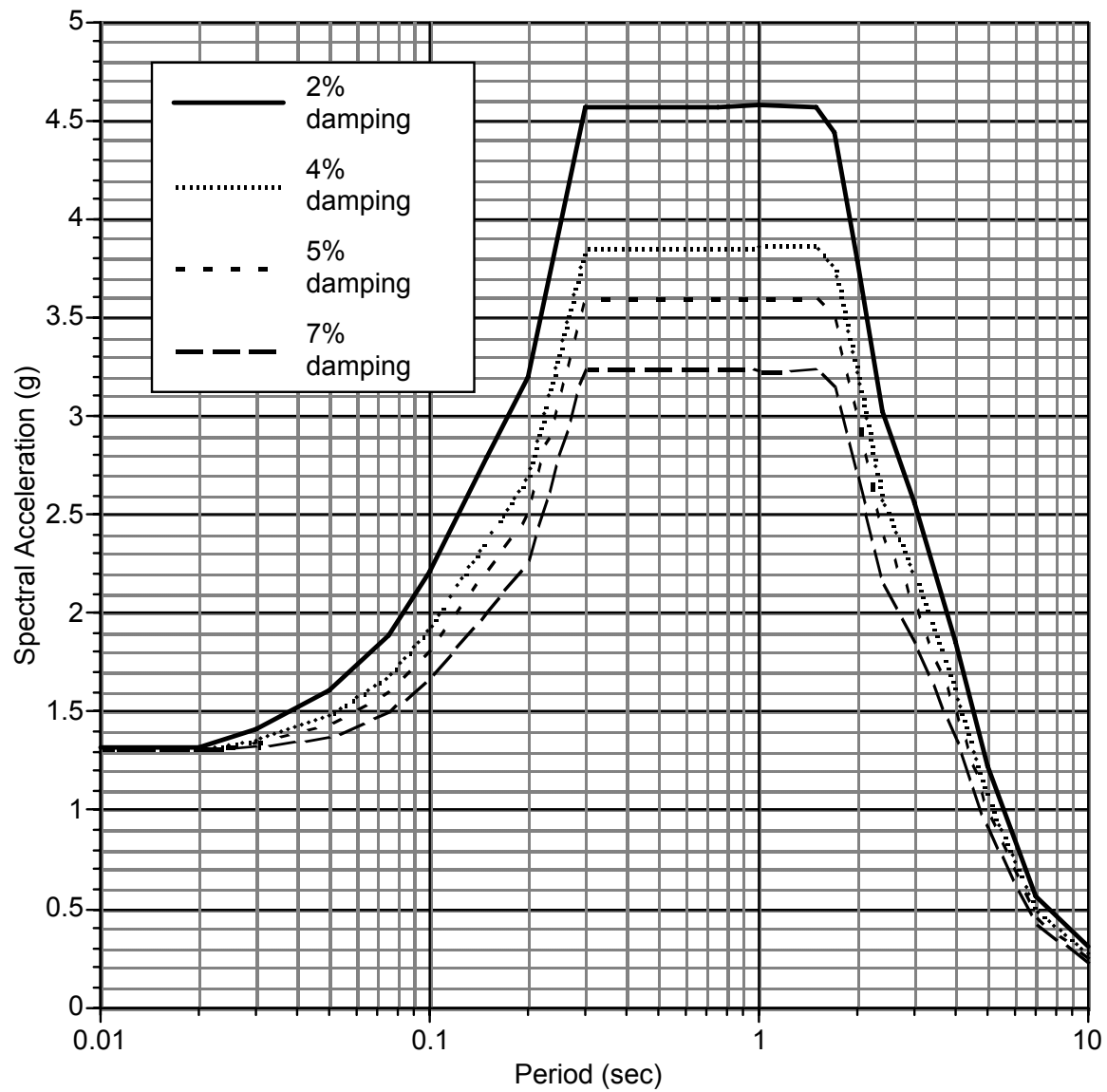
**FSAR UPDATE
HUMBOLDT BAY ISFSI
FIGURE 2.6-64**

Fracture lined with black compressed rootlets in clayey-silt bed in trench GMX-T2. Fracture is at station 40 ft., depth ~11 ft. (Photograph FHS-00/7-3 #21 taken August 3, 2000.)



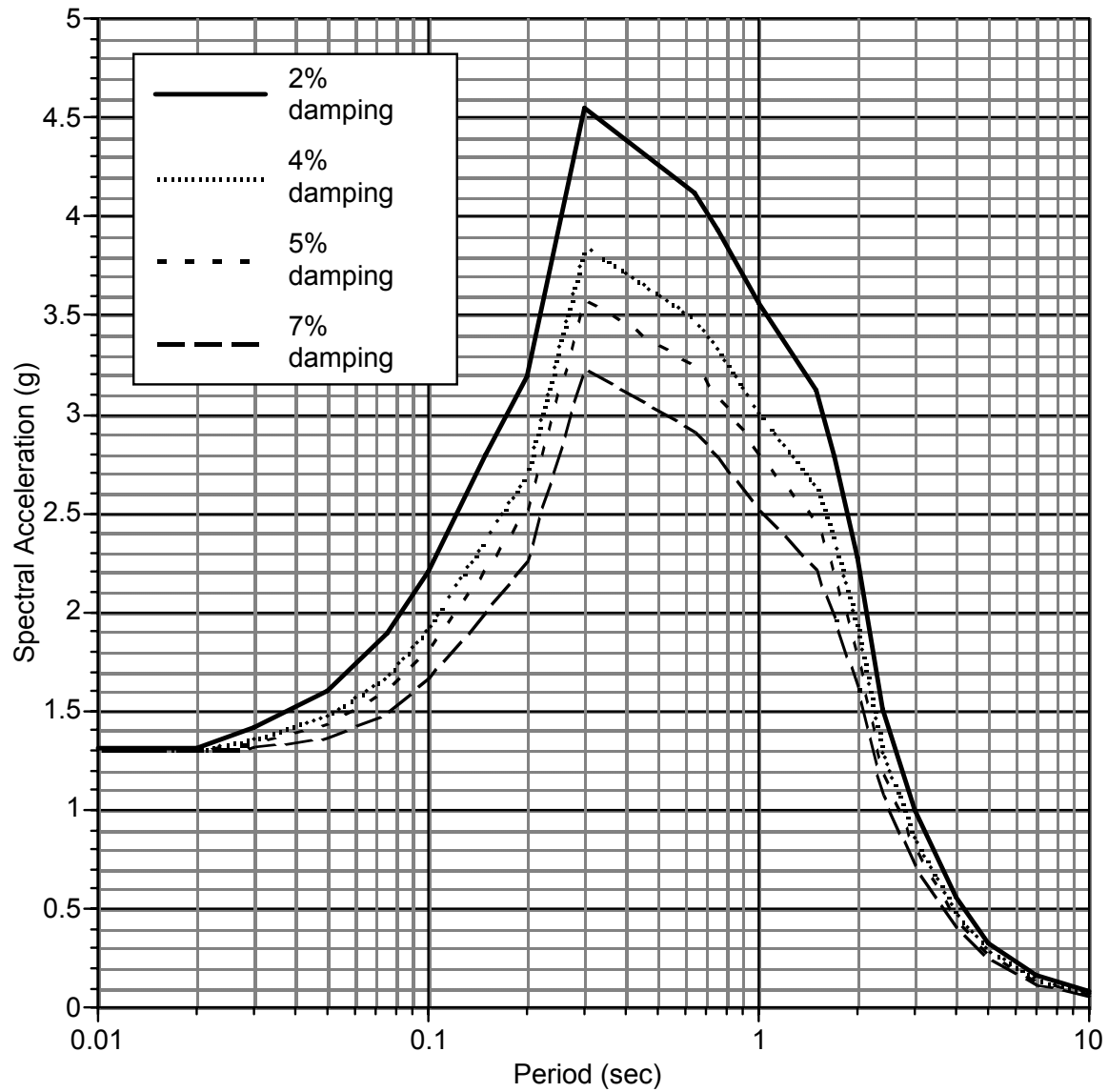
**FSAR UPDATE
HUMBOLDT BAY ISFSI
FIGURE 2.6-65**

**Continuous bedding across bleached fracture in silty clay in trench
GMX-T2. Fractures are at station 30 ft., depth ~4 ft. (Photograph
FHS-00/8-3 #26 taken August 3, 2000.)**



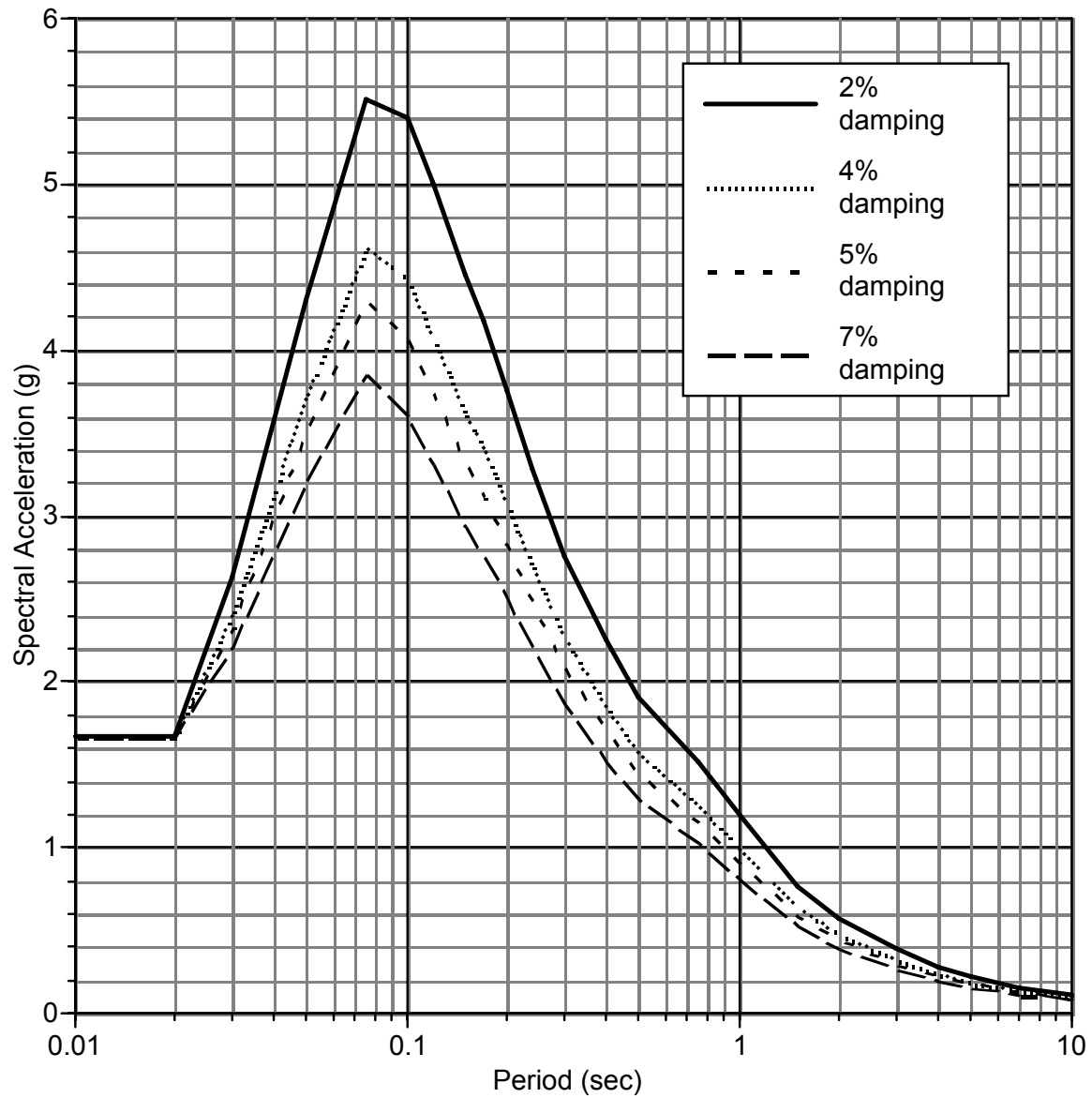
FSAR UPDATE
HUMBOLDT BAY ISFSI
FIGURE 2.6-66 FAULT NORMAL DESIGN SPECTRUM FOR DAMPING VALUES OF 2%, 4%, 5%, AND 7%

Revision 0 January 2006



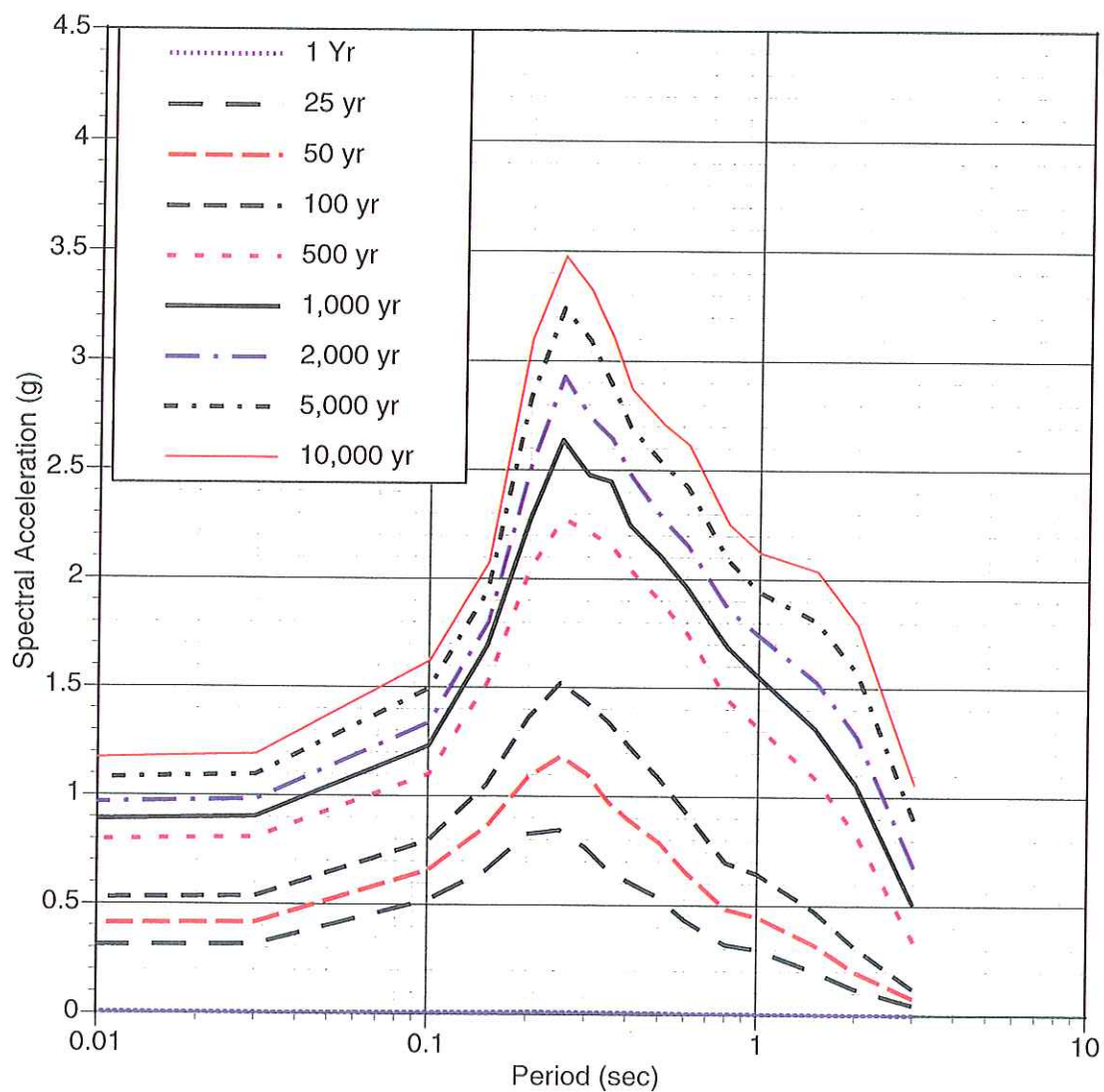
FSAR UPDATE
HUMBOLDT BAY ISFSI
FIGURE 2.6-67 FAULT PARALLEL DESIGN SPECTRUM FOR DAMPING VALUES OF 2%, 4%, 5%, AND 7%

Revision 0 January 2006



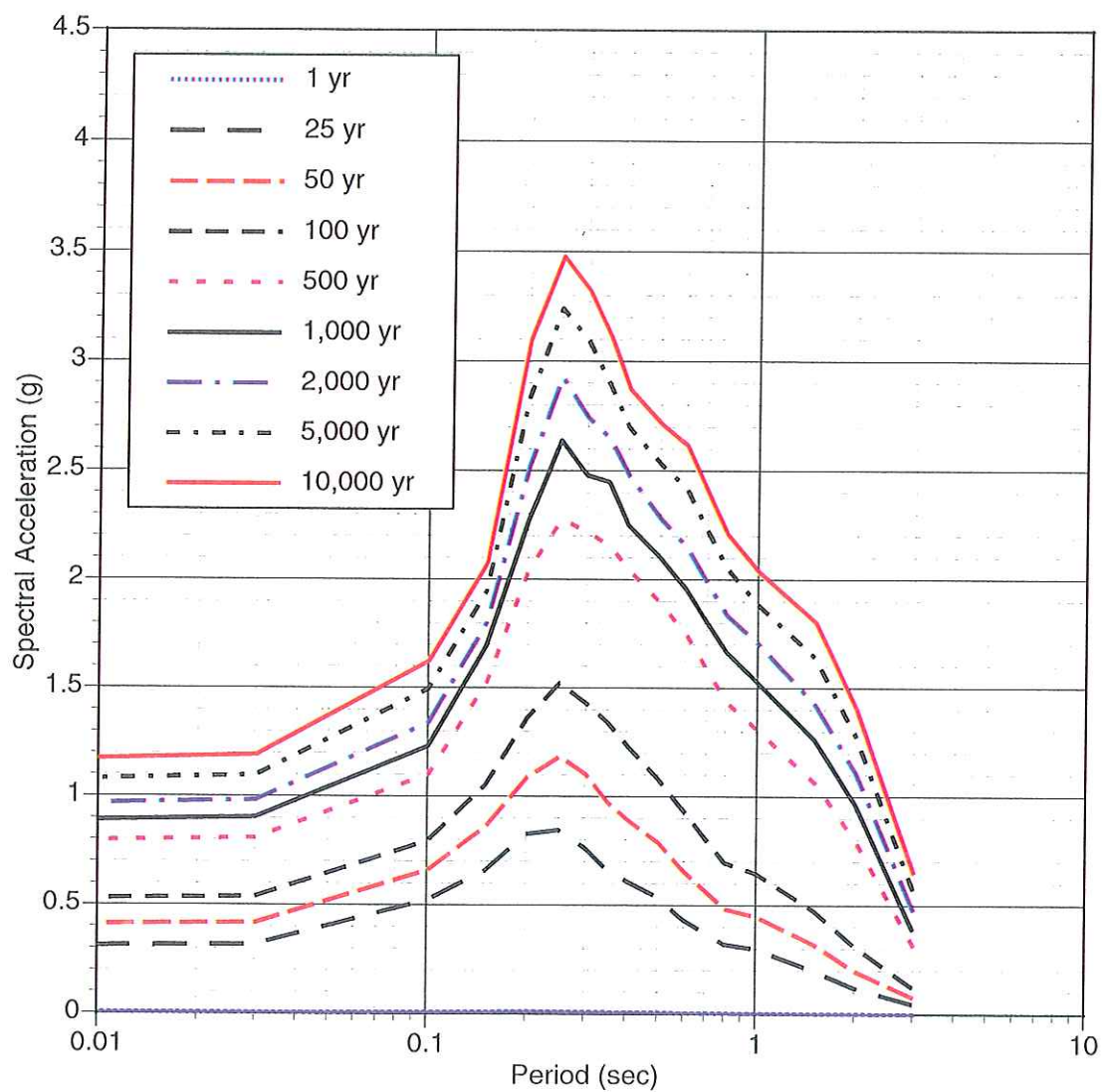
FSAR UPDATE
HUMBOLDT BAY ISFSI
FIGURE 2.6-68 VERTICAL SPECTRUM FOR DAMPING VALUES OF 2%, 4%, 5%, AND 7%

Revision 0 January 2006



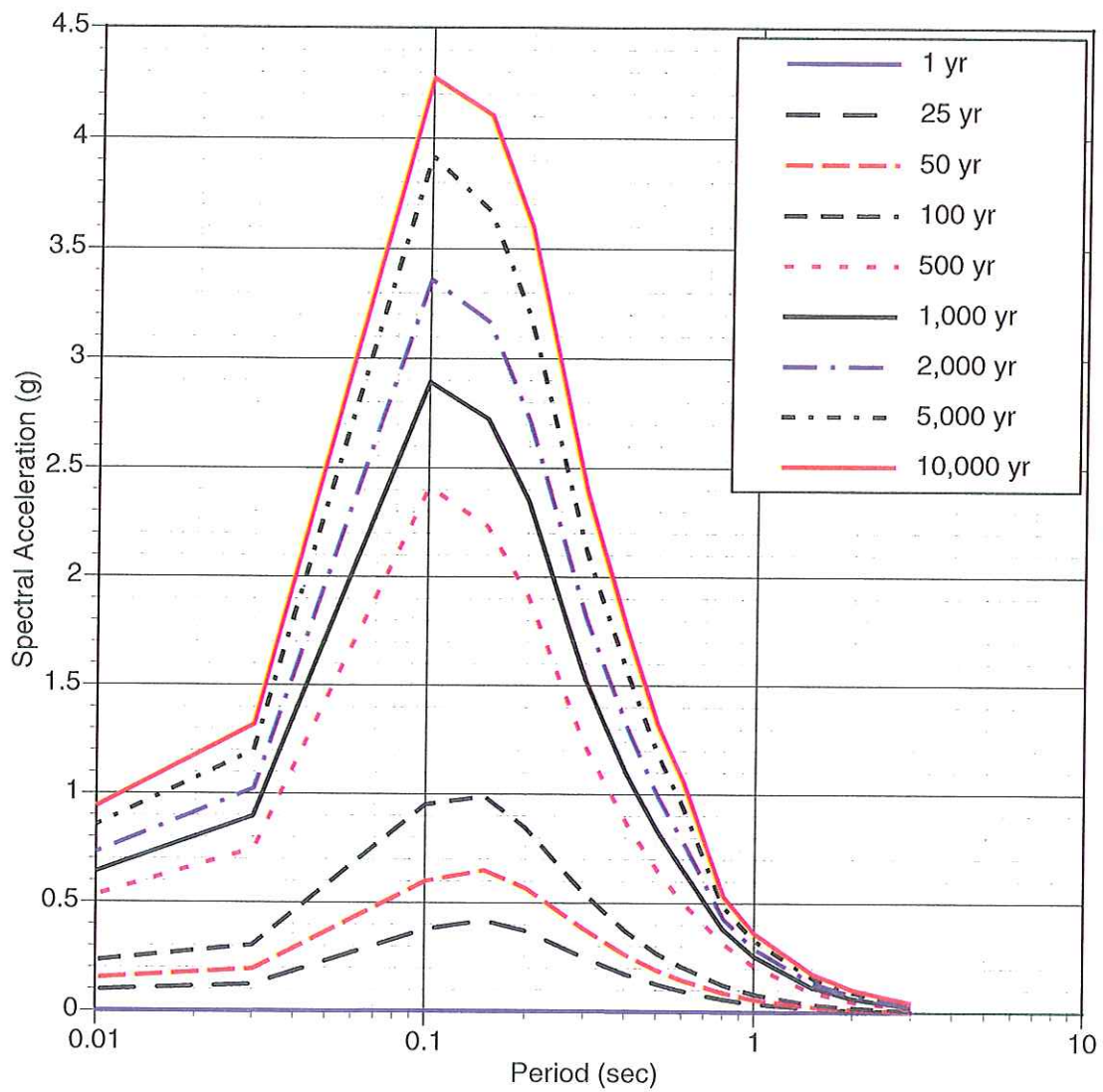
FSAR UPDATE
HUMBOLDT BAY ISFSI
FIGURE 2.6-69 EQUAL HAZARD SPECTRA FOR THE FN COMPONENT, SOIL SITE CONDITIONS

Revision 0 January 2006



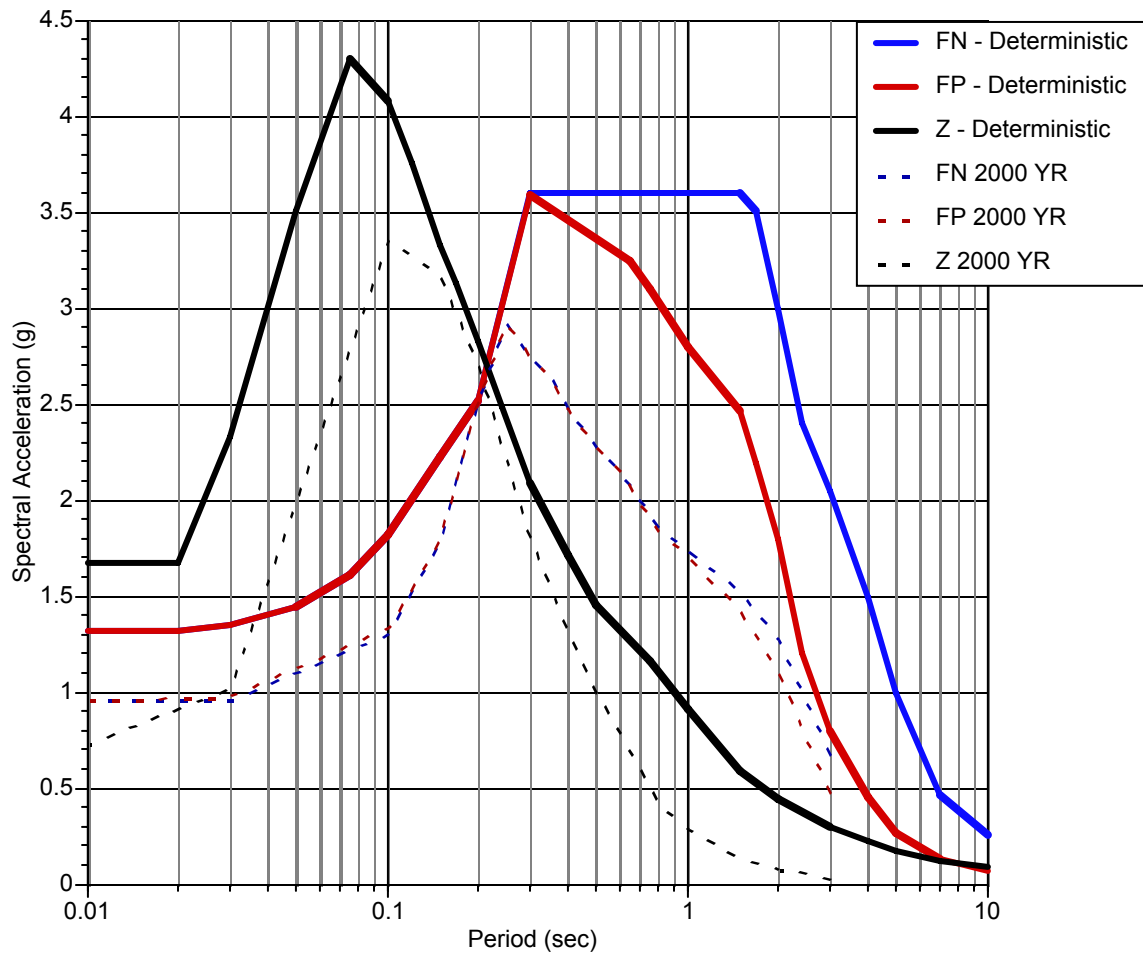
FSAR UPDATE
HUMBOLDT BAY ISFSI
FIGURE 2.6-70 EQUAL HAZARD SPECTRA FOR THE FP COMPONENT, SOIL SITE CONDITIONS

Revision 0 January 2006



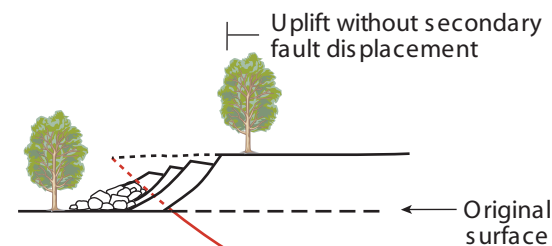
FSAR UPDATE
HUMBOLDT BAY ISFSI
FIGURE 2.6-71 EQUAL HAZARD SPECTRA FOR THE VERTICAL COMPONENTS FOR SOIL

Revision 0 January 2006

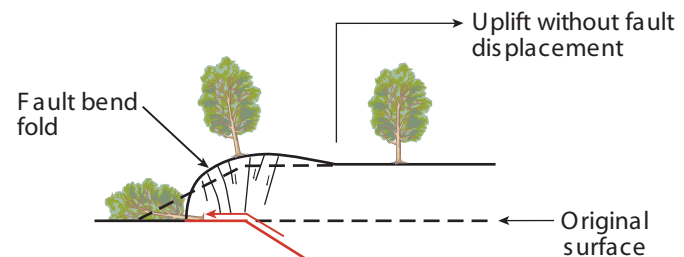


FSAR UPDATE
HUMBOLDT BAY ISFSI
FIGURE 2.6-72 COMPARISON OF DETERMINISTIC SPECTRA WITH 2000-YEAR PROBABILISTIC SPECTRA

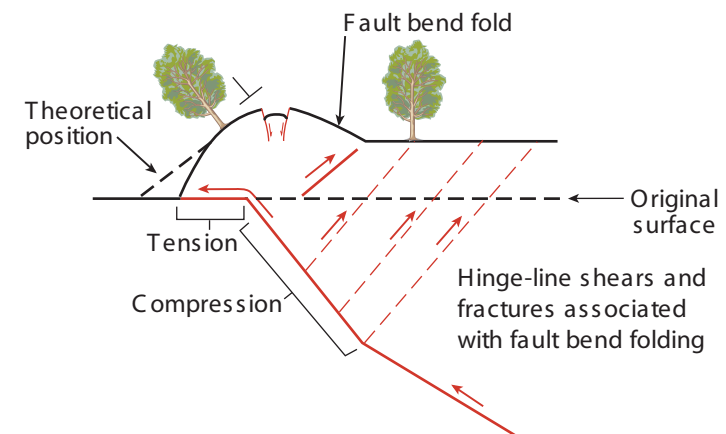
Revision 0 January 2006



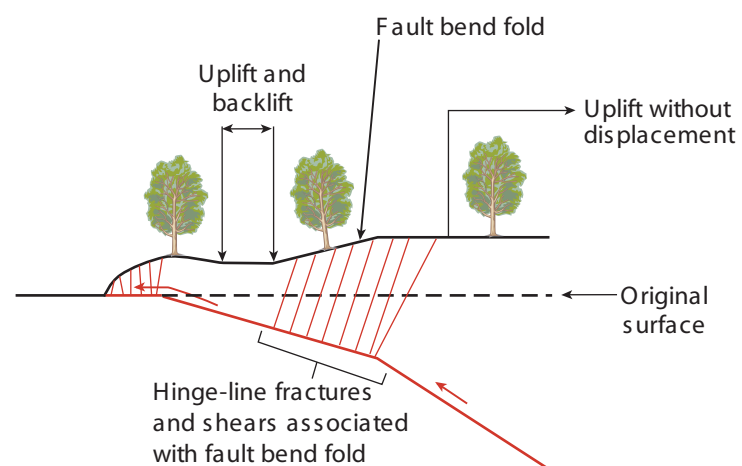
a) Collapsed fault scarp from reverse fault having constant dip.



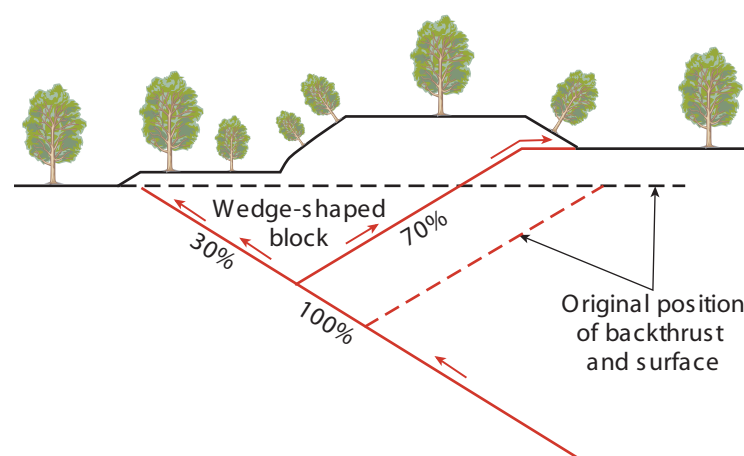
b) Uplift, folding and bulldozing at fault scarp from reverse fault having constant dip.



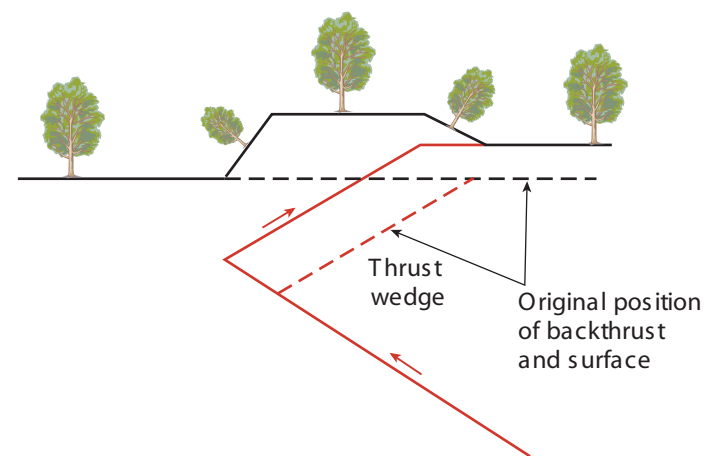
c) Uplift, compact folding at fault scarp from reverse fault that steepens dip as it approaches the surface.



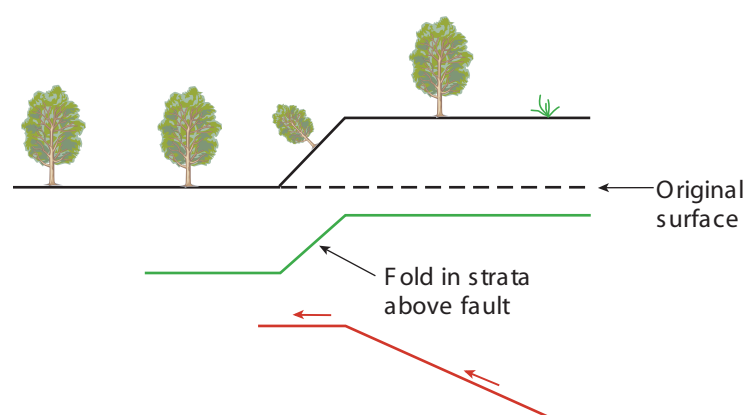
d) Uplift, folding, bulldozing, and tilting from reverse fault that shallows in dip as it approaches the surface.



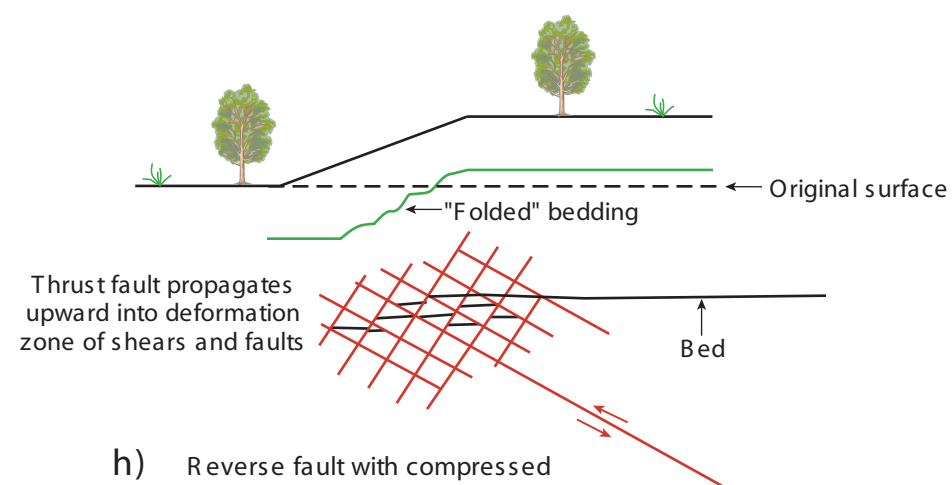
e) Reverse fault with forethrust (30% of slip), backthrust (70% of slip), and wedge-shaped block.



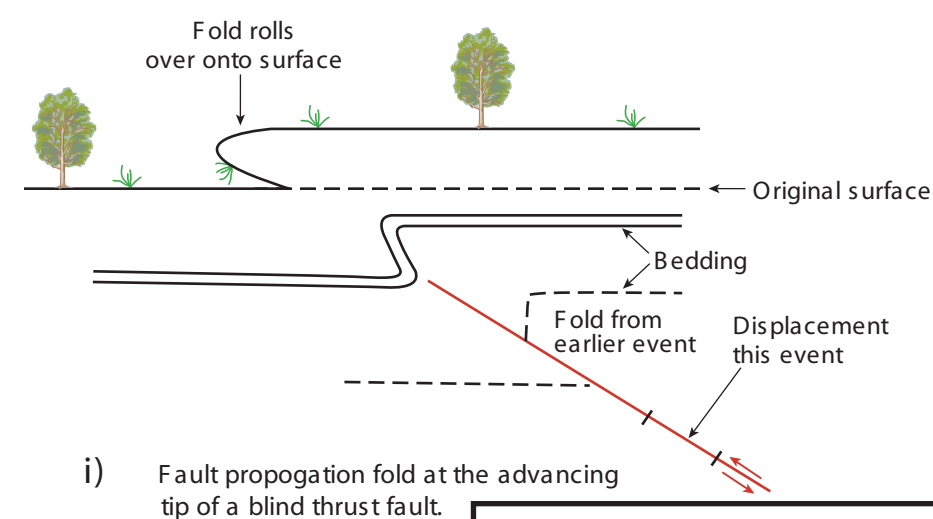
f) Reverse fault with blind forethrust and simple backthrust produced by a thrust wedge.



g) Simple blind thrust with fault bend fold developed above a fault ramp.



h) Reverse fault with compressed shear and "surface fold."



i) Fault propagation fold at the advancing tip of a blind thrust fault.

FSAR UPDATE

HUMBOLDT BAY ISFSI

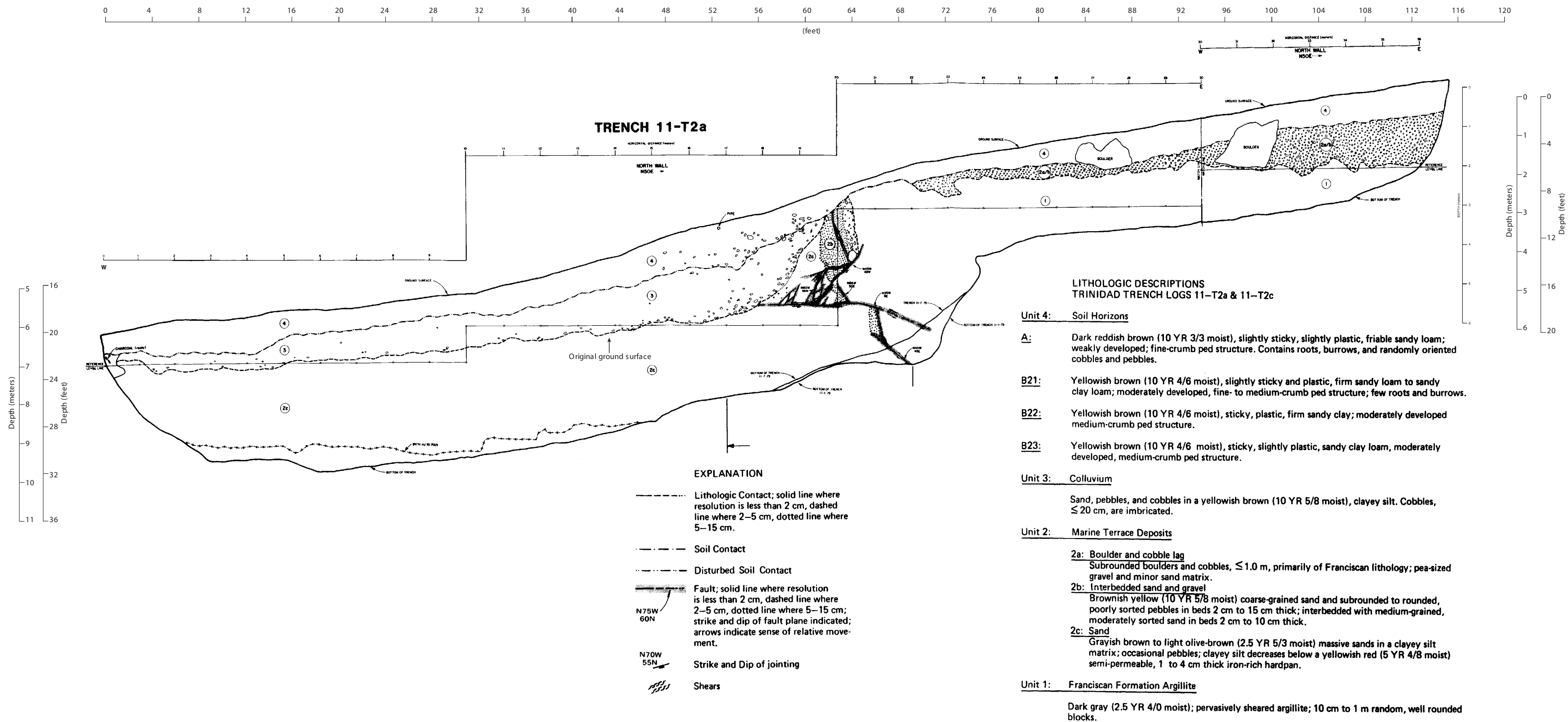
FIGURE 2.6-73
TYPICAL TYPES OF SURFACE
DEFORMATION ASSOCIATED
WITH THRUST FAULTING

Revision 0 January 2006



**FSAR UPDATE
HUMBOLDT BAY ISFSI
FIGURE 2.6-74**

[Collapsed fault scarp in alluvium on the Hanning Bay fault, Montague Island, Alaska. The fault dips to the left into the scarp that formed during the 1964 Alaska earthquake (from Plafker and others, 1969).



FSAR UPDATE
HUMBOLDT BAY ISFSI
FIGURE 2.6-75

This trench exposure near Trinidad, approximately 36 kilometers north of the ISFSI site, is an example of surface deformation produced by a displacement on a low-angle thrust fault (from Woodward-Clyde Consultants, 1980, Figure B-14). The style of deformation corresponds to Type b on Figure 2.6-73

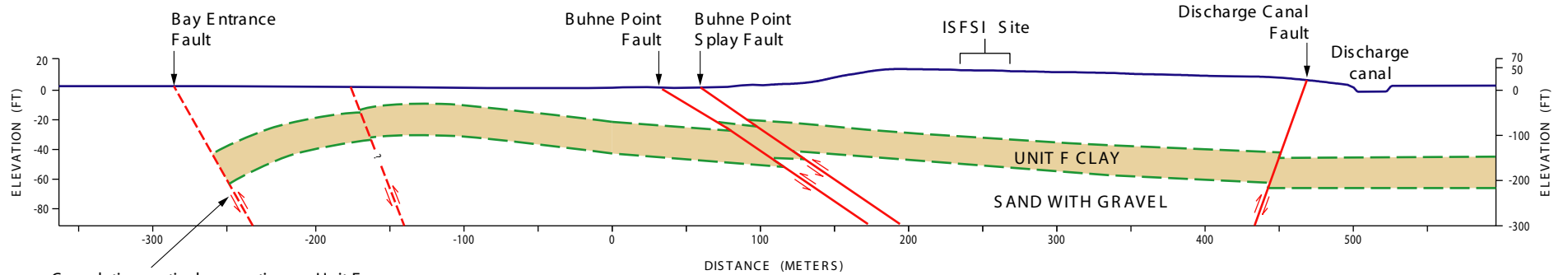


**FSAR UPDATE
HUMBOLDT BAY ISFSI
FIGURE 2.6-76**

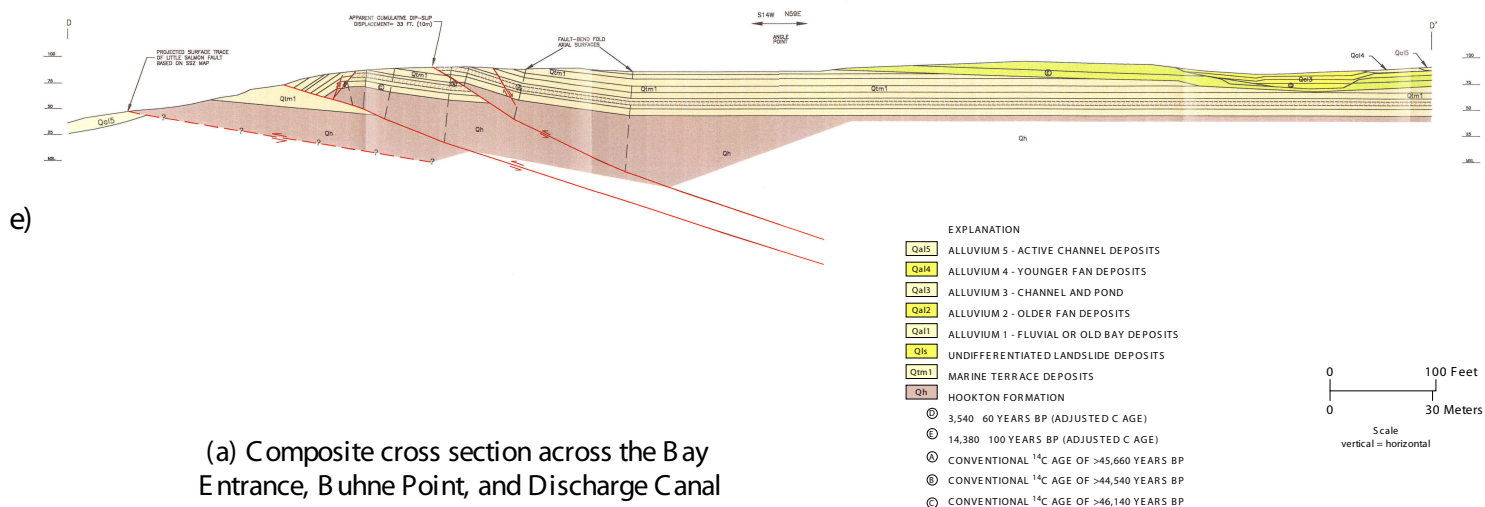
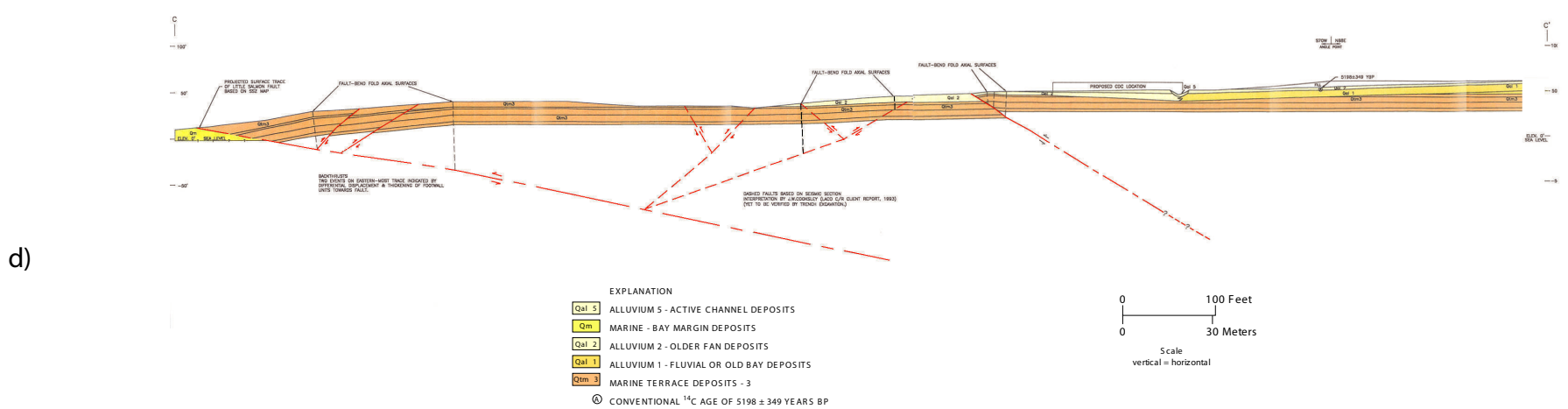
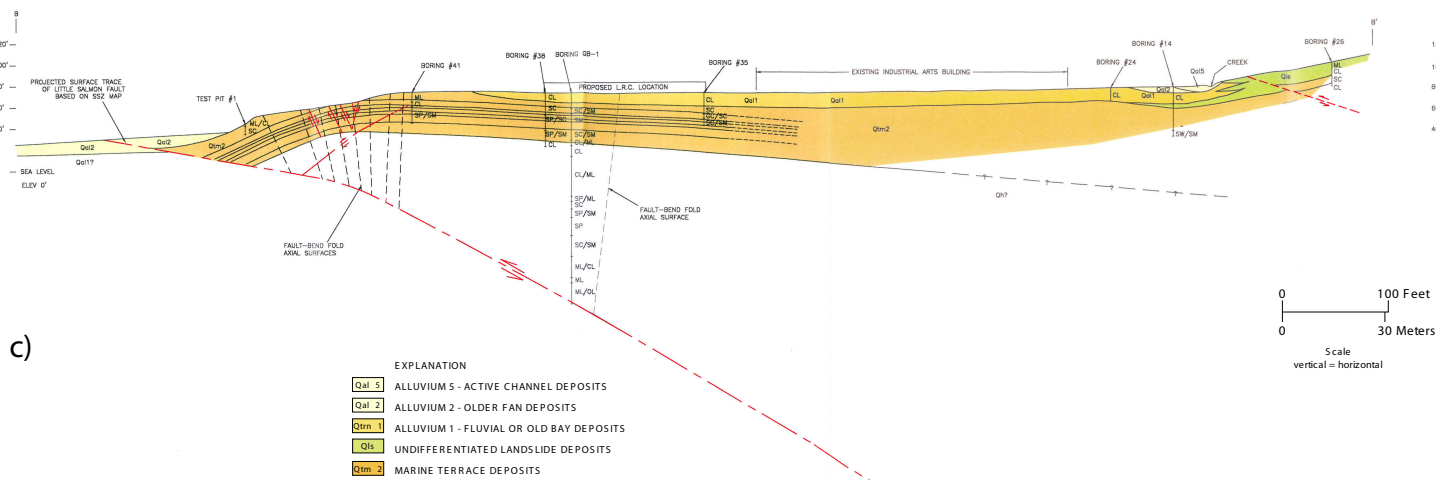
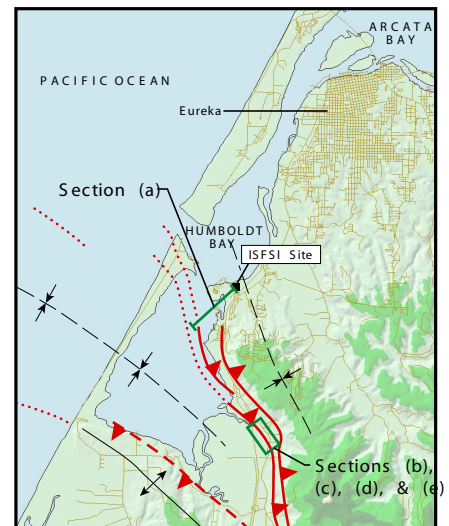
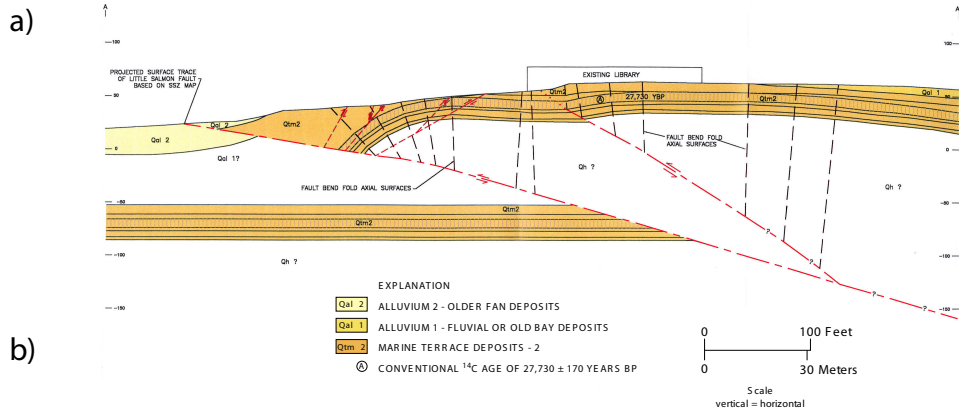
Fault scarp on the Chelungpu fault at the Kuang Fu Middle School, Taiwan. The scarp, formed during the 1999 Chi-Chi earthquake, illustrates the type of faulting in which the fault tip follows the ground surface.

West-Southwest

East-Northeast



Cumulative vertical separation on Unit F across the Bay Entrance fault is 270 m down to the southwest



(a) Composite cross section across the Bay Entrance, Buhne Point, and Discharge Canal faults at the site (based on Figure 2.6-55 and Woodward-Clyde Consultants, 1980, Figure C-8).

(b through e) Geologic cross sections across a trace of the Little Salmon fault zone at College of the Redwoods (from LACO Associates, 1999b, Figures 5 through 8, respectively).

**FSAR UPDATE
HUMBOLDT BAY ISFSI
FIGURE 2.6-77**

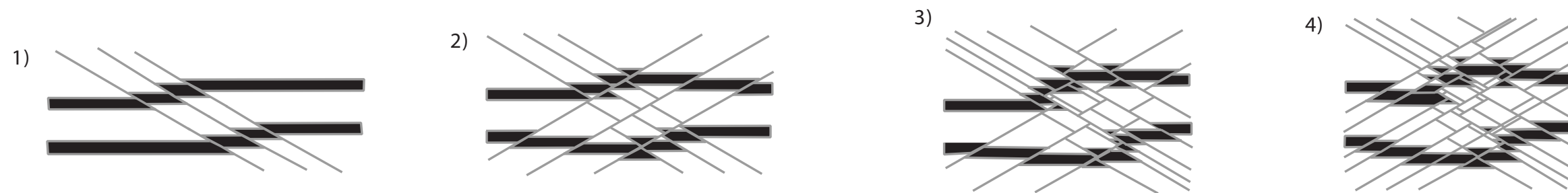
Comparison of faulting near the Humboldt Bay ISFSI site with deformation mapped in the hanging wall of the Little Salmon fault zone at College of the Redwoods, about 5 kilometers south of the site.

← Northeast

Southwest →



(a) Complex zones of deformation in the hanging wall of the McKinleyville fault (Mad River fault zone) exposed in the sea cliff at Clam Beach, north of Arcata (photograph by Thomas Dunklin, Arcata, California, 1999). The displacement is up to the northeast. The cliff is about 35 m high, and the photo shows a section about 150 m long.



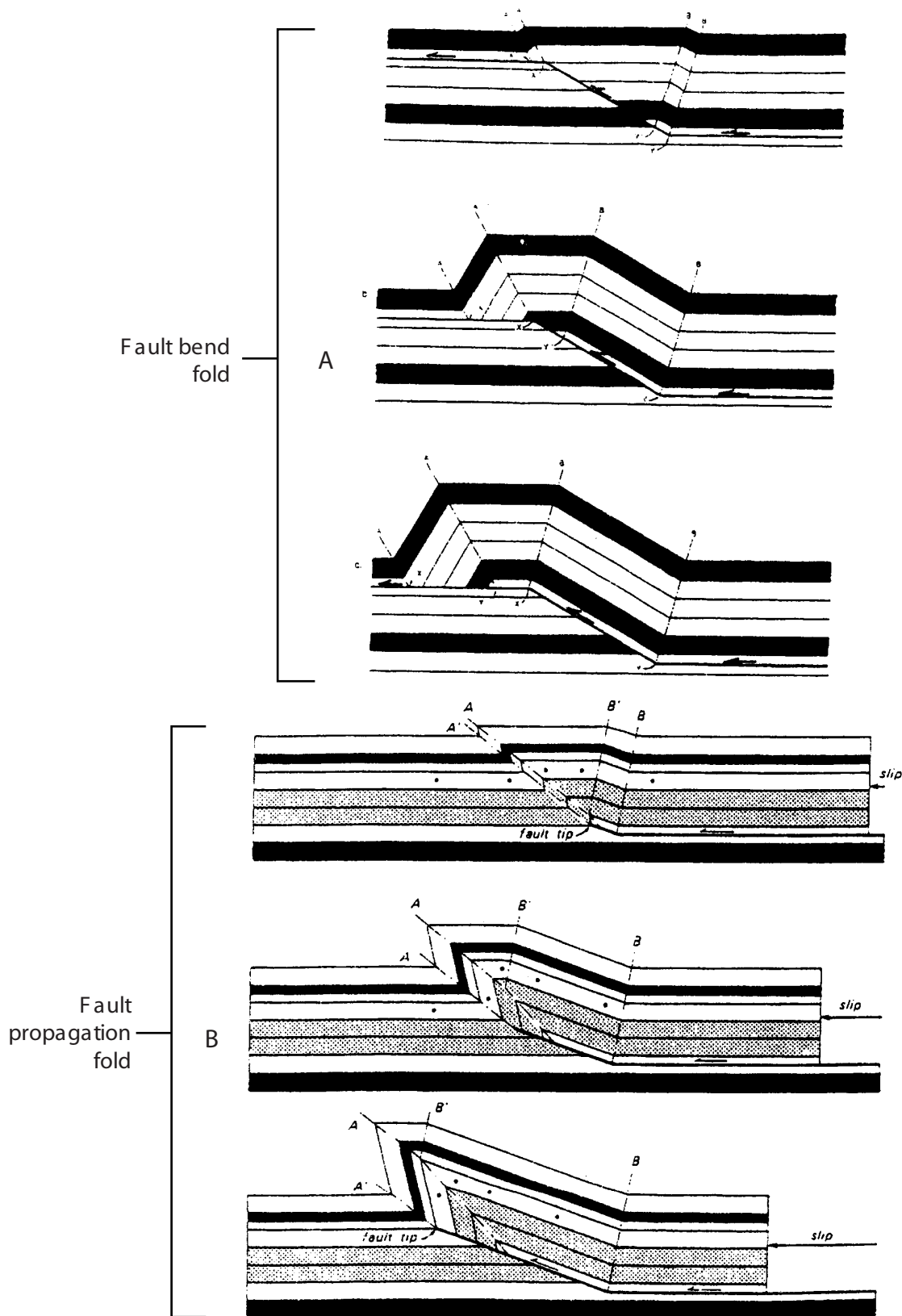
(b) The evolution of complex zones of deformation is shown sequentially with (1) initiation of faulting and development of synthetic shears and (2) continued deformation and development of antithetic shears. Repeating the process during continued movement (during either the same earthquake or subsequent earthquakes) produces a complex rhomboidal pattern of closely spaced shears (3) and (4) that individually have small displacements, but collectively can accommodate a large amount of crustal shortening.

FSAR UPDATE

HUMBOLDT BAY ISFSI

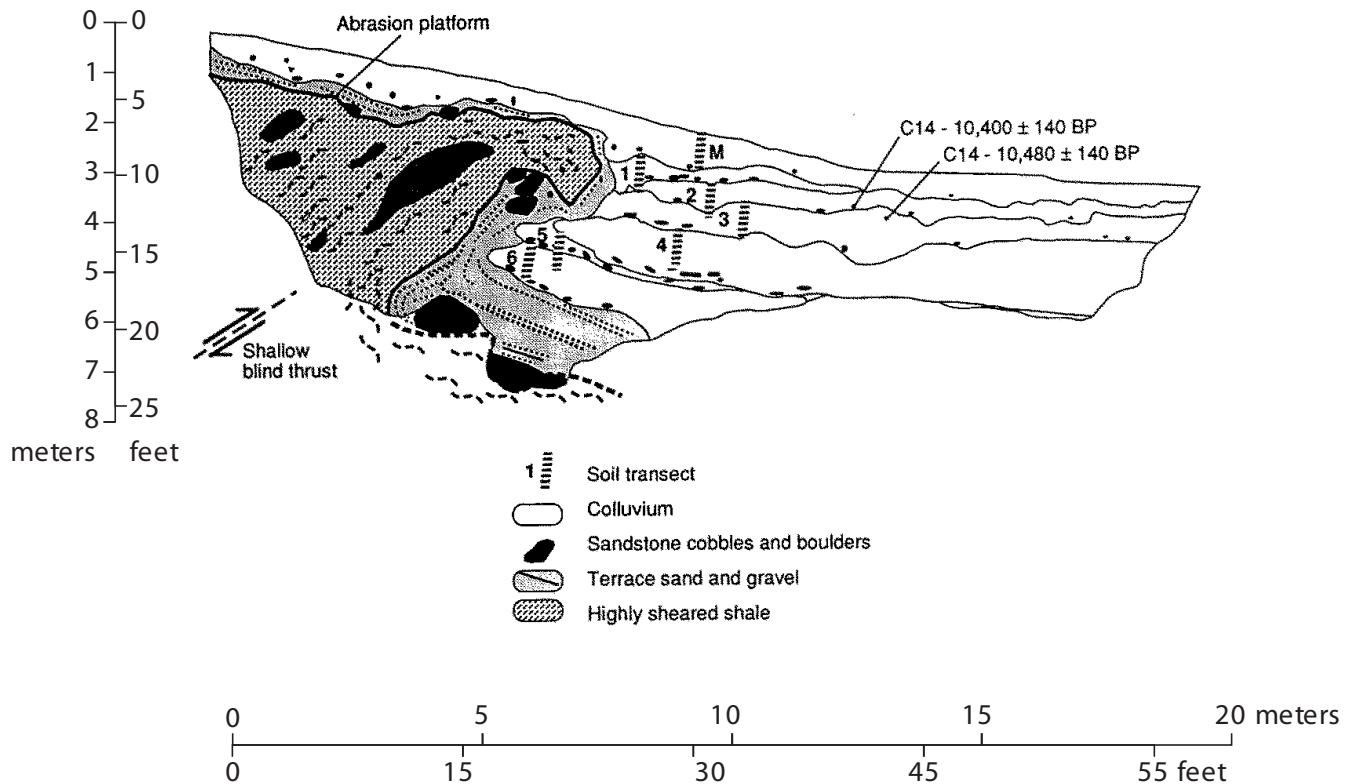
FIGURE 2.6-78
COMPLEX ZONES OF DEFORMATION
WHERE CRUSTAL SHORTENING IS
ACCOMMODATED BY NUMEROUS
SMALL-DISPLACEMENT
CONJUGATE FAULTS

Revision 0 January 2006



**FSAR UPDATE
HUMBOLDT BAY ISFSI
FIGURE 2.6-79**

Schematic progressive development of fault bend and fault propagation folds (from Suppe, 1983). Folds develop as thrust sheet rides over a step in decollement.



The fault displaces a late Pleistocene marine terrace near Humboldt Bay (from Carver and McCalpin, 1996, Figure 5.13). The terrace deposits are underlain by very ductile, intensely sheared shaley melange. The thrust fault is blind, and displacement occurs at the surface as a sharp, overturned fault-propagation fold. The marine terrace platform (heavy line) and overlying terrace sand and gravel are overturned in the forelimb of the fold. The sequence of colluvial deposits, labeled 1 through 6 (from youngest to oldest), is interpreted to have formed on the scarp face between slip events, indicating there have been repeated surface displacements along this fault trace. The style of deformation corresponds to Type i on Figure 8-1.

FSAR UPDATE

HUMBOLDT BAY ISFSI

FIGURE 2.6-80 LOG OF TRENCH ACROSS A TRACE OF THE MAD RIVER FAULT ZONE

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A) Fault bend fold appears as flexure on the floor of a building destroyed by surface faulting during the 1999 Chi-Chi earthquake.



B) Shears and fractures in wall over the fault bend fold shown above.

FSAR UPDATE

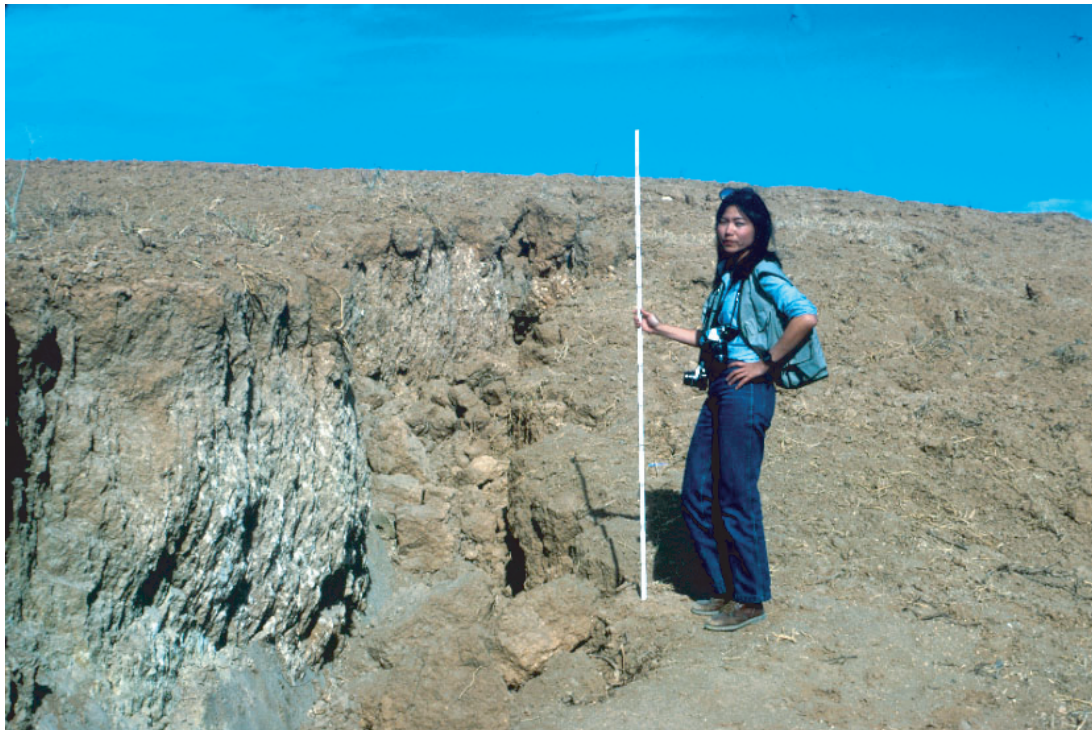
HUMBOLDT BAY ISFSI

FIGURE 2.6-81 FAULT BEND FOLD AND ASSOCIATED SHEARS AND FRACTURES ON THE CHELUNGPU FAULT, FENGYUAN, TAIWAN

Revision 0 January 2006



A) Tensional cracks and normal faults that formed in the 1980 El Asnam earthquake along a secondary fault that is about 7 kilometers from the main fault trace (photograph by F. H. Swan).



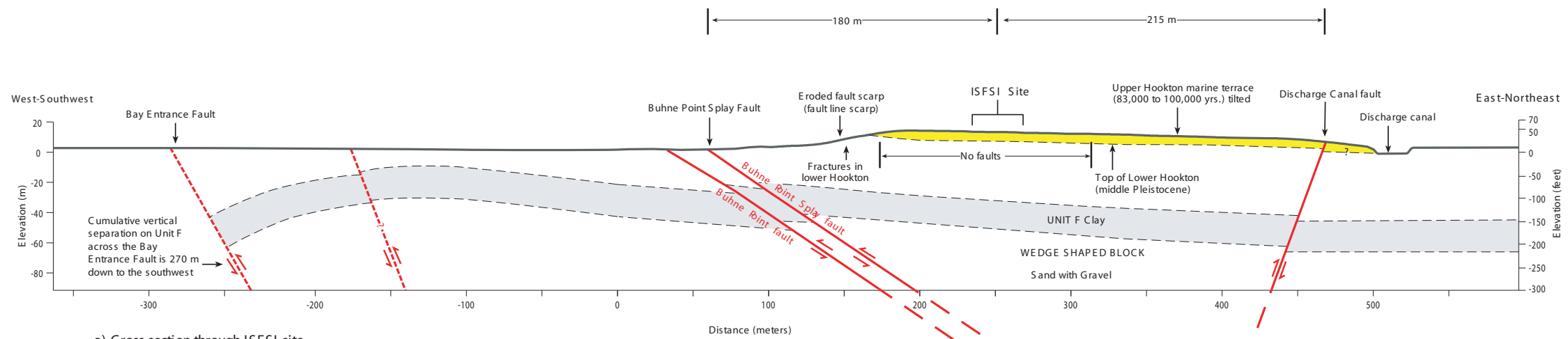
B) Normal fault scarp in the hanging wall near the same location as above.

FSAR UPDATE

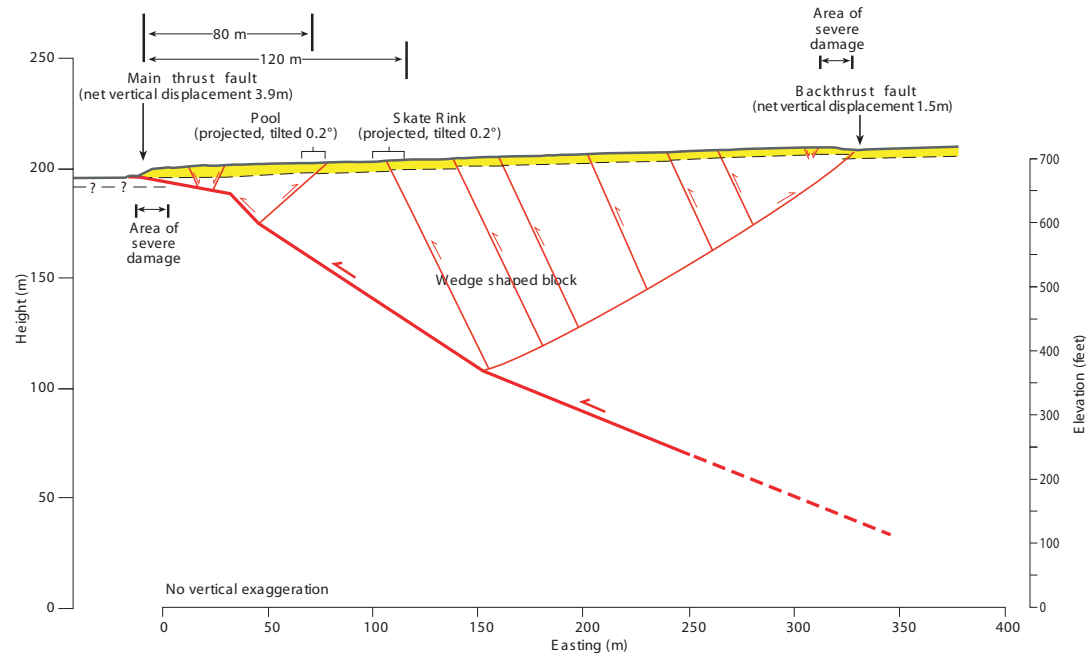
HUMBOLDT BAY ISFSI

**FIGURE 2.6-82
FRACTURES AND FAULTS IN THE
HANGING WALL OF THE OUED
FODDA FAULT, ALGERIA**

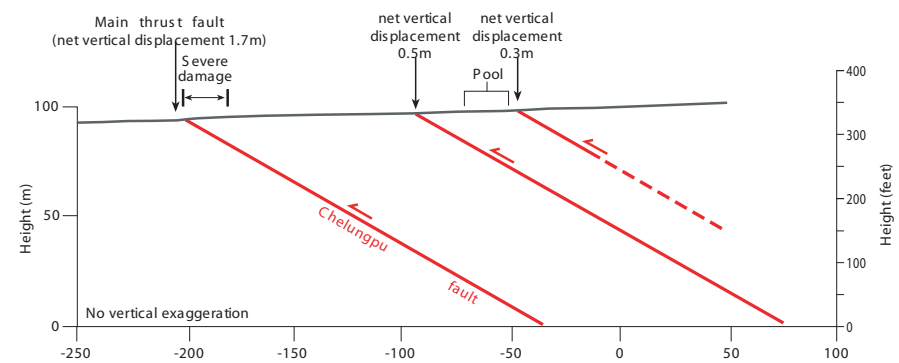
Revision 0 January 2006



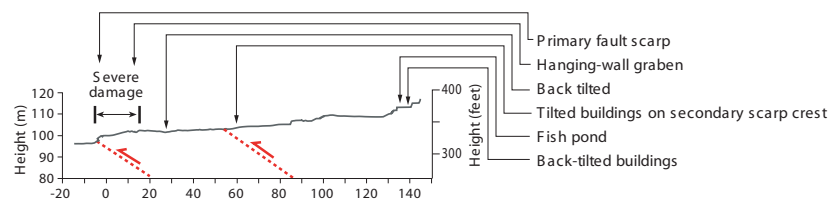
a) Cross section through ISFSI site.



b) Schematic geologic cross section through Chung Chen Park, Taichung, Taiwan showing inferred subsurface configuration of faults based on surface observations. Swimming pool and skate rink projected onto cross section along local structural trends.



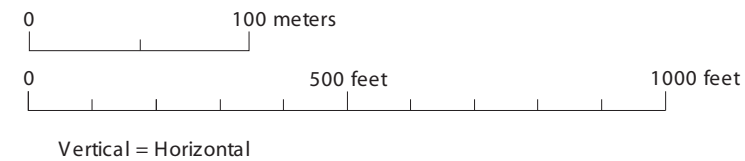
c) Topographic profile C-C' across the Chelungpu fault, along the paved road directly north of Kuang Fu Middle School.



d) Topographic profile at Taiwan Studio City, showing locations of tilted fish pond, and other structures.

EXPLANATION

- Fault, dashed where inferred; arrows show relative sense of displacement
- Lithologic contact, dashed where approximate

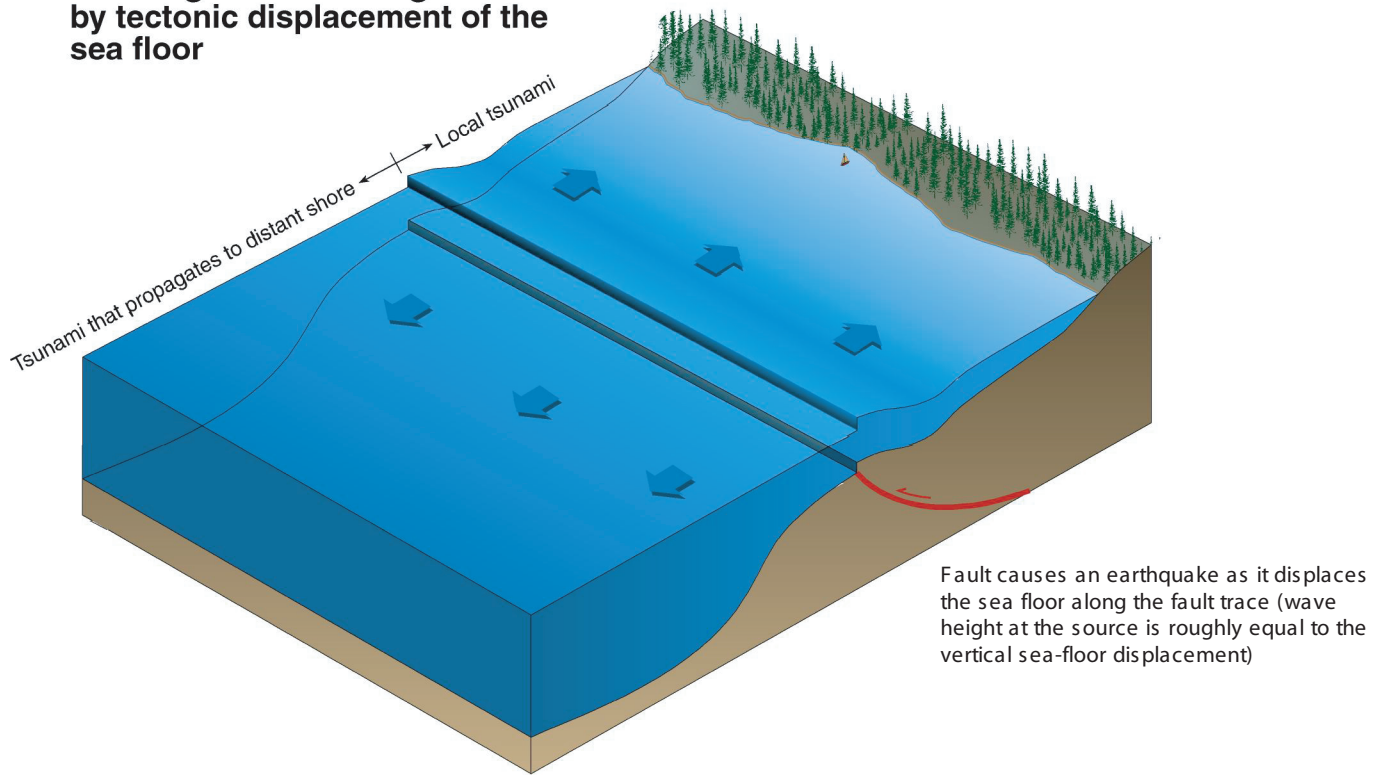


(a) Composite cross section across the Bay Entrance, Buhne Point, and Discharge Canal faults at the site (based on Figure 2.6-55 and Woodward-Clyde Consultants, 1980, Figure C-8).

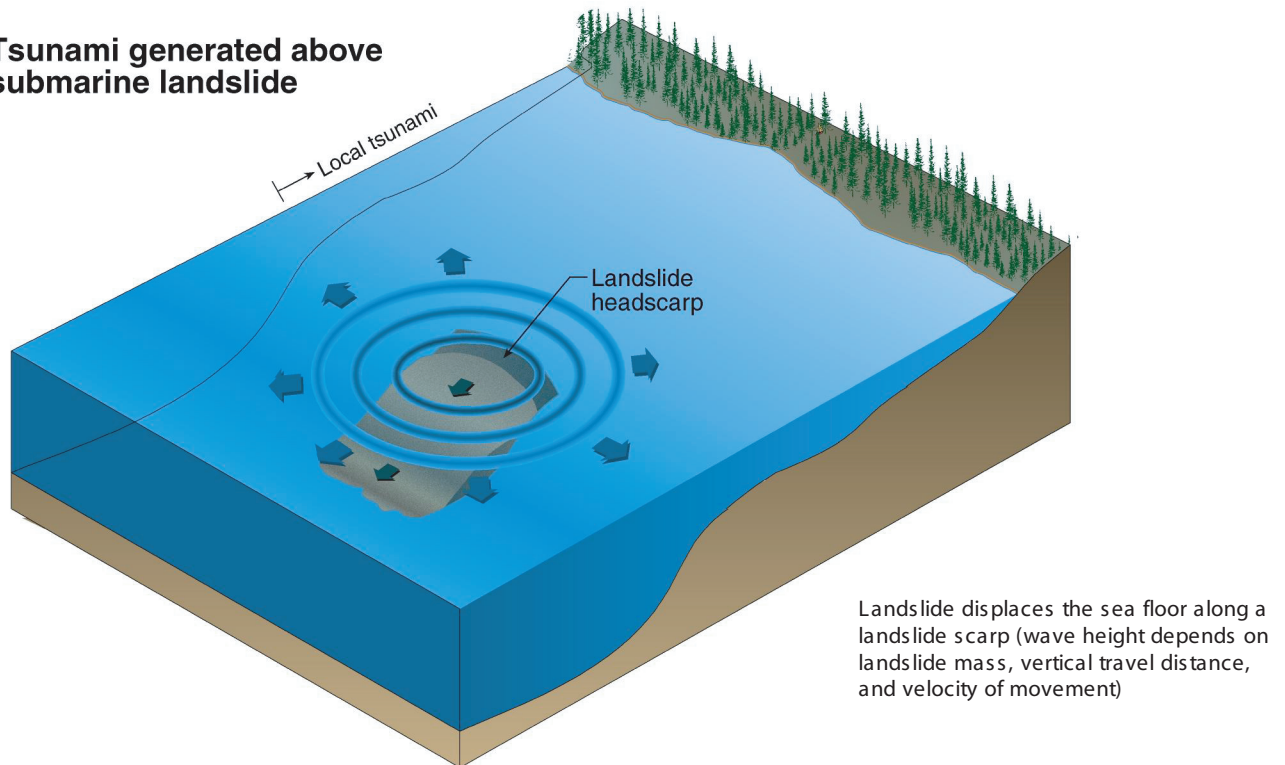
(b through d) Geologic cross sections across the 1999 Chelungpu fault rupture (from Kelson and others, 2001).

**FSAR UPDATE
HUMBOLDT BAY ISFSI
FIGURE 2.6-83
Comparison of faulting near the Humboldt
Bay ISFSI site with 1999 surface rupture
along the Chelungpu fault, Taiwan.**

Seismogenic tsunami generated by tectonic displacement of the sea floor



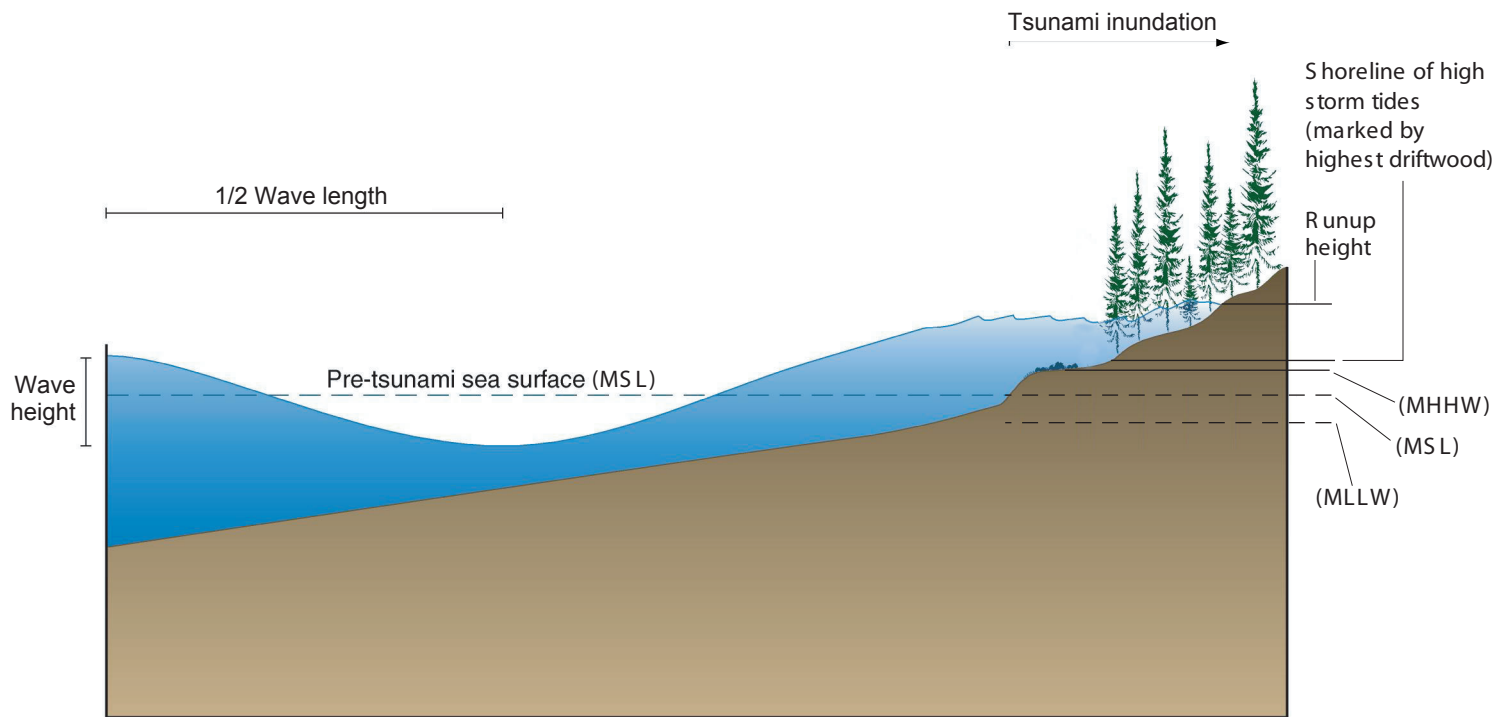
Tsunami generated above submarine landslide



Vertical scale is greatly exaggerated

FSAR UPDATE
HUMBOLDT BAY ISFSI
FIGURE 2.6-84
SCHEMATIC DIAGRAMS OF MAJOR
TSUNAMI SOURCES

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FSAR UPDATE
HUMBOLDT BAY ISFSI
FIGURE 2.6-85
ILLUSTRATION OF TSUNAMI TERMS

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