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RECEIVED

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TOWN OF SAN ANSELMO
PLANNING, BLDG, DPW

Kyle and Margot Biehle
217 Crescent Road
San Anselmo, CA 94960

RE: Geotechnical Reconnaissance
Proposed Residential Improvements
217 Crescent Road, San Anselmo

Dear Mr. and Mrs. Biehle:

In accordance with your request I have performed a geotechnical reconnaissance of your property located at 217 Crescent Road in San Anselmo. The purpose of this examination was to investigate geological conditions underlying the area and to provide foundation recommendations for support of proposed improvements.

The scope of this limited reconnaissance included a visual examination of the existing structures, review of geologic mapping of the area and excavation of four hand-auger probes to depths of 3 to 8 feet. No deep borings or lab testing were performed in this limited reconnaissance.

BACKGROUND AND PROPOSED CONSTRUCTION: The subject property consists of a partial two-story wood framed house located on a moderately down-sloping lot, approximately 1/4 mile west of downtown San Anselmo. The property currently contains the existing house structure with a detached two-car garage, located southwest of the house.

The original structure apparently dates back to 1909. Several additions were added over the years, including front addition and porch structure added in the 1980's, and a large two story wing added at the rear in the 1990's. The present garage was apparently added with the 1990's addition. There is also small bathroom addition at the northeastern corner of the existing structure, which appears to be at least 75 years old.

It is my understanding that you plan to demolish the existing garage structure, and construct a new garage forward of the present location. A new in-ground swimming pool will be constructed in the vicinity of the present garage. A modest amount of fill will be placed at the outboard edge of the pool deck, retained by a concrete retaining wall up to

5 or 6 feet in height, to be perched on the rear slope. The kitchen in the main house structure will be remodeled, and will include a small bump out at the eastern side of the existing structure.

EVALUATION OF EXISTING FOUNDATIONS: The original 1908 structure apparently had a brick foundation, which was largely replaced with reinforced concrete as part of the 1980's addition. The newer foundations appear to consist of conventional spread footings. Most of the existing house foundations appear to be in very good condition. However the northern perimeter footing is visibly undermined at the older bathroom addition, at the northwestern corner of the original structure. The foundations of the existing garage structure are also in excellent condition.

During my site visits level surveys were performed in both the house and the garage. The house was found to be within 1.5 inches of relative level, whereas the garage is within 1 inch. Thus both structures have performed very well on the existing conventional footings.

GEOLOGY REVIEW AND OBSERVED SUBSURFACE CONDITIONS: The majority of the site, including the areas of existing and proposed improvements, descends to the northwest at an average gradient of approximately 8:1. At the rear property line (just beyond the proposed pool deck), the slope steepens to nearly 1.5:1 and descends about 10 feet into a minor natural drainage swale, which feeds to San Anselmo Creek, located about 1/4 mile to the east. Cetaceous Sandstone and Shale bedrock are mapped in the steeper hillsides to the west. The site lies at the edge of an alluvial deposit, although the immediate vicinity is mapped as a colluvium, derived from erosion and shallow sloughing off the steeper slopes. However, based on prior experience in the area (156 Crescent Road), Sandstone Shale bedrock exists at a relatively shallow depth in the modestly sloping areas.

The nearest mapped landslide is indicated about 1/4 mile to the west. The site has been assigned a stability number of 1, indicating a very low risk of landsliding. No evidence of creep or instability were noted in my reconnaissance of the site.

During my site visit four exploratory probes were excavated to depths of 3 to 8 feet. Probes were performed at the proposed addition at the northern side of the house, at the front and rear perimeters of the proposed new swimming pool (present garage), and at in the vicinity of the proposed new garage. All four borings encountered 1 to 2 feet of top soils consisting of dark brown Clayey SILT with organics and rock fragments. Beneath the top soils, dense brown Silty CLAY with abundant Sandstone and Shale fragments was encountered. This material graded to decomposed Shale at depths of approximately 4 to 6 feet. Contrary to the map designation, I suspect that the rocky Clay soils are "residual soils", derived from in-place weathering of the parent bedrock, rather than "colluvial soils", deposit by erosion. The material is very dense, requiring a roto hammer with a core barrel

to penetrate through the rock fragments. The probe at the front of the existing garage met refusal on an apparently rock fragment at a depth of approximately 3 feet. Clearly the existing structures have performed well to date bearing on this material.

SEISMICITY: The site is located approximately 7 miles east of the San Andreas Fault (type A), which has a Maximum Credible Earthquake (MCE) magnitude of 7.9 on the Richtor Scale. Other surrounding active faults with equal or lesser expected magnitudes and probabilities include the Hayward Fault (type A), located approximately 12 miles to the east, and the Concord/Calavaras Fault (type B), located approximately 25 miles to the east.

The subject site is situated outside of the Alquist-Priolo Special Studies Zones, and therefore the likelihood of seismic ground rupture is considered to be low at this site. Given the clayey nature of the site soils and the shallow depth to bedrock, liquefaction should not be of concern.

Design of the new improvements in accordance with the 2013 CBC should utilize the following factors:

Mapped Short Period Spectral Acceleration, Ss:	1.500
Mapped 1-Second Spectral Acceleration, S1:	0.604
Site Class:	B
Short Period Site Coefficient, Fa:	1.0
1-Second Site Coefficient, Fv:	1.0
Modified Short Period Acceleration, Sms:	1.500
Modified Short Period Acceleration, Sms:	0.604
Design Short Period Acceleration, Sds:	1.000
Design Short Period Acceleration, Sds:	0.403
Design Category:	D

DISCUSSION AND CONCLUSIONS: It is my opinion that the proposed improvements may bear on conventional spread footings, utilizing "Code Minimum" bearing values. The new footings should extend at least 24 inches below the existing grades, to bear through the top soils and into the underlying rocky clay residual soils. In conjunction with the kitchen addition at the main house structure, consideration should be given to replacing the undermined footing of the adjacent older addition.

Conventional construction should be appropriate for the proposed in ground swimming pool, provided that the bottom bears in firm natural soils. The new retaining wall at the outboard perimeters of the pool deck should be supported on drilled piers, as it will bear on the steep rear slope.

It is my opinion that the site is suitable for the proposed construction, provided that the following recommendations are adhered to.

RECOMMENDATIONS:

1. **GRADING:** Moderate fill grading is anticipated for this project, to support the outboard edge of the pool deck, and possibly to raise the level of the garage floor.

   1.1 **Site Preparation:** Areas to receive fill or flatwork shall be cleared of vegetation and stripped to a sufficient depth to remove major root systems. The stripped organic top soil material may be stock piled for later use in landscaping areas.

   1.2 **Cut Grading:** Permanent cut slopes shall be at a maximum inclination of 2:1 (horizontal to vertical) or shall be retained by structural walls in accordance to the recommendations below. Temporary shoring may be required for vertical cut slopes over 5 feet in height, particularly if the excavations are required to stand through the rainy season (which is not advised).

   1.3 **Fill Grading:** Fills placed on slopes steeper than 6:1 shall be keyed into bedrock at the base, and progressively step benched proceeding up the slope. The undersigned Geotechnical Engineer shall inspect and approve all keyways and shall intermittently inspect all fill placement in progress. Fills shall be placed in level lifts no more than 8 inches in thickness, and shall be compacted to 95% relative compaction under all building and pavement areas, and to 90% relative compaction under all other areas. Existing site soils are suitable as fill provided they are free of organic material and rocks or rubble over 6 inches in diameter. If fill is needed under the garage slab, I recommend that 3/4-inch drain rock be used, which requires no compactive effort.

   1.4 **Backfill of Utility Trenches:** Utility trench backfill shall be compacted to a relative density of 95% under pavement and foundation areas, and 90% elsewhere. Trenches shall be capped with at least 18 inches of relatively impermeable material (site soils are acceptable).

   1.5 **Erosion Control:** Due to their silty nature, the site soils are susceptible to erosion, particularly on the steeper graded slopes. Therefore it is recommended that no grading be performed during wet weather, and all graded or otherwise denuded slopes shall be covered with appropriate erosion control fabric and seeded or landscaped prior to the onset of the rainy season.

2. **FOUNDATIONS:** The proposed new structure may be founded on continuous spread footings. Drilled pier and grade foundations should be used for the wall below the pool, or for any other significant structure on the steeper rear slope. Specific recommendations for each foundation type are discussed below:

2.1 Spread Footings: Spread footings shall be a minimum of 18 inches in width, and shall extend to minimum depths of 24 inches below the *existing* site grades undisturbed rocky clay material as verified by the undersigned Geotechnical Engineer.

2.1a Bearing Pressures of Footings: Footings constructed in accordance with Section 2.1 may be designed for bearing pressure of 1500 psf.

2.1b Lateral Resistance of Footings: Lateral resistance for spread footings constructed in accordance with Section 2.1, may assume a friction value of 0.30 and a passive resistance of 250pcf, beginning at grade.

2.1c Minimal Footing Reinforcing: All spread footings shall contain a minimum of one #5 bar top and bottom, with #3 shear ties at 18 inches on center.

2.2 Pier and Grade Beam Foundations: All piers should be a minimum of 18-inches in diameter and should extend a minimum of 6 feet into bedrock as verified by the undersigned Geotechnical Engineer. Total depths of 10 to 15 feet should be anticipated.

2.2a Bearing Friction of Piers: Piers constructed in accordance with Section 2.2 may be designed for a friction value of 750psf, neglecting the upper 4 feet of surface soils.

2.2b Lateral Resistance of Piers: Resistance to lateral loadings may be assume a passive pressure of 450pcf, acting against 2 pier diameters, beginning at a depth of 4 feet. This value may be increased by one third for short-term seismic loads.

2.2c Minimal Pier Reinforcing: All piers shall contain a minimum of six #5 bars enclosed by #3 ties at 12 inches on center. This reinforcing is intended to provide resistance to incidental creep forces.

2.2d Grade Beams: The perimeter grade beams shall have minimum dimensions of 10"x18" and shall contain a minimum of two #5 bars top and bottom, with #3 closed ties at 18 inches on center. The grade beams shall be connected to the foundation piers with a minimum of four #5 angle dowels.

2.3 **Floor Slabs on Grade:** Floor slabs shall be a minimum of 4 inches thick and shall be reinforced with #4 bars at 18 inches on center in each direction, and shall be epoxy doweled to the perimeter foundations. Floor slabs used as living space shall be poured over a capillary break consisting of 4 inches of pea gravel covered by a 10 mil vapor barrier. Despite these measures, some cracking should be expected due to minor soil movement or concrete shrinkage.

3. **RETAINING WALLS:** The new retaining wall below the pool, which will support level grade, may be designed for an active pressure of 45pcf. This wall may bear on a drilled piers per Section 2.2. Note that bottom of the wall should be keyed at least 12 inches below the descending slope, and this additional foot should be added to the effective design height (thus a 5-foot tall wall should be designed for an effective height of 6 feet). A full gravel drains should be provided the retaining wall, wrapped in filter cloth. Weep holes may be installed along the base of the wall, just above the descending grade (the gravel should not extend below the weep holes).

4. **DRAINAGE:** Adequate drainage is important in order to minimize mold and mildew growth in crawlspace areas. All roof downspouts shall be fitted with 4-inch solid PVC discharge pipes. Surrounding yard and patio areas shall utilize V-1 or brass catch basins tied to the roof downspout lines, or shall be graded to shed runoff away from the house in an unconcentrated manner. All piping shall be 4-inch SDR-35 PVC.

4.1 **Dispersal of Storm Water:** All drain lines shall be continuously sloped at 1% minimum to outlet to the drainage channel at the rear property line. If on site dispersal is required, a junction box could be placed within the gravel field behind the new retaining wall below the pool. The drain lines would feed into this box, allowing the storm drain to disperse into the gravel and out through the weep holes at the base of the wall.

4.2 **Maintenance:** Drainage systems require regular maintenance to insure proper functioning. Catch basins and downspout pipes should be flushed regularly, and the washed debris should be removed from the junction box at the dispersal field. Discharge points should be also be periodically inspected to insure that outlet piping is not obstructed and to verify that erosion is not occurring. It is recommended that an accurate as-built plan of the drainage systems be prepared, and that maintenance requirements be disclosed to all future buyers of the property.

5. **EXTERIOR FLATWORK:** Exterior flatwork, including driveways, walkways and patios may be constructed as 4-inch thick concrete slabs and should be reinforced with a minimum of #4 bars at 18-inch centers. Some distress can be expected due to minor soil movement or concrete shrinkage.

6. **PLAN REVIEW AND CONSTRUCTION OBSERVATION:** The undersigned Geotechnical Engineer should review the final building plans for conformance with the above recommendations. Pier drilling and footing and subdrain trenches should also be inspected prior to placement of reinforcing steel, concrete or backfill. Allowances should be made for potential changes to the final design requirements in the event that actual construction conditions differ from the conditions assumed in this report. Third party compaction testing may be required, depending on the amount of fill to be placed.

LIMIT OF LIABILITY: This report was prepared under written contractual agreement with the addressee (client) indicated above. The client has agreed to limit the liability of Dave Olnes P.E., Inc. to an amount not to exceed ten times the fee for services indicated above, for any and all matters arising from this visual examination and report. The information provided herein is for the exclusive use of the specified client. Any recommendations provided should be considered preliminary only, and are not intended as complete construction plans. Dave Olnes P.E., Inc. shall assume no liability for other parties who use the report without its express written consent.

If there are any questions regarding this matter, please contact my office.

Sincerely,

David A. Olnes, PE

REFERENCES

Knudsen, Keith L., Sowers, Janet M. Witter, Robert S., Wentworth, Carl M, Helley, Edward J., "Maps of Quaternary Deposits and Liquefaction Susceptibility in the Central San Francisco Bay Region, California", USGS Open File Report 06-1037, 2006.

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State of California Division of Mines and Geology,"Maps of Known Active Fault Near-Source Zones in California and Adjacent portions of Nevada", 1998.