Western Technologies
An RMA Company

GEOTECHNICAL EVALUATION REPORT

GOODROW DEVELOPMENT
APN: 408-24-069
60 Goodrow Lane
Sedona, Arizona
WT Job No. 25-224085-0

PREPARED FOR:
Sefton Engineering Consultants
40 Stutz Bearcat Drive
Sedona, Arizona, 86336
Attn: Mr. Crockett Saline, P.E.

April 30, 2024

REGISTERED PROFESSIONAL ENGINEER (CIVIL)
CERTIFICATE NO.
79669
GREGORY
BURR
DATE SIGNED 4/30/24
ARIZONA, U.S.A.

Registered Professional Engineer (Civil)
CERTIFICATE NO.
11860
CRAIG P.
WIEDEMAN
Date Signed
ARIZONA U.S.A.
4/30/24

Gregory L. E. Burr, P.E, R.G.
Geotechnical Department Manager

Craig P. Wiedeman, P.E.
Senior Geotechnical Engineer

GEOTECHNICAL ENVIRONMENTAL INSPECTIONS NDT MATERIALS

2400 East Huntington Drive
Flagstaff, Arizona 86004
(928)-774-8700
rma-western.com

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Western Technologies
An RMA Company

April 30, 2024

Sefton Engineering Consultants
40 Stutz Bearcat Drive
Sedona, Arizona, 86336

Attn: Mr. Crockett Saline, P.E.

Re: Geotechnical Evaluation — Job No. 25-224085-0
Goodrow Development
APN: 408-24-069
60 Goodrow Lane
Sedona, Arizona

Western Technologies Inc. has completed the geotechnical evaluation for the new apartment complex to be located in Sedona, Arizona. This study was performed in general accordance with our proposal number 25-224085-0 dated March 8, 2024. The results of our study, including the boring location diagram, laboratory test results, boring logs, and the geotechnical recommendations are attached.

We have appreciated being of service to you in the geotechnical engineering phase of this project and are prepared to assist you during the construction phases as well. If design conditions change, or if you have any questions concerning this report or any of our testing, inspection, design and consulting services, please do not hesitate to contact us. We look forward to working with you on future projects.

Sincerely,
WESTERN TECHNOLOGIES, INC.
Geotechnical Engineering Services

Gregory L. E. Burr, P.E., R.G.
Geotechnical Department Manager

Copies to: Addressee (emailed)

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GEOTECHNICAL EVALUATION
GOODROW DEVLOPMENT
APN: 408-24-069
60 GOODROW LANE
SEDONA, ARIZONA
JOB NO. 25-224085-0

1.0 PURPOSE

This report contains the results of our geotechnical evaluation for the proposed apartment complex to be located at 60 Goodrow Lane in Sedona, Arizona. The purpose of these services is to provide information and recommendations regarding:

- Subsurface conditions
- Foundation design parameters
- Slabs-on-grade
- Lateral earth pressures
- Seismic considerations
- Earthwork guidelines
- On-site pavements
- Drainage
- Corrosivity (soil to concrete)

Results of the field exploration, field tests, and laboratory testing program are presented in the Appendices.

2.0 PROJECT DESCRIPTION

Based on information provided by Mr. Crockett Saline, PE, the proposed project will consist of nine, three-story apartment buildings with approximate plan areas ranging from about 3,000 to 7,000 square feet to be constructed on a 2.84-acre lot. The structures will use wood frame and masonry construction with slab-on-grade first floors. Maximum wall and column loads for the structures are assumed to be 3 kips per linear foot and 50 kips, respectively. On-site asphalt paved parking and drives will be included as part of the proposed development. We anticipate no extraordinary slab-on-grade criteria and that the finished first floor levels will be within about 5 feet of the existing site grades. Should any of our information or assumptions not be correct, we request that the Client notify Western Technologies (WT) immediately.

3.0 SCOPE OF SERVICES

3.1 Field Exploration

Five borings were auger drilled to depths of about 3 to 17 feet below existing site grades in the proposed building and pavement areas. The borings were at the approximate locations shown on the attached Boring Location Diagram. A field log was prepared for each boring. These logs contain visual classifications of the materials encountered during drilling as well as interpolation of the subsurface conditions between samples. Final logs, included in Appendix A, represent our interpretation of the field logs and may include modifications based on laboratory observations and tests of the field samples. The final logs describe the materials encountered, their thickness, and the locations where samples were obtained. The Unified Soil Classification System was used to classify soils. The soil classification symbols appear on the boring logs and are briefly described in Appendix A. The soil classification symbols appear on the boring logs and are briefly described in Appendix A. Local and regional geologic characteristics were used to estimate the seismic design criteria and liquefaction potential.

3.2 Laboratory Analyses

Laboratory analyses were performed on representative soil samples to aid in material classification and to estimate pertinent engineering properties of the on-site soils for preparation of this report. Testing was performed in general accordance with applicable standard test methods. The following tests were performed and the results are presented in Appendix B.

- Water content
- Dry density
- Compression
- Maximum density/optimum moisture (proctor)
- Remolded expansion potential
- Gradation
- Plasticity
- Soluble salt/sulfate/chloride content

Test results were utilized in the development of the recommendations contained in this report.

3.3 Analyses and Report

This geotechnical engineering report includes a description of the project, a discussion of the field and laboratory testing programs, a discussion of the subsurface conditions, and design recommendations as appropriate to the purpose. The scope of services for this project does not include, either specifically or by implication, any environmental assessment of the site, discovery of underground storage tanks or other underground structures, or identification of contaminated or hazardous materials or conditions. If there is concern about the potential for such contamination, other studies should be undertaken. We are available to discuss the scope of such studies with you.

4.0 SITE CONDITIONS

4.1 Surface

At the time of our exploration, the site was an undeveloped lot. Prior to our arrival on site, the previously existing structures and asphalt paved access drives had been demolished, and the site had been cleared and grubbed. The site was bordered on all sides by developed residential and commercial lots. The ground surface contained embedded sandstone gravel, cobbles, boulders and occasional outcrops, and exhibited a gentle slope down to the south. Site surface drainage appeared to be fair to good by means of sheet flow to the south. Vegetation surrounding the previously cleared area on the site consisted of a sparse to heavy growth of native juniper tree, bushes, cacti, grasses and weeds.

4.2 Subsurface

As presented on the Boring Logs, surface and subsoils extending to the full depth of exploration in all of the locations explored included loose to very dense, Silty SANDS; soft Sandy SILTS; and hard Sandy, Silty CLAYS. All soils encountered contained random amounts of non-plastic to low plasticity fines, gravel, cobbles and boulders. Refusal to auger penetration occurred in all of the borings at depths of about 3 to 17 feet below the existing site grades on SANDSTONE. Groundwater was not encountered in any boring at the time of exploration. A detailed description of the soils encountered can be found on the borings logs in Appendix A.

The boring logs included in this report are indicators of subsurface conditions only at the specific location and date noted. Variations from the field conditions represented by the borings may become evident during construction. If variations appear, we should be contacted to re-evaluate our recommendations.

5.0 GEOTECHNICAL PROPERTIES AND ANALYSIS

5.1 Laboratory Tests

Laboratory test results (see Appendix B) indicate that on-site subsoils located near and below anticipated shallow foundation levels exhibit low to moderate compressibility at existing water contents. Moderate to high additional compression occurs when the water content is increased.

Near-surface soils contain non-plastic to low plasticity fines. These soils exhibit low expansion potential when recompacted, confined by loads approximating floor loads and saturated. Slabs-on-grade supported on recompacted on-site soils have a low potential for heaving if the water content of the soil increases.

5.2 Field Tests

On-site subsoils located near and below anticipated shallow foundation levels exhibited low to high resistance to penetration using the ring-lined barrel sampler (ASTM D3550). The penetration resistance values also exhibited variability between test locations and with depth. This represents a potential for differential movement within structures supported on existing soils in their present condition.

6.0 RECOMMENDATIONS

6.1 General

Recommendations contained in this report are based on our understanding of the project criteria described in Section 2.0 and the assumption that the soil and subsurface conditions are those disclosed by the explorations. Others may change the plans, final elevations, number and type of structures, foundation loads, and floor levels during design or construction. Substantially different subsurface conditions from those described herein may be encountered or become known. Any changes in the project criteria or subsurface conditions shall be brought to our attention in writing.

6.2 Design Considerations

Laboratory test results indicate that the site soils become weaker and more compressible with an increase in moisture content under typical foundation loadings. These soils are not considered suitable for support of foundations in their present state and should be over-excavated as recommended in the **EARTHWORK** section of this report. Proper drainage should be provided to help prevent infiltration of moisture below the foundations and concrete slabs.

Cobbles and boulders were encountered in the site soils. These oversized materials, greater than 6 inches, could present construction difficulties for foundation, utility trench, and other excavations. In cut areas and excavations, exposed oversized materials should be removed.

6.3 Conventional Spread Foundations

It is anticipated that variable cut/fill depths will be required across the site. The main geotechnical concern on this project will be the possibility of differential bearing conditions between native soil/rock areas. Basically, we anticipate that two different types of bearing conditions may occur on this site:

1. Structures bearing entirely within native soil/rock areas.
2. Structures bearing partially on native soil/rock and partially on shallow fills (less than 5 feet deep).

To help reduce differential movements, mixed bearing conditions (native soil/rock and fill) should be avoided within an individual structural unit.

Conventional shallow spread footings may be used to support the proposed structures. Footings should bear at least 2 feet below the lowest adjacent finished grade. Footings may be designed to impose a maximum dead plus live-load pressure of 3500 pounds per square foot if bearing completely on dense sandstone and 2500 pounds per square foot if bearing on engineered fill. Foundation preparation procedures may vary significantly depending on the structure location within the site. Refer to Section 7.4 **Foundation Preparation** of this report for details.

Settlements will also vary depending on the foundation bearing conditions. For foundation elements bearing on dense rock, total and differential settlements should be nominal. Settlement of foundation elements bearing on engineered fill will vary depending on the total depth of the fill, and may approach 1 to 2 inches in the deeper fill areas. Differential settlements are anticipated to be approximately one-half of the total settlements. Additional foundation movements could occur if water from any source infiltrates the foundation bearing soils. Therefore, proper drainage should be provided in the final design and during construction.

Finished grade is the lowest adjacent grade for perimeter footings and floor level for interior footings. The design bearing capacity applies to dead loads plus design live load conditions. Recommended minimum widths of column and wall footings are 24 inches and 16 inches, respectively. The bearing value given is a net bearing value and the weight of the concrete in the footings may be ignored.

For foundations located adjacent to slopes, a minimum horizontal setback of five (5) feet should be maintained between the foundation base and slope face. In addition, the setback should be such that an imaginary line extending downward at 45 degrees from the nearest foundation edge does not intersect the slope. Thickened slab sections can be used to support interior partitions, provided that loads do not exceed 900 pounds per linear foot, thickened sections have a minimum width of 12 inches, and thickness and reinforcement are consistent with structural requirements.

All footings, stem walls and masonry walls should be reinforced to reduce the potential for distress caused by differential foundation movements. The use of joints at openings or other discontinuities in masonry walls is recommended.

Site preparation procedures and foundation excavations should be observed by the geotechnical engineer to assess that adequate bearing conditions exist and that recompaction of native soils and/or placement of engineered fill has been performed satisfactorily. If the soil conditions encountered differ significantly from those presented in this report, supplemental recommendations will be required.

6.4 Lateral Design Criteria

For retaining walls located above any free water surface with no surcharge loads, recommended equivalent fluid pressures and coefficients of base friction for unrestrained elements are:

- Active:
  Undisturbed subsoil ....35 psf/ft
  Compacted granular backfill ....30 psf/ft
  Compacted site soils ....35 psf/ft

- Passive:
  Shallow wall footings ....250 psf/ft
  Shallow column footings..375 psf/ft
  Dense rock ....500 psf/ft

- Coefficient of base friction:
  Soil.. 0.35*
  Rock..0.50

  * The coefficient of base friction should be reduced to 0.25 when used in conjunction with passive pressure.

Where the design includes restrained elements, the following equivalent fluid pressures are recommended:

- At-rest:
  Undisturbed subsoil ....60 psf/ft
  Compacted granular backfill ....55 psf/ft

These lateral earth pressures are not applicable for submerged soils. We should be consulted for additional recommendations if such conditions are to be included in the design. Any surcharge from adjacent loadings must also be considered. Walls below grade should be waterproofed.

We recommend a free-draining soil layer or manufactured geocomposite material, be constructed adjacent to the back of the retaining wall. A filter may be required between the soil backfill and drainage layer. This drainage zone should help prevent hydrostatic pressure buildup. This vertical drain should be tied into a gravity drainage system at the base of the retaining wall. It is important that all backfill be properly placed and compacted. Backfill should be mechanically compacted in layers. Flooding or jetting should not be permitted. Care should be taken not to damage the walls when placing the backfill. Backfills should be inspected and tested during placement.

Fill against footings, stem walls and retaining walls should be compacted to densities specified in **EARTHWORK**. Medium to high plasticity clay soils should not be used as backfill against retaining walls. Compaction of each lift adjacent to walls should be accomplished with hand-operated tampers or other lightweight compactors. Overcompaction may cause excessive lateral earth pressures which could result in wall movements.

6.5 Seismic Considerations

Structures should be designed in accordance with applicable building codes. The seismic design parameters presented in the following table, in accordance with the 2021 International Building Code and ASCE 7-16, are applicable to the project site:

Seismic Design Parameters International Building Code 2021, ASCE 7-16	
Soil Site Class	C
Mapped Spectral Response Acceleration at 0.2 sec period (S_s)	0.295g
Mapped Spectral Response Acceleration at 1.0 sec period (S_1)	0.093g
Site Coefficient for 0.2 sec period (F_a)	1.3
Site Coefficient for 1.0 sec period (F_v)	1.5
Design Spectral Response Acceleration at 0.2 sec period (S_{DS})	0.256g
Design Spectral Response Acceleration at 1.0 sec period (S_{D1})	0.093g

The soil site class is based upon conditions identified in shallow exploratory borings and local knowledge of the subsurface conditions in the vicinity of the site. Soil conditions extending beyond the depth of our borings to a depth of 100 feet were assumed for the purposes of providing the information presented in the table. Based upon the density of the on-site soils, the shallow rock conditions and lack of groundwater, the potential settlement and lateral spread due to liquefaction is not considered to be a significant concern on this site.

6.6 Conventional Slab-on-Grade Support

Floor slabs can be supported on properly placed and compacted fill or approved, properly recompacted native soils. For design of interior slabs-on-grade, we recommend using a modulus of subgrade reaction (k) of 250 pounds per cubic inch (pci) for the on-site soils or imported fill material, based on a 30-inch diameter plate. The slab subgrade should be prepared by the procedures outlined in this report. A minimum 4-inch thick layer of base course should be provided beneath all slabs to help prevent capillary rise and a damp slab. The use of vapor retarders is desirable for any slab-on-grade where the floor will be covered by products using water-based adhesives, wood, vinyl backed carpet, impermeable floor coatings (urethane, epoxy, acrylic terrazzo, etc.) or where the floor will be in contact with moisture sensitive equipment or product. When used, the design and installation should be in accordance with the guidance provided in ACI 302.1R and 302.2R. Final determination on the use of a vapor retarder should be left to the slab designer.

All concrete placement and curing operations should follow the American Concrete Institute manual recommendations. Improper curing techniques and/or high slump (water-cement ratio) could cause excessive shrinkage, cracking or curling. The plastic properties of the concrete should be documented at the time of placement and specimens should also be prepared for strength testing to verify compliance with project specifications. Concrete slabs should be allowed to cure adequately before placing vinyl or other moisture sensitive floor covering.

6.7 Drainage

The major cause of soil-related foundation and slab-on-ground problems is moisture increase in soils below structures. Properly functioning conventional foundations and floor slabs-on-ground require appropriately constructed and maintained site drainage conditions. Therefore, it is extremely important that positive drainage be provided during construction and maintained throughout the life of the structures. It is also important that proper planning and control of landscape and irrigation practices be performed.

Infiltration of water into utility or foundation excavations must be prevented during construction. Backfill against footings, exterior walls, and in utility and sprinkler line trenches should be well compacted and free of all construction debris to minimize the possibility of moisture infiltration. If utility line trenches are backfilled with a granular material, then a clay or concrete plug should be placed in the trench adjacent to the structures to prevent water from following the trench back under the structures.

In areas where sidewalks, patios or driveways do not immediately adjoin the structures, protective slopes should be provided with an outfall of about 5 percent for at least 10 feet from perimeter walls. Scuppers and/or gutters and drain pipes should be designed to provide drainage away from the structures for a minimum distance of 10 feet. Planters or other surface features that could retain water adjacent to the structures should be avoided if at all possible. If planters and/or landscaping are adjacent to or near the structures, there will be a greater potential for moisture infiltration, soil movement and structure distress. As a minimum, we recommend the following:

- Grades should slope away from the structures.
- Planters should slope away from the structures and should not pond water. Drains should be installed in enclosed planters to facilitate flow out of the planters.
- Only shallow rooted landscaping should be used.
- Watering should be kept to a minimum. Irrigation systems should be situated on the far side of any planting and away from the structures to minimize infiltration beneath foundations from possible leaks.
- Trees should be planted no closer than a distance equal to three-quarters of their mature height or 15 feet, whichever is greater.

It should be understood that these recommendations will help minimize the potential for soil movement and resulting distress, but will not eliminate this potential.

6.8 Corrosivity to Concrete

The chemical test results indicate that the soils at the site classify as Class S0 in accordance with Table 19.3.1.1 of ACI 318-19. However, in order to be consistent with standard local practice and for reasons of material availability, we recommend that Type II portland cement be used for all concrete on and below grade.

6.9 Pavements

Based on existing subgrade conditions, the following pavement sections are recommended for the areas indicated:

Traffic Area	Asphalt Concrete (in.)	Base Course (in.)
Passenger car parking/drives (low traffic frequency)	3	5
Major access drives (high traffic frequency)	4	6

Bituminous surfacing should be constructed of dense-graded, central plant-mix, asphalt concrete. Base course and asphalt concrete should conform with City of Sedona specifications.

Material and compaction requirements should conform to the recommendations presented under **EARTHWORK**. The gradient of paved surfaces should ensure positive drainage. Water should not pond in areas directly adjoining paved sections. The native subgrade soils will soften and lose stability if subjected to conditions which result in an increase in water content.

Due to the high static loads imposed by parked trucks in loading and unloading areas and at dumpster locations, we recommend that a rigid pavement section be considered for these areas. A minimum 6-inch thick concrete pavement over 4 inches of aggregate base course material is recommended.

6.9.1 Pavement Analyses

The recommended pavement sections are based on the following conditions. This firm should be contacted if any of these conditions change so that revised recommendations can be provided, if necessary.

a. A correlated R-value of 28 for the on-site soils which corresponds to a resilient modulus of approximately 9,800 pounds per square inch. Any required fills should be constructed using on-site or imported materials with subgrade support characteristics equal to or greater than the subgrade soils in the area being filled.

b. Structural coefficients of 0.40 for asphalt concrete and 0.12 for aggregate base course material.

c. A present serviceability index of 4.5, a terminal serviceability index of 2.5, an overall standard deviation of 0.35, a reliability factor of 85 percent, a drainage coefficient of 0.85, a seasonal variation factor of 2.4, and a design life of 20 years.

d. A total 18-kip equivalent single axle load (ESAL) of 25,000 for the passenger car parking areas and 50,000 for the major access drive areas.

7.0 EARTHWORK

7.1 General

The conclusions contained in this report for the proposed construction are contingent upon compliance with recommendations presented in this section. Any excavating, trenching, or disturbance that occurs after completion of the earthwork must be backfilled, compacted and tested in accordance with the recommendations contained herein. It is not reasonable to rely upon our conclusions and recommendations if any future unobserved and untested trenching, earthwork activities or backfilling occurs.

Evidence of existing fill and underground utilities were observed, and other underground features might be encountered during construction. These features should be demolished in accordance with the recommendations of the geotechnical engineer. Any loose or disturbed soils resulting from demolition should be removed or recompacted as engineered fill, and any excavations should be backfilled in accordance with recommendations presented herein.

7.2 Site Clearing

Strip and remove any existing fill, demolition debris, structural remnants, vegetation, debris, and any other deleterious materials from the structure and pavement areas. The structure area is defined as that area within the footprint plus 5 feet beyond the perimeter of that footprint. All exposed surfaces should be free of mounds and depressions that could prevent uniform compaction.

7.3 Excavation

We anticipate that excavations into the site soils for shallow foundations and utility trenches for the proposed construction can be accomplished with conventional equipment. Any deeper excavations penetrating the underlying sandstone will require the use of heavy-duty, specialized equipment to facilitate removal. The speed and ease of excavation is dependent on the nature of the deposit, the type of equipment used, and the skill and experience of the equipment operator.

On-site soils may pump or become unworkable at high water contents. Workability may be improved by scarifying and drying. Over-excavation of wet zones and replacement with drier granular materials may be necessary. The use of lightweight excavation and compaction equipment may be required to minimize subgrade pumping.

7.4 Foundation Preparation

For structures where rock is encountered throughout the entire building area, remove all loose, disturbed materials from the bottoms and sides of the footing excavations prior to the placement of foundation reinforcement and concrete. The depth and lateral extent of removal required for this condition will vary and is best determined in the field during foundation excavation operations. If desired, lean mix (2-sack) concrete backfill may then be used to backfill any deeper portions of the excavations to design bottom of foundation elevation.

For structures bearing partially on native soil/rock areas and partially on fills, provide a minimum of 2 feet of engineered fill material below all foundation elements. Removal and replacement in native soil/rock areas may extend straight down along the sides of the footing.

7.5 Slab-on-Grade Preparation

Scarify, moisten or dry as required, and compact all subgrade soils to a minimum depth of 8 inches. The subgrade preparation should be accomplished in a manner which will result in uniform water contents and densities after compaction. All subgrade preparation in the building area should extend a minimum of 5 feet beyond perimeter footings.

7.6 Pavement Preparation

Prior to placement of fill and/or pavement materials, the exposed subgrade soils should be proof-rolled and observed by the geotechnical engineer or his qualified representative to verify that stable subgrade conditions exist. Any loose, soft, disturbed, or otherwise unsuitable materials should be over-excavated and replaced with engineered fill. The subgrade should then be scarified, moisture conditioned as required, and recompacted for a minimum depth of 8 inches.

7.7 Materials

a. Clean on-site soils with low expansive potentials and maximum dimension of 6 inches or imported materials may be used as fill material for the following:

- Foundation areas
- Slab-on-grade areas
- Pavement areas
- Backfill
- Landscape areas

b. Frozen soils should not be used as fill or backfill.

c. Lean mix (2-sack) concrete backfill should consist of aggregate base course type material combined with 2 sacks of cement per cubic yard. A coarse rock mix should not be used.

d. Imported soils should conform to the following:

- Gradation (ASTM C136): percent finer by weight

6"	100
4"	85-100
¾”	70-100
No. 4 Sieve	50-100
No. 200 Sieve	40 (max)

- Maximum expansive potential (%)[1] 1.5
- Maximum soluble sulfates (%) 0.10

e. Base course should conform to City of Sedona, Current Edition specifications.

7.8 Placement and Compaction

a. Place and compact fill in horizontal lifts, using equipment and procedures that will produce recommended water contents and densities throughout the lift.

b. Uncompacted lift thickness should not exceed 8 inches.

c. Materials should be compacted to the following:

Material	Minimum Percent Compaction (ASTM D698)
Imported and on-site soil, fill and reworked:	
Below foundations	95
Below slabs-on-grade	95
Pavement areas	95
Landscape areas	85
Aggregate base:	
Below slabs-on-grade	95
Pavement areas	100
Backfill:	
Structural	95
Nonstructural	90

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[1] Measured on a sample compacted to approximately 95 percent of the ASTM D698 maximum dry density at about 3 percent below optimum water content. The sample is confined under a 100 psf surcharge and submerged.

d. On-site soils and imported soils with low expansive potential and aggregate base course materials should be compacted with a moisture content in the range of 3 percent below to 3 percent above optimum.

7.9 Compliance

Recommendations for foundations, slabs-on-grade and pavements supported on compacted fills or prepared subgrade depend upon compliance with the **EARTHWORK** recommendations. To assess compliance, observation and testing should be performed under the direction of a WT geotechnical engineer. Please contact us to provide these observation and testing services.

8.0 ADDITIONAL SERVICES

The recommendations provided in this report are based on the assumption that a sufficient schedule of tests and observations will be performed during construction to verify compliance. At a minimum, these tests and observations should be comprised of the following:

- Observations and testing during site preparation and earthwork,
- Observation of foundation excavations, and
- Consultation as may be required during construction.

Retaining the geotechnical engineer who developed your report to provide construction observation is the best way to verify compliance and to help you manage the risks associated with unanticipated conditions.

9.0 LIMITATIONS

This report has been prepared assuming the project criteria described in **2.0 PROJECT DESCRIPTION**. If changes in the project criteria occur, or if different subsurface conditions are encountered or become known, the conclusions and recommendations presented herein shall become invalid. In any such event, WT should be contacted in order to assess the effect that such variations may have on our conclusions and recommendations. If WT is not retained for the construction observation and testing services to determine compliance with this report, our professional responsibility is accordingly limited.

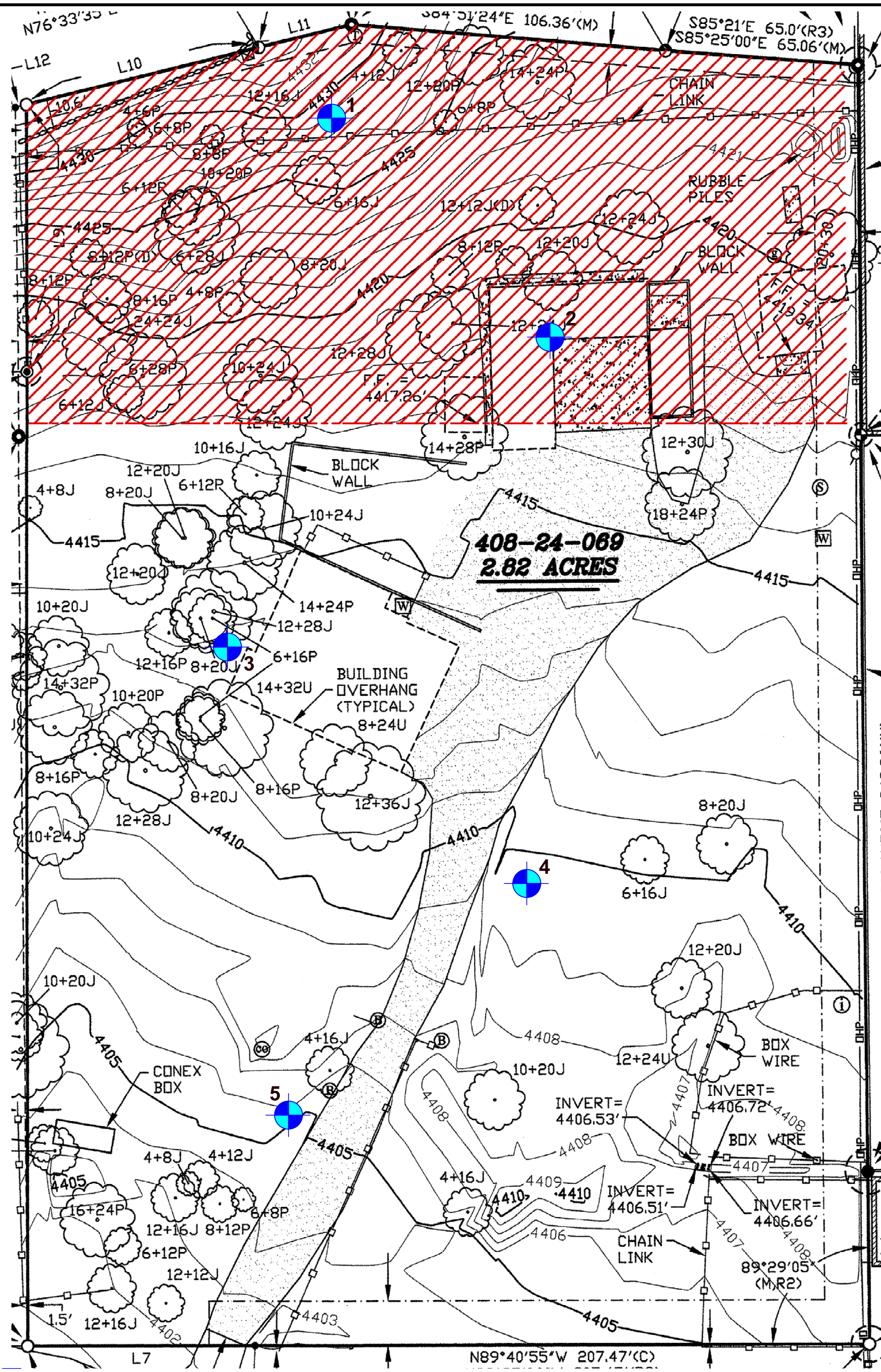
The recommendations presented are based entirely upon data derived from a limited number of samples obtained from widely spaced explorations. The attached logs are indicators of subsurface conditions only at the specific locations and times noted. This report assumes the uniformity of the geology and soil structure between explorations, however variations can and often do exist. Whenever any deviation, difference, or change is encountered or becomes known, WT should be contacted.

This report is for the exclusive benefit of our client alone. There are no intended third-party beneficiaries of our contract with the client or this report, and nothing contained in the contract or this report shall create any express or implied contractual or any other relationship with, or claim or cause of action for, any third party against WT.

This report is valid for the earlier of one year from the date of issuance, a change in circumstances, or discovered variations. After expiration, no person or entity shall rely on this report without the express written authorization of WT.

10.0 CLOSURE

We prepared this report as an aid to the designers of the proposed project. The comments, statements, recommendations and conclusions set forth in this report reflect the opinions of the authors. These opinions are based upon data obtained at the location of the explorations, and from laboratory tests. Work on your project was performed in accordance with generally accepted standards and practices utilized by professionals providing similar services in this locality. No other warranty, express or implied, is made.



Not to Scale

Approximate Test Boring Location

GOODROW DEVELOPMENT	
Boring Location Diagram	
Western Technologies Inc.	
Job No.: 25-224085-0	Plate: 1

Allowable Soil Bearing Capacity	The recommended maximum contact stress developed at the interface of the foundation element and the supporting material.
Backfill	A specified material placed and compacted in a confined area.
Base Course	A layer of specified aggregate material placed on a subgrade or subbase.
Base Course Grade	Top of base course.
Bench	A horizontal surface in a sloped deposit.
Caisson/Drilled Shaft	A concrete foundation element cast in a circular excavation which may have an enlarged base (or belled caisson).
Concrete Slabs-On-Grade	A concrete surface layer cast directly upon base course, subbase or subgrade.
Crushed Rock Base Course	A base course composed of crushed rock of a specified gradation.
Differential Settlement	Unequal settlement between or within foundation elements of a structure.
Engineered Fill	Specified soil or aggregate material placed and compacted to specified density and/or moisture conditions under observations of a representative of a soil engineer.
Existing Fill	Materials deposited through the action of man prior to exploration of the site.
Existing Grade	The ground surface at the time of field exploration.
Expansive Potential	The potential of a soil to expand (increase in volume) due to absorption of moisture.
Fill	Materials deposited by the actions of man.
Finished Grade	The final grade created as a part of the project.
Gravel Base Course	A base course composed of naturally occurring gravel with a specified gradation.
Heave	Upward movement.
Native Grade	The naturally occurring ground surface.
Native Soil	Naturally occurring on-site soil.
Rock	A natural aggregate of mineral grains connected by strong and permanent cohesive forces. Usually requires drilling, wedging, blasting or other methods of extraordinary force for excavation.
Sand and Gravel Base Course	A base course of sand and gravel of a specified gradation.
Sand Base Course	A base course composed primarily of sand of a specified gradation.
Scarify	To mechanically loosen soil or break down existing soil structure.
Settlement	Downward movement.
Soil	Any unconsolidated material composed of discrete solid particles, derived from the physical and/or chemical disintegration of vegetable or mineral matter, which can be separated by gentle mechanical means such as agitation in water.
Strip	To remove from present location.
Subbase	A layer of specified material placed to form a layer between the subgrade and base course.
Subbase Grade	Top of subbase.
Subgrade	Prepared native soil surface.

COARSE-GRAINED SOILS
LESS THAN 50% FINES

GROUP SYMBOLS	DESCRIPTION	MAJOR DIVISIONS
GW	WELL-GRADED GRAVEL OR WELL-GRADED GRAVEL WITH SAND, LESS THAN 5% FINES	GRAVELS MORE THAN HALF OF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE SIZE
GP	POORLY-GRADED GRAVEL OR POORLY-GRADED GRAVEL WITH SAND, LESS THAN 5% FINES	
GM	SILTY GRAVEL OR SILTY GRAVEL WITH SAND, MORE THAN 12% FINES	
GC	CLAYEY GRAVEL OR CLAYEY GRAVEL WITH SAND, MORE THAN 12% FINES	
SW	WELL-GRADED SAND OR WELL-GRADED SAND WITH GRAVEL, LESS THAN 5% FINES	SANDS MORE THAN HALF OF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE SIZE
SP	POORLY-GRADED SAND OR POORLY-GRADED SAND WITH GRAVEL, LESS THAN 5% FINES	
SM	SILTY SAND OR SILTY SAND WITH GRAVEL, MORE THAN 12% FINES	
SC	CLAYEY SAND OR CLAYEY SAND WITH GRAVEL, MORE THAN 12% FINES	

NOTE: Coarse-grained soils receive dual symbols if they contain 5% to 12% fines (e.g., SW-SM, GP-GC).

FINE-GRAINED SOILS
MORE THAN 50% FINES

GROUP SYMBOLS	DESCRIPTION	MAJOR DIVISIONS
ML	SILT, SILT WITH SAND OR GRAVEL, SANDY SILT, OR GRAVELLY SILT	SILTS AND CLAYS LIQUID LIMIT LESS THAN 50
CL	LEAN CLAY OF LOW TO MEDIUM PLASTICITY, SANDY CLAY, OR GRAVELLY CLAY	
OL	ORGANIC SILT OR ORGANIC CLAY OF LOW TO MEDIUM PLASTICITY	
MH	ELASTIC SILT, SANDY ELASTIC SILT, OR GRAVELLY ELASTIC SILT	SILTS AND CLAYS LIQUID LIMIT MORE THAN 50
CH	FAT CLAY OF HIGH PLASTICITY, SANDY FAT CLAY, OR GRAVELLY FAT CLAY	
OH	ORGANIC SILT OR ORGANIC CLAY OF HIGH PLASTICITY	
PT	PEAT AND OTHER HIGHLY ORGANIC SOILS	HIGHLY ORGANIC SOILS

NOTE: Fine-grained soils may receive dual classification based upon plasticity characteristics (e.g. CL-ML).

SOIL SIZES

COMPONENT	SIZE RANGE
BOULDERS	Above 12 in.
COBBLES	3 in. – 12 in.
GRAVEL	No. 4 – 3 in.
Coarse	¾ in. – 3 in.
Fine	No. 4 – ¾ in.
SAND	No. 200 – No. 4
Coarse	No. 10 – No. 4
Medium	No. 40 – No. 10
Fine	No. 200 – No. 40
Fines (Silt or Clay)	Below No. 200

NOTE: Only sizes smaller than three inches are used to classify soils

CONSISTENCY

CLAYS & SILTS	BLOWS PER FOOT
VERY SOFT	0 – 2
SOFT	3 – 4
FIRM	5 – 8
STIFF	9 – 15
VERY STIFF	16 – 30
HARD	OVER 30

RELATIVE DENSITY

SANDS & GRAVELS	BLOWS PER FOOT
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

NOTE: Number of blows using 140-pound hammer falling 30 inches to drive a 2-inch-OD (1⅜-inch ID) split-barrel sampler (ASTM D1586).

PLASTICITY OF FINE GRAINED SOILS

PLASTICITY INDEX	TERM
0	NON-PLASTIC
1 – 7	LOW
8 – 20	MEDIUM
Over 20	HIGH

DEFINITION OF WATER CONTENT

DRY
SLIGHTLY DAMP
DAMP
MOIST
WET
SATURATED

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METHOD OF CLASSIFICATION

PLATE
A-2

090414

The number shown in **"BORING NO."** refers to the approximate location of the same number indicated on the "Boring Location Diagram" as positioned in the field by pacing or measurement from property lines and/or existing features.

"DRILLING TYPE" refers to the exploratory equipment used in the boring wherein **HSA = hollow stem auger**, and the dimension presented is the outside diameter of the HSA used.

"R" in "BLOW COUNTS" refers to a 3-inch outside diameter ring-lined split barrel sampler driven into the ground with a 140 pound drop-hammer dropped 30 inches repeatedly until a penetration of 12 inches is achieved or until refusal. The number of blows required to advance the sampler 12 inches is defined as the "**R**" blow count. The "**R**" blow count requires an engineered conversion to an equivalent SPT N-Value. Refusal to penetration is considered more than 50 blows per foot. An **X** within the symbol indicates no sample recovery. A half-filled **X** within the symbol indicates sample disturbance.

"SAMPLE TYPE" refers to the form of sample recovery, in which **R** = Ring-lined sample and **G** = Grab sample.

"DRY DENSITY (LBS/CU FT)" refers to the laboratory-determined dry density in pounds per cubic foot.

"WATER (MOISTURE) CONTENT" (% of Dry Wt.) refers to the laboratory-determined water content in percent using the standard test method ASTM D2216.

"USCS" refers to the "Unified Soil Classification System" Group Symbol for the soil type as defined by ASTM D2487 and D2488. The soils were classified visually in the field, and where appropriate, classifications were modified by visual examination of samples in the laboratory and/or by appropriate tests.

These notes and boring logs are intended for use in conjunction with the purposes of our services defined in the text. Boring log data should not be construed as part of the construction plans nor as defining construction conditions.

Boring logs depict our interpretations of subsurface conditions at the locations and on the date(s) noted. Variations in subsurface conditions and characteristics may occur between borings. Groundwater levels may fluctuate due to seasonal variations and other factors.

The stratification lines shown on the boring logs represent our interpretation of the approximate boundary between soil or rock types based upon visual field classification at the boring location. The transition between materials is approximate and may be more or less gradual than indicated.

Western Technologies An RMA Company	**BORING LOG NOTES**	PLATE **A-3**

Project: Goodrow Development Project Number: 25-224085-0	BORING NO. 1	Western Technologies An RMA Company

Date(s) Drilled **4/9/24**	Logged By **S. Garcia**	Checked By **J. Quinlan**
Drilling Method **HSA**	Drill Bit Size/Type **6" HSA**	Approximate Surface Elevation **Not Determined**
Drill Rig Type **CME-75**	Drilling Contractor **Integrity**	
Groundwater Level and Date Measured **Not Enocuntered**	Location **See Location Diagram**	

Water Content, %	Dry Unit Weight, pcf	Sample Type	Sample	Sampling Resistance, blows/ft	Depth (feet)	Soil Type	Graphic Log	MATERIAL DESCRIPTION
			G		0	CL-ML		Sandy, Silty CLAY; some gravel, cobbles and boulders, red, hard, slightly damp
4.8	110		R	50/10"				
			R	50/1"	5			
								Auger Refusal at 6 Feet on SANDSTONE
					10			
					15			
					20			

Figure A-4

Project: Goodrow Development Project Number: 25-224085-0	BORING NO. 2	Western Technologies An RMA Company

Date(s) Drilled **4/9/24**	Logged By **S. Garcia**	Checked By **J. Quinlan**
Drilling Method **HSA**	Drill Bit Size/Type **6" HSA**	Approximate Surface Elevation **Not Determined**
Drill Rig Type **CME-75**	Drilling Contractor **Integrity**	
Groundwater Level and Date Measured **Not Enocuntered**	Location **See Location Diagram**	

Water Content, %	Dry Unit Weight, pcf	Sample Type	Sample	Sampling Resistance, blows/ft	Depth (feet)	Soil Type	Graphic Log	MATERIAL DESCRIPTION
			G		0	SM		Silty SAND; with gravel, cobbles and boulders, red, dense to very dense, damp
			R	47				
10.2	48		R	50/8"	5			
			R	50/6"	10			
					13			Auger Refusal at 13 Feet on SANDSTONE
					15			
					20			

Figure A-5

Project: Goodrow Development Project Number: 25-224085-0	BORING NO. 3	Western Technologies An RMA Company

Date(s) Drilled **4/9/24**	Logged By **S. Garcia**	Checked By **J. Quinlan**
Drilling Method **HSA**	Drill Bit Size/Type **6" HSA**	Approximate Surface Elevation **Not Determined**
Drill Rig Type **CME-75**	Drilling Contractor **Integrity**	
Groundwater Level and Date Measured **Not Enocuntered**	Location **See Location Diagram**	

Water Content, %	Dry Unit Weight, pcf	Sample Type	Sample	Sampling Resistance, blows/ft	Depth (feet)	Soil Type	Graphic Log	MATERIAL DESCRIPTION
			G		0	ML		Sandy SILT; some gravel, cobbles and boulders, red, soft, slightly damp
			R	4				
					3			Auger Refusal at 3 Feet on SANDSTONE
					5			
					10			
					15			
					20			

Figure A-6

Project: Goodrow Development Project Number: 25-224085-0	BORING NO. 4	Western Technologies An RMA Company

Date(s) Drilled **4/9/24**	Logged By **S. Garcia**	Checked By **J. Quinlan**
Drilling Method **HSA**	Drill Bit Size/Type **6" HSA**	Approximate Surface Elevation **Not Determined**
Drill Rig Type **CME-75**	Drilling Contractor **Integrity**	
Groundwater Level and Date Measured **Not Enocuntered**	Location **See Location Diagram**	

Water Content, %	Dry Unit Weight, pcf	Sample Type	Sample	Sampling Resistance, blows/ft	Depth (feet)	Soil Type	Graphic Log	MATERIAL DESCRIPTION
			G		0	SM		Silty SAND; with gravel, cobbles and boulders, red, medium dense to very dense, slightly damp
6.5	97		R	12				
3.5	95		R	13	5			
2.3	115		R	50/7"	10			
					14			Auger Refusal at 14 Feet on SANDSTONE
					15			
					20			

Figure A-7

Project: Goodrow Development Project Number: 25-224085-0	BORING NO. 5	Western Technologies An RMA Company

Date(s) Drilled **4/9/24**	Logged By **S. Garcia**	Checked By **J. Quinlan**
Drilling Method **HSA**	Drill Bit Size/Type **6" HSA**	Approximate Surface Elevation **Not Determined**
Drill Rig Type **CME-75**	Drilling Contractor **Integrity**	
Groundwater Level and Date Measured **Not Enocuntered**	Location **See Location Diagram**	

Water Content, %	Dry Unit Weight, pcf	Sample Type	Sample	Sampling Resistance, blows/ft	Depth (feet)	Soil Type	Graphic Log	MATERIAL DESCRIPTION
			G		0	SM		Silty SAND; with gravel, cobbles and boulders, red, loose to very dense, slightly damp
6.4	93		R	9				
5.8	104		R	13	5			
4.8	104		R	31	10			
3.7	81		R	50/1"	15			
					17			Auger Refusal at 17 Feet on SANDSTONE
					20			

Figure A-8

Boring No.	Depth (ft)	USCS Class.	Particle Size Distribution (%) Passing by Weight							Atterberg Limits		Laboratory Compaction Characteristics			Remarks
			3”	¾”	#4	#10	#40	#200	2µ	LL	PI	Dry Density (pcf)	Optimum Moisture (%)	Method	
1	0-5	CL-ML	100	95	85	77	68	59.9		25	5				2
3	0-3	ML	100	96	84	79	73	59.2			NP				2
5	0-5	SM	100	98	83	79	74	46.7		19	3				2

NOTE: NP = Non-plastic
µ = microns (2µ = 0.002mm)

REMARKS

Classification / Particle Size / Moisture-Density Relationship
1. Visual
2. Laboratory Tested
3. Minus #200 Only
4. Test Method ASTM D698/AASHTO T99
5. Test Method ASTM D1557/AASHTO T180
6. From the ADOT Family of Curves

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PROJECT: GOODROW DEVELOPMENT
JOB NO.: 25-224085-0

PLATE
B-1

SOIL PROPERTIES

Boring No.	Depth (ft.)	USCS Class.	Initial Dry Density (pcf)	Initial Water Content (%)	Laboratory Compaction Characteristics			Expansion Properties		Plasticity		Soluble		Remarks
					Dry Density(pcf)	Optimum Moisture(%)	Method	Surcharge (ksf)	Expansion (%)	LL	PI	Salts (ppm)	Sulfate (ppm)	
1	0-5	CL-ML	115.4	9.0	121.5	12.0	A	0.1	1.4					1,2,3

Notes: Initial Dry Density and Initial Water Content are remolded.

Remarks

1. Compacted density (approx. 95% of ASTM D698 max. density at moisture content slightly below optimum.)
2. Submerged to approximate saturation.
3. Test Method ASTM D698/AASHTO T99
4. Test Method ASTM D1557/AASHTO T180
5. From the ADOT Family of Curves

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PROJECT: GOODROW DEVELOPMENT
JOB NO.: 25-224085-0

SOIL PROPERTIES

PLATE
B-2

Nortest Analytical
An RMA Company

Reported: 4/17/2024
Received: 4/12/2024

LABORATORY ANALYSIS REPORT

Project: 25-224085-0

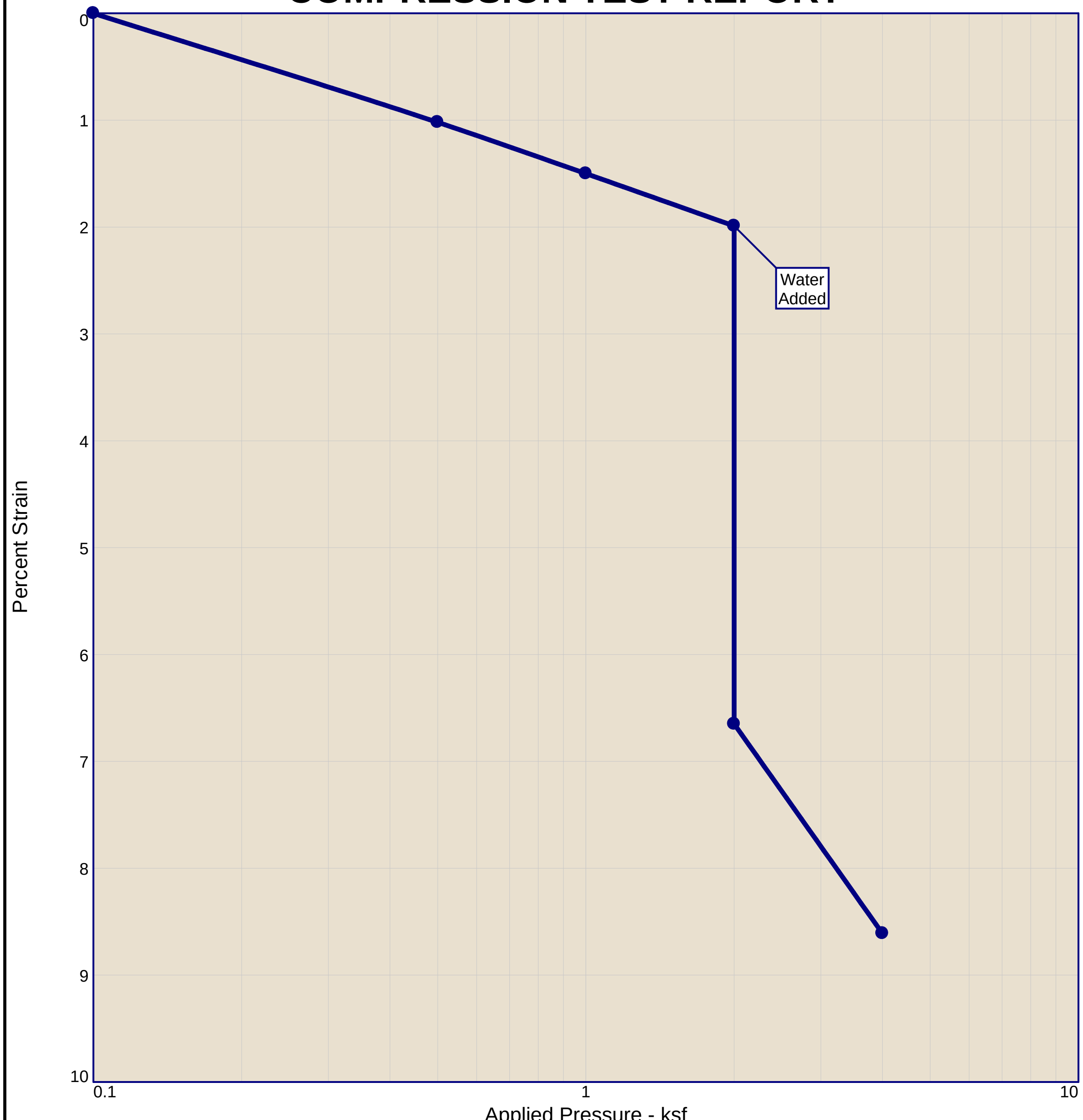
Lab Number: 24S0051

Sample ID: 1(0-5)

Test Parameter

Test	*Method*	*Result*	*Units*
Soluble Salts	ARIZ 237b	207	ppm
Sulfate	ARIZ 733b	21	ppm
Chloride	ARIZ 736b	10	ppm

COMPRESSION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (ksf)	P_c (ksf)	C_c	C_r	Swell Press. (ksf)	Clpse. %	e_o
Sat.	Moist.											
25.8 %	4.8 %	110.4			2.65						4.7	0.499

MATERIAL DESCRIPTION	USCS	AASHTO
SANDY SILTY CLAY	CL-ML	

Project No. 25-224085-0 **Client:** SEFTON ENGINEERING CONSULTANTS

Project: GOODROW DEVELOPMENT

Source: RING SAMPLES **Depth:** 2-3 FEET **Sample No.:** BORING 1

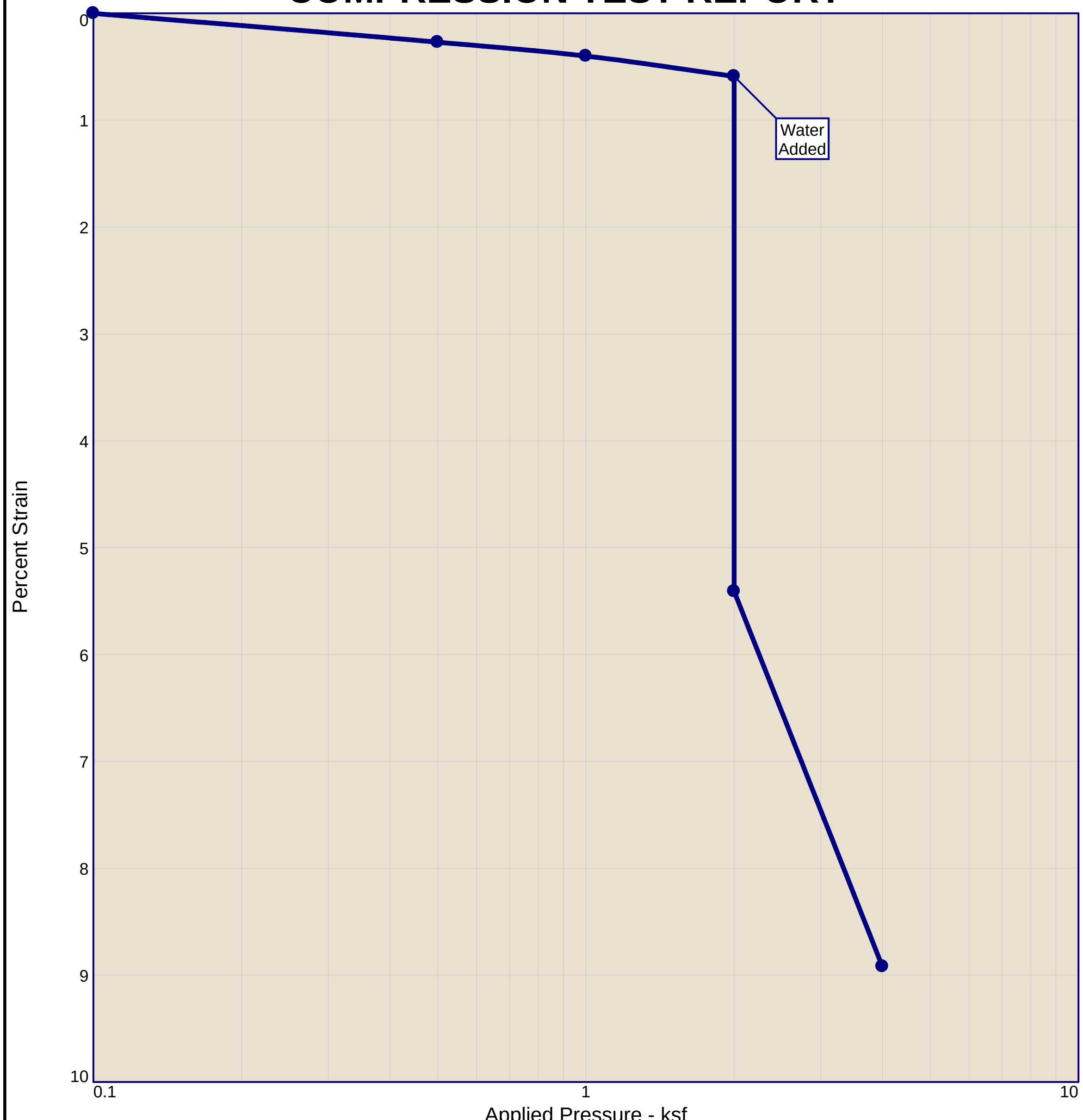
Remarks:

Western Technologies, Inc.

Flagstaff, AZ

Plate B-4

COMPRESSION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (ksf)	P_c (ksf)	C_c	C_r	Swell Press. (ksf)	Clpse. %	e_o
Sat.	Moist.											
24.8 %	6.5 %	97.0			2.65						4.8	0.694

MATERIAL DESCRIPTION	USCS	AASHTO
SILTY SAND WITH GRAVEL	SM	

Project No. 25-224085-0 **Client:** SEFTON ENGINEERING CONSULTANTS

Project: GOODROW DEVELOPMENT

Source: RING SAMPLES **Depth:** 2-3 FEET **Sample No.:** BORING 4

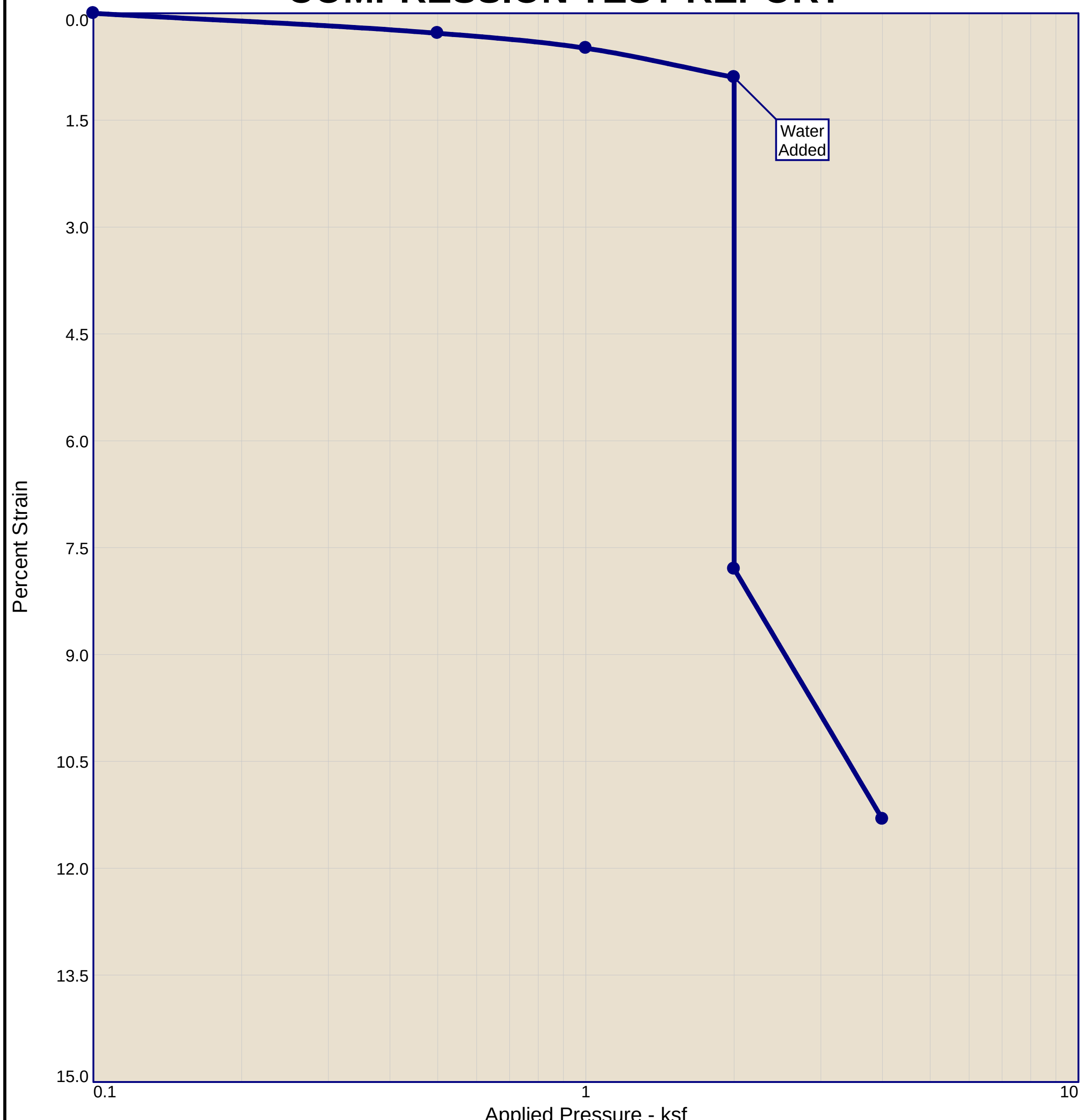
Remarks:

Western Technologies, Inc.

Flagstaff, AZ

Plate B-5

COMPRESSION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (ksf)	P_c (ksf)	C_c	C_r	Swell Press. (ksf)	Clpse. %	e_o
Sat.	Moist.											
21.9 %	6.4 %	92.9			2.65						6.9	0.780

MATERIAL DESCRIPTION	USCS	AASHTO
SILTY SAND WITH GRAVEL	SM	

Project No. 25-224085-0 **Client:** SEFTON ENGINEERING CONSULTANTS

Project: GOODROW DEVELOPMENT

Source: RING SAMPLES **Depth:** 2-3 FEET **Sample No.:** BORING 5

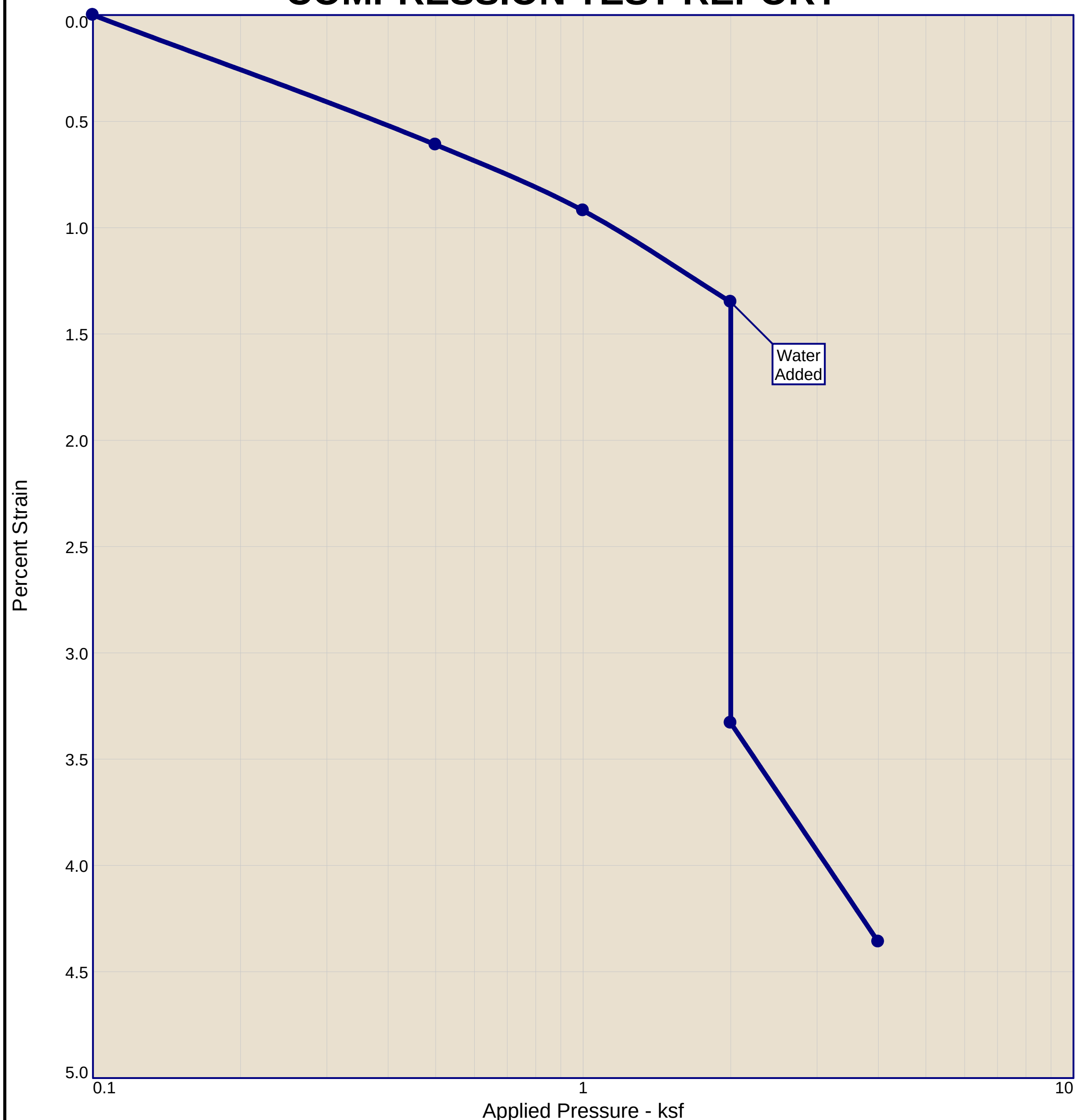
Remarks:

Western Technologies, Inc.

Flagstaff, AZ

Plate B-6

COMPRESSION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (ksf)	P_c (ksf)	C_c	C_r	Swell Press. (ksf)	Clpse. %	e_o
Sat.	Moist.											
25.9 %	5.8 %	103.9			2.65						2.0	0.592

MATERIAL DESCRIPTION	USCS	AASHTO
SILTY SAND WITH GRAVEL	SM	

Project No. 25-224085-0 **Client:** SEFTON ENGINEERING CONSULTANTS

Project: GOODROW DEVELOPMENT

Source: RING SAMPLES **Depth:** 5-6 FEET **Sample No.:** BORING 5

Remarks:

Western Technologies, Inc.

Flagstaff, AZ

Plate B-7