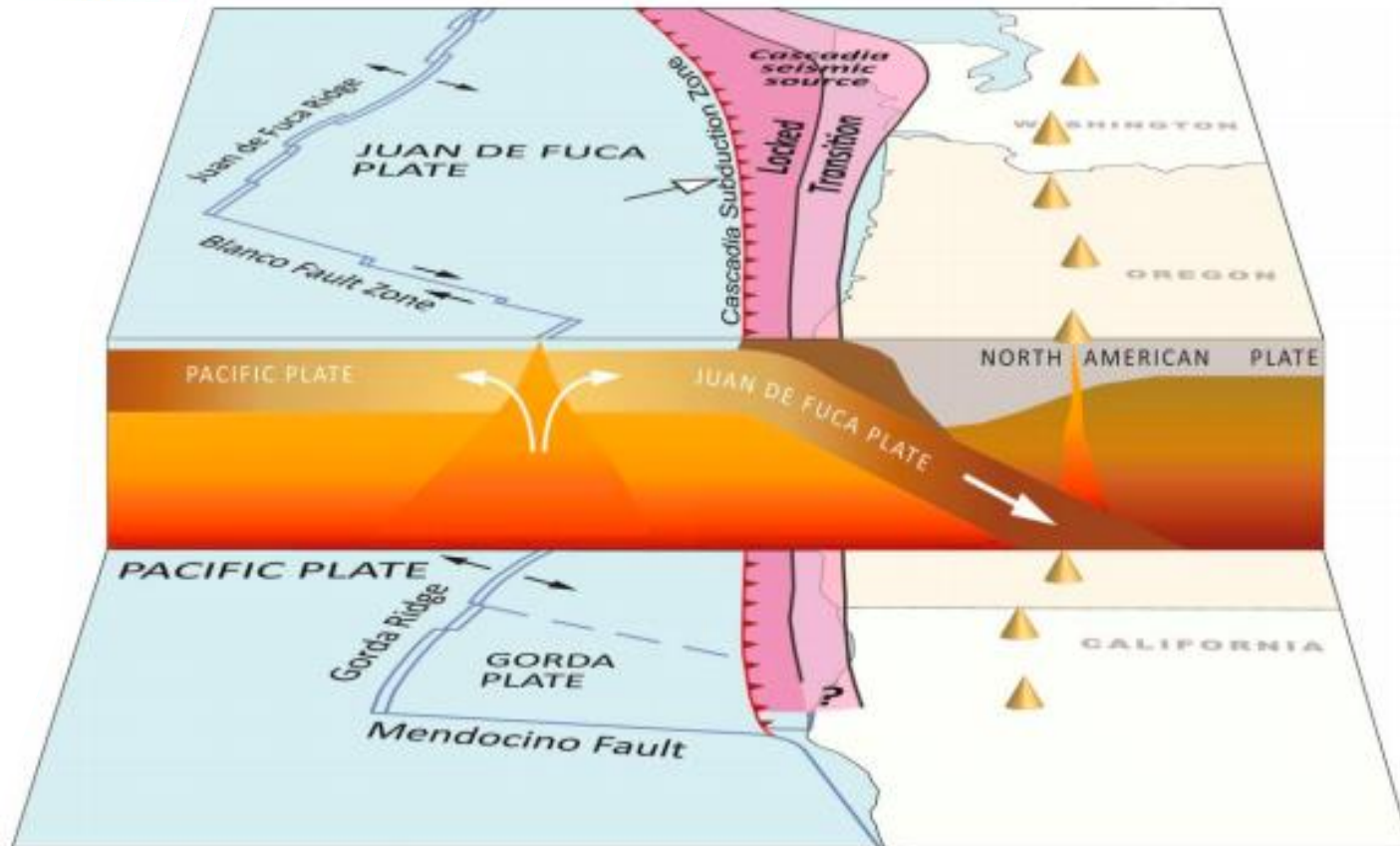


Geologic Setting and Subsurface Conditions at the Demonstration Site



23 June 2016

Armin W. Stuedlein, PhD, P.E.

Associate Professor

Acknowledgements

- Soil sampling and CPT donated by Oregon Geotechnical Explorations, Inc.



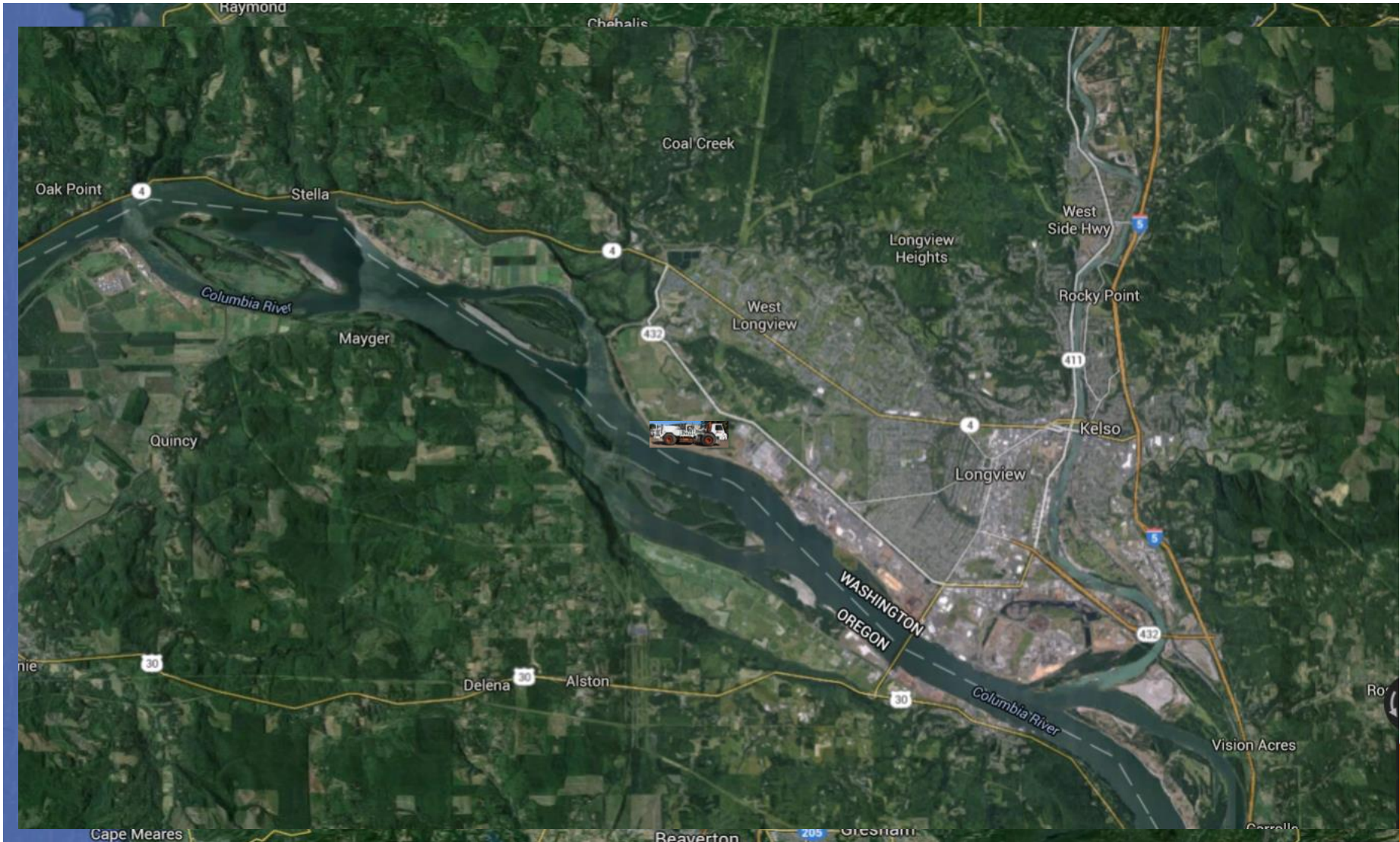
- Coordination and access to Barlow Point courtesy of the Port of Longview



Presentation Outline

- Demonstration site
- Overview of the regional geology
- Regional Seismicity
- General considerations for liquefaction analyses
- Site-specific information
 - USGS Deaggregation for Longview
 - Site and Exploration Plan, cross-section
 - Mobile shaker site characterization

Demonstration Site



[A (very) Brief Geologic Overview]

Overview of the Regional Geology

- West coast circa 215 million years ago
- Hawaii-like island chains conveyed to what is now eastern California, mid-Nevada, and Idaho



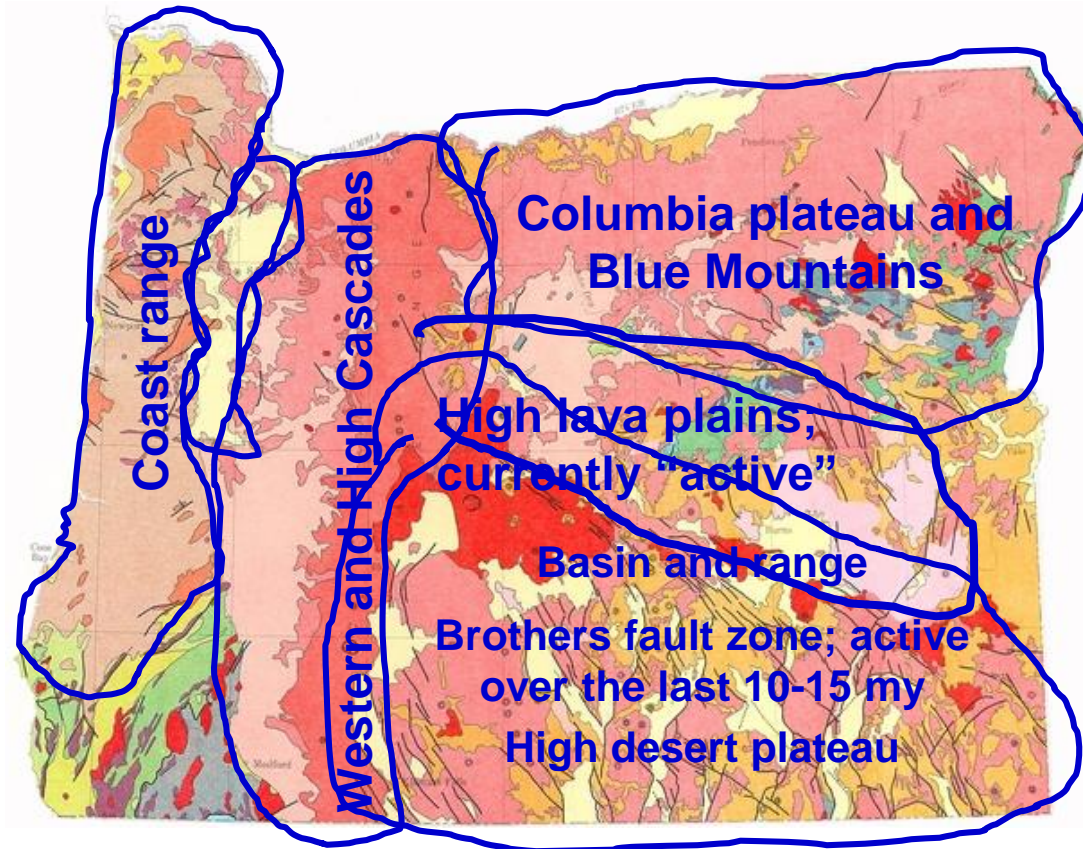
Overview of the Regional Geology

- West coast circa 130 million years ago
- Features include islands, lagoons, peninsulas
- Tens of millions of years before we acquire our current landmass



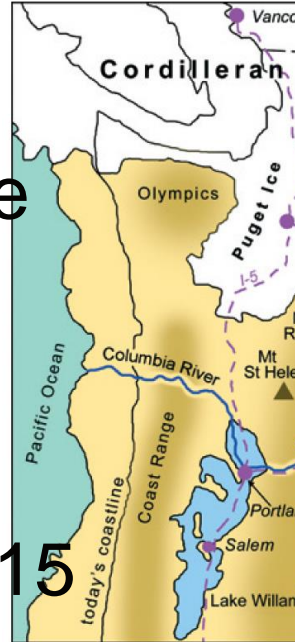
Overview of the Regional Geology

- Current landform
- Reflects complex accretionary history
- Upward movement
- Produced crustal shear with NW trending faults
- 70% of Oregonians (~3 million) live in the Willamette Valley



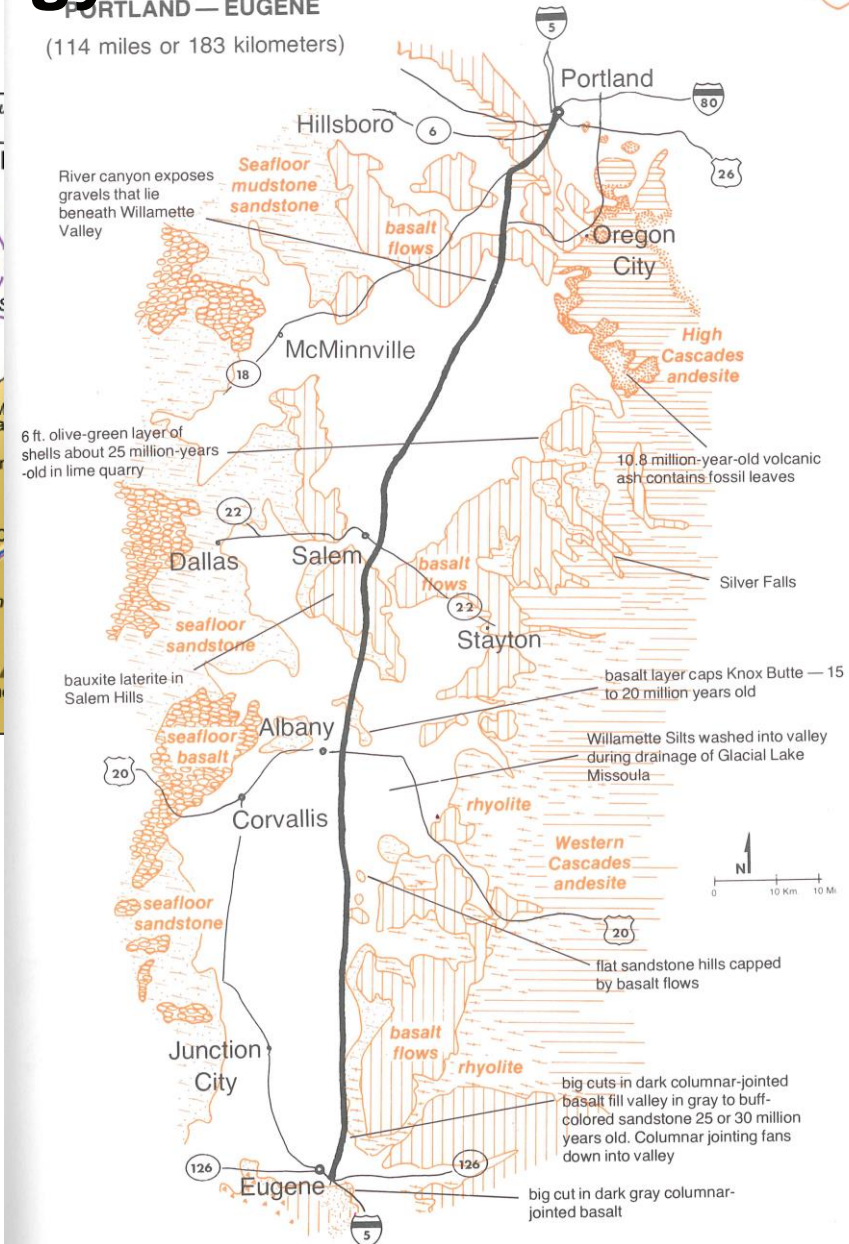
Overview of Regional Geology

- Surficial soils of the Willamette Valley characterized by the Missoula flood deposits
- Catastrophic floods occurring regularly 15 to 17,000 ybp
- Known as Willamette Silt, this material is highly heterogenous, non-plastic to highly plastic



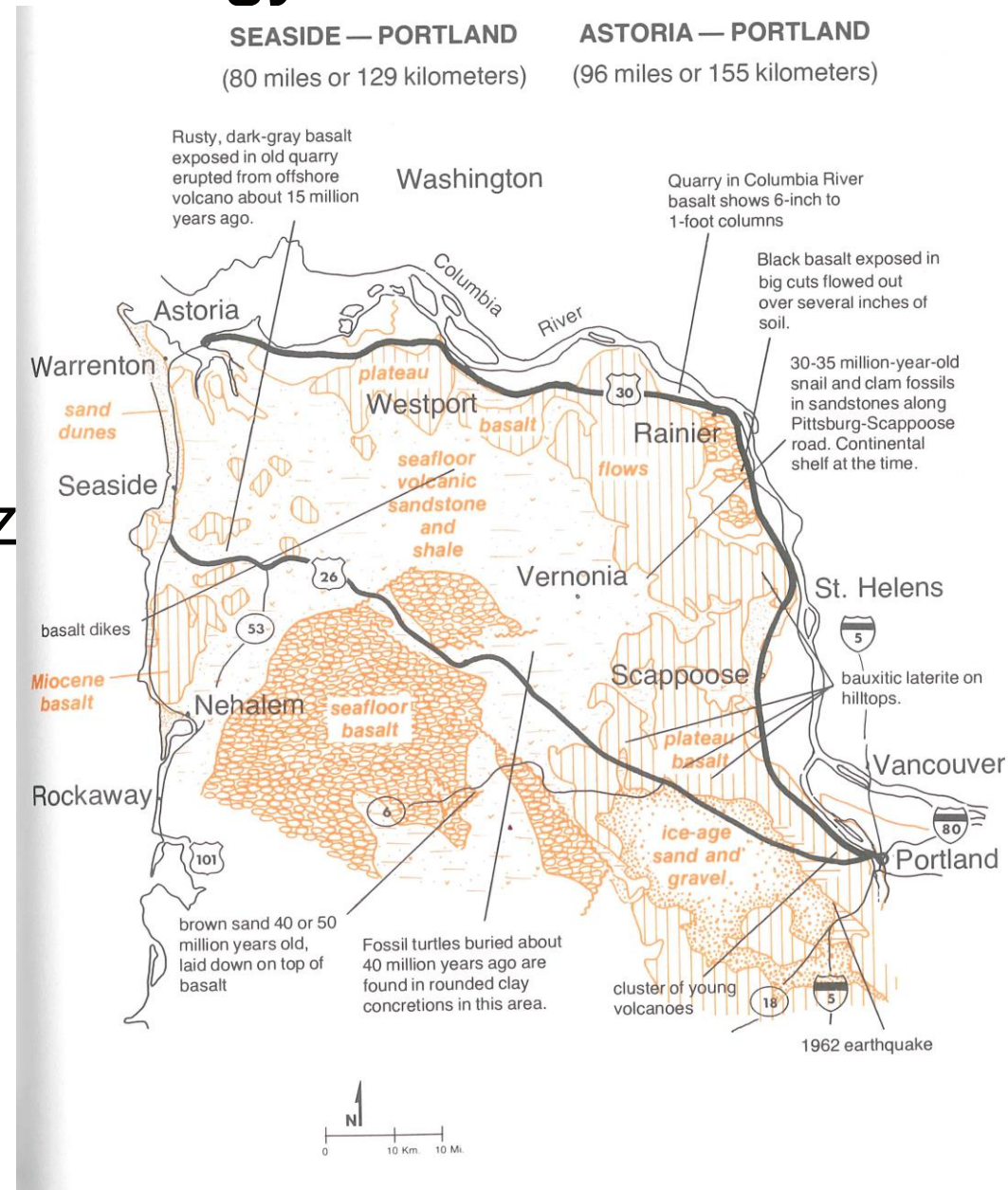
PORTLAND — EUGENE

(114 miles or 183 kilometers)



Overview of Regional Geology

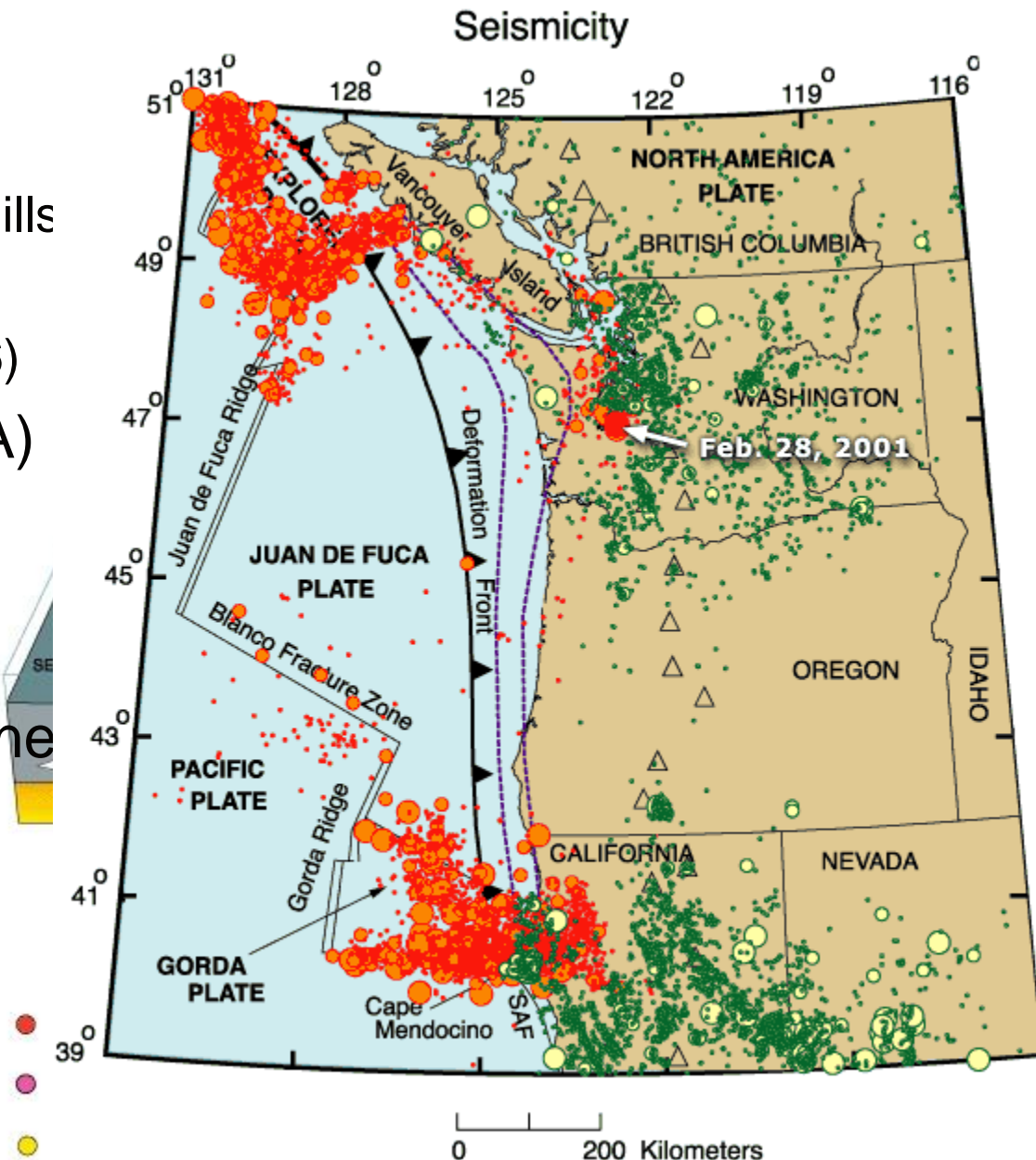
- Test site tomorrow not in Willamette Silt deposits; Columbia river alluvium with contributions from the Willamette and Cowlitz Rivers
- Deep deposits of soft, compressible, non-plastic to plastic silt and sand mantling the Columbia Basalt flows



[Regional Seismicity]

Seismic Hazards

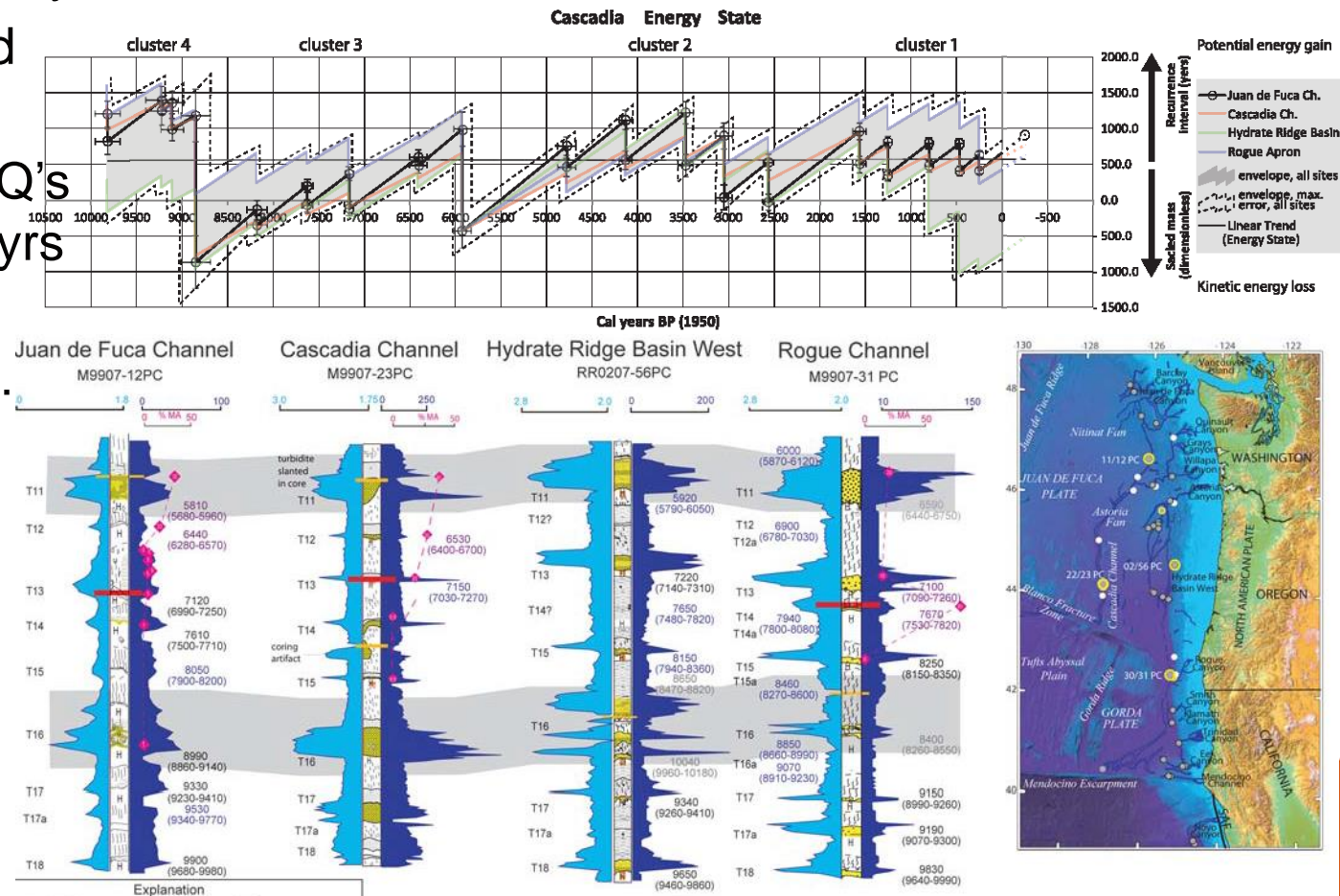
- Crustal faults
 - Seattle, Tacoma, Portland Hills
 - 1962 Vancouver, WA (M5.2)
 - 1993 Scotts Mills, OR (M5.6)
- Deep intraslab faults (WA)
 - 1949 Olympia EQ (M6.8)
 - 1965 Renton EQ (M6.5)
 - 2001 Nisqually EQ (M6.8)
- Cascadia Subduction Zone
 - Partial rupture: SW Oregon, ~400 km, with M8 to M8.5
 - Full rupture: SW Oregon to Vancouver, BC, ~1,000 km, with M9 to M9.5



Seismic Hazards

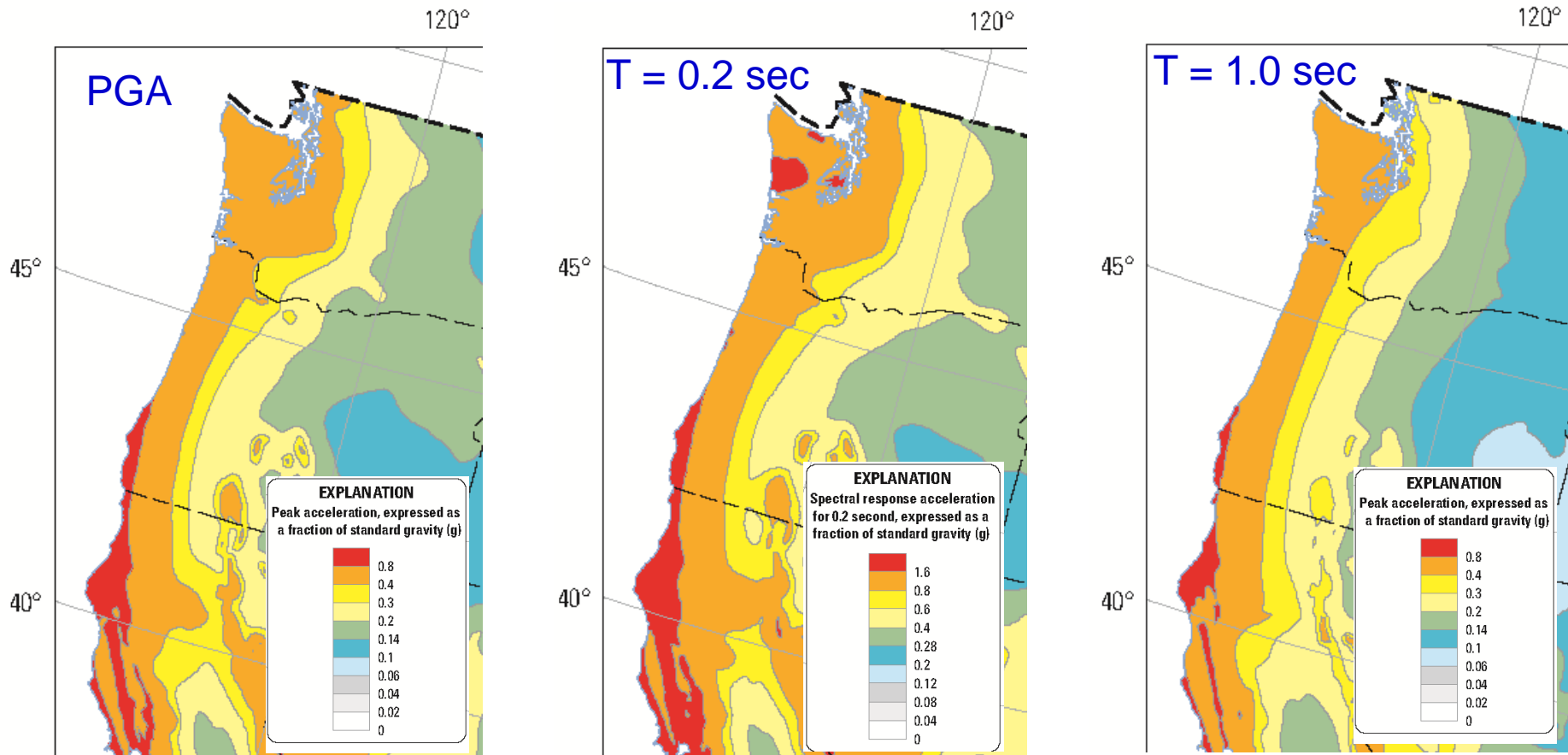
Cascadia Subduction Zone

- ~10,000yr turbidite record (Goldfinger et al 2014)
- ~ 4 clusters of activity
- Clusters separated by ~1,000 yrs
- Within a cluster, EQ's occur ~300 to 500yrs
- Last EQ was January 26, 1700..



Seismic Hazard

- 2014 USGS Maps for 2% in 50yrs



[Considerations for Liquefaction Hazards]

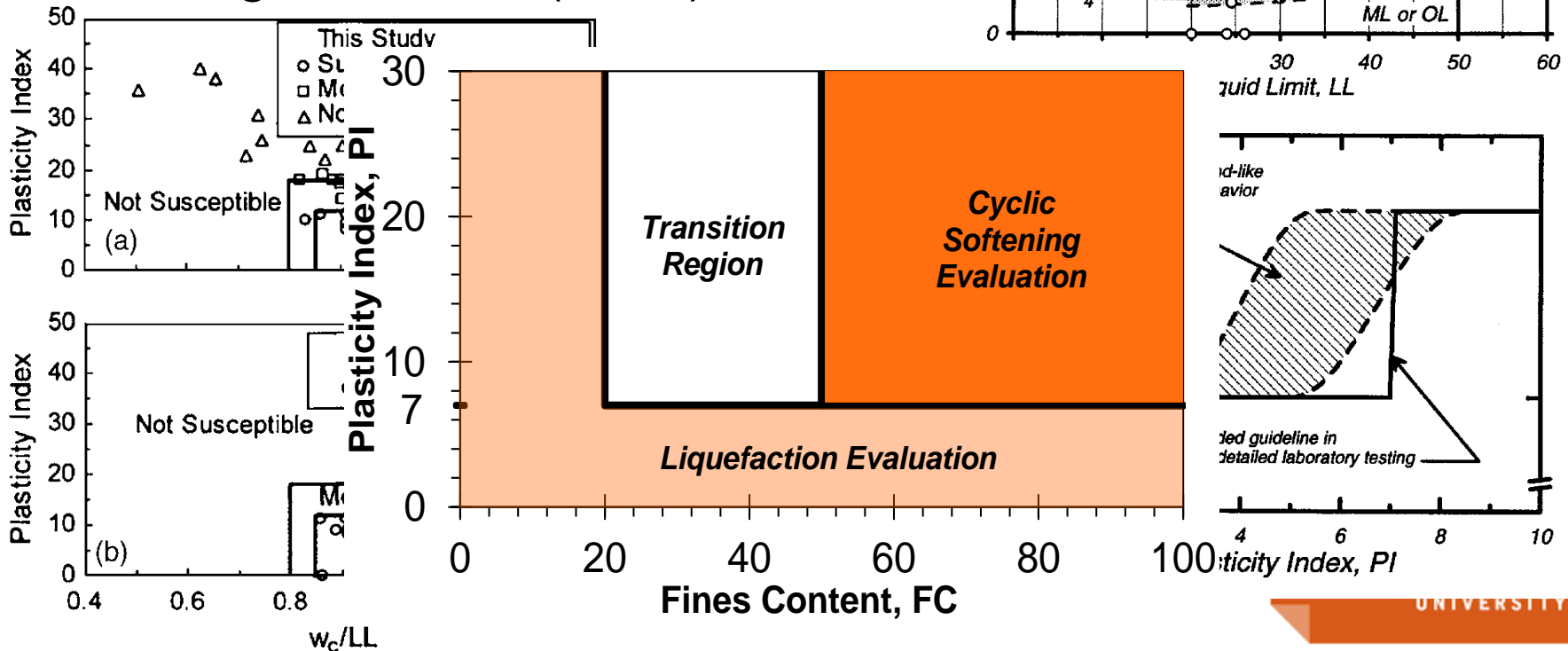
General Considerations in the Region

- Susceptibility of transitional soils:
 - What fines content (FC) matters?
 - What plasticity index (PI)?
 - What is the interaction between FC and PI?
 - How does fabric play a role?
 - Role of stress history?
- Static and cyclic strength of transitional soils
- Post-cyclic volumetric strain of transitional soils

General Considerations in the Region

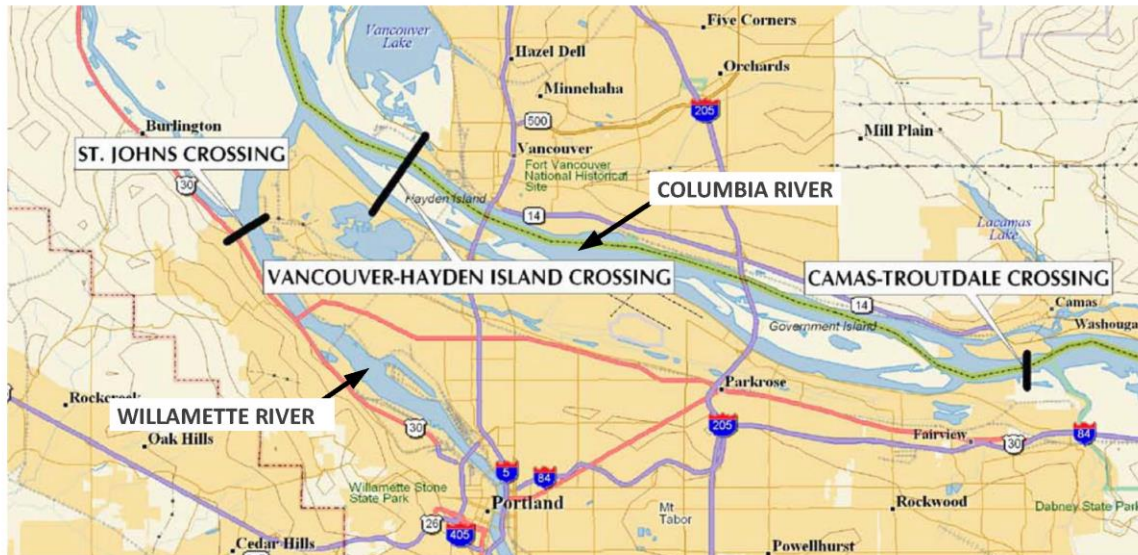
Susceptibility

- Chinese criteria – not valid
- Bray & Sancio (2006)
- Boulanger & Idriss (2006)
- Armstrong & Malvick (2015)

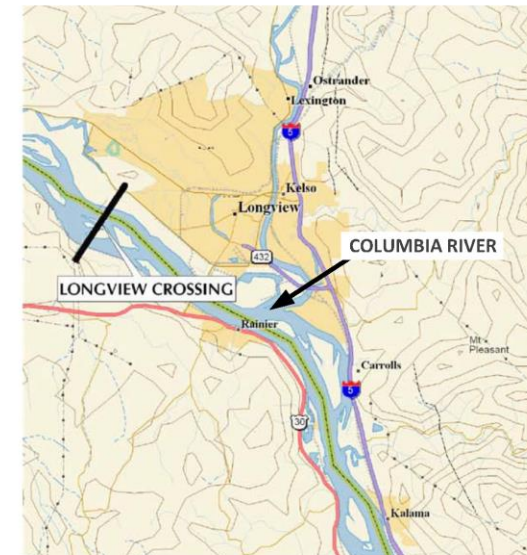


General Considerations in the Region

- Some pertinent data on cyclic strength and post-cyclic consequences (after Beaty et al. 2014)
- Focus on transmission line support towers



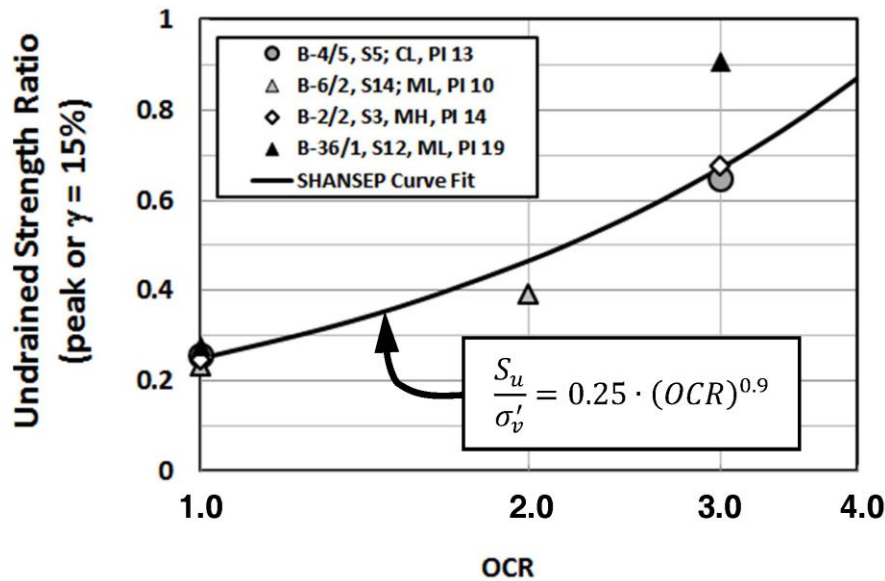
a) Near Portland OR and Vancouver WA



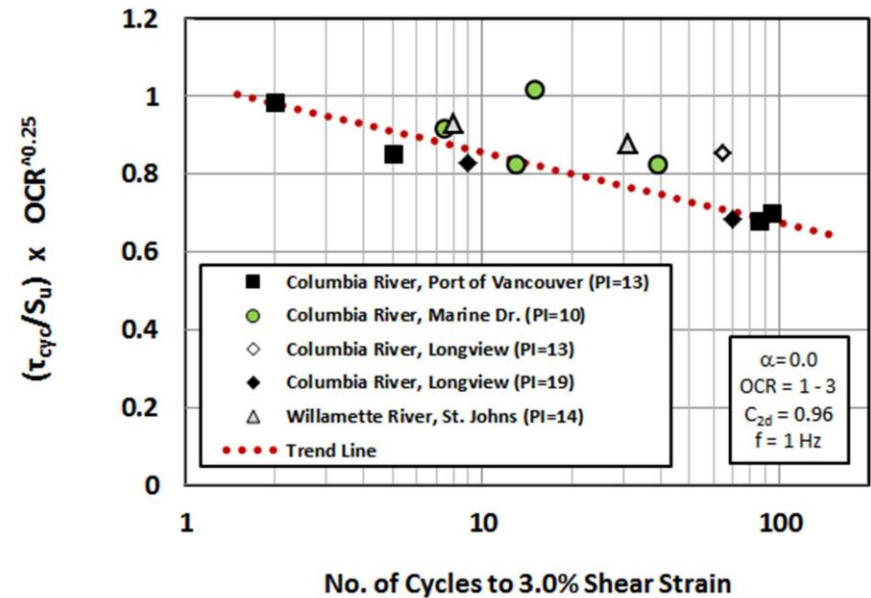
b) Near Longview WA

Figure 1. Vicinity maps of transmission tower crossings.

General Considerations in the Region



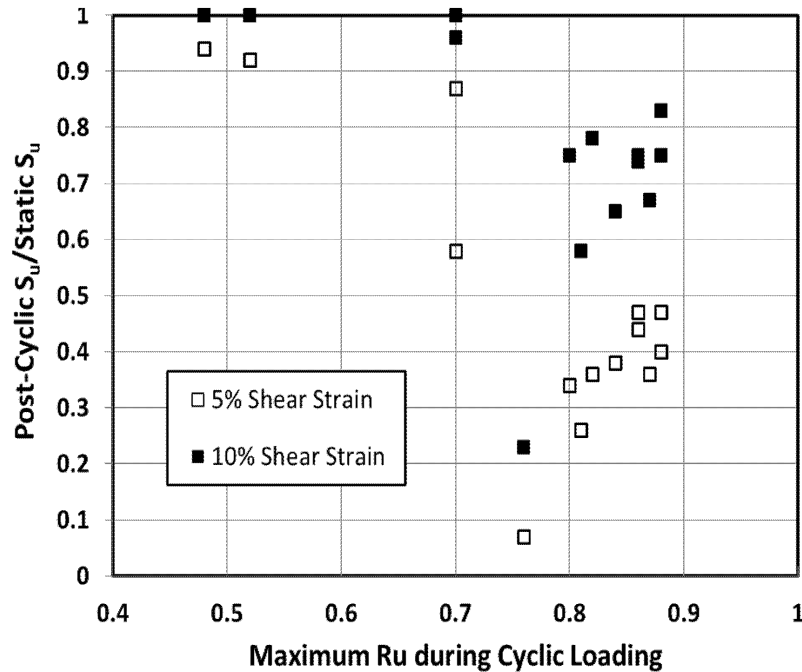
a) Static undrained strength ratio.



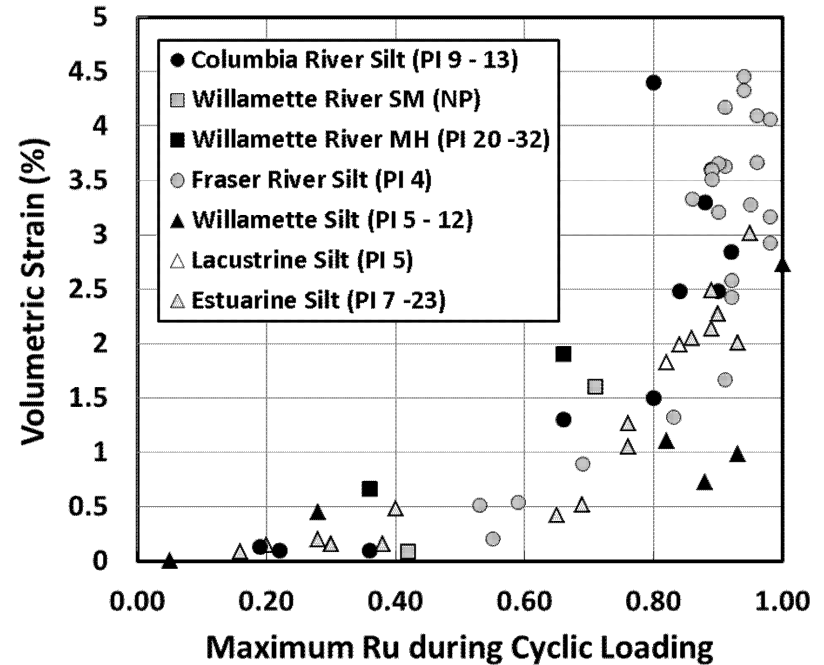
b) Cyclic strength curve.

Figure 3. Static and cyclic shearing resistance of silt-rich soils.

General Considerations in the Region



a) Relationship between cyclic strength loss and R_u .



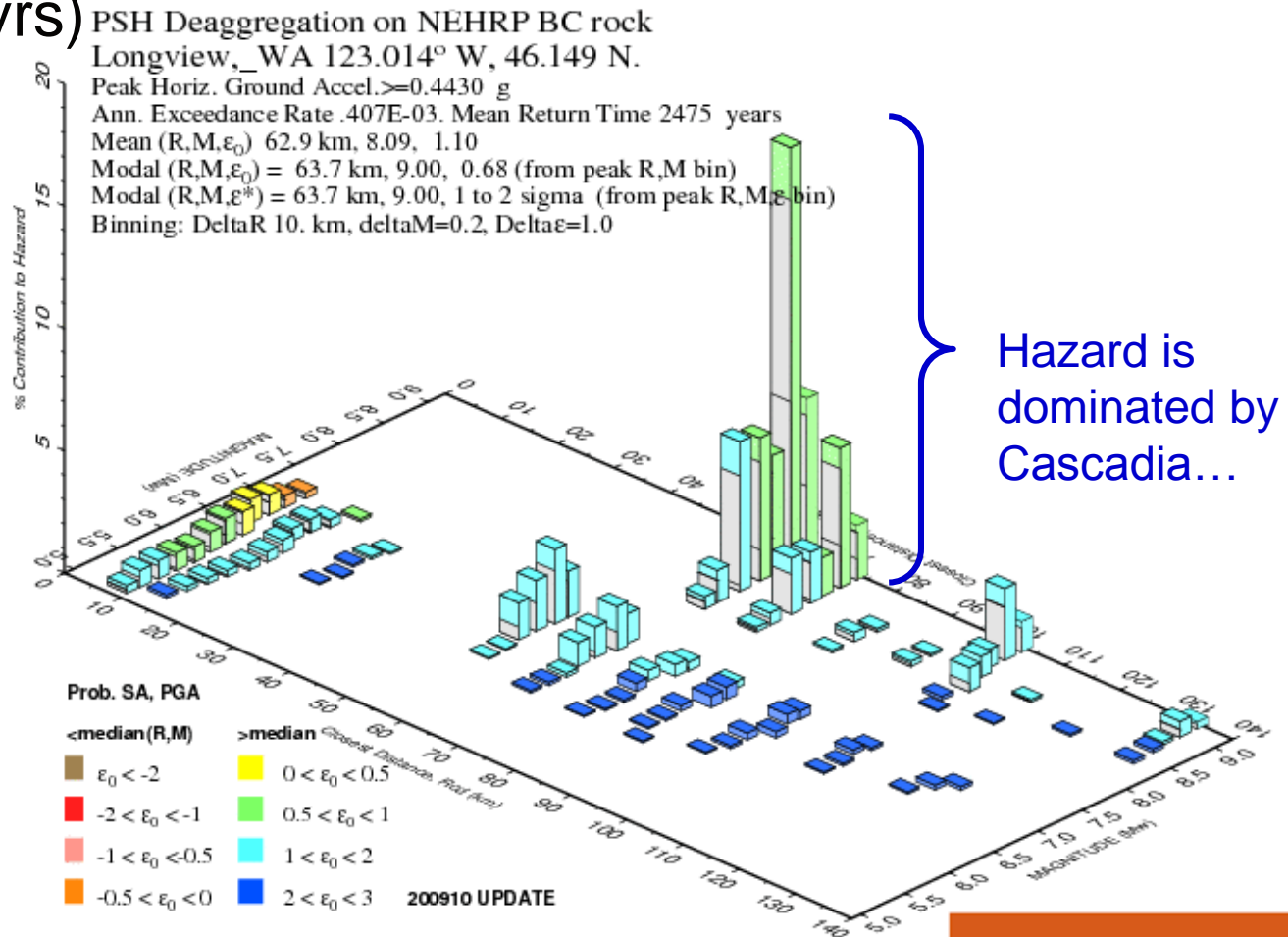
b) Relationship between post-cyclic 1D strain and R_u .

Figure 4. Post-cyclic deviatoric and volumetric behavior of silt-rich soils.

[Barlow Point, Port of Longview]

Seismic Hazard at Barlow Point, Longview, WA

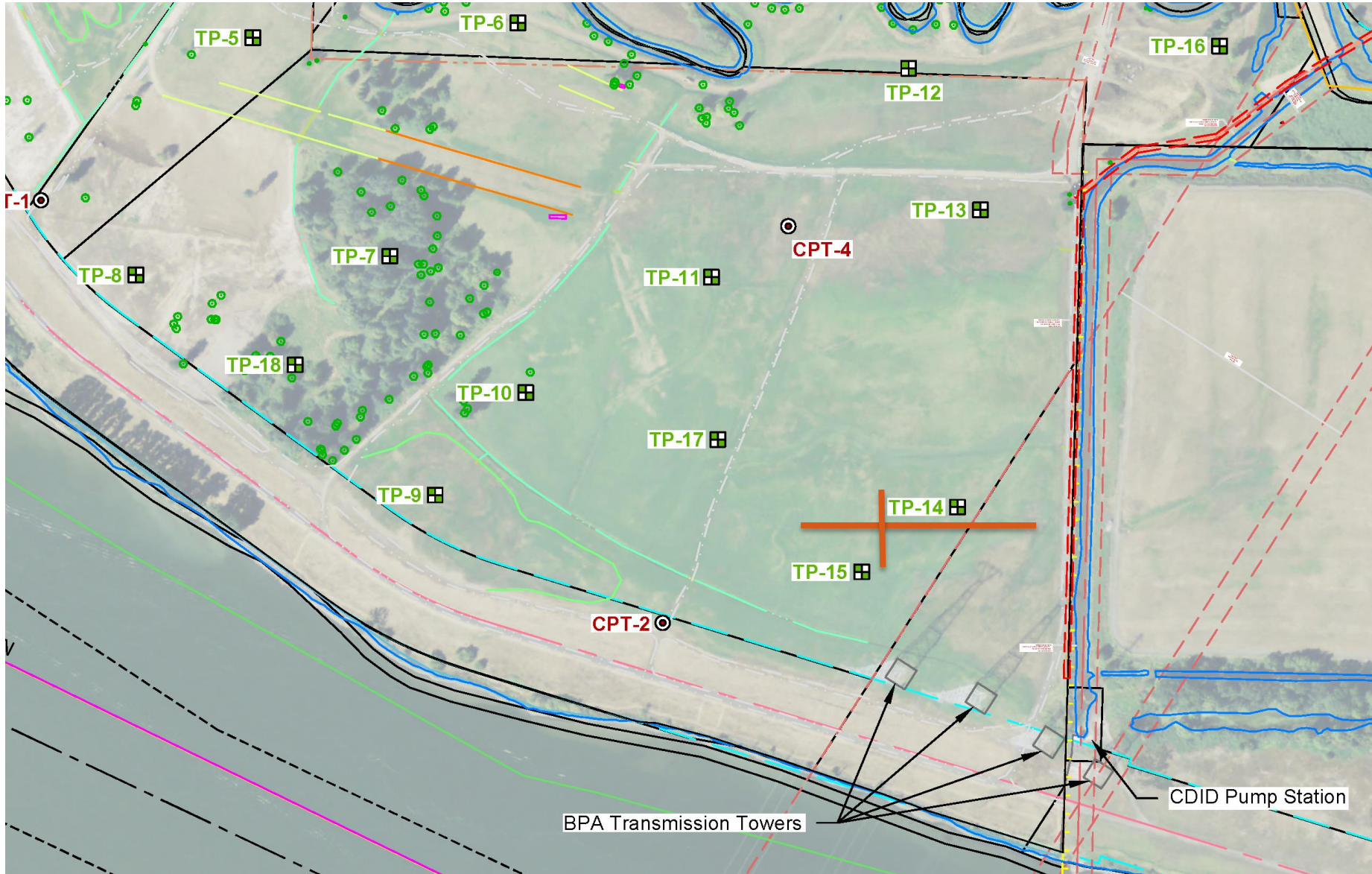
- 2008 USGS Deaggregation for Longview, WA (PGA; 2% in 50yrs)
- Deep soft soil site with basin effects
- Amplification will be high



Barlow Point, Port of Longview

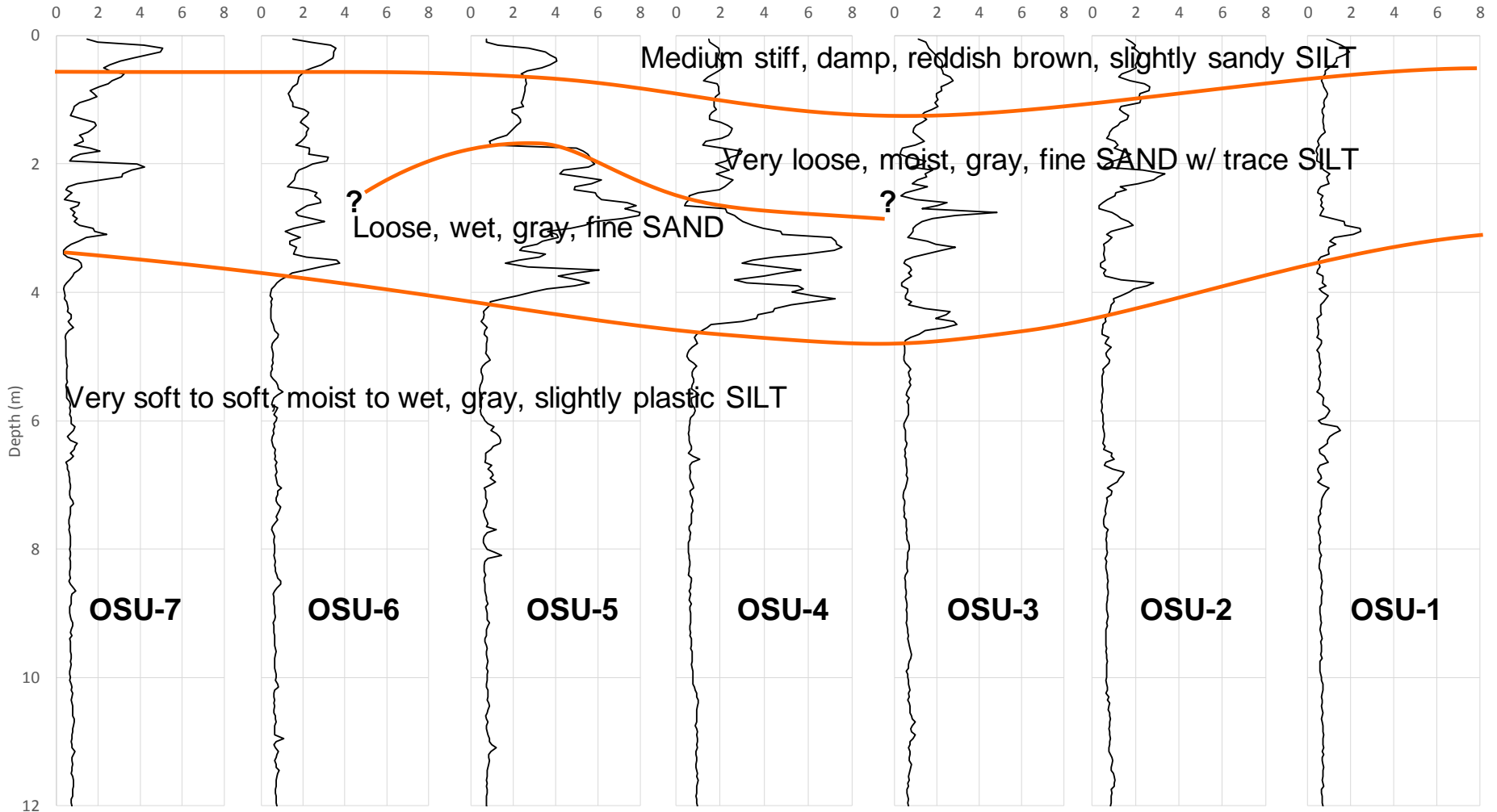


Site and Exploration Plan

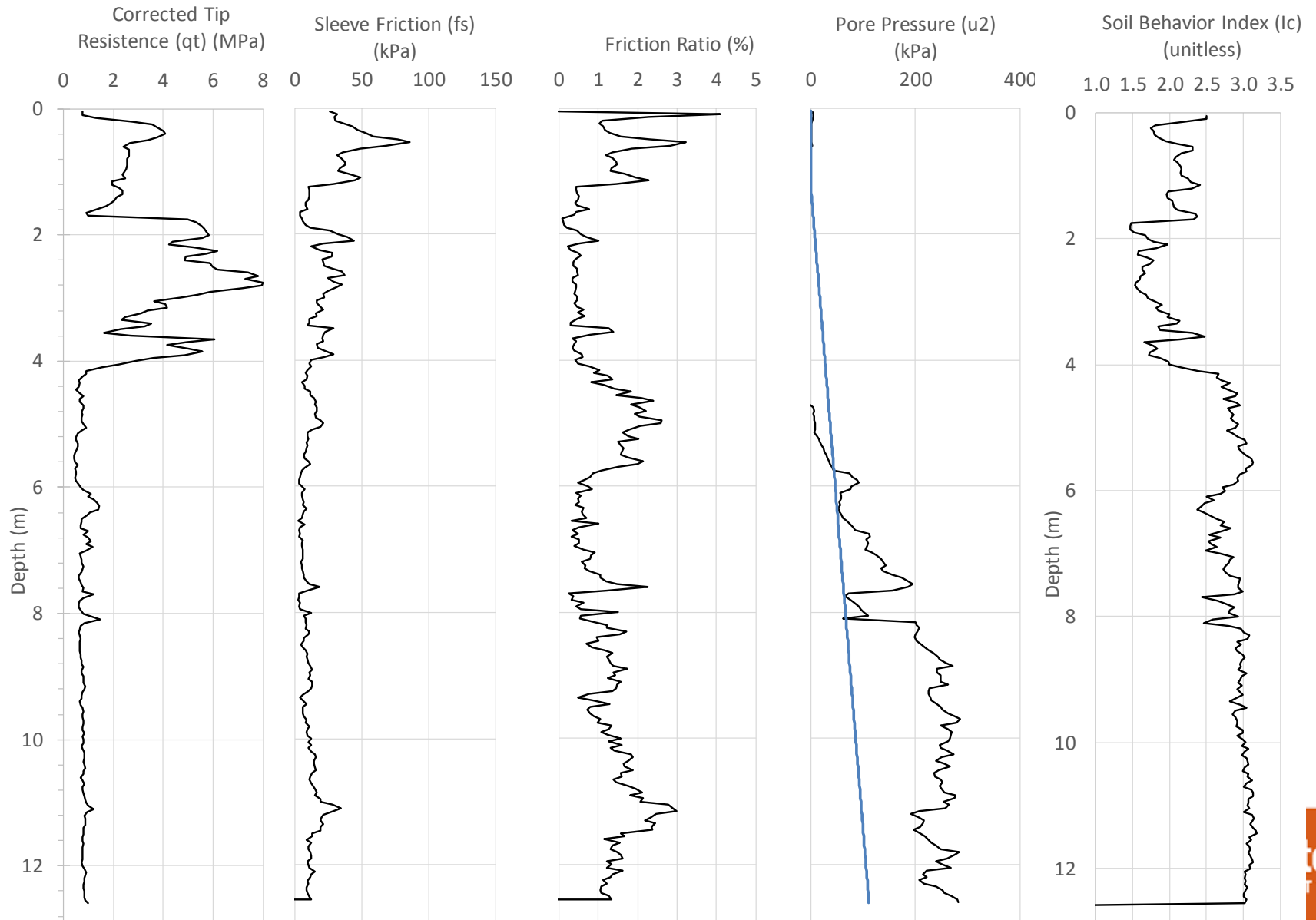


Site and Exploration Plan

Corrected Cone Tip Resistance (MPa)



Mobile Shaker Site





[and now, back to
Brady and Ken]

