

# Three Kings Quarry

## 28<sup>th</sup> May 2018 – Site Liaison Group Meeting

### Site Monitoring Report



# May 2018 Site Monitoring Report

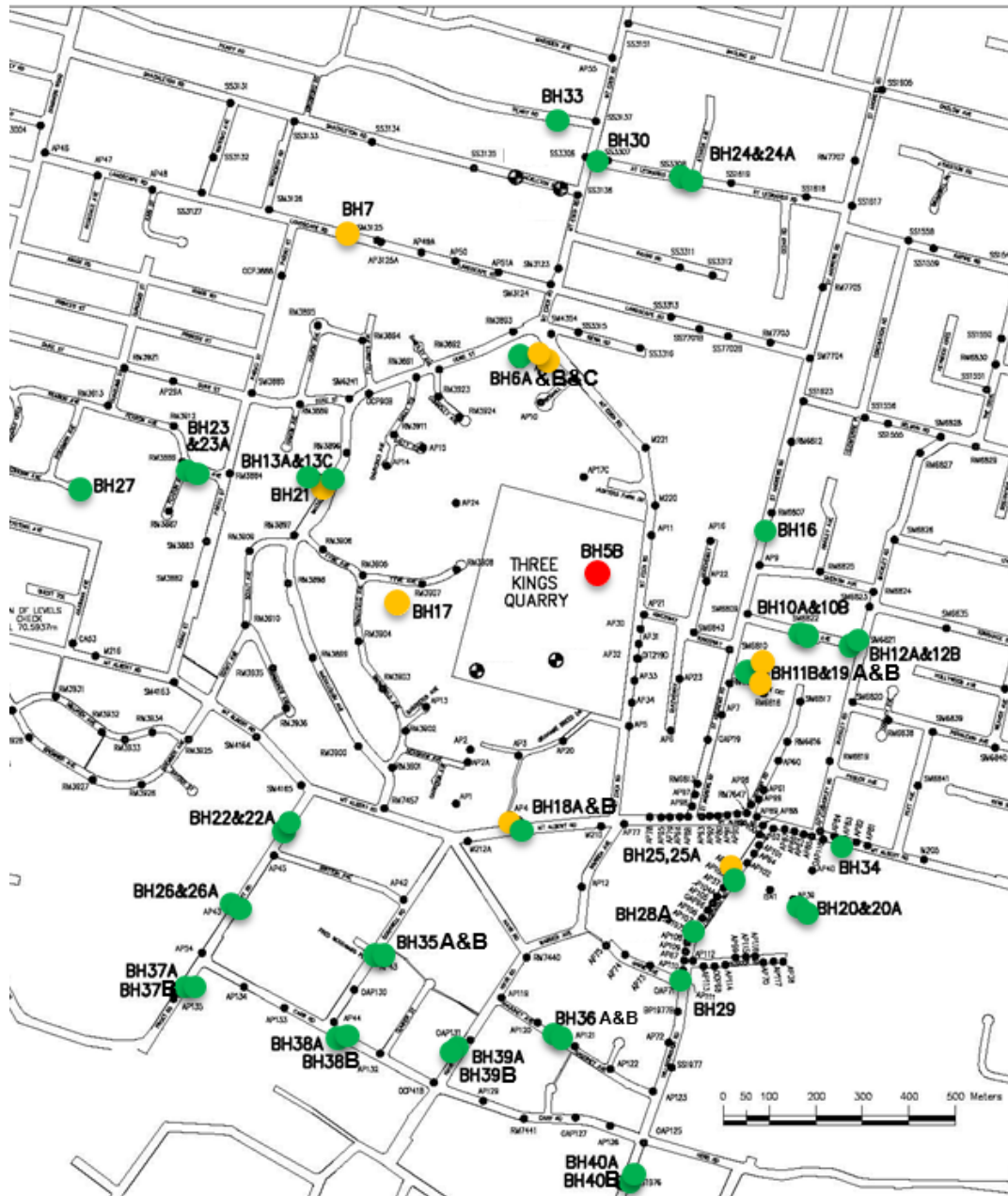
This Site Monitoring Report is a summary of environmental monitoring data collected since the last Site Liaison Group meeting and includes:

- Groundwater Level Monitoring Results
- Groundwater Chemistry Monitoring Results
  - Air Quality Monitoring Results
  - Precise Level Survey

## Groundwater Level Monitoring

- Dewatering of Three Kings Quarry commenced in March 1999
- Groundwater levels within Three Kings Quarry have been held above RL34m since October 2002
- Groundwater levels are currently being measured monthly in 51 boreholes and piezometers located in and around Three Kings Quarry
- Groundwater levels are generally following seasonal trends

# Borehole Location Plan with April 2018 Groundwater Levels Included



## LEGEND

- 34 – 36 RL m
- 36 – 45 RL m
- >45 RL m

# Groundwater Chemistry Monitoring

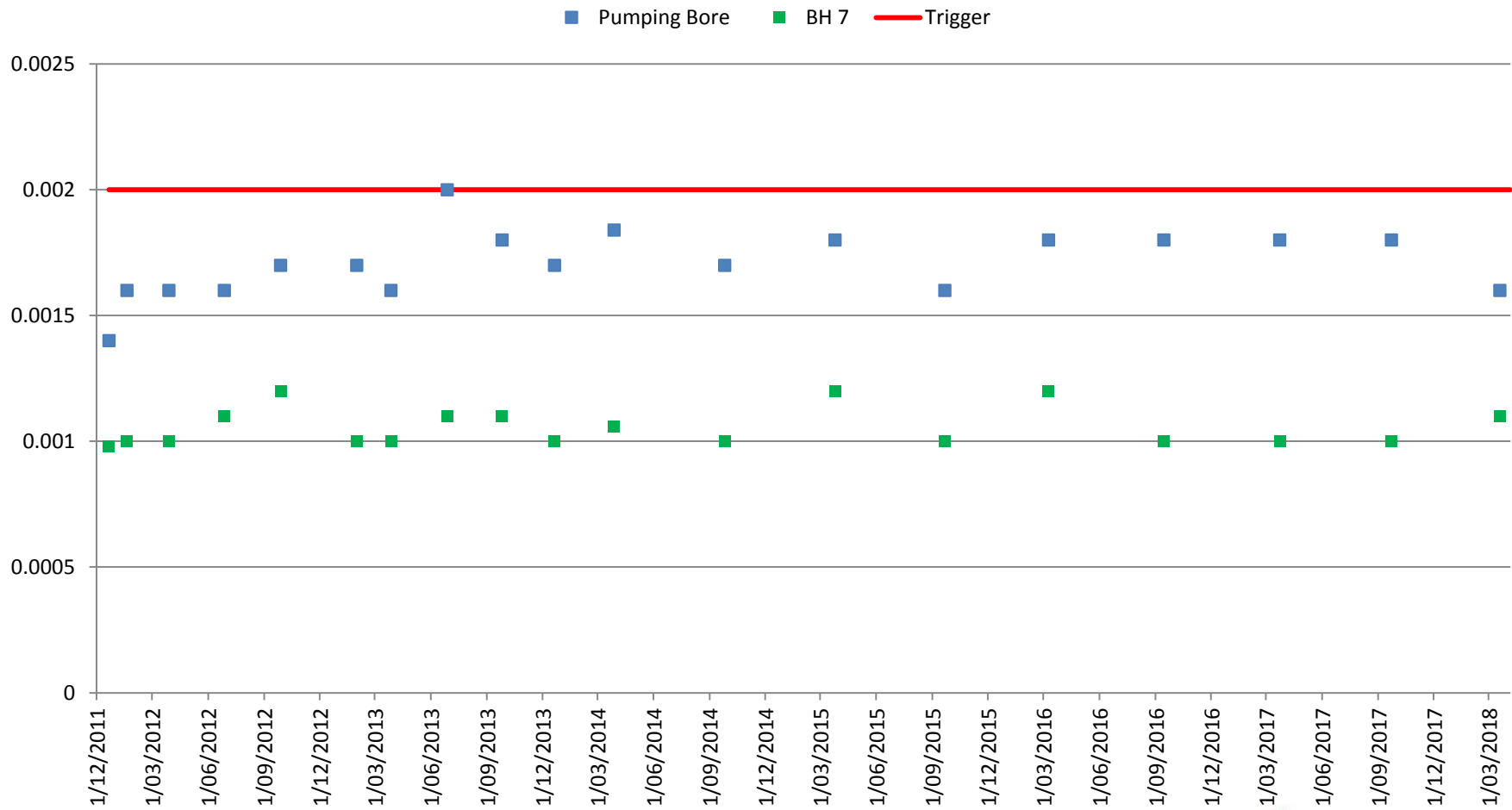
- Monitoring of Groundwater Chemistry commenced in December 2011 following the granting of Resource Consents to fill Three Kings Quarry.
- Samples were taken at 3 monthly intervals from the Pumping Bore within Three Kings Quarry and from BH 7 on Landscape Road for analysis of a suite of chemical parameters for the first 2 years of monitoring.
- Following 2 years of monitoring, samples for chemical analysis are required to be taken at 6 monthly intervals from the Pumping Bore within Three Kings Quarry and from BH 7 on Landscape Road (March and September).
- Results from the March 2018 monitoring round have been received since the last SLG meeting. All parameters were less than the trigger limits with the exception of Zinc in BH7. BH7 currently has no direct groundwater link to Three Kings Quarry. Auckland Council and Watercare were notified of the trigger exceedance.

# Groundwater Chemistry Results

The following figure show all the results for Arsenic since the commencement of sampling.

All results are in g/m<sup>3</sup> unless otherwise stated.

## Arsenic

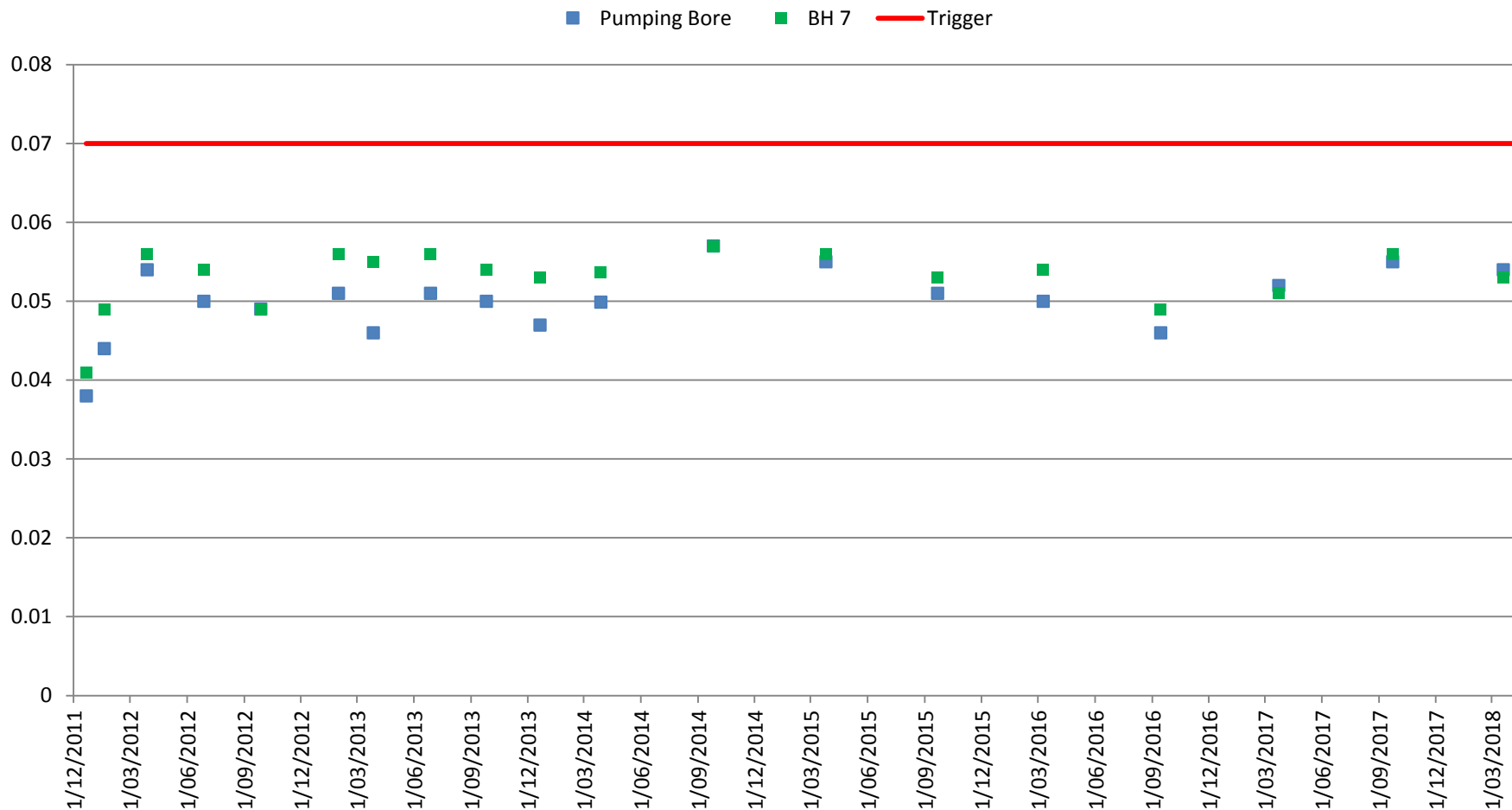


# Groundwater Chemistry Results

The following figure show all the results for the Boron since the commencement of sampling.

All results are in g/m<sup>3</sup> unless otherwise stated.

## Boron

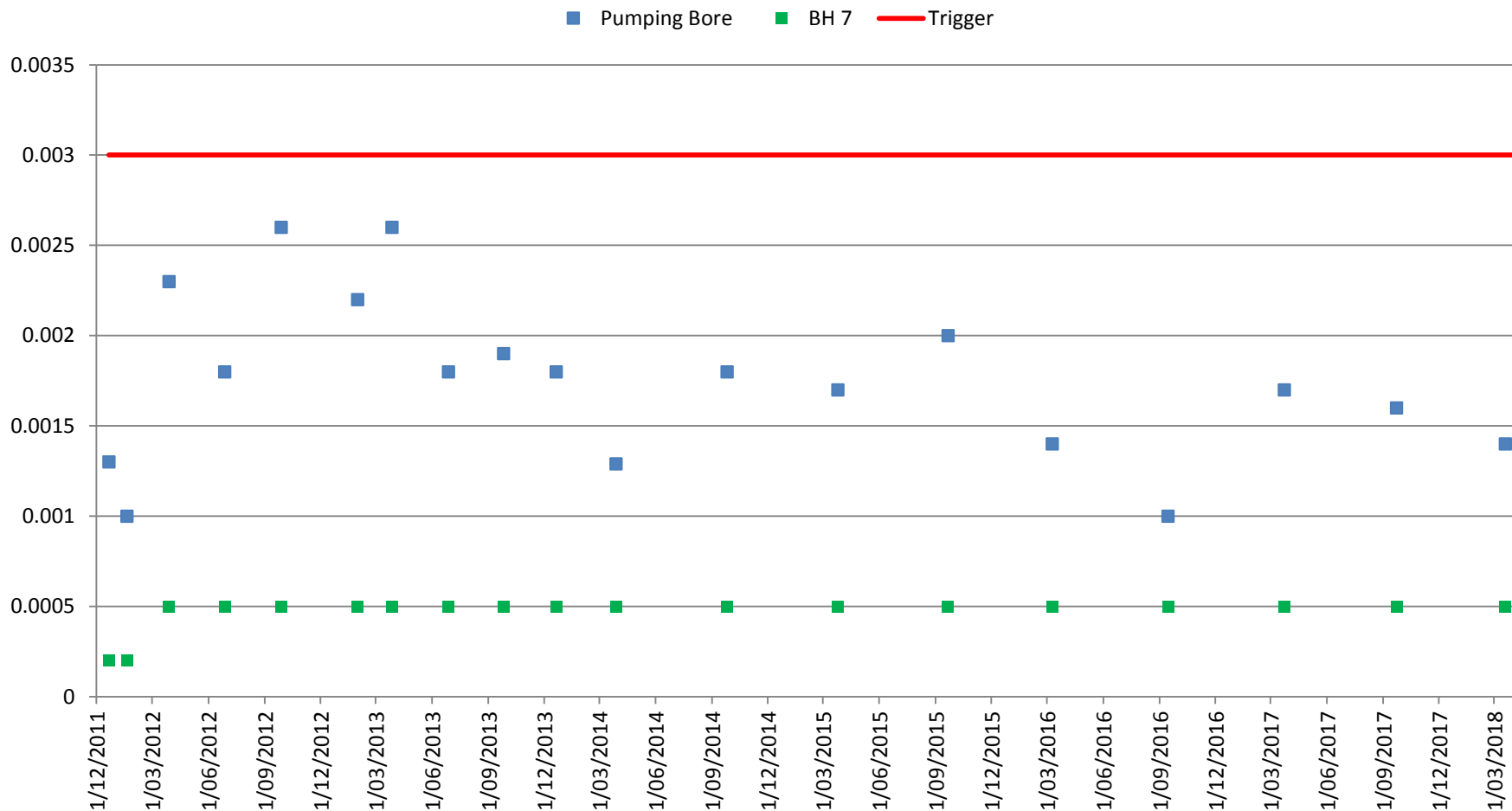


# Groundwater Chemistry Results

The following figure show all the results for the Copper since the commencement of sampling.

All results are in g/m<sup>3</sup> unless otherwise stated.

## Copper



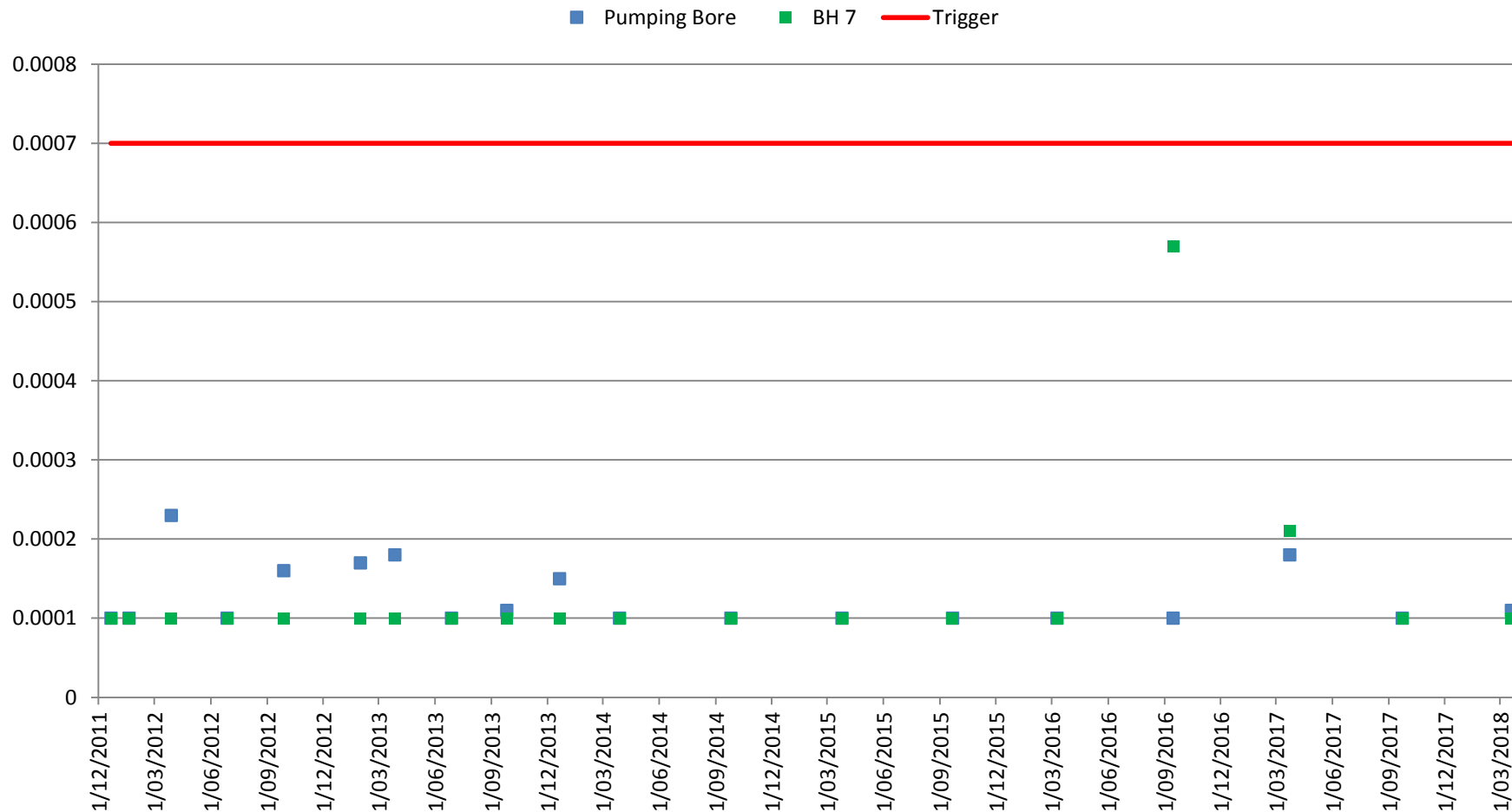


# Groundwater Chemistry Results

The following figure show all the results for the Lead since the commencement of sampling.

All results are in g/m<sup>3</sup> unless otherwise stated.

## Lead

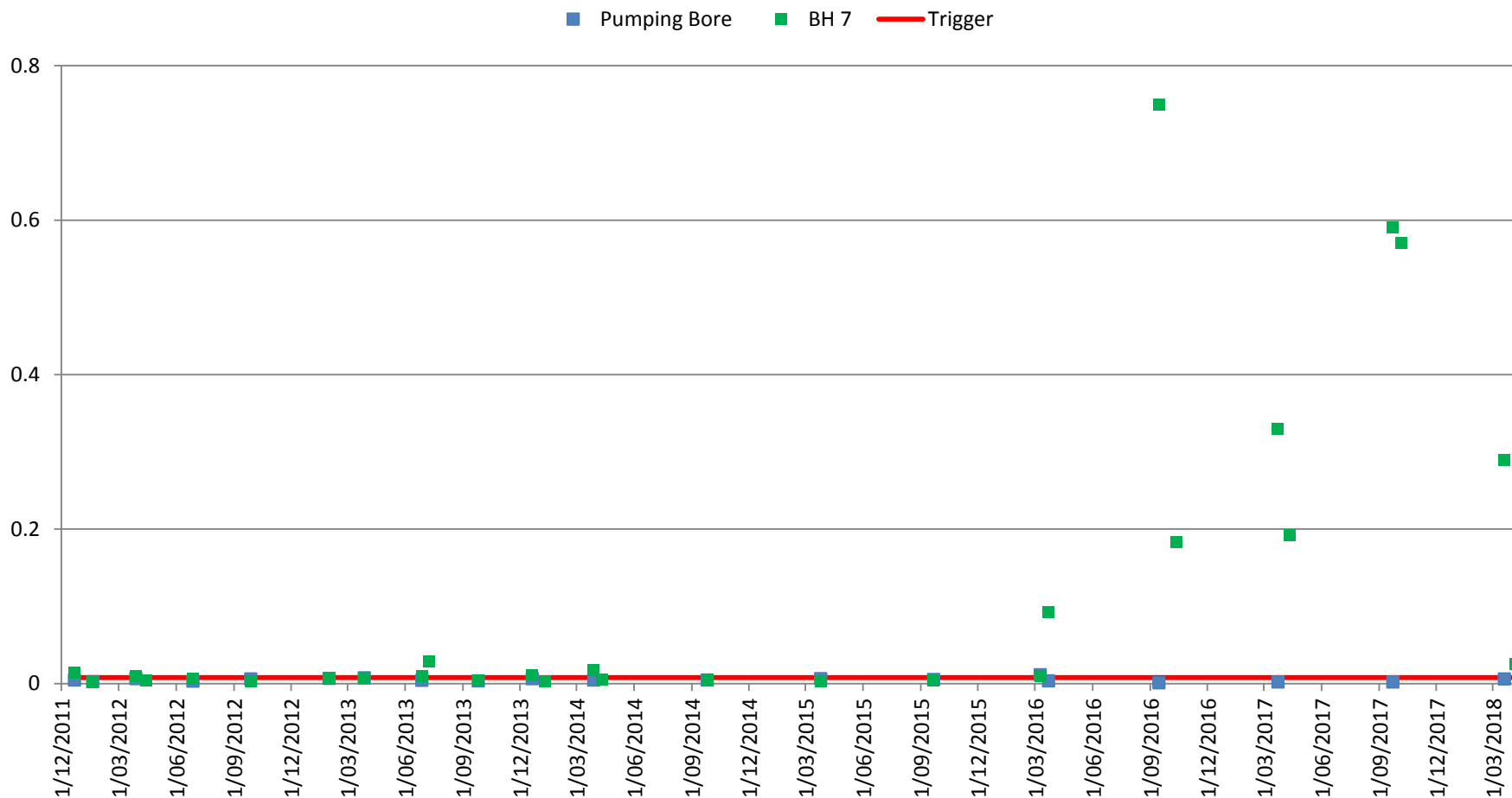


# Groundwater Chemistry Results

The following figure show all the results for the Zinc since the commencement of sampling.

All results are in g/m<sup>3</sup> unless otherwise stated.

## Zinc

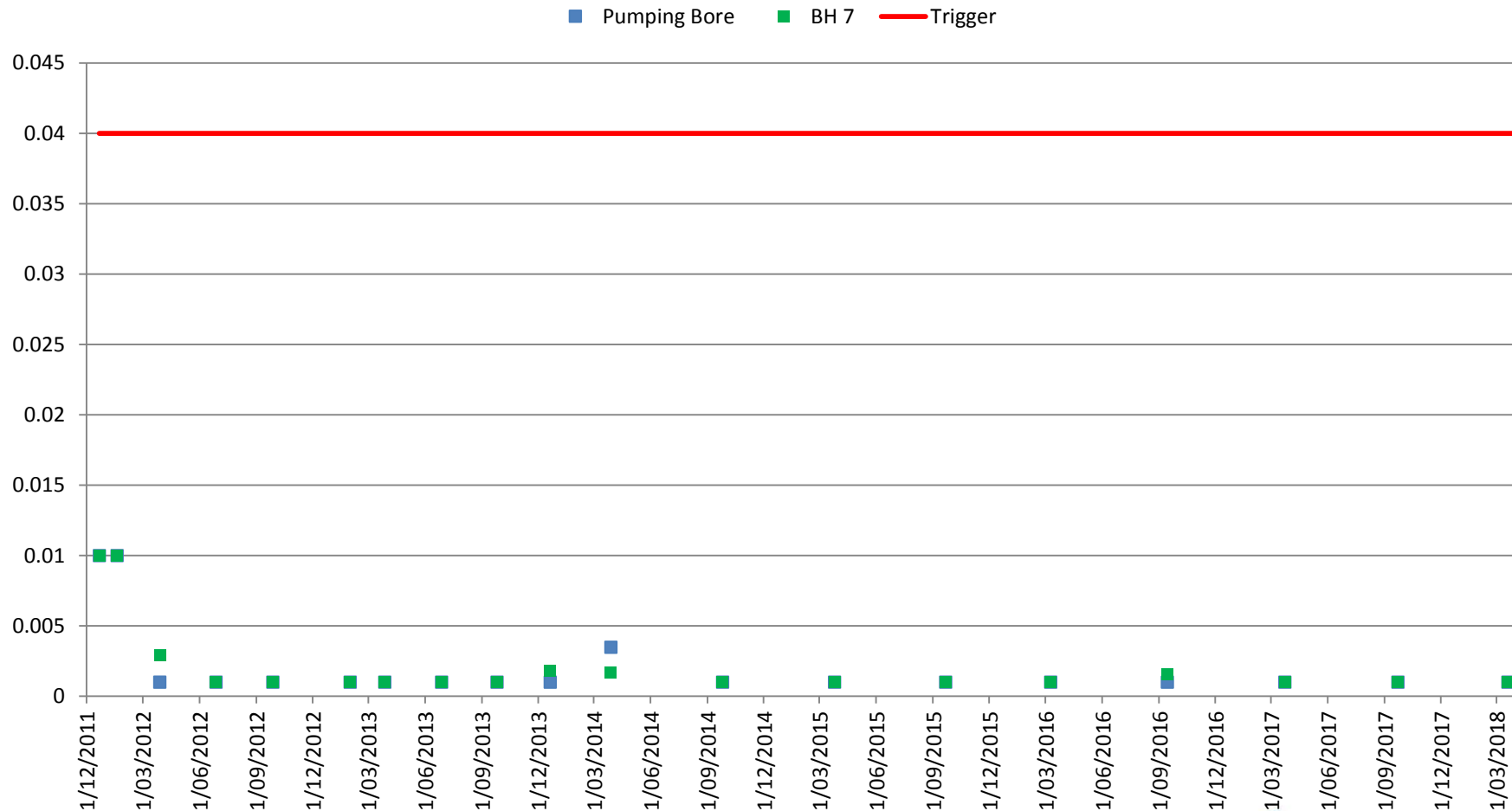


# Groundwater Chemistry Results

The following figure show all the results for the Cyanide since the commencement of sampling.

All results are in g/m<sup>3</sup> unless otherwise stated.

## Cyanide

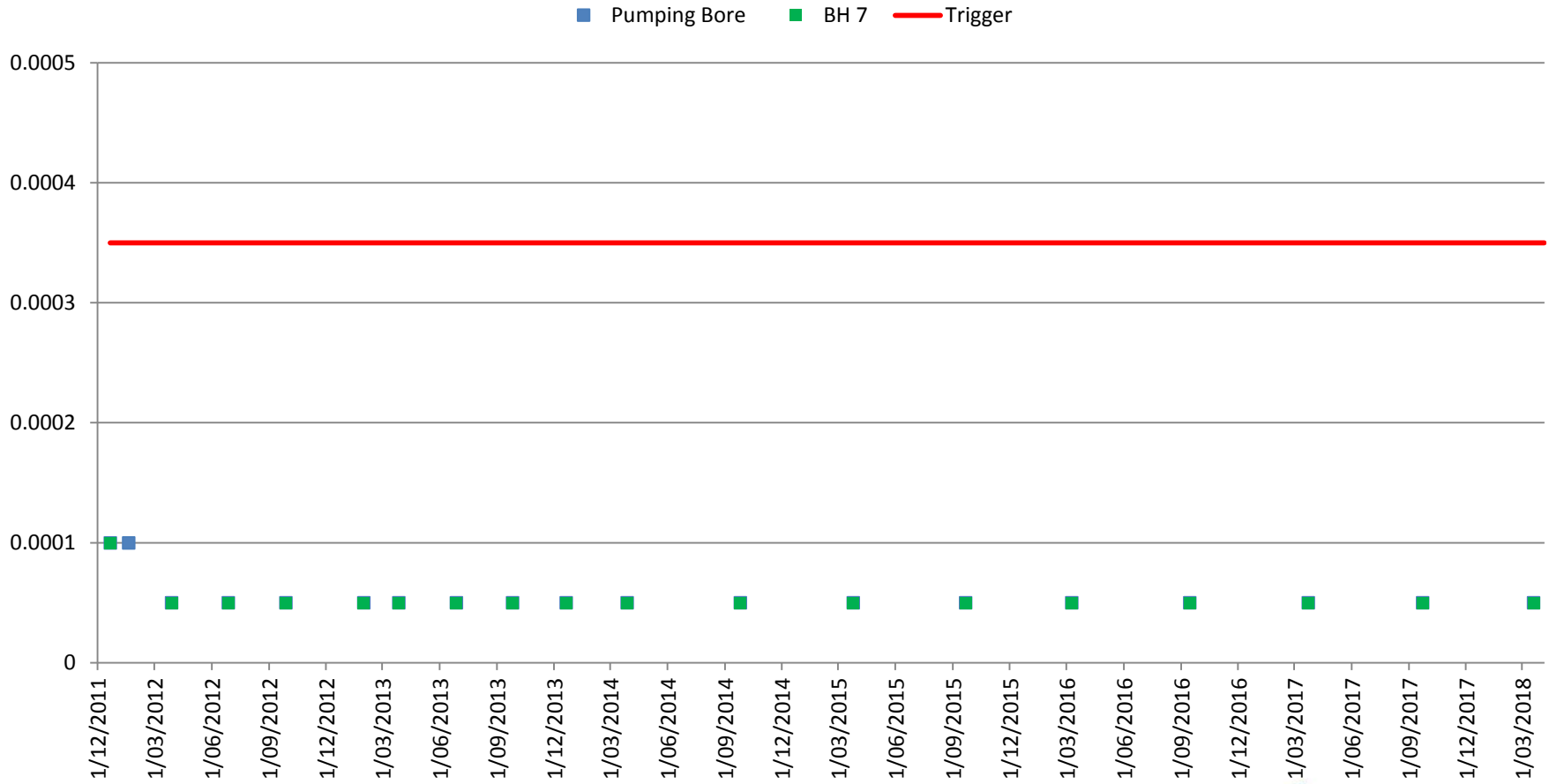


# Groundwater Chemistry Results

The following figure show all the results for BaP(eq) since the commencement of sampling.

All results are in g/m<sup>3</sup>.

## BaP (eq)



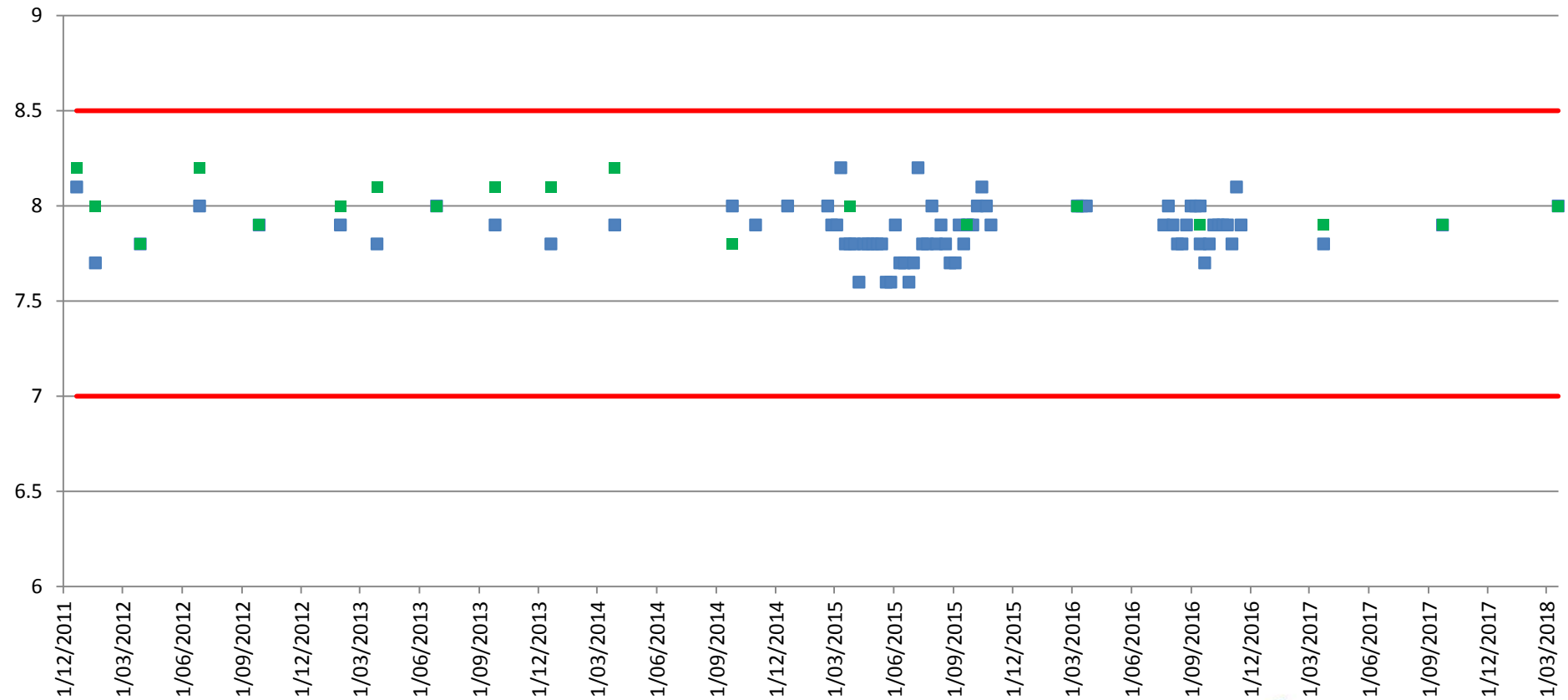
# Groundwater Chemistry Results

The following figure show all the results for pH since the commencement of sampling.

All results are in pH Units

pH

■ Pumping Bore ■ BH 7 — Trigger Max — Trigger Min

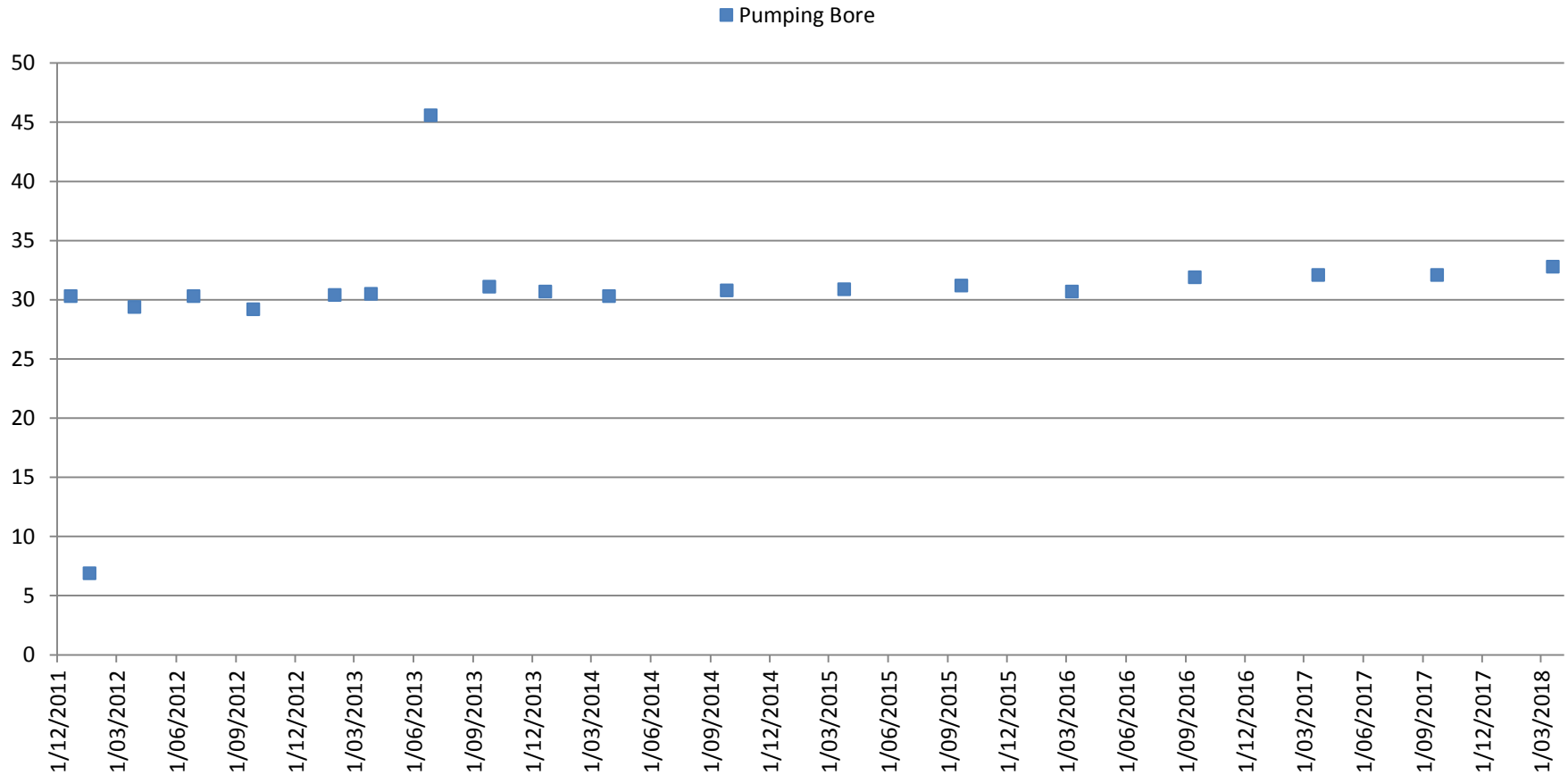


# Groundwater Chemistry Results

The following figure show all the results for EC since the commencement of sampling.

All results are in mS/m.

## Electrical Conductivity

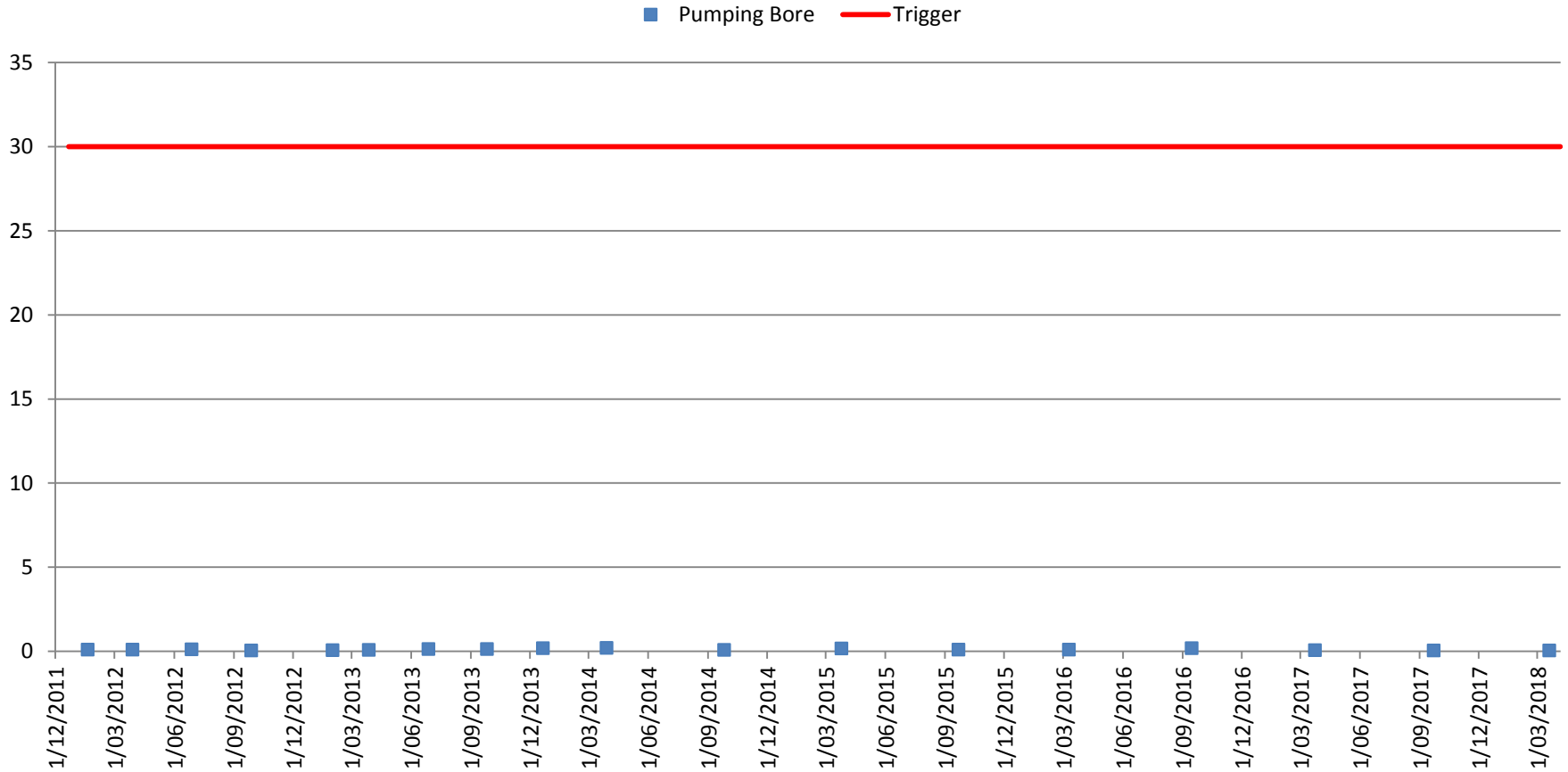


# Groundwater Chemistry Results

The following figure show all the results for Turbidity since the commencement of sampling.

All results are in NTU.

## Turbidity

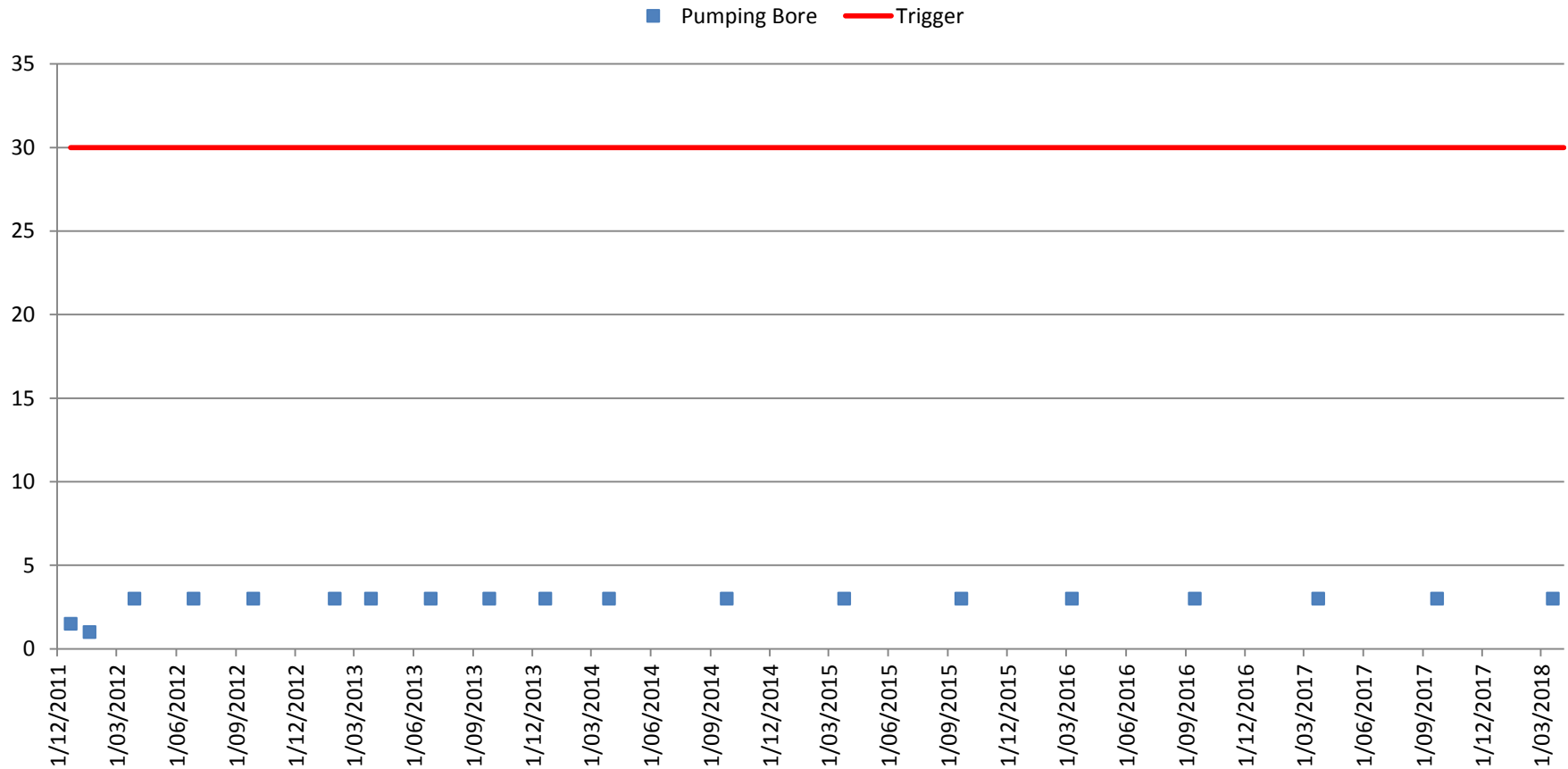


# Groundwater Chemistry Results

The following figure show all the results for TSS since the commencement of sampling.

All results are in g/m<sup>3</sup>.

## Total Suspended Solids



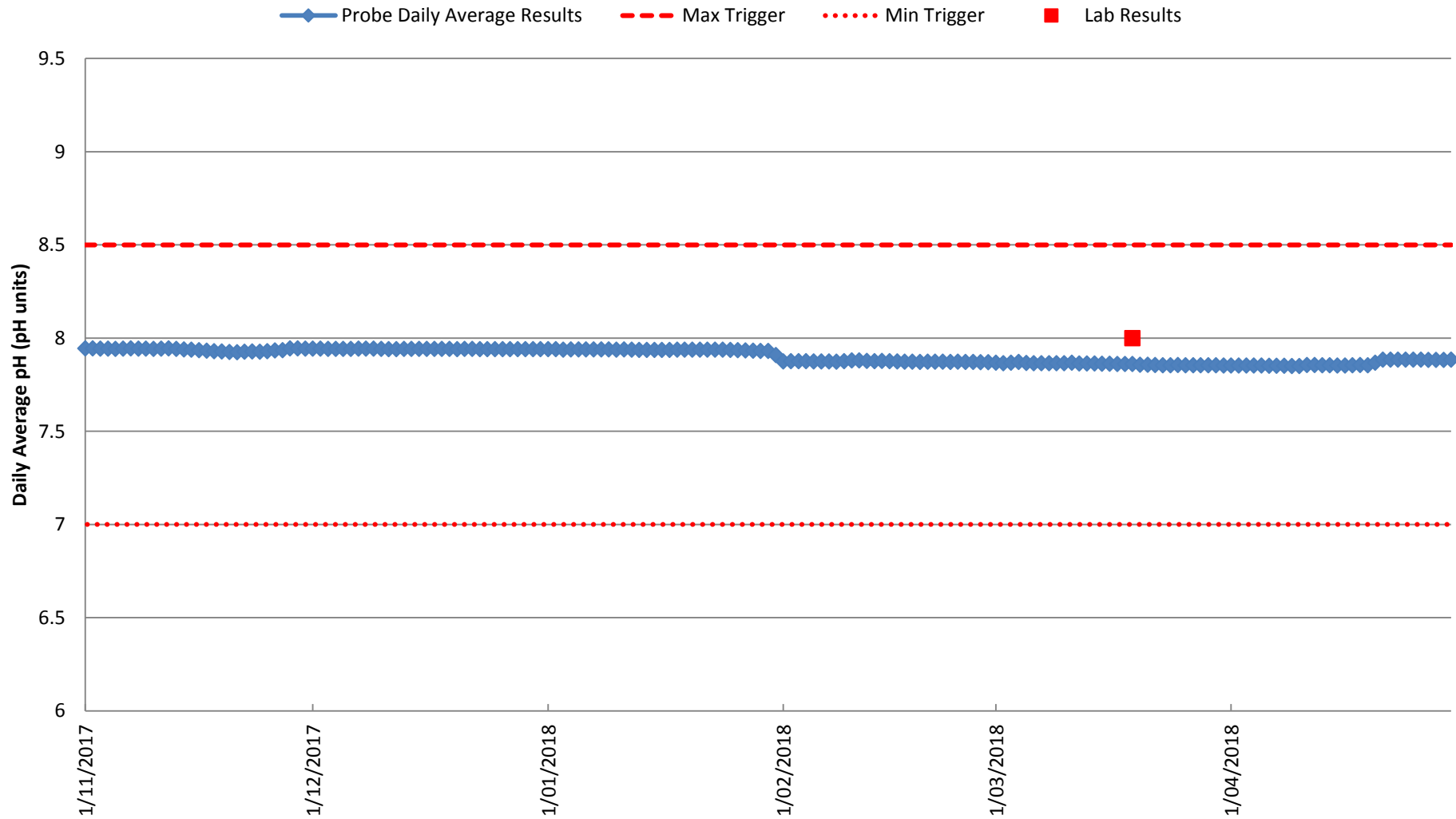


# Continuous Groundwater Quality Monitoring

- Continuous monitoring of electrical conductivity (EC) and pH is required to be undertaken in the Three Kings Quarry pumping bore.
- New pH & EC probes were installed at the Three Kings Quarry pumping bore in August 2015.
- The pH & EC probes are calibrated quarterly by an external technician and the pH electrode is currently being replaced annually (July 2016 and July 2017).
- No pH triggers have been recorded since the last SLG meeting.

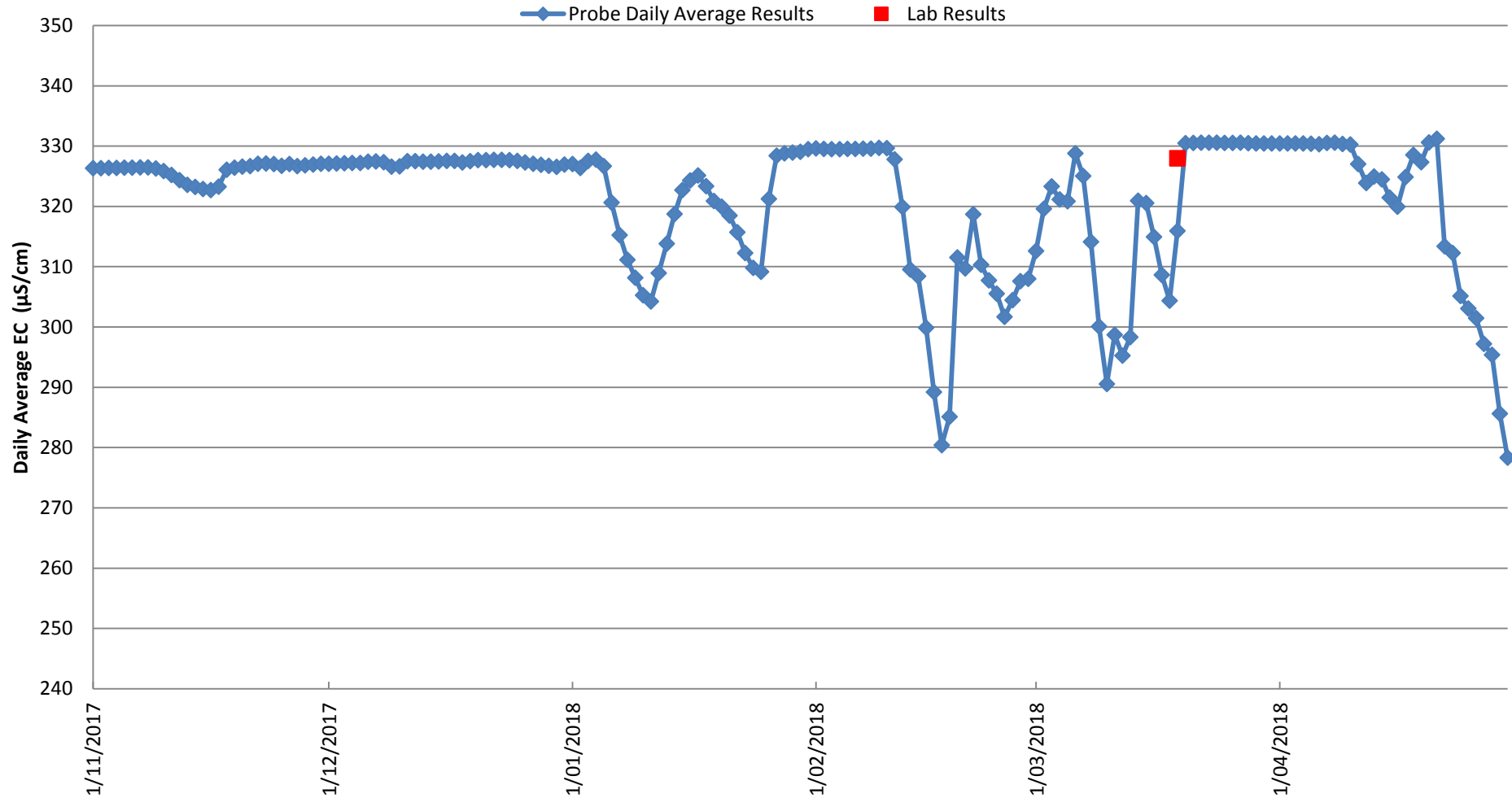
# Continuous Groundwater Quality Monitoring

## Average Daily pH Graph



# Continuous Groundwater Quality Monitoring

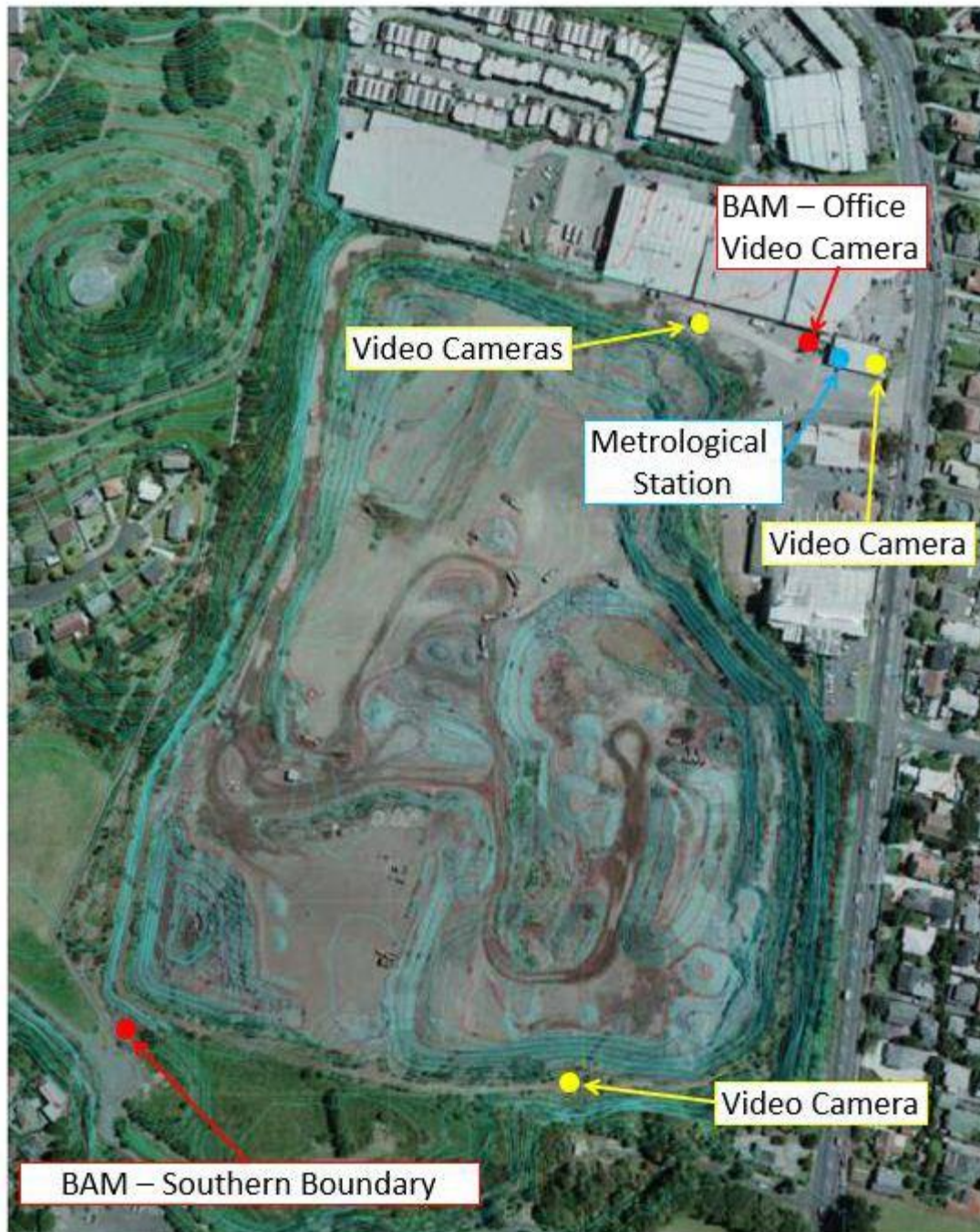
## Average Daily EC Graph



# Air Quality Monitoring

- Air Quality Monitoring equipment at Three Kings Quarry consists of two Continuous Real Time Beta Attenuation Monitors (BAM), time lapse video cameras and a metrological station
- The BAM monitor located on the roof of the site office has been operating since April 2008. A second BAM monitor was commissioned in April 2012 in the south-western corner of Three Kings Quarry
- The Air Discharge Consent for Three Kings Quarry was renewed in February 2015.
- The air quality trigger was changed from 80 micrograms per cubic metre as a 24hour average (all results) to 60 micrograms per cubic metre as a 24hour average as measured by the BAM units.

# Air Quality Monitoring Equipment



# Air Quality Monitoring Results

- Continuous air quality monitoring results recorded since the last SLG meeting have been less than 42 micrograms per cubic meter as a 24 hour average.
- No air quality triggers have been recorded since the last SLG meeting.
- The Southern Boundary BAM unit encountered several issues since the last SLG meeting resulting in periods of missing and/or invalid data as follows:
  - 15/02/2018 – 6/03/2018: Air conditioning unit in the Southern Boundary BAM hut was found to not be working. The BAM unit was turned off until the air conditioning unit was fixed so that the instrument did not overheat.
  - 14/03/2018 – 6/04/2018: Inlet tube malfunction following BAM unit calibration
  - 11/04/2018 – present: Southern Boundary BAM hut blew over and was severely damaged in a storm event. Equipment including air conditioning unit and BAM unit are currently being repaired.

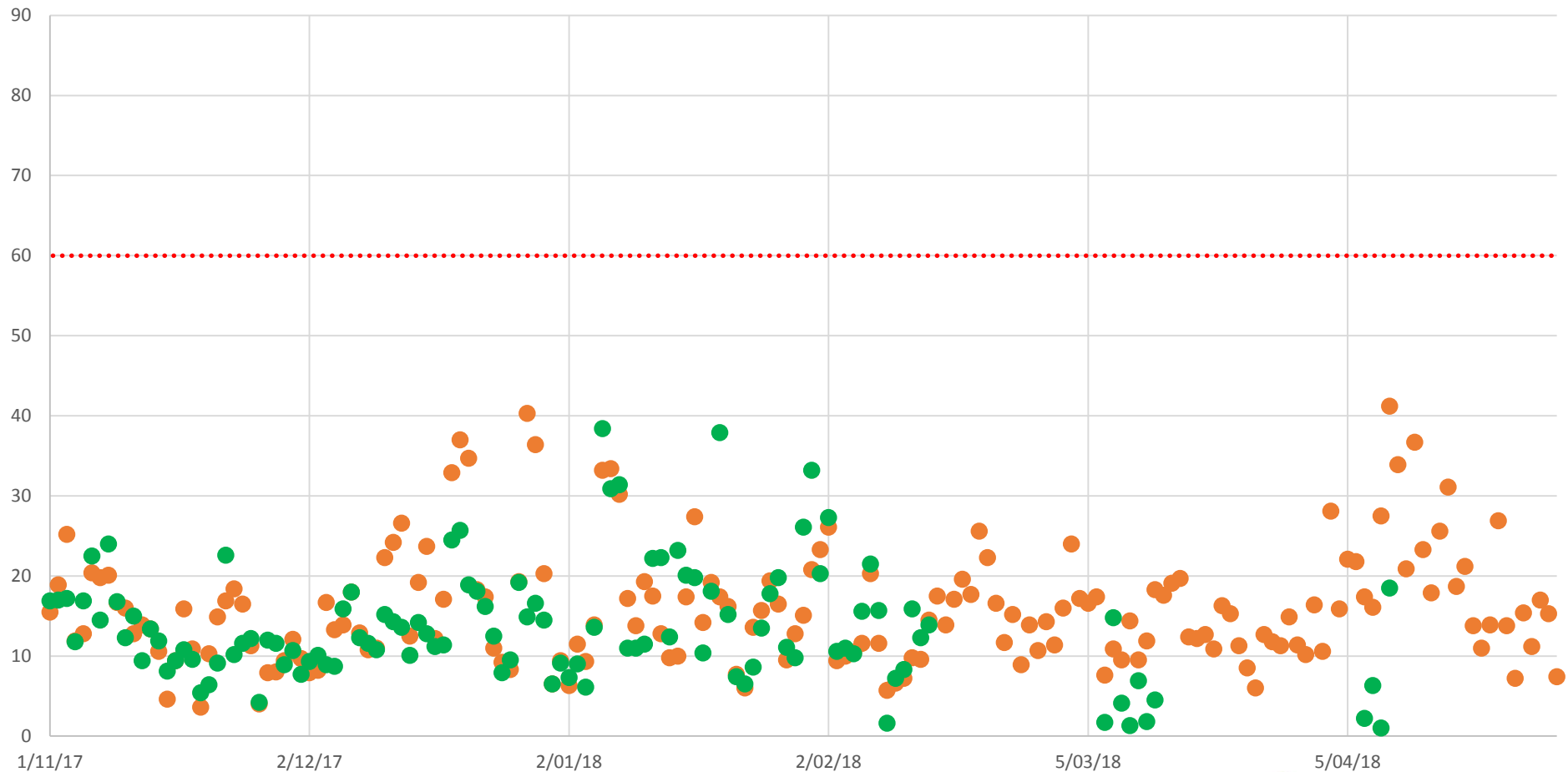
During this time the BAM unit located at the site office has continued to work as normal.

# Air Quality Monitoring Results

The following figure shows air monitoring results from 1<sup>st</sup> November 2017 to 30<sup>th</sup> April 2018.

All results are in  $\mu\text{g}/\text{m}^3$ .

● BAM Site Office    ● BAM Southern Boundary    ..... BAM Trigger



# Precise Level Survey

- The 2018 precise level survey has been undertaken and the results are currently being analysed.



**Thank you - that concludes the  
May 2018 Monitoring Report**