Introduction

The proposed development site is a parcel of land comprising the former Harthill Depot, Beechley House, Calder Kids, Riding School, Miniature Railway and Paddock area. The site is located to the north west of Calderstones Park, Liverpool. The proposed development site is approximately 5.23 Ha in overall area and is off mixed use, i.e. brownfield and greenfield. A planning application has been submitted for 39 new build properties and 12 refurbished dwellings. A summary of site areas is listed below:

Greenfield Areas = 1.0ha

Brownfield Areas = 4.23ha

Existing Site Drainage

A pre-development enquiry was submitted to United Utilities (UU) to advise on a potential discharge rate for the development. UU confirmed that an allowable discharge rate for surface water to the public sewer of 17l/s would be satisfactory. A copy of this correspondence can be found within the site's FRA. Report ref 15RED096/DS produced by Betts Associates dated August 2016.

Amey have produced a guidance note "LCC Greenfield/Brownfield Sites Surface Water Management Guidance" with regards to determining brownfield/greenfield run-off rates, which Amey have confirmed takes precedence over UU.

A drainage survey was undertaken in October 2016 to investigate the existing site drainage network for the area surrounding Beechley House and The Depot Site. It was not proven that the depot site discharged positively to the existing public sewer. A copy of the survey findings can be found within Appendix B.

Existing Flow Rates / Capacity

The results of the survey confirm that the final connection from Beechley House into the public sewer is laid a gradient such that the pipe can facilitate a flow rate of 26l/s. Therefore in order to calculate the allowable proposed discharge rate from the site 30% betterment is applied, which indicates an allowable discharge rate for the development of 18.2l/s.

United Utilities have confirmed that the capacity of the existing sewer can only facilitate a maximum discharge of surface water from the development of 17l/s therefore in this instance we must use the lower rate.

An allowable surface water discharge rate of **17l/s** shall be applied to the development.

Assessment of Site for Soakaways

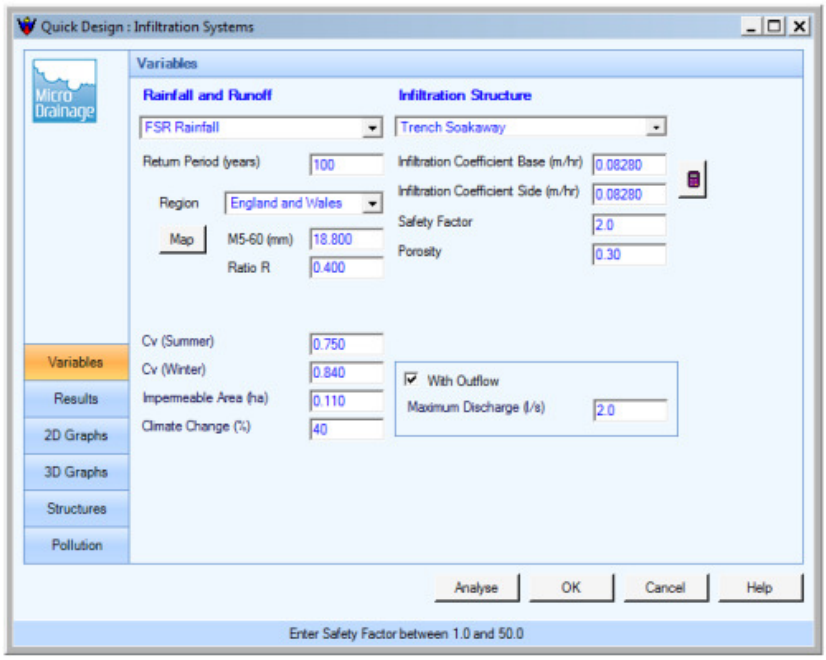
A limited site investigation was undertaken during October 16. Due to the existing vegetation in the paddock area, machine access was limited and no tests were undertaken. Further tests will be undertaken post planning and vacant possession of the site is available and the area has been cleared.

Three tests were undertaken within the depot site (SA1, SA2 & SA3) these are shown on the exploratory hole location plan within Appendix C. SA1 & SA3 proved acceptable for infiltration with rates of 2.3E-05m/sec and 1.0E-05m/sec respectively. SA2 was proven to be unsuccessful as water levels failed to drain to 75% effective depth. The results are included within Appendix D.

An assessment for storage requirements using soakaways has been undertaken using Micro drainage software.

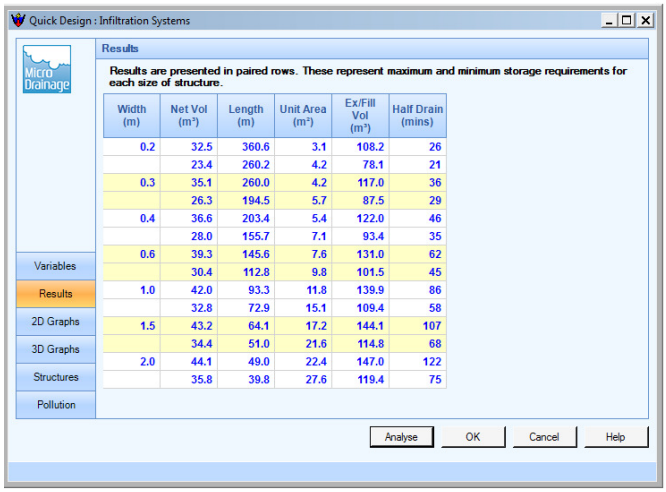
Assessment of SA1

An assessment against SA1 has been undertaken to provide volume of storage required. Plots 1-5 are located in the vicinity of SA1 and these plots have been used to assess the storage requirements. Due to the limited impermeable area a discharge rate of 2l/s is proposed. A copy of the design parameters are shown below;



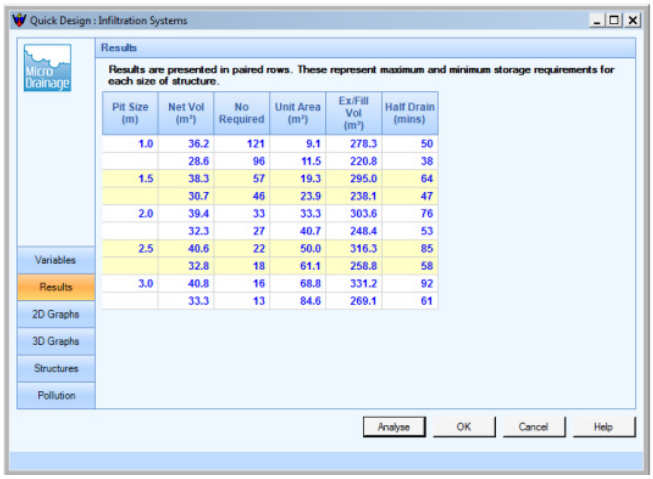
Two types of soakaways have been modelling using the Microdrainage Software, a trench soakaway and a house soakaway. Results for both models are shown below;

Trench Soakaway



Width (m)	Net Vol (m³)	Length (m)	Unit Area (m²)	Ex/Fill Vol (m³)	Half Drain (mins)
0.2	32.5	360.6	3.1	108.2	26
	23.4	260.2	4.2	78.1	21
0.3	35.1	260.0	4.2	117.0	36
	26.3	194.5	5.7	87.5	29
0.4	36.6	203.4	5.4	122.0	46
	28.0	155.7	7.1	93.4	35
0.6	39.3	145.6	7.6	131.0	62
	30.4	112.8	9.8	101.5	45
1.0	42.0	93.3	11.8	139.9	86
	32.8	72.9	15.1	109.4	58
1.5	43.2	64.1	17.2	144.1	107
	34.4	51.0	21.6	114.8	68
2.0	44.1	49.0	22.4	147.0	122
	35.8	39.8	27.6	119.4	75

House Soakaway



Pit Size (m)	Net Vol (m³)	No Required	Unit Area (m²)	Ex/Fill Vol (m³)	Half Drain (mins)
1.0	36.2	121	9.1	278.3	50
	28.6	96	11.5	220.8	38
1.5	38.3	57	19.3	295.0	64
	30.7	46	23.9	238.1	47
2.0	39.4	33	33.3	303.6	76
	32.3	27	40.7	248.4	53
2.5	40.6	22	50.0	316.3	85
	32.8	18	61.1	258.8	58
3.0	40.8	16	68.8	331.2	92
	33.3	13	84.6	269.1	61

A considerable length/number of soakaways is required to successfully infiltrate the plots identified above. A trench soakaway of approximately 45m long x 2m wide x 2m deep or approximately 15no 3m diameter x 2.3m deep house soakaways are required.

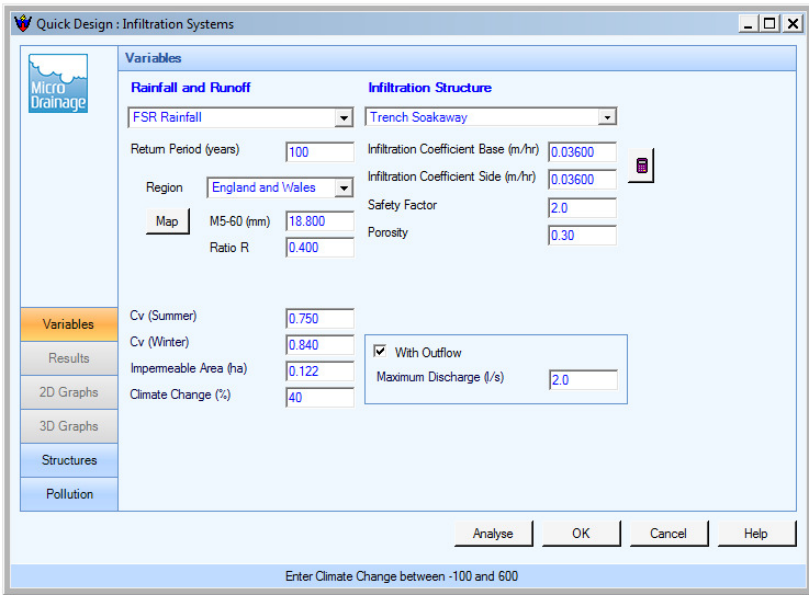
Soakaways are usually located approx. 5m from the back of a dwelling. On this development it is expected potential customers to construct conservatories and therefore must make an allowance for this when we design drainage systems within the plot curtilage. To avoid any potential clash the soakaways need to be located at least 9m from the back of each dwelling.

However the boundary of the site is lined by mature trees at varying heights between 12m and 25m with considerable root protection zones.

Soakaways will not be able to be constructed in the RPZ's and therefore construction of house soakaway of the required size is impractical.

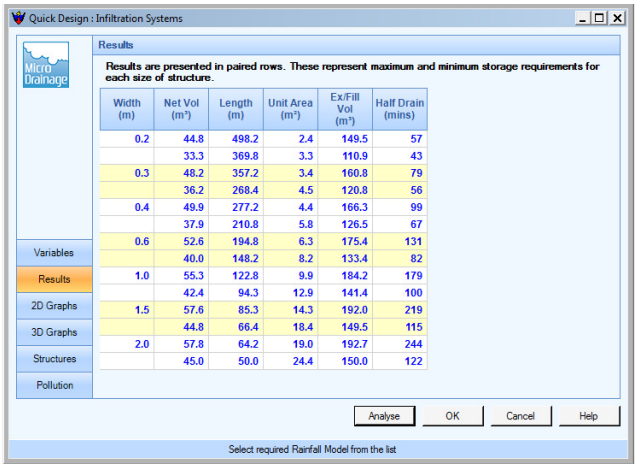
Assessment of SA3

An assessment against SA3 has been undertaken to provide volume of storage required. Plots 16-21 are located in the vicinity of SA3 and these plots have been used to assess the storage requirements. Due to the limited impermeable area a discharge rate of 2l/s is proposed. A copy of the design parameters are shown below;

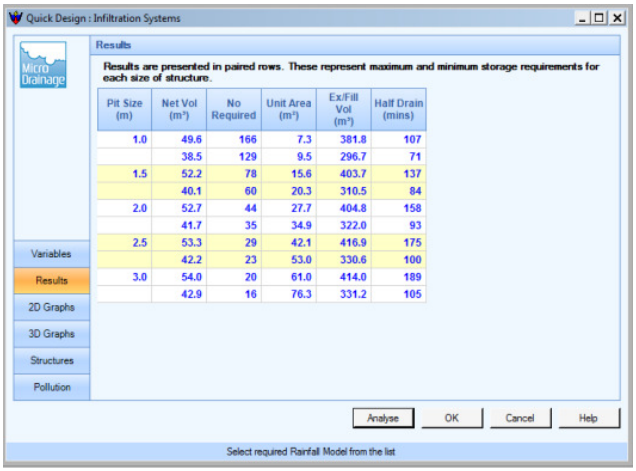


As per the assessment for SA1 two types of soakaways have been modelling using the Microdrainage Software, a trench soakaway and a house soakaway. Results for both models are shown below;

Trench Soakaway



House Soakaway



As per the assessment for SA1 a considerable length/number of soakaways is required to successfully infiltrate the plots identified above. A trench soakaway of approximately 57m long x 2m wide x 2m deep or approximately 18no 3m diameter x 2.3m deep house soakaways are required.

These plots are affected by the similar issues to those of SA1. It is considered that whilst the area in the vicinity of SA1 & SA3 is suitable to drain via infiltration and the drainage strategy is to were possible follow the SW Hierarchy as set out in the NPPF and the scheme should be in accordance with the Non-Statutory Technical standards for Sustainable Drainage systems (March 2015) the location of any such soakaway structure would be too close to building foundations, within the root protection zone, large surface area and crossing property boundary's resulting in maintenance issues, it is proposed to drain this area by a more conventional gravity system to discharge into the existing public sewer at a restricted discharge rate.

Proposed Site Drainage

The proposed development is split into three separate phases; The Depot Site (New Build), The Paddock (New Build) and Beechley House (Refurb & New Build). These phases are highlighted on the detailed site layout found in Appendix A.

The Depot Site & The Paddock will ultimately discharge into the existing public combined sewer within Harthill Road via one connection. Beechley House will drain into the existing public combined sewer within Harthill Road via an existing connection located within the Beechley House grounds. A copy of the proposed drainage layout is enclosed within Appendix C.

The Depot Site

Surface Water

The surface water drainage for The Depot Site will drain via gravity into a series of cellular storage blocks located opposite plots 9-11 within an area of POS. The volume of storage required is approximately 310m3. A Hydrobrake will be fitted to the downstream manhole to restrict flows to 6l/s.

Cellular storage will be maintained by the appointed development management company.

Foul Water

Foul water will drain via gravity into the existing public combined sewer within Harthill Road. Surface water downstream of the Hydrobrake will converge with the foul water and drain via a combined sewer to the outfall. The combined sewer will also receive a combined connection from The Paddock.

All sewers within The Depot Site with the exception of the cellular storage will be offered for adoption with United Utilities.

The Paddock

Surface Water

The northern area of The Paddock will drain via gravity into a series of cellular storage blocks located opposite plot 24 within an area of POS. The volume of storage required is approximately 220m3. A Hydrobrake will be fitted to the downstream manhole to restrict flows to 6l/s.

Again the cellular storage will be maintained by the appointed development management company.

The southern area of The Paddock will drain via gravity to the lowest point of the site adjacent plots 34-36 where it will be attenuated within a series of cellular storage blocks before discharging into a combined pumping station. The combined water will then be pumped approximately 250m into the proposed combined outlet for the northern area of The Paddock. The volume of surface water storage for attenuation is approximately 190m3. An orifice plate will be fitted to the outlet pipe to restrict flows to 5l/s. The attenuation and restriction of surface water flows is prior to discharge to the pumping station.

Foul Water

The northern area of The Paddock will drain via gravity into the proposed combined sewer serving The Depot Site and discharges into existing public combined sewer within Harthill Road. Foul water for the northern area will converge with the surface water downstream of the Hydrobrake.

The southern area of The Paddock will drain via a pumped solution into the proposed combined outlet for the northern area. The pumping station will be located adjacent plots 34-36.

The foul and surface water drainage within the southern area of The Paddock will remain private and maintained by the appointed development management company.

The foul and surface water drainage for the northern area of The Paddock with the exception of the cellular storage will be offered for adoption with United Utilities.

Beechley House

Surface Water

A drainage survey has been undertaken for the area of Beechley House. The results of which identify surface water draining via infiltration. It is proposed that the refurbished buildings will drain via infiltration and a series of soakaways are proposed.

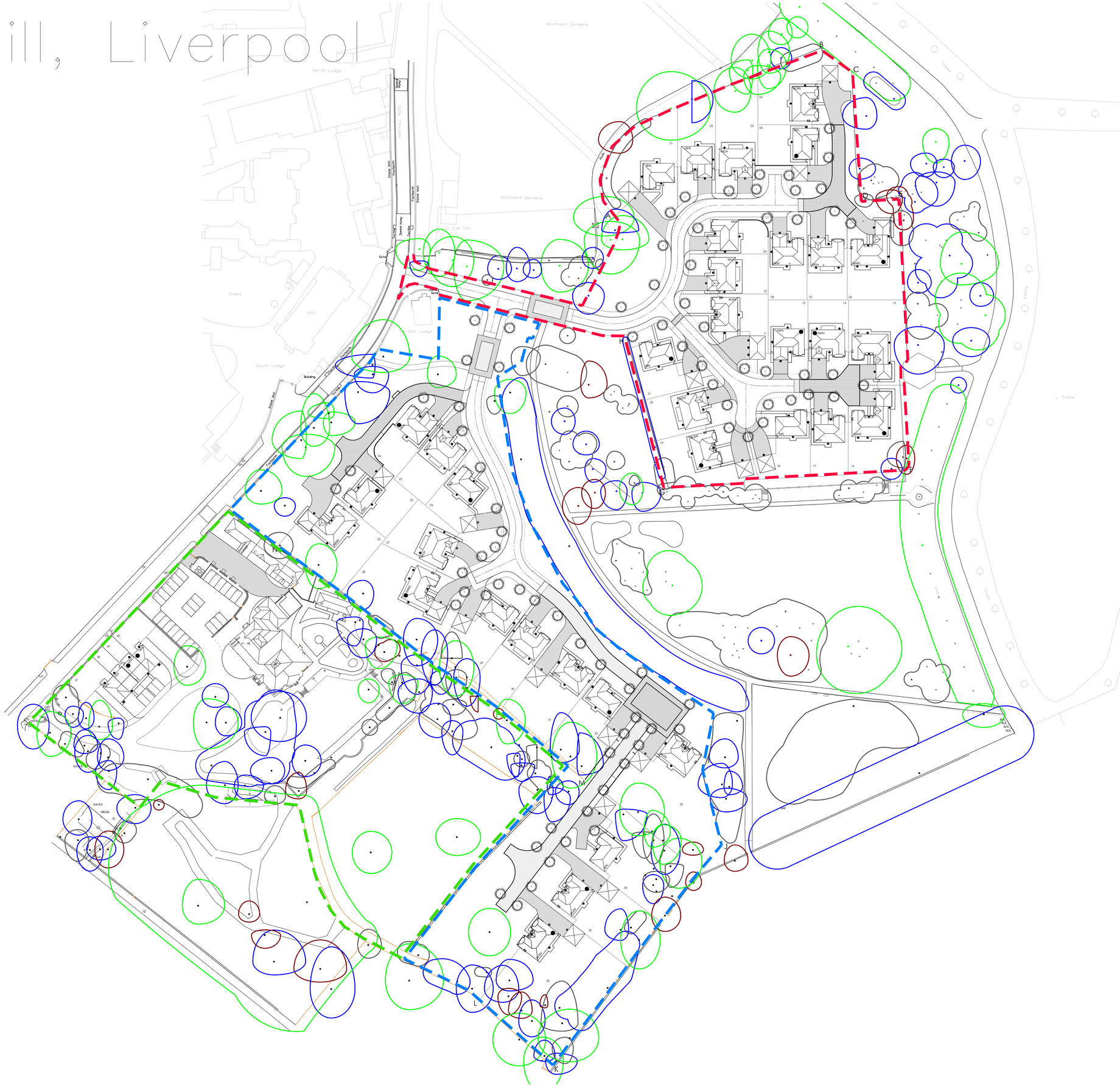
Foul Water

The existing foul drainage network is proposed to be removed and upgraded. It is proposed that the existing outlet pipe into the existing combined public sewer will remain and be utilised to discharge foul flows from this area of the site.

Foul and surface water within Beechley House grounds will be maintained by the appointed development management company.

APPENDIX A

Harthill, Liverpool



Legend

- THE DEPOT SITE
- THE PADDOCK
- BEECHLEY HOUSE

Item	Description

Revision	Date	Amendment	Initials

Development	**Harthill**
Location	Liverpool
Marketing Name	
Drawing Title	Detailed Site Layout
Drawing Number	**DSL-01**
Revision	Scale @ A0: 1:500
Drawn By: MJC	Date Started: June 16
Checked by	Date

REDROW HOMES

Redrow Homes Lancashire

Redrow House, 14 Eaton Avenue, Buckshaw Village, Chorley, PR7 7NA
Tel: 01772 643700 Fax: 01772 643701 Web: www.redrow.co.uk

Notes

DO NOT SCALE.

ALL LEVELS ARE IN METRES.

SURVEY INFORMATION OBTAINED FROM ????.

DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECT'S AND ENGINEER'S DRAWINGS, SPECIFICATIONS AND SITE INVESTIGATION REPORT.

THE CONTRACTOR SHALL CHECK THE DEPTH AND POSITION OF THE EXISTING DRAINS TO WHICH THE PROPOSED SEWERS ARE TO BE CONNECTED AND REPORT ANY DISCREPANCIES PRIOR TO COMMENCEMENT OF EXCAVATIONS.

THE CONTRACTOR SHALL CHECK THE PROPOSED OUTFALLS CAN BE ACHEIVED PRIOR TO CONSTRUCTION OF ANY SITE DRAINAGE.

COVER LEVELS SHOWN ARE APPROXIMATE AND SHOULD BE CHECKED AND ADJUSTED TO MATCH SURROUNDING FINISH.

Legend

- PROPOSED SURFACE WATER
- PROPOSED FOUL WATER
- EXISTING FOUL WATER
- ROAD GULLY AND CONNECTION.
- PROPOSED SEWER EASEMENT
- PROPOSED SECTION 104 BOUNDARY

Item	Description

Revision	Date	Amendment	Initials

Development	Harthill Depot		
Location	Liverpool		
Marketing Name			
Drawing Title	DRAINAGE LAYOUT Sheet 1 of 2		
Drawing Number	ENG001-1		
Revision	/	Scale @ A1	1:500
Drawn By	JJP	Date Started	19.10.16
Checked by			Date

REDROW HOMES
Redrow Homes Ltd - Lancs Division
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Notes

DO NOT SCALE.

ALL LEVELS ARE IN METRES.

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THE CONTRACTOR SHALL CHECK THE PROPOSED OUTFALLS CAN BE ACHEIVED PRIOR TO CONSTRUCTION OF ANY SITE DRAINAGE.

COVER LEVELS SHOWN ARE APPROXIMATE AND SHOULD BE CHECKED AND ADJUSTED TO MATCH SURROUNDING FINISH.

Legend

- PROPOSED SURFACE WATER
- PROPOSED FOUL WATER
- EXISTING FOUL WATER
- ROAD GULLY AND CONNECTION.
- PROPOSED SEWER EASEMENT
- PROPOSED SECTION 104 BOUNDARY

Item	Description

HARTHILL ROAD

C99-PRIVATE COMB PUMPING STATION
CL=9.857
IL LOWEST INCOMING PIPE=7.123
LENGTH 250m APPROX
QUNTHLOUR RISE
OUTFALL IL 53.249

S4-TANK
ORIFICE PLATE
IL53.244
DIAMETER 0.060m (60mm)
DISCHARGE RATE: 5.0L/S

S4-STORMCELL
IL=7.467
SL=8.467
192m³

Revision	Date	Amendment	Initials

Development	**Harthill Depot**
Location	Liverpool
Marketing Name	
Drawing Title	DRAINAGE LAYOUT Sheet 2 of 2
Drawing Number	**ENG001-1**
Revision	/
Scale @ A1	1:500
Drawn By	JJP
Date Started	19.10.16
Checked by	Date

REDROW HOMES

Redrow Homes Ltd - Lancs Division

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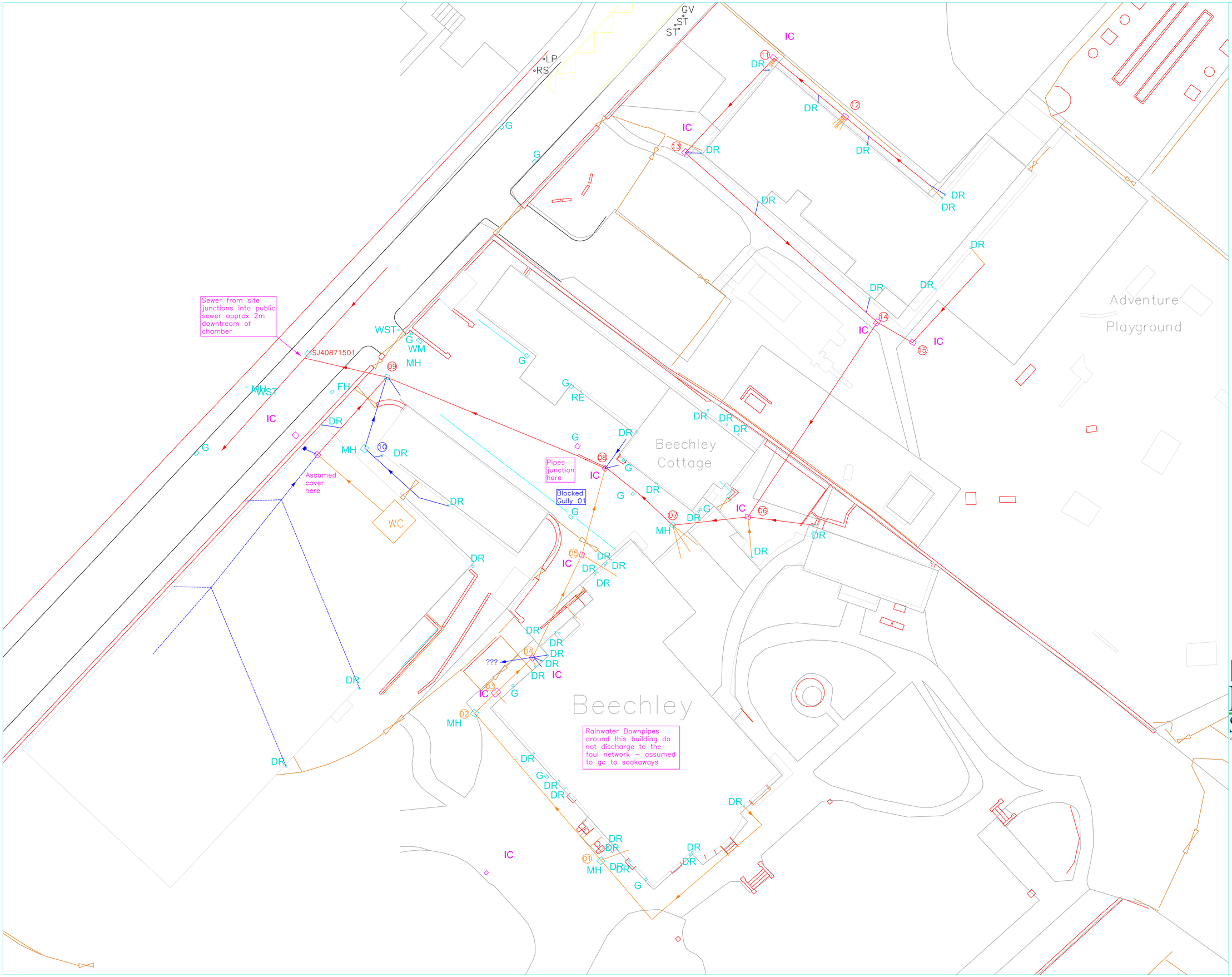
APPENDIX B



N

Legend/Notes:

- Combined Sewer
- Foul Sewer
- SW Sewer
- Assumed Sewer (Not Proven)
- Gully

The results shown in this report were gathered in the agreed one day on site.

The general arrangement was picked up and all chambers found were surveyed and photographed. Not all downpipes were tested and proved for connectivity due to time restraints.

The overall site requested for drainage survey extended beyond what is shown here, however, no chambers/drainage network was found other than what is shown here.

The topo survey has shown some covers on the plan and noted them as being "IC" inspection chambers; please note that we have looked at these and if not shown as part of the drainage network on our overlay, then they weren't drainage.

Provisional

BUILDER'S PROFILE | National Sewerage Association

INVEK SURVEYS LTD.
Warrington Business Park, Long Lane, Warrington, Cheshire, WA2 8TX
Tel: 01925 244376 Fax: 01925 241517
Email: kevin@invek.com – www.invek.com

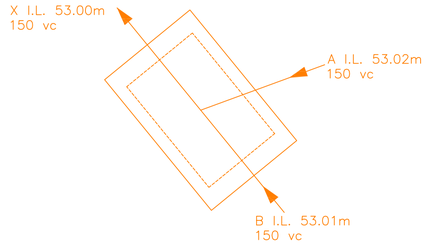
Client: Redrow Homes

Drawing Title: Harthill Depot Liverpool Drainage Layout

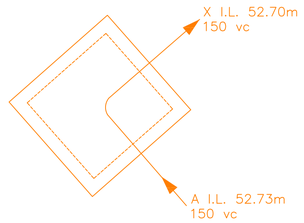
Scale(s)	N.T.S	Drawn	PW
Date	07.10.16	Checked	RD
Job Number	1091	Approved	KN

Sheet Size, Drawing Number & Revision: A1_1091/01_Rev_00

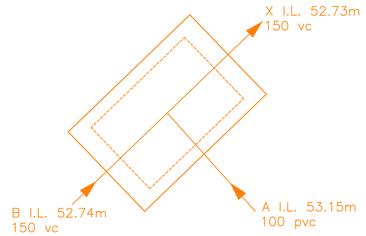
MH01 C.L. 53.60m



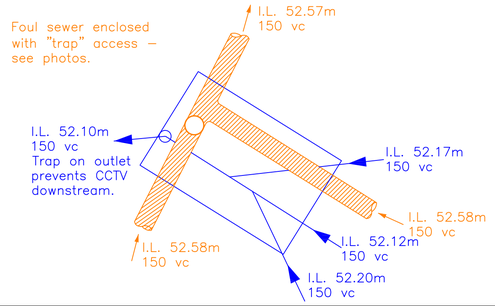
MH02 C.L. 53.53m



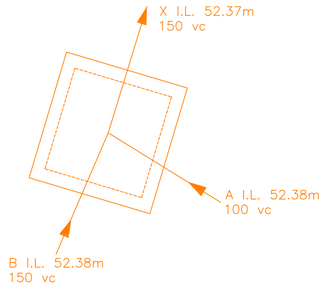
MH03 C.L. 53.58m



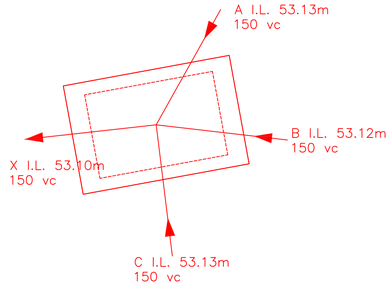
MH04 C.L. 53.26m



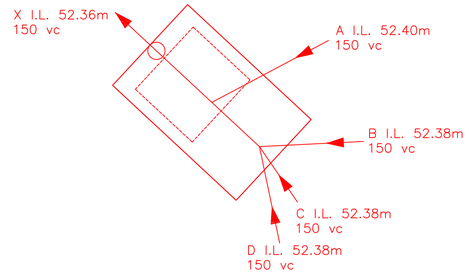
MH05 C.L. 53.86m



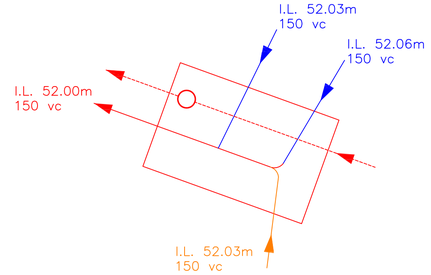
MH06 C.L. 54.10m



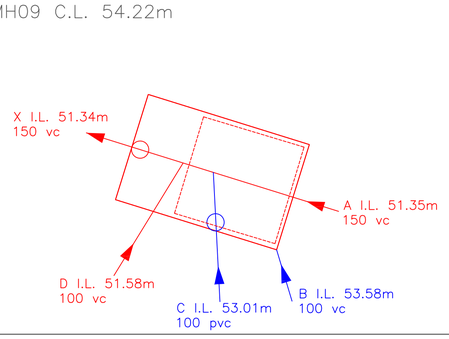
MH07 C.L. 53.99m



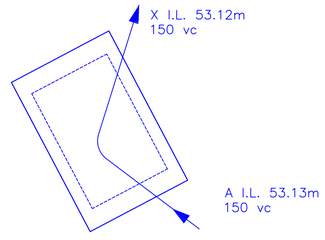
MH08 C.L. 53.88m



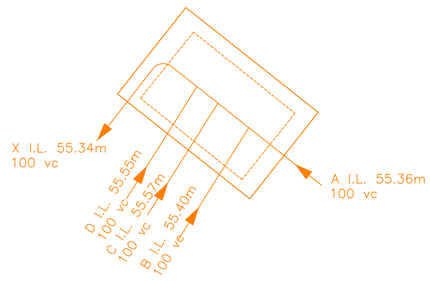
MH09 C.L. 54.22m



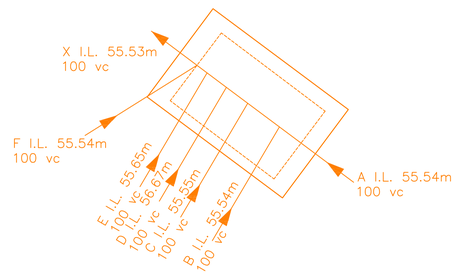
MH10 C.L. 53.84m



MH11 C.L. 56.12m



MH12 C.L. 56.15m



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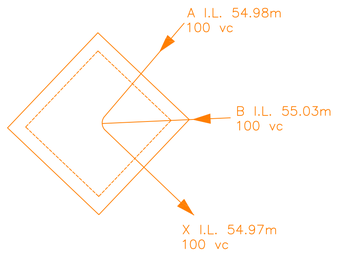
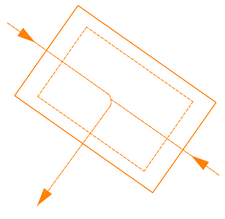
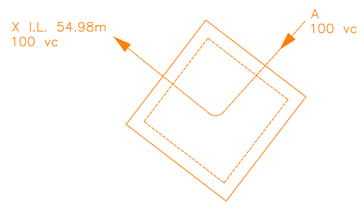


MH14 C.L. 56.04m Surcharged to top = 1.40m



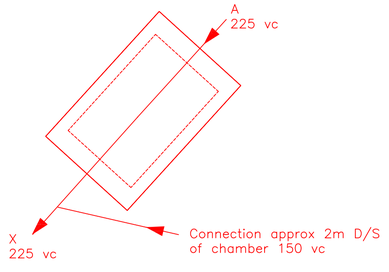
Assumed Lines

MH15 C.L. 56.06m Silted to top = 0.86m



Assumed Lines. Silted to top = 0.86m

Public MH C.L. 54.01m



INVEK SURVEYS LTD.
Warrington Business Park, Long Lane, Warrington, Cheshire, WA2 8TX
Tel: 01925 244376 Fax: 01925 241517
Email: kevin@invek.com – www.invek.com

Client
Redrow Homes

Drawing Title
Harthill Depot
Liverpool
Drainage Chamber Details

Scale(s)	N.T.S	Drawn	PW
Date	05.10.16	Checked	RD
Job Number	1091	Approved	KN

Sheet Size, Drawing Number & Revision
A1_1091/02_Rev_00

APPENDIX C

DO NOT SCALE

NOTES

THIS DRAWING SHOWS THE INDICATIVE LOCATION OF EXPLORATORY HOLES TO BE UNDERTAKEN BY BETTS GEO-ENVIRONMENTAL LTD IN 2016.

THE PLAN OVERLAYS THE TOPOGRAPHICAL SURVEY.

KEY

- TP — TRIAL PIT LOCATION (PHASE 1).
- WS — LOCATION OF WINDOW SAMPLE.
- WS — LOCATION OF WINDOW SAMPLE WITH INSTALLATION.
- HP — HAND PIT LOCATION.
- NO ACCESS DUE TO TREES / STOCKPILES.

REV	DATE	BY	DESCRIPTION	CHK

DRAWING STATUS: DRAFT

BETTS ASSOCIATES
GEO ENVIRONMENTAL
Unit 6, Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire CH5 2LY
Tel: 01244 288178 Fax: 01244 288516 enquiries@betts-associates.co.uk

REDROW
LANCASHIRE

PROJECT: HARTHILL DEPOT, CALDERSTONES PARK (FULL SCOPE)

TITLE: PHASE 1 - EXPLORATORY HOLE LOCATION PLAN (TOPO)

DATE:	SCALE @ SIZE:	DRAWN:	CHECKED:
06.10.16	1:750 @ A1	PH	SM

PROJECT No:	DRAWING No:	REV:
15RED096	EXP PHASE 1	-

APPENDIX D

SOAKAWAY TEST RESULTS

Date of Test: 04-10-16

Hole ID: SA1

Test No 1

Trial Pit Dimensions (m)	Length	Width	Depth	Depth for Analysis
	1.80	0.70	2.10	0.48

Time (mins)	Depth of water (m bgl)	Time (mins)	Depth of water (m bgl)
0.0	1.620		
5.0	1.650		
10.0	1.680		
20.0	1.720		
60.0	1.820		
90.0	1.870		
120.0	1.940		
150.0	1.990		

$V_{(p75-25)}$ = Effective storage volume in trial pit between effective depths 25% to 75%. = 0.30 m^3

$a_{(p50)}$ = Initial surface area of trial pit up to 50% effective depth and including the base area. = 2.46 m^2

$t_{(p75-25)}$ = Time for the water level to fall from 75 % to 25% effective depth. = 90 min

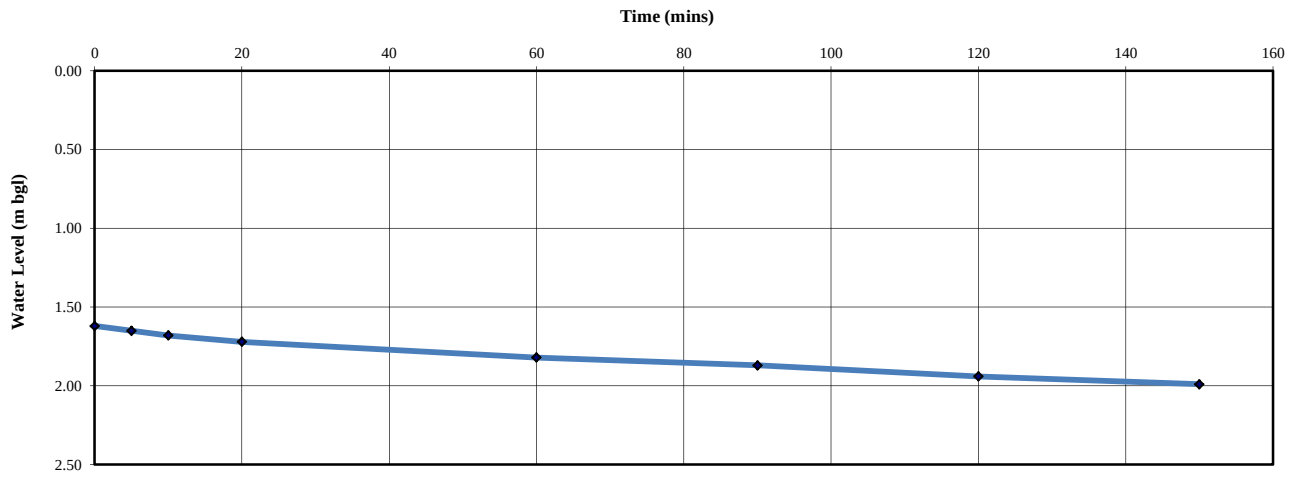
$$\text{Soil infiltration rate} = \frac{V_{(p75-25)}}{t_{(p75-25)} \times a_{(p50)} \times 60}$$

Depth $_{(25\%)}$ = 1.98 | Depth $_{(75\%)}$ = 1.740 m

Soil infiltration rate = 2.3E-05 m/sec

Remarks

Dry sandstone, easily broken up.



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CIVIL AND STRUCTURAL ENGINEERS

Project: Harthill Depot, Liverpool

Project No:

SOAKAWAY TEST RESULTS

Date of Test: 04-10-16

Hole ID: SA1

Test No 2

Trial Pit Dimensions (m)	Length	Width	Depth	Depth for Analysis
	1.80	0.70	2.10	0.49

Time (mins)	Depth of water (m bgl)	Time (mins)	Depth of water (m bgl)
0.0	1.610		
5.0			
10.0			
15.0	1.650		
25.0	1.690		
55.0	1.760		
85.0	1.820		
115.0	1.880		
150.0	1.940		
170.0	2.000		

$V_{(p75-25)}$ = Effective storage volume in trial pit between effective depths 25% to 75%. = 0.31 m^3

$a_{(p50)}$ = Initial surface area of trial pit up to 50% effective depth and including the base area. = 2.49 m^2

$t_{(p75-25)}$ = Time for the water level to fall from 75 % to 25% effective depth. = 120 min

$$\text{Soil infiltration rate} = \frac{V_{(p75-25)}}{t_{(p75-25)} \times a_{(p50)} \times 60}$$

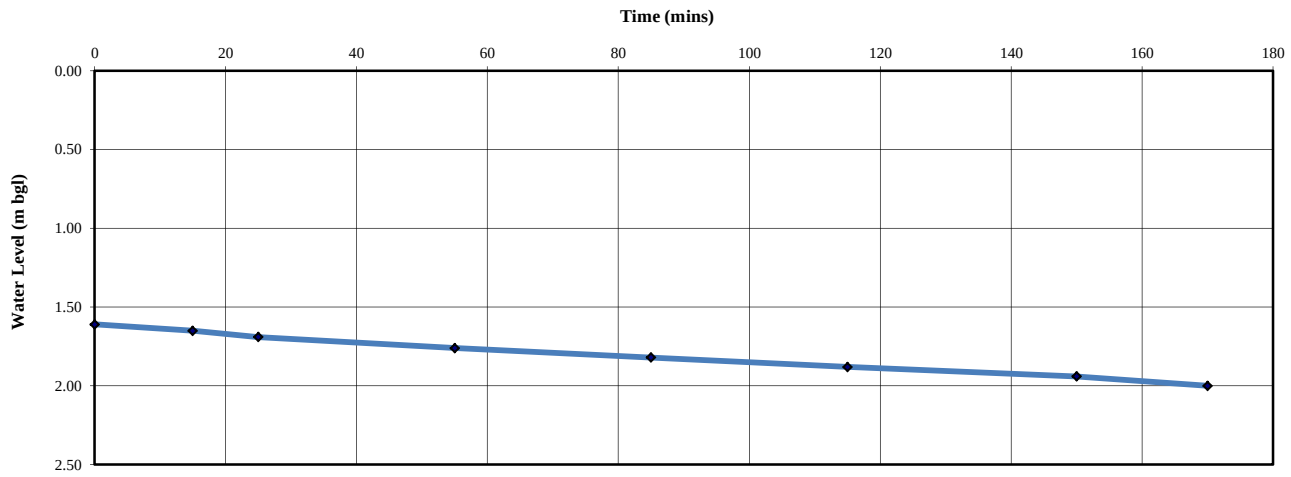
Depth $_{(25\%)}$ = 1.9775 m

Depth $_{(75\%)}$ = 1.733 m

Soil infiltration rate = 1.7E-05 m/sec

Remarks

Dry sandstone, easily broken up.



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Project: Harthill Depot, Liverpool

Project No:

SOAKAWAY TEST RESULTS

Date of Test: 04-10-16

Hole ID: SA2

Test No 1

Trial Pit Dimensions (m)	Length	Width	Depth	Depth for Analysis
	1.00	0.70	1.45	0.50

Time (mins)	Depth of water (m bgl)	Time (mins)	Depth of water (m bgl)
0.0	0.950		
5.0	0.980		
25.0	1.000		
55.0	1.040		
85.0	1.060		
115.0	1.080		
145.0	1.100		
175.0	1.120		
205.0	1.135		
235.0	1.150		
265.0	1.155		
295.0	1.160		

$V_{(p75-25)}$ = Effective storage volume in trial pit between effective depths 25% to 75%. = 0.18 m^3

$a_{(p50)}$ = Initial surface area of trial pit up to 50% effective depth and including the base area. = 1.55 m^2

$t_{(p75-25)}$ = Time for the water level to fall from 75 % to 25% effective depth. = na min

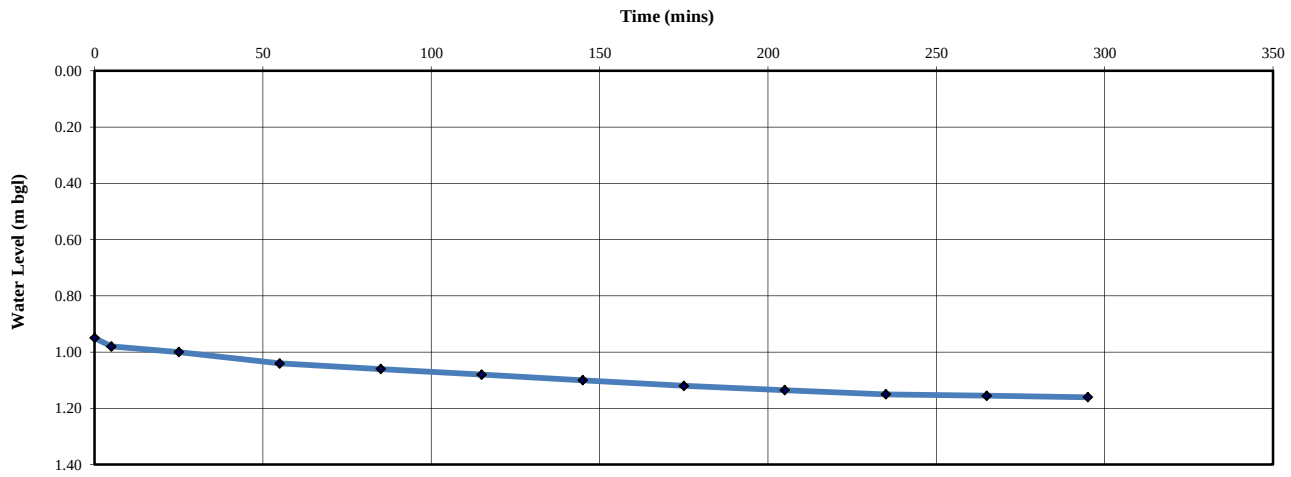
$$\text{Soil infiltration rate} = \frac{V_{(p75-25)}}{t_{(p75-25)} \times a_{(p50)} \times 60}$$

Depth $_{(25\%)}$ = 1.325 | Depth $_{(75\%)}$ = 1.075 m

Soil infiltration rate = #VALUE! m/sec

Remarks

Dry sandstone, quite dense. No rate calculated as pit failed to drain to 75% effective depth.



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Project: Harthill Depot, Liverpool

Project No:

SOAKAWAY TEST RESULTS

Date of Test: 04-10-16

Hole ID: SA3

Test No 1

Trial Pit Dimensions (m)	Length	Width	Depth	Depth for Analysis
	1.00	0.70	2.00	0.55

Time (mins)	Depth of water (m bgl)	Time (mins)	Depth of water (m bgl)
0.0	1.450		
20.0	1.530		
50.0	1.610		
80.0	1.660		
110.0	1.710		
140.0	1.750		
170.0	1.790		
200.0	1.840		
230.0	1.880		

$V_{(p75-25)}$ = Effective storage volume in trial pit between effective depths 25% to 75%. = 0.19 m^3

$a_{(p50)}$ = Initial surface area of trial pit up to 50% effective depth and including the base area. = 1.64 m^2

$t_{(p75-25)}$ = Time for the water level to fall from 75 % to 25% effective depth. = 190 min

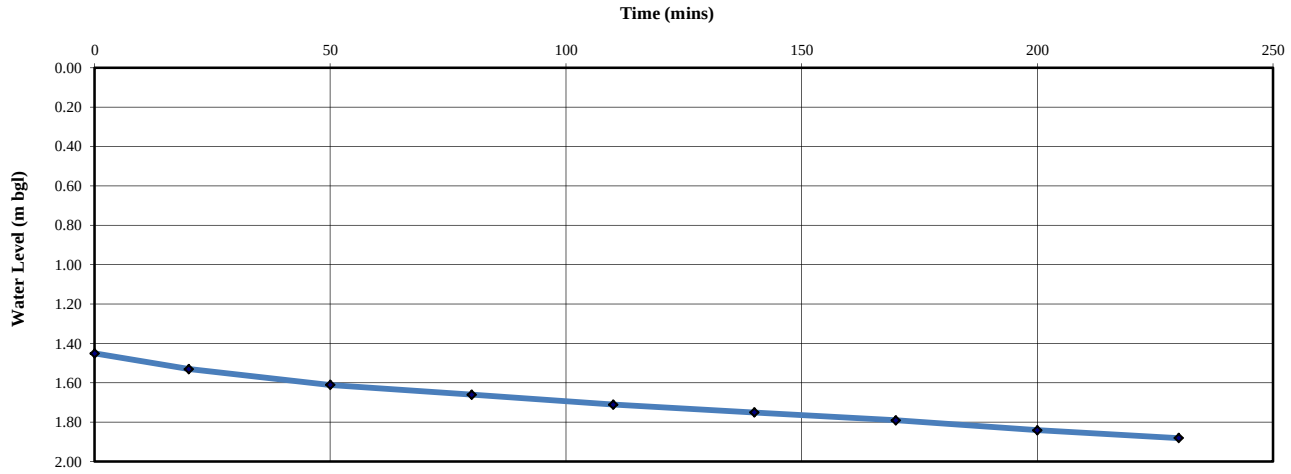
$$\text{Soil infiltration rate} = \frac{V_{(p75-25)}}{t_{(p75-25)} \times a_{(p50)} \times 60}$$

Depth $_{(25\%)}$ = 1.8625 | Depth $_{(75\%)}$ = 1.588 m

Soil infiltration rate = 1.0E-05 m/sec

Remarks

Dry sandstone, easily broken up



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Project: Harthill Depot, Liverpool

Project No:

SOAKAWAY TEST RESULTS

Date of Test: 04-10-16

Hole ID: SA3

Test No 2

Trial Pit Dimensions (m)	Length	Width	Depth	Depth for Analysis
	1.00	0.70	2.00	0.58

Time (mins)	Depth of water (m bgl)	Time (mins)	Depth of water (m bgl)
0.0	1.420		
10.0	1.460		
20.0	1.470		
30.0	1.490		
60.0	1.540		
90.0	1.580		
120.0	1.620		
150.0	1.660		
180.0	1.700		
210.0	1.740		
240.0	1.780		
270.0	1.820		
300.0	1.860		

$V_{(p75-25)}$ = Effective storage volume in trial pit between effective depths 25% to 75%. = 0.20 m^3

$a_{(p50)}$ = Initial surface area of trial pit up to 50% effective depth and including the base area. = 1.69 m^2

$t_{(p75-25)}$ = Time for the water level to fall from 75 % to 25% effective depth. = 230 min

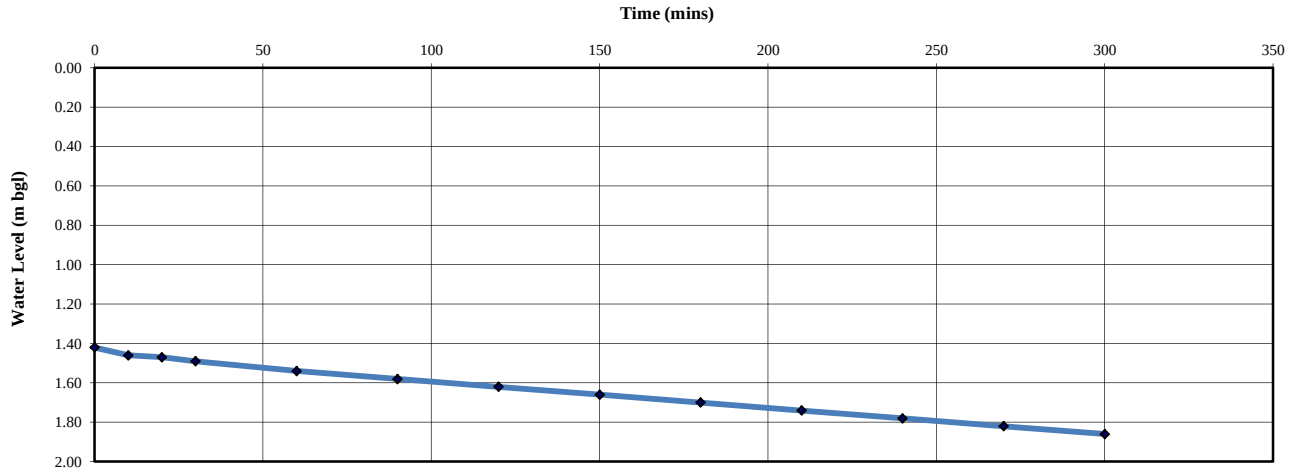
$$\text{Soil infiltration rate} = \frac{V_{(p75-25)}}{t_{(p75-25)} \times a_{(p50)} \times 60}$$

Depth $_{(25\%)}$ = 1.855 | Depth $_{(75\%)}$ = 1.565 m

Soil infiltration rate = 8.7E-06 m/sec

Remarks

Dry sandstone, easily broken up. 75% time extrapolated



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