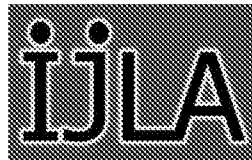
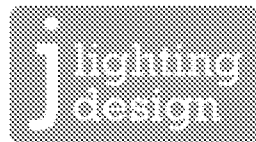
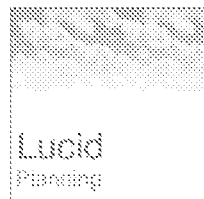


# Groundwater Monitoring

DREW SMITH GROUP



## Land at Summer Lane Pagham Reserved Matters Application Planning Update

July 2019 Rev. A

11<sup>th</sup> June 2019

Our ref: GE17671/SA01/190611



Daniel O'Shea  
Drew Smith Limited  
Drew Smith House  
Mill Court  
The Sawmills  
Durley  
Southampton  
Hampshire  
SO32 2EJ

Dear Daniel,

**RE: Summer Lane, Pagham, Bognor Regis, PO21 4NQ – Winter Groundwater Monitoring**

We are pleased to present the results of the winter groundwater monitoring undertaken at the above site.

Eleven windowless sample boreholes (WS01 to WS11) were drilled on the 11<sup>th</sup> and 14<sup>th</sup> January 2019 to allow the installation of monitoring standpipes for winter groundwater level monitoring. Spot monitoring of the groundwater levels within these standpipes was undertaken on eight occasions between 16<sup>th</sup> January and 25<sup>th</sup> April 2019. Three additional boreholes (BH03, BH08 and BH10) were drilled on 4<sup>th</sup> February 2019 immediately adjacent to WS03, WS08 and WS10 and installed with large diameter monitoring standpipes to allow the use of in-situ continuous groundwater dataloggers. Continuous groundwater level dataloggers were installed within BH03, BH08 and BH10 from 5<sup>th</sup> February to 11<sup>th</sup> March 2019. The exploratory positions were located in line with instructions from Drew Smith Limited and access constraints at the time of investigation.

The ground conditions revealed within the boreholes are recorded in Geo-Environmental's letter report (GE17671-SA02-190128) which also details the results of the soakage testing previously carried out at the site.

**Background**

It is understood that the site is proposed to be developed with a residential development and associated infrastructure. As such, winter groundwater monitoring was required to assist in assessing the suitability of underlying soils for drainage via soakaways and to inform the planning, design and construction strategies for the site.

The ground conditions revealed in the exploratory holes at the site comprised River Terrace Deposits of clayey sand and sandy gravelly clay overlying clay soils of the London Clay Formation.

**Site Description**

At the time of the investigation works the site comprised a section of a large arable field in the west with a grass paddock with areas of trees and scrub in the east. The site appeared generally level. The western field was accessed from the west end of Summer Lane via a gap in the hedgerow. Access to the paddock was afforded by a grass track in the south-eastern corner of the site.

Geo-Environmental Services Ltd  
Unit 7 Danworth Farm, Cuckfield Road, Hurstpierpoint, West Sussex BN6 9GL



## Groundwater Monitoring

The results of the groundwater spot monitoring are summarised in Table 1.

| Location | Minimum depth to groundwater (m bgl) | Maximum depth to groundwater (m bgl) |
|----------|--------------------------------------|--------------------------------------|
| WS01     | 0.73                                 | 1.12                                 |
| WS02     | 0.40                                 | 0.93                                 |
| WS03     | 0.15                                 | 1.02                                 |
| WS04     | 0.86                                 | 1.11                                 |
| WS05     | 0.58                                 | 0.95                                 |
| WS06     | 0.00                                 | 0.80                                 |
| WS07     | 0.82                                 | 1.81                                 |
| WS08     | 0.59                                 | 0.89                                 |
| WS09     | 0.50                                 | 1.17                                 |
| WS10     | 0.10                                 | 0.55                                 |
| WS11     | 0.85                                 | 1.36                                 |

**Table 1 Summary of groundwater depths from spot monitoring (January to April 2019)**

The full results of the groundwater spot monitoring are presented within Appendix A.

Continuous groundwater level dataloggers were installed within BH03, BH08 and BH10 from 5<sup>th</sup> February to 11<sup>th</sup> March 2019. The results are presented graphically in Appendix B.

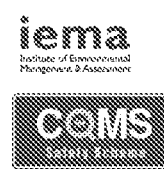
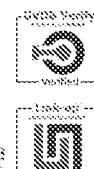
The results have been compared against rainfall observations recorded at Thorney Island weather station approximately 20 kilometres north-west of the site. During the monitoring period two periods of high precipitation occurred: a period of wet weather in the days surrounding 7<sup>th</sup> February where 13mm of rainfall was recorded; and wet weather between 4<sup>th</sup> March (16mm rainfall) and 10<sup>th</sup> March (10mm rainfall).

The groundwater levels over the monitoring period show groundwater at a peak during the first rainfall event, then reducing to a relatively steady level before peaking in response to the second rainfall event.

The time taken for the groundwater level in BH03 to recover following the February rainfall event was approximately 14 days with an approximate decrease of 0.40m. The levels in BH08 took approximately 13 days, dropping approximately 0.25m. Within BH10 the fall in water level took approximately 15 days for an approximate 0.30m drop in water level. The response to the March rainfall event starting on 4<sup>th</sup> March appears to be less than 12 hours for all of the boreholes with increases in water level of approximately 0.50m, 0.25m and 0.25m for BH03, BH08 and BH10 respectively. The data also shows some evidence of the potential tidal effect on groundwater levels with daily variance in levels of up to 0.05m on some occasions.

## Conclusions

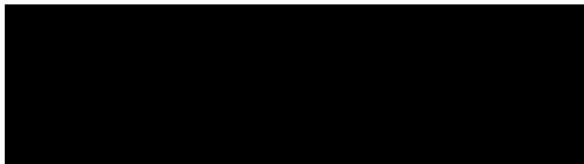
The monitoring undertaken indicates that the winter groundwater levels at the site are likely to interfere with the effective performance of conventional stormwater soakaways. As a result, on-site storage and attenuation together with alternative storm water disposal options should be considered.



## Closure

We trust that we have interpreted your instructions correctly, and please do not hesitate to contact us should you have any queries.

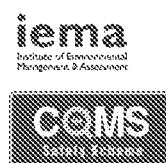
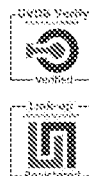
Yours sincerely  
For and on Behalf of Geo-Environmental



**SHAUN ARMITAGE BSc (Hons), FGS**  
**Senior Consulting Engineer**

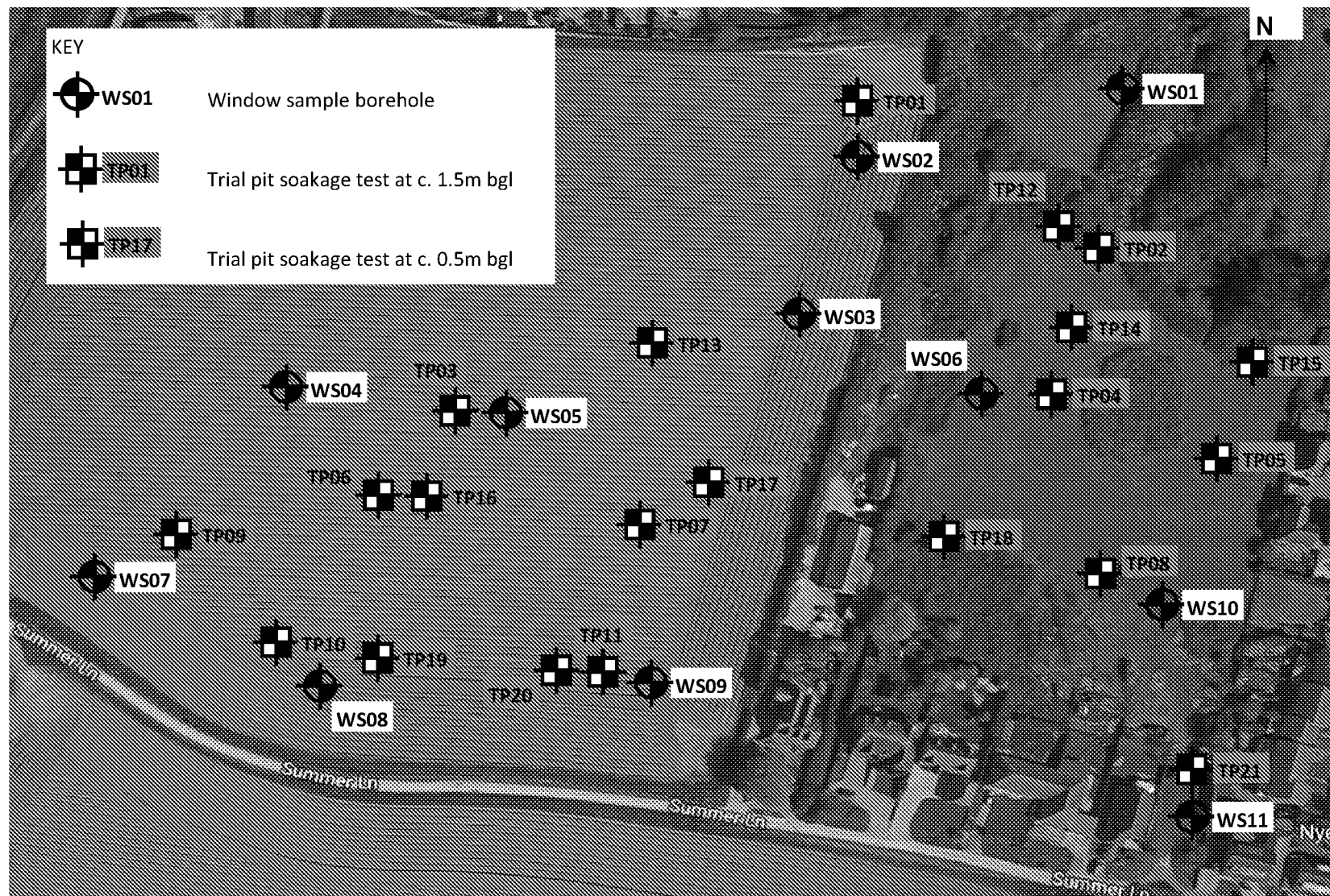


|     |            |                                           |
|-----|------------|-------------------------------------------|
| Enc | Figure 1   | Site Location Plan                        |
|     | Figure 2   | Exploratory Hole Location Plan            |
|     | Appendix A | Winter Groundwater Monitoring Results     |
|     | Appendix B | Continuous Groundwater Monitoring Results |





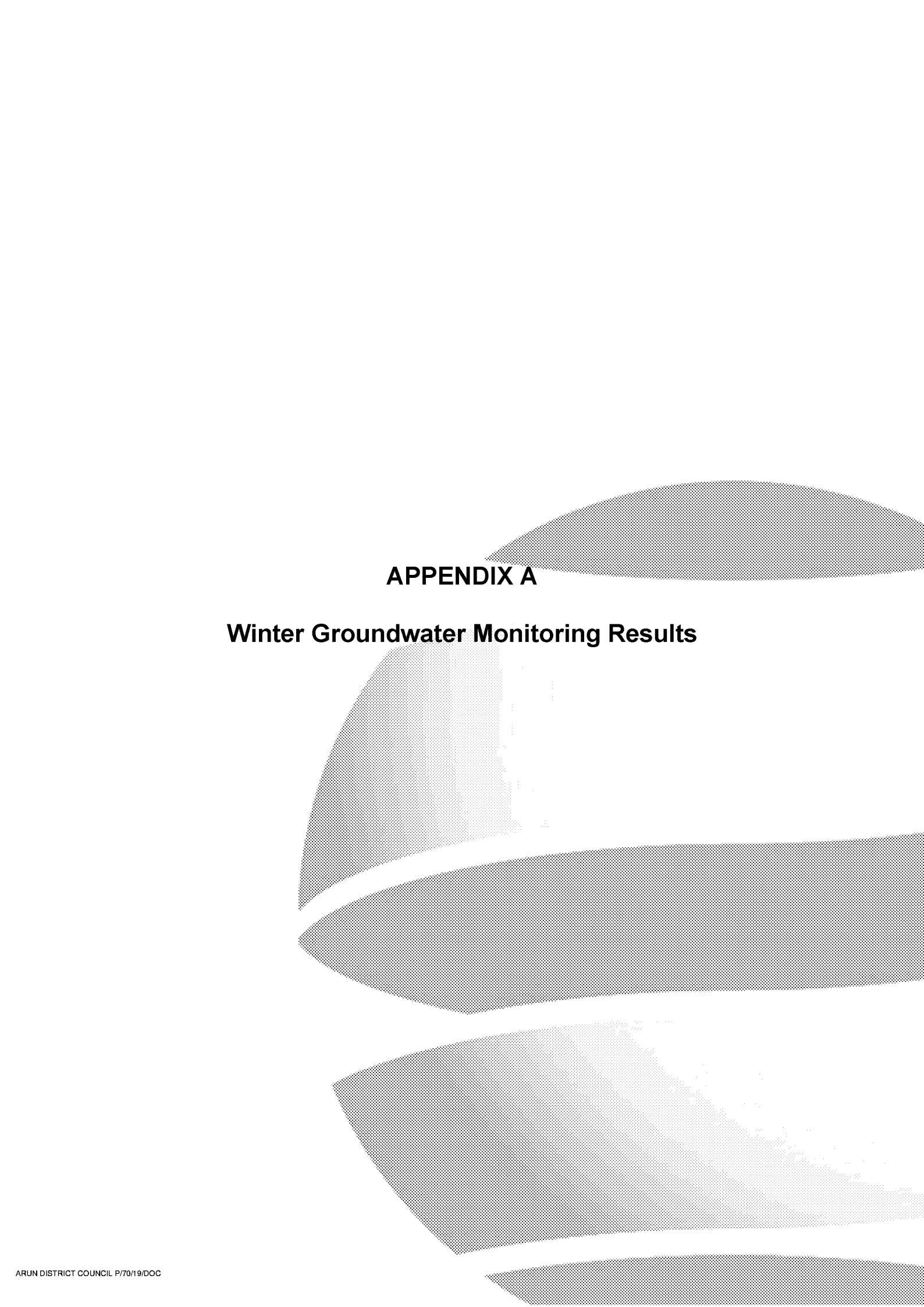
|                 |                                             |                  |              |                                                                                                                                                                                                      |                                                                                                                   |  |
|-----------------|---------------------------------------------|------------------|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|--|
| <b>Project:</b> | Summer Lane, Pagham, Bongor Regis, PO21 4NQ |                  |              | <b>Title</b>                                                                                                                                                                                         | Site Location Plan                                                                                                |  |
| <b>Client:</b>  | Drew Smith Limited                          |                  |              | <b>Geo-Environmental Services Ltd</b><br><br>Unit 7 Danworth Farm, Cuckfield Road<br><br>Hurstpierpoint, West Sussex BN6 9GL<br><br>+44(0)1273 832972 <a href="http://www.gesl.net">www.gesl.net</a> | <br><b>Geo-Environmental</b> |  |
| <b>Ref No:</b>  | GE17671                                     | <b>Revision:</b> | 0            |                                                                                                                                                                                                      |                                                                                                                   |  |
| <b>Drawn:</b>   | SA                                          | <b>Date:</b>     | 07/01/2019   |                                                                                                                                                                                                      |                                                                                                                   |  |
| <b>Figure:</b>  | 1                                           | <b>Scale:</b>    | Not To Scale |                                                                                                                                                                                                      |                                                                                                                   |  |



|                 |                                             |                  |              |                                                                                                                                                                                                                                                                        |                                |  |
|-----------------|---------------------------------------------|------------------|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|--|
| <b>Project:</b> | Summer Lane, Pagham, Bongor Regis, PO21 4NQ |                  |              | <b>Title</b>                                                                                                                                                                                                                                                           | Exploratory Hole Location Plan |  |
| <b>Client:</b>  | Drew Smith Limited                          |                  |              | <div>Geo-Environmental Services Ltd</div> <div>Unit 7 Danworth Farm, Cuckfield Road</div> <div>Hurstpierpoint, West Sussex BN6 9GL</div> <div></div> <div>Geo-Environmental</div> |                                |  |
| <b>Ref No:</b>  | GE17671                                     | <b>Revision:</b> | 0            |                                                                                                                                                                                                                                                                        |                                |  |
| <b>Drawn:</b>   | SA                                          | <b>Date:</b>     | 23/01/2019   |                                                                                                                                                                                                                                                                        |                                |  |
| <b>Figure:</b>  | 2                                           | <b>Scale:</b>    | Not To Scale |                                                                                                                                                                                                                                                                        |                                |  |



Geo-Environmental



## **APPENDIX A**

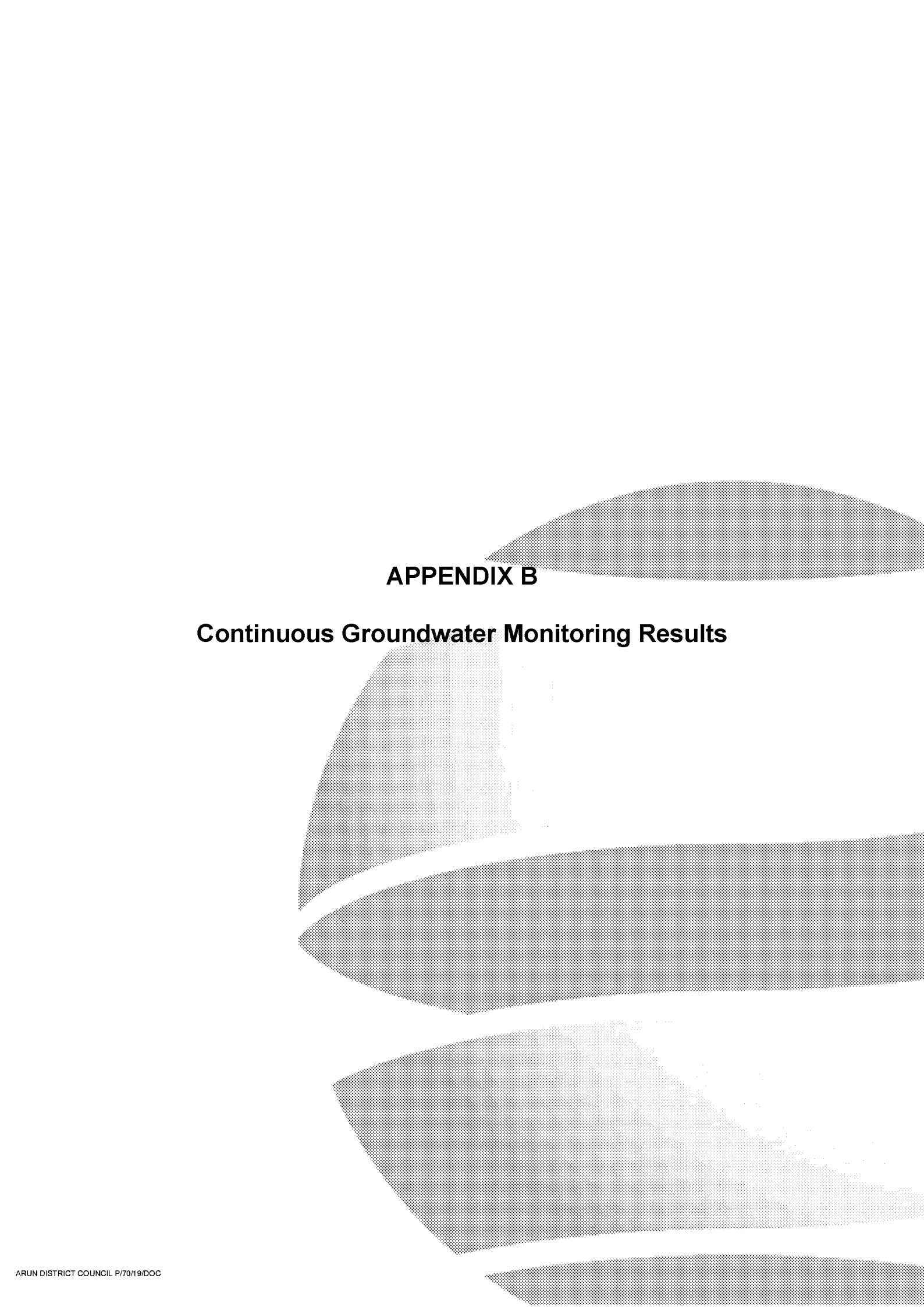
### **Winter Groundwater Monitoring Results**

**Project:** Summer Lane, Pagham, Bognor Regis.  
**Ref:** GE17671  
**Client:** Drew Smith Limited

| Location | Date     | GWL (m bgl) |
|----------|----------|-------------|
| WS01     | 16/01/19 | 1.07        |
| WS02     | 16/01/19 | 0.80        |
| WS03     | 16/01/19 | 0.76        |
| WS04     | 16/01/19 | 1.00        |
| WS05     | 16/01/19 | 0.88        |
| WS06     | 16/01/19 | 0.52        |
| WS07     | 16/01/19 | 1.53        |
| WS08     | 16/01/19 | 0.83        |
| WS09     | 16/01/19 | 0.99        |
| WS10     | 16/01/19 | 0.42        |
| WS11     | 16/01/19 | 1.32        |
| WS01     | 04/02/19 | 0.88        |
| WS02     | 04/02/19 | 0.62        |
| WS03     | 04/02/19 | 0.42        |
| WS04     | 04/02/19 | 0.86        |
| WS05     | 04/02/19 | 0.63        |
| WS06     | 04/02/19 | 0.32        |
| WS07     | 04/02/19 | 1.32        |
| WS08     | 04/02/19 | 0.65        |
| WS09     | 04/02/19 | 0.59        |
| WS10     | 04/02/19 | 0.10        |
| WS11     | 04/02/19 | 0.97        |
| WS01     | 13/02/19 | 0.80        |
| WS02     | 13/02/19 | 0.40        |
| WS03     | 13/02/19 | 0.22        |
| WS04     | 13/02/19 | 0.97        |
| WS05     | 13/02/19 | 0.65        |
| WS06     | 13/02/19 | 0.07        |
| WS07     | 13/02/19 | 0.82        |
| WS08     | 13/02/19 | 0.70        |
| WS09     | 13/02/19 | 0.52        |
| WS10     | 13/02/19 | 0.15        |
| WS11     | 13/02/19 | 1.13        |
| WS01     | 28/02/19 | 1.02        |
| WS02     | 28/02/19 | 0.74        |
| WS03     | 28/02/19 | 0.67        |
| WS04     | 28/02/19 | 1.01        |
| WS05     | 28/02/19 | 0.85        |
| WS06     | 28/02/19 | 0.30        |
| WS07     | 28/02/19 | 1.50        |
| WS08     | 28/02/19 | 0.79        |
| WS09     | 28/02/19 | 0.86        |
| WS10     | 28/02/19 | 0.36        |
| WS11     | 28/02/19 | 1.26        |

**Project:** Summer Lane, Pagham, Bognor Regis.  
**Ref:** GE17671  
**Client:** Drew Smith Limited

| Location   | Date     | GWL (m bgl) |
|------------|----------|-------------|
| WS01       | 12/03/19 | 0.73        |
| WS02       | 12/03/19 | 0.42        |
| WS03       | 12/03/19 | 0.15        |
| WS04       | 12/03/19 | 0.94        |
| WS05       | 12/03/19 | 0.58        |
| WS06       | 12/03/19 | 0.00        |
| WS07       | 12/03/19 | 1.02        |
| WS08       | 12/03/19 | 0.59        |
| WS09       | 12/03/19 | 0.50        |
| WS10       | 12/03/19 | 0.21        |
| WS11       | 12/03/19 | 0.85        |
| WS01       | 29/03/19 | 1.03        |
| WS02       | 29/03/19 | 0.78        |
| WS03       | 29/03/19 | 0.74        |
| WS04       | 29/03/19 | 1.01        |
| WS05       | 29/03/19 | 0.85        |
| WS06       | 29/03/19 | 0.51        |
| WS07       | 29/03/19 | 1.49        |
| WS08       | 29/03/19 | 0.76        |
| WS09       | 29/03/19 | 0.88        |
| WS10       | 29/03/19 | 0.48        |
| WS11       | 29/03/19 | 1.29        |
| WS01       | 11/04/19 | 1.09        |
| WS02       | 11/04/19 | 0.88        |
| WS03       | 11/04/19 | 0.91        |
| WS04       | 11/04/19 | 1.05        |
| WS05       | 11/04/19 | 0.91        |
| WS06       | 11/04/19 | 0.66        |
| WS07       | 11/04/19 | 1.68        |
| WS08       | 11/04/19 | 0.85        |
| WS09       | 11/04/19 | 1.15        |
| WS10       | 11/04/19 | 0.53        |
| WS11       | 11/04/19 | 1.30        |
| WS01       | 25/04/19 | 1.12        |
| WS02       | 25/04/19 | 0.93        |
| WS03       | 25/04/19 | 1.02        |
| WS04       | 25/04/19 | 1.11        |
| WS05       | 25/04/19 | 0.95        |
| WS06       | 25/04/19 | 0.80        |
| WS07       | 25/04/19 | 1.81        |
| WS08       | 25/04/19 | 0.89        |
| WS09       | 25/04/19 | 1.17        |
| WS10       | 25/04/19 | 0.55        |
| WS11       | 25/04/19 | 1.36        |
| Max values |          | 1.81        |
| Min Vaules |          | 0.00        |



## **APPENDIX B**

### **Continuous Groundwater Monitoring Results**

BH03

