St Nicholas

Redrow Homes South Wales

REDROW

Drainage Strategy

February 2015

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Contents

APPENDICES

APPENDIX A	3936-15-06-PL01	Engineering Layout
APPENDIX B	3936-15-06-PL02	Longitudinal Sections
APPENDIX C		Site Investigation Permeability Tests
APPENDIX D		Cellular Storage Calculations
APPENDIX E		Welsh Water Records

1.0 INTRODUCTION

1.1 This report provides information on the drainage strategy for the proposed residential development at St Nicholas, Vale of Glamorgan. The undertaking given by Redrow Homes South Wales Limited requires this information to support a full planning application for a proposed residential development.

1.2 The details in this report demonstrates how the drainage for the development will be dealt with and how flows will be managed to prevent increased flood risk.

1.3 The report also includes the flood risk for the development.

2.0 KEY DESIGN CRITERIA

2.1 Proposed Development Catchment Area

The total site area is 3.7 Ha and the proposed scheme has an impermeable area of 1.9 Ha.

2.2 Existing Green-field Run-off Rates

The site is located just off the A48 in St Nicholas and consists of undeveloped greenfield with existing residential development located along the southern and western boundary.

There is no evidence of any surface water drainage features on site but there are some small ponds located offsite to the north and north easterly boundary, some 100m away and at a lower level >5m.

The surface water run-off from the proposed development would have been designed to the Mean Annual Flood (Qbar), but due to favourable soakaway test results, see Appendix C, all surface water will discharge to ground. So there will be no run-off from this proposed development.

2.3 Climate Change

To take in to account climate change impact for the 100 year life of the residential development a 30% allowance for the predicted increase in rainfall intensity should be assumed for the design of the surface water drainage/SuDS in accordance with Technical Advice Note 15 (TAN15).

2.4 Surface & Foul Water Sewer Design

All surface water from the main highway, shared drives, private hard paved and roof-top areas will be managed via various infiltration methods located across the site.

It is proposed that surface water from the adoptable highway be dealt with separately from the domestic run-off and managed via a traditional piped system to a main cellular storage system within the POS area in the middle of the development. This can then be offered for adoption to the council via a Section 38 Agreement along with associated carriageway and footway.

The cellular system is designed to cater for the 1 in 30 year event with exceedance flows up to and including the 1 in 100 year event, plus 30% climate change managed within the POS area. Such systems are preferable as they are rarely in use as a hydraulic feature and the area above remains usable as public open space.

Due to site topography at the entrance to the site, a 1.5m change in level from the A48 up to the main site a small cellular system is required at the entrance to deal with a small catchment. Following detailed design there may be the possibility to connect this small catchment to the existing highway drainage within the A48, subject to agreement with the council. This would remove the need for this small cellular system.

Domestic run-off shall be managed in a similar way at source and subject to detailed design.

Following site investigation shallow permeability will be utilised at a rate ranging between 1.28x10-4 m/s and 1.81x10-5 m/s. This is derived from infiltration rate testing carried out by Integral Geotechnique (See Appendix C).

For this assessment the cellular structure has been designed to the lowest value obtained which equates to a rate of 65mm/hr as a worst case scenario and calculations for an appropriately sized system is shown in Appendix D.

The cellular system has been designed in accordance to the SUDS Manual Ciria C697 and to associated designed parameters. A safety factor of 2 is stated within Table 4.8 with a consequence of failure as a minor inconvenience (e.g. surface water on car parking areas). A one-step improvement in standards has been utilised on other recent developments within the region therefore a safety factor of 3 has been utilised.

This should be sufficient for this scheme as the proposed system will be offered for adoption to the council, all direct surface water to the system will be via catchpits and the cells will be enclosed with a terram surround.

All piped surface water upstream from the system will be designed to meet the hydraulic design and construction requirements within "Sewers for Adoption" 7th Edition. It will also be offered for adoption to the council under a Section 38 Agreement in addition to the associated carriageways and footways serving the site.

Foul sewers also serving the proposed development will be designed to meet the hydraulic design and construction requirements within "Sewers for Adoption" 7th Edition. It is a mandatory requirement to offer the foul sewer to Welsh Water for adoption under a Section 104 agreement in accordance with The Water Industries Act 1991.

Foul drainage will discharge via gravity to the existing adopted system within the site (via manhole ST09742401, Appendix E) with connection made via a Section 106 Notice, Water Industry Act 1991, with Welsh Water.

3.0 GROUND CONDITIONS

3.1 Ground Investigation - A ground investigation has been carried out for the site by Intégral Géotechnique in April 2014.

3.2 Geology - The site is underlain by gravelly clay and cobbles, then weathered bedrock. This is conducive for the use of soakaways and rates vary from 1.28x10-04m/s to 1.81x10-05m/s, see Appendix C.

3.3 Groundwater – During investigation there was no reporting of groundwater inflows within trial pits located within the site and therefore is not deemed an issue on this development.

4.0 FLOOD RISK ASSESSMENT

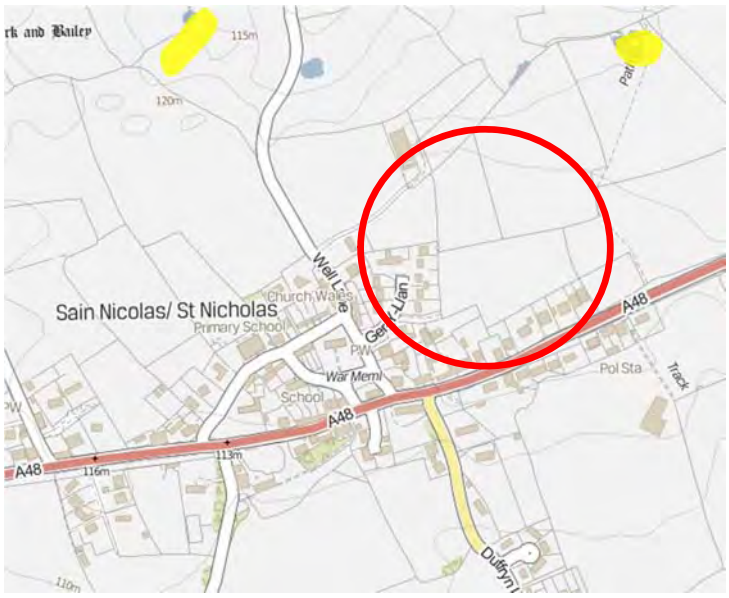
4.1 Flood Zone

According to the Environment Agency Flood Zone Map (see extract below), the site is identified as being located within Flood Zones A.

Flood Zone A is defined in the Welsh Assemblies Technical Advice Note 15 (TAN 15) as land assessed having the following annual probability of flooding:

Flood Zone A "Low Risk"

Considered to be at little or no risk of fluvial or tidal/coastal flooding.



4.2 Flood Risk Vulnerability Classification

The Flood Risk Vulnerability Classification of the proposed development (i.e. Residential) is 'Highly Vulnerable' in accordance with Figure 2 within TAN 15.

4.3 Flood Risk Vulnerability and Flood Zone Compatibility

In accordance with Section 6, TAN 15, all development is appropriate for this site with it being located within Flood Zone A.

There is a small pond to the north east of the site located some 100m away, but also >5m lower than this proposed development and not considered a risk.

4.4 Flooding Hazards

4.4.1 Fluvial & Tidal

The nearest watercourse is the River Ely 2 km to the north of the site and some minor distributors. The risk for this development is deemed low due to level difference between the watercourse and the site.

The sea (Bristol Channel) is located approx. 10 km to the south of the site and is not at risk from flooding from the sea.

4.4.2 Surface Water (Overland Flow)

Intense periods of rainfall over a short duration can often lead to overland flow as rainwater is unable to infiltrate into the ground or enter drainage systems. Flooding is likely to occur at low points within the site.

Surface water drainage for the 1 in 100 year event, plus 30% climate change for *this* development will be dealt with on-site.

Overland flow from adjacent land appears to be limited to a small parcel of land to the north eastern boundary and a potential catchment of circa 1 ha from it, the remaining catchment from that area and all other adjacent land runs north towards the existing pond mentioned previously.

Due to the small catchment overland flow is deemed a low risk.

4.4.3 Groundwater Flooding

Groundwater flooding is when the water levels in the ground rise above surface elevations, which is most likely to occur in low lying areas underlain by permeable rocks (aquifers). The ground investigation has recorded no water ingress in any of the trial holes therefore the risk of flooding from groundwater can be ruled out. Also EA Maps shows no evidence of groundwater flooding within a close proximity of the site.

4.4.4 Sewer Flooding

There have been no reported flooding incidents from these sewers adjacent to the site.

4.4.5 Artificial Sources

Artificial sources of flooding include reservoirs, canals and lakes. There are no artificial sources near the development.

5.0 SUMMARY

5.1 This report provides information on the foul and surface water strategy for the development to support a full planning application as required by the undertaking given by Redrow Homes South Wales Limited.

5.2 To take in to account climate change impact for the 100 year life of the residential development a 30% allowance for the predicted increase in rainfall intensity has been assumed for the design of the surface water drainage/SuDS in accordance with Technical Advise Note (TAN 15).

5.3 All surface water drainage will be managed by infiltration and will be designed to accommodate surface water in a 1 in 100 year event + 30% climate change.

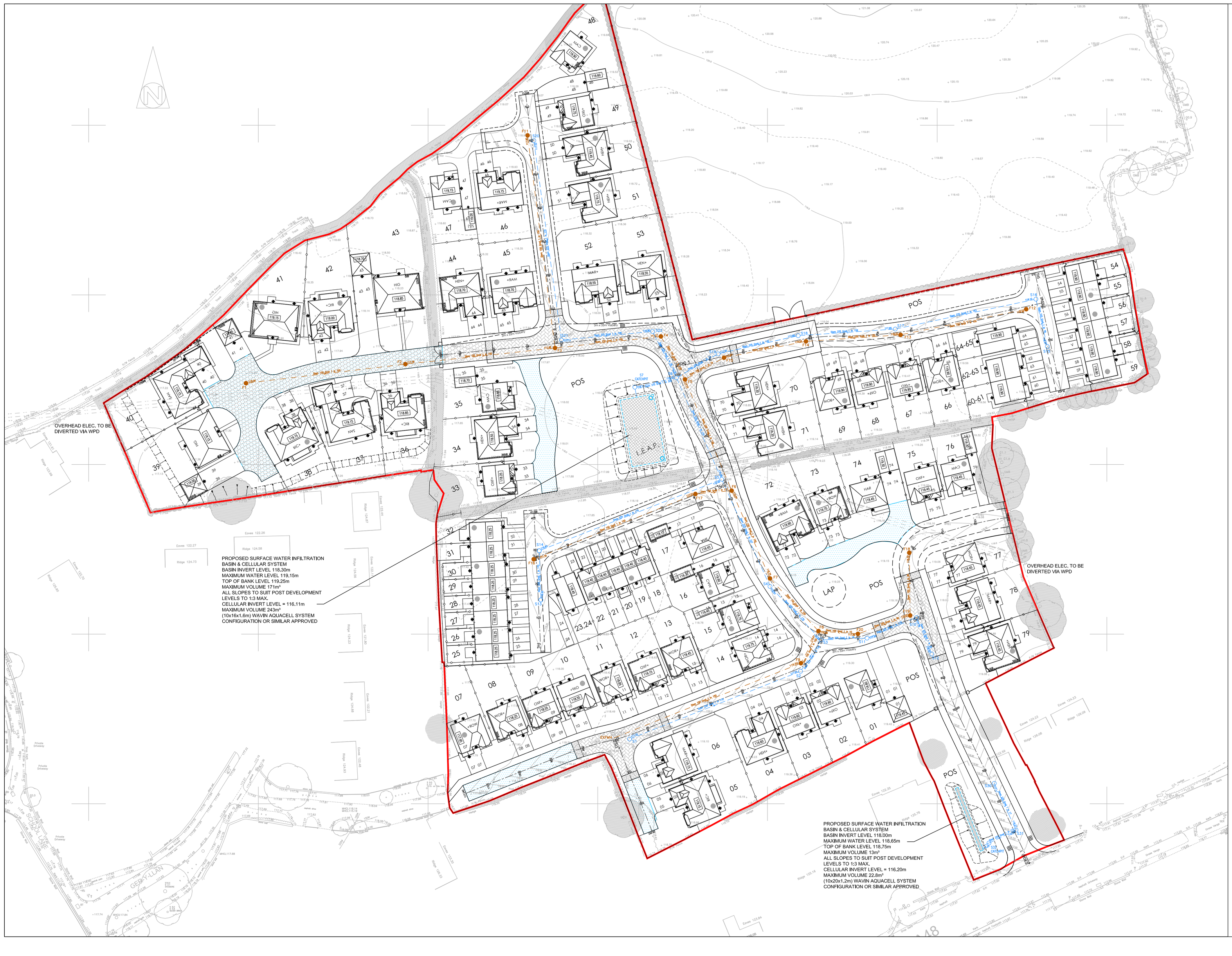
5.4 The cellular attenuation system and highway surface water drainage shall be offered to the council for adoption to ensure the long term maintenance and performance of the feature.

5.5 Foul water sewers will be adopted via a Section 104 Agreement with Welsh Water and will connect to the existing adopted system that crosses the site.

5.6 The site is located within Flood Zone A and considered to be at little or no risk of fluvial or tidal/coastal flooding.

Appendix A

3936-15-06-PL01 Engineering Layout



GENERAL NOTES

1. Do Not Scale
2. The contractor is to check and verify all buildings and site dimensions and levels, including sewer invert levels, before works start on site. The contractor is to comply in all aspects with the current building legislation, British Standards, building regulations etc.
3. Positions of existing services/statutory undertakers apparatus adjacent to or crossing proposed excavations are to be checked by the contractor prior to starting work
4. This drawing is to be read in conjunction with and checked against all other drawings,Engineering Details, Specification and any structural, geotechnical or other specialist document provided.
5. Any anomaly or contradiction between any of the above is to be reported to Redrow Homes.
6. This drawing is schematic for clarity only, positions of pipe runs and manholes may vary on site due to site conditions.

ROAD AND SEWER ADOPTION NOTES

1. All works for adoption under a Section 38 Agreement shall be carried out to the approval of the Vale of Glamorgan Council,
2. All works for adoption under a Section 104 Agreement shall be carried out to the National Water Council guide "Sewers for Adoption" 7th edition and Welsh Water's requirements.
3. Street lighting positions to be pegged on site and agreed by the Local Authority PRIOR to erection commencing.

LEGEND

- Adoptable foul sewer & manhole (Section 104 Agreement)
- Adoptable highway surface water sewer & manhole (S38 Agreement)
- Extent of private porous paving / asphalt (refer to architects plan for areas of asphalt / paving)

NB: Domestic drainage to discharge to private cellular systems in rear gardens

- 00.000 — House DPC Level
- (0.000) — Garage Slab Level
- Proposed Spot Level
- 70.30 — Exisiting Level
- Retaining Wall

A 20/02/2015 Updated following layout review.

Revisions

Project: St Nicholas, Vale of Glamorgan

Client: REDROW HOMES

Drawing: Engineering Layout Planning

Scale: 1:500@A1 Date: February 2015 Drawn by: SJD

Drawing No: 3936-15-06-PL01 Rev: A

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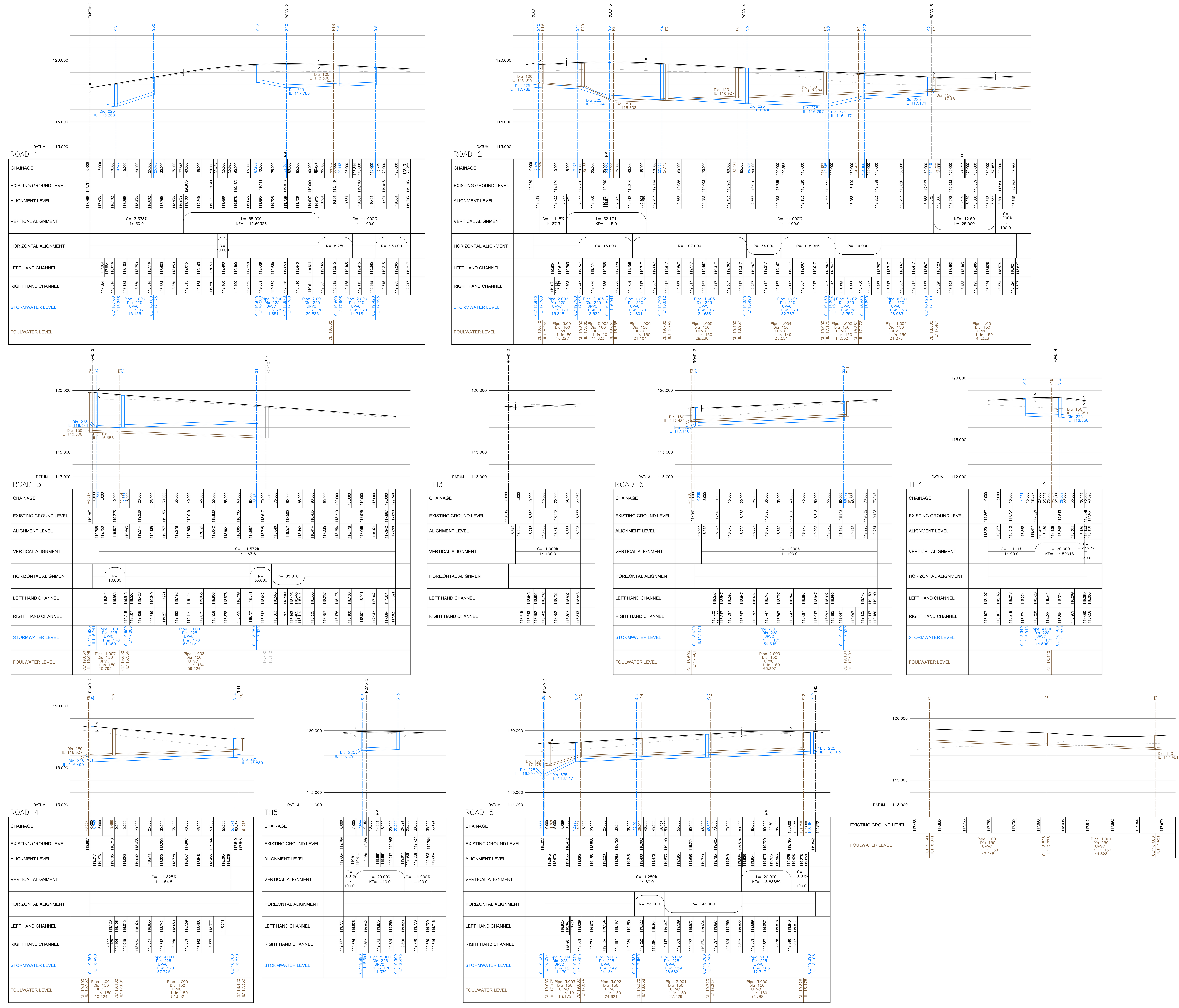
Drg.Status:

Appendix B

3936-15-06-PL02 Longitudinal Sections



NOTES

1. All works to be adopted under a Section 104 Agreement shall be carried out in accordance with 'Sewers for Adoption' 7th Edition & Welsh Water's requirements.

2. All concrete class pipes for diameters 375mm and above are to be Class '120'.

3. Do Not Scale

4. This drawing is to be read in conjunction with and checked against all other drawings, Engineering Details, specification and any structural, geotechnical or other specialist document provided.

5. A +I% gradient represents a rise of 1m in 100m.

6. Left and Right hand channels are on the left and right side respectively, when standing at Chainage Zero and looking along the road.

7. Pipe sizes are shown in millimetres and levels shown in metres AOD.

8. All pipes to have flexible joints with granular bed and surround (Class S having a min of 150mm granular bed and side fill with 300mm min above pipe) unless otherwise stated. Where cover under roads or vehicular access areas is less than 1200mm a concrete slab protection should be used in accordance with Welsh Water's details.

9. All pipe runs including connections to existing sewers are to be Soffit to Soffit, unless otherwise noted.

10. All connections for house drainage shall be 100mm unless stated otherwise and must extend a minimum of 500mm behind the back of the footpath. All connections when laid shall be plugged, protected as necessary and marked with a stake for future use. Surface Water Lateral drains to be 100mm dia. min. unless stated otherwise

11. All manholes and gullies are to be positioned at the chainages given on the long-sections.

12. For details of gradients and routes of house drainage connections refer to house drainage layout drawings.

13. Subject to drainage authority approval plastic pipes for gravity sewer, 100mm - 300mm are to be either:-
- Marley Twinwall system
- Uponer Ultrarib system
- Osma Ultrarib system
- Polysewer Twinwall system

Plastic pipes approval by DCWW for larger diameter gravity sewers are:
- Polypipe - Rigisewer (400mm-600mm)
- Polypipe - Ridgistorm XL (750mm-900mm)

Any proposed changes to the material must be authorised by DCWW.

14. The Developer Certifies that the Design Criteria, Material Standards and Workmanship Specification for the Proposed Adoptable Sewers are in accordance with those set out in 'Sewers for Adoption 7th Edition' and the requirements of the Statutory Undertaker - Welsh Water.

LEGEND

Adoptable Foul Sewer & Manhole

Adoptable Highway Surface Water Sewer & Manhole

DRAINAGE DESIGN AND CONSTRUCTION TO BE IN ACCORDANCE WITH SEWERS FOR ADOPTION 7TH EDITION AND THE REQUIREMENTS OF THE STATUTORY SEWERAGE UNDERTAKER

PLANNING

Revisions

Project: St Nicholas Vale of Glamorgan

Client: REDROW HOMES

Drawing: Road and Drainage Longitudinal Sections

Scale: 1:500H; 1:100V@A0 | Date: Feb 2015 | Drawn by: TL

Drawing No: 3936-15-06-PL02 | Rev:

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Appendix C

Site Investigation Permeability Tests

St. Nicholas

SOAKAWAY — SA1 TP2 (2.3m) cylce 1

Date 10-Apr-14

Engineer JJ **Job Number** 11308

Main Stratigraphic Unit Slightly silty slightly sandy very gravelly CLAY with frequent cobbles.
Pit Stable ? Sides stable
Weather Conditions Dry

Time (min.)	Depth (m)
0	1.02
1	1.02
2	1.02
3	1.02
5	1.12
6	1.37
7	1.58
8	1.76
9	1.82
10	1.84
16	1.90
20	1.93
25	1.97

Pit Dimensions

Length (m)	2.0
Width (m)	0.7
Depth (m)	2.3

Effective Storage

Water Depth at Start of Test (m)	1.02		
Water Depth at End of Test (m)	1.97		
Effective Depth (Measured) (m)	0.95		
% Effective Storage Depth	74.22%		
		Depth below GL	
Effective Storage Depth (100%) (m)	1.28		
Effective storage depth (75%) (m)	0.96	1.98	0
Effective storage depth (50%) (m)	0.64		
Effective storage depth (25%) (m)	0.32	1.34	0

Time for Soakaway

Time for measured outflow	25	minutes
Time for 100% outflow (see graph or readings?)	61	minutes
Time for 75-25% outflow (see graph)	24	minutes

Volume of infiltrated Water = length x width x effective storage depth

Volume outflowing between measured effective depth	1.330 m^3
Volume outflowing over 100% effective depth	1.792 m^3
Volume outflowing between 75% and 25% effective depth	0.896 m^3

Surface Area

(100% effective Storage)		(75-25% effective storage)		(over measured Depth)	
Length Area (m^2)	5.12	Length Area (m^2)	2.56	Length Area (m^2)	3.80
Width Area (m^2)	1.79	Width Area (m^2)	0.90	Width Area (m^2)	1.33
Base (m^2)	1.40	Base (m^2)	1.40	Base (m^2)	1.40

Mean Surface Area through which outflow occurs = (length area x 2) = (width area x 2) + base area

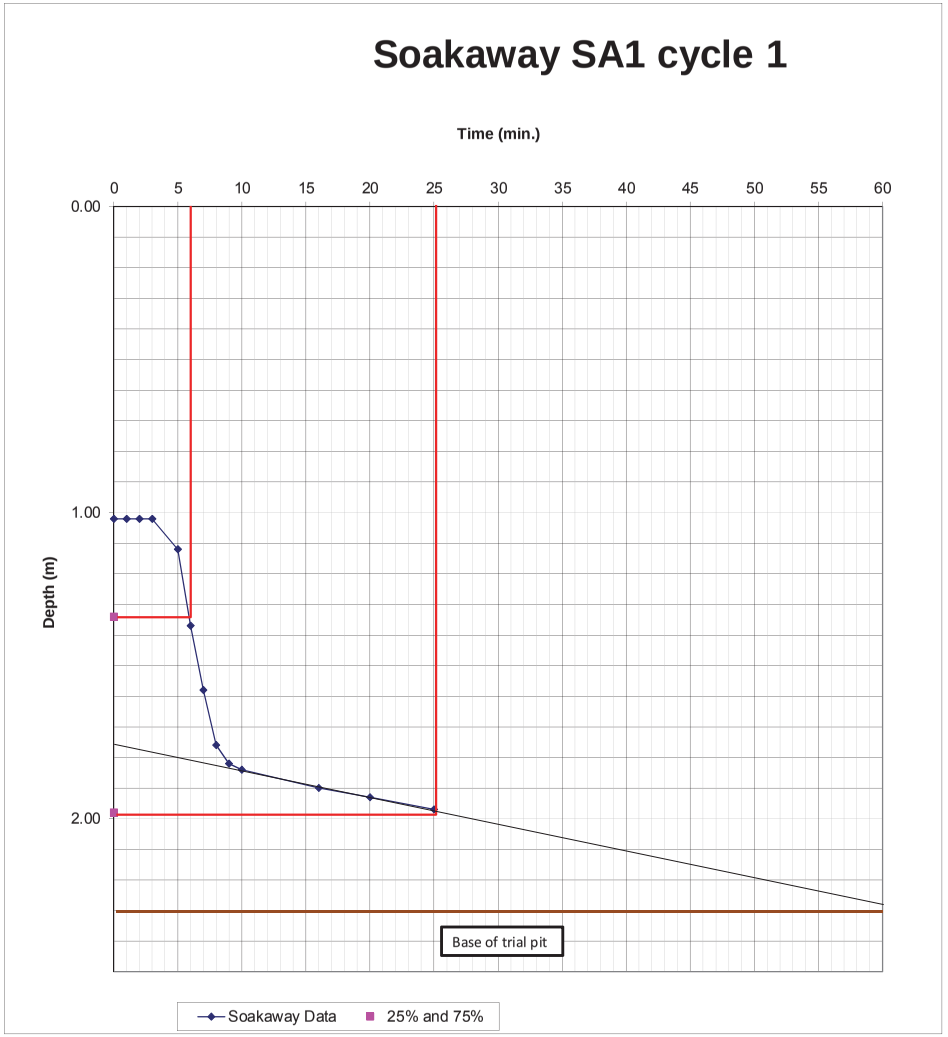
(100% effective storage)	8.31 m^2
(50% effective storage)	4.86 m^2
(Over Measured depth)	6.53 m^2

Soil Infiltration Rate = volume of infiltrated water / (surface area x infiltration time x 60)

Over 100% effective depth:	**5.89E-05** m/s
Over measured Depth	**1.36E-04** m/s
Over 75% - 25% effective depth:	**1.28E-04** m/s

Comments

Rapid infiltration recorded between 5 and 10 minutes. Could hear water draining away. (Anomalous behaviour compared to rest of soil infiltration test locations).



St. Nicholas

SOAKAWAY — SA1 TP2 (2.3m) cylce 2

Date 10-Apr-14

Engineer JJ **Job Number** 11308

Main Stratigraphic Unit Slightly silty slightly sandy very gravelly CLAY with frequent cobbles.
Pit Stable ? Minor collapse above where water was rapidly draining.
Weather Conditions Dry

Time (min.)	Depth (m)
0	1.04
1	1.28
2	1.50
3	1.62
4	1.70
5	1.73
6	1.74
12	1.78
20	1.82

Pit Dimensions

Length (m)	2.0
Width (m)	0.7
Depth (m)	2.3

Effective Storage

Water Depth at Start of Test (m)	1.04	
Water Depth at End of Test (m)	1.82	
Effective Depth (Measured) (m)	0.78	
% Effective Storage Depth	61.90%	
		Depth below GL
Effective Storage Depth (100%) (m)	1.26	
Effective storage depth (75%) (m)	0.945	1.99
Effective storage depth (50%) (m)	0.63	
Effective storage depth (25%) (m)	0.315	1.355

0

0

Time for Soakaway

Time for measured outflow	20	minutes
Time for 100% outflow (see graph or readings?)	92	minutes
Time for 75-25% outflow (see graph)	41	minutes

Volume of infiltrated Water = length x width x effective storage depth

Volume outflowing between measured effective depth	1.092	m^3
Volume outflowing over 100% effective depth	1.764	m^3
Volume outflowing between 75% and 25% effective depth	0.882	m^3

Surface Area

(100% effective Storage)		(75-25% effective storage)		(over measured Depth)	
Length Area (m^2)	5.04	Length Area (m^2)	2.52	Length Area (m^2)	3.12
Width Area (m^2)	1.76	Width Area (m^2)	0.88	Width Area (m^2)	1.09
Base (m^2)	1.40	Base (m^2)	1.40	Base (m^2)	1.40

Mean Surface Area through which outflow occurs = (length area x 2) = (width area x 2) + base area

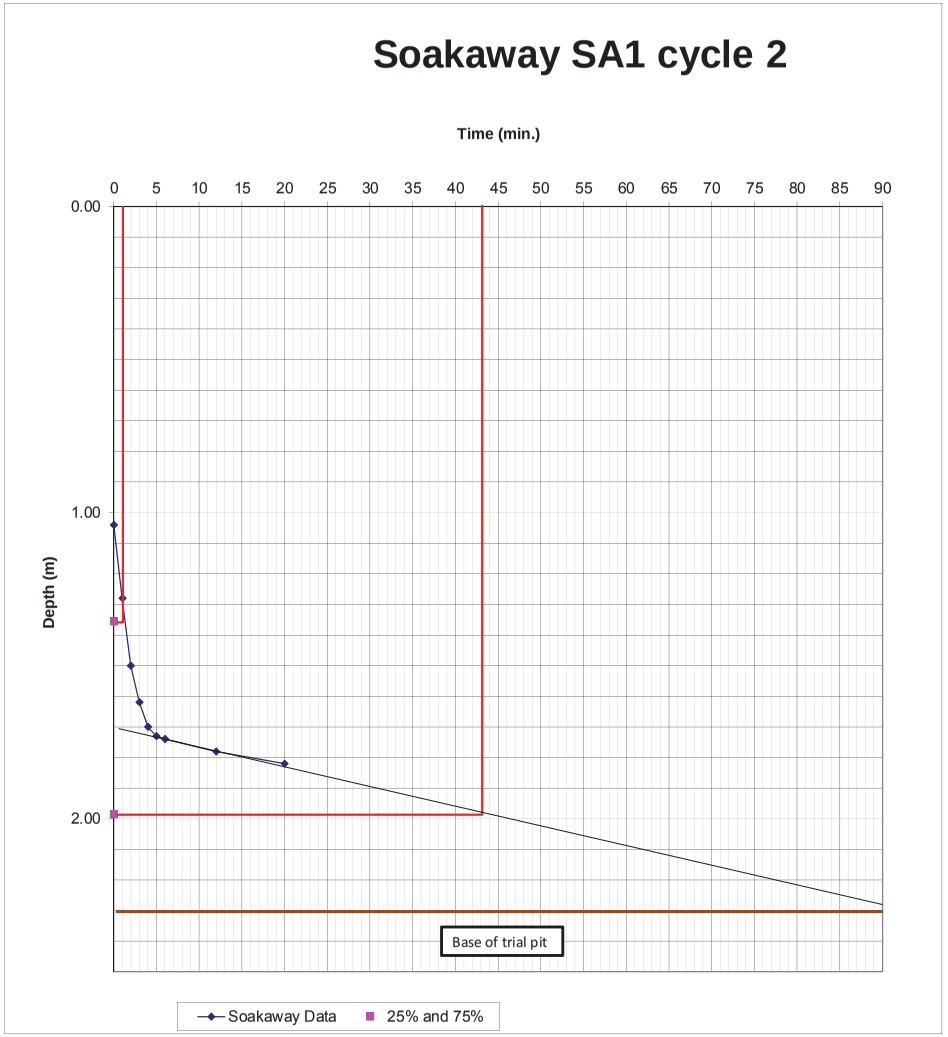
(100% effective storage)	8.20	m^2
(50% effective storage)	4.80	m^2
(Over Measured depth)	5.61	m^2

Soil Infiltration Rate = volume of infiltrated water / (surface area x infiltration time x 60)

Over 100% effective depth:	**3.90E-05**	m/s
Over measured Depth	**1.62E-04**	m/s
Over 75% - 25% effective depth:	**7.47E-05**	m/s

Comments

Rapid infiltration recorded between 0 and 5 minutes. Could hear water draining away. (Anomalous behaviour compared to rest of soil infiltration test loactions).



St. Nicholas

SOAKAWAY — SA1 TP2 (2.3m) cylce 3

Date 10-Apr-14

Engineer JJ **Job Number** 11308

Main Stratigraphic Unit Slightly silty slightly sandy very gravelly CLAY with frequent cobbles.
Pit Stable ? Migrating void formed where water was rapidly draining.
Weather Conditions Dry

Time (min.)	Depth (m)
0	1.05
1	1.23
2	1.37
3	1.49
4	1.55
5	1.61
7	1.64
15	1.70
42	1.75

Pit Dimensions

Length (m)	2.0
Width (m)	0.7
Depth (m)	2.3

Effective Storage

Water Depth at Start of Test (m)	1.04		
Water Depth at End of Test (m)	1.82		
Effective Depth (Measured) (m)	0.78		
% Effective Storage Depth	61.90%		
		Depth below GL	
Effective Storage Depth (100%) (m)	1.26		
Effective storage depth (75%) (m)	0.945	1.99	0
Effective storage depth (50%) (m)	0.63		
Effective storage depth (25%) (m)	0.315	1.355	0

Time for Soakaway

Time for measured outflow	42	minutes
Time for 100% outflow (see graph or readings?)	320	minutes
Time for 75-25% outflow (see graph)	169	minutes

Volume of infiltrated Water = length x width x effective storage depth

Volume outflowing between measured effective depth	1.092	m^3
Volume outflowing over 100% effective depth	1.764	m^3
Volume outflowing between 75% and 25% effective depth	0.882	m^3

Surface Area

(100% effective Storage)		(75-25% effective storage)		(over measured Depth)	
Length Area (m^2)	5.04	Length Area (m^2)	2.52	Length Area (m^2)	3.12
Width Area (m^2)	1.76	Width Area (m^2)	0.88	Width Area (m^2)	1.09
Base (m^2)	1.40	Base (m^2)	1.40	Base (m^2)	1.40

Mean Surface Area through which outflow occurs = (length area x 2) = (width area x 2) + base area

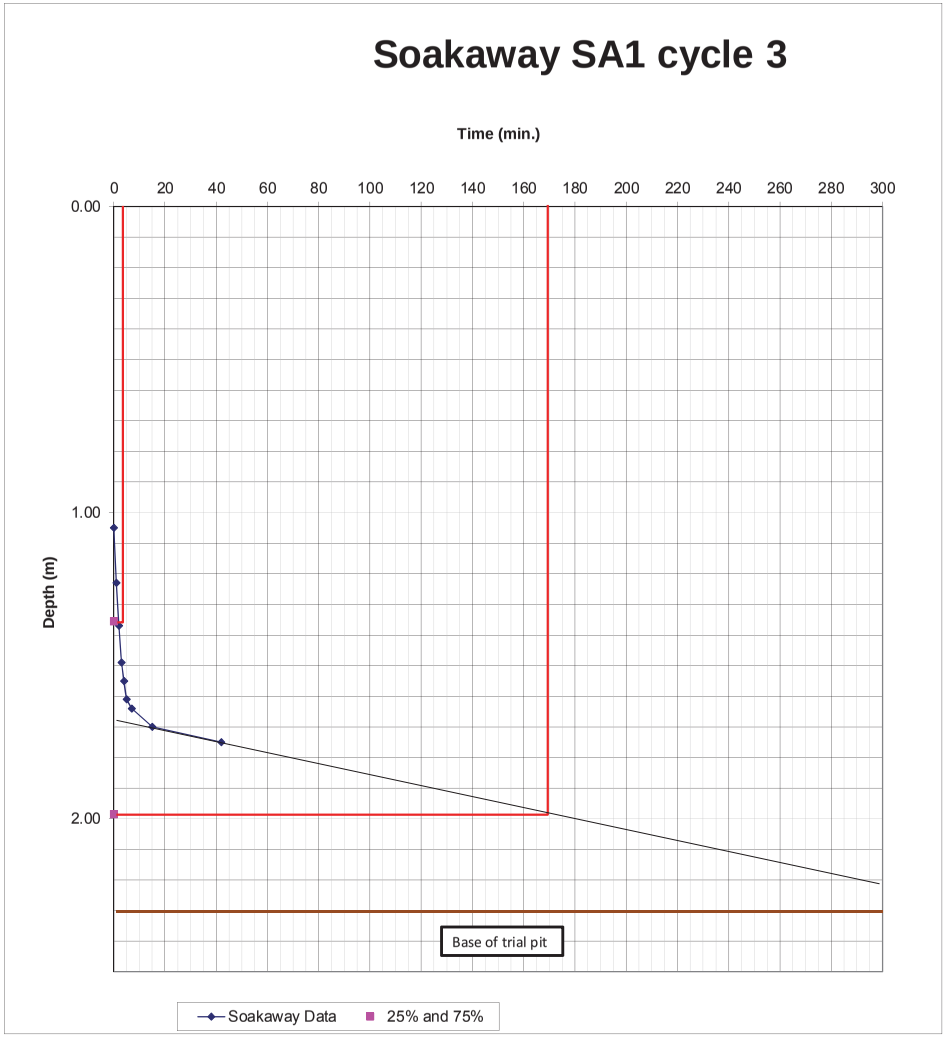
(100% effective storage)	8.20	m^2
(50% effective storage)	4.80	m^2
(Over Measured depth)	5.61	m^2

Soil Infiltration Rate = volume of infiltrated water / (surface area x infiltration time x 60)

Over 100% effective depth:	**1.12E-05**	m/s
Over measured Depth	**7.72E-05**	m/s
Over 75% - 25% effective depth:	**1.81E-05**	m/s

Comments

Rapid infiltration recorded between 0 and 5 minutes, Before slowing down due to collapse.



St. Nicholas

SOAKAWAY **SA2 TP4 (2.0m) cylce 1**

Date **10-Apr-14**

Engineer **JJ** **Job Number** 11308

Main Stratigraphic Unit silty gravelly CLAY with frequent cobbles AND clayey GRAVEL and COBBLES
Pit Stable ? Collapsed after an hour
Weather Conditions Dry

Time (min.)	Depth (m)
0	1.00
1	1.02
2	1.05
3	1.08
4	1.13
5	1.15
10	1.25
15	1.33
34	1.52
62	1.67

Pit Dimensions

Length (m)	2.0
Width (m)	0.7
Depth (m)	2.0

Effective Storage

Water Depth at Start of Test (m)	1.00	
Water Depth at End of Test (m)	1.67	
Effective Depth (Measured) (m)	0.67	
% Effective Storage Depth	67.00%	
		Depth below GL
Effective Storage Depth (100%) (m)	1.00	
Effective storage depth (75%) (m)	0.75	1.75 0
Effective storage depth (50%) (m)	0.5	
Effective storage depth (25%) (m)	0.25	1.25 0

Time for Soakaway

Time for measured outflow	62	minutes
Time for 100% outflow (see graph or readings?)	120	minutes
Time for 75-25% outflow (see graph)	65	minutes

Volume of infiltrated Water = length x width x effective storage depth

Volume outflowing between measured effective depth	0.938	m^3
Volume outflowing over 100% effective depth	1.400	m^3
Volume outflowing between 75% and 25% effective depth	0.700	m^3

Surface Area

(100% effective Storage)		(75-25% effective storage)		(over measured Depth)	
Length Area (m^2)	4.00	Length Area (m^2)	2.00	Length Area (m^2)	2.68
Width Area (m^2)	1.40	Width Area (m^2)	0.70	Width Area (m^2)	0.94
Base (m^2)	1.40	Base (m^2)	1.40	Base (m^2)	1.40

Mean Surface Area through which outflow occurs = (length area x 2) = (width area x 2) + base area

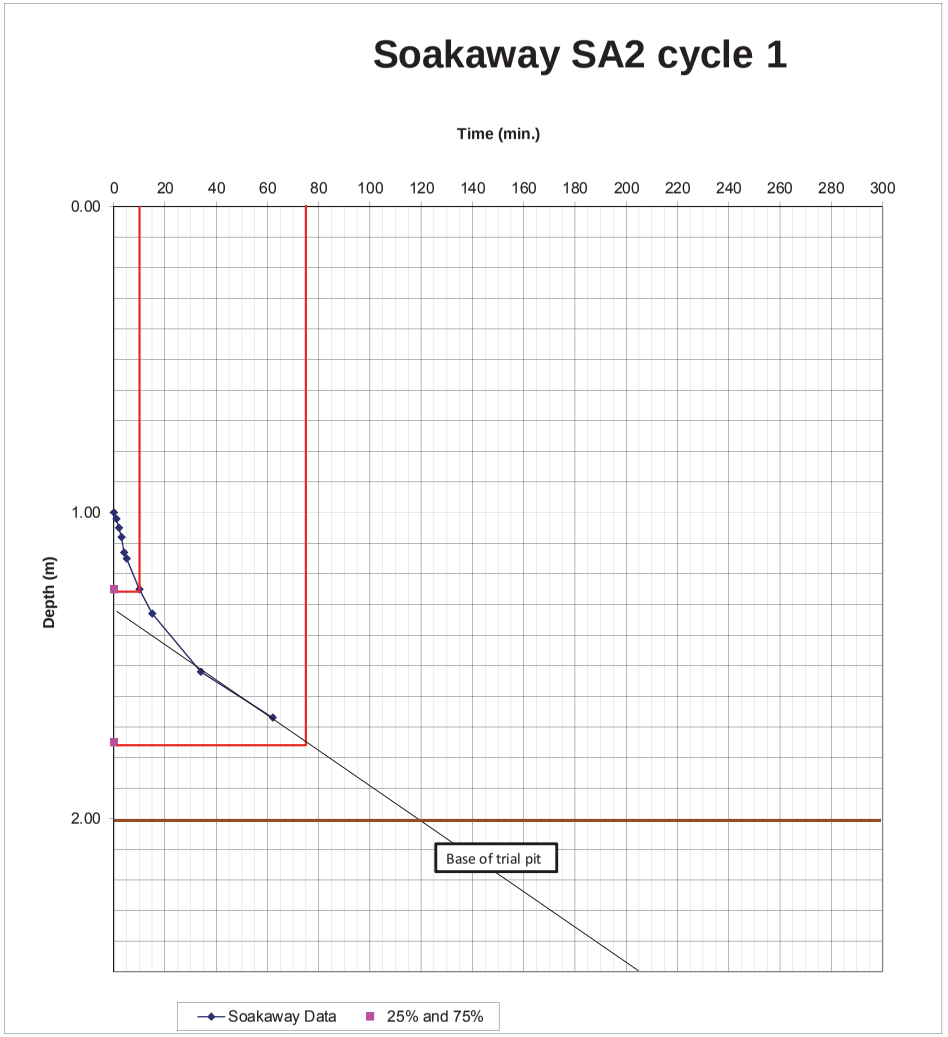
(100% effective storage)	6.80	m^2
(50% effective storage)	4.10	m^2
(Over Measured depth)	5.02	m^2

Soil Infiltration Rate = volume of infiltrated water / (surface area x infiltration time x 60)

Over 100% effective depth:	**2.86E-05**	m/s
Over measured Depth	**5.02E-05**	m/s
Over 75% - 25% effective depth:	**4.38E-05**	m/s

Comments

Pit collapsed during test.



St. Nicholas

SOAKAWAY — SA3 TP10 (2.2m) cylce 1

Date 11-Apr-14

Engineer JJ **Job Number** 11308

Main Stratigraphic Unit Silty gravelly CLAY with frequent cobbles AND clayey GRAVEL and COBBLES.
Pit Stable ? Sides stable.
Weather Conditions Dry

Time (min.)	Depth (m)
0	1.06
1	1.11
2	1.15
4	1.22
6	1.29
10	1.37
15	1.50
25	1.62
30	1.68
35	1.73

Pit Dimensions

Length (m)	1.6
Width (m)	0.8
Depth (m)	2.2

Effective Storage

Water Depth at Start of Test (m)	1.06	
Water Depth at End of Test (m)	1.73	
Effective Depth (Measured) (m)	0.67	
% Effective Storage Depth	60.36%	
		Depth below GL
Effective Storage Depth (100%) (m)	1.11	
Effective storage depth (75%) (m)	0.8325	1.89
Effective storage depth (50%) (m)	0.555	
Effective storage depth (25%) (m)	0.2775	1.3375

0
0

Time for Soakaway

Time for measured outflow	35	minutes
Time for 100% outflow (see graph or readings?)	74	minutes
Time for 75-25% outflow (see graph)	42	minutes

Volume of infiltrated Water = length x width x effective storage depth

Volume outflowing between measured effective depth	0.858 m^3
Volume outflowing over 100% effective depth	1.421 m^3
Volume outflowing between 75% and 25% effective depth	0.710 m^3

Surface Area

(100% effective Storage)		(75-25% effective storage)		(over measured Depth)	
Length Area (m^2)	3.55	Length Area (m^2)	1.78	Length Area (m^2)	2.14
Width Area (m^2)	1.78	Width Area (m^2)	0.89	Width Area (m^2)	1.07
Base (m^2)	1.28	Base (m^2)	1.28	Base (m^2)	1.28

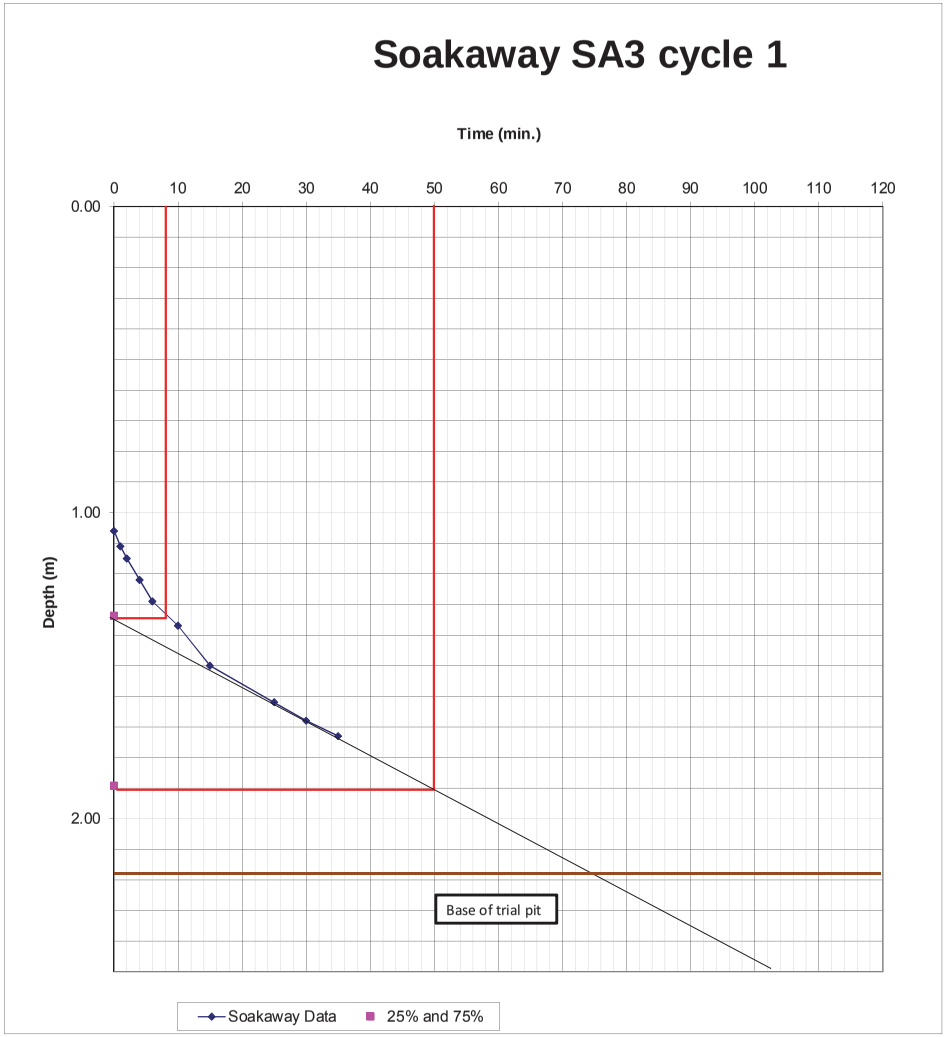
Mean Surface Area through which outflow occurs = (length area x 2) = (width area x 2) + base area

(100% effective storage)	6.61 m^2
(50% effective storage)	3.94 m^2
(Over Measured depth)	4.50 m^2

Soil Infiltration Rate = volume of infiltrated water / (surface area x infiltration time x 60)

Over 100% effective depth:	**4.84E-05** m/s
Over measured Depth	**9.08E-05** m/s
Over 75% - 25% effective depth:	**7.15E-05** m/s

Comments



St. Nicholas

SOAKAWAY — SA3 TP10 (2.2m) cylce 2

Date 11-Apr-14

Engineer JJ **Job Number** 11308

Main Stratigraphic Unit Silty gravelly CLAY with frequent cobbles AND clayey GRAVEL and COBBLES.
Pit Stable ? Minor collapses during test.
Weather Conditions Dry

Time (min.)	Depth (m)
0	1.02
1	1.07
3	1.15
5	1.21
10	1.30
22	1.50
40	1.68
45	1.72
80	1.92

Pit Dimensions

Length (m)	1.6
Width (m)	0.8
Depth (m)	2.0

Effective Storage

Water Depth at Start of Test (m)	1.02	
Water Depth at End of Test (m)	1.92	
Effective Depth (Measured) (m)	0.90	
% Effective Storage Depth	91.84%	
		Depth below GL
Effective Storage Depth (100%) (m)	0.98	
Effective storage depth (75%) (m)	0.735	1.76
Effective storage depth (50%) (m)	0.49	
Effective storage depth (25%) (m)	0.245	1.265

0

0

Time for Soakaway

Time for measured outflow	80	minutes
Time for 100% outflow (see graph or readings?)	92	minutes
Time for 75-25% outflow (see graph)	42	minutes

Volume of infiltrated Water = length x width x effective storage depth

Volume outflowing between measured effective depth	1.152 m^3
Volume outflowing over 100% effective depth	1.254 m^3
Volume outflowing between 75% and 25% effective depth	0.627 m^3

Surface Area

(100% effective Storage)		(75-25% effective storage)		(over measured Depth)	
Length Area (m^2)	3.14	Length Area (m^2)	1.57	Length Area (m^2)	2.88
Width Area (m^2)	1.57	Width Area (m^2)	0.78	Width Area (m^2)	1.44
Base (m^2)	1.28	Base (m^2)	1.28	Base (m^2)	1.28

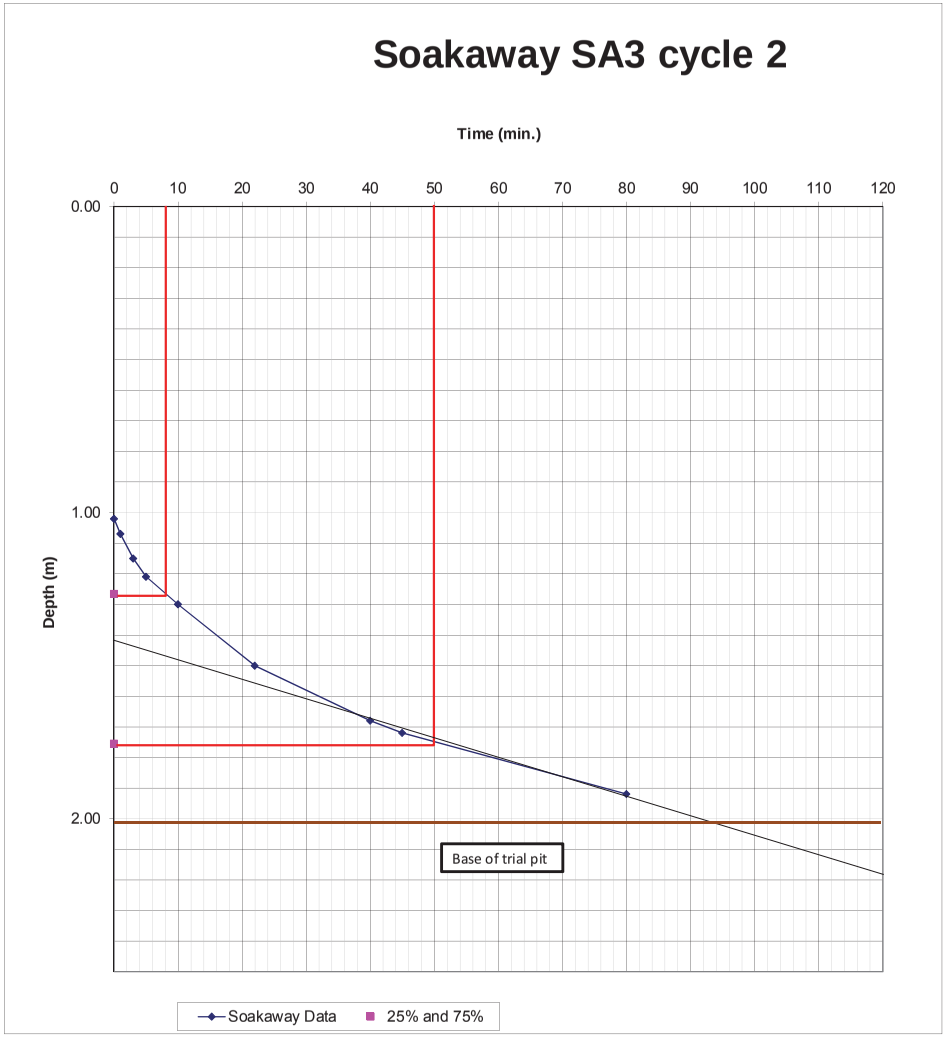
Mean Surface Area through which outflow occurs = (length area x 2) = (width area x 2) + base area

(100% effective storage)	5.98 m^2
(50% effective storage)	3.63 m^2
(Over Measured depth)	5.60 m^2

Soil Infiltration Rate = volume of infiltrated water / (surface area x infiltration time x 60)

Over 100% effective depth:	**3.80E-05** m/s
Over measured Depth	**4.29E-05** m/s
Over 75% - 25% effective depth:	**6.85E-05** m/s

Comments



St. Nicholas

SOAKAWAY **SA3 TP10 (2.2m) cylce 3**

Date **11-Apr-14**

Engineer **JJ** **Job Number** 11308

Main Stratigraphic Unit Silty gravelly CLAY with frequent cobbles AND clayey GRAVEL and COBBLES.
Pit Stable ? Minor collapses during test.
Weather Conditions Dry

Time (min.)	Depth (m)
0	1.17
2	1.22
4	1.26
6	1.30
10	1.35
25	1.53
52	1.75
82	1.89

Pit Dimensions

Length (m)	1.6
Width (m)	0.8
Depth (m)	2.0

Effective Storage

Water Depth at Start of Test (m)	1.17	
Water Depth at End of Test (m)	1.89	
Effective Depth (Measured) (m)	0.72	
% Effective Storage Depth	86.75%	
		Depth below GL
Effective Storage Depth (100%) (m)	0.83	
Effective storage depth (75%) (m)	0.6225	1.79
Effective storage depth (50%) (m)	0.415	
Effective storage depth (25%) (m)	0.2075	1.3775

0
0

Time for Soakaway

Time for measured outflow	82	minutes
Time for 100% outflow (see graph or readings?)	96	minutes
Time for 75-25% outflow (see graph)	50	minutes

Volume of infiltrated Water = length x width x effective storage depth

Volume outflowing between measured effective depth	0.922 m^3
Volume outflowing over 100% effective depth	1.062 m^3
Volume outflowing between 75% and 25% effective depth	0.531 m^3

Surface Area

(100% effective Storage)		(75-25% effective storage)		(over measured Depth)	
Length Area (m^2)	2.66	Length Area (m^2)	1.33	Length Area (m^2)	2.30
Width Area (m^2)	1.33	Width Area (m^2)	0.66	Width Area (m^2)	1.15
Base (m^2)	1.28	Base (m^2)	1.28	Base (m^2)	1.28

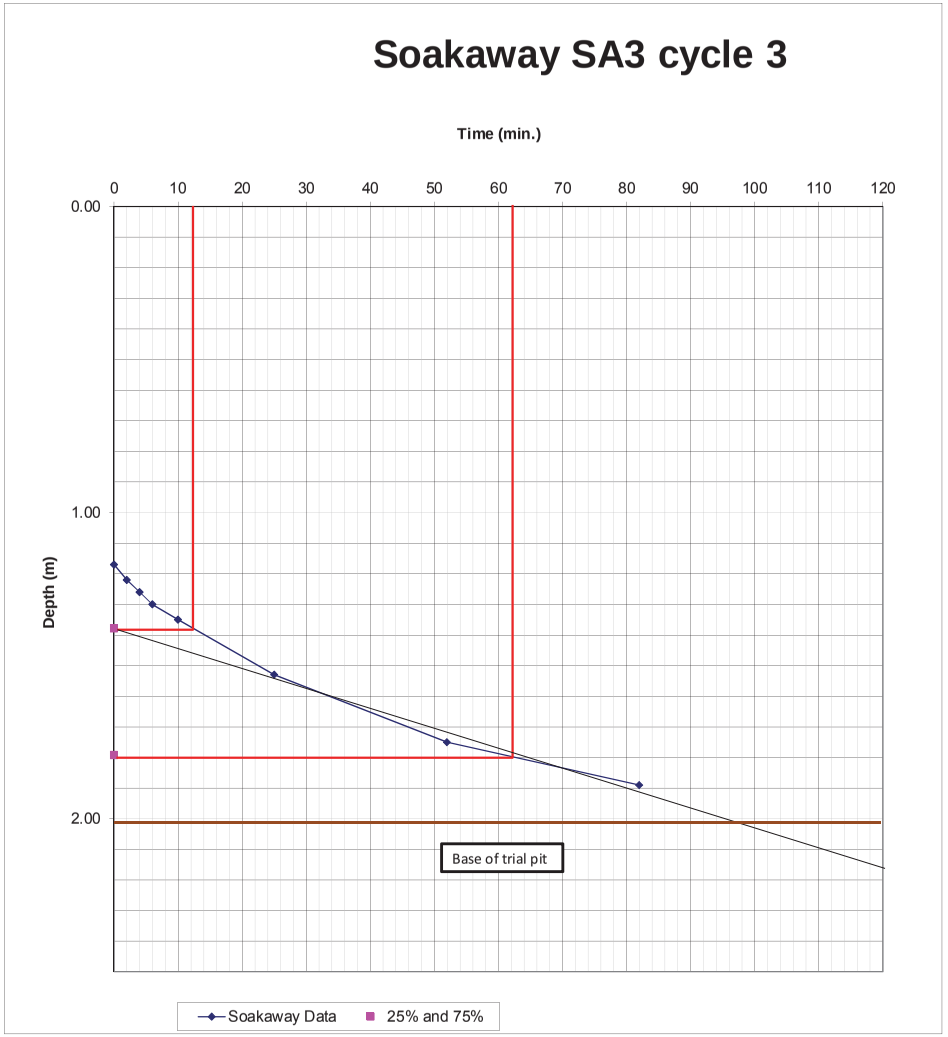
Mean Surface Area through which outflow occurs = (length area x 2) = (width area x 2) + base area

(100% effective storage)	5.26 m^2
(50% effective storage)	3.27 m^2
(Over Measured depth)	4.74 m^2

Soil Infiltration Rate = volume of infiltrated water / (surface area x infiltration time x 60)

Over 100% effective depth:	**3.50E-05** m/s
Over measured Depth	**3.96E-05** m/s
Over 75% - 25% effective depth:	**5.41E-05** m/s

Comments



St. Nicholas

SOAKAWAY — SA4 TP11 (2.5m) cylce 1

Date 11-Apr-14

Engineer JJ **Job Number** 11308

Main Stratigraphic Unit Silty gravelly CLAY with frequent cobbles AND clayey slightly sandy GRAVEL with occasional cobbles.
Pit Stable ? Sides stable.
Weather Conditions Dry

Time (min.)	Depth (m)
0	1.11
1	1.21
2	1.24
3	1.29
5	1.38
7	1.47
10	1.58
15	1.74
20	1.84
25	1.96
30	2.01
54	2.35

Pit Dimensions

Length (m)	1.7
Width (m)	0.7
Depth (m)	2.5

Effective Storage

Water Depth at Start of Test (m)	1.11		
Water Depth at End of Test (m)	2.35		
Effective Depth (Measured) (m)	1.24		
% Effective Storage Depth	89.21%		
		Depth below GL	
Effective Storage Depth (100%) (m)	1.39		
Effective storage depth (75%) (m)	1.0425	2.15	0
Effective storage depth (50%) (m)	0.695		
Effective storage depth (25%) (m)	0.3475	1.4575	0

Time for Soakaway

Time for measured outflow	54	minutes
Time for 100% outflow (see graph or readings?)	62	minutes
Time for 75-25% outflow (see graph)	34	minutes

Volume of infiltrated Water = length x width x effective storage depth

Volume outflowing between measured effective depth	1.476 m^3
Volume outflowing over 100% effective depth	1.654 m^3
Volume outflowing between 75% and 25% effective depth	0.827 m^3

Surface Area

(100% effective Storage)		(75-25% effective storage)		(over measured Depth)	
Length Area (m^2)	4.73	Length Area (m^2)	2.36	Length Area (m^2)	4.22
Width Area (m^2)	1.95	Width Area (m^2)	0.97	Width Area (m^2)	1.74
Base (m^2)	1.19	Base (m^2)	1.19	Base (m^2)	1.19

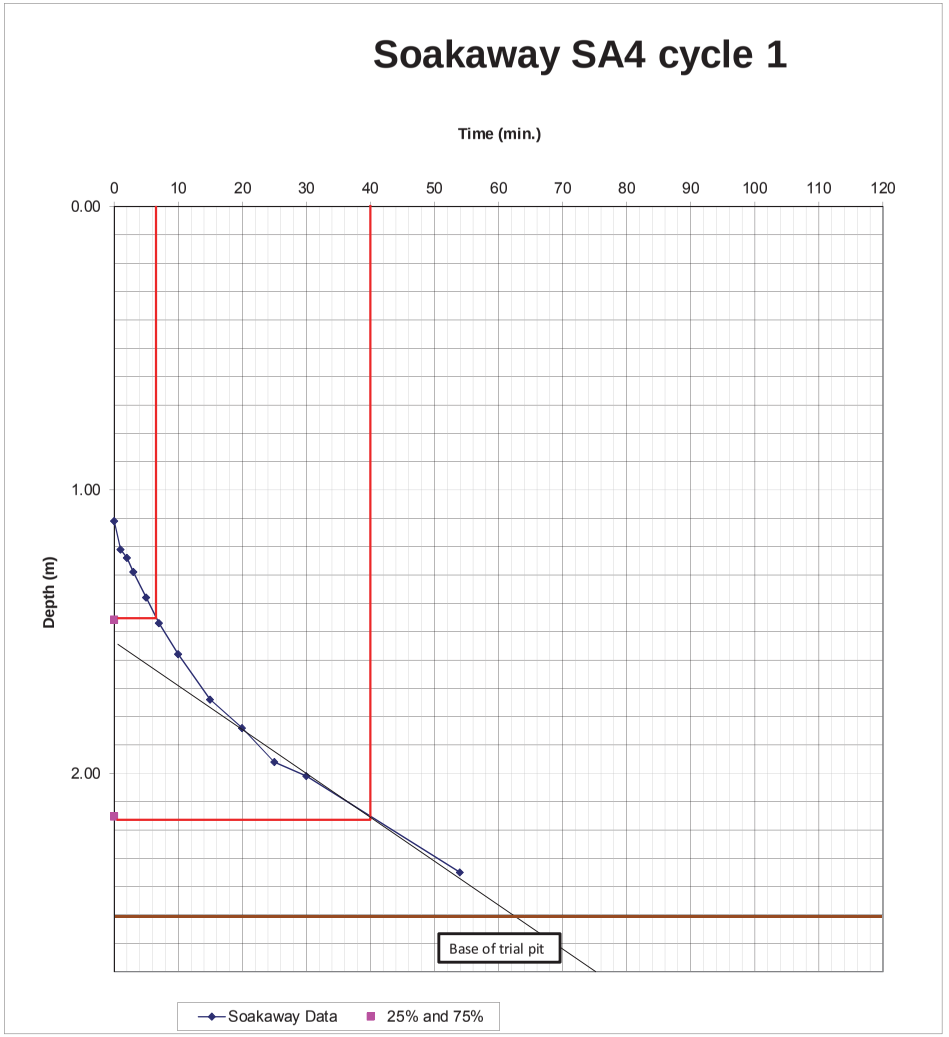
Mean Surface Area through which outflow occurs = (length area x 2) = (width area x 2) + base area

(100% effective storage)	7.86 m^2
(50% effective storage)	4.53 m^2
(Over Measured depth)	7.14 m^2

Soil Infiltration Rate = volume of infiltrated water / (surface area x infiltration time x 60)

Over 100% effective depth:	**5.66E-05** m/s
Over measured Depth	**6.38E-05** m/s
Over 75% - 25% effective depth:	**8.96E-05** m/s

Comments



St. Nicholas

SOAKAWAY

SA4 TP11 (2.5m) cylce 2

Date 11-Apr-14

Engineer JJ **Job Number** 11308

Main Stratigraphic Unit Silty gravelly CLAY with frequent cobbles AND clayey slightly sandy GRAVEL with occasional cobbles.
Pit Stable ? Sides stable.
Weather Conditions Dry

Time (min.)	Depth (m)
0	1.44
5	1.57
8	1.63
30	1.93
70	2.15
85	2.25

Pit Dimensions

Length (m)	1.7
Width (m)	0.7
Depth (m)	2.3

Effective Storage

Water Depth at Start of Test (m)	1.44	
Water Depth at End of Test (m)	2.25	
Effective Depth (Measured) (m)	0.81	
% Effective Storage Depth	94.19%	
		Depth below GL
Effective Storage Depth (100%) (m)	0.86	
Effective storage depth (75%) (m)	0.645	2.09
Effective storage depth (50%) (m)	0.43	
Effective storage depth (25%) (m)	0.215	1.655

0

0

Time for Soakaway

Time for measured outflow	85	minutes
Time for 100% outflow (see graph or readings?)	92	minutes
Time for 75-25% outflow (see graph)	50	minutes

Volume of infiltrated Water = length x width x effective storage depth

Volume outflowing between measured effective depth	0.964 m^3
Volume outflowing over 100% effective depth	1.023 m^3
Volume outflowing between 75% and 25% effective depth	0.512 m^3

Surface Area

(100% effective Storage)		(75-25% effective storage)		(over measured Depth)	
Length Area (m^2)	2.92	Length Area (m^2)	1.46	Length Area (m^2)	2.75
Width Area (m^2)	1.20	Width Area (m^2)	0.60	Width Area (m^2)	1.13
Base (m^2)	1.19	Base (m^2)	1.19	Base (m^2)	1.19

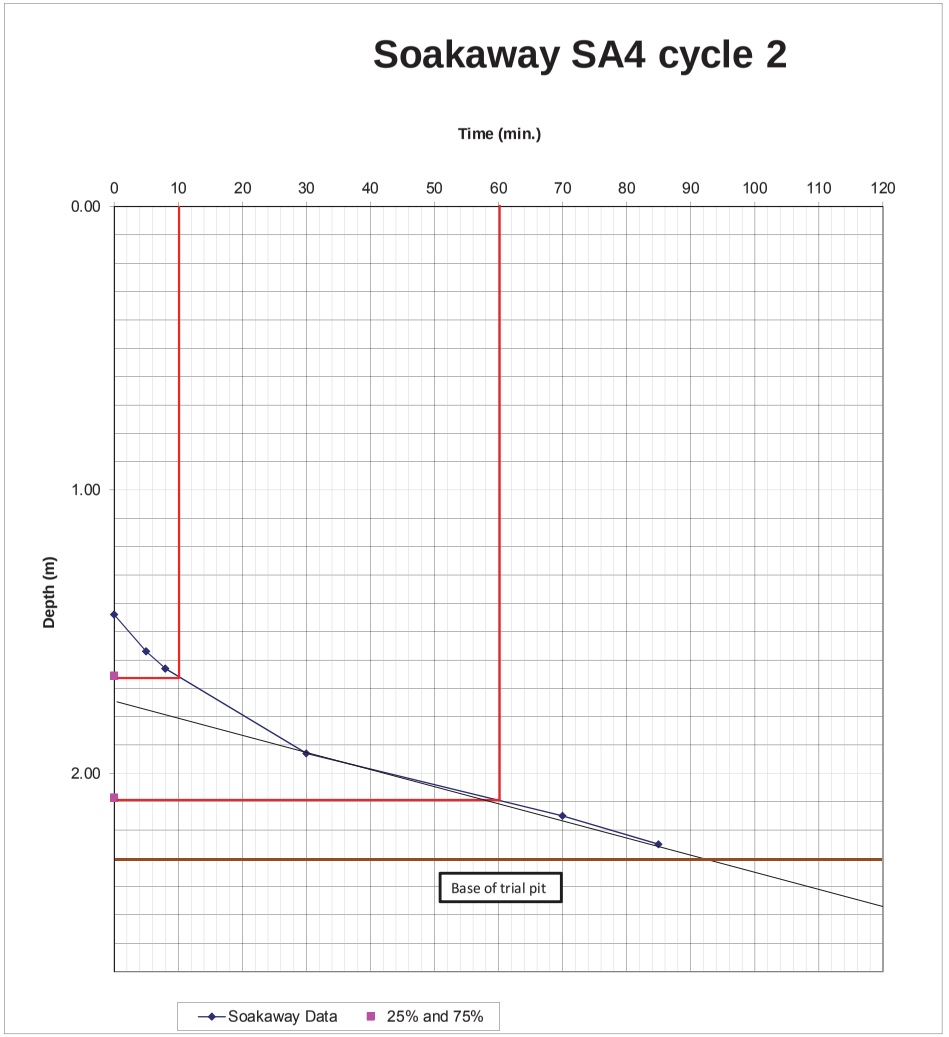
Mean Surface Area through which outflow occurs = (length area x 2) = (width area x 2) + base area

(100% effective storage)	5.32	m^2
(50% effective storage)	3.25	m^2
(Over Measured depth)	5.08	m^2

Soil Infiltration Rate = volume of infiltrated water / (surface area x infiltration time x 60)

Over 100% effective depth:	3.49E-05	m/s
Over measured Depth	3.72E-05	m/s
Over 75% - 25% effective depth:	5.24E-05	m/s

Comments



St. Nicholas

SOAKAWAY — SA4 TP11 (2.5m) cylce 3

Date 11-Apr-14

Engineer JJ **Job Number** 11308

Main Stratigraphic Unit Silty gravelly CLAY with frequent cobbles AND clayey slightly sandy GRAVEL with occasional cobbles.
Pit Stable ? Sides stable.
Weather Conditions Dry

Time (min.)	Depth (m)
0	1.33
1	1.38
3	1.43
5	1.52
12	1.66
32	1.97
68	2.13

Pit Dimensions

Length (m)	1.7
Width (m)	0.7
Depth (m)	2.3

Effective Storage

Water Depth at Start of Test (m)	1.33	
Water Depth at End of Test (m)	2.13	
Effective Depth (Measured) (m)	0.80	
% Effective Storage Depth	82.47%	
		Depth below GL
Effective Storage Depth (100%) (m)	0.97	
Effective storage depth (75%) (m)	0.7275	2.06
Effective storage depth (50%) (m)	0.485	
Effective storage depth (25%) (m)	0.2425	1.5725

0

0

Time for Soakaway

Time for measured outflow	68	minutes
Time for 100% outflow (see graph or readings?)	104	minutes
Time for 75-25% outflow (see graph)	44	minutes

Volume of infiltrated Water = length x width x effective storage depth

Volume outflowing between measured effective depth	0.952 m^3
Volume outflowing over 100% effective depth	1.154 m^3
Volume outflowing between 75% and 25% effective depth	0.577 m^3

Surface Area

(100% effective Storage)		(75-25% effective storage)		(over measured Depth)	
Length Area (m^2)	3.30	Length Area (m^2)	1.65	Length Area (m^2)	2.72
Width Area (m^2)	1.36	Width Area (m^2)	0.68	Width Area (m^2)	1.12
Base (m^2)	1.19	Base (m^2)	1.19	Base (m^2)	1.19

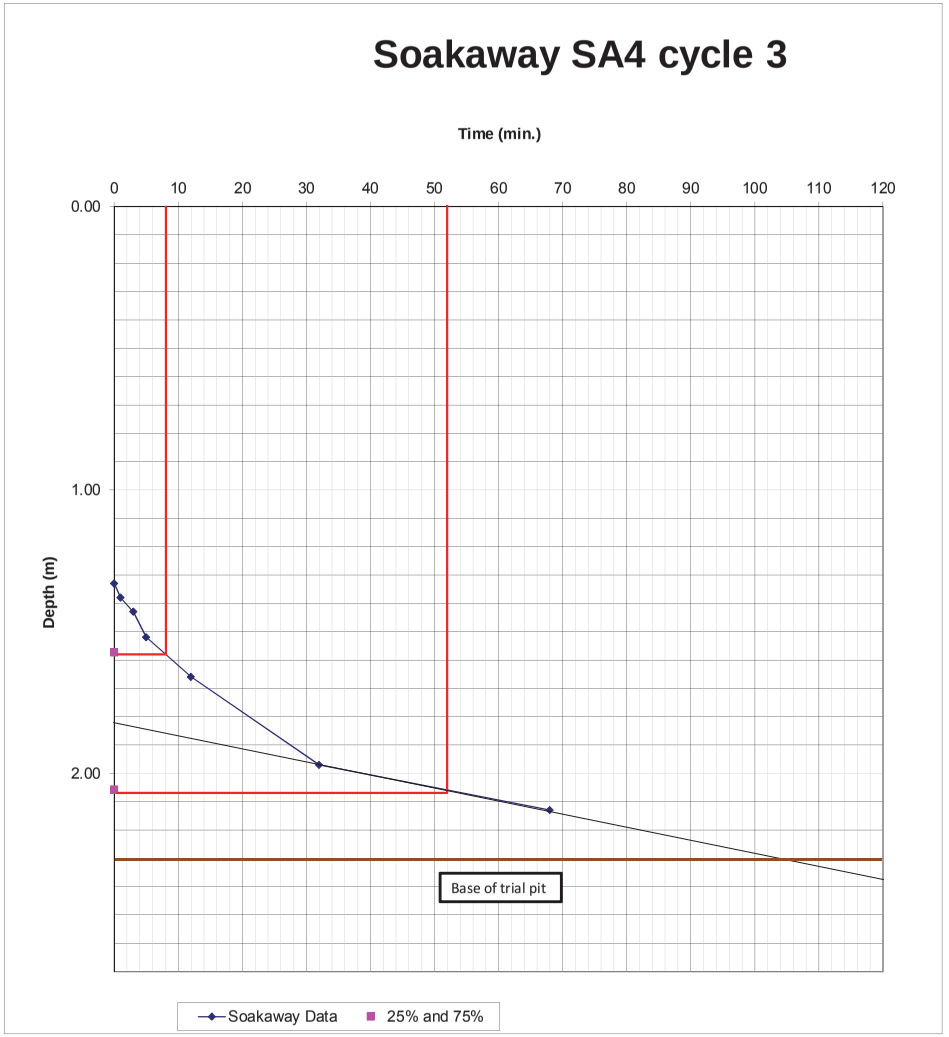
Mean Surface Area through which outflow occurs = (length area x 2) = (width area x 2) + base area

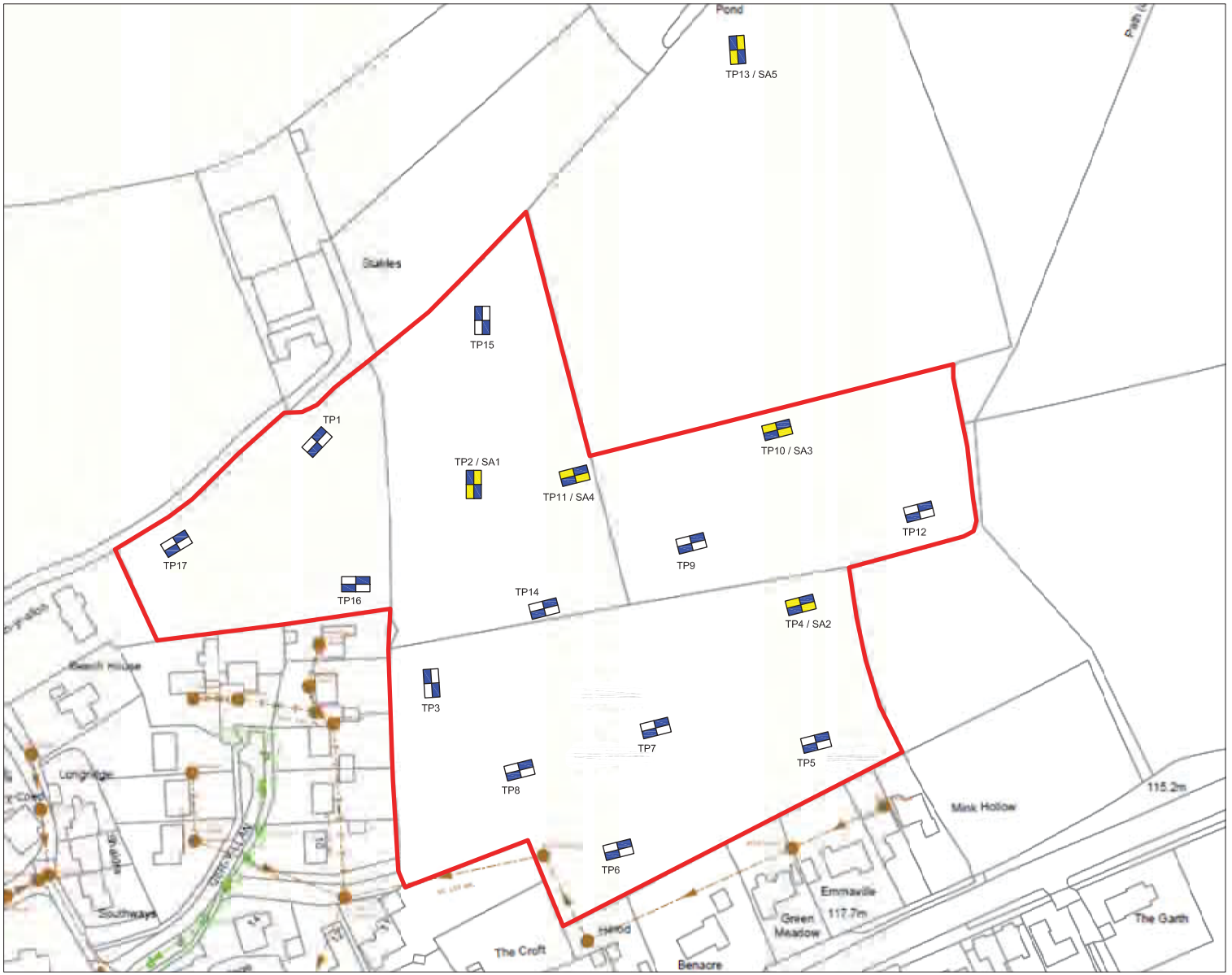
(100% effective storage)	5.85 m^2
(50% effective storage)	3.52 m^2
(Over Measured depth)	5.03 m^2

Soil Infiltration Rate = volume of infiltrated water / (surface area x infiltration time x 60)

Over 100% effective depth:	**3.16E-05** m/s
Over measured Depth	**4.64E-05** m/s
Over 75% - 25% effective depth:	**6.21E-05** m/s

Comments





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Legend:

- Approximate Location of Trial Pit
- Approximate Location of Soil Infiltration Test
- Approximate Site Boundary

Figure 2: Site Plan

Project: St. Nicholas, Vale of Glamorgan	Job No.: 11308	Intégral Géotechnique
Client: Redrow Homes South Wales	Scale: 1:1500 at A3	

Integral House,
7 Beddau Way,
Castlegate Business Park,
Caerphilly,
CF83 2AX.
Tel: 029 2080 7991

Appendix D

Cellular System Microdrainage Calculations

Summary of Results for 30 year Return Period

Half Drain Time : 1430 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	116.479	0.329	1.1	50.0	O K
30 min Summer	116.609	0.459	1.1	69.8	O K
60 min Summer	116.761	0.611	1.2	92.9	O K
120 min Summer	116.931	0.781	1.2	118.7	O K
180 min Summer	117.031	0.881	1.2	133.9	O K
240 min Summer	117.101	0.951	1.3	144.6	O K
360 min Summer	117.200	1.050	1.3	159.6	O K
480 min Summer	117.265	1.115	1.3	169.4	O K
600 min Summer	117.309	1.159	1.3	176.2	O K
720 min Summer	117.340	1.190	1.3	180.9	O K
960 min Summer	117.376	1.226	1.3	186.3	O K
1440 min Summer	117.398	1.248	1.4	189.7	O K
2160 min Summer	117.397	1.247	1.4	189.6	O K
2880 min Summer	117.383	1.233	1.3	187.5	O K
4320 min Summer	117.345	1.195	1.3	181.7	O K
5760 min Summer	117.298	1.148	1.3	174.5	O K
7200 min Summer	117.246	1.096	1.3	166.6	O K
8640 min Summer	117.193	1.043	1.3	158.6	O K
10080 min Summer	117.141	0.991	1.3	150.7	O K
15 min Winter	116.520	0.370	1.1	56.2	O K
30 min Winter	116.665	0.515	1.1	78.4	O K
60 min Winter	116.837	0.687	1.2	104.5	O K
120 min Winter	117.030	0.880	1.2	133.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	62.011	0.0	26
30 min Summer	43.419	0.0	41
60 min Summer	29.238	0.0	70
120 min Summer	19.079	0.0	130
180 min Summer	14.639	0.0	188
240 min Summer	12.084	0.0	248
360 min Summer	9.212	0.0	366
480 min Summer	7.585	0.0	486
600 min Summer	6.518	0.0	604
720 min Summer	5.755	0.0	722
960 min Summer	4.725	0.0	960
1440 min Summer	3.570	0.0	1218
2160 min Summer	2.691	0.0	1604
2880 min Summer	2.201	0.0	2020
4320 min Summer	1.661	0.0	2856
5760 min Summer	1.360	0.0	3688
7200 min Summer	1.166	0.0	4536
8640 min Summer	1.029	0.0	5288
10080 min Summer	0.926	0.0	6152
15 min Winter	62.011	0.0	26
30 min Winter	43.419	0.0	41
60 min Winter	29.238	0.0	70
120 min Winter	19.079	0.0	128

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
180 min Winter	117.146	0.996	1.3	151.3	O K
240 min Winter	117.228	1.078	1.3	163.8	O K
360 min Winter	117.344	1.194	1.3	181.6	O K
480 min Winter	117.423	1.273	1.4	193.6	O K
600 min Winter	117.480	1.330	1.4	202.1	O K
720 min Winter	117.521	1.371	1.4	208.4	O K
960 min Winter	117.574	1.424	1.4	216.4	O K
1440 min Winter	117.611	1.461	1.4	222.0	O K
2160 min Winter	117.605	1.455	1.4	221.2	O K
2880 min Winter	117.580	1.430	1.4	217.3	O K
4320 min Winter	117.509	1.359	1.4	206.6	O K
5760 min Winter	117.424	1.274	1.4	193.7	O K
7200 min Winter	117.335	1.185	1.3	180.1	O K
8640 min Winter	117.246	1.096	1.3	166.6	O K
10080 min Winter	117.160	1.010	1.3	153.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
180 min Winter	14.639	0.0	186
240 min Winter	12.084	0.0	244
360 min Winter	9.212	0.0	360
480 min Winter	7.585	0.0	476
600 min Winter	6.518	0.0	590
720 min Winter	5.755	0.0	704
960 min Winter	4.725	0.0	930
1440 min Winter	3.570	0.0	1356
2160 min Winter	2.691	0.0	1696
2880 min Winter	2.201	0.0	2168
4320 min Winter	1.661	0.0	3108
5760 min Winter	1.360	0.0	3984
7200 min Winter	1.166	0.0	4896
8640 min Winter	1.029	0.0	5712
10080 min Winter	0.926	0.0	6560

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Shortest Storm (mins)	15
Ratio R	0.257	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.441

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.147	4	8	0.147	8	12	0.147

Model Details

Storage is Online Cover Level (m) 118.200

Cellular Storage Structure

Invert Level (m) 116.150 Safety Factor 3.0
Infiltration Coefficient Base (m/hr) 0.06500 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.06500

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	160.0	160.0	1.700	0.0	243.2
1.600	160.0	243.2			

Summary of Results for 30 year Return Period

Half Drain Time : 525 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	116.451	0.301	0.2	5.7	O K
30 min Summer	116.568	0.418	0.2	7.9	O K
60 min Summer	116.701	0.551	0.3	10.5	O K
120 min Summer	116.840	0.690	0.3	13.1	O K
180 min Summer	116.912	0.762	0.3	14.5	O K
240 min Summer	116.957	0.807	0.3	15.3	O K
360 min Summer	117.005	0.855	0.3	16.2	O K
480 min Summer	117.031	0.881	0.3	16.7	O K
600 min Summer	117.048	0.898	0.3	17.1	O K
720 min Summer	117.059	0.909	0.4	17.3	O K
960 min Summer	117.069	0.919	0.4	17.5	O K
1440 min Summer	117.060	0.910	0.4	17.3	O K
2160 min Summer	117.023	0.873	0.3	16.6	O K
2880 min Summer	116.981	0.831	0.3	15.8	O K
4320 min Summer	116.901	0.751	0.3	14.3	O K
5760 min Summer	116.829	0.679	0.3	12.9	O K
7200 min Summer	116.766	0.616	0.3	11.7	O K
8640 min Summer	116.712	0.562	0.3	10.7	O K
10080 min Summer	116.663	0.513	0.3	9.7	O K
15 min Winter	116.488	0.338	0.2	6.4	O K
30 min Winter	116.620	0.470	0.2	8.9	O K
60 min Winter	116.771	0.621	0.3	11.8	O K
120 min Winter	116.929	0.779	0.3	14.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	62.011	0.0	26
30 min Summer	43.419	0.0	40
60 min Summer	29.238	0.0	68
120 min Summer	19.079	0.0	126
180 min Summer	14.639	0.0	184
240 min Summer	12.084	0.0	242
360 min Summer	9.212	0.0	350
480 min Summer	7.585	0.0	404
600 min Summer	6.518	0.0	468
720 min Summer	5.755	0.0	530
960 min Summer	4.725	0.0	668
1440 min Summer	3.570	0.0	946
2160 min Summer	2.691	0.0	1364
2880 min Summer	2.201	0.0	1764
4320 min Summer	1.661	0.0	2556
5760 min Summer	1.360	0.0	3344
7200 min Summer	1.166	0.0	4104
8640 min Summer	1.029	0.0	4848
10080 min Summer	0.926	0.0	5552
15 min Winter	62.011	0.0	26
30 min Winter	43.419	0.0	40
60 min Winter	29.238	0.0	68
120 min Winter	19.079	0.0	124

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
180 min Winter	117.014	0.864	0.3	16.4	O K
240 min Winter	117.068	0.918	0.4	17.4	O K
360 min Winter	117.129	0.979	0.4	18.6	O K
480 min Winter	117.157	1.007	0.4	19.1	O K
600 min Winter	117.174	1.024	0.4	19.5	O K
720 min Winter	117.186	1.036	0.4	19.7	O K
960 min Winter	117.192	1.042	0.4	19.8	O K
1440 min Winter	117.167	1.017	0.4	19.3	O K
2160 min Winter	117.099	0.949	0.4	18.0	O K
2880 min Winter	117.029	0.879	0.3	16.7	O K
4320 min Winter	116.905	0.755	0.3	14.3	O K
5760 min Winter	116.801	0.651	0.3	12.4	O K
7200 min Winter	116.714	0.564	0.3	10.7	O K
8640 min Winter	116.641	0.491	0.2	9.3	O K
10080 min Winter	116.578	0.428	0.2	8.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
180 min Winter	14.639	0.0	182
240 min Winter	12.084	0.0	238
360 min Winter	9.212	0.0	348
480 min Winter	7.585	0.0	450
600 min Winter	6.518	0.0	484
720 min Winter	5.755	0.0	558
960 min Winter	4.725	0.0	714
1440 min Winter	3.570	0.0	1018
2160 min Winter	2.691	0.0	1460
2880 min Winter	2.201	0.0	1880
4320 min Winter	1.661	0.0	2720
5760 min Winter	1.360	0.0	3512
7200 min Winter	1.166	0.0	4264
8640 min Winter	1.029	0.0	5024
10080 min Winter	0.926	0.0	5760

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Shortest Storm (mins)	15
Ratio R	0.257	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.051

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.017	4	8	0.017	8	12	0.017

Model Details

Storage is Online Cover Level (m) 118.200

Cellular Storage Structure

Invert Level (m) 116.150 Safety Factor 3.0
Infiltration Coefficient Base (m/hr) 0.06500 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.06500

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	20.0	20.0	1.300	0.0	70.4
1.200	20.0	70.4			

Appendix E

Welsh Water Sewer Records

Dŵr Cymru
Welsh Water

PPA0000459

N
W E
S

LEGEND(Representative of most common features)

Waste network:

- Foul chamber
- Surface water chamber
- Combined chamber
- Combined sewer overflow
- Special purpose chamber
- Treatment works
- Pumping station
- Outfall
- Lamphole
- Storm Overflow
- Rising main
- Gravity sewer
- Private sewer
- Private sewer subject to Sect. 104 adoption agreement
- Private Sewer Transfer
- Lateral Drain
- Inspection Chamber

NB: Sewer symbol colour indicates the type.

RED - Combined
GREEN - Surface Water
BROWN - Foul
Purple - Former S24 sewers (for indicative purposes only)

Notes:

Whilst every reasonable effort has been taken to correctly record the pipe material of DCWW assets there is a possibility that in some cases pipe material (other than Asbestos Cement or Pitch Fibre) may be found to be asbestos cement (AC) or Pitch Fibre (PF) . It is therefore advisable that the possible presence of AC or PF pipes be anticipated and considered as part of any risk assessment prior to excavation

Dwr Cymru Cyf gives this information as to the position of its underground apparatus by way of general guidance only on the strict understanding that it is based on the best information available and no warranty as to its correctness is relied upon in the event of excavations or other works made in the vicinity of the Company's apparatus and any onus of locating the apparatus before carrying out any excavations rests entirely on you. It must be understood that the furnishing of the information is entirely without prejudice to the provision of the New Roads and Streetworks Act 1991 and of the Company's right to be compensated for any damage to its apparatus.

Service pipes are not generally shown but their presence should be anticipated.

EXACT LOCATIONS OF ALL APPARATUS TO BE DETERMINED ON SITE.

Map Ref:	309099,174512
Map scale:	1:1,250
Printed by:	bg
Printed on:	10th April 2014

Stables
Llan-yr-afon
Beech House
St Nicholas
(Sain Nicolas)
Kingfauns
Mink Hollow
Longridge
Swn-y-Coed
Shaldra
Southways
GER-Y-LLAN
Village Farmhouse
Church
Lych Gate
117.0m
Rise
Fernley
Manor Cottages
The Coach House
Three
Cottage
The Croft
Highdene
Hafod
Benacre
Green Meadow
Emmaville
117.7m
Pheasant
Cedar Parc
Milford
Los Andes
10
11
12
14
ST09740401
ST09740403
ST09740402
ST09740408
ST09740404
ST09740384
ST09740318
ST09740319
ST09740305
ST09740307
ST09741416
ST09741417
ST09741305
ST09741304
ST09742401
ST09742402
ST09743403
ST09742303
ST09743303
UPVC 100 mm.
VC 150 mm.
VC 225 mm.