MWH

BUILDING A BETTER WORLD

Annual Report

Cape Peron Groundwater Study

Prepared for Strategen

April 2011

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REVISION SCHEDULE

REV. NO.	DATE	DESCRIPTION	PREPARED BY	REVIEWED BY	APPROVED BY
1.0	7/9/2010	Draft Report	K Amor / C Jones	G Clark	G Clark
2.0	14/01/2011	Draft Report (update)	C Jones	G Clark	G Clark
3.0	5/04/2011	Draft Annual Report	C Jones	G Clark	J Campbell
4.0	13/04/2011	Annual Report	C Jones	G Clark	J Campbell

1 Introduction

The Mangles Bay area of Cape Peron, Rockingham, is the focus for the proposed development of a marina-based tourist precinct. The concept is a tourist based marina which will accommodate more than 500 boats and will incorporate local boating clubs and commercial areas. Surrounding the proposed marina, land use will be 'mixed-use' with recreational, commercial and residential components.

Lake Richmond is located to the south east of the proposed development and is separated from the development area by Safety Bay Road. Lake Richmond has national conservation significance and supports many biological and social values. Potential risks and impacts that may occur from the proposed development need to be understood to allow appropriate mitigation measures to be put in place to protect Lake Richmond's integrity. Some of the potential risks that have been identified are:

- lowering of Lake Richmond's water levels,
- saltwater intrusion into Lake Richmond; and
- an increase in nutrient levels.

All land within the proposed development area south of Point Peron Road, including Lake Richmond is within a Bush Forever Protection Area (BFPA 355) and Rockingham Lakes Regional Park.

1.1 Project Scope

MWH were contracted by Strategen to undertake groundwater monitoring at Cape Peron, near Rockingham, to determine the groundwater characteristics of the area, and thus, assist in determining the relationship between the local groundwater system and Lake Richmond.

The Project consisted of two parts:

1) The drilling and construction of 17 monitoring bores; and
2) The periodic monitoring of the monitoring bores including:
    a. monthly manual measurements of depth-to-water of all monitoring bores,
    b. monthly electrical conductivity (EC), pH, dissolved oxygen (DO), redox and temperature profiling of all monitoring bores,
    c. monthly bailed water samples and analysis of all bores, and
    d. installation, and monthly downloading, of data loggers that measure water levels and temperature at half-hourly intervals.

This Report provides details on the drilling, construction, testing and monitoring program undertaken at Cape Peron during the period March 2010 to March 2011.

2 Background

2.1 Location

The Mangles Bay area of Cape Peron is located approximately two kilometres west of the City of Rockingham and 38 kilometres south of Perth. The proposed development site covers the area east of Garden Island causeway and is bound by both Mangles Bay to the north and Shoalwater Bay to the south. Safety Bay Road borders the most eastern extent of the proposed development site (Figure 2-1).

2.2 General Geology

The regional geology for the Project area consists of a thin covering of superficial regolith deposited during the Late Tertiary and into the Quaternary. This regolith covers much of the Perth Basin extending down and making up the local geology of the Project area. The Project area consists of two main geological units (1) the Safety Bay Sand, and (2) the Tamala Limestone (Table 2-1). Both these formations belong to the early Pleistocene to Holocene Kwinana Group (Playford *et al*., 1976).

The Safety Bay Sand unconformably overlies the Tamala Limestone. It consists of primarily shell fragments (foraminifers and molluscs) and variable amounts of white, unlithified, calcareous, fine to medium grained quartz sand with traces of fine grained black, heavy minerals (Davidson,1995). It occurs along the coast as eolian stable and mobile dunes becoming weakly lithified below the dune surface, making the first stage in conversion to eolianite.

The Tamala Limestone unconformably overlies the Rockingham Sand formation and has been described by Playford *et. al.* (1976) as a creamy-white to yellow or light grey, calcareous aeolianite. Consisting largely of course to medium grained shell fragments (foraminifers and molluscs) and variable amounts of fine to coarse grained, sub angular to rounded quartz. The limestone exhibits areas influenced by solution particularly in the region of the watertable fluctuation. This solution establishes secondary porosity from the addition of cavities, channels and in some locations karst structures.

The Rockingham Sand occupies what is thought to be a paleo-channel (erosional channel) incised into the bedrock Cretaceous sediments, which extend offshore from Rockingham to beneath the southern end of Garden Island. The unit comprises mainly slightly silty, medium-grained to coarse-grained sand of shallow marine origin. The maximum thickness of the Rockingham Sand is approximately 110 metres at the southern end of Cockburn Sound in the Rockingham area (Worley Parsons, 2005).

Table 2-1: General stratigraphy of the Project area

<table>
<tr><th>Era</th><th>Period</th><th>Group</th><th>Formation</th></tr>
<tr><td rowspan="3">Cainozoic</td><td rowspan="3">Quaternary</td><td rowspan="2">Kwinana Group</td><td>Safety Bay Sand</td></tr>
<tr><td>Tamala Limestone</td></tr>
<tr><td colspan="2">Rockingham Sand</td></tr>
</table>

2.3 Hydrogeology

The primary aquifer in the proposed development site is associated with the superficial aquifer comprising of Quaternary sediments of the Kwinana Group. The superficial aquifer is a complex unconfined aquifer with a maximum thickness of approximately 70 metres with an average thickness of between 45 and 20 metres (Davidson,1995).

Water table depths vary on location throughout the superficial aquifer. These variations are contributed to permeability of the underlying geology, topography and location within the groundwater flow system. The water table relationship for Cape Peron is dominated by the presence of the Safety Bay Mound (Worley Parsons, 2005). Groundwater flow from this mound has been divided into four distinctive channels, each carrying rainfall recharge from the crest of the mound to discharge boundaries.

An average aquifer transmissivity (T) for the superficial aquifer has been estimated at approximately 600 m^2/d with a saturated thickness of 20 metres. Hydraulic conductivity (k) values are estimated in the range of 100-1000 m/d for the Tamala Limestone and 50 m/d for the Safety Bay sand (Davidson, 1995).

Figure 2-1: Cape Peron Monitoring Bore and Data Logger Location

3 Rainfall

The two closest meteorological stations to the Project area are Garden Island (BoM station 9256) and Kwinana BP Refinery (BoM station 9064). Daily rainfall data for the monitoring period (1 April 2010 to 30 March 2011) from these two stations has been collated and is shown in Figures 3-1 and 3-2. The two BoM stations also provide long term rainfall data with the average monthly rainfall provided in Tables 3-1 and 3-2. As seen in Tables 3-1 and 3-2, rainfall occurs in the area mostly during the winter months.

Actual rainfall data for the monitoring period are provided also in Tables 3-1 and 3-2. Rainfall during the monitoring period is significantly lower than the mean with an annual reduction of over 200 mm at the Garden Island station and over 300 mm at the Kwinana BP Refinery station.

Table 3-1: Mean monthly rainfall (2001 to 2010) and actual rainfall during the monitoring period – Garden Island (BoM, 2011)

Long Term Rainfall Data													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean rainfall (mm) for years 2001 to 2010	9.1	10.5	15.0	47.2	72.6	119.2	115.8	90.9	62.5	33.8	26.5	6.3	627.0
Actual Rainfall During Monitoring Period													
	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Annual
Actual rainfall during monitoring period Apr-2010 to Mar-2011	32.4	63.2	54.6	84.2	77.2	32.0	18.0	11.0	11.4	20.6	0	0	404.6

Table 3-2: Mean monthly rainfall (1955 to 2010) and actual rainfall during the monitoring period – Kwinana BP Refinery (BoM, 2011)

Long Term Rainfall Data													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean rainfall (mm) for years 1955 to 2010	11.2	15.0	16.1	43.2	102.5	156.3	156.0	105.5	66.8	40.3	23.3	8.4	748.0
Actual Rainfall During Monitoring Period													
	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Annual
Actual rainfall during monitoring period Apr-2010 to Mar-2011	25.6	74.0	53.0	111.6	64.8	30.4	22.4	10.0	7.0	17.6	3.2	NA	419.6

NA = data not available

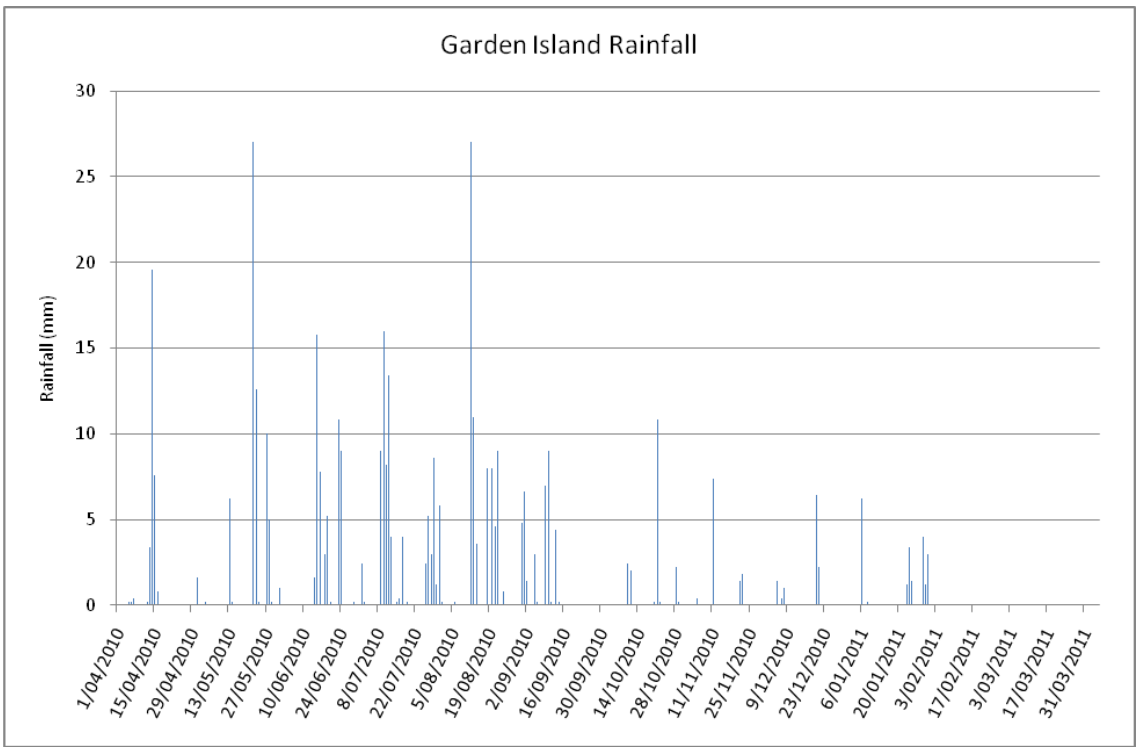

Figure 3-1: Daily rainfall – Garden Island (1 April 2010 to 30 March 2011) (BoM, 2011)

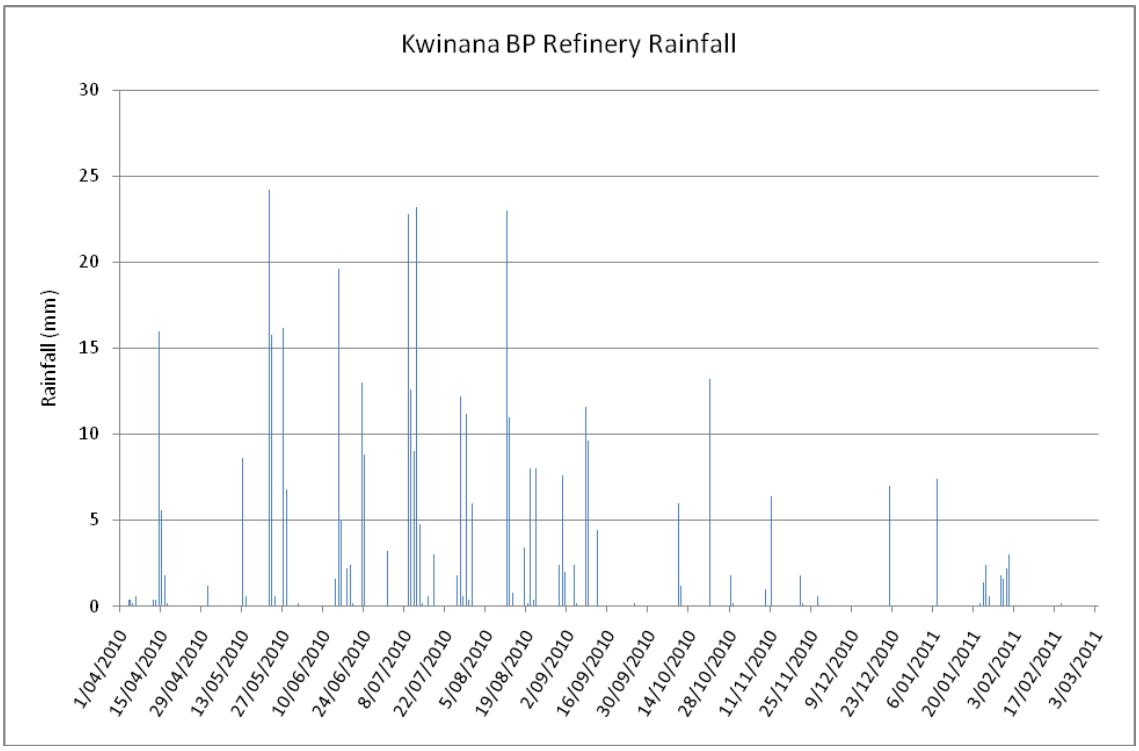

Figure 3-2: Daily rainfall – Kwinana BP Refinery (1 April 2010 to 28 February 2011) (BoM, 2011)

4 Tidal Data

The Mangles Bay Marina area is bordered by the Indian Ocean on the northern, western and southern edges.

Forecasted Cape Peron tidal data was obtained by converting the actual tides provided by Australian Bureau of Meteorology for standard ports and data from the Australian National Tide Tables (http://tides.willyweather.com.au/wa/perth/peron.html).

Forecasted maximum high and low tidal elevations at Cape Peron during the monitoring period are 1.3 and 0.3 mAHD (May 2010 and January 2011 respectively) respectively, as illustrated in Figure 4-1.

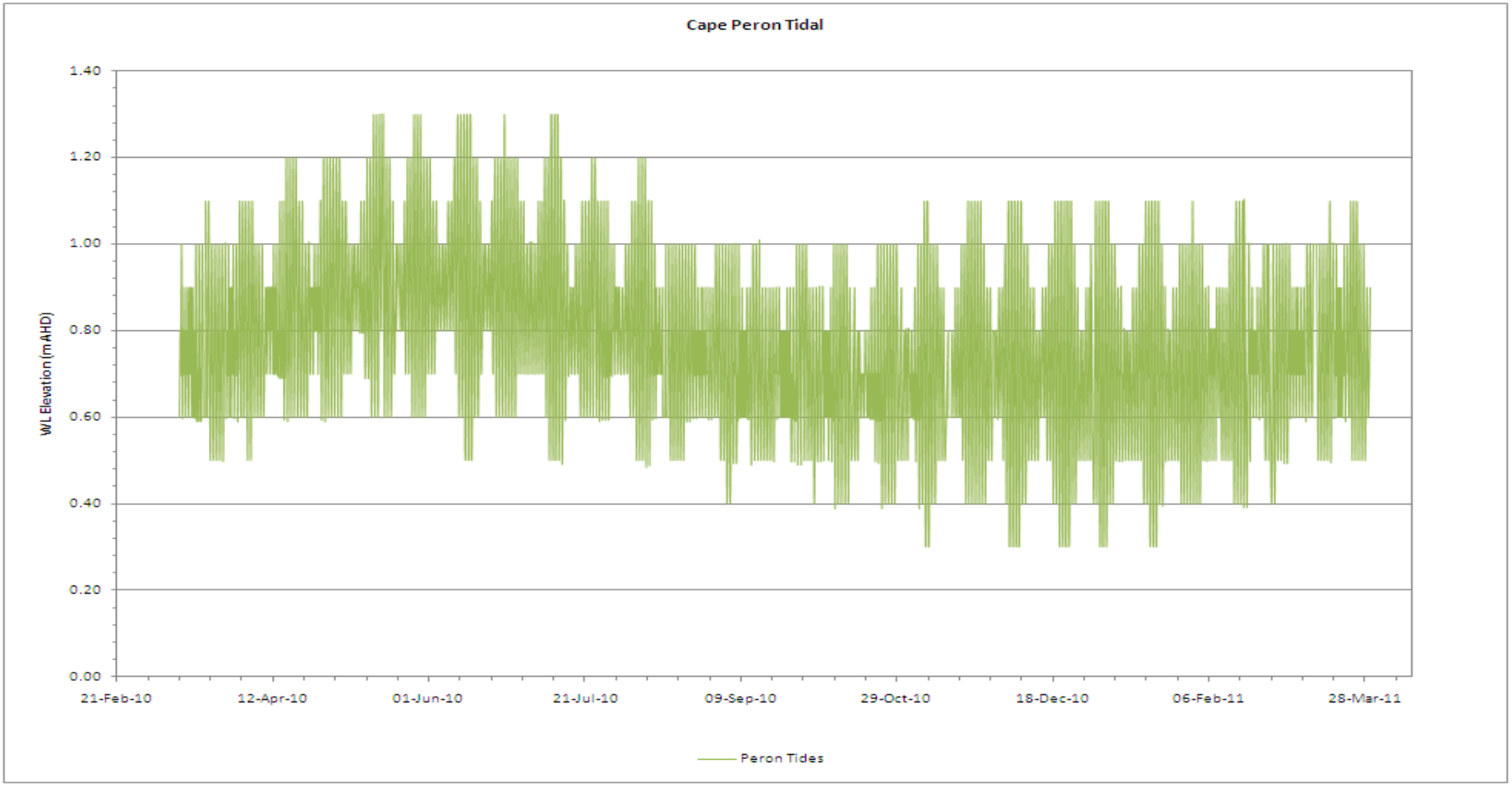

Figure 4-1: Cape Peron tidal data for March 2010 to March 2011.

5 Field Program 2010 / 11

The Cape Peron field program was initiated in March 2010 and will continue until September 2011. This Report addresses the monitoring period of April 2010 to March 2011. The field program consisted of an initial site visit to identify appropriate locations for the monitoring network, hydrogeological investigation phase and a monitoring phase.

The hydrogeological investigation phase included:

- drilling and construction of 14 piezometers throughout the Project area. The monitoring bores were designed as single piezometers in order to allow water quality analysis, conducting downhole EC surveys and gather accurate water level measurements,
- drilling and construction of two observation bores (deep (MB14D) and shallow (MB14S)) and a production bore (PB1), and, undertaking a test pumping program on the production bore, and
- undertake a test pumping program on existing bore MB09S.

The details of the last two points above are further detailed in the report *Cape Peron Drilling and Test Pumping Program* (MWH, 2011).

The monitoring phase (to date) included:

- twelve months (April 2010 to March 2011) of water sample collection, conducting downhole surveys and water level monitoring.

The drilling, installation and completion of piezometers was undertaken by *Mathews Drilling Pty Ltd* using reverse circulation and conventional mud drilling techniques.

Analysis of the water chemistry is conducted by *SGS Pty Ltd Australia*.

Downhole electrical conductivity surveys and water level recording is undertaken by MWH using a *Quanta G Water Quality Monitoring System*.

Manual water levels are measured by MWH using *Enviro Equip* water level indicators.

Six *Insitu Level Troll 300* data loggers, one *Insitu Level Troll 500* data logger and an *Insitu Baro Troll 500* data logger are used to monitor water levels in the monitoring bores.

6 Monitoring Bore Drilling Program

A monitoring bore drilling program was conducted consisting of drilling 14 monitoring bores at various locations throughout the Project area. Monitoring targets were nominated by site visits, review of aerial photos, satellite images, and geological maps.

An additional two monitoring bores (MB14S and MB14D) and a production bore (PB1) were drilled in February 2011 for the purpose of conducting a test pumping program. The details of this drilling and test pumping are summarised in this report and detailed in a separate report *Cape Peron Drilling and Test Pumping Program* (MWH, 2011)

A series of administrative approvals were undertaken prior to drilling including:

- nominating the site and obtaining GPS or survey of location (MGA, Zone 50),
- submission of nominated location to Strategen for review,
- obtaining 26D Licence to Construct or Alter Well permits, and
- obtaining dig permits outlining all utilities within the nominated locations.

Monitoring bore drilling commenced on 22 March 2010. All pilot exploration bores were drilled using a reverse circulation drill rig operated by *Mathews Drilling* contractors.

Bore logs and data sheets were developed (Appendix A and B respectively) from drilling chip samples collected every one metre and water quality measurements at various depths during drilling. Field EC (in µS/cm), pH, total dissolved solids (TDS) and temperature were measured at the time of sampling. The recorded measurements are presented under each monitoring bore heading.

In general the drilling work sequence was as follows:

- select site and set up of drill rig,
- drill to nominated depth using a 101.6 mm diameter air core bit to collect accurate water quality and geological samples,
- re enter borehole and ream out hole with a 152.4 mm diameter tri-cone bit using mud rotary to the target depth,
- case exploration holes as monitoring sites using Class 9 blank and slotted 100 mm diameter uPVC casing,
- gravel pack annulus with +1.6-3.2 mm sorted gravel,
- airlift develop bores, and
- cement in lockable steel cover, to protect the monitoring bore, flush with the ground surface.

During drilling the following data was recorded:

- geological samples collected and logged at one metre intervals,
- depth that water was cut, and
- field water quality.

Details of the bores are summarised in Table 6-1.

Table 6-1: Bore details

Borehole ID	Coordinates (MDA94)		Collar RL (m AHD)	Date Drilled	Total Depth Drilled (mbgl)	Bore Construction Material	SWL[1] (mbgl)
	Easting[2]	Northing[2]					
MB01	378534.3	6427559.9	2.112	29-30/03/10	30	0-30m slotted Cl 9 100 mm PVC	1.62 (08/04/10)
MB02	377921.8	6427850.7	6.449	14/04/10	22	0-22m slotted Cl 9 100 mm PVC	6.24 (16/04/10)
MB03	378523.4	6428086.1	2.827	06-07/04/10	27	0-27m slotted Cl 9 100 mm PVC	2.39 (08/04/10)
MB04	378459.6	6428260.6	2.501	15/04/10	11	0-11m slotted Cl 9 100 mm PVC	2.19 (16/04/10)
MB05	378135.2	6427452.3	6.094	09/04/10	30	0-30m slotted Cl 9 100 mm PVC	5.16 (16/04/10)
MB06	377818.8	6428338.5	1.529	22/03/10	8.0	0-8m slotted Cl 9 100 mm PVC	1.42 (24/03/10)
MB07	378420.9	6427873.8	3.296	26/03/10	30	0-30m slotted Cl 9 100 mm PVC	2.81 (30/03/10)
MB08	378198.3	6428232.8	2.382	15/04/10	11	0-11m slotted Cl 9 100 mm PVC	2.04 (16/04/10)
MB09S	378298.4	6428081.1	2.800	01-06/04/10	21.5	0-21.5m slotted Cl 9 100 mm PVC	2.76 (09/04/10)
MB09D	378299.1	6428092.1	2.825	12-14/04/10	30	0-22m blank Cl 9 50 mm PVC 22-30m slotted Cl 9 50 mm PVC	2.05 (19/04/10)
MB10	378586.8	6427906.9	2.952	30-31/03/10	30	0-29m slotted Cl 9 100 mm PVC	2.36 (16/04/10)
MB11	378554.8	6427796.1	1.856	23-24/03/10	30	0-30m slotted Cl 9 100 mm PVC	1.28 (26/03/10)
MB12	378462.2	6427723.5	2.002	25/03/10	30	0-30m slotted Cl 9 100 mm PVC	1.80 (16/04/10)
MB13	378078.7	6427935.9	4.354	08/04/10	21	0-21m slotted Cl 9 100 mm PVC	4.24 (09/04/10)
MB14S	378021	6428016	not yet surveyed	10/02/11	12	0-2.25 m blank 100 mm PVC 2.25-12 m slotted 100 mm PVC	4.135 (16/02/11)
MB14D	378018	6428013	not yet surveyed	9/02/11	20	0-18 m blank 100 mm PVC 18-20 m slotted 100 mm PVC	3.998 (16/02/11)
PB1	378004	6428021	not yet surveyed	14/02/11	12	0-6 m blank 200 mm PVC 6-12 m slotted 200 mm PVC	3.92 (16/02/11)

Notes:

[1]SWL = Static water level measured in metres below ground level (mbgl)

[2]Coordinates measured in MDA94 Zone 50 by credited surveyor

6.1 Monitoring Bore MB01

Bore MB01 was located west of Lake Richmond adjacent to Safety Bay Road at grid reference 378534 E, 6427559 N.

Drilling commenced on 29 March, 2010 and finished on 30 March, 2010 at a total depth of 30 metres.

The geology at MB01 consisted of loose, moderate to well sorted, angular sand to a depth of 23 metres. Grey, moderately hard, sub-rounded Tamala Limestone was encountered from 23 metres to 28 metres with a shelly silt encountered to its final depth of 30 metres. Groundwater inflow occurred at approximately 8 mbgl.

The exploration borehole was constructed as a piezometer with 100 mm PVC slotted casing from the surface to 30 mbgl and gravel packed from 0.5 to 30 mbgl with +1.6 – 3.2 mm sized gravel. The bore was airlifted for 0.5 hours on 30 March 2010.

Water quality was brackish to 26 metres with EC measurements ranging from 1100 to 5540 μS/cm and increasing to more than 20000 μS/cm by the completed depth. An alkaline pH was recorded with measurements up to 8.39 (Table 6-2). The static water level was recorded on the 8 April, 2010 at 1.62 mbgl.

Table 6-2: MB01 Field Water Quality

Depth (m)	EC (µS/cm)	pH	Temp (°C)
10	1610	8.39	19.0
13	1520	8.06	20.0
16	1100	7.69	20.5
22	1580	7.88	29.4
24	2860	7.88	27.6
25	4040	7.84	27.9
26	5540	7.78	26.3
27	13340	7.66	24.7
28	>20000	7.58	32.0

6.2 Monitoring Bore MB02

Bore MB02 was located within the Rockingham Returned and Services Leagues (RSL) car park on Memorial Drive at grid reference 377921 E, 6427850 N.

Drilling commenced and was completed on the 14 April, 2010 at a total depth of 22 metres.

The geology at MB02 consisted of an initial metre of compacted brown, poorly sorted, angular sand. This initial metre is not insitu and was most likely introduced to provide a base for the RSL car park. Poorly to well sorted, angular Safety Bay Sands were then encountered consistently to the total depth of 22 metres. Groundwater inflow occurred at approximately 9 mbgl.

The exploration borehole was constructed as a piezometer with 100 mm PVC slotted casing from the surface to 22 mbgl and gravel packed from 0.5 to 22 mbgl with +1.6 – 3.2 mm sized gravel. The bore was airlifted for 0.5 hours on 14 April 2010.

Water quality ranged from slightly brackish to brackish with EC measurements ranging from 1550 to 6420 μS/cm at the completed depth. An alkaline pH was recorded with measurements up to 8.25 (Table 6-3). The static water level was recorded on the 16 April, 2010 at 6.24 mbgl.

Table 6-3: MB02 Field Water Quality

Depth (m)	EC (µS/cm)	pH	Temp (°C)
11	2050	8.13	18.5
14	1550	8.25	18.5
15	1550	8.13	18.7
16	2530	8.05	18.5
17	6740	8.08	18.6
18	3910	8.01	19.2
19	5140	8.06	19.6
20	6420	8.10	19.5

6.3 Monitoring Bore MB03

Bore MB03 was located on the verge of Point Peron Road at grid reference 378523 E, 6428086 N.

Drilling commenced on 6 April, 2010 and finished on 7 April, 2010 at a total depth of 27 metres.

The geology at MB03 consisted of loose, moderate to well sorted, angular sand to a depth of 14 metres. Brown, well sorted silts were then encountered between 14 and 23 metres. These silts contained a thin bed of organic rich material most likely sea grass between 17 and 19 metres and caused delays in the drilling progress. Grey, moderately hard, sub-rounded Tamala Limestone was then encountered from 23 metres to its final depth of 27 metres. Groundwater inflow occurred at approximately 6 mbgl.

The exploration borehole was constructed as a piezometer with 100 mm PVC slotted casing from the surface to 27 mbgl and gravel packed from 0.5 to 27 mbgl with +1.6 – 3.2 mm sized gravel. The bore was airlifted for 0.5 hours on 7 April 2010.

Water quality ranged from slightly brackish to saline at 27 metres with EC measurements ranging from 800 to 13600 μS/cm by the completed depth. An alkaline pH was recorded with measurements up to 8.18 (Table 6-4). The static water level was recorded on the 8 April, 2010 at 2.39 mbgl.

Table 6-4: MB03 Field Water Quality

Depth (m)	EC (µS/cm)	pH	Temp (°C)
9	880	8.18	26.2
13	800	8.06	24.3
18	1340	7.71	28.6
19	1830	7.86	28.3
21	3160	8.02	28.7
23	5050	8.01	27.1
24	5560	7.94	26.2
25	5650	7.93	25.8
26	6280	7.93	27.3
27	13600	7.71	27.3

6.4 Monitoring Bore MB04

Bore MB04 was located within the A.I.W Recreation Centre on Point Peron Road at grid reference 378459 E, 6428260 N.

Drilling commenced and finished on 15 April, 2010 at a total depth of 11 metres.

The geology at MB04 consisted of loose, well sorted, angular Safety Bay Sand to its final depth of 11 metres. Groundwater inflow occurred at approximately 6 mbgl.

The exploration borehole was constructed as a piezometer with 100 mm PVC slotted casing from the surface to 11 mbgl and gravel packed from 0.5 to 11 mbgl with +1.6 – 3.2 mm sized gravel. The bore was airlifted for 0.5 hours on 15 April 2010.

Water quality was saline with an EC measurement of 13100 μS/cm at 9 metres (Table 6-5). The static water level was recorded on the 16 April, 2010 at 2.19 mbgl.

Table 6-5: MB04 Field Water Quality

Depth (m)	EC (µS/cm)	pH	Temp (°C)
9	13100	-	28.7

6.5 Monitoring Bore MB05

Bore MB05 was located at the most southern extent of the Project area at grid reference 378135 E, 6427452 N.

Drilling commenced and was completed on the 9 April, 2010 at a total depth of 30 metres.

The geology at MB05 consisted of loose, moderate to well sorted, angular Safety Bay Sand to a depth of 22 metres. A thin bed of light grey, well sorted silty Safety Bay Sand was then encountered to a depth of 25 metres with a grey, moderately hard, sub-rounded Tamala Limestone sampled to its final depth. Groundwater inflow occurred at approximately 9 mbgl.

The exploration borehole was constructed as a piezometer with 100 mm PVC slotted casing from the surface to 30 mbgl and gravel packed from 0.5 to 30 mbgl with +1.6 – 3.2 mm sized gravel. The bore was airlifted for 0.5 hours on 9 April 2010.

Water quality was potable increasing to brackish by a depth of 28 metres with EC measurements ranging from 360 to 5360 μS/cm. Within the final two metres of the monitoring bore the water quality became saline with EC measurements increasing to more than 20000 μS/cm. An alkaline pH was recorded with measurements up to 8.53 (Table 6-6). The static water level was recorded on the 16 April, 2010 at 5.16 mbgl.

Table 6-6: MB05 Field Water Quality

Depth (m)	EC (µS/cm)	pH	Temp (°C)
13	1110	8.34	27.5
16	670	8.48	24.6
17	460	8.53	24.1
18	360	8.45	23.2
19	400	8.45	22.8
20	430	8.47	21.4
21	380	8.39	20.1
22	500	8.39	20.2
25	980	8.22	20.1
26	1140	8.15	19.9
27	1890	8.06	21.5
28	5230	7.93	20.3
29	13820	7.73	21.1
30	20000+	7.68	21.8

6.6 Monitoring Bore MB06

Bore MB06 was located within the Rockingham Yacht Club on Point Peron Road at grid reference 377818 E, 6428338 N and close to the ocean.

Drilling commenced and completed on the 22 March, 2010 at a total depth of 8 metres below ground level.

The geology at MB06 consisted of entirely loose, moderately sorted, angular Safety Bay Sand to a depth of 8 metres. Groundwater inflow occurred at approximately 6 mbgl.

The exploration borehole was constructed as a piezometer with 100 mm PVC slotted casing from the surface to 8 mbgl and gravel packed from 0.5 to 8 mbgl with +1.6 – 3.2 mm sized gravel. The bore was airlifted for 0.5 hours on 22 March 2010.

Water quality was saline with EC measurements of more than 20000 μS/cm at six metres. An alkaline pH was recorded with a measurement of 8.04 (Table 6-7). The static water level was recorded on the 24 March, 2010 at 1.42 mbgl.

Table 6-7: MB06 Field Water Quality

Depth (m)	EC (µS/cm)	pH	Temp (°C)
6	20000+	8.04	29.0

6.7 Monitoring Bore MB07

Bore MB07 was located approximately 200 metres west of Safety Bay Road and north of monitoring bore MB12 at grid reference 378420 E, 6427873 N.

Drilling commenced and completed on the 26 March, 2010 at a total depth of 30 metres.

The geology at MB07 consisted of loose, moderate to well sorted, angular Safety Bay Sand to a depth of 18 metres. Light grey, well sorted silt was encountered from 18 to 23 metres with a grey, moderately hard, sub-rounded Tamala Limestone encountered to its final depth of 30 metres. Groundwater inflow occurred at approximately 9 mbgl.

The exploration borehole was constructed as a piezometer with 100 mm PVC slotted casing from the surface to 30 mbgl and gravel packed from 0.5 to 30 mbgl with +1.6 – 3.2 mm sized gravel. The bore was airlifted for 0.5 hours on 26 March 2010.

Water quality was brackish to 25 metres with EC measurements ranging from 820 to 4370 μS/cm and increasing to more than 20000 μS/cm by the completed depth. An alkaline pH was recorded with measurements up to 8.16 (Table 6-8). The static water level was recorded on the 30 March, 2010 at 2.81 mbgl.

Table 6-8: MB07 Field Water Quality

Depth (m)	EC (µS/cm)	pH	Temp (°C)
9	1570	8.05	23.8
14	910	8.04	23.0
15	1150	8.07	23.3
16	2120	8.05	23.2
17	1110	8.15	23.1
18	820	8.12	23.0
19	920	8.16	23.2
22	1020	8.15	22.8
24	1620	8.06	23.5
25	4370	8.05	24.0
26	7060	7.93	23.1
27	8940	7.91	22.7
28	20000+	7.65	22.9

6.8 Monitoring Bore MB08

Bore MB08 was located on the coast line at the Rockingham Returned and Services Leagues (RSL) caravan park on Point Peron road at grid reference 378421 E, 6427874 N.

Drilling commenced and was completed on the 15 April, 2010 at a total depth of 9 metres below ground level.

The geology at MB08 consisted of entirely loose, moderately sorted, angular Safety Bay Sand to a depth of 9 metres. Groundwater inflow occurred at approximately 6 mbgl.

The exploration borehole was constructed as a piezometer with 100 mm PVC slotted casing from the surface to 9 mbgl and gravel packed from 0.5 to 11 mbgl with +1.6 – 3.2 mm sized gravel. The bore was airlifted for 0.5 hours on 15 April 2010.

Water quality was hyper-saline with EC measurements of more than 22000 μS/cm at 9 metres. No pH measurements were taken because of a fault with the pH meter (Table 6-9). The static water level was recorded on the 16 April, 2010 at 2.04 mbgl.

Table 6-9: MB08 Field Water Quality

Depth (m)	EC (µS/cm)	pH	Temp (°C)
9	22000	-	22.1

6.9 Monitoring Bore MB09S

Bore MB09S was located on the southern side of Point Peron road at grid reference 378298 E, 6428092 N.

Drilling commenced on 1 April, 2010 and was completed on the 6 April, 2010 at a total depth of 21.5 metres.

The geology at MB09S consisted of loose, moderate to well sorted, angular to very angular Safety Bay Sands to a depth of 19 metres. Grey, well sorted, loose shelly silt was then encountered to its final depth of 21.5 metres. Groundwater inflow occurred at approximately 10 mbgl.

The exploration borehole was constructed as a piezometer with 100 mm PVC slotted casing from the surface to 21.5 mbgl and gravel packed from 0.5 to 21.5 mbgl with +1.6 – 3.2 mm sized gravel. The bore was airlifted for 0.5 hours on 6 April 2010.

Water quality was potable to brackish with EC measurements ranging from 270 to 2540 μS/cm by the completed depth. An alkaline pH was recorded with measurements up to 8.26 (Table 6-10). The static water level was recorded on the 9 April, 2010 at 2.76 mbgl.

Table 6-10: MB09S Field Water Quality

Depth (m)	EC (µS/cm)	pH	Temp (°C)
10	870	8.26	43.5
12	340	8.13	38.7
13	270	8.25	37.1
15	650	8.12	32.4
16	950	8.06	30.1
18	1420	8.10	28.8
20	2540	8.13	28.6

6.10 Monitoring Bore MB09D

Bore MB09D was located on the southern side of Point Peron road at grid reference 378299 E, 6428092 N.

Drilling commenced on 12 April, 2010 and finished on 14 April, 2010 at a total depth of 30 metres.

The geology at MB09D consisted of loose, moderate to well sorted, angular Safety Bay Sand to a depth of 19 metres. Light grey, well sorted silt was encountered from 19 to 22 metres with a grey, moderately hard, sub-rounded Tamala Limestone encountered to its final depth of 30 metres. Groundwater inflow occurred at approximately 6 mbgl.

The exploration borehole was constructed as a piezometer with 50 mm slotted PVC casing from 22 to 30 mbgl. Blank 50 mm PVC casing was then installed from 22 mbgl to the surface with a bentonite seal located between both the slotted and blank casing. The borehole was gravel packed from 0.5 to 30 mbgl with +1.6 – 3.2 mm sized gravel. The bore was airlifted for 0.5 hours on 14 April 2010.

Water quality was brackish to 23 metres with EC measurements ranging from 420 to 7100 μS/cm and increasing to more than 20000 μS/cm by the completed depth. An alkaline pH was recorded with measurements up to 8.50 (Table 6-11). The static water level was recorded on the 19 April, 2010 at 2.05 mbgl.

Table 6-11: MB09D Field Water Quality

Depth (m)	EC (µS/cm)	pH	Temp (°C)
9	630	8.37	18.2
12	420	8.50	17.7
13	470	8.37	17.7
14	690	8.33	17.4
15	1050	8.15	17.7
16	1280	8.13	17.9
17	2470	8.07	17.7
18	3960	8.12	17.9
19	3900	8.14	18.1
23	7100	7.96	16.8
24	10150	7.90	17.6
25	12480	7.82	17.7
26	17980	7.72	17.1
27	20000+	7.78	17.3

6.11 Monitoring Bore MB10

Bore MB10 was located on the western verge of Safety Bay Road at grid reference 378587 E, 6427907 N.

Drilling commenced on 30 March, 2010 and finished on 31 March, 2010 at a total depth of 30 metres.

The geology at MB10 consisted of loose, moderate to well sorted, angular sand to a depth of 20 metres. Grey brown, well sorted silts were then encountered between 20 and 22 metres. These silts contained a thin bed of organic rich material most likely sea grass. Grey, moderately hard, sub-rounded Tamala Limestone was then encountered from 22 metres to its final depth of 30 metres. Groundwater inflow occurred at approximately 10 mbgl.

The exploration borehole was constructed as a piezometer with 100 mm PVC slotted casing from the surface to 29 mbgl and gravel packed from 0.5 to 29 mbgl with +1.6 – 3.2 mm sized gravel. The bore was airlifted for 0.5 hours on 31 March 2010.

Water quality was brackish to 28 metres with EC measurements ranging from 1980 to 8320 μS/cm by the completed depth. An alkaline pH was recorded with measurements up to 8.23 (Table 6-12). The static water level was recorded on the 16 April, 2010 at 2.36 mbgl.

Table 6-12: MB10 Field Water Quality

Depth (m)	EC (µS/cm)	pH	Temp (°C)
10	3200	8.03	31.2
11	1980	8.09	30.7
12	2080	8.12	29.8
13	2320	8.22	28.5
14	2470	8.23	27.8
15	2540	8.21	29.1
21	2380	7.96	38.4
22	2780	7.99	34.3
23	2890	8.01	32.2
24	3550	8.08	28.4
25	4130	8.11	26.1
26	4650	8.05	25.1
27	5640	7.98	25.2
28	8320	7.88	24.4

6.12 Monitoring Bore MB11

Bore MB11 was located west of Safety Bay Road at grid reference 378555 E, 6427796 N.

Drilling commenced on 23 March, 2010 and finished on 24 March, 2010 at a total depth of 30 metres.

The geology at MB11 consisted of loose, moderate to poorly sorted, angular sand to a depth of 14 metres. Grey brown, well sorted silts were then encountered between 14 and 22 metres. These silts contained a thin bed of organic rich material most likely sea grass. Grey, moderately hard, sub-rounded Tamala Limestone was then encountered from 22 metres to its final depth of 30 metres. Groundwater inflow occurred at approximately 9 mbgl.

The exploration borehole was constructed as a piezometer with 100 mm PVC slotted casing from the surface to 30 mbgl and gravel packed from 0.5 to 30 mbgl with +1.6 – 3.2 mm sized gravel. The bore was airlifted for 0.5 hours on 24 March 2010.

Water quality was brackish to 26 metres with EC measurements ranging from 2260 to 7760 μS/cm and increasing to more than 20000 μS/cm by the completed depth. An alkaline pH was recorded with measurements up to 8.68 (Table 6-13). The static water level was recorded on the 26 March, 2010 at 1.28 mbgl.

Table 6-13: MB11 Field Water Quality

Depth (m)	EC (µS/cm)	pH	Temp (°C)
9	2260	-	23.4
12	2320	8.68	23.3
13	2450	8.48	23
23	3300	7.9	23.1
24	3540	7.91	22.9
25	5500	7.75	24.9
26	7760	7.71	24.7
27	12620	7.61	24.8
28	20000+	7.19	24.6

6.13 Monitoring Bore MB12

Bore MB12 was located within the reserve on the northern side of Oleando Road at grid reference 378462 E, 6427723 N.

Drilling commenced and was completed on the 25 March, 2010 at a total depth of 30 metres.

The geology at MB12 consisted of loose, moderate to well sorted, angular Safety Bay Sand to a depth of 26 metres. Grey, moderately hard, sub-rounded Tamala Limestone was encountered from 26 metres to 29 metres with light brown silt encountered to its final depth of 30 metres. Groundwater inflow occurred at approximately 6 mbgl.

The exploration borehole was constructed as a piezometer with 100 mm PVC slotted casing from the surface to 30 mbgl and gravel packed from 0.5 to 30 mbgl with +1.6 – 3.2 mm sized gravel. The bore was airlifted for 0.5 hours on 25 March 2010.

Water quality was brackish to 26 metres with EC measurements ranging from 420 to 7170 μS/cm and increasing to more than 20000 μS/cm by the completed depth. An alkaline pH was recorded with measurements up to 8.42 (Table 6-14). The static water level was recorded on the 16 April, 2010 at 1.80 mbgl.

Table 6-14: MB12 Field Water Quality

Depth (m)	EC (µS/cm)	pH	Temp (°C)
6	1320	8.04	22.8
10	570	8.29	22.5
11	530	8.31	22.5
12	420	8.42	22.5
13	450	8.32	22.4
14	610	8.21	21.9
15	600	7.93	21.6
21	2310	8.08	25.2
22	2930	7.89	31.1
24	3060	7.93	30.8
25	4940	7.89	31.2
26	7170	7.79	28.7
27	19130	7.64	28.1
28	20000+	7.63	28.2

6.14 Monitoring Bore MB13

Bore MB13 was located approximately 150 metres east of the Rockingham Returned and Services League establishment at grid reference 378079 E, 6427936 N.

Drilling commenced and was completed on the 8 April, 2010 at a total depth of 21 metres.

The geology at MB13 consisted of loose, moderate to well sorted, angular Safety Bay Sand to a depth of 19 metres. Light grey, loose, well sorted silts were then encountered to its final depth of 21 metres. Groundwater inflow occurred at approximately 9 mbgl.

The exploration borehole was constructed as a piezometer with 100 mm PVC slotted casing from the surface to 21 mbgl and gravel packed from 0.5 to 21 mbgl with +1.6 – 3.2 mm sized gravel. The bore was airlifted for 0.5 hours on 8 April 2010.

Water quality was brackish to saline with EC measurements ranging from 2820 to 14860 μS/cm. An alkaline pH was recorded with measurements up to 8.01 (Table 6-15). The static water level was recorded on the 9 April, 2010 at 4.24 mbgl.

Table 6-15: MB13 Field Water Quality

Depth (m)	EC (µS/cm)	pH	Temp (°C)
13	2820	7.89	36.7
14	3110	7.79	34.4
15	3750	7.86	29.6
16	4990	7.86	28.1
17	12730	7.86	26.5
18	13230	7.93	25.8
19	14860	7.91	25.1
20	7390	7.89	25.5
21	8110	8.01	25.3

6.15 Monitoring Bore 14S

MB14S was located northwest of existing monitoring bore MB13 at grid reference 378021 E, 6428016 N.

Drilling commenced on 10 February 2011 and finished on the same day at a total depth of 12 m.

The geology at MB14S consisted of light brown / tan sand with shell fragments to a depth of 6 m overlaying dark grey fine sand with shells to 12 m. Groundwater inflow was unable to be recorded due to the utilisation of mud as the drilling medium.

The observation borehole was constructed with 100 mm PVC slotted casing from 2.25 to 12mbgl, with blank 100 mm PVC casing from 0 – 2.25mbgl. The borehole was gravel packed from 1.5 to 12mbgl with +1.6 – 3.2 mm sized gravel.

The bore was airlifted for 50 minutes on 10 February 2011.

Water quality was measured in the drilling mud returns during drilling (Table 6-16). Water quality was brackish with EC measurements ranging from 2630 to 3800 μS/cm.

The static water level was recorded on 16 February 2011 at 4.135mbgl.

Table 6-16: MB14S field water quality

Depth (m)	Drilling Mud EC (µS/cm)	Temp (°C)
3	3800	26.5
6	3630	27.4
9	3580	27.7
12	2630	28.7

6.16 Monitoring Bore 14D

MB14D was located northwest of existing monitoring bore MB13 and adjacent to MB14S at grid reference 378018 E, 6428013 N.

Drilling commenced on 9 February 2011 and finished on the same day at a total depth of 20 m.

The geology at MB14D consisted of light brown / tan sand with shell fragments to a depth of 6 m overlaying dark grey fine sand with shells to 20 m with grey fine silty sand from 18 to 20 m. Groundwater inflow was unable to be recorded due to the utilisation of mud as the drilling medium.

The observation borehole was constructed with 100 mm PVC slotted casing from 18 to 20 mbgl with blank 100 mm PVC casing from 0 – 18 mbgl. The borehole was gravel packed from 17 to 20 mbgl with +1.6 – 3.2 mm sized gravel.

The bore was airlifted for 50 minutes on 9 February 2011.

Water quality was measured in the drilling mud returns during drilling. Water quality was brackish with EC measurements ranging from 2020 to 3100 μS/cm (**Table 6-17**).

The static water level was recorded on 16 February 2011 at 3.998mbgl.

Table 6-17: MB14D field water quality

Depth (m)	Drilling Mud EC (µS/cm)	Temp (°C)
3	2470	-
6	2450	-
9	2090	-
12	2020	-
15	2060	-
18	2810	-
20	3100	28.1

6.17 Test Production Bore PB1

PB1 was located northwest of existing monitoring bore MB13 and approximately 10 m north of the observation bores at grid reference 378004 E, 6428021 N.

Drilling commenced on 14 February 2011 and finished on the same day at a total depth of 12 m.

The geology at PB1 consisted of light brown / tan sand with shell fragments to a depth of 6 m overlaying dark grey fine sand with shells to 12 m. Groundwater inflow was unable to be recorded due to the utilisation of mud as the drilling medium.

The production borehole was constructed with 200 mm PVC slotted casing from 6 to 12mbgl with blank 200 mm PVC casing from 0 – 6mbgl. The borehole was gravel packed from 5 to 12mbgl with +1.6 – 3.2 mm sized gravel.

Development of the production was attempted using chemical dispersants, water jetting and surging and airlifting with an air compressor, but was abandoned due to the low airlift yield. Further development of the production bores was undertaken using an electrical submersible pump over a period of two hours on 15 February 2011.

Water quality was measured in the drilling mud returns during drilling. Water quality was fresh with EC measurements ranging from 540 to 740 μS/cm (Table 6-18). The static water level was recorded on 16 February 2011 at 3.92mbgl.

Table 6-18: PB1 field water quality

Depth (m)	Drilling Mud EC (µS/cm)	Temp (°C)
4	540	26.2
7	540	25.3
10	540	24.9
12	740	25.5

7 Test Pumping

The test pumping program was undertaken to determine the hydraulic parameters of the Safety Bay Sands aquifer. Two bores were test pumped:

1. PB1; and
2. existing monitoring bore MB09S.

Test pumping was undertaken in PB1 on 16 February 2011 using a small electrical submersible pump provided by the drilling contractor. The test pumping involved three parts:

- step-rate test;
- constant rate test; and
- recovery test.

Test pumping was undertaken in MB09S on 9 March 2011 using a small electrical submersible pump provided by the drilling contractor. The test pumping was undertaken to gain additional data on the Safety Bay Sands aquifer. MB09S was chosen due to its 'shallow' depth, location and its close proximity to other existing bores. The test pumping involved:

- constant rate test; and
- recovery test.

The details of both pump testing programs are provided in the following sections and further detailed in the report *Cape Peron Drilling and Test Pumping Program* (MWH, 2011).

7.1 PB1 Test Pumping

The electric submersible test pump unit was installed into PB1 to a depth of 11.5 mbgl. The pumping unit was installed on a HPDE rising main, with a dip tube strapped to the rising main to allow monitoring of water levels to be undertaken. The discharge rate was regulated using a gate valve and discharge rate measured using both an impeller type flow meter and measuring bucket.

Monitoring bores MB14S and MB14D were utilised to observe aquifer response to abstraction during the testing program (Figure 7-1). Water levels were measured using a water level indicator probe.

Water quality was measured using a hand held EC probe and water samples collected and sent to a certified laboratory at various times throughout the testing program.

Figure 7-1: Bore locations for test pumping of PB1

7.1.1 Step-Rate Test

A step-rate test was planned to be conducted on PB1 at flow rates of 0.1, 0.3, 0.5 and 0.7 L/sec in hourly consecutive steps.

Static water level prior to the commencement of the test was 4.38 mbtc.

The step rate test was undertaken on the 16 February 2011. During the first step (0.1 L/sec) the bore displayed excessive drawdown and the step-rate test had to be terminated after 30 minutes. A total drawdown of 7.15 m was recorded over this period. The results of the step-rate test are illustrated in Figure 7-2.

The results of the step-rate test indicated that the bore was unable to sustain a yield of 0.1 L/sec.

A calculated transmissivity value of 0.25m^{2}/d for the later part of the test was determined. The very low transmissivity value and excessive drawdown suggested the bore potentially was not developed effectively.

The test pump unit was then utilised to pump, surge and improve the efficiency of the bore for a period of 3 hours. No noticeable improvement in the bore was observed nor was there any evidence of bore development during this period.

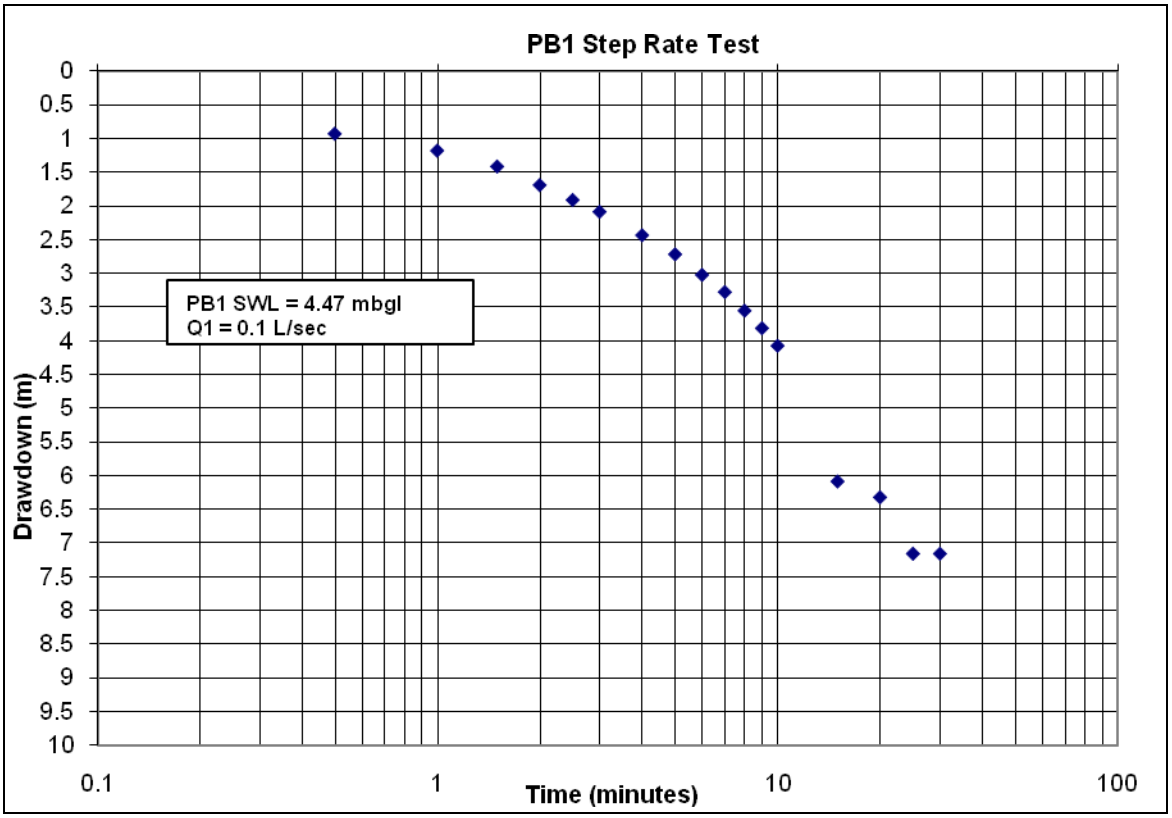

Figure 7-2: PB1 step rate test results.

7.1.2 Constant Rate Test

A constant rate test was conducted on PB1 following the step-rate test and additional bore development with the pump unit, on 16 February 2011, upon the water level in the bore having returned to its initial level.

The constant rate test was planned to pump PB1 at a rate of 0.05 L/sec for approximately six hours. The pump inlet setting was situated at a depth of 11.5 mbtc.

The test was terminated after 25 minutes due to excessive drawdown. A total drawdown of 7.03 m was recorded.

Water levels were measured in the adjacent observation bores (MB14S and MB14D) which are situated 10 m to the south of PB1. A drawdown of 0.015 m was observed in the observation bore MB14S, whilst no drawdown was recorded in MB14D.

The results of the constant rate test are illustrated in Figure 7-3.

Analysis of the constant rate test data indicate very high losses within the production bore PB1. Analysis of the shallow monitoring bore (MB14S) indicates a transmissivity value of around 16 m^2/d or a hydraulic conductivity value of 2 m/d assuming an effective saturated thickness of 8 m.

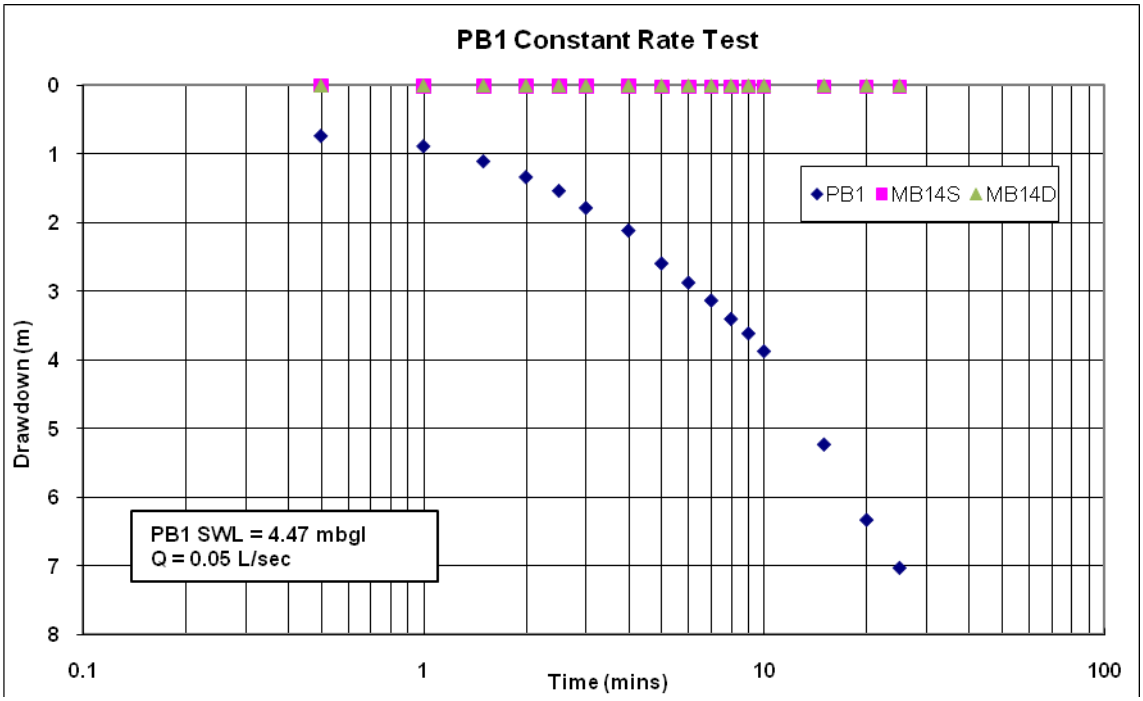

Figure 7-3: PB1 constant rate test results.

7.1.3 Recovery Test

Recovery test data was collected in bore PB1 following the cessation of pumping.

The collection of recovery test data was undertaken for 65 minutes. The results of the recovery test are illustrated in Figure 7-4.

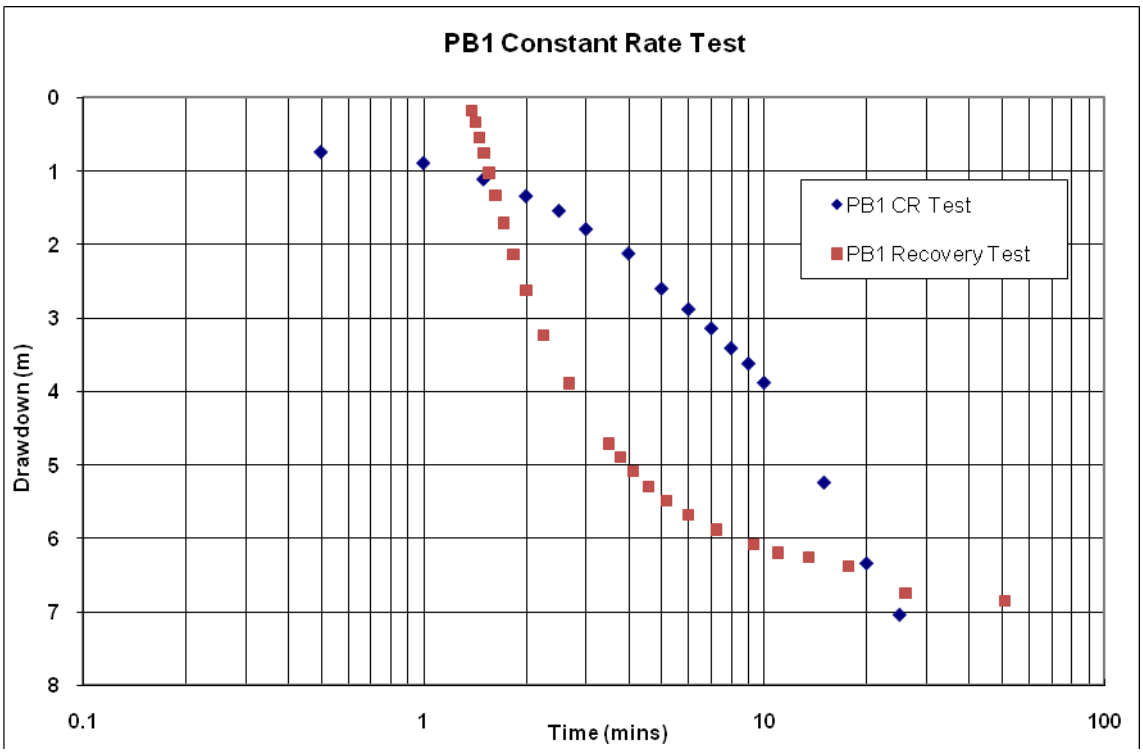

Figure 7-4: PB1 recovery test results.

7.1.4 Summary of Pump Testing Analysis

The results of the analysis of test pumping at PB1 indicates unusually low values for the fine grained sands encountered within the Safety Bay Sands. Considerable well loss appears to be occurring within the pump bore PB1 suggesting potential clogging of the slotted casing has occurred.

Based on the limited drawdown observed in the monitoring bore MB14S, the shallow monitoring bore located within the Safety Bay Sands, suggests a transmissivity value of around 16 m^2/d and a hydraulic conductivity value of 2 m/d (Table 7-1). Results from this test appear abnormally low for the nature of the lithology of the Safety Bay Sand.

Table 7-1: Hydraulic Analysis of PB1 Pump Test

	Bore No.	Transmissivity (T)	Storativity (S)	Hydraulic Conductivity (k)	Comments
Step Rate Test	PB1	0.25	-	-	Only one step completed
Constant Rate Test	PB1 MB14S MB14D	0.10 16.00 ND	ND 9.8×10^{-6} ND	2	-
Recovery Test	PB1	Early time 0.70 Late time 0.05	-	-	-

7.2 MB09S Test Pumping

Following the unusually low hydraulic conductivity result achieved from the test pumping of PB1, it was decided to undertake a short pump test on one of the shallow (Safety Bay Sand) monitoring bores – MB09S. This bore lies within the proposed footprint of the marina.

The electric submersible test pump unit was installed into MB09S to a depth of 8 mbgl. The pumping unit was installed on a HPDE rising main, with a dip tube strapped to the rising main to allow monitoring of water levels to be undertaken. The discharge rate was regulated using a gate valve and discharge rate measured using both an impeller type flow meter and measuring bucket.

Monitoring bores MB09D, MB03 and MB07 were utilised to observe aquifer response to abstraction during the testing program. Water levels were measured using a water level indicator probe and data loggers.

Water quality was measured using a hand held EC probe and water samples collected and sent to a certified laboratory at various times throughout the testing program.

7.2.1 Constant Rate Test

A constant rate test was undertaken in MB09S. Static water level in MB09S was 2.64 mbtc.

The bore was pumped at a flow rate of 1.6 L/sec for 360 minutes. The pump was situated at a depth of 8 mbgl.

Water levels in three existing monitoring bores were regularly monitored during the test (MB09D, MB03 and MB07) (Figure 7-5).

The results of the constant rate test are illustrated in Figure 7-6.

Within the pumping bore the drawdown follows a near linear trend until around 150 minutes after which it would appear that water level rose slightly followed by an acceleration in the rate of drawdown. This late time trend appears to correlate with the observed tidal trends observed in the observation bores.

All three observation bores did not display any drawdown in response to the pumping from bore MB09S. Instead, they showed a response to tidal movements. It is known from monitoring as part of the baseline collection of water levels in the Project area, that these three bores are tidally influenced with all three bores penetrating the Tamala Limestone aquifer. No hydraulic analysis could be undertaken on the observation bore data.

The analysis of the drawdown on the pumping bore MB09S during the constant rate test indicate that the aquifer is behaving as an unconfined aquifer with a calculated transmissivity value of 337 m^2/d, and a hydraulic conductivity of 42 m/d

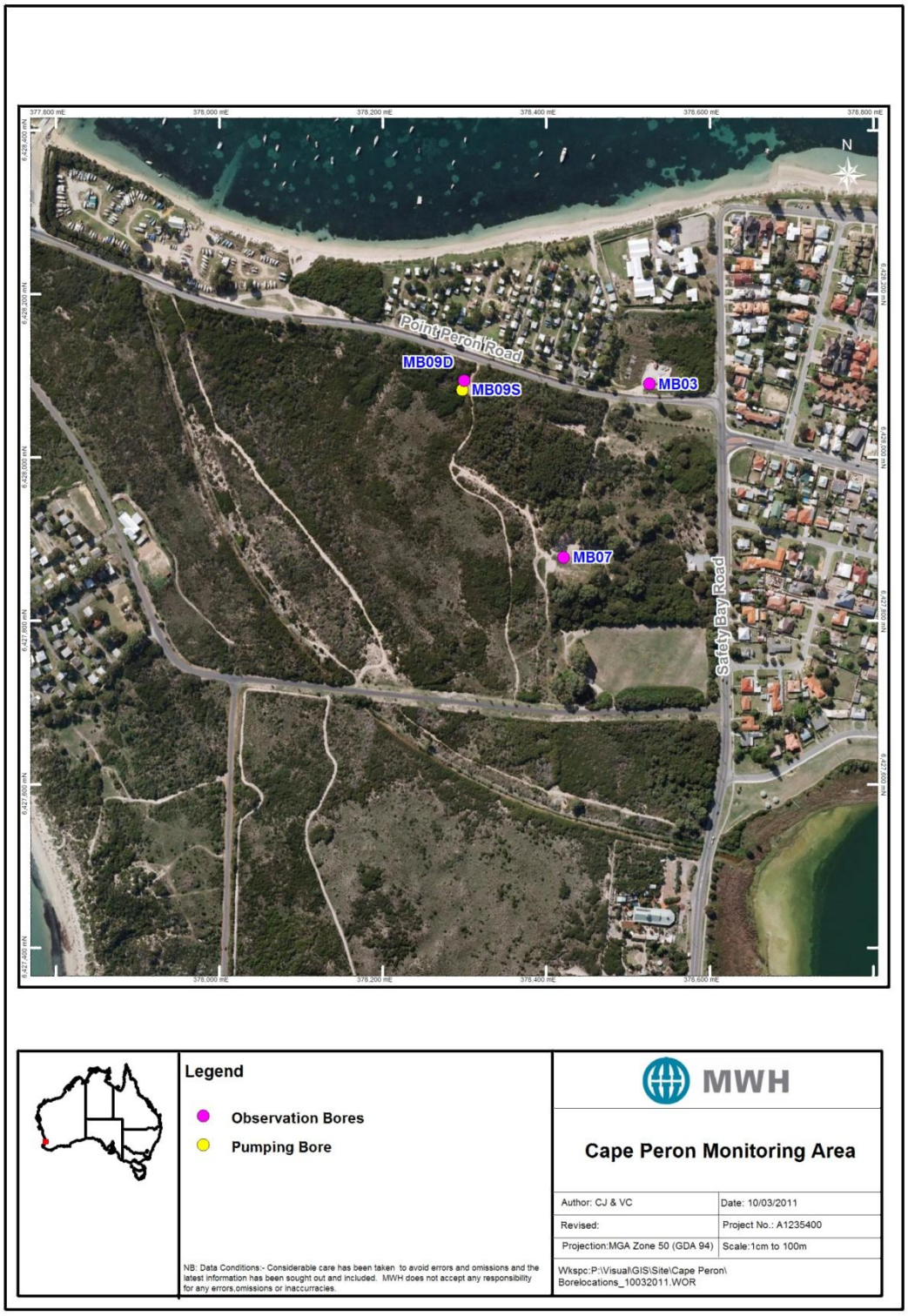

Figure 7-5: Location of the pumping and observation bores for the MB09S constant rate test.

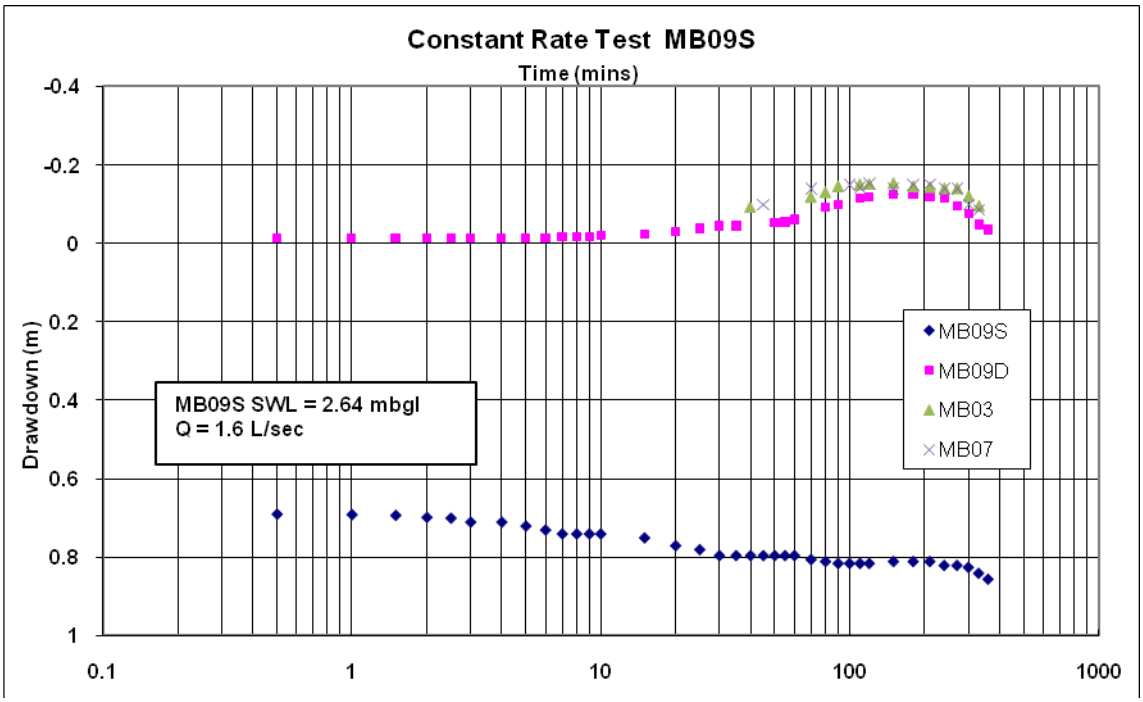

Figure 7-6: MB09S constant rate test results.

7.2.2 Recovery Test

At the conclusion of the constant rate test recovery data was collected from MB09S for 60 minutes. The results of the recovery test are illustrated in **Figure 7-7**.

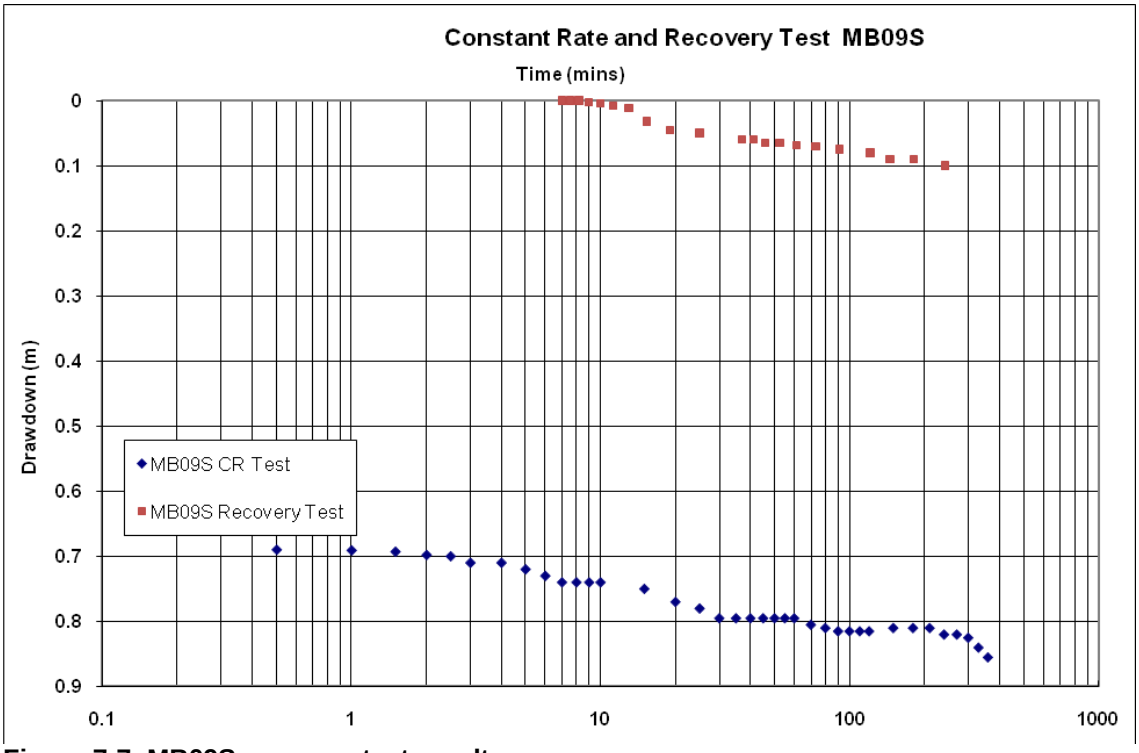

Figure 7-7: MB09S recovery test results.

7.2.3 Summary of Pump Testing Analysis

A summary of the pump test analysis on bore MB09S is provided in Table 7-2.

Table 7-2: Summary of Pump Test Analysis on Bore MB09S

	Bore No.	Transmissivity (T)	Storativity (S)	Hydraulic Conductivity (k)	Comments
Constant Rate Test	MB09S MB09D MB03 MB07	337 ND ND ND	ND	42	
Recovery Test	MB09S	Middle time: 602	-	75	

8 Monitoring Program

The Cape Peron monthly monitoring program is currently being undertaken by MWH. The program started in April 2010 and will be completed in September 2011. The monitoring program consists of:

- water level monitoring;
- downloading data loggers;
- downhole EC, pH, DO, temperature and redox surveys; and
- water sampling.

The results from this monitoring program, for the period April 2010 to March 2011, are included in the Field Program Results in the following section.

8.1 Water Level Monitoring

Depth-to-water measurements are taken in all bores (including the new bores MB14S, MB14D and PB1, and, existing bore BH03 (drilled as part of a separate program by another company)) on a monthly basis using an *Enviro Equip* water level indicator. The depth-to-water measurements are converted to metres AHD using the bore's collar RL (Table 6-1) which were surveyed by *McMullen Nolan*.

8.2 Data Loggers

Six data loggers and one barometric logger were installed in selected bores (MB01, MB12, MB07, MB09S, MB08 and MB13) on completion of drilling (Table 19). An additional data logger was installed in bore MB09D in September 2010. These data loggers are programmed to measure the head of water above the device every thirty minutes to collect groundwater fluctuation data.

The data loggers consist of six *Insitu Level Troll 300* loggers, one *Insitu Level Troll 500* logger and one *Insitu Baro Troll 500* logger. All loggers are non-vented type, have a range of 0 to 10.5 m and are suspended on SSS cable from the bore cap. The Level Troll loggers record the head of water (pressure (kPa)) and temperature (^{o}C), whilst the Baro Troll records barometric pressure (kPa) and temperature (^{o}C). The head above water (pressure) data retrieved from the Level Troll data loggers were corrected for barometric pressure (data retrieved from the Baro Troll), using the bore's collar RL (Table 24), which allowed the water level data to be displayed in metres AHD.

The data collected is then used to assess groundwater level fluctuation throughout the Project area.

Details of bores in which data loggers were installed at Cape Peron are summarised in Table 8-1.

Table 8-1: Data Logger Installation Locations

Borehole ID	Easting	Northing	Serial Number	SWL (mbgl)	Installed Depth (mbgl)	Date Installed
MB01	378534.3	6427559.9	156785	1.62	7.0	08/04/10
MB01*	378534.3	6427559.9	152989	1.62	0.5	08/04/10
MB12	378462.2	6427723.5	157340	1.81	7.28	19/04/10
MB07	378420.9	6427873.8	156786	2.79	7.0	09/04/10
MB09S	378298.4	6428081.9	156778	2.76	7.0	09/04/10
MB09D	378299.1	6428092.1	101075	2.26	5.7	23/09/10
MB08	378198.3	6428232.8	158039	2.04	5.0	16/04/10
MB13	378078.7	6427936.0	156779	4.24	7.0	09/04/10

***Barotroll installation location**

8.3 Downhole Surveys

Downhole EC, pH, DO, temperature and redox surveys are conducted monthly in each bore (including the new bores MB14S, MB14D and PB1, and, existing bore BH03). The process involves lowering the Q*uanta G Water Quality Monitoring System* down the bore to record EC, pH, DO, temperature and redox at depths of one metre intervals below the manual depth to water reading.

8.4 Water Sampling

Monthly bailed water sampling is conducted on each of the 14 monitoring bores (aswell as the new bores MB14S and MB14D). Laboratory analysis of the water samples is conducted by *SGS Pty Ltd Australia*.

The water sampling process involves bailing each bore before sampling to ensure the sample is fresh, collecting the bailed water sample, storing it in a chilled esky and providing it to SGS as soon as possible.

Each sample is analysed for:

- general water chemistry (total dissolved solids (TDS), pH, electrical conductivity (EC) cations, anions, Ca, Cl, Na, K, Mg, Fe, SO4, NO3, HCO3 and CO3);
- eight standard metals (As, Cd, Cu, Cr, Hg, Pb, Ni and Zn); and
- nutrients (TKN, TN, NH3, NO3, NO2, PO4 and TP).

9 Field Program Results

9.1 Depth to Water

Manual depth-to-water measurements recorded during the monitoring program have been collated and illustrated in Figures 9-1 and 9-2.

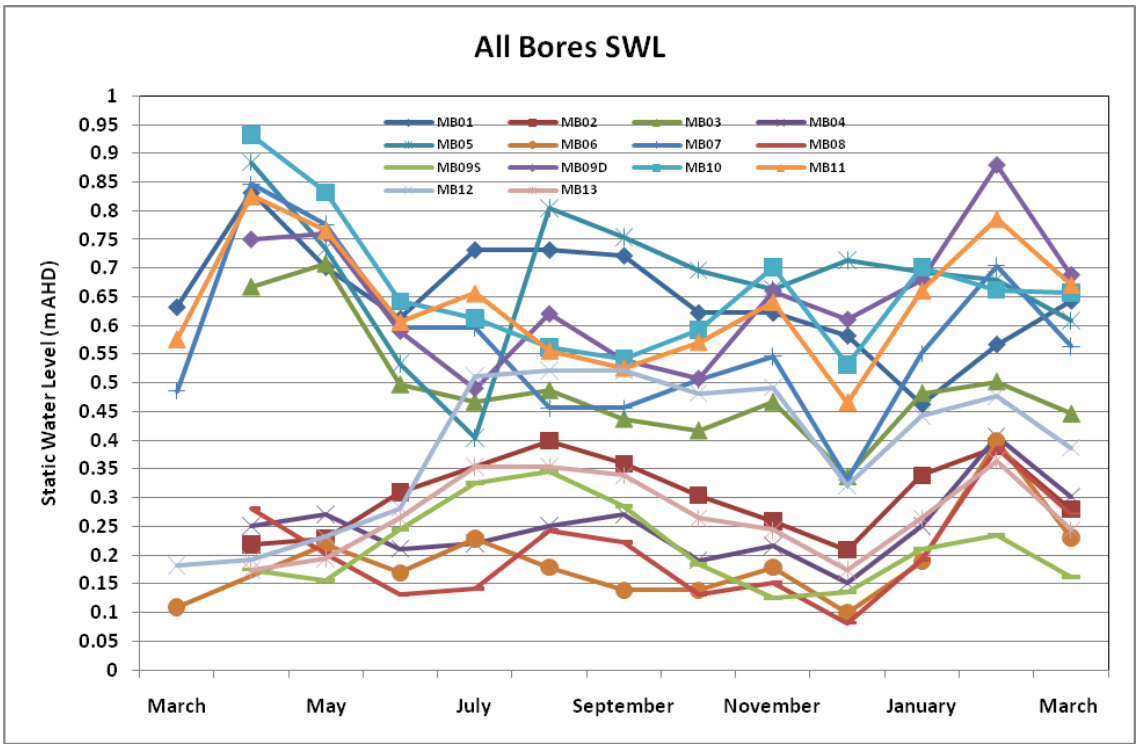

Figure 9-1: Groundwater levels.

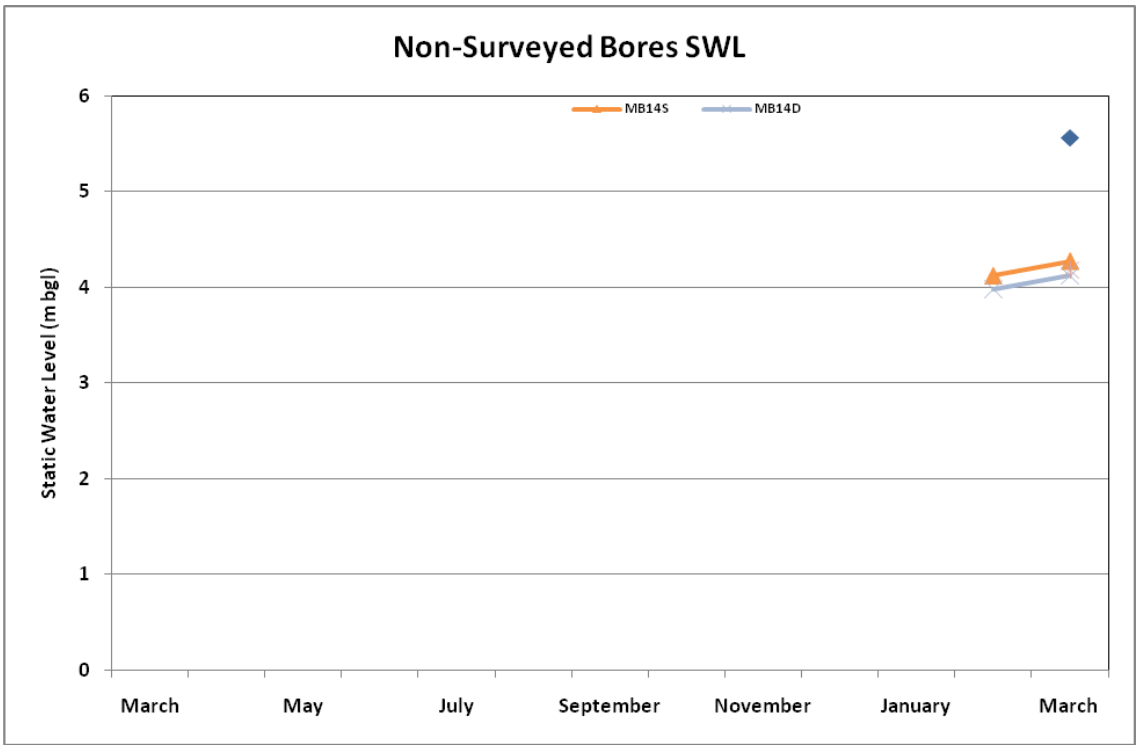

Figure 9-2: Groundwater levels in non-surveyed bores.

9.2 Data Loggers

Water level data retrieved from the data loggers have been plotted and provided in Figures 9-3 to 9-16 (raw data are provided in Appendix D). The manual depth-to-water readings are also plotted in the data logger graphs.

Tidal data has been plotted with the data logger's data (Figures 9-3 to 9-16) to illustrate the tidal influence on bores which penetrate the Tamala Limestone.

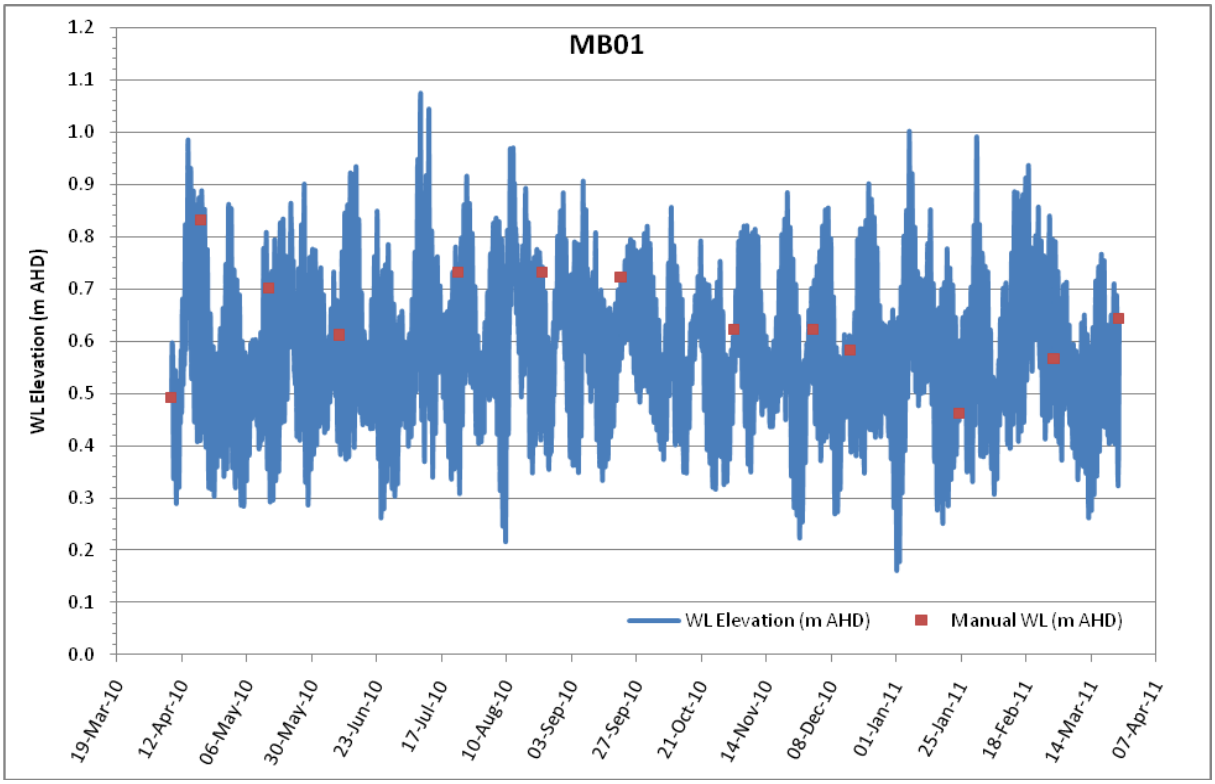

Figure 9-3: MB01 water level logger data.

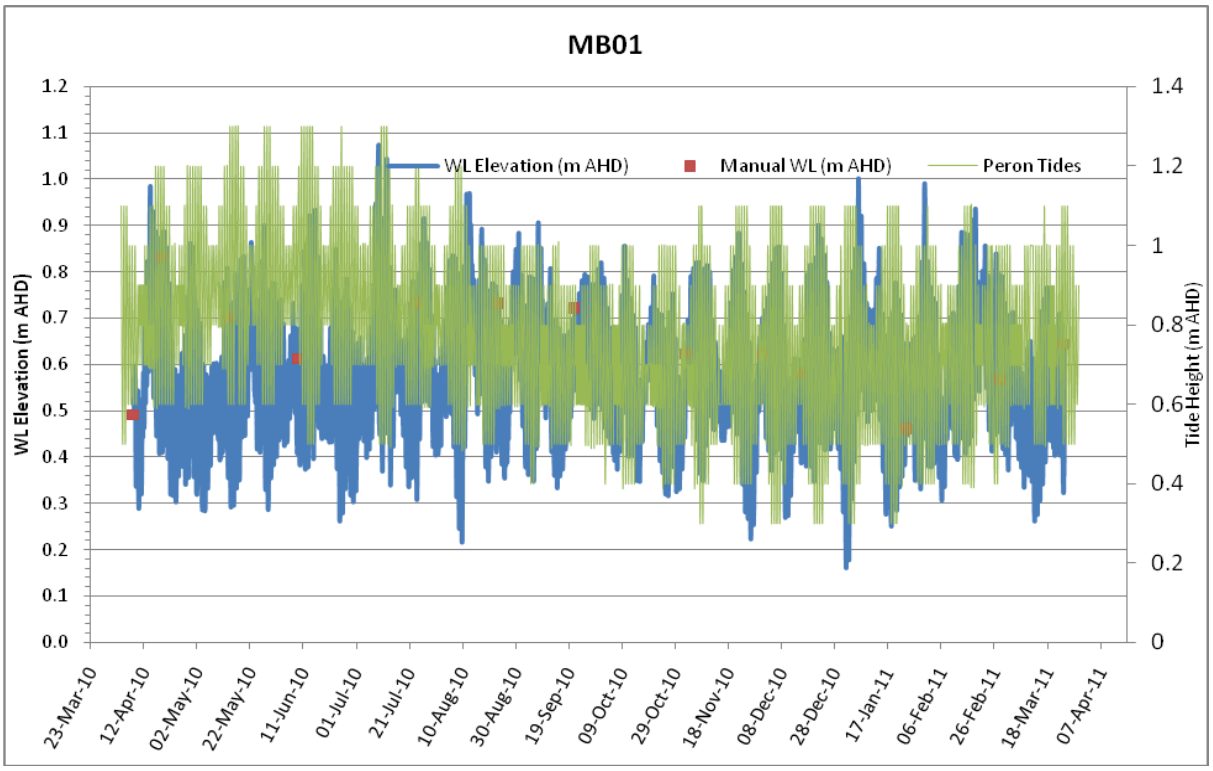

Figure 9-4: MB01 water level logger data with Cape Peron tidal data.

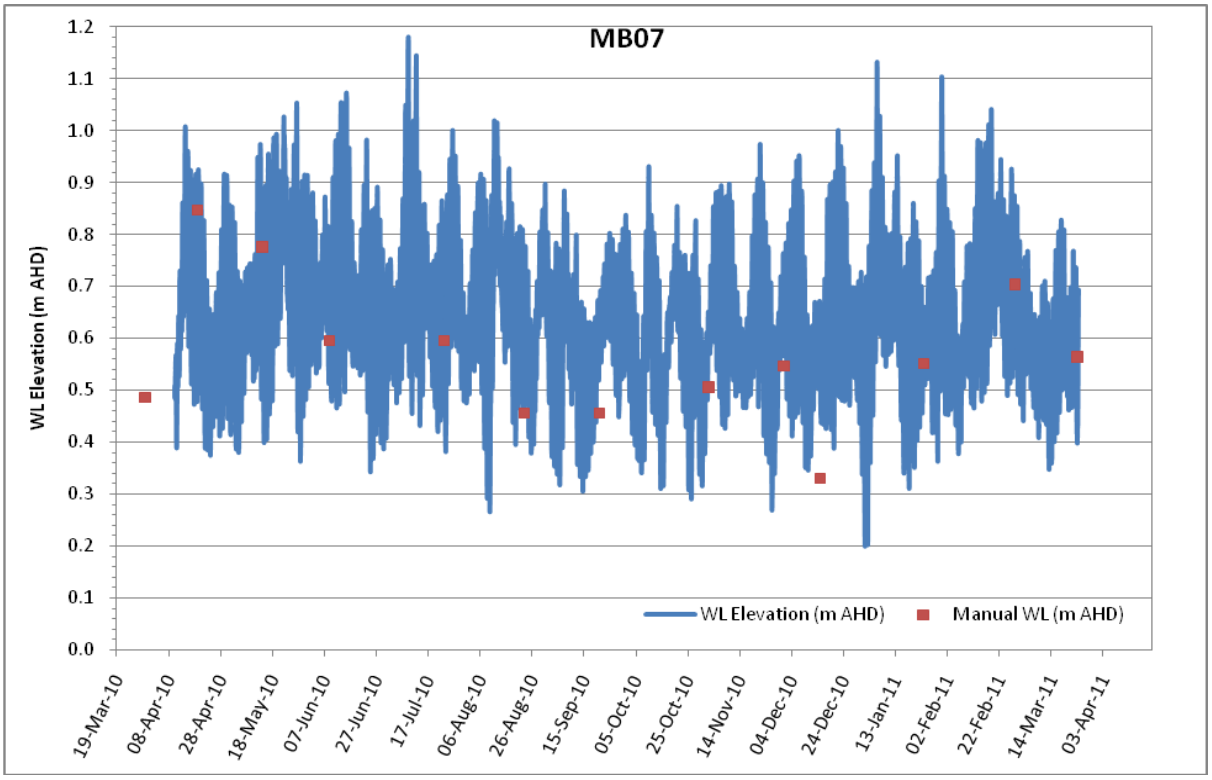

Figure 9-5: MB07 water level logger data.

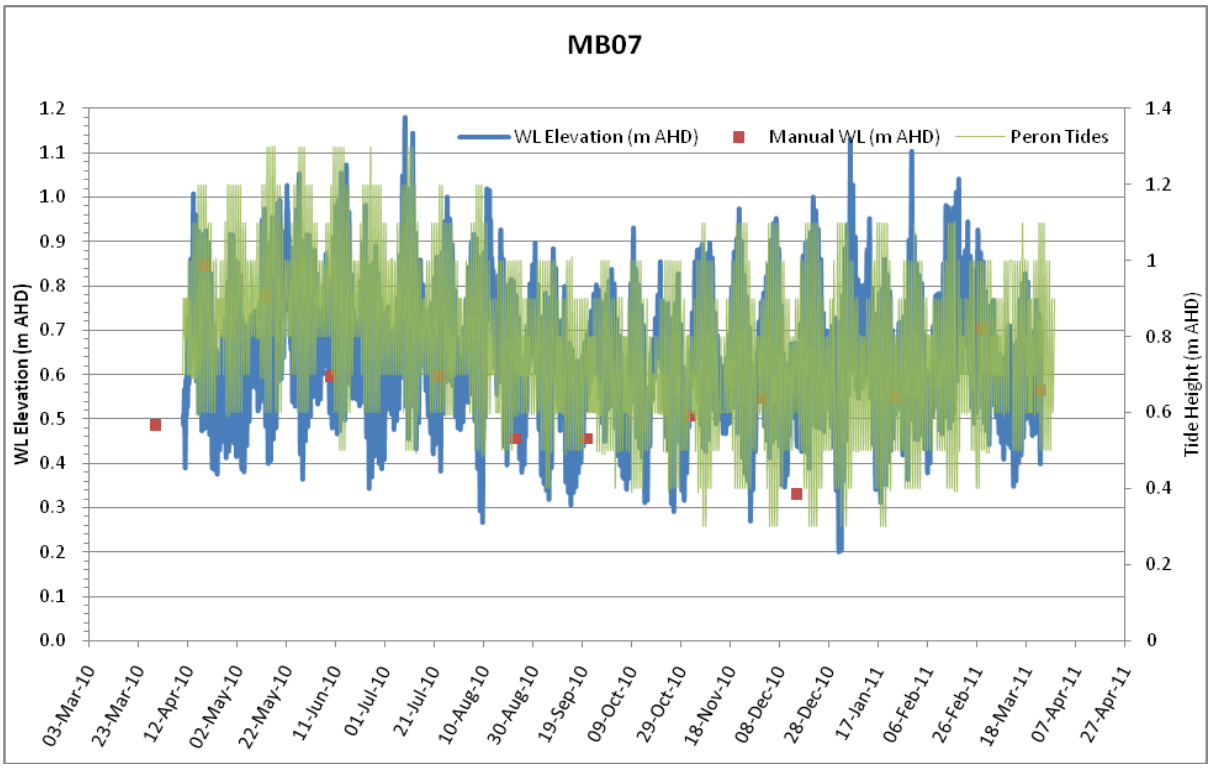

Figure 9-6: MB07 water level logger data with Cape Peron tidal data.

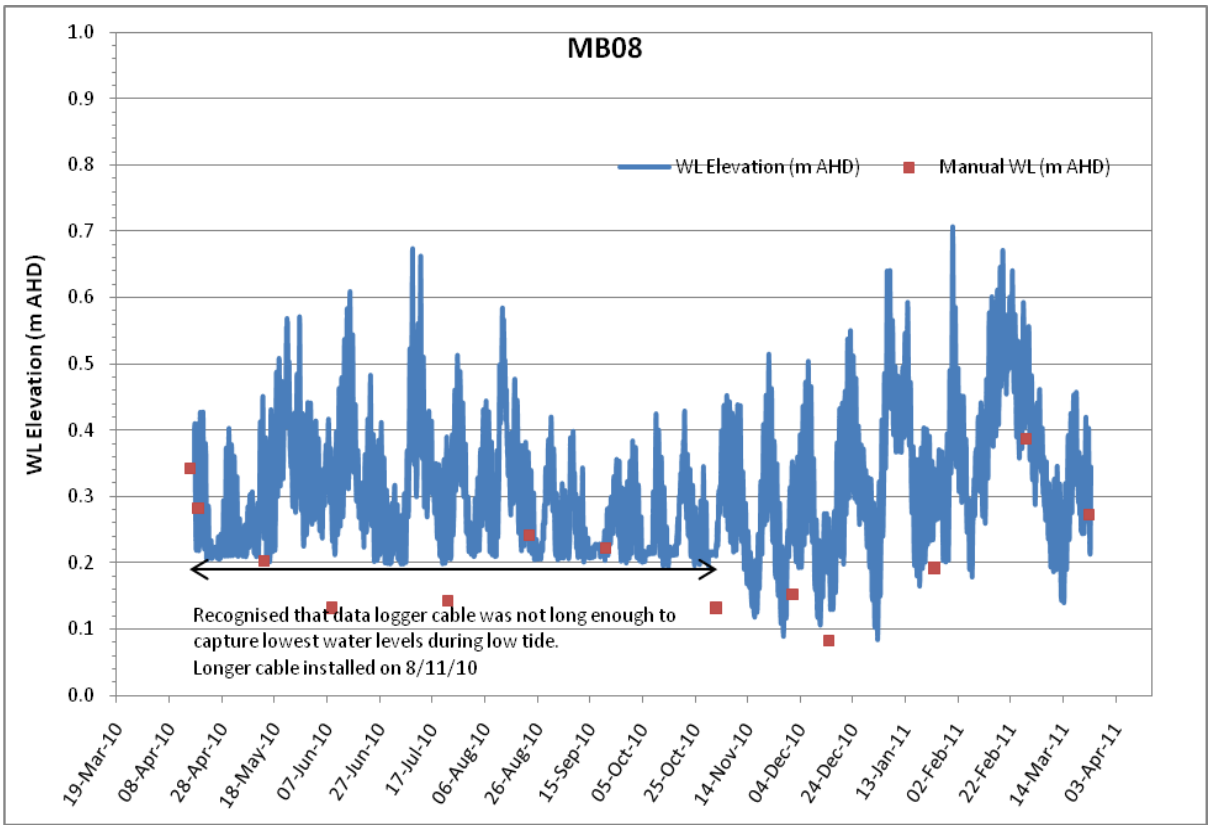

Figure 9-7: MB08 water level logger data.

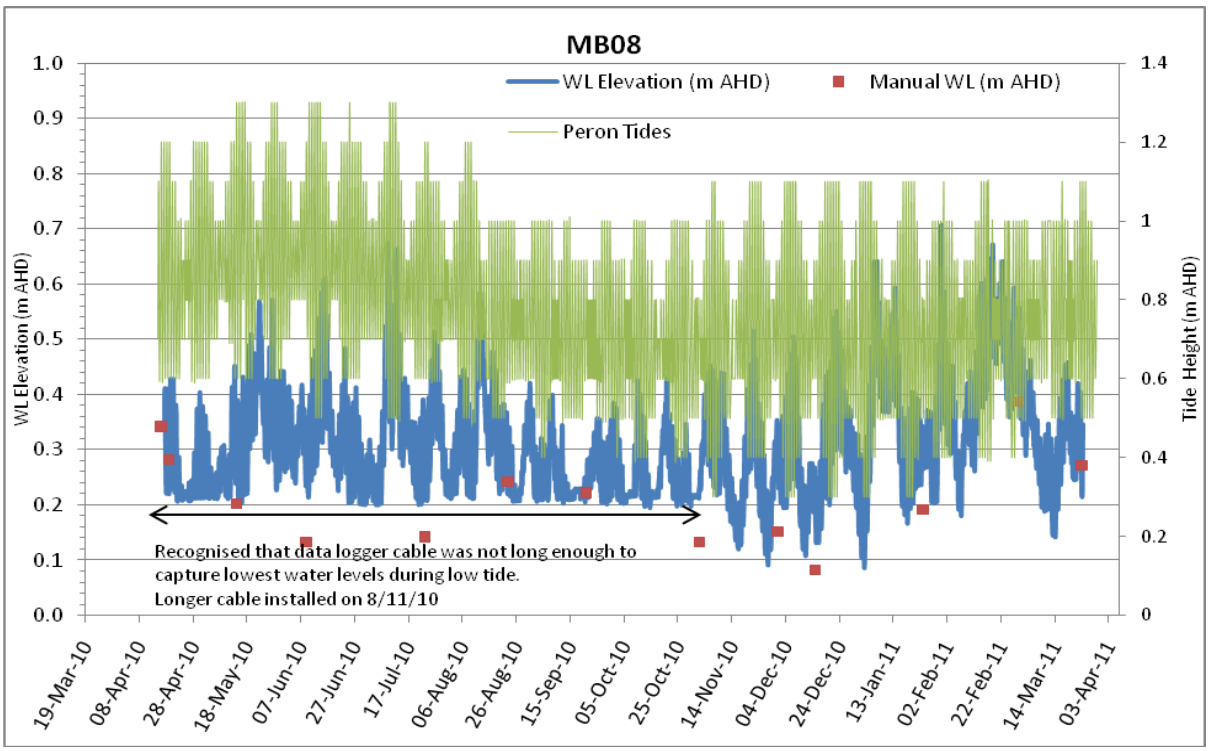

Figure 9-8: MB08 water level logger data with Cape Peron tidal data.

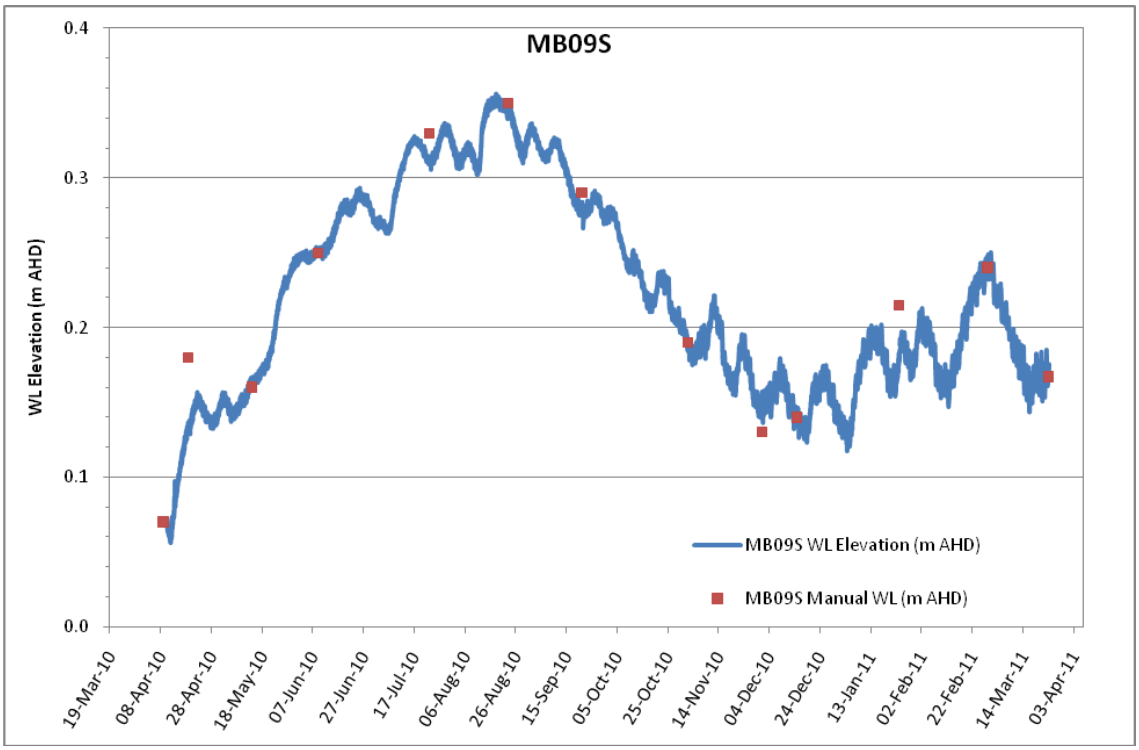

Figure 9-9: MB09S water level logger data.

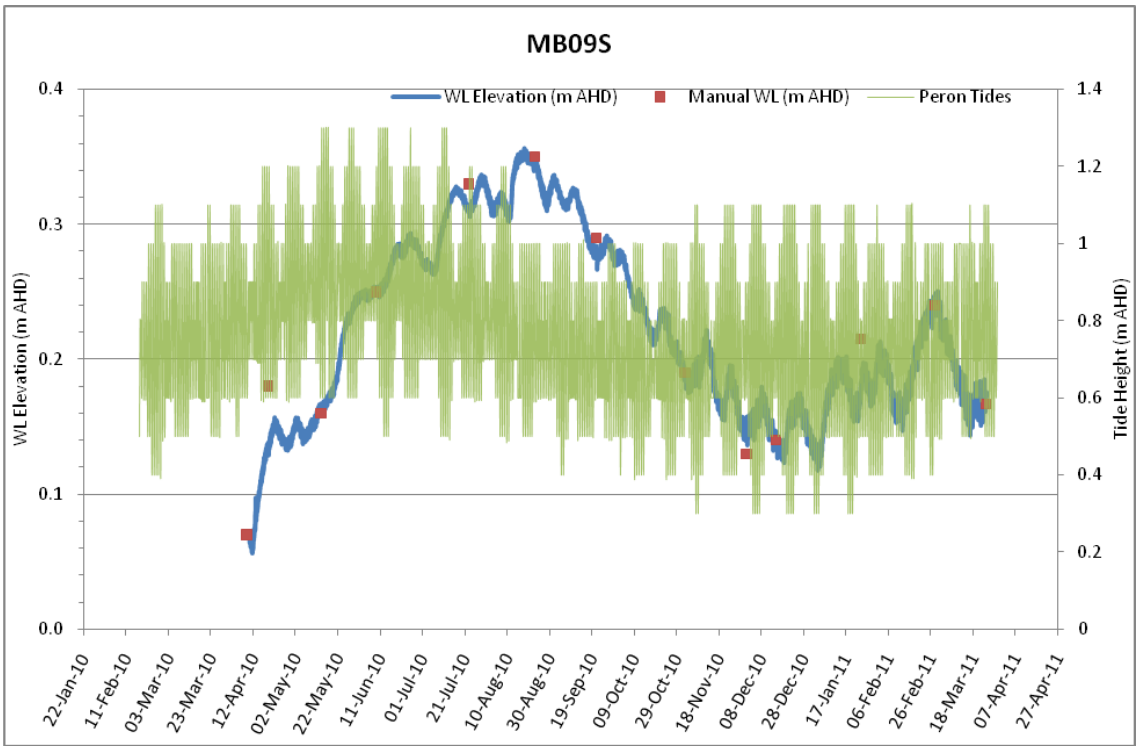

Figure 9-10: MB09S water level logger data with Cape Peron tidal data.

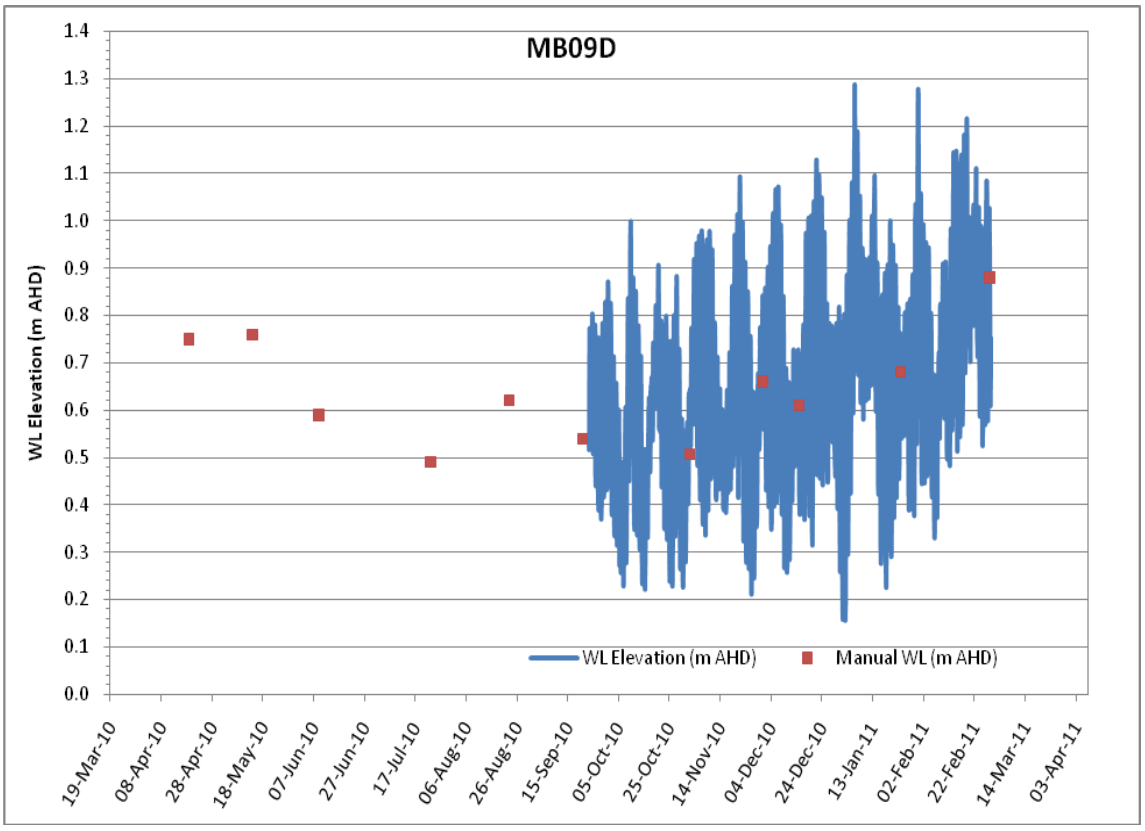

Figure 9-11: MBO9D water level logger data (unable to download data from logger during March monitoring run).

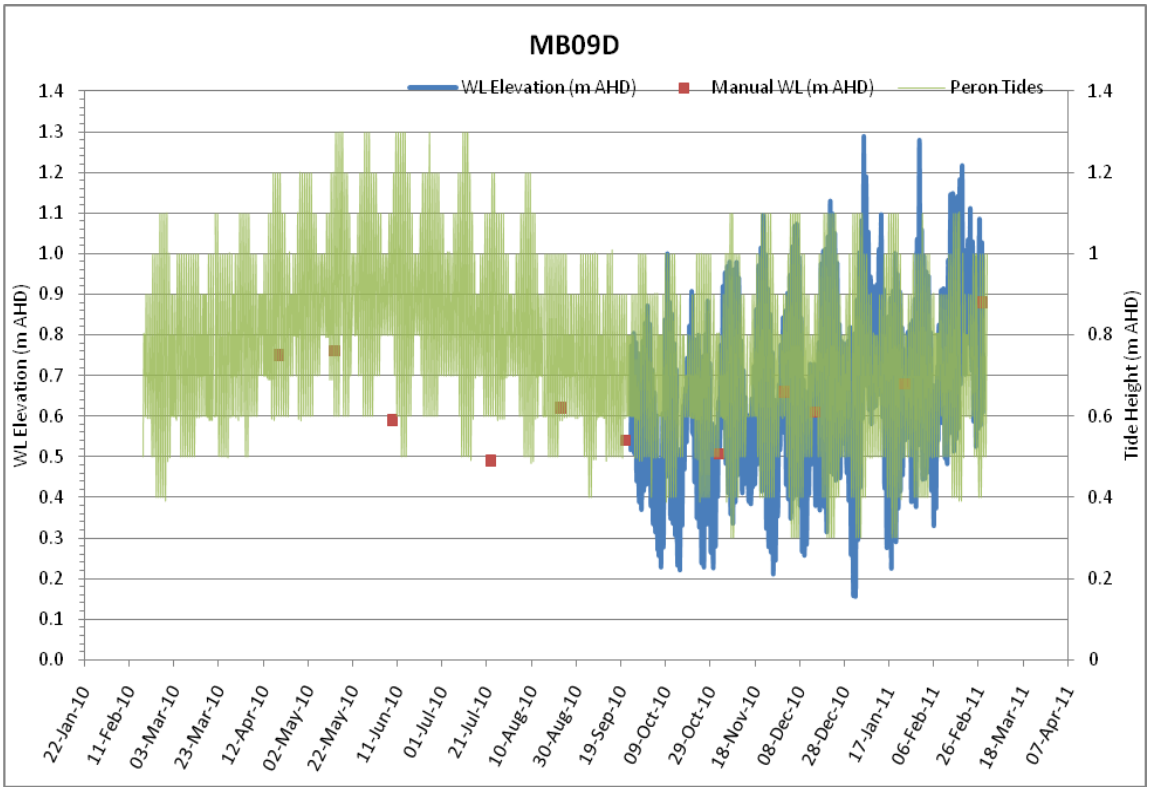

Figure 9-12: MB09D water level logger data with Cape Peron tidal data (unable to download data from logger during March monitoring run).

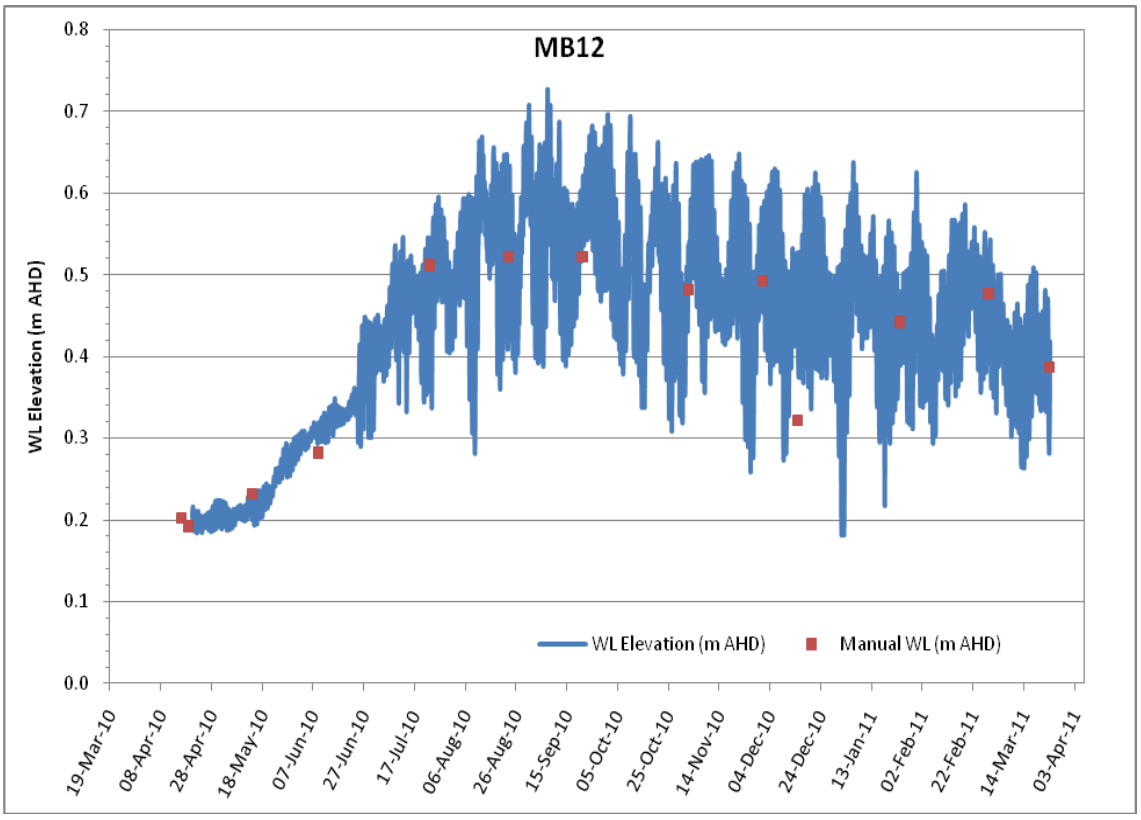

Figure 9-13: MB12 water level logger data.

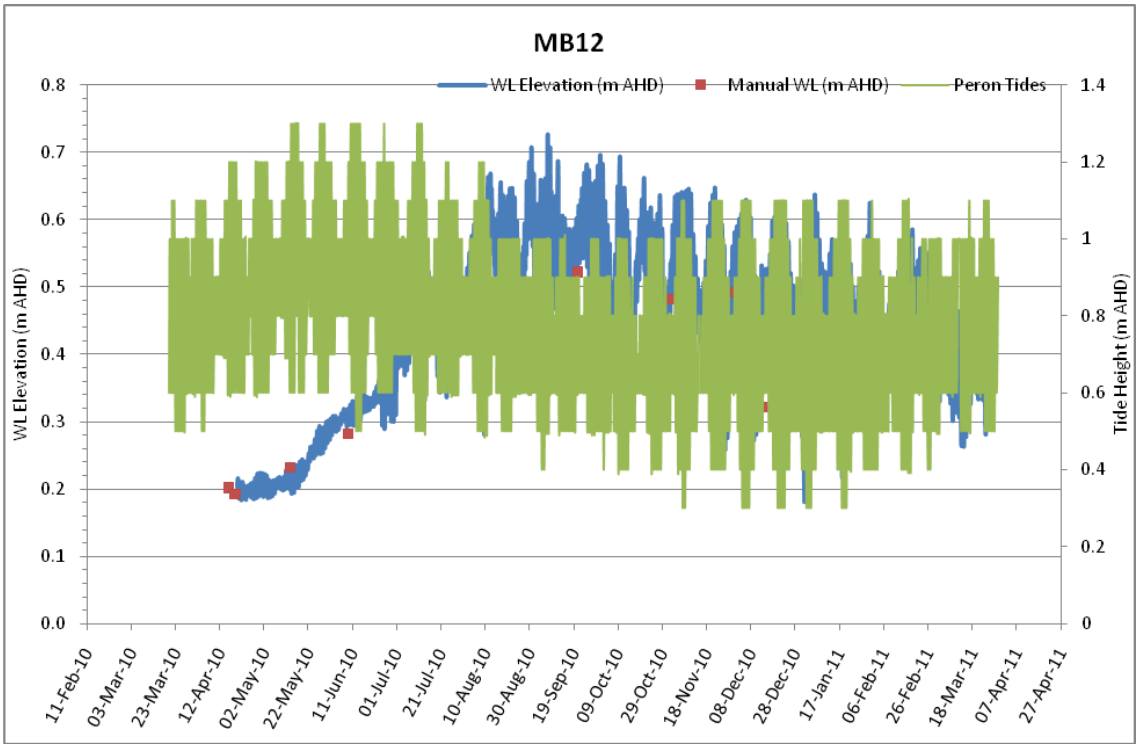

Figure 9-14: MB12 water level logger data with Cape Peron tidal data.

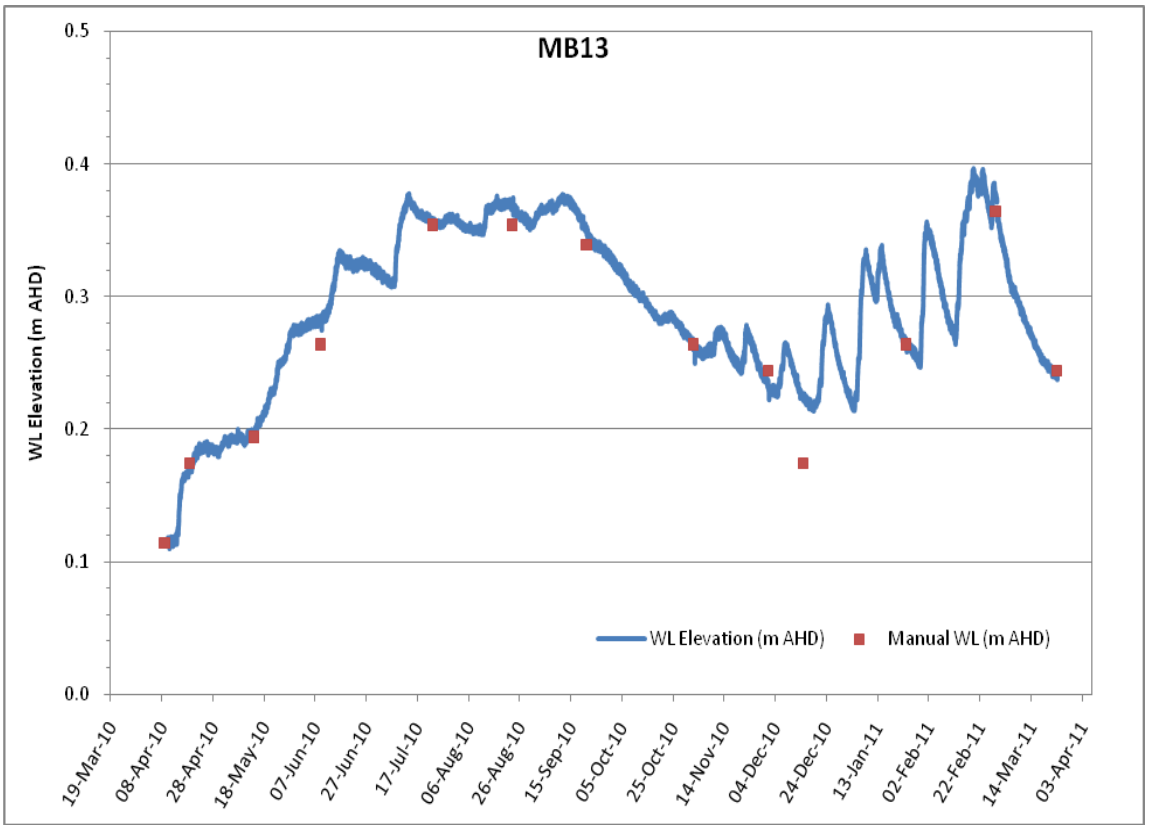

Figure 9-15: MB13 water level logger data.

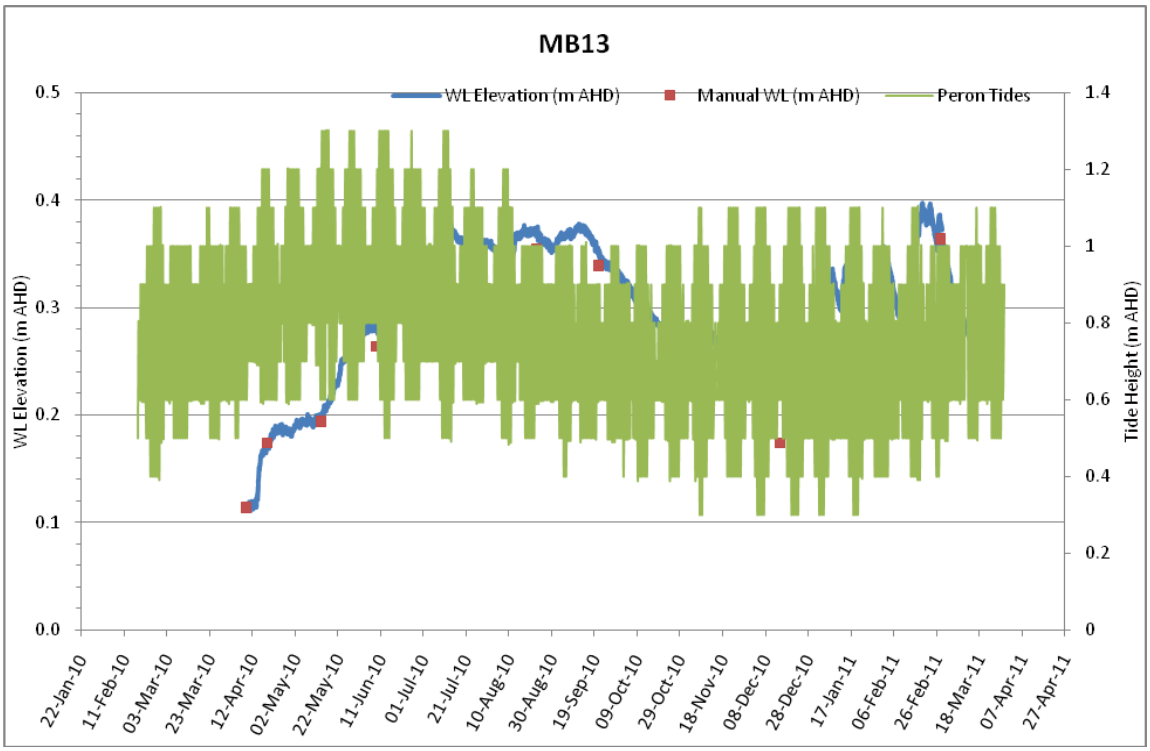

Figure 9-16: MB13 water level logger data with Cape Peron tidal data.

9.3 Downhole Surveys

The downhole EC, pH, DO, temperature and redox surveys for each bore are provided in Appendix E. All data is referred back to AHD using the bore's collar RL (where available) (Table 6-1).

The depth to the 'saline' water (>40,000 µS/cm) interface has been estimated based on the collected data and is provided in Table 9-1 with the maximum observed EC. For the purpose of this investigation, saline water is defined as more than 40,000 µS/cm (based on the EC of the ocean adjacent to MB08 measured at 62,000 µS/cm).

Table 9-1: Depth to saline water interface.

Borehole	Bore Depth (m bgl)	Depth to Saline Water (m bgl)	Level of Saline Water (m AHD)	Maximum EC (µs/cm)
MB01	30	24 to 27	-23 to -26	53,300
MB02	22	NA	NA	11,800
MB03	27	23 to 25	-22 to -24	50,700
MB04	11	7 to 9	-6 to -8	57,300
MB05	30	24 to 25	-23 to -24	62,900
MB06	8	5 to 7	-4.5 to -6	59,400
MB07	30	23 to 26	-22 to -25	53,300
MB08	11	5 to 7	-4.5 to -6.5	60,600
MB09S	21.5	NA	NA	9,100
MB09D	30	24 to 26	-23 to -25	87,400
MB10	30	26	-25	40,600
MB11	30	24 to 26	-23 to -25	77,000
MB12	30	24 to 27	-23 to -26	53,000
MB13	21	NA	NA	22,900
MB14S	12	NA	NA	14,270
MB14D	20	NA	NA	11,980
BH03	7.8	NA	NA	1,670

NA = Bore above saline water interface

9.4 Water Quality Analysis

The results of the water quality analysis are presented in Tables 9-2 to 9-17 with the laboratory analytical reports provided in Appendix C. No water sample was taken for MB02 in July 2010 due to the bore being unable to be accessed on the day. Laboratory analysis methods and reporting limits have been specified where analytes of similar names have been reported.

Table 9-2: MB01 Groundwater quality

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Date Sampled	-	19/4/10	14/5/10	9/6/10	23/7/10	23/8/10	21/9/10	2/11/10	1/12/10	15/12/10	24/1/11	28/02/11	24/3/11	-	-	-	-
pH	pH Units	7.7	7.7	7.3	7.4	7.4	8.0	7.1	7.4	7.7	7.4	7.4	7.4	7.5	7.4	7.1	8
Conductivity @25°C	µS/cm	7600	16000	15000	12000	10000	1500	13000	17000	13000	16000	19000	20000	13342	14000	1500	20000
Total Dissolved Solids @ 180°C	mg/L	5100	10000	10000	7100	5900	790	6300	9000	8600	10000	13000	13000	8233	8800	790	13000
Soluble Iron, Fe	mg/L	0.2	0.48	0.82	0.23	0.33	0.1	0.72	1.5	1.5	6.3	14	32	5	0.77	0.1	32
Sodium, Na	mg/L	1400	2900	2600	2100	1700	170	1800	2600	2300	2600	3800	3800	2314	2450	170	3800
Potassium, K	mg/L	39	78	70	55	51	8.6	57	79	71	81	120	110	68	70.5	8.6	120
Calcium, Ca	mg/L	160	220	210	200	170	58	130	190	170	210	270	250	187	195	58	270
Magnesium, Mg	mg/L	240	420	370	330	270	55	280	370	340	380	530	550	345	355	55	550
Chloride, Cl	mg/L	2800	5700	5400	3700	3100	280	3600	4800	4400	5300	6500	7300	4407	4600	280	7300
Carbonate, CO_3	mg/L	<1	<1	<1	<1	<1	7	<1	<1	<1	<1	<1	<1	2	<1	<1	7
Bicarbonate, HCO_3	mg/L	400	390	410	390	400	310	320	350	370	360	370	370	370	370	310	410
Sulphate, SO_4	mg/L	270	720	630	430	360	65	490	730	650	680	870	900	566	640	65	900
Fluoride, F	mg/L	0.8	0.9	0.8	0.9	0.7	0.8	0.8	0.8	0.9	0.7	0.5	0.7	0.78	0.80	0.50	0.90
Soluble Manganese, Mn	mg/L	0.018	<0.05	<0.05	<0.05	<0.025	<0.005	<0.025	<0.025	0.011	0.020	0.03	0.053	0.03	0.03	0.01	0.05
Soluble Silica, SiO2	mg/L	9.9	1.3	6.8	8.8	9.8	12	9.7	7.4	9.6	7.4	8.5	<0.5	7.64	8.65	0.50	12.00

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Cation/Anion balance	%	-1.3	-2.3	-5.3	4	1	2	-3	-1	-2	-4	4	0	-0.66	-1.15	-5.30	4.00
Sum of Ions (calc.)	mg/L	5350	10385	9643	7090	5970	904	6670	9000	8300	9540	12400	13300	8213	8650	904	13300
Soluble Mercury, Hg	mg/L	0.0001	<0.0005	<0.00001	<0.00005	<0.00005	<0.0001	<0.0001	<0.0001	<0.0001	<0.00005	<0.00005	<0.00005	0.00015	0.0001	0.00005	0.00050
Soluble Arsenic, As	mg/L	0.008	<0.02	0.003	<0.2	<0.1	<0.02	<1	<0.1	<0.02	<0.02	<0.1	<0.2	0.1493	0.06	0.0030	1.0000
Soluble Cadmium, Cd	mg/L	<0.0002	<0.01	<0.00001	<0.01	<0.005	<0.001	<0.005	<0.005	<0.005	0.001	<0.005	<0.01	0.0048	0.005	0.0001	0.0100
Soluble Chromium, Cr	mg/L	<0.002	<0.05	<0.001	<0.05	<0.025	<0.005	<0.025	<0.025	<0.005	<0.005	<0.025	<0.05	0.0223	0.025	0.0010	0.0500
Soluble Copper, Cu	mg/L	<0.002	<0.05	0.004	<0.05	<0.025	<0.005	<0.025	<0.025	<0.005	<0.005	<0.025	<0.05	0.0226	0.025	0.0020	0.0500
Soluble Lead, Pb	mg/L	<0.002	<0.05	<0.001	<0.05	<0.025	<0.005	<0.025	<0.025	<0.005	<0.005	<0.025	<0.05	0.0223	0.025	0.0010	0.0500
Soluble Nickel, Ni	mg/L	0.003	<0.05	0.004	<0.05	<0.025	<0.005	<0.025	<0.025	0.007	0.027	0.039	0.064	0.027	0.025	0.0030	0.0640
Soluble Zinc, Zn	mg/L	0.034	<0.1	0.02	<0.05	<0.05	<0.01	<0.05	<0.05	0.03	0.02	<0.05	<0.1	0.047	0.050	0.0100	0.1000
Ortho Phosphorus, PO_4-P	mg/L	0.09	0.02	0.009	0.06	0.072	0.024	0.021	0.002	0.011	0.003	0.007	<0.002	0.0268	0.0155	0.0020	0.0900
Total Phosphorus	mg/L	0.09	0.04	0.04	0.04	0.08	0.04	0.01	<0.01	0.02	0.10	0.1	0.20	0.0642	0.04	0.0100	0.2000
Nitrate, NO_3 (method AN258, reporting limit = <0.2)	mg/L	<0.2	<0.2	<0.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.2	<0.2	0.2000	0.2000
Nitrate, NO_3 (method AN258, reporting limit = <0.05)	mg/L	0.05	NA	0.08	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.065	0.065	0.0500	0.0800

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Nitrate Nitrogen, NO_3 as N (method AN258, reporting limit 0.005)	mg/L	NA	NA	NA	<0.005	0.064	0.40	0.033	<0.005	0.012	0.084	0.014	0.02	0.0708	0.02	0.0050	0.4000
Nitrate, NO_3 as NO_3 (method AN258, reporting limit 0.05)	mg/L	NA	NA	NA	<0.05	0.28	1.8	0.15	<0.05	0.05	0.37	0.06	0.09	0.3222	0.09	0.0500	1.8000
Total Nitrogen (method AN209, reporting limit <0.05)	mg/L	3.9	3.8	4.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.9	3.9	3.8000	4.0000
Total Nitrogen (Persulphate Digestion) (method AN268, reporting limit 0.05)	mg/L	NA	NA	NA	3.9	3.7	0.98	1.7	3.1	3.4	NA	NA	NA	2.7967	3.25	0.9800	3.9000
Total Nitrogen (calc) (method AN281/292, reporting limit 0.05)	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.1	4	1.4	3.1667	4	1.4000	4.1000

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Total Kjeldahl Nitrogen (TKN) (Calculated) (method AN268, reporting limit 0.05)	mg/L	NA	NA	NA	3.9	3.6	0.49	1.7	3.1	3.3	NA	NA	NA	2.6817	3.2	0.4900	3.9000
Total Kjeldahl Nitrogen (method AN281/292, reporting limit 0.05)	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	4	4	1.4	3.1333	4	1.4000	4.0000
Kjeldahl Nitrogen (calculated) (method calculation, reporting limit <0.05)	mg/L	3.9	NA	4	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.95	3.95	3.9000	4.0000
Nitrate/Nitrite Nitrogen, NOx as N (method AN258, reporting limit 0.005)	mg/L	0.011	NA	0.017	<0.005	0.064	0.49	0.033	<0.005	0.012	0.084	0.014	0.02	0.0686	0.017	0.0050	0.4900
Nitrite, NO_2 (method AN258, reporting limit <0.05)	mg/L	<0.05	<0.05	<0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.05	<0.05	<0.05	<0.05

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Nitrite Nitrogen, NO_2 as N (method AN258, reporting limit <0.05)	mg/L	NA	NA	NA	<0.005	<0.005	0.083	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0137	0.005	0.0050	0.0830
Nitrite, NO_2 as NO_2 (method AN258, reporting limit 0.05)	mg/L	NA	NA	NA	<0.05	<0.05	NA	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Ammonia Nitrogen, NH_3 as N (method AN261, reporting limit 0.005)	mg/L	3.6	NA	3.7	3.6	3.2	0.15	1.4	2.8	3.0	3.5	3.9	0.41	2.66	3.2	0.1500	3.9000

NA = sample not analysed for analyte

Table 9-3: MB02 Groundwater quality

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Date Sampled	-	19/4/10	14/5/10	9/6/10	no sample collected	23/8/10	21/9/10	2/11/10	1/12/10	15/12/10	24/1/11	28/2/11	24/3/11	-	-	-	-
pH	pH Units	8.4	8.0	7.7	-	7.6	7.9	7.4	7.6	8.0	7.6	7.6	7.6	7.8	7.6	7.4	8.4
Conductivity @25°C	µS/cm	1100	1200	1300	-	1200	1200	1200	1200	1100	1200	1200	1300	1200.0	1200	1100	1300
Total Dissolved Solids @ 180°C	mg/L	680	700	730	-	620	670	670	650	690	730	700	760	690.9	690	620	760
Soluble Iron, Fe	mg/L	0.09	0.06	0.09	-	0.12	0.19	0.14	0.22	0.06	0.06	0.16	0.08	0.1	0.09	0.06	0.22
Sodium, Na	mg/L	190	180	150	-	110	140	120	120	120	110	120	130	135.5	120	110	190
Potassium, K	mg/L	4.6	5.6	5.2	-	4.7	6.3	4.9	5.0	4.9	4.9	4.9	6.3	5.2	4.9	4.6	6.3
Calcium, Ca	mg/L	41	50	67	-	74	91	76	78	77	74	79	85	72.0	76	41	91
Magnesium, Mg	mg/L	32	36	39	-	37	42	34	35	35	35	40	40	36.8	36	32	42
Chloride, Cl	mg/L	240	250	250	-	210	200	210	230	230	230	240	230	229.1	230	200	250
Carbonate, CO_3	mg/L	10	<1	<1	-	<1	8	4	<1	<1	<1	<1	<1	2.7	1	1	10
Bicarbonate, HCO_3	mg/L	270	340	330	-	330	320	310	330	320	320	300	350	320.0	320	270	350
Sulphate, SO_4	mg/L	52	42	62	-	56	61	59	77	82	60	65	69	62.3	61	42	82
Fluoride, F	mg/L	0.8	1	0.7	-	0.6	0.7	0.6	0.6	0.7	0.6	0.5	0.6	0.7	0.6	0.5	1
Soluble Manganese, Mn	mg/L	<0.005	0.006	0.007	-	0.017	0.014	0.007	0.009	<0.005	<0.005	<0.025	<0.005	0.0095	0.007	0.0050	0.0250
Soluble Silica, SiO2	mg/L	5.9	6	5.7	-	5.9	6.5	5	5	5.3	5.1	4.7	4.5	5.4182	5.3	4.5000	6.5000
Cation/Anion balance	%	1.9	-0.4	-2.9	-	-4	5	-3	-5	-6	-6	-1	-3	-2.2182	-3	-6.0000	5.0000

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Sum of Ions (calc.)	mg/L	836	907	906	-	752	833	782	830	818	781	808	881	830	830	752.0000	907.0000
Soluble Mercury, Hg	mg/L	<0.0001	<0.0005	<0.0001	-	<0.00005	<0.0001	<0.0001	<0.0001	<0.0001	<0.00005	<0.00005	<0.0005	0.0002	0.0001	0.0001	0.0005
Soluble Arsenic, As	mg/L	0.005	0.005	0.001	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.1	<0.02	0.0228	0.02	0.0010	0.1000
Soluble Cadmium, Cd	mg/L	<0.0001	<0.001	<0.0001	-	<0.005	<0.001	<0.005	<0.005	<0.005	<0.001	<0.005	<0.001	0.0027	0.001	0.0001	0.0050
Soluble Chromium, Cr	mg/L	0.001	<0.005	0.001	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.025	<0.005	0.0061	0.005	0.0010	0.0250
Soluble Copper, Cu	mg/L	0.003	<0.005	0.002	-	0.006	0.008	<0.005	<0.005	<0.005	<0.005	<0.025	<0.005	0.0067	0.005	0.0020	0.0250
Soluble Lead, Pb	mg/L	<0.001	<0.005	<0.001	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.025	<0.005	0.0061	0.0050	0.0010	0.0250
Soluble Nickel, Ni	mg/L	0.002	<0.005	0.002	-	<0.005	0.007	<0.005	<0.005	<0.005	<0.005	<0.025	<0.005	0.0065	0.0050	0.0020	0.0250
Soluble Zinc, Zn	mg/L	0.068	0.012	0.024	-	0.014	0.05	0.02	0.03	0.04	0.03	<0.05	0.03	0.0335	0.0300	0.0120	0.0680
Ortho Phosphorus, PO_4-P	mg/L	0.03	<0.003	0.01	-	0.013	0.016	0.019	0.018	0.028	0.024	0.033	0.030	0.0204	0.0190	0.0030	0.0330
Total Phosphorus	mg/L	0.06	0.03	0.02	-	0.02	0.01	<0.01	0.01	0.03	0.08	0.06	0.09	0.0382	0.0300	0.0100	0.0900
Nitrate, NO_3 (method AN258, reporting limit = <0.2)	mg/L	5.4	4	9.5	-	NA	NA	NA	NA	NA	NA	NA	NA	6.3000	5.4000	4.0000	9.5000
Nitrate, NO_3 (method AN258, reporting limit = <0.05)	mg/L	5.4	NA	9.5	-	NA	NA	NA	NA	NA	NA	NA	NA	7.4500	7.4500	5.4000	9.5000

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Nitrate Nitrogen, NO_3 as N (method AN258, reporting limit 0.005)	mg/L	NA	NA	NA	-	2.6	3.0	3.0	2.7	2.9	2.0	2.3	6.2	3.0875	2.8000	2.0000	6.2000
Nitrate, NO_3 as NO_3 (method AN258, reporting limit 0.05)	mg/L	NA	NA	NA	-	11	13	13	12	13	8.7	10	27	13.4625	12.5000	8.7000	27.0000
Total Nitrogen (method AN209, reporting limit <0.05)	mg/L	2.1	1.9	2.7	-	NA	NA	NA	NA	NA	NA	NA	NA	2.2333	2.1000	1.9000	2.7000
Total Nitrogen (Persulphate Digestion) (method AN268, reporting limit 0.05)	mg/L	NA	NA	NA	-	2.7	3.2	3.4	3.3	3.1	NA	NA	NA	3.1400	3.2000	2.7000	3.4000
Total Nitrogen (calc) (method AN281/292, reporting limit 0.05)	mg/L	NA	NA	NA	-	NA	NA	NA	NA	NA	2.5	0.58	0.72	1.2667	0.7200	0.5800	2.5000
Total Kjeldahl Nitrogen (TKN) (Calculated) (method AN268, reporting limit 0.05)	mg/L	NA	NA	NA	-	0.16	0.22	0.48	0.61	0.21	NA	NA	NA	0.3360	0.2200	0.1600	0.6100

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Total Kjeldahl Nitrogen (method AN281/292, reporting limit 0.05)	mg/L	NA	NA	NA	-	NA	NA	NA	NA	NA	0.52	2.9	6.9	3.4400	2.9000	0.5200	6.9000
Kjeldahl Nitrogen (calculated) (method calculation, reporting limit <0.05)	mg/L	0.8	NA	0.51	-	NA	NA	NA	NA	NA	NA	NA	NA	0.6550	0.6550	0.5100	0.8000
Nitrate/Nitrite Nitrogen, NOx as N (method AN258, reporting limit 0.005)	mg/L	1.3	NA	2.2	-	2.6	3.0	3.0	2.7	2.9	2.0	2.3	6.2	2.8200	2.6500	1.3000	6.2000
Nitrite, NO_2 (method AN258, reporting limit <0.05)	mg/L	0.29	<0.05	0.11	-	NA	NA	NA	NA	NA	NA	NA	NA	0.1500	0.1100	0.0500	0.2900
Nitrite Nitrogen, NO_2 as N (method AN258, reporting limit <0.05)	mg/L	NA	NA	NA	-	<0.005	0.012	<0.005	<0.005	<0.005	<0.005	0.015	<0.005	0.0071	0.0050	0.0050	0.0150
Nitrite, NO_2 as NO_2 (method AN258, reporting limit 0.05)	mg/L	NA	NA	NA	-	<0.05	NA	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.0500	0.0500	0.0500	0.0500

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Ammonia Nitrogen, NH_3 as N (method AN261, reporting limit 0.005)	mg/L	0.2	NA	0.05	-	0.034	<0.005	<0.005	<0.005	<0.005	<0.005	0.12	0.057	0.0486	0.0195	0.0050	0.2000

NA = sample not analysed for analyte

Table 9-4: MB03 Groundwater quality

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Date Sampled	-	19/4/10	14/5/10	9/6/10	23/7/10	23/8/10	21/9/10	2/11/10	1/12/10	15/12/10	24/1/11	28/2/11	24/3/11	-	-	-	-
pH	pH Units	7.8	7.7	7.4	7.5	7.4	7.8	7.3	7.3	7.7	7.4	7.4	7.4	7.5	7.4	7.3	7.8
Conductivity @25°C	µS/cm	14000	15000	16000	17000	16000	16000	25000	28000	20000	26000	28000	28000	20750	18500	14000	28000
Total Dissolved Solids @ 180°C	mg/L	7400	9000	11000	10000	9700	9800	12000	14000	14000	17000	19000	18000	12575	11500	7400	19000
Soluble Iron, Fe	mg/L	0.69	0.4	0.85	0.34	0.96	1.2	1	1.4	1.6	2.3	2.4	2.1	1.3	1.1	0.34	2.4
Sodium, Na	mg/L	2300	2700	3000	3100	3000	2900	3400	4100	4200	4500	6100	5600	3741.7	3250	2300	6100
Potassium, K	mg/L	88	97	100	110	120	120	130	140	150	170	240	190	137.9	125	88	240
Calcium, Ca	mg/L	160	170	190	190	230	220	220	250	230	290	360	290	233.3	225	160	360
Magnesium, Mg	mg/L	270	330	360	390	380	370	450	520	460	590	800	690	467.5	420	270	800
Chloride, Cl	mg/L	4400	5300	6100	5300	5100	5000	6700	7800	7000	9100	9800	10000	6800.0	6400	4400	10000
Carbonate, CO_3	mg/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Bicarbonate, HCO_3	mg/L	330	290	300	300	320	260	290	280	310	270	260	260	289.2	290	260	330
Sulphate, SO_4	mg/L	500	610	660	660	640	630	830	1100	1000	1200	1500	1300	885.8	745	500	1500
Fluoride, F	mg/L	0.6	0.7	0.7	0.7	0.6	0.7	0.6	0.6	0.7	0.5	0.4	0.6	0.6	0.6	0.4	0.7
Soluble Manganese, Mn	mg/L	0.02	<0.05	<0.05	<0.05	<0.05	0.033	0.033	<0.05	0.039	0.052	0.062	0.052	0.0451	0.05	0.0200	0.062
Soluble Silica, SiO2	mg/L	9.6	8.7	6.7	8.3	8.7	8.7	7.3	3.5	8.6	6.7	8.4	<0.5	7.1417	8.35	0.5000	9.6

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Cation/Anion balance	%	-1.9	-3	-4.9	4	3	3	-3	-2	3	-4	7	-1	0.0167	-1.4500	-4.9000	7
Sum of Ions (calc.)	mg/L	8029	9551	10660	10000	9760	9450	12000	14100	13400	16100	18900	18600	12545.8333	11330.0000	8029.0000	18900
Soluble Mercury, Hg	mg/L	<0.0001	<0.0005	<0.00001	<0.00005	<0.00005	<0.0001	<0.0001	<0.0001	<0.0001	<0.00005	<0.00005	<0.0005	0.0002	0.0001	0.0001	0.0005
Soluble Arsenic, As	mg/L	0.014	<0.02	0.004	<0.2	<0.2	<0.02	<1	<0.2	<0.02	0.023	<0.1	<0.2	0.1668	0.0615	0.0040	1
Soluble Cadmium, Cd	mg/L	<0.0005	<0.01	<0.00001	<0.01	<0.01	<0.001	<0.005	<0.01	<0.005	<0.001	<0.005	<0.01	0.0061	0.0050	0.0001	0.01
Soluble Chromium, Cr	mg/L	<0.005	<0.05	0.001	<0.05	<0.05	<0.005	<0.025	<0.05	<0.005	<0.005	<0.025	<0.05	0.0287	0.0250	0.0010	0.05
Soluble Copper, Cu	mg/L	<0.005	<0.05	0.009	<0.05	<0.05	<0.005	<0.025	<0.05	0.006	0.007	<0.025	<0.05	0.0277	0.0250	0.0050	0.05
Soluble Lead, Pb	mg/L	<0.005	<0.05	<0.001	<0.05	<0.05	<0.005	<0.025	<0.05	<0.005	<0.005	<0.025	<0.05	0.0287	0.0250	0.0010	0.05
Soluble Nickel, Ni	mg/L	<0.005	<0.05	0.003	<0.05	<0.05	0.021	<0.025	<0.05	0.007	0.022	0.026	<0.05	0.0299	0.0255	0.0030	0.05
Soluble Zinc, Zn	mg/L	0.055	<0.1	0.018	<0.05	<0.1	0.05	<0.05	<0.1	0.03	0.02	<0.05	<0.1	0.0603	0.0500	0.0180	0.1
Ortho Phosphorus, PO_4-P	mg/L	0.05	0.03	0.03	0.022	0.018	0.016	0.011	0.006	0.009	0.005	0.004	0.005	0.0172	0.0135	0.0040	0.05
Total Phosphorus	mg/L	0.08	0.05	0.05	<0.01	0.02	0.06	<0.01	0.02	0.02	0.14	0.07	0.10	0.0525	0.0500	0.0100	0.14
Nitrate, NO3 (method AN258, reporting limit = <0.2)	mg/L	<0.2	0.4	<0.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.2667	0.2000	0.2000	0.4
Nitrate, NO3 (method AN258, reporting limit = <0.05)	mg/L	0.16	NA	0.09	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.1250	0.1250	0.0900	0.16

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Nitrate Nitrogen, NO3 as N (method AN258, reporting limit 0.005)	mg/L	NA	NA	NA	0.056	0.088	0.11	0.023	0.024	0.037	<0.005	<0.005	0.010	0.0398	0.0240	0.0050	0.11
Nitrate, NO3 as NO3 (method AN258, reporting limit 0.05)	mg/L	NA	NA	NA	0.25	0.39	0.51	0.1	0.11	0.16	<0.05	<0.05	<0.05	0.1856	0.1100	0.0500	0.51
Total Nitrogen (method AN209, reporting limit <0.05)	mg/L	15	1.7	1.8	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.1667	1.8000	1.7000	15
Total Nitrogen (Persulphate Digestion) (method AN268, reporting limit 0.05)	mg/L	NA	NA	NA	2	1.9	1.9	1.8	1.8	1.8	NA	NA	NA	1.8667	1.8500	1.8000	2
Total Nitrogen (calc) (method AN281/292, reporting limit 0.05)	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.05	2.1	2.3	1.4833	2.1000	0.0500	2.3
Total Kjeldahl Nitrogen (TKN) (Calculated) (method AN268, reporting limit 0.05)	mg/L	NA	NA	NA	1.9	1.7	1.6	1.7	1.6	1.6	NA	NA	NA	1.6833	1.6500	1.6000	1.9

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Total Kjeldahl Nitrogen (method AN281/292, reporting limit 0.05)	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.05	2.2	2.4	1.5500	2.2000	0.0500	2.4
Kjeldahl Nitrogen (calculated) (method calculation, reporting limit <0.05)	mg/L	15	NA	1.6	NA	NA	NA	NA	NA	NA	NA	NA	NA	8.3000	8.3000	1.6000	15
Nitrate/Nitrite Nitrogen, NOx as N (method AN258, reporting limit 0.005)	mg/L	0.22	NA	0.16	0.13	0.16	0.32	0.084	0.19	0.28	0.016	0.10	0.031	0.1537	0.1600	0.0160	0.32
Nitrite, NO2 (method AN258, reporting limit <0.05)	mg/L	0.6	<0.05	0.45	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.3667	0.4500	0.0500	0.6
Nitrite Nitrogen, NO2 as N (method AN258, reporting limit <0.05)	mg/L	NA	NA	NA	0.07	0.071	0.21	0.061	0.17	0.25	0.013	0.099	0.021	0.1072	0.0710	0.0130	0.25
Nitrite, NO2 as NO2 (method AN258, reporting limit 0.05)	mg/L	NA	NA	NA	0.23	0.23	NA	0.2	0.55	0.8	<0.05	0.32	0.07	0.3063	0.2300	0.0500	0.8

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Ammonia Nitrogen, NH3 as N (method AN261, reporting limit 0.005)	mg/L	7.1	NA	1.6	1.6	1.6	1.4	1.7	1.3	1.4	1.7	1.7	2.2	2.1182	1.6000	1.3000	7.1

NA = sample not analysed for analyte

Table 9-5: MB04 Groundwater quality

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Date Sampled	-	19/4/10	14/5/10	9/6/10	23/7/10	23/8/10	21/9/10	2/11/10	1/12/10	15/12/10	24/1/11	28/2/11	24/3/11	-	-	-	-
pH	pH Units	7.8	7.8	7.6	7.6	7.5	7.9	7.5	7.4	7.6	7.5	7.8	7.5	7.6250	7.6000	7.4000	7.9000
Conductivity @25°C	µS/cm	1600	1700	1300	1200	1300	1500	1800	2200	1400	2100	2300	2400	1733.3333	1650.0000	1200.0000	2400.0000
Total Dissolved Solids @ 180°C	mg/L	1000	1000	740	690	680	810	990	1200	820	1200	1200	1300	969.1667	995.0000	680.0000	1300.0000
Soluble Iron, Fe	mg/L	0.44	0.08	0.32	0.09	0.14	<0.02	0.05	0.06	0.2	0.19	0.19	0.20	0.1650	0.1650	0.0200	0.4400
Sodium, Na	mg/L	260	250	150	140	120	160	200	260	150	250	320	320	215.0000	225.0000	120.0000	320.0000
Potassium, K	mg/L	9.1	8.5	5.3	5.2	5.5	7	8	9.9	6.2	10	12	12	8.2250	8.2500	5.2000	12.0000
Calcium, Ca	mg/L	110	73	76	87	85	73	80	87	130	90	100	92	90.2500	87.0000	73.0000	130.0000
Magnesium, Mg	mg/L	44	49	35	37	35	43	50	57	42	51	60	61	47.0000	46.5000	35.0000	61.0000
Chloride, Cl	mg/L	420	380	260	240	250	320	360	490	320	510	480	580	384.1667	370.0000	240.0000	580.0000
Carbonate, CO_3	mg/L	<1	<1	<1	7	<1	10	5	<1	<1	<1	<1	<1	2.5833	1.0000	1.0000	10.0000
Bicarbonate, HCO_3	mg/L	370	410	380	340	360	380	400	420	350	350	340	340	370.0000	365.0000	340.0000	420.0000
Sulphate, SO_4	mg/L	74	58	37	29	43	42	45	53	47	74	81	81	55.3333	50.0000	29.0000	81.0000
Fluoride, F	mg/L	0.6	0.7	0.6	0.6	0.5	0.7	0.7	0.6	0.6	0.5	0.4	0.6	0.5917	0.6000	0.4000	0.7000
Soluble Manganese, Mn	mg/L	0.025	0.011	0.009	0.005	<0.005	<0.005	<0.005	<0.005	0.007	0.007	0.005	0.009	0.0082	0.0060	0.0050	0.0250

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Soluble Silica, SiO2	mg/L	7.9	10	7.8	7.3	7.4	10	9.3	9.6	7.5	6.9	7.2	6.1	8.0833	7.6500	6.1000	10.0000
Cation/Anion balance	%	2.7	0.8	-2.5	1	-5	-6	-2	-3	3	-5	7	1	-0.6667	-0.6000	-6.0000	7.0000
Sum of Ions (calc.)	mg/L	1280	1229	942	830	841	976	1090	1300	987	1270	1330	1420	1124.5833	1159.5000	830.0000	1420.0000
Soluble Mercury, Hg	mg/L	0.0001	<0.0005	<0.00001	<0.00005	<0.00005	<0.0001	<0.0001	<0.0001	<0.0001	<0.00005	0.00005	<0.0005	0.0002	0.0001	0.0001	0.0005
Soluble Arsenic, As	mg/L	0.013	0.029	0.012	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.021	<0.02	<0.02	0.0196	0.0200	0.0120	0.0290
Soluble Cadmium, Cd	mg/L	<0.0001	<0.001	<0.00001	<0.005	<0.005	<0.001	<0.005	<0.005	<0.005	<0.001	<0.001	<0.001	0.0025	0.0010	0.0001	0.0050
Soluble Chromium, Cr	mg/L	0.002	<0.005	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0044	0.0050	0.0010	0.0050
Soluble Copper, Cu	mg/L	0.004	<0.005	0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0046	0.0050	0.0010	0.0050
Soluble Lead, Pb	mg/L	0.003	<0.005	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0045	0.0050	0.0010	0.0050
Soluble Nickel, Ni	mg/L	0.004	<0.005	0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0047	0.0050	0.0020	0.0050
Soluble Zinc, Zn	mg/L	0.11	<0.01	0.026	0.006	<0.005	0.02	0.01	0.03	0.02	0.03	0.03	0.03	0.0273	0.0230	0.0050	0.1100
Ortho Phosphorus, PO_4-P	mg/L	0.01	0.01	0.007	0.023	0.02	0.013	0.012	0.043	0.027	0.017	0.023	0.029	0.0195	0.0185	0.0070	0.0430
Total Phosphorus	mg/L	0.11	0.06	0.04	0.01	0.03	0.05	0.01	0.05	0.04	0.07	0.05	0.06	0.0483	0.0500	0.0100	0.1100
Nitrate, NO3 (method AN258, reporting limit = <0.2)	mg/L	<0.2	<0.2	<0.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.2000	0.2000	0.2000	0.2000

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Nitrate, NO3 (method AN258, reporting limit = <0.05)	mg/L	0.09	NA	0.14	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.1150	0.1150	0.0900	0.1400
Nitrate Nitrogen, NO3 as N (method AN258, reporting limit 0.005)	mg/L	NA	NA	NA	0.01	0.11	<0.005	0.014	0.01	0.039	0.045	0.020	0.022	0.0306	0.0200	0.0050	0.1100
Nitrate, NO3 as NO3 (method AN258, reporting limit 0.05)	mg/L	NA	NA	NA	<0.05	0.47	<0.05	0.06	<0.05	0.17	0.20	0.09	0.10	0.1378	0.0900	0.0500	0.4700
Total Nitrogen (method AN209, reporting limit <0.05)	mg/L	1	2.1	0.74	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.2800	1.0000	0.7400	2.1000
Total Nitrogen (Persulphate Digestion) (method AN268, reporting limit 0.05)	mg/L	NA	NA	NA	0.83	1.1	2.7	3.2	3.5	1.9	NA	NA	NA	2.2050	2.3000	0.8300	3.5000
Total Nitrogen (calc) (method AN281/292, reporting limit 0.05)	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.11	1.0	1.2	0.7700	1.0000	0.1100	1.2000

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Total Kjeldahl Nitrogen (TKN) (Calculated) (method AN268, reporting limit 0.05)	mg/L	NA	NA	NA	0.82	0.96	2.7	3.2	3.4	1.8	NA	NA	NA	2.1467	2.2500	0.8200	3.4000
Total Kjeldahl Nitrogen (method AN281/292, reporting limit 0.05)	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.05	1.1	1.2	0.7833	1.1000	0.0500	1.2000
Kjeldahl Nitrogen (calculated) (method calculation, reporting limit <0.05)	mg/L	1	NA	0.71	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.8550	0.8550	0.7100	1.0000
Nitrate/Nitrite Nitrogen, NOx as N (method AN258, reporting limit 0.005)	mg/L	0.02	NA	0.031	0.01	0.11	<0.005	0.014	0.023	0.08	0.060	0.020	0.022	0.0359	0.0220	0.0050	0.1100
Nitrite, NO2 (method AN258, reporting limit <0.05)	mg/L	<0.05	<0.05	<0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0500	0.0500	0.0500	0.0500
Nitrite Nitrogen, NO2 as N (method AN258, reporting limit <0.05)	mg/L	NA	NA	NA	<0.005	<0.005	<0.005	<0.005	0.013	0.041	0.015	<0.005	<0.005	0.0110	0.0050	0.0050	0.0410

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Nitrite, NO2 as NO2 (method AN258, reporting limit 0.05)	mg/L	NA	NA	NA	<0.05	<0.05	NA	<0.05	<0.05	0.13	<0.05	<0.05	<0.05	0.0600	0.0500	0.0500	0.1300
Ammonia Nitrogen, NH3 as N (method AN261, reporting limit 0.005)	mg/L	0.3	NA	0.4	0.56	0.65	2.4	3.1	2.5	0.78	0.45	0.62	0.59	1.1227	0.6200	0.3000	3.1000

NA = sample not analysed for analyte

Table 9-6: MB05 Groundwater quality

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Date Sampled	-	19/4/10	14/5/10	9/6/10	23/7/10	23/8/10	21/9/10	2/11/10	1/12/10	15/12/10	24/1/11	28/2/11	24/3/11	-	-	-	-
pH	pH Units	8.1	7.7	7.8	7.8	7.7	8.1	7.6	7.6	7.8	7.8	7.8	7.7	7.7917	7.8000	7.6000	8.1000
Conductivity @25°C	µS/cm	2100	1700	2100	2500	3000	1400	2800	4800	3700	4000	4800	3900	3066.6667	2900.0000	1400.0000	4800.0000
Total Dissolved Solids @ 180°C	mg/L	1300	990	1200	1300	1600	730	1600	2600	2200	2300	2800	2100	1726.6667	1600.0000	730.0000	2800.0000
Soluble Iron, Fe	mg/L	0.28	0.44	0.11	<0.02	0.14	0.12	0.07	0.1	0.03	0.06	0.13	0.37	0.1682	0.1200	0.0300	0.4400
Sodium, Na	mg/L	350	240	280	370	400	170	410	690	600	580	800	600	457.5000	405.0000	170.0000	800.0000
Potassium, K	mg/L	15	12	13	16	18	7.7	15	26	22	23	30	23	18.3917	17.0000	7.7000	30.0000
Calcium, Ca	mg/L	57	36	48	44	64	42	51	70	61	61	86	72	57.6667	59.0000	36.0000	86.0000
Magnesium, Mg	mg/L	78	72	77	88	88	54	84	120	110	100	130	110	92.5833	88.0000	54.0000	130.0000
Chloride, Cl	mg/L	610	440	520	680	830	300	790	1300	1200	1200	1400	1100	864.1667	810.0000	300.0000	1400.0000
Carbonate, CO_3	mg/L	10	<1	<1	81	<1	8	2	<1	<1	<1	<1	<1	9.0833	1.0000	1.0000	81.0000
Bicarbonate, HCO_3	mg/L	330	370	370	270	370	290	330	390	370	<5	390	390	322.9167	370.0000	5.0000	390.0000
Sulphate, SO_4	mg/L	45	18	20	25	48	27	72	130	110	81	120	70	63.8333	59.0000	18.0000	130.0000
Fluoride, F	mg/L	1	1.2	1.1	1.2	1	1.2	1.1	1	1.2	0.9	0.7	1.0	1.0500	1.0500	0.7000	1.2000
Soluble Manganese, Mn	mg/L	0.018	0.26	0.007	<0.005	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.005	0.007	0.0277	0.0050	0.0050	0.2600

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Soluble Silica, SiO2	mg/L	12	130	13	13	14	11	14	13	12	12	13	12	22.4167	13.0000	11.0000	130.0000
Cation/Anion balance	%	2.1	-1	0.4	-1	-4	1	-2	-2	-5	2	1	0	-0.7083	-0.5000	-5.0000	2.1000
Sum of Ions (calc.)	mg/L	1503	1188	1322	1570	1750	853	1700	2700	2430	2070	2930	2350	1863.8333	1725.0000	853.0000	2930.0000
Soluble Mercury, Hg	mg/L	<0.0001	<0.0005	<0.00001	<0.00005	<0.00005	<0.0001	<0.0001	<0.0001	<0.0001	<0.00005	0.00005	<0.0005	0.0002	0.0001	0.0001	0.0005
Soluble Arsenic, As	mg/L	0.017	0.021	0.011	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.0191	0.0200	0.0110	0.0210
Soluble Cadmium, Cd	mg/L	<0.0001	<0.01	<0.00001	<0.005	<0.005	<0.001	<0.005	<0.005	<0.005	<0.001	<0.001	<0.001	0.0033	0.0030	0.0001	0.0100
Soluble Chromium, Cr	mg/L	0.002	<0.05	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0082	0.0050	0.0010	0.0500
Soluble Copper, Cu	mg/L	0.002	<0.05	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0082	0.0050	0.0010	0.0500
Soluble Lead, Pb	mg/L	0.001	<0.05	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0081	0.0050	0.0010	0.0500
Soluble Nickel, Ni	mg/L	0.003	<0.05	0.001	<0.005	<0.005	0.005	<0.005	0.005	<0.005	0.006	0.007	0.006	0.0089	0.0050	0.0010	0.0500
Soluble Zinc, Zn	mg/L	0.044	<0.1	0.035	0.006	<0.005	0.03	0.02	0.03	0.05	0.03	0.03	0.03	0.0342	0.0300	0.0050	0.1000
Ortho Phosphorus, PO_4-P	mg/L	<0.003	0.02	0.09	0.092	0.092	0.04	0.075	0.095	0.1	0.097	0.097	0.10	0.0751	0.0920	0.0030	0.1000
Total Phosphorus	mg/L	0.11	0.29	0.13	0.06	0.09	0.06	0.08	0.1	0.11	0.15	0.13	0.14	0.1208	0.1100	0.0600	0.2900
Nitrate, NO3 (method AN258, reporting limit = <0.2)	mg/L	<0.2	0.5	<0.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.3000	0.2000	0.2000	0.5000

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Nitrate, NO3 (method AN258, reporting limit = <0.05)	mg/L	<0.05	NA	0.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0750	0.0750	0.0500	0.1000
Nitrate Nitrogen, NO3 as N (method AN258, reporting limit 0.005)	mg/L	NA	NA	NA	<0.005	<0.005	<0.005	0.059	<0.005	0.013	<0.005	<0.005	0.026	0.0142	0.0050	0.0050	0.0590
Nitrate, NO3 as NO3 (method AN258, reporting limit 0.05)	mg/L	NA	NA	NA	<0.05	<0.05	<0.05	0.26	<0.05	0.06	<0.05	<0.05	0.12	0.0822	0.0500	0.0500	0.2600
Total Nitrogen (method AN209, reporting limit <0.05)	mg/L	10	6.8	4.3	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.0333	6.8000	4.3000	10.0000
Total Nitrogen (Persulphate Digestion) (method AN268, reporting limit 0.05)	mg/L	NA	NA	NA	4.1	3.6	2.5	3	4.1	4.4	NA	NA	NA	3.6167	3.8500	2.5000	4.4000
Total Nitrogen (calc) (method AN281/292, reporting limit 0.05)	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.05	5.0	5.0	3.3500	5.0000	0.0500	5.0000

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Total Kjeldahl Nitrogen (TKN) (Calculated) (method AN268, reporting limit 0.05)	mg/L	NA	NA	NA	4.1	3.6	2.5	2.9	4.1	4.3	NA	NA	NA	3.5833	3.8500	2.5000	4.3000
Total Kjeldahl Nitrogen (method AN281/292, reporting limit 0.05)	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.05	5.0	5.1	3.3833	5.0000	0.0500	5.1000
Kjeldahl Nitrogen (calculated) (method calculation, reporting limit <0.05)	mg/L	10	NA	4.3	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.1500	7.1500	4.3000	10.0000
Nitrate/Nitrite Nitrogen, NOx as N (method AN258, reporting limit 0.005)	mg/L	<0.005	NA	0.022	<0.005	<0.005	<0.005	0.059	<0.005	0.013	<0.005	<0.005	0.026	0.0141	0.0050	0.0050	0.0590
Nitrite, NO2 (method AN258, reporting limit <0.05)	mg/L	<0.05	<0.05	<0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0500	0.0500	0.0500	0.0500
Nitrite Nitrogen, NO2 as N (method AN258, reporting limit <0.05)	mg/L	NA	NA	NA	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0050	0.0050	0.0050	0.0050

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Nitrite, NO2 as NO2 (method AN258, reporting limit 0.05)	mg/L	NA	NA	NA	<0.05	<0.05	NA	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.0500	0.0500	0.0500	0.0500
Ammonia Nitrogen, NH3 as N (method AN261, reporting limit 0.005)	mg/L	5.3	NA	3.7	3.7	3.4	2.1	2.7	3.2	4.3	4.0	4.3	4.6	3.7545	3.7000	2.1000	5.3000

NA = sample not analysed for analyte

Table 9-7: MB06 Groundwater quality

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Date Sampled	-	19/4/10	14/5/10	9/6/10	23/7/10	23/8/10	21/9/10	2/11/10	1/12/10	15/12/10	24/1/11	28/2/11	24/3/11	-	-	-	-
pH	pH Units	7.8	7.6	7.7	7.7	7.6	7.8	7.5	7.5	7.8	7.6	7.5	7.5	7.6333	7.6000	7.5000	7.8000
Conductivity @25°C	µS/cm	15000	8600	6000	7000	7300	13000	12000	16000	5100	8700	13000	17000	10725.0000	10350.0000	5100.0000	17000.0000
Total Dissolved Solids @ 180°C	mg/L	8000	6000	3500	4200	4200	7300	6300	8200	3500	5200	9200	10000	6300.0000	6150.0000	3500.0000	10000.0000
Soluble Iron, Fe	mg/L	1.2	0.26	0.61	0.06	0.29	0.85	0.54	0.79	0.43	0.11	0.14	0.93	0.5175	0.4850	0.0600	1.2000
Sodium, Na	mg/L	2800	1900	860	1100	1000	2200	1600	2400	880	1600	2800	3700	1903.3333	1750.0000	860.0000	3700.0000
Potassium, K	mg/L	89	56	26	47	41	96	60	93	37	57	110	130	70.1667	58.5000	26.0000	130.0000
Calcium, Ca	mg/L	170	110	80	99	93	140	110	150	140	130	190	200	134.3333	135.0000	80.0000	200.0000
Magnesium, Mg	mg/L	280	180	79	150	130	280	190	310	120	200	340	450	225.7500	195.0000	79.0000	450.0000
Chloride, Cl	mg/L	4600	2600	1300	2000	2100	5500	3500	4200	1800	2700	4500	5800	3383.3333	3100.0000	1300.0000	5800.0000
Carbonate, CO_3	mg/L	<1	<1	<1	<1	<1	9	2	<1	<1	<1	<1	<1	1.7500	1.0000	1.0000	9.0000
Bicarbonate, HCO_3	mg/L	270	330	410	410	430	380	420	370	420	360	330	300	369.1667	375.0000	270.0000	430.0000
Sulphate, SO_4	mg/L	820	520	260	360	350	760	480	660	270	380	660	750	522.5000	500.0000	260.0000	820.0000
Fluoride, F	mg/L	1.5	1.7	2.1	2.2	2	1.5	1.6	1.7	2.8	2.2	1.7	1.8	1.9000	1.7500	1.5000	2.8000
Soluble Manganese, Mn	mg/L	0.1	<0.05	<0.05	0.029	<0.025	0.052	0.059	0.067	0.023	0.040	0.061	0.074	0.0525	0.0510	0.0230	0.1000

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Soluble Silica, SiO2	mg/L	13	2.1	10	12	13	15	8.7	7.8	13	11	11	2.7	9.9417	11.0000	2.1000	15.0000
Cation/Anion balance	%	2	7.3	-0.9	-3	-10	-16	-11	1	-6	2	5	6	-1.9667	0.0500	-16.0000	7.3000
Sum of Ions (calc.)	mg/L	9014	5700	3032	4160	4060	9240	6340	9150	3570	5290	8850	11300	6642.1667	6020.0000	3032.0000	11300.0000
Soluble Mercury, Hg	mg/L	0.0001	<0.0005	<0.00001	<0.00005	<0.00005	<0.0001	<0.0001	<0.0001	<0.0001	<0.00005	<0.00005	<0.0005	0.0002	0.0001	0.0001	0.0005
Soluble Arsenic, As	mg/L	0.019	<0.02	0.008	<0.02	<0.1	<0.02	<1	<0.1	<0.02	<0.02	<0.1	<0.2	0.1356	0.0200	0.0080	1.0000
Soluble Cadmium, Cd	mg/L	<0.0005	<0.01	0.0001	<0.005	<0.005	<0.001	<0.005	<0.005	<0.005	<0.001	<0.005	<0.01	0.0044	0.0050	0.0001	0.0100
Soluble Chromium, Cr	mg/L	<0.005	<0.05	0.001	<0.005	<0.025	<0.005	<0.025	<0.025	<0.005	<0.005	<0.025	<0.05	0.0188	0.0150	0.0010	0.0500
Soluble Copper, Cu	mg/L	0.037	<0.05	0.022	0.029	0.051	0.052	<0.025	<0.025	0.082	0.047	0.040	<0.05	0.0425	0.0435	0.0220	0.0820
Soluble Lead, Pb	mg/L	0.007	<0.05	0.002	<0.005	<0.025	<0.005	<0.025	<0.025	0.006	<0.005	<0.025	<0.05	0.0192	0.0160	0.0020	0.0500
Soluble Nickel, Ni	mg/L	0.006	<0.05	0.004	0.008	<0.025	0.022	<0.025	<0.025	0.008	0.007	<0.025	<0.05	0.0213	0.0235	0.0040	0.0500
Soluble Zinc, Zn	mg/L	0.079	<0.1	0.036	0.023	<0.05	0.05	<0.05	<0.05	0.05	0.05	0.05	<0.1	0.0573	0.0500	0.0230	0.1000
Ortho Phosphorus, PO_4-P	mg/L	<0.003	<0.003	0.03	0.033	0.043	0.033	0.029	0.031	0.037	0.035	0.043	0.039	0.0299	0.0330	0.0030	0.0430
Total Phosphorus	mg/L	0.07	0.1	0.09	0.01	0.03	0.02	0.02	0.03	0.04	0.07	0.07	0.10	0.0542	0.0550	0.0100	0.1000
Nitrate, NO3 (method AN258, reporting limit = <0.2)	mg/L	0.2	0.3	0.97	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.4900	0.3000	0.2000	0.9700

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Nitrate, NO3 (method AN258, reporting limit = <0.05)	mg/L	0.05	NA	0.97	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.5100	0.5100	0.0500	0.9700
Nitrate Nitrogen, NO3 as N (method AN258, reporting limit 0.005)	mg/L	NA	NA	NA	0.63	1.6	1.2	1.1	0.063	0.17	0.21	0.16	0.032	0.5739	0.2100	0.0320	1.6000
Nitrate, NO3 as NO3 (method AN258, reporting limit 0.05)	mg/L	NA	NA	NA	2.8	6.9	5.5	5	0.28	0.76	0.92	0.71	0.14	2.5567	0.9200	0.1400	6.9000
Total Nitrogen (method AN209, reporting limit <0.05)	mg/L	0.93	1.3	0.96	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.0633	0.9600	0.9300	1.3000
Total Nitrogen (Persulphate Digestion) (method AN268, reporting limit 0.05)	mg/L	NA	NA	NA	1.2	2.2	2	2.1	0.77	0.68	NA	NA	NA	1.4917	1.6000	0.6800	2.2000
Total Nitrogen (calc) (method AN281/292, reporting limit 0.05)	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.26	0.79	1.1	0.7167	0.7900	0.2600	1.1000

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Total Kjeldahl Nitrogen (TKN) (Calculated) (method AN268, reporting limit 0.05)	mg/L	NA	NA	NA	0.51	0.63	0.75	0.99	0.71	0.51	NA	NA	NA	0.6833	0.6700	0.5100	0.9900
Total Kjeldahl Nitrogen (method AN281/292, reporting limit 0.05)	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.05	0.95	1.1	0.7000	0.9500	0.0500	1.1000
Kjeldahl Nitrogen (calculated) (method calculation, reporting limit <0.05)	mg/L	0.93	NA	0.72	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.8250	0.8250	0.7200	0.9300
Nitrate/Nitrite Nitrogen, NOx as N (method AN258, reporting limit 0.005)	mg/L	0.005	NA	0.24	0.66	1.6	1.2	1.1	0.063	0.17	0.21	0.16	0.032	0.4945	0.2100	0.0050	1.6000
Nitrite, NO2 (method AN258, reporting limit <0.05)	mg/L	0.05	0.05	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0500	0.0500	0.0500	0.0500
Nitrite Nitrogen, NO2 as N (method AN258, reporting limit <0.05)	mg/L	NA	NA	NA	0.033	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.0081	0.0050	0.0050	0.0330

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Nitrite, NO2 as NO2 (method AN258, reporting limit 0.05)	mg/L	NA	NA	NA	0.11	0.05	NA	0.05	0.05	0.05	0.05	0.05	0.05	0.0575	0.0500	0.0500	0.1100
Ammonia Nitrogen, NH3 as N (method AN261, reporting limit 0.005)	mg/L	0.08	NA	0.1	0.17	0.14	0.28	0.19	0.27	0.081	0.005	0.12	0.35	0.1624	0.1400	0.0050	0.3500

NA = sample not analysed for analyte

Table 9-8: MB07 Groundwater quality

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Date Sampled	-	19/4/10	14/5/10	9/6/10	23/7/10	23/8/10	21/9/10	2/11/10	1/12/10	15/12/10	24/1/11	28/2/11	24/3/11				
pH	pH Units	7.8	7.6	7.4	7.7	7.4	7.9	7.4	7.3	7.9	7.4	7.3	7.3	7.5333	7.4000	7.3000	7.9000
Conductivity @25°C	µS/cm	19000	16000	13000	13000	12000	16000	18000	26000	15000	26000	30000	29000	19416.6667	17000.0000	12000.0000	30000.0000
Total Dissolved Solids @ 180°C	mg/L	10000	9500	8400	7500	7000	9300	8700	13000	9500	17000	21000	20000	11741.6667	9500.0000	7000.0000	21000.0000
Soluble Iron, Fe	mg/L	1.5	0.04	0.51	0.22	0.29	0.09	0.5	1.1	0.61	1.9	2.3	1.9	0.9133	0.5600	0.0400	2.3000
Sodium, Na	mg/L	3100	2900	2300	2300	1900	2300	2500	3900	2600	4900	6800	5800	3441.6667	2750.0000	1900.0000	6800.0000
Potassium, K	mg/L	92	87	72	71	70	85	82	120	83	180	250	190	115.1667	86.0000	70.0000	250.0000
Calcium, Ca	mg/L	220	200	190	200	180	190	190	250	210	310	380	310	235.8333	205.0000	180.0000	380.0000
Magnesium, Mg	mg/L	400	360	290	300	260	350	340	510	350	650	860	720	449.1667	355.0000	260.0000	860.0000
Chloride, Cl	mg/L	6200	5400	4500	4000	3700	4700	5200	7400	5000	8900	11000	11000	6416.6667	5300.0000	3700.0000	11000.0000
Carbonate, CO_3	mg/L	<1	<1	<1	5	<1	10	<1	<1	<1	<1	<1	<1	2.0833	1.0000	1.0000	10.0000
Bicarbonate, HCO_3	mg/L	310	330	320	310	330	280	310	310	310	300	280	290	306.6667	310.0000	280.0000	330.0000

Analyte	Units	April	May	June	July	August	Septe mber	October	November	December	January	February	March	Mean	Median	Min	Max
Sulphate, SO_4	mg/L	720	650	460	440	410	620	580	1000	670	1200	1300	1400	787.50 00	660.000 0	410.00 00	1400.0 000
Fluoride, F	mg/L	1.5	0.8	0.7	0.8	0.7	0.9	0.8	0.8	0.8	0.7	0.5	0.8	0.8167	0.8000	0.5000	1.5000
Soluble Manganese, Mn	mg/L	<0.05	<0.005	<0.05	<0.05	<0.05	<0.005	<0.025	<0.05	0.008	0.020	<0.025	<0.05	0.0323	0.0375	0.0050	0.0500
Soluble Silica, SiO2	mg/L	1.5	<0.05	5.9	8.1	8.6	1.4	6.4	2.9	8.6	6.5	7.1	<0.5	4.7958	6.1500	0.0500	8.6000
Cation/Anion balance	%	-3.3	-1.7	-2.6	4	-1	-4	-5	-1	-3	1	8	-1	- 0.8000	-1.3500	- 5.0000	8.0000
Sum of Ions (calc.)	mg/L	11100	9872	8177	7550	6810	8490	9100	13400	9180	16400	20400	19400	11656. 5833	9526.00 00	6810.0 000	20400. 0000
Soluble Mercury, Hg	mg/L	<0.0001	<0.0005	<0.000 1	<0.0000 5	<0.0000 5	<0.000 1	<0.0001	<0.0001	<0.0001	<0.0000 5	<0.00005	<0.0005	0.0002	0.0001	0.0001	0.0005
Soluble Arsenic, As	mg/L	0.018	0.004	0.002	<0.2	<0.2	<0.02	<1	<0.2	<0.02	<0.02	<0.1	<0.2	0.1653	0.0600	0.0020	1.0000
Soluble Cadmium, Cd	mg/L	<0.001	<0.001	<0.000 1	<0.01	<0.01	<0.001	<0.005	<0.01	<0.005	<0.001	<0.005	<0.01	0.0049	0.0050	0.0001	0.0100
Soluble Chromium, Cr	mg/L	<0.01	<0.005	<0.001	<0.05	<0.05	<0.005	<0.025	<0.05	<0.005	<0.005	<0.025	<0.05	0.0234	0.0175	0.0010	0.0500
Soluble Copper, Cu	mg/L	0.26	<0.005	0.004	<0.05	<0.05	<0.005	<0.025	<0.05	<0.005	0.007	<0.025	<0.05	0.0447	0.0250	0.0040	0.2600
Soluble Lead, Pb	mg/L	<0.01	<0.005	<0.001	<0.05	<0.05	<0.005	<0.025	<0.05	<0.005	<0.005	<0.025	<0.05	0.0234	0.0175	0.0010	0.0500
Soluble Nickel, Ni	mg/L	<0.01	<0.005	0.004	<0.05	<0.05	<0.005	<0.025	<0.05	0.007	0.023	<0.025	<0.05	0.0253	0.0240	0.0040	0.0500
Soluble Zinc, Zn	mg/L	0.044	<0.01	0.019	<0.05	<0.1	<0.01	<0.05	<0.1	0.04	0.02	<0.05	<0.1	0.0494	0.0470	0.0100	0.1000
Ortho Phosphorus, PO_4-P	mg/L	0.02	0.03	0.05	0.071	0.078	0.033	0.047	0.01	0.052	0.006	0.005	0.002	0.0337	0.0315	0.0020	0.0780

Analyte	Units	April	May	June	July	August	Septe mber	October	November	December	January	February	March	Mean	Median	Min	Max
Total Phosphorus	mg/L	0.08	0.07	0.06	<0.01	0.03	<0.01	0.05	0.02	0.15	0.12	0.12	0.24	0.0800	0.0650	0.0100	0.2400
Nitrate, NO_3	mg/L	<0.2	<0.2	0.7	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.3667	0.2000	0.2000	0.7000
Nitrate, NO_3	mg/L	<0.05	NA	0.74	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.3950	0.3950	0.0500	0.7400
Nitrate Nitrogen, NO_3 as N	MG/L	NA	NA	NA	<0.005	0.066	0.014	<0.005	0.005	0.2	<0.005	0.012	0.074	0.0429	0.0120	0.0050	0.2000
Nitrate, NO_3 as NO_3	MG/L	NA	NA	NA	<0.05	0.29	0.06	<0.05	<0.05	0.88	<0.05	0.05	0.33	0.2011	0.0500	0.0500	0.8800
Total Nitrogen	mg/L	2.7	2.9	3	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.8667	2.9000	2.7000	3.0000
Total Nitrogen (Persulphate Digestion)	MG/L	NA	NA	NA	3.3	3	3.2	3.1	2.8	3	NA	NA	NA	3.0667	3.0500	2.8000	3.3000
Total Nitrogen (calc)	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.08	3.1	2.9	2.0267	2.9000	0.0800	3.1000
Total Kjeldahl Nitrogen (TKN) (Calculated)	MG/L	NA	NA	NA	3.3	2.9	3.1	3.1	2.7	2.8	NA	NA	NA	2.9833	3.0000	2.7000	3.3000
Total Kjeldahl Nitrogen	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.08	3.1	3.0	2.0600	3.0000	0.0800	3.1000
Kjeldahl Nitrogen (calculated)	mg/L	2.7	NA	2.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.8000	2.8000	2.7000	2.9000

Analyte	Units	April	May	June	July	August	Septe mber	October	November	December	January	February	March	Mean	Median	Min	Max
Nitrate/Nitrite Nitrogen, NOx as N	MG/L	<0.005	NA	0.18	<0.005	0.066	0.014	0.016	0.018	0.21	<0.005	0.012	0.074	0.0550	0.0160	0.0050	0.2100
Nitrite, NO_2	mg/L	<0.05	<0.05	<0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0500	0.0500	0.0500	0.0500
Nitrite Nitrogen, NO_2 as N	MG/L	NA	NA	NA	<0.005	<0.005	<0.005	0.013	0.013	0.016	<0.005	<0.005	<0.005	0.0080	0.0050	0.0050	0.0160
Nitrite, NO_2 as NO_2	MG/L	NA	NA	NA	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	<0.05	<0.05	<0.05	0.0500	0.0500	0.0500	0.0500
Ammonia Nitrogen, NH_3 as N	MG/L	2.7	NA	2.9	2.8	2.6	2.5	2.8	2.1	3	2.6	2.5	2.5	2.6364	2.6000	2.1000	3.0000

NA = sample not analysed for analyte

Table 9-9: MB08 Groundwater quality

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Date Sampled	-	19/4/10	14/5/10	9/6/10	23/7/10	23/8/10	21/9/10	2/11/10	1/12/10	15/12/10	24/1/11	28/2/11	24/3/11				
pH	pH Units	8.1	7.7	7.4	7.4	7.4	7.7	7.3	7.4	7.8	7.4	7.4	7.3	7.5250	7.4000	7.3000	8.1000
Conductivity @25°C	µS/cm	8300	9300	11000	11000	11000	10000	11000	11000	9000	11000	12000	13000	10633.3333	11000.0000	8300.0000	13000.0000
Total Dissolved Solids @ 180°C	mg/L	5800	6100	7100	6700	6300	5900	6100	6200	6000	6500	7400	8200	6525.0000	6250.0000	5800.0000	8200.0000
Soluble Iron, Fe	mg/L	3.9	0.24	1	<0.2	1.9	5	1.6	1.6	1.8	0.79	1.4	1.1	1.7108	1.5000	0.2000	5.0000
Sodium, Na	mg/L	1800	1800	1900	2000	1800	1600	1700	1700	1600	1700	2500	2500	1883.3333	1800.0000	1600.0000	2500.0000
Potassium, K	mg/L	62	61	69	72	75	64	65	65	62	69	94	93	71.4545	69.0000	61.000	94.000
Calcium, Ca	mg/L	150	130	180	180	170	180	170	160	170	150	210	200	170.8333	170.0000	130.0000	210.0000
Magnesium, Mg	mg/L	190	210	240	250	230	210	220	220	220	210	320	320	236.6667	220.0000	190.0000	320.0000
Chloride, Cl	mg/L	3300	3200	3700	3400	3200	3200	3300	3100	3100	3200	3800	4600	3425.0000	3250.0000	3100.0000	4600.0000
Carbonate, CO_3	mg/L	15	<1	<1	13	<1	9	<1	<1	<1	<1	<1	<1	3.8333	1.0000	1.0000	15.000
Bicarbonate, HCO_3	mg/L	430	520	510	490	530	460	450	480	470	470	480	480	480.8333	480.0000	430.0000	530.0000

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Sulphate, SO_4	mg/L	380	360	270	430	410	320	360	310	120	430	500	520	367.5000	370.0000	120.0000	520.0000
Fluoride, F	mg/L	0.7	0.8	0.5	0.6	0.5	0.7	0.6	0.6	0.6	0.5	0.4	0.6	0.5917	0.6000	0.4000	0.8000
Soluble Manganese, Mn	mg/L	0.039	<0.05	<0.05	<0.05	<0.05	0.02	<0.025	<0.025	0.013	0.010	<0.025	<0.025	0.0318	0.0250	0.0100	0.0500
Soluble Silica, SiO2	mg/L	10	10	9.8	12	12	13	9.5	9.2	12	11	13	7.9	10.7833	10.5000	7.9000	13.0000
Cation/Anion balance	%	-2.4	-0.9	-2.3	2	-1	-3	-2	-1	0	-3	8	-1	-0.5500	-1.0000	-3.0000	8.0000
Sum of Ions (calc.)	mg/L	6265	6275	6950	6820	6320	5950	6240	5980	5590	6150	7770	8560	6572.5000	6270.0000	5590.0000	8560.0000
Soluble Mercury, Hg	mg/L	0.0001	<0.0005	<0.0001	<0.00005	<0.00005	<0.0001	<0.0001	<0.0001	<0.0001	<0.00005	<0.00005	<0.0005	0.0002	0.0001	0.0001	0.0005
Soluble Arsenic, As	mg/L	0.084	<0.02	0.12	<0.2	<0.2	0.081	<1	<0.1	<0.02	<0.02	<0.1	<0.1	0.1704	0.1000	0.0200	1.0000
Soluble Cadmium, Cd	mg/L	<0.0005	<0.01	0.0001	<0.01	<0.01	<0.001	<0.005	<0.005	<0.005	<0.001	<0.005	<0.005	0.0048	0.0050	0.0001	0.0100
Soluble Chromium, Cr	mg/L	<0.005	<0.05	0.001	<0.05	<0.05	<0.005	<0.025	<0.025	<0.005	<0.005	<0.025	<0.025	0.0226	0.0250	0.0010	0.0500
Soluble Copper, Cu	mg/L	0.006	<0.05	0.006	<0.05	<0.05	0.009	<0.025	<0.025	0.007	<0.005	<0.025	<0.025	0.0236	0.0250	0.0050	0.0500
Soluble Lead, Pb	mg/L	<0.005	<0.005	0.001	<0.05	<0.05	<0.005	<0.025	<0.025	<0.005	<0.005	<0.025	<0.025	0.0188	0.0150	0.0010	0.0500

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Soluble Nickel, Ni	mg/L	0.007	<0.05	0.005	<0.05	<0.05	0.023	<0.025	<0.025	0.008	0.007	<0.025	<0.025	0.0250	0.0250	0.0050	0.0500
Soluble Zinc, Zn	mg/L	0.082	<0.1	0.027	<0.05	<0.1	0.06	<0.05	<0.05	0.06	0.02	0.09	<0.05	0.0616	0.0550	0.0200	0.1000
Ortho Phosphorus, PO_4-P	mg/L	0.004	0.05	0.11	0.12	0.13	0.07	0.08	0.089	0.12	0.091	0.070	0.062	0.0830	0.0845	0.0040	0.1300
Total Phosphorus	mg/L	0.11	0.14	0.26	0.05	0.18	0.07	0.02	0.1	0.12	0.28	0.22	0.31	0.1550	0.1300	0.0200	0.3100
Nitrate, NO_3	mg/L	<0.2	<0.2	<0.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.2000	0.2000	0.2000	0.2000
Nitrate, NO_3	mg/L	0.07	NA	0.16	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.1150	0.1150	0.0700	0.1600
Nitrate Nitrogen, NO_3 as N	MG/L	NA	NA	NA	0.085	0.19	0.037	0.099	0.19	0.056	0.019	0.049	0.008	0.0814	0.0560	0.0080	0.1900
Nitrate, NO_3 as NO_3	MG/L	NA	NA	NA	0.38	0.84	0.16	0.44	0.83	0.25	0.08	0.22	<0.05	0.3611	0.2500	0.0500	0.8400
Total Nitrogen	mg/L	1.5	2.7	1.3	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.8333	1.5000	1.3000	2.7000
Total Nitrogen (Persulphate Digestion)	MG/L	NA	NA	NA	1.1	1.2	3.1	1.8	0.94	0.8	NA	NA	NA	1.4900	1.1500	0.8000	3.1000
Total Nitrogen (calc)	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.06	1.8	1.7	1.1867	1.7000	0.0600	1.8000

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Total Kjeldahl Nitrogen (TKN) (Calculated)	MG/L	NA	NA	NA	0.86	0.92	2.9	1.5	0.69	0.73	NA	NA	NA	1.2667	0.8900	0.6900	2.9000
Total Kjeldahl Nitrogen	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.05	1.9	1.7	1.2167	1.7000	0.0500	1.9000
Kjeldahl Nitrogen (calculated)	mg/L	1.5	NA	1.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.3500	1.3500	1.2000	1.5000
Nitrate/Nitrite Nitrogen, NOx as N	MG/L	0.015	NA	0.045	0.23	0.28	0.21	0.36	0.26	0.072	0.030	0.071	0.022	0.1450	0.0720	0.0150	0.3600
Nitrite, NO_2	mg/L	<0.05	<0.05	<0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0500	0.0500	0.0500	0.0500
Nitrite Nitrogen, NO_2 as N	MG/L	NA	NA	NA	0.14	0.093	0.17	0.26	0.068	0.016	0.011	0.022	0.014	0.0882	0.0680	0.0110	0.2600
Nitrite, NO_2 as NO_2	MG/L	NA	NA	NA	0.47	0.31		0.84	0.22	0.05	<0.05	0.07	<0.05	0.2575	0.1450	0.0500	0.8400
Ammonia Nitrogen, NH_3 as N	MG/L	0.4	NA	0.4	0.23	0.049	2.5	0.97	0.054	0.13	0.11	0.19	0.43	0.4966	0.2300	0.0490	2.5000

NA = sample not analysed for analyte

Table 9-10: MB09S Groundwater quality

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Date Sampled	-	19/4/10	14/5/10	9/6/10	23/7/10	23/8/10	21/9/10	2/11/10	1/12/10	15/12/10	24/1/11	28/2/11	24/3/11				
pH	pH Units	8.3	8	7.7	7.7	7.6	7.8	7.5	7.5	7.8	7.6	7.7	7.8	7.7500	7.7000	7.5000	8.3000
Conductivity @25°C	µS/cm	1100	1200	1000	1100	1000	990	940	950	890	870	780	690	959.1667	970.0000	690.0000	1200.0000
Total Dissolved Solids @ 180°C	mg/L	750	800	550	580	540	530	560	520	530	500	430	350	553.3333	535.0000	350.0000	800.0000
Soluble Iron, Fe	mg/L	0.34	<0.02	0.07	<0.1	0.2	0.19	0.33	0.18	0.25	0.66	0.70	0.57	0.3008	0.2250	0.0200	0.7000
Sodium, Na	mg/L	220	230	110	110	86	86	84	74	80	61	59	47	103.9167	85.0000	47.0000	230.0000
Potassium, K	mg/L	3.3	3.8	1.7	1.6	1.6	2	2.4	1.6	1.4	1.6	2.5	1.9	2.1167	1.8000	1.4000	3.8000
Calcium, Ca	mg/L	45	33	66	76	85	85	79	71	75	68	62	58	66.9167	69.5000	33.0000	85.0000
Magnesium, Mg	mg/L	25	28	30	31	29	31	31	30	31	31	35	37	30.7500	31.0000	25.0000	37.0000
Chloride, Cl	mg/L	210	230	180	190	160	170	170	170	180	120	120	92	166.0000	170.0000	92.0000	230.0000
Carbonate, CO_3	mg/L	13	<1	<1	9	<1	10	4	<1	<1	<1	<1	<1	3.9091	1.0000	1.0000	13.0000

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Bicarbonate, HCO_3	mg/L	320	400	320	300	340	320	310	300	300	320	290	280	316.6667	315.0000	280.0000	400.0000
Sulphate, SO_4	mg/L	61	62	19	25	28	25	45	20	23	26	29	21	32.0000	25.5000	19.0000	62.0000
Fluoride, F	mg/L	0.7	1.1	0.5	0.5	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.8	0.5583	0.5000	0.4000	1.1000
Soluble Manganese, Mn	mg/L	0.014	<0.005	0.008	<0.025	0.034	0.044	0.084	0.03	0.041	0.057	0.055	0.036	0.0361	0.0350	0.0050	0.0840
Soluble Silica, SiO2	mg/L	8.7	9	5.7	6	6.2	5.5	4.8	4.5	5.1	6.6	6.7	6.7	6.2917	6.1000	4.5000	9.0000
Cation/Anion balance	%	3.6	-1.4	-1.8	-1	-2	-1	-4	-5	-2	-2	0	4	-1.0500	-1.6000	-5.0000	4.0000
Sum of Ions (calc.)	mg/L	898	987	734	696	672	676	677	615	628	568	545	484	681.6667	674.0000	484.0000	987.0000
Soluble Mercury, Hg	mg/L	<0.0001	<0.0005	<0.0001	<0.00005	<0.00005	<0.0001	<0.0001	<0.0001	<0.0001	<0.00005	<0.00005	<0.0005	0.0001	0.0001	0.0001	0.0005
Soluble Arsenic, As	mg/L	0.007	0.006	0.029	<0.1	<0.02	0.025	0.03	0.03	0.04	0.050	0.044	0.025	0.0338	0.0295	0.0060	0.1000
Soluble Cadmium, Cd	mg/L	0.0001	<0.001	<0.0001	<0.005	<0.005	<0.001	<0.005	<0.005	<0.005	<0.001	<0.001	<0.001	0.0027	0.0010	0.0001	0.0050
Soluble Chromium, Cr	mg/L	0.002	<0.005	<0.001	<0.025	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0062	0.0050	0.0010	0.0250

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Soluble Copper, Cu	mg/L	0.005	<0.005	0.002	<0.025	<0.005	<0.005	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0065	0.0050	0.0020	0.0250
Soluble Lead, Pb	mg/L	0.005	<0.005	0.002	<0.025	<0.005	<0.005	0.006	<0.005	0.005	<0.005	<0.005	<0.005	0.0066	0.0050	0.0020	0.0250
Soluble Nickel, Ni	mg/L	0.002	<0.005	0.002	<0.025	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0063	0.0050	0.0020	0.0250
Soluble Zinc, Zn	mg/L	0.056	<0.01	0.023	<0.025	0.006	0.04	0.03	0.02	0.04	0.04	0.03	0.03	0.0292	0.0300	0.0060	0.0560
Ortho Phosphorus, PO_4-P	mg/L	0.03	<0.003	0.03	0.027	0.027	0.018	0.034	0.025	0.039	0.027	0.024	0.029	0.0261	0.0270	0.0030	0.0390
Total Phosphorus	mg/L	0.11	0.08	0.05	0.02	0.03	0.05	0.02	0.04	0.04	0.16	0.11	0.09	0.0667	0.0500	0.0200	0.1600
Nitrate, NO_3	mg/L	0.6	<0.2	1.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.6333	0.6000	0.2000	1.1000
Nitrate, NO_3	mg/L	0.68	NA	1.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.8900	0.8900	0.6800	1.1000
Nitrate Nitrogen, NO_3 as N	MG/L	NA	NA	NA	0.22	0.2	0.044	0.16	0.13	0.073	0.009	0.020	0.058	0.1016	0.0730	0.0090	0.2200
Nitrate, NO_3 as NO_3	MG/L	NA	NA	NA	0.98	0.88	0.19	0.71	0.56	0.32	<0.05	0.09	0.26	0.4489	0.3200	0.0500	0.9800
Total Nitrogen	mg/L	1.4	2.9	0.52	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.6067	1.4000	0.5200	2.9000

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Total Nitrogen (Persulphate Digestion)	MG/L	NA	NA	NA	0.37	0.45	0.42	0.41	0.36	0.34	NA	NA	NA	0.3917	0.3900	0.3400	0.4500
Total Nitrogen (calc)	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.87	1.3	0.88	1.0167	0.8800	0.8700	1.3000
Total Kjeldahl Nitrogen (TKN) (Calculated)	MG/L	NA	NA	NA	0.15	0.25	0.36	0.23	0.21	0.24	NA	NA	NA	0.2400	0.2350	0.1500	0.3600
Total Kjeldahl Nitrogen	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.84	1.4	1.0	1.0800	1.0000	0.8400	1.4000
Kjeldahl Nitrogen (calculated)	mg/L	0.85	NA	0.26	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.5550	0.5550	0.2600	0.8500
Nitrate/Nitrite Nitrogen, NOx as N	MG/L	0.58	NA	0.26	0.22	0.2	0.059	0.19	0.15	0.11	0.027	0.084	0.13	0.1827	0.1500	0.0270	0.5800
Nitrite, NO_2	mg/L	1.4	<0.05	<0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.5000	0.0500	0.0500	1.4000
Nitrite Nitrogen, NO_2 as N	MG/L	NA	NA	NA	<0.005	<0.005	0.015	0.025	0.025	0.032	0.018	0.064	0.073	0.0291	0.0250	0.0050	0.0730
Nitrite, NO_2 as NO_2	MG/L	NA	NA	NA	<0.05	<0.05	NA	0.08	0.08	0.1	0.06	0.21	0.24	0.1088	0.0800	0.0500	0.2400

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Ammonia Nitrogen, NH_3 as N	MG/L	0.1	NA	0.02	<0.005	<0.005	<0.005	<0.005	0.014	0.07	0.076	0.12	0.33	0.0682	0.0200	0.0050	0.3300

NA = sample not analysed for analyte

Table 9-11: MB09D Groundwater quality

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Date Sampled	-	19/4/10	14/5/10	9/6/10	23/7/10	23/8/10	21/9/10	2/11/10	1/12/10	15/12/10	28/1/11	24/2/11	24/3/11				
pH	pH Units	7.7	7.6	7.4	7.7	7.6	7.9	7.5	7.5	7.8	7.7	7.6	7.7	7.6417	7.6500	7.4000	7.9000
Conductivity @25°C	µS/cm	29000	9500	9300	9100	9000	9100	9700	9800	8100	9000	8600	8700	10741.6667	9100.0000	8100.0000	29000.0000
Total Dissolved Solids @ 180°C	mg/L	16000	6200	5900	5400	5200	5300	5300	5200	5300	5300	5200	5500	6316.6667	5300.0000	5200.0000	16000.0000
Soluble Iron, Fe	mg/L	2.6	<0.2	0.4	0.19	0.26	0.23	0.74	0.47	0.03	0.53	0.59	0.71	0.5792	0.4350	0.0300	2.6000
Sodium, Na	mg/L	11000	1800	1600	1600	1500	1500	1500	1500	1300	1400	1800	1600	2341.6667	1550.0000	1300.0000	11000.0000
Potassium, K	mg/L	360	65	61	60	62	61	49	60	57	58	71	61	85.4167	61.0000	49.0000	360.0000
Calcium, Ca	mg/L	700	160	150	160	170	140	110	150	160	150	160	170	198.3333	160.0000	110.0000	700.0000
Magnesium, Mg	mg/L	1300	230	200	200	200	180	180	180	190	180	200	190	285.8333	195.0000	180.0000	1300.0000
Chloride, Cl	mg/L	9000	3300	2700	2800	2800	2700	2900	2800	2800	2800	2700	2900	3350.0000	2800.0000	2700.0000	9000.0000
Carbonate, CO_3	mg/L	<1	<1	<1	9	<1	7	4	<1	<1	<1	<1	<1	2.4167	1.0000	1.0000	9.0000
Bicarbonate, HCO_3	mg/L	270	330	330	330	340	340	330	330	350	300	310	320	323.3333	330.0000	270.0000	350.0000

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Sulphate, SO_4	mg/L	2700	390	260	320	310	290	300	230	250	270	280	270	489.1667	285.0000	230.0000	2700.0000
Fluoride, F	mg/L	0.9	0.7	0.6	0.7	0.7	0.7	0.6	0.6	0.7	0.6	0.4	0.7	0.6583	0.7000	0.4000	0.9000
Soluble Manganese, Mn	mg/L	0.11	<0.05	<0.05	<0.025	<0.025	0.014	<0.005	0.047	0.03	0.035	0.036	0.043	0.0392	0.0355	0.0050	0.1100
Soluble Silica, SiO2	mg/L	1.7	6.8	5.9	7.5	3.5	7.4	1.6	7.6	8.1	7.3	7.8	7.4	6.0500	7.3500	1.6000	8.1000
Cation/Anion balance	%	33.2	-0.4	3.8	2	1	0	-4	1	-4	-3	9	0	3.2167	0.5000	-4.0000	33.2000
Sum of Ions (calc.)	mg/L	25351	6198	5298	5420	4310	5230	5390	5160	5090	5020	5530	5450	6953.9167	5344.0000	4310.0000	25351.0000
Soluble Mercury, Hg	mg/L	<0.0001	<0.0005	<0.0001	<0.00005	<0.00005	<0.0001	<0.0001	<0.0001	<0.0001	<0.00005	<0.00005	<0.0005	0.0002	0.0001	0.0001	0.0005
Soluble Arsenic, As	mg/L	0.076	<0.02	0.007	<0.1	<0.1	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.0369	0.0200	0.0070	0.1000
Soluble Cadmium, Cd	mg/L	<0.002	<0.01	<0.0001	<0.005	<0.005	<0.001	<0.005	<0.005	<0.005	<0.001	<0.001	<0.001	0.0034	0.0035	0.0001	0.0100
Soluble Chromium, Cr	mg/L	<0.02	<0.05	0.001	<0.025	<0.025	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0130	0.0050	0.0010	0.0500
Soluble Copper, Cu	mg/L	0.17	<0.05	0.002	<0.025	<0.025	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0256	0.0050	0.0020	0.1700
Soluble Lead, Pb	mg/L	0.048	<0.005	0.002	<0.025	<0.025	<0.005	<0.005	0.005	<0.005	<0.005	<0.005	0.009	0.0120	0.0050	0.0020	0.0480

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Soluble Nickel, Ni	mg/L	0.026	<0.05	0.003	<0.025	<0.025	0.006	<0.005	0.012	0.009	0.008	0.008	0.010	0.0156	0.0095	0.0030	0.0500
Soluble Zinc, Zn	mg/L	0.17	<0.1	0.019	0.03	<0.05	0.07	<0.01	0.03	<0.01	0.04	0.03	0.05	0.0508	0.0350	0.0100	0.1700
Ortho Phosphorus, PO_4-P	mg/L	<0.003	<0.003	0.02	0.066	0.06	0.072	0.05	0.067	0.073	0.061	0.063	0.079	0.0514	0.0620	0.0030	0.0790
Total Phosphorus	mg/L	0.05	0.06	0.07	0.05	0.06	0.07	0.04	0.08	0.07	0.15	0.12	0.18	0.0833	0.0700	0.0400	0.1800
Nitrate, NO_3	mg/L	<0.2	<0.2	<0.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.2000	0.2000	0.2000	0.2000
Nitrate, NO_3	mg/L	0.07	NA	<0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0600	0.0600	0.0500	0.0700
Nitrate Nitrogen, NO_3 as N	MG/L	NA	NA	NA	<0.005	0.085	<0.005	0.17	0.005	0.068	0.062	0.076	0.11	0.0651	0.0680	0.0050	0.1700
Nitrate, NO_3 as NO_3	MG/L	NA	NA	NA	<0.05	0.38	<0.05	0.74	<0.05	0.3	0.27	0.34	0.47	0.2944	0.3000	0.0500	0.7400
Total Nitrogen	mg/L	2.5	1.1	2.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.0333	2.5000	1.1000	2.5000
Total Nitrogen (Persulphate Digestion)	MG/L	NA	NA	NA	2.4	2.3	1.9	1	1.1	1.4	NA	NA	NA	1.6833	1.6500	1.0000	2.4000
Total Nitrogen (calc)	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.2	1.2	2.1	1.5000	1.2000	1.2000	2.1000

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Total Kjeldahl Nitrogen (TKN) (Calculated)	MG/L	NA	NA	NA	2.4	2.2	1.7	0.19	0.8	0.99	NA	NA	NA	1.3800	1.3450	0.1900	2.4000
Total Kjeldahl Nitrogen	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.1	1.4	2.2	1.5667	1.4000	1.1000	2.2000
Kjeldahl Nitrogen (calculated)	mg/L	2.5	NA	2.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.5000	2.5000	2.5000	2.5000
Nitrate/Nitrite Nitrogen, NOx as N	MG/L	0.016	NA	<0.005	<0.005	0.14	0.17	0.81	0.3	0.44	0.11	0.19	0.17	0.2142	0.1700	0.0050	0.8100
Nitrite, NO_2	mg/L	<0.05	<0.05	<0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0500	0.0500	0.0500	0.0500
Nitrite Nitrogen, NO_2 as N	MG/L	NA	NA	NA	<0.005	0.058	0.17	0.64	0.3	0.37	0.049	0.11	0.058	0.1956	0.1100	0.0050	0.6400
Nitrite, NO_2 as NO_2	MG/L	NA	NA	NA	<0.05	0.19	NA	2.1	0.97	1.2	0.16	0.37	0.19	0.6538	0.2800	0.0500	2.1000
Ammonia Nitrogen, NH_3 as N	MG/L	1.5	NA	2.1	2	1.7	1.2	0.017	0.37	0.66	0.50	0.56	0.91	1.0470	0.9100	0.0170	2.1000

NA = sample not analysed for analyte

Table 9-12: MB10 Groundwater quality

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Date Sampled	-	19/4/10	14/0/10	9/6/10	23/7/10	23/8/10	21/9/10	2/11/10	1/12/10	15/12/10	28/1/11	24/2/11	24/3/11				
pH	pH Units	7.8	7.7	7.4	7.5	7.4	7.8	7.4	7.4	7.6	7.5	7.4	7.4	7.5250	7.4500	7.4000	7.8000
Conductivity @25°C	µS/cm	4700	7000	8400	8400	8200	8000	8300	9300	7000	10000	11000	11000	8441.6667	8350.0000	4700.0000	11000.0000
Total Dissolved Solids @180°C	mg/L	3000	4500	5200	4800	4700	4600	4800	5000	4500	6300	6800	6600	5066.6667	4800.0000	3000.0000	6800.0000
Soluble Iron, Fe	mg/L	0.45	<0.02	0.87	0.33	0.54	0.83	0.47	0.72	1.9	1.1	1.7	1.4	0.8608	0.7750	0.0200	1.9000
Sodium, Na	mg/L	850	1200	1400	1300	1200	1100	1200	1400	1200	1700	2300	2000	1404.1667	1250.0000	850.0000	2300.0000
Potassium, K	mg/L	34	46	46	53	51	51	62	48	52	59	72	65	53.2500	51.5000	34.0000	72.0000
Calcium, Ca	mg/L	130	140	150	160	170	140	140	150	210	160	220	190	163.3333	155.0000	130.0000	220.0000
Magnesium, Mg	mg/L	120	160	180	190	180	160	180	180	160	220	300	280	192.5000	180.0000	120.0000	300.0000
Chloride, Cl	mg/L	1500	2300	3000	2700	2500	2400	2600	2600	2400	3200	3500	4000	2725.0000	2600.0000	1500.0000	4000.0000

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Carbonate, CO_3	mg/L	8	<1	<1	4	<1	3	<1	<1	<1	<1	<1	<1	2.0000	1.0000	1.0000	8.0000
Bicarbonate, HCO_3	mg/L	310	320	320	300	350	410	320	310	390	<5	310	290	302.9167	315.0000	5.0000	410.0000
Sulphate, SO_4	mg/L	130	210	220	240	230	220	220	260	240	330	370	380	254.1667	235.0000	130.0000	380.0000
Fluoride, F	mg/L	0.8	0.7	0.6	0.8	0.6	0.7	0.7	0.7	0.8	0.6	0.4	0.7	0.6750	0.7000	0.4000	0.8000
Soluble Manganese, Mn	mg/L	0.035	0.011	<0.05	0.01	<0.025	0.013	0.066	0.01	0.022	0.012	<0.025	<0.025	0.0253	0.0235	0.0100	0.0660
Soluble Silica, SiO2	mg/L	9.5	8.2	6.4	8.8	4	8.6	7.4	8.4	9.1	8.0	8.6	4.7	7.6417	8.3000	4.0000	9.5000
Cation/Anion balance	%	3.5	-1.5	-6.3	-3	-4	-8	-3	0	-1	1	9	-1	-1.1917	-1.2500	-8.0000	9.0000
Sum of Ions (calc.)	mg/L	3070	4372	5306	4810	3880	4410	4640	4910	4570	5660	7010	7190	4985.6667	4725.0000	3070.0000	7190.0000
Soluble Mercury, Hg	mg/L	<0.0001	<0.0005	<0.0001	<0.00005	<0.00005	<0.0001	<0.0001	<0.0001	<0.0001	<0.00005	<0.00005	<0.0005	0.0002	0.0001	0.0001	0.0005
Soluble Arsenic, As	mg/L	0.012	<0.02	0.006	<0.02	<0.1	<0.02	<0.02	<0.02	<0.02	<0.02	<0.1	<0.1	0.0382	0.0200	0.0060	0.1000
Soluble Cadmium, Cd	mg/L	<0.0001	<0.001	<0.0001	<0.005	<0.005	<0.001	<0.005	<0.005	<0.005	<0.001	<0.005	<0.005	0.0032	0.0050	0.0001	0.0050

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Soluble Chromium, Cr	mg/L	<0.001	<0.005	<0.001	<0.005	<0.025	<0.005	<0.005	<0.005	<0.005	<0.005	<0.025	<0.025	0.0093	0.0050	0.0010	0.0250
Soluble Copper, Cu	mg/L	<0.001	<0.005	0.002	<0.005	<0.025	<0.005	0.005	<0.005	<0.005	<0.005	<0.025	<0.025	0.0094	0.0050	0.0010	0.0250
Soluble Lead, Pb	mg/L	0.014	<0.005	0.007	<0.005	<0.025	0.018	0.012	<0.005	0.006	0.006	<0.025	<0.025	0.0128	0.0095	0.0050	0.0250
Soluble Nickel, Ni	mg/L	0.003	0.006	0.002	0.006	<0.025	0.006	0.024	<0.005	0.006	0.005	<0.025	<0.025	0.0115	0.0060	0.0020	0.0250
Soluble Zinc, Zn	mg/L	0.082	0.01	0.016	0.007	<0.05	0.03	0.03	0.02	0.02	0.02	<0.05	<0.05	0.0321	0.0250	0.0070	0.0820
Ortho Phosphorus, PO_4-P	mg/L	0.02	0.003	<0.003	0.003	0.005	0.006	0.008	0.006	0.012	0.004	0.008	0.007	0.0071	0.0060	0.0030	0.0200
Total Phosphorus	mg/L	0.07	0.03	0.02	<0.01	<0.01	<0.01	<0.01	0.02	0.01	0.08	0.07	0.14	0.0400	0.0200	0.0100	0.1400
Nitrate, NO_3	mg/L	<0.2	<0.2	<0.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.2000	0.2000	0.2000	0.2000
Nitrate, NO_3	mg/L	<0.05	NA	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0500	0.0500	0.0500	0.0500
Nitrate Nitrogen, NO_3 as N	MG/L	NA	NA	NA	<0.005	0.043	0.033	0.07	0.014	0.02	<0.005	0.005	0.016	0.0234	0.0160	0.0050	0.0700
Nitrate, NO_3 as NO_3	MG/L	NA	NA	NA	<0.05	0.19	0.15	0.31	0.06	0.09	<0.05	<0.05	0.07	0.1133	0.0700	0.0500	0.3100

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Total Nitrogen	mg/L	3.8	2.5	2.3	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.8667	2.5000	2.3000	3.8000
Total Nitrogen (Persulphate Digestion)	MG/L	NA	NA	NA	2.2	2.3	2.3	2.4	2.4	3.1	NA	NA	NA	2.4500	2.3500	2.2000	3.1000
Total Nitrogen (calc)	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.0	3.2	3.4	3.2000	3.2000	3.0000	3.4000
Total Kjeldahl Nitrogen (TKN) (Calculated)	MG/L	NA	NA	NA	2.2	2.3	2.3	2.3	2.4	3.1	NA	NA	NA	2.4333	2.3000	2.2000	3.1000
Total Kjeldahl Nitrogen	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.0	3.2	3.4	3.2000	3.2000	3.0000	3.4000
Kjeldahl Nitrogen (calculated)	mg/L	3.8	NA	2.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.0000	3.0000	2.2000	3.8000
Nitrate/Nitrite Nitrogen, NOx as N	MG/L	<0.005	NA	0.011	<0.005	0.043	0.033	0.07	0.014	0.034	<0.005	0.016	0.016	0.0229	0.0160	0.0050	0.0700
Nitrite, NO_2	mg/L	<0.05	<0.05	<0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0500	0.0500	0.0500	0.0500

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Nitrite Nitrogen, NO_2 as N	MG/L	NA	NA	NA	<0.005	<0.005	<0.005	<0.005	<0.005	0.014	<0.005	0.011	<0.005	0.0067	0.0050	0.0050	0.0140
Nitrite, NO_2 as NO_2	MG/L	NA	NA	NA	<0.05	<0.05	NA	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.0500	0.0500	0.0500	0.0500
Ammonia Nitrogen, NH_3 as N	MG/L	3.3	NA	2.3	2.1	2.1	2	2.2	1.7	2.3	3.8	2.4	3.3	2.5000	2.3000	1.7000	3.8000

Table 9-13: MB11 Groundwater quality

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Date Sampled	-	19/4/10	14/5/10	9/6/10	23/7/10	23/8/10	21/9/10	2/11/10	1/12/10	15/12/10	24/1/11	28/2/11	24/3/11				
pH	pH Units	7.7	7.5	7.3	7.4	7.4	7.8	7.4	7.3	7.5	7.4	7.3	7.4	7.4500	7.4000	7.3000	7.8000
Conductivity @25°C	µS/cm	14000	13000	10000	9300	8300	6100	9500	12000	8300	14000	18000	15000	11458.3333	11000.0000	6100.0000	18000.0000
Total Dissolved Solids @180°C	mg/L	7500	7800	6400	5400	4800	3500	4900	6300	5300	8800	12000	9500	6850.0000	6350.0000	3500.0000	12000.0000
Soluble Iron, Fe	mg/L	1.3	0.31	0.87	0.57	0.58	2.9	0.71	1.4	5.6	2.5	4.3	4.4	2.1200	1.3500	0.3100	5.6000
Sodium, Na	mg/L	2200	2200	1700	1600	1200	820	1400	1700	1400	2300	3900	2700	1926.6667	1700.0000	820.0000	3900.0000
Potassium, K	mg/L	69	65	51	48	49	33	77	57	47	78	120	83	64.7500	61.0000	33.0000	120.0000
Calcium, Ca	mg/L	190	200	170	180	160	100	140	180	160	210	290	220	183.3333	180.0000	100.0000	290.0000
Magnesium, Mg	mg/L	290	310	230	220	200	160	170	260	200	320	510	360	269.1667	245.0000	160.0000	510.0000
Chloride, Cl	mg/L	4600	4600	3700	2900	2600	1700	2700	3400	2900	4500	6200	5200	3750.0000	3550.0000	1700.0000	6200.0000

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Carbonate, CO_3	mg/L	<1	<1	<1	4	<1	14	<1	<1	<1	<1	<1	<1	2.3333	1.0000	1.0000	14.0000
Bicarbonate, HCO_3	mg/L	320	330	330	320	340	380	320	330	320	310	310	310	326.6667	320.0000	310.0000	380.0000
Sulphate, SO_4	mg/L	460	510	310	290	250	230	250	410	310	560	830	590	416.6667	360.0000	230.0000	830.0000
Fluoride, F	mg/L	0.7	0.7	0.6	0.6	0.6	0.9	0.7	0.7	0.7	0.6	0.4	0.7	0.6583	0.7000	0.4000	0.9000
Soluble Manganese, Mn	mg/L	0.031	<0.05	<0.05	0.009	<0.025	0.011	0.01	<0.025	0.016	0.015	<0.025	<0.025	0.0243	0.0250	0.0090	0.0500
Soluble Silica, SiO2	mg/L	8.4	7.9	6.1	8	3.8	12	8.3	6.3	8.7	6.3	8.3	4.4	7.3750	7.9500	3.8000	12.0000
Cation/Anion balance	%	-4.3	-5.1	-6.6	2	-5	-4	-2	-1	-2	-1	8	-1	-1.8333	-2.0000	-6.6000	8.0000
Sum of Ions (calc.)	mg/L	8100	8224	6453	5530	3920	3400	5040	6310	5270	8270	12100	9440	6838.0833	6381.5000	3400.0000	12100.0000
Soluble Mercury, Hg	mg/L	<0.0001	<0.00005	<0.0001	<0.00005	<0.00005	<0.0001	<0.0001	<0.0001	<0.0001	<0.00005	<0.00005	<0.00005	0.0002	0.0001	0.0001	0.0005
Soluble Arsenic, As	mg/L	0.019	<0.02	0.004	0.03	<0.1	<0.02	<0.02	<0.1	<0.02	<0.02	<0.1	<0.1	0.0461	0.0200	0.0040	0.1000

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Soluble Cadmium, Cd	mg/L	0.0005	<0.01	<0.0001	<0.005	<0.005	<0.001	<0.005	<0.005	<0.005	<0.001	<0.005	<0.005	0.0040	0.0050	0.0001	0.0100
Soluble Chromium, Cr	mg/L	<0.005	<0.05	<0.001	<0.005	<0.025	<0.005	<0.005	<0.025	<0.005	<0.005	<0.025	<0.025	0.0151	0.0050	0.0010	0.0500
Soluble Copper, Cu	mg/L	<0.005	<0.05	0.003	0.006	<0.025	<0.005	<0.005	<0.025	<0.005	<0.005	<0.025	<0.025	0.0153	0.0055	0.0030	0.0500
Soluble Lead, Pb	mg/L	<0.005	<0.005	<0.001	<0.005	<0.025	<0.005	0.011	<0.025	<0.005	<0.005	<0.025	<0.025	0.0118	0.0050	0.0010	0.0250
Soluble Nickel, Ni	mg/L	<0.005	<0.05	0.003	0.01	<0.025	0.007	<0.005	<0.025	0.006	0.020	<0.025	<0.025	0.0172	0.0150	0.0030	0.0500
Soluble Zinc, Zn	mg/L	0.13	<0.1	0.014	0.02	<0.05	0.05	0.01	<0.05	0.04	<0.01	<0.05	<0.05	0.0478	0.0500	0.0100	0.1300
Ortho Phosphorus, PO_4-P	mg/L	<0.003	<0.003	<0.003	0.004	0.019	0.01	0.005	0.004	<0.002	0.004	<0.002	<0.002	0.0051	0.0035	0.0020	0.0190
Total Phosphorus	mg/L	0.02	0.02	0.01	<0.01	0.02	0.04	0.01	0.01	0.01	0.10	0.11	0.11	0.0392	0.0200	0.0100	0.1100
Nitrate, NO_3	mg/L	<0.2	<0.2	<0.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.2000	0.2000	0.2000	0.2000
Nitrate, NO_3	mg/L	<0.05	NA	<0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0500	0.0500	0.0500	0.0500

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Nitrate Nitrogen, NO_3 as N	MG/L	NA	NA	NA	<0.005	0.015	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0061	0.0050	0.0050	0.0150
Nitrate, NO_3 as NO_3	MG/L	NA	NA	NA	<0.05	0.07	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.0522	0.0500	0.0500	0.0700
Total Nitrogen	mg/L	3.2	3.4	3.3	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.3000	3.3000	3.2000	3.4000
Total Nitrogen (Persulphate Digestion)	MG/L	NA	NA	NA	3.4	3.5	2.1	3.3	3.3	3.4	NA	NA	NA	3.1667	3.3500	2.1000	3.5000
Total Nitrogen (calc)	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.0	4.8	4.9	4.5667	4.8000	4.0000	4.9000
Total Kjeldahl Nitrogen (TKN) (Calculated)	MG/L	NA	NA	NA	3.4	3.4	2.1	3.3	3.3	3.4	NA	NA	NA	3.1500	3.3500	2.1000	3.4000
Total Kjeldahl Nitrogen	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.0	4.8	4.9	4.5667	4.8000	4.0000	4.9000

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Kjeldahl Nitrogen (calculated)	mg/L	3.2	NA	3.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.2000	3.2000	3.2000	3.2000
Nitrate/Nitrite Nitrogen, NOx as N	MG/L	<0.005	NA	<0.005	<0.005	0.086	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0124	0.0050	0.0050	0.0860
Nitrite, NO_2	mg/L	<0.05	<0.05	<0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0500	0.0500	0.0500	0.0500
Nitrite Nitrogen, NO_2 as N	MG/L	NA	NA	NA	<0.005	0.071	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0123	0.0050	0.0050	0.0710
Nitrite, NO_2 as NO_2	MG/L	NA	NA	NA	<0.05	0.23		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.0725	0.0500	0.0500	0.2300
Ammonia Nitrogen, NH_3 as N	MG/L	3.1	NA	3.3	3.1	3.1	1.7	3.2	2.7	3.3	3.5	3.3	4.9	3.2000	3.2000	1.7000	4.9000

NA = sample not analysed for analyte

Table 9-14: MB12 Groundwater quality

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Date Sampled	-	19/4/10	14/5/10	9/6/10	23/7/10	23/8/10	21/9/10	2/11/10	1/12/10	15/12/10	24/1/11	28/2/11	24/3/11				
pH	pH Units	7.7	7.6	7.4	7.4	7.4	7.8	7.4	7.3	7.5	7.4	7.4	7.4	7.4750	7.4000	7.3000	7.8000
Conductivity @25°C	µS/cm	8900	9900	9600	16000	16000	2300	16000	21000	13000	20000	22000	22000	14725.0000	16000.0000	2300.0000	22000.0000
Total Dissolved Solids @180°C	mg/L	6000	6400	6100	9900	9700	1200	8000	11000	8400	13000	14000	13000	8891.6667	9050.0000	1200.0000	14000.0000
Soluble Iron, Fe	mg/L	0.45	0.22	3.3	0.68	0.96	0.83	5.3	4.7	11	5.2	9.7	5.5	3.9867	4.0000	0.2200	11.0000
Sodium, Na	mg/L	1700	1800	1600	2900	2700	220	2600	2900	2100	3500	4700	4100	2568.3333	2650.0000	220.0000	4700.0000
Potassium, K	mg/L	53	52	46	84	85	6.6	76	88	65	110	150	120	77.9667	80.0000	6.6000	150.0000
Calcium, Ca	mg/L	160	150	160	210	200	100	180	250	230	310	450	310	225.8333	205.0000	100.0000	450.0000
Magnesium, Mg	mg/L	260	290	240	430	410	61	320	460	330	510	680	600	382.5833	370.0000	61.0000	680.0000
Chloride, Cl	mg/L	3400	3500	3600	5200	4900	490	4700	5900	4100	6900	7500	7900	4840.8333	4800.0000	490.0000	7900.0000

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Carbonate, CO_3	mg/L	5	<1	<1	<1	<1	4	<1	<1	<1	<1	<1	<1	1.5833	1.0000	1.0000	5.0000
Bicarbonate, HCO_3	mg/L	390	400	390	390	420	340	390	400	450	360	360	370	388.3333	390.0000	340.0000	450.0000
Sulphate, SO_4	mg/L	380	420	230	710	690	74	590	840	570	940	1100	1000	628.6667	640.0000	74.0000	1100.0000
Fluoride, F	mg/L	0.9	0.9	0.8	0.9	0.9	0.8	0.9	0.9	1	0.9	0.6	0.9	0.8667	0.9000	0.6000	1.0000
Soluble Manganese, Mn	mg/L	0.029	<0.05	<0.05	<0.025	<0.05	<0.005	0.044	<0.05	0.026	0.020	0.034	<0.05	0.0361	0.0390	0.0050	0.0500
Soluble Silica, SiO2	mg/L	9.6	9	7.5	3.2	7.5	9	41	4.7	10	7.5	10	0.88	9.9900	8.2500	0.8800	41.0000
Cation/Anion balance	%	-2.2	-1.8	-7.3	2	1	-3	0	-3	0	-2	9	0	-0.6083	-0.9000	-7.3000	9.0000
Sum of Ions (calc.)	mg/L	6454	6586	6204	9940	9350	1240	8800	10900	7800	12500	14800	14300	9072.8333	9075.0000	1240.0000	14800.0000
Soluble Mercury, Hg	mg/L	<0.0001	<0.0005	<0.0001	<0.00005	<0.00005	<0.0001	<0.0001	<0.0001	<0.0001	<0.00005	<0.00005	<0.0005	0.0002	0.0001	0.0001	0.0005
Soluble Arsenic, As	mg/L	0.022	<0.02	0.004	<0.1	<0.2	<0.02	<1	<0.2	<0.02	<0.02	<0.1	<0.2	0.1588	0.0610	0.0040	1.0000
Soluble Cadmium, Cd	mg/L	0.0005	<0.01	<0.0001	<0.005	<0.01	<0.001	<0.005	<0.01	<0.005	<0.001	<0.005	<0.01	0.0052	0.0050	0.0001	0.0100

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Soluble Chromium, Cr	mg/L	<0.005	<0.05	0.002	<0.025	<0.05	<0.005	<0.025	<0.05	0.006	<0.005	<0.025	<0.05	0.0248	0.0250	0.0020	0.0500
Soluble Copper, Cu	mg/L	<0.005	<0.05	0.003	<0.025	<0.05	<0.005	<0.025	<0.05	<0.005	<0.005	<0.025	<0.05	0.0248	0.0250	0.0030	0.0500
Soluble Lead, Pb	mg/L	<0.005	<0.005	0.002	<0.025	<0.05	<0.005	<0.025	<0.05	0.007	<0.005	<0.025	<0.05	0.0212	0.0160	0.0020	0.0500
Soluble Nickel, Ni	mg/L	<0.005	<0.05	0.004	0.039	<0.05	0.005	<0.025	<0.05	0.011	0.023	0.031	<0.05	0.0286	0.0280	0.0040	0.0500
Soluble Zinc, Zn	mg/L	0.13	<0.1	0.019	<0.025	<0.1	0.04	0.07	<0.1	0.04	0.01	0.06	<0.1	0.0662	0.0650	0.0100	0.1300
Ortho Phosphorus, PO_4-P	mg/L	0.06	0.03	0.008	<0.002	<0.002	0.007	0.038	0.073	<0.002	0.015	<0.002	<0.002	0.0201	0.0075	0.0020	0.0730
Total Phosphorus	mg/L	0.16	0.05	0.03	<0.01	0.01	0.03	0.03	0.09	<0.01	0.20	0.19	0.23	0.0867	0.0400	0.0100	0.2300
Nitrate, NO_3	mg/L	<0.2	<0.2	<0.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.2000	0.2000	0.2000	0.2000
Nitrate, NO_3	mg/L	0.19	NA	0.17	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.1800	0.1800	0.1700	0.1900
Nitrate Nitrogen, NO_3 as N	MG/L	NA	NA	NA	<0.005	<0.005	<0.005	<0.005	<0.005	0.07	<0.005	<0.005	0.012	0.0130	0.0050	0.0050	0.0700
Nitrate, NO_3 as NO_3	MG/L	NA	NA	NA	<0.05	<0.05	<0.05	<0.05	<0.05	0.31	<0.05	<0.05	0.05	0.0789	0.0500	0.0500	0.3100

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Total Nitrogen	mg/L	4.1	3.9	3.4	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.8000	3.9000	3.4000	4.1000
Total Nitrogen (Persulphate Digestion)	MG/L	NA	NA	NA	3.5	3.6	0.56	3.7	3.5	3.5	NA	NA	NA	3.0600	3.5000	0.5600	3.7000
Total Nitrogen (calc)	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.9	3.9	4.3	4.0333	3.9000	3.9000	4.3000
Total Kjeldahl Nitrogen (TKN) (Calculated)	MG/L	NA	NA	NA	3.5	3.6	0.56	3.7	3.5	3.4	NA	NA	NA	3.0433	3.5000	0.5600	3.7000
Total Kjeldahl Nitrogen	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.9	3.9	4.3	4.0333	3.9000	3.9000	4.3000
Kjeldahl Nitrogen (calculated)	mg/L	4.1	NA	3.4	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.7500	3.7500	3.4000	4.1000
Nitrate/Nitrite Nitrogen, NOx as N	MG/L	0.042	NA	0.077	0.03	<0.005	<0.005	<0.005	<0.005	0.07	<0.005	<0.005	0.012	0.0237	0.0050	0.0050	0.0770
Nitrite, NO_2	mg/L	<0.05	<0.05	0.13	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0767	0.0500	0.0500	0.1300

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Nitrite Nitrogen, NO_2 as N	MG/L	NA	NA	NA	0.026	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0073	0.0050	0.0050	0.0260
Nitrite, NO_2 as NO_2	MG/L	NA	NA	NA	0.09	<0.05	NA	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.0550	0.0500	0.0500	0.0900
Ammonia Nitrogen, NH_3 as N	MG/L	3.5	NA	2.9	3.3	3.3	0.031	3.5	2.7	3.3	3.5	3.5	4.1	3.0574	3.3000	0.0310	4.1000

Table 9-15: MB13 Groundwater quality

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Date Sampled	-	19/4/10	14/5/10	9/6/10	23/7/10	23/8/10	21/9/10	2/11/10	1/12/10	15/12/10	24/1/11	28/2/11	24/3/2011				
pH	pH Units	8.1	7.9	7.8	7.9	7.8	8.1	7.8	7.7	7.6	7.8	7.8	7.7	7.8333	7.8000	7.6000	8.1000
Conductivity @25°C	µS/cm	1400	1100	1000	920	850	790	750	720	790	730	750	750	879.1667	790.0000	720.0000	1400.0000
Total Dissolved Solids @180°C	mg/L	900	640	590	520	470	410	380	410	610	440	400	390	513.3333	455.0000	380.0000	900.0000
Soluble Iron, Fe	mg/L	1.1	0.05	0.37	<0.2	0.34	0.36	0.46	0.62	0.46	0.50	0.40	0.43	0.4408	0.4150	0.0500	1.1000
Sodium, Na	mg/L	240	160	150	130	94	68	67	63	74	56	61	57	101.6667	71.0000	56.0000	240.0000
Potassium, K	mg/L	5.5	3.6	2.8	2.5	2.2	1.9	1.9	1.9	2.1	1.9	1.8	1.8	2.4917	2.0000	1.8000	5.5000
Calcium, Ca	mg/L	58	38	49	38	41	36	40	45	56	45	48	44	44.8333	44.5000	36.0000	58.0000
Magnesium, Mg	mg/L	41	30	29	29	27	26	30	31	32	30	34	33	31.0000	30.0000	26.0000	41.0000
Chloride, Cl	mg/L	340	170	140	140	130	97	94	120	240	140	110	110	152.5833	135.0000	94.0000	340.0000
Carbonate, CO_3	mg/L	8	<1	<1	11	5	9	4	<1	<1	<1	<1	<1	3.6667	1.0000	1.0000	11.0000
Bicarbonate, HCO_3	mg/L	270	330	350	280	300	270	260	280	280	250	250	250	280.8333	275.0000	250.0000	350.0000

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Sulphate, SO_4	mg/L	90	93	77	61	51	33	27	22	23	22	25	25	45.7500	30.0000	22.0000	93.0000
Fluoride, F	mg/L	0.6	1.2	1.1	1.2	1.2	1.2	1.1	1	1	0.8	0.6	0.9	0.9917	1.0500	0.6000	1.2000
Soluble Manganese, Mn	mg/L	0.034	0.053	0.057	<0.05	0.05	0.044	0.038	0.038	0.039	0.041	0.039	0.035	0.0432	0.0400	0.0340	0.0570
Soluble Silica, SiO2	mg/L	5.4	5	6.4	6	6	4.7	4.8	5.2	5.3	4.9	4.8	4.9	5.2833	5.1000	4.7000	6.4000
Cation/Anion balance	%	1.5	-2.6	0.5	0	-7	-8	-1	-5	-15	-8	3	-2	-3.6333	-2.3000	-15.0000	3.0000
Sum of Ions (calc.)	mg/L	1057	829	801	644	596	497	482	509	661	497	479	480	627.6667	552.5000	479.0000	1057.0000
Soluble Mercury, Hg	mg/L	<0.0001	<0.0005	<0.0001	<0.00005	<0.00005	<0.0001	<0.0001	<0.0001	<0.0001	<0.00005	<0.00005	<0.0005	0.0002	0.0001	0.0001	0.0005
Soluble Arsenic, As	mg/L	0.063	0.026	0.15	0.38	0.52	0.83	0.59	0.55	0.5	0.52	0.40	0.31	0.4033	0.4500	0.0260	0.8300
Soluble Cadmium, Cd	mg/L	0.0006	<0.001	0.0004	<0.01	<0.005	<0.001	<0.005	<0.005	<0.005	<0.001	<0.001	<0.001	0.0030	0.0010	0.0004	0.0100
Soluble Chromium, Cr	mg/L	0.002	<0.005	<0.001	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0082	0.0050	0.0010	0.0500
Soluble Copper, Cu	mg/L	0.001	<0.005	0.001	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0081	0.0050	0.0010	0.0500

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Soluble Lead, Pb	mg/L	<0.001	<0.005	<0.001	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0081	0.0050	0.0010	0.0500
Soluble Nickel, Ni	mg/L	0.003	<0.005	0.001	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0083	0.0050	0.0010	0.0500
Soluble Zinc, Zn	mg/L	0.02	0.012	0.037	<0.05	0.01	0.04	0.02	0.03	0.03	0.03	0.03	0.03	0.0283	0.0300	0.0100	0.0500
Ortho Phosphorus, PO_4-P	mg/L	0.01	0.009	0.04	0.1	0.22	0.17	0.098	0.067	0.16	0.095	0.061	0.056	0.0905	0.0810	0.0090	0.2200
Total Phosphorus	mg/L	0.07	0.06	0.07	0.11	0.22	0.39	0.13	0.19	0.18	0.35	0.20	0.20	0.1808	0.1850	0.0600	0.3900
Nitrate, NO_3	mg/L	0.3	<0.2	<0.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.2333	0.2000	0.2000	0.3000
Nitrate, NO_3	mg/L	0.94	NA	0.17	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.5550	0.5550	0.1700	0.9400
Nitrate Nitrogen, NO_3 as N	MG/L	NA	NA	NA	0.087	0.13	0.048	0.04	0.044	2.1	0.029	0.050	0.020	0.2831	0.0480	0.0200	2.1000
Nitrate, NO_3 as NO_3	MG/L	NA	NA	NA	0.39	0.59	0.21	0.18	0.19	9.1	0.13	0.22	0.09	1.2333	0.2100	0.0900	9.1000
Total Nitrogen	mg/L	4.2	4.7	4.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.3333	4.2000	4.1000	4.7000
Total Nitrogen (Persulphate Digestion)	MG/L	NA	NA	NA	2.2	1.9	1.2	0.94	1	2.9	NA	NA	NA	1.6900	1.5500	0.9400	2.9000

Analyte	Units	April	May	June	July	August	September	October	November	December	January	February	March	Mean	Median	Min	Max
Total Nitrogen (calc)	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.2	0.81	1.4	1.1367	1.2000	0.8100	1.4000
Total Kjeldahl Nitrogen (TKN) (Calculated)	MG/L	NA	NA	NA	2.1	1.7	1.1	0.84	0.93	0.8	NA	NA	NA	1.2450	1.0150	0.8000	2.1000
Total Kjeldahl Nitrogen	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.2	0.89	1.4	1.1633	1.2000	0.8900	1.4000
Kjeldahl Nitrogen (calculated)	mg/L	3.6	NA	4.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.8500	3.8500	3.6000	4.1000
Nitrate/Nitrite Nitrogen, NOx as N	MG/L	0.54	NA	0.065	0.11	0.16	0.1	0.098	0.088	2.1	0.060	0.078	0.020	0.3108	0.0980	0.0200	2.1000
Nitrite, NO_2	mg/L	1.1	<0.05	0.08	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.4100	0.0800	0.0500	1.1000
Nitrite Nitrogen, NO_2 as N	MG/L	NA	NA	NA	0.021	0.024	0.054	0.058	0.044	0.028	0.031	0.028	<0.005	0.0326	0.0280	0.0050	0.0580
Nitrite, NO_2 as NO_2	MG/L	NA	NA	NA	0.07	0.08	NA	0.19	0.14	0.09	0.10	0.09	<0.05	0.1013	0.0900	0.0500	0.1900
Ammonia Nitrogen, NH_3 as N	MG/L	2.3	NA	2.5	1.4	0.89	0.54	0.58	0.48	0.62	0.29	0.24	0.41	0.9318	0.5800	0.2400	2.5000

NA = sample not analysed for analyte

Table 9-16: MB14S Groundwater quality

Analyte	Units	February	March	Mean	Median	Min	Max
Date Sampled	-	28/2/211	24/3/211				
pH	pH Units	8.2	8.2	8.2	8.2	8.2	8.2
Conductivity @25°C	µS/cm	1500	1300	1400.0	1400.0	1300.0	1500.0
Total Dissolved Solids @180°C	mg/L	890	760	825.0	825.0	760.0	890.0
Soluble Iron, Fe	mg/L	0.07	0.22	0.1	0.1	0.1	0.2
Sodium, Na	mg/L	280	230	255.0	255.0	230.0	280.0
Potassium, K	mg/L	4.3	3.3	3.8	3.8	3.3	4.3
Calcium, Ca	mg/L	31	37	34.0	34.0	31.0	37.0
Magnesium, Mg	mg/L	32	29	30.5	30.5	29.0	32.0
Chloride, Cl	mg/L	310	250	280.0	280.0	250.0	310.0
Carbonate, CO_3	mg/L	<1	<1	1.0	1.0	1.0	1.0
Bicarbonate, HCO_3	mg/L	320	330	325.0	325.0	320.0	330.0
Sulphate, SO_4	mg/L	52	43	47.5	47.5	43.0	52.0
Fluoride, F	mg/L	1.0	1.5	1.3	1.3	1.0	1.5
Soluble Manganese, Mn	mg/L	0.010	0.015	0.0	0.0	0.0	0.0
Soluble Silica, SiO2	mg/L	4.7	5.0	4.9	4.9	4.7	5.0
Cation/Anion balance	%	4	3	3.5	3.5	3.0	4.0
Sum of Ions (calc.)	mg/L	977	872	924.5	924.5	872.0	977.0
Soluble Mercury, Hg	mg/L	<0.00005	<0.0005	0.0	0.0	0.0	0.0
Soluble Arsenic, As	mg/L	0.021	<0.02	0.0	0.0	0.0	0.0
Soluble Cadmium, Cd	mg/L	<0.001	<0.001	0.0	0.0	0.0	0.0
Soluble Chromium, Cr	mg/L	<0.005	<0.005	0.0	0.0	0.0	0.0
Soluble Copper, Cu	mg/L	<0.005	<0.005	0.0	0.0	0.0	0.0
Soluble Lead, Pb	mg/L	<0.005	<0.005	0.0	0.0	0.0	0.0
Soluble Nickel, Ni	mg/L	<0.005	<0.005	0.0	0.0	0.0	0.0
Soluble Zinc, Zn	mg/L	0.03	0.06	0.0	0.0	0.0	0.1
Ortho Phosphorus, PO_4-P	mg/L	0.004	0.003	0.0	0.0	0.0	0.0
Total Phosphorus	mg/L	0.07	0.08	0.1	0.1	0.1	0.1
Nitrate, NO_3	mg/L	NA	NA	NA	NA	NA	NA

Analyte	Units	February	March	Mean	Median	Min	Max
Nitrate, NO_3	mg/L	NA	NA	NA	NA	NA	NA
Nitrate Nitrogen, NO_3 as N	MG/L	<0.005	0.016	0.0	0.0	0.0	0.0
Nitrate, NO_3 as NO_3	MG/L	<0.05	0.07	0.1	0.1	0.1	0.1
Total Nitrogen	mg/L	NA	NA	NA	NA	NA	NA
Total Nitrogen (Persulphate Digestion)	MG/L	NA	NA	NA	NA	NA	NA
Total Nitrogen (calc)	mg/L	6.1	5.9	6.0	6.0	5.9	6.1
Total Kjeldahl Nitrogen (TKN) (Calculated)	MG/L	NA	NA	NA	NA	NA	NA
Total Kjeldahl Nitrogen	mg/L	6.1	5.9	6.0	6.0	5.9	6.1
Kjeldahl Nitrogen (calculated)	mg/L	NA	NA	NA	NA	NA	NA
Nitrate/Nitrite Nitrogen, NOx as N	MG/L	<0.005	0.026	0.0	0.0	0.0	0.0
Nitrite, NO_2	mg/L	NA	NA	NA	NA	NA	NA
Nitrite Nitrogen, NO_2 as N	MG/L	<0.005	0.010	0.0	0.0	0.0	0.0
Nitrite, NO_2 as NO_2	MG/L	<0.05	<0.05	0.1	0.1	0.1	0.1
Ammonia Nitrogen, NH_3 as N	MG/L	0.085	0.063	0.1	0.1	0.1	0.1

NA = sample not analysed for analyte

Table 9-17: MB14D Groundwater quality

Analyte	Units	February	March	Mean	Median	Min	Max
Date Sampled	-	28/2/11	24/3/11				
pH	pH Units	7.7	7.7	7.7	7.7	7.7	7.7
Conductivity @25°C	µS/cm	7900	8000	7950.0	7950.0	7900.0	8000.0
Total Dissolved Solids @180°C	mg/L	4900	4800	4850.0	4850.0	4800.0	4900.0
Soluble Iron, Fe	mg/L	0.24	0.10	0.2	0.2	0.1	0.2
Sodium, Na	mg/L	1600	1400	1500.0	1500.0	1400.0	1600.0
Potassium, K	mg/L	59	53	56.0	56.0	53.0	59.0
Calcium, Ca	mg/L	130	110	120.0	120.0	110.0	130.0
Magnesium, Mg	mg/L	210	200	205.0	205.0	200.0	210.0
Chloride, Cl	mg/L	2600	2600	2600.0	2600.0	2600.0	2600.0
Carbonate, CO_3	mg/L	<1	<1	1.0	1.0	1.0	1.0
Bicarbonate, HCO_3	mg/L	320	340	330.0	330.0	320.0	340.0
Sulphate, SO_4	mg/L	240	230	235.0	235.0	230.0	240.0
Fluoride, F	mg/L	1.1	1.0	1.1	1.1	1.0	1.1
Soluble Manganese, Mn	mg/L	0.032	0.018	0.0	0.0	0.0	0.0
Soluble Silica, SiO2	mg/L	12	11	11.5	11.5	11.0	12.0
Cation/Anion balance	%	6	1	3.5	3.5	1.0	6.0
Sum of Ions (calc.)	mg/L	5100	4840	4970.0	4970.0	4840.0	5100.0
Soluble Mercury, Hg	mg/L	<0.00005	<0.0005	0.0	0.0	0.0	0.0
Soluble Arsenic, As	mg/L	<0.02	<0.02	0.0	0.0	0.0	0.0
Soluble Cadmium, Cd	mg/L	<0.001	<0.001	0.0	0.0	0.0	0.0
Soluble Chromium, Cr	mg/L	<0.005	<0.005	0.0	0.0	0.0	0.0
Soluble Copper, Cu	mg/L	<0.005	<0.005	0.0	0.0	0.0	0.0
Soluble Lead, Pb	mg/L	<0.005	<0.005	0.0	0.0	0.0	0.0
Soluble Nickel, Ni	mg/L	0.007	0.005	0.0	0.0	0.0	0.0
Soluble Zinc, Zn	mg/L	0.04	0.03	0.0	0.0	0.0	0.0
Ortho Phosphorus, PO_4-P	mg/L	0.10	0.094	0.1	0.1	0.1	0.1
Total Phosphorus	mg/L	0.14	0.16	0.2	0.2	0.1	0.2
Nitrate, NO_3	mg/L	0.07	<0.05	0.1	0.1	0.1	0.1
Nitrate, NO_3	mg/L	NA	NA	NA	NA	NA	NA

Analyte	Units	February	March	Mean	Median	Min	Max
Nitrate Nitrogen, NO_3 as N	MG/L	0.015	<0.005	0.0	0.0	0.0	0.0
Nitrate, NO_3 as NO_3	MG/L	0.07	<0.05	0.1	0.1	0.1	0.1
Total Nitrogen	mg/L	NA	NA	NA	NA	NA	NA
Total Nitrogen (Persulphate Digestion)	MG/L	NA	NA	NA	NA	NA	NA
Total Nitrogen (calc)	mg/L	3.4	3.8	3.6	3.6	3.4	3.8
Total Kjeldahl Nitrogen (TKN) (Calculated)	MG/L	NA	NA	NA	NA	NA	NA
Total Kjeldahl Nitrogen	mg/L	3.4	3.8	3.6	3.6	3.4	3.8
Kjeldahl Nitrogen (calculated)	mg/L	NA	NA	NA	NA	NA	NA
Nitrate/Nitrite Nitrogen, NOx as N	MG/L	0.015	<0.005	0.0	0.0	0.0	0.0
Nitrite, NO_2	mg/L	NA	NA	NA	NA	NA	NA
Nitrite Nitrogen, NO_2 as N	MG/L	<0.005	<0.005	0.0	0.0	0.0	0.0
Nitrite, NO_2 as NO_2	MG/L	<0.05	<0.05	0.1	0.1	0.1	0.1
Ammonia Nitrogen, NH_3 as N	MG/L	2.9	3.1	3.0	3.0	2.9	3.1

NA = sample not analysed for analyte

10 References

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Appendix A: Bore Logs

WELL COMPLETION DETAILS: MB01

Client: Landcorp
Date Drilled: 29-30/03/10
Logged By: Shawn Butland

Driller: Mathews Drilling
Fluid : Air/Water
Drilling Method: Reverse Circulation
Drilled Diameter: 152.4 mm

Easting: 378534
Northing: 6427559
Surface RL: 2.11 mAHD

MWH

HYDRAULIC DATA:
SWL: 1.62 mbgl
SWL Date Collected: 08/04/2010

Depth mbgl	Fm.	Lithological Description	Lithology	Well Construction	Well Details	Water Quality
0	Safety Bay Sand	SAND Light brown, moderately sorted, angular to very angular shell fragments.			Steel lockable cover Cement grout (0-0.5 m)	
5		SAND Light grey, moderately sorted, medium grain size, angular shell fragments.				
10						**EC; 1.61mS/cm, TDS; 0.81 ppt, Temp; 19.0 °C, pH; 8.39 at 10 m**
15		SILTY SAND Brown, well sorted, silty sand. Contains some organic material.			100 mm UPVC PN9 Slotted casing (0-30 m)	**EC; 1.52 mS/cm, TDS; 0.83 ppt, Temp; 20.0 °C, pH; 8.06 at 13 m** **EC; 1.1 mS/cm, TDS; 0.56 ppt, Temp; 20.5 °C, pH; 7.69 at 16 m**
20					Gravel Pack (1.6-3.2 mm)	**EC; 1.58 mS/cm, TDS; 0.80 ppt, Temp; 29.4 °C, pH; 7.88 at 23 m** **EC; 2.86 mS/cm, TDS; 1.27 ppt, Temp; 27.6 °C, pH; 7.88 at 24 m**
25	Tamala Limestone	SANDSTONE Grey, poorly sorted, cemented qaurtz rich sandstone. Clasts contain 90 % rounded to sub rounded quartz 2-5 mm in size and 10 % angular shell fragments.				**EC; 4.04 mS/cm, TDS; 2.07 ppt, Temp; 27.9 °C, pH; 7.84 at 25 m** **EC; 5.54 mS/cm, TDS; 2.92 ppt, Temp; 26.3 °C, pH; 7.78 at 26 m** **EC; 13.34 mS/cm, TDS; 6.82 ppt, Temp; 24.7 °C, pH; 7.66 at 27 m**
30		SILT Yellow/brown, fine grained, well sorted silt. Contains some clasts of shell fragments and rounded quartz.			End cap (30 mbgl) EOH 30 m	**EC; 20+ mS/cm, TDS; 10+ ppt, Temp; 32.0 °C, pH; 7.58 at 28 m**

TD: 30 m
Notes: Has data logger and barotroll installed in the bore.

WELL COMPLETION DETAILS: MB02

Client: Landcorp
Date Drilled: 14/04/2010
Logged By: Shawn Butland

Driller: Mathews Drilling
Fluid : Air/Water
Drilling Method: Reverse Circulation
Drilled Diameter: 152.4 mm

Easting: 377921
Northing: 6427850
Surface RL: 6.45 mAHD

MWH

HYDRAULIC DATA:
SWL: 6.23 mbgl
SWL Date Collected: 19/04/2010

Depth mbgl	Fm.	Lithological Description	Lithology	Well Construction	Well Details	Water Quality
0	Safety Bay Sand	SAND Light brown, well sorted, angular to very angular shell fragments.			Steel lockable cover	
		SAND Cream/brown, well sorted, angular, shell rich sand.			Cement grout (0-0.5 m)	
5		SAND Cream, poorly sorted, very angular, shell rich sand.				
10		SAND Dark grey, moderately sorted, angular, shell rich sand.			100 mm UPVC PN9 Slotted casing (0-22 m)	**EC; 2.05 mS/cm, TDS; 1.0 ppt, Temp; 20.6 °C, pH; 8.10 at 11 m** **EC; 1.55 mS/cm, TDS; 0.73 ppt, Temp; 18.5 °C, pH; 8.25 at 14 m** **EC; 1.55 mS/cm, TDS; 0.79 ppt, Temp; 18.7 °C, pH; 8.13 at 15 m**
15					Gravel Pack (1.6-3.2 mm)	**EC; 2.53 mS/cm, TDS; 1.19 ppt, Temp; 18.5 °C, pH; 8.05 at 16 m** **EC; 6.74 mS/cm, TDS; 3.51 ppt, Temp; 18.6 °C, pH; 8.08 at 17 m** **EC; 3.91 mS/cm, TDS; 1.96 ppt, Temp; 19.2 °C, pH; 8.01 at 18 m** **EC; 5.14 mS/cm, TDS; 2.05 ppt, Temp; 19.6 °C, pH; 8.06 at 19 m**
20					End cap (22 mbgl) EOH 22 m	**EC; 6.42 mS/cm, TDS; 3.02 ppt, Temp; 19.5 °C, pH; 8.10 at 20 m**

TD: 22 m
Notes:

WELL COMPLETION DETAILS: MB03

Client: Landcorp
Date Drilled: 06-07/04/2010
Logged By: Shawn Butland

Driller: Mathews Drilling
Fluid : Air/Water
Drilling Method: Reverse Circulation
Drilled Diameter: 152.4 mm

Easting: 378523
Northing: 6428086
Surface RL: 2.83 mAHD

MWH

HYDRAULIC DATA:
SWL: 2.16 mbgl
SWL Date Collected: 19/04/2010

Depth mbgl	Fm.	Lithological Description	Lithology	Well Construction	Well Details	Water Quality
0 – 5	Safety Bay Sand	SAND Cream, moderately sorted, very angular, shell rich sand.			Steel lockable cover Cement grout (0-0.5 m)	
5 – 10	Safety Bay Sand	SAND Cream/grey, moderately-poorly sorted, very angular, shell rich sand.				**EC; 0.88 mS/cm, TDS; 0.44 ppt, Temp; 26.2 °C, pH; 8.18 at 9 m** **EC; 0.80 mS/cm, TDS; 0.40 ppt, Temp; 24.3 °C, pH; 8.06 at 13 m** **EC; 1.34 mS/cm, TDS; 0.64 ppt, Temp; 28.7 °C, pH; 7.71 at 18 m**
10 – 15	Safety Bay Sand	SANDY SILT Brown/grey, well sorted, fine silty sand. Contains some organic material.			100 mm UPVC PN9 Slotted casing (0-27 m)	**EC; 1.83 mS/cm, TDS; 0.83 ppt, Temp; 28.3 °C, pH; 7.86 at 19 m** **EC; 3.16 mS/cm, TDS; 1.49 ppt, Temp; 28.6 °C, pH; 8.02 at 21 m**
15 – 20	Safety Bay Sand				Gravel Pack (1.6-3.2 mm)	**EC; 5.05 mS/cm, TDS; 2.60 ppt, Temp; 27.1 °C, pH; 8.01 at 23 m** **EC; 5.56 mS/cm, TDS; 2.79 ppt, Temp; 26.2 °C, pH; 8.06 at 24 m**
20 – 25	Safety Bay Sand					**EC; 5.65 mS/cm, TDS; 3.04 ppt, Temp; 25.8 °C, pH; 7.93 at 25 m**
25 – 27	Tamala Limestone	SANDSTONE Grey, moderately sorted, sub rounded, cemented sandstone. Clasts contain approximately 70 % rounded to sub rounded quartz and minor amounts of shell fragments.			End cap (27 mbgl) EOH 27 m	**EC; 6.28 mS/cm, TDS; 3.13 ppt, Temp; 27.3 °C, pH; 7.93 at 26 m** **EC; 13.60 mS/cm, TDS; 6.81 ppt, Temp; 27.3 °C, pH; 7.91 at 27 m**

TD: 27 m
Notes:

WELL COMPLETION DETAILS: MB04

Client: Landcorp
Date Drilled: 15/04/2010
Logged By: Shawn Butland

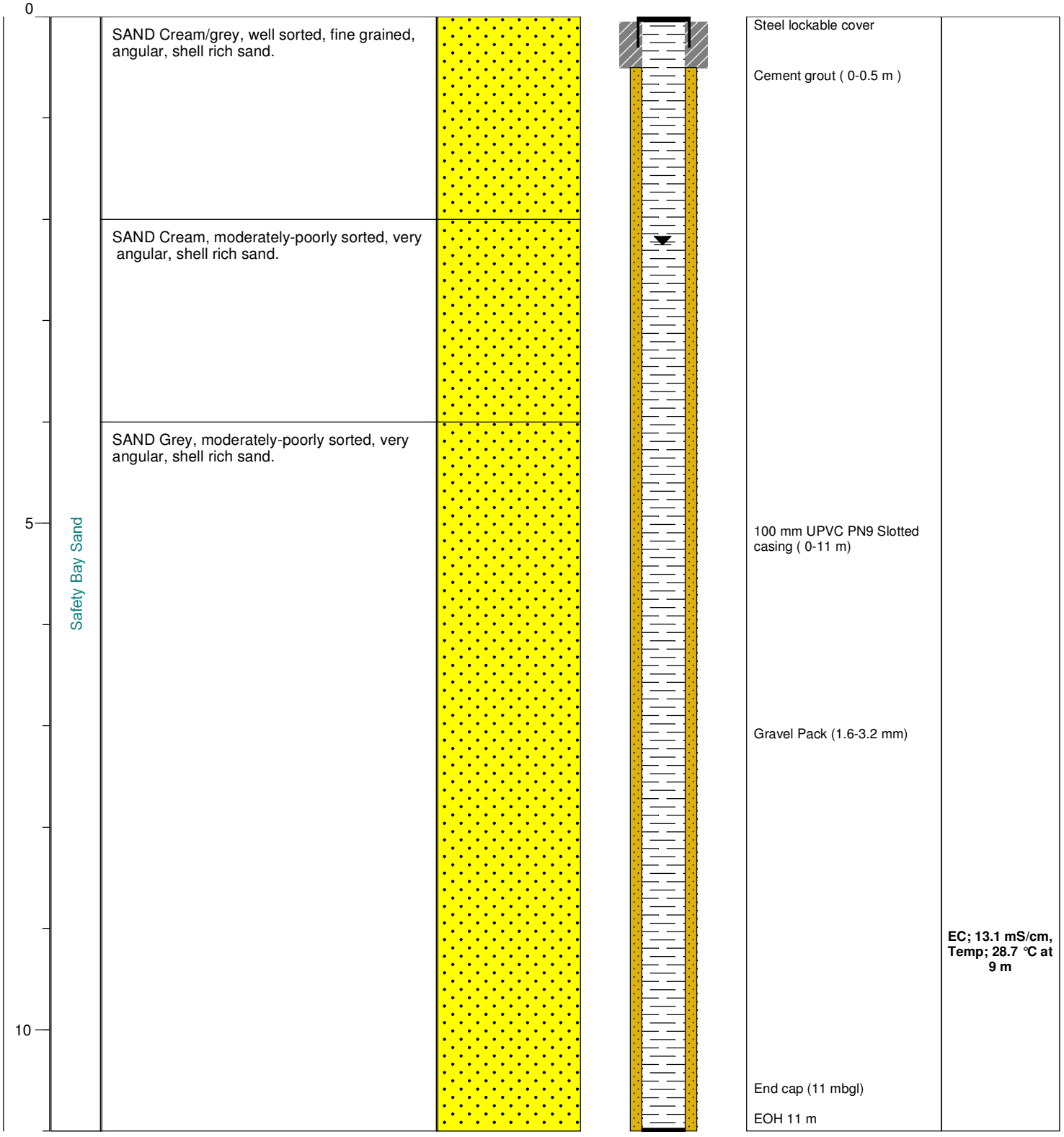
Driller: Mathews Drilling
Fluid : Air/Water
Drilling Method: Reverse Circulation
Drilled Diameter: 152.4 mm

Easting: 378459
Northing: 6428261
Surface RL: 2.50 mAHD

MWH

HYDRAULIC DATA:
SWL: 2.25 mbgl
SWL Date Collected: 19/04/2010

Depth mbgl	Fm.	Lithological Description	Lithology	Well Construction	Well Details	Water Quality
0	Safety Bay Sand	SAND Cream/grey, well sorted, fine grained, angular, shell rich sand.			Steel lockable cover Cement grout (0-0.5 m)	
		SAND Cream, moderately-poorly sorted, very angular, shell rich sand.				
5		SAND Grey, moderately-poorly sorted, very angular, shell rich sand.			100 mm UPVC PN9 Slotted casing (0-11 m) Gravel Pack (1.6-3.2 mm)	**EC; 13.1 mS/cm, Temp; 28.7 ℃ at 9 m**
10					End cap (11 mbgl) EOH 11 m	



TD: 11 m
Notes:

WELL COMPLETION DETAILS: MB05

Client: Landcorp
Date Drilled: 09/04/2010
Logged By: Shawn Butland

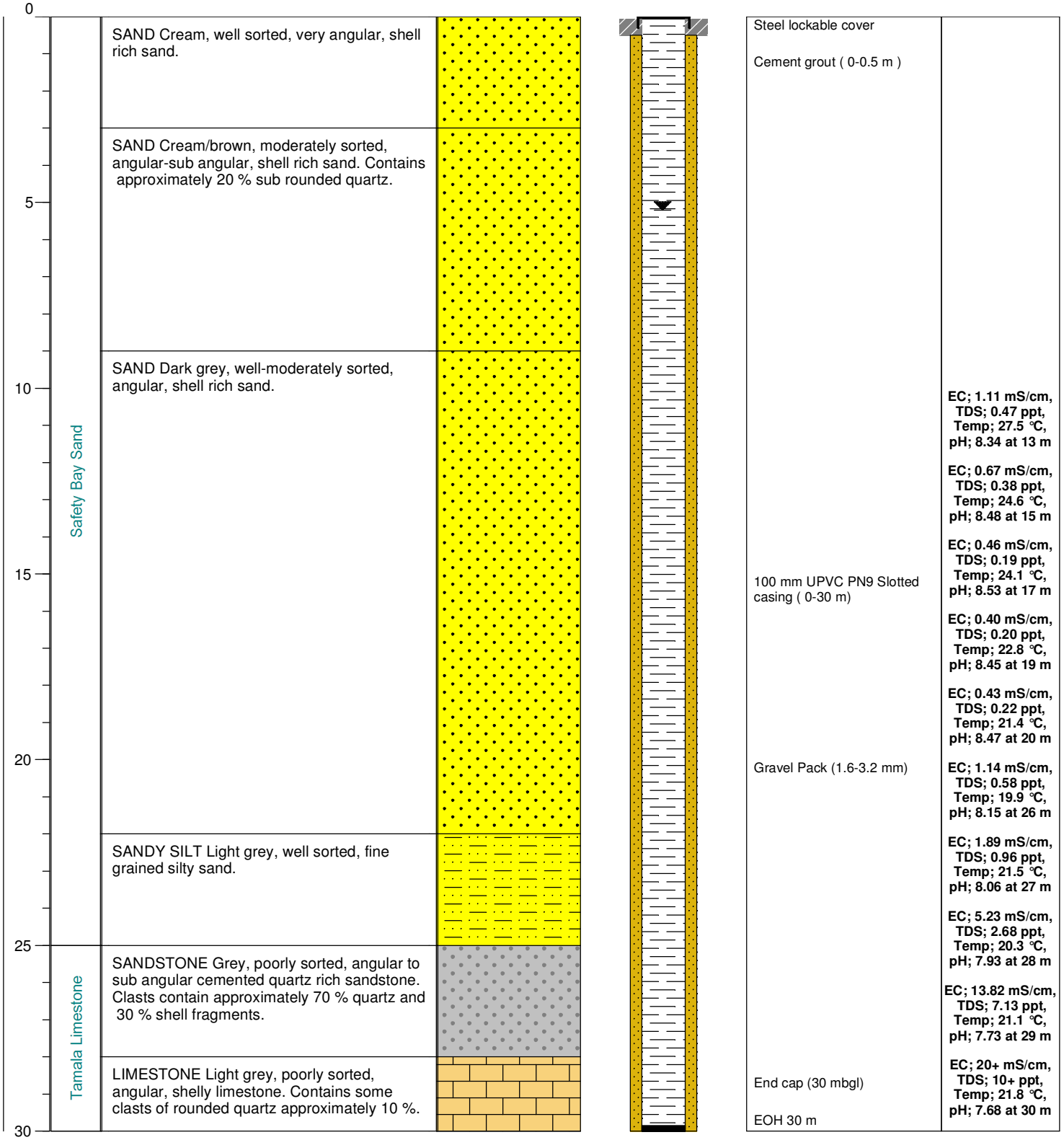
Driller: Mathews Drilling
Fluid : Air/Water
Drilling Method: Reverse Circulation
Drilled Diameter: 152.4 mm

Easting: 378135
Northing: 6427452
Surface RL: 6.09 mAHD

MWH

HYDRAULIC DATA:
SWL: 5.21 mbgl
SWL Date Collected: 19/04/2010

Depth mbgl	Fm.	Lithological Description	Lithology	Well Construction	Well Details	Water Quality
0	Safety Bay Sand	SAND Cream, well sorted, very angular, shell rich sand.			Steel lockable cover Cement grout (0-0.5 m)	
5		SAND Cream/brown, moderately sorted, angular-sub angular, shell rich sand. Contains approximately 20 % sub rounded quartz.				
10		SAND Dark grey, well-moderately sorted, angular, shell rich sand.				**EC; 1.11 mS/cm, TDS; 0.47 ppt, Temp; 27.5 °C, pH; 8.34 at 13 m** **EC; 0.67 mS/cm, TDS; 0.38 ppt, Temp; 24.6 °C, pH; 8.48 at 15 m** **EC; 0.46 mS/cm, TDS; 0.19 ppt, Temp; 24.1 °C, pH; 8.53 at 17 m**
15					100 mm UPVC PN9 Slotted casing (0-30 m)	**EC; 0.40 mS/cm, TDS; 0.20 ppt, Temp; 22.8 °C, pH; 8.45 at 19 m** **EC; 0.43 mS/cm, TDS; 0.22 ppt, Temp; 21.4 °C, pH; 8.47 at 20 m**
20					Gravel Pack (1.6-3.2 mm)	**EC; 1.14 mS/cm, TDS; 0.58 ppt, Temp; 19.9 °C, pH; 8.15 at 26 m**
25		SANDY SILT Light grey, well sorted, fine grained silty sand.				**EC; 1.89 mS/cm, TDS; 0.96 ppt, Temp; 21.5 °C, pH; 8.06 at 27 m** **EC; 5.23 mS/cm, TDS; 2.68 ppt, Temp; 20.3 °C, pH; 7.93 at 28 m**
	Tamala Limestone	SANDSTONE Grey, poorly sorted, angular to sub angular cemented quartz rich sandstone. Clasts contain approximately 70 % quartz and 30 % shell fragments.				**EC; 13.82 mS/cm, TDS; 7.13 ppt, Temp; 21.1 °C, pH; 7.73 at 29 m**
30		LIMESTONE Light grey, poorly sorted, angular, shelly limestone. Contains some clasts of rounded quartz approximately 10 %.			End cap (30 mbgl) EOH 30 m	**EC; 20+ mS/cm, TDS; 10+ ppt, Temp; 21.8 °C, pH; 7.68 at 30 m**



TD: 30 m
Notes:

WELL COMPLETION DETAILS: MB06

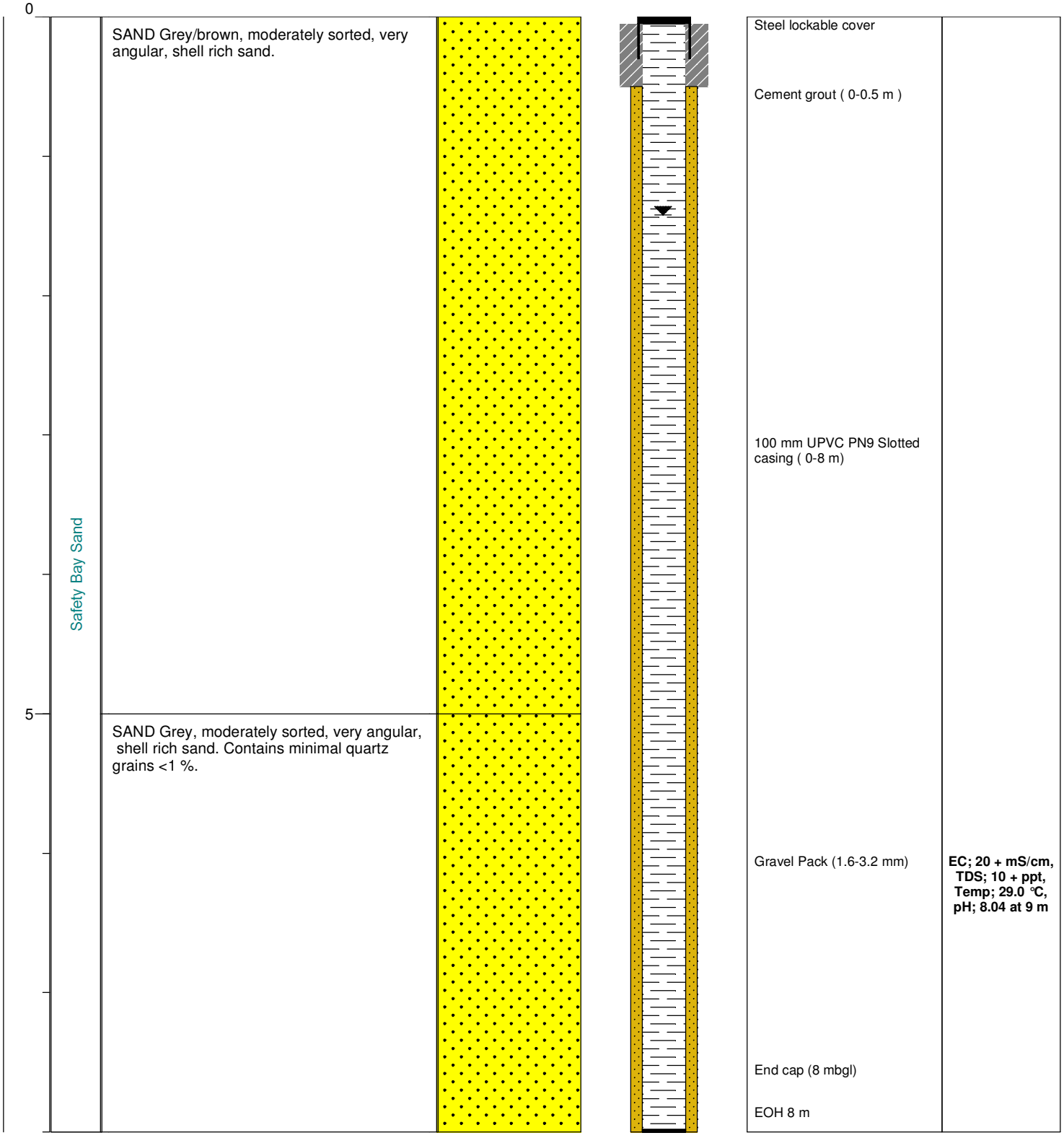
Client: Landcorp
Date Drilled: 22/03/2010
Logged By: Shawn Butland

Driller: Mathews Drilling
Fluid : Air/Water
Drilling Method: Reverse Circulation
Drilled Diameter: 152.4 mm

Easting: 377818
Northing: 6428338
Surface RL: 1.53 mAHD

HYDRAULIC DATA:
SWL: 1.42 mbgl
SWL Date Collected: 24/03/2010

Depth mbgl	Fm.	Lithological Description	Lithology	Well Construction	Well Details	Water Quality
0	Safety Bay Sand	SAND Grey/brown, moderately sorted, very angular, shell rich sand.			Steel lockable cover Cement grout (0-0.5 m) 100 mm UPVC PN9 Slotted casing (0-8 m)	
5		SAND Grey, moderately sorted, very angular, shell rich sand. Contains minimal quartz grains <1 %.			Gravel Pack (1.6-3.2 mm) End cap (8 mbgl) EOH 8 m	**EC; 20 + mS/cm, TDS; 10 + ppt, Temp; 29.0 °C, pH; 8.04 at 9 m**



TD: 8 m
Notes:

WELL COMPLETION DETAILS: MB07

Client: Landcorp
Date Drilled: 26/03/2010
Logged By: Shawn Butland

Driller: Mathews Drilling
Fluid : Air/Water
Drilling Method: Reverse Circulation
Drilled Diameter: 152.4 mm

Easting: 378420
Northing: 6427873
Surface RL: 3.30 mAHD

MWH

HYDRAULIC DATA:
SWL: 2.45 mbgl
SWL Date Collected: 19/04/2010

Depth mbgl	Fm.	Lithological Description	Lithology	Well Construction	Well Details	Water Quality
0	Safety Bay Sand	SAND Cream, well sorted, very angular, shell rich sand.			Steel lockable cover Cement grout (0-0.5 m)	
5		SAND Light grey, moderately sorted, angular, shell rich sand.				**EC; 1.57 mS/cm, TDS; 0.92 ppt, Temp; 23.8 °C, pH; 8.05 at 9 m**
10						
15		SAND Dark grey, poorly sorted, angular-very angular, coarse grained, shell rich sand.			100 mm UPVC PN9 Slotted casing (0-30 m)	**EC; 0.91 mS/cm, TDS; 0.47 ppt, Temp; 23.0 °C, pH; 8.04 at 14 m** **EC; 2.12 mS/cm, TDS; 0.98 ppt, Temp; 23.2 °C, pH; 8.05 at 16 m**
20		SANDY SILT Grey, well sorted, fine grained silty sand.			Gravel Pack (1.6-3.2 mm)	**EC; 0.82 mS/cm, TDS; 0.44 ppt, Temp; 23.0 °C, pH; 8.12 at 18 m**
25	Tamala Limestone	LIMESTONE Grey, poorly sorted, very angular, shelly limestone. Contains some clasts of rounded quartz approximately 30 %.				**EC; 1.02 mS/cm, TDS; 0.51 ppt, Temp; 22.8 °C, pH; 8.15 at 22 m** **EC; 1.62 mS/cm, TDS; 1.05 ppt, Temp; 23.5 °C, pH; 8.06 at 24 m**
		SANDSTONE Grey, poorly sorted, sub rounded, cemented quartz rich sandstone. Clasts contain approximately 70 % quartz and 30 % shell fragments.			End cap (30 mbgl) EOH 30 m	**EC; 8.94 mS/cm, TDS; 4.48 ppt, Temp; 22.7 °C, pH; 7.90 at 27 m** **EC; 20+ mS/cm, TDS; 10+ ppt, Temp; 22.9 °C, pH; 7.65 at 28 m**
30						

TD: 30 m
Notes: Has data logger installed in bore

WELL COMPLETION DETAILS: MB08

Client: Landcorp
Date Drilled: 15/04/2010
Logged By: Shawn Butland

Driller: Mathews Drilling
Fluid : Air/Water
Drilling Method: Reverse Circulation
Drilled Diameter: 152.4 mm

Easting: 378198
Northing: 6428232
Surface RL: 2.38 mAHD

MWH

HYDRAULIC DATA:
SWL: 2.10 mbgl
SWL Date Collected: 19/04/2010

Depth mbgl	Fm.	Lithological Description	Lithology	Well Construction	Well Details	Water Quality
0	Safety Bay Sand	SAND Cream, moderately sorted, very angular, shell rich sand.			Steel lockable cover Cement grout (0-0.5 m)	
5		SAND Grey, moderately sorted, angular, shell rich sand.			100 mm UPVC PN9 Slotted casing (0-11 m) Gravel Pack (1.6-3.2 mm)	
10					End cap (11 mbgl) EOH 11 m	**EC; 22.0 mS/cm, Temp; 22.1 ℃ at 9 m**

TD: 11 m
Notes: Has data logger installed down bore.

WELL COMPLETION DETAILS: MB09D

Client: Landcorp
Date Drilled: 12-14/04/2010
Logged By: Shawn Butland

Driller: Mathews Drilling
Fluid : Air/Water
Drilling Method: Reverse Circulation
Drilled Diameter: 152.4 mm

Easting: 378299
Northing: 6428092
Surface RL: 2.80 mAHD

MWH

HYDRAULIC DATA:
SWL: 2.05 mbgl
SWL Date Collected: 19/04/2010

Depth mbgl	Fm.	Lithological Description	Lithology	Well Construction	Well Details	Water Quality
0	Safety Bay Sand	SAND Cream, well sorted, very angular, shell rich sand.			Steel lockable cover	
		SAND Cream, poorly sorted, very angular, coarse, shell rich sand.			Cement grout (0-0.5 m)	
5		SAND Grey, moderately sorted, angular, shell rich sand.				**EC; 0.63 mS/cm, TDS; 0.42 ppt, Temp; 17.1 °C, pH; 8.37 at 9 m**
10						**EC; 0.42 mS/cm, TDS; 0.21 ppt, Temp; 17.1 °C, pH; 8.50 at 12 m**
						EC; 0.69 mS/cm, TDS; 0.35 ppt, Temp; 17.7 °C, pH; 8.33 at 14 m
15					50 mm UPVC PN9 Blank casing (0-22 m)	**EC; 1.28 mS/cm, TDS; 0.59 ppt, Temp; 17.4 °C, pH; 8.13 at 16 m**
						EC; 2.47 mS/cm, TDS; 1.24 ppt, Temp; 17.7 °C, pH; 8.07 at 17 m
20		SANDY SILT Grey, well sorted, fine grained silty sand.				**EC; 3.910 mS/cm, TDS; 2.01 ppt, Temp; 18.1 °C, pH; 8.14 at 19 m**
					Cement grout (21-22 m)	**EC; 7.10 mS/cm, TDS; 2.98 ppt, Temp; 16.8 °C, pH; 7.96 at 23 m**
	Tamala Limestone	SANDSTONE Grey, poorly sorted, sub rounded, cemented quartz rich sandstone. Clasts contain approximately 90 % quartz and 10 % shell fragments.				**EC; 10.15 mS/cm, TDS; 5.05 ppt, Temp; 17.6 °C, pH; 7.90 at 24 m**
25					50 mm UPVC PN9 Slotted casing (22-30 m)	**EC; 12.48 mS/cm, TDS; 6.31 ppt, Temp; 17.7 °C, pH; 7.82 at 25 m**
						EC; 17.98 mS/cm, TDS; 9.13 ppt, Temp; 17.1 °C, pH; 7.72 at 26 m
		LIMESTONE Cream, poorly sorted, very angular, shelly limestone. Contains some clasts of rounded quartz approximately 15 %.			Gravel Pack (1.6-3.2 mm)	
					End cap (30 mbgl)	**EC; 20+ mS/cm, TDS; 10+ ppt, Temp; 17.3 °C, pH; 7.78 at 27 m**
30					EOH 30 m	

TD: 30 m
Notes: Cased with 50 mm uPVC

WELL COMPLETION DETAILS: MB09S

Client: Landcorp
Date Drilled: 01-06/04/2010
Logged By: Shawn Butland

Driller: Mathews Drilling
Fluid : Air/Water
Drilling Method: Reverse Circulation
Drilled Diameter: 152.4 mm

Easting: 378298
Northing: 6428082
Surface RL: 2.83 mAHD

MWH

HYDRAULIC DATA:
SWL: 2.65 mbgl
SWL Date Collected: 19/04/2010

Depth mbgl	Fm.	Lithological Description	Lithology	Well Construction	Well Details	Water Quality
0	Safety Bay Sand	SAND Cream/brown, moderately sorted, angular to very angular, shell rich sand.			Steel lockable cover Cement grout (0-0.5 m)	
5		SAND Grey, well sorted, angular, shell rich sand.				**EC; 0.87 mS/cm, TDS; 0.37 ppt, Temp; 43.5 °C, pH; 8.26 at 10 m**
10					100 mm UPVC PN9 Slotted casing (0-21.5 m)	**EC; 0.34 mS/cm, TDS; 0.15 ppt, Temp; 38.7 °C, pH; 8.13 at 12 m** **EC; 0.27 mS/cm, TDS; 0.19 ppt, Temp; 37.0 °C, pH; 8.25 at 13 m**
15					Gravel Pack (1.6-3.2 mm)	**EC; 0.65 mS/cm, TDS; 0.32 ppt, Temp; 32.4 °C, pH; 8.12 at 15 m** **EC; 0.95 mS/cm, TDS; 0.52 ppt, Temp; 30.1 °C, pH; 8.06 at 16 m**
20		SANDY SILT Grey, well sorted, silty sand.			End cap (21.5 mbgl)	**EC; 1.42 mS/cm, TDS; 0.72 ppt, Temp; 28.8 °C, pH; 8.10 at 18 m** **EC; 2.54 mS/cm, TDS; 1.27 ppt, Temp; 28.6 °C, pH; 8.13 at 20 m**

TD: 21.5 m
Notes: Data logger installed in this bore.

WELL COMPLETION DETAILS: MB10

Client: Landcorp
Date Drilled: 30-31/03/2010
Logged By: Shawn Butland

Driller: Mathews Drilling
Fluid : Air/Water
Drilling Method: Reverse Circulation
Drilled Diameter: 152.4 mm

Easting: 378587
Northing: 6427907
Surface RL: 2.95 mAHD

MWH

HYDRAULIC DATA:
SWL: 2.02 mbgl
SWL Date Collected: 19/04/2010

Depth mbgl	Fm.	Lithological Description	Lithology	Well Construction	Well Details	Water Quality
0 – 5	Safety Bay Sand	SAND Cream, moderately sorted, very angular, shell rich sand.			Steel lockable cover Cement grout (0-0.5 m)	
5 – 10	Safety Bay Sand	SAND Grey, poorly sorted, very angular, coarse, shell rich sand. Contains some organic material.				**EC; 3.20 mS/cm, TDS; 0.93 ppt, Temp; 31.2 °C, pH; 8.03 at 10 m** **EC; 1.98 mS/cm, TDS; 0.98 ppt, Temp; 30.7 °C, pH; 8.09 at 11 m** **EC; 2.32 mS/cm, TDS; 1.17 ppt, Temp; 28.5 °C, pH; 8.22 at 13 m**
10 – 15	Safety Bay Sand				100 mm UPVC PN9 Slotted casing (0-29 m)	**EC; 2.54 mS/cm, TDS; 1.23 ppt, Temp; 29.1 °C, pH; 8.20 at 15 m**
15 – 20	Safety Bay Sand	SANDY SILT Brown/grey, moderately sorted, sandy silt. Contains some larger shell material and organics.				**EC; 2.38 mS/cm, TDS; 1.05 ppt, Temp; 38.4 °C, pH; 7.96 at 21 m** **EC; 2.89 mS/cm, TDS; 1.41 ppt, Temp; 32.2 °C, pH; 8.01 at 23 m**
20 – 25	Safety Bay Sand	SAND Grey, moderately sorted, very angular, shell rich sand. Contains approximately 5 % sub rounded quartz grains.			Gravel Pack (1.6-3.2 mm)	**EC; 4.13 mS/cm, TDS; 1.99 ppt, Temp; 26.0 °C, pH; 8.11 at 25 m** **EC; 5.64 mS/cm, TDS; 2.90 ppt, Temp; 25.2 °C, pH; 7.98 at 27 m**
25 – 30	Tamala Limestone	SANDSTONE Light grey, poorly sorted, sub rounded, cemented quartz rich sandstone. Clasts contain approximately 85 % quartz and 15 % shell fragments. Increasing in shell content towards the base of the hole.			End cap (29 mbgl) EOH 29 m	**EC; 8.32 mS/cm, TDS; 4.40 ppt, Temp; 24.4 °C, pH; 7.88 at 28 m**

TD: 30 m
Notes:

WELL COMPLETION DETAILS: MB11

Client: Landcorp
Date Drilled: 23-24/03/2010
Logged By: Shawn Butland

Driller: Mathews Drilling
Fluid : Air/Water
Drilling Method: Reverse Circulation
Drilled Diameter: 152.4 mm

Easting: 378555
Northing: 6427796
Surface RL: 1.86 mAHD

MWH

HYDRAULIC DATA:
SWL: 1.03 mbgl
SWL Date Collected: 19/04/2010

Depth mbgl	Fm.	Lithological Description	Lithology	Well Construction	Well Details	Water Quality
0	Safety Bay Sand	SAND Light brown, moderately sorted, angular, shell rich sand.			Steel lockable cover Cement grout (0-0.5 m)	
5		SAND Dark grey, poorly sorted, very angular, coarse, shell rich sand.				
10		SAND Brown/dark grey, poorly sorted, vary angular-angular, shell rich sand. Contains some organics material.				**EC; 2.26 mS/cm, Temp; 23.4 ℃, at 9 m** **EC; 2.32 mS/cm, TDS; 1.14 ppt, Temp; 23.3 ℃, pH; 8.68 at 12 m** **EC; 2.45 mS/cm, TDS; 1.27 ppt, Temp; 23.0 ℃, pH; 8.48 at 13 m**
15		SILTY SAND Brown/grey, moderately sorted, fine grained silty sand. Contains brocken shells as well as some organic material.			100 mm UPVC PN9 Slotted casing (0-30 m)	
20					Gravel Pack (1.6-3.2 mm)	**EC; 3.30 mS/cm, TDS; 1.60 ppt, Temp; 23.1 ℃, pH; 7.90 at 23 m** **EC; 3.54 mS/cm, TDS; 1.74 ppt, Temp; 22.9 ℃, pH; 7.91 at 24 m** **EC; 5.50 mS/cm, TDS; 2.79 ppt, Temp; 29.9 ℃, pH; 7.75 at 25 m** **EC; 7.76 mS/cm, TDS; 3.89 ppt, Temp; 24.7 ℃, pH; 7.71 at 26 m** **EC; 12.62 mS/cm, TDS; 6.34 ppt, Temp; 24.8 ℃, pH; 7.61 at 27 m** **EC; 20+ mS/cm, TDS; 10+ ppt, Temp; 24.6 ℃, pH; 7.19 at 28 m**
25	Tamala Limestone	SANDSTONE Light grey, poorly sorted, sub rounded, cemented quartz rich sandstone. Clasts contain approximately 60 % quartz and 40 % shell fragments.				
		LIMESTONE Orange/brown, poorly sorted, angular, shell rich limestone. Contains minimal amounts of rounded quartz.				
30					End cap (30 mbgl) EOH 30 m	

TD: 30 m
Notes:

WELL COMPLETION DETAILS: MB12

Client: Landcorp
Date Drilled: 25/03/2010
Logged By: Shawn Butland

Driller: Mathews Drilling
Fluid : Air/Water
Drilling Method: Reverse Circulation
Drilled Diameter: 152.4 mm

Easting: 378462
Northing: 6427723
Surface RL: 2.00 mAHD

MWH

HYDRAULIC DATA:
SWL: 1.81 mbgl
SWL Date Collected: 19/04/2010

Depth mbgl	Fm.	Lithological Description	Lithology	Well Construction	Well Details	Water Quality
0	Safety Bay Sand	SAND Light brown, moderately sorted, angular, shell rich sand.			Steel lockable cover	
		SAND Light grey, poorly sorted, angular, coarse, shell rich sand. Contains minor amounts of sub rounded to rounded quartz grains.			Cement grout (0-0.5 m)	
5		SAND Grey, moderately sorted, very angular-angular, shell rich sand.				**EC; 1.32 mS/cm, TDS; 0.65 ppt, Temp; 22.8 °C, pH; 8.04 at 6 m** **EC; 0.57 mS/cm, TDS; 0.37 ppt, Temp; 22.5 °C, pH; 8.29 at 10 m**
10						
15		SILTY SAND Brown/grey, well sorted, fine grained silty sand.			100 mm UPVC PN9 Slotted casing (0-30 m)	**EC; 0.61 mS/cm, TDS; 0.31 ppt, Temp; 21.9 °C, pH; 8.21 at 14 m** **EC; 2.31 mS/cm, TDS; 1.20 ppt, Temp; 25.2 °C, pH; 8.08 at 21 m**
20		SAND Grey, moderately sorted, sub rounded, coarse grained, quartz rich sand.			Gravel Pack (1.6-3.2 mm)	**EC; 3.06 mS/cm, TDS; 1.54 ppt, Temp; 30.8 °C, pH; 7.93 at 24 m** **EC; 4.94 mS/cm, TDS; 2.34 ppt, Temp; 30.8 °C, pH; 7.93 at 25 m** **EC; 7.17 mS/cm, TDS; 2.34 ppt, Temp; 28.7 °C, pH; 7.79 at 26 m**
25	Tamala Limestone	SANDSTONE Light grey, poorly sorted, sub rounded, quartz rich sandstone.				**EC; 19.13 mS/cm, TDS; 9.40 ppt, Temp; 28.1 °C, pH; 7.64 at 27 m** **EC; 20 + mS/cm, TDS; 10+ ppt, Temp; 28.2 °C, pH; 7.63 at 28 m**
		LIMESTONE Light brown, poorly sorted, angular to sub angular, shell rich limestone. Contains approximately 2% rounded quartz.			End cap (30 mbgl) EOH 30 m	
30						

TD: 30 m
Notes: Data logger installed in this bore.

WELL COMPLETION DETAILS: MB13

Client: Landcorp
Date Drilled: 08/04/2010
Logged By: Shawn Butland

Driller: Mathews Drilling
Fluid : Air/Water
Drilling Method: Reverse Circulation
Drilled Diameter: 152.4 mm

Easting: 378079
Northing: 6427936
Surface RL: 4.35 mAHD

MWH

HYDRAULIC DATA:
SWL: 4.18 mbgl
SWL Date Collected: 19/04/2010

Depth mbgl	Fm.	Lithological Description	Lithology	Well Construction	Well Details	Water Quality
0	Safety Bay Sand	SAND Light brown/ cream, well sorted, angular to sub angular, shell rich sand.			Steel lockable cover Cement grout (0-0.5 m)	
5		SAND Light brown/ cream, moderately sorted, angular to very angular, shell rich sand. Contains some large shell fragments up to 10 mm in size.				**EC; 2.82 mS/cm, TDS; 1.19 ppt, Temp; 36.7 °C, pH; 7.89 at 13 m** **EC; 3.11 mS/cm, TDS; 1.73 ppt, Temp; 34.4 °C, pH; 7.79 at 14 m**
10		SAND Dark grey, moderately sorted, angular, shell rich sand.			100 mm UPVC PN9 Slotted casing (0-21 m)	**EC; 3.75 mS/cm, TDS; 2.06 ppt, Temp; 29.6 °C, pH; 7.86 at 15 m** **EC; 4.99 mS/cm, TDS; 2.53 ppt, Temp; 28.0 °C, pH; 7.86 at 16 m** **EC; 12.73 mS/cm, TDS; 5.75 ppt, Temp; 26.5 °C, pH; 7.86 at 17 m**
15					Gravel Pack (1.6-3.2 mm)	**EC; 13.23 mS/cm, TDS; 5.46 ppt, Temp; 25.8 °C, pH; 7.93 at 18 m** **EC; 14.86 mS/cm, TDS; 7.26 ppt, Temp; 25.1 °C, pH; 7.90 at 19 m** **EC; 7.39 mS/cm, TDS; 4.19 ppt, Temp; 25.5 °C, pH; 7.89 at 20 m**
20		SILTY SAND Light grey, well sorted, fine grained silty sand.			End cap (21 mbgl) EOH 21 m	**EC; 8.11 mS/cm, TDS; 3.94 ppt, Temp; 25.3 °C, pH; 8.00 at 21 m**

TD: 21 m
Notes: Data logger installed in this bore.

WELL COMPLETION DETAILS: MB14D

Client: Cedar Woods
Date Drilled: 09/02/2011
Logged By: Chris Jones

Driller: Mathews Drilling
Fluid : Water
Drilling Method: Reverse Circulation
Drilled Diameter: 152.4 mm

Easting: 378018
Northing: 6428013
Surface RL:

MWH

HYDRAULIC DATA:
SWL: 3.998 mbgl
SWL Date Collected: 16/02/2011

Depth mbgl	Fm.	Lithological Description	Lithology	Well Construction	Well Details	Water Quality
0	Safety Bay Sand	SAND Light brown / tan, shell fragments			Steel cover (flush with ground level) Cement grout (0-0.5 m)	
5		SAND Light brown / tan, shell fragments (5 - 10 mm), limestone (subangular, 3 - 7 mm)			SWL (3.998 mbgl) Backfill (0.5-16 m)	
10		SAND Grey, whole shells (5 - 10 mm), minor limestone (2 mm).			100 mm UPVC PN9 Blank casing (0-18 m)	**EC; 2.47 mS/cm, pH; 10.98 at 9 m**
15		SAND Grey, shell rich sand, whole shells (5 - 10 mm)			Bentonite seal (16-17 m) Gravel Pack (1.6-3.2 mm) (17 - 20 m)	**EC; 2.06 mS/cm, pH; 10.66 at 15 m**
20		SILTY SAND Grey fine silty sand, lighter grey from 19 - 20 m.			100 mm UPVC PN9 Slotted casing (18-20 m) End cap (20 m) EOH	**EC; 2.81 mS/cm, pH; 10.37 at 18 m** **EC; 3.1 mS/cm, Temp; 28.1 °C, pH; 10.04 at 20 m**

TD: 20 m
Notes:

WELL COMPLETION DETAILS: MB14S

Client: Cedar Woods
Date Drilled: 10/02/2011
Logged By: Chris Jones

Driller: Mathews Drilling
Fluid : Water
Drilling Method: Reverse Circulation
Drilled Diameter: 152.4 mm

Easting: 378021
Northing: 6428016
Surface RL:

MWH

HYDRAULIC DATA:
SWL: 4.135 mbgl
SWL Date Collected: 16/02/2011

Depth mbgl	Fm.	Lithological Description	Lithology	Well Construction	Well Details	Water Quality
0	Safety Bay Sand	SAND Light brown / tan, shell fragments			Steel cover (flush with ground level) Cement grout (0-0.5 m) Bentonite seal (0.5-1.5 m) 100 mm UPVC PN9 Blank casing (0-2 m)	
5		SAND Light brown / tan, shell fragments (5 - 10 mm), limestone (subangular, 3 - 7 mm)			SWL (4.135 mbgl)	
		SAND Grey, whole shells (5 - 10 mm), minor limestone (2 mm).			Gravel Pack (1.6-3.2 mm) (1.5 - 12 m)	**EC; 3.63 mS/cm, Temp; 27.4 °C, pH; 11.19 at 6 m**
10		SAND Grey, shell rich sand, whole shells (5 - 10 mm)			100 mm UPVC PN9 Slotted casing (2-12 m) End cap (12 m) EOH	**EC; 3.58 mS/cm, Temp; 27.7 °C, pH; 11.29 at 9 m** **EC; 3.63 mS/cm, Temp; 28.7 °C, pH; 11.01 at 12 m**

TD: 12 m
Notes:

WELL COMPLETION DETAILS: PB1

Client: Cedar Woods
Date Drilled: 14/02/2011
Logged By: Chris Jones

Driller: Mathews Drilling
Fluid : Water
Drilling Method: Reverse Circulation
Drilled Diameter: 250 mm

Easting: 378004
Northing: 6428021
Surface RL:

MWH

HYDRAULIC DATA:
SWL: 3.92 mbgl
SWL Date Collected: 16/02/2011

Depth mbgl	Fm.	Lithological Description	Lithology	Well Construction	Well Details	Water Quality
0	Safety Bay Sand	SAND Light brown / tan, shell fragments			Steel cover (flush with ground level) Cement grout (0-0.5 m) Backfill (0.5-4 m) 200 mm UPVC Blank casing (0-6 m)	
5		SAND Light brown / tan, shell fragments (5 - 10 mm), limestone (subangular, 3 - 7 mm)			SWL (3.92 mbgl) Bentonite seal (4-5 m)	
		SAND Grey, whole shells (5 - 10 mm), minor limestone (2 mm).			Gravel Pack (1.6-3.2 mm) (5 - 12 m)	**EC; 0.54 mS/cm, Temp; 25.3 °C, pH; 10.05 at 7 m**
10		SAND Grey, shell rich sand, whole shells (5 - 10 mm)			200 mm UPVC Slotted casing (6-12 m) End cap (12 mbgl) EOH 12 m	**EC; 0.54 mS/cm, Temp; 24.9 °C, pH; 9.94 at 10 m** **EC; 0.74 mS/cm, Temp; 25.5 °C, pH; 9.76 at 12 m**

TD: 12 m
Notes:

Appendix B: Bore Data Sheets

MB01

Details

Location	Cape Peron
Tenement	
Easting (MGA94)	378534
Northing (MGA94)	6427559
Surface RL (m AHD)	2.11
Date Drilling Commenced	29-Mar-10
Date Drilling Completed	30-Mar-10
Logged By	SB
Drilled Diameter (mm)	152.4
Drilling Medium	Air/Water

Airlift Yield Data During Drilling

Depth (m bgl)	TDS (ppt)	Temp (°C)	EC (µs/cm)	pH
10	0.81	19	1610	8.39
13	0.83	20	1520	8.06
16	0.56	20.5	1100	7.69
23	0.8	29.4	1580	7.88
24	1.27	27.6	2860	7.88
25	2.07	27.9	4040	7.84
26	2.92	26.3	5540	7.78
27	6.82	24.7	13340	7.66
28	10+	32	20+	7.58

Airlift Yield Data within Cased Hole

Depth (m bgl)	V-notch (mm)	Q (L/s)	EC (µs/cm)	pH

Water Level Data

SWL (mbgl)	Date
1.62	8-Apr-10

Drilling Details

Method		Diam	(m bgl) From	To
OH	Rotary Mud	152.4	0.0	30

Construction Details

	(m bgl) From	To
Collar		
165 mm OD x 7mm Steel		
Blank Casing		
60mm OD x 5mm WT uPVC PN12		
Slotted Casing		
100 mm UPVC PN9	0	30
Screens		
Gravel Pack		
Size 1.6 - 3.2 mm	0.5	30
Cement	0	0.5
Bentonite		
A + B Foam		

Casing Details

Casing Stickup (m)	0
Casing Material	UPVC PN9
Casing Diam (mm ID)	105
Screen Diam (mm ID)	Nil
Screen Aperture (mm)	Nil
Slot Size (mm)	1

Comments

Has data logger and barotroll installed in the bore.

Depth (m)	Lithological Description
0-2	SAND Light brown, moderately sorted, angular to very angular shell fragments
2-15	SILTY SAND Brown, well sorted, silty sand. Contains some organic material
15-23	SILTY SAND Brown, well soted, silty sand. Contains some organic material.
23-28	SANDSTONE Grey, poorly sorted, cemented quartz rich sandstone. Clasts contain 90% rounded to sub rounded quartz 2-5 mm in size and 10% angular shell framents.
28-30	SILT Yellow / brown, fine grained, well sorted silt. Contains some clasts of shell fragments and rounded quartz.
	EOH: 30 mbgl

MB02

Details

Location	Cape Peron
Tenement	
Easting (MGA94)	377921
Northing (MGA94)	6427850
Surface RL (m AHD)	6.45
Date Drilling Commenced	14-Apr-10
Date Drilling Completed	14-Apr-10
Logged By	SB
Drilled Diameter (mm)	152.4
Drilling Medium	Air/Water

Airlift Yield Data During Drilling

Depth (m bgl)	TDS (ppt)	Temp (°C)	EC (µs/cm)	pH
11	1	20.6	2050	8.10
14	0.73	18.5	1550	8.25
15	0.79	18.7	1550	8.13
16	1.19	18.5	2530	8.05
17	3.51	18.6	6740	8.08
18	1.96	19.2	3910	8.01
19	2.05	19.6	5140	8.06
20	3.02	19.5	6420	8.1

Airlift Yield Data within Cased Hole

Depth (m bgl)	V-notch (mm)	Q (L/s)	EC (µs/cm)	pH

Water Level Data

SWL (mbgl)	Date
6.23	19-Apr-10

Drilling Details

Method		Diam	(m bgl) From	To
OH	Rotary Mud	152.4	0.0	22

Construction Details

	(m bgl) From	To
Collar		
165 mm OD x 7mm Steel		
Blank Casing		
60mm OD x 5mm WT uPVC PN12		
Slotted Casing		
100 mm UPVC PN9	0	22
Screens		
Gravel Pack		
Size 1.6 - 3.2 mm	0.5	22
Cement	0	0.5
Bentonite		
A + B Foam		

Casing Details

Casing Stickup (m)	0
Casing Material	UPVC PN9
Casing Diam (mm ID)	105
Screen Diam (mm ID)	Nil
Screen Aperture (mm)	Nil
Slot Size (mm)	1

Comments

Depth (m)	Lithological Description
0-1	SAND Light bown, well sorted, angular to very angular shell fragments.
1-5	SAND Cream / brown, well sorted, angular, shell rich sand.
5-9	SAND Cream, poorly sorted, very angular, shell rich sand.
9-22	SAND Dark grey, moderatly sorted, angular, shell rich sand.
	EOH: 22 mbgl

MB03

Details

Location	Cape Peron
Tenement	
Easting (MGA94)	378523
Northing (MGA94)	6428086
Surface RL (m AHD)	2.83
Date Drilling Commenced	6-Apr-10
Date Drilling Completed	7-Apr-10
Logged By	SB
Drilled Diameter (mm)	152.4
Drilling Medium	Air/Water

Airlift Yield Data During Drilling

Depth (m bgl)	TDS (ppt)	Temp (°C)	EC (µs/cm)	pH
9	0.44	26.2	880	8.18
13	0.4	24.3	800	8.06
18	0.64	28.7	1340	7.71
19	0.83	28.3	1830	7.86
21	1.49	28.6	3160	8.02
23	2.6	27.1	5050	8.01
24	2.79	26.2	5560	8.06
25	3.04	25.8	5650	7.93
26	3.13	27.3	6280	7.93
27	6.81	27.3	13600	7.91

Airlift Yield Data within Cased Hole

Depth (m bgl)	V-notch (mm)	Q (L/s)	EC (µs/cm)	pH

Water Level Data

SWL (mbgl)	Date
2.16	19-Apr-10

Drilling Details

Method		Diam	(m bgl) From	To
OH	Rotary Mud	152.4	0.0	27

Construction Details

	(m bgl) From	To
Collar		
165 mm OD x 7mm Steel		
Blank Casing		
60mm OD x 5mm WT uPVC PN12		
Slotted Casing		
100 mm UPVC PN9	0	27
Screens		
Gravel Pack		
Size 1.6 - 3.2 mm	0.5	27
Cement	0	0.5
Bentonite		
A + B Foam		

Casing Details

Casing Stickup (m)	0
Casing Material	UPVC PN9
Casing Diam (mm ID)	105
Screen Diam (mm ID)	Nil
Screen Aperture (mm)	Nil
Slot Size (mm)	1

Comments

Depth (m)	Lithological Description
0-5	SAND Cream, moderatly sorted, very angular, shell rich sand.
5-14	SAND Cream / grey, moderatly-poorly sorted, very angular, shell rich sand.
14-23	SANDY SILT Brown / grey, well sorted, fine silty sand. Contains some organic material
23-27	SANDSTONE Grey, moderately sorted, sub rounded, cemented sandstone. Clasts
	contain approximately 70% rounded to sub rounded quartz and minor amounts of shell
	fragements
	EOH: 27 mbgl

MB04

Details

Location	Cape Peron
Tenement	
Easting (MGA94)	378459
Northing (MGA94)	6428261
Surface RL (m AHD)	2.5
Date Drilling Commenced	15-Apr-10
Date Drilling Completed	15-Apr-10
Logged By	SB
Drilled Diameter (mm)	152.4
Drilling Medium	Air/Water

Airlift Yield Data During Drilling

Depth (m bgl)	TDS (ppt)	Temp (°C)	EC (µs/cm)	pH
9		28.7	13100	

Airlift Yield Data within Cased Hole

Depth (m bgl)	V-notch (mm)	Q (L/s)	EC (µs/cm)	pH

Water Level Data

SWL (mbgl)	Date
2.25	19-Apr-10

Drilling Details

Method		Diam	(m bgl) From	To
OH	Rotary Mud	152.4	0.0	11

Construction Details

	(m bgl) From	To
Collar		
165 mm OD x 7mm Steel		
Blank Casing		
60mm OD x 5mm WT uPVC PN12		
Slotted Casing		
100 mm UPVC PN9	0	11
Screens		
Gravel Pack		
Size 1.6 - 3.2 mm	0.5	11
Cement	0	0.5
Bentonite		
A + B Foam		

Casing Details

Casing Stickup (m)	0
Casing Material	UPVC PN9
Casing Diam (mm ID)	105
Screen Diam (mm ID)	Nil
Screen Aperture (mm)	Nil
Slot Size (mm)	1

Comments

Depth (m)	Lithological Description
0-2	SAND Cream / grey, well sorted, fine grained, angular, shell rich sand.
2-4	SAND Cream, moderately-poorly sorted, very angular, shell rich sand.
4-11	SAND Grey, moderately-poorly sorted, very angular, shell rich sand.
	EOH: 11 mbgl

MB05

Details

Location	Cape Peron
Tenement	
Easting (MGA94)	378135
Northing (MGA94)	6427452
Surface RL (m AHD)	6.09
Date Drilling Commenced	9-Apr-10
Date Drilling Completed	9-Apr-10
Logged By	SB
Drilled Diameter (mm)	152.4
Drilling Medium	Air/Water

Airlift Yield Data During Drilling

Depth (m bgl)	TDS (ppt)	Temp (°C)	EC (µs/cm)	pH
13	0.47	27.5	1110	8.34
15	0.38	24.6	670	8.48
17	0.19	24.1	460	8.53
19	0.2	22.8	400	8.45
20	0.22	21.4	430	8.47
26	0.58	19.9	1140	8.15
27	0.96	21.5	1890	8.06
28	2.68	20.3	5230	7.93
29	7.13	21.1	13820	7.73
30	10+	21.8	20000+	7.68

Airlift Yield Data within Cased Hole

Depth (m bgl)	V-notch (mm)	Q (L/s)	EC (µs/cm)	pH

Water Level Data

SWL (mbgl)	Date
5.21	19-Apr-10

Drilling Details

Method		Diam	(m bgl) From	To
OH	Rotary Mud	152.4	0.0	30

Construction Details

	(m bgl) From	To
Collar		
165 mm OD x 7mm Steel		
Blank Casing		
60mm OD x 5mm WT uPVC PN12		
Slotted Casing		
100 mm UPVC PN9	0	30
Screens		
Gravel Pack		
Size 1.6 - 3.2 mm	0.5	30
Cement	0	0.5
Bentonite		
A + B Foam		

Casing Details

Casing Stickup (m)	0
Casing Material	UPVC PN9
Casing Diam (mm ID)	105
Screen Diam (mm ID)	Nil
Screen Aperture (mm)	Nil
Slot Size (mm)	1

Comments

Depth (m)	Lithological Description
0-3	SAND Cream, well sorted, very angular, shell rich sand.
3-9	SAND Cream / brown, moderately sorted, angular-sub angular, shell rich sand. Contains
	approximately 20% sub rounded quartz.
9-22	SANDY Dark grey, well-moderately sorted, angular, shell rich sand.
22-25	SANDY SILT Light grey, well sorted, fine grained silty sand.
25-28	SANDSTONE Grey, poorly sorted, angular to sub angular cemented quartz rich
	sandstone. Clasts contain approximately 70% quartz and 30% shell fragments.
28-30	LIMESTOME Light grey, poorly sorted, angular, shelly limestone. Contains some clasts of
	rounded quartz approximately 10%.
	EOH: 30 mbgl

MB06

Details

Location	Cape Peron
Tenement	
Easting (MGA94)	377818
Northing (MGA94)	6428338
Surface RL (m AHD)	1.53
Date Drilling Commenced	22-Mar-10
Date Drilling Completed	22-Mar-10
Logged By	SB
Drilled Diameter (mm)	152.4
Drilling Medium	Air/Water

Airlift Yield Data During Drilling

Depth (m bgl)	TDS (ppt)	Temp (°C)	EC (µs/cm)	pH
9	10+	29	20000+	8.04

Airlift Yield Data within Cased Hole

Depth (m bgl)	V-notch (mm)	Q (L/s)	EC (µs/cm)	pH

Water Level Data

SWL (mbgl)	Date
1.42	24-Mar-10

Drilling Details

Method		Diam	(m bgl) From	To
OH	Rotary Mud	152.4	0.0	8

Construction Details

	(m bgl) From	To
Collar		
165 mm OD x 7mm Steel		
Blank Casing		
60mm OD x 5mm WT uPVC PN12		
Slotted Casing		
100 mm UPVC PN9	0	8
Screens		
Gravel Pack		
Size 1.6 - 3.2 mm	0.5	8
Cement	0	0.5
Bentonite		
A + B Foam		

Casing Details

Casing Stickup (m)	0
Casing Material	UPVC PN9
Casing Diam (mm ID)	105
Screen Diam (mm ID)	Nil
Screen Aperture (mm)	Nil
Slot Size (mm)	1

Comments

Depth (m)	Lithological Description
0-5	SAND Grey / brown, moderately sorted, very angular, shell rich sand.
5-8	SAND Grey, moderately sorted, very angular, shell rich sand. Contains minimal quartz grains <1%.
	EOH: 8 mbgl

MB07

Details

Location	Cape Peron
Tenement	
Easting (MGA94)	378420
Northing (MGA94)	6427873
Surface RL (m AHD)	3.3
Date Drilling Commenced	26-Mar-10
Date Drilling Completed	26-Mar-10
Logged By	SB
Drilled Diameter (mm)	152.4
Drilling Medium	Air/Water

Airlift Yield Data During Drilling

Depth (m bgl)	TDS (ppt)	Temp (°C)	EC (µs/cm)	pH
9	0.92	23.8	1570	8.05
14	0.47	23	910	8.04
16	0.98	23.2	2120	8.05
18	0.44	23	820	8.12
22	0.51	22.8	1020	8.15
24	1.05	23.5	1620	8.06
27	4.48	22.7	8940	7.9
28	10+	22.9	20000+	7.65

Airlift Yield Data within Cased Hole

Depth (m bgl)	V-notch (mm)	Q (L/s)	EC (µs/cm)	pH

Water Level Data

SWL (mbgl)	Date
2.45	19-Apr-10

Drilling Details

Method		Diam	(m bgl) From	To
OH	Rotary Mud	152.4	0.0	30

Construction Details

	(m bgl) From	To
Collar		
165 mm OD x 7mm Steel		
Blank Casing		
60mm OD x 5mm WT uPVC PN12		
Slotted Casing		
100 mm UPVC PN9	0	30
Screens		
Gravel Pack		
Size 1.6 - 3.2 mm	0.5	30
Cement	0	0.5
Bentonite		
A + B Foam		

Casing Details

Casing Stickup (m)	0
Casing Material	UPVC PN9
Casing Diam (mm ID)	105
Screen Diam (mm ID)	Nil
Screen Aperture (mm)	Nil
Slot Size (mm)	1

Comments

Has data logger installed in bore.

Depth (m)	Lithological Description
0-5	SAND Cream, well sorted, very angular, shell rich sand.
5-16	SAND Light grey, moderately sorted, angular, shell rich sand.
16-18	SAND Dark grey, poorly sorted, angular-very angular, coarse grained, shell rich sand.
18-23	SANDY SILT Grey, well sorted, fine grained silty sand.
23-25	LIMESTONE Grey, poorly sorted, very angular, shelly limestone. Contains some clasts of rounded quartz approximately 30%.
25-30	SANDSTONE Grey, poorly sorted, sub rounded, cemented quartz rich sandstone. Clasts contain approximately 70% quartz and 30% shell fragments.
	EOH: 30 mbgl

MB08

Details

Location	Cape Peron
Tenement	
Easting (MGA94)	378198
Northing (MGA94)	6428232
Surface RL (m AHD)	2.38
Date Drilling Commenced	15-Apr-10
Date Drilling Completed	15-Apr-10
Logged By	SB
Drilled Diameter (mm)	152.4
Drilling Medium	Air/Water

Airlift Yield Data During Drilling

Depth (m bgl)	TDS (ppt)	Temp (°C)	EC (µs/cm)	pH
9		22.1	22000	

Airlift Yield Data within Cased Hole

Depth (m bgl)	V-notch (mm)	Q (L/s)	EC (µs/cm)	pH

Water Level Data

SWL (mbgl)	Date
2.1	19-Apr-10

Drilling Details

Method		Diam	(m bgl) From	To
OH	Rotary Mud	152.4	0.0	11

Construction Details

	(m bgl) From	To
Collar		
165 mm OD x 7mm Steel		
Blank Casing		
60mm OD x 5mm WT uPVC PN12		
Slotted Casing		
100 mm UPVC PN9	0	11
Screens		
Gravel Pack		
Size 1.6 - 3.2 mm	0.5	11
Cement	0	0.5
Bentonite		
A + B Foam		

Casing Details

Casing Stickup (m)	0
Casing Material	UPVC PN9
Casing Diam (mm ID)	105
Screen Diam (mm ID)	Nil
Screen Aperture (mm)	Nil
Slot Size (mm)	1

Comments

Has data logger installed down bore.

Depth (m)	Lithological Description
0-3	SAND Cream, moderately sorted, very angular, shell rich sand.
3-11	SAND Grey, moderately sorted, angular, shell rich sand.
	EOH: 11 mbgl

MB09D

Details	
Location	Cape Peron
Tenement	
Easting (MGA94)	378299
Northing (MGA94)	6428092
Surface RL (m AHD)	2.8
Date Drilling Commenced	12-Apr-10
Date Drilling Completed	14-Apr-10
Logged By	SB
Drilled Diameter (mm)	152.4
Drilling Medium	Air/Water

Airlift Yield Data During Drilling

Depth (m bgl)	TDS (ppt)	Temp (°C)	EC (µs/cm)	pH
9	0.42	17.1	630	8.37
12	0.21	17.1	210	8.50
14	0.35	17.7	350	8.33
16	0.59	17.4	1280	8.13
17	1.24	17.7	2470	8.07
19	2.01	18.1	3910	8.14
23	2.98	16.8	7100	7.96
24	5.05	17.6	10150	7.9
25	6.31	17.7	12480	7.82
26	9.13	17.1	17980	7.72
27	10+	17.3	20000+	7.78

Airlift Yield Data within Cased Hole

Depth (m bgl)	V-notch (mm)	Q (L/s)	EC (µs/cm)	pH

Water Level Data

SWL (mbgl)	Date
2.05	19-Apr-10

Drilling Details

Method		Diam	From (m bgl)	To (m bgl)
OH	Rotary Mud	152.4	0.0	30.0

Construction Details

	From (m bgl)	To (m bgl)
Collar		
165 mm OD x 7mm Steel		
Blank Casing		
50mm UPVC PN9	0	22
Slotted Casing		
50 mm UPVC PN9	22	30
Screens		
Gravel Pack		
Size 1.6 - 3.2 mm	0.5	30
Cement	0	0.5
	21	22
Bentonite		
A + B Foam		

Casing Details

Casing Stickup (m)	0
Casing Material	UPVC PN9
Casing Diam (mm ID)	105
Screen Diam (mm ID)	105
Screen Aperture (mm)	Nil
Slot Size (mm)	1

Comments

Cased with 50 mm UPVC

Depth (m)	Lithological Description
0-1	SAND Cream, well sorted, very angular, shell rich sand
1-5	SAND Cream, poorly sorted, very angular, coarse, shell rich sand.
5-19	SAND Grey, moderately sorted, angular, shell rich sand.
19-22	SANDY SILT Grey, well sorted, fine grained silty sand.
22-27	SANDSTONE Grey, poorly sorted, subrounded, cemented quartz rich sandstone. Clasts contain approximately 90% quartz and 10% shell fragments.
27-30	LIMESTONE Cream, poorly sorted, very angular, shelly limestone. Contains some clasts of rounded quartz approximately 15%.
	EOH: 30 mbgl

MB09S

Details

Location	Cape Peron
Tenement	
Easting (MGA94)	378298
Northing (MGA94)	6428082
Surface RL (m AHD)	2.83
Date Drilling Commenced	1-Apr-10
Date Drilling Completed	6-Apr-10
Logged By	SB
Drilled Diameter (mm)	152.4
Drilling Medium	Air/Water

Airlift Yield Data During Drilling

Depth (m bgl)	TDS (ppt)	Temp (°C)	EC (µs/cm)	pH
10	0.37	43.5	370	8.26
12	0.15	38.7	340	8.13
13	0.19	37	270	8.25
15	0.32	32.4	650	8.12
16	0.52	30.1	950	8.06
18	0.72	28.8	1420	8.10
20	1.27	28.6	2540	8.13

Airlift Yield Data within Cased Hole

Depth (m bgl)	V-notch (mm)	Q (L/s)	EC (µs/cm)	pH

Water Level Data

SWL (mbgl)	Date
2.65	19-Apr-10

Drilling Details

Method		Diam	(m bgl) From	To
OH	Rotary Mud	152.4	0.0	21.5

Construction Details

	(m bgl) From	To
Collar		
165 mm OD x 7mm Steel		
Blank Casing		
60mm OD x 5mm WT uPVC PN12		
Slotted Casing		
100 mm UPVC PN9	0	21.5
Screens		
Gravel Pack		
Size 1.6 - 3.2 mm	0.5	21.5
Cement	0	0.5
Bentonite		
A + B Foam		

Casing Details

Casing Stickup (m)	0
Casing Material	UPVC PN9
Casing Diam (mm ID)	105
Screen Diam (mm ID)	Nil
Screen Aperture (mm)	Nil
Slot Size (mm)	1

Comments

Data logger installed in this bore

Depth (m)	Lithological Description
0-4	SAND Cream / brown, moderately sorted, angular to very angular, shell rich sand.
4-19	SAND Grey, well sorted, angular, shell rich sand.
19-21.5	SANDY SILT Grey, well sorted, silty sand.
	EOH: 21.5 mbgl

MB10

Details

Location	Cape Peron
Tenement	
Easting (MGA94)	378587
Northing (MGA94)	6427907
Surface RL (m AHD)	2.95
Date Drilling Commenced	30-Mar-10
Date Drilling Completed	31-Mar-10
Logged By	SB
Drilled Diameter (mm)	152.4
Drilling Medium	Air/Water

Airlift Yield Data During Drilling

Depth (m bgl)	TDS (ppt)	Temp (°C)	EC (µs/cm)	pH
10	0.93	31.2	3200	8.03
11	0.98	30.7	1980	8.09
13	1.17	28.5	2320	8.22
15	1.23	29.1	2540	8.20
21	1.05	38.4	2380	7.96
23	1.41	32.2	2890	8.01
25	1.99	26	4130	8.11
27	2.9	25.2	5640	7.98
28	4.4	24.4	8320	7.88

Airlift Yield Data within Cased Hole

Depth (m bgl)	V-notch (mm)	Q (L/s)	EC (µs/cm)	pH

Water Level Data

SWL (mbgl)	Date
2.02	19-Apr-10

Drilling Details

Method		Diam	(m bgl) From	To
OH	Rotary Mud	152.4	0.0	29.0

Construction Details

	(m bgl) From	To
Collar		
165 mm OD x 7mm Steel		
Blank Casing		
60mm OD x 5mm WT uPVC PN12		
Slotted Casing		
100 mm UPVC PN9	0	29
Screens		
Gravel Pack		
Size 1.6 - 3.2 mm	0.5	29
Cement	0	0.5
Bentonite		
A + B Foam		

Casing Details

Casing Stickup (m)	0
Casing Material	UPVC PN9
Casing Diam (mm ID)	105
Screen Diam (mm ID)	Nil
Screen Aperture (mm)	Nil
Slot Size (mm)	1

Comments

Depth (m)	Lithological Description
0-6	SAND Cream, moderately sorted, very angular, shell rich sand.
6-18	SAND Grey, poorly sorted, very angular, coarse, shell rich sand. Contains some organic material
18-22	SANDY SILT Brown/grey, moderately sorted, sandy silt. Contains some larger shell material and organics.
22-24	SAND Grey, moderately sorted, very angular, shell rich sand. Contains approximately 5% sub rounded quartz grains.
24-30	SANDSTONE Light grey, poorly sorted, sub rounded cemented quartz rich sandstone. Clasts contain approximately 85% quartz and 15% shell fragments. Increasing in shell content towards the base of the hole.
	EOH: 29 mbgl

MB11

Details

Location	Cape Peron
Tenement	
Easting (MGA94)	378555
Northing (MGA94)	6427796
Surface RL (m AHD)	1.86
Date Drilling Commenced	23-Mar-10
Date Drilling Completed	24-Mar-10
Logged By	SB
Drilled Diameter (mm)	152.4
Drilling Medium	Air/Water

Airlift Yield Data During Drilling

Depth (m bgl)	TDS (ppt)	Temp (°C)	EC (µs/cm)	pH
9		23.4	2260	
12	1.14	23.3	2320	8.68
13	1.27	23	2450	8.48
23	1.6	23.1	3300	7.90
24	1.74	22.9	3540	7.91
25	2.79	29.9	5500	7.75
26	3.89	24.7	7760	7.71
27	6.34	24.8	12620	7.61
28	10+	24.6	20000+	7.19

Airlift Yield Data within Cased Hole

Depth (m bgl)	V-notch (mm)	Q (L/s)	EC (µs/cm)	pH

Water Level Data

SWL (mbgl)	Date
1.03	19-Apr-10

Drilling Details

Method		Diam	(m bgl) From	To
OH	Rotary Mud	152.4	0.0	30.0

Construction Details

	(m bgl) From	To
Collar		
165 mm OD x 7mm Steel		
Blank Casing		
60mm OD x 5mm WT uPVC PN12		
Slotted Casing		
100 mm UPVC PN9	0	30
Screens		
Gravel Pack		
Size 1.6 - 3.2 mm	0.5	30
Cement	0	0.5
Bentonite		
A + B Foam		

Casing Details

Casing Stickup (m)	0
Casing Material	UPVC PN9
Casing Diam (mm ID)	105
Screen Diam (mm ID)	Nil
Screen Aperture (mm)	Nil
Slot Size (mm)	1

Comments

Depth (m)	Lithological Description
0-2	SAND Light brown, moderately sorted, angular, shell rich sand.
2-13	SAND Dark grey, poorly sorted, very angular, coarse, shell rich sand.
13-14	SAND Brown / dark grey, poorly sorted, vary angular-angular, shell rich sand. Contains some organics material
14-22	SILTY SAND Brown / grey, moderately sorted, fine grained silty sand. Contains brocken shells as well as some organic material.
22-24	SANDSTONE Light grey, poorly sorted, sub rounded, cemented quartz rich sandstone. Clasts contain approximately 60% quartz and 40% shell fragments.
24-30	LIMESTONE Orange / brown, poorly sorted, angular, shell rich limestone. Contains minimal amounts of rounded quartz.
	EOH: 30 mbgl

MB12

Details

Location	Cape Peron
Tenement	
Easting (MGA94)	378462
Northing (MGA94)	6427723
Surface RL (m AHD)	2
Date Drilling Commenced	25-Mar-10
Date Drilling Completed	25-Mar-10
Logged By	SB
Drilled Diameter (mm)	152.4
Drilling Medium	Air/Water

Airlift Yield Data During Drilling

Depth (m bgl)	TDS (ppt)	Temp (°C)	EC (µs/cm)	pH
6	0.65	22.8	1320	8.04
10	0.37	22.5	570	8.29
14	0.31	21.9	610	8.21
21	1.2	25.2	2310	8.08
24	1.54	30.8	3060	7.93
25	2.34	30.8	4940	7.93
26	2.34	28.7	7170	7.79
27	9.4	28.1	19130	7.64
28	10+	28.2	20000+	7.63

Airlift Yield Data within Cased Hole

Depth (m bgl)	V-notch (mm)	Q (L/s)	EC (µs/cm)	pH

Water Level Data

SWL (mbgl)	Date
1.81	19-Apr-10

Drilling Details

Method		Diam	From (m bgl)	To (m bgl)
OH	Rotary Mud	152.4	0.0	30.0

Construction Details

	From (m bgl)	To (m bgl)
Collar		
165 mm OD x 7mm Steel		
Blank Casing		
60mm OD x 5mm WT uPVC PN12		
Slotted Casing		
100 mm UPVC PN9	0	30
Screens		
Gravel Pack		
Size 1.6 - 3.2 mm	0.5	30
Cement	0	0.5
Bentonite		
A + B Foam		

Casing Details

Casing Stickup (m)	0
Casing Material	UPVC PN9
Casing Diam (mm ID)	105
Screen Diam (mm ID)	Nil
Screen Aperture (mm)	Nil
Slot Size (mm)	1

Comments

Data logger installed in this bore.

Depth (m)	Lithological Description
0-1	SAND Light brown, moderately sorted, angular, shell rich sand.
1-4	SAND Light grey, poorly sorted, angular, coarse, shell rich sand. Contains minor amounts of sub rounded to rounded quartz grains.
4-16	SAND Grey, moderately sorted, very angular-angular, shell rich sand.
16-20	SILTY SAND Brown / grey, well sorted, fine grained silty sand.
20-26	SAND Grey, moderately sorted, sub rounded, coarse grained, quartz rich sand.
26-28	SANDSTONE Light grey, poorly sorted, sub rounded, quartz rich sandstone.
28-30	LIMESTONE Light brown, poorly sorted, angular to sub angular, shell rich limestone. Contains approximately 2% rounded quartz.
	EOH: 30 mbgl

MB13

Details	
Location	Cape Peron
Tenement	
Easting (MGA94)	378079
Northing (MGA94)	6427936
Surface RL (m AHD)	4.35
Date Drilling Commenced	8-Apr-10
Date Drilling Completed	8-Apr-10
Logged By	SB
Drilled Diameter (mm)	152.4
Drilling Medium	Air/Water

Airlift Yield Data During Drilling

Depth (m bgl)	TDS (ppt)	Temp (°C)	EC (µs/cm)	pH
13	1.19	36.7	2820	7.89
14	1.73	34.4	3110	7.79
15	2.06	29.6	3750	7.86
16	2.53	28	4990	7.86
17	5.75	26.5	12730	7.86
18	5.46	25.8	13230	7.93
19	7.26	25.1	14860	7.9
20	4.19	25.5	7390	7.89
21	3.94	25.3	8110	8

Airlift Yield Data within Cased Hole

Depth (m bgl)	V-notch (mm)	Q (L/s)	EC (µs/cm)	pH

Water Level Data

SWL (mbgl)	Date
4.18	19-Apr-10

Drilling Details

Method		Diam	From (m bgl)	To (m bgl)
OH	Rotary Mud	152.4	0.0	21.0

Construction Details

	From (m bgl)	To (m bgl)
Collar		
165 mm OD x 7mm Steel		
Blank Casing		
60mm OD x 5mm WT uPVC PN12		
Slotted Casing		
100 mm UPVC PN9	0	21
Screens		
Gravel Pack		
Size 1.6 - 3.2 mm	0.5	21
Cement	0	0.5
Bentonite		
A + B Foam		

Casing Details

Casing Stickup (m)	0
Casing Material	UPVC PN9
Casing Diam (mm ID)	105
Screen Diam (mm ID)	Nil
Screen Aperture (mm)	Nil
Slot Size (mm)	1

Comments

Data logger installed in this bore.

Depth (m)	Lithological Description
0-4	SAND Light brown / cream, well sorted, angular to sub angular, shell rich sand.
4-7	SAND Light brown / cream, moderately sorted, angular to very angular, shell rich sand.
	Contains some large shell fragments up to 10 mm in size.
7-19	SAND Dark grey, moderately sorted, angular, shell rich sand.
19-21	SILTY SAND Light grey, well sorted, fine grained silty sand.
	EOH: 21 mbgl

MB14D

Details

Location	Cape Peron
Tenement	
Easting (MGA94)	378018
Northing (MGA94)	6428013
Surface RL (m AHD)	
Date Drilling Commenced	9-Feb-11
Date Drilling Completed	9-Feb-11
Logged By	CJ
Drilled Diameter (mm)	152.4
Drilling Medium	Mud

Airlift Yield Data During Drilling

Depth (m bgl)	TDS (ppt)	Temp (°C)	EC (µs/cm)	pH
3			2470	10.91
6			2450	10.92
9			2090	10.80
12			2020	10.68
15			2060	10.66
18			2810	10.37
20		28.1	3100	10.04

Airlift Yield Data within Cased Hole

Depth (m bgl)	V-notch (mm)	Q (L/s)	EC (µs/cm)	pH
15			17050	8.19
20			17970	8.03

Water Level Data

SWL (mbgl)	Date
3.998	16-Feb-11

Drilling Details

Method		Diam	(m bgl) From	To
OH	Rotary Mud	152.4	0.0	20

Construction Details

	(m bgl) From	To
Collar		
165 mm OD x 7mm Steel		
Blank Casing	0	18
100 mm PVC		
Slotted Casing	18	20
100 mm PVC		
Screens		
Gravel Pack		
Size 1.6 - 3.2 mm	17	20
Cement		
Bentonite	16	17
A + B Foam		

Casing Details

Casing Stickup (m)	0
Casing Material	UPVC PN9
Casing Diam (mm ID)	100
Screen Diam (mm ID)	Nil
Screen Aperture (mm)	Nil
Slot Size (mm)	1

Comments

Depth (m)	Lithological Description
0 - 4	SAND Light brown / tan, shell fragments
4 - 6	SAND Light brown / tan, shell fragments (5 - 10 mm), limestone (subangular, 3 - 7 mm)
6 - 10	SAND Grey, whole shells (5 - 10 mm), minor limestone (2 mm).
10 - 18	SAND Grey, shell rich sand, whole shells (5 - 10 mm)
18 - 20	SAND Grey fine silty sand, lighter grey from 19 - 20 m.
	EOH: 20 mbgl

MB14S					Depth (m)	Lithological Description
Details					0 - 4	SAND Light brown / tan, shell fragments
Location			Cape Peron			
Tenement					4 - 6	SAND Light brown / tan, shell fragments (5 - 10 mm), limestone (subangular, 3 - 7 mm)
Easting (MGA94)			378021			
Northing (MGA94)			6428016		6 - 10	SAND Grey, whole shells (5 - 10 mm), minor limestone (2 mm).
Surface RL (m AHD)						
Date Drilling Commenced			10-Feb-11		10 - 12	SAND Grey, shell rich sand, whole shells (5 - 10 mm)
Date Drilling Completed			10-Feb-11			
Logged By			CJ			EOH: 12 mbgl
Drilled Diameter (mm)			152.4			
Drilling Medium			Mud			
Airlift Yield Data During Drilling						
Depth (m bgl)	TDS (ppt)	Temp (°C)	EC (µs/cm)	pH		
3		26.5	3800	11.22		
6		27.4	3630	11.19		
9		27.7	3580	11.29		
12		28.7	3630	11.01		
Airlift Yield Data within Cased Hole						
Depth (m bgl)	V-notch (mm)	Q (L/s)	EC (µs/cm)	pH		
10			7920	8.3		
12			8470	8.34		
Water Level Data						
SWL (mbgl)			Date			
4.135			16-Feb-11			
Drilling Details			(m bgl)			
Method		Diam	From	To		
OH	Rotary Mud	152.4	0.0	12		
Construction Details			(m bgl)			
			From	To		
Collar						
165 mm OD x 7mm Steel						
Blank Casing			0	2.25		
100 mm PVC						
Slotted Casing						
100 mm PVC			2.25	12		
Screens						
Gravel Pack						
Size 1.6 - 3.2 mm			1.5	12		
Cement			0	0.5		
Bentonite			0.5	1.5		
A + B Foam						
Casing Details						
Casing Stickup (m)			0			
Casing Material			UPVC PN9			
Casing Diam (mm ID)			100			
Screen Diam (mm ID)			Nil			
Screen Aperture (mm)			Nil			
Slot Size (mm)			1			
Comments						

PB1				
Details				
Location		Cape Peron		
Tenement				
Easting (MGA94)		378004		
Northing (MGA94)		6428021		
Surface RL (m AHD)				
Date Drilling Commenced		14-Feb-11		
Date Drilling Completed		14-Feb-11		
Logged By		CJ		
Drilled Diameter (mm)		250		
Drilling Medium		Mud		
Airlift Yield Data During Drilling				
Depth (m bgl)	TDS (ppt)	Temp (°C)	EC (µs/cm)	pH
4		26.2	540	9.45
7		25.3	540	10.05
10		24.9	540	9.94
12		25.5	740	9.76
Airlift Yield Data within Cased Hole				
Depth (m bgl)	V-notch (mm)	Q (L/s)	EC (µs/cm)	pH
11		<1	6120	8.17
Water Level Data				
SWL (mbgl)			Date	
3.92			16-Feb-11	
Drilling Details			(m bgl)	
Method		Diam	From	To
OH	Rotary Mud	250.0	0.0	20
Construction Details			(m bgl)	
			From	To
Collar				
165 mm OD x 7mm Steel				
Blank Casing			0	6
200 mm PVC				
Slotted Casing			6	12
200 mm				
Screens				
Gravel Pack				
Size 1.6 - 3.2 mm			5	12
Cement			4	5
Bentonite				
A + B Foam				
Casing Details				
Casing Stickup (m)			0	
Casing Material			PVC	
Casing Diam (mm ID)			200	
Screen Diam (mm ID)			Nil	
Screen Aperture (mm)			Nil	
Slot Size (mm)			1	
Comments				

Depth (m)	Lithological Description
0 - 4	SAND Light brown / tan, shell fragments
4 - 6	SAND Light brown / tan, shell fragments (5 - 10 mm), limestone (subangular, 3 - 7 mm)
6 - 10	SAND Grey, whole shells (5 - 10 mm), minor limestone (2 mm).
10 - 12	SAND Grey, shell rich sand, whole shells (5 - 10 mm)
	EOH: 12 mbgl

Appendix C: Laboratory Analytical Reports

(REFER TO CD)

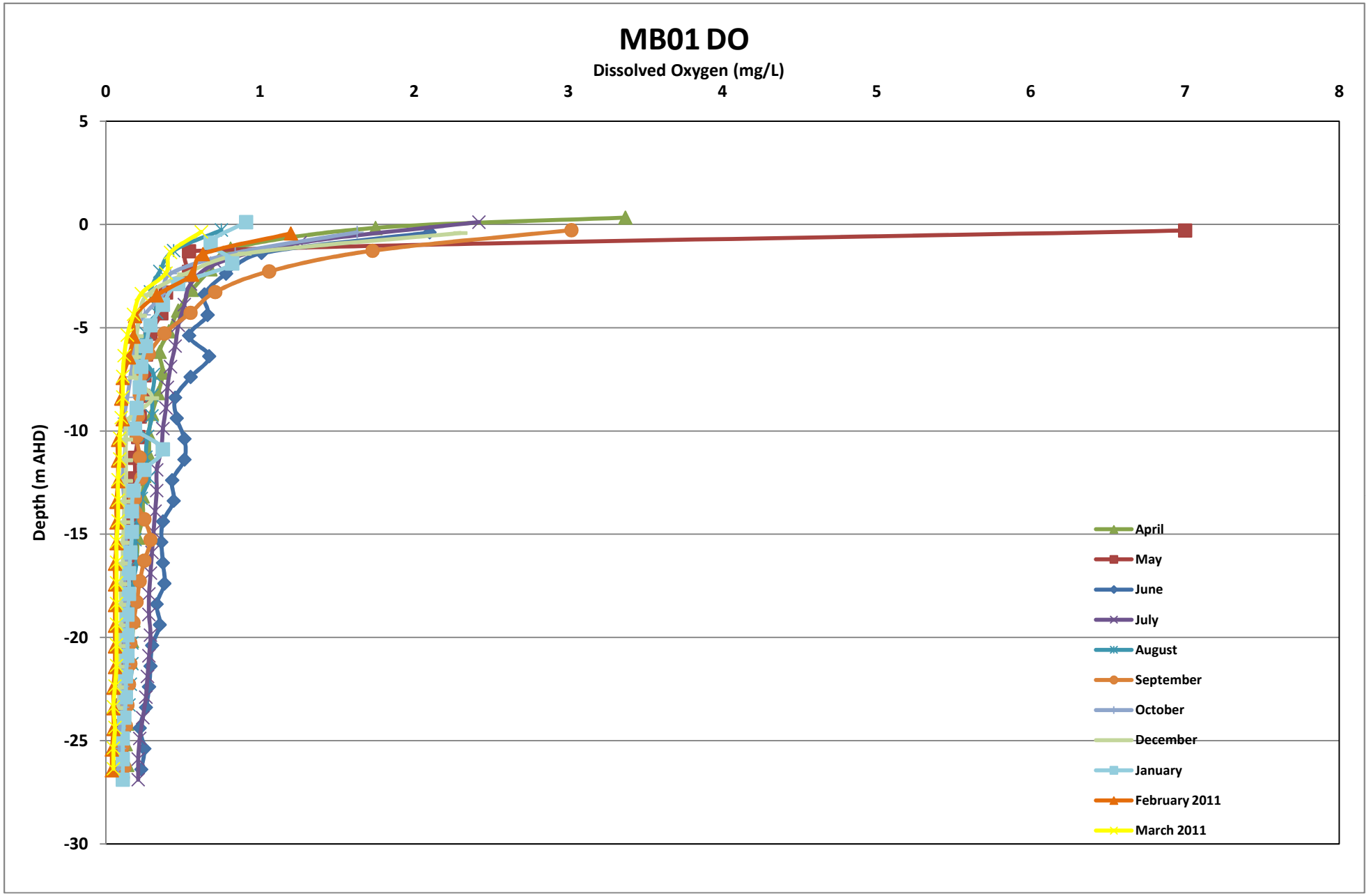
Appendix D: Data Logger Raw Data

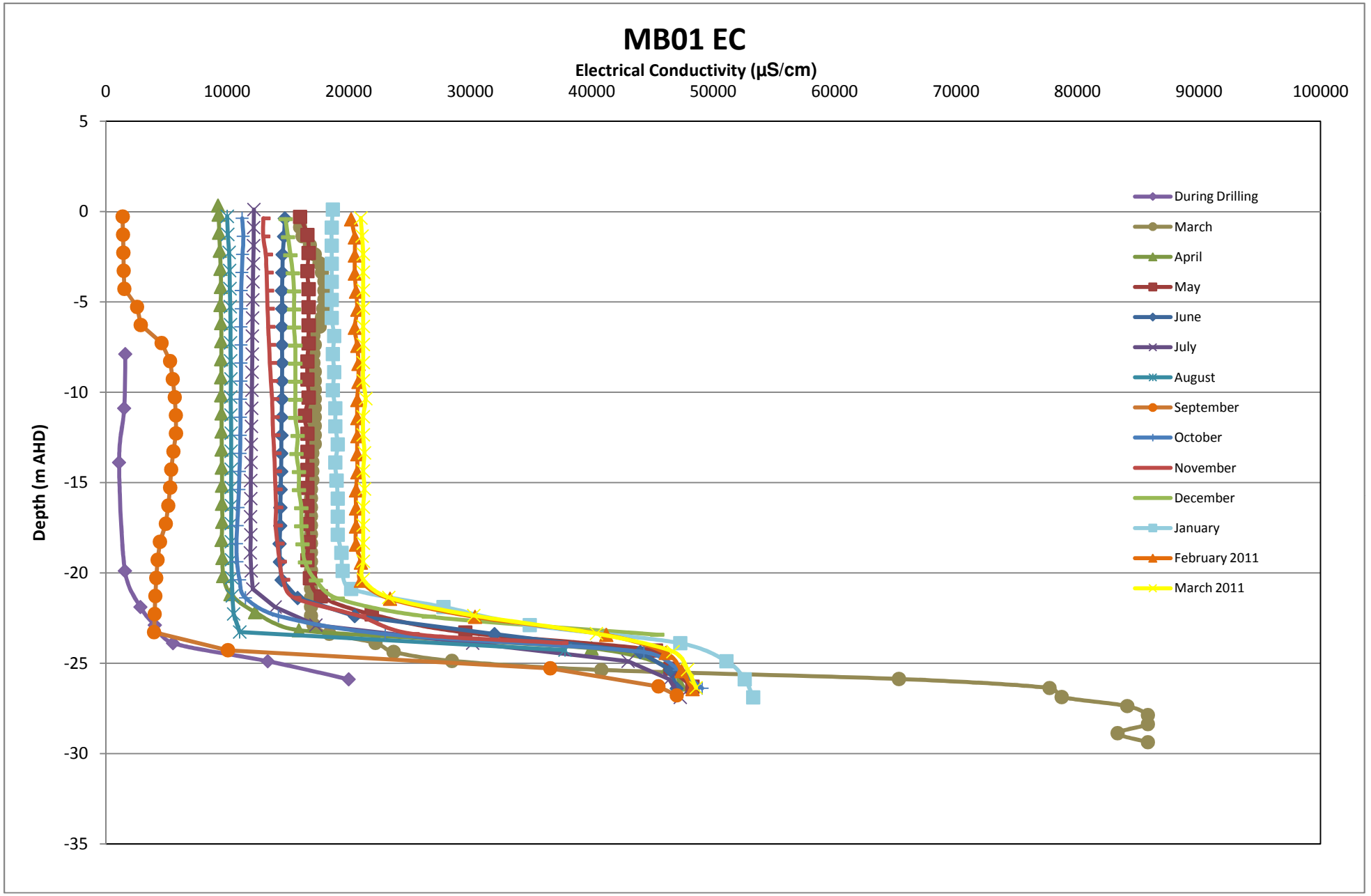
(REFER TO CD)

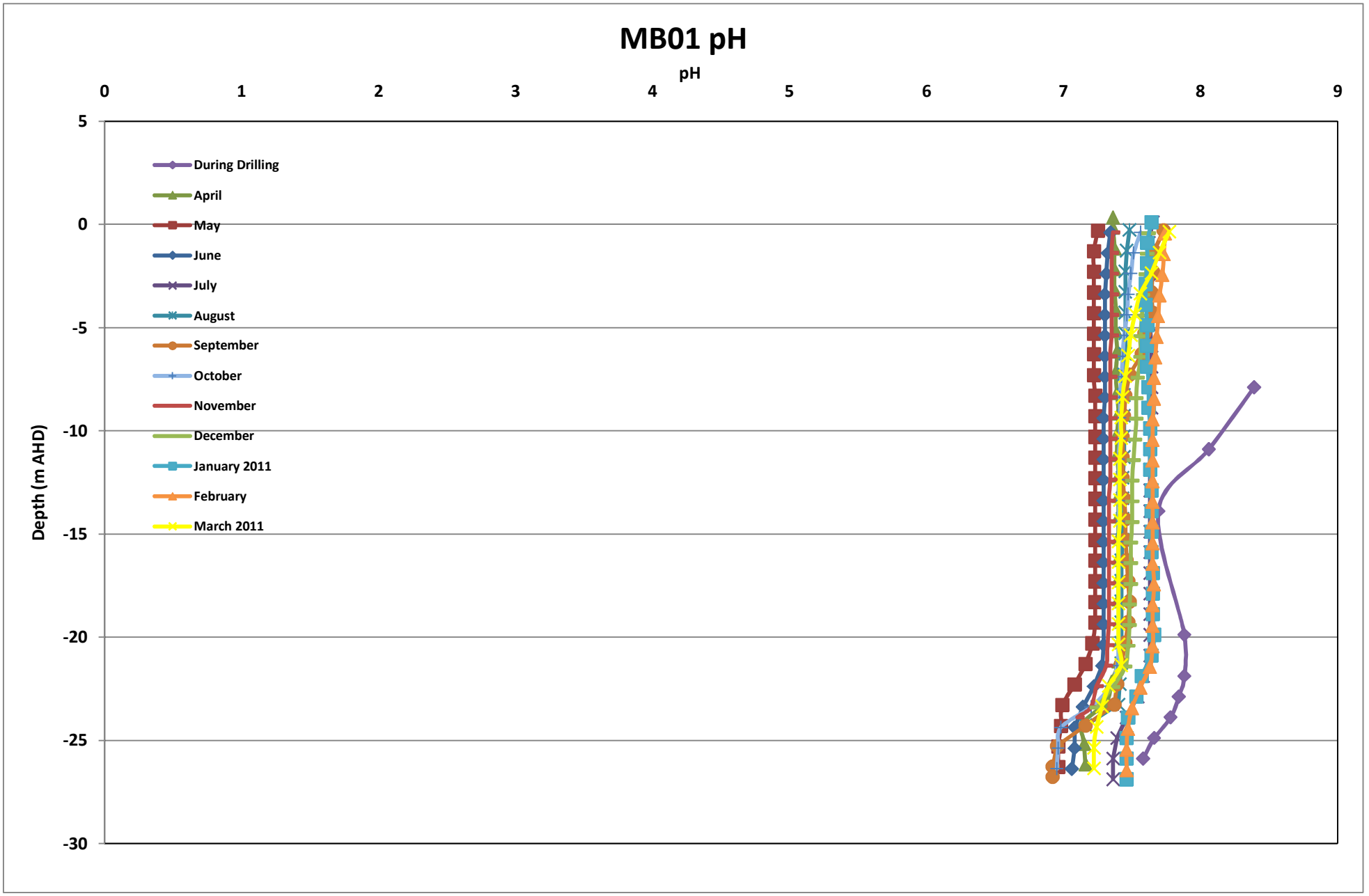
Appendix E: Downhole Surveys

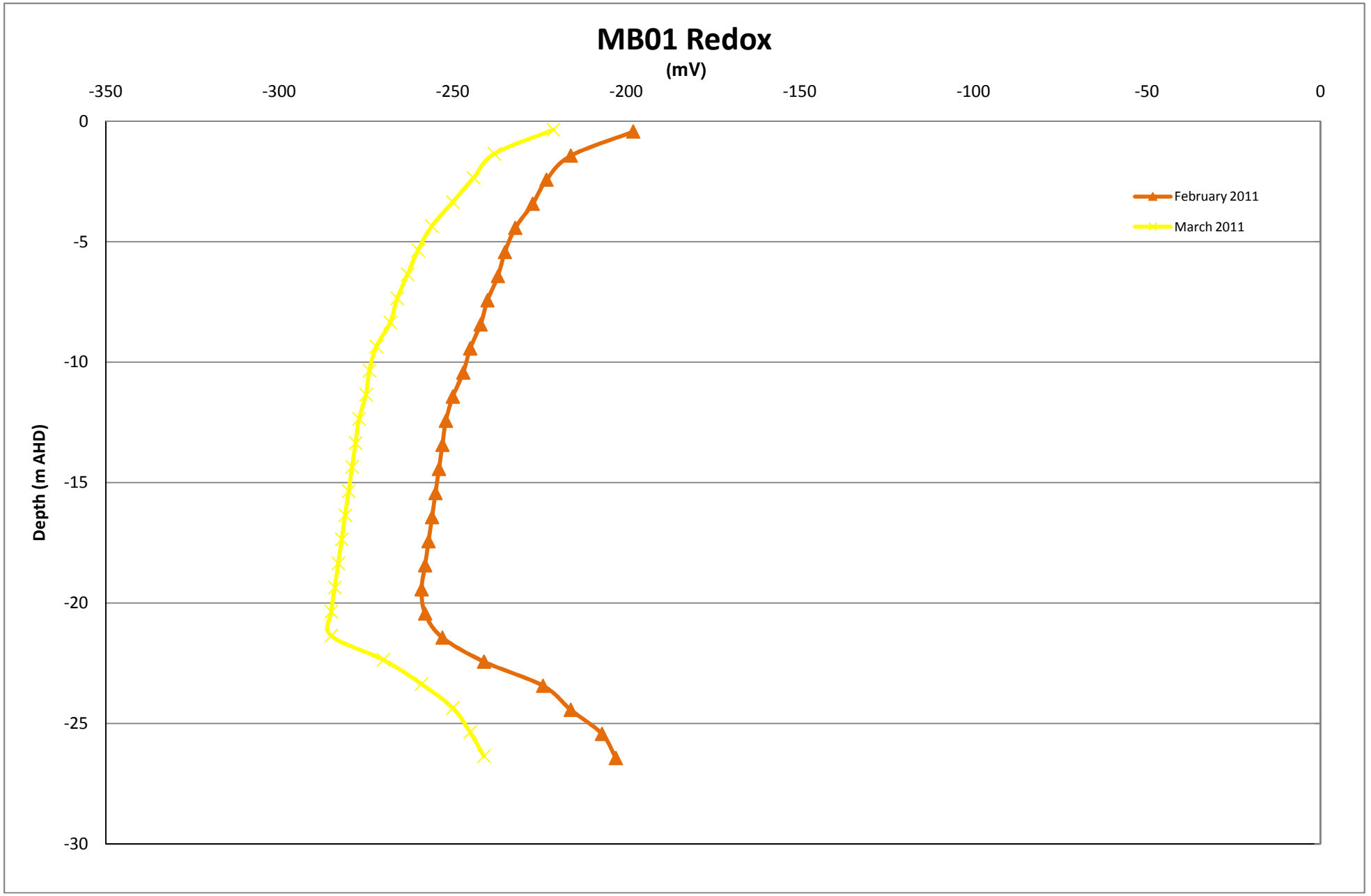
MWH

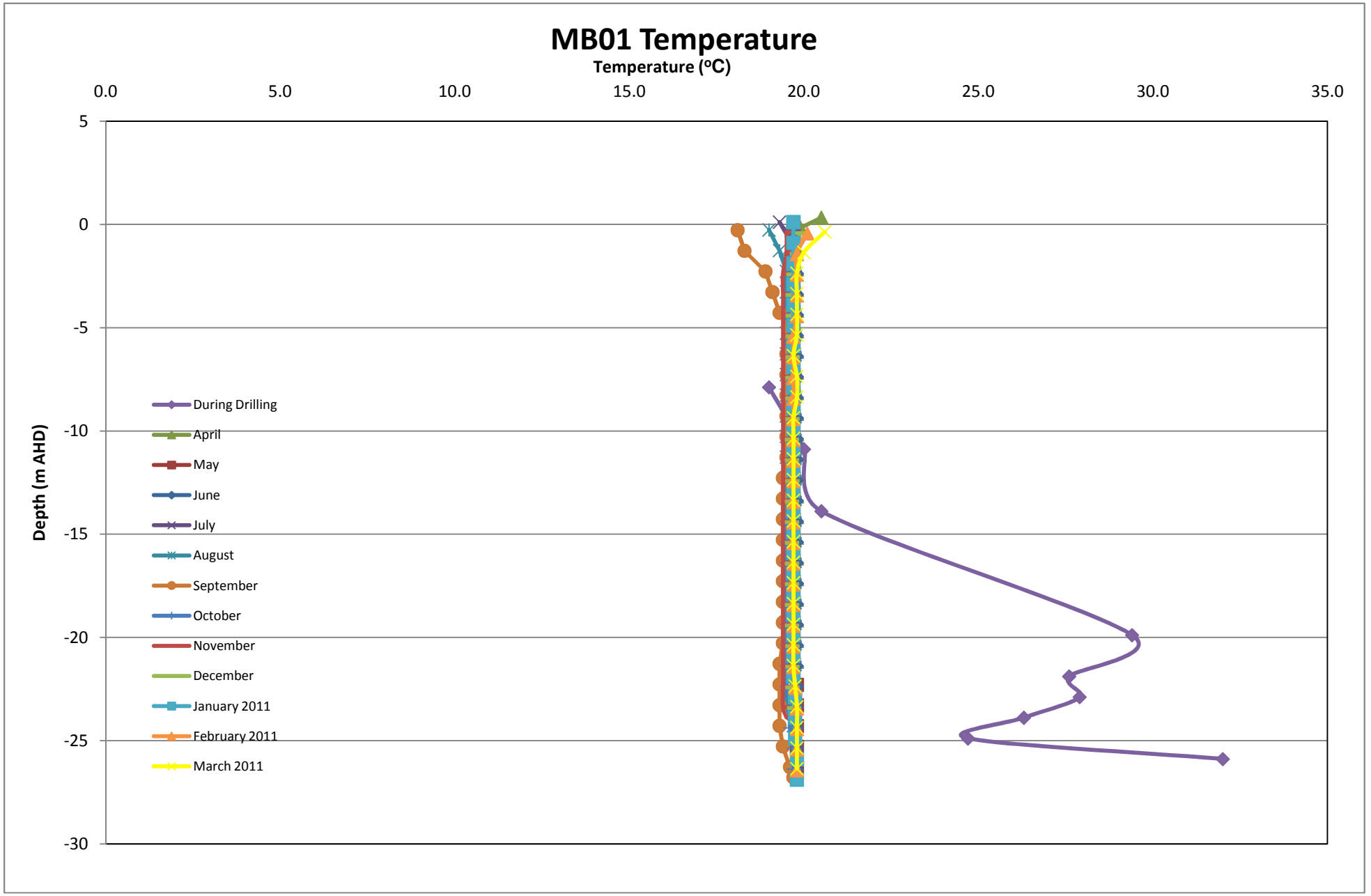
MB01


MB01 DO
Dissolved Oxygen (mg/L)
0
1
2
3
4
5
6
7
8
Depth (m AHD)
5
0
-5
-10
-15
-20
-25
-30
April
May
June
July
August
September
October
December
January
February 2011
March 2011


MB01 EC
Electrical Conductivity (µS/cm)
0
10000
20000
30000
40000
50000
60000
70000
80000
90000
100000
Depth (m AHD)
5
0
-5
-10
-15
-20
-25
-30
-35
During Drilling
March
April
May
June
July
August
September
October
November
December
January
February 2011
March 2011

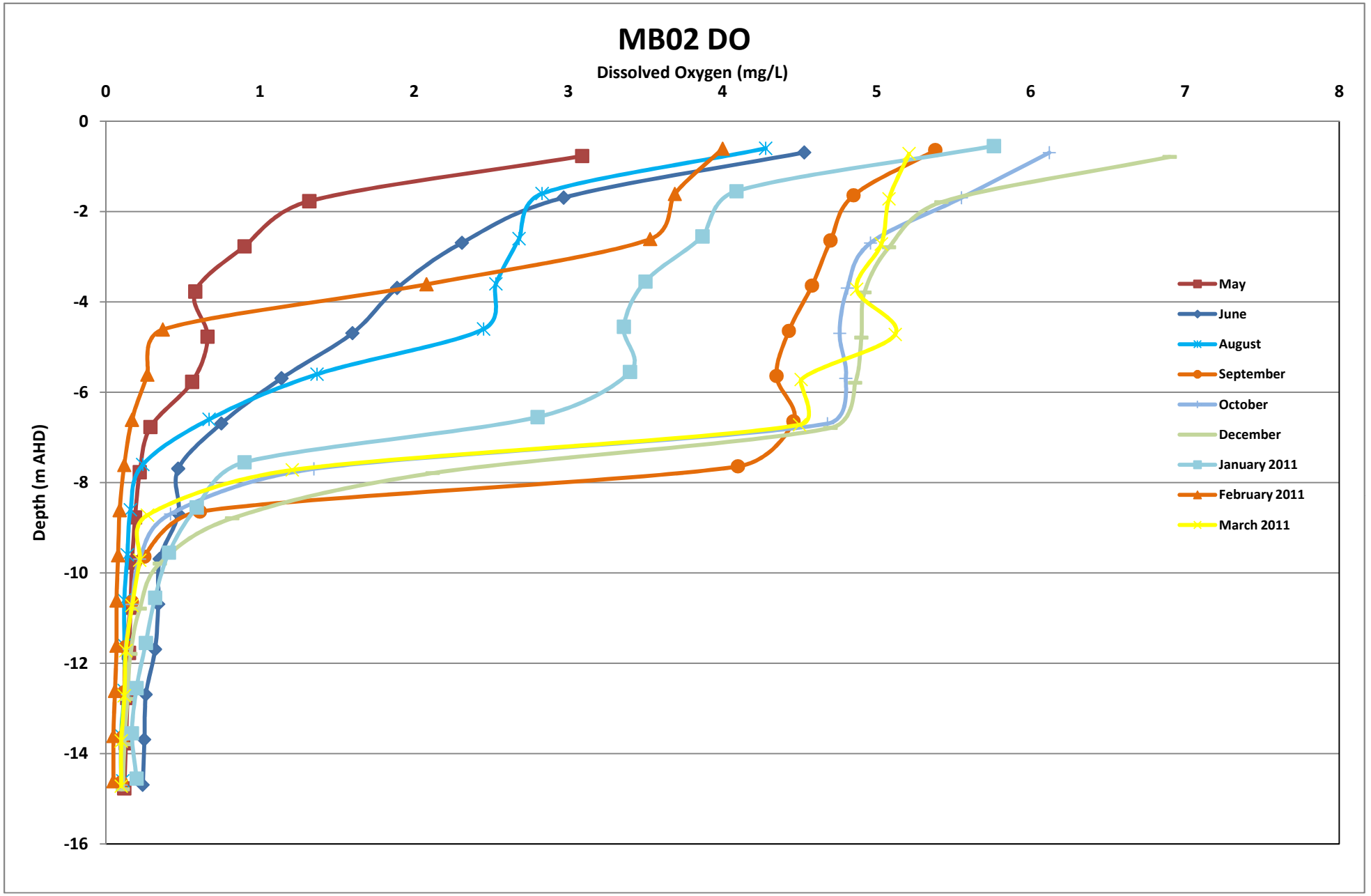

MB01 pH
pH
0
1
2
3
4
5
6
7
8
9
5
0
-5
-10
-15
-20
-25
-30
Depth (m AHD)
During Drilling
April
May
June
July
August
September
October
November
December
January 2011
February
March 2011

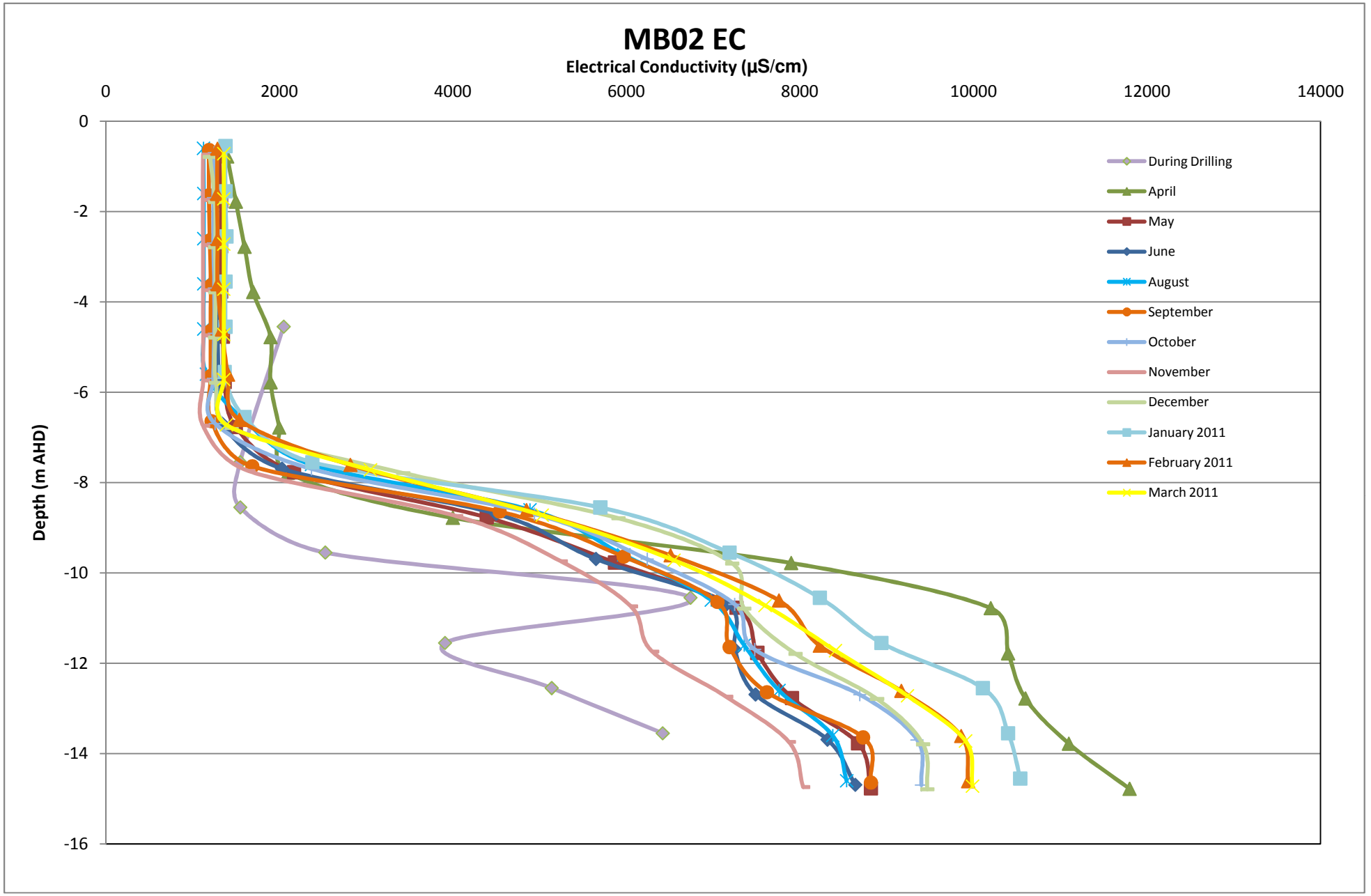

MB01 Redox
(mV)
-350
-300
-250
-200
-150
-100
-50
0
0
-5
-10
-15
-20
-25
-30
Depth (m AHD)
February 2011
March 2011

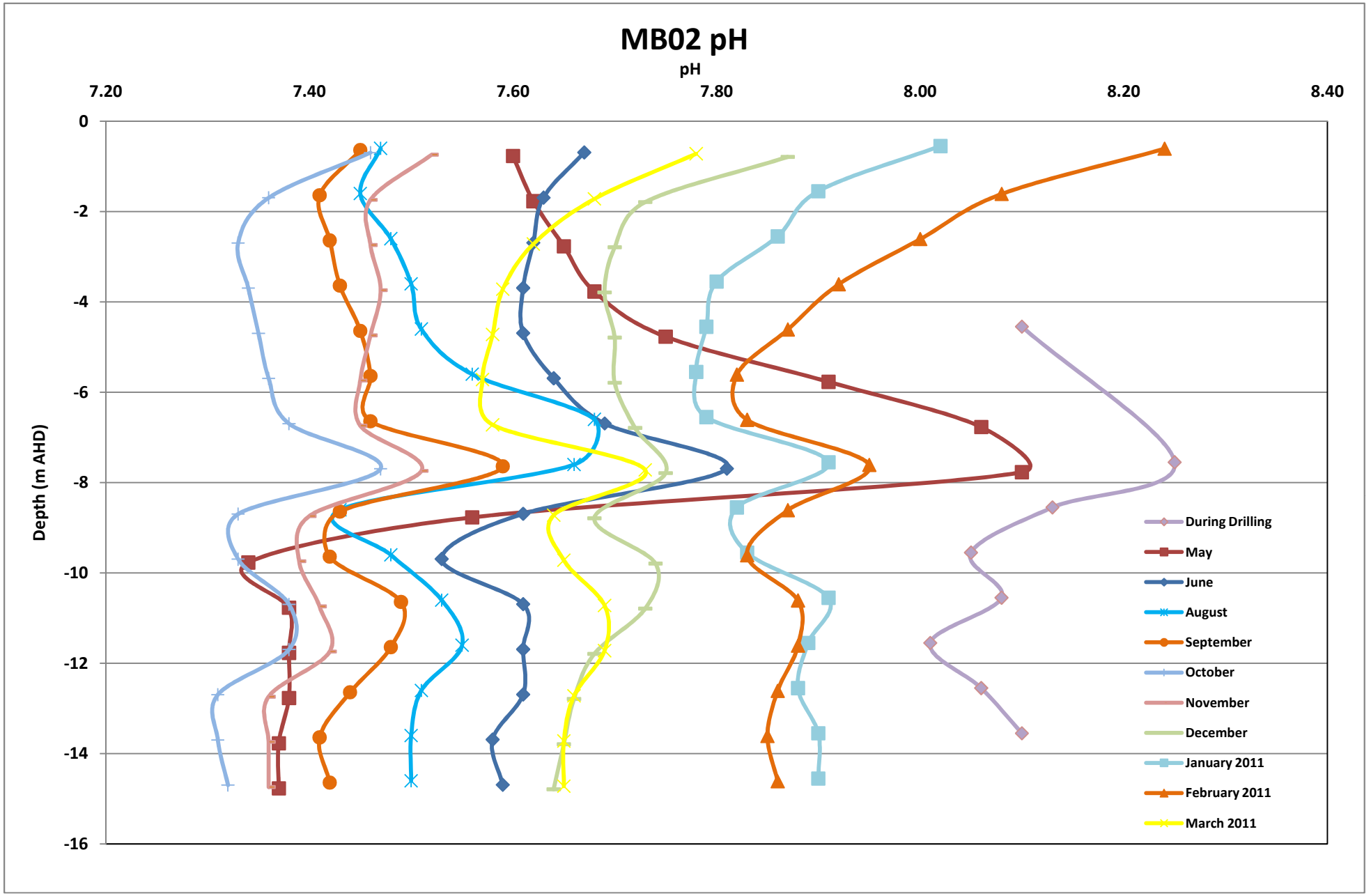

MB01 Temperature
Temperature (ºC)
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
5
0
-5
-10
-15
-20
-25
-30
Depth (m AHD)
During Drilling
April
May
June
July
August
September
October
November
December
January 2011
February 2011
March 2011

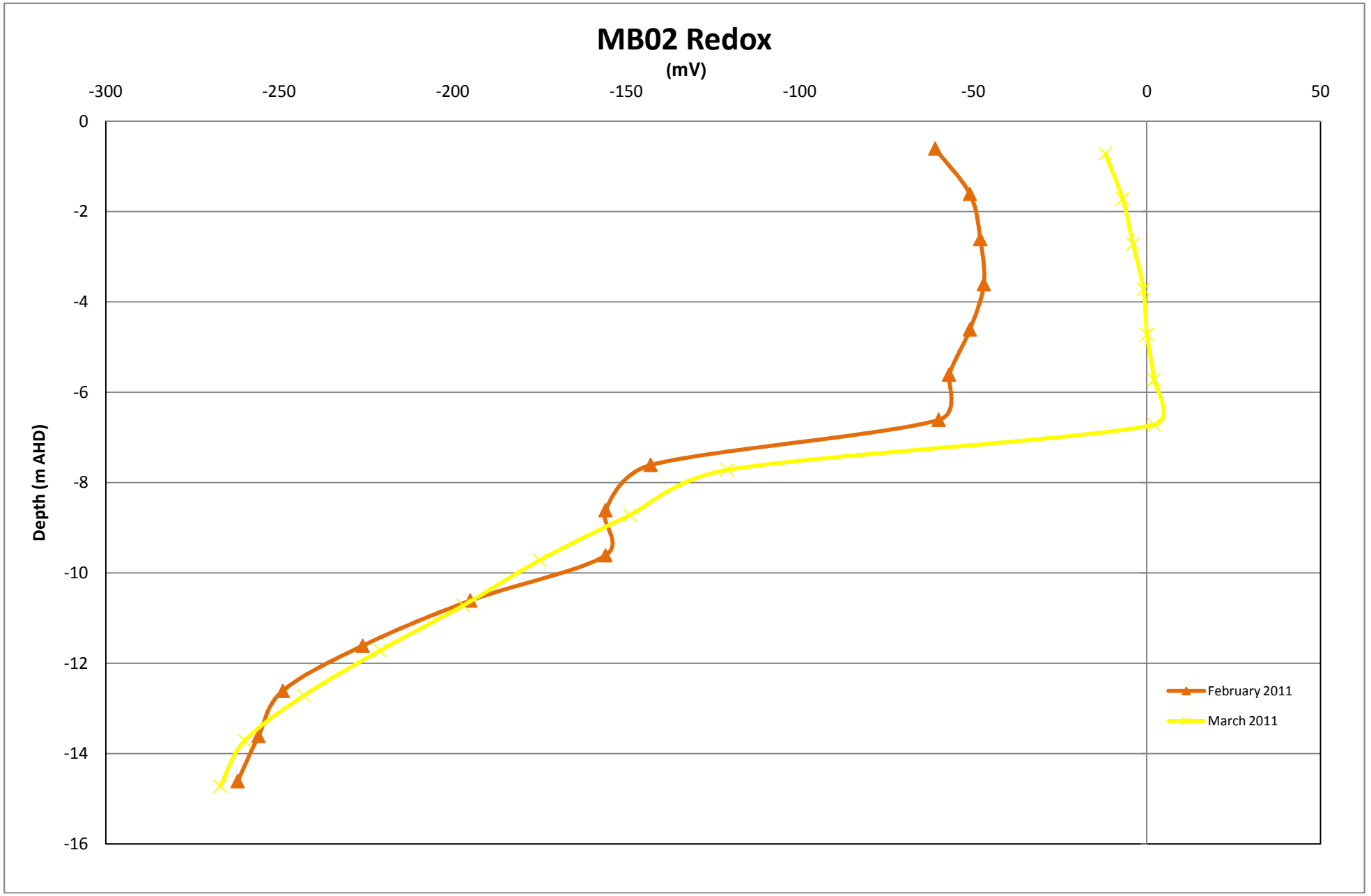
MWH

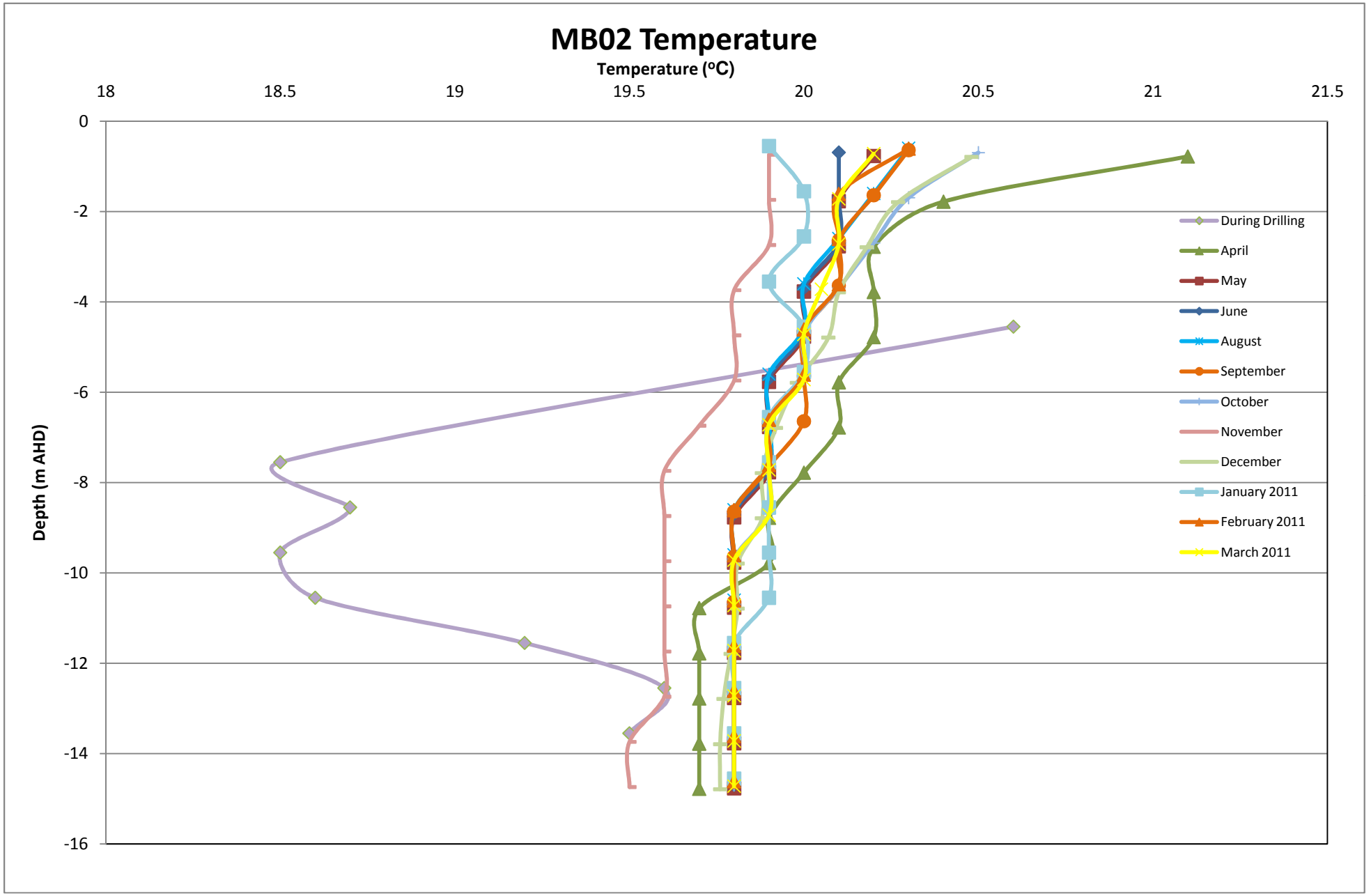
MB02


MB02 DO
Dissolved Oxygen (mg/L)
0
1
2
3
4
5
6
7
8
Depth (m AHD)
0
-2
-4
-6
-8
-10
-12
-14
-16
May
June
August
September
October
December
January 2011
February 2011
March 2011


MB02 EC
Electrical Conductivity (µS/cm)
0
2000
4000
6000
8000
10000
12000
14000
Depth (m AHD)
0
-2
-4
-6
-8
-10
-12
-14
-16
During Drilling
April
May
June
August
September
October
November
December
January 2011
February 2011
March 2011

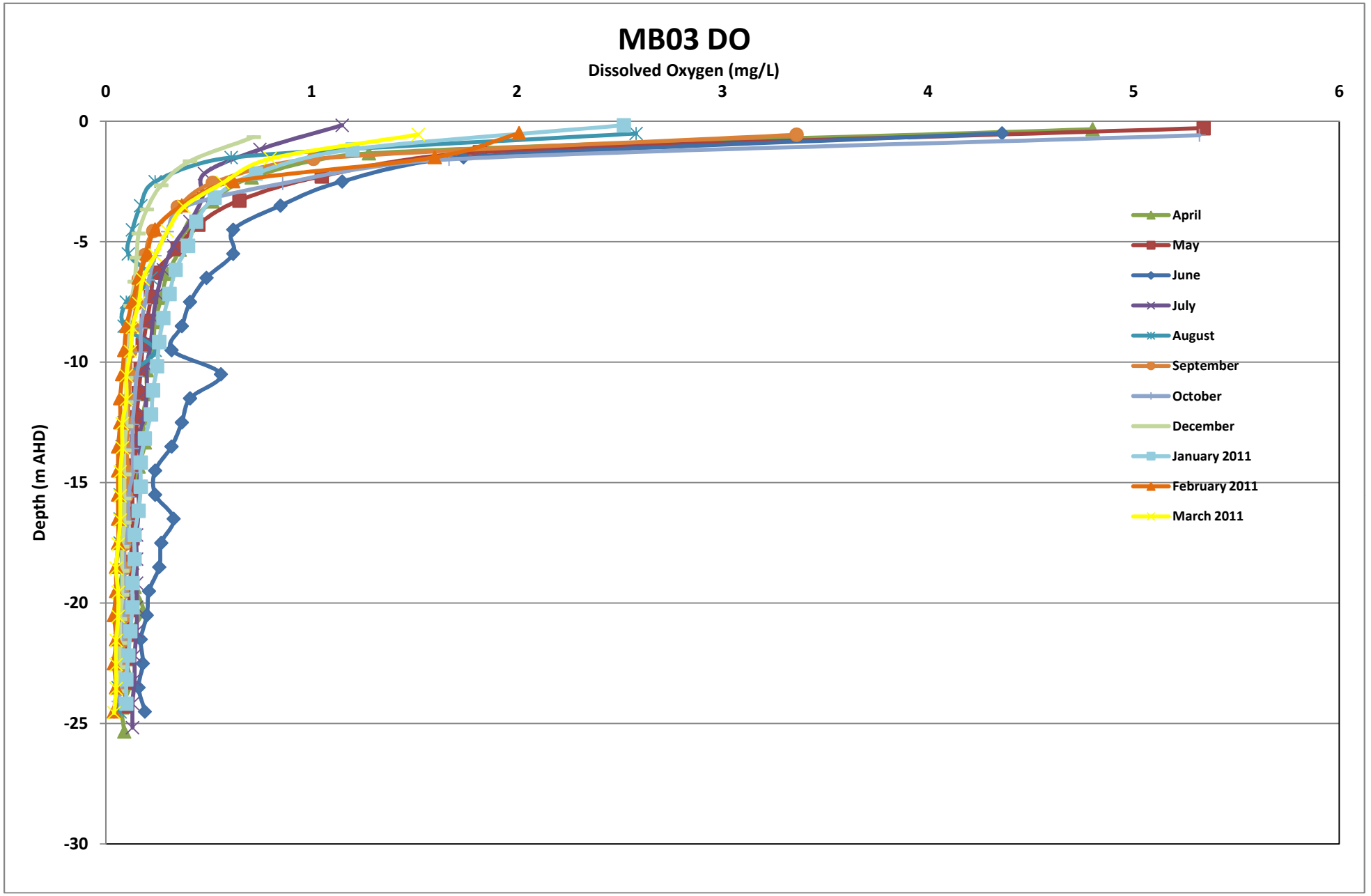

MB02 pH
pH
7.20
7.40
7.60
7.80
8.00
8.20
8.40
0
-2
-4
-6
-8
-10
-12
-14
-16
Depth (m AHD)
During Drilling
May
June
August
September
October
November
December
January 2011
February 2011
March 2011

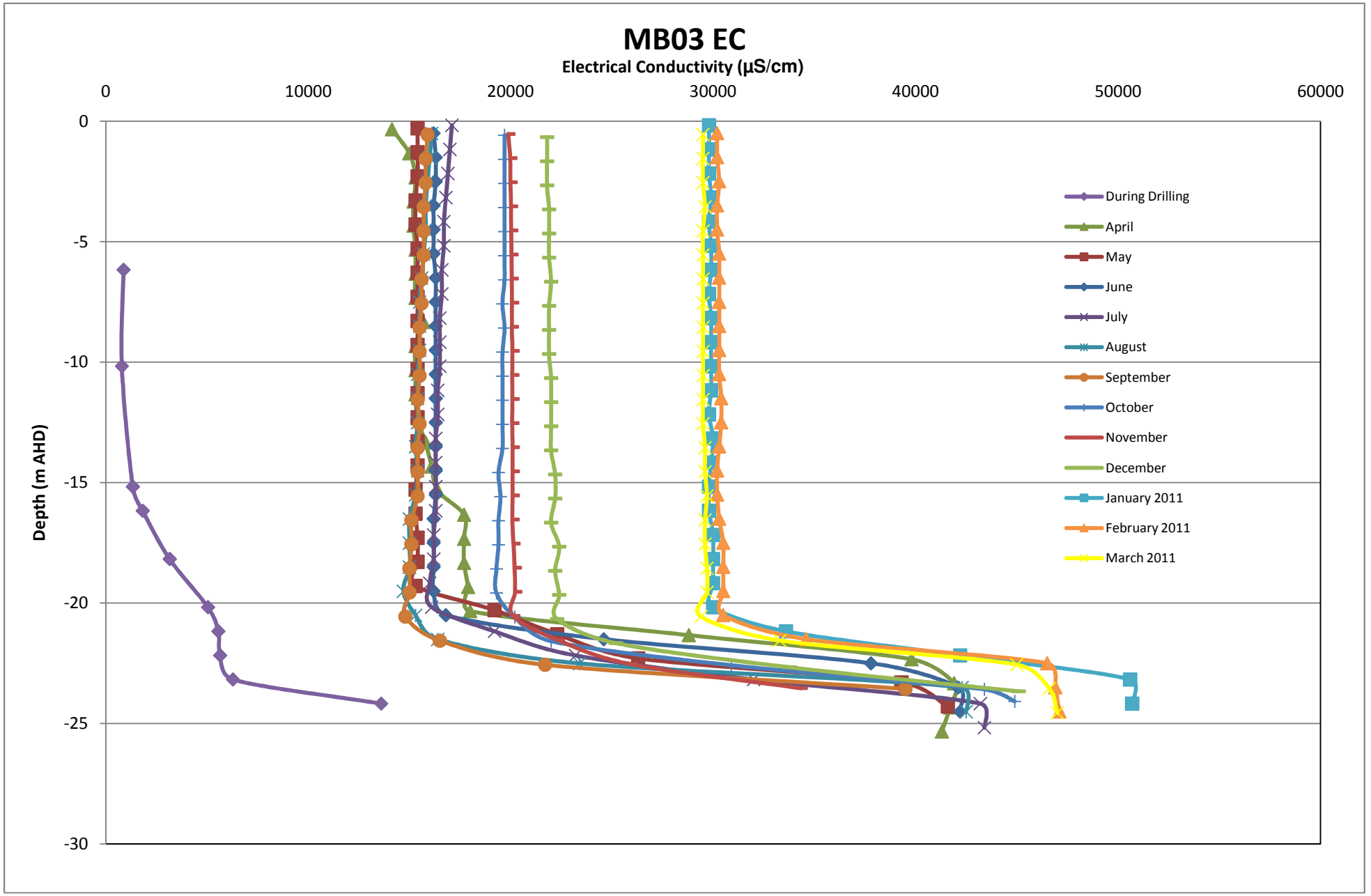

MB02 Redox
(mV)
-300
-250
-200
-150
-100
-50
0
50
0
-2
-4
-6
-8
-10
-12
-14
-16
Depth (m AHD)
February 2011
March 2011

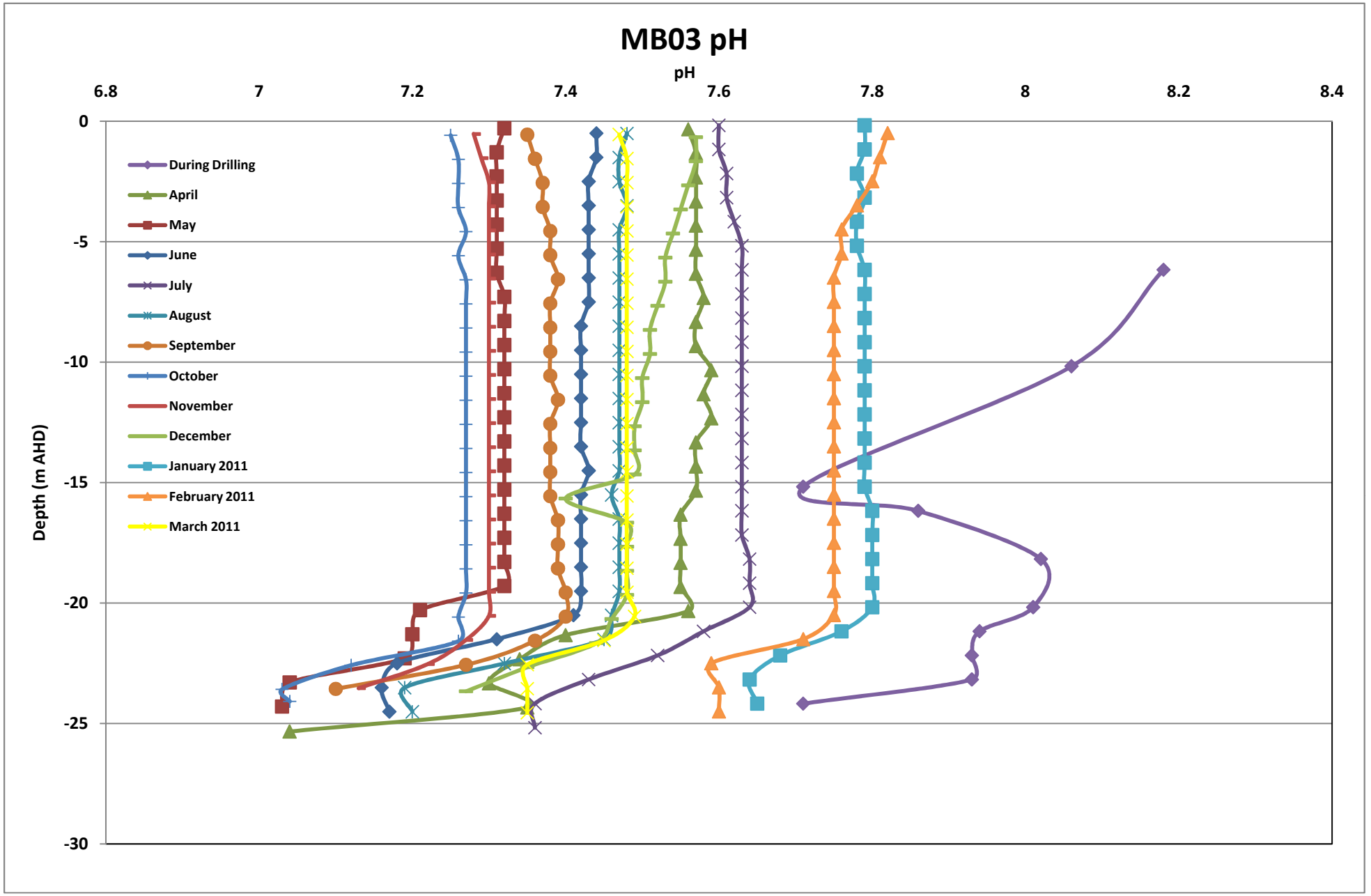

MB02 Temperature
Temperature (ºC)
18
18.5
19
19.5
20
20.5
21
21.5
0
-2
-4
-6
-8
-10
-12
-14
-16
Depth (m AHD)
During Drilling
April
May
June
August
September
October
November
December
January 2011
February 2011
March 2011

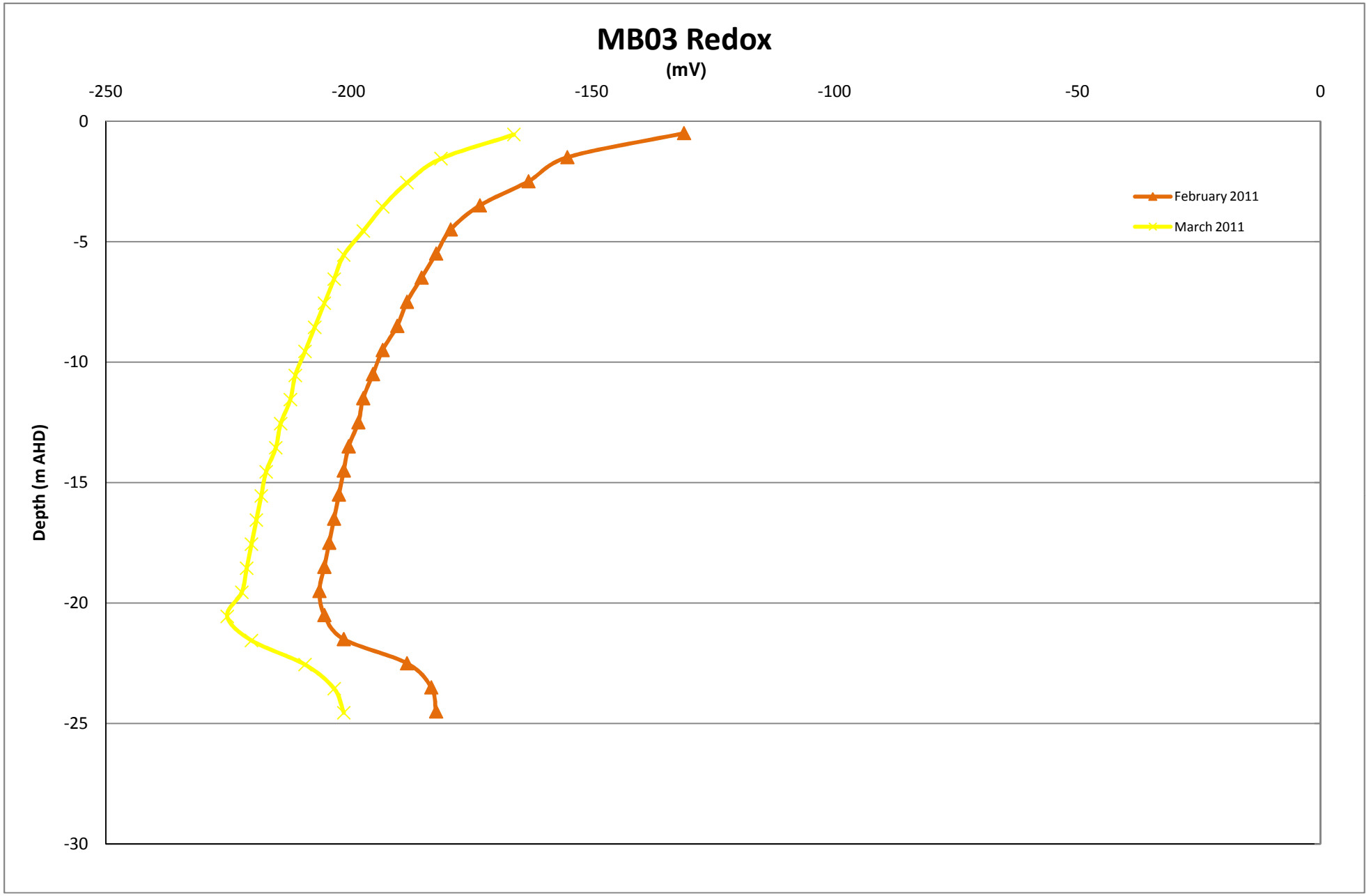
MWH

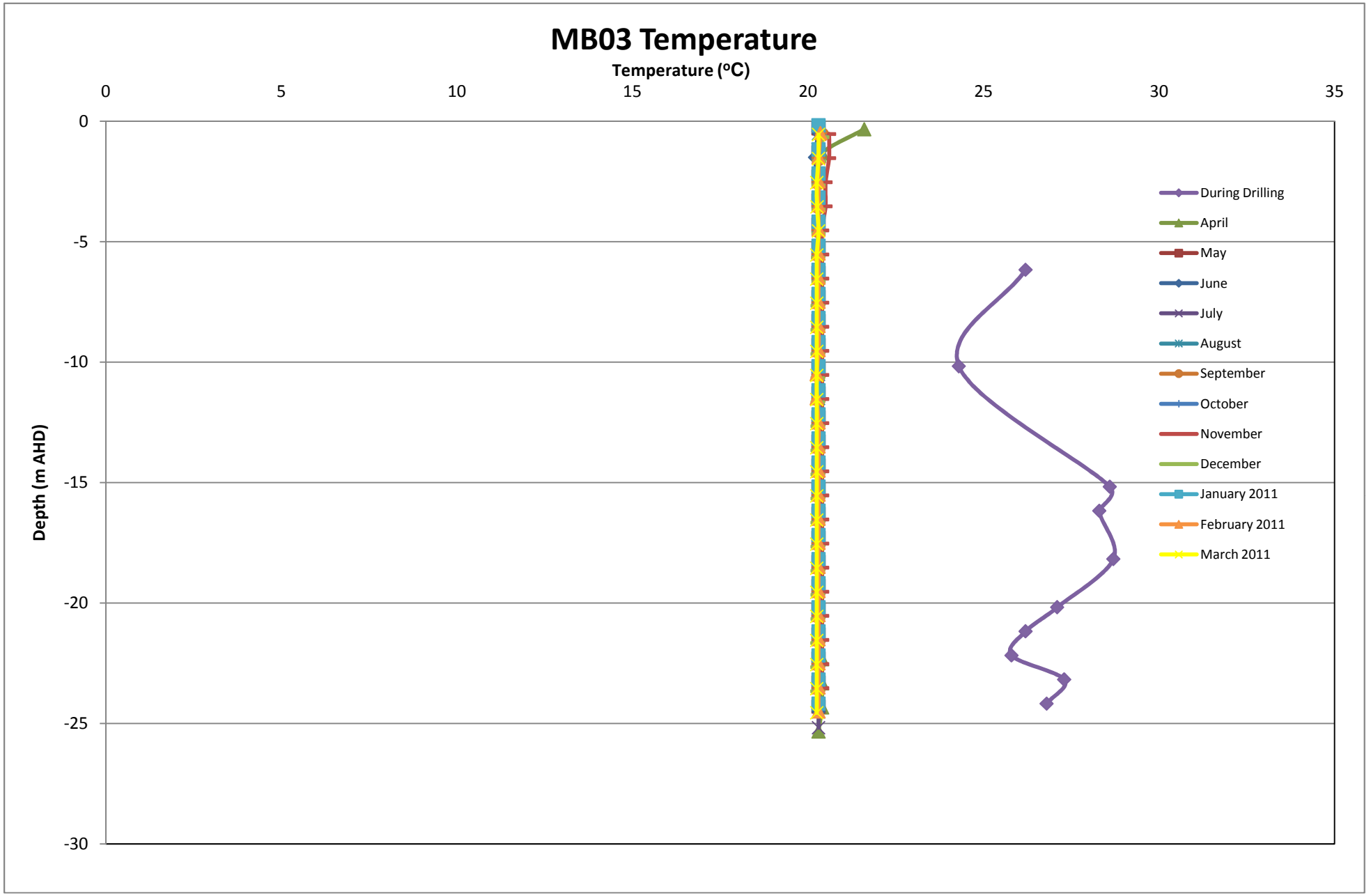
MB03


MB03 DO
Dissolved Oxygen (mg/L)
0
1
2
3
4
5
6
Depth (m AHD)
0
-5
-10
-15
-20
-25
-30
April
May
June
July
August
September
October
December
January 2011
February 2011
March 2011


MB03 EC
Electrical Conductivity (µS/cm)
0
10000
20000
30000
40000
50000
60000
Depth (m AHD)
0
-5
-10
-15
-20
-25
-30
During Drilling
April
May
June
July
August
September
October
November
December
January 2011
February 2011
March 2011

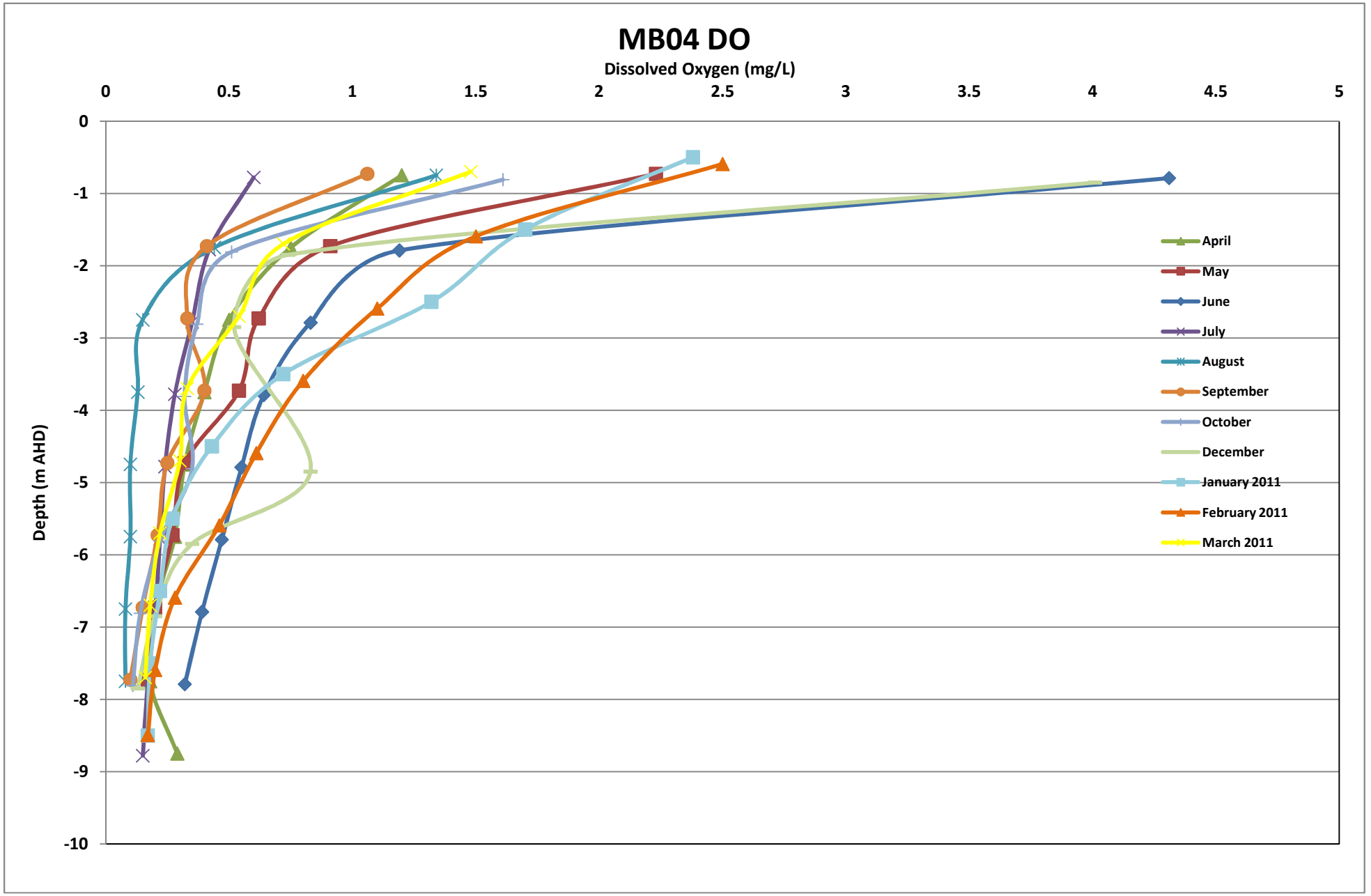

MB03 pH
pH
6.8
7
7.2
7.4
7.6
7.8
8
8.2
8.4
0
-5
-10
-15
-20
-25
-30
Depth (m AHD)
During Drilling
April
May
June
July
August
September
October
November
December
January 2011
February 2011
March 2011

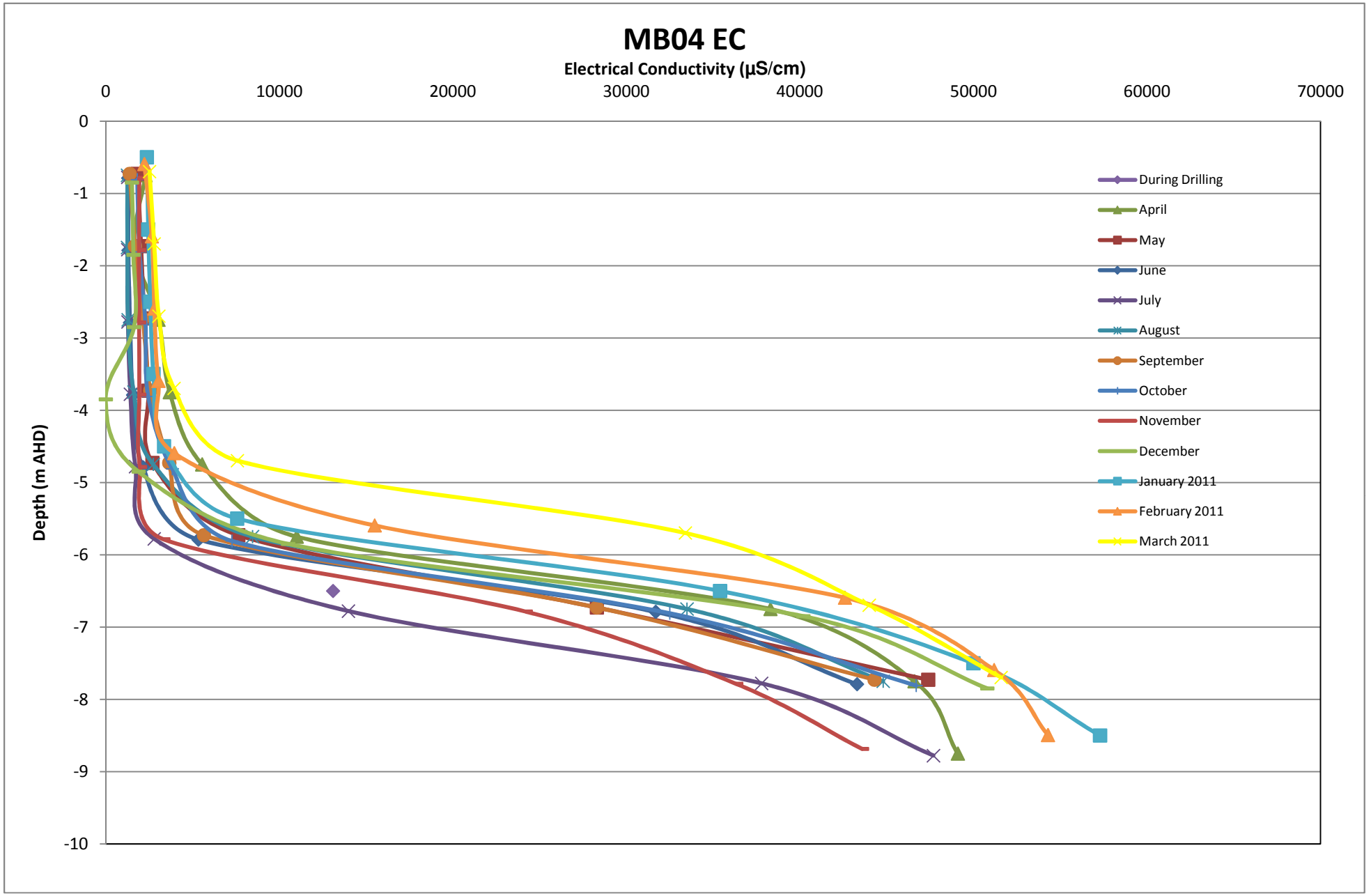

MB03 Redox
(mV)
-250
-200
-150
-100
-50
0
0
-5
-10
-15
-20
-25
-30
Depth (m AHD)
February 2011
March 2011

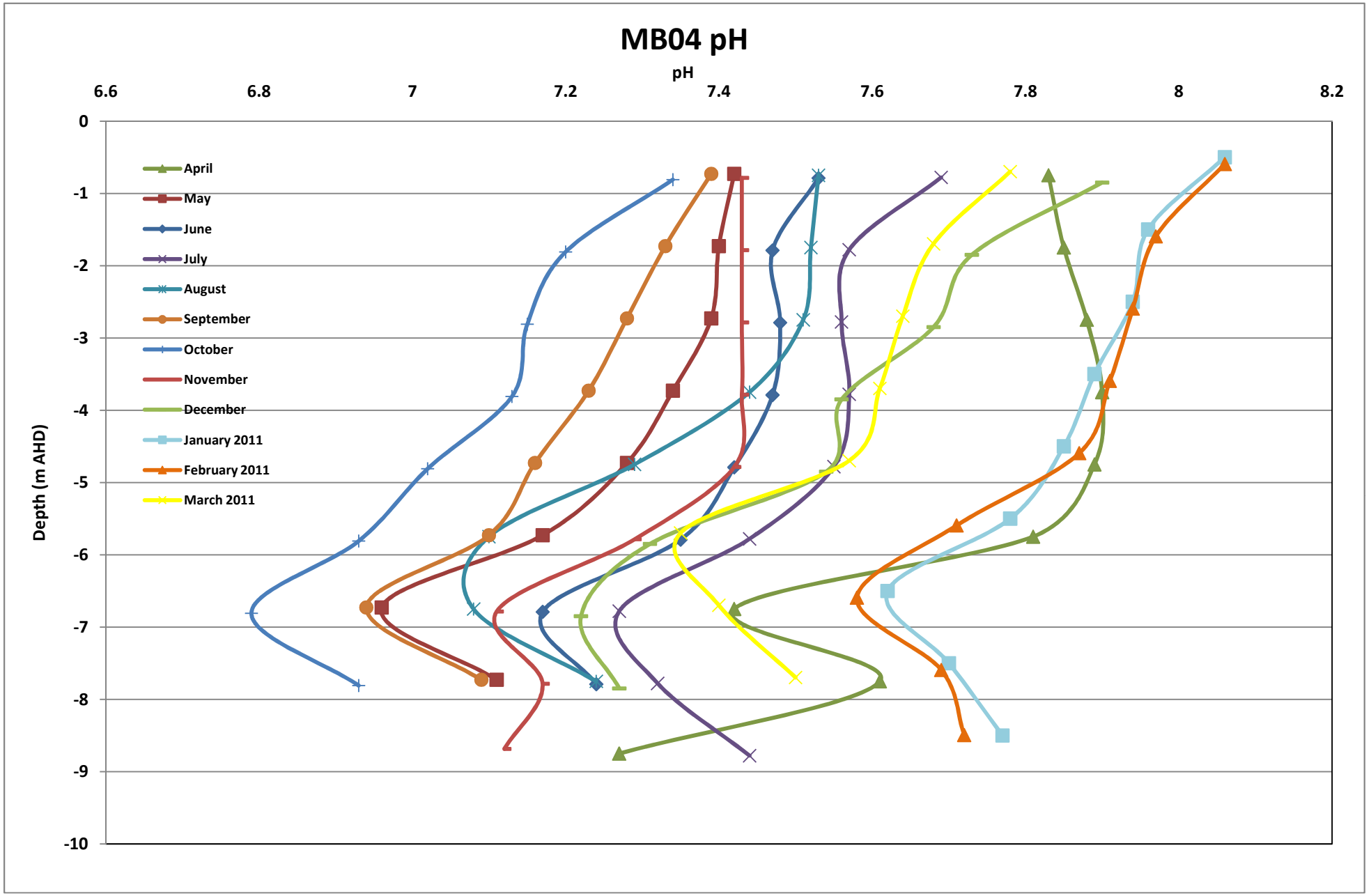

MB03 Temperature
Temperature (ºC)
0
5
10
15
20
25
30
35
Depth (m AHD)
0
-5
-10
-15
-20
-25
-30
During Drilling
April
May
June
July
August
September
October
November
December
January 2011
February 2011
March 2011

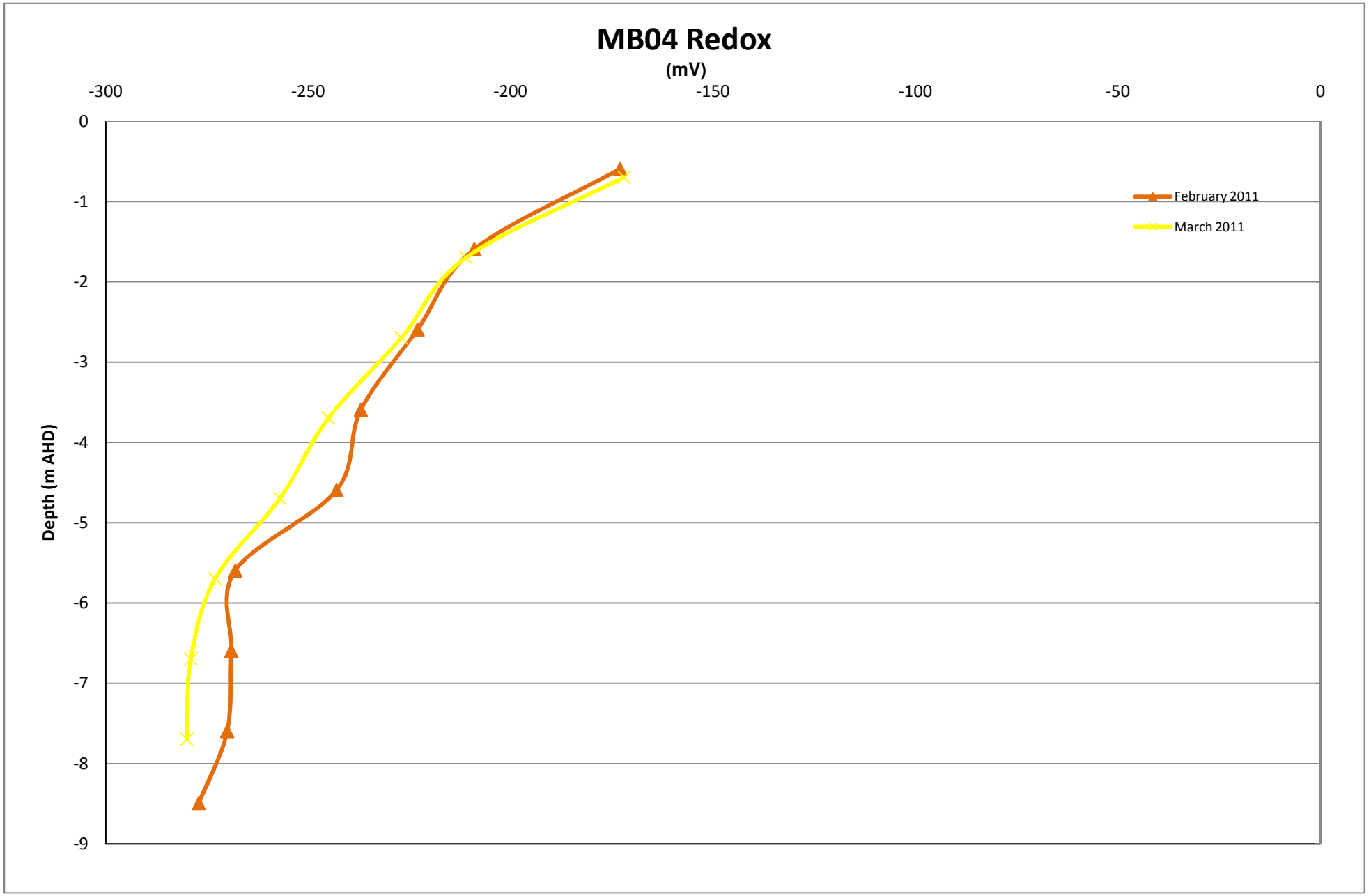
MWH

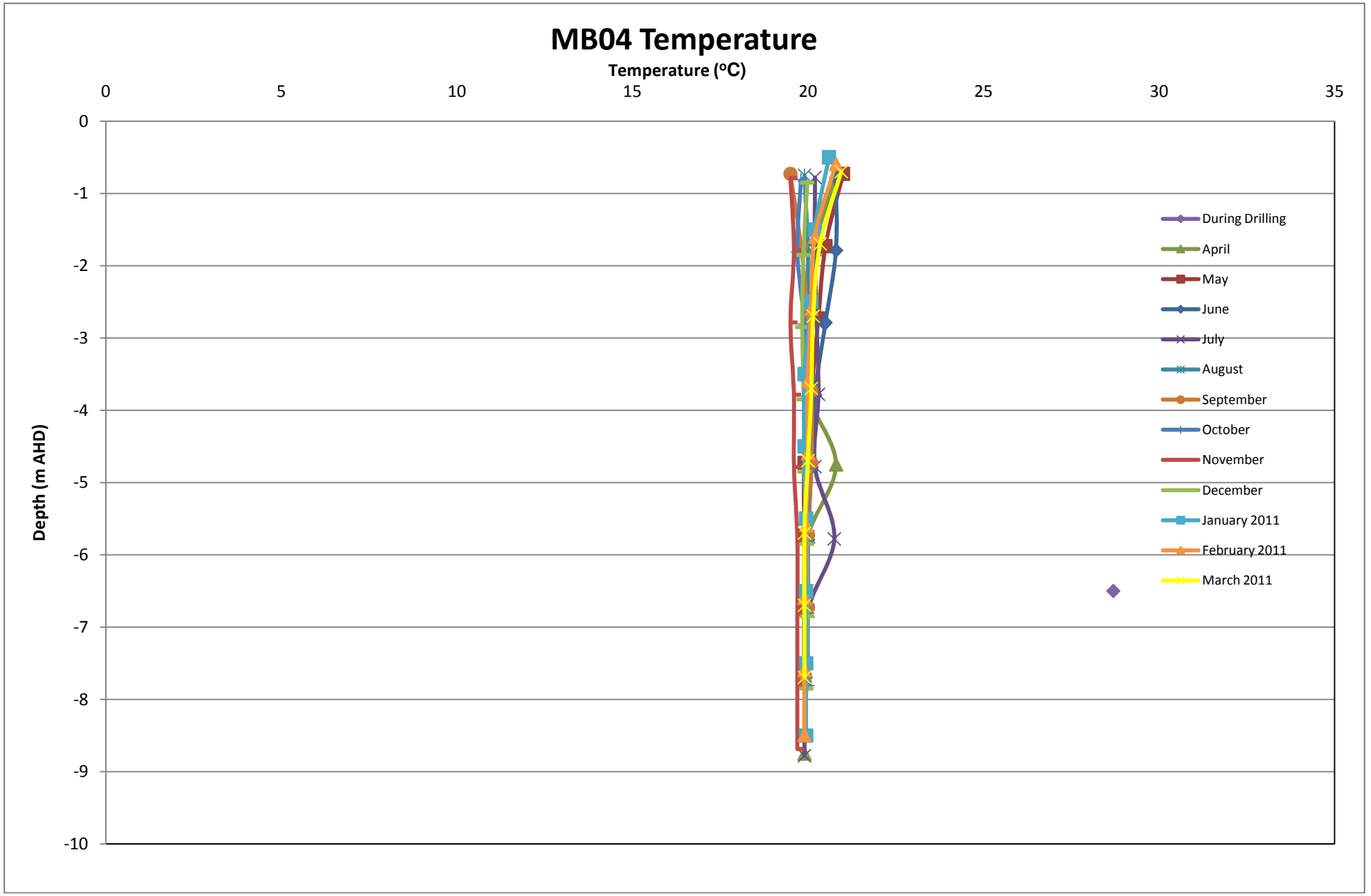
MB04


MB04 DO
Dissolved Oxygen (mg/L)
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
Depth (m AHD)
0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
April
May
June
July
August
September
October
December
January 2011
February 2011
March 2011


MB04 EC
Electrical Conductivity (µS/cm)
0
10000
20000
30000
40000
50000
60000
70000
Depth (m AHD)
0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
During Drilling
April
May
June
July
August
September
October
November
December
January 2011
February 2011
March 2011

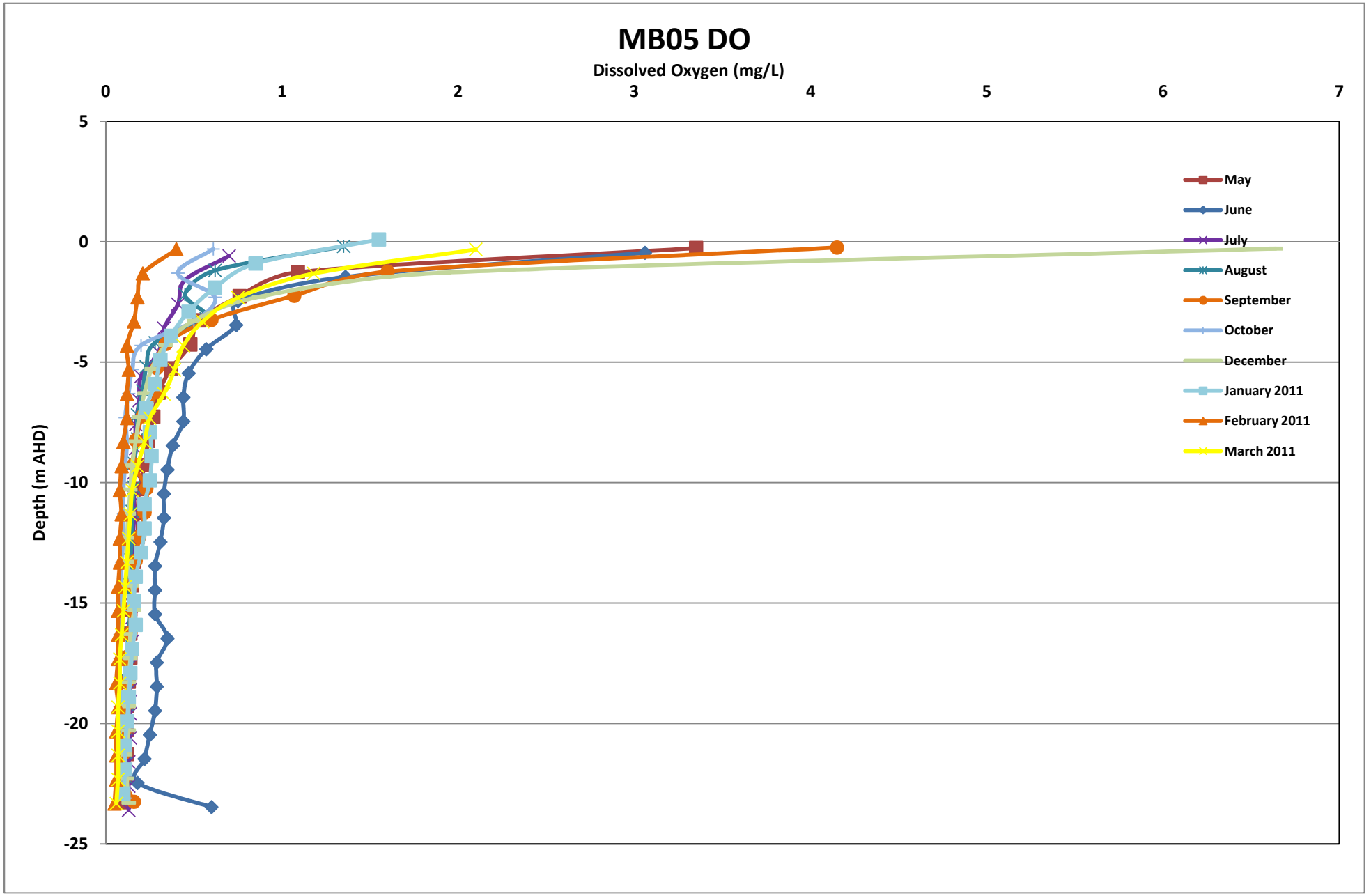

MB04 pH
pH
6.6
6.8
7
7.2
7.4
7.6
7.8
8
8.2
Depth (m AHD)
0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
April
May
June
July
August
September
October
November
December
January 2011
February 2011
March 2011

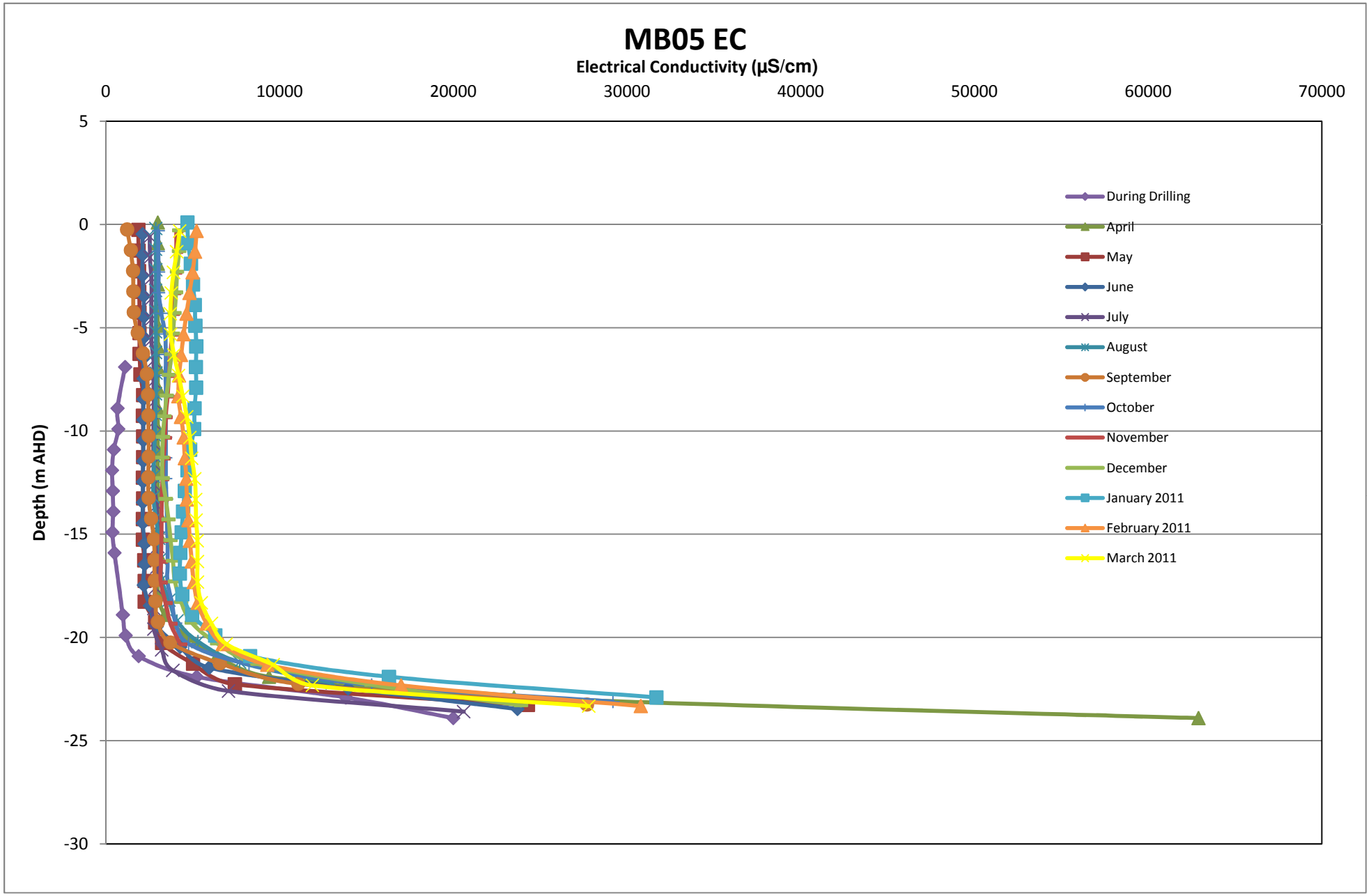

MB04 Redox
(mV)
-300
-250
-200
-150
-100
-50
0
0
-1
-2
-3
-4
-5
-6
-7
-8
-9
Depth (m AHD)
February 2011
March 2011

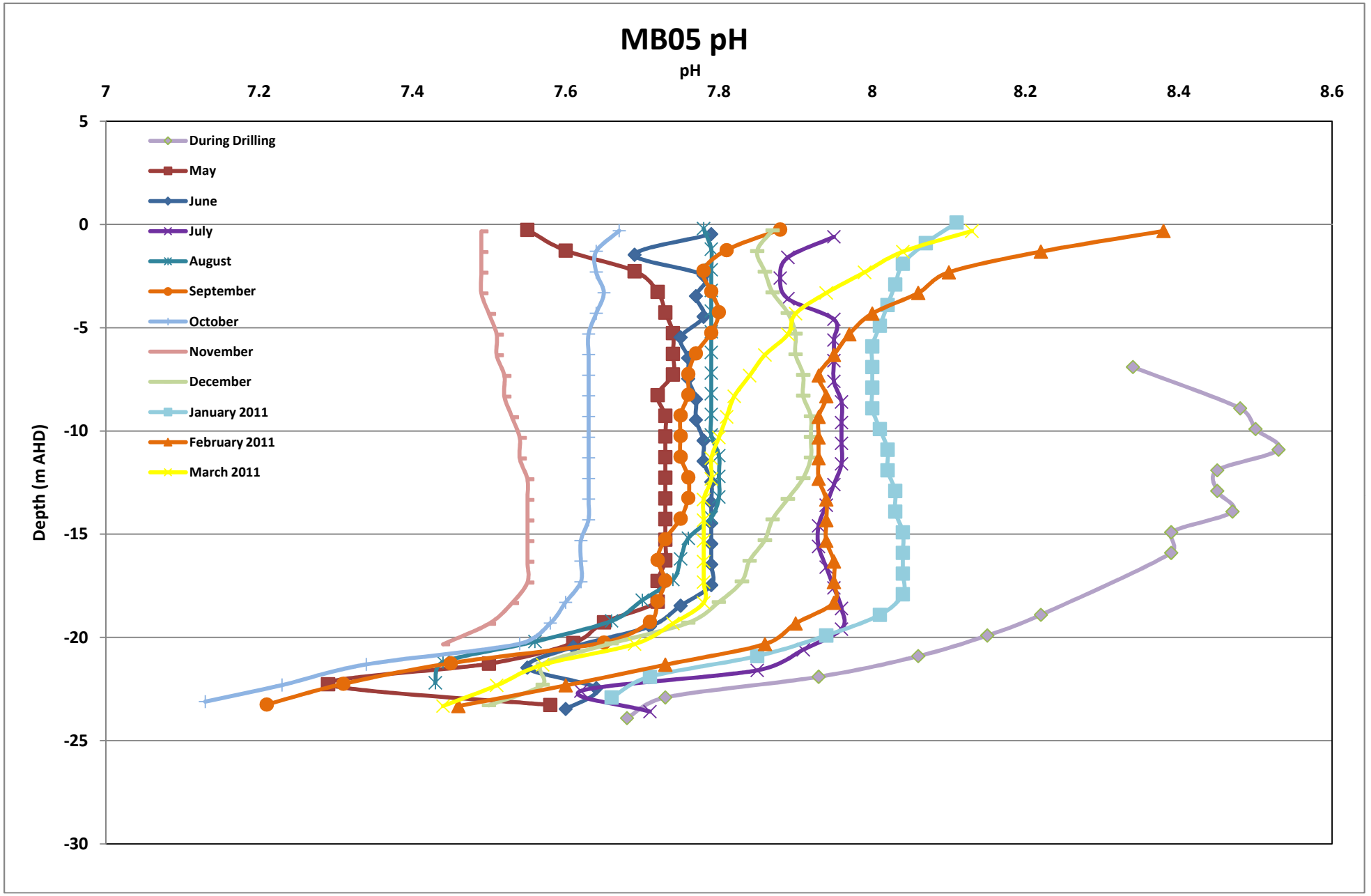

MB04 Temperature
Temperature (°C)
0
5
10
15
20
25
30
35
Depth (m AHD)
0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
During Drilling
April
May
June
July
August
September
October
November
December
January 2011
February 2011
March 2011

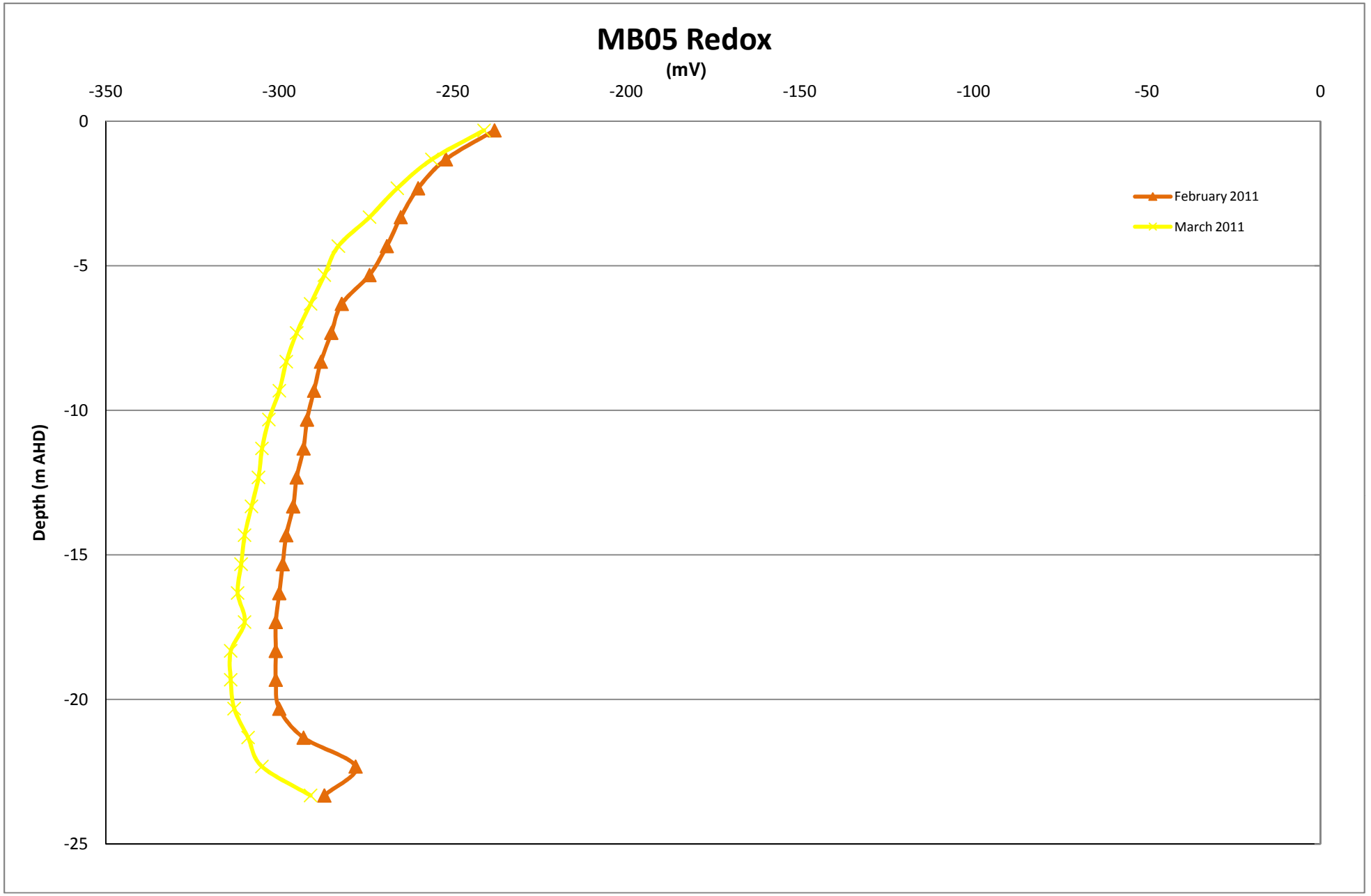
MWH

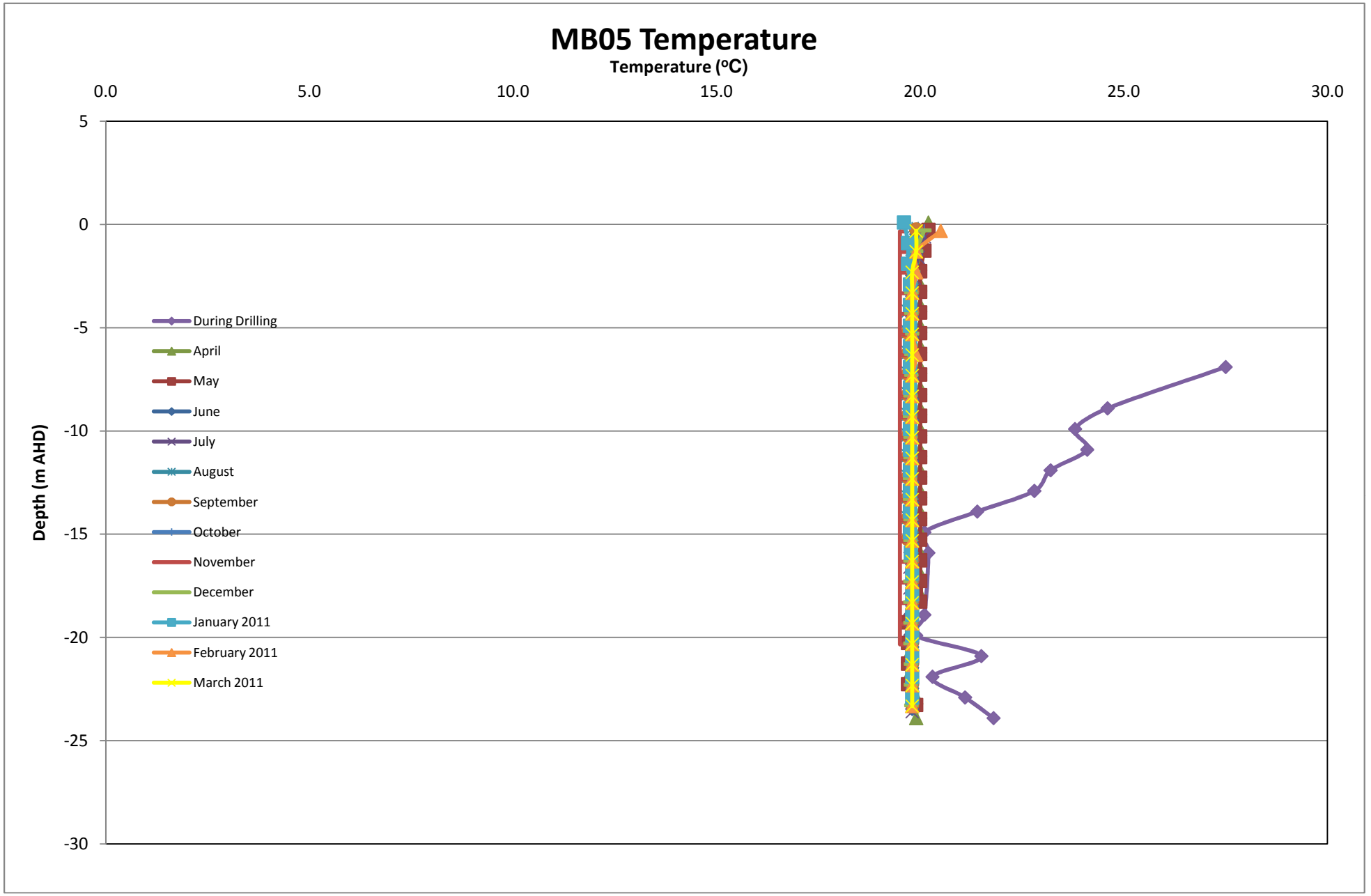
MB05


MB05 DO
Dissolved Oxygen (mg/L)
0
1
2
3
4
5
6
7
5
0
-5
-10
-15
-20
-25
Depth (m AHD)
May
June
July
August
September
October
December
January 2011
February 2011
March 2011


MB05 EC
Electrical Conductivity (µS/cm)
0
10000
20000
30000
40000
50000
60000
70000
5
0
-5
-10
-15
-20
-25
-30
Depth (m AHD)
During Drilling
April
May
June
July
August
September
October
November
December
January 2011
February 2011
March 2011

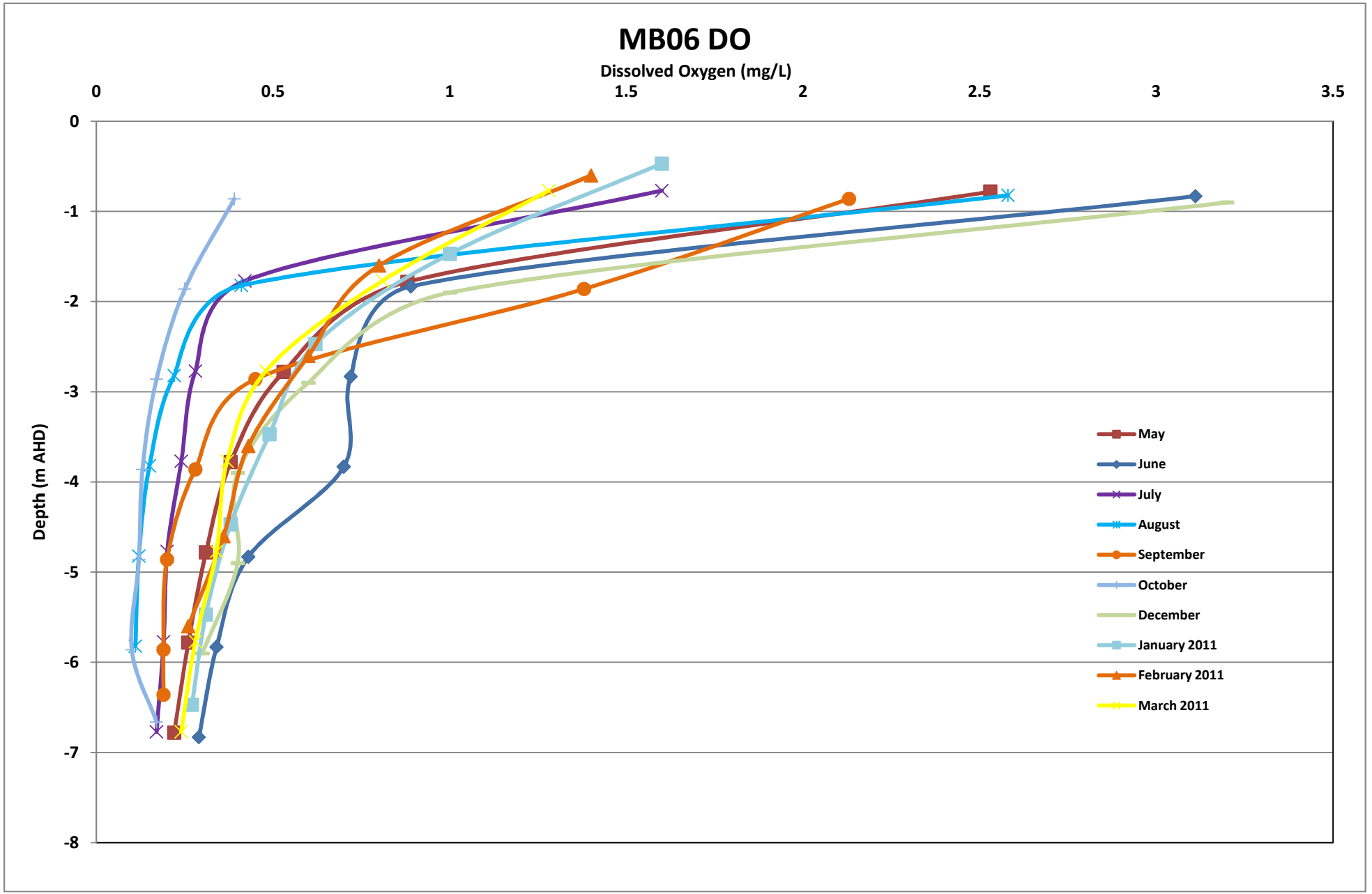

MB05 pH
pH
7
7.2
7.4
7.6
7.8
8
8.2
8.4
8.6
Depth (m AHD)
5
0
-5
-10
-15
-20
-25
-30
During Drilling
May
June
July
August
September
October
November
December
January 2011
February 2011
March 2011

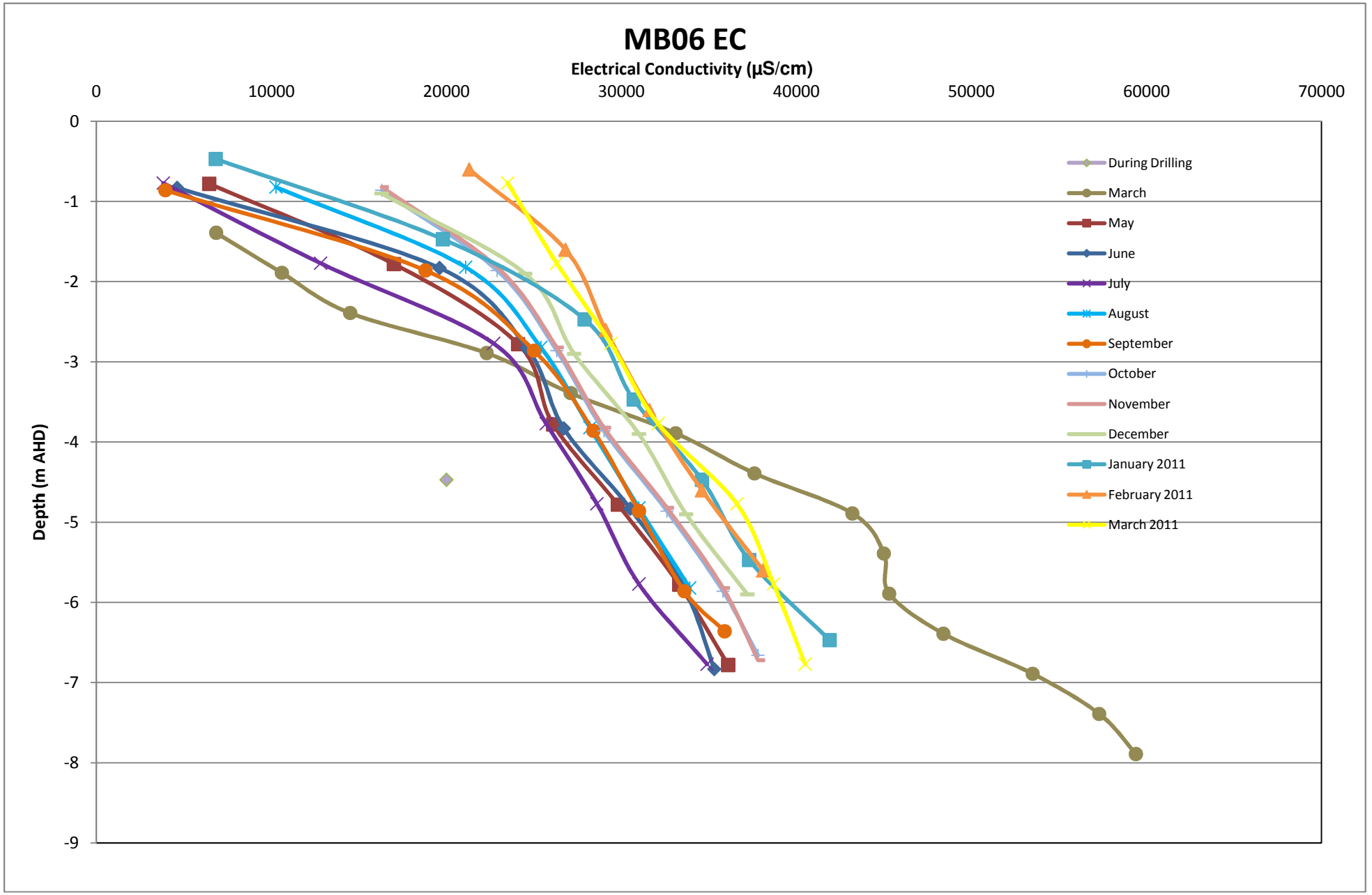

MB05 Redox
(mV)
-350
-300
-250
-200
-150
-100
-50
0
0
-5
-10
-15
-20
-25
Depth (m AHD)
February 2011
March 2011

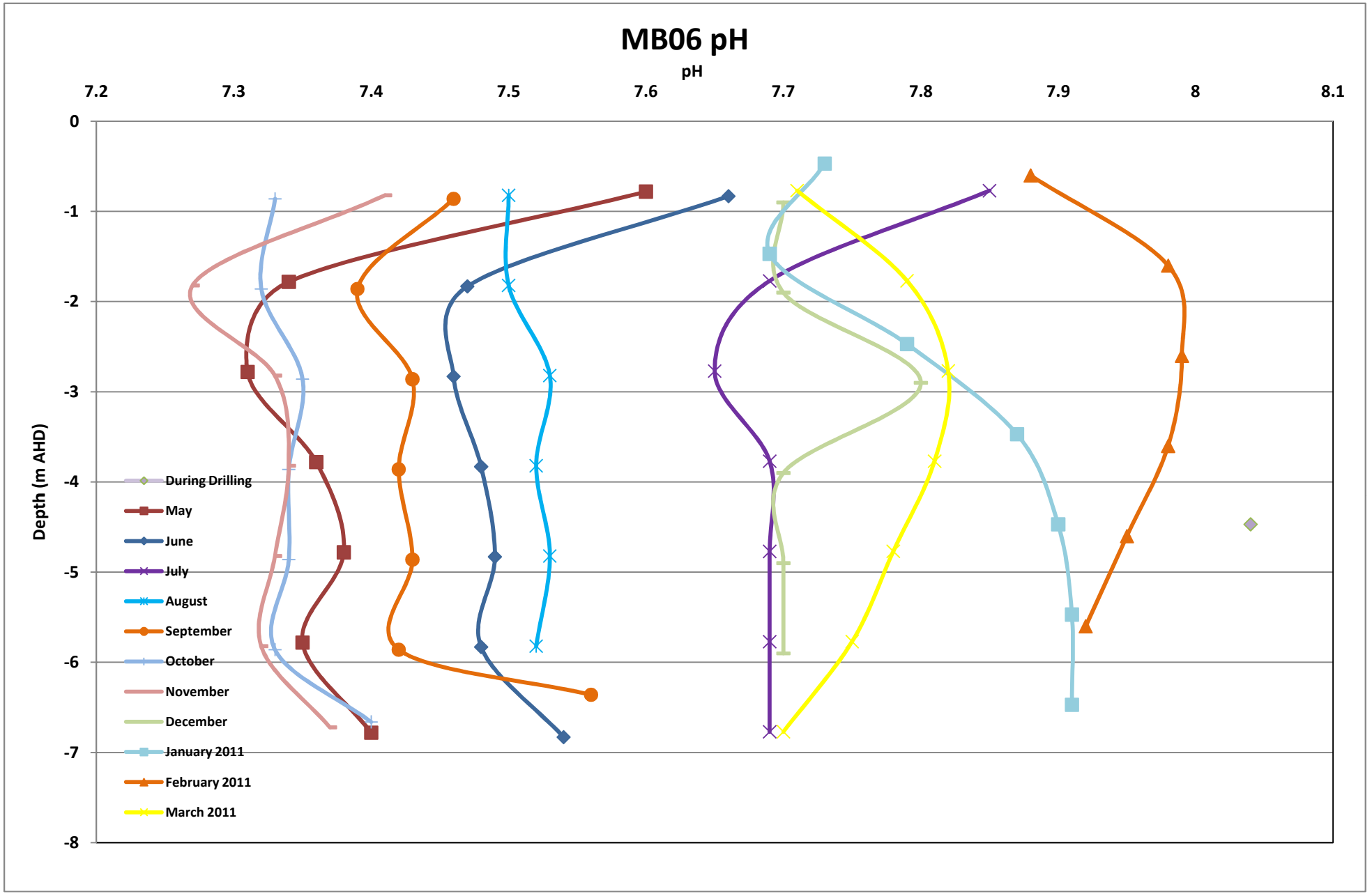

MB05 Temperature
Temperature (°C)
0.0
5.0
10.0
15.0
20.0
25.0
30.0
5
0
-5
-10
-15
-20
-25
-30
Depth (m AHD)
During Drilling
April
May
June
July
August
September
October
November
December
January 2011
February 2011
March 2011

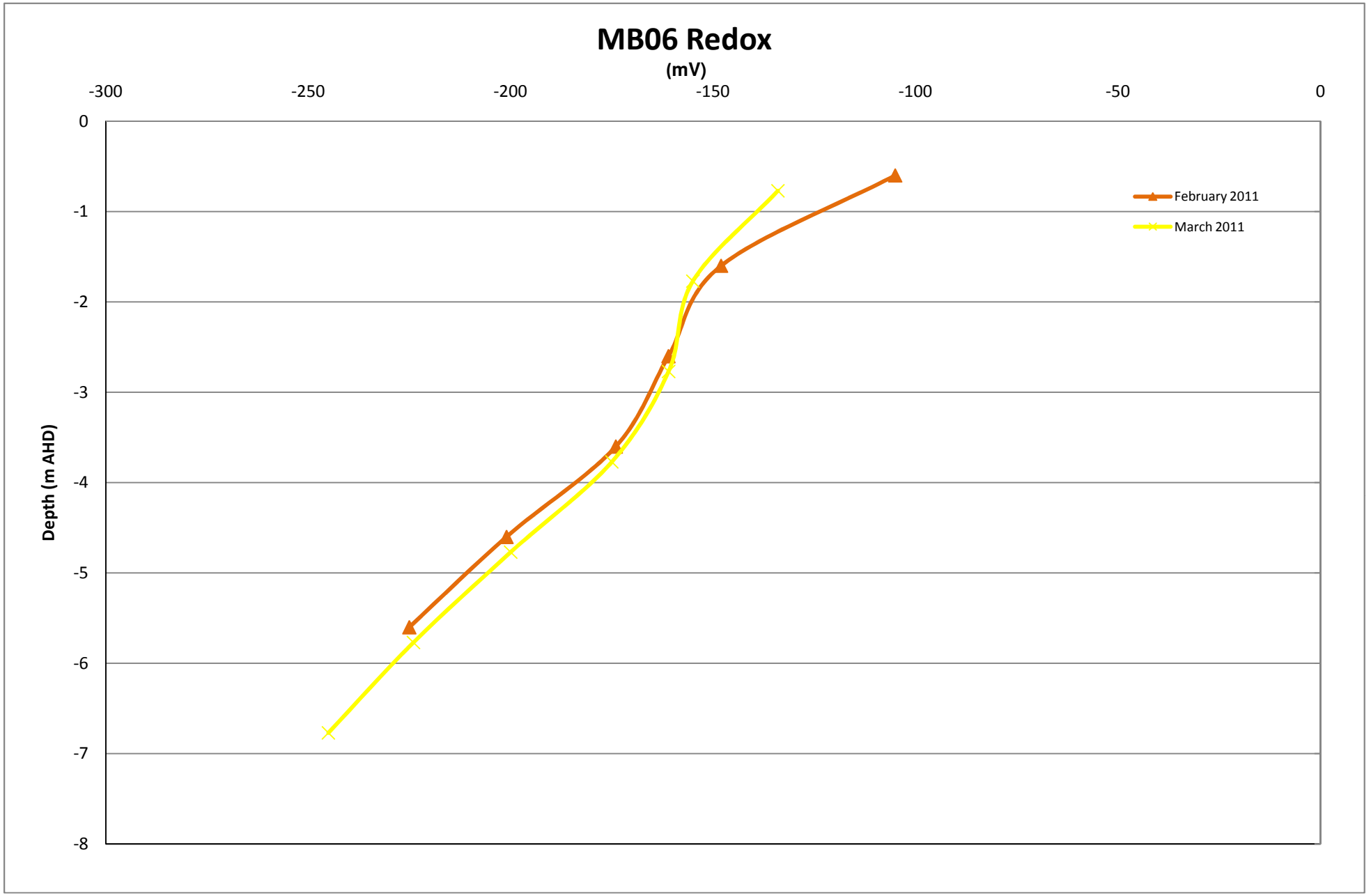
MWH

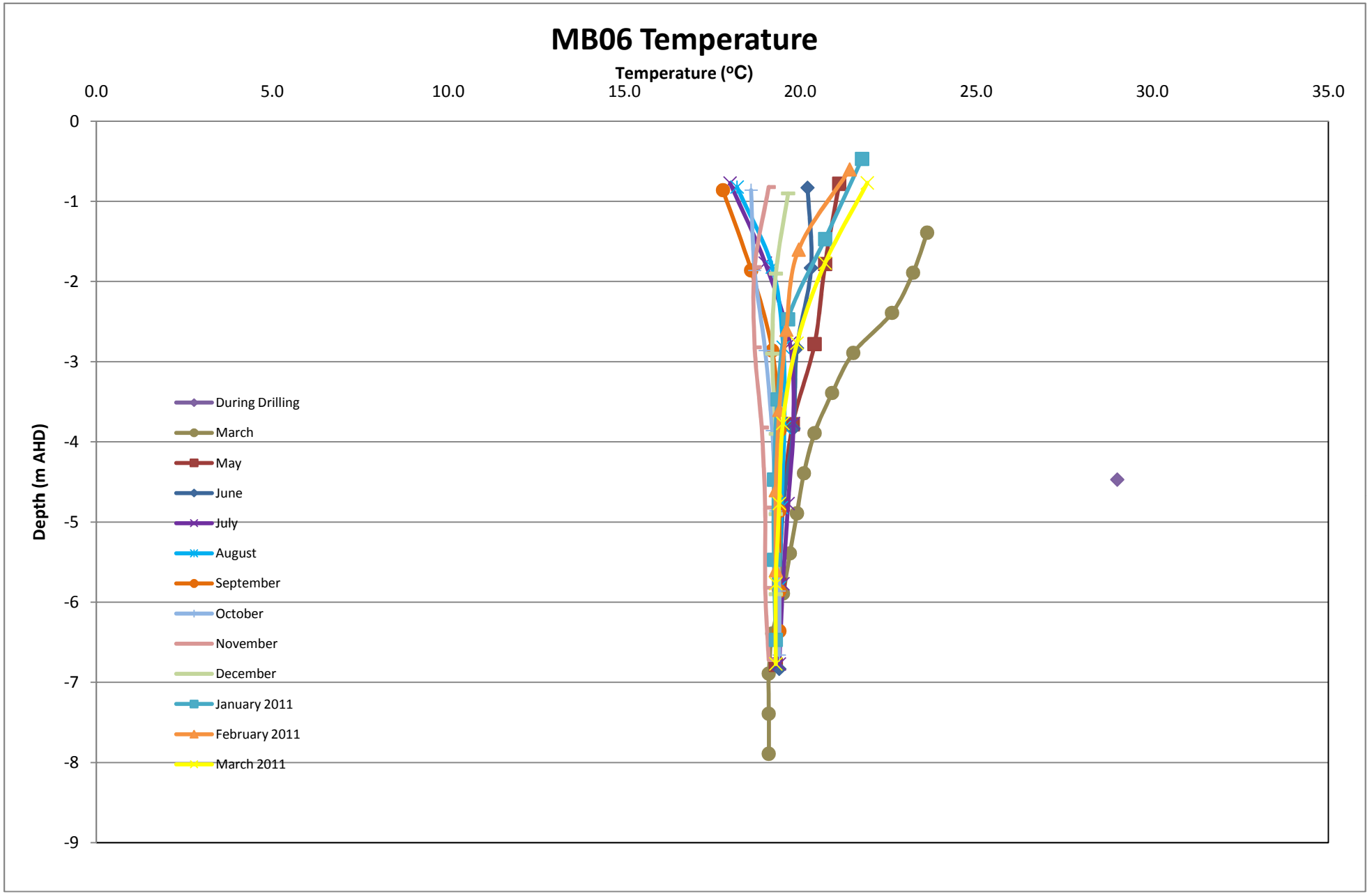
MB06


MB06 DO
Dissolved Oxygen (mg/L)
0
0.5
1
1.5
2
2.5
3
3.5
Depth (m AHD)
0
-1
-2
-3
-4
-5
-6
-7
-8
May
June
July
August
September
October
December
January 2011
February 2011
March 2011


MB06 EC
Electrical Conductivity (µS/cm)
0
10000
20000
30000
40000
50000
60000
70000
Depth (m AHD)
0
-1
-2
-3
-4
-5
-6
-7
-8
-9
During Drilling
March
May
June
July
August
September
October
November
December
January 2011
February 2011
March 2011

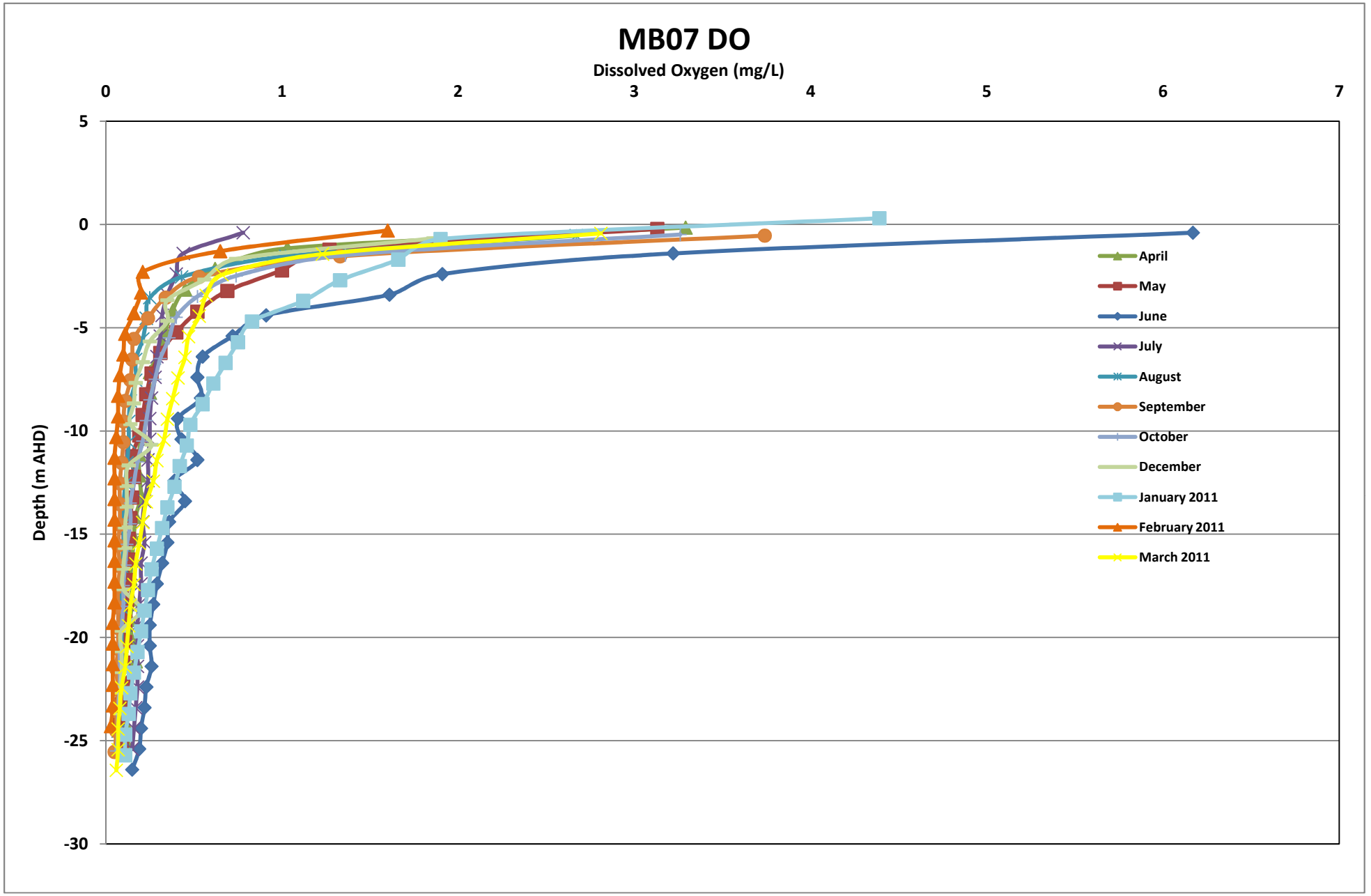

MB06 pH
pH
7.2
7.3
7.4
7.5
7.6
7.7
7.8
7.9
8
8.1
0
-1
-2
-3
-4
-5
-6
-7
-8
Depth (m AHD)
During Drilling
May
June
July
August
September
October
November
December
January 2011
February 2011
March 2011

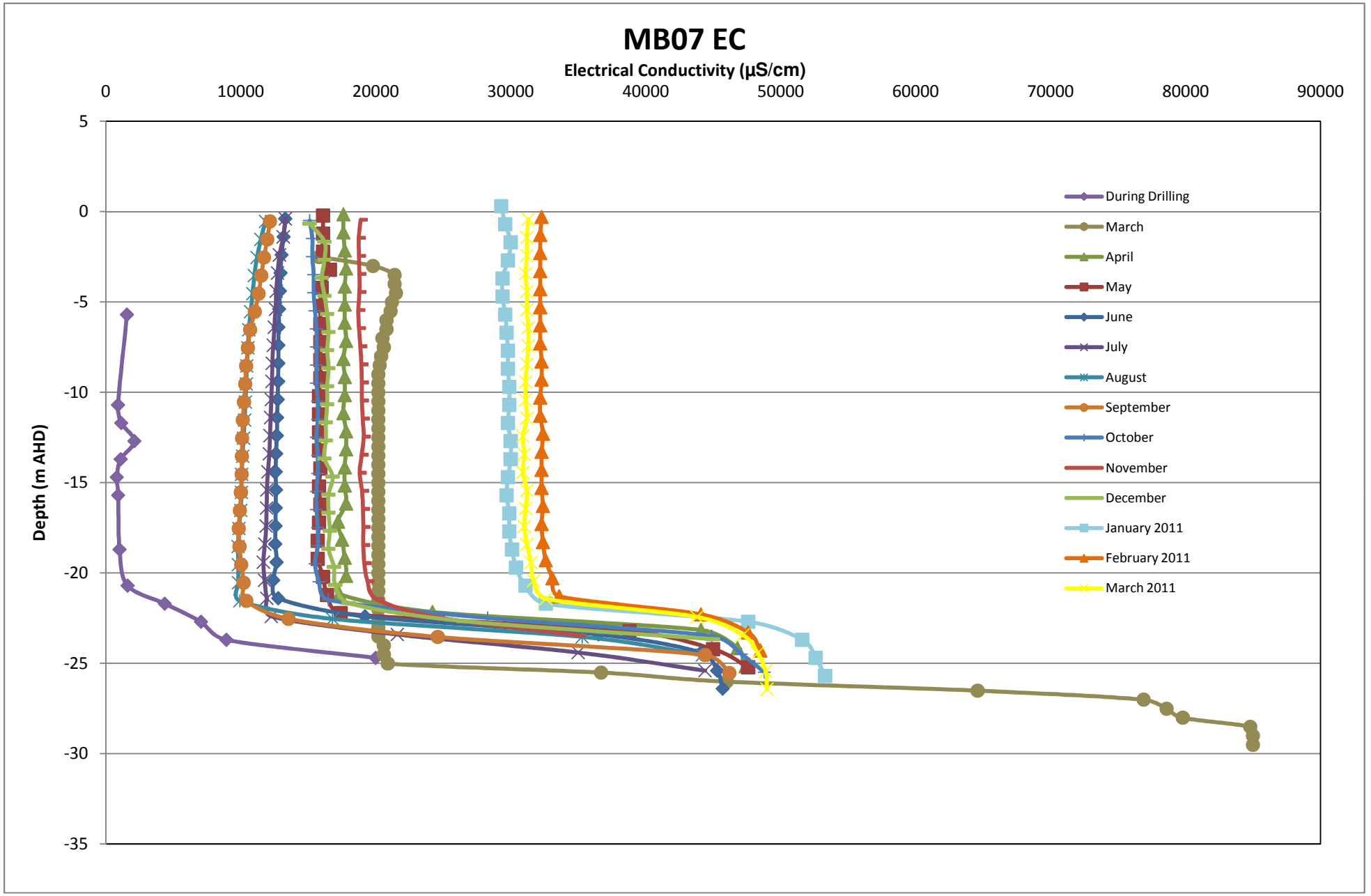

MB06 Redox
(mV)
-300
-250
-200
-150
-100
-50
0
0
-1
-2
-3
-4
-5
-6
-7
-8
Depth (m AHD)
February 2011
March 2011

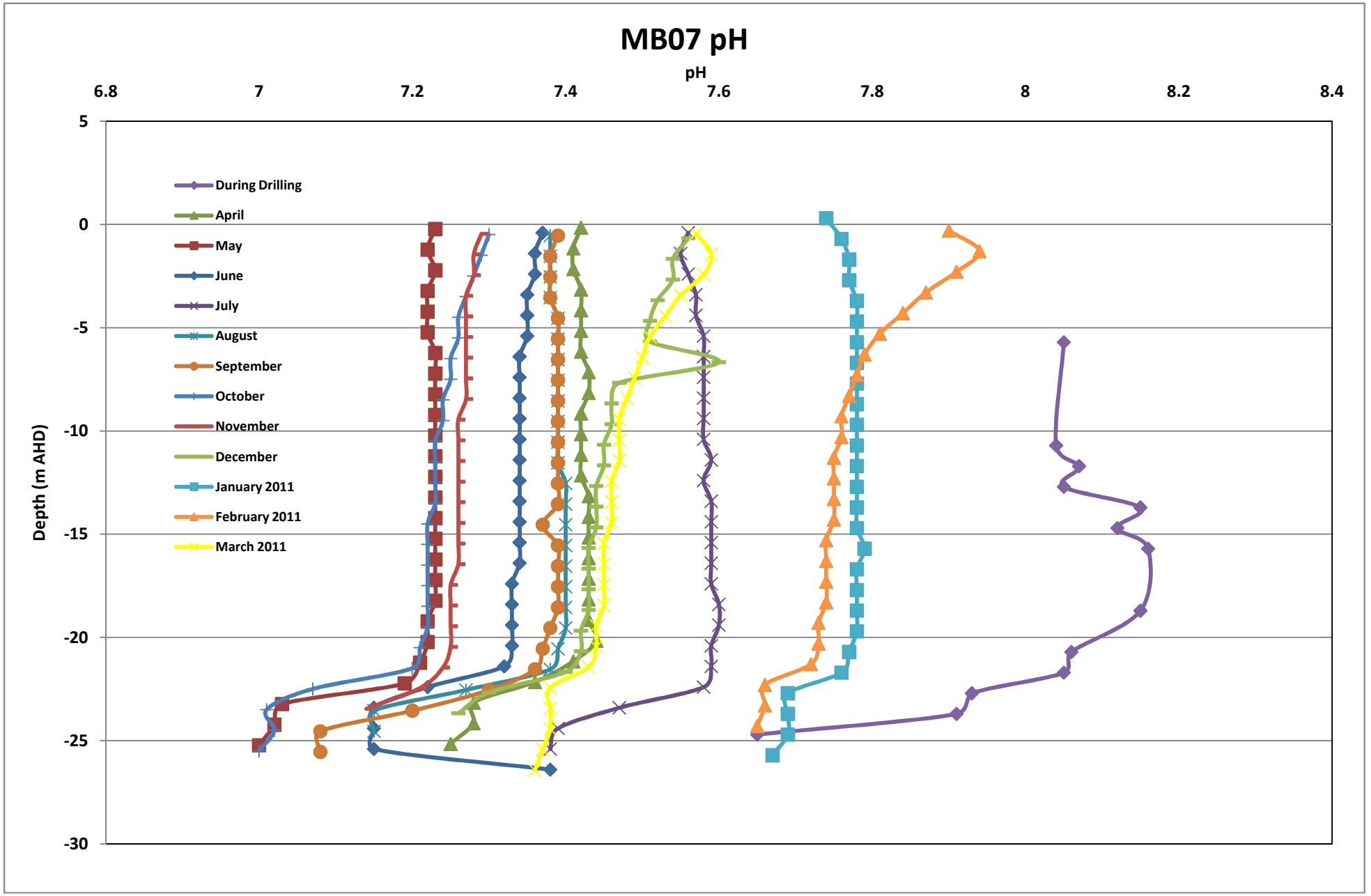

MB06 Temperature
Temperature (ºC)
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
0
-1
-2
-3
-4
-5
-6
-7
-8
-9
Depth (m AHD)
During Drilling
March
May
June
July
August
September
October
November
December
January 2011
February 2011
March 2011

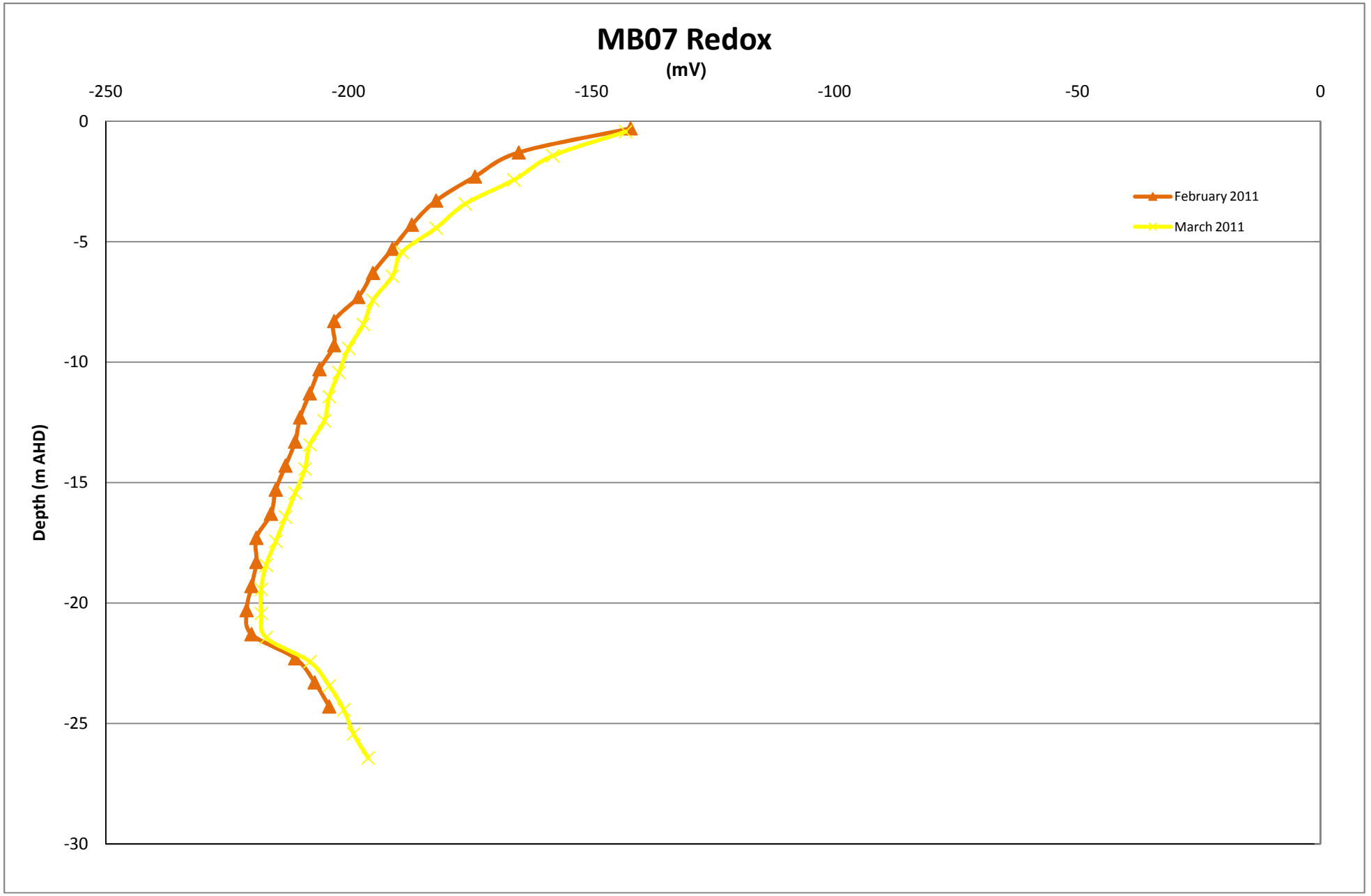
MWH

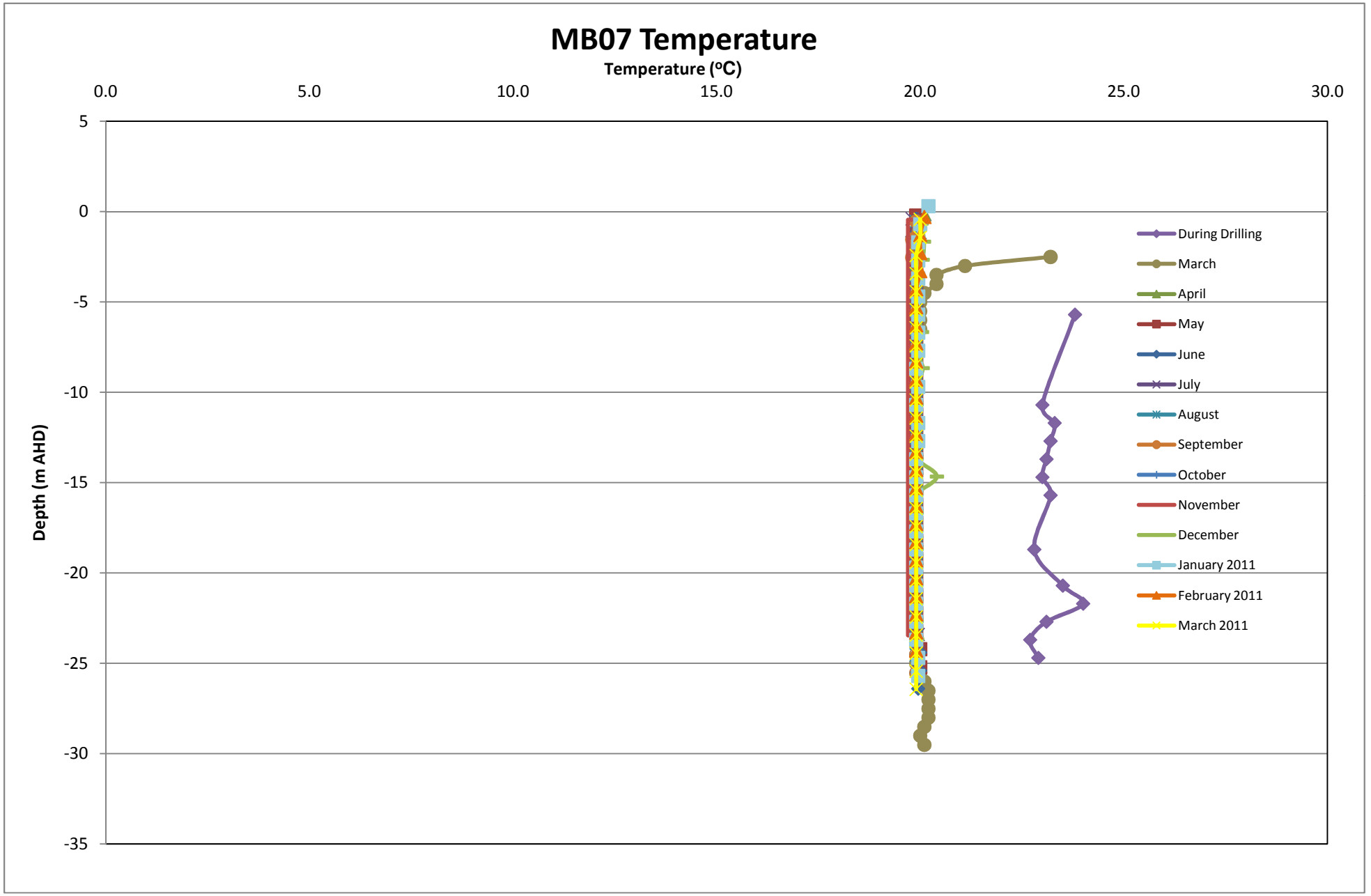
MB07


MB07 DO
Dissolved Oxygen (mg/L)
0
1
2
3
4
5
6
7
5
0
-5
-10
-15
-20
-25
-30
Depth (m AHD)
April
May
June
July
August
September
October
December
January 2011
February 2011
March 2011


MB07 EC
Electrical Conductivity (µS/cm)
0
10000
20000
30000
40000
50000
60000
70000
80000
90000
Depth (m AHD)
5
0
-5
-10
-15
-20
-25
-30
-35
During Drilling
March
April
May
June
July
August
September
October
November
December
January 2011
February 2011
March 2011

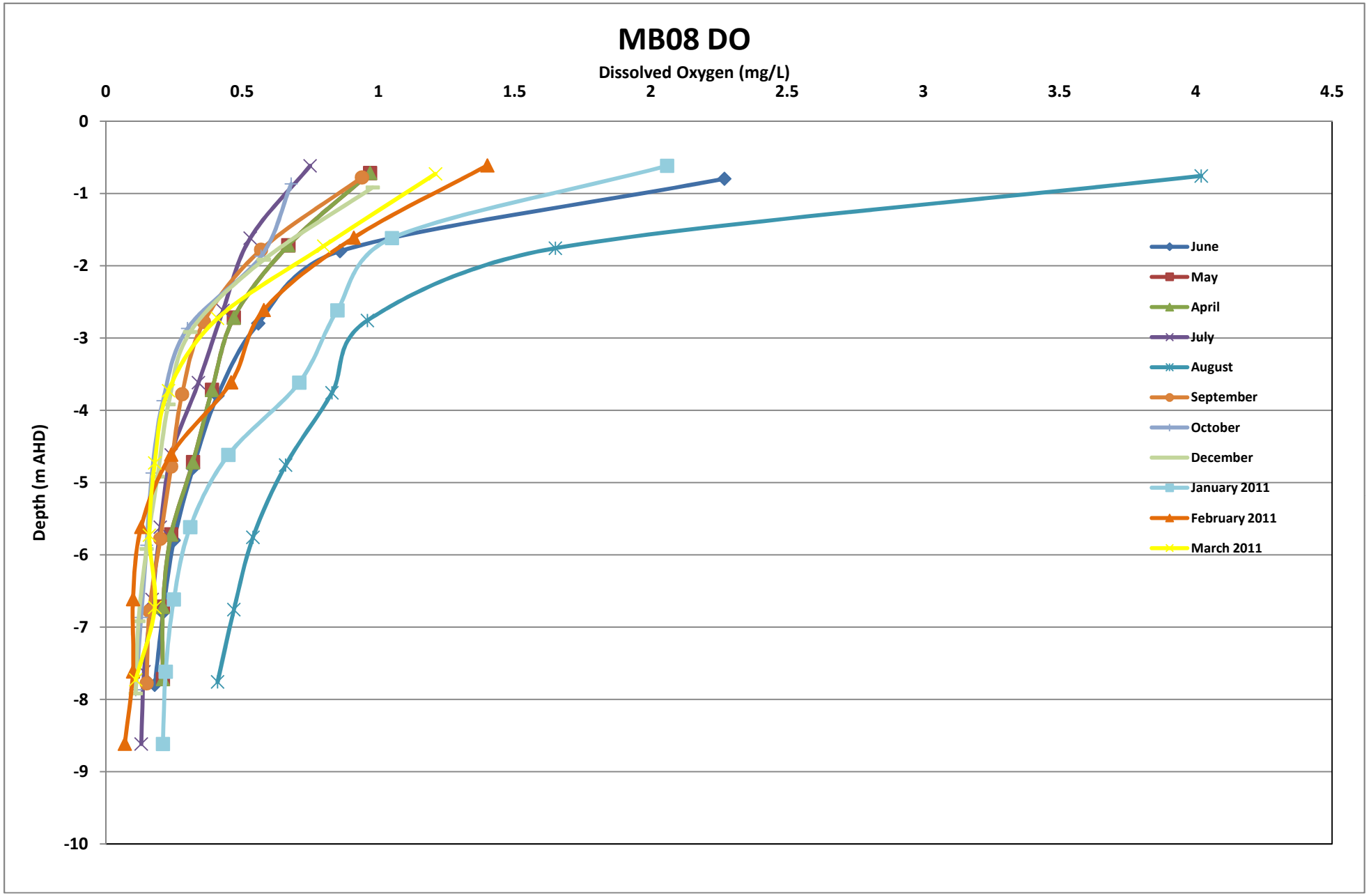

MB07 pH
pH
6.8
7
7.2
7.4
7.6
7.8
8
8.2
8.4
5
0
-5
-10
-15
-20
-25
-30
Depth (m AHD)
During Drilling
April
May
June
July
August
September
October
November
December
January 2011
February 2011
March 2011

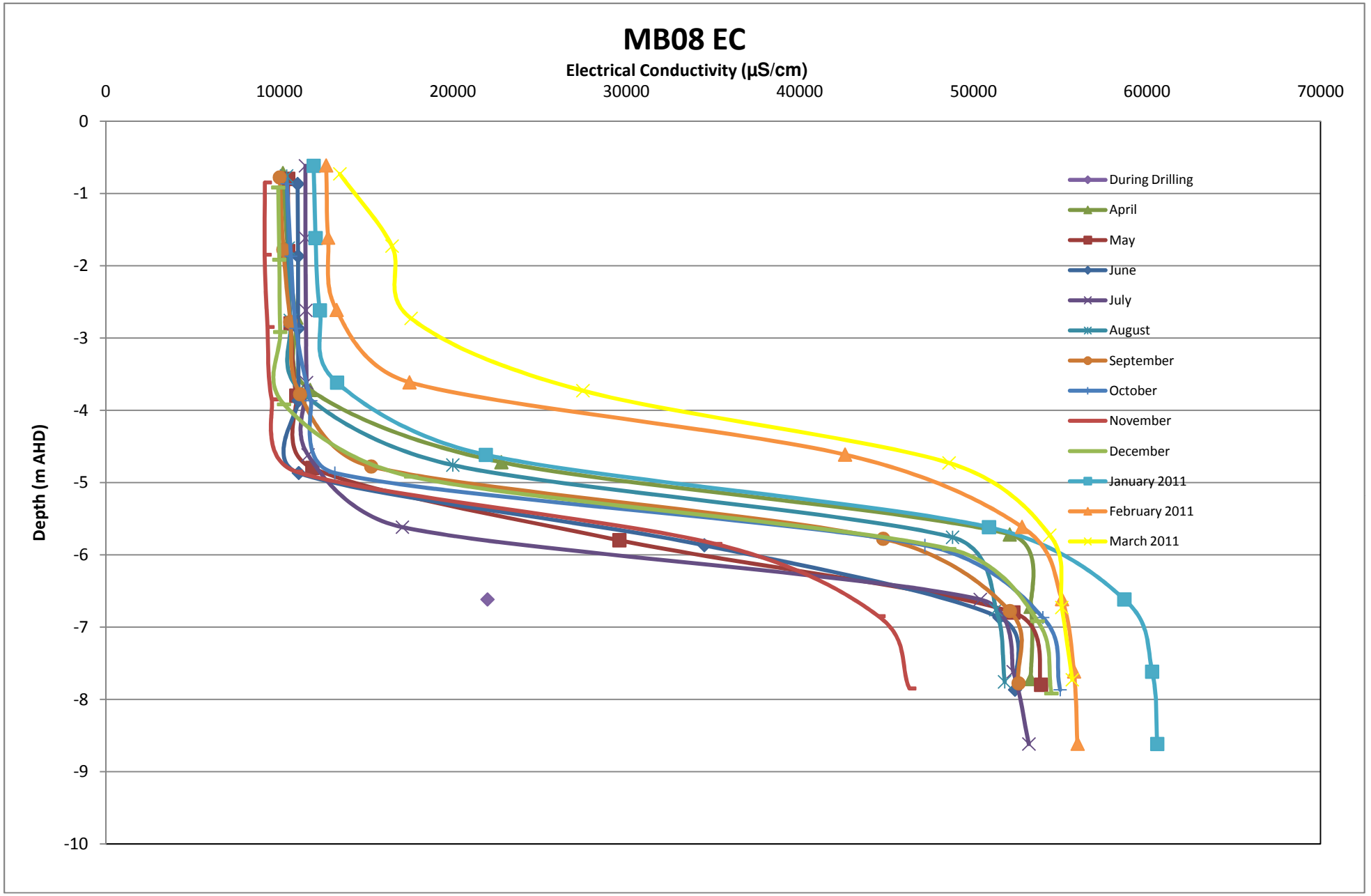

MB07 Redox
(mV)
-250
-200
-150
-100
-50
0
0
-5
-10
-15
-20
-25
-30
Depth (m AHD)
February 2011
March 2011

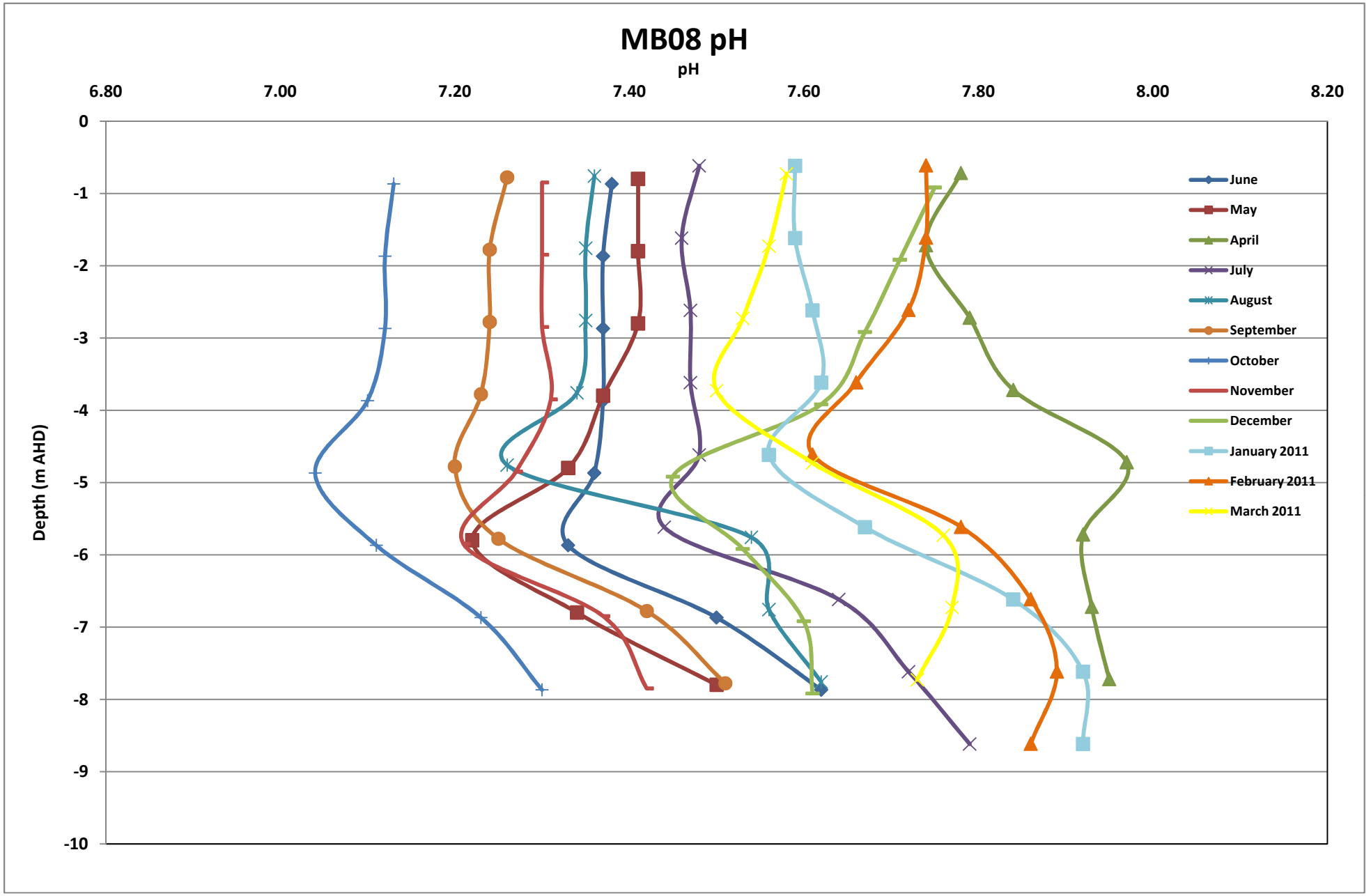

MB07 Temperature
Temperature (ºC)
0.0
5.0
10.0
15.0
20.0
25.0
30.0
Depth (m AHD)
5
0
-5
-10
-15
-20
-25
-30
-35
During Drilling
March
April
May
June
July
August
September
October
November
December
January 2011
February 2011
March 2011

MWH

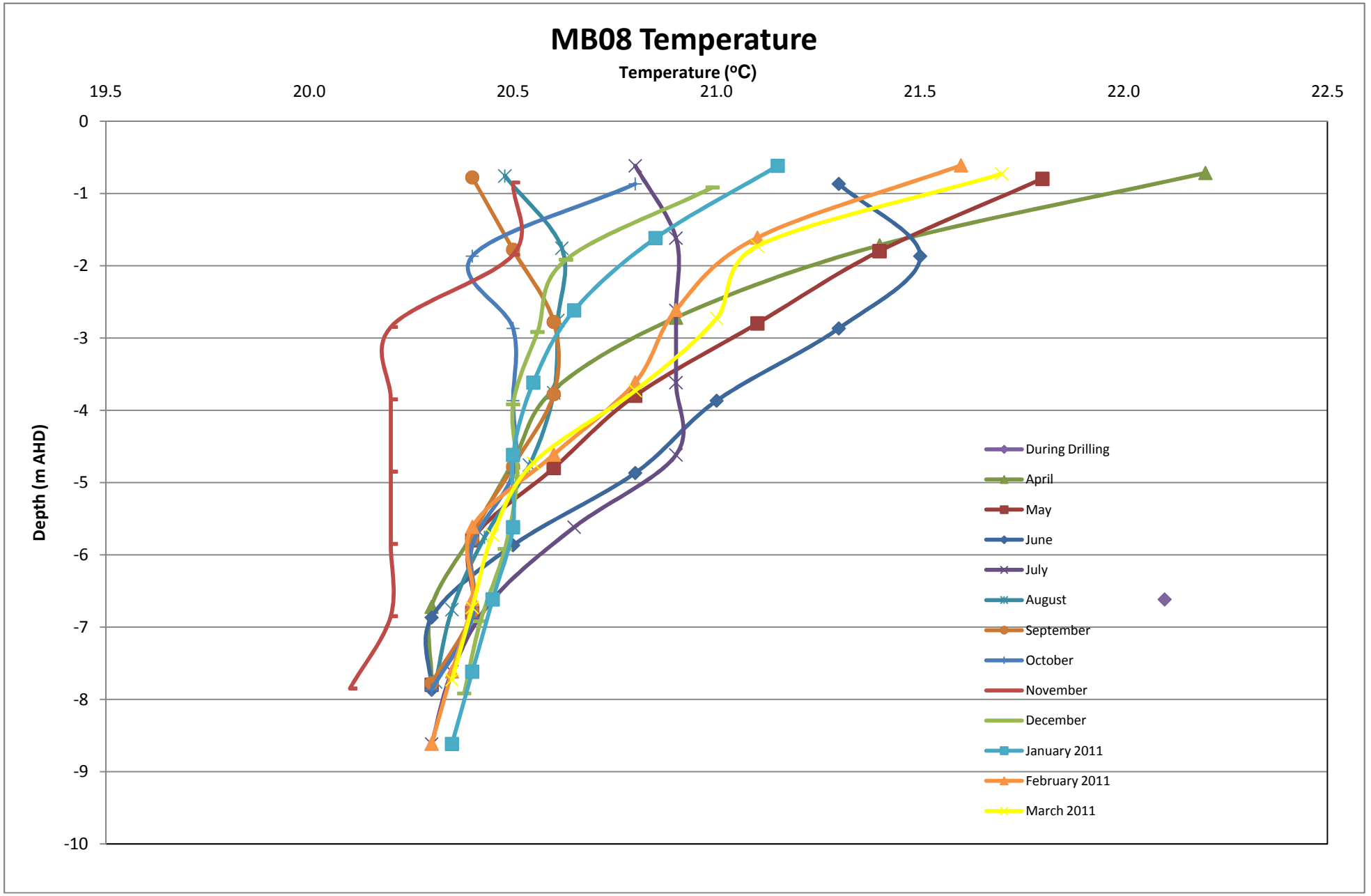
MB08


MB08 DO
Dissolved Oxygen (mg/L)
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
Depth (m AHD)
0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
June
May
April
July
August
September
October
December
January 2011
February 2011
March 2011


MB08 EC
Electrical Conductivity (µS/cm)
0
10000
20000
30000
40000
50000
60000
70000
Depth (m AHD)
0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
During Drilling
April
May
June
July
August
September
October
November
December
January 2011
February 2011
March 2011

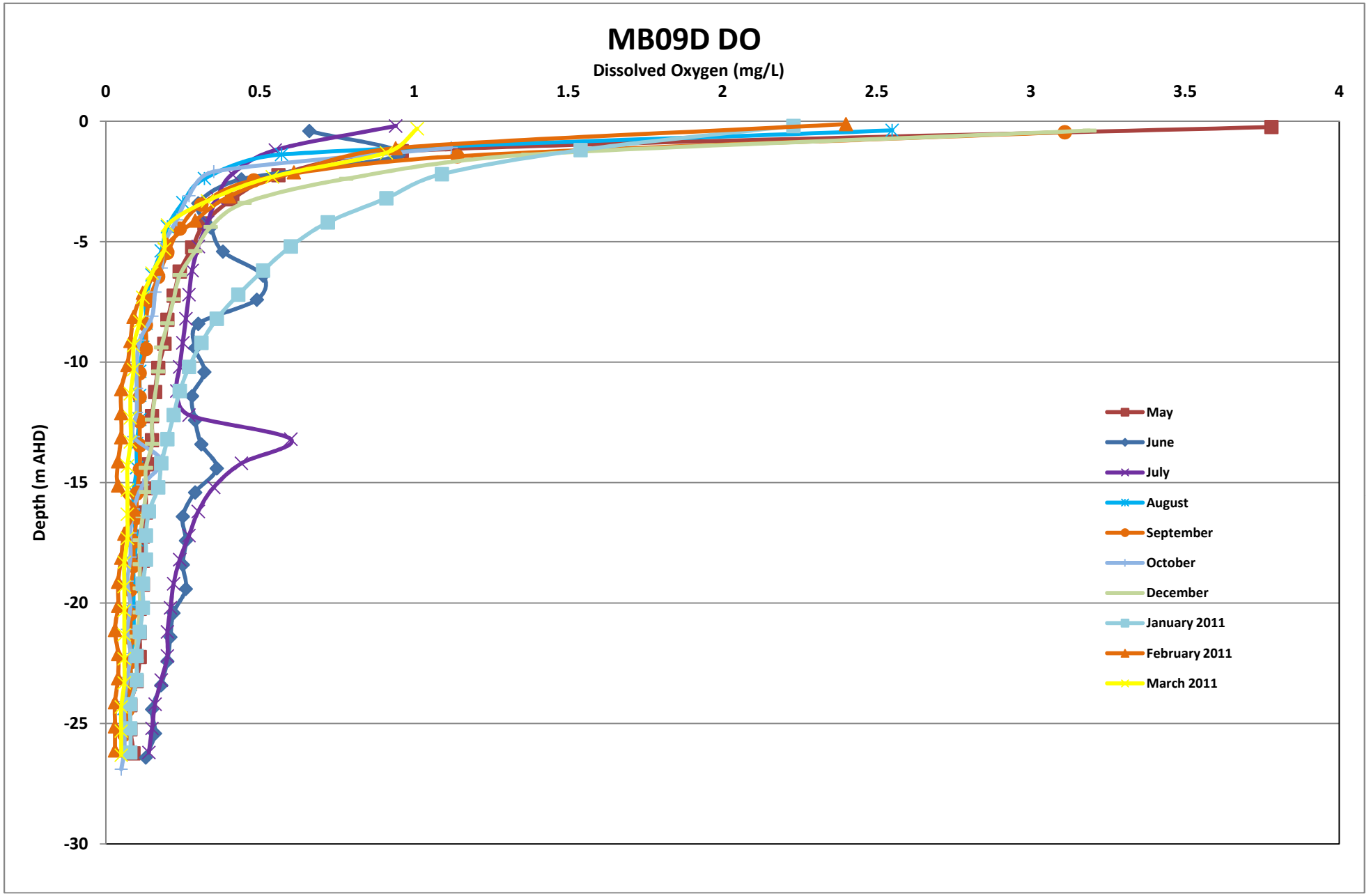

MB08 pH
pH
6.80
7.00
7.20
7.40
7.60
7.80
8.00
8.20
Depth (m AHD)
0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
June
May
April
July
August
September
October
November
December
January 2011
February 2011
March 2011

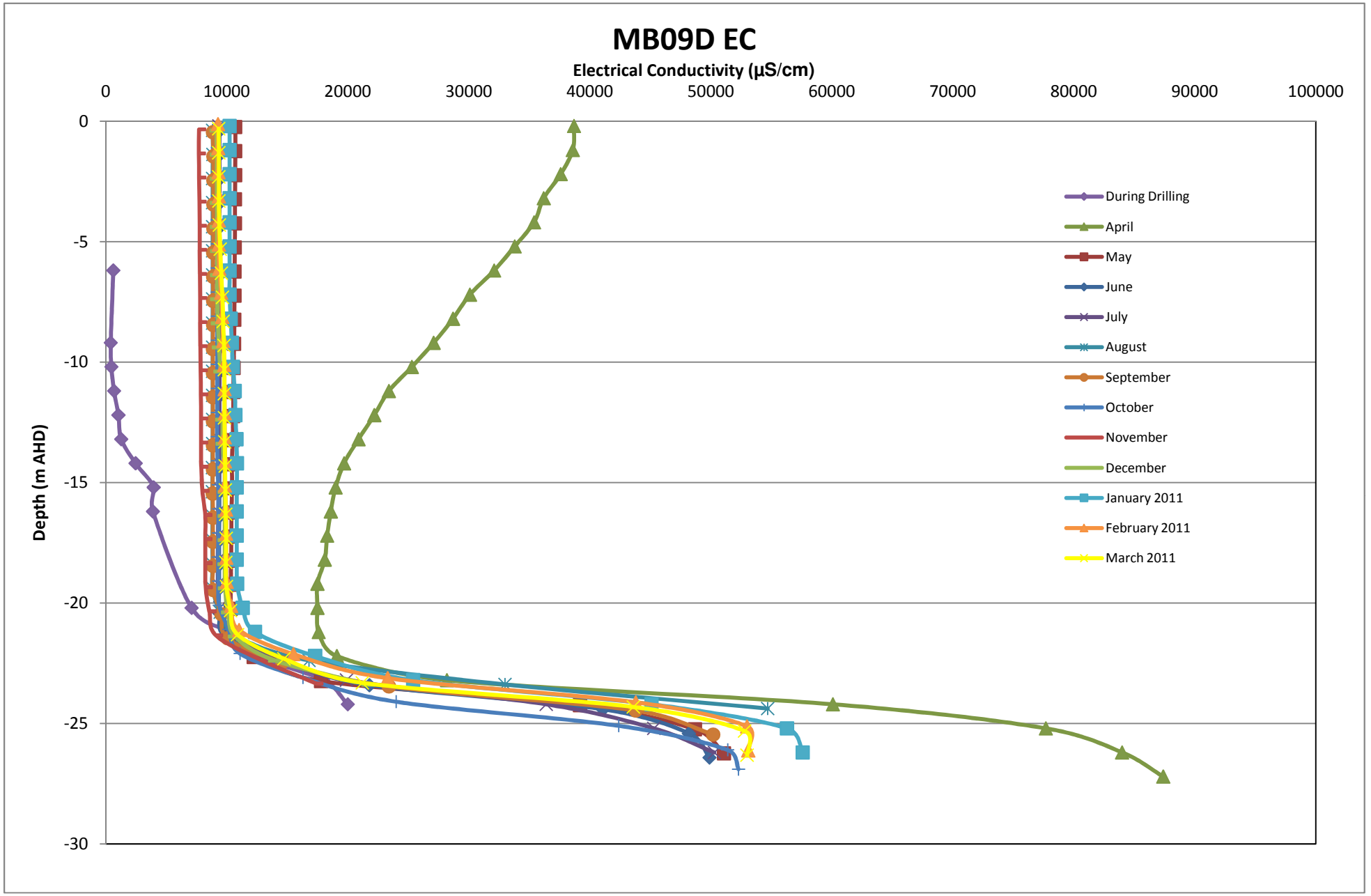

MB08 Redox
(mV)
-300
-250
-200
-150
-100
-50
0
Depth (m AHD)
0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
February 2011
March 2011

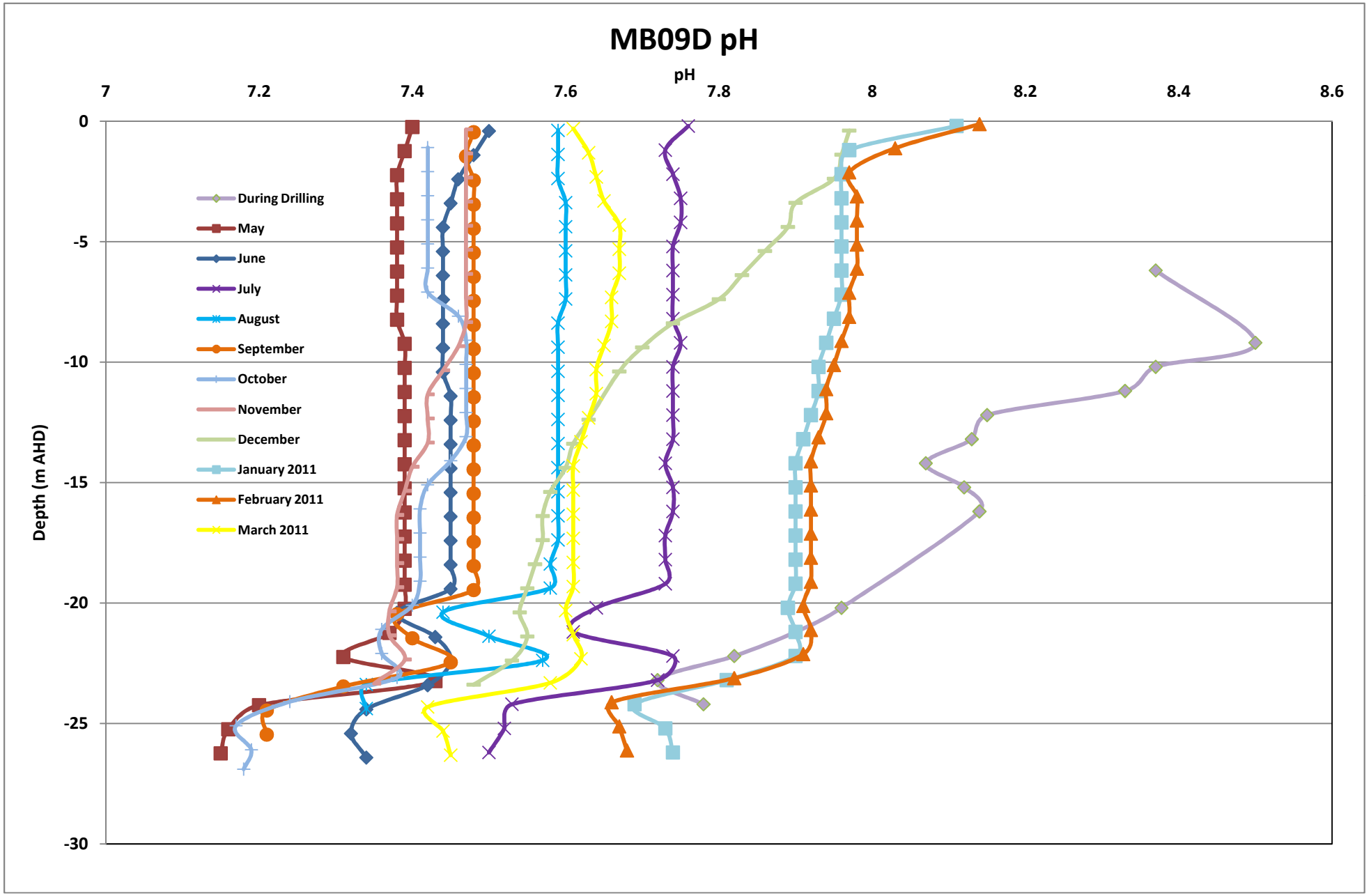

MB08 Temperature
Temperature (ºC)
19.5
20.0
20.5
21.0
21.5
22.0
22.5
Depth (m AHD)
0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
During Drilling
April
May
June
July
August
September
October
November
December
January 2011
February 2011
March 2011

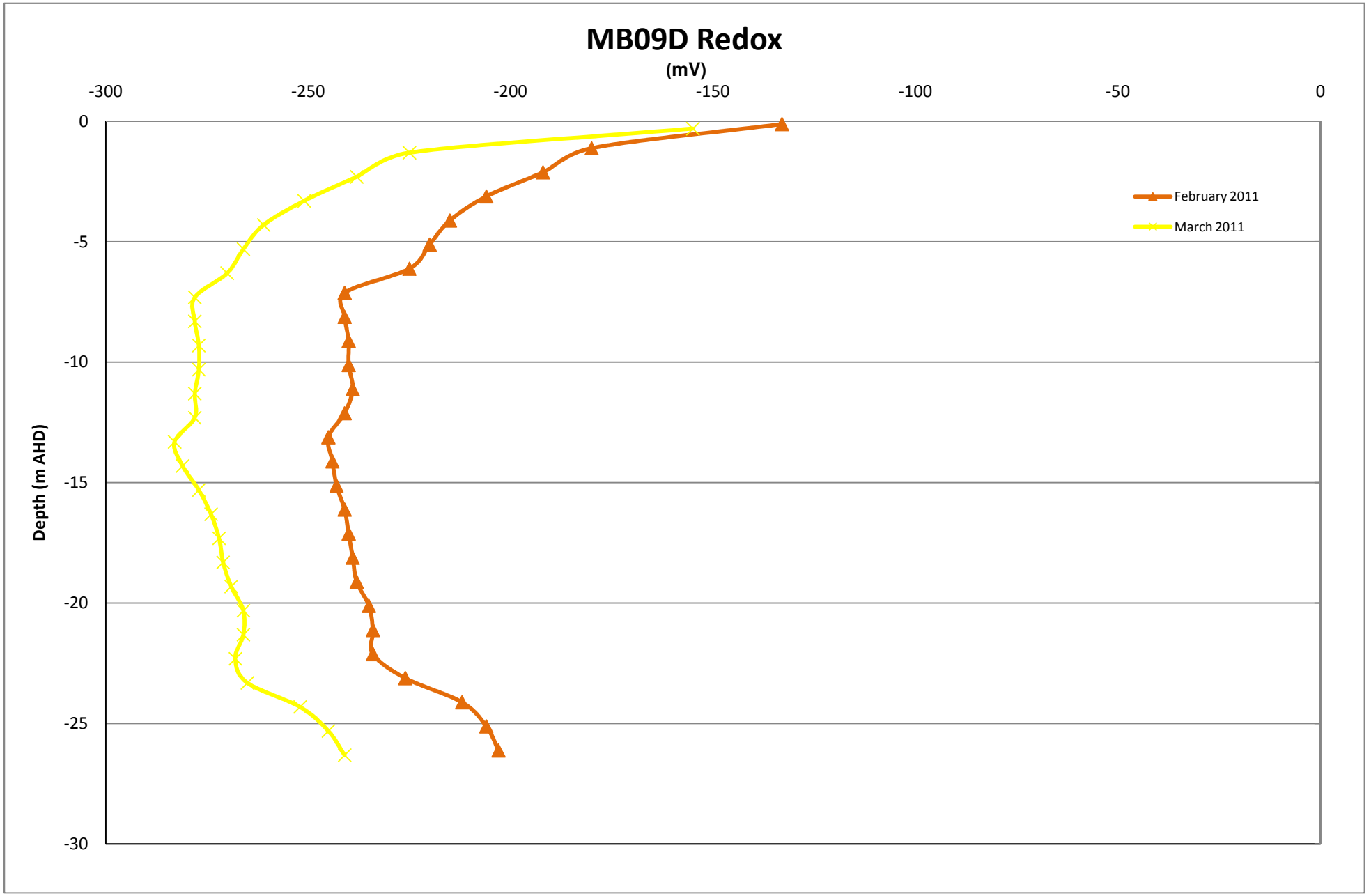
MWH

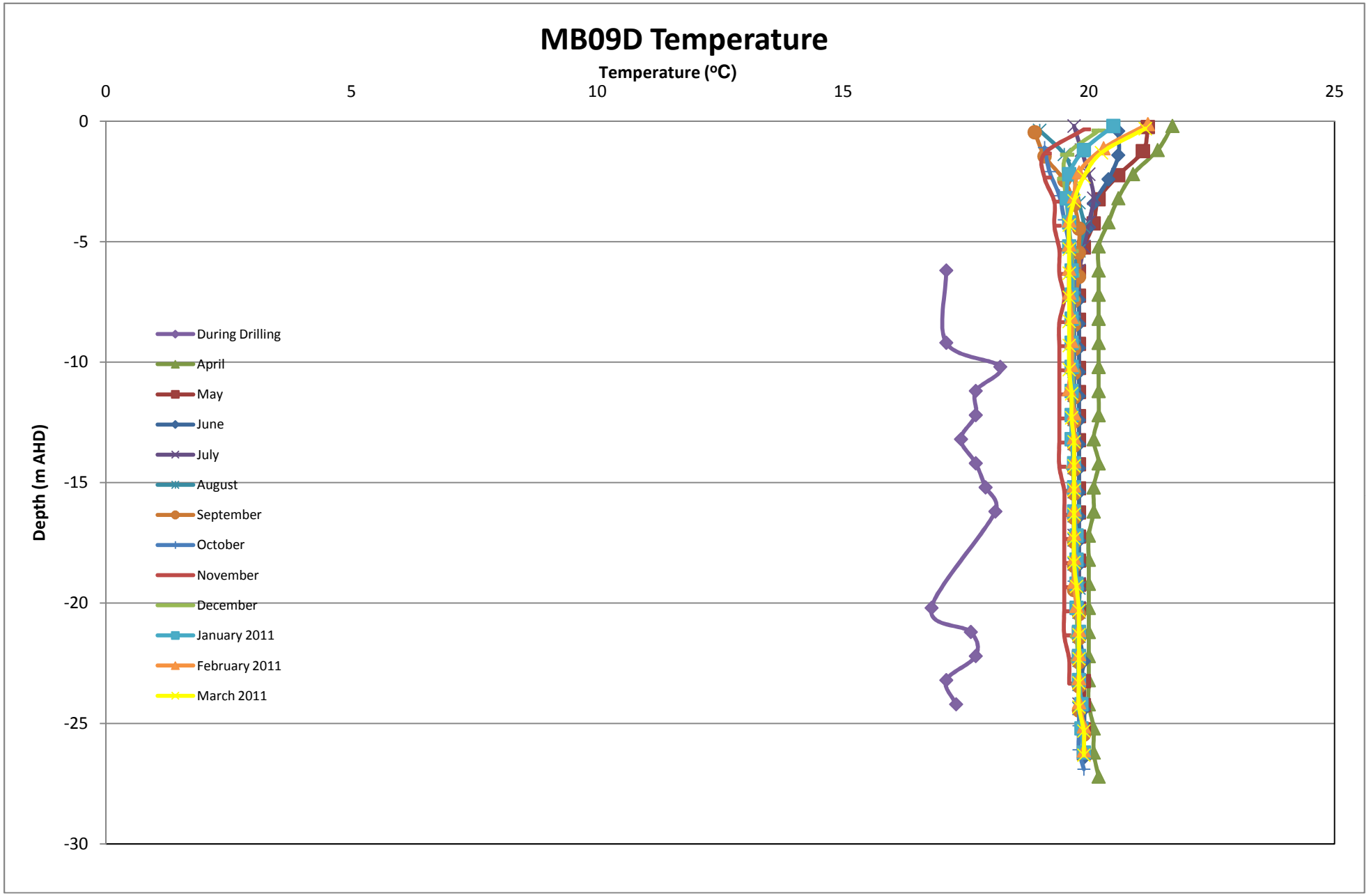
MB09D


MB09D DO
Dissolved Oxygen (mg/L)
0
0.5
1
1.5
2
2.5
3
3.5
4
Depth (m AHD)
0
-5
-10
-15
-20
-25
-30
May
June
July
August
September
October
December
January 2011
February 2011
March 2011

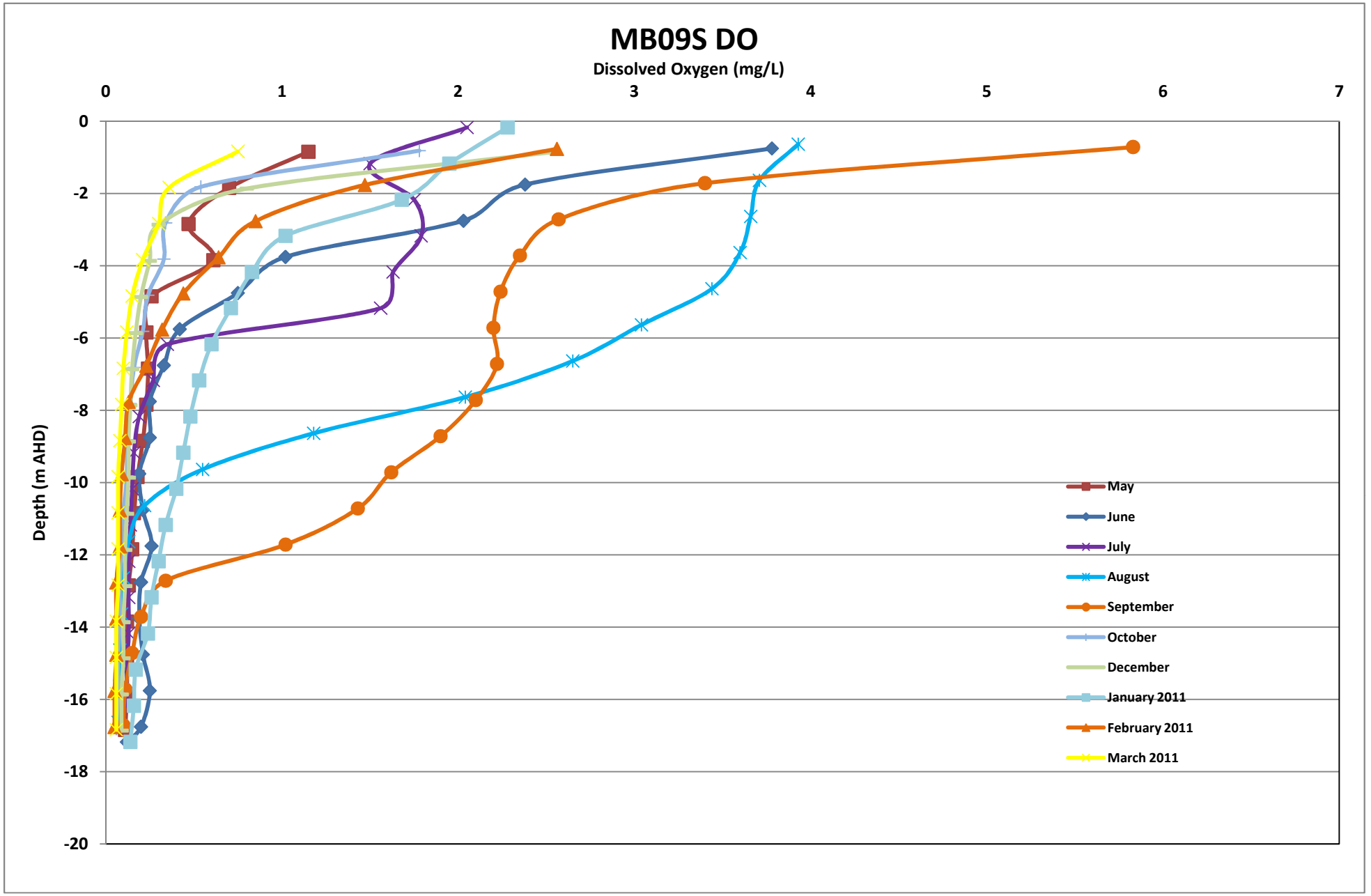

MB09D EC
Electrical Conductivity (µS/cm)
0
10000
20000
30000
40000
50000
60000
70000
80000
90000
100000
Depth (m AHD)
0
-5
-10
-15
-20
-25
-30
During Drilling
April
May
June
July
August
September
October
November
December
January 2011
February 2011
March 2011

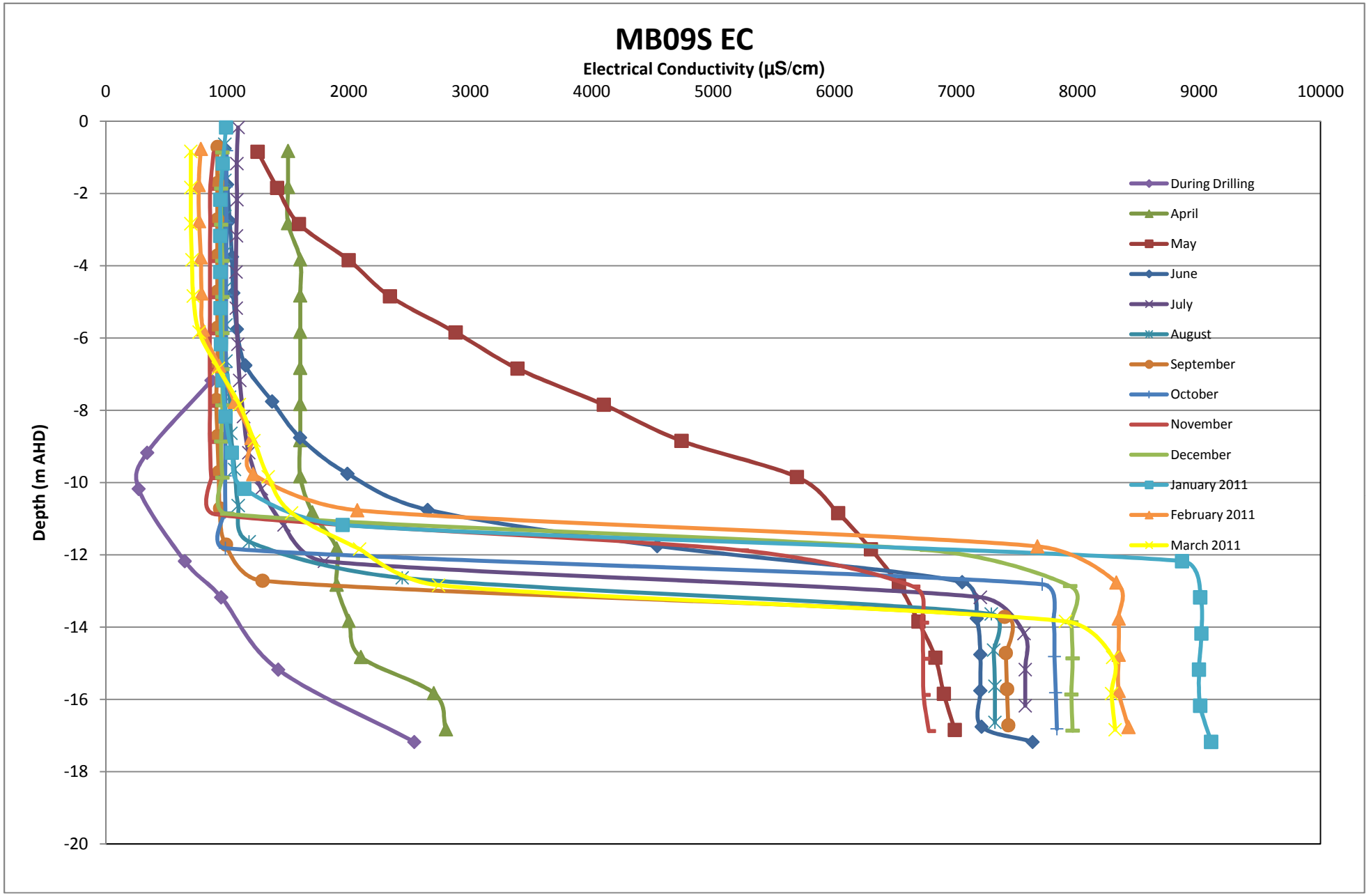

MB09D pH
pH
7
7.2
7.4
7.6
7.8
8
8.2
8.4
8.6
0
-5
-10
-15
-20
-25
-30
Depth (m AHD)
During Drilling
May
June
July
August
September
October
November
December
January 2011
February 2011
March 2011

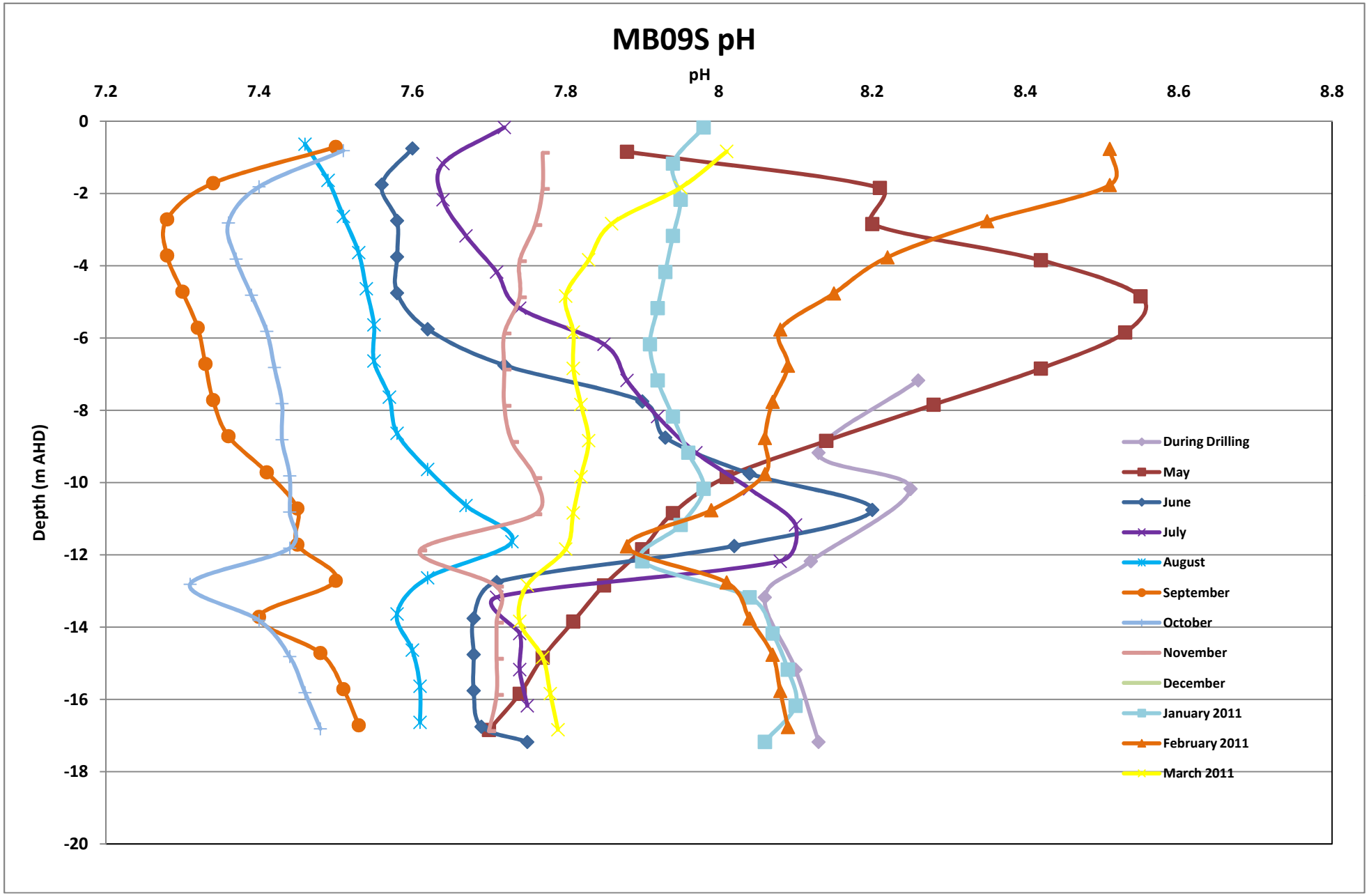

MB09D Redox
(mV)
-300
-250
-200
-150
-100
-50
0
0
-5
-10
-15
-20
-25
-30
Depth (m AHD)
February 2011
March 2011

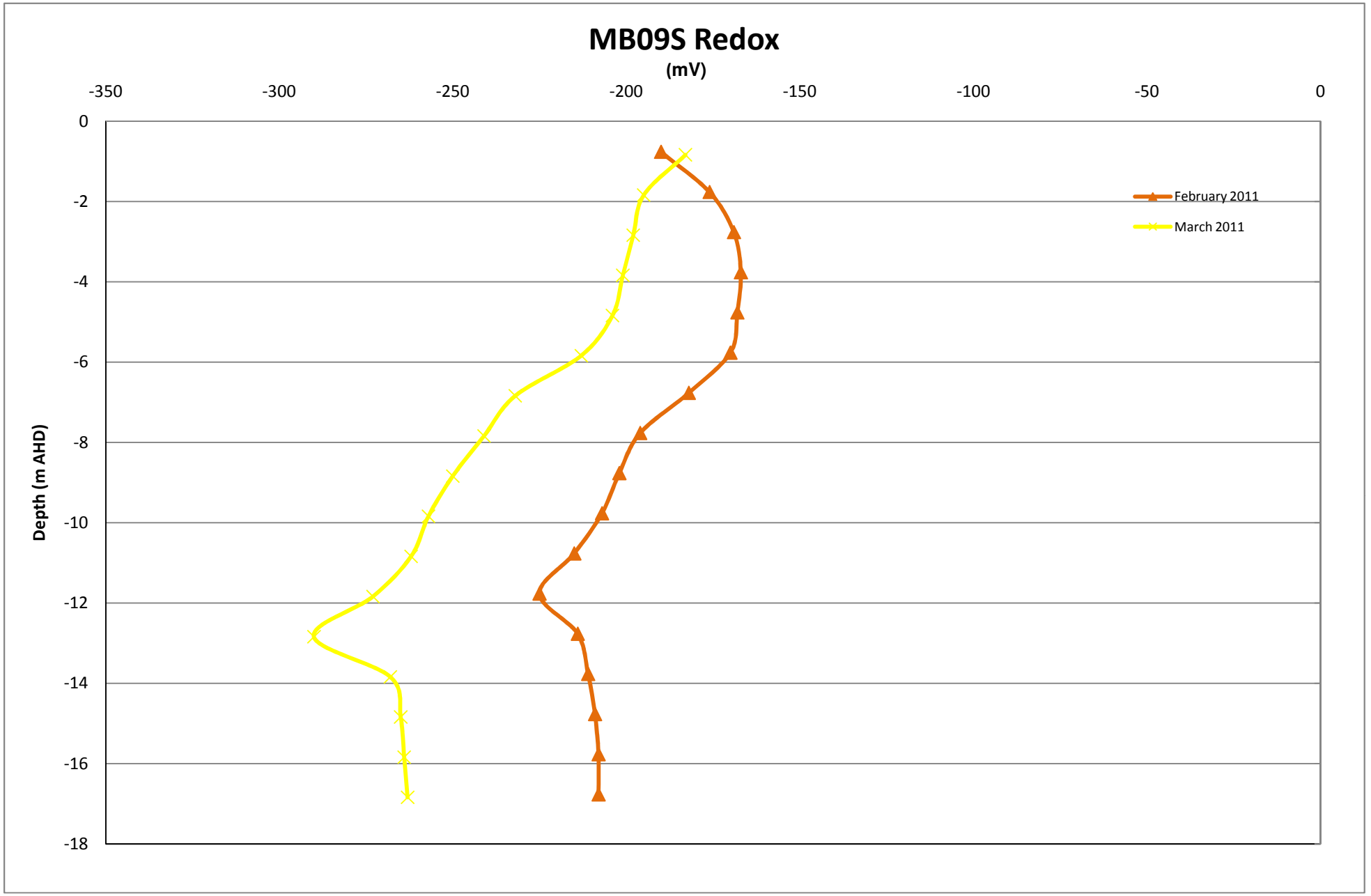

MB09D Temperature
Temperature (ºC)
0
5
10
15
20
25
0
-5
-10
-15
-20
-25
-30
Depth (m AHD)
During Drilling
April
May
June
July
August
September
October
November
December
January 2011
February 2011
March 2011

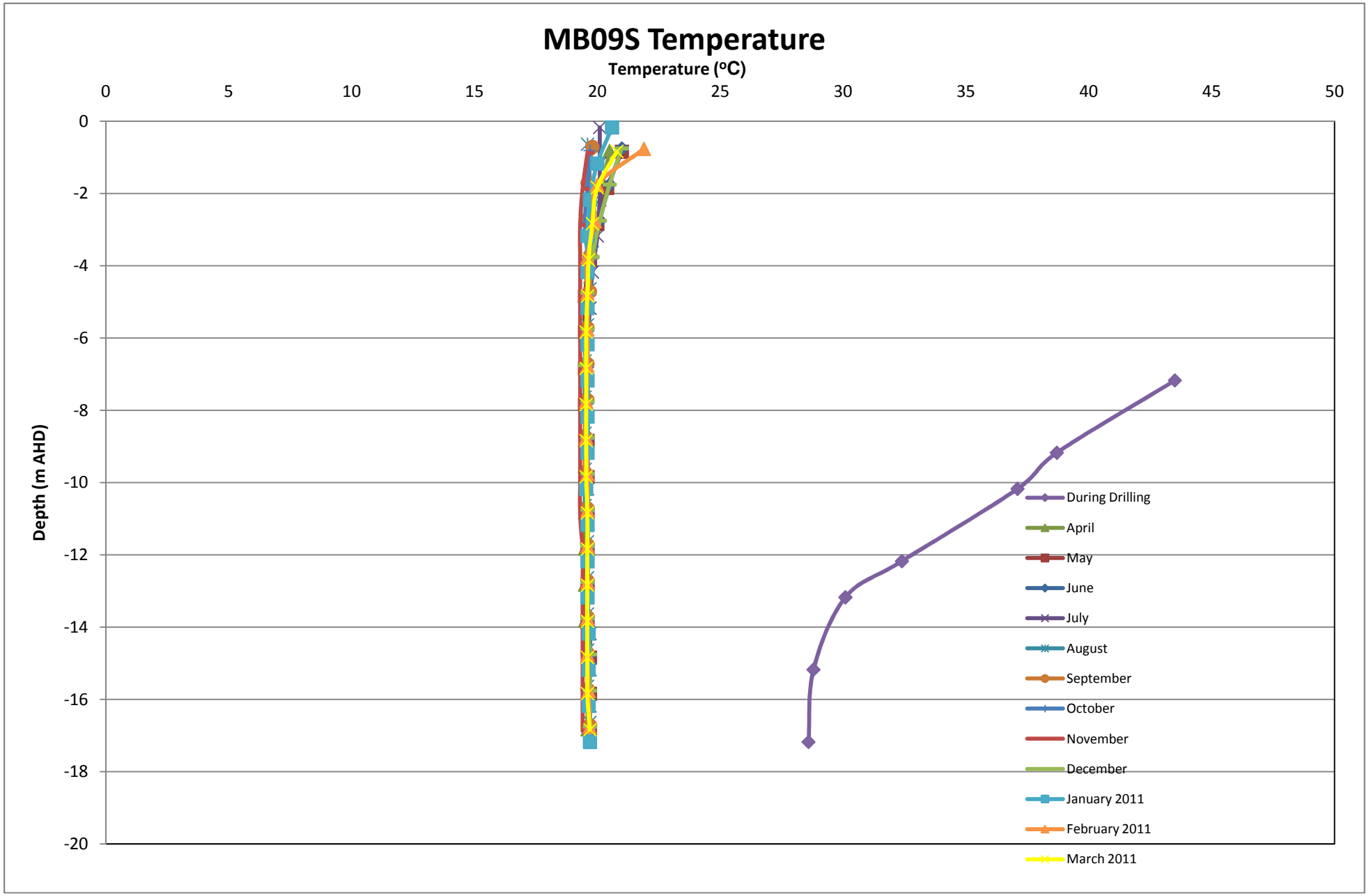
MB09S


MB09S DO
Dissolved Oxygen (mg/L)
0
1
2
3
4
5
6
7
Depth (m AHD)
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
May
June
July
August
September
October
December
January 2011
February 2011
March 2011


MB09S EC
Electrical Conductivity (µS/cm)
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
Depth (m AHD)
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
During Drilling
April
May
June
July
August
September
October
November
December
January 2011
February 2011
March 2011

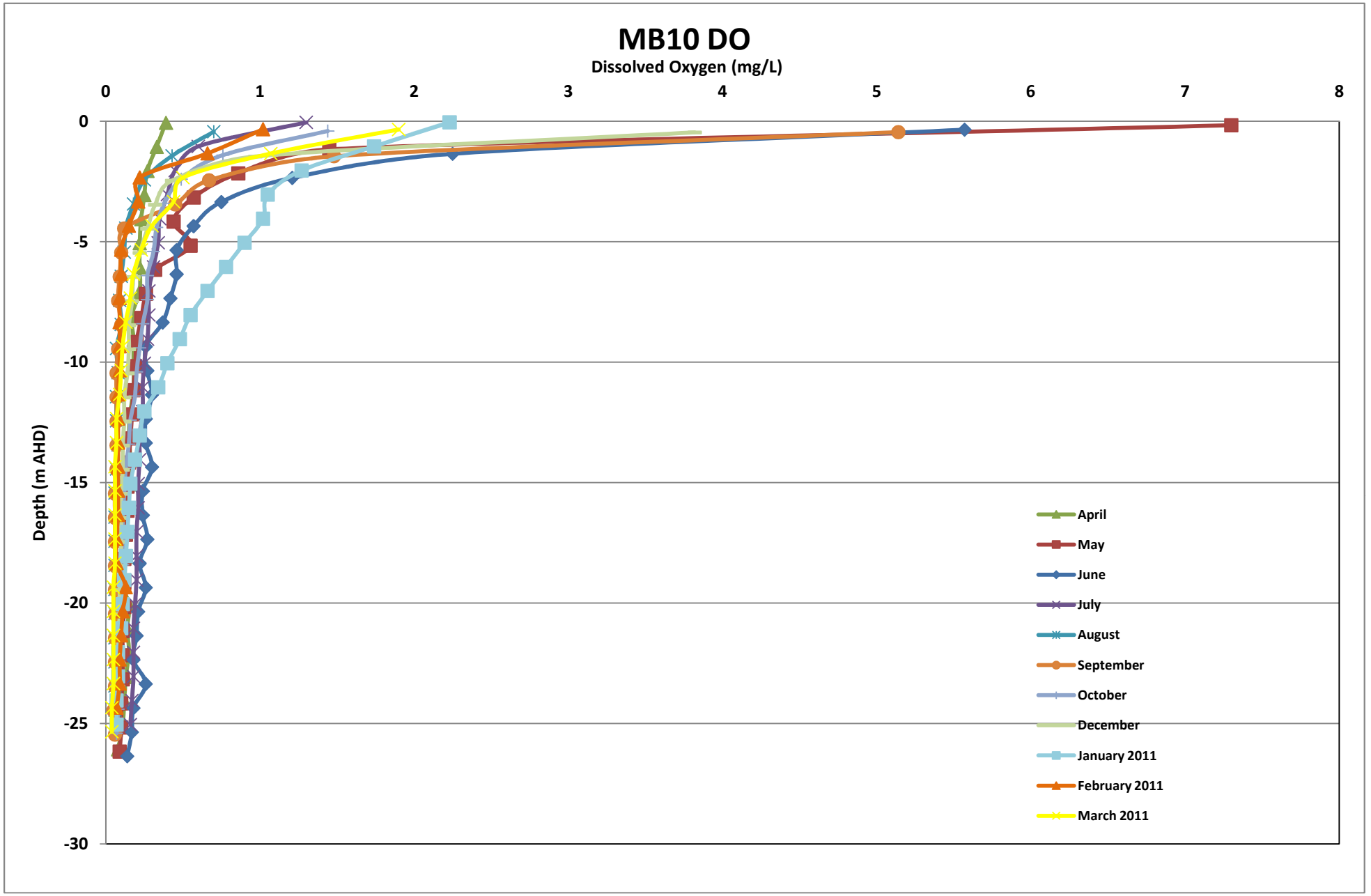

MB09S pH
pH
7.2
7.4
7.6
7.8
8
8.2
8.4
8.6
8.8
Depth (m AHD)
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
During Drilling
May
June
July
August
September
October
November
December
January 2011
February 2011
March 2011

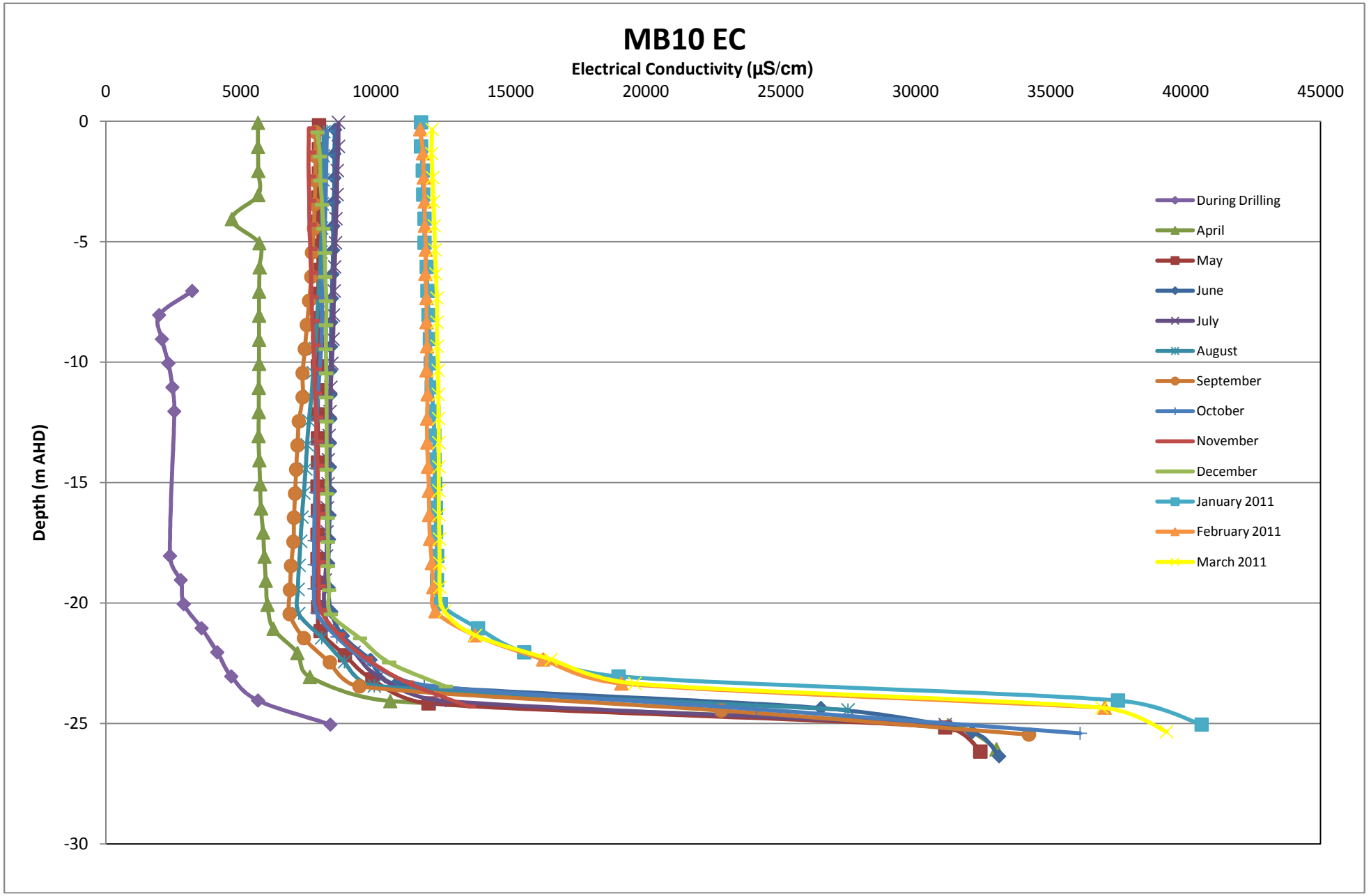

MB09S Redox
(mV)
-350
-300
-250
-200
-150
-100
-50
0
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
Depth (m AHD)
February 2011
March 2011

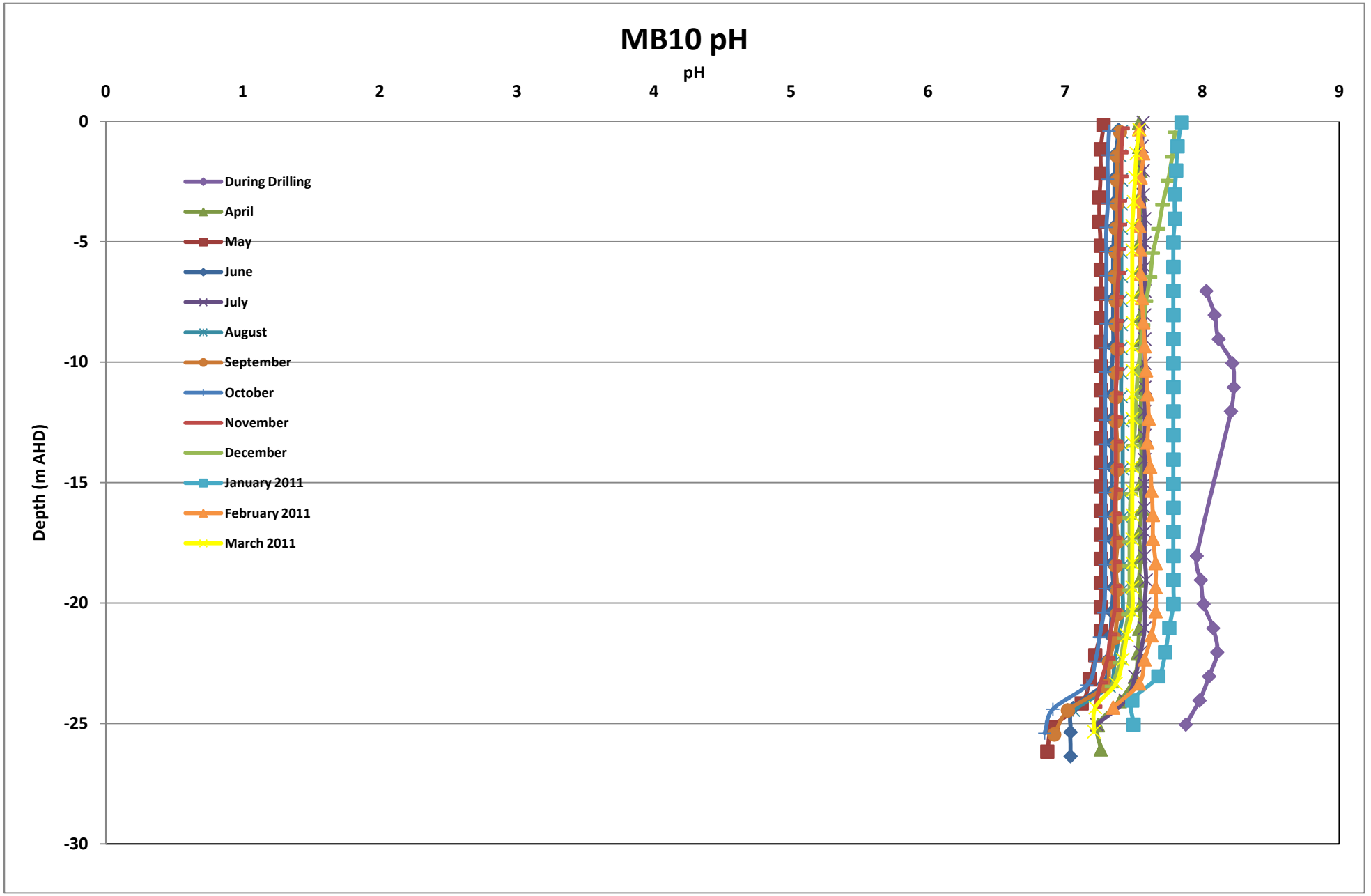

MB09S Temperature
Temperature (°C)
0
5
10
15
20
25
30
35
40
45
50
Depth (m AHD)
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
During Drilling
April
May
June
July
August
September
October
November
December
January 2011
February 2011
March 2011

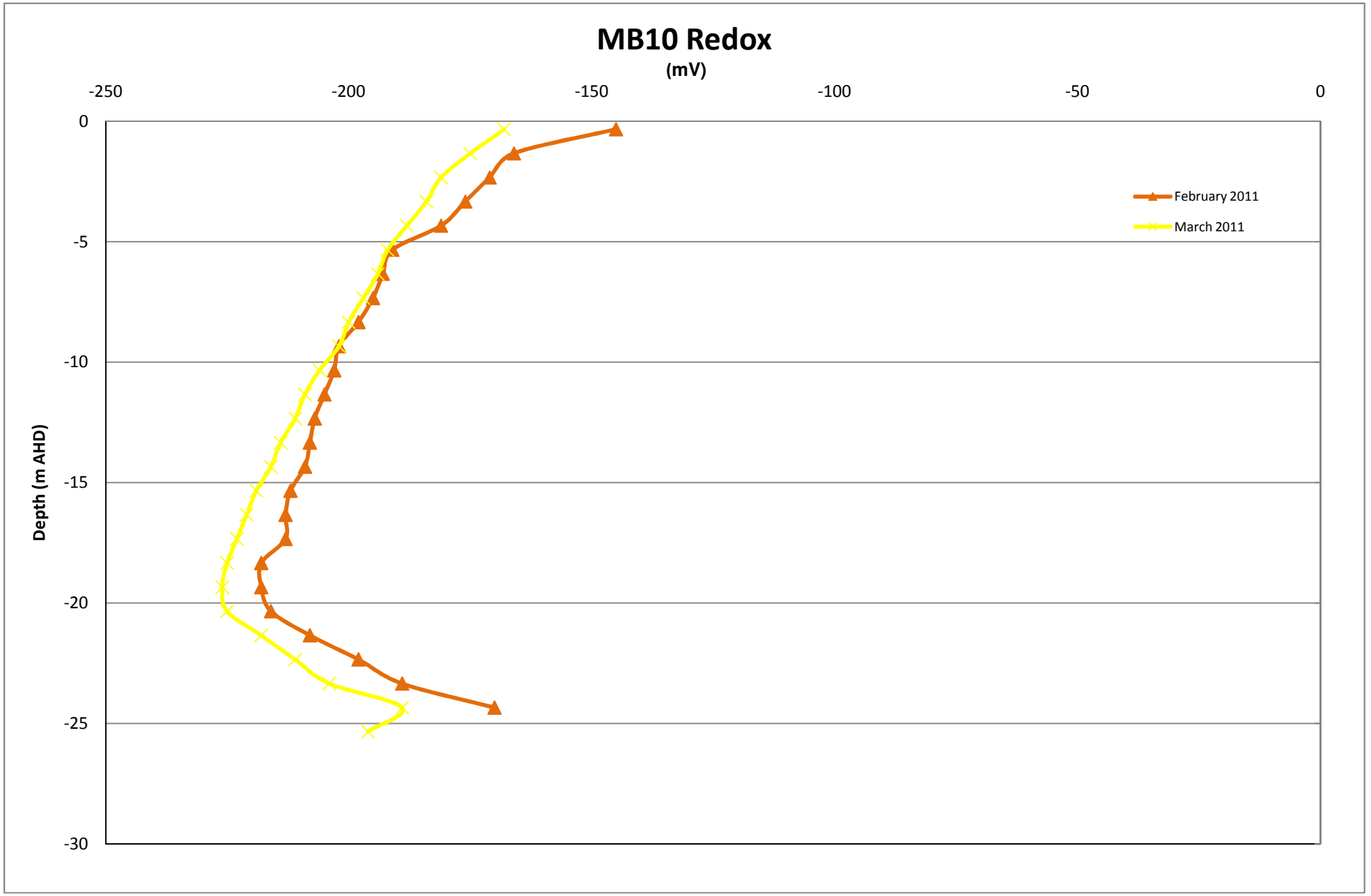
MWH

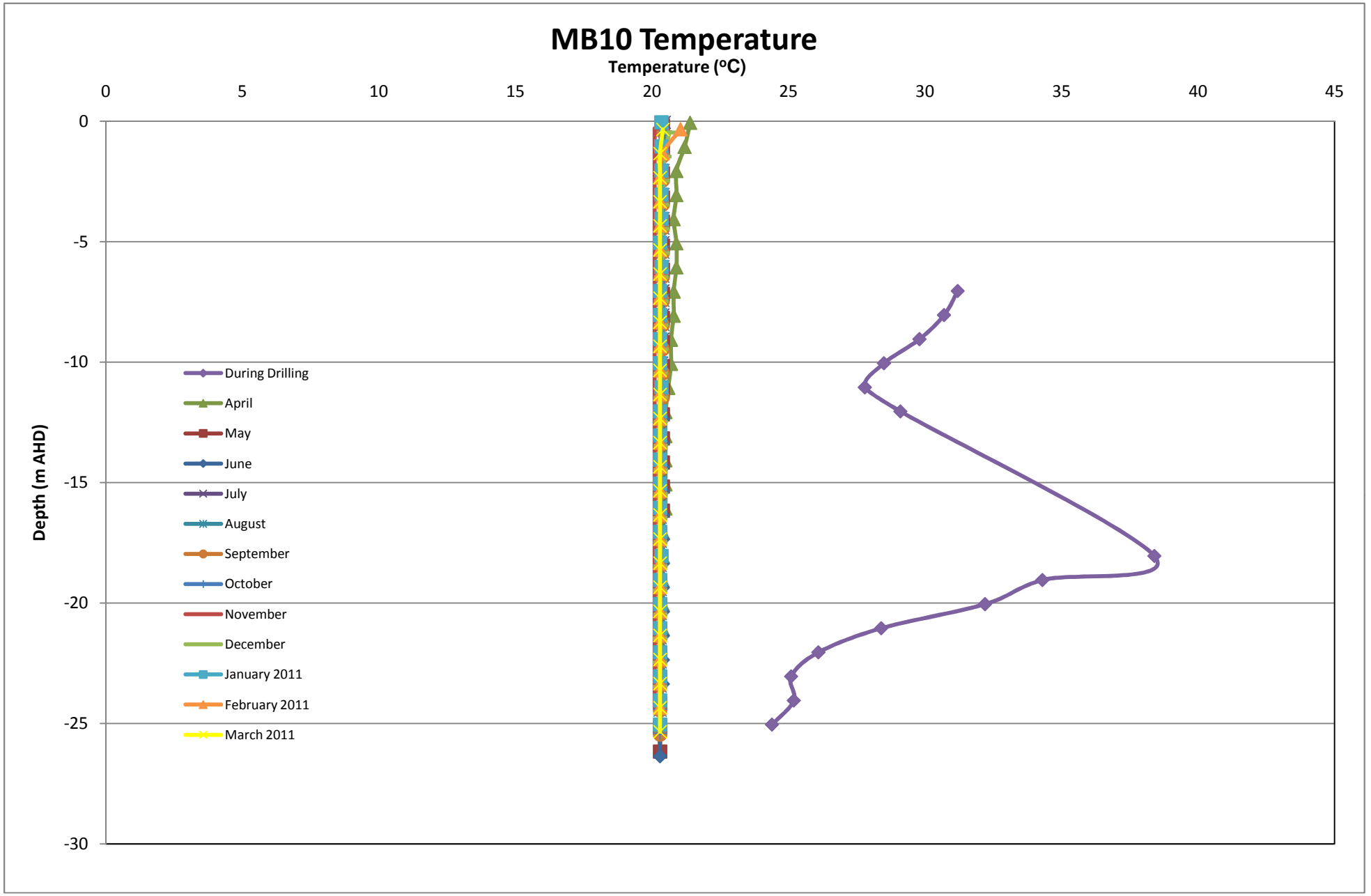
MB10


MB10 DO
Dissolved Oxygen (mg/L)
0
1
2
3
4
5
6
7
8
Depth (m AHD)
0
-5
-10
-15
-20
-25
-30
April
May
June
July
August
September
October
December
January 2011
February 2011
March 2011


MB10 EC
Electrical Conductivity (µS/cm)
0
5000
10000
15000
20000
25000
30000
35000
40000
45000
Depth (m AHD)
0
-5
-10
-15
-20
-25
-30
During Drilling
April
May
June
July
August
September
October
November
December
January 2011
February 2011
March 2011

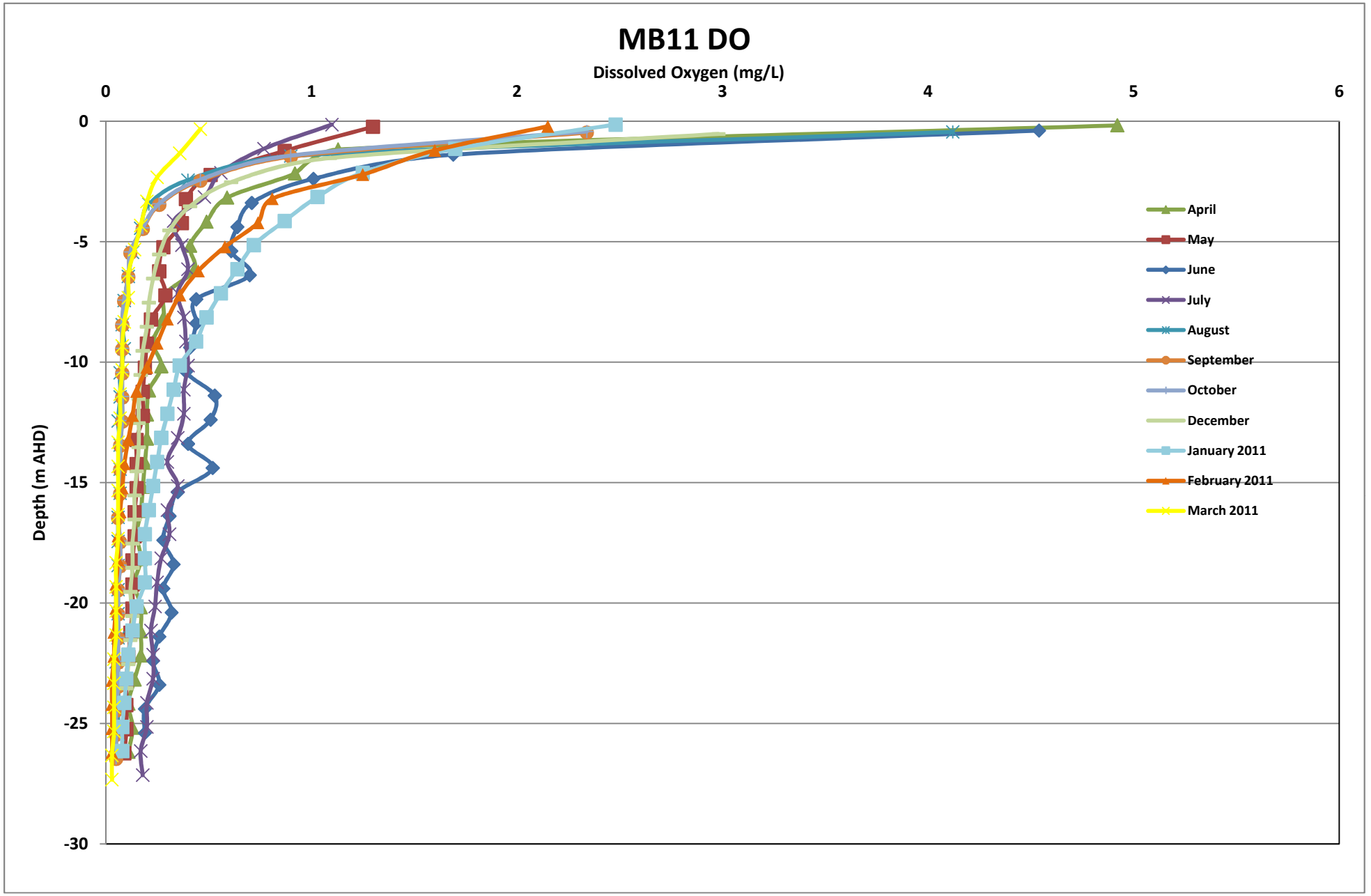

MB10 pH
pH
0
1
2
3
4
5
6
7
8
9
Depth (m AHD)
0
-5
-10
-15
-20
-25
-30
During Drilling
April
May
June
July
August
September
October
November
December
January 2011
February 2011
March 2011

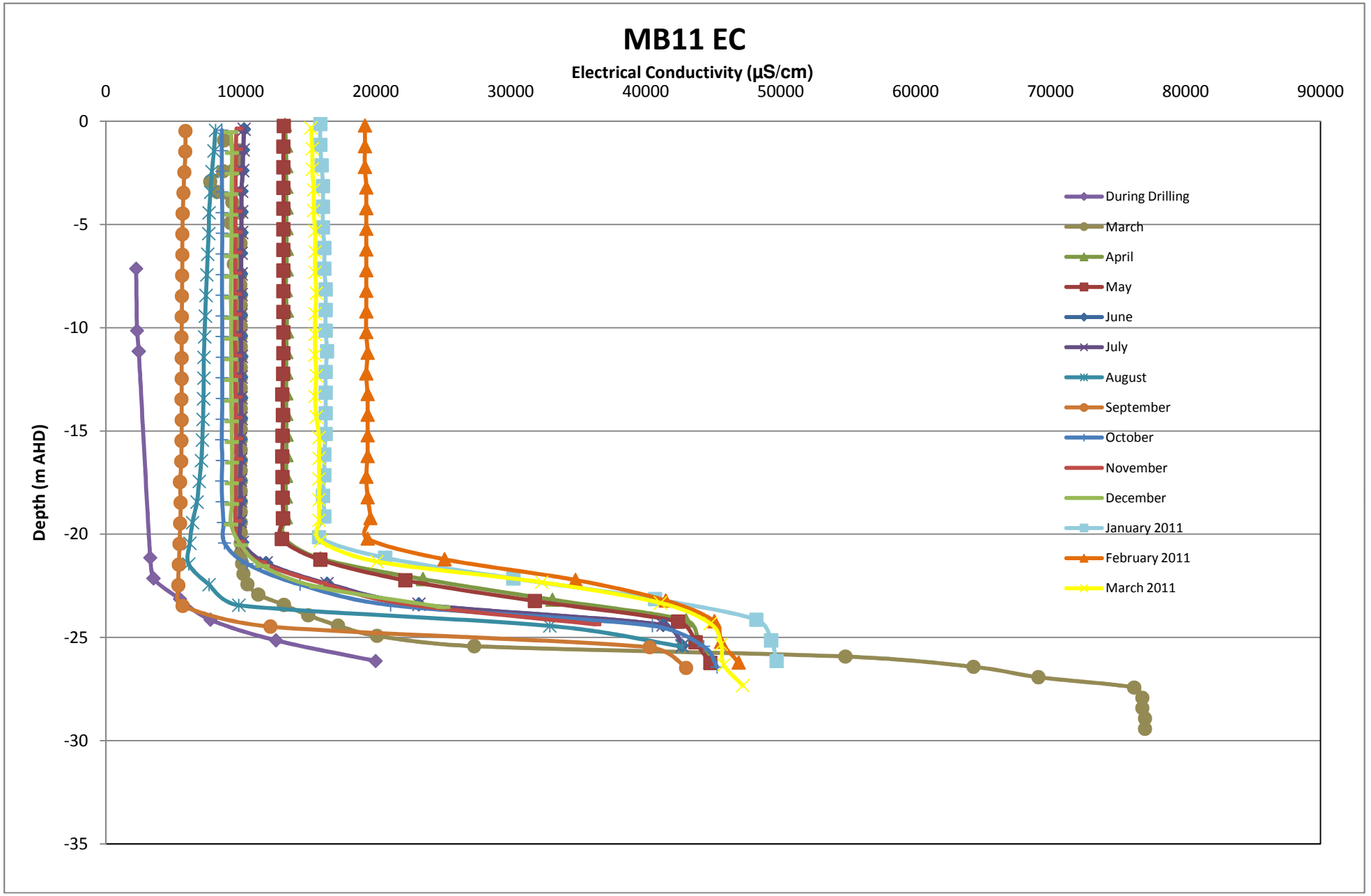

MB10 Redox
(mV)
-250
-200
-150
-100
-50
0
0
-5
-10
-15
-20
-25
-30
Depth (m AHD)
February 2011
March 2011

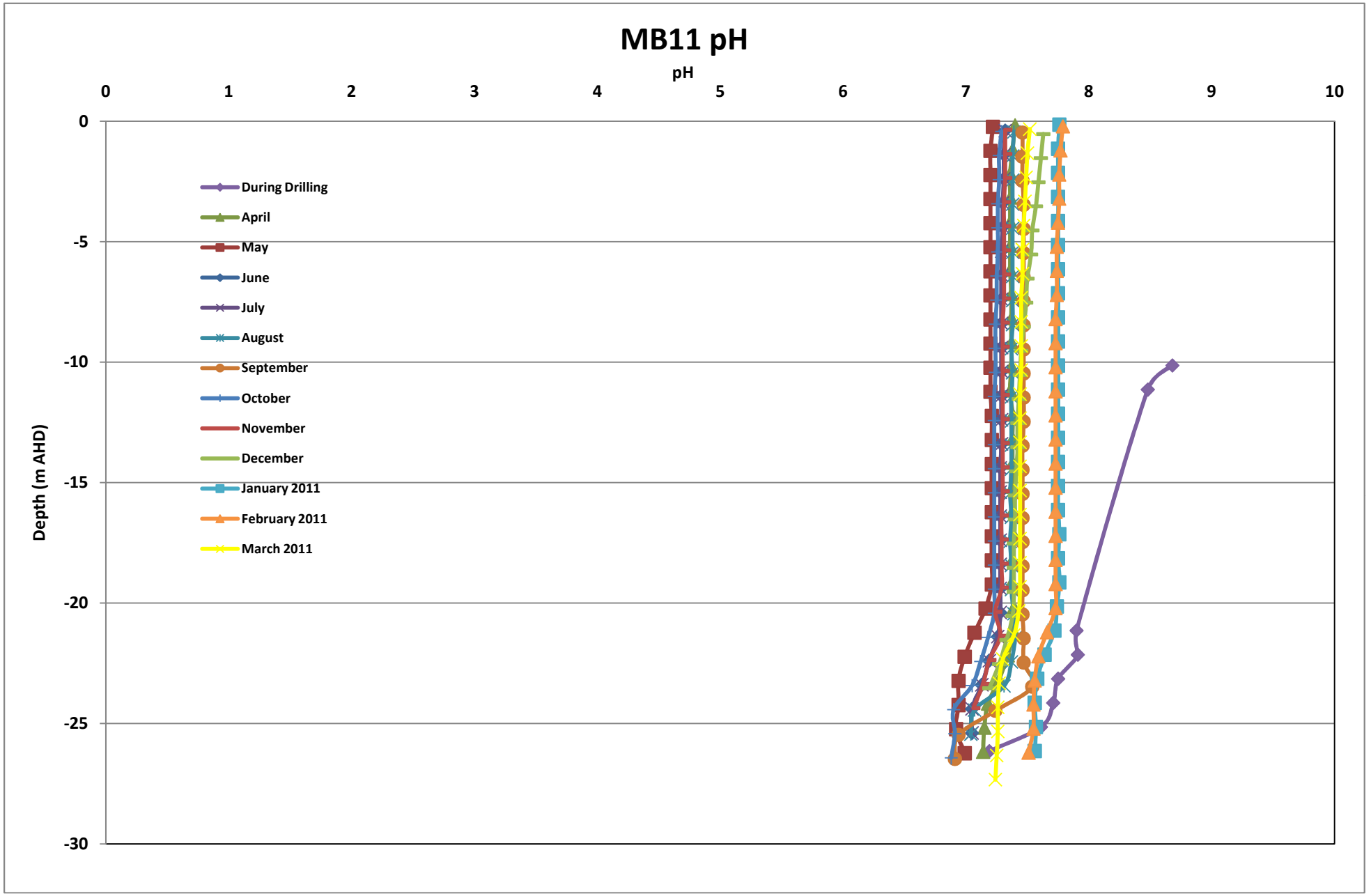

MB10 Temperature
Temperature (°C)
0
5
10
15
20
25
30
35
40
45
Depth (m AHD)
0
-5
-10
-15
-20
-25
-30
During Drilling
April
May
June
July
August
September
October
November
December
January 2011
February 2011
March 2011

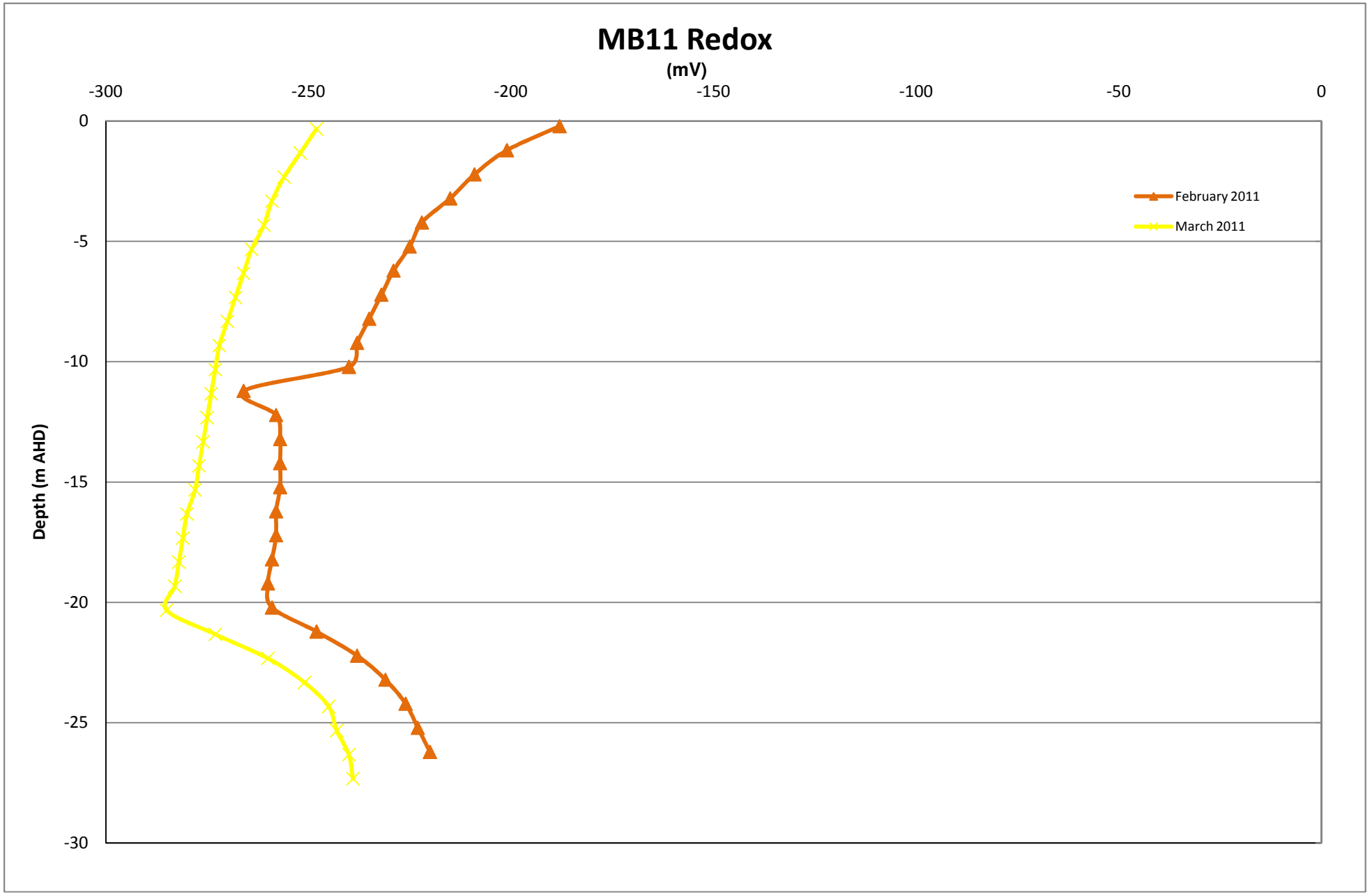
MWH

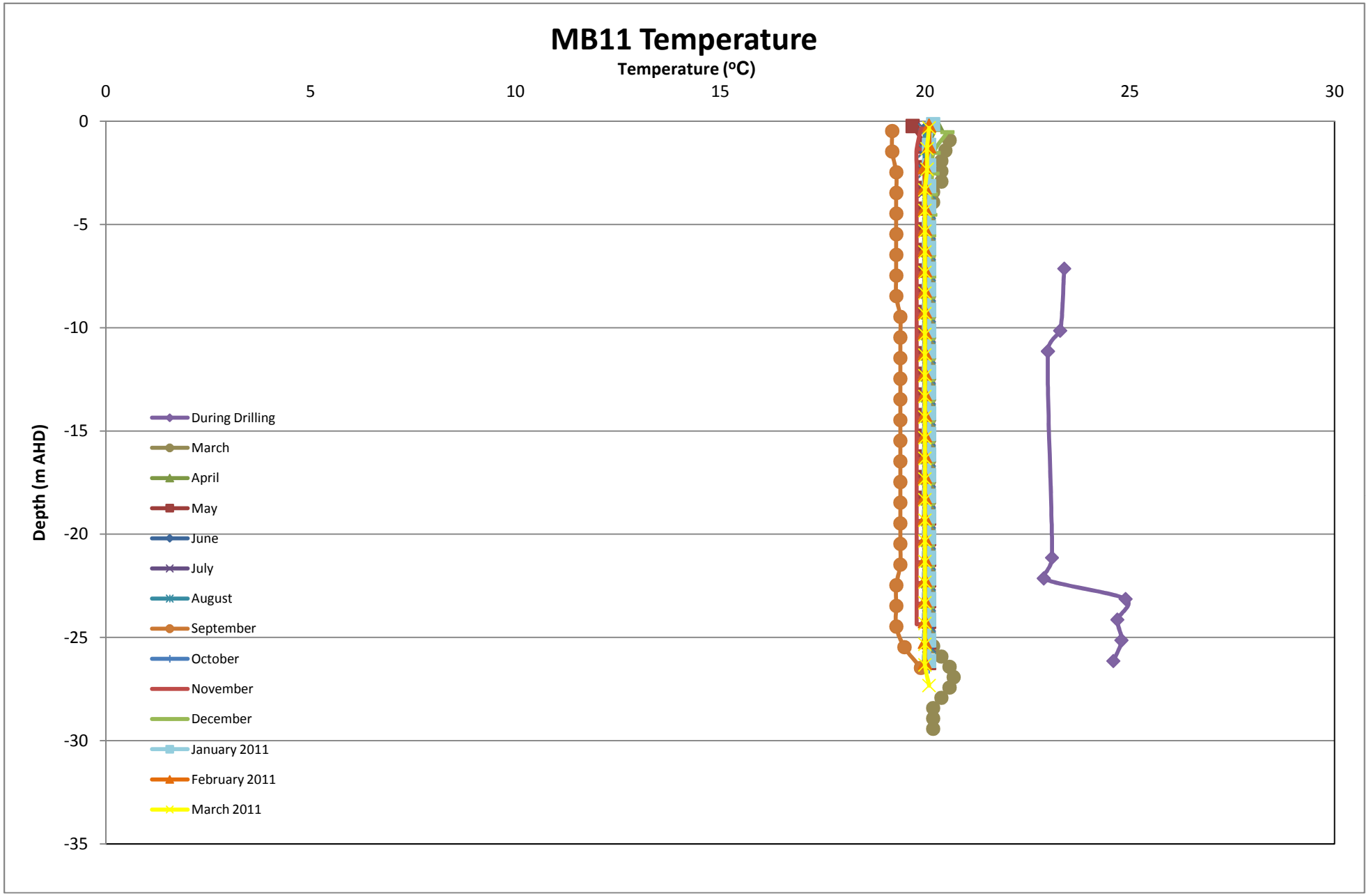
MB11


MB11 DO
Dissolved Oxygen (mg/L)
0
1
2
3
4
5
6
Depth (m AHD)
0
-5
-10
-15
-20
-25
-30
April
May
June
July
August
September
October
December
January 2011
February 2011
March 2011


MB11 EC
Electrical Conductivity (µS/cm)
0
10000
20000
30000
40000
50000
60000
70000
80000
90000
Depth (m AHD)
0
-5
-10
-15
-20
-25
-30
-35
During Drilling
March
April
May
June
July
August
September
October
November
December
January 2011
February 2011
March 2011

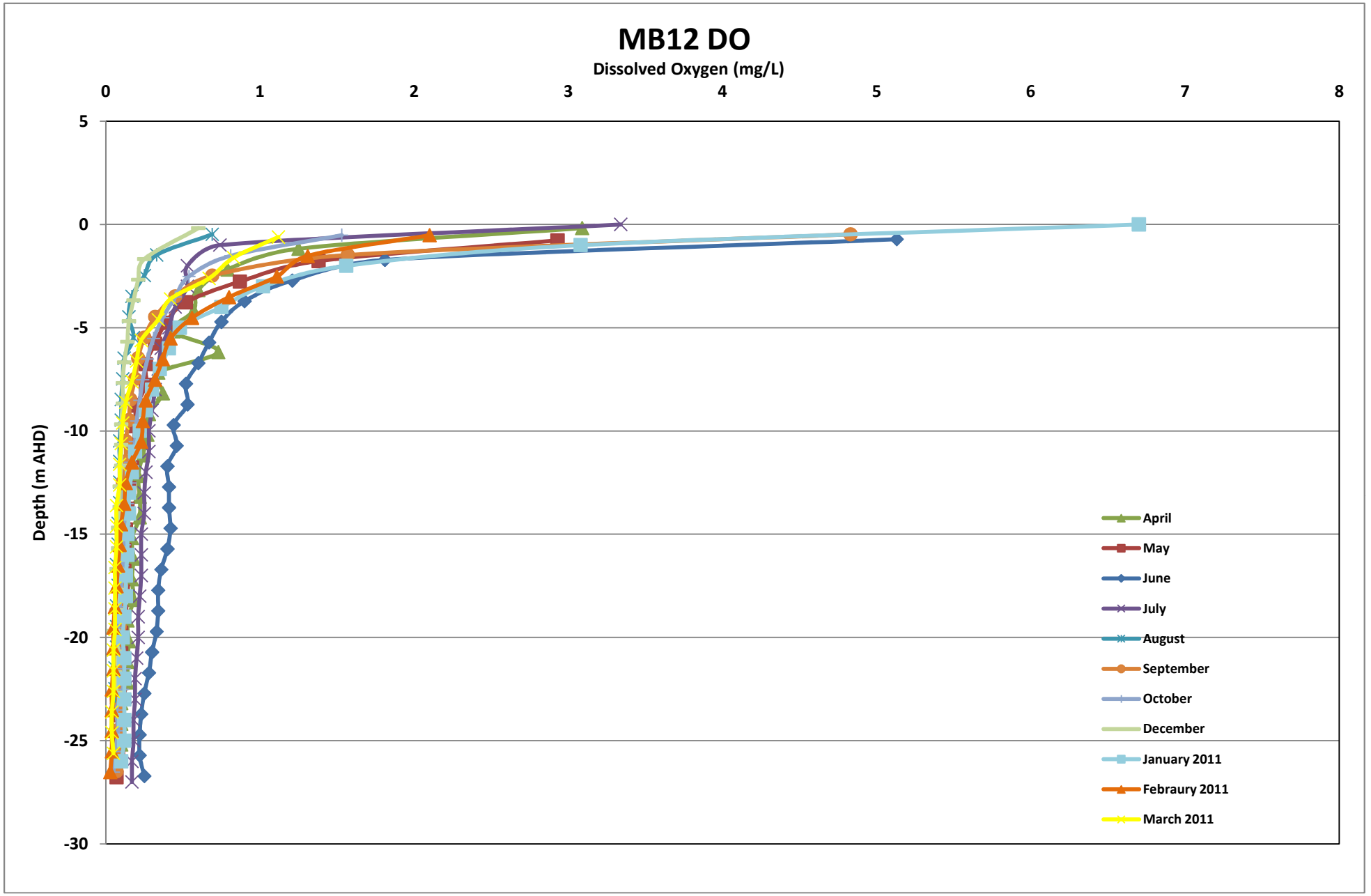

MB11 pH
pH
0
1
2
3
4
5
6
7
8
9
10
Depth (m AHD)
0
-5
-10
-15
-20
-25
-30
During Drilling
April
May
June
July
August
September
October
November
December
January 2011
February 2011
March 2011

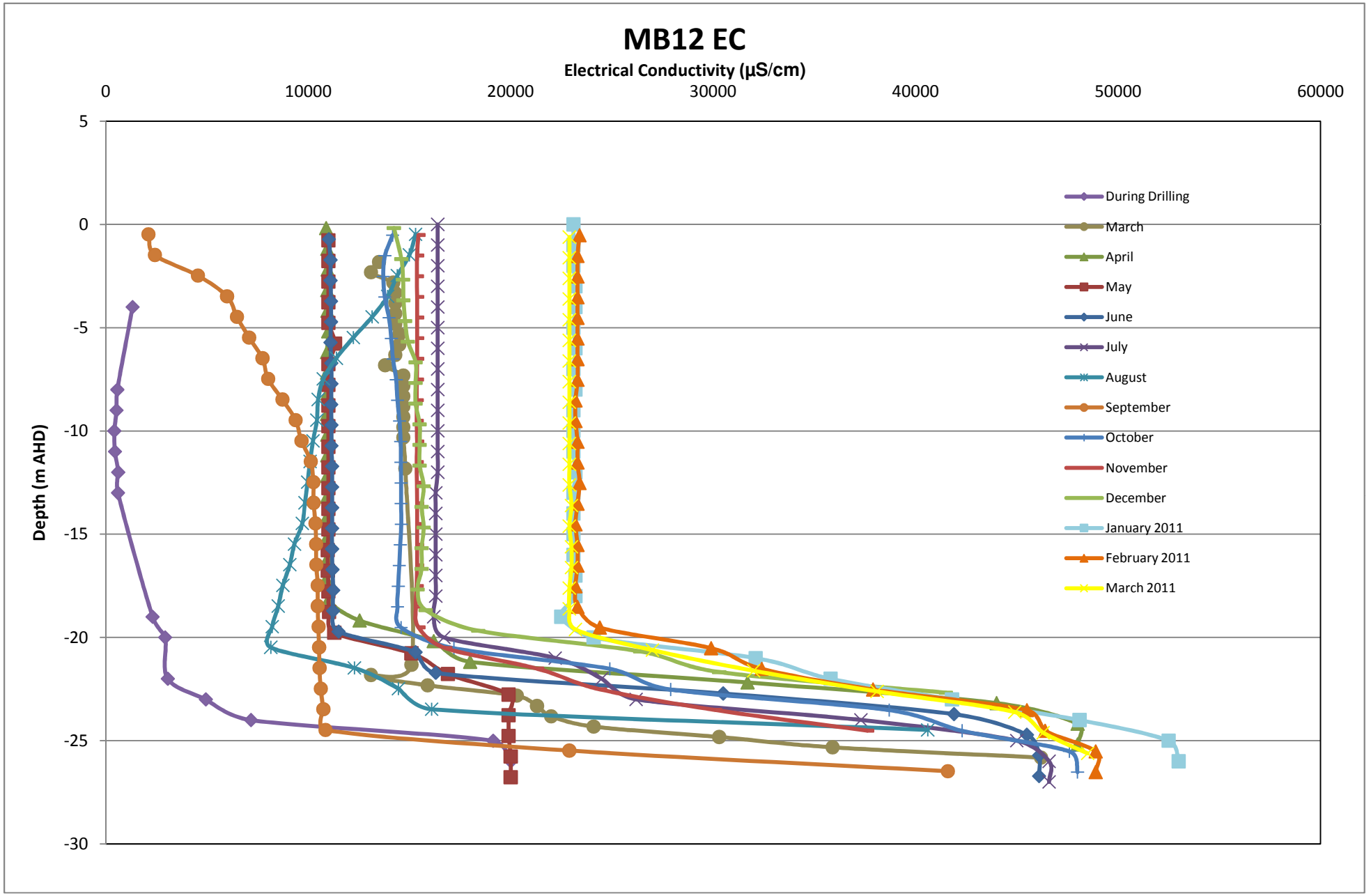

MB11 Redox
(mV)
-300
-250
-200
-150
-100
-50
0
0
-5
-10
-15
-20
-25
-30
Depth (m AHD)
February 2011
March 2011

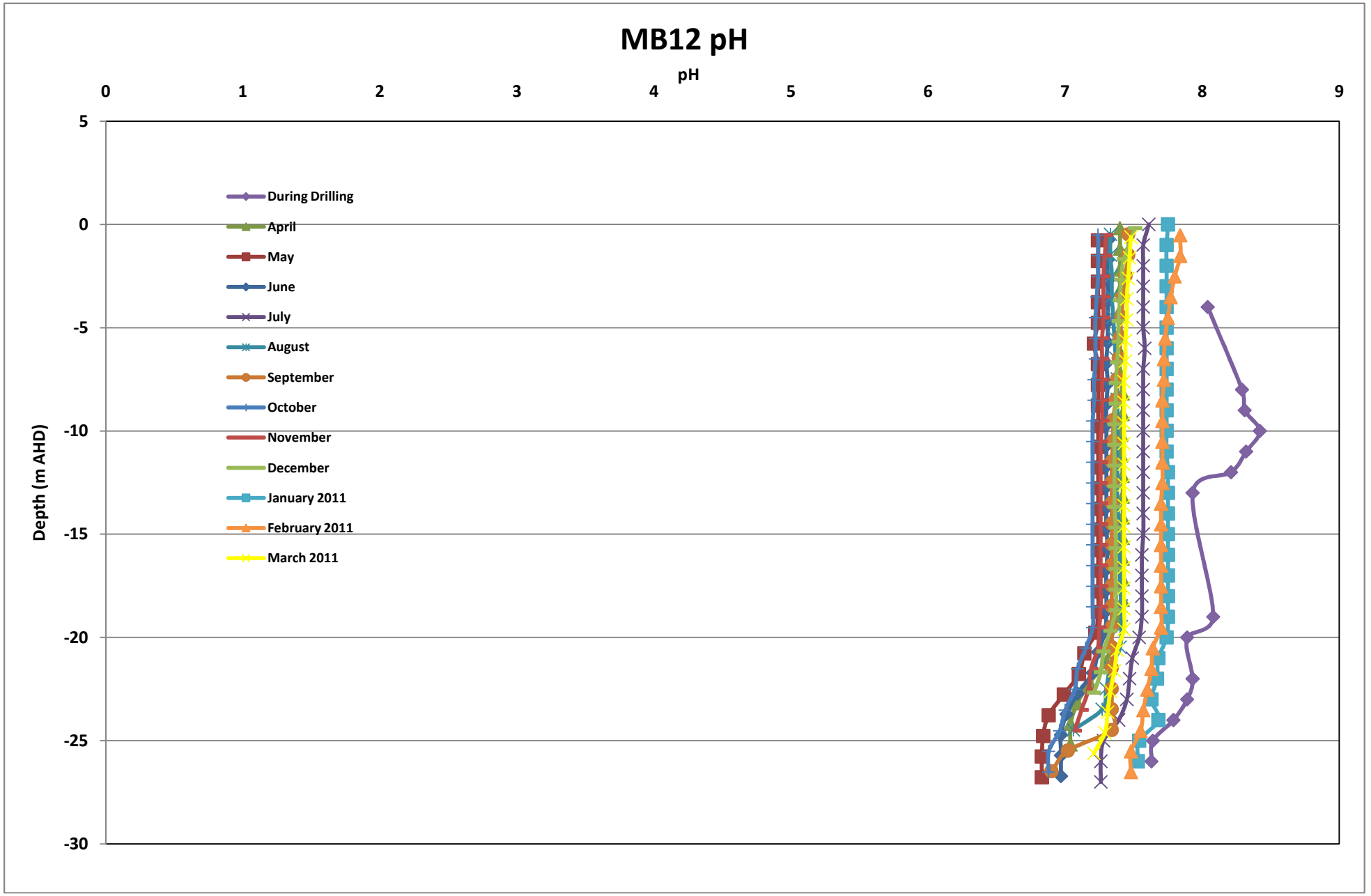

MB11 Temperature
Temperature (°C)
0
5
10
15
20
25
30
Depth (m AHD)
0
-5
-10
-15
-20
-25
-30
-35
During Drilling
March
April
May
June
July
August
September
October
November
December
January 2011
February 2011
March 2011

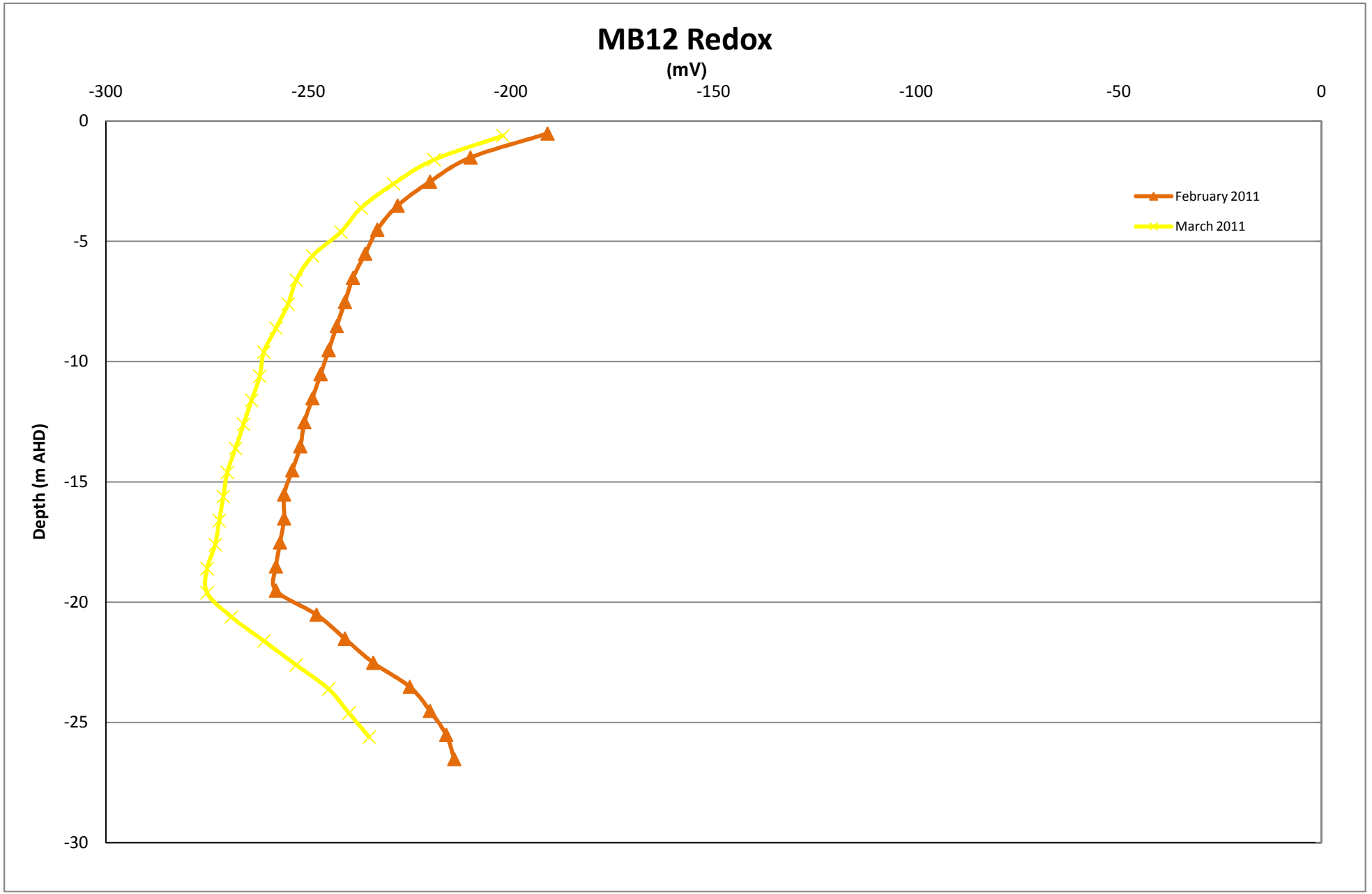
MWH

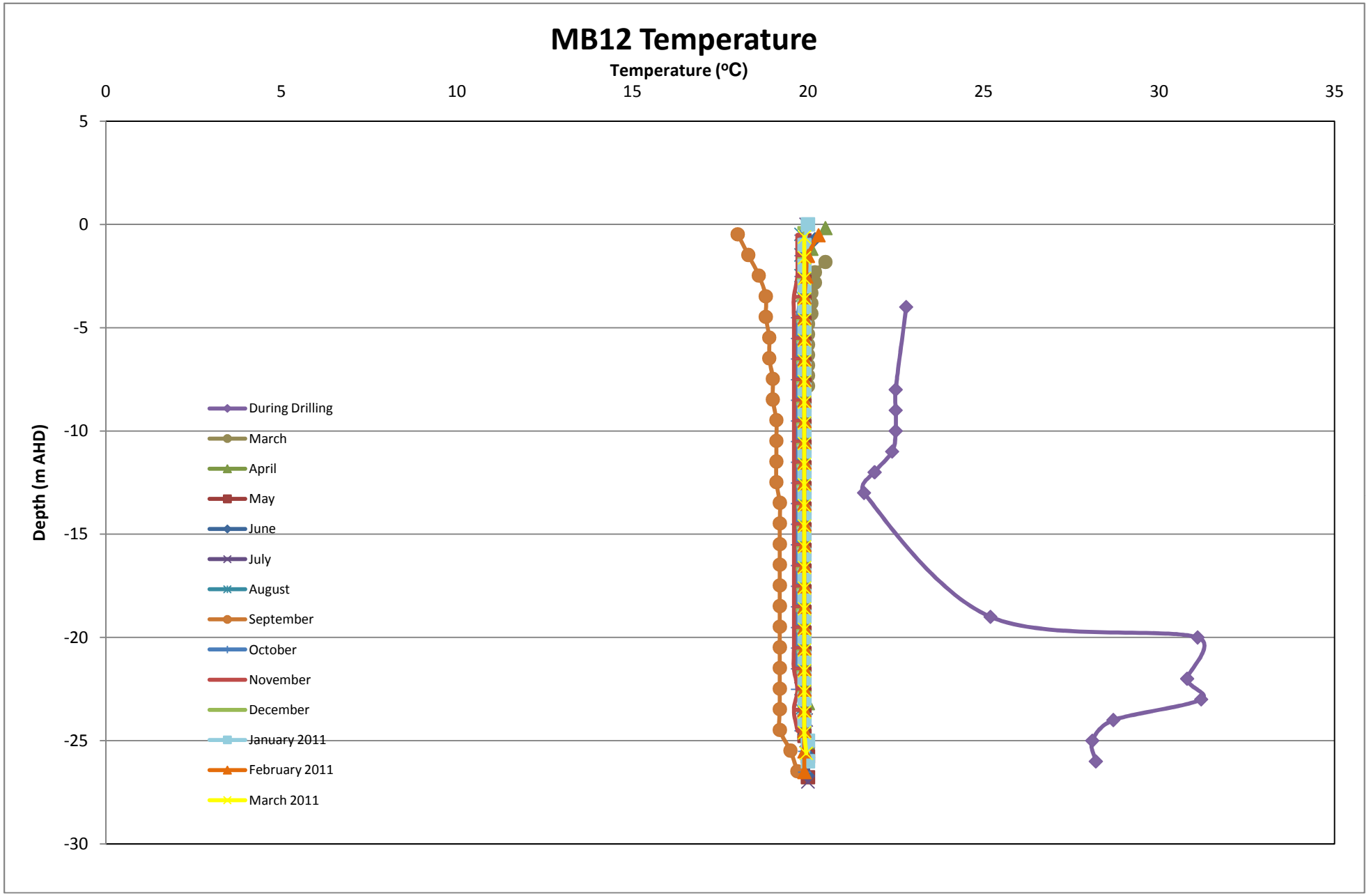
MB12


MB12 DO
Dissolved Oxygen (mg/L)
0
1
2
3
4
5
6
7
8
5
0
-5
-10
-15
-20
-25
-30
Depth (m AHD)
April
May
June
July
August
September
October
December
January 2011
Febraury 2011
March 2011


MB12 EC
Electrical Conductivity (µS/cm)
0
10000
20000
30000
40000
50000
60000
5
0
-5
-10
-15
-20
-25
-30
Depth (m AHD)
During Drilling
March
April
May
June
July
August
September
October
November
December
January 2011
February 2011
March 2011

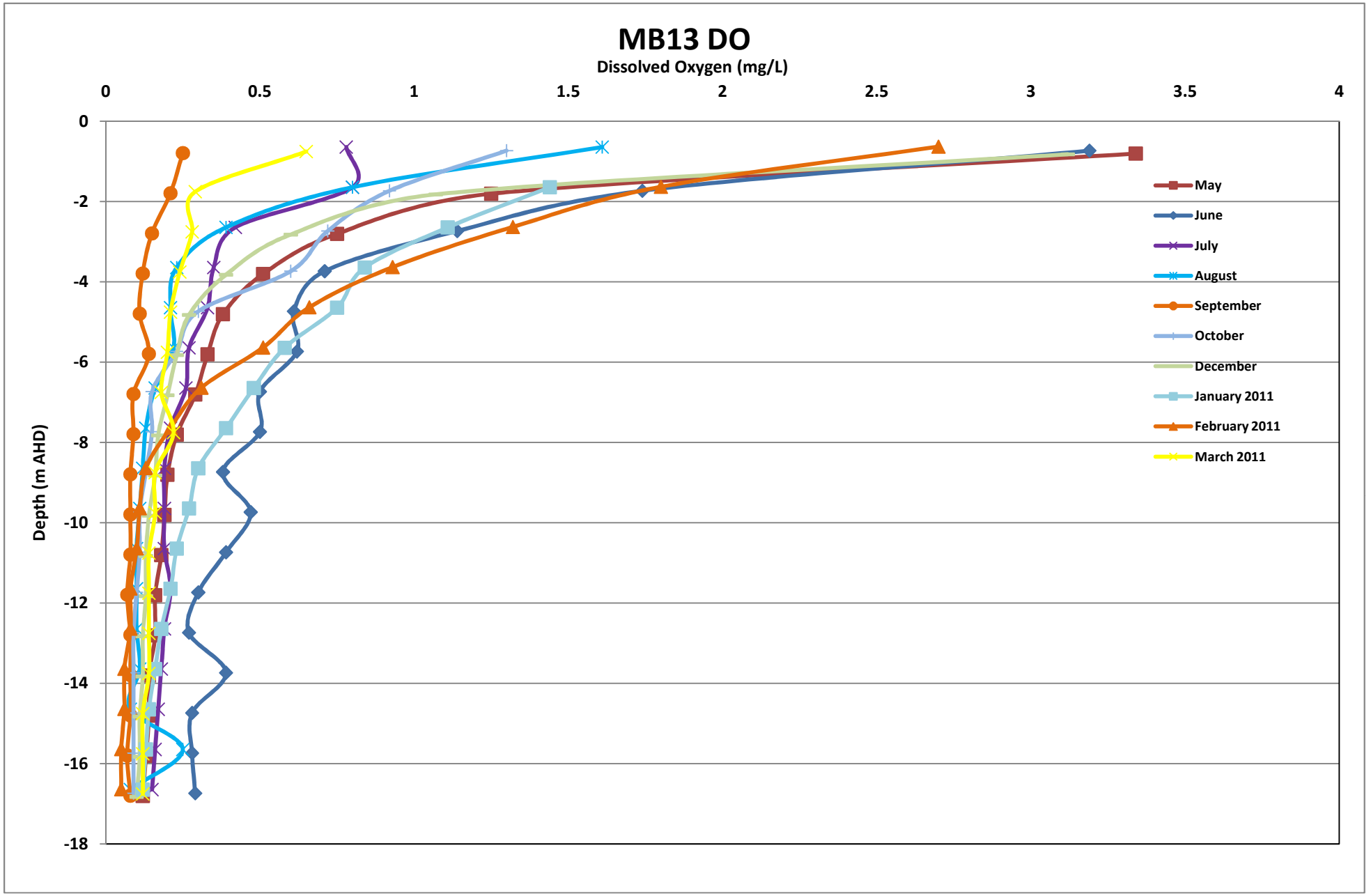

MB12 pH
pH
0
1
2
3
4
5
6
7
8
9
5
0
-5
-10
-15
-20
-25
-30
Depth (m AHD)
During Drilling
April
May
June
July
August
September
October
November
December
January 2011
February 2011
March 2011

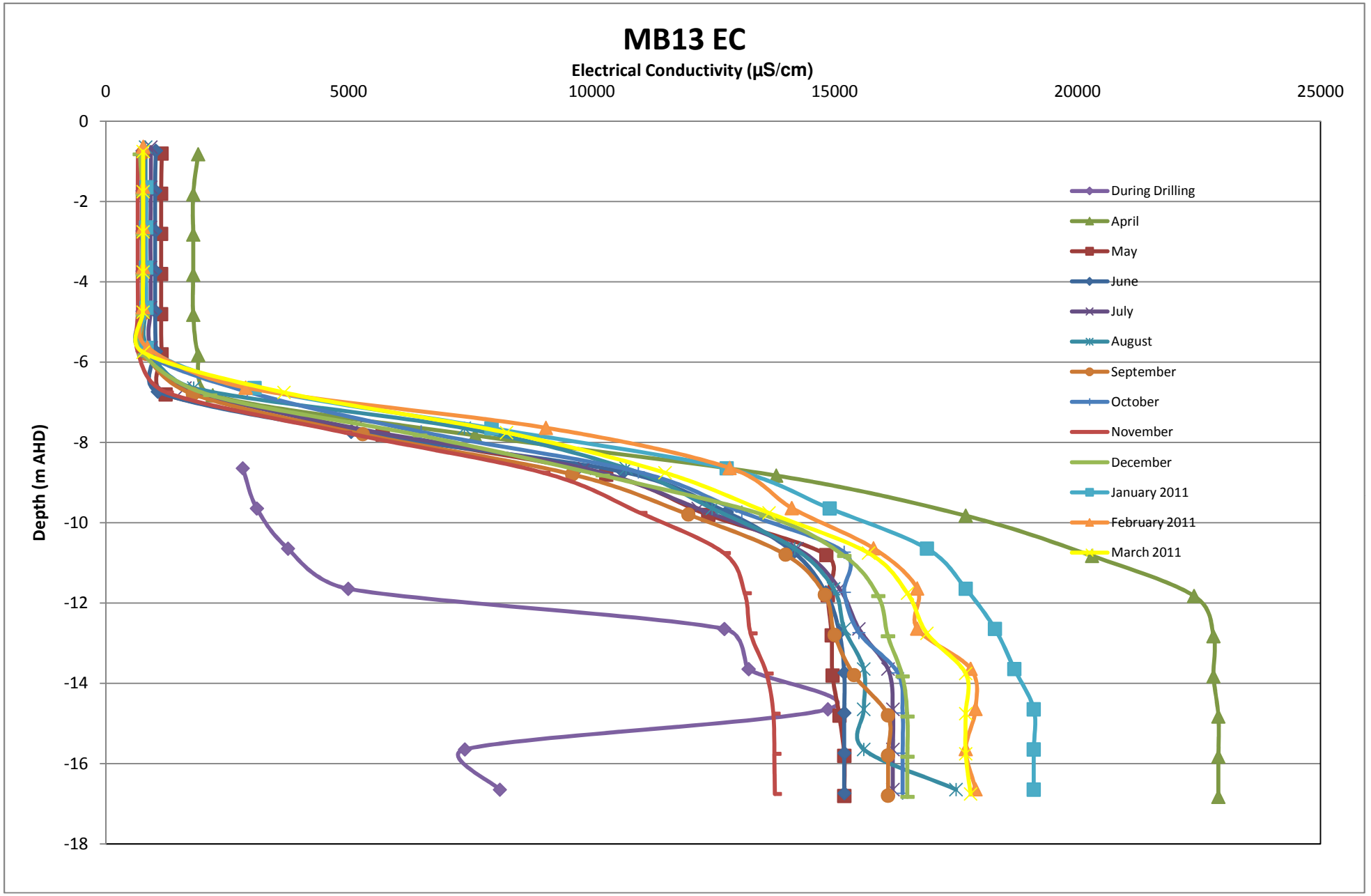

MB12 Redox
(mV)
-300
-250
-200
-150
-100
-50
0
0
-5
-10
-15
-20
-25
-30
Depth (m AHD)
February 2011
March 2011

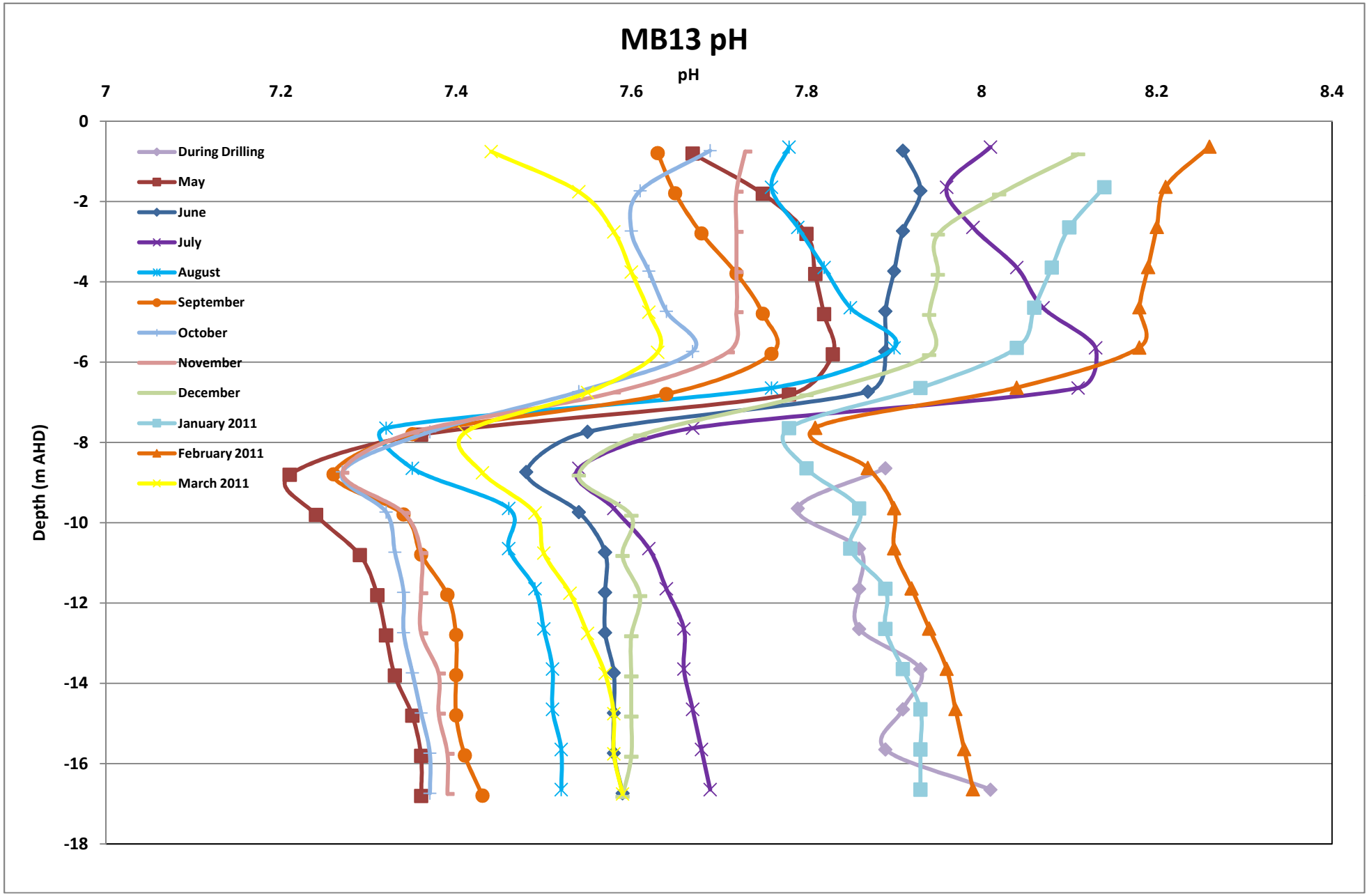

MB12 Temperature
Temperature (°C)
0
5
10
15
20
25
30
35
5
0
-5
-10
-15
-20
-25
-30
Depth (m AHD)
During Drilling
March
April
May
June
July
August
September
October
November
December
January 2011
February 2011
March 2011

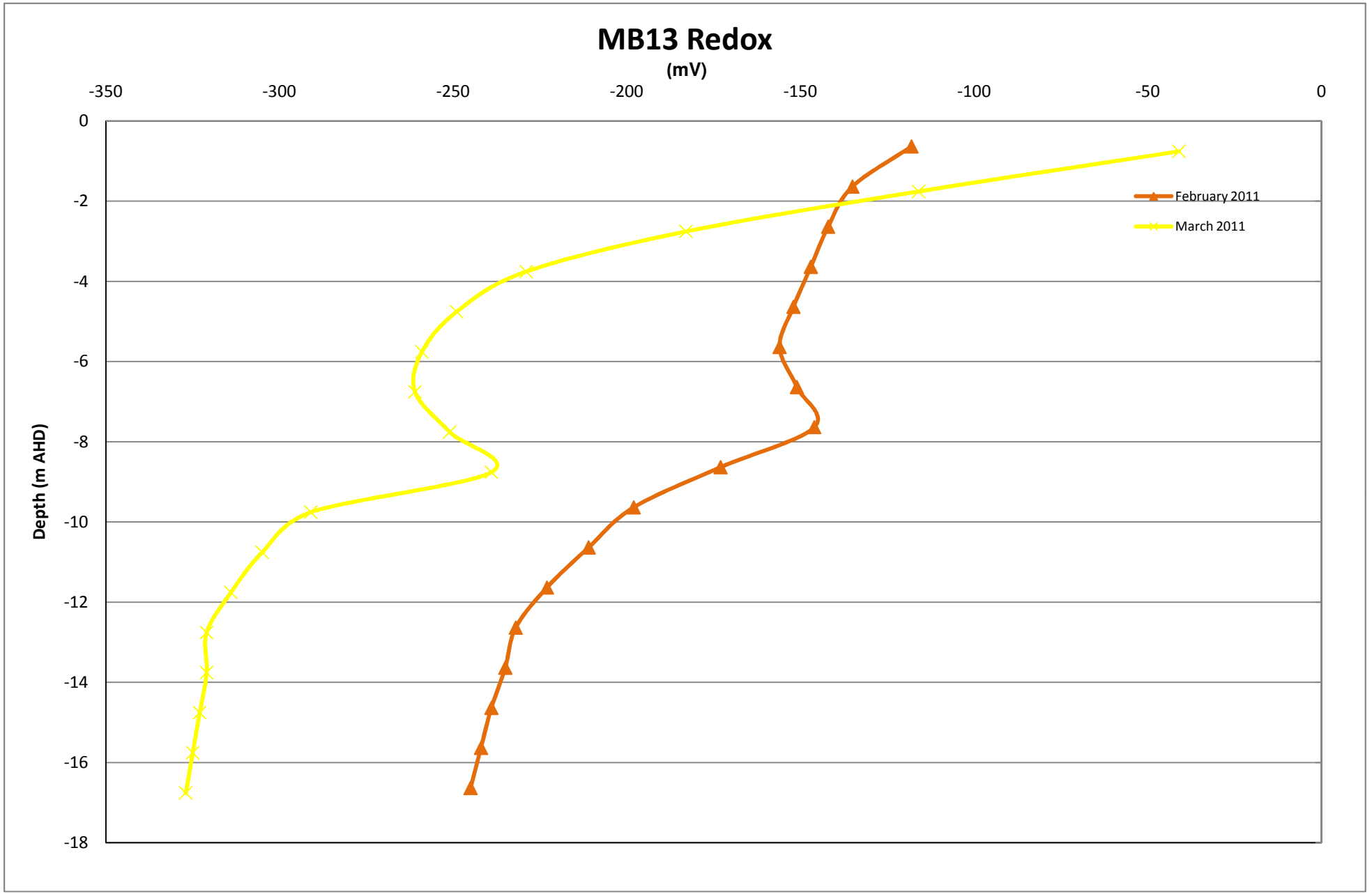
MWH

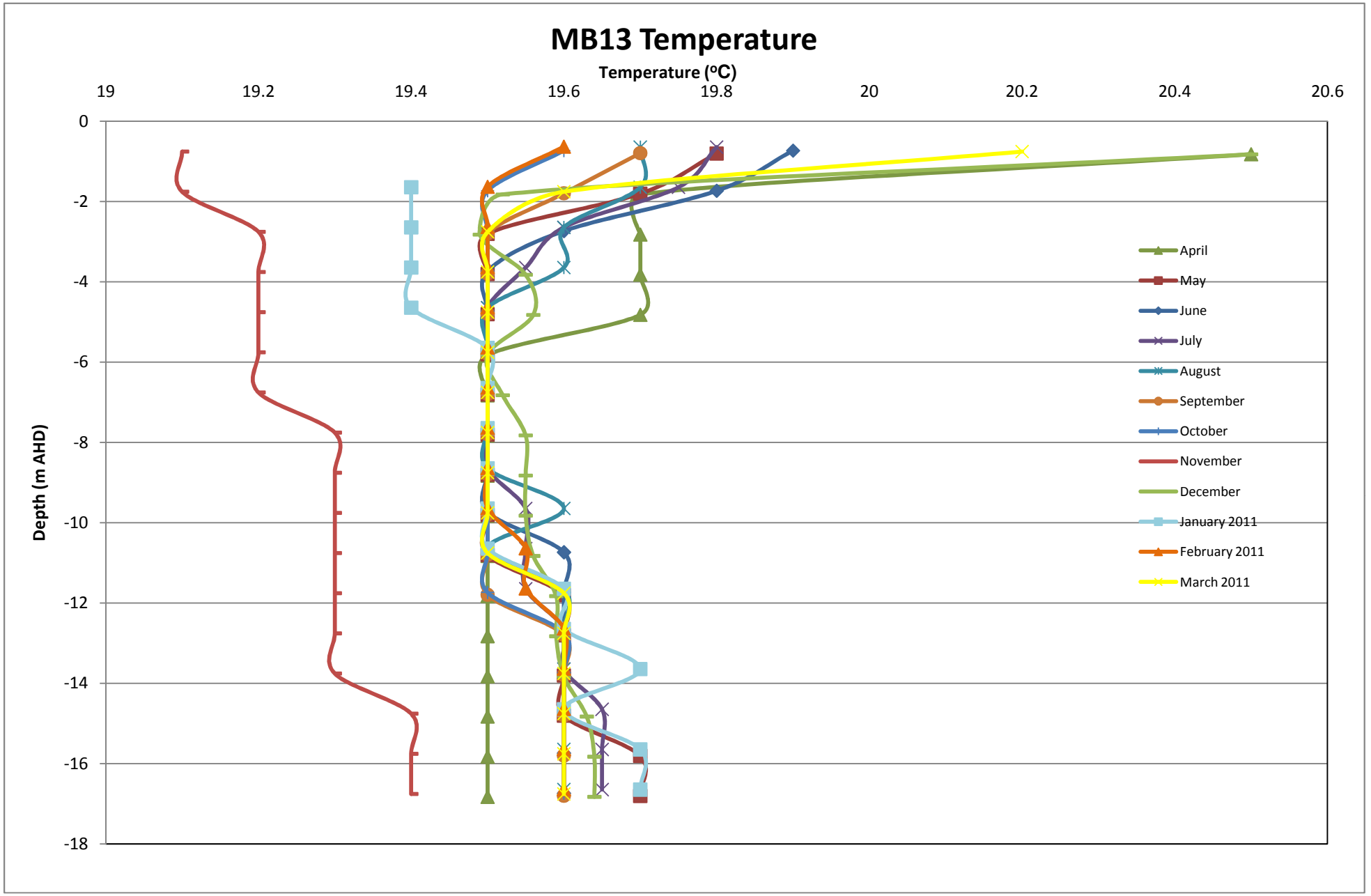
MB13


MB13 DO
Dissolved Oxygen (mg/L)
0
0.5
1
1.5
2
2.5
3
3.5
4
Depth (m AHD)
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
May
June
July
August
September
October
December
January 2011
February 2011
March 2011


MB13 EC
Electrical Conductivity (µS/cm)
0
5000
10000
15000
20000
25000
Depth (m AHD)
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
During Drilling
April
May
June
July
August
September
October
November
December
January 2011
February 2011
March 2011

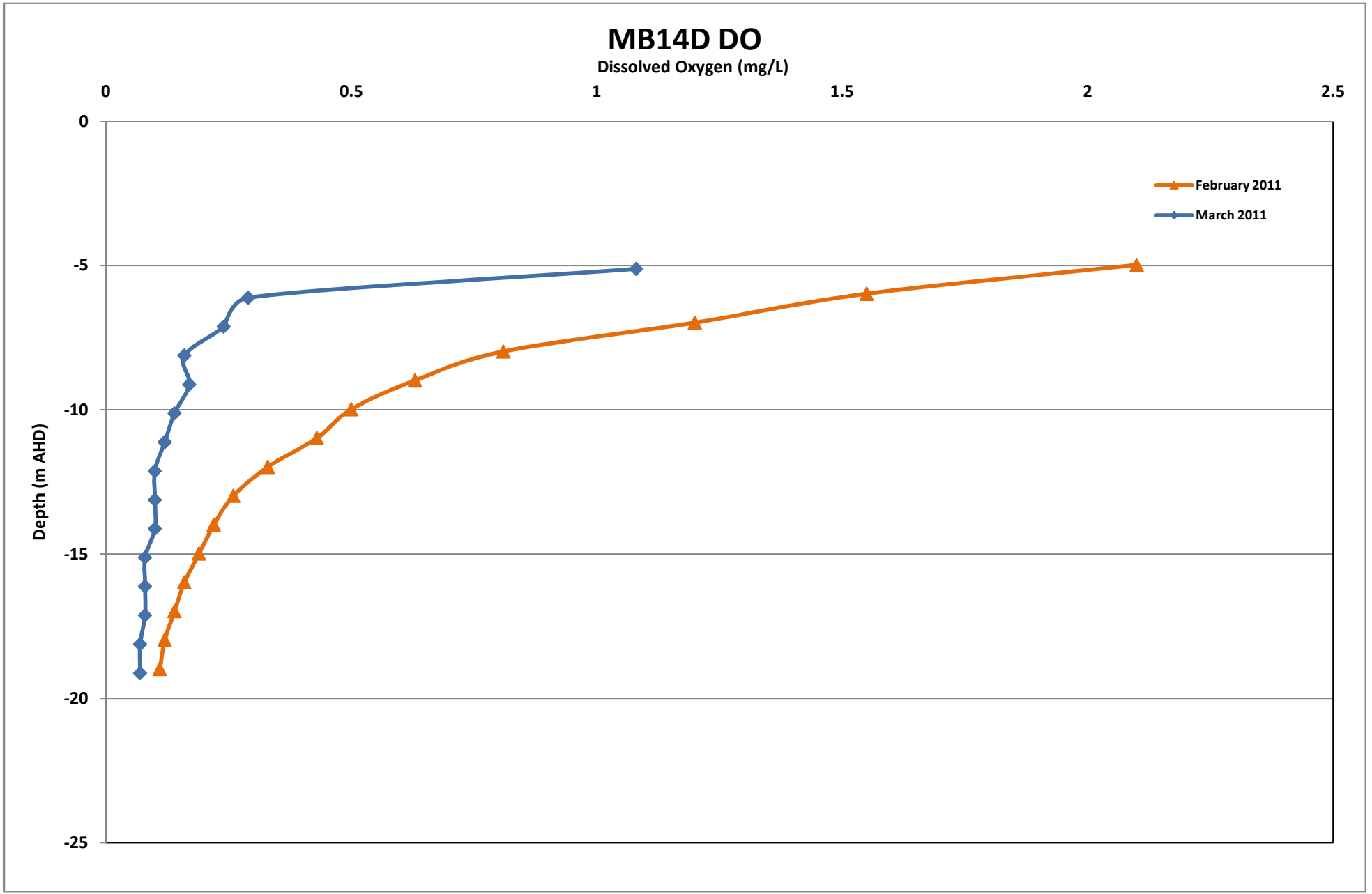

MB13 pH
pH
7
7.2
7.4
7.6
7.8
8
8.2
8.4
Depth (m AHD)
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
During Drilling
May
June
July
August
September
October
November
December
January 2011
February 2011
March 2011

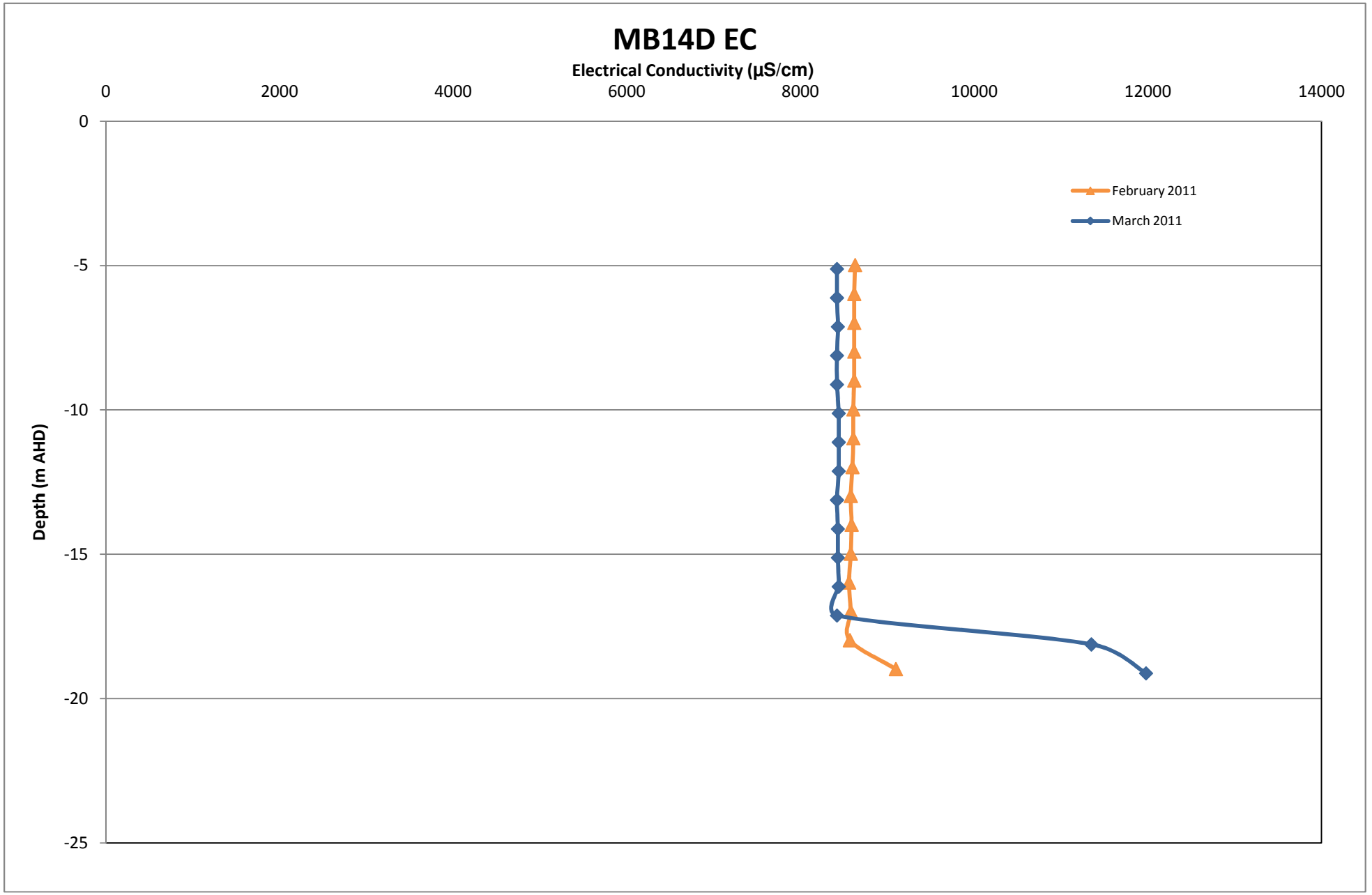

MB13 Redox
(mV)
-350
-300
-250
-200
-150
-100
-50
0
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
Depth (m AHD)
February 2011
March 2011

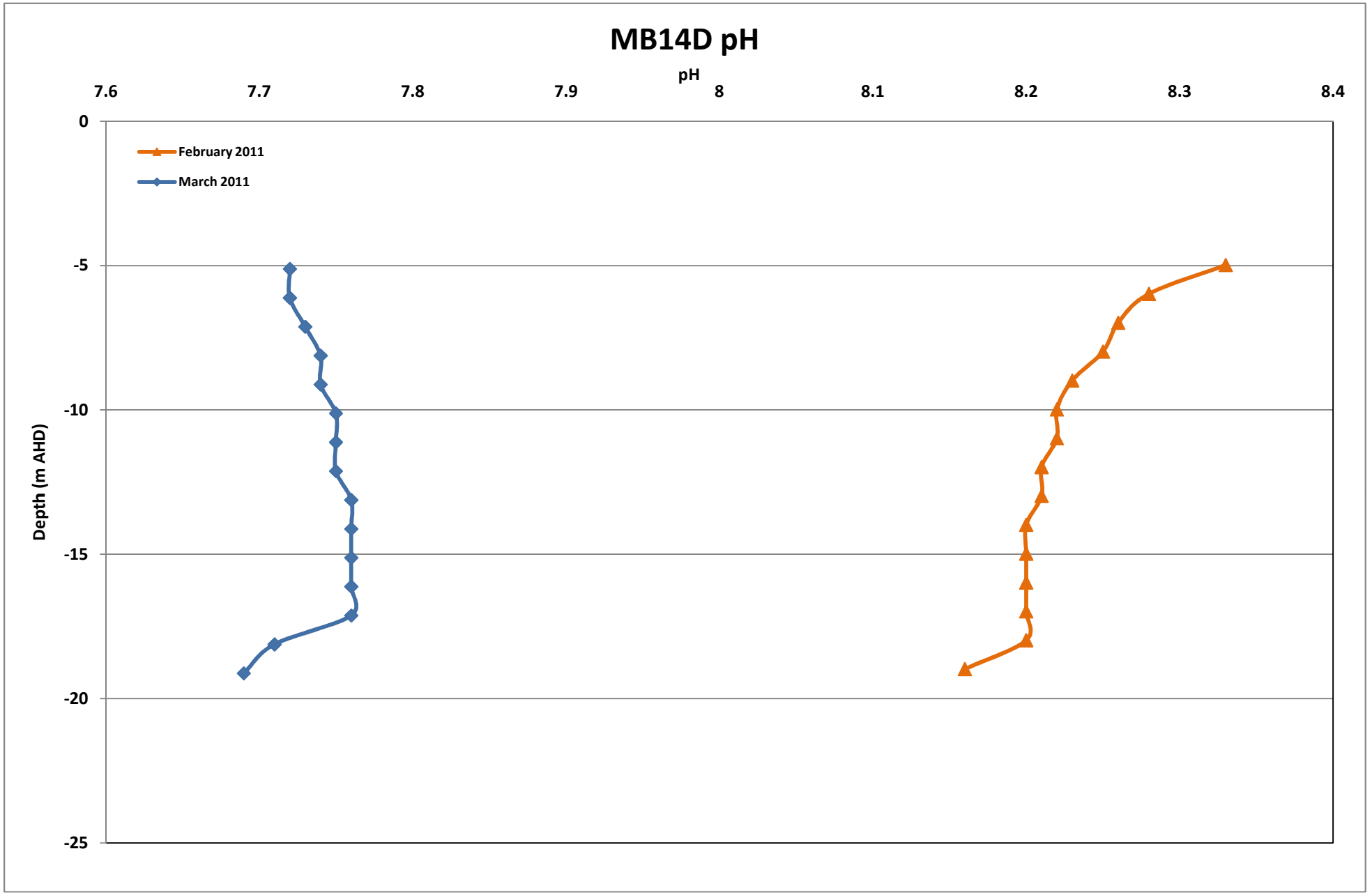

MB13 Temperature
Temperature (ºC)
19
19.2
19.4
19.6
19.8
20
20.2
20.4
20.6
Depth (m AHD)
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
April
May
June
July
August
September
October
November
December
January 2011
February 2011
March 2011

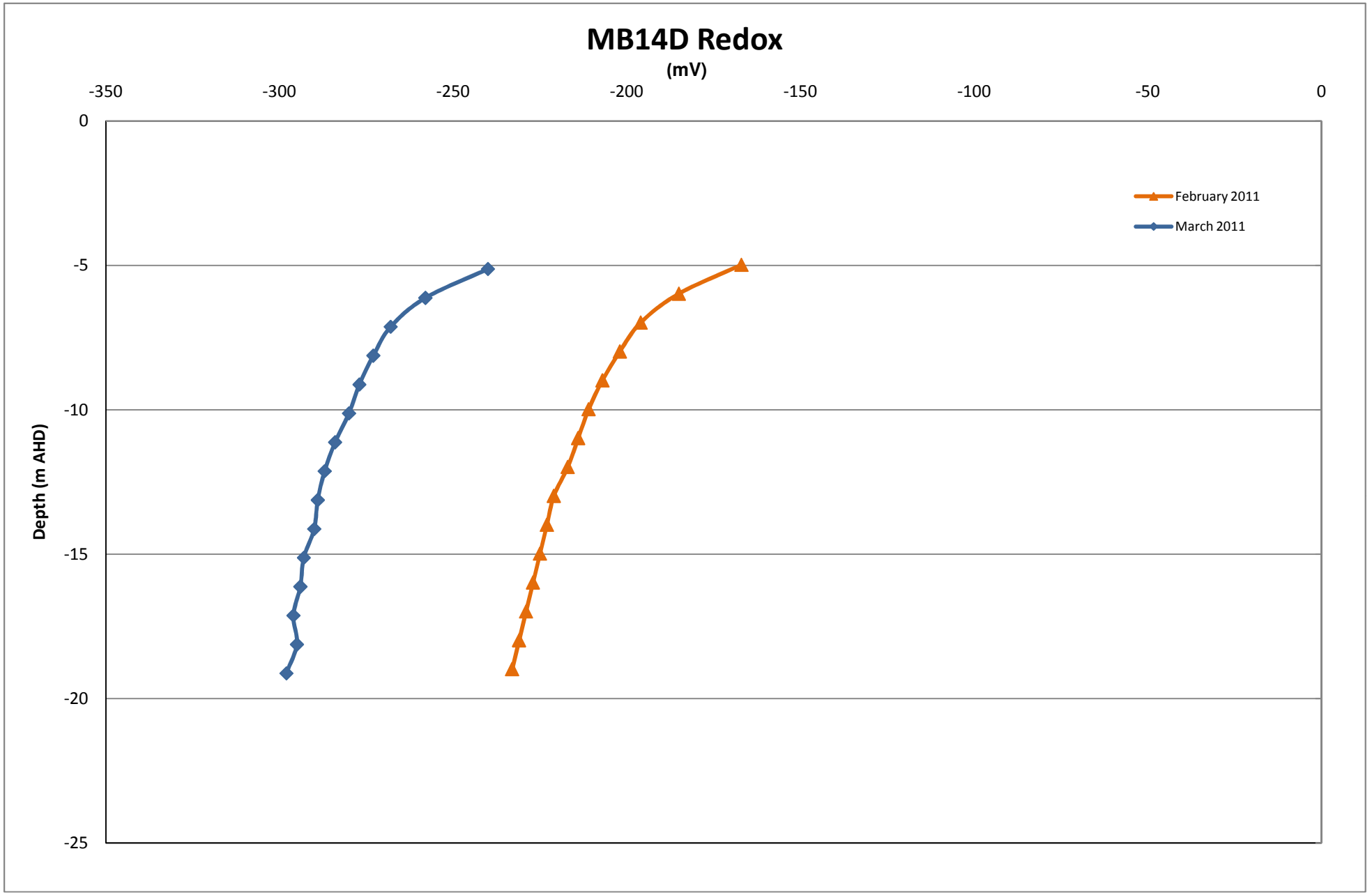
MWH

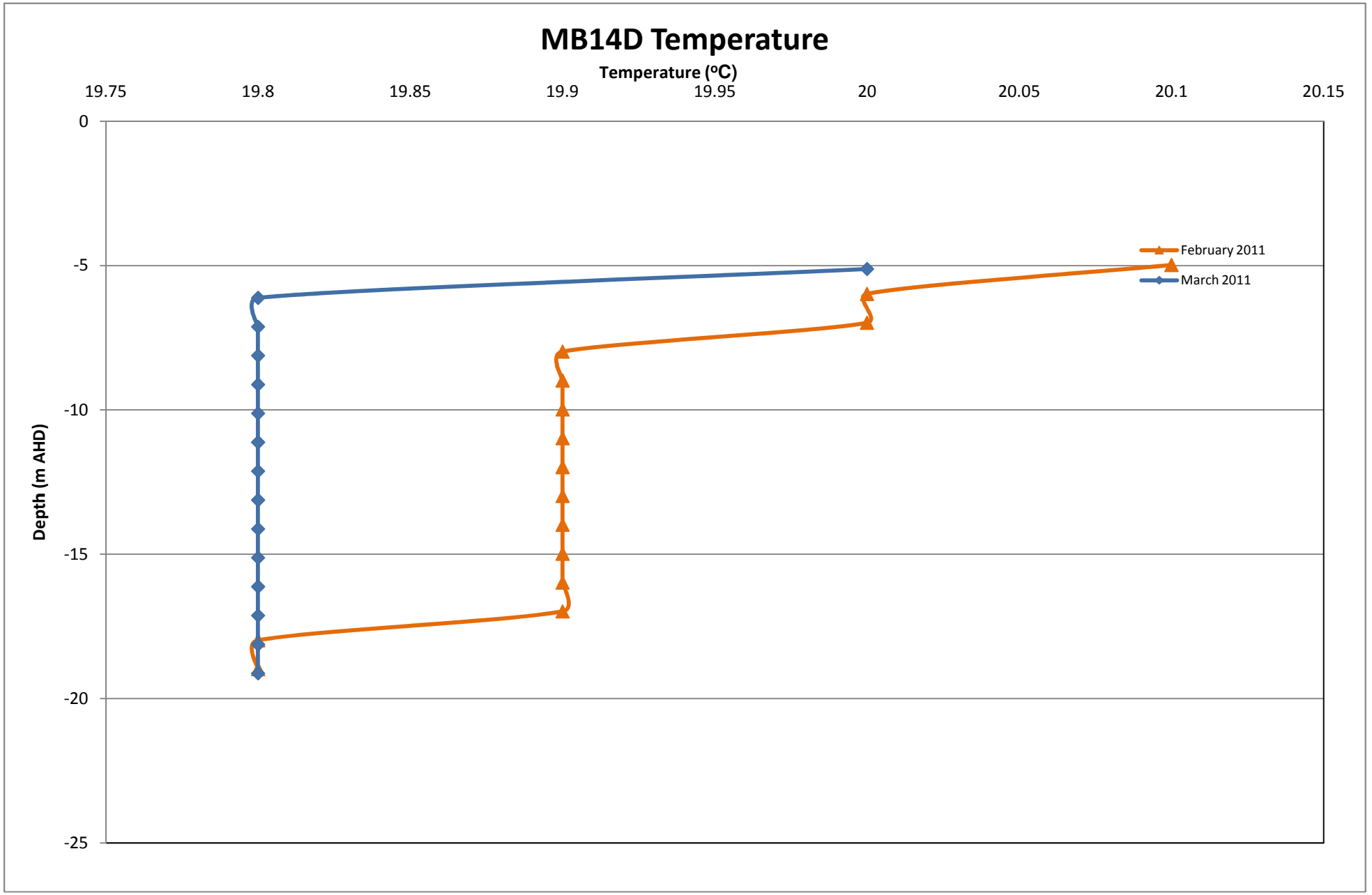
MB14D


MB14D DO
Dissolved Oxygen (mg/L)
0
0.5
1
1.5
2
2.5
Depth (m AHD)
0
-5
-10
-15
-20
-25
February 2011
March 2011


MB14D EC
Electrical Conductivity (µS/cm)
0
2000
4000
6000
8000
10000
12000
14000
Depth (m AHD)
0
-5
-10
-15
-20
-25
February 2011
March 2011

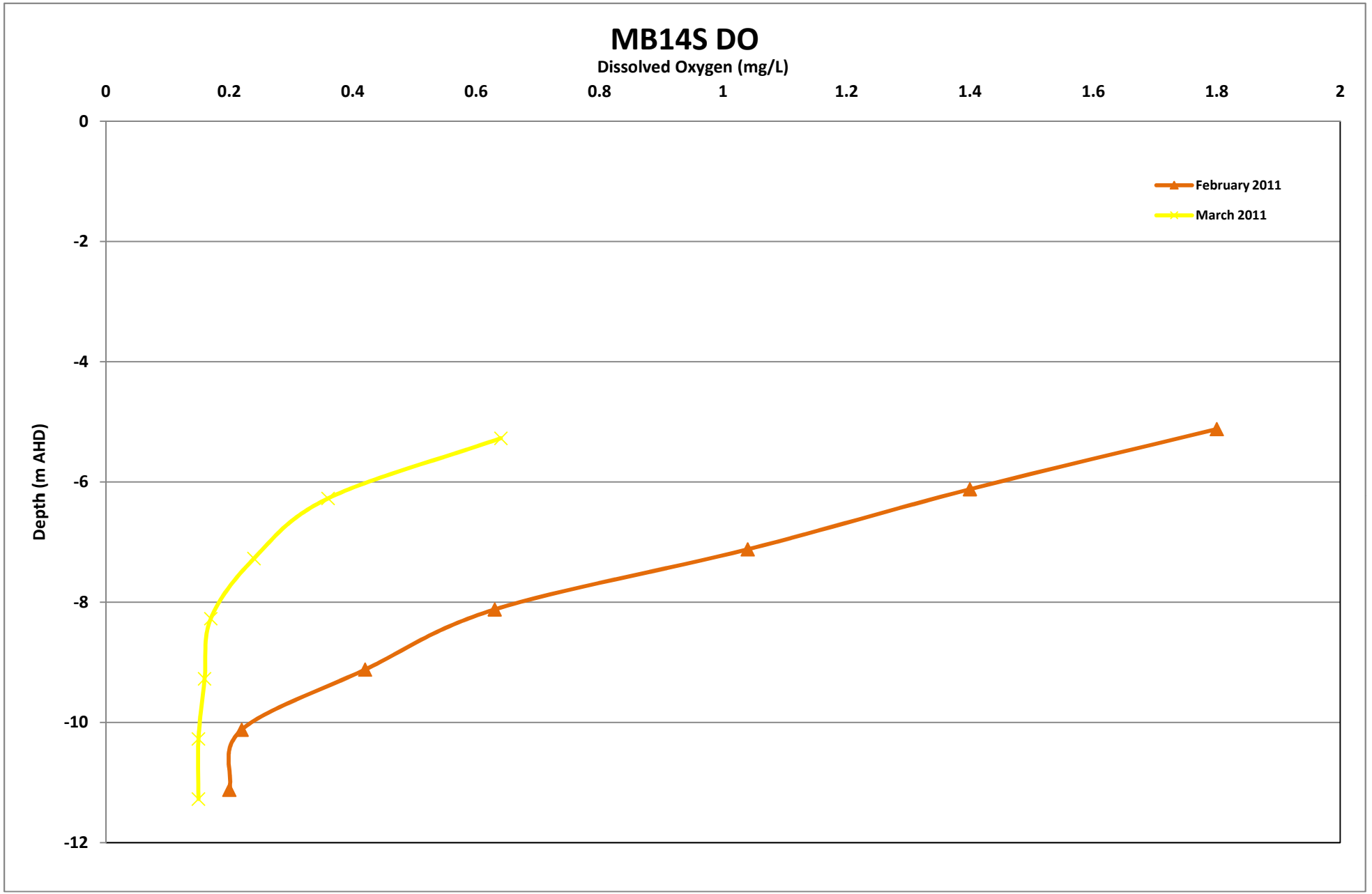

MB14D pH
pH
7.6
7.7
7.8
7.9
8
8.1
8.2
8.3
8.4
0
-5
-10
-15
-20
-25
Depth (m AHD)
February 2011
March 2011

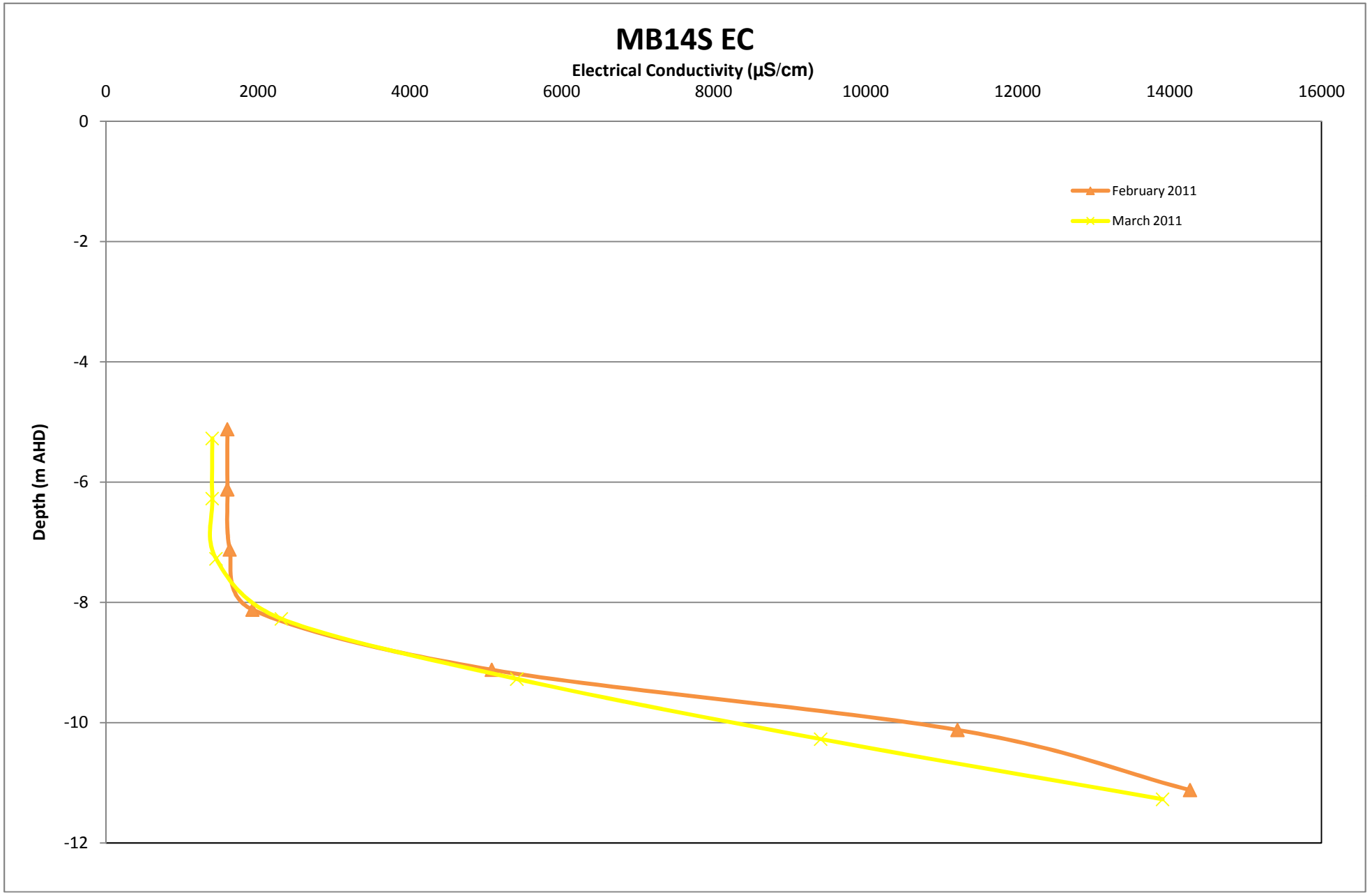

MB14D Redox
(mV)
-350
-300
-250
-200
-150
-100
-50
0
0
-5
-10
-15
-20
-25
Depth (m AHD)
February 2011
March 2011

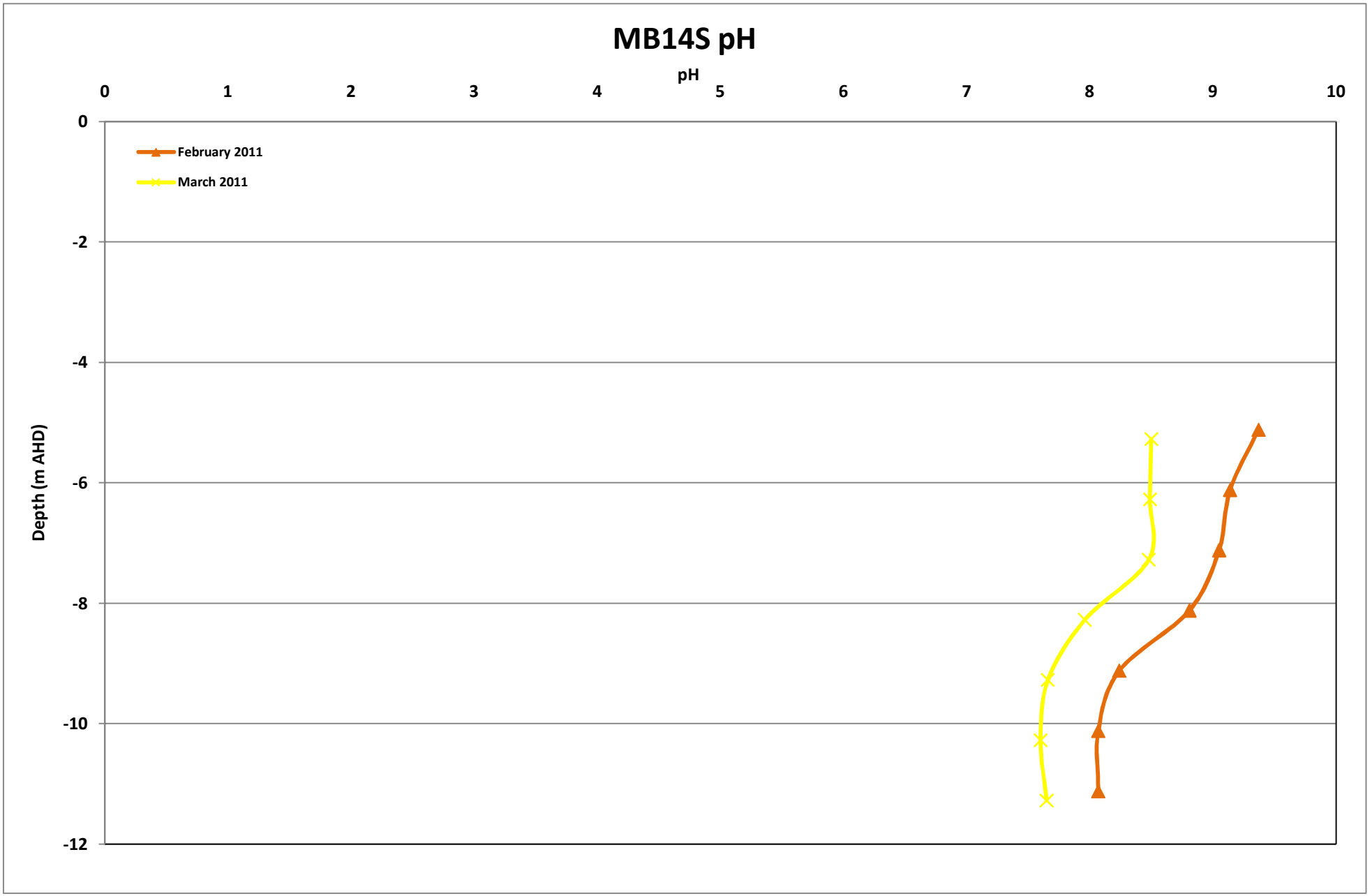

MB14D Temperature
Temperature (ºC)
19.75
19.8
19.85
19.9
19.95
20
20.05
20.1
20.15
0
-5
-10
-15
-20
-25
Depth (m AHD)
February 2011
March 2011

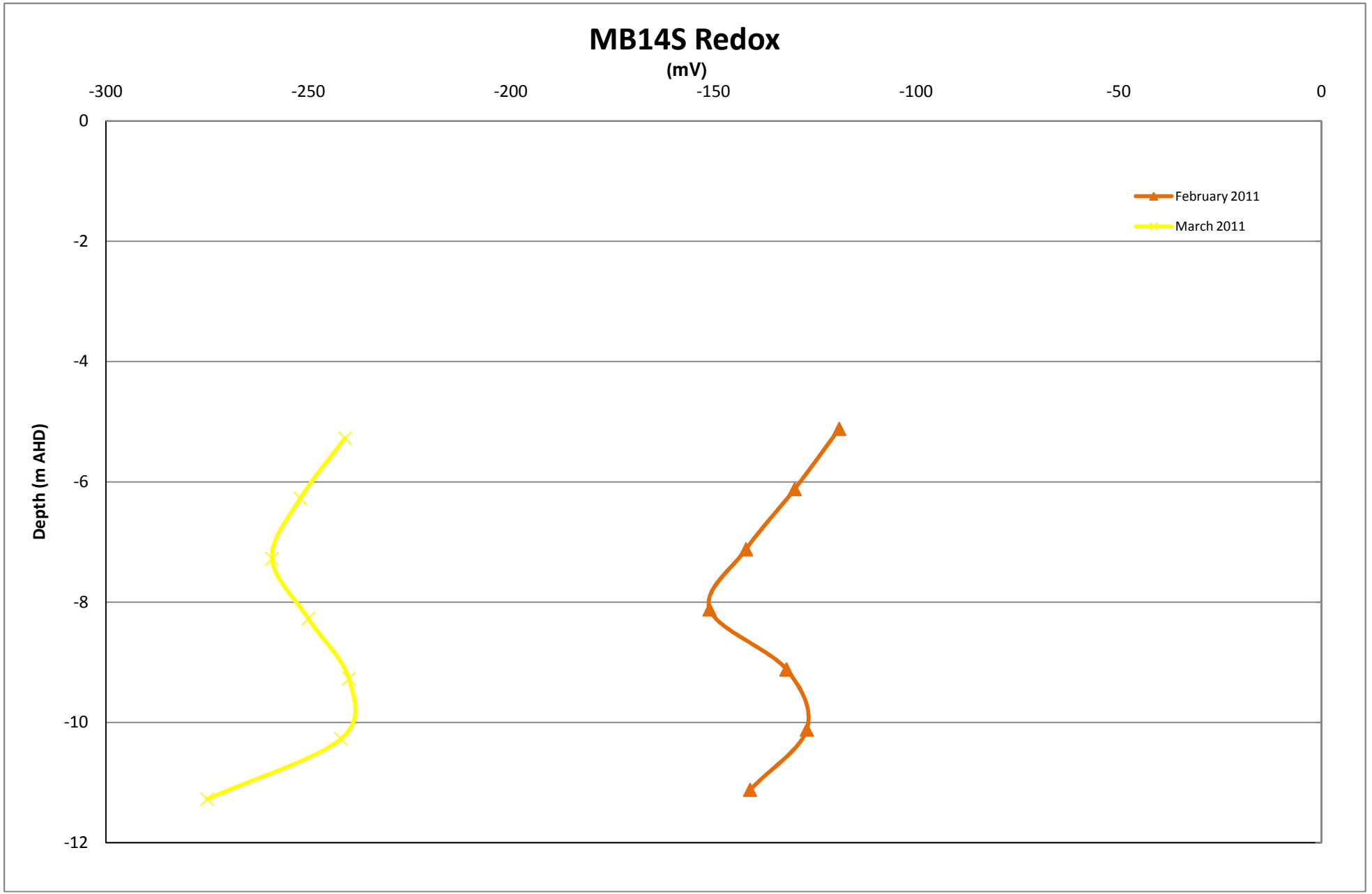
MWH

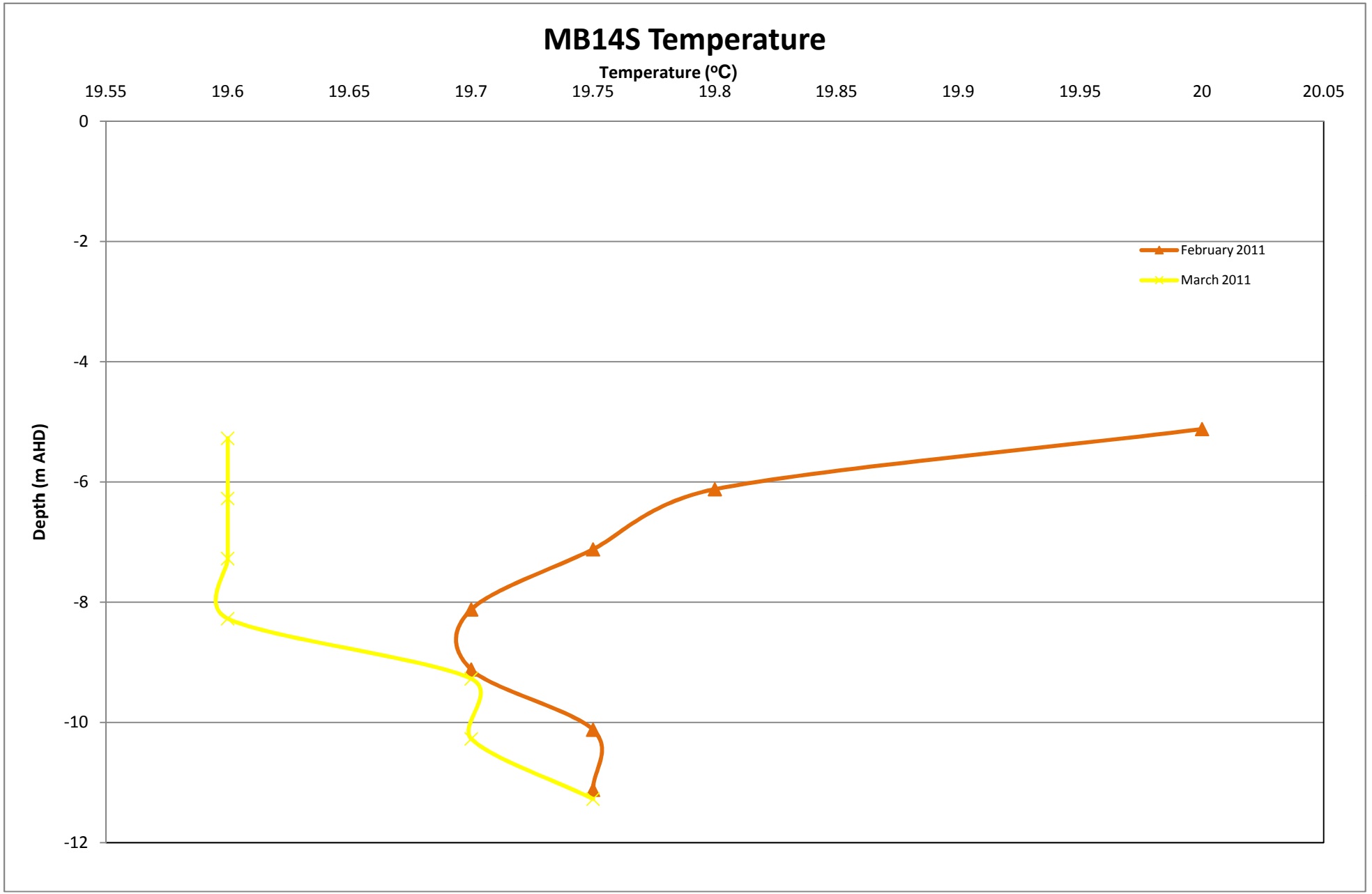
MB14S


MB14S DO
Dissolved Oxygen (mg/L)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
Depth (m AHD)
0
-2
-4
-6
-8
-10
-12
February 2011
March 2011

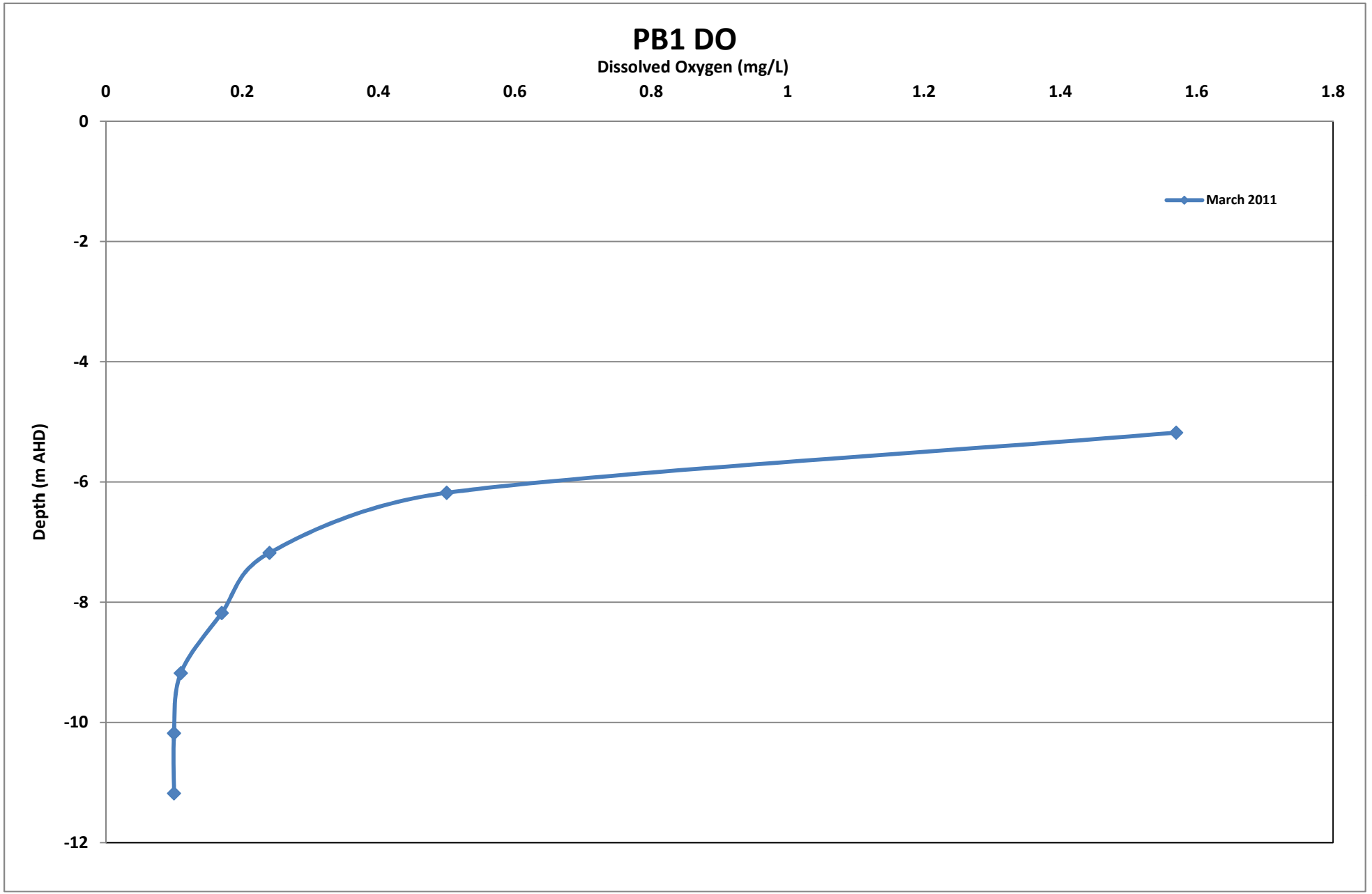

MB14S EC
Electrical Conductivity (µS/cm)
0
2000
4000
6000
8000
10000
12000
14000
16000
Depth (m AHD)
0
-2
-4
-6
-8
-10
-12
February 2011
March 2011

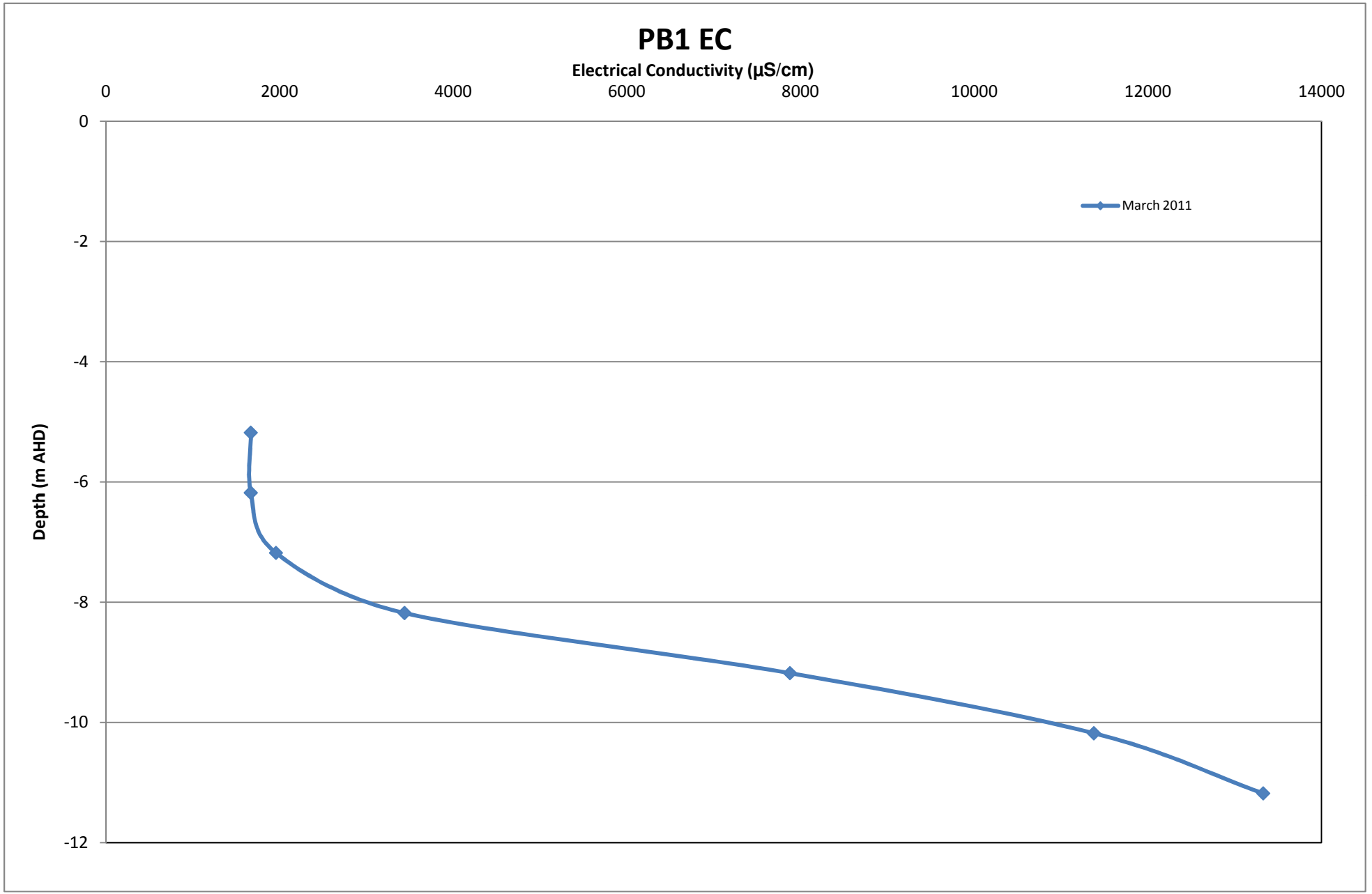

MB14S pH
pH
0
1
2
3
4
5
6
7
8
9
10
Depth (m AHD)
0
-2
-4
-6
-8
-10
-12
February 2011
March 2011

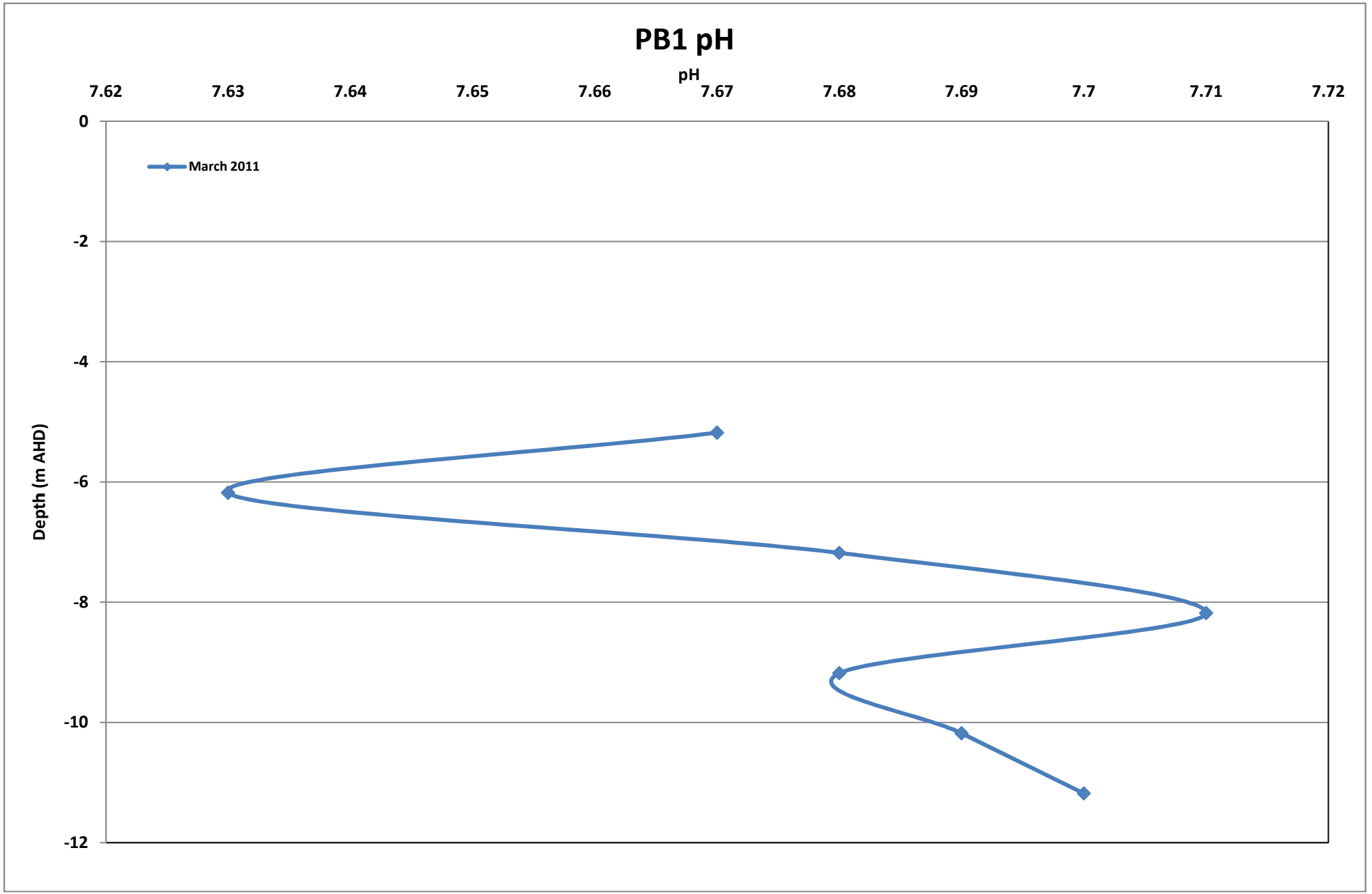

MB14S Redox
(mV)
-300
-250
-200
-150
-100
-50
0
Depth (m AHD)
0
-2
-4
-6
-8
-10
-12
February 2011
March 2011

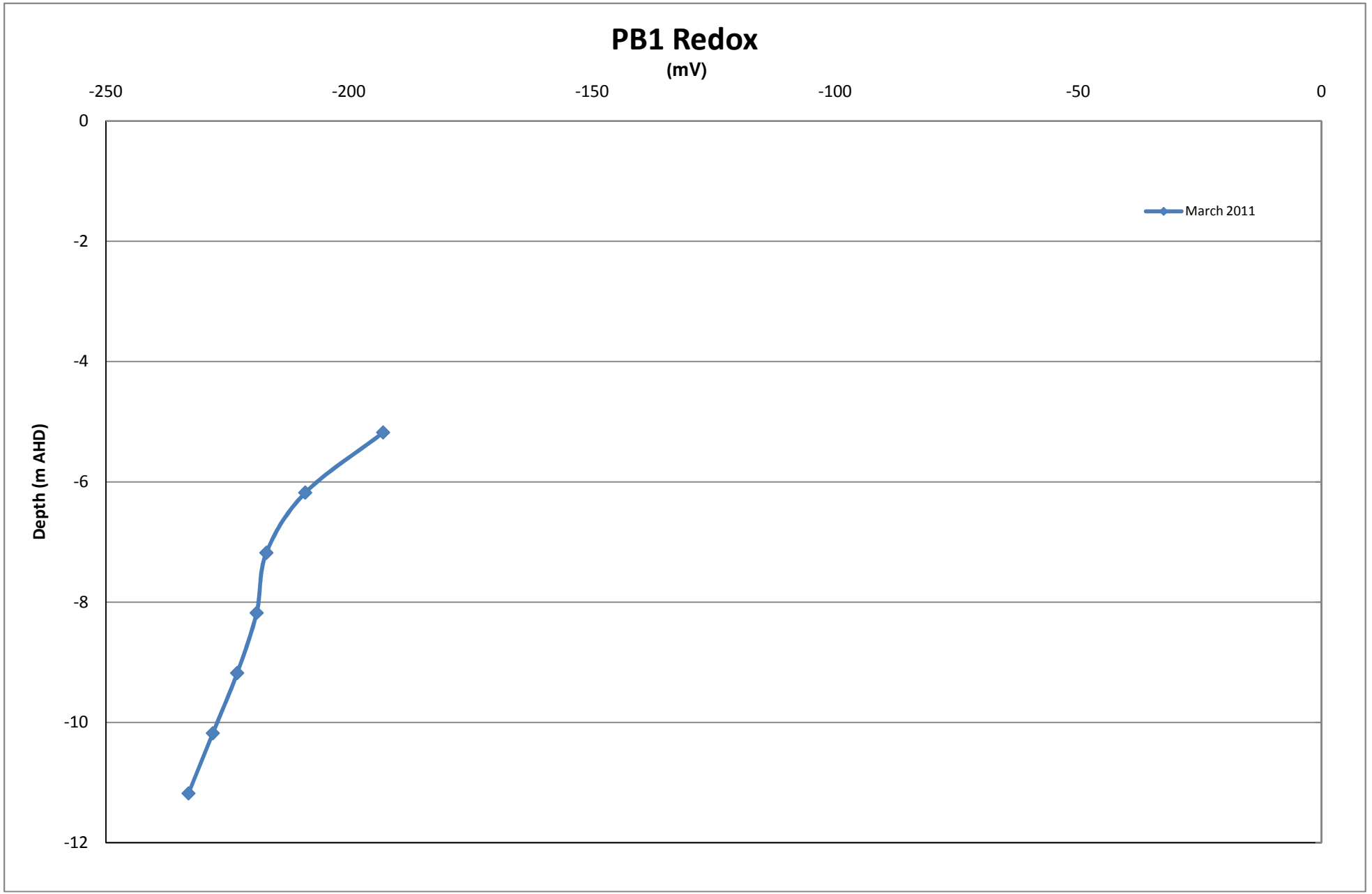

MB14S Temperature
Temperature (ºC)
19.55
19.6
19.65
19.7
19.75
19.8
19.85
19.9
19.95
20
20.05
0
-2
-4
-6
-8
-10
-12
Depth (m AHD)
February 2011
March 2011

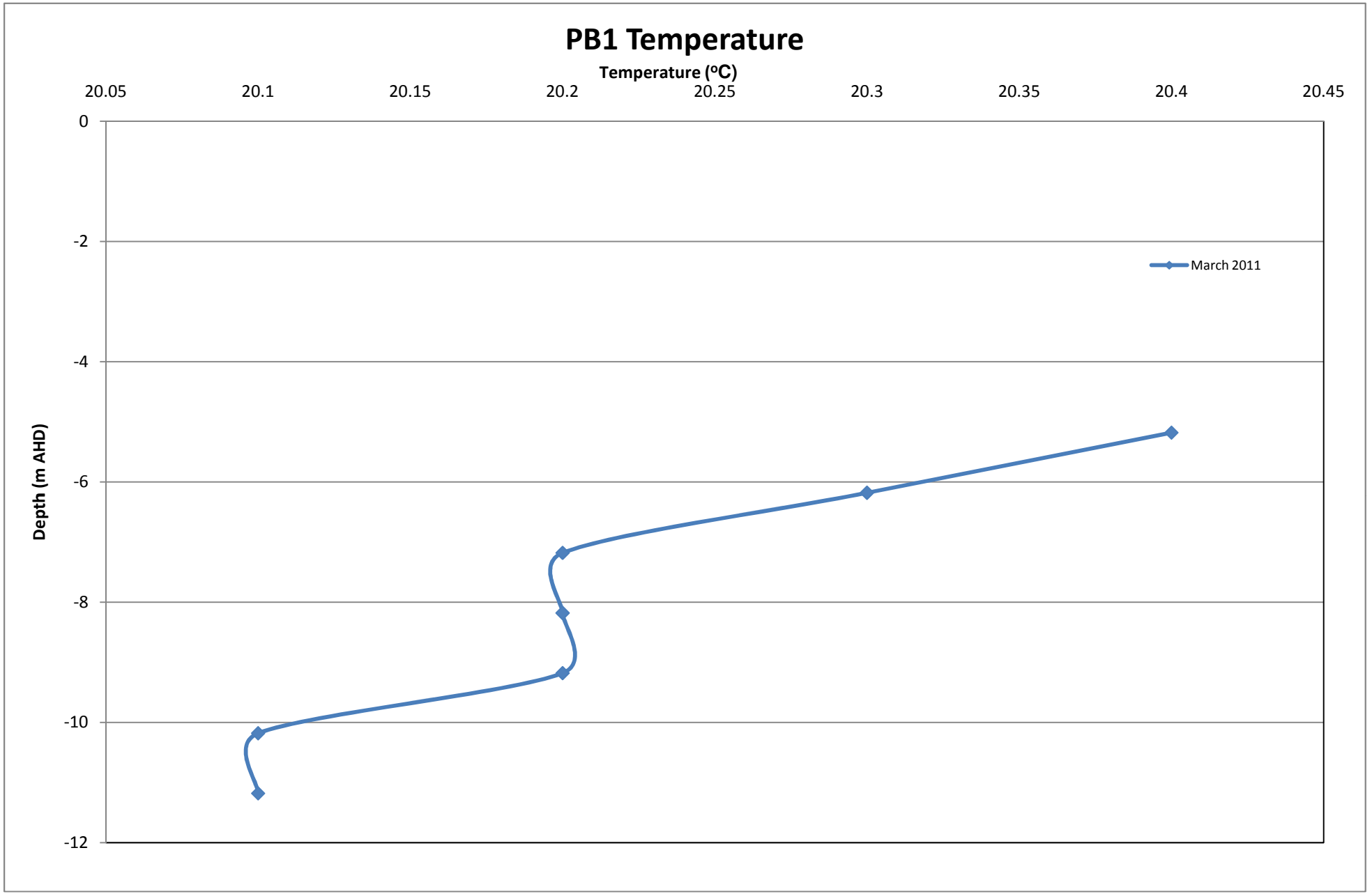
PB1


PB1 DO
Dissolved Oxygen (mg/L)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
Depth (m AHD)
0
-2
-4
-6
-8
-10
-12
March 2011

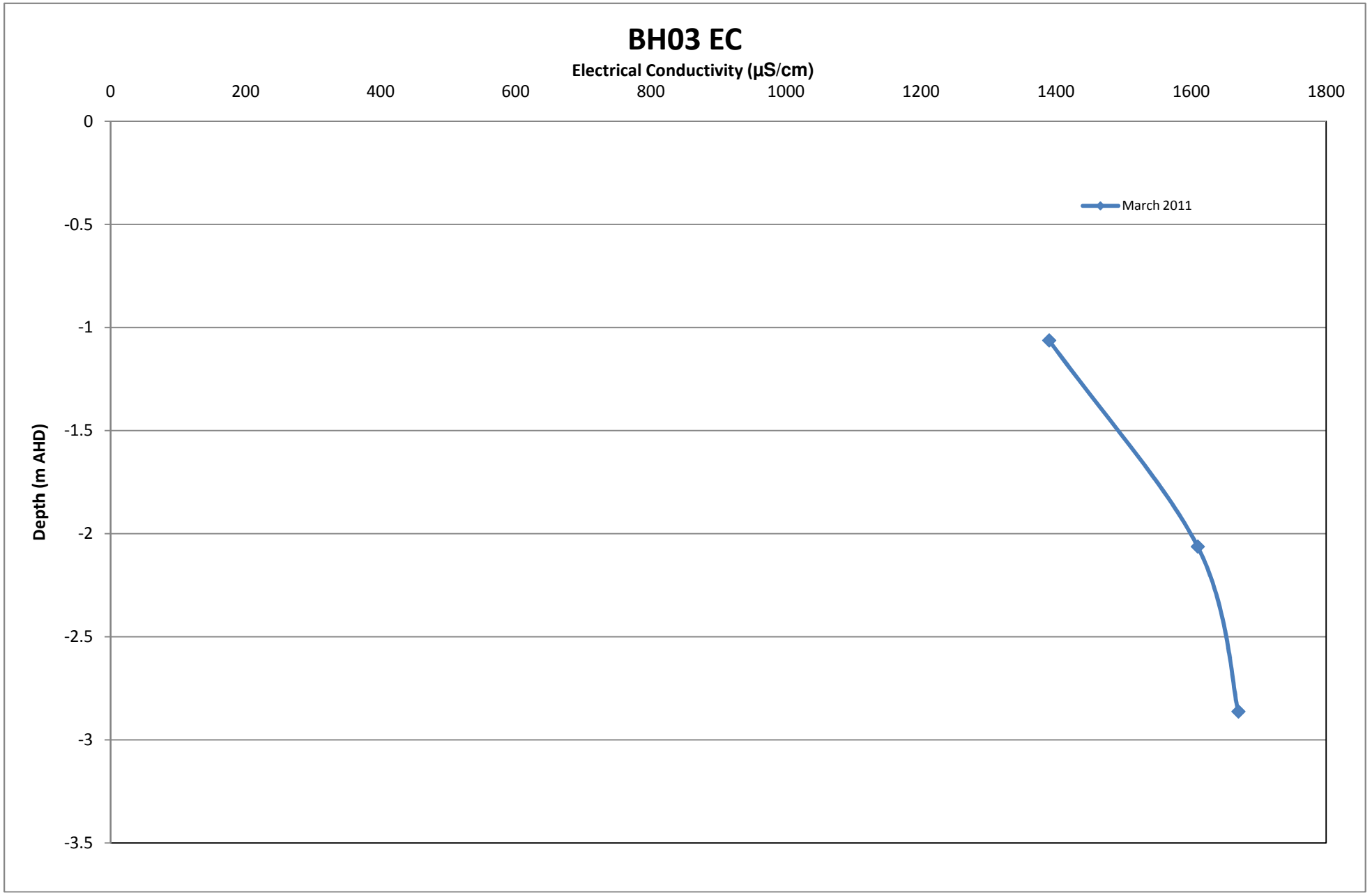

PB1 EC
Electrical Conductivity (µS/cm)
0
2000
4000
6000
8000
10000
12000
14000
Depth (m AHD)
0
-2
-4
-6
-8
-10
-12
March 2011

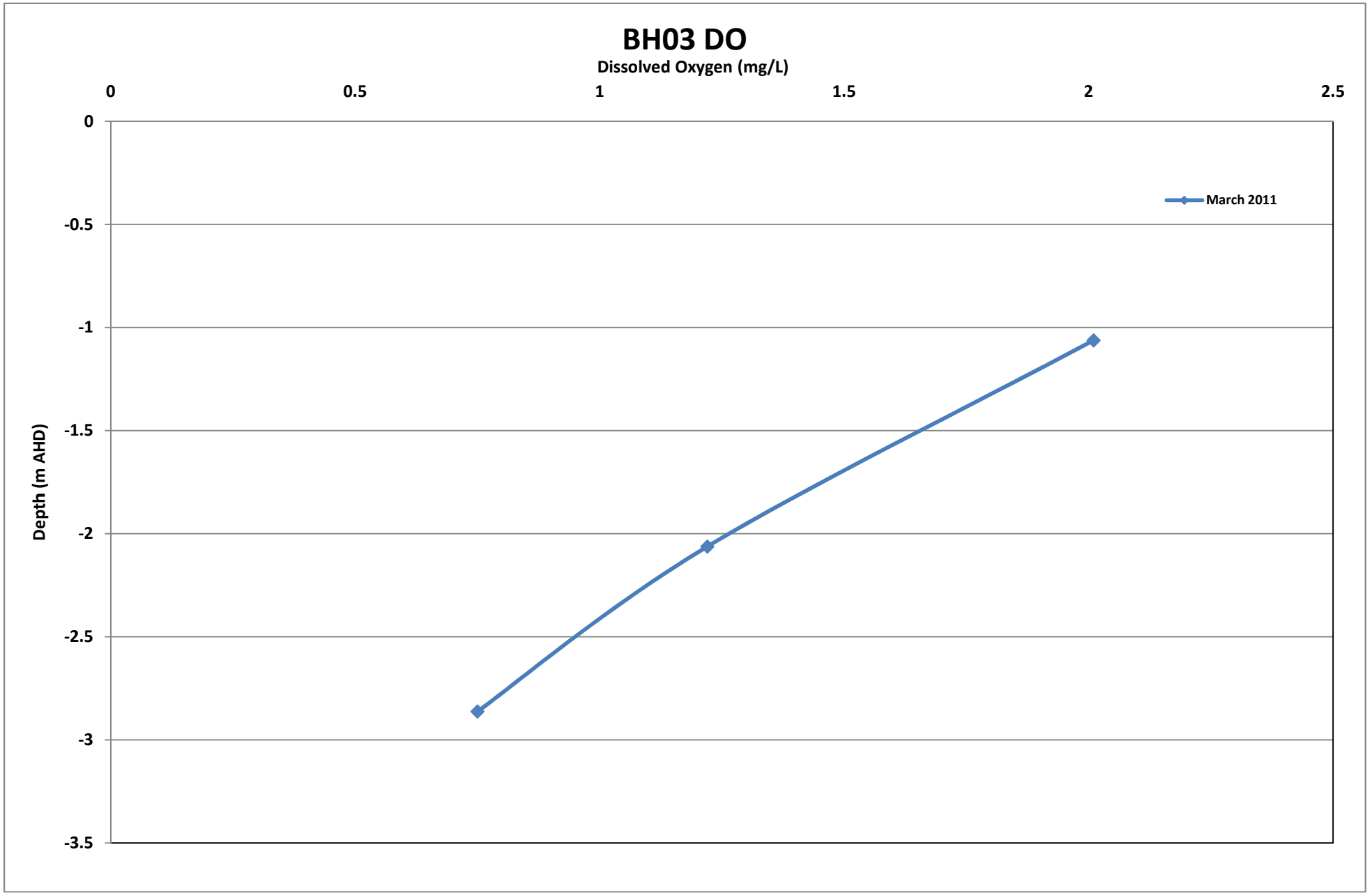

PB1 pH
pH
7.62
7.63
7.64
7.65
7.66
7.67
7.68
7.69
7.7
7.71
7.72
0
-2
-4
-6
-8
-10
-12
Depth (m AHD)
March 2011

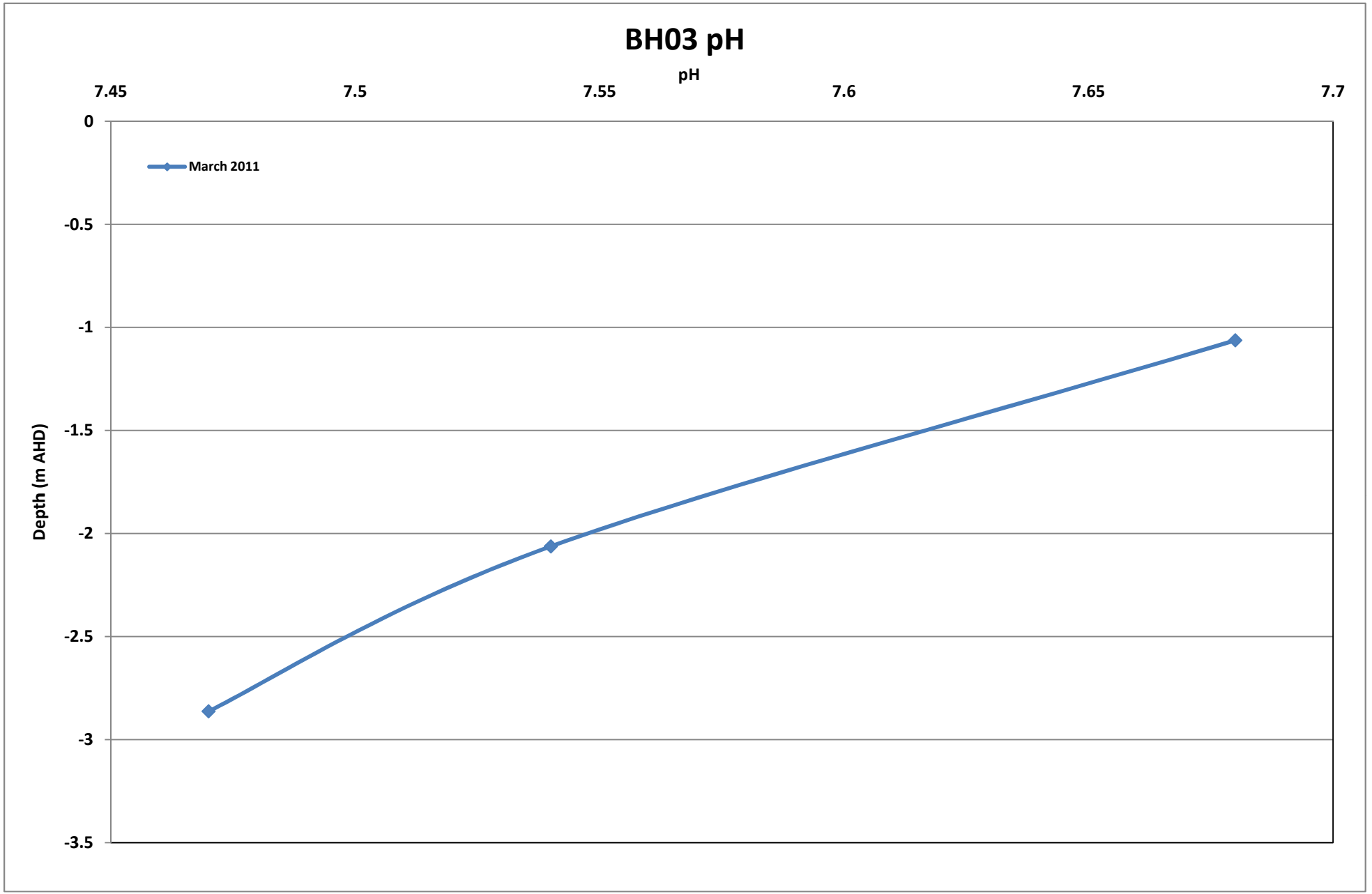

PB1 Redox
(mV)
-250
-200
-150
-100
-50
0
0
-2
-4
-6
-8
-10
-12
Depth (m AHD)
March 2011

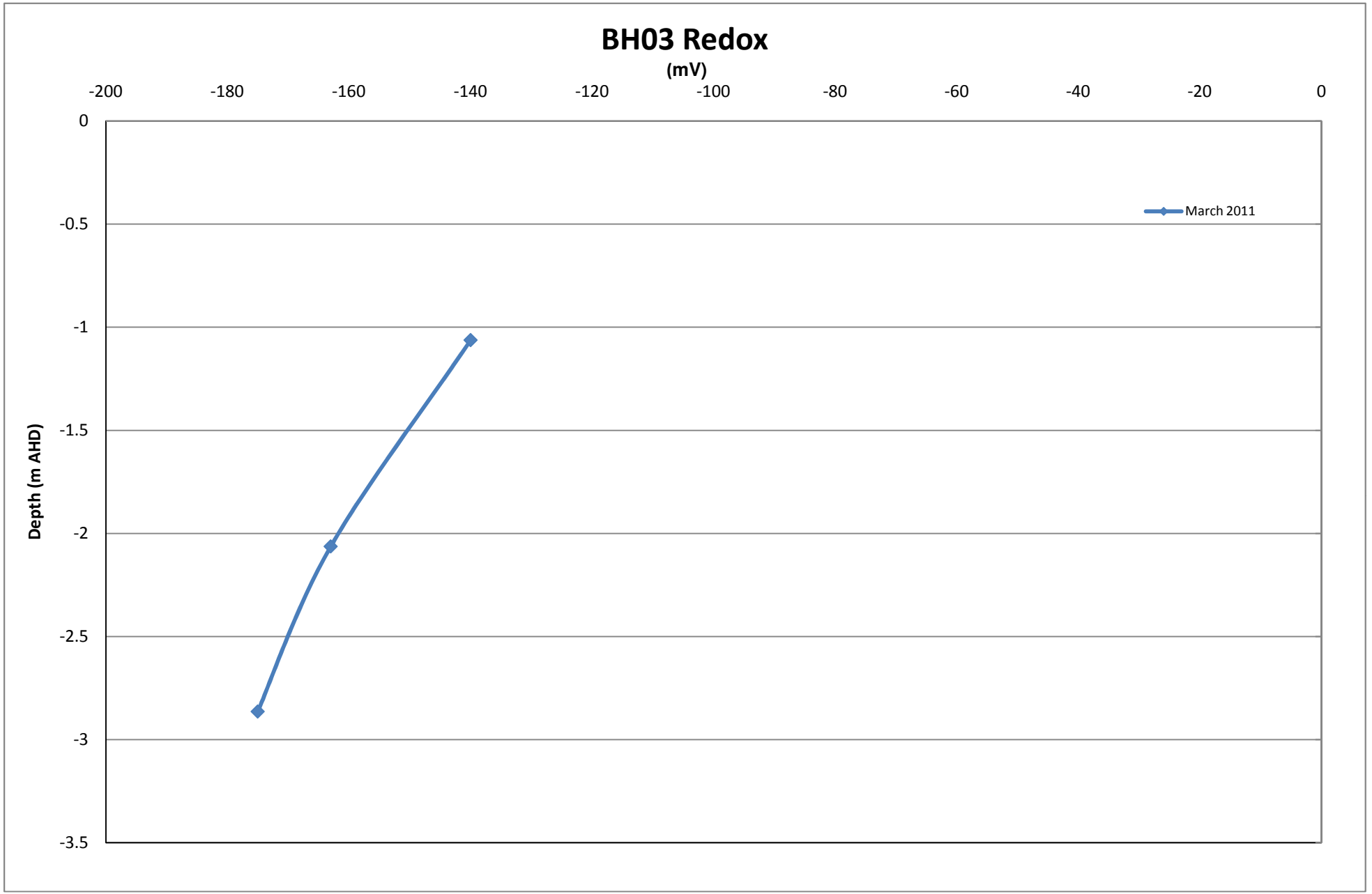

PB1 Temperature
Temperature (ºC)
20.05
20.1
20.15
20.2
20.25
20.3
20.35
20.4
20.45
0
-2
-4
-6
-8
-10
-12
Depth (m AHD)
March 2011

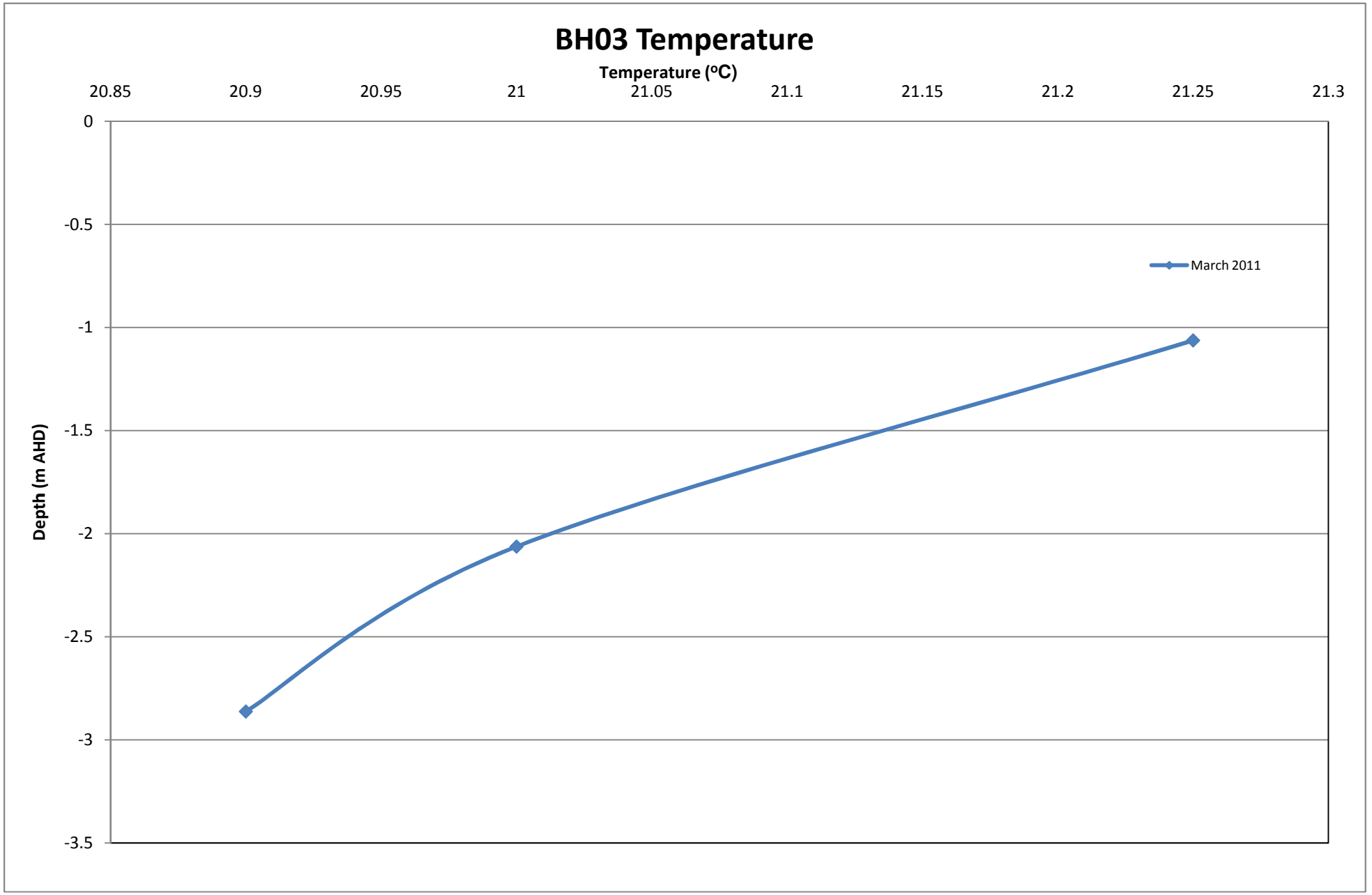
BH03


BH03 EC
Electrical Conductivity (µS/cm)
0
200
400
600
800
1000
1200
1400
1600
1800
Depth (m AHD)
0
-0.5
-1
-1.5
-2
-2.5
-3
-3.5
March 2011


BH03 DO
Dissolved Oxygen (mg/L)
0
0.5
1
1.5
2
2.5
Depth (m AHD)
0
-0.5
-1
-1.5
-2
-2.5
-3
-3.5
March 2011


BH03 pH
pH
7.45
7.5
7.55
7.6
7.65
7.7
0
-0.5
-1
-1.5
-2
-2.5
-3
-3.5
Depth (m AHD)
March 2011


BH03 Redox
(mV)
-200
-180
-160
-140
-120
-100
-80
-60
-40
-20
0
Depth (m AHD)
0
-0.5
-1
-1.5
-2
-2.5
-3
-3.5
March 2011


BH03 Temperature
Temperature (ºC)
20.85
20.9
20.95
21
21.05
21.1
21.15
21.2
21.25
21.3
0
-0.5
-1
-1.5
-2
-2.5
-3
-3.5
Depth (m AHD)
March 2011