April 8, 1999

Aliquot
Planners-Engineers-Surveyors
125 Ryan Industrial Court, Suite 109
San Ramon, CA 94583
Attn: Paul Tran

RE: Geotechnical Recommendations
5-feet high Retaining Wall between Lots 3 and 4
Subdivision 8123, Pleasant Hill, CA

Dear Mr. Tran:

In accordance with your request, we have re-opened our geotechnical data files on the Buttner Court Subdivision 8123 in Pleasant Hill, CA. Prior to this work we had issued a "*Geotechnical Investigation and Grading Plan Review, Proposed 8-Lot Residential Development, Subdivision 8123, 1860 Buttner Road, Pleasant Hill, CA*", dated March 11, 1998.

Recommended Earth Pressures

The wall you are proposing between Lots 3 (lower) and 4 (upper) would be surcharged by a 2:1 fill slope, with a near-level front slope, below the wall. All retaining walls must be designed to resist lateral earth pressures plus additional lateral pressures that may be caused by surcharge loads applied at the ground surface behind the walls (see Retaining Wall Drainage section, presented below).

Because of the expansive nature of the native soils to be incorporated in the fill, and the 2:1 slope surcharge, we recommend that unrestrained walls, 8 feet in height or less, be designed to resist an equivalent fluid pressure of **78 pounds per cubic foot** (pcf).

If simple cantilever walls are being considered, the passive resisting pressure on the level ground at the base of slope can be taken to be **280 pcf** equivalent fluid pressure from ground surface to –5 feet, and **350 psf** equivalent fluid pressure at depths greater than –5 feet. The reason for the high active load is the slope surcharge and the expansive nature of the material, which can be expected to cause the entire slope to swell outward, once subjected to landscape irrigation. If conventional footings or pier-supported footings are contemplated, see our recommendations for "Retaining Wall Foundations", given below.

Calculation of Tributary Load Area

For simple cantilever walls, such as wood post retaining walls, the tributary loading area for active pressures should be calculated as the center-to-center distance, between posts. The passive reaction should be taken to be 2.5 pier diameters, provided the piers are at least 3 diameters apart, with level ground on the downhill side of the piers. Encasing posts in at least 12-inch diameter concrete-filled holes is usually necessary to develop sufficient passive resistance.

Retaining Wall Foundations

The footings for these walls may be designed for an allowable bearing pressure of 2500 pounds per square foot due to dead plus live loads with a one-third increase for all live loads, including seismic. These allowable bearing pressures are net values; therefore, the weight of the footings can be neglected for design purposes. However, all footings should have a minimum embedment of 18-inches or as designated by the 1997 U.B.C., which ever is greater.

Lateral loads may be resisted by: (1) friction between the foundation bottoms and the supporting materials and (2) passive pressures acting against the sides of the footings. We recommend a coefficient of friction of 0.38 and a passive pressure equal to an equivalent fluid weighing 280 pounds per cubic foot starting at the top of the footing for retaining walls when the finish grade surface is level, and increasing to 350 pcf at depths greater than 5 feet below grade.

These values are not valid for other walls which might be situated **above or upon to descending 2:1 slopes** (where the ground slopes away from the wall's footing). In such cases, the passive resistance would decrease to only 200 pcf. Such walls would also need to be designed to resist horizontal creep forces within 10 feet of the crest of any slope. On a 2:1 slope in materials with Plasticity Indices close to 25, this creep force is recommended to bear 725 PSF at the ground surface to zero at a depth of 3 feet (2 pier diameters if piers are used).

Retaining Wall Drainage

The above pressures assume that sufficient drainage will be provided behind the walls to prevent the build-up of hydrostatic pressures from surface and subsurface water infiltration. Adequate drainage may be provided by a subdrain system consisting of a three-inch diameter perforated pipe (ABS SDR 23.5) bedded in 3/4-inch diameter drain rock wrapped effectively with geotextile filter fabric for the full height of the wall. The perforations should be placed downward to prevent siltation of the drain pipe. Flexible corrugated plastic pipes should not be used.

Alternatively, a prefabricated drain, such as Miradrain or Enkadrain, may also be used, and are, in fact, preferable. The bottom of these can be curled around a 2-inch diameter collector pipe, sloped to drain at a suitable point of discharge (a 2-inch pipe can be used with a

prefabricated drain because these have built-in filtration protection).

After the subdrains are placed, the remaining portions of the walls should be backfilled with on-site or imported fill. All fill must be compacted to at least 90 percent relative compaction (ASTM D-1557-91), utilizing equipment that will not damage the wall. Temporary bracing may be required if large compaction equipment is utilized.

Reference to Geotechnical Engineering Reports and As-Built Grading Plans

Section 3309.4.7 of the Uniform Building Code states that: *The dates of the soils engineering and engineering geology reports together with names, addresses and phone numbers of the firms or individuals who prepared the reports*. These should be written on the Improvement Plans. These references should include our March 11, 1998 geotechnical investigation, as well as addendum recommendations, such as this, and these should be indicated on the appropriate pages of the Improvement Plans, in accord with UBC Section 3318.1.1.

WARRANTY and CLOSURE

We have employed standard geotechnical engineering procedures, and our professional recommendations and opinions are made in accordance with generally accepted geotechnical engineering principles and practices. This warranty is in lieu of all other warranties, either expressed or implied.

We hope this letter provides you with the information which you require at this time. If you have any questions regarding the recommendations presented in this letter, please feel free to give us a call at your earliest convenience.

Very truly yours,

GEOLITH CONSULTANTS, INC.

J. David Rogers, Ph.D., R.G., C.E.G., C.H.G.
Principal Engineering Geologist

Fred H. P. Chin, Ph.D., P.E.
Principal Engineer

Copies: Addressee (2)
Walter P. McEnerney, Focus Realty Services (1)