GEOTECHNICAL EVALUATION

SHADED PERFORMANCE FACILITY
BARBARA ANTONSEN MEMORIAL PARK
SEDONA, ARIZONA
JOB NO. 2520JW231

NOTICE
Electronic Copy of Final Document; sealed original document is with Craig P Wiedeman AZ P.E. No. 11860

Western Technologies Inc.
The Quality People
Since 1955

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Prepared for:

CRANDALL DESIGN GROUP

September 3, 2010

Registered Professional Engineer (Civil)
CERTIFICATE NO.
11860
CRAIG P.
WIEDEMAN
Signed
ARIZONA U.S.A.

Craig P. Wiedeman, P.E. 9/7/10
Senior Geotechnical Engineer
exp. 12/31/10

Reviewed by: Bruce M. Mac Ilroy, P.E.
Senior Geotechnical Engineer

Western Technologies Inc.
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September 3, 2010

Crandall Design Group
922 North Gilbert Road, Suite 101
Mesa, Arizona 85203

Attn: Mr. Rick Crandall
Architect

Re: Geotechnical Evaluation
Shaded Performance Facility
Barbara Antonsen Memorial Park
Sedona, Arizona

Job No. 2520JW231

Western Technologies Inc. has completed the geotechnical evaluation for the proposed performance facility to be located in Sedona, Arizona. This study was performed in general accordance with our proposal number 2520PM187 dated April 29, 2010. 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

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

Copies to: Addressee (1)
Shephard Wesnitzer, Inc./A. Beckwith (1)
ZZ Consulting/C. Zweifel (1)

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GEOTECHNICAL EVALUATION
SHADED PERFORMANCE FACILITY
BARBARA ANTONSEN MEMORIAL PARK
SEDONA, ARIZONA
JOB NO. 2520JW231

1.0 PURPOSE

This report contains the results of our geotechnical evaluation for the proposed shaded performance facility to be located at Barbara Antonsen Memorial Park in Sedona, Arizona. The purpose of these services is to provide information and recommendations regarding:

- foundation design parameters
- floor slab support
- lateral earth pressures
- earthwork
- pavement sections
- drainage
- corrosivity to concrete

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

2.0 PROJECT DESCRIPTION

Project information supplied by Mr. Rick Crandall indicates the proposed facility will consist of a circular, monolithic concrete shell approximately 100 feet in diameter and 25 feet high. Eight inch wide CMU walls, an elevated stage and concrete slabs-on-grade will be located within the interior of the structure. Maximum cut depths and fill heights of about 3 feet are anticipated, although final site grading plans were not available prior to preparation of this report. The maximum wall and column loads will be about 3.5 kips per linear foot and 22 kips, respectively. An asphalt paved entrance drive and small parking area will be included as part of the proposed development. Should any of this information be incorrect, we request that the Client notify WT immediately.

3.0 SCOPE OF SERVICES

3.1 Field Exploration

Six borings were drilled to depths ranging from about 2 to 6.5 feet below existing site grades at the approximate locations shown on the attached boring location diagram. Logs of the borings are presented in Appendix A. Subsoils encountered during drilling were examined visually and sampled at selected depth intervals.

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 include modifications based on laboratory observations and tests of the field samples. The final logs describe the materials encountered, their thicknesses, 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 ASTM and Arizona methods. The following tests were performed and the results are presented in Appendix B.

- Water content
- Expansion
- Gradation
- Plasticity
- Soluble salts and sulfates

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

3.3 Analyses and Report

This geotechnical evaluation 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 required to satisfy the purpose previously described.

This report is for the exclusive purpose of providing geotechnical engineering and/or testing information and recommendations. The scope of services for this project does not include, either specifically or by implication, any environmental assessment of the site or identification of contaminated or hazardous materials or conditions. If the owner is concerned 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 basically vacant property. The ground surface on the western portion of the site adjacent to Posse Ground Road was relatively flat and had been cleared of most of the vegetation. The ground surface on the eastern portion of the site sloped moderately down to the southeast and contained a moderate growth of medium sized juniper trees, scrub oak and cacti. Low sandstone outcrops were present on some portions of the site. Site surface drainage was fair to good by means of sheet flow.

4.2 Subsurface

As presented on the boring logs, surface soils to depths of about 1 to 3 feet were found to be dense clayey and silty gravels with variable amounts of cobbles, sand and generally low plasticity fines. The materials underlying the surface soils and extending to the full depth of exploration consisted of hard to very hard moderately cemented siltstone and sandstone. Refusal to auger penetration occurred in all of the borings at depths of about 2 to 6.5 feet below the existing site grades. Groundwater was not encountered in any boring at the time of exploration. The logs in Appendix A show details of the subsurface conditions encountered during the field exploration.

5.0 GEOTECHNICAL PROPERTIES

5.1 Laboratory Tests

Undisturbed samples suitable for consolidation/compression testing were not obtained due to the granular nature of the soils. When water is added to compacted near-surface soils, low expansion occurs.

5.2 Field Tests

Native materials near anticipated shallow foundation level exhibited high resistance to penetration using the standard penetration test method (ASTM D1586). This corresponds to a moderate to high bearing capacity for native materials 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, **PROJECT DESCRIPTION**, and the assumption that the soil and subsurface conditions are those disclosed by the borings. 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 Foundations

If the recommendations contained in this report are followed, the proposed structure can be supported by conventional shallow spread footings bearing on dense, undisturbed site materials. 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 up to 2500 pounds per square foot.

We anticipate that total settlement of the proposed structure, supported as recommended, should be less than 3/4 inch. Differential settlement should be less than 1/2 inch. Additional foundation movements could occur if water from any source infiltrates the foundation bearing materials. 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.
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. It should be determined whether the bearing materials exposed are similar to those anticipated for support of the footings. Any soft, loose or unacceptable materials should be undercut to suitable materials and backfilled with either lean mix or structural concrete.

6.3 Lateral Design Criteria

Lateral loads can be resisted by soil friction and by the passive resistance of the soils. A coefficient of friction of 0.4 can be used between floor slabs and/or foundations and the supporting soils. The passive resistance of natural soils or properly compacted fill can be approximated by the pressure developed by a fluid with a density of 250 pounds per cubic foot (psf/ft). A one-third increase in the passive value can be used for wind or seismic loads. The passive pressure and the frictional resistance of the soils can be combined without reduction in determining the total lateral resistance.

6.4 Seismic Considerations

For structural designs based upon the International Building Code 2006, the recommended site class is C.

6.5 Slab-on-Grade Support

Floor slabs can be supported on properly placed and compacted fill or approved site materials. The slab subgrade should be prepared by the procedures outlined in this report. 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. 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 recommendation given in ACI 302.2R-06. 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.

6.6 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. No planters or other surface features which could retain water adjacent to the structure should be constructed.

In areas where sidewalks or paving do not immediately adjoin the structure, protective slopes should be provided with an outfall of about 5 percent for at least 10 feet from perimeter walls. 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.

6.7 Corrosivity to Concrete

The chemical test results indicate that the site soils are negligibly corrosive to concrete. 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.

6.8 Pavements

Based on existing subgrade conditions, a pavement section consisting of 3 inches of asphalt concrete over 4 inches of aggregate base course material is recommended for the pavement areas on the site.

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 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.

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 which 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, grading or backfilling occurs.

7.2 Site Clearing

Strip and remove existing vegetation, organic topsoils, debris, and any other deleterious materials from the structure and pavement areas. The structure area is defined as that area within the structure footprint plus 5 feet beyond the perimeter of the footprint. All exposed surfaces should be free of mounds and depressions which 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 new fills. Benches should be level and wide enough to accommodate compaction and earth moving equipment.

7.3 Excavation

We anticipate that excavations into the shallow surficial soils for the proposed construction can be accomplished with conventional equipment. Excavations penetrating the underlying rock will require the use of heavy-duty, specialized equipment, possibly together with drilling and blasting, to facilitate rock break up and removal.

On-site soils may pump or become unworkable at high water contents. Workability may be improved by scarifying and drying. Overexcavation 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

Specialized treatment of existing materials within foundation areas is not required. Remove all loose or disturbed materials from the bottoms and sides of the excavations prior to the placement of foundation concrete.

7.5 Interior Slab Preparation

Scarify, moisten or dry as required, and compact all subgrade soils to a minimum depth of inches. Scarifying and compacting are not required in areas where bedrock or heavily cemented formations are encountered as identified by the geotechnical engineer of his qualified representative. The subgrade preparation is to be accomplished in a manner which will result in uniform water contents and densities after compaction. All subgrade preparation in building areas should extend a minimum of 5 feet beyond perimeter footings.

7.6 Pavement Preparation

The subgrade should be scarified, moistened as required, and recompacted for a minimum depth of 8 inches prior to placement of fill and pavement materials. Scarifying and compacting are not required in areas where bedrock or heavily cemented formations are encountered as identified by the geotechnical engineer of his qualified representative.

7.7 Materials

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

- interior slab areas
- pavement areas
- backfill

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

c. Imported soils should conform to the following:

- Gradation (ASTM C136): percent finer by weight

6"	100
4"	85-100
3/4"	70-100

No. 4 Sieve.....50-100
No. 200 Sieve.....50 (max)

- Maximum expansive potential (%)*.....1.5
- Maximum soluble sulfates (%).....0.10

* 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. Base course should conform to City of Sedona 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 fill lifts should not exceed 8 inches.

c. No fill should be placed over frozen ground.

d. Materials should be compacted to the following:

Material	Minimum Percent Compaction (ASTM D698)
• On-site and imported soils, reworked and fill:	
Below slabs-on-grade	90
Below pavement	95
• Aggregate base:	
Below slabs-on-grade	95
Below pavement	100
• Miscellaneous backfill	90

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

7.9 Compliance

Recommendations for slabs-on-grade and pavement elements supported on compacted fills or prepared subgrade depend upon compliance with **EARTHWORK** recommendations. To assess compliance, observation and testing should be performed under the direction of a geotechnical engineer.

8.0 LIMITATIONS

This report has been prepared based on our understanding of the project criteria as described in Section 2.0. Others may make changes in the project criteria during design or construction, and substantially different subsurface conditions may be encountered or become known. The conclusions and recommendations presented herein shall not continue to be valid unless all variations are brought to our attention in writing, and we have had an opportunity to assess the effect such variations may have on our conclusions and recommendations and respond in writing.

The recommendations presented are based upon data derived from a limited number of samples obtained from widely spaced borings. The attached logs are indicators of subsurface conditions only at the specific locations and times noted. The geotechnical engineer necessarily makes assumptions as to the uniformity of the geology and soil structure between borings/test pits, but variations can exist. Accordingly, whenever any deviation or change is encountered or become known during design or construction, the conclusions and recommendations presented herein shall not continue to be valid unless WT is notified in writing, has actually reviewed the matter, and has issued a written response.

This report does not provide information relative to construction methods or sequences. Any person reviewing this report must draw his own conclusions regarding site conditions as they relate to the employment or development of construction techniques. This report is valid for one year after the date of issuance unless there is a change in circumstances or discovered variations justifying an earlier expiration of validity. After expiration, no person or entity has any right to rely on this report without further review and reporting by WT under a separate contract.

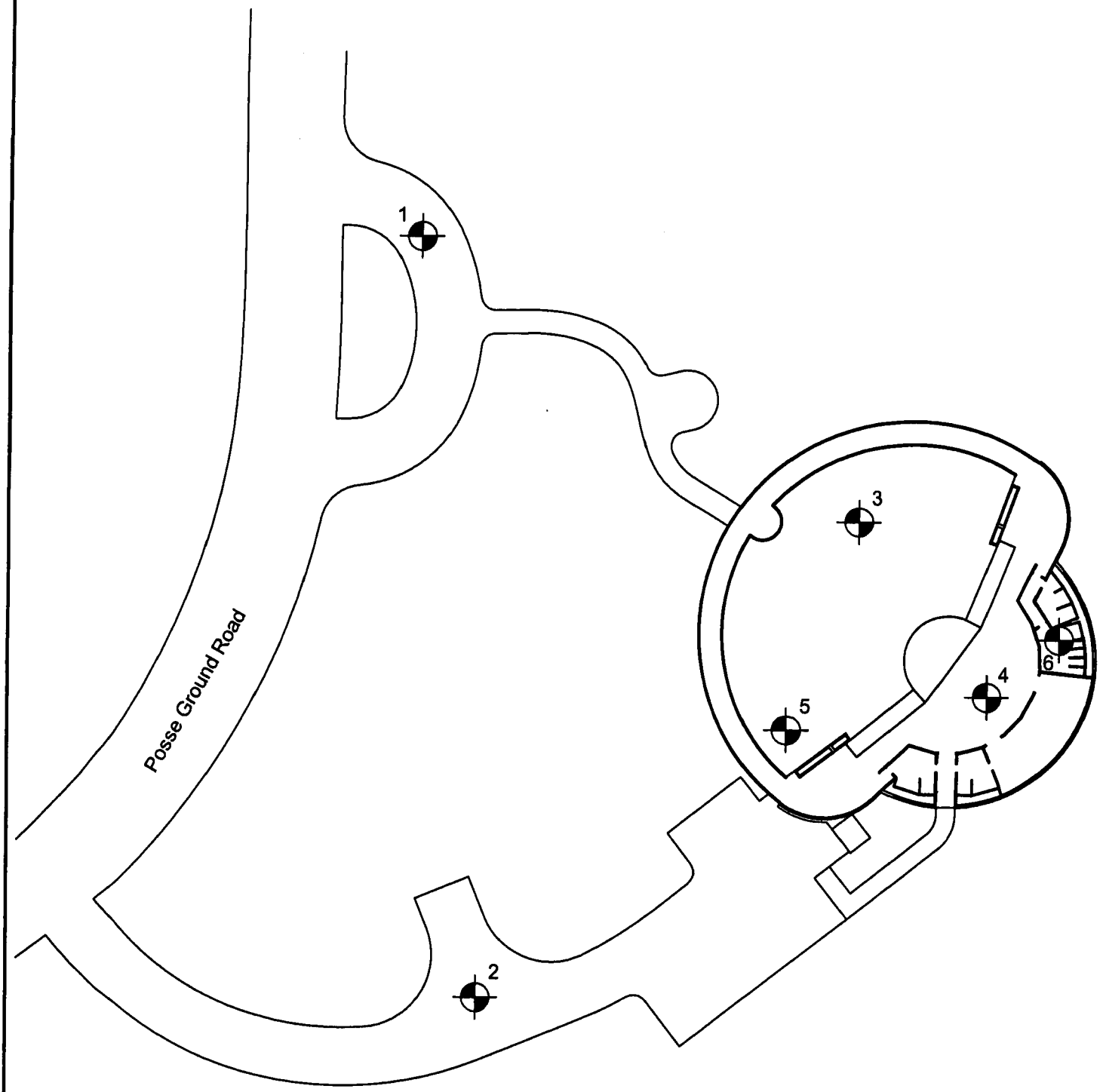
9.0 OTHER SERVICES

The geotechnical engineer should be retained for a general review of final plans and specifications to determine compliance with our recommendations. The geotechnical engineer should also be retained to provide observation and testing services during excavation,

earthwork operations, and foundation and construction phases of the project. Observation of footing excavations should be performed prior to placement of reinforcing and concrete to confirm that satisfactory bearing materials are present.

10.0 CLOSURE

We have 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 conditions at the location of specific tests and observations, and on the data developed to satisfy the scope of services defined by the contract documents. Work on your project was performed in accordance with generally accepted industry standards and practices by professionals providing similar services in this locality. No other warranty, express or implied, is made.



Scale: 1 in. = 50 ft.

Approximate Test Boring Location

SHADED PERFORMANCE STRUCTURE	
Boring Location Diagram	
Western Technologies, Inc.	
Job No.: 2520JW231	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 material placed on a subgrade or subbase.
Base Course Grade	Top of base course.
Bench	A horizontal surface in a sloped deposit.
Caisson	A concrete foundation element cast in a circular excavation which may have an enlarged base. Sometimes referred to as a cast-in-place pier.
Concrete Slabs-on-Grade	A concrete surface layer cast directly upon a base, 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 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 & Gravel Base	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.

SHADED PERFORMANCE FACILITY	
Definition of Terminology	
Western Technologies Inc.	
Job No.: 2520JW231	Plate: A-1

COARSE-GRAINED SOILS
LESS THAN 50% FINES*

GROUP SYMBOLS	DESCRIPTION	MAJOR DIVISIONS
GW	WELL-GRADED GRAVELS OR GRAVEL-SAND MIXTURES, LESS THAN 5% FINES	GRAVELS MORE THAN HALF OF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE SIZE
GP	POORLY-GRADED GRAVELS OR GRAVEL-SAND MIXTURES, LESS THAN 5% FINES	
GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES, MORE THAN 12% FINES	
GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES, MORE THAN 12% FINES	
SW	WELL-GRADED SANDS OR GRAVELLY SANDS, LESS THAN 5% FINES	SANDS MORE THAN HALF OF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE SIZE
SP	POORLY-GRADED SANDS OR GRAVELLY SANDS, LESS THAN 5% FINES	
SM	SILTY SANDS, SAND-SILT MIXTURES, MORE THAN 12% FINES	
SC	CLAYEY SANDS, SAND-CLAY MIXTURES, 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	INORGANIC SILTS, VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS	SILTS AND CLAYS LIQUID LIMIT LESS THAN 50
CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS	
OL	ORGANIC SILTS OR ORGANIC SILT-CLAYS OF LOW PLASTICITY	
MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDS OR SILTS, ELASTIC SILTS	SILTS AND CLAYS LIQUID LIMIT MORE THAN 50
CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	
OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY	
PT	PEAT, MUCK AND OTHER HIGHLY ORGANIC SOILS	HIGHLY ORGANIC SOILS

NOTE: Fine-grained soils may receive dual classification based upon plasticity characteristics.

SOIL SIZES

COMPONENT	SIZE RANGE
BOULDERS	Above 12 in.
COBBLES	3 in. – 12 in.
GRAVEL	No. 4 – 3 in.
Coarse	3/4 in. – 3 in.
Fine	No. 4 – 3/4 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	2 – 4
FIRM	4 – 8
STIFF	8 – 16
VERY STIFF	16 – 32
HARD	Over 32

RELATIVE DENSITY

SANDS & GRAVELS	BLOWS PER FOOT*
VERY LOOSE	0 – 4
LOOSE	4 – 10
MEDIUM DENSE	10 – 30
DENSE	30 – 50
VERY DENSE	Over 50

*Number of blows of 140 pound hammer falling 30 inches to drive a 2 inch O.D. (1 3/8 inch ID) split spoon (ASTM D1586).

PLASTICITY OF FINE GRAINED SOILS

PLASTICITY INDEX	TERM
0	NON-PLASTIC
1 – 7	LOW
8 – 25	MEDIUM
Over 25	HIGH

DEFINITION OF WATER CONTENT

DRY
SLIGHTLY DAMP
DAMP
MOIST
WET
SATURATED

SHADED PERFORMANCE FACILITY

Method of Soil Classification

Western Technologies Inc.

Job No.: 2520JW231 | Plate: A-2

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.

"N" in "BLOWS/FT." refers to a 2-in. outside diameter split-barrel sampler driven into the ground with a 140 lb. drop-hammer dropped 30 in. repeatedly until a penetration of 18 in. is achieved or until refusal. The number of blows, or "blow count", of the hammer is recorded for each of three 6-in. increments totaling 18 in. The number of blows required for advancing the sampler for the last 12 in. (2^{nd} and 3^{rd} increments) is defined as the Standard Penetration Test (SPT) "N"-Value. Refusal to penetration is considered more than 50 blows per foot. (Ref. ASTM D 1586).

"SAMPLE TYPE" refers to the form of sample recovery, in which **N = Split-barrel sample** and **G = Grab sample.**

"USCS" refers to the "Unified Soil Classification System" Group Symbol for the soil type as defined by ASTM D 2487 and D 2488. 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.

SHADED PERFORMANCE FACILITY	
Boring Log Notes	
Western Technologies Inc.	
Job No.: 2520JW231	Plate: A-3

DATE DRILLED: **8-2-10**
LOCATION: **See Location Diagram**
ELEVATION: **Not Determined**

BORING NO. 1

EQUIPMENT TYPE: **CME-55**
DRILLING TYPE: **7"HSA**
FIELD ENGINEER: **M. Miller**

MOISTURE CONTENT (% OF DRY WT.)	DRY DENSITY (LBS/CU FT)	SAMPLE TYPE	SAMPLE	BLOWS/FT.	DEPTH (FEET)	USCS	GRAPHIC	SOIL DESCRIPTION
3.9		G				GC-GM		Clayey Silty GRAVEL; with sand, red brown, dense, slightly damp
								SILTSTONE; moderately weathered, red brown, hard
					5			**Auger Refusal at 5 Feet**
					10			

N- **STANDARD PENETRATION TEST**
R- **RING SAMPLE**
C- **CORE: %RECOVERY/RQD**
G- **GRAB SAMPLE**
B- **BUCKET SAMPLE**

NOTES: **Groundwater Not Encountered**

WESTERN TECHNOLOGIES INC.
2400 Huntington Drive
Flagstaff, AZ 86004-8934

PROJECT: **SHADED PERFORMANCE FACILITY**
PROJECT NO.: **2520JW231**

PLATE **A-4**

BORING LOG

DATE DRILLED: **8-2-10**
LOCATION: **See Location Diagram**
ELEVATION: **Not Determined**

BORING NO. 2

EQUIPMENT TYPE: **CME-55**
DRILLING TYPE: **7"HSA**
FIELD ENGINEER: **M. Miller**

MOISTURE CONTENT (% OF DRY WT.)	DRY DENSITY (LBS/CU FT)	SAMPLE TYPE	SAMPLE	BLOWS/FT.	DEPTH (FEET)	USCS	GRAPHIC	SOIL DESCRIPTION
2.5		G				GM		Silty GRAVEL; with sand and cobbles, red brown, dense, slightly damp
								SILTSTONE; red brown, moderately cemented, hard
								Auger Refusal at 2 Feet

5

10

N- **STANDARD PENETRATION TEST**
R- **RING SAMPLE**
C- **CORE: %RECOVERY/RQD**
G- **GRAB SAMPLE**
B- **BUCKET SAMPLE**

NOTES: **Groundwater Not Encountered**

WESTERN TECHNOLOGIES INC.
2400 Huntington Drive
Flagstaff, AZ 86004-8934

PROJECT: **SHADED PERFORMANCE FACILITY**
PROJECT NO.: **2520JW231**

PLATE **A-5**

BORING LOG

DATE DRILLED: **8-2-10**
LOCATION: **See Location Diagram**
ELEVATION: **Not Determined**

BORING NO. 3

EQUIPMENT TYPE: **CME-55**
DRILLING TYPE: **7"HSA**
FIELD ENGINEER: **M. Miller**

MOISTURE CONTENT (% OF DRY WT.)	DRY DENSITY (LBS/CU FT)	SAMPLE TYPE	SAMPLE	BLOWS/FT.	DEPTH (FEET)	USCS	GRAPHIC	SOIL DESCRIPTION
10.3		G				GM		Sandy GRAVEL; some sand, trace cobbles, red brown, dense, damp
		N		50-3"				SANDSTONE; red, moderately cemented, hard
		G			5			
		N		50-1"				**Auger Refusal at 6 Feet**
					10			

N- **STANDARD PENETRATION TEST**
R- **RING SAMPLE**
C- **CORE: %RECOVERY/RQD**
G- **GRAB SAMPLE**
B- **BUCKET SAMPLE**

NOTES: **Groundwater Not Encountered**

WESTERN TECHNOLOGIES INC.
2400 Huntington Drive
Flagstaff, AZ 86004-8934

PROJECT: **SHADED PERFORMANCE FACILITY**
PROJECT NO.: **2520JW231**

PLATE **A-6**

BORING LOG

DATE DRILLED: **8-2-10**
LOCATION: **See Location Diagram**
ELEVATION: **Not Determined**

BORING NO. 4

EQUIPMENT TYPE: **CME-55**
DRILLING TYPE: **7"HSA**
FIELD ENGINEER: **M. Miller**

MOISTURE CONTENT (% OF DRY WT.)	DRY DENSITY (LBS/CU FT)	SAMPLE TYPE	SAMPLE	BLOWS/FT.	DEPTH (FEET)	USCS	GRAPHIC	SOIL DESCRIPTION
7.7		G				GC		Clayey GRAVEL; some sand, with cobbles, red brown, dense, damp
		N		50-6"				SANDSTONE; red brown, moderately cemented, very hard
		N		50-1"	5			**Auger Refusal at 6 Feet**
					10			

N- **STANDARD PENETRATION TEST**
R- **RING SAMPLE**
C- **CORE: %RECOVERY/RQD**
G- **GRAB SAMPLE**
B- **BUCKET SAMPLE**

NOTES: **Groundwater Not Encountered**

WESTERN TECHNOLOGIES INC.
2400 Huntington Drive
Flagstaff, AZ 86004-8934

PROJECT: **SHADED PERFORMANCE FACILITY**
PROJECT NO.: **2520JW231**

PLATE **A-7**

BORING LOG

DATE DRILLED: **8-2-10**
LOCATION: **See Location Diagram**
ELEVATION: **Not Determined**

BORING NO. 5

EQUIPMENT TYPE: **CME-55**
DRILLING TYPE: **7"HSA**
FIELD ENGINEER: **M. Miller**

MOISTURE CONTENT (% OF DRY WT.)	DRY DENSITY (LBS/CU FT)	SAMPLE TYPE	SAMPLE	BLOWS/FT.	DEPTH (FEET)	USCS	GRAPHIC	SOIL DESCRIPTION
						GM		Silty GRAVEL; with sand and cobbles, red brown, dense, slightly damp
		G						SANDSTONE; red brown, moderately cemented, very hard
		N		50-5"				
								Auger Refusal at 3.5 Feet
					5			
					10			

N- **STANDARD PENETRATION TEST**
R- **RING SAMPLE**
C- **CORE: %RECOVERY/RQD**
G- **GRAB SAMPLE**
B- **BUCKET SAMPLE**

NOTES: **Groundwater Not Encountered**

WESTERN TECHNOLOGIES INC.
2400 Huntington Drive
Flagstaff, AZ 86004-8934

PROJECT: **SHADED PERFORMANCE FACILITY**
PROJECT NO.: **2520JW231**

PLATE **A-8**

BORING LOG

DATE DRILLED: **8-2-10**
LOCATION: **See Location Diagram**
ELEVATION: **Not Determined**

BORING NO. 6

EQUIPMENT TYPE: **CME-55**
DRILLING TYPE: **7"HSA**
FIELD ENGINEER: **M. Miller**

MOISTURE CONTENT (% OF DRY WT.)	DRY DENSITY (LBS/CU FT)	SAMPLE TYPE	SAMPLE	BLOWS/FT.	DEPTH (FEET)	USCS	GRAPHIC	SOIL DESCRIPTION
9.1		G				GC		Clayey GRAVEL; some sand, red brown, dense, damp
		N		50-3"				SANDSTONE; red brown, moderately cemented, very hard
		N		50-5"	5			
					10			**Auger Refusal at 6.5 Feet**

N- **STANDARD PENETRATION TEST**
R- **RING SAMPLE**
C- **CORE: %RECOVERY/RQD**
G- **GRAB SAMPLE**
B- **BUCKET SAMPLE**

NOTES: **Groundwater Not Encountered**

WESTERN TECHNOLOGIES INC.
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Flagstaff, AZ 86004-8934

PROJECT: **SHADED PERFORMANCE FACILITY**
PROJECT NO.: **2520JW231**

PLATE **A-9**

BORING LOG

PHYSICAL PROPERTIES

BORING NO.	DEPTH (FEET)	SOIL CLASSIFICATION	PARTICLE SIZE DISTRIBUTION, % PASSING BY WEIGHT						ATTERBERG LIMITS		SOIL PROPERTY		EXPANSION		WATER SOLUBLE MATTER (PPM)		REMARKS
			3 IN.	NO. 4	NO. 10	NO. 40	NO. 200	2 μ	LL	PI	INITIAL DRY DENSITY (PCF)	INITIAL WATER CONTENT (%)	SURCHARGE (KSF)	EXPANSION (%)	SALTS	SULFATES	
1	0-3	GC-GM	100	68	58	50	42.3		23	5							2
2	0-1.5	GM	100	51	40	31	25.8		21	2							2
3	0-2	GM	95	46	45	42	31.8			NP	128.4	9.7	0.1	0	105	35	2,6,7
4	0-1.5	GC	88	29	26	24	20.9		26	11							2
6	0-1.5	GC	96	40	37	34	29.3		30	9	128.0	9.9	0.1	0			2,6,7

REMARKS:

CLASSIFICATION / PARTICLE SIZE
1. Visual Classification
2. Laboratory Tested
3. Minus No. 200 Only

MOISTURE-DENSITY RELATIONSHIP
4. Tested ASTM D698/AASHTO T99
5. Tested ASTM D1557/AASHTO T180

REMOLDED SWELL
6. Compacted Density (approximately 95% of ASTM D698 maximum density at moisture content slightly below optimum)
7. Submerged to approximate saturation
8. Dry Density determined from one ring of a multi-ring sample

Note: NP NONPLASTIC

SHADED PERFORMANCE FACILITY

Physical Properties

Western Technologies Inc.

Job No.: 2520JW231 | Plate: B-1