



February 6, 2019

Kleinfelder Project No.: 20180195.001A

**Mr. Nicholas Jacobson**  
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**SUBJECT: Recommended Mix Design Percentage of High Calcium Quick Lime  
Basin Slope Repair and Drilling Equipment Area  
Pipeline and Well Improvements Project  
Cantua Creek, California**

**File Reference: Recommendations for Chemical Treatment of  
Basin Slope Repair and Drilling Equipment Area  
Cantua Creek, California  
Kleinfelder Project No. 20180195, dated July 27, 2018**

Dear Mr. Jacobson:

Kleinfelder prepared this letter to provide recommendations associated with the lime treatment of subgrades for the above referenced project in pipeline and well improvements project in Cantua Creek, California.

## **BACKGROUND**

Project plans and specifications for the project call for chemical treatment of the basin slope repair and drilling equipment area associated with the pipeline and well improvements project in Cantua Creek. Kleinfelder prepared recommendations for chemical treatment of the subject areas in the above referenced letter. Kleinfelder was subsequently requested to obtain samples of the subgrade and perform laboratory tests to assess the required percentage of high calcium quick lime to achieve an unconfined compressive strength of 400 psi as indicated in the referenced letter.

This following summarizes the laboratory test results and provides recommendations for the recommended minimum percentage of high calcium quick lime additive for the chemical treatment of the basin slope repair and drilling equipment area of the project.

## **LABORATORY TEST RESULTS**

A representative of Kleinfelder collected three (3) bulk soil samples on December 21, 2018 within the proposed area to receive lime treatment. The samples were taken to the laboratory and it was observed that all three samples appeared to be similar. Material from Sample 1 was treated with 4 percent high calcium quicklime and tested for the maximum density/optimum moisture

relationship. Table 1 presents the test results of the moisture-density relationship of the treated soil.

**TABLE 1  
MAXIMUM DENSITY/OPTIMUM MOISTURE**

Sample No.	Test Method	Percent Quicklime (%)	Maximum Dry Density (pcf)	Optimum Moisture (%)
1	ASTM D1557-07	4	93.0	27.4

Additionally, three (3) test specimens were molded at different lime treatment percentages (4%, 5%, and 6%) and tested to obtain the unconfined compressive strengths at each percentage. Table 2 provides a summary of unconfined compressive strength results.

**TABLE 2  
UNCONFINED COMPRESSIVE STRENGTH TESTS**

Test Specimen	Specimen Age, Days (Oven Cure)	Percent Quicklime (%)	Compressive Strength (psi)
1	7	4	240
2	7	5	400
3	7	6	390**

\*\* Sample strength below anticipated achieved strength due to low moisture content.

## CONCLUSIONS

Based on the chemical treatment recommendations and the laboratory testing it is recommended the on-site clay soils within the basin slope repair and drilling equipment area be amended with a minimum of 5 percent by dry weight, high calcium quicklime in accordance with the recommendations and construction specifications provided in the referenced letter prepared by Kleinfelder (reference file 20180195, dated July 27, 2018) and the project plans and specifications. Five (5) percent high calcium quicklime additive should result in an unconfined compressive strength of approximately 400 psi after compaction and curing and to provide stabilization on the basin slopes and in the drilling equipment area.

The chemical treatment process should follow the recommendations in the previous letter and construction specifications.

## LIMITATIONS

The recommendations contained in this letter are based on information as a result of the previous investigation and present knowledge of the proposed construction. This letter has been prepared in substantial accordance with the generally accepted geotechnical engineering practice, as it exists in the site area at the time of the study. No warranty, express or implied is made or provided.

This letter may be used only by Provost and Pritchard Consulting Group and their designers only for the purposes stated, within a reasonable time from its issuance. Any other party who wishes to use this report shall notify Kleinfelder of such intended use. Land use, site conditions or other factors may change over time. Non-compliance with any of these requirements by the client or anyone else will release Kleinfelder from any liability resulting from the miss-use of this report by any party.

## CLOSING

Kleinfelder appreciates the opportunity to provide geotechnical engineering services during the construction phase of this project. If there are any questions concerning the information presented in this letter, please contact the undersigned this office at your convenience.

Respectfully,

**KLEINFELDER, INC**



Adam AhTye, EIT  
**Staff Engineer**



Stephen P. Plauson, PE, GE  
**Principal Geotechnical Engineer**



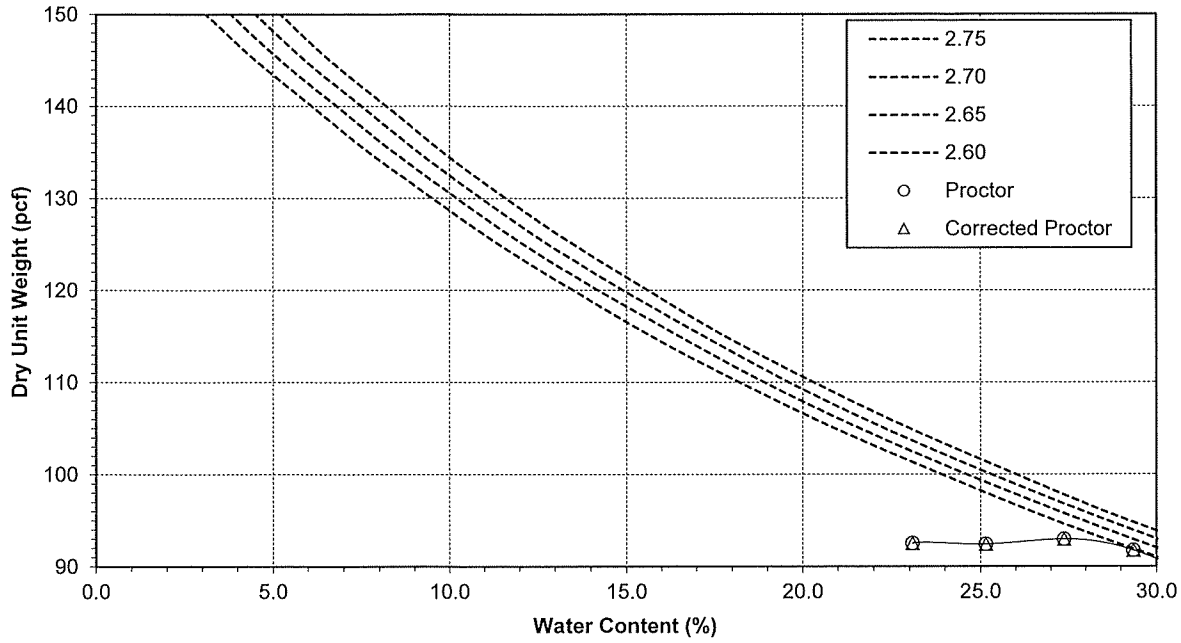
Attachments: Modified Proctor Test Results

AA:SPP:jb

Tested on 1/10/2019 by J.Sykes

Material Description: Clayey Silt/ Treated with 4% Quicklime

Location: Sample #1



Test Method: ASTM D1557 A	Uncorrected	Corrected
Maximum Dry Unit Weight (pcf)	93.0	na
Optimum Water Content (%)	27.4	na
Oversize Fraction, retained on (%)		<5
Bulk Specific Gravity of Oversize Fraction		na

Rammer Type: Mechanical

Specimen Preparation: Moist