



Groundwater Science Corp.

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Township of Puslinch

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Transmittal

To: CBM Aggregates

From: Andrew

410 Waverly Road

Ref: Roszell Road Pit

Bowmanville, ON L1C 3K3

2012 Annual Report

Attn: Colin Evans

Date: 4/2/2013

For Review As Requested Returned With Thanks For Analysis For your information

Enclosed:

1 Copy 2012 Annual Groundwater Monitoring Report, Licence No. 625189

Remarks:

Colin,

Enclosed is a copy of the Roszell Road Pit 2012 Annual monitoring report for your files/information.

We have also sent copies directly to the following agencies, in accordance with the approved monitoring program:

- the Ministry of Natural Resources;
- the Ministry of the Environment;
- the Grand River Conservation Authority; and
- the Township of Puslinch.

Please call if you have any questions or need further information.



*Groundwater
Science Corp.*

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**Roszell Road Pit, Licence No. 625189
2012 Groundwater Monitoring Report**

Prepared For:

CBM Aggregates
410 Waverly Rd
Bowmanville, Ont
L1C 3K3

Prepared By:

Andrew Pentney, P.Geo.
Groundwater Science Corp.

March 2013

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1.0 INTRODUCTION

This report summarizes the results of the 2012 Roszell Road Pit groundwater monitoring program as per conditions shown under the *Hydrogeological Recommendations (Monitoring, Triggers and Mitigation)* of the approved Site Plan. The Roszell Road Pit is owned and Licenced by Preston Sand & Gravel Company Limited and operated by CBM Aggregates. Information regarding Items listed on the Site Plan under *General Controls, Part D below water extraction* is provided in **Section 2.1** of this report. Site details; test and wash pond locations; and, monitoring locations are shown on **Figure 1**.

1.1 MONITORING PROGRAM

The groundwater monitoring program requirements for the Roszell Road Pit are outlined in the document: *Groundwater Monitoring Program, Preston Sand & Gravel Company Limited, Roszell Pit, Part Lots 1 and 2, Concessions 3 and 4, Township of Puslinch; Blackport Hydrogeology Inc. (and Groundwater Science Corp.), December 2009*. Please refer to that report for specific additional details (e.g. Trigger Mechanisms, Mitigation Measures, Contingency Plans and Response Protocol, etc.).

The monitoring and reporting requirements for the site are summarized as follows:

The following hydrogeologic monitoring plan is recommended to ensure potential groundwater impacts related to this proposal are measured and understood on an on-going basis:

1. Manual groundwater level measurements will be obtained on a monthly basis at the following existing on-site locations as accessible:

BH1, BH2-S, BH2-D, BH3-S, BH3-D, BH4-S, BH4-D, BH5 (and/or replacement well), BH6-S, BH6-D, BH7-S, BH7-D, BH8, BH9-S, BH9-D, BH10-S, BH10-D, DP1, DP2, DP3, DP4, DP5, DP6, DP7 and DP8.

And at the following new on-site locations as accessible:

BH14, BH15; and,
Monitors installed for the thermal assessment (see item #14).

And at the following off-site locations as accessible:

BH11, BH12 and BH13.

2. Monitors BH6-S and BH6-D will be removed as extraction or site preparation proceeds into that area and will not be replaced.
3. Monitor BH5 may be abandoned as extraction or site preparation proceeds into that area and if abandoned will be replaced by another water table monitor in the same general area.
4. Manual and/or datalogger groundwater level measurements will be obtained on a regular basis (frequency to be determined in conjunction with the landowner) at the following off-site private wells as accessible and at landowner request:

PW1, PW2 and other private wells where access has been granted.

Monitoring at private wells can include datalogger measurements as access permits. Where dataloggers are installed the monitoring frequency will be every hour (on the hour, Eastern Standard Time) and data downloaded quarterly as accessible.

5. Dataloggers will be installed to collect groundwater level measurements and/or groundwater temperature within the screened interval every hour (on the hour, Eastern Standard Time) and data downloaded quarterly at the following existing on-site monitoring wells as accessible:

BH1, BH3-S, BH3-D, BH4-D, BH5 (and/or replacement well), BH7-S, BH7-D, BH8, BH9-S, BH9-D, BH10-S and BH10-D

And at the following new on-site locations as accessible:

BH14, BH15, and,

Monitors installed for the thermal assessment (see item #14).

6. Manual groundwater temperature profiles will be obtained on a monthly basis by measuring the temperature within the monitors at one metre intervals starting at ground surface and proceeding to the bottom of the well at the following existing locations as accessible:

BH1, BH2-D, BH3-D, BH4-D, BH5 (and/or replacement well), BH7-D, BH8, BH9-D, BH10-D, DP1, DP2, DP3, DP7, DP8

And at the following new locations as accessible:

BH14, BH15, and,

Monitors installed for the thermal assessment (see item #14).

7. Staff gauges and/or stilling wells will be installed at the following off-site ponds along Roszell Road to the immediate east of the extraction area, if accessible, prior to below water table extraction at the site:

PG1, PG2, PG3, PG4, PG5 and PG6

Manual pond level measurements will be obtained on a monthly basis as accessible.

In addition, dataloggers will be installed at these pond gauges, if accessible, and pond level measurements will be obtained every hour (on the hour, Eastern Standard Time). Datalogger data will be downloaded quarterly.

8. Staff gauges and/or stilling wells will be installed on-site to measure the water level in the wash pond (LG1) and extraction lake(s) (LG2, LG3, LG4, etc.) as soon as possible after the lakes are developed. Manual pond and lake level measurements will be obtained on a monthly basis as accessible. Water level dataloggers will be installed at the wash pond and lake gauges to collect water level measurements every hour (on the hour, Eastern Standard Time). Datalogger data will be downloaded quarterly.
9. Manual surface water level and temperature measurements will be obtained on a monthly basis at the following locations as accessible:

DP1, DP2, DP3, DP4, DP5, DP6, DP7 and DP8.

10. A stilling well and datalogger will be installed prior to below water extraction at the site within the Roszell Wetland (between DP4 and DP5) to measure surface water (pond) level every hour (on the hour, Eastern Standard Time), data will be downloaded quarterly.
11. Dataloggers will be installed to collect surface water temperature measurements every hour (on the hour, Eastern Standard Time) and data downloaded quarterly at the following locations as accessible:
SW1, SW2, SW3, SW4, SW5, SW6, SW8, SW10, SW12, DP3, DP7, DP8 and extraction lakes at depths of 1 m and 5 m.
12. Manual stream-flow measurements will be obtained as conditions allow and under baseflow conditions (if possible) on a monthly basis during extraction periods at the following locations as accessible:
SW1, SW2, SW3 and SW4.
13. Water quality samples will be obtained for major anions, metals, pH, nutrients, and total petroleum hydrocarbons (F1 to F3) on an annual basis at the end of the extraction season at the following locations as accessible:
BH1, BH5 (and/or replacement well), BH7-S, BH7-D, BH8, BH10-S, BH10-D, active extraction lake, SW2, SW3, SW6, SW8 and SW10.
14. For the three years after the "test pond" is in place thermal monitoring will be completed in the vicinity of the "test pond" to monitor the extent and magnitude of downgradient temperature changes in the groundwater system. Temperature profiles will be obtained on a monthly basis and/or temperature dataloggers will be installed at the lake, within 20 m downgradient of the lake edge and at approximately 60 m distance downgradient of the lake edge. The results of the monitoring will be summarized in a separate report completed to the satisfaction of the MNR discussing the development and extent of any thermal impact and making appropriate recommendations regarding final setback distances between the lake(s) and the west Licence boundary.
15. After excavation of both Lakes A and B are complete (or near complete) the available monitoring data will be reviewed to the satisfaction of the MNR to determine if excavation of Lake C and/or development of a single lake is feasible. A separate report will be prepared at that time, and could include a computer groundwater model update, and submitted to MNR.
16. Threshold exceedance or Incident Response reporting will be completed as specified in the Action Response Plan
17. Annual Monitoring Reports summarizing the results of all of the monitoring specified by the monitoring program for the period January 1 to December 31 will be provided to the MNR, the MOE, the GRCA and the Township of Puslinch by March 31 following each year of operation, and will include the following:
 - description of monitoring methodology and locations,
 - all monitoring data, including tables of manual measurements and graphs of both manual and datalogger data,

- figures showing extraction locations and extents,
- description of operational activities,
- a summary and discussion of monitoring results (including thermal impacts and water quality),
- documentation of any threshold exceedances and resulting action and results, as per the incident response protocol,
- documentation of any remedial or contingency actions that are implemented, rationale for implementation and evaluation of success (if available at that time).

2.0 MONITORING COMPLETED

2.1 OPERATIONS SUMMARY

Site operations in 2012 include site preparation and stripping, and, above water table extraction through much of the year. The initial Test Pond and Wash (source) Pond (see **Figure 1**) were excavated between December 16, 2011 and January 19, 2012. Construction of the Silt Barrier is expected after washing operations begin, however no aggregate washing operations have occurred to date.

2.2 LOCATIONS MONITORED

In 2012 the following locations were monitored routinely:

On-Site

Monitoring wells (groundwater level and temperature) BH1, BH2-S, BH2-D, BH3-S, BH3-D, BH4-S, BH4-D, BH5, BH6-S, BH6-D, BH7-S, BH7-D, BH8, BH9-S, BH9-D, BH10-S, BH10-D, BH14, BH15, BH16 and BH17.

Pond and Wetland Gauges (surface water level and temperature) LG1 (Wash Pond), LG2 (Test Pond) and PG7 (Roszell Wetland).

Drive-Points (groundwater and surface water level and temperature) DP1, DP2, DP3, DP4, DP5, DP6, DP7 and DP8.

Surface Water monitoring (streamflow and/or temperature) sites SW2, SW3, SW4, SW5, SW6, SW8, SW10, and SW12.

Off-Site

Monitoring wells (groundwater level) BH11, BH12 and BH13.

Surface water monitoring (streamflow and temperature) site SW1.

Private wells (groundwater level) PW1 and PW2.

Private Pond Gauges (surface water level) PG1, PG2, PG3, PG4, PG5 and PG6.

In addition, water quality samples were obtained at the locations specified by the monitoring program. The water level monitoring locations and current extent of extraction is shown on **Figure 1**. The current monitoring network includes the initial Test Pond and monitoring well instrumentation for the Thermal Impact Assessment described in monitoring requirement item #14.

2.3 METHODOLOGY

Monitoring conducted for this program includes: manual water level measurements or observations; manual temperature measurements; manual streamflow measurements; automated continuous (datalogger) water level or barometric measurements; and, automated continuous temperature measurements. All manual measurements are recorded in the field as they are collected. Datalogger data is downloaded and saved onto a field laptop computer. Water level elevations are calculated based on the elevation of the reference point from which the measurement is made.

The manual water level measurements are obtained by direct measurement from an established reference point (typically top of well) using a commercially available electronic graduated water level tape (Solinst® or Heron Instruments® brand) according to manufacturer's instructions. Water level observations are also obtained visually at staff gauges (Water Survey of Canada type) installed in ponds (reference point is bottom, or zero mark, of gauge).

The manual water temperature measurements are obtained using electronic thermistor type instruments (Heron Instruments® temperature option included with water level tape or Oakton Acorn Series Temp 4 ® meter) according to manufacturer's instructions.

The manual streamflow measurements are obtained using the area-velocity method. Stream width is measured using a commercially available standard fiberglass measuring tape and stream depth is measured using a commercially available aluminum meter-stick. Water velocity is measured using a Swoffer Instruments Inc. Model 2100® current meter according to manufacturer's instructions.

Automated water level measurements are obtained using commercially available non-vented integrated transducer/dataloggers (water level dataloggers) according to the manufacturer's instructions. All of the water level dataloggers currently installed have been programmed to take measurements at the (hourly) frequency specified by the Monitoring Program. Historical measurements have varied from 0.5 hour to 4 hour frequency, depending on location and according to the baseline data requirements at the time of installation. Water level dataloggers currently in use at the site include Heron Instruments DipperLog®, Solinst Levellogger®, Schlumberger Diver®, and, In-Situ RT or LT® series units. Barometric pressure is measured on-site using both Heron Instruments® and In-Situ® dedicated barometric dataloggers.

Automated temperature measurements within monitoring wells are obtained using: temperature sensors integrated into the water level dataloggers; Onset Tidbit® dataloggers (sealed integrated datalogger/temperature probe); or, Onset Hobo U12 Outdoor® units (enclosed weatherproof datalogger with up to 4 external temperature probes), and, according to the manufacturer's instructions. Automated temperature measurements within surface water locations are also obtained using the Tidbit® or Hobo® series temperature dataloggers. All of the temperature dataloggers currently installed have been programmed to take measurements at the (hourly) frequency specified by the Monitoring Program. Historical measurements have varied from 0.5 hour to 4 hour frequency, depending on location and according to the baseline data requirements at the time of installation.

3.0 DATA SUMMARY

Monitoring data available at the site includes measurements beginning in March 2004, obtained as part of the original site characterization. Over the impact assessment and Licence application process the series of monitoring wells, private wells or surface water locations in use was expanded to the current network. Historical data was presented in the 2011 Annual Monitoring Report. This report provides the data collected in 2012. Hydrographs illustrating historical data are also provided.

3.1 WATER LEVEL MEASUREMENTS

A summary table of manual water level measurements obtained in 2012, and hydrographs illustrating overall historical trends, are included in **Appendix A**. Hydrographs illustrating datalogger data available for the site are included in **Appendix B**. Overall, a detailed set of baseline data defining annual and seasonal groundwater and surface water level fluctuation has been established at most locations. Occasional issues with datalogger operations continue to occur, however given the frequency of manual measurements and historical record, datalogger data losses that have occurred have not affected the ability to monitor and assess groundwater conditions and/or impact. Currently all dataloggers at the site are functional, however due to freezing conditions, some locations were not able to be downloaded in December 2012. This data is continuing to be collected, and will be available at the next download event.

Monitoring and datalogger installation at private wells and ponds has been implemented according to access permissions with respective residents. Location PG4 is instrumented with a datalogger and locations PG2, PG3 and PG5 are each instrumented with a Staff Gauge and monitored (manually) on a quarterly basis.

3.2 TEMPERATURE MEASUREMENTS

Tables summarizing manual temperature measurements collected in 2012 included in **Appendix A**. Manual measurements include temperature profiles at monitoring wells and drive-points, and, surface water temperatures.

Graphs illustrating temperature measurement results available for surface water locations at the site are included in **Appendix C**. Continuous temperature measurements have been collected at some locations since 2005. Although some of the historical data is "missing" due to previous datalogger problems, overall a detailed record (manual and continuous) has been established at most locations.

3.3 STREAMFLOW MEASUREMENTS

A summary table of streamflow calculated from measurements obtained in 2012 is included in **Appendix A**. Streamflow measurements are available since 2004.

3.4 WATER QUALITY SAMPLING

Water quality samples for major anion and metals was obtained at locations SW2, SW3, SW6, SW8, SW10, BH1, BH5, BH7-S, BH7-D, BH8, BH10-S and BH10-D on November 28th and 29th, 2012.. The 2012 water quality sampling results are summarized in **Appendix D**.

4.0 DISCUSSION

The extraction completed to date has remained above water table and is limited to the central portion of the site. Extraction at the site to date is expected to have only limited effects on groundwater and surface water conditions.

4.1 WATER LEVEL

Water level variation at and near the site to date reflects seasonal and annual precipitation conditions. For comparison to the hydrographs, a plot of the Environment Canada reported monthly precipitation relative to the 30-year monthly precipitation normal ("average" value) for the Waterloo-Wellington Airport (and overall area) for the years 1994 to 2012 is included in **Appendix A**. Missing or incomplete 2007, 2008 and 2010 (November) data for the station was augmented using data reported for the University of Waterloo weather station (<http://weather.uwaterloo.ca/>).

In 2012 the total reported precipitation of 655.5 mm is approximately 252.6 mm below the current 30-yr mean value of 908.1 mm. As indicated by the graph, below normal precipitation occurred over most months of the year (with the exception of June, September and October). Dry conditions persisted through the early "recharge" season, such that by the end of May total precipitation was 206 mm below average. As a result, in 2012 water table levels at many locations declined to the lowest levels (or near the lowest levels) observed at the site to date.

4.2 TEMPERATURE

A detailed record of seasonal temperatures at various depths within monitoring wells, drive-points, and, at surface water locations continues to be collected. An analysis of relevant temperature data will be provided as part of the Thermal Impact Assessment (Monitoring Recommendation item #14) report to be completed after (at least) 3 years of data at the test pond is available.

4.3 STREAMFLOW

The streamflow measurements obtained in 2012 reflect seasonal variations. Overall, summer streamflow was only slightly lower than previously observed. The maintenance of baseflow despite relatively low water table levels illustrates the influence of regional (bedrock) flow contributions to the stream.

4.4 WATER QUALITY

The water quality results from 2012 continue to reflect agricultural activities in the area (e.g. elevated Nitrate-N concentrations) in addition to some road salt effects (e.g. elevated sodium and chloride concentrations at BH5). No evidence of petroleum hydrocarbons was found at any the groundwater or surface water sampling locations.

4.5 THRESHOLD RESPONSE

To date there have been no threshold exceedances, no Trigger Mechanism response, no Mitigation Measures taken or implementation of any Contingency Plans and/or Response Protocol needed.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 CONCLUSIONS

The following conclusions are based on the monitoring program results to date.

1. The current monitoring program implementation is in accordance with the requirements of the Site Plan.
2. The historical and ongoing monitoring program results provide a detailed characterization of baseline conditions at the site.
3. Extraction related operations to date are limited to above water table extraction within the central portion of the site and have had no significant effect on groundwater or surface water conditions at the site.
4. To date no threshold exceedances have occurred, there has been no Trigger Mechanism response required, no Mitigation Measures taken or implementation of any Contingency Plans and/or Response Protocol.

5.2 RECOMMENDATIONS

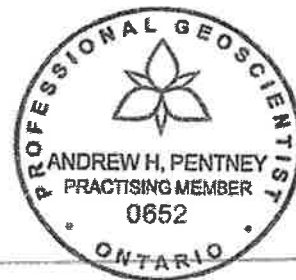
The following recommendations are based on the monitoring program results to date.

1. The monitoring program should be implemented in 2013 according to the requirements of the Site Plan.

All of which is respectfully submitted,

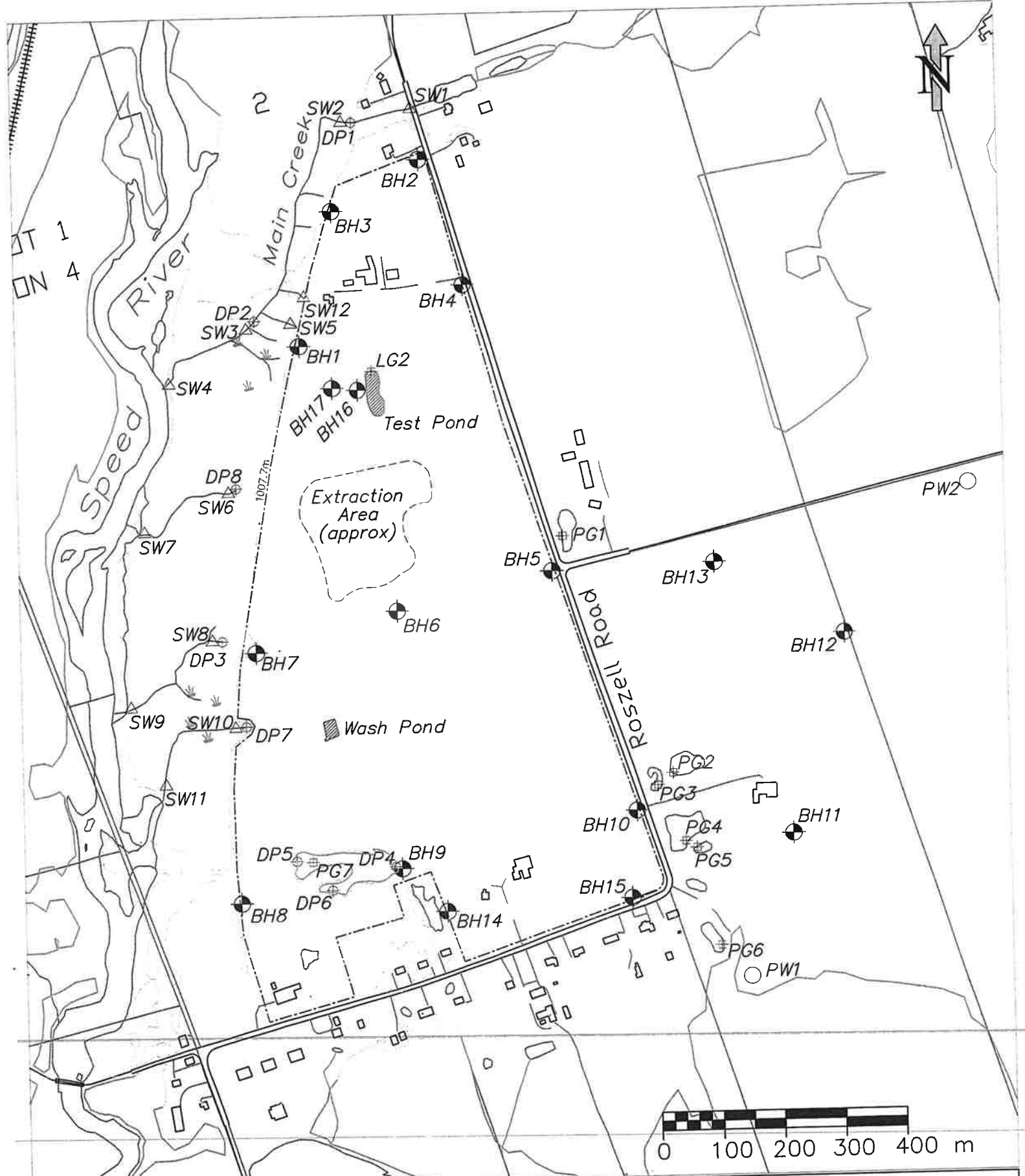


Andrew Pentney, P.Geol.
Senior Hydrogeologist
Groundwater Science Corp.



Figures





- existing monitoring well (or well nest)
- drive-point piezometer
- surface water flow/temperature
- pond/Lake gauge
- private well

Groundwater Science Corp.

March 2013
Scale: as shown
modified from:
1:10,000 OBM

Groundwater Monitoring Program

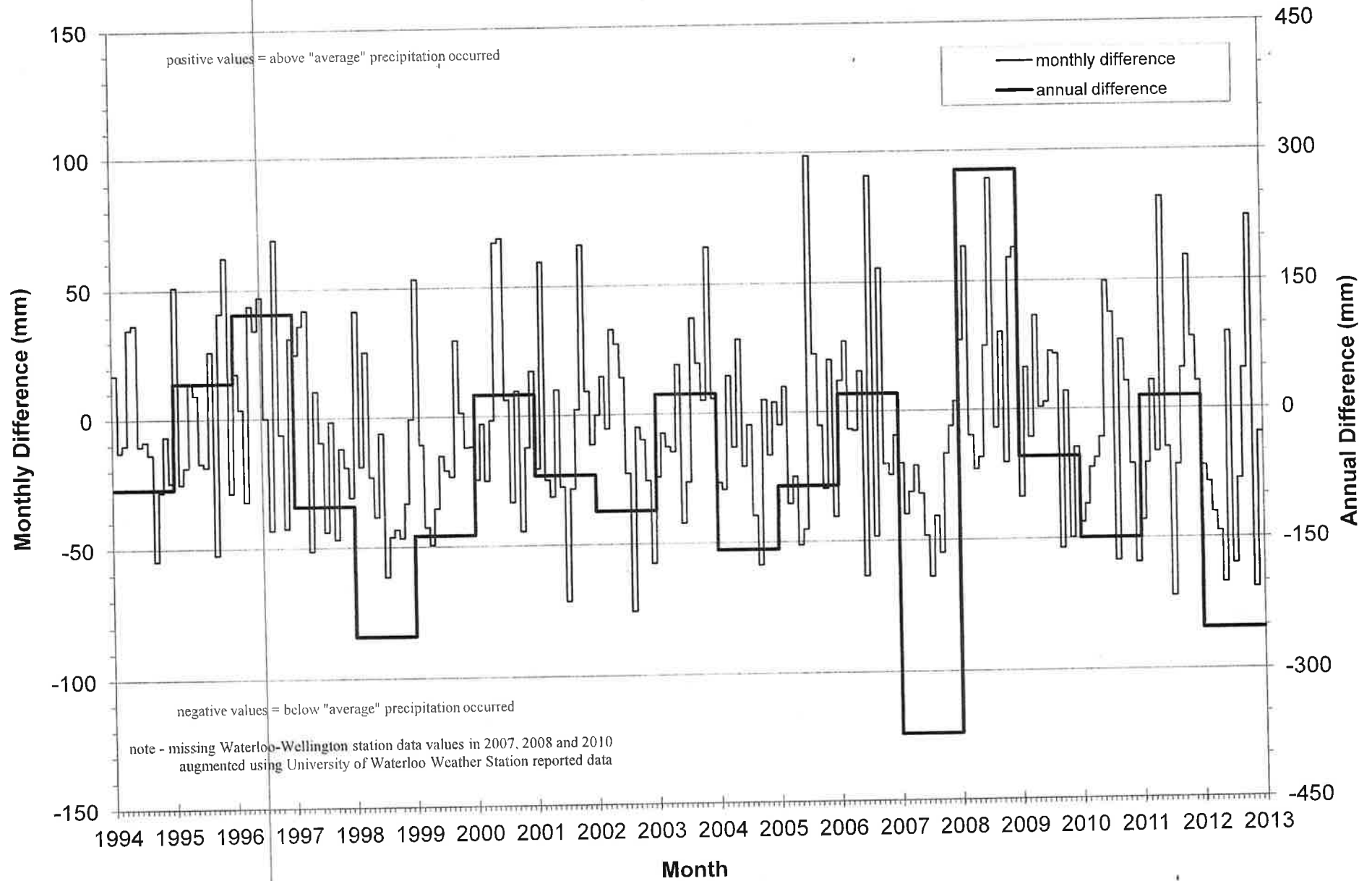
Figure 1: Site Details, Monitor Locations

Preston Sand and Gravel Company Limited
Roszell Pit

Part Lots 1 & 2, Concessions 3 & 4
Township of Puslinch,
County of Wellington

Appendix A
Manual Monitoring Results

Precipitation Analysis - Waterloo/Wellington Station Reported Precipitation minus 30-yr Normal



Date	Groundwater Elevation Summary - Monitoring Wells (mAMSL)																							
	BH1	BH2-S	BH2-D	BH3-S	BH3-D	BH4-S	BH4-D	BH5	BH6-S	BH6-D	BH7-S	BH7-D	BH8	BH9-S	BH9-D	BH10-S	BH10-D	BH11	BH12	BH13	BH14	BH15	BH16	BH17
11-Jan-12	297.65	297.12	296.84	295.33	296.15	298.23	#N/A	299.43	299.13	299.13	296.96	294.64	297.64	299.43	299.43	300.02	300.11	303.59	303.24	302.53	299.57	300.00	298.44	298.33
15-Feb-12	297.56	297.06	296.79	295.33	296.12	298.13	#N/A	299.29	298.98	298.98	296.85	294.57	297.46	299.31	299.30	299.90	300.00	303.58	303.22	302.52	299.44	299.89	298.37	298.24
15-Mar-12	297.63	297.11	296.85	295.36	296.18	298.21	#N/A	299.42	299.09	299.09	296.90	294.61	297.56	299.44	299.42	300.05	300.16	303.66	303.30	302.62	299.58	300.02	298.41	298.25
27-Apr-12	297.46	296.97	296.69	295.28	296.02	298.00	297.99	299.14	298.82	298.83	296.74	294.49	297.25	299.17	299.16	299.78	299.86	#N/A	#N/A	#N/A	299.32	299.75	298.26	298.12
24-May-12	297.42	296.91	296.64	295.24	295.97	297.93	297.92	299.04	298.73	298.74	296.69	294.45	297.12	299.05	299.05	299.67	299.78	#N/A	#N/A	#N/A	299.20	299.64	298.15	298.04
27-Jun-12	297.36	296.85	296.58	295.23	295.91	297.86	#N/A	#N/A	#N/A	#N/A	296.65	294.42	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	298.34	297.96
20-Aug-12	297.28	296.77	296.51	#N/A	#N/A	297.78	#N/A	298.85	298.56	298.57	296.60	294.40	296.98	298.88	298.87	#N/A	299.57	#N/A	#N/A	302.11	299.04	299.47	297.91	297.79
21-Aug-12	#N/A	#N/A	#N/A	295.21	295.86	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	303.23	302.92	#N/A	#N/A	#N/A	#N/A	#N/A
21-Sep-12	297.32	296.80	296.53	295.23	295.90	297.80	297.81	298.90	298.59	298.59	296.63	294.42	297.01	298.94	298.94	299.55	299.62	303.16	302.82	302.05	299.11	299.53	298.02	297.90
25-Oct-12	297.40	296.88	296.61	295.28	295.98	297.88	#N/A	299.02	298.70	298.70	296.69	294.47	297.20	299.13	299.15	299.71	299.81	303.21	302.86	302.08	299.30	299.74	298.20	298.03
26-Nov-12	297.45	296.95	296.70	295.30	296.05	297.95	297.95	299.07	298.75	298.76	296.84	294.54	297.35	299.14	299.14	299.68	299.78	303.22	302.85	302.09	299.28	299.68	298.18	298.07
20-Dec-12	297.48	297.00	296.74	295.31	296.11	297.99	298.00	299.10	298.81	298.81	296.85	294.57	297.41	299.23	299.24	299.74	299.83	303.24	302.90	302.12	299.39	299.75	298.14	298.01
30-Jan-13	297.66	297.19	296.92	295.43	296.24	298.22	298.23	299.45	299.03	299.03	296.98	294.66	297.67	299.47	299.46	300.02	300.11	303.35	303.07	302.30	299.63	300.11	298.57	298.40
28-Feb-13	297.52	297.04	296.78	295.34	296.14	298.05	298.04	299.18	298.82	298.83	296.90	294.72	297.41	299.18	299.17	299.80	299.90	303.31	303.03	302.25	299.31	299.81	298.28	298.18

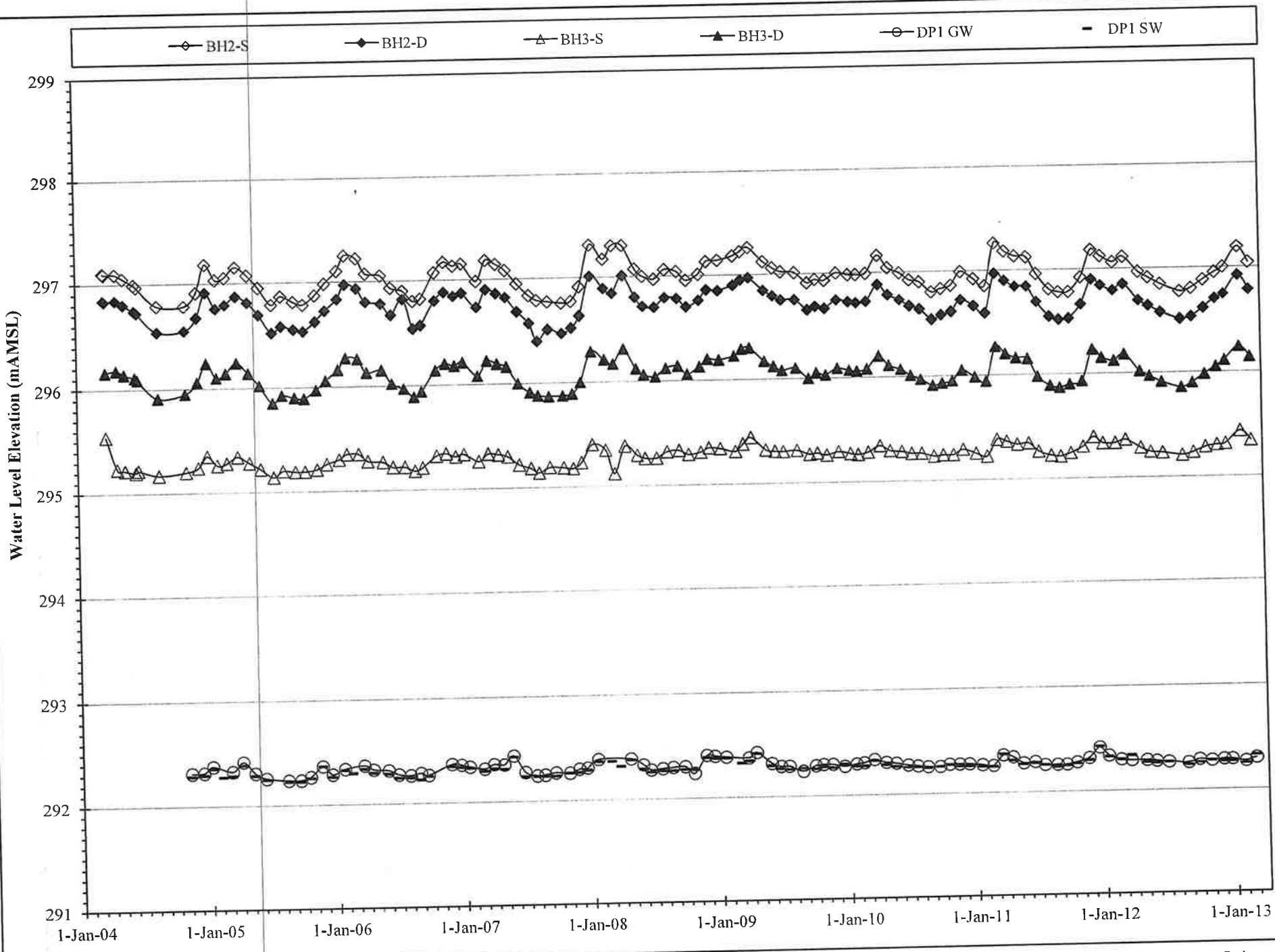
Notes mAMSL = metres above mean sea level

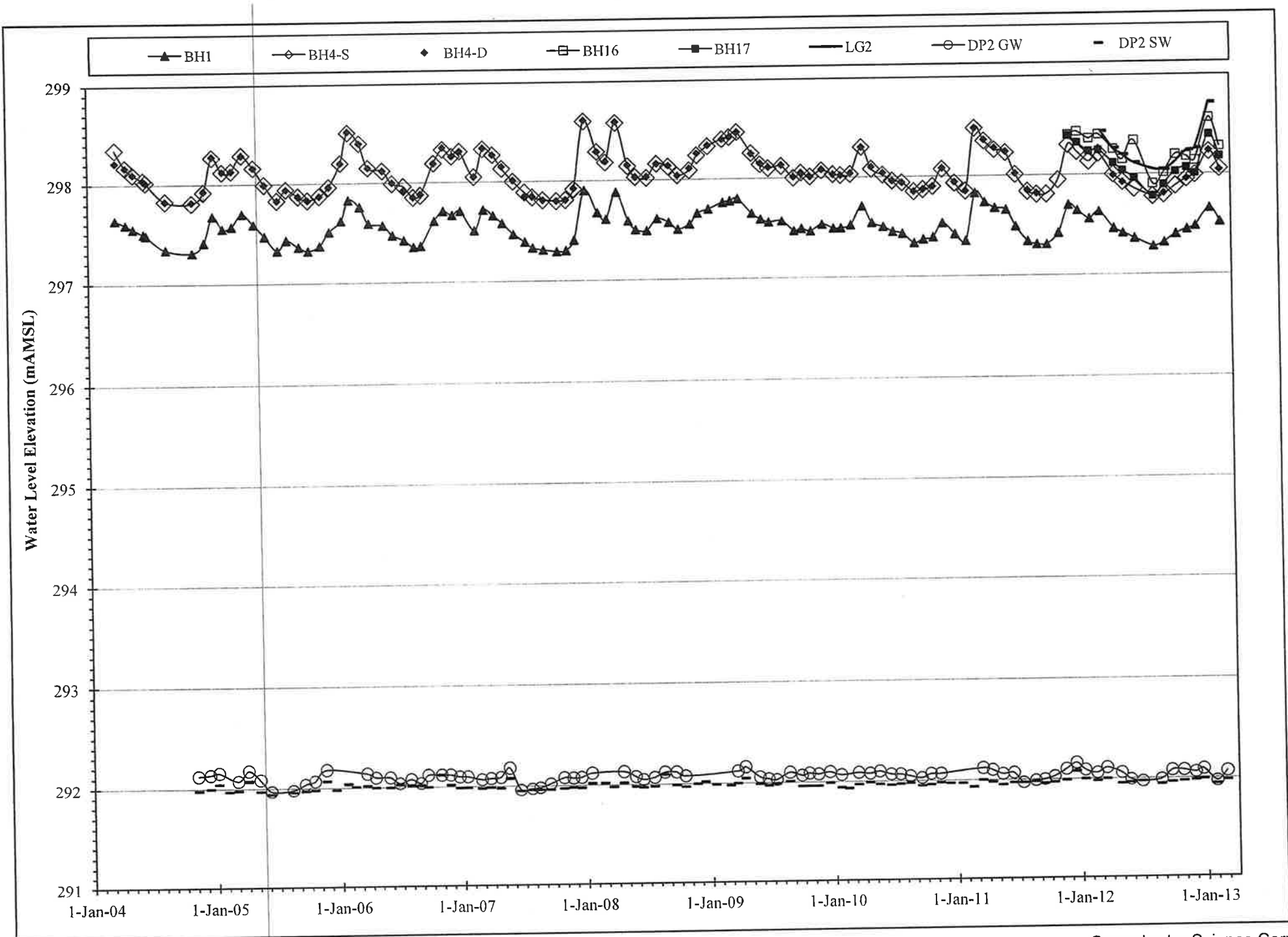
#NA = not available (no access or not measured)

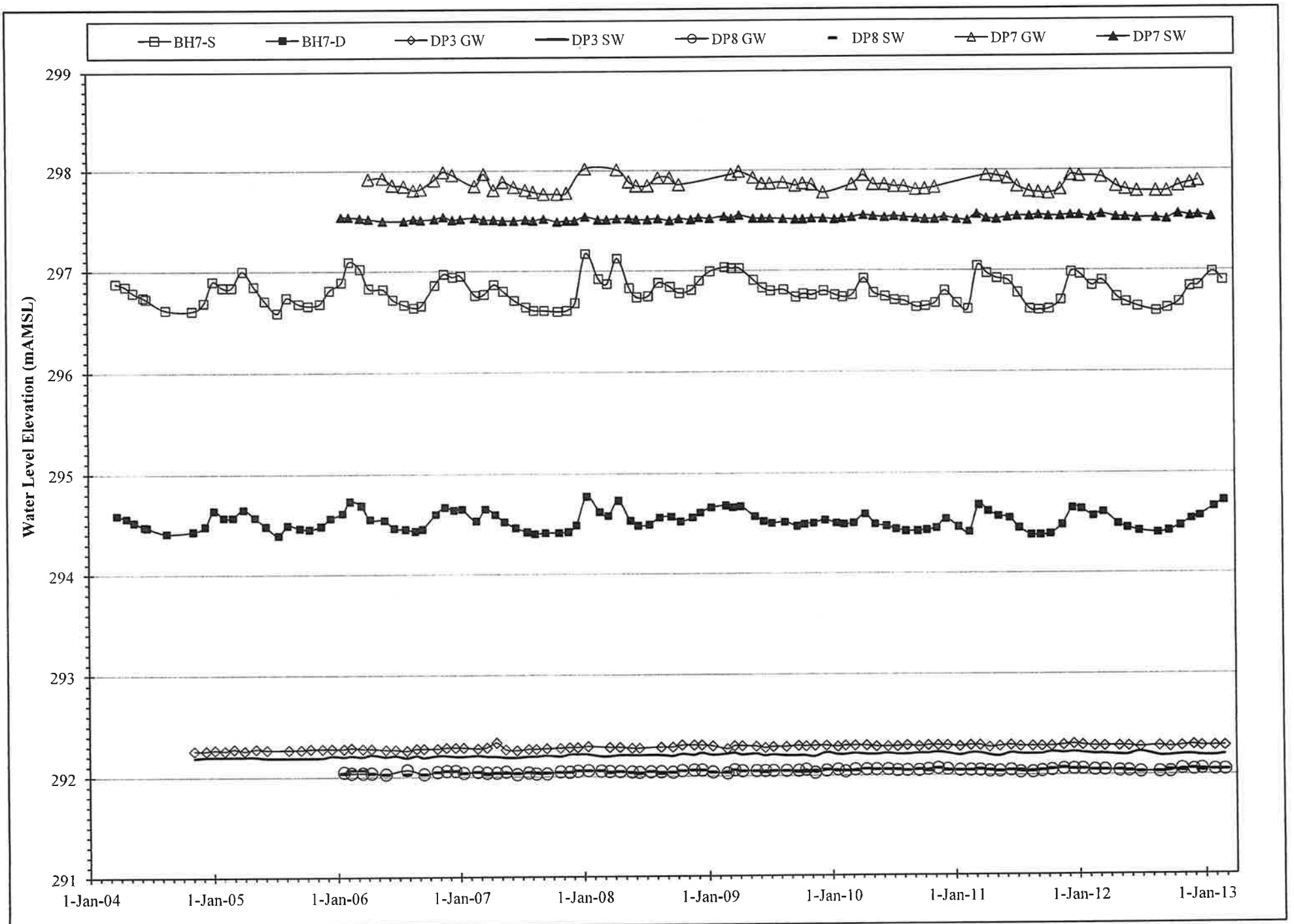
Groundwater and Surface Water Elevation Summary - LG, PG and DP Locations On-Site (mAMSL)																		
Well No.:	LG2	PG7	DP1		DP2		DP3		DP4		DP5		DP6		DP7		DP8	
	SW	SW	GW	SW	GW	SW	GW	SW	GW	SW	GW	SW	GW	SW	GW	SW	GW	SW
11-Jan-12	#N/A	#N/A	292.34	292.33	292.09	292.00	292.30	292.22	299.59	#N/A	299.40	#N/A	299.63	#N/A	297.94	297.55	292.06	292.06
15-Feb-12	#N/A	#N/A	292.30	292.30	292.06	291.98	292.29	292.21	#N/A	#N/A	299.24	#N/A	#N/A	#N/A	#N/A	297.53	292.05	292.05
15-Mar-12	#N/A	299.59	292.29	292.34	292.11	292.00	292.29	292.21	299.59	299.59	299.36	299.58	299.63	299.65	297.93	297.56	292.05	292.05
22-Mar-12	298.44	299.59	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	299.55	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
27-Apr-12	298.27	299.39	292.29	292.27	292.06	291.95	292.29	292.20	299.34	#N/A	299.11	#N/A	299.39	299.43	297.84	297.53	292.04	292.05
24-May-12	298.20	299.20	292.28	292.26	291.99	291.96	292.29	292.20	299.18	#N/A	298.97	#N/A	299.16	#N/A	297.81	297.53	292.04	292.04
27-Jun-12	298.12	#N/A	292.27	292.27	291.97	291.97	292.28	292.23	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	297.79	297.52	292.03	292.03
20-Aug-12	#N/A	298.76	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	299.03	#N/A	298.80	#N/A	299.00	#N/A	#N/A	#N/A	#N/A	#N/A
21-Aug-12	#N/A	#N/A	292.26	292.24	291.99	291.94	292.29	292.19	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	297.79	297.52	292.03	292.03
21-Sep-12	298.05	298.99	292.29	292.26	292.08	291.96	292.28	292.19	299.09	#N/A	298.86	#N/A	299.15	#N/A	297.79	297.51	292.03	292.05
25-Oct-12	#N/A	299.20	292.28	292.28	292.08	291.97	292.29	292.20	299.29	#N/A	299.08	#N/A	299.35	299.32	297.84	297.56	292.06	292.04
28-Nov-12	298.24	299.19	292.29	292.27	292.06	291.98	292.30	292.20	299.29	#N/A	299.08	#N/A	299.36	299.43	297.87	297.54	292.05	292.06
21-Dec-12	298.26	#N/A	292.29	292.27	292.09	291.99	292.29	292.19	299.38	#N/A	299.17	#N/A	299.44	299.44	297.89	297.55	292.06	292.04
28-Jan-13	#N/A	#N/A	292.27	292.25	291.97	291.94	292.29	292.19	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	297.53	292.05	292.05
30-Jan-13	298.72	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	299.59	299.49	299.43	299.49	299.63	299.56	#N/A	#N/A	#N/A	#N/A
26-Feb-13	#N/A	#N/A	292.30	292.33	292.07	291.98	292.29	292.20	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	292.05	292.05

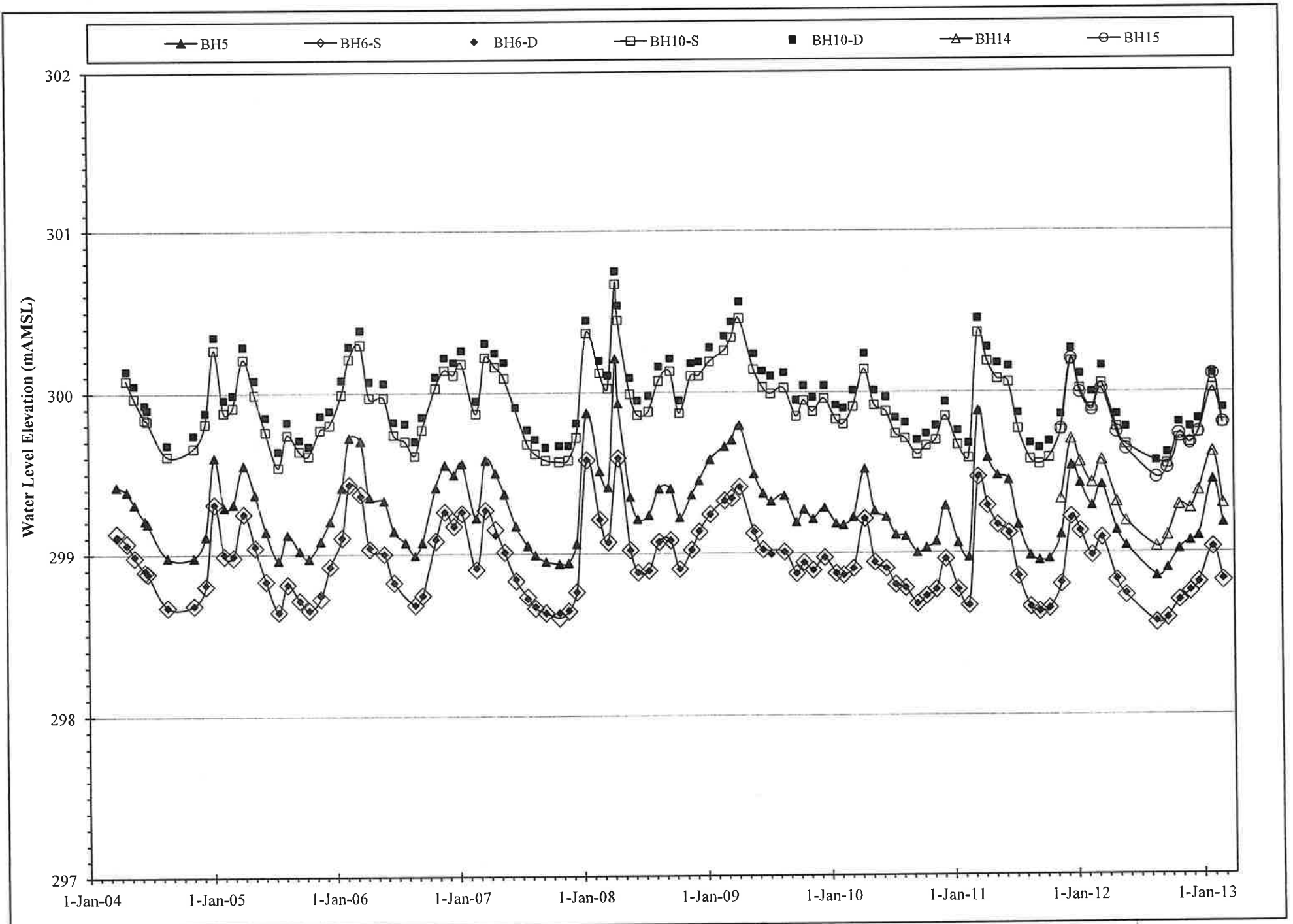
Notes mAMSL = metres above mean sea level #NA = not available (no access or not measured)
 SW = surface water GW = groundwater

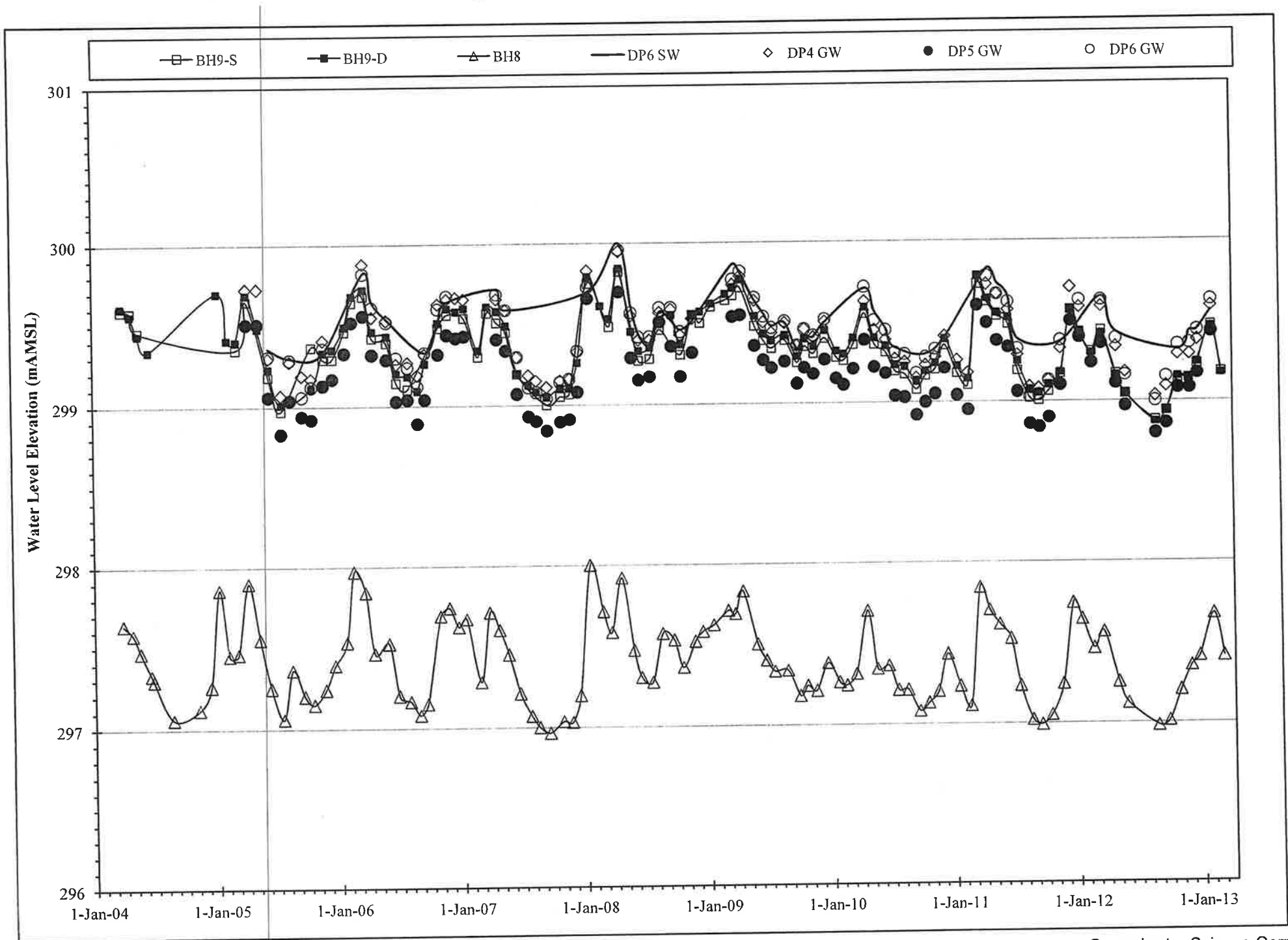
Groundwater and Surface Water Elevation Summary - Off-Site (mAMSL)								
Well No.:	PG1	PG2	PG3	PG4	PG5	PG6	PW1	PW2
11-Jan-12	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
15-Feb-12	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
15-Mar-12	301.10	302.12	#N/A	302.04	301.63	#N/A	#N/A	#N/A
21-Mar-12	#N/A	302.09	301.44	301.96	301.66	301.29	302.18	303.80
22-Mar-12	301.19	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
28-Jun-12	300.79	301.73	300.88	301.63	301.61	300.94	301.94	303.90
21-Aug-12	#N/A	301.57	#N/A	301.47	301.57	#N/A	#N/A	#N/A
27-Sep-12	300.61	301.56	#N/A	301.45	301.56	#N/A	#N/A	303.53
5-Oct-12	300.89	#N/A	#N/A	#N/A	#N/A	300.85	301.84	#N/A
25-Oct-12	300.64	301.61	300.73	301.51	301.59	#N/A	#N/A	#N/A
27-Nov-12	300.76	301.35	300.84	301.57	301.60	#N/A	#N/A	#N/A
4-Jan-13	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	301.85	303.50
Notes	mAMSL = metres above mean sea level				#NA = not available (no access or not measured)			











Date	SW1		SW2		SW3		SW4	
	Flow (L/s)	Temp. (°C)	Flow (L/s)	Temp. (°C)	Flow (L/s)	Temp. (°C)	Flow (L/s)	Temp. (°C)
15-Mar-11	44.3	3.6	55.9	2.8	74.6	2.4	89.3	2.3
12-Apr-11	32.4	6.9	48.1	6.9	57.5	7.2	68.3	7.1
12-May-11	20.2	12.5	36.4	11.8	45.3	10.6	48.8	10.6
17-Aug-11	7.5	21.5	18.8	17.4	23.8	15.8	28.5	15.7
18-Oct-11	9.5	n/a	17.0	13.3	23.6	12.8	36.2	12.8
27-Apr-12	26.9	8.9	16.1	n/a	27.6	n/a	11.8	8.1
24-May-12	9.8	18.1	9.5	n/a	14.3	n/a	18.1	16.5
27-Jun-12	2.9	18.3	7.7	15.8	11.5	14.3	14.1	14.0
21-Aug-12	5.9	n/a	12.8	15.5	28.5	14.3	13.8	14.1
21-Sep-12	9.3	17.8	16.6	17.0	28.5	16.0	31.2	16.7
27-Nov-12	n/a	8.5	n/a	4.8	n/a	5.1	n/a	4.4
20-Dec-12	15.9	3.9	18.7	4.8	34.4	5.0	29.0	5.0

Notes: n/a = not available, no measurement obtained

Monitor: BH7-D		Temperature (C) at Depth (mBGS)												
Date	Air	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0
11-Jan-12	5.0	8.1	7.8	7.4	7.3	7.4	7.4	7.6	7.8	9.4	9.8	9.8	9.7	9.6
15-Feb-12	2.0	5.1	4.9	4.8	4.6	4.6	4.8	4.9	5.2	8.1	9.4	9.6	9.6	9.6
15-Mar-12	18.0	10.2	10.0	9.3	9.1	8.9	8.8	8.8	8.8	9.3	9.4	9.4	9.4	9.4
27-Apr-12	n/a	10.4	9.5	8.8	7.9	7.8	7.7	7.8	7.8	7.9	8.4	8.7	8.8	n/a
24-May-12	n/a	23.4	20.6	19.4	18.2	17.1	16.3	15.3	14.8	14.3	9.4	8.7	8.6	n/a
27-Jun-12	n/a	20.1	19.6	18.8	17.6	16.8	16.0	14.9	14.0	13.3	9.2	8.5	8.4	n/a
20-Aug-12	n/a	20.7	21.1	20.8	20.4	19.5	17.9	17.4	16.0	15.4	9.8	8.8	8.6	n/a
21-Sep-12	11.4	12.6	13.6	14.6	15.1	15.0	14.4	13.8	13.2	12.8	9.8	9.2	8.9	n/a
25-Oct-12	15.3	14.4	14.3	14.1	14.1	14.1	13.9	13.6	13.3	12.9	10.4	9.8	9.4	n/a
26-Nov-12	0.6	3.7	3.8	5.3	6.2	7.4	8.3	8.8	9.2	9.7	10.1	10.0	9.8	n/a
20-Dec-12	1.8	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
30-Jan-13	11.7	8.3	6.8	6.5	6.4	6.6	6.9	7.4	7.7	9.3	9.9	10.1	10.0	n/a
28-Feb-13	3.2	3.5	3.4	5.3	6.3	7.3	8.2	9.0	9.2	9.8	10.0	10.0	9.8	9.8

Monitor: BH9-D		Temperature (C) at Depth (mBGS)														
Date	Air	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0
11-Jan-12	5.0	4.8	4.5	5.8	6.8	7.9	8.6	9.1	9.4	9.4	9.4	9.3	9.3	9.1	9.0	8.9
15-Feb-12	2.0	2.4	2.4	4.1	5.3	6.4	7.2	7.9	8.4	8.7	8.9	9.0	8.9	8.9	8.9	8.9
15-Mar-12	18.0	10.3	5.6	4.3	4.4	4.8	5.4	6.1	6.9	7.8	8.3	8.5	8.7	8.8	8.8	8.8
27-Apr-12	n/a	9.6	9.3	7.1	6.4	6.2	6.3	6.7	7.3	7.8	8.1	8.4	8.6	8.7	8.8	8.8
24-May-12	n/a	20.3	18.0	10.4	8.1	7.4	7.1	7.1	7.6	7.8	8.1	8.3	8.5	8.6	8.7	8.8
29-Jun-12	n/a	21.3	19.0	12.8	10.6	9.4	8.8	8.3	8.3	8.2	8.3	8.4	8.5	8.6	8.7	8.8
20-Aug-12	n/a	19.0	18.6	15.2	13.3	11.9	10.9	10.1	9.4	9.0	8.8	8.7	8.7	8.7	8.7	8.7
21-Sep-12	11.4	14.5	14.4	14.1	13.6	12.8	11.9	11.0	10.3	9.6	9.2	8.9	8.8	8.8	8.8	8.7
25-Oct-12	16.7	15.1	14.7	12.6	12.3	12.2	11.9	11.3	10.6	n/a	n/a	n/a	n/a	n/a	n/a	n/a
26-Nov-12	0.6	3.5	3.6	8.4	9.8	10.7	10.8	10.8	10.5	10.1	9.6	9.4	9.2	9.1	8.9	8.8
20-Dec-12	1.8	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
30-Jan-13	11.7	6.9	5.0	5.1	6.3	7.1	8.0	8.5	8.9	9.1	9.1	9.1	9.1	9.1	9.0	8.9
28-Feb-13	3.2	3.7	3.6	8.5	9.9	10.8	10.9	10.8	10.4	10.1	9.8	9.4	9.2	9.1	8.9	8.9

Monitor: BH10-D		Temperature (C) at Depth (mBGS)									
Date	Air	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	9.8
11-Jan-12	5.0	6.8	6.6	6.8	7.6	8.1	8.4	8.6	8.8	8.9	n/a
15-Feb-12	2.0	4.3	4.1	4.8	5.6	6.6	7.2	7.6	8.4	n/a	n/a
15-Mar-12	18.0	7.1	6.4	4.6	4.7	5.5	6.4	7.0	7.9	8.2	n/a
27-Apr-12	n/a	7.2	7.3	6.7	6.3	6.4	6.7	7.1	7.5	7.9	8.0
24-May-12	n/a	19.3	18.0	10.4	8.4	7.6	7.5	7.6	7.8	7.9	8.0
29-Jun-12	n/a	22.6	21.4	16.9	12.0	10.1	9.3	8.8	8.4	8.3	n/a
20-Aug-12	n/a	21.4	20.3	18.8	14.6	12.4	11.3	10.6	9.3	8.8	n/a
21-Sep-12	11.4	14.5	14.6	14.6	14.1	12.9	11.8	11.0	9.7	9.2	n/a
25-Oct-12	15.3	12.8	12.6	12.5	12.5	12.2	11.6	11.0	9.9	9.4	n/a
26-Nov-12	0.6	5.6	5.6	8.8	9.9	10.4	10.4	10.3	9.8	9.6	n/a
20-Dec-12	1.8	2.6	3.3	7.3	8.6	9.1	9.4	9.4	9.3	9.3	9.3
30-Jan-13	11.7	7.2	6.9	6.0	6.4	7.1	7.8	8.1	8.6	8.9	n/a
28-Feb-13	3.2	3.8	3.6	3.4	4.9	6.0	6.8	7.3	8.2	8.4	n/a

Monitor: BH14		Temperature (C) at Depth (mBGS)						
Date	Air	1.0	2.0	3.0	4.0	5.0	6.0	7.0
11-Jan-12	5.0	5.6	5.5	5.9	6.9	7.8	8.5	8.9
15-Feb-12	2.0	4.3	4.2	4.6	5.9	6.6	7.4	7.9
15-Mar-12	18.0	11.6	6.1	5.3	5.5	5.9	6.2	6.6
27-Apr-12	n/a	10.3	8.1	7.6	7.4	7.4	7.4	n/a
24-May-12	n/a	20.1	14.4	10.6	9.1	8.1	7.9	n/a
29-Jun-12	n/a	24.4	22.9	13.4	11.3	9.6	9.0	n/a
20-Aug-12	n/a	18.1	17.8	15.9	14.2	11.9	10.6	n/a
21-Sep-12	11.4	13.4	14.2	14.8	14.1	12.5	11.3	n/a
25-Oct-12	16.7	16.3	12.6	12.2	12.4	12.1	11.6	n/a
26-Nov-12	0.6	4.9	8.3	9.3	10.0	10.5	10.8	n/a
20-Dec-12	1.8	n/a	n/a	n/a	n/a	n/a	n/a	n/a
30-Jan-13	11.7	6.3	5.5	5.6	6.8	7.6	8.2	n/a
28-Feb-13	3.2	4.2	5.5	5.8	6.9	7.8	8.3	n/a

Monitor: BH15		Temperature (C) at Depth (mBGS)							
Date	Air	1.0	2.0	3.0	4.0	5.0	6.0	7.0	
11-Jan-12	5.0	7.3	7.2	6.8	7.4	8.0	8.4	8.7	
15-Feb-12	2.0	5.9	5.8	5.7	6.3	6.8	7.1	7.1	
15-Mar-12	18.0	9.3	9.1	5.7	5.5	5.6	5.9	6.1	
27-Apr-12	n/a	11.7	11.3	7.3	6.6	6.4	6.5	n/a	
24-May-12	n/a	18.8	17.9	16.3	8.3	7.5	7.1	n/a	
29-Jun-12	n/a	26.1	23.3	13.5	11.3	9.7	8.8	n/a	
20-Aug-12	n/a	15.4	15.6	14.8	13.2	11.8	10.8	n/a	
21-Sep-12	11.4	13.5	13.5	13.8	13.1	12.3	11.4	n/a	
25-Oct-12	15.3	11.6	11.6	11.4	11.5	11.6	11.4	n/a	
26-Nov-12	0.6	5.8	5.8	8.8	9.6	9.9	10.3	n/a	
20-Dec-12	1.8	3.1	3.3	7.5	8.6	8.9	9.3	n/a	
30-Jan-13	11.7	8.9	8.8	6.1	6.8	7.3	7.6	n/a	
28-Feb-13	3.2	4.3	4.4	4.5	5.7	6.2	6.6	n/a	

Monitor: BH16		Temperature (C) at Depth (mBGS)										
Date	Air	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0
11-Jan-12	5.0	7.0	6.9	6.8	6.8	8.2	8.6	8.8	9.0	9.1	9.0	
15-Feb-12	2.0	3.8	3.7	3.6	3.7	7.0	7.6	7.7	7.6	7.4	7.3	7.3
15-Mar-12	18.0	17.1	16.6	16.2	15.8	6.6	5.9	5.9	6.0	6.1	6.3	6.4
27-Apr-12	n/a	7.4	7.3	7.2	7.0	5.3	5.3	5.7	6.4	7.3	7.9	8.2
24-May-12	n/a	18.8	16.9	15.4	13.8	7.3	6.7	7.0	7.6	8.4	8.9	n/a
27-Jun-12	n/a	19.3	17.6	15.0	14.5	10.4	9.6	9.8	10.4	10.8	11.4	11.6
20-Aug-12	n/a	19.5	19.6	19.5	19.2	18.9	16.4	15.8	14.9	14.1	13.1	12.9
21-Sep-12	11.4	13.4	13.4	13.9	14.9	17.3	17.7	16.9	15.6	14.1	12.4	12.4
25-Oct-12	15.3	13.2	13.3	13.1	13.1	14.3	14.8	14.8	14.0	12.7	11.1	10.9
26-Nov-12	0.6	3.6	3.4	3.6	4.1	9.4	10.3	10.6	10.8	10.3	9.2	9.1
20-Dec-12	1.8	1.4	1.6	1.9	2.3	6.4	8.0	8.2	8.4	8.5	8.1	8.1
30-Jan-13	11.7	7.5	6.3	5.3	5.0	4.6	5.1	5.4	6.3	6.6	6.9	n/a
28-Feb-13	3.2	2.8	2.7	2.6	2.5	2.3	2.8	4.4	5.4	6.1	6.7	6.9

Monitor: BH17		Temperature (C) at Depth (mBGS)								
Date	Air	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0
11-Jan-12	5.0	5.4	5.2	5.2	7.8	8.6	9.1	9.4	9.5	9.6
15-Feb-12	2.0	4.1	3.9	3.9	3.9	7.2	8.1	8.6	8.7	8.9
15-Mar-12	18.0	12.7	12.1	11.4	11.1	8.0	7.8	8.0	8.3	8.3
27-Apr-12	n/a	5.0	5.3	5.6	5.9	7.0	7.4	7.6	7.8	7.9
24-May-12	n/a	18.4	17.6	16.5	14.3	8.2	7.8	7.8	7.9	7.9
27-Jun-12	n/a	17.3	17.3	16.8	16.2	10.4	9.1	8.5	8.3	8.3
20-Aug-12	n/a	17.8	18.1	18.0	17.1	12.3	10.8	10.0	9.5	9.1
21-Sep-12	11.4	12.6	13.1	13.4	13.6	12.4	11.4	10.6	10.0	9.6
25-Oct-12	15.3	12.8	12.6	12.5	12.5	11.9	11.5	11.1	10.5	10.1
26-Nov-12	0.6	4.6	4.7	5.1	6.1	10.2	10.7	10.8	10.5	10.2
20-Dec-12	1.8	1.3	1.6	2.4	3.9	9.0	9.9	10.1	10.2	10.1
30-Jan-13	11.7	8.3	6.1	5.9	6.3	8.1	8.6	8.9	9.1	9.1
28-Feb-13	3.2	5.3	5.1	4.9	5.1	7.3	7.6	8.1	8.3	8.3

Monitor: DP1/SW2			
Date:	Air	SW	1.2m
11-Jan-12	5.0	3.4	4.1
15-Feb-12	2.0	3.0	3.5
15-Mar-12	18.0	7.2	5.2
27-Apr-12	n/a	8.3	7.6
24-May-12	n/a	16.3	13.1
27-Jun-12	n/a	15.8	14.6
20-Aug-12	n/a	n/a	15.5
25-Oct-12	15.3	14.4	14.3
28-Nov-12	1.1	4.8	4.8
20-Dec-12	1.8	4.8	5.0
26-Feb-13	2.70	2.8	2.8

Monitor: DP2/SW3			
Date:	Air	SW	1.2m
11-Jan-12	5.0	3.9	4.8
15-Feb-12	2.0	3.7	3.6
15-Mar-12	18.0	6.1	5.1
27-Apr-12	n/a	8.2	7.1
24-May-12	n/a	16.0	10.9
27-Jun-12	n/a	n/a	12.8
20-Aug-12	n/a	n/a	14.3
25-Oct-12	15.3	13.6	13.6
28-Nov-12	1.1	5.1	5.1
20-Dec-12	1.8	5.0	5.4
26-Feb-13	2.7	3.1	2.7

Monitor: DP3/SW8			
Date:	Air	SW	1.2m
11-Jan-12	5.0	8.9	8.2
15-Feb-12	2.0	8.4	8.9
15-Mar-12	18.0	9.0	9.3
27-Apr-12	n/a	8.1	8.4
24-May-12	n/a	9.1	9.9
27-Jun-12	n/a	10.1	8.8
20-Aug-12	n/a	n/a	9.1
21-Sep-12	11.4	13.1	n/a
25-Oct-12	15.3	9.2	9.1
28-Nov-12	1.1	8.4	8.9
20-Dec-12	1.8	9.4	8.4
26-Feb-13	2.70	9.3	9.1

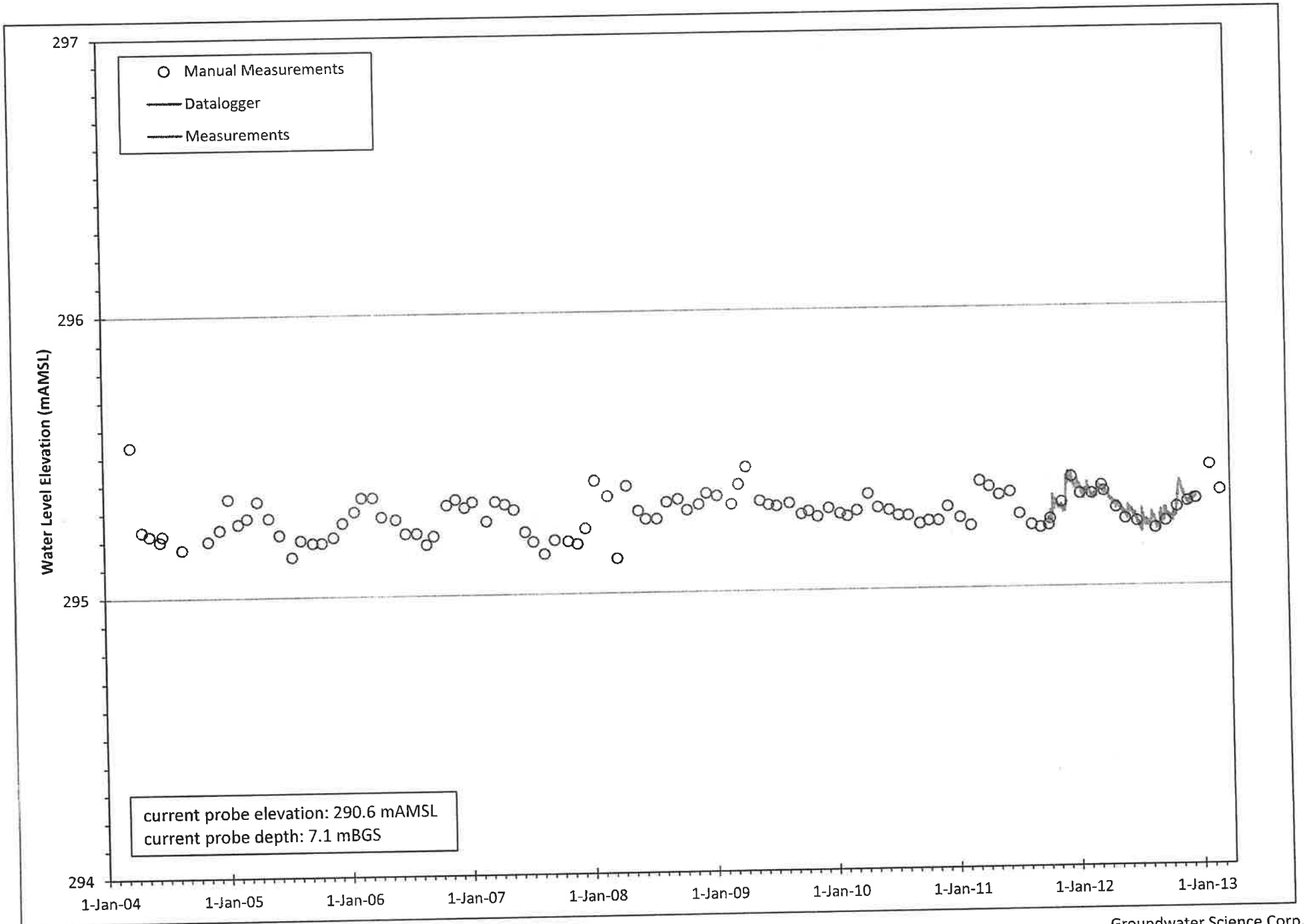
Monitor: DP7/SW10			
Date:	Air	SW	1.0m
11-Jan-12	5.0	4.7	n/a
15-Feb-12	2.0	4.3	n/a
15-Mar-12	18.0	7.5	n/a
27-Apr-12	n/a	6.5	7.8
24-May-12	n/a	12.7	9.1
27-Jun-12	n/a	8.8	11.8
20-Aug-12	n/a	n/a	10.3
21-Sep-12	11.4	16.1	n/a
25-Oct-12	15.3	11.1	10.9
28-Nov-12	1.1	5.4	5.4
20-Dec-12	1.8	6.6	9.2
26-Feb-13	2.7	3.3	frozen

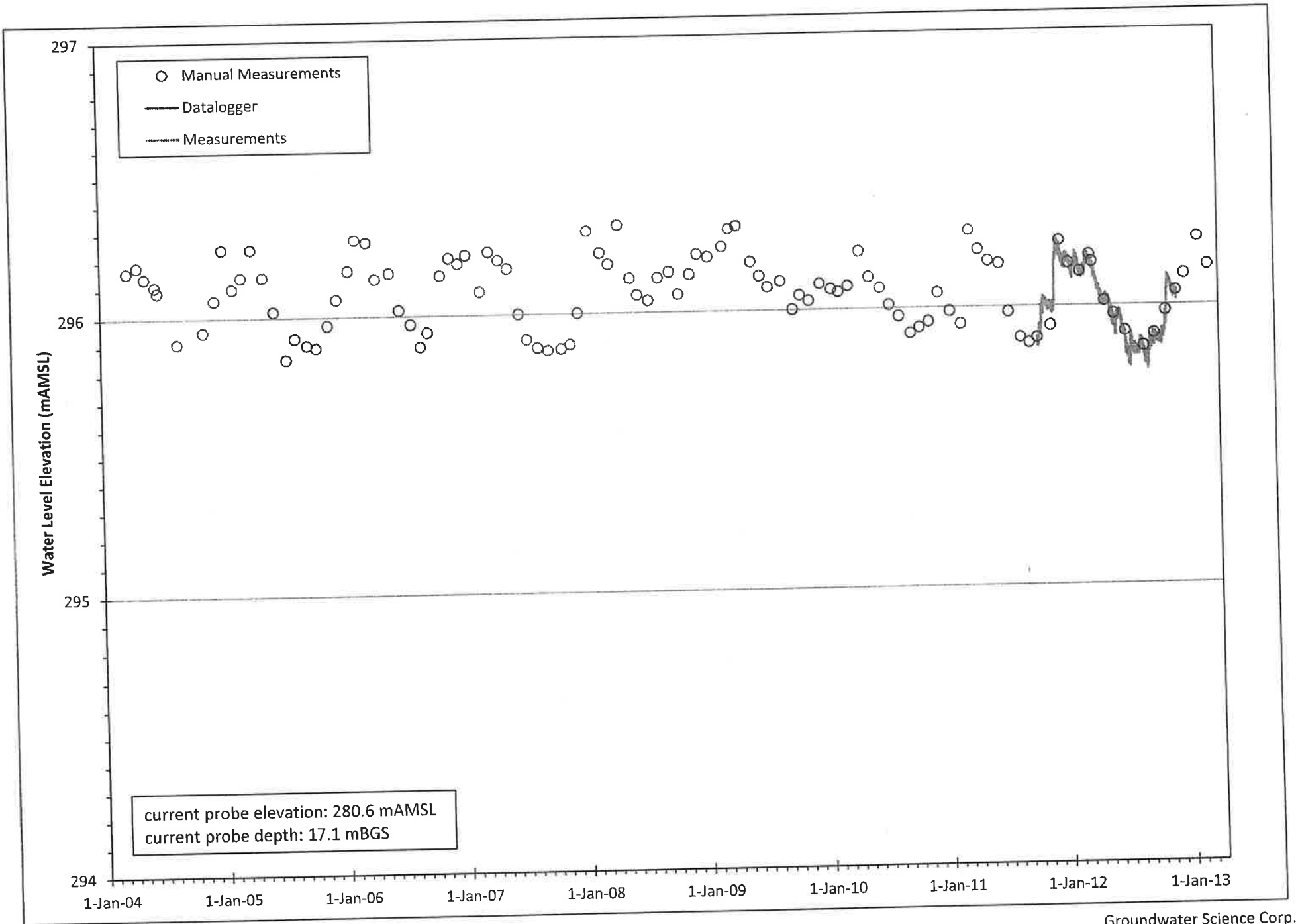
Monitor: DP8/SW6			
Date:	Air	SW	1.9m
11-Jan-12	5.00	8.6	7.9
15-Feb-12	2.00	8.6	7.9
15-Mar-12	18.00	8.3	8.4
27-Apr-12	n/a	7.9	7.2
24-May-12	n/a	8.4	9.0
27-Jun-12	n/a	10.0	8.5
20-Aug-12	n/a	10.0	10.0
21-Sep-12	11.40	13.3	n/a
25-Oct-12	15.30	9.6	10.2
28-Nov-12	1.12	9.1	8.0
20-Dec-12	1.80	9.1	8.9
26-Feb-13	2.70	7.2	7.1

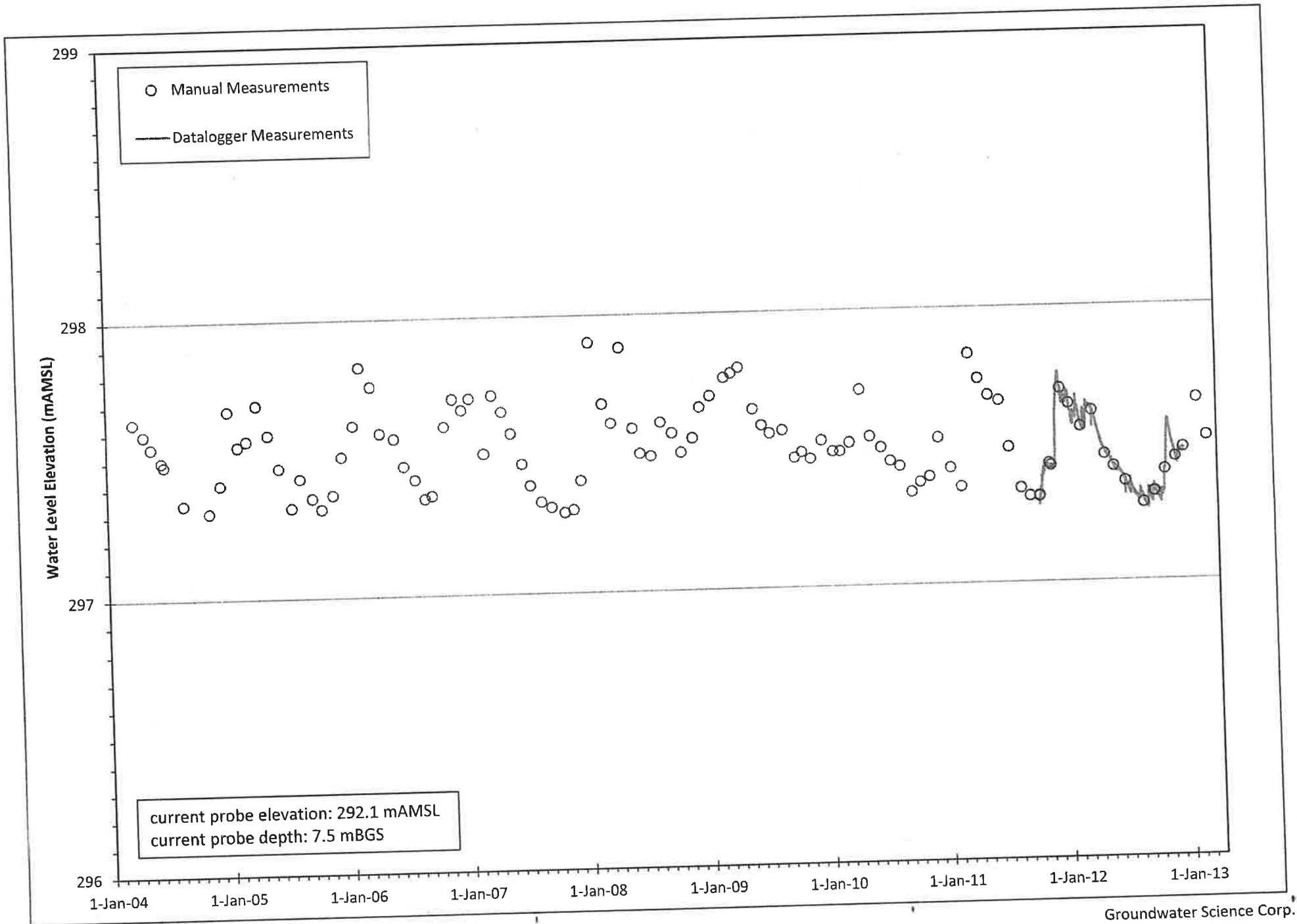
Monitor: SW5		
Date:	Air	SW
11-Jan-12	5.0	10.4
15-Feb-12	2.0	7.7
15-Mar-12	18.0	9.0
27-Apr-12	n/a	7.4
24-May-12	n/a	8.7
27-Jun-12	n/a	9.8
21-Aug-12	n/a	11.6
21-Sep-12	11.4	15.4
25-Oct-12	15.3	15.1
28-Nov-12	1.1	10.1
20-Dec-12	1.8	9.5
26-Feb-13	2.7	8.3

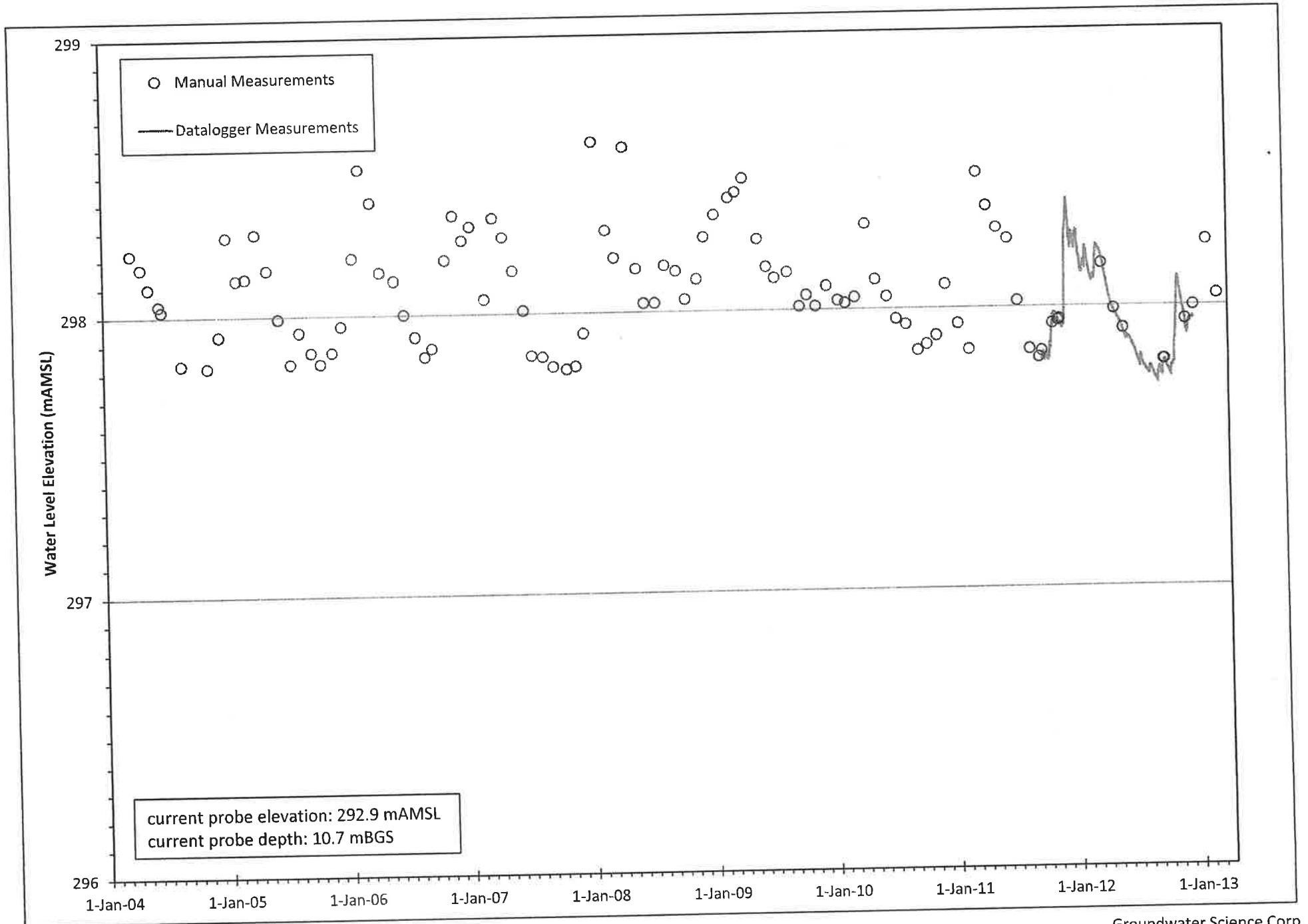
Monitor: SW12		
Date:	Air	SW
11-Jan-12	5.0	10.1
15-Feb-12	2.0	8.0
15-Mar-12	18.0	7.8
27-Apr-12	n/a	8.6
24-May-12	n/a	9.2
27-Jun-12	n/a	9.4
20-Aug-12	n/a	10.4
21-Sep-12	11.4	14.5
25-Oct-12	15.3	14.5
28-Nov-12	1.1	9.6
20-Dec-12	1.8	9.8
26-Feb-13	2.7	8.2

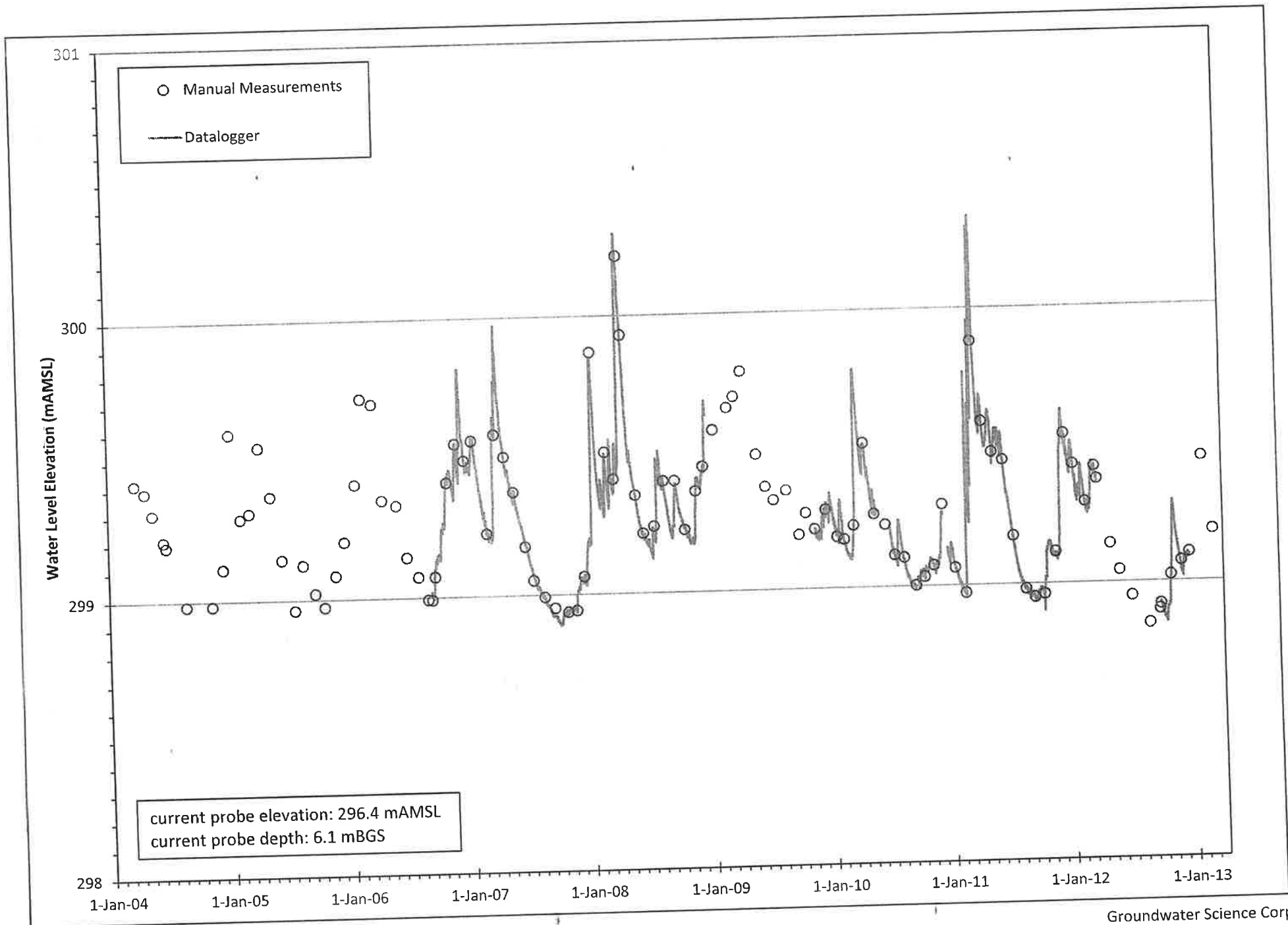
Appendix B
Hydrographs of
Datalogger Data

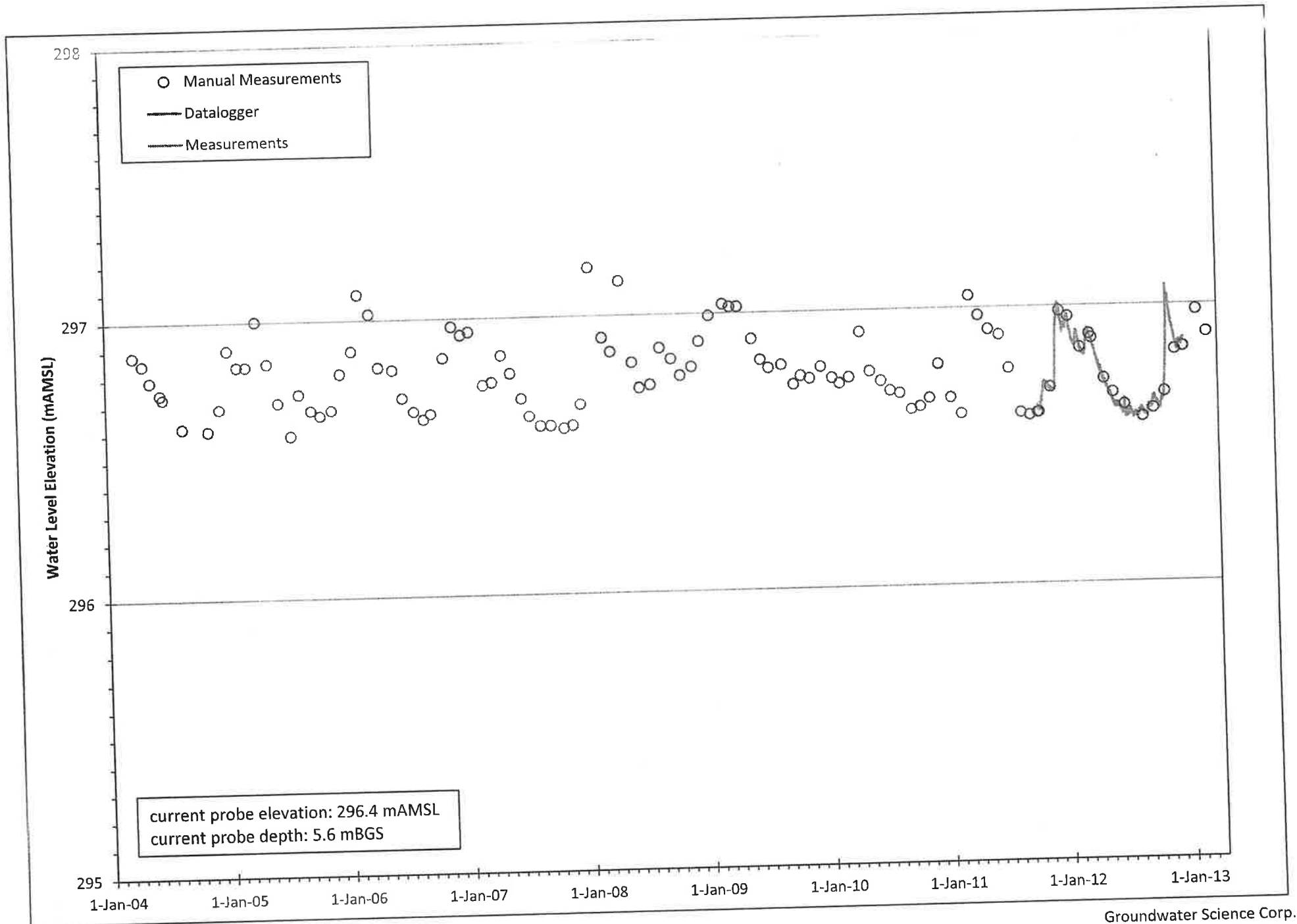


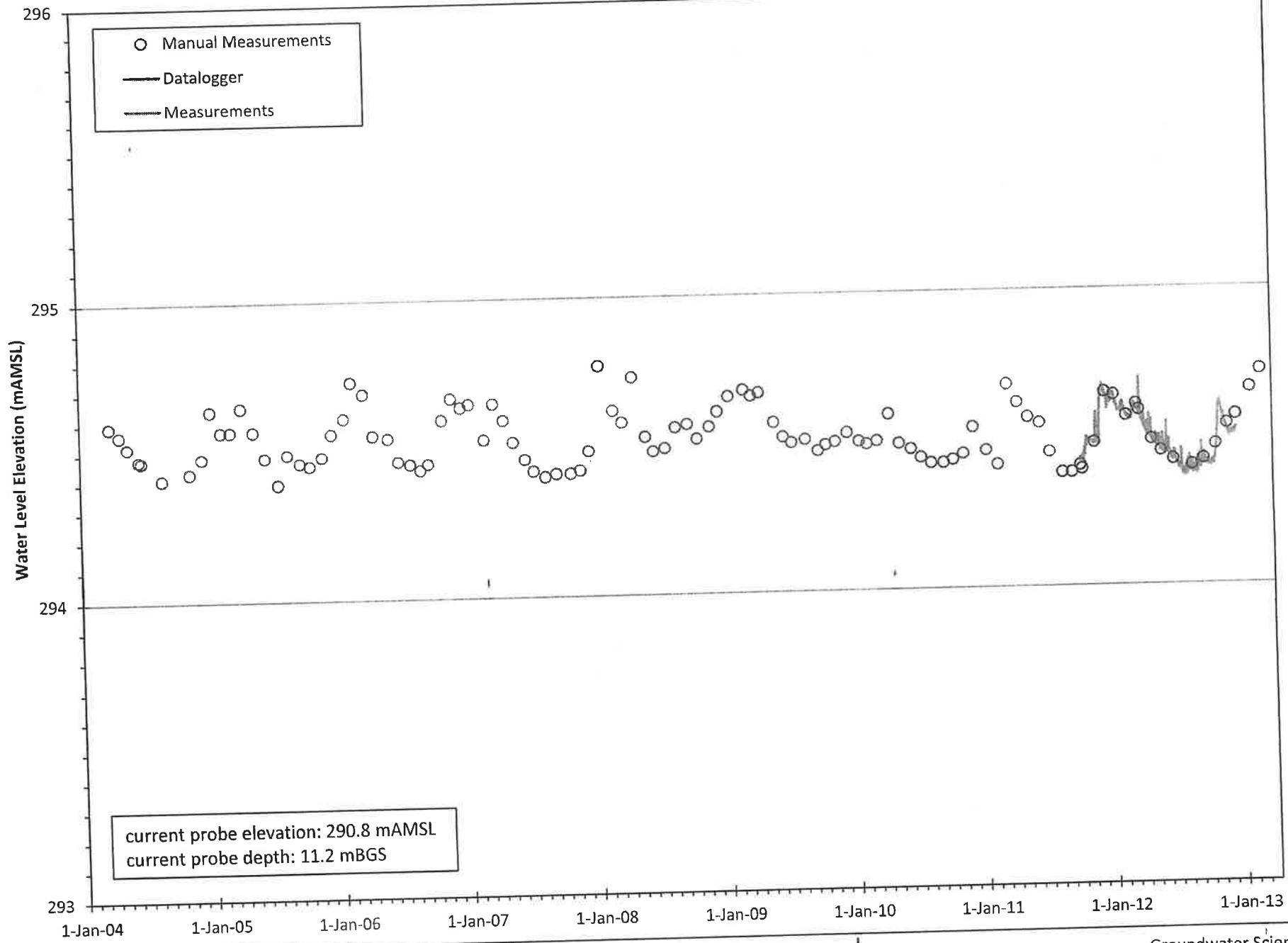


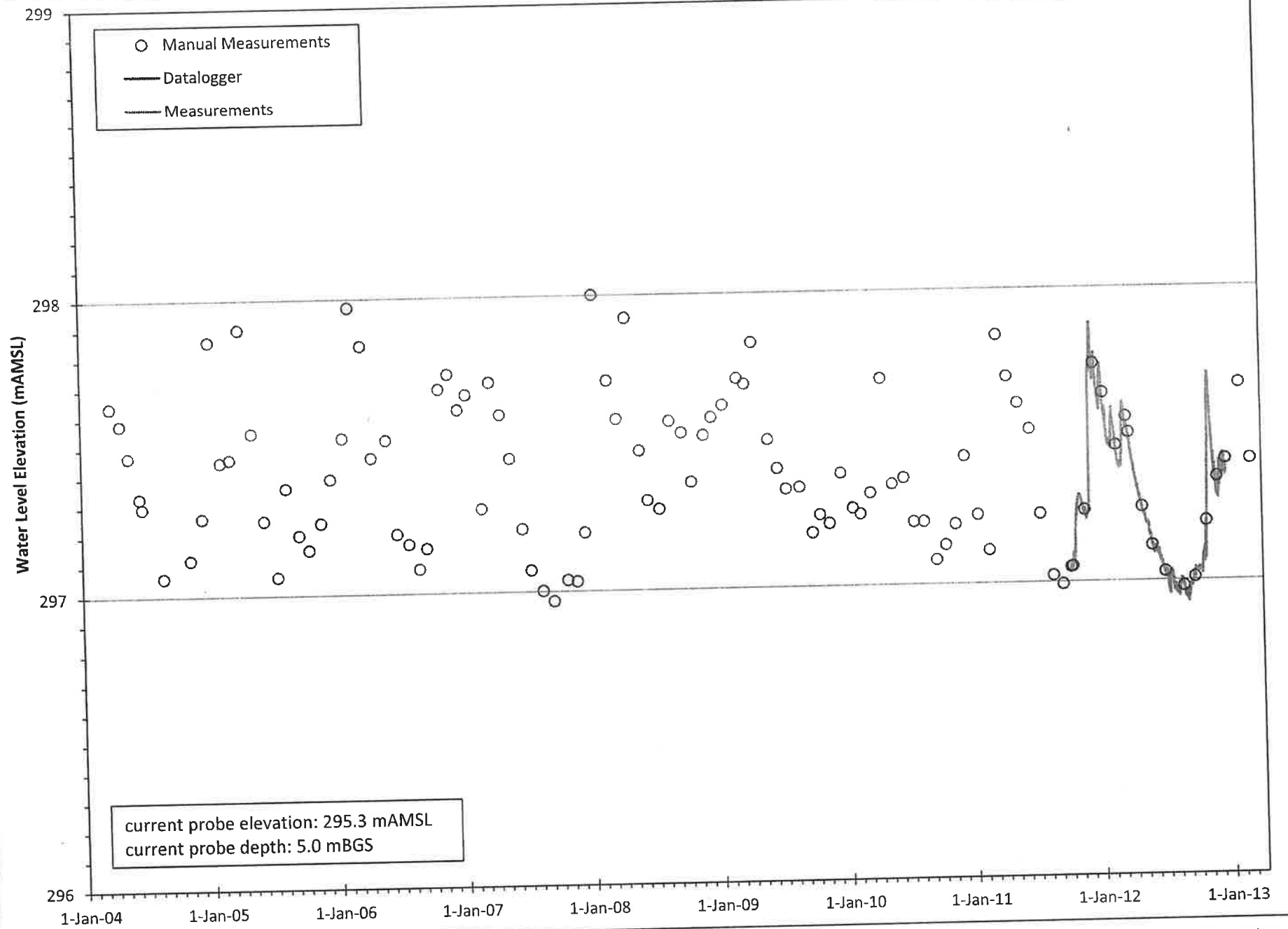


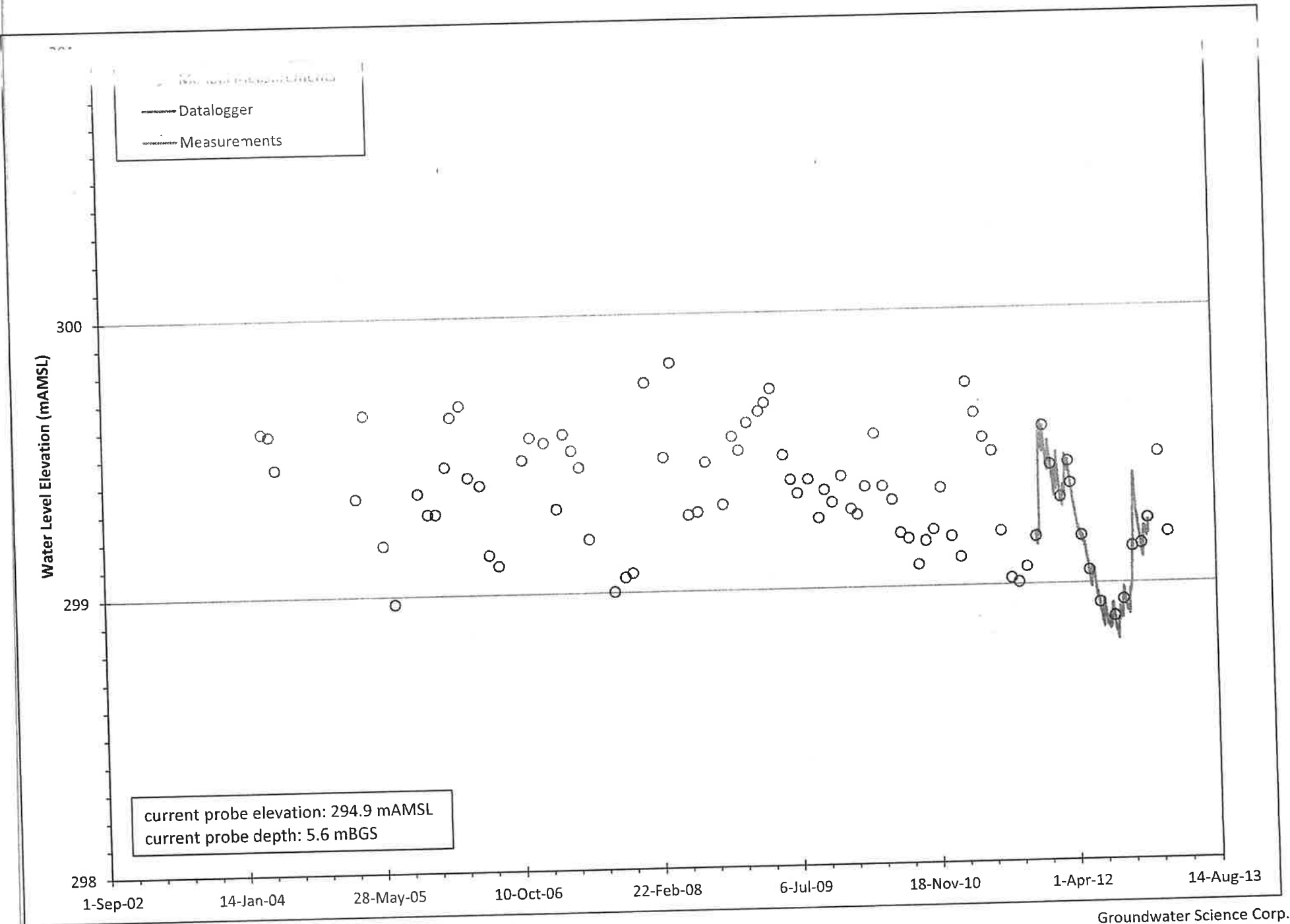


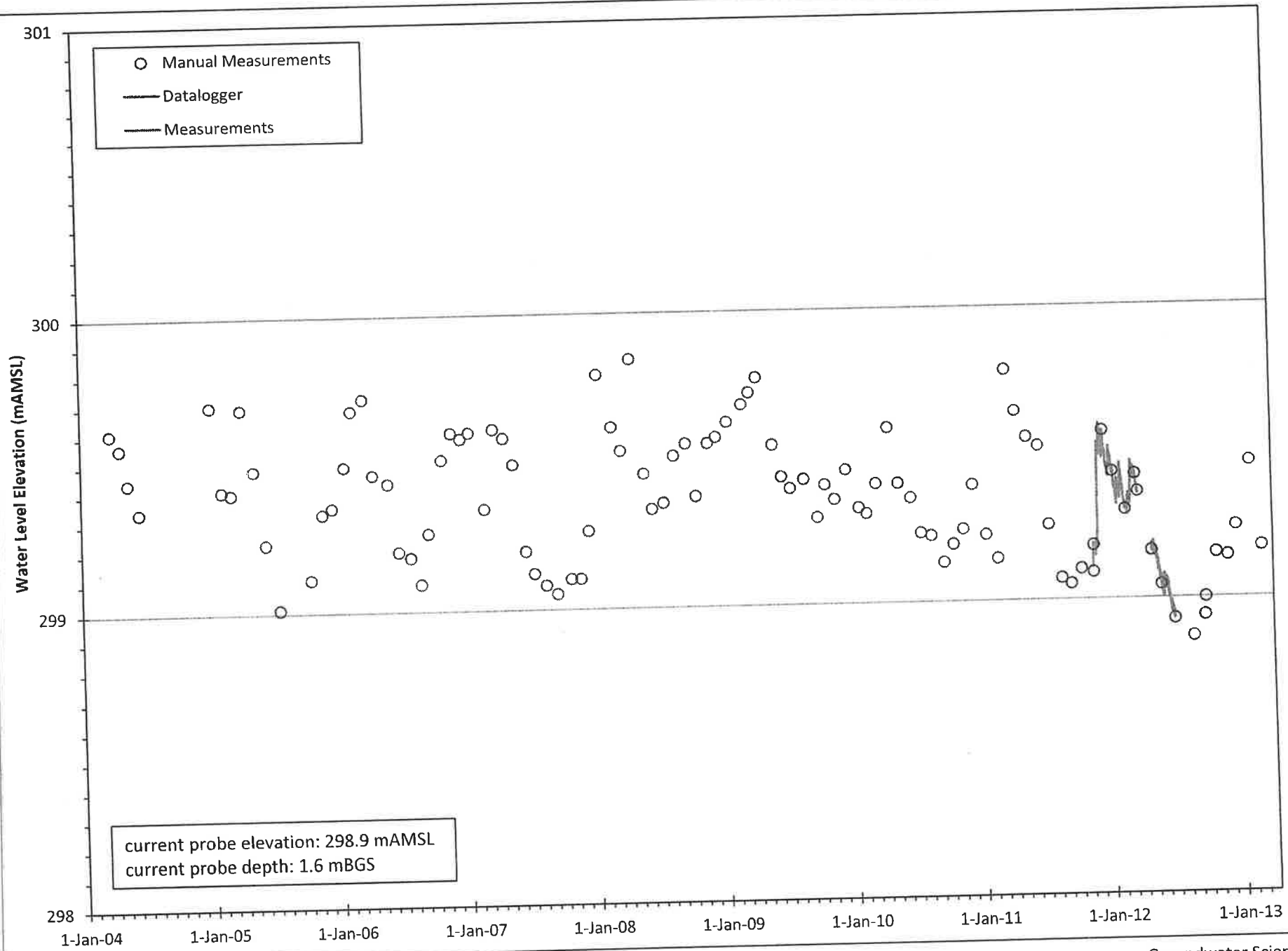




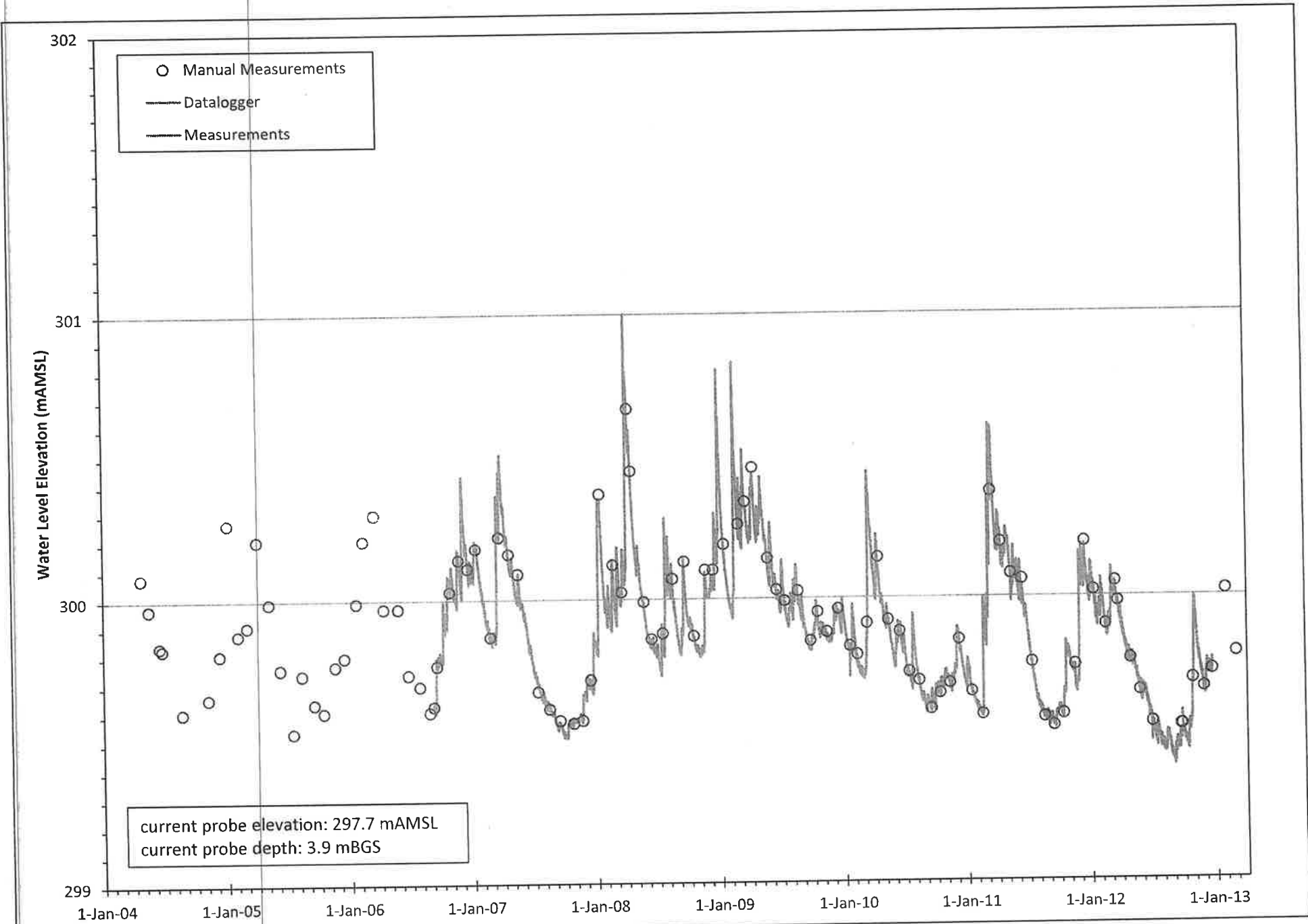


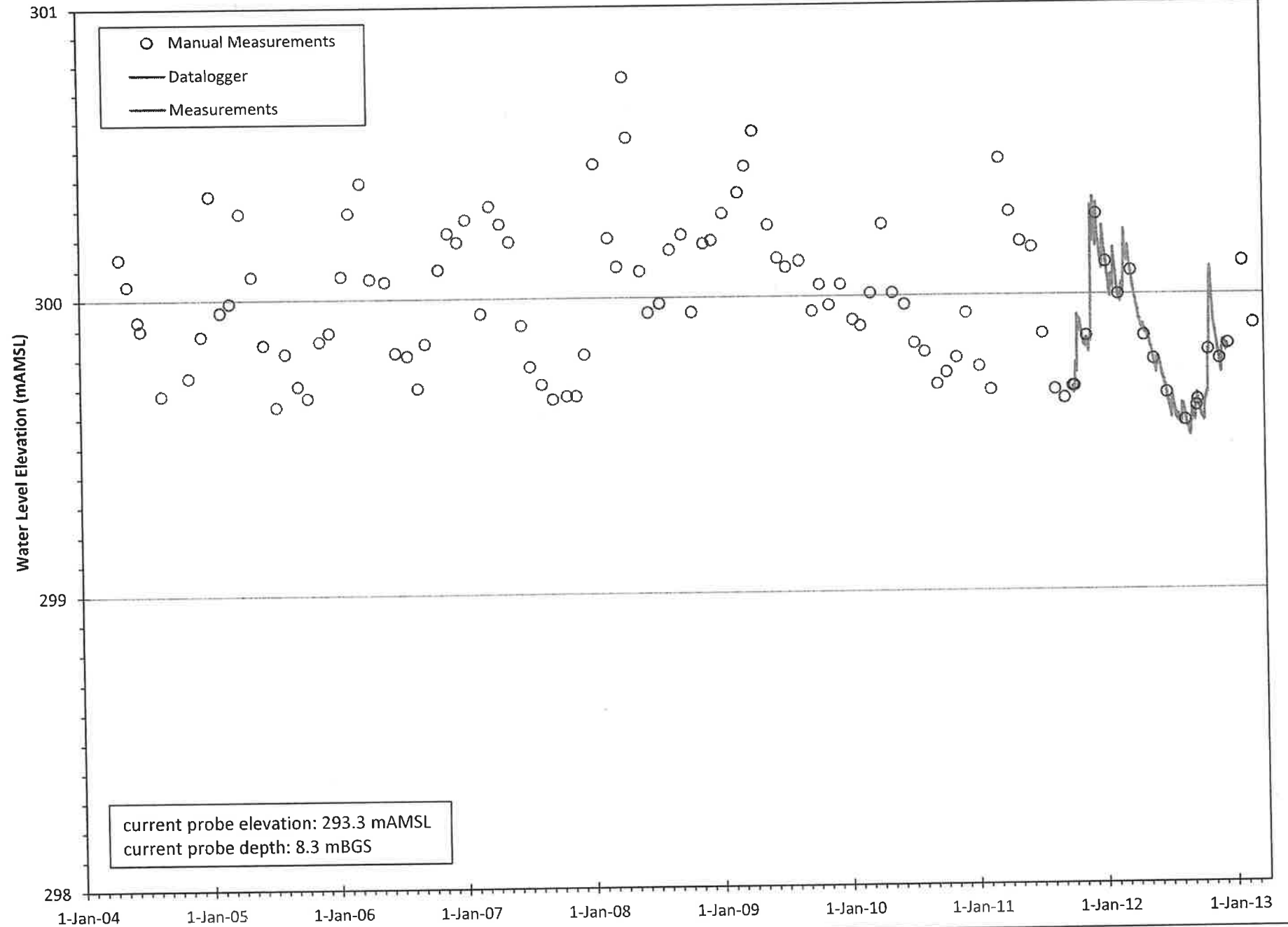


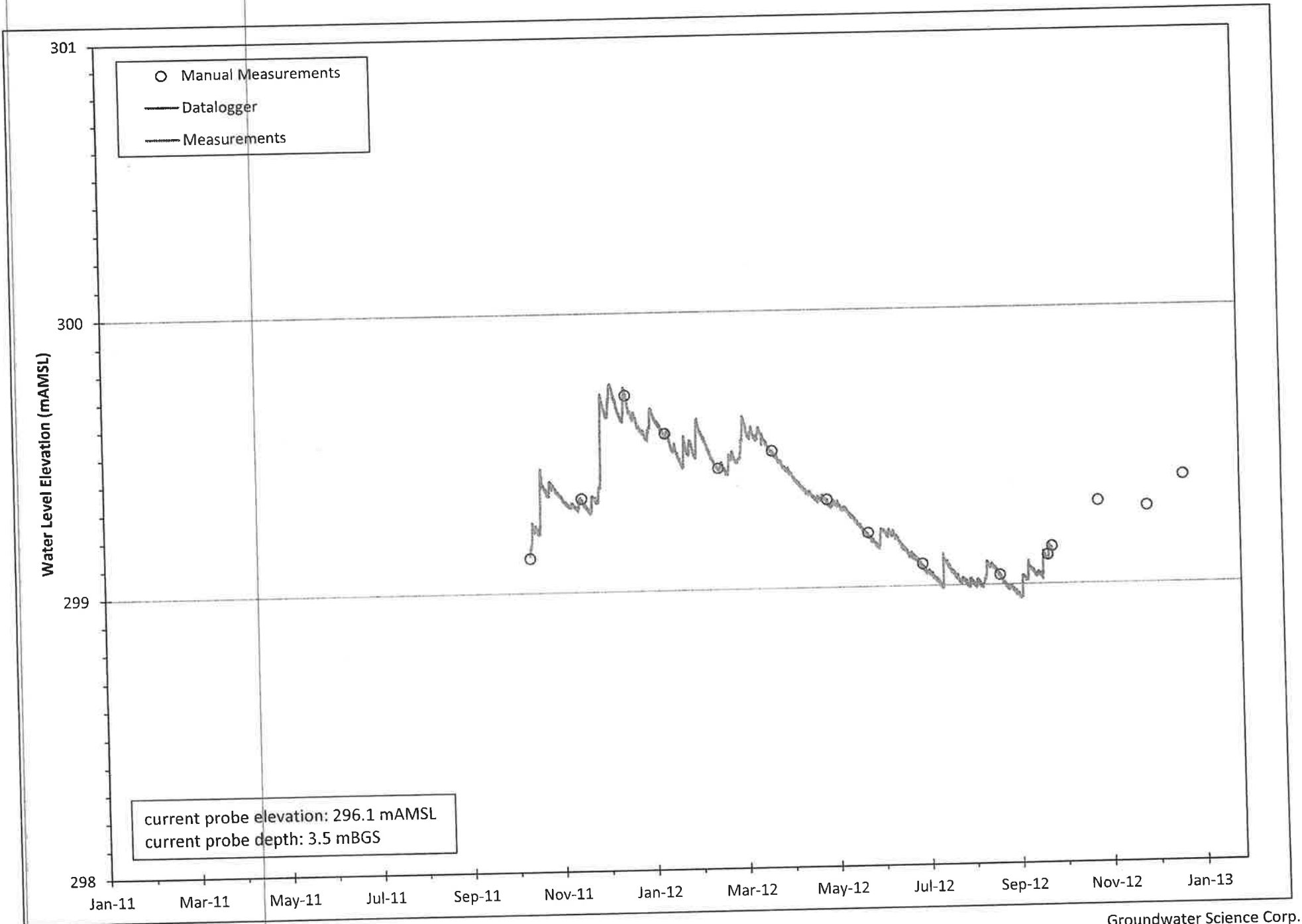


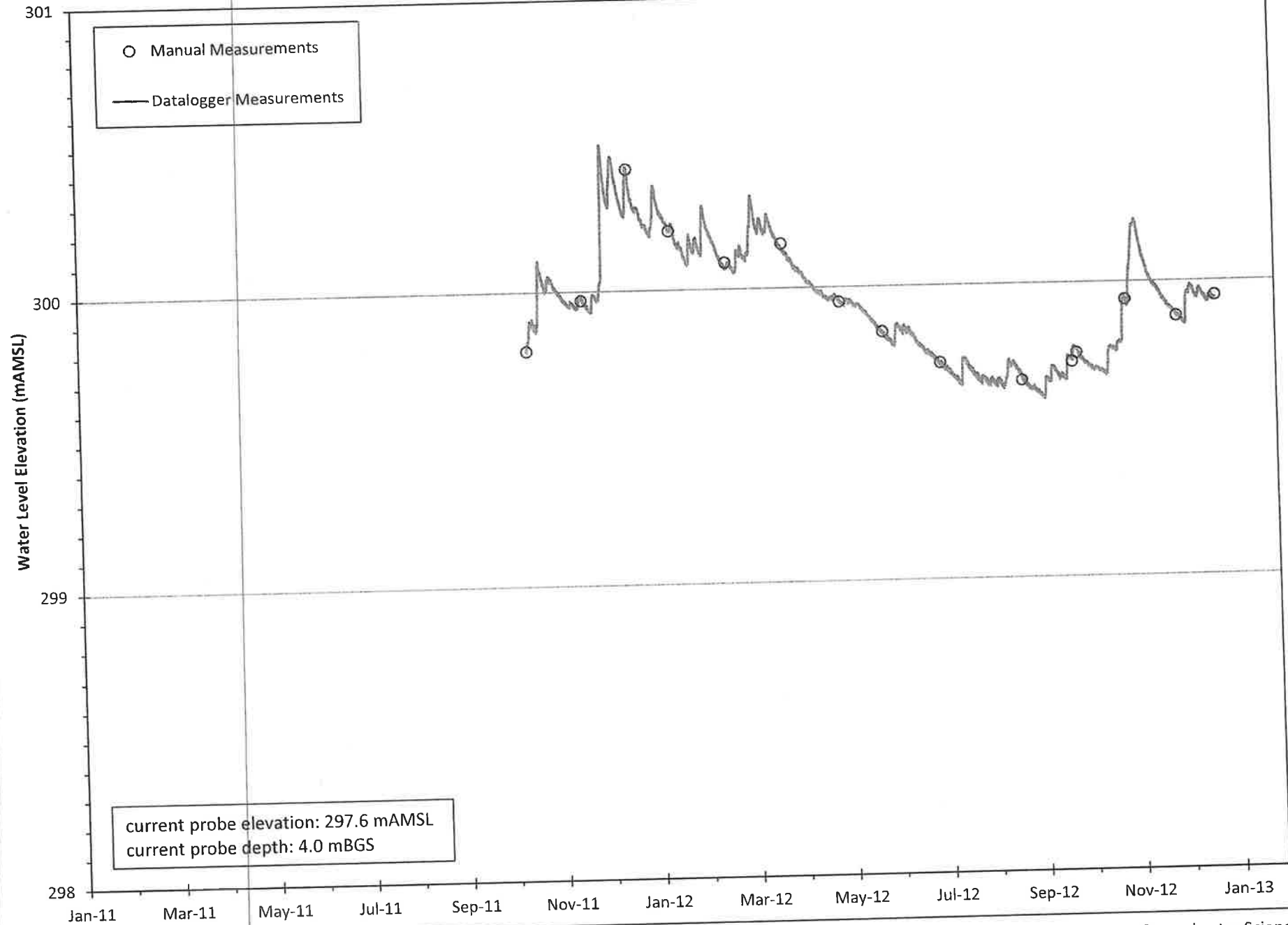


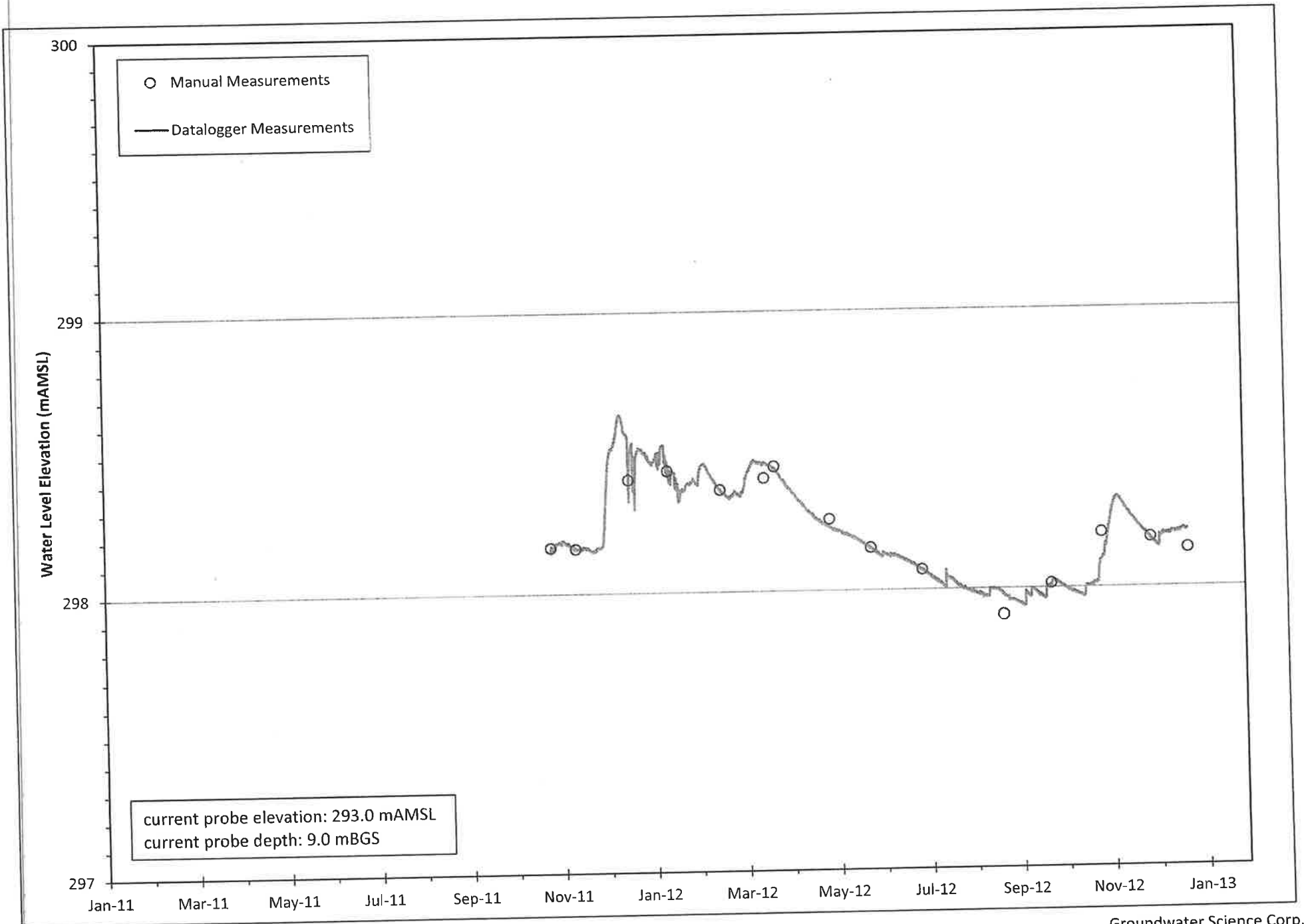
current probe elevation: 298.9 mAMSL
 current probe depth: 1.6 mBGS

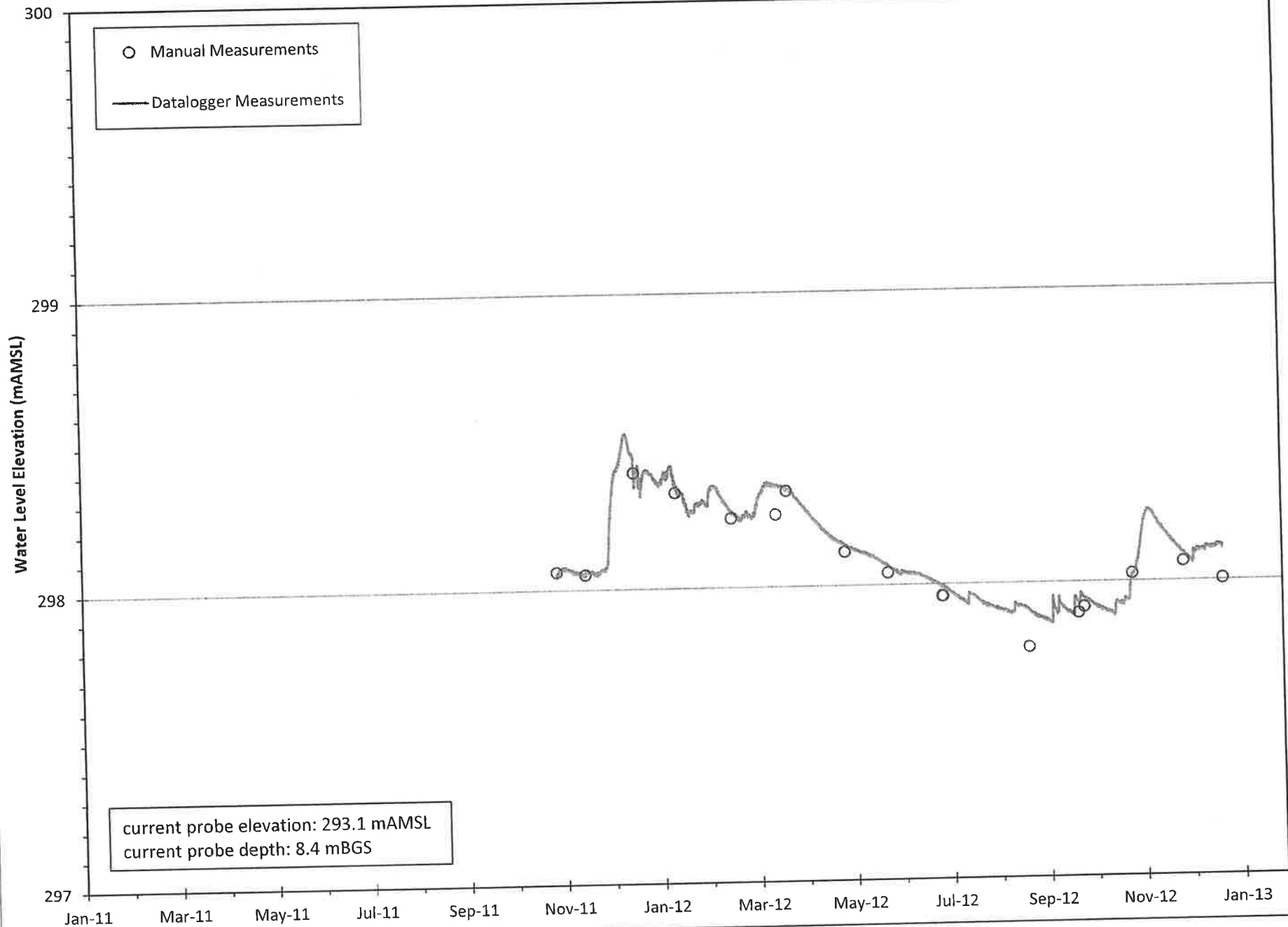




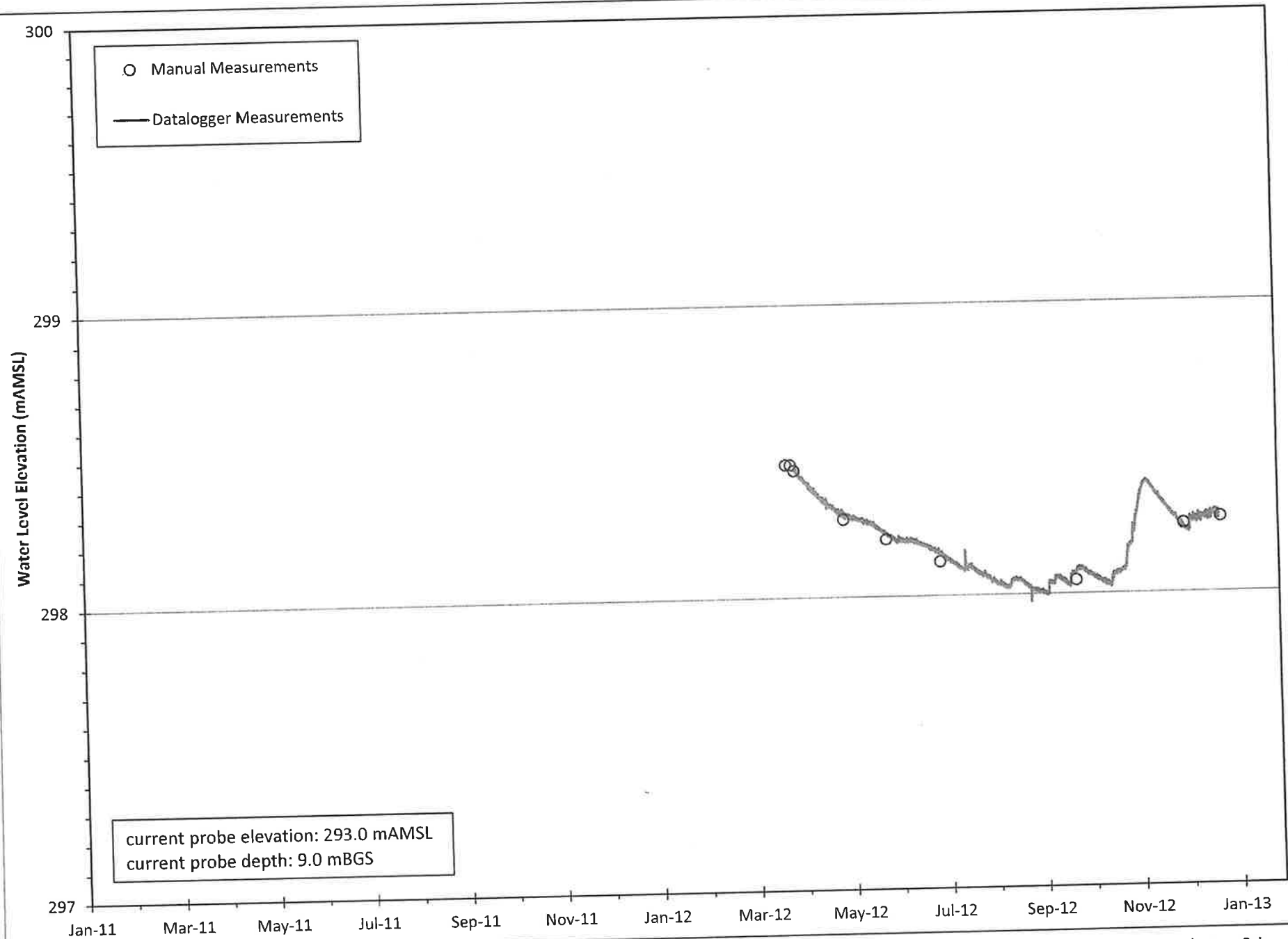


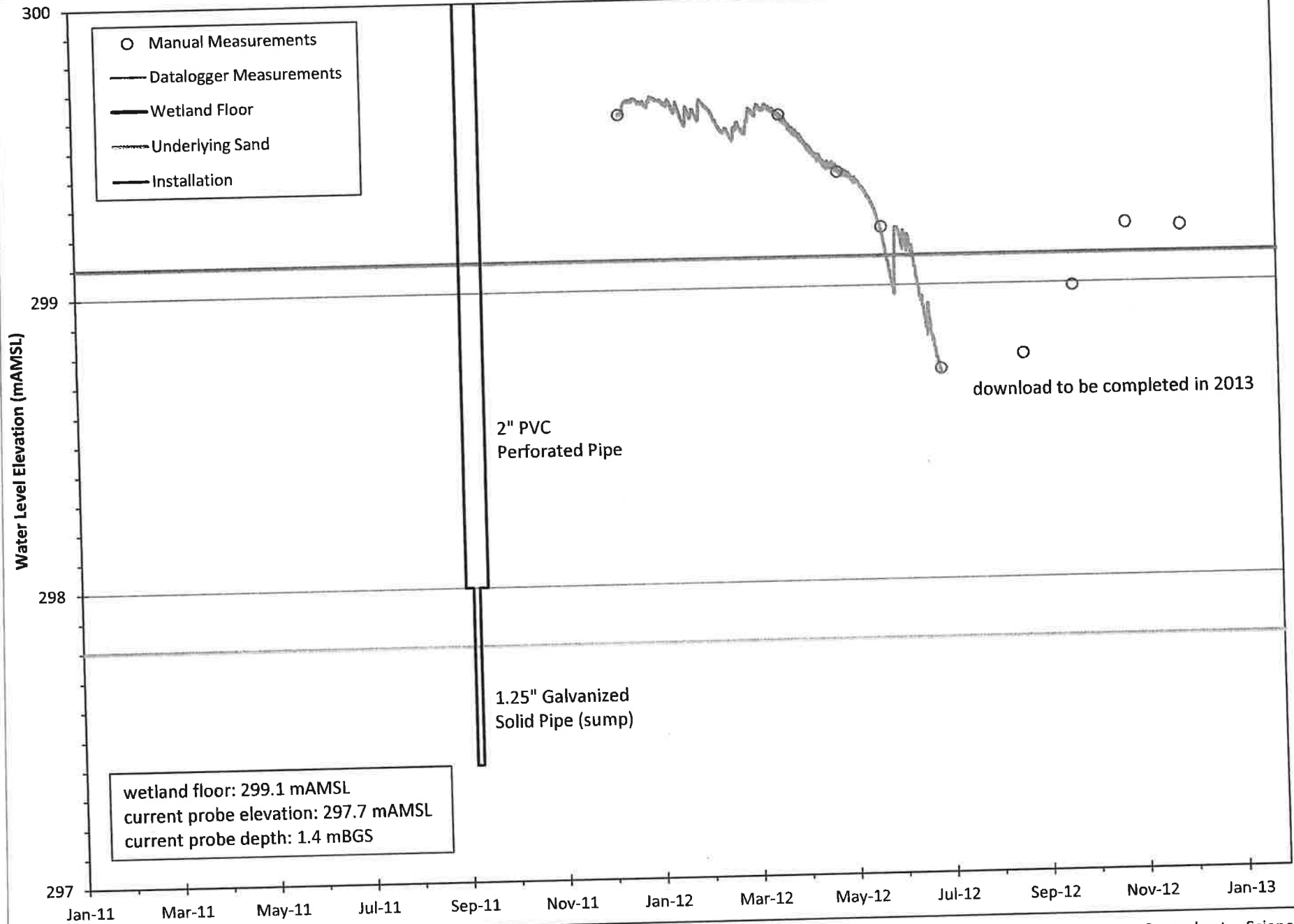




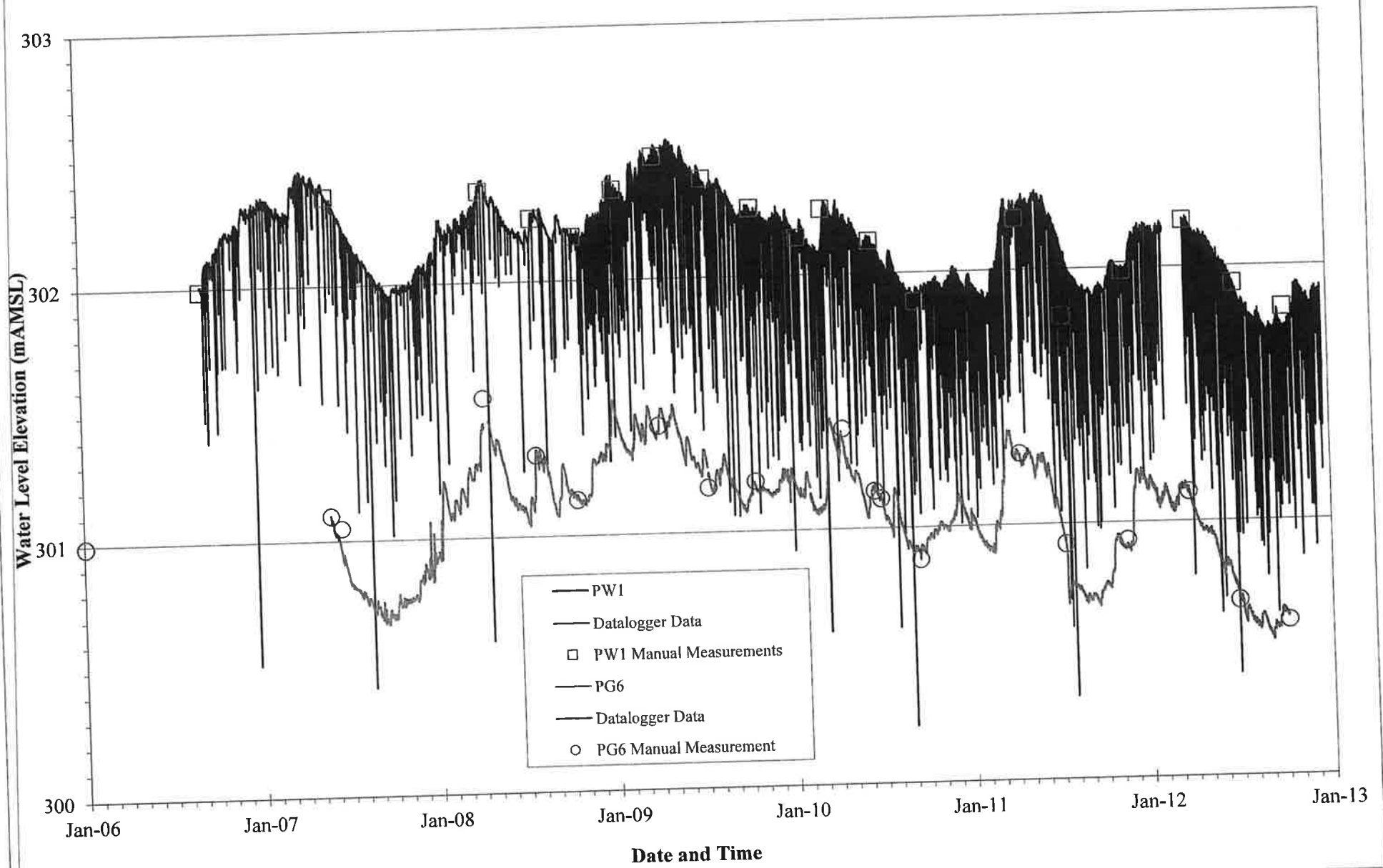


current probe elevation: 293.1 mAMS
 current probe depth: 8.4 mBGS

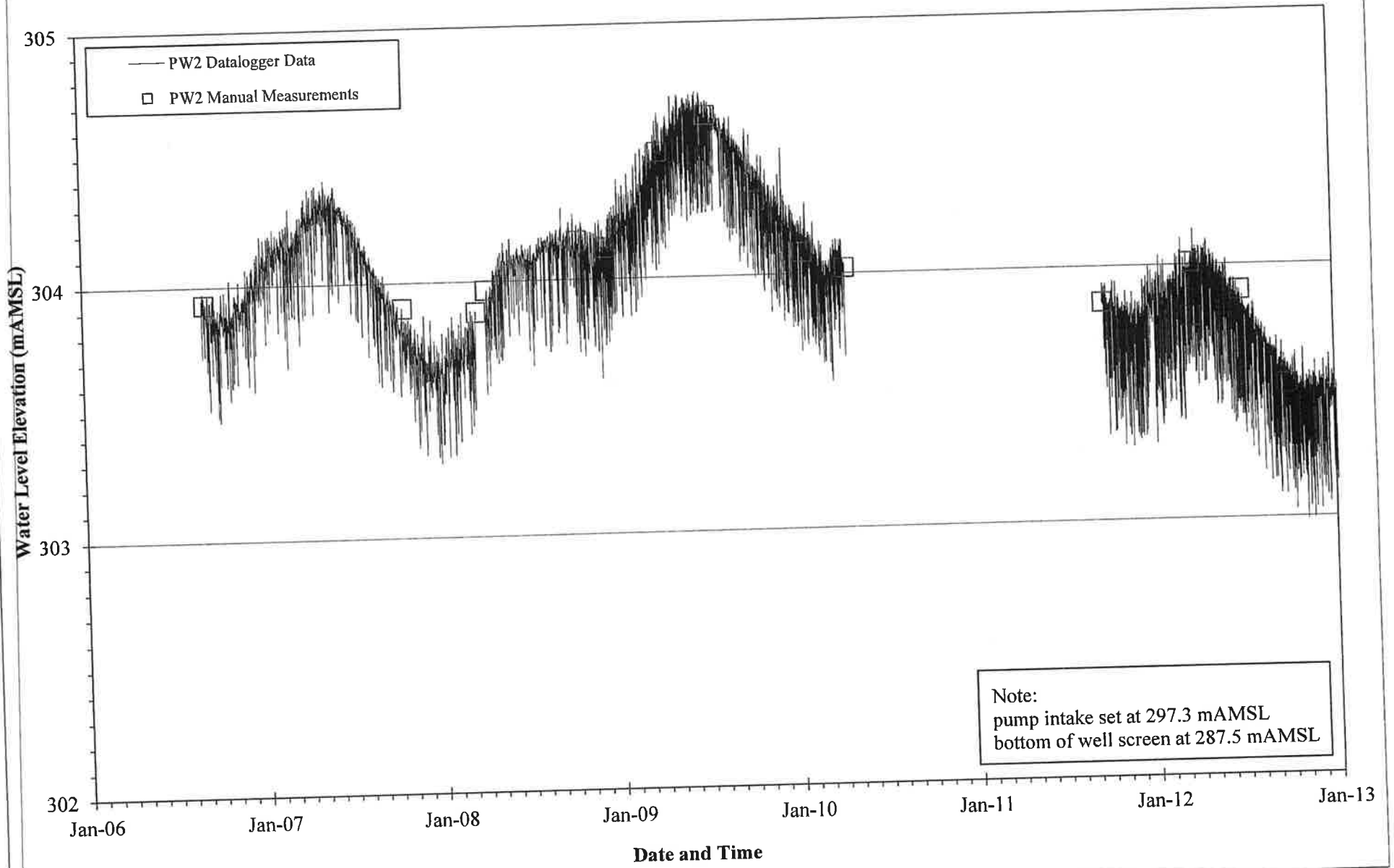




Hydrograph - Private Well PW1 and Pond PG6



Hydrograph - Private Well PW2



Note:
pump intake set at 297.3 mAMSL
bottom of well screen at 287.5 mAMSL

