

## **APPENDIX E**

### **SOIL THERMAL RESISTIVITY TESTING**

**10-0014.3 - BLUE SKY WEST WIND POWER PROJECT  
THERMAL RESISTIVITY TESTING SUMMARY  
2013 - FIELD LAB TEST RESULTS**

Sample ID	FIELD					Sample ID	Geotherm				Bangor			
	rho °C·cm/W	Depth (ft)	Density (dry pcf)	Moisture (%)	Temp(0) °C		rho -°C·cm/W		Density (dry pcf)	Moisture (%)	rho -°C·cm/W		Density (dry pcf)	Moisture (%)
							Wet	Dry			Wet	Dry		
G-TP101	45	1.9	115.1	17	7.83	G-TP101								
G-TP105	40	3.5	119.1	12.9	9.72	G-TP105	47	169	120	10				
G-TP107	45	3.1	117.2	11.3	8.47	G-TP107								
G-TP109	61	2.2	108.9	19.7	7.37	G-TP109								
G-TP114	39	3.3	118.8	11.2	8.37	G-TP114								
G-TP120	66	2.8	122.6	4.2	6.25	G-TP120	44	119	133	7				
G-TP123	53	1.9	112.2	13.4	7.46	G-TP123								
G-TP126	45	3.5	124.4	14.1	9.55	G-TP126								
G-TP128	46	2.3	108.1	15.9	6.2	G-TP128	49	171	114	13				
G-TP129						G-TP129	53	173	125	7				
G-TP133	48	2.5	122.1	10.5	8.03	G-TP133								
G-TP137	46	3.1	111.4	12.5	7.72	G-TP137					52	230	121.1	9
G-TP141	47	2.2	112	17.3	7.49	G-TP141	49	165	123	10				
G-TP144	39	3.5	133.1	12.7	7.53	G-TP144	47	162	123	9				
G-TP146	48	2.8	121.6	11.1	7.56	G-TP146								
G-TP148	43	3	123.8	11.2	7.35	G-TP148					38	217	124.5	9
G-TP151	38	3.4	126	12.9	7.65	G-TP151					42	202	124.1	9
G-TP154						G-TP154	48	148	127	8				
G-TP159	44	2.3	113.7	16.7	6.32	G-TP159	47	135	131	9				
G-TP154						G-TP154	42	150	126	9				
G-TP162	37	3.2	120.3	15	7.37	G-TP162								
G-TP165	43	2.7	122.1	13.3	7.57	G-TP165								
G-TP167	39	2.2	115.5	15.9	6.52	G-TP167								
G-TP168	62	2.2	97.2	28.8	8.07	G-TP168					42	256	119.9	12
G-TP174	21	3.6	120.1	14.5	7.84	G-TP175					36	248	126.7	6
G-TP178	50	1.9	91.2	27.7	6.32	G-TP178	51	170	125	9				



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December 31, 2013

**SW Cole Engineering, Inc.**  
555 Eastern Avenue  
Augusta, ME 04330-6700  
**Attn: Michael St. Pierre, P.E.**

**Re: Thermal Analysis of Native Soil Samples**  
**Blue Sky Wind Power Project, Bingham, ME, Project No. 10-0014.3**

The following is the report of thermal dryout characterization tests conducted on ten (10) bulk samples of native soil from the referenced project.

**Thermal Resistivity Tests:** The samples were re-compacted at the moisture content and density ***provided by SW Cole***. A series of thermal resistivity measurements were made in stages with moisture content ranging from the 'wet' to the totally dry condition. The tests were conducted in accordance with the IEEE standard. The results are tabulated below and the thermal dryout curves are presented in **Figures 1 & 2**.

**Sample ID, Description, Thermal Resistivity, Moisture Content and Density**

Sample ID	Visual Description (SW Cole)	Thermal Resistivity (°C-cm/W)		Moisture Content (%)	Dry Density (lb/ft <sup>3</sup> )
		Wet	Dry		
8032A @ 6'-8'	TILL	49	165	10	123
8033A @ 4'-6'	TILL	47	162	9	123
8034A @ 5'-6.5'	TILL	48	148	8	127
8035A @ 5'-6'	TILL	47	135	9	131
8036A @ 10'-12'	TILL	42	150	9	126
8037A @ 4'-6'	TILL	47	169	10	120
8039A @ 3'-4'	TILL	44	119	7	133
8040A @ 3'-4'	TILL	49	171	13	114
8041A @ 4'-5'	TILL	53	173	7	125
8061A @ 4'-6'	TILL	51	170	9	125

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**Comments:** The thermal characteristic depicted in the dryout curves apply for the soils at their respective test dry density.

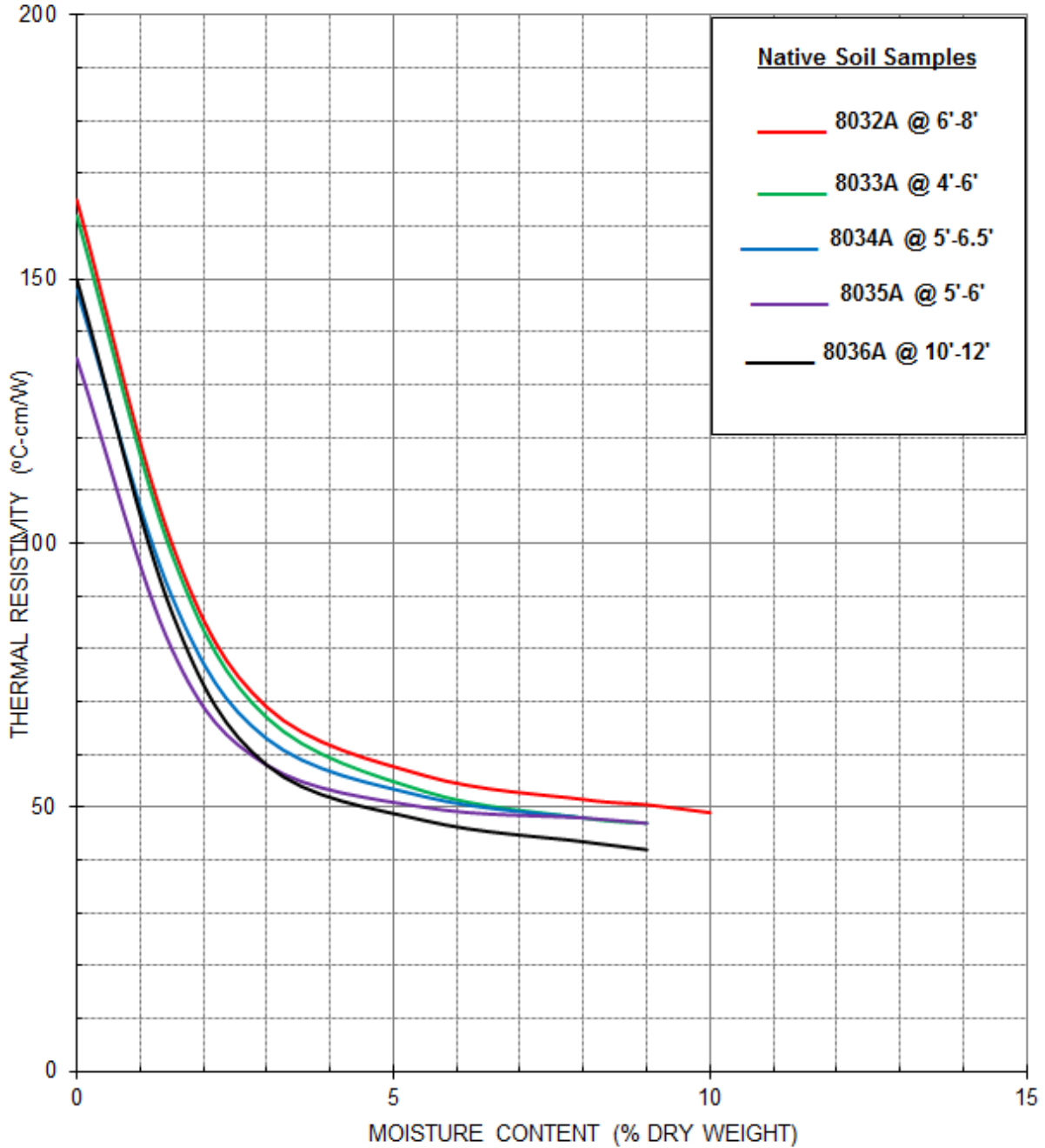
Please contact us if you have any questions or require additional information.

***Geotherm USA LLC***

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Deepak Parmar

## THERMAL DRYOUT CURVES



SW Cole Engineering, Inc. Project No. 10-0014.3

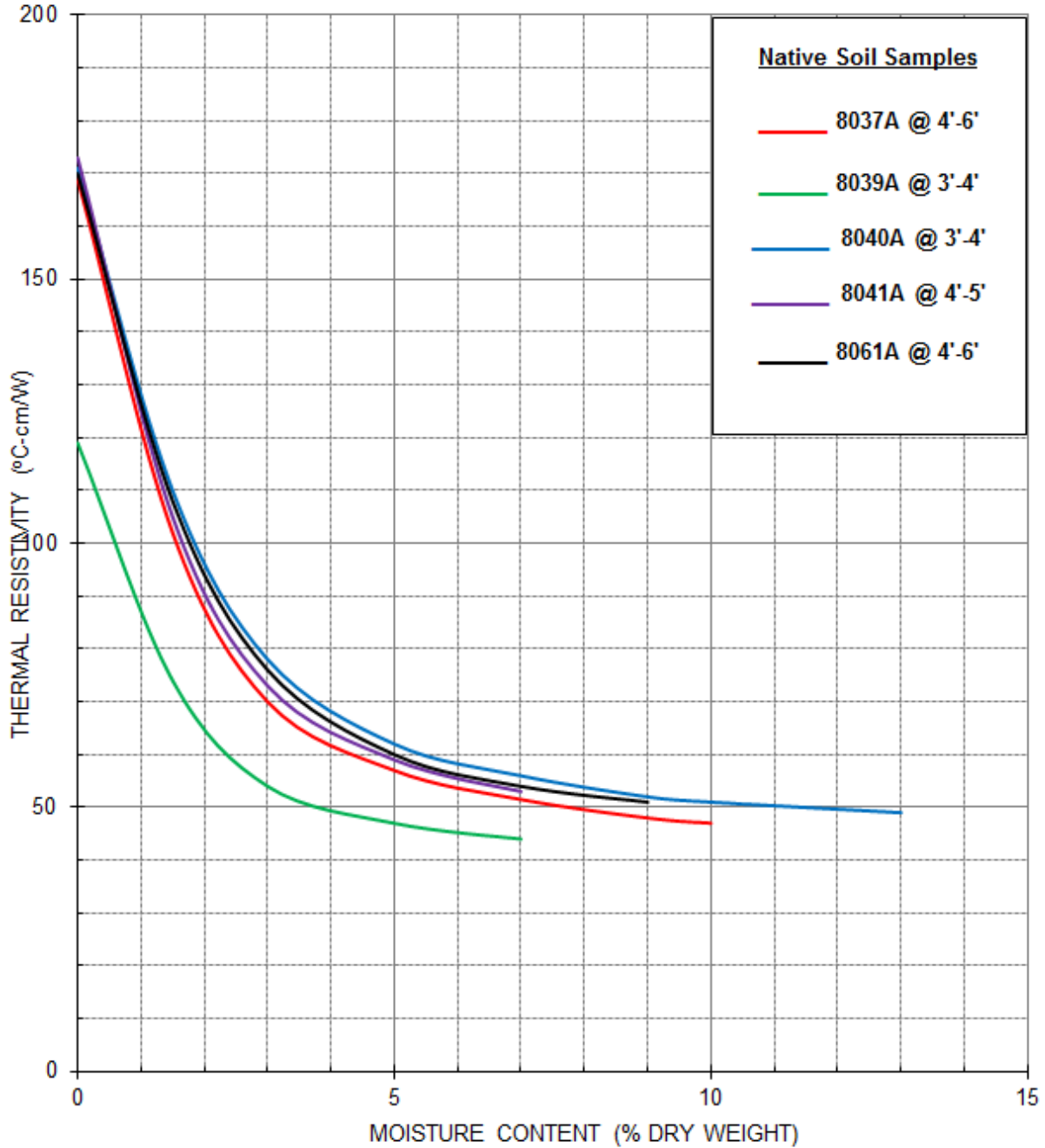
Thermal Analysis of Native Soil

Blue Sky Wind Power Project, Bingham, ME

December 2013

Figure 1

## THERMAL DRYOUT CURVES



SW Cole Engineering, Inc. Project No. 10-0014.3

Thermal Analysis of Native Soil

Blue Sky Wind Power Project, Bingham, ME

December 2013

Figure 2



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December 10, 2012

SW Cole Engineering, Inc.  
 286 Portland Road  
 Gary, ME 04039  
Attn: Paul F. Kohler, P.E.

**Re: Thermal Analysis of Native Soil Samples  
Blue Sky West Wind Project**

The following is a report of thermal dryout characterization tests conducted on the three (3) disturbed bulk soil samples collected on November 15, 2012.

**Test Procedure and Equipment:**

The tests included the measurement of moisture content, density and thermal dryout characterization (thermal resistivity as a function of moisture content). The samples were re-compacted at the “optimum” moisture content and at 95% of the modified Proctor density **provided by SW Cole**. A series of measurements were made in stages with the moisture contents ranging from ‘moist’ to the totally dry condition. The tests were conducted in accordance with the IEEE standard. The results are tabulated below and the thermal dryout curves are presented in **Figure 1**.

**Sample ID, Moisture, Density and Thermal Resistivity**

ID	SW Cole Sample Lab ID	Sample Depth (ft)	Visual Description	Thermal Resistivity (°C-cm/W)		Moisture Content (%)	Dry Density (lb/ft <sup>3</sup> )
				Wet	Dry		
TP-1 S-1 TURBINE 28	16135G	N/A	sandy silt, some gravel	46	174	11	125.5
TP-2 SUBSTATION	16133G	3' – 3.5'	till	45	178	14	123.3
TP-9 S-1 TURBINE 14	16134G	N/A	silt and sand; some gravel	50	148	8	132.3

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**Comments:**

Please contact us if you have any questions, wish to discuss any part of this report or if we can be of further assistance.

***Geotherm USA***

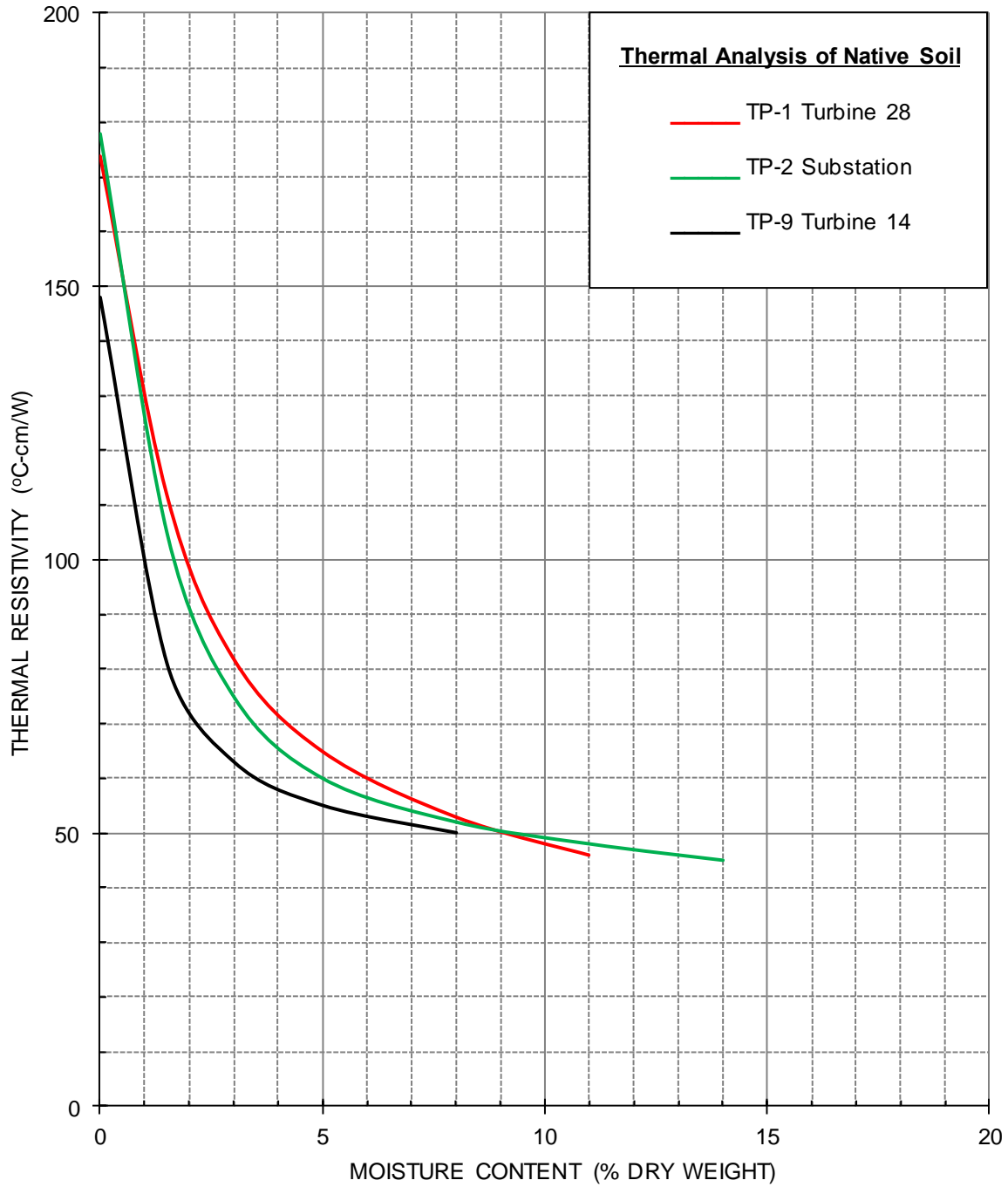
A handwritten signature in black ink, appearing to read "Nimesh Patel", is positioned below the company name.

Nimesh Patel

**Please Note: Samples will be disposed of after 5 days from date of report**



## THERMAL DRYOUT CURVE



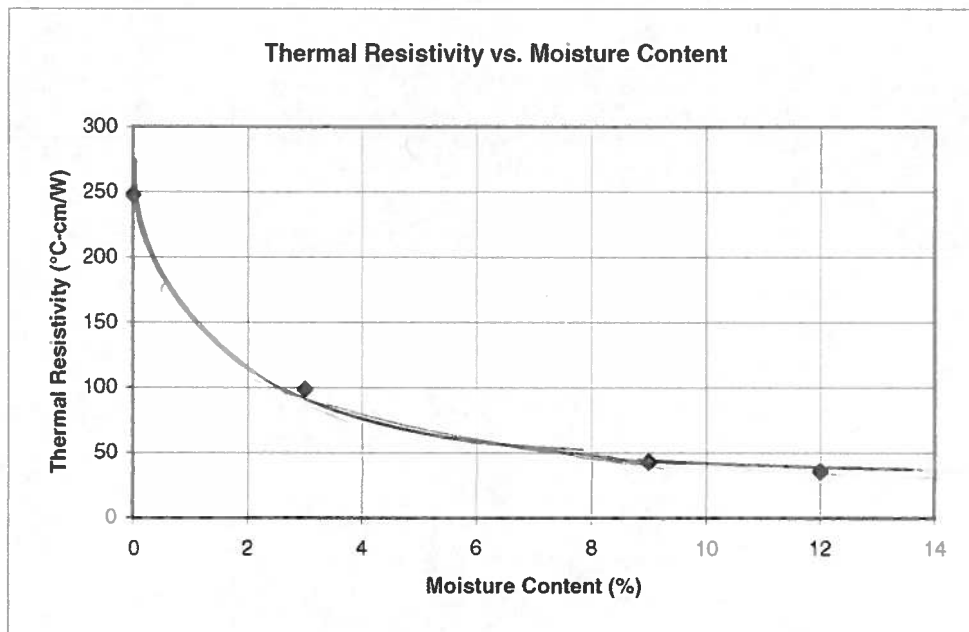
SW Cole Engineering, Inc.

Thermal Analysis of Native Soil

Blue Sky West Wind Project

**Project Name:** Blue Sky West Wind Power Project  
**Project Location:** Bingham, ME  
**Client:** Reed & Reed, Inc.  
**Material Description:** Gravelly silty sand (glacial till)  
**Material Source:** TP-175

**Project Number:** 10-0014.3  
**Lab ID:** 8060A  
**Date Received:** 12/03/13  
**Date Completed:** 01/06/13  
**Tested By:** NDS



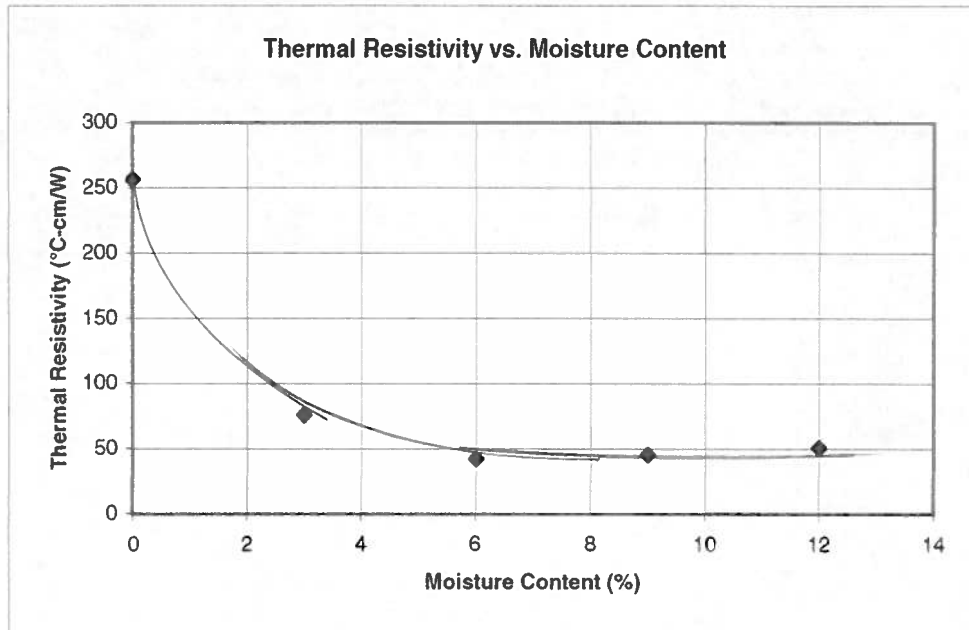
Uncorrected Proctor Value: 133.4 pcf  
 Percent Compaction: 95  
 Dry Density: 126.7 pcf  
 Wet Thermal Resistivity: 36 °C-cm/W  
 Dry Thermal Resistivity: 248 °C-cm/W

**Comments:** Laboratory screened on the #4 sieve

Reviewed By: \_\_\_\_\_

**Project Name:** Blue Sky West Wind Power Project  
**Project Location:** Bingham, ME  
**Client:** Reed & Reed, Inc.  
**Material Description:** Sandy silt, some gravel (glacial till)  
**Material Source:** TP-168

**Project Number:** 10-0014.3  
**Lab ID:** 8059A  
**Date Received:** 12/03/13  
**Date Completed:** 12/20/13  
**Tested By:** NDS



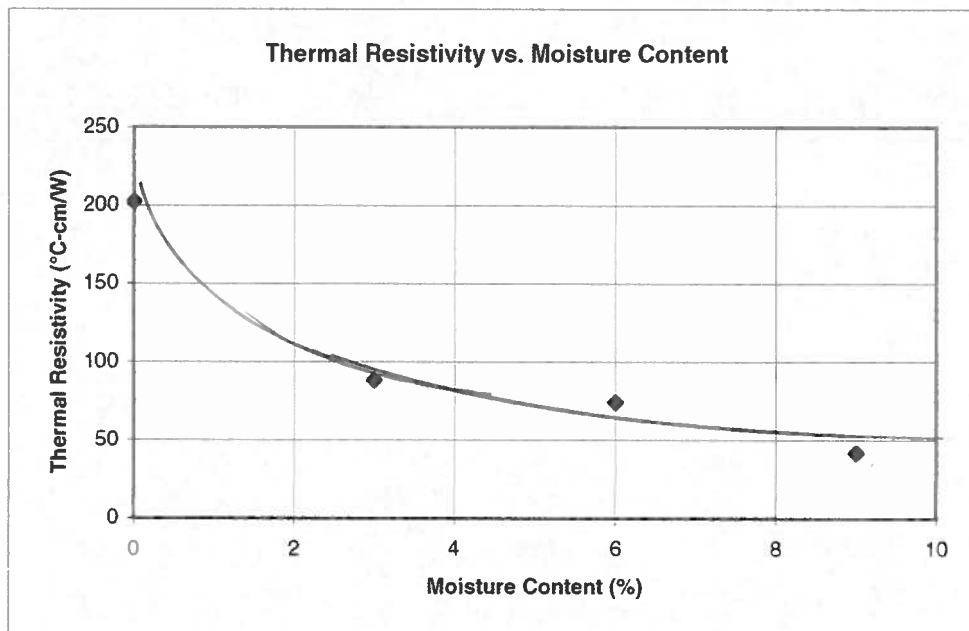
Uncorrected Proctor Value: 126.2 pcf  
 Percent Compaction: 95  
 Dry Density: 119.9 pcf  
 Wet Thermal Resistivity: 42 °C-cm/W  
 Dry Thermal Resistivity: 256 °C-cm/W

**Comments:** Laboratory screened on the #4 sieve

Reviewed By: \_\_\_\_\_

**Project Name:** Blue Sky West Wind Power Project  
**Project Location:** Bingham, ME  
**Client:** Reed & Reed, Inc.  
**Material Description:** Gravelly sandy silt (glacial till)  
**Material Source:** TP-151

**Project Number:** 10-0014.3  
**Lab ID:** 8078A  
**Date Received:** 12/03/13  
**Date Completed:** 01/08/14  
**Tested By:** NDS



Uncorrected Proctor Value: 130.6 pcf  
 Percent Compaction: 95  
 Dry Density: 124.1 pcf  
 Wet Thermal Resistivity: 42 °C-cm/W  
 Dry Thermal Resistivity: 202 °C-cm/W

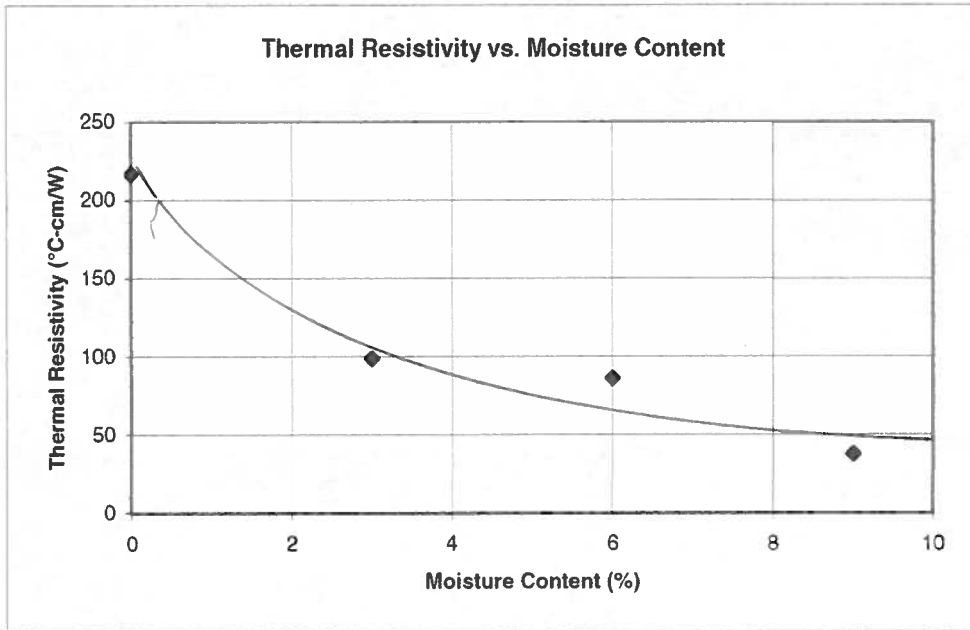
**Comments:** Laboratory screened on the #4 sieve

Reviewed By: \_\_\_\_\_

## Report of Thermal Resistivity

**Project Name:** Blue Sky West Wind Power Project  
**Project Location:** Bingham, ME  
**Client:** Reed & Reed, Inc.  
**Material Description:** Gravelly sandy silt (glacial till)  
**Material Source:** TP-148

**Project Number:** 10-0014.3  
**Lab ID:** 8077A  
**Date Received:** 12/03/13  
**Date Completed:** 01/09/14  
**Tested By:** NDS



Uncorrected Proctor Value: 131.1 pcf  
 Percent Compaction: 95  
 Dry Density: 124.5 pcf  
 Wet Thermal Resistivity: 38 °C-cm/W  
 Dry Thermal Resistivity: 217 °C-cm/W

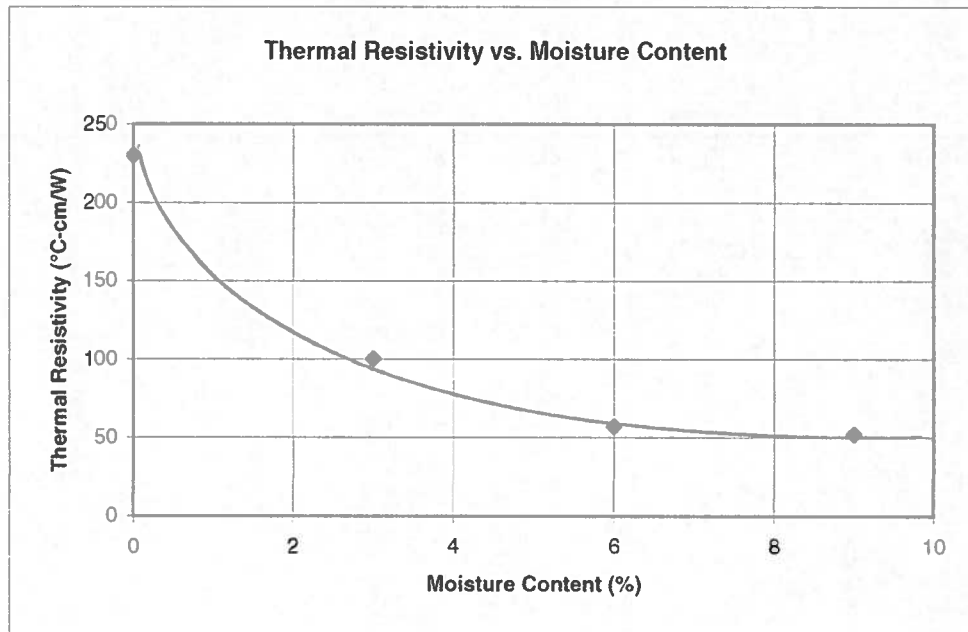
**Comments:** Laboratory screened on the #4 sieve

Reviewed By: \_\_\_\_\_

## Report of Thermal Resistivity

**Project Name:** Blue Sky West Wind Power Project  
**Project Location:** Bingham, ME  
**Client:** Reed & Reed, Inc.  
**Material Description:** Sandy gravel and silt (glacial till)  
**Material Source:** TP-137

**Project Number:** 10-0014.3  
**Lab ID:** 8076A  
**Date Received:** 12/03/13  
**Date Completed:** 01/14/14  
**Tested By:** NDS



Uncorrected Proctor Value: 127.5 pcf  
 Percent Compaction: 95  
 Dry Density: 121.1 pcf  
 Wet Thermal Resistivity: 52 °C-cm/W  
 Dry Thermal Resistivity: 230 °C-cm/W

**Comments:** Laboratory screened on the #4 sieve

Reviewed By: \_\_\_\_\_