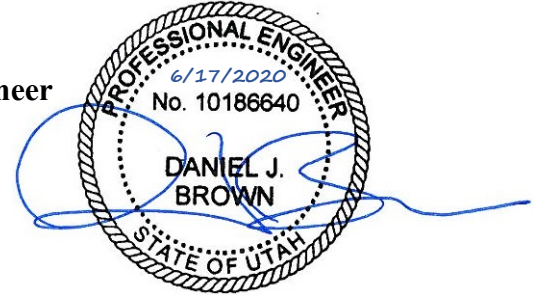


**To: Mr. Michael Johnson
Director of Community and Economic Development
City of Cottonwood Heights**

**Mr. Adam Ginsberg
Staff Engineer
Public Works, City of Cottonwood Heights**

From: Daniel J. Brown, P.E., Senior Geotechnical Engineer



Date: June 17, 2020

**Subject: Review of Geotechnical Study and Slope Stability Analysis
Proposed Wasatch Rock Development
6695 South Wasatch Boulevard
Cottonwood Heights, Utah (May 13, 2020)**

Introduction

At the request of Mr. Michael Johnson and Mr. Adam Ginsberg, GeoStrata reviewed the subject report for the Wasatch Rock Development completed by Gordon Geotechnical Engineering, Inc. (Gordon) and dated May 13, 2020. The referenced report was submitted to Cottonwood Heights City for a proposed mixed-use development currently planned to include a hotel, a large apartment building, a condominium tower, a senior living center, three mixed-use pads, various ancillary parking areas, three retail pads and re-alignment of Wasatch Boulevard along the western boundary of the subject site. Our review of the Gordon Geotechnical May 13, 2020 report was conducted on behalf of Cottonwood Heights City to assist the city in protecting public health, safety, and welfare, and to reduce risks to future property owners. The purposes of our review are to assess whether or not the report adequately addresses the geotechnical and slope stability concerns associated with the project consistent with reasonable standards of practice and in accordance with Cottonwood Heights City's Sensitive Lands Evaluation & Development Standards (SLEDS) (Title 19 Chapter 19.72 of the Cottonwood Heights City Municipal code). The objectives to be achieved by the designation of a sensitive lands district include, without limitation, the following:

- A. The protection of the public from natural hazards, such as landslide, rockfall, debris flow, earthquake ground rupture, liquefaction, shallow ground water, snow melt/storm water runoff and erosion.

Review Discussion

Section 1.3, Objectives and Scope, of the May 13, 2020 Gordon geotechnical report states:

“The objectives and scope of our study were planned in discussions between Mr. Josh Cowley of Rockworth Companies and Mr. Patrick Emery of G2.

In general, the objectives of this study were to:

- 1. Accurately define and evaluate the general subsurface soil and groundwater conditions across the site.*
- 2. Provide foundation, earthwork, floor slab, pavement, drainage, slope stability, and geoseismic recommendations and parameters to be utilized in the design and construction of the proposed facilities.”*

Section 1.5, Professional Statements, of the May 13, 2020 Gordon geotechnical report states:

“Supporting data upon which our recommendations are based are presented in subsequent sections of this report. Recommendations presented herein are governed by the physical properties of the soils encountered in the exploration borings, test pits, and trenches, measured and projected groundwater conditions, and the layout and design data discussed in Section 2., Proposed Construction, of this report. If subsurface conditions other than those described in this report are encountered and/or if design and layout changes are implemented, G2 must be informed so that our recommendations can be reviewed and amended, if necessary.

Our professional services have been performed, our findings developed, and our recommendations prepared in accordance with generally accepted engineering principles and practices in this area at this time.”

Based on the stated objectives of the May 13, 2020 Gordon geotechnical report, the Cottonwood Heights City ordinance, and the standard of care for geotechnical engineering and slope stability analysis for the type of proposed development, the following are our review comments.

Review Comment 1

Section 2, Proposed Construction, of the May 13, 2020 Gordon geotechnical report states:

“Development plans for the site have changed since the previous geotechnical reports for the site. Development at the site is complicated by the existence of several fault lines and a buried aqueduct which render significant portions of the site as “un-buildable” for habitable structures. These fault lines and buried aqueduct have been considered from the onset when designing the latest development plans. The proposed structures have been strategically located in the “buildable” areas defined in the surface fault rupture hazard report.

Currently, a hotel, an apartment, condominium, senior living center, three mixed-use pads, and three retail pads are planned for the site. Additionally, Wasatch Boulevard along the western boundary of the site will be re-aligned to bi-sect the site in a generally north-south direction.”

GeoStrata understands that a geologic hazards study has been completed for the site concurrently with this geotechnical study, which includes a surface fault rupture hazard assessment. GeoStrata recommends that Cottonwood Heights City request that the GeoStrata review comments regarding the surface fault rupture hazard be addressed prior to approving final buildable areas for the proposed development.

Review Comment 2

Section 2, Proposed Construction, of the May 13, 2020 Gordon geotechnical report states:

“Maximum column and wall loads for the condominium structure are anticipated to be very large, on the order of 1,000 to 1,500 kips and 15 to 30 kips per lineal foot, respectively. Detailed structural loads will be needed to finalize geotechnical recommendations for this structure.”

Following approval of buildable areas and final subdivision of lots for the subject property, GeoStrata recommends that Cottonwood Heights City request that a design level geotechnical assessment be performed for each of the proposed buildings, which incorporates detailed structural loads. This is especially critical for the proposed condominium structure

Review Comment 3

Section 2, Proposed Construction, of the May 13, 2020 Gordon geotechnical report states:

“Final site grading will require cuts up to 30 feet in the northern portions of the site and fills on the order of 5 to 10 feet in the southwest portion of the site. Fills up to 35 feet in height are planned for the eastern portion of the site and will buttress the existing gravel pit cut slope. Final site grading slopes are generally not anticipated to not exceed 50 percent or 2.0:1.0 (H:V) with localized areas of up to 56 percent or 1.8:1.0 (H:V).”

GeoStrata recommends that Cottonwood Heights City request that the project geotechnical engineer review final site grading plans to assess whether the final grading plan conforms to the slope stability analysis and recommendations presented in the May 13, 2020 Gordon geotechnical report or whether additional slope stability analysis is needed for the subject development.

Review Comment 4

Section 5.1, Summary of Findings, of the May 13, 2020 Gordon geotechnical report states:

“The condominium structure at Section A-A’ incorporates a deep cut for below-grade parking. A structural element must extend a minimum of 15 feet below the bottom of footings to assure an adequate factor of safety. This may consist of deep foundations, soil improvement, or a permanent shoring solution such as soil nails.”

GeoStrata recommends that Cottonwood Heights City request that internal, external, and global stability of the permanent shoring and/or retaining wall to be constructed on the uphill side of the proposed condominium structure be evaluated prior to approval for construction. This evaluation will likely be completed during final design of this structure.

Review Comment 5

Section 5.2.2, Geometry, of the May 13, 2020 Gordon geotechnical report states:

“The geometry for the slope stability models was developed from the geologic cross-sections provided with the concurrent Geologic Hazards Evaluation report. Topography was obtained from 2013 lidar data with 0.5-meter resolution. Three cross-sections (A-A’, B-B’, and C-C’) for slope stability analysis were selected based on the locations of the proposed developments and the most adverse topographic and geologic conditions.”

Based on our review of the slope stability results presented in Appendix D and review of the Western Geologic prepared geologic cross sections, the slope stability cross sections closely match the Western Geologic cross sections. If any changes to the geologic cross sections are made based on comments from our review of the Western Geologic geologic hazards study, any updated information, or otherwise, GeoStrata recommends that Cottonwood Heights City request that slope stability cross sections likewise be updated.

Review Comment 6

Section 5.2.3, Soil Strength, of the May 13, 2020 Gordon geotechnical report states:

“The soil parameters were selected for analysis based upon direct shear test results performed on undisturbed and laboratory recompacted samples. Strength parameters for the more coarse-grained granular soils were selected based upon our experience with similar soils in the area. These coarse-grained sand and gravel soils are projected to exhibit relatively high strengths based on their performance history in gravel pit cut slopes which have been known to stand near vertical for extended periods of time. The cohesive characteristic of these granular soils may be explained by a slight cementation and interlocking of particles. Parameters of concrete washout are estimated as a hybrid between high strength soil and low-grade concrete.”

Slope cross section B-B’ includes a large area of ‘Inferred Extents of Concrete Washout’. As the extents of this material are unknown, GeoStrata recommends that Cottonwood Heights City request that reduced strength parameters be applied to this soil unit. In our opinion, the reduced strength parameters for the ‘Concrete Washout’ material should be similar to the ‘Site Grading Fill’ soil strength parameters in order to account for the unknown extents of the materials.

Review Comment 7

Section 5.2.4, Analysis Results, of the May 13, 2020 Gordon geotechnical report lists recommendations for site grading

GeoStrata recommends that Cottonwood Heights City request that the applicant include these recommendations and detail drawings for benching of fill slopes into the existing slope with the final grading plan.

Review Comment 8

Cottonwood Height Code of Ordinances, Title 19, Chapter 19.72, Appendix C, Section 3.0, Submittals, Subsection (c) states:

“The results of any slope stability analyses must be submitted with pertinent backup documentation (i.e., calculations, computer output, etc.). Printouts of input data, output data (if requested), and graphical plots must be submitted for each computer-aided slope stability analysis.”

GeoStrata recommends that Cottonwood Heights City request that printouts of input/output data for the near-surface and global slope stability analysis calculations be provided as required by the Cottonwood Heights Code of Ordinances.

Review Comment 9

Section 5.3.1, Site Preparation, of the May 13, 2020 Gordon geotechnical report states:

“Preparation of the site must consist of the removal of all non-engineered fills, loose surficial soils, topsoil, debris, and other deleterious materials from beneath an area extending at least five feet beyond the perimeter of the proposed building, rigid pavement, and exterior flatwork areas.

The non-engineered fills may remain in flexible pavement areas as long as they are properly prepared. Proper preparation will consist of scarifying and moisture conditioning the upper eight inches and recompacting to the requirements of structural fill. However, it should be noted that compaction of fine-grained soils (if encountered) as structural site grading fill will be very difficult, if not impossible, during wet and cold periods of the year. As an option for proper preparation and recompaction, the upper eight inches of the non-engineered fills may be removed and replaced with granular subbase over proofrolled subgrade. Even with proper preparation, flexible pavements established on non-engineered fills may experience some longterm movements. If the possibility of these movements is not acceptable, these non-engineered fills must be completely removed.”

GeoStrata recommends that Cottonwood Heights City request that the recommendation to not fully remove non-engineered fills from beneath flexible pavements be modified to only include private parking and driveway areas. All city roads will require all undocumented or non-engineered fills be fully removed beneath pavements.

Review Comment 10

Section 5.4.2, Reinforced Continuous Mat, of the May 13, 2020 Gordon geotechnical report states:

“We request that a bearing pressure distribution plan be provided to our office for review, when available.”

As part of final design of the proposed structures and as recommended in Review Comment 2, GeoStrata recommends that Cottonwood Heights City request that a design level geotechnical assessment be performed for each of the proposed buildings, which incorporates detailed structural loads. As part of preparation of these reports, a review of planned building foundations and foundation loads should be completed by the geotechnical engineer.

Review Comment 11

Cottonwood Height Code of Ordinances, Title 19, Chapter 19.72, Appendix D, Section 7.0, Submittals, Subsection (c) states:

“The results of any liquefaction analyses must be submitted with pertinent backup documentation (i.e., calculations, computer output, etc.). Printouts of input data, output data (on request), and graphical plots must be submitted for each computer aided liquefaction analysis. In addition, input data files, recorded on diskettes, CDs, or other electronic media, may be requested to facilitate the city's review.”

GeoStrata recommends that Cottonwood Heights City request that printouts of input/output data for liquefaction hazard analysis calculations be provided as required by the Cottonwood Heights Code of Ordinances.

Closure

This review letter is issued in response to the consultant’s assessment of the above referenced site. Comments and recommendations in this review letter are based on field data presented by the Consultant. GeoStrata has not performed an independent site assessment. GeoStrata has relied on the Consultant's reports in performing its services. Consequently, it does not represent or warrant that the Consultant's report contains accurate data or proper recommendations. Recommendations and Comments presented in this review letter are provided to Cottonwood Heights City to aid in reducing risks from geologic hazards. GeoStrata makes no warranty; either expressed or implied and shall not be liable for any direct, special, incidental, or consequential damages with respect to claims by users of this review.

All services performed by GeoStrata for this review were provided for the exclusive use and benefit of Cottonwood Heights City. No other person or entity is entitled to rely on GeoStrata’s services or use the information contained in this letter without the express written consent of GeoStrata.

If there are any questions concerning the contents of this review, please feel free to contact our office at (801) 501-0583.