APPENDIX G
INSTRUMENTATION SUMMARY

VWP and Slope Displacement Instrumentation Installation

Vibrating Wire Piezometers

This installation procedure for the Vibrating Wire Piezometer (VWP) instruments was developed in cooperation with Slope Indicator's VWP consultant, experienced CRUX project managers and drillers and WNROCK personnel.

1. Advance the borehole to the total depth by HQ triple-tube wire line coring technology.
2. Flush hole with clean water for 15 minutes.
3. Remove HQ rods and replace diamond bit with a casing shoe and reinstall rods to total depth to verify that no slough remains in the bottom of the boring.
4. Flush hole with clean water for a minimum of 15 minutes or until surfacing fluid is visually free of cuttings.
5. Complete any downhole survey required for the borehole (ie: optical televiewer survey).
6. Place 10-20 silica sand from total depth of borehole to elevation of first VWP instrument by slowly pouring the sand in from the surface and frequently "tagging" the bottom of the hole to confirm the sand elevation and ensure that no bridging occurs. Add clean water at the top of the borehole into the stickup of the drill rods to assist in "flushing" the sand down the rods.
7. Assemble the PVC grout tube and VWP instrument package as follows:
    a. Glued-together ½ inch PVC is used with an end cap to seal the bottom. The first grout hole (drilled into the side of PVC) is located at approximately 2 feet above the top of filter pack elevation. Either ½ diameter flexible polyethylene pipe are attached to the PVC to various depths or a removable tremie pipe is constructed to allow for secondary and tertiary grouting of the borehole.
    b. VWPs are attached to the PVC grout tremie tube. The VWPs are inverted, hydrated and placed in 18-inch long "socks" filled with sand and attached to the PVC casing using drywall tape to reduce the potential for settling of the sand and "mushrooming" of the sock. Electrical tape should be used every six inches over the drywall tape. The sand within the sock is hydrated by the water remaining within the borehole during installation. The wires from each VWP and the secondary grout tubes are taped to the PVC approximately every 5 feet to reduce the potential for "snagging" during casing removal.
8. Due to limited annulus space, once the PVC and instruments are installed to the designed elevation and no sloughing has been observed in the borehole the HQ drill rods can be removed from the hole to allow for the silica sand to be placed to the designed top of filter pack elevation. Prior to removing the rods the instruments should be tested to ensure proper operation. The height above ground of the PVC grout tube should be measured to the nearest 0.1 foot regularly to ensure that the instrument string has not been snagged or pulled up during rod removal.

9. Grouting should be completed in a continuous operation using the following mix proportions:
    a. 94 lbs Portland Cement
    b. 30 gallons of water
    c. 25 to 50 pounds (as necessary) of **pure** bentonite powder. The bentonite is added until the mix is sufficiently thick to reduce the potential for separation once in the boring (marsh funnel value of 50 to 60 seconds).
10. The cement and water are mixed first and the bentonite powder added afterwards. The grout mix is pumped through the primary grout tube until visually observed at the surface. The secondary and tertiary grout tubes are also pumped to ensure a continuous grout column.
11. The total grout volume that is pumped into the borehole is compared to the calculated net volume of the borehole to independently verify a continuous grout column.
12. A stickup monument is installed as the surface completion for the well with sand used as backfill inside the stickup to bring the wires to an elevation that is accessible for data acquisition. An $^{1}/_{8}$ inch diameter hole should be drilled approximately 6 inches above the ground surface in the stickup monument to allow for drainage of water that collects on the interior of the monument.

The calibration sheets for the vibrating wire piezometers installed in 2006, 2007 and 2008 are provided within this appendix. A summary of the VWP locations by borehole with serial number and depth interval is provided within the main report.

Time Domain Reflectometer Cable

When installing TDR cable adjacent to the VWP instruments the TDR cable can be attached to the PVC instrument string using electrical tape. The grout mix for backfilling the borehole should be amended to match as closely as reasonable the subsurface soil or rock strength. Both ends of the TDR cable must be sealed using electrical tape coated with electrical tape glue to ensure no moisture enters the cable. TDR cable was installed in boreholes as part of the 2007 and 2008 Investigations.

The following pages provide the information listed below:

1. Vibrating Wire Piezometer Calibration Sheets
2. Vibrating Wire Piezometer Summary Graphs by Instrument
3. Time Domain Reflectometer Graphs (as available)

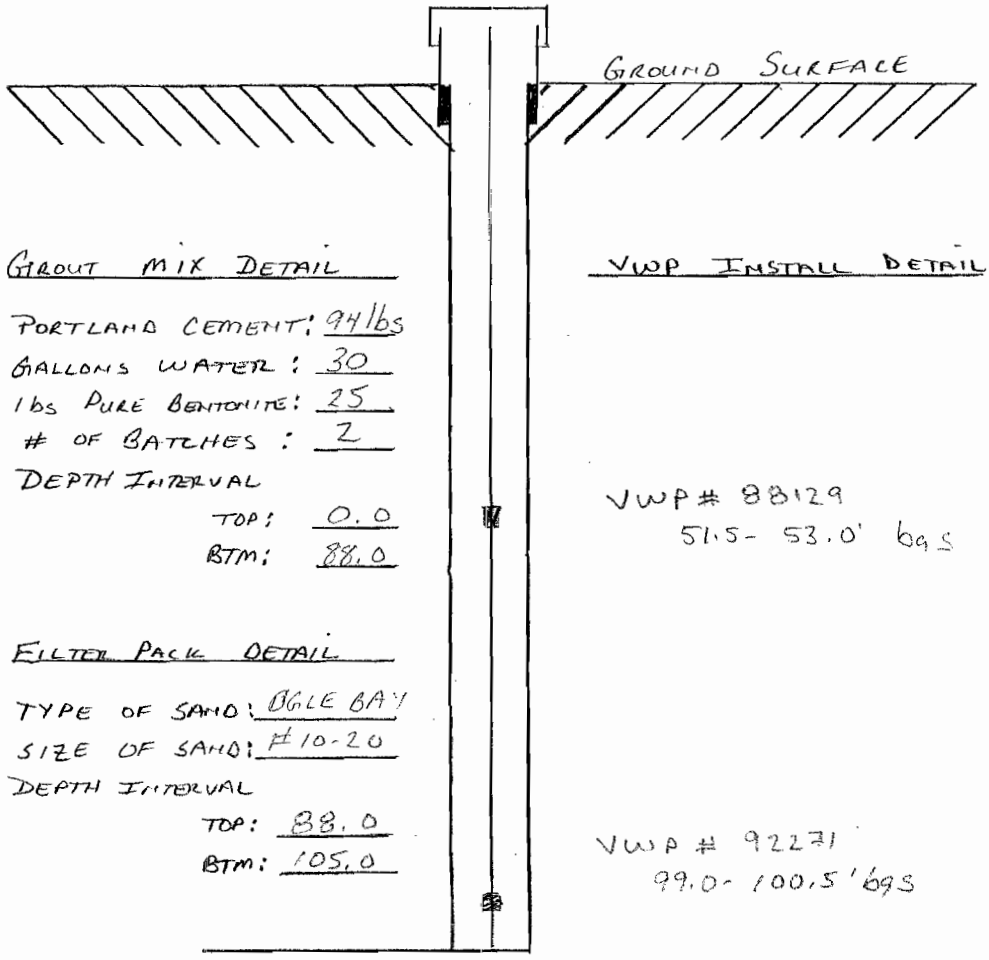
Job I-90 NAF | Project No. | Sheet | of

Description VIBRATING WIRE PIEZOMETER | Computed by BBS | Date 9-12-07

INSTALLATION DIAGRAM | Checked by | Date

Reference

BOREHOLE # RKS-8-07



GROUT MIX DETAIL

PORTLAND CEMENT: 94 lbs
GALLONS WATER: 30
lbs PURE BENTONITE: 25
OF BATCHES: 2
DEPTH INTERVAL
TOP: 0.0
BTM: 88.0

FILTER PACK DETAIL

TYPE OF SAND: OGLE BAY
SIZE OF SAND: #10-20
DEPTH INTERVAL
TOP: 88.0
BTM: 105.0

VWP INSTALL DETAIL

VWP # 88129
51.5 - 53.0' bgs

VWP # 92271
99.0 - 100.5' bgs

INITIAL VWP READINGS

VWP #	READING (Hz)
88219	2862.9
92271	2841.1

TOTAL DEPTH: 105.0
BORE HOLE
DIAMETER: 3.78" [HQ]
WELL TAG #: APC425

VW Piezometer Calibration Certificate

Serial #: 88129
Range : 50 psi
Cable Length: 30 m
Date of Calibration: 8/18/2007

Part #: 52611024
Cable Part # : 50613524
Calibrated by: KB
Note:

ABC Calibration Factors

	A	B	C
kPa	-6.966366E-5	-2.016967E-1	1.139123E+3
psi	-1.010386E-5	-2.925363E-2	1.652159E+2

Pressure in kPa/psi = $(A \times Hz^2) + (B \times Hz) + C$, where Hz is frequency in Hertz.

TI Calibration Factors

	C0	C1	C2	C3	C4	C5
kPa	1.143159E+3	-2.050363E-1	-2.814891E-2	-6.924580E-5	6.588939E-5	-1.277066E-3
psi	1.657954E+2	-2.973696E-2	-4.082510E-3	-1.004290E-5	9.556111E-6	-1.852163E-4

Pressure in kPa/psi = $C0 + (C1 \times Hz) + (C2 \times T) + (C3 \times Hz^2) + (C4 \times Hz \times T) + (C5 \times T^2)$

Where Hz is the frequency reading in Hertz and T is the Thermistor reading in degrees C.
TI factors are calculated from temperatures at 5.0, 15.0 and 25.0 degrees C.
Applied pressure and temperature are NIST traceable.

Summary of Test Results at 15°C

Thermistor reading is 14.4 °C.

Applied Pressure is referenced to 1 atm. Calculated Pressure uses ABC Calibration factors.

Applied (psi)	Equivalent (kPa)	Frequency (Hz)	Calculated (psi)	Calculated (kPa)	Error (%FS)
0.00	0.0	2847.0	0.03	0.2	-0.06
5.00	34.5	2789.4	5.00	34.5	0.00
10.00	68.9	2730.9	9.97	68.7	0.05
15.00	103.4	2671.3	14.97	103.2	0.05
20.00	137.9	2610.7	19.98	137.8	0.04
25.00	172.4	2549.0	25.00	172.4	0.00
30.00	206.8	2486.3	30.02	207.0	-0.04
35.00	241.3	2422.9	35.02	241.5	-0.04
40.00	275.8	2358.4	40.03	276.0	-0.05
45.00	310.3	2293.1	45.01	310.3	-0.01
50.00	344.7	2226.9	49.97	344.5	0.06

VW Piezometer Calibration Certificate

Serial #: 92271
Range : 100 psi
Cable Length: 60 m
Date of Calibration: 8/14/2007

Part #: 52611035
Cable Part # : 50613524
Calibrated by: KB
Note:

ABC Calibration Factors

	A	B	C
kPa	-1.613343E-4	2.985556E-2	1.271062E+3
psi	-2.339957E-5	4.330183E-3	1.843520E+2

Pressure in kPa/psi = $(A \times Hz^2) + (B \times Hz) + C$, where Hz is frequency in Hertz.

TI Calibration Factors

	C0	C1	C2	C3	C4	C5
kPa	1.268877E+3	2.959462E-2	2.042029E-1	-1.613273E-4	1.348851E-5	-3.269053E-3
psi	1.840285E+2	4.292186E-3	2.961609E-2	-2.339773E-5	1.956274E-6	-4.741194E-4

Pressure in kPa/psi = $C0 + (C1 \times Hz) + (C2 \times T) + (C3 \times Hz^2) + (C4 \times Hz \times T) + (C5 \times T^2)$

Where Hz is the frequency reading in Hertz and T is the Thermistor reading in degrees C.
TI factors are calculated from temperatures at 5.0, 15.0 and 25.0 degrees C.
Applied pressure and temperature are NIST traceable.

Summary of Test Results at 15°C

Thermistor reading is 14.8 °C.

Applied Pressure is referenced to 1 atm. Calculated Pressure uses ABC Calibration factors.

Applied (psi)	Equivalent (kPa)	Frequency (Hz)	Calculated (psi)	Calculated (kPa)	Error (%FS)
0.00	0.0	2900.9	0.00	0.0	0.00
10.00	68.9	2823.8	9.99	68.9	0.00
20.00	137.9	2744.3	20.01	138.0	-0.01
30.00	206.8	2662.4	30.02	207.0	-0.01
40.00	275.8	2578.1	39.99	275.7	0.01
50.00	344.7	2490.6	49.99	344.7	0.01
60.00	413.7	2399.7	60.00	413.7	0.00
70.00	482.6	2305.1	70.00	482.6	0.00
80.00	551.6	2206.2	80.01	551.6	-0.01
90.00	620.5	2102.6	90.01	620.6	-0.01
100.00	689.5	1993.5	99.99	689.4	0.01

Job # I-90 NAF | Project No. | Sheet | of

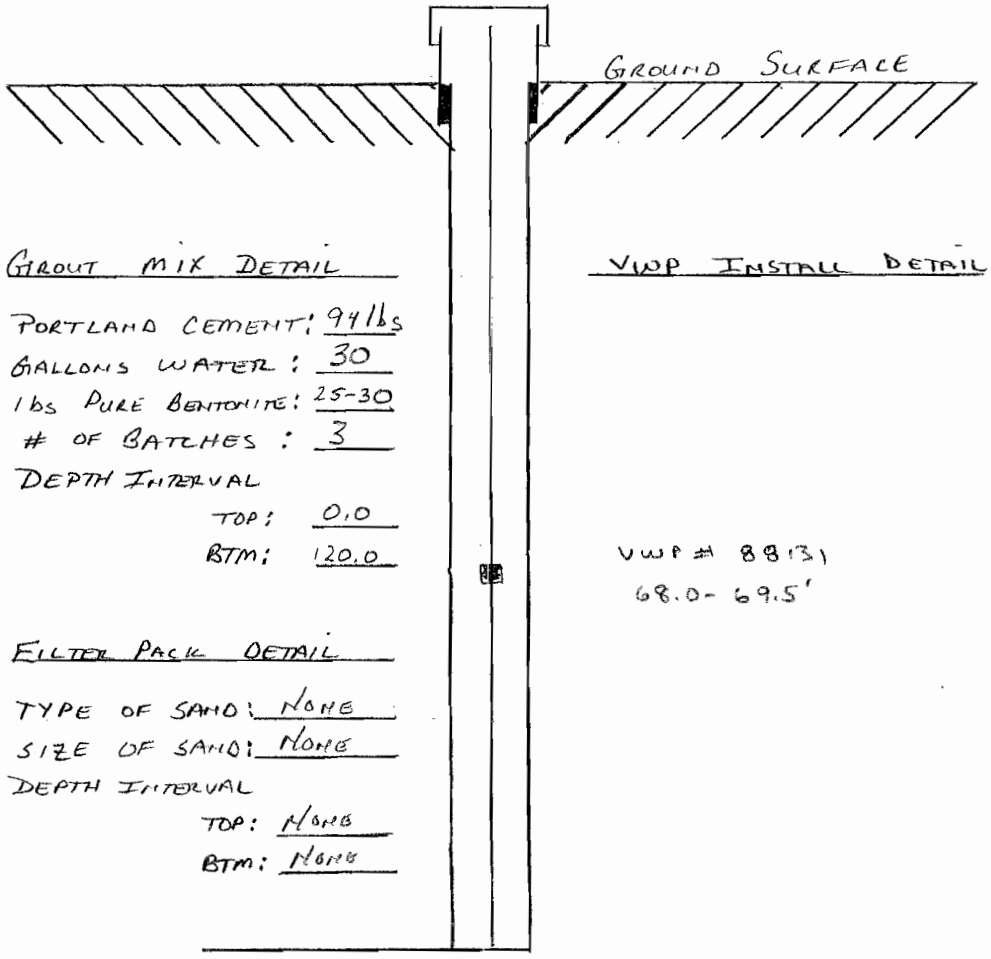
Description VIBRATING WIRE PIEZOMETER INSTALLATION DIAGRAM | Computed by B. STRICKLER | Date

Checked by | Date

Reference

BOREHOLE #

RKS-9-07



GROUT MIX DETAIL

PORTLAND CEMENT: 94 lbs
GALLONS WATER: 30
lbs PURE BENTONITE: 25-30
OF BATCHES: 3
DEPTH INTERVAL
TOP: 0.0
BTM: 120.0

FILTER PACK DETAIL

TYPE OF SAND: NONE
SIZE OF SAND: NONE
DEPTH INTERVAL
TOP: NONE
BTM: NONE

VWP INSTALL DETAIL

VWP # 88131
68.0 - 69.5'

INITIAL VWP READINGS

VWP #	READING (Hz)
88131	~~2844.1~~ 2961.7

TOTAL DEPTH: 120.0
BORE HOLE DIAMETER: 3.78" [HQ]
WELL TAG #: APC423

VW Piezometer Calibration Certificate

Serial #: 88131
Range : 50 psi
Cable Length: 30 m
Date of Calibration: 8/18/2007

Part #: 52611024
Cable Part # : 50613524
Calibrated by: KB
Note:

ABC Calibration Factors

	A	B	C
kPa	-7.091926E-5	-1.806649E-1	1.148256E+3
psi	-1.028597E-5	-2.620323E-2	1.665405E+2

Pressure in kPa/psi = $(A \times Hz^2) + (B \times Hz) + C$, where Hz is frequency in Hertz.

TI Calibration Factors

	C0	C1	C2	C3	C4	C5
kPa	1.148079E+3	-1.805543E-1	-6.262107E-2	-7.111827E-5	6.319656E-5	-1.055110E-3
psi	1.665089E+2	-2.618626E-2	-9.082098E-3	-1.031447E-5	9.165564E-6	-1.530254E-4

Pressure in kPa/psi = $C0 + (C1 \times Hz) + (C2 \times T) + (C3 \times Hz^2) + (C4 \times Hz \times T) + (C5 \times T^2)$

Where Hz is the frequency reading in Hertz and T is the Thermistor reading in degrees C.
TI factors are calculated from temperatures at 5.0, 15.0 and 25.0 degrees C.
Applied pressure and temperature are NIST traceable.

Summary of Test Results at 15°C

Thermistor reading is 14.5 °C.

Applied Pressure is referenced to 1 atm. Calculated Pressure uses ABC Calibration factors.

Applied (psi)	Equivalent (kPa)	Frequency (Hz)	Calculated (psi)	Calculated (kPa)	Error (%FS)
0.00	0.0	2946.5	0.03	0.2	-0.06
5.00	34.5	2888.9	5.00	34.5	0.00
10.00	68.9	2830.4	9.97	68.7	0.05
15.00	103.4	2770.8	14.97	103.2	0.06
20.00	137.9	2710.0	19.99	137.8	0.02
25.00	172.4	2648.3	25.01	172.4	-0.01
30.00	206.8	2585.6	30.02	207.0	-0.04
35.00	241.3	2522.2	35.02	241.5	-0.03
40.00	275.8	2457.7	40.01	275.9	-0.02
45.00	310.3	2392.1	45.00	310.3	0.00
50.00	344.7	2325.5	49.98	344.6	0.04

Job I-70 NAF | Project No. | Sheet ___ of ___

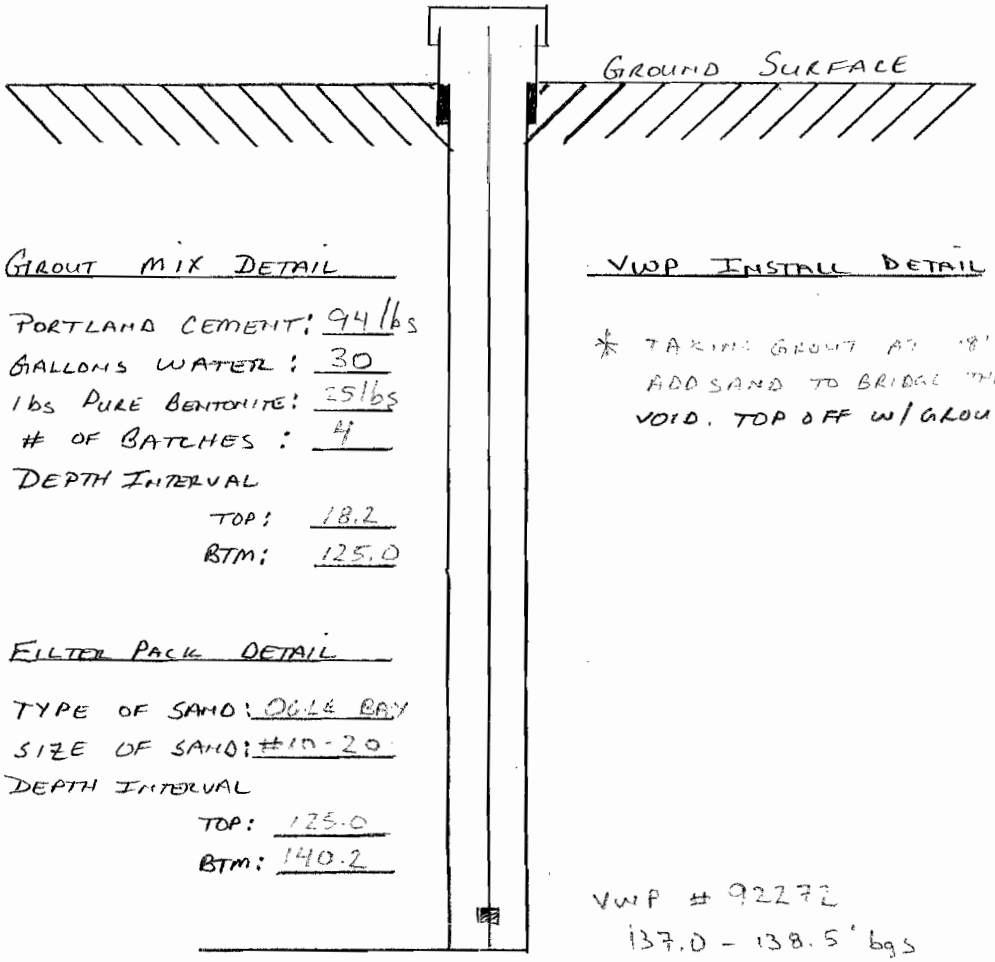
Description VIBRATING WIRE PIEZOMETER INSTALLATION DIAGRAM | Computed by B. STRICKLER | Date 9-19-07

Checked by | Date

Reference

BOREHOLE #

RKS-10-07



GROUT MIX DETAIL

PORTLAND CEMENT: 94 lbs
GALLONS WATER: 30
lbs PURE BENTONITE: 25 lbs
OF BATCHES: 4
DEPTH INTERVAL
TOP: 18.2
BTM: 125.0

FILTER PACK DETAIL

TYPE OF SAND: OGLE BAY
SIZE OF SAND: #10-20
DEPTH INTERVAL
TOP: 125.0
BTM: 140.2

VWP INSTALL DETAIL

* TAKING GROUT AT 18'
ADD SAND TO BRIDGE THROUGH
VOID. TOP OFF W/GROUT

VWP # 92272
137.0 - 138.5' bgs

INITIAL VWP READINGS

VWP #	READING (Hz)
92272	2914.2

TOTAL DEPTH: 140.2'
BORE HOLE
DIAMETER: 3.78" [illegible]
WELL TAG #: APC 424

VW Piezometer Calibration Certificate

Serial #: 92272
Range : 100 psi
Cable Length: 60 m
Date of Calibration: 8/14/2007

Part #: 52611035
Cable Part # : 50613524
Calibrated by: KB
Note:

ABC Calibration Factors

	A	B	C
kPa	-1.720893E-4	4.577688E-2	1.352200E+3
psi	-2.495945E-5	6.639375E-3	1.961200E+2

Pressure in kPa/psi = $(A \times Hz^2) + (B \times Hz) + C$, where Hz is frequency in Hertz.

TI Calibration Factors

	C0	C1	C2	C3	C4	C5
kPa	1.350979E+3	4.483460E-2	2.029738E-1	-1.719755E-4	2.420015E-5	-4.728998E-3
psi	1.959361E+2	6.502480E-3	2.943783E-2	-2.494206E-5	3.509812E-6	-6.858591E-4

Pressure in kPa/psi = $C0 + (C1 \times Hz) + (C2 \times T) + (C3 \times Hz^2) + (C4 \times Hz \times T) + (C5 \times T^2)$

Where Hz is the frequency reading in Hertz and T is the Thermistor reading in degrees C.
TI factors are calculated from temperatures at 5.0, 15.0 and 25.0 degrees C.
Applied pressure and temperature are NIST traceable.

Summary of Test Results at 15°C

Thermistor reading is 14.8 °C.

Applied Pressure is referenced to 1 atm. Calculated Pressure uses ABC Calibration factors.

Applied (psi)	Equivalent (kPa)	Frequency (Hz)	Calculated (psi)	Calculated (kPa)	Error (%FS)
0.00	0.0	2939.2	0.01	0.1	-0.01
10.00	68.9	2867.0	10.00	68.9	0.00
20.00	137.9	2792.6	20.01	138.0	-0.01
30.00	206.8	2716.4	29.98	206.7	0.02
40.00	275.8	2637.6	39.99	275.7	0.01
50.00	344.7	2556.3	49.99	344.7	0.01
60.00	413.7	2472.1	60.00	413.7	0.00
70.00	482.6	2384.7	70.01	482.7	-0.01
80.00	551.6	2294.0	80.00	551.6	0.00
90.00	620.5	2199.2	90.01	620.6	-0.01
100.00	689.5	2100.0	99.99	689.4	0.01

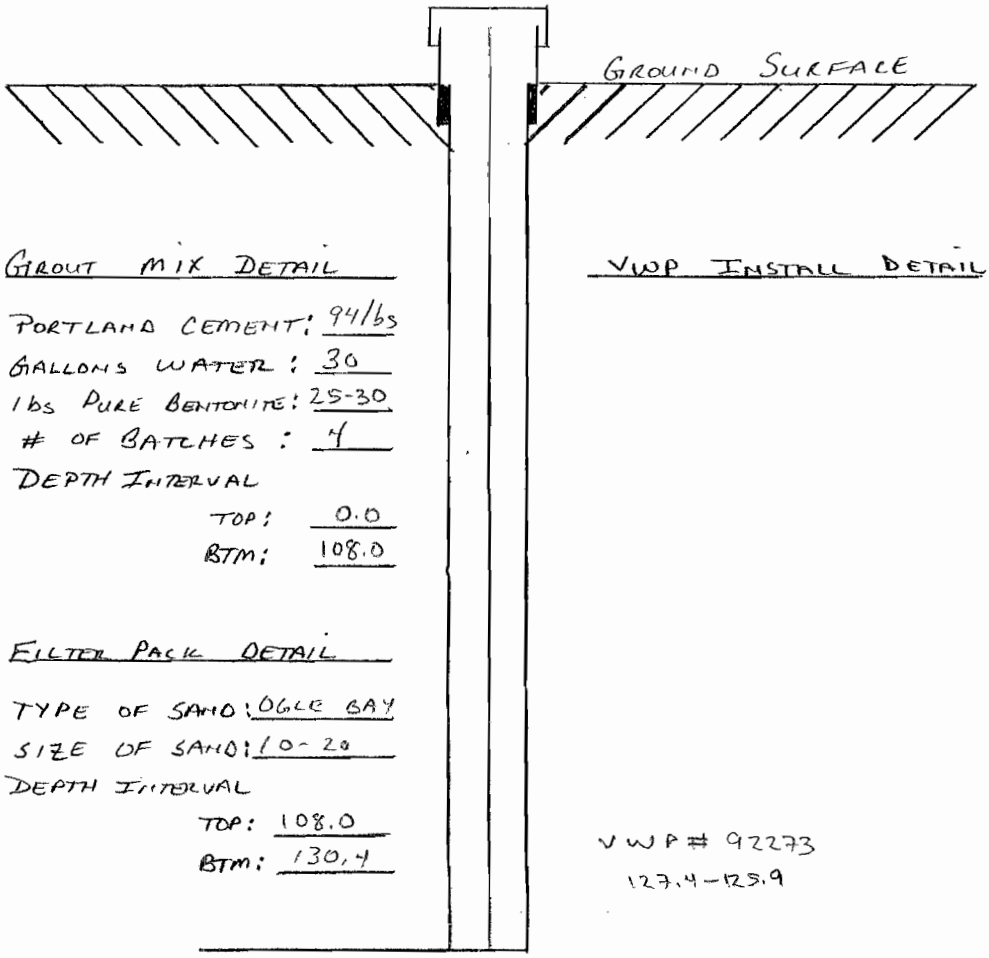
Job I-90 NAF | Project No. | Sheet of

Description VIBRATING WIRE PIEZOMETER | Computed by B. STRICKLER | Date 9-8-07

INSTALLATION DIAGRAM | Checked by | Date

Reference

BOREHOLE # RKS-12-07



GROUT MIX DETAIL

PORTLAND CEMENT: 94 lbs
GALLONS WATER: 30
lbs PURE BENTONITE: 25-30
OF BATCHES: 4
DEPTH INTERVAL
TOP: 0.0
BTM: 108.0

FILTER PACK DETAIL

TYPE OF SAND: OGLE BAY
SIZE OF SAND: 10-20
DEPTH INTERVAL
TOP: 108.0
BTM: 130.4

VWP INSTALL DETAIL

VWP # 92273
127.4-125.9

INITIAL VWP READINGS

VWP #	READING (Hz)
92273	2879.5

TOTAL DEPTH: 130.4' bgs
BORE HOLE
DIAMETER: [HQ] 3.78"
WELL TAG #: APC 420

VW Piezometer Calibration Certificate

Serial #: 92273
Range : 100 psi
Cable Length: 60 m
Date of Calibration: 8/14/2007

Part #: 52611035
Cable Part # : 50613524
Calibrated by: KB
Note:

ABC Calibration Factors

	A	B	C
kPa	-1.584804E-4	-1.546970E-2	1.425799E+3
psi	-2.298564E-5	-2.243690E-3	2.067947E+2

Pressure in kPa/psi = $(A \times Hz^2) + (B \times Hz) + C$, where Hz is frequency in Hertz.

TI Calibration Factors

	C0	C1	C2	C3	C4	C5
kPa	1.425250E+3	-1.582023E-2	7.060990E-2	-1.585376E-4	4.120760E-5	-3.452439E-3
psi	2.067078E+2	-2.294450E-3	1.024074E-2	-2.299313E-5	5.976447E-6	-5.007163E-4

Pressure in kPa/psi = $C0 + (C1 \times Hz) + (C2 \times T) + (C3 \times Hz^2) + (C4 \times Hz \times T) + (C5 \times T^2)$

Where Hz is the frequency reading in Hertz and T is the Thermistor reading in degrees C.
TI factors are calculated from temperatures at 5.0, 15.0 and 25.0 degrees C.
Applied pressure and temperature are NIST traceable.

Summary of Test Results at 15°C

Thermistor reading is 14.6 °C.

Applied Pressure is referenced to 1 atm. Calculated Pressure uses ABC Calibration factors.

Applied (psi)	Equivalent (kPa)	Frequency (Hz)	Calculated (psi)	Calculated (kPa)	Error (%FS)
0.00	0.0	2950.7	0.05	0.3	-0.04
10.00	68.9	2877.6	10.00	68.9	0.00
20.00	137.9	2802.6	19.96	137.6	0.03
30.00	206.8	2725.2	29.97	206.6	0.03
40.00	275.8	2645.6	39.98	275.7	0.02
50.00	344.7	2563.6	49.98	344.6	0.02
60.00	413.7	2478.7	60.01	413.8	-0.01
70.00	482.6	2390.8	70.05	483.0	-0.04
80.00	551.6	2300.1	80.03	551.8	-0.03
90.00	620.5	2205.8	90.01	620.6	-0.01
100.00	689.5	2107.7	99.95	689.1	0.04

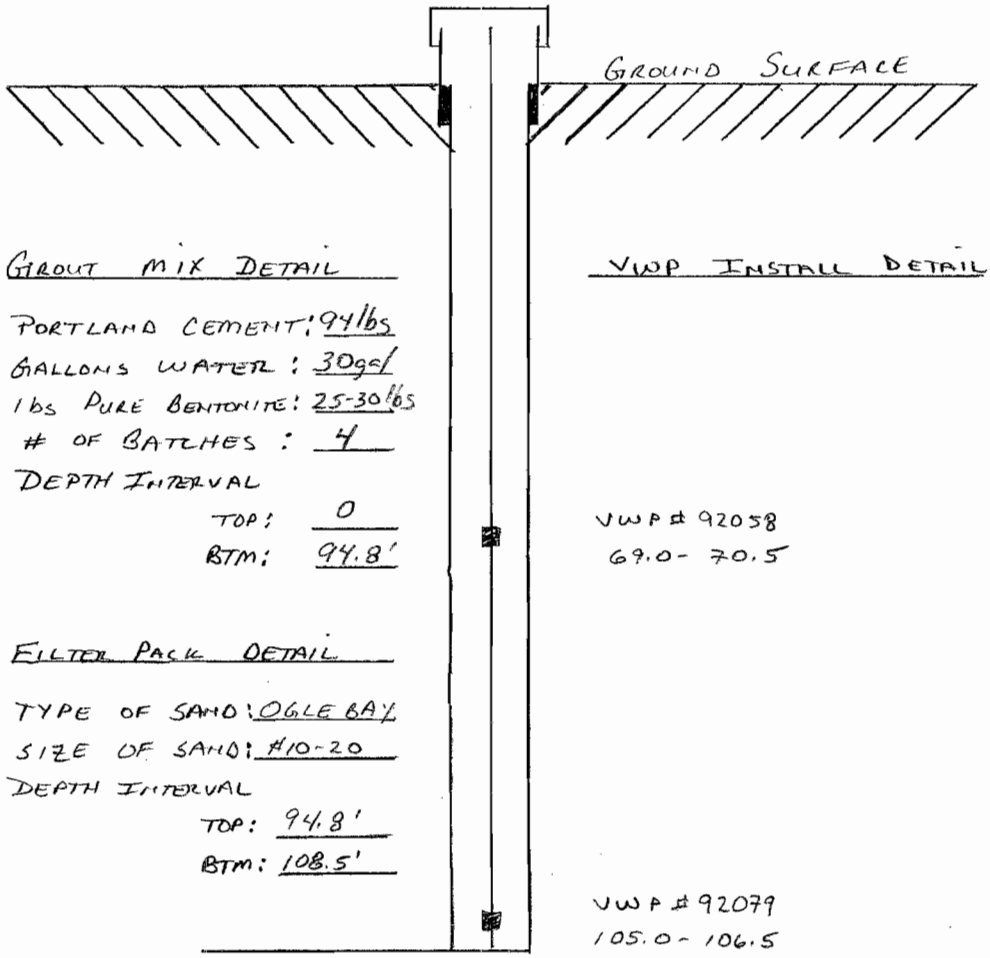
Job I-90 NAF | Project No. 03-2007 | Sheet ____ of ____

Description VIBRATING WIRE PIEZOMETER INSTALLATION DIAGRAM | Computed by B. STRICKLER | Date 10-4-07

Checked by ____ | Date ____

Reference

BOREHOLE # RKS-13-07



GROUT MIX DETAIL

PORTLAND CEMENT: 94 lbs
GALLONS WATER: 30 gal
lbs PURE BENTONITE: 25-30 lbs
OF BATCHES: 4
DEPTH INTERVAL
TOP: 0
BTM: 94.8'

FILTER PACK DETAIL

TYPE OF SAND: OGLE BAY
SIZE OF SAND: #10-20
DEPTH INTERVAL
TOP: 94.8'
BTM: 108.5'

VWP INSTALL DETAIL

VWP # 92058
69.0 - 70.5

VWP # 92079
105.0 - 106.5

INITIAL VWP READINGS

VWP #	READING (Hz)
92058	2789.9
92079	2823.1

TOTAL DEPTH: 108.5'
BORE HOLE DIAMETER: 3.78 [HQ]
WELL TAG #: APC 418

VW Piezometer Calibration Report

Customer	Washington DOT	Serial No.	92079 T
Cust. No.	20383	Part No.	52611035
Order No.	28080	Range	0-100 PSI
Date	26-Jul-07	Cable	50613524
Cal. By.	kb	Length	60 m
Note			

Conversion Factors for Serial No. 92079 T

Referenced To Standard Atmosphere*

	ABC Factors			IDA ABC Factors		
Units	A	B	C	A	B	C
psi	-0.000024846	0.0057226	182.27	-44.171	7.6301	182.27
ft H2O	-0.000057311	0.013200	420.43	-101.89	17.600	420.43
kN/m² (kPa)	-0.00017131	0.039456	1256.7	-304.55	52.608	1256.7
m H2O	-0.000017469	0.0040234	128.15	-31.055	5.3645	128.15
bar	-0.0000017131	0.00039456	12.567	-3.0455	0.52608	12.567
kg/cm²	-0.0000017469	0.00040234	12.815	-3.1055	0.53645	12.815
				IF Factor = T		

Temp. Coefficients (m = 0.0209 PSI/°C, b = -0.526 PSI) TempOffset: -0.2 °C

Test Data

Referenced To Standard Atmosphere*

PSI	Frequency	% FS Error
0.000	2825.85	0.04
10.000	2751.02	-0.02
20.000	2673.45	-0.01
30.000	2593.44	0.00
40.000	2510.89	0.00
50.000	2425.41	-0.01
60.000	2336.42	0.01
70.000	2243.89	0.01
80.000	2147.09	0.02
90.000	2045.58	0.01
100.000	1938.69	-0.02

Calibrated at = 23.5 °C Thermistor Reading = 23.3 °C

*Standard Atmosphere = 14.696 psi, 1013 millibar.

VW Piezometer Calibration Report

Customer	Washington DOT	Serial No.	92058 T
Cust. No.	20383	Part No.	52611024
Order No.	28080	Range	0-50 PSI
Date	30-Jul-07	Cable	50613524
Cal. By.	kb	Length	30 m
Note			

Conversion Factors for Serial No. 92058 T

Referenced To Standard Atmosphere*

	ABC Factors			IDA ABC Factors		
Units	A	B	C	A	B	C
psi	-0.000013050	-0.0013749	104.28	-23.199	-1.8332	104.28
ft H2O	-0.000030101	-0.0031714	240.55	-53.513	-4.2286	240.55
kN/m² (kPa)	-0.000089973	-0.0094797	719.01	-159.95	-12.640	719.01
m H2O	-0.0000091747	-0.00096666	73.318	-16.311	-1.2889	73.318
bar	-0.00000089973	-0.000094797	7.1901	-1.5995	-0.12640	7.1901
kg/cm²	-0.00000091747	-0.000096666	7.3318	-1.6311	-0.12889	7.3318
				IF Factor = T		

Temp. Coefficients (m = 0.0111 PSI/°C, b = -0.231 PSI) TempOffset: -0.2 °C

Test Data

Referenced To Standard Atmosphere*

PSI	Frequency	% FS Error
-5.000	2841.30	0.04
0.000	2774.93	-0.05
5.000	2706.31	-0.04
10.000	2635.87	-0.03
15.000	2563.66	-0.03
20.000	2489.41	-0.03
25.000	2412.69	0.00
30.000	2333.51	0.02
35.000	2251.91	0.01
40.000	2167.36	0.00
45.000	2079.45	-0.02
50.000	1987.74	-0.03

Calibrated at = 23.0 °C Thermistor Reading = 22.8 °C

*Standard Atmosphere = 14.696 psi, 1013 millibar.

Job I-70 NAF | Project No. | Sheet | of

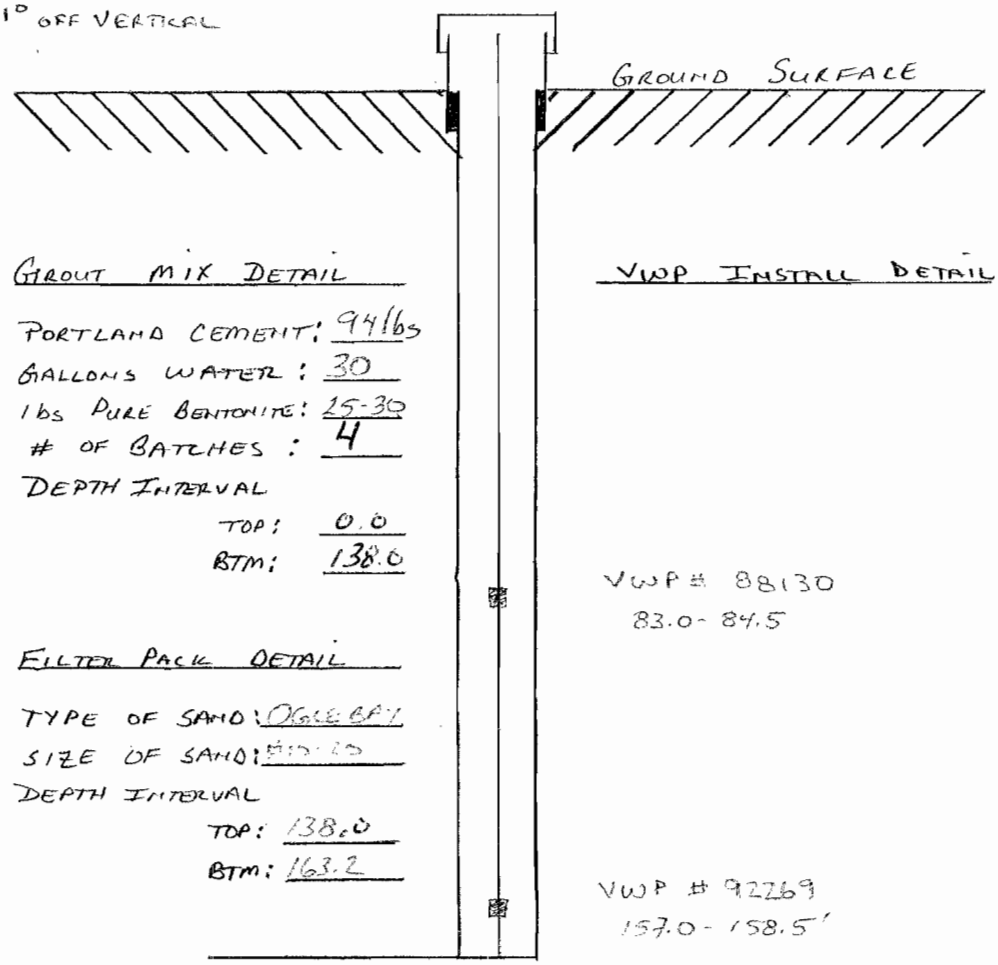
Description VIBRATING WIRE PIEZOMETER INSTALLATION DIAGRAM | Computed by B. STRICKLER | Date 9-20-07 | Checked by | Date

Reference

BOREHOLE

RKS-15-07

NOTE: ANGLE HOLE
REPORT DEPTHS FOR
TRUE BGS & ELEVATION
$\angle$ = 11° OFF VERTICAL



GROUT MIX DETAIL

PORTLAND CEMENT: 94 lbs
GALLONS WATER: 30
lbs PURE BENTONITE: 15-30
OF BATCHES: 4
DEPTH INTERVAL
TOP: 0.0
BTM: 138.0

FILTER PACK DETAIL

TYPE OF SAND: OGLEBAY
SIZE OF SAND: #10-20
DEPTH INTERVAL
TOP: 138.0
BTM: 163.2

VWP INSTALL DETAIL

INITIAL VWP READINGS

VWP #	READING (Hz)
88130	3014.4
92269	2696.8

TOTAL DEPTH: 163.2' bgs
BORE HOLE
DIAMETER: 3.78 [HQ]
WELL TAG #: APC 422

VW Piezometer Calibration Certificate

Serial #: 88130
Range : 50 psi
Cable Length: 30 m
Date of Calibration: 8/18/2007

Part #: 52611024
Cable Part # : 50613524
Calibrated by: KB
Note:

ABC Calibration Factors

	A	B	C
kPa	-8.758217E-5	1.233533E-2	7.635550E+2
psi	-1.270272E-5	1.789089E-3	1.107443E+2

Pressure in kPa/psi = $(A \times Hz^2) + (B \times Hz) + C$, where Hz is frequency in Hertz.

TI Calibration Factors

	C0	C1	C2	C3	C4	C5
kPa	7.637061E+2	1.104278E-2	5.733166E-2	-8.746108E-5	4.556799E-5	-7.148722E-4
psi	1.107623E+2	1.601564E-3	8.314961E-3	-1.268471E-5	6.608846E-6	-1.036798E-4

Pressure in kPa/psi = $C0 + (C1 \times Hz) + (C2 \times T) + (C3 \times Hz^2) + (C4 \times Hz \times T) + (C5 \times T^2)$

Where Hz is the frequency reading in Hertz and T is the Thermistor reading in degrees C.
TI factors are calculated from temperatures at 5.0, 15.0 and 25.0 degrees C.
Applied pressure and temperature are NIST traceable.

Summary of Test Results at 15°C

Thermistor reading is 14.4 °C.

Applied Pressure is referenced to 1 atm. Calculated Pressure uses ABC Calibration factors.

Applied (psi)	Equivalent (kPa)	Frequency (Hz)	Calculated (psi)	Calculated (kPa)	Error (%FS)
0.00	0.0	3023.7	0.02	0.1	-0.03
5.00	34.5	2956.6	4.99	34.4	0.01
10.00	68.9	2887.5	10.00	68.9	0.00
15.00	103.4	2816.9	14.99	103.4	0.02
20.00	137.9	2744.2	19.99	137.8	0.01
25.00	172.4	2669.5	25.00	172.4	0.00
30.00	206.8	2592.5	30.01	206.9	-0.01
35.00	241.3	2513.2	35.01	241.4	-0.01
40.00	275.8	2431.4	40.00	275.8	0.00
45.00	310.3	2346.5	45.00	310.3	0.00
50.00	344.7	2258.5	49.99	344.7	0.02

VW Piezometer Calibration Certificate

Serial #: 92269
Range : 100 psi
Cable Length: 60 m
Date of Calibration: 8/14/2007

Part #: 52611035
Cable Part # : 50613524
Calibrated by: KB
Note:

ABC Calibration Factors

	A	B	C
kPa	-1.756199E-4	7.355113E-2	1.298587E+3
psi	-2.547152E-5	1.066769E-2	1.883442E+2

Pressure in kPa/psi = $(A \times Hz^2) + (B \times Hz) + C$, where Hz is frequency in Hertz.

TI Calibration Factors

	C0	C1	C2	C3	C4	C5
kPa	1.292446E+3	7.503353E-2	4.347212E-1	-1.754923E-4	-1.251405E-4	-8.328498E-4
psi	1.874468E+2	1.088231E-2	6.304876E-2	-2.545211E-5	-1.814946E-5	-1.207904E-4

Pressure in kPa/psi = $C0 + (C1 \times Hz) + (C2 \times T) + (C3 \times Hz^2) + (C4 \times Hz \times T) + (C5 \times T^2)$

Where Hz is the frequency reading in Hertz and T is the Thermistor reading in degrees C.
TI factors are calculated from temperatures at 5.0, 15.0 and 25.0 degrees C.
Applied pressure and temperature are NIST traceable.

Summary of Test Results at 15°C

Thermistor reading is 14.9 °C.

Applied Pressure is referenced to 1 atm. Calculated Pressure uses ABC Calibration factors.

Applied (psi)	Equivalent (kPa)	Frequency (Hz)	Calculated (psi)	Calculated (kPa)	Error (%FS)
0.00	0.0	2937.1	-0.06	-0.4	0.05
10.00	68.9	2863.6	10.02	69.1	-0.02
20.00	137.9	2788.4	20.04	138.2	-0.04
30.00	206.8	2711.3	30.02	207.0	-0.02
40.00	275.8	2631.6	40.02	275.9	-0.02
50.00	344.7	2549.4	49.99	344.7	0.01
60.00	413.7	2464.2	59.96	413.4	0.04
70.00	482.6	2375.3	69.97	482.4	0.03
80.00	551.6	2282.5	79.99	551.5	0.01
90.00	620.5	2185.4	90.01	620.6	-0.01
100.00	689.5	2083.3	100.02	689.6	-0.02

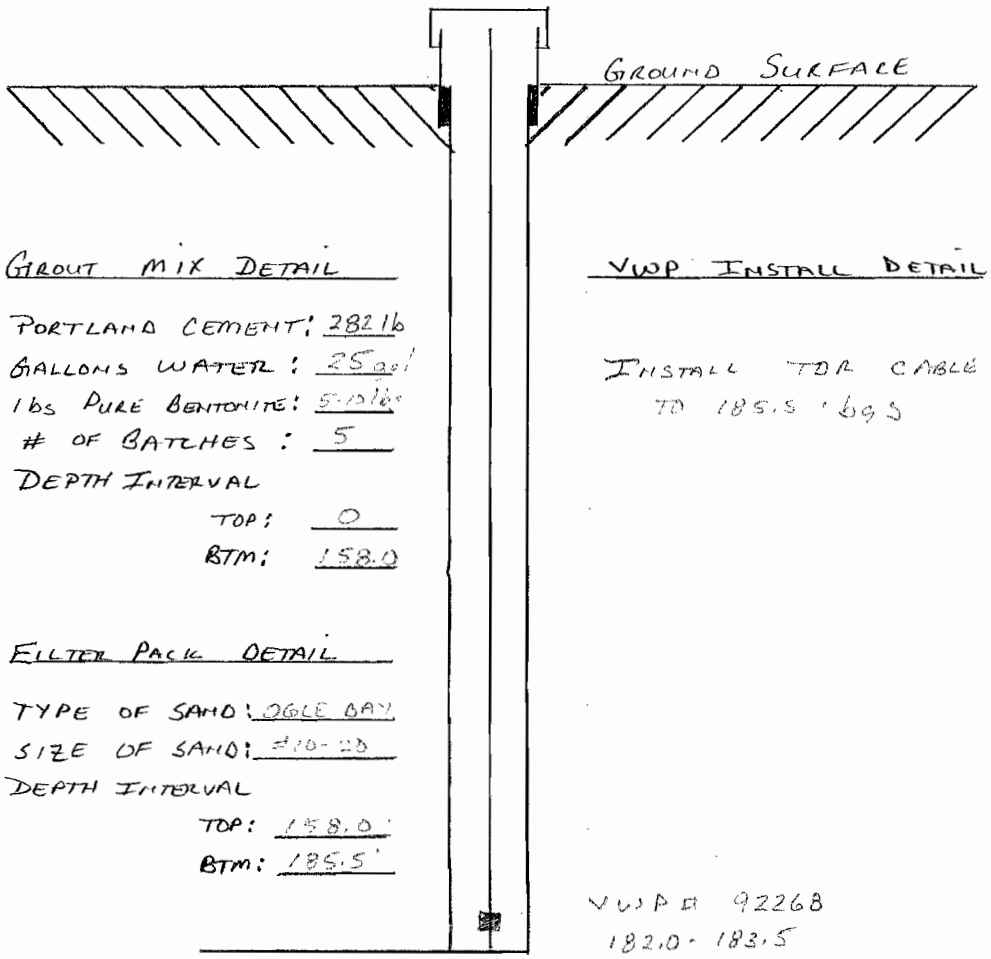
Job I-90 NAF | Project No. | Sheet | of

Description VIBRATING WIRE PIEZOMETER INSTALLATION DIAGRAM | Computed by B. STRICKLER | Date 9-25-07

Checked by | Date

Reference

BOREHOLE # RKS-18-07



GROUT MIX DETAIL

PORTLAND CEMENT: 282 lb
GALLONS WATER: 25 gal
lbs PURE BENTONITE: 5-10 lbs
OF BATCHES: 5
DEPTH INTERVAL
TOP: 0
BTM: 158.0

FILTER PACK DETAIL

TYPE OF SAND: OGLE BAY
SIZE OF SAND: #10-20
DEPTH INTERVAL
TOP: 158.0'
BTM: 185.5'

VWP INSTALL DETAIL

INSTALL TDR CABLE TO 185.5 'bgs

VWP # 92268
182.0 - 183.5

INITIAL VWP READINGS

VWP #	READING (Hz)
92268	2535.1

TOTAL DEPTH: 185.5 'bgs
BORE HOLE
DIAMETER: 3.78" [HQ]
WELL TAG #: AFC 421

VW Piezometer Calibration Certificate

Serial #: 92268
Range : 100 psi
Cable Length: 60 m
Date of Calibration: 8/14/2007

Part #: 52611035
Cable Part # : 50613524
Calibrated by: KB
Note:

ABC Calibration Factors

	A	B	C
kPa	-1.682606E-4	4.229561E-2	1.198621E+3
psi	-2.440414E-5	6.134460E-3	1.738453E+2

Pressure in kPa/psi = $(A \times Hz^2) + (B \times Hz) + C$, where Hz is frequency in Hertz.

TI Calibration Factors

	C0	C1	C2	C3	C4	C5
kPa	1.197146E+3	4.111623E-2	2.153548E-1	-1.681333E-4	3.871671E-5	-4.448745E-3
psi	1.736252E+2	5.963195E-3	3.123348E-2	-2.438481E-5	5.615186E-6	-6.452132E-4

Pressure in kPa/psi = $C0 + (C1 \times Hz) + (C2 \times T) + (C3 \times Hz^2) + (C4 \times Hz \times T) + (C5 \times T^2)$

Where Hz is the frequency reading in Hertz and T is the Thermistor reading in degrees C.
TI factors are calculated from temperatures at 5.0, 15.0 and 25.0 degrees C.
Applied pressure and temperature are NIST traceable.

Summary of Test Results at 15°C

Thermistor reading is 14.7 °C.

Applied Pressure is referenced to 1 atm. Calculated Pressure uses ABC Calibration factors.

Applied (psi)	Equivalent (kPa)	Frequency (Hz)	Calculated (psi)	Calculated (kPa)	Error (%FS)
0.00	0.0	2797.6	0.01	0.1	-0.01
10.00	68.9	2719.8	10.00	68.9	0.00
20.00	137.9	2639.6	20.00	137.9	0.00
30.00	206.8	2556.9	29.98	206.7	0.02
40.00	275.8	2471.1	39.98	275.7	0.01
50.00	344.7	2382.0	49.99	344.7	0.01
60.00	413.7	2289.2	60.00	413.7	0.00
70.00	482.6	2192.2	70.01	482.7	-0.01
80.00	551.6	2090.5	80.02	551.7	-0.02
90.00	620.5	1983.4	90.01	620.6	-0.01
100.00	689.5	1870.0	99.98	689.3	0.02

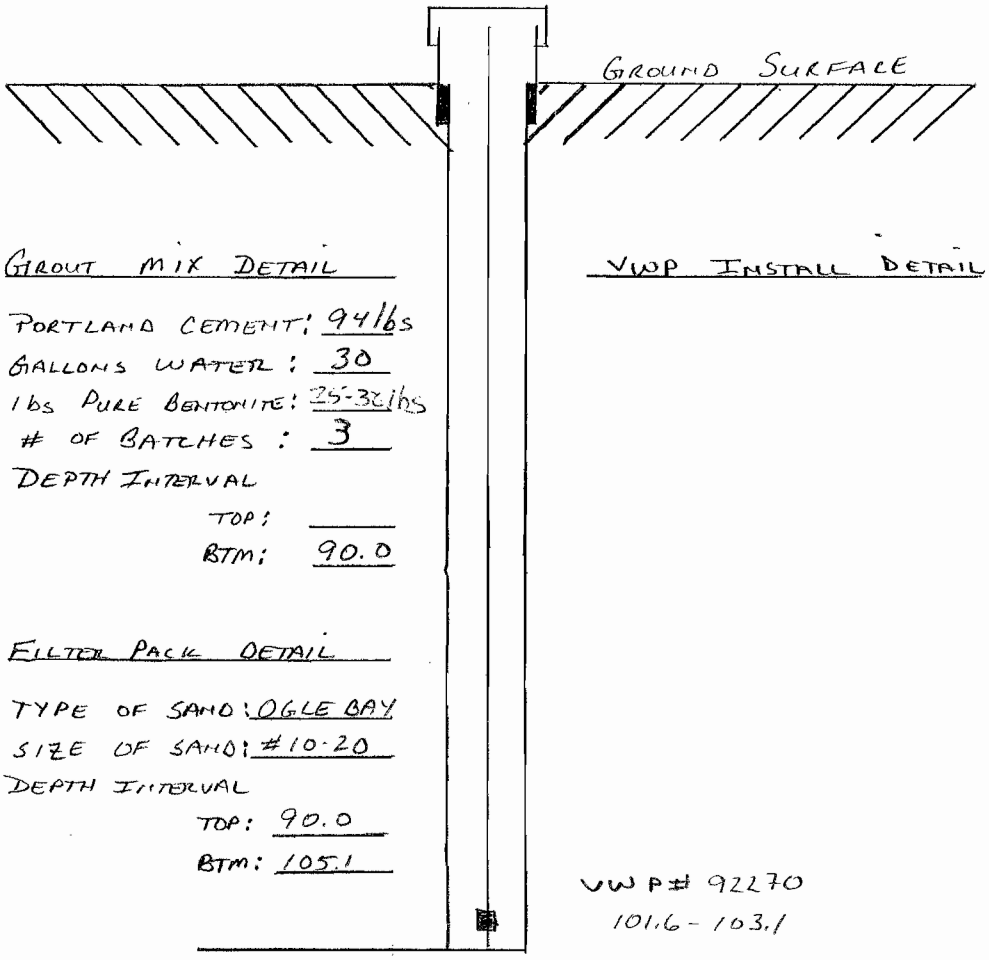
Job I-90 · SCD | Project No. 03-2007 | Sheet ____ of ____

Description VIBRATING WIRE PIEZOMETER INSTALLATION DIAGRAM | Computed by B. STRICKLER | Date 9-21-07

Checked by ____ | Date ____

Reference

BOREHOLE # RKS-19-07



GROUT MIX DETAIL

PORTLAND CEMENT: 94 lbs
GALLONS WATER: 30
lbs PURE BENTONITE: 25-32 lbs
OF BATCHES: 3
DEPTH INTERVAL
TOP: ____
BTM: 90.0

FILTER PACK DETAIL

TYPE OF SAND: OGLE BAY
SIZE OF SAND: #10-20
DEPTH INTERVAL
TOP: 90.0
BTM: 105.1

VWP INSTALL DETAIL

VWP # 92270
101.6 - 103.1

INITIAL VWP READINGS

VWP #	READING (Hz)
92270	2685.0

TOTAL DEPTH: 105.1 'bgs
BORE HOLE DIAMETER: 3.78" [HO]
WELL TAG #: APC419

VW Piezometer Calibration Certificate

Serial #: 92270
Range : 100 psi
Cable Length: 60 m
Date of Calibration: 8/14/2007

Part #: 52611035
Cable Part # : 50613524
Calibrated by: KB
Note:

ABC Calibration Factors

	A	B	C
kPa	-1.659516E-4	5.500690E-2	1.245891E+3
psi	-2.406925E-5	7.978076E-3	1.807012E+2

Pressure in kPa/psi = $(A \times Hz^2) + (B \times Hz) + C$, where Hz is frequency in Hertz.

TI Calibration Factors

	C0	C1	C2	C3	C4	C5
kPa	1.244429E+3	5.429432E-2	1.575923E-1	-1.658574E-4	2.005573E-5	-2.013164E-3
psi	1.804828E+2	7.874448E-3	2.285602E-2	-2.405473E-5	2.908736E-6	-2.919745E-4

Pressure in kPa/psi = $C0 + (C1 \times Hz) + (C2 \times T) + (C3 \times Hz^2) + (C4 \times Hz \times T) + (C5 \times T^2)$

Where Hz is the frequency reading in Hertz and T is the Thermistor reading in degrees C.
TI factors are calculated from temperatures at 5.0, 15.0 and 25.0 degrees C.
Applied pressure and temperature are NIST traceable.

Summary of Test Results at 15°C

Thermistor reading is 15.0 °C.

Applied Pressure is referenced to 1 atm. Calculated Pressure uses ABC Calibration factors.

Applied (psi)	Equivalent (kPa)	Frequency (Hz)	Calculated (psi)	Calculated (kPa)	Error (%FS)
0.00	0.0	2910.8	-0.01	-0.1	0.01
10.00	68.9	2834.0	10.00	68.9	0.00
20.00	137.9	2754.7	20.03	138.1	-0.03
30.00	206.8	2673.5	29.99	206.8	0.01
40.00	275.8	2589.3	39.99	275.7	0.01
50.00	344.7	2502.0	49.99	344.7	0.01
60.00	413.7	2411.3	59.99	413.6	0.01
70.00	482.6	2316.8	69.99	482.6	0.01
80.00	551.6	2217.8	80.01	551.6	-0.01
90.00	620.5	2114.0	90.00	620.5	0.00
100.00	689.5	2004.3	100.00	689.5	0.00

Job 2008 E-90 [illegible]

Description ~~Slope Inclinometer~~ [illegible]

Installation Diagram

Project No. [illegible]

Computed by [illegible]

Checked by —

Page 1 of 1

Sheet — of —

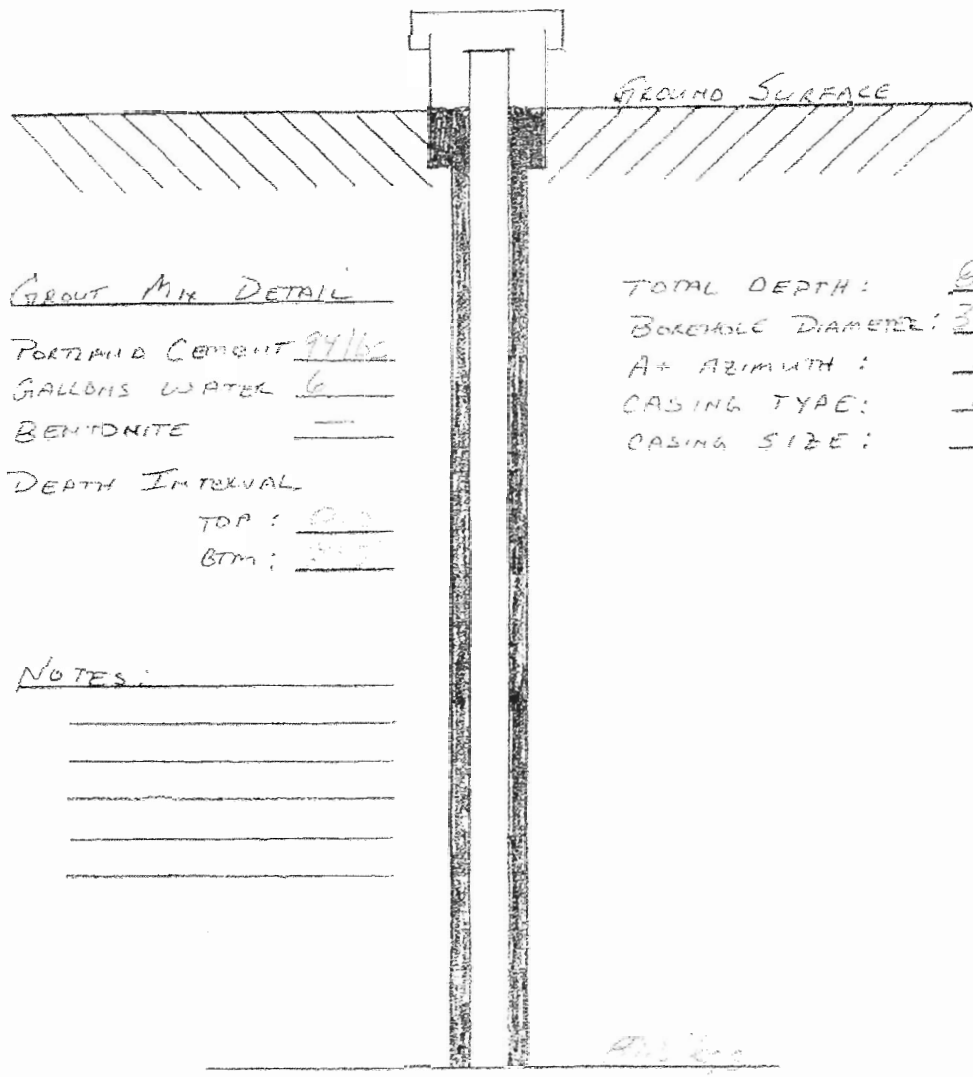
Date 11/6/08

Date —

Reference

Borehole #

[illegible]



Grout Mix Detail

Portland Cement 94/bc

Gallons Water 6

Bentonite —

Depth Interval

Top : [illegible]

Btm : [illegible]

Notes:

Total Depth: 89.5'

Borehole Diameter: 3.7[illegible]

A+ Azimuth : N/A

Casing Type: N/A

Casing Size: N/A

Job 2008 I-70 [illegible]

Description ~~SLOPE INCLINOMETER~~ TDR INSTALLATION DIAGRAM

Project No 102[illegible]A

Computed by [illegible]

Checked by —

Page 1 of 1

Sheet — of —

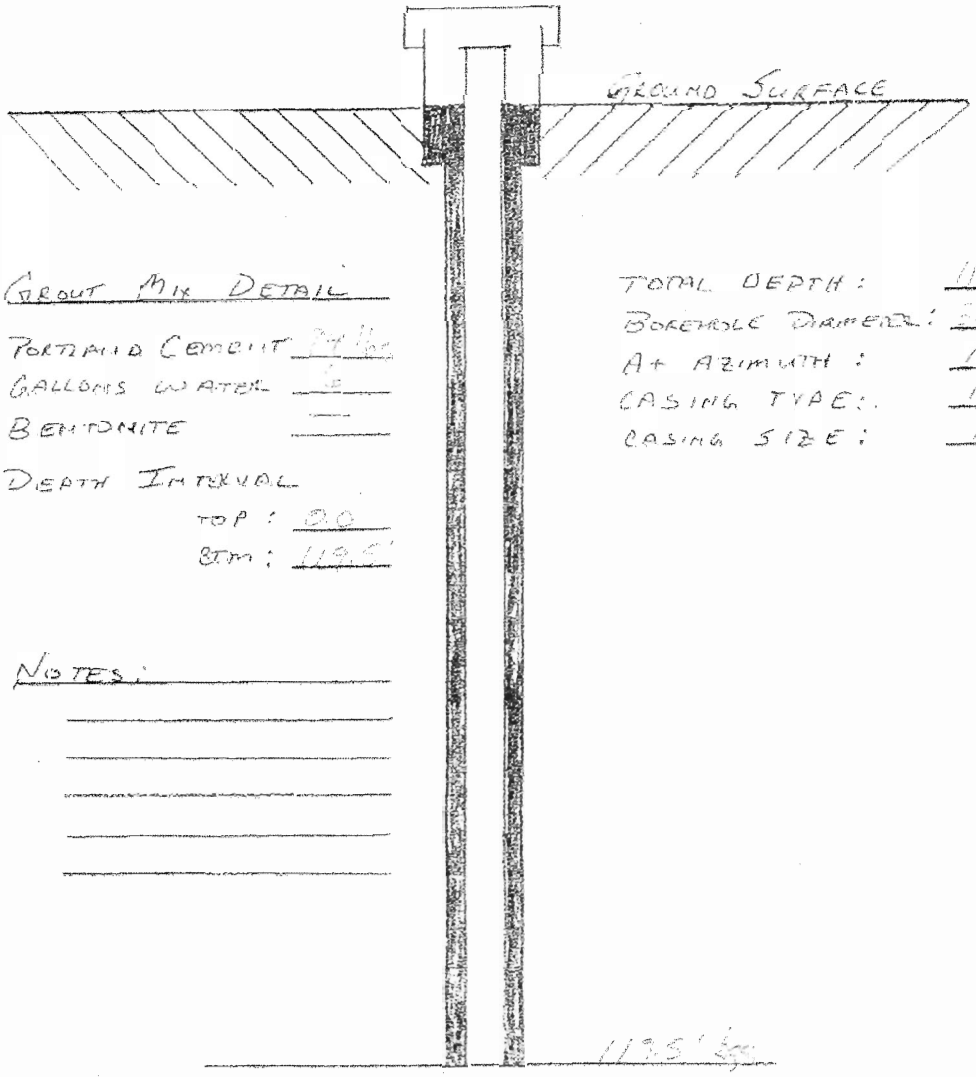
Date 10 [illegible]

Date —

Reference

BOREHOLE #

[illegible]



GROUT MIX DETAIL

PORTLAND CEMENT [illegible]

GALLONS WATER [illegible]

BENTONITE —

DEPTH INTERVAL

TOP : 0.0

BTM : 119.5'

NOTES:

TOTAL DEPTH : 119.5'

BOREHOLE DIAMETER : [illegible]

AT AZIMUTH : N/A

CASING TYPE : N/A

CASING SIZE : N/A

Job 2008 I-90 GEOTECHNICAL ANALYSIS | Project No. 103 WA | Sheet — of —

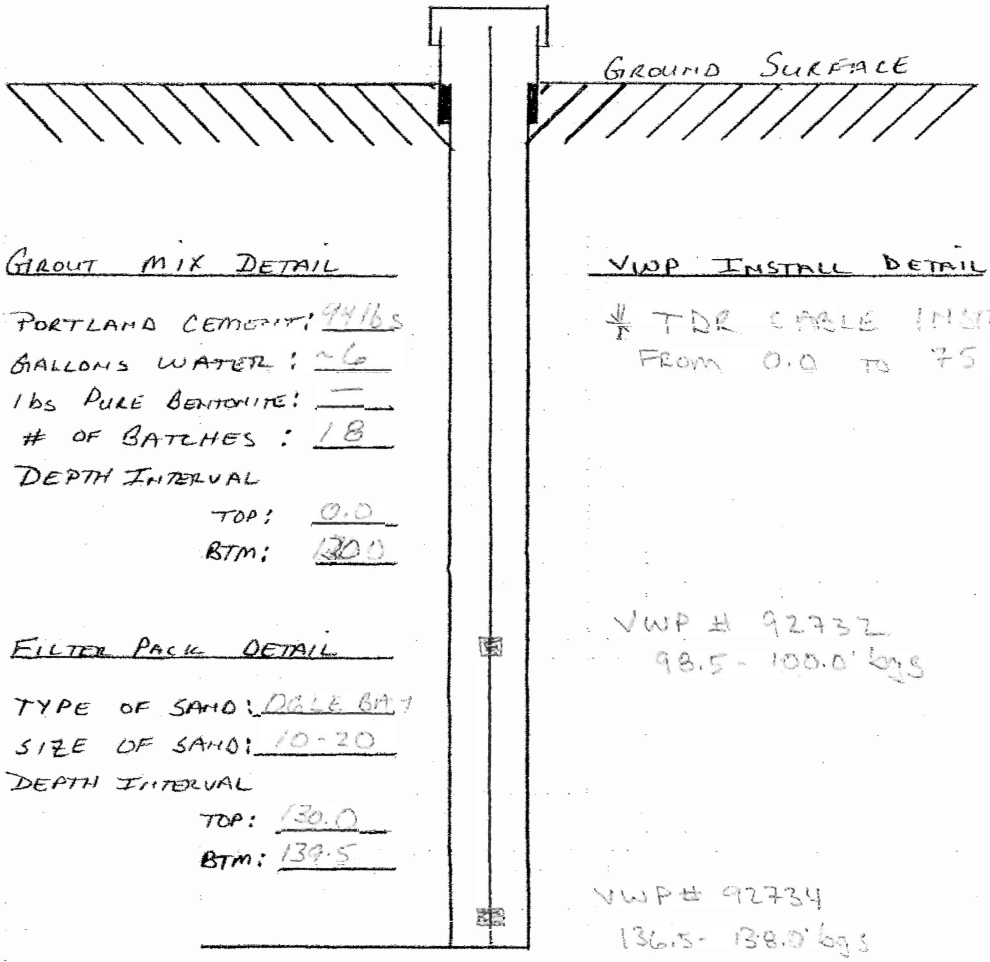
Description VIBRATING WIRE PIEZOMETER | Computed by B SHERMAN | Date 11/6/08

INSTALLATION DIAGRAM | Checked by — | Date —

Reference

BOREHOLE #

RKS-40-08



GROUT MIX DETAIL

PORTLAND CEMENT: 94 lbs
GALLONS WATER: ~6
lbs PURE BENTONITE: —
OF BATCHES: 18
DEPTH INTERVAL
TOP: 0.0
BTM: 130'

FILTER PACK DETAIL

TYPE OF SAND: DALE #7
SIZE OF SAND: 10-20
DEPTH INTERVAL
TOP: 130.0
BTM: 139.5

VWP INSTALL DETAIL

TDR CABLE INSTALLED FROM 0.0 TO 75' bgs

VWP # 92732
98.5 - 100.0' bgs

VWP # 92734
136.5 - 138.0' bgs

INITIAL VWP READINGS

VWP #	READING (Hz)
92734	2889.8 Hz
92732	2965.3 Hz

TOTAL DEPTH: 139.5' bgs
BORE HOLE
DIAMETER: 3.782" [HQ]
WELL TAG #: ADA654

VW Piezometer Calibration Certificate

Serial #: 92734
Range : 100 psi
Cable Length: 60 m
Date of Calibration: 9/17/2007

Part #: 52611035
Cable Part # : 50613524
Calibrated by: KB
Note:

ABC Calibration Factors

	A	B	C
kPa	-1.700295E-4	2.844766E-2	1.331653E+3
psi	-2.466069E-5	4.125985E-3	1.931400E+2

Pressure in kPa/psi = $(A \times Hz^2) + (B \times Hz) + C$, where Hz is frequency in Hertz.

TI Calibration Factors

	C0	C1	C2	C3	C4	C5
kPa	1.330012E+3	2.818532E-2	1.376633E-1	-1.700701E-4	2.768176E-5	-2.320203E-3
psi	1.928951E+2	4.087791E-3	1.996567E-2	-2.466572E-5	4.014759E-6	-3.365052E-4

Pressure in kPa/psi = $C0 + (C1 \times Hz) + (C2 \times T) + (C3 \times Hz^2) + (C4 \times Hz \times T) + (C5 \times T^2)$

Where Hz is the frequency reading in Hertz and T is the Thermistor reading in degrees C.
TI factors are calculated from temperatures at 5.0, 15.0 and 25.0 degrees C.
Applied pressure and temperature are NIST traceable.

Summary of Test Results at 15°C

Thermistor reading is 14.9 °C.

Applied Pressure is referenced to 1 atm. Calculated Pressure uses ABC Calibration factors.

Applied (psi)	Equivalent (kPa)	Frequency (Hz)	Calculated (psi)	Calculated (kPa)	Error (%FS)
0.00	0.0	2883.4	0.01	0.1	-0.01
10.00	68.9	2810.1	10.00	68.9	0.00
20.00	137.9	2734.6	20.01	138.0	-0.01
30.00	206.8	2657.2	29.98	206.7	0.02
40.00	275.8	2577.1	39.99	275.7	0.01
50.00	344.7	2494.4	49.99	344.7	0.01
60.00	413.7	2408.7	60.00	413.7	0.00
70.00	482.6	2319.7	70.01	482.7	-0.01
80.00	551.6	2227.1	80.01	551.6	-0.01
90.00	620.5	2130.3	90.01	620.6	-0.01
100.00	689.5	2029.1	99.98	689.3	0.02

VW Piezometer Calibration Certificate

Serial #: 92732
Range : 100 psi
Cable Length: 60 m
Date of Calibration: 9/17/2007

Part #: 52611035
Cable Part # : 50613524
Calibrated by: KB
Note:

ABC Calibration Factors

	A	B	C
kPa	-1.706074E-4	7.021496E-2	1.285292E+3
psi	-2.474451E-5	1.018382E-2	1.864158E+2

Pressure in kPa/psi = $(A \times Hz^2) + (B \times Hz) + C$, where Hz is frequency in Hertz.

TI Calibration Factors

	C0	C1	C2	C3	C4	C5
kPa	1.283997E+3	6.989958E-2	1.423620E-1	-1.705975E-4	1.511865E-5	-2.880564E-3
psi	1.862214E+2	1.013772E-2	2.064713E-2	-2.474220E-5	2.192698E-6	-4.177758E-4

Pressure in kPa/psi = $C0 + (C1 \times Hz) + (C2 \times T) + (C3 \times Hz^2) + (C4 \times Hz \times T) + (C5 \times T^2)$

Where Hz is the frequency reading in Hertz and T is the Thermistor reading in degrees C.
TI factors are calculated from temperatures at 5.0, 15.0 and 25.0 degrees C.
Applied pressure and temperature are NIST traceable.

Summary of Test Results at 15°C

Thermistor reading is 14.8 °C.

Applied Pressure is referenced to 1 atm. Calculated Pressure uses ABC Calibration factors.

Applied (psi)	Equivalent (kPa)	Frequency (Hz)	Calculated (psi)	Calculated (kPa)	Error (%FS)
0.00	0.0	2958.0	0.03	0.2	-0.03
10.00	68.9	2883.8	10.00	68.9	0.00
20.00	137.9	2807.4	19.98	137.8	0.02
30.00	206.8	2728.7	29.96	206.6	0.04
40.00	275.8	2647.0	40.00	275.8	0.00
50.00	344.7	2562.8	49.99	344.7	0.01
60.00	413.7	2475.1	60.03	413.9	-0.03
70.00	482.6	2384.4	70.02	482.8	-0.02
80.00	551.6	2289.7	80.00	551.6	0.00
90.00	620.5	2190.4	90.00	620.5	0.00
100.00	689.5	2086.0	99.99	689.4	0.01

Job [illegible] Project No. [illegible] Sheet — of —

Description VIBRATING WIRE PIEZOMETER INSTALLATION DIAGRAM

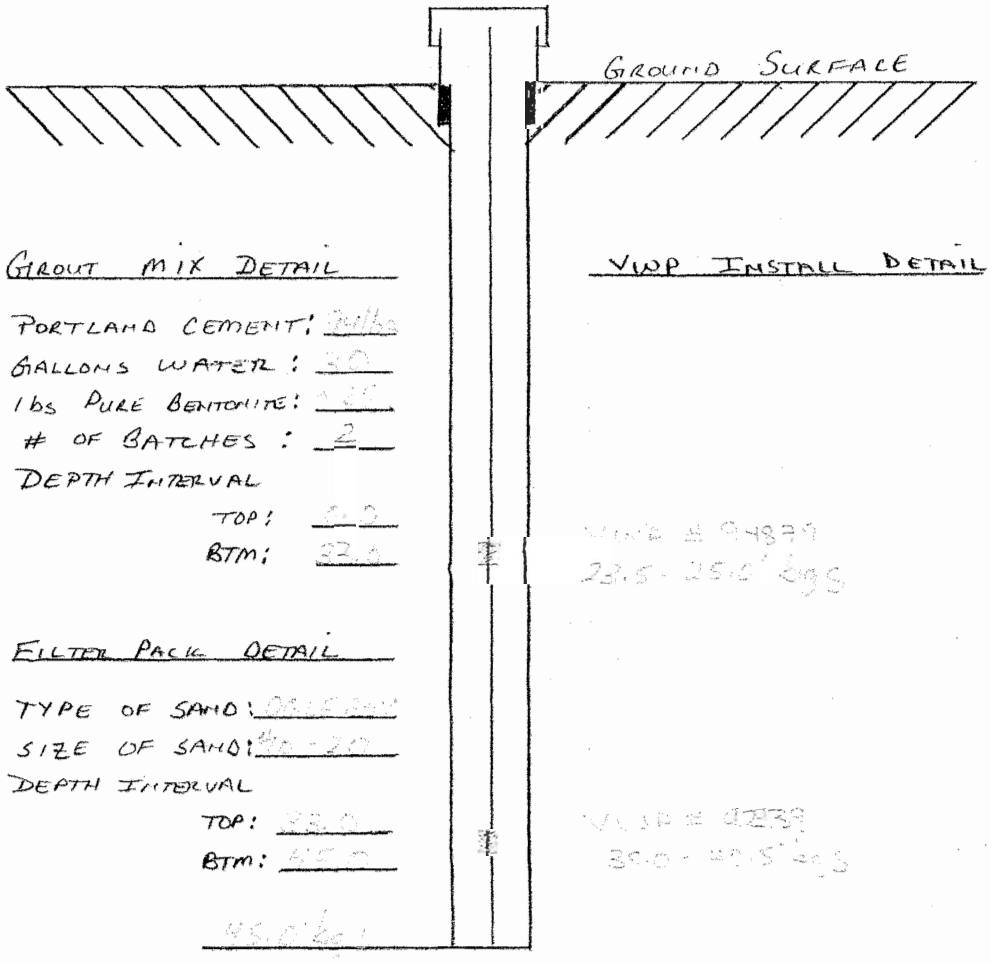
Computed by [illegible] Date 11/7/08

Checked by — Date —

Reference

BOREHOLE #

[illegible]



GROUT MIX DETAIL

PORTLAND CEMENT: [illegible]

GALLONS WATER: 30

lbs PURE BENTONITE: [illegible]

OF BATCHES: 2

DEPTH INTERVAL

TOP: [illegible]

BTM: 33.0

FILTER PACK DETAIL

TYPE OF SAND: [illegible]

SIZE OF SAND: [illegible]

DEPTH INTERVAL

TOP: 33.0

BTM: 45.0

INITIAL VWP READINGS

VWP #	READING (HZ)
94879	
92939	

TOTAL DEPTH: 45.0'

BORE HOLE DIAMETER: [illegible]

WELL TAG #: [illegible]

VW Piezometer Calibration Certificate

Serial #: 92939
Range : 50 psi
Cable Length: 30 m
Date of Calibration: 9/28/2007

Part #: 52611024
Cable Part # : 50613524
Calibrated by: KB
Note:

ABC Calibration Factors

	A	B	C
kPa	-1.204406E-4	4.075254E-2	8.298819E+2
psi	-1.746844E-5	5.910657E-3	1.203642E+2

Pressure in kPa/psi = $(A \times Hz^2) + (B \times Hz) + C$, where Hz is frequency in Hertz.

TI Calibration Factors

	C0	C1	C2	C3	C4	C5
kPa	8.271476E+2	4.073136E-2	1.845987E-1	-1.205369E-4	3.569160E-5	-2.977602E-3
psi	1.199634E+2	5.907377E-3	2.677284E-2	-1.748178E-5	5.176446E-6	-4.318494E-4

Pressure in kPa/psi = $C0 + (C1 \times Hz) + (C2 \times T) + (C3 \times Hz^2) + (C4 \times Hz \times T) + (C5 \times T^2)$

Where Hz is the frequency reading in Hertz and T is the Thermistor reading in degrees C.
TI factors are calculated from temperatures at 5.0, 15.0 and 25.0 degrees C.
Applied pressure and temperature are NIST traceable.

Summary of Test Results at 15°C

Thermistor reading is 14.8 °C.

Applied Pressure is referenced to 1 atm. Calculated Pressure uses ABC Calibration factors.

Applied (psi)	Equivalent (kPa)	Frequency (Hz)	Calculated (psi)	Calculated (kPa)	Error (%FS)
0.00	0.0	2799.5	0.01	0.1	-0.01
5.00	34.5	2744.6	5.00	34.5	0.00
10.00	68.9	2688.5	9.99	68.9	0.01
15.00	103.4	2631.1	14.99	103.4	0.02
20.00	137.9	2572.1	20.00	137.9	0.00
25.00	172.4	2511.8	25.00	172.4	0.00
30.00	206.8	2449.8	30.01	206.9	-0.01
35.00	241.3	2386.2	35.00	241.3	-0.01
40.00	275.8	2320.7	40.00	275.8	0.00
45.00	310.3	2253.2	45.00	310.3	0.01
50.00	344.7	2183.3	50.00	344.7	0.00

VW Piezometer Calibration Certificate

Serial #: 94879
Range : 50 psi
Cable Length: 30 m
Date of Calibration: 3/15/2008

Part #: 52611024
Cable Part # : 50613524
Calibrated by: KB
Note:

ABC Calibration Factors

	A	B	C
kPa	-1.091387E-4	-5.740786E-2	1.111236E+3
psi	-1.582923E-5	-8.326307E-3	1.611711E+2

Pressure in kPa/psi = $(A \times Hz^2) + (B \times Hz) + C$, where Hz is frequency in Hertz.

TI Calibration Factors

	C0	C1	C2	C3	C4	C5
kPa	1.115144E+3	-6.103790E-2	1.603142E-2	-1.086218E-4	6.008000E-5	-2.236602E-3
psi	1.617322E+2	-8.852487E-3	2.325079E-3	-1.575371E-5	8.713561E-6	-3.243803E-4

Pressure in kPa/psi = $C0 + (C1 \times Hz) + (C2 \times T) + (C3 \times Hz^2) + (C4 \times Hz \times T) + (C5 \times T^2)$

Where Hz is the frequency reading in Hertz and T is the Thermistor reading in degrees C.
TI factors are calculated from temperatures at 5.0, 15.0 and 25.0 degrees C.
Applied pressure and temperature are NIST traceable.

Summary of Test Results at 15°C

Thermistor reading is 14.5 °C.

Applied Pressure is referenced to 1 atm. Calculated Pressure uses ABC Calibration factors.

Applied (psi)	Equivalent (kPa)	Frequency (Hz)	Calculated (psi)	Calculated (kPa)	Error (%FS)
0.00	0.0	2938.6	0.01	0.1	-0.02
5.00	34.5	2889.0	5.00	34.5	0.00
10.00	68.9	2838.5	10.00	68.9	0.00
15.00	103.4	2787.2	14.99	103.4	0.01
20.00	137.9	2735.1	19.98	137.8	0.03
25.00	172.4	2682.0	24.98	172.2	0.04
30.00	206.8	2627.4	30.02	207.0	-0.04
35.00	241.3	2572.2	35.02	241.5	-0.05
40.00	275.8	2516.1	40.01	275.9	-0.02
45.00	310.3	2458.8	45.00	310.3	0.00
50.00	344.7	2400.3	49.99	344.7	0.03

Job 2008 I-90 Geotechnical Program | Project No. 103 [illegible] | Sheet — of —

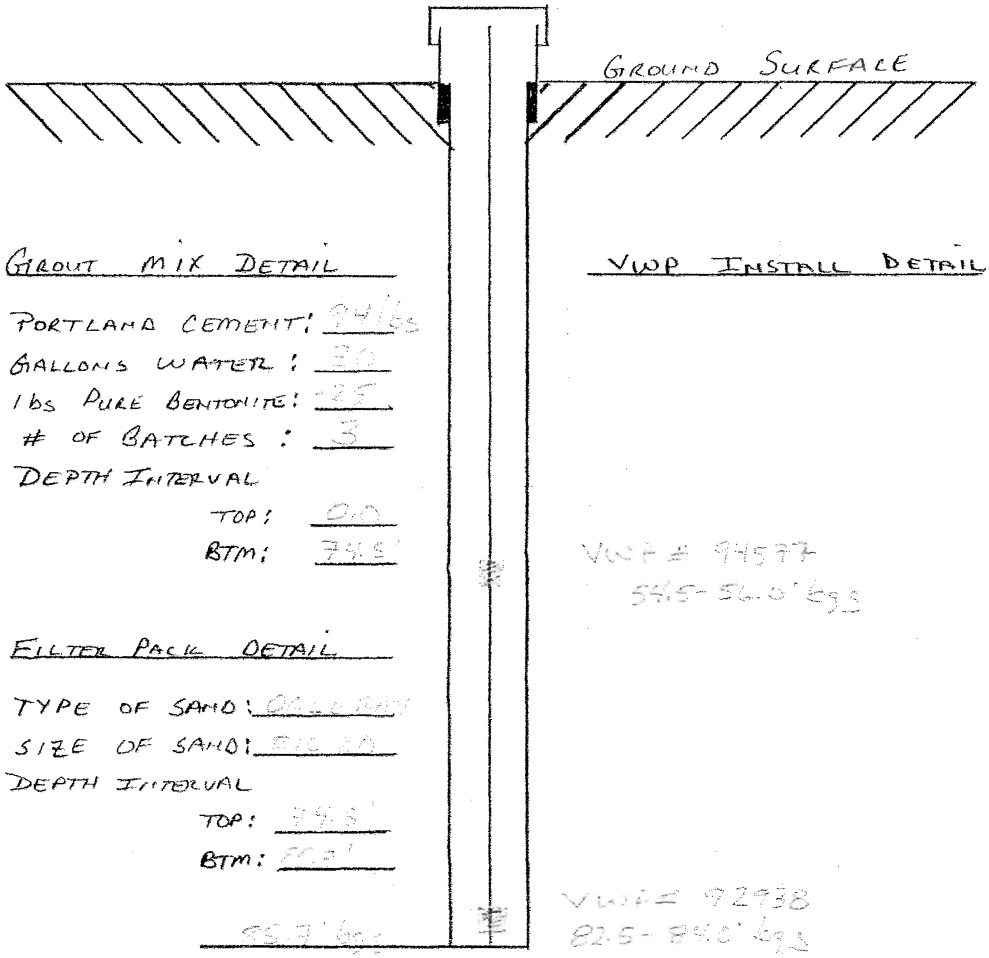
Description VIBRATING WIRE PIEZOMETER INSTALLATION DIAGRAM | Computed by [illegible] | Date 11/8/08

Checked by — | Date —

Reference

BOREHOLE #

[illegible]



GROUT MIX DETAIL

PORTLAND CEMENT: 94 lbs
GALLONS WATER: 30
lbs PURE BENTONITE: 25
OF BATCHES: 3
DEPTH INTERVAL
TOP: 0.0
BTM: 74.5'

FILTER PACK DETAIL

TYPE OF SAND: [illegible]
SIZE OF SAND: [illegible]
DEPTH INTERVAL
TOP: 74.5'
BTM: [illegible]

VWP INSTALL DETAIL

INITIAL VWP READINGS

VWP #	READING (Hz)
94577	2912.9
92938	2769.4

TOTAL DEPTH: 85.7' bgs
BORE HOLE DIAMETER: [illegible]
WELL TAG #: [illegible]

VW Piezometer Calibration Certificate

Serial #: 92938
Range : 50 psi
Cable Length: 30 m
Date of Calibration: 9/28/2007

Part #: 52611024
Cable Part # : 50613524
Calibrated by: KB
Note:

ABC Calibration Factors

	A	B	C
kPa	-1.188335E-4	2.074805E-2	8.454406E+2
psi	-1.723534E-5	3.009251E-3	1.226208E+2

Pressure in kPa/psi = $(A \times Hz^2) + (B \times Hz) + C$, where Hz is frequency in Hertz.

TI Calibration Factors

	C0	C1	C2	C3	C4	C5
kPa	8.429944E+2	2.076047E-2	1.816864E-1	-1.188931E-4	1.938948E-5	-2.804465E-3
psi	1.222617E+2	3.010946E-3	2.635046E-2	-1.724338E-5	2.812108E-6	-4.067390E-4

Pressure in kPa/psi = $C0 + (C1 \times Hz) + (C2 \times T) + (C3 \times Hz^2) + (C4 \times Hz \times T) + (C5 \times T^2)$

Where Hz is the frequency reading in Hertz and T is the Thermistor reading in degrees C.
TI factors are calculated from temperatures at 5.0, 15.0 and 25.0 degrees C.
Applied pressure and temperature are NIST traceable.

Summary of Test Results at 15°C

Thermistor reading is 14.8 °C.

Applied Pressure is referenced to 1 atm. Calculated Pressure uses ABC Calibration factors.

Applied (psi)	Equivalent (kPa)	Frequency (Hz)	Calculated (psi)	Calculated (kPa)	Error (%FS)
0.00	0.0	2756.0	0.00	0.0	0.00
5.00	34.5	2701.3	4.98	34.3	0.03
10.00	68.9	2644.9	10.01	69.0	-0.02
15.00	103.4	2587.5	15.01	103.5	-0.03
20.00	137.9	2528.9	20.01	138.0	-0.01
25.00	172.4	2468.8	25.00	172.4	0.00
30.00	206.8	2407.2	29.99	206.8	0.01
35.00	241.3	2343.8	34.99	241.2	0.01
40.00	275.8	2278.5	40.00	275.8	0.00
45.00	310.3	2211.3	45.00	310.3	0.01
50.00	344.7	2141.7	50.01	344.8	-0.02

VW Piezometer Calibration Certificate

Serial #: 94577
Range : 50 psi
Cable Length: 30 m
Date of Calibration: 2/26/2008

Part #: 52611024
Cable Part # : 50613524
Calibrated by: KB
Note:

ABC Calibration Factors

	A	B	C
kPa	-1.295097E-4	4.987260E-4	1.088849E+3
psi	-1.878380E-5	7.233410E-5	1.579242E+2

Pressure in kPa/psi = $(A \times Hz^2) + (B \times Hz) + C$, where Hz is frequency in Hertz.

TI Calibration Factors

	C0	C1	C2	C3	C4	C5
kPa	1.088868E+3	-7.608260E-4	1.116856E-1	-1.294074E-4	4.124419E-5	-2.963475E-3
psi	1.579214E+2	-1.103446E-4	1.619806E-2	-1.876829E-5	5.981754E-6	-4.298006E-4

Pressure in kPa/psi = $C0 + (C1 \times Hz) + (C2 \times T) + (C3 \times Hz^2) + (C4 \times Hz \times T) + (C5 \times T^2)$

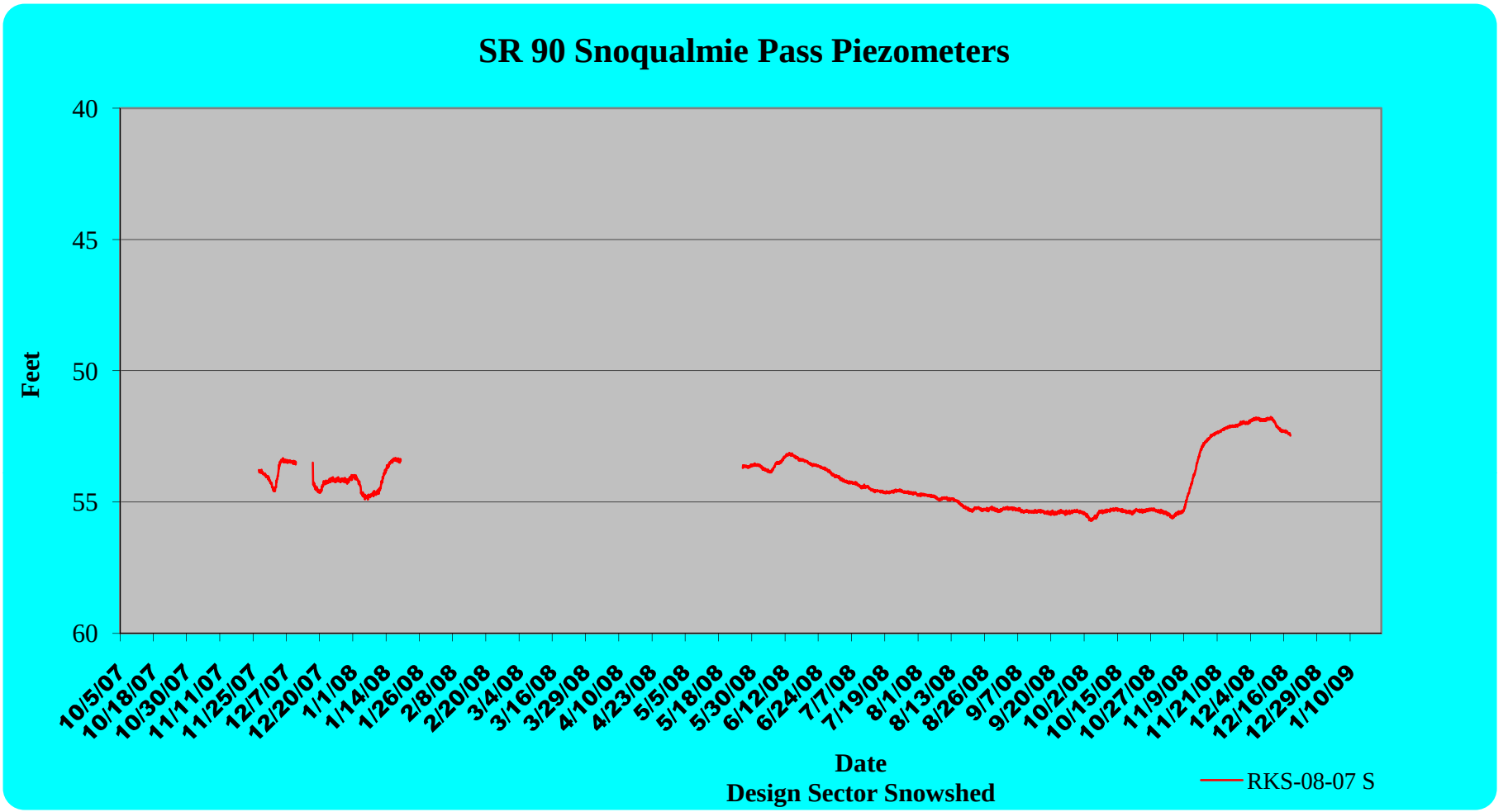
Where Hz is the frequency reading in Hertz and T is the Thermistor reading in degrees C.
TI factors are calculated from temperatures at 5.0, 15.0 and 25.0 degrees C.
Applied pressure and temperature are NIST traceable.

Summary of Test Results at 15°C

Thermistor reading is 14.7 °C.

Applied Pressure is referenced to 1 atm. Calculated Pressure uses ABC Calibration factors.

Applied (psi)	Equivalent (kPa)	Frequency (Hz)	Calculated (psi)	Calculated (kPa)	Error (%FS)
0.00	0.0	2901.5	0.00	0.0	0.00
5.00	34.5	2855.2	5.00	34.5	0.00
10.00	68.9	2808.2	10.00	68.9	0.00
15.00	103.4	2760.4	14.99	103.4	0.01
20.00	137.9	2711.7	20.00	137.9	0.01
25.00	172.4	2662.1	25.00	172.4	0.00
30.00	206.8	2611.7	29.99	206.8	0.02
35.00	241.3	2560.1	35.00	241.3	0.00
40.00	275.8	2507.3	40.02	275.9	-0.04
45.00	310.3	2453.7	45.01	310.3	-0.02
50.00	344.7	2399.1	49.98	344.6	0.03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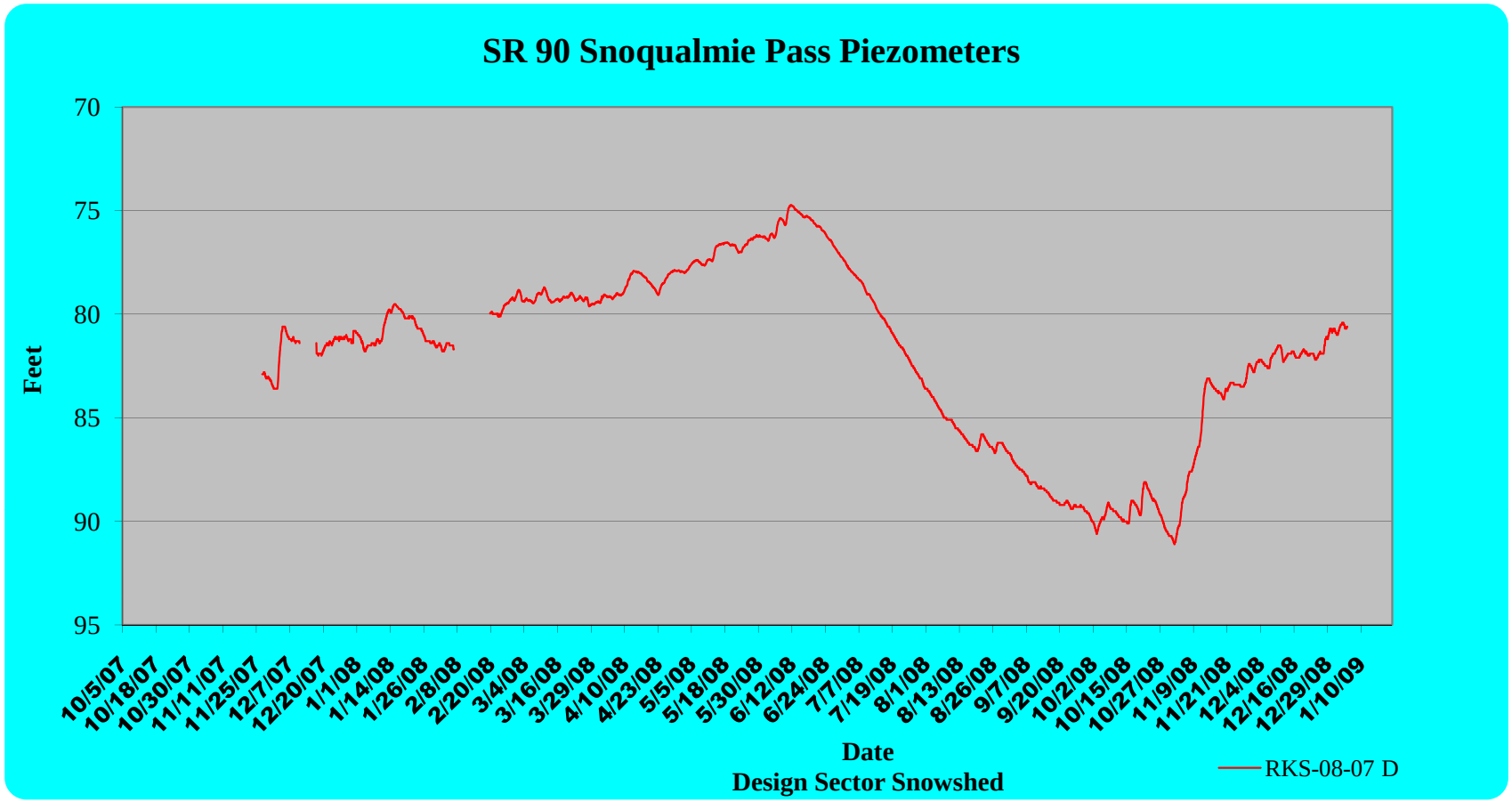
Date
Design Sector Snowshed
RKS-08-07 S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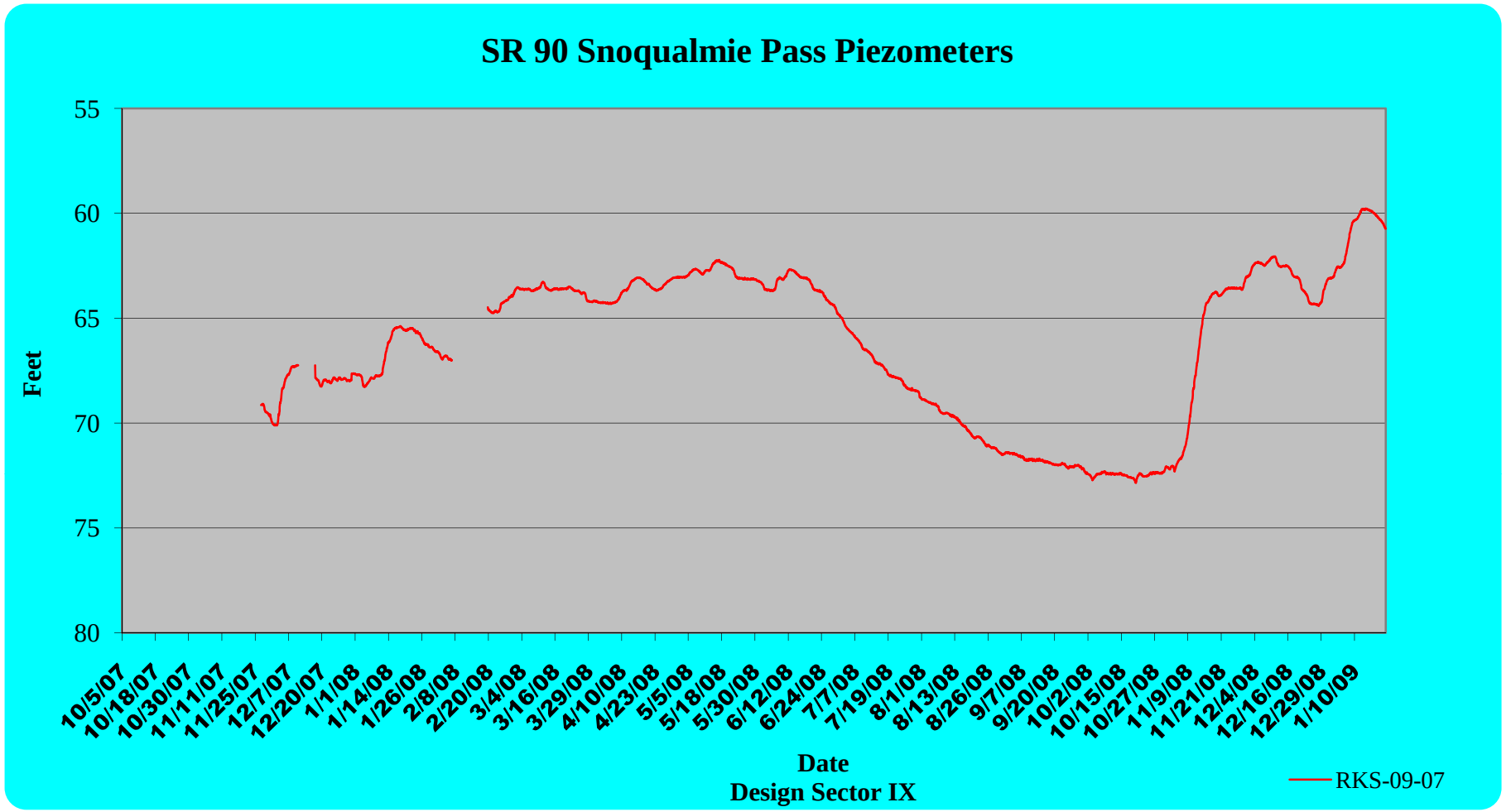
Design Sector Snowshed
RKS-08-07 D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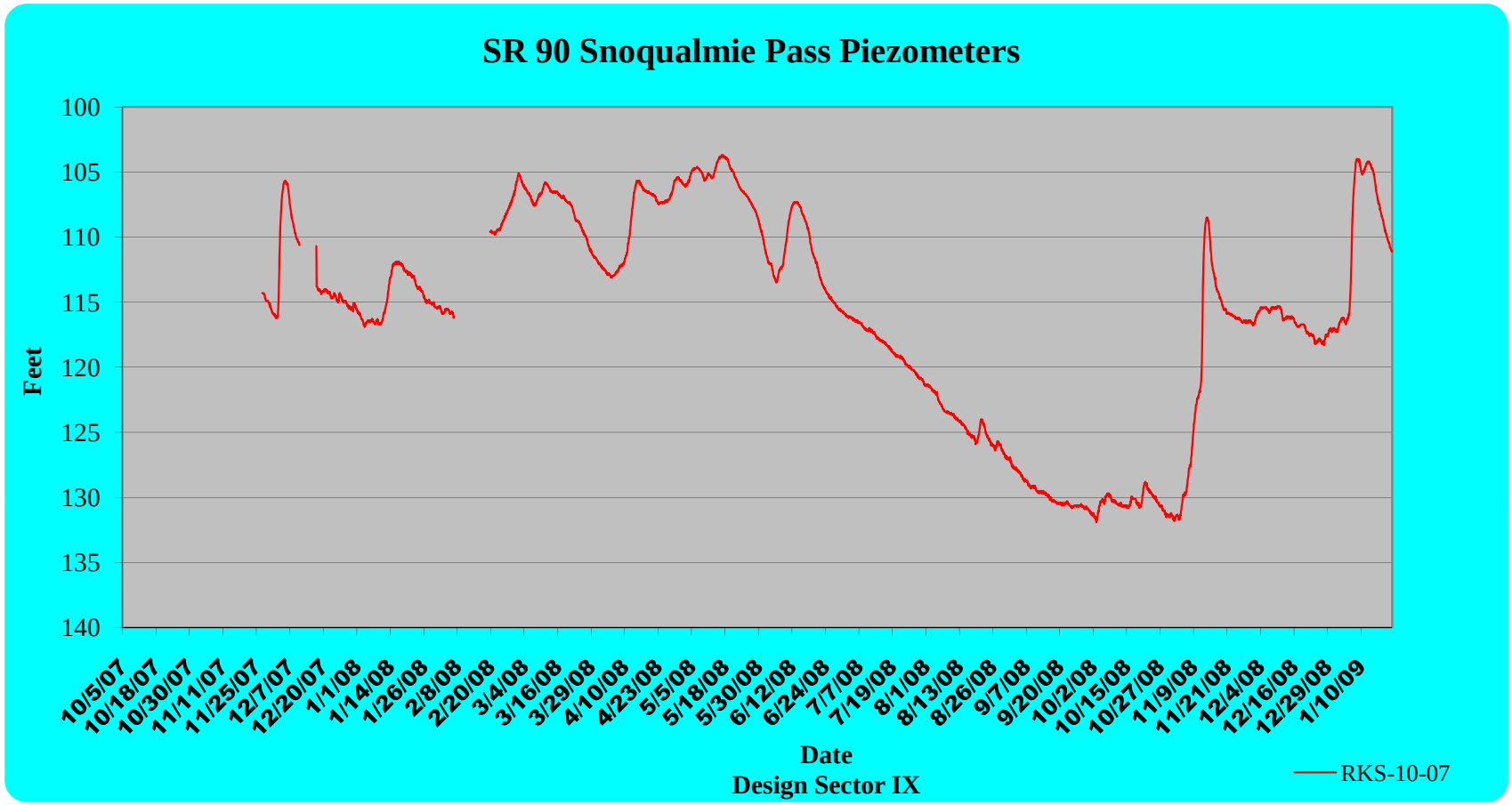
Design Sector IX
RKS-09-07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Design Sector IX
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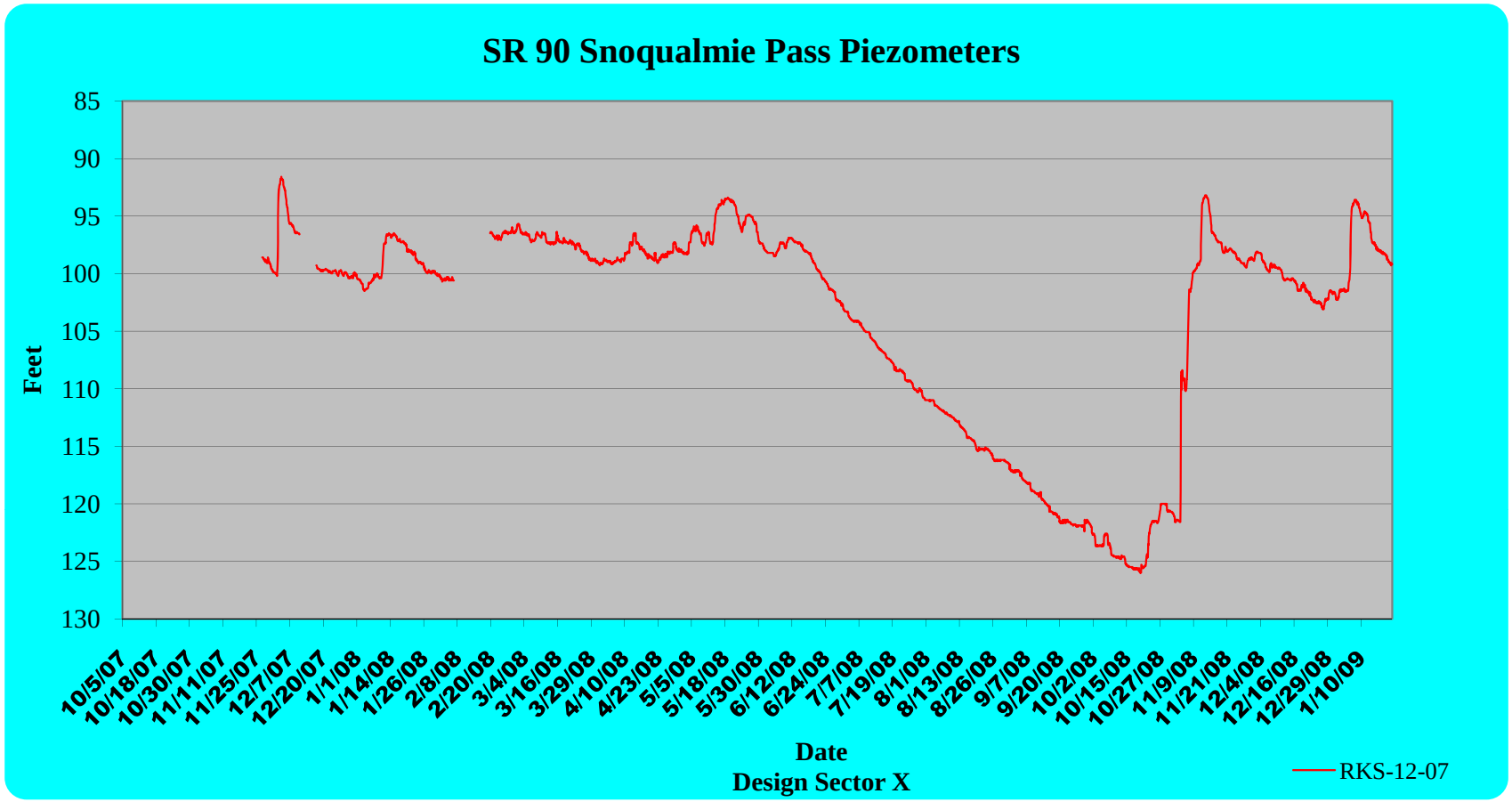
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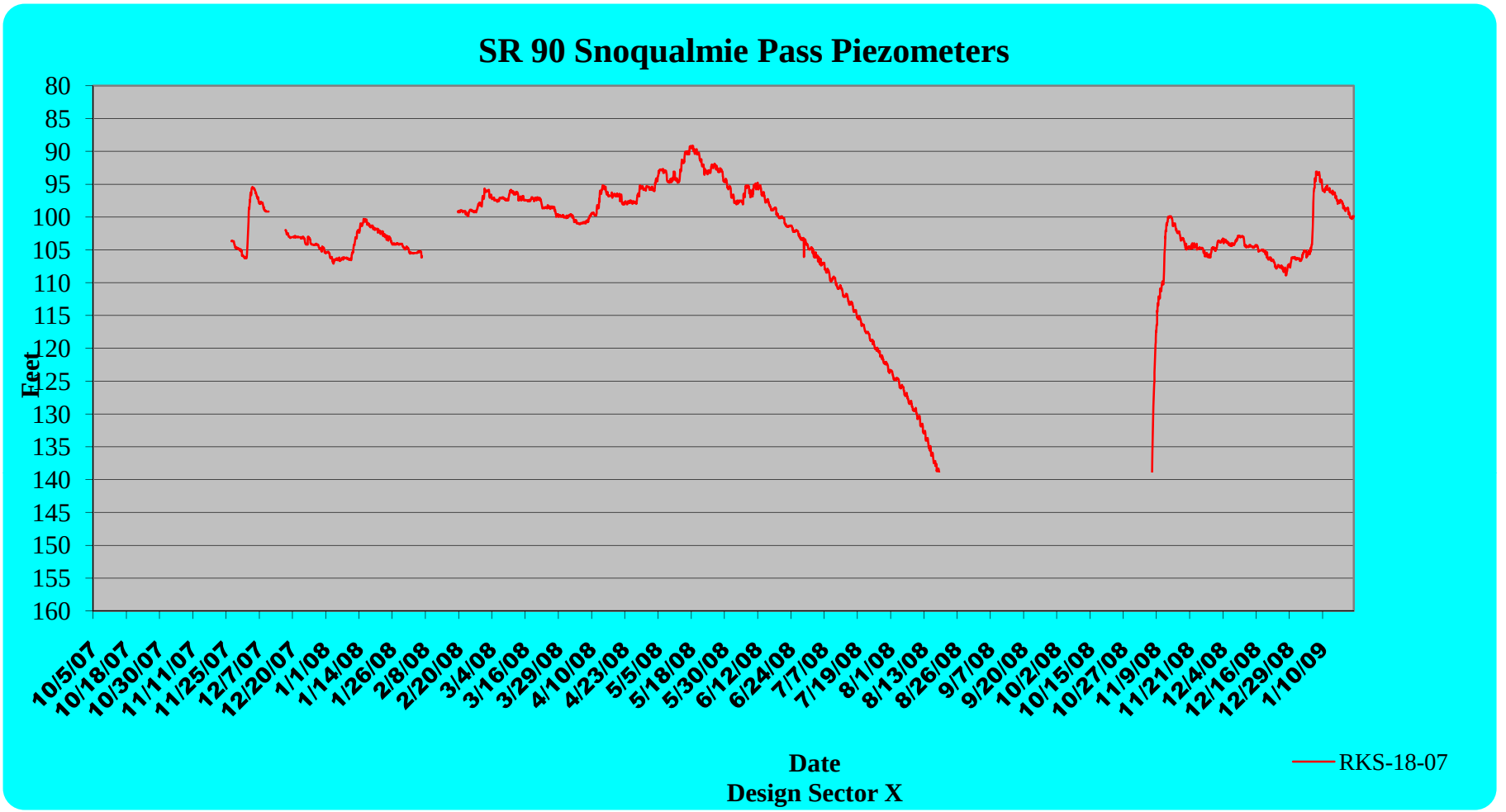
RKS-12-07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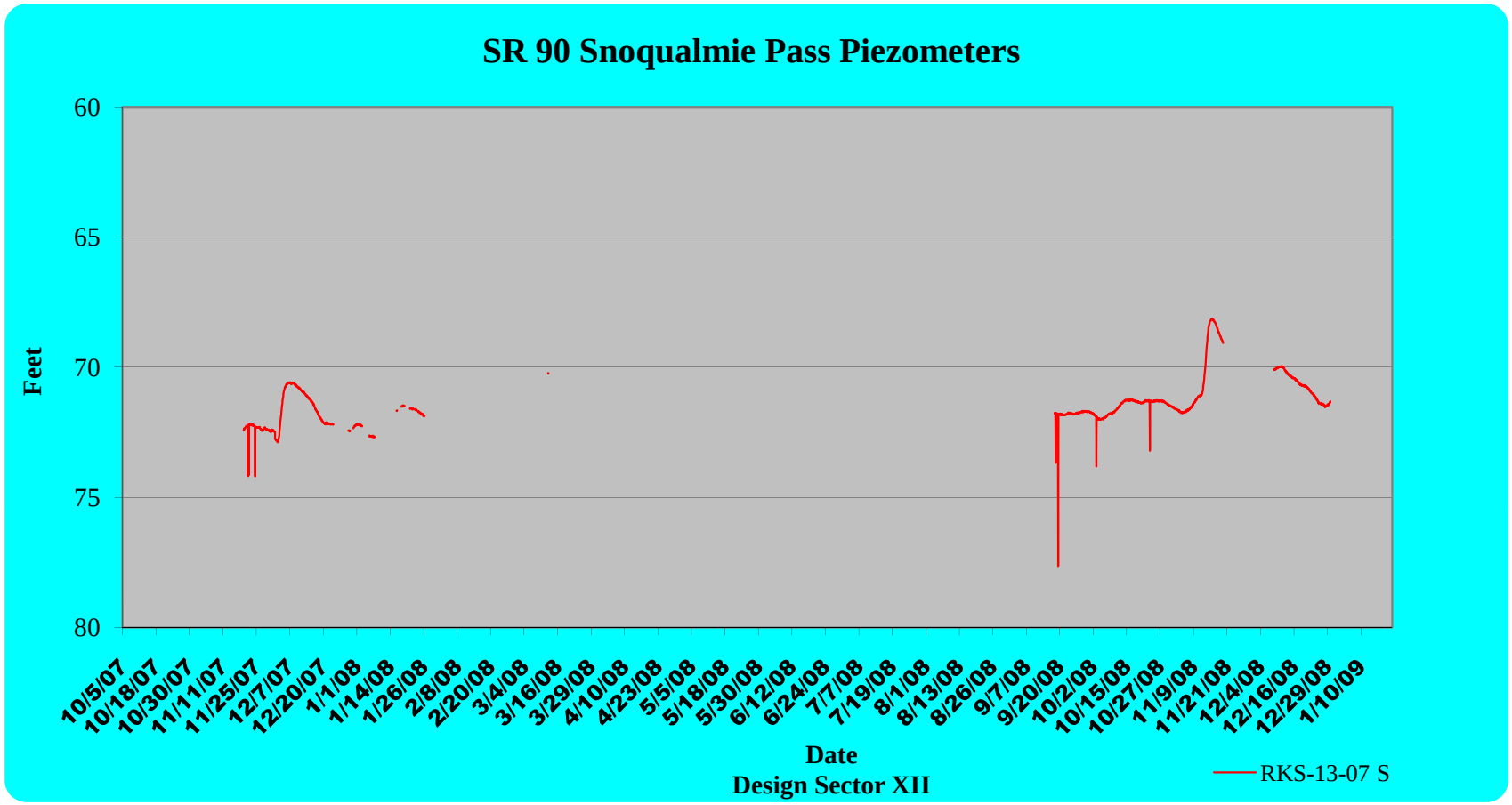
Design Sector X
RKS-18-07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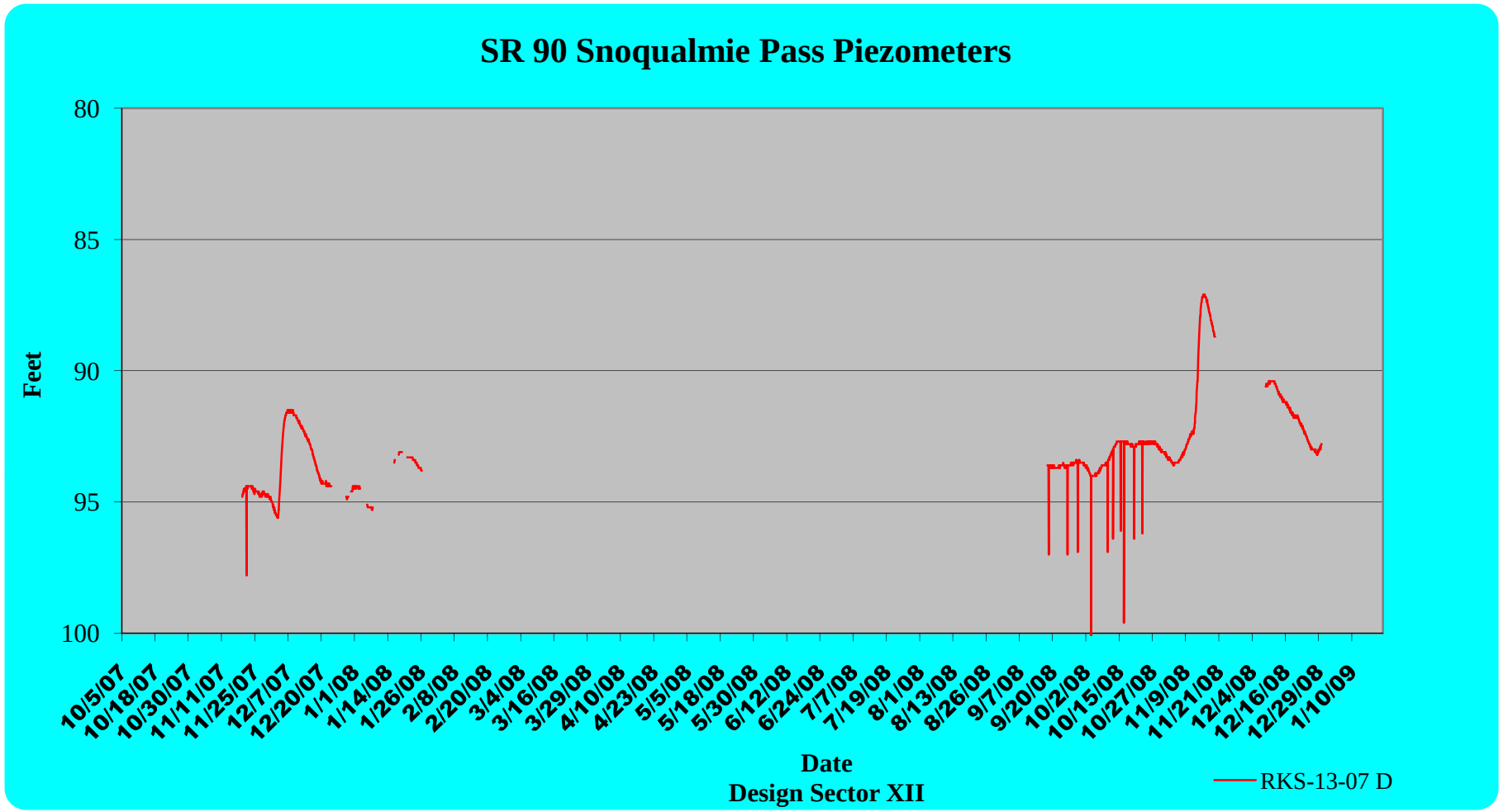
Date
Design Sector XII
RKS-13-07 S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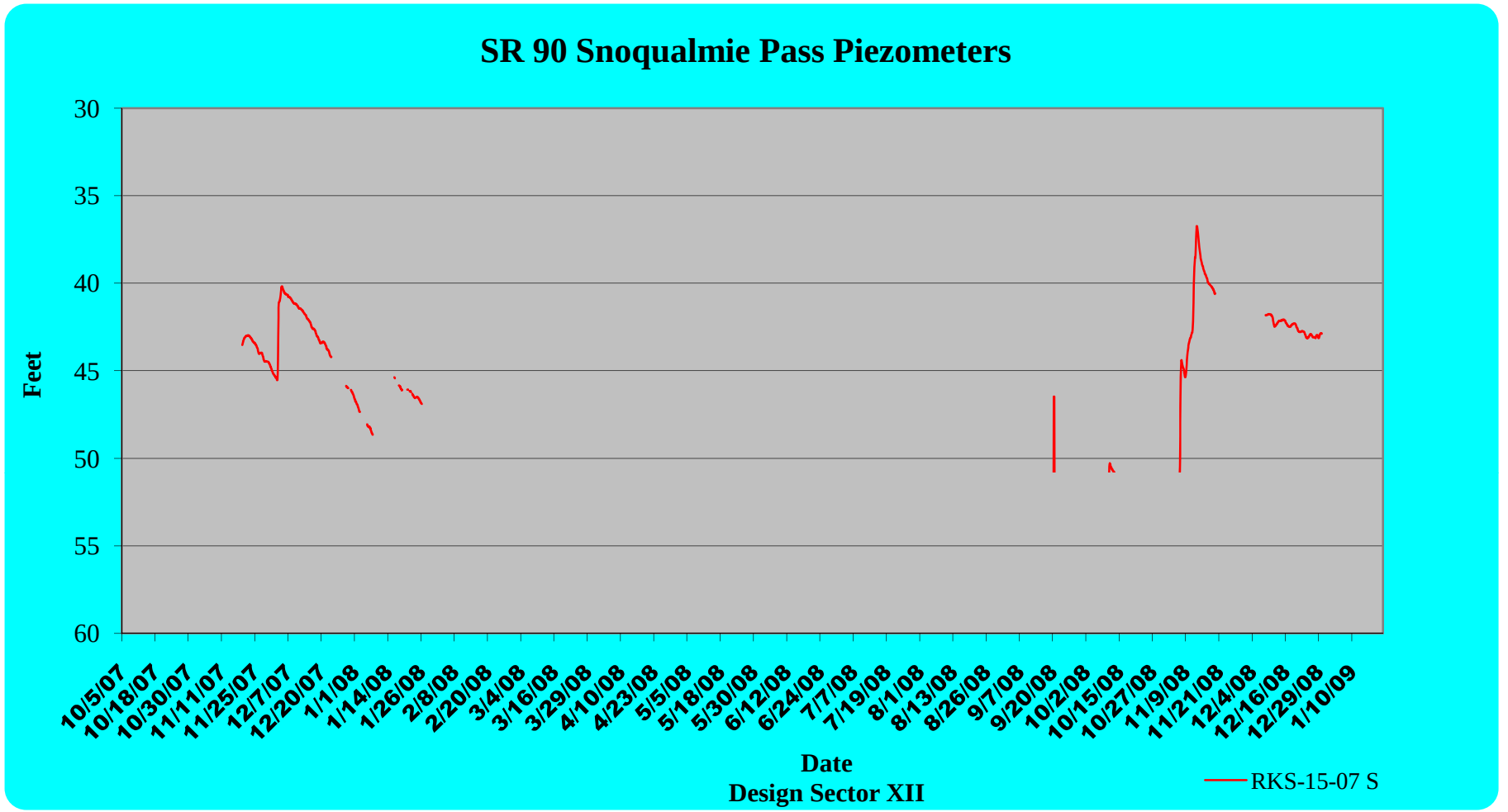
Design Sector XII
RKS-13-07 D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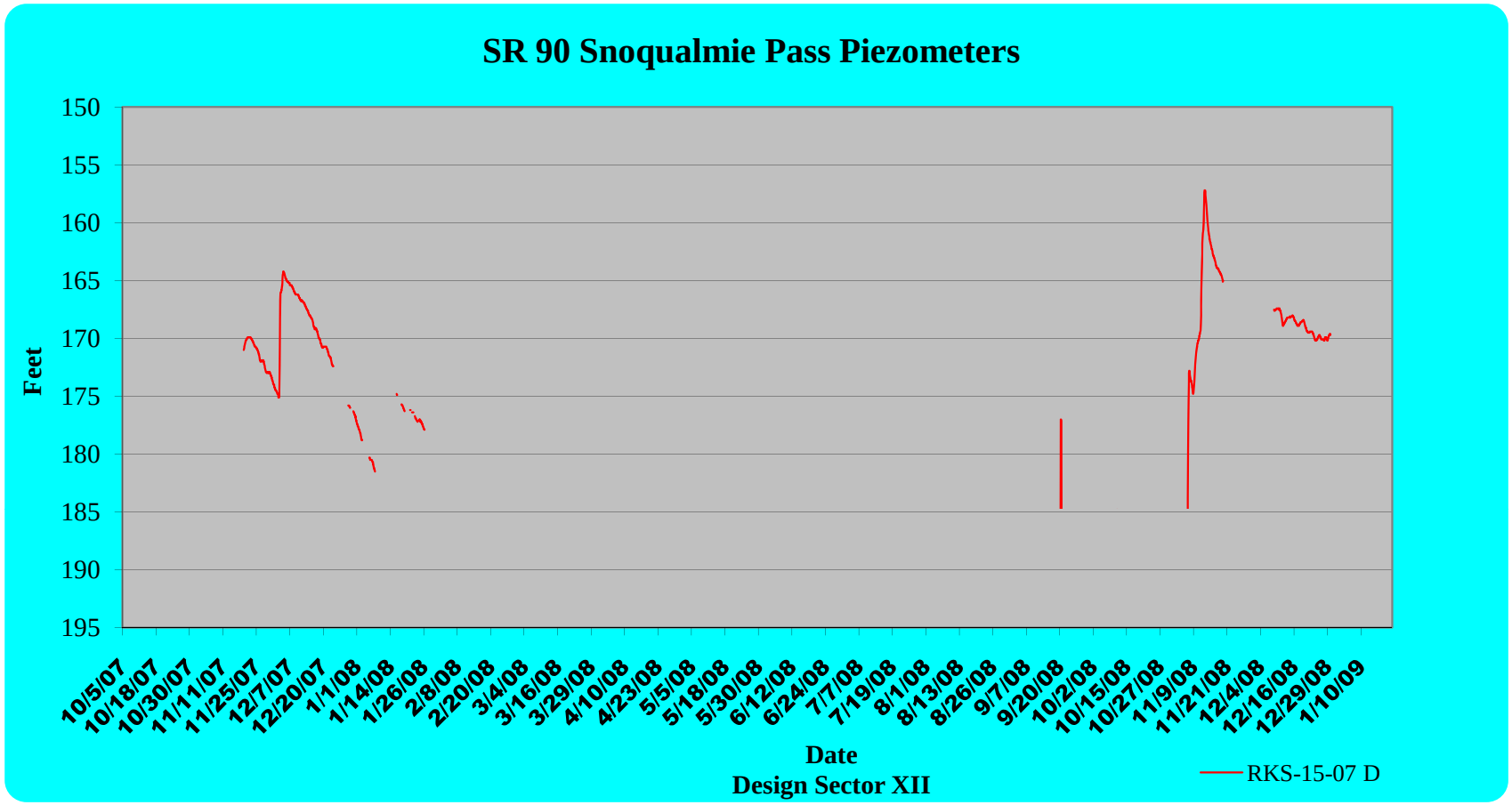
Design Sector XII
RKS-15-07 S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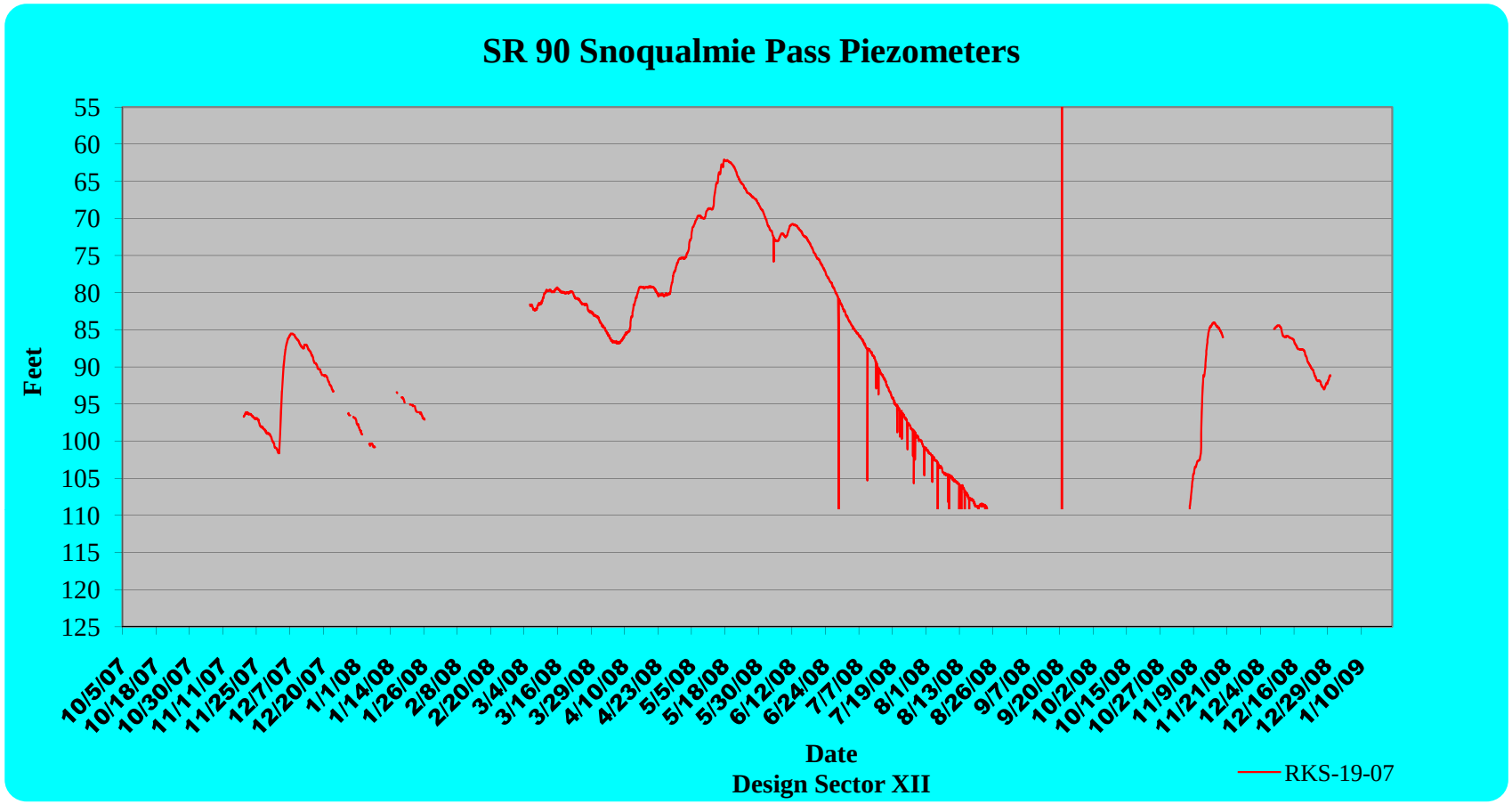
Design Sector XII
RKS-15-07 D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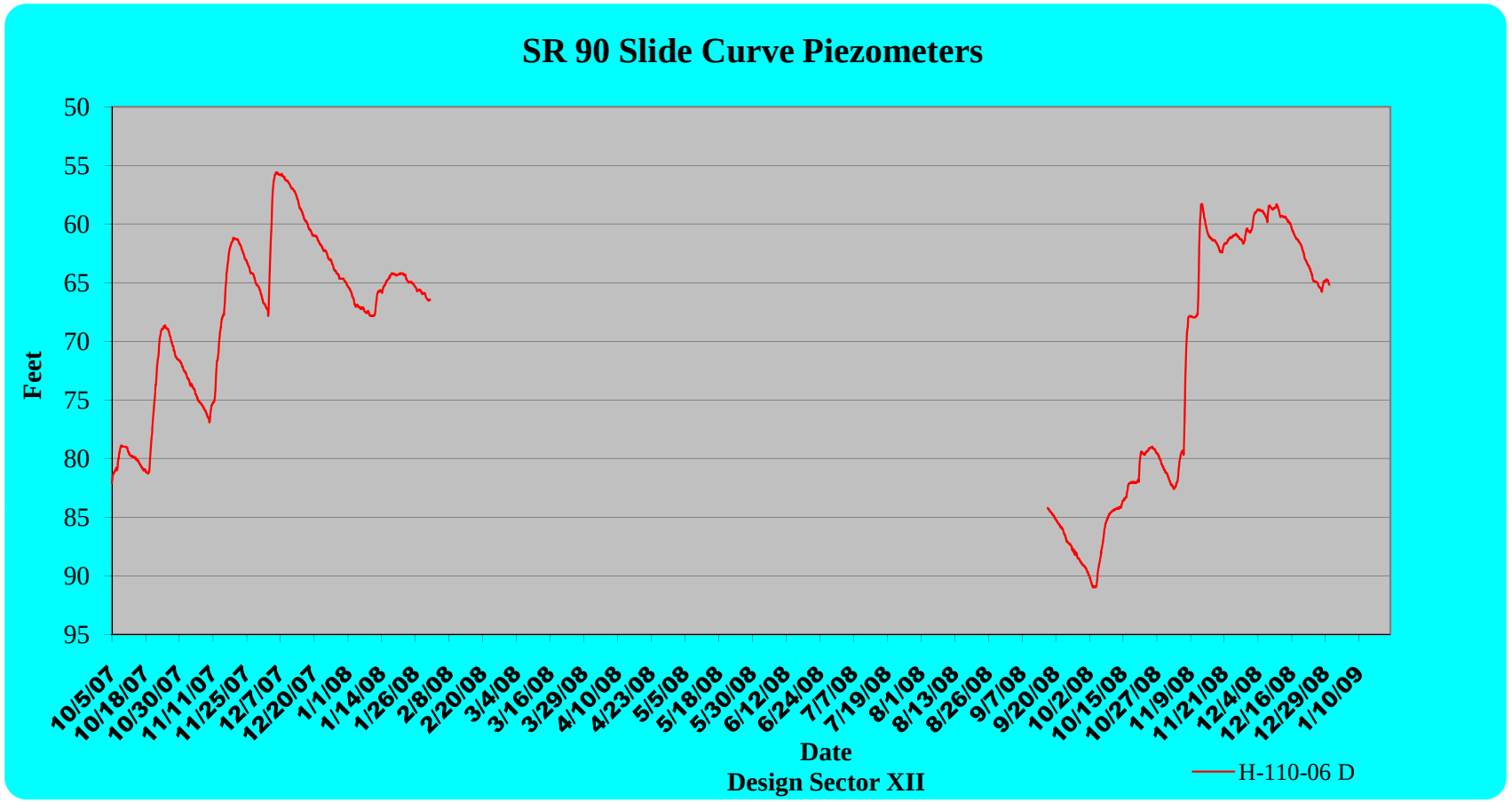
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Design Sector XII
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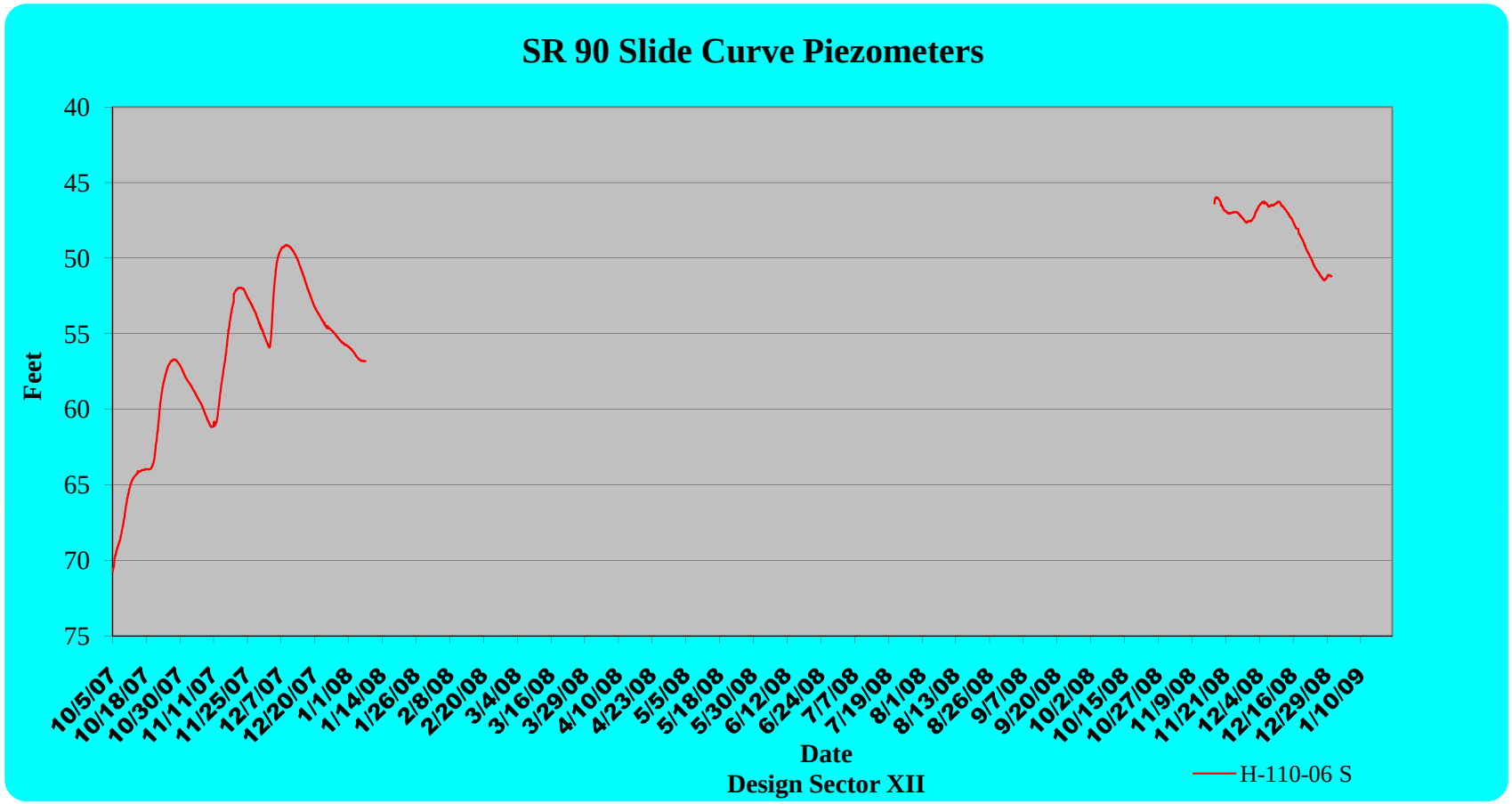
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