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Groundwater Studies

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Our File: 0521

May 30, 2024

Township of Puslinch
7404 Wellington Road 34
Guelph, ON, N1H 6H9

Attention: Courtenay Hoytfox
Interim CAO

Dear Courtenay:

Regarding: 2023 Groundwater Monitoring Report, CBM, Roszell Road Pit

We have conducted a review of the following monitoring reports for the Roszell Pit in Puslinch Township.

Roszell Road Pit, Licence No. 625189, 2023 Groundwater Monitoring Report, Groundwater Science Corporation, March 2024

Below water table extraction at the site is no longer occurring and no below water table extraction occurred in 2023.

Summary of Comments

The 2023 water level reporting indicates that water level conditions are improving in the area of concern south and east of the extraction area. Harden attributes this to the increasing water level observed in Lake 3. However, it appears that the water level cannot increase due to the overtopping of the causeway between Lake 2 and Lake 3. Our recommendation is to increase the elevation of the causeway to allow Lake 3 to achieve a higher water level.

The observed improvement in water levels are not such that they are the same as pre-extraction water levels and it remains our opinion that

groundwater levels and nearby pond levels are depressed in the area south and east of Lake 3 as a result of the extractive activity.

Comments on the 2023 Groundwater Monitoring Report

2023 was a relatively normal precipitation year resulting in the partial recovery of low water levels observed at the end of 2022.

The water level history in the southernmost lake (Lake 3) is unique in that there was very little variation of the lake level throughout the year. The lake level rose some 0.10 m throughout the year but did not have typical seasonal water level changes. The lake is at historic high-water levels (of the four years of monitoring in the Lake) and increasing slowly. Similarly, water levels in Lake 2 are also on an increasing trend. It can be observed from the Google Earth images (May 2023) that there is water on the causeway between Lake 2 and Lake 3. This would account for the water level pattern in Lake 3 where Lake 3 water is flowing onto the causeway and eventually into Lake 2. **Given the positive response in nearby groundwater levels, we recommend that the barrier between Lake 2 and Lake 3 be raised to allow the water level in Lake 3 to equilibrate to its highest possible level.**

A review water levels in nearby groundwater monitors BH10, BH15, BH14, BH9S, Roszell Wetland, PG4 and PG6 suggests that these locations are influenced by the water levels in Lake 3. The water levels at these locations remain depressed relative to pre-extraction conditions, however, stabilizing or increasing water levels appear to be occurring. Additional monitoring will help with this determination. This is important in that as the water levels in Lake 3 recover a similar effect is expected in the nearby groundwater monitors and ponds.

The water level in the Roszell Wetland remained relatively low compared to pre-extraction conditions and only a brief period in the spring shows water levels above the wetland floor at the location of monitor PG7. The data set presented includes the first three months of 2024 and unlike the previous three years, the water level was above the wetland floor. The stabilization of the water level in Lake 3 may also be having a positive effect in this area.

No additional thermal impact has been recorded in the nearby surface water features. The history of temperature recordings shows that groundwater discharging to some of the springs along the banks of the Speed River tributaries has increased. These changes have stabilized and ecological monitoring is being done to confirm that brook trout habitat has not been changed significantly.

The recommendation from Groundwater Science is to continue monitoring and we concur with this recommendation.

Sincerely,

Harden Environmental Services Ltd.

[redacted]

Stan Denhoed, M.Sc.,P.Eng.

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Roszell Pit, Licence No. 625189
2023 Groundwater Monitoring Report

Prepared For:

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Toronto, ON
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Prepared By:

Andrew Pentney, P.Geo.
Groundwater Science Corp.

March 2024

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1.0 INTRODUCTION

This report summarizes the results of the 2023 Roszell Pit groundwater monitoring program as per conditions shown under the *Hydrogeological Recommendations (Monitoring, Triggers and Mitigation)* of the approved Site Plan. The Roszell Pit is operated by CBM Aggregates (CBM).

The monitoring program is summarized in Section 1.1 of this report. Information regarding Items listed on the Site Plan under General Controls, Part D below water extraction is provided in Section 2.0 of this report. Site details; test and extraction pond locations; and, monitoring locations are shown on **Figure 1**.

1.1 MONITORING PROGRAM

The groundwater monitoring program requirements for the Roszell 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:

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 MNRF 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 MNRF 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 MNRF.

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 MNRF, the MECP, 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).

Lake A, B and C are also referenced as Lake 1, 2 and 3 in this report.

We note that on behalf of CBM, a Thermal Impact Assessment was provided to all commenting agencies in March 2018. As part of that assessment the following recommendations were made with respect to the monitoring program and associated temperature thresholds:

1. The monitoring program be revised as follows:
    a. Manual spot surface water temperature measurements shall be discontinued;
    b. Manual groundwater temperature profile or spot measurements shall be discontinued;
    c. Manual groundwater level, surface water level and streamflow measurements shall be obtained on a quarterly basis;
    d. Detailed groundwater temperature monitoring at the site shall consist of profiles using dataloggers as established elevations within BH116, BH17 and BH1, and, using dataloggers at established elevations within the screened interval at BH2-S, BH2-D, BH3-S, BH3-D, BH7-D and BH8.
2. The temperature trigger thresholds be revised to the following:
    a. Surface water temperature increase of 1 degree Celsius beyond the seasonal natural range observed to date (defined as the maximum 7-day average temperature at each location) at SW3, SW4, SW7 or SW9.

As indicated in the Township of Puslinch August 15, 2018 Council Meeting Agenda Package, the assessment and above noted recommendations were reviewed on behalf of the Township by Harden Environmental Ltd. and GWS Ecological & Forestry Services Inc. (Township consultants). The review concurred with the recommended monitoring program changes and accepted the threshold recommendations.

However, no ministry review response has been received to date. Therefore the monitoring program has continued as per historical practice.

2.0 MONITORING COMPLETED

2.1 OPERATIONS SUMMARY

In 2023 there were no extraction operations at the site. The extraction Lake outline, and Silt Barrier configuration, is shown on **Figure 1**.

2.2 LOCATIONS MONITORED

In 2023 the following locations were monitored:

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), LG3 (Lake 1), LG4 (Lake 2), LG5 (Lake 3) 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, SW7, SW8, SW9, SW10, and SW12.

Off-Site

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.

The monitoring locations and current extent of extraction is shown on **Figure 1**.

In 2017 the Lake 1 gauge (LG3) datalogger stopped operating. Attempts to retrieve the datalogger were unsuccessful, however manual monitoring has continued on an occasional basis. Continuous water levels and temperatures at Lake 1 are represented by location BH16, which is located approximately 5 m from Lake 1.

The Lake 3 water level monitoring station LG5 was established in April 2020, as soon as safe access became available.

Off-site monitoring wells BH11 has become inaccessible due to livestock presence and access restrictions to the property. Locations BH12 and BH13 were monitored on an occasional basis in 2023, as access permitted.

Water quality samples were obtained in December 2023 at the locations specified by the monitoring program, with the exception of BH10-D due to well damage sustained when a vehicle left Roszell Road and hit the well casing. BH10-S remains functional and is used to monitor groundwater conditions at that location.

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

The manual water temperature measurements are obtained using electronic thermistor type instruments (Heron Instruments® temperature option included with the 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 and depth is measured using commercially available fiberglass measuring tape and aluminum meter-stick. Historical water velocity was measured using a Swoffer Instruments Inc. Model 2100 ® current meter according to manufacturer's instructions. Current water velocity measurements are obtained using an OTT Hydromet MF Pro ® current meter according to manufacturer's instructions.

Automated water level measurements are obtained using commercially available non-vented water level dataloggers according to the manufacturer's instructions. All of the dataloggers are currently programmed to take hourly measurements as 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 Schlumberger Diver®, and, In-Situ RT® or LT® series units. Barometric pressure is measured on-site using an In-Situ® dedicated barometric datalogger.

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 are currently programmed to take hourly measurements as 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. Additional data was presented in the 2012 to 2019 annual reports. This report provides the manual data collected from 2022 to 2023, in addition to hydrographs illustrating historical data.

3.1 WATER LEVEL MEASUREMENTS

A summary table of manual water level measurements obtained in 2023, 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.

Monitoring and datalogger installation at private wells and ponds has been implemented according to access permissions with respective residents. These private locations are monitored as accessible.

3.2 TEMPERATURE MEASUREMENTS

Manual surface water temperature measurements collected in 2023 are summarized on **Table A4** (**Appendix A**). Temperature profile data at monitoring wells and drive-points is collected, however as per the 2018 report recommendations is no longer presented or assessed. The data can be made available on request.

Graphs illustrating continuous 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 intermittent datalogger problems, overall a detailed record (manual and continuous) has been established at most locations.

3.2 STREAMFLOW MEASUREMENTS

A summary of streamflow measurements/calculations obtained in 2023 is included in in **Table A4** (**Appendix A**). Streamflow measurements are available since 2004.

3.3 WATER QUALITY SAMPLING

Water Quality samples were obtained at locations BH1, BH5, BH7-D, BH8 and BH10-S on December 6, 2023. Location BH7-S did not have enough water column to allow sampling at that time. Location BH10-D was not available for sampling due to the well damage described previously. Samples at locations SW2, SW3, SW6, SW8, SW10 and Extraction Pond were obtained on November 29, 2023. The 2023 water quality sampling results are included in **Appendix D**.

2.0 DISCUSSION

Below water table extraction was initiated at Lake 1 and Lake 2 in March 2014. From 2015 to 2017 most below water extraction occurred at Lake 1. In May 2017 extraction at Lake 1 was fully completed. In 2018 and 2019 all below water extraction occurred at Lake 2. Lake 3 extraction was initiated in February 2020. Both Lake 2 and Lake 3 extraction was complete in 2022.

4.1 PRECIPITATION

Water level variation at and near the site is influenced by seasonal and annual precipitation. Groundwater recharge in southern Ontario typically follows a pattern that includes significant infiltration in response to spring snowmelt and rainfall which results in high water table conditions; a subsequent reduction in infiltration through the summer/fall growing period (as plants use much of the rainfall that does occur) which results in a water table decline; and, moderate rainfall infiltration during late fall and early winter periods which can result in some water table recovery. Critical periods are spring and fall seasons; if snowmelt and precipitation volumes are low during these periods then groundwater recharge can be significantly reduced. This would result in lower than average seasonal or annual water table levels. Extended dry periods can lead to overall seasonal or annual water table declines.

To date daily precipitation data as reported by Environment Canada for the Kitchener/Waterloo Station (former Waterloo-Wellington Airport or Waterloo Wellington 2) has been used as the primary indicator of climate conditions in the area of the site. Occasional daily precipitation values for this series of stations are missing and daily values from nearby Environment Canada weather stations are used to complete the data set. These stations include (in order of priority): Roseville and Elora RCS. To our knowledge this is the same methodology, and is consistent with, that reported by other annual monitoring assessments for the area, (e.g. former Golder Associates for former Nestlé Waters Canada), as part of a coordinated approach to monthly and annual precipitation analysis requested by the Township of Puslinch.

For comparison to the hydrographs, a plot of the compiled seasonal and annual precipitation, compared to the current 30-year (1981 to 2010) monthly precipitation normal reported by Environment Canada for the Waterloo Wellington A (Airport) station is included in **Appendix A**.

We note that in 2023 a total of 11 daily values were “missing” from the K/W station dataset. Using the substitution methodology (Roseville station) the total annual precipitation is calculated to be 863.4 mm. This equates to 94% of the reported 30 year “Normal” annual precipitation value of 916.5 mm.

As indicated by the graph, increasingly dry to very dry annual precipitation conditions have occurred in this area since 2018. Of note, winter/spring precipitation has also been below average since 2018, and most precipitation has occurred during summer to fall periods. As a result seasonal and annual groundwater recharge potential was significantly reduced (as compared to “average” conditions represented by reported climate normals) over the last 5 years.

4.2 NATURAL WATER TABLE FLUCTUATION

The "natural" water table response at the site to seasonal and annual conditions appears to be represented by BH8, based on a comparison of hydrographs and the location of the monitor relative to site activities (cross-gradient and most distant). As illustrated by the BH8 hydrograph, seasonally low water levels since 2019 were lower than historically experienced (by 10 to 20 cm). The overall decline in seasonally low water levels from 2018 to 2022 is consistent with the relatively dry conditions experienced over that period.

We note that in 2021 the spring "high" was much reduced (60 to 80 cm) as compared to historical conditions, which indicates groundwater recharge was also significantly less than average over that period. The effects of relatively low recharge potential associated with dry conditions persisted through 2022.

Some "recovery" occurred in 2023, with spring to fall water table maximum and minimum levels more consistent with historical ranges, as compared to conditions observed in 2021 and 2022.

4.3 WATER TABLE RESPONSE

4.3.1 Potential Groundwater Changes Due To Extraction

Potential water table response to the below water extraction can be associated with two separate "mechanisms", temporary changes due to the removal of aggregate (gravel), and, longer term changes due to the creation of a pond.

The first factor is related to the removal of the gravel and corresponding immediate inflow of water into the resulting "hole" to form a pond. The gravel is piled beside the pond and allowed to drain. Water flowing into the pond is a combination of water drained from the gravel pile, any direct precipitation on the pond, any surface water (runoff) that occurs from the pit floor surrounding the pond and groundwater from the surrounding aquifer. The inflow of groundwater can result in water table changes in the area surrounding the excavation, primarily within the upgradient flow system. These changes are temporary because once aggregate removal stops (at the end of each day, each weekend, or at the end of the extraction season, and, once site extraction is complete), the groundwater system begins to recover. Over time normal seasonal recharge will mitigate the temporary effect and the overall system will return to a natural condition.

The second factor is related to the formation of the extraction pond (or Lake) within the water table flow system. The open water body created will have no resistance to flow. However the Roszell Lakes have no direct "outlet", therefore will not result in a significant increase in the volume of groundwater flow from east to west in the overall area. The total rate and volume of groundwater flow toward the Speed River valley will be controlled by the material left in place between the lake and the valley. Water level changes associated with the lake will also not be large enough to change the amount of water flowing toward the site from the east within the regional system. The lake will focus local flow, resulting in a water table decline immediately upgradient of the lake and a corresponding rise in water table downgradient of the lake. The Silt Barrier along the south edge of the extraction area is designed to limit water level change south of the site.

4.3.2 Water Table Response

In general, 2023 water levels at most locations across the site exhibited a “recovery”, to various degrees, relative to dry conditions in 2021/2022. The water table increase was most notable at the south end of the property. No specific water level threshold exceedances were observed at the site in 2023.

It also appears that the overall groundwater system continues to equilibrate to the physical conditions created by the pond excavation and barrier wall construction, in addition to naturally varying climate conditions.

In 2023 water levels in Lake 1 varied from a spring high of approximately 298.3 mASL to a fall low of approximately 297.3 mASL (see BH16). Seasonal water levels (approximately 1 m fluctuation) exhibited a typical expected pattern through the year.

In 2023 water levels in Lake 2 varied from a spring high of approximately 298.8 mASL to a fall low of approximately 298.5 mASL. Seasonal water levels exhibited a much more subdued variation (0.3 m) as compared to Lake 1. Summer water levels, from June to August, remained within an approximate 10 cm range, at about 298.65 mASL. It appears there is a general increasing trend in water levels at Lake 2 since monitoring began.

In 2023 water levels in Lake 3 had a very limited fluctuation over the year, and remained within an approximate 10 cm range at about 298.9 mASL.

North of Lake 1, at BH2 and BH3 recent water levels are similar to historically observed, showing a general pattern of variation similar to the Lake 1 area but within a smaller range (more subdued seasonal and annual fluctuations). The data indicates no significant changes related to extraction at the site have occurred in this area.

Immediately downgradient of Lake 1 water levels at BH1, BH4 and BH17 showed seasonal water level patterns in 2023 similar to Lake 1, as expected. There may be a general declining water level trend since about 2018 at, and immediately adjacent to, Lake 1. No measurable water level changes are observed within discharge areas (e.g. DP2 and DP8) west of Lake 1.

The pattern of water level variation in 2023 at BH5 appears to match Lake 2, which is expected. At BH5 the spring high and fall low levels were approximately 299.1 mASL and 298.8 mASL (30 cm higher than Lake 2). The fall low level was within the range historically observed (e.g. 2012 prior to extraction), however the spring high was about 0.3 to 0.7 m lower than commonly observed prior to extraction. This difference may be partially attributed to recent precipitation patterns. The overall effect of Lake 2 on the immediately upgradient groundwater system appears limited to 0.5 m or less.

Further east (upgradient) of Lake 2 groundwater levels appear to be marginally lower (20 to 30 cm) in 2023 as compared to the historical record.

West (downgradient) of Lake 2 water levels at BH7-S in 2023 appear to be maintained within, or close to, baseline conditions. Based on the recent data, no significant change is observed at BH7-S as related to extraction. Water levels in BH7-D continue to rise, with an overall increase on the order of 0.5 m evident. No measurable water level changes are observed at the discharge areas (e.g. DP3 and DP7) west of Lake 2.

Water levels in the southern portion of the site in 2023 (e.g. BH9 S/D, BH10 S/D, BH14 and BH15) appear to have a subdued pattern and range of seasonal fluctuation, somewhat similar to Lake 2 and Lake 3. Water levels appear to be recovering somewhat as compared to the relatively dry 2018 to 2022 period.

Similarly, water levels at the Roszell Wetland (PG7) were also higher on average in 2023 as compared to 2018 to 2022. Seasonal ponding occurred, but was limited in extent and duration. A spring pond has again developed in early 2024.

4.3.3 Conditions Off-Site

As noted above, no significant water level response is observed at BH12 and BH13, particularly given the dry conditions experienced in the last number of years. Ongoing groundwater system equilibration and response to precipitation patterns is expected.

Off-site monitoring results indicate that precipitation is a major factor in controlling seasonal groundwater and surface water levels in the area. As noted previously, no specified water level elevation threshold exceedances occurred at the site. Continued monitoring is recommended to assess conditions.

4.4 TEMPERATURE

A detailed record of seasonal temperatures at various depths within monitoring wells, drive-points and surface water locations continues to be collected. An analysis of relevant temperature data was provided in the Thermal Impact Assessment (Monitoring Recommendation item #14) report submitted in March 2018. Please refer to that report for the specific summary, discussion and recommendations related to thermal influences and monitoring.

As noted in **Section 1.1**, although some temperature thresholds have been exceeded at certain monitoring wells and surface water discharge locations, based on the thermal and ecological assessments completed to date no ecological impacts are noted. As a result, revised thresholds, consisting of maximum stream temperature changes within the Main Creek and Tributaries #7 and #8, have been recommended and accepted by the Township of Puslinch.

Overall the temperature monitoring results confirm conditions as outlined in the Thermal Impact Assessment report. Results observed in 2023 are largely similar to those assessed in the impact assessment, with the exception of SW8. Seasonal high temperatures at SW8 increased since late 2020, however have remained consistent since that time. As indicated in the Thermal Impact Assessment, downstream temperatures, and related habitat conditions, do not appear to be affected.

The temperature monitoring results at LG4 provide the shallow (surface) pond temperature for comparison to adjacent groundwater temperatures. In 2023 the seasonal range in pond temperature was generally between 0.5 and 25 degrees Celsius. The temperature results from BH16 indicate that similar temperatures occur within the shallow groundwater immediately downgradient of the pond, however the seasonal maximum is about 0.5 degrees Celsius lower. At depth adjacent to the pond (elevation 293 mASL, which is close to the bottom of Lake 1) the seasonal range in temperature is

approximately 5.5 to 22 degrees Celsius, which represents a thermal attenuation of about 3 to 5 degrees as compared to the shallow zone or surficial pond temperature.

At BH17 the temperature monitoring results indicates that within 20 m of BH16 seasonal maximum temperatures are moderated by about 5 to 9 degrees Celsius, and remains generally below 17 degrees. The post extraction measurements represent a temperature change of approximately 5 to 6 degrees Celsius since the pond was created. Seasonal minimum temperatures are also moderated somewhat and remain 5 degrees Celsius. This represents a maximum decrease on the order of 2 degrees Celsius.

At BH1, located approximately 115 m downgradient of Lake 1, seasonal maximum temperatures remain within historical ranges. A slight increase in seasonal minimum (on the order of 2 degrees Celsius) is observed.

The temperature changes observed at SW5, consisting of an increase in seasonal minimum temperature of approximately 2 degree Celsius, matches that observed at BH1. This can be expected due to the close proximity of the two monitoring locations. A slightly larger temperature increase is observed at SW12, however again matches the general pattern of change observed at BH1.

Overall, based on the monitoring and assessments completed, no changes in stream temperature or negative influences on fish habitat have been observed within the Main Creek, Trib #7 or Trib #8. In addition, no groundwater or surface water temperature changes are observed within spawning areas of the Main Creek (including the primary spawning area between SW1 and SW2) or Tributary #7.

4.5 STREAMFLOW

Streamflow monitoring results to date indicate that flow within the creek system reflects seasonal variations in precipitation, in addition to baseflow contribution from the shallow groundwater system. Typical high (freshet) flows occur in spring as a result of snowmelt runoff, or, at other times of the year in response to major precipitation events. Streamflow at SW1 represents the outflow of two inline ponds located immediately east of Roszell Road, and will be partially controlled by the outlet structures.

Streamflow measured in 2023 was within previously observed ranges and seasonal patterns.

4.6 WATER QUALITY

The water quality results from 2023 continue to reflect agricultural activities in the area (e.g. elevated Nitrate-N concentrations) in addition to some road salt effects (e.g. some elevated sodium and chloride concentrations). Based on the overall sampling results no evidence of petroleum hydrocarbon impact is found at within the groundwater or surface water system.

4.7 THRESHOLD RESPONSE

No specific water level threshold response was triggered in 2023. Spring surface water levels at the Roszell Wetland continue to be monitored and assessed.

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 to date has had limited effect on groundwater and surface water conditions observed at the site. The groundwater system continues to equilibrate to the construction of the ponds and barrier, and, seasonal/annual precipitation.
4. No specific water level elevation threshold exceedance occurred at monitoring locations in 2023. Spring water levels at the Roszell Wetland resulted continue to be monitored and assessed.
5. Revisions to temperature monitoring and thresholds, as presented in the March 2018 Thermal Impact Assessment Report, should be implemented upon approval by MNRF.

5.2 RECOMMENDATIONS

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

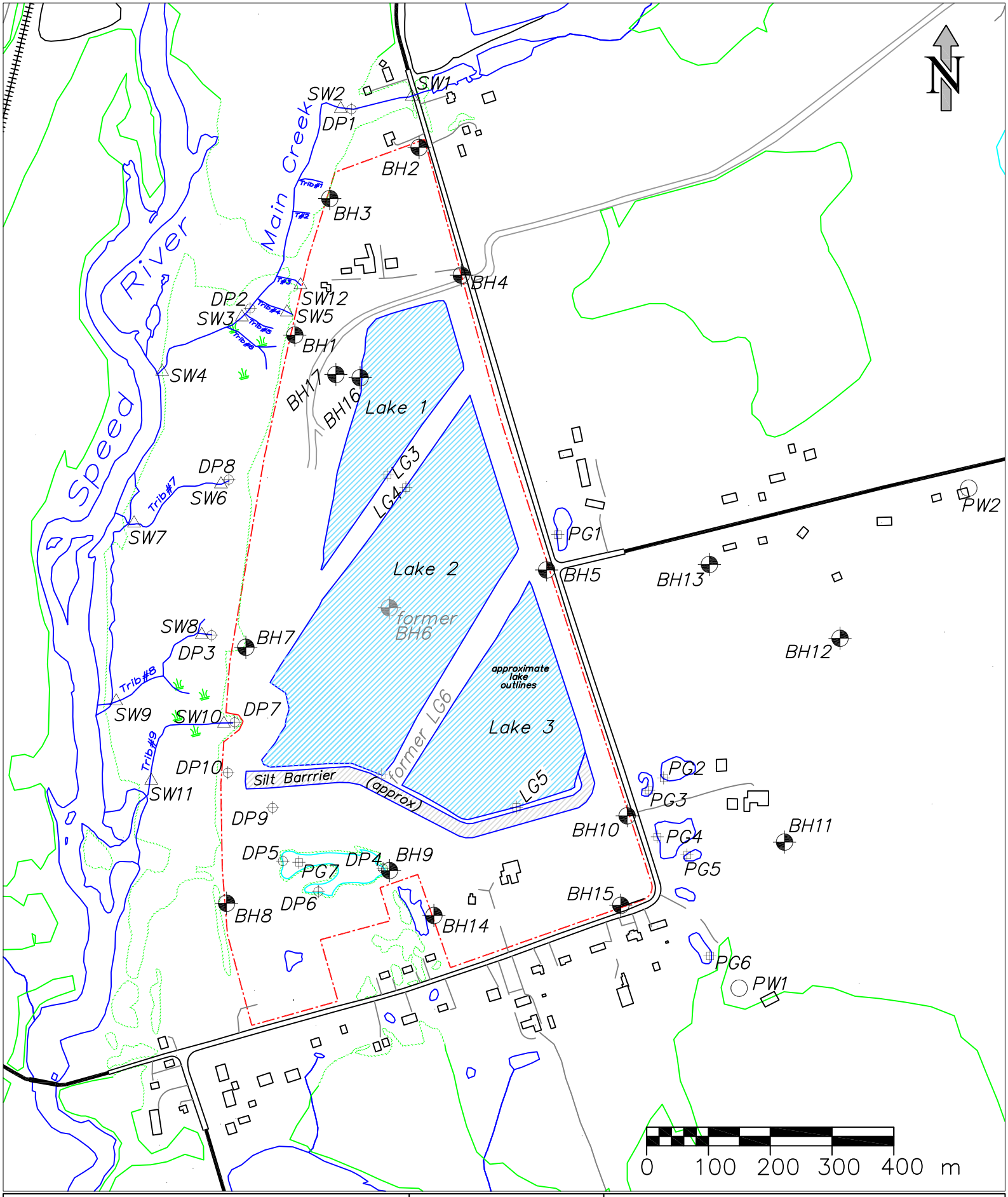
1. The monitoring program should be implemented in 2024 according to the requirements of the Site Plan and recommendations of the Thermal Impact Assessment.

All of which is respectfully submitted,

[redacted]

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

Figures



monitoring well (or well nest)

drive-point piezometer

surface water flow/temperature

pond/Lake gauge

private well

Groundwater Science Corp.

Figure 1: Site Details and Monitor Locations

March 2023 Scale: as shown modified from: 1:10,000 OBM	Groundwater Monitoring Program	CBM Aggregates Roszell Pit	Part Lots 1 & 2, Concessions 3 & 4 Township of Puslinch, County of Wellington

Appendix A
Manual Monitoring Results

Date	Groundwater Elevation Summary - Monitoring Wells (mASL)																							
	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
26-Jan-22	#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	#N/A	#N/A	#N/A	#N/A	301.99	#N/A	#N/A	#N/A	#N/A
14-Feb-22	297.02	296.70	296.46	295.21	295.87	297.44	#N/A	299.02	#N/A	#N/A	296.69	294.81	297.06	298.88	298.89	299.44	299.54	#N/A	#N/A	302.01	299.03	299.41	297.65	297.55
24-Feb-22	#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	#N/A	#N/A	#N/A	#N/A	302.14	#N/A	#N/A	#N/A	#N/A
24-Mar-22	297.63	297.20	296.91	295.43	296.27	298.21	#N/A	299.15	#N/A	#N/A	297.08	294.97	297.59	299.02	299.05	299.58	299.67	#N/A	#N/A	#N/A	299.17	299.55	298.48	298.33
31-Mar-22	297.63	297.20	296.91	295.43	296.27	298.21	#N/A	299.15	#N/A	#N/A	297.08	294.97	297.59	299.02	299.05	299.58	299.67	#N/A	#N/A	302.47	299.17	299.55	298.48	298.33
13-Apr-22	297.56	297.13	296.85	295.40	296.21	298.11	#N/A	299.08	#N/A	#N/A	297.11	295.02	297.38	298.98	299.01	299.55	299.63	#N/A	303.12	302.43	299.12	299.52	298.38	298.24
28-Apr-22	297.48	297.05	296.78	295.36	296.15	297.98	#N/A	299.03	#N/A	#N/A	297.16	294.99	297.42	#N/A	#N/A	299.52	299.61	#N/A	#N/A	302.41	#N/A	299.48	298.34	298.13
12-May-22	297.40	297.01	296.75	#N/A	#N/A	297.88	#N/A	299.02	#N/A	#N/A	297.15	295.00	297.39	298.94	298.95	299.50	299.59	#N/A	303.14	302.42	299.03	299.46	298.12	298.02
27-May-22	297.33	296.93	296.68	#N/A	#N/A	297.80	#N/A	298.99	#N/A	#N/A	297.14	294.99	297.30	298.87	298.90	299.47	299.56	#N/A	#N/A	#N/A	299.01	299.42	298.04	297.93
01-Jun-22	#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	#N/A	#N/A	#N/A	#N/A	302.36	#N/A	#N/A	#N/A	#N/A
04-Jul-22	#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	#N/A	#N/A	#N/A	#N/A	302.25	#N/A	#N/A	#N/A	#N/A
14-Jul-22	297.06	296.70	296.44	#N/A	#N/A	297.43	#N/A	298.84	#N/A	#N/A	296.96	294.94	296.97	298.89	298.71	299.31	299.39	#N/A	303.01	302.19	298.81	299.25	297.68	297.59
29-Aug-22	296.87	296.54	296.30	295.11	295.68	297.24	#N/A	298.73	#N/A	#N/A	296.77	294.86	296.88	298.60	298.61	299.21	299.31	#N/A	#N/A	302.04	298.73	299.18	297.44	297.36
31-Aug-22	#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	#N/A	#N/A	#N/A	#N/A	302.04	#N/A	#N/A	#N/A	#N/A
28-Sep-22	296.79	296.48	296.25	295.09	295.67	297.19	#N/A	298.63	#N/A	#N/A	296.58	294.82	296.85	298.55	298.57	299.15	299.24	#N/A	302.74	301.93	298.69	299.13	297.34	297.26
31-Oct-22	296.70	296.42	296.20	295.07	295.65	297.15	#N/A	298.55	#N/A	#N/A	296.42	294.75	296.88	298.54	298.56	299.15	299.22	#N/A	302.69	301.84	298.68	299.13	297.22	297.15
04-Nov-22	#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	#N/A	#N/A	#N/A	#N/A	301.84	#N/A	#N/A	#N/A	#N/A
14-Nov-22	296.67	296.40	296.18	295.06	295.65	297.13	#N/A	298.55	#N/A	#N/A	296.35	294.77	296.89	298.54	298.57	299.17	299.27	#N/A	302.63	301.81	298.70	299.14	297.19	297.12
01-Dec-22	#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	#N/A	#N/A	#N/A	#N/A	301.81	#N/A	#N/A	#N/A	#N/A
20-Dec-22	296.66	296.41	296.21	295.06	295.67	297.13	#N/A	298.64	#N/A	#N/A	296.35	294.76	296.94	298.71	298.73	299.29	299.41	#N/A	302.57	301.77	298.87	299.32	297.20	297.12
30-Dec-22	#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	#N/A	#N/A	#N/A	#N/A	301.83	#N/A	#N/A	#N/A	#N/A
31-Jan-23	296.80	296.65	296.42	295.11	295.85	297.38	#N/A	298.63	#N/A	#N/A	296.60	294.93	297.15	298.79	298.70	299.27	299.35	#N/A	#N/A	301.85	298.85	299.29	297.58	297.32
24-Feb-23	297.13	296.70	296.61	#N/A	#N/A	297.61	#N/A	298.72	#N/A	#N/A	296.62	295.00	297.35	298.80	298.76	299.50	299.46	#N/A	#N/A	#N/A	298.91	299.33	297.81	297.69
28-Feb-23	#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	#N/A	#N/A	#N/A	#N/A	301.95	#N/A	#N/A	#N/A	#N/A
30-Mar-23	297.35	296.74	#N/A	#N/A	#N/A	297.77	#N/A	299.03	#N/A	#N/A	296.87	294.92	297.72	298.92	298.87	299.39	299.46	#N/A	302.54	301.97	299.20	299.43	297.90	297.80
06-Apr-23	#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	#N/A	#N/A	#N/A	#N/A	302.24	#N/A	#N/A	#N/A	#N/A
26-Apr-23	#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	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
05-May-23	#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	#N/A	#N/A	#N/A	#N/A	302.23	#N/A	#N/A	#N/A	#N/A
07-Jun-23	#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	#N/A	#N/A	#N/A	#N/A	302.17	#N/A	#N/A	#N/A	#N/A
27-Jun-23	297.19	296.82	296.57	295.28	295.97	297.67	#N/A	298.96	#N/A	#N/A	296.88	295.04	297.28	298.89	298.92	299.50	299.60	#N/A	302.80	302.08	299.02	299.46	297.87	297.78
12-Jul-23	297.13	296.77	296.52	295.25	295.94	297.57	#N/A	298.94	#N/A	#N/A	296.86	295.04	297.09	298.88	298.88	299.47	299.57	#N/A	#N/A	302.03	299.02	299.43	297.79	297.70
02-Aug-23	#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	#N/A	#N/A	#N/A	#N/A	302.00	#N/A	#N/A	#N/A	#N/A
06-Sep-23	#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	#N/A	#N/A	#N/A	#N/A	301.91	#N/A	#N/A	#N/A	#N/A
20-Sep-23	296.97	296.67	296.44	295.20	295.86	297.38	#N/A	298.92	#N/A	#N/A	296.71	294.93	297.10	298.85	298.88	299.42	#N/A	#N/A	#N/A	#N/A	299.02	299.43	297.69	297.47
02-Oct-23	#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	#N/A	#N/A	#N/A	#N/A	301.87	#N/A	#N/A	#N/A	#N/A
31-Oct-23	296.80	296.54	296.32	#N/A	#N/A	297.19	#N/A	298.83	#N/A	#N/A	296.50	294.89	297.06	298.88	298.85	299.43	#N/A	#N/A	302.63	301.84	299.04	299.45	297.36	297.28
23-Nov-23	296.76	296.52	296.30	295.13	295.78	297.16	#N/A	298.89	#N/A	#N/A	#N/A	294.81	297.07	298.89	298.90	299.44	#N/A	#N/A	302.61	301.82	299.07	299.47	297.30	297.23
29-Nov-23	#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	#N/A	#N/A	#N/A	#N/A	301.81	#N/A	#N/A	#N/A	#N/A
07-Dec-23	296.78	296.54	296.33	295.15	295.81	297.19	#N/A	298.94	#N/A	#N/A	296.45	294.87	297.07	298.96	298.96	299.44	#N/A	#N/A	#N/A	#N/A	299.10	299.49	297.32	297.26
05-Jan-24	#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	#N/A	#N/A	#N/A	#N/A	301.86	#N/A	#N/A	#N/A	#N/A
30-Jan-24	297.31	297.05	296.80	295.38	296.17	297.81	#N/A	#N/A	#N/A	#N/A	296.92	295.13	297.78	299.13	299.15	299.56	#N/A	#N/A	302.70	302.09	299.26	299.63	297.99	297.90
13-Feb-24	297.34	297.01	296.76	295.36	296.15	297.88	#N/A	299.07	#N/A	#N/A	296.86	295.06	297.41	299.02	299.03	299.47	#N/A	#N/A	302.74	302.07	299.14	299.52	298.11	297.99

Notes mASL = 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 (mASL)																					
Well No.:	LG2	LG3	LG4	LG5	LG6	PG7	DP1		DP2		DP3		DP4		DP5		DP6		DP7		DP8	
	SW	SW	SW	SW	SW	SW	GW	SW	GW	SW	GW	SW	GW	SW	GW	SW	GW	SW	GW	SW	GW	SW
05-Jan-22	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	292.30	292.28	291.96	291.92	292.30	292.19	299.05	#N/A	298.83	#N/A	299.08	#N/A	#N/A	297.48	292.04	292.03
26-Jan-22	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	292.27	292.26	#N/A	291.89	292.28	292.19	299.01	#N/A	298.80	#N/A	299.13	#N/A	#N/A	297.48	292.02	292.02
14-Feb-22	#N/A	#N/A	#N/A	#N/A	#N/A	299.23	#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	#N/A
24-Feb-22	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	292.35	292.33	#N/A	291.97	292.30	292.19	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	297.48	292.04	292.03
31-Mar-22	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	292.28	292.25	291.94	291.93	292.28	292.19	299.24	#N/A	298.98	#N/A	299.27	299.38	297.63	297.49	292.04	292.03
13-Apr-22	#N/A	298.39	298.80	298.87	298.71	#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	#N/A	#N/A
28-Apr-22	#N/A	#N/A	298.73	#N/A	#N/A	#N/A	292.28	292.27	292.01	291.93	292.28	292.18	299.15	#N/A	298.93	#N/A	299.17	#N/A	297.66	297.49	292.03	292.03
12-May-22	#N/A	298.12	298.75	298.82	#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	#N/A	#N/A	#N/A
27-May-22	#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	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
01-Jun-22	#N/A	#N/A	298.73	#N/A	#N/A	#N/A	292.27	292.25	291.95	291.91	292.27	292.18	299.01	#N/A	298.79	#N/A	298.96	#N/A	297.66	297.49	292.01	292.03
04-Jul-22	#N/A	#N/A	298.66	#N/A	#N/A	#N/A	292.24	292.23	291.91	291.89	292.27	292.19	298.90	#N/A	298.68	#N/A	298.89	#N/A	297.66	297.49	292.01	292.02
14-Jul-22	#N/A	#N/A	298.66	#N/A	#N/A	298.38	#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	#N/A
29-Aug-22	#N/A	#N/A	298.54	#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	#N/A	#N/A	#N/A	#N/A
31-Aug-22	#N/A	#N/A	298.49	#N/A	#N/A	#N/A	292.24	292.21	291.92	291.88	292.27	292.19	298.76	#N/A	#N/A	#N/A	298.75	#N/A	297.60	297.49	291.98	292.02
28-Sep-22	#N/A	#N/A	#N/A	#N/A	#N/A	298.34	#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	#N/A
04-Oct-22	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	292.23	292.21	291.92	291.88	292.27	292.18	298.67	#N/A	#N/A	#N/A	298.69	#N/A	297.59	297.48	292.01	292.03
31-Oct-22	#N/A	#N/A	#N/A	#N/A	#N/A	298.39	#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	#N/A
04-Nov-22	#N/A	#N/A	298.24	#N/A	#N/A	#N/A	292.25	292.24	291.97	291.92	292.27	292.29	298.69	#N/A	#N/A	#N/A	298.72	#N/A	297.56	297.47	292.02	292.04
14-Nov-22	#N/A	#N/A	#N/A	#N/A	#N/A	298.35	#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	#N/A
01-Dec-22	#N/A	#N/A	298.30	#N/A	#N/A	#N/A	292.26	292.25	291.99	291.92	292.28	292.19	298.77	#N/A	298.55	#N/A	298.76	#N/A	297.53	#N/A	292.01	292.04
20-Dec-22	#N/A	#N/A	#N/A	#N/A	#N/A	298.56	#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	#N/A
30-Dec-22	#N/A	#N/A	298.35	#N/A	#N/A	#N/A	292.23	292.21	291.91	291.94	292.27	292.19	298.99	#N/A	298.76	#N/A	298.94	#N/A	297.59	297.47	292.04	292.04
31-Jan-23	#N/A	#N/A	#N/A	#N/A	#N/A	298.97	#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	#N/A
24-Feb-23	#N/A	#N/A	#N/A	#N/A	#N/A	299.18	#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	#N/A
30-Mar-23	#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	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
06-Apr-23	#N/A	#N/A	298.86	#N/A	#N/A	#N/A	292.44	292.42	292.14	292.03	292.35	292.19	299.43	#N/A	299.13	#N/A	299.41	299.42	297.75	297.50	292.05	292.03
05-May-23	#N/A	#N/A	298.84	#N/A	#N/A	299.09	292.40	292.38	292.07	291.93	292.32	292.17	299.26	#N/A	299.09	#N/A	299.35	#N/A	297.69	297.49	292.05	292.06
07-Jun-23	#N/A	#N/A	298.69	#N/A	#N/A	299.05	292.35	292.34	291.94	291.89	292.28	292.18	299.29	#N/A	299.05	#N/A	299.30	#N/A	297.63	297.49	292.02	292.02
27-Jun-23	#N/A	297.89	298.73	#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	#N/A	#N/A	#N/A	#N/A
30-Jun-23	#N/A	#N/A	298.71	#N/A	#N/A	#N/A	292.33	292.34	291.99	291.89	292.29	292.20	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	297.61	297.50	292.04	292.04
12-Jul-23	#N/A	297.78	298.72	#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	#N/A	#N/A	#N/A	#N/A
02-Aug-23	#N/A	#N/A	298.74	#N/A	#N/A	299.03	292.31	292.29	291.98	291.87	292.29	292.18	299.29	#N/A	299.04	#N/A	299.28	#N/A	297.61	297.49	292.03	292.03
06-Sep-23	#N/A	#N/A	298.67	#N/A	#N/A	298.99	292.25	292.22	291.92	291.87	292.30	292.18	299.26	#N/A	299.02	#N/A	299.25	#N/A	297.58	297.46	292.04	292.04
20-Sep-23	#N/A	#N/A	298.67	#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	#N/A	#N/A	#N/A	#N/A
02-Oct-23	#N/A	#N/A	298.60	#N/A	#N/A	298.95	292.26	292.23	291.94	291.88	292.31	292.18	299.25	#N/A	299.01	#N/A	299.21	#N/A	297.59	297.46	292.01	292.00
31-Oct-23	#N/A	#N/A	298.62	298.83	#N/A	298.92	292.28	292.23	291.93	291.87	292.20	292.17	299.24	#N/A	298.99	#N/A	299.19	#N/A	297.59	297.47	292.04	292.03
29-Nov-23	#N/A	#N/A	298.68	#N/A	#N/A	299.02	292.27	292.24	#N/A	291.88	292.30	292.18	299.26	#N/A	299.03	#N/A	299.32	#N/A	297.58	297.46	292.04	292.03
05-Jan-24	#N/A	#N/A	298.80	#N/A	#N/A	#N/A	292.26	292.23	#N/A	291.88	292.29	292.18	299.17	#N/A	298.96	#N/A	299.19	#N/A	297.64	297.46	292.05	292.05

Notes: mAMSL = metres above mean sea level; #NA = not available (dry, frozen, 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
05-Jan-22	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
24-Feb-22	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
31-Mar-22	301.25	301.56	301.88	301.60	301.24	#N/A	#N/A	#N/A
28-Apr-22	301.12	301.36	301.82	301.55	301.22	#N/A	302.06	303.79
01-Jun-22	300.99	#N/A	301.76	301.45	301.22	#N/A	#N/A	#N/A
04-Jul-22	300.81	#N/A	301.60	301.29	#N/A	#N/A	#N/A	#N/A
24-Aug-22	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	303.63
30-Aug-22	#N/A	#N/A	#N/A	#N/A	#N/A	300.21	301.71	#N/A
31-Aug-22	#N/A	#N/A	301.44	301.18	#N/A	#N/A	#N/A	#N/A
04-Oct-22	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
04-Nov-22	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
01-Dec-22	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
30-Dec-22	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
09-Jan-23	#N/A	#N/A	#N/A	301.26	#N/A	300.42	301.75	303.30
01-Feb-23	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
28-Feb-23	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
06-Apr-23	301.06	301.43	301.76	301.44	301.22	#N/A	#N/A	#N/A
05-May-23	301.04	301.32	301.72	301.43	301.20	#N/A	#N/A	#N/A
07-Jun-23	300.84	#N/A	301.57	301.32	301.13	#N/A	#N/A	#N/A
16-Jun-23	300.82	#N/A	#N/A	301.31	#N/A	300.40	301.82	303.46
30-Jun-23	300.74	#N/A	301.56	301.19	301.11	#N/A	#N/A	#N/A
02-Aug-23	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
06-Sep-23	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
02-Oct-23	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
13-Oct-23	#N/A	#N/A	#N/A	301.17	#N/A	300.28	301.70	303.35
31-Oct-23	#N/A	#N/A	#N/A	301.19	#N/A	#N/A	#N/A	#N/A
29-Nov-23	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
05-Jan-24	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
27-Mar-23	300.86	#N/A	#N/A	301.37	#N/A	300.55	301.89	303.44
Notes	mAMSL = metres above mean sea level			#NA = not available (no access, frozen, or not measured)				

	SW1		SW2		SW3		SW4	
Date	Flow (L/s)	Temp. (^{o}C)	Flow (L/s)	Temp. (^{o}C)	Flow (L/s)	Temp. (^{o}C)	Flow (L/s)	Temp. (^{o}C)
05-Jan-22	16.6	2.4	20.4	2.8	45.4	4.6	30.9	4.4
26-Jan-22	14.2	2.0	21.1	0.3	34.1	0.3	38.5	0.3
24-Feb-22	62.5	0.8	73.7	1.1	94.4	0.9	93.2	0.3
31-Mar-22	36.4	3.0	52.1	5.2	56.3	5.0	62.2	5.5
28-Apr-22	19.7	8.5	33.6	7.6	43.5	7.9	36.9	7.7
01-Jun-22	14.3	20.6	16.6	16.9	37.8	16.6	37.2	16.6
04-Jul-22	10.2	20.4	13.9	15.8	34.1	16.1	23.5	16.2
31-Aug-22	8.7	20.1	20.1	18.3	21.0	17.0	24.9	16.7
04-Oct-22	10.2	13.2	17.3	10.9	17.8	10.6	20.9	10.1
04-Nov-22	6.9	10.3	11.6	9.7	18.8	9.2	18.8	8.9
01-Dec-22	10.2	3.3	14.9	4.7	27.5	4.8	27.4	4.5
30-Dec-22	20.8	1.8	28.0	1.9	30.9	4.9	28.0	4.6
01-Feb-23	6.9	2.2	17.0	1.7	22.3	1.8	23.2	1.3
28-Feb-23	13.6	3.0	25.8	2.9	30.6	3.1	36.8	3.7
06-Apr-23	52.4	5.1	95.2	5.3	132.1	5.5	127.8	5.5
05-May-23	23.5	9.2	32.9	9.5	61.0	9.9	54.5	10.1
07-Jun-23	8.9	17.6	19.7	12.7	25.6	12.9	32.1	12.7
04-Jul-23	10.0	20.6	26.0	15.5	31.1	15.8	31.2	15.7
02-Aug-23	11.3	18.9	n/a	16.4	n/a	16.5	27.2	15.4
06-Sep-23	8.5	19.6	14.0	18.1	23.3	18.0	29.8	16.8
02-Oct-23	6.7	17.2	9.7	13.9	30.4	14.2	25.8	14.5
31-Oct-23	6.9	8.9	15.2	9.3	28.4	9.5	26.1	8.2
29-Nov-23	8.7	4.6	18.8	3.9	29.2	2.6	26.9	3.3
05-Jan-24	11.3	2.2	20.0	3.2	36.7	3.3	32.6	3.3

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

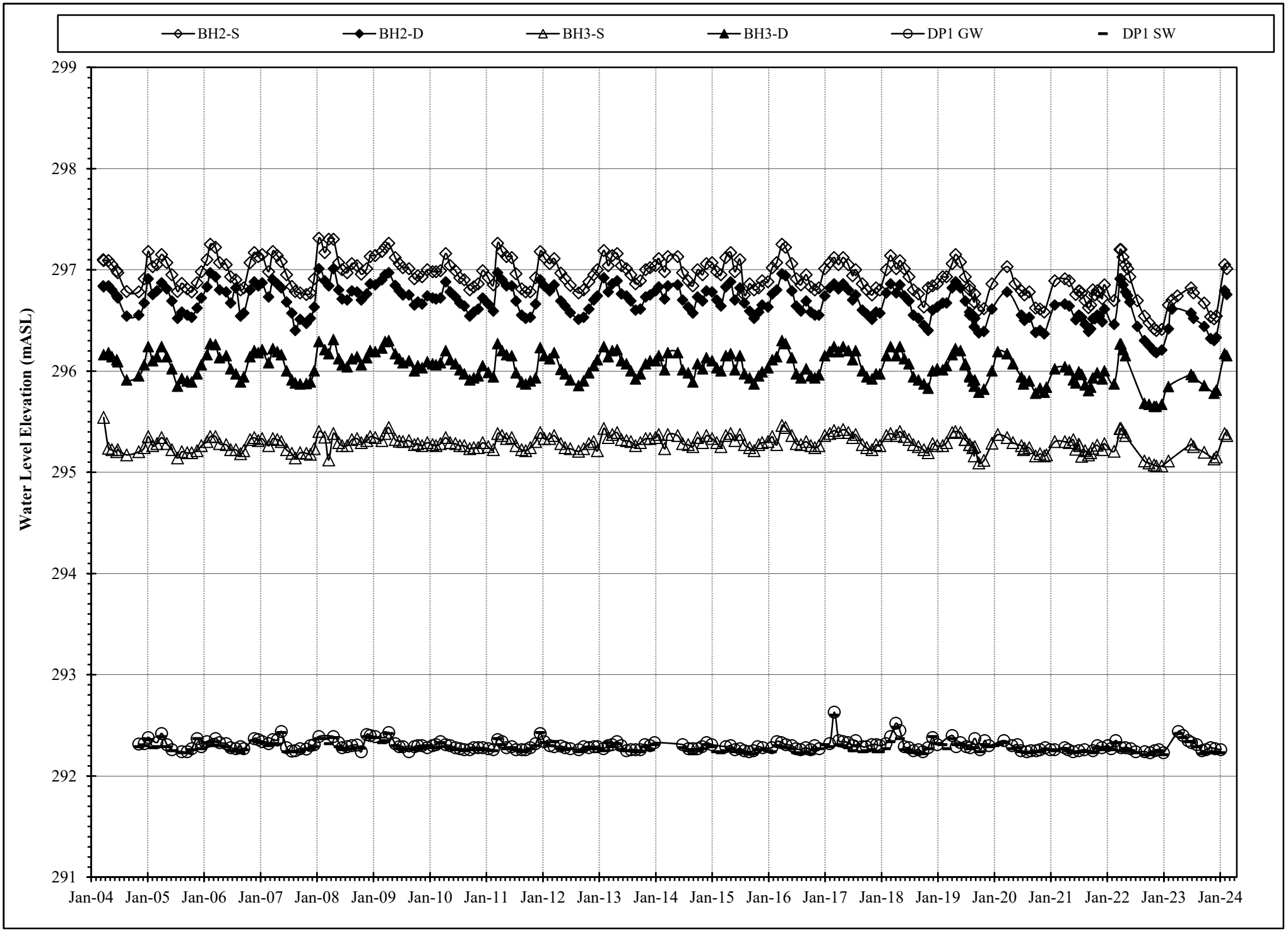
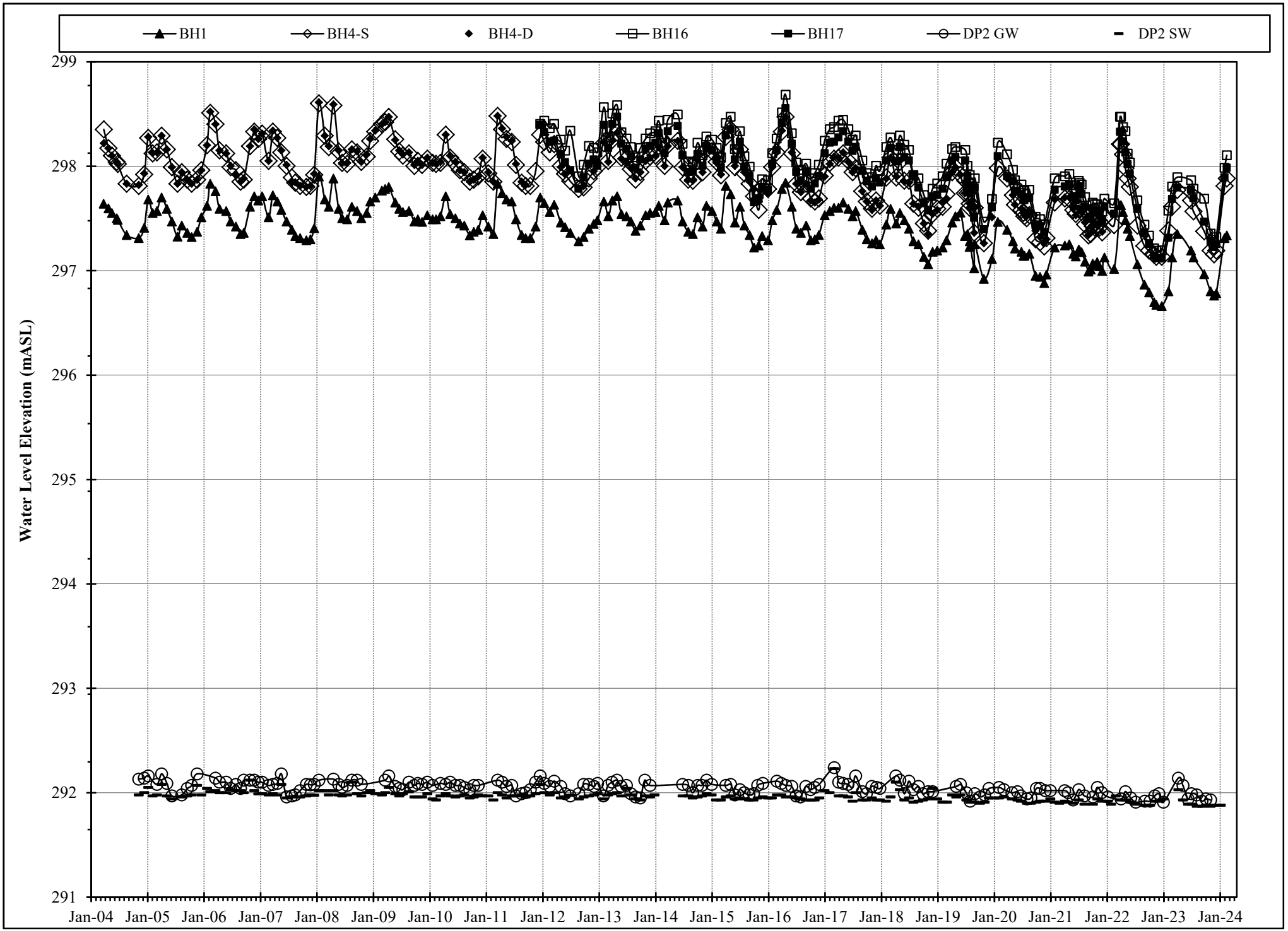


Figure A1: Hydrograph - North of Extraction Area


BH1
BH4-S
BH4-D
BH16
BH17
DP2 GW
DP2 SW
Water Level Elevation (mASL)
299
298
297
296
295
294
293
292
291
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24

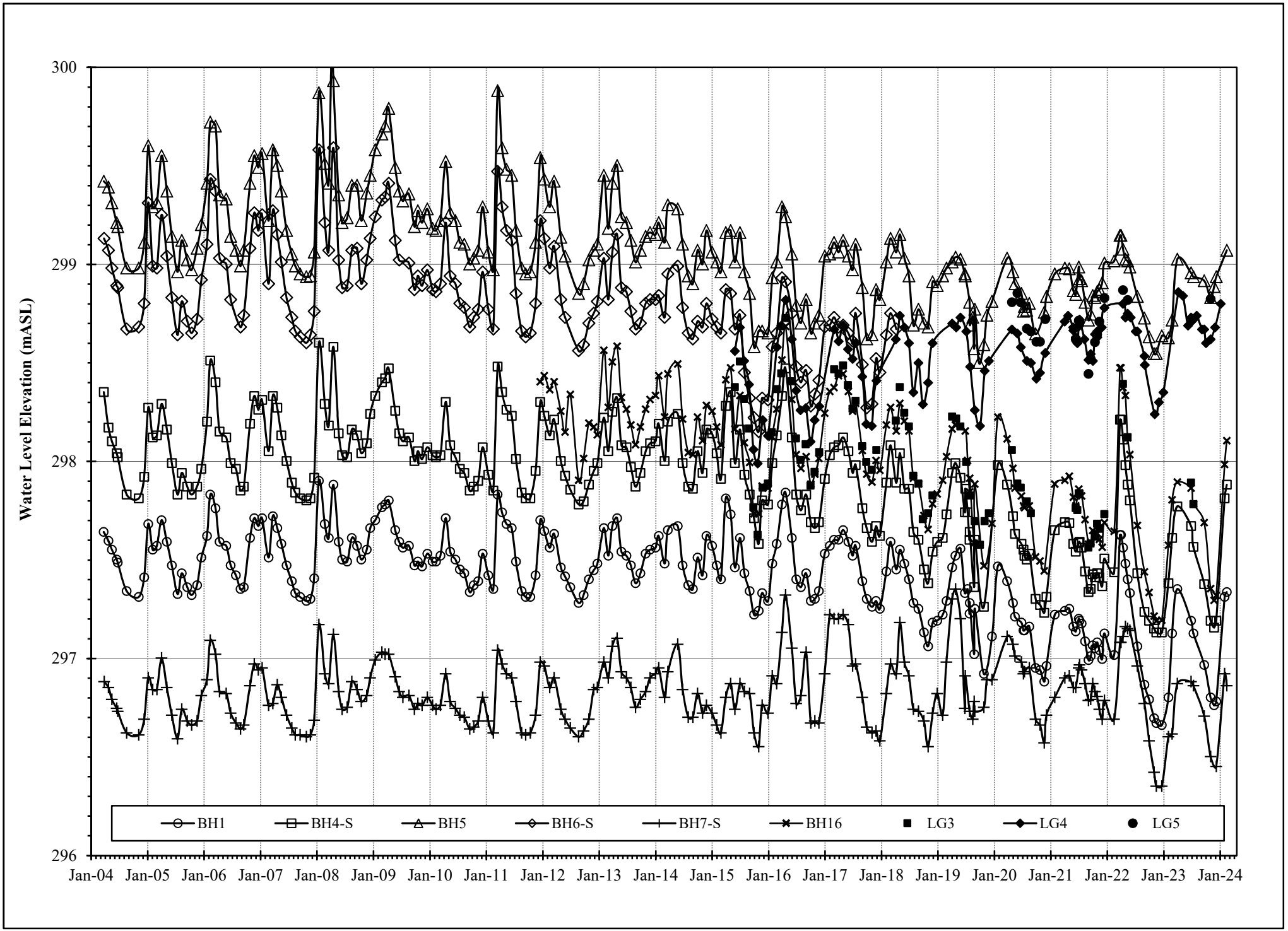
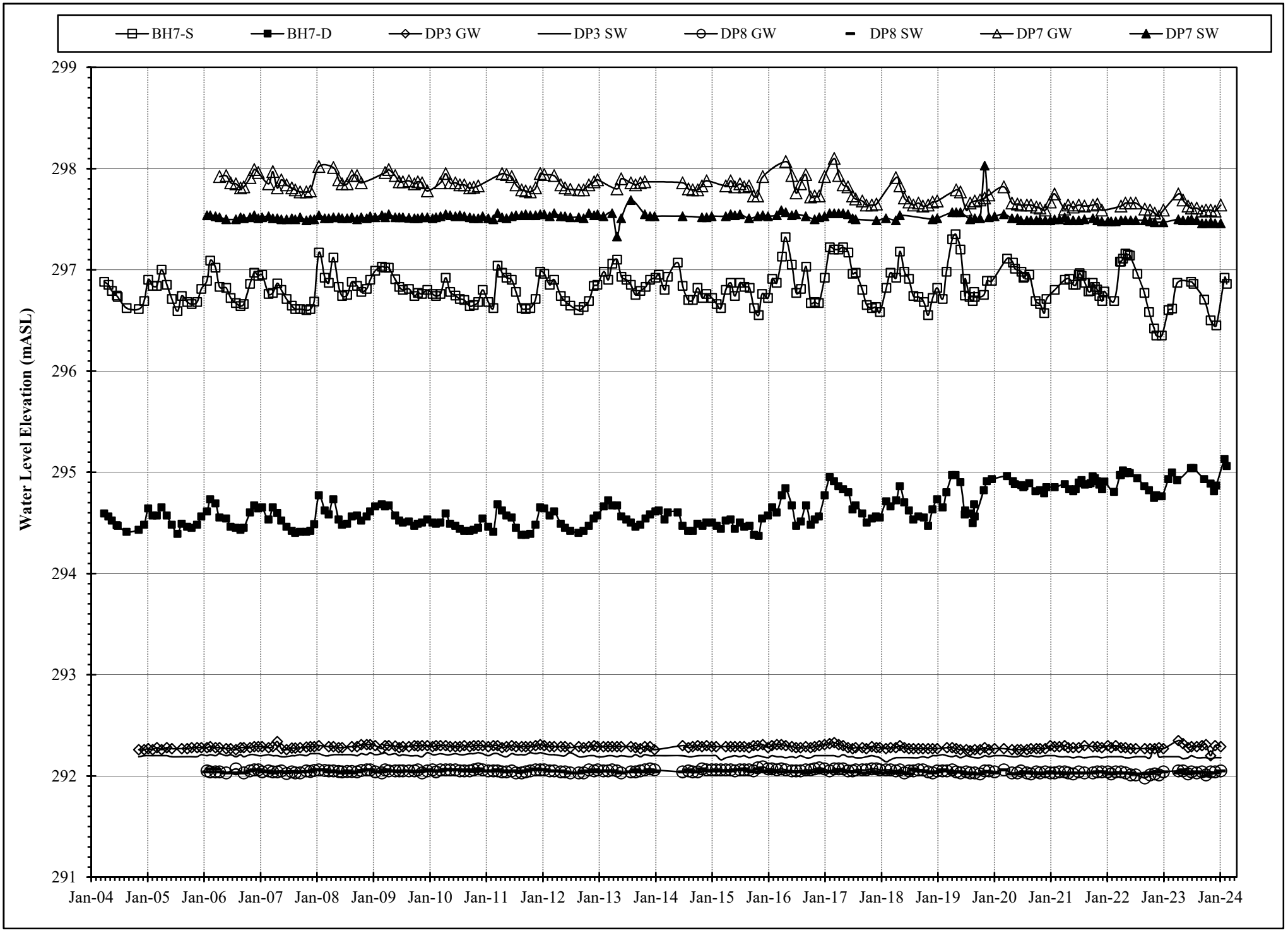


Figure A3: Hydrograph - Monitors Surrounding Extraction Area


BH7-S
BH7-D
DP3 GW
DP3 SW
DP8 GW
DP8 SW
DP7 GW
DP7 SW
Water Level Elevation (mASL)
299
298
297
296
295
294
293
292
291
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24

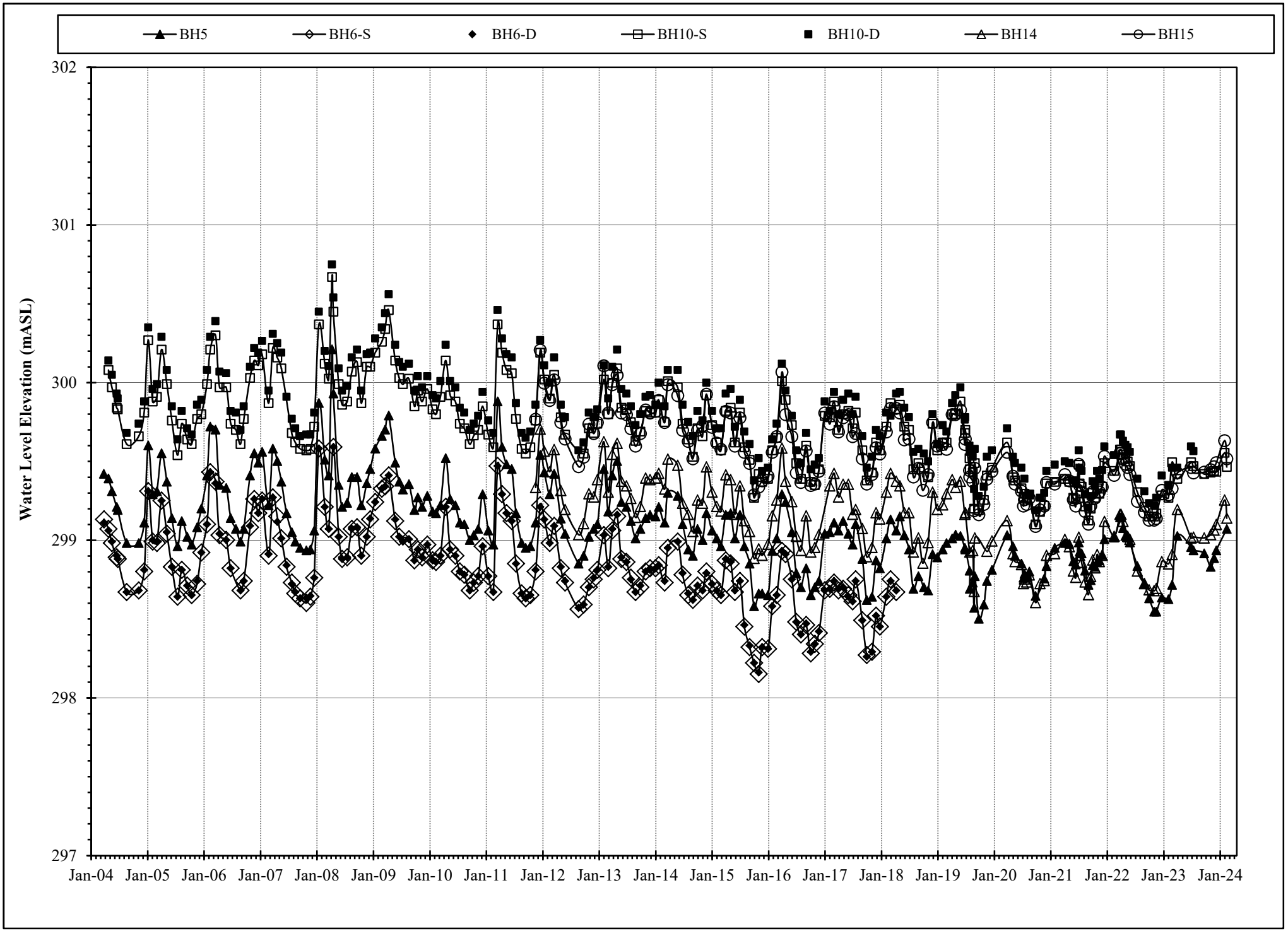


Figure A5: Hydrograph - Southeast Portion of Site

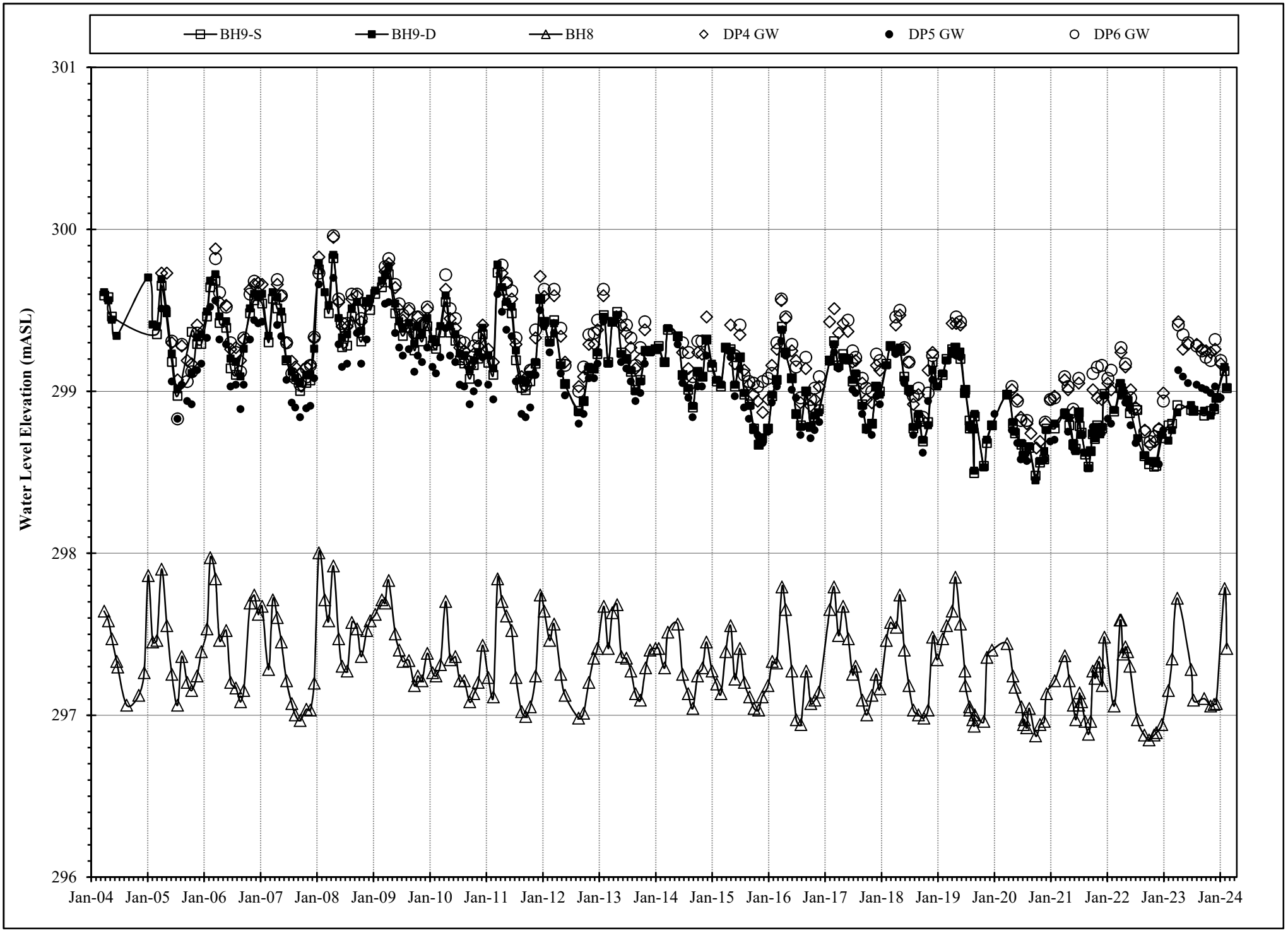
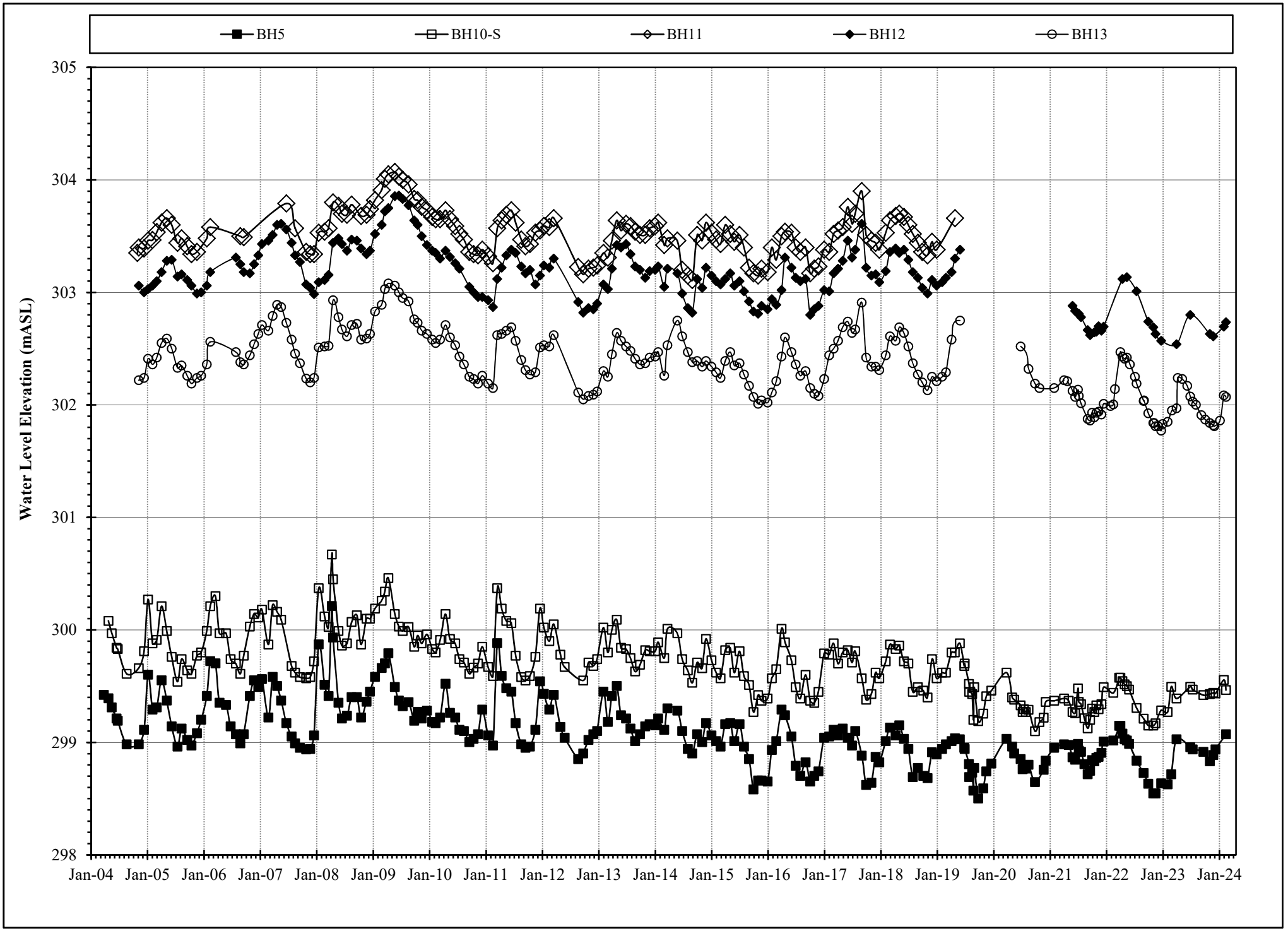
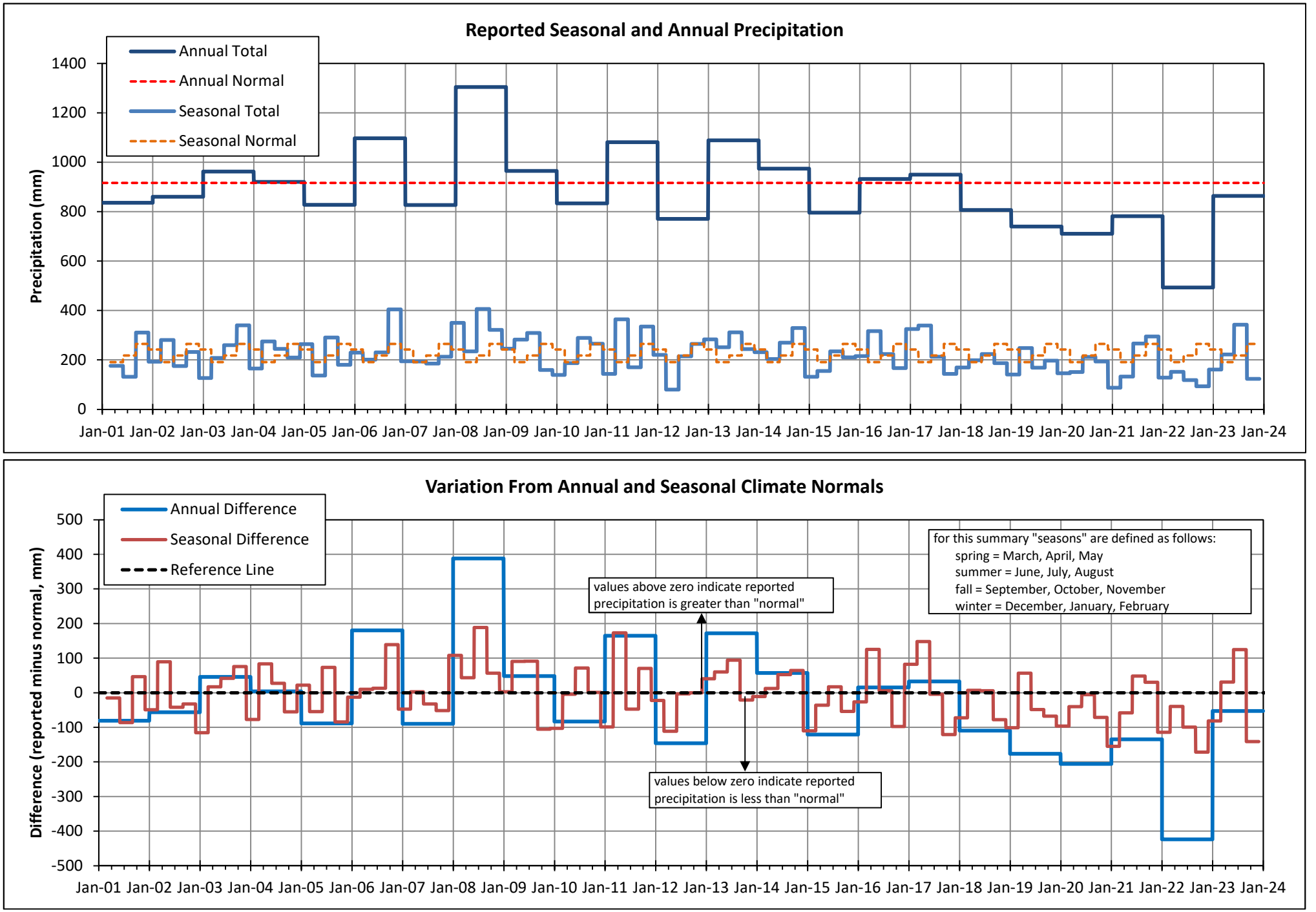
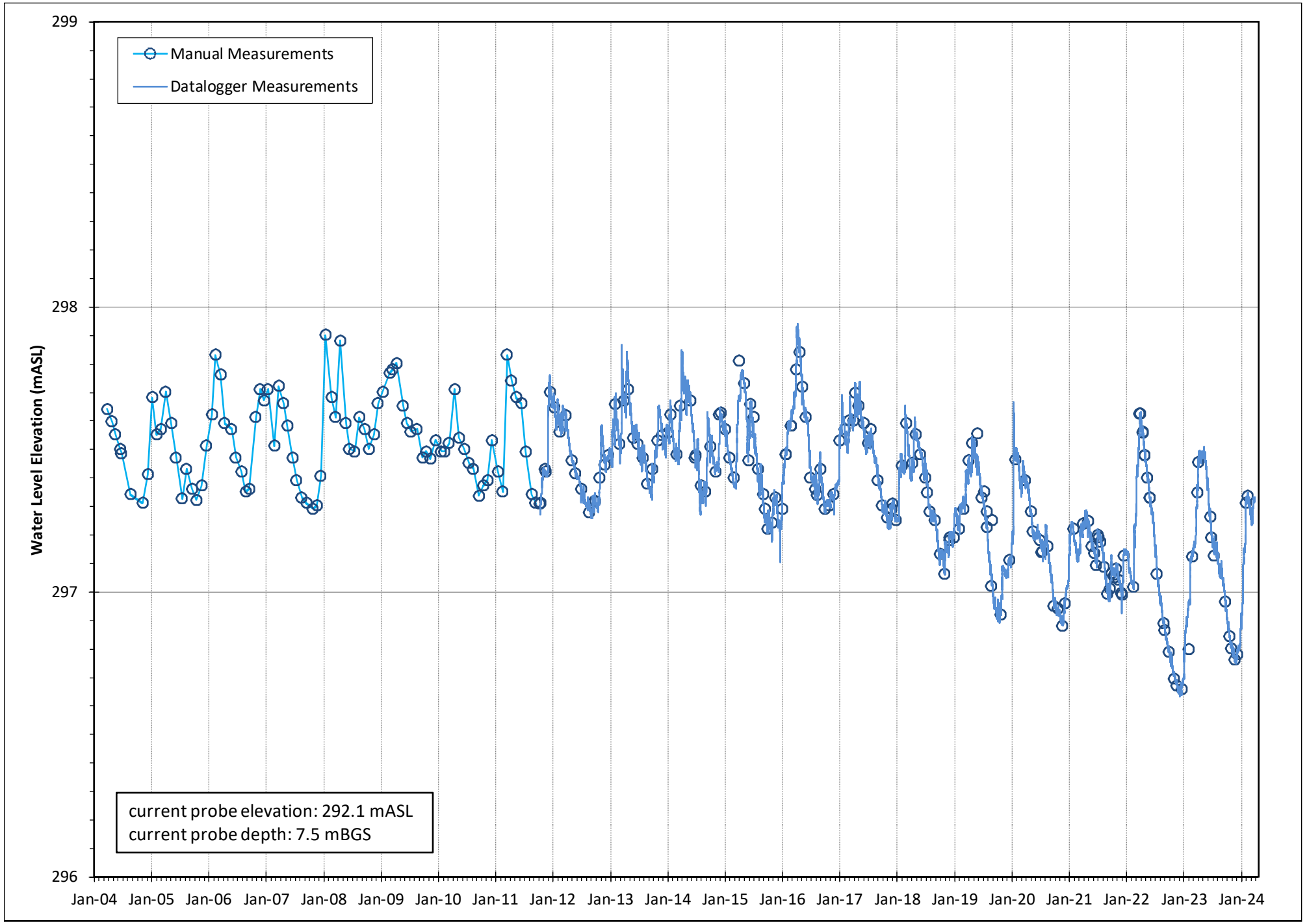


Figure A6: Hydrograph - Roszell Wetland Area


BH5
BH10-S
BH11
BH12
BH13
Water Level Elevation (mASL)
305
304
303
302
301
300
299
298
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24


Reported Seasonal and Annual Precipitation
Annual Total
Annual Normal
Seasonal Total
Seasonal Normal
Precipitation (mm)
1400
1200
1000
800
600
400
200
0
Jan-01 Jan-02 Jan-03 Jan-04 Jan-05 Jan-06 Jan-07 Jan-08 Jan-09 Jan-10 Jan-11 Jan-12 Jan-13 Jan-14 Jan-15 Jan-16 Jan-17 Jan-18 Jan-19 Jan-20 Jan-21 Jan-22 Jan-23 Jan-24
Variation From Annual and Seasonal Climate Normals
Annual Difference
Seasonal Difference
Reference Line
Difference (reported minus normal, mm)
500
400
300
200
100
0
-100
-200
-300
-400
-500
values above zero indicate reported precipitation is greater than "normal"
values below zero indicate reported precipitation is less than "normal"
for this summary "seasons" are defined as follows:
spring = March, April, May
summer = June, July, August
fall = September, October, November
winter = December, January, February
Jan-01 Jan-02 Jan-03 Jan-04 Jan-05 Jan-06 Jan-07 Jan-08 Jan-09 Jan-10 Jan-11 Jan-12 Jan-13 Jan-14 Jan-15 Jan-16 Jan-17 Jan-18 Jan-19 Jan-20 Jan-21 Jan-22 Jan-23 Jan-24

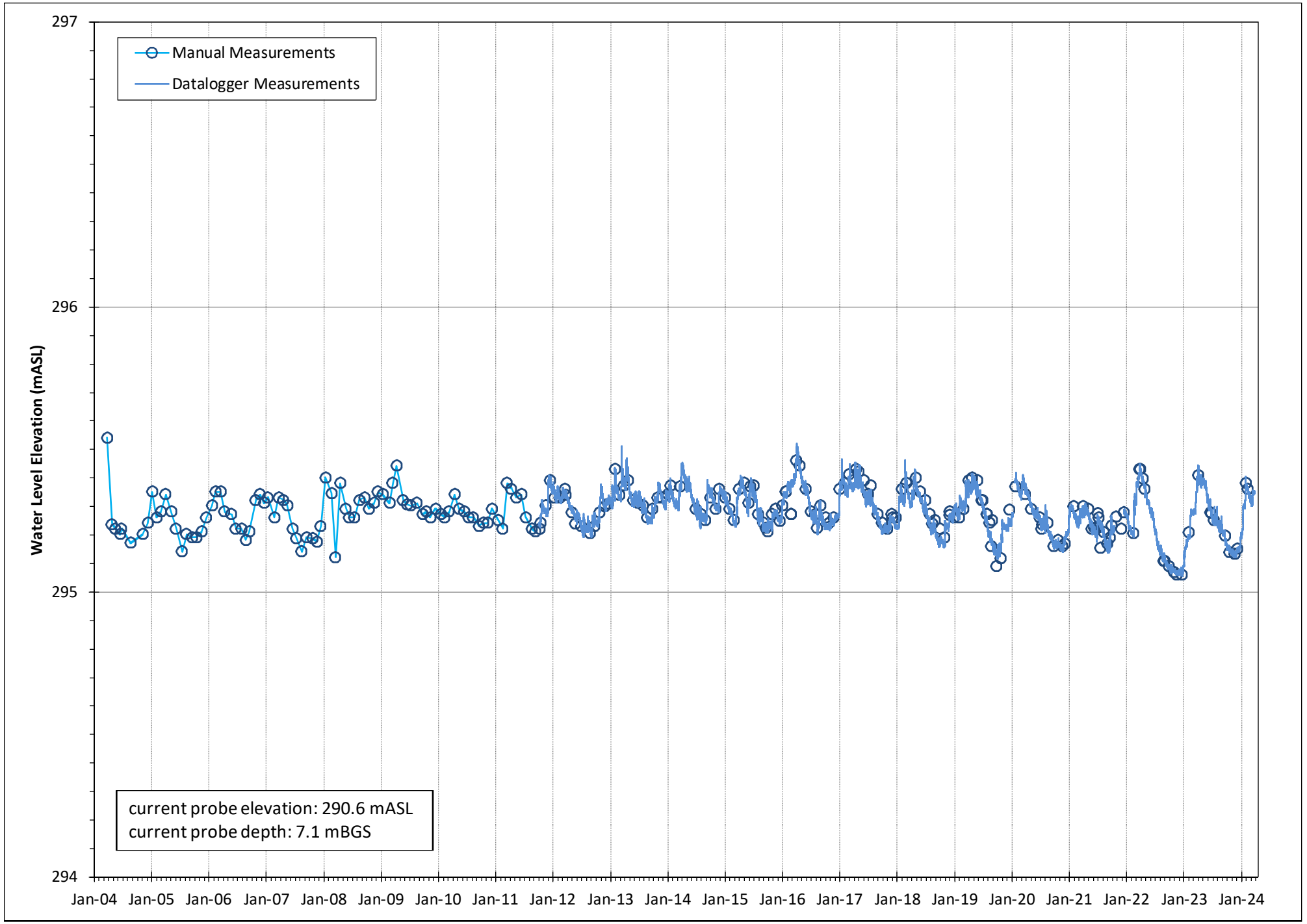
Appendix B
Hydrographs of Datalogger Data



CBM Aggregates
Roszell Pit

Figure B1: BH1 Hydrograph

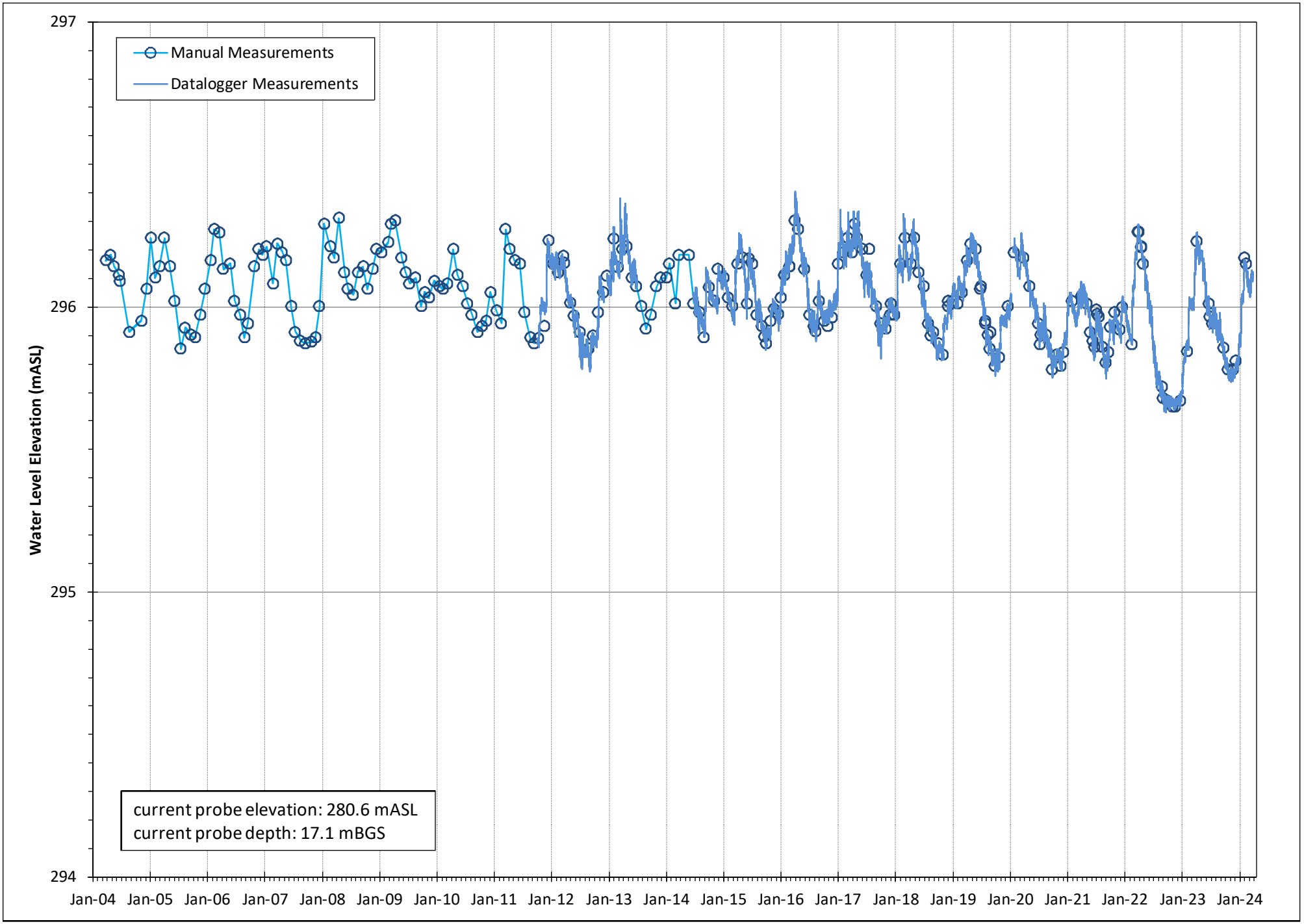
Groundwater Science Corp.
Monitoring Program



CBM Aggregates
Roszell Pit

Figure B2: BH3-S Hydrograph

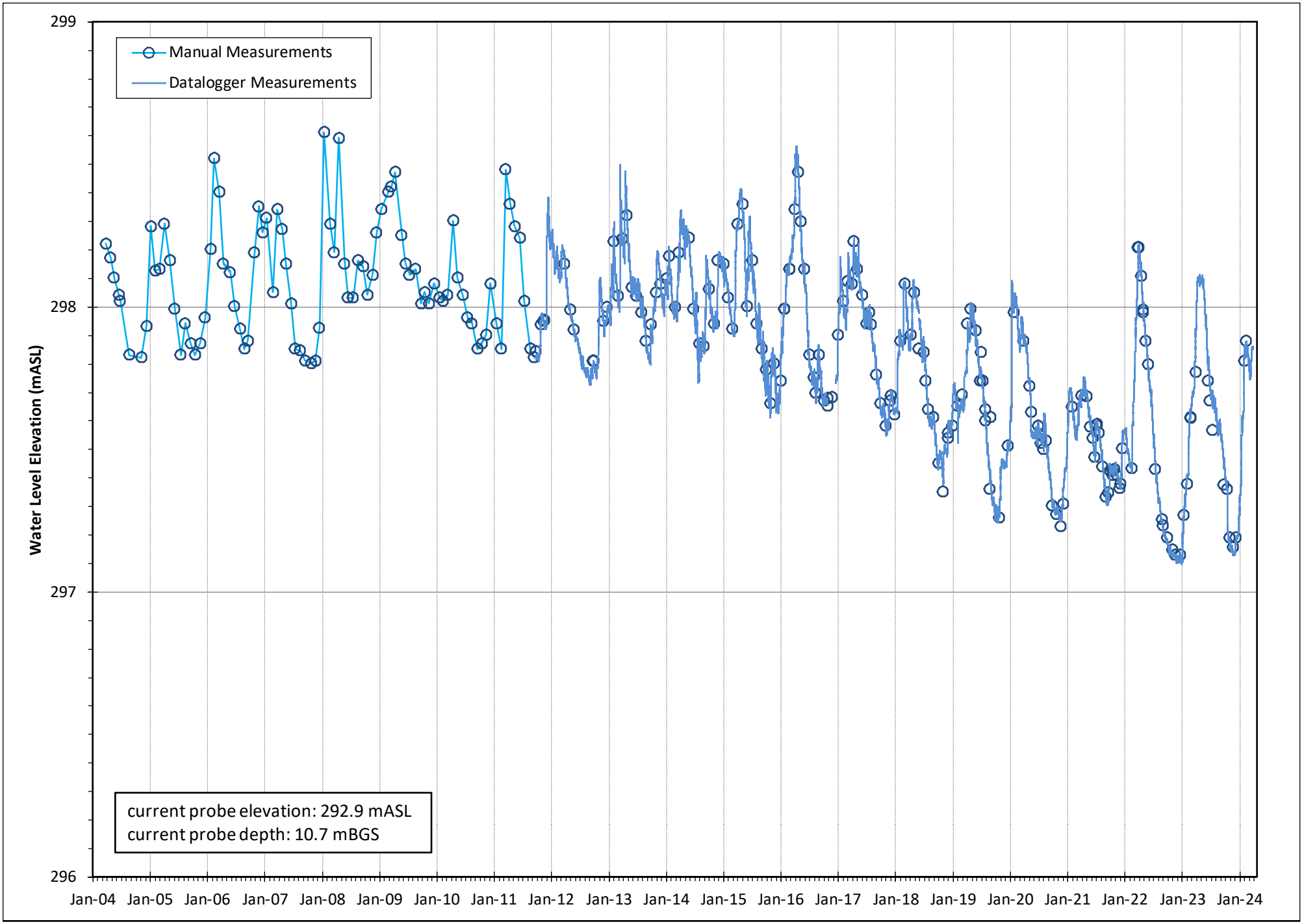
Groundwater Science Corp.
Monitoring Program



CBM Aggregates
Roszell Pit

Figure B3: BH3-D Hydrograph

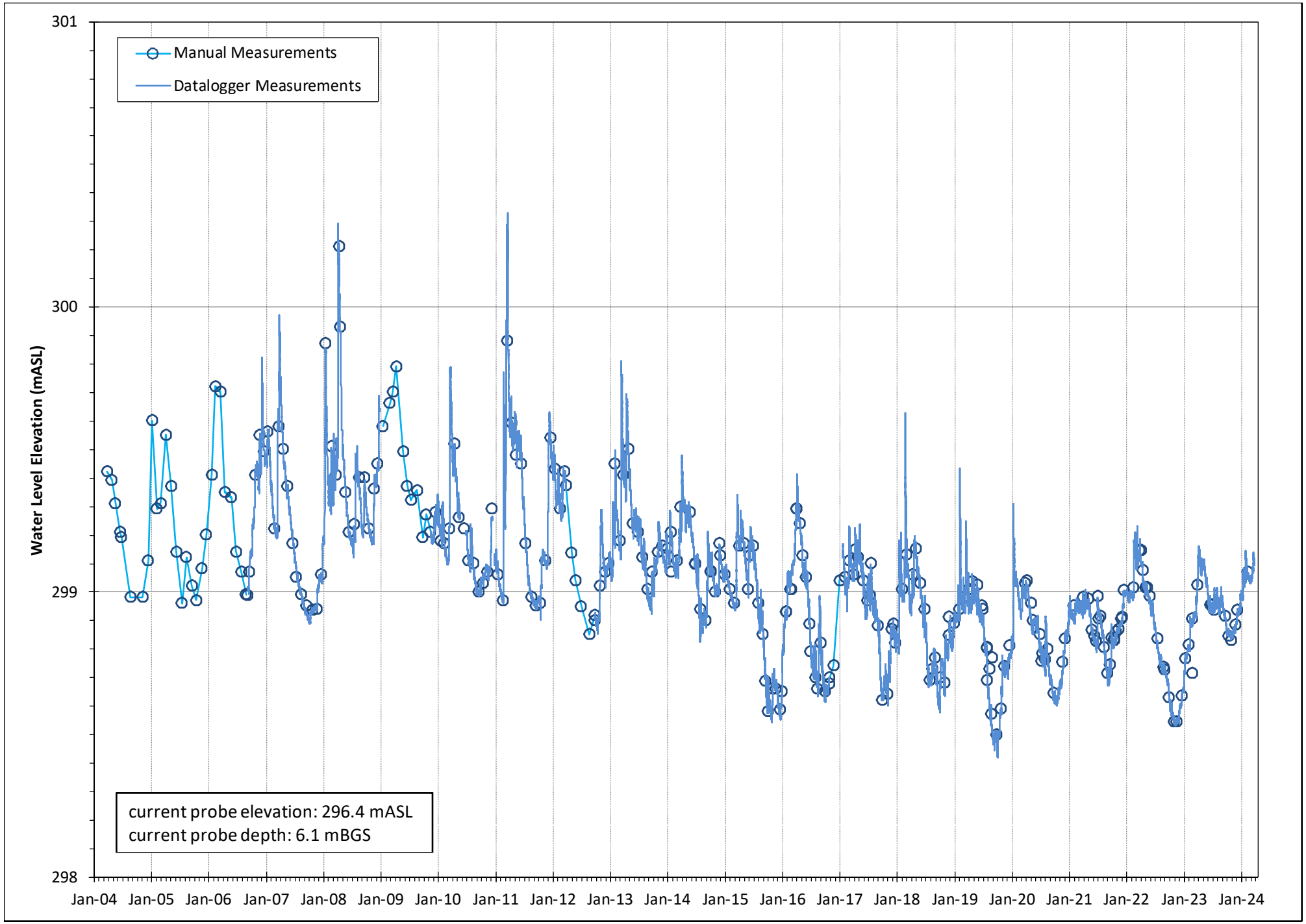
Groundwater Science Corp.
Monitoring Program



CBM Aggregates
Roszell Pit

Figure B4: BH4-D Hydrograph

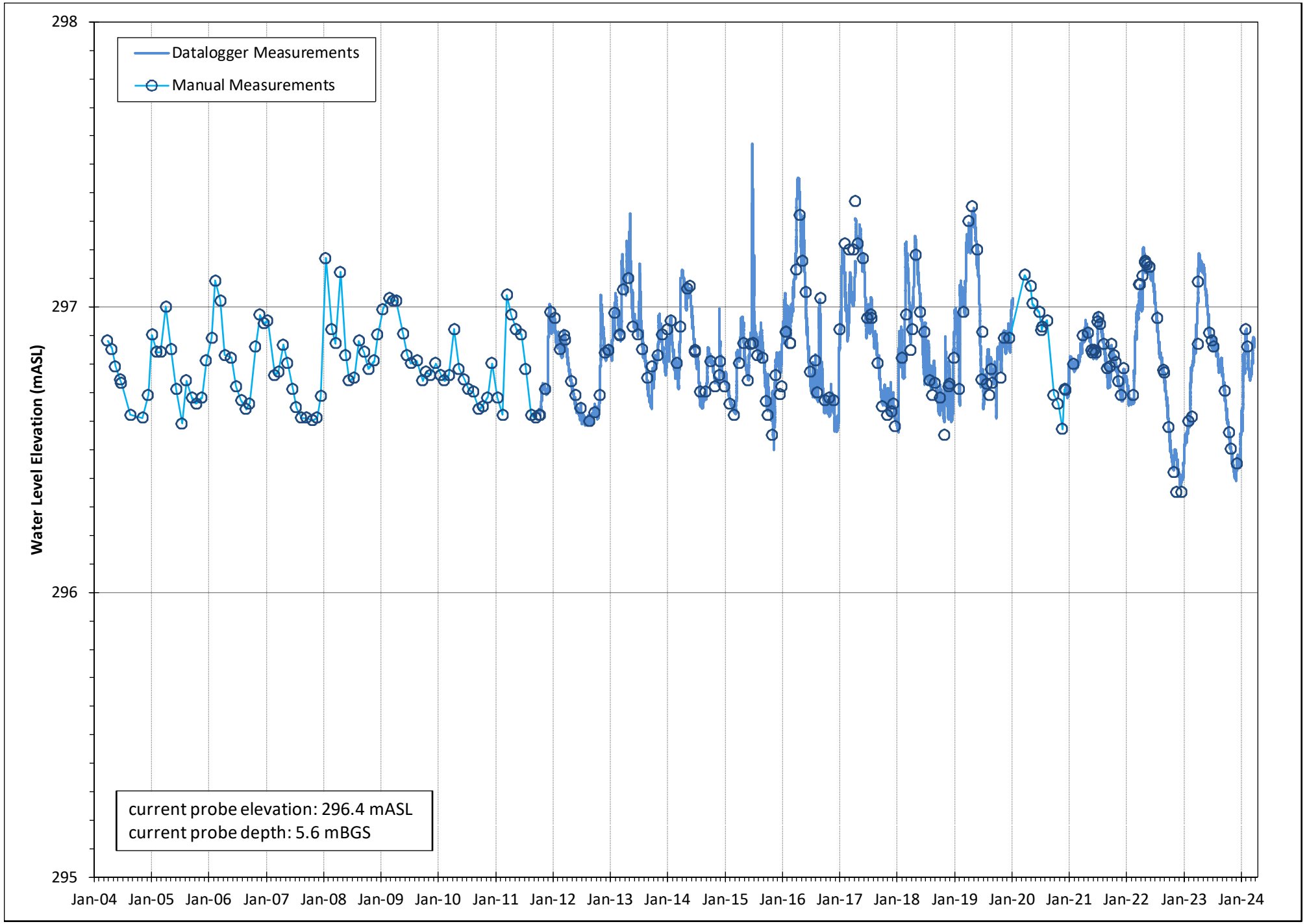
Groundwater Science Corp.
Monitoring Program



CBM Aggregates
Roszell Pit

Figure B5: BH5 Hydrograph

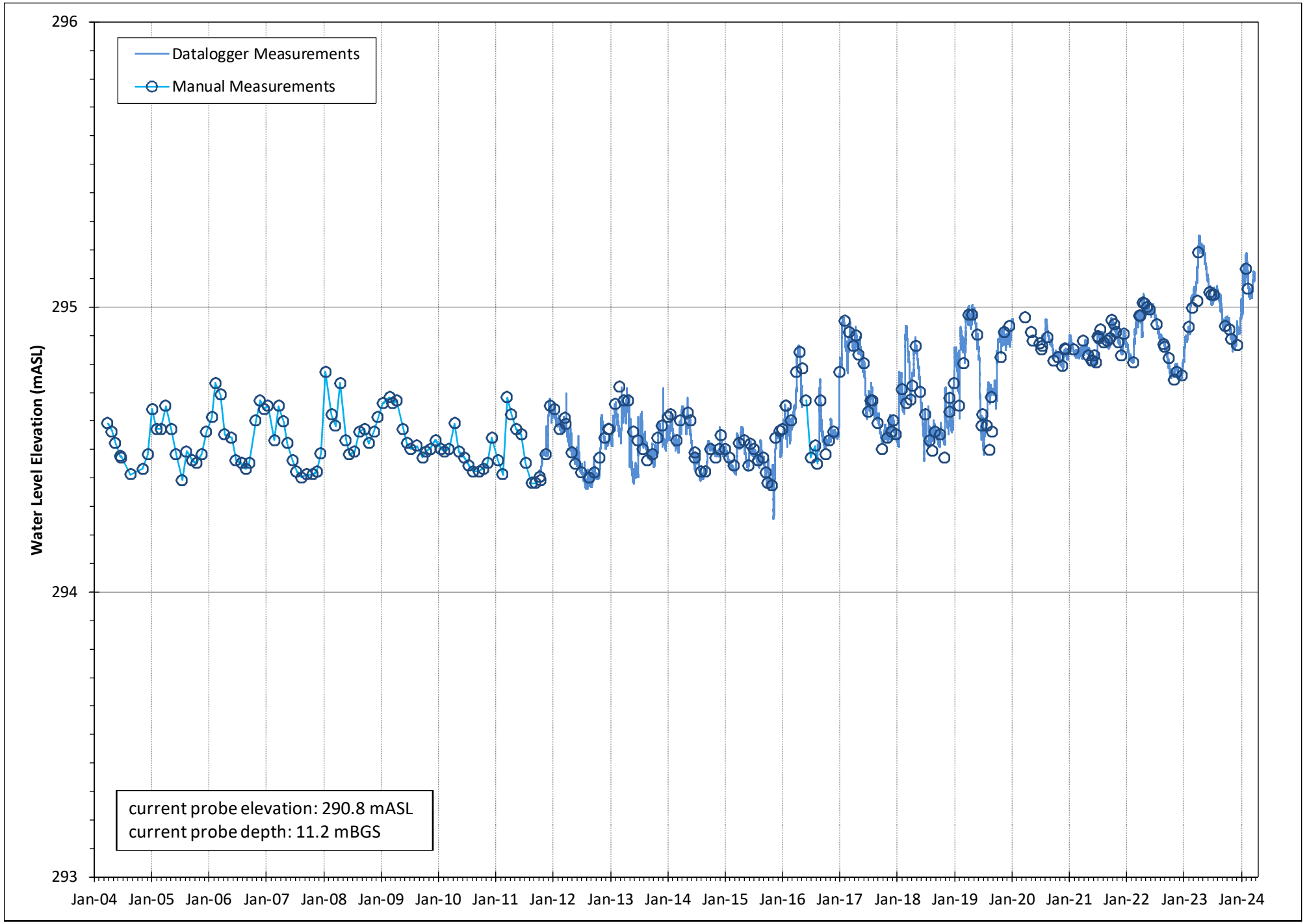
Groundwater Science Corp.
Monitoring Program



CBM Aggregates
Roszell Pit

Figure B6: BH7-S Hydrograph

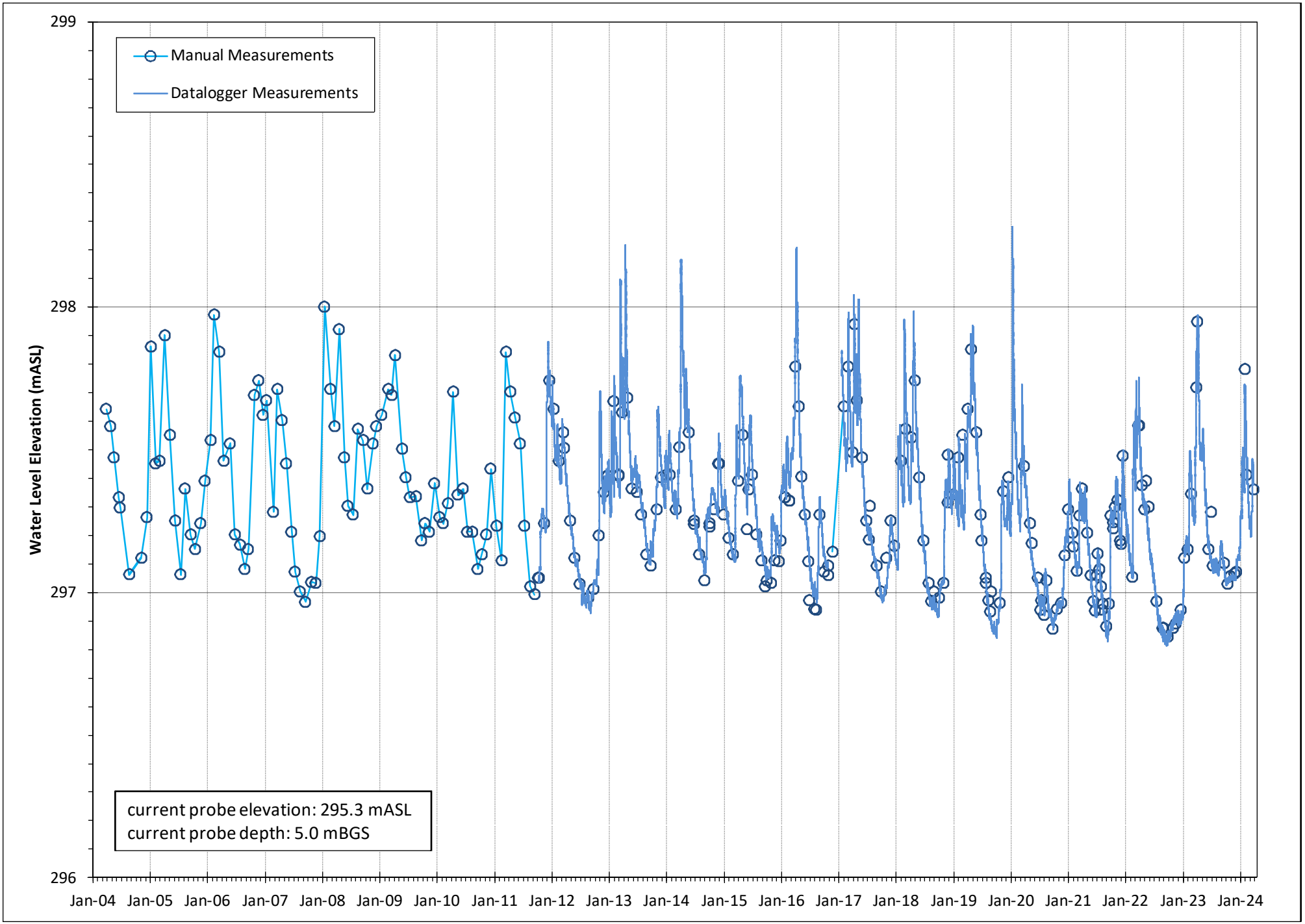
Groundwater Science Corp.
Monitoring Program



CBM Aggregates
Roszell Pit

Figure B7: BH7-D Hydrograph

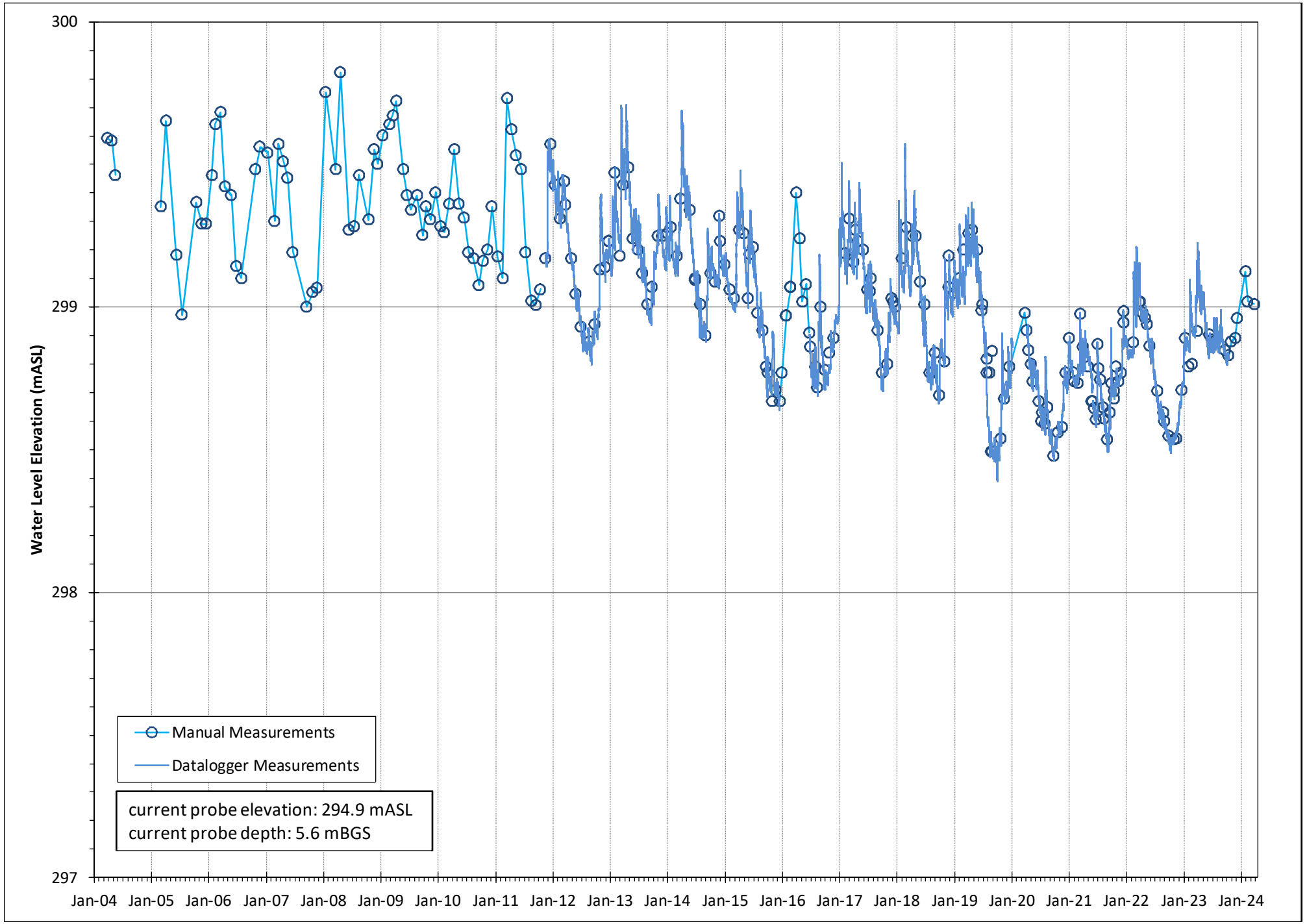
Groundwater Science Corp.
Monitoring Program



CBM Aggregates
Roszell Pit

Figure B8: BH8 Hydrograph

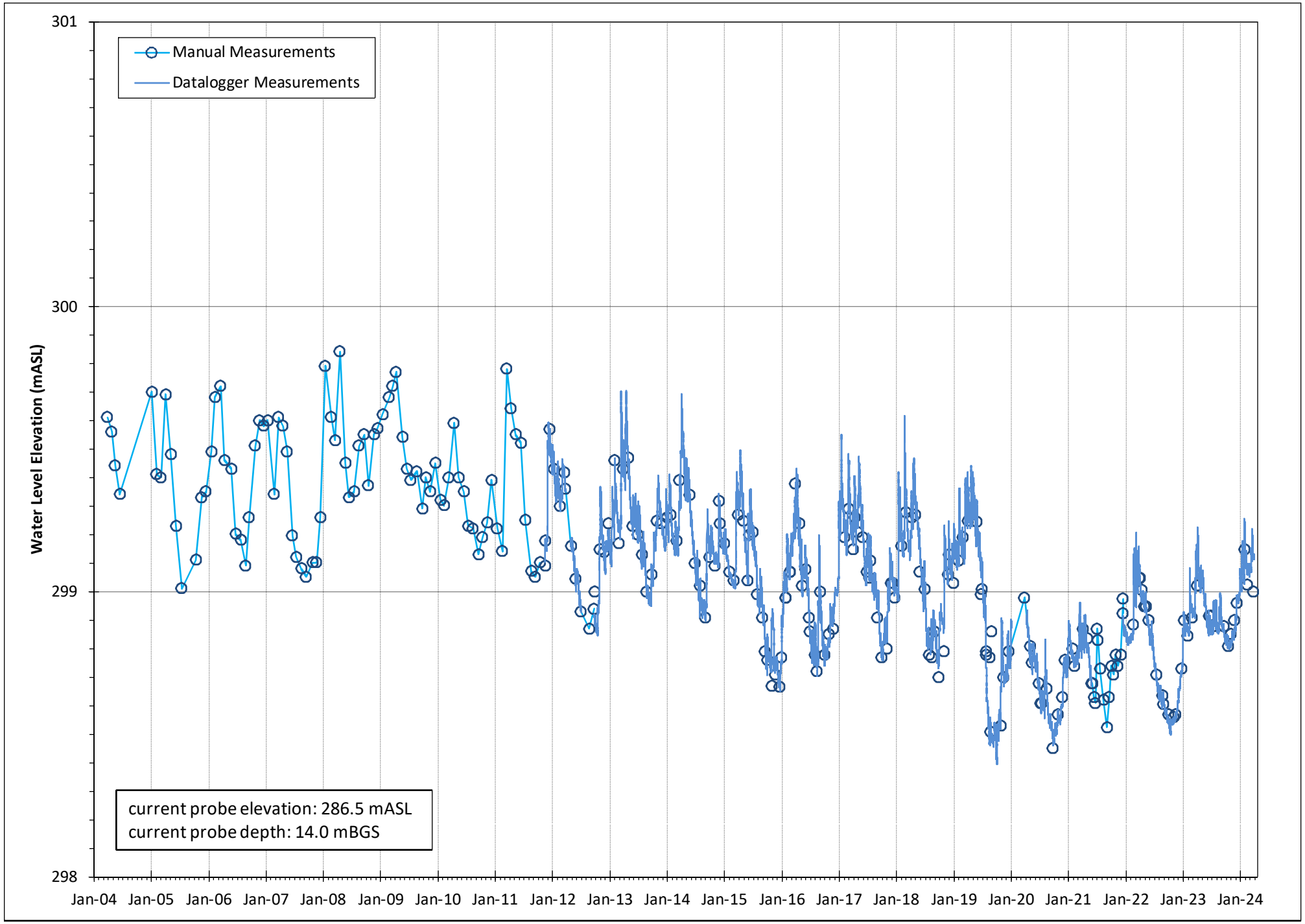
Groundwater Science Corp.
Monitoring Program



CBM Aggregates
Roszell Pit

Figure B9: BH9-S Hydrograph

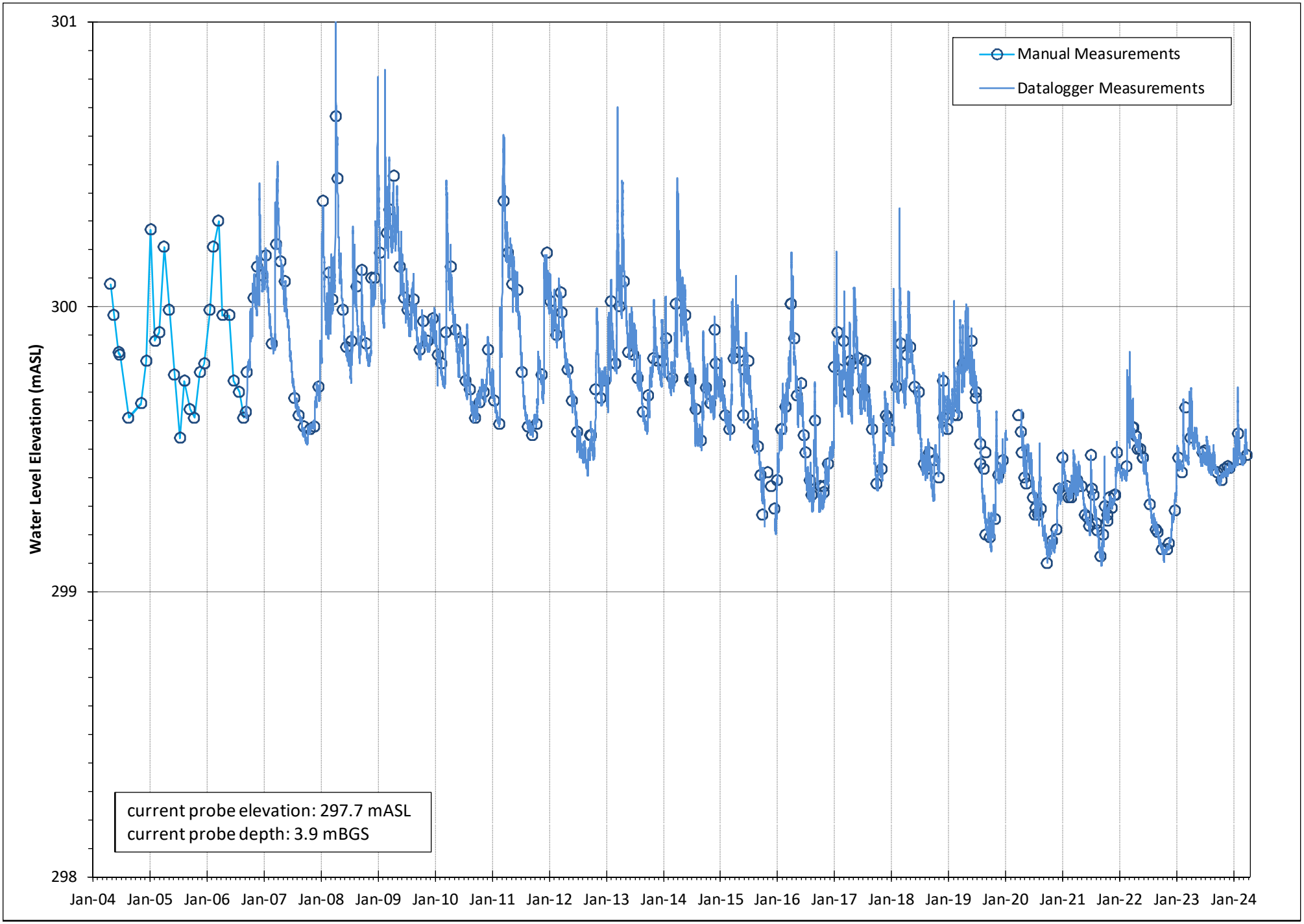
Groundwater Science Corp.
Monitoring Program



CBM Aggregates
Roszell Pit

Figure B10: BH9-D Hydrograph

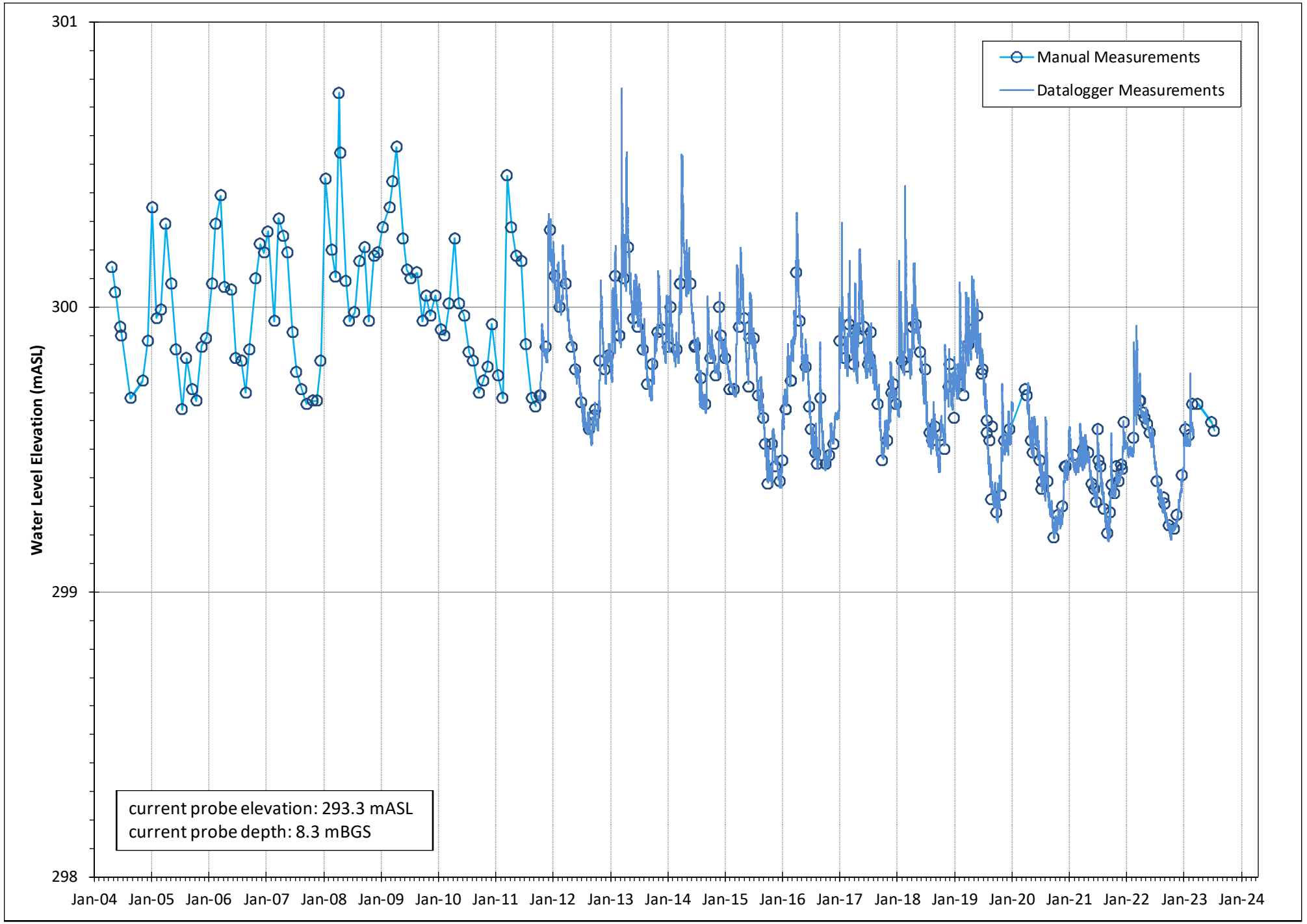
Groundwater Science Corp.
Monitoring Program



CBM Aggregates
Roszell Pit

Figure B11: BH10-S Hydrograph

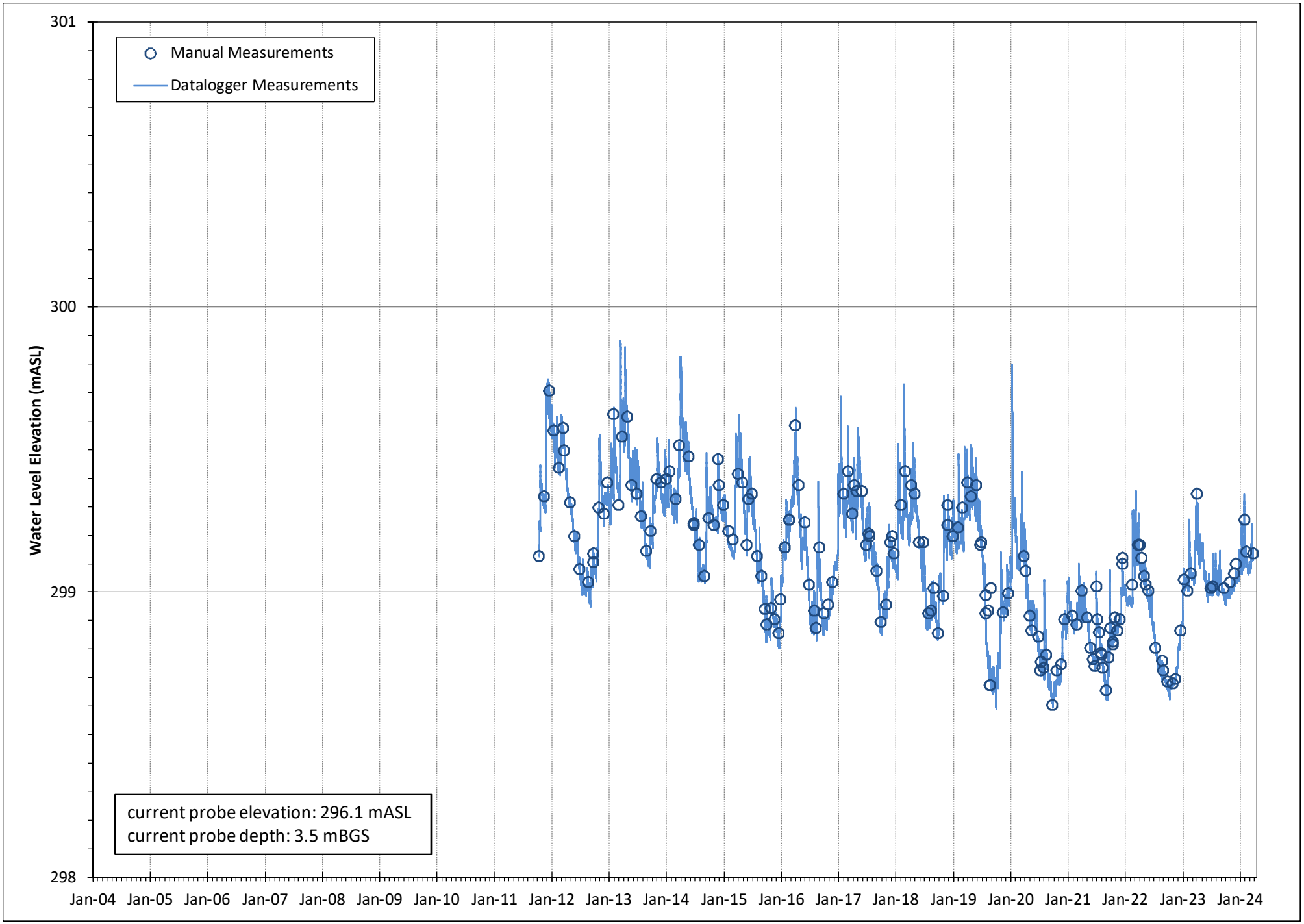
Groundwater Science Corp.
Monitoring Program



CBM Aggregates
Roszell Pit

Figure B 12: BH10-D Hydrograph

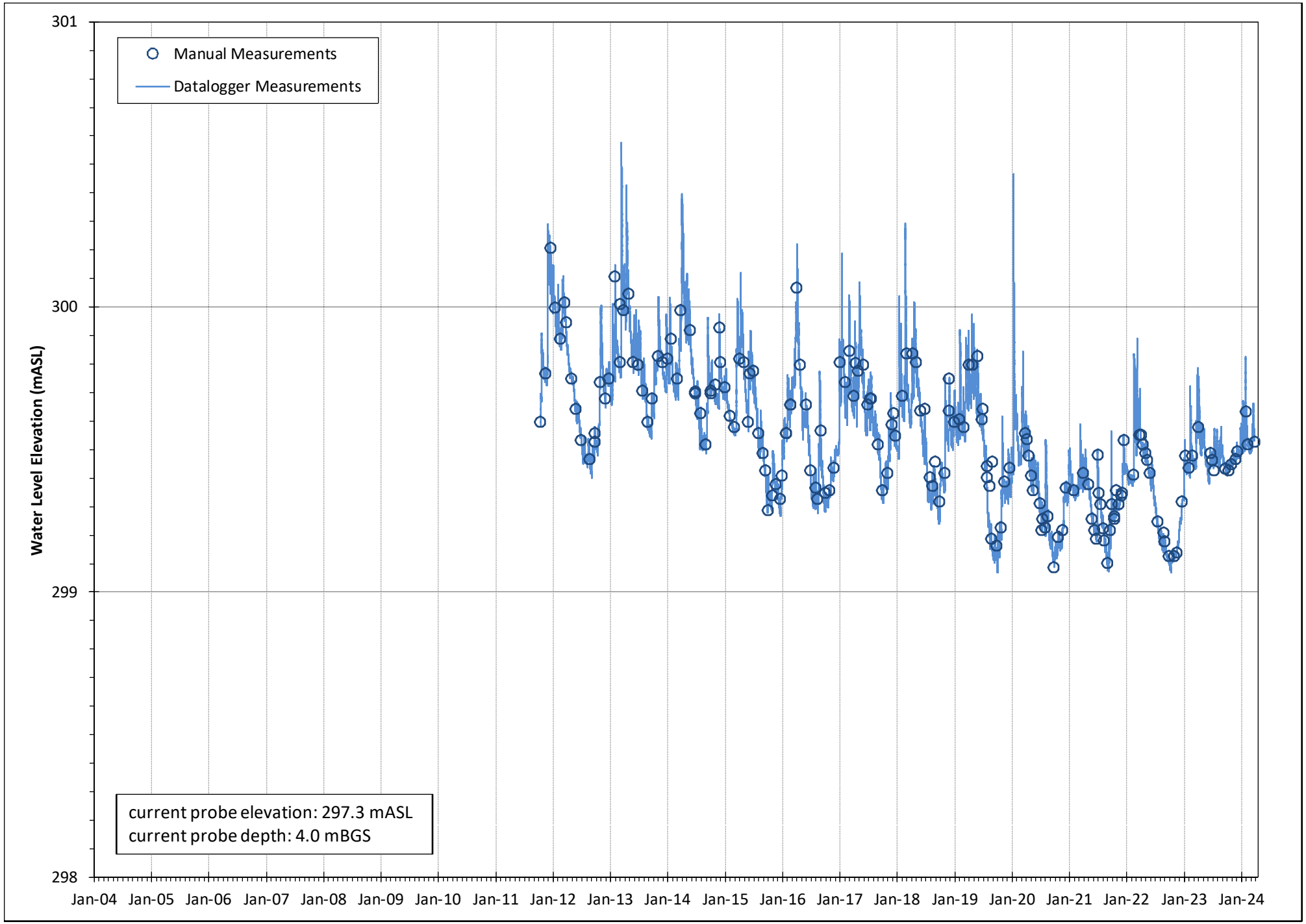
Groundwater Science Corp.
Monitoring Program



CBM Aggregates
Roszell Pit

Figure B13: BH14 Hydrograph

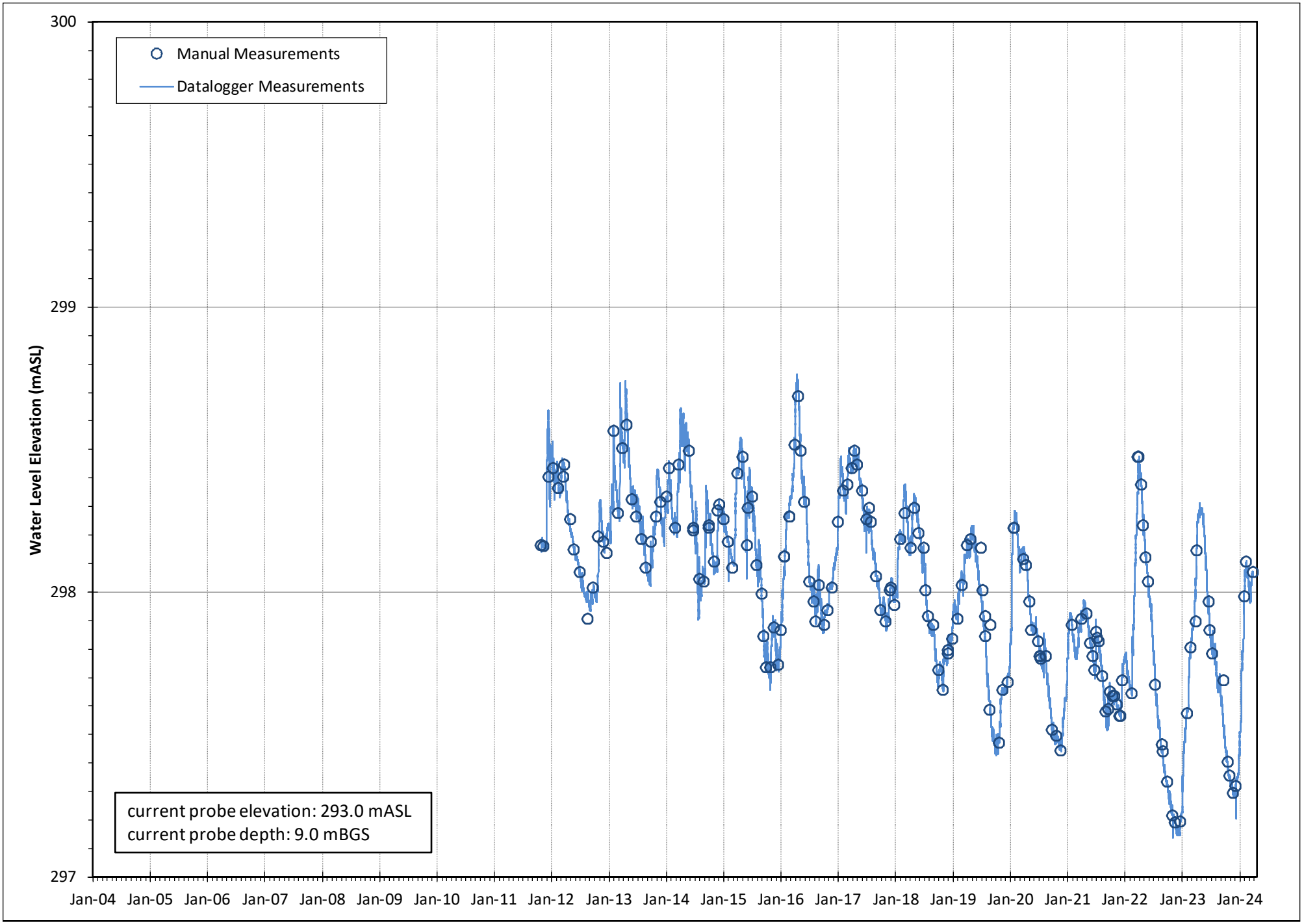
Groundwater Science Corp.
Monitoring Program



CBM Aggregates
Roszell Road Pit

Figure B14: BH15 Hydrograph

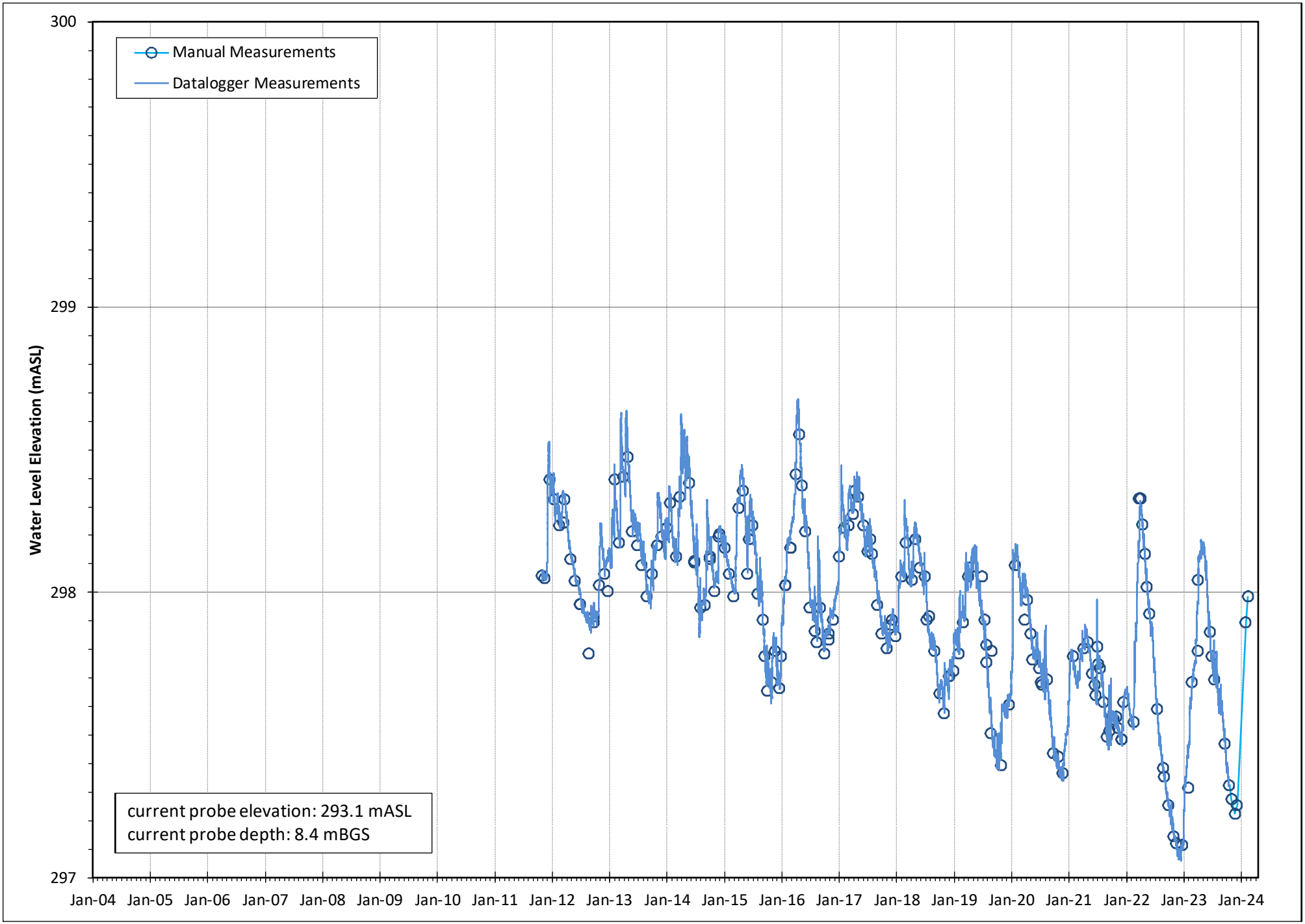
Groundwater Science Corp.
Monitoring Program



CBM Aggregates
Roszell Pit

Figure B15: BH16 Hydrograph

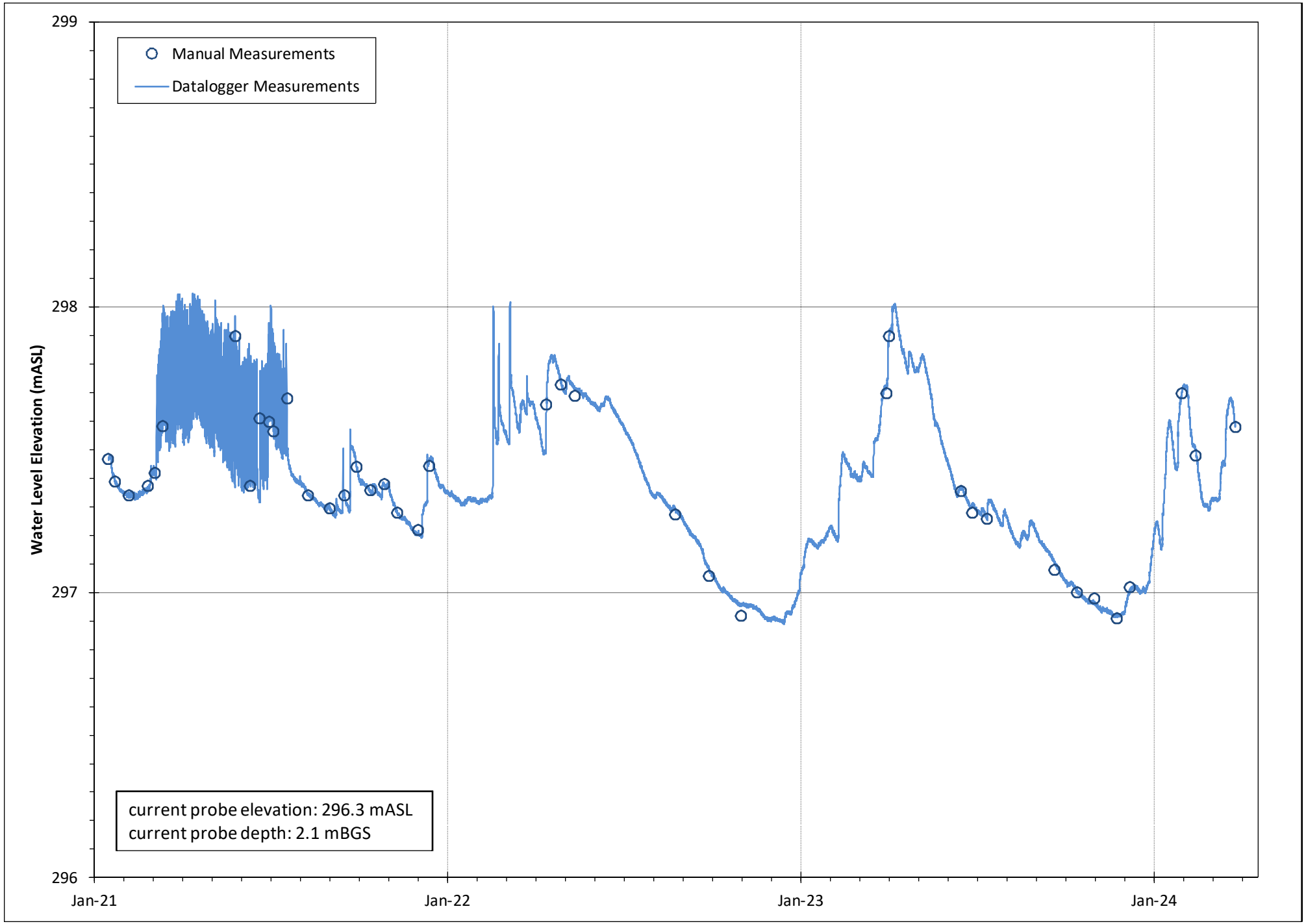
Groundwater Science Corp.
Monitoring Program



CBM Aggregates
Roszell Pit

Figure B16: BH17 Hydrograph

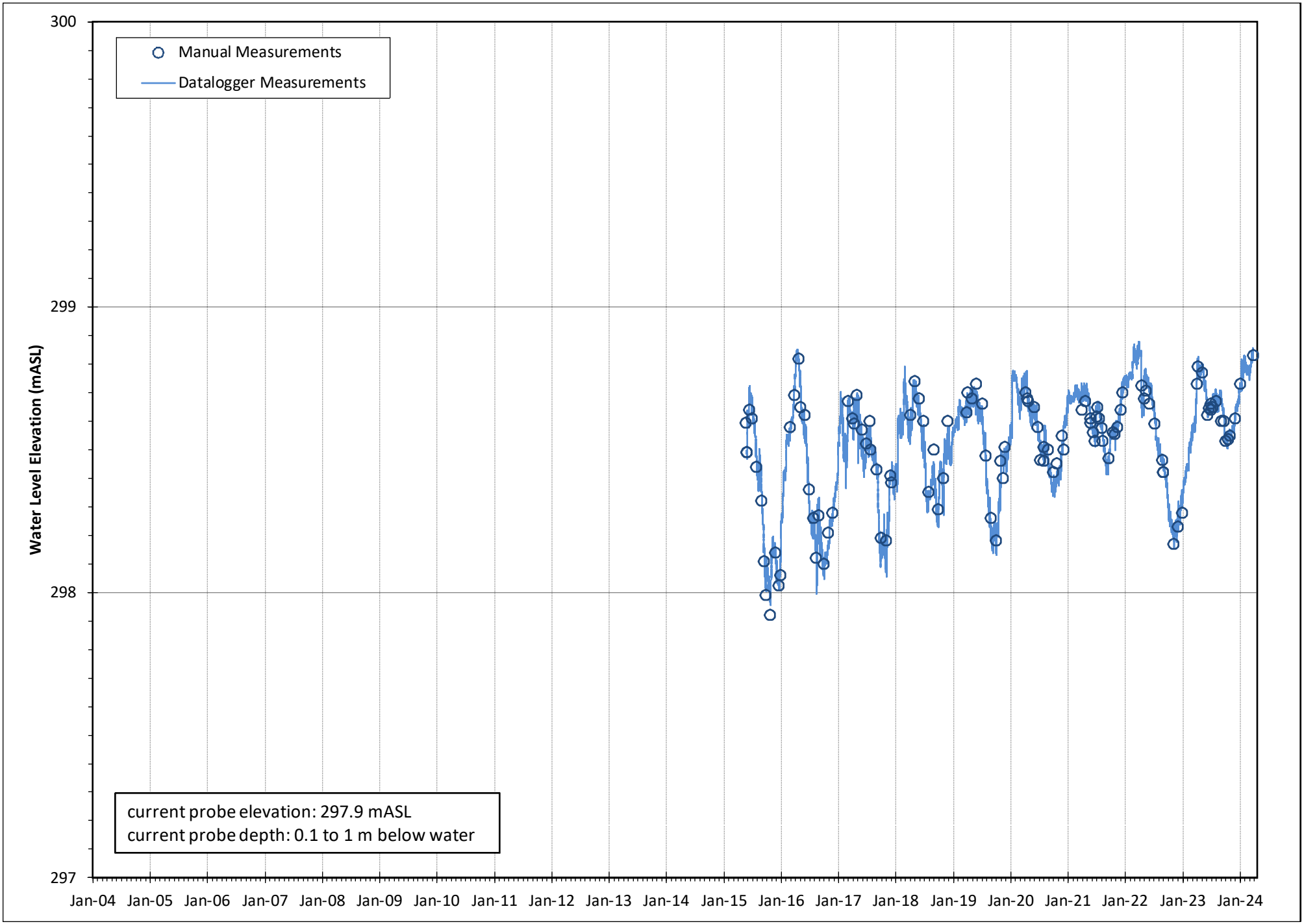
Groundwater Science Corp.
Monitoring Program



CBM Aggregates
Roszell Pit

Figure B17: DP9 Hydrograph

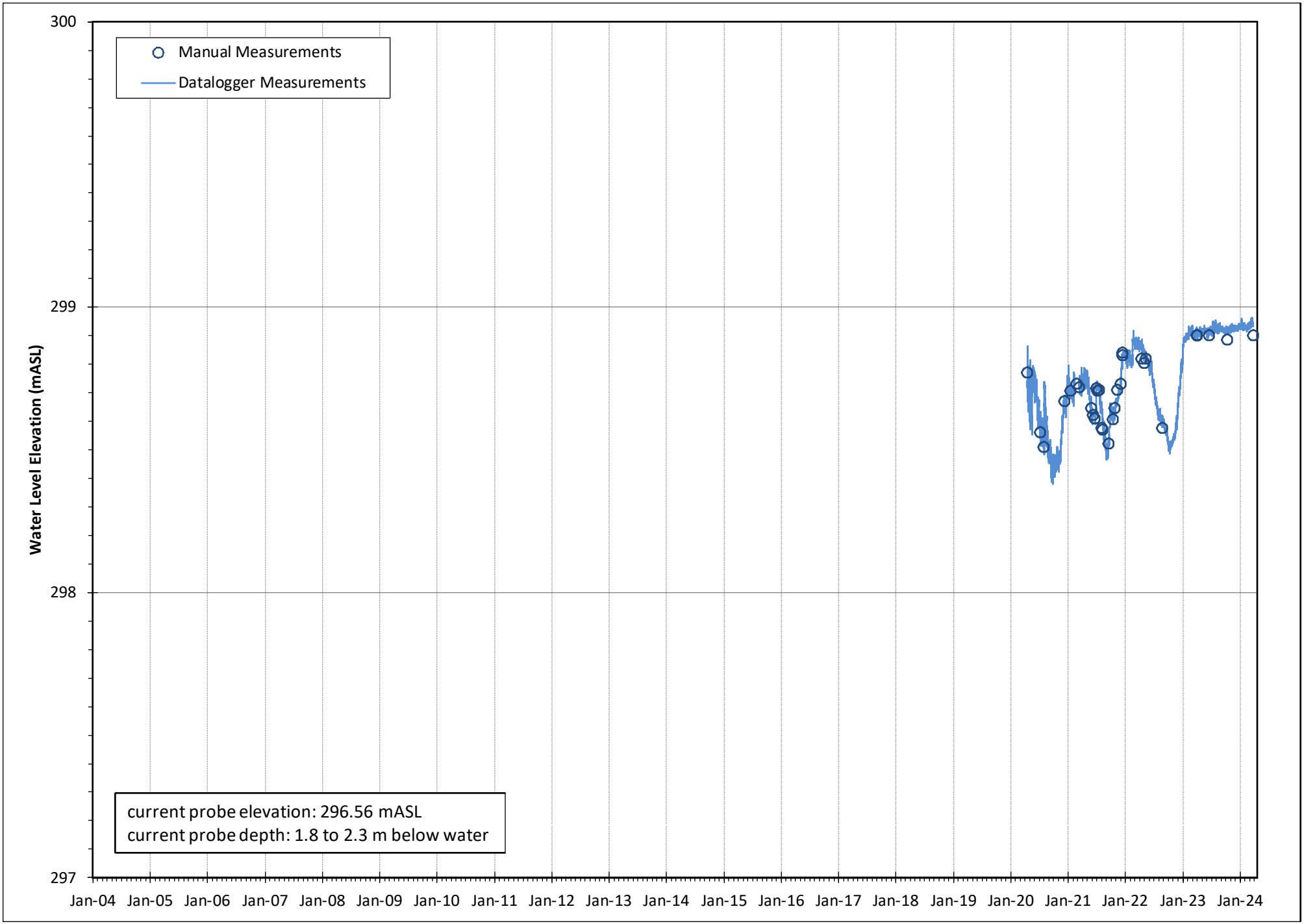
Groundwater Science Corp.
Monitoring Program



CBM Aggregates
Roszell Pit

Figure B18: LG4 Hydrograph (Lake 2)

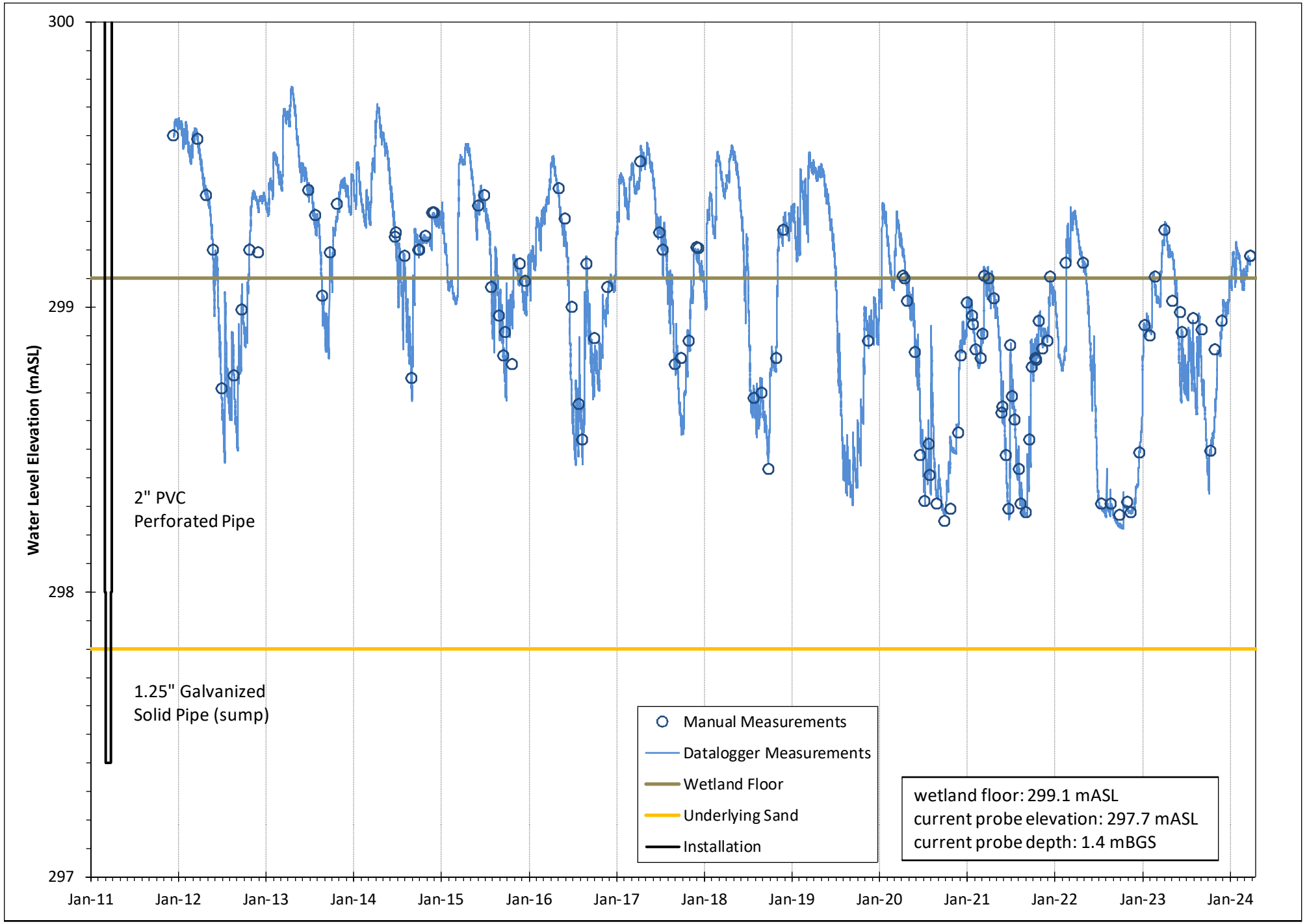
Groundwater Science Corp.
Monitoring Program



CBM Aggregates
Roszell Pit

Figure B19: LG5 Hydrograph (Lake 3)

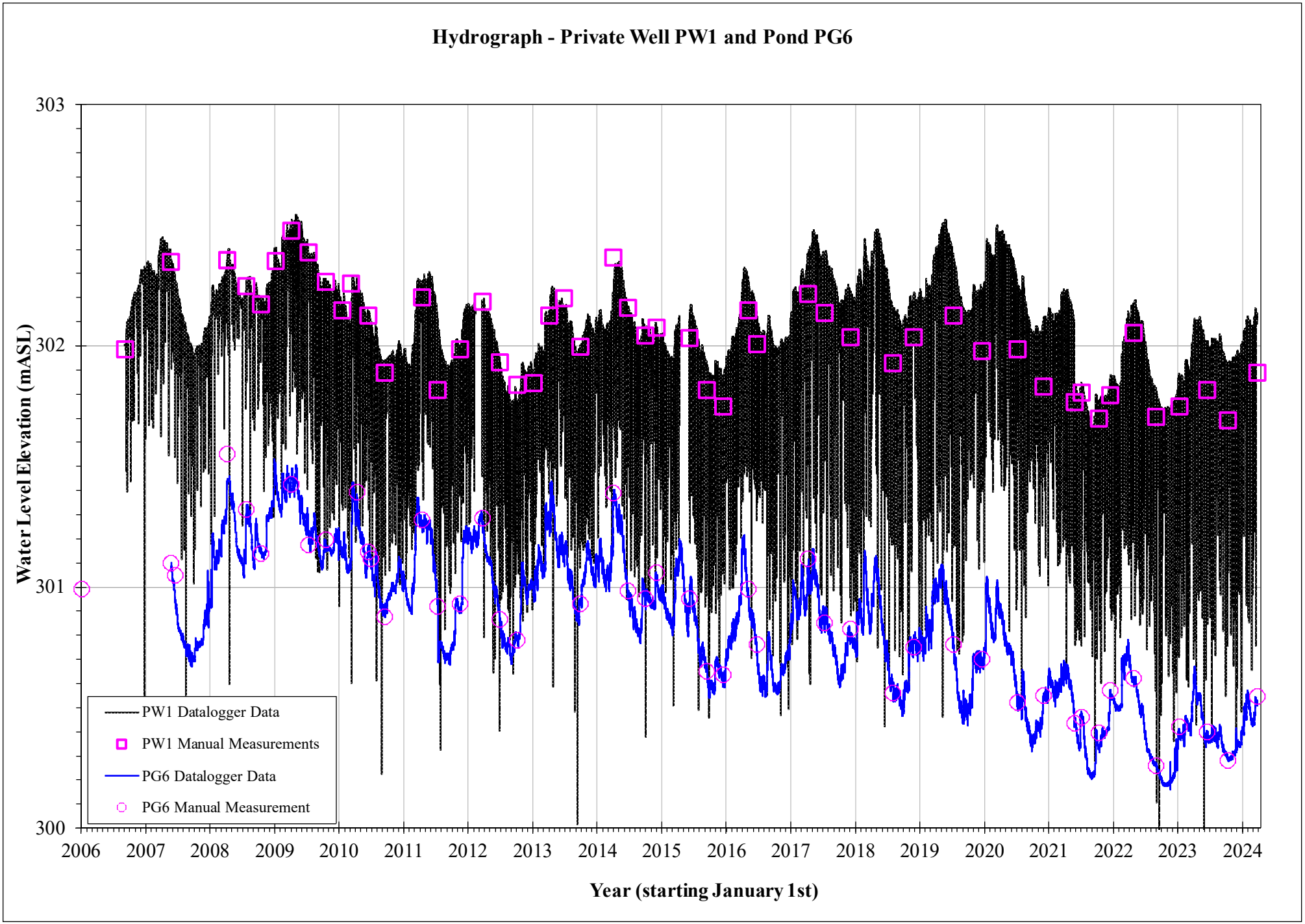
Groundwater Science Corp.
Monitoring Program



CBM Aggregates
Roszell Pit

Figure B20: PG7 (Roszell Wetland) Hydrograph

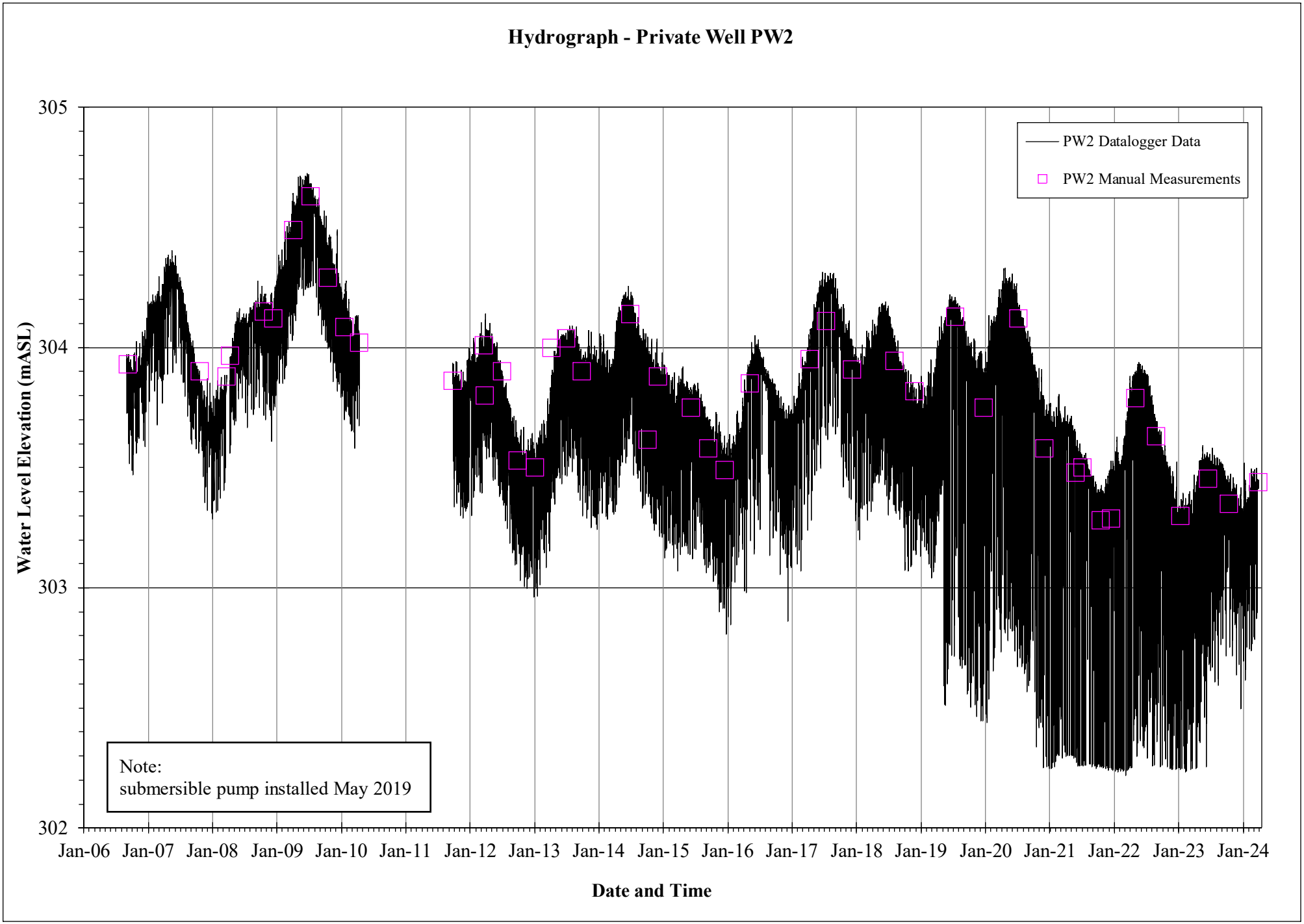
Groundwater Science Corp.
Monitoring Program



CBM Aggregates
Roszell Pit

Figure B21

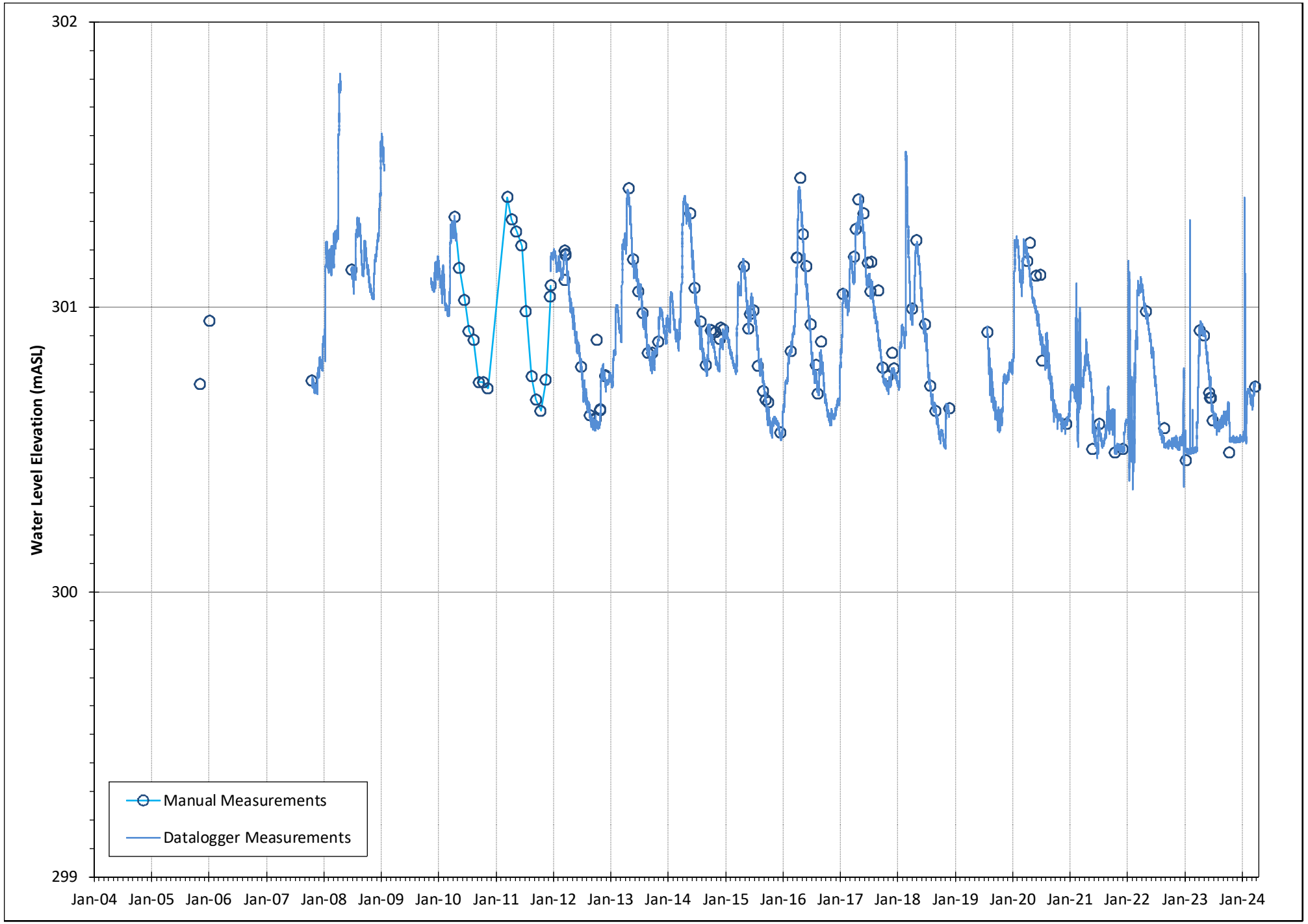
Groundwater Science Corp.
Monitoring Program



CBM Aggregates
Roszell Pit

Figure B22

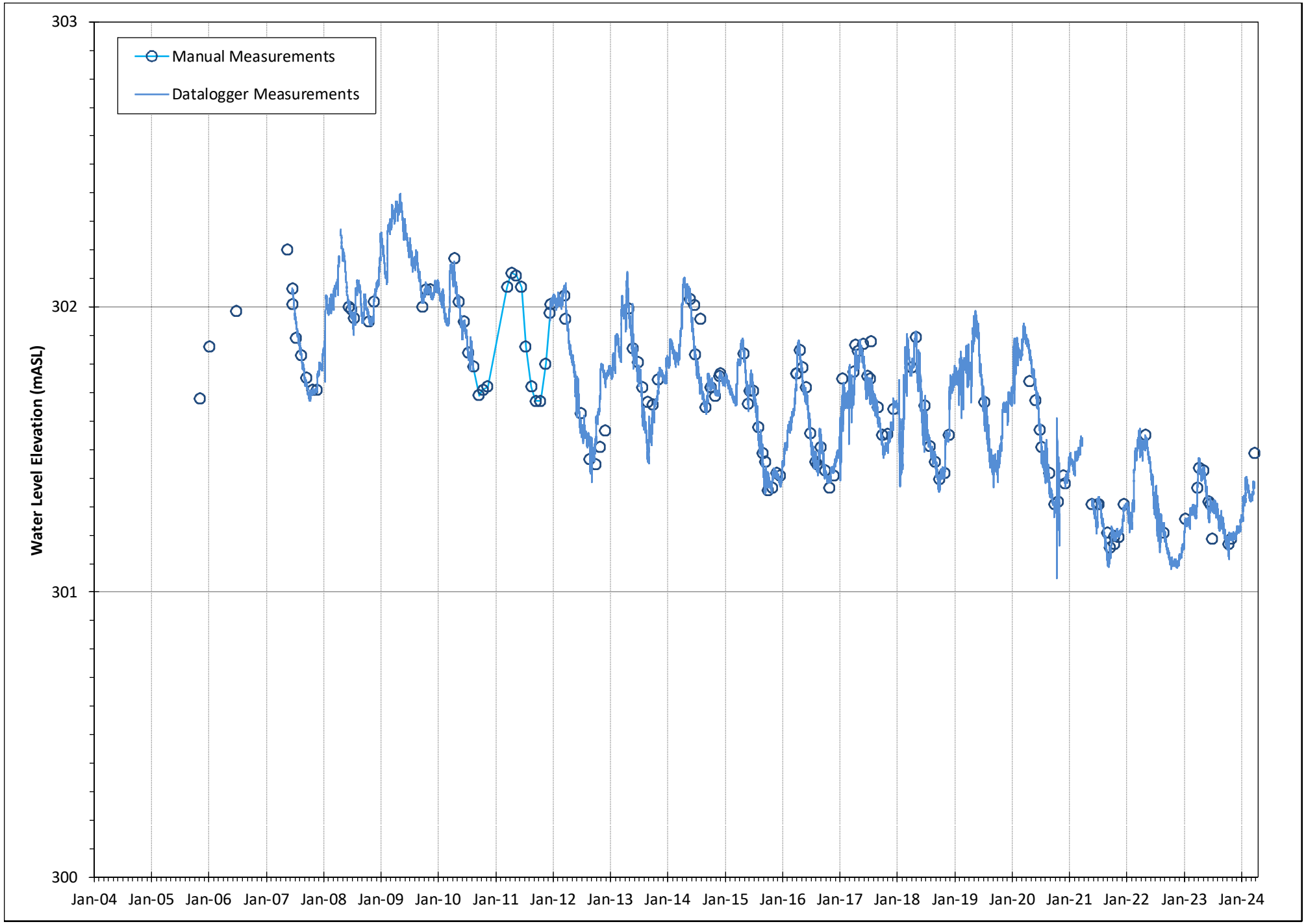
Groundwater Science Corp.
Monitoring Program



CBM Aggregates
Roszell Pit

Figure B23: PG1 Hydrograph

Groundwater Science Corp.
Monitoring Program

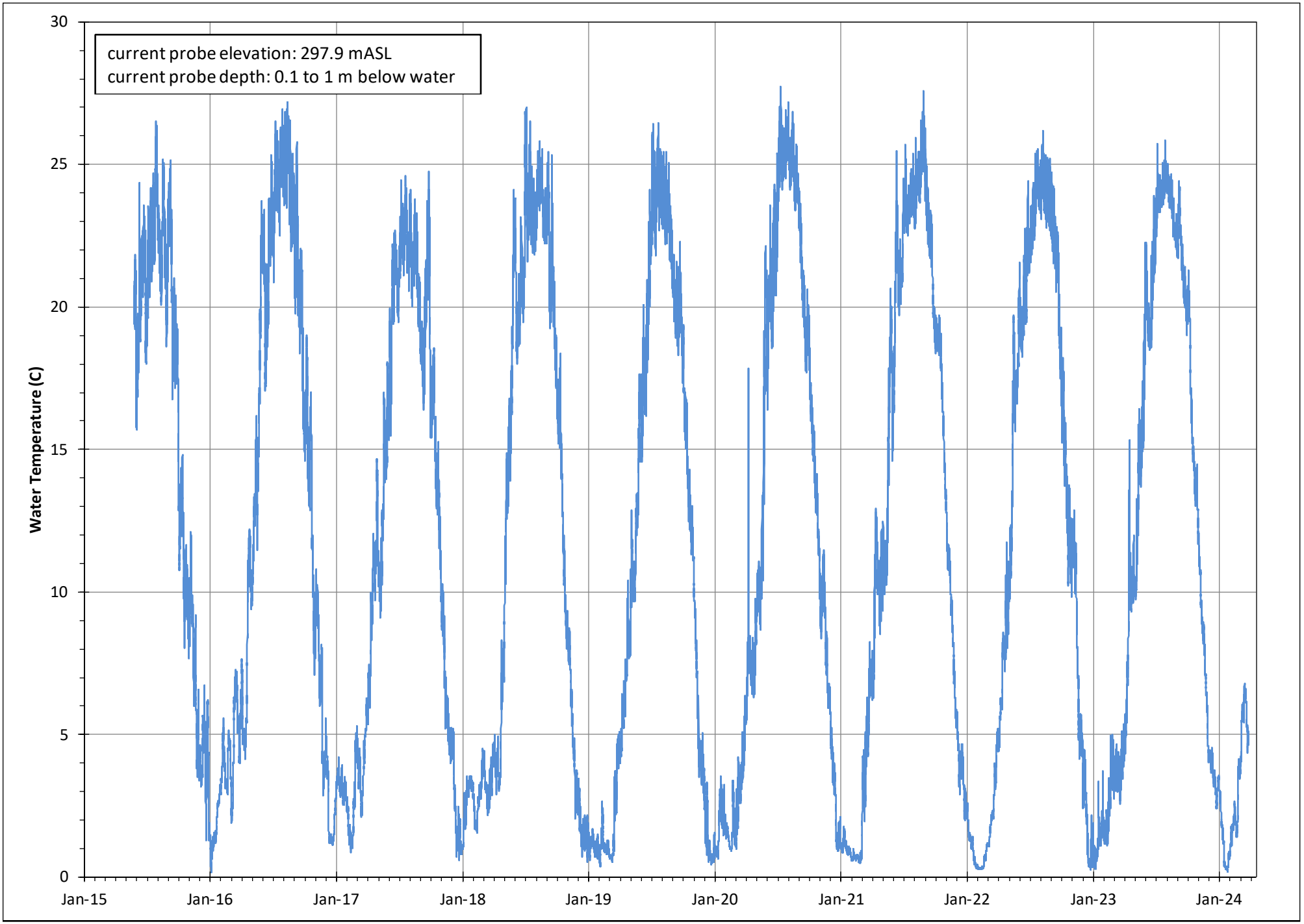


CBM Aggregates
Roszell Pit

Figure B24: PG4 Hydrograph

Groundwater Science Corp.
Monitoring Program

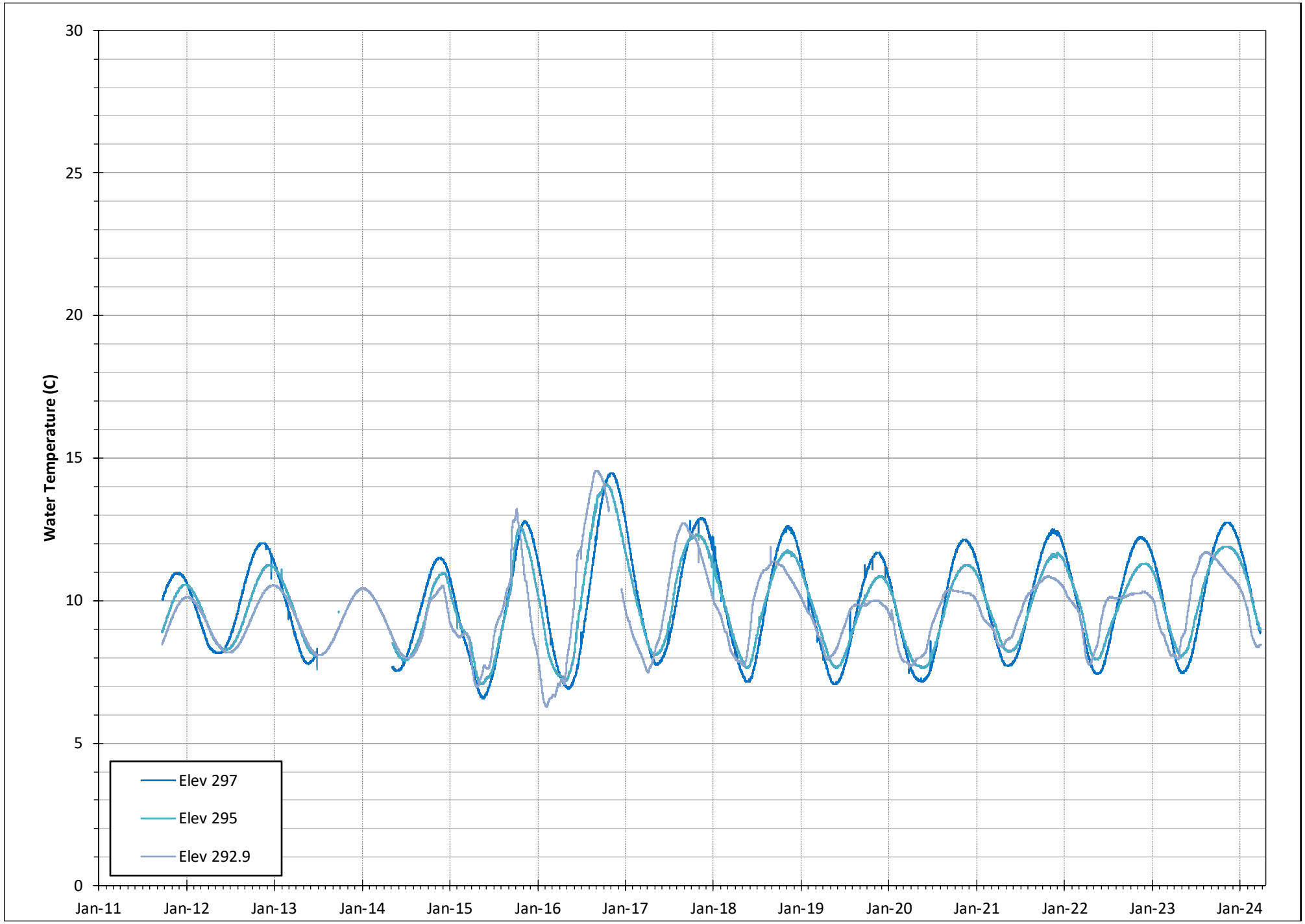
Appendix C
Temperature Plots



CBM Aggregates
Roszell Road Pit

Figure C1: LG4 Temperature Plot

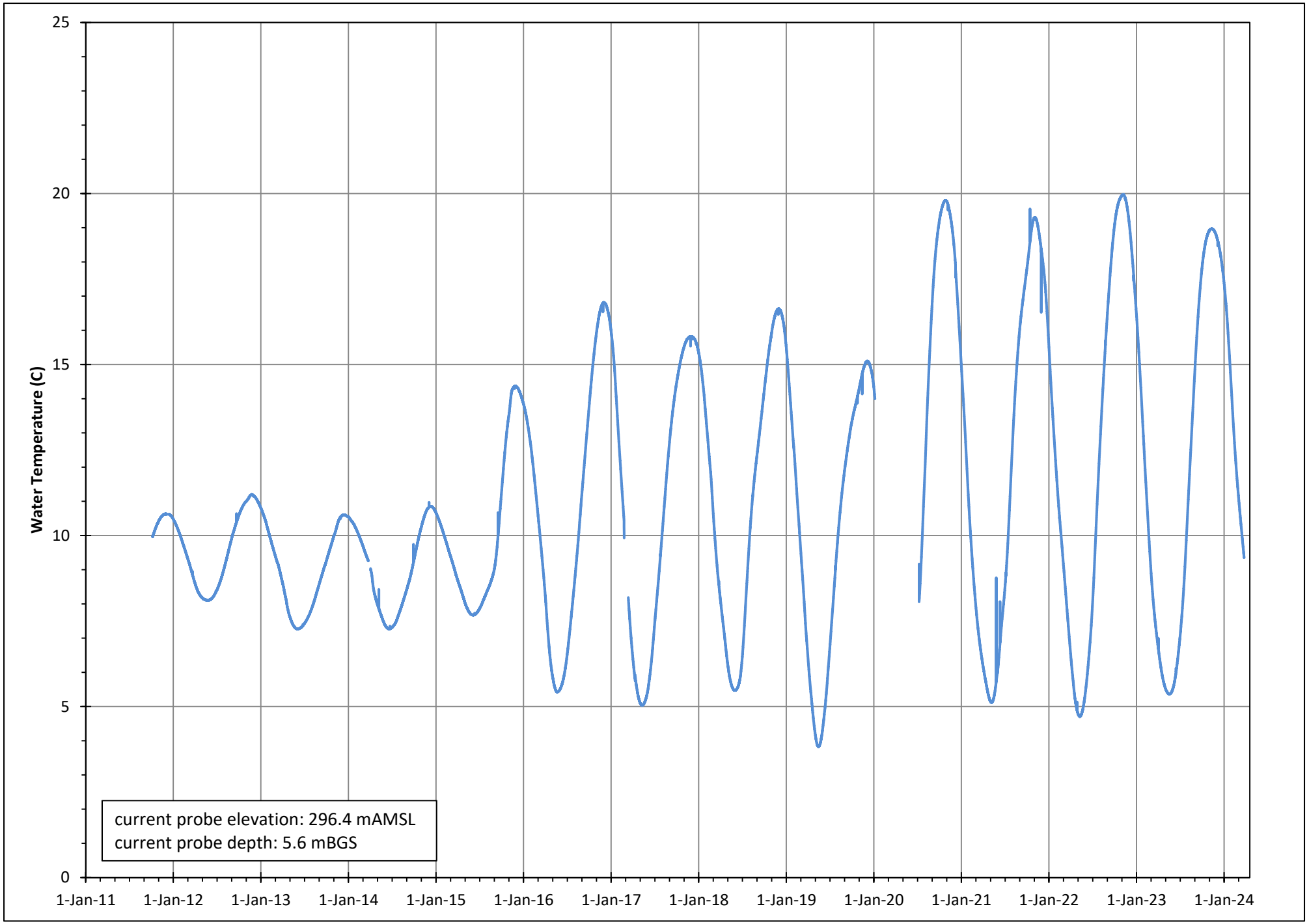
Groundwater Science Corp.
Monitoring Program



CBM Aggregates
Roszell Pit

Figure C2: BH4-D Groundwater Temperature Plot

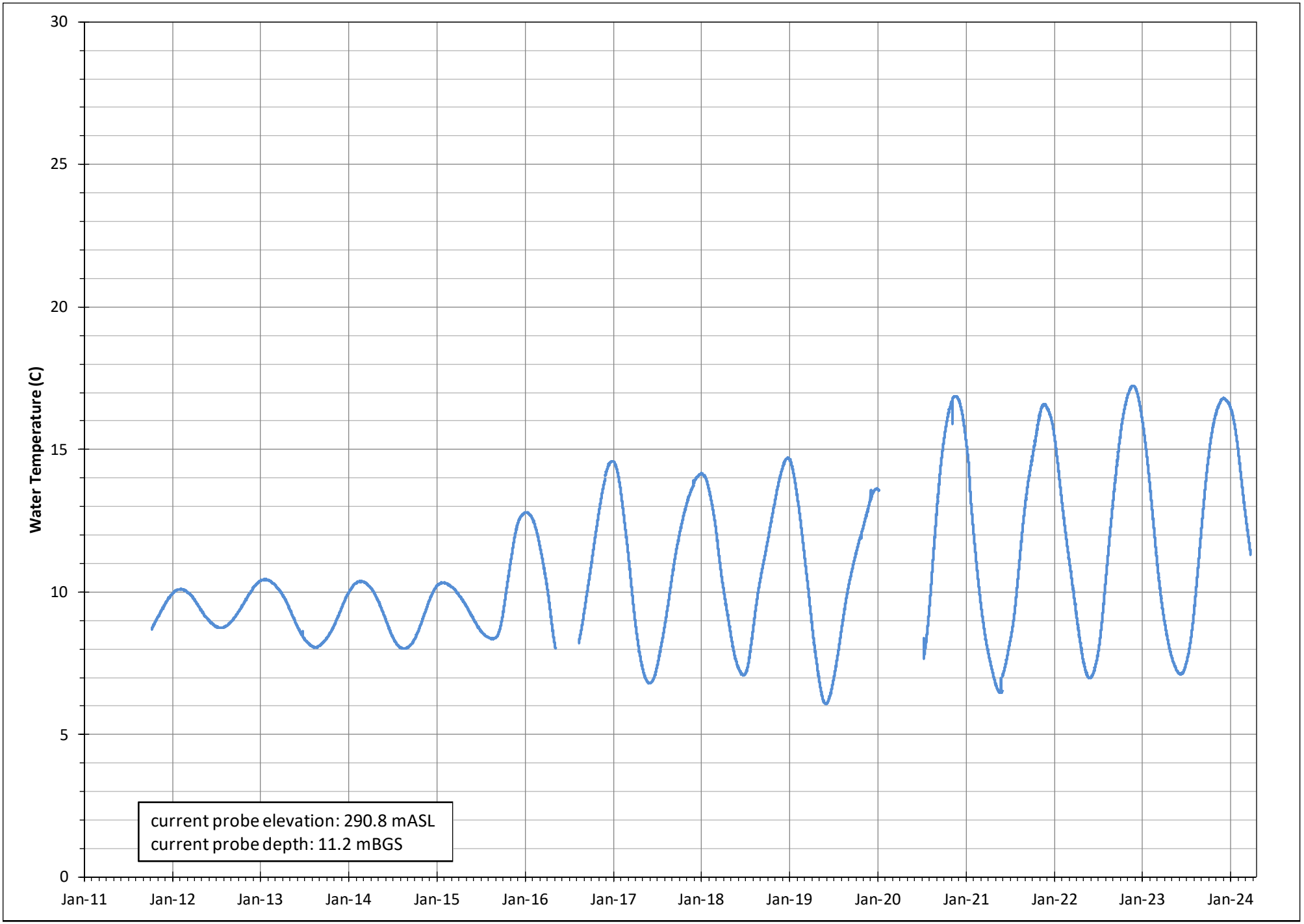
Groundwater Science Corp.
Monitoring Program



CBM Aggregates
Roszell Pit

Figure C3: BH7-S Groundwater Temperature Plot

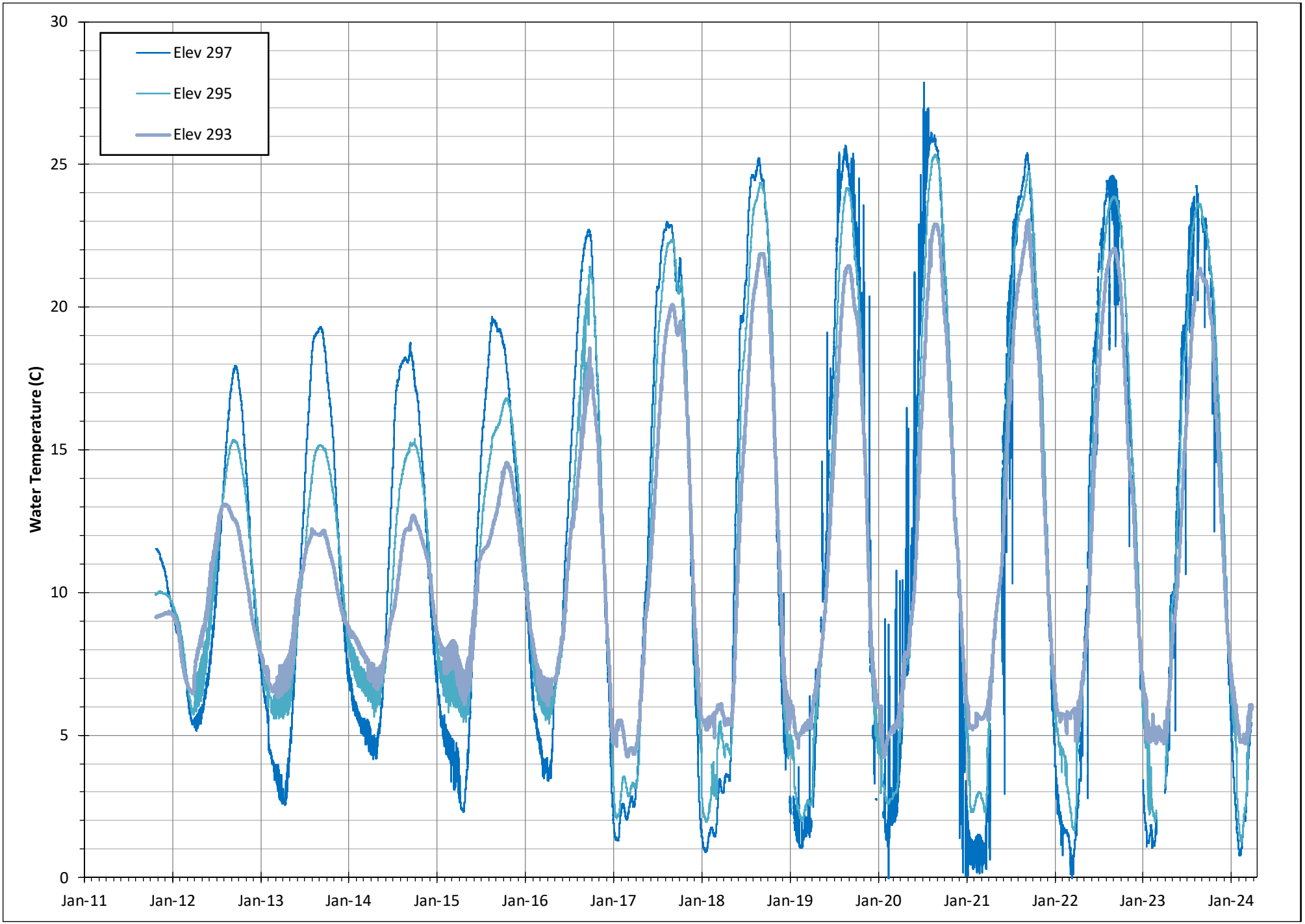
Groundwater Science Corp.
Monitoring Program



CBM Aggregates
Roszell Pit

Figure C4: BH7-D Groundwater Temperature Plot

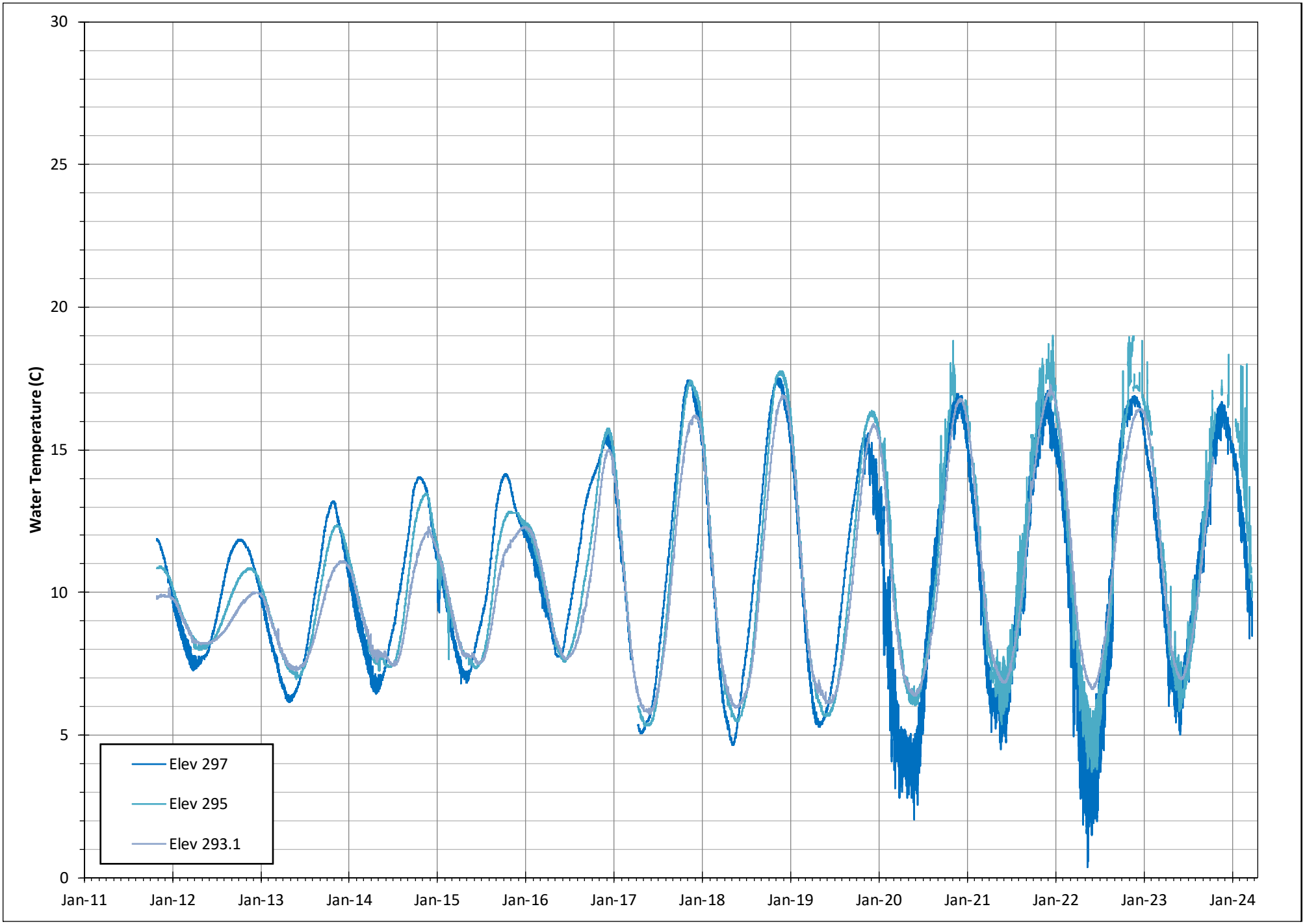
Groundwater Science Corp.
Monitoring Program



CBM Aggregates
Roszell Pit

Figure C5: BH16 Groundwater Temperature Plot

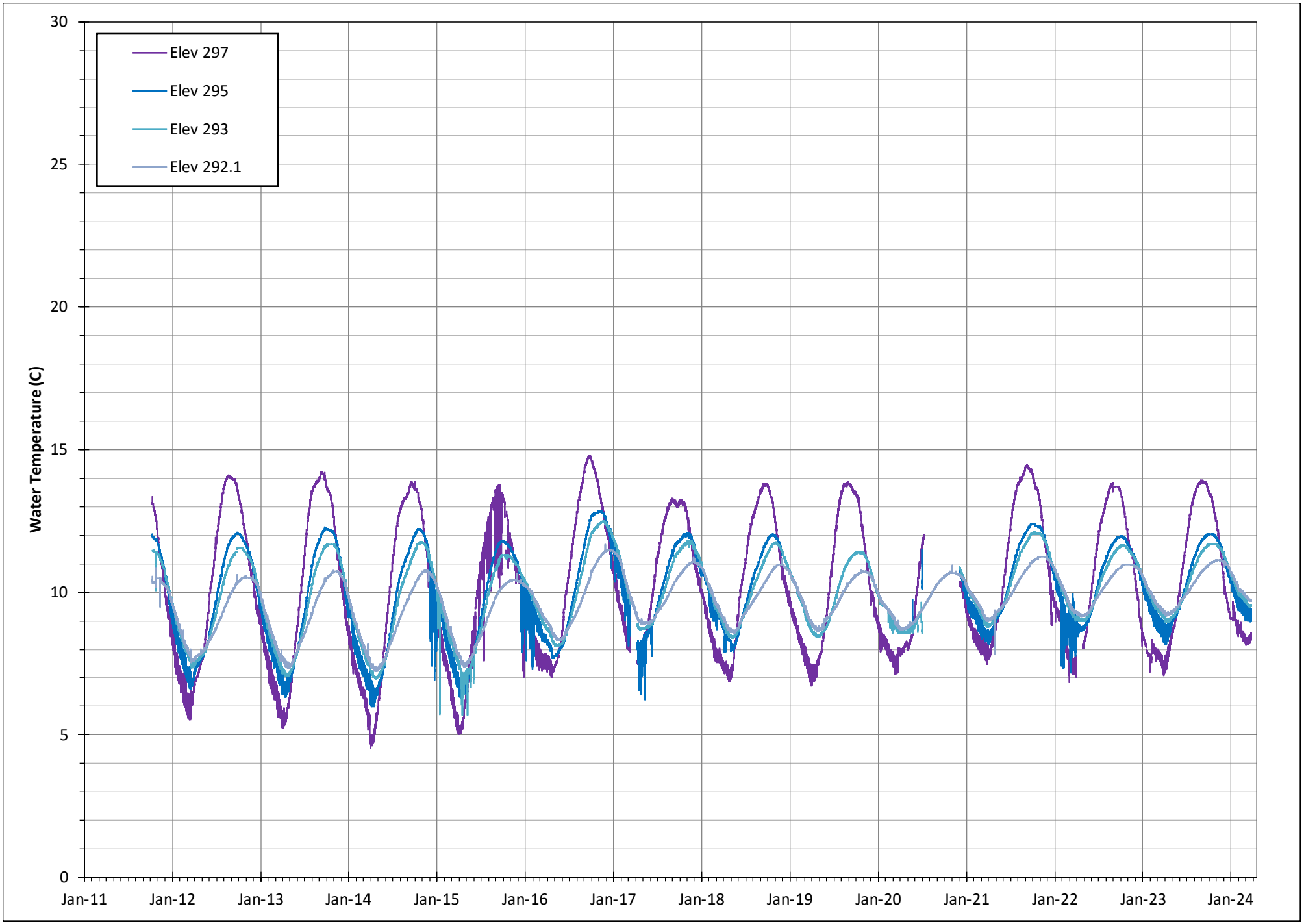
Groundwater Science Corp.
Monitoring Program



CBM Aggregates
Roszell Pit

Figure C6: BH17 Groundwater Temperature Plot

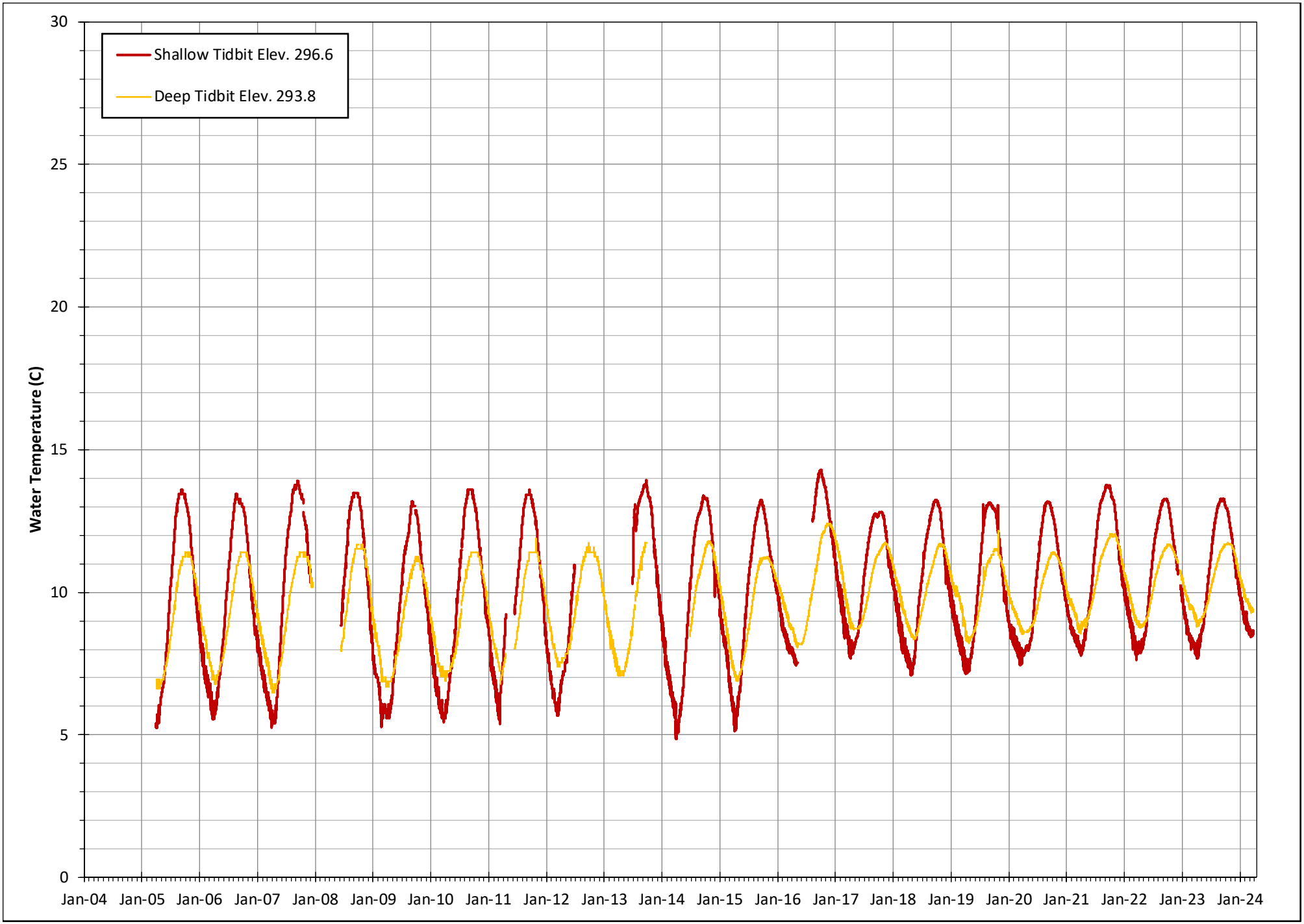
Groundwater Science Corp.
Monitoring Program



CBM Aggregates
Roszell Pit

Figure C7: BH1 Groundwater Temperature Plot

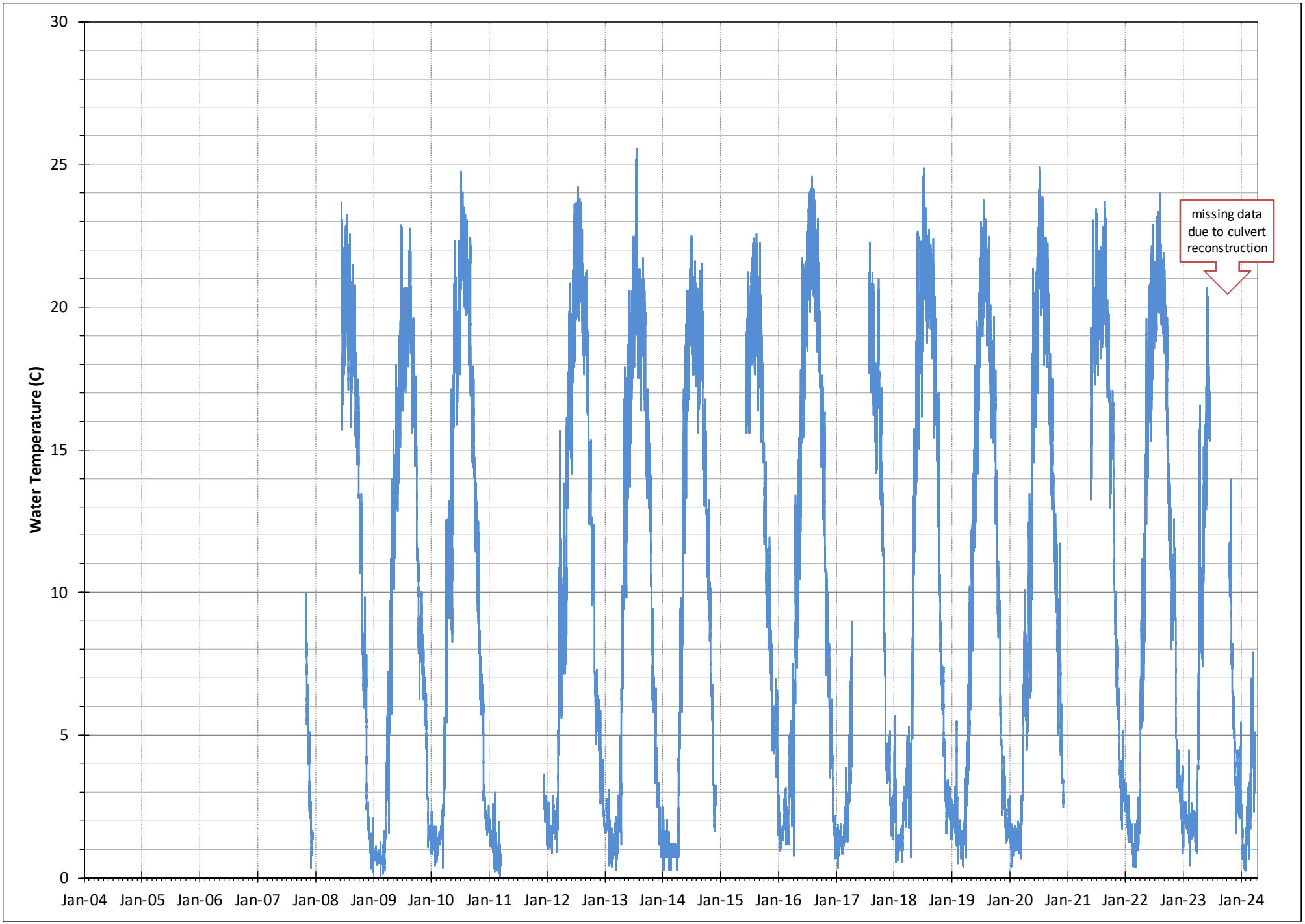
Groundwater Science Corp.
Monitoring Program



CBM Aggregates
Roszell Pit

Figure C8: BH1 Long-Term Groundwater Temperature Plot

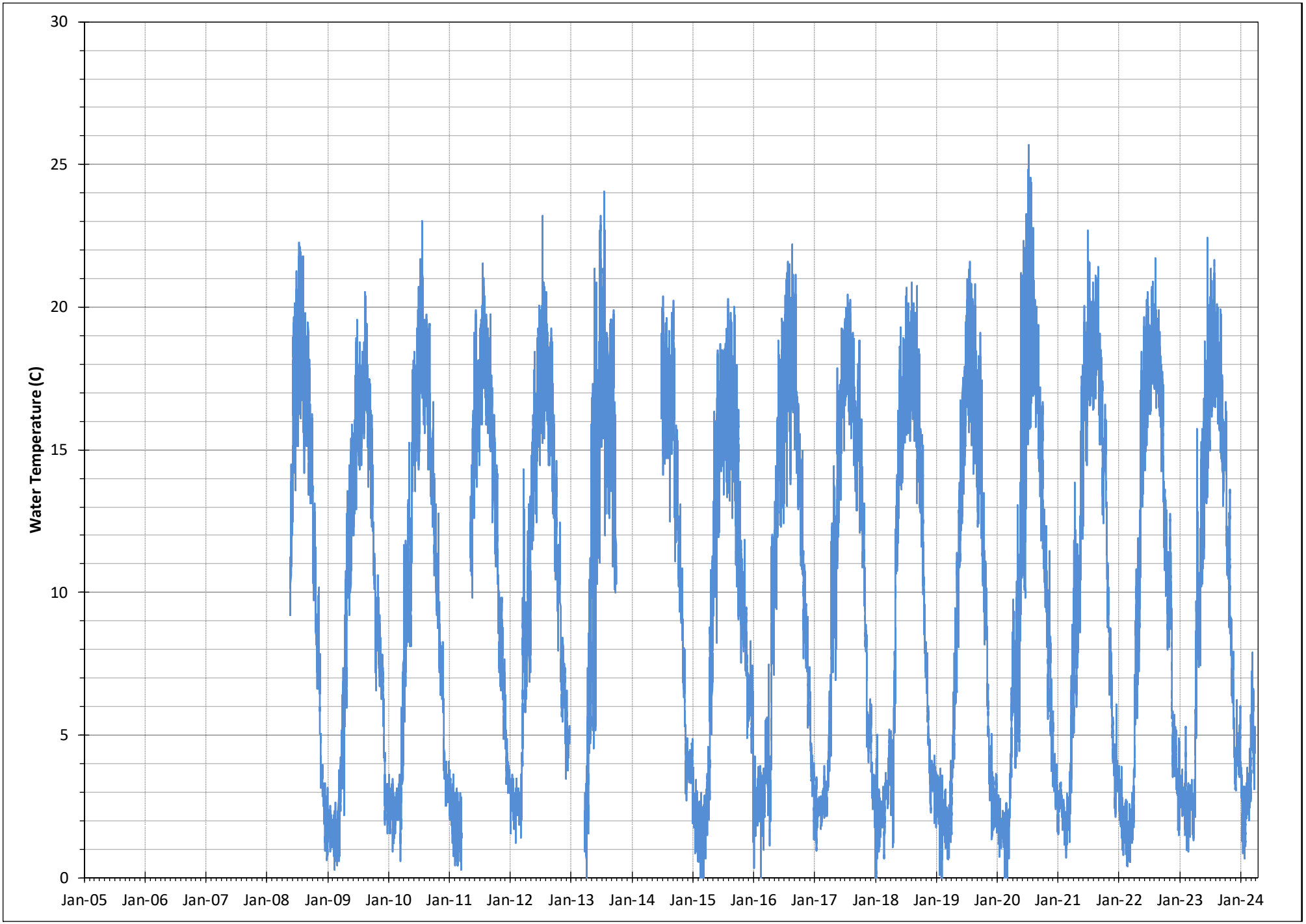
Groundwater Science Corp.
Monitoring Program



CBM Aggregates
Roszell Pit

Figure C9: SW1 Temperature Plot

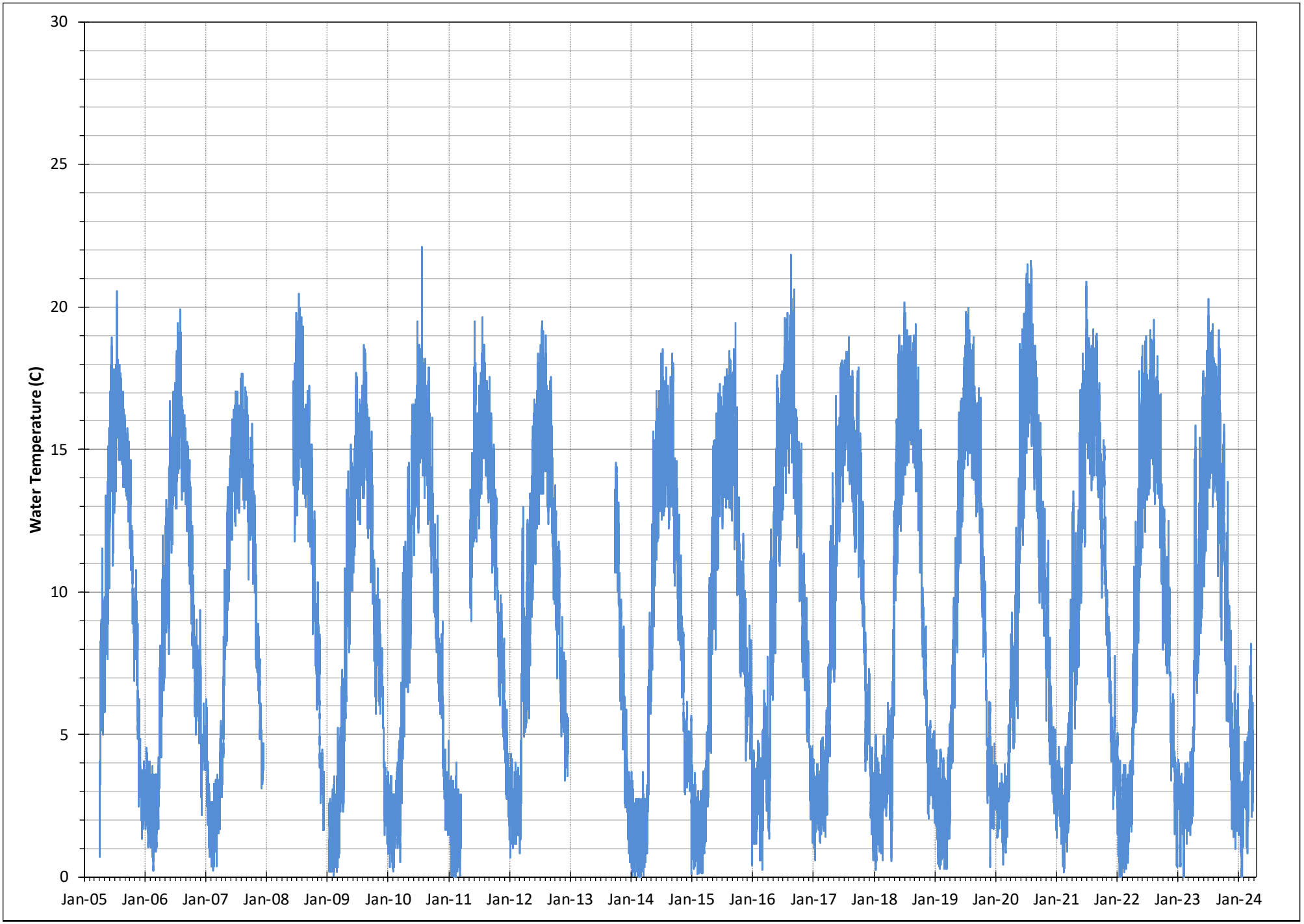
Groundwater Science Corp.
Monitoring Program



CBM Aggregates
Roszell Pit

Figure C10: SW2 Temperature Plot

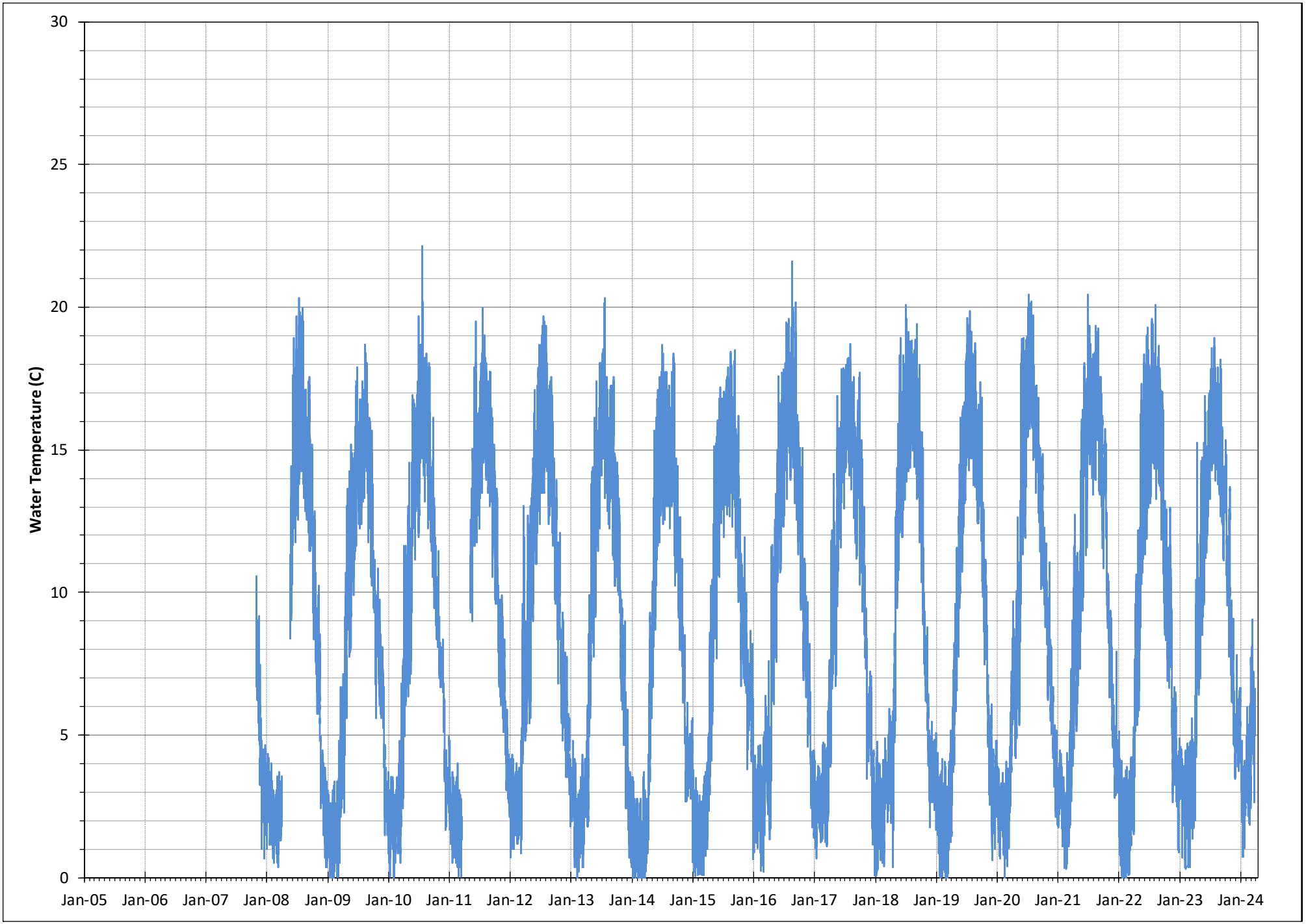
Groundwater Science Corp.
Monitoring Program



CBM Aggregates
Roszell Pit

Figure C11: SW3 Temperature Plot

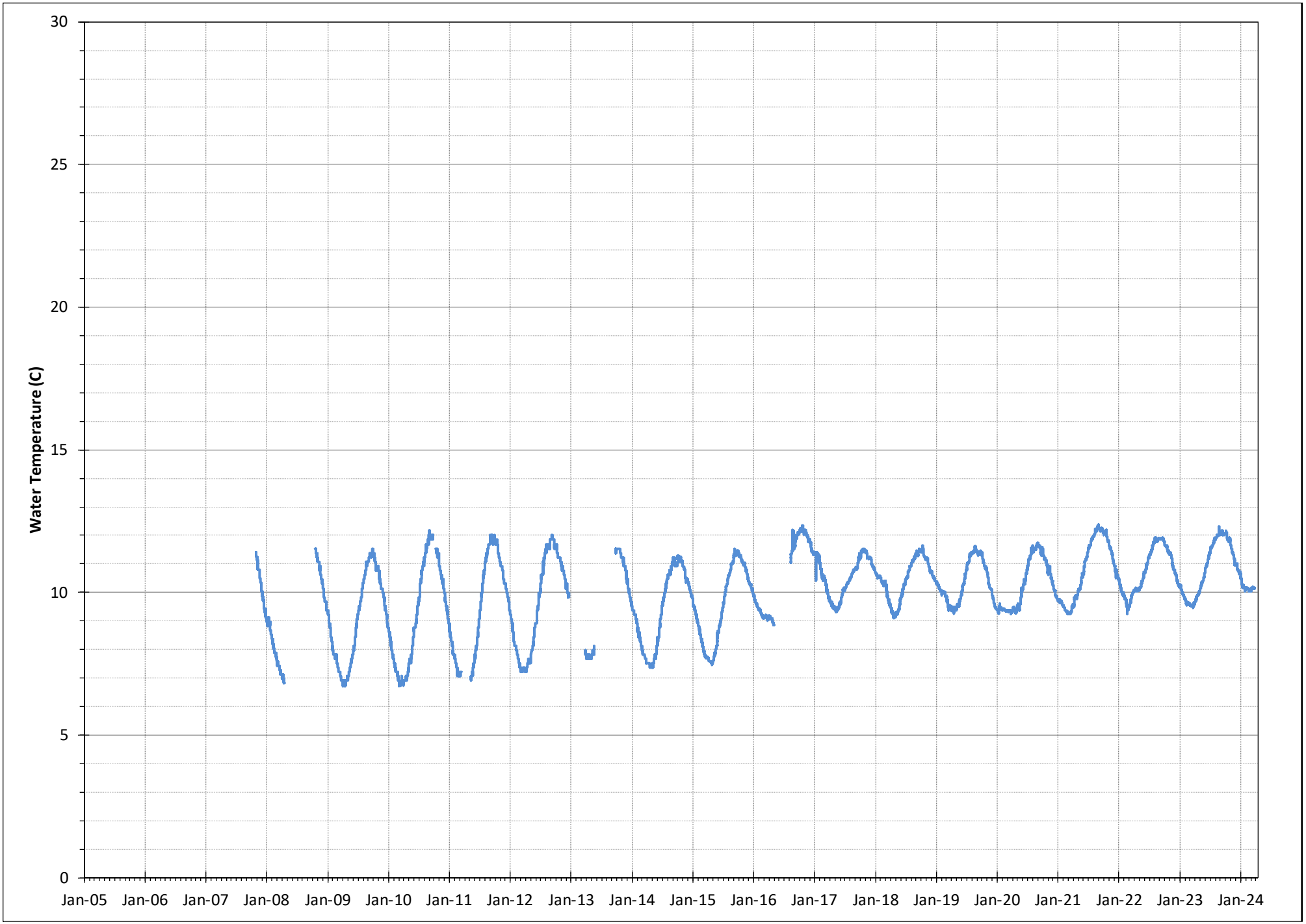
Groundwater Science Corp.
Monitoring Program



CBM Aggregates
Roszell Pit

Figure C12: SW4 Temperature Plot

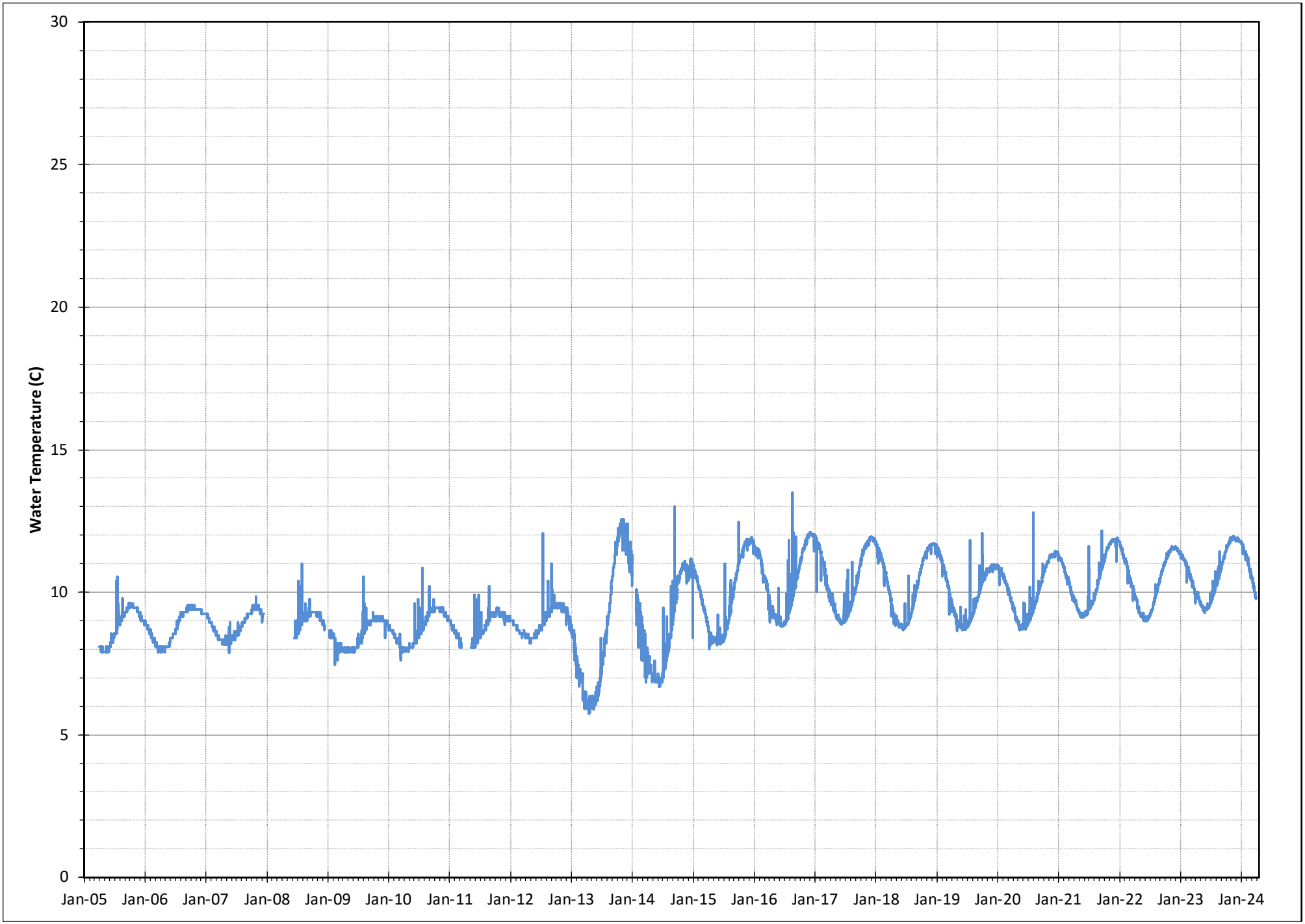
Groundwater Science Corp.
Monitoring Program

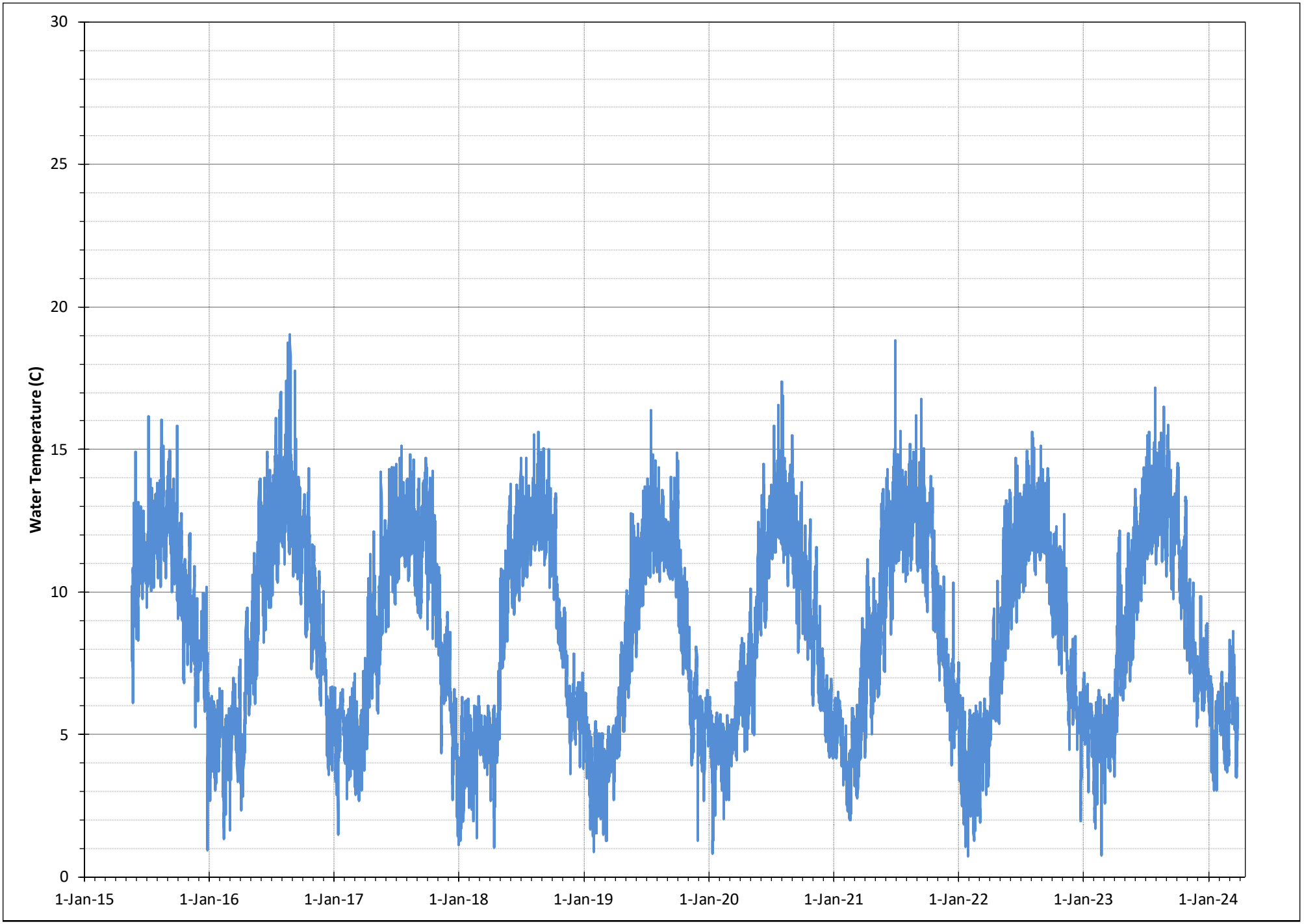


CBM Aggregates
Roszell Pit

Figure C13: SW5 Temperature Plot

Groundwater Science Corp.
Monitoring Program

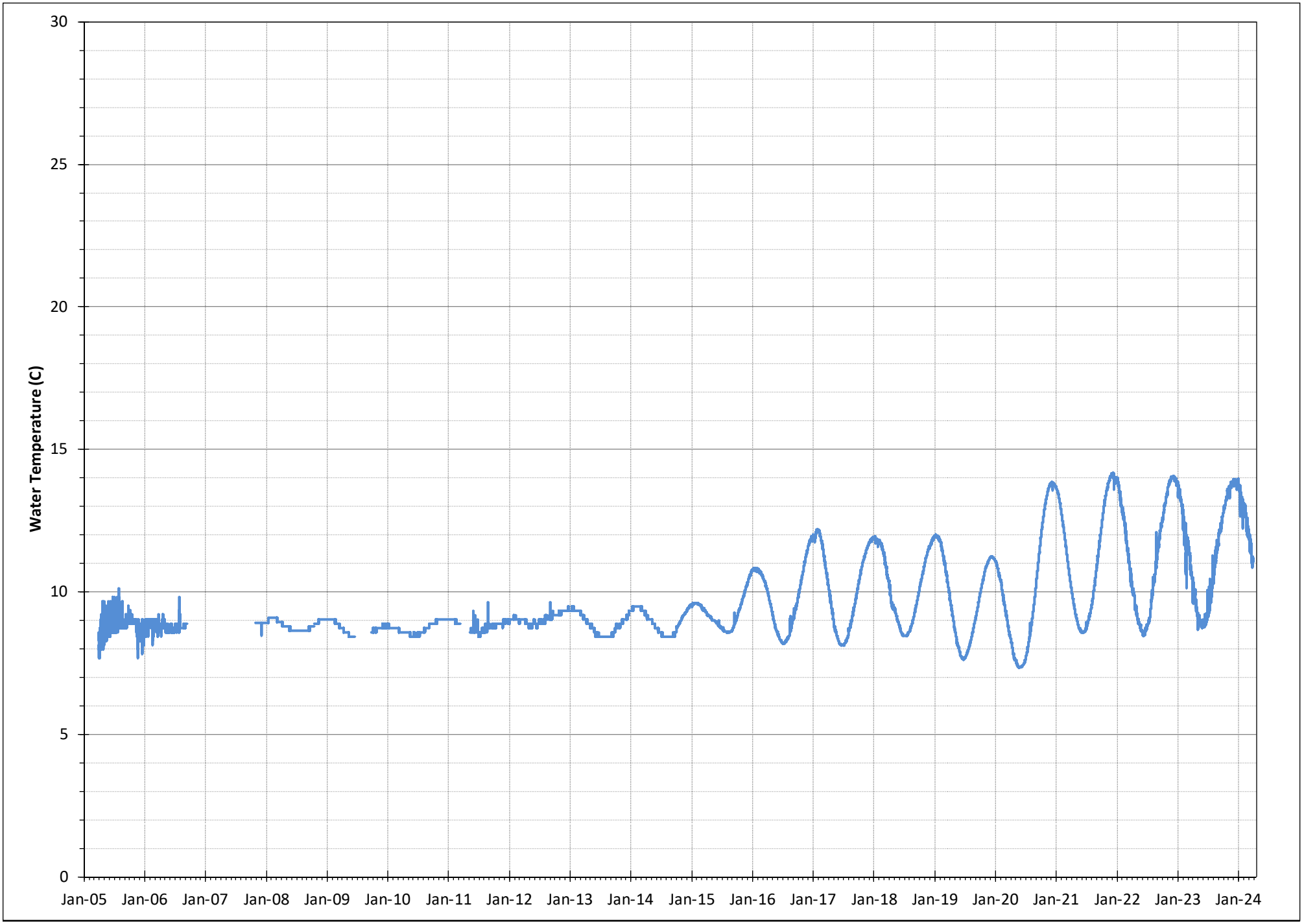

Water Temperature (C)
30
25
20
15
10
5
0
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Jan-17
Jan-18
Jan-19
Jan-20
Jan-21
Jan-22
Jan-23
Jan-24



CBM Aggregates
Roszell Road Pit

Figure C15: SW7 Temperature Plot

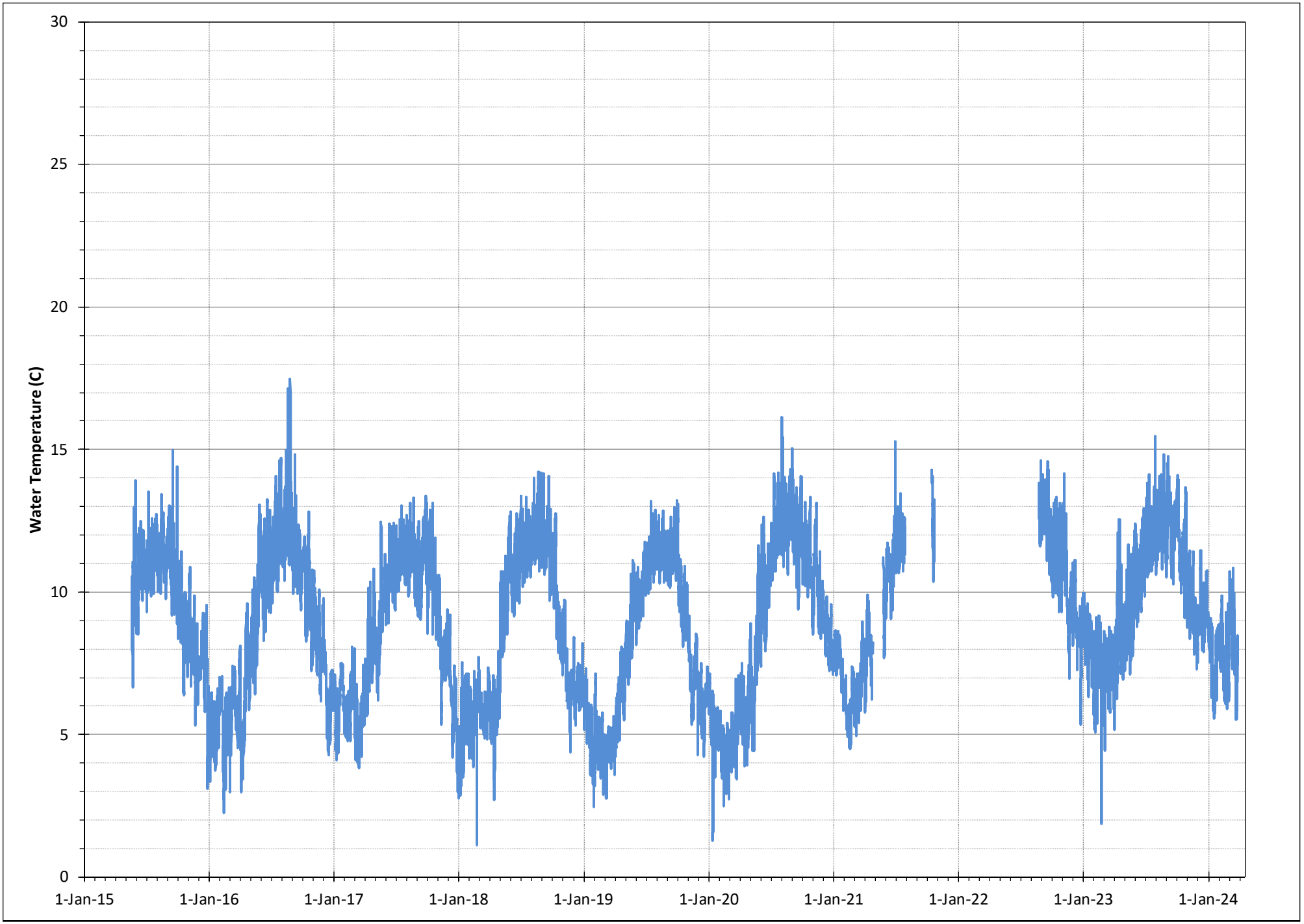
Groundwater Science Corp.
Monitoring Program

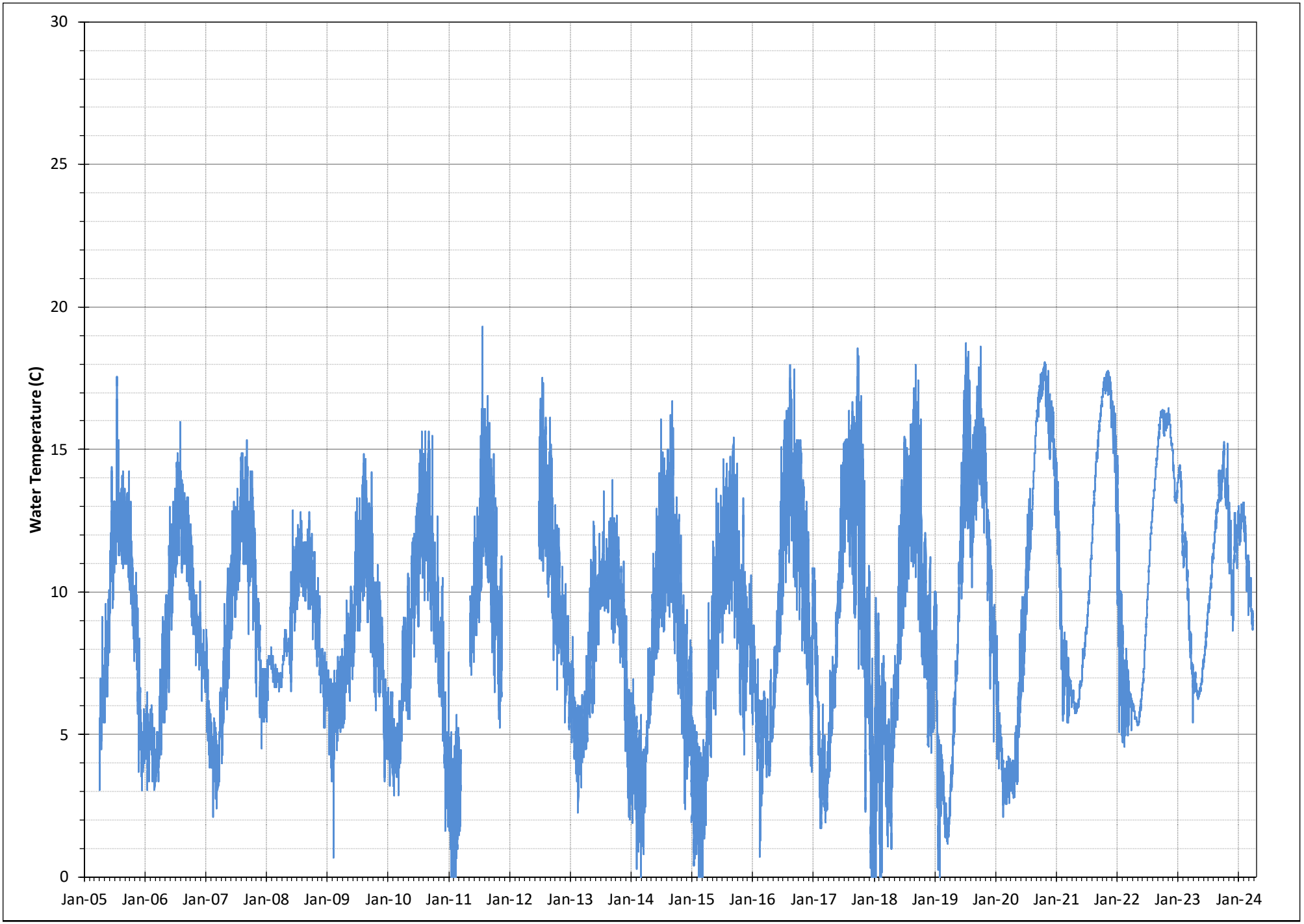


CBM Aggregates
Roszell Road Pit

Figure C16: SW8 Temperature Plot

Groundwater Science Corp.
Monitoring Program

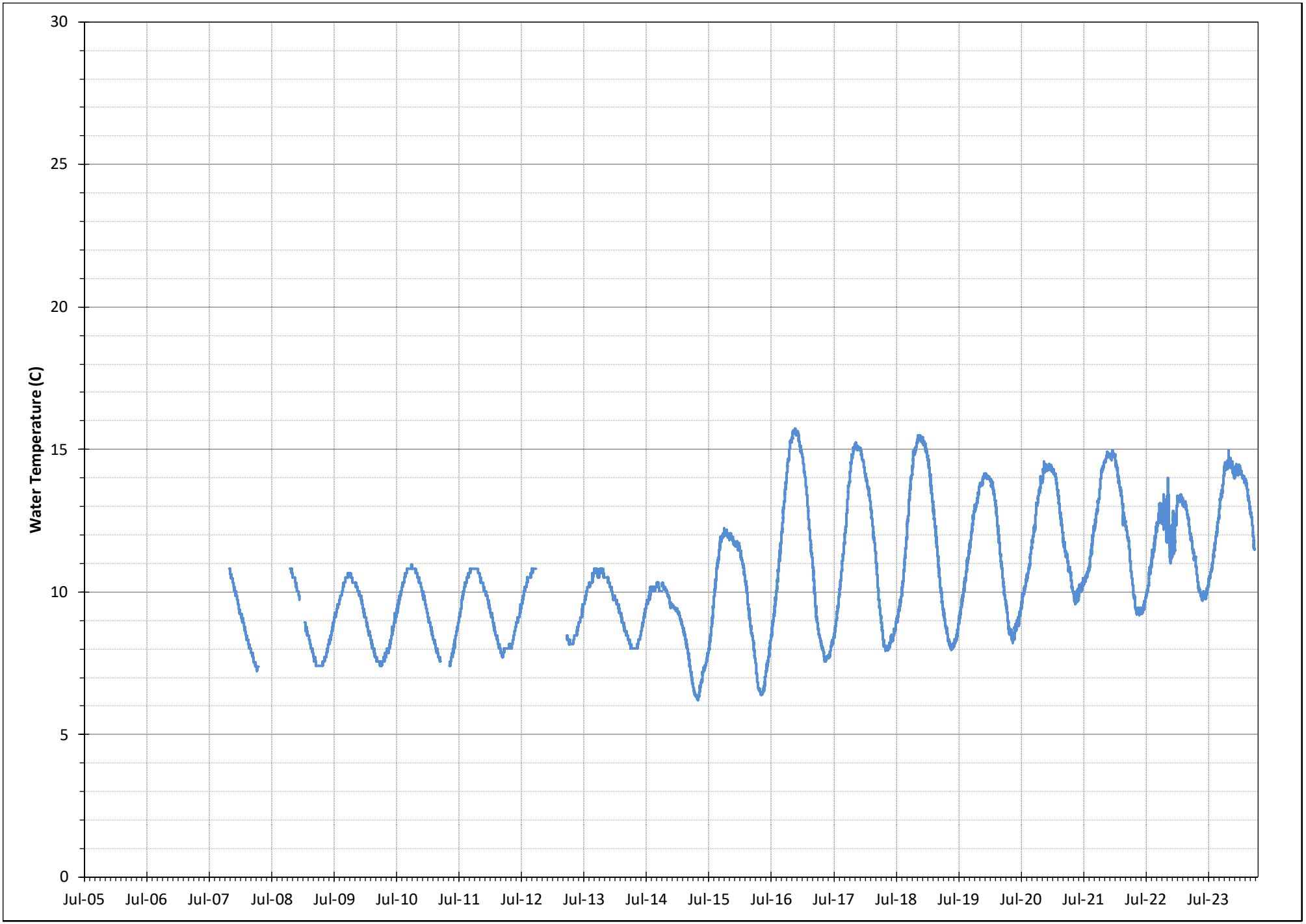

30
25
20
15
10
5
0
Water Temperature (C)
1-Jan-15
1-Jan-16
1-Jan-17
1-Jan-18
1-Jan-19
1-Jan-20
1-Jan-21
1-Jan-22
1-Jan-23
1-Jan-24



CBM Aggregates
Roszell Road Pit

Figure C18: SW10 Temperature Plot

Groundwater Science Corp.
Monitoring Program



CBM Aggregates
Roszell Pit

Figure C19: SW12 Temperature Plot

Groundwater Science Corp.
Monitoring Program

Appendix D
Water Quality Results

CERTIFICATE OF ANALYSIS

Work Order	: **WT2339694**	Page	: 1 of 5
Client	: **Groundwater Science Corp.**	Laboratory	: ALS Environmental - Waterloo
Contact	: Andrew Pentney	Account Manager	: Costas Farassoglou
Address	: 465 Kingscourt Drive Unit 2 Waterloo ON Canada N2K 3R5	Address	: 60 Northland Road, Unit 1 Waterloo ON Canada N2V 2B8
Telephone	: 519 746 6916	Telephone	: 613 225 8279
Project	: ROSZELL RD PIT	Date Samples Received	: 06-Dec-2023 13:10
PO	: ----	Date Analysis Commenced	: 06-Dec-2023
C-O-C number	: ----	Issue Date	: 12-Dec-2023 16:03
Sampler	: Dave Nahrgang		
Site	: ----		
Quote number	: WT21-GWSC100-001		
No. of samples received	: 5		
No. of samples analysed	: 5		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Greg Pokocky	Manager - Inorganics	Inorganics, Waterloo, Ontario
Jocelyn Kennedy	Department Manager - Semi-Volatile Organics	Organics, Waterloo, Ontario
John Tang	Lab Analyst	Inorganics, Waterloo, Ontario
Jon Fisher	Production Manager, Environmental	Inorganics, Waterloo, Ontario
Nik Perkio	Inorganics Analyst	Inorganics, Waterloo, Ontario
Nik Perkio	Inorganics Analyst	Metals, Waterloo, Ontario
Sarah Birch	VOC Section Supervisor	VOC, Waterloo, Ontario

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances

LOR: Limit of Reporting (detection limit).

Unit	*Description*
-	no units
µg/L	micrograms per litre
mg/L	milligrams per litre
pH units	pH units

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Qualifiers

Qualifier	*Description*
DLDS	*Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.*
DLM	*Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).*
OWP	*Organic water sample contained visible sediment (must be included as part of analysis). Measured concentrations of organic substances in water can be biased high due to presence of sediment.*
SUR-ND	*Surrogate recovery marginally exceeded ALS DQO. Reported non-detect results for associated samples were deemed to be unaffected.*
TKNI	*TKN result may be biased low due to Nitrate interference. Nitrate-N is > 10x TKN.*

Analytical Results

Sub-Matrix: Water
(Matrix: Water)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID	BH1	BH7D	BH5	BH105	BH8
					Client sampling date / time	06-Dec-2023 09:30	06-Dec-2023 10:00	06-Dec-2023 10:30	06-Dec-2023 10:45	06-Dec-2023 11:15
						WT2339694-001	WT2339694-002	WT2339694-003	WT2339694-004	WT2339694-005
						Result	Result	Result	Result	Result
Physical Tests										
pH	----	E108/WT	0.10	pH units		7.78	7.96	7.64	7.65	7.72
Anions and Nutrients										
Ammonia, total (as N)	7664-41-7	E298/WT	0.0050	mg/L		<0.0050	0.0071	<0.0050	0.0082	<0.0050
Bromide	24959-67-9	E235.Br/WT	0.10	mg/L		<0.10	<0.10	<0.50 DLDS	<0.10	<0.10
Chloride	16887-00-6	E235.Cl/WT	0.50	mg/L		46.8	40.9	135 DLDS	26.9	50.3
Fluoride	16984-48-8	E235.F/WT	0.020	mg/L		0.101	0.110	<0.100 DLDS	0.081	0.095
Nitrate (as N)	14797-55-8	E235.NO3/WT	0.020	mg/L		3.36	4.44	9.96 DLDS	14.9	5.42
Nitrite (as N)	14797-65-0	E235.NO2/WT	0.010	mg/L		<0.010	<0.010	<0.050 DLDS	<0.010	<0.010
Phosphorus, total	7723-14-0	E372-U/WT	0.0020	mg/L		0.0049	0.683 DLM	0.0134	1.17 DLM	0.0125
Sulfate (as SO4)	14808-79-8	E235.SO4/WT	0.30	mg/L		19.4	23.7	20.3 DLDS	30.4	36.4
Kjeldahl nitrogen, total [TKN]	----	E318/WT	0.200	mg/L		0.312 TKNI	0.398 TKNI	0.434 TKNI	1.13 TKNI	0.380 TKNI
Dissolved Metals										
Aluminum, dissolved	7429-90-5	E421/WT	0.0010	mg/L		0.0020	0.0022	<0.0010	0.0017	<0.0010
Antimony, dissolved	7440-36-0	E421/WT	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic, dissolved	7440-38-2	E421/WT	0.00010	mg/L		0.00014	0.00018	0.00012	0.00030	0.00019
Barium, dissolved	7440-39-3	E421/WT	0.00010	mg/L		0.0404	0.0390	0.0896	0.0583	0.0652
Beryllium, dissolved	7440-41-7	E421/WT	0.000020	mg/L		<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
Bismuth, dissolved	7440-69-9	E421/WT	0.000050	mg/L		<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron, dissolved	7440-42-8	E421/WT	0.010	mg/L		0.016	0.013	0.014	0.016	0.016
Cadmium, dissolved	7440-43-9	E421/WT	0.0000050	mg/L		0.0000327	0.0000293	0.0000845	0.0000451	0.0000489
Calcium, dissolved	7440-70-2	E421/WT	0.050	mg/L		50.1	45.0	99.0	89.6	83.7
Cesium, dissolved	7440-46-2	E421/WT	0.000010	mg/L		<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Chromium, dissolved	7440-47-3	E421/WT	0.00050	mg/L		<0.00050	<0.00050	<0.00050	0.00145	<0.00050
Cobalt, dissolved	7440-48-4	E421/WT	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	0.00016
Copper, dissolved	7440-50-8	E421/WT	0.00020	mg/L		0.00044	0.00065	0.00047	0.00180	0.00057
Iron, dissolved	7439-89-6	E421/WT	0.010	mg/L		<0.010	<0.010	<0.010	<0.010	<0.010
Lead, dissolved	7439-92-1	E421/WT	0.000050	mg/L		<0.000050	<0.000050	<0.000050	0.000093	<0.000050
Lithium, dissolved	7439-93-2	E421/WT	0.0010	mg/L		0.0051	0.0024	0.0023	0.0018	0.0032
Magnesium, dissolved	7439-95-4	E421/WT	0.0050	mg/L		22.5	25.6	29.9	29.7	32.0

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID	BH1	BH7D	BH5	BH105	BH8
					Client sampling date / time	06-Dec-2023 09:30	06-Dec-2023 10:00	06-Dec-2023 10:30	06-Dec-2023 10:45	06-Dec-2023 11:15
						WT2339694-001	WT2339694-002	WT2339694-003	WT2339694-004	WT2339694-005
						Result	Result	Result	Result	Result
Dissolved Metals										
Manganese, dissolved	7439-96-5	E421/WT	0.00010	mg/L		0.00015	0.00194	0.00023	0.00110	0.0555
Molybdenum, dissolved	7439-98-7	E421/WT	0.000050	mg/L		0.000499	0.000696	0.000162	0.000217	0.000527
Nickel, dissolved	7440-02-0	E421/WT	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Phosphorus, dissolved	7723-14-0	E421/WT	0.050	mg/L		<0.050	<0.050	<0.050	<0.050	<0.050
Potassium, dissolved	7440-09-7	E421/WT	0.050	mg/L		1.65	1.77	1.78	2.96	1.62
Rubidium, dissolved	7440-17-7	E421/WT	0.00020	mg/L		0.00129	0.00224	0.00155	0.00041	0.00188
Selenium, dissolved	7782-49-2	E421/WT	0.000050	mg/L		0.000051	<0.000050	0.000381	0.000407	0.000189
Silicon, dissolved	7440-21-3	E421/WT	0.050	mg/L		4.26	3.99	6.62	5.99	5.36
Silver, dissolved	7440-22-4	E421/WT	0.000010	mg/L		<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium, dissolved	7440-23-5	E421/WT	0.050	mg/L		18.9	18.3	79.4	15.1	21.1
Strontium, dissolved	7440-24-6	E421/WT	0.00020	mg/L		0.146	0.0872	0.157	0.129	0.116
Sulfur, dissolved	7704-34-9	E421/WT	0.50	mg/L		6.94	8.38	7.95	11.3	12.9
Tellurium, dissolved	13494-80-9	E421/WT	0.00020	mg/L		<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Thallium, dissolved	7440-28-0	E421/WT	0.000010	mg/L		<0.000010	<0.000010	<0.000010	<0.000010	0.000031
Thorium, dissolved	7440-29-1	E421/WT	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Tin, dissolved	7440-31-5	E421/WT	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium, dissolved	7440-32-6	E421/WT	0.00030	mg/L		<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Tungsten, dissolved	7440-33-7	E421/WT	0.00010	mg/L		0.00036	<0.00010	<0.00010	<0.00010	<0.00010
Uranium, dissolved	7440-61-1	E421/WT	0.000010	mg/L		0.000271	0.000386	0.000453	0.000401	0.00107
Vanadium, dissolved	7440-62-2	E421/WT	0.00050	mg/L		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc, dissolved	7440-66-6	E421/WT	0.0010	mg/L		0.0091	0.0071	0.0250	0.0133	0.0118
Zirconium, dissolved	7440-67-7	E421/WT	0.00030	mg/L		<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Dissolved metals filtration location	----	EP421/WT	-	-		Field	Field	Field	Field	Field
Volatile Organic Compounds										
Benzene	71-43-2	E611A/WT	0.50	µg/L		<0.50	<0.50 OWP	<0.50	<0.50 OWP	<0.50
Ethylbenzene	100-41-4	E611A/WT	0.50	µg/L		<0.50	<0.50 OWP	<0.50	<0.50 OWP	<0.50
Toluene	108-88-3	E611A/WT	0.50	µg/L		<0.50	<0.50 OWP	<0.50	<0.50 OWP	<0.50
Xylene, m+p-	179601-23-1	E611A/WT	0.40	µg/L		<0.40	<0.40 OWP	<0.40	<0.40 OWP	<0.40
Xylene, o-	95-47-6	E611A/WT	0.30	µg/L		<0.30	<0.30 OWP	<0.30	<0.30 OWP	<0.30
Xylenes, total	1330-20-7	E611A/WT	0.50	µg/L		<0.50	<0.50	<0.50	<0.50	<0.50

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID	BH1	BH7D	BH5	BH105	BH8
					Client sampling date / time	06-Dec-2023 09:30	06-Dec-2023 10:00	06-Dec-2023 10:30	06-Dec-2023 10:45	06-Dec-2023 11:15
						WT2339694-001	WT2339694-002	WT2339694-003	WT2339694-004	WT2339694-005
						Result	Result	Result	Result	Result
Volatile Organic Compounds										
BTEX, total	----	E611A/WT	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Hydrocarbons										
F1 (C6-C10)	----	E581.F1-L/WT	25	µg/L		<25	<25 OWP	<25	<25 OWP	<25
F2 (C10-C16)	----	E601.SG/WT	100	µg/L		<100	<100	<100	<100	<100
F3 (C16-C34)	----	E601.SG/WT	250	µg/L		<250	<250	<250	<250	<250
F4 (C34-C50)	----	E601.SG/WT	250	µg/L		<250	<250	<250	<250	<250
F1-BTEX	----	EC580/WT	25	µg/L		<25	<25	<25	<25	<25
Hydrocarbons, total (C6-C50)	n/a	EC581SG/WT	240	µg/L		<370	<370	<370	<370	<370
Chromatogram to baseline at nC50	n/a	E601.SG/WT	-	-		YES	YES	YES	YES	YES
Hydrocarbons Surrogates										
Bromobenzotrifluoride, 2- (F2-F4 surrogate)	392-83-6	E601.SG/WT	1.0	%		70.2	74.6	75.3	76.8	74.6
Dichlorotoluene, 3,4-	95-75-0	E581.F1-L/WT	1.0	%		64.5	50.2 SUR-ND	78.1	66.3	72.6
Volatile Organic Compounds Surrogates										
Bromofluorobenzene, 4-	460-00-4	E611A/WT	1.0	%		89.1	84.1	94.0	88.2	89.5
Difluorobenzene, 1,4-	540-36-3	E611A/WT	1.0	%		99.0	99.2	98.3	97.9	97.9

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.

ALS Canada Ltd.

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CERTIFICATE OF ANALYSIS

Work Order	: **WT2339002**	Page	: 1 of 8
Client	: **Groundwater Science Corp.**	Laboratory	: ALS Environmental - Waterloo
Contact	: Andrew Pentney	Account Manager	: Costas Farassoglou
Address	: 465 Kingscourt Drive Unit 2 Waterloo ON Canada N2K 3R5	Address	: 60 Northland Road, Unit 1 Waterloo ON Canada N2V 2B8
Telephone	: 519 746 6916	Telephone	: 613 225 8279
Project	: ROSZELL RD PIT	Date Samples Received	: 29-Nov-2023 14:20
PO	: ----	Date Analysis Commenced	: 29-Nov-2023
C-O-C number	: ----	Issue Date	: 05-Dec-2023 10:33
Sampler	: Dave Nahrgang		
Site	: ----		
Quote number	: WT21-GWSC100-001		
No. of samples received	: 6		
No. of samples analysed	: 6		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Greg Pokocky	Manager - Inorganics	Inorganics, Waterloo, Ontario
Greg Pokocky	Manager - Inorganics	Metals, Waterloo, Ontario
Jeremy Gingras	Supervisor - Semi-Volatile Instrumentation	Organics, Waterloo, Ontario
Sarah Birch	VOC Section Supervisor	VOC, Waterloo, Ontario

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.
Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit).

Unit	*Description*
-	no units
µg/L	micrograms per litre
mg/L	milligrams per litre
pH units	pH units

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Qualifiers

Qualifier	*Description*
DLM	*Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).*
OWP	*Organic water sample contained visible sediment (must be included as part of analysis). Measured concentrations of organic substances in water can be biased high due to presence of sediment.*
SUR-ND	*Surrogate recovery marginally exceeded ALS DQO. Reported non-detect results for associated samples were deemed to be unaffected.*
TKNI	*TKN result may be biased low due to Nitrate interference. Nitrate-N is > 10x TKN.*

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID	Extraction Pond	SW10	SW8	SW6	SW3
					Client sampling date / time	29-Nov-2023 11:00	29-Nov-2023 11:30	29-Nov-2023 11:45	29-Nov-2023 12:00	29-Nov-2023 12:45
						WT2339002-001	WT2339002-002	WT2339002-003	WT2339002-004	WT2339002-005
						Result	Result	Result	Result	Result
Physical Tests										
pH	----	E108/WT	0.10	pH units		8.38	8.31	8.23	8.23	8.39
Anions and Nutrients										
Ammonia, total (as N)	7664-41-7	E298/WT	0.0050	mg/L		0.0540	0.0076	<0.0050	0.0060	0.0135
Bromide	24959-67-9	E235.Br/WT	0.10	mg/L		<0.10	<0.10	<0.10	<0.10	<0.10
Chloride	16887-00-6	E235.Cl/WT	0.50	mg/L		41.2	40.4	39.8	43.8	52.2
Fluoride	16984-48-8	E235.F/WT	0.020	mg/L		0.080	0.091	0.110	0.096	0.070
Nitrate (as N)	14797-55-8	E235.NO3/WT	0.020	mg/L		5.15	2.13	3.82	4.02	8.14
Nitrite (as N)	14797-65-0	E235.NO2/WT	0.010	mg/L		0.058	<0.010	<0.010	<0.010	<0.010
Phosphorus, total	7723-14-0	E372-U/WT	0.0020	mg/L		0.0142	0.185 DLM	0.0070	0.0198	0.0628
Sulfate (as SO4)	14808-79-8	E235.SO4/WT	0.30	mg/L		23.3	23.0	23.1	21.3	21.0
Kjeldahl nitrogen, total [TKN]	----	E318/WT	0.200	mg/L		0.870	3.98	0.593	0.206 TKNI	0.713 TKNI
Total Metals										
Aluminum, total	7429-90-5	E420/WT	0.0030	mg/L		0.0166	0.633	0.0790	<0.0030	0.257
Antimony, total	7440-36-0	E420/WT	0.00010	mg/L		0.00011	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic, total	7440-38-2	E420/WT	0.00010	mg/L		0.00040	0.00057	0.00024	0.00016	0.00036
Barium, total	7440-39-3	E420/WT	0.00010	mg/L		0.0289	0.0563	0.0447	0.0403	0.0532
Beryllium, total	7440-41-7	E420/WT	0.000020	mg/L		<0.000020	0.000042	<0.000020	<0.000020	<0.000020
Bismuth, total	7440-69-9	E420/WT	0.000050	mg/L		<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron, total	7440-42-8	E420/WT	0.010	mg/L		0.014	0.018	0.014	0.014	0.013
Cadmium, total	7440-43-9	E420/WT	0.0000050	mg/L		0.0000150	0.000470	0.000153	0.0000329	0.000122
Calcium, total	7440-70-2	E420/WT	0.050	mg/L		38.4	62.4	53.2	51.0	83.1
Cesium, total	7440-46-2	E420/WT	0.000010	mg/L		<0.000010	0.000078	0.000012	<0.000010	0.000028
Chromium, total	7440-47-3	E420/WT	0.00050	mg/L		<0.00050	0.00150	<0.00050	<0.00050	0.00085
Cobalt, total	7440-48-4	E420/WT	0.00010	mg/L		<0.00010	0.00041	<0.00010	<0.00010	0.00018
Copper, total	7440-50-8	E420/WT	0.00050	mg/L		0.00130	0.00884	0.00347	<0.00050	0.00277
Iron, total	7439-89-6	E420/WT	0.010	mg/L		0.023	0.999	0.075	<0.010	0.420
Lead, total	7439-92-1	E420/WT	0.000050	mg/L		0.000165	0.00851	0.00134	<0.000050	0.00256
Lithium, total	7439-93-2	E420/WT	0.0010	mg/L		0.0018	0.0026	0.0020	0.0020	0.0017
Magnesium, total	7439-95-4	E420/WT	0.0050	mg/L		27.8	29.1	26.0	23.8	28.3

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID	Extraction Pond	SW10	SW8	SW6	SW3
					Client sampling date / time	29-Nov-2023 11:00	29-Nov-2023 11:30	29-Nov-2023 11:45	29-Nov-2023 12:00	29-Nov-2023 12:45
						WT2339002-001	WT2339002-002	WT2339002-003	WT2339002-004	WT2339002-005
						Result	Result	Result	Result	Result
Total Metals										
Manganese, total	7439-96-5	E420/WT	0.00010	mg/L		0.00181	0.0970	0.0164	0.00023	0.0420
Molybdenum, total	7439-98-7	E420/WT	0.000050	mg/L		0.000495	0.000523	0.000610	0.000598	0.000368
Nickel, total	7440-02-0	E420/WT	0.00050	mg/L		<0.00050	0.00140	<0.00050	<0.00050	0.00057
Phosphorus, total	7723-14-0	E420/WT	0.050	mg/L		<0.050	0.094	<0.050	<0.050	0.072
Potassium, total	7440-09-7	E420/WT	0.050	mg/L		1.69	1.85	1.78	1.72	2.03
Rubidium, total	7440-17-7	E420/WT	0.00020	mg/L		0.00110	0.00283	0.00210	0.00158	0.00140
Selenium, total	7782-49-2	E420/WT	0.000050	mg/L		0.000120	0.000389	0.000066	0.000063	0.000172
Silicon, total	7440-21-3	E420/WT	0.10	mg/L		1.54	4.94	4.06	4.30	5.28
Silver, total	7440-22-4	E420/WT	0.000010	mg/L		<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium, total	7440-23-5	E420/WT	0.050	mg/L		18.9	18.0	18.5	20.9	26.0
Strontium, total	7440-24-6	E420/WT	0.00020	mg/L		0.0830	0.106	0.0953	0.106	0.118
Sulfur, total	7704-34-9	E420/WT	0.50	mg/L		8.45	8.42	8.41	7.66	7.88
Tellurium, total	13494-80-9	E420/WT	0.00020	mg/L		<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Thallium, total	7440-28-0	E420/WT	0.000010	mg/L		0.000032	0.000055	0.000021	<0.000010	0.000015
Thorium, total	7440-29-1	E420/WT	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Tin, total	7440-31-5	E420/WT	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	0.00030
Titanium, total	7440-32-6	E420/WT	0.00030	mg/L		0.00058	0.0190	0.00185	<0.00030	0.00823
Tungsten, total	7440-33-7	E420/WT	0.00010	mg/L		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Uranium, total	7440-61-1	E420/WT	0.000010	mg/L		0.000427	0.000680	0.000434	0.000358	0.000533
Vanadium, total	7440-62-2	E420/WT	0.00050	mg/L		<0.00050	0.00134	<0.00050	<0.00050	0.00065
Zinc, total	7440-66-6	E420/WT	0.0030	mg/L		0.0035	0.0716	0.0225	0.0079	0.0305
Zirconium, total	7440-67-7	E420/WT	0.00020	mg/L		<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Hydrocarbons										
F1 (C6-C10)	----	E581.F1-L/WT	25	µg/L		<25	<25 OWP	<25 OWP	<25	<25 OWP
F2 (C10-C16)	----	E601.SG/WT	100	µg/L		<100	<100	<100	<100	<100
F3 (C16-C34)	----	E601.SG/WT	250	µg/L		<250	<250	<250	<250	<250
F4 (C34-C50)	----	E601.SG/WT	250	µg/L		<250	<250	<250	<250	<250
Hydrocarbons, total (C6-C50)	n/a	EC581SG/WT	240	µg/L		<370	<370	<370	<370	<370
Chromatogram to baseline at nC50	n/a	E601.SG/WT	-	-		YES	YES	YES	YES	YES
Hydrocarbons Surrogates										

Analytical Results

Sub-Matrix: Water (Matrix: Water)					Client sample ID	Extraction Pond	SW10	SW8	SW6	SW3
					Client sampling date / time	29-Nov-2023 11:00	29-Nov-2023 11:30	29-Nov-2023 11:45	29-Nov-2023 12:00	29-Nov-2023 12:45
Analyte	CAS Number	Method/Lab	LOR	Unit		WT2339002-001	WT2339002-002	WT2339002-003	WT2339002-004	WT2339002-005
						Result	Result	Result	Result	Result
Hydrocarbons Surrogates										
Bromobenzotrifluoride, 2- (F2-F4 surrogate)	392-83-6	E601.SG/WT	1.0	%		96.9	94.7	91.2	90.4	93.5
Dichlorotoluene, 3,4-	95-75-0	E581.F1-L/WT	1.0	%		129	127	140	143 SUR-ND	126

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.

Analytical Results

Sub-Matrix: Water (Matrix: Water)				Client sample ID	SW2	----	----	----	----
				Client sampling date / time	29-Nov-2023 13:00	----	----	----	----
Analyte	CAS Number	Method/Lab	LOR	Unit	WT2339002-006	--------	--------	--------	--------
					Result	----	----	----	----
Physical Tests									
pH	----	E108/WT	0.10	pH units	8.37	----	----	----	----
Anions and Nutrients									
Ammonia, total (as N)	7664-41-7	E298/WT	0.0050	mg/L	<0.0050	----	----	----	----
Bromide	24959-67-9	E235.Br/WT	0.10	mg/L	<0.10	----	----	----	----
Chloride	16887-00-6	E235.Cl/WT	0.50	mg/L	54.0	----	----	----	----
Fluoride	16984-48-8	E235.F/WT	0.020	mg/L	0.059	----	----	----	----
Nitrate (as N)	14797-55-8	E235.NO3/WT	0.020	mg/L	10.6	----	----	----	----
Nitrite (as N)	14797-65-0	E235.NO2/WT	0.010	mg/L	<0.010	----	----	----	----
Phosphorus, total	7723-14-0	E372-U/WT	0.0020	mg/L	0.0093	----	----	----	----
Sulfate (as SO4)	14808-79-8	E235.SO4/WT	0.30	mg/L	19.8	----	----	----	----
Kjeldahl nitrogen, total [TKN]	----	E318/WT	0.200	mg/L	0.462 TKNI	----	----	----	----
Total Metals									
Aluminum, total	7429-90-5	E420/WT	0.0030	mg/L	0.0187	----	----	----	----
Antimony, total	7440-36-0	E420/WT	0.00010	mg/L	<0.00010	----	----	----	----
Arsenic, total	7440-38-2	E420/WT	0.00010	mg/L	0.00026	----	----	----	----
Barium, total	7440-39-3	E420/WT	0.00010	mg/L	0.0458	----	----	----	----
Beryllium, total	7440-41-7	E420/WT	0.000020	mg/L	<0.000020	----	----	----	----
Bismuth, total	7440-69-9	E420/WT	0.000050	mg/L	<0.000050	----	----	----	----
Boron, total	7440-42-8	E420/WT	0.010	mg/L	0.012	----	----	----	----
Cadmium, total	7440-43-9	E420/WT	0.0000050	mg/L	0.0000288	----	----	----	----
Calcium, total	7440-70-2	E420/WT	0.050	mg/L	87.9	----	----	----	----
Cesium, total	7440-46-2	E420/WT	0.000010	mg/L	<0.000010	----	----	----	----
Chromium, total	7440-47-3	E420/WT	0.00050	mg/L	<0.00050	----	----	----	----
Cobalt, total	7440-48-4	E420/WT	0.00010	mg/L	<0.00010	----	----	----	----
Copper, total	7440-50-8	E420/WT	0.00050	mg/L	0.00070	----	----	----	----
Iron, total	7439-89-6	E420/WT	0.010	mg/L	0.028	----	----	----	----
Lead, total	7439-92-1	E420/WT	0.000050	mg/L	0.000157	----	----	----	----
Lithium, total	7439-93-2	E420/WT	0.0010	mg/L	0.0011	----	----	----	----
Magnesium, total	7439-95-4	E420/WT	0.0050	mg/L	28.9	----	----	----	----
Manganese, total	7439-96-5	E420/WT	0.00010	mg/L	0.00822	----	----	----	----

Analytical Results

Sub-Matrix: Water (Matrix: Water)					Client sample ID	SW2	----	----	----	----
					Client sampling date / time	29-Nov-2023 13:00	----	----	----	----
Analyte	CAS Number	Method/Lab	LOR	Unit		WT2339002-006	--------	--------	--------	--------
						Result	----	----	----	----
Total Metals										
Molybdenum, total	7439-98-7	E420/WT	0.000050	mg/L		0.000235	----	----	----	----
Nickel, total	7440-02-0	E420/WT	0.00050	mg/L		<0.00050	----	----	----	----
Phosphorus, total	7723-14-0	E420/WT	0.050	mg/L		<0.050	----	----	----	----
Potassium, total	7440-09-7	E420/WT	0.050	mg/L		1.79	----	----	----	----
Rubidium, total	7440-17-7	E420/WT	0.00020	mg/L		0.00101	----	----	----	----
Selenium, total	7782-49-2	E420/WT	0.000050	mg/L		0.000129	----	----	----	----
Silicon, total	7440-21-3	E420/WT	0.10	mg/L		4.92	----	----	----	----
Silver, total	7440-22-4	E420/WT	0.000010	mg/L		<0.000010	----	----	----	----
Sodium, total	7440-23-5	E420/WT	0.050	mg/L		28.8	----	----	----	----
Strontium, total	7440-24-6	E420/WT	0.00020	mg/L		0.121	----	----	----	----
Sulfur, total	7704-34-9	E420/WT	0.50	mg/L		7.23	----	----	----	----
Tellurium, total	13494-80-9	E420/WT	0.00020	mg/L		<0.00020	----	----	----	----
Thallium, total	7440-28-0	E420/WT	0.000010	mg/L		<0.000010	----	----	----	----
Thorium, total	7440-29-1	E420/WT	0.00010	mg/L		<0.00010	----	----	----	----
Tin, total	7440-31-5	E420/WT	0.00010	mg/L		<0.00010	----	----	----	----
Titanium, total	7440-32-6	E420/WT	0.00030	mg/L		0.00064	----	----	----	----
Tungsten, total	7440-33-7	E420/WT	0.00010	mg/L		<0.00010	----	----	----	----
Uranium, total	7440-61-1	E420/WT	0.000010	mg/L		0.000518	----	----	----	----
Vanadium, total	7440-62-2	E420/WT	0.00050	mg/L		<0.00050	----	----	----	----
Zinc, total	7440-66-6	E420/WT	0.0030	mg/L		0.0088	----	----	----	----
Zirconium, total	7440-67-7	E420/WT	0.00020	mg/L		<0.00020	----	----	----	----
Hydrocarbons										
F1 (C6-C10)	----	E581.F1-L/WT	25	µg/L		<25	----	----	----	----
F2 (C10-C16)	----	E601.SG/WT	100	µg/L		<100	----	----	----	----
F3 (C16-C34)	----	E601.SG/WT	250	µg/L		<250	----	----	----	----
F4 (C34-C50)	----	E601.SG/WT	250	µg/L		<250	----	----	----	----
Hydrocarbons, total (C6-C50)	n/a	EC581SG/WT	240	µg/L		<370	----	----	----	----
Chromatogram to baseline at nC50	n/a	E601.SG/WT	-	-		YES	----	----	----	----
Hydrocarbons Surrogates										
Bromobenzotrifluoride, 2- (F2-F4 surrogate)	392-83-6	E601.SG/WT	1.0	%		82.7	----	----	----	----

Analytical Results

Sub-Matrix: Water (Matrix: Water)					Client sample ID	SW2	----	----	----	----
					Client sampling date / time	29-Nov-2023 13:00	----	----	----	----
Analyte	CAS Number	Method/Lab	LOR	Unit		WT2339002-006	--------	--------	--------	--------
						Result	----	----	----	----
Hydrocarbons Surrogates										
Dichlorotoluene, 3,4-	95-75-0	E581.F1-L/WT	1.0	%		148 SUR-ND	----	----	----	----

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.