Stevens Ferrone & Bailey Engineering Company, Inc

Geotechnical Engineering
Engineering Geology
Storm Water Management
Construction Observation & Testing Services

August 28, 2020

Mr. Kerri Watt
DeNova Homes
1500 Willow Pass Court
Concord, CA 94520

Re: Geotechnical Engineering Peer Review and Assessment
Proposed Residential Development at 2151 Appian Way – Pinole, California
SFB Project No.: 155-97

Mr. Watt:

Stevens, Ferrone & Bailey Engineering Company, Inc. (SFB) performed a geotechnical engineering pee review and assessment for the proposed residential development to be located at 2151 Appian Way in Pinole, California. Based on our review of the available information, we understand that the project may consist of developing approximately 7.38 acres of land for a multi-unit, moderately dense, residential development. Grading is anticipated and associated underground utilities and roadways are proposed. Our geotechnical assessment included the following scope of work:

- Review a previous geotechnical report, dated December 11, 2018, addressing the geotechnical design and construction of a proposed school campus development to be located at the site;
- Review available published and unpublished geological and geotechnical literature relevant to the project area and surrounding vicinity;
- Review available aerial photographs and images of the area to evaluate geologic and geotechnical site conditions, including historical topographic maps;
- Perform a visual site reconnaissance of the site and surrounding area on August 26, 2020, to evaluate the geological and geotechnical conditions that impact the development of the site;
- Perform geotechnical engineering analyses and evaluation of the research and reconnaissance data in order to provide general geotechnically related development recommendations for the project; and
- Prepare this report summarizing the results of our study.

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1.0 SUMMARY OF GEOTECHNICAL AND GEOLOGICAL CONDITIONS

1.1 Surface Description

Based on our August 26, 2020 reconnaissance, our review of the previous report, and review of aerial photographs/images (GoogleEarth Pro), it appears that the site has previously been graded and developed for a one-story medical office building and associated parking and access ways. At the time of our reconnaissance, the building and parking areas were still present, along with associated infrastructure such as utility structures and pipelines.

The site had been previously graded level to accommodate the building, parking areas, and supporting infrastructure. Hillsides existed along the northern and eastern boundaries of the site. The slope along the northern portion of the site sloped downward into the site and included retaining walls at the base. The slope along the eastern boundary sloped downward away from the site and included overturning wooden posts, an old cinder block retaining wall, and small wooden landscaping type walls. It is unknown if the walls are in a stable configuration. The site was bounded by Appian Way on the west and Canyon Drive on the south. Trash and debris were observed throughout the site. Wells, leach fields, and septic systems may exist.

1.2 Subsurface Conditions, Geology, and Seismicity

The ground surface is underlain by fills, clayey soils, and sandy/gravelly soils. Bedrock was encountered in borings performed at the site; the bedrock was encountered at depths ranging from 7 to 30 feet below the ground surface. The borings encountered undocumented fills blanketing the site to depths ranging from 2 to 12 feet in thickness. Alluvial soils were encountered below the fills which extended to residual soils (bedrock weathered to a soil like consistency). The residual soils extended to bedrock. Groundwater was not encountered in the previous borings except in one location where water was encountered at the top of the bedrock; perched water and seepage may be encountered during the rainy season. The more clayey soils are expansive. The clayey surface soils are highly corrosive to unprotected metal in contact with these soils.

According to Graymer, et al (1994)[1], the site is underlain (at depths below the fills and soils) by Miocene diatomite and sandstone.

Earthquake intensities will vary throughout central California and the San Francisco Bay Area depending upon numerous factors including the magnitude of earthquake, the distance of the site from the causative fault, and the type of materials underlying the site. The U.S. Geological Survey (2016)[2] indicated that there is a 72 percent chance of at least one magnitude 6.7 or greater

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[1]R.W. Graymer, D.L. Jones, and E.E. Brabb, 1994, *Preliminary Geologic Map Emphasizing Bedrock Formations in Contra Costa County, California*, U.S. Geological Survey Open-File Report 94-622.
[2]Aagaard, Blair, Boatwright, Garcia, Harris, Michael, Schwartz, and DiLeo, *Earthquake Outlook for the San*

earthquake striking the San Francisco Bay region between 2014 and 2043. Therefore, the site will probably be subjected to at least one moderate to severe earthquake that will cause strong ground shaking.

Using the ASCE 7-16 Standard for Risk Category II (accessed August 27, 2020)[3] and based on our analyses, the Maximum Considered Earthquake (MCE) site modified peak ground acceleration (PGA_m) for the site is 1.071g. The MCE peak ground acceleration has a 2% probability of being exceeded in a 50-year period (mean return time of 2,475 years). According to the U.S. Geological Survey's Unified Hazard Tool and applying the Dynamic Conterminous U.S. 2014 model, the site has a 10% probability of exceeding a peak ground acceleration of 0.60g in 50 years.

1.3 Geologic Hazards

The site is not located with an Alquist-Priolo Earthquake Fault Zone as designated by the State of California[4].

Nilsen[5] has not mapped landslides impacting the site. During our reconnaissance, we did not observe evidence of landslides or debris flows. We did observe minor erosion on some of the slopes. Similar results were noted in the previous report.

The site is not located within a State of California designated seismic hazard zone.

According to the results of the previous exploratory borings, the potential for liquefaction occurring at the site is very low.

Francisco Bay Region 2014–2043, USGS Fact Sheet 2016–3020, Revised August 2016 (ver. 1.1).

[3] https://seismicmaps.org, OSHPD, U.S. Seismic Design Maps.

[4] Hart and Bryant, *Fault-Rupture Hazard Zones in California*, CDMG Special Publication 42, Interim Revision 2007.

[5] Nilsen, 1975, *Preliminary Photointerpretation Map of Landslide and Other Surficial Deposits of the Richmond 71/2' Quadrangle, Contra Costa and Solano Counties, California*, USGS Open File Map 75-277-47.

2.0 GEOTECHNICAL ENGINEERING OPINIONS AND CONCLUSIONS

From a geotechnical engineering standpoint, it is our opinion that the site can be developed for the proposed project. The following are the primary geotechnical issues for development of the site. Additional geotechnical issues may be revealed at the conclusion of future onsite subsurface investigations.

FILL MATERIALS: Portions of the site are underlain by fill materials that were placed during previous grading operations at the site. Unless documentation is provided showing that the fill was placed in accordance with current engineering standards, we recommend the fill materials be over-excavated to a depth where competent soils or bedrock is encountered and recompacted.

Over-excavations should be performed so that no more than 5 feet of differential fill thickness will occur below the proposed building foundations. Removed soil and fill can be used as new fill provided it is placed and compacted in accordance with typical geotechnical engineering standards. The extent of the removal and re-compaction will vary across the site and should be determined based on future exploratory borings and in the field by SFB at the time of the earthwork operations.

SLOPES AND RETAINING WALLS: Cut and fill slopes (and combination cut/fill slopes), along with retaining walls, exist at the site. The stability of these slopes and walls are unknown. We recommend the stability of the slopes be evaluated based on computer aided slope stability analyses. Re-grading of slopes may be necessary based on the results of the slope stability analyses in order to comply with current engineering standards. If the stability of the existing retaining walls cannot be determined by a structural engineer, then we recommend the walls not be relied upon to support the proposed development and slopes.

FOUNDATIONS: To reduce the potential for post-construction distress to the proposed structures resulting from shrinkage and swelling of these materials, we recommend that the proposed structures be supported on a post-tensioned slab foundation system that is designed to reduce the impact of the expansive soils.

FUTURE COMPREHENSIVE GEOTECHNICAL ENGINEERING REPORT: We recommend a comprehensive geotechnical engineering report be prepared the specifically addresses the proposed residential development. The previous exploratory boring and laboratory data from the previous report can be used to perform the geotechnical engineering analyses and prepare the report. The future report would provide detailed geotechnical design and construction criteria for the residential project. The geotechnical engineering and report should be prepared in accordance with the most recent California Building Code.

3.0 PRELIMINARY EARTHWORK RECOMMENDATIONS

The site should be cleared of all obstructions including existing structures and their entire foundation systems, the access roadways, existing utilities and pipelines and their associated backfill, designated trees and their associated entire root systems, and debris. Holes resulting from the removal of underground obstructions extending below the proposed finish grade should be cleared and backfilled with compacted fill materials. Existing tree roots may extend to depths of 3 to 4 feet. Foundations likely extend to depths of about 1-1/2 to 2 feet. Wells, septic systems, and leach field systems should be removed/abandoned in accordance the County requirements.

From a geotechnical engineering standpoint, any existing trench backfill materials, clay or concrete pipes, gravel, pavements, and concrete that are removed can be used as new fill onsite provided debris is removed and it is broken up. Portions of the site containing vegetation that is not removed during clearing and disking should be stripped to an appropriate depth to remove these materials.

All existing fill materials should be over-excavated to a depth where competent soil or bedrock is encountered. The actual depth of over-excavation would depend upon the subsurface conditions encountered and future slope stability analyses. In order to reduce the potential for excessive differential movement across the proposed foundations, we recommend that foundations bear entirely on an engineered fill layer and that no more than 5 feet of differential fill thickness exist below foundations.

From a geotechnical and mechanical standpoint, onsite soils and fills having an organic content of less than 3 percent by volume can be used as fill. Fill should not contain rocks or lumps larger than 6 inches in greatest dimension with not more than 15 percent larger than 2.5 inches.

Fill materials will require compacting to about 90 percent relative compaction and moisture conditioned approximately 3 to 5 percent over optimum water content. Fill material should be spread and compacted in lifts not exceeding approximately 8 to 12 inches in uncompacted thickness.

Pipeline trenches should be backfilled with fill placed in lifts of approximately 8 to 12 inches in uncompacted thickness. Thicker lifts can be used provided the method of compaction is approved by SFB and the required minimum degree of compaction is achieved. Backfill should be placed by mechanical means only. Jetting is not permitted. The upper 3 feet of trench backfill in foundation, slab, and pavement areas should be entirely compacted to at least 95 percent relative compaction.

We recommend that exterior slabs (including patios, sidewalks, walkways, and driveways) be placed directly on the properly compacted fills. We do not recommend using aggregate base,

gravel, or crushed rock below these improvements. If imported granular materials are placed below these elements, subsurface water can seep through the granular materials and cause the underlying soils to saturate or pipe. Prior to placing concrete, subgrade soils should be moisture conditioned to increase their water content to approximately 3 to 5 percent above laboratory optimum moisture (ASTM D-1557). We recommend reinforcing exterior slabs with steel bars in lieu of wire mesh.

4.0 PRELIMINARY FOUNDATION RECOMMENDATIONS

We recommend the proposed residential buildings be supported on a post-tensioned slab foundation that is designed for the expansion potential of the onsite soils. The slab foundation should bear entirely on properly prepared, compacted structural fill. The post-tensioned slab thickness should be determined by the Structural Engineer; however, we recommend the post-tensioned slabs be at least 10 inches thick. A vapor retarder must be placed between the subgrade soils and the bottom of the slabs-on-grade. We recommend the vapor retarder consist of a single layer of Stego Wrap Vapor Barrier 15 mil Class A or equivalent.

In order to reduce the potential for vapor transmission through the concrete slab, we recommend the concrete mix design for the slabs have a maximum water/cement ratio of 0.45. If a higher water/cement ratio is being considered, we recommend higher vapor transmission be taken into account in the design and construction of the homes. The actual water/cement ratio may need to be reduced if the concentration of soluble sulfates or chlorides in the supporting subgrade is detrimental to the concrete and/or reinforcing steel.

If used, retaining walls and soundwalls can be supported on drilled, cast-in-place, straight shaft friction piers that develop their load carrying capacity in the materials underlying the site. Alternatively, walls can be supported by footing foundations.

5.0 PRELIMINARY PAVEMENT RECOMMENDATIONS

The soils are expansive which results in R-values of 5 to 10. We anticipate that roadway sections will consist of approximately 3 inches of asphalt concrete over 9 inches of Caltrans Class 2 baserock.

6.0 ADDITIONAL RECOMMENDATIONS, CONDITIONS, AND LIMITATIONS

We recommend a comprehensive geotechnical engineering report be prepared by SFB for the residential development project that specifically addresses the proposed development, that conforms to the most recent edition of the California Building Code, and provides geotechnical design and construction criteria for the project. The future report should include detailed drainage, earthwork, foundation, and pavement recommendations. Once the report is completed, we

recommend SFB review the project's design and specifications to verify that the recommendations presented in the future report have been properly interpreted and implemented in the design, plans, and specifications. We also recommend SFB be retained to provide consulting services and to perform construction observation and testing services during the construction phase of the project to observe and test the implementation of our recommendations, and to provide supplemental or revised recommendations in the event conditions different than those described in our reports are encountered. We assume no responsibility for misinterpretation of our recommendations if we do not review the plans and specifications and are not retained during construction.

If you have any questions or need additional information, please call us.

Sincerely,

Stevens, Ferrone & Bailey Engineering Company, Inc.

Kenneth C. Ferrone, P.E., G.E., C.E.G.
Principal Civil/Geotechnical Engineer
Principal Certified Engineering Geologist