GORDON
GEOTECHNICAL
ENGINEERING, INC.

REPORT
GEOTECHNICAL STUDY
PROPOSED BEAR LAKE TOWNS
2300 SWEET WATER PARKWAY
GARDEN CITY, UTAH

September 29, 2022

Job No. 538-006-22

Prepared for:
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September 29, 2022
Job No. 538-006-22

Regency Excavation
1384 North Washington Boulevard
Ogden, Utah 84404

Attention: Mr. Tyson Lund

Ladies and Gentlemen:

Re: Report
Geotechnical Study
Proposed Bear Lake Towns
2300 Sweet Water Parkway
Garden City, Utah

1. INTRODUCTION

1.1 GENERAL

This report presents the results of our geotechnical study performed at the site of the proposed Bear Lake Towns, which will be located at 2300 Sweet Water Parkway in Garden City, Utah. The general location of the site with respect to major topographic features and existing facilities, as of 1986 and 1998, is presented on Figure 1, Vicinity Map. A detailed location of the site showing existing roadways, surrounding facilities, on an air photograph base, is presented on Figure 2, Area Map. The locations and alignments of photographs taken of the site during the field portion of study are also presented on Figure 2. A more detailed layout of the site showing the proposed structures and parking areas is presented on Figure 3, Site Plan. The test pit locations excavated in conjunction with this study are also presented on Figure 3.

1.2 OBJECTIVES AND SCOPE

The objectives and scope of our study were planned in discussions between Mr. Tyson Lund of Regency Excavation and Mr. Patrick Emery of Gordon Geotechnical Engineering, Inc. (G^2).

In general, the objectives of this study were to:

1. Accurately define and evaluate the subsurface soil and groundwater conditions across the site.

2. Provide appropriate earthwork, foundation, floor slabs, pavement, and geoseismic recommendations to be utilized in the design and construction of the proposed development.

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

1. A field program consisting of the excavating, logging, and sampling of 14 test pits to depths of 12 to 15 feet.

2. A laboratory testing program.

3. An office program consisting of the correlation of available data, engineering analyses, and the preparation of this summary report.

1.3 AUTHORIZATION

Authorization was provided by returning a signed copy of our Professional Services Agreement No. 22-0827 dated August 16, 2022 and authorized on August 17, 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 exploration test pits, 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, G^2 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

A residential subdivision consisting of 207 townhome units is planned for the 23.8-acre site. The proposed structures are anticipated to be two to three levels in height and of wood-frame construction established slab-on-grade.

It is anticipated that the maximum anticipated column and wall loads will be in the range of 60 to 90 kips and 2 to 3 kips per lineal foot, respectively.

Site development will require a minor amount of earthwork in the form of site grading. It is estimated that maximum cuts and fills to achieve design grades will be on the order of two to three feet.

Paved surface parking areas will also be part of the overall development. Traffic over the pavements will consist of a light to moderately light volume of automobiles and light trucks, and some medium-weight trucks. In roadways, the traffic will be somewhat higher.

3. INVESTIGATIONS

3.1 FIELD PROGRAM

In order to define and evaluate the subsurface soil and groundwater conditions across the site, 14 test pits were excavated to depths ranging from 12 to 15 feet below existing grade. Locations of the test pits are presented on Figure 3.

The field portion of our study was under the direct control and continual supervision of an experienced member of our geotechnical staff. During the course of the excavation operations, a continuous log of the subsurface conditions encountered was maintained. In addition, relatively undisturbed and small disturbed samples of the typical soils encountered were obtained for subsequent laboratory testing and examination. The soils were classified in the field based upon visual and textural examination. These classifications have been supplemented by subsequent inspection and testing in our laboratory. Detailed graphical representation of the subsurface conditions encountered is presented on Figures 4A through 4N, Log of Test Pits. Soils were classified in accordance with the nomenclature described on Figure 5, Unified Soil Classification System.

Disturbed bag samples were collected from the soils brought up by the backhoe bucket.

Following completion of excavating and logging, each test pit was backfilled. Although an effort was made to compact the backfill with the backhoe, backfill was not placed in uniform lifts and compacted to a specific density. Consequently, settlement of the backfill with time is likely to occur.

Following completion of drilling operations, one and one-quarter-inch diameter slotted PVC pipe was installed in the majority of the test pits in order to provide a means of monitoring the groundwater fluctuations.

3.2 LABORATORY TESTING

3.2.1 General

In order to provide data necessary for our engineering analyses, a laboratory testing program was performed. The program included: moisture and density, partial gradation, consolidation, Atterberg limits, and chemical tests. The following paragraphs describe the tests and summarize the test data.

3.2.2 Moisture and Density Tests

To aid in classifying the soils and to help correlate other test data, moisture and density tests were performed on selected undisturbed samples. The results of these tests are presented on the test pit logs, Figures 4A through 4N.

3.2.3 Partial Gradation Tests

To aid in classifying the soils and to provide general index parameters, a partial gradation test was performed upon four representative samples of the soils encountered in the exploration test pits. The results of the test are tabulated below:

Test Pit No.	Depth (feet)	Percent Passing No. 200 Sieve	Soil Classification
TP-3	10.0	95.0	CL
TP-4	8.0	96.0	CL
TP-6	8.0	77.2	CL
TP-9	6.0	99.3	CL

3.2.4 Consolidation Tests

To provide data necessary for our settlement analyses, a consolidation test was performed on two representative samples of the fine-grained cohesive soils encountered in the exploration test pits. The results of these tests indicate that the natural silty clays are slightly to moderately over-consolidated and will exhibit moderate compressibility characteristics when loaded below the preconsolidation pressure. Detailed results of the tests are maintained within our files and can be transmitted to you, at your request.

3.2.5 Atterberg Limits Tests

To further aid in classifying the site soils, an Atterberg limits tests was performed on three selected samples. Results of the tests are tabulated below:

Test Pit No.	Depth (feet)	Liquid Limit (percent)	Plastic Limit (percent)	Plasticity Index (percent)	Soil Classification
TP-1	4.0	50	17	33	CL
TP-3	10.0	42	15	27	CL
TP-6	8.0	36	15	21	CL

3.2.6 Chemical Tests

To determine if the site soils will react detrimentally with concrete, chemical tests were performed on a representative sample of the natural soils. The results of the chemical tests are tabulated below:

Test Pit No.	Depth (feet)	Soil Classification	pH	Total Water Soluble Sulfate (mg/kg-dry)
TP-1	4.0	CL	9.0	1,540

4. SITE CONDITIONS

4.1 SURFACE

The site consists of a rectangular-parcel containing approximately 23.8-acres of vacant land. The undeveloped site is currently covered by grasses and weeds. Historical photographs indicate that agricultural and earthwork operations have previously occurred at the site. The surficial soils are plow-disturbed.

The site is bordered by similar undeveloped land to the north, east, south, and west.

The overall topography across the site slopes down to the east with up to two to three feet of relief.

Representative photographs of the site area are shown on Figure 6, Photographs.

4.2 SUBSURFACE SOIL

In order to evaluate the subsurface soil and groundwater conditions across the site, 14 test pits were excavated to depths ranging from 12 to 15 feet below surrounding grades. Subsurface conditions encountered at the test pit locations were relatively consistent. At the surface in Test Pits TP-1 through TP-14 and extending to a depth of one foot, non-engineered fill/plow-disturbed soil was encountered. The fill consists of clayey silt. The fill varies in density and is anticipated to exhibit variable, and most likely poor engineering characteristics.

In general, underlying the surficial fill/plow-disturbed soil, natural soils were encountered the extend to the depths explored of 12 to 15 feet. The natural soils consist of clay that is medium stiff to soft, brown, slightly moist to moist, and is anticipated to exhibit moderate strength and compressibility characteristics under the anticipated loading range.

The lines designating the interface between soil types on the test pit logs generally represent approximate boundaries. In-situ, the transition between soil types may be gradual.

4.3 GROUNDWATER

Immediately following excavation operations, the groundwater was measured in each test pit. Groundwater measurements are tabulated on the following page.

Test Pit No.	Groundwater Depth (feet)	
	September 8, 2022	September 27, 2022
TP-1	12.8*	11.5
TP-2	11.5*	**
TP-3	11.0*	**
TP-4	10.3*	8.5
TP-5	12.0*	**
TP-6	10.0*	**
TP-7	12.1*	10.2
TP-8	10.0*	**
TP-9	11.0*	**
TP-10	12.0*	**
TP-11	9.3*	6.9
TP-12	11.0*	**
TP-13	7.0*	7.3
TP-14	10.0*	**

* During excavating; not stabilized

** PVC pipe not installed.

Seasonal and longer-term groundwater fluctuations on the order of one to two feet are projected, with the highest seasonal levels generally occurring during the late spring and early summer months.

5. DISCUSSIONS AND RECOMMENDATIONS

5.1 SUMMARY OF FINDINGS

The proposed structures may be supported upon conventional spread and continuous wall foundations over suitable natural soils and/or structural fill extending to suitable natural soils.

The most significant geotechnical aspects of the site are:

1. The non-engineered fill encountered at Test Pits TP-1 through TP-14 to a depth of one foot below existing grade. Additionally, historical photographs indicate that agricultural and earthwork operations have previously occurred at the site. Non-engineered fills must be completely removed from beneath the building footprints and rigid pavement areas.

2. The water table was measured at a depth of 6.9 to 11.5 feet below existing grade. Considering seasonal and long-term groundwater fluctuations, we recommend that a design groundwater table of 4.9 to 9.5 feet below existing grade be utilized in the design. We recommend that all habitable floor slabs be established a minimum of two feet above the design water table.

Due to the variable nature of the non-engineered fills encountered, a qualified geotechnical engineer from our staff must aid in verifying that all non-engineered fills have been completely removed prior to the placement of structural site grading fills, footings, or foundations.

Detailed discussions pertaining to earthwork, foundations, floor slabs, pavement, and the geoseismic setting of the site are discussed in the following sections.

5.2 EARTHWORK

5.2.1 Site Preparation

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 three 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 (clays and silts) 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 long-term movements. If the possibility of these movements is not acceptable, these non-engineered fills must be completely removed.

Subsequent to the above operations and prior to the placement of footings, structural site grading fill, or floor slabs, the exposed natural subgrade must be proofrolled by passing

moderate-weight rubber tire-mounted construction equipment over the surface at least twice. If any loose, soft, or disturbed zones are encountered, they must be completely removed in footing and floor slab areas and replaced with granular structural fill. If removal depth required is greater than two feet, G^2 must be notified to provide further recommendations. In pavement areas, unsuitable soils encountered during recompaction and proofrolling must be removed to a maximum depth of two feet and replaced with compacted granular structural fill.

5.2.2 Excavations

Temporary construction excavations through fine-grained cohesive soils, not exceeding four feet in depth, above or below the groundwater table, may be constructed with near-vertical sideslopes. Temporary excavations up to eight feet deep in fine-grained cohesive soils and above or below the water table may be constructed with sideslopes no steeper than one-half horizontal to one vertical (0.5H:1.0V). Temporary excavations up to eight feet deep in granular soils above or below the water table may be constructed with sideslopes no steeper than one horizontal to one vertical (1.0H:1.0V).

Trench excavations must be constructed in accordance with OSHA trench safety guidelines.

All excavations must be inspected periodically by qualified personnel. If any signs of instability or excessive sloughing are noted, immediate remedial action must be initiated.

5.2.3 Structural Fill

Structural fill is defined as all fill which will ultimately be subjected to structural loadings, such as imposed by footings, floor slabs, pavements, etc. Structural fill will be required as backfill over foundations and utilities, as site grading fill, and in some areas, as replacement fill below footings. All structural fill must be free of sod, rubbish, topsoil, frozen soil, and other deleterious materials. Structural site grading fill is defined as fill placed over fairly large open areas to raise the overall site grade. For structural site grading fill, the maximum particle size should generally not exceed four inches; although, occasional larger particles, not exceeding six inches in diameter may be incorporated if placed randomly in a manner such that “honeycombing” does not occur and the desired degree of compaction can be achieved. The maximum particle size within structural fill placed within confined areas should generally be restricted to two inches.

The on-site non-engineered fills and underlying natural soils may be utilized as structural site grading fill. It should be noted that unless moisture control is maintained, utilization of fine-grained (silt or clay) soils as structural site grading fill will be very difficult, if not impossible, during wet and cold periods of the year. Only granular soils are recommended as structural fill in confined areas, such as around foundations and within utility trenches.

To stabilize soft subgrade conditions or where structural fill is required to be placed below a level one foot above the water table at the time of construction, a mixture of coarse gravels and cobbles and/or one and one-half- to two-inch gravel (stabilizing fill) should be utilized.

Non-structural site grading fill is defined as all fill material not designated as structural fill and may consist of any cohesive or granular soils not containing excessive amounts of degradable material.

5.2.4 Fill Placement and Compaction

Structural fill shall be placed in lifts not exceeding eight inches in loose thickness. Structural fills shall be compacted in accordance with the percent of the maximum dry density as determined by the AASHTO[1] T-180 (ASTM[2] D-1557) compaction criteria in accordance with the following table:

Location	Total Fill Thickness (feet)	Minimum Percentage of Maximum Dry Density
Beneath an area extending at least 3 feet beyond the perimeter of the structure	0 to 8	95
Outside area defined above	0 to 6	90
Outside area defined above	6 to 8	92
Road base	-	96

Structural fills greater than eight feet thick are not anticipated at the site.

Subsequent to stripping and prior to the placement of structural site grading fill, the subgrade must be prepared as discussed in Section 5.2.1, Site Preparation, of this report. In confined areas, subgrade preparation should consist of the removal of all loose or disturbed soils.

Non-structural fill may be placed in lifts not exceeding 12 inches in loose thickness and compacted by passing construction, spreading, or hauling equipment over the surface at least twice.

Coarse gravel and cobble mixtures (stabilizing fill), if utilized, shall be end-dumped, spread to a maximum loose lift thickness of 15 inches, and compacted by dropping a backhoe bucket onto the surface continuously at least twice. As an alternative, the fill may be compacted by passing

1 American Association of State Highway and Transportation Officials
2 American Society for Testing and Materials

moderately heavy construction equipment or large self-propelled compaction equipment over the surface at least twice. Subsequent fill material placed over the coarse gravels and cobbles shall be adequately placed so that the "fines" are "worked into" the voids in the underlying coarser gravels and cobbles.

5.2.5 Utility Trenches

All utility trench backfill material below structurally loaded facilities (flatwork, floor slabs, roads, etc.) should be placed at the same density requirements established for structural fill. If the surface of the backfill becomes disturbed during the course of construction, the backfill should be proofrolled and/or properly compacted prior to the construction of any exterior flatwork over a backfilled trench. Proofrolling may be performed by passing moderately loaded rubber tire-mounted construction equipment uniformly over the surface at least twice. If excessively loose or soft areas are encountered during proofrolling, they should be removed to a maximum depth of two feet below design finish grade and replaced with structural fill.

Most utility companies and City-County governments are now requiring that Type A-1 or A-1-a (AASHTO Designation – basically granular soils with limited fines) soils be used as backfill over utilities. These organizations are also requiring that in public roadways the backfill over major utilities be compacted over the full depth of fill to at least 96 percent of the maximum dry density as determined by the AASHTO T-180 (ASTM D-1557) method of compaction. We recommend that as the major utilities continue onto the site that these compaction specifications are followed.

The natural sand and gravel soils (and surficial granular fills) may be suitable for use as trench backfill provided it meets the requirements of Type A-1 or A-1-a soils.

5.3 SPREAD AND CONTINUOUS WALL FOUNDATIONS

5.3.1 Design Data

The proposed structures may be supported upon conventional spread and continuous wall foundations established upon suitable natural soils and/or structural fill extending to suitable natural soils. Under no circumstances shall footings be placed overlying non-engineered fills.

For design, the following parameters are provided with respect to the projected loading discussed in Section 2., Proposed Construction, of this report:

Minimum Recommended Depth of Embedment for Frost Protection	- 30 inches
Minimum Recommended Depth of Embedment for Non-frost Conditions	- 15 inches
Recommended Minimum Width for Continuous Wall Footings	- 18 inches
Minimum Recommended Width for Isolated Spread Footings	- 24 inches
Recommended Net Bearing Pressure for Real Load Conditions	
For footings on suitable natural soils and/or structural fill extending to suitable natural soils	- 2,000 pounds per square foot
Bearing Pressure Increase for Seismic Loading	- 50 percent*

* Not applicable for edge bearing pressure when the footings are established upon granular soil. Use 25 percent for overturning or other inclined loading.

The term “net bearing pressure” refers to the pressure imposed by the portion of the structure located above lowest adjacent final grade. Therefore, the weight of the footing and backfill to the lowest adjacent final grade need not be considered. Real loads are defined as the total of all dead plus frequently applied live loads. Total load includes all dead and live loads, including seismic and wind.

5.3.2 Installation

Under no circumstances shall the footings be established upon non-engineered fills, loose or disturbed soils, rubbish, construction debris, other deleterious materials, frozen soils, or within ponded water. If unsuitable soils are encountered, they must be completely removed and replaced with compacted structural fill.

The width of structural replacement fill below footings should be equal to the width of the footing plus one foot for each foot of fill thickness.

5.3.3 Settlements

Settlements of foundations designed and installed in accordance with the above recommendations and supporting maximum projected structural loads are anticipated to be on the order of one inch or less. Settlements are expected to occur rapidly with approximately 60 to 70 percent of the settlements occurring during construction.

5.4 LATERAL PRESSURES

The lateral pressure parameters, as presented within this section, assume that the backfill extending at least five feet from the back of the wall be properly placed and compacted natural granular soil. The lateral pressures imposed upon subgrade facilities will, therefore, be basically dependent upon the relative rigidity and movement of the backfilled structure. For active walls, such as retaining walls which can move outward (away from the backfill), granular backfill may be considered equivalent to a fluid with a density of 35 pounds per cubic foot in computing lateral pressures. For more rigid basement walls, granular backfill may be considered equivalent to a fluid with a density of 45 pounds per cubic foot. For very rigid non-yielding walls, granular backfill should be considered equivalent to a fluid with a density with at least 55 pounds per cubic foot. The above values assume that the surface of the soils slope behind the wall is horizontal, that the granular fill has been placed and lightly compacted, not as structural fill. If the fill is placed as a structural fill the values should be increased to 45 pounds per cubic foot, 60 pounds per cubic foot, and 120 pounds per cubic foot, respectively.

Recommended average uniform seismic lateral pressure for various height walls are tabulated below and assume a granular wall backfill with a horizontal grade above the wall. It should be noted that the lateral pressures as quoted assume that the backfill materials will not become saturated. If the backfill becomes saturated, the above values may be decreased by one-half; however, full hydrostatic water pressures will have to be included.

Wall Height (feet)	Uniform Seismic Lateral Pressure* (psf)
4	56

* Maximum short-term pressures, they are not sustained loads.

Note that the pressures presented in this section do not include surcharge loadings, such as floor slabs, adjacent footings, etc.

5.5 LATERAL RESISTANCE

Lateral loads imposed upon foundations may be resisted by the development of passive earth pressures and friction between the base of the footings and the supporting soils. In determining

frictional resistance on granular soils, a coefficient of 0.45 should be utilized. In determining frictional resistance on fine-grained soils, a coefficient of 0.40 should be utilized. Passive resistance provided by properly placed and compacted granular structural fill above the water table may be considered equivalent to a fluid with a density of 300 pounds per cubic foot. Below the water table, this granular soil should be considered equivalent to a fluid with a density of 150 pounds per cubic foot.

A combination of passive earth resistance and friction may be utilized provided that the friction component of the total is divided by 1.5.

5.6 FLOOR SLABS

Floor slabs may be established upon suitable undisturbed natural soils, and/or upon structural fill extending to suitable natural soils. Non-engineered fills and topsoil are not considered suitable. It is recommended that floor slabs be directly underlain by at least four inches of “free-draining” fill, such as “pea” gravel or three-quarters- to one-inch minus clean gravel. Settlements of lightly to moderately loaded floor slabs are anticipated to be minor.

5.7 PAVEMENTS

The properly prepared non-engineered fills will exhibit poor engineering characteristics when saturated or nearly saturated. Non-engineered fills may remain in flexible pavement areas if properly prepared, as stated previously in this report. Rigid pavements shall not be placed overlying non-engineered fills, even if properly prepared. Considering the existing non-engineered soils as the subgrade soils and the projected traffic, the pavement sections on the following pages are recommended.

Parking Areas

(Light Volume of Automobiles and Light Trucks,
Occasional Medium-Weight Trucks,
and No Heavy-Weight Trucks)
[1 equivalent 18-kip axle load per day]

Flexible:

2.5 inches	Asphalt concrete
8.0 inches	Aggregate base
Over	Properly prepared natural soils, properly prepared existing non-engineered fill, and/or structural site grading fill extending to suitable stabilized natural soils.

Rigid:

5.0 inches	Portland cement concrete (non-reinforced)
4.0 inches	Aggregate base
Over	Properly prepared natural soils, and/or structural site grading fill extending to suitable stabilized natural soils.*

* Rigid pavements shall not be placed over non-engineered fills, even if properly prepared.

Primary Roadway Areas

(Moderate Volume of Automobiles and Light Trucks,
Light Volume of Medium-Weight Trucks,
and Occasional Heavy-Weight Trucks)
[5 equivalent 18-kip axle loads per day]

Flexible:

3.0 inches	Asphalt concrete
8.0 inches	Aggregate base
Over	Properly prepared natural soils, properly prepared existing non-engineered fill, and/or structural site grading fill extending to suitable stabilized natural soils.

Rigid:

5.5 inches	Portland cement concrete (non-reinforced)
5.0 inches	Aggregate base
Over	Properly prepared natural soils, and/or structural site grading fill extending to suitable stabilized natural soils.*

* Rigid pavements shall not be placed over non-engineered fills, even if properly prepared.

For dumpster pads, we recommend a pavement section consisting of six and one-half inches of Portland cement concrete, four inches of aggregate base, over properly prepared natural stabilized subgrade or site grading structural fills.

These above rigid pavement sections are for non-reinforced Portland cement concrete. Concrete should be designed in accordance with the American Concrete Institute (ACI) and joint details should conform to the Portland Cement Association (PCA) guidelines. The concrete should have a minimum 28-day unconfined compressive strength of 4,000 pounds per square inch and contain 6 percent ±1 percent air-entrainment.

5.8 GEOSEISMIC SETTING

5.8.1 General

As of July 2019, the State of Utah has adopted the International Building Code (IBC) 2018. The IBC 2018 determines the seismic hazard for a site based upon 2014 mapping of bedrock accelerations prepared by the United States Geologic Survey (USGS) and the soil site class. The USGS values are presented on maps incorporated into the IBC and are also available based on latitude and longitude coordinates (grid points).

Depending on the structure's occupancy class and the applicable building code, the structures must either be designed in accordance with Section 1613, Earthquake Loads, of the 2018 IBC.

5.8.2 Faulting

Based on our review of available literature, no active faults are known to pass through or immediately adjacent to the site.

5.8.3 Soil Class

Based on the soils encountered and our knowledge of the underlying geology, we recommend that the Site Class D - Stiff Soil Profile as defined in Table 20.3-1, Site Classification, of ASCE 7-16 be utilized for dynamic structural analysis.

5.8.4 Ground Motions

The IBC 2018 code is based on 2008 USGS mapping, which provides values of short and long period accelerations for Site Class B for the Maximum Considered Earthquake (MCE). Site Class B represents a hypothetical bedrock surface and must be corrected for local soil conditions. The following table summarizes the peak ground and short and long period accelerations for a MCE event and incorporates a soil amplification factor for a Site Class D soil profile in the second column. Based on the site latitude and longitude (41.9037 degrees north and -111.3840 degrees west, respectively), the values for this site are tabulated on the following page.

Spectral Acceleration Value, T Seconds	Site Class B Boundary [mapped values] (% g)	Site Class D [adjusted for site class effects] (% g)
Peak Ground Acceleration	44.4	51.3
0.2 Seconds, (Short Period Acceleration)	S_S = 101.0	S_{MS} = 110.7
1.0 Seconds (Long Period Acceleration)	S_1 = 33.4	S_{M1} = *

* See Section 11.4.8 of ASCE 7-16 for requirements on site-specific ground motion studies.

The IBC 2018 code design accelerations (S_{DS} and S_{D1}) are based on multiplying the above accelerations (adjusted for site class effects) for the MCE event by two-thirds.

5.8.5 Liquefaction

Liquefaction is defined as the condition when saturated, loose, finer-grained sand-type soils lose their support capabilities because of excessive pore water pressure which develops during a seismic event.

Due to the fine grained nature of saturated soils encountered, our analysis indicates liquefaction is not anticipated during the design seismic event. However, a deep boring for liquefaction analysis was beyond the scope of this study.

Calculations were performed using the procedures described in the 2008 Soil Liquefaction During Earthquakes Monograph by Idriss and Boulanger[3].

5.9 SITE OBSERVATIONS

As stated previously, due to the variable nature of the non-engineered fills encountered, a qualified geotechnical engineer from our staff must aid in verifying that all non-engineered fills have been completely removed prior to the placement of structural site grading fills, footings, or foundations.

[3] Idriss, I. M., and Boulanger, R. W. (2008), Soil liquefaction during earthquakes: Monograph MNO-12, Earthquake Engineering Research Institute, Oakland, CA, 261 pp.

5.10 DESIGN WATER TABLE

As stated previously, the water table was measured at a depth of 6.9 to 11.5 feet below existing grade. Considering seasonal and long-term groundwater fluctuations, we recommend that the design groundwater table of 4.9 to 9.5 feet below existing grade be utilized in the design. We recommend that all habitable floor slabs be established a minimum of two feet above the design water table.

5.11 CEMENT TYPES

The laboratory tests indicate that the natural soils tested contain a moderate amount of water-soluble sulfates. Based on our test results, concrete in contact with the on-site soil will have a low potential for sulfate reaction (ACI 318, Table 4.3.1). Therefore, all concrete which will be in contact with the site soils may be prepared using Type II cement.

We appreciate the opportunity of providing this service for you. If you have any questions or require additional information, please do not hesitate to contact us.

Respectfully submitted,

Gordon Geotechnical Engineering, Inc.

Joshua M. Whitney, State of Utah No. 6252902
Senior Engineer

Reviewed by:

Patrick R. Emery, State of Utah No. 7941710
Senior Engineer

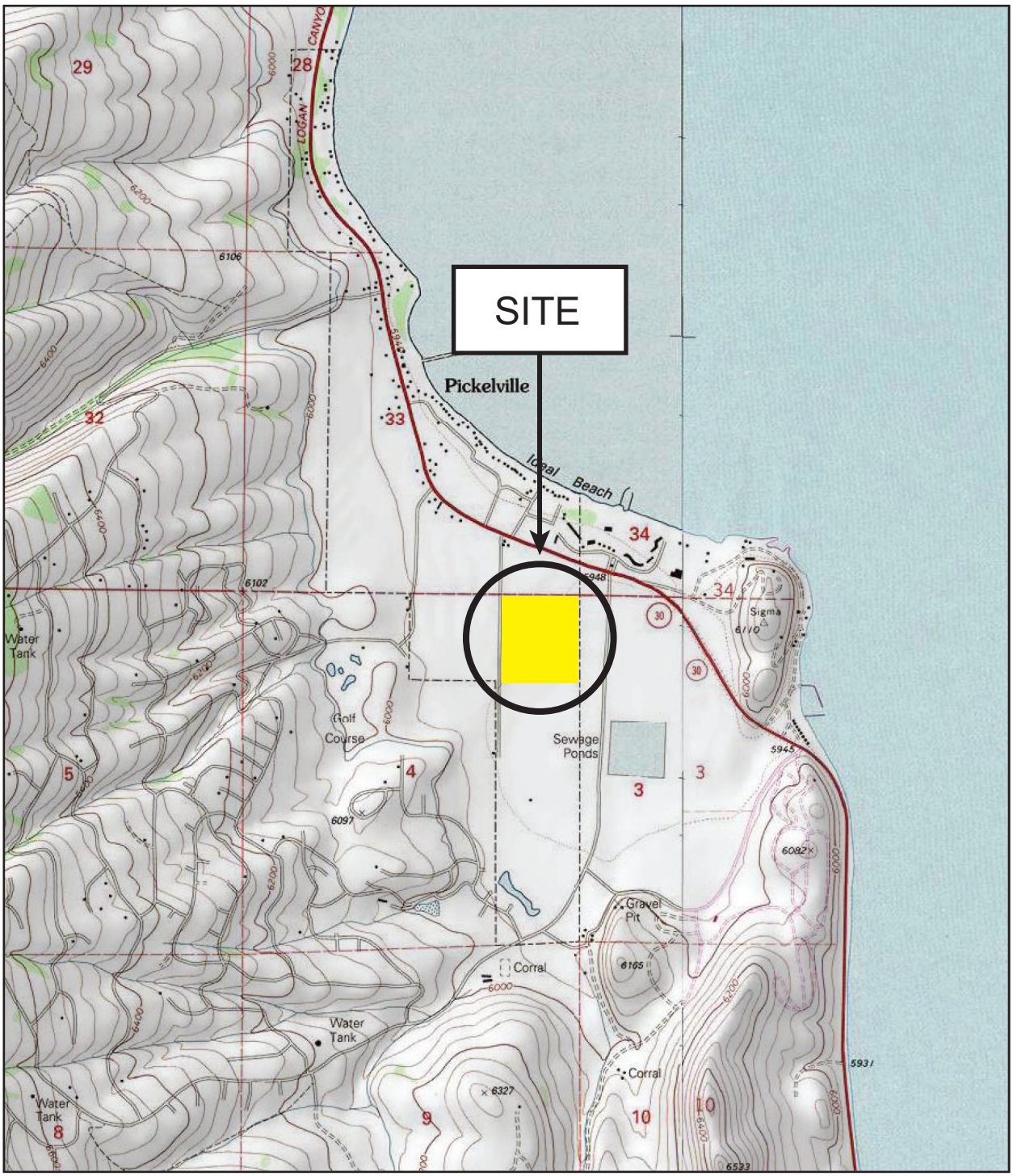
JMW/PRE:sn

Encl. Figure 1, Vicinity Map
Figure 2, Area Map
Figure 3, Site Plan
Figures 4A through 4N, Log of Test Pits
Figure 5, Unified Soil Classification System
Figure 6, Photographs

Addressee (3 + email)

REGENCY EXCAVATION
JOB NO. 538-006-32

GORDON GEOTECHNICAL ENGINEERING, INC.



SCALE IN FEET
1000 0 1000 2000

FIGURE 1
VICINITY MAP

REFERENCE:
USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE MAPS
TITLED “BEAR LAKE SOUTH, UTAH”, DATED 1986 AND
“GARDEN CITY, UTAH / IDAHO”, DATED 1998

REGENCY EXCAVATION
JOB NO. 538-006-22

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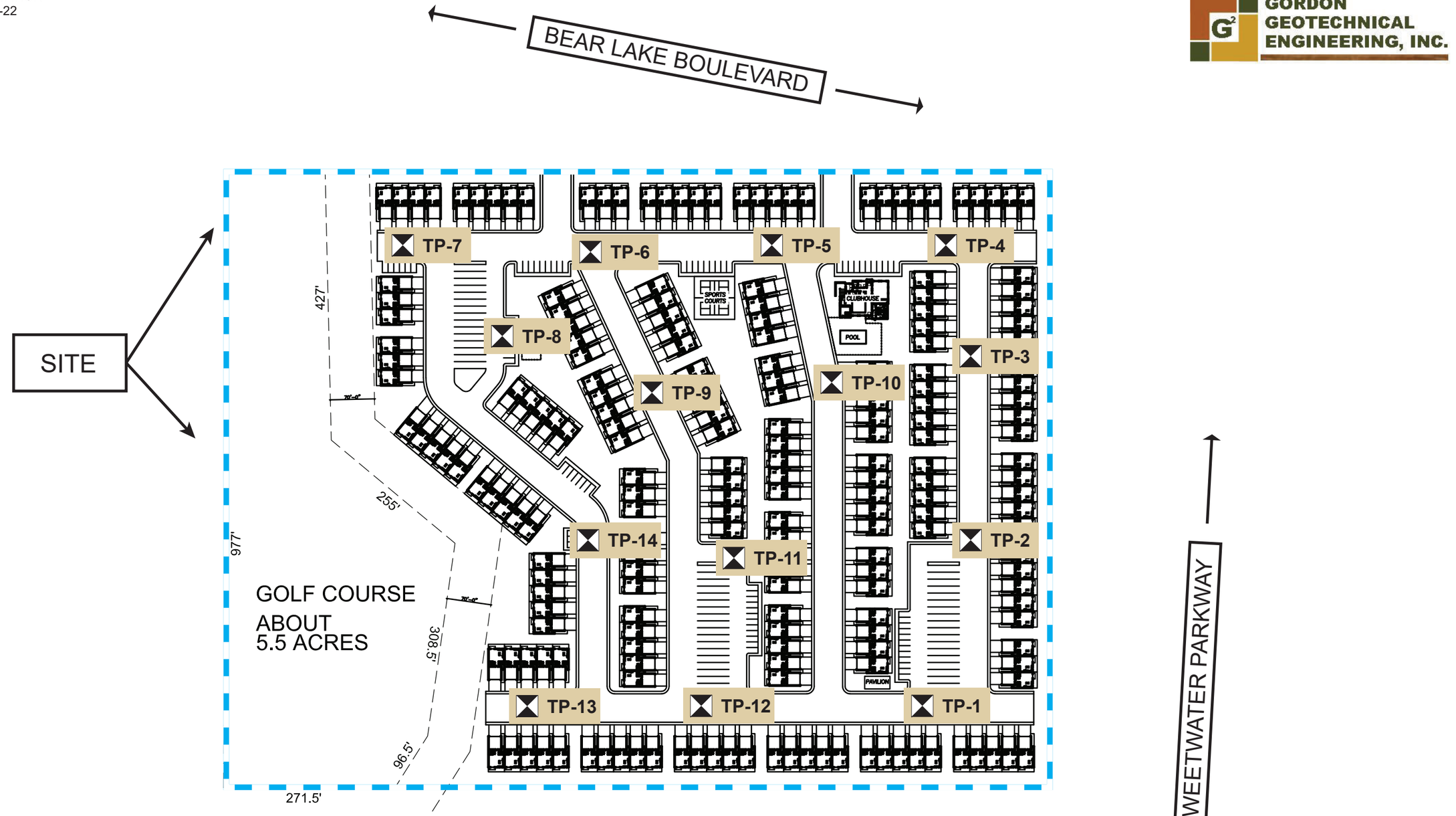
FIGURE 2
AREA MAP

REGENCY EXCAVATION
JOB NO. 538-006-22

GORDON GEOTECHNICAL ENGINEERING, INC.



REFERENCE:
ADAPTED FROM DRAWING ENTITLED
"BEAR LAKE SITE PLAN" PROVIDED BY CLIENT,
DATED AUGUST 3, 2022

NOT TO SCALE

FIGURE 3
SITE PLAN

Gordon Geotechnical Engineering, Inc.
4426 South Century Drive, Suite 100
Salt Lake City, Utah 84123

TEST PIT TP-1

Project Name: Proposed Bear Lake Towns
Project No.: 538-006-22
Location: 2300 Sweet Water Parkway, Garden City, Utah
Client: Regency Excavation
Excavating Method: Mini-Excavator
Date Excavated: 09-08-22
Elevation: ---
Water Level: 11.0' (09-08-22), 12.8" (09-08-22 - stabilized), 11.5' (09-27-22)
Remarks:

DESCRIPTION	DEPTH (FT.)	SAMPLE SYMBOL	SAMPLE TYPE	BLOWS/FT.	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	REMARKS
CLAYEY SILT, FILL with trace fine sand; plow-disturbed; dark brown (ML-FILL)										slightly moist "soft"
SILTY CLAY with some fine sand; light brown (CL)										moist "soft"
			TW		22.8	96		50	17	
	5									
grades reddish-brown			B							
	10									saturated
grades with occasional 3" thick layer of silty fine sand with organics; red and black			B							
	15									
Stopped excavating at 15.0'. Installed slotted PVC pipe to 15.0'. No signficant sidewall caving.	20									
	25									

The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary for a proper understanding of the nature of the subsurface material.

FIGURE 4A

Gordon Geotechnical Engineering, Inc.
4426 South Century Drive, Suite 100
Salt Lake City, Utah 84123

TEST PIT TP-2

Project Name: Proposed Bear Lake Towns
Project No.: 538-006-22
Location: 2300 Sweet Water Parkway, Garden City, Utah
Client: Regency Excavation
Excavating Method: Mini-Excavator
Date Excavated: 09-08-22
Elevation: ---
Water Level: 11.5' (09-08-22)
Remarks:

DESCRIPTION	GRAPHIC LOG	WATER LEVEL	DEPTH (FT.)	SAMPLE SYMBOL	SAMPLE TYPE	BLOWS/FT.	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	REMARKS
CLAYEY SILT, FILL with trace fine sand; plow-disturbed; dark brown (ML-FILL)												slightly moist "soft"
SILTY CLAY with some fine sand; light brown (CL)												moist "soft"
			5		B							
grades with mottling												
			10									
grades with occasional 3" thick layer of silty fine sand; red and black												saturated
Stopped excavating at 12.0'. No signficant sidewall caving.			15									
			20									
			25									

The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary for a proper understanding of the nature of the subsurface material.

FIGURE 4B

Gordon Geotechnical Engineering, Inc.
4426 South Century Drive, Suite 100
Salt Lake City, Utah 84123

TEST PIT TP-3

Project Name: Proposed Bear Lake Towns
Project No.: 538-006-22
Location: 2300 Sweet Water Parkway, Garden City, Utah
Client: Regency Excavation
Excavating Method: Mini-Excavator
Date Excavated: 09-08-22
Elevation: ---
Water Level: 11.0' (09-08-22)
Remarks:

DESCRIPTION	DEPTH (FT.)	SAMPLE TYPE	BLOWS/FT.	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	REMARKS
CLAYEY SILT, FILL with trace fine sand; plow-disturbed; dark brown (ML-FILL)									slightly moist "soft"
SILTY CLAY with some fine sand; light brown (CL)		B							slightly moist "soft"
grades with mottling	5								moist
grades with occasional 3" thick layer of silty fine sand and organics; red and black	10	B		29.0		95.0	42	15	saturated
Stopped excavating at 12.0'. No signficant sidewall caving.	15 20 25								

The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary for a proper understanding of the nature of the subsurface material.

FIGURE 4C

Gordon Geotechnical Engineering, Inc.
4426 South Century Drive, Suite 100
Salt Lake City, Utah 84123

TEST PIT TP-4

Project Name: Proposed Bear Lake Towns
Project No.: 538-006-22
Location: 2300 Sweet Water Parkway, Garden City, Utah
Client: Regency Excavation
Excavating Method: Mini-Excavator
Date Excavated: 09-08-22
Elevation: ---
Water Level: 11.5' (09-08-22), 10.3' (09-08-22 - stabilized), 8.5' (09-27-22)
Remarks:

DESCRIPTION	DEPTH (FT.)	SAMPLE SYMBOL	SAMPLE TYPE	BLOWS/FT.	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	REMARKS
CLAYEY SILT, FILL with trace fine sand; plow-disturbed; dark brown (ML-FILL)										slightly moist "soft"
SILTY CLAY with some fine sand; light brown (CL)										slightly moist "soft"
	5		TW							
grades with oxidation mottling			TW		29.0		96.0			moist
	10		B							saturated
Stopped excavating at 15.0'. No signficant sidewall caving. Installed slotted PVC pipe to 15.0'.	15									
	20									
	25									

The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary for a proper understanding of the nature of the subsurface material.

FIGURE 4D

Gordon Geotechnical Engineering, Inc.
4426 South Century Drive, Suite 100
Salt Lake City, Utah 84123

TEST PIT TP-5

Project Name: Proposed Bear Lake Towns
Project No.: 538-006-22
Location: 2300 Sweet Water Parkway, Garden City, Utah
Client: Regency Excavation
Excavating Method: Mini-Excavator
Date Excavated: 09-08-22
Elevation: ---
Water Level: 12.0' (09-08-22)
Remarks:

DESCRIPTION	GRAPHIC LOG	WATER LEVEL	DEPTH (FT.)	SAMPLE SYMBOL	SAMPLE TYPE	BLOWS/FT.	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	REMARKS
CLAYEY SILT, FILL with trace fine sand; plow-disturbed; dark brown (ML-FILL)												slightly moist "soft"
SILTY CLAY with some fine sand; light brown (CL)					B							slightly moist "soft"
grades with oxidation mottling			5									
grades with old roots			10		B							saturated
Stopped excavating at 12.0'. No signficant sidewall caving.			15 20 25									

The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary for a proper understanding of the nature of the subsurface material.

FIGURE 4E

Gordon Geotechnical Engineering, Inc.
4426 South Century Drive, Suite 100
Salt Lake City, Utah 84123

TEST PIT TP-6

Project Name: Proposed Bear Lake Towns
Project No.: 538-006-22
Location: 2300 Sweet Water Parkway, Garden City, Utah
Client: Regency Excavation
Excavating Method: Mini-Excavator
Date Excavated: 09-08-22
Elevation: ---
Water Level: 10.0' (09-08-22)
Remarks:

DESCRIPTION	DEPTH (FT.)	SAMPLE SYMBOL	SAMPLE TYPE	BLOWS/FT.	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	REMARKS
CLAYEY SILT, FILL with trace fine sand; plow-disturbed; dark brown (ML-FILL)										slightly moist "soft"
SILTY CLAY with some fine sand; light brown (CL)										slightly moist "soft"
grades with oxidation mottling	5		B		26.1		77.2	36	15	moist
	10									saturated "very soft"
grades with trace fine to coarse sand			B							
Stopped excavating at 12.0'. No signficant sidewall caving.	15 20 25									

The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary for a proper understanding of the nature of the subsurface material.

FIGURE 4F

Gordon Geotechnical Engineering, Inc.
4426 South Century Drive, Suite 100
Salt Lake City, Utah 84123

TEST PIT TP-7

Project Name: Proposed Bear Lake Towns
Project No.: 538-006-22
Location: 2300 Sweet Water Parkway, Garden City, Utah
Client: Regency Excavation
Excavating Method: Mini-Excavator
Date Excavated: 09-08-22
Elevation: ---
Water Level: 10.0' (09-08-22), 12.1' (09-08-22 - stabilized), 10.2' (09-27-22)
Remarks:

DESCRIPTION	GRAPHIC LOG	WATER LEVEL	DEPTH (FT.)	SAMPLE SYMBOL	SAMPLE TYPE	BLOWS/FT.	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	REMARKS
CLAYEY SILT, FILL with trace fine sand; plow-disturbed; dark brown (ML-FILL)												slightly moist "soft"
SILTY CLAY with some fine sand; light brown (CL)												slightly moist "medium stiff"
			5									
grades with oxidation mottling					TW							
		▼	10									saturated
					B							
			15									
Stopped excavating at 15.0'. No signficant sidewall caving. Installed slotted PVC pipe to 15.0'.			20									
			25									

The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary for a proper understanding of the nature of the subsurface material.

FIGURE 4G

Gordon Geotechnical Engineering, Inc.
4426 South Century Drive, Suite 100
Salt Lake City, Utah 84123

TEST PIT TP-8

Project Name: Proposed Bear Lake Towns
Project No.: 538-006-22
Location: 2300 Sweet Water Parkway, Garden City, Utah
Client: Regency Excavation
Excavating Method: Mini-Excavator
Date Excavated: 09-08-22
Elevation: ---
Water Level: 10.0' (09-08-22)
Remarks:

DESCRIPTION	GRAPHIC LOG	WATER LEVEL	DEPTH (FT.)	SAMPLE SYMBOL	SAMPLE TYPE	BLOWS/FT.	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	REMARKS
CLAYEY SILT, FILL with trace fine sand; plow-disturbed; dark brown (ML-FILL)												slightly moist "soft"
SILTY CLAY with some fine sand; light brown (CL)												slightly moist "medium stiff"
					B							
			5									
grades with oxidation mottling												
					B							moist
			10									saturated
grades with trace fine sand; red and black												
Stopped excavating at 12.0'. No signficant sidewall caving.			15									
			20									
			25									

The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary for a proper understanding of the nature of the subsurface material.

FIGURE 4H

Gordon Geotechnical Engineering, Inc.
4426 South Century Drive, Suite 100
Salt Lake City, Utah 84123

TEST PIT TP-9

Project Name: Proposed Bear Lake Towns
Project No.: 538-006-22
Location: 2300 Sweet Water Parkway, Garden City, Utah
Client: Regency Excavation
Excavating Method: Mini-Excavator
Date Excavated: 09-08-22
Elevation: ---
Water Level: 11.0' (09-08-22)
Remarks:

DESCRIPTION	GRAPHIC LOG	WATER LEVEL	DEPTH (FT.)	SAMPLE SYMBOL	SAMPLE TYPE	BLOWS/FT.	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	REMARKS
CLAYEY SILT, FILL with trace fine sand; plow-disturbed; dark brown (ML-FILL)												slightly moist "soft"
SILTY CLAY with some fine sand; brown (CL)			5		B		14.1		99.3			slightly moist "stiff"
grades with oxidation mottling												
grades with trace fine sand; red and black			10		B							saturated
Stopped excavating at 12.0'. No signficant sidewall caving.			15									
			20									
			25									

The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary for a proper understanding of the nature of the subsurface material.

FIGURE 4I

Gordon Geotechnical Engineering, Inc.
4426 South Century Drive, Suite 100
Salt Lake City, Utah 84123

TEST PIT TP-10

Project Name: Proposed Bear Lake Towns
Project No.: 538-006-22
Location: 2300 Sweet Water Parkway, Garden City, Utah
Client: Regency Excavation
Excavating Method: Mini-Excavator
Date Excavated: 09-08-22
Elevation: ---
Water Level: 12.0' (09-08-22)
Remarks:

DESCRIPTION	DEPTH (FT.)	SAMPLE TYPE	REMARKS
CLAYEY SILT, FILL with trace fine sand; plow-disturbed; dark brown (ML-FILL)			slightly moist "soft"
CLAYEY SILT with some fine sand; light brown (CL)			slightly moist "soff"
		B	
	5		moist
grades with oxidation mottling			
	10		"medium stiff"
		B	moist/sat
Stopped excavating at 12.0'. No signficant sidewall caving.	15		
	20		
	25		

The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary for a proper understanding of the nature of the subsurface material.

FIGURE 4J

Gordon Geotechnical Engineering, Inc.
4426 South Century Drive, Suite 100
Salt Lake City, Utah 84123

TEST PIT TP-11

Project Name: Proposed Bear Lake Towns
Project No.: 538-006-22
Location: 2300 Sweet Water Parkway, Garden City, Utah
Client: Regency Excavation
Excavating Method: Mini-Excavator
Date Excavated: 09-08-22
Elevation: ---
Water Level: 11.0' (09-08-22), 9.3' (09-08-22 - stabilized), 6.9' (09-27-22)
Remarks:

DESCRIPTION	DEPTH (FT.)	SAMPLE SYMBOL	SAMPLE TYPE	BLOWS/FT.	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	REMARKS
CLAYEY SILT, FILL with trace fine sand; plow-disturbed; dark brown (ML-FILL)										slightly moist "soft"
SILTY CLAY with some fine sand; light brown (CL)										slightly moist "stiff"
			TW		12.9	98				
grades with oxidation mottling	5									
	10		B							
grades with trace fine sand; reddish-brown										saturated
grades brown	15									
Stopped excavating at 15.0'. No signficant sidewall caving. Installed slotted PVC pipe to 15.0'.	20									
	25									

The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary for a proper understanding of the nature of the subsurface material.

FIGURE 4K

Gordon Geotechnical Engineering, Inc.
4426 South Century Drive, Suite 100
Salt Lake City, Utah 84123

TEST PIT TP-12

Project Name: Proposed Bear Lake Towns
Project No.: 538-006-22
Location: 2300 Sweet Water Parkway, Garden City, Utah
Client: Regency Excavation
Excavating Method: Mini-Excavator
Date Excavated: 09-08-22
Elevation: ---
Water Level: 11.0' (09-08-22)
Remarks:

DESCRIPTION	GRAPHIC LOG	WATER LEVEL	DEPTH (FT.)	SAMPLE SYMBOL	SAMPLE TYPE	BLOWS/FT.	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	REMARKS
CLAYEY SILT, FILL with trace fine sand; plow-disturbed; dark brown (ML-FILL)												slightly moist "soft"
SILTY CLAY with some fine sand; light brown (CL)												slightly moist "stiff"
			5									
					B							"medium stiff"
grades with oxidation mottling												
			10									
		▽										saturated "soft"
					B							
Stopped excavating at 12.0'. No signficant sidewall caving.			15									
			20									
			25									

The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary for a proper understanding of the nature of the subsurface material.

FIGURE 4L

Gordon Geotechnical Engineering, Inc.
4426 South Century Drive, Suite 100
Salt Lake City, Utah 84123

TEST PIT TP-13

Project Name: Proposed Bear Lake Towns
Project No.: 538-006-22
Location: 2300 Sweet Water Parkway, Garden City, Utah
Client: Regency Excavation
Excavating Method: Mini-Excavator
Date Excavated: 09-08-22
Elevation: ---
Water Level: 9.0' (09-08-22),7.0' (09-08-22 - stabilized), 7.3' (09-27-22)
Remarks:

DESCRIPTION	GRAPHIC LOG	WATER LEVEL	DEPTH (FT.)	SAMPLE SYMBOL	SAMPLE TYPE	BLOWS/FT.	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	REMARKS
CLAYEY SILT, FILL with trace fine sand; plow-disturbed; dark brown (ML-FILL)												slightly moist "soft"
SILTY CLAY with some fine sand; light brown (CL)												slightly moist "stiff"
			5		TW							
grades with oxidation mottling		▼										saturated
			10		B							
Stopped excavating at 15.0'. No signficant sidewall caving. Installed slotted PVC pipe to 15.0'.			15 20 25									

The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary for a proper understanding of the nature of the subsurface material.

FIGURE 4M

Gordon Geotechnical Engineering, Inc.
4426 South Century Drive, Suite 100
Salt Lake City, Utah 84123

TEST PIT TP-14

Project Name: Proposed Bear Lake Towns
Project No.: 538-006-22
Location: 2300 Sweet Water Parkway, Garden City, Utah
Client: Regency Excavation
Excavating Method: Mini-Excavator
Date Excavated: 09-08-22
Elevation: ---
Water Level: 10.0' (09-08-22)
Remarks:

DESCRIPTION	GRAPHIC LOG	WATER LEVEL	DEPTH (FT.)	SAMPLE SYMBOL	SAMPLE TYPE	BLOWS/FT.	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	REMARKS
CLAYEY SILT, FILL with trace fine sand; plow-disturbed; dark brown (ML-FILL)												slightly moist "soft"
SILTY CLAY with some fine sand; light brown (CL)			5									slightly moist "soft"
grades with oxidation mottling					B							moist "medium stiff"
			10									saturated
Stopped excavating at 12.0'. No signficant sidewall caving.			15									
			20									
			25									

The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary for a proper understanding of the nature of the subsurface material.

FIGURE 4N

GORDON GEOTECHNICAL ENGINEERING, INC.

UNIFIED SOIL CLASSIFICATION SYSTEM

FIELD IDENTIFICATION PROCEDURES				GRAPH SYMBOL	LETTER SYMBOL [1]	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS More than half of material is larger than No. 200 sieve size. [2] (The No. 200 sieve size is about the smallest particle visible to the naked eye)	GRAVELS More than half of coarse fraction is larger than No. 4 sieve size. (For visual classifications, the 1/4" size may be used as equivalent to the No. 4 sieve size.)	CLEAN GRAVELS (Little or no fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes.		GW	Well graded gravels, gravel-sand mixtures, little or no fines.
			Predominantly one size or a range of sizes with some intermediate sizes missing.		GP	Poorly graded gravels, gravel-sand mixtures, little or no fines.
		GRAVELS WITH FINES (Appreciable amount of fines)	Non-plastic fines (for identification procedures see ML below).		GM	Silty gravels, poorly graded gravel-sand-silt mixtures.
			Plastic fines (for identification procedures see CL below).		GC	Clayey gravels, poorly graded gravel-sand-clay mixtures.
	SANDS More than half of coarse fraction is smaller than No. 4 sieve size. (For visual classifications, the 1/4" size may be used as equivalent to the No. 4 sieve size.)	CLEAN SANDS (Little or no fines)	Wide range in grain sizes and substantial amounts of all intermediate particle sizes.		SW	Well graded sands, gravelly sands, little or no fines.
			Predominantly one size or a range of sizes with some intermediate sizes missing.		SP	Poorly graded sands, gravelly sands, little or no fines.
		SANDS WITH FINES (Appreciable amount of fines)	Non-plastic fines (for identification procedures see ML below).		SM	Silty sands, poorly graded sand-silt mixtures.
			Plastic fines (for identification procedures see CL below).		SC	Clayey sands, poorly graded sand-clay mixtures.
FINE GRAINED SOILS More than half of material is smaller than No. 200 sieve size. (The No. 200 sieve size is about the smallest particle visible to the naked eye)	IDENTIFICATION PROCEDURES ON FRACTION SMALLER THAN No. 40 SIEVE SIZE					
		DRY STRENGTH (CRUSHING CHARACTERISTICS)	DILATANCY (REACTION TO SHAKING)	TOUGHNESS (CONSISTENCY NEAR PLASTIC LIMIT)		
	SILTS AND CLAYS Liquid limit less than 50	None to slight	Quick to slow	None	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sand with slight plasticity.
		Medium to high	None to very slow	Medium	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
		Slight to medium	Slow	Slight	OL	Organic silts and organic silt-clays of low plasticity.
	SILTS AND CLAYS Liquid limit greater than 50	Slight to medium	Slow to none	Slight to medium	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
		High to very high	None	High	CH	Inorganic clays of high plasticity, fat clays.
		Medium to high	None to very slow	Slight to medium	OH	Organic clays of medium to high plasticity.
HIGHLY ORGANIC SOILS		Readily identified by color, odor, spongy feel and frequently by fibrous texture.			Pt	Peat and other highly organic soils.

[1] Boundary classifications: —Soils possessing characteristics of two groups are designated by combinations of group symbols. For example GW—GC, well graded gravel—sand mixture with clay binder.
[2] All sieve sizes on this chart are U.S. standard.

GENERAL NOTES

1. In general, Unified Soil Classification Designations presented on the logs were evaluated by visual methods only. There rore, actual designations (based on laboratory testing) may differ.
2. Lines seperating strata on the logs represent approximate boundaries only Actual transitions may be gradual.
3. Logs represent general soil conditions observed at teh point of exploration onthe date indicated.
4. No warranty is provided as to the continuity of soil conditions between individual sample locations.

FINE - GRAINED SOIL

CONSISTENCY	SPT (blows/ft)	TORVANE UNDRAINED SHEAR STRENGTH (tsf)	POCKET PENETROMETER UNCONFINED COMPRESSIVE STRENGTH (tsf)	FIELD TEST
Very Soft	<2	<0.125	<0.25	Easily penetrated several inches by Thumb. Squeezes through fingers.
Soft	2 - 4	0.125 - 0.25	0.25 - 0.5	Easily penetrated 1 " by Thumb . Molded by light finger pressure.
Medium Stiff	4 - 8	0.25 - 0.5	0.5 - 1.0	Penetrated over 1/2 " by Thumb with moerate effort. Molded by strong finger pressure.
Stiff	8 - 15	0.5 - 1.0	1.0 - 2.0	Indented about 1/2 " by Thumb but penetrated only with great effort
Very Stiff	15 - 30	1.0 - 2.0	2.0 - 4.0	Readily indented by Thumbnail
Hard	>30	>2.0	>4.0	Indented with difficulty by Thumbnail

LOG KEY SYMBOLS

- Bulk / Bag Sample
- Standard Penetration Split Spoon Sampler
- Rock Core
- Water Level
- Thin Wall
- No Recovery
- 3-3/4" ID D&M Sampler
- 3" ID D&M Sampler
- California Sampler

COARSE -GRAINDE SOIL

APPERENT DENSITY	SPT (blows/ft)	RELATIVE DENSITY (%)	FIELD TEST
Very Loose	<4	0 - 15	Easily penetrated with 1/2 " reinforcing rod pushed by hand
Loose	4 - 10	15 - 35	Difficult to penetrated with 1/2 " reinforcing rod pushed by hand
Medium Dense	10 - 30	35 - 65	Easily penetrated a foot with 1/2 " reinforcing rod driven with 5-lb hammer
Dense	30 - 50	65 - 85	Difficult to penetrated a foot with 1/2 " reinforcing rod driven with 5-lb hammer
Very Dense	>50	85 - 100	Penetrated only a few inches with 1/2 " reinforcing rod driven with 5-lb hammer

STRATIFICATION

DESCRIPTION	THICKNESS
SEAM	1/16 - 1/2 "
LAYER	1/2 - 12 "

DESCRIPTION	THICKNESS
Occasional	One or less per foot of thickness
Frequent	More than on per foot of thichness

CEMENTATION

DESCRIPTION	DESCRIPTION
Weakely	Crumbles or breaks with handling of slight finger pressure
Moderately	Crumbles or breaks with considerable finger pressure
Strongly	Will not crumbles or breaks with finger pressure

MODIFIERS

DESCRIPTION	%
Trace	<5
Some	5 - 12
With	>12

MOISTURE CONTENT

DESCRIPTION	FIELD TEST
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible water, usually soil below Water Table

FIGURE 5

REGENCY EXCAVTION
JOB NO. 538-006-22

GORDON GEOTECHNICAL ENGINEERING, INC.

#1 Looking north.

#2 Looking east.

#3 Looking south.

#4 Looking west.

Locations and direction, see Figure 2, Area Map

FIGURE 6
PHOTOGRAPHS