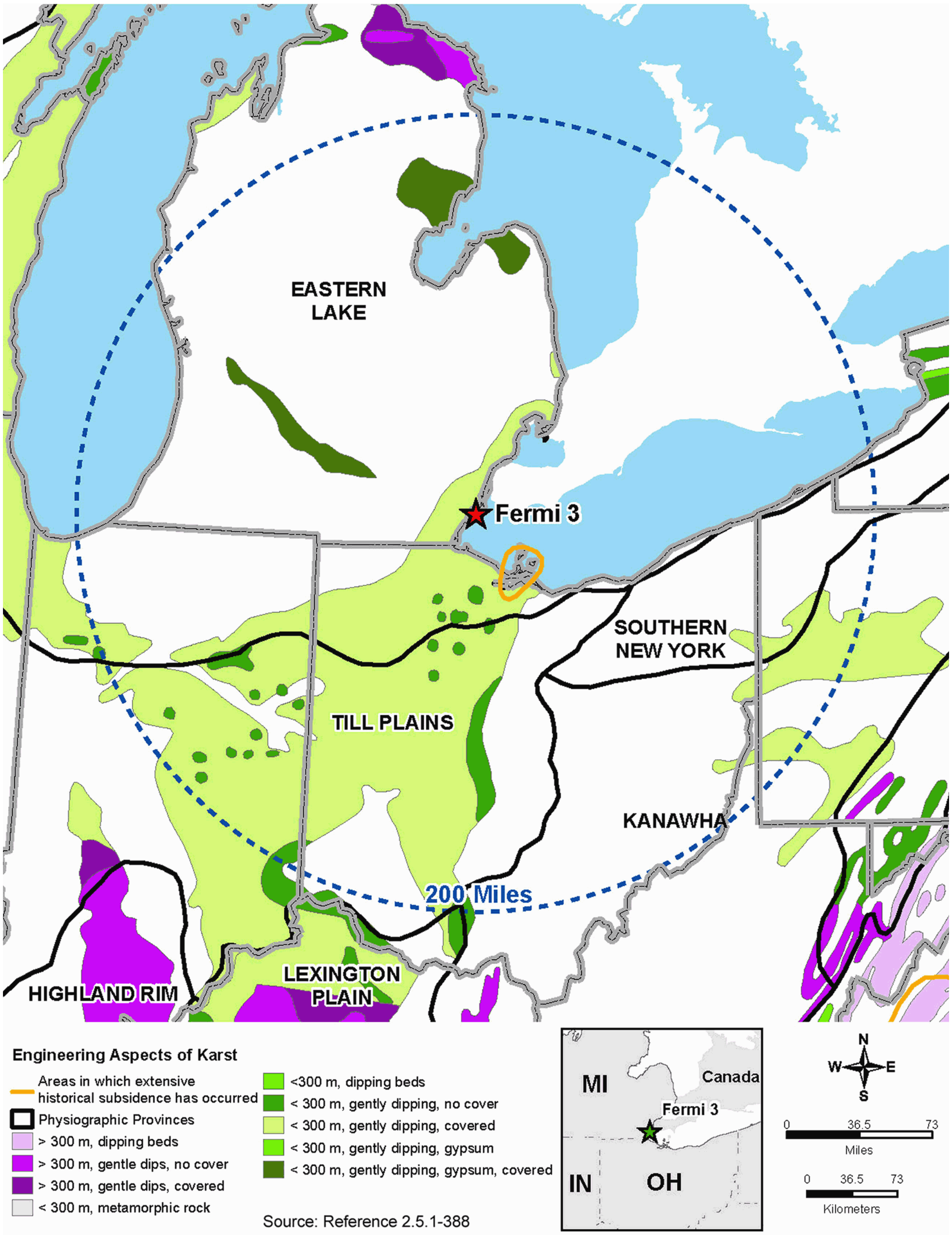
Figure 2.5.1-228 Engineering Aspects of Karst Map for the Fermi 3 Site Region
[EF3 COL 2.0-26-A]



Source: Reference 2.5.1-388

Figure 2.5.1-229 Topography of the Fermi 3 Site Location [EF3 COL 2.0-26-A]

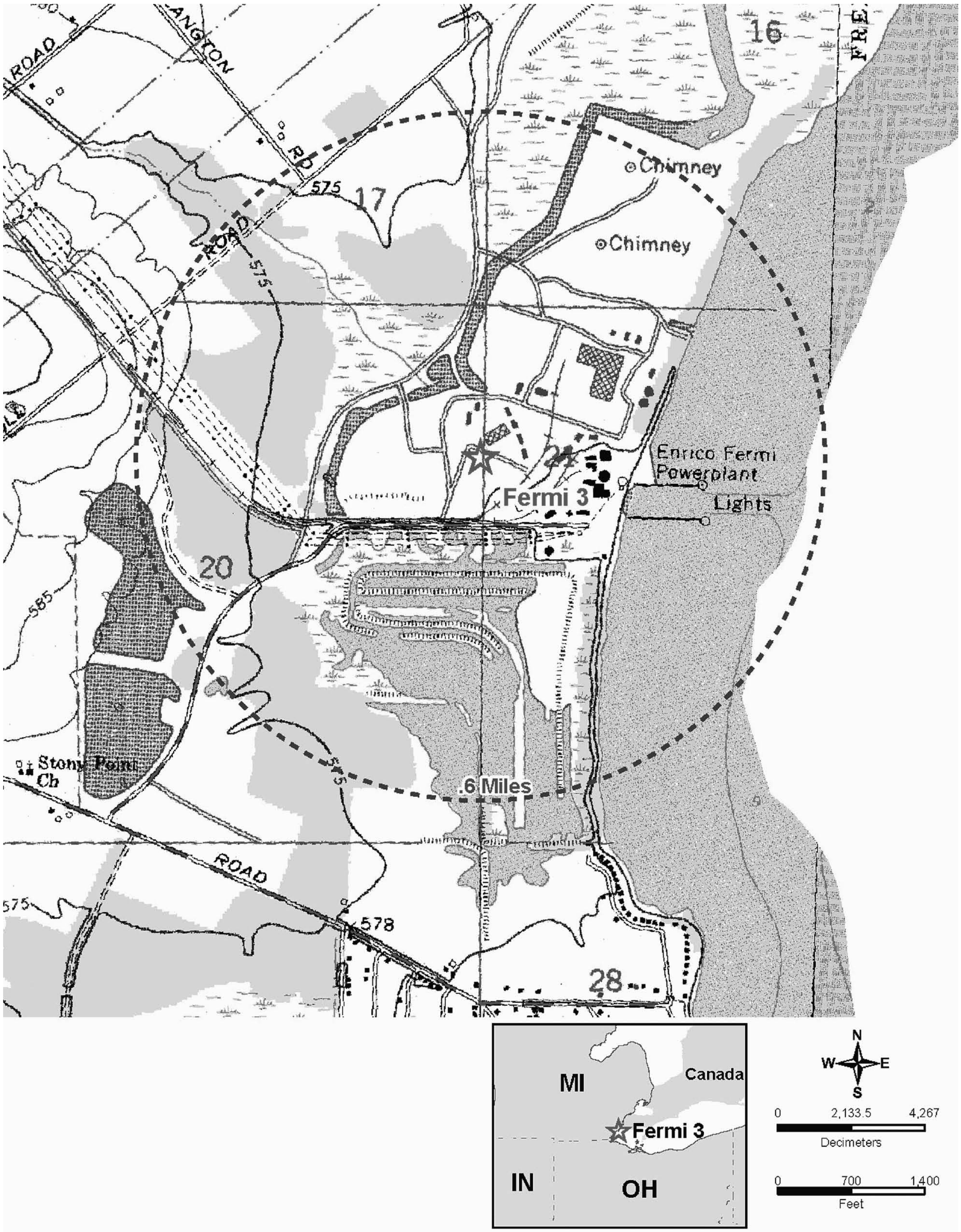
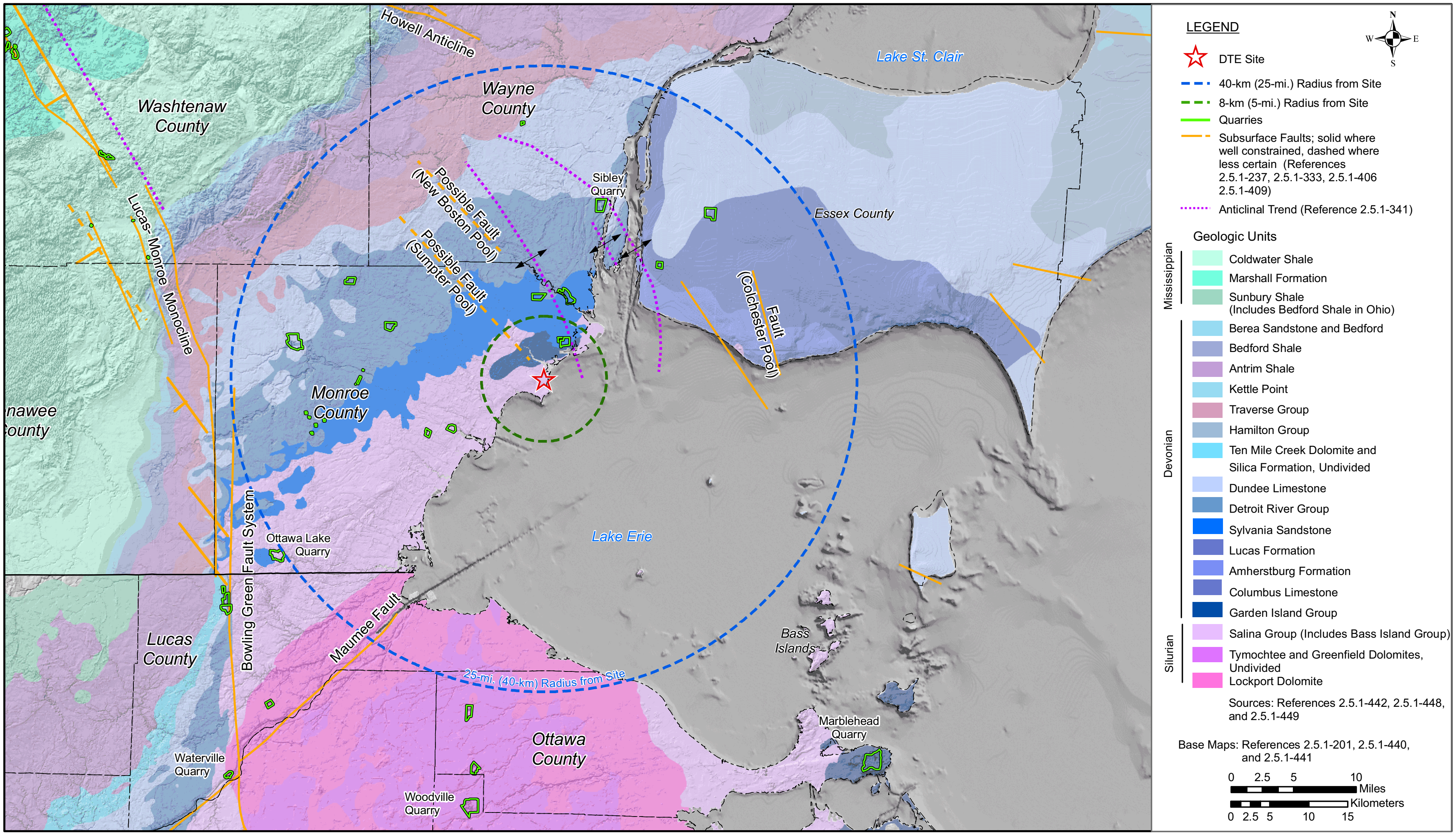


Figure 2.5.1-230 Geologic Map of the Fermi 3 Site Vicinity [EF3 COL 2.0-26-A]



File path: S:\13300\13356\figures\2.5.1_figures\DTE_FSAR_FIG02_05_01_230.mxd; Date: [07/03/2008]

Figure 2.5.1-231 Geologic Map Showing Quaternary Features of the Fermi 3 Site Vicinity [EF3 COL 2.0-26-A]

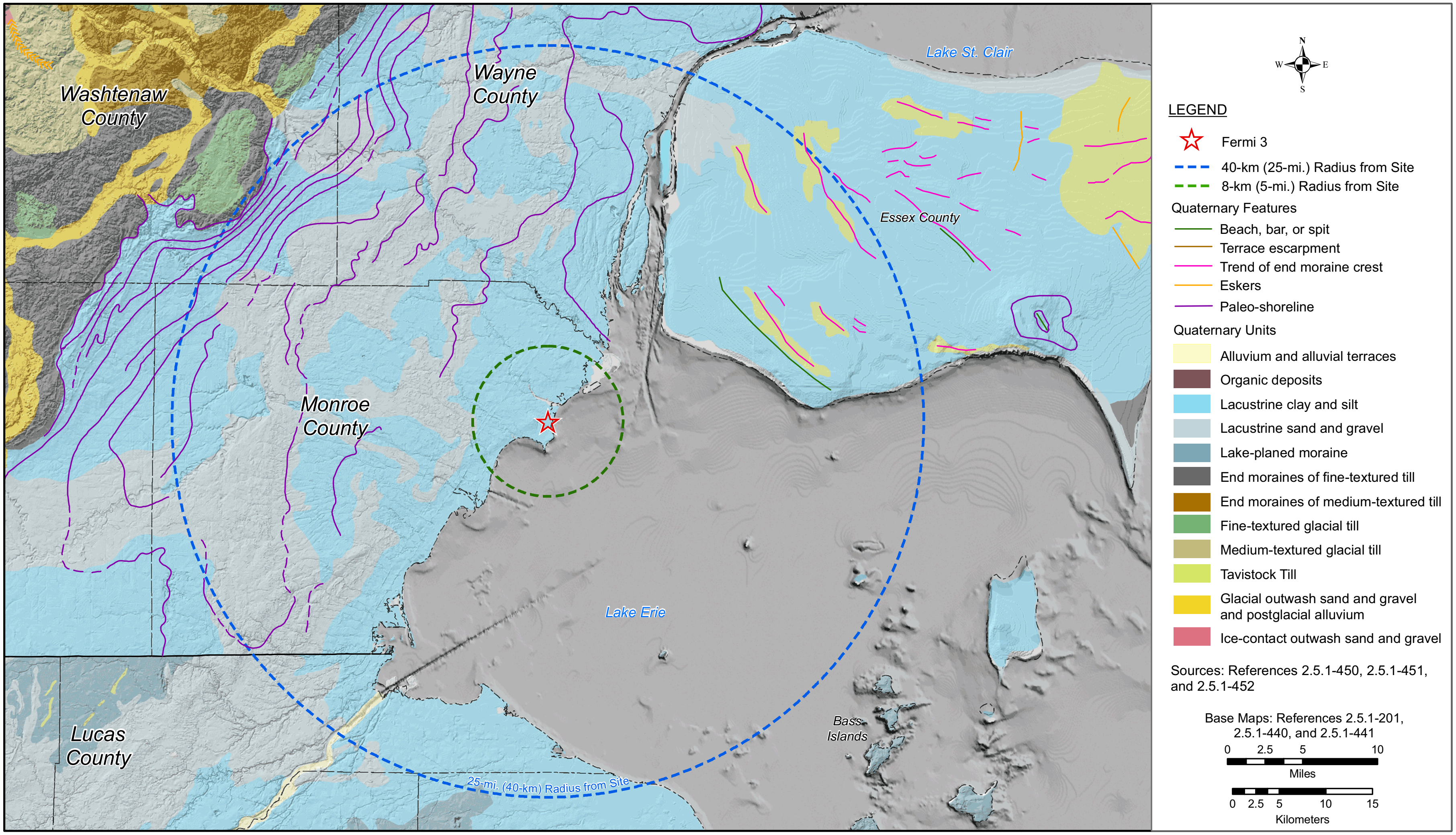
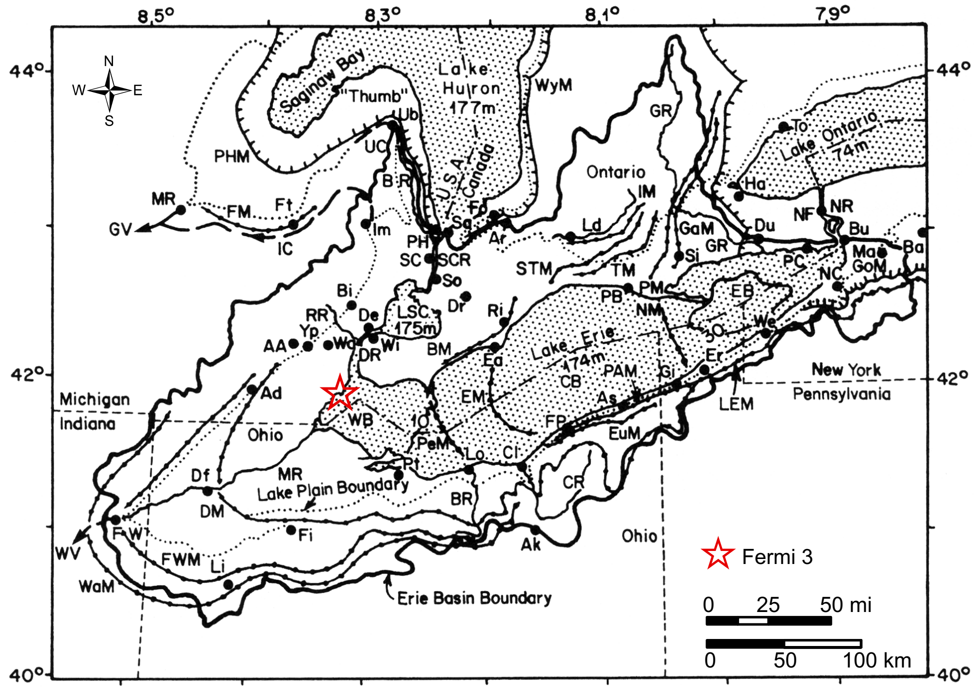


Figure 2.5.1-232 Map Showing Quaternary Features of the Erie Basin
[EF3 COL 2.0-26-A]



LEGEND

Towns ●

AA – Ann Arbor
Ad – Adrian
Ar – Arkona
As – Ashtabula
Ba – Batavia
Bi – Birmingham
Bu – Buffalo
Cl – Cleveland
De – Detroit
Df – Defiance
Dr – Dresden
Du – Dunnville
Ea – Erieau
Er – Erie
Fi – Findlay
Fl – Flint
Fo – Forest
FP – Fairport-Painesville
FW – Fort Wayne
Gi – Girard
Ha – Hamilton
Im – Imlay

Ld – London
Li – Lima
Lo – Lorain
Ma – Marilla
MR – Maple Rapids
NC – North Collins
NF – Niagara Falls
PB – Port Burwell
PC – Port Colborne
PH – Port Huron
Pt – Parkertown
Ri – Ridgetown
Sa – Sarnia
SC – St. Clair
Si – Simcoe
So – Sombra
To – Toronto
Ub – Ubly
Wa – Wayne
We – Westfield
Wi – Windsor
Yp – Ypsilanti

LSC – Lake St. Clair

Lake Erie:
CB – Central Basin
EB – Eastern Basin
WB – Western Basin
30 – Depth contour in meters

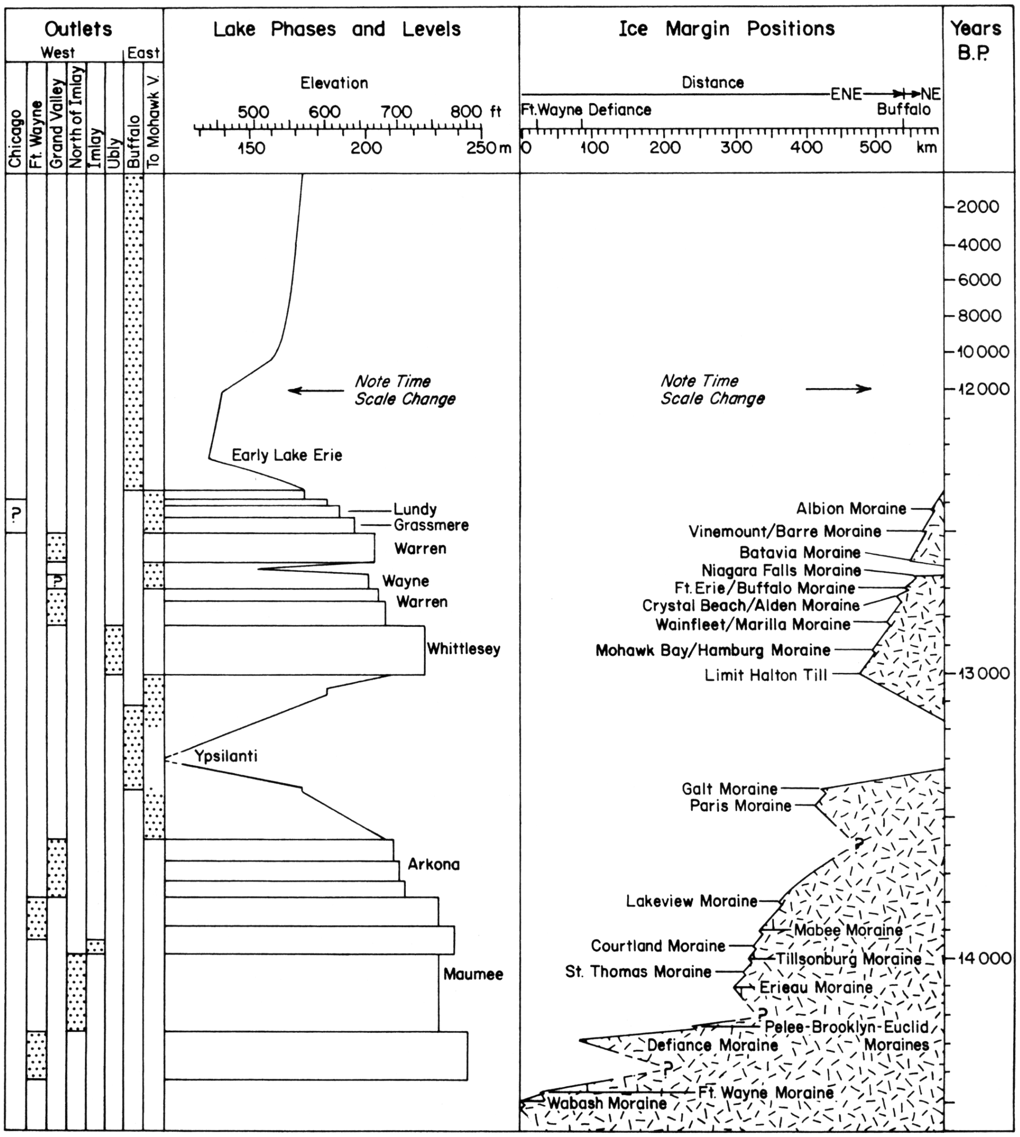
BR – Black River
CR – Cuyahoga River
DR – Detroit River
GR – Grand River
MR – Maumee River
NR – Niagara River
RR – River Rouge
SCR – St. Clair River

– Former Outlet
GV – Grand Valley
IC – Imlay Channel
UC – Ubly Channel
WV – Wabash Valley

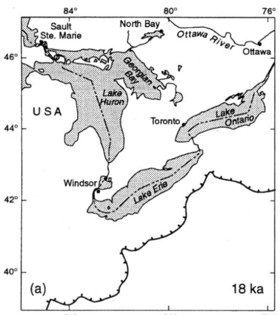
Ice Margin Positions:
– Port Bruce Stadial
BM – Blenheim Moraine
DM – Defiance Moraine
EM – Erieau Moraine
EuM – Euclid Moraine
FM – Flint Moraine
FWM – Fort Wayne Moraine
GaM – Galt Moraine
IM – Ingersoll Moraine
LEM – Lake Escarpment Moraine
NM – Norfolk Moraine
PAM – Painesville & Ashtabula M.
PeM – Pelee Moraine
PM – Paris Moraine
STM – St. Thomas Moraine
TM – Tillsonburg Moraine
WaM – Wabash Moraine
– Port Huron Stadial
GoM – Gowanda Moraine
PHM – Port Huron Moraine
WyM – Wyoming Moraine

Source: Reference 2.5.1-297

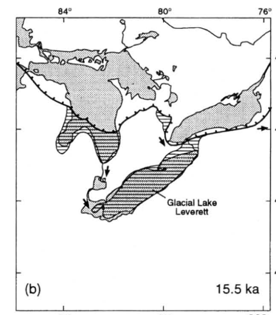
Figure 2.5.1-233 Chart Showing the Lake Phases and Levels and Ice Margin Positions for the Quaternary [EF3 COL 2.0-26-A]



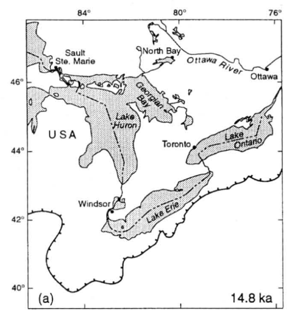
Source: Reference 2.5.1-297



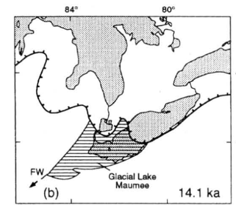
a) Ice margin at the 18,000 BP (Nissouri Stade) maximum position; no lakes are impounded as the margin lies south of the Great Lakes-Gulf of Mexico drainage.



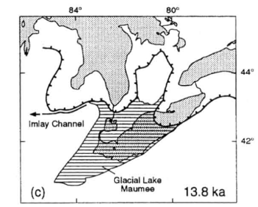
b) Maximum extent of lakes inferred for the Erie Interstade ice position.



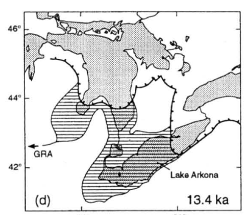
c) Port Bruce ice margin maximum at 14,800 BP drains without impoundments to Gulf of Mexico.



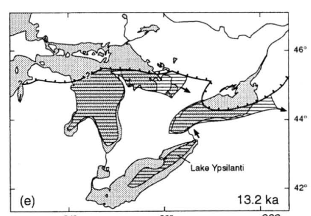
d) Highest Lake Maumee about 14,100 BP, drainage past Fort Wayne (FW) to Mississippi River.



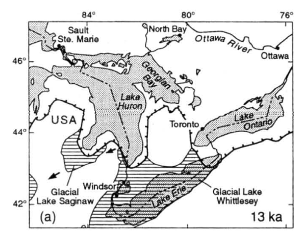
e) Final phase of Lake Maumee about 13,800 BP, drainage to the Michigan basin and Mississippi River via the Imlay channel south of Saginaw Bay.



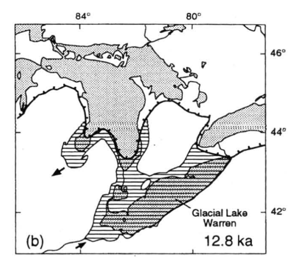
f) Early Lake Arkona about 13,400 BP impounded in the Huron and Erie basins, drainage to the Michigan basin via the Grand River Valley (GRA).



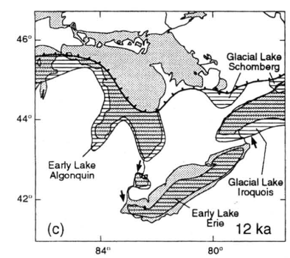
g) Low-level lakes about 13,200 BP during the Mackinaw Interstade.



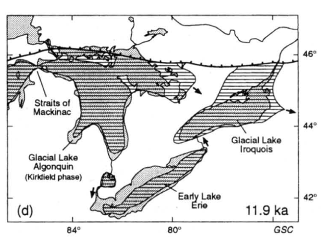
h) Glacial lakes Whittlesey and Saginaw about 13,000 BP draining to the Michigan basin.



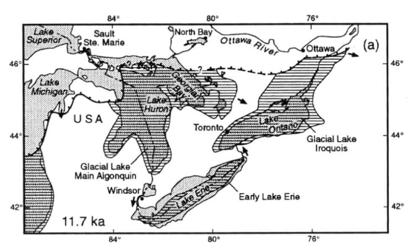
i) Highest Lake Warren about 12,800 BP, drainage to the Michigan basin.



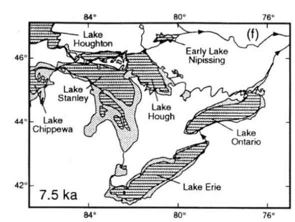
j) Early Lake Algonquin and Lake Schomberg about 12,000 BP.



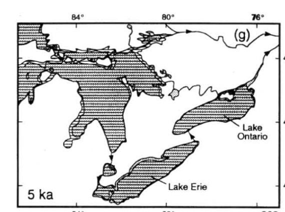
k) Early Kirkfield phase of Lake Algonquin about 11,900 BP.



l) Kirkfield phase of Lake Algonquin in the Huron basin during the Greatlakean Stade about 11,800 BP.



m) Post-Mattawa low or onset of the Nipissing transgression about 7,500 BP.



n) Nipissing Great Lakes about 5,000 BP.

Source: Reference 2.5.1-272

Figure 2.5.1-235 Site Exploration Plan [EF3 COL 2.0-26-A]

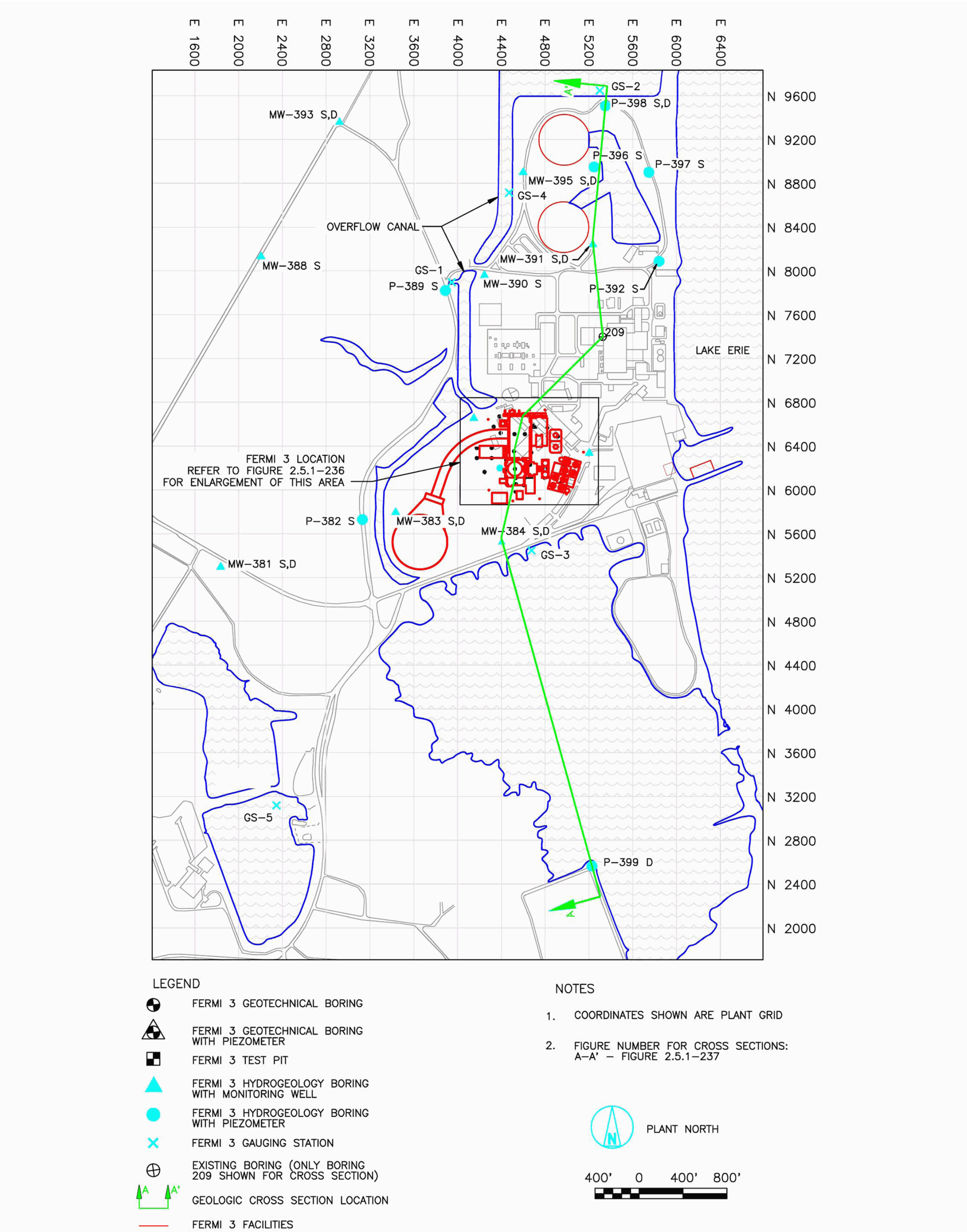
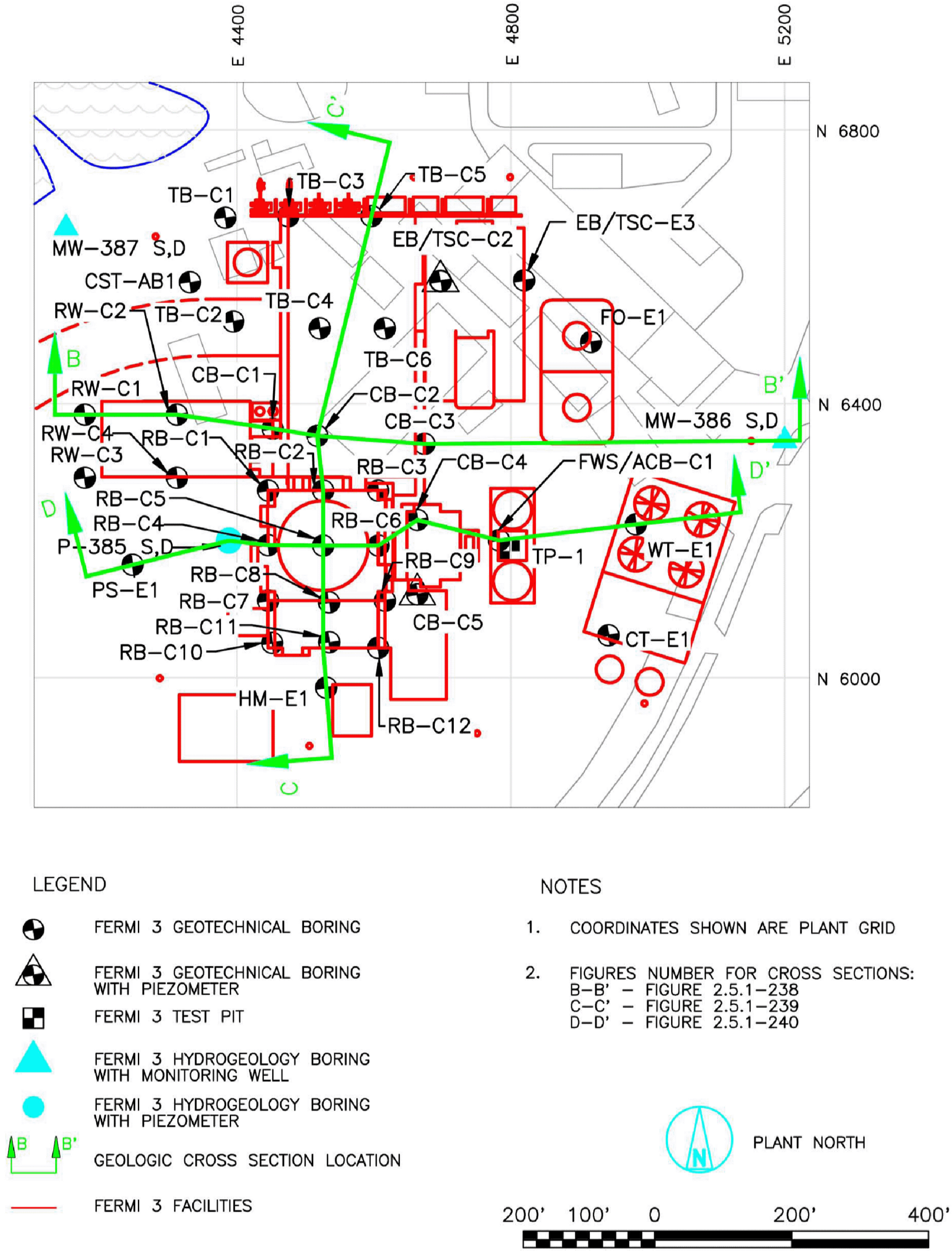


Figure 2.5.1-236 Enlargement of Site Exploration Plan [EF3 COL 2.0-26-A]



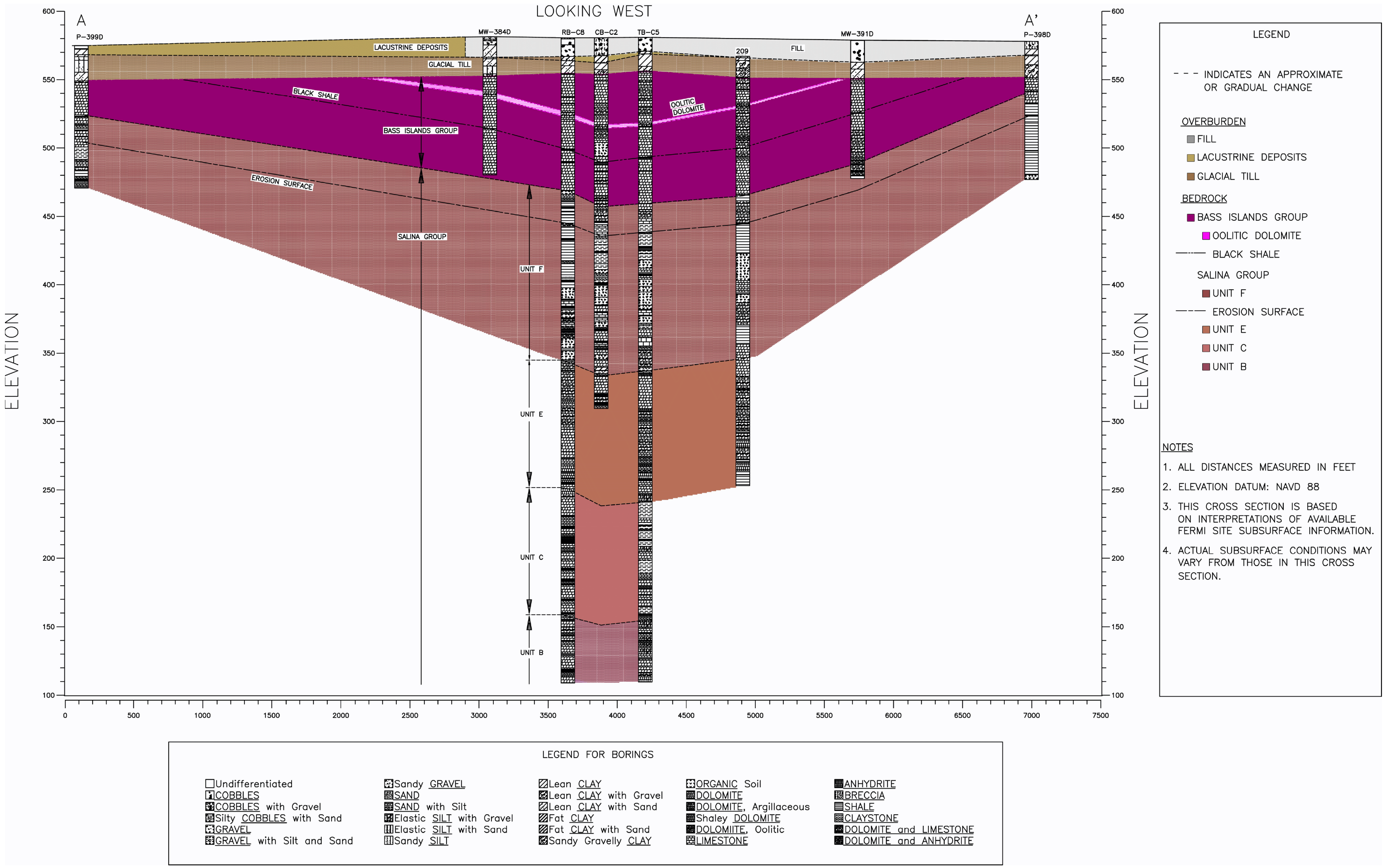

LOOKING WEST
A
A'
P-399D
MW-384D
RB-C8
CB-C2
TB-C5
209
MW-391D
P-398D
LACUSTRINE DEPOSITS
GLACIAL TILL
FILL
BLACK SHALE
OOLITIC DOLOMITE
BASS ISLANDS GROUP
EROSION SURFACE
SALINA GROUP
UNIT F
UNIT E
UNIT C
UNIT B
ELEVATION
600
550
500
450
400
350
300
250
200
150
100
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
6500
7000
7500
LEGEND
INDICATES AN APPROXIMATE OR GRADUAL CHANGE
OVERBURDEN
FILL
LACUSTRINE DEPOSITS
GLACIAL TILL
BEDROCK
BASS ISLANDS GROUP
OOLITIC DOLOMITE
BLACK SHALE
SALINA GROUP
UNIT F
EROSION SURFACE
UNIT E
UNIT C
UNIT B
NOTES
1. ALL DISTANCES MEASURED IN FEET
2. ELEVATION DATUM: NAVD 88
3. THIS CROSS SECTION IS BASED ON INTERPRETATIONS OF AVAILABLE FERMI SITE SUBSURFACE INFORMATION.
4. ACTUAL SUBSURFACE CONDITIONS MAY VARY FROM THOSE IN THIS CROSS SECTION.
LEGEND FOR BORINGS
Undifferentiated
COBBLES
COBBLES with Gravel
Silty COBBLES with Sand
GRAVEL
GRAVEL with Silt and Sand
Sandy GRAVEL
SAND
SAND with Silt
Elastic SILT with Gravel
Elastic SILT with Sand
Sandy SILT
Lean CLAY
Lean CLAY with Gravel
Lean CLAY with Sand
Fat CLAY
Fat CLAY with Sand
Sandy Gravelly CLAY
ORGANIC Soil
DOLOMITE
DOLOMITE, Argillaceous
Shaley DOLOMITE
DOLOMIITE, Oolitic
LIMESTONE
ANHYDRITE
BRECCIA
SHALE
CLAYSTONE
DOLOMITE and LIMESTONE
DOLOMITE and ANHYDRITE

Figure 2.5.1-238 Geologic Cross Section B-B [EF3 COL 2.0-26-A]

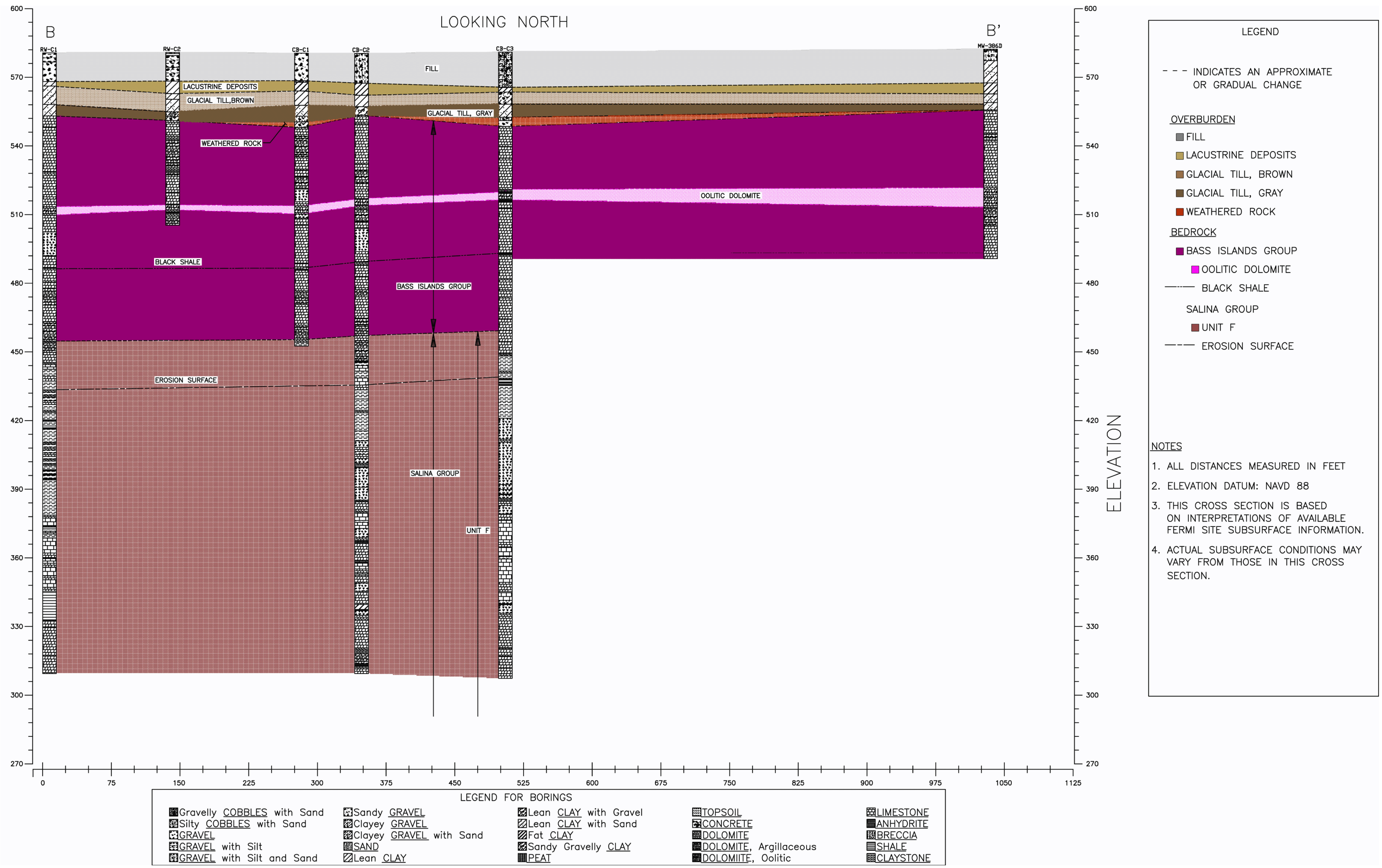


Figure 2.5.1-239 Geologic Cross Section C-C [EF3 COL 2.0-26-A]

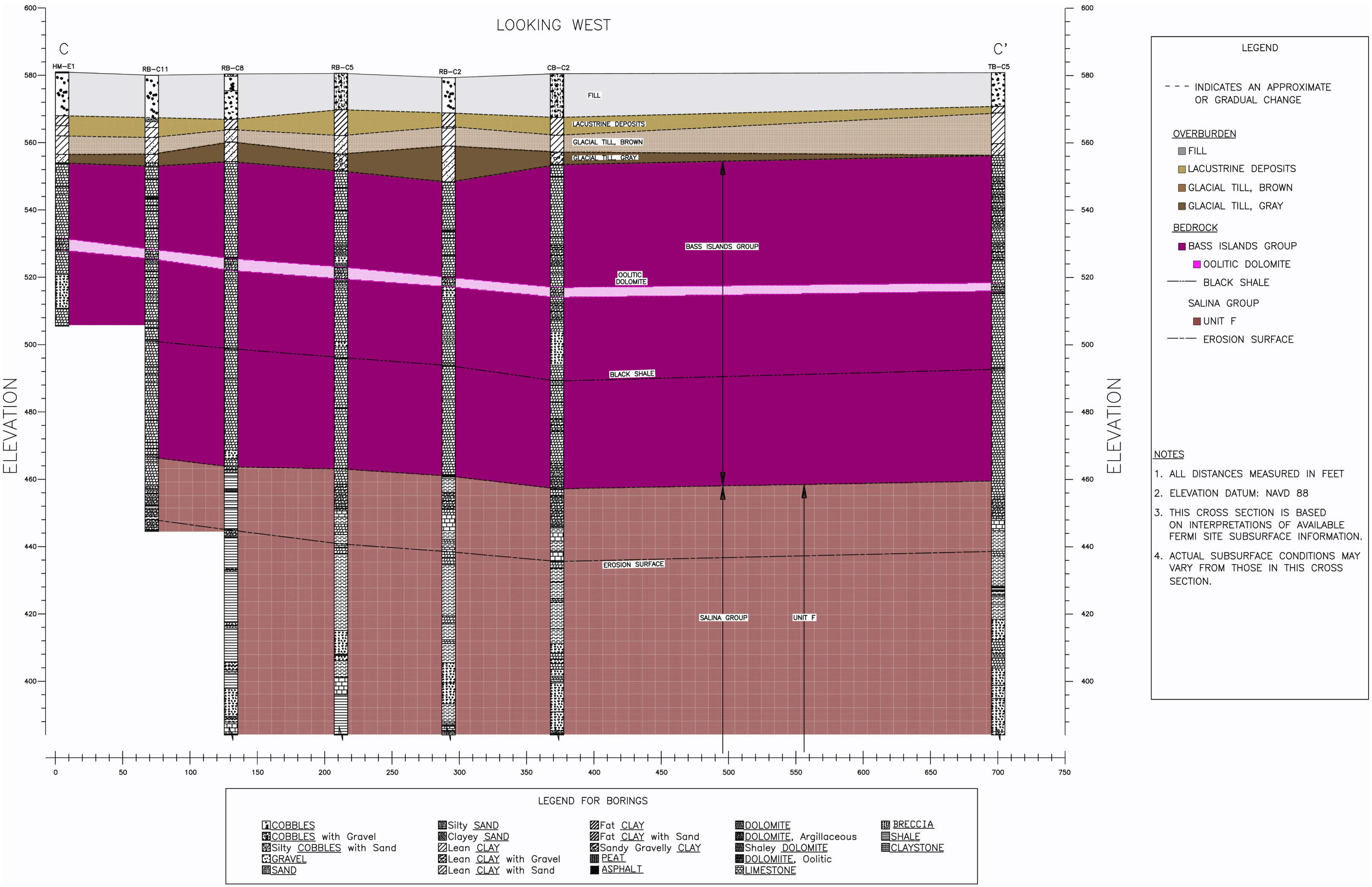


Figure 2.5.1-240 Geologic Cross Section D-D [EF3 COL 2.0-26-A]

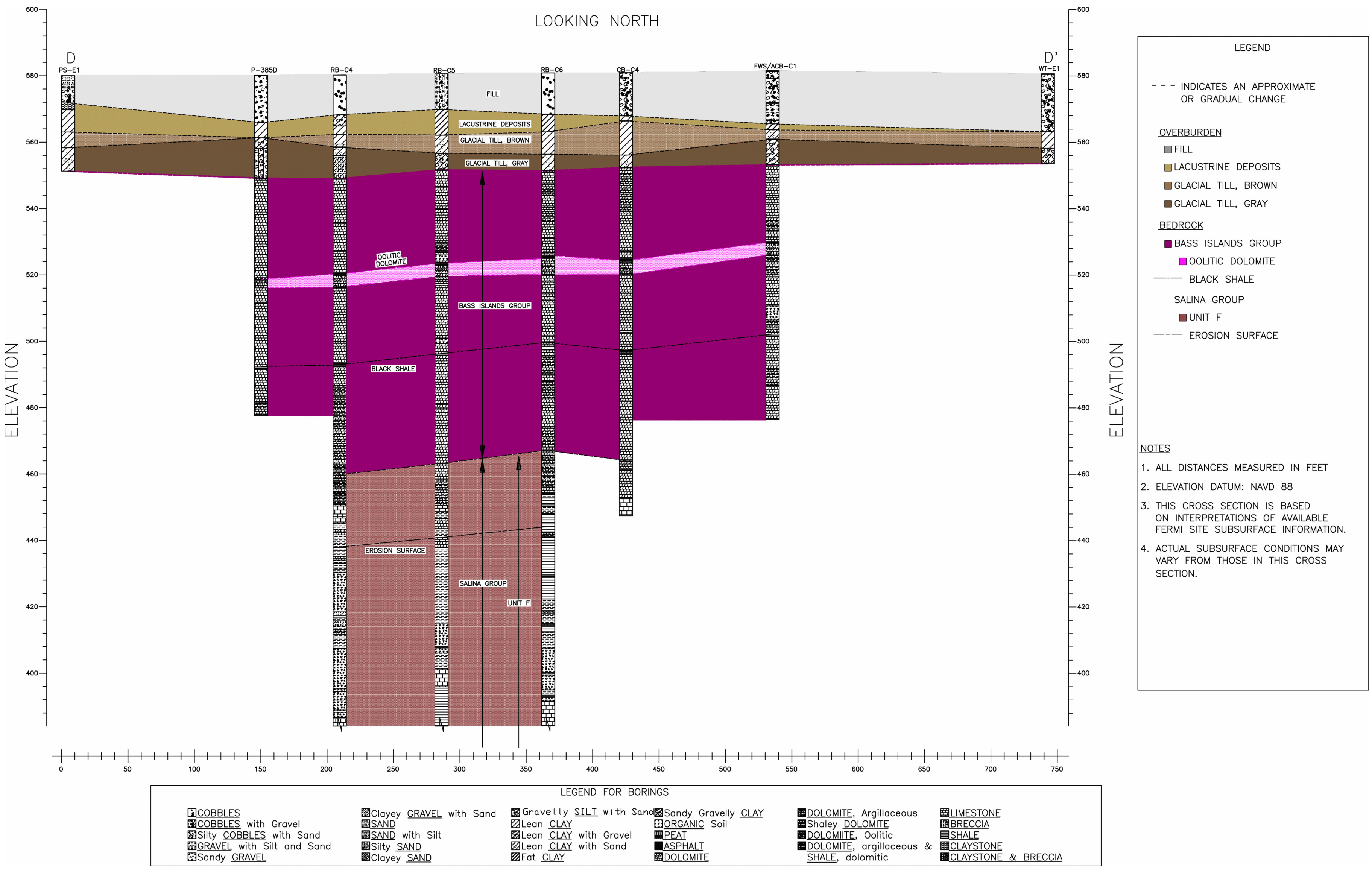
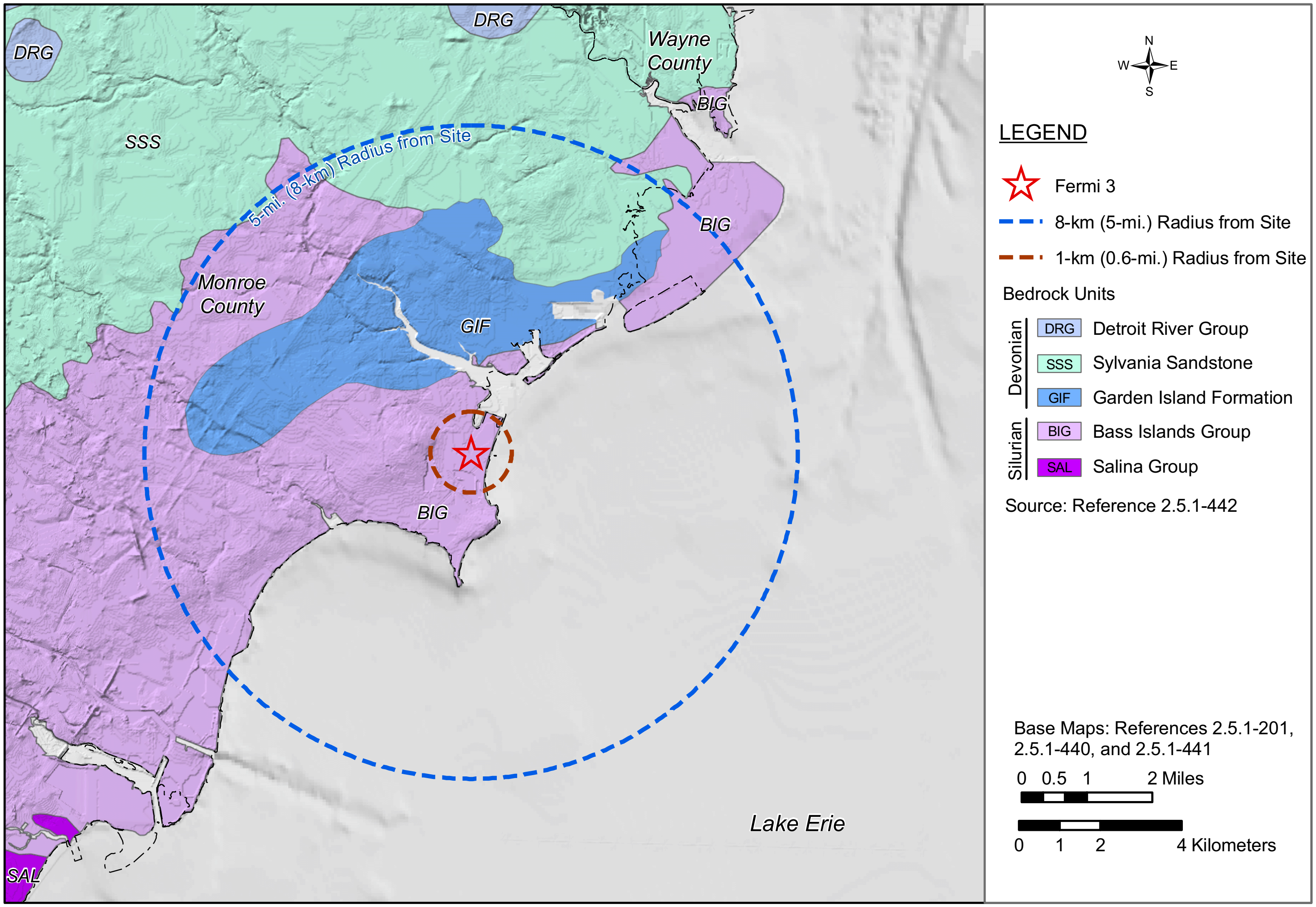


Figure 2.5.1-241 Geologic Map of the Fermi 3 Site Area [EF3 COL 2.0-26-A]



File path: S:\13300\13356\figures\2.5.1_figures\DTE_FSAR_FIG02_05_01_241.mxd; Date: [07/03/2008]

Figure 2.5.1-242 Natural Gamma Log of Fermi 3 Boring RB-C8 [EF3 COL 2.0-26-A]

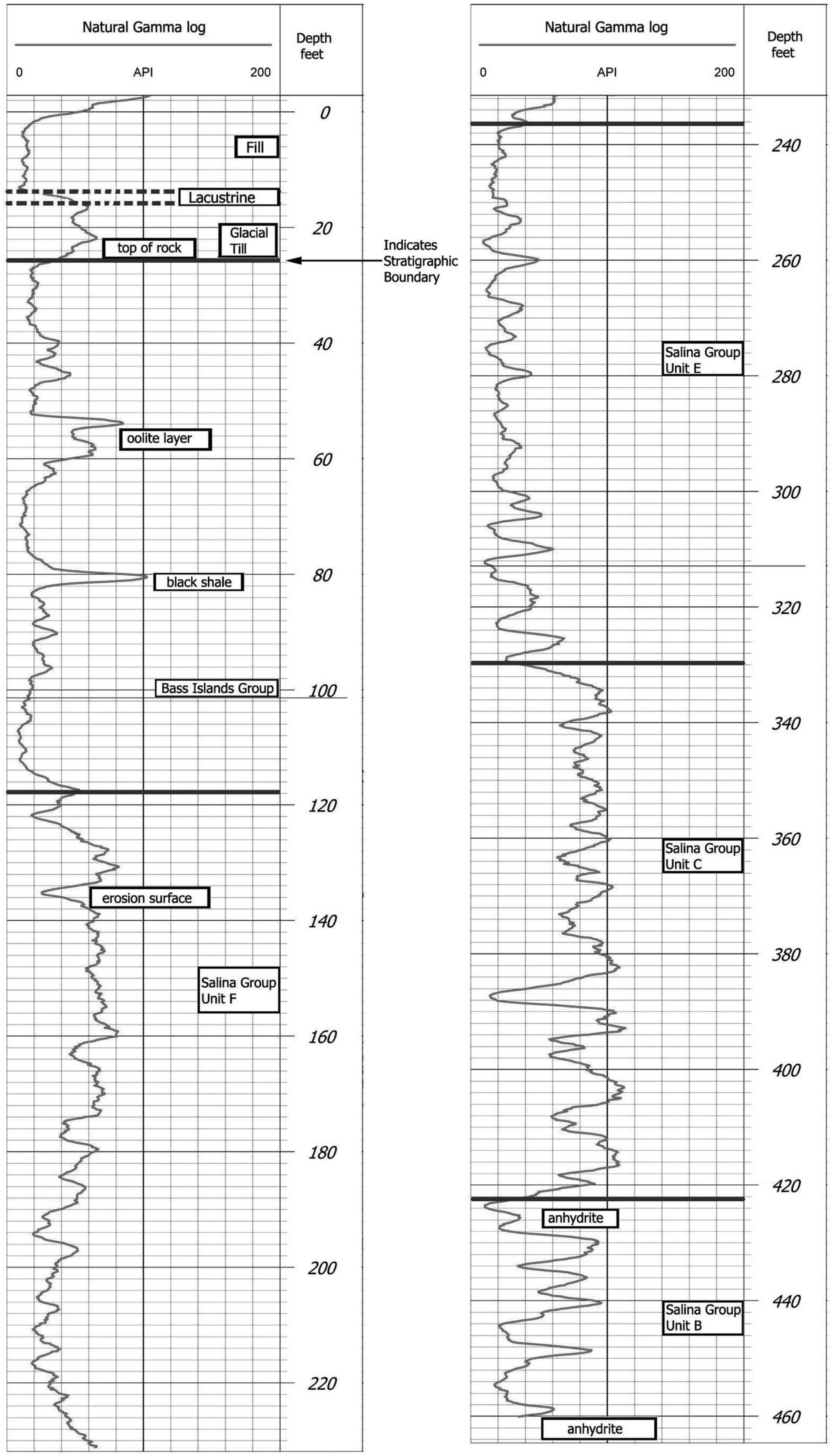


Figure 2.5.1-243 Photograph of Erosion Surface in Salina Unit F, Fermi 3 Boring CB-C2 [EF3 COL 2.0-26-A]

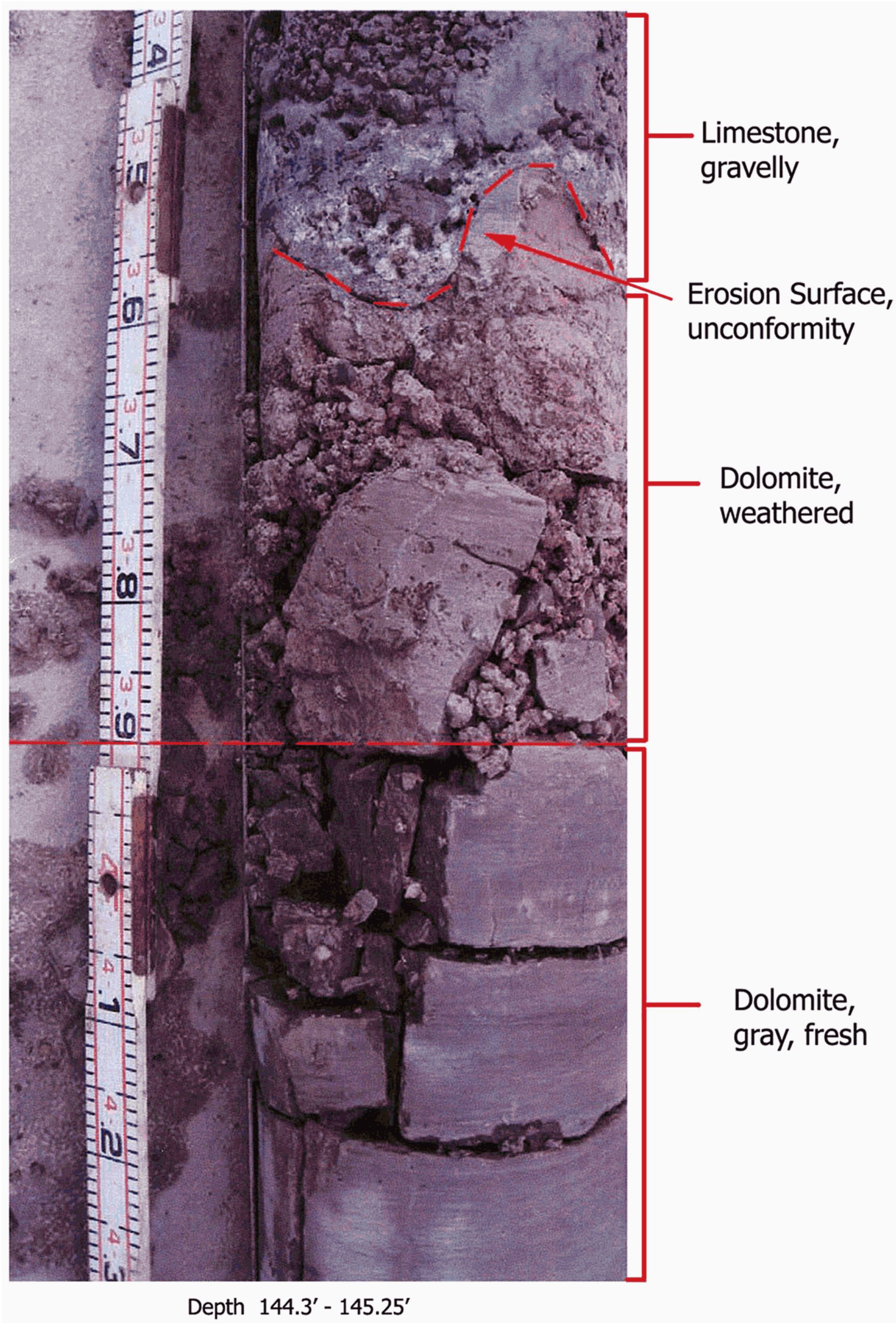
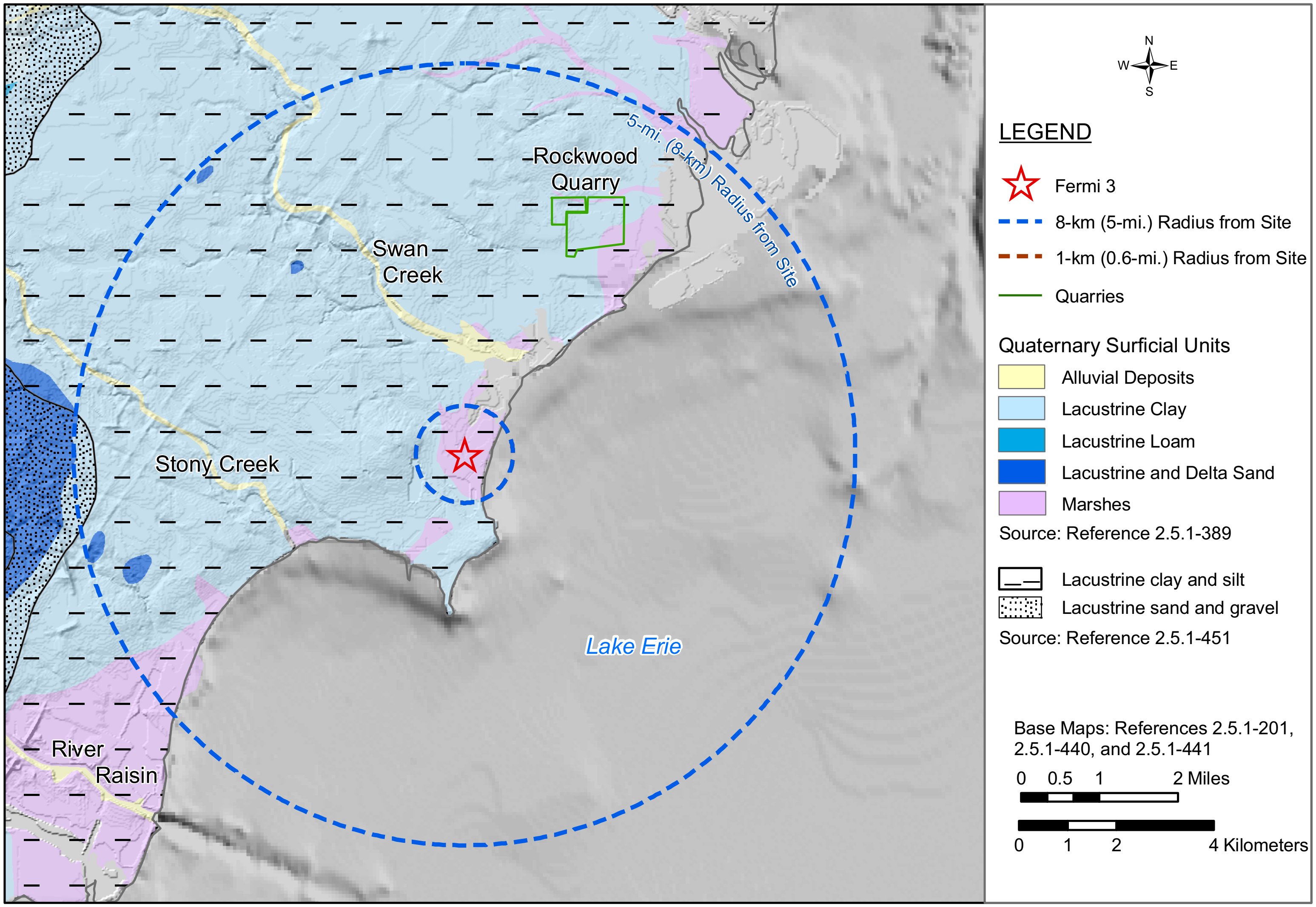


Figure 2.5.1-244 Quaternary Geologic Map of the Site Area [EF3 COL 2.0-26-A]



File path: S:\13300\13356\figures\2.5.1_figures\DTE_FSAR_FIG02_05_01_244.mxd; Date: [07/03/2008]

Figure 2.5.1-245 Map Showing Soils of the Fermi 3 Site Location [EF3 COL 2.0-26-A]

File path: S:\13300\13356\figures\2.5.1_figures\DTE_FSAR_FIG02_05_01_245.mxd; Date: [07/07/2008]

Figure 2.5.1-246 Tectonic Structures in the Fermi 3 Site Vicinity

[EF3 COL 2.0-26-A]

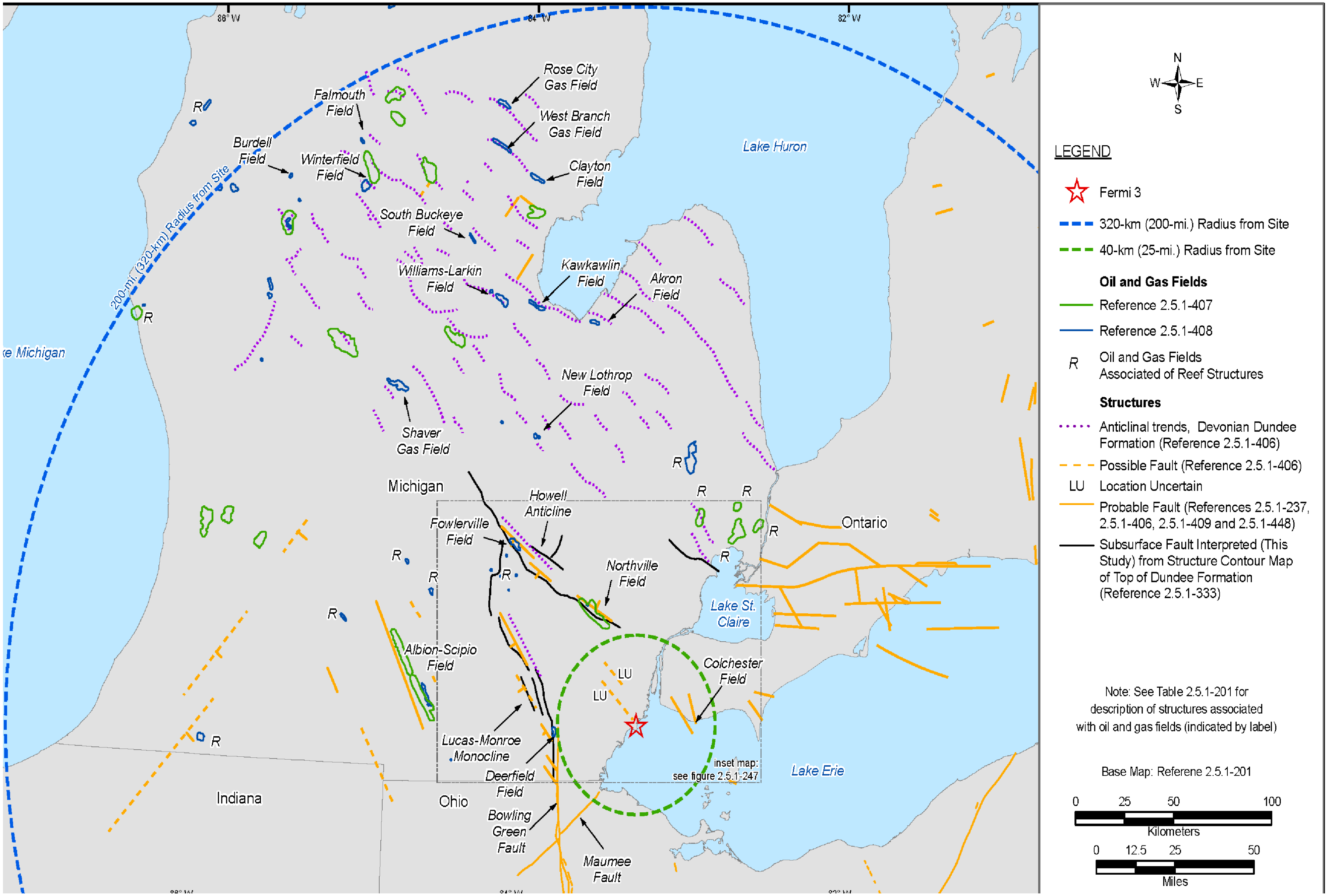


Figure 2.5.1-247 Structure Contour Maps from Monroe County, Michigan

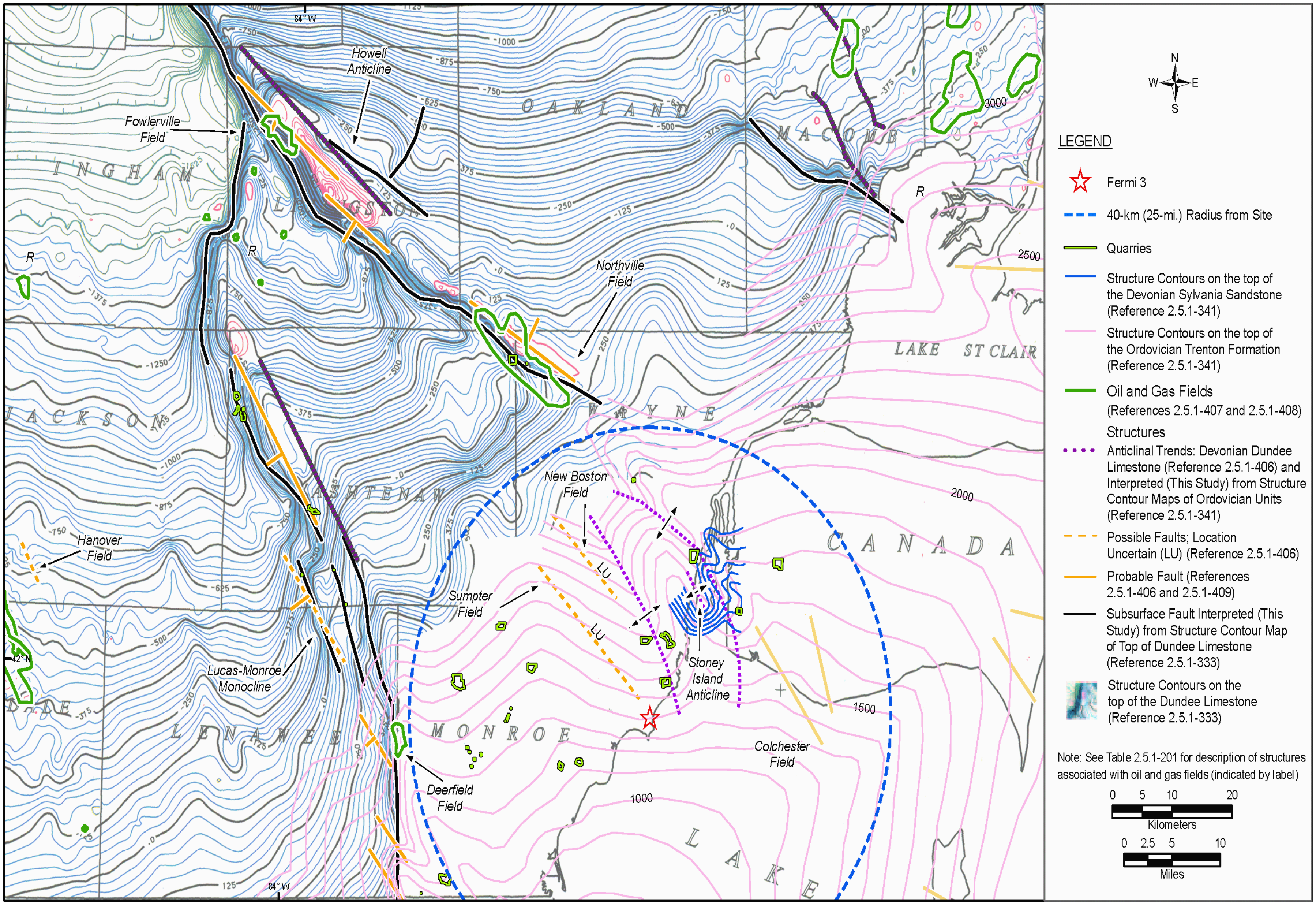
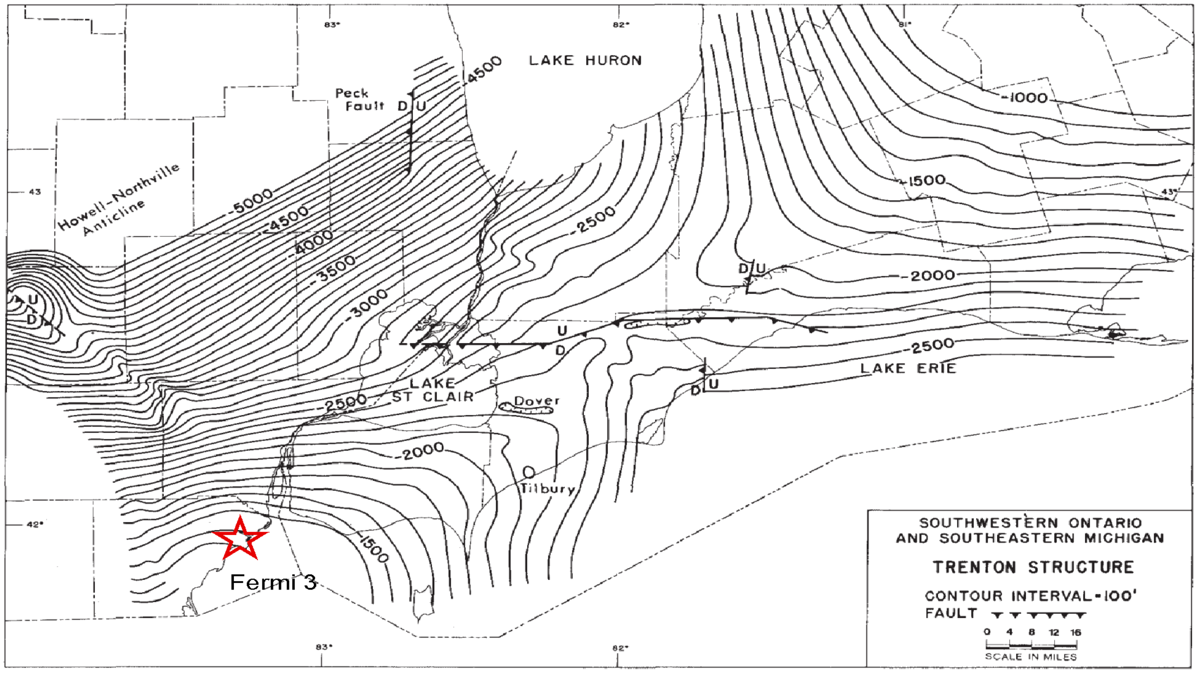
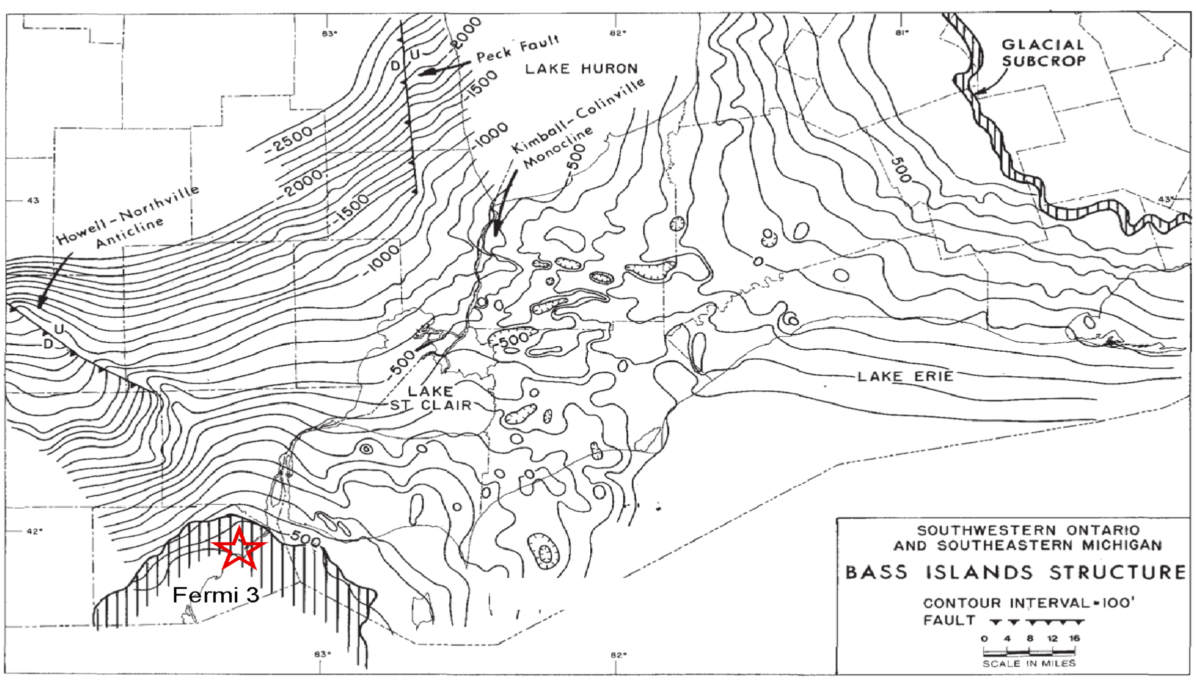


Figure 2.5.1-248 Structural Contour Maps Showing Bedrock Elevation of the Ordovician Trenton Group and the Silurian Bass Islands Formation [EF3 COL 2.0-26-A]



a. Structure contour on Ordovician Trenton Group



b. Structure contours on Silurian Bass Islands Formation

Source Reference 2.5.1-325

Figure 2.5.1-249 Structural Contour Map on the Top of the Bass Islands Group, Oolitic Dolomite Marker Horizon [EF3 COL 2.0-26-A]

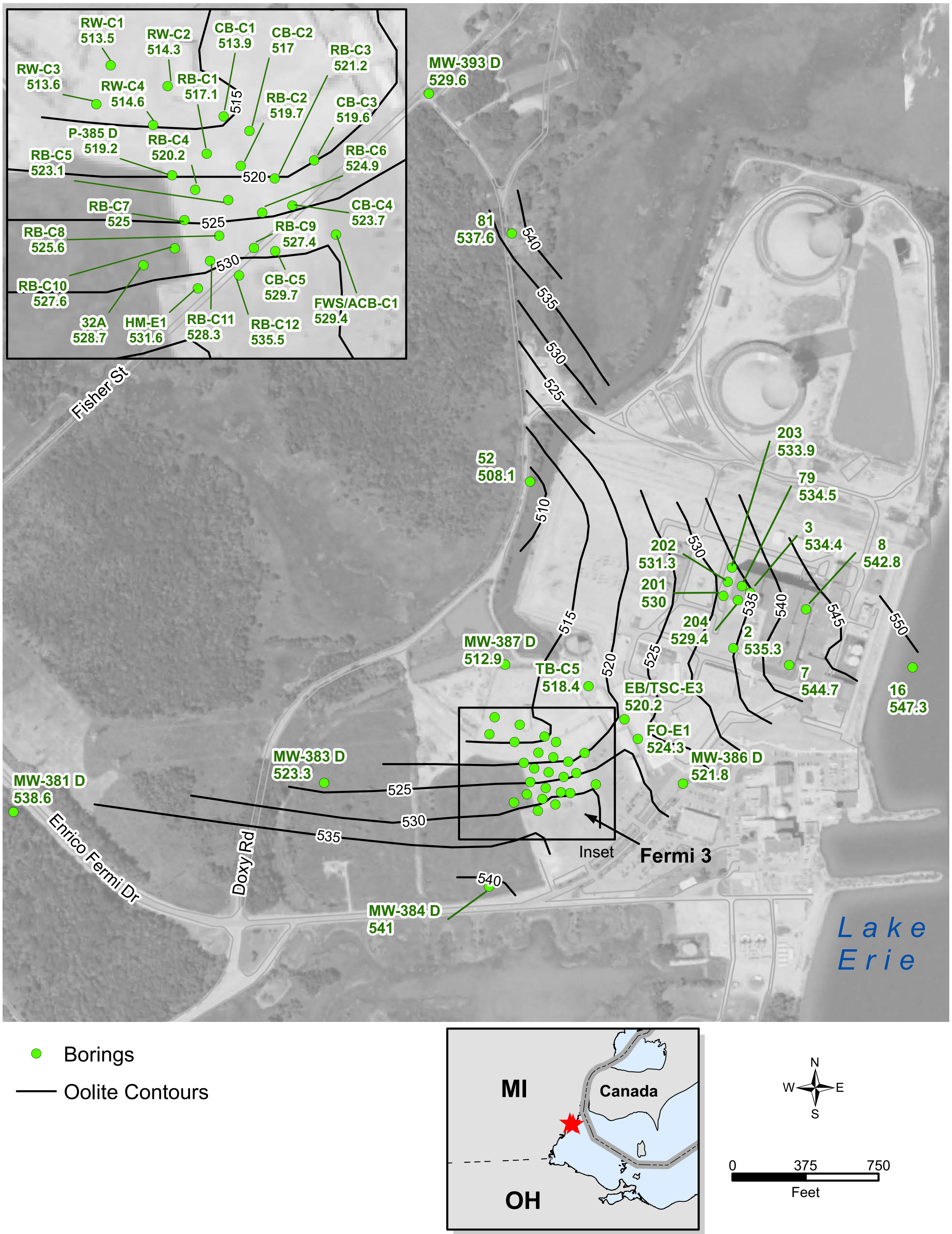


Figure 2.5.1-250 Fermi 3 Site Vicinity Physiographic Map

[EF3 COL 2.0-26-A]

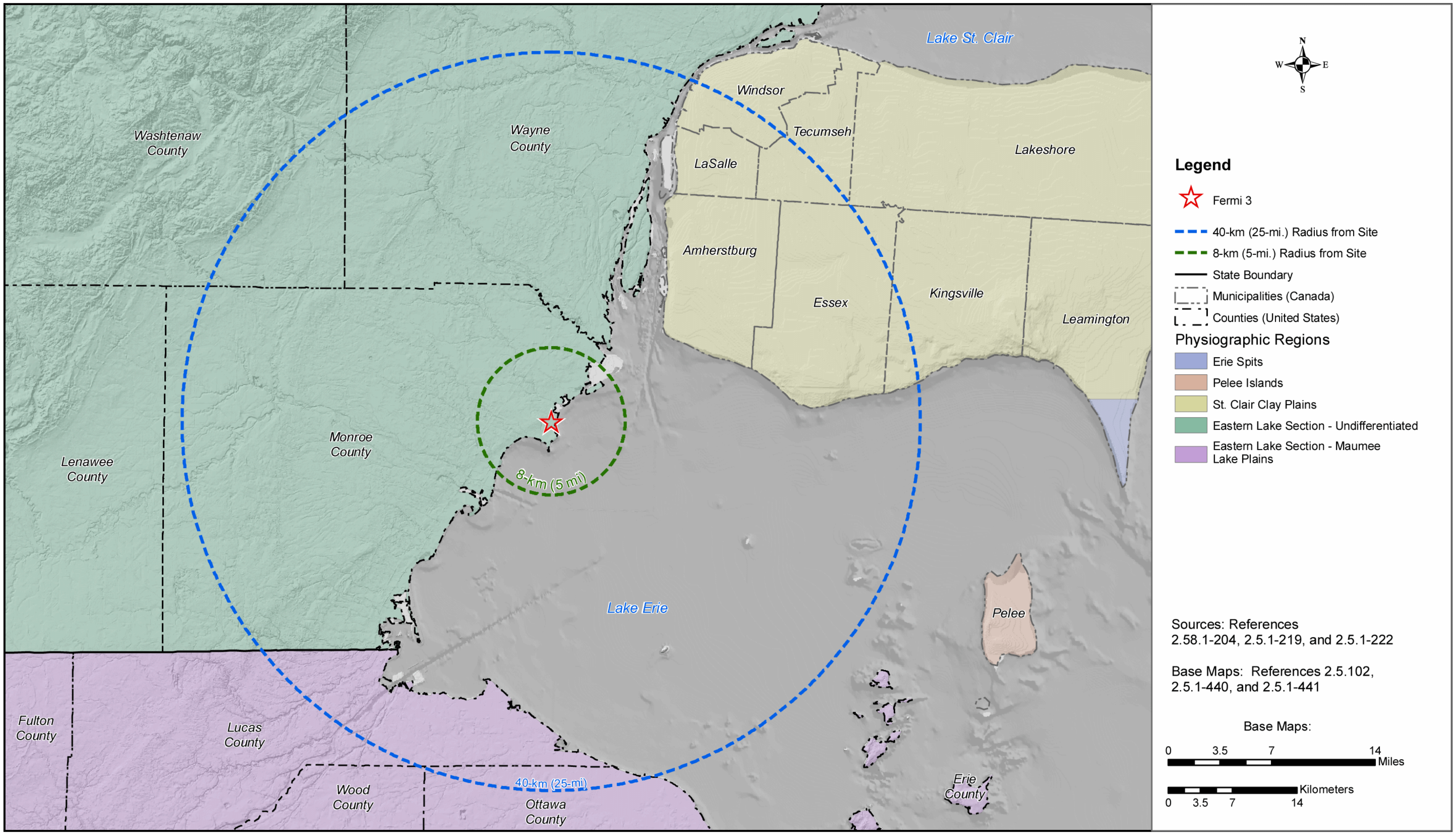
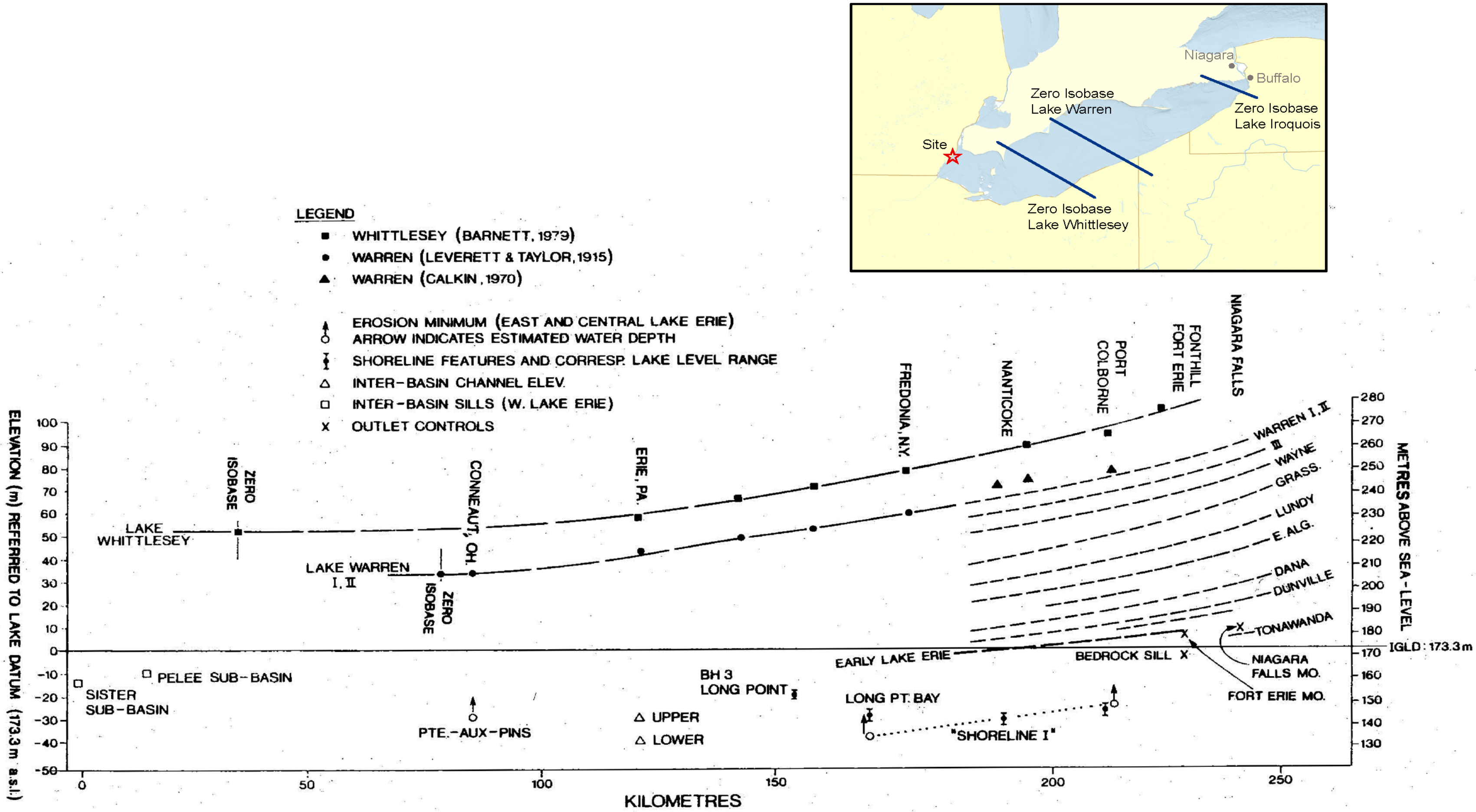


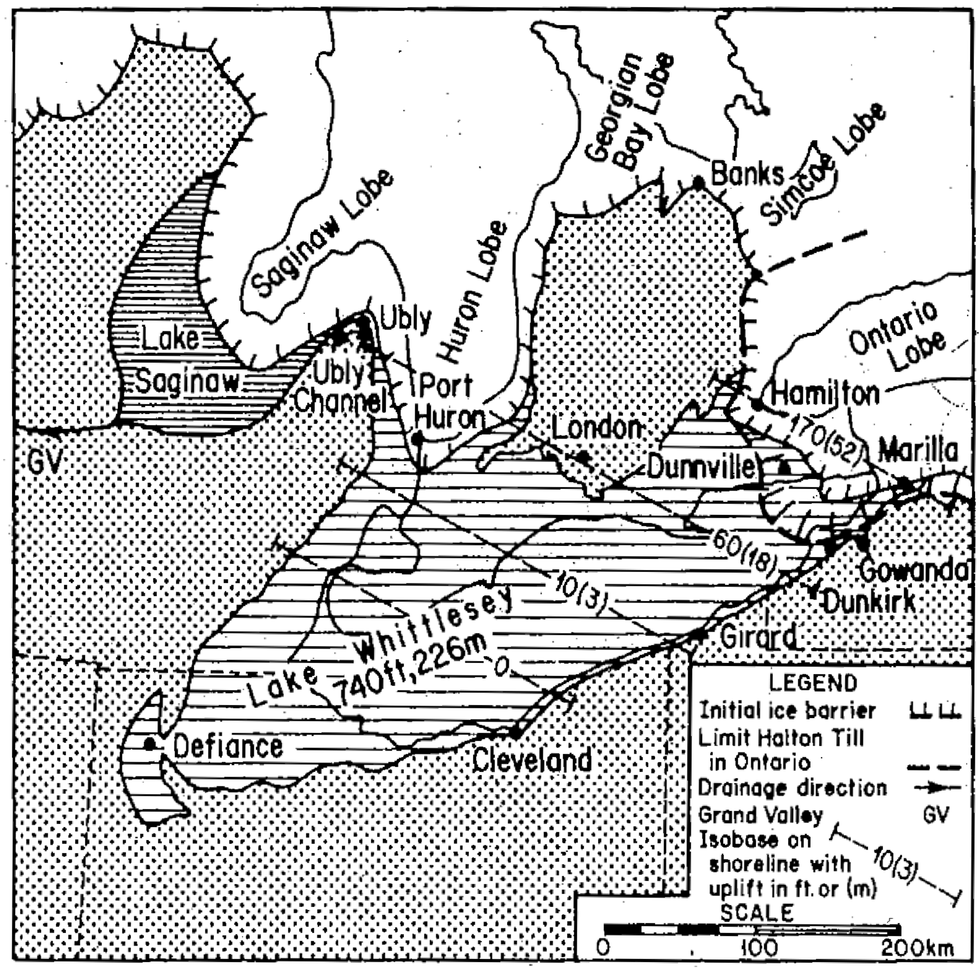
Figure 2.5.1-251 Plot of Elevation Versus Distance of Raised and Uptilted Shorelines of the Whittlesey and Subsequent Lake Phases [EF3 COL 2.0-26-A]



Note. Profile is oriented N 24º E, the direction of maximum tilting. Also plotted are submerged geomorphological features noted on or below the lake bottom, and their relationship to possible outlet controls at the Niagara River.

Source: Reference 2.5.1-296

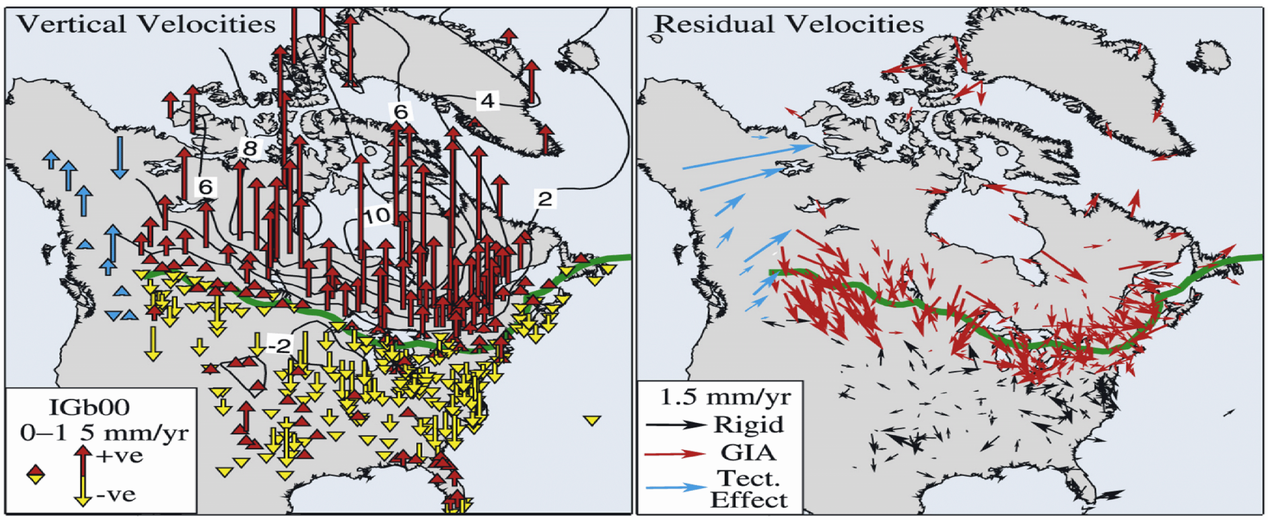
Figure 2.5.1-252 Lakes Whittlesey and Saginaw, and the Port Huron Stade Ice Barriers [EF3 COL 2.0-26-A]



Note. Isobases on Whittlesey shoreline features tilted in N27ºE direction. The true isobases may bow southwestward more nearly parallel to former ice margins as they cross the basin.

Source: Reference 2.5.1-297

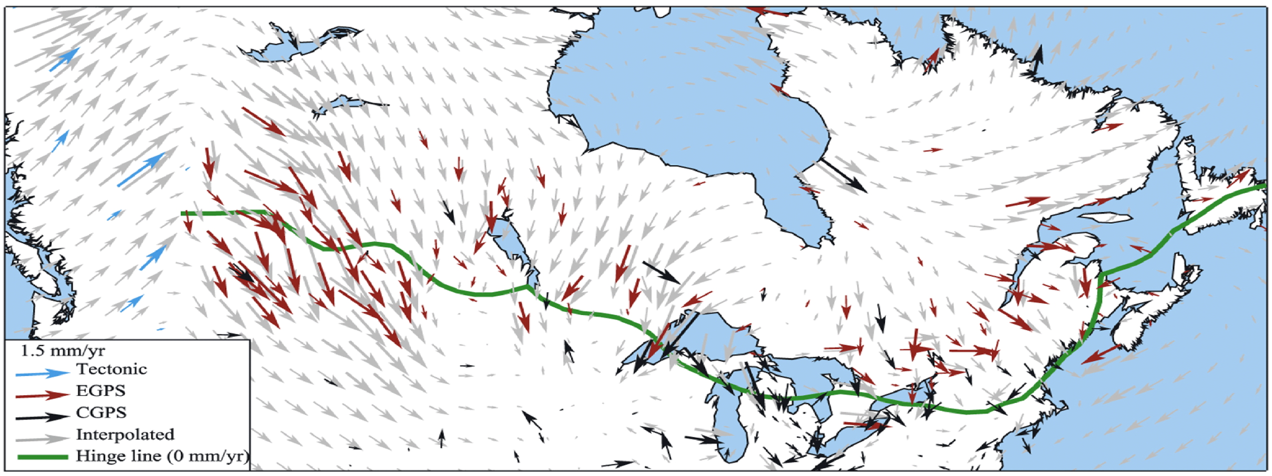
Figure 2.5.1-253 GPS Motions [EF3 COL 2.0-26-A]



Note. (left) Vertical GPS site motions with respect to IGb00. Note large uplift rates around Hudson Bay, and subsidence to the south. Green line shows interpolated 0 mm/yr vertical "hinge line" separating uplift from subsidence. (right) Horizontal motion site residuals after substracting best fit rigid plate rotation model defined by sites shown with black arrows. Red vectors represent sites primarily affected by GIA. Blue vectors represent sites that include effects of tectonics.

Source: Reference 2.5.1-291

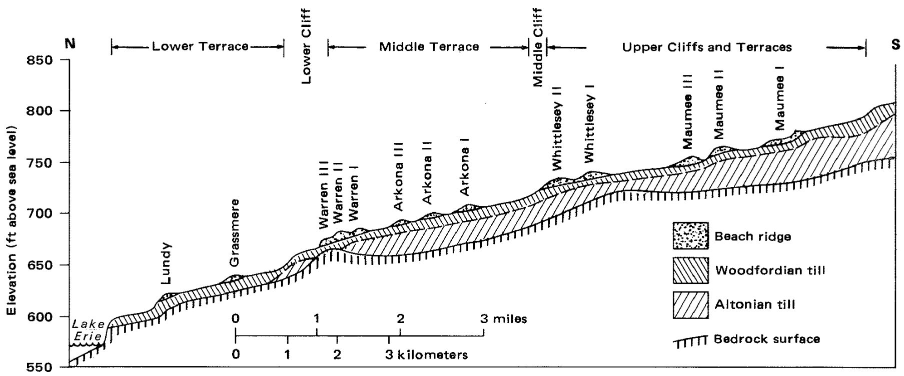
Figure 2.5.1-254 GPS Horizontal Velocities with Motion of Rigid North America Removed [EF3 COL 2.0-26-A]



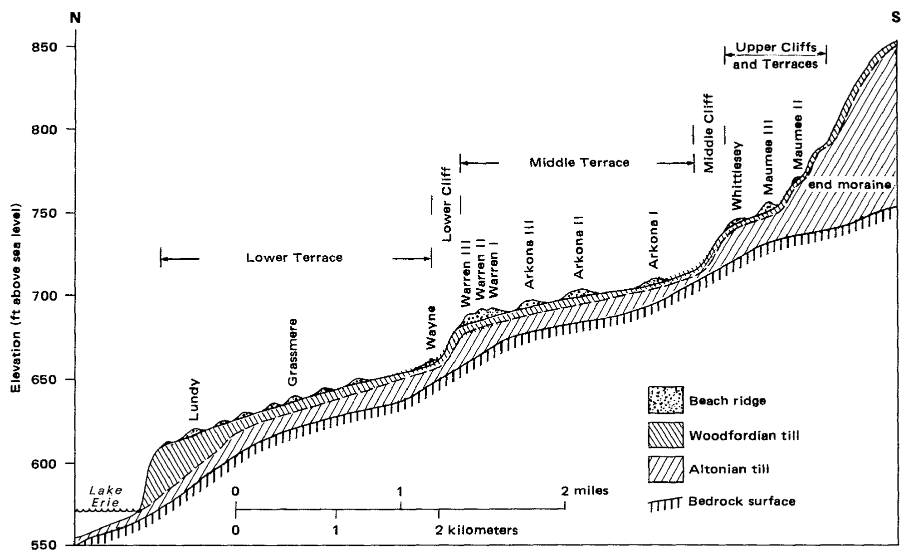
Notes.
CGPS = Continuosly Recorded GPS
EGPS = Episodic GPS

Source: Reference 2.5.1-291

Figure 2.5.1-255 Composite Cross Sections of Strandlines in Northern Ohio
[EF3 COL 2.0-26-A]



Composite cross section of strandlines south of Lake Erie in Lorain and western Cuyahoga Counties.



Composite cross section of strandlines south of Lake Erie in Lake and Ashtabula Counties.

Note. Three features are evident: (1) cliffs and terraces cut into bedrock; (2) cliffs and terraces cut into Altonian till (early Wisconsinan in age) and later mantled with Woodfordian till (late Wisconsinan in age); and (3) beach ridges on terraces.

Source: Reference 2.5.1- 489

Figure 2.5.1-256 Paleo-shorelines and Structural Features in the Vicinity of Fermi 3 Site [EF3 COL 2.0-26-A]

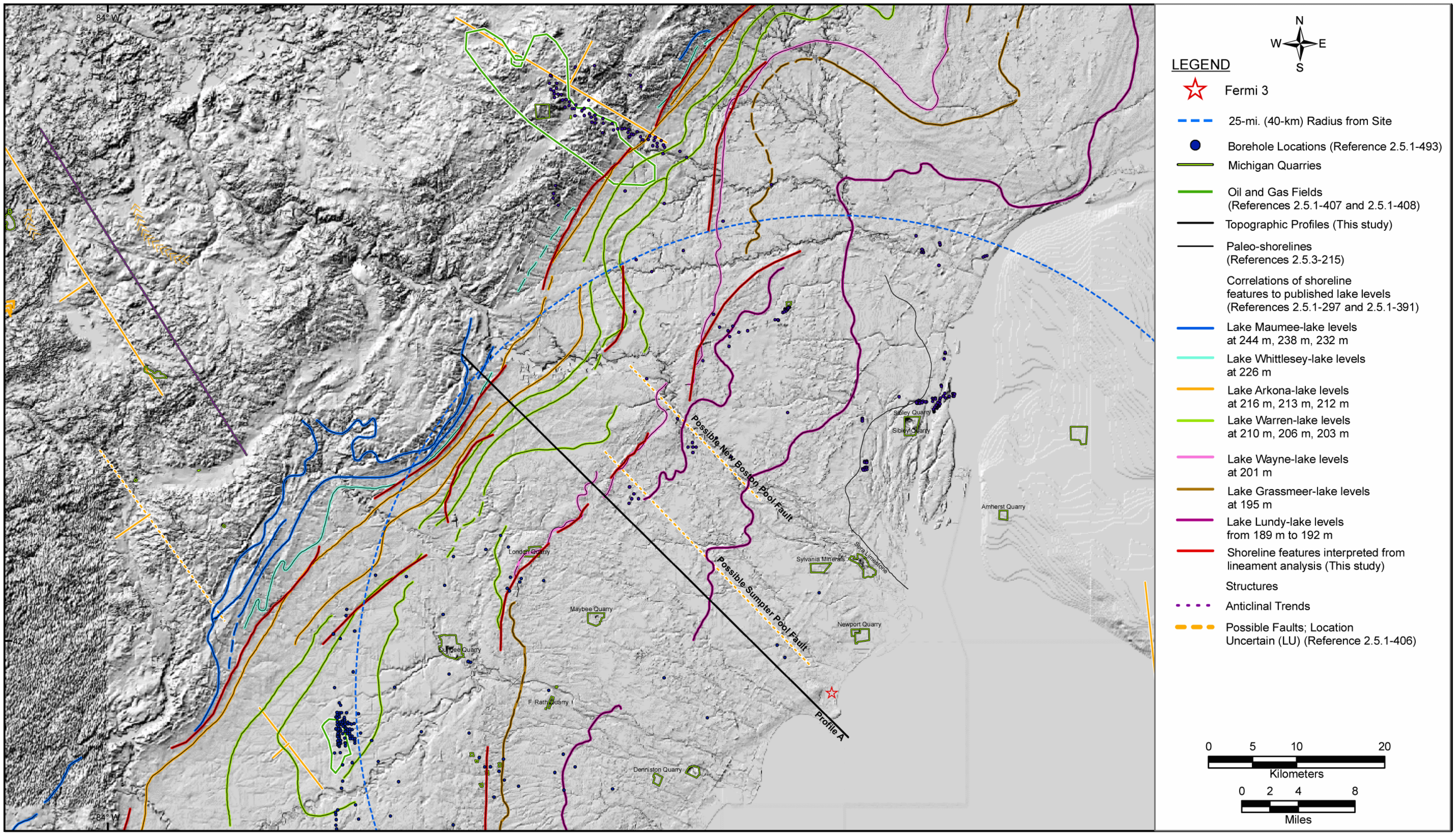
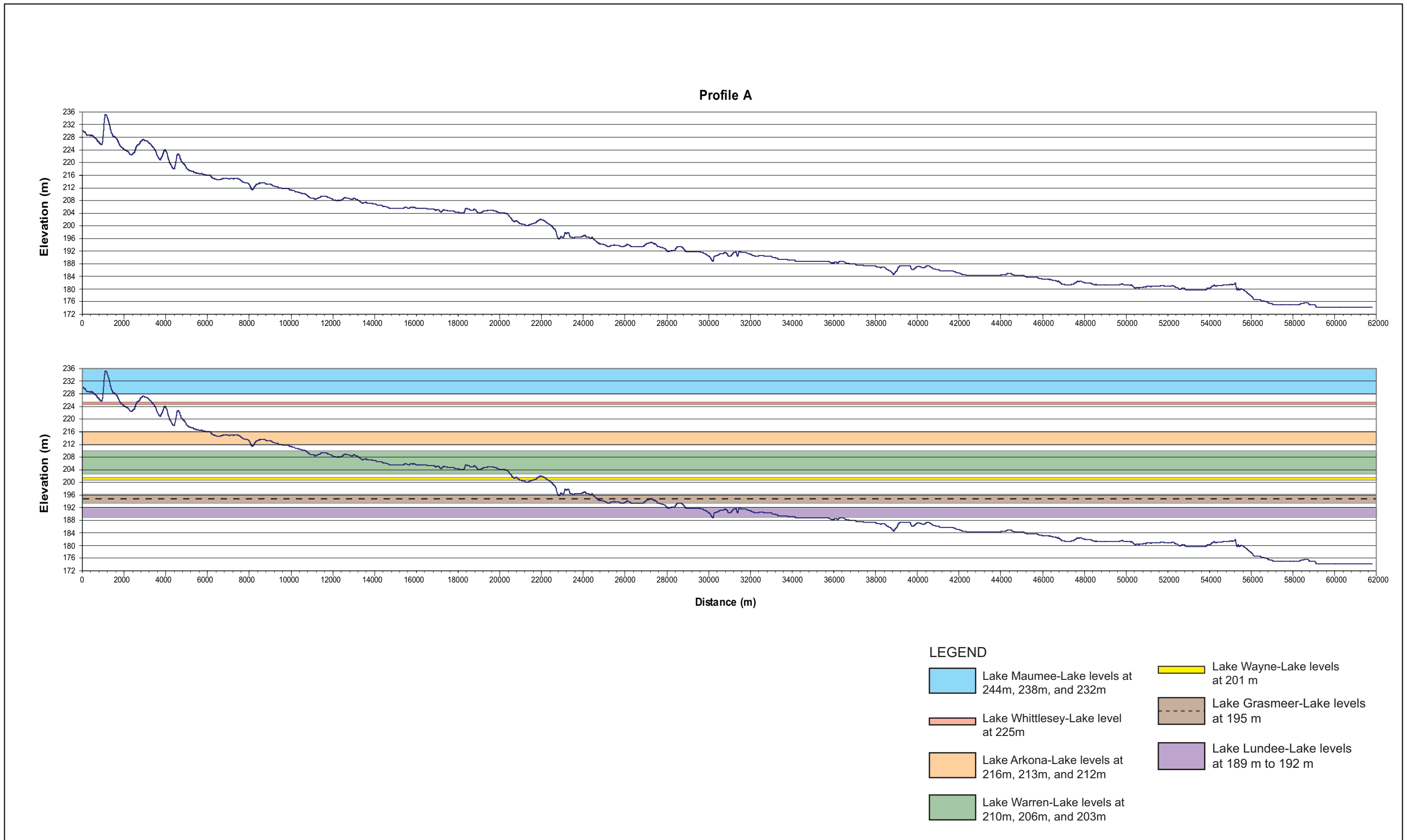


Figure 2.5.1-257 Topographic Profile AA′ Relative to Published Elevations of Mapped Paleo-shoreline Features

[EF3 COL 2.0-26-A]

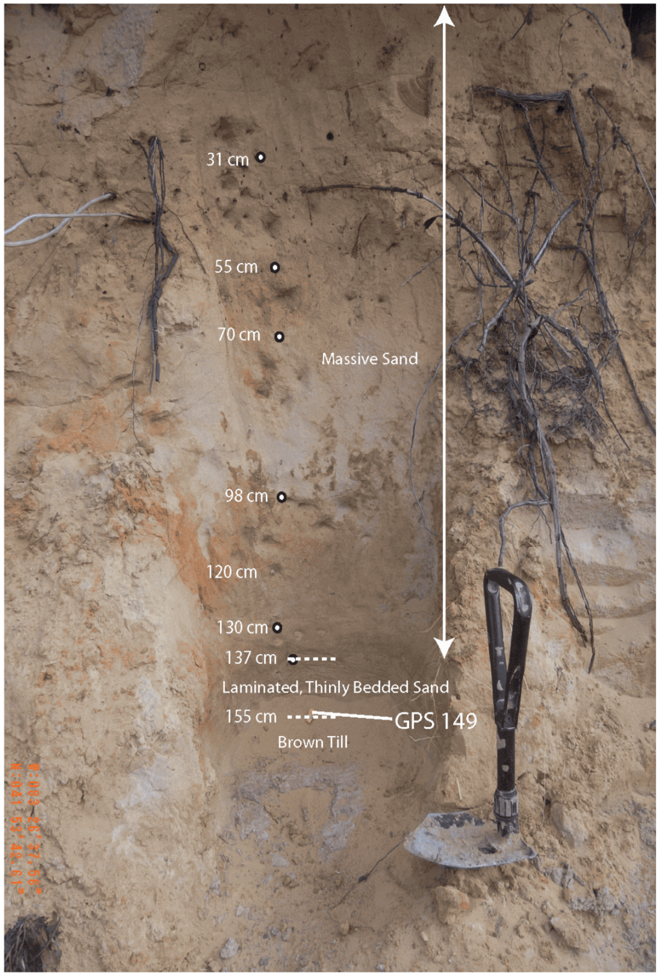


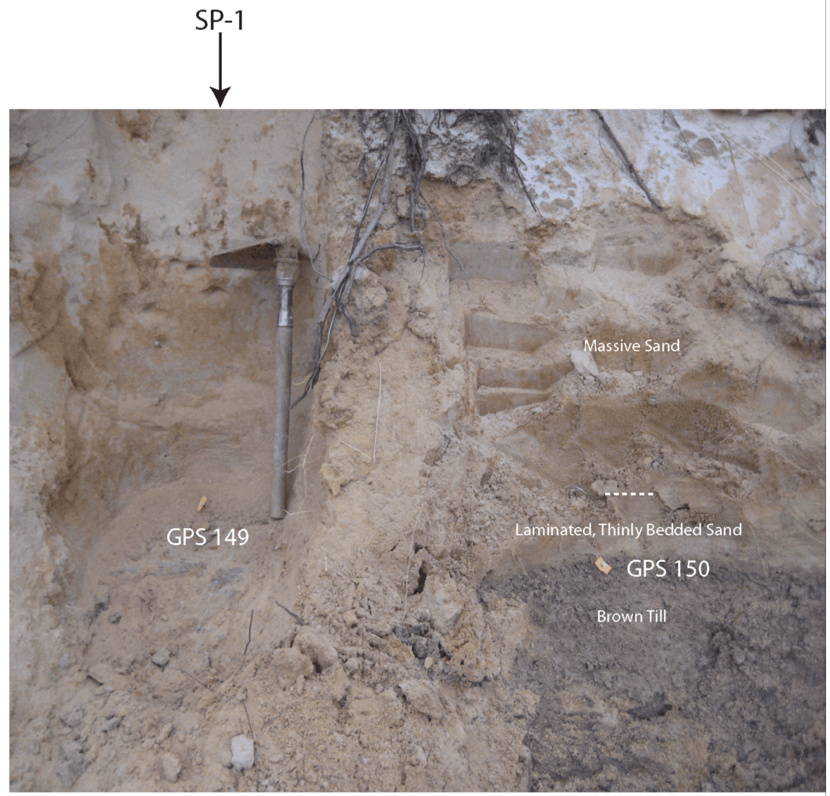
Source: Raference 2.5.1-297, Reference 2.5.1-391

Figure 2.5.1-258 Denniston Quarry: Quaternary Excavations, Soil Profile Locations and Mapped Soil Units

[EF3 COL 2.0-26-A]

Figure 2.5.1-259 Denniston Quarry: Soil Profile SP-1 in Quaternary Excavation QE-1 [EF3 COL 2.0-26-A]





Photograph showing SP-1 soil horizon boundaries (designated by depth).

Figure 2.5.1-260 Denniston Quarry: Stratigraphy Exposed in Quaternary QE-2 [EF3 COL 2.0-26-A]

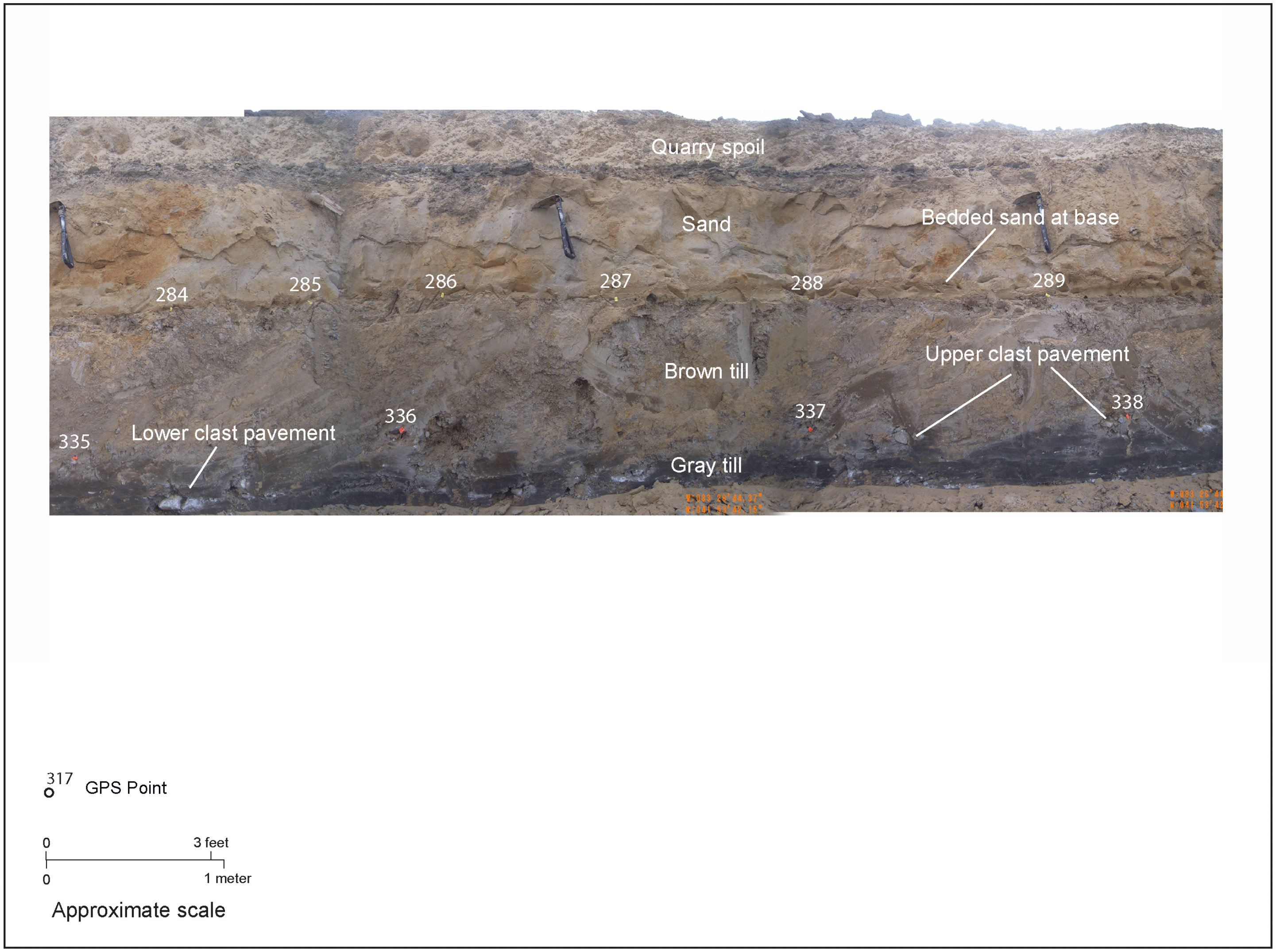


Figure 2.5.1-261 Denniston Quarry: Quaternary Excavation QE-3 and Soil Profiles SP-2 and SP-3

[EF3 COL 2.0-26-A]

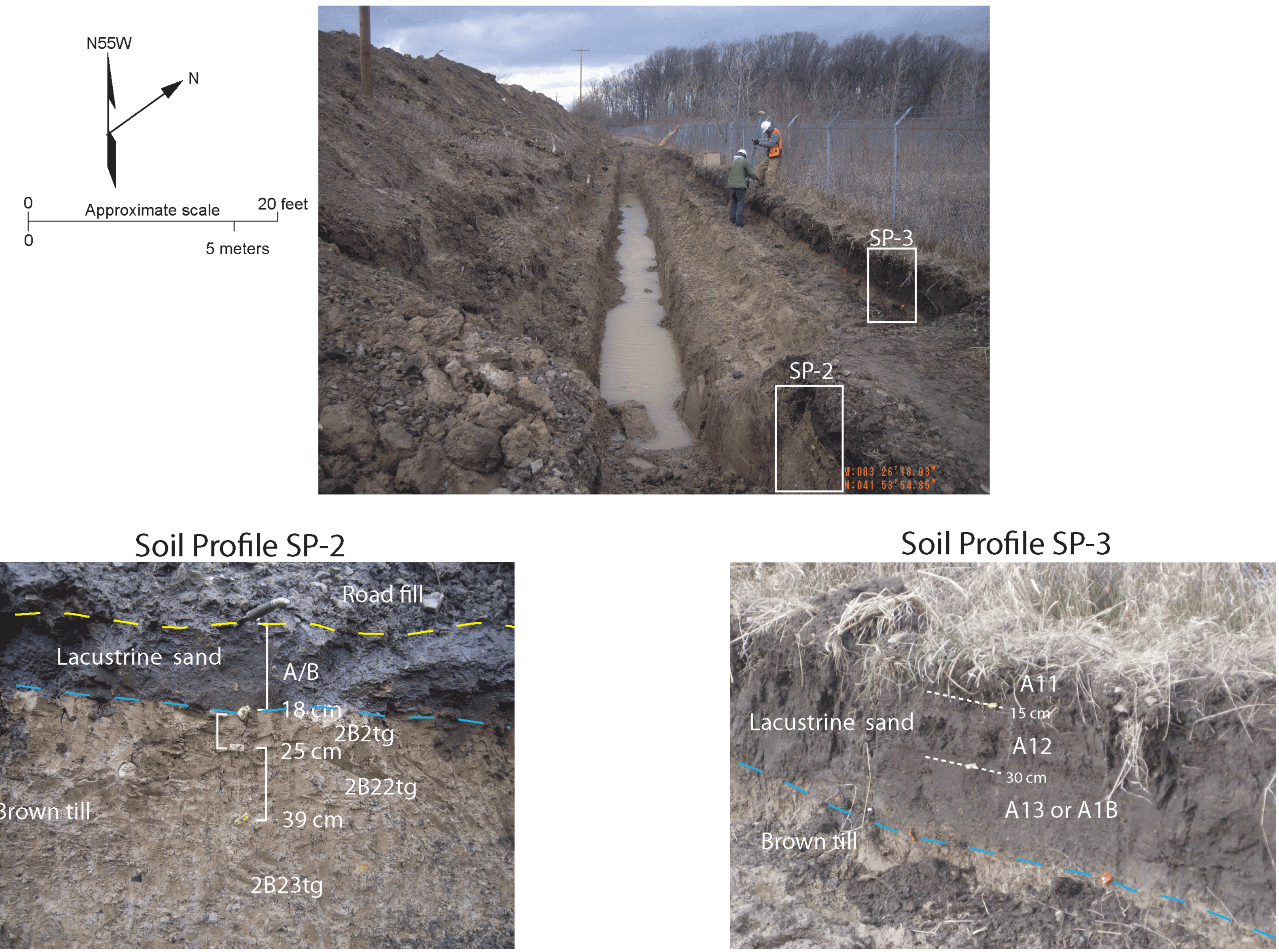
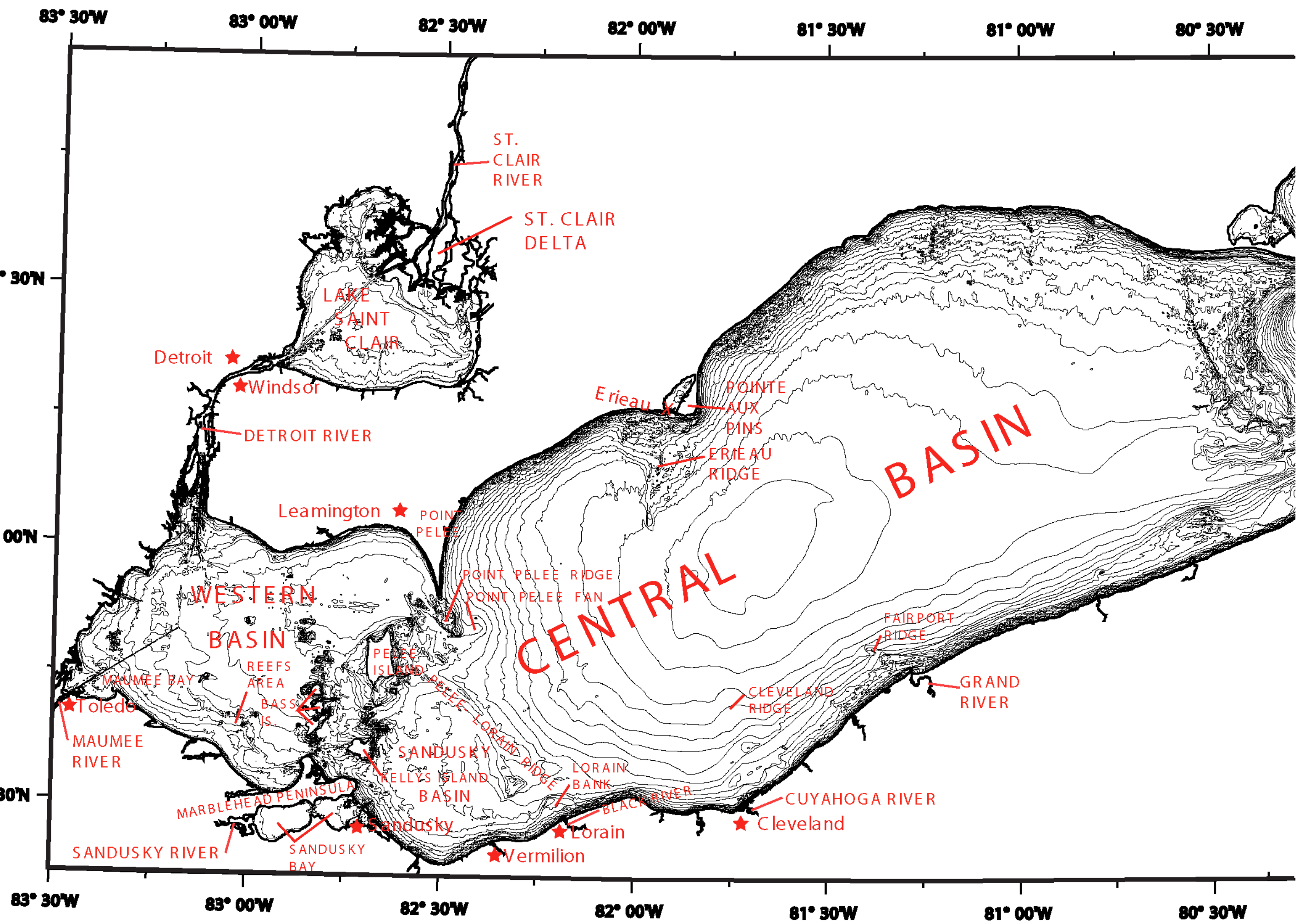


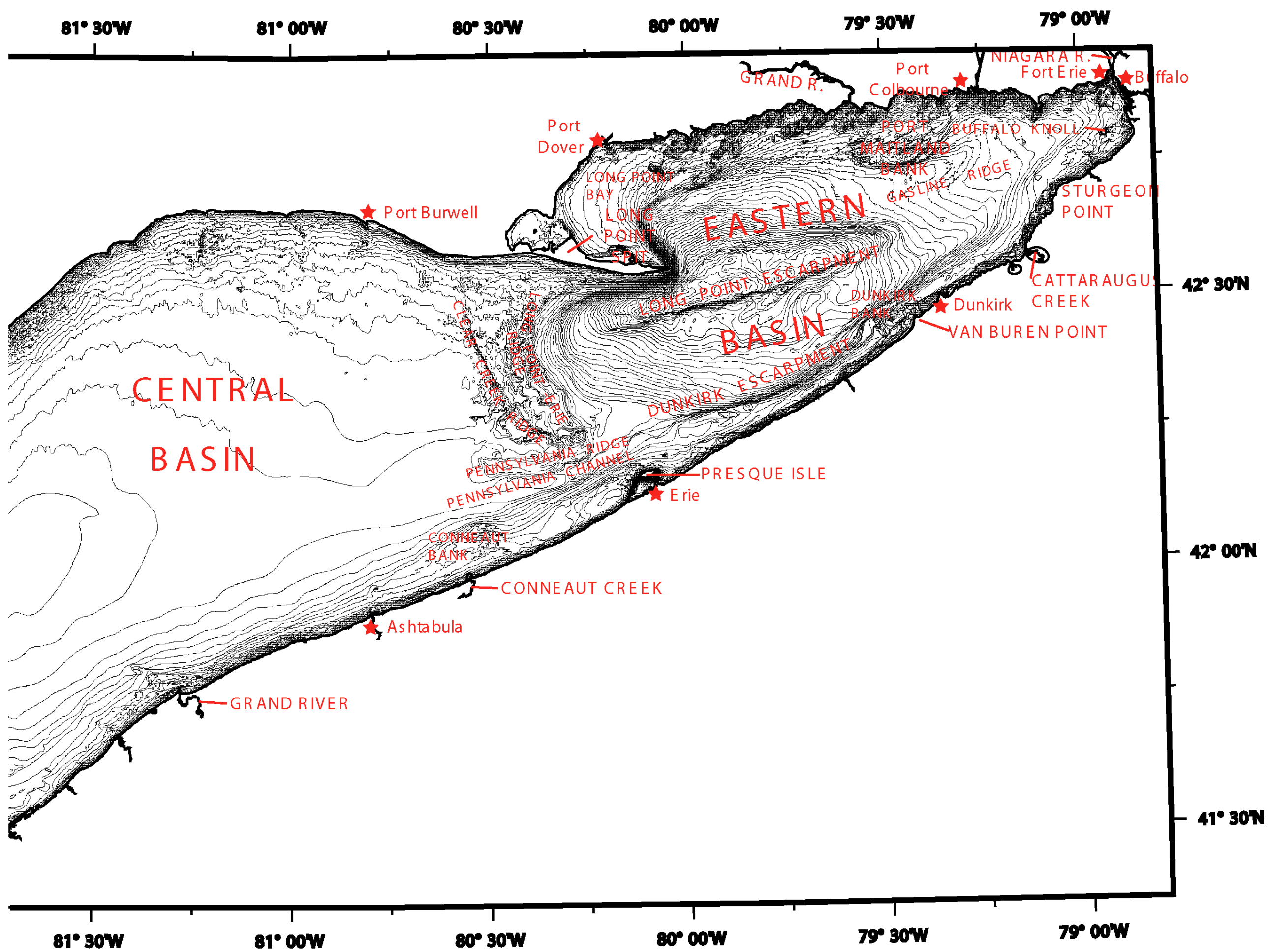
Figure 2.5.1-262 Denniston Quarry: North Wall of Quaternary Excavation QE-3 [EF3 COL 2.0-26-A]

Figure 2.5.1-263 Index Map of Western Lake Erie Showing Names of Geographic Features [EF3 COL 2.0-26-A]



Source: Reference 2.5.1-494

Figure 2.5.1-264 Index Map of Eastern Lake Erie Showing Names of Geographic Features [EF3 COL 2.0-26-A]



Source: Reference 2.5.1-494

Figure 2.5.1-265 Map Showing Locations of the Oil and Gas Wells Near the Sumpter and New Boston Pool Possible Faults

[EF3 COL 2.0-26-A]

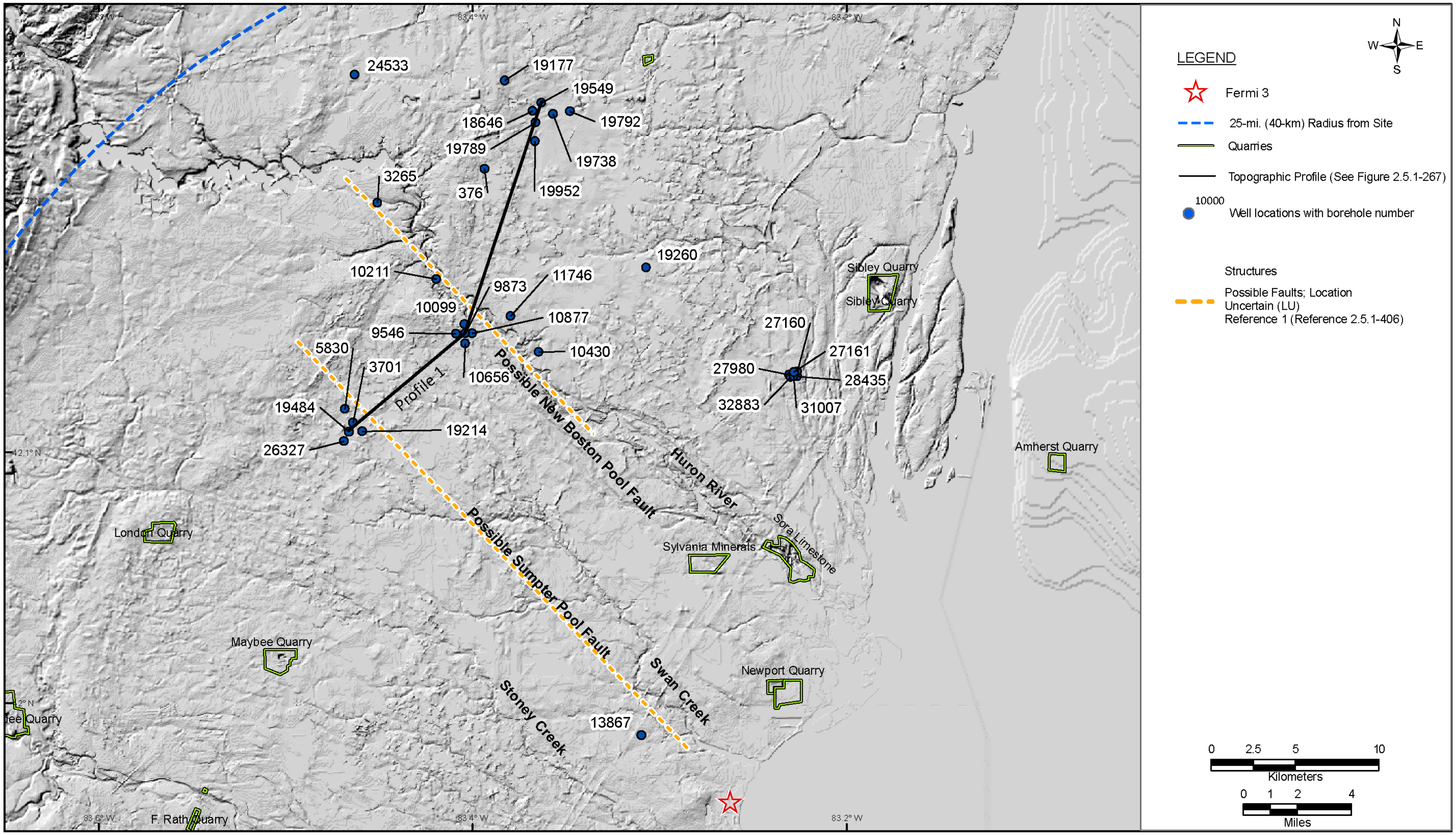
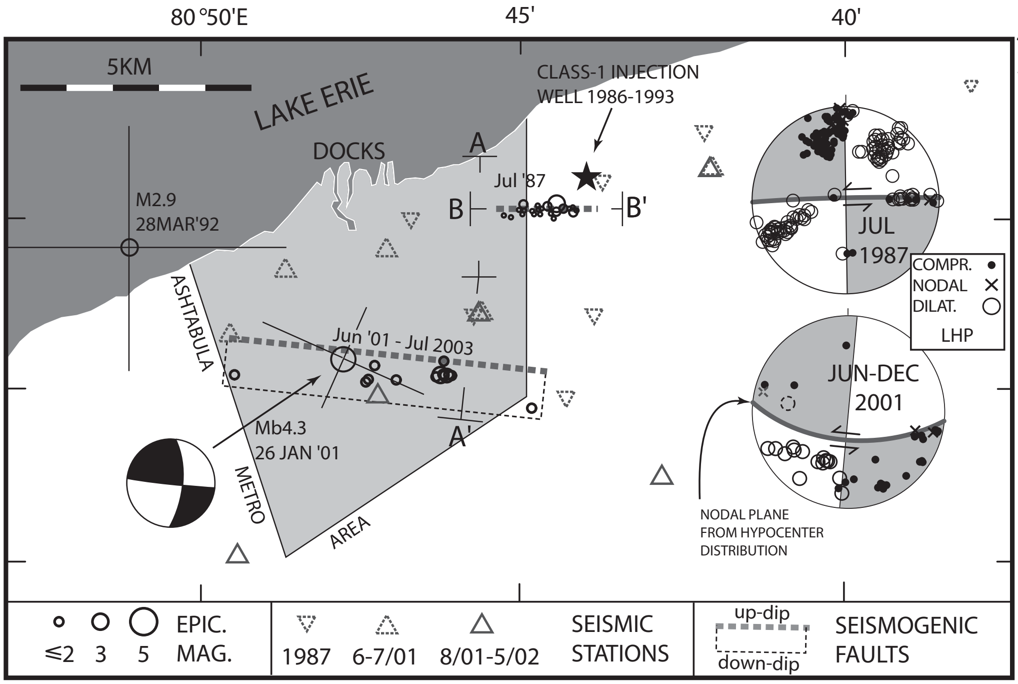


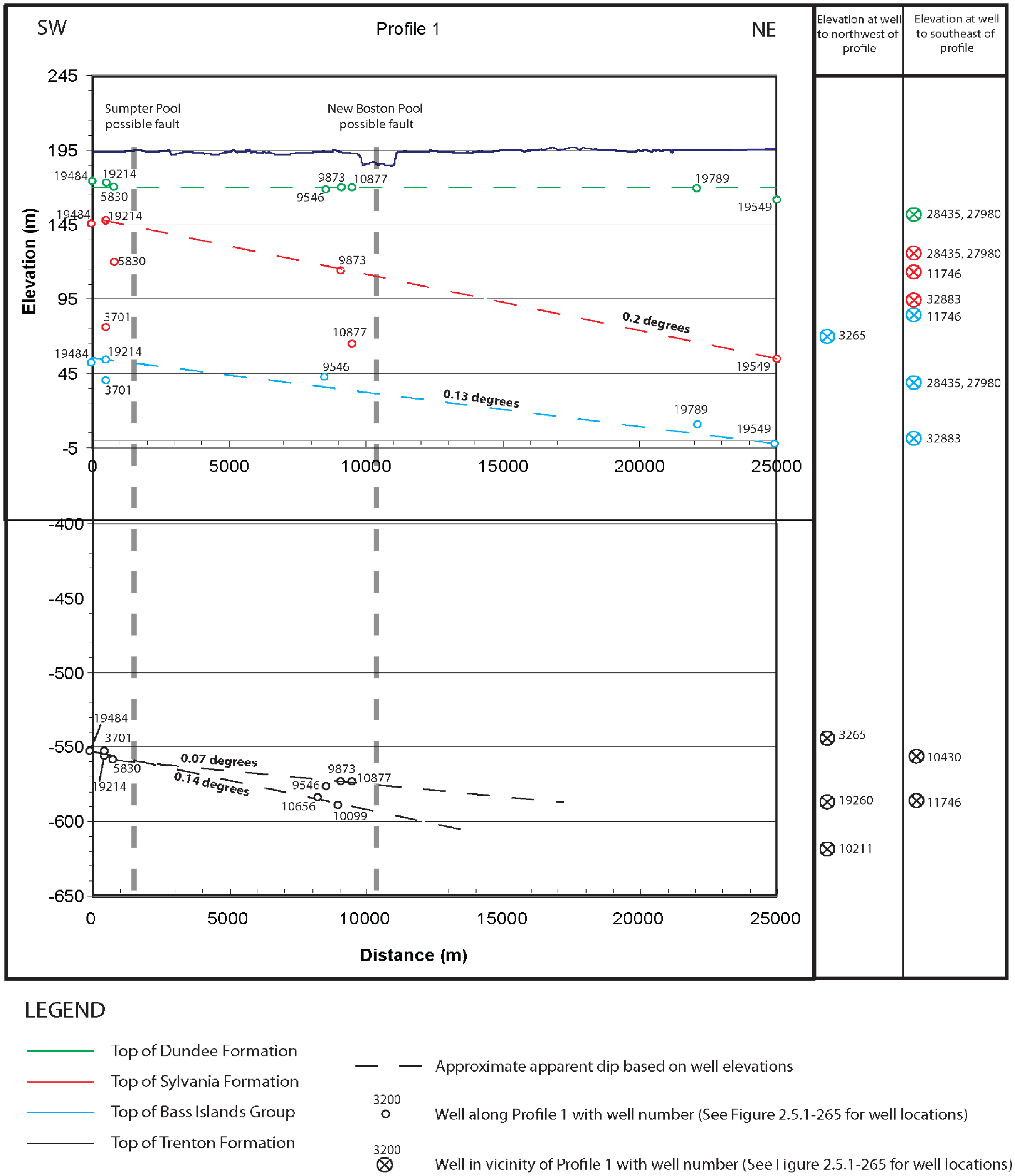
Figure 2.5.1-266 Earthquake and Inferred Fault Planes in the Ashtabula, Ohio, Area
[EF3 COL 2.0-26-A]



Reference 2.5.1-455

Accurate hypocenters and first motions in Ashtabula, Ohio, from two short-term deployments of portable seismographs. Data from 1987 illuminated a vertical east–west–striking left-lateral fault in the basement (Seeber and Armbruster, 1993). This activity was 0.7–2.0 km from a waste-disposal well (star) and started 1 year after the onset of injection. Several episodes of felt earthquakes during the following years were not monitored by local instruments. An M_{blg} 4.3 mainshock on 26 January 2001 caused light damage (MMI VI). The focal mechanism (Du *et al.*, 2003) and epicenter of this event were obtained from regional waveforms. Another fore– main-aftershock subsequence during June 2001 was captured with a local network. These data illuminate another fault (thick line is fault trace at unconformity) similar to the one in 1987, but 4 km south. The January mainshock is probably also from this source. The two dotted first motions are from the latest and westernmost hypocenter and are inconsistent with the composite focal mechanism.

Figure 2.5.1-267 Plot Showing Elevations of Bedrock Surfaces Based on Oil Wells across the Sumpter Pool and New Boston Pool Possible Faults
[EF3 COL 2.0-26-A]



Note: Locations of possible faults from Reference 1 (Reference 2.5.1-406)