October 27, 2022
Job No. 1111-030-22

Mr. Benjamin Wheat
Roderick Enterprises
1214 East Vine Street
Salt Lake City, Utah 84121

Mr. Wheat:

Re: Summary Report
Site-Specific Seismic Study
Proposed Catalyst Business Park Buildings 6, 7, 8, and 9
South of 5750 West and 1500 South
American Fork, Utah

1. INTRODUCTION

1.1 GENERAL

This report presents the results of our site-specific seismic study performed at the site of the proposed Catalyst Business Park Buildings 6, 7, 8, and 9 to be located south of 5750 West and 1500 South in American Fork, Utah. GSH Geotechnical, Inc (GSH) completed a geotechnical study[1] for the site. Data from the geotechnical study along with a geophysical survey was used for this site-specific seismic study.

The shear-wave velocity profile for the upper 350 feet at the site (including $\overline{v}_{s30}$ for the upper 100 feet) was determined utilizing boring data from our geotechnical study and a geophysical survey consisting of Refraction Microtremor (ReMi) testing.

The ground motion hazard and design ground motion response spectra at the site were developed utilizing a site-specific site response analysis (SRA). The analysis was completed in accordance with the procedures presented in ASCE 7-16, Minimum Design Loads and Associated Criteria for Buildings and Other Structures (ASCE 7-16) and Supplement 1 to ASCE 7-16.

[1] "Report, Geotechnical Study, Proposed Catalyst Business Park Buildings 6, 7, 8, and 9, South of 5750 West 1500 South, American Fork, Utah." GSH Job No. 1111-029-22. Dated August 31, 2022.

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1.2 OBJECTIVES AND SCOPE

The objectives and scope of the study were planned in discussions between Mr. Benjamin Wheat of Roderick Enterprises and Mr. Alan Spilker, PE, of GSH.

In general, the objectives of this study were to:

1. Further define the subsurface conditions at the site, including a shear-wave profile to a depth of 350 feet.

2. Develop site-specific and design ground motion response spectra for the site.

In accomplishing these objectives, our scope has included the following:

1. A review of available subsurface information from the geotechnical study completed for the site.

2. A field program consisting of the completion of a Refraction Microtremor (ReMi) geophysical exploration to a depth of 350 feet including the development of $\overline{v}_{s30}$ for the upper 100 feet.

3. Performance of a site-specific site response analysis (SRA) in accordance with the ASCE 7-16 Section 21.1, Site Response Analysis.

4. Development of site-specific and design ground motion response spectra for the site in accordance with the ASCE 7-16 Section 21.3, Design Response Spectrum.

1.3 AUTHORIZATION

Authorization was provided by returning a signed copy of the Professional Services Agreement No. 22-0810 dated August 2, 2022.

1.4 PROFESSIONAL STATEMENTS

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 geophysical testing, exploration borings, and projected groundwater conditions. If subsurface conditions other than those described in this report are encountered, GSH 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.

2. PROPOSED CONSTRUCTION

The project is to consist of the construction of four (4) office/warehouse structures with footprints ranging from approximately 90,627 to 145,669 square feet with associated pavements. The structures are anticipated to be 1- to 2-levels of tilt-up concrete construction, placed slab-on-grade, and supported upon conventional spread and continuous wall footings.

Paved parking areas, access roadways, and loading/unloading areas are planned around the structure(s). Projected traffic in the parking areas is anticipated to consist of a light volume of automobiles and light trucks, occasional medium-weight trucks, and no heavyweight trucks. Projected traffic in the roadways is anticipated to consist of a moderate volume of automobiles, light trucks, and light volume of medium-weight and heavyweight trucks. Projected traffic in the truck drive lanes is anticipated to consist of a moderate volume of automobiles, light trucks, and medium-weight to heavyweight trucks.

It is estimated that the structure’s fundamental period will be approximately 0.4 seconds.

3. SITE CONDITIONS

3.1 SURFACE

The site is located south of 5750 West and 1500 South in American Fork, Utah. The northwest portion of the site is currently developed with existing commercial structures that have recently been demolished. GSH observed floor slabs, walls, and concrete debris associated with the demolition of the previously existing structures in the northwest portion of the site. The remainder of the site is vacant/undeveloped land previously used for agricultural purposes. The topography of the site is relatively flat, grading down to the south with a total relief of approximately 9 to 11 feet. Site vegetation consists of various weeds and brush/grass land in the northwestern portion with agricultural grass fields in the remainder of the site as well as a patch of mature trees in the northern portion.

The site is bounded to the north by 1500 South Street followed by commercial structures along with similar vacant/undeveloped brush land; to the east by single-family residential and commercial structures along with the active construction site for other Catalyst Business Park Structures; to the south by 1700 South Street followed by vacant/undeveloped brush/grass land; and to the west by commercial structures and vacant/undeveloped brush/grass land.

3.2 SUBSURFACE SOIL AND GROUNDWATER

The following paragraphs provide generalized descriptions of the subsurface profiles and soil conditions encountered within the borings conducted during the geotechnical study. As previously noted, soil conditions may vary in unexplored locations.

The borings were completed to depths ranging from 5.0 to 46.5 feet. The soil conditions encountered in each of the borings, to the depths completed, were generally similar across the boring locations.

- Non-engineered fill soils were encountered in each boring, to depths ranging from 1 to 6 feet beneath the existing ground surface. Borings B-26 through B-28 encountered non-engineered fills to depths ranging from 6 to 11 feet below the ground surface within the area of the previously existing structures. The non-engineered fill soils primarily consisted of clay with varying silt, sand, and gravel content as well as sand and gravel with varying clay and silt content.

- Natural soils were encountered below the non-engineered fill or the ground surface in each boring except Boring B-14. The natural soils consisted primarily of clay with varying silt, sand, and gravel content. Borings B-3 and B-4 encountered intermittent layers of sand with varying clay, silt, and gravel content at depths beginning at approximately 22 feet below the ground surface.

The natural clay soils were very soft to stiff, slightly moist to saturated, varied in color (white, gray, dark gray, black, red, tan, light brown, brown, and dark brown), and low to moderately over-consolidated. The natural clay soils are anticipated to exhibit low to moderate strength and moderate to high compressibility characteristics under the anticipated loading.

The natural sand soils were loose to medium dense, moist to saturated, and gray, dark gray, and brown in color. The natural sand soils are anticipated to exhibit moderately high strength and moderately low compressibility characteristics under the anticipated load range.

Groundwater was measured as shallow as 1.8 feet below the existing ground surface during the geotechnical study for the site.

For a more descriptive interpretation of subsurface conditions, please refer our geotechnical report completed for the site (GSH Job No. 1111-029-22).

3.3 SHEAR WAVE VELOCITY PROFILE

The site shear-wave velocity profile was completed utilizing geophysical exploration. The testing consisted of Refraction Microtremor (ReMi) testing. Testing is performed at the surface using a series of geophone sensors and a seismic source. A wavefield transformation is performed on the recorded geophone movements. The transformation is then utilized to create a shear-wave dispersion curve to model the subsurface shear-wave velocity profile.

The location of the ReMi line on the site is presented on Figure 1, Site Plan. The borings completed in conjunction with the geotechnical study are also shown on Figure 1.

The site classification for ASCE 7-16 was Site Class F in the geotechnical report due to potentially liquefiable soils at the site. As a follow up to the geotechnical report the ReMi testing results were analyzed to a depth of 350 feet with a resulting $\overline{v}_{s30}$ value of 658 ft/s. This characterizes the site as a Site Class D, Stiff Soil Profile as defined in Chapter 20 of ASCE 7-16.

The shear-wave velocity results are provided on attached Figure 2, Shear-Wave Velocity Profile.

3.4 GEOLOGIC SETTING

The site is located in the Utah Valley, which is in the Basin and Range Physiographic Province. The Utah Valley is near (west of) the transition between the Basin and Range Physiographic Province to the west and the Middle Rocky Mountain Physiographic Province to the east. The Basin and Range Province is characterized by generally north-trending valleys and mountain ranges that have formed by displacement along normal faults. The Wasatch Fault forms the boundary between the 2 provinces and has been active for approximately 10 million years. The Middle Rocky Mountains were formed during a period of regional compression that occurred in Cretaceous time, about 75 to 70 million years ago (Hunt, 1967). The surficial geology of the area is characterized by materials deposited within the past 30,000 years by late Pleistocene Lake Bonneville (Currey and Oviatt, 1985), and young lacustrine and deltaic deposits (Holocene to upper Pleistocene) deposited on delta margins as the lake receded to its present Great Salt Lake levels (Hylland et al., 2014). As the ancient lake(s) receded, streams began to regrade through shoreline deltas formed at the mouths of major Wasatch Range canyons and the eroded material was deposited in the basin as a series of recessional deltas, alluvial fans, and shoreline sequences. Toward the east-central portion of the valley where the site is located, shallow-water sediments of clay, silt, and sand predominate.

The surficial geology of most of the site as interpreted by Solomon and others (2009) primarily consists of "Younger alluvial-fan deposits, undivided" (**Qafy**). A small area of "Lacustrine silt and clay" (**Qlmp**) and "Young lacustrine silt and clay" (**Qlmy**) are also mapped in isolated areas of the site.

3.5 FAULTING

There are a number of mapped faults near the site. The faults are primarily normal mechanism. Some of the faults included are the Utah Lake Faults (mapped 0.79 miles south-southwest of the site), the Provo section of the Wasatch fault zone (mapped 4.29 miles northeast of the site), the Salt Lake City section of the Wasatch fault zone (mapped 10.30 miles north of the site), and the Nephi section of the Wasatch fault zone (mapped 18.39 miles south-southeast of the site).

4. SITE RESPONSE ANALYSIS

A soil model was developed from the boring, laboratory, and ReMi data from this study and the geotechnical study for the site.

A series of earthquake time histories were selected and scaled to match the MCE_R response spectrum at the base of the soil column. Histories were selected from events with similar magnitudes, distances and spectral shape in the period ranges of significance for the proposed structure (approximately 0.4 seconds). These ground motion time histories were input at the base of the soil column model as outcrop motions, propagated through the soil column model, and calculated as surface ground motions. The results of the SRA analysis are presented in the table in the following section.

5. DESIGN RESPONSE SPECTRUM

The response spectrum produced from the site-specific seismic analysis was compared with the minimum code spectrum values per ASCE 7-16 Section 21.3, including updates presented in Supplement 1 to ASCE 7-16. This process includes taking the 2014 mapped values from the USGS and utilizing F_a from Table 11.4-1 and 2.5 as F_v to obtain the modified accelerations, then reducing them by 20 percent to obtain the code minimum spectral accelerations.

The site-specific response spectrum is lower than the minimum code spectrum at select periods; therefore, the minimum code spectrum governs the design spectrum for the site at these periods. These values are presented in the table on the following page.

Period (sec)	Code 80% Minimum Spectral Acceleration (g)	Site-Specific Spectral Acceleration (g)	Code Modified* Site-Specific Spectral Acceleration (g)	Design Spectral Acceleration (2/3 of Code Modified Site-Specific Acceleration) (g)
0.05	0.569	0.456	0.569	0.379
0.1	0.737	0.478	0.737	0.491
0.2	1.006	0.651	1.006	0.671
0.3	1.006	0.793	1.006	0.671
0.4	1.006	0.820	1.006	0.671
0.5	1.006	0.924	1.006	0.671
0.6	1.006	1.089	1.089	0.726
0.8	1.006	1.080	1.080	0.720
1.0	0.907	1.006	1.006	0.671
1.2	0.756	1.092	1.092	0.728
1.4	0.648	0.931	0.931	0.621
1.6	0.567	0.781	0.781	0.521
1.8	0.504	0.633	0.633	0.422
2.0	0.454	0.523	0.523	0.348
3.0	0.302	0.270	0.302	0.201
4.0	0.227	0.146	0.227	0.151
5.0	0.181	0.091	0.181	0.121

*The greater of the site-specific and the code minimum spectral acceleration.

6. DESIGN ACCELERATION PARAMETERS

The site-specific response spectrum was analyzed in accordance with the procedure outlined in ASCE 7-16 Section 21.4 to produce the design acceleration parameters presented in the table below:

Site-Specific Parameter	Spectral Acceleration Value (g)
S_{DS}	0.671
S_{D1}	0.874

7. CLOSURE

If you have any questions or would like to discuss these items further, please feel free to contact us at (801) 685-9190.

Respectfully submitted,

GSH Geotechnical, Inc.

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MSH/ADS:jmt

Encl.
- Figure 1, Site Plan
- Figure 2, Shear-Wave Velocity Profile

Addressee (email)

Geologic References

Currey, D.R., and Oviatt, C.G., 1985, Durations, average rates, and probable causes of Lake Bonneville expansion, still-stands, and contractions during the last deep-lake cycle, 32,000 to 10,000 years ago, in Kay, P.A., and Diaz, H.F., (eds.), Problems of and prospects for predicting Great Salt Lake levels - Processing of a NOAA Conference, March 26-28, 1985: Salt Lake City, Utah.

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Hylland, M. D., DuRoss, C.B., McDonald, G.N., Olig, S.S., Oviatt, C.G., Mahan, S.A., Crone, A.J., and Personius, S.F., 2014, Late Quaternary paleoseismology of the West Valley fault zone, Utah: Insights from the Baileys Lake trench site, *in* DuRoss, C.B. and Hylland, M.D., Evaluating surface faulting chronologies of graben-bounding faults in Salt Lake Valley, Utah—new paleoseismic data from the Salt Lake City segment of the Wasatch fault zone and the West Valley fault zone—Paleoseismology of Utah, Volume 24: Utah Geological Survey Special Study 149, p. 41–76, 8 appendices, 1 plate.

Solomon, Barry J., Biek, Robert F., and Ritter, Scott M., 2009, Geologic Map of the Pelican Point Quadrangle, Utah County, Utah. Utah Geologic Survey, Plate 1.

RODERICK ENTERPRISES
JOB NO. 1111-030-22

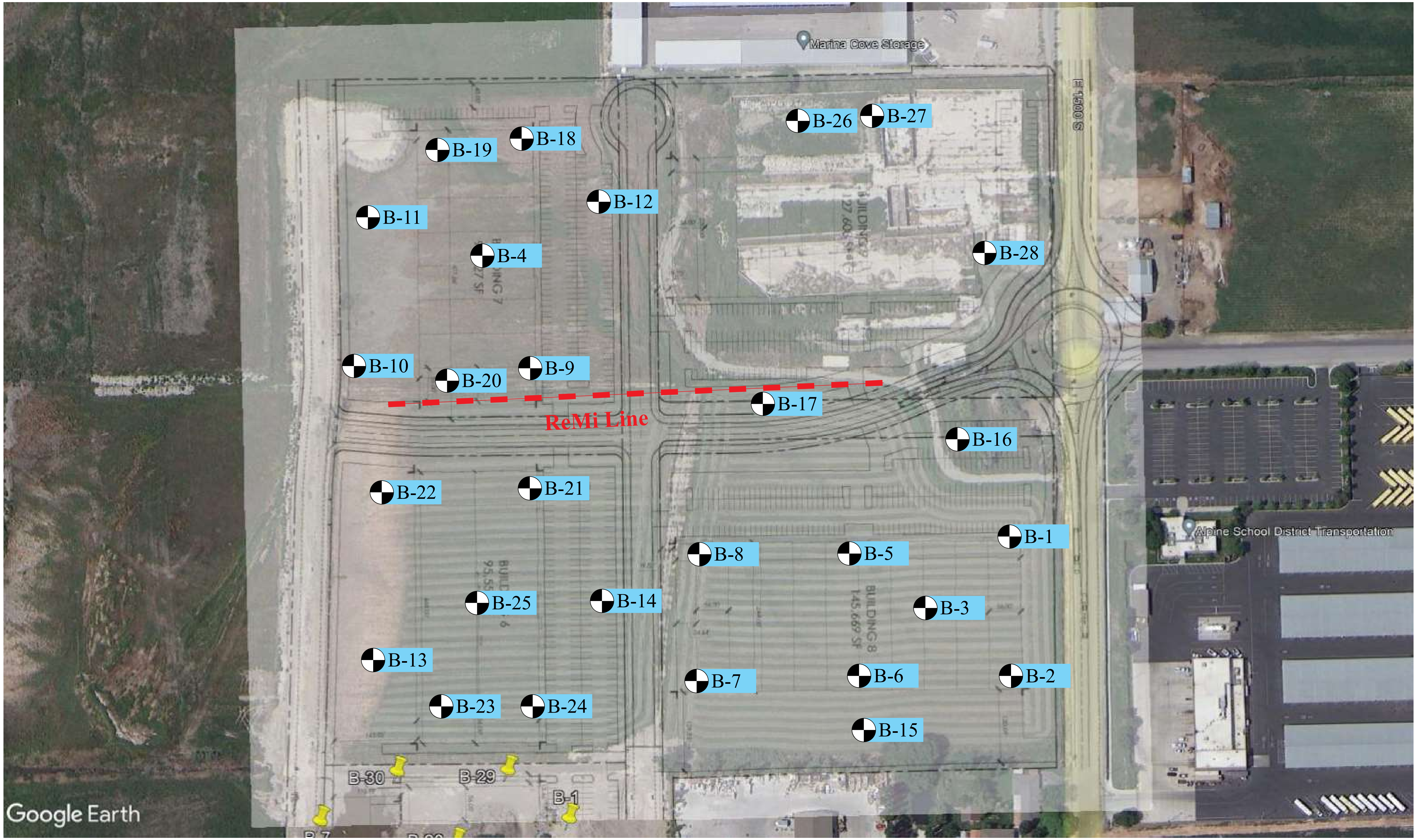


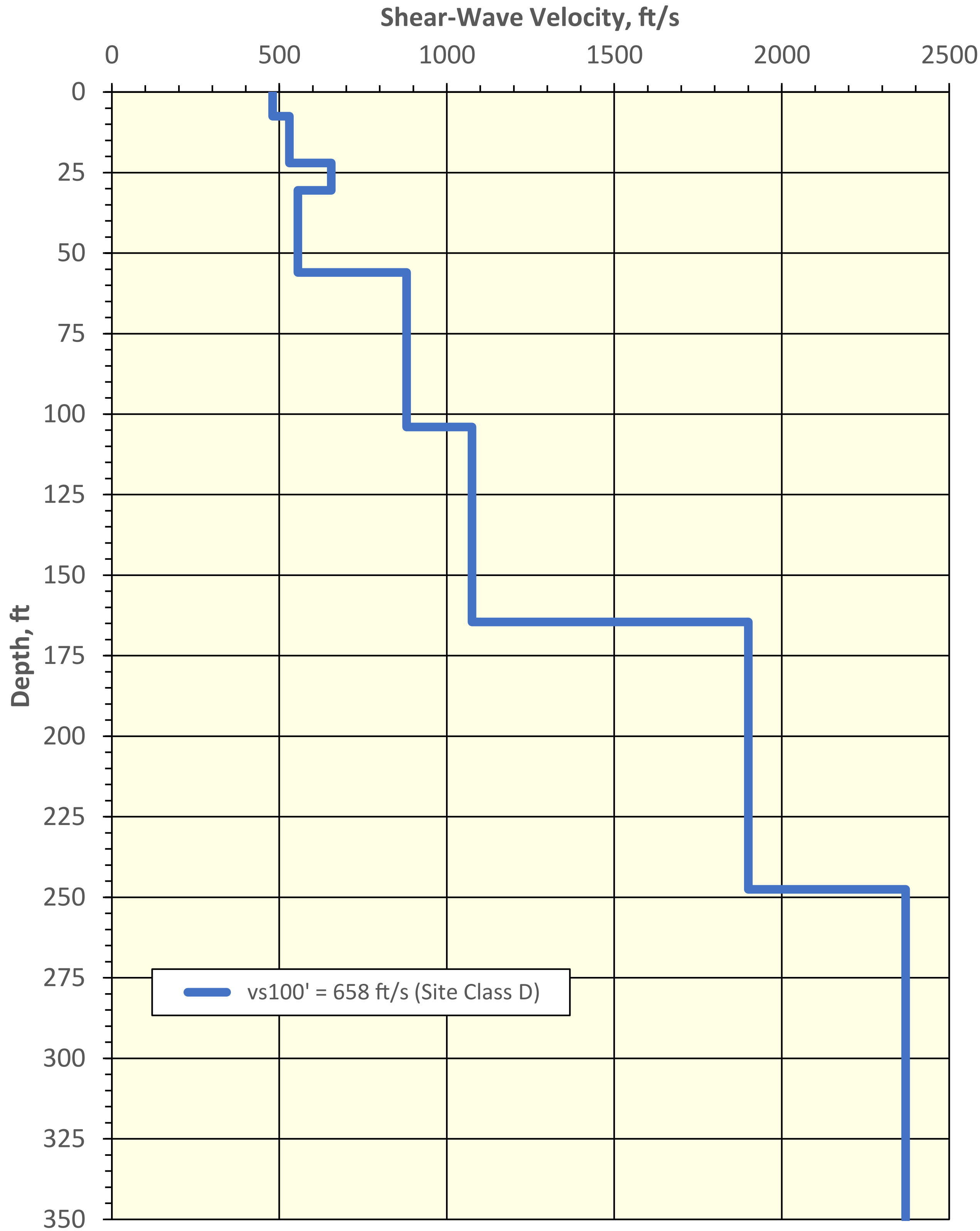
FIGURE 1
SITE PLAN

GSH

REFERENCE:
ADAPTED FROM DRAWING ENTITLED
"CATALYST 6, 7, 8, 9 - AMERICAN FORK, UTAH"
BY AEURBIA ACHITECTS AND ENGINEERS, DATED 5/13/2022

APPROXIMATE SCALE IN FEET
45 0 45 90

SHEAR-WAVE VELOCITY PROFILE



PROJECT NO.: 1111-030-22	GSH	**FIGURE NO.:** 2