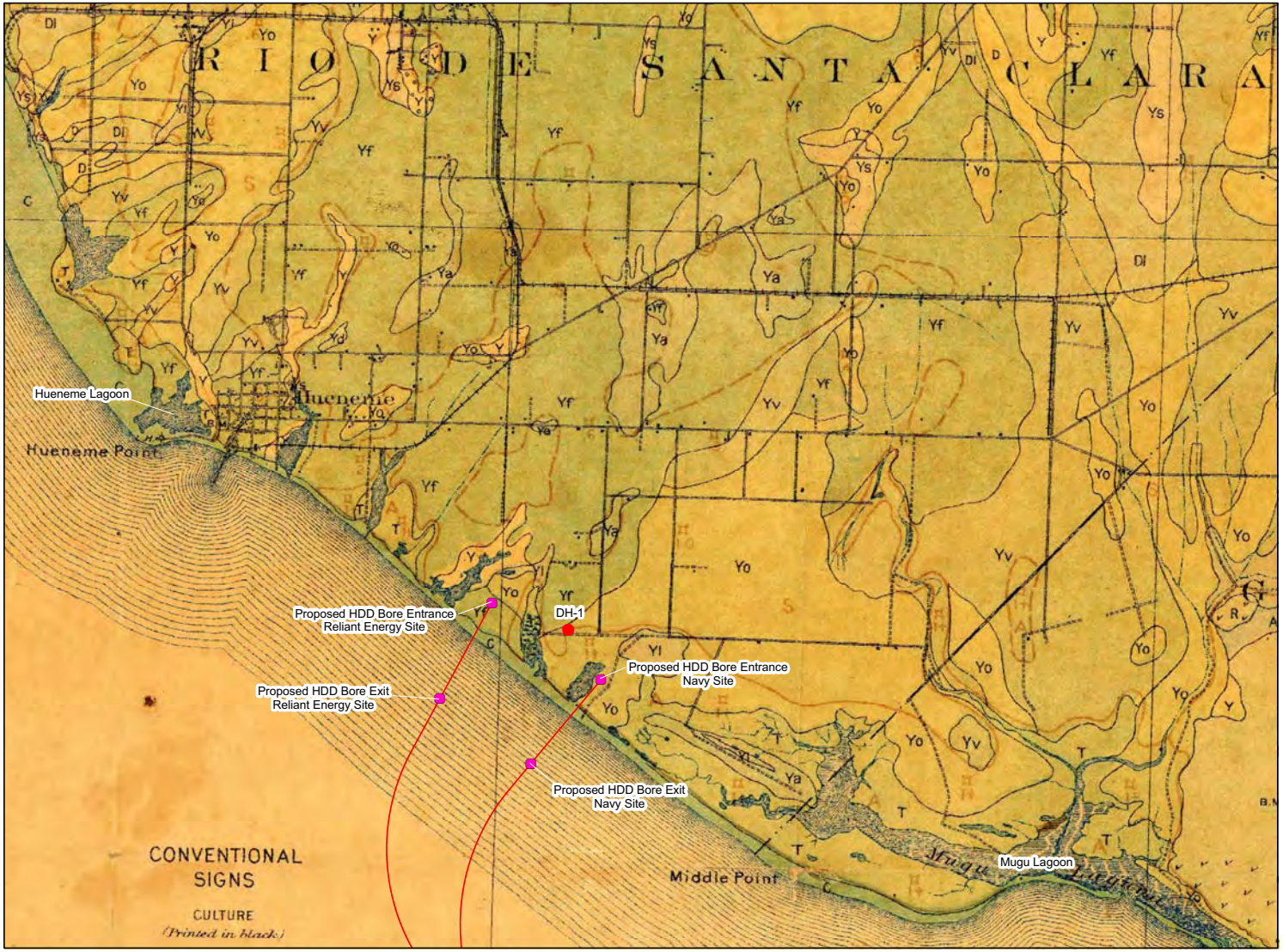
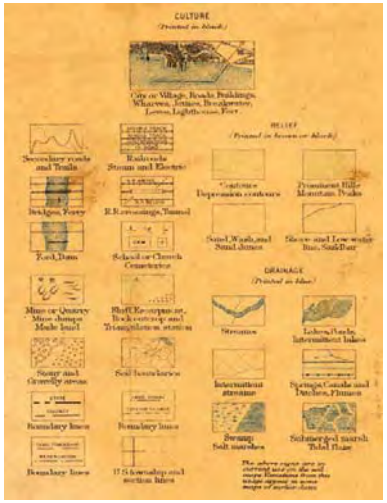
BHP Billiton
Project No. 3390.002.07



Legend

- Fugro 2005 Boring Location
- Proposed HDD Bore Entrance and Exit Locations
- Proposed HDD Alignment



Source: United States Department of Agriculture, Bureau of Soils (1917), Soil Map, California, Ventura Sheet.

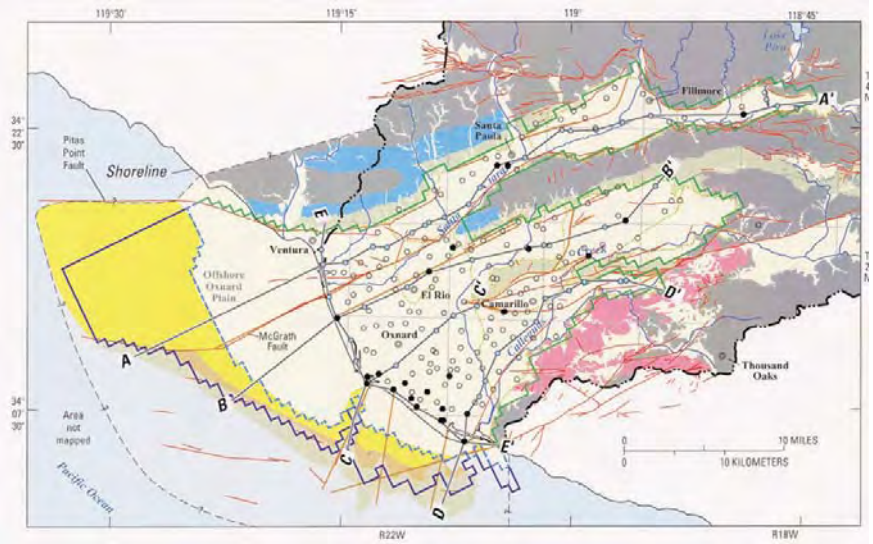
N

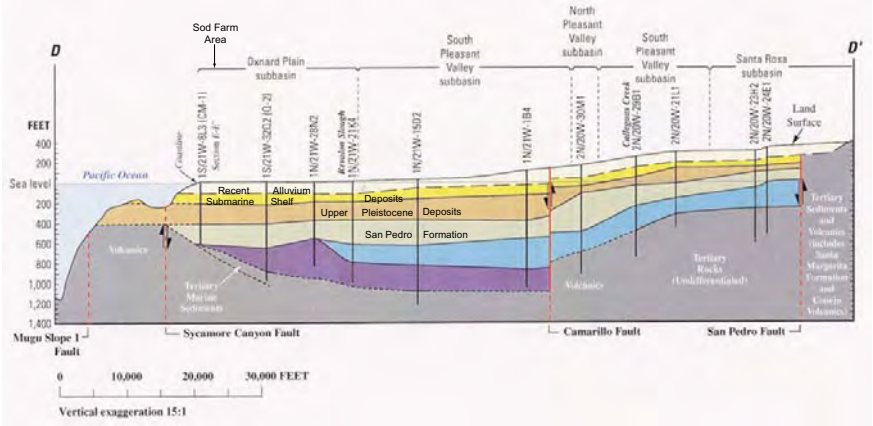
2,000 1,000 0 2,000 Meters

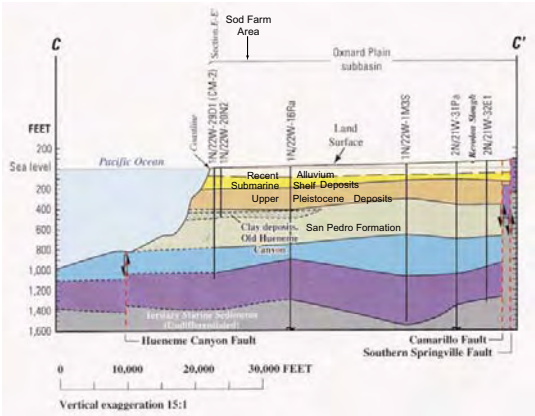
1917 SOILS MAP
BHP Cabrillo Port HDD Shore Crossing Project
Oxnard, CA

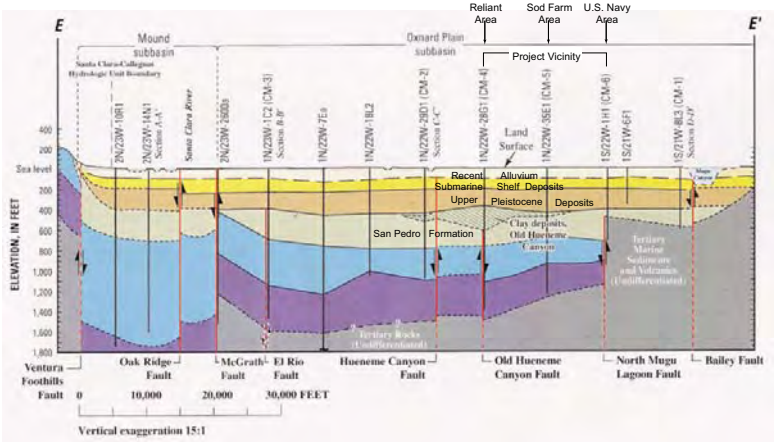
PLATE 5

L:\LandGeoTech\Ventura\3390-002_CabrilloPort\April Desktop Report\Plates.mxd\Data-map.mxd, 04/13/05, abroughton



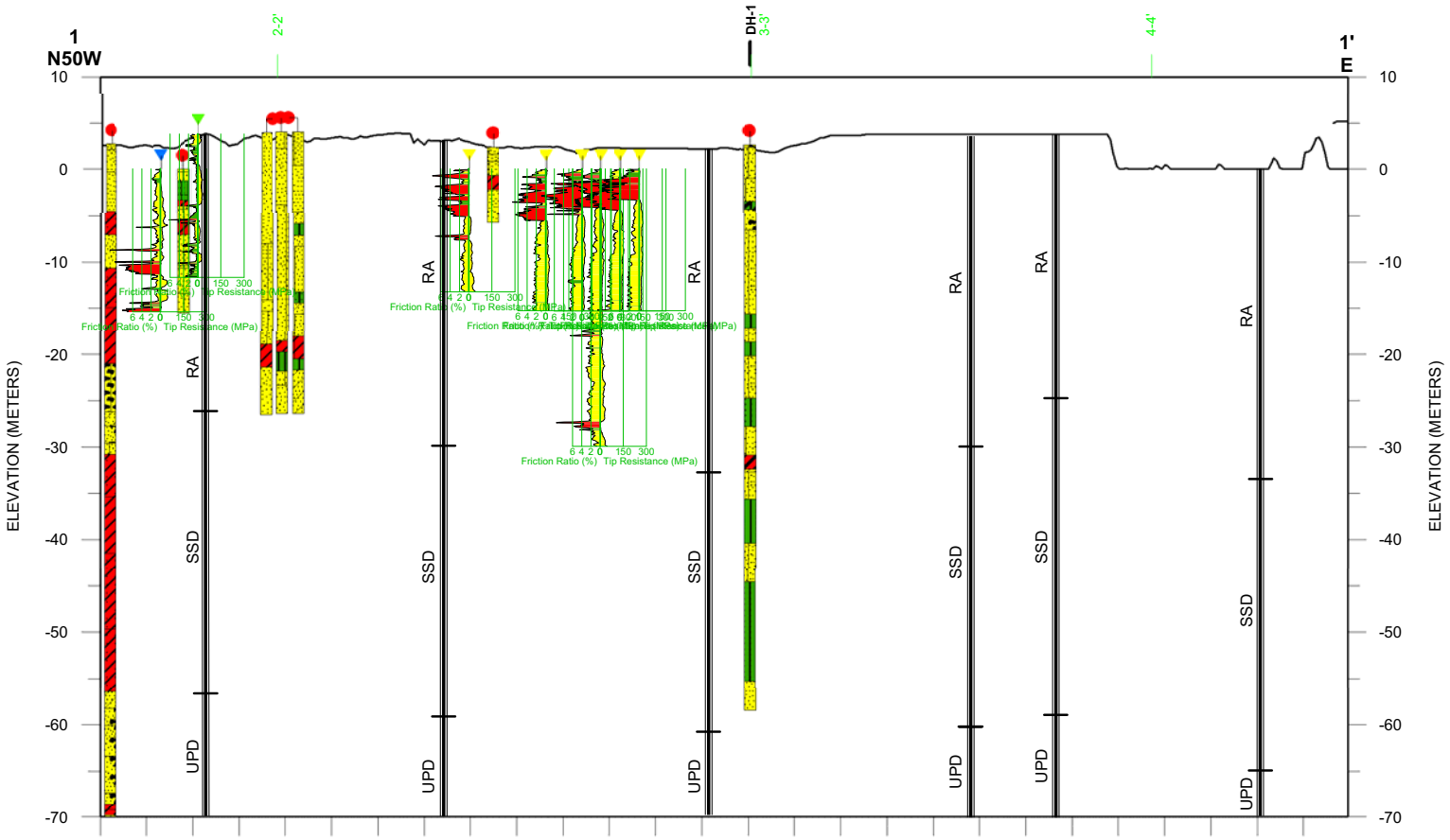


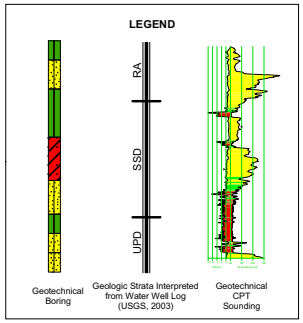




Source: Modified from Simulation of Ground Water/Surface-Water Flow in the Santa Clara-Calleguas Ground-Water Basin, Ventura County, California; USGS Water Resources Investigations Report 02-4136, (Hart, Martin, and Koczot, 2003).

GENERALIZED GEOLOGIC CROSS SECTIONS
BHP Cabrillo Port HDD Shore Crossing Project
Oxnard, CA





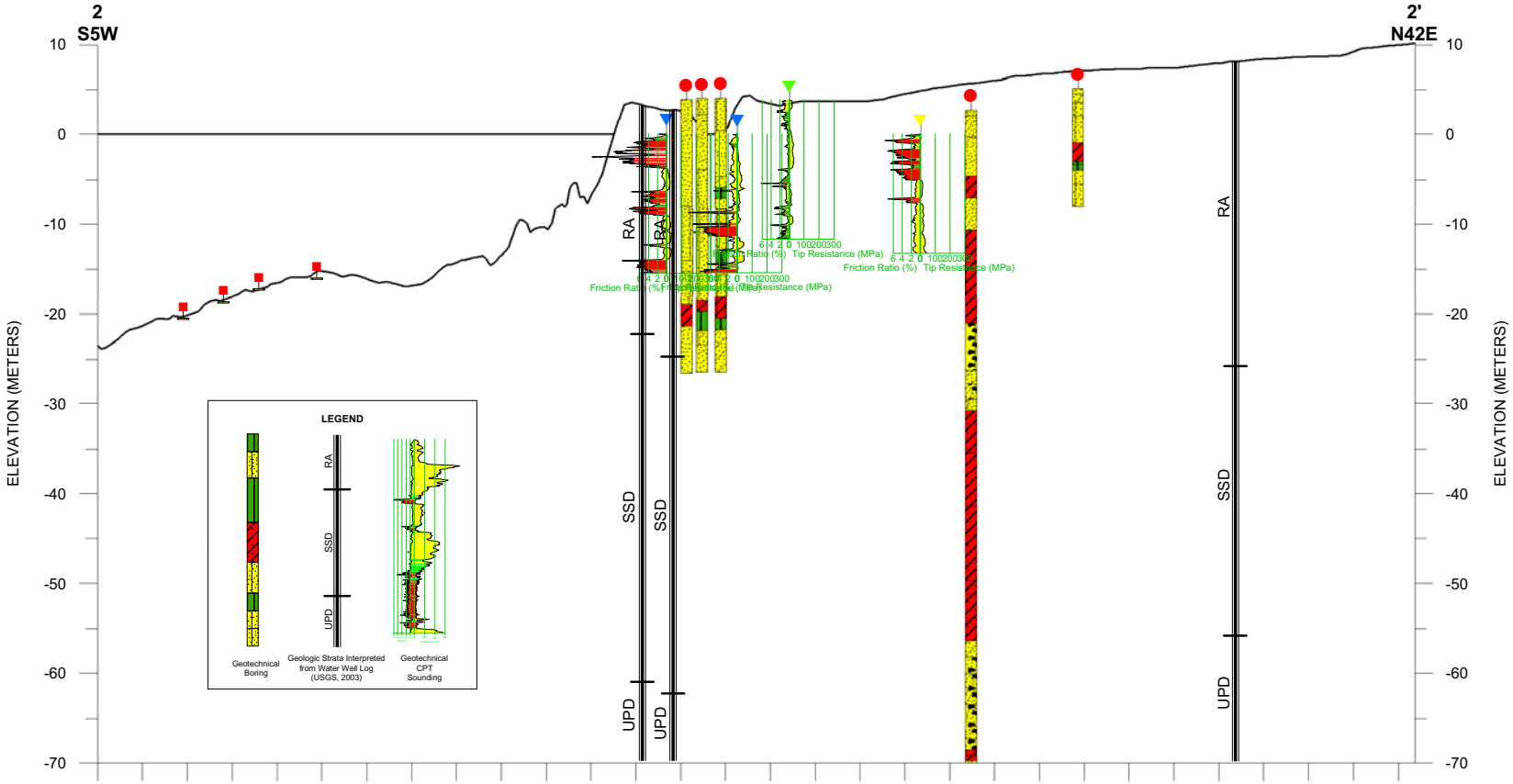
5
500

Note: Refer to Plate 11 for Key to Subsurface Profiles.

RA = Recent Alluvium
SSD = Submarine Shelf Deposits
UPD = Upper Pleistocene Deposits

Exploration offsets range from 4 to 1025 meters north or south of the profile line.

SUBSURFACE PROFILE 1-1'
BHP Cabrillo Port HDD Shore Crossing Project
Oxnard, CA



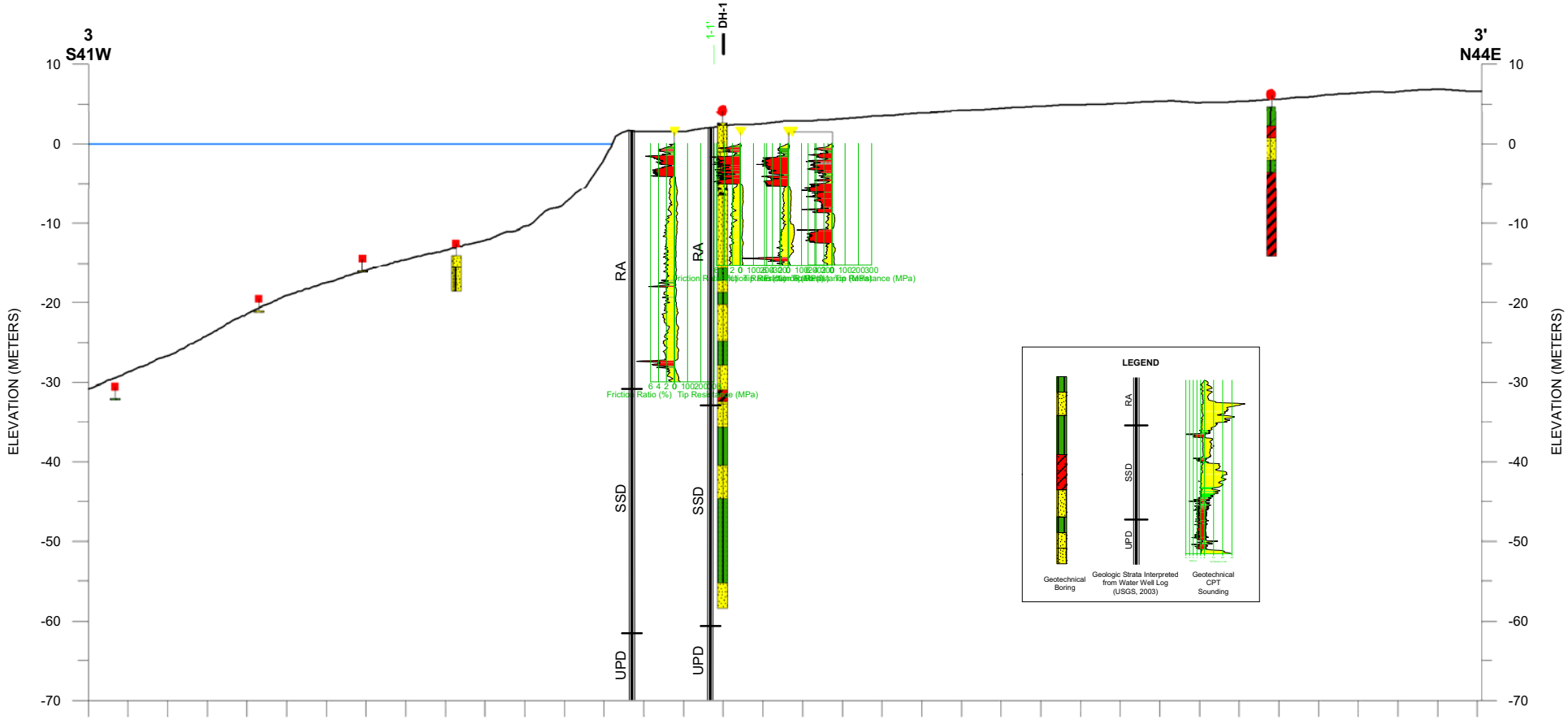
5
250

Note: Refer to Plate 11 for Key to Subsurface Profiles.

RA = Recent Alluvium
SSD = Submarine Shelf Deposits
UPD = Upper Pleistocene Deposits

Exploration offsets range from 32 to 2532 meters east or west of the profile line.

SUBSURFACE PROFILE 2-2'
BHP Cabrillo Port HDD Shore Crossing Project
Oxnard, CA



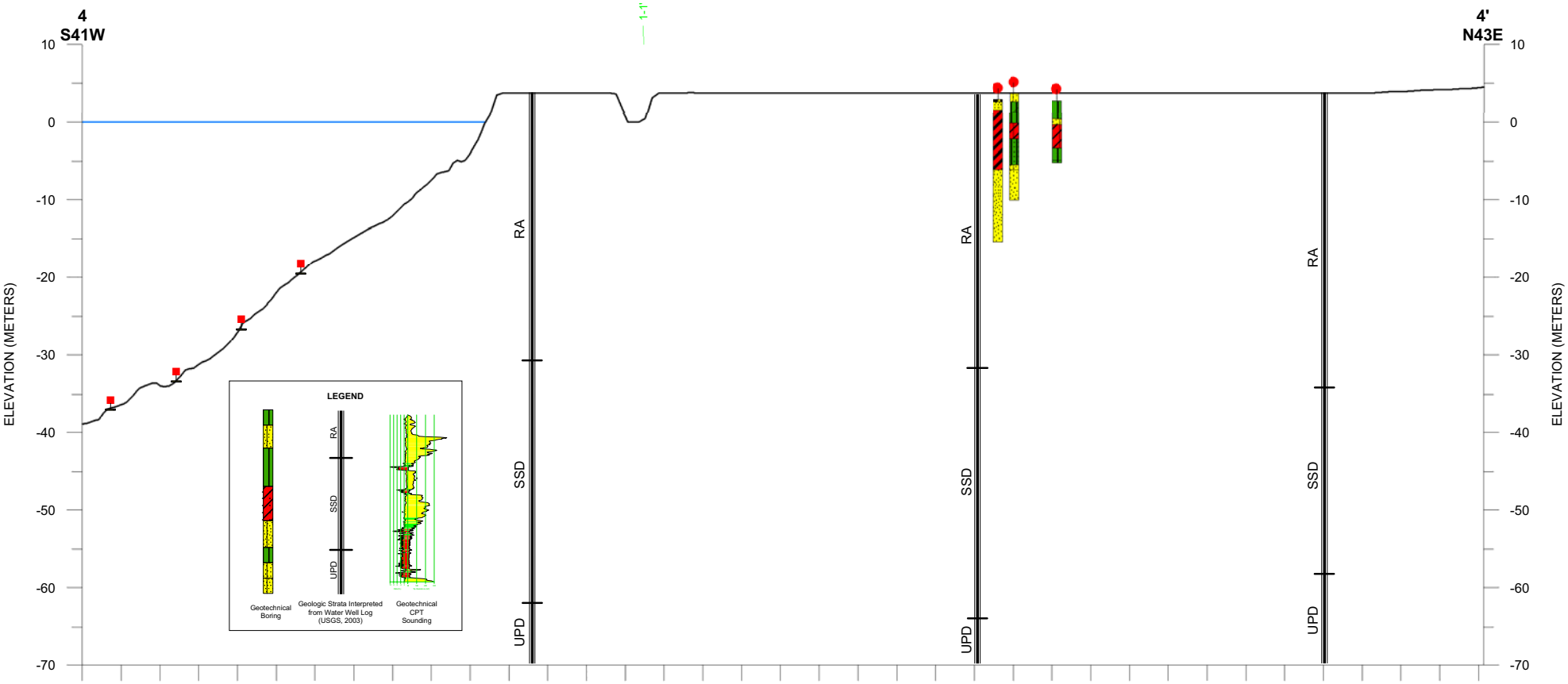
5
250

Note: Refer to Plate 11 for Key to Subsurface Profiles.

RA = Recent Alluvium
SSD = Submarine Shelf Deposits
UPD = Upper Pleistocene Deposits

Exploration offsets range from 19 to 2622 meters east or west of the profile line.

SUBSURFACE PROFILE 3-3'
BHP Cabrillo Port HDD Shore Crossing Project
Oxnard, CA



5
250

Note: Refer to Plate 11 for Key to Subsurface Profiles.

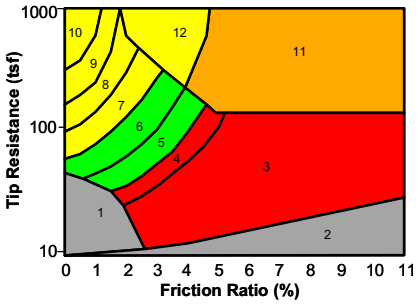
RA = Recent Alluvium
SSD = Submarine Shelf Deposits
UPD = Upper Pleistocene Deposits

Exploration offsets range from 81 to 199 meters east or west of the profile line.

SUBSURFACE PROFILE 4-4'
BHP Cabrillo Port HDD Shore Crossing Project
Oxnard, CA

SOIL TYPES

- Well graded GRAVEL (GW)
- Poorly graded GRAVEL (GP)
- GRAVEL with sand (GP or GW)
- GRAVEL with clay (GP or GW)
- Clayey GRAVEL (GC)
- GRAVEL with silt (GP or GW)
- Silty GRAVEL (GM)
- Well graded SAND (SW)
- Poorly graded SAND (SP)
- SAND with gravel (SP or SW)
- SAND with clay (SP-SC)
- Clayey SAND (SC)
- Silty SAND (SM)
- SAND with silt (SP-SM)
- Fat CLAY (CH)
- Sandy fat CLAY (CH)
- Lean CLAY (CL)
- Sandy lean CLAY (CL)
- Silty CLAY (CL-ML)
- Elastic SILT (MH)
- SILT (ML)
- Sandy SILT (ML)
- Clayey SILT (ML/CL)
- Highly plastic ORGANICS (OH)
- Low plasticity ORGANICS (OL)
- SANDSTONE (Rx)
- SILTSTONE (Rx)
- CLAYSTONE (Rx)
- Conglomerate (Rx)
- Interbedded Rock Strata (Rx)
- Pavement



Zone	Soil Behavior Type	U.S.C.S.
1	Sensitive Fine-grained	OL-CH
2	Organic Material	OL-OH
3	Clay	CH
4	Silty Clay to Clay	CL-CH
5	Clayey Silt to Silty Clay	MH-CL
6	Sandy Silt to Clayey Silt	ML-MH
7	Silty Sand to Sandy Silt	SM-ML
8	Sand to Silty Sand	SM-SP
9	Sand	SW-SP
10	Gravelly Sand to Sand	SW-GW
11	Very Stiff Fine-grained *	CH-CL
12	Sand to Clayey Sand *	SC-SM

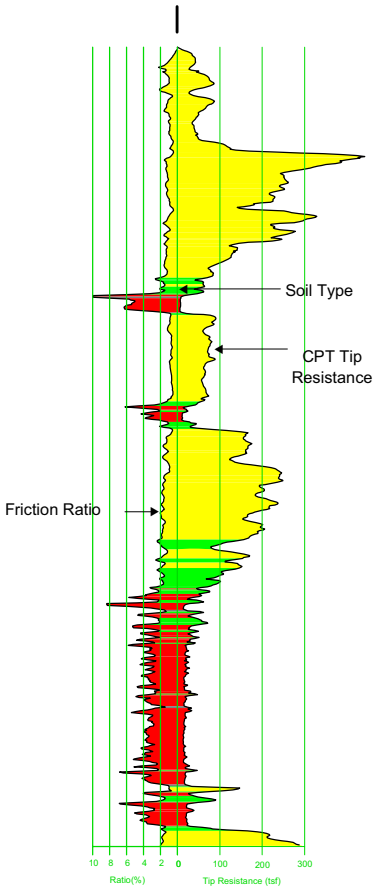
*overconsolidated or cemented

CPT CORRELATION CHART
(Robertson and Campanella, 1984)

SOIL BORING LITHOLOGY

RA = Recent Alluvium
SSD = Submarine Shelf Deposits
UPD = Upper Pleistocene Deposits

WATER WELL LOG
with stratigraphic units
from USGS (2003)



CPT SOUNDING WITH INTERPRETED LITHOLOGY

KEY TO SUBSURFACE PROFILES

BHP Cabrillo Port HDD Shore Crossing Project
Oxnard, CA

L:\PolB\Gis\mxd\2003-425\xsectkey.mxd, 02/23/04, tmcadam