embankment construction is completed during wet weather. Disturbance of shallow subgrade soils should be expected if construction is completed during periods of wet weather.

"Gravel Borrow" will likely be required for embankment construction during wet weather. "Select Borrow" and "Common Borrow" materials are not considered to be wet weather construction materials. It should be noted that compaction of borrow materials, even "Gravel Borrow," may be difficult during wet weather, unless the fines content is restricted to less than 5 percent. **Section 3.2** of this report provides some general guidance regarding the reuse of on-site soils for fill and what gradation criteria ("Common Borrow," "Select Borrow" or "Gravel Borrow") they often meet.

In some areas along the project alignment the contractor should expect limited work and staging areas for embankment and cut slope construction because of right-of-way constraints and the need to maintain operation of I-405 during construction.

6.0 SUPPLEMENTAL SUBSURFACE EXPLORATIONS

The eight new explorations for this study were completed to fill in data gaps along the project corridor and to aid in general site characterization. Additional geotechnical explorations for the planned facilities will be necessary to confirm subsurface conditions and to develop final design criteria for the facilities. The number and location of supplemental explorations should meet the minimum criteria provided in the GDM.

7.0 LIMITATIONS

GeoEngineers has prepared this report for the exclusive use by the I-405 Design Team, WSDOT and other members of the project team for the I-405 / I-5 to SR 169 Stage 2 – Widening and SR 515 Interchange Project. The data and report should be provided to prospective contractors for their bidding or estimating purposes, but our report, conclusions and interpretations should not be construed as a warranty of the subsurface conditions.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices in the field of geotechnical engineering in this area at the time this report was prepared. No warranty or other conditions, express or implied, should be understood.

Any electronic form, facsimile or hard copy of the original document (email, text, table, and/or figure), if provided, and any attachments are only a copy of the original document. The original document is stored by GeoEngineers, Inc. and will serve as the official document of record.

8.0 REFERENCES

American Association of State Highway and Transportation Officials, 2007, "LRFD Bridge Design Specifications, Fourth Edition."

Atwater, B.F., 1996, "Coastal Evidence for Great Earthquakes in Western Washington." Assessing Earthquake Hazards and Reducing Risk in the Pacific Northwest, USGS Professional Paper 1560 Vol. 1: pp. 77-90.

Bakun, W.H., Haugerud, R.A., Hopper, M.G., and Ludwin, R.S., 2002, "The December 1872 Washington State Earthquake," Bulletin of the Seismological Society of America, Vol. 92, No. 8.

Geo. Watkins Evans Consulting Mining Engineer, 1919, "Geologic Structure Map of Renton Coal Mine, Renton Coal Company, Renton, Washington," March 13, 1919.

GeoEngineers, Inc., 2005, "Geotechnical Engineering Services, Liquefaction Evaluation, I-405 Renton Nickel Improvement Project, Tukwila and Renton, Washington."

GeoEngineers, Inc., 2005, "Geotechnical Baseline Report, I-405 Renton Nickel Improvement Project, Tukwila and Renton, Washington."

Johnson, S.Y., Dadisman, S.V., Childs, J.R., and Stanley, W.D., 1999, "Active Tectonics of the Seattle Fault and Central Puget Sound, Washington: Implications for Earthquake Hazards," Geological Society of American Bulletin, Vol. 11, No. 7.

Halpert, 0. September 12, 2001, "Renton Avenue Bridge Sound, Inspector Says," Renton Reporter.

Kelsey, H.M., Sherrod, B.L., and Johnson, S.Y., 2003, "A Late Holocene Earthquake on Central Whidbey Island: Surface Folding Above a Blind Fault," Geological Society of America Abstracts with Programs, Vol. 35, No. 6.

King County, Washington, 1990, "Sensitive Areas Map Folio"

King County, Washington, 2004, GIS Center: http://www.metrokc.gov/gis/sdc/raster/elevation/index.htm

King County, Washington, 2004, GIS Center: http://www.metrokc.gov/gis/sdc/raster/ortho/index.htm

Livingston, Jr., V.E., 1971, State of Washington Department of Natural Resources, Division of Mines and Geology, "Geology and Mineral Resources of King County, Washington," Bulletin No. 63.

Mullineaux, D.R., 1965, United States Geologic Survey, "Geologic Map of the Renton Quadrangle, King County, Washington," Geologic Quadrangle Map GQ-405.

Preedy, M., 2003, "I-405 Geotech info:" internal WSDOT correspondence, September 9, 2003.

Satake, K., et al., 1996, "Time and Size of a Giant Earthquake in Cascadia Inferred from Japanese Tsunami Records of January 1700." Nature, Vol. 379, pp. 247-248.

Shannon & Wilson, Inc., February 22, 1993, "Geotechnical Report, SR 167, HOV Lanes, Renton, Washington" (part of documentation for project **W-6391**).

Sherrod, B.L., Brocher, T.M., Weaver, C.S., Bucknam, R.C., Blakely, R.J., Kelsey, H.M., Nelson, A.R., and Haugerud, R.A., 2003, "Evidence for a Late Holocene Earthquake on the Tacoma Fault, Puget Sound, Washington," Geological Society of America, Vol. 35, No. 6, September, 2003.

Sherrod, B.L., Nelson, A.R., Kelsey, H.M., Brocher, T.M., Blakely, R.J., Weaver, C.S., Rountree, N.K., Rhea S., and Jackson, B.S., 2003, The Catfish Lake Scarp, Allyn, Washington: Preliminary Field Data and Implications for Earthquake Hazards Posed by the Tacoma Fault", USGS Open File Report 03-0455.

United States Department of Agriculture Soil Conservation Service, November 1973, "Soil Survey, King County Area, Washington."

United States Geological Survey, "Earthquake Hazards Program, Interpolated Probabilistic Ground Motion for the Conterminous 48 States by Latitude Longitude, 2002 Data," accessed via http://eqint.cr.usgs.gov/eq/html/lookup-interp.html, on March 25, 2007.

Walsh, T.J. and Bailey, M.J., 1987, "Coal Mine Subsidence at Renton, Washington," Engineering Geology in Washington, Volume II, Washington Division of Geology and Earth Resources Bulletin 78, pp. 703-712.

Warren, W.C., Norbisrath, H. Grivetti, R.M. and Brown, S.P., 1945, "Preliminary Geologic Map and Brief Description of the Coal Fields of King County, Washington."

Washington State Department of Transportation, September 20-October 7, WSDOT personnel daily field records (Mr. Jolley) regarding original I-405 construction.

Washington State Department of Transportation, May 11, 1989, "CS 1743, SR 405, **L-7974**, South Renton to Sunset Blvd. HOV Lanes, Retaining Walls 3, 5, 6, 10, and Temporary Detour Wall at Bridge 405/17B, Foundation Recommendations."

Washington State Department of Transportation, July 5, 1989, "CS 1743, SR 405, **L-7974**, South Renton to Sunset Blvd. HOV Lanes, Cedar Ave. S. U'Xing 405/17A, Foundation Recommendations."

Washington State Department of Transportation, July 11, 1989, "SR 405, CS 1743, **L-7974**, South Renton to Sunset Blvd. HOV Lanes, Renton Ave. S. U'Xing No. 405/17B, Foundation Recommendations."

Washington State Department of Transportation, March 27, 1990, "CS 1743, SR 405, **L-7974**, Renton Ave. U'zing No. 405-17B, Addendum to Bridge Foundation Report."

Washington State Department of Transportation, May 1, 1990, "C.S. 1743, SR 405, **L-7974**, So. Renton I/C to Sunset Blvd., Walls 1, 17, 18, 20, 21, and 22, Foundation Recommendations."

Washington State Department of Transportation, August 1, 1990, "C.S. 1743, SR 405, **L-7974**, South Renton I/C to Sunset Blvd., Walls 2A, 2B, and 4, and M-Line Design, and FR-Line Design, Final Foundation Recommendations."

Washington State Department of Transportation, August 2, 1990, "C.S. 1743, SR 405, **L-7974**, South Renton I/C to Sunset Blvd., Detour Wall at Bridge 405/17B, Design Revision."

Washington State Department of Transportation, September 20, 1990, "Geotechnical Report – Volume 1, SR 405, South Renton Interchange to Sunset Boulevard HOV Lanes, CS 1743/1744 , **L-7974**, Milepost 2.30 to 4.55."

Washington State Department of Transportation, December 23, 1994, "Geotechnical Report, Tukwila to Factoria, SC and DI and HOV Ramp ByPass, C.S. 1744, SR 405, **XL-0560**."

Washington State Department of Transportation, 2006, "Geotechnical Design Manual."

Washington State Department of Transportation, March 2004, "Highway Runoff Manual" M31-16.

Washington State Department of Transportation, 2006, "Standard Specifications for Road, Bridge and Municipal Construction."

Yount, J.C., Dembroff, G.R., and Barats, G.M., 1985, "Map Showing Depth to Bedrock in the Seattle 30' by 60' Quadrangle, Washington."