clarkebond

Addendum to FRA/DS Report (WB03590/FR01 V5)

Inglewood Urban Extension, Paignton

WB03590-TN01(V3.1)

Abacus Projects and Deeley Freed Estates

clarkebond

MULTIDISCIPLINARY ENGINEERING CONSULTANTS

The Cocoa House 129 Cumberland Road Bristol BS1 6UY
tel +44(0) 117 929 2244 fax +44(0) 117 929 3095
email bristol@clarkebond.com web www.clarkebond.com

TECHNICAL NOTE

Project:	**Inglewood Urban Extension**	**WB03590-TN01(V3.1)**
Subject:	Addendum to FRA & Drainage Strategy Report (WB03590 – FR01, V5)	Page 1 of 5
Prepared by	Andy Jenner BEng CEng MICE (Associate Director)	
Approved by	Seymour D'Oyley (Associate Director)	08/03/2018

Introduction

This report is provided for the benefit of the Client. We do not accept responsibility in the event that the report contents are used in whole or in part by a third party and we exercise no duty of care to any such third party.

Abacus Projects and Deeley Freed Estates have appointed Clarkebond to undertake Civil and Structural engineering, including Hydrology and Flood Risk Assessments for a development at White Rock adjacent to the A3022 Brixham Road in Paignton.

The development proposals have been submitted for Outline Planning and as part of the consultation process comments have been received in respect of the Drainage Strategy requiring further clarification as to the design parameters employed.

Version 1 of this Technical Note was submitted and received general approval, however the Planning Authority have insisted on soakaway testing in accordance with BRE Digest 365 which some of the original testing did not accord with. This additional testing has been completed and this Technical Note has been amended to reflect the additional information and the recently revised masterplan.

Soakaway Testing

Soakaway testing has been undertaken on three separate occasions and in a variety of locations. The locations are illustrated in Appendix A, and the detailed results provided in Appendix B. Table 1 below summarises the findings at all locations:

Table 1 - Soakaway Results

Test Reference	Date of Test	Depth of Test (m bgl)	Corresponding Strata	Infiltration Rate (m/s)			
				Test 1	Test 2	Test 3	Minimum
TP1	20/09/16	1.10	Saltern Cove - Mudstone	8.45E-05			8.45E-05
TP2	20/09/16	2.20	Saltern Cove - Mudstone	3.66E-06			3.66E-06
TP3	20/09/16	2.20	Saltern Cove - Mudstone	8.87E-05			8.87E-05
TP4	20/09/16	2.00	Saltern Cove - Mudstone	1.14E-05			1.14E-05
TP5	20/09/16	1.90	Brixham Limestone	2.34E-05			2.34E-05
TP6	20/09/16	2.70	Saltern Cove - Mudstone	2.06E-05			2.06E-05
TP8	20/09/16	2.50	Saltern Cove - Mudstone	7.04E-05	4.13E-05	3.94E-05	3.94E-05
TP9	20/09/16	1.10	Brixham Limestone	4.98E-05	3.43E-05	1.04E-03	3.43E-05
TP101	19/04/17	2.20	Brixham Limestone	7.94E-05	1.02E-04	8.09E-05	7.94E-05
TP102	19/04/17	2.40	Saltern Cove - Mudstone	3.61E-05	3.04E-05		3.04E-05
TP103	19/04/17	1.10	Brixham Limestone	4.07E-04	4.47E-04	3.63E-04	3.63E-04
TP104	19/04/17	1.90	Brixham Limestone	5.49E-05	5.87E-05	3.46E-05	3.46E-05
TP202	12/02/18	1.80	Brixham Limestone	3.27E-05	2.93E-05	3.23E-05	2.93E-05
TP203	12/02/18	1.80	Brixham Limestone	4.80E-05	2.38E-05	2.08E-05	2.08E-05
TP206	21/02/18	2.50	Saltern Cove - Mudstone	9.78E-05	8.15E-05	7.16E-05	7.16E-05
TP210	21/02/18	2.00	Saltern Cove - Mudstone	4.46E-05	3.05E-05	2.66E-05	2.66E-05

These values are all compatible with soakaway design and soakaway drainage.

clarkebond

MULTIDISCIPLINARY ENGINEERING CONSULTANTS

The Cocoa House 129 Cumberland Road Bristol BS1 6UY
tel +44(0) 117 929 2244 fax +44(0) 117 929 3095
email bristol@clarkebond.com web www.clarkebond.com

TECHNICAL NOTE

Project:	**Inglewood Urban Extension**	**WB03590-TN01(V3.1)**
Subject:	Addendum to FRA & Drainage Strategy Report (WB03590 – FR01, V5)	Page 2 of 5
Prepared by	Andy Jenner BEng CEng MICE (Associate Director)	
Approved by	Seymour D'Oyley (Associate Director)	08/03/2018

Figure 1, below, illustrates the current outline masterplan.

Figure 1 - Drainage Masterplan

Drainage Strategy

The drainage strategy is outlined in the FRA, but as a summary the site is designed based on the test results available to drain in 4 basic ways:

- To on plot individual soakaways in areas of good percolation;
- To communal on plot soakaways in areas of good percolation but where plot densities prevent soakaways being sited more than 5m adjacent buildings;
- To a communal soakaway structure (underground) where the plots are not located in areas of good percolation with separate structures for the residential development and the adopted highways to allow adoption of the highway drainage; and
- By attenuation to the existing surface water drainage system in areas where there is inadequate percolation and topography prevents drainage to a soakaway basin in a more favourable location

clarkebond

MULTIDISCIPLINARY ENGINEERING CONSULTANTS

The Cocoa House 129 Cumberland Road Bristol BS1 6UY
tel +44(0) 117 929 2244 fax +44(0) 117 929 3095
email bristol@clarkebond.com web www.clarkebond.com

TECHNICAL NOTE

Project:	**Inglewood Urban Extension**	**WB03590-TN01(V3.1)**
Subject:	Addendum to FRA & Drainage Strategy Report (WB03590 – FR01, V5)	
Prepared by	Andy Jenner BEng CEng MICE (Associate Director)	
Approved by	Seymour D'Oyley (Associate Director)	08/03/2018

Changes to Original Drainage Strategy (FRA & Drainage Strategy Report WB03590 – FR01, V5)

The strategy has been changed in detail but not in principle; there are still areas where individual on-plot soakaways are feasible but some of the areas where the preliminary testing showed good rates have turned out to be lower from the additional percolation tests and revised percolation factors obtained in the latest tests.

The 2 underground soakaway structures (previously identified as infiltration basins) are to be re-sited to new locations. The residential underground soakaway structure is to be re-sited circa TP210 and the highway underground soakaway structure is to be re-sited either in the corner of the same field on the opposite side of the hedge to TP202 or circa TP9. The percolation rate is consistent with the lower of these two locations. These soakaway structures will not change the existing gradients and topography of the field where they are to be sited.

Soakaways have been designed using Micro Drainage WinDes, and the full results are contained within Appendix C.

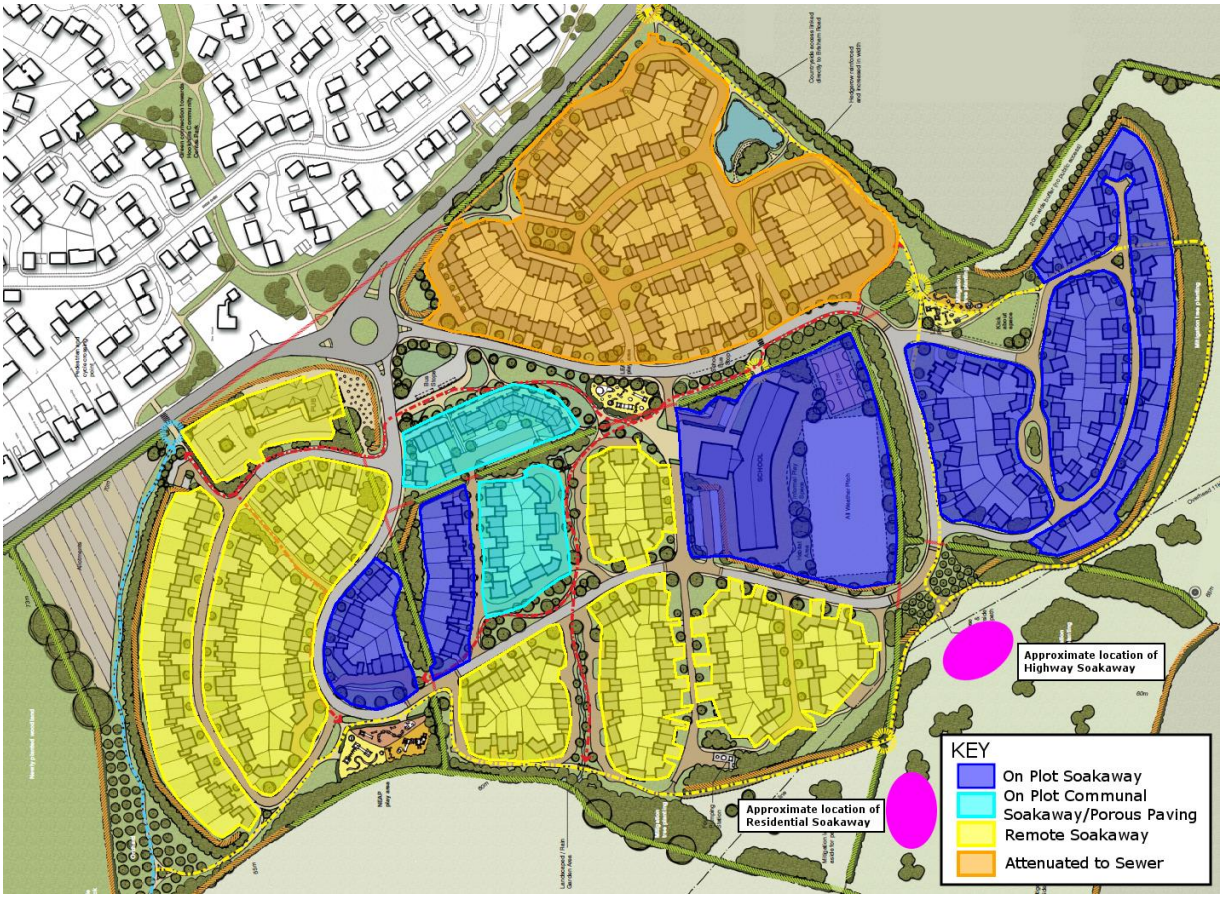


Figure 2 - Drainage Masterplan

Area 1 represents the areas of the site where on plot soakaways are considered viable. The preliminary design adopts a percolation factor of 3.43×10^{-5}m/s, being the minimum of the measured

clarkebond

MULTIDISCIPLINARY ENGINEERING CONSULTANTS

The Cocoa House 129 Cumberland Road Bristol BS1 6UY
tel +44(0) 117 929 2244 fax +44(0) 117 929 3095
email bristol@clarkebond.com web www.clarkebond.com

TECHNICAL NOTE

percolation rates in TPs; 8, 9, 101, 103, 104, 206. The individual plots have been designed on the basis of 90m^2 per plot. No allowance has been made for base percolation in line with the recommendations in BRE Digest 365 and to further ensure a conservative design is utilised a factor of safety of 2 has been applied to the side percolation rate. A crate soakaway measuring 4.2m x 2.4m x 0.61m has been shown to have adequate performance.

The school plot in the centre of the site adopts a percolation factor of 2.08x10^{-5}m/s in the design, being the lower of the rates observed in TPs: 3, 104 and 203. The plot has been designed on the basis of 4570m^2 based on the indicative layout and no allowance has been made for base percolation in line with the recommendations in BRE Digest 365 and to further ensure a conservative design is utilised a factor of safety of 2 has been applied to the side percolation rate. A crate soakaway of 14.6m x 12.8m x 1.22m has been shown to have adequate performance.

The remote soakaway structure for the residential areas adopts a percolation factor of 2.66x10^{-5}m/s in the design, being the rate observed at TP210 in the vicinity of the proposed remote structure. The impermeable area draining to this structure is estimated to be 14060m^2 based on an allowance of 90m^2 per plot and a potential 142 plots plus a 10% allowance. Base and side percolation have been included in the design as appropriate to the type of structure, however to ensure that a conservative design is prepared a factor of safety of 5 has been applied to the base and side percolation. The structure is sized to provide a base area of 912m^2 (20m x 45.6m) and a height of 1.32m. The location of this structure has a prevailing ground level of 56m and the assumed invert level of 54m is consistent with the test depth of 2.0m. Half drain time in the 100 year + 40% Climate Change storm is estimated to be 1723 minutes which is marginally in excess of the BRE Digest 365 recommended 1440 minutes. However BRE Digest 365 notes that achieving the 1440 minute half drain time for the 100 year events is unlikely to be possible. In the 10 year event the half drain time is 674 minutes well within the recommendations.

The remote soakaway structure for the adopted highway utilises a percolation factor of 2.93x10^{-5}m/s in the design, being the rate observed at TP202 in the vicinity of the proposed remote structure. The impermeable area draining to this structure is estimated to be 18690m^2. Base and side percolation have been included in the design as appropriate to the type of structure, however to ensure that a conservative design is prepared, a factor of safety of 5 has been applied to the base and side percolation. The structure is sized to provide a base area of 1210.88m^2 (35.2m x 34.4m) and a height of 1.32m. The location of this structure has a prevailing ground level of 65m and the assumed invert level of 63.2m is consistent with the test depth of 1.8m. Half-drain time in the 100 year + 40% Climate Change storm is 1575 minutes which is marginally in excess of the BRE Digest 365 recommended 1440 minutes. However BRE Digest 365 notes that achieving the 1440 minute half drain time for the 100 year events is unlikely to be possible. In the 10 year event the half drain time is 601 minutes well within the recommendations.

The remaining area of the site is situated in a region where the observed percolation rates are not suitable for percolation drainage and where the prevailing topography prevents draining to a remote basin. In these areas it is proposed to drain the development impermeable area to the adjoining public sewer with an attenuated discharge rate with a suitable attenuation basin.

clarkebond

MULTIDISCIPLINARY ENGINEERING CONSULTANTS

The Cocoa House 129 Cumberland Road Bristol BS1 6UY
tel +44(0) 117 929 2244 fax +44(0) 117 929 3095
email bristol@clarkebond.com web www.clarkebond.com

TECHNICAL NOTE

Project:	**Inglewood Urban Extension**	**WB03590-TN01(V3.1)**
Subject:	Addendum to FRA & Drainage Strategy Report (WB03590 – FR01, V5)	
Prepared by	Andy Jenner BEng CEng MICE (Associate Director)	
Approved by	Seymour D'Oyley (Associate Director)	08/03/2018

The estimation of the Greenfield runoff rate is presented in Appendix D. In summary the Micro Drainage WinDes modelling estimates that the 1:10 year Greenfield runoff rate is 4.8l/s/ha.

The area drained through the attenuation basin amounts to circa 107 plots based on the current masterplan plus 610m of highway assumed to be 2 no. 2.0m footways plus a 5.5m carriageway amounting to 5795m^2. Therefore the total impermeable area amounts to 107 plots at an assumed 90m^2/plot plus the highway making a total of 15425m^2.

Based on 4.8l/s/ha as a limiting runoff; the total estimated area of 15425m^2 should be limited to 7.4l/s. A Quick Store estimate suggests that a total attenuation of 1132m^3 – 1653m^3.

The pond provides 744m^3 of storage; in addition the underground attenuation tank provides around 679m^3 bringing the total volume of attenuation to 1423m^3 being just over the median of the potential storage range. When coupled with in network storage it should be possible to provide sufficient attenuation.

clarkebond

MULTIDISCIPLINARY ENGINEERING CONSULTANTS

The Cocoa House 129 Cumberland Road Bristol BS1 6UY
tel +44(0) 117 929 2244 fax +44(0) 117 929 3095
email bristol@clarkebond.com web www.clarkebond.com

TECHNICAL NOTE

Project:	**Inglewood Urban Extension**	**WB03590-TN01(V3.1)**
Subject:	TN01 - Drainage Strategy	
Prepared by	Andy Jenner BEng CEng MICE (Associate Director)	
Approved by	Seymour D'Oyley (Associate Director)	07/03/2018

Appendix A

Trial Pit Locations

CDM RESIDUAL RISKS

The work shown on this drawing is both familiar to the designers and routinely safely built in similar circumstances by competent contractors.

Risks are not considered significant.

Relevant data is included in the Pre-Construction Information Pack

Signed: .. Date: .....

DO NOT SCALE THIS DRAWING FOR CONSTRUCTION PURPOSES.

CONTRACTOR TO CHECK ALL DIMENSIONS AND REPORT ALL ERRORS AND OMISSIONS TO THE ENGINEER

N

TP1
TP2
TP3
TP4
TP5
TP6
TP7
TP8
TP9
TP101
TP102
TP103
TP104

Trial Pit Location

0 50 100 200

SCALE 1:2000 (A3) METRES

Rev	Detail	By	Chk	Date
*	PRELIMINARY FIRST ISSUE.	..	..	.....

Revisions

Client: Deeley Freed Estates Ltd

Project: Inglewood, Paignton

Drawing Status: Final

clarkebond
MULTIDISCIPLINARY ENGINEERING CONSULTANTS

The Cocoa House
129 Cumberland Road
Bristol BS1 6UY
tel +44 (0) 117 929 2244
fax +44 (0) 117 929 3095
e-mail bristol@clarkebond.com
web www.clarkebond.com

Bristol Exeter London

Drawing Title: Exploratory Hole Location Plan For 2016 and 2017

Project No.	Discipline	Drawing No.
WB0590	G	SK1

Scale	Date	Revision
1:2000	Feb 18	*

Drawn	Checked	Sheet Size
HG	AG	A3

CDM RESIDUAL RISKS

The work shown on this drawing is both familiar to the designers and routinely safely built in similar circumstances by competent contractors.

Risks are not considered significant.

Relevant data is included in the Pre-Construction Information Pack

Signed: .. Date: .....

DO NOT SCALE THIS DRAWING FOR CONSTRUCTION PURPOSES.

CONTRACTOR TO CHECK ALL DIMENSIONS AND REPORT ALL ERRORS AND OMISSIONS TO THE ENGINEER

TP207
TP206
TP201
TP204
TP205
TP208
TP202
TP203
TP209
TP210
TP211

Trial Pit Location

0 50 100 200

SCALE 1:2000 (A3) METRES

Rev	Detail	By	Chk	Date
*	PRELIMINARY FIRST ISSUE.	..	..	.....

Revisions

Client: Deeley Freed Estates Ltd

Project: Inglewood, Paignton

Drawing Status: Final

clarkebond
MULTIDISCIPLINARY ENGINEERING CONSULTANTS
The Cocoa House
129 Cumberland Road
Bristol BS1 6UY
tel +44 (0) 117 929 2244
fax +44 (0) 117 929 3095
e-mail bristol@clarkebond.com
web www.clarkebond.com
Bristol Exeter London

Drawing Title: Exploratory Hole Location Plan For 2018

Project No.	Discipline	Drawing No.
WB0590	G	SK2

Scale	Date	Revision
1:2000	Feb 18	*

Drawn	Checked	Sheet Size
HG	AG	A3

DWG INFO: M:\CLARKEBOND UK LIMITED\BRISTOL PROJECTS\WB03590 - WHITE ROCK 2 URBAN EXTENSION\DRAWINGS\CURRENT\WB03590-3.1-EHLP 2018 PROPOSED

clarkebond

MULTIDISCIPLINARY ENGINEERING CONSULTANTS

The Cocoa House 129 Cumberland Road Bristol BS1 6UY
tel +44(0) 117 929 2244 fax +44(0) 117 929 3095
email bristol@clarkebond.com web www.clarkebond.com

TECHNICAL NOTE

Project:	**Inglewood Urban Extension**	**WB03590-TN01(V3.1)**
Subject:	TN01 - Drainage Strategy	
Prepared by	Andy Jenner BEng CEng MICE (Associate Director)	
Approved by	Seymour D'Oyley (Associate Director)	07/03/2018

Appendix B

Soakaway Results

clarkebond

SOIL INFILTRATION RATE TEST

(B.R.E. Digest 365, 1991, Soakaway Design)

Site:	Inglewood, Paignton
Job Number:	WB03590
Date of Test:	20/09/16

Trial Pit Number:	TP1
Length (m):	2.00
Width (m):	0.45
Depth (mbegl):	1.10
Groundwater Depth# (mbegl):	

#: not used in calculations but ensure > pit base

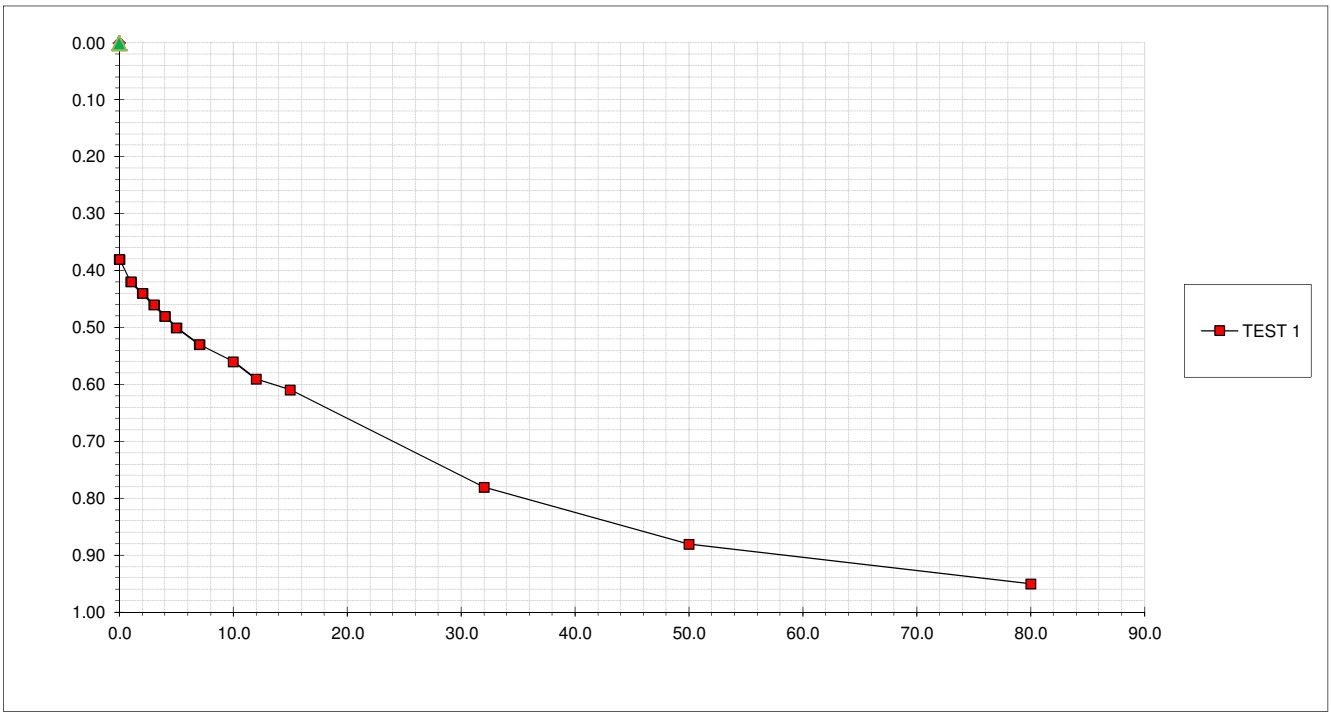
Remarks -

One fill only due to water and distance constraints

TEST 1		TEST 2		TEST 3	
Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
0	0.38				
1	0.42				
2	0.44				
3	0.46				
4	0.48				
5	0.50				
7	0.53				
10	0.56				
12	0.59				
15	0.61				
32	0.78				
50	0.88				
80	0.95				

		TEST 1	TEST 2	TEST 3
Effective Storage Depth	m	0.72		
75% Effective Storage Depth	m	0.54		
(i.e. depth below GL)	m	0.56		
25% Effective Storage Depth	m	0.18		
(i.e. depth below GL)	m	0.92		
Effective Storage Depth 75%-25%	m	0.36		
Time to fall to 75% effective depth	mins	10		
Time to fall to 25% effective depth	mins	34		
V (75%-25%)	m3	0.32		
a (50%)	m2	2.66		
t (75%-25%)	mins	24.00		
SOIL INFILTRATION RATE	m/s	**8.45E-05**		

DESIGN SOIL INFILTRATION RATE, f **8.45E-05 m/s**



clarkebond

SOIL INFILTRATION RATE TEST

(B.R.E. Digest 365, 1991, Soakaway Design)

Site:	Inglewood, Paignton
Job Number:	WB03590
Date of Test:	20/09/16

Trial Pit Number:	TP2
Length (m):	2.00
Width (m):	0.45
Depth (mbegl):	2.20
Groundwater Depth# (mbegl):	

#: not used in calculations but ensure > pit base

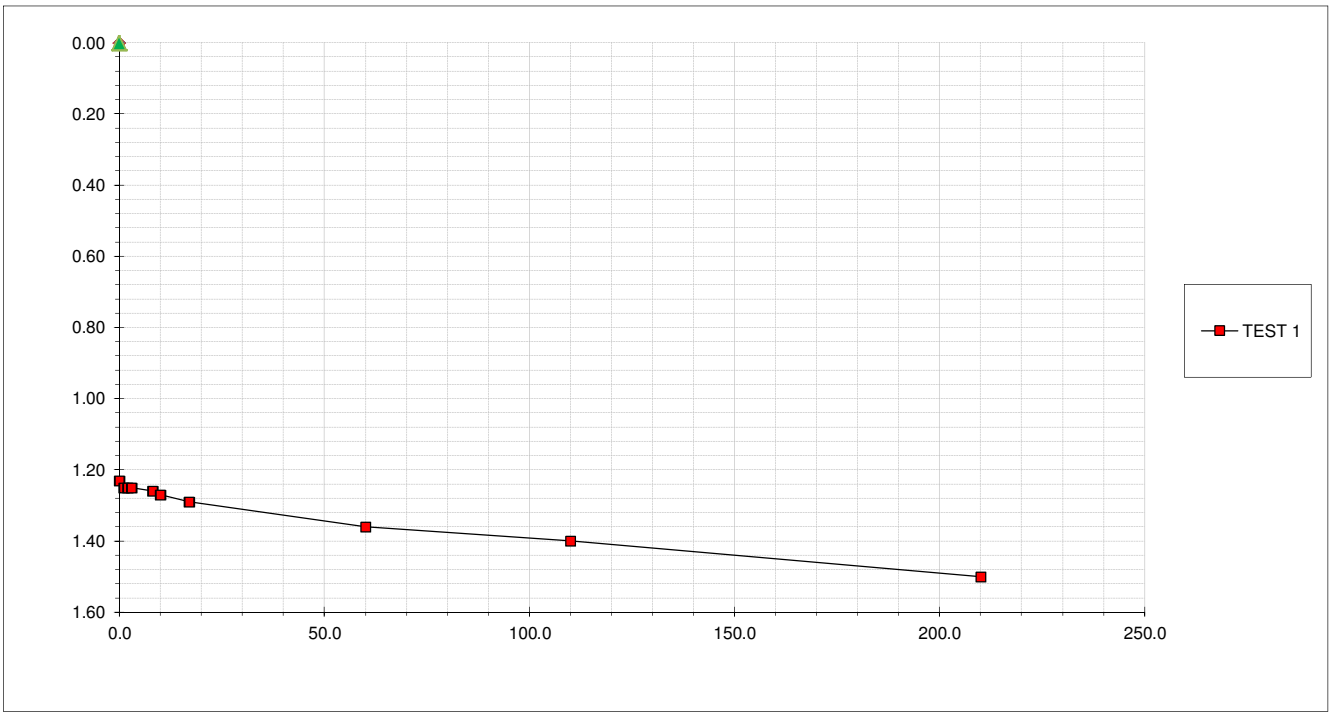
Remarks -

One fill only due to slow infiltration rates

TEST 1		TEST 2		TEST 3	
Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
0	1.23				
1	1.25				
2	1.25				
3	1.25				
8	1.26				
10	1.27				
17	1.29				
60	1.36				
110	1.40				
210	1.50				

		TEST 1	TEST 2	TEST 3
Effective Storage Depth	m	0.97		
75% Effective Storage Depth	m	0.73		
(i.e. depth below GL)	m	1.47		
25% Effective Storage Depth	m	0.24		
(i.e. depth below GL)	m	1.96		
Effective Storage Depth 75%-25%	m	0.49		
Time to fall to 75% effective depth	mins	201		
Time to fall to 25% effective depth	mins	807		
V (75%-25%)	m3	0.44		
a (50%)	m2	3.28		
t (75%-25%)	mins	606.25		
SOIL INFILTRATION RATE	m/s	**3.66E-06**		

DESIGN SOIL INFILTRATION RATE, f **3.66E-06 m/s**



clarkebond

SOIL INFILTRATION RATE TEST

(B.R.E. Digest 365, 1991, Soakaway Design)

Site:	Inglewood, Paignton
Job Number:	WB03590
Date of Test:	20/09/16

Trial Pit Number:	TP3
Length (m):	2.20
Width (m):	0.45
Depth (mbegl):	2.20
Groundwater Depth# (mbegl):	

#: not used in calculations but ensure > pit base

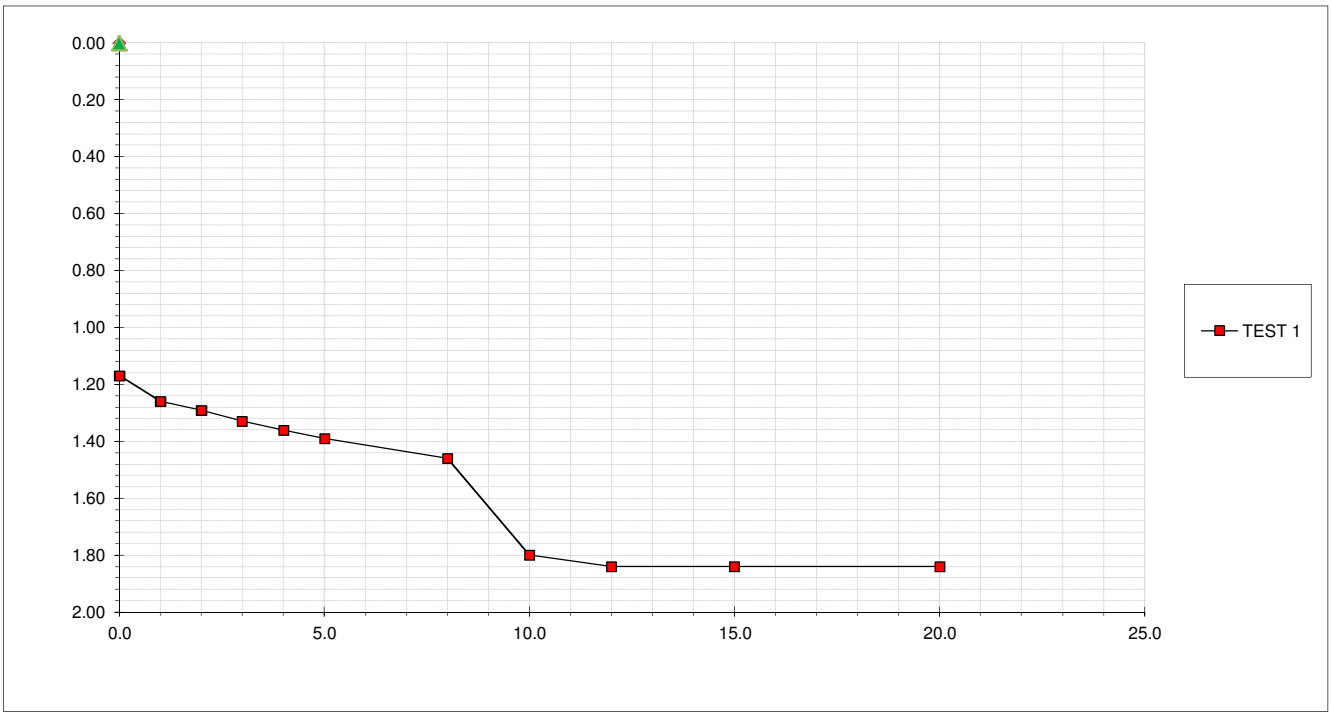
Remarks -

Fissure opened in the base of the pit. Further soakaway testing

TEST 1		TEST 2		TEST 3	
Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
0	1.17				
1	1.26				
2	1.29				
3	1.33				
4	1.36				
5	1.39				
8	1.46				
10	1.80				
12	1.84				
15	1.84				
20	1.84				

		TEST 1	TEST 2	TEST 3
Effective Storage Depth	m	1.03		
75% Effective Storage Depth	m	0.77		
(i.e. depth below GL)	m	1.43		
25% Effective Storage Depth	m	0.26		
(i.e. depth below GL)	m	1.94		
Effective Storage Depth 75%-25%	m	0.52		
Time to fall to 75% effective depth	mins	-9		
Time to fall to 25% effective depth	mins	17		
V (75%-25%)	m3	0.51		
a (50%)	m2	3.72		
t (75%-25%)	mins	25.75		
SOIL INFILTRATION RATE	m/s	**8.87E-05**		

DESIGN SOIL INFILTRATION RATE, f **8.87E-05 m/s**



clarkebond

SOIL INFILTRATION RATE TEST

(B.R.E. Digest 365, 1991, Soakaway Design)

Site:	Inglewood, Paignton
Job Number:	WB03590
Date of Test:	20/09/16

Trial Pit Number:	TP4
Length (m):	2.00
Width (m):	0.45
Depth (mbegl):	2.00
Groundwater Depth# (mbegl):	

#: not used in calculations but ensure > pit base

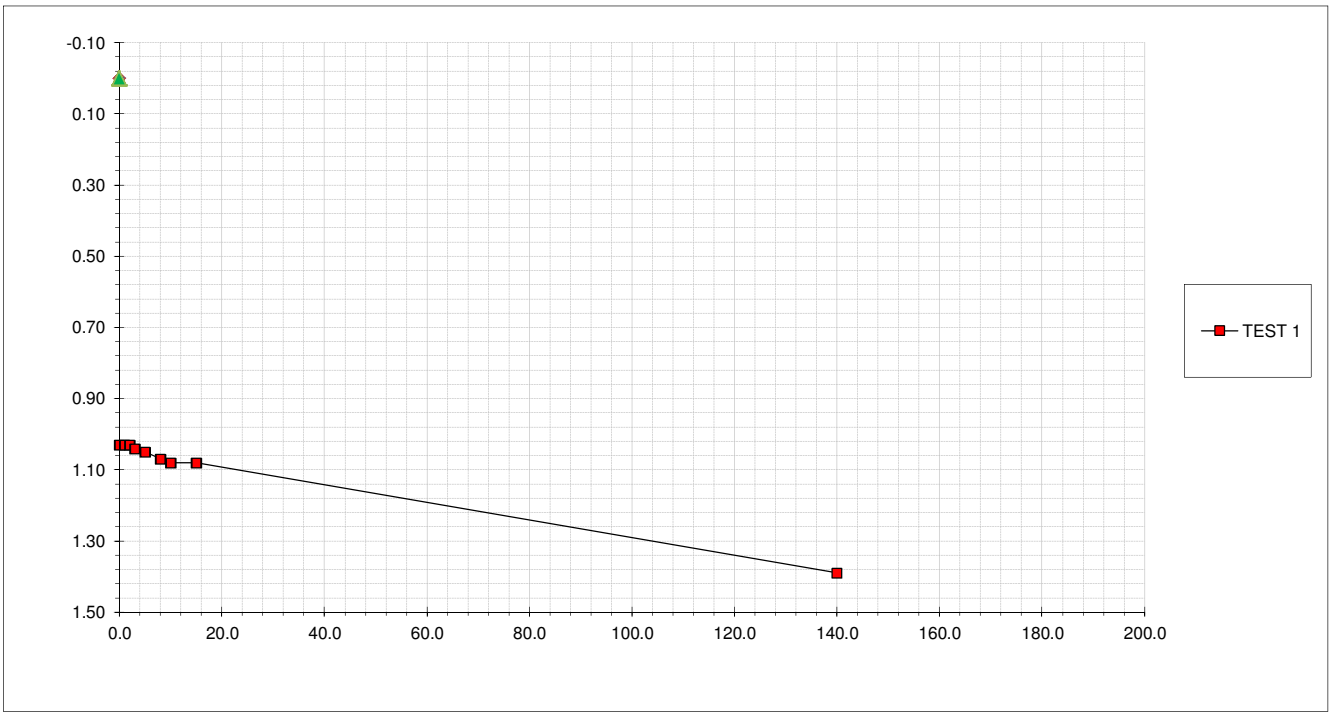
Remarks -

One fill only due to time constraints

TEST 1		TEST 2		TEST 3	
Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
0	1.03				
1	1.03				
2	1.03				
3	1.04				
5	1.05				
8	1.07				
10	1.08				
15	1.08				
140	1.39				

		TEST 1	TEST 2	TEST 3
Effective Storage Depth	m	0.97		
75% Effective Storage Depth	m	0.73		
(i.e. depth below GL)	m	1.27		
25% Effective Storage Depth	m	0.24		
(i.e. depth below GL)	m	1.76		
Effective Storage Depth 75%-25%	m	0.49		
Time to fall to 75% effective depth	mins	93		
Time to fall to 25% effective depth	mins	288		
V (75%-25%)	m3	0.44		
a (50%)	m2	3.28		
t (75%-25%)	mins	195.56		
SOIL INFILTRATION RATE	m/s	**1.14E-05**		

DESIGN SOIL INFILTRATION RATE, f **1.14E-05 m/s**



clarkebond

SOIL INFILTRATION RATE TEST

(B.R.E. Digest 365, 1991, Soakaway Design)

Site:	Inglewood, Paignton
Job Number:	WB03590
Date of Test:	20/09/16

Trial Pit Number:	TP5
Length (m):	2.00
Width (m):	0.45
Depth (mbegl):	1.90
Groundwater Depth# (mbegl):	

#: not used in calculations but ensure > pit base

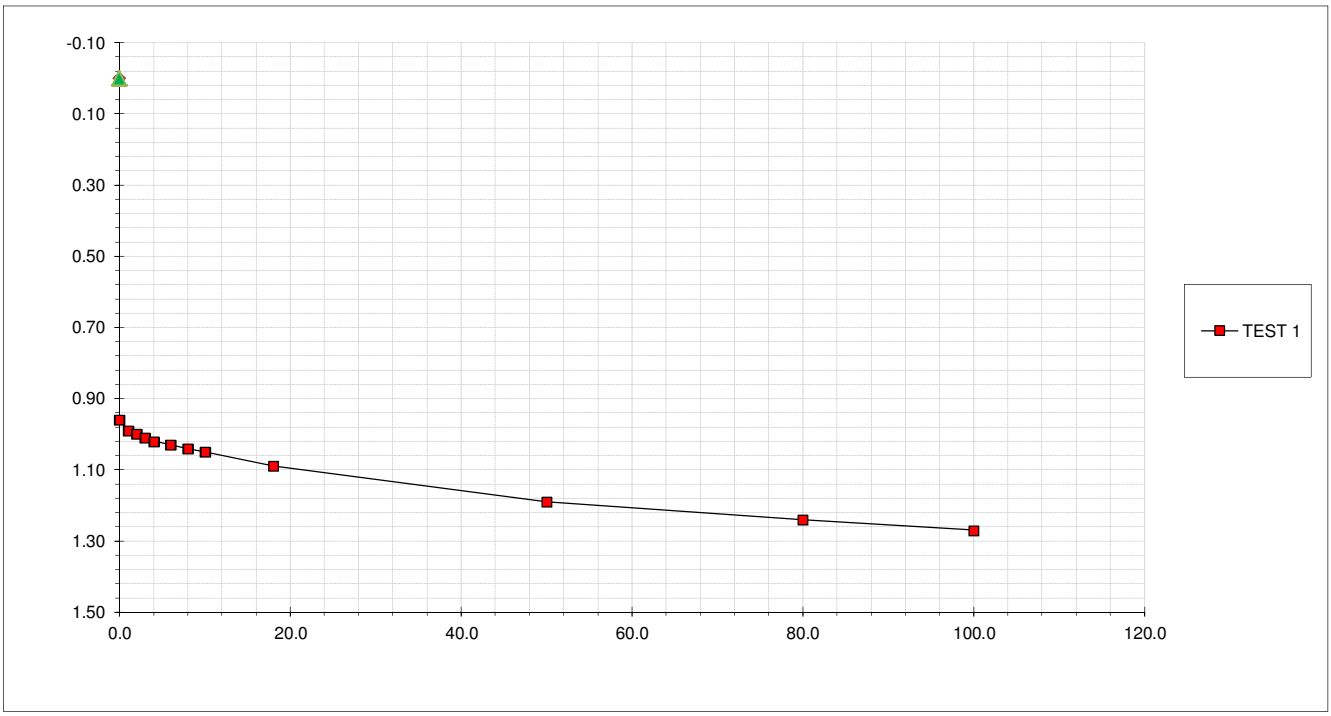
Remarks -

One fill only due to time contraints

TEST 1		TEST 2		TEST 3	
Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
0	0.96				
1	0.99				
2	1.00				
3	1.01				
4	1.02				
6	1.03				
8	1.04				
10	1.05				
18	1.09				
50	1.19				
80	1.24				
100	1.27				

		TEST 1	TEST 2	TEST 3
Effective Storage Depth	m	0.94		
75% Effective Storage Depth	m	0.71		
(i.e. depth below GL)	m	1.20		
25% Effective Storage Depth	m	0.24		
(i.e. depth below GL)	m	1.67		
Effective Storage Depth 75%-25%	m	0.47		
Time to fall to 75% effective depth	mins	39		
Time to fall to 25% effective depth	mins	133		
V (75%-25%)	m3	0.42		
a (50%)	m2	3.20		
t (75%-25%)	mins	94.00		
SOIL INFILTRATION RATE	m/s	**2.34E-05**		

DESIGN SOIL INFILTRATION RATE, f **2.34E-05 m/s**



clarkebond

SOIL INFILTRATION RATE TEST

(B.R.E. Digest 365, 1991, Soakaway Design)

Site:	Inglewood, Paignton
Job Number:	WB03590
Date of Test:	20/09/16

Trial Pit Number:	TP6
Length (m):	2.00
Width (m):	0.45
Depth (mbegl):	2.70
Groundwater Depth# (mbegl):	

#: not used in calculations but ensure > pit base

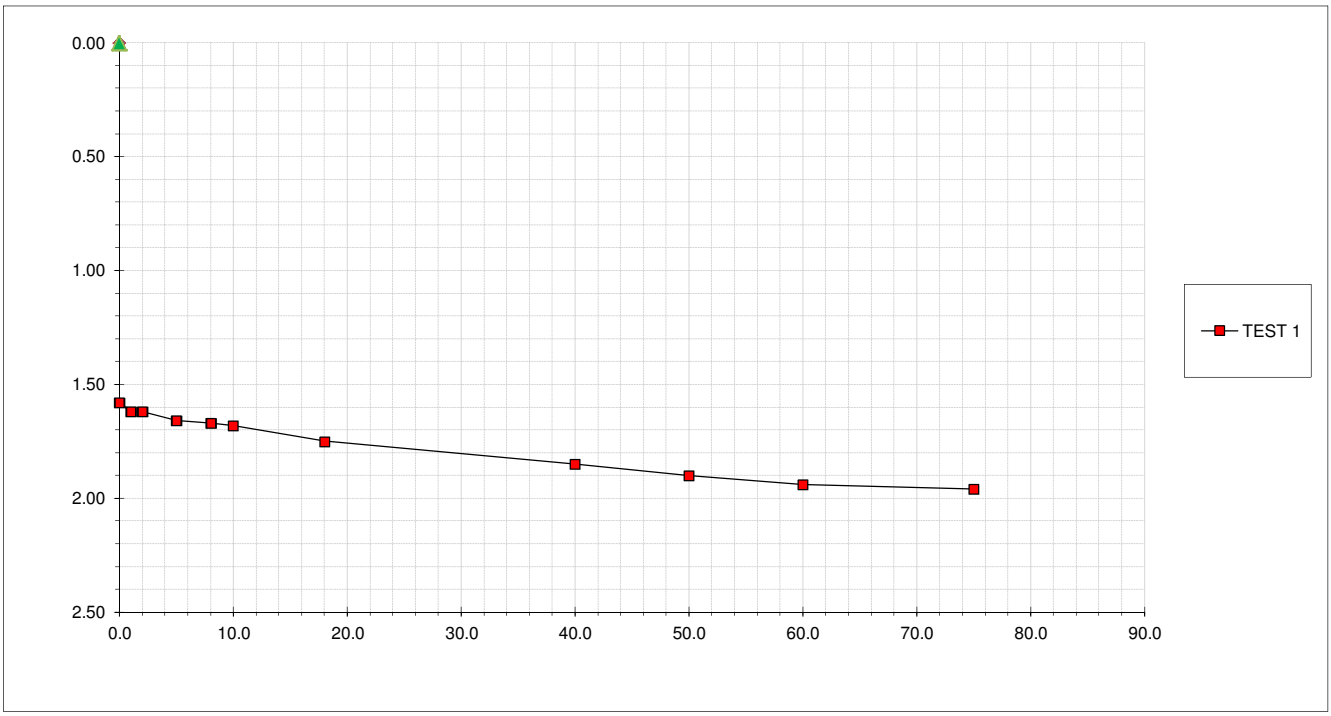
Remarks -

One fill only due to time constraints

TEST 1		TEST 2		TEST 3	
Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
0	1.58				
1	1.62				
2	1.62				
5	1.66				
8	1.67				
10	1.68				
18	1.75				
40	1.85				
50	1.90				
60	1.94				
75	1.96				

		TEST 1	TEST 2	TEST 3
Effective Storage Depth	m	1.12		
75% Effective Storage Depth	m	0.84		
(i.e. depth below GL)	m	1.86		
25% Effective Storage Depth	m	0.28		
(i.e. depth below GL)	m	2.42		
Effective Storage Depth 75%-25%	m	0.56		
Time to fall to 75% effective depth	mins	42		
Time to fall to 25% effective depth	mins	154		
V (75%-25%)	m3	0.50		
a (50%)	m2	3.64		
t (75%-25%)	mins	112.00		
SOIL INFILTRATION RATE	m/s	**2.06E-05**		

DESIGN SOIL INFILTRATION RATE, f **2.06E-05 m/s**



clarkebond

SOIL INFILTRATION RATE TEST

(B.R.E. Digest 365, 1991, Soakaway Design)

Site:	Inglewood, Paignton
Job Number:	WB03590
Date of Test:	20/09/16

Trial Pit Number:	TP8
Length (m):	2.30
Width (m):	0.45
Depth (mbegl):	2.50
Groundwater Depth# (mbegl):	

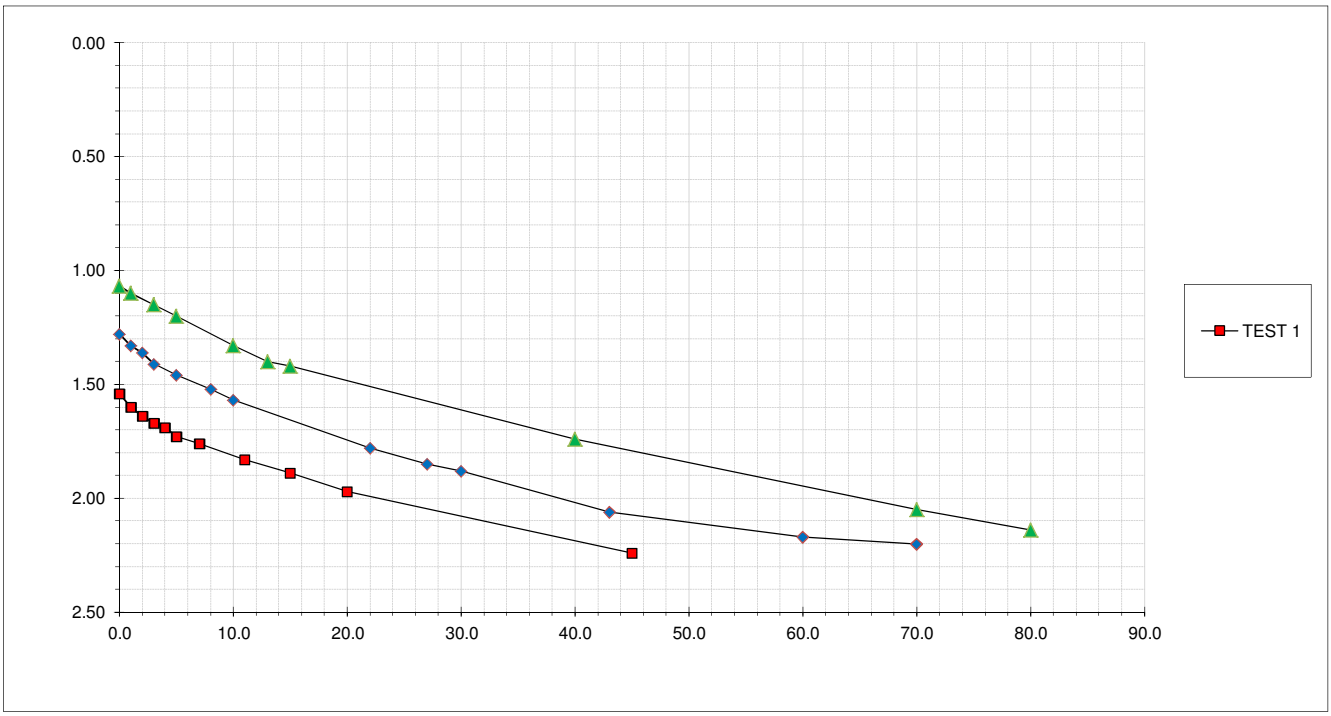
#: not used in calculations but ensure > pit base

Remarks -

TEST 1		TEST 2		TEST 3	
Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
0	1.54	0	1.28	0	1.07
1	1.60	1	1.33	1	1.10
2	1.64	2	1.36	3	1.15
3	1.67	3	1.41	5	1.20
4	1.69	5	1.46	10	1.33
5	1.73	8	1.52	13	1.40
7	1.76	10	1.57	15	1.42
11	1.83	22	1.78	40	1.74
15	1.89	27	1.85	70	2.05
20	1.97	30	1.88	80	2.14
45	2.24	43	2.06		
		60	2.17		
		70	2.20		

		TEST 1	TEST 2	TEST 3
Effective Storage Depth	m	0.96	1.22	1.43
75% Effective Storage Depth	m	0.72	0.92	1.07
(i.e. depth below GL)	m	1.78	1.59	1.43
25% Effective Storage Depth	m	0.24	0.31	0.36
(i.e. depth below GL)	m	2.26	2.20	2.14
Effective Storage Depth 75%-25%	m	0.48	0.61	0.72
Time to fall to 75% effective depth	mins	8	12.00	17.00
Time to fall to 25% effective depth	mins	40	70.00	80.00
V (75%-25%)	m3	0.50	0.63	0.74
a (50%)	m2	3.68	4.39	4.97
t (75%-25%)	mins	32.00	58.00	63.00
SOIL INFILTRATION RATE	m/s	**7.04E-05**	**4.13E-05**	**3.94E-05**

DESIGN SOIL INFILTRATION RATE, f **3.94E-05 m/s**



clarkebond

SOIL INFILTRATION RATE TEST

(B.R.E. Digest 365, 1991, Soakaway Design)

Site:	Inglewood, Paignton
Job Number:	WB03590
Date of Test:	20/09/16

Trial Pit Number:	TP9
Length (m):	2.20
Width (m):	0.45
Depth (mbegl):	1.10
Groundwater Depth# (mbegl):	

#: not used in calculations but ensure > pit base

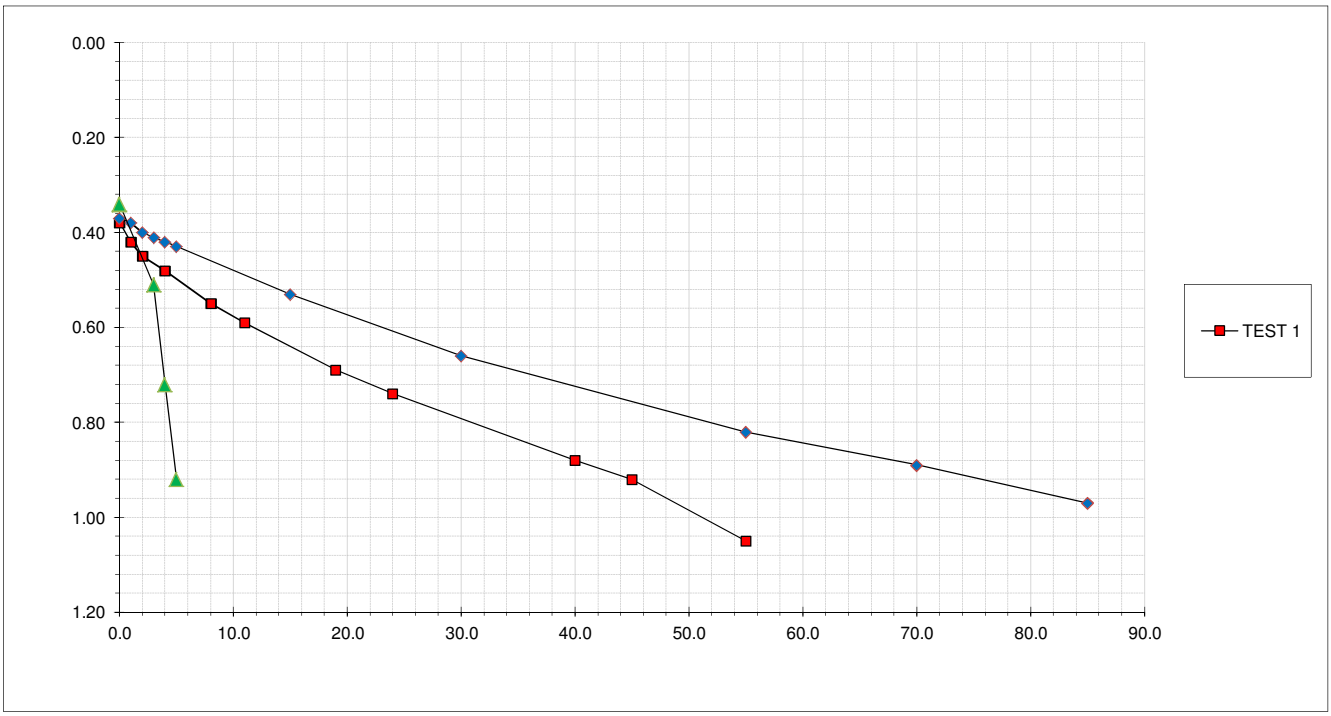
Remarks -

Fissure opened in the base of the pit in the 3rd fill

TEST 1		TEST 2		TEST 3	
Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
0	0.38	0	0.37	0	0.34
1	0.42	1	0.38	3	0.51
2	0.45	2	0.40	4	0.72
4	0.48	3	0.41	5	0.92
8	0.55	4	0.42		
11	0.59	5	0.43		
19	0.69	15	0.53		
24	0.74	30	0.66		
40	0.88	55	0.82		
45	0.92	70	0.89		
55	1.05	85	0.97		

		TEST 1	TEST 2	TEST 3
Effective Storage Depth	m	0.72	0.73	0.76
75% Effective Storage Depth	m	0.54	0.55	0.57
(i.e. depth below GL)	m	0.56	0.55	0.53
25% Effective Storage Depth	m	0.18	0.18	0.19
(i.e. depth below GL)	m	0.92	0.92	0.91
Effective Storage Depth 75%-25%	m	0.36	0.37	0.38
Time to fall to 75% effective depth	mins	3	20.00	3.00
Time to fall to 25% effective depth	mins	45	80.00	5.00
V (75%-25%)	m3	0.36	0.36	0.38
a (50%)	m2	2.90	2.92	3.00
t (75%-25%)	mins	41.14	60.00	2.00
SOIL INFILTRATION RATE	m/s	**4.98E-05**	**3.43E-05**	**1.04E-03**

DESIGN SOIL INFILTRATION RATE, f **3.43E-05 m/s**



clarkebond

SOIL INFILTRATION RATE TEST

(B.R.E. Digest 365, 1991, Soakaway Design)

Site:	Inglewood, Paignton
Job Number:	WB03590
Date of Test:	19/04/17

Trial Pit Number:	TP101
Length (m):	3.00
Width (m):	0.70
Depth (mbegl):	2.20
Groundwater Depth# (mbegl):	

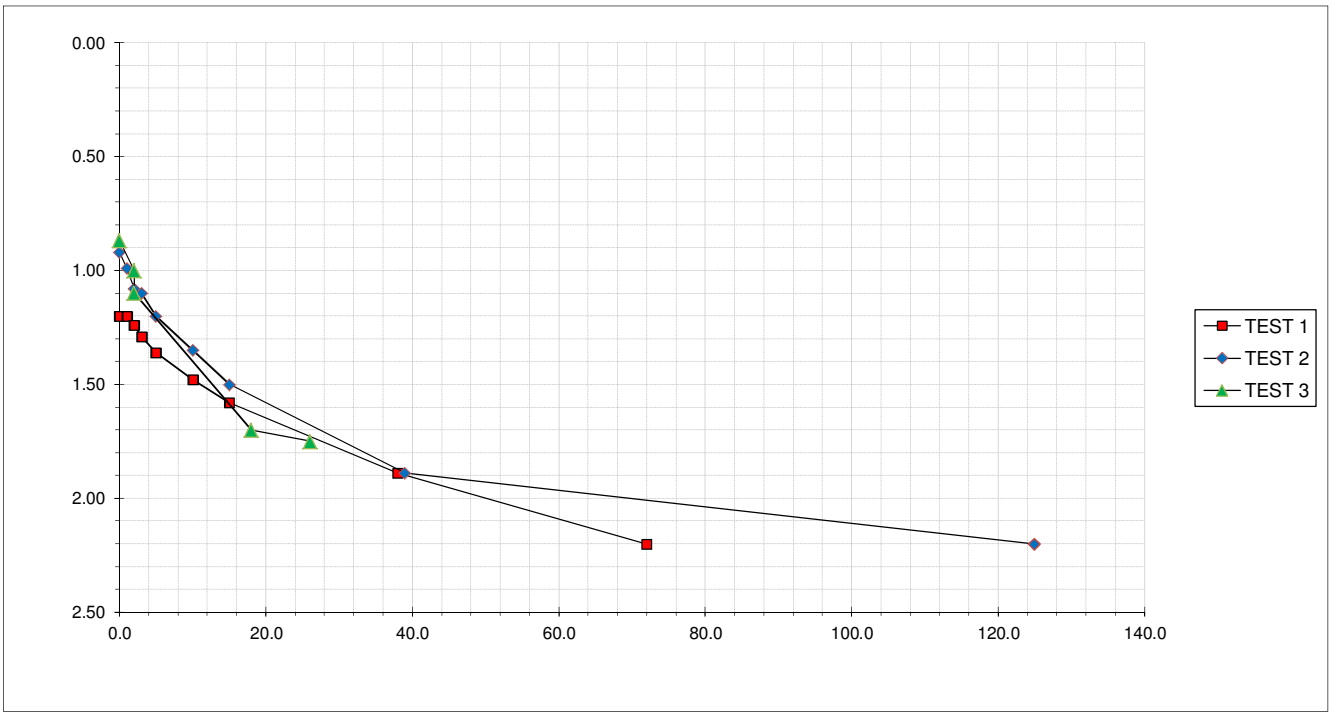
#: not used in calculations but ensure > pit base

Remarks -

TEST 1		TEST 2		TEST 3	
Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
0	1.20	0	0.92	0	0.87
1	1.20	1	0.99	2	1.00
2	1.24	2	1.08	2	1.10
3	1.29	3	1.10	18	1.70
5	1.36	5	1.20	26	1.75
10	1.48	10	1.35		
15	1.58	15	1.50		
38	1.89	39	1.89		
72	2.20	125	2.20		

		TEST 1	TEST 2	TEST 3
Effective Storage Depth	m	1.00	1.28	1.33
75% Effective Storage Depth	m	0.75	0.96	1.00
(i.e. depth below GL)	m	1.45	1.24	1.20
25% Effective Storage Depth	m	0.25	0.32	0.33
(i.e. depth below GL)	m	1.95	1.88	1.87
Effective Storage Depth 75%-25%	m	0.50	0.64	0.67
Time to fall to 75% effective depth	mins	8.00	7.00	4.00
Time to fall to 25% effective depth	mins	46.00	39.00	45.00
V (75%-25%)	m3	1.05	1.34	1.40
a (50%)	m2	5.80	6.84	7.02
t (75%-25%)	mins	38.00	32.00	41.00
SOIL INFILTRATION RATE	m/s	**7.94E-05**	**1.02E-04**	**8.09E-05**

DESIGN SOIL INFILTRATION RATE, f **7.94E-05 m/s**



clarkebond

SOIL INFILTRATION RATE TEST

(B.R.E. Digest 365, 1991, Soakaway Design)

Site:	Inglewood, Paignton
Job Number:	WB03590
Date of Test:	19/04/17

Trial Pit Number:	TP102
Length (m):	2.70
Width (m):	0.60
Depth (mbegl):	2.40
Groundwater Depth# (mbegl):	

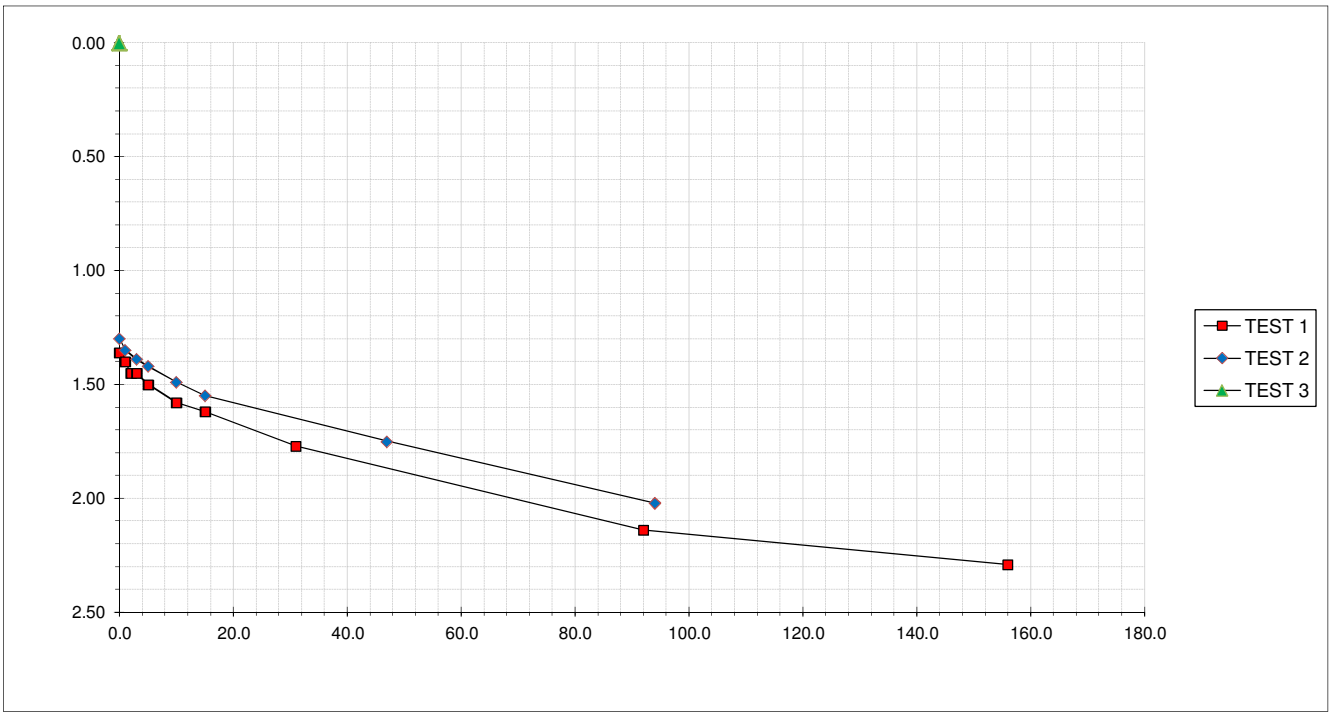
#: not used in calculations but ensure > pit base

Remarks -

TEST 1		TEST 2		TEST 3	
Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
0	1.36	0	1.30		
1	1.40	1	1.35		
2	1.45	3	1.39		
3	1.45	5	1.42		
5	1.50	10	1.49		
10	1.58	15	1.55		
15	1.62	47	1.75		
31	1.77	94	2.02		
92	2.14				
156	2.29				

		TEST 1	TEST 2	TEST 3
Effective Storage Depth	m	1.04	1.10	
75% Effective Storage Depth	m	0.78	0.83	
(i.e. depth below GL)	m	1.62	1.58	
25% Effective Storage Depth	m	0.26	0.28	
(i.e. depth below GL)	m	2.14	2.13	
Effective Storage Depth 75%-25%	m	0.52	0.55	
Time to fall to 75% effective depth	mins	15.00	17.00	
Time to fall to 25% effective depth	mins	92.00	110.00	
V (75%-25%)	m3	0.84	0.89	
a (50%)	m2	5.05	5.25	
t (75%-25%)	mins	77.00	93.00	
SOIL INFILTRATION RATE	m/s	**3.61E-05**	**3.04E-05**	

DESIGN SOIL INFILTRATION RATE, f **3.04E-05 m/s**



clarkebond

SOIL INFILTRATION RATE TEST

(B.R.E. Digest 365, 1991, Soakaway Design)

Site:	Inglewood, Paignton
Job Number:	WB03590
Date of Test:	19/04/17

Trial Pit Number:	TP103
Length (m):	2.70
Width (m):	0.80
Depth (mbegl):	1.10
Groundwater Depth# (mbegl):	

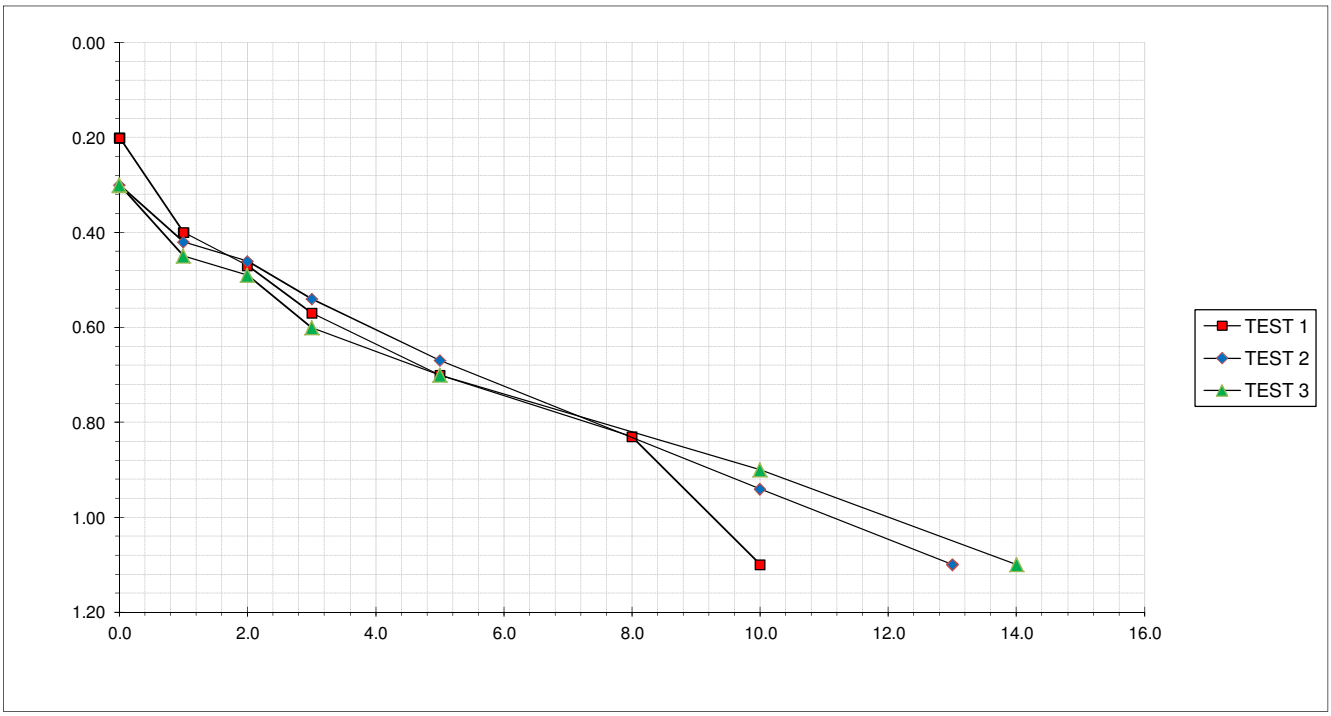
#: not used in calculations but ensure > pit base

Remarks -

TEST 1		TEST 2		TEST 3	
Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
0	0.20	0	0.30	0	0.30
1	0.40	1	0.42	1	0.45
2	0.47	2	0.46	2	0.49
3	0.57	3	0.54	3	0.60
5	0.70	5	0.67	5	0.70
8	0.83	10	0.94	10	0.90
10	1.10	13	1.10	14	1.10

		TEST 1	TEST 2	TEST 3
Effective Storage Depth	m	0.90	0.80	0.80
75% Effective Storage Depth	m	0.68	0.60	0.60
(i.e. depth below GL)	m	0.43	0.50	0.50
25% Effective Storage Depth	m	0.23	0.20	0.20
(i.e. depth below GL)	m	0.88	0.90	0.90
Effective Storage Depth 75%-25%	m	0.45	0.40	0.40
Time to fall to 75% effective depth	mins	1.50	2.50	2.00
Time to fall to 25% effective depth	mins	9.00	9.00	10.00
V (75%-25%)	m3	0.97	0.86	0.86
a (50%)	m2	5.31	4.96	4.96
t (75%-25%)	mins	7.50	6.50	8.00
SOIL INFILTRATION RATE	m/s	**4.07E-04**	**4.47E-04**	**3.63E-04**

DESIGN SOIL INFILTRATION RATE, f **3.63E-04 m/s**



clarkebond

SOIL INFILTRATION RATE TEST

(B.R.E. Digest 365, 1991, Soakaway Design)

Site:	Inglewood, Paignton
Job Number:	WB03590
Date of Test:	19/04/17

Trial Pit Number:	TP104
Length (m):	2.70
Width (m):	0.60
Depth (mbegl):	1.90
Groundwater Depth# (mbegl):	

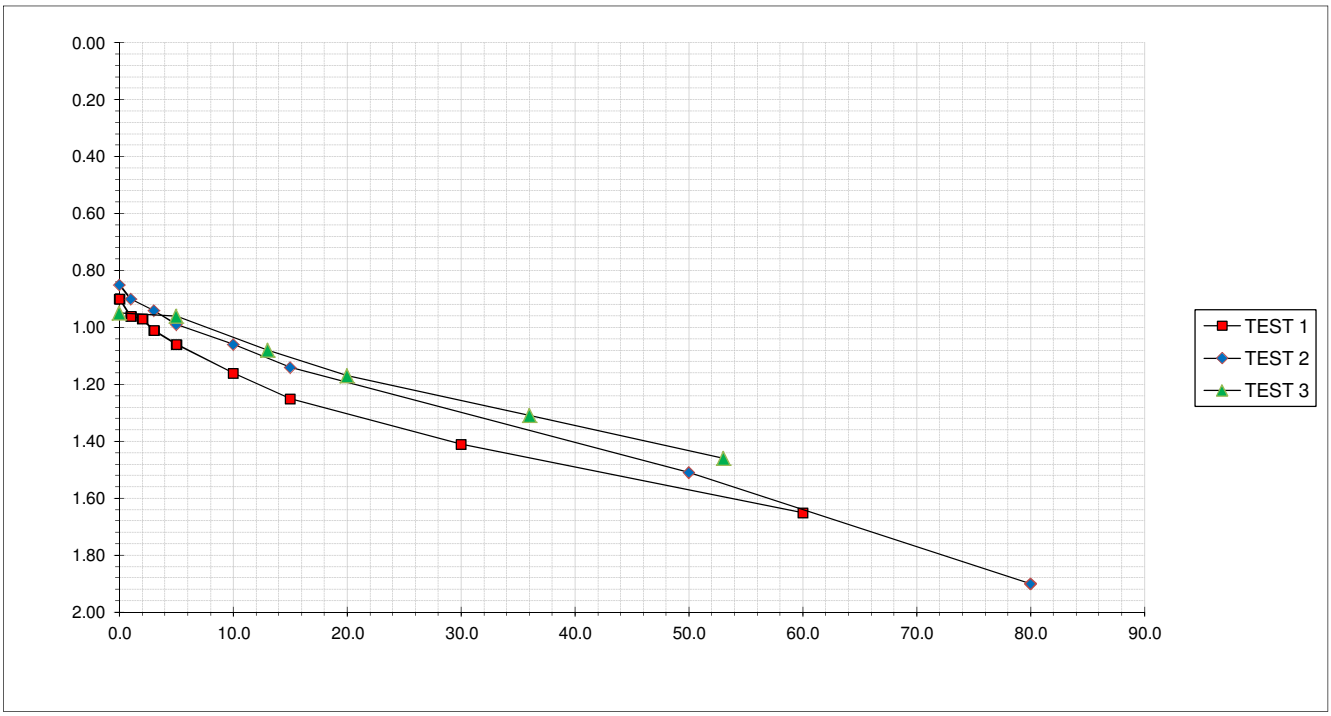
#: not used in calculations but ensure > pit base

Remarks -

TEST 1		TEST 2		TEST 3	
Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
0	0.90	0	0.85	0	0.95
1	0.96	1	0.90	5	0.96
2	0.97	3	0.94	13	1.08
3	1.01	5	0.99	20	1.17
5	1.06	10	1.06	36	1.31
10	1.16	15	1.14	53	1.46
15	1.25	50	1.51		
30	1.41	80	1.90		
60	1.65				

		TEST 1	TEST 2	TEST 3
Effective Storage Depth	m	1.00	1.05	0.95
75% Effective Storage Depth	m	0.75	0.79	0.71
(i.e. depth below GL)	m	1.15	1.11	1.19
25% Effective Storage Depth	m	0.25	0.26	0.24
(i.e. depth below GL)	m	1.65	1.64	1.66
Effective Storage Depth 75%-25%	m	0.50	0.53	0.48
Time to fall to 75% effective depth	mins	10.00	12.50	22.00
Time to fall to 25% effective depth	mins	60.00	60.00	100.00
V (75%-25%)	m3	0.81	0.85	0.77
a (50%)	m2	4.92	5.09	4.76
t (75%-25%)	mins	50.00	47.50	78.00
SOIL INFILTRATION RATE	m/s	**5.49E-05**	**5.87E-05**	**3.46E-05**

DESIGN SOIL INFILTRATION RATE, f **3.46E-05 m/s**



clarkebond

SOIL INFILTRATION RATE TEST

(B.R.E. Digest 365, 1991, Soakaway Design)

Site:	Inglewood, Paignton
Job Number:	WB03590
Date of Test:	12/02/18

Trial Pit Number:	TP201
Length (m):	1.80
Width (m):	0.50
Depth (mbegl):	1.80
Groundwater Depth# (mbegl):	

#: not used in calculations but ensure > pit base

Remarks -

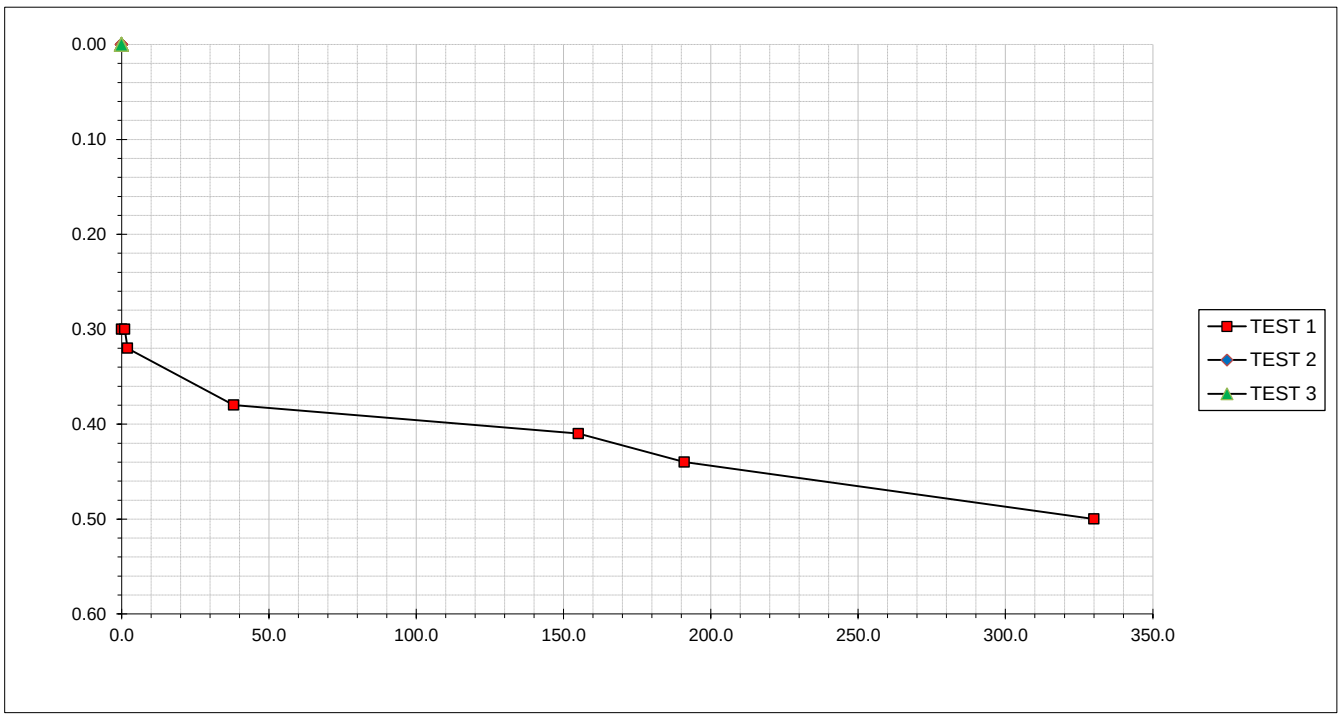
Only 1nr fill undertaken due to slow infiltration rate.

Indicative infiltration rate is thus from extraploated readings

TEST 1		TEST 2		TEST 3	
Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
0	0.30				
1	0.30				
2	0.32				
38	0.38				
155	0.41				
191	0.44				
330	0.50				

		TEST 1	TEST 2	TEST 3
Effective Storage Depth	m	1.50		
75% Effective Storage Depth	m	1.13		
(i.e. depth below GL)	m	0.68		
25% Effective Storage Depth	m	0.38		
(i.e. depth below GL)	m	1.43		
Effective Storage Depth 75%-25%	m	0.75		
Time to fall to 75% effective depth	mins	735		
Time to fall to 25% effective depth	mins	2473		
V (75%-25%)	m3	0.68		
a (50%)	m2	4.35		
t (75%-25%)	mins	1737.50		
SOIL INFILTRATION RATE	m/s	**1.49E-06**		

DESIGN SOIL INFILTRATION RATE, f **1.49E-06 m/s**



clarkebond

SOIL INFILTRATION RATE TEST

(B.R.E. Digest 365, 1991, Soakaway Design)

Site:	hite Rock Phase 2 Extensi
Job Number:	WB03590
Date of Test:	12/02/18

Trial Pit Number:	TP202
Length (m):	2.10
Width (m):	0.65
Depth (mbegl):	1.80
Groundwater Depth# (mbegl):	

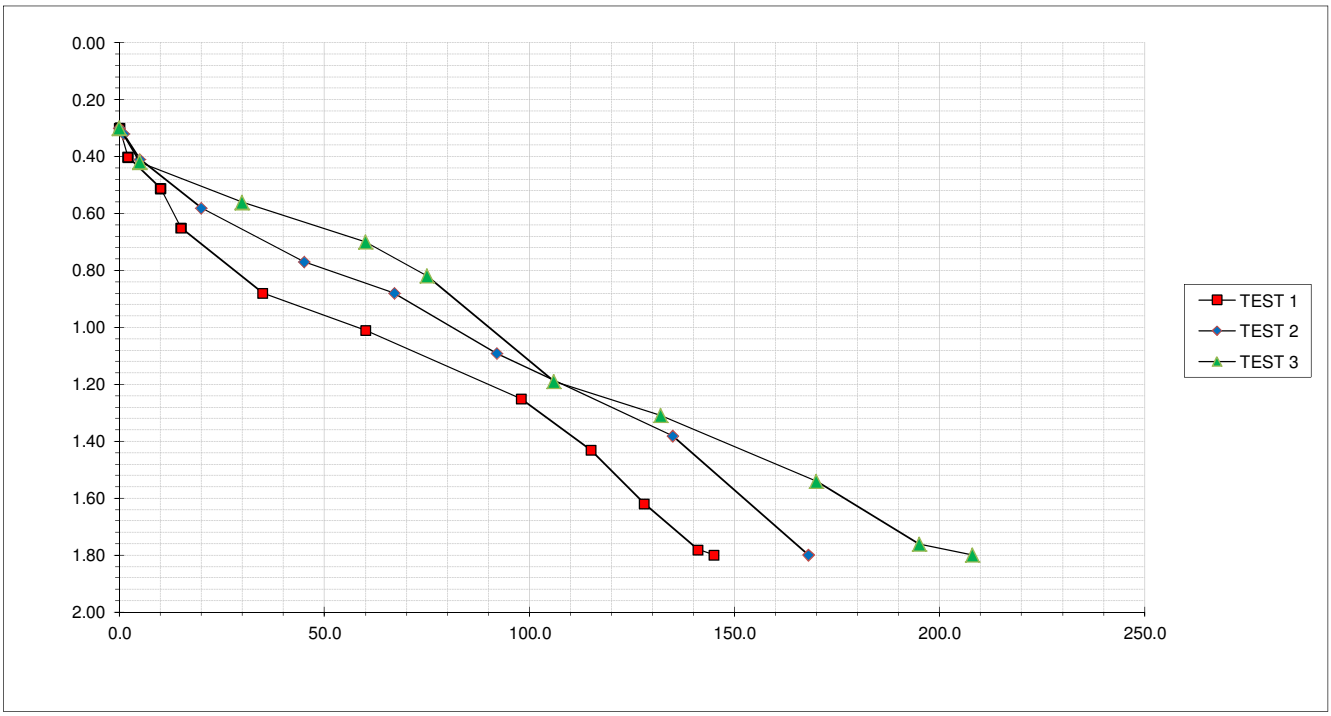
#: not used in calculations but ensure > pit base

Remarks -

TEST 1		TEST 2		TEST 3	
Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
0	0.30	0	0.30	0	0.30
2	0.40	1	0.32	5	0.42
10	0.51	5	0.41	30	0.56
15	0.65	20	0.58	60	0.70
35	0.88	45	0.77	75	0.82
60	1.01	67	0.88	106	1.19
98	1.25	92	1.09	132	1.31
115	1.43	135	1.38	170	1.54
128	1.62	168	1.80	195	1.76
141	1.78			208	1.80
145	1.80				

Effective Storage Depth	m	1.50	1.50	1.50
75% Effective Storage Depth	m	1.13	1.13	1.13
(i.e. depth below GL)	m	0.68	0.68	0.68
25% Effective Storage Depth	m	0.38	0.38	0.38
(i.e. depth below GL)	m	1.43	1.43	1.43
Effective Storage Depth 75%-25%	m	0.75	0.75	0.75
Time to fall to 75% effective depth	mins	20.00	33	55
Time to fall to 25% effective depth	mins	115.00	139	151
V (75%-25%)	m3	1.02	1.02	1.02
a (50%)	m2	5.49	5.49	5.49
t (75%-25%)	mins	95.00	106.04	96.36
SOIL INFILTRATION RATE	m/s	**3.27E-05**	**2.93E-05**	**3.23E-05**

DESIGN SOIL INFILTRATION RATE, f **2.93E-05 m/s**



clarkebond

SOIL INFILTRATION RATE TEST

(B.R.E. Digest 365, 1991, Soakaway Design)

Site:	hite Rock Phase 2 Extensi
Job Number:	WB03590
Date of Test:	12/02/18

Trial Pit Number:	TP203
Length (m):	2.40
Width (m):	0.60
Depth (mbegl):	1.80
Groundwater Depth# (mbegl):	

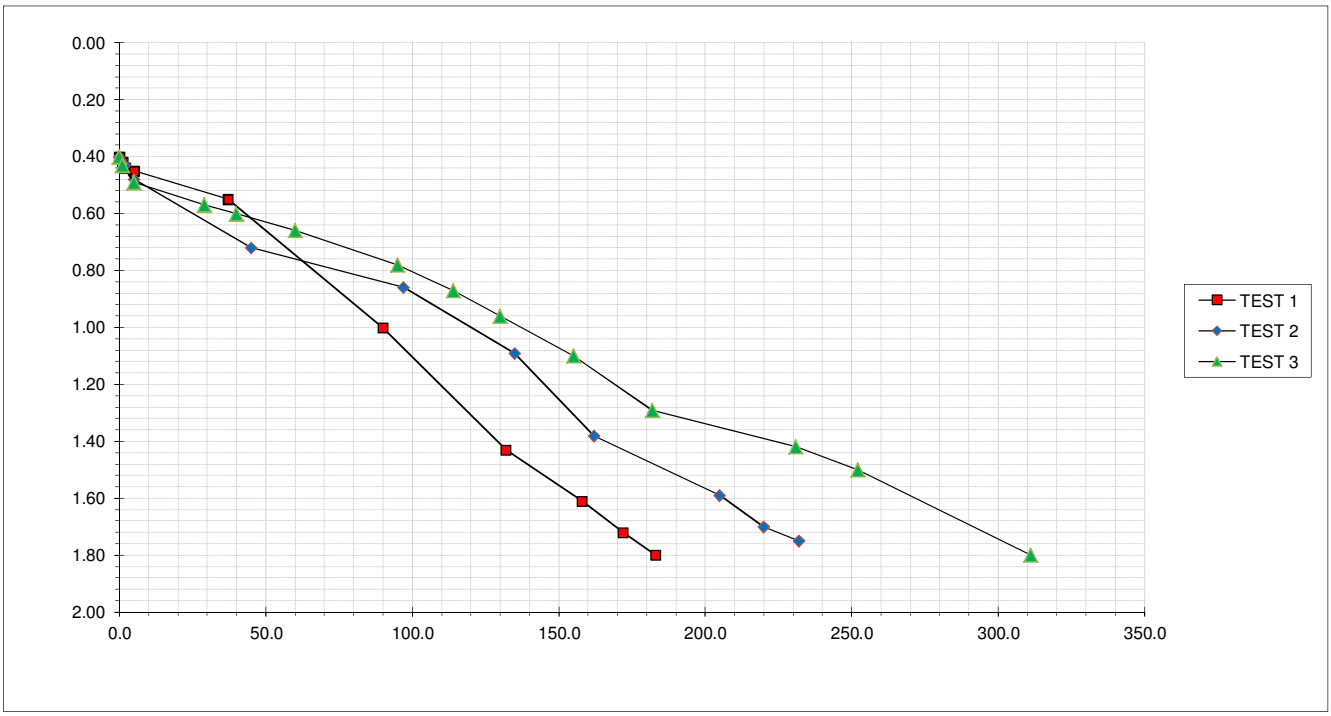
#: not used in calculations but ensure > pit base

Remarks -

TEST 1		TEST 2		TEST 3	
Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
0	0.40	0	0.40	0	0.40
1	0.42	2	0.43	1	0.43
2	0.44	5	0.48	5	0.49
5	0.45	45	0.72	29	0.57
37	0.55	97	0.86	40	0.60
90	1.00	135	1.09	60	0.66
132	1.43	162	1.38	95	0.78
158	1.61	205	1.59	114	0.87
172	1.72	220	1.70	130	0.96
183	1.80	232	1.75	155	1.10
				182	1.29
				231	1.42
				252	1.50
				311	1.80

		TEST 1	TEST 2	TEST 3
Effective Storage Depth	m	1.40	1.40	1.40
75% Effective Storage Depth	m	1.05	1.05	1.05
(i.e. depth below GL)	m	0.75	0.75	0.75
25% Effective Storage Depth	m	0.35	0.35	0.35
(i.e. depth below GL)	m	1.45	1.45	1.45
Effective Storage Depth 75%-25%	m	0.70	0.70	0.70
Time to fall to 75% effective depth	mins	70.00	45.00	92.00
Time to fall to 25% effective depth	mins	132.00	170.00	235.00
V (75%-25%)	m3	1.01	1.01	1.01
a (50%)	m2	5.64	5.64	5.64
t (75%-25%)	mins	62.00	125.00	143.00
SOIL INFILTRATION RATE	m/s	**4.80E-05**	**2.38E-05**	**2.08E-05**

DESIGN SOIL INFILTRATION RATE, f **2.08E-05 m/s**



clarkebond

SOIL INFILTRATION RATE TEST

(B.R.E. Digest 365, 1991, Soakaway Design)

Site:	Inglewood, Paignton
Job Number:	WB03590
Date of Test:	20/02/18

Trial Pit Number:	TP204
Length (m):	1.85
Width (m):	0.60
Depth (mbegl):	3.00
Groundwater Depth# (mbegl):	

#: not used in calculations but ensure > pit base

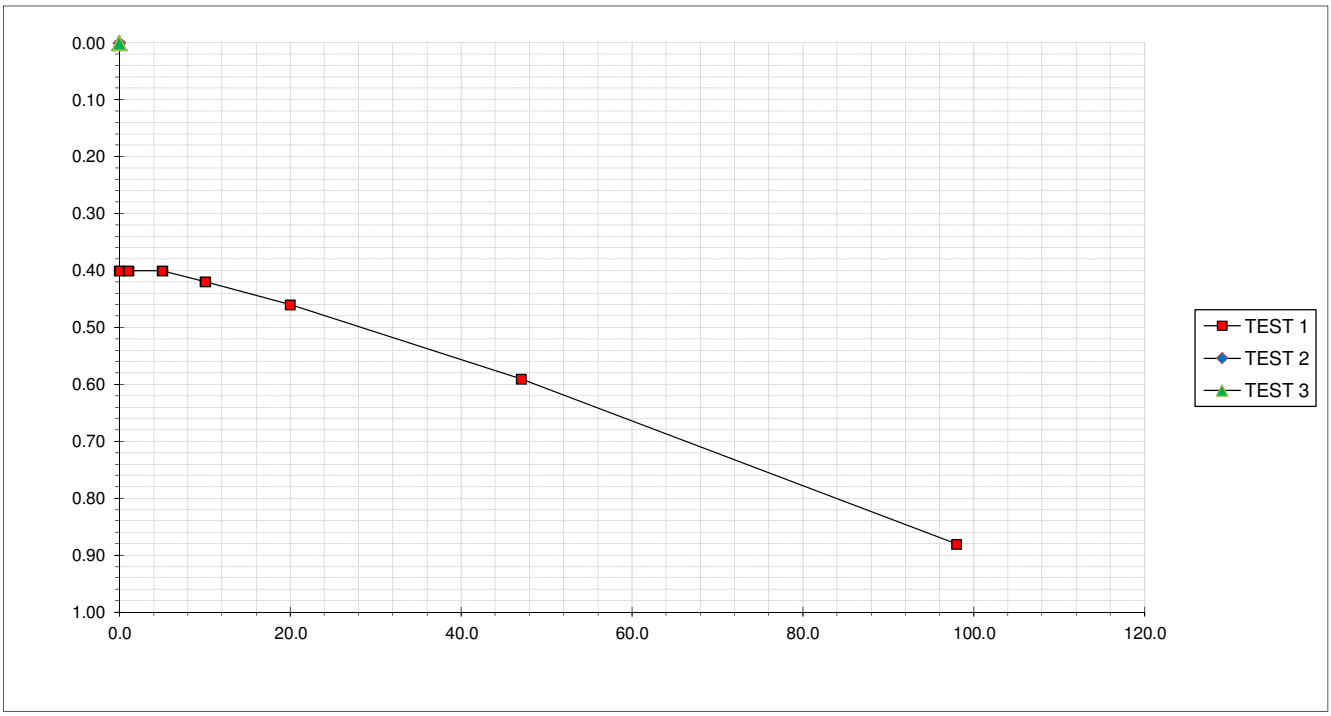
Remarks -

Only 1nr fill undertaken due to slow infiltration rate.

TEST 1		TEST 2		TEST 3	
Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
0	0.40				
1	0.40				
5	0.40				
10	0.42				
20	0.46				
47	0.59				
98	0.88				
130	0.88				
223	0.88				
186	0.88				
342	0.88				

		TEST 1	TEST 2	TEST 3
Effective Storage Depth	m	2.60		
75% Effective Storage Depth	m	1.95		
(i.e. depth below GL)	m	1.05		
25% Effective Storage Depth	m	0.65		
(i.e. depth below GL)	m	2.35		
Effective Storage Depth 75%-25%	m	1.30		
Time to fall to 75% effective depth	mins			
Time to fall to 25% effective depth	mins			
V (75%-25%)	m3	1.44		
a (50%)	m2	7.48		
t (75%-25%)	mins	0.00		
SOIL INFILTRATION RATE	m/s	**#DIV/0!**		

DESIGN SOIL INFILTRATION RATE, f **#DIV/0!** **m/s**



clarkebond

SOIL INFILTRATION RATE TEST

(B.R.E. Digest 365, 1991, Soakaway Design)

Site:	Inglewood, Paignton
Job Number:	WB03590
Date of Test:	20/02/18

Trial Pit Number:	TP205
Length (m):	2.20
Width (m):	0.68
Depth (mbegl):	2.50
Groundwater Depth# (mbegl):	

#: not used in calculations but ensure > pit base

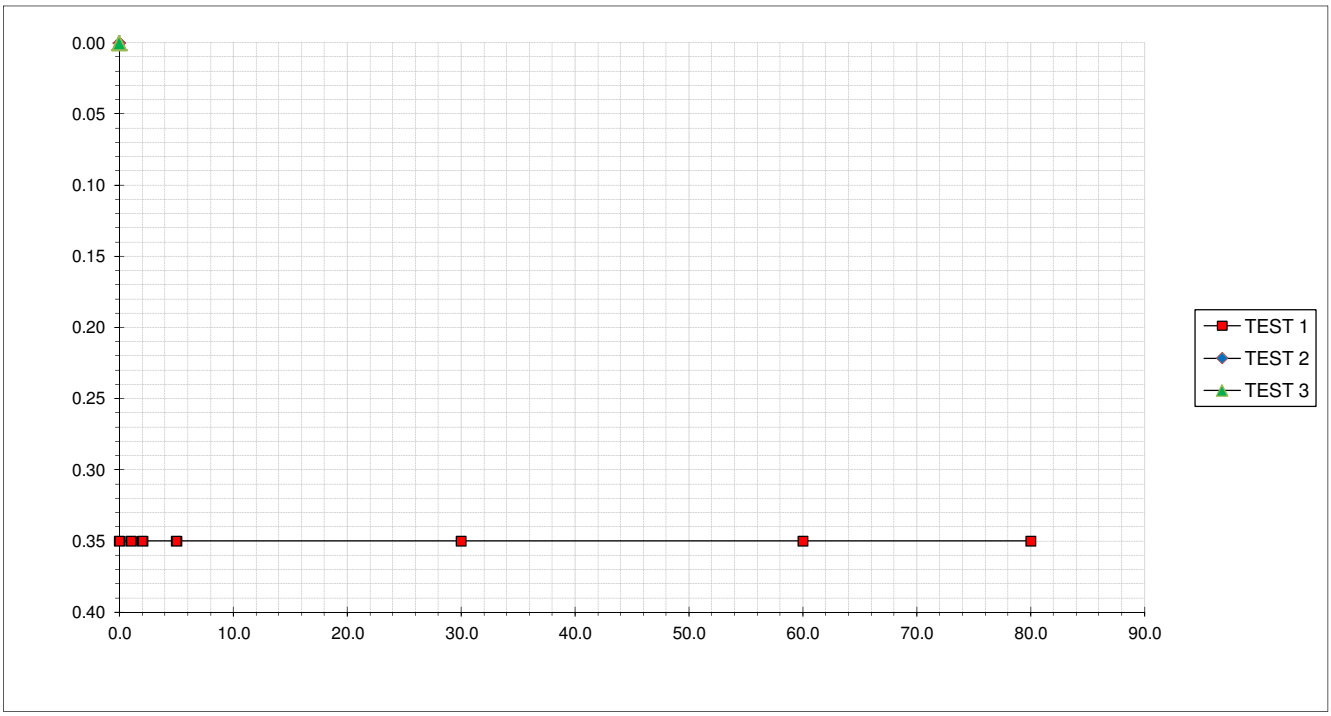
Remarks -

Only 1nr fill undertaken due to slow infiltration rate.

TEST 1		TEST 2		TEST 3	
Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
0	0.35				
1	0.35				
2	0.35				
5	0.35				
30	0.35				
60	0.35				
80	0.35				
182	0.35				
240	0.35				
310	0.35				

		TEST 1	TEST 2	TEST 3
Effective Storage Depth	m	2.15		
75% Effective Storage Depth	m	1.61		
(i.e. depth below GL)	m	0.89		
25% Effective Storage Depth	m	0.54		
(i.e. depth below GL)	m	1.96		
Effective Storage Depth 75%-25%	m	1.08		
Time to fall to 75% effective depth	mins			
Time to fall to 25% effective depth	mins			
V (75%-25%)	m3	1.61		
a (50%)	m2	7.69		
t (75%-25%)	mins	0.00		
SOIL INFILTRATION RATE	m/s	**#DIV/0!**		

DESIGN SOIL INFILTRATION RATE, f **#DIV/0!** **m/s**



clarkebond

SOIL INFILTRATION RATE TEST

(B.R.E. Digest 365, 1991, Soakaway Design)

Site:	Inglewood, Paignton
Job Number:	WB03590
Date of Test:	21/02/18

Trial Pit Number:	TP206
Length (m):	2.15
Width (m):	0.55
Depth (mbegl):	2.50
Groundwater Depth# (mbegl):	

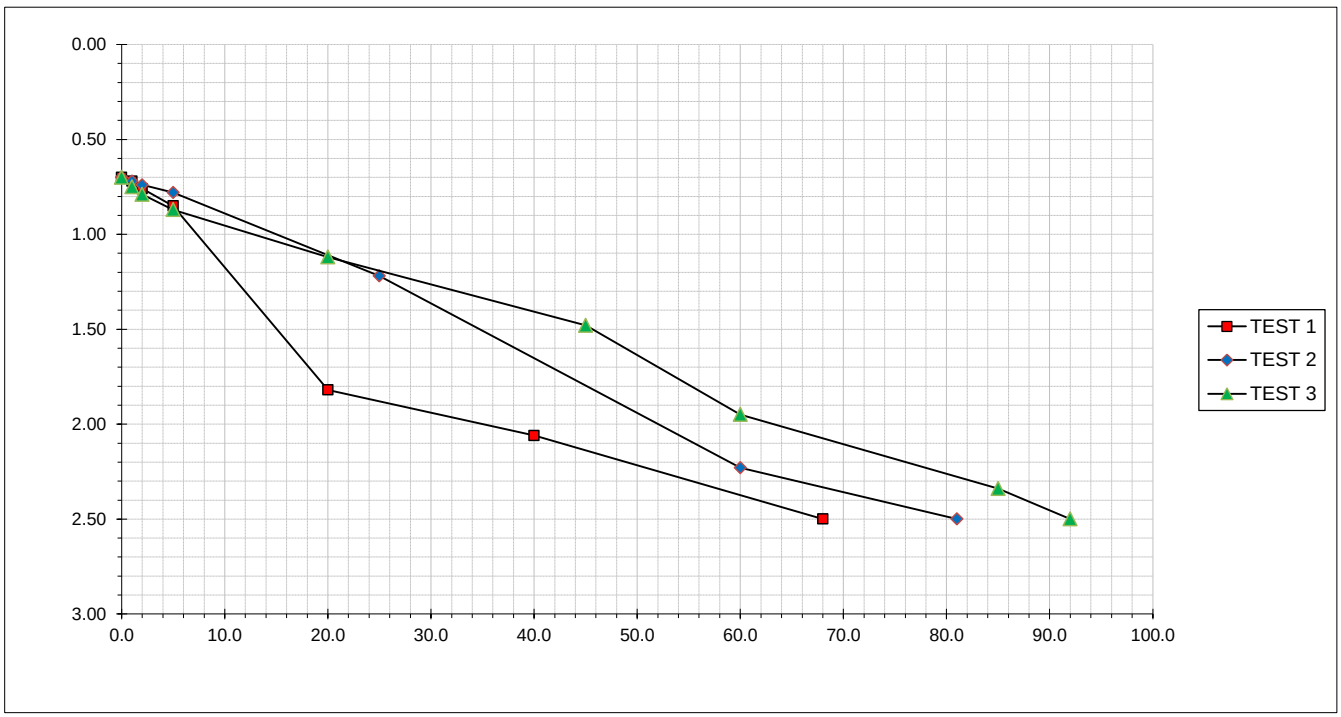
#: not used in calculations but ensure > pit base

Remarks -

TEST 1		TEST 2		TEST 3	
Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
0	0.70	0	0.70	0	0.70
1	0.72	1	0.72	1	0.75
2	0.76	2	0.74	2	0.79
5	0.85	5	0.78	5	0.87
20	1.82	25	1.22	20	1.12
40	2.06	60	2.23	45	1.48
68	2.50	81	2.50	60	1.95
				85	2.34
				92	2.50

		TEST 1	TEST 2	TEST 3
Effective Storage Depth	m	1.80	1.80	1.80
75% Effective Storage Depth	m	1.35	1.35	1.35
(i.e. depth below GL)	m	1.15	1.15	1.15
25% Effective Storage Depth	m	0.45	0.45	0.45
(i.e. depth below GL)	m	2.05	2.05	2.05
Effective Storage Depth 75%-25%	m	0.90	0.90	0.90
Time to fall to 75% effective depth	mins	8	16.00	22.00
Time to fall to 25% effective depth	mins	38	52.00	63.00
V (75%-25%)	m3	1.06	1.06	1.06
a (50%)	m2	6.04	6.04	6.04
t (75%-25%)	mins	30.00	36.00	41.00
SOIL INFILTRATION RATE	m/s	**9.78E-05**	**8.15E-05**	**7.16E-05**

DESIGN SOIL INFILTRATION RATE, f **7.16E-05 m/s**



clarkebond

SOIL INFILTRATION RATE TEST

(B.R.E. Digest 365, 1991, Soakaway Design)

Site:	Inglewood, Paignton
Job Number:	WB03590
Date of Test:	21/02/18

Trial Pit Number:	TP207
Length (m):	1.95
Width (m):	0.68
Depth (mbegl):	2.50
Groundwater Depth# (mbegl):	

#: not used in calculations but ensure > pit base

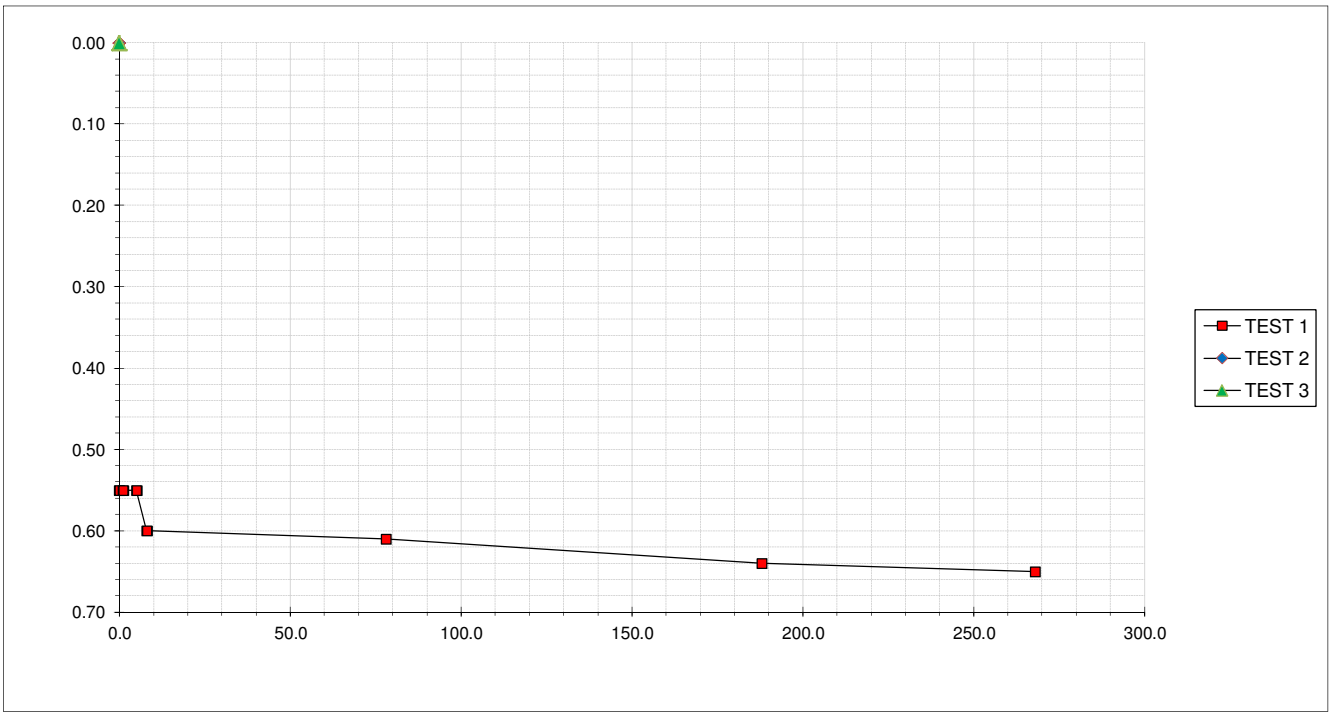
Remarks -

Only 1nr fill undertaken due to slow infiltration rate.

TEST 1		TEST 2		TEST 3	
Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
0	0.55				
1	0.55				
5	0.55				
8	0.60				
78	0.61				
188	0.64				
268	0.65				
342	0.66				

		TEST 1	TEST 2	TEST 3
Effective Storage Depth	m	1.95		
75% Effective Storage Depth	m	1.46		
(i.e. depth below GL)	m	1.04		
25% Effective Storage Depth	m	0.49		
(i.e. depth below GL)	m	2.01		
Effective Storage Depth 75%-25%	m	0.98		
Time to fall to 75% effective depth	mins	3136		
Time to fall to 25% effective depth	mins	10351		
V (75%-25%)	m3	1.29		
a (50%)	m2	6.45		
t (75%-25%)	mins	7215.00		
SOIL INFILTRATION RATE	m/s	**4.63E-07**		

DESIGN SOIL INFILTRATION RATE, f **4.63E-07 m/s**



clarkebond

SOIL INFILTRATION RATE TEST

(B.R.E. Digest 365, 1991, Soakaway Design)

Site:	Inglewood, Paignton
Job Number:	WB03590
Date of Test:	20/02/18

Trial Pit Number:	TP208
Length (m):	1.60
Width (m):	0.50
Depth (mbegl):	1.60
Groundwater Depth# (mbegl):	

#: not used in calculations but ensure > pit base

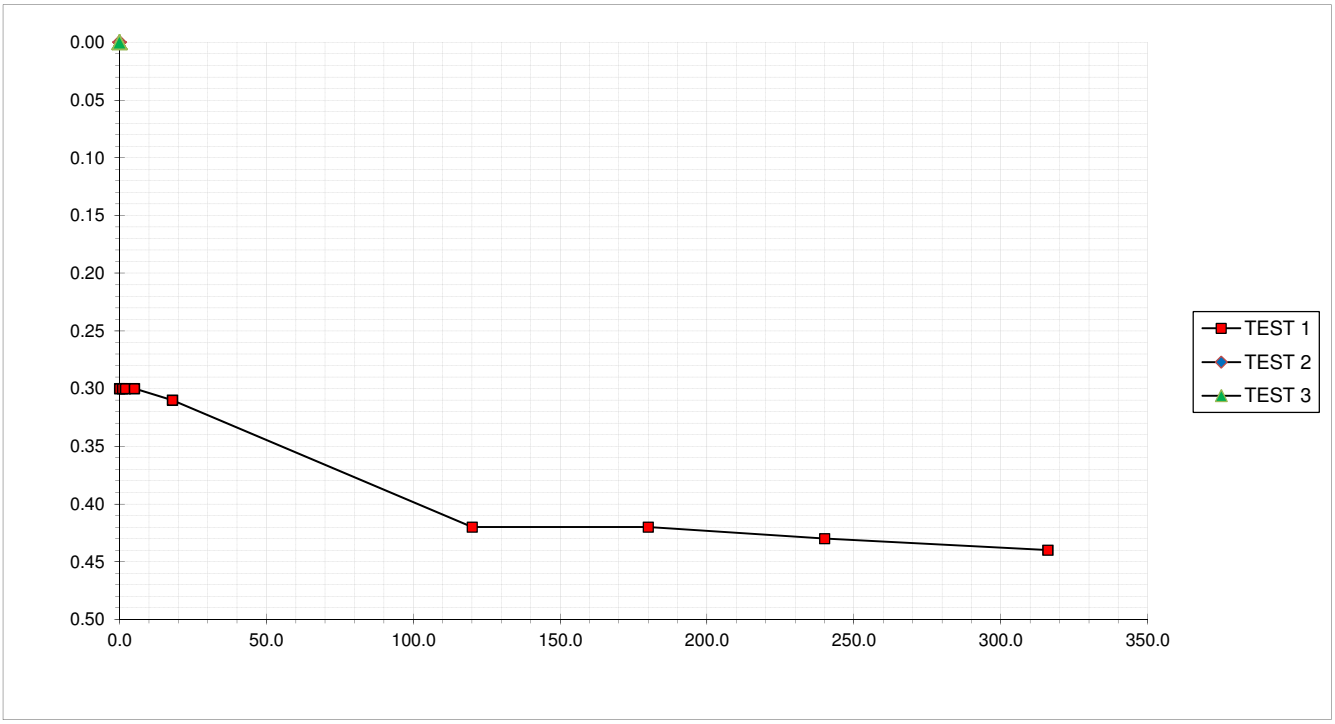
Remarks -

Only 1nr fill undertaken due to slow infiltration rate.

TEST 1		TEST 2		TEST 3	
Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
0	0.30				
1	0.30				
2	0.30				
5	0.30				
18	0.31				
120	0.42				
180	0.42				
240	0.43				
316	0.44				
422	0.45				

		TEST 1	TEST 2	TEST 3
Effective Storage Depth	m	1.30		
75% Effective Storage Depth	m	0.98		
(i.e. depth below GL)	m	0.63		
25% Effective Storage Depth	m	0.33		
(i.e. depth below GL)	m	1.28		
Effective Storage Depth 75%-25%	m	0.65		
Time to fall to 75% effective depth	mins	2277		
Time to fall to 25% effective depth	mins	9167		
V (75%-25%)	m3	0.52		
a (50%)	m2	3.53		
t (75%-25%)	mins	6890.00		
SOIL INFILTRATION RATE	m/s	**3.56E-07**		

DESIGN SOIL INFILTRATION RATE, f **3.56E-07 m/s**



clarkebond

SOIL INFILTRATION RATE TEST

(B.R.E. Digest 365, 1991, Soakaway Design)

Site:	Inglewood, Paignton
Job Number:	WB03590
Date of Test:	21/02/18

Trial Pit Number:	TP209
Length (m):	2.10
Width (m):	0.60
Depth (mbegl):	2.80
Groundwater Depth# (mbegl):	

#: not used in calculations but ensure > pit base

Remarks -

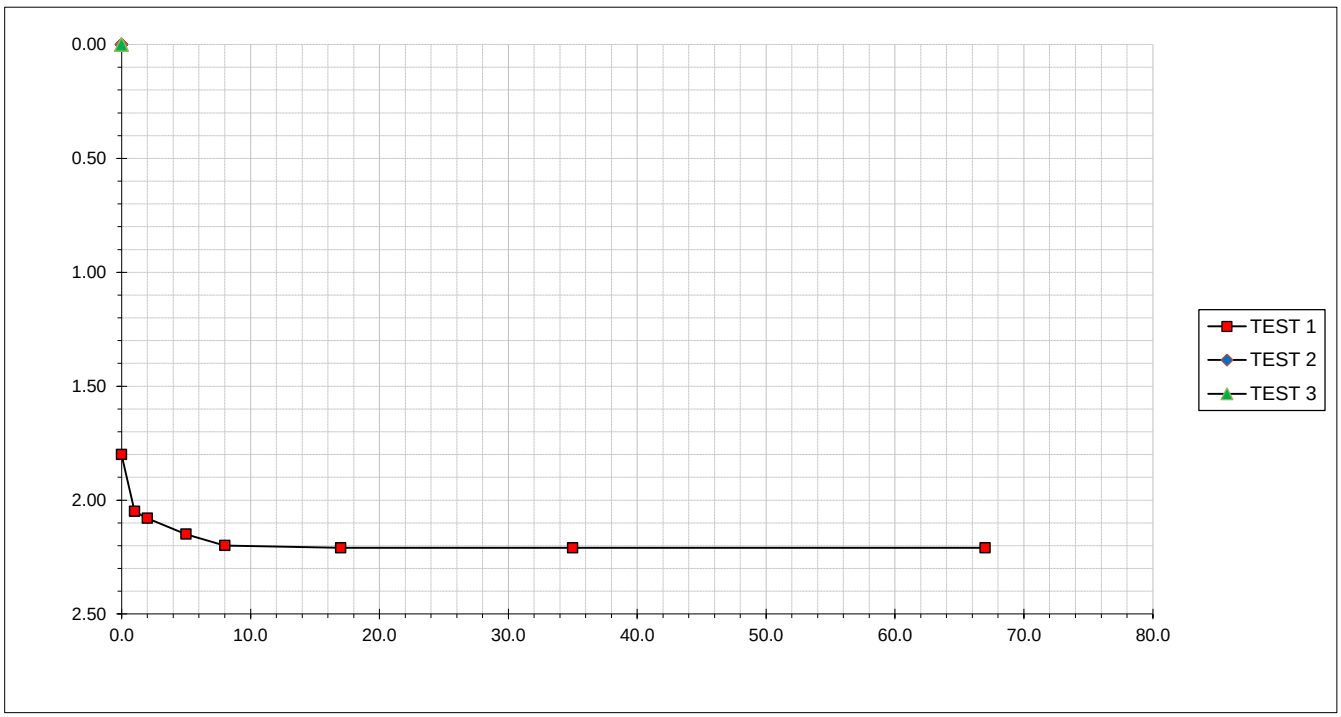
Unable to fill pit shallower than 1.8m due to rapid water egress above that depth.

Testing commenced but test then cancelled due to the probability of groundwater standing at ~2.2m depth. Test moved to TP210 with pit taken to only 2m.

TEST 1		TEST 2		TEST 3	
Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
0	1.80				
1	2.05				
2	2.08				
5	2.15				
8	2.20				
17	2.21				
35	2.21				
67	2.21				

		TEST 1	TEST 2	TEST 3
Effective Storage Depth	m	1.00		
75% Effective Storage Depth	m	0.75		
(i.e. depth below GL)	m	2.05		
25% Effective Storage Depth	m	0.25		
(i.e. depth below GL)	m	2.55		
Effective Storage Depth 75%-25%	m	0.50		
Time to fall to 75% effective depth	mins			
Time to fall to 25% effective depth	mins			
V (75%-25%)	m3	0.63		
a (50%)	m2	3.96		
t (75%-25%)	mins	0.00		
SOIL INFILTRATION RATE	m/s	**#DIV/0!**		

DESIGN SOIL INFILTRATION RATE, f **#DIV/0!** **m/s**



clarkebond

SOIL INFILTRATION RATE TEST

(B.R.E. Digest 365, 1991, Soakaway Design)

Site:	Inglewood, Paignton
Job Number:	WB03590
Date of Test:	21/02/18

Trial Pit Number:	TP210
Length (m):	1.70
Width (m):	0.60
Depth (mbegl):	2.00
Groundwater Depth# (mbegl):	

#: not used in calculations but ensure > pit base

Remarks -

Due to pit collapses during testing, results have been adjusted to allow for such

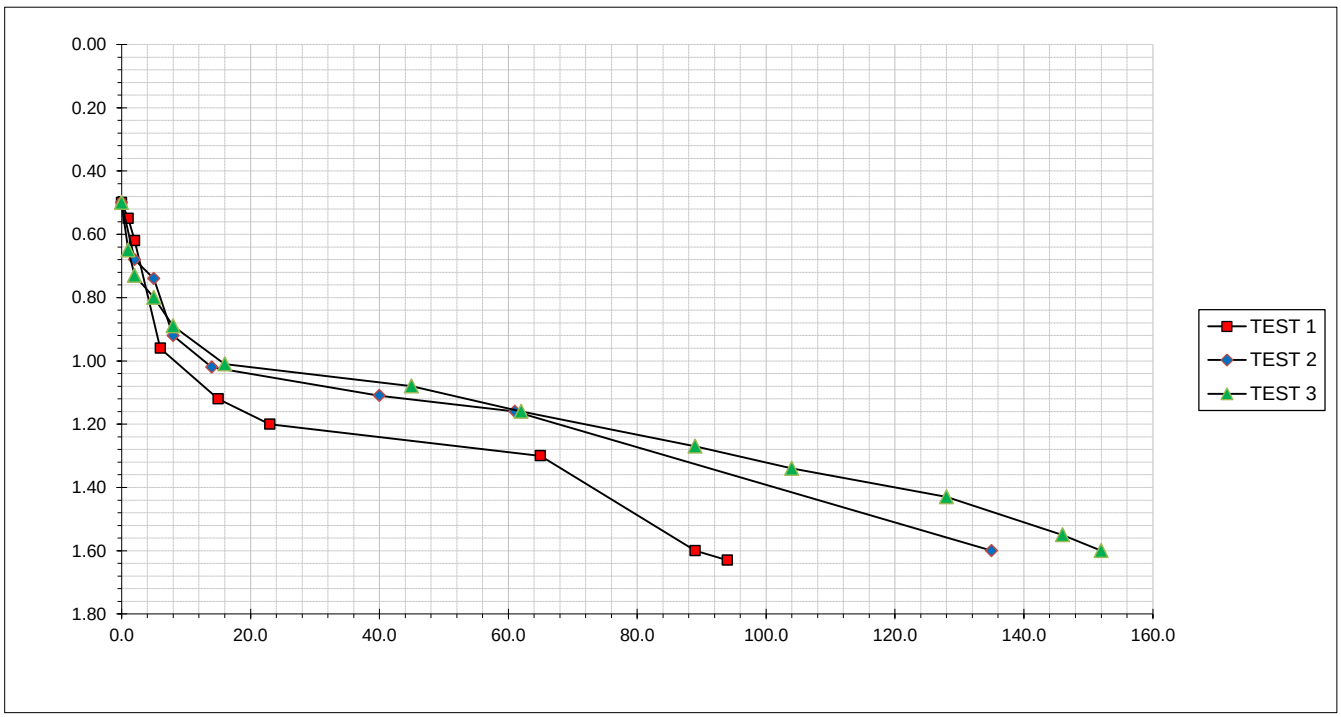
Test 1 - Side collapse at 5.0 min and 13.0min. New depth = 1.63m.

Test 2 - Side collapse at 2.0min. New depth = 1.60m.

TEST 1		TEST 2		TEST 3	
Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
0	0.50	0	0.50	0	0.50
1	0.55	2	0.68	1	0.65
2	0.62	5	0.74	2	0.73
6	0.96	8	0.92	5	0.80
15	1.12	14	1.02	8	0.89
23	1.20	40	1.11	16	1.01
65	1.30	61	1.16	45	1.08
89	1.60	135	1.60	62	1.16
94	1.63			89	1.27
				104	1.34
				128	1.43
				146	1.55
				152	1.60

		TEST 1	TEST 2	TEST 3
Effective Storage Depth	m	1.50	1.13	1.10
75% Effective Storage Depth	m	1.13	0.85	0.83
(i.e. depth below GL)	m	0.88	0.78	0.78
25% Effective Storage Depth	m	0.38	0.28	0.28
(i.e. depth below GL)	m	1.63	1.35	1.33
Effective Storage Depth 75%-25%	m	0.75	0.57	0.55
Time to fall to 75% effective depth	mins	4	6.00	5.00
Time to fall to 25% effective depth	mins	68	93.00	104.00
V (75%-25%)	m3	0.77	0.58	0.56
a (50%)	m2	4.47	3.62	3.55
t (75%-25%)	mins	64.00	87.00	99.00
SOIL INFILTRATION RATE	m/s	**4.46E-05**	**3.05E-05**	**2.66E-05**

DESIGN SOIL INFILTRATION RATE, f **2.66E-05 m/s**



clarkebond

MULTIDISCIPLINARY ENGINEERING CONSULTANTS

The Cocoa House 129 Cumberland Road Bristol BS1 6UY
tel +44(0) 117 929 2244 fax +44(0) 117 929 3095
email bristol@clarkebond.com web www.clarkebond.com

TECHNICAL NOTE

Project:	**Inglewood Urban Extension**	**WB03590-TN01(V3.1)**
Subject:	TN01 - Drainage Strategy	
Prepared by	Andy Jenner BEng CEng MICE (Associate Director)	
Approved by	Seymour D'Oyley (Associate Director)	07/03/2018

Appendix C

WinDes Calculations for Greenfield Runoff

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 473 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	0.207	0.207	0.0	2.0	O K
30 min Summer	0.281	0.281	0.1	2.7	O K
60 min Summer	0.362	0.362	0.1	3.5	O K
120 min Summer	0.439	0.439	0.1	4.2	O K
180 min Summer	0.476	0.476	0.1	4.6	O K
240 min Summer	0.493	0.493	0.1	4.7	O K
360 min Summer	0.512	0.512	0.1	4.9	O K
480 min Summer	0.523	0.523	0.1	5.0	O K
600 min Summer	0.530	0.530	0.1	5.1	O K
720 min Summer	0.534	0.534	0.1	5.1	O K
960 min Summer	0.535	0.535	0.1	5.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	119.177	0.0	19
30 min Summer	81.881	0.0	33
60 min Summer	53.779	0.0	64
120 min Summer	34.054	0.0	122
180 min Summer	25.620	0.0	182
240 min Summer	20.762	0.0	240
360 min Summer	15.458	0.0	308
480 min Summer	12.515	0.0	370
600 min Summer	10.612	0.0	432
720 min Summer	9.269	0.0	498
960 min Summer	7.478	0.0	636

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
1440 min Summer	0.525	0.525	0.1	5.0	O K
2160 min Summer	0.498	0.498	0.1	4.8	O K
2880 min Summer	0.469	0.469	0.1	4.5	O K
4320 min Summer	0.418	0.418	0.1	4.0	O K
5760 min Summer	0.377	0.377	0.1	3.6	O K
7200 min Summer	0.345	0.345	0.1	3.3	O K
8640 min Summer	0.318	0.318	0.1	3.1	O K
10080 min Summer	0.296	0.296	0.1	2.8	O K
15 min Winter	0.232	0.232	0.1	2.2	O K
30 min Winter	0.315	0.315	0.1	3.0	O K
60 min Winter	0.406	0.406	0.1	3.9	O K
120 min Winter	0.493	0.493	0.1	4.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
1440 min Summer	5.512	0.0	910
2160 min Summer	4.052	0.0	1316
2880 min Summer	3.252	0.0	1704
4320 min Summer	2.380	0.0	2468
5760 min Summer	1.909	0.0	3232
7200 min Summer	1.610	0.0	3968
8640 min Summer	1.401	0.0	4680
10080 min Summer	1.245	0.0	5448
15 min Winter	119.177	0.0	19
30 min Winter	81.881	0.0	33
60 min Winter	53.779	0.0	62
120 min Winter	34.054	0.0	120

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
180 min Winter	0.535	0.535	0.1	5.1	O K
240 min Winter	0.556	0.556	0.1	5.3	O K
360 min Winter	0.576	0.576	0.1	5.5	O K
480 min Winter	0.586	0.586	0.1	5.6	O K
600 min Winter	0.591	0.591	0.1	5.7	O K
720 min Winter	0.592	0.592	0.1	5.7	O K
960 min Winter	0.587	0.587	0.1	5.6	O K
1440 min Winter	0.562	0.562	0.1	5.4	O K
2160 min Winter	0.517	0.517	0.1	5.0	O K
2880 min Winter	0.474	0.474	0.1	4.6	O K
4320 min Winter	0.405	0.405	0.1	3.9	O K
5760 min Winter	0.354	0.354	0.1	3.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
180 min Winter	25.620	0.0	176
240 min Winter	20.762	0.0	232
360 min Winter	15.458	0.0	336
480 min Winter	12.515	0.0	380
600 min Winter	10.612	0.0	456
720 min Winter	9.269	0.0	532
960 min Winter	7.478	0.0	684
1440 min Winter	5.512	0.0	980
2160 min Winter	4.052	0.0	1404
2880 min Winter	3.252	0.0	1792
4320 min Winter	2.380	0.0	2592
5760 min Winter	1.909	0.0	3344

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
7200 min Winter	0.314	0.314	0.1	3.0	O K
8640 min Winter	0.284	0.284	0.1	2.7	O K
10080 min Winter	0.259	0.259	0.1	2.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
7200 min Winter	1.610	0.0	4104
8640 min Winter	1.401	0.0	4840
10080 min Winter	1.245	0.0	5552

Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	19.000	Winter Storms	Yes	Shortest Storm (mins)	15
Return Period (years)	100	Ratio R	0.308	Cv (Summer)	0.750	Longest Storm (mins)	10080
Region	England and Wales	Summer Storms	Yes	Cv (Winter)	0.840	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.009

Time (mins) From:	To:	Area (ha)
0	4	0.009

Model Details

Storage is Online Cover Level (m) 1.600

Cellular Storage Structure

Invert Level (m) 0.000 Infiltration Coefficient Side (m/hr) 0.12348 Porosity 0.95
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	10.1	0.0	0.610	10.1	8.1

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 411 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	0.565	0.565	3.2	100.3	O K
30 min Summer	0.765	0.765	4.4	135.9	O K
60 min Summer	0.977	0.977	5.6	173.5	O K
120 min Summer	1.171	1.171	6.7	207.8	O K
180 min Summer	1.251	1.251	7.0	222.1	O K
240 min Summer	1.287	1.287	7.0	228.4	O K
360 min Summer	1.335	1.335	7.0	237.0	Flood Risk
480 min Summer	1.360	1.360	7.0	241.5	Flood Risk
600 min Summer	1.372	1.372	7.0	243.6	Flood Risk
720 min Summer	1.374	1.374	7.0	244.0	Flood Risk
960 min Summer	1.360	1.360	7.0	241.5	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	119.177	0.0	19
30 min Summer	81.881	0.0	33
60 min Summer	53.779	0.0	62
120 min Summer	34.054	0.0	122
180 min Summer	25.620	0.0	180
240 min Summer	20.762	0.0	226
360 min Summer	15.458	0.0	286
480 min Summer	12.515	0.0	350
600 min Summer	10.612	0.0	418
720 min Summer	9.269	0.0	486
960 min Summer	7.478	0.0	624

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
1440 min Summer	1.299	1.299	7.0	230.6	O K
2160 min Summer	1.194	1.194	6.8	212.1	O K
2880 min Summer	1.104	1.104	6.3	196.1	O K
4320 min Summer	0.959	0.959	5.5	170.3	O K
5760 min Summer	0.852	0.852	4.9	151.2	O K
7200 min Summer	0.769	0.769	4.4	136.6	O K
8640 min Summer	0.702	0.702	4.0	124.7	O K
10080 min Summer	0.649	0.649	3.7	115.3	O K
15 min Winter	0.632	0.632	3.6	112.3	O K
30 min Winter	0.858	0.858	4.9	152.3	O K
60 min Winter	1.096	1.096	6.3	194.7	O K
120 min Winter	1.319	1.319	7.0	234.2	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
1440 min Summer	5.512	0.0	894
2160 min Summer	4.052	0.0	1276
2880 min Summer	3.252	0.0	1672
4320 min Summer	2.380	0.0	2420
5760 min Summer	1.909	0.0	3168
7200 min Summer	1.610	0.0	3896
8640 min Summer	1.401	0.0	4592
10080 min Summer	1.245	0.0	5344
15 min Winter	119.177	0.0	19
30 min Winter	81.881	0.0	33
60 min Winter	53.779	0.0	62
120 min Winter	34.054	0.0	120

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
180 min Winter	1.424	1.424	7.0	252.9	Flood Risk
240 min Winter	1.474	1.474	7.0	261.8	Flood Risk
360 min Winter	1.519	1.519	7.0	269.8	Flood Risk
480 min Winter	1.538	1.538	7.0	273.1	Flood Risk
600 min Winter	1.542	1.542	7.0	273.9	Flood Risk
720 min Winter	1.534	1.534	7.0	272.3	Flood Risk
960 min Winter	1.494	1.494	7.0	265.3	Flood Risk
1440 min Winter	1.377	1.377	7.0	244.6	Flood Risk
2160 min Winter	1.206	1.206	6.9	214.2	O K
2880 min Winter	1.083	1.083	6.2	192.3	O K
4320 min Winter	0.897	0.897	5.1	159.3	O K
5760 min Winter	0.769	0.769	4.4	136.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
180 min Winter	25.620	0.0	176
240 min Winter	20.762	0.0	232
360 min Winter	15.458	0.0	334
480 min Winter	12.515	0.0	376
600 min Winter	10.612	0.0	454
720 min Winter	9.269	0.0	530
960 min Winter	7.478	0.0	682
1440 min Winter	5.512	0.0	966
2160 min Winter	4.052	0.0	1344
2880 min Winter	3.252	0.0	1732
4320 min Winter	2.380	0.0	2508
5760 min Winter	1.909	0.0	3280

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
7200 min Winter	0.674	0.674	3.8	119.8	O K
8640 min Winter	0.603	0.603	3.4	107.0	O K
10080 min Winter	0.546	0.546	3.1	96.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
7200 min Winter	1.610	0.0	4032
8640 min Winter	1.401	0.0	4752
10080 min Winter	1.245	0.0	5448

Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	19.000	Winter Storms	Yes	Shortest Storm (mins)	15
Return Period (years)	100	Ratio R	0.308	Cv (Summer)	0.750	Longest Storm (mins)	10080
Region	England and Wales	Summer Storms	Yes	Cv (Winter)	0.840	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.457

Time (mins) From:	To:	Area (ha)
0	4	0.457

Model Details

Storage is Online Cover Level (m) 1.600

Cellular Storage Structure

Invert Level (m) 0.000 Infiltration Coefficient Side (m/hr) 0.74880 Porosity 0.95
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	186.9	0.0	1.220	186.9	66.9

Summary of Results for 10 year Return Period

Half Drain Time : 674 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	54.154	0.154	5.0	133.3	O K
30 min Summer	54.205	0.205	5.0	177.4	O K
60 min Summer	54.260	0.260	5.0	224.9	O K
120 min Summer	54.316	0.316	5.1	273.7	O K
180 min Summer	54.347	0.347	5.1	300.3	O K
240 min Summer	54.366	0.366	5.1	316.9	O K
360 min Summer	54.388	0.388	5.1	335.9	O K
480 min Summer	54.397	0.397	5.1	344.0	O K
600 min Summer	54.401	0.401	5.1	347.1	O K
720 min Summer	54.402	0.402	5.1	348.6	O K
960 min Summer	54.402	0.402	5.1	348.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	52.210	0.0	19
30 min Summer	35.150	0.0	33
60 min Summer	22.792	0.0	64
120 min Summer	14.424	0.0	122
180 min Summer	10.944	0.0	182
240 min Summer	8.968	0.0	242
360 min Summer	6.768	0.0	360
480 min Summer	5.536	0.0	480
600 min Summer	4.735	0.0	538
720 min Summer	4.166	0.0	600
960 min Summer	3.403	0.0	730

Summary of Results for 10 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
1440 min Summer	54.393	0.393	5.1	340.9	O K
2160 min Summer	54.373	0.373	5.1	323.0	O K
2880 min Summer	54.349	0.349	5.1	302.2	O K
4320 min Summer	54.298	0.298	5.1	258.5	O K
5760 min Summer	54.250	0.250	5.0	216.7	O K
7200 min Summer	54.206	0.206	5.0	178.7	O K
8640 min Summer	54.168	0.168	5.0	145.6	O K
10080 min Summer	54.136	0.136	4.9	117.4	O K
15 min Winter	54.173	0.173	5.0	149.7	O K
30 min Winter	54.230	0.230	5.0	199.5	O K
60 min Winter	54.293	0.293	5.1	253.6	O K
120 min Winter	54.358	0.358	5.1	309.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
1440 min Summer	2.556	0.0	998
2160 min Summer	1.918	0.0	1408
2880 min Summer	1.564	0.0	1820
4320 min Summer	1.172	0.0	2636
5760 min Summer	0.955	0.0	3400
7200 min Summer	0.815	0.0	4112
8640 min Summer	0.716	0.0	4840
10080 min Summer	0.642	0.0	5544
15 min Winter	52.210	0.0	19
30 min Winter	35.150	0.0	33
60 min Winter	22.792	0.0	62
120 min Winter	14.424	0.0	120

Summary of Results for 10 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
180 min Winter	54.394	0.394	5.1	341.5	O K
240 min Winter	54.418	0.418	5.1	361.9	O K
360 min Winter	54.447	0.447	5.2	387.0	O K
480 min Winter	54.462	0.462	5.2	399.9	O K
600 min Winter	54.469	0.469	5.2	405.9	O K
720 min Winter	54.470	0.470	5.2	407.6	O K
960 min Winter	54.467	0.467	5.2	404.5	O K
1440 min Winter	54.453	0.453	5.2	392.9	O K
2160 min Winter	54.419	0.419	5.1	362.7	O K
2880 min Winter	54.378	0.378	5.1	327.7	O K
4320 min Winter	54.295	0.295	5.1	256.0	O K
5760 min Winter	54.219	0.219	5.0	190.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
180 min Winter	10.944	0.0	178
240 min Winter	8.968	0.0	236
360 min Winter	6.768	0.0	352
480 min Winter	5.536	0.0	464
600 min Winter	4.735	0.0	572
720 min Winter	4.166	0.0	678
960 min Winter	3.403	0.0	780
1440 min Winter	2.556	0.0	1082
2160 min Winter	1.918	0.0	1540
2880 min Winter	1.564	0.0	1988
4320 min Winter	1.172	0.0	2812
5760 min Winter	0.955	0.0	3576

Summary of Results for 10 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
7200 min Winter	54.154	0.154	5.0	133.5	O K
8640 min Winter	54.102	0.102	4.9	88.1	O K
10080 min Winter	54.064	0.064	4.9	55.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
7200 min Winter	0.815	0.0	4320
8640 min Winter	0.716	0.0	4928
10080 min Winter	0.642	0.0	5448

Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	19.000	Winter Storms	Yes	Shortest Storm (mins)	15
Return Period (years)	10	Ratio R	0.308	Cv (Summer)	0.750	Longest Storm (mins)	10080
Region	England and Wales	Summer Storms	Yes	Cv (Winter)	0.840	Climate Change %	+0

Time Area Diagram

Total Area (ha) 1.401

Time (mins) From:	To:	Area (ha)
0	4	1.401

Model Details

Storage is Online Cover Level (m) 56.000

Cellular Storage Structure

Invert Level (m) 54.000 Infiltration Coefficient Side (m/hr) 0.09576 Porosity 0.95
Infiltration Coefficient Base (m/hr) 0.09576 Safety Factor 5.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	912.0	912.0	1.320	912.0	1085.2

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 1723 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	54.356	0.356	5.1	308.7	O K
30 min Summer	54.487	0.487	5.2	421.7	O K
60 min Summer	54.633	0.633	5.3	548.1	O K
120 min Summer	54.786	0.786	5.4	681.2	O K
180 min Summer	54.872	0.872	5.5	755.6	O K
240 min Summer	54.927	0.927	5.5	802.9	O K
360 min Summer	55.003	1.003	5.6	869.2	O K
480 min Summer	55.051	1.051	5.6	910.8	O K
600 min Summer	55.083	1.083	5.6	938.1	O K
720 min Summer	55.103	1.103	5.6	955.8	O K
960 min Summer	55.123	1.123	5.6	972.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	119.177	0.0	19
30 min Summer	81.881	0.0	34
60 min Summer	53.779	0.0	64
120 min Summer	34.054	0.0	124
180 min Summer	25.620	0.0	184
240 min Summer	20.762	0.0	242
360 min Summer	15.458	0.0	362
480 min Summer	12.515	0.0	482
600 min Summer	10.612	0.0	602
720 min Summer	9.269	0.0	722
960 min Summer	7.478	0.0	960

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
1440 min Summer	55.115	1.115	5.6	966.1	O K
2160 min Summer	55.079	1.079	5.6	935.1	O K
2880 min Summer	55.041	1.041	5.6	902.2	O K
4320 min Summer	54.969	0.969	5.5	839.2	O K
5760 min Summer	54.900	0.900	5.5	779.8	O K
7200 min Summer	54.833	0.833	5.4	722.1	O K
8640 min Summer	54.768	0.768	5.4	665.6	O K
10080 min Summer	54.706	0.706	5.3	611.6	O K
15 min Winter	54.400	0.400	5.1	346.2	O K
30 min Winter	54.546	0.546	5.2	473.3	O K
60 min Winter	54.711	0.711	5.3	615.8	O K
120 min Winter	54.886	0.886	5.5	767.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
1440 min Summer	5.512	0.0	1368
2160 min Summer	4.052	0.0	1708
2880 min Summer	3.252	0.0	2076
4320 min Summer	2.380	0.0	2900
5760 min Summer	1.909	0.0	3744
7200 min Summer	1.610	0.0	4544
8640 min Summer	1.401	0.0	5360
10080 min Summer	1.245	0.0	6152
15 min Winter	119.177	0.0	19
30 min Winter	81.881	0.0	33
60 min Winter	53.779	0.0	64
120 min Winter	34.054	0.0	122

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
180 min Winter	54.984	0.984	5.5	852.9	O K
240 min Winter	55.048	1.048	5.6	908.2	O K
360 min Winter	55.139	1.139	5.6	986.9	O K
480 min Winter	55.198	1.198	5.7	1038.1	O K
600 min Winter	55.239	1.239	5.7	1073.3	O K
720 min Winter	55.267	1.267	5.7	1098.0	O K
960 min Winter	55.300	1.300	5.8	1126.5	O K
1440 min Winter	55.312	1.312	5.8	1136.8	O K
2160 min Winter	55.268	1.268	5.7	1098.3	O K
2880 min Winter	55.217	1.217	5.7	1054.8	O K
4320 min Winter	55.113	1.113	5.6	964.3	O K
5760 min Winter	55.007	1.007	5.6	872.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
180 min Winter	25.620	0.0	180
240 min Winter	20.762	0.0	240
360 min Winter	15.458	0.0	358
480 min Winter	12.515	0.0	474
600 min Winter	10.612	0.0	590
720 min Winter	9.269	0.0	706
960 min Winter	7.478	0.0	934
1440 min Winter	5.512	0.0	1382
2160 min Winter	4.052	0.0	1968
2880 min Winter	3.252	0.0	2224
4320 min Winter	2.380	0.0	3156
5760 min Winter	1.909	0.0	4040

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
7200 min Winter	54.903	0.903	5.5	782.2	O K
8640 min Winter	54.802	0.802	5.4	694.7	O K
10080 min Winter	54.706	0.706	5.3	611.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
7200 min Winter	1.610	0.0	4904
8640 min Winter	1.401	0.0	5792
10080 min Winter	1.245	0.0	6560

Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	19.000	Winter Storms	Yes	Shortest Storm (mins)	15
Return Period (years)	100	Ratio R	0.308	Cv (Summer)	0.750	Longest Storm (mins)	10080
Region	England and Wales	Summer Storms	Yes	Cv (Winter)	0.840	Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.401

Time (mins) From:	To:	Area (ha)
0	4	1.401

Model Details

Storage is Online Cover Level (m) 56.000

Cellular Storage Structure

Invert Level (m) 54.000 Infiltration Coefficient Side (m/hr) 0.09576 Porosity 0.95
Infiltration Coefficient Base (m/hr) 0.09576 Safety Factor 5.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	912.0	912.0	1.320	912.0	1085.2

Summary of Results for 10 year Return Period

Half Drain Time : 601 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	63.354	0.154	7.2	177.4	O K
30 min Summer	63.405	0.205	7.3	235.9	O K
60 min Summer	63.459	0.259	7.3	298.3	O K
120 min Summer	63.514	0.314	7.4	361.7	O K
180 min Summer	63.544	0.344	7.4	395.5	O K
240 min Summer	63.562	0.362	7.4	415.9	O K
360 min Summer	63.581	0.381	7.4	437.9	O K
480 min Summer	63.588	0.388	7.4	445.8	O K
600 min Summer	63.590	0.390	7.4	449.0	O K
720 min Summer	63.591	0.391	7.4	450.0	O K
960 min Summer	63.589	0.389	7.4	447.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	52.210	0.0	19
30 min Summer	35.150	0.0	33
60 min Summer	22.792	0.0	62
120 min Summer	14.424	0.0	122
180 min Summer	10.944	0.0	182
240 min Summer	8.968	0.0	242
360 min Summer	6.768	0.0	360
480 min Summer	5.536	0.0	458
600 min Summer	4.735	0.0	514
720 min Summer	4.166	0.0	578
960 min Summer	3.403	0.0	710

Summary of Results for 10 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
1440 min Summer	63.578	0.378	7.4	434.9	O K
2160 min Summer	63.554	0.354	7.4	407.1	O K
2880 min Summer	63.527	0.327	7.4	376.1	O K
4320 min Summer	63.472	0.272	7.3	312.8	O K
5760 min Summer	63.421	0.221	7.3	254.0	O K
7200 min Summer	63.376	0.176	7.2	202.3	O K
8640 min Summer	63.338	0.138	7.2	159.3	O K
10080 min Summer	63.308	0.108	7.2	124.1	O K
15 min Winter	63.373	0.173	7.2	199.2	O K
30 min Winter	63.431	0.231	7.3	265.3	O K
60 min Winter	63.493	0.293	7.3	336.5	O K
120 min Winter	63.556	0.356	7.4	409.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
1440 min Summer	2.556	0.0	982
2160 min Summer	1.918	0.0	1404
2880 min Summer	1.564	0.0	1812
4320 min Summer	1.172	0.0	2596
5760 min Summer	0.955	0.0	3344
7200 min Summer	0.815	0.0	4040
8640 min Summer	0.716	0.0	4760
10080 min Summer	0.642	0.0	5448
15 min Winter	52.210	0.0	18
30 min Winter	35.150	0.0	33
60 min Winter	22.792	0.0	62
120 min Winter	14.424	0.0	120

Summary of Results for 10 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
180 min Winter	63.592	0.392	7.4	450.4	O K
240 min Winter	63.614	0.414	7.4	475.9	O K
360 min Winter	63.640	0.440	7.5	506.0	O K
480 min Winter	63.652	0.452	7.5	520.2	O K
600 min Winter	63.657	0.457	7.5	525.3	O K
720 min Winter	63.656	0.456	7.5	524.9	O K
960 min Winter	63.652	0.452	7.5	519.6	O K
1440 min Winter	63.633	0.433	7.4	498.6	O K
2160 min Winter	63.593	0.393	7.4	451.7	O K
2880 min Winter	63.547	0.347	7.4	399.7	O K
4320 min Winter	63.458	0.258	7.3	296.8	O K
5760 min Winter	63.379	0.179	7.2	206.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
180 min Winter	10.944	0.0	178
240 min Winter	8.968	0.0	236
360 min Winter	6.768	0.0	350
480 min Winter	5.536	0.0	462
600 min Winter	4.735	0.0	570
720 min Winter	4.166	0.0	670
960 min Winter	3.403	0.0	760
1440 min Winter	2.556	0.0	1068
2160 min Winter	1.918	0.0	1516
2880 min Winter	1.564	0.0	1960
4320 min Winter	1.172	0.0	2768
5760 min Winter	0.955	0.0	3520

Summary of Results for 10 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
7200 min Winter	63.315	0.115	7.2	132.5	O K
8640 min Winter	63.269	0.069	7.2	79.7	O K
10080 min Winter	63.249	0.049	7.0	56.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
7200 min Winter	0.815	0.0	4176
8640 min Winter	0.716	0.0	4752
10080 min Winter	0.642	0.0	5144

Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	19.000	Winter Storms	Yes	Shortest Storm (mins)	15
Return Period (years)	10	Ratio R	0.308	Cv (Summer)	0.750	Longest Storm (mins)	10080
Region	England and Wales	Summer Storms	Yes	Cv (Winter)	0.840	Climate Change %	+0

Time Area Diagram

Total Area (ha) 1.869

Time (mins) From:	To:	Area (ha)
0	4	1.869

Model Details

Storage is Online Cover Level (m) 65.000

Cellular Storage Structure

Invert Level (m) 63.200 Infiltration Coefficient Side (m/hr) 0.10548 Porosity 0.95
Infiltration Coefficient Base (m/hr) 0.10548 Safety Factor 5.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	1210.9	1210.9	1.320	1210.9	1394.6

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 1575 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	63.558	0.358	7.4	411.3	O K
30 min Summer	63.688	0.488	7.5	561.6	O K
60 min Summer	63.834	0.634	7.6	729.2	O K
120 min Summer	63.987	0.787	7.7	905.0	O K
180 min Summer	64.071	0.871	7.8	1002.3	O K
240 min Summer	64.125	0.925	7.9	1063.7	O K
360 min Summer	64.198	0.998	7.9	1148.5	O K
480 min Summer	64.243	1.043	7.9	1200.4	O K
600 min Summer	64.272	1.072	8.0	1233.2	O K
720 min Summer	64.290	1.090	8.0	1253.4	O K
960 min Summer	64.304	1.104	8.0	1269.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	119.177	0.0	19
30 min Summer	81.881	0.0	34
60 min Summer	53.779	0.0	64
120 min Summer	34.054	0.0	124
180 min Summer	25.620	0.0	184
240 min Summer	20.762	0.0	242
360 min Summer	15.458	0.0	362
480 min Summer	12.515	0.0	482
600 min Summer	10.612	0.0	602
720 min Summer	9.269	0.0	722
960 min Summer	7.478	0.0	960

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
1440 min Summer	64.288	1.088	8.0	1251.2	O K
2160 min Summer	64.248	1.048	8.0	1205.2	O K
2880 min Summer	64.208	1.008	7.9	1159.4	O K
4320 min Summer	64.129	0.929	7.9	1069.1	O K
5760 min Summer	64.055	0.855	7.8	983.7	O K
7200 min Summer	63.982	0.782	7.7	899.9	O K
8640 min Summer	63.913	0.713	7.7	819.8	O K
10080 min Summer	63.846	0.646	7.6	743.1	O K
15 min Winter	63.601	0.401	7.4	461.3	O K
30 min Winter	63.748	0.548	7.5	630.4	O K
60 min Winter	63.912	0.712	7.7	819.5	O K
120 min Winter	64.087	0.887	7.8	1020.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
1440 min Summer	5.512	0.0	1286
2160 min Summer	4.052	0.0	1664
2880 min Summer	3.252	0.0	2048
4320 min Summer	2.380	0.0	2856
5760 min Summer	1.909	0.0	3688
7200 min Summer	1.610	0.0	4472
8640 min Summer	1.401	0.0	5280
10080 min Summer	1.245	0.0	6056
15 min Winter	119.177	0.0	19
30 min Winter	81.881	0.0	33
60 min Winter	53.779	0.0	64
120 min Winter	34.054	0.0	122

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
180 min Winter	64.184	0.984	7.9	1132.4	O K
240 min Winter	64.247	1.047	7.9	1204.3	O K
360 min Winter	64.335	1.135	8.0	1305.8	O K
480 min Winter	64.392	1.192	8.1	1370.8	O K
600 min Winter	64.429	1.229	8.1	1414.3	O K
720 min Winter	64.455	1.255	8.1	1443.8	O K
960 min Winter	64.483	1.283	8.1	1475.5	O K
1440 min Winter	64.484	1.284	8.1	1477.2	O K
2160 min Winter	64.429	1.229	8.1	1414.2	O K
2880 min Winter	64.377	1.177	8.1	1353.5	O K
4320 min Winter	64.261	1.061	8.0	1220.9	O K
5760 min Winter	64.145	0.945	7.9	1087.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
180 min Winter	25.620	0.0	180
240 min Winter	20.762	0.0	240
360 min Winter	15.458	0.0	356
480 min Winter	12.515	0.0	474
600 min Winter	10.612	0.0	590
720 min Winter	9.269	0.0	706
960 min Winter	7.478	0.0	932
1440 min Winter	5.512	0.0	1370
2160 min Winter	4.052	0.0	1772
2880 min Winter	3.252	0.0	2196
4320 min Winter	2.380	0.0	3116
5760 min Winter	1.909	0.0	4032

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
7200 min Winter	64.032	0.832	7.8	957.0	O K
8640 min Winter	63.924	0.724	7.7	832.3	O K
10080 min Winter	63.821	0.621	7.6	714.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
7200 min Winter	1.610	0.0	4896
8640 min Winter	1.401	0.0	5704
10080 min Winter	1.245	0.0	6464

Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	19.000	Winter Storms	Yes	Shortest Storm (mins)	15
Return Period (years)	100	Ratio R	0.308	Cv (Summer)	0.750	Longest Storm (mins)	10080
Region	England and Wales	Summer Storms	Yes	Cv (Winter)	0.840	Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.869

Time (mins) From:	To:	Area (ha)
0	4	1.869

Model Details

Storage is Online Cover Level (m) 65.000

Cellular Storage Structure

Invert Level (m) 63.200 Infiltration Coefficient Side (m/hr) 0.10548 Porosity 0.95
Infiltration Coefficient Base (m/hr) 0.10548 Safety Factor 5.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	1210.9	1210.9	1.320	1210.9	1394.6

clarkebond

MULTIDISCIPLINARY ENGINEERING CONSULTANTS

The Cocoa House 129 Cumberland Road Bristol BS1 6UY
tel +44(0) 117 929 2244 fax +44(0) 117 929 3095
email bristol@clarkebond.com web www.clarkebond.com

TECHNICAL NOTE

Project:	**Inglewood Urban Extension**	**WB03590-TN01(V3.1)**
Subject:	TN01 - Drainage Strategy	
Prepared by	Andy Jenner BEng CEng MICE (Associate Director)	
Approved by	Seymour D'Oyley (Associate Director)	07/03/2018

Appendix D

WinDes Quickstore Estimate

ICP SUDS Mean Annual Flood

Input

Return Period (years) 10 SAAR (mm) 1133 Urban 0.000
Area (ha) 1.000 Soil 0.300 Region Number Region 8

Results l/s

QBAR Rural 3.2
QBAR Urban 3.2

Q10 years 4.8

Q1 year 2.5
Q30 years 6.1
Q100 years 7.7

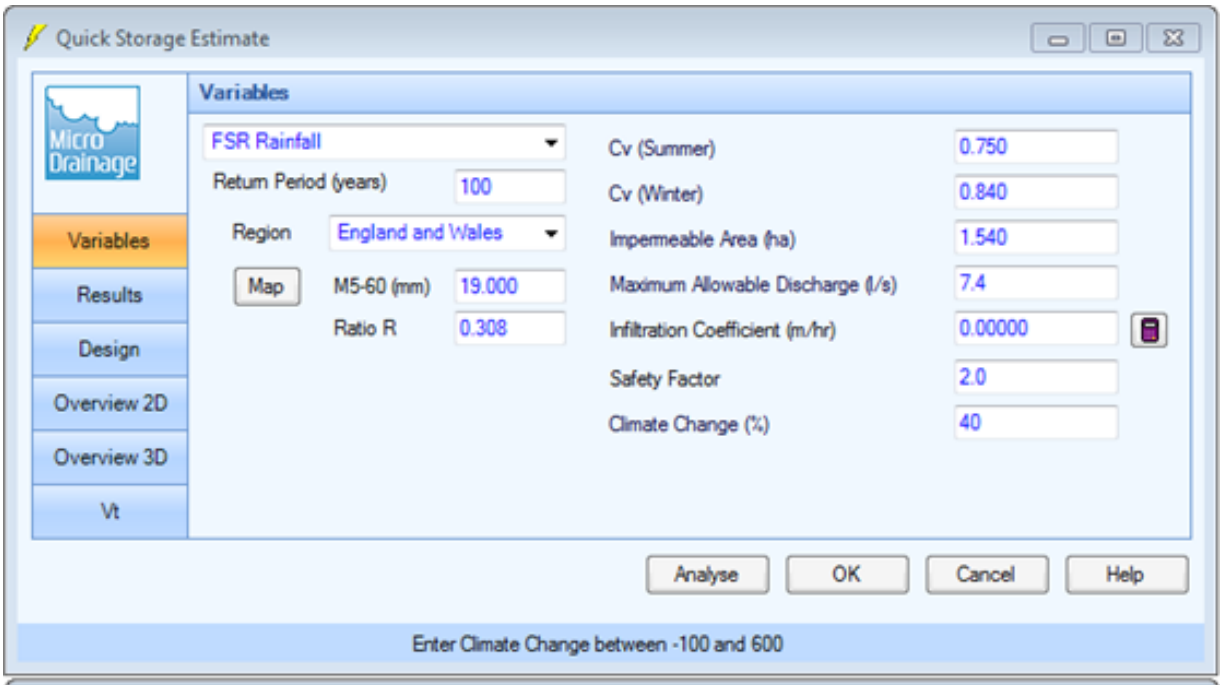
clarkebond

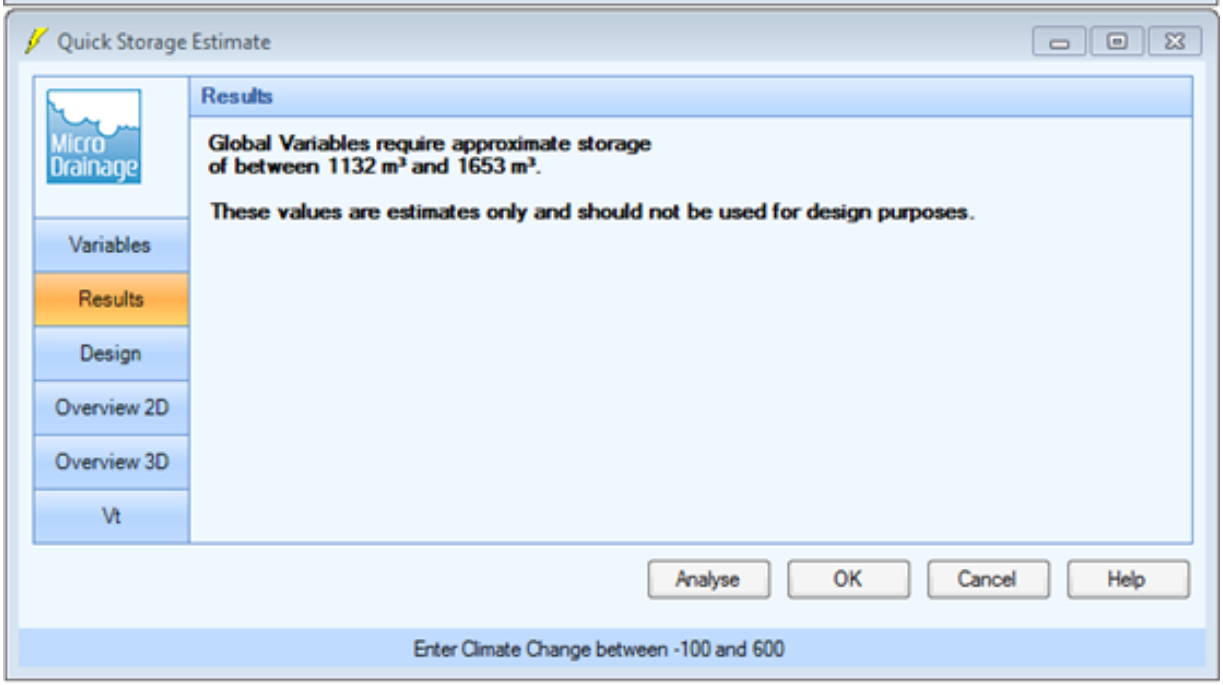
MULTIDISCIPLINARY ENGINEERING CONSULTANTS

The Cocoa House 129 Cumberland Road Bristol BS1 6UY
tel +44(0) 117 929 2244 fax +44(0) 117 929 3095
email bristol@clarkebond.com web www.clarkebond.com

TECHNICAL NOTE

Project:	**Inglewood Urban Extension**	**WB03590-TN01(V3.1)**
Subject:	TN01 - Drainage Strategy	
Prepared by	Andy Jenner BEng CEng MICE (Associate Director)	
Approved by	Seymour D'Oyley (Associate Director)	07/03/2018





clarkebond

MULTIDISCIPLINARY ENGINEERING CONSULTANTS

The Cocoa House
129 Cumberland Road
Bristol
BS1 6UY

tel: +44 (0)117 929 2244

GF Suite
Bickleigh House
Park Five Buisness Centre
Exeter EX2 7HU

tel: +44 (0)1392 369098

Unit 17.1
The Leathermarket
11-13 Weston Street
London SE1 3ER

tel: +44(0)20 7939 0959

www.clarkebond.com