KRP/MRD/MW/43632

July 2019

Kendray Hospital, Barnsley

New Car Park

Proposed Surface Water Drainage Strategy

The project involves the creation of additional car parking on an area of existing soft landscaping. The proposed site plan is shown on the appended TAD Architects Drg. No. 1909/A/(G)/02C.

An intrusive site investigation has been undertaken, with several trial pits identifying that beneath a layer of topsoil the area has natural subsoils overlying sandstone bedrock at a depth of approx. 1.25m. No groundwater was encountered in any of the excavations.

Three infiltration tests were carried out in a single location, the results of which gave BRE365 Soil Infiltration Rates of 180, 100 and 73 ($x10^{-6}$). Soakaways are therefore suitable for this site, with the lowest infiltration rate of 73 $x10^{-6}$ being used within the design calculations.

The new parking area is to have an impermeable tarmac surfacing with drainage channels and gullies providing positive drainage, as shown on the appended Eastwood & Partners Drg. No. 43632/011A. Due to the sloping nature of the site, three separate systems of soakaway silt trap chambers and soakaway trenches are to be provided, with the contributing areas for each as listed below :-

System A (SA1 – SA2) – 232m^2.
System B (SA3 – SA4) – 262m^2.
System C (SA5 – SA7) – 300m^2.

The base of each soakaway silt trap chamber is to be taken down to the surface of the competent rock, the anticipated levels of which are stated on the drawing. These levels have then been used to estimate the working depths for each of the chambers, which are taken as the distance from assumed base level up to either the underside of the manhole cover slab

or to the surface level at the drainage channel/gully, whichever is the lowest. The working depths obtained are listed in the following table :-

Chamber Ref.	Assumed Base Level	U/S cover slab	Lowest Gully/ Channel Level	Working Depth
SA1	92.35	93.40	93.50	0.95m
SA2	92.40	93.20	93.50	0.80m
SA3	91.50	92.45	92.35	0.85m
SA4	91.30	92.20	92.35	0.90m
SA5	90.05	91.35	90.85 *	0.80m
SA6	89.75	90.80	90.85 *	1.05m
SA7	90.15	91.00	90.85 *	0.70m

* Allowance for 100mm depth of localised surface ponding around the lowest gully up to top of perimeter kerbing.

The average working depth for the trench elements have been estimated in a similar way, being either the distance from assumed rock level up to the top of the stone trench or to the surface level at the drainage channel/gully, whichever is the lowest. The working depths obtained are listed in the following table :-

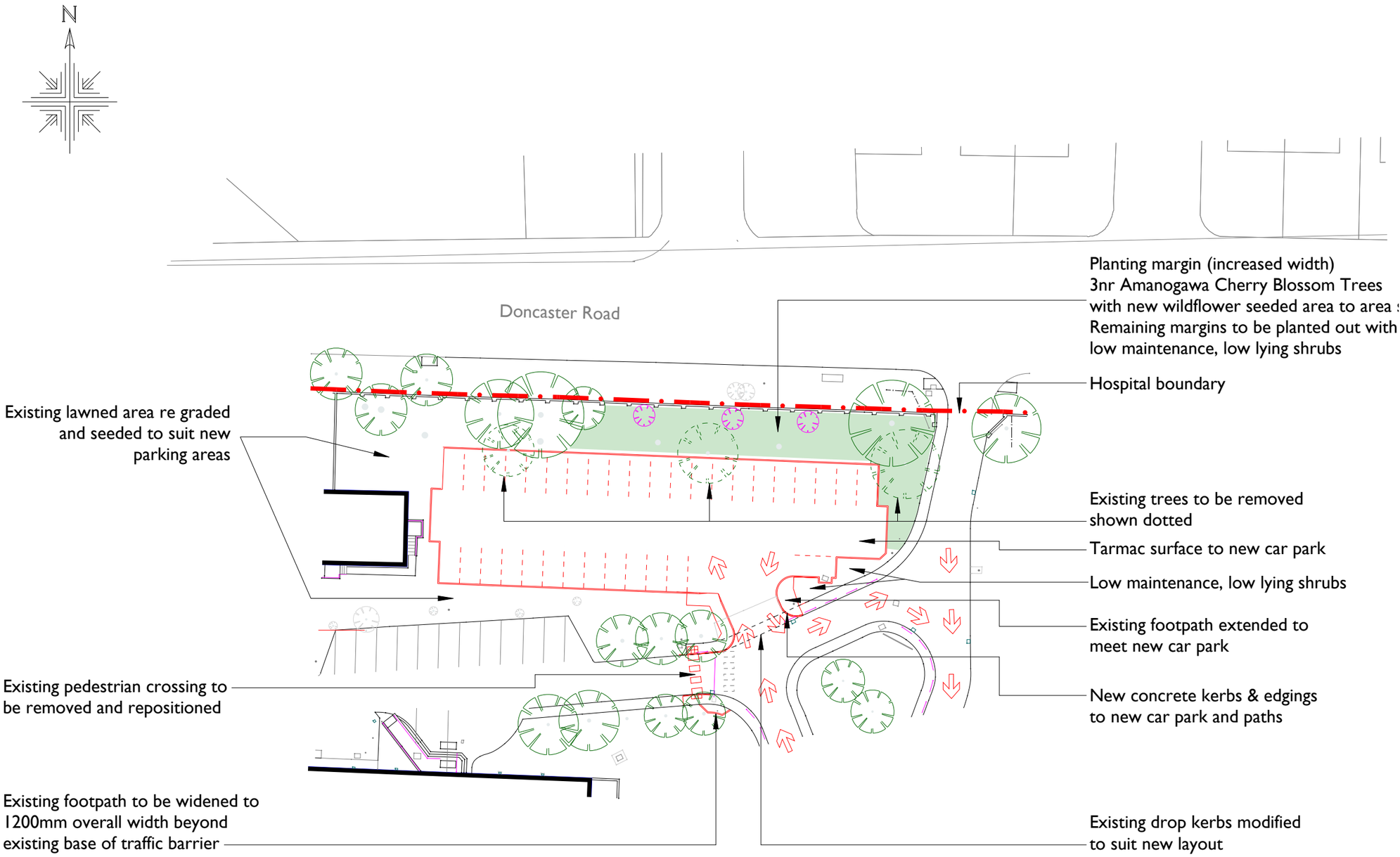
Chamber Ref.	Assumed Base Level	Top of stone trench	Lowest Gully/ Channel Level	Working Depth	Average Working Depth
SA1	92.35	93.45	93.50	1.10m	0.975m
SA2	92.40	93.25	93.50	0.85m	
SA3	91.50	92.50	92.35	0.85m	0.900m
SA4	91.30	92.25	92.35	0.95m	
SA5	90.05	91.40	90.85 *	0.80m	0.867m
SA6	89.75	90.85	90.85 *	1.10m	
SA7	90.15	91.05	90.85 *	0.70m	

* Allowance for 100mm depth of localised surface ponding around the lowest gully up to top of perimeter kerbing.

The average working depths for the chambers and trenches have been incorporated into the appended Soakaway Calculation Sheets SW1-SW6 to determine the lengths of soakaway trenches required for each of the three systems, which are designed for all rainfall events up to and including the 1 in 10 year return period.

In the event of the soakaway systems being overwhelmed, any exceedance volume will flow to existing gullies in the adjacent access road and will not prevent the use of the car park or access road.

The proposed drainage channels, gullies and sokaways will remain in private ownership, maintained by the hospital.



Revision	Description	Drawn	Checked	Date
C	Amended to suit levels and include feedback from planners	dejr		04.07.19
B	Turning area added	lt		02.7.19
A	General revisions	pja		28.6.19

Current Status: **PRELIMINARY**

t/a/d ARCHITECTS

T.A.D. Architects
Smithy Wood House,
Smithy Wood Crescent,
Sheffield, S8 0NU

Tel: 0114 250 9600
Fax: 0114 258 3681
Email: enquiries@tadarchitects.co.uk
www. tadarchitects.co.uk

Project
Proposed new Car Park to Kendray Hospital, Doncaster Road, Barnsley, S70 3RD

Drawing Title
Site Plan as Proposed (Revised Layout)

DO NOT SCALE FROM DRAWING

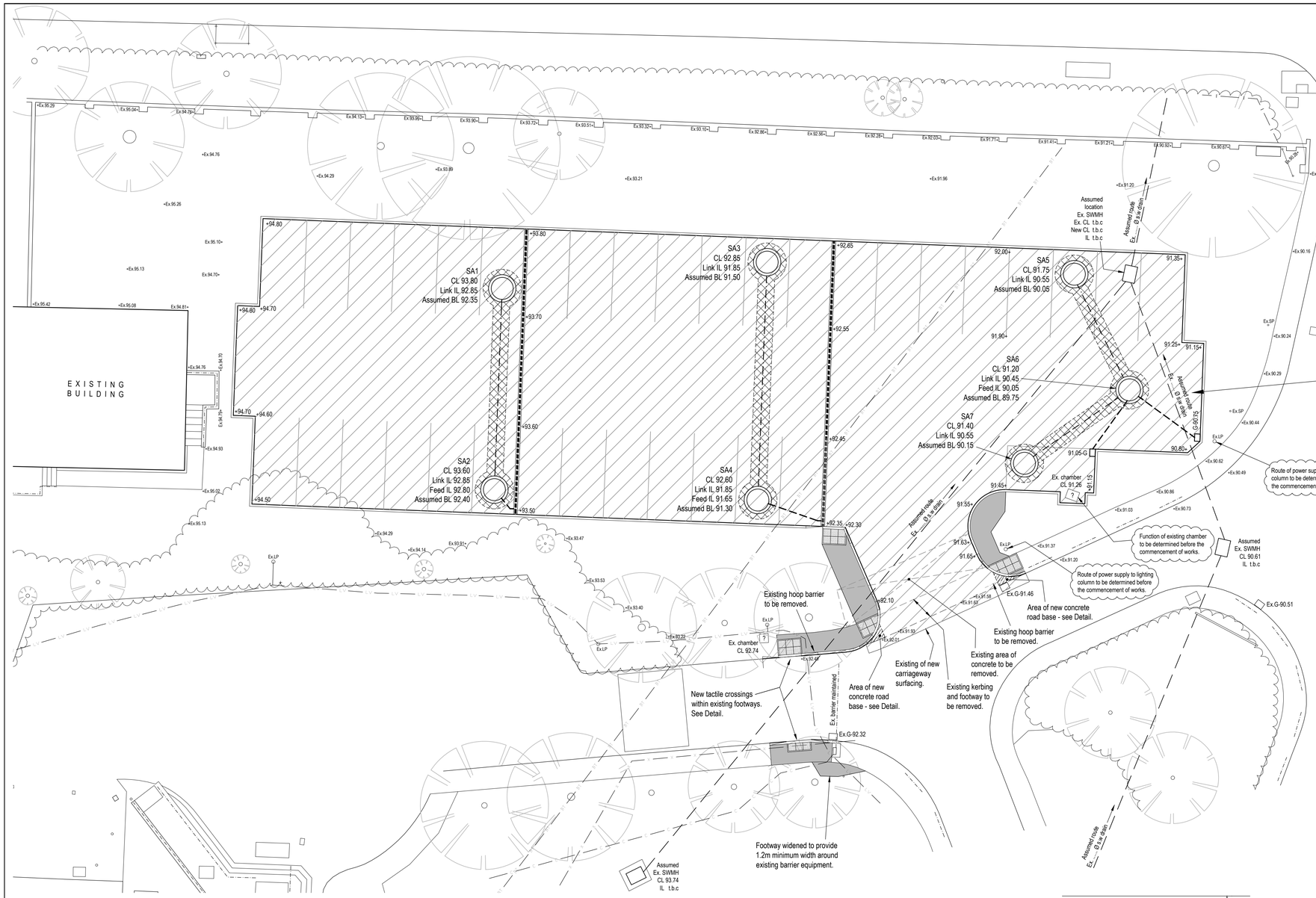
Scale	Date	Drawn	Checked
1:500 @A3	28.06.2019	pja	-

Drawing Number	Revision
1909/A/(G)/02	**C**

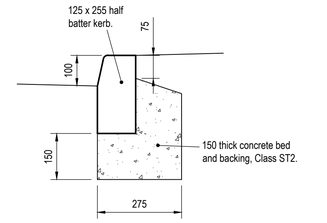
CAD Reference: xxxx\GDS FILES\xxxx xxx.rpj

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INFORMATION WITHIN THIS DRAWING IS NOT NECESSARILY PRODUCED TO SCALE.
ALWAYS USE FIGURED DIMENSIONS AND CO-ORDINATES - IF IN DOUBT, ASK.

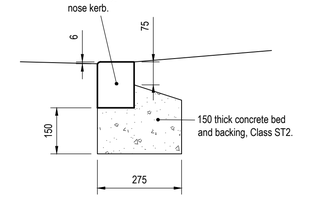


IMPORTANT NOTE :-
THE LINE AND LEVEL OF THE EXISTING SURFACE WATER DRAINAGE SYSTEM IN THE AREA OF THE NEW PARKING IS TO BE DETERMINED AT THE START OF WORKS ON SITE TO ALLOW ANY NECESSARY AMENDMENTS TO THE PROPOSED SOAKAWAY SYSTEM TO BE IDENTIFIED.

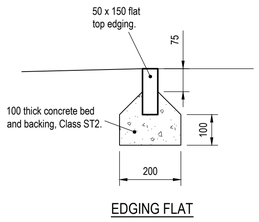


HALF BATTER KERB

Where the bed and haunch are not cast monolithically, R10 dowel bars 200 long at 600 centres are to be provided between the bed and haunch.



BULL NOSE KERB



EDGING FLAT

TYPICAL KERB BED & HAUNCH DETAILS

NOTE :-
At the end of each days pour of all kerb bedding, 2/R10 dowel bars, 200mm long are to be cast in and project by 100mm to provide a tie into the next days pour.

TARMAC PARKING AREA SPECIFICATION

30 thickness SMA 10 surface 40/60 to BS EN13108-1.

55 thickness AC20 Dense binder 100/150 to BS EN13108-1.

250 thickness Type 1 granular sub-base to Specification for Highway Works Clause 803, to be free from extraneous matter.

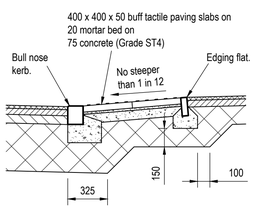
Formation to be proof rolled and any soft spots replaced with granular material laid and compacted in layers.

TARMAC FOOTWAY SPECIFICATION

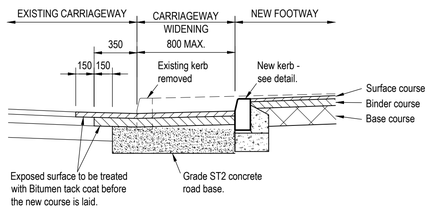
20 thickness AC6 Close surface 160/220 to BS EN13108-1.

50 thickness AC20 Dense binder 100/150 to BS EN13108-1.

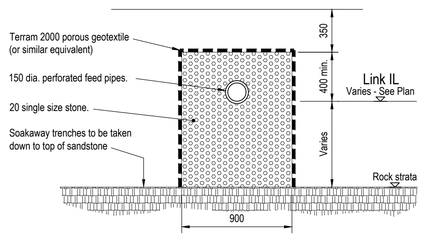
250 thickness Type 1 granular sub-base to Specification for Highway Works Clause 803, to be free from extraneous matter.



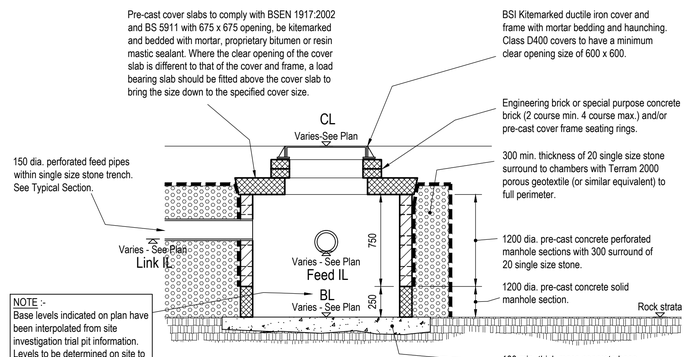
TACTILE PAVING DETAIL



DETAIL OF NARROW CARRIAGEWAY WIDENING



TYPICAL SOAKAWAY TRENCH



TYPICAL SOAKAWAY CHAMBER

NOTES

1. This drawing to be read in conjunction with Eastwood & Partner's Drg. Nos. 43463/012.
2. All pipes shall be either :-
   - A - Vitrified clay to BS EN 295 with a minimum crushing strength as follows :- 150 dia. - 40 kN/m, 225 dia. - 45 kN/m, 300 dia. - 72 kN/m OR
   - B - Class H concrete to BS 5911. OR
   - C - PVC to have BSI kitemark status (certified to WIS 4-35-01) Wavin or similar approved. Maximum pipe length to be 3m.
3. All pipes are to be laid soffit to soffit at manholes unless noted otherwise.
4. Pipes entering manholes and road gullies shall have a flexible joint within 600 of the inside of the manhole or gully joining with a short Rocker pipe.
5. All pipes to be 100 dia. unless noted otherwise.
6. All works and materials to be in accordance with "Sewers for Adoption" (6th edition), bedded with a Class S granular bed and surround as a minimum requirement. Pipes within highways with cover less than 1200 to have a Class Z concrete bed and surround. Pipes within paved areas with cover less than 600 to have a Class Z concrete bed and surround. Pipes within landscaped areas with cover less than 300 to have a Class Z concrete bed and surround.
7. All trenches in roads and paved areas shall be backfilled with Type 1 DOT granular sub-base material.
8. All cover levels are indicative only. Covers to be set to suit camber/gradient of existing and proposed surfacings.
9. The invert levels at the proposed points of connection to existing drains shall be checked before any new drains are constructed. Any variation to the levels shown on the drawing shall be notified to Eastwood & Partners.

KEY TO EXISTING SERVICES :-

- Ex. BT cabling
- Ex. Comms. cabling
- Ex. L.V lighting cabling
- Ex. function unknown

Existing services information has been taken from Met Geo Environmental Utility Tracing Survey DWG Ref 12330-128_GEO A0 (2), dated 27/03/13.
The full area of the works is to be investigated at the start on site to identify the line and level of all live services in order that they can be protected throughout the works as necessary.

KEY TO DRAINAGE :-

- Existing surface water drain.
- G Road gully with 150 dia roddable outlet.
- Soakaway system consisting of 1200 dia. silt trap chambers and trenches. See Typical Details.
- ACO M100D drainage channels with Load Class C250 covers and 150 dia. roddable sump outlets.

REV	DESCRIPTION	SIG	CHK	DATE
A	First Issue.			

TAD ARCHITECTS

KENDRAY HOSPITAL, BARNSLEY
NEW CAR PARK

EXTERNAL DRAINAGE LAYOUT

Eastwood & Partners
CONSULTING ENGINEERS
St. Andrew's House
23 Kingfield Road
Sheffield
S11 9AS
Tel 0114 255 4554
Fax 0114 255 4330
mail@eastwoodandpartners.com
www.eastwoodandpartners.com

SCALE WHEN PLOTTED AT A1	DRAWING STATUS
1:125 1:25 1:10	PRELIMINARY

DRAWN	CHECKED	DATE	DRAWING NUMBER	REV
MW	MRD	08-07-19	43632/011	A

43632/SW1 **Kendray Hospital, Barnsley - Soakaway SA1- SA2**

Calculation of Soakaway Size
Using the method given in BRE Digest 365:2016

Inflow to soakaway

Area of Britain:	England & Wales	Scotland & N Ireland
Rainfall ratio r =	**0.36**	**0.00**

Impermeable Area = **232** m^2

Infiltration rate = **73** m/s x 10^{-6} or 0.0044 m/min

Time		Rainfall		Rainfall	Inflow
min	*Z1*	*M5-D mm*	*Z2*	*M10-D mm*	m^3
5	0.36	7.20	1.21	8.70	2.0
10	0.51	10.20	1.22	12.44	2.9
15	0.62	12.40	1.22	15.13	3.5
30	0.79	15.80	1.23	19.43	4.5
60	1.00	20.00	1.24	24.80	5.8
120	1.22	24.40	1.24	30.26	7.0
240	1.48	29.60	1.24	36.70	8.5
360	1.67	33.40	1.23	41.20	9.6
600	1.90	38.00	1.23	46.61	10.8
1440	2.42	48.40	1.22	58.81	13.6

Outflow from Soakaway

Soakaway Properties - Trench

Length =	**9.00** m		
Width =	**0.90** m	Storage =	2.37 m^3
Average Working Depth =	**0.975** m		
Void Ratio =	**0.3**	Soakaway Area (a_s50) =	9.65 m^2
Factor of Safety =	**3.0**		

Outflow = 0.014 m^3/min

Soakaway Properties - Chamber

Internal Dia =	**1.20** m	Inner Storage =	0.99 m^3
Outer Dia =	**1.80** m	Outer Storage =	0.37 m^3
Average Working Depth =	**0.875** m	Total Storage/Chamber =	1.36 m^3
Internal Void Ratio =	**1.0**	Total Storage =	2.72 m^3
Outer Void Ratio =	**0.3**		
Factor of Safety =	**3.0**	Soakaway Area (a_s50) =	2.47 m^2
Number of Chambers	**2**		

Outflow = 0.007 m^3/min

43632/SW2 **Kendray Hospital, Barnsley - Soakaway SA1- SA2**

Calculation of Soakaway Size
Using the method given in BRE Digest 365:2016

Storage Required

Time	Inflow	Outflow	Storage
min	m^3	m^3	m^3
5	2.0	0.1	1.9
10	2.9	0.2	2.7
15	3.5	0.3	3.2
30	4.5	0.6	3.9
60	5.8	1.3	4.5
120	7.0	2.6	4.5
240	8.5	5.1	3.4
360	9.6	7.7	1.9
600	10.8	12.8	-2.0
1440	13.6	30.7	-17.1

Minimum Storage Required = 4.47 m^3
Storage Provided = 5.09 m^3

Soakaway volume is satisfactory

Storage required after 24 hour storm period should not be greater than half the storage required

Half storage provided = 2.55 m^3
Storage required after 24 hr = -17.05 m^3

Soakaway rate is satisfactory

Additional storage where an impermeable layer overlies permeable ground:-

Working depth above permeable layer = **0.00** m
Additional storage = 0.00 m^3
Total storage = 5.09 m^3
Minimum Storage Required = 4.47 m^3

Soakaway volume is satisfactory

43632/SW3 **Kendray Hospital, Barnsley - Soakaway SA3 - SA4**

Calculation of Soakaway Size
Using the method given in BRE Digest 365:2016

Inflow to soakaway

Area of Britain:	England & Wales	Scotland & N Ireland
Rainfall ratio r =	**0.36**	**0.00**

Impermeable Area = **262** m^2

Infiltration rate = **73** m/s x 10^{-6} or 0.0044 m/min

Time		Rainfall		Rainfall	Inflow
min	*Z1*	*M5-D mm*	*Z2*	*M10-D mm*	m^3
5	0.36	7.20	1.21	8.70	2.3
10	0.51	10.20	1.22	12.44	3.3
15	0.62	12.40	1.22	15.13	4.0
30	0.79	15.80	1.23	19.43	5.1
60	1.00	20.00	1.24	24.80	6.5
120	1.22	24.40	1.24	30.26	7.9
240	1.48	29.60	1.24	36.70	9.6
360	1.67	33.40	1.23	41.20	10.8
600	1.90	38.00	1.23	46.61	12.2
1440	2.42	48.40	1.22	58.81	15.4

Outflow from Soakaway

Soakaway Properties - Trench

Length =	**11.00** m		
Width =	**0.90** m	Storage =	2.67 m^3
Average Working Depth =	**0.90** m		
Void Ratio =	**0.3**	Soakaway Area (a_s50) =	10.71 m^2
Factor of Safety =	**3.0**		

Outflow = 0.016 m^3/min

Soakaway Properties - Chamber

Internal Dia =	**1.20** m	Inner Storage =	0.99 m^3
Outer Dia =	**1.80** m	Outer Storage =	0.37 m^3
Average Working Depth =	**0.875** m	Total Storage/Chamber =	1.36 m^3
Internal Void Ratio =	**1.0**	Total Storage =	2.72 m^3
Outer Void Ratio =	**0.3**		
Factor of Safety =	**3.0**	Soakaway Area (a_s50) =	2.47 m^2
Number of Chambers	**2**		

Outflow = 0.007 m^3/min

43632/SW4 **Kendray Hospital, Barnsley - Soakaway SA3 - SA4**

Calculation of Soakaway Size
Using the method given in BRE Digest 365:2016

Storage Required

Time	Inflow	Outflow	Storage
min	m^3	m^3	m^3
5	2.3	0.1	2.2
10	3.3	0.2	3.0
15	4.0	0.3	3.6
30	5.1	0.7	4.4
60	6.5	1.4	5.1
120	7.9	2.7	5.2
240	9.6	5.5	4.1
360	10.8	8.2	2.6
600	12.2	13.7	-1.5
1440	15.4	32.9	-17.5

Minimum Storage Required = 5.18 m^3
Storage Provided = 5.39 m^3

Soakaway volume is satisfactory

Storage required after 24 hour storm period should not be greater than half the storage required

Half storage provided = 2.70 m^3
Storage required after 24 hr = -17.51 m^3

Soakaway rate is satisfactory

Additional storage where an impermeable layer overlies permeable ground:-

Working depth above permeable layer = **0.00** m
Additional storage = 0.00 m^3
Total storage = 5.39 m^3
Minimum Storage Required = 5.18 m^3

Soakaway volume is satisfactory

43632/SW5 Kendray Hospital, Barnsley - Soakaway SA5 - SA7

Calculation of Soakaway Size
Using the method given in BRE Digest 365:2016

Inflow to soakaway

Area of Britain: England & Wales Scotland & N Ireland

Rainfall ratio r = **0.36** **0.00**

Impermeable Area = **300** m^2

Infiltration rate = **73** m/s x 10^{-6} or 0.0044 m/min

Time		Rainfall		Rainfall	Inflow
min	*Z1*	*M5-D mm*	*Z2*	*M10-D mm*	m^3
5	0.36	7.20	1.21	8.70	2.6
10	0.51	10.20	1.22	12.44	3.7
15	0.62	12.40	1.22	15.13	4.5
30	0.79	15.80	1.23	19.43	5.8
60	1.00	20.00	1.24	24.80	7.4
120	1.22	24.40	1.24	30.26	9.1
240	1.48	29.60	1.24	36.70	11.0
360	1.67	33.40	1.23	41.20	12.4
600	1.90	38.00	1.23	46.61	14.0
1440	2.42	48.40	1.22	58.81	17.6

Outflow from Soakaway

Soakaway Properties - Trench

Length = **10.00** m

Width = **0.90** m

Average Working Depth = **0.867** m

Void Ratio = **0.3**

Factor of Safety = **3.0**

Storage = 2.34 m^3

Soakaway Area (a_s50) = 9.45 m^2

Outflow = 0.014 m^3/min

Soakaway Properties - Chamber

Internal Dia = **1.20** m

Outer Dia = **1.80** m

Average Working Depth = **0.850** m

Internal Void Ratio = **1.0**

Outer Void Ratio = **0.3**

Factor of Safety = **3.0**

Number of Chambers **3**

Inner Storage = 0.96 m^3

Outer Storage = 0.36 m^3

Total Storage/Chamber = 1.32 m^3

Total Storage = 3.97 m^3

Soakaway Area (a_s50) = 2.40 m^2

Outflow = 0.011 m^3/min

43632/SW6 **Kendray Hospital, Barnsley - Soakaway SA5 - SA7**

Calculation of Soakaway Size
Using the method given in BRE Digest 365:2016

Storage Required

Time	Inflow	Outflow	Storage
min	m^3	m^3	m^3
5	2.6	0.1	2.5
10	3.7	0.2	3.5
15	4.5	0.4	4.2
30	5.8	0.7	5.1
60	7.4	1.5	6.0
120	9.1	2.9	6.2
240	11.0	5.8	5.2
360	12.4	8.8	3.6
600	14.0	14.6	-0.6
1440	17.6	35.0	-17.4

Minimum Storage Required = 6.16 m^3
Storage Provided = 6.31 m^3

Soakaway volume is satisfactory

Storage required after 24 hour storm period should not be greater than half the storage required

Half storage provided = 3.15 m^3
Storage required after 24 hr = -17.38 m^3

Soakaway rate is satisfactory

Additional storage where an impermeable layer overlies permeable ground:-

Working depth above permeable layer = **0.00** m
Additional storage = 0.00 m^3
Total storage = 6.31 m^3
Minimum Storage Required = 6.16 m^3

Soakaway volume is satisfactory