

April 17, 2011

Anderson Engineering of Minnesota, LLC  
Attention: Gary R. Johnson, P.E.  
13605 1st Avenue North, Suite 100  
Plymouth, MN 55441

**SUBJECT: SUMMARY LETTER, GEOTHERMAL WELL BORING, EAGLE POINT NATIONAL CEMETERY, EAGLE POINT, OREGON**

At your request, Applied Geotechnical Engineering and Geologic Consulting LLC (AGEGC) has provided geologic services during completion of an exploratory boring at the Eagle Point National Cemetery for the new geothermal well system. The exploratory boring was completed to provide subsurface information necessary for the design of the new system. At your request, the boring was completed to a total depth of 125 ft. This letter report should be considered an addendum to our previous geotechnical report for this area of the cemetery.

Subsurface materials and conditions at the proposed geothermal system location were investigated by AGEGC on April 13 and 14, 2011, by a single boring (designated geothermal boring) at the location provided by you. The boring was drilled using a CME 75 truck-mounted drill rig provided and operated by Western States Drilling of Aurora, Oregon. All field operations were observed by a licensed geotechnical engineer/geologist provided by our firm, who maintained a detailed log of the materials and conditions encountered in the boring and directed the sampling operations.

Soil samples were obtained from the boring at 10-ft-intervals using a standard split-spoon sampler. Due to the relative softness of the materials encountered in the boring, it was not feasible to use rock coring methods to complete the boring to the required depth. The Standard Penetration Test (SPT) was conducted at the time of sampling with the split-spoon. This test consists of driving the standard split-spoon sampler into the soil a distance of up to 18 in. using a 140-lb hammer dropped 30 in. The CME drill rig was equipped with an automatic hammer. The number of blows required to drive the sampler the last 12 in. is known as the Standard Penetration Resistance or N-value (unless practical refusal of the sampler is encountered). Practical refusal of the sampler is when the number of blows required to drive the sampler is greater than 50 for 6 in. or less. The N-values provide a measure of the relative density of granular soils, such as sand, and the relative consistency, or stiffness, of cohesive soils, such as silt. The soil samples obtained from the split-spoon sampler were carefully examined in the field and representative portions were saved in airtight containers for further examination in our laboratory.

The log of the geothermal boring is attached. The log presents a descriptive summary of the materials and conditions encountered in the boring. The interval and type of samples taken during the drilling operation are shown to the right of the descriptive summary. The N-values from the SPT are also shown. The terms used to describe the materials encountered in the borings are defined in Tables 1A and 2A.

In general, the materials encountered in the boring are severely weathered to completely altered volcanic sedimentary rock, primarily sandstone and siltstone. Very hard rock was not encountered in the boring and in our opinion, so, in our opinion, the risk of encountering hard rock during installation of the geothermal wells is slight; however, a knob of hard rock was encountered during construction of a previous phase of the cemetery so there is still a slight risk of encountering hard rock.



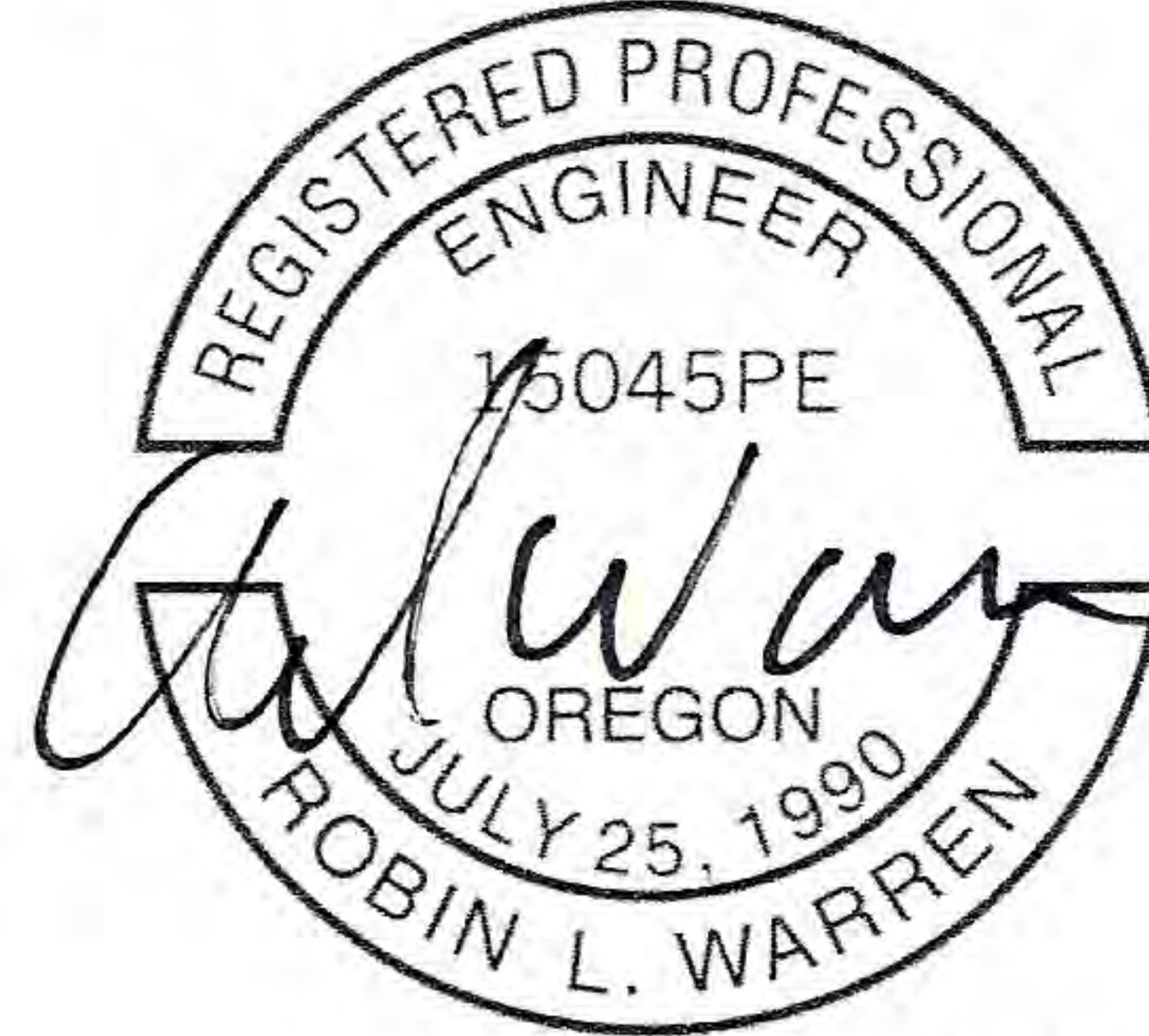
Please contact AGE GC if you have any questions or require additional information.

Sincerely,

**Applied Geotechnical Engineering and Geologic Consulting, LLC**



Robin L. Warren, P.E., G.E., R.G.  
Principal



Renewal: June 2012



# BORING LOG

Drill Rig: CME 75



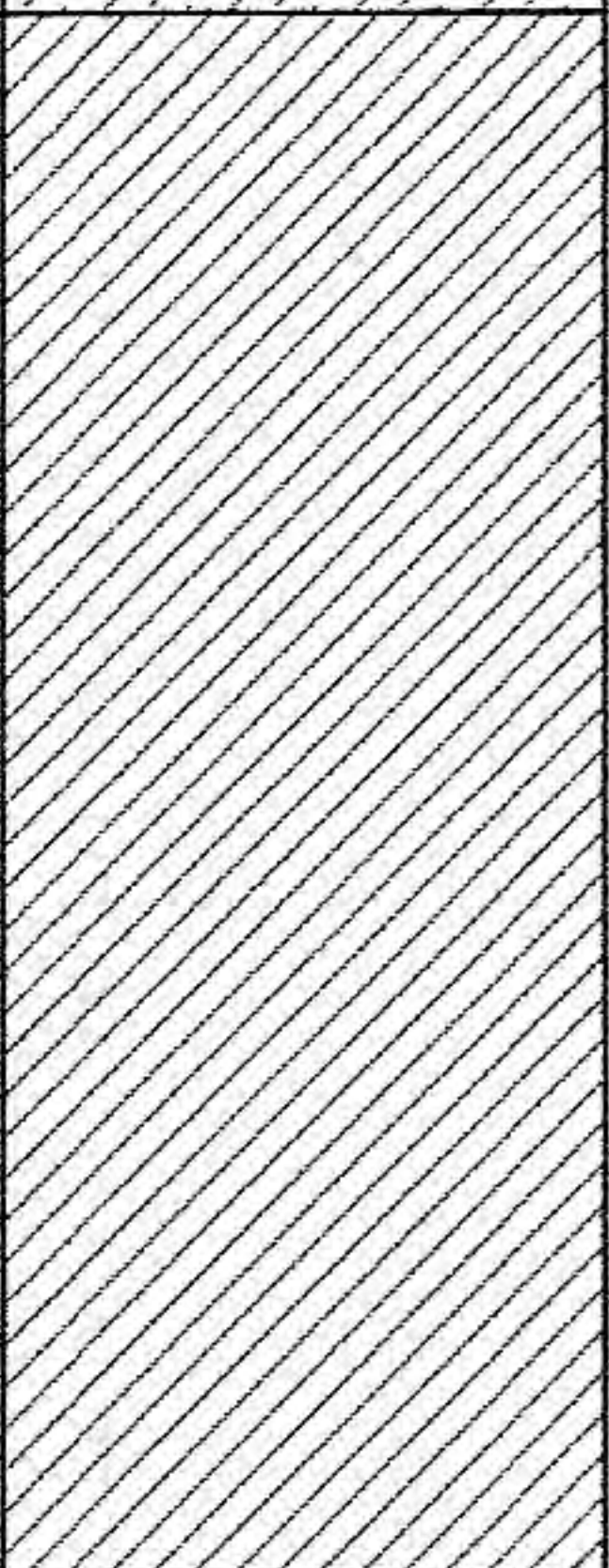
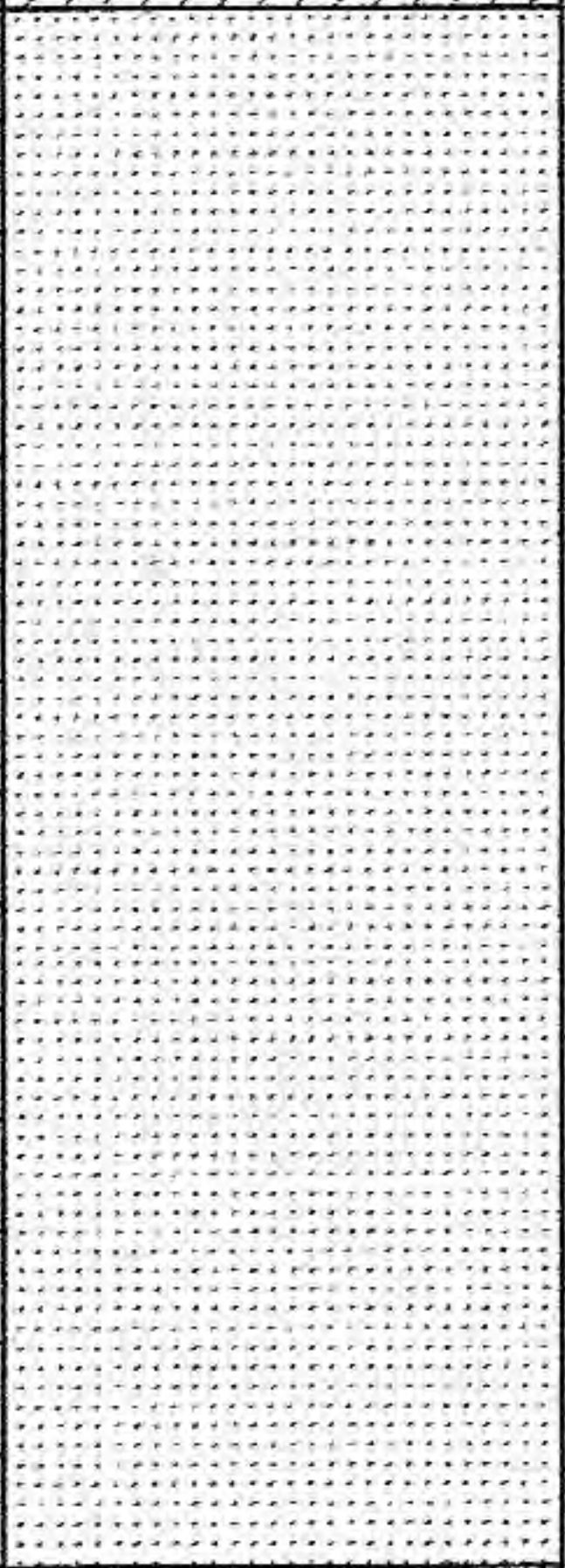
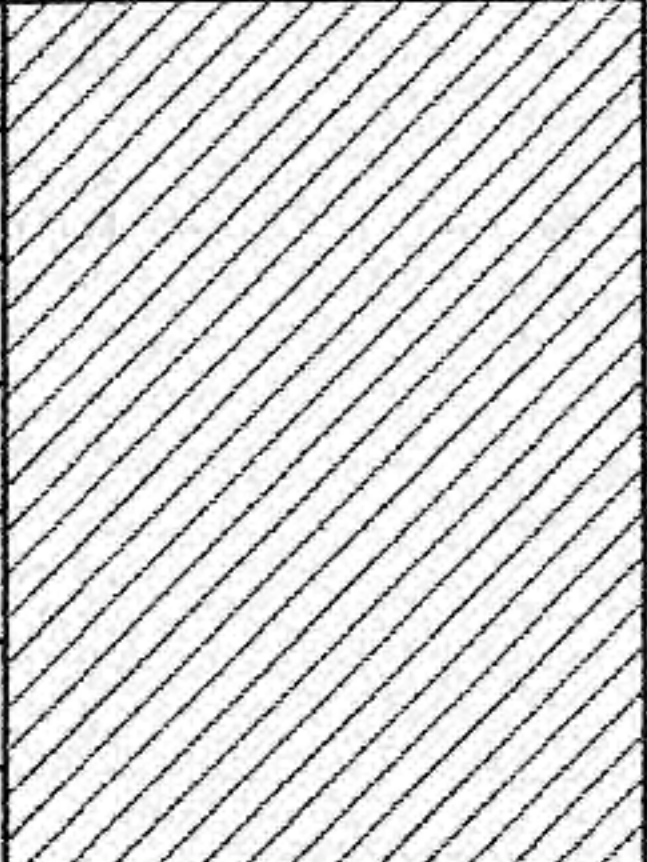
Date Drilled: April 14, 2011

Logged By:

Client Anderson Eng.

Boring Number: Geotherm

Robin Warren PE

Sample	Blow Counts	Moisture %	Depth Feet	Lithology	Description
					FILL: Crushed rock up to 4 in. in size.
			5		Medium stiff to stiff, gray clayey SILT
	46		10		Very stiff to hard SILT; trace to some fine sand, trace clay, relict sandstone structure (consistency of a soft rock).
	73		20		Hard, brown SILT; trace to some clay, trace sand, relict sandstone structure (consistency of a medium soft to medium hard rock).
	34/50 for 5in		30		
			35		Dark gray SILT; some clay to clayey, relict siltstone structure (consistency of a medium soft rock).

Completion Notes:

Undefined

Site:

Eagle Point National Cemetery

Eagle Point, Oregon

Project No.: 3366-11

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# BORING LOG

Drill Rig: CME 75

Date Drilled: April 14, 2011

Logged By:

Client Anderson Eng.

Boring Number: Geotherm

Robin Warren PE

Sample	Blow Counts	Moisture %	Depth Feet	Lithology	Description
	46				(Cont.)
			45		Dark gray SILT; some clay to clayey, relict siltstone structure (consistency of a medium soft rock)
	50 for 3 in		50		
			55		
	50 for 1 in		60		Hard, gray sandy SILT; trace clay, relict sandstone structure, interbedded zones of variably weathered material (consistency of a medium soft rock interbedded with consistency of medium hard rock).
			65		Loss of drilling mud circulation between 63 and 68 ft.
	50 for 3 in		70		
			75		Hard gray SILT; some clay to clayey, local zones with trace to some sand, relict siltstone structure including thin bedding, (consistency of a medium hard rock).

Completion Notes:

Undefined

Site:

Eagle Point National Cemetery

Eagle Point, Oregon

Project No.: 3366-11

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# BORING LOG

Drill Rig: CME 75

Date Drilled: April 14, 2011

Logged By:

Client Anderson Eng.

Boring Number: Geotherm

Robin Warren PE

Sample	Blow Counts	Moisture %	Depth Feet	Lithology	Description
	50 for 4 in		85		(Con't.)
	50 for 4 in		90		
	50 for 5 in		100		
	50 for 4 in		110		
			115		
Completion Notes: Undefined					Site: Eagle Point National Cemetery Eagle Point, Oregon
					Project No.: 3366-11      Page 3



			<b>BORING LOG</b>			
			Drill Rig: CME 75		Date Drilled: April 14, 2011	Logged By: Robin Warren PE
			Client Anderson Eng.		Boring Number: Geotherm	
Sample	Blow Counts	Moisture %	Depth Feet	Lithology	Description	
	50 for 3 in		125		Hard gray SILT; some clay to clayey, local zones with a trace to some sand, relict siltstone structure including thin bedding (consistency of a medium hard rock).	
			130			
			135			
			140			
			145			
			150			
			155			
Completion Notes: Undefined					Site: Eagle Point National Cemetery Eagle Point, Oregon	
					Project No.: 3366-11 <div>Page 4</div>	



**TABLE 1A: SOIL DESCRIPTION TERMINOLOGY**

**Coarse-Grained Soils (Sand Size and Larger)**

<b><u>Relative Density</u></b>	<b><u>Standard Penetration Resistance (N-Values)</u></b>
Very Loose	0-4
Loose	4-10
Medium Dense	10-30
Dense	30-50
Very Dense	Over 50

**Fine-Grained (Cohesive) Soils**

<b><u>Consistency</u></b>	<b><u>Standard Penetration Resistance (N-Value)</u></b>	<b><u>Torvane Undrained Shear Strength, tsf</u></b>	<b><u>Field Identification</u></b>
Very Soft	2	Less than 0.125	• Easily penetrated by fist.
Soft	2-4	0.125-0.25	• Easily penetrated by thumb.
Medium Stiff	5-8	0.25-0.50	• Penetrated by thumb with moderate effort.
Stiff	9-15	0.50-1.0	• Readily indented by thumb but penetrated only with great effort.
Very Stiff	16-30	1.0-2.0	• Readily indented by thumbnail.
Hard	Over 30	Over 2.0	• Indented with difficulty by thumbnail.

**Grain Shape**

<b><u>Term</u></b>	<b><u>Description</u></b>
Angular	Corners and edges sharp.
Subangular	Corners worn off, angles not worn off
Subrounded	Corners and angles worn off, flat surfaces remain.
Rounded	Worn to almost spherical shape.

**Grain Size Classification**

Boulders	6 to 36 inches
Cobbles	3 to 6 inches
Gravel	1/4-3/4 inch (fine) 3/4-3 inches (coarse)
Sand	No. 200-No. 40 sieve (fine) No. 40-No. 10 sieve (medium) No. 10-No. 4 sieve (coarse)
Silt/Clay	Pass No. 200 sieve

**Modifier for Subclassification**

<b><u>Adjective</u></b>	<b><u>Percentage of Other Material in Total Sample</u></b>
Clean	0 - 1.5
Trace	1.5 - 10
Some	10 - 30
Sandy, Silty, or Clayey	30 - 50



**TABLE 2A: ROCK DESCRIPTION TERMINOLOGY**

<b><u>Scale of Rock Hardness (After Panama Canal Company, 1959)</u></b>		
RH-1	Soft	Slightly harder than very hard over-burden, rock-like character, but crumbles or breaks easily by hand.
RH-1	Medium Soft	Cannot be crumbled between fingers but can be easily picked with light blows of the geology hammer.
RH-2	Medium Hard	Can be picked with moderate blows of geology hammer. Can be cut with knife.
RH-3	Hard	Cannot be picked with geology hammer but can be chipped with moderate blows of the hammer.
RH-4	Very Hard	Chips can be broken off only with heavy blows of the geology hammer.

<b><u>Terms Used to Describe the Degree of Weathering</u></b>	
<b><u>Descriptive Term</u></b>	<b><u>Defining Characteristics</u></b>
Fresh	Rock is unstained. May be fractured but discontinuities are not stained.
Slight	Rock is unstained. Discontinuities show some staining on their surface but discoloration does not penetrate rock mass.
Moderate	Discontinuity surfaces are stained. Discoloration may extend into rock along discontinuity surfaces.
High	Individual rock fragments are thoroughly stained and can be crushed with pressure hammer. Discontinuous surfaces are thoroughly stained and may be crumbly.
Severe	Rock appears to consist of gravel-sized fragments in a "soil" matrix. Individual fragments are thoroughly discolored and can be broken with fingers.

<b><u>Thickness of Bedding</u></b>	
Massive	Beds are 3 feet thick or greater.
Thick Bedding	Beds from 1 to 3 feet thick.
Medium Bedded	Beds from 4 inch to 1 feet thick.
Thin Bedded	Beds less than 4 inch thick.