February 19, 2019 Job No. 3445.11

Manzana Products Co.
Attention: Mark Fitzgerald
9141 Green Valley Road
Graton, CA 95472
mfitzgerald@manzanaproductsco.com

Subject: Geotechnical Report Update
Proposed Electrical Service Pad
Manzana Products Company
9141 Green Valley Road
Graton, California

References: Report titled "Design Level Geotechnical Investigation, Proposed Warehouse Building, Manzana Facility, 9141 Green Valley Road, Graton, California, prepared by PJC & Associates., dated April 16, 2007.

Report titled, "Geotechnical Investigation, Proposed Office Building, Manzana Products Company, 9141 Green Valley Road, Graton, California," prepared by PJC & Associates, Inc., dated May 12, 2014.

Architectural Plan, Sheet A1.10, prepared by Ross Drulis Cusenbery Architecture, dated October 26, 2018.

Project Plans, Sheets E0.0, E0.1, E0.2, E0.3, E0.4, E1.0, E1.1, E1.4, E2.0 and E3.0, prepared by McDonell Electric Inc., dated December 7, 2018.

Dear Mark:

PJC & Associates, Inc. (PJC) is pleased to present this geotechnical investigation report update for the proposed electrical service pad located at 9141 Green Valley Road in Graton, California. The site corresponds to the geographic coordinates of 38.44°N and 122.87°W, according to Google Earth Imagery. Our work was completed in accordance with our agreement for geotechnical engineering services and your authorization to proceed with the work. The purpose of this report was to review our previously completed geotechnical reports performed at the site and update the geotechnical criteria for application in the design and construction of the subject project. Based on the results of our work, we judge that the project is feasible from a geotechnical engineering standpoint, provided the recommendations and geotechnical criteria presented in this report are incorporated into design and construction of the project.

1. PROJECT DESCRIPTION

Based on the aforementioned preliminary plans by Ross Drulis Cusenbery and McDonnell Electric and information provided by Bob Cary Construction, it is our understanding that the project will consist of constructing a new electrical equipment pad adjacent to the northeastern perimeter of an existing warehouse building. The warehouse is located at the northwestern portion of the subject property. Construction will consist of constructing concrete and/or shotcrete engineered retaining walls along the northern, southern and western perimeters of the pad and backfilling with engineered fill to achieve a level pad for construction of a six-inch thick slab that will be used to support the electrical equipment.

Structural loading information was not available at the time of this report. For our analysis, we assume that structural loads will be light with dead plus live continuous wall loads less than two kips per lineal foot and uniform equipment and slab-on-grade load less than 1000 psf. If these assumed loads vary from the actual loads, we should be consulted to review the actual loading conditions and provide revised recommendations, if necessary.

We anticipate that grading will consist of cuts and fills up to six feet and less to achieve the desired pad grade and adequate gradients for site drainage. We anticipate the engineered retaining walls up to six feet will be required.

2. PREVIOUSLY COMPLETED WORK

PJC previously performed a geotechnical investigation at the facility for an office building and presented the results of the investigation in a written report dated May 12, 2014. Construction of the office building was completed in 2015. That report supplemented our work on the project. The office building is located approximately 150 feet southeast of the site. PJC also prepared a geotechnical investigation report for a warehouse and presented the results in a written report dated April 16, 2007. That project was completed in 2008.

3. SITE CONDITIONS

The electrical pad site is located adjacent to the northeast perimeter of the most northwestern warehouse building. It appears that the proposed building pad was graded level by cutting to achieve a level pad. The eastern perimeter of the pad consists of a cut/fill slope with an estimated gradient of 50 percent. At the time of our site visit, the site was partially being used as a staging and storage area.

4. CONCLUSIONS

Based on the results of our work, we judge that the project is feasible from a geotechnical engineering standpoint, provided the recommendations presented in this report are incorporated in design and construction of the proposed project, as described above. The following provides geotechnical recommendations and criteria for design and construction of the project.

5. UPDATED SEISMIC DESIGN CRITERIA

The seismic design criteria have since become outdated from the time of our previous reports. Below are the updated seismic design criteria. Based on criteria presented in the 2016 edition of the California Building Code (CBC) and ASCE (American Society of Civil Engineers) STANDARD ASCE/SEI 7-10, the following minimum criteria should be used in seismic design:

a.	Site Class:	D
b.	Mapped Acceleration Parameters:	S_S = 1.500 g S_1 = 0.600 g
c.	Spectral Response Acceleration Parameters:	S_{MS} = 1.500 g S_{M1} = 0.900 g
d.	Design Spectral Acceleration Parameters:	S_{DS} = 1.000 g S_{D1} = 0.600 g

6. GRADING AND EARTHWORK

Grading and drainage plans or finish floor elevations were not available at the time of this report. We assume that site grading will consist of cuts and fills of six feet and less to achieve the finish pad grades and provide adequate gradients for site drainage.

a. Demolition and Stripping. Existing structures to be removed should be completely demolished and removed off site. We recommend that structural areas be stripped of the surface vegetation, debris, old fills, topsoil containing a significant amount of organic matter (more than three percent by volume), underground utilities, etc. These materials should be moved off site; some of them, if suitable, could be stockpiled for later use in landscape areas. If underground utilities pass through the site, we recommend that these utilities be removed in their entirety or rerouted where they exist outside an imagery plane sloped two horizontal to one vertical (2H:1V) from the outside bottom edge of the nearest footing. Voids left by removal of utilities or other obstructions should be replaced with compacted engineered fill under the observation of the project geotechnical engineer.

b. Excavation and Compaction. Following demolition and site stripping excavation should be performed to achieve finish grades or prepare areas to receive fill. Where fill is required and/or weak soils exist, they should be subexcavated until firm soils are exposed. The depth of the subexcavation should be determined by the geotechnical engineer in the field during construction. The lateral extent of the subexcavation and recompaction should be a minimum of five feet beyond perimeter foundation edges, where possible.

The bottom of the subexcavation should then be scarified to a minimum depth of eight inches, moisture conditioned to a moisture content within two percent of optimum moisture content, and compacted to 90 percent of relative maximum dry density as determined by ASTM D-1557 test procedures. The subexcavated material, free of organics and rocks larger than four inches in diameter, may be reused as compacted engineered fill. Expansive soils, if encountered, should not be used as engineered fill. All fill material should be placed and compacted in accordance with the recommendations presented in Table 1. It is recommended that any import fill to be used on site should be of a low to non-expansive nature and should meet the following criteria:

Plasticity Index	less than 12
Liquid Limit	less than 35
Percent Soil Passing #200 Sieve	between 15% and 35%
Maximum Aggregate Size	4 inches

All fill should be placed in lifts no greater than eight inches in loose thickness and compacted to the general recommendations provided for engineered fill.

TABLE 1
SUMMARY OF COMPACTION RECOMMENDATIONS

Area	Compaction Recommendations*
General Engineered Fill (Import)	In lifts, a maximum of eight inches loose thickness, compact to a minimum of 90 percent relative compaction at or within two percent of the optimum moisture content.
General Engineered Fill (Low to non-expansive native soil)	In lifts, a maximum of eight inches loose thickness, compact to 90 percent relative compaction at or within two percent of optimum moisture content.
Trenches**	Compact to at least 90 percent relative compaction at or within two percent of optimum moisture content.

*All compaction requirements stated in this report refer to dry density and moisture content relationships obtained through the laboratory standard described by ASTM D-1557-12e1
**Depths below finished subgrade elevations

All site preparation and fill placement should be observed by a representative of PJC. It is important that during the stripping, subexcavation and grading/scarifying processes, a representative of our firm be present to observe whether any undesirable material is encountered in the construction area. All cut and fill slopes should be graded to an inclination no steeper than 2H:1V. Steeper slopes should be retained.

Generally, grading is most economically performed during the summer months when on-site soils are usually dry of optimum moisture content. Delays should be anticipated in site grading performed during the rainy season or early spring due to excessive moisture in the on-site soils. Special and relatively expensive construction procedures should be anticipated if grading must be completed during the winter and early spring.

7. FOUNDATIONS: SPREAD FOOTINGS

a. Vertical Loads. The proposed retaining walls may be supported by spread footings extending a minimum of 12 inches into firm soils or compacted engineered fill, as determined by the geotechnical engineer in the field during construction. All footings should be reinforced. Footing should be stepped as necessary to produce level tops and (and up to 10 percent slope) bottoms and should be deepened as needed to provide at least seven horizontal feet of confinement from the face of any adjacent slope. The recommended soil bearing pressures, depth of embedment and minimum widths of footings are presented in Table 2. The bearing values provided have been calculated assuming that all footings uniformly bear on firm native soils, or compacted engineered fill, as determined by the geotechnical engineer on site during construction.

TABLE 2
FOUNDATION DESIGN CRITERIA

Footing Type	Allowable Bearing Pressure (psf)*	Minimum Embedment (in)**	Minimum Width (in)
Continuous wall	2,000	12	12
Isolated Column	2,500	12	18

* Dead plus live load.
**into firm soils or compacted fill.

The allowable bearing pressures are net values. The weight of the foundation and backfill over the foundation may be neglected when computing dead loads. Allowable bearing pressures may be increased by one-third for transient applications such as wind and seismic loads.

b. Lateral Loads. Resistance to lateral forces may be computed by using friction and passive pressure. A friction factor of 0.30 is considered appropriate between the bottom of the concrete structures and the firm native soils or engineered fill. A passive pressure of 300 pounds per square foot per foot of depth (psf/ft) is recommended. Unless restrained at the surface, the top six inches should be neglected for passive resistance.

Footing concrete should be placed neat against firm soils or engineered fill. Footing excavations should not be allowed to dry before placing concrete. If shrinkage cracks appear in the footing excavations, the soil should be thoroughly moistened prior to concrete placement.

c. Settlement. Total and differential settlements are anticipated to be less than one-inch and one-half inch, respectively.

We should be retained to review the spread footing excavations, to review the actual soil conditions exposed, and provide modifications in the field, if necessary.

8. SLABS-ON-GRADE

Slab-on-grade for the electrical pad should be supported on a relatively uniform layer of compacted engineered fill. Slab subgrade should be firm and unyielding, and not allowed to dry. All slabs should be supported on at least four inches of clean gravel or crushed rock to provide a capillary moisture break and provide uniform support for the slab. The rock should be graded so that 100 percent passes the one-inch sieve and no more than five percent passes the No. 4 sieve.

We recommend that the gravel be placed as soon as possible after compaction of the fill to prevent drying of the subgrade soils. If the subgrade is allowed to dry out prior to slab-on-grade construction, the subgrade soil should be moisture conditioned by sprinkling prior to slab construction.

We recommend that the slabs be at least six inches thick and designed and reinforced to control cracking, and support the structural loads, as determined by the project structural engineer. Special care should be taken to insure that reinforcement is placed at the slab mid-height.

For slabs-on-grade with moisture sensitive surfacing, we recommend that a vapor retarder be placed over the rock to prevent migration of moisture vapor through the concrete slab. To induce and control cracking, we recommend that expansion and control joints be provided.

Special precautions must be taken during the placement and curing of concrete slabs-on-grade. Excessive slump (high water-cement ratio) of the concrete and/or improper curing procedures and ad mixtures used during either hot or cold weather conditions will lead to excessive shrinkage, cracking or curling of the slabs. High water-cement ratios and/or improper curing also greatly increases water vapor transmission through concrete floors that damage interior flooring. Concrete placement and curing operations should be performed in accordance with the American Concrete Institute Manual (ACI).

9. RETAINING WALLS

a. Static Lateral Earth Pressures. Retaining walls free to rotate on the top should be designed to resist active lateral earth pressures. If walls are restrained by rigid elements to prevent rotation or supporting compacted engineered fill, they should be designed for "at rest" lateral earth pressures.

Retaining walls should be designed to resist the following earth pressures (triangular distribution):

Active Pressure (level backfill) (5H:1V or less)....................35 psf/ft
At Rest Pressure (level backfill) (5H:1V or less)..................50 psf/ft

b. Lateral Earth Pressures from Surcharge Loads. Retaining walls should be designed to resist additional induced lateral pressures due to equipment surcharge loads when they encroach within a distance equal to the height of the wall.

Retaining walls should be designed to resist pressures generated from equipment surcharge loads (rectangular distribution). We recommend that the following equation be used for estimating surcharge loads against retaining walls.

$q = \frac{1}{2} p$
q = Surcharge Load (rectangular distribution psf)
p = Uniform load (psf)

c. Pseudostatic Force. The horizontal pseudostatic force acting upon the retaining wall greater than six feet in height, during a seismic event should be calculated from the following equation:

$$P_E = 11.4 H^2$$

H = retained height (ft)

The location of the pseudostatic force is assumed to act at a distance of 0.33H above the base of the wall.

d. Drainage. We recommend that a backdrain be provided behind all retaining walls or that the walls be designed for full hydrostatic pressures. The backdrains should consist of four-inch diameter SDR 35 perforated pipe sloped to drain to outlets by gravity, and of clean, free-draining, Class II permeable material. The Class II permeable material should extend 12 inches horizontally from the back face of the wall and extend from the bottom of the wall to one foot below the finished ground surface. A Tencate Mirafi Drainage composite may be used if approved by the geotechnical engineer. Under no circumstances should surface water be diverted into retaining wall backdrains. Where migration of moisture through walls would be detrimental, the walls should be waterproofed.

10. DRAINAGE

Drainage control design should include provisions for positive surface gradients so that surface runoff is not permitted to pond on the slab or adjacent to retaining wall foundation. Surface runoff should be directed away from foundations. If the drainage facilities discharge onto the natural ground, adequate means should be provided to control erosion and to create sheet flow. Care must be taken so that discharges from the roof gutter and downspout systems are not allowed to infiltrate the subsurface near any foundations.

11. ADDITIONAL SERVICES

Upon completion of the project plans and structural calculations, they should be reviewed by our firm to determine that the design is consistent with the recommendations of this report. During the course of this investigation, several assumptions were made regarding development concepts. Should our assumptions differ significantly from the final intent of the project designers, our office should be notified of the changes to assess any potential need for revised recommendations. Observation and testing services should also be provided by PJC to verify that the intent of the plans and specifications are carried out during construction; these services should include observing grading and earthwork and observing foundation excavation.

These services will be performed only if PJC is provided with sufficient notice to perform the work. PJC does not accept responsibility for items we are not notified to observe.

We trust that this is the information you require at this time. If you have any questions concerning the content of this report, please feel free to call.

Sincerely,

PJC & ASSOCIATES, INC.

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