



THURBER ENGINEERING LTD.

**ALBERTA TRANSPORTATION
NORTH CENTRAL REGION – ATHABASCA AREA
INSTRUMENTATION MONITORING RESULTS**

FALL 2011

SECTION C

SITE NC14: HWY 661:02 FORT ASSINIBOINE

1. OBSERVATIONS

1.1 Field Program and Instrumentation Status

Two slope inclinometers (SI06-6 and 06-11) and twelvestandpipe piezometers (SP06-1, 06-2, 06-3, 06-4, 06-5, 06-9, 06-10, 06-13, 06-14, 06-17, 06-18 and 06-19) were read at the HWY 661:02 Fort Assiniboine site on September 27, 2011, by Mr. Justin Sousa, C.E.T. and Mr. Francis O'Brien, E.I.T., of Thurber Engineering Ltd. (Thurber). SI06-12 has been destroyed since the Spring 2011 readings.

Three levelloggers (SP06-2, SP06-3 and SP06-13) and two vibrating wire piezometers (SP06-4 and SP06-5) attached to a datalogger were inserted in selected standpipes in November 2010 to provide continuous monitoring of water levels. A weather station was also activated on site in Spring 2011 to record rainfall data.

The SI's were read using a RST Digital Inclinometer probe with 2 ft wheelbase and a RST Pocket PC readout. Inclinometer reading depths were defined as per cable markings with respect to the top of the inclinometer casing. The standpipe piezometers were read using a SINCO dipmeter.



2. INTERPRETATION

2.1 General

SI plots for A and B directions are presented in Section D and are summarized below. Where movement has been recorded the resultant plot (X direction) and rate of movement have also been provided. Standpipe piezometer results are also provided in Section D.

2.2 Zones of Movement

No new zones of movement were observed since the last set of readings in the spring of 2011.

Historical zones of movement are summarized on Table NC14-1 at the end of this report. Table NC14-1 also provides a historical account of the total movement that has occurred at this site since the initialization of the slope inclinometers, the depth of movement, and the maximum rate of movement.

2.3 Interpretation of Monitoring Results

Slope inclinometers SI06-6 and SI06-11 have shown no discernible movement since the spring 2011 readings. SI06-12 has been blocked or destroyed since the spring 2011 readings.

There were minor variations in the water levels, since the spring 2011 readings, ranging from a decrease of 0.20 m in SP06-5 to an increase of 0.60 m in SP06-17.

Water level plots, provided at two different scales, were prepared for the levelloggers and vibrating wire piezometers to show the variation in water level in SP06-2, SP06-3, SP06-4, SP06-5 and SP06-13 over the period of November 5, 2010 to September 27, 2011. The levelloggers located in SP06-2, SP06-3 and SP06-13 indicated a range in the depth below ground surface to the water level of 6.00 m to 6.08 m, 5.99 m to 6.11 m, and 7.43 m to 7.55 m, respectively, since the readings on November 5, 2010. Vibrating wire piezometers located in SP06-4 and SP06-5 indicated a range in the depth below ground surface to the water level of 8.27 m to 8.70 m and 14.14 m to 14.41 m, respectively, since the initial readings on November 5, 2010. The instruments in SP06-2, SP06-3, SP06-4, SP06-5 and SP06-13 were installed at a depth of 7.25 m, 9.22 m, 12.22 m, 19.07 m and 8.90 m, respectively, below ground surface. The plots of the groundwater level in relation to temperature and precipitation are attached in Section D.



Total precipitation taken from Alberta Environment's weather station in Barrhead was plotted in relation to the water levels in SP06-2, SP06-3, SP06-4, SP06-5 and SP06-13. The VWs and Levelloggers showed an increase in water level with increased precipitation. SP06-2, SP06-3, and SP06-4 screened in sand showed a higher response to change in rainfall as compared to SP06-05 and SP06-13 which were screened in clay. SP06-4 and SP06-5 showed a decrease in water level as temperature dropped and winter season started. With spring and temperature increase, water levels increased. SP06-13 located downslope of Hwy. 661 showed a similar trend in water level as the other four instruments located upslope of Hwy. 661.

3. RECOMMENDATIONS

3.1 Future Work

The instruments should be read again in the spring of 2012.

3.2 Instrumentation Repairs

No instrument repairs are needed at this time.



**TABLE NC14-1
FALL 2011 – FORT ASSINIBOINE
SLOPE INCLINOMETER
INSTRUMENTATION READING SUMMARY**

Date Monitored: September 27, 2011

INSTRUMENT #	DATE INITIALIZED	TOTAL CUMULATIVE RESULTANT MOVEMENT AND DEPTH OF MOVEMENT TO DATE (mm)	MAXIMUM RATE OF MOVEMENT (mm/yr)	CURRENT STATUS OF SI	DATE OF PREVIOUS READING	INCREMENTAL MOVEMENT SINCE PREVIOUS READING (mm)	CURRENT RATE OF MOVEMENT (mm/yr)	CHANGE IN RATE OF MOVEMENT SINCE PREVIOUS READING (mm/yr)
SI06-6	Mar. 31, 2006	No discernable movement	N/A	Operational	May 13, 2011	No discernible movement	N/A	N/A
SI06-11	Apr. 1, 2006	No discernable movement	N/A	Operational	May 13, 2011	No discernible movement	N/A	N/A
SI06-12	Mar. 30, 2006	4.3 over 6.4 m depth to 6.8 m depth in 193° direction	1.5 mm/yr between September 2010 and May 2011	Blocked/ Destroyed	May 13, 2011	N/A	N/A	N/A
SI06-15	Mar. 28, 2006	No discernable movement	N/A	Blocked	May 22, 2007	N/A	N/A	N/A
SI06-16	Mar. 29, 2006	4.0 over 4.6 m depth to 8.2 m depth in 183° direction	2.6 mm/yr between May 2007 and May 2008	Sheared off at 7.8 m	Sept. 28, 2009	N/A	N/A	N/A



**TABLE NC14-2
FALL 2011 – FORT ASSINIBOINE
STANDPIPE PIEZOMETER
INSTRUMENTATION READING SUMMARY**

Date Monitored: September 27, 2011

INSTRUMENT #	DATE INITIALIZED	TIP ELEV. (m)	GROUND ELEV. (m)	CURRENT STATUS	MAXIMUM GROUNDWATER ELEV. (m)	MEASURED GROUNDWATER ELEVATION (m) (FALL 2011)	PREVIOUS READING (m) (SPRING 2011)	CHANGE IN GROUNDWATER ELEV. SINCE PREVIOUS READING (m)
SP06-1	Apr. 2, 2006	9.13 mBGS	N/A	Active	Oct. 5, 2007 (2.35 mBGS)	(2.55 mBGS)	(2.68 mBGS)	0.13
SP06-2	Apr. 2, 2006	9.12 mBGS	N/A	Active	May 28, 2006 (5.51 mBGS)	(6.08 mBGS)	(6.03 mBGS)	-0.05
SP06-3	Apr. 2, 2006	25.00 mBGS	N/A	Active	May 28, 2006 (5.54 mBGS)	(6.08 mBGS)	(6.02 mBGS)	-0.06
SP06-4	Mar. 31, 2006	15.21 mBGS	N/A	Active	Oct. 5, 2007 (8.72 mBGS)	(8.93 mBGS)	(8.89 mBGS)	-0.04
SP06-5	Mar. 31, 2006	25.00 mBGS	N/A	Active	Apr. 2, 2006 (9.46 mBGS)	(14.87 mBGS)	(14.67 mBGS)	-0.20
SP06-9	Apr. 1, 2006	15.24 mBGS	N/A	Active	Apr. 2, 2006 (4.46 mBGS)	(6.75 mBGS)	(6.73 mBGS)	-0.02
SP06-10	Apr. 2, 2006	25.00 mBGS	N/A	Active	Apr. 2, 2006 (6.72 mBGS)	(7.92 mBGS)	(7.97 mBGS)	0.05
SP06-13	Apr. 2, 2006	9.95 mBGS	N/A	Active	Oct. 5, 2007 (7.10 mBGS)	(7.16 mBGS)	(7.19 mBGS)	0.03
SP06-14	Mar. 28, 2006	9.16 mBGS	N/A	Active	Oct. 5, 2007 (7.03 mBGS)	(7.07 mBGS)	(7.40 mBGS)	0.33

**TABLE NC14-2 CONTINUED...
FALL 2011 – FORT ASSINIBOINE
STANDPIPE PIEZOMETER
INSTRUMENTATION READING SUMMARY**

Date Monitored: September 27, 2011

INSTRUMENT #	DATE INITIALIZED	TIP ELEV. (m)	GROUND ELEV. (m)	CURRENT STATUS	MAXIMUM GROUNDWATER ELEV. (m)	MEASURED GROUNDWATER ELEVATION (m) (FALL 2011)	PREVIOUS READING (m) (SPRING 2011)	CHANGE IN GROUNDWATER ELEV. SINCE PREVIOUS READING (m)
SP06-17	Apr. 2 2006	8.83 mBGS	N/A	Active	27 September 2011 (6.12 mBGS)	(6.12 mBGS)	(6.72 mBGS)	0.60
SP06-18	Apr. 2, 2006	9.43 mBGS	N/A	Active	10 October 2006 (6.80 mBGS)	(7.31 mBGS)	(7.55 mBGS)	0.24
SP06-19	Apr. 2, 2006	7.95 mBGS	N/A	Active	10 October 2006 (7.01 mBGS)	Dry	Dry	N/A
A11	N/A	N/A	N/A	<i>Destroyed</i>	28 May 2006 (6.70 mBGS)	N/A	N/A	N/A

Drawing 15-16-260-NC14 in section D provides a sketch of the approximate location of the monitoring instrumentation for this site.



**ALBERTA TRANSPORTATION
NORTH CENTRAL REGION – ATHABASCA AREA
INSTRUMENTATION MONITORING RESULTS**

FALL 2011

**SECTION D
DATA PRESENTATION**

SITE NC14: HWY 661:02 FORT ASSINIBOINE

ALBERTA TRANSPORTATION
 NORTH CENTRAL REGION - ATHABASCA AREA
 SLOPE INCLINOMETER MONITORING FIELD SUMMARY (NC14)
 FALL 2011

Location: HWY 661:02, Fort Assiniboine File Number: 15-16-260 Probe: RST #4 Cable: RST #4	Readout: RST Extension: 2.75" Temp: 20°C Read by: JCS/FOB
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SLOPE INCLINOMETER (SI) READINGS

SI#	GPS Location (NAD83)		Date	Stickup (ft)	Depth from top of casing (ft)	Azimuth of A+ Groove	Current Bottom Depth Readings				Remarks
	Latitude (N)	Longitude (W)					A+	A-	B+	B-	
06-6	54.3388890	114.7741670	27-Sep-11	3	83 to 5	170°	544	-557	404	-416	
06-11	54.3390330	114.7719000	27-Sep-11	3	81 to 3	181°	362	-375	-674	662	
06-12	54.3386110	114.7744440	27-Sep-11	3	67 to 5	179°	-	-	-	-	*

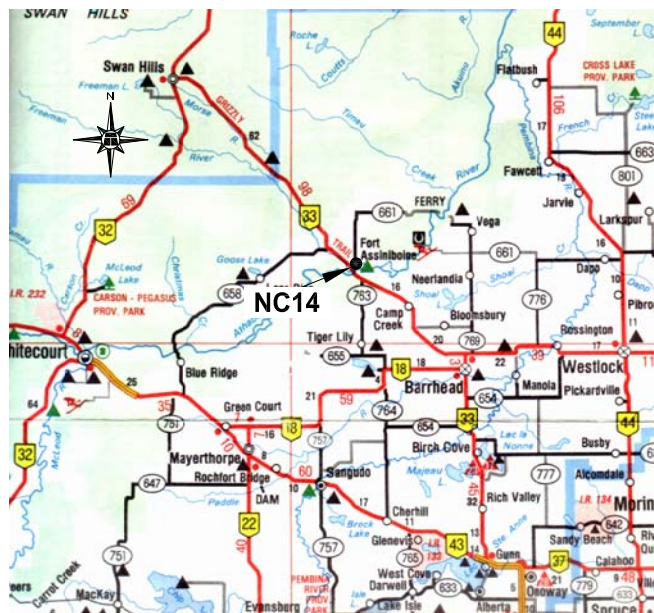
STANDPIPE PIEZOMETER (SP) READINGS

SP#	GPS Location (NAD83)		Date	Stick-up (m)	Reading below top of casing (m)	Bottom Pipe Depth (below top of casing (m))
	Latitude (N)	Longitude (W)				
06-1	54.340556	114.775833	27-Sep-11	1.05	3.60	9.13
06-2	54.339500	114.773383	27-Sep-11	0.95	7.03	9.12
06-3	54.339500	114.773367	27-Sep-11	0.78	6.86	25.00
06-4	54.338889	114.774167	27-Sep-11	0.78	9.71	15.21
06-5	54.338889	114.774167	27-Sep-11	0.93	15.80	25.00
06-9	55.339033	114.771900	27-Sep-11	0.72	7.47	15.24
06-10	54.339033	114.771900	27-Sep-11	0.80	8.72	25.00
06-13	54.338611	114.774444	27-Sep-11	0.90	8.06	9.95
06-14	54.338333	114.773611	27-Sep-11	0.97	8.04	9.16
06-17	54.337778	114.773056	27-Sep-11	0.65	6.77	8.83
06-18	54.336111	114.770000	27-Sep-11	1.20	8.51	9.43
06-19	54.336111	114.770000	27-Sep-11	0.99	Dry	7.95

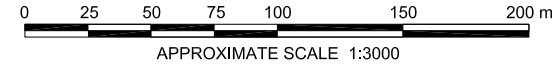
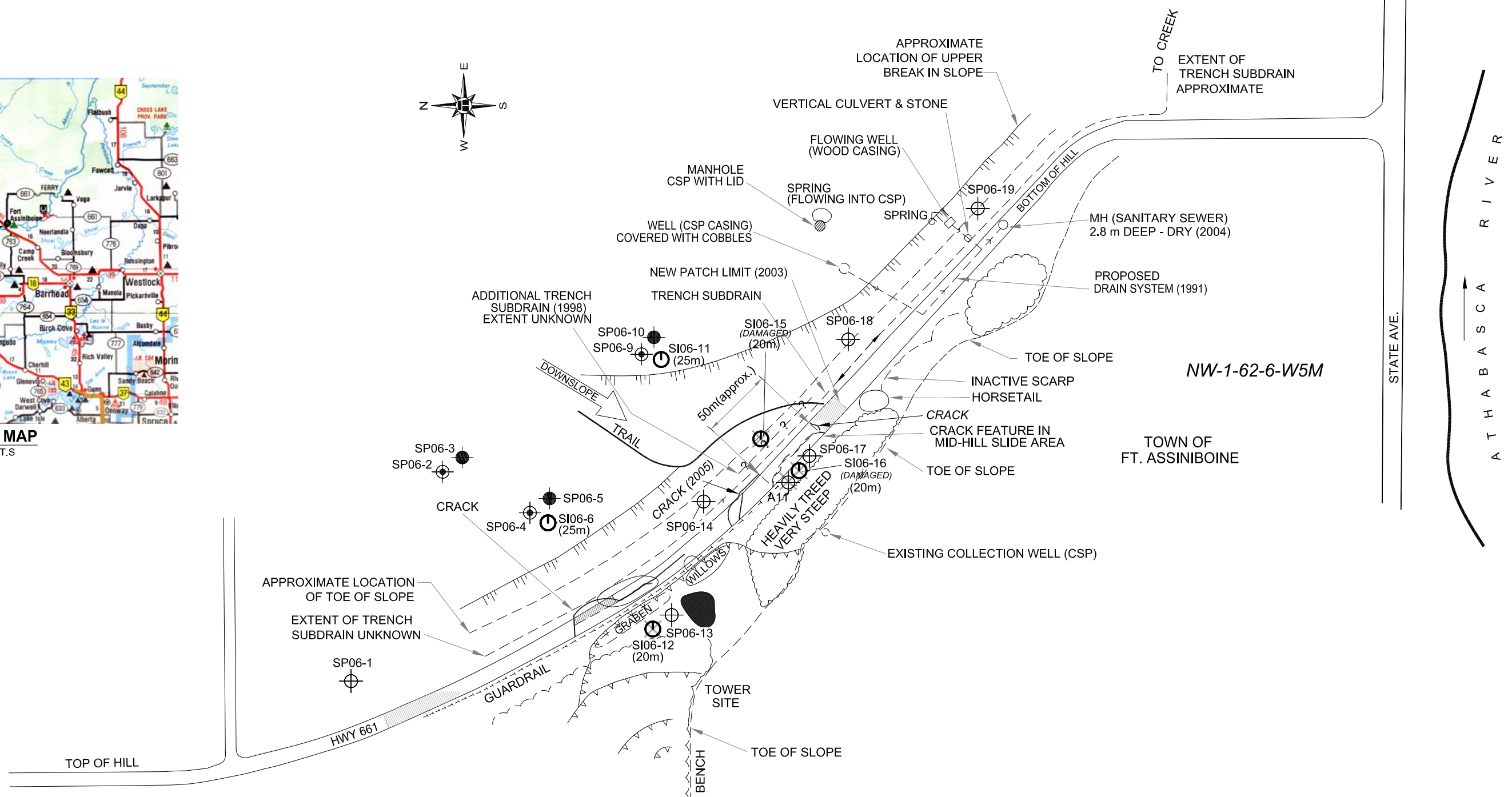
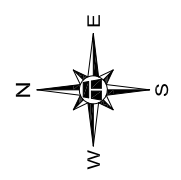
INSPECTOR REPORT ON 27-SEPT-11

*SI06-12 has been destroyed since the Spring 2011 Readings. The probe could not be inserted into the SI casing.

Z:\1516-260\FALL 2011\15-16-260 NC14.dwg



KEY MAP
N.T.S



LEGEND

- SI (m) SLOPE INCLINOMETER AND DEPTH
- SP STANDPIPE PIEZOMETER (25m DEPTH)
- SP STANDPIPE PIEZOMETER (15m DEPTH)
- SP STANDPIPE PIEZOMETER (10m DEPTH)
- SI SLOPE INCLINOMETER NON OPERATIONAL
- SP STANDPIPE PIEZOMETER NON OPERATIONAL

MR. CARTWRIGHT PROPERTY

BASE PLAN FROM THURBER ENGINEERING REPORT 15-16-192

THURBER PROJECT #15-16-260

ALBERTA TRANSPORTATION

**NC 14 - FT. ASSINIBOINE
INSTRUMENTATION LOCATIONS**

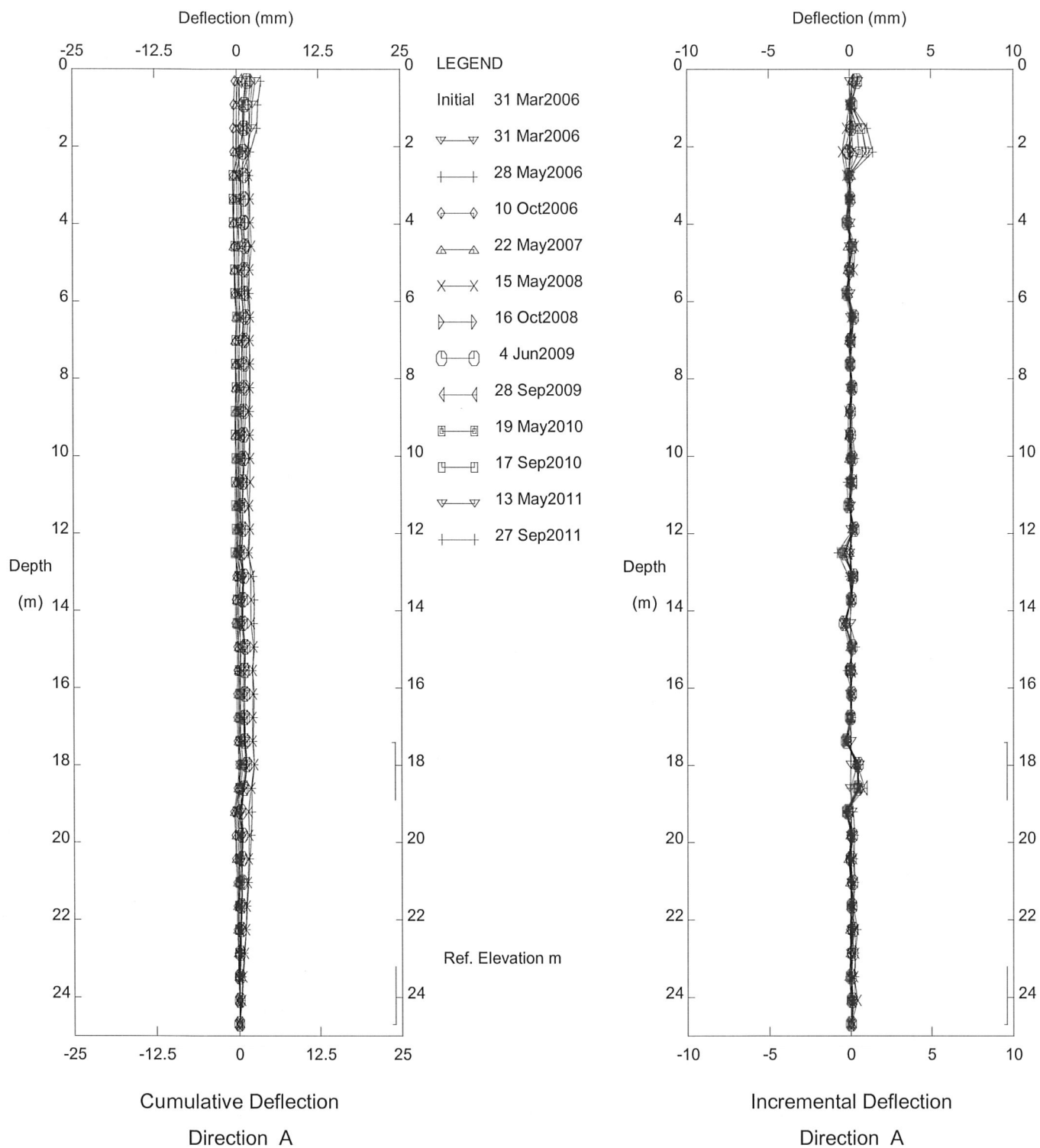
NC14 - HWY 661:02 km1.8
NW-1-62-6-W5M
N. OF FT. ASSINIBOINE, AB

NORTH CENTRAL 2011

THURBER ENGINEERING LTD.
GEOTECHNICAL • ENVIRONMENTAL • MATERIALS

ENGINEER: NFR	DRAWN: HH	APPROVED: DWP
DATE: SEPTEMBER 2011	SCALE: APPR. SCALE 1:3,000	DRAWING No. 15-16-260-NC14

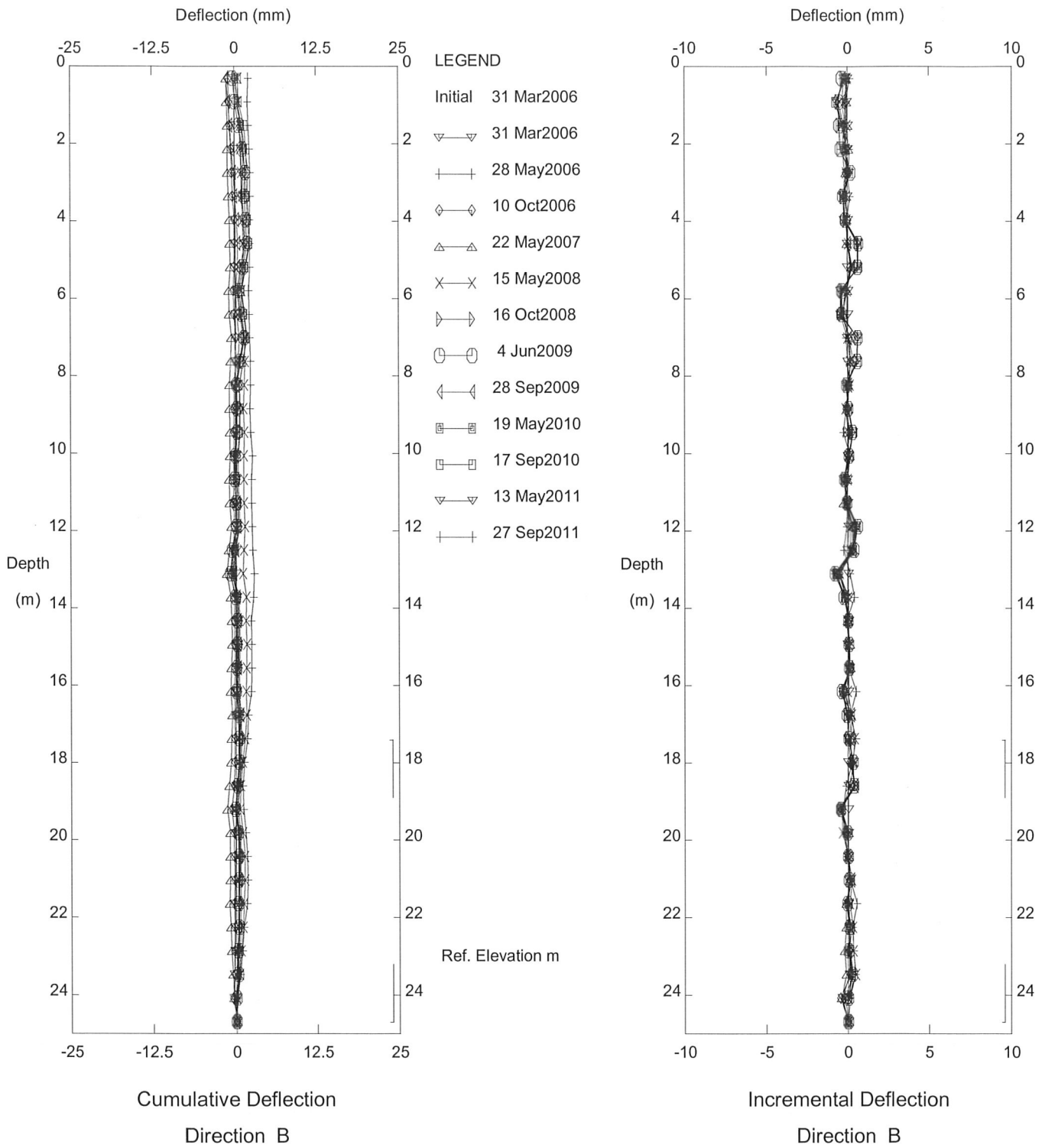
Thurber Engineering Ltd. - Edmonton, AB



Hwy 661:02 Ft Assiniboine (NC14), Inclinometer SI06-6

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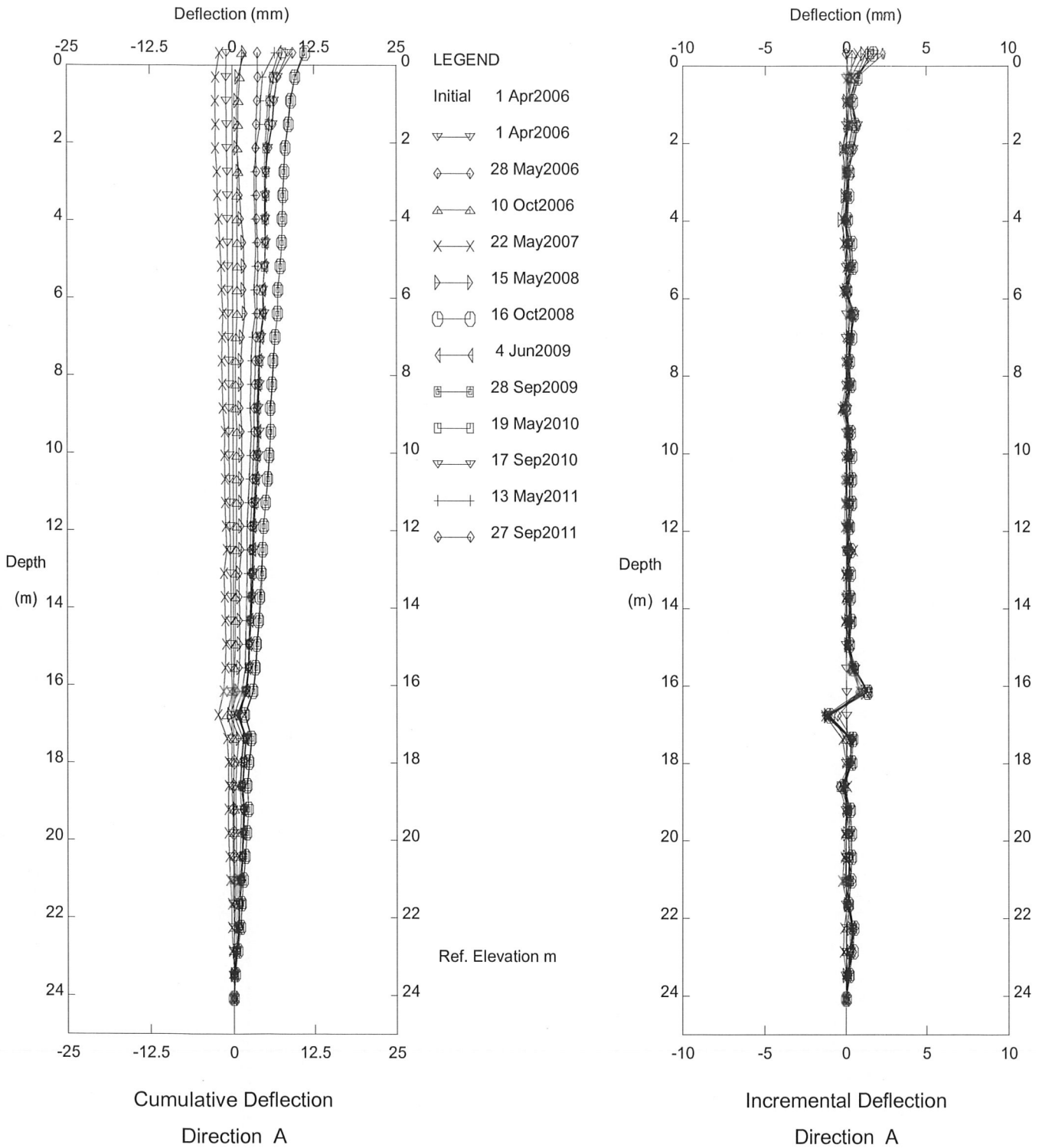
Thurber Engineering Ltd. - Edmonton, AB



Hwy 661:02 Ft Assiniboine (NC14), Inclinometer SI06-6

Alberta Transportation

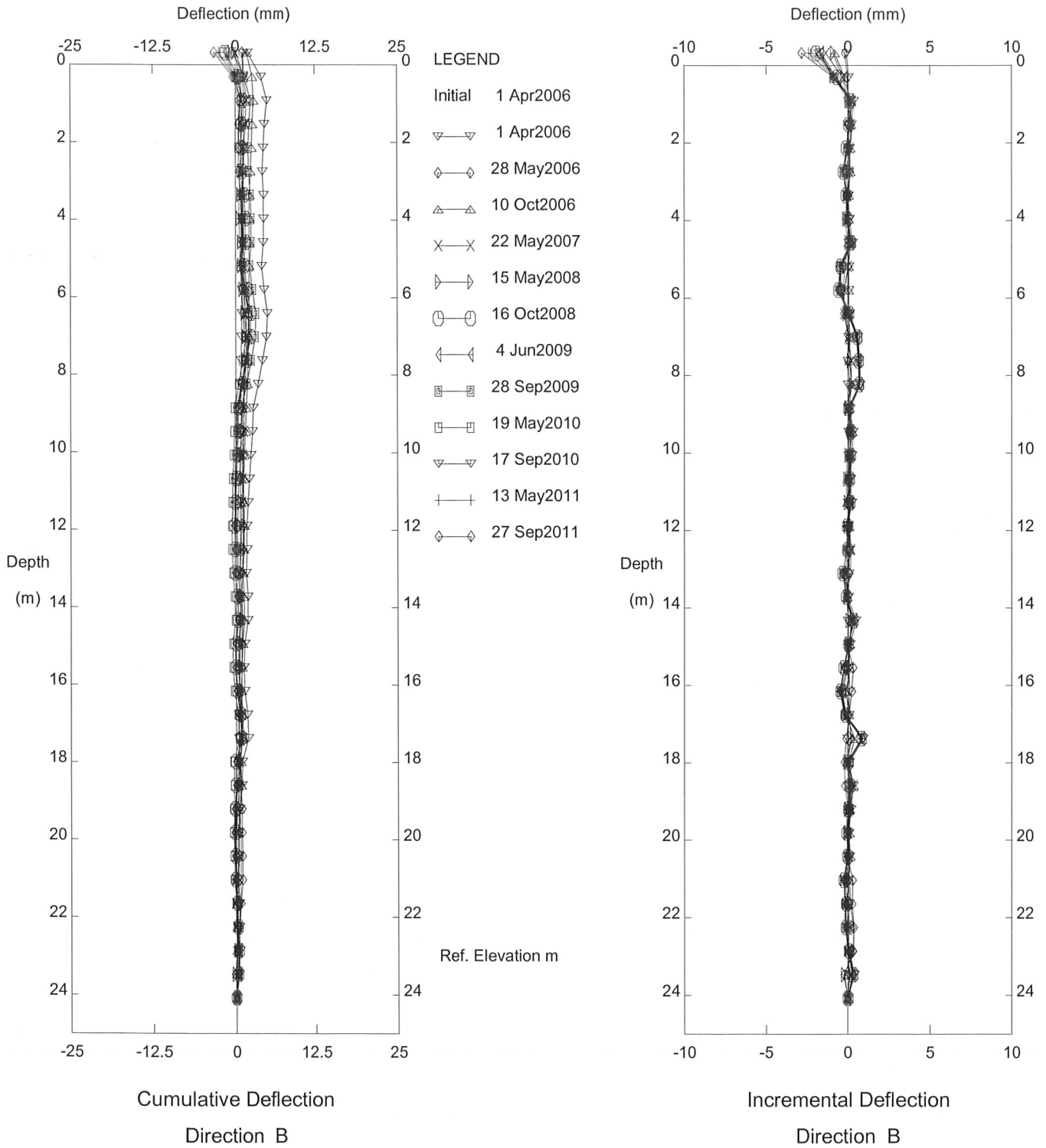
Thurber Engineering Ltd. - Edmonton, AB



Hwy 661:02 Ft Assiniboine (NC14), Inclinator SI-11

Alberta Transportation

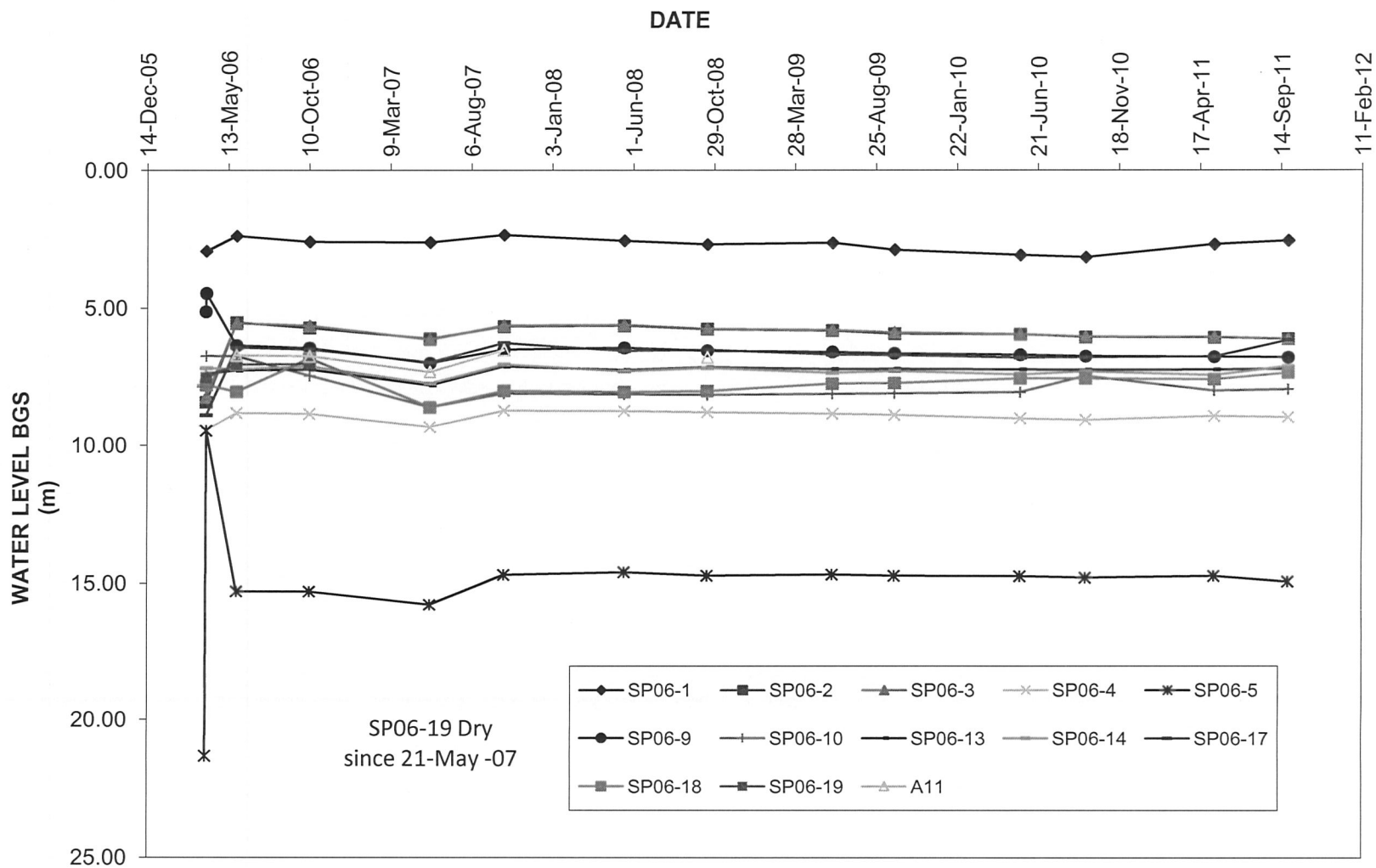
Thurber Engineering Ltd. - Edmonton, AB



Hwy 661:02 Ft Assiniboine (NC14), Inclinometer SI-11

Alberta Transportation

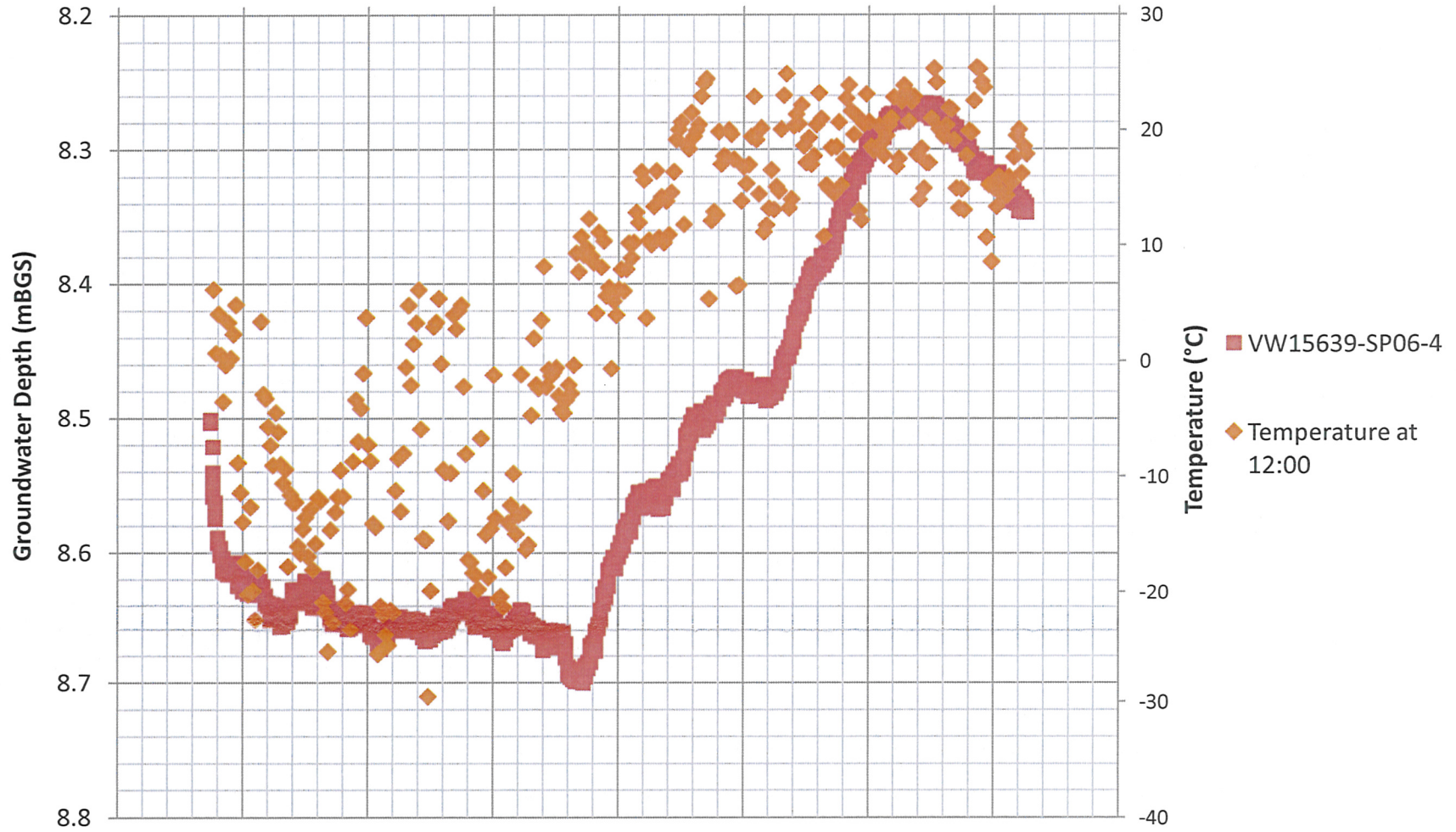
HWY661:02 FORT ASSINIBOINE (NC14) - STANDPIPE DATA WATER TABLE DEPTH



NC 14 - VW SP06-4 80 m Upslope from Highway 661

Date

29-Sep-10 18-Nov-10 7-Jan-11 26-Feb-11 17-Apr-11 6-Jun-11 26-Jul-11 14-Sep-11 3-Nov-11

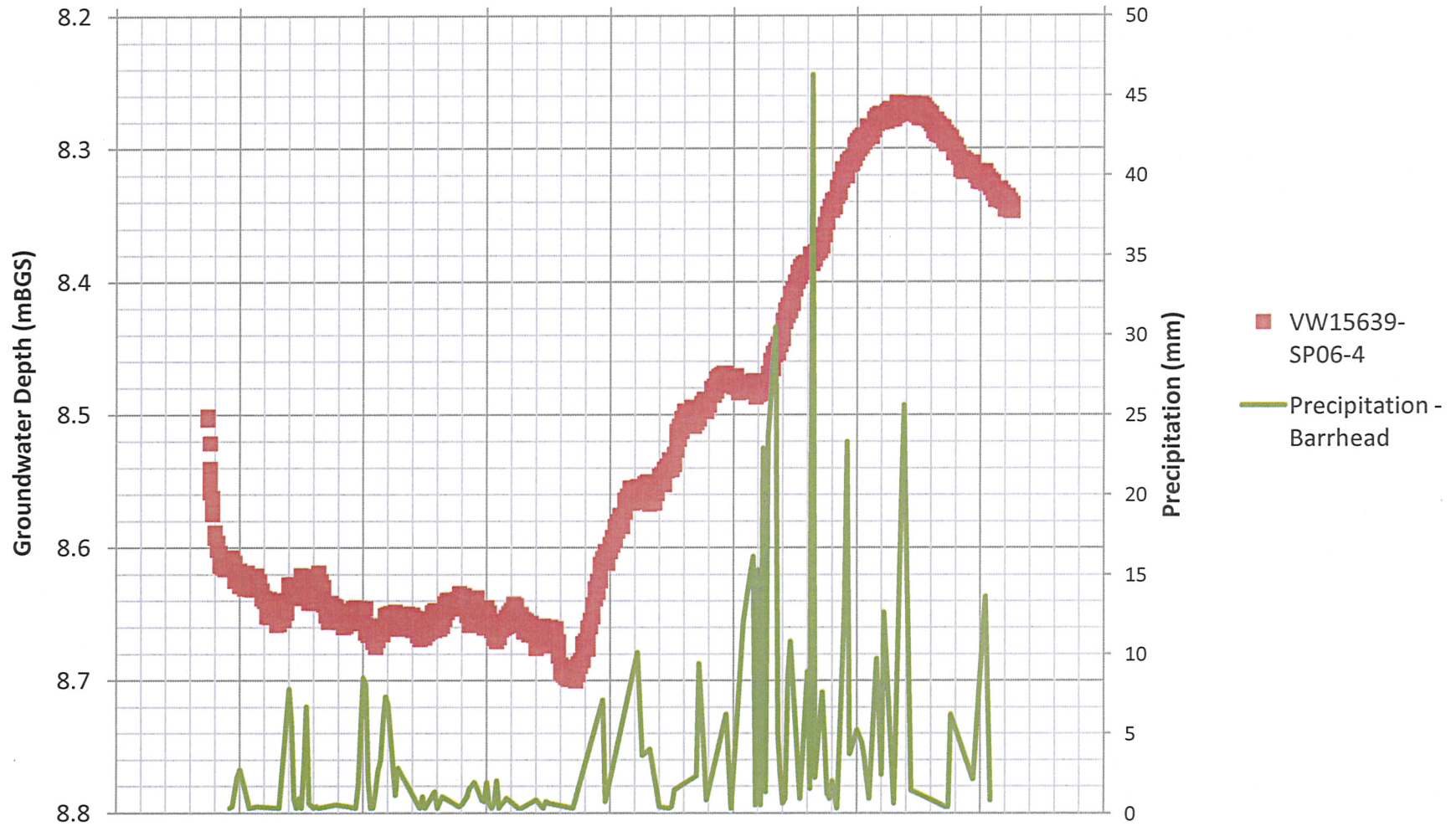


Screened in Sand from 12.2 m to 15.2 m depth.

NC 14 - VW SP06-4 80 m Upslope from Highway 661

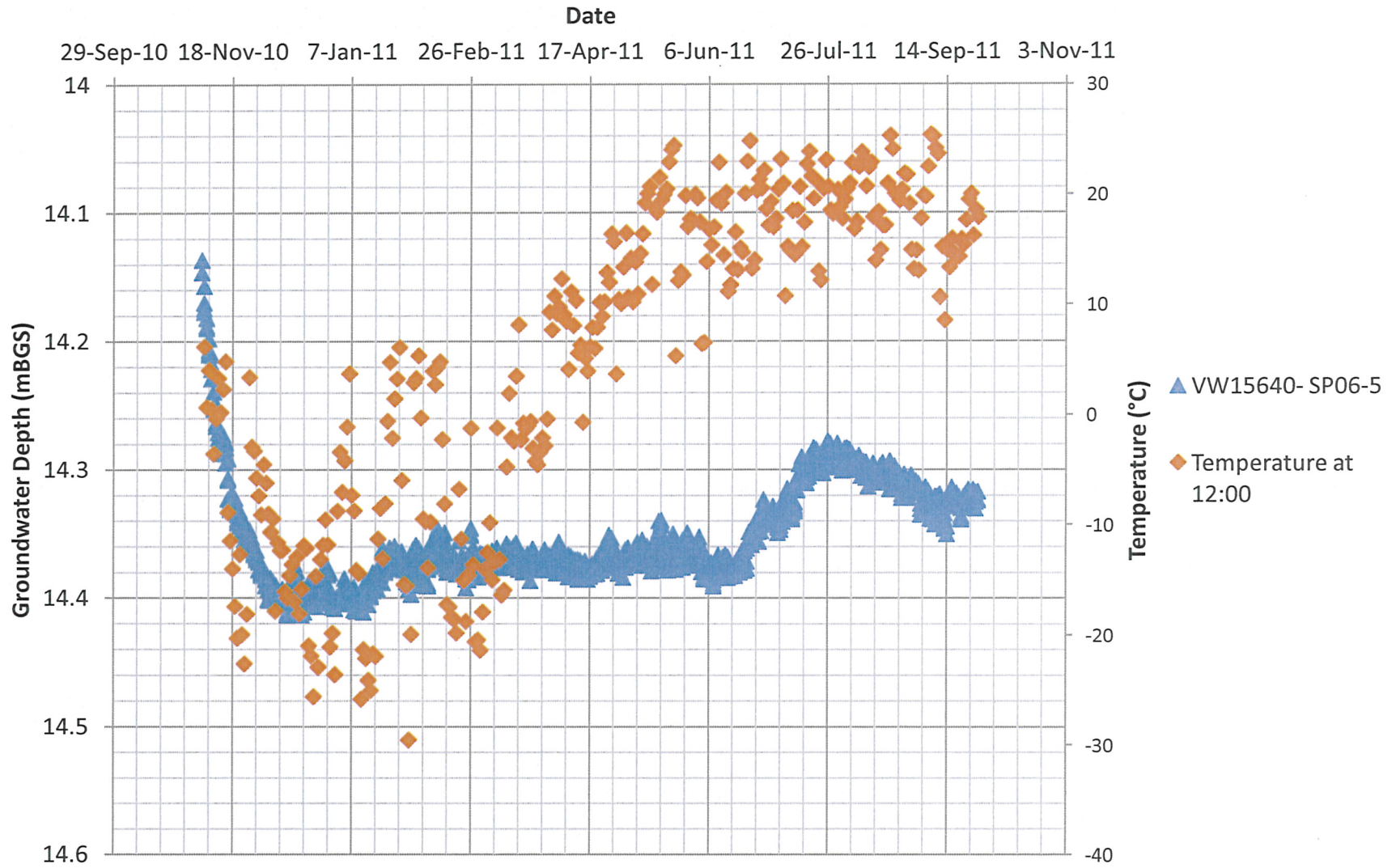
Date

29-Sep-10 18-Nov-10 7-Jan-11 26-Feb-11 17-Apr-11 6-Jun-11 26-Jul-11 14-Sep-11 3-Nov-11



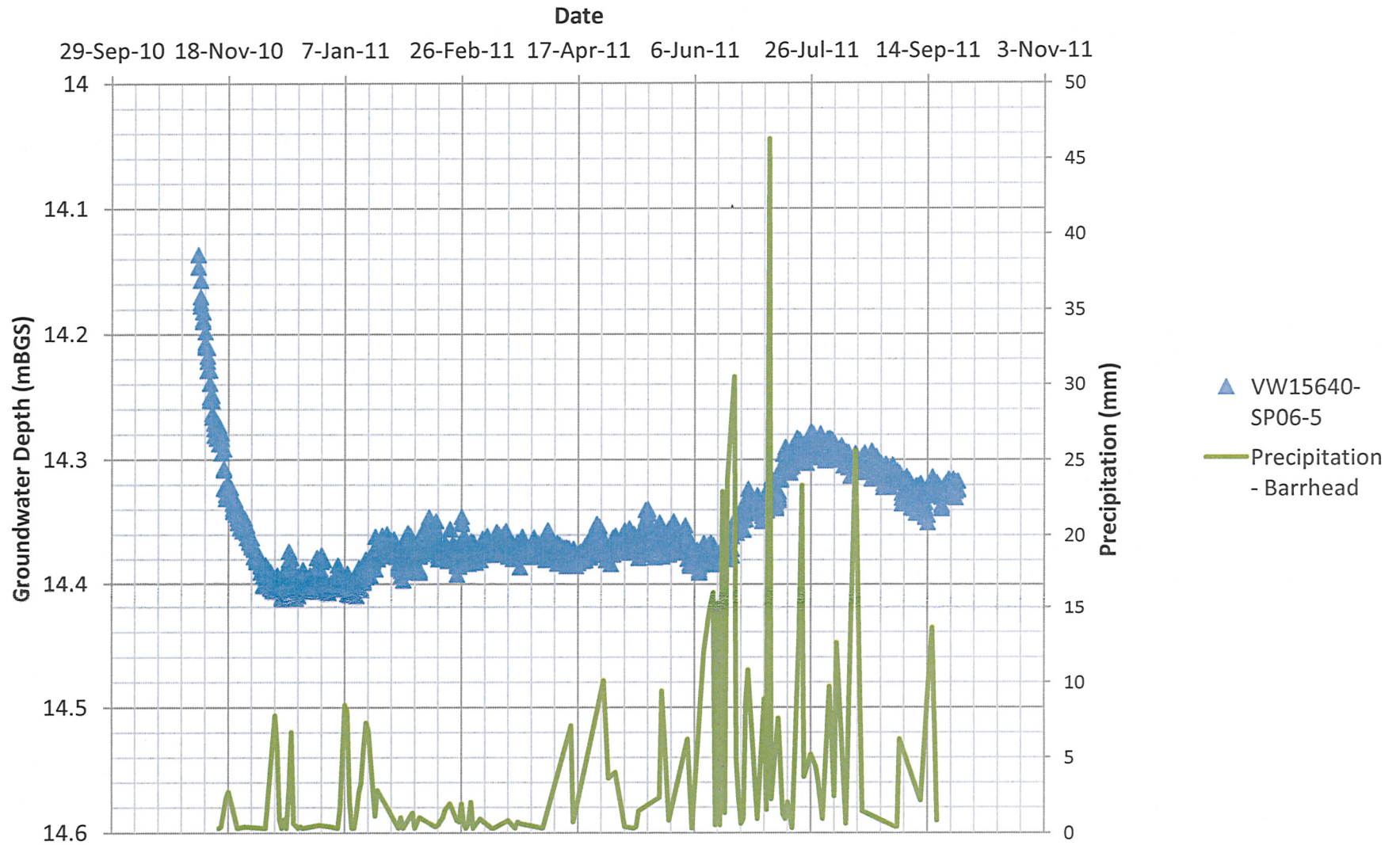
Screened in Sand from 12.2 m to 15.2 m depth.

NC 14 - VW SP06-5 80 m Upslope from Highway 661



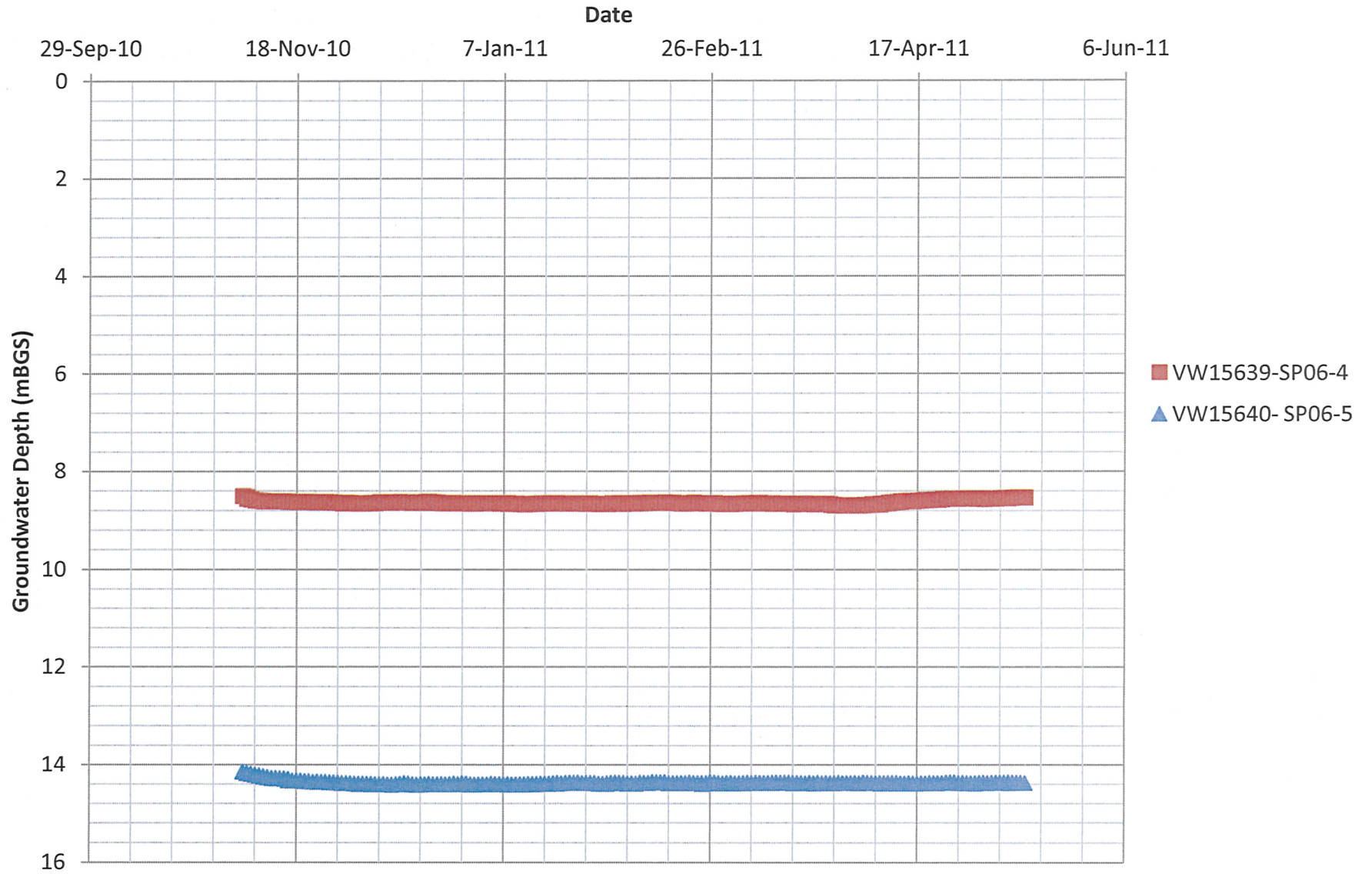
Screened in Clay from 22.0 m to 25.0 m depth.

NC 14 - VW SP06-5 80 m Upslope from Highway 661

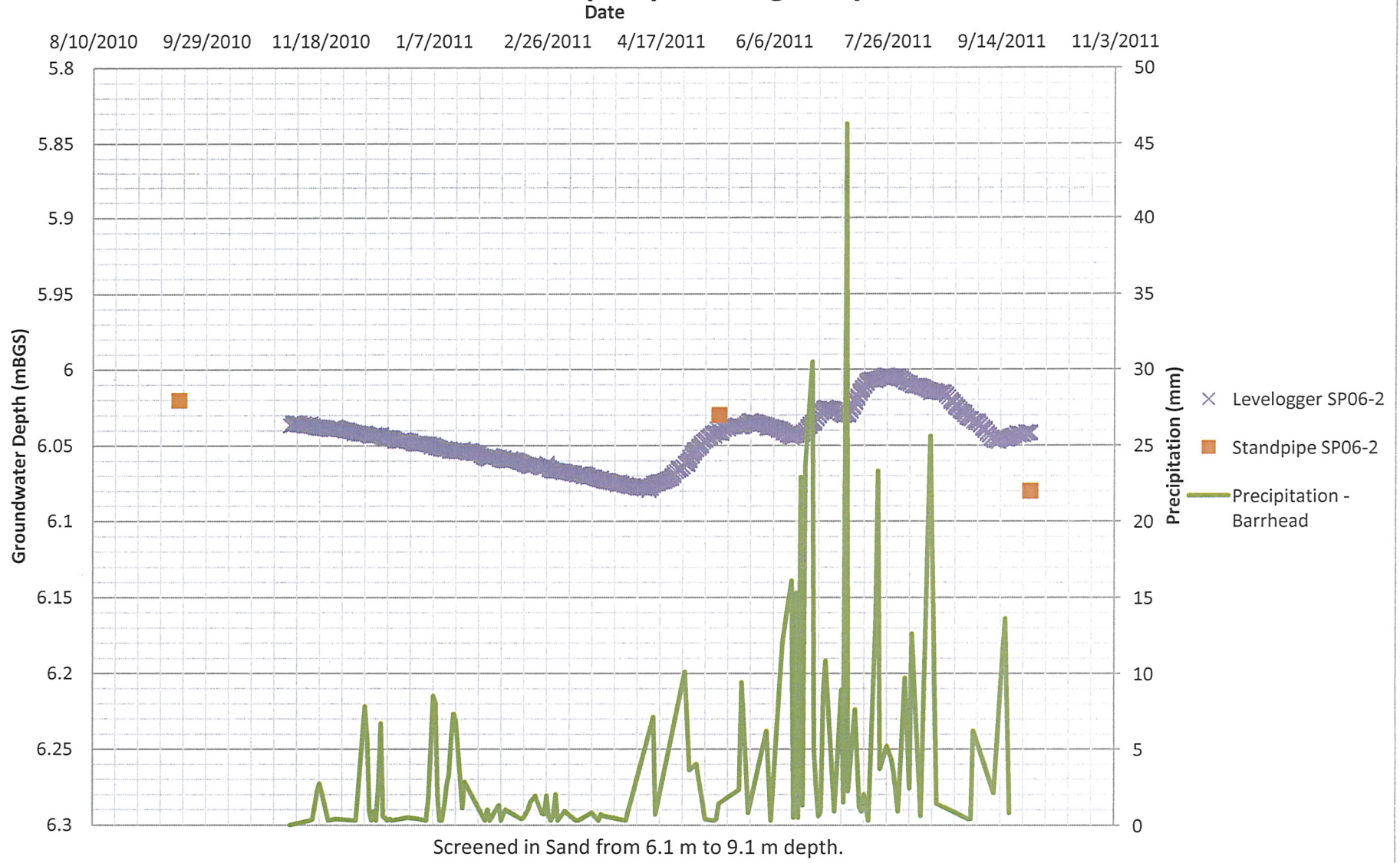


Screened in Clay from 22.0 m to 25.0 m depth.

NC 14- VW WEATHER STATION LOGGER

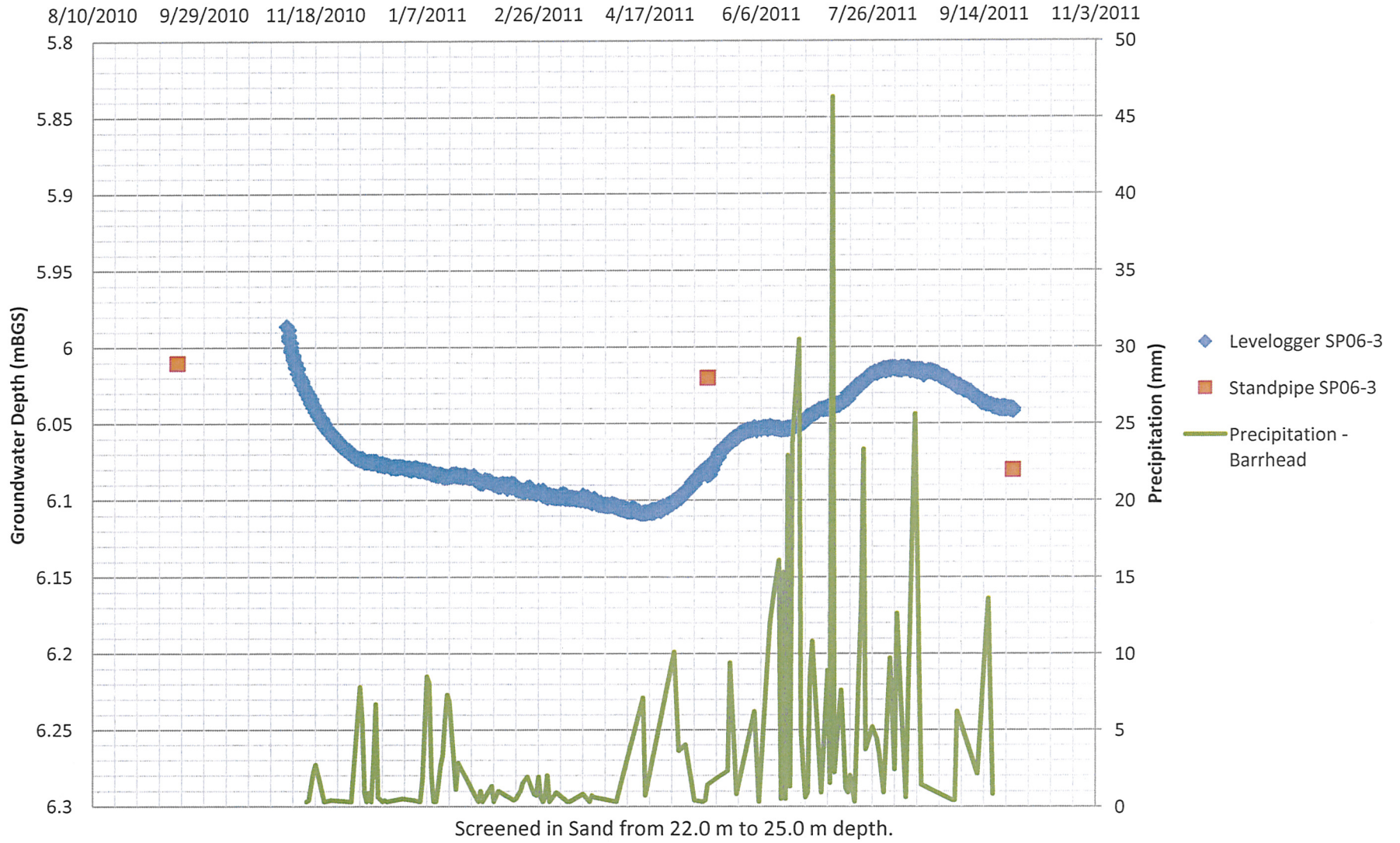


NC14 LEVELOGGER SP06-2 135 m Upslope of Highway 661

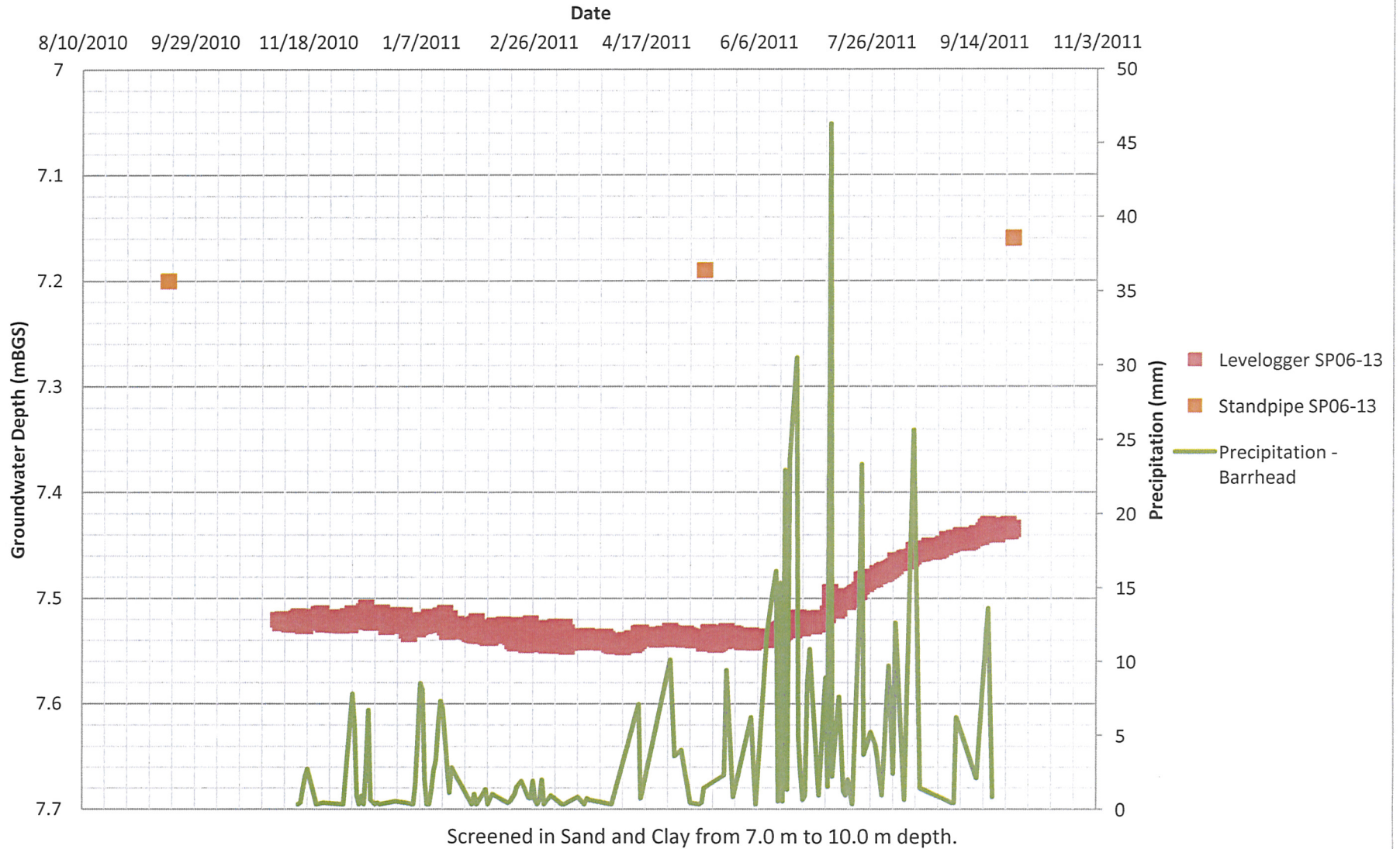


NC14 LEVELLOGGER SP06-3 135 m Upslope of Highway 661

Date



NC14 LEVELLOGGER SP06-13 20 m Downslope of Highway 661



NC14 LEVELLOGGER SP06-2, SP06-3 and SP06-13

