



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

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December 15, 2006

Mr. Colin McKay  
R.R. 4, P.O. Box 1012  
Flagstaff, Arizona 86001

Re: Report of Site Observations  
Wind Turbine Foundation  
Kendrick Park  
Coconino County, Arizona

Job No. 2526JW601

In accordance with your request, we visited the above referenced site on December 7, 2006. The purpose of the visit was to observe materials exposed in a previously excavated test pit excavation and provide soil classifications for the materials observed. We understand that a mat foundation for a wind turbine is planned for the site, and that the mat foundation will be designed based on current *International Residential Code* presumptive foundation bearing pressure criteria.

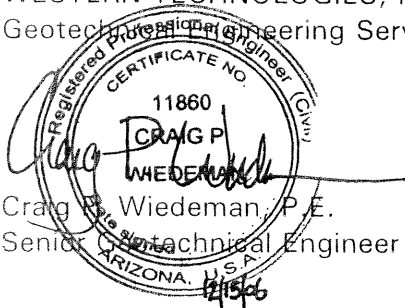
Materials exposed in the test pit consisted of about 1 foot of silty sand topsoil underlain by very dense, lightly cemented black cinders extending to a depth of about 4 feet. The cinders were mostly fine gravel to coarse sand sizes and were lightly cemented. The Unified Soil Classification of the cinders would be GP. The cinders were underlain by basalt gravel and cobbles in a silty sand matrix. This material was very dense and extended to the full depth of the test pit excavation at about 8 feet below the existing site grade. The Unified Soil Classification of this material would be GM. Mr. McKay indicated that dense basalt was encountered during excavation at a depth of about 9.5 to 10 feet below the existing site grade. No groundwater or evidence of any subsurface water seepage was observed in the test pit at the time of our site visit.

Based on the materials exposed in the test pit and the elevation of this site, we recommend that the mat foundation be designed to bear at a minimum depth of 3 feet below the lowest adjacent finished grade for frost protection. All loose or disturbed materials should be removed from the bottom of the foundation excavation prior to the placement of reinforcement and foundation concrete. A log of the test pit excavation and the results of some laboratory testing are attached.

Mr. Colin McKay  
Job No. 2526JW601

This completes our current services on this project. If you have any questions concerning this information, or require additional consultation, design, observation, or testing services, please contact us.

Sincerely,  
WESTERN TECHNOLOGIES, INC.  
Geotechnical Engineering Services



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

Copies to: Addressee (1)  
AnemErgonics, LLC/P. Migliore (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

WIND TURBINE FOUNDATION

Method of Soil Classification

**Western Technologies Inc.**

Job No.: 2526JW601

Plate: 1



**PHYSICAL PROPERTIES**

SAMPLE NO.	DEPTH (FEET)	SOIL CLASSIFICATION	PARTICLE SIZE DISTRIBUTION % PASSING BY WEIGHT					ATTERBERG LIMITS		MOISTURE-DENSITY RELATIONSHIP			'R' VALUE	REMARKS
			3 IN.	NO. 4	NO. 10	NO. 40	NO. 200	LL	PI	DRY DENSITY (PCF)	OPTIMUM MOISTURE (%)	METHOD		
1	4-8	SM	90	68	56	42	35	30	6					2

**REMARKS:**  
**CLASSIFICATION / PARTICLE SIZE**

1. Visual
2. Laboratory Tested
3. Minus No. 200 Only

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

**NOTE:** NP Nonplastic

<b>WIND TURBINE FOUNDATION</b>	
Physical Properties	
<b>Western Technologies Inc.</b>	
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