

# GEOTECHNICAL EVALUATION REPORT

**PROPOSED GABION WALLS**

Route 6460 over Laguna Creek  
Dennehotso, Arizona  
WT Reference No. 3127JS001

**PREPARED FOR:**

Dibble Engineering  
7500 North Dreamy Draw Drive, Suite No. 200  
Phoenix, Arizona 85020-4996

May 8, 2017



Roger K. Southworth, P.E.  
Managing Director

A handwritten signature in blue ink that reads "Bruce M. MacIlroy, P.E." with a stylized flourish at the end.

Bruce M. MacIlroy, P.E.  
Technical Director





**Western  
Technologies  
Inc.**

The Quality People  
Since 1955

400 South Lorena Avenue  
Farmington, New Mexico 87401-5943  
(505) 327-4966 • fax 327-5293

May 8, 2017

Dibble Engineering  
7500 North Dreamy Draw Drive, Suite 200  
Phoenix, Arizona 85020-4996

Attn: Mr. Drew Spear, P.E.

Re: Geotechnical Evaluation  
Proposed Gabion Walls  
Route 6460 over Laguna Creek  
Dennehotso, Arizona

Job No. 3127JS001

Western Technologies Inc. (WT) has completed the geotechnical evaluation for the above-referenced project. The results of our evaluation, including the boring location diagram, boring logs, laboratory test results, 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. Please do not hesitate to contact us if the design conditions change or if you have any questions concerning this report. We look forward to working with you on future projects.

Sincerely,

**WESTERN TECHNOLOGIES INC.**

Roger K. Southworth, P.E.  
Managing Director

## TABLE OF CONTENTS

<b>1.0</b>	<b>PURPOSE</b> .....	<b>1</b>
<b>2.0</b>	<b>PROJECT DESCRIPTION</b> .....	<b>1</b>
<b>3.0</b>	<b>SCOPE OF SERVICES</b> .....	<b>1</b>
3.1	Field Exploration .....	1
3.2	Laboratory Testing .....	2
3.3	Analyses and Report .....	2
<b>4.0</b>	<b>SITE CONDITIONS</b> .....	<b>3</b>
4.1	Surface .....	3
4.2	Subsurface .....	3
4.3	Groundwater .....	3
<b>5.0</b>	<b>RECOMMENDATIONS</b> .....	<b>3</b>
5.1	General .....	3
5.2	Bearing Capacity .....	4
5.3	Lateral Design Criteria .....	4
<b>6.0</b>	<b>EARTHWORK</b> .....	<b>5</b>
6.1	General .....	5
6.2	Materials .....	5
6.3	Corrosivity .....	5
6.4	Compliance .....	6
<b>7.0</b>	<b>LIMITATIONS</b> .....	<b>6</b>
<b>8.0</b>	<b>CLOSURE</b> .....	<b>7</b>
	<b>SITE LOCATION DIAGRAM</b> .....	<b>Plate 1</b>
	<b>BORING LOCATION DIAGRAM</b> .....	<b>Plate 2</b>
<b>APPENDIX A</b>		
	Definition of Terminology .....	A-1
	Method of Soil Classification .....	A-2
	Boring Log Notes .....	A-3
	Boring Logs .....	A-4 through A-11
<b>APPENDIX B</b>		
	Laboratory Test Results .....	B-1 and B-2



**GEOTECHNICAL EVALUATION  
PROPOSED GABION WALLS  
ROUTE 6460 OVER LAGUNA CREEK  
DENNEHOTO, ARIZONA**

**JOB NO. 3127JS001**

**1.0 PURPOSE**

This report contains the results of our geotechnical evaluation for the construction of gabion walls at the proposed Route 6460 crossing over Laguna Creek. The purpose of these services is to provide information and recommendations for gabion wall design. The results of the field exploration and the field and laboratory testing programs are presented in the Appendices.

**2.0 PROJECT DESCRIPTION**

The project will consist of constructing a bridge crossing over Laguna Creek. The approximate location of the proposed crossing is shown on the attached *Site Location Diagram* (Plate 1). The crossing will include the construction of a bridge and gabion retaining walls. Design recommendations for the bridge were presented in a previous report. Three separate gabion walls will be constructed. The approximate locations of these walls are presented on the attached *Boring Location Diagram* (Plate 2). It was assumed that the maximum wall heights would not exceed 15 feet. We should be notified immediately if any of our assumptions are incorrect since a revision of the recommendations presented herein could then be necessary.

**3.0 SCOPE OF SERVICES**

**3.1 Field Exploration**

Eight borings were drilled for this project to depths of 16 to 38 feet. The borings were drilled at the approximate locations indicated on the attached *Boring Location Diagram* (Plate 1).

A WT engineer monitored the drilling operations and prepared a field log for each boring. These logs contain visual classifications of the materials encountered during drilling, as well as interpolation of the subsurface conditions between samples.

The final boring logs, included in Appendix A, represent our interpretation of the field logs and may include modifications based on laboratory observations of the recovered soil



samples. The final logs describe the materials encountered, their thicknesses, and the depths at which samples were obtained.

The Unified Soil Classification System was used to classify the soil. The soil classification symbols appear on the boring logs and are briefly described in Appendix A.

### **3.2 Laboratory Testing**

Laboratory tests were performed on representative samples to aid in material classification and to estimate the pertinent engineering properties of the soil. Testing was performed in general accordance with applicable ASTM methods. The following tests were performed and the results are presented in Appendix B.

- Grain Size Distribution
- Water Content
- Compression
- Liquid and Plastic Limits
- Sulfates, Chlorides, and pH
- Resistivity

The laboratory test results were used to develop the recommendations contained in this report.

### **3.3 Analyses and Report**

Analyses were performed and this report was prepared for the exclusive purpose of providing geotechnical engineering 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.

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 required to satisfy the purpose previously described.



## 4.0 SITE CONDITIONS

### 4.1 Surface

The crossing will be located in an undeveloped area east of an unimproved low-water crossing over Laguna Creek. The base of the low-water crossing is sandstone bedrock. The ground surface in the area of the walls slopes down toward Laguna Creek. The banks of Laguna Creek are near vertical and are approximately 10 feet high. Groundcover generally consists of desert grasses and brush.

### 4.2 Subsurface

Very loose to medium dense silty sand was encountered in the borings to depths of about 6½ to 13 feet. The silty sand was underlain by sandstone bedrock that extended to the boring termination depths.

### 4.3 Groundwater

Groundwater was not encountered in Borings B-5 and B-7 during drilling. Groundwater was encountered in the other borings at depths of about 9 to 13 feet during drilling. The level of the groundwater table will fluctuate seasonally with variations in the amount of precipitation, evaporation, and the water level in Laguna Creek. The observations made during this investigation must be interpreted carefully because they are short-term and do not constitute a groundwater study.

## 5.0 RECOMMENDATIONS

### 5.1 General

The 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, or details of the project 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.



## 5.2 Bearing Capacity

Walls supported on the silty sand can be designed for a maximum net allowable bearing capacity of 1,000 pounds per square foot (psf). Walls supported on the underlying sandstone can be designed for a maximum net allowable bearing capacity of 4,000 psf. The allowable bearing capacity includes a factor of safety of at least 2.5.

For walls adjacent to slopes, the walls should be positioned so that an imaginary line extending downward at 45 degrees from the nearest gabion basket edge does not intersect the slope.

## 5.3 Lateral Design Criteria

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

- Active Equivalent Fluid Pressure
  - Level Backslope..... 35 psf/ft
  - 4H:1V Backslope ..... 40 psf/ft
  - 3H:1V Backslope ..... 45 psf/ft

The equivalent fluid pressures presented above do not include lateral loading due to surcharge loads. A uniform load distribution with depth can be assumed for design for uniformly distributed surcharge loads next to the walls. The following active earth pressure coefficients can be used to calculate the lateral loading due to surcharge loads:

- Active Earth Pressure Coefficients
  - Level Backslope.....0.30
  - 4H:1V Backslope .....0.35
  - 3H:1V Backslope .....0.37

A passive earth pressure resistance of 140 pounds per square foot per foot (psf/ft) and a coefficient of sliding friction of 0.58 is recommended for design.

The wall backfill should extend a horizontal distance of at least one-half the wall height from the face of the wall in order to develop the recommended equivalent fluid pressures. The lateral earth pressures are for well-drained soil. Any surcharge from adjacent loading must also be considered.



It is important that all backfill be properly placed and compacted. Backfill should be mechanically compacted in lifts. Flooding or jetting should not be permitted. Care should be taken not to damage the walls during compaction operations. Backfill should be inspected and tested during placement.

A non-woven geotextile should be placed between the gabion baskets and the backfill to prevent the migration of the backfill into the voids in the gabion baskets.

## 6.0 EARTHWORK

### 6.1 General

The conclusions contained in this report 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.

### 6.2 Materials

The on-site soil can be used as fill and backfill in the gabion wall areas. Imported fill should consist of free-draining granular material having a friction angle of at least 30 degrees.

### 6.3 Corrosivity

Sulfate, chloride, pH and resistivity tests were performed to evaluate the corrosion potential of the soil against steel and the potential for attack on concrete. The results of this testing are presented in the following table.

**TABLE 1 - CHEMICAL TEST RESULTS**

Sample Location	Resistivity	Chlorides	pH	Sulfates
Boring B-2; 0 to 2 ft	1,700 ohm-cm	<10.8 ppm	8.87	39.1 ppm
Boring B-4; 5 to 6 ft.	2,000 ohm-cm	20.5 ppm	8.61	124 ppm
Boring B-5; 2 to 3 ft.	1,100 ohm-cm	<10.3 ppm	8.97	<10.3
Boring B-8; 0 to 2 ft.	9,000 ohm-cm	14.0 ppm	8.58	83.5 ppm





The resistivity tests indicate that the soil is corrosive to steel in contact with the soil. We recommend engaging a corrosion engineer to review the test results presented herein to determine the appropriate level of corrosion protection for buried metals.

The test results indicate that the soil is negligibly corrosive to concrete. However, previous tests performed on samples obtained from nearby borings that were drilled for the design of Route 6460 indicated sulfate contents as high as 3,200 parts per million (ppm). These test results indicate that the soils classify as corrosive to concrete. We therefore recommended that all concrete in contact with the site soil be made with Type V or equivalent cement, as set forth in ACI 318-4.3.

#### 6.4 Compliance

Recommendations for gabion walls supported on compacted fill or prepared subgrade depend upon compliance with the **Earthwork** recommendations. To assess compliance, observation and testing should be performed under the direction of the project geotechnical engineer. Please contact us to provide these observation and testing services.

### 7.0 LIMITATIONS

This report has been prepared assuming the project criteria described in Section 2.0. 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, contact WT 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 test pits. 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 the test pits, 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 until the earlier of one year from the date of issuance, a change in circumstances, or discovered variations. After expiration, no person or entity shall have any right to rely on this report without the express written authorization of WT.

## **8.0 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 boring locations 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.





Geotechnical  
Environmental  
Inspections  
Materials



**Western  
Technologies Inc.**  
The Quality People  
Since 1955

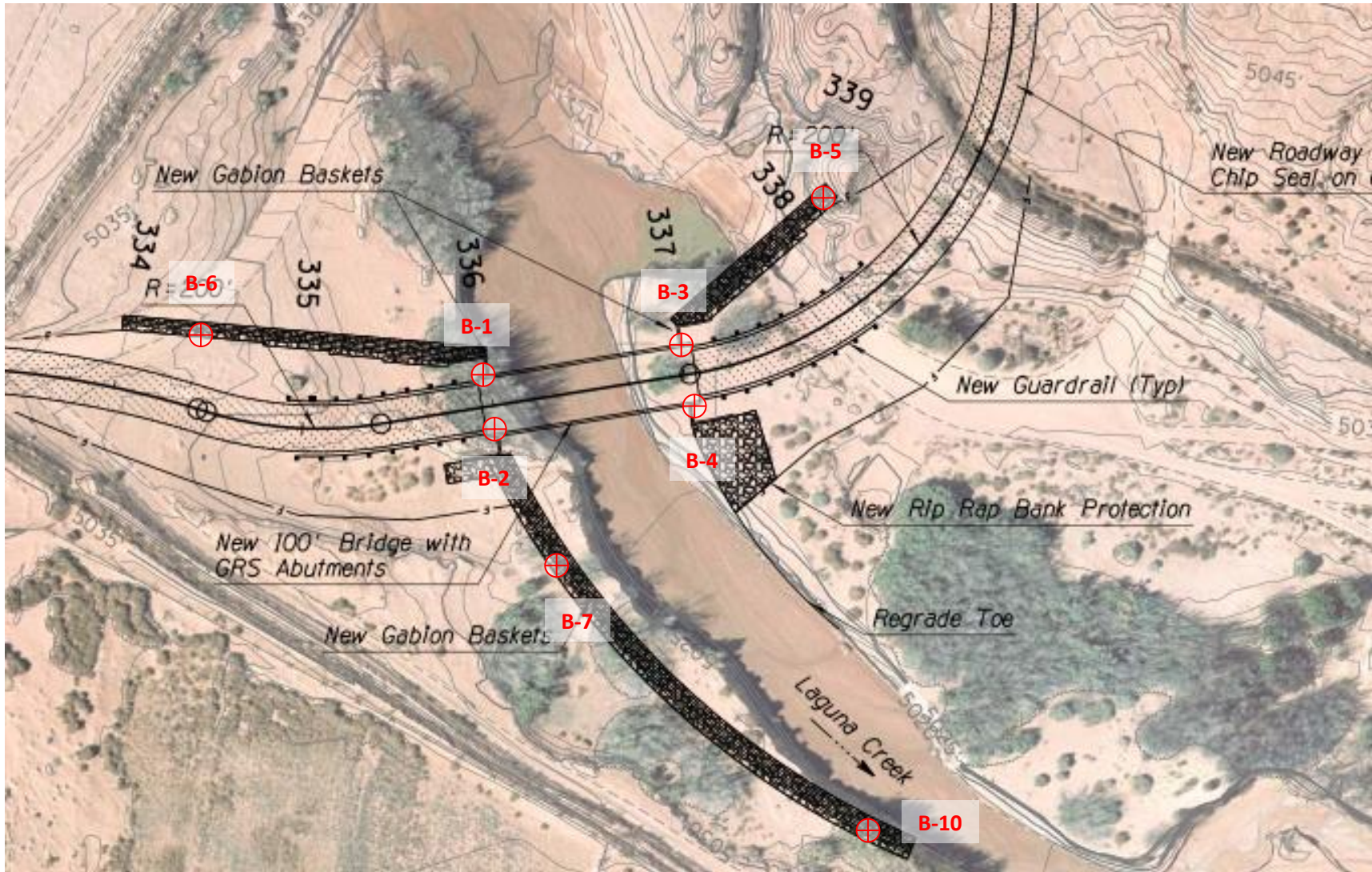
wt-us.com

PROJECT: PROPOSED GABION WALLS

JOB NO.: 3127JS001

## SITE LOCATION DIAGRAM

PLATE: 1



⊕ APPROXIMATE BORING LOCATION

Geotechnical  
Environmental  
Inspections  
Materials



**Western  
Technologies Inc.**  
The Quality People  
Since 1955

wt-us.com

PROJECT: PROPOSED GABION WALLS  
JOB NO.: 3127JS001

## BORING LOCATION DIAGRAM

PLATE: 1

<b>Allowable Soil Bearing Capacity</b>	The recommended maximum contact stress developed at the interface of the foundation element and the supporting material.
<b>Backfill</b>	A specified material placed and compacted in a confined area.
<b>Base Course</b>	A layer of specified aggregate material placed on a subgrade or subbase.
<b>Base Course Grade</b>	Top of base course.
<b>Bench</b>	A horizontal surface in a sloped deposit.
<b>Caisson/Drilled Shaft</b>	A concrete foundation element cast in a circular excavation which may have an enlarged base (or belled caisson).
<b>Concrete Slabs-On-Grade</b>	A concrete surface layer cast directly upon base course, subbase or subgrade.
<b>Crushed Rock Base Course</b>	A base course composed of crushed rock of a specified gradation.
<b>Differential Settlement</b>	Unequal settlement between or within foundation elements of a structure.
<b>Engineered Fill</b>	Specified soil or aggregate material placed and compacted to specified density and/or moisture conditions under observations of a representative of a soil engineer.
<b>Existing Fill</b>	Materials deposited through the action of man prior to exploration of the site.
<b>Existing Grade</b>	The ground surface at the time of field exploration.
<b>Expansive Potential</b>	The potential of a soil to expand (increase in volume) due to absorption of moisture.
<b>Fill</b>	Materials deposited by the actions of man.
<b>Finished Grade</b>	The final grade created as a part of the project.
<b>Gravel Base Course</b>	A base course composed of naturally occurring gravel with a specified gradation.
<b>Heave</b>	Upward movement.
<b>Native Grade</b>	The naturally occurring ground surface.
<b>Native Soil</b>	Naturally occurring on-site soil.
<b>Rock</b>	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.
<b>Sand and Gravel Base Course</b>	A base course of sand and gravel of a specified gradation.
<b>Sand Base Course</b>	A base course composed primarily of sand of a specified gradation.
<b>Scarify</b>	To mechanically loosen soil or break down existing soil structure.
<b>Settlement</b>	Downward movement.
<b>Soil</b>	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.
<b>Strip</b>	To remove from present location.
<b>Subbase</b>	A layer of specified material placed to form a layer between the subgrade and base course.
<b>Subbase Grade</b>	Top of subbase.
<b>Subgrade</b>	Prepared native soil surface.



**COARSE-GRAINED SOILS**  
LESS THAN 50% FINES

GROUP SYMBOLS	DESCRIPTION	MAJOR DIVISIONS
<b>GW</b>	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
<b>GP</b>	POORLY-GRADED GRAVEL OR POORLY-GRADED GRAVEL WITH SAND, LESS THAN 5% FINES	
<b>GM</b>	SILTY GRAVEL OR SILTY GRAVEL WITH SAND, MORE THAN 12% FINES	
<b>GC</b>	CLAYEY GRAVEL OR CLAYEY GRAVEL WITH SAND, MORE THAN 12% FINES	
<b>SW</b>	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
<b>SP</b>	POORLY-GRADED SAND OR POORLY-GRADED SAND WITH GRAVEL, LESS THAN 5% FINES	
<b>SM</b>	SILTY SAND OR SILTY SAND WITH GRAVEL, MORE THAN 12% FINES	
<b>SC</b>	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
<b>ML</b>	SILT, SILT WITH SAND OR GRAVEL, SANDY SILT, OR GRAVELLY SILT	SILTS AND CLAYS LIQUID LIMIT LESS THAN 50
<b>CL</b>	LEAN CLAY OF LOW TO MEDIUM PLASTICITY, SANDY CLAY, OR GRAVELLY CLAY	
<b>OL</b>	ORGANIC SILT OR ORGANIC CLAY OF LOW TO MEDIUM PLASTICITY	
<b>MH</b>	ELASTIC SILT, SANDY ELASTIC SILT, OR GRAVELLY ELASTIC SILT	SILTS AND CLAYS LIQUID LIMIT MORE THAN 50
<b>CH</b>	FAT CLAY OF HIGH PLASTICITY, SANDY FAT CLAY, OR GRAVELLY FAT CLAY	
<b>OH</b>	ORGANIC SILT OR ORGANIC CLAY OF HIGH PLASTICITY	
<b>PT</b>	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 (1½-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 (2<sup>nd</sup> and 3<sup>rd</sup> 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 (2<sup>nd</sup> and 3<sup>rd</sup> 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.

<p><i>Geotechnical Environmental Inspections Materials</i></p>  <p><b>Western Technologies Inc.</b> The Quality People Since 1955 wt-us.com</p>	<p><b>BORING LOG NOTES</b></p>	<p>PLATE <b>A-3</b></p>
--	--------------------------------	-----------------------------

DATE DRILLED: 1-17-17  
 LOCATION: See Boring Location Diagram  
 ELEVATION: Not determined

**BORING NO. B-1**

EQUIPMENT TYPE: CME-75  
 DRILLING TYPE: 7" HSA  
 FIELD ENGINEER: C. Dumrtru

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.

WATER CONTENT (%)	POCKET PENETROMETER (tsf)	SAMPLE TYPE	SAMPLE	BLOWS/FT.	DEPTH (FEET)	USCS	GRAPHIC	SOIL DESCRIPTION
6.2		G				SM		SILTY SAND; orange-brown, medium dense, damp
		R		27				changing to very loose to loose
		R		6	5			changing to moist
19.6		R		10				
		N		50/6"	10			SANDSTONE; orange-brown, soft to moderately hard
		N		50/6"	15			
		N		50/4"	20			
		N		50/4"	25			
		C			30			
					35			
Boring terminated at 38 feet								

- N- STANDARD PENETRATION TEST
- R- RING SAMPLE
- NR- NO SAMPLE RECOVERY
- G- GRAB SAMPLE
- B- BUCKET SAMPLE
- BN- BLUNT NOSE PENETROMETER

NOTES: Groundwater encountered at 9 feet during drilling



PROJECT: PROPOSED GABION WALLS  
 REF. NO.: 3127JS001

**BORING LOG**

PLATE  
**A-4**



DATE DRILLED: 1-17-17  
 LOCATION: See Boring Location Diagram  
 ELEVATION: Not determined

**BORING NO. B-2**

EQUIPMENT TYPE: CME-75  
 DRILLING TYPE: 7" HSA  
 FIELD ENGINEER: C. Dumrtru

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.

WATER CONTENT (%)	POCKET PENETROMETER (tsf)	SAMPLE TYPE	SAMPLE	BLOWS/FT.	DEPTH (FEET)	USCS	GRAPHIC	SOIL DESCRIPTION
2.7		G				SM		SILTY SAND; orange-brown, loose to medium dense, damp
		R		16				
3.6		R		14	5			
8.1		R		21				
		N		50/4"	10			SANDSTONE; orange-brown, soft to moderately hard
		N		50/4"	15			
		N		50/4"	20			
		N		50/2"	25			
		C						
					35			Boring terminated at 35 feet

- N- STANDARD PENETRATION TEST
- R- RING SAMPLE
- NR- NO SAMPLE RECOVERY
- G- GRAB SAMPLE
- B- BUCKET SAMPLE
- BN- BLUNT NOSE PENETROMETER

NOTES: **Groundwater encountered at 9 feet during drilling**



PROJECT: **PROPOSED GABION WALLS**  
 REF. NO.: 3127JS001

**BORING LOG**

PLATE  
**A-5**

DATE DRILLED: 1-18-17  
 LOCATION: See Boring Location Diagram  
 ELEVATION: Not determined

**BORING NO. B-3**

EQUIPMENT TYPE: CME-75  
 DRILLING TYPE: 7" HSA  
 FIELD ENGINEER: C. Dumrtru

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.

WATER CONTENT (%)	POCKET PENETROMETER (tsf)	SAMPLE TYPE	SAMPLE	BLOWS/FT.	DEPTH (FEET)	USCS	GRAPHIC	SOIL DESCRIPTION
0.6		G				SM		SILTY SAND; orange-brown, loose, damp
		R		16				
1.0		R		12	5			
3.1		R		10				
		N		10	10			changing to medium dense
		N		50/1"	15			SANDSTONE; orange-brown, soft to moderately hard
		C			20			
					25			Boring terminated at 25 feet
					30			
					35			

- N- STANDARD PENETRATION TEST
- R- RING SAMPLE
- NR- NO SAMPLE RECOVERY
- G- GRAB SAMPLE
- B- BUCKET SAMPLE
- BN- BLUNT NOSE PENETROMETER

NOTES: Groundwater encountered at 13 feet during drilling



PROJECT: PROPOSED GABION WALLS  
 REF. NO.: 3127JS001

**BORING LOG**

PLATE  
**A-6**

DATE DRILLED: 1-18-17  
 LOCATION: See Boring Location Diagram  
 ELEVATION: Not determined

**BORING NO. B-4**

EQUIPMENT TYPE: CME-75  
 DRILLING TYPE: 7" HSA  
 FIELD ENGINEER: C. Dumrtru

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.

WATER CONTENT (%)	POCKET PENETROMETER (tsf)	SAMPLE TYPE	SAMPLE	BLOWS/FT.	DEPTH (FEET)	USCS	GRAPHIC	SOIL DESCRIPTION
0.9		G				SM		SILTY SAND; orange-brown, loose, damp
		R		14				
		R		14	5			
5.5		R		12				
		N		50/4'	10			SANDSTONE; orange-brown, soft to moderately hard
		N		50/2"	15			
		C			25			
					30			
					35			
								Boring terminated at 25 feet

- N- STANDARD PENETRATION TEST
- R- RING SAMPLE
- NR- NO SAMPLE RECOVERY
- G- GRAB SAMPLE
- B- BUCKET SAMPLE
- BN- BLUNT NOSE PENETROMETER

NOTES: **Groundwater encountered at 9 feet during drilling**



PROJECT: **PROPOSED GABION WALLS**  
 REF. NO.: 3127JS001

**BORING LOG**

PLATE  
**A-7**

DATE DRILLED: 1-19-17  
 LOCATION: See Boring Location Diagram  
 ELEVATION: Not determined

**BORING NO. B-5**

EQUIPMENT TYPE: CME-75  
 DRILLING TYPE: 7" HSA  
 FIELD ENGINEER: C. Dumrtru

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.

WATER CONTENT (%)	POCKET PENETROMETER (tsf)	SAMPLE TYPE	SAMPLE	BLOWS/FT.	DEPTH (FEET)	USCS	GRAPHIC	SOIL DESCRIPTION	
1.3		G				SM		SILTY SAND; orange-brown, loose, damp	
		R		16					
		R		14	5				with sandstone fragments
		R		50/3"					SANDSTONE; orange-brown, soft to moderately hard
		N		50/2"	10				
		N		50/4"	15			Boring terminated at 16 feet due to auger refusal in sandstone	
					20				
					25				
					30				
					35				

- N- STANDARD PENETRATION TEST
- R- RING SAMPLE
- NR- NO SAMPLE RECOVERY
- G- GRAB SAMPLE
- B- BUCKET SAMPLE
- BN- BLUNT NOSE PENETROMETER

NOTES: **Groundwater not encountered during drilling**



PROJECT: **PROPOSED GABION WALLS**  
 REF. NO.: 3127JS001

**BORING LOG**

PLATE  
**A-8**

DATE DRILLED: 1-19-17  
 LOCATION: See Boring Location Diagram  
 ELEVATION: Not determined

**BORING NO. B-6**

EQUIPMENT TYPE: CME-75  
 DRILLING TYPE: 7" HSA  
 FIELD ENGINEER: C. Dumrtru

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.

WATER CONTENT (%)	POCKET PENETROMETER (tsf)	SAMPLE TYPE	SAMPLE	BLOWS/FT.	DEPTH (FEET)	USCS	GRAPHIC	SOIL DESCRIPTION
6.1		G				SM		SILTY SAND; orange-brown, very loose, damp
		R		6				
		R		3	5			
6.1		R		5				
		N		50/4"	10			SANDSTONE; orange-brown, soft to moderately hard
		N		50/5"	15			
		N		50/2"	20			
		N		50/3"	25			
<b>Boring terminated at 25 feet</b>								

- N- STANDARD PENETRATION TEST
- R- RING SAMPLE
- NR- NO SAMPLE RECOVERY
- G- GRAB SAMPLE
- B- BUCKET SAMPLE
- BN- BLUNT NOSE PENETROMETER

NOTES: **Groundwater encountered at 10 feet during drilling**



**WESTERN TECHNOLOGIES INC.**

PROJECT: **PROPOSED GABION WALLS**  
 REF. NO.: 3127JS001

**BORING LOG**

PLATE  
**A-9**

DATE DRILLED: 1-17-17  
 LOCATION: See Boring Location Diagram  
 ELEVATION: Not determined

**BORING NO. B-7**

EQUIPMENT TYPE: CME-75  
 DRILLING TYPE: 7" HSA  
 FIELD ENGINEER: C. Dumrtru

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.

WATER CONTENT (%)	POCKET PENETROMETER (tsf)	SAMPLE TYPE	SAMPLE	BLOWS/FT.	DEPTH (FEET)	USCS	GRAPHIC	SOIL DESCRIPTION
0.8		G				SM		SILTY SAND; orange-brown, very loose to loose, damp
		R		18				
		R		13	5			
0.9		R		7				
		N		12	10			changing to medium dense
		N		50/6"	15			SANDSTONE; orange-brown, soft to moderately hard
		N		50/2"	20			<b>Boring terminated at 20 feet due to auger refusal in sandstone</b>
					25			
					30			
					35			

- N- STANDARD PENETRATION TEST
- R- RING SAMPLE
- NR- NO SAMPLE RECOVERY
- G- GRAB SAMPLE
- B- BUCKET SAMPLE
- BN- BLUNT NOSE PENETROMETER

NOTES: **Groundwater not encountered during drilling**



PROJECT: **PROPOSED GABION WALLS**  
 REF. NO.: 3127JS001

**BORING LOG**

PLATE  
**A-10**

DATE DRILLED: 1-19-17  
 LOCATION: See Boring Location Diagram  
 ELEVATION: Not determined

**BORING NO. B-8**

EQUIPMENT TYPE: CME-75  
 DRILLING TYPE: 7" HSA  
 FIELD ENGINEER: C. Dumrtru

WATER CONTENT (%)	POCKET PENETROMETER (tsf)	SAMPLE TYPE	SAMPLE	BLOWS/FT.	DEPTH (FEET)	USCS	GRAPHIC	SOIL DESCRIPTION
1.6		G				SM		SILTY SAND; orange-brown, very loose to loose, damp
	R			7				
	R			6	5			
	R			11				
	N			10	10			changing to medium dense
	N			50/3"	15			SANDSTONE; orange-brown, soft to moderately hard
N			50/4'	20		Boring terminated at 22 feet due to auger refusal in sandstone		
					25			
					30			
					35			

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.

- N- STANDARD PENETRATION TEST
- R- RING SAMPLE
- NR- NO SAMPLE RECOVERY
- G- GRAB SAMPLE
- B- BUCKET SAMPLE
- BN- BLUNT NOSE PENETROMETER

NOTES: Groundwater encountered at 10 feet during drilling



PROJECT: PROPOSED GABION WALLS  
 REF. NO.: 3127JS001

**BORING LOG**

PLATE  
**A-11**

Boring No.	Depth (ft.)	USCS Class.	Dry Density (pcf)	Water Content (%)	Compression Properties			Plasticity		Percent Passing #200	Remarks
					Surcharge (ksf)	Total Compression (%)		Liquid Limit	Plasticity Index		
						In-Situ	After Saturation				
B-1	5 - 6	SP-SM	97	6.2					7.2		
B-1	7 - 8	SM	102	19.6					14.4		
B-2	2 - 3	SM	96	2.7	0.69	0.8			35.9	1	
					1.38	2.7	3.5	2			
B-2	5 - 6	SM	101	3.6					29.6		
B-2	7 - 8	SM	108	8.1					16.8		
B-3	2 - 3	SP-SM	105	0.6	0.69	0.9		NP	11.9	1	
					1.38	2.2	3.2			2	
B-3	5 - 6	SP-SM		1.0					8.1		
B-3	7 - 8	SP-SM	104	3.1					11.3		
B-4	2 - 3	SM		0.9					13.7		
B-4	7 - 8	SM	98	5.5					14.8		
B-5	2 - 3	SM	100	1.3	0.69	1.4		NP	13.9	1, 2	
					1.38		4.2				
B-6	2 - 3	SM	102	6.1					31.6		
B-6	7 - 8	SM		6.1					32.2		
B-7	2 - 3	SM	101	0.8	0.69	1.3		NP	20.7	1, 2	
					1.38		2.0				

**Note:** Initial Dry Density and Initial Water Content are in-situ values unless otherwise noted.  
NP = Non-Plastic

**Remarks**

1. Test performed on undisturbed sample
2. Submerged to approximate saturation.

*Geotechnical  
Environmental  
Inspections  
Materials*

**Western Technologies Inc.**  
 The Quality People  
 Since 1955  
 wt-us.com

PROJECT: PROPOSED GABION WALLS  
JOB NO.: 3127JS001

PLATE

**B-1**

**SOIL PROPERTIES**



Boring No.	Depth (ft.)	USCS Class.	Dry Density (pcf)	Water Content (%)	Compression Properties			Plasticity		Percent Passing #200	Remarks
					Surcharge (ksf)	Total Compression (%)		Liquid Limit	Plasticity Index		
						In-Situ	After Saturation				
B-7	7 - 8	SM		0.9					14.7		
B-8	2 - 3	SM		1.6					26.3		

**Note:** Initial Dry Density and Initial Water Content are in-situ values unless otherwise noted.  
NP = Non-Plastic

**Remarks**

1. Test performed on undisturbed sample
2. Submerged to approximate saturation.

*Geotechnical  
Environmental  
Inspections  
Materials*

**Western Technologies Inc.**  
 The Quality People  
 Since 1955  
 wt-us.com

PROJECT: PROPOSED GABION WALLS  
JOB NO.: 3127JS001

**SOIL PROPERTIES**

PLATE  
**B-2**