

# **APPENDIX A**

## **Boring Logs and Piezometer Completion Details**



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# Geologic & Monitoring Well Construction Log

Project Number  
EH130580

Well Number  
HB-1 / P-4

Sheet  
1 of 1

Project Name **Fisher Creek Basin**  
Elevation (Top of Well Casing) \_\_\_\_\_  
Water Level Elevation \_\_\_\_\_  
Drilling/Equipment **Hand Auger**  
Hammer Weight/Drop **N/A**

Location **Skagit County, WA**  
Surface Elevation (ft) **335.50**  
Date Start/Finish **4/9/14, 4/9/14**  
Hole Diameter (in) **3 inches**

Depth (ft)	Water Level	WELL CONSTRUCTION	Blows/ 6"	Graphic Symbol	DESCRIPTION
		Slip cap at -1.6			
		Threaded steel pipe -1.6 to 3.4 feet			<b>Peat</b> Very soft, wet, dark brown, fine organic PEAT (PT). Wet.
5		Watersource well point 3.4 to 5.9 feet			Grades to soft, wet, light brown to light gray, clayey SILT, with organics (CH-OH).
		Solid drive point 5.9 to 6.4 feet			<b>Alluvial Fan Deposits</b> Grades to soft, wet, light brown to light gray, sandy clayey SILT (CH).
					Boring terminated at 6 feet. Well completed at 5.9 feet on 4/9/14. Wet at 1 foot. Well completed in undisturbed soil approximately 5 feet west of boring location.

**Sampler Type (ST):**



2" OD Split Spoon Sampler (SPT)



No Recovery

M - Moisture

**Logged by:** JWC



3" OD Split Spoon Sampler (D & M)



Ring Sample



Water Level ( )

**Approved by:**



Grab Sample



Shelby Tube Sample



Water Level at time of drilling (ATD)

NWELL-B\_130580.GPJ BORING.GDT 6/12/14



# Geologic & Monitoring Well Construction Log

Project Number  
EH130580

Well Number  
HB-2 / P-5

Sheet  
1 of 1

Project Name **Fisher Creek Basin**  
 Elevation (Top of Well Casing) \_\_\_\_\_  
 Water Level Elevation \_\_\_\_\_  
 Drilling/Equipment **Hand Auger**  
 Hammer Weight/Drop **N/A**

Location **Skagit County, WA**  
 Surface Elevation (ft) **335.80**  
 Date Start/Finish **4/9/14, 4/9/14**  
 Hole Diameter (in) **3 inches**

Depth (ft)	Water Level	WELL CONSTRUCTION	Blows/ 6"	Graphic Symbol	DESCRIPTION
		Slip cap at -1.6			<b>Peat</b>
		Threaded steel pipe -1.6 to 3.4 feet		Wet.	
5		Watersource well point 3.4 to 5.9 feet		Soft, wet, dark brown, fine organic PEAT (PT).	
		Solid drive point 5.9 to 6.4 feet			
10					Boring terminated at 8 feet. Well completed at 5.9 feet on 4/9/14. Wet at 1 foot. Well completed in undisturbed soil approximately 5 feet west of boring location.
15					

NWELL-B\_130580.GPJ BORING.GDT 6/12/14

**Sampler Type (ST):**

-  2" OD Split Spoon Sampler (SPT)
-  3" OD Split Spoon Sampler (D & M)
-  Grab Sample
-  No Recovery
-  Ring Sample
-  Shelby Tube Sample

M - Moisture

 Water Level ( )

 Water Level at time of drilling (ATD)

**Logged by:** JWC

**Approved by:**



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# Geologic & Monitoring Well Construction Log

Project Number  
EH130580

Well Number  
HB-6 / P-3

Sheet  
1 of 1

Project Name Fisher Creek Basin  
 Elevation (Top of Well Casing) \_\_\_\_\_  
 Water Level Elevation \_\_\_\_\_  
 Drilling/Equipment Hand Auger  
 Hammer Weight/Drop N/A

Location Skagit County, WA  
 Surface Elevation (ft) \_\_\_\_\_  
 Date Start/Finish 4/9/14, 4/9/14  
 Hole Diameter (in) 3 inches

Depth (ft)	Water Level	WELL CONSTRUCTION	Blows/ 6"	Graphic Symbol	DESCRIPTION
		Slip cap at -1.6			<b>Peat</b>  Wet.  Very soft, wet, dark brown, fine organic PEAT, trace silt, trace fine sand (PT).
		Threaded steel pipe -1.6 to 3.4 feet			
5		Watersource well point 3.4 to 5.9 feet			
		Solid drive point 5.9 to 6.4 feet			Boring terminated at 7 feet. Well completed at 5.9 feet on 4/9/14. Well completed in undisturbed soil approximately 5 feet west of boring location.
10					
15					

**Sampler Type (ST):**



2" OD Split Spoon Sampler (SPT)



No Recovery

M - Moisture

**Logged by:** JWC



3" OD Split Spoon Sampler (D & M)



Ring Sample



Water Level ( )

**Approved by:**



Grab Sample



Shelby Tube Sample



Water Level at time of drilling (ATD)

NWELL-B\_130580.GPJ\_BORING.GDT\_6/12/14



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# Geologic & Monitoring Well Construction Log

Project Number  
EH130580

Well Number  
-P-1

Sheet  
1 of 1

Project Name Fisher Creek Basin  
 Elevation (Top of Well Casing) \_\_\_\_\_  
 Water Level Elevation \_\_\_\_\_  
 Drilling/Equipment Drive Point  
 Hammer Weight/Drop N/A

Location Skagit County, WA  
 Surface Elevation (ft) 334.50  
 Date Start/Finish 4/9/14, 4/9/14  
 Hole Diameter (in) 3 inches

Depth (ft)	Water Level	WELL CONSTRUCTION	Blows/ 6"	Graphic Symbol	DESCRIPTION
	▼	Slip cap at -1.72			<b>Peat</b>
		Threaded steel pipe -1.72 to 3.45 feet		[Wavy pattern symbol]	
5		Johnson 10-slot screen 3.45 to 6.42 feet			No soil observation.
		Solid drive point			
10					
15					
					Boring terminated at 6.75 feet. Well completed at 6.42 feet on 4/9/14.

NWELL-B\_130580.GPJ BORING.GDT 6/12/14

**Sampler Type (ST):**

- 2" OD Split Spoon Sampler (SPT)
- 3" OD Split Spoon Sampler (D & M)
- Grab Sample
- No Recovery
- Ring Sample
- Shelby Tube Sample

M - Moisture

Water Level ( )

Water Level at time of drilling (ATD)

**Logged by:** JWC

**Approved by:**



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# Geologic & Monitoring Well Construction Log

Project Number  
EH130580

Well Number  
-P-2

Sheet  
1 of 1

Project Name Fisher Creek Basin  
 Elevation (Top of Well Casing) \_\_\_\_\_  
 Water Level Elevation \_\_\_\_\_  
 Drilling/Equipment Drive Point  
 Hammer Weight/Drop N/A

Location Skagit County, WA  
 Surface Elevation (ft) 334.00  
 Date Start/Finish 4/9/14, 4/9/14  
 Hole Diameter (in) 3 inches

Depth (ft)	Water Level	WELL CONSTRUCTION	Blows/ 6"	Graphic Symbol	DESCRIPTION
		Slip cap at -1.67			<b>Peat</b>
		Threaded steel pipe -1.67 to 3.49 feet			
5		Johnson 10-slot screen 3.49 to 6.46 feet			No soil observation.
		Solid drive point			
10					Boring terminated at 6.79 feet. Well completed at 6.46 feet on 4/9/14.
15					

Sampler Type (ST):

- 2" OD Split Spoon Sampler (SPT)
- 3" OD Split Spoon Sampler (D & M)
- Grab Sample
- No Recovery
- Ring Sample
- Shelby Tube Sample

M - Moisture

Water Level ( )

Water Level at time of drilling (ATD)

Logged by: JWC

Approved by:

NWELL-B\_130580.GPJ BORING.GDT 6/12/14



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# Exploration Log

Project Number  
EH130580

Exploration Number  
HB-3

Sheet  
1 of 1

Project Name Fisher Creek Basin  
Location Skagit County, WA  
Driller/Equipment Hand Auger  
Hammer Weight/Drop N/A

Ground Surface Elevation (ft) \_\_\_\_\_  
Datum N/A  
Date Start/Finish 4/9/14, 4/9/14  
Hole Diameter (in) 3 inches

Depth (ft)	S T	Samples	Graphic Symbol	DESCRIPTION	Well Completion	Water Level	Blows/6" Blows/6"	Blows/Foot				Other Tests
								10	20	30	40	
				<b>Topsoil</b>								
		S-1		<b>Alluvial Fan Deposits</b> Medium stiff, slightly moist, brown gray, sandy SILT, fine sand; slightly mottled at 1 foot (ML). Wet at 1.5 feet.  Grades to slightly silty fine SAND (SP).								
		S-2		<b>Peat</b> Soft, wet, dark brown, PEAT (PT).  Bottom of exploration boring at 4 feet Refusal at 4 feet (wood). Wet at 1.5 foot.								
5												
10												
15												

AESIBOR 130580.GPJ June 12, 2014

**Sampler Type (ST):**



2" OD Split Spoon Sampler (SPT)



3" OD Split Spoon Sampler (D & M)



Grab Sample



No Recovery



Ring Sample



Shelby Tube Sample

M - Moisture

Water Level ( )

Water Level at time of drilling (ATD)

**Logged by:** JWC

**Approved by:**



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# Exploration Log

Project Number  
EH130580

Exploration Number  
HB-4

Sheet  
1 of 1

Project Name Fisher Creek Basin  
 Location Skagit County, WA  
 Driller/Equipment Hand Auger  
 Hammer Weight/Drop N/A

Ground Surface Elevation (ft) \_\_\_\_\_  
 Datum N/A  
 Date Start/Finish 4/9/14, 4/9/14  
 Hole Diameter (in) 3 inches

Depth (ft)	S T	Samples	Graphic Symbol	DESCRIPTION	Well Completion	Water Level	Blows/6" Blows/6"	Blows/Foot				Other Tests	
								10	20	30	40		
				<b>Topsoil</b>									
		S-1		<b>Alluvial Fan Deposits</b> Wet at 0.5 feet. Medium stiff, wet, brown slightly sandy SILT, with >30% organics (OL/OH).									
		S-2		Stiff, wet, light brown to light gray, clayey SILT (CL-ML).									
		S-3		<b>Peat</b> Soft, wet, dark brown, PEAT (PT); no recovery.									
5				Bottom of exploration boring at 3 feet Refusal at 3 feet (wood). Wet at 0.5 foot.									
10													
15													

Sampler Type (ST):



2" OD Split Spoon Sampler (SPT)



3" OD Split Spoon Sampler (D & M)



Grab Sample



No Recovery



Ring Sample



Shelby Tube Sample

M - Moisture

Water Level ()

Water Level at time of drilling (ATD)

Logged by: JWC

Approved by:



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# Exploration Log

Project Number  
EH130580

Exploration Number  
HB-5

Sheet  
1 of 1

Project Name Fisher Creek Basin  
Location Skagit County, WA  
Driller/Equipment Hand Auger  
Hammer Weight/Drop N/A

Ground Surface Elevation (ft) \_\_\_\_\_  
Datum N/A  
Date Start/Finish 4/9/14, 4/9/14  
Hole Diameter (in) 3 inches

Depth (ft)	S T	Samples	Graphic Symbol	DESCRIPTION	Well Completion	Water Level	Blows/6"	Blows/Foot				Other Tests
								10	20	30	40	
				<b>Topsoil</b>								
		S-1		<b>Everson Glaciomarine Outwash</b> Medium dense, slightly moist, light brown, very silty SAND, well graded fine to coarse subrounded to rounded gravel (SM).  Wet and grades gray at 2 feet.		▼						
		S-2		Bottom of exploration boring at 3 feet Refusal at 3 feet (gravel or cobble). Wet at 2 feet.								
5												
10												
15												

AESIBOR 130580.GPJ June 12, 2014

**Sampler Type (ST):**



2" OD Split Spoon Sampler (SPT)



3" OD Split Spoon Sampler (D & M)



Grab Sample



No Recovery



Ring Sample



Shelby Tube Sample

M - Moisture

▽ Water Level ( )

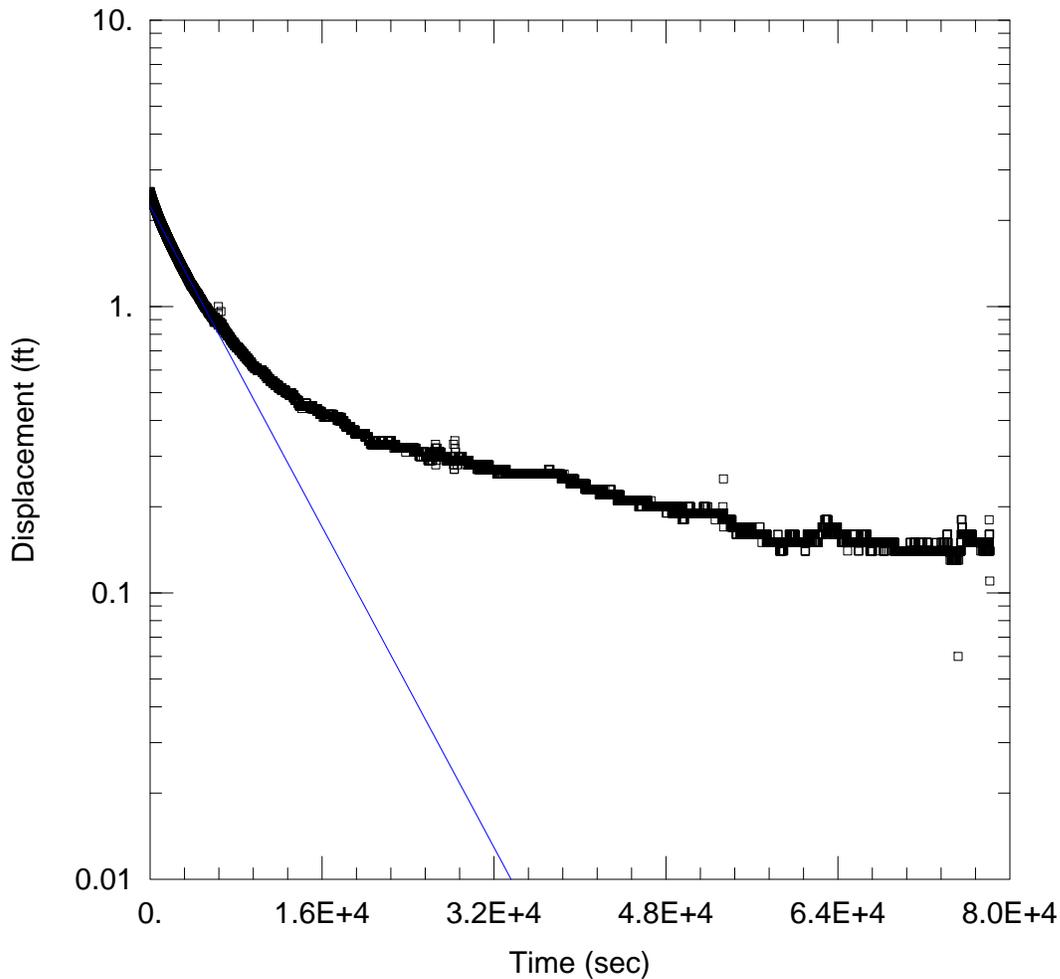
▼ Water Level at time of drilling (ATD)

**Logged by:** JWC

**Approved by:**

# **APPENDIX B**

## **Slug Test Results**



### WELL TEST ANALYSIS

Data Set: C:\Program Files (x86)\HydroSOLVE\AQTESOLV Pro 4.0\Hanika\DP1a.aqt  
 Date: 04/21/14 Time: 16:23:46

### PROJECT INFORMATION

Company: AESI  
 Client: USIT  
 Project: EH130580  
 Location: Hanika  
 Test Well: DP-1  
 Test Date: 4/8/14

### AQUIFER DATA

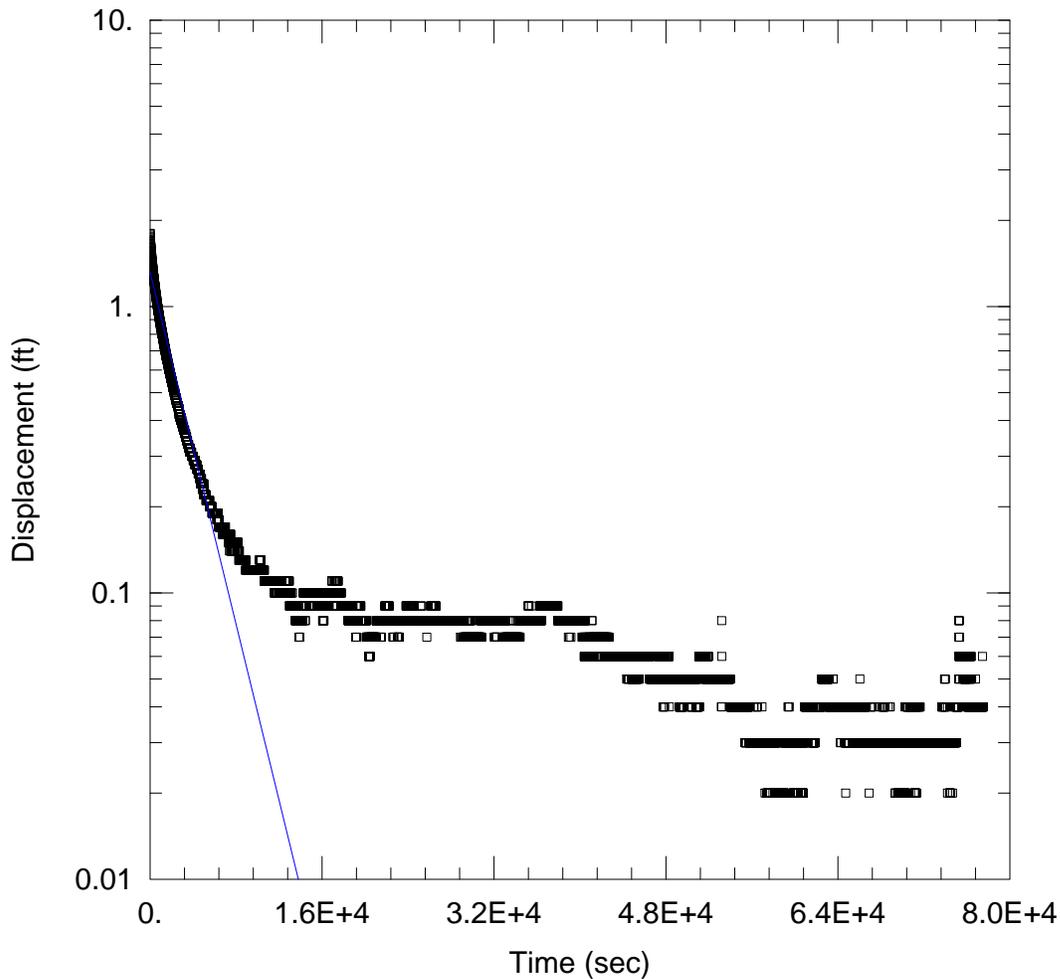
Saturated Thickness: 30. ft Anisotropy Ratio (Kz/Kr): 0.1

### WELL DATA (DP-1)

Initial Displacement: 2.52 ft Static Water Column Height: 5.651 ft  
 Total Well Penetration Depth: 6.42 ft Screen Length: 2.97 ft  
 Casing Radius: 0.05729 ft Well Radius: 0.04948 ft  
 Gravel Pack Porosity: 0.

### SOLUTION

Aquifer Model: Unconfined Solution Method: Bower-Rice  
 K = 0.0158 ft/day y0 = 2.239 ft



WELL TEST ANALYSIS

Data Set: C:\Program Files (x86)\HydroSOLVE\AQTESOLV Pro 4.0\Hanika\DP-2a.aqt  
 Date: 04/21/14 Time: 16:23:01

PROJECT INFORMATION

Company: AESI  
 Client: USIT  
 Project: EH130580  
 Location: Hanika  
 Test Well: DP-2  
 Test Date: 4/8/14

AQUIFER DATA

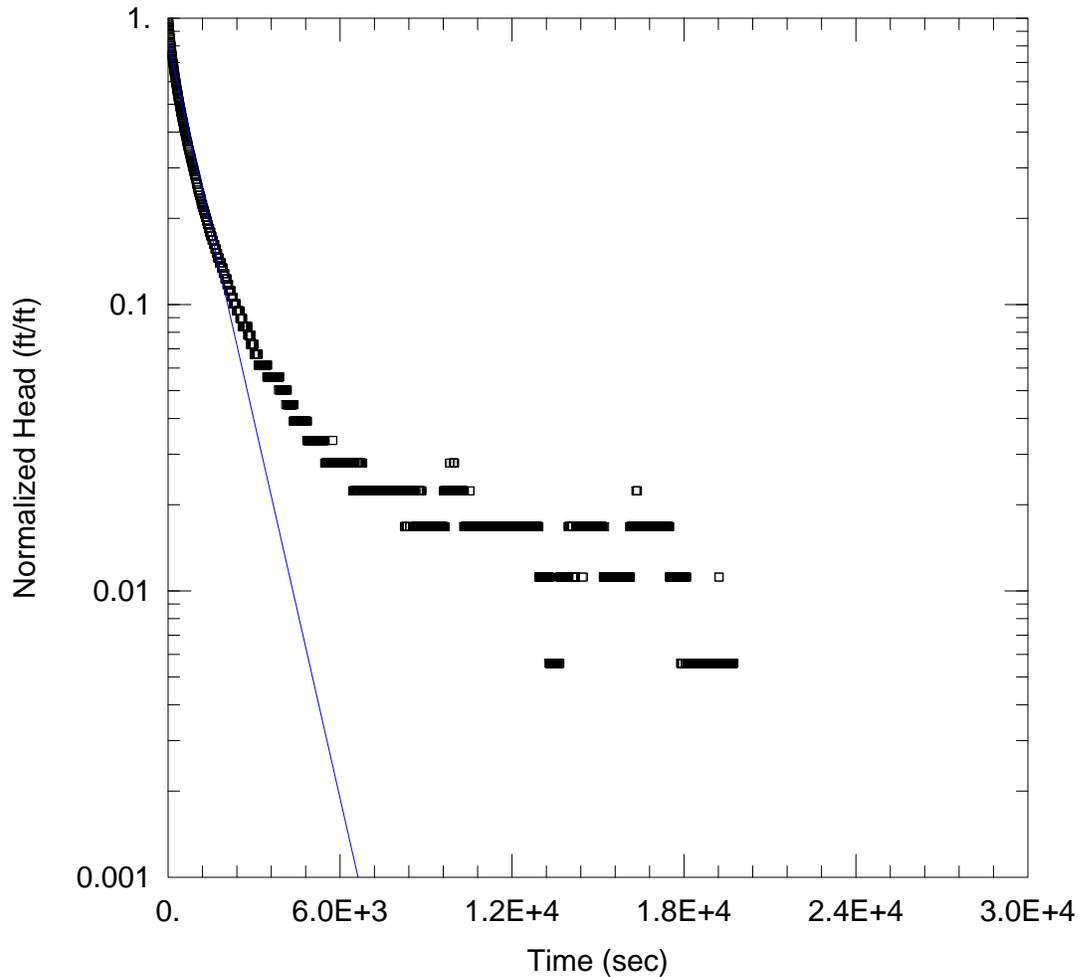
Saturated Thickness: 30 ft Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (DP-2)

Initial Displacement: 1.8 ft Static Water Column Height: 5.167 ft  
 Total Well Penetration Depth: 5.269 ft Screen Length: 2.969 ft  
 Casing Radius: 0.05729 ft Well Radius: 0.04948 ft  
 Gravel Pack Porosity: 0

SOLUTION

Aquifer Model: Unconfined Solution Method: Bower-Rice  
 K = 0.03386 ft/day y0 = 1.316 ft



### WELL TEST ANALYSIS

Data Set: C:\Program Files (x86)\HydroSOLVE\AQTESOLV Pro 4.0\Hanika\DP-3.aqt  
 Date: 04/21/14 Time: 16:22:10

### PROJECT INFORMATION

Company: AESI  
 Client: USIT  
 Project: EH130580  
 Location: Hanika  
 Test Well: DP-3  
 Test Date: 4/8/14

### AQUIFER DATA

Saturated Thickness: 30. ft Anisotropy Ratio (Kz/Kr): 0.1

### WELL DATA (DP-3)

Initial Displacement: 1.79 ft Static Water Column Height: 6.227 ft  
 Total Well Penetration Depth: 5.88 ft Screen Length: 2.5 ft  
 Casing Radius: 0.05729 ft Well Radius: 0.05729 ft  
 Gravel Pack Porosity: 0.

### SOLUTION

Aquifer Model: Unconfined Solution Method: Bower-Rice  
 K = 0.1104 ft/day y0 = 1.464 ft

## **APPENDIX C**

### **Geophysical Investigation Report (Philip Duos)**

**GEOPHYSICAL INVESTIGATION**

**PEAT EVALUATION  
STARBIRD ROAD AREA  
SKAGIT COUNTY, WASHINGTON**

**FOR**

**ASSOCIATED EARTH SCIENCES, INC.  
EVERETT, WASHINGTON**

**MAY 2014**

**PHILIP H. DUOOS  
GEOPHYSICAL CONSULTANT**

June 2, 1014

Our Ref: 1116-14

Mr. Jay Chennault  
Associated Earth Sciences, Inc.  
2911 ½ Hewitt Avenue, Ste. 2  
Everett, Washington 98201

**REPORT:** Geophysical Investigation  
Peat Evaluation  
Skagit County, Washington

Dear Mr. Chennault:

This letter report presents the results of the geophysical investigation I performed on April 29 and May 2, 2014. The purpose of the investigation was to help determine the thickness of peat. Based on our early conversations I understand that the peat is probably underlain by dense till. Subsequent information you provided included a paper on Peat Resources of Washington that provided additional information indicating that parts of the site are underlain by clay (soft), sand, and gravel.

Seismic surveys were performed along five seismic lines at the site. A measurement of the shear wave (s-wave) velocities was made using the multichannel analysis of surface waves (MASW) method. Compressional wave (p-wave) velocities were also obtained using the refraction method. Ground penetrating radar (GPR) was also used at the site, and provided the most useful information.

The Google™ airphoto (Figure 1) shows the locations of the five seismic lines (SL-1 through SL-5; shown in red). The small dots with the seismic line labels correspond to the pin flag locations that I located with my GPS system. The two GPR lines are shown by a blue line. GPR Line 1 runs west to east near the southern ends of the four seismic lines in the southern portion of the site. Approximate stationing for GPR Line 1 is also shown. Please note that the stationing between 800 feet and 1400 feet is adjusted to account for inaccuracy in the distances. GPR line 1 was marked with plastic pin flags placed at 50-foot intervals using a string-chain. GPR Line 2 crosses seismic line SL-5 in the northern portion of the site and runs south to north.

## **INTERPRETATION RESULTS – SOUTHERN AREA**

### Ground Penetrating Radar

The profile on Figure 2 provides a summary of the results from GPR Line 1 that runs parallel to and north of Starbird Road. The seismic results and the historical boring results from the paper on Peat Resources of Washington are also shown. The borings were located along Starbird Road, and their locations were approximated based on the sketch map provided in the paper.

The raw GPR data profile for GPR Line 1 is provided on Figure 4. The data shown on the upper half of the figure (Stations 0' to 800') was recorded using a GSSI SIR-3000 radar system with a 100 MHz single antenna set to a depth range of about 25 feet. The lower profile (Stations 750' to 1945') was recorded with a 100 MHz dual antenna set to a depth range of about 40 feet.

The approximate velocity of the GPR signal in these materials was determined by performing a walk away velocity test using the strong reflector at depth (interpreted base of peat). Three tests were performed along GPR Line 1 near Stations 65', 150' and 200'. These tests indicate that the two-way travel time of the GPR signal is about 11 nanoseconds/foot for shallow materials (to about 6 feet), and about 13 ns/foot (average) for materials to about 15 feet deep. This is in the range of published travel times for some types of peat. The velocity of the GPR signal will vary depending on the actual subsurface materials, so the interpreted depths are estimates. Maximum penetration of the GPR signal seems to be about 25 feet over most of GPR Line 1.

GPR Line 1 begins on the hill on the western edge of the flat peat area. The north-south wire fence is about 20 feet to the west of the start of the line. The interpreted base of the peat creates a strong reflection below the western portion of the site. The peat is thin near the base of the slope, and increases to a thickness of about 25 feet near Station 300'. This GPR depth is similar to the depth of the higher p-wave velocity layer observed at Seismic Line SL-1. The GPR reflection also correlates well with the base of peat observed in the nearby Boring B-6 (shown by the red dot).

The peat is interpreted to be thinner to the east, and is only about 7 feet thick between Stations 525' to 675'. It then becomes thicker again to the east, and the strong reflection is not visible to the east of Station 850'. It is probably deeper than about 25 feet. There is also the possibility that the shallow materials are different in this portion of the site, and do not allow for good GPR signal propagation.

However, a fainter, and shallower reflection is observed above the interpreted base of peat between Stations 600' to 850'. This layer continues to the east and is visible below most of the line at a depth of about 15 to 18 feet. This layer is interpreted to be the thin Pumicite layer observed in the nearby borings at similar depths (as shown by the open red diamonds). The Pumicite layer observed in the borings seems to be generally parallel to the base of the peat based on the boring results. Assuming that this general trend continues to the north below GPR Line 1, I have inferred a possible base of the peat as indicated by the queried line. The depth to the base of the peat is inferred to be deeper below the GPR line than it is at the borings.

### Seismic Refraction (p-wave)

The results of the seismic refraction (p-wave) survey indicate a two-layer model below the site. A low velocity layer (1,000 to 1,600 ft/sec) near the surface is interpreted to be loose, organic peat that is water-saturated but may contain gases that keep the p-wave velocity low. A higher velocity layer, ranging from 4,400 to 5,300 ft/sec is observed in the southern portion of the site and may be caused by a variety of materials.

At Seismic Lines SL-1 and SL-2, the top of this higher velocity layer correlates well with the base of the peat interpreted in the GPR data. These velocities are in the range of water-saturated clays, sands and gravels, and perhaps a weak till unit. However, this higher velocity seismic layer does not correlate well with the base of the peat at Seismic Lines SL-3 or SL-4. These velocities are also in the range of loose water-saturated sediments. Below the eastern portion of the site this higher-velocity layer may be related to the water-saturated sedimentary peat with more mineral soils than organic materials. The p-wave velocity is often primarily a factor of the water in unconsolidated materials.

In the northern area of the site at Seismic Line SL-5, the higher velocity layer has a range of 5,700 to 6,200 fps. These higher p-wave velocities may indicate denser till material. The interpreted layer models of the refraction lines (p-wave) are provided in Attachment A, Figures A1-A5.

### MASW (s-wave)

The shear wave investigation using the MASW method was used to avoid this problem with the water-saturated materials. The shear wave is not affected by water, and was believed to be a better method to delineate the loose peat above the denser mineral sediments below. However, the MASW results were inconclusive. It is possible that the shear wave velocity contrast is too large, and the sharp boundary between the two materials traps the shear waves within the low velocity peat.

## INTERPRETATION RESULTS – NORTHERN AREA

### Ground Penetrating Radar & Seismic Refraction

The profile on Figure 3 provides a summary of the results from GPR Line 2 that runs south to north. The line begins near the north edge of the gravel driveway/ road about 80 feet east of the east edge of the shed. The raw GPR data profile for GPR Line 2 is provided on Figure 5, and was recorded with a 200 MHz antenna set to a depth range of about 16 feet.

A strong, smooth reflection is interpreted as the base of the peat, and ranges in depth from about 2 feet near the road to about 5 feet in the woods to the south of the road. The GPR profile crosses Seismic Line SL-5 which is also interpreted to show the base of the peat at a similar shallow depth.

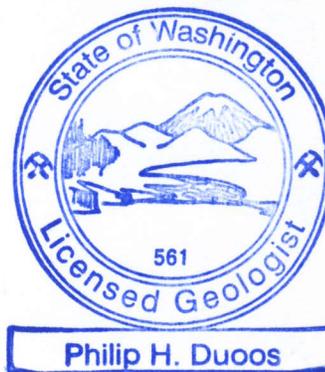
## CONCLUSIONS

The GPR data over the southwest and northern areas of the site show a strong GPR reflector interpreted to indicate the base of peat. In these areas the interpreted depths also correlate well with the seismic refraction (p-wave) results. In the southeast area of the site the base of peat is interpreted to be deeper than could be detected with the 100 MHz dual GPR antenna. The seismic results in this area are not interpreted to indicate the base of the peat either. However, a thin layer of Pumicite (observed in nearby historical borings) is interpreted from the GPR data. This Pumicite layer was used to infer the possible depth to the base of peat below the eastern half of GPR Line 1.

The use of these geophysical methods provided a rapid and non-intrusive means of investigating the area of interest. These results are interpretive in nature, and may change based on additional information. Only intrusive methods such as test pits or other means can ultimately characterize the subsurface conditions. Please contact me if you have any questions or comments regarding this information, or if you require further assistance.

Sincerely,

Philip H. Duos  
Geophysical Consultant (Lic. Geol. # 561)



- Figure 1: Geophysical Survey Location Map
- Figure 2: GPR Line 1 Results Profile
- Figure 3: GPR Line 2 Results Profile
- Figure 4: GPR Line 1 Data Profile
- Figure 5: GPR Line 2 Data Profile
- Attachment A: Seismic Refraction Lines, P-Wave Velocity Layer Results



Seismic Refraction Line

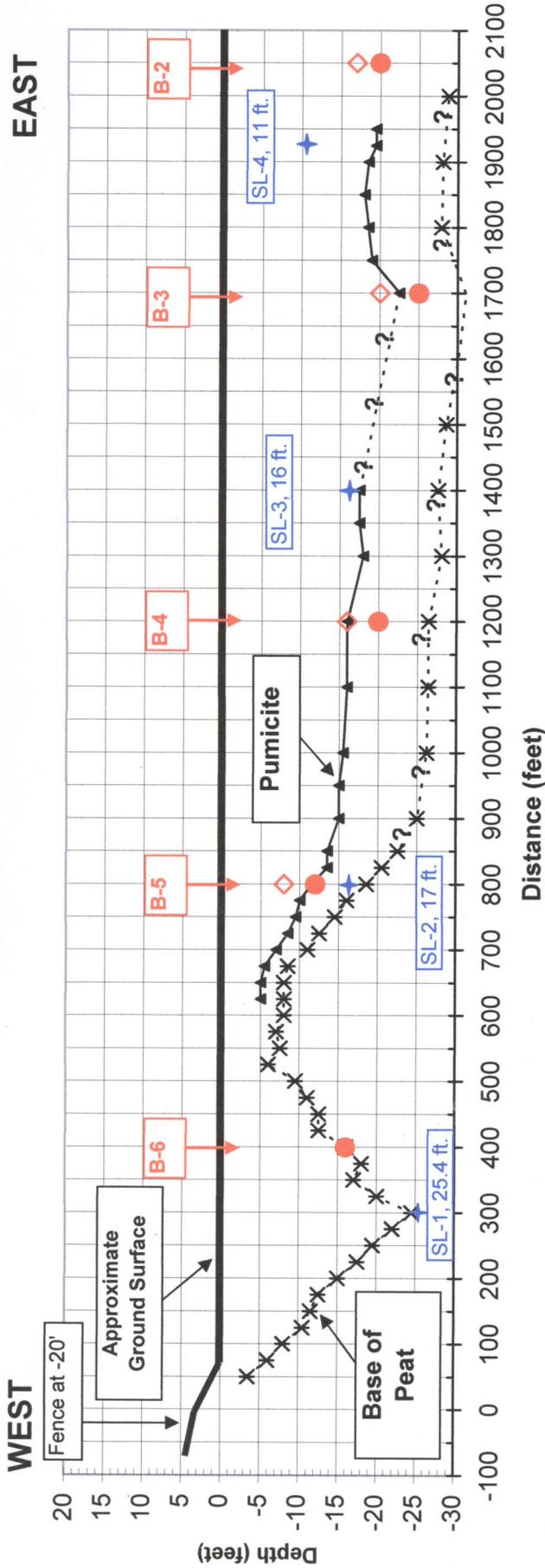
Ground Penetrating Radar Line

**GEOPHYSICAL INVESTIGATION  
LOCATION MAP**

STARBIRD ROAD PEAT EVALUATION  
SKAGIT COUNTY, WASHINGTON

**FIGURE 1**

# Starbird Peat, GPR Profile 1



Boring results from the paper "Peat Resources of Washington" are shown in red. Red diamonds indicate depth of Pumicite layer, and red circles indicate base of peat. Borings are along Starbird Road, which runs parallel and to the south of the GPR line by about 160 to 180 feet.

Depths to higher velocity layer interpreted from seismic refraction lines are shown in blue. The seismic results seem to be related to the base of the peat in some areas, but are probably related to other subsurface changes in other areas.

Base of peat not observed in GPR data east of Station 850'. Possible base inferred from probable Pumicite layer observed in GPR data.

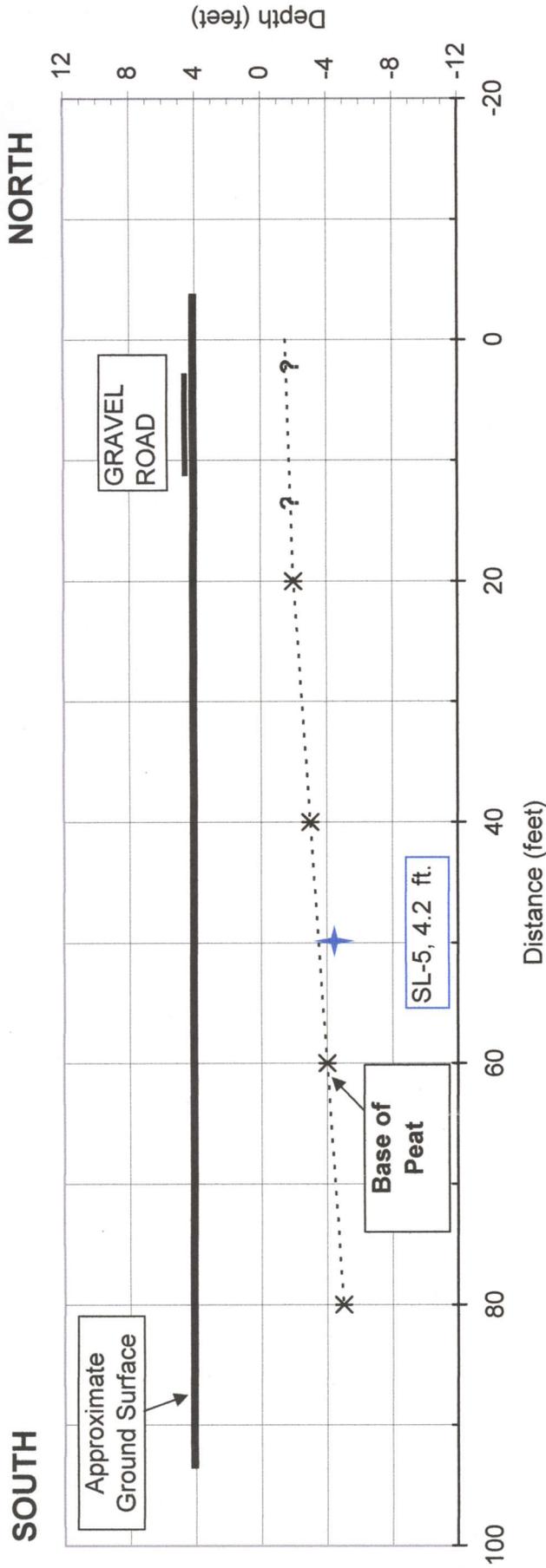
## GPR PROFILE RESULTS, LINE 1

SOUTHERN AREA OF SITE  
 STARBIRD ROAD PEAT EVALUATION  
 SKAGIT COUNTY, WASHINGTON

## FIGURE 2

Philip H. Duoss, Geophysical Consultant  
 June, 2014 Our Project No. 11116-14

Starbird Peat, GPR Profile 2



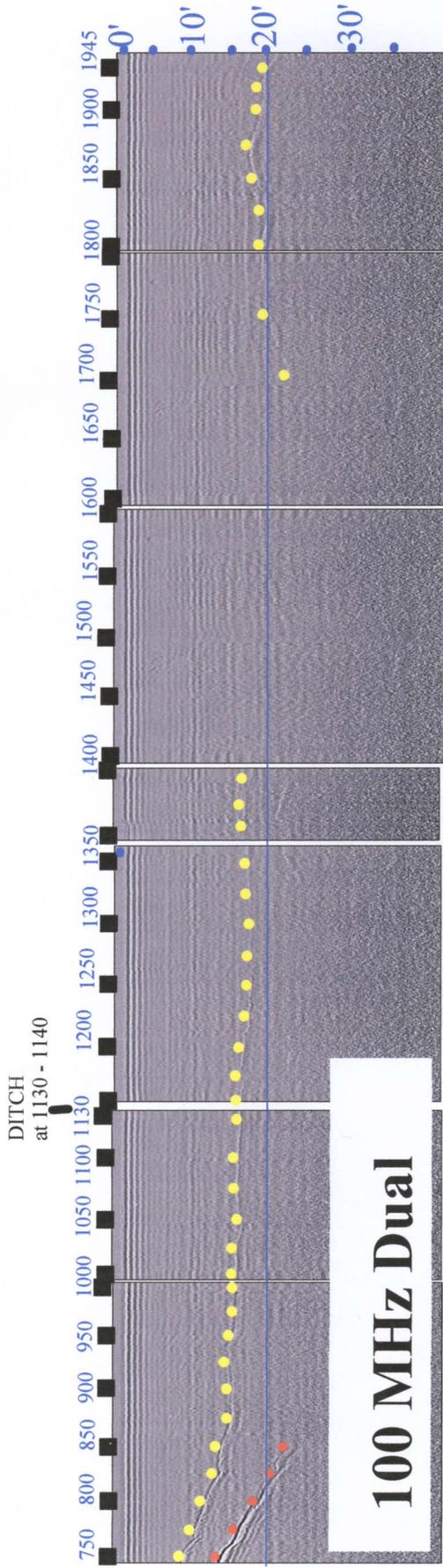
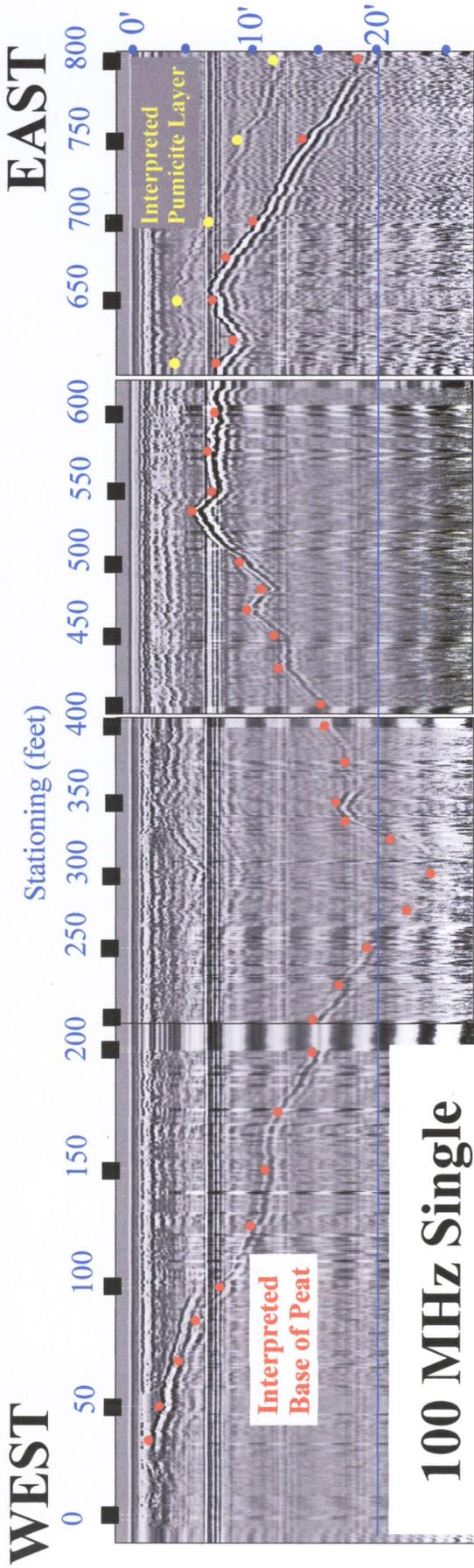
Depth to higher velocity layer interpreted from seismic refraction line SL-5 is shown in blue. The seismic results in this area seem to be related to the base of the peat .

**GPR PROFILE RESULTS, LINE 2**

NORTHERN AREA OF SITE  
 STARBIRD ROAD PEAT EVALUATION  
 SKAGIT COUNTY, WASHINGTON

**FIGURE 3**

Philip H. Duos, Geophysical Consultant  
 June, 2014 Our Project No. 1116-14



Top profile is data obtained over western portion of the site using a 100 MHz single antenna with an approximate depth range setting of 25 feet.

Lower profile over the eastern portion of the site obtained using a 100 MHz dual antenna with an approximate depth range setting of 40 feet.

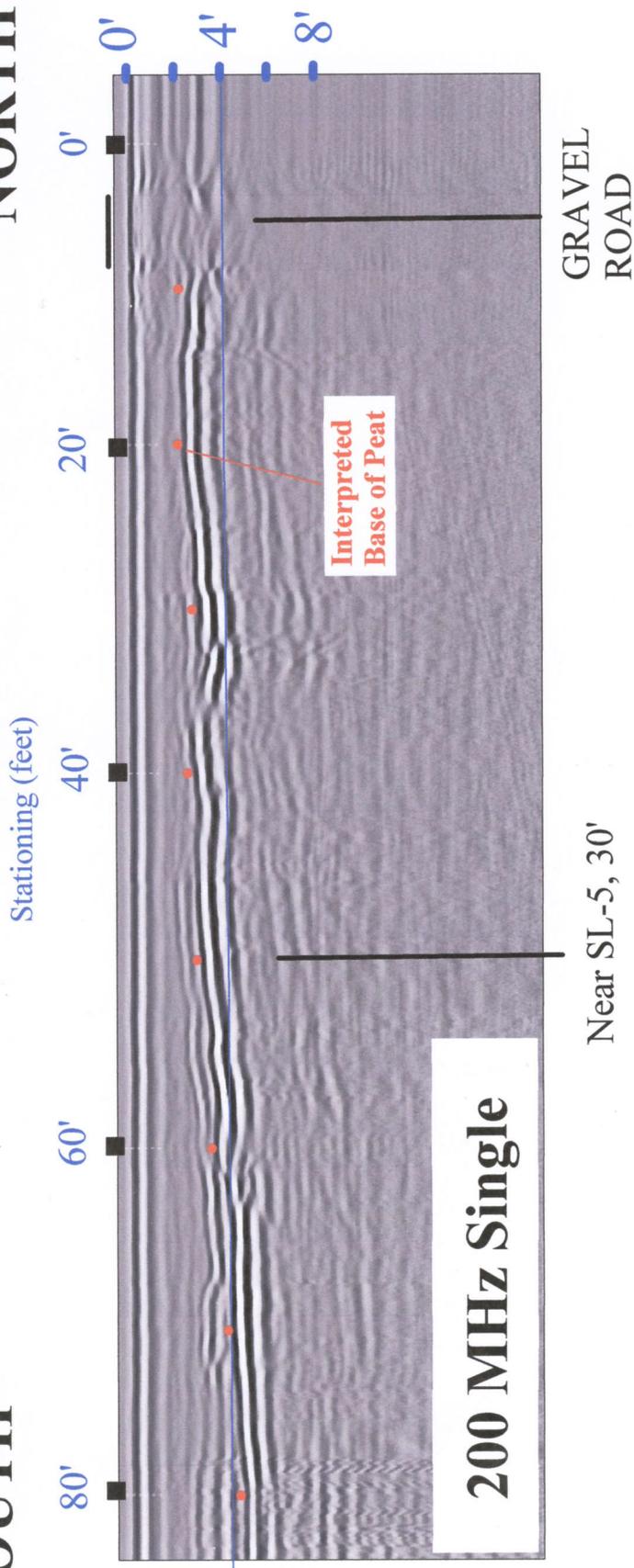
**GPR PROFILE, LINE 1**

Southern Area of Site  
 Starbird Road Peat Evaluation  
 Skagit County, Washington

**FIGURE 4**

**SOUTH**

**NORTH**



GPR PROFILE, LINE 2

Northern Area of Site  
Starbird Road Peat Evaluation  
Skagit County, Washington

FIGURE 5

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June 2014

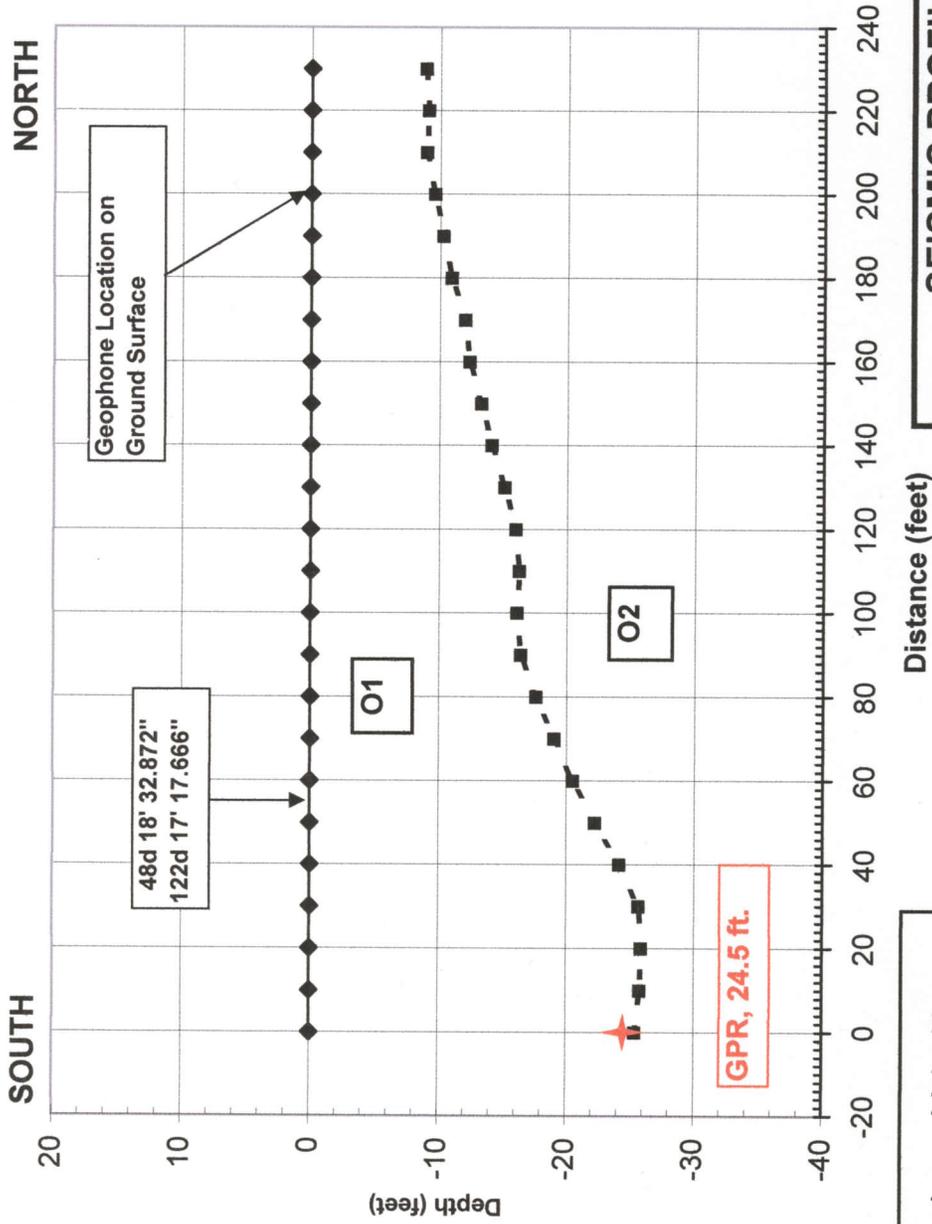
Job #1116-14

# **ATTACHMENT A**

**SEISMIC REFRACTION INTERPRETED PROFILES  
COMPRESSSIONAL WAVE (P-WAVE) VELOCITY LAYERS**

**PEAT EVALUATION  
STARBIRD ROAD AREA  
SKAGIT COUNTY, WASHINGTON**

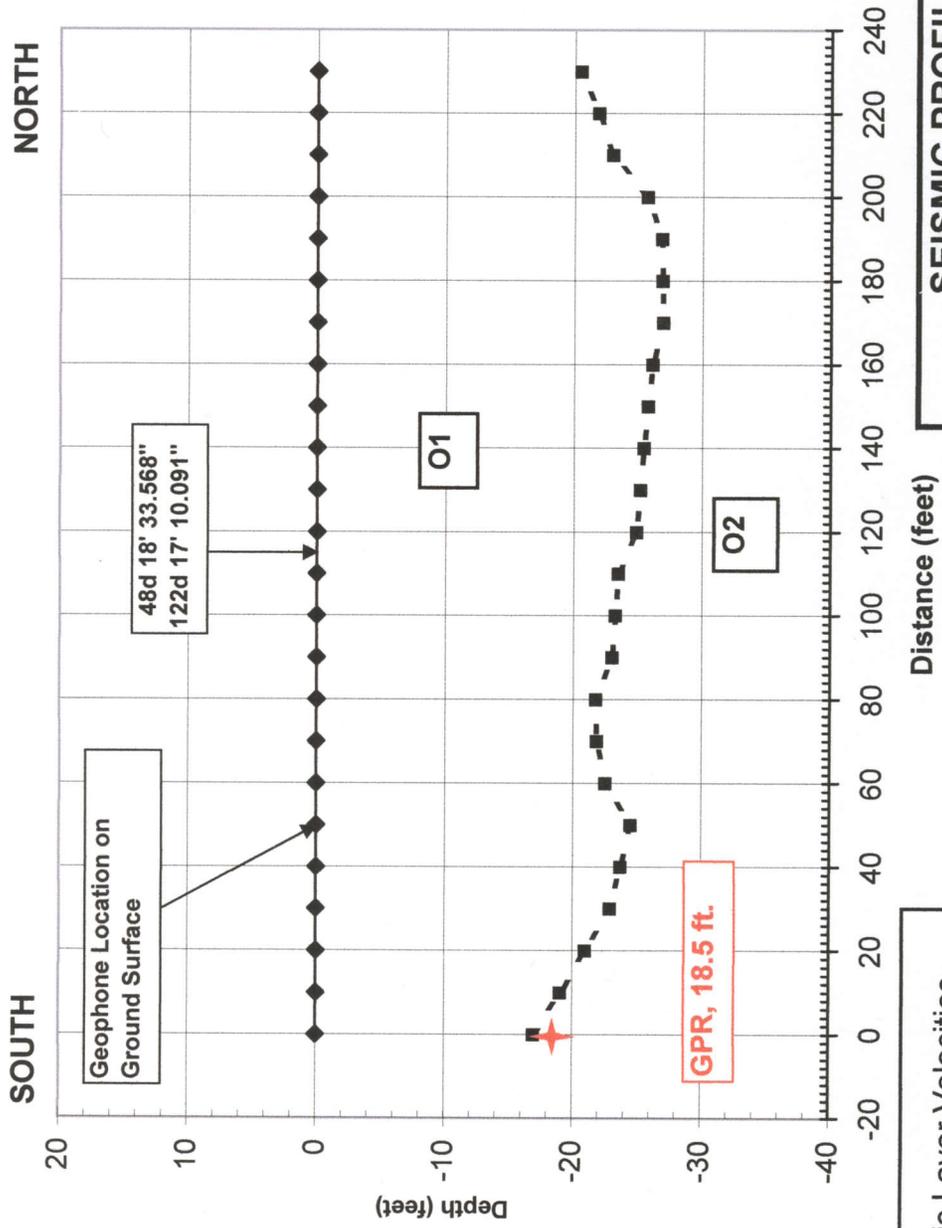
Skagit Peat, SL-1



Seismic Layer Velocities  
 O1: 1,000 - 1,300 fps  
 O2: 4,700 - 5,200 fps

SEISMIC PROFILE, SL-1  
 STARBIRD ROAD PEAT EVALUATION  
 SKAGIT COUNTY, WASHINGTON  
 FIGURE A1

Skagit Peat, SL-2



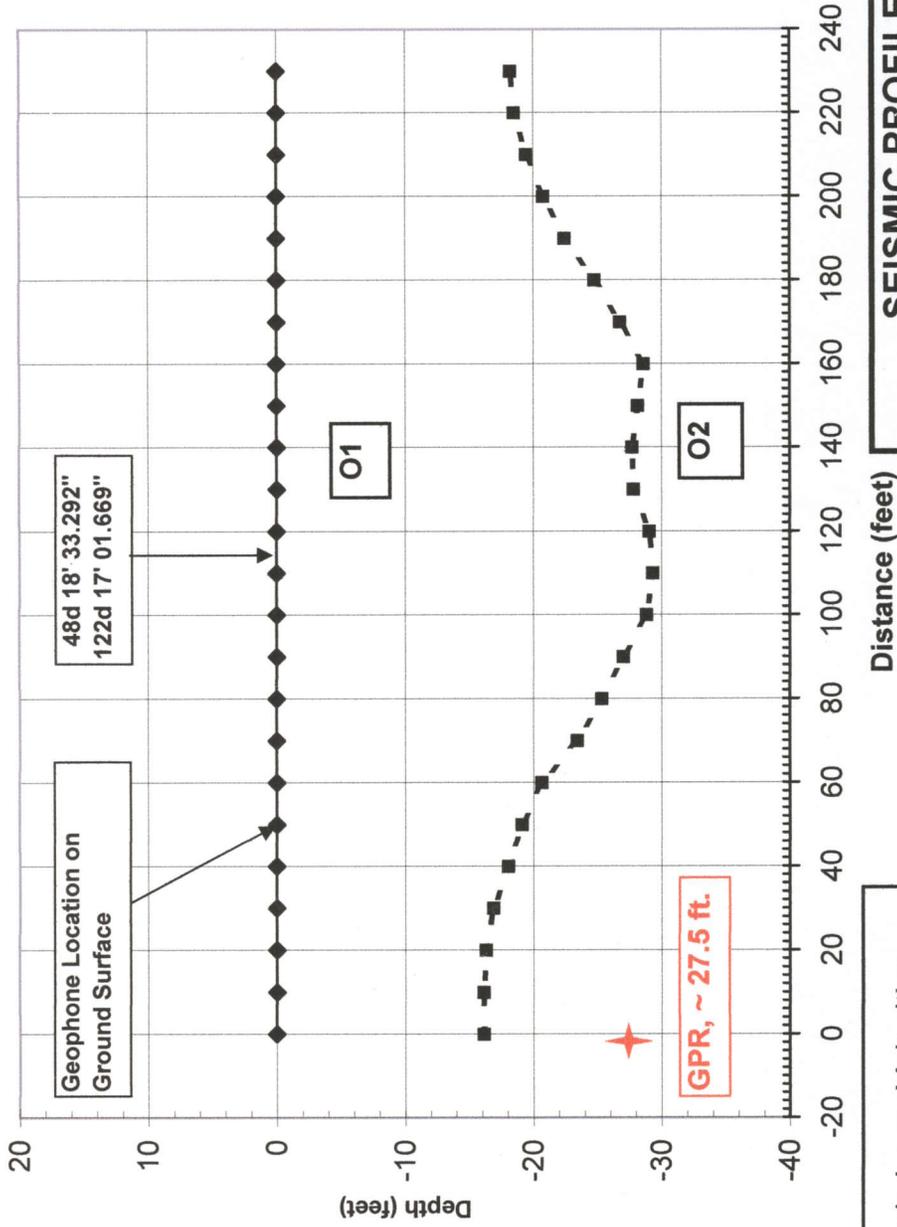
**SEISMIC PROFILE, SL-2**  
**STARBIRD ROAD PEAT EVALUATION**  
**SKAGIT COUNTY, WASHINGTON**  
**FIGURE A2**

**Seismic Layer Velocities**  
 O1: 1,100 - 1,300 fps  
 O2: 4,400 - 4,800 fps

Skagit Peat, SL-3

SOUTH

NORTH



**SEISMIC PROFILE, SL-3**  
**STARBIRD ROAD PEAT EVALUATION**  
**SKAGIT COUNTY, WASHINGTON**  
**FIGURE A3**

Seismic Layer Velocities

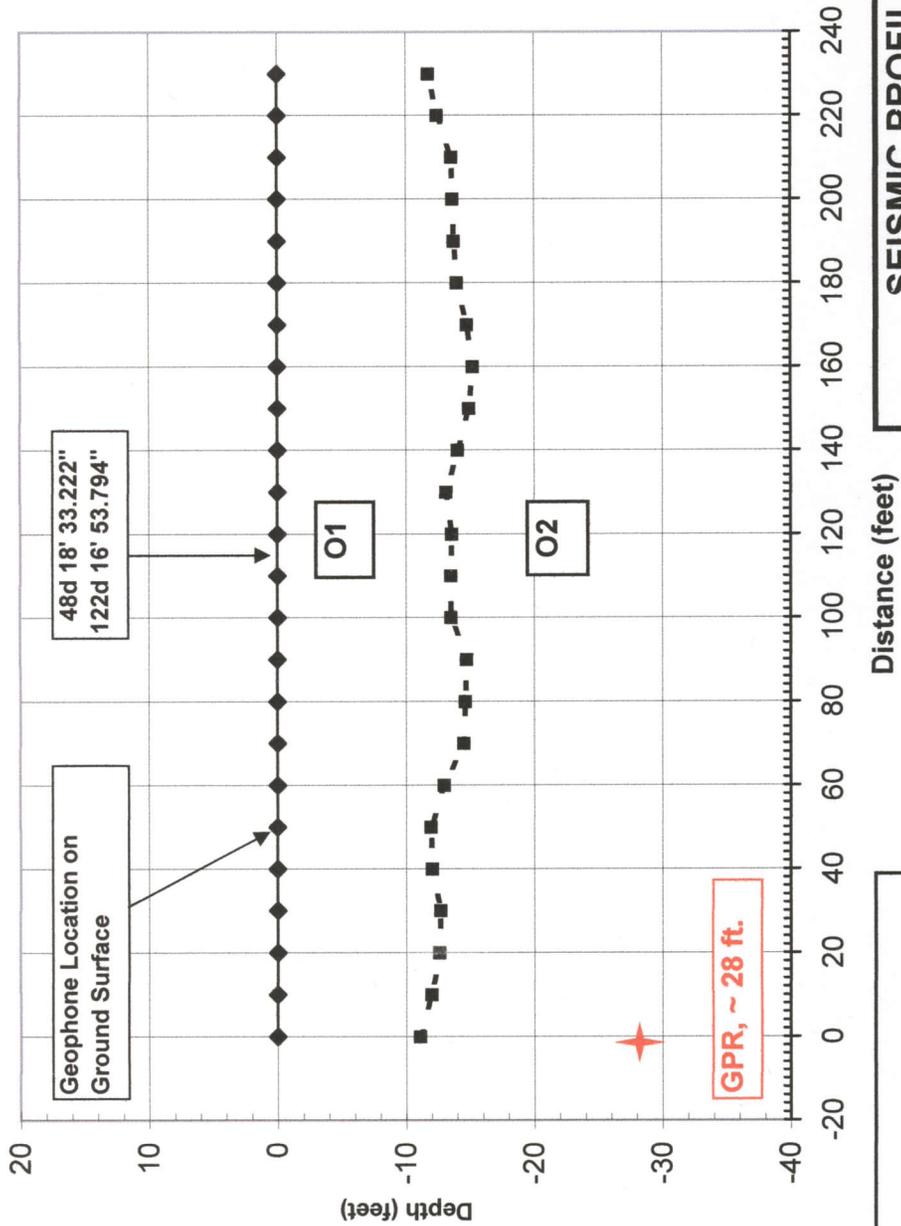
O1:	1,000 - 1,400 fps
O2:	4,600 - 5,300 fps

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Skagit Peat, SL-4

NORTH

SOUTH



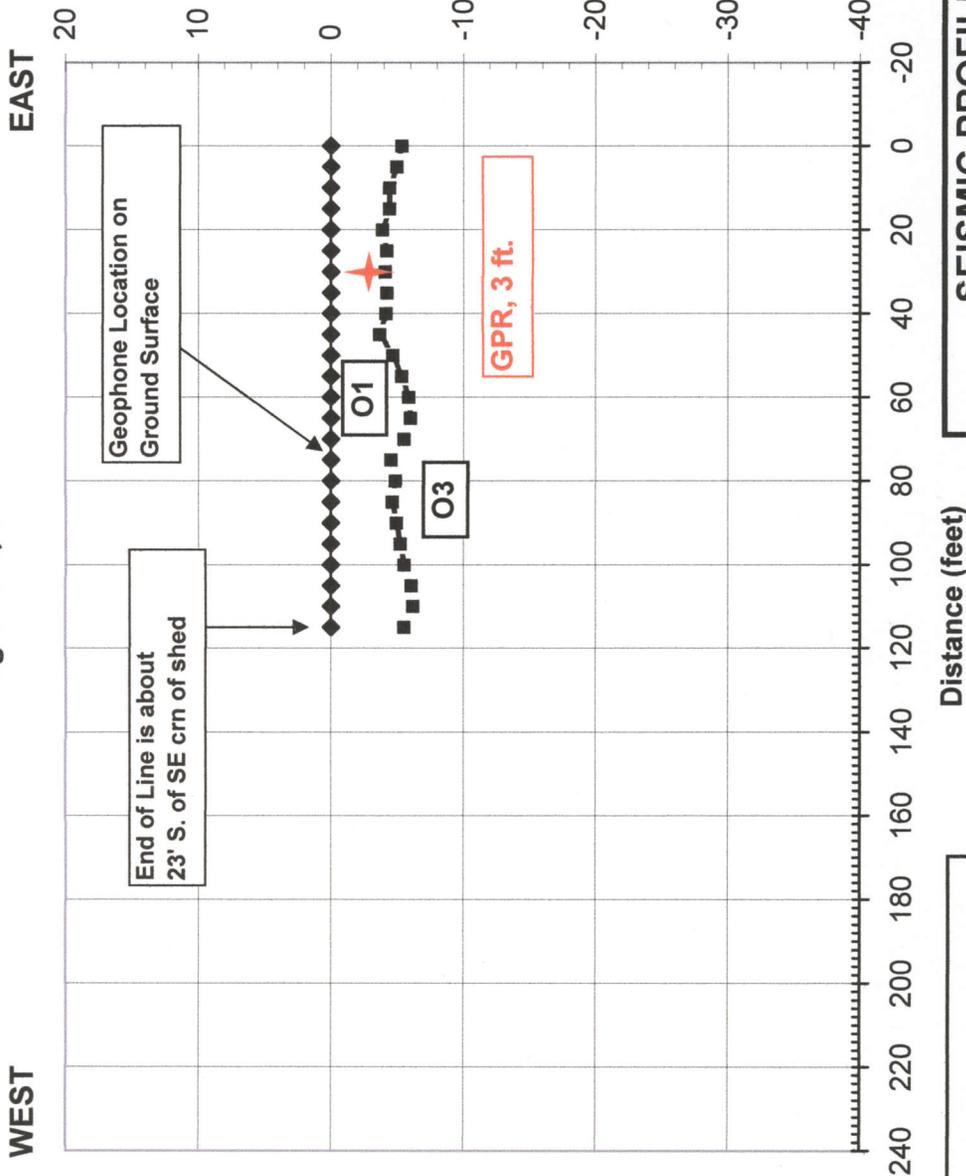
**SEISMIC PROFILE, SL-4**  
**STARBIRD ROAD PEAT EVALUATION**  
**SKAGIT COUNTY, WASHINGTON**  
**FIGURE A4**

Seismic Layer Velocities

O1:	1,300 - 1,600 fps
O2:	4,600 - 4,900 fps

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Skagit Peat, SL-5



**SEISMIC PROFILE, SL-5**  
**STARBIRD ROAD PEAT EVALUATION**  
**SKAGIT COUNTY, WASHINGTON**  
**FIGURE A5**

Seismic Layer Velocities

O1:	1,000 - 1,200 fps
O3:	5,700 - 6,200 fps

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