AGEC
Applied GeoTech

GEOTECHNICAL INVESTIGATION

KENADI COVE PHASE 2

12000 SOUTH REDWOOD ROAD

RIVERTON, UTAH

PREPARED FOR:

NEWMAN CONSTRUCTION
13331 SOUTH 1700 WEST
RIVERTON, UTAH 84065

ATTENTION: KASEY JACKSON

O.K.

PROJECT NO. 1140272 MAY 1, 2014

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EXECUTIVE SUMMARY

1. Subsurface soils encountered at the site consist of approximately 10 inches of topsoil in Test Pit TP-1 and approximately 1½ to 2 feet of fill in Test Pits TP-2 and TP-3 overlying lean clay. The lean clay extends the full depth investigated in Test Pit TP-1 and to depths of approximately 12 and 7 feet below the ground surface in Test Pits TP-2 and TP-3, respectively. Sand was encountered below the clay in Test Pit TP-2 extending to the full depth of the test pit. Interlayered sand and clay was encountered below the lean clay in Test Pit TP-3 extending to the full depth of this test pit. The maximum depth investigated was approximately 13½ feet below the ground surface.

2. No subsurface water was encountered in the test pits at the time of excavating to the maximum depth investigated.

3. The proposed residences may be supported on spread footings bearing on the undisturbed natural soil or on compacted structural fill extending down to the undisturbed natural soil. Spread footings bearing on the undisturbed natural soil or on compacted structural fill may be designed using an allowable net bearing pressure of 1,500 pounds per square foot. Footings bearing on at least 2 feet of compacted structural fill may be designed for a net allowable bearing pressure of 2,500 pounds per square foot.

4. The upper soil consists of clay. The clay may result in construction difficulties which may become worse when the upper soil is very moist to wet, such as in the winter and spring or at times of prolonged rainfall. Placement of 1 to 2 feet of granular fill above the clay will provide limited access for construction equipment when the subgrade is very moist to wet.

5. Geotechnical information related to foundations, subgrade preparation, pavement design and materials is included in the report.

SCOPE

This report presents the results of a geotechnical investigation for the proposed Kenadi Cove Phase 2 subdivision to be located at approximately 12000 South Redwood Road in Riverton, Utah. The report presents the subsurface conditions encountered, laboratory test results and recommendations for foundations and pavement. The study was conducted in general accordance with our proposal dated April 4, 2014.

Field exploration was conducted to obtain information on the subsurface conditions. Samples obtained from the field investigation were tested in the laboratory to determine physical and engineering characteristics of the on-site soil. Information obtained from the field and laboratory was used to define conditions at the site for our engineering analysis and to develop recommendations for the proposed foundations and pavement.

This report has been prepared to summarize the data obtained during the study and to present our conclusions and recommendations based on the proposed construction and the subsurface conditions encountered. Design parameters and a discussion of geotechnical engineering considerations related to construction are included in the report.

SITE CONDITIONS

The site generally consists of vacant land. There is a single-story wood-frame building in the east/central portion of the property. There are occasional fill piles and some debris scattered across the surface of the property.

The surface of the property is relatively flat with a gentle slope down to the northeast.

Vegetation at the site consists of short grass and scattered weeds with occasional trees.

The site is bordered on the south by the first phase of the subdivision where an asphalt-paved road and subdivision improvements have been constructed, but the building lots are generally vacant. The site is bordered on the west by a field that is part of an LDS Church property and vacant land to the west of the north part of the site. There is residential development to the north and east of the site.

FIELD STUDY

The field study was conducted on April 15, 2014. Three test pits were excavated at the approximate locations indicated on Figure 1 using a rubber-tired backhoe. The test pits were logged and soil samples obtained by an engineer from AGEC. Logs of the subsurface conditions encountered in the test pits are graphically shown on Figure 2.

The test pits were backfilled without significant compaction. The backfill in the test pits should be properly compacted where it will support proposed buildings, floor slabs, pavement or other improvements.

SUBSURFACE CONDITIONS

Subsurface soils encountered at the site consist of approximately 10 inches of topsoil in Test Pit TP-1 and approximately 1½ to 2 feet of fill in Test Pits TP-2 and TP-3 overlying lean clay. The lean clay extends the full depth investigated in Test Pit TP-1 and to depths of approximately 12 and 7 feet below the ground surface in Test Pits TP-2 and TP-3, respectively. Sand was encountered below the clay in Test Pit TP-2 extending to the full depth of the test pit. Interlayered sand and clay was encountered below the lean clay in Test Pit TP-3 extending to the full depth of this test pit. The maximum depth investigated was approximately 13½ feet below the ground surface.

A description of the various soils encountered in the test pits follows:

Fill - The fill consists of sandy lean clay with gravel. It is slightly moist to moist, brown and contains roots and wood debris in Test Pit TP-3.

Topsoil - The topsoil consists of sandy lean clay. It is slightly moist, dark brown and contains roots.

Lean Clay - The clay contains small to moderate amounts of sand and occasional silt layers. The clay is stiff to very stiff, slightly moist to moist and brown.

Laboratory tests conducted on samples of the clay indicate natural moisture contents range from 18 to 24 percent and natural dry densities range from 99 to 104 pounds per cubic foot (pcf).

Consolidation tests conducted on samples of the clay indicate that the soil will compress a small to moderate amount with the addition of light to moderate loads. Results of the consolidation tests are presented on Figure 3 and 4.

Lean Clay and Silty Sand - The clay and sand are interlayered. The interlayered soil is medium dense, stiff, moist to very moist and brown.

Poorly-Graded Sand - The sand is medium dense, slightly moist and gray to brown.

Results of the laboratory tests are summarized on Table I and are included on the logs of test pits.

SUBSURFACE WATER

No subsurface water was encountered in the test pits at the time of excavation to the maximum depth investigated, approximately 13½ feet below the ground surface.

PROPOSED CONSTRUCTION

We understand that the site will be subdivided for approximately 11 residential lots. We anticipate that residences will consist of one to two-story, wood frame structures with basements. We have assumed building loads consisting of wall loads up to 3 kips per lineal foot and column loads up to 20 kips.

Roads are planned to extend through the subdivision. We have assumed a traffic consisting of 1,000 cars per day, 1 delivery truck per day and 2 garbage trucks per week.

If building loads or traffic is significantly different from what is described above, we should be notified so that we can re-evaluate the recommendations given.

RECOMMENDATIONS

Based on the subsurface conditions encountered, laboratory test results, and the proposed construction, the following recommendations are given:

A. Site Grading

Final site grading plans were not available at the time of our investigation. We anticipate that there will be less than 3 feet of grade change.

1. Subgrade Preparation

Prior to placing grading fill or base course, the topsoil, organic material, unsuitable fill and other deleterious material should be removed.

Access difficulties can be expected when the upper soil is very moist to wet. Increased difficulties can be expected during the winter or spring or after periods of rainfall. Care should be taken not to disturb the natural soil in proposed building and pavement areas. Placement of 1 to 2 feet of granular fill may be needed for limited access of moderately loaded rubber-tired equipment above very moist to wet clay.

2. Excavation

We anticipate that excavation at the site can be accomplished with typical excavation equipment.

3. Materials

Listed below are materials recommended for imported structural fill.

Fill to Support	Recommendation
Footings	Non-expansive granular soil Passing the No. 200 Sieve <35% Liquid Limit < 30% Maximum size 4 inches
Floor Slabs (Upper 4 inches)	Sand and/or Gravel Passing the No. 200 Sieve < 5% Maximum size 2 inches
Slab Support	Non-expansive granular soil Passing the No. 200 Sieve < 50% Liquid Limit < 30% Maximum size 6 inches

The natural soil and existing fill generally consist of lean clay. The clay is not considered suitable for use as fill below proposed buildings but may be considered for use as fill in proposed pavement areas, as utility trench backfill and site grading fill outside of building areas, if the organics, debris and other deleterious materials are removed or it may be used in landscaping areas. The moisture content of the soil is generally near or above optimum and may require moisture conditioning (wetting or drying) prior to use as fill. Drying of the soil may not be practical during cold or wet times of the year.

4. Compaction

Compaction of materials placed at the site should equal or exceed the minimum densities as indicated below when compared to the maximum dry density as determined by ASTM D-1557.

Fill to Support	Compaction
Foundations	≥ 95%
Concrete Flatwork and Pavement	≥ 90%
Landscaping	≥ 85%
Retaining Wall Backfill	85 to 90%

To facilitate the compaction process, the fill should be compacted at a moisture content within 2 percent of the optimum moisture content.

The base course should be compacted to at least 95 percent of the maximum dry density as determined by ASTM D-1557.

Fill and pavement materials placed for the project should be frequently tested for compaction.

5. Drainage

The ground surface surrounding the proposed buildings should be sloped away from the buildings in all directions. Roof down spouts and drains should discharge beyond the limits of backfill.

The collection and diversion of drainage away from the pavement surface is important to the satisfactory performance of the pavement section. Proper drainage should be provided.

B. Foundations

1. Bearing Material

With the proposed construction and the subsurface conditions encountered, the residences may be supported on spread footings bearing on the undisturbed natural soil, or on compacted structural fill extending down to the undisturbed natural soil. Structural fill placed below footings should extend out away from the footings at least a distance equal to the depth of fill beneath footings.

Topsoil, unsuitable fill and other deleterious material should be removed from below proposed building areas.

2. Bearing Pressure

Footings bearing on the undisturbed natural soil may be designed for a net allowable bearing pressure of 1,500 psf. Footings bearing on at least 2 feet of compacted structural fill may be designed for a net allowable bearing pressure of 2,500 psf. Footings should have a minimum width of 18 inches and a minimum depth of embedment of 10 inches.

3. Temporary Loading Conditions

The allowable bearing pressure may be increased by one-half for temporary loading conditions such as wind or seismic loads.

4. Settlement

We estimate that total and differential settlement will be on the order of 1 inch and ¾ inch, respectively, for footings designed as indicated above.

5. Frost Depth

Exterior footings and footings beneath unheated areas should be placed at least 30 inches below grade for frost protection.

6. Foundation Base

The base of footing excavations should be cleared of loose or deleterious material prior to structural fill or concrete placement.

7. Construction Observation

A representative of the geotechnical engineer should observe footing excavations prior to structural fill or concrete placement.

C. Concrete Slab-on-Grade

1. Slab Support

Concrete slabs may be supported on the undisturbed natural soil or on compacted structural fill extending down to the undisturbed natural soil.

Topsoil, unsuitable fill, organics and other deleterious materials should be removed from below proposed floor slabs.

2. Underslab Sand and/or Gravel

A 4-inch layer of free draining sand and/or gravel (less than 5 percent passing the No. 200 sieve) should be placed below the concrete slabs.

D. Lateral Earth Pressures

1. Lateral Resistance for Footings

Lateral resistance for spread footings placed on the natural soil or on compacted structural fill is controlled by sliding resistance between the footing and the foundation soils. A friction value of 0.35 may be used in design for ultimate lateral resistance.

2. Subgrade Walls and Retaining Structures

The following equivalent fluid weights are given for design of subgrade walls and retaining structures. The active condition is where the wall moves away from the soil. The passive condition is where the wall moves into the soil and the at-rest condition is where the wall does not move. The values listed below assume a horizontal surface adjacent the wall.

Soil Type	Active	At-Rest	Passive
Clay and Silt	50 pcf	65 pcf	250 pcf
Sand and Gravel	40 pcf	55 pcf	300 pcf

3. Seismic Conditions

Under seismic conditions, the equivalent fluid weight should be increased by 34 pcf for the active condition, increased by 19 pcf for the at-rest condition and decreased by 34 pcf for the passive condition. This assumes a peak horizontal ground acceleration of 0.55g for a 2 percent probability of exceedance in a 50-year period (IBC 2012).

4. Safety Factors

The values recommended above for active and passive pressures assume mobilization of the soil to achieve the assumed soil strength. Conventional safety factors used for structural analysis for such items as overturning and sliding resistance should be used in design.

E. Seismicity, Faulting and Liquefaction

1. Seismicity

Listed below is a summary of the site parameters for the 2012 International Building Code.

a.	Site Class	D
b.	Short Period Spectral Response Acceleration, S_S	1.31g
c.	One Second Period Spectral Response Acceleration, S_1	0.44g

2. Faulting

There are no mapped active faults extending through the site. The closest mapped fault considered to be active is the Wasatch fault located approximately 5½ miles east of the site (Salt Lake County, 2002).

3. Liquefaction

The site is located in an area mapped as having a "very low"potential for liquefaction (Salt Lake County, 2002). A "very low" potential for liquefaction represents a less than 5 percent probability that liquefaction will occur during a 100 year time period. Based on the subsurface conditions encountered to the depth investigated and the liquefaction potential hazard map, liquefaction is not considered to be a significant hazard for the site.

granular fill with a CBR of at least 20 percent is provided below the base course.

3. Pavement Materials and Construction

   a. Flexible Pavement (Asphaltic Concrete)

   The pavement materials should meet the Utah Department of Transportation specifications for gradation and quality. Other materials may be considered for use in the pavement section. The use of other materials may result in the need for different pavement material thicknesses.

   b. Rigid Pavement (Portland Cement Concrete)

   The pavement thickness indicated assumes that the pavement will have aggregate interlock joints and that a concrete shoulder or curb will be provided.

   The pavement materials should meet the Utah Department of Transportation Specifications. The pavement thickness indicated above assumes that the concrete will have a 28-day compressive strength of 4,000 pounds per square inch. Concrete should be air-entrained with approximately 6 percent air. Maximum allowable slump will depend on the method of placement but should not exceed 4 inches.

REFERENCES CITED

International Building Code, 2012; International Code Council, Inc., Falls Church, Virginia.

Salt Lake County, 2002; Surface Rupture and Liquefaction Potential Special Study Areas Map, Salt Lake County, Utah, adopted March 31, 1989, updated March 2002, Salt Lake County Public Works - Planning Division, 2001 South State Street, Salt Lake City, Utah.