Victorville Wellness Center
Victorville, California

Geotechnical Investigation Report

Prepared For: City of Victorville
Prepared By: Merrell Johnson

MerrellJohnson

December 9, 2020

Scott Webb, City Planner
City of Victorville, Development Department
14343 Civic Drive, P. O. Box 5001
Victorville, California 92393-5001

**Re: Geotechnical Investigation Report 0| Victorville Wellness Center |
Victorville, California | M.J. Project No. 2102.041.500**

Mr. Webb,

In accordance with your authorization, we have performed a geotechnical investigation for the above-referenced project and prepared this site-specific report. The report presents our findings based on the results of our field and laboratory programs, data review and engineering analyses.

The investigation was planned and performed using the information provided by the City of Victorville in the development of this project. Our report includes recommendations for the development of this site, and presents an evaluation of existing conditions for the design of proposed foundations.

We trust that the enclosed report provides the information you need at this time. If you have questions, please do not hesitate to contact Merrell Johnson Companies.

Sincerely,

Merrell Engineering Company, Inc.

James J. Stone, Geotechnical Engineer
RGE 808 Exp. 12/31/2021

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Attachments

Introduction

This report presents the results of the geotechnical investigation performed by Merrell Johnson (MJ) for the proposed Victorville Wellness Center in Victorville, California. This report presents our findings based on the results of our field and laboratory programs, data review and engineering analyses. The investigation was planned and performed using the information provided by the City of Victorville, the rough grading plans prepared by the City (undated) , and the “Proposed Victorville Wellness and Recuperative Care Center” updated site plan (undated).

Preliminary geotechnical information for development was previously submitted in a letter report dated November 10, 2020. An Infiltration Test Report was submitted on November 9th, 2020.

The location of the project is shown on the Location Plan in Appendix A.

Proposed Development

The 3.956-acre site will be developed using LifeArk modules to construct 7 Navigation and 3 Recuperative Clusters. Additional facilities will include 2 clinics, 2 toilet/shower buildings, 1 dining building and 1 storage building. Associated site improvements will also be constructed.

Scope of Investigation

The scope of the geotechnical investigation consisted of field exploration, laboratory testing, engineering analysis and preparation of this report presenting conclusions and recommendations regarding:

1. Site and subsurface conditions
2. Earthwork
3. Foundation support for the new buildings
4. Lateral loads on retaining structures along with resistance to lateral loads
5. Temporary excavation support
6. Soil corrosivity with respect to concrete and ferrous metals
7. Seismic design parameters and liquefaction potential, along with measures for mitigating potential settlements due to liquefaction
8. Flexible pavement structural sections.

Field Exploration and Laboratory Testing

Field Exploration

The field exploration program consisted of drilling 10 exploratory borings to depths of 25 to 50 feet at the locations shown on the Boring Location Plan in Appendix A. The borings were logged a MJ representative who also collected samples of the materials encountered for examination and laboratory testing. Soils are described according to the Unified Soil Classification System explained in Appendix B. The logs of the borings are also in Appendix B.

Relatively undisturbed samples were obtained by driving a 2.5-inch inside diameter Modified California sampler with a 140-pound hammer falling 30 inches in general accordance with American Society for Testing and Materials (ASTM) Test Designation D3550. The number of blows required to advance the sampler each 6-inch increment of an 18-inch total drive was recorded and noted on the boring logs as “N Value.” Disturbed samples were obtained from drill cuttings and during Standard Penetration Testing (SPT). The SPTs were performed in accordance with ASTM D1586. Blow counts recorded during SPT are noted on the boring logs in the column headed “N” Value.

Laboratory Testing

The laboratory program consisted of in-place moisture content and dry density determinations, a maximum density/optimum moisture content test, sieve analyses, an R-(Resistance-) value test, and a corrosivity assessment. The tests were performed in accordance with ASTM and California Test procedures. The results of the laboratory tests are summarized in Appendix C.

Site and Subsurface Conditions

Site Conditions

The site consists of vacant land. The surface is nearly level and covered with scattered brush and trees. Several dirt roads traverse the property.

Subsurface Conditions

The site is underlain by relatively clean and silty or clayey, well-graded to poorly-graded sands to the maximum depth explored, 50 feet. The sands are generally medium dense in the upper 5 to 10 feet and loose between depths of about 10 and 20 to 25 feet. The sands are typically medium dense to dense below depths of 25 to 40 feet, and generally increase in density with depth.

Groundwater was encountered at depths of 7 to 11 feet in the test borings. Groundwater levels could rise depending on rainfall runoff and the depth of water in the Mojave River.

Site Class, Site Coefficient and Seismic Design Category

Based on the available information gathered for the proposed project, the soils underlying the site can be classified as Default Site Class according to the 2019 California Building Code (CBC). The Design Acceleration Parameters were determined according ASCE 7-16 following ATC procedures and are provided in the table below.

2019 California Building Code – Seismic Parameters

S_S	1.092	MCE_R ground motion (period=0.2s)
S_1	0.422	MCE_R ground motion (period=1.0s)
S_{MS}	1.31	Site-modified spectral acceleration value
S_{M1}	null	Site-modified spectral acceleration value
S_{DS}	0.873	Numeric seismic design value at 0.2s SA
S_{D1}	null	Numeric seismic design value at 1.0s SA
F_a	1.2	Site amplification factor at 0.2s
PGA	0.469	MCE_G peak ground acceleration
PGA_M	0.562	Site modified peak ground acceleration

Conclusions

Groundwater was encountered at depths of 7 to 11 feet and the subsurface soils between typical depths of 10 and 20 to 25 feet consist of loose, relatively clean sands. Analyses indicate that at some locations the soils between these depths could liquefy during or immediately following a major earthquake. Consequently, there is a potential for ground surface settlements of 4 to 6 inches in the event of a major earthquake. The test borings indicate that liquefaction is somewhat more likely near the perimeter of the site and less likely in the central area, due to both fines content and soil density. Significant differential settlement over close horizontal distances are unlikely.

To minimize the potential effects of liquefaction on the development, a mat of compacted fill can be constructed beneath the structures and pavements, and the new facilities supported on conventional spread footings. This mat would assist in spanning areas of non-uniform support should differential settlement occur due to liquefaction. Alternatively, the structures can be supported on deep foundations that develop support in the relatively dense soils below a depth of about 40 feet below the ground surface, which would minimize deformations and potential damage from liquefaction settlement.

Recommendations

Clearing & Grubbing

Debris, vegetation, irrigation lines and deleterious material should be removed prior to grading. Unsuitable materials should be disposed of off-site in accordance with City instructions. Roots should be removed to a depth of 2 feet below the building pad elevation.

Excavation

Areas to support footings and slabs-on-grade should be over-excavated to a depth of 3 feet below the bottom of the deepest footing or slab. Over-excavation in paved areas should extend at least 2 feet below the bottom of the pavement structural section. Excavation should extend horizontally 5 feet beyond perimeter foundation, slab and pavement lines. Rocks exceeding 6 inches in maximum dimension encountered during excavation should be removed and not used in fill.

Scarification

The surface exposed by excavation should be scarified to a depth of 8 inches, moisture conditioned to within 2 to 4 percentage points of optimum moisture content and compacted to a minimum 95% relative compaction based on the ASTM D1557 laboratory test method. All references to optimum moisture content and maximum density in this report are based on this test method.

Compacted Fill Material

Fill material should consist of clean soils containing no rocks or other particles with a maximum dimension larger than 6 inches. A MJ representative should approve proposed imported fill prior to placement. The on-site soils, except for the oversized particles, debris and organic matter, can be used as fill.

Compacted Fill Placement

Fill materials should be placed in lifts 8 inches or less in loose thickness. Each lift should be moisture conditioned to between 2 and 4 percentage points above optimum moisture content and compacted to at least 95% relative compaction.

Imported Soils

Imported soils should consist of predominantly granular material with an expansion index less than 20 when tested in accordance with ASTM D4829 and should have a minimum R-value of 65. Imported material should be inspected and approved by our Engineer or representative prior to placement. Imported material utilized for trench backfill operations should consist of granular material with a minimum Sand Equivalent of 35.

Foundation Design

Shallow Foundations

If settlement resulting from liquefaction during an earthquake is considered acceptable, the proposed facilities can be supported on shallow spread footing foundations in compacted fill. Foundations should have bottom levels at a minimum depth of 18 inches below the lowest adjacent finished grade. A minimum width of 18 inches is recommended for continuous footings. Isolated footings should be at least 24 inches wide. Foundation excavations should be observed by MJ personnel to check bearing materials and cleaning.

Foundations can be designed for an allowable vertical bearing capacity of 2500 pounds per square foot (psf) for dead plus long term live loads. This value can be increased by ⅓ when considering the total of all loads, including wind or seismic forces. Total settlements under static conditions are expected to be less than 1 inch and differential static settlements less than ½ inch between adjacent isolated footings or between the middle and end of a continuous footing.

Resistance to lateral loads will be provided by passive earth pressure against the faces of foundations and other structural elements below grade, and by friction along the bases of shallow spread footings and slabs. A lateral bearing pressure of 350 psf per foot of depth can be used. Base friction can be taken as 0.35 times the actual dead load. Base friction and passive earth pressure can be combined without reduction.

Caisson (Drilled Pier) Foundations

The soils underlying the site between depths of 10 and 25 to 40 feet are potentially liquefiable and will not provide adequate support for shallow foundations placed above them in the event of an earthquake. If building damage resulting from earthquake-induced settlement is to be minimized, drilled piers or driven piles extending at least 5 feet below the bottom of the liquefiable soil zone could be used for foundation support. For the typical subsurface conditions underlying the site, a 24-inch diameter pier or pile supporting approximately 50 kips should extend at least 45 feet below the existing ground surface. Uplift resistance, if required, can be taken as 40 kips for 45-foot long, 24-inch diameter piers or piles. The lateral load required to induce ¼ inch of movement in a 24-inch diameter, 45-foot long pier or pile can be taken as 14 kips for the free-head condition and 30 kips for the fixed-head condition. MJ should be contacted to develop detailed recommendations for the size and type of deep foundation being considered as the design is developed.

Total and differential settlements of structures supported on piers or piles extending at least 45 feet below the existing ground surface are expected to be less than ½ inch under both static and seismic conditions.

Active and At-Rest Lateral Pressures

Retaining structures free to rotate up to 0.001 radian at the top can be designed for an active equivalent fluid pressure of 35 pounds per cubic foot (pcf), plus additional building or equipment surcharges. Walls restrained against movement at the top should be designed for an at-rest pressure of 45 pcf plus surcharge.

The dynamic load increment imposed on a cantilever wall due to an earthquake can be computed using a factor of 20 pcf added to the static load for level ground conditions. For restrained walls, a factor of 24 pcf can be used. Because the soils are cohesionless, a triangular distribution can be used to evaluate the location of the resultant of dynamic forces.

Retaining walls should be provided with backdrains or weepholes at no more than 6-foot intervals along the wall. Positive surface drainage should be provided in front of the wall to conduct rainfall runoff away from the wall and minimize the potential for ponding.

Slabs on Grade

Slab-on-grade floors should be structurally supported if deep foundations are used. If settlement due to liquefaction in the event of an earthquake is considered acceptable, floor slabs can be supported on-grade. The final pad surface should be proof-rolled to provide a smooth dense surface upon which to place the concrete. A moisture vapor retarder/barrier should be placed beneath slabs where floor coverings will be installed. Typically, plastic is used as a vapor retarder/barrier. If plastic is used, a minimum 10 mils is recommended. The plastic should comply with ASTM E 1745. Plastic installation should comply with ASTM E 1643.

Current construction practice typically includes placement of a 2-inch-thick sand cushion between the bottom of the concrete slab and the moisture vapor retarder/barrier. This cushion can provide some protection to the vapor retarder/barrier during construction, and may assist in reducing the potential for edge curling in the slab during curing. However, the sand layer also provides a source of moisture vapor to the underside of the slab that can increase the time required to reduce moisture vapor emissions to limits acceptable for the type of floor covering placed on top of the slab. The floor covering manufacturer should be contacted to determine the volume of moisture vapor allowable and any treatment needed to reduce moisture vapor emissions to acceptable limits for the particular type of floor covering to be installed.

Drainage

It is important that surface water be kept a minimum of five feet from structures and slabs. No ponding adjacent to buildings/structures should be allowed. Final surfaces should have a two percent minimum slope away from structures.

Shoring

Temporary shoring will be required for those excavations where temporary slopes as described below are not feasible. The static lateral earth pressures listed above for permanent walls can be used for cantilever shoring and walls with one level of bracing. It is recommended that temporary shoring with multiple levels of bracing be designed considering a uniform lateral earth pressure distribution for the full height of the shoring equal to 25H psf, where H is the height of shoring in feet.

The recommended soil pressure applies to level soil conditions behind shoring. Where a combination of sloped embankment and braced shoring is used, the soil pressure will be greater and should be evaluated for actual conditions.

In addition to the above recommended lateral earth pressures, a minimum uniform lateral pressure of 125 psf should be incorporated in the design of the upper 10 feet of shoring when traffic is permitted within 10 feet of the wall.

Temporary Slopes

On-site soils can be classified as Type C in accordance with OSHA and Cal-OSHA guidelines. Temporary excavations should be sloped no steeper than 1-½ horizontal to 1 vertical for excavations up to 20 feet in depth. Compound excavations with vertical sides in lower portions should be properly shielded to a minimum height of 18 inches above the top of the vertical side, with the upper portion having a maximum allowable slope of 1-½ horizontal to 1 vertical.

A Registered Professional Engineer should design slopes for excavations greater than 20 feet in depth. Should running sand conditions be experienced during excavation operations, flattening of cut slope faces, or other special procedures, may be required to achieve stable temporary slopes.

During construction, excavation conditions should be evaluated twice a day by the contractor's competent person before personnel are allowed to enter the excavation.

Corrosivity

Laboratory test results indicate that site soils have a low potential for corrosion with respect to reinforced concrete and ferrous metals. Nevertheless, Type II modified or Type V cement is recommended for use in concrete in contact with the ground. Foundations should be designed with continuous reinforcing steel top and bottom. Reinforcing steel should maintain minimum clearances specified by applicable codes and good construction practice.

Flexible Pavements

One laboratory R-value test was performed on a bulk sample of near surface soil reasonably representative of the materials anticipated at subgrade in the proposed parking area. A value of 65 was measured, indicating good pavement support characteristics.

On this basis, flexible pavement structural section thicknesses were calculated for assumed values of Traffic Index (TI) following Caltrans procedures. Calculated pavement sections are listed in the following table:

FLEXIBLE PAVEMENT STRUCTURAL SECTIONS

Traffic	TI	AC[1] (inches)	AB[2] (inches)
Automobiles and Light Trucks - Parking	5	2-½	4
Automobiles and Light Trucks – Access Roads and Driveways	7	3	4

[1] Asphalt Concrete Surface Course – PG70-10 Asphalt Binder

[2] Class 2 Aggregate Base or Crushed Miscellaneous Base

Limitations

The recommendations in this report are based on the results of field and laboratory studies, combined with interpolation and extrapolation of subsurface conditions between and beyond boring locations. The nature and extent of variations may not become evident until construction. If variations are exposed during construction, MJ should be notified so these variations can be reviewed and the recommendations in this report modified or verified as appropriate.

This report has been prepared to aid in the evaluation of this site and to provide geotechnical recommendations for the design of this project. Any person using this report for bidding or construction purposes should be aware of the limitations of this report and should conduct independent investigations as necessary to satisfy themselves as to the surface and subsurface conditions to be encountered, and the procedures to be used in the performance of work.

Our professional services have been performed using the degree of care and skill ordinarily exercised, under similar circumstances by reputable engineering consultants practicing in similar localities. No other warranty, express or implied, is made as to the professional advice and data included. This report has not been prepared for use by parties other than the addressee, and may not contain sufficient information for purposes of other parties or other users.