May 2, 2008
Project No. 401294010

Mr. Jeffrey Kingston
Chabot-Las Positas Community College District
5020 Franklin Drive
Pleasanton, California 94588

Subject: Remedial Grading Recommendations - Lime Treatment Option
College Center for the Arts
Las Positas College Campus, Livermore, California

References: Ninyo & Moore, 2007, Geotechnical Evaluation, College Center for the Arts, Las Positas College, Livermore, California, Project No. 401294001, dated March 30.

Ninyo & Moore, 2008, Clarification of Recommendations - Building Pad Remedial Grading, College Center for the Arts, Las Positas College, Livermore, California, Project No. 401294010, dated April 9.

Dear Mr. Kingston:

As requested, we are providing alternative optional remedial grading recommendations for the College Center for the Arts project to be constructed at the Las Positas College campus in Livermore, California. Our lime treatment option remedial grading recommendations are presented based on our understanding of the project and the needs of the project team.

Laboratory testing documented in the referenced geotechnical report indicates that the site soils are expansive; a condition that has been documented at other locations withint the campus. In order to reduce the potential detrimental effects of expansive soils on the proposed improvements, we recommend that one of the following alternatives be implemented: 1) removal of the expansive soils and replacement with non-expansive imported materials, or 2) lime treatment of the existing onsite soils. Recommendations for removal and replacement of expansive soils have been provided previously in the referenced documents.

LIME TREATMENT OF EXPANSIVE SOIL

Based on our review of project documentation, experience with specialty contractors, and knowledge of previous grading operations on the campus, lime treatment is a feasible alternative to removal and replacement of the existing expansive soils. In structural areas, we recommend that lime treatment extend 2 feet below foundation elements, and extend 8 feet beyond the structural footprint. We also recommend that the upper 18 inches of subgrade soil beneath Portland cement concrete (PCC) pavements and flatwork areas be lime treated. Lime treatment should extend laterally beyond the edge of the PCC pavement or flatwork a distance of 2 feet. In the PCC pavement areas where lime treatment is proposed, the on site clayey soils may be utilized to achieve design grades.

The following preliminary lime treatment criteria are provided for bidding purposes. If this method is selected, laboratory testing should be performed to aid in preparation of construction specifications.

Prior to lime treatment, the overburden soils within the limits stated above should be removed and spread to facilitate mixing. As is typical of the equipment used in bay area practice, the bottom18 inches of soil to undergo lime treatment can be processed in-place and does not need to be excavated and moved to another location for treatment. Soils to be treated should not contain rocks or clods larger than 2-1/2 inches in dimension. Each lift of soil to be treated should not exceed 18-inches in thickness. The actual lift thickness may need to be limited by the capabilities of the mixing and compacting equipment mobilized to the project.

High calcium quicklime should be utilized that possesses the physical and chemical properties designated under American Society of Testing and Materials (ASTM) C 977, with the noted exception that the available lime index shall be 90 percent or more available calcium oxide (CaO) when tested in accordance with ASTM C 25. When the soil is adquately processes, the quicklime should reduce the Plasticity Index of the soil to a value of 5, or less. Although laboratory testing has not been performed to evaluate the actual amount of lime needed to achieve this criterion, based on our experience with similar materials, we anticipate roughly 4 to 6 percent lime by

weight of the dry soil will be needed. We recommend laboratory testing be performed prior to issuance of a specification for bid.

During the process, the treated soil should be mixed while introducing water into the soil through the metering/pump system on the mixer. Sufficient water should be added to the soil during mixing to provide a moisture content of 3 percent or more above the optimum moisture content of the soil-lime mixture. This process will facilitate the chemical reaction between the lime and soil. The soil-lime mixture should be allowed to cure, or "mellow," at a condition above the optimum moisture content, in an uncompacted state, prior to secondary mixing, pulverization, and compaction.

The moisture content of the soil-lime mixture should be 2 percent or more above the optimum moisture content at the time of compaction. The measured field dry density of the compacted mixture should be 93 percent or more of relative compaction as assessed by an ASTM D 1557 laboratory compaction test. After achieving the specified relative compaction, a subsequent layer or layers of lime-treated soil should be placed in the manner stated above to achieve design finished grades.

The geotechnical engineer should perform full-time field observation of site preparation, spreading of the lime, the primary mixing with the soil, secondary mixing, and compaction of each lift with the sheepsfoot compactor. Field density testing of the lime-treated soil should be performed in conformance with ASTM D 6938.

We appreciate the opportunity to be of continued service on this project.

Respectfully submitted,
NINYO & MOORE

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MRC/TKW/dhi

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