Western Technologies Inc.

GEOTECHNICAL EVALUATION REPORT

RUSSELL GULCH LANDFILL OFFICES & SCALES
5977 East Hope Lane
Globe, Arizona 85501
WT Job No. 2122JP123

PREPARED FOR:
Gila County Public Works Department
745 North Rose Mofford Way
Globe, Arizona 85501

August 16, 2022

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1.0 PURPOSE

This report contains the results of our geotechnical evaluation for a proposed office building and truck scales to be located in Globe, Arizona. The purpose of these services is to provide information and recommendations regarding:

- Subsurface conditions
- Foundation design parameters
- Lateral earth pressures
- Earthwork guidelines
- Pavement sections
- Drainage
- Geology
- Retaining walls
- Groundwater
- Corrosivity (soil to concrete)
- Slabs-on-grade
- Seismic conditions
- Excavation conditions
- Trench backfill
- Geologic hazards

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

2.0 PROJECT DESCRIPTION

Based on information provided, the proposed development will consist of an approximately 1,600 square-foot, single-story slab-on-grade structure using masonry and/or frame construction. Maximum wall and column loads are assumed to be 3 klf and 75 kips, respectively. Additionally, truck scales will be constructed northeast of the structure. We anticipate no extraordinary slab-on-grade criteria and that ground floor level will be within a few feet of existing site grade. On-site asphalt paved areas for parking and driveways and rigid pavement sections for loading/unloading and dumpster areas will be constructed. Any off-site improvements have not been included as part of this evaluation. Should this information not be correct, we should be notified immediately.

3.0 SCOPE OF SERVICES

3.1 Field Exploration

Two borings were drilled to depths ranging from about 16.5 to 21.5 feet below existing site grade in the proposed building areas. In addition, one boring was drilled to a depth of about 5 feet in the proposed paved parking and drive area. 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. Local and regional geologic characteristics were used to estimate the seismic design criteria.

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
- Plasticity
- Sieve analysis
- Soil pH
- Minimum electrical resistivity
- Soluble sulfate and chloride content
- Expansion index

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 its 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 a vacant, graded area within the Russell Gulch Landfill property. The ground surface was relatively flat and contained a sparse growth of brush and grasses. Site drainage trended to the southwest as sheet surface flow to a natural wash. Other site features included an existing warehouse building at the northwest area of the site and electrical line towers and overhead utility lines parallel to Hope Lane at the eastern portion of the site. The site is bound by East Hope Lane to the northeast, a natural wash to the southwest, and undeveloped land within the landfill property to the northwest and southeast. A photograph of the site at the time of our exploration is provided below.

View of the site from the southeast property line taken on July 15, 2022.

4.2 Aerial Photography Review

Historic aerial photographs dating back to 1992 were reviewed for the subject site. The photographs depict the site as undeveloped until about 2003, when fill was placed on the site and a small accessory building was constructed. The site development appears unchanged until about 2013 when additional fill was placed, the previous structure was removed, and the current warehouse building was constructed. Current site development appears to have been present since that time.

4.3 Subsurface

As presented on the Boring Logs, surface soils to the full depths of exploration consisted of loose to dense Clayey SAND with gravel. Near surface soils are of medium plasticity. No apparent zones of carbonate cementation were encountered. Groundwater was not encountered in any boring at the time of exploration. A detailed description of the soils encountered can be found on the boring logs in Appendix A.

Fill was encountered in some of the borings to depths of approximately 8 feet and consisted of loose to medium dense Clayey SAND. There may be deeper fill in areas beyond or between our borings. It is not known if the fill was placed under the observation and testing of a geotechnical engineer and is, therefore, assumed to be uncontrolled fill for the purposes of this report.

4.4 Geology

The site is located in the Basin and Range Geologic Province. The Basin and Range Province is characterized by a modern landscape consisting of broad alluvial valleys bound by steep, relatively rugged mountain ranges. The trend of the valleys and mountain ranges is generally in a north-south to northwest-southeast direction. The modern landscape was formed primarily by middle and late Cenozoic extensional tectonism, which resulted in high angle normal faults. The Site is located in Recent and Pleistocene Age alluvial materials that are of substantial thickness. These sediments are well consolidated and, in places, are lightly cemented.

4.5 Geologic Hazards

There are no known or mapped seismic faults on or adjacent to the site. The nearest seismic fault is located 43 miles to the northwest. This fault is not generally considered to be seismically active.

No known or mapped earth subsidence fissures, due to regional groundwater withdrawal, are on or adjacent to the site. No evidence has been noted of distress arising from areal subsidence due to regional groundwater withdrawal. The closest mapped earth fissure zone is located approximately 45 miles to the west of the site.

5.0 GEOTECHNICAL PROPERTIES & ANALYSIS

5.1 Laboratory Tests

Laboratory test results (see Appendix B) indicate that on-site subsoils near shallow foundation level exhibit low compressibility at existing water contents. Low to moderately high levels of additional compression occurs when the water content is increased.

Near-surface soils are of medium plasticity. Tests performed in accordance with ASTM D4829 (Standard Test Method for Expansion Index of Soils), resulted in a value of 3 which corresponds to low expansive potential. Slabs-on-grade supported on recompacted on-site soils have a low potential for heaving if the water content of the soil increases.

Chemical tests were performed on representative samples of the surficial on-site soils to determine the amount of water-soluble sulfate and chloride. The tests were performed by Motzz Laboratories, Inc. and the test results are presented in Appendix B.

Minimum electrical resistivity and hydrogen ion concentration (pH) were performed on representative samples to aid in assessing, by others, the potential for corrosion of buried metals. The test results are presented in Appendix B.

5.2 Field Tests

Existing subsoils near shallow foundation level exhibited low to moderate resistance to penetration using test method ASTM D3550. This corresponds to a low bearing capacity for existing soils in their present condition. Penetration resistance values exhibited some variability between test locations. This represents a potential for differential settlements within structures supported on the existing soils in their present condition.

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.

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. This report does not encompass the effects, if any, of underlying geologic hazards or regional groundwater withdrawal and expresses no opinion regarding their effects on surface movements at the project site.

6.2 Design Considerations

Some of the surficial on-site soils encountered are loose in relative density and are considered uncontrolled fill. In addition, laboratory test results indicate that these soils become weaker and collapsible with an increase in moisture content. These soils are not suitable for support of foundations in their present state and should be over-excavated and recompacted as recommended in the **EARTHWORK** section of this report. Existing fill soils should be removed to their full depth and recompacted as engineered fill. Proper drainage should be provided to help prevent infiltration of moisture below the foundations.

It should be noted that shallow foundation systems are not designed to resist soil movements resulting from sewer or plumbing leaks, excessive or leaking irrigation systems, poor drainage, or water ponding near structures.

6.3 Foundations

Shallow spread-type footings may be used to support the proposed structure and should bear on engineered fills achieved by removal and recompaction of the soils below foundations. The depth and lateral extent of the engineered fills is presented in the **EARTHWORK** section of this report.

The existing fill on the site should not be used for support of foundations without removal and recompaction.

Alternative footing depths and allowable bearing capacities are presented in the following tabulation:

Footing Depth Below Finished Grade[1] (ft)	Allowable Bearing Capacity[2] (psf)
1.5	2,000
2.0	2,500
3.0	3,500

We anticipate that total settlement of the proposed structure, supported as recommended, should be less than ¾ inch. Differential settlement is anticipated to be less than ½ inch. Additional foundation movements could occur if water from any source infiltrates the foundation soils. Therefore, proper drainage should be provided in the final design and during construction.

[1] Finished grade is the lowest adjacent grade for perimeter footings and floor level for interior footings.

[2] Allowable bearing capacities assume fulfillment of **EARTHWORK** recommendations. Pounds per square foot (psf).

Footings should have minimum widths in accordance with local building codes. The bearing capacities given are net bearing capacities and the weight of the concrete in the footings may be ignored.

For foundations adjacent to slopes, a minimum horizontal setback of 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.

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.

We recommend that the geotechnical engineer or his representative observe the footing excavations before reinforcing steel and concrete are placed. This observation is to evaluate whether the soils exposed are similar to those anticipated for support of the footings. Any soft, loose or unacceptable soils should be undercut to suitable materials and backfilled with approved fill materials or lean concrete. Soil backfill should be properly compacted.

6.4 Lateral Design Criteria

Lateral loads may be resisted by concrete interface friction and by passive resistance. For shallow foundations bearing on properly compacted fill at this site, we recommend the following lateral resistance criteria:

- Passive:
  Shallow wall footings .... 250 psf/ft
  Shallow column footings.. 400 psf/ft

- Coefficient of base friction (passive)... 0.30

Earth retaining structures less than 10 feet in height, above any free water surface, with level backfill and no surcharge loads may be designed using the equivalent fluid pressure method. Recommended active equivalent fluid pressures and coefficients of base friction for unrestrained elements are:

- Active:
  Undisturbed subsoil .... 40 psf/ft
  Compacted granular backfill .... 30 psf/ft
  Compacted site soils .... 35 psf/ft

- Coefficient of base friction (active)..0.40

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

The equivalent fluid pressures presented herein do not include the lateral pressures arising from the presence of:

- hydrostatic conditions, submergence or partial submergence
- sloping backfill, positively or negatively
- surcharge loading, permanent or temporary
- seismic or dynamic conditions

We recommend a free-draining soil layer or manufactured geosynthetic material be constructed adjacent to the back of any retaining walls. A filter may be required between the soil backfill and drainage layer. This drainage zone should help prevent development of hydrostatic pressure on the wall. This vertical drainage zone should be tied into a gravity drainage system at the base of the 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 observed and tested during placement.

Fill against footings, stem walls, and any retaining walls should be compacted to densities specified in **EARTHWORK**. Clayey 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. Over-compaction may cause excessive lateral earth pressures that 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 2018 International Building Code and ASCE 7-16, are applicable to the project site:

Seismic Design Parameters International Building Code 2018, ASCE 7-16	
Soil Site Class	D
Mapped Spectral Response Acceleration at 0.2 sec period (S_s)	0.312g
Mapped Spectral Response Acceleration at 1.0 sec period (S_1)	0.093g
Site Coefficient for 0.2 sec period (F_a)	1.55
Site Coefficient for 1.0 sec period (F_v)	2.40
Design Spectral Response Acceleration at 0.2 sec period (S_{DS})	0.323g
Design Spectral Response Acceleration at 1.0 sec period (S_{D1})	0.149g

The soil site class is based upon conditions identified in shallow explorations and local knowledge of the soil conditions in the vicinity of the site. Soil conditions extending beyond the depth of our explorations to a depth of 100 feet were assumed for the purposes of providing the information presented in the table.

6.6 Conventional Slab-on-Grade Support

Floor slabs can be supported on properly placed and compacted fill. The slab subgrade should be prepared by the procedures outlined in this report. A minimum 4-inch layer of base course should be provided beneath all slabs to help prevent capillary rise and a damp slab. The modulus of subgrade reaction (k) is estimated to be 250 pounds per cubic inch (pci), based upon a 30-inch diameter plate.

The use of vapor retarders or barriers 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 recommendations given in ACI 302.1R and 302.2R. Final determination on the use of a vapor retarder should be left to others in the design team.

All concrete placement and curing operations should follow the American Concrete Institute manual recommendations. Improper curing techniques and/or high slump (high water-cement ratio) could cause excessive shrinkage, cracking or curling. 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 problems in this vicinity is moisture increase in soils below structures. Therefore, it is extremely important that positive drainage be provided during construction and maintained throughout the life of the proposed structure. Infiltration of water into utility or foundation excavations must be prevented during construction.

In areas where sidewalks or paving do not immediately adjoin the structure, protective slopes should be provided with an outfall of 5 percent for at least 10 feet from perimeter walls. Scuppers and drainpipes should be designed to provide drainage away from the structure for a minimum of 10 feet. 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.

Water and sewer utility lines should be properly installed to avoid possible sources for subsurface saturation. It is important that all utility trenches be properly backfilled. If practicable, planters and/or landscaping should not be constructed adjacent to or near structure. If planters and/or landscaping are adjacent to or near the structure, we recommend the following:

- Planters should be sealed
- Grades should slope away from the structure
- Only shallow rooted landscaping should be used
- Watering should be kept to a minimum

It should be understood that these recommendations will help reduce 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:

Traffic Area	Asphalt Concrete Pavement (inches)	Base Course (inches)
Passenger car parking and drives (low traffic frequency)	2.5	5.0
Major access drives (medium traffic frequency)	3.0	6.0

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

Bituminous surfacing should be constructed of dense-graded, central plant-mix, asphalt concrete. Base course material should conform to the specification requirements for Untreated Base, Aggregate Base of the *Maricopa Association of Governments* (MAG) *Uniform Standard Specifications for Public Works Construction*. Asphalt concrete should conform to the specification requirements for "½-inch" Marshall Mix of the MAG specifications.

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

The pavement section designs presented herein are based upon the (indicated or normal) traffic loading. Some damage may occur in localized areas during periods of abnormally heavy traffic loads, such as from repeated passage of construction equipment, heavily loaded delivery, haul or concrete trucks during facility construction. Consideration should be given to a staged construction and maintenance program or alternative access routes during these periods to limit damage to the final pavement section.

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.

If any unobserved and untested earthwork, trenching or backfilling occurs, then the conclusions and recommendations in this report may not be relied on. We recommend that Western Technologies Inc. be retained to provide services during these phases of the project. Observation and testing of all foundation excavations should be performed prior to placement of reinforcing steel and concrete to confirm that foundations are constructed on satisfactory bearing materials.

Underground utilities were observed on the site. Previously placed fill and backfill, and disturbed soils are likely to be encountered during construction. These features should be handled in accordance with the recommendations of the geotechnical engineer and/or any applicable regulatory requirements. 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 material, vegetation, debris, and any other deleterious materials from the building and pavement areas. The building area is defined as that area within the building 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.

Sloping areas steeper than 5:1 (horizontal:vertical) should be benched to reduce the potential for slippage between existing slopes and fills. Benches should be level and wide enough to accommodate compaction and earth moving equipment.

7.3 Keyways and Benches

Fill placed on slopes steeper than 5H:1V (horizontal:vertical) should be keyed and benched into the existing slope to reduce the potential for slippage between existing slopes and fills. In general, keyways should extend vertically downward into undisturbed native soil, be a minimum of 8 feet wide and a minimum of 2 feet deep, and extend the full length of the slope. Benches should extend at least 2 feet laterally into undisturbed native soils. Benches should be level and wide enough to accommodate compaction and earth moving equipment. Cut slopes between benches should not be flatter than 1H:1V and should not exceed 5 feet in height.

7.4 Excavation

We anticipate that excavations for shallow foundations and utility trenches for the proposed construction can be accomplished with conventional equipment.

The soils to be penetrated by the proposed excavations may vary significantly across the site. Our soil classifications are based solely on the materials encountered in widely spaced exploratory test borings. The contractor should verify that similar conditions exist throughout the proposed area of excavation. If different subsurface conditions are found at the time of construction, we should be contacted immediately to evaluate the conditions encountered.

7.4.1 Temporary Excavations and Slopes

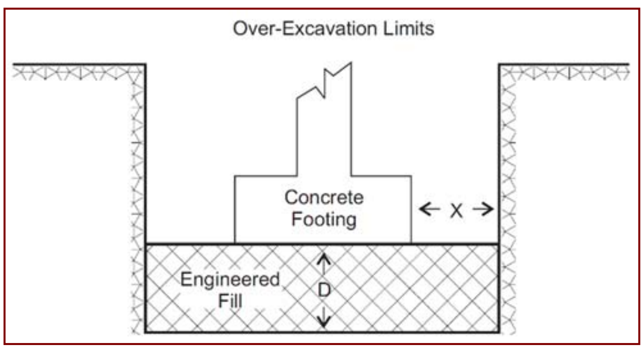
Temporary, non-surcharged construction excavations should be sloped or shored. The individual contractor should be made responsible for designing and constructing stable, temporary excavations as required to maintain stability of both the excavation sides and bottom. All excavations should be sloped or shored in the interest of safety following local and federal regulations, including current OSHA excavation and trench safety standards. OSHA recommends a maximum slope inclination of ¾:1 (horizontal:vertical) for Type A soils, 1:1 for Type B soils, and 1½:1 for Type C soils.

As a safety measure, it is recommended that all vehicles and soil piles be kept a minimum lateral distance back from the crest of the slope at least equal to the slope height. The exposed slope face should be protected against the elements.

We recommend that the contractor retain a geotechnical engineer to observe the soils exposed in all excavations and provide engineering design for the slopes. This will provide an opportunity to classify the soil types encountered, and to modify the excavation slopes as necessary. This also allows the opportunity to analyze the stability of the excavation slopes during construction.

7.5 Foundation Preparation

In footing areas, remove existing soils as required to a minimum depth of feet below the bottom of the footing (depth D in the diagram below), 3 feet below existing grade or to the full depth of existing fill, whichever is deepest. Removal should extend a minimum of 3 feet beyond the footing edges (length X in the diagram below). Replace with engineered fill material.



It may be more practical to remove soils to the maximum depth beneath all portions of the structure area. If this is done, the removal and recompaction should extend at least 5 feet beyond the perimeter footings.

Any existing fill or disturbed soil on the site should not be used for support of foundations without removal to its full depth and recompaction.

7.6 Conventional Interior Slab Preparation

Scarify, moisten or dry as required, and compact all subgrade soils to a minimum depth of 12 inches. The subgrade preparation is to be accomplished in a manner that will result in uniform water contents and densities after compaction.

7.7 Exterior Slab Preparation

Compacted subgrade soils expand when the water content increases. Therefore, exterior concrete grade slabs may heave, resulting in cracking or vertical offsets. This potential would be greatest where slabs overlie compacted clay subgrade soils or in areas where the passage of construction equipment has inadvertently densified the subsoils. To reduce the potential for damage, we recommend:

- Use of fill with low expansion potential
- Placement of effective control joints on relatively close centers
- Moisture-density control during placement of subgrade fills
- Provision for adequate drainage in areas adjoining the slabs
- Use of designs which allow vertical movement between the exterior slabs and adjoining structural elements

7.8 Pavement Preparation

The subgrade should be scarified, moistened as required, and recompacted for a minimum depth of 10 inches prior to placement of fill and pavement materials.

Prior to placement of base course 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.

7.9 Materials

On-site soils, minus any debris or organic matter may be used in required fills. Materials used in the upper 3 to 5 feet of the building pads should be reasonably free of rock and lumps having a particle diameter greater than 4 inches. Acceptance of the quantity of oversized materials shall be at the discretion of the geotechnical engineer. Any required import material should consist of relatively non-expansive and preferably granular material. All imported material should be approved prior to importing.

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 .... 50 (max)

- Maximum expansive potential (%)[3] 1.5
- Maximum Expansion Index (EI) 20

- Maximum soluble sulfates (%) 0.10

Oversize material, greater than 4 inches but less than 12 inches, may be used in the lower portions of the building pad, below 5 feet, provided that the particles are distributed throughout the fill and no nesting of oversize material occurs.

The materials used in the upper 5 feet of fill in the building pad should be reasonably free of rocks or lumps having a particle diameter greater than 4 inches. Acceptance of the quantity of oversize material shall be at the discretion of the geotechnical engineer.

Base course should conform to the *Maricopa Association of Governments Uniform Standard Specifications for Public Works Construction* (MAG) or other local government specifications.

7.10 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.

[3] Measured on a sample compacted to approximately 95 percent of the ASTM D698 maximum dry density at about 2 percent below optimum water content. The sample is confined under a 144 psf surcharge and submerged.

b. Uncompacted lift thickness should not exceed 10 inches.

c. Materials should be compacted to the following:

Material	Minimum Percent Compaction (ASTM D698)
• On-site or imported soil, reworked and fill:	
Below footings	95
Below slabs-on-grade	95
Below pavement	95
• Base course below slabs-on-grade and foundations	95
• Aggregate base below pavement (public right-of-way)	100
• Aggregate base below pavement (private drives, parking areas)	95
• Nonstructural backfill	90

Fill at depths greater than 5 feet below finished grade should be compacted to at least 100 percent of the ASTM D698 dry-density value to within 5 feet of finished grade. Fill at depths less than 5 feet below finished grade should be compacted to the minimum values provided above.

On-site and imported soils should be compacted within a water content range of 3 percent below to 3 percent above optimum.

7.11 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.

NORTH

NOT TO SCALE

Geotechnical Environmental Inspections Materials — **Western Technologies Inc.** The Quality People Since 1955	**PROJECT VICINITY MAP** RUSSELL GULCH LANDFILL OFFICES & SCALES 5977 EAST HOPE LANE GLOBE, ARIZONA WT Job No. 2122JP123	**PLATE 1**

LEGEND

⊕ Approximate Boring Location

Geotechnical
Environmental
Inspections
Materials

Western Technologies Inc.
The Quality People
Since 1955

BORING LOCATION DIAGRAM

RUSSELL GULCH LANDFILL OFFICES & SCALES
5977 EAST HOPE LANE
GLOBE, ARIZONA

WT Job No. 2122JP123

PLATE 2

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

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, or through the use of Global Positioning System (GPS) devices. The accuracy of GPS devices is somewhat variable.

"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.

"N" in "BLOW COUNTS" refers to a 2-inch outside diameter split-barrel sampler driven into the ground with a 140 pound drop-hammer dropped 30 inches repeatedly until a penetration of 18 inches is achieved or until refusal. The number of blows, or "blow count", of the hammer is recorded for each of three 6-inch increments totaling 18 inches. The number of blows required for advancing the sampler for the last 12 inches (2nd and 3rd increments) is defined as the Standard Penetration Test (SPT) "**N**"-Value. Refusal to penetration is considered more than 50 blows per 6 inches. (Ref. ASTM D1586).

"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 inch 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. (Ref. ASTM D3550).

"CS" in "BLOWS/FT." refers to a 2½-in. outside diameter California style split-barrel sampler, lined with brass sleeves, driven into the ground with a 140-pound hammer dropped 30 inches repeatedly until a penetration of 18 inches is achieved or until refusal. The number of blows of the hammer is recorded for each of the three 6-inch increments totaling 18 inches. The number of blows required for advancing the sampler for the last 12 inches (2nd and 3rd increments) is defined as the "CS" blow count. The "CS" blow count requires an engineered conversion to an equivalent SPT N-Value. Refusal to penetration is considered more than 50 blows for a 6-inch increment. (Ref. ASTM D 3550)

"SAMPLE TYPE" refers to the form of sample recovery, in which **N** = Split-barrel sample, **R** = Ring-lined sample, **"CS"** = California style split-barrel sample, **G** = Grab sample, **B** = Bucket sample, **C** = Core sample (ex. diamond bit rock coring).

"DRY DENSITY (LBS/CU FT)" refers to the laboratory-determined dry density in pounds per cubic foot. The symbol **"NR"** indicates that no sample was recovered.

"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.

DATE DRILLED: **7-27-22**
LOCATION: **See Location Diagram**
ELEVATION: **Not Determined**

BORING NO. 1

EQUIPMENT TYPE: **CME-55**
DRILLING TYPE: **6" H.S.A**
FIELD ENGINEER: **S. Wells**

MOISTURE CONTENT (% OF DRY WT.)	DRY DENSITY (LBS/CU FT)	SAMPLE TYPE	BLOWS/FT.	DEPTH (FEET)	USCS	SOIL DESCRIPTION
		B			SC	Fill: Clayey SAND with gravel; brown to gray, damp
7.3	109	R	21			medium dense
7.9	118	R	13	5		loose
					SC	Clayey SAND with gravel; brown to gray, damp
						decrease in clay content, decrease in gravel content
6.0	105	R	27	10		medium dense
						increase in gravel content
		N	12	15		
						decrease in clay content
		N	15	20		
						Boring Terminated at 21.5-feet

N- STANDARD SAMPLER
R- RING SAMPLER
B- BUCKET SAMPLE
G- GRAB SAMPLE
M- OPEN SAMPLER - (no rings)

NOTES: **Groundwater Not Encountered**

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH TIME. DATA PRESENTED IS A SIMPLIFICATION.

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Western Technologies Inc.
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Since 1955

PROJECT: **RUSSELL GULCH LANDFILL OFFICES & SCALES**
LOCATION: **GLOBE, ARIZONA**
PROJECT NO.: **2122JP123**

BORING LOG

PLATE **A-4**

DATE DRILLED: **7-27-22**
LOCATION: **See Location Diagram**
ELEVATION: **Not Determined**

BORING NO. 2

EQUIPMENT TYPE: **CME-55**
DRILLING TYPE: **6" H.S.A**
FIELD ENGINEER: **S. Wells**

MOISTURE CONTENT (% OF DRY WT.)	DRY DENSITY (LBS/CU FT)	SAMPLE TYPE	BLOWS/FT.	DEPTH (FEET)	USCS	SOIL DESCRIPTION
		B		0	SC	Fill: Clayey SAND with gravel; brown to gray, damp
6.8	105	R	17	2		medium dense
5.8	101	R	20	5		
				8	SC	Clayey SAND with gravel; brown to gray, damp
5.7	118	R	19	10		decrease in clay content, medium dense
		N	15	15		
				16.5		**Boring Terminated at 16.5-feet**

N- STANDARD SAMPLER
R- RING SAMPLER
B- BUCKET SAMPLE
G- GRAB SAMPLE
M- OPEN SAMPLER - (no rings)

NOTES: **Groundwater Not Encountered**

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH TIME. DATA PRESENTED IS A SIMPLIFICATION.

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LOCATION: **GLOBE, ARIZONA**
PROJECT NO.: **2122JP123**

BORING LOG

PLATE **A-5**

DATE DRILLED: 7-27-22
LOCATION: **See Location Diagram**
ELEVATION: **Not Determined**

BORING NO. 3

EQUIPMENT TYPE: **CME-55**
DRILLING TYPE: **6" H.S.A**
FIELD ENGINEER: **S. Wells**

MOISTURE CONTENT (% OF DRY WT.)	DRY DENSITY (LBS/CU FT)	SAMPLE TYPE	SAMPLE	BLOWS/FT.	DEPTH (FEET)	USCS	GRAPHIC	SOIL DESCRIPTION
					0	SC		Fill: Clayey SAND with gravel; brown to gray, damp
					5			**Boring Terminated at 5-feet**
					10			
					15			
					20			

N- STANDARD SAMPLER
R- RING SAMPLER
B- BUCKET SAMPLE
G- GRAB SAMPLE
M- OPEN SAMPLER - (no rings)

NOTES: **Groundwater Not Encountered**

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH TIME. DATA PRESENTED IS A SIMPLIFICATION.

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LOCATION: **GLOBE, ARIZONA**
PROJECT NO.: **2122JP123**

BORING LOG

PLATE **A-6**

Boring No.	Sample Depth (ft)	USCS Class.	Particle Size Distribution Percent Passing by Weight					Atterberg Limits		Initial Dry Density (pcf)	Initial Water Content (%)	Compression Properties			Expansion Index (EI)	Soluble Sulfates (ppm)	Soluble Chlorides (ppm)	pH	Minimum Resistivity (Ω·cm)	Remarks
												Surcharge (ksf)	Total Compression (%)							
			¾"	#4	#10	#40	#200	LL	PI				In-Situ	After Saturation						
1	0-5	SC	98	84	65	36	18	31	15						3	< 3	3	8.8	1007	5, 6, 7, 8, 9, 12
	2-3	SC								109	7.3	0.5	0.9							12
												1.0	1.3	4.1						2
												2.0		6.3						2
	5-6	SC								118	7.9	0.5	1.6							11
												1.0	1.9	2.4						2
												2.0		3.4						2
	10-11	SC								105	6.0									11
2	2-3	SC								105	6.8									11
	5-6	SC								101	5.8									11
	10-11	SC								118	5.7									11

Remarks

1. Compacted density is approximately 95% of ASTM D698 maximum density at a moisture content slightly below optimum.
2. Submerged to approximate saturation.
3. Slight rebound after saturation.
4. Sample disturbance observed.
5. Expansion Index (EI) test in accordance with ASTM D4829.
6. Chloride Content (ARIZ 736a).
7. Sulfate Content (ARIZ 733a).
8. pH (ARIZ 237b).
9. Minimum Resistivity (ARIZ 236c).
10. Test Method ASTM D698 / AASHTO T99.
11. Field Visual Classification (ASTM D 2488).
12. Laboratory Soil Classification (ASTM D 2487).
13. Test Method ASTM D1557 / AASHTO T180.
14. From the ADOT Family of Curves for Maricopa County.
15. See Corrosion Plate.
16. Initial Dry Density and Initial Water Content from Remolded Swell.

Notes: Initial Dry Density and Initial Water Content are in-situ values unless otherwise noted.
NP = Non-Plastic **NV** = No Value

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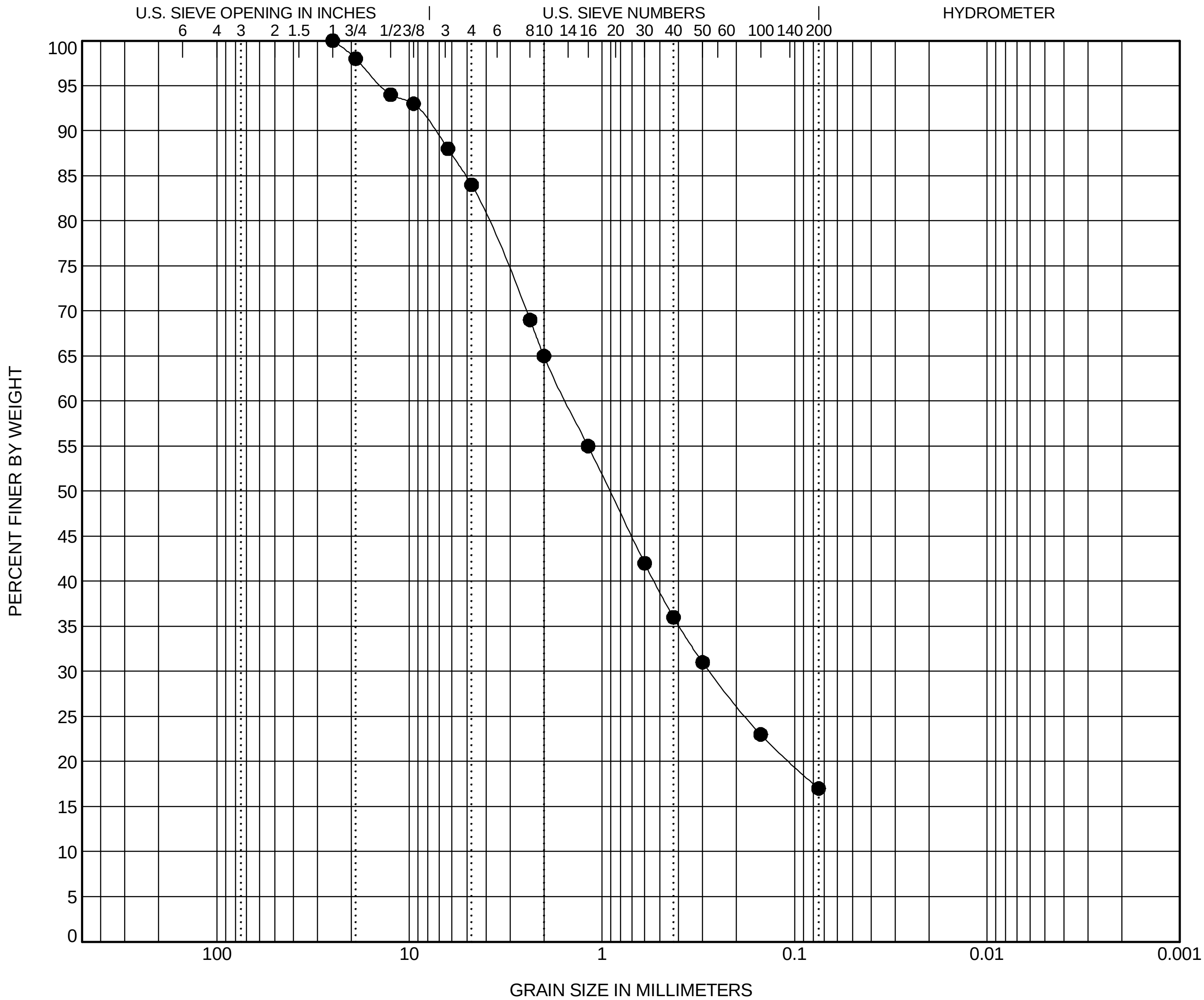
JOB NO.: **2122JP123**

SOIL PROPERTIES

PLATE

B-1



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample Identification		Symbol	Classification	LL	PL	PI	C_c	C_u	F_m
●	**B-1**	**2.5 ft**	**SC**	**Clayey SAND with gravel**	**31**	**16**	**15**			**2.26**

	Sample Identification		D_{100}	D_{60}	D_{30}	D_{10}	%Gravel	%Sand	%Silt	%Clay
●	**B-1**	**2.5 ft**	**25**	**1.536**	**0.275**		**16.0**	**67.0**	**17.0**	

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LOCATION: **GLOBE, ARIZONA**
PROJECT NO.: **2122JP123**

GRAIN SIZE DISTRIBUTION

PLATE **B-2**

Laboratory Analysis Report

Western Technologies
Christian Tolentino
3737 E Broadway Rd
Phoenix AZ 85040-2921

Project: 2122JP123
Date Received: 8/1/2022
Date Reported: 8/8/2022

PO Number: 2142P1466

Lab Number: 943130-1 124730 B1 (0-5)

Test Parameter	Method	Result	Units	Levels
pH (ARIZ 236e)	ARIZ 236e	8.8	SU	
Minimum Resistivity	ARIZ 236e	1007	ohm-cm	
Sulfate	ASTM C 1580	< 3	ppm	
Chloride	ARIZ 736b	3	ppm	