Appendix E1. Update of the Geotechnical Evaluation of Marja Acres

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UPDATE OF THE GEOTECHNICAL UPDATE
FOR MARJA ACRES
APN 207-101-35 & -37, 1910 EL CAMINO REAL
CARLSBAD, SAN DIEGO COUNTY, CALIFORNIA

FOR

NEW URBAN WEST, INC.
16935 WEST BERNARDO DRIVE, SUITE 260
SAN DIEGO, CALIFORNIA 92127

W.O. 6971-A1-SC JUNE 11, 2018

GeoSoils, Inc.

Geotechnical • Geologic • Coastal • Environmental

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June 11, 2018

W.O. 6971-A1-SC

New Urban West, Inc.
16935 West Bernardo Drive, Suite 260
San Diego, California 92127

Attention: Mr. Jason Han

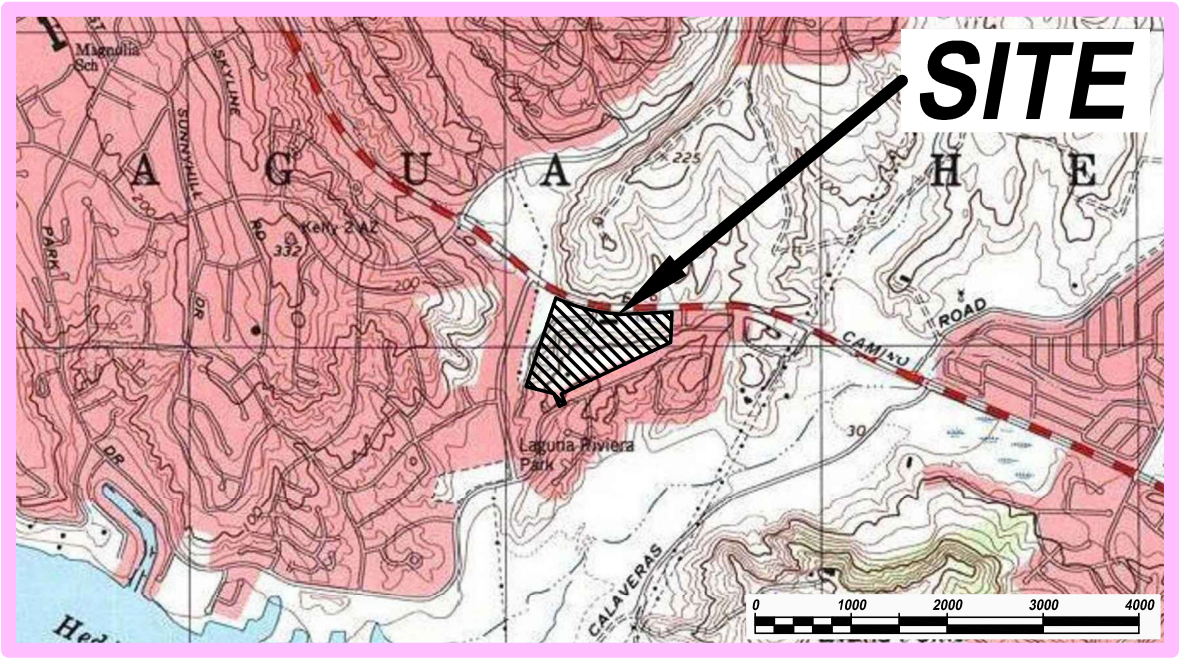
Subject: Update of the Geotechnical Evaluation for Marja Acres, APN 207-101-35 & -37, 1910 El Camino Real, Carlsbad, San Diego County, California

Attention: Mr. Jason Han

In accordance with your request and authorization, GeoSoils, Inc. (GSI) has prepared the following update of geotechnical work for the site, with respect to the governing building code (2016 edition of the California Building Code [{2016 CBC}, California Building Standards Commission {CBSC}, 2016a]) for this project, the preliminary grading plans prepared by Hunsaker & Associates, San Diego, Inc. ([H&A], undated), and the body of existing geotechnical work (see Appendix A). GSI's scope of services included a review of the referenced reports/plans, engineering and geologic analysis, and preparation of this update report. Unless specifically superceded in the text of this report, the conclusions and recommendations presented in the previous reports by GeoSoils, Inc. (GSI, 2016, 2018) are considered valid and applicable with respect to the subject site, and should be properly incorporated into the design and construction phases of site development.

SITE DESCRIPTION/PROPOSED DEVELOPMENT

The site consists of an irregular shaped, approximately 20-acre property located on the west side of El Camino Real, and south of Kelly Drive, in the City of Carlsbad, San Diego County, California (see Figure 1, Site Location Map). Topographically, the site consists of a relatively flat lying upper "mesa" area within the western portion of the site. Along the eastern edge of the mesa, moderate slopes descend eastward toward a relatively flat lying "bottom," or alluviated area, located between the slope and the existing alignment of El Camino Real. Site drainage generally appears to be directed from the mesa onto offsite areas to the north, and eastward into the "bottom" area. Runoff within the bottom area appears to ultimately be directed via sheet flow and a small channel, offsite to the north. Previous grading operations appear to have occurred within the bottom area, along the western edge of El Camino Real, and at the southernmost portion of the site, where



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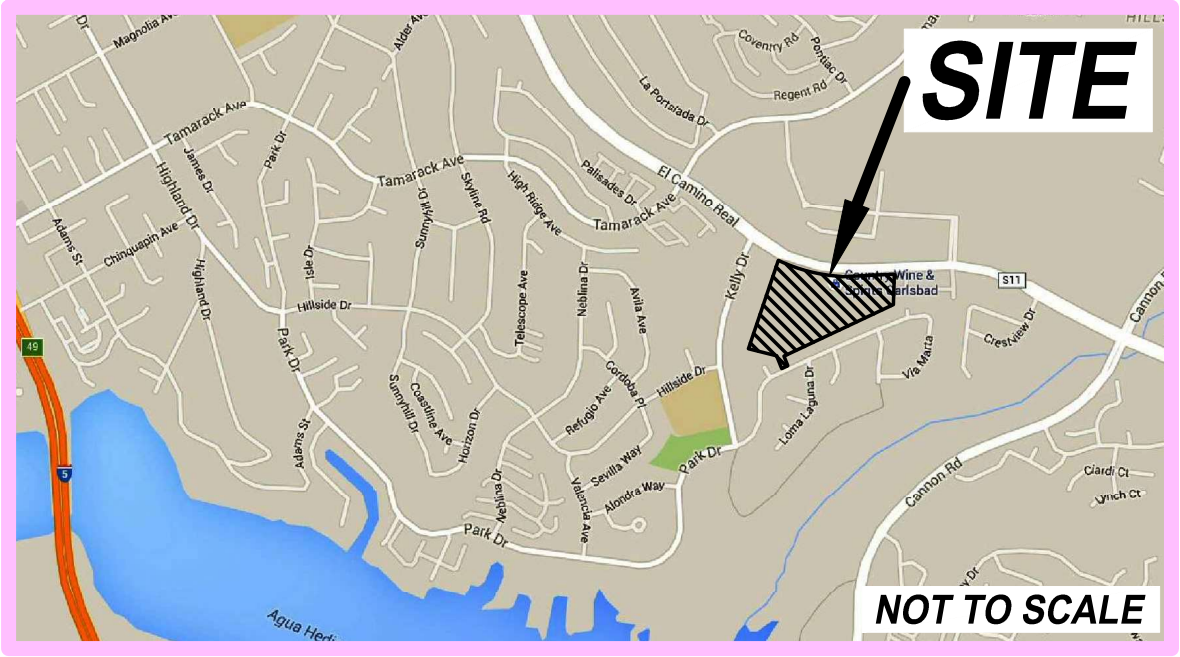

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SITE LOCATION MAP

Figure 1

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existing fill appears to have been placed as part of an existing onsite, and adjacent, offsite residential development. Elevations range from approximately 110 feet above Mean Sea Level (MSL) on the mesa, down to approximately 46 feet MSL, within the "bottom" area, at the northeast corner of the site, for a total relief on the order of ±64 feet. Existing improvements to the site consist of a single-story commercial building and smaller outbuildings within the bottom area, and a single-family residential structure, sheds, and storage containers within the mesa. A communication facility (antennas) also appears to be located along the eastern edge of the mesa. Nursery facilities are also located within the northern and southern ends of the bottom area.

As indicated on the "preliminary site grading plan, prepared by Howes Weiler & Associates (HWA, 2018), the site will be prepared for the construction of a mixed use residential/commercial project. Cut and fill grading techniques are anticipated in order to bring the site to the desired grades. A review of the preliminary grading plan, indicates maximum cut and fill thicknesses, ranging up to approximately 30 to 20 feet, or less, respectively. Graded slopes are anticipated up to heights of approximately 25 feet at gradients of 2:1 (horizontal:vertical [h:v]) or flatter. Site walls shown on HWA (2018) appears to be a mix of conventional concrete masonry unit (CMU) and mechanically stabilized earth (MSE) walls ranging up to about 19 feet in height. Underground and street improvements are anticipated, along with bioretention basins and other storm water BMP's. Proposed site development is shown on the Geotechnical Map, included herein as Plates 1 through 3. Plates 1 through 3 which uses HWA (2018) as a base.

GSI anticipates that the construction would consist of masonry block, and/or wood frames with typical foundations and slab-on-grade ground floors. Building loads are assumed to be typical for this type of construction. Sewage disposal is anticipated to be connected into the regional, municipal system. Storm water may be treated onsite prior to its delivery into the municipal system.

PREVIOUS WORK

A preliminary geotechnical evaluation ofteh site was completed by GSI in May of 2016 (GSI, 2016). Site-specific field studies included the excavation of three (3) exploratory borings with a hollow stem auger drill rig, and ten (10) exploratory test pits with a rubber tire backhoe. Soil samples were collected for laboratory testing, with engineering analysis and geotechnical recommendations summarized in GSI (2016).

In 2018, an addendum to the geotechnical evaluation was prepared for the site, regarding the presence of landslides, and anticipated slope performance.

Based upon the field exploration, geologic, and geotechnical engineering analysis, performed in preparation of GSI (2016, 2018), the most significant elements of the previous studies are summarized below:

- A review of conceptual plans by SWC (2015), indicate that the site will be prepared for the construction of a mixed use project consisting of commercial buildings along El Camino Real, and residential units within the upper elevations of the site, with associated underground utilities, and other typical residential improvements. The buildings are anticipated to be supported by perimeter and isolated footing foundation systems. Or review of HWA (2018) indicates that this is still the general development concept.

- The project area is primarily underlain with a surficial deposits of undocumented fill, colluvium (topsoil), and alluvium, which is underlain by formational deposits of Quaternary older alluvium and Eocene-age sedimentary bedrock. The general distribution of geologic units onsite is shown on the Geotechnical Map (Plates 1 through 3) included in this report.

- The regional groundwater table currently occurs at a depth of approximately 14 to 17 feet below existing surface grades across the lower portion of the site (elevation of approximately 31.5 feet to 35 feet Mean Sea Level [MSL]) (GSI, 2016). Historically, groundwater levels appear to generally be moderated by the adjacent Agua Hedionda Lagoon. Provided that the recommendations contained in this report are followed, regional groundwater is not expected to be a major factor in development of the site, but will need to be considered during planning and construction. Deep utilities, if planned, may encounter groundwater.

- Based on the presence of alluvium, and a relatively shallow groundwater table, an analysis of liquefaction and seismic settlement was performed. Our analyses, performed in preparation of GSI (2016) indicate that the alluvial soils are generally not susceptible to surface deformations from liquefaction, and seismic settlement is anticipated to be within tolerable limits for a typical foundation system. The potential for the site to experience surface manifestation of liquefaction (sand boils, injection dikes, etc.), is considered low; however, this potential would increase around manholes or utility risers.

- Alluvium was also evaluated for hydrocollaspe potential. Our evaluation indicated that the potential for adverse settlement due to hydrocollaspe is low, provided that the recommended mitigative earthwork is incorporated into the design and construction oft eh project.

- Representative soil samples were evaluated as ranging from very low to highly expansive (Expansion index [E.I.] range of 17 to 128). As such, some onsite soils are considered detrimentally expansive, as defined in Section 1803.5.3 of the 2016 California Building Code ([2016 CBC], California Building Standards Commission [CBSC], 2016), and will require special design. Soil expansivity should be re-evaluated at the conclusion of grading and provide updated data for final foundation design.

- A representative sample of site soil was evaluated for corrosion potential. Test results indicate a “not applicable” sulfate exposure to concrete (per ACI 318-14), a slightly elevated chloride level, alkaline pH, and a severely corrosive environment to buried metal, when saturated. Consultation from a qualified corrosion engineer may be obtained based on the level of corrosion protection requirements by the project architect and structural engineer.

- Undocumented fill, surficial deposits of colluvium (topsoil), and near surface deposits of alluvium, are not considered suitable for the support of settlement-sensitive improvements or engineered fill in their existing state. Thus, these earth materials should be removed, moisture conditioned, and recompacted. Prior to placement of fill, the exposed removal bottom should be scarified, moisture conditions, and compacted to at least 90 percent relative compaction.

- It should be noted that the 2016 CBC (CBSC, 2016) indicates that remedial grading be performed across all areas under the purview of the grading permit, not just within the influence of the proposed residential structures. Relatively deep removals may also necessitate a special zone of consideration on perimeter/confining areas. This zone would be approximately equal to the depth of removals, if removals cannot be performed onsite and/or offsite. Thus, any settlement-sensitive improvements (walls, flatwork, etc.), constructed within this zone, may require deepened foundations, reinforcements, etc., or will retain some potential for settlement and associated distress. This will require proper disclosure to all interested/affected parties, should this condition exist at the conclusion of site grading.

- Support of the new structures should be provided entirely by compacted fill. Due to the potential differential settlements and soil expansion potential evaluated herein, a properly designed concrete slab on grade foundation system may be utilized, based on the available data, and assuming the recommended remedial grading. All foundations should be designed for expansive soil conditions, as warranted. Foundations underlain with up to 30 feet of compacted fill over formation should be designed to accommodate at least 1 inch of static differential settlement in a 40-foot span, without exhibiting distress to the superstructure. Thicker fill, or compacted fill placed on alluvial soil left in place, will require more onerous foundation design, and/or waiting periods prior to construction, as recommended herein.

- Based on the current body of work (GSI, 2016), slope areas are anticipated to perform adequately (i.e., considered stable), assuming proper construction and periodic/regular maintenance, under the prevailing climate, and that grading and development impacts are mitigatable for at least 75 years, or the life of the structure(s). All slopes should be designed and constructed in accordance with the minimum requirements per the current governing Code, and the recommendations presented in GSI (2016), and this update.

- GSI's review indicates no known active faults are crossing the site, and the site is not located within an Alquist-Priolo Earthquake Fault Zone. The subject site is situated in a seismically active region. As is typical in southern California, the site may experience moderate to strong ground shaking should an earthquake occur on any of the regional active faults. The seismic acceleration values and design parameters provided herein should be utilized during the design of the proposed project.

- Adverse geologic structures that would preclude project feasibility were not encountered. However, the potentially liquefiable and compressible deposits of alluvium will require some mitigation during earthwork and/or specialized foundation design, as discussed herein.

- With respect to storm water infiltration system designs, undisturbed site soils and planned compacted fills are anticipated to belong within Hydrologic Soil Group D (no infiltration). Basins located within 10 feet of any structure or settlement/expansion sensitive improvement, will also need to be designed for no infiltration. It should be noted that the local groundwater table was evaluated to be as shallow as 14 feet below existing site grades. Infiltration is generally not feasible when the bottom of basins are located 10 feet, or less, from the water table.

GEOTECHNICAL UPDATE

Geotechnical recommendations presented in GSI (2016) were based on the previous, 2013 edition of the California Building Code (CBSC, 2013), and a previous version (SWA, 2015) of the current development plan (HWA, 2018). Based on our review, the following updated recommendations are provided. Unless specifically superceded herein, the conclusions and recommendations presented in GSI (2016) remain valid and applicable.

LABORATORY TESTING

General

Laboratory tests were performed on representative onsite earth materials in order to evaluate their physical characteristics. The test procedures utilized and laboratory results obtained are presented below.

Direct Shear

In preparation of GSI (2018), a strain-controlled direct shear test was performed on a representative sample of sedimentary bedrock (formation), in general accordance with ASTM D 3080. The test results are summarized in the following table.

SAMPLE	PRIMARY		RESIDUAL (Ultimate)	
	COHESION (PSF)	FRICTION ANGLE (DEGREES)	COHESION (PSF)	FRICTION ANGLE (DEGREES)
Bedrock/Formation (Remolded)	325	30.8	204	29.1

Laboratory Standard

The maximum density and optimum moisture content was evaluated for the major soil type encountered in the borings, in general accordance with the laboratory standard, ASTM D 1557. The moisture-density relationships obtained for this soil are shown on the following table:

SAMPLE	SOIL TYPE	MAXIMUM DENSITY (PCF)	OPTIMUM MOISTURE CONTENT (%)
Bedrock/Formation	Clayey SAND (SC)	114.7	13.9

PRELIMINARY CONCLUSIONS AND RECOMMENDATIONS

Based on our current and previous site work, and geotechnical engineering analysis, it is our opinion that the site appears suitable for the proposed development from a geotechnical engineering and geologic viewpoint. Unless specifically superceded herein, the conclusions and recommendations presented in GSI (2016, 2018) are considered valid and applicable, and should be properly incorporated into the design and construction phases of site development.

EARTHWORK CONSTRUCTION RECOMMENDATIONS

General

All earthwork should conform to the guidelines presented in the 2016 CBC (CBSC, 2016), the requirements of the City, and the General Earthwork and Grading Guidelines presented in the text and Appendix D of GSI (2016), except where specifically superceded in the text of this report. Prior to earthwork, a GSI representative should be present at the preconstruction meeting to provide additional earthwork guidelines, if needed, and review the earthwork schedule. This office should be notified in advance of any fill placement, supplemental regrading of the site, or backfilling underground utility trenches and retaining walls after rough earthwork has been completed. This includes grading for pools, driveway approaches, driveways, and exterior hardscape.

During earthwork construction, all site preparation and the general grading procedures of the contractor should be observed and the fill selectively tested by a representative(s) of GSI. If unusual or unexpected conditions are exposed in the field, they should be reviewed by this office and, if warranted, modified and/or additional recommendations will be offered. All applicable requirements of local and national construction and general industry safety orders, the Occupational Safety and Health Act (OSHA), and the Construction Safety Act should be met. It is the onsite general contractor and individual subcontractors responsibility to provide a save working environment for our field staff who are onsite. GSI does not consult in the area of safety engineering.

Perimeter Conditions

It should be noted, that the 2016 CBC (CBSC, 2016) indicates that removals of unsuitable soils be performed across all areas under the purview of the grading permit, not just within the influence of the proposed buildings. Relatively deep removals may also necessitate a special zone of consideration, on perimeter/confining areas.

Any proposed improvement or future homeowner improvements such as walls, swimming pools, house additions, etc. that are located above a 1:1 (h:v) projection up from the outermost limit of the remedial grading excavations will require deepened foundations that extend below this plane. Other site improvements, such as pavements, constructed above the aforementioned plane would retain some potential for settlement and associated distress, which may require increased maintenance/repair or replacement. This potential should be disclosed to all interested/affected parties should remedial grading excavations be constrained by property lines.

FOUNDATION DESIGN AND CONSTRUCTION

General

Preliminary recommendations for foundation design and construction are provided in GSI (2016). These preliminary recommendations have been developed from our understanding of the currently planned site development, site observations, and engineering analyses. Foundation design should be re-evaluated at the conclusion of site grading/remedial earthwork for the as-graded soil conditions. Although not anticipated, revisions to these recommendations may be necessary. In the event that the information concerning the proposed development plan is not correct, or any changes in the design, location or loading conditions of the proposed residential structures are made, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and conclusions of this report are modified or approved in writing by this office.

The information and recommendations presented in this section are not meant to supercede design by the project structural engineer or civil engineer specializing in

structural design. Upon request, GSI could provide additional input/consultation regarding soil parameters, as related to foundation design. The foundation systems should be designed and constructed in accordance with guidelines presented in the 2016 CBC (CBSC, 2016a).

Foundations in Consideration of Expansive and Corrosive Soils

Laboratory testing completed in preparation of GSI (2016) indicates that the onsite soils exhibit an expansion index(E.I.) values ranging from about 17 (very low) to 128 (high), with a plasticity index (P.I.) evaluated between 30 and 47. As such, site soil meets the criteria of detrimentally expansive soils as defined in Section 1803.5.2 of the 2016 CBC. Foundation systems constructed within the influence of detrimentally expansive soils (i.e., E.I. > 20 and P.I. $\geq$ 15) will require specific design to resist expansive soil effects per Sections 1808.6.1 or 1808.6.2 of the 2016 CBC, and should be reviewed by the project structural engineer. These foundation types generally include mat slabs (WRI, 1996), or post-tension slab foundations (PTI; 2014, 2013, 2012). Recommendations for "PT" slab foundations are provided in GSI (2016).

Laboratory testing performed in preparation of GSI (2016) indicates that the tested sample of the onsite soil is alkaline with respect to soil acidity/alkalinity, is severely corrosive to exposed, buried metals when saturated, present a "not applicable" per ACI 318-14 for sulfate exposure to concrete, and chloride levels appear somewhat elevated, but below action levels (Caltrans, 2003). Reinforced concrete mix design for foundations, slab-on-grade floors, and pavements should minimally conform to "Exposure Class C1" in Table 4.2.1 of ACI 318-14, as concrete would likely be exposed to moisture. It should be noted that GSI does not consult in the field of corrosion engineering. The client and project architect should agree on the level of corrosion protection required for the project and seek consultation from a qualified corrosion consultant as warranted.

The foundation systems should be designed and constructed in accordance with guidelines presented in the 2016 CBC.

Foundation Settlement

When designing residential foundations for the existing soil conditions, the estimated settlement and angular distortion values that an individual structure could be subjected to should be evaluated by a qualified structural engineer. In addition, significant site improvements such as retaining walls, sound walls, spas, pools, or other settlement-sensitive improvements should be evaluated by a structural engineer given the site conditions and geotechnical parameters expressed in this report. The levels of angular distortion were evaluated on a 40-foot length assumed as the minimum dimension of buildings; if, from a structural standpoint, a decreased or increased length over which the differential settlement is assumed to occur is justified, this change should be incorporated into the design. This also applies to the other site improvements previously discussed.

A settlement analysis, including an analysis of improvements supported on alluvial soils left in place, and/or deep fills, is presented in GSI (2016).

RETAINING WALLS

General

Recommendations for the design and construction of conventional restrained, or cantilevered retaining walls is presented in GSI (2016). All retaining wall shall be designed and constructed in accordance with the 2016 edition of the CBC (CBSC, 2016a).

Mechanically Stabilized Earth (MSE) Walls

Based on our review, it is our understanding that proposed development includes the construction of several Mechanically Stabilized Earth, or MSE retaining walls, on the order of approximately 10 to 20 feet in height. Graded slopes, ranging on the order of up to about 15 feet in height, and at gradients of 2:1 (h:v) or flatter, appear to be planned above the wall(s).

The MSE retaining wall design parameters, provided herein, assume that either non-expansive soils (typically Class 2 permeable filter material or Class 3 aggregate base) or select soil import materials (up to and including an E.I. of < 20, a P.I. $\leq$15, and $\leq$20 percent passing the No. 200 sieve, and 100 percent 3-inch minus material), or suitable native soils meeting select criteria, are used to backfill any MSE retaining walls within the "reinforced zone." Based on the available data, and our site observations, suitable, non-detrimentally expansive, granular soils occur onsite and may be suitable for use in wall construction, provided laboratory testing indicates acceptable expansion and plasticity indices, grain size, and strength characteristics (as evaluated by the geotechnical engineer and wall designer). Owing to the need for such testing, there is inherently some associated delay in construction and job progress. This should be considered during planning and design. The type of backfill, should be specified by the wall designer, and clearly shown on the plans.

Onsite Soil Suitability

Onsite earth materials primarily consist of localized undocumented fill, topsoil, colluvium, and sedimentary bedrock. These materials appear to predominantly consist of an admixture of silty sands, sands, clayey sands, sandy clays and clays and likely range from very low to highly expansive throughout the site. Based on a review of laboratory testing completed on a selected sample of sandstone formation, cut excavation into the sandy, granular facies of the underlying formation may generate potentially suitable materials. However, due to the variability of earth materials throughout the site, the related soil parameters should be anticipated as non-uniform. Wall backfill derived from surficial soil deposits (topsoil, colluvium, alluvium, and fine grained formation, etc.) will have a greater

potential for increased fines and lower strengths, locally, and the selected materials should be adequately evaluated for suitability prior to use. Select grading to stockpile suitable, granular soils generated during grading of the site may be performed, and is recommended.

Guidelines for MSE Retaining Wall Design/Construction

General

MSE retaining walls are, by nature, a flexible system and, as such, not suited for every slope support condition. This will need to be considered and ultimately determined by the project design civil engineer and client.

The following recommendations are specific to MSE retaining wall design and construction. These recommendations have been provided in an effort to achieve the most desirable and efficient means of construction. Some of these do not deal specifically with geotechnical aspects, but do have significant effects on the quality of the end product. As project geotechnical consultants, we feel that strong consideration should be given to these recommendations. If more onerous project specifications are required by the manufacturer or governing agency, then those guidelines should be followed.

Compared to conventional retaining walls, MSE retaining walls require significantly more geotechnical observation and testing. The costs for these services depend on wall size, conscientiousness of the contractor, the number of backfill sources, and other factors. GSI should evaluate the geotechnical aspects of the wall layouts (offsets, cross-section, alignments) prior to construction. This approval by the geotechnical consultant should be sought (in writing) prior to 100 percent submittal by the wall designer.

Design

As part of MSEW (Mechanically Stabilized Earth Wall design, MSE retaining wall design may be generally subdivided into three components: 1.) Foundation Zone, 2.) Retained Zone, and 3.) Reinforced Zone (i.e., the zone containing the grid reinforcement layers).

1. On a preliminary basis, a cohesion of c=0, a phi angle of 29 degrees, and a unit weight of 125 pcf, may be used in the design of the “foundation” zone.

2. On a preliminary basis, a cohesion of c=100, a phi angle of 29 degrees, and a unit weight of 125 pcf (95 percent relative compaction), may be used in the design of the “retained” zone.

3. On a preliminary basis, a cohesion of c=100, a phi angle of 29 degrees, and a unit weight of 125 pcf (95 percent relative compaction), may be used in the design of the “reinforced” zone.

4. A site acceleration (PGAm) of 0.457g (site class "D") was evaluated in GSI (2016) and may be used for the evaluation of seismic stability.

5. The recommended equivalent fluid pressure for design of the MSE retaining walls should be 50 pcf for level backfill and 65 pcf for 2:1 backfill, assuming the use of granular backfill material (E.I. $\leq$20, P.I. $\leq$ 15, ϕ $\geq$29 degrees, c = 0 psf, and $\leq$20 percent passing the No. 200 sieve). These equivalent fluid pressures are based solely on static soil conditions and do not include seismic loading, expansive soil pressures, earthwork surcharge, or traffic loading which will need to be included, as necessary.

6. An evaluation of global stability (i.e., static and seismic) is typically not performed by the wall designer. Once preliminary plans/calculations are completed, the geotechnical consultant should review global stability with respect to a factor of safety of 1.5 (static) and 1.1 (seismic).

Foundation Construction

1. Prior to excavation for the wall base, the alignment and grade for the wall should be established in the field by the project civil engineer or project surveyor.

2. The contractor should have a qualified grade checker onsite to continually verify the gradient (or batter) and alignment of the base excavation and wall during construction.

3. Defective segments or wall units should <u>not</u> be utilized.

4. The project surveyor should spot-check wall gradient (face-of-wall slope) and alignment and using this data, the civil design/wall designer should evaluate if the wall installation is per plan.

5. When locating the base of the wall, structural setbacks established by the governing agency, and/or geotechnical engineer should be followed.

6. Walls should be founded on engineered fill approved by this office, or dense, suitable bedrock. GSI recommends that the MSE wall footings be embedded at least 1 foot into suitable bearing material for adequate lateral support.

7. Prior to placement of the MSE wall units, the excavation for the wall base should be observed by representatives of this firm, and should be a minimum of 12 inches into approved engineered fill or bedrock. However, deeper excavation may be necessary due to the depth of removals , and or setbacks from the face of adjacent, descending slopes.

8. A crushed stone leveling pad may be used to provide a uniform surface for the wall base.

9. If it is necessary to locally deepen the wall base to obtain suitable bearing materials, the contractor should consult the project design engineer to determine if the wall location or design of the wall is affected.

10. MSE retaining wall height at the terminal ends of the wall should not exceed 4 feet, unless lateral support is provided.

Backfill

1. Fill placed within the geotextile reinforcement zone, and in front of the MSE retaining walls, should be compacted to a minimum of 95 percent relative compaction unless otherwise specified by the manufacturer. Any backfill other than the "unit core fill (¾ inch crushed rock or stone)" should be placed in controlled lifts not to exceed 6 inches in thickness, and moisture-conditioned as necessary to achieve at least optimum moisture content. Backfill within and immediately behind the walls should also be as indicated on the (precise and rough) grading plans.

2. Backfill materials should be free draining, and free from organic materials, with an E.I. less than 20, a Plasticity Index less than 15, and a maximum of 20 percent fines passing the No. 200 sieve. Lifts should be placed horizontally and compaction equipment should not be allowed to damage the geotextile reinforcement, where utilized.

3. If gravel or other select granular material is used as backfill within or behind the MSE retaining wall, it should be capped with a minimum 18 inches compacted fill composed of relatively impervious material. A layer of filter fabric (Mirafi 140N or approved equivalent) should separate the gravel from the soil cap.

4. During construction, the unfilled section of wall should not be stacked more than 2 feet above the fill behind the wall. If gravel is used to fill the wall, the wall may be stacked 3 feet above adjacent grades. The maximum gravel size should be less than ¾ inch. If this option is selected, additional review with respect to drainage and potential for backfill scouring and/or piping at the face of the wall should be performed. Gravel (if used) should be separated from any adjacent soil with filter fabric (Mirafi 140N or approved equivalent).

5. Adequate space should be provided both behind and in front of the wall so that sufficient compaction can be obtained for all backfill. The slope of the MSE retaining walls and benching (in cross-section and alignment) should be in accordance with the manufacturer's recommendations and as approved by the geotechnical consultant.

Wall Back Drains

A drainage system should be installed for all MSE retaining walls in excess of 3 feet in overall height. The design of the system will depend on specific conditions. For most cases, a Schedule 40 perforated drain pipe (Schedule 40 or approved equivalent), encased in clean crushed ½- to ¾-inch gravel, and wrapped in Mirafi 140N filter fabric (or approved equivalent) is adequate. The drain should be placed at the heel of the wall, i.e., inside, rear edge of the reinforced zone. In areas where bedrock and/or perched water are exposed in the backcut of the geotextile reinforced zone, a secondary backdrain system, of similar construction, should be placed at the toe of the backcut and along zones of perched water seepage. If necessary, outlets may pass below the base of the wall at a minimum 2 percent gradient. Outlets should be tight-lined via a solid drain pipe (Schedule 40 or approved equivalent) that drain toward an approved outlet area in accordance with the design civil engineer's recommendations. A concrete cut-off wall should be constructed at the connection between solid and perforated drain pipes to force seepage water into the solid pipe. The cut-off wall should surround the pipe connection and extend at least 12 inches beyond the outer edge of the pipe (in all directions [360 degrees]). The trenches for the solid drain pipe should be backfilled with either compacted fill material or gravel. If gravel is used, it should be separated from the surrounding soils with Mirafi 140N filter fabric and should be capped with at least 12 inches of compacted fill material. Seepage should be anticipated below all MSE retaining walls, and this should be disclosed to all interested/affected parties.

Materials and Wall Construction

Only sound MSE retaining wall units/members and components that meet all required specifications should be used for construction of the walls. Wall units/members should be free of honeycombing, cracks, broken lugs, or slumped bearing surfaces. All geotextile reinforcement should comply with the required technical specifications. Geotextile reinforcement should be placed horizontally to the required length/width behind. The strong axis of the geotextile reinforcement should be placed perpendicular to the wall alignment if uniaxial geogrid is used.

Structural Setbacks from Proposed MSE Retaining Walls

Slope and structural setbacks from the heel of walls and/or geogrid will be necessary, owing to potential deflection/movement. The necessary setbacks should be defined by the various project consultants and approved by the governing agencies prior to final design. At a minimum, the building setback should be up at a 1:1 (h:v) projection from the heel of the MSE wall reinforced (grid) zone, and should be shown on the precise grading plans by the design civil engineer. Building setback mitigation may be accomplished by deepening any adjoining foundations through this zone of 1:1 projection, provided this does not disturb any geogrid. Appurtenant structures, including pools, utilities, and landscaping, should not disrupt the geogrid behind the walls. All structures proposed within the setback zone will be subject to both horizontal and vertical deflections and

potential distressed. All construction proposed within the setback area should be reviewed by the design civil engineer and geotechnical consultant. This review should be provided in writing to the Client prior to installation in the field. Homeowners and all interested parties should be notified of the setback zones.

Other Considerations

- Surcharge loads (slopes, traffic, etc.) should be applied by the design engineer as necessary.

- GSI recommends that geotextile reinforcement is not placed beneath appurtenant structures or improvements that require significant excavation that could damage the geotextile reinforcement. Appurtenant structures, should not disrupt the geotextile reinforcement behind the walls. Relatively deep underground utilities (i.e., greater than 2 to 3 feet in depth) should be located above a 1½:1 (h:v) projection down and away from the rear of the uppermost layer of geotextile reinforcement such that any future trenching for repairs would not damage the geotextile reinforcement. All structures proposed within the setback zones will be subject to both horizontal and vertical deflections and potential distress. All construction proposed within the setback area should be reviewed by the design civil engineer and geotechnical consultant. This review should be provided in writing to the Client, prior to installation in the field.

- The alternative use of paver stone flatwork should be considered where Portland Cement Concrete (PCC) concrete hardscape (walkways, patios, etc.) are planned above a 1:1 (h:v) projection up from the heel of MSE retaining walls reinforced zone. Paver stone flatwork is more capable of tolerating the ground deformations related to MSE retaining walls. Structures/improvements that are settlement sensitive should not be placed in the setback zone.

- Wall drainage should be reviewed by this office as plans become available. The gravel pad provided for the support of the base course should be adequately drained.

- As with any settlement-sensitive structure, setbacks from adjacent descending slopes should be included in the wall design. A setback (lateral distance) equivalent to H/3 (where H is the height of the slope) should be provided for top of slope improvements. The setback should minimally be 7 feet and need not be greater than 40 feet. A setback (lateral distance) equivalent to H/2 (where H is the height of the slope) should be provided from the outside bottom edge of the wall for toe of slope improvements. The setback need not be more than 15 feet for these conditions.

- Periodic testing of earth materials will be recommended in order to evaluate that soils with the minimum strength parameters are provided during construction of the walls.

Review of MSE Retaining Wall Plans and Structural Calculations

Proposed wall configurations should be reviewed for global stability. MSE retaining walls must meet City, County, local code, and slope stability factors-of-safety of 1.5 and 1.1 for static and seismic conditions, respectively. Criteria for residential use (limitations of land use) within geotextile reinforced backfill areas should be provided by the wall designer and reviewed by both the Client and the project geotechnical, and civil consultants. These limitations should be disclosed to all interested/affected parties.

Additional Testing

The parameters provided are preliminary, based on the available data, as exact wall locations, design, and the nature of earth materials used in wall construction are determined, additional testing during earthwork is recommended in order to evaluate and/or modify the preliminary design values provided.

STORM WATER TREATMENT AND HYDROMODIFICATION MANAGEMENT

Based on our review and analysis performed in preparation of GSI (2016), full infiltration does not appear feasible. Partial infiltration may be feasible for areas of undisturbed soil, located no closer than 10 feet of any structure, or settlement/moisture sensitive improvement. For hydromodification structures located within 10 feet of a residential structure, storm water treatment and hydromodification management should be designed for no infiltration. Plans (HWA, 2018) indicate several “bio-filtration basins” located throughout the project, at, or very near the toe of graded slopes. For these basins, a “no infiltration” or “flow through” design is recommended. All storm water BMP design and construction should be in accordance with the City’s BMP design manual (City, 2016).

LIMITATIONS

The conclusions and recommendations presented herein are professional opinions. These opinions have been derived in accordance with current standards of practice, and no warranty is express or implied. Standards of practice are subject to change with time. GSI assumes no responsibility or liability for work or testing performed by others, or their inaction; or work performed when GSI is not requested to be onsite, to evaluate if our recommendations have been properly implemented. Use of this report constitutes an agreement and consent by the user to all the limitations outlined above, notwithstanding any other agreements that may be in place. In addition, this report may be subject to review by the controlling authorities. Thus, this report brings to completion our scope of services for this portion of the project.

The opportunity to be of service is sincerely appreciated. If you should have any questions, please do not hesitate to contact our office.

Respectfully submitted,

GeoSoils, Inc.

Robert G. Crisman
Engineering Geologist, CEG 1934

David W. Skelly
Civil Engineer, RCE 47857

RGC/DWS/JPF/jh

Attachments: Appendix - References
Plates 1 through 3 - Revised Geotechnical Maps

Distribution: (1) Addressee (PDF via email)

APPENDIX

REFERENCES

APPENDIX

REFERENCES

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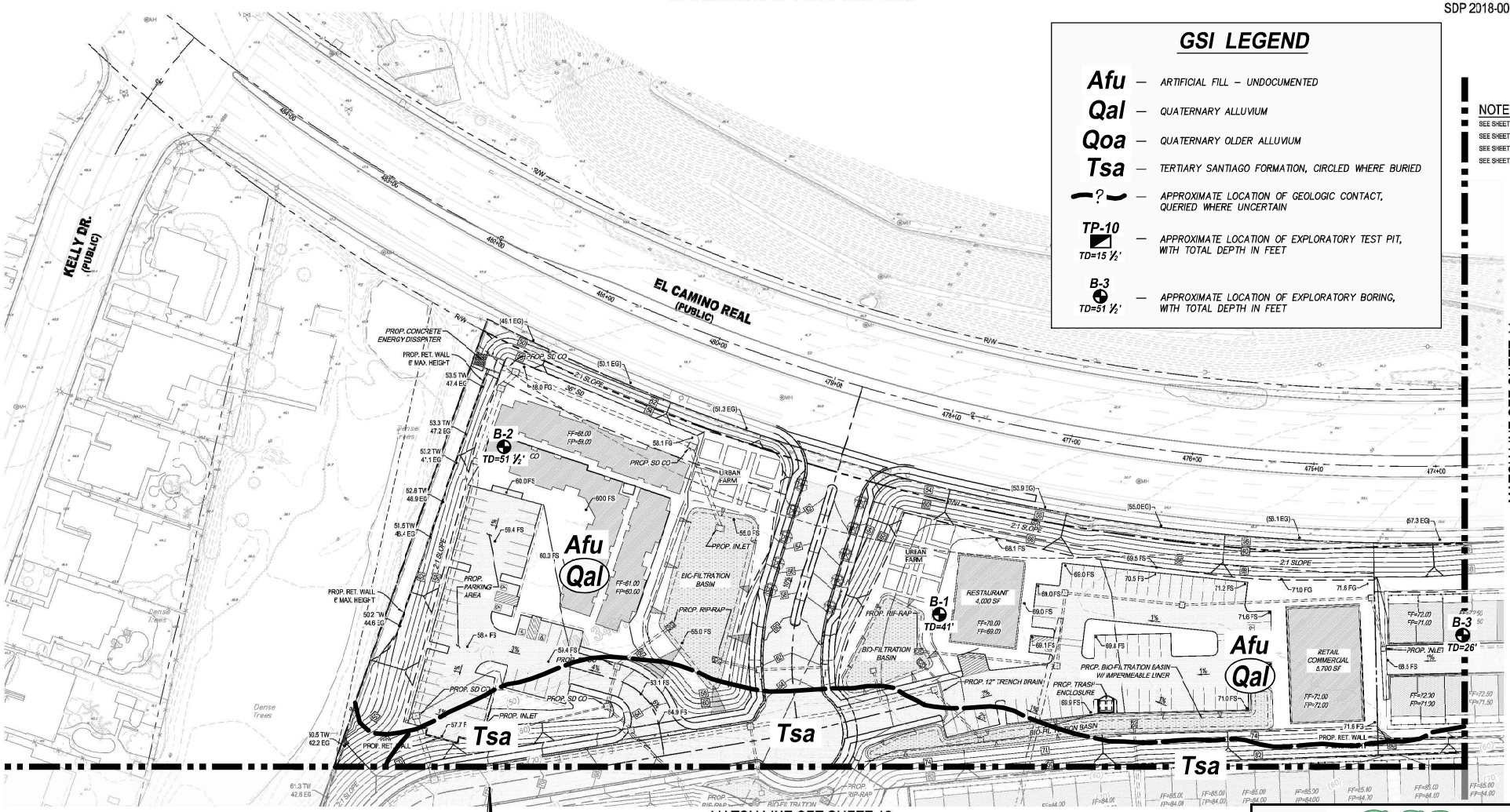
MARJA ACRES TENTATIVE MAP

CDP 16-33
SDP 2018-0001



GSI LEGEND

Afu	—	ARTIFICIAL FILL – UNDOCUMENTED
Qal	—	QUATERNARY ALLUVIUM
Qoa	—	QUATERNARY OLDER ALLUVIUM
Tsa	—	TERTIARY SANTIAGO FORMATION, CIRCLED WHERE BURIED
?	—	APPROXIMATE LOCATION OF GEOLOGIC CONTACT, QUERIED WHERE UNCERTAIN
TP-10 TD=15 ½'	—	APPROXIMATE LOCATION OF EXPLORATORY TEST PIT, WITH TOTAL DEPTH IN FEET
B-3 TD=51 ½'	—	APPROXIMATE LOCATION OF EXPLORATORY BORING, WITH TOTAL DEPTH IN FEET

NOTES:
SEE SHEET 6 FOR
SEE SHEETS 7-9 FO
SEE SHEETS 15-17
SEE SHEETS 18-20

GRAPHIC SCALE
80 0 40 80 160
1" = 80'

N

ALL LOCATIONS ARE APPROXIMATE

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SHEET	CITY OF CARLSBAD PLANNING DEPARTMENT	SHEETS
10		24

TENTATIVE MAP FOR:
MARJA ACRES

DRAWING NAME:
PRELIMINARY SITE GRADING PLAN

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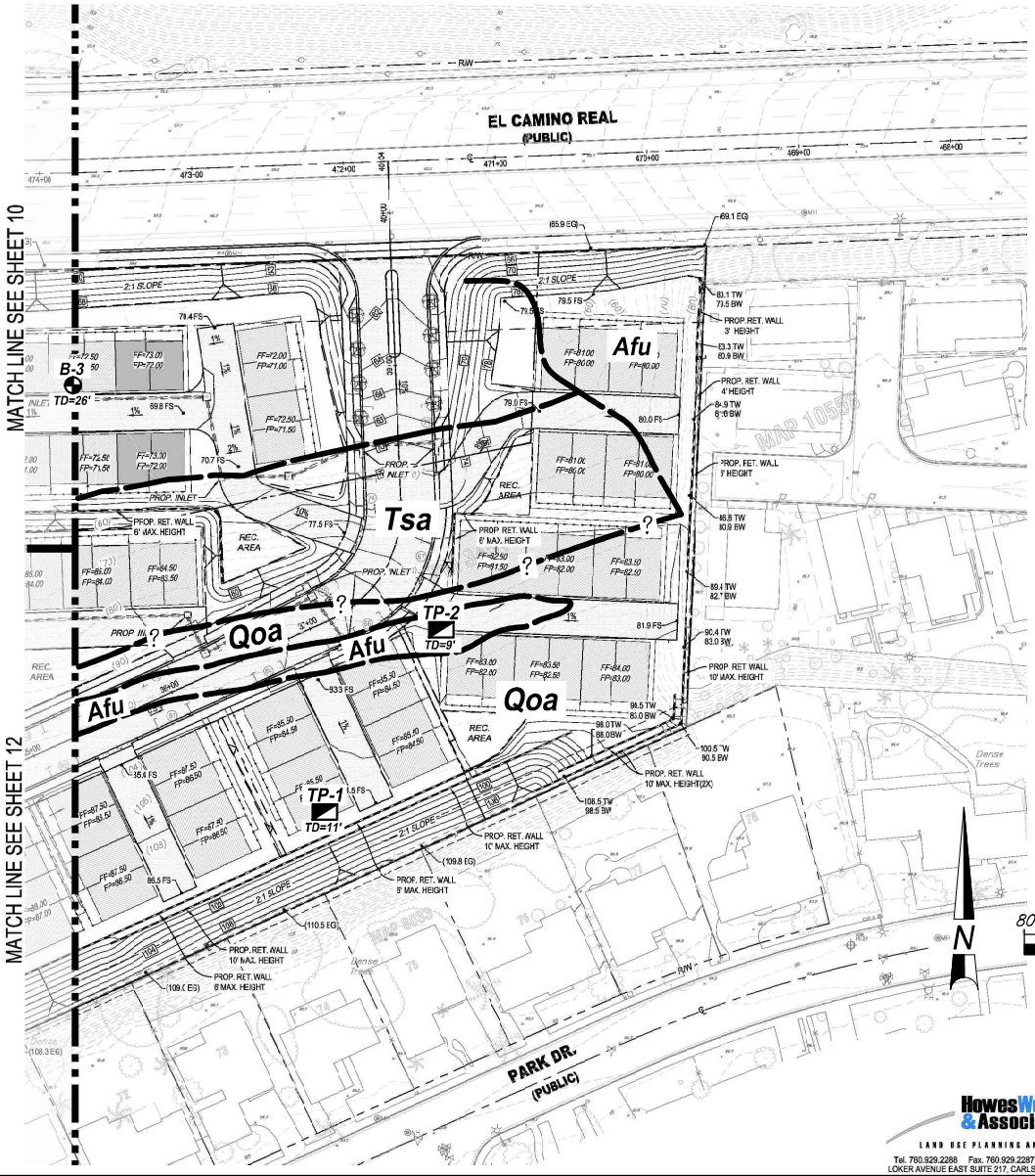
GeoSoils, Inc.

REVISED GEOTECHNICAL MAP
Plate 1

W.O. 6971-A1-SC	DATE: 06/18	SCALE: 1" = 80'

MARJA ACRES TENTATIVE MAP



GRAPHIC SCALE

80 0 40 80 160

1" = 80'

SEE PLATE 1 FOR LEGEND

ALL LOCATIONS ARE APPROXIMATE

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SHEET 11	CITY OF CARLSBAD PLANNING DEPARTMENT	SHEETS 24

TENTATIVE MAP FOR: MARJA ACRES

DRAWING NAME: PRELIMINARY SITE GRADING PLAN

GeoSoils, Inc.

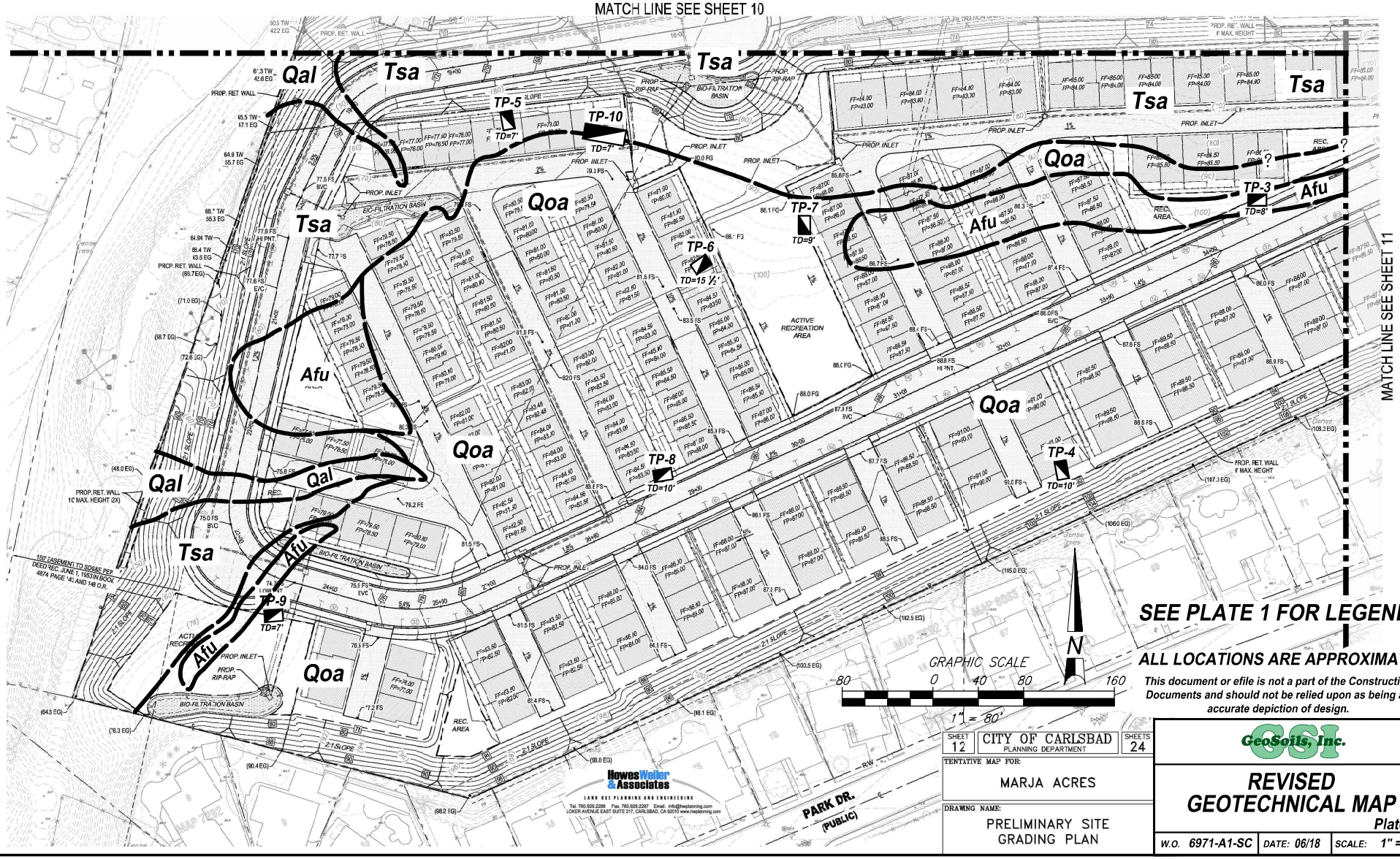
REVISED GEOTECHNICAL MAP

Plate 2

W.O. 6971-A1-SC	DATE: 06/18	SCALE: 1" = 80'

MARJA ACRES TENTATIVE MAP

C
SDP 2



SHEET 12	CITY OF CARLSBAD PLANNING DEPARTMENT	SHEETS 24

TENTATIVE MAP FOR: MARJA ACRES

DRAWING NAME: PRELIMINARY SITE GRADING PLAN

GeoSoils, Inc.

REVISED GEOTECHNICAL MAP

Plate 3

W.O. 6971-A1-SC	DATE: 06/18	SCALE: 1" = 80'