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Wellington City Council
07-Aug-2020

# Southern Landfill Annual Monitoring Report - Water Quality Review, June 2017 to May 2020

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Client: Wellington City Council

Co No.: N/A

Prepared by

**AECOM New Zealand Limited**
Level 19, 171 Featherston Street, Wellington 6011, PO Box 27277, Wellington 6141, New Zealand
T +64 4 896 6000 F +64 4 896 6001 www.aecom.com

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# 1.0 Introduction

## 1.1 Terms of Reference

This report has been prepared for Wellington City Council (WCC) by AECOM New Zealand Limited (AECOM). It presents a summary and interpretation of surface water and groundwater monitoring results obtained by WCC at the Southern Landfill (SLF), Wellington, as required under conditions 25, 26 and 27 and 28 of Resource Consent Number WGN940045 (01) (SLF consent). This report takes account of surface water and groundwater monitoring data obtained over the three year period June 2017 to May 2020 and includes a description of the following:

- When sampling events took place;
- Main trends in the data for each sampling event; and
- Likely reasons for 'significant' changes observed in the data between monitoring events.

This report forms an addendum to the 2020 Annual Monitoring report prepared by WCC for Greater Wellington Regional Council (GWRC) as required under condition 29 of the SLF consent.

## 1.2 SLF Consent Conditions 25, 26, 27 and 28

A summary of the requirements under SLF consent conditions 25, 26, 27 and 28 are provided below. The parameters included in the compliance monitoring are considered to be contaminants of concern for the landfill.

**Condition 25:**

Monthly monitoring of bores BH2A, BH2B, BH3A (subsequently replaced by BH103A) and BH3B (subsequently replaced by BH103B) and Careys Gully Stream upstream (Upstr Surface Water 1) and downstream (Dstr Surface Water 2) of the landfill for the following parameters:

- pH,
- Conductivity,
- Ammonia as Nitrogen ($NH_4$-N),
- Faecal Coliforms,
- 5-day Biochemical Oxygen Demand ($BOD_5$),
- Iron; and
- Manganese.

**Condition 26:**

Six monthly monitoring of bores BH2A, BH2B, BH3A (BH103A) and BH3B (BH103B) and Careys Gully Stream upstream (Upstr Surface Water 1) and downstream (Dstr Surface Water 2) of the landfill for the following parameters:

- Chlorides,
- Nitrate as Nitrogen,
- Aluminium,
- Boron,
- Arsenic,
- Copper,
- Lead,

- Zinc,
- Nickel,
- Chromium,
- Cadmium; and
- Dissolved Reactive Phosphorous (DRP).

**Condition 27:**

Six monthly monitoring of Careys Gully Stream upstream (Upstr Surface Water 1) and downstream (Dstr Surface Water 2) of the landfill for the following parameters;

- Freshwater macroinvertebrates; and
- Determination of a Macroinvertebrate Community Index (MCI) value.

**Condition 28:**

Monthly monitoring of groundwater pressure (groundwater levels) in bores BH2A, BH2B, BH3A (BH103A), BH3B (BH103B), BH4 and BH5.

## 1.3 Monitoring Locations

The monitoring locations as pictured in the SLF consent are shown by Map 1, presented in **Appendix A**. The monitoring locations are also shown in Figure 3-1 in **Appendix A**, taken from Montgomery Watson New Zealand Limited report Southern Landfill Surface and Groundwater Monitoring Report, June 2001 (MW, 2001), prepared for WCC and by Figure 1 from URS New Zealand Limited (now AECOM) (2013)[1]. Figure 3-1 also shows the location of additional bores, including BH6 located on the edge of the active landfill near BH4 and BH5. Bores BH4 and BH5 are shown as 'destroyed'. In 2001 MW noted that bores BH4 and BH5 were destroyed by landfill development and were replaced in April 2000 by BH6, in agreement with GWRC. Bore BH6 was sampled in general accordance with condition 25 and 26 except during the April 2017 and the October 2018 to March 2020 monitoring periods, as samples which were unable to be collected owing to landslip debris covering the bore[2]. Surface water sampling locations Upstr Surface Water 1 and Dstr Surface Water 2 are also labelled CAREUS and CAREDS, respectively. CAREDS (new) is also shown. It was reported by MW (2001) that CAREDS (new) was established in October 2000 after completion of the stormwater tunnel diversion and that it replaces CAREDS/Dstr Surface Water 2.

## 1.4 Replacement Bore Installation

In April 2013, two new bores (BH103A and BH103B) were installed to replace the existing bores BH3A and BH3B, which were decommissioned. The installation details of these bores were reported to WCC by URS New Zealand Limited (now AECOM) in May 2013[1]. As these two new bores were installed in equivalent locations and to equivalent depths as the previous bores (BH103A to 6 m and BH103B to 10 m), the consent conditions outlined above in relation to bores BH3A and BH3A were transferred to the two new bores BH103A and BH103B, respectively. Bores BH3A and BH3B were decommissioned by grouting to ground surface. As this report covers the period June 2017 to May 2020 any reference to historical bores BH3A and BH3B have been removed.

[1] Southern Landfill Replacement Monitoring Bores: Bore Completion Report. Report prepared for Wellington City Council, ref 42787950, dated 23 May 2013.
[2] It would appear that there is no requirement under the SLF consent for the sampling of this monitoring bore, except that groundwater pressure data should be collected

## 1.5 Data Sources

Surface water and groundwater monitoring data for the SLF are obtained by Eurofins Environmental Laboratory Services (ELS) under contract to WCC. This review by AECOM is based directly on the monitoring information provided to AECOM by WCC (July 2010 to June 2011) and from ELS (July 2011 to May 2020, mainly in the form of excel format workbooks prepared by ELS and (previously) by WCC.

# 2.0 Compliance Summary

## 2.1 Groundwater Monitoring

Compliance with SLF consent requirements for groundwater monitoring between June 2017 and May 2020 is summarised in **Table 1**. Data tables for each bore, including monitoring dates, are presented in **Appendix B**.

**Table 1 Summary of Groundwater Monitoring Results against Consent Requirements**

| Bore | Resource Consent Requirements | | | Compliance Summary |
|---|---|---|---|---|
| | Condition | Monitoring Parameters | Frequency | |
| BH2A<br>BH2B<br>BH3A<br>(BH103A)<br>BH3B<br>(BH103B) | 25 | • pH<br>• Conductivity<br>• $NH_4$-N<br>• Faecal Coliforms<br>• $BOD_5$<br>• Iron<br>• Manganese | Monthly | • Fully compliant.<br>• Since June/July 2013 samples have been analysed monthly for chemical oxygen demand; although this is not required by the consent. |
| BH2A<br>BH2B<br>BH3A<br>(BH103A)<br>BH3B<br>(BH103B) | 26 | • Chlorides<br>• Nitrate-Nitrogen<br>• Aluminium<br>• Boron<br>• Arsenic<br>• Copper<br>• Lead<br>• Zinc<br>• Nickel<br>• Chromium<br>• Cadmium<br>• Dissolved Reactive Phosphorus | Six Monthly | • Generally compliant.<br>• Six monthly analysis of monitoring parameters not undertaken for two events, June 2019 and December 2019. |
| BH2A<br>BH2B<br>BH3A<br>(BH103A)<br>BH3B<br>(BH103B)<br>BH4<br>BH5 (BH6) | 28 | • Groundwater pressure | Monthly | • Generally compliant.<br>• Bore BH6 was substituted for bore BH4 and bore BH5 in April 2000.<br>• Groundwater gauging between June and September 2012 is recorded following the purge of the well only. From October 2012 pre-purge water levels are recorded.<br>• Bore BH6 was not gauged from October 2018 to March 2020 (bore not accessible as covered by debris from landslip). |

## 2.2 Surface Water Monitoring

Compliance with SLF consent requirements for surface water monitoring between June 2017 and May 2020 is summarised in **Table 2**. Data tables for each sampling location, including monitoring dates, are presented in **Appendix B**.

**Table 2 Summary of Surface Water Monitoring Results against Consent Requirements**

| Surface Water | Resource Consent Requirements | | | Compliance Summary |
|---|---|---|---|---|
| | Condition | Monitoring Parameters | Frequency | |
| Upstr Surface Water 1 and Dstr Surface Water 2 | 25 | • pH<br>• Conductivity<br>• NH4-N<br>• Faecal Coliforms<br>• BOD5<br>• Iron<br>• Manganese | Monthly | • Fully compliant.<br>• Since June 2014 samples have been analysed monthly for chemical oxygen demand and suspended solids; although this is not required by the consent. |
| Upstr Surface Water 1 and Dstr Surface Water 2 | 26 | • Chlorides<br>• Nitrate-Nitrogen<br>• Aluminium<br>• Boron<br>• Arsenic<br>• Copper<br>• Lead<br>• Zinc<br>• Nickel<br>• Chromium<br>• Cadmium<br>• Dissolved Reactive Phosphorus | Six Monthly | • Generally compliant.<br>• Six monthly analysis of monitoring parameters not undertaken for two events, June 2019 and December 2019..<br>• Dstr Surface Water 2 June 2018 sample not analysed for faecal coliforms.<br>• Nitrate-nitrogen is being analysed on a monthly basis; although this is not required by the consent. |
| Upstr Surface Water 1 and Dstr Surface Water 2 | 27 | • Freshwater macro invertebrates<br>• Determination of a MCI value | Six Monthly | • Generally compliant.<br>• One sampling event not undertaken during December 2019. |

# 3.0 Monitoring Results

## 3.1 Groundwater Levels

Groundwater gauging data are presented in the data tables for each bore, included as **Appendix B**. Results are summarised in **Table 3**. Groundwater levels were recorded at their lowest over the summer period November 2017 through April 2018; and to a lesser extent over the summer period November 2019 through February 2020. Overall, no significant trends in groundwater levels were recorded.

**Table 3 Summary of Depth to Groundwater Measurements (June 2017 to May 2020)**

| Bore | Depth to Groundwater (m btoc) | |
|---|---|---|
| | Minimum | Maximum |
| BH2A | 1.4 | 3.5 |
| BH2B | 1.2 | 2.5 |
| BH103A | 3.0 | 4.9 |
| BH103B* | 2.8 | 7.1 |
| BH6 | 0.4 | 2.0 |

**Note:**
m btoc - metres below top of casing (of bore).
BH6 not gauged from October 2018 to March 2020 as the bore was not accessible (covered by debris from a landslip).
*AECOM notes that groundwater levels recorded in BH103B typically range between 4.1 m btoc and 5.5 m btoc, however levels recorded in January 2020 and February 2020 were reported at 7.1 m btoc and 2.8 m btoc, respectively. ELS have been queried regarding these groundwater levels, however AECOM have not yet received a response as of the date of this report.

## 3.2 Groundwater Analyses

Compliance monitoring results for bores BH2A, BH2B, BH103A and BH103B are summarised in **Table 4** through **Table 7**. Full results are presented in **Appendix B**. Time series graphs of individual constituents for each monitoring bore are presented in **Appendix C**. In summary:

- Contaminants of concern have been recorded within each of the bores over the compliance monitoring period. This would suggest that historic activities at the Carey's Gully Complex may have impacted the groundwater at the toe of the landfill.
- Short term variability in concentrations of contaminants of concern were recorded across all sample locations over the compliance monitoring period. The greatest number of individual data spikes were recorded as part of the December 2017, February 2018 and November 2019 compliance monitoring events.
- A comparison of water quality recorded across the bores indicates that recorded concentrations of key contaminants of concern such as ammoniacal nitrogen, $BOD_5$, faecal coliforms, and dissolved manganese are elevated in bore BH103B (and BH103A to a lesser extent).
- Based on a visual analysis of the time series graphs:
  - No significant short-term trends in contaminant concentrations were recorded over the compliance monitoring period.
  - The following parameters illustrate potentially increasing long-term trends (entire dataset), with recent concentrations generally recorded higher than historical values:
    - BH2A: electrical conductivity and phosphorous.
    - BH2B: electrical conductivity and manganese.
    - BH3A: pH.

  - BH3B: $BOD_5$.
- The following parameters illustrate potentially decreasing long-term trends:
  - BH2A: nitrate-nitrogen.
  - BH2B: nitrate-nitrogen.
  - BH3A: electrical conductivity.
  - BH3B: electrical conductivity and aluminium.

- Faecal coliforms have been periodically recorded at all locations. A review of longer term trends in faecal coliform concentrations (40 individual data points over the period February 2017 through May 2020) using Mann-Kendall statistical analysis indicates increasing trends in contaminant concentrations in bore BH103B, and no trend in bores BH2A, BH2B and BH103A. Mann-Kendall statistical analysis for faecal coliforms are presented in **Appendix D**.
- A review of longer term trends in manganese concentrations (40 individual data points over the period February 2017 through May 2020) using Mann-Kendall statistical analysis indicates either no trend (in bores BH2A and BH2B) or decreasing trends (in bores BH103A and BH103B). Mann-Kendall statistical analysis for manganese is presented in **Appendix D**.
- Further investigations into the increasing faecal coliform trend at BH103B have been initiated by WCC, these investigations had not been concluded within this reporting period.

**Table 4 Summary of Groundwater Quality Results for Bore BH2A (June 2017 through May 2020)**

| Parameter | Recorded Concentration | | Comment |
|---|---|---|---|
| | Median | Maximum | |
| Ammonia Nitrogen | 0.01 | 0.04 | • Generally less than the MDL.<br>• Spike recorded – February 2018, June 2018 and December 2019. |
| $BOD_5$ – Total | 1 | 6 | • Generally less than the MDL.<br>• Spike recorded – November 2018, June and November 2019. |
| Conductivity at 25°C (mS/m)[3] | 85.15 | 106 | • Spike recorded – September 2018. |
| Faecal Coliforms (cfu/100ml) | 1 | 110 | • Generally less than MDL.<br>• Spike recorded – February 2018 and March 2019. |
| Manganese - Dissolved | 0.0172 | 0.645 | • Spike recorded – February 2018, September 2018, May 2019 and April 2020. |
| Aluminium – Dissolved | 0.003 | 0.005 | • Generally less than the MDL.<br>• Spike recorded – December 2017. |
| Chloride | 96.35 | 101 | • Spike recorded – December 2017. |
| Copper - Dissolved | 0.00085 | 0.0012 | • Spike recorded – December 2017 and June 2018. |
| Dissolved Reactive Phosphorus | 0.0185 | 0.041 | • Spike recorded – June 2018. |
| Nickel - Dissolved | 0.0009 | 0.0014 | • Spike recorded – December 2017. |
| Nitrate – Nitrogen | 2.005 | 3.7 | • Slight decreasing trend to December 2017.<br>• Spike recorded – June 2018. |
| Zinc - Dissolved | 0.002 | 0.006 | • Spike recorded – December 2017. |

**Note:** * – trend relative to the compliance monitoring period June 2016 through May 2020 All values $g/m^3$ unless otherwise noted; mS/m – milli siemens per metre, cfu/100ml – colony forming units per 100 millilitres. The following parameters have been removed from the table as recorded concentrations were generally below the MDL over the monitoring period and/or no significant change/trends in contaminant concentrations were recorded – iron (dissolved), pH, arsenic (dissolved), boron (dissolved), cadmium (dissolved), chromium (dissolved), and lead (dissolved).

[3].

**Table 5 Summary of Groundwater Quality Results for Bore BH2B (June 2017 through May 2020)**

| Parameter | Recorded Concentration | | Comment |
|---|---|---|---|
| | Median | Maximum | |
| Ammonia Nitrogen | 0.01 | 0.15 | • Generally less than MDL.<br>• Spike recorded – February 2018, January and April 2020. |
| $BOD_5$ – Total | 1 | 6 | • Generally less than MDL.<br>• Spike recorded – November 2018, June and November 2019. |
| Conductivity at 25°C (mS/m) | 106 | 113 | • Period low in June 2018. |
| Faecal Coliforms (cfu/100ml) | 1 | 36 | • Generally less than the MDL.<br>• Spike recorded - February 2018. |
| Manganese - Dissolved | 0.2725 | 1.43 | • Spike recorded – February 2018. |
| pH (pH units) | 6.8 | 8 | • Spike recorded – May 2019. |
| Chloride | 108 | 109 | • Period low in June 2018. |
| Copper - Dissolved | 0.0007 | 0.0039 | • Generally less than MDL.<br>• Slight increase – December 2017.<br>• Spike identified – June 2018. |
| Iron – Dissolved | 0.01 | 0.71 | • Generally less than MDL.<br>• Spike identified – January and April 2020. |
| Nickel - Dissolved | 0.0016 | 0.003 | • Slight increase – December 2017. |
| Nitrate-Nitrogen | 1.065 | 1.59 | • Slight decreasing trend to December 2016.<br>• Slight increase – June 2018. |
| Zinc - Dissolved | 0.0025 | 0.012 | • Generally less than MDL.<br>• Spike identified – December 2017. |

**Note:** * – trend relative to the compliance monitoring period June 2016 through May 2020 All values $g/m^3$ unless otherwise noted; mS/m – milli siemens per metre, cfu/100ml – colony forming units per 100 millilitres. The following parameters have been removed from the table as recorded concentrations were generally below the MDL over the monitoring period and/or no significant change/trends in contaminant concentrations were recorded – iron (dissolved), aluminium (dissolved), arsenic (dissolved), boron (dissolved), cadmium (dissolved), chloride, chromium (dissolved), dissolved reactive phosphorus, lead (dissolved), and nitrate nitrogen.

**Table 6 Summary of Groundwater Quality Results for Bore BH103A (June 2017 through May 2020)**

| Parameter | Recorded Concentration | | Comment |
|---|---|---|---|
| | Median | Maximum | |
| Ammonia Nitrogen | 0.01 | 0.42 | • Spike recorded – October 2017, March and November 2019. |
| $BOD_5$ – Total | 1 | 6 | • Generally less than the MDL. |
| Conductivity at 25°C (mS/m) | 63.1 | 126 | • Spike recorded – December 2017.<br>• Slight decreasing trend. |
| Faecal Coliforms (cfu/100ml) | 2.5 | 90 | • Spike recorded – September 2018, October 2018 and April 2019. |
| Manganese - Dissolved | 0.01215 | 0.662 | • Spike recorded – October 2017, December 2017, March 2019 and November 2019. |
| pH (pH units) | 6.6 | 7.8 | • Spike recorded – September 2019 |
| Chloride | 106.25 | 146 | • Variable concentrations recorded. |
| Copper - Dissolved | 0.00135 | 0.0031 | • Variable concentrations recorded. |
| Dissolved Reactive Phosphorus | 0.0415 | 0.043 | • Variable concentrations recorded. |
| Nickel - Dissolved | 0.00115 | 0.003 | • Variable concentrations recorded. |
| Nitrate – Nitrogen | 1.4 | 2.24 | • Variable concentrations recorded. |

**Note:** * – trend relative to the compliance monitoring period June 2016 through May 2020. All values $g/m^3$ unless otherwise noted; mS/m – milli siemens per metre, cfu/100ml – colony forming units per 100 millilitres. The following parameters have been removed from the table as recorded concentrations were generally below the MDL over the monitoring period and/or no significant change/trends in contaminant concentrations were recorded – iron (dissolved), aluminium (dissolved), cadmium (dissolved), chromium (dissolved), lead (dissolved), and zinc (dissolved).

**Table 7 Summary of Groundwater Quality Results for Bore BH103B (June 2017 through May 2020)**

| Parameter | Recorded Concentration | | Comment |
|---|---|---|---|
| | Median | Maximum | |
| Ammonia Nitrogen | 1.81 | 2.91 | • Variable concentrations recorded. |
| $BOD_5$ – Total | 3 | 14 | • Variable concentrations recorded. |
| Conductivity at 25°C (mS/m) | 125.5 | 175 | • Variable concentrations recorded. |
| Faecal Coliforms (cfu/100ml) | 6 | 130 | • Spike recorded – January 2018. |
| Manganese – Dissolved | 6.9 | 11.4 | • Variable concentrations recorded. |
| pH (pH units) | 6.7 | 7.7 | • Spike recorded – July 2019. |
| Arsenic - Dissolved | 0.0045 | 0.01 | • Variable concentrations recorded. |
| Boron - Dissolved | 0.37 | 0.56 | • Variable concentrations recorded. |
| Chloride | 162 | 181 | • Variable concentrations recorded. |
| Copper - Dissolved | 0.001 | 0.0075 | • Spike recorded - December 2017. |
| Dissolved Reactive Phosphorus | 0.0235 | 0.025 | • Variable concentrations recorded. |
| Nickel - Dissolved | 0.0042 | 0.0056 | • Variable concentrations recorded. |
| Nitrate – Nitrogen | 0.21 | 1.01 | • Spike recorded – June 2018. |
| Zinc - Dissolved | 0.0055 | 0.03 | • Spike recorded – December 2017. |

**Note:** * – trend relative to the compliance monitoring period June 2016 through May 2020 All values $g/m^3$ unless otherwise noted; mS/m – milli siemens per metre, cfu/100ml – colony forming units per 100 millilitres. The following parameters have been removed from the table as recorded concentrations were generally below the MDL over the monitoring period and/or no significant change/trends in contaminant concentrations were recorded – iron (dissolved), aluminium (dissolved), cadmium (dissolved), chromium (dissolved), and lead (dissolved).

## 3.3 Surface Water Sampling

Compliance monitoring results for surface water samples are presented in **Table 8**. Full results are presented in **Appendix B**. Time series graphs of individual constituents for the upstream and downstream monitoring locations of Carey's Stream are presented in **Appendix C**. In summary:

- When comparing analytical results for the upstream and downstream monitoring location, contaminants of concern have generally been recorded at higher concentrations in the downstream monitoring location.
- Recorded concentrations were variable across the period. Based on a visual analysis of the time series graphs, general increasing trends in contaminant concentrations were recorded for electrical conductivity, ammoniacal nitrogen, BOD5, iron, and manganese in the downstream monitoring locations over the 2018 to 2019 period. Samples collected in 2020 generally illustrate a decrease in recorded concentrations in line with the historical dataset.
- In December 2018 boron was recorded in the downstream sample location at a concentration which exceeded the ANZG[4] for the protection of 95% of freshwater species. With the exception of this one exceedance all other metals were recorded at concentrations below the ANZG at the downstream sample location.
- Faecal coliforms have been regularly recorded within both upstream and downstream locations. Elevated concentrations were recorded in the downstream monitoring location in July 2018, October 2018 and April 2019. Elevated concentrations were recorded in the upstream monitoring location in February 2020. A review of longer term trends in faecal coliform concentrations (40 individual data points over the period February 2017 through May 2020) using Mann-Kendall statistical analysis indicates increasing trends in contaminant concentrations in both upstream and downstream monitoring locations. Mann-Kendall statistical analysis for faecal coliforms are presented in **Appendix D**.
- Further investigations into the increasing faecal coliform trend in the downstream monitoring location have been initiated by WCC, these investigations had not been concluded within this reporting period.
- A review of longer term trends in manganese concentrations (40 individual data points over the period February 2017 through May 2020) using Mann-Kendall statistical analysis indicates no trend in both upstream and downstream monitoring locations. Mann-Kendall statistical analysis for manganese is presented in **Appendix D**.
- Based on the median MCI values recorded for upstream and downstream of the landfill the quality of the stream would is categorised as "good"[5].

[4] National Water Quality Management Strategy: Australian and New Zealand Guidelines for Fresh and Marine Water Quality, 2018 (ANZG). Freshwater Trigger Values for Protection of Species (Level of Protection 95%).

[5] Stark and Maxted (2007)[5] provide the following interpretation of New Zealand MCI results: "excellent – clean water" >120, "good - doubtful quality or possible mild pollution" 100-119, "fair - probable moderate pollution" 80-99, "poor - probable severe pollution" <80. Based on the median.

**Table 8 Summary of Carey's Gully Surface Water Sampling Results (June 2017 to May 2020)**

| Parameter | Upstream Concentrations | | Downstream Concentrations | |
|---|---|---|---|---|
| | Median | Maximum | Median | Maximum |
| Ammonia – Nitrogen | 0.01 | 0.02 | 0.525 | 1.29 |
| $BOD_5$ – Total | 1 | 6 | 2.5 | 11 |
| Conductivity at 25°C (mS/m) | 23.4 | 27.5 | 39.35 | 86.7 |
| Faecal Coliforms (cfu/100ml) | 75 | 2,900 | 35 | 10,000 |
| Iron – Acid Soluble | 0.01 | 0.05 | 0.1 | 2.03 |
| Manganese - Acid Soluble | 0.0016 | 0.0187 | 0.341 | 1.11 |
| pH (pH units) | 7.75 | 7.9 | 7.8 | 8.1 |
| Aluminium - Acid Soluble | 0.0115 | 0.015 | 0.09 | 0.017 |
| Arsenic - Acid Soluble | 0.001 | 0.001 | 0.001 | 0.002 |
| Boron - Acid Soluble | 0.03 | 0.03 | 0.045 | 0.38 |
| Cadmium - Acid Soluble | 0.0002 | 0.0002 | 0.0002 | 0.0002 |
| Chloride | 42.85 | 47.4 | 53.4 | 61.2 |
| Chromium - Acid Soluble | 0.001 | 0.001 | 0.001 | 0.001 |
| Copper - Acid Soluble | 0.0005 | 0.0005 | 0.0005 | 0.0005 |
| Dissolved Reactive Phosphorus | 0.0115 | 0.013 | 0.0125 | 0.016 |
| Lead - Acid Soluble | 0.0005 | 0.0005 | 0.0005 | 0.0005 |
| Nickel - Acid Soluble | 0.0005 | 0.0005 | 0.0006 | 0.0009 |
| Nitrate – Nitrogen | 0.3 | 0.51 | 1.165 | 2.09 |
| Zinc - Acid Soluble | 0.002 | 0.002 | 0.002 | 0.002 |
| MCI | 103 | 136 | 107 | 113 |

**Note:** All values $g/m^3$ unless otherwise noted; mS/m **–** milli siemens per metre**,** cfu **–** colony forming units per 100 millilitres. MCI – Macroinvertebrate Community Index;

# 4.0 Discussion

Compliance monitoring was completed in general accordance with resource consent requirements over the period June 2017 through May 2020. However, AECOM notes that two six monthly sampling rounds were not collected and analysed for the additional parameters during the months of June 2019 and December 2019; and one six monthly macroinvertebrate sampling event was not undertaken during December 2019. AECOM understands that WCC has had discussions with ELS regarding the six monthly sampling events and that ELS have since resumed six monthly sampling and analysis from June 2020 (outside the scope of this reporting period). Groundwater levels were measured between approximately 1.2 to 7.1 m throughout the compliance monitoring period. No significant trends in groundwater level change were recorded over the compliance monitoring period. AECOM notes that groundwater levels recorded in BH103B typically range between 4.1 m btoc and 5.5 m btoc, however levels recorded in January 2020 and February 2020 were reported at 7.1 m btoc and 2.8 m btoc, respectively. ELS have been queried regarding these groundwater levels, however AECOM have not yet received a response as of the date of this report.

Based on recorded concentrations of key contaminants of concern such as ammoniacal nitrogen, $BOD_5$, iron, and faecal coliforms in bore BH103B (and to a lesser extent bore BH103A), as well as the down stream surface water monitoring location; there is evidence to suggest that historic and current activities at the Carey's Gully Complex may be impacting groundwater and the stream at the toe of the landfill. However, it is important to note that with the exception of boron (one sample event over the monitoring period), no exceedances of the ANZG for the protection of 95% of freshwater species were recorded in the down stream monitoring location.

A review of longer term trends in faecal coliform indicates increasing trends in contaminant concentrations in BH103B and both the upstream and downstream surface water sample locations. WCC are currently undertaking additional faecal coliform sampling in parallel with the review of potential sources of the impact. The results these investigations had not been concluded within this reporting period.

# 5.0 Limitations

This conclusion and all information in this Report are provided strictly in accordance with and subject to the following limitations and recommendations:

a. This Report should be read in full and no excerpts are to be taken as representative of the findings. No responsibility is accepted by AECOM for use of any part of this Report in any other context.

b. This conclusion is based solely on the information and findings contained in this Report.

c. This conclusion is based solely on the scope of work agreed between AECOM and Wellington City Council and described in section 1 ("Introduction") of this Report. Specifically, no soil sampling or drilling / excavation activity has been undertaken by AECOM as part of the investigations referred to in this Report.

d. This Report has been prepared for the sole benefit of Wellington City Council and neither the whole nor any part of this Report may be used or relied upon by any party other than Wellington City Council.

e. This Report is dated 7 August 2020 and is based on the information reviewed from June 2017 to May 2020 AECOM accepts no responsibility for any events arising from any changes in site conditions or in the information reviewed that have occurred after the completion of the site monitoring.

f. The investigations carried out for the purposes of the Report have been undertaken, and the Report has been prepared, in accordance with normal prudent practice and by reference to applicable environmental regulatory authority and industry standards, guidelines and assessment criteria in existence at the date of this Report.

g. Where this Report indicates that information has been provided to AECOM by third parties, AECOM has made no independent verification of this information except as expressly stated in the Report. AECOM assumes no liability for any inaccuracies in or omissions to that information.

h. Except as specifically stated above, AECOM makes no warranty, statement or representation of any kind concerning the suitability of the site for any purpose or the permissibility of any use, development or re-development of the site.

i. Use, development or re-development of the site for any purpose may require planning and other approvals and, in some cases, environmental regulatory authority and accredited site auditor approvals. AECOM offers no opinion as to whether the current use has any or all approvals required, is operating in accordance with any approvals, the likelihood of obtaining any approvals for development or redevelopment of the site, or the conditions and obligations which such approvals may impose, which may include the requirement for additional environmental works.

j. AECOM makes no determination or recommendation regarding a decision to provide or not to provide financing with respect to the site.

k. Except as required by law, no third party may use or rely on, this Report unless otherwise agreed by AECOM in writing. Where such agreement is provided, AECOM will provide a letter of reliance to the agreed third party in the form required by AECOM.

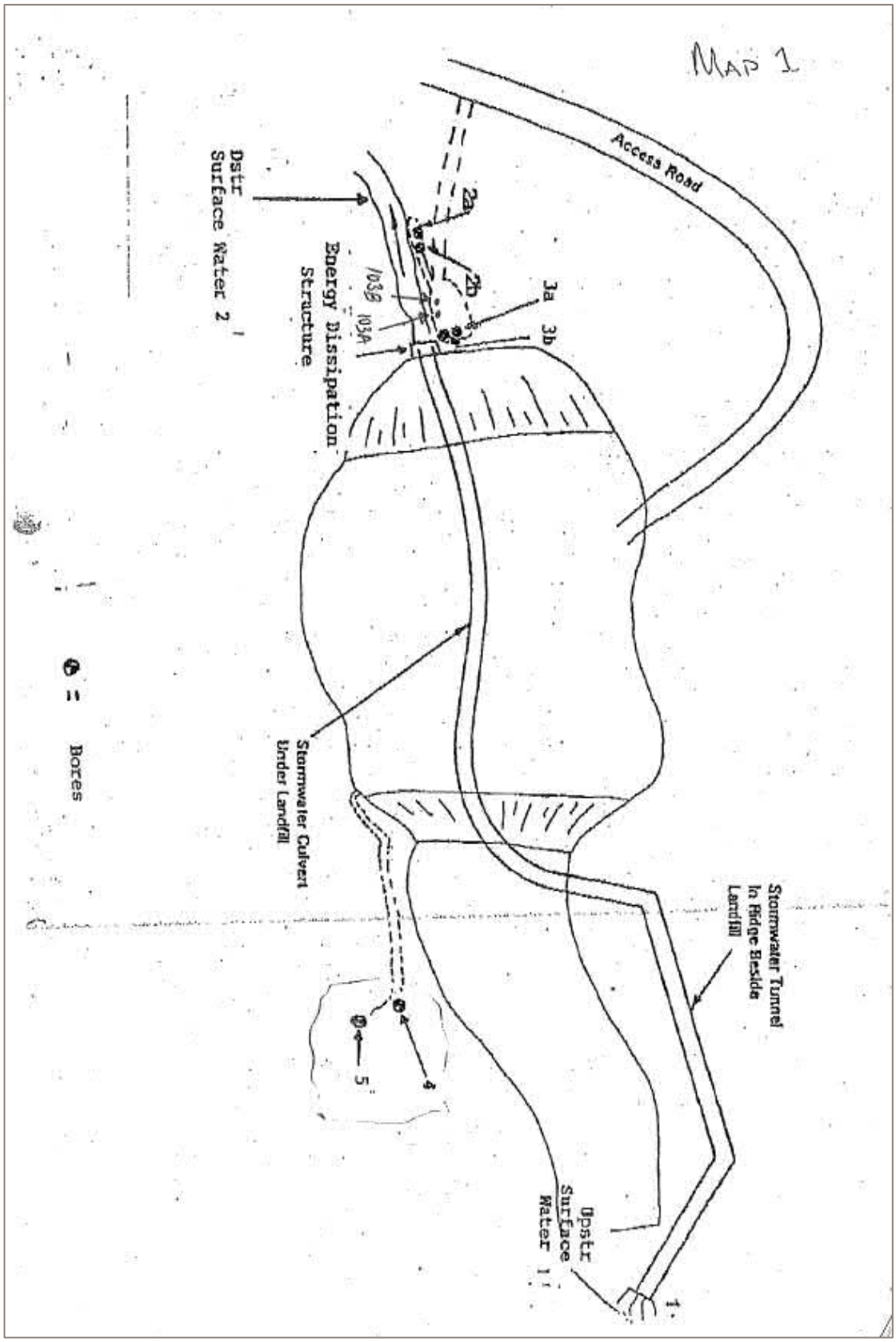
l. To the extent permitted by law, AECOM expressly disclaims and excludes liability for any loss, damage, cost or expenses suffered by any third party relating to or resulting from the use of, or reliance on, any information contained in this Report. AECOM does not admit that any action, liability or claim may exist or be available to any third party.

# Appendix A

Figures

# Appendix A Figures

**Map 1**



**MW 2001 Figure 3-1 Location of surface water and groundwater monitoring sites**

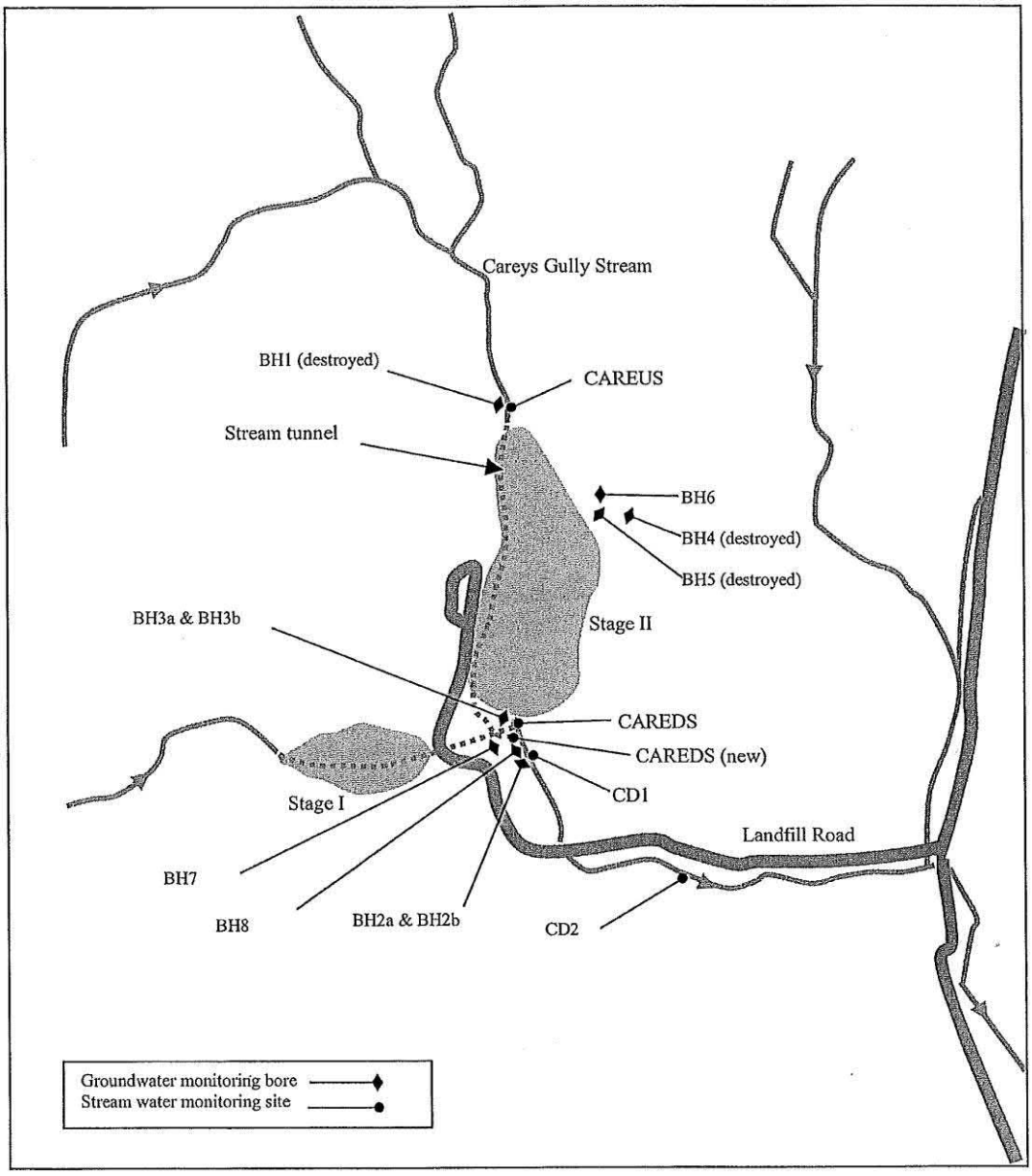


**Figure 1 Wellington City Council Southern Landfill – Monitoring Well Location Plan**

# Appendix B

## Data Tables

# Appendix B Data Tables

| Condition | Description | Measure | 22/06/2017 | 17/07/2017 | 18/08/2017 | 21/09/2017 | 18/10/2017 | 27/11/2017 | 21/12/2017 | 26/01/2018 | 27/02/2018 | 21/03/2018 | 17/04/2018 | 29/05/2018 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 26 | Aluminium - Dissolved | g/m³ | 0.002 | | | | | | 0.005 | | | | | |
| 25 | Ammonia Nitrogen | g/m³ | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.04 | 0.01 | 0.01 | 0.01 |
| 26 | Arsenic - Dissolved | g/m³ | 0.001 | | | | | | 0.001 | | | | | |
| 25 | BOD5 - Total | g/m³ | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 26 | Boron - Dissolved | g/m³ | 0.14 | | | | | | 0.12 | | | | | |
| 26 | Cadmium - Dissolved | g/m³ | 0.0002 | | | | | | 0.0002 | | | | | |
| Other | Chemical Oxygen Demand | g/m³ | 54 | 15 | 15 | 15 | 15 | 25 | 15 | 52 | 37 | 15 | 15 | 15 |
| 26 | Chloride | g/m³ | 93.7 | | | | | | 101 | | | | | |
| 26 | Chromium - Dissolved | g/m³ | 0.001 | | | | | | 0.001 | | | | | |
| Other | Comments | | Clear, floating solids | Clear, floating solids | Clear, floating solids | Clear | Clear, floating solids | Clear, floating solids | Clear/misty grey | Clear and floating solids | | Clear | Clear | Clear |
| 25 | Conductivity at 25°C | mS/m | 85 | 84.5 | 85.3 | 87.3 | 89.1 | 90.6 | 90.7 | 90.8 | 43.2 | 88.3 | 87.9 | 87.3 |
| 26 | Copper - Dissolved | g/m³ | 0.0005 | | | | | | 0.0012 | | | | | |
| 26 | Dissolved Reactive Phosphorus | g/m³ | 0.018 | | | | | | 0.018 | | | | | |
| 25 | Faecal Coliforms | cfu/100ml | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 18 | 1 | 1 | 1 |
| 25 | Iron - Dissolved | g/m³ | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| 26 | Lead - Dissolved | g/m³ | 0.0005 | | | | | | 0.0005 | | | | | |
| 25 | Manganese - Dissolved | g/m³ | 0.0049 | 0.004 | 0.0032 | 0.0041 | 0.0031 | 0.0067 | 0.0508 | 0.0308 | 0.645 | 0.034 | 0.0371 | 0.0328 |
| 26 | Nickel - Dissolved | g/m³ | 0.0009 | | | | | | 0.0014 | | | | | |
| 26 | Nitrate - Nitrogen | g/m³ | 2.05 | | | | | | 1.81 | | | | | |
| 25 | pH | | 6.8 | 7 | 7 | 6.8 | 6.7 | 6.7 | 6.6 | 6.8 | 6.4 | 6.8 | 6.8 | 6.7 |
| Other | Water Level of Bore | Metres | 1.8 | 1.7 | 1.8 | 1.7 | 1.8 | 2.2 | 2.5 | 2.2 | 3.5 | 2.2 | 2.4 | 1.5 |
| Other | Weather - 24 hr | | | | No Rain | Some Rain | No Rain | No Rain | No Rain | Some Rain | No Rain | Some Rain | Some Rain | |
| 26 | Zinc - Dissolved | g/m³ | 0.002 | | | | | | 0.006 | | | | | |

| Condition | Description | Measure | 29/06/2018 | 24/07/2018 | 28/08/2018 | 28/09/2018 | 30/10/2018 | 13/11/2018 | 13/12/2018 | 10/01/2019 | 25/02/2019 | 27/03/2019 | 23/04/2019 | 29/05/2019 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 26 | Aluminium - Dissolved | g/m³ | 0.004 | | | | | | 0.002 | | | | | |
| 25 | Ammonia Nitrogen | g/m³ | 0.03 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| 26 | Arsenic - Dissolved | g/m³ | 0.001 | | | | | | 0.001 | | | | | |
| 25 | BOD5 - Total | g/m³ | 1 | 1 | 1 | 1 | 1 | 6 | 1 | 1 | 1 | 1 | 1 | 1 |
| 26 | Boron - Dissolved | g/m³ | 0.12 | | | | | | 0.12 | | | | | |
| 26 | Cadmium - Dissolved | g/m³ | 0.0002 | | | | | | 0.0002 | | | | | |
| Other | Chemical Oxygen Demand | g/m³ | 22 | 15 | 26 | 25 | 15 | 19 | 29 | 15 | 15 | 15 | 18 | 24 |
| 26 | Chloride | g/m³ | 59.2 | | | | | | 99 | | | | | |
| 26 | Chromium - Dissolved | g/m³ | 0.001 | | | | | | 0.001 | | | | | |
| Other | Comments | | Clear | Clear | Clear, floating solids | Clear | | Clear | Clear | | Clear | | | |
| 25 | Conductivity at 25°C | mS/m | 64.7 | 74.4 | 88.8 | 106 | 89.6 | 87.7 | 88.3 | 88.6 | 85.4 | 87.2 | 85.8 | 84.9 |
| 26 | Copper - Dissolved | g/m³ | 0.0012 | | | | | | 0.0005 | | | | | |
| 26 | Dissolved Reactive Phosphorus | g/m³ | 0.041 | | | | | | 0.019 | | | | | |
| 25 | Faecal Coliforms | cfu/100ml | 1 | 1 | 1 | 4 | 3 | 1 | 1 | 1 | 1 | 96 | 12 | 1 |
| 25 | Iron - Dissolved | g/m³ | 0.01 | 0.02 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| 26 | Lead - Dissolved | g/m³ | 0.0005 | | | | | | 0.0005 | | | | | |
| 25 | Manganese - Dissolved | g/m³ | 0.0018 | 0.0128 | 0.0271 | 0.235 | 0.0287 | 0.03 | 0.0267 | 0.0342 | 0.0299 | 0.0345 | 0.0207 | 0.219 |
| 26 | Nickel - Dissolved | g/m³ | 0.0009 | | | | | | 0.0007 | | | | | |
| 26 | Nitrate - Nitrogen | g/m³ | 3.7 | | | | | | 1.96 | | | | | |
| 25 | pH | | 6.4 | 7.1 | 6.7 | 7 | 6.8 | 6.6 | 6.7 | 6.7 | 6.7 | 6.8 | 6.9 | 7.1 |
| Other | Water Level of Bore | Metres | 1.8 | 1.5 | 1.8 | 1.8 | 1.7 | 1.7 | 1.5 | 1.8 | 1.7 | 1.6 | 1.4 | 1.7 |
| Other | Weather - 24 hr | | No Rain | Some Rain | Some Rain | No Rain | Some Rain | No Rain | No Rain | No Rain | No Rain | Much Rain | Much Rain | No Rain |
| 26 | Zinc - Dissolved | g/m³ | 0.002 | | | | | | 0.002 | | | | | |

| Condition | Description | Measure | 13/06/2019 | 29/07/2019 | 30/08/2019 | 24/09/2019 | 25/10/2019 | 8/11/2019 | 19/12/2019 | 29/01/2020 | 28/02/2020 | 27/03/2020 | 17/04/2020 | 21/05/2020 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 26 | Aluminium - Dissolved | g/m³ | | | | | | | | | | | | |
| 25 | Ammonia Nitrogen | g/m³ | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.03 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| 26 | Arsenic - Dissolved | g/m³ | | | | | | | | | | | | |
| 25 | BOD5 - Total | g/m³ | 6 | 1 | 1 | 1 | 1 | 6 | 1 | 1 | 1 | 1 | 1 | 1 |
| 26 | Boron - Dissolved | g/m³ | | | | | | | | | | | | |
| 26 | Cadmium - Dissolved | g/m³ | | | | | | | | | | | | |
| Other | Chemical Oxygen Demand | g/m³ | 15 | 28 | 15 | 132 | 15 | 15 | 69 | 29 | 15 | 15 | 15 | 15 |
| 26 | Chloride | g/m³ | | | | | | | | | | | | |
| 26 | Chromium - Dissolved | g/m³ | | | | | | | | | | | | |
| Other | Comments | | | | | | | | | | | | | |
| 25 | Conductivity at 25°C | mS/m | 85 | 84.2 | 84.6 | 84.4 | 84.7 | 84.2 | 84.4 | 82.6 | 84.8 | 83.8 | 83.4 | 82.5 |
| 26 | Copper - Dissolved | g/m³ | | | | | | | | | | | | |
| 26 | Dissolved Reactive Phosphorus | g/m³ | | | | | | | | | | | | |
| 25 | Faecal Coliforms | cfu/100ml | 1 | 1 | 1 | 1 | 1 | 1 | 4 | 1 | 1 | 1 | 110 | 1 |
| 25 | Iron - Dissolved | g/m³ | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.02 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| 26 | Lead - Dissolved | g/m³ | | | | | | | | | | | | |
| 25 | Manganese - Dissolved | g/m³ | 0.0085 | 0.0065 | 0.0093 | 0.0058 | 0.0081 | 0.0108 | 0.0322 | 0.0081 | 0.0097 | 0.0137 | 0.0884 | 0.0135 |
| 26 | Nickel - Dissolved | g/m³ | | | | | | | | | | | | |
| 26 | Nitrate - Nitrogen | g/m³ | | | | | | | | | | | | |
| 25 | pH | | 7 | 6.9 | 6.9 | 7.8 | 7.2 | 7 | 7.1 | 7.4 | 7.4 | 6.7 | 6.8 | 6.7 |
| Other | Water Level of Bore | Metres | 1.5 | 1.8 | 1.6 | 2 | 1.5 | 2.2 | 2.1 | 2 | 1.8 | 2.4 | 2 | 1.8 |
| Other | Weather - 24 hr | | No Rain | No Rain | No Rain | Some Rain | Some Rain | No Rain | Some Rain | Some Rain | No Rain | Some Rain | Some Rain | No Rain |
| 26 | Zinc - Dissolved | g/m³ | | | | | | | | | | | | |

Notes:
Values in red were reported below the detection limit.

**SOUTHERN LANDFILL - BH2B MONITORING RESULTS**

| Condition | Description | Measure | 22/06/2017 | 17/07/2017 | 18/08/2017 | 21/09/2017 | 18/10/2017 | 27/11/2017 | 21/12/2017 | 26/01/2018 | 27/02/2018 | 21/03/2018 | 17/04/2018 | 29/05/2018 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 26 | Aluminium - Dissolved | g/m³ | 0.002 | | | | | | 0.002 | | | | | |
| 25 | Ammonia Nitrogen | g/m³ | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.07 | 0.01 | 0.01 | 0.01 |
| 26 | Arsenic - Dissolved | g/m³ | 0.001 | | | | | | 0.001 | | | | | |
| 25 | BOD5 - Total | g/m³ | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 26 | Boron - Dissolved | g/m³ | 0.21 | | | | | | 0.17 | | | | | |
| 26 | Cadmium - Dissolved | g/m³ | 0.0002 | | | | | | 0.0002 | | | | | |
| Other | Chemical Oxygen Demand | g/m³ | 15 | 15 | 15 | 15 | 15 | 17 | 15 | 21 | 57 | 17 | 15 | 15 |
| 26 | Chloride | g/m³ | 108 | | | | | | 109 | | | | | |
| 26 | Chromium - Dissolved | g/m³ | 0.001 | | | | | | 0.001 | | | | | |
| Other | Comments | | Clear, floating solids | Clear, floating solids | Clear, floating solids | Clear | Clear, floating solids | Clear, floating solids | Clear/misty grey | Clear, floating solids | Cloudy | Clear | Clear | Clear |
| 25 | Conductivity at 25°C | mS/m | 107 | 111 | 113 | 107 | 112 | 109 | 106 | 108 | 43 | 111 | 105 | 105 |
| 26 | Copper - Dissolved | g/m³ | 0.0005 | | | | | | 0.0009 | | | | | |
| 26 | Dissolved Reactive Phosphorus | g/m³ | 0.017 | | | | | | 0.017 | | | | | |
| 25 | Faecal Coliforms | cfu/100ml | 1 | 1 | 1 | 1 | 3 | 1 | 1 | 1 | 36 | 1 | 1 | 1 |
| 25 | Iron - Dissolved | g/m³ | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| 26 | Lead - Dissolved | g/m³ | 0.0005 | | | | | | 0.0005 | | | | | |
| 25 | Manganese - Dissolved | g/m³ | 0.273 | 0.287 | 0.323 | 0.271 | 0.252 | 0.217 | 0.171 | 0.403 | 1.43 | 0.398 | 0.275 | 0.273 |
| 26 | Nickel - Dissolved | g/m³ | 0.002 | | | | | | 0.003 | | | | | |
| 26 | Nitrate - Nitrogen | g/m³ | 1.08 | | | | | | 1.05 | | | | | |
| 25 | pH | | 6.7 | 6.8 | 6.8 | 6.8 | 7 | 6.7 | 6.6 | 6.8 | 6.5 | 6.7 | 6.8 | 6.7 |
| Other | Water Level of Bore | Metres | 1.4 | 1.3 | 1.3 | 1.3 | 1.3 | 1.6 | 1.7 | 1.6 | 2.5 | 1.6 | 1.3 | 2 |
| Other | Weather - 24 hr | | | | No Rain | Some Rain | No Rain | No Rain | No Rain | Some Rain | Some Rain | Some Rain | Some Rain | |
| 26 | Zinc - Dissolved | g/m³ | 0.002 | | | | | | 0.012 | | | | | |

| Condition | Description | Measure | 29/06/2018 | 24/07/2018 | 28/08/2018 | 28/09/2018 | 30/10/2018 | 13/11/2018 | 13/12/2018 | 10/01/2019 | 25/02/2019 | 27/03/2019 | 23/04/2019 | 29/05/2019 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 26 | Aluminium - Dissolved | g/m³ | 0.002 | | | | | | 0.002 | | | | | |
| 25 | Ammonia Nitrogen | g/m³ | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| 26 | Arsenic - Dissolved | g/m³ | 0.001 | | | | | | 0.001 | | | | | |
| 25 | BOD5 - Total | g/m³ | 1 | 1 | 1 | 1 | 1 | 6 | 1 | 1 | 1 | 1 | 1 | 1 |
| 26 | Boron - Dissolved | g/m³ | 0.06 | | | | | | 0.17 | | | | | |
| 26 | Cadmium - Dissolved | g/m³ | 0.0002 | | | | | | 0.0002 | | | | | |
| Other | Chemical Oxygen Demand | g/m³ | 25 | 15 | 24 | 22 | 15 | 15 | 23 | 18 | 15 | 17 | 15 | 15 |
| 26 | Chloride | g/m³ | 32.1 | | | | | | 108 | | | | | |
| 26 | Chromium - Dissolved | g/m³ | 0.001 | | | | | | 0.001 | | | | | |
| Other | Comments | | Clear | Clear | Clear, floating solids | Clear | | Clear | Clear | | Clear | | | |
| 25 | Conductivity at 25°C | mS/m | 41.3 | 91.4 | 107 | 89.2 | 107 | 106 | 107 | 106 | 91.6 | 109 | 108 | 104 |
| 26 | Copper - Dissolved | g/m³ | 0.0039 | | | | | | 0.0005 | | | | | |
| 26 | Dissolved Reactive Phosphorus | g/m³ | 0.012 | | | | | | 0.017 | | | | | |
| 25 | Faecal Coliforms | cfu/100ml | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 25 | Iron - Dissolved | g/m³ | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| 26 | Lead - Dissolved | g/m³ | 0.0005 | | | | | | 0.0005 | | | | | |
| 25 | Manganese - Dissolved | g/m³ | 0.0059 | 0.0018 | 0.266 | 0.0208 | 0.272 | 0.293 | 0.244 | 0.253 | 0.404 | 0.322 | 0.293 | 0.0129 |
| 26 | Nickel - Dissolved | g/m³ | 0.0007 | | | | | | 0.0012 | | | | | |
| 26 | Nitrate - Nitrogen | g/m³ | 1.59 | | | | | | 1.03 | | | | | |
| 25 | pH | | 6.8 | 6.9 | 6.6 | 7.2 | 7.1 | 6.7 | 6.7 | 7 | 6.5 | 6.7 | 7.1 | 8 |
| Other | Water Level of Bore | Metres | 1.3 | 1.2 | 1.5 | 1.4 | 1.3 | 1.5 | 1.8 | 1.7 | 1.4 | 1.4 | 1.4 | 1.5 |
| Other | Weather - 24 hr | | No Rain | Some Rain | Some Rain | No Rain | Some Rain | No Rain | No Rain | No Rain | Some Rain | Much Rain | Much Rain | No Rain |
| 26 | Zinc - Dissolved | g/m³ | 0.003 | | | | | | 0.002 | | | | | |

| Condition | Description | Measure | 13/06/2019 | 29/07/2019 | 30/08/2019 | 24/09/2019 | 25/10/2019 | 8/11/2019 | 19/12/2019 | 29/01/2020 | 28/02/2020 | 27/03/2020 | 17/04/2020 | 21/05/2020 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 26 | Aluminium - Dissolved | g/m³ | | | | | | | | | | | | |
| 25 | Ammonia Nitrogen | g/m³ | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.15 | 0.01 | 0.01 | 0.11 | 0.01 |
| 26 | Arsenic - Dissolved | g/m³ | | | | | | | | | | | | |
| 25 | BOD5 - Total | g/m³ | 6 | 1 | 1 | 1 | 1 | 6 | 1 | 1 | 1 | 1 | 1 | 1 |
| 26 | Boron - Dissolved | g/m³ | | | | | | | | | | | | |
| 26 | Cadmium - Dissolved | g/m³ | | | | | | | | | | | | |
| Other | Chemical Oxygen Demand | g/m³ | 15 | 26 | 15 | 15 | 15 | 15 | 56 | 33 | 15 | 15 | 44 | 15 |
| 26 | Chloride | g/m³ | | | | | | | | | | | | |
| 26 | Chromium - Dissolved | g/m³ | | | | | | | | | | | | |
| Other | Comments | | | | | | | | | | | | | |
| 25 | Conductivity at 25°C | mS/m | 103 | 103 | 102 | 102 | 102 | 107 | 106 | 61.4 | 108 | 101 | 101 | 104 |
| 26 | Copper - Dissolved | g/m³ | | | | | | | | | | | | |
| 26 | Dissolved Reactive Phosphorus | g/m³ | | | | | | | | | | | | |
| 25 | Faecal Coliforms | cfu/100ml | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 6 | 1 |
| 25 | Iron - Dissolved | g/m³ | 0.01 | 0.01 | 0.01 | 0.02 | 0.01 | 0.01 | 0.02 | 0.17 | 0.02 | 0.01 | 0.71 | 0.01 |
| 26 | Lead - Dissolved | g/m³ | | | | | | | | | | | | |
| 25 | Manganese - Dissolved | g/m³ | 0.231 | 0.251 | 0.26 | 0.224 | 0.243 | 0.341 | 0.473 | 0.403 | 0.37 | 0.262 | 0.302 | 0.309 |
| 26 | Nickel - Dissolved | g/m³ | | | | | | | | | | | | |
| 26 | Nitrate - Nitrogen | g/m³ | | | | | | | | | | | | |
| 25 | pH | | 7.2 | 6.9 | 7.5 | 7.3 | 7.1 | 6.9 | 7.1 | 6.9 | 7.6 | 7.3 | 6.7 | 6.6 |
| Other | Water Level of Bore | Metres | 1.4 | 1.5 | 1.7 | 1.5 | 2.4 | 2.2 | 2.3 | 2.3 | 1.7 | 2.3 | 1.8 | 1.3 |
| Other | Weather - 24 hr | | No Rain | No Rain | No Rain | Some Rain | Some Rain | No Rain | Some Rain | Some Rain | No Rain | Some Rain | Some Rain | No Rain |
| 26 | Zinc - Dissolved | g/m³ | | | | | | | | | | | | |

Notes:
Values in red were reported below the detection limit.

**SOUTHERN LANDFILL - BOREHOLE BH3A/BH103A MONITORING RESULTS**

| Condition | Description | Measure | 22/06/2017 | 17/07/2017 | 18/08/2017 | 21/09/2017 | 18/10/2017 | 27/11/2017 | 21/12/2017 | 26/01/2018 | 27/02/2018 | 21/03/2018 | 17/04/2018 | 29/05/2018 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 26 | Aluminium - Dissolved | g/m³ | 0.002 | | | | | | 0.025 | | | | | |
| 25 | Ammonia Nitrogen | g/m³ | 0.01 | 0.01 | 0.01 | 0.01 | 0.2 | 0.01 | 0.06 | 0.01 | 0.08 | 0.01 | 0.01 | 0.01 |
| 26 | Arsenic - Dissolved | g/m³ | 0.001 | | | | | | 0.001 | | | | | |
| 25 | BOD5 - Total | g/m³ | 1 | 1 | 1 | 1 | 1 | 1 | 6 | 1 | 1 | 1 | 1 | 1 |
| 26 | Boron - Dissolved | g/m³ | 0.21 | | | | | | 0.25 | | | | | |
| 26 | Cadmium - Dissolved | g/m³ | 0.0002 | | | | | | 0.0002 | | | | | |
| Other | Chemical Oxygen Demand | g/m³ | 55 | 15 | 27 | 16 | 15 | 43 | 26 | 27 | 15 | 28 | 15 | 15 |
| 26 | Chloride | g/m³ | 116 | | | | | | 146 | | | | | |
| 26 | Chromium - Dissolved | g/m³ | 0.001 | | | | | | 0.001 | | | | | |
| Other | Comments | | Cloudy, floating solids | Clear, floating solids | Cloudy, brownish, floating solids | Light brown | Cloudy, misty grey, floating solids | Clear, floating solids | Brown and floating solids | Clear and floating solids | Cloudy | Cloudy | Clear | Clear |
| 25 | Conductivity at 25°C | mS/m | 102 | 57.8 | 57 | 87 | 95.3 | 118 | 126 | 89.6 | 85.6 | 82.1 | 49.2 | 56.1 |
| 26 | Copper - Dissolved | g/m³ | 0.0014 | | | | | | 0.0031 | | | | | |
| 26 | Dissolved Reactive Phosphorus | g/m³ | 0.041 | | | | | | 0.043 | | | | | |
| 25 | Faecal Coliforms | cfu/100ml | 3 | 1 | 2 | 1 | 2 | 1 | 1 | 8 | 20 | 2 | 14 | 5 |
| 25 | Iron - Dissolved | g/m³ | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.03 | 0.02 | 0.02 | 0.01 | 0.01 | 0.01 |
| 26 | Lead - Dissolved | g/m³ | 0.0005 | | | | | | 0.0005 | | | | | |
| 25 | Manganese - Dissolved | g/m³ | 0.0134 | 0.0287 | 0.0136 | 0.001 | 0.662 | 0.0246 | 0.473 | 0.224 | 0.0337 | 0.0338 | 0.147 | 0.0179 |
| 26 | Nickel - Dissolved | g/m³ | 0.0015 | | | | | | 0.003 | | | | | |
| 26 | Nitrate - Nitrogen | g/m³ | 0.88 | | | | | | 0.22 | | | | | |
| 25 | pH | | 6.5 | 6.5 | 6.6 | 6.7 | 6.6 | 6.5 | 6.4 | 6.6 | 6.7 | 6.5 | 6.5 | 6.5 |
| Other | Water Level of Bore | Metres | 4.8 | 4.4 | 4.5 | 4.6 | 4.8 | 4.9 | 4.8 | 4.8 | 4.6 | 4.9 | 4.7 | 4.5 |
| Other | Weather - 24 hr | | | | No Rain | Some Rain | No Rain | No Rain | No Rain | Some Rain | Some Rain | Some Rain | Some Rain | |
| 26 | Zinc - Dissolved | g/m³ | 0.002 | | | | | | 0.006 | | | | | |

| Condition | Description | Measure | 29/06/2018 | 24/07/2018 | 28/08/2018 | 24/09/2018 | 30/10/2018 | 13/11/2018 | 13/12/2018 | 10/01/2019 | 25/02/2019 | 27/03/2019 | 23/04/2019 | 29/05/2019 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 26 | Aluminium - Dissolved | g/m³ | 0.002 | | | | | | 0.012 | | | | | |
| 25 | Ammonia Nitrogen | g/m³ | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.03 | 0.01 | 0.42 | 0.01 | 0.13 |
| 26 | Arsenic - Dissolved | g/m³ | 0.001 | | | | | | 0.001 | | | | | |
| 25 | BOD5 - Total | g/m³ | 1 | 1 | 6 | 6 | 1 | 6 | 1 | 1 | 1 | 1 | 1 | 1 |
| 26 | Boron - Dissolved | g/m³ | 0.12 | | | | | | 0.13 | | | | | |
| 26 | Cadmium - Dissolved | g/m³ | 0.0002 | | | | | | 0.0002 | | | | | |
| Other | Chemical Oxygen Demand | g/m³ | 15 | 15 | 15 | 21 | 15 | 15 | 28 | 26 | 15 | 34 | 15 | 15 |
| 26 | Chloride | g/m³ | 96.5 | | | | | | 73 | | | | | |
| 26 | Chromium - Dissolved | g/m³ | 0.001 | | | | | | 0.001 | | | | | |
| Other | Comments | | | Clear | Brown, floating solids | Brown | | Cloudy | Brownish | | Clear | | | |
| 25 | Conductivity at 25°C | mS/m | 64.4 | 69.3 | 54 | 61.8 | 52.4 | 51.5 | 74.4 | 98.1 | 19.6 | 43.5 | 33.6 | 66.3 |
| 26 | Copper - Dissolved | g/m³ | 0.0005 | | | | | | 0.0013 | | | | | |
| 26 | Dissolved Reactive Phosphorus | g/m³ | 0.021 | | | | | | 0.042 | | | | | |
| 25 | Faecal Coliforms | cfu/100ml | 1 | 1 | 7 | 45 | 80 | 14 | 33 | 1 | 21 | 2 | 90 | 26 |
| 25 | Iron - Dissolved | g/m³ | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.02 | 0.01 | 0.04 | 0.02 | 0.01 |
| 26 | Lead - Dissolved | g/m³ | 0.0005 | | | | | | 0.0005 | | | | | |
| 25 | Manganese - Dissolved | g/m³ | 0.0207 | 0.0019 | 0.0055 | 0.0014 | 0.002 | 0.0163 | 0.004 | 0.0086 | 0.0025 | 0.579 | 0.0012 | 0.0061 |
| 26 | Nickel - Dissolved | g/m³ | 0.0008 | | | | | | 0.0007 | | | | | |
| 26 | Nitrate - Nitrogen | g/m³ | 1.92 | | | | | | 2.24 | | | | | |
| 25 | pH | | 6.7 | 6.5 | 6.7 | 6.6 | 6.6 | 6.6 | 6.5 | 6.6 | 6.8 | 6.7 | 6.7 | 7 |
| Other | Water Level of Bore | Metres | 4.8 | 4.7 | 4.8 | 4.8 | 4.1 | 4.5 | 4.4 | 4.7 | 3.5 | 4.1 | 3.8 | 4.2 |
| Other | Weather - 24 hr | | No Rain | Some Rain | Some Rain | No Rain | Some Rain | No Rain | No Rain | No Rain | Some Rain | Much Rain | Much Rain | No Rain |
| 26 | Zinc - Dissolved | g/m³ | 0.002 | | | | | | 0.002 | | | | | |

| Condition | Description | Measure | 13/06/2019 | 29/07/2019 | 30/08/2019 | 24/09/2019 | 25/10/2019 | 8/11/2019 | 19/12/2019 | 29/01/2020 | 28/02/2020 | 27/03/2020 | 17/04/2020 | 21/05/2020 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 26 | Aluminium - Dissolved | g/m³ | | | | | | | | | | | | |
| 25 | Ammonia Nitrogen | g/m³ | 0.09 | 0.1 | 0.03 | 0.03 | 0.02 | 0.3 | 0.01 | 0.01 | 0.01 | 0.01 | 0.03 | 0.01 |
| 26 | Arsenic - Dissolved | g/m³ | | | | | | | | | | | | |
| 25 | BOD5 - Total | g/m³ | 6 | 1 | 6 | 1 | 1 | 6 | 1 | 1 | 1 | 6 | 1 | 1 |
| 26 | Boron - Dissolved | g/m³ | | | | | | | | | | | | |
| 26 | Cadmium - Dissolved | g/m³ | | | | | | | | | | | | |
| Other | Chemical Oxygen Demand | g/m³ | 15 | 30 | 16 | 23 | 15 | 19 | 48 | 25 | 15 | 15 | 15 | 15 |
| 26 | Chloride | g/m³ | | | | | | | | | | | | |
| 26 | Chromium - Dissolved | g/m³ | | | | | | | | | | | | |
| Other | Comments | | | | | | | | | | | | | |
| 25 | Conductivity at 25°C | mS/m | 83.5 | 86 | 58.2 | 70.4 | 68.2 | 91.4 | 37.1 | 20.8 | 19 | 19.2 | 19.4 | 19.1 |
| 26 | Copper - Dissolved | g/m³ | | | | | | | | | | | | |
| 26 | Dissolved Reactive Phosphorus | g/m³ | | | | | | | | | | | | |
| 25 | Faecal Coliforms | cfu/100ml | 1 | 20 | 1 | 1 | 3 | 1 | 18 | 1 | 1 | 1 | 7 | 7 |
| 25 | Iron - Dissolved | g/m³ | 0.01 | 0.01 | 0.02 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| 26 | Lead - Dissolved | g/m³ | | | | | | | | | | | | |
| 25 | Manganese - Dissolved | g/m³ | 0.0109 | 0.0294 | 0.0388 | 0.0103 | 0.0094 | 0.643 | 0.0174 | 0.0017 | 0.0026 | 0.003 | 0.0022 | 0.0013 |
| 26 | Nickel - Dissolved | g/m³ | | | | | | | | | | | | |
| 26 | Nitrate - Nitrogen | g/m³ | | | | | | | | | | | | |
| 25 | pH | | 6.7 | 7.8 | 6.8 | 7 | 6.7 | 6.5 | 7 | 6.6 | 7 | 6.7 | 6.7 | 6.6 |
| Other | Water Level of Bore | Metres | 4.5 | 4.5 | 4.2 | 4.3 | 4.3 | 4.4 | 4.2 | 4.2 | 3 | 3.8 | 4.1 | 4.1 |
| Other | Weather - 24 hr | | No Rain | No Rain | No Rain | Some Rain | Some Rain | No Rain | Some Rain | Some Rain | No Rain | Some Rain | Some Rain | No Rain |
| 26 | Zinc - Dissolved | g/m³ | | | | | | | | | | | | |

Notes:
Values in red were reported below the detection limit.

**SOUTHERN LANDFILL - BOREHOLE BH3B/BH103B MONITORING RESULTS**

| Condition | Description | Measure | 22/06/2017 | 17/07/2017 | 18/08/2017 | 21/09/2017 | 18/10/2017 | 27/11/2017 | 21/12/2017 | 26/01/2018 | 27/02/2018 | 21/03/2018 | 17/04/2018 | 29/05/2018 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 26 | Aluminium - Dissolved | g/m³ | 0.002 | | | | | | 0.012 | | | | | |
| 25 | Ammonia Nitrogen | g/m³ | 2.26 | 2.39 | 2.66 | 2.82 | 2 | 2.91 | 2.83 | 0.18 | 0.05 | 0.08 | 1.97 | 1.97 |
| 26 | Arsenic - Dissolved | g/m³ | 0.01 | | | | | | 0.007 | | | | | |
| 25 | BOD5 - Total | g/m³ | 2 | 5 | 3 | 9 | 11 | 14 | 5 | 1 | 1 | 1 | 2 | 8 |
| 26 | Boron - Dissolved | g/m³ | 0.56 | | | | | | 0.38 | | | | | |
| 26 | Cadmium - Dissolved | g/m³ | 0.0002 | | | | | | 0.0002 | | | | | |
| Other | Chemical Oxygen Demand | g/m³ | 76 | 27 | 45 | 43 | 32 | 56 | 50 | 107 | 15 | 54 | 26 | 22 |
| 26 | Chloride | g/m³ | 168 | | | | | | 181 | | | | | |
| 26 | Chromium - Dissolved | g/m³ | 0.001 | | | | | | 0.001 | | | | | |
| Other | Comments | | Clear, floating solids | Clear, mistry grey, floating solids | Clear, floating solids | Grey | Cloudy, misty grey, floating solids | Cloudy. Grey, floating solids | Clear/misty grey | Clear and floating solids | Cloudy | Cloudy | Greyish | Clear |
| 25 | Conductivity at 25°C | mS/m | 171 | 147 | 158 | 175 | 119 | 173 | 174 | 51.6 | 106 | 48 | 121 | 130 |
| 26 | Copper - Dissolved | g/m³ | 0.0005 | | | | | | 0.0075 | | | | | |
| 26 | Dissolved Reactive Phosphorus | g/m³ | 0.024 | | | | | | 0.017 | | | | | |
| 25 | Faecal Coliforms | cfu/100ml | 1 | 1 | 1 | 1 | 15 | 1 | 1 | 130 | 4 | 17 | 26 | 2 |
| 25 | Iron - Dissolved | g/m³ | 0.55 | 0.23 | 0.25 | 0.09 | 0.05 | 0.07 | 0.13 | 0.03 | 0.01 | 0.01 | 0.09 | 0.13 |
| 26 | Lead - Dissolved | g/m³ | 0.0006 | | | | | | 0.0005 | | | | | |
| 25 | Manganese - Dissolved | g/m³ | 10.9 | 10.7 | 9.66 | 10.4 | 5.76 | 10.2 | 10.8 | 1.89 | 0.564 | 1.65 | 8 | 7.19 |
| 26 | Nickel - Dissolved | g/m³ | 0.0048 | | | | | | 0.0056 | | | | | |
| 26 | Nitrate - Nitrogen | g/m³ | 0.02 | | | | | | 0.24 | | | | | |
| 25 | pH | | 6.6 | 6.6 | 6.7 | 6.8 | 6.7 | 6.6 | 6.6 | 6.7 | 6.7 | 6.5 | 6.6 | 6.7 |
| Other | Water Level of Bore | Metres | 4.3 | 4.1 | 4.1 | 4.2 | 4.7 | 4.8 | 5.2 | 4.9 | 4.8 | 4.8 | 4.7 | 5 |
| Other | Weather - 24 hr | | | | No Rain | Some Rain | No Rain | No Rain | No Rain | Some Rain | Some Rain | Some Rain | Some Rain | |
| 26 | Zinc - Dissolved | g/m³ | 0.005 | | | | | | 0.03 | | | | | |

| Condition | Description | Measure | 29/06/2018 | 24/07/2018 | 28/08/2018 | 24/09/2018 | 30/10/2018 | 13/11/2018 | 13/12/2018 | 10/01/2019 | 25/02/2019 | 27/03/2019 | 23/04/2019 | 29/05/2019 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 26 | Aluminium - Dissolved | g/m³ | 0.002 | | | | | | 0.003 | | | | | |
| 25 | Ammonia Nitrogen | g/m³ | 0.01 | 0.01 | 1.9 | 1.72 | 0.24 | 1.46 | 2.21 | 2.56 | 0.01 | 0.01 | 0.64 | 1.47 |
| 26 | Arsenic - Dissolved | g/m³ | 0.001 | | | | | | 0.002 | | | | | |
| 25 | BOD5 - Total | g/m³ | 1 | 1 | 11 | 11 | 1 | 6 | 3 | 3 | 1 | 1 | 9 | 6 |
| 26 | Boron - Dissolved | g/m³ | 0.17 | | | | | | 0.36 | | | | | |
| 26 | Cadmium - Dissolved | g/m³ | 0.0002 | | | | | | 0.0002 | | | | | |
| Other | Chemical Oxygen Demand | g/m³ | 19 | 15 | 40 | 43 | 15 | 35 | 34 | 48 | 15 | 15 | 43 | 40 |
| 26 | Chloride | g/m³ | 104 | | | | | | 156 | | | | | |
| 26 | Chromium - Dissolved | g/m³ | 0.001 | | | | | | 0.001 | | | | | |
| Other | Comments | | Clear | Clear | Light brown, floating solids | Cloudy | | Clear | Clear | | Clear | | | |
| 25 | Conductivity at 25°C | mS/m | 46.1 | 44.5 | 154 | 163 | 63.6 | 130 | 157 | 171 | 23.3 | 21.8 | 82.9 | 83.8 |
| 26 | Copper - Dissolved | g/m³ | 0.0005 | | | | | | 0.0015 | | | | | |
| 26 | Dissolved Reactive Phosphorus | g/m³ | 0.023 | | | | | | 0.025 | | | | | |
| 25 | Faecal Coliforms | cfu/100ml | 1 | 1 | 7 | 22 | 29 | 28 | 6 | 1 | 1 | 17 | 62 | 11 |
| 25 | Iron - Dissolved | g/m³ | 0.01 | 0.01 | 0.02 | 0.02 | 0.01 | 0.01 | 0.02 | 0.04 | 0.01 | 0.01 | 0.01 | 0.02 |
| 26 | Lead - Dissolved | g/m³ | 0.0005 | | | | | | 0.0005 | | | | | |
| 25 | Manganese - Dissolved | g/m³ | 0.38 | 0.0068 | 9.63 | 8.87 | 2.13 | 6.61 | 7.25 | 10.2 | 0.0158 | 0.0011 | 2.68 | 5.04 |
| 26 | Nickel - Dissolved | g/m³ | 0.0019 | | | | | | 0.0036 | | | | | |
| 26 | Nitrate - Nitrogen | g/m³ | 1.01 | | | | | | 0.18 | | | | | |
| 25 | pH | | 7 | 6.8 | 6.6 | 6.6 | 6.6 | 6.6 | 6.6 | 6.7 | 6.7 | 6.6 | 6.8 | 6.6 |
| Other | Water Level of Bore | Metres | 4.7 | 4.5 | 4.8 | 4.8 | 4.5 | 4.7 | 4.5 | 4.7 | 4.2 | 4.1 | 4.1 | 4.2 |
| Other | Weather - 24 hr | | No Rain | Some Rain | Some Rain | No Rain | Some Rain | No Rain | No Rain | No Rain | Some Rain | Much Rain | Much Rain | No Rain |
| 26 | Zinc - Dissolved | g/m³ | 0.003 | | | | | | 0.006 | | | | | |

| Condition | Description | Measure | 13/06/2019 | 29/07/2019 | 30/08/2019 | 24/09/2019 | 25/10/2019 | 8/11/2019 | 19/12/2019 | 29/01/2020 | 28/02/2020 | 27/03/2020 | 17/04/2020 | 21/05/2020 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 26 | Aluminium - Dissolved | g/m³ | | | | | | | | | | | | |
| 25 | Ammonia Nitrogen | g/m³ | 2.27 | 2.51 | 2.68 | 2.68 | 2.38 | 2.49 | 0.76 | 0.01 | 0.02 | 0.28 | 0.55 | 0.89 |
| 26 | Arsenic - Dissolved | g/m³ | | | | | | | | | | | | |
| 25 | BOD5 - Total | g/m³ | 1 | 3 | 6 | 1 | 2 | 6 | 3 | 1 | 1 | 1 | 1 | 6 |
| 26 | Boron - Dissolved | g/m³ | | | | | | | | | | | | |
| 26 | Cadmium - Dissolved | g/m³ | | | | | | | | | | | | |
| Other | Chemical Oxygen Demand | g/m³ | 19 | 43 | 70 | 19 | 33 | 37 | 63 | 19 | 24 | 15 | 15 | 32 |
| 26 | Chloride | g/m³ | | | | | | | | | | | | |
| 26 | Chromium - Dissolved | g/m³ | | | | | | | | | | | | |
| Other | Comments | | | | | | | | | | | | | |
| 25 | Conductivity at 25°C | mS/m | 154 | 164 | 169 | 164 | 166 | 169 | 88.9 | 28.1 | 23 | 46.9 | 68 | 90 |
| 26 | Copper - Dissolved | g/m³ | | | | | | | | | | | | |
| 26 | Dissolved Reactive Phosphorus | g/m³ | | | | | | | | | | | | |
| 25 | Faecal Coliforms | cfu/100ml | 4 | 6 | 2 | 2 | 7 | 3 | 110 | 98 | 37 | 7 | 4 | 12 |
| 25 | Iron - Dissolved | g/m³ | 0.03 | 0.02 | 0.05 | 0.04 | 0.05 | 0.04 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| 26 | Lead - Dissolved | g/m³ | | | | | | | | | | | | |
| 25 | Manganese - Dissolved | g/m³ | 8.86 | 10.3 | 11.4 | 9.58 | 10 | 11 | 3.7 | 0.0029 | 0.077 | 1.05 | 2.52 | 3.89 |
| 26 | Nickel - Dissolved | g/m³ | | | | | | | | | | | | |
| 26 | Nitrate - Nitrogen | g/m³ | | | | | | | | | | | | |
| 25 | pH | | 6.9 | 7.7 | 7 | 6.8 | 7 | 6.6 | 7.1 | 6.9 | 7.2 | 6.6 | 6.6 | 6.5 |
| Other | Water Level of Bore | Metres | 4.3 | 4.4 | 4.1 | 4.3 | 4.3 | 4.3 | 4.6 | 7.1 | 2.8 | 4.2 | 4.4 | 4.3 |
| Other | Weather - 24 hr | | No Rain | No Rain | No Rain | Some Rain | Some Rain | No Rain | Some Rain | Some Rain | No Rain | Some Rain | Some Rain | No Rain |
| 26 | Zinc - Dissolved | g/m³ | | | | | | | | | | | | |

Notes:
Values in red were reported below the detection limit.

**SOUTHERN LANDFILL - BOREHOLE BH6 MONITORING RESULTS**

| Condition | Description | Measure | 22/06/2017 | 17/07/2017 | 17/08/2017 | 21/09/2017 | 17/10/2017 | 27/11/2017 | 21/12/2017 | 26/01/2018 | 27/02/2018 | 21/03/2018 | 17/04/2018 | 29/05/2018 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 26 | Aluminium - Dissolved | g/m³ | 0.009 | | | | | | 0.039 | | | | | |
| 25 | Ammonia Nitrogen | g/m³ | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| 26 | Arsenic - Dissolved | g/m³ | 0.001 | | | | | | 0.001 | | | | | |
| 25 | BOD5 - Total | g/m³ | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 26 | Boron - Dissolved | g/m³ | 0.05 | | | | | | 0.04 | | | | | |
| 26 | Cadmium - Dissolved | g/m³ | 0.0002 | | | | | | 0.0002 | | | | | |
| Other | Chemical Oxygen Demand | g/m³ | 86 | 15 | 15 | 15 | 15 | 19 | 17 | 49 | 15 | 15 | 15 | 15 |
| 26 | Chloride | g/m³ | 110 | | | | | | 119 | | | | | |
| 26 | Chromium - Dissolved | g/m³ | 0.001 | | | | | | 0.001 | | | | | |
| Other | Comments | | Clear, floating solids, misty grey | Clear, misty grey, floating solids | Cloudy, misty grey, floating solids | Light brown | Clear, misty grey, floating solids | Clear, misty/grey, floating solids | Clear/misty grey | Clear and floating solids | Cloudy | Cloudy | Clear | Clear |
| 25 | Conductivity at 25°C | mS/m | 58.2 | 57.8 | 58.1 | 58.6 | 59.6 | 54.4 | 55.6 | 29.3 | 37.7 | 46.6 | 57.3 | 56.2 |
| 26 | Copper - Dissolved | g/m³ | 0.0005 | | | | | | 0.0013 | | | | | |
| 26 | Dissolved Reactive Phosphorus | g/m³ | 0.019 | | | | | | 0.024 | | | | | |
| 25 | Faecal Coliforms | cfu/100ml | 15 | 3 | 3 | 4 | 1 | 4 | 2 | 110 | 2400 | 440 | 150 | 25 |
| 25 | Iron - Dissolved | g/m³ | 0.01 | 0.01 | 0.01 | 0.01 | 0.04 | 0.01 | 0.04 | 0.07 | 0.03 | 0.04 | 0.01 | 0.01 |
| 26 | Lead - Dissolved | g/m³ | 0.0005 | | | | | | 0.0005 | | | | | |
| 25 | Manganese - Dissolved | g/m³ | 0.0121 | 0.0067 | 0.014 | 0.0533 | 0.0273 | 0.0301 | 0.0313 | 0.0154 | 0.0081 | 0.0141 | 0.0464 | 0.0377 |
| 26 | Nickel - Dissolved | g/m³ | 0.0039 | | | | | | 0.004 | | | | | |
| 26 | Nitrate - Nitrogen | g/m³ | 0.27 | | | | | | 0.21 | | | | | |
| 25 | pH | | 6.3 | 6.2 | 6.5 | 6.5 | 6.2 | 6.2 | 6 | 6.2 | 6.1 | 6.4 | 6.4 | 6.5 |
| Other | Water Level of Bore | Metres | 1.5 | 1 | 1 | 0.4 | 1 | 1.5 | 1.4 | 1.5 | 1.4 | 1.5 | 0.5 | 1 |
| Other | Weather - 24 hr | | | | Some Rain | Some Rain | No Rain | No Rain | No Rain | Some Rain | Some Rain | Some Rain | Some Rain | |
| 26 | Zinc - Dissolved | g/m³ | 0.011 | | | | | | 0.015 | | | | | |

| Condition | Description | Measure | 29/06/2018 | 24/07/2018 | 28/08/2018 | 24/09/02018 | 30/10/2018 | 13/11/2018 | 13/12/2018 | 10/01/2019 | 25/02/2019 | 27/03/2019 | 23/04/2019 | 29/05/2019 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 26 | Aluminium - Dissolved | g/m³ | 0.009 | | | | | | | | | | | |
| 25 | Ammonia Nitrogen | g/m³ | 0.01 | 0.01 | 0.01 | 0.01 | | | | | | | | |
| 26 | Arsenic - Dissolved | g/m³ | 0.001 | | | | | | | | | | | |
| 25 | BOD5 - Total | g/m³ | 1 | 1 | 1 | 1 | | | | | | | | |
| 26 | Boron - Dissolved | g/m³ | 0.03 | | | | | | | | | | | |
| 26 | Cadmium - Dissolved | g/m³ | 0.0002 | | | | | | | | | | | |
| Other | Chemical Oxygen Demand | g/m³ | 15 | 15 | 15 | 17 | | | | | | | | |
| 26 | Chloride | g/m³ | 101 | | | | | | | | | | | |
| 26 | Chromium - Dissolved | g/m³ | 0.001 | | | | | | | | | | | |
| Other | Comments | | Clear | Clear | Light brown, floating solids | Clear | No sample collected - Bore covered by landslip, not accessible | No sample collected - Bore covered, not accessible | No sample collected - Bore covered, not accessible | No sample collected - Bore still covered by landslip, not accessible | No sample collected | No sample collected - Bore covered, not accessible | No sample collected | No sample collected - Bore covered, not accessible |
| 25 | Conductivity at 25°C | mS/m | 55.2 | 56.4 | 57.7 | 57.3 | | | | | | | | |
| 26 | Copper - Dissolved | g/m³ | 0.0005 | | | | | | | | | | | |
| 26 | Dissolved Reactive Phosphorus | g/m³ | 0.025 | | | | | | | | | | | |
| 25 | Faecal Coliforms | cfu/100ml | 2 | 1 | 1 | 1 | | | | | | | | |
| 25 | Iron - Dissolved | g/m³ | 0.01 | 0.01 | 0.01 | 0.01 | | | | | | | | |
| 26 | Lead - Dissolved | g/m³ | 0.0005 | | | | | | | | | | | |
| 25 | Manganese - Dissolved | g/m³ | 0.0043 | 0.0092 | 0.0258 | 0.0278 | | | | | | | | |
| 26 | Nickel - Dissolved | g/m³ | 0.0019 | | | | | | | | | | | |
| 26 | Nitrate - Nitrogen | g/m³ | 0.32 | | | | | | | | | | | |
| 25 | pH | | 6.1 | 6.3 | 6.6 | 6.6 | | | | | | | | |
| Other | Water Level of Bore | Metres | 1.3 | 1 | 2 | 0.7 | | | | | | | | |
| Other | Weather - 24 hr | | No Rain | Some Rain | Some Rain | No Rain | | | | | | | | |
| 26 | Zinc - Dissolved | g/m³ | 0.008 | | | | | | | | | | | |

| Condition | Description | Measure | 13/06/2019 | 29/07/2019 | 30/08/2019 | 24/09/2019 | 25/10/2019 | 8/11/2019 | 19/12/2019 | 29/01/2020 | 28/02/2020 | 27/03/2020 | 17/04/2020 | 21/05/2020 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 26 | Aluminium - Dissolved | g/m³ | | | | | | | | | | | | |
| 25 | Ammonia Nitrogen | g/m³ | | | | | | | | | | | 0.01 | 0.02 |
| 26 | Arsenic - Dissolved | g/m³ | | | | | | | | | | | | |
| 25 | BOD5 - Total | g/m³ | | | | | | | | | | | 1 | 6 |
| 26 | Boron - Dissolved | g/m³ | | | | | | | | | | | | |
| 26 | Cadmium - Dissolved | g/m³ | | | | | | | | | | | | |
| Other | Chemical Oxygen Demand | g/m³ | | | | | | | | | | | 15 | 15 |
| 26 | Chloride | g/m³ | | | | | | | | | | | | |
| 26 | Chromium - Dissolved | g/m³ | | | | | | | | | | | | |
| Other | Comments | | No sample collected - Bore covered, not accessible | No sample collected - Bore covered, not accessible | No sample collected - Bore covered, not accessible | No sample collected - Bore covered, not accessible | No sample collected - Bore covered, not accessible | No sample collected - Bore covered, not accessible | No sample collected - Bore covered, not accessible | No sample collected - Bore covered, not accessible | No sample collected - Bore covered, not accessible | No sample collected - Bore covered, not accessible | | |
| 25 | Conductivity at 25°C | mS/m | | | | | | | | | | | 36.6 | 43.2 |
| 26 | Copper - Dissolved | g/m³ | | | | | | | | | | | | |
| 26 | Dissolved Reactive Phosphorus | g/m³ | | | | | | | | | | | | |
| 25 | Faecal Coliforms | cfu/100ml | | | | | | | | | | | 60 | 72 |
| 25 | Iron - Dissolved | g/m³ | | | | | | | | | | | 0.05 | 0.03 |
| 26 | Lead - Dissolved | g/m³ | | | | | | | | | | | | |
| 25 | Manganese - Dissolved | g/m³ | | | | | | | | | | | 0.0711 | 0.0264 |
| 26 | Nickel - Dissolved | g/m³ | | | | | | | | | | | | |
| 26 | Nitrate - Nitrogen | g/m³ | | | | | | | | | | | | |
| 25 | pH | | | | | | | | | | | | 6.1 | 6.2 |
| Other | Water Level of Bore | Metres | | | | | | | | | | | 1.8 | 1.3 |
| Other | Weather - 24 hr | | | | | | | | | | | | Some Rain | No Rain |
| 26 | Zinc - Dissolved | g/m³ | | | | | | | | | | | | |

Notes:
Values in red were reported below the detection limit.

**SOUTHERN LANDFILL - UPSTREAM MONITORING OF CAREY'S STREAM**

| Condition | Description | Measure | 22/06/2017 | 20/07/2017 | 18/08/2017 | 21/09/2017 | 17/10/2017 | 27/11/2017 | 21/12/2017 | 26/01/2018 | 27/02/2018 | 21/03/2018 | 17/04/2018 | 29/05/2018 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 26 | Aluminium - Acid Soluble | g/m³ | 0.015 | | | | | | 0.005 | | | | | |
| 25 | Ammonia Nitrogen | g/m³ | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| 26 | Arsenic - Acid Soluble | g/m³ | 0.001 | | | | | | 0.001 | | | | | |
| 25 | BOD5 - Total | g/m³ | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 26 | Boron - Acid Soluble | g/m³ | 0.03 | | | | | | 0.03 | | | | | |
| 26 | Cadmium - Acid Soluble | g/m³ | 0.0002 | | | | | | 0.0002 | | | | | |
| Other | Chemical Oxygen Demand | g/m³ | 15 | 59 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| 26 | Chloride | g/m³ | 43.3 | | | | | | 47.4 | | | | | |
| 26 | Chromium - Acid Soluble | g/m³ | 0.001 | | | | | | 0.001 | | | | | |
| 25 | Conductivity at 25°C | mS/m | 23.8 | 22.1 | 21.5 | 23.5 | 23.9 | 26.3 | 26.5 | 27.5 | 22.1 | 24.7 | 22.2 | 22.3 |
| 26 | Copper - Acid Soluble | g/m³ | 0.0005 | | | | | | 0.0005 | | | | | |
| 26 | Dissolved Reactive Phosphorus | g/m³ | 0.011 | | | | | | 0.012 | | | | | |
| 25 | Faecal Coliforms | cfu/100ml | 8 | 4 | 12 | 32 | 58 | 150 | 12 | 84 | 96 | 77 | 20 | 28 |
| 25 | Iron - Acid Soluble | g/m³ | 0.02 | 0.01 | 0.02 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.02 | 0.01 | 0.02 | 0.02 |
| 26 | Lead - Acid Soluble | g/m³ | 0.0005 | | | | | | 0.0005 | | | | | |
| 25 | Manganese - Acid Soluble | g/m³ | 0.0027 | 0.0007 | 0.0052 | 0.0016 | 0.0006 | 0.0007 | 0.0005 | 0.0013 | 0.0023 | 0.0015 | 0.0068 | 0.0013 |
| 26 | Nickel - Acid Soluble | g/m³ | 0.0005 | | | | | | 0.0005 | | | | | |
| 26 | Nitrate - Nitrogen | g/m³ | 0.46 | 0.48 | 0.51 | 0.46 | 0.38 | 0.36 | 0.35 | 0.39 | 0.26 | 0.31 | 0.25 | 0.31 |
| 25 | pH | | 7.7 | 7.6 | 7.7 | 7.7 | 7.7 | 7.7 | 7.6 | 7.8 | 7.7 | 7.7 | 7.8 | 7.8 |
| Other | Suspended Solids - Total | g/m³ | 5 | 5 | 6 | 6 | 6 | 6 | 6 | 7 | 6 | 6 | 6 | 6 |
| 26 | Zinc - Acid Soluble | g/m³ | 0.002 | | | | | | 0.002 | | | | | |

| Condition | Description | Measure | 29/06/2018 | 24/07/2018 | 28/08/2018 | 24/09/2018 | 30/10/2018 | 13/11/2018 | 13/12/2018 | 10/01/2019 | 25/02/2019 | 27/03/2019 | 23/04/2019 | 29/05/2019 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 26 | Aluminium - Acid Soluble | g/m³ | 0.01 | | | | | | 0.013 | | | | | |
| 25 | Ammonia Nitrogen | g/m³ | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| 26 | Arsenic - Acid Soluble | g/m³ | 0.001 | | | | | | 0.001 | | | | | |
| 25 | BOD5 - Total | g/m³ | 1 | 1 | 1 | 1 | 1 | 6 | 1 | 3 | 1 | 1 | 3 | 1 |
| 26 | Boron - Acid Soluble | g/m³ | 0.03 | | | | | | 0.03 | | | | | |
| 26 | Cadmium - Acid Soluble | g/m³ | 0.0002 | | | | | | 0.0002 | | | | | |
| Other | Chemical Oxygen Demand | g/m³ | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 28 | 15 | 15 |
| 26 | Chloride | g/m³ | 42.4 | | | | | | 40.5 | | | | | |
| 26 | Chromium - Acid Soluble | g/m³ | 0.001 | | | | | | 0.001 | | | | | |
| 25 | Conductivity at 25°C | mS/m | 22.7 | 23.3 | 22.7 | 23.5 | 18.4 | 20.6 | 22.7 | 24.8 | 26.1 | 25.4 | 20.5 | 23.5 |
| 26 | Copper - Acid Soluble | g/m³ | 0.0005 | | | | | | 0.0005 | | | | | |
| 26 | Dissolved Reactive Phosphorus | g/m³ | 0.013 | | | | | | 0.01 | | | | | |
| 25 | Faecal Coliforms | cfu/100ml | 4 | 4 | 84 | 120 | 4 | 88 | 65 | 36 | 110 | 150 | 80 | 20 |
| 25 | Iron - Acid Soluble | g/m³ | 0.01 | 0.01 | 0.01 | 0.01 | 0.05 | 0.01 | 0.02 | 0.02 | 0.01 | 0.02 | 0.03 | 0.01 |
| 26 | Lead - Acid Soluble | g/m³ | 0.0005 | | | | | | 0.0005 | | | | | |
| 25 | Manganese - Acid Soluble | g/m³ | 0.0033 | 0.0086 | 0.0013 | 0.0006 | 0.0032 | 0.0008 | 0.0061 | 0.0053 | 0.0048 | 0.0034 | 0.0016 | 0.0024 |
| 26 | Nickel - Acid Soluble | g/m³ | 0.0005 | | | | | | 0.0005 | | | | | |
| 26 | Nitrate - Nitrogen | g/m³ | 0.4 | 0.43 | 0.32 | 0.26 | 0.29 | 0.2 | 0.24 | 0.28 | 0.35 | 0.28 | 0.25 | 0.31 |
| 25 | pH | | 7.6 | 7.7 | 7.7 | 7.8 | 7.7 | 7.3 | 7.8 | 7.8 | 7.7 | 7.8 | 7.9 | 7.8 |
| Other | Suspended Solids - Total | g/m³ | 6 | 6 | 6 | 6 | 6 | 5 | 6 | 6 | 6 | 6 | 6 | 6 |
| 26 | Zinc - Acid Soluble | g/m³ | 0.002 | | | | | | 0.002 | | | | | |

| Condition | Description | Measure | 13/06/2019 | 29/07/2019 | 30/08/2019 | 24/09/2019 | 25/10/2019 | 8/11/2019 | 19/12/2019 | 29/01/2020 | 28/02/2020 | 27/03/2020 | 17/04/2020 | 21/05/2020 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 26 | Aluminium - Acid Soluble | g/m³ | | | | | | | | | | | | |
| 25 | Ammonia Nitrogen | g/m³ | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.02 |
| 26 | Arsenic - Acid Soluble | g/m³ | | | | | | | | | | | | |
| 25 | BOD5 - Total | g/m³ | 6 | 1 | 3 | 1 | 3 | 6 | 6 | 1 | 6 | 1 | 3 | 1 |
| 26 | Boron - Acid Soluble | g/m³ | | | | | | | | | | | | |
| 26 | Cadmium - Acid Soluble | g/m³ | | | | | | | | | | | | |
| Other | Chemical Oxygen Demand | g/m³ | 15 | 16 | 45 | 15 | 15 | 15 | 40 | 27 | 15 | 15 | 15 | 15 |
| 26 | Chloride | g/m³ | | | | | | | | | | | | |
| 26 | Chromium - Acid Soluble | g/m³ | | | | | | | | | | | | |
| 25 | Conductivity at 25°C | mS/m | 23.3 | 22.0 | 22.6 | 23.0 | 21.3 | 23.7 | 18.7 | 25.3 | 26.1 | 26.2 | 26.0 | 25.2 |
| 26 | Copper - Acid Soluble | g/m³ | | | | | | | | | | | | |
| 26 | Dissolved Reactive Phosphorus | g/m³ | | | | | | | | | | | | |
| 25 | Faecal Coliforms | cfu/100ml | 73 | 220 | 4 | 16 | 24 | 230 | 500 | 260 | 2900 | 100 | 150 | 340 |
| 25 | Iron - Acid Soluble | g/m³ | 0.05 | 0.01 | 0.01 | 0.03 | 0.01 | 0.03 | 0.03 | 0.01 | 0.01 | 0.01 | 0.01 | 0.02 |
| 26 | Lead - Acid Soluble | g/m³ | | | | | | | | | | | | |
| 25 | Manganese - Acid Soluble | g/m³ | 0.0045 | 0.0005 | 0.001 | 0.0065 | 0.0014 | 0.0187 | 0.0021 | 0.0013 | 0.003 | 0.0008 | 0.0009 | 0.0013 |
| 26 | Nickel - Acid Soluble | g/m³ | | | | | | | | | | | | |
| 26 | Nitrate - Nitrogen | g/m³ | 0.3 | 0.38 | 0.32 | 0.25 | 0.21 | 0.23 | 0.25 | 0.23 | 0.25 | 0.3 | 0.22 | 0.29 |
| 25 | pH | | 7.8 | 7.8 | 7.8 | 7.8 | 7.7 | 7.6 | 7.6 | 7.8 | 7.8 | 7.8 | 7.9 | 7.9 |
| Other | Suspended Solids - Total | g/m³ | 6 | 6 | 6 | 6 | 6 | 6 | 5 | 6 | 6 | 6 | 6 | 6 |
| 26 | Zinc - Acid Soluble | g/m³ | | | | | | | | | | | | |

Notes:
Values in red were reported below the detection limit.

**SOUTHERN LANDFILL - DOWNSTREAM MONITORING OF CAREY'S STREAM**

| Condition | Description | Measure | 22/06/2017 | 20/07/2017 | 17/08/2017 | 21/09/2017 | 17/10/2017 | 27/11/2017 | 21/12/2017 | 26/01/2018 | 27/02/2018 | 21/03/2018 | 17/04/2018 | 29/05/2018 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 26 | Aluminium - Acid Soluble | g/m³ | 0.01 | | | | | | 0.004 | | | | | |
| 25 | Ammonia Nitrogen | g/m³ | 0.71 | 0.42 | 0.34 | 0.67 | 0.61 | 0.3 | 0.2 | 0.02 | 0.25 | 0.15 | 0.19 | 0.24 |
| 26 | Arsenic - Acid Soluble | g/m³ | 0.001 | | | | | | 0.001 | | | | | |
| 25 | BOD5 - Total | g/m³ | 3 | 2 | 2 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 26 | Boron - Acid Soluble | g/m³ | 0.05 | | | | | | 0.04 | | | | | |
| 26 | Cadmium - Acid Soluble | g/m³ | 0.0002 | | | | | | 0.0002 | | | | | |
| Other | Chemical Oxygen Demand | g/m³ | 61 | 36 | 15 | 15 | 15 | 31 | 15 | 21 | 20 | 16 | 21 | 15 |
| 26 | Chloride | g/m³ | 50.7 | | | | | | 56.1 | | | | | |
| 26 | Chromium - Acid Soluble | g/m³ | 0.001 | | | | | | 0.001 | | | | | |
| 25 | Conductivity at 25°C | mS/m | 37.6 | 29.8 | 27.9 | 35.1 | 37.8 | 43.2 | 44.9 | 45 | 66.6 | 38.2 | 29.1 | 29.2 |
| 26 | Copper - Acid Soluble | g/m³ | 0.0005 | | | | | | 0.0005 | | | | | |
| 26 | Dissolved Reactive Phosphorus | g/m³ | 0.012 | | | | | | 0.013 | | | | | |
| 25 | Faecal Coliforms | cfu/100ml | 4 | 4 | 4 | 8 | 20 | 20 | 4 | 4 | 96 | 4 | 65 | 12 |
| 25 | Iron - Acid Soluble | g/m³ | 0.07 | 0.06 | 0.41 | 0.07 | 0.05 | 0.1 | 0.07 | 0.07 | 0.2 | 0.03 | 0.04 | 0.06 |
| 26 | Lead - Acid Soluble | g/m³ | 0.0005 | | | | | | 0.0005 | | | | | |
| 25 | Manganese - Acid Soluble | g/m³ | 0.505 | 0.233 | 0.259 | 0.41 | 0.345 | 0.337 | 0.294 | 0.211 | 0.453 | 0.208 | 0.169 | 0.193 |
| 26 | Nickel - Acid Soluble | g/m³ | 0.0009 | | | | | | 0.0007 | | | | | |
| 26 | Nitrate - Nitrogen | g/m³ | 1.05 | 0.41 | 0.69 | 0.73 | 0.86 | 1.31 | 1.46 | 1.62 | 1.47 | 1.38 | 0.64 | 0.7 |
| 25 | pH | | 7.7 | 7.6 | 7.7 | 7.9 | 7.7 | 7.9 | 7.8 | 8.1 | 7.6 | 7.8 | 7.8 | 7.5 |
| Other | Suspended Solids - Total | g/m³ | 5 | 6 | 6 | 6 | 6 | 6 | 6 | 7 | 6 | 6 | 6 | 6 |
| 26 | Zinc - Acid Soluble | g/m³ | 0.002 | | | | | | 0.002 | | | | | |

| Condition | Description | Measure | 29/06/2018 | 24/07/2018 | 28/08/2018 | 24/09/2018 | 30/10/2018 | 13/11/2018 | 13/12/2018 | 10/01/2019 | 25/02/2019 | 27/03/2019 | 23/04/2019 | 29/05/2019 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 26 | Aluminium - Acid Soluble | g/m³ | 0.008 | | | | | | 0.017 | | | | | |
| 25 | Ammonia Nitrogen | g/m³ | 0.49 | 0.89 | 0.53 | 0.52 | 0.44 | 0.49 | 1.05 | 0.95 | 1.08 | 0.76 | 1 | 0.84 |
| 26 | Arsenic - Acid Soluble | g/m³ | 0.001 | | | | | | 0.002 | | | | | |
| 25 | BOD5 - Total | g/m³ | 1 | 6 | 2 | 3 | 2 | 9 | 4 | 5 | 6 | 3 | 11 | 6 |
| 26 | Boron - Acid Soluble | g/m³ | 0.01 | | | | | | 0.38 | | | | | |
| 26 | Cadmium - Acid Soluble | g/m³ | 0.0002 | | | | | | 0.0002 | | | | | |
| Other | Chemical Oxygen Demand | g/m³ | 15 | 33 | 15 | 19 | 15 | 15 | 19 | 28 | 15 | 55 | 42 | 15 |
| 26 | Chloride | g/m³ | 45.3 | | | | | | 61.2 | | | | | |
| 26 | Chromium - Acid Soluble | g/m³ | 0.001 | | | | | | 0.001 | | | | | |
| 25 | Conductivity at 25°C | mS/m | 30.5 | 79.5 | 33.1 | 35.5 | 38.8 | 62.7 | 76.1 | 74.4 | 72.4 | 74.0 | 37.4 | 68.2 |
| 26 | Copper - Acid Soluble | g/m³ | 0.0005 | | | | | | 0.0005 | | | | | |
| 26 | Dissolved Reactive Phosphorus | g/m³ | 0.011 | | | | | | 0.016 | | | | | |
| 25 | Faecal Coliforms | cfu/100ml | | 2500 | 35 | 120 | 5900 | 8 | 4 | 4 | 270 | 230 | 10000 | 58 |
| 25 | Iron - Acid Soluble | g/m³ | 0.04 | 0.35 | 0.05 | 0.05 | 0.52 | 0.26 | 0.39 | 0.59 | 0.43 | 0.8 | 2.03 | 0.36 |
| 26 | Lead - Acid Soluble | g/m³ | 0.0005 | | | | | | 0.0005 | | | | | |
| 25 | Manganese - Acid Soluble | g/m³ | 0.213 | 0.961 | 0.3 | 0.319 | 0.215 | 0.694 | 1.02 | 1.11 | 1.05 | 1.05 | 0.453 | 0.835 |
| 26 | Nickel - Acid Soluble | g/m³ | 0.0005 | | | | | | 0.0005 | | | | | |
| 26 | Nitrate - Nitrogen | g/m³ | 0.59 | 1.85 | 0.73 | 0.86 | 1.18 | 1.22 | 1.41 | 1.15 | 1.28 | 1.15 | 0.8 | 1.34 |
| 25 | pH | | 7.6 | 7.9 | 7.7 | 7.6 | 7.7 | 7.5 | 7.6 | 8.0 | 7.5 | 8.0 | 7.5 | 7.8 |
| Other | Suspended Solids - Total | g/m³ | 6 | 7 | 6 | 6 | 73 | 5 | 6 | 6 | 6 | 29 | 62 | 6 |
| 26 | Zinc - Acid Soluble | g/m³ | 0.002 | | | | | | 0.002 | | | | | |

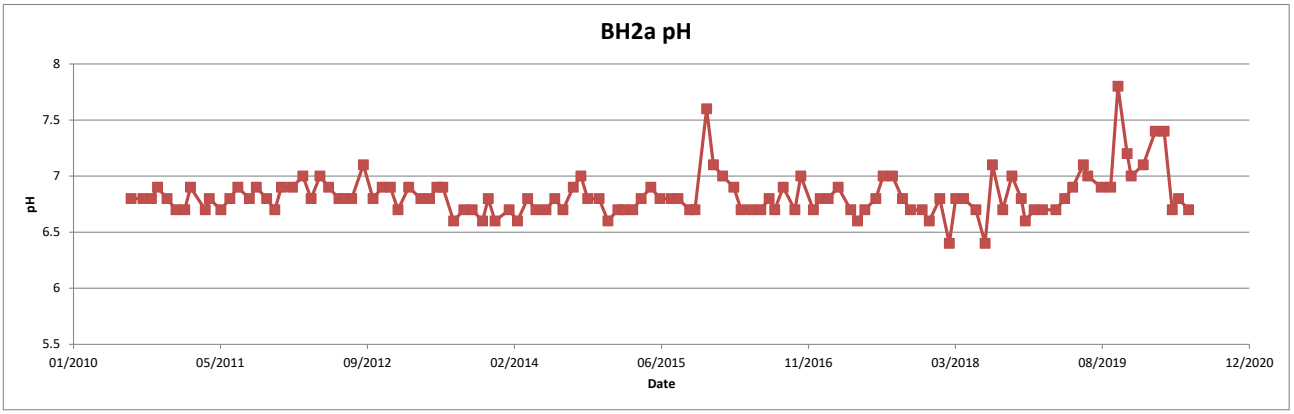
| Condition | Description | Measure | 13/06/2019 | 29/07/2019 | 30/08/2019 | 24/09/2019 | 25/10/2019 | 8/11/2019 | 19/12/2019 | 29/01/2020 | 28/02/2020 | 27/03/2020 | 17/04/2020 | 21/05/2020 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 26 | Aluminium - Acid Soluble | g/m³ | | | | | | | | | | | | |
| 25 | Ammonia Nitrogen | g/m³ | 0.83 | 1.29 | 1.22 | 1.08 | 0.57 | 0.68 | 0.24 | 0.22 | 0.12 | 0.1 | 0.49 | 0.81 |
| 26 | Arsenic - Acid Soluble | g/m³ | | | | | | | | | | | | |
| 25 | BOD5 - Total | g/m³ | 6 | 6 | 8 | 4 | 3 | 6 | 3 | 1 | 1 | 1 | 3 | 1 |
| 26 | Boron - Acid Soluble | g/m³ | | | | | | | | | | | | |
| 26 | Cadmium - Acid Soluble | g/m³ | | | | | | | | | | | | |
| Other | Chemical Oxygen Demand | g/m³ | 15 | 49 | 48 | 15 | 15 | 15 | 44 | 31 | 45 | 15 | 15 | 15 |
| 26 | Chloride | g/m³ | | | | | | | | | | | | |
| 26 | Chromium - Acid Soluble | g/m³ | | | | | | | | | | | | |
| 25 | Conductivity at 25°C | mS/m | 71.5 | 86.7 | 74.7 | 75.2 | 30.4 | 37.4 | 22.6 | 39.9 | 40.4 | 37.8 | 40.0 | 38.8 |
| 26 | Copper - Acid Soluble | g/m³ | | | | | | | | | | | | |
| 26 | Dissolved Reactive Phosphorus | g/m³ | | | | | | | | | | | | |
| 25 | Faecal Coliforms | cfu/100ml | 4 | 48 | 16 | 80 | 38 | 230 | 200 | 110 | 32 | 170 | 12 | 400 |
| 25 | Iron - Acid Soluble | g/m³ | 0.24 | 0.27 | 0.36 | 0.36 | 0.07 | 0.08 | 0.07 | 0.1 | 0.06 | 0.1 | 0.04 | 0.1 |
| 26 | Lead - Acid Soluble | g/m³ | | | | | | | | | | | | |
| 25 | Manganese - Acid Soluble | g/m³ | 0.822 | 0.811 | 0.977 | 0.885 | 0.274 | 0.404 | 0.147 | 0.314 | 0.232 | 0.227 | 0.303 | 0.39 |
| 26 | Nickel - Acid Soluble | g/m³ | | | | | | | | | | | | |
| 26 | Nitrate - Nitrogen | g/m³ | 1.44 | 2.09 | 1.4 | 1.39 | 0.4 | 0.68 | 0.35 | 1.18 | 1.3 | 1.19 | 0.89 | 0.6 |
| 25 | pH | | 8 | 7.9 | 7.8 | 7.7 | 7.6 | 7.9 | 6.8 | 7.8 | 8.0 | 7.9 | 8.0 | 7.9 |
| Other | Suspended Solids - Total | g/m³ | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| 26 | Zinc - Acid Soluble | g/m³ | | | | | | | | | | | | |

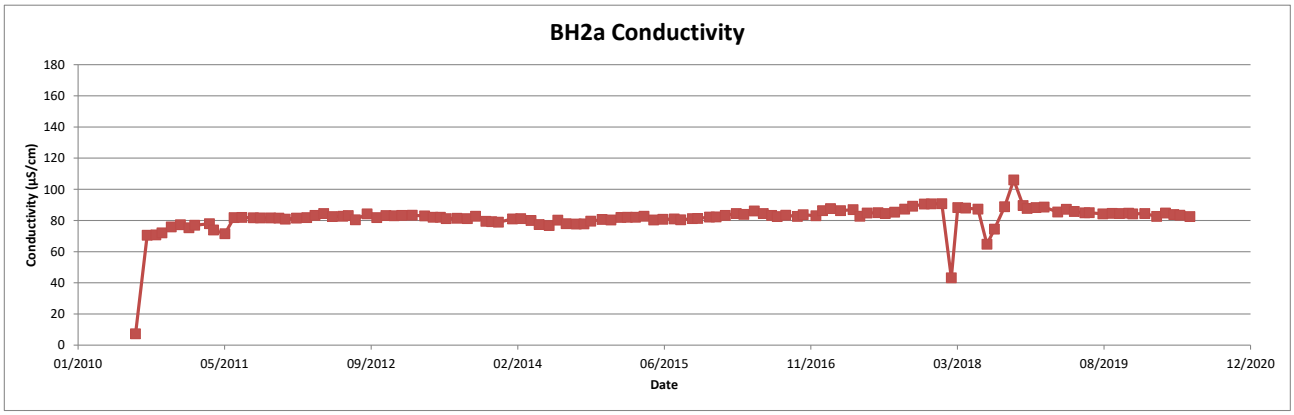
Notes:
Values in red were reported below the detection limit.

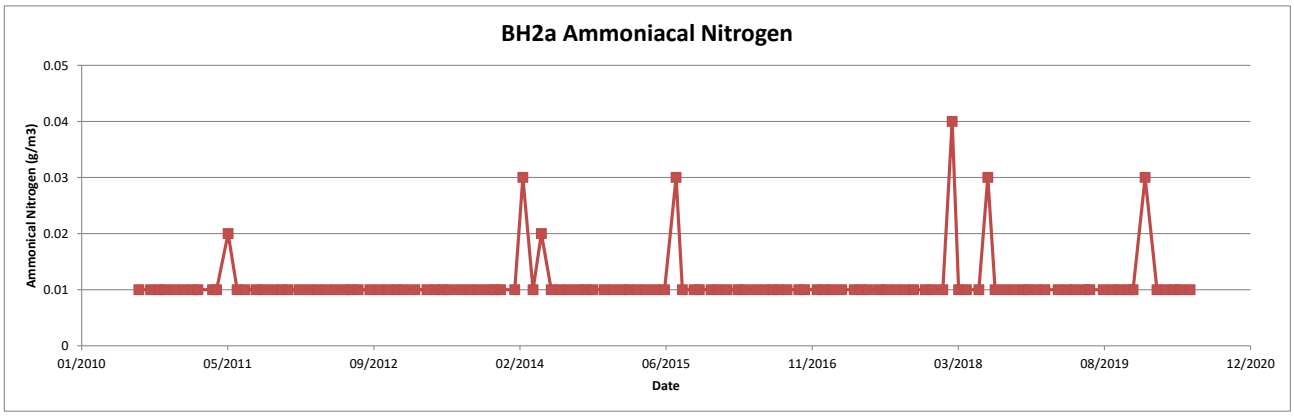
# Appendix C

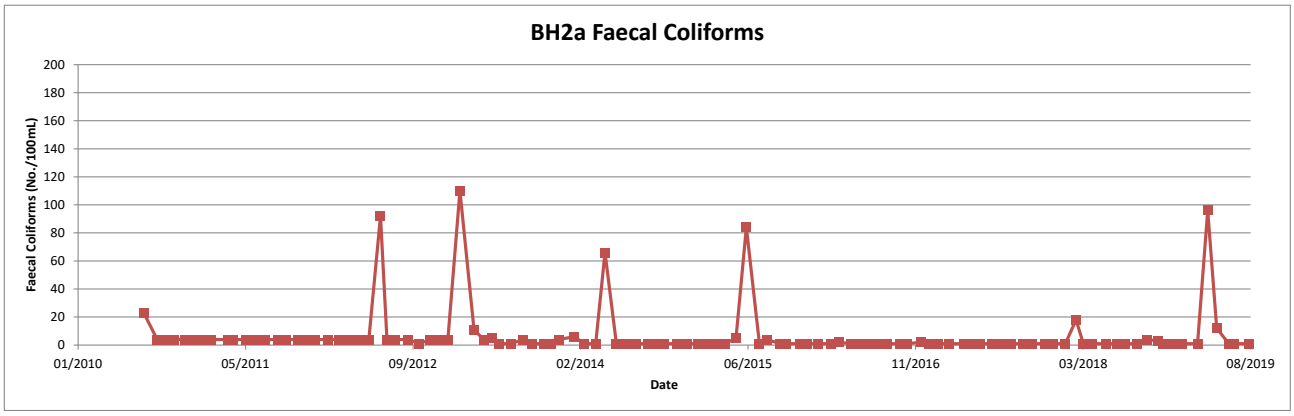
## Time Series Graphs

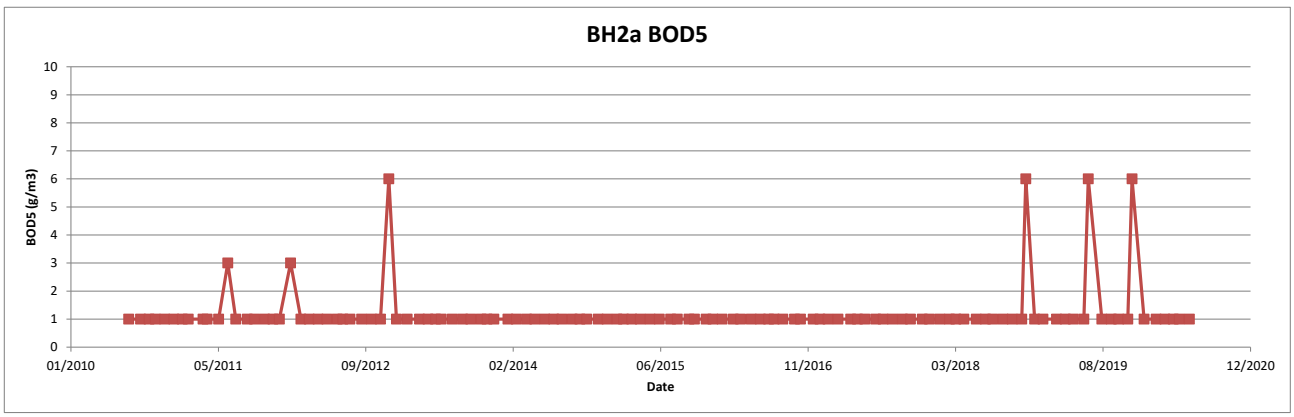
# Appendix C Time Series Graphs

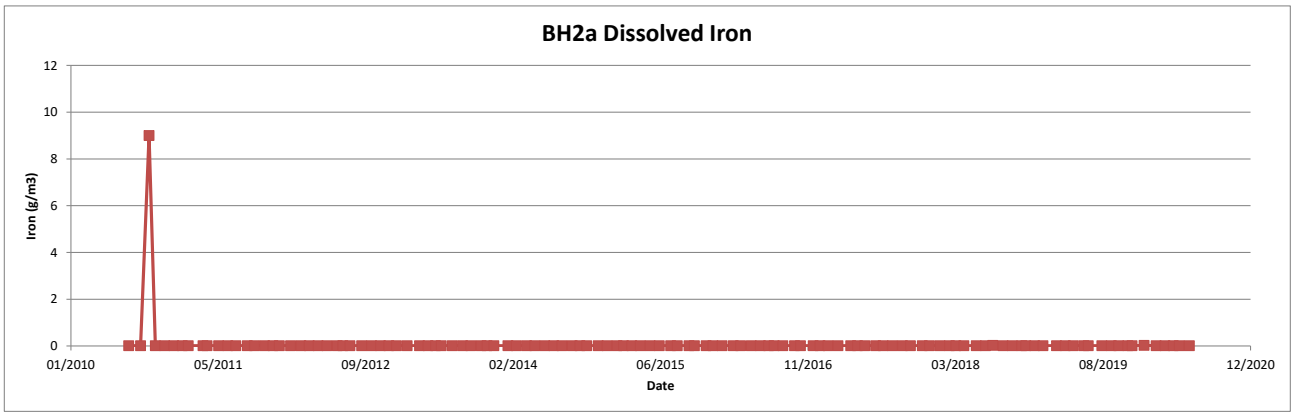

BH2a pH
pH
8
7.5
7
6.5
6
5.5
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

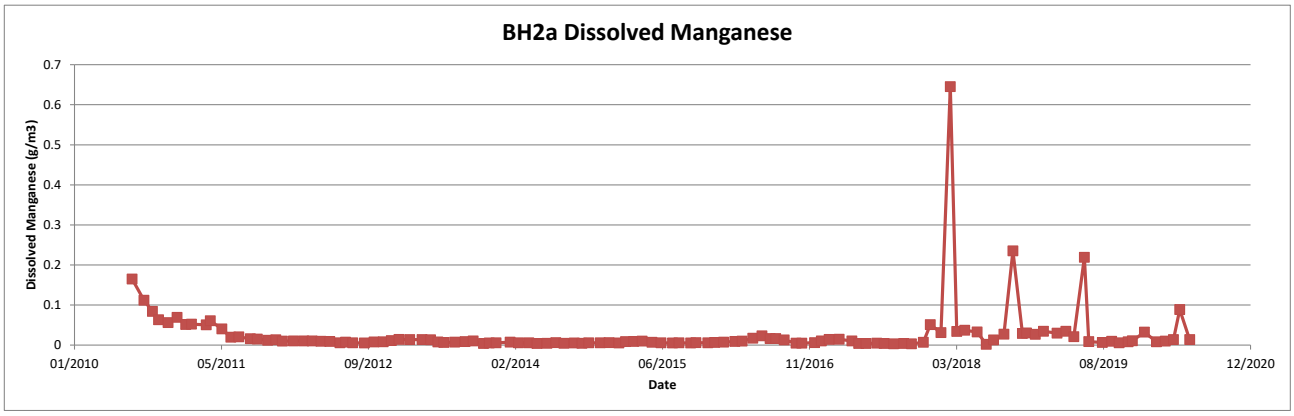

BH2a Conductivity
Conductivity (µS/cm)
180
160
140
120
100
80
60
40
20
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

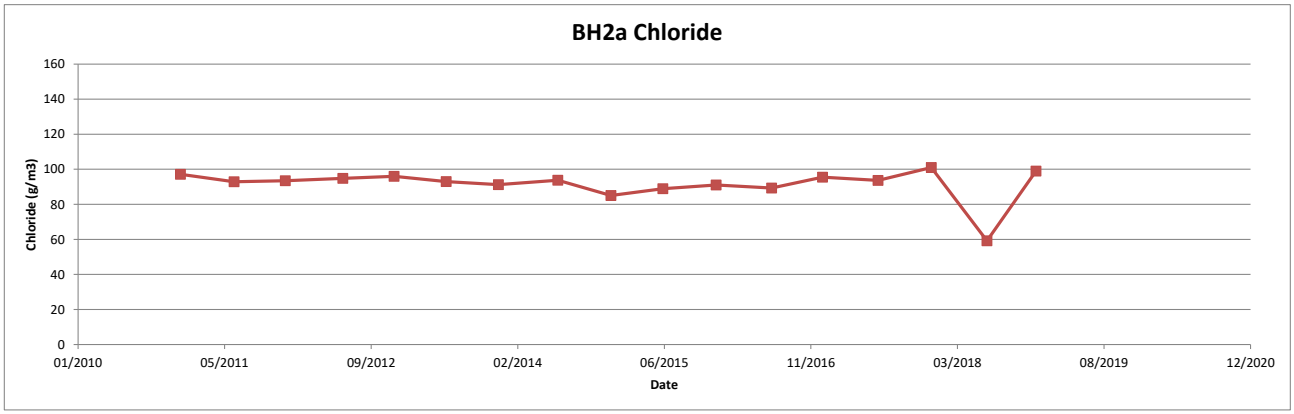

BH2a Ammoniacal Nitrogen
Ammonical Nitrogen (g/m3)
0.05
0.04
0.03
0.02
0.01
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

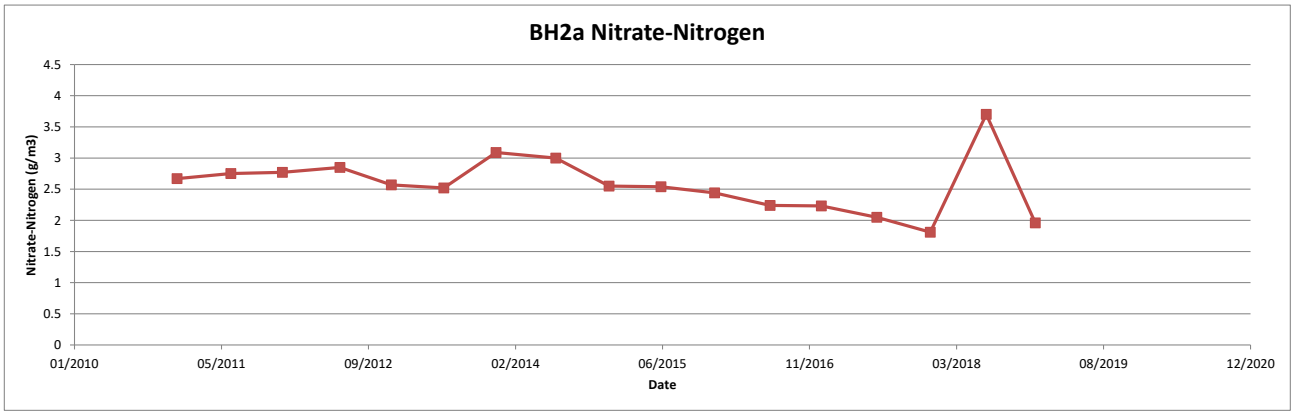

BH2a Faecal Coliforms
Faecal Coliforms (No./100mL)
200
180
160
140
120
100
80
60
40
20
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
Date

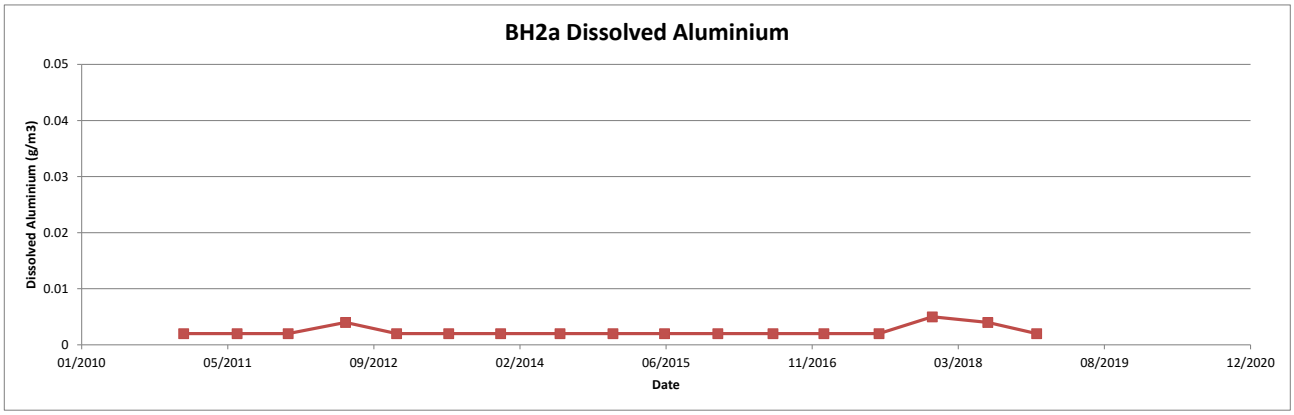

BH2a BOD5
BOD5 (g/m3)
10
9
8
7
6
5
4
3
2
1
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

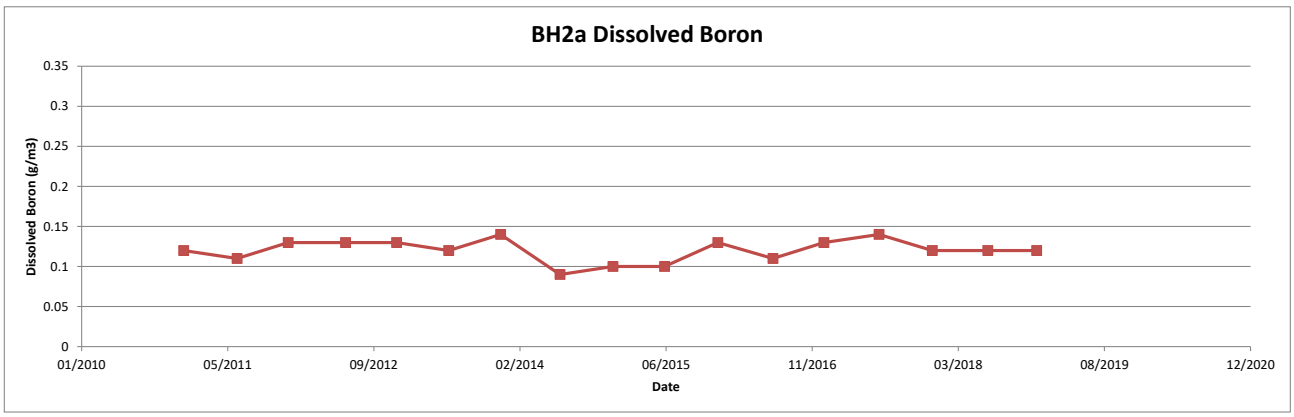

BH2a Dissolved Iron
Iron (g/m3)
12
10
8
6
4
2
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

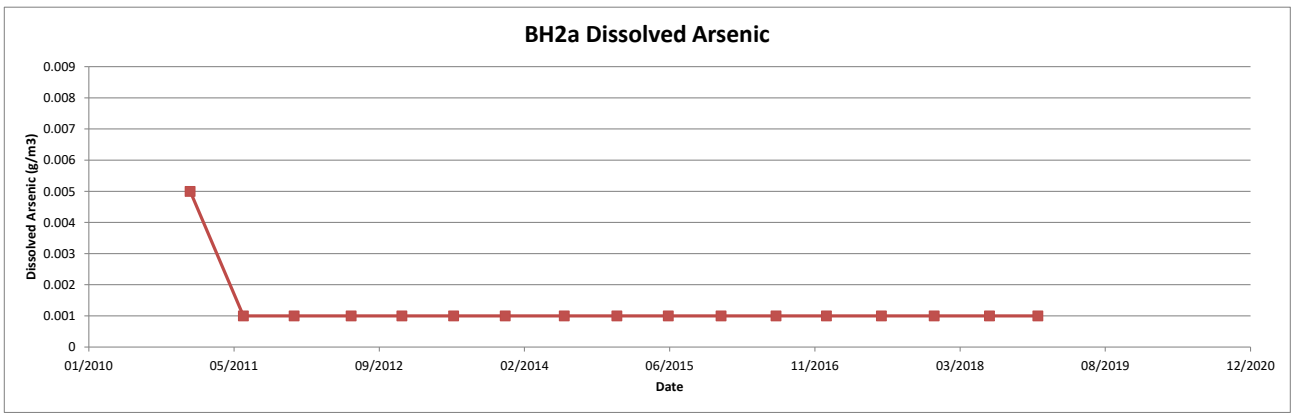

BH2a Dissolved Manganese
Dissolved Manganese (g/m3)
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

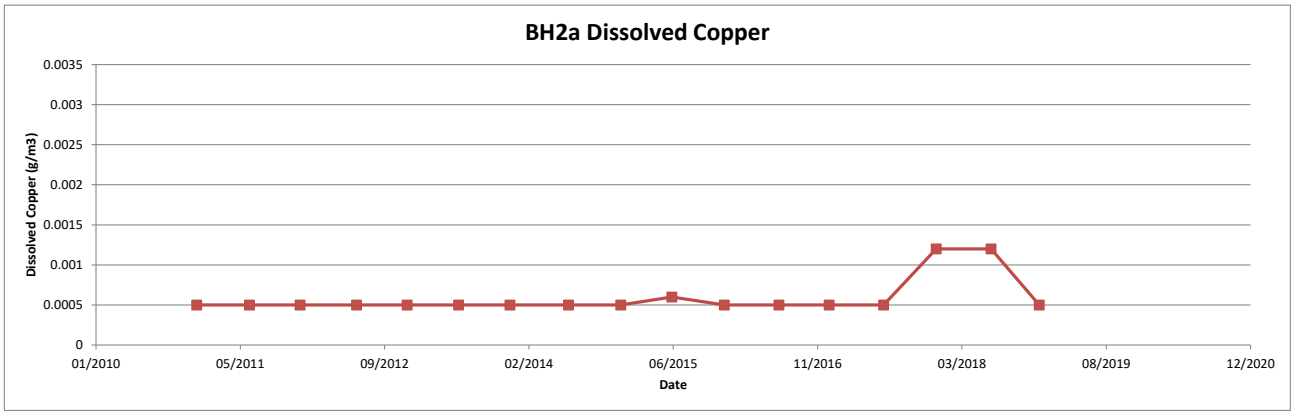

BH2a Chloride
Chloride (g/m3)
160
140
120
100
80
60
40
20
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

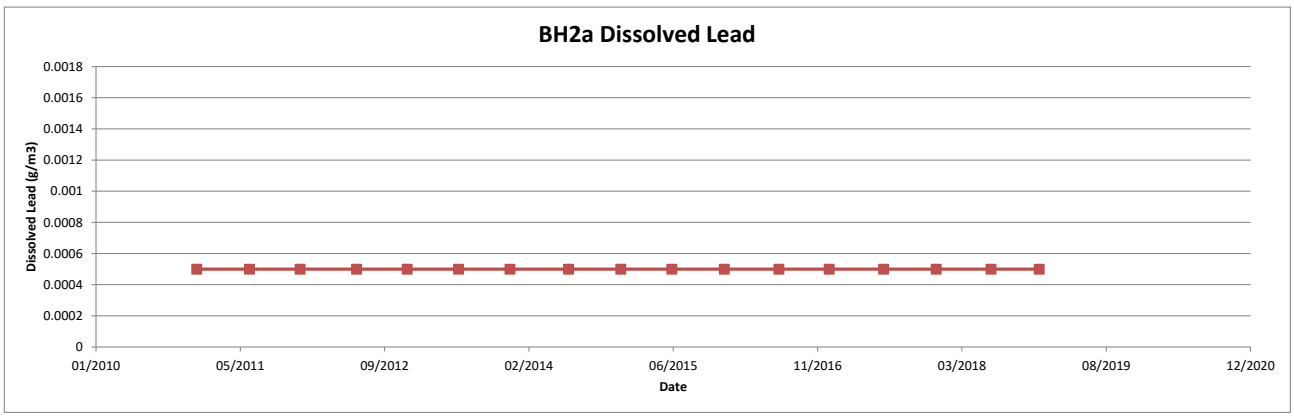

BH2a Nitrate-Nitrogen
Nitrate-Nitrogen (g/m3)
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

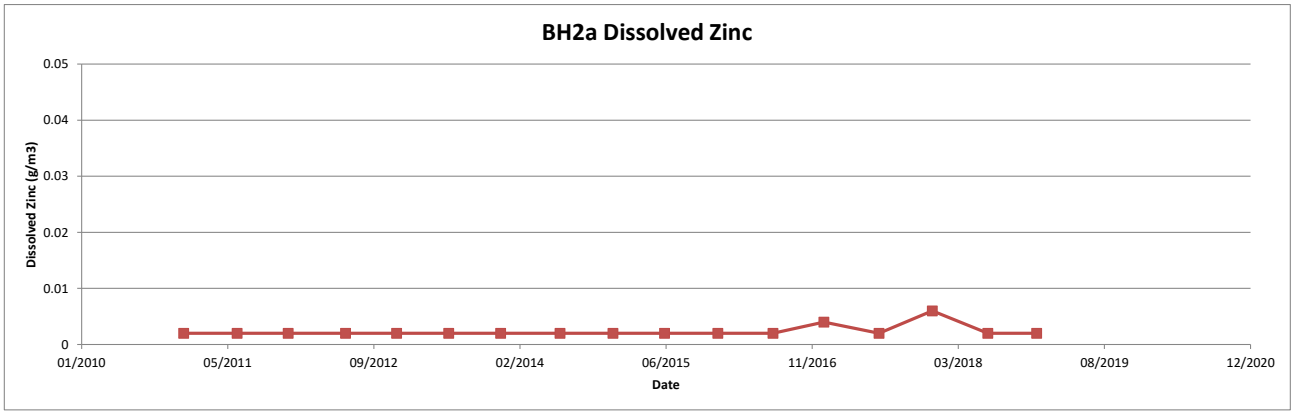

BH2a Dissolved Aluminium
Dissolved Aluminium (g/m3)
0.05
0.04
0.03
0.02
0.01
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

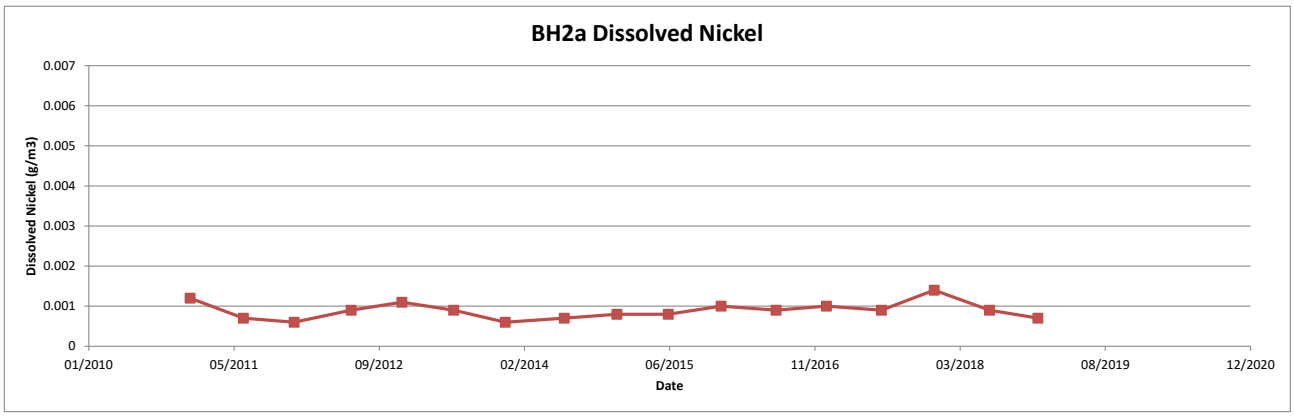

BH2a Dissolved Boron
Dissolved Boron (g/m3)
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

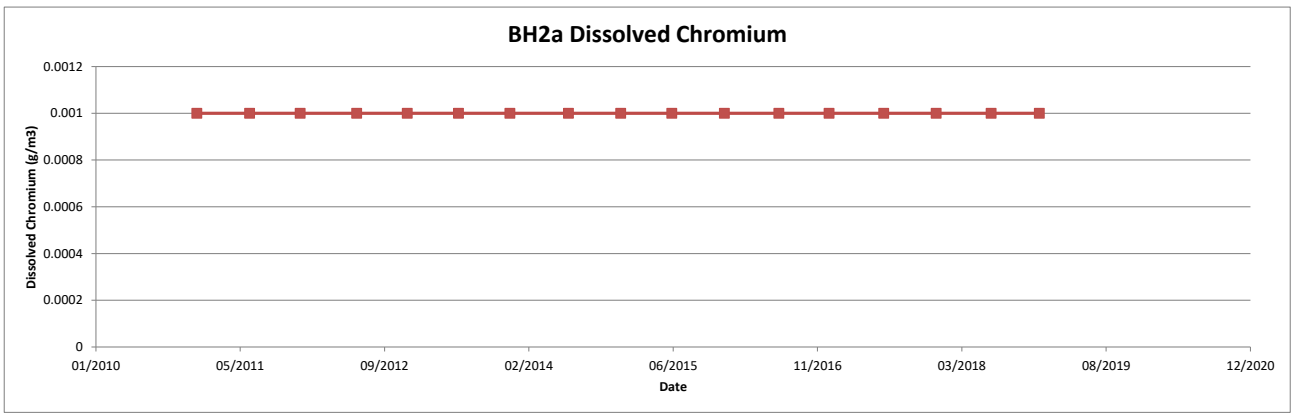

BH2a Dissolved Arsenic
Dissolved Arsenic (g/m3)
0.009
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

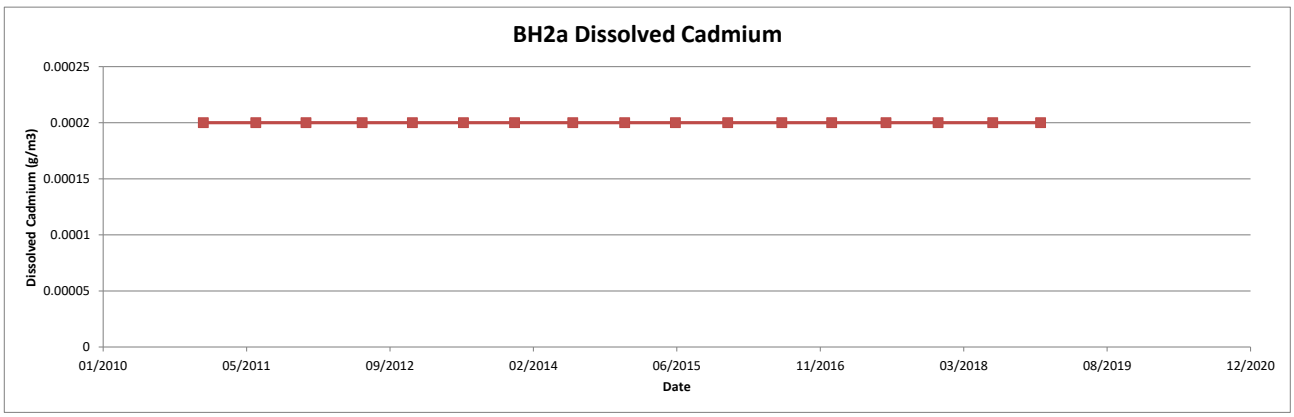

BH2a Dissolved Copper
Dissolved Copper (g/m3)
0.0035
0.003
0.0025
0.002
0.0015
0.001
0.0005
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

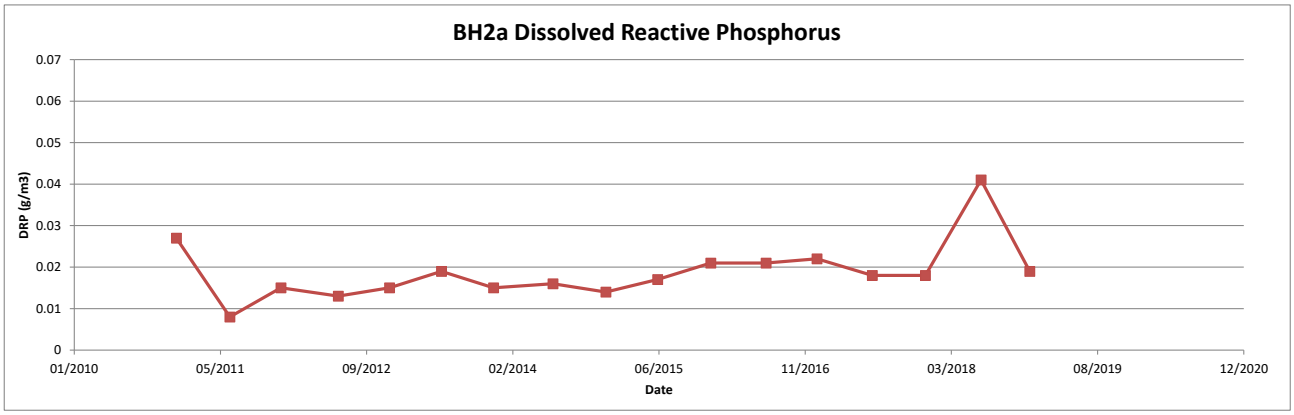

BH2a Dissolved Lead
Dissolved Lead (g/m3)
0.0018
0.0016
0.0014
0.0012
0.001
0.0008
0.0006
0.0004
0.0002
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

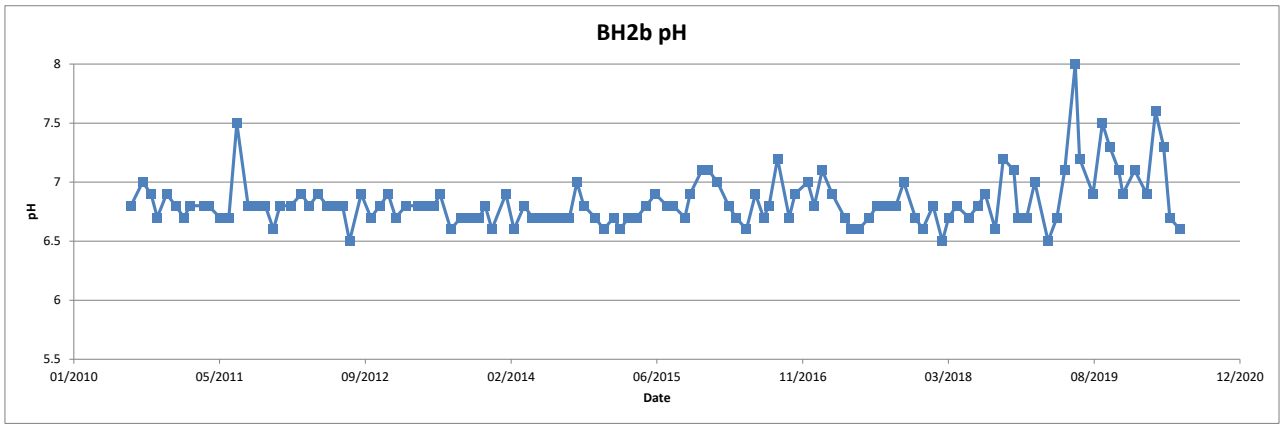

BH2a Dissolved Zinc
Dissolved Zinc (g/m3)
0.05
0.04
0.03
0.02
0.01
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

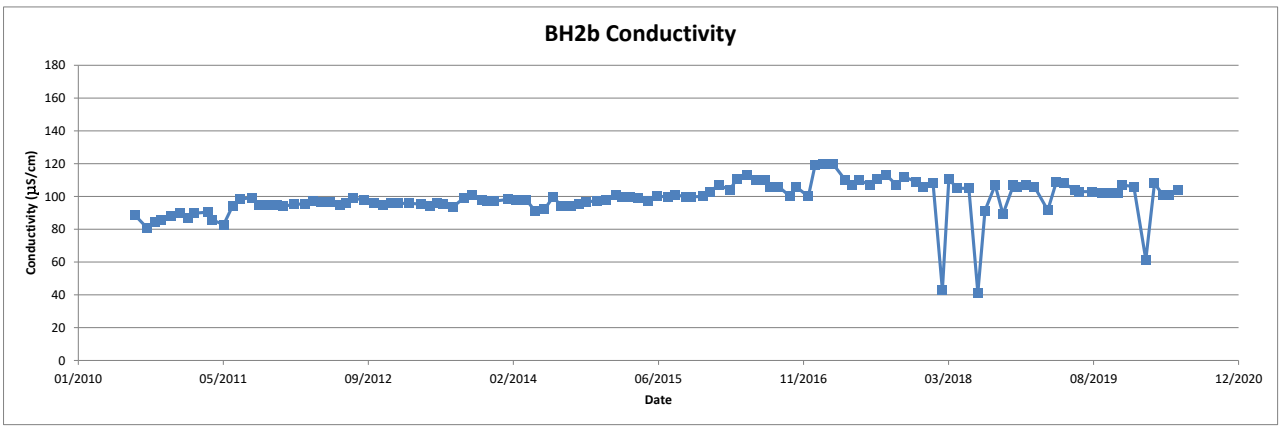

BH2a Dissolved Nickel
Dissolved Nickel (g/m3)
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

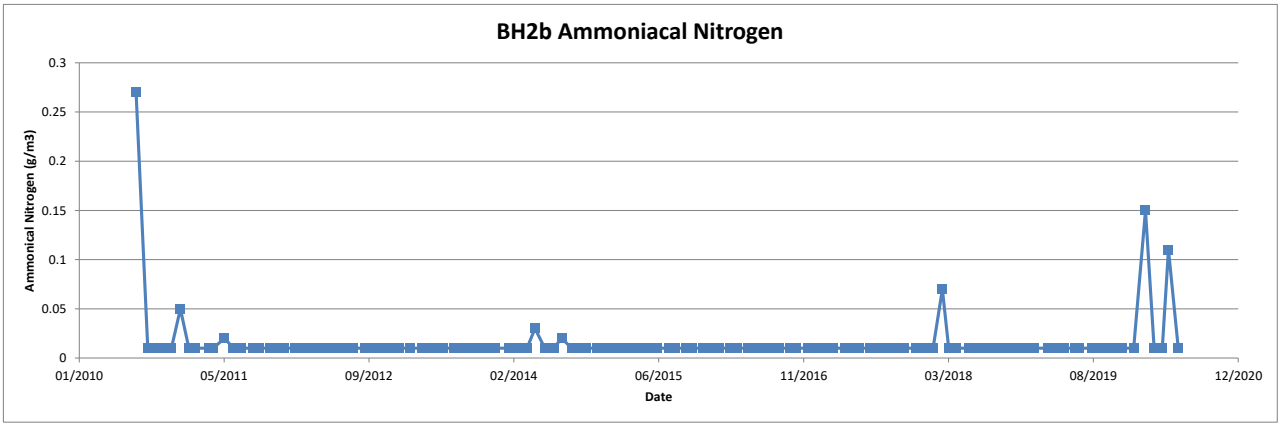

BH2a Dissolved Chromium
Dissolved Chromium (g/m3)
0.0012
0.001
0.0008
0.0006
0.0004
0.0002
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

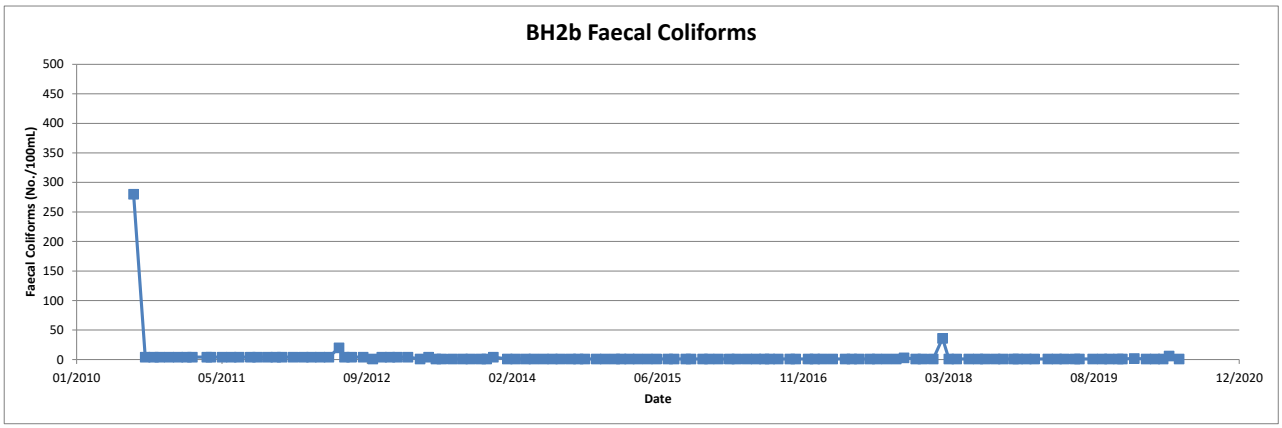

BH2a Dissolved Cadmium
Dissolved Cadmium (g/m3)
0.00025
0.0002
0.00015
0.0001
0.00005
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

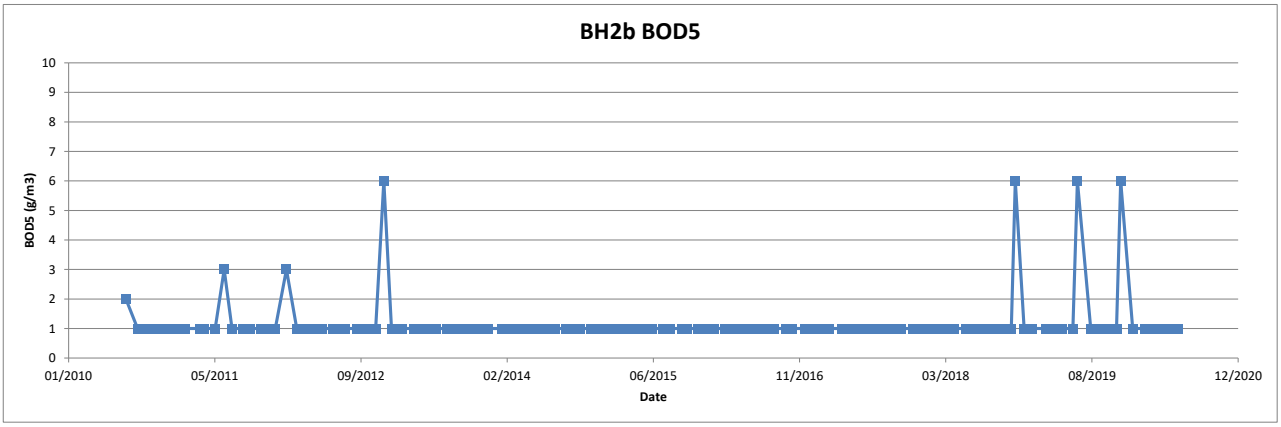

BH2a Dissolved Reactive Phosphorus
DRP (g/m3)
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

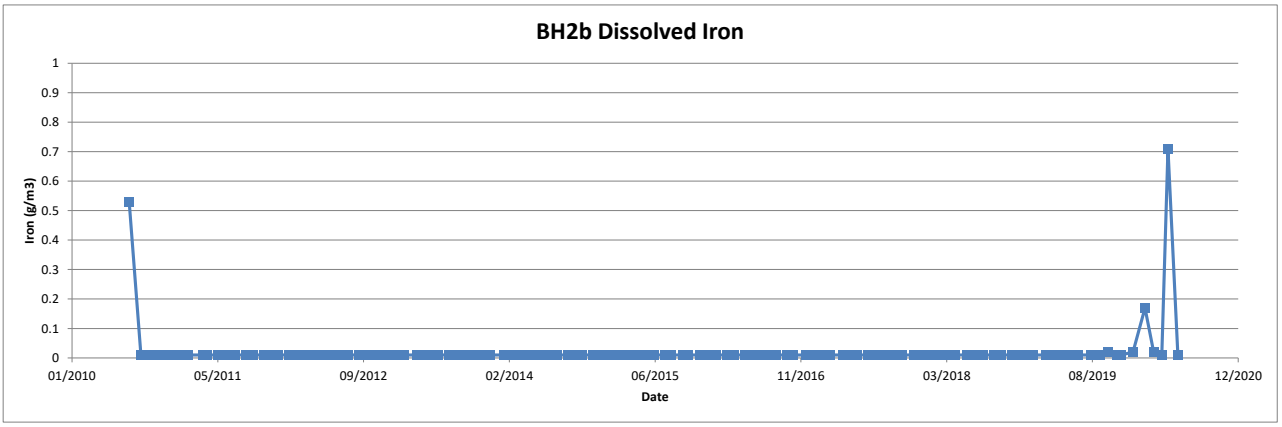

BH2b pH
pH
8
7.5
7
6.5
6
5.5
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

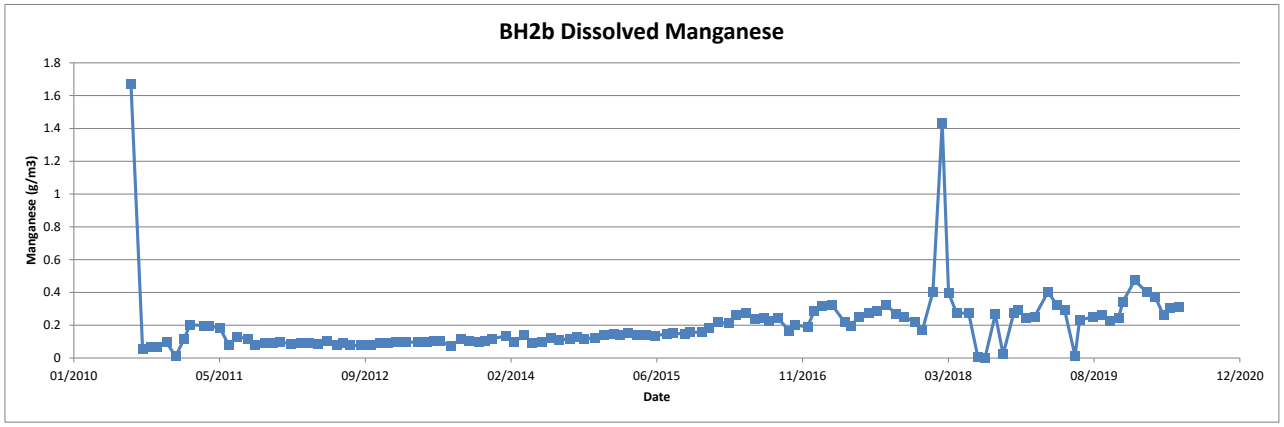

BH2b Conductivity
Conductivity (µS/cm)
180
160
140
120
100
80
60
40
20
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

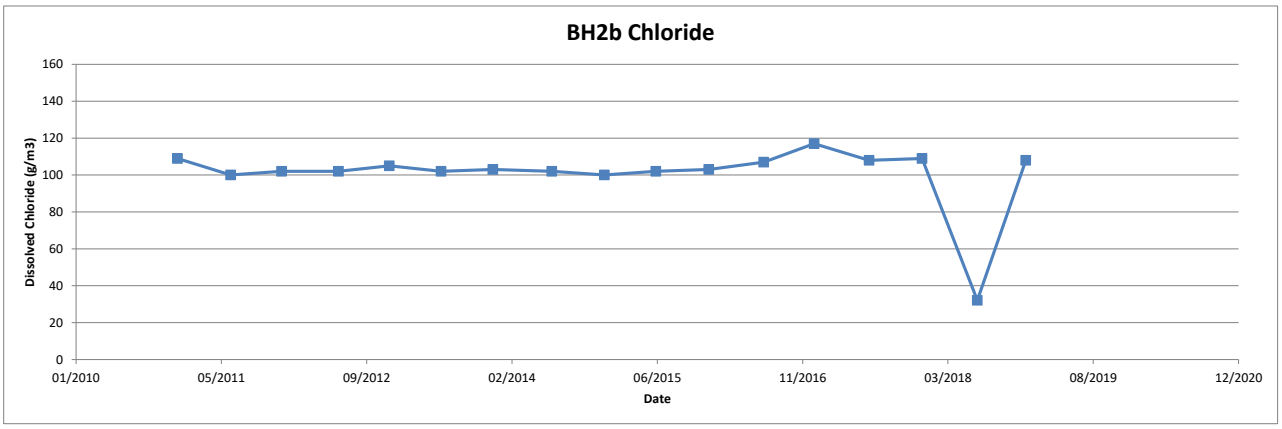

BH2b Ammoniacal Nitrogen
Ammonical Nitrogen (g/m3)
0.3
0.25
0.2
0.15
0.1
0.05
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

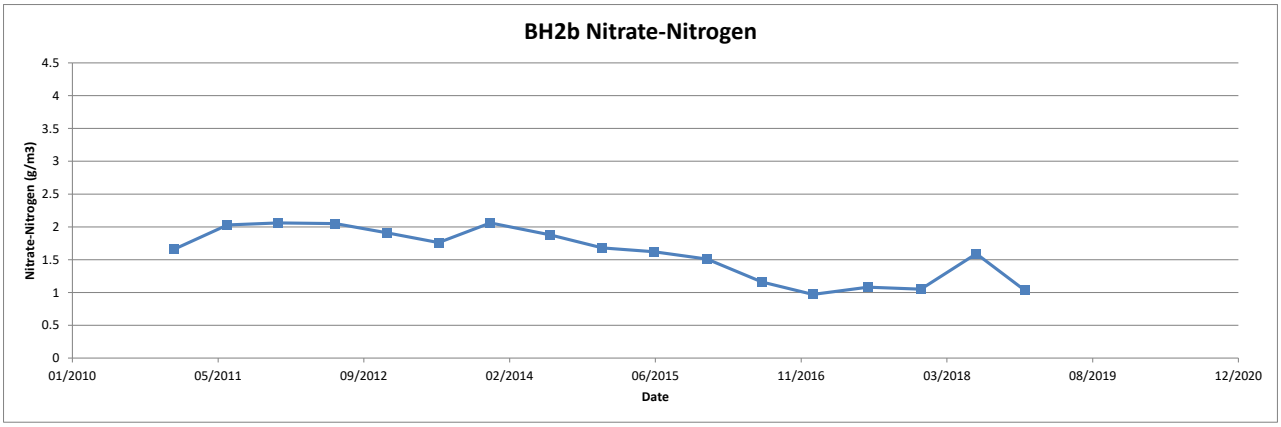

BH2b Faecal Coliforms
Faecal Coliforms (No./100mL)
500
450
400
350
300
250
200
150
100
50
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

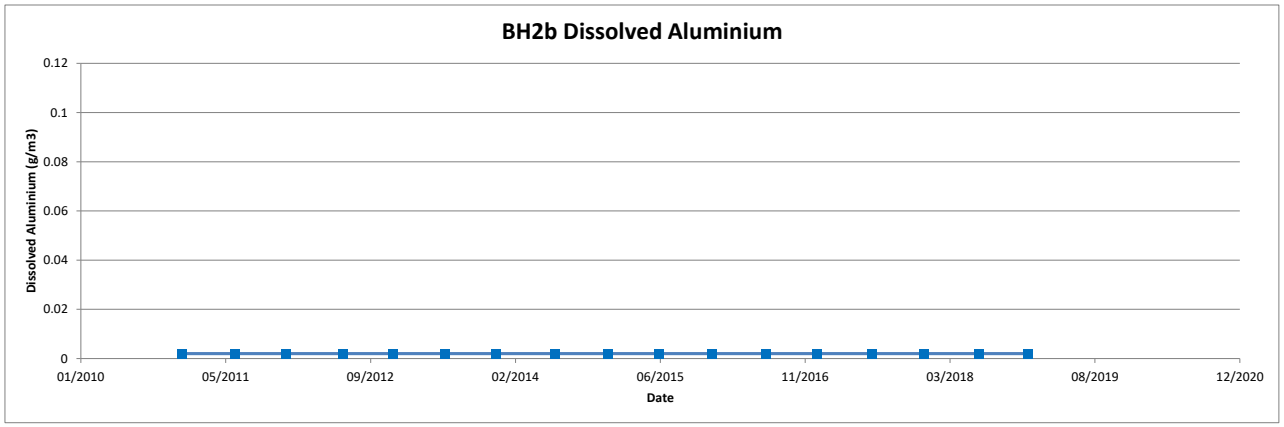

BH2b BOD5
BOD5 (g/m3)
10
9
8
7
6
5
4
3
2
1
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

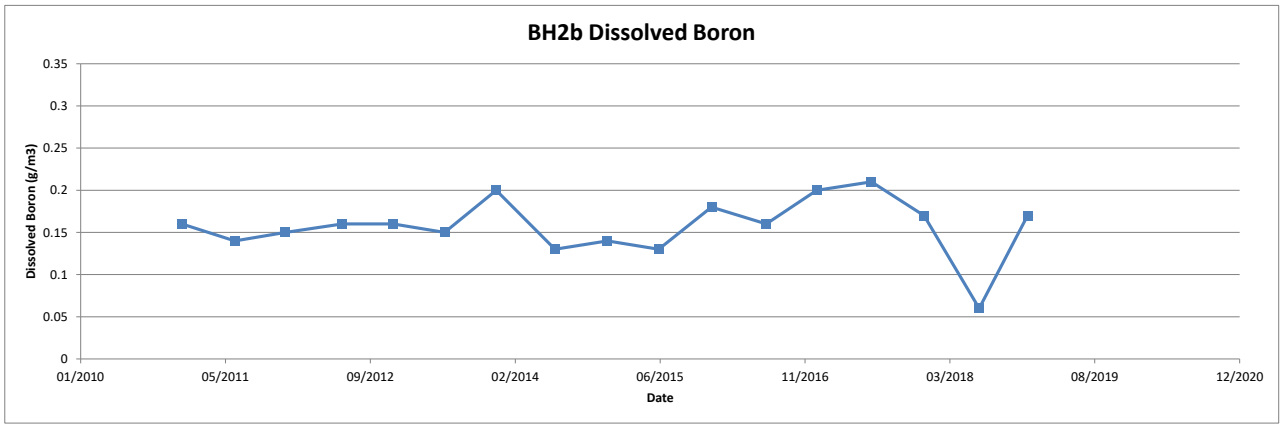

BH2b Dissolved Iron
Iron (g/m3)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

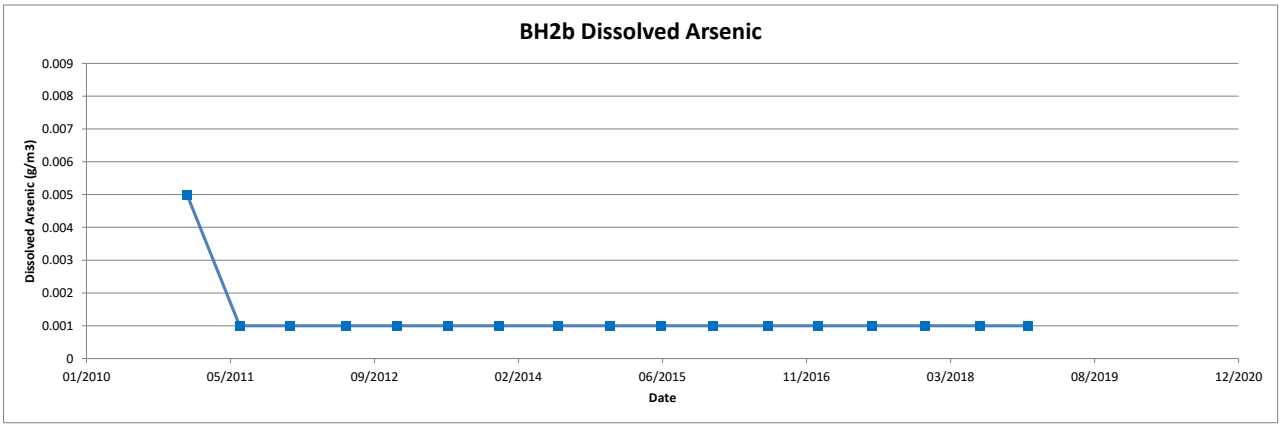

BH2b Dissolved Manganese
Manganese (g/m3)
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

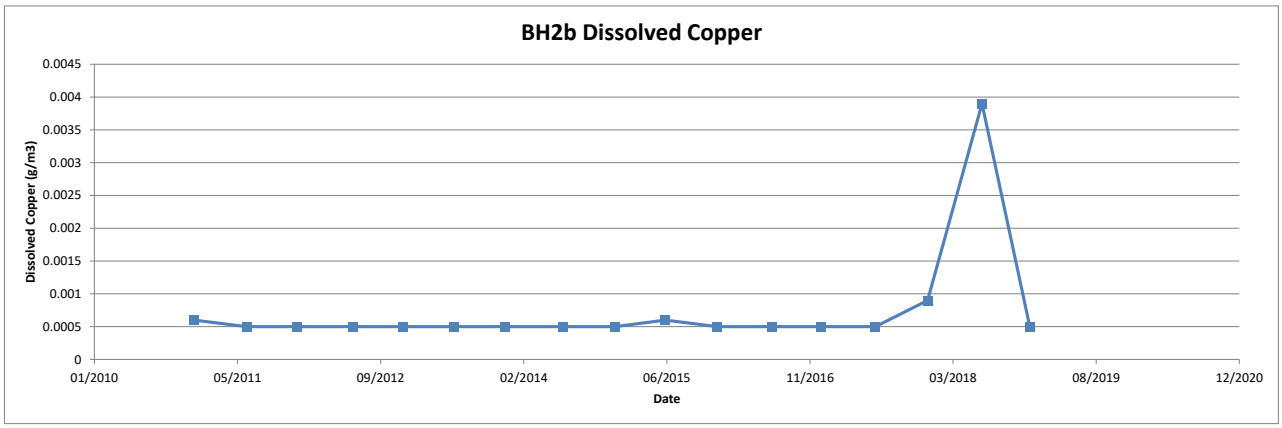

BH2b Chloride
Dissolved Chloride (g/m3)
160
140
120
100
80
60
40
20
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

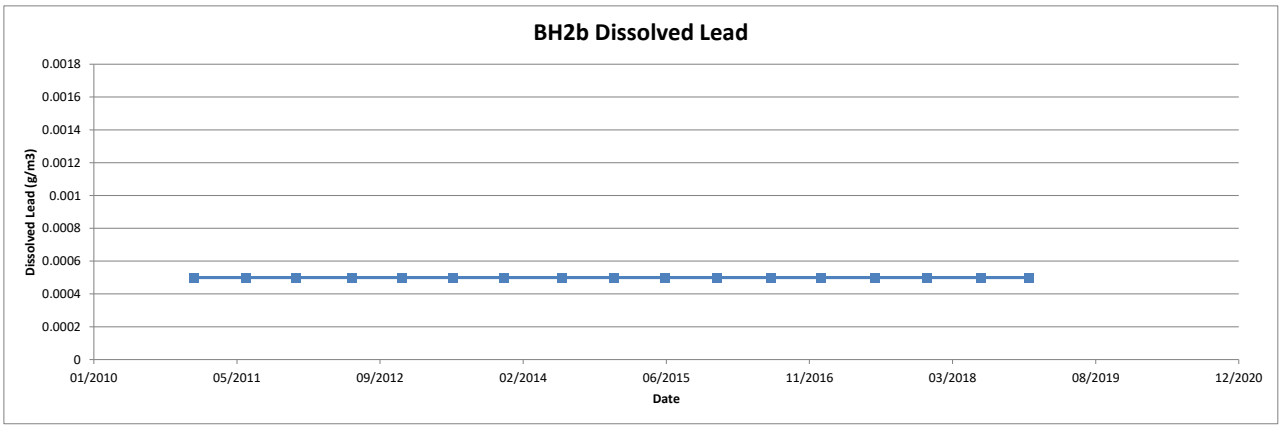

BH2b Nitrate-Nitrogen
Nitrate-Nitrogen (g/m3)
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

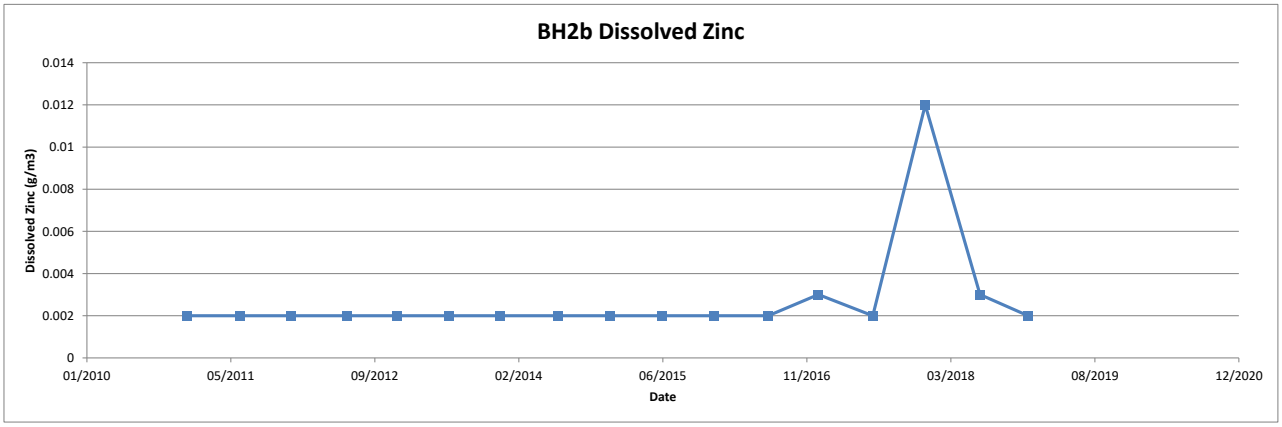

BH2b Dissolved Aluminium
Dissolved Aluminium (g/m3)
0.12
0.1
0.08
0.06
0.04
0.02
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

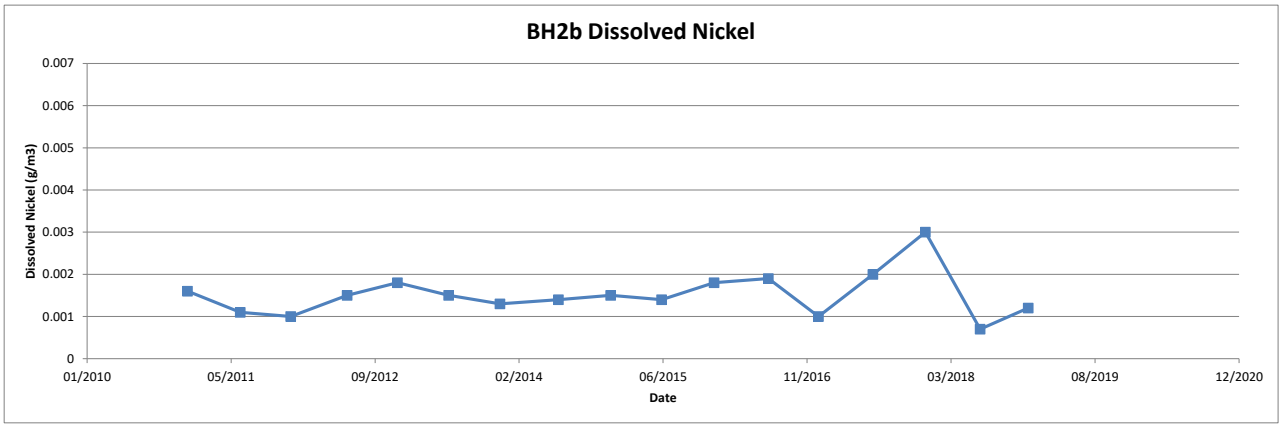

BH2b Dissolved Boron
Dissolved Boron (g/m3)
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

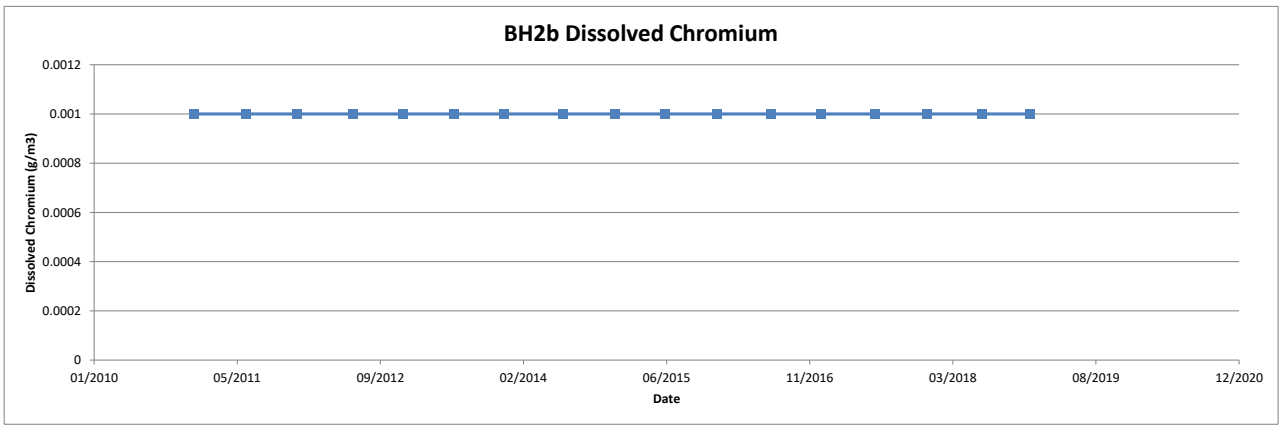

BH2b Dissolved Arsenic
Dissolved Arsenic (g/m3)
0.009
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

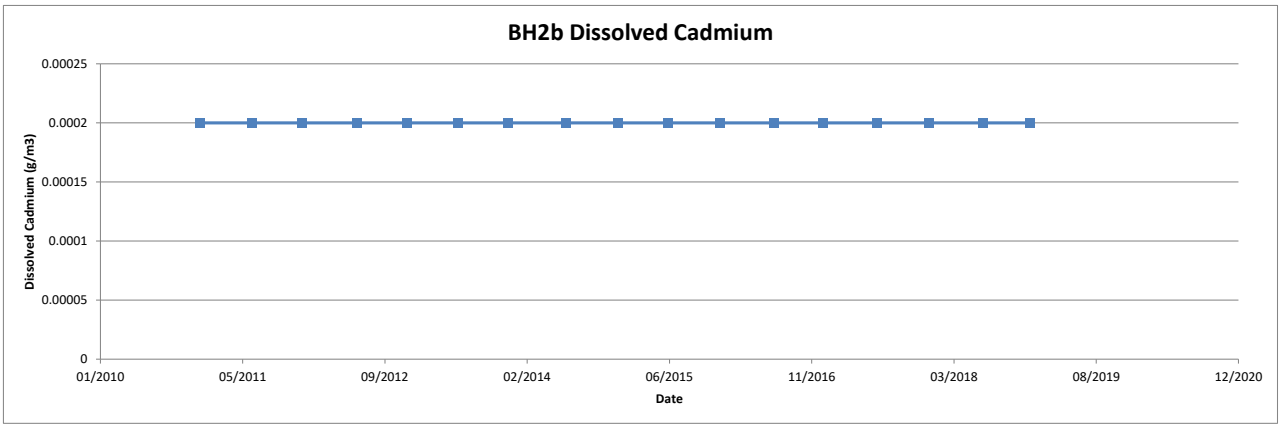

BH2b Dissolved Copper
Dissolved Copper (g/m3)
0.0045
0.004
0.0035
0.003
0.0025
0.002
0.0015
0.001
0.0005
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

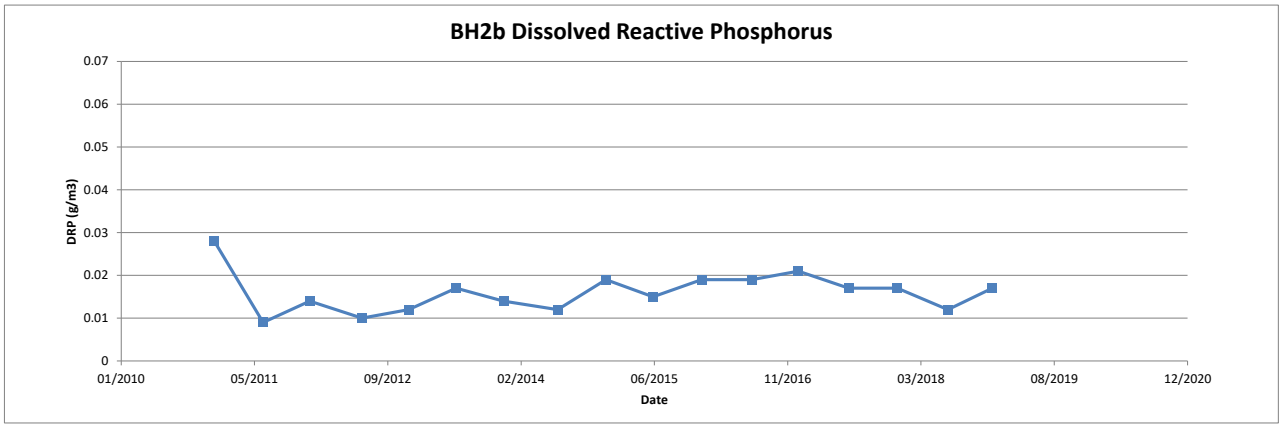

BH2b Dissolved Lead
Dissolved Lead (g/m3)
0.0018
0.0016
0.0014
0.0012
0.001
0.0008
0.0006
0.0004
0.0002
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

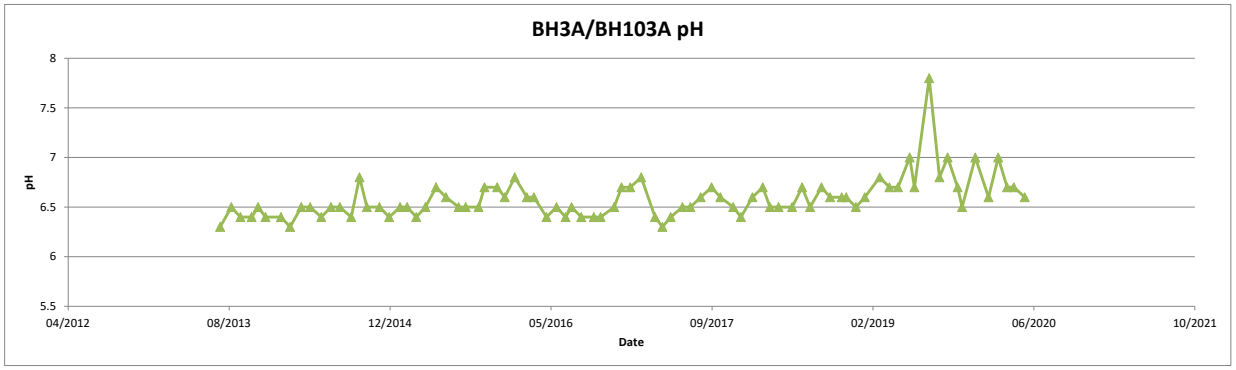

BH2b Dissolved Zinc
Dissolved Zinc (g/m3)
0.014
0.012
0.01
0.008
0.006
0.004
0.002
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

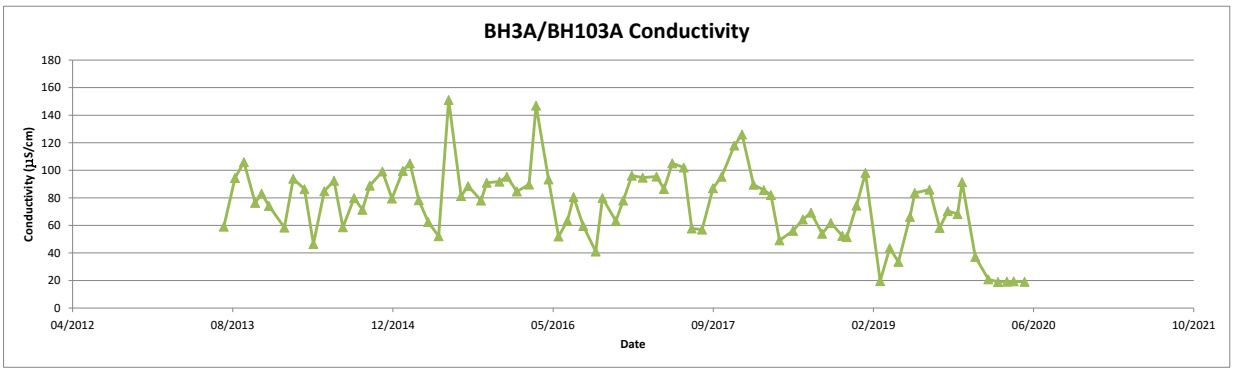

BH2b Dissolved Nickel
Dissolved Nickel (g/m3)
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

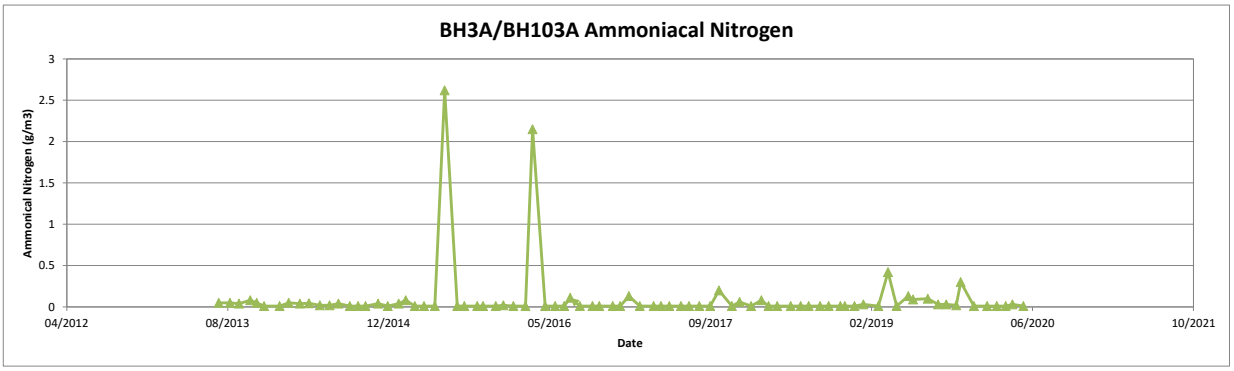

BH2b Dissolved Chromium
Dissolved Chromium (g/m3)
0.0012
0.001
0.0008
0.0006
0.0004
0.0002
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

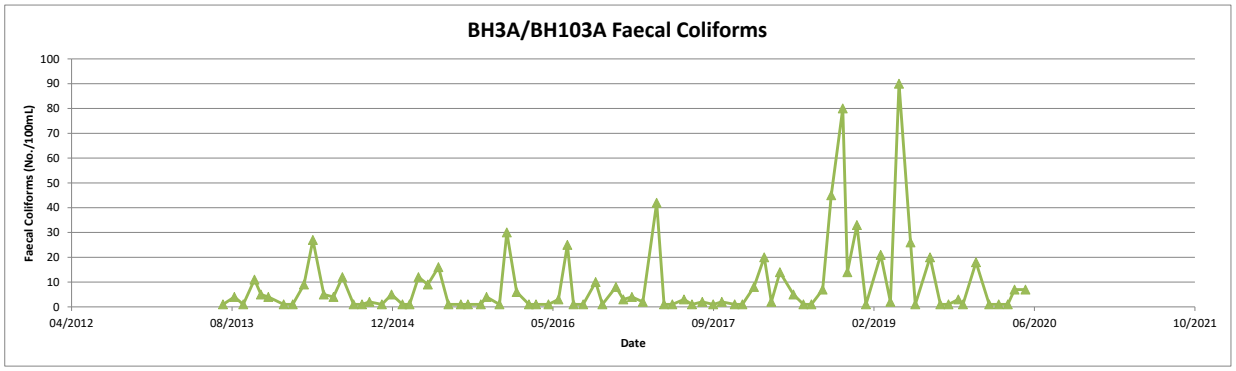

BH2b Dissolved Cadmium
Dissolved Cadmium (g/m3)
0.00025
0.0002
0.00015
0.0001
0.00005
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

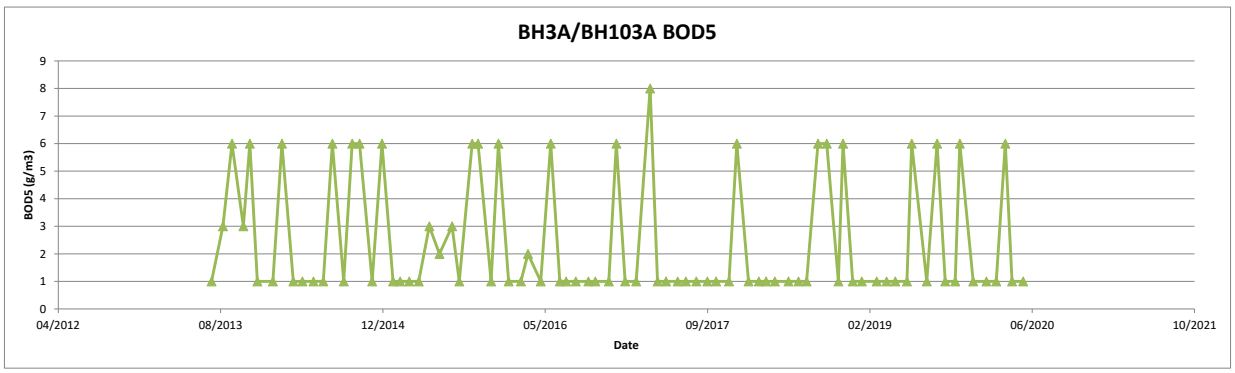

BH2b Dissolved Reactive Phosphorus
DRP (g/m3)
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

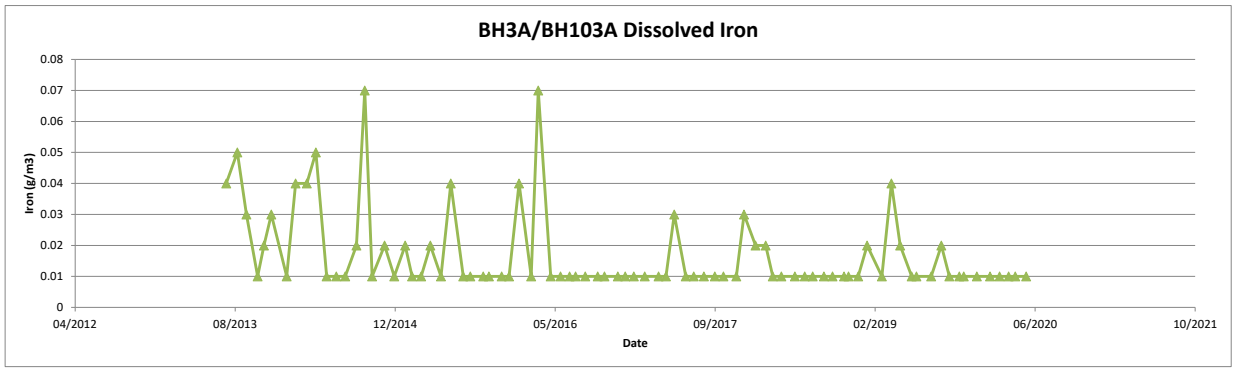

BH3A/BH103A pH
pH
8
7.5
7
6.5
6
5.5
04/2012
08/2013
12/2014
05/2016
09/2017
02/2019
06/2020
10/2021
Date

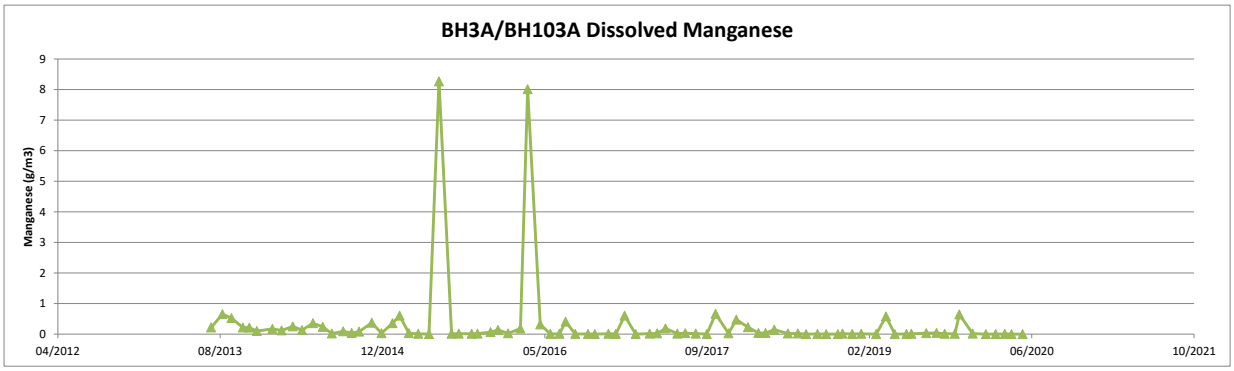

BH3A/BH103A Conductivity
Conductivity (µS/cm)
180
160
140
120
100
80
60
40
20
0
04/2012
08/2013
12/2014
05/2016
09/2017
02/2019
06/2020
10/2021
Date

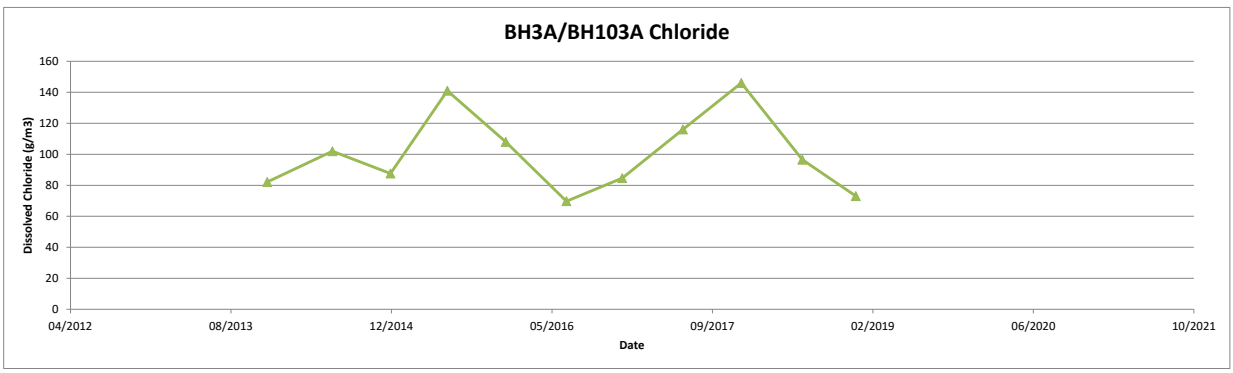

BH3A/BH103A Ammoniacal Nitrogen
Ammonical Nitrogen (g/m3)
3
2.5
2
1.5
1
0.5
0
04/2012
08/2013
12/2014
05/2016
09/2017
02/2019
06/2020
10/2021
Date

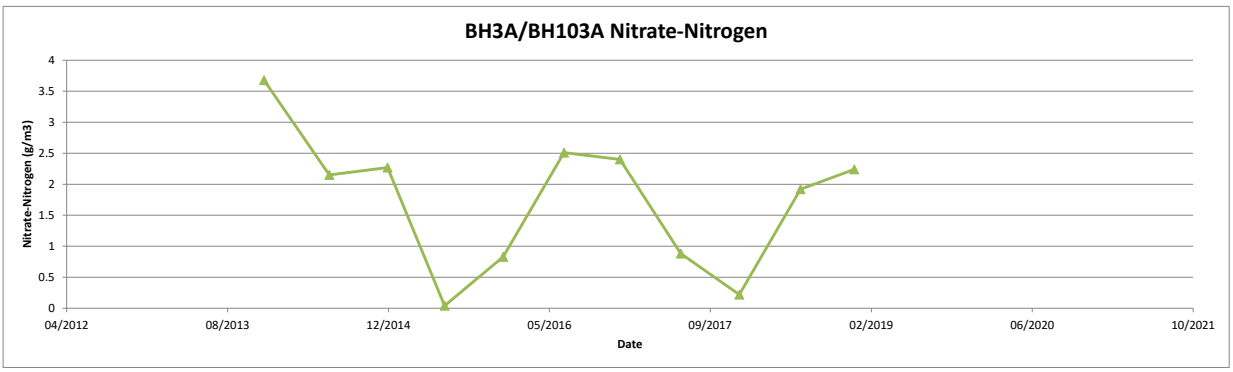

BH3A/BH103A Faecal Coliforms
Faecal Coliforms (No./100mL)
100
90
80
70
60
50
40
30
20
10
0
04/2012
08/2013
12/2014
05/2016
09/2017
02/2019
06/2020
10/2021
Date

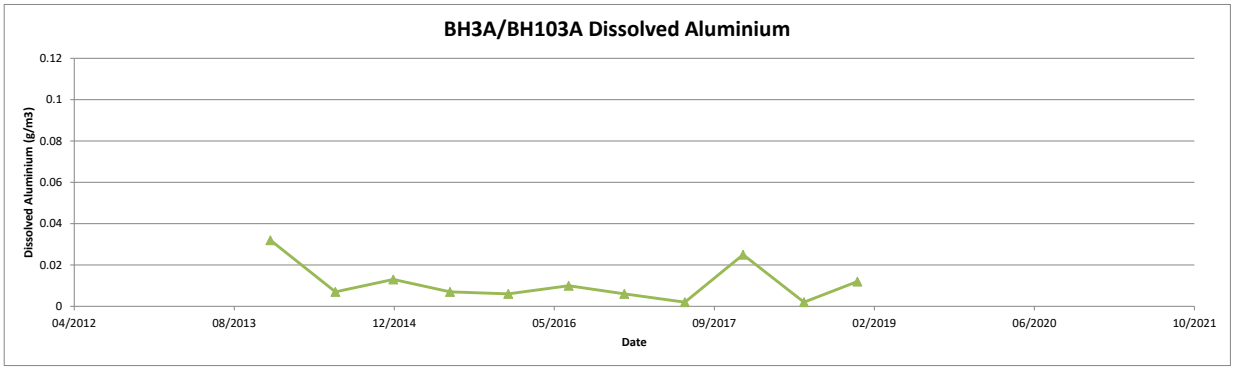

BH3A/BH103A BOD5
BOD5 (g/m3)
9
8
7
6
5
4
3
2
1
0
04/2012
08/2013
12/2014
05/2016
09/2017
02/2019
06/2020
10/2021
Date

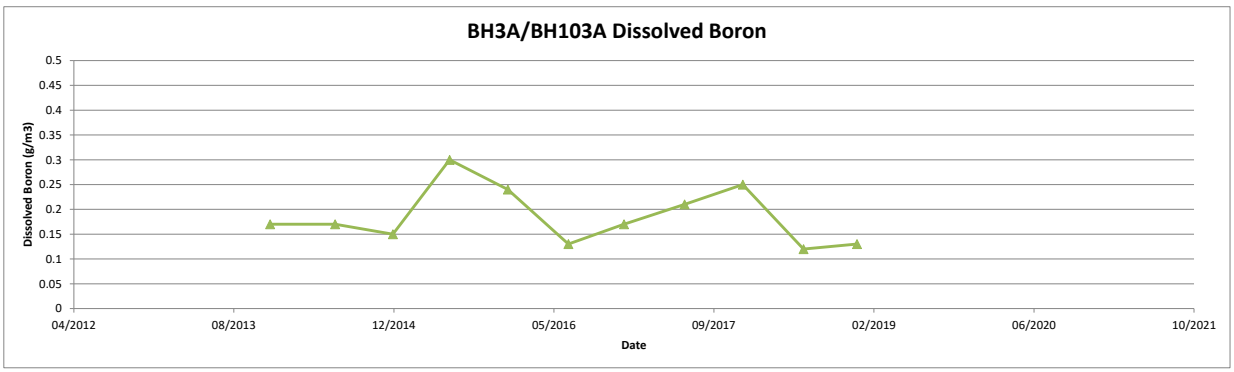

BH3A/BH103A Dissolved Iron
Iron (g/m3)
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
04/2012
08/2013
12/2014
05/2016
09/2017
02/2019
06/2020
10/2021
Date

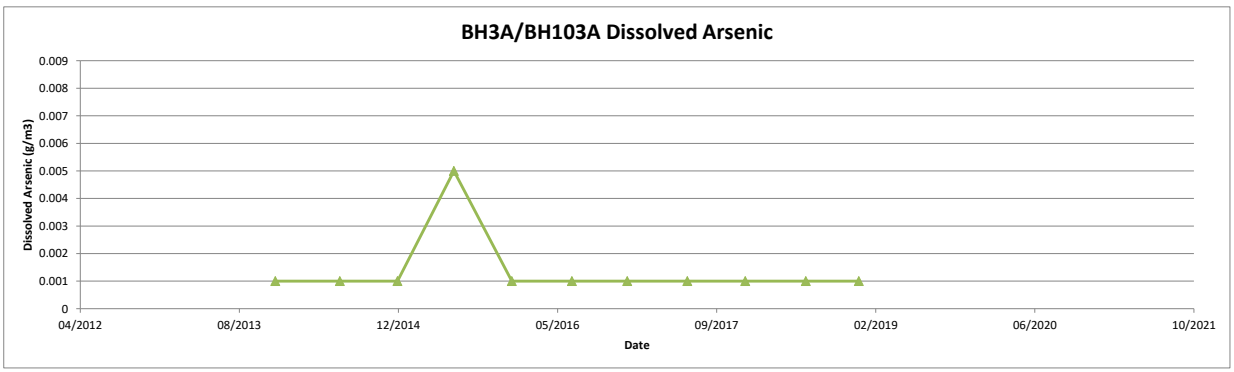

BH3A/BH103A Dissolved Manganese
Manganese (g/m3)
0
1
2
3
4
5
6
7
8
9
04/2012
08/2013
12/2014
05/2016
09/2017
02/2019
06/2020
10/2021

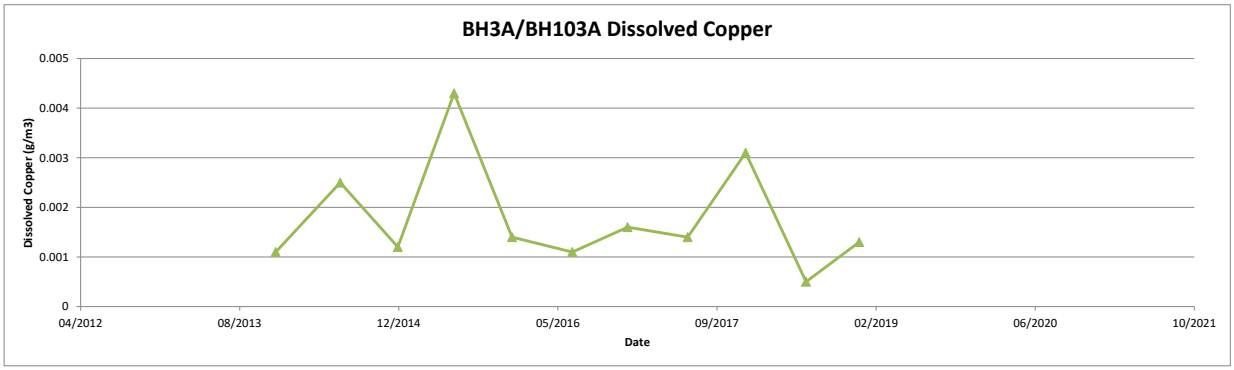

BH3A/BH103A Chloride
Dissolved Chloride (g/m3)
0
20
40
60
80
100
120
140
160
04/2012
08/2013
12/2014
05/2016
09/2017
02/2019
06/2020
10/2021
Date

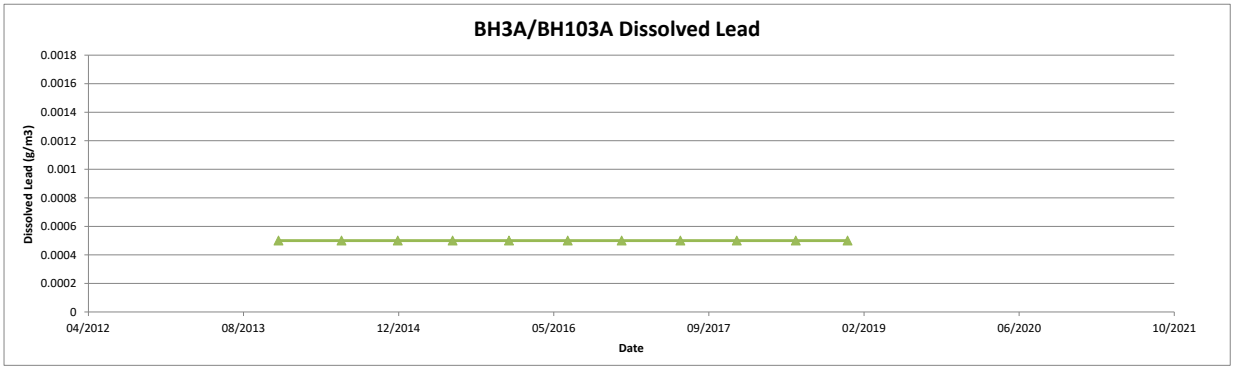

BH3A/BH103A Nitrate-Nitrogen
Nitrate-Nitrogen (g/m3)
0
0.5
1
1.5
2
2.5
3
3.5
4
04/2012
08/2013
12/2014
05/2016
09/2017
02/2019
06/2020
10/2021
Date

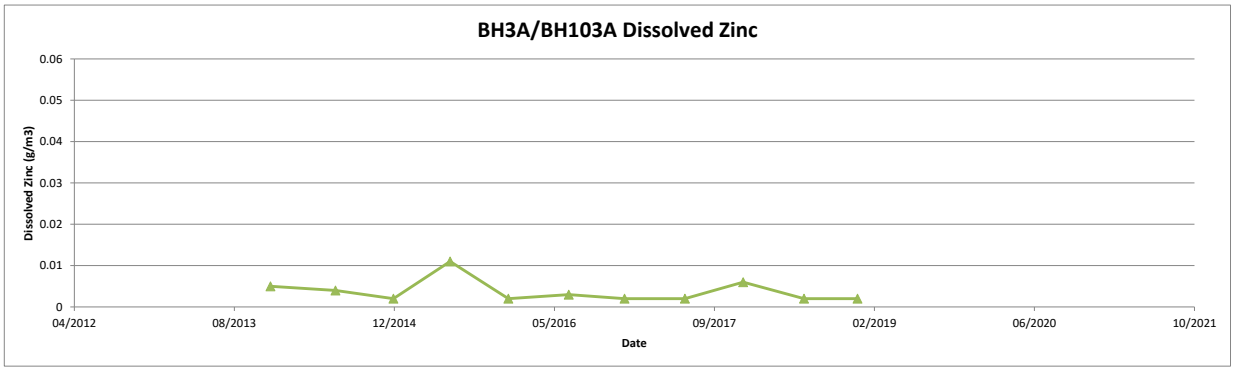

BH3A/BH103A Dissolved Aluminium
Dissolved Aluminium (g/m3)
0.12
0.1
0.08
0.06
0.04
0.02
0
04/2012
08/2013
12/2014
05/2016
09/2017
02/2019
06/2020
10/2021
Date

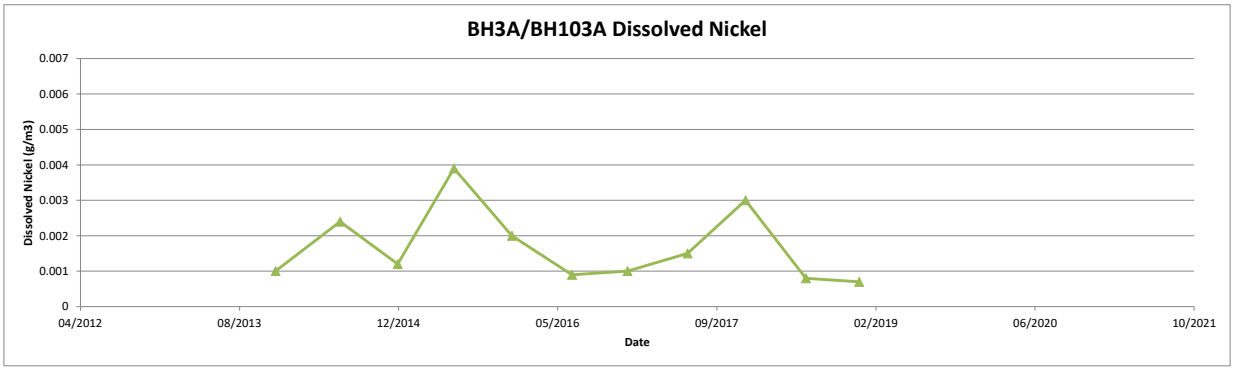

BH3A/BH103A Dissolved Boron
Dissolved Boron (g/m3)
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
04/2012
08/2013
12/2014
05/2016
09/2017
02/2019
06/2020
10/2021
Date

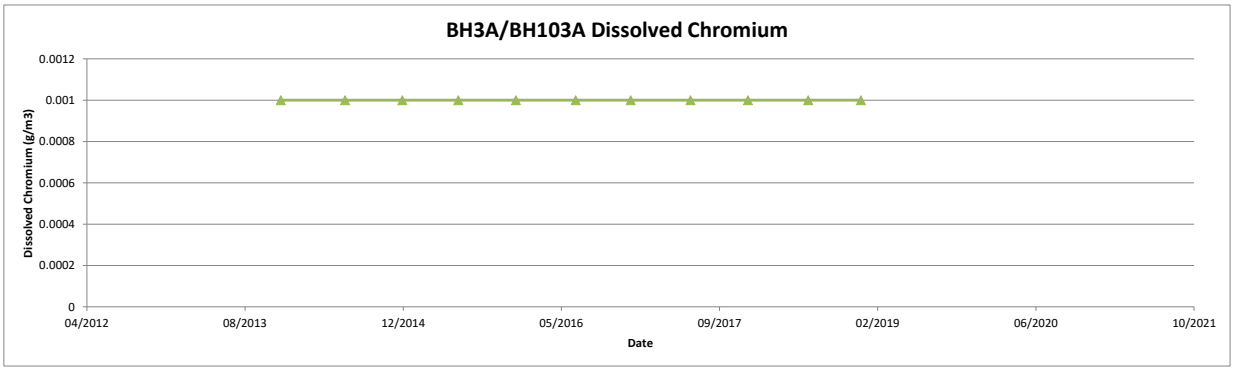

BH3A/BH103A Dissolved Arsenic
Dissolved Arsenic (g/m3)
0.009
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0
04/2012
08/2013
12/2014
05/2016
09/2017
02/2019
06/2020
10/2021
Date

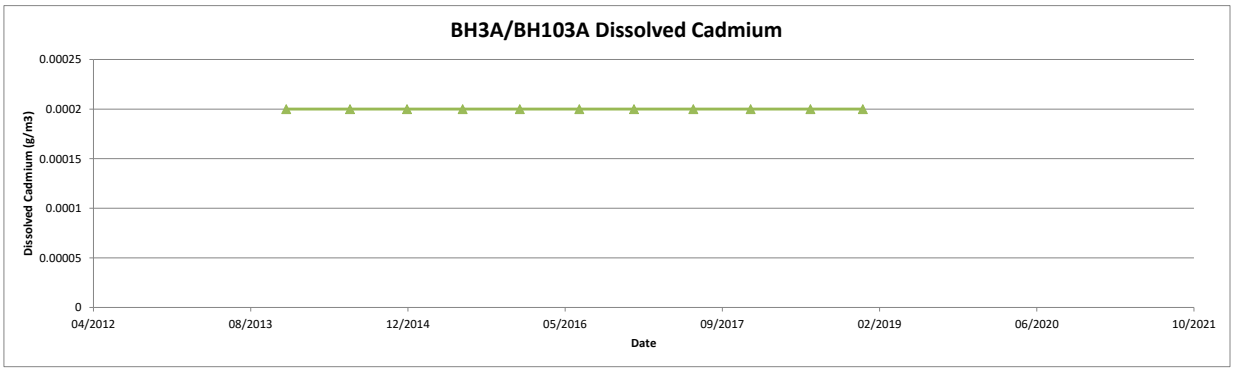

BH3A/BH103A Dissolved Copper
Dissolved Copper (g/m3)
0.005
0.004
0.003
0.002
0.001
0
04/2012
08/2013
12/2014
05/2016
09/2017
02/2019
06/2020
10/2021
Date

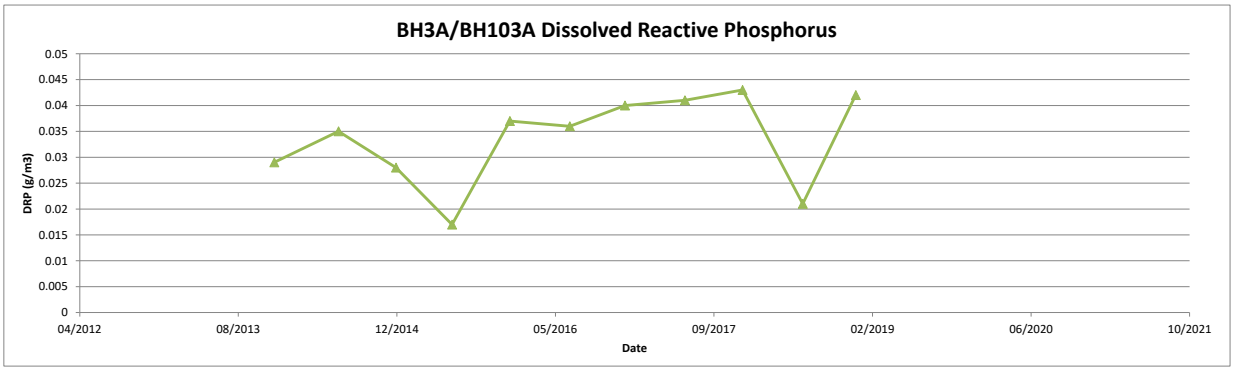

BH3A/BH103A Dissolved Lead
Dissolved Lead (g/m3)
0.0018
0.0016
0.0014
0.0012
0.001
0.0008
0.0006
0.0004
0.0002
0
04/2012
08/2013
12/2014
05/2016
09/2017
02/2019
06/2020
10/2021
Date

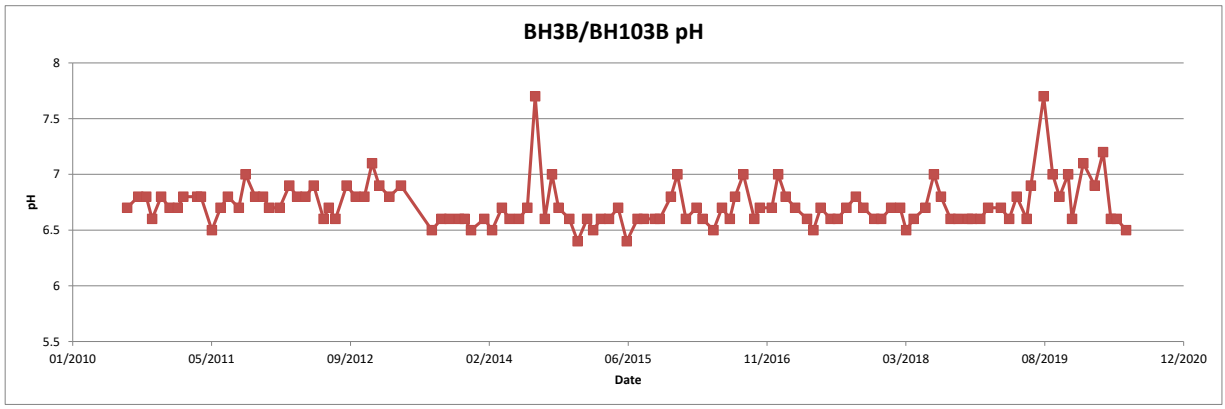

BH3A/BH103A Dissolved Zinc
Dissolved Zinc (g/m3)
0.06
0.05
0.04
0.03
0.02
0.01
0
04/2012
08/2013
12/2014
05/2016
09/2017
02/2019
06/2020
10/2021
Date

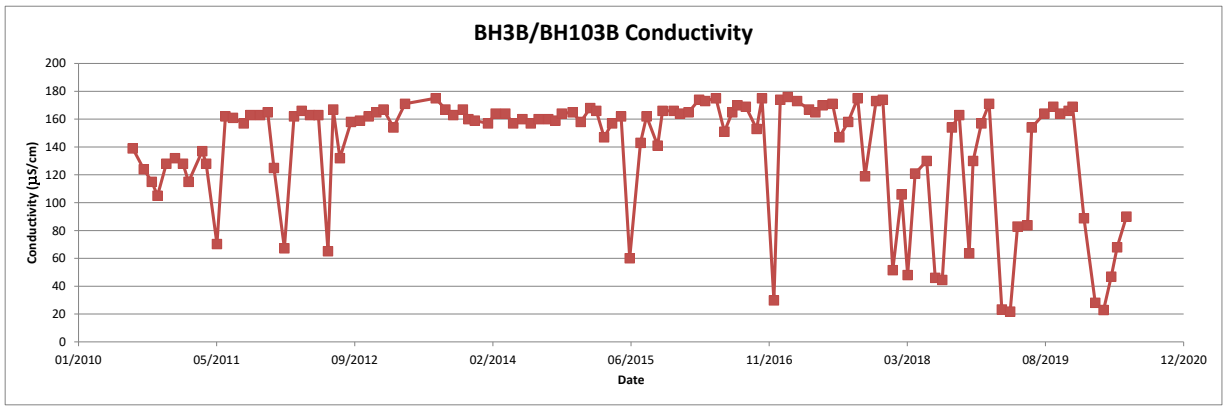

BH3A/BH103A Dissolved Nickel
Dissolved Nickel (g/m3)
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0
04/2012
08/2013
12/2014
05/2016
09/2017
02/2019
06/2020
10/2021
Date

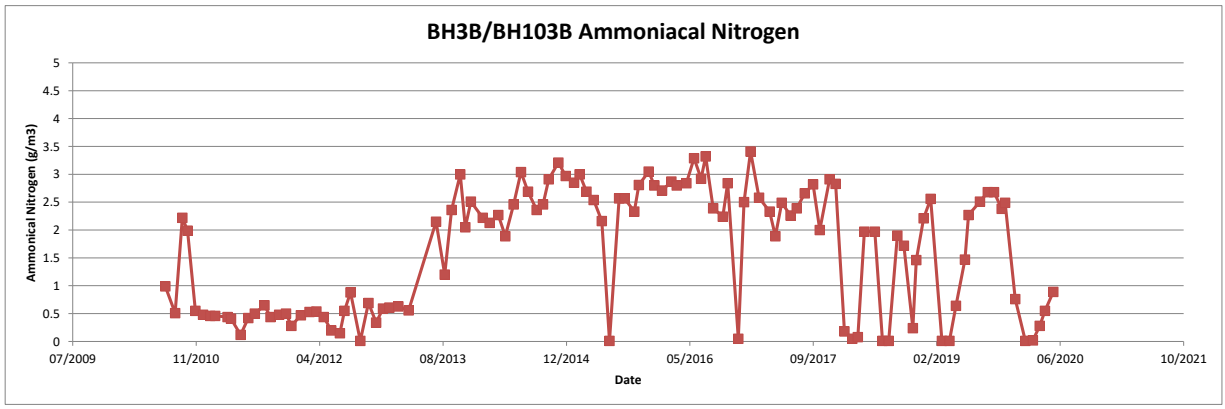

BH3A/BH103A Dissolved Chromium
Dissolved Chromium (g/m3)
0.0012
0.001
0.0008
0.0006
0.0004
0.0002
0
04/2012
08/2013
12/2014
05/2016
09/2017
02/2019
06/2020
10/2021
Date

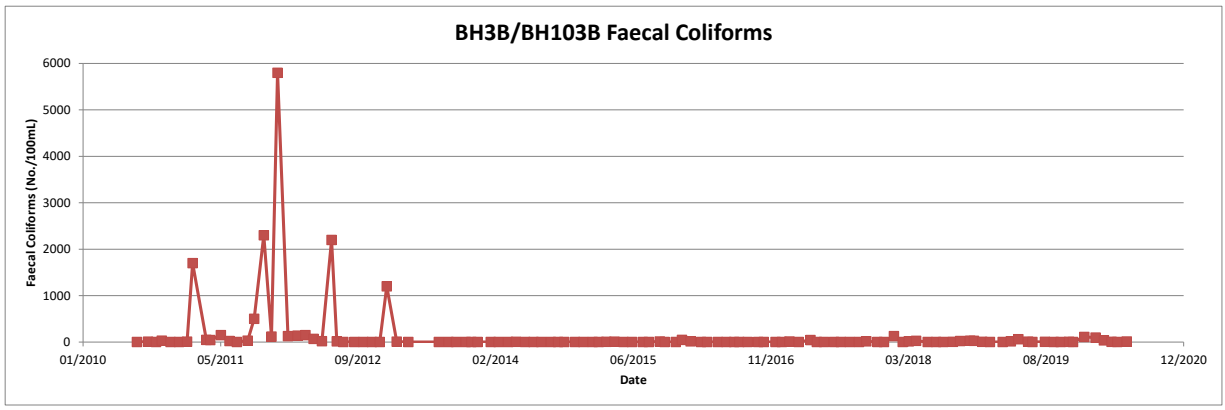

BH3A/BH103A Dissolved Cadmium
Dissolved Cadmium (g/m3)
0.00025
0.0002
0.00015
0.0001
0.00005
0
04/2012
08/2013
12/2014
05/2016
09/2017
02/2019
06/2020
10/2021
Date

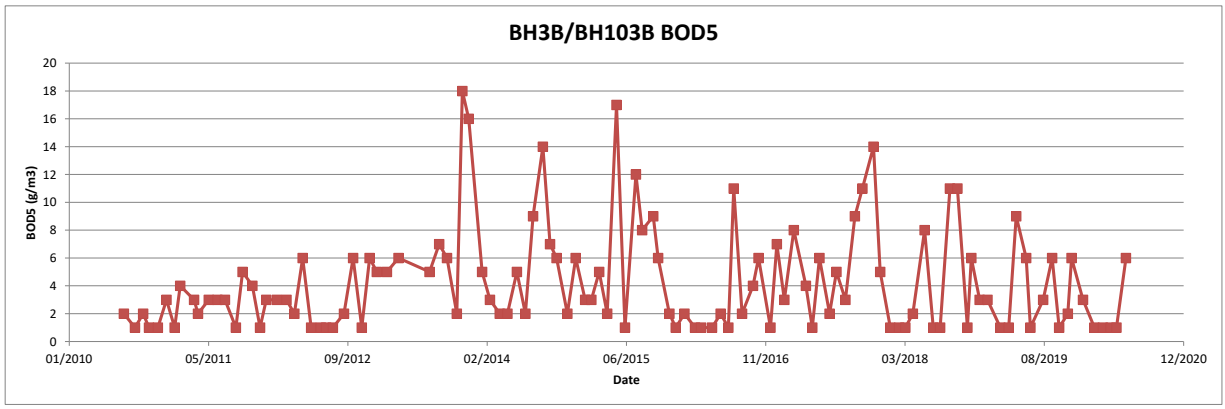

BH3A/BH103A Dissolved Reactive Phosphorus
DRP (g/m3)
0.05
0.045
0.04
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
04/2012
08/2013
12/2014
05/2016
09/2017
02/2019
06/2020
10/2021
Date

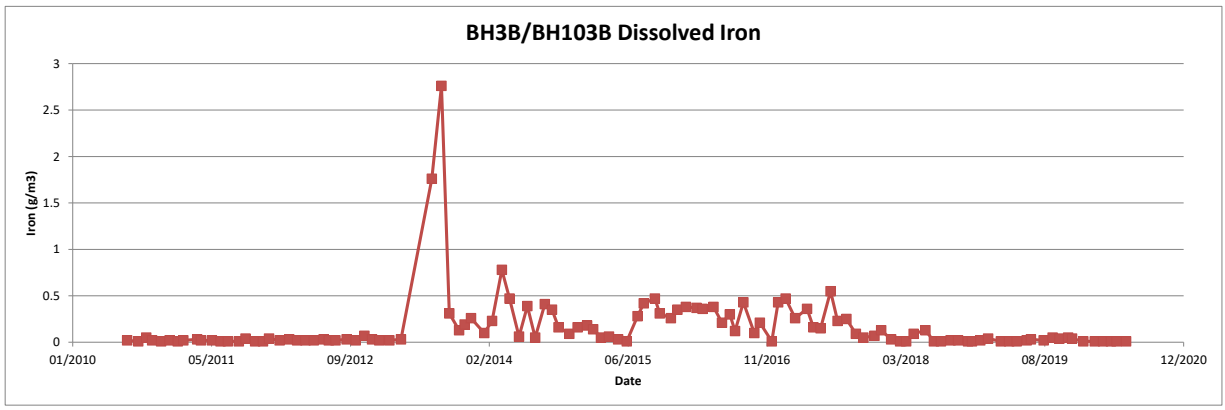

BH3B/BH103B pH
pH
8
7.5
7
6.5
6
5.5
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

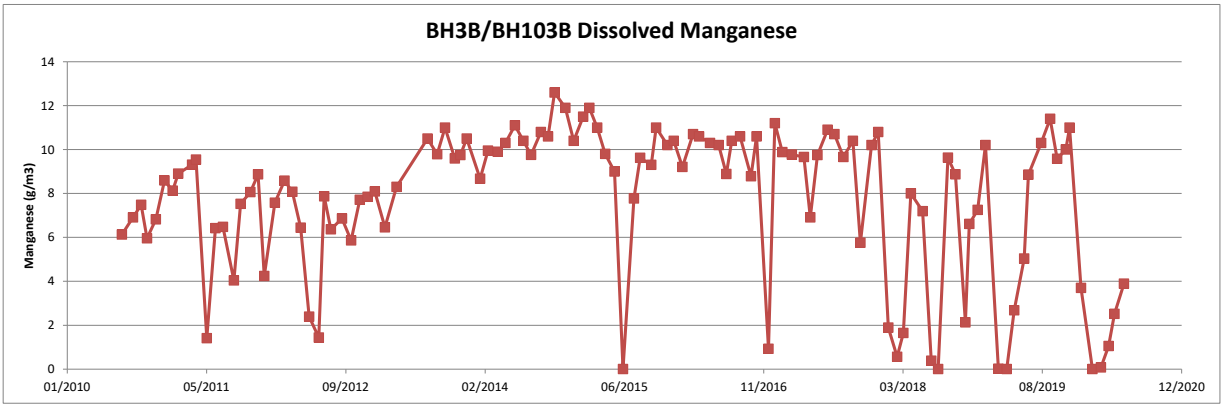

BH3B/BH103B Conductivity
Conductivity (µS/cm)
200
180
160
140
120
100
80
60
40
20
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

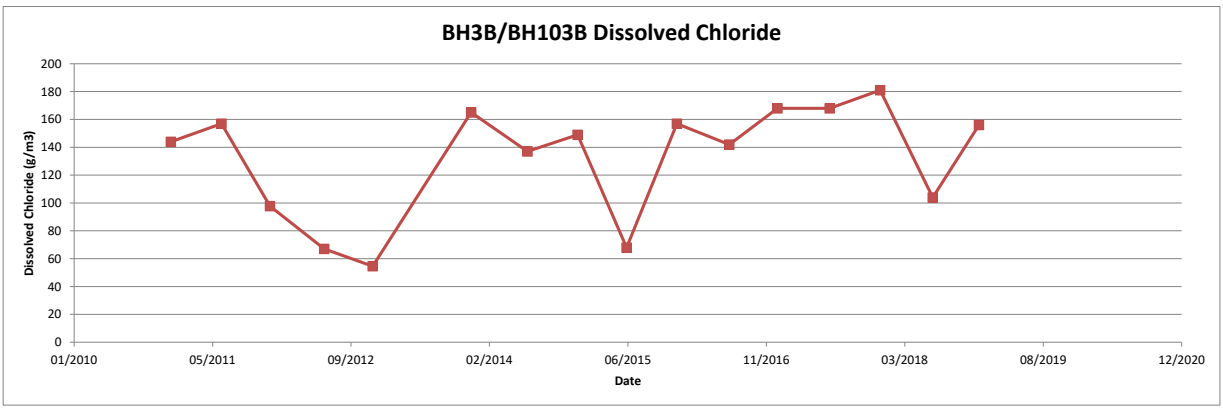

BH3B/BH103B Ammoniacal Nitrogen
Ammonical Nitrogen (g/m3)
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
07/2009
11/2010
04/2012
08/2013
12/2014
05/2016
09/2017
02/2019
06/2020
10/2021
Date

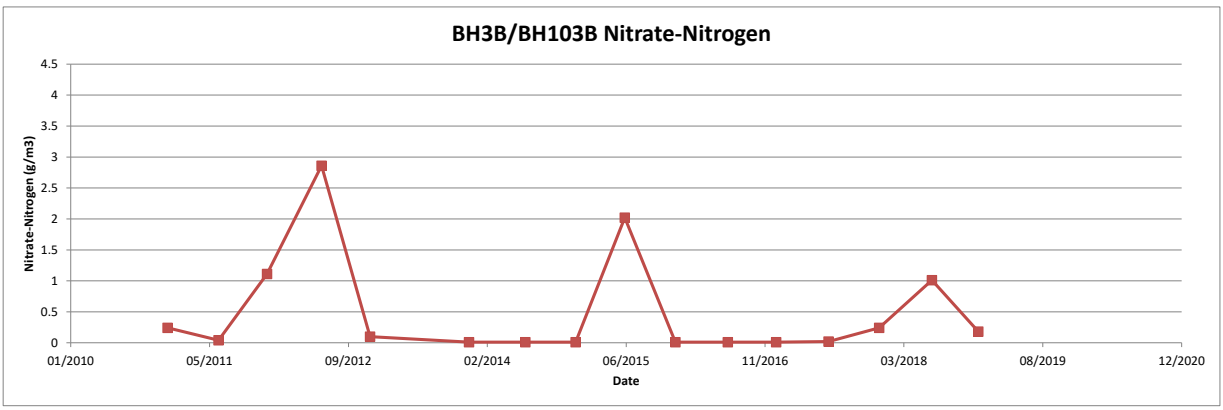

BH3B/BH103B Faecal Coliforms
Faecal Coliforms (No./100mL)
6000
5000
4000
3000
2000
1000
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

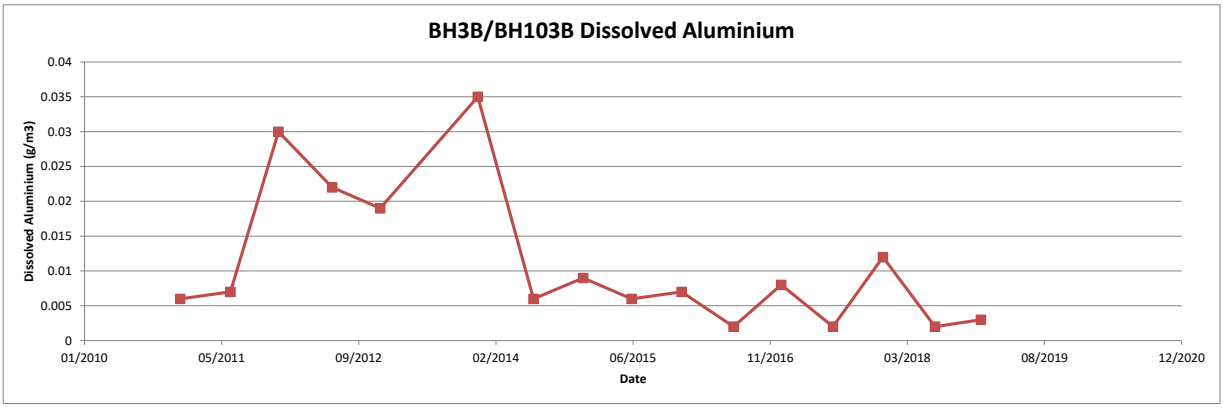

BH3B/BH103B BOD5
BOD5 (g/m3)
20
18
16
14
12
10
8
6
4
2
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

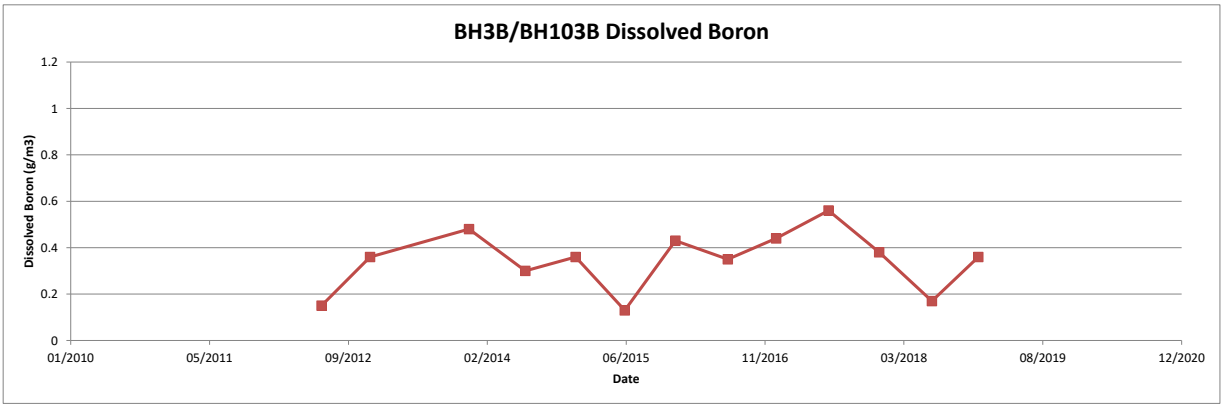

BH3B/BH103B Dissolved Iron
Iron (g/m3)
3
2.5
2
1.5
1
0.5
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

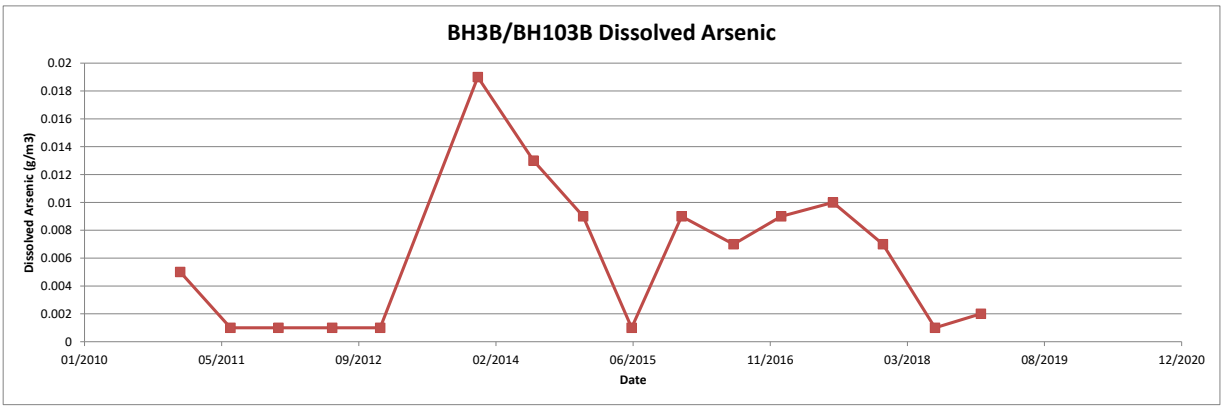

BH3B/BH103B Dissolved Manganese
Manganese (g/m3)
0
2
4
6
8
10
12
14
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020

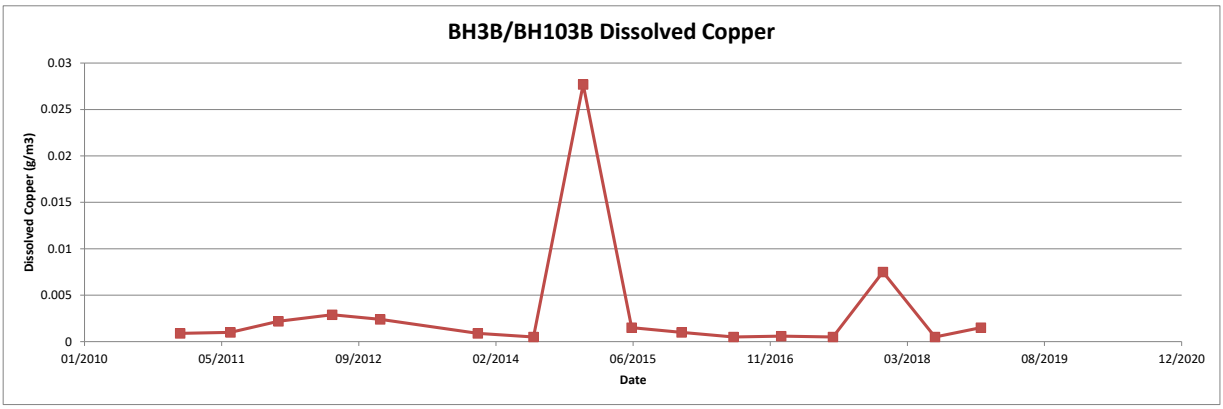

BH3B/BH103B Dissolved Chloride
Dissolved Chloride (g/m3)
0
20
40
60
80
100
120
140
160
180
200
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

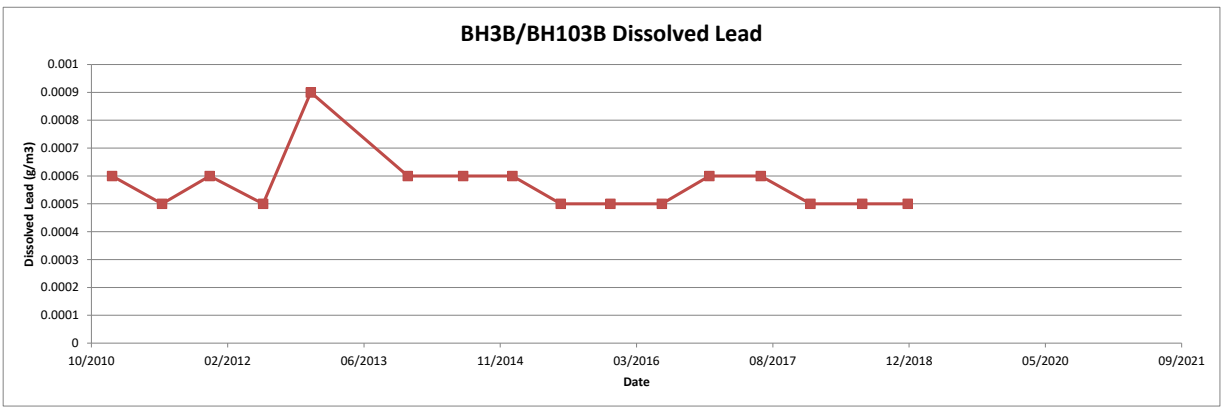

BH3B/BH103B Nitrate-Nitrogen
Nitrate-Nitrogen (g/m3)
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

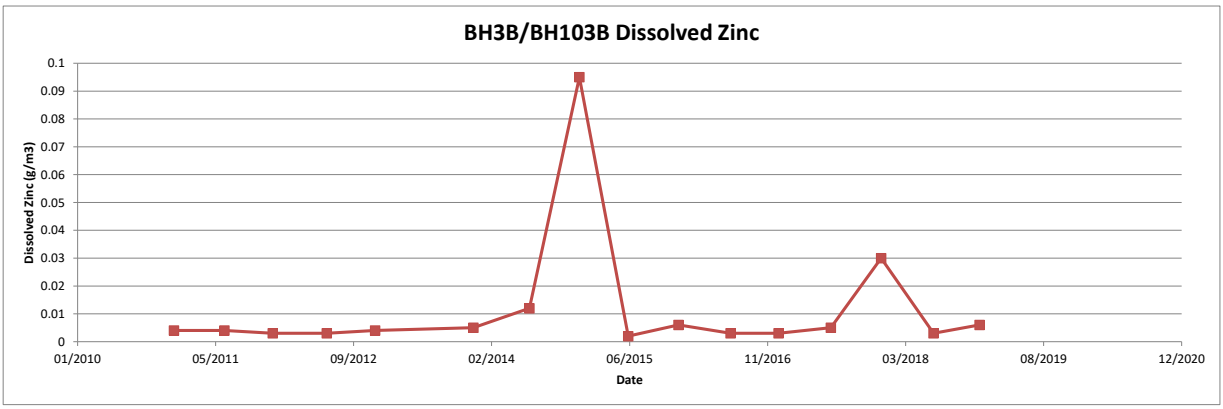

BH3B/BH103B Dissolved Aluminium
Dissolved Aluminium (g/m3)
0.04
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

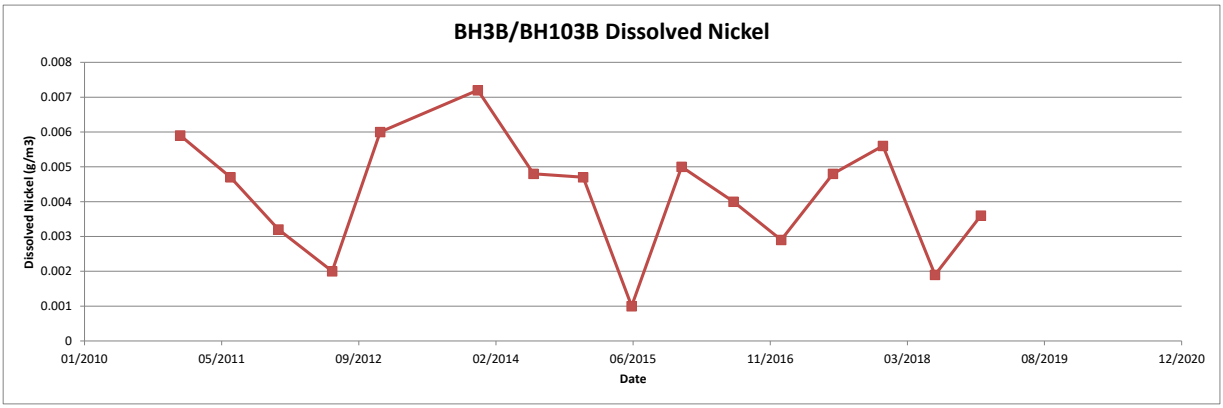

BH3B/BH103B Dissolved Boron
Dissolved Boron (g/m3)
1.2
1
0.8
0.6
0.4
0.2
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

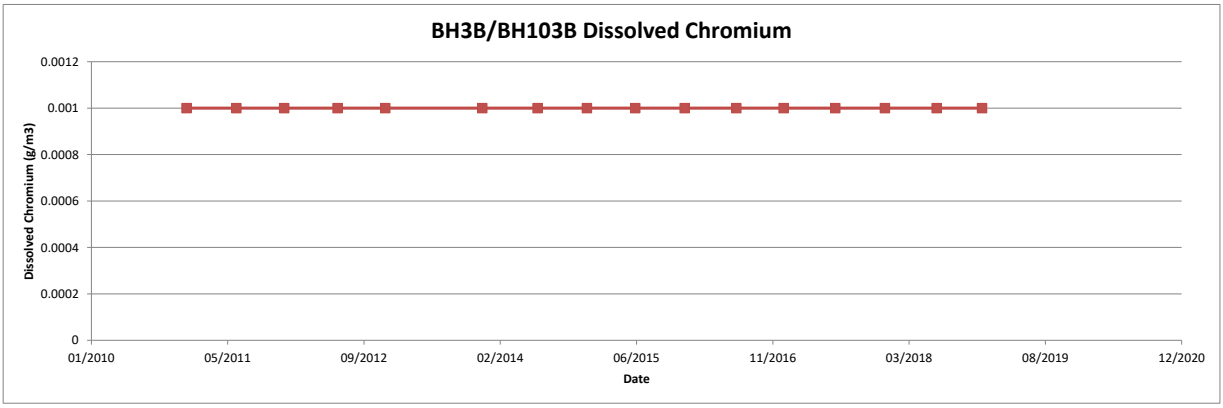

BH3B/BH103B Dissolved Arsenic
Dissolved Arsenic (g/m3)
0.02
0.018
0.016
0.014
0.012
0.01
0.008
0.006
0.004
0.002
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

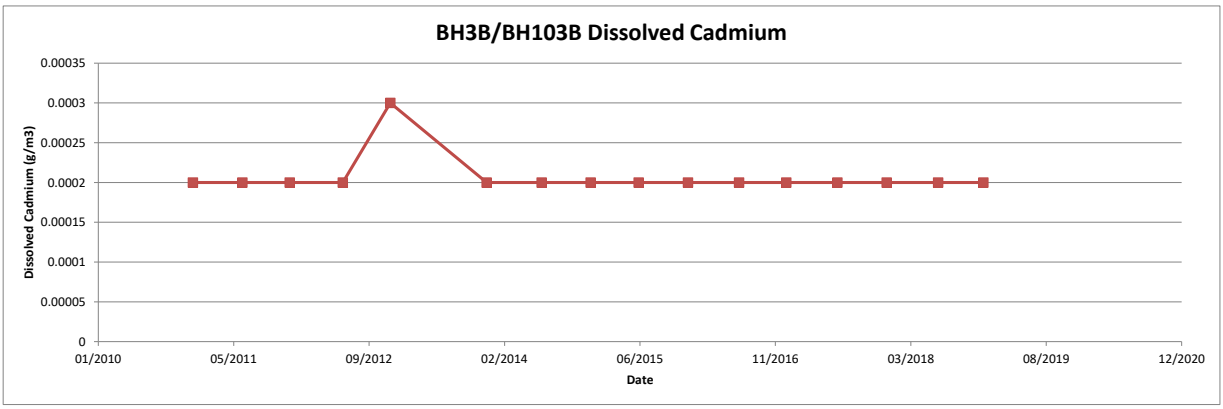

BH3B/BH103B Dissolved Copper
Dissolved Copper (g/m3)
0.03
0.025
0.02
0.015
0.01
0.005
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

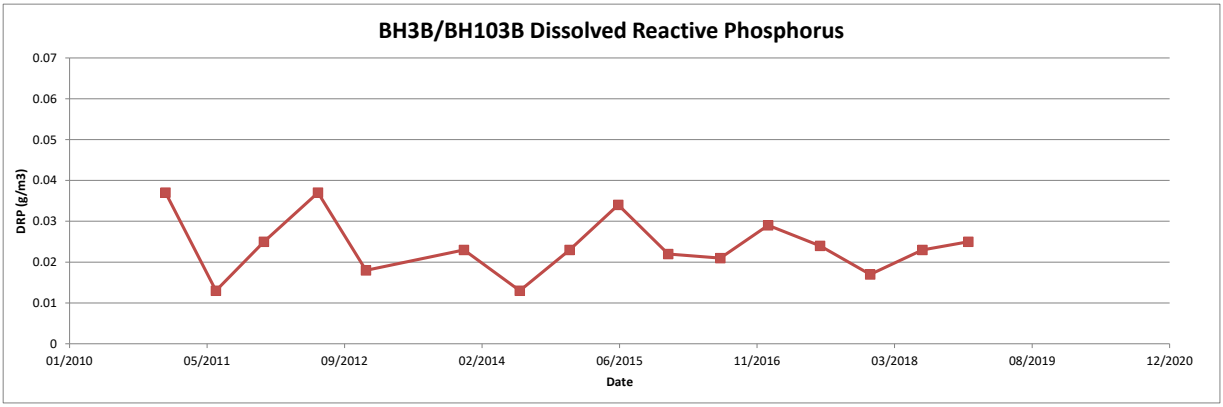

BH3B/BH103B Dissolved Lead
Dissolved Lead (g/m3)
0.001
0.0009
0.0008
0.0007
0.0006
0.0005
0.0004
0.0003
0.0002
0.0001
0
10/2010
02/2012
06/2013
11/2014
03/2016
08/2017
12/2018
05/2020
09/2021
Date

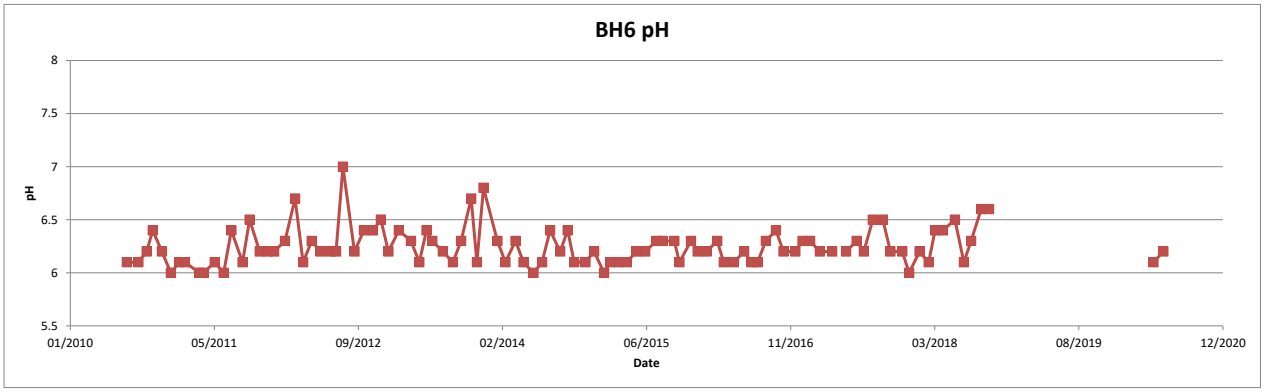

BH3B/BH103B Dissolved Zinc
Dissolved Zinc (g/m3)
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

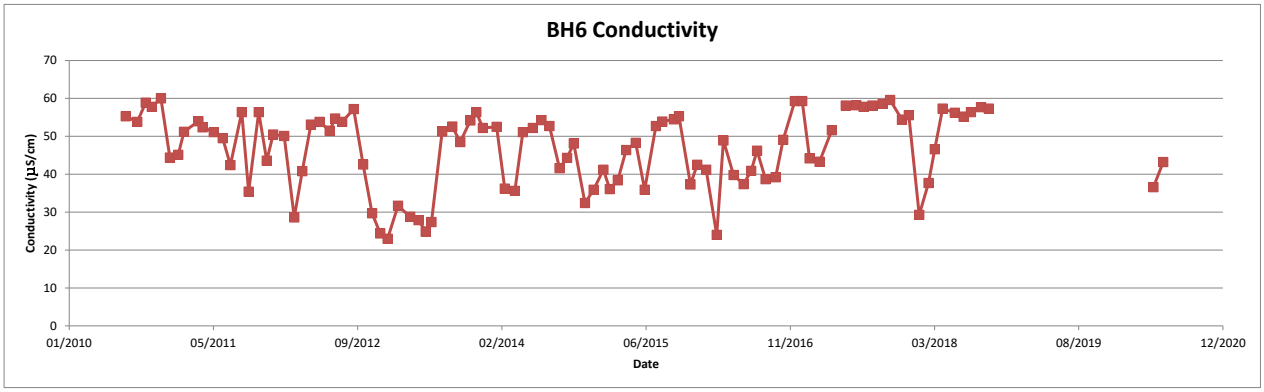

BH3B/BH103B Dissolved Nickel
Dissolved Nickel (g/m3)
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

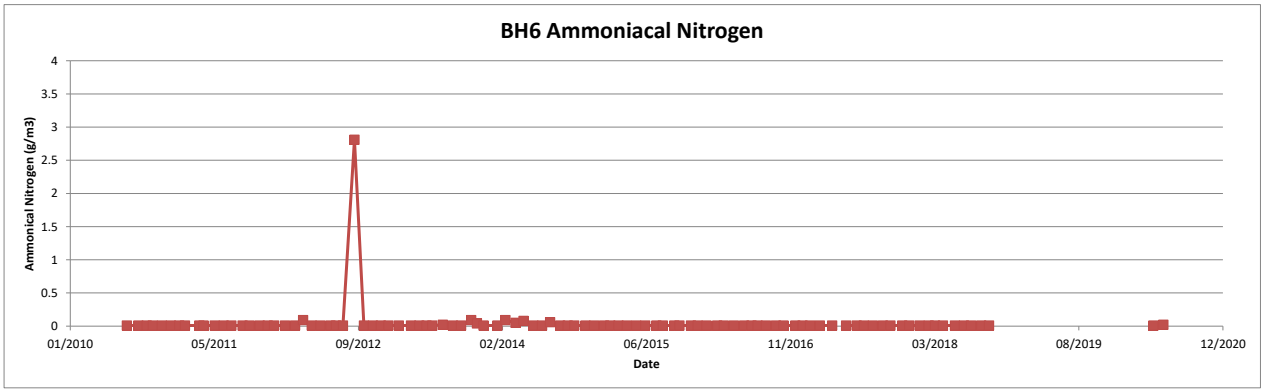

BH3B/BH103B Dissolved Chromium
Dissolved Chromium (g/m3)
0.0012
0.001
0.0008
0.0006
0.0004
0.0002
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

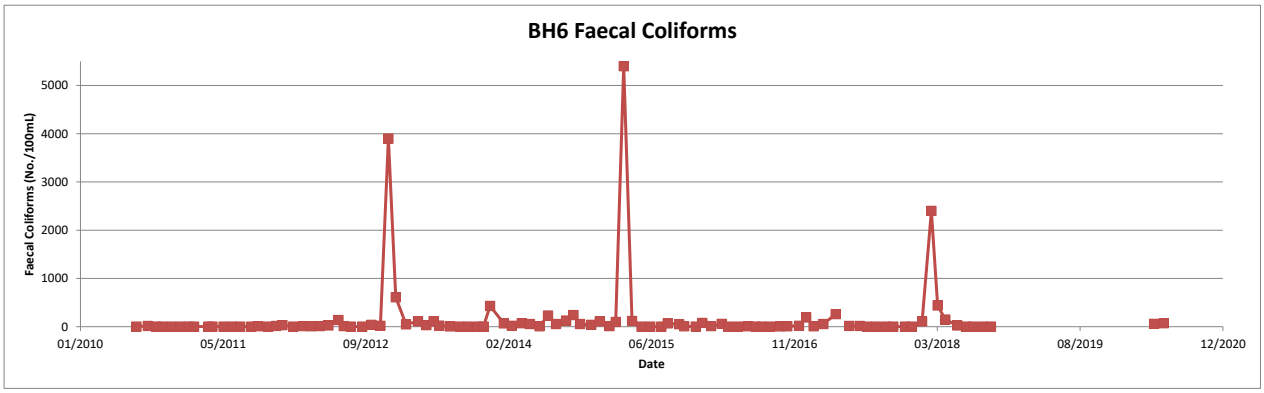

BH3B/BH103B Dissolved Cadmium
Dissolved Cadmium (g/m3)
0.00035
0.0003
0.00025
0.0002
0.00015
0.0001
0.00005
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

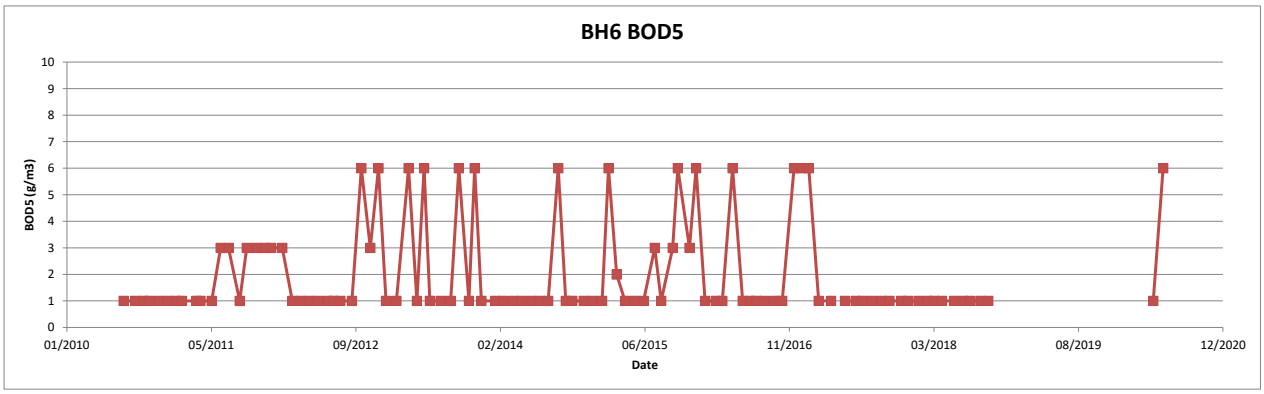

BH3B/BH103B Dissolved Reactive Phosphorus
DRP (g/m3)
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

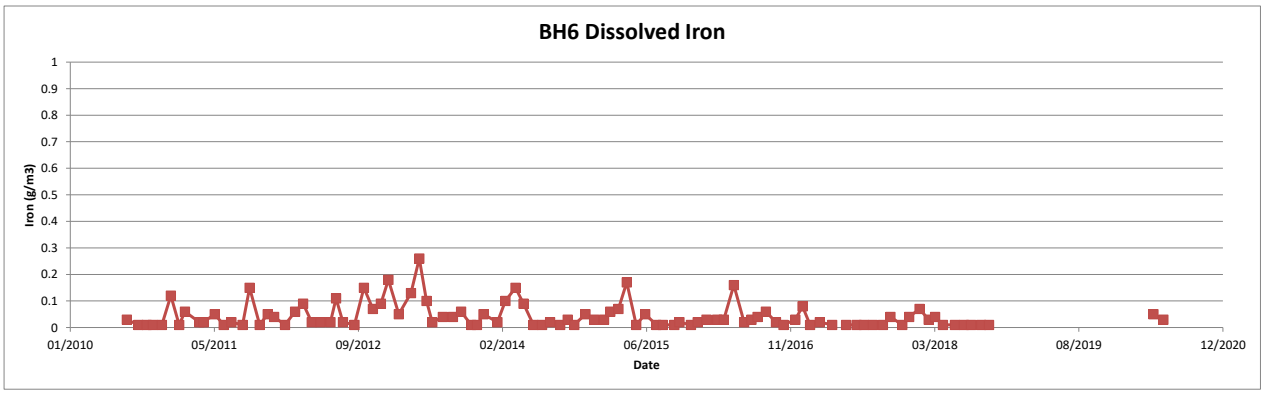

BH6 pH
pH
8
7.5
7
6.5
6
5.5
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

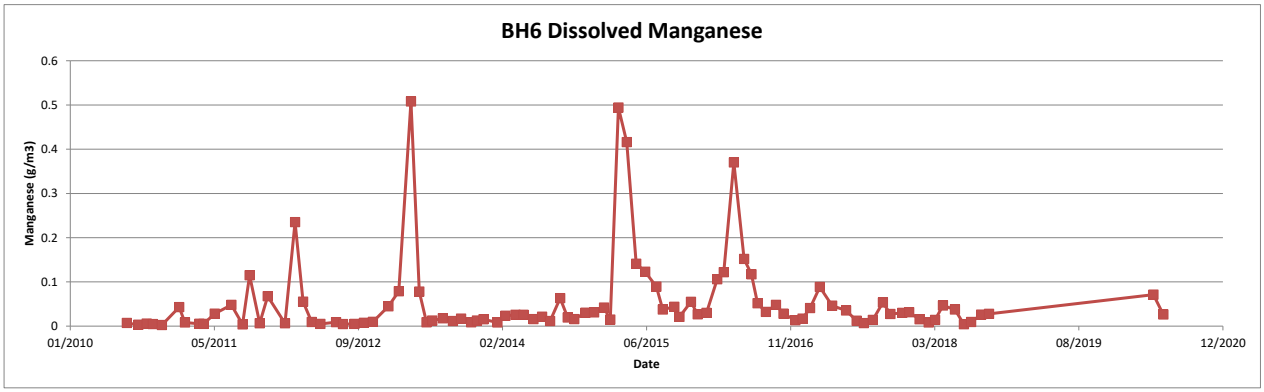

BH6 Conductivity
Conductivity (µS/cm)
70
60
50
40
30
20
10
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

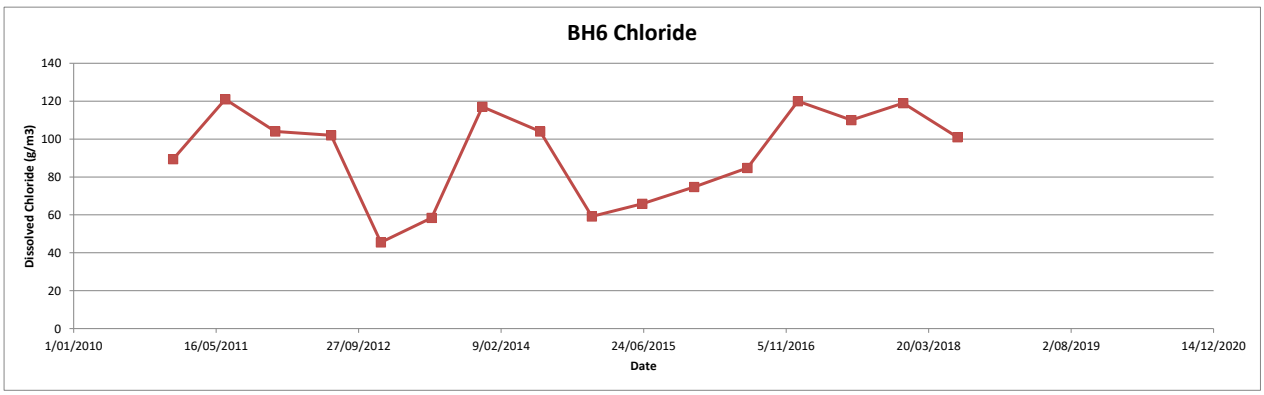

BH6 Ammoniacal Nitrogen
Ammonical Nitrogen (g/m3)
4
3.5
3
2.5
2
1.5
1
0.5
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

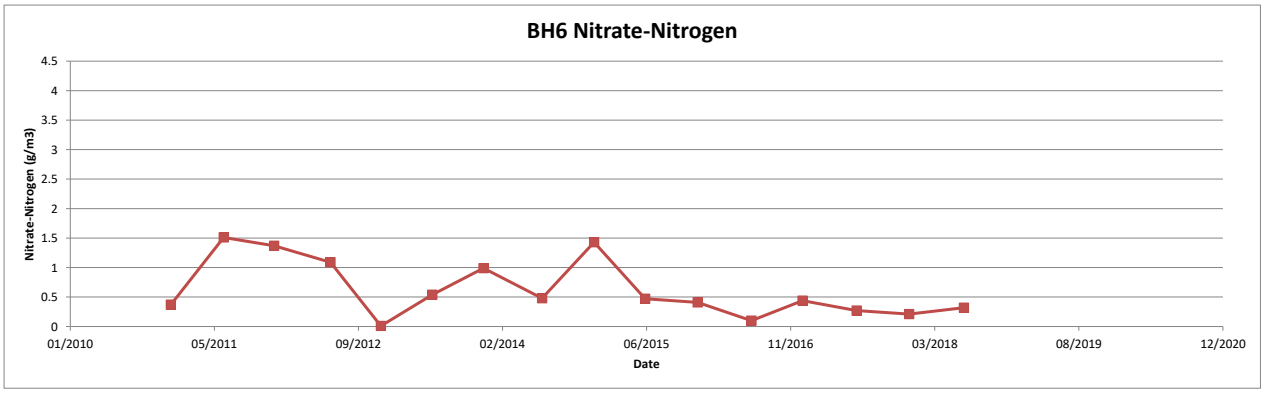

BH6 Faecal Coliforms
Faecal Coliforms (No./100mL)
5000
4000
3000
2000
1000
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

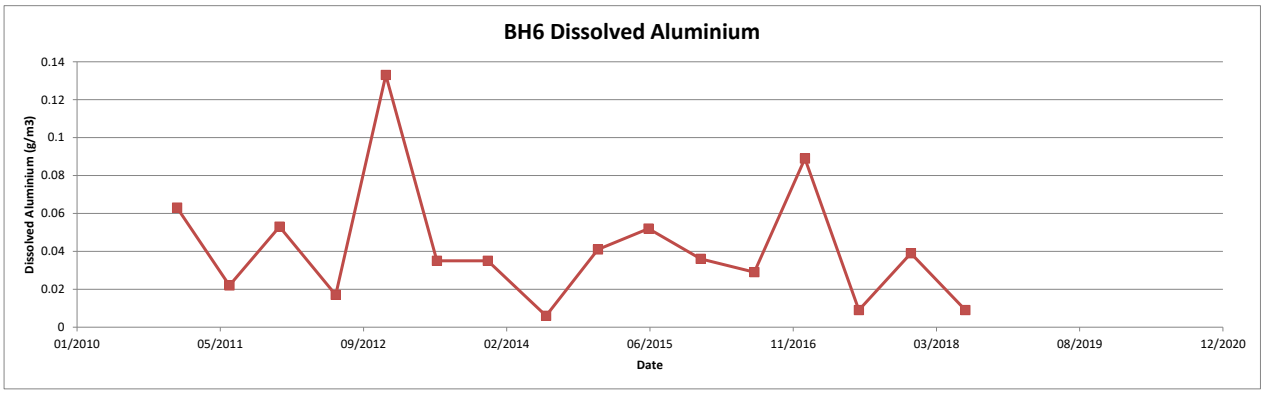

BH6 BOD5
BOD5 (g/m3)
10
9
8
7
6
5
4
3
2
1
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

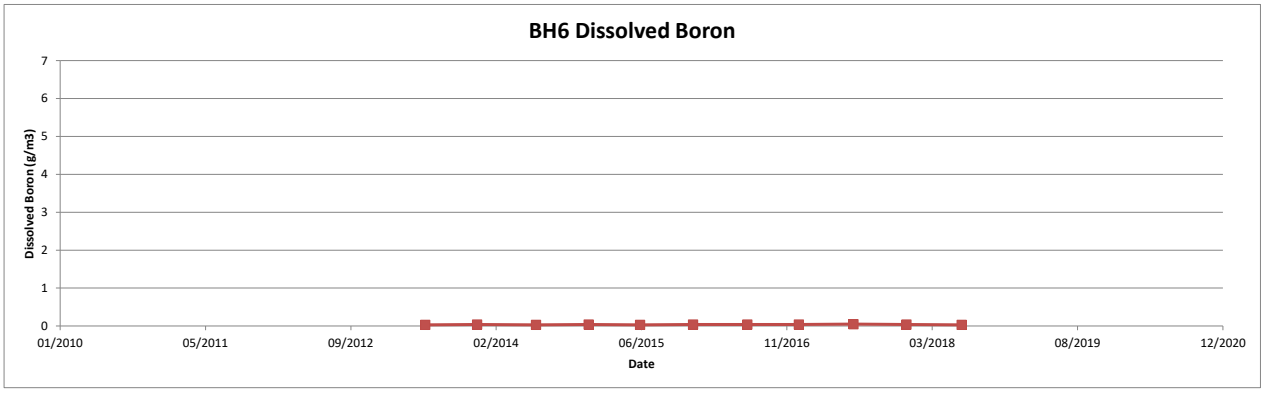

BH6 Dissolved Iron
Iron (g/m3)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

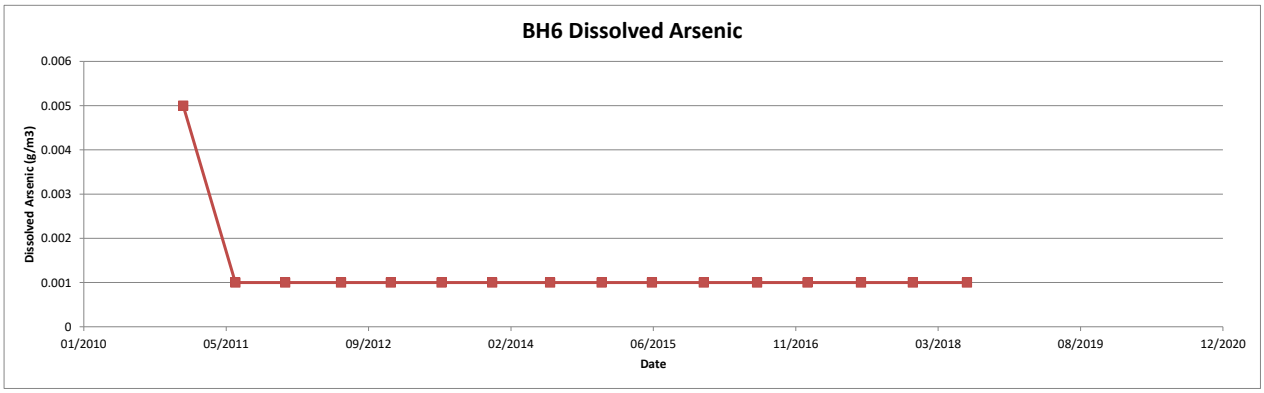

BH6 Dissolved Manganese
Manganese (g/m3)
0.6
0.5
0.4
0.3
0.2
0.1
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

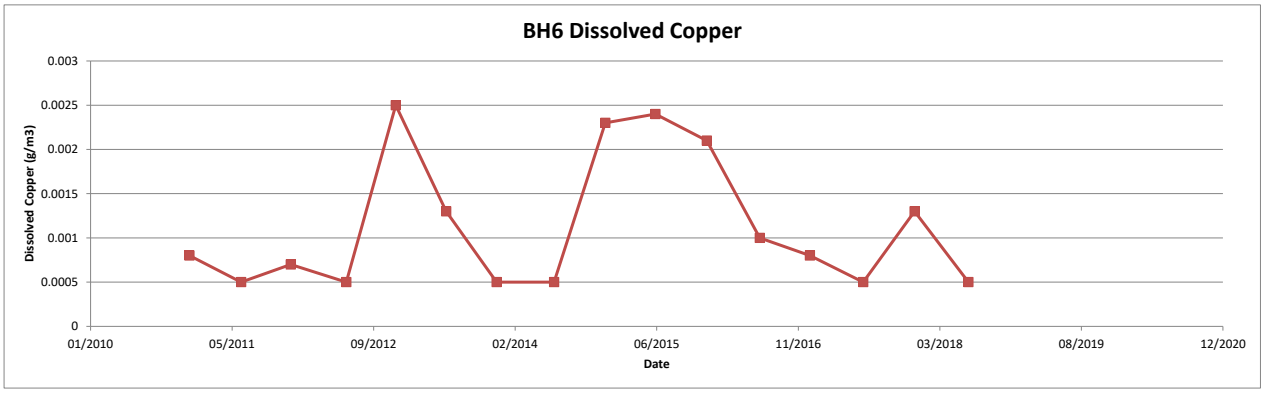

BH6 Chloride
Dissolved Chloride (g/m3)
140
120
100
80
60
40
20
0
1/01/2010
16/05/2011
27/09/2012
9/02/2014
24/06/2015
5/11/2016
20/03/2018
2/08/2019
14/12/2020
Date

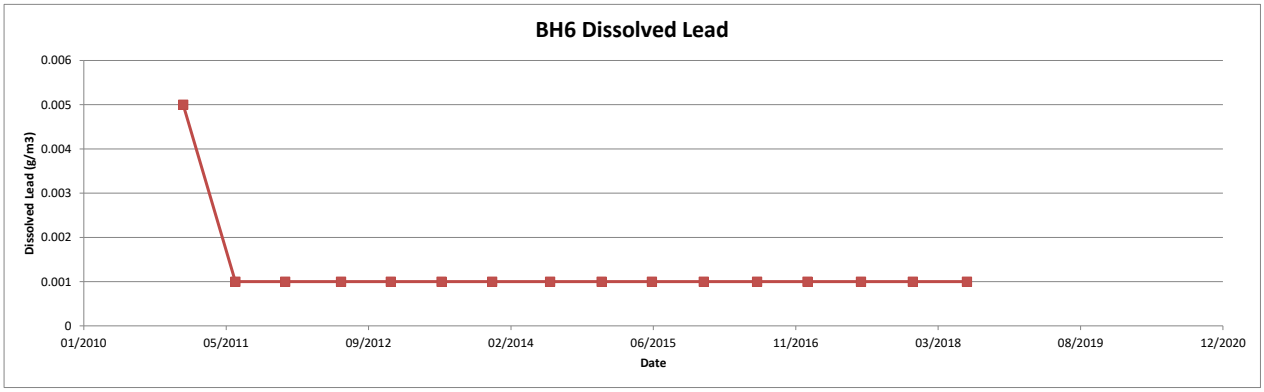

BH6 Nitrate-Nitrogen
Nitrate-Nitrogen (g/m3)
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

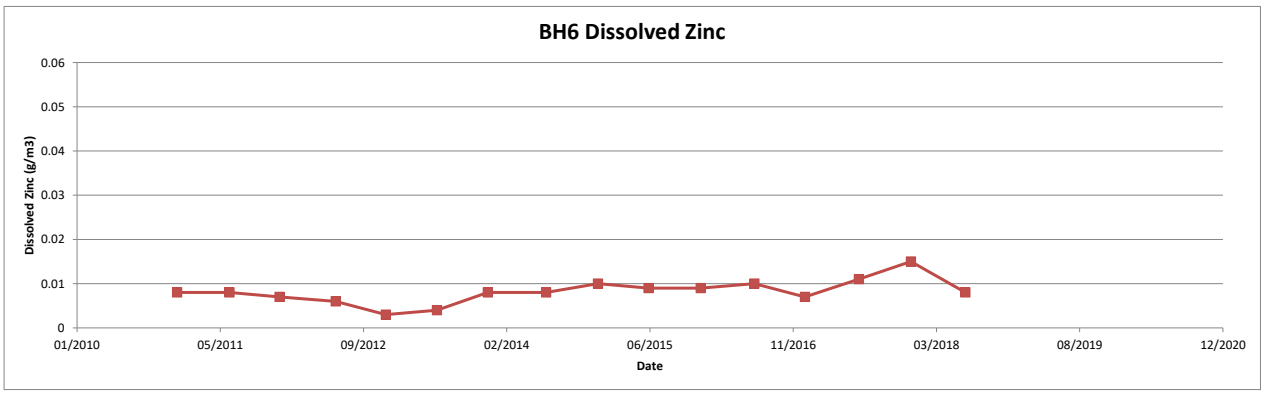

BH6 Dissolved Aluminium
Dissolved Aluminium (g/m3)
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

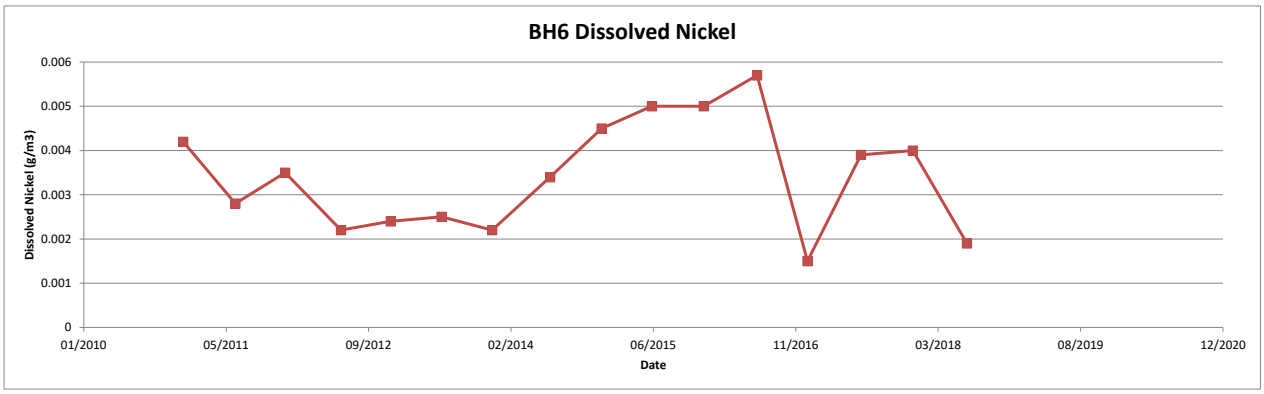

BH6 Dissolved Boron
Dissolved Boron (g/m3)
7
6
5
4
3
2
1
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

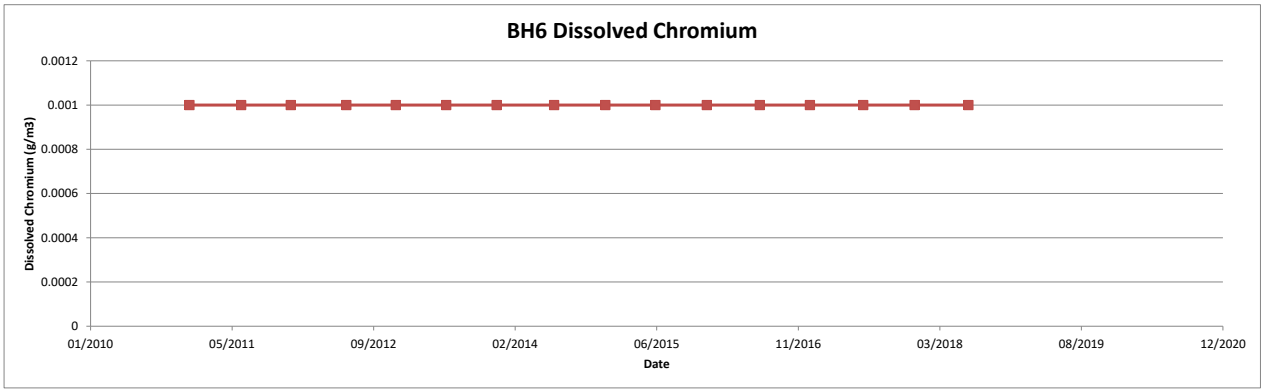

BH6 Dissolved Arsenic
Dissolved Arsenic (g/m3)
0.006
0.005
0.004
0.003
0.002
0.001
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

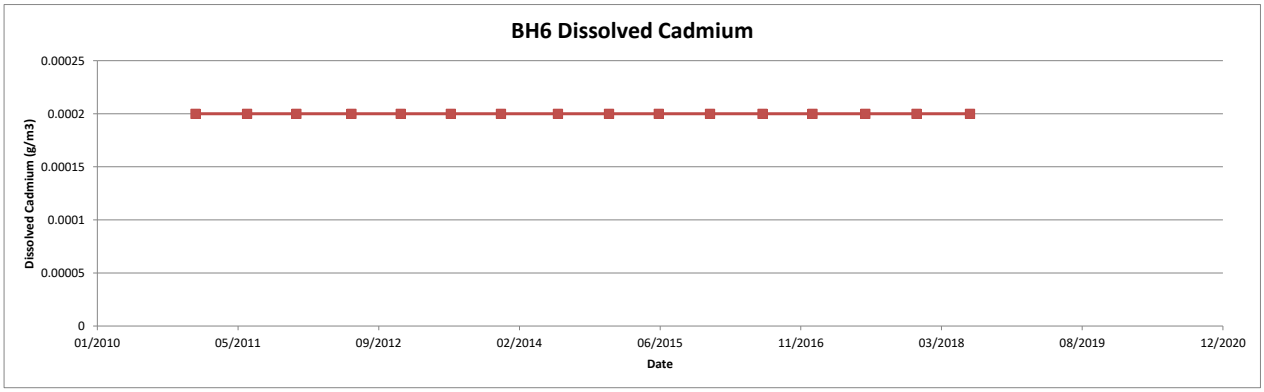

BH6 Dissolved Copper
Dissolved Copper (g/m3)
0.003
0.0025
0.002
0.0015
0.001
0.0005
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

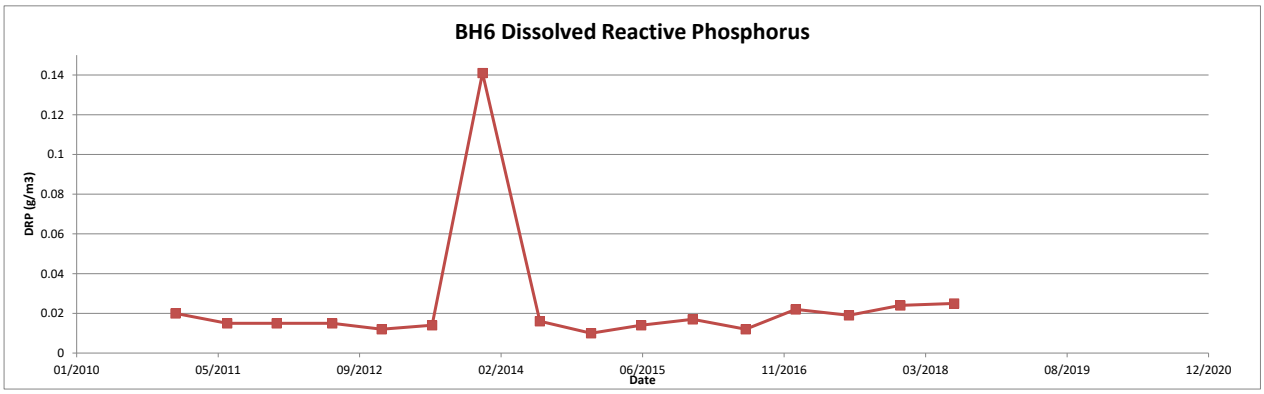

BH6 Dissolved Lead
Dissolved Lead (g/m3)
0.006
0.005
0.004
0.003
0.002
0.001
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

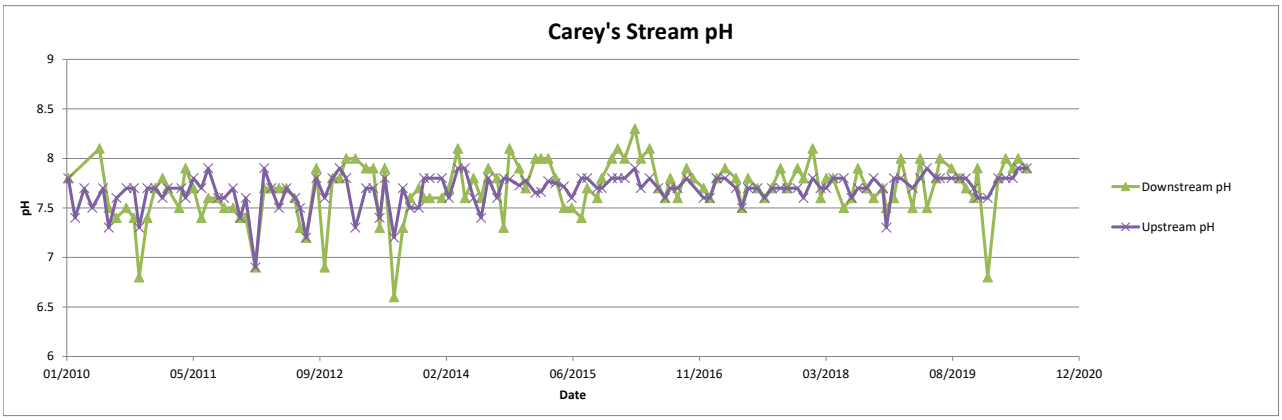

BH6 Dissolved Zinc
Dissolved Zinc (g/m3)
0.06
0.05
0.04
0.03
0.02
0.01
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

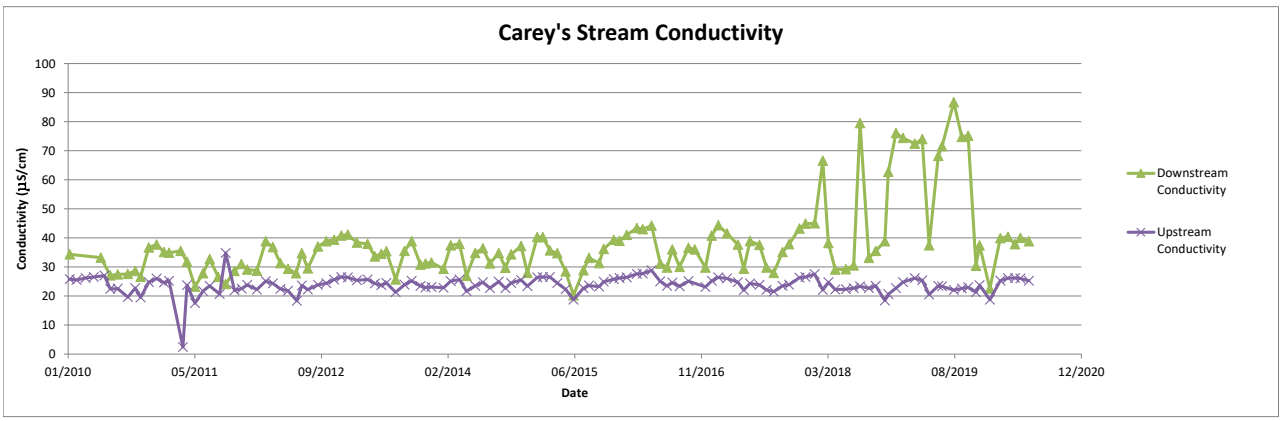

BH6 Dissolved Nickel
Dissolved Nickel (g/m3)
0.006
0.005
0.004
0.003
0.002
0.001
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

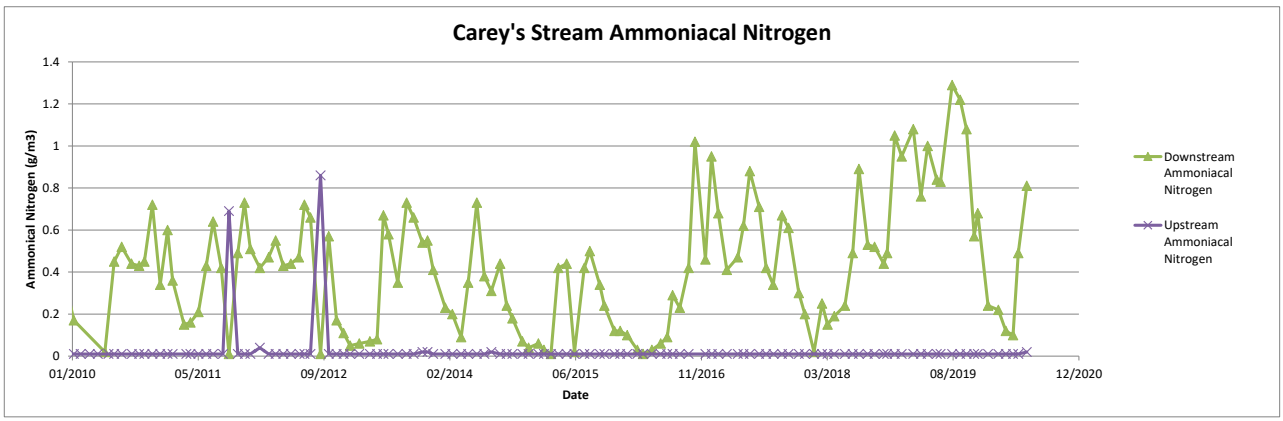

BH6 Dissolved Chromium
Dissolved Chromium (g/m3)
0.0012
0.001
0.0008
0.0006
0.0004
0.0002
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

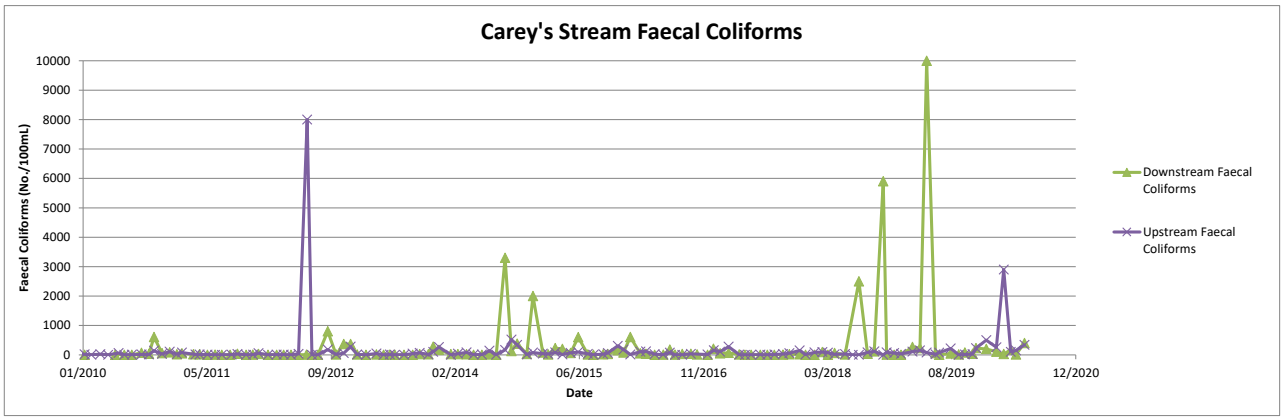

BH6 Dissolved Cadmium
Dissolved Cadmium (g/m3)
0.00025
0.0002
0.00015
0.0001
0.00005
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

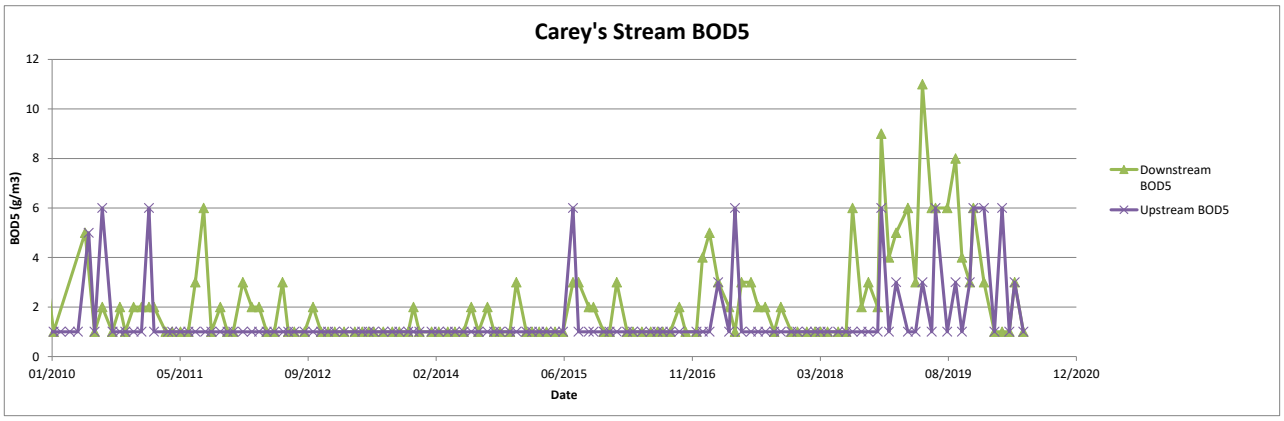

BH6 Dissolved Reactive Phosphorus
DRP (g/m3)
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date

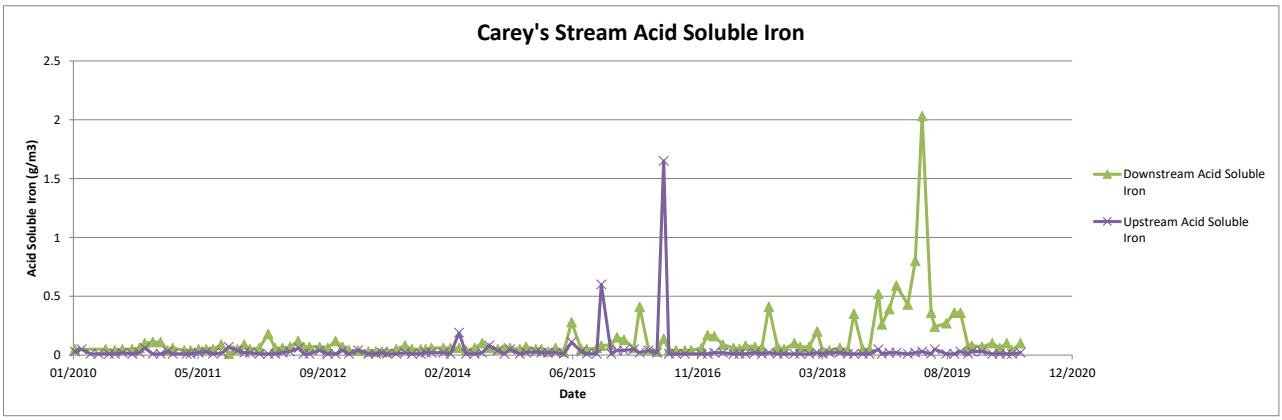

Carey's Stream pH
pH
9
8.5
8
7.5
7
6.5
6
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date
Downstream pH
Upstream pH

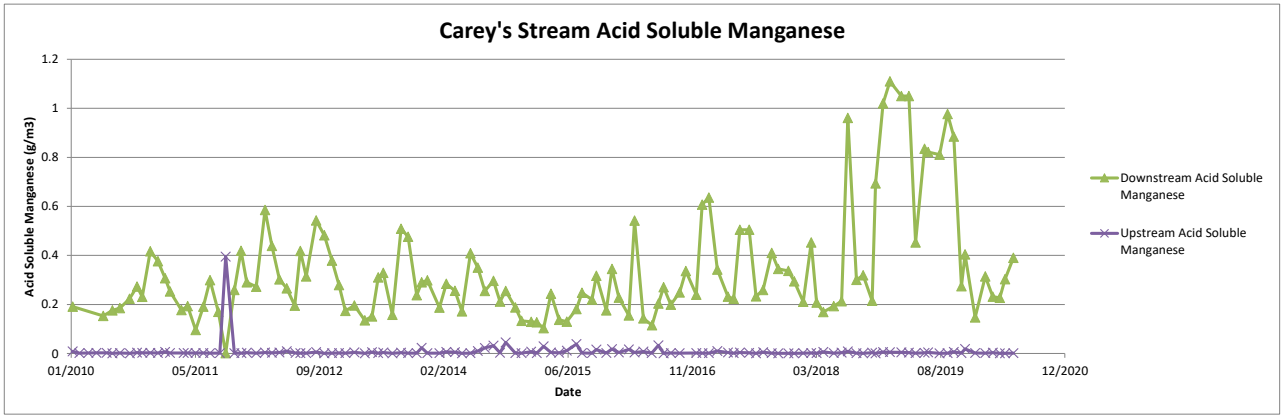

Carey's Stream Conductivity
Conductivity (µS/cm)
100
90
80
70
60
50
40
30
20
10
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date
Downstream Conductivity
Upstream Conductivity

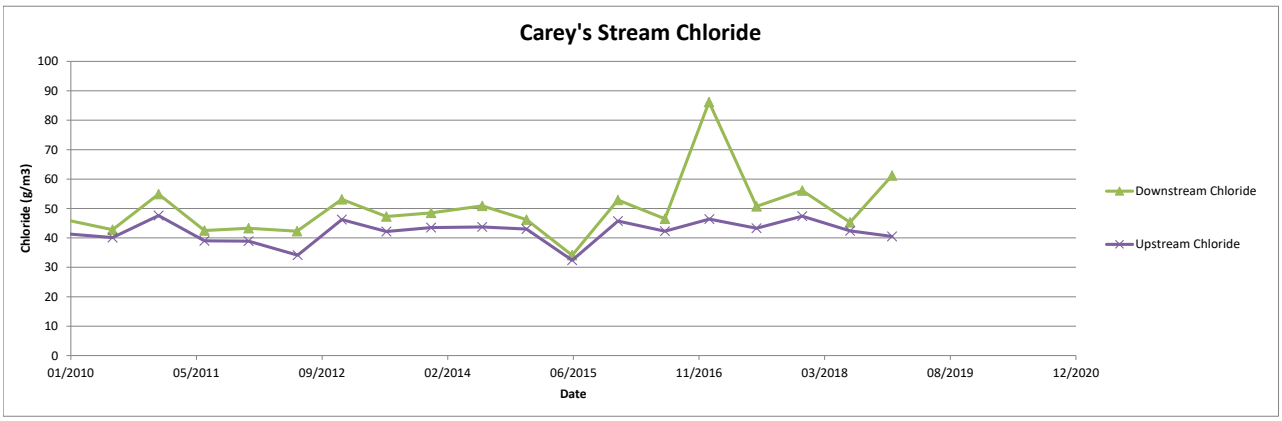

Carey's Stream Ammoniacal Nitrogen
Ammonical Nitrogen (g/m3)
1.4
1.2
1
0.8
0.6
0.4
0.2
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date
Downstream Ammoniacal Nitrogen
Upstream Ammoniacal Nitrogen

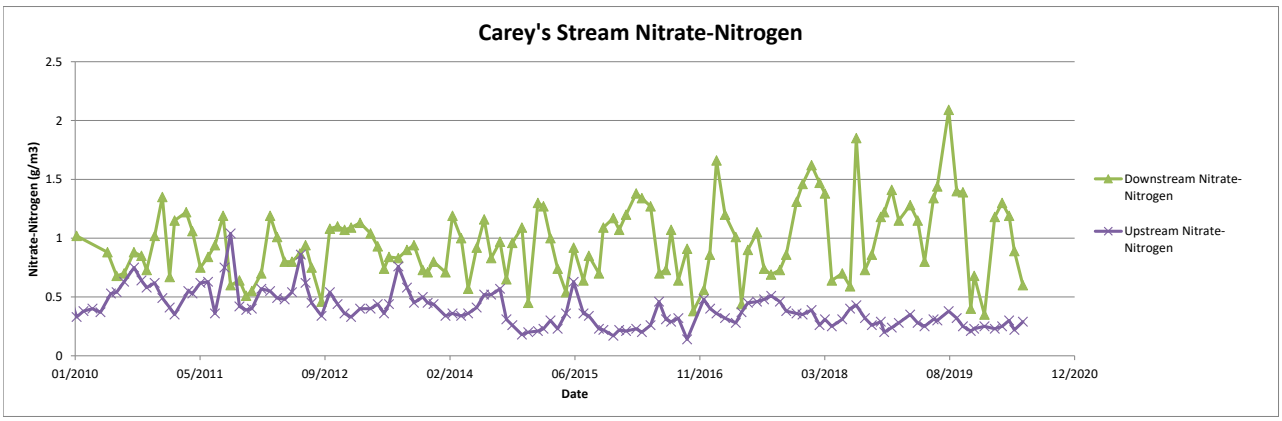

Carey's Stream Faecal Coliforms
Faecal Coliforms (No./100mL)
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date
Downstream Faecal Coliforms
Upstream Faecal Coliforms

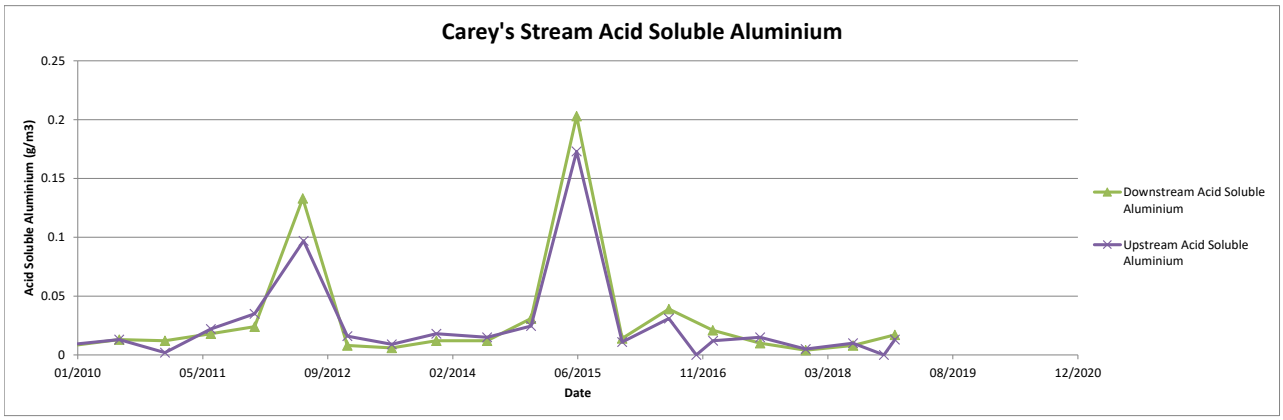

Carey's Stream BOD5
BOD5 (g/m3)
12
10
8
6
4
2
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date
Downstream BOD5
Upstream BOD5

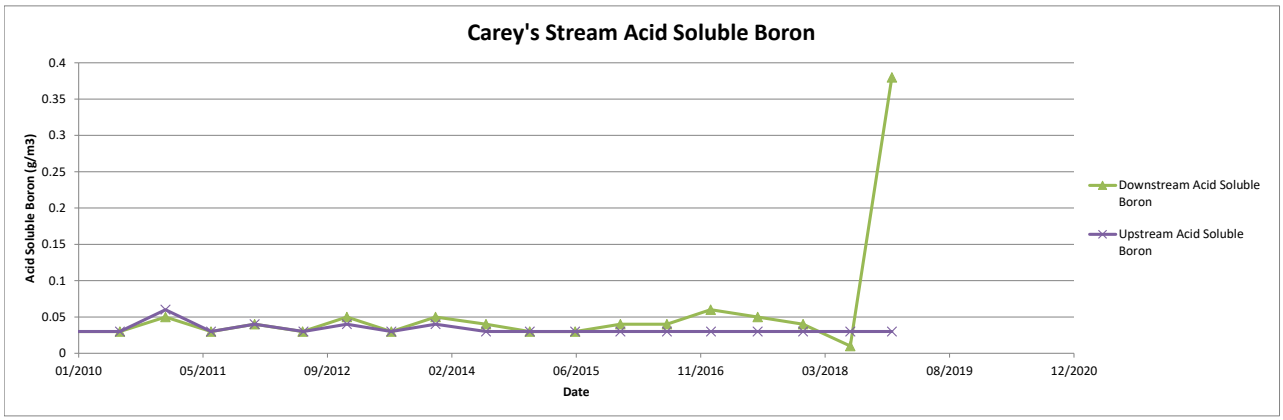

Carey's Stream Acid Soluble Iron
Acid Soluble Iron (g/m3)
2.5
2
1.5
1
0.5
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date
Downstream Acid Soluble Iron
Upstream Acid Soluble Iron

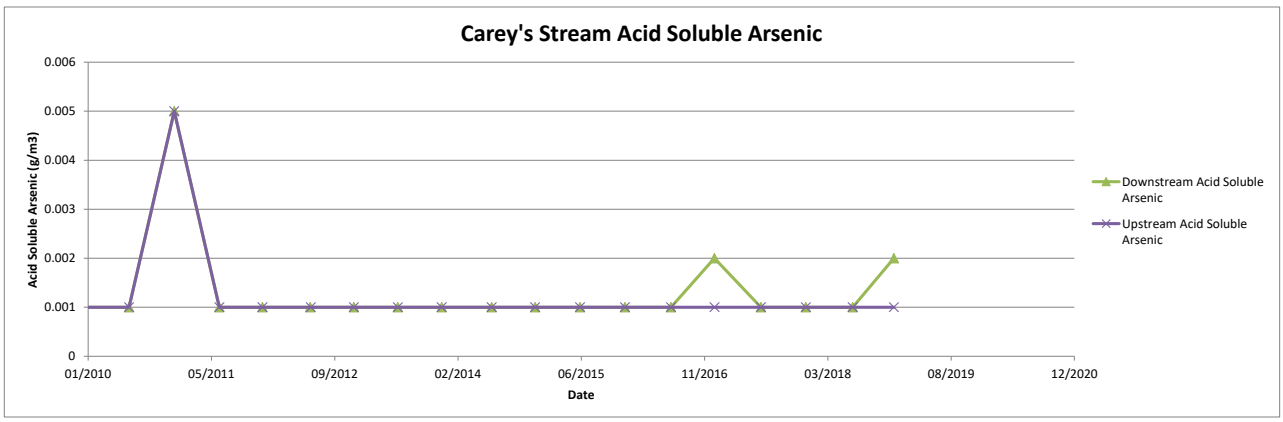

Carey's Stream Acid Soluble Manganese
Acid Soluble Manganese (g/m3)
1.2
1
0.8
0.6
0.4
0.2
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date
Downstream Acid Soluble Manganese
Upstream Acid Soluble Manganese

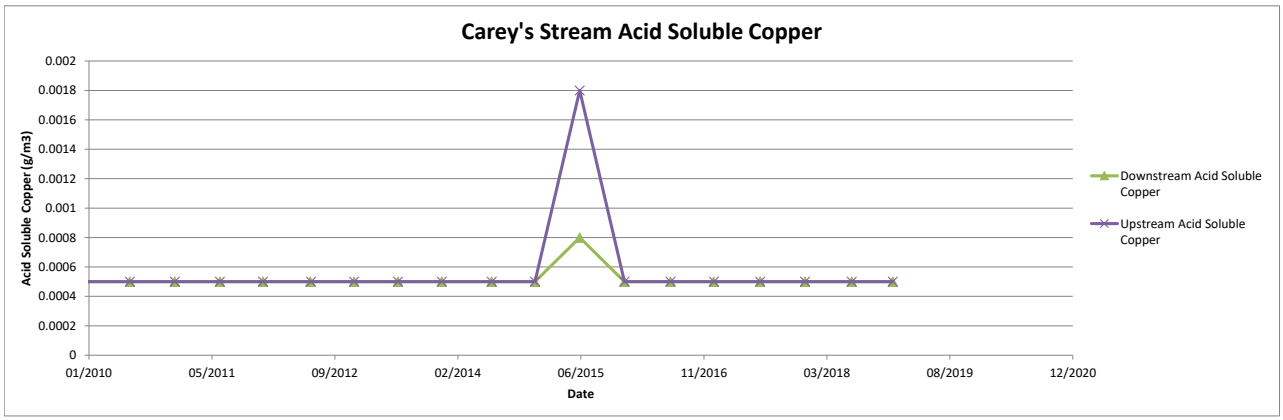

Carey's Stream Chloride
Chloride (g/m3)
100
90
80
70
60
50
40
30
20
10
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date
Downstream Chloride
Upstream Chloride

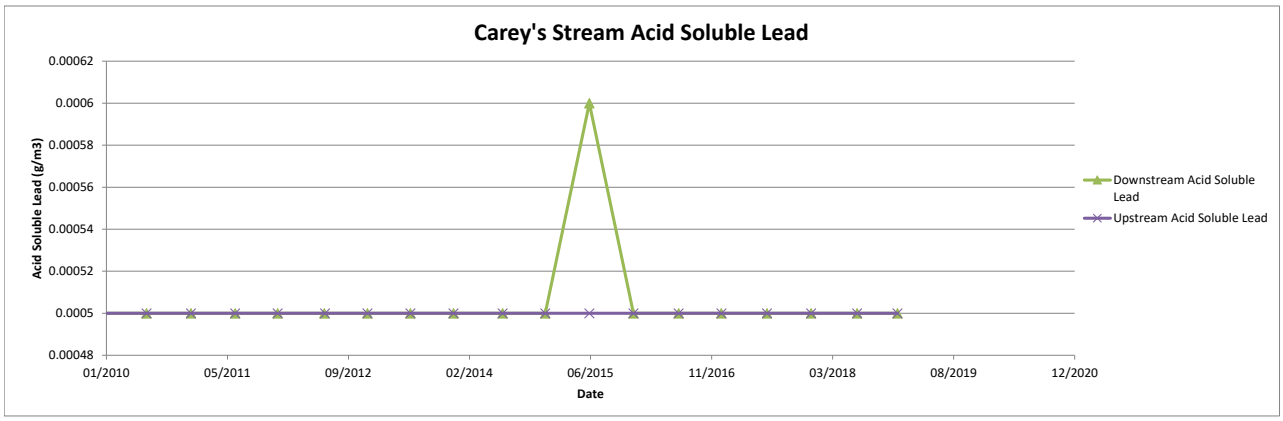

Carey's Stream Nitrate-Nitrogen
Nitrate-Nitrogen (g/m3)
2.5
2
1.5
1
0.5
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date
Downstream Nitrate-Nitrogen
Upstream Nitrate-Nitrogen

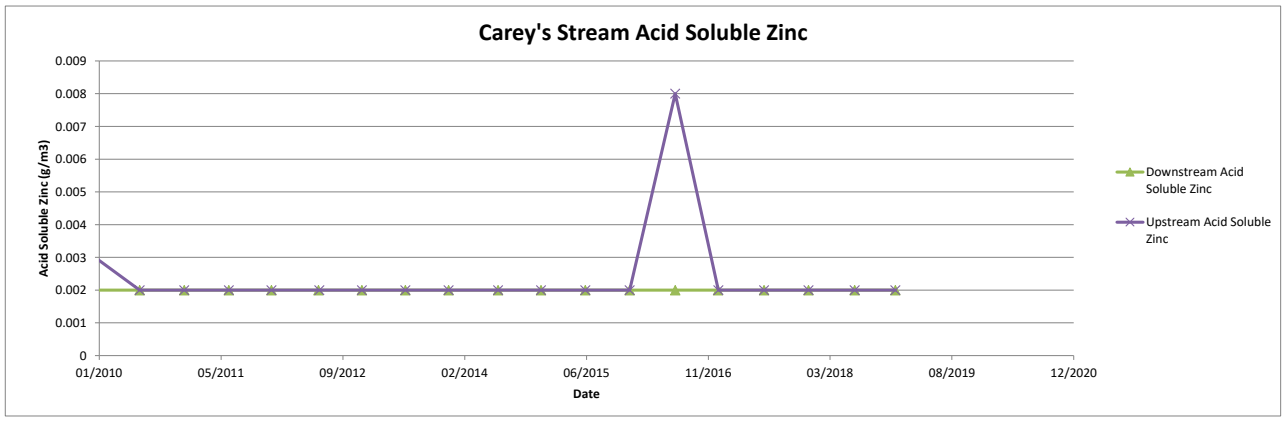

Carey's Stream Acid Soluble Aluminium
Acid Soluble Aluminium (g/m3)
0.25
0.2
0.15
0.1
0.05
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date
Downstream Acid Soluble Aluminium
Upstream Acid Soluble Aluminium

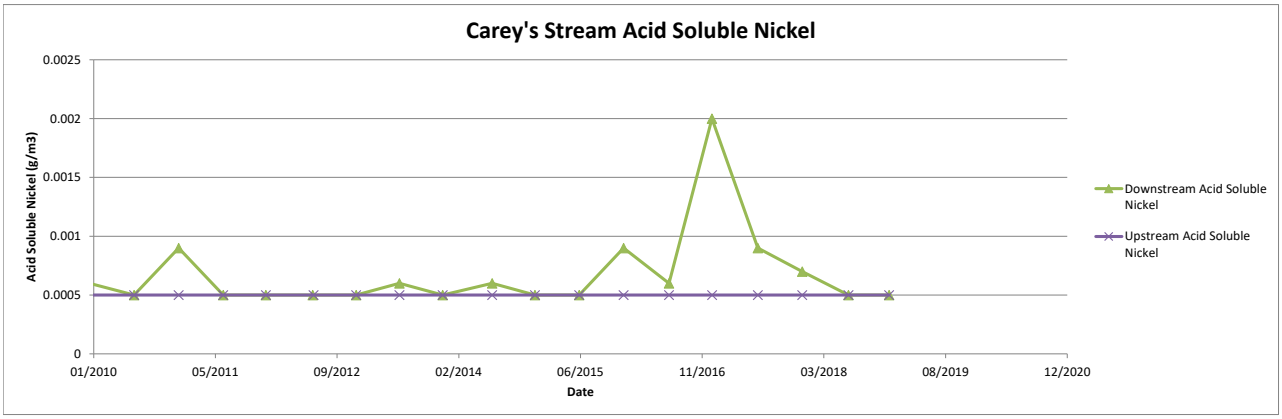

Carey's Stream Acid Soluble Boron
Acid Soluble Boron (g/m3)
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date
Downstream Acid Soluble Boron
Upstream Acid Soluble Boron

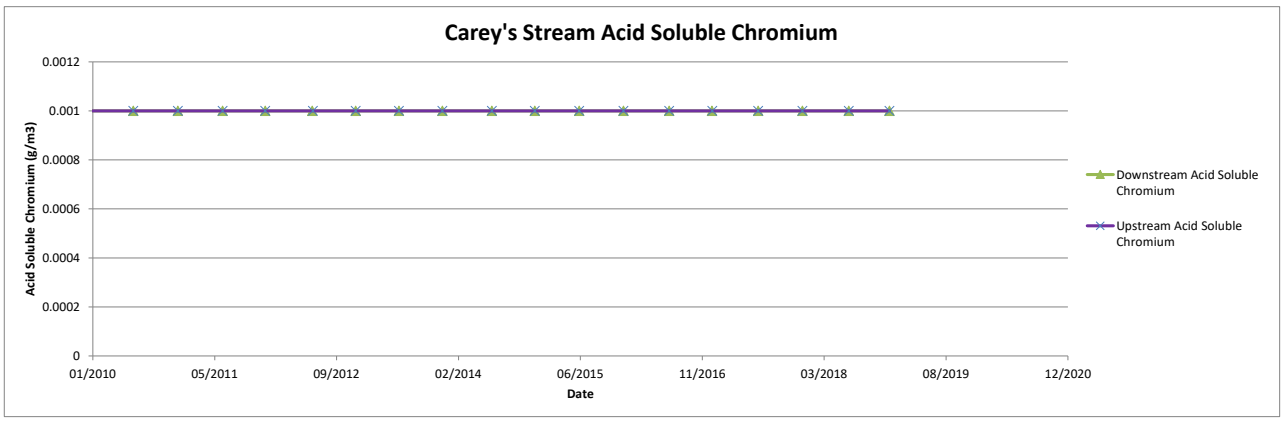

Carey's Stream Acid Soluble Arsenic
Acid Soluble Arsenic (g/m3)
0.006
0.005
0.004
0.003
0.002
0.001
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date
Downstream Acid Soluble Arsenic
Upstream Acid Soluble Arsenic

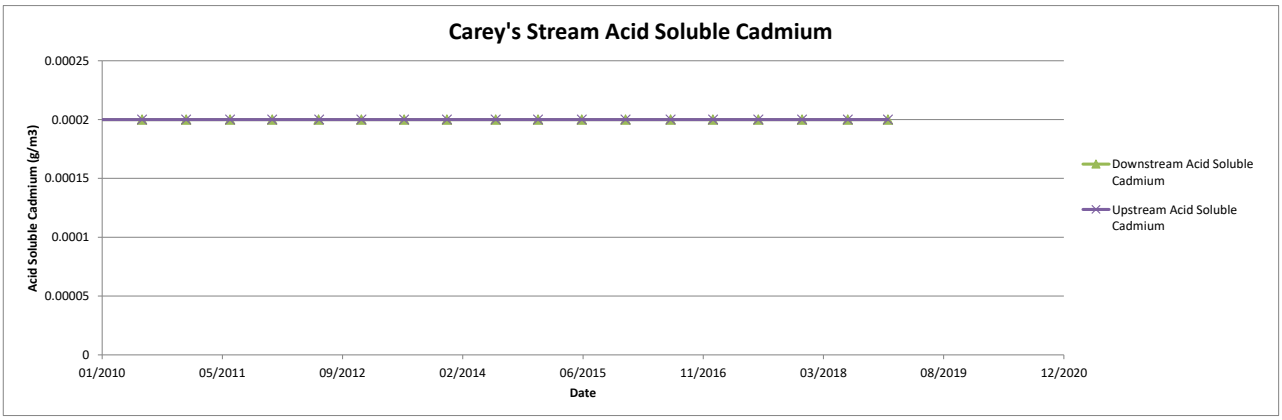

Carey's Stream Acid Soluble Copper
Acid Soluble Copper (g/m3)
0.002
0.0018
0.0016
0.0014
0.0012
0.001
0.0008
0.0006
0.0004
0.0002
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date
Downstream Acid Soluble Copper
Upstream Acid Soluble Copper

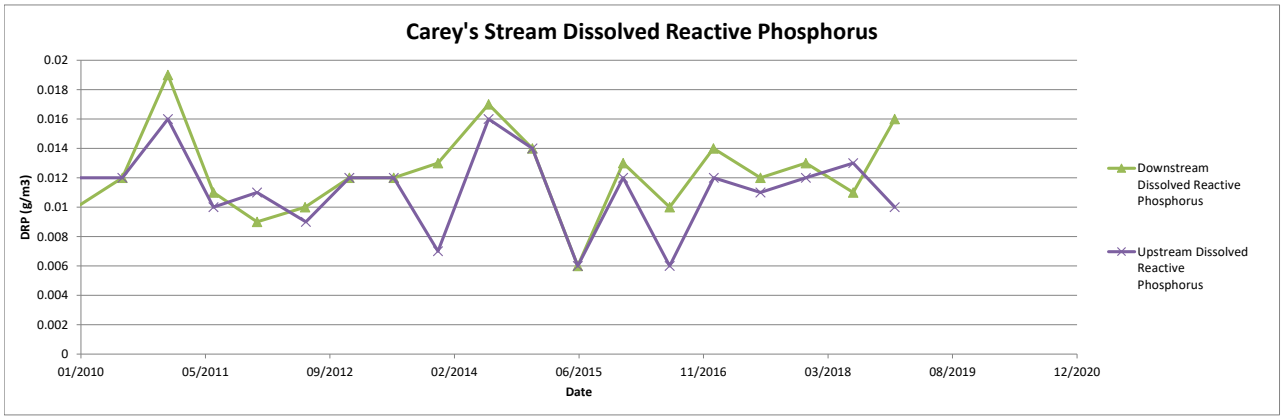

Carey's Stream Acid Soluble Lead
Acid Soluble Lead (g/m3)
0.00062
0.0006
0.00058
0.00056
0.00054
0.00052
0.0005
0.00048
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date
Downstream Acid Soluble Lead
Upstream Acid Soluble Lead

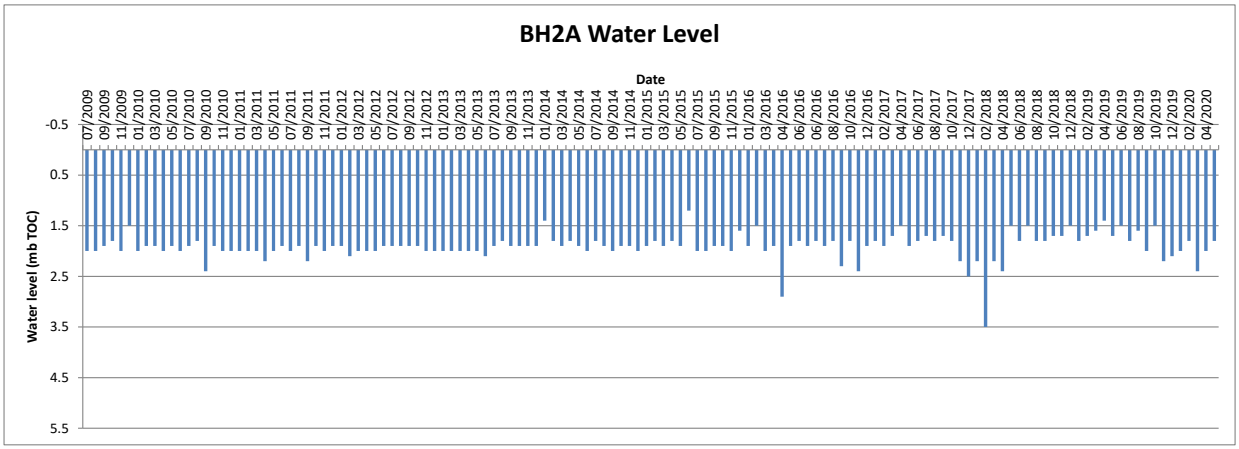

Carey's Stream Acid Soluble Zinc
Acid Soluble Zinc (g/m3)
0.009
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date
Downstream Acid Soluble Zinc
Upstream Acid Soluble Zinc

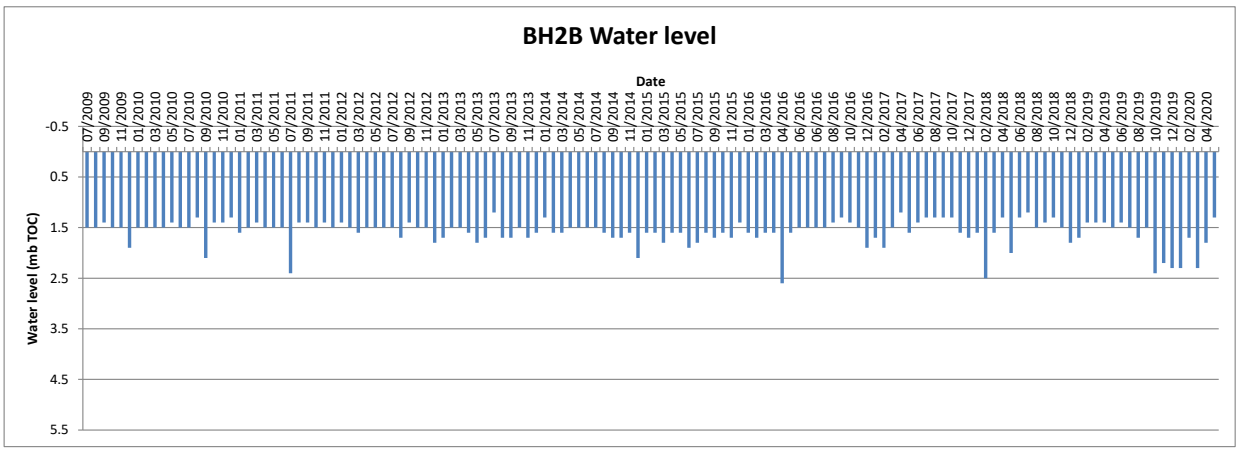

Carey's Stream Acid Soluble Nickel
Acid Soluble Nickel (g/m3)
0.0025
0.002
0.0015
0.001
0.0005
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date
Downstream Acid Soluble Nickel
Upstream Acid Soluble Nickel

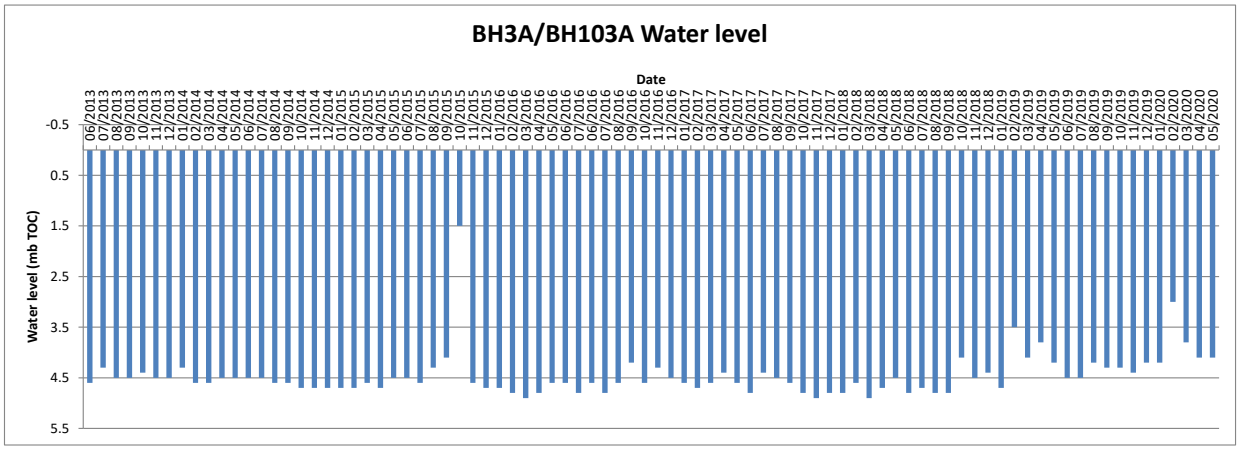

Carey's Stream Acid Soluble Chromium
Acid Soluble Chromium (g/m3)
0.0012
0.001
0.0008
0.0006
0.0004
0.0002
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date
Downstream Acid Soluble Chromium
Upstream Acid Soluble Chromium

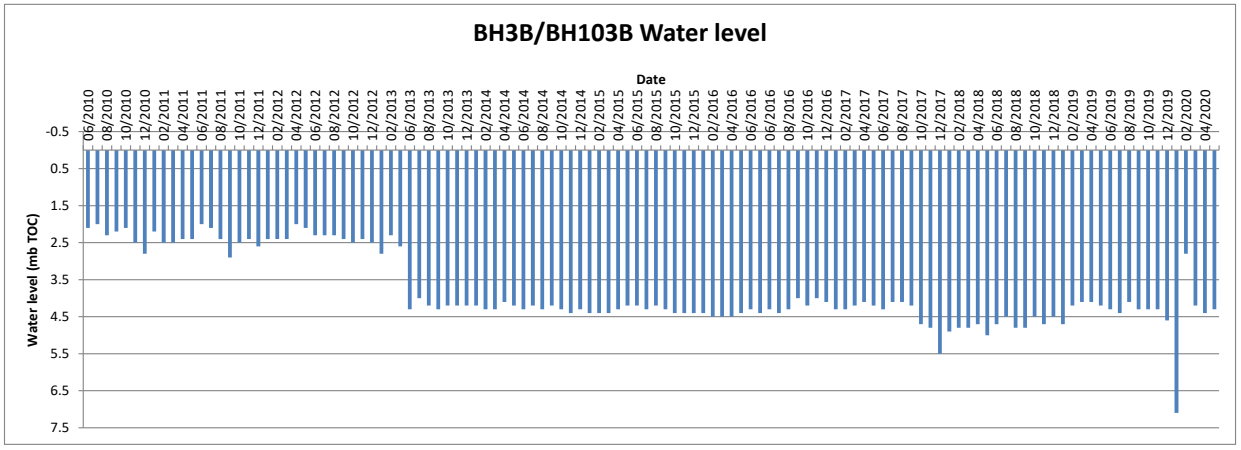

Carey's Stream Acid Soluble Cadmium
Acid Soluble Cadmium (g/m3)
0.00025
0.0002
0.00015
0.0001
0.00005
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date
Downstream Acid Soluble Cadmium
Upstream Acid Soluble Cadmium


Carey's Stream Dissolved Reactive Phosphorus
DRP (g/m3)
0.02
0.018
0.016
0.014
0.012
0.01
0.008
0.006
0.004
0.002
0
01/2010
05/2011
09/2012
02/2014
06/2015
11/2016
03/2018
08/2019
12/2020
Date
Downstream Dissolved Reactive Phosphorus
Upstream Dissolved Reactive Phosphorus


BH2A Water Level
Date
Water level (mb TOC)
-0.5
0.5
1.5
2.5
3.5
4.5
5.5


BH2B Water level
Date
Water level (mb TOC)
-0.5
0.5
1.5
2.5
3.5
4.5
5.5


BH3A/BH103A Water level
Date
Water level (mb TOC)
-0.5
0.5
1.5
2.5
3.5
4.5
5.5


BH3B/BH103B Water level
Date
Water level (mb TOC)
-0.5
0.5
1.5
2.5
3.5
4.5
5.5
6.5
7.5
06/2010
08/2010
10/2010
12/2010
02/2011
04/2011
06/2011
08/2011
10/2011
12/2011
02/2012
04/2012
06/2012
08/2012
10/2012
12/2012
02/2013
06/2013
08/2013
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12/2013
02/2014
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06/2014
08/2014
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12/2017
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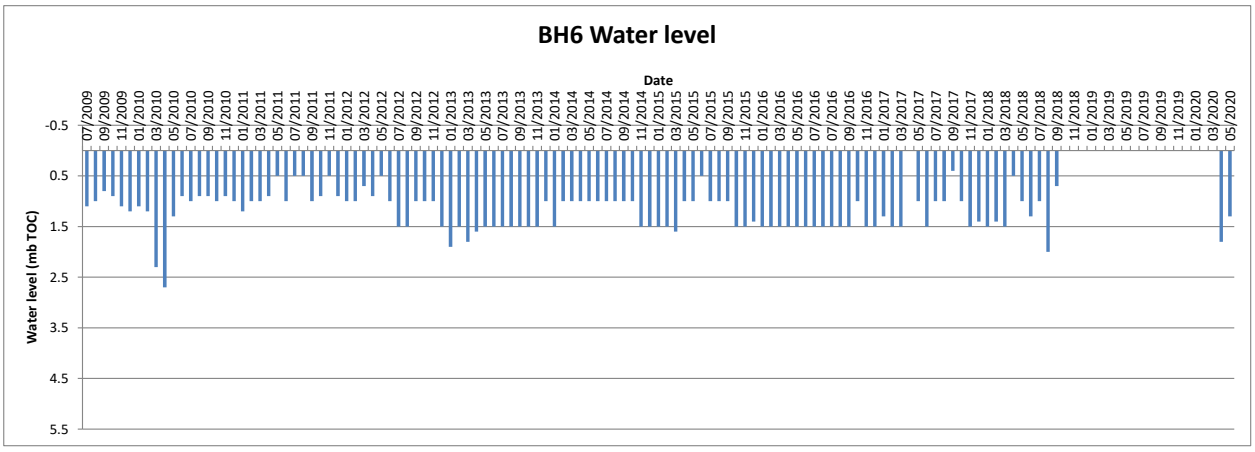
08/2018
10/2018
12/2018
02/2019
04/2019
06/2019
08/2019
10/2019
12/2019
02/2020
04/2020


BH6 Water level
Date
Water level (mb TOC)
-0.5
0.5
1.5
2.5
3.5
4.5
5.5
07/2009
09/2009
11/2009
01/2010
03/2010
05/2010
07/2010
09/2010
11/2010
01/2011
03/2011
05/2011
07/2011
09/2011
11/2011
01/2012
03/2012
05/2012
07/2012
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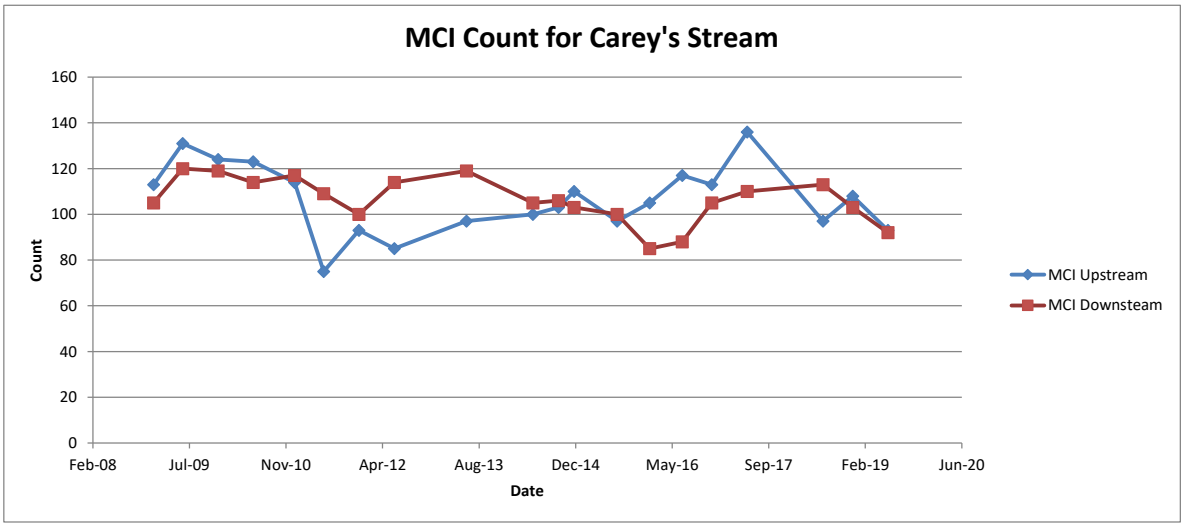
01/2018
03/2018
05/2018
07/2018
09/2018
11/2018
01/2019
03/2019
05/2019
07/2019
09/2019
11/2019
01/2020
03/2020
05/2020


MCI Count for Carey's Stream
160
140
120
100
80
60
40
20
0
Count
Feb-08
Jul-09
Nov-10
Apr-12
Aug-13
Dec-14
May-16
Sep-17
Feb-19
Jun-20
Date
MCI Upstream
MCI Downsteam

# Appendix D

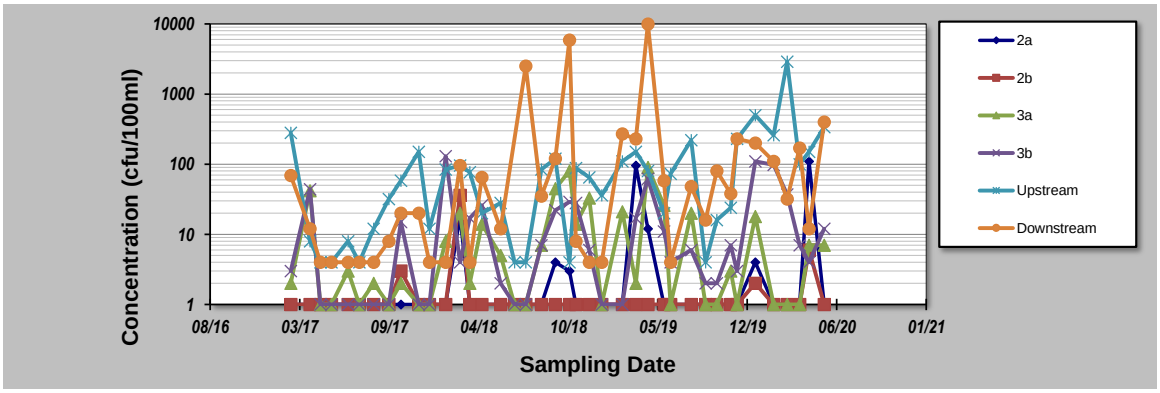
## Mann-Kendall Statistical Analysis

# Appendix D Mann-Kendall Statistical Analysis

# GSI MANN-KENDALL TOOLKIT
## for Constituent Trend Analysis

| | | | |
|---|---|---|---|
| Evaluation Date: | 2-Jun-20 | Job ID: | 60629483 |
| Facility Name: | Southern Landfill | Constituent: | Faecal Coliform |
| Conducted By: | AECOM New Zealand Limited | Concentration Units: | cfu/100ml |

| Sampling Point ID: | 2a | 2b | 3a | 3b | Upstream | Downstream | |
|---|---|---|---|---|---|---|---|
| Sampling Event | Sampling Date | FAECAL COLIFORM CONCENTRATION (cfu/100ml) | | | | | |
| 1 | 14-Feb-17 | 1 | 1 | 2 | 3 | 280 | 69 |
| 2 | 29-Mar-17 | 1 | 1 | 42 | 44 | 8 | 12 |
| 3 | 21-Apr-17 | 1 | 1 | 1 | 1 | 4 | 4 |
| 4 | 16-May-17 | 1 | 1 | 1 | 1 | 4 | 4 |
| 5 | 22-Jun-17 | 1 | 1 | 3 | 1 | 8 | 4 |
| 6 | 17-Jul-17 | 1 | 1 | 1 | 1 | 4 | 4 |
| 7 | 18-Aug-17 | 1 | 1 | 2 | 1 | 12 | 4 |
| 8 | 21-Sep-17 | 1 | 1 | 1 | 1 | 32 | 8 |
| 9 | 18-Oct-17 | 1 | 3 | 2 | 15 | 58 | 20 |
| 10 | 27-Nov-17 | 1 | 1 | 1 | 1 | 150 | 20 |
| 11 | 21-Dec-17 | 1 | 1 | 1 | 1 | 12 | 4 |
| 12 | 26-Jan-18 | 1 | 1 | 8 | 130 | 84 | 4 |
| 13 | 27-Feb-18 | 18 | 36 | 20 | 4 | 96 | 96 |
| 14 | 21-Mar-18 | 1 | 1 | 2 | 17 | 77 | 4 |
| 15 | 17-Apr-18 | 1 | 1 | 14 | 26 | 20 | 65 |
| 16 | 29-May-18 | 1 | 1 | 5 | 2 | 28 | 12 |
| 17 | 29-Jun-18 | 1 | 1 | 1 | 1 | 4 | |
| 18 | 24-Jul-18 | 1 | 1 | 1 | 1 | 4 | 2500 |
| 19 | 28-Aug-18 | 1 | 1 | 7 | 7 | 84 | 35 |
| 20 | 28-Sep-18 | 4 | 1 | 45 | 22 | 120 | 120 |
| 21 | 30-Oct-18 | 3 | 1 | 80 | 29 | 4 | 5900 |
| 22 | 13-Nov-18 | 1 | 1 | 14 | 28 | 88 | 8 |
| 23 | 13-Dec-18 | 1 | 1 | 33 | 6 | 65 | 4 |
| 24 | 10-Jan-19 | 1 | 1 | 1 | 1 | 36 | 4 |
| 25 | 25-Feb-19 | 1 | 1 | 21 | 1 | 110 | 270 |
| 26 | 27-Mar-19 | 96 | 1 | 2 | 17 | 150 | 230 |
| 27 | 23-Apr-19 | 12 | 1 | 90 | 62 | 80 | 10000 |
| 28 | 29-May-19 | 1 | 1 | 26 | 11 | 20 | 58 |
| 29 | 13-Jun-19 | 1 | 1 | 1 | 4 | 73 | 4 |
| 30 | 29-Jul-19 | 1 | 1 | 20 | 6 | 220 | 48 |
| 31 | 30-Aug-19 | 1 | 1 | 1 | 2 | 4 | 16 |
| 32 | 24-Sep-19 | 1 | 1 | 1 | 2 | 16 | 80 |
| 33 | 25-Oct-19 | 1 | 1 | 3 | 7 | 24 | 38 |
| 34 | 8-Nov-19 | 1 | 1 | 1 | 3 | 230 | 230 |
| 35 | 19-Dec-19 | 4 | 2 | 18 | 110 | 500 | 200 |
| 36 | 29-Jan-20 | 1 | 1 | 1 | 98 | 260 | 110 |
| 37 | 28-Feb-20 | 1 | 1 | 1 | 37 | 2900 | 32 |
| 38 | 27-Mar-20 | 1 | 1 | 1 | 7 | 100 | 170 |
| 39 | 17-Apr-20 | 110 | 6 | 7 | 4 | 150 | 12 |
| 40 | 21-May-20 | 1 | 1 | 7 | 12 | 340 | 400 |
| Coefficient of Variation: | | 3.23 | 2.68 | 1.67 | 1.69 | 2.83 | 3.47 |
| Mann-Kendall Statistic (S): | | 79 | 28 | 30 | 192 | 290 | 238 |
| Confidence Factor: | | 81.7% | 62.3% | 63.1% | 98.7% | >99.9% | 99.8% |
| Concentration Trend: | | No Trend | No Trend | No Trend | Increasing | Increasing | Increasing |



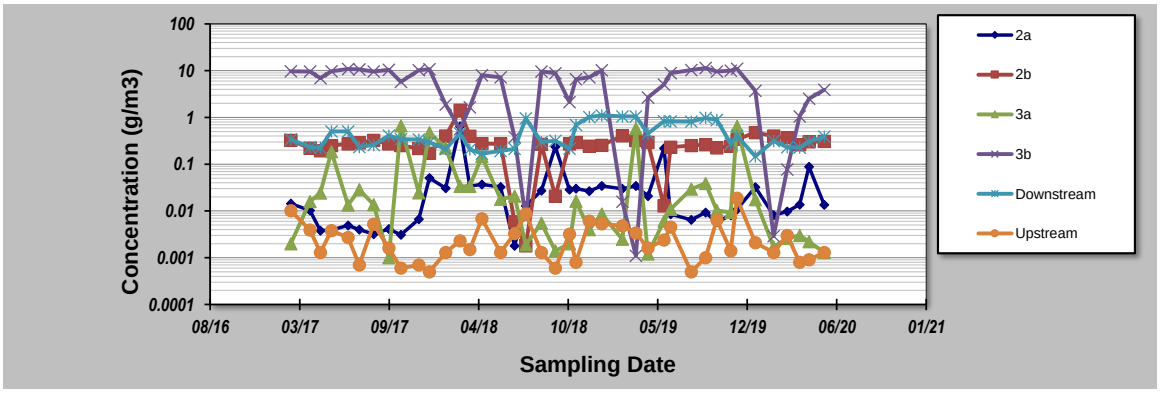

**Notes:**

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water* , 41(3):355-367, 2003.

# GSI MANN-KENDALL TOOLKIT
## for Constituent Trend Analysis

| | | | |
|---|---|---|---|
| Evaluation Date: | 2-Jun-20 | Job ID: | 60629483 |
| Facility Name: | Southern Landfill | Constituent: | Manganese |
| Conducted By: | AECOM New Zealand Limited | Concentration Units: | g/m3 |

| Sampling Point ID: | 2a | 2b | 3a | 3b | Downstream | Upstream | |
|---|---|---|---|---|---|---|---|
| Sampling Event | Sampling Date | MANGANESE CONCENTRATION (g/m3) | | | | | |
| 1 | 14-Feb-17 | 0.0144 | 0.324 | 0.002 | 9.77 | 0.342 | 0.0102 |
| 2 | 29-Mar-17 | 0.0103 | 0.219 | 0.0159 | 9.66 | 0.232 | 0.0039 |
| 3 | 21-Apr-17 | 0.0038 | 0.195 | 0.0242 | 6.91 | 0.223 | 0.0013 |
| 4 | 16-May-17 | 0.0039 | 0.252 | 0.187 | 9.75 | 0.505 | 0.0038 |
| 5 | 22-Jun-17 | 0.0049 | 0.273 | 0.0134 | 10.9 | 0.505 | 0.0027 |
| 6 | 17-Jul-17 | 0.004 | 0.287 | 0.0287 | 10.7 | 0.233 | 0.0007 |
| 7 | 18-Aug-17 | 0.0032 | 0.323 | 0.0136 | 9.66 | 0.259 | 0.0052 |
| 8 | 21-Sep-17 | 0.0041 | 0.271 | 0.001 | 10.4 | 0.41 | 0.0016 |
| 9 | 18-Oct-17 | 0.0031 | 0.252 | 0.662 | 5.76 | 0.345 | 0.0006 |
| 10 | 27-Nov-17 | 0.0067 | 0.217 | 0.0246 | 10.2 | 0.337 | 0.0007 |
| 11 | 21-Dec-17 | 0.0508 | 0.171 | 0.473 | 10.8 | 0.294 | 0.0005 |
| 12 | 26-Jan-18 | 0.0308 | 0.403 | 0.224 | 1.89 | 0.211 | 0.0013 |
| 13 | 27-Feb-18 | 0.645 | 1.43 | 0.0337 | 0.564 | 0.453 | 0.0023 |
| 14 | 21-Mar-18 | 0.034 | 0.398 | 0.0338 | 1.65 | 0.208 | 0.0015 |
| 15 | 17-Apr-18 | 0.0371 | 0.275 | 0.147 | 8 | 0.169 | 0.0068 |
| 16 | 29-May-18 | 0.0328 | 0.273 | 0.0179 | 7.19 | 0.193 | 0.0013 |
| 17 | 29-Jun-18 | 0.0018 | 0.0059 | 0.0207 | 0.38 | 0.213 | 0.0033 |
| 18 | 24-Jul-18 | 0.0128 | 0.0018 | 0.0019 | 0.0068 | 0.961 | 0.0086 |
| 19 | 28-Aug-18 | 0.0271 | 0.266 | 0.0055 | 9.63 | 0.3 | 0.0013 |
| 20 | 28-Sep-18 | 0.235 | 0.0208 | 0.0014 | 8.87 | 0.319 | 0.0006 |
| 21 | 30-Oct-18 | 0.0287 | 0.272 | 0.002 | 2.13 | 0.215 | 0.0032 |
| 22 | 13-Nov-18 | 0.03 | 0.293 | 0.0163 | 6.61 | 0.694 | 0.0008 |
| 23 | 13-Dec-18 | 0.0267 | 0.244 | 0.004 | 7.25 | 1.02 | 0.0061 |
| 24 | 10-Jan-19 | 0.0342 | 0.253 | 0.0086 | 10.2 | 1.11 | 0.0053 |
| 25 | 25-Feb-19 | 0.0299 | 0.404 | 0.0025 | 0.0158 | 1.05 | 0.0048 |
| 26 | 27-Mar-19 | 0.0345 | 0.322 | 0.579 | 0.0011 | 1.05 | 0.0034 |
| 27 | 23-Apr-19 | 0.0207 | 0.293 | 0.0012 | 2.68 | 0.453 | 0.0016 |
| 28 | 29-May-19 | 0.219 | 0.0129 | 0.0061 | 5.04 | 0.835 | 0.0024 |
| 29 | 13-Jun-19 | 0.0085 | 0.231 | 0.0109 | 8.86 | 0.822 | 0.0045 |
| 30 | 29-Jul-19 | 0.0065 | 0.251 | 0.0294 | 10.3 | 0.811 | 0.0005 |
| 31 | 30-Aug-19 | 0.0093 | 0.26 | 0.0388 | 11.4 | 0.977 | 0.001 |
| 32 | 24-Sep-19 | 0.0058 | 0.224 | 0.0103 | 9.58 | 0.885 | 0.0065 |
| 33 | 25-Oct-19 | 0.0081 | 0.243 | 0.0094 | 10 | 0.274 | 0.0014 |
| 34 | 8-Nov-19 | 0.0108 | 0.341 | 0.643 | 11 | 0.404 | 0.0187 |
| 35 | 19-Dec-19 | 0.0322 | 0.473 | 0.0174 | 3.7 | 0.147 | 0.0021 |
| 36 | 29-Jan-20 | 0.0081 | 0.403 | 0.0017 | 0.0029 | 0.314 | 0.0013 |
| 37 | 28-Feb-20 | 0.0097 | 0.37 | 0.0026 | 0.077 | 0.232 | 0.003 |
| 38 | 27-Mar-20 | 0.0137 | 0.262 | 0.003 | 1.05 | 0.227 | 0.0008 |
| 39 | 17-Apr-20 | 0.0884 | 0.302 | 0.0022 | 2.52 | 0.303 | 0.0009 |
| 40 | 21-May-20 | 0.0135 | 0.309 | 0.0013 | 3.89 | 0.39 | 0.0013 |
| Coefficient of Variation: | | 2.41 | 0.73 | 2.16 | 0.66 | 0.64 | 1.08 |
| Mann-Kendall Statistic (S): | | 99 | 84 | -163 | -160 | 78 | -38 |
| Confidence Factor: | | 87.3% | 83.2% | 97.1% | 96.8% | 81.4% | 66.6% |
| Concentration Trend: | | No Trend | No Trend | Decreasing | Decreasing | No Trend | No Trend |




**Notes:**

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water* , 41(3):355-367, 2003.