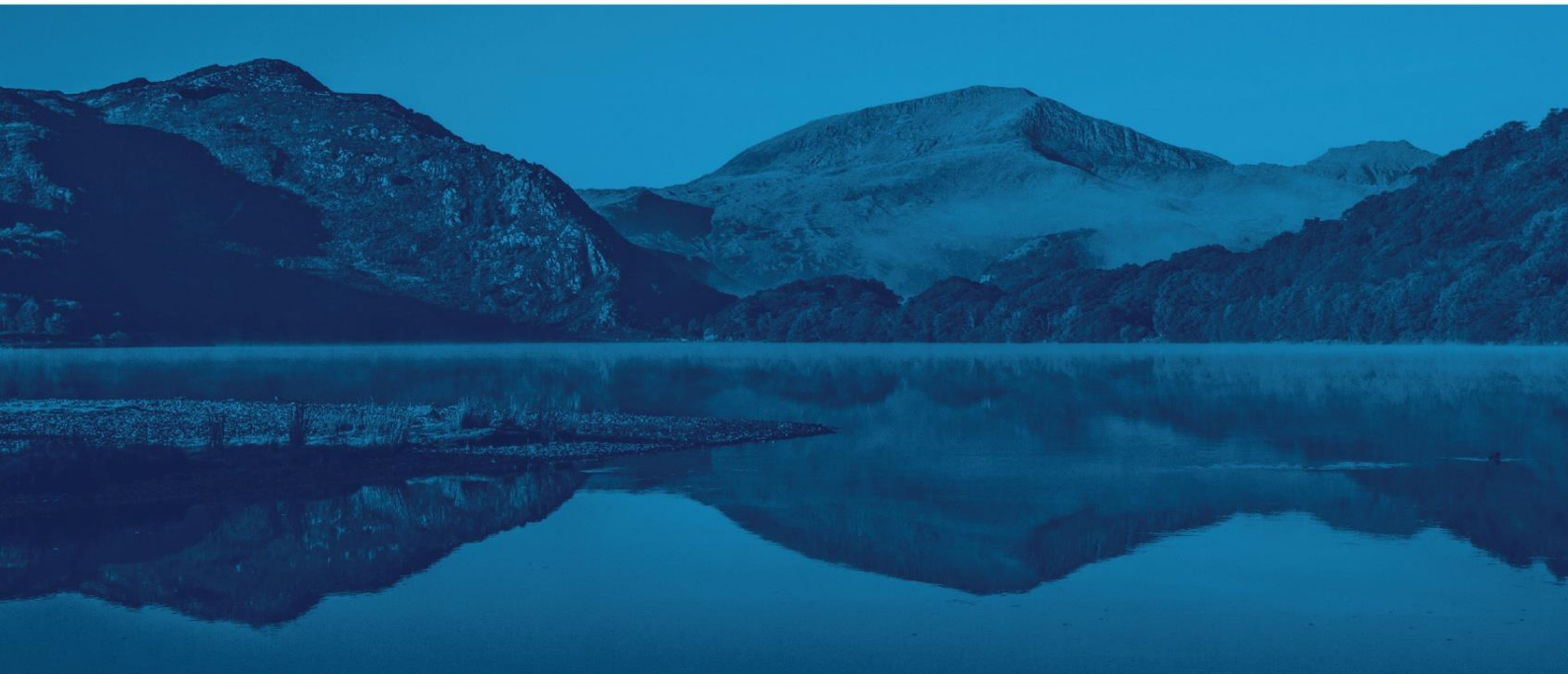




## Royal British Legion, Llay

### Infiltration Test Report

April 2018



Assessment / Modelling / Design

[waterco.co.uk](http://waterco.co.uk)

## DOCUMENT VERIFICATION RECORD

|                     |                                                                                                                              |
|---------------------|------------------------------------------------------------------------------------------------------------------------------|
| <b>CLIENT:</b>      | The Royal British Legion                                                                                                     |
| <b>SCHEME:</b>      | Proposed Residential Development at The Royal British Legion, Watts Dyke, Llay, Wrexham, LL12 0RL – Infiltration Test Report |
| <b>INSTRUCTION:</b> | The instruction to carry out this report was received from Mr Andy McMullan of Freeths LLP on behalf of the Client.          |

## DOCUMENT REVIEW &amp; APPROVAL

|                  |                                             |
|------------------|---------------------------------------------|
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| <b>CHECKER:</b>  | Josh Rigby BSc (Hons) MCIWEM                |
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## ISSUE HISTORY

| ISSUE DATE | COMMENTS    |
|------------|-------------|
| 17/04/2018 | First issue |
|            |             |
|            |             |

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01824 702220

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## **Introduction**

Waterco Consultants have been commissioned to undertake infiltration testing in relation to a proposed residential development at The Royal British Legion, Watts Dyke, Llay, Wrexham, LL12 0RL.

The infiltration testing will provide information regarding expected soil permeability at the site and will be used to inform suitable sustainable drainage measures used in the development.

## **Site Overview**

### **Site Description**

The 2.18ha (hectare) development site is located at National Grid reference: 333124E, 355330N. A location plan and an aerial image are included in Appendix A.

The site comprises the existing Royal British Legion building with associated car parking, a war memorial and landscaping. The site is bordered by Watts Dyke (Road) to the north with residential dwellings beyond, Llay New Road to the east with residential dwellings beyond, agricultural land and a wooded area to the south and residential dwellings to the west. Access to the site is provided from Watts Dyke north of the site.

### **Published Ground Conditions**

Reference to the British Geological Survey online mapping (1:50,000 scale) indicates that the site is underlain by superficial Glaciofluvial deposits generally comprising sand and gravel. The superficial deposits are identified as being underlain by the Salop Formation consisting of mudstone, sandstone and conglomerate.

The Cranfield University 'Soilscapes' map indicates that the site is underlain by 'freely draining soils.' Land immediately north of the site is shown to be underlain by 'slowly permeable, seasonally wet, clayey soils'.

### **Antecedent Conditions**

The infiltration testing was completed on 10<sup>th</sup> April 2018. It is understood that the site had experienced persistent heavy rain for up to 18 hours prior to start of the infiltration testing. Prolonged heavy rainfall continued during the infiltration testing until approximately 3 hours prior to the completion of

the works. The grassed ground onsite was saturated and surface water was evident when traversing the site. Significant surface water run-off was observed in areas of hard standing and accumulation of water was recorded in low points on site (on hard surfacing) to depths of 2 to 10cm.

## Development Proposals

The development proposals include the retention of the Royal British Legion building with a full planning application submitted for a new car park east of the building. A concurrent outline planning application is to be submitted to remove the existing car park and erect 38 residential properties with associated gardens, car parking, access roads, public open space and a new war memorial. The residential element will occupy approximately 1.58ha. A proposed development plan is included in Appendix B.

## Methodology

Waterco Consultants undertook infiltration testing in general accordance with the BRE 365 specification in April 2018. Three trial pits were excavated onsite under the instruction and guidance of Waterco Consultants.

The trial pits were excavated to depths of between 1.26metres below existing ground level (m.bgl) and 1.39m.bgl. The trial pits were left open for the duration of the testing, before backfilling with the earthworks after completion. Trial pit dimensions are provided in Table 1 below.

**Table 1** – Trial pit dimensions

| Trial Pit | Depth (m.bgl) | Width (m) | Length (m) |
|-----------|---------------|-----------|------------|
| TP01      | 1.39          | 0.8       | 2.0        |
| TP02      | 1.26          | 0.6       | 2.0        |
| TP03      | 1.32          | 0.6       | 2.0        |

Approximate trial pit locations are annotated on the trial pit location sketch in Appendix C. Water for the infiltration test was provided from a 19,000-litre water bowser.

The strata identified on site generally comprised Made Ground to depths of approximately 0.3m, underlain by sands and gravels in TP01 and TP02. In TP03, Made Ground was recorded to a depth of approximately 0.7m, with more clay as well as sands, gravels and pebbles evident. Anecdotal information provided by a representative of The Royal British Legion, advised that land raising using imported Made Ground was undertaken, approximately 20 years ago, in the vicinity of TP03.

The test procedure was repeated three times in TP02, twice in TP03 and the second test in TP01 was abandoned due to health and safety concerns relating to the collapse of the pit.

## Test Results

The infiltration rates have been calculated in accordance with the BRE 365 guidance;

$$\text{Soil infiltration rate, } f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

whereby:

$V_{p75-25}$  = the effective storage volume of water in the trial pit between 75% and 25% effective depth;

$a_{p50}$  = the internal surface area of the trial pit up to 50% effective depth including the base area;

$t_{p75-25}$  = the time for the water level to fall from 75% to 25% effective depth.

The results of the infiltration testing are included in Appendix D. The most conservative calculated infiltration rates for each trial pit are shown in Table 2 below:

**Table 2 – Infiltration rates**

| Trial Pit | Description            |
|-----------|------------------------|
| 1         | $1.199 \times 10^{-4}$ |
| 2         | $8.87 \times 10^{-5}$  |
| 3         | $2.039 \times 10^{-5}$ |

## Conclusions

It can be concluded that soakaways would be a suitable method for surface water drainage onsite.

The development proposals may include an element of cut and fill earthworks and as such, final ground levels may vary when compared to existing ground levels. Soakaways should be located within the strata tested and cannot be located within Made Ground.

## Appendix A – Location Plan & Aerial Image





NOTES:  
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE

**LEGEND**

— Site Boundary

CLIENT:

THE ROYAL BRITISH  
**LEGION**

**waterco**  
consultants

Waterco Ltd  
Eden Court, Ruthin, LL15 1NJ

01824 702220  
www.waterco.co.uk

SCHEME:

**ROYAL BRITISH LEGION CLUB  
LLAY, WREXHAM**

PLOT TITLE:

**AERIAL PLAN**

|              |  |  |            |
|--------------|--|--|------------|
| PLOT STATUS: |  |  | DATE:      |
| <b>FINAL</b> |  |  | 23/12/2016 |

|        |          |           |                           |
|--------|----------|-----------|---------------------------|
| DRAWN: | CHECKED: | APPROVED: | PLOT SCALE @ A3:          |
| ELO    | RCL      | VG        | 1:4,000                   |
|        |          |           | (UNLESS STATED OTHERWISE) |

|                    |      |
|--------------------|------|
| PLOT NAME:         | REV: |
| w10229-Aerial_Plan | -    |

## Appendix B – Development Plan

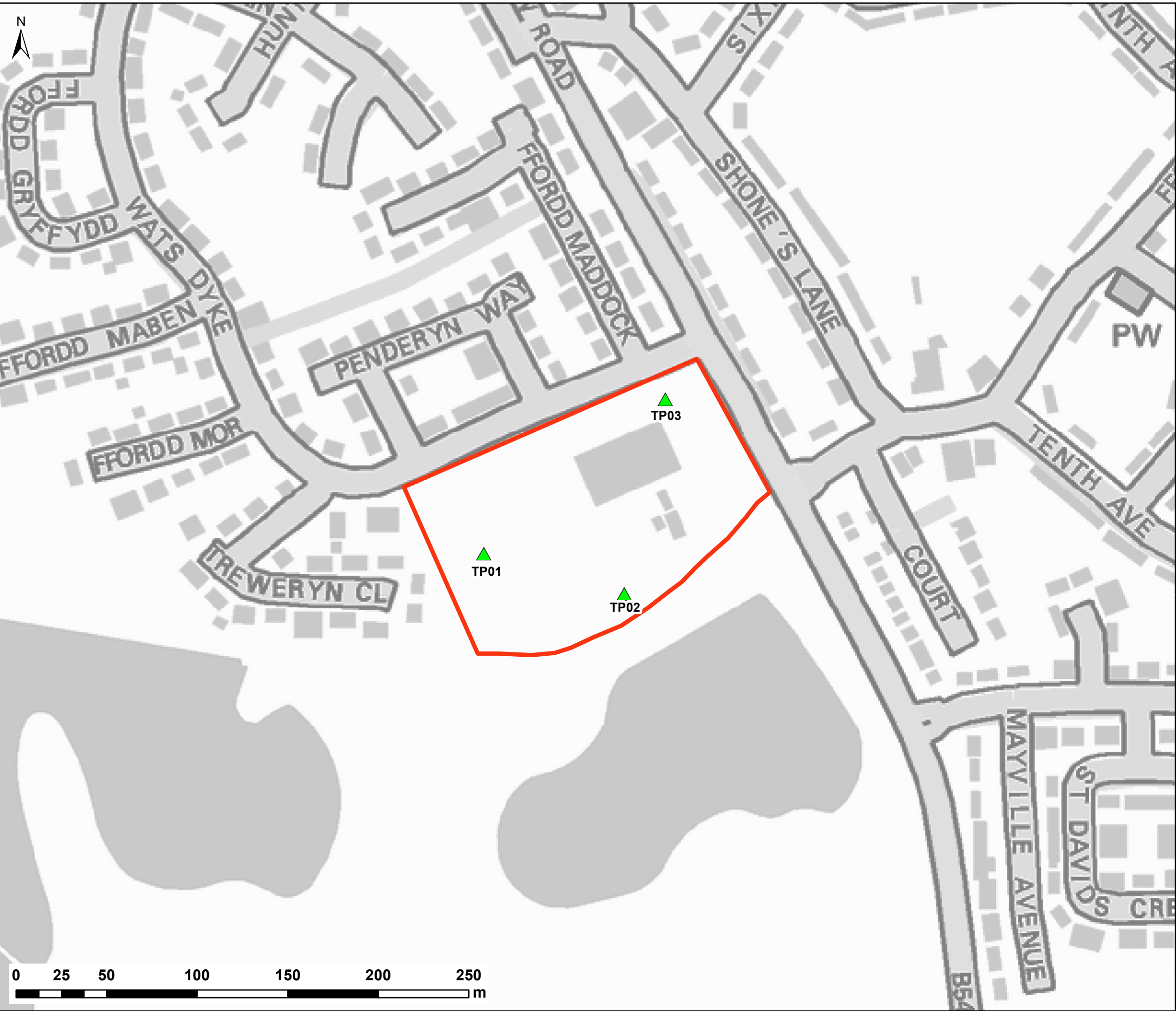


|                              |    |
|------------------------------|----|
| 2 Bed Townhouse (Affordable) | 12 |
| 3 Bed Semi-detached          | 16 |
| 4 Bed Semi-detached          | 16 |
| 4 Bed Detached with garage   | 7  |
| Total:                       | 51 |

DAY Architectural Ltd

452 - 16 Wats Dyke Road, Wrexham  
Proposed Indicative Plan Layout  
28/03/2017

## Appendix C – Approximate Trial Pit Locations



NOTES:  
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE

**LEGEND**

- Site Boundary
- Trial Pits (TP)

CLIENT:

SCHEME:

**ROYAL BRITISH LEGION CLUB  
LLAY, WREXHAM**

PLOT TITLE:

**APPROXIMATE TRIAL  
PIT LOCATION**

|              |  |  |            |
|--------------|--|--|------------|
| PLOT STATUS: |  |  | DATE:      |
| FINAL        |  |  | 17/04/2018 |

|        |          |           |                           |
|--------|----------|-----------|---------------------------|
| DRAWN: | CHECKED: | APPROVED: | PLOT SCALE @ A3:          |
| HW     | JR       | VG        | 1:2,000                   |
|        |          |           | (UNLESS STATED OTHERWISE) |

|                                       |      |
|---------------------------------------|------|
| PLOT NAME:                            | REV: |
| w10229-Approximate_Trial_Pit_Location | -    |

## Appendix D – Infiltration Test Results

|              |                                |
|--------------|--------------------------------|
| Client :     | The Royal British Legion       |
| Scheme :     | The Royal British Legion, Llay |
| Section :    |                                |
| Prepared by: | JW                             |
| Checked by:  | JR                             |
| Approved by: | VG                             |

Page 1 of 4

|          |          |
|----------|----------|
| Initials | Revision |
|----------|----------|

TP1

Date: 16-04-2018

Date: 16-04-2018

Date: 17-04-2018

**Based on method described in BRE Digest 365**

[illegible]

### Test pit details

|                                |      |
|--------------------------------|------|
| Stone fill (% voids)           | 100  |
| Length (m)                     | 2.00 |
| Width (m)                      | 0.80 |
| Depth (m)                      | 1.39 |
| Obs tube ht relative to GL (m) | 0.00 |

|      |
|------|
| 100  |
| 2.00 |
| 0.80 |
| 1.39 |
| 0.00 |

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### Infiltration rate calculations

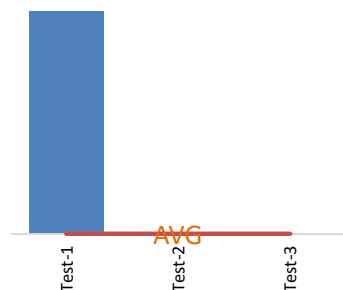
|                               |           |
|-------------------------------|-----------|
| Max Eff depth (m)             | 0.39      |
| 25% Eff depth (m)             | 0.10      |
| 75% Eff depth (m)             | 0.29      |
| Time 25% $t_{25}$ (min)       | 21.06     |
| Time 75% $t_{75}$ (min)       | 4.96      |
| Time $t_{p75-25}$ (sec)       | 966       |
| Drop $H_{75-25}$ (m)          | 0.20      |
| Volume $V_{p75-25}$ ( $m^3$ ) | 0.31      |
| Eff Area $a_{p50}$ ( $m^2$ )  | 2.69      |
| Infiltration rate (m/s)       | 1.199E-04 |

|         |
|---------|
| 0.27    |
| 0.07    |
| 0.20    |
| #VALUE! |
| 4.88    |
| #VALUE! |
| 0.14    |
| 0.22    |
| 2.36    |
| #VALUE! |

|         |
|---------|
|         |
| #VALUE! |
| #VALUE! |
| #VALUE! |
| #VALUE! |
| #VALUE! |
| #VALUE! |
| #VALUE! |
| #VALUE! |

**#VALUE!**

### Infiltration rate results



Client :

The Royal British Legion

Scheme :

The Royal British Legion, Llay

Section :

Page 2 of 4

Initials

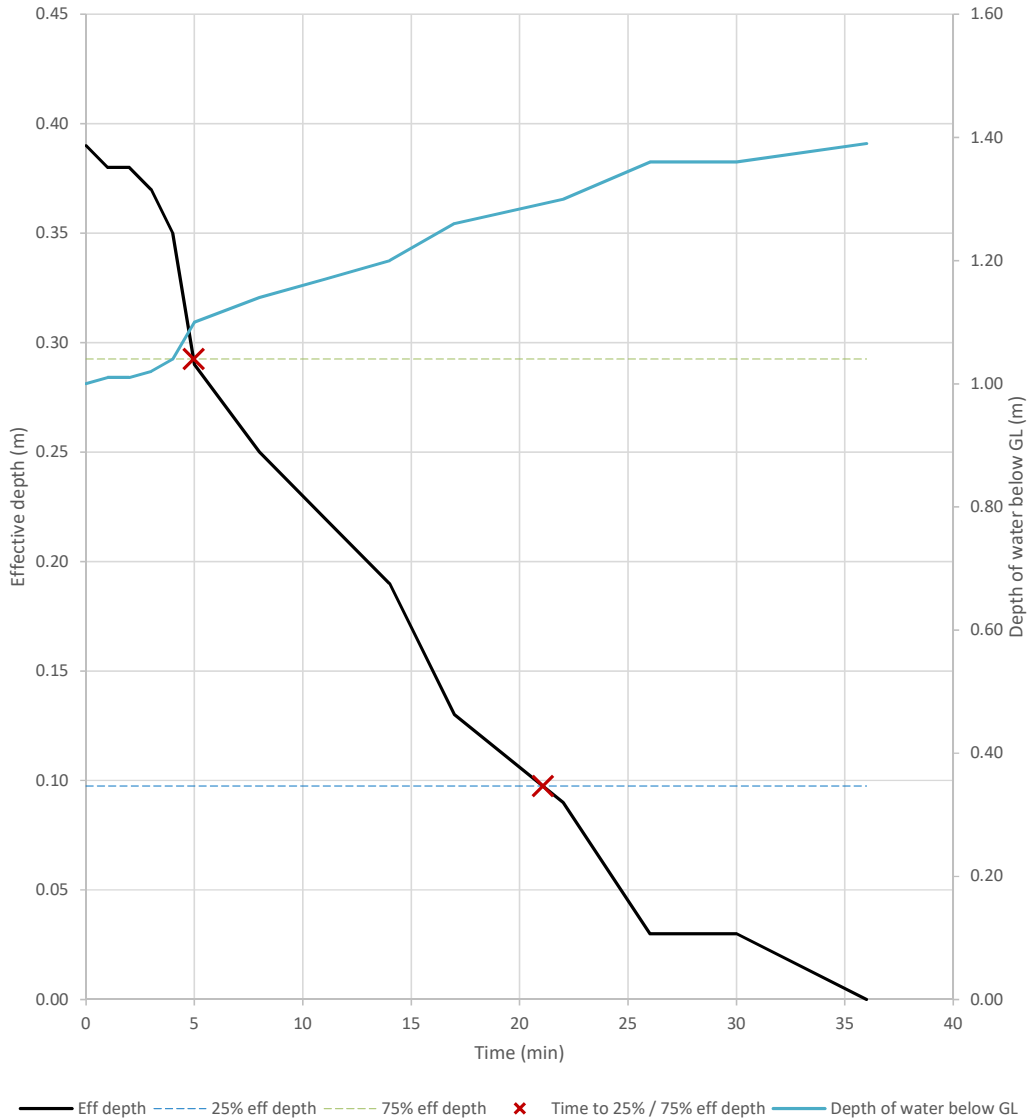
TP1

Revision

0

Based on method described in BRE Digest 365

## Test 1



### Calculations for pro-rata time to 25% & 75% depths

| Time         | Depth       | Description           |
|--------------|-------------|-----------------------|
| 17           | 0.13        | higher than 25% value |
| <b>21.06</b> | <b>0.10</b> | pro-rata 25%          |
| 22           | 0.09        | lower than 25% value  |
| 4            | 0.35        | higher than 75% value |
| <b>4.96</b>  | <b>0.29</b> | pro-rata 75%          |
| 5            | 0.29        | lower than 75% value  |

Client : The Royal British Legion

Scheme : The Royal British Legion, Llay

Section :

Page 3 of 4

Initials

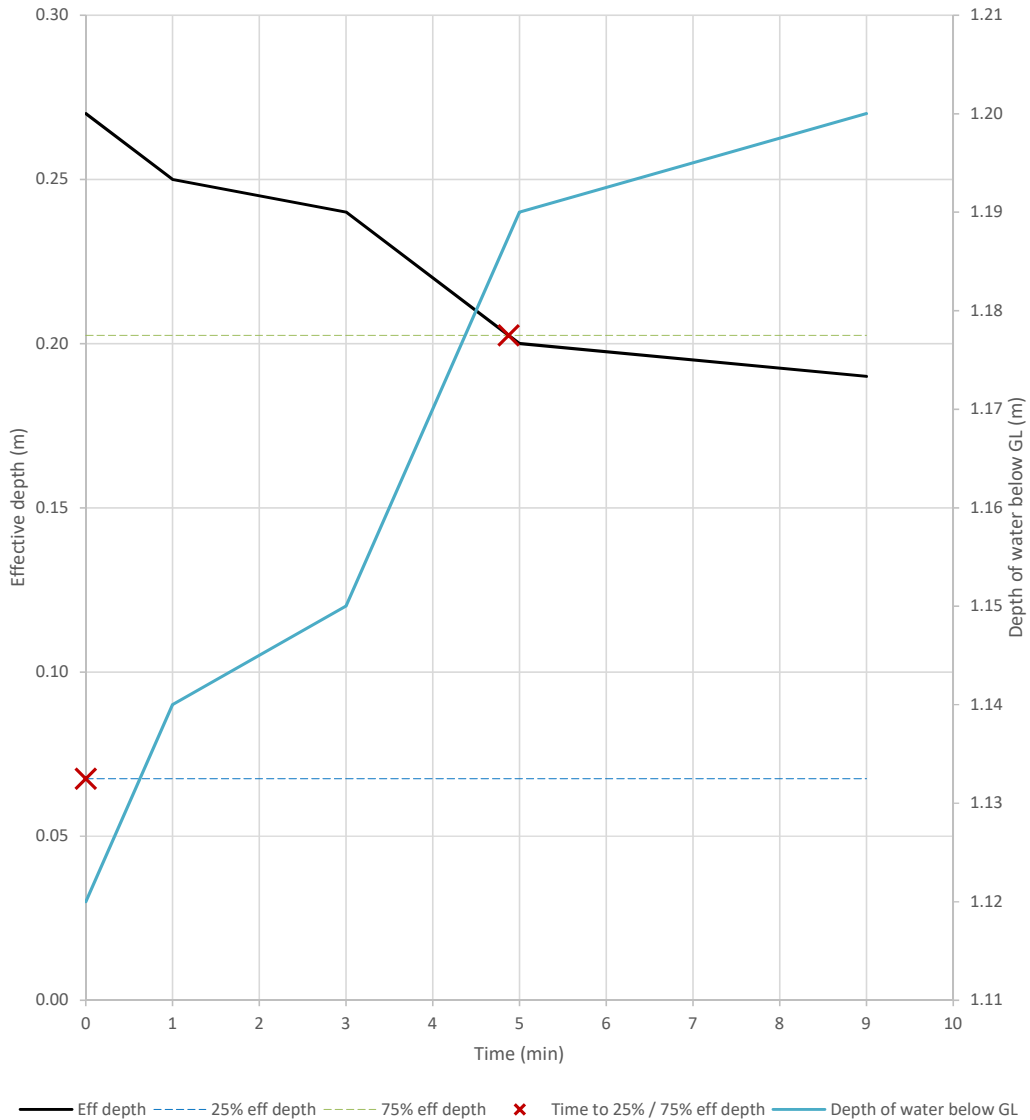
Revision

TP1

0

Based on method described in BRE Digest 365

## Test 2



### Calculations for pro-rata time to 25% & 75% depths

| Time    | Depth   | Description           |
|---------|---------|-----------------------|
| 9       | 0.19    | higher than 25% value |
| #VALUE! | 0.07    | pro-rata 25%          |
|         | #VALUE! | lower than 25% value  |
| 3       | 0.24    | higher than 75% value |
| 4.88    | 0.20    | pro-rata 75%          |
| 5       | 0.20    | lower than 75% value  |



Client :

The Royal British Legion

Scheme :

The Royal British Legion, Llay

Section :

Page 2 of 4

Initials

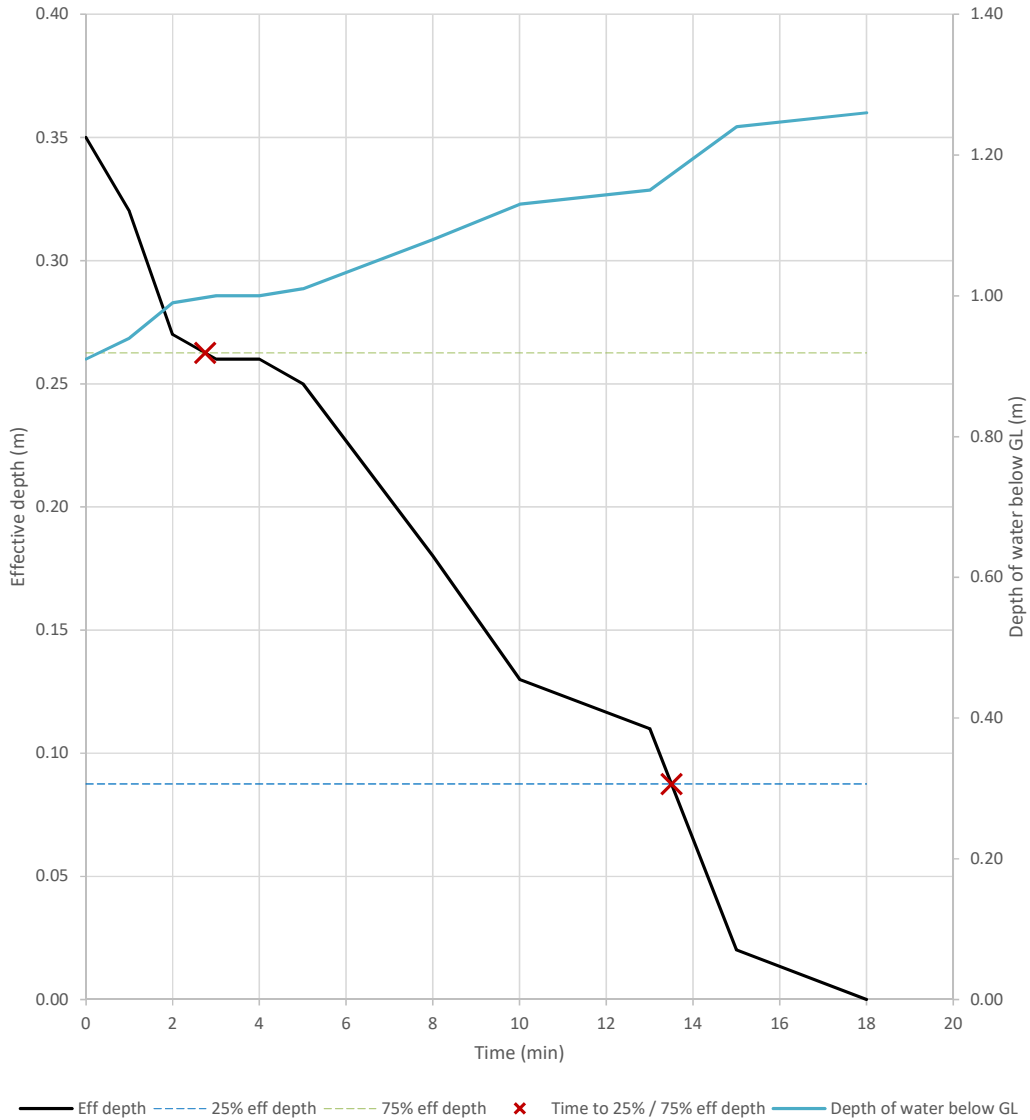
TP2

Revision

0

Based on method described in BRE Digest 365

## Test 1



### Calculations for pro-rata time to 25% & 75% depths

| Time         | Depth       | Description           |
|--------------|-------------|-----------------------|
| 13           | 0.11        | higher than 25% value |
| <b>13.50</b> | <b>0.09</b> | pro-rata 25%          |
| 15           | 0.02        | lower than 25% value  |
| 2            | 0.27        | higher than 75% value |
| <b>2.75</b>  | <b>0.26</b> | pro-rata 75%          |
| 3            | 0.26        | lower than 75% value  |

Client : The Royal British Legion

Scheme : The Royal British Legion, Llay

Section :

Page 3 of 4

Initials

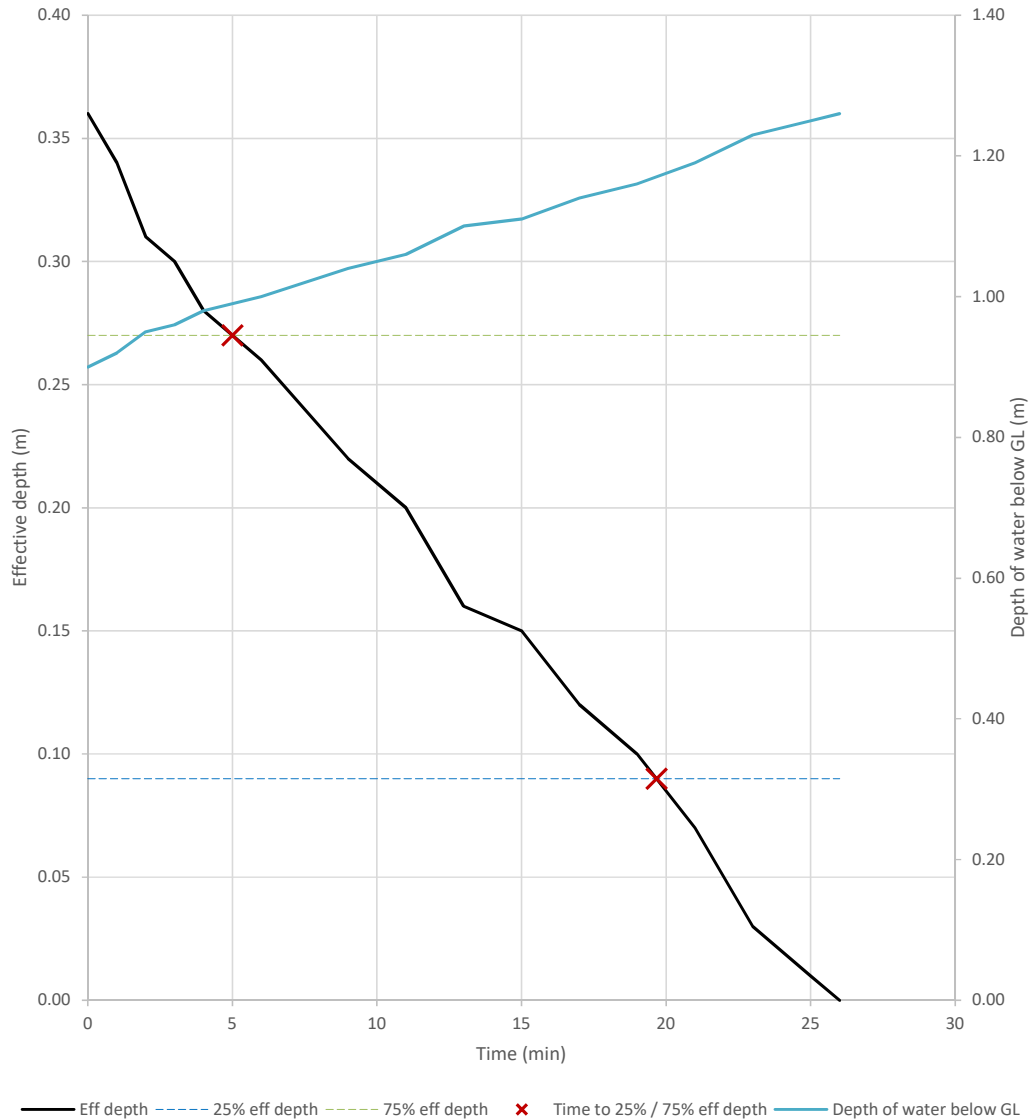
TP2

Revision

0

Based on method described in BRE Digest 365

## Test 2



### Calculations for pro-rata time to 25% & 75% depths

| Time         | Depth       | Description           |
|--------------|-------------|-----------------------|
| 19           | 0.10        | higher than 25% value |
| <b>19.67</b> | <b>0.09</b> | pro-rata 25%          |
| 21           | 0.07        | lower than 25% value  |
| 4            | 0.28        | higher than 75% value |
| <b>5.00</b>  | <b>0.27</b> | pro-rata 75%          |
| 6            | 0.26        | lower than 75% value  |

Client :

The Royal British Legion

Scheme :

The Royal British Legion, Llay

Section :

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Initials

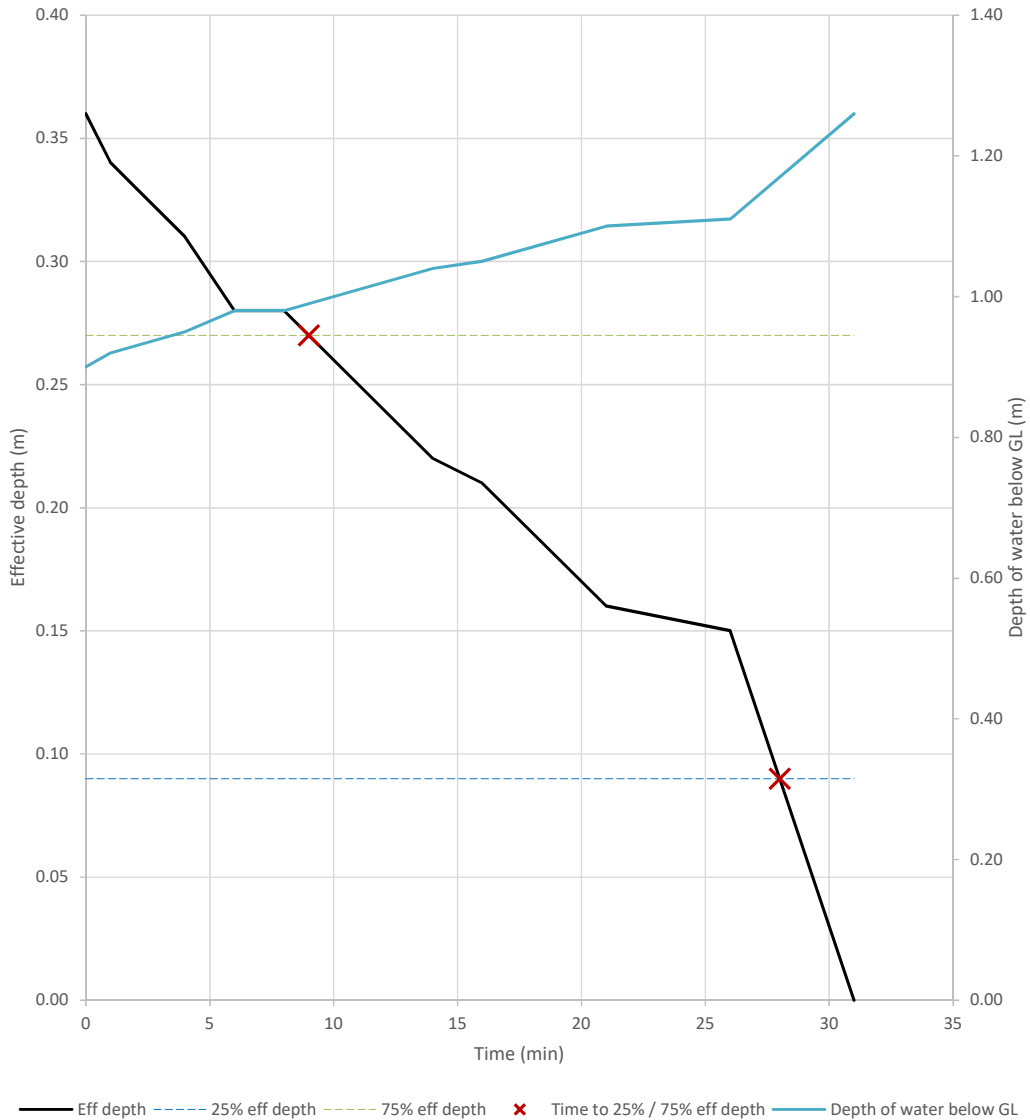
TP2

Revision

0

Based on method described in BRE Digest 365

## Test 3



### Calculations for pro-rata time to 25% & 75% depths

| Time         | Depth       | Description           |
|--------------|-------------|-----------------------|
| 26           | 0.15        | higher than 25% value |
| <b>28.00</b> | <b>0.09</b> | <b>pro-rata 25%</b>   |
| 31           | 0.00        | lower than 25% value  |
| 8            | 0.28        | higher than 75% value |
| <b>9.00</b>  | <b>0.27</b> | <b>pro-rata 75%</b>   |
| 10           | 0.26        | lower than 75% value  |

|              |                                |
|--------------|--------------------------------|
| Client :     | The Royal British Legion       |
| Scheme :     | The Royal British Legion, Llay |
| Section :    |                                |
| Prepared by: | JW                             |
| Checked by:  | JR                             |
| Approved by: | VG                             |

Page 1 of 4

|          |          |
|----------|----------|
| Initials | Revision |
|----------|----------|

TP3

Date: 16-04-2018

Date: 16-04-2018

Date: 16-04-2018

**Based on method described in BRE Digest 365**

[illegible]

### Test pit details

|                                |      |
|--------------------------------|------|
| Stone fill (% voids)           | 100  |
| Length (m)                     | 2.00 |
| Width (m)                      | 0.60 |
| Depth (m)                      | 1.32 |
| Obs tube ht relative to GL (m) | 0.00 |

|      |
|------|
| 100  |
| 2.00 |
| 0.60 |
| 1.32 |
| 0.00 |

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### Infiltration rate calculations

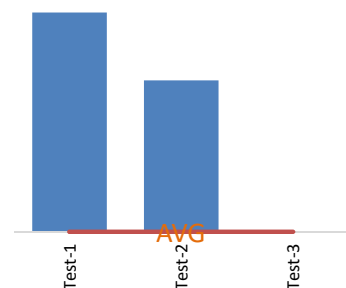
| Infiltration rate calculations |           |
|--------------------------------|-----------|
| Max Eff depth (m)              | 0.32      |
| 25% Eff depth (m)              | 0.08      |
| 75% Eff depth (m)              | 0.24      |
| Time 25% $t_{25}$ (min)        | 75.00     |
| Time 75% $t_{75}$ (min)        | 21.67     |
| Time $t_{p75-25}$ (sec)        | 3200      |
| Drop $H_{75-25}$ (m)           | 0.16      |
| Volume $V_{p75-25}$ ( $m^3$ )  | 0.19      |
| Eff Area $a_{p50}$ ( $m^2$ )   | 2.03      |
| Infiltration rate (m/s)        | 2.953E-05 |

|             |
|-------------|
| 0.37        |
| 0.09        |
| 0.28        |
| 109.55      |
| 25.63       |
| 5035        |
| 0.19        |
| 0.22        |
| 2.16        |
| 🔴 2.039E-05 |

|         |
|---------|
|         |
| #VALUE! |
| #VALUE! |
| #VALUE! |
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| #VALUE! |
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#VALUE!

### Infiltration rate results



Client : The Royal British Legion

Scheme : The Royal British Legion, Llay

Section :

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Initials

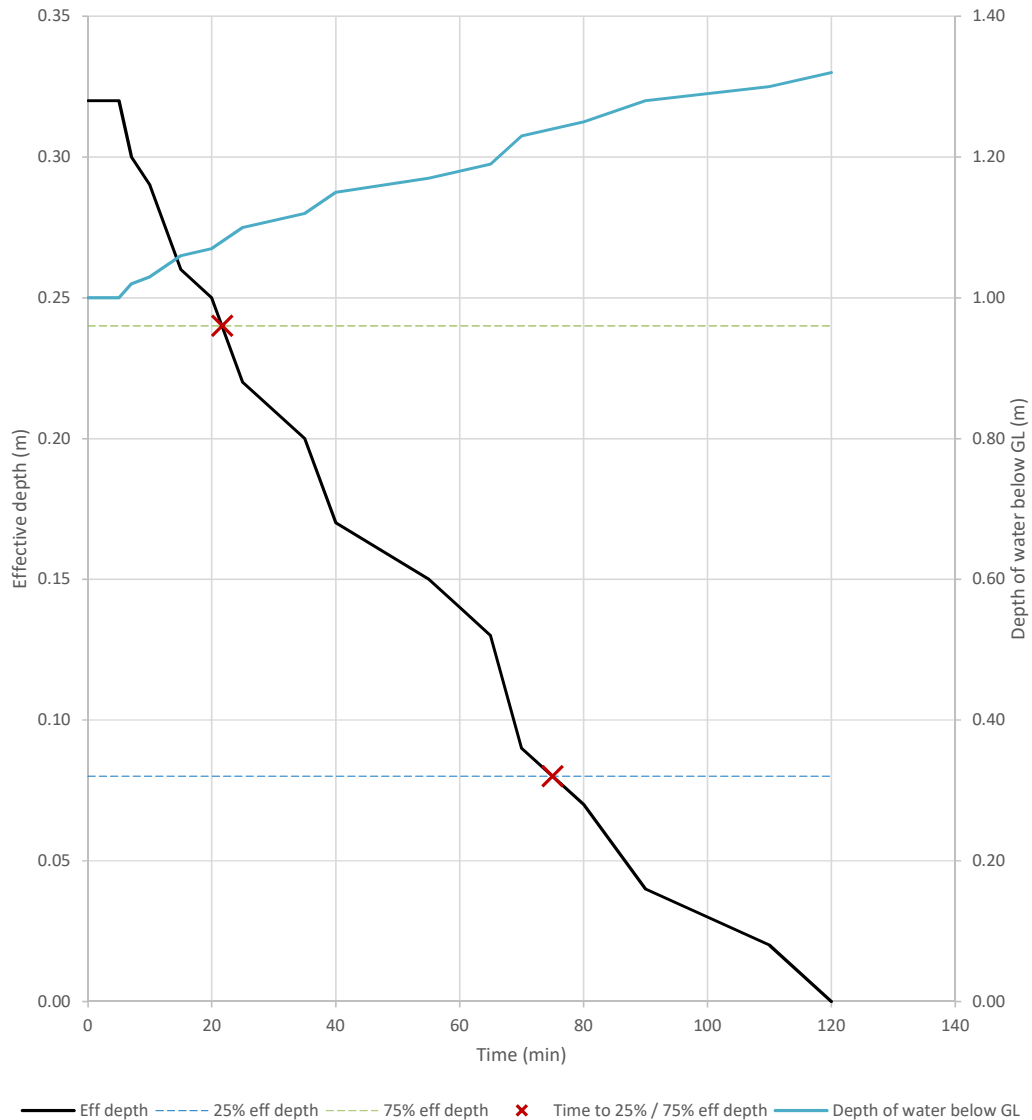
TP3

Revision

0

Based on method described in BRE Digest 365

## Test 1



### Calculations for pro-rata time to 25% & 75% depths

| Time         | Depth       | Description           |
|--------------|-------------|-----------------------|
| 70           | 0.09        | higher than 25% value |
| <b>75.00</b> | <b>0.08</b> | pro-rata 25%          |
| 80           | 0.07        | lower than 25% value  |
| 20           | 0.25        | higher than 75% value |
| <b>21.67</b> | <b>0.24</b> | pro-rata 75%          |
| 25           | 0.22        | lower than 75% value  |

Client :

The Royal British Legion

Scheme :

The Royal British Legion, Llay

Section :

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Initials

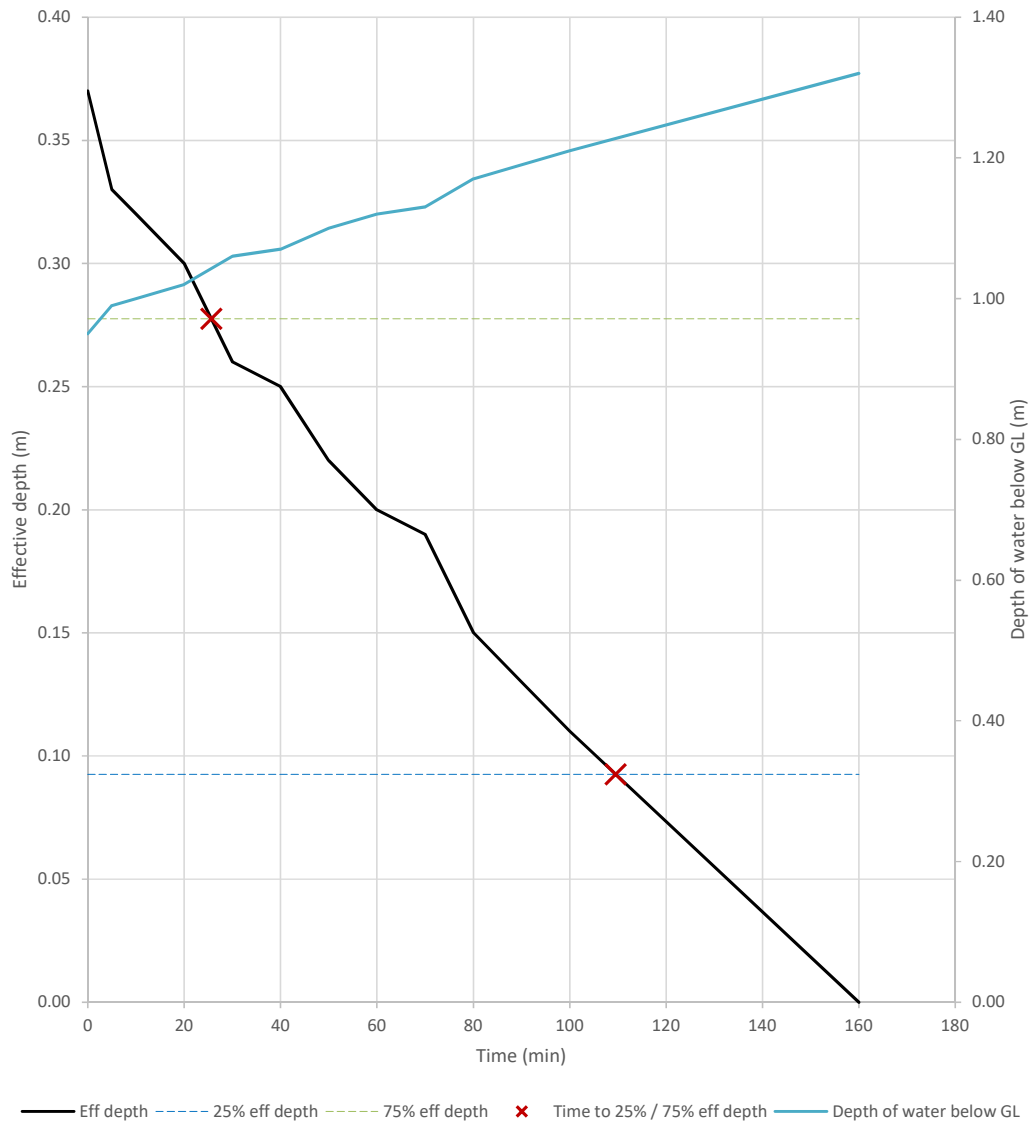
TP3

Revision

0

Based on method described in BRE Digest 365

## Test 2



### Calculations for pro-rata time to 25% & 75% depths

| Time          | Depth       | Description           |
|---------------|-------------|-----------------------|
| 100           | 0.11        | higher than 25% value |
| <b>109.55</b> | <b>0.09</b> | pro-rata 25%          |
| 160           | 0.00        | lower than 25% value  |
| 20            | 0.30        | higher than 75% value |
| <b>25.63</b>  | <b>0.28</b> | pro-rata 75%          |
| 30            | 0.26        | lower than 75% value  |