

RUSHBY BREWSTER
CONSULTING CIVIL & STRUCTURAL ENGINEERS

DRAINAGE STRATEGY

for

**Proposed Residential Development
at
Holybourne Road
Leigh Park
Havant**

Client:

PMC Construction and Development
Services Ltd
106 Queens Road
Portsmouth
Hampshire
PO2 7NE

Architect:

Kenn Scaddan Associates
Concept House
35 Kingston Crescent
North End
Portsmouth
PO2 8AA

Issue		A	B
Issued By	Allen Rushby	Allen Rushby	
Date	March 2016	Aug 2016	
Purpose	Planning	Planning	
Approved By			

Project No: PMC 239

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Rushby Brewster Associates Limited. Registered in England: 3832290

CONTENTS

- 1.0 Introduction**
- 2.0 The Site**
 - 2.1 Site Location & Description
 - 2.2 Existing Site Topography & Drainage
 - 2.3 Ground Conditions
 - 2.4 Environment Agency data
- 3.0 Proposed Foul Water Drainage**
- 4.0 Proposed Surface Water Drainage**
 - 4.1 Control of Water Quantity Run-off
 - 4.2 Water Quality Management
- 5.0 Maintenance of SuDs Components**

APPENDICES

- 1. Southern Water Sewer Plan
- 2. Drainage Calculations
- 3. Extracts from Ground Investigation Report
- 4. Extracts from SuDs Manual re Water Quality Management
- 5. Drawings:
 - a) Architect's Site Plan
 - b) PMC 239 – 500 - Drainage Strategy
PMC 239 – 551 - Drainage Strategy Details (sheet 1)
PMC 239 – 552 - Drainage Strategy Details (sheet 2)
 - c) Topographical Survey

1.0 Introduction

It is proposed to re-develop the site at Holybourne Road, Leigh Park to provide new residential accommodation of 5 No houses and 4 No flats with associated entrance road, parking areas and soft landscaping.

This report outlines the proposed foul and surface water drainage strategy for the proposed development.

2.0 The Site

2.1 Site Location and Description

The site is located to the east of Holybourne Road in a predominantly residential area of Havant, neighbouring Trosant Junior School.

The site is irregular in plan and covers an area of approximately 0.29ha. of open flat grassland. The northern boundary of the site is denoted by the fences and hedges of neighbouring residential properties. The eastern edge of the site is defined by the wall to a neighbouring residential property and a line of vegetation. The southern site boundary is marked by a number of tall conifers and fence line. The western site limit meets a pedestrian footpath, fence line to the sports ground of the neighbouring school lying further to the west and a low post and rail fence separating the site from Holybourne Road.

2.2 Existing Site Topography and Drainage

Refer to the Hampshire Land Surveys Ltd drawing in the Appendix.

Site topography is relatively flat with a gradual fall from the north toward the south west at the frontage with Holybourne Road.

There is currently no known foul or surface water drainage on the site. A 225mm diameter public foul sewer is located within Holybourne Road adjacent to No 15 and a 225mm diameter storm water sewer at the end of Holybourne Road adjacent to the site entrance. These are shown on the Southern Water Sewer Plan in the Appendix.

Enquiries with the Environment Agency has confirmed that to the southern boundary of the site there is a 1400mm diameter culvert which is designated by the EA as a 'main river'.

2.3 Ground Conditions

Reference to the British Geological Survey (BGS) Map (Sheet 315, Southampton, Scale 1:50,000) indicates the site to directly overlie superficial geology of River Terrace Deposits (sand, silt and clay) and the London Clay Formation (clay, silt and sand).

A ground investigation report has been prepared by Ridge Property and Construction Consultants together with additional infiltration tests by Soils Ltd. Relevant extracts from these reports are contained within the Appendix for reference.

2.4 Environment Agency Data

The Environment Agency Ground Water Vulnerability map indicates that the site is underlain by superficial Secondary Aquifer.

The site lies within a ground water source protection zone (SPZ), recorded as 1C- Inner Catchment within a confined aquifer.

3.0 Proposed Foul Water Drainage

It is proposed that foul water from the site will be discharged to the existing public sewer in Holybourne Road subject to agreement with Southern Water.

In accordance with 'Sewers For Adoption', the design peak flow rate to the receiving sewer based upon 4000 litres per dwelling per day = 0.42 litres/sec.

4.0 Proposed Surface Water Drainage

4.1 Control of Water Quantity run-off

It is proposed that surface water run-off from roofs of the new development will be discharged into the local sewer in Holybourne Road via an attenuation tank with run-off restricted to the greenfield run-off rate. HR Wallingford calculation for greenfield run-off estimation and calculations for attenuation storage are included within the Appendix.

All remaining access road and parking bays will be constructed in permeable paving including those within tree root protection zones as shown on the drawings contained within the Appendix.

The ground investigation report carried out in July 2015 by Ridge recorded ground water depths at approximately 3.2m to 3.7m below existing ground levels. The further investigation carried out in January 2016 by Soils Ltd obtained reasonably good infiltration results for one of the three locations tested (ST3).

Test ST2 test depth was too shallow to reach the gravel layer which is at approximately 2m below ground level and recorded inconclusive results. Test ST1 recorded no result due to water entering from the saturated ground at surface level.

It should be noted that the infiltration tests were carried out after two days of exceptional rainfall (26th and 27th January) for which days Southampton Weather Station recorded 13.0mm and 27.6mm of rainfall respectively.

It is proposed therefore that the permeable paving subbase storage will be designed for a conservative value of 1×10^{-6} m/s for the 1 in 100 year + 40% climate change event – see calculations within the Appendix.

4.2 Water Quality Management

Ciria 753 SuDs Manual – 2015 has specific guidance on water quality management for the protection of surface and ground water and extracts are included in Appendix 4 for reference.

Interception

Wherever possible SuDs should be designed to intercept run-off (and associated pollutants) for most rainfall events up to approximately 5mm in depth.

This requirement will be achieved for the parking areas and roadway by the use of permeable pavement construction.

Protection of Ground and Surface Water

Table 4.3 refers to the minimum water quality management requirements for discharges to receiving ground water.

For residential roofs the pollution hazard is 'very low' and therefore discharge of rainwater directly to soakaways via silt traps to intercept sediment is acceptable. For the driveway and parking areas, the pollutions hazard is 'low' and the table refers to the 'simple index approach'.

Table 26.1 shows the approach to water quality risk management from which the 'simple index approach' refers to tables 26.2 and 26.4.

Table 26.2 lists the pollution hazard indices for various land use and these indices have to be exceeded by the mitigation indices shown in Table 26.4.

With reference to these tables permeable paving will provide the required mitigation measures and therefore the driveway and parking areas will be constructed with sufficient sub base storage to contain the 1 in 100 year storm + 40% climate change run-off.

5.0 Maintenance of SuDs Components

The maintenance requirements of the surface water drainage system are outlined on the drainage strategy drawing. This maintenance will be the responsibility of the building management company which will be put in place upon commission of the building.



Allen Rushby IEng, AMIStructE
For and on behalf of Rushby Brewster

APPENDICES

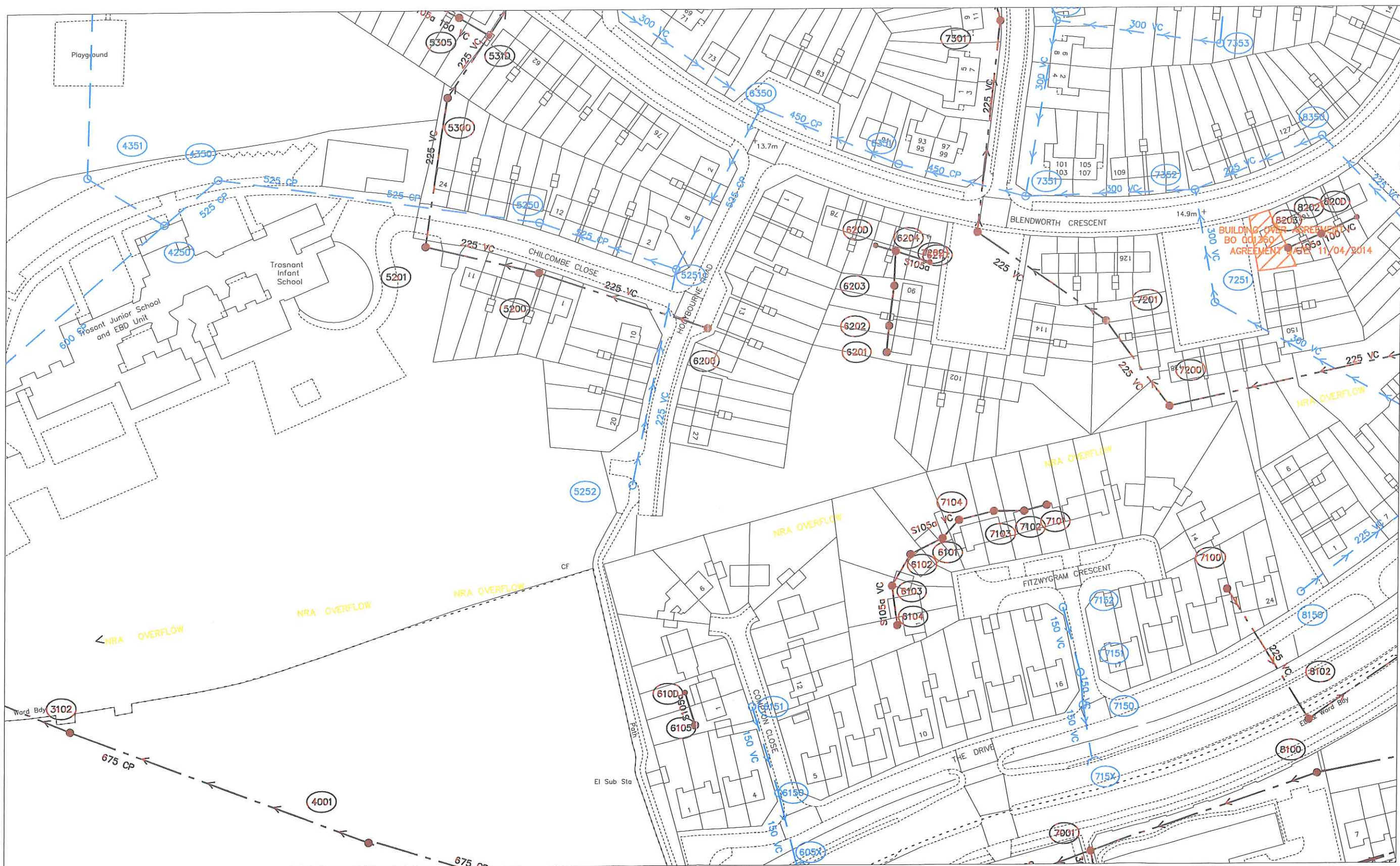
1. Southern Water Sewer Plan
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APPENDIX 1

Southern Water Sewer Plan

SEWER RECORDS PAGE 1 OF 2

107367



107079

471374

O.S. REF.

SU7107SE

Title: 192756_Land adjacent Holybourn

Drawn by: mondalb

Scale: 1:1250

Date: 07/04/2015

The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy.

The actual positions should be determined on site.

WARNING: BAC pipes are constructed of Bonded Asbestos Cement
WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement

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Southern Water

471845

SEWER RECORDS PAGE 2 OF 2

Node	Cover	Invert	Size	Material	Shape	Node	Cover	Invert	Size	Material	Shape	Node	Cover	Invert	Size	Material	Shape	Node	Cover	Invert	Size	Material	Shape
3102X	12.68	6.96	675	CP	CIRC																		
4001X	13.44	7.19	675	CP	CIRC																		
4250X	12.16		600	CP	CIRC																		
4350X	12.22		525	CP	CIRC																		
4351X	11.02		525	CP	CIRC																		
5200X	13.33	12.23	225	VC	CIRC																		
5201X	13.09		225	VC	CIRC																		
5250X	13.25		525	CP	CIRC																		
5251X	13.94	11.74	525	CP	CIRC																		
5252X	14.34	12.1	225	VC	CIRC																		
5300X	12.74	11.47	225	VC	CIRC																		
5305X			150	VC	CIRC																		
531DX			225	VC	CIRC																		
6101X			UNK	VC	CIRC																		
6102X			UNK	VC	CIRC																		
6103X			UNK	VC	CIRC																		
610DX			UNK	UNK	CIRC																		
6150X	13.47	12.7	150	VC	CIRC																		
6151X	13.81	13.02	150	VC	CIRC																		
6200X	14.14	12.69	225	VC	CIRC																		
6201X			UNK	UNK	CIRC																		
6202X			UNK	UNK	CIRC																		
6203X			UNK	UNK	CIRC																		
6204X			UNK	UNK	CIRC																		
620DX			UNK	UNK	CIRC																		
6350X	13.73	10.28	525	CP	CIRC																		
6351X	14.39	11.2	450	CP	CIRC																		
6351X	12.82	8.52	675	CP	CIRC																		
6351X	13.59	11.56	225	VC	CIRC																		
7101X			UNK	VC	CIRC																		
7102X			UNK	VC	CIRC																		
7103X			UNK	VC	CIRC																		
7104X			UNK	VC	CIRC																		
7150X	13.66	12.71	150	VC	CIRC																		
7151X	13.87	12.92	150	VC	CIRC																		
7152X	14.14	13.38	150	VC	CIRC																		
7200X	14.98	12.98	225	VC	CIRC																		
7201X	14.7	12.6	225	VC	CIRC																		
7202X	14.41	12.17	225	VC	CIRC																		
7251X	14.88	11.43	300	VC	CIRC																		
7301X	14.52	11.64	225	VC	CIRC																		
7350X	14.56	11.72	300	VC	CIRC																		
7351X	14.53	10.83	450	CP	CIRC																		
7352X	14.92	11.34	300	VC	CIRC																		
7353X	14.75	12	300	VC	CIRC																		
8100X	12.29		UNK	UNK	CIRC																		
8102X	13.77	12.52	225	VC	CIRC																		
8150X	13.77	12.44	225	VC	CIRC																		
8202X			100	VC	CIRC																		
820DX			100	VC	CIRC																		
8350X	15.22	12.04	225	VC	CIRC																		

LINE STYLES / COLOURS

Brown: Foul Syphon Sewer, Foul Vacuum Main, Foul Rising Main

Red: Combined, Combined Syphon Sewer, Combined Rising Main

Orange: Lateral Drain, Building Over Agreement Area

Dark Blue: Treated Effluent

Purple: Sludge, Sewer Catchment

Light Blue: Section 104 Area, Surface Water, Surface Water Rising Main

Yellow: Private, Access Shaft

Green: Decommissioned

MATERIALS

AK: Alkathane

BAC: Bonded Asbestos Cement

BRC: Brick (Common)

BRE: Brick (Engineering)

CC: Concrete Box Culvert

CI: Cast Iron

CO: Concrete (In-Situ)

CP: Concrete (Pre-Cast)

CSB: Concrete Segments (bolted)

CSU: Concrete Segments (unbolted)

DI: Ductile Iron

GRP: Glass Reinforced Concrete

GRP: Glass Reinforced Plastic

MAC: Masonry in regular Courses

MAK: Masonry in random Courses

PE: Polyethylene

PF: Pitch Fibre

PP: Polypropylene

PVC: Polyvinyl Chloride

RPM: Reinforced Plastic Mastic

SI: Spun Iron

ST: Steel

VC: Vitified Clay

XXX: Other

ZZZ: Unknown

LEGEND - SEWERS

Manhole (SW), Manhole (F&C), Lamp hole (SW), Lamp hole (F&C), Pumping Station (SW), Pumping Station (F&C), Side entry manhole (SW), Side entry manhole (F&C), Blind shaft (SW), Blind shaft (F&C), Ejector station (SW), Ejector station (F&C), Waterlight door (SW), Waterlight door (F&C), Flushing ch. M-e (SW), Flushing ch. M-e (F&C), Flushing ch. No-e (SW), Flushing ch. No-e (F&C), Demarcation Chamber

Washout (SW), Washout (F&C), Rodding Eye (SW), Rodding Eye (F&C), Gauging point (SW), Gauging point (F&C), Intercept chamber (SW), Intercept chamber (F&C), Storm Tank (SW), Storm Tank (F&C), Vortex chamber (SW), Vortex chamber (F&C), Label ellipse, Dummy/S24 manhole, Outfall, Penstock chamber, Damboards, Storm Overflow, Backdrop manhole

Other (s), Other, Change in sewer (s), Change in sewer, Reflux valve, Flap valve, Cascade, Anode, Valve, Closed Valve, Air Valve, Hatch box (SW), Hatch box (F&C), Direction arrow, Emptying valve, Catchpit, Soakaway, Inlet, Balancing Pond

Wastewater treatment works, Marine treatment works, Outfall headworks, Vent, Vent column, Tidal storage tank, Blank end, Head of Public Sewer, Micro Pumping Station

SHAPES (S)

A: Arched, B: Banded, C: Circular, E: Egg, H: Horseshoe, R: Rectangular, S: Square, T: Trapezoidal, U: U Shape, X: Other

NODE REFERENCING SYSTEM

1st digit: hundred metre easting identifier

2nd digit: hundred metre northing identifier

3rd digit: sewer type identifier

4th digit: next sequential node

D-4 = Foul/Combined

S-9 = Surface Water

Drawn by:	mondalb
Title:	192756_Land adjacent Holybourn
Date:	07/04/2015

APPENDIX 2

Drainage Calculations

Greenfield runoff estimation for sites

Site name: Holybourne Road

Site location: Havant

Site coordinates

Latitude: 50.85997° N

Longitude: 0.98375° W

This is an estimation of the greenfield runoff rate limits that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the CIRIA SUDS Manual (2007). It is not to be used for detailed design of drainage systems. It is recommended that every drainage scheme uses hydraulic modelling software to finalise volume requirements and design details before drawings are produced.

Reference: gcp33dg8ucwf / 0.29

Date: 17 Aug 2016

Site characteristics

Total site area	0.29	ha
Significant public open space	0	ha
Area positively drained	0.29	ha

Methodology

Greenfield runoff method	IH124
Qbar estimation method	Calculate from SPR and SAAR
SPR estimation method	Calculate from SOIL type
SOIL type	2
HOST class	N/A
SPR	0.30

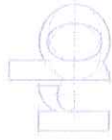
Hydrological characteristics

	Default	Edited	
SAAR	743	743	mm
M5-60 Rainfall Depth	20	20	mm
'r' Ratio M5-60/M5-2 day	0.4	0.4	
FEH/FSR conversion factor	0.83	0.83	
Hydrological region	7	7	
Growth curve factor: 1 year	0.85	0.85	
Growth curve factor: 10 year	1.62	1.62	
Growth curve factor: 30 year	2.3	2.3	
Growth curve factor: 100 year	3.19	3.19	

Greenfield runoff rates

	Default	Edited	
Qbar	0.57	0.57	l/s
1 in 1 year	0.48	0.48	l/s
1 in 30 years	1.30	1.30	l/s
1 in 100 years	1.81	1.81	l/s

Please note that a minimum flow of 5 l/s applies to any site



RUSHBY BREWSTER

CONSULTING CIVIL & STRUCTURAL ENGINEERS

The Town House, St. Georges Square
Bishops Waltham, Southampton
Hampshire SO32 1AF
Telephone: 01489 890004
Facsimile: 01489 890005

Job Title	Holybourne Road Havant			
	Post-Development			
	DESIGN RAINFALL RATES			
	Job No.	PMC239	Sht. No.	
	Prepared	AR	Date	16.08.16
	Checked	CH	Date	

Impermeable Area = 840 m²

600 x 1.4 = 840 i.e. + 40% for climate change

Runoff Limit

2

Storm Duration	1 in 1 year				1 in 100 year			
	M5 Rainfall mm	Z2	Rainfall mm	Intensity mm/hr	SW Runoff l/s	Runoff vol. m ³	Z2	Rainfall mm
5 min	6.8	0.62	4.2	50.6	11.80	3.54	1.83	12.4
10 min	9.6	0.61	5.9	35.1	8.20	4.92	1.90	18.2
15 min	11.7	0.61	7.1	28.5	6.66	6.00	1.94	22.7
30 min	14.9	0.62	9.2	18.5	4.31	7.76	1.99	29.7
1 hr	19.0	0.64	12.2	12.2	2.84	10.21	2.02	38.4
2 hrs	23.2	0.65	15.1	7.5	1.76	12.67	2.02	46.9
4 hrs	28.4	0.67	19.0	4.8	1.11	15.98	1.98	56.2
6 hrs	32.1	0.68	21.8	3.6	0.85	18.34	1.95	62.6
10 hrs	37.0	0.70	25.9	2.6	0.60	21.76	1.91	70.7
24 hrs	47.1	0.71	33.4	1.4	0.33	28.09	1.83	86.2

Ratio of 60 minute to 2 day rainfalls for 5 year return period r =

0.35

M5 rainfalls are calculated from Table 1 BRE Digest 365 using Factor Z1

Attenuation	
Outflow m ³	Storage Rq'd m ³
1	9.85
1	14.12
2	17.27
4	21.31
7	25.04
14	24.97
29	18.43
43	9.38
72	-12.64
173	-100.40

 RUSHBY BREWSTER CONSULTING CIVIL AND STRUCTURAL ENGINEERS Rushby Brewster	Project Holybourne Road Havant				Job no. PMC239	
	Calcs for Permeable Pavement				Start page no./Revision D4	
	Calcs by AWR	Calcs date 11/03/2016	Checked by	Checked date	Approved by	Approved date

PLANE INFILTRATION SYSTEM DESIGN

In accordance with CIRIA C697 SUDS

Tedds calculation version 2.0.00

Design rainfall intensity

Location of catchment area Other
 Impermeable area drained to the system $A = 100.0 \text{ m}^2$
 Return period Period = 100 yr
 Ratio 60 min to 2 day rainfall of 5 yr return period $r = 0.350$
 5-year return period rainfall of 60 minutes duration $M5_{60\text{min}} = 20.0 \text{ mm}$
 Increase of rainfall intensity due to global warming $p_{\text{climate}} = 30 \%$

Infiltration blanket details

Base area of blanket $A_b = 100.0 \text{ m}^2$
 Porosity $n = 0.4$
 Drainage ratio $R = A / A_b = 1.0$
 Soil infiltration rate $f = 1.00 \times 10^{-6} \text{ m/s}$

Table equations

Rainfall intensity $i = M100 / D$
 Minimum depth required $H = D / n \times (R \times i - f)$

Duration, D (min)	Growth factor Z1	M5 rainfalls (mm)	Growth factor Z2	100 year rainfall, M100 (mm)	Intensity, i (mm/hr)	Depth (mm)
5	0.36	9.3	1.89	17.6	210.60	43
10	0.51	13.2	1.96	25.8	154.98	63
15	0.62	16.0	2.00	32.0	128.16	78
30	0.79	20.5	2.03	41.5	82.97	99
60	1.00	26.0	2.00	52.1	52.05	121
120	1.22	31.8	1.96	62.2	31.10	137
240	1.50	38.9	1.90	73.9	18.47	149
360	1.69	43.9	1.86	81.7	13.61	150
600	1.95	50.6	1.81	91.4	9.14	138
1440	2.48	64.5	1.71	110.4	4.60	60

Min depth of blanket req'd $H_{\text{max}} = 150 \text{ mm}$

Time for emptying blanket to half volume $t_{50} = n \times H_{\text{max}} / (2 \times f) = 8\text{hr } 20\text{min } 31\text{s}$

PASS - Infiltration system discharge time less than or equal to 24 hours

APPENDIX 3

Extracts from Ground Investigation Report



Thomas Telford House
Sun Valley Business Park
Winnall Close
Winchester SO23 0LB

01962 673 330
soilslimited.co.uk

Ridge and Partners LLP

F.A.O. Antony Platt

By Email only: APlatt@ridge.co.uk

Our Ref: I5409/LR

4th February 2016

Dear Antony

RE: Land to rear of 27 Holybourne Road, Havant, Hampshire PO9 2BN

We are writing in regards to the intrusive investigation undertaken at the above named site.

Brief

The Soils Limited quotation (reference Q17228, dated 15th January 2016) set out the scope of the investigation. The investigation was to comprise machine excavated trial holes and infiltration tests in accordance with the principles of BRE Digest 365 Soakaway design: 1991.

General

The site had an approximate area of 0.24ha and was located between Holybourne Road and Blendworth Avenue, Havant, Hampshire at O.S Land Ranger Grid Reference of SU 710 072.

A site location plan has been included as Figure 1.

Site Works

Site works were undertaken on the 28th January 2016 and comprised three machine excavated trial pits (ST1 – ST3). Following the construction of the trial holes, infiltration tests broadly in accordance with the principles of BRE 365 were carried out. A trial hole location plan is included as Figure 2. Infiltration tests could only be carried out once in each of the trial pits due negligible infiltration rates and saturated ground conditions.

Upon completion all trial holes were backfilled with arisings and mounded over for future settlement.

Ground Conditions

The ground conditions encountered during the site investigation have been summarised below:

Topsoil River Terrace Deposits

Table 1 – Summary of Ground Conditions

Strata	Depth Encountered (m bgl)		Typical Description
	Top	Base	
Topsoil	0.00	0.30 -0.40	Grass over brown slightly gravelly clayey SILT. Gravel was fine to medium sub-angular flint and rare fine brick. Frequent fine roots and rootlets.
River Terrace Deposits	0.30 – 0.40	1.40 ¹ -1.90 ¹	Upper (cohesive): Soft orangey brown mottled grey slightly gravelly silty CLAY. Gravel was fine sub-rounded flint. Occasional fine roots and rootlets. Lower (granular): Brown clayey fine to coarse sub-angular to sub-rounded flint GRAVEL with occasional sub-angular flint cobbles.

Notes: ¹ encountered to base of trial hole

Two machine excavated trial pits were dug for ST2. The first encountered groundwater at 1.65m bgl, this water was pumped out and the pit backfilled with arisings. The second trial pit was excavated close by to a depth of 1.40m bgl in order to avoid groundwater and ensure that accurate infiltration results were obtained.

Infiltration Testing

Infiltration tests were performed in all three of the trial pits during the investigation, in areas selected by Ridge and Partners LLP, in order to provide guidance on the suitability of the ground for the adoption of a surface water drainage system. Each test was undertaken within the River Terrace deposits at depths of 1.90m bgl (ST1), 1.40m bgl (ST2) and 1.90m bgl (ST3). Tests were conducted broadly in accordance with the principles of BRE Digest 365 Soakaway design: 1991.

BRE 365 states that for an accurate infiltration rate to be obtained a soakage pit needs to be filled three times in quick succession. Each test is completed once 75% of the water present has drained away, in order to determine whether or not the underlying ground conditions may be suitable for surface water drainage. Only one test was carried out in trial pit ST1-ST2 and two tests within ST3 due to low infiltration rates observed and the time available during the day of the test (1 day allowed).

The test comprised piping water via a water tanker into the open trial hole, the drop in water level over time was then recorded to give an indication of soakage potential. The test stratum comprised the River Terrace Deposits (RTD).

Table 2 - Infiltration Test Results

Trial Hole (Test No.)	Test Stratum	Test Depth (m bgl)	Infiltration Rate (m/sec)	Notes
ST1	RTD	1.90	N/A	Water levels increasing to ground level over duration of test due to saturated ground at surface – test abandoned after 251 minutes
ST2	RTD	1.40	N/A	Minimal infiltration observed after 200 minutes. Between 200 and 262 minutes: zero infiltration recorded. Test aborted – unable to calculate infiltration rate in accordance with BRE 365.
ST3 - T1	RTD	1.90	1.04×10^{-5}	Test complete after 280 minutes
ST3 - T2	RTD	1.90	1.05×10^{-5}	Extrapolated data used after 120 minutes due to insufficient daylight remaining to continue test within day allowed.

Indicative infiltration rates could not be calculated in ST1 and ST2 due to the negligible infiltration rates and saturated ground conditions.

Full results are included within Appendix A.

Conclusions

Given the observed infiltration over the test period, it is considered unlikely that the whole site would benefit from the adoption of a soakaway system for surface water drainage. The granular soils of the River Terrace Deposits at the location of TP3/ST3 did however show good infiltration over the test period and therefore further investigation of the extent of the granular soils of the River Terrace Deposits may identify other areas across the site where soakaways could be considered. The drainage conditions across the rest of the site are presently unknown as is the depth to groundwater.

It should be noted that the Environment Agency must be consulted on any works which may impact groundwater sources.

The following attachments make up the remainder of this letter report.

Figure 1. Site Location Plan

Figure 2. Trial Hole Location Plan

Appendix A. Field Data

Should you have any further questions please do not hesitate to contact the undersigned.

Yours Sincerely

A handwritten signature in black ink, reading "J Hills". The signature is written in a cursive, flowing style.

John Hills BSc (Hons)
Graduate Geo-Environmental Engineer
jh@soilslimited.co.uk



Figure number
2

Title
Trail hole location plan

Project
Land to rear of 27 Holybourne Road, Havant,
Hampshire PO9 2BN

Date
February 2016

Client
Ridge and Partners LLP

Reference
I5409

Southampton Weather

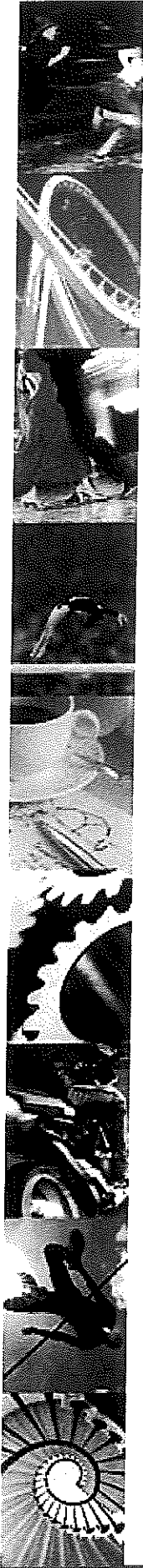
This Stations Daily Rainfall Reports (mm)

Report for the Year 2016

Data last updated: 22/03/16 - 15:40

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	6.2	0.0	6.2	---	---	---	---	---	---	---	---	---
2	10.3	0.0	2.4	---	---	---	---	---	---	---	---	---
3	24.4	0.0	3.8	---	---	---	---	---	---	---	---	---
4	2.6	0.0	1.4	---	---	---	---	---	---	---	---	---
5	1.8	4.4	0.1	---	---	---	---	---	---	---	---	---
6	0.1	8.5	0.0	---	---	---	---	---	---	---	---	---
7	18.5	16.9	0.0	---	---	---	---	---	---	---	---	---
8	8.5	1.3	1.3	---	---	---	---	---	---	---	---	---
9	6.3	1.0	32.6	---	---	---	---	---	---	---	---	---
10	7.7	0.0	0.0	---	---	---	---	---	---	---	---	---
11	19.2	0.0	0.0	---	---	---	---	---	---	---	---	---
12	0.0	3.7	0.0	---	---	---	---	---	---	---	---	---
13	5.9	7.3	0.0	---	---	---	---	---	---	---	---	---
14	0.1	1.6	0.0	---	---	---	---	---	---	---	---	---
15	0.0	0.0	0.0	---	---	---	---	---	---	---	---	---
16	0.1	0.0	0.0	---	---	---	---	---	---	---	---	---
17	2.3	12.1	0.0	---	---	---	---	---	---	---	---	---
18	1.2	0.6	0.0	---	---	---	---	---	---	---	---	---
19	0.0	3.1	0.0	---	---	---	---	---	---	---	---	---
20	0.0	0.8	0.0	---	---	---	---	---	---	---	---	---
21	0.4	0.0	0.0	---	---	---	---	---	---	---	---	---
22	10.2	4.0	0.0	---	---	---	---	---	---	---	---	---
23	3.4	0.1	---	---	---	---	---	---	---	---	---	---
24	1.0	0.0	---	---	---	---	---	---	---	---	---	---
25	0.0	0.0	---	---	---	---	---	---	---	---	---	---
26	13.0	0.0	---	---	---	---	---	---	---	---	---	---
27	27.6	0.0	---	---	---	---	---	---	---	---	---	---
28	0.0	0.0	---	---	---	---	---	---	---	---	---	---
29	5.6	1.3	---	---	---	---	---	---	---	---	---	---
30	6.9		---	---	---	---	---	---	---	---	---	---
31	1.0		---	---	---	---	---	---	---	---	---	---
Rain Days	25	15	7	0	0	0	0	0	0	0	0	0
Month Total	184.3 mm	66.7 mm	47.8 mm	0.0 mm	0.0 mm	0.0 mm	0.0 mm	0.0 mm	0.0 mm	0.0 mm	0.0 mm	0.0 mm
YTD Total	184.3 mm	251.0 mm	298.8 mm	298.8 mm	298.8 mm	298.8 mm	298.8 mm	298.8 mm	298.8 mm	298.8 mm	298.8 mm	298.8 mm

Colour Key												
< 1.0	1.0 - 2.0	2.0 - 3.0	3.0 - 4.0	4.0 - 5.0	5.0 - 6.0	6.0 - 7.0	7.0 - 8.0	8.0 - 9.0	9.0 - 10.0	10.0 - 11.0	11.0 - 12.0	12.0 >



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Property and Construction Consultants

Portsmouth City Council

Ground Condition Assessment
Land at Holybourne Road,
Havant

July 2015

Prepared for:
Portsmouth City Council
Housing Development
Core 1 Floor 1
Civic Offices
Guildhall square
Portsmouth
PO1 2AY

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Moorside Road
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Ground Condition Assessment

Section 9 – Conclusions and Recommendations

9.1. Contamination

No significant sources of contamination have been identified in association with the site. No viable pollutant linkages are therefore considered to be present in relation to the proposed residential development at the site.

General Notes

In order to mitigate the generic risks associated with development on potentially contaminated land the following mitigation measures are recommended:

- Preparation of a Discovery Strategy outlining the procedures to be followed in the event that unanticipated contamination is encountered during the development.
- Compliance with relevant Health and Safety procedures during construction works.
- Contractors on site should wear appropriate PPE to mitigate the risks from the chemical and physical impacts to the Made Ground at the site.
- The local authority should be informed if any sources of contamination are identified during the development that have not been assessed in this report. These sources should then be assessed and dealt with appropriately, with the agreement of the local authority.

The conclusions of this assessment are subject to agreement with the regulatory authority, be it the Local Authority for human health related issues or the Environment Agency for environmental issues.

It is recommended that any removal and disposal of sub-soil arisings and/or groundwater from the site should be undertaken in a controlled manner to a licensed facility, with due regard to Duty of Care responsibilities. In addition, an appropriate degree of health and safety provision should be incorporated to protect both the site workers and the general public alike.

During any ground works, it is recommended that skin contact with soils is kept to a minimum in accordance with good working practice / specific control measures and the HSE guidance document 'Protection of Workers and the General Public During the Development of Contaminated Land', 1991.

Ground Condition Assessment

9.2. Geotechnical

The ground investigation revealed the site to be underlain by Topsoil / Made Ground over River Terrace Deposits in turn overlying London Clay Formation to the full depth of the investigation. The River Terrace Deposits comprised an upper layer of fine-grained deposits overlying dense gravels.

Groundwater seepages were not recorded during the ground investigation but subsequent monitoring visits indicated a minimum at rest groundwater level to be 3.24mbgl.

Shallow Foundations

It is recommended that shallow foundations at a minimum depth of 0.90mbgl or below the any Made Ground, should thicker sequences be encountered, are adopted for this site. Foundation excavations should remain stable in the short term; however founding materials should not be left exposed for extended periods of time.

Ultimate bearing resistance calculations have been carried out for foundations constructed in the fine-grained RTD and returned a ULS bearing resistance of 135kN/m².

Serviceability limit state settlement analyses were carried out under a foundation loading of 135kN/m² on a strip foundation constructed within the upper RTD. The results show that, with the foundation loading of 135kN/m², total settlement of less than 25mm should be expected.

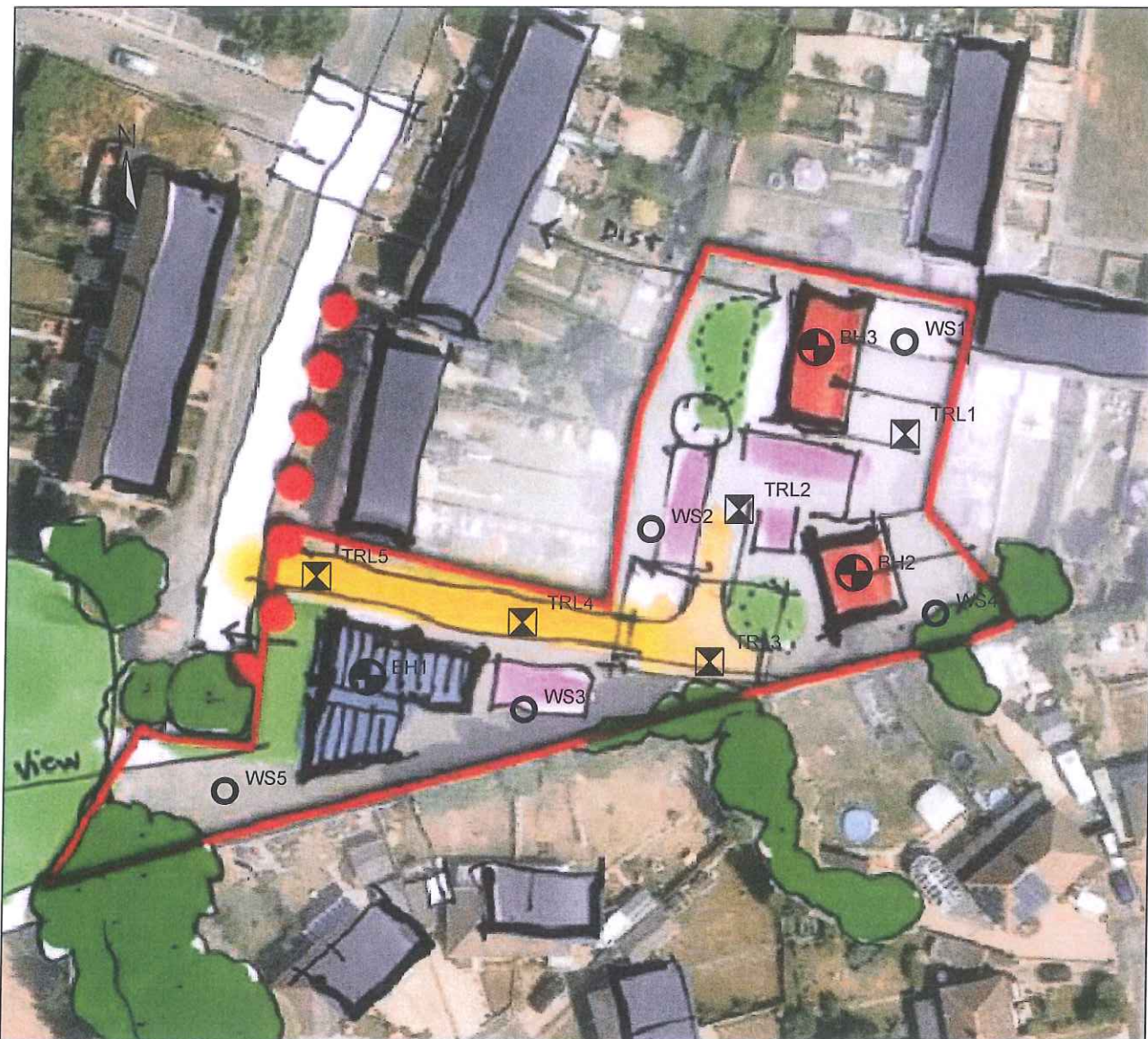
Piled Foundations

It is unclear at the time of reporting whether any multi-storey blocks are to form part of this development. If this is the case it is possible that the calculated bearing resistance may be too restrictive. Therefore, ULS axial pile resistances have been calculated for a range of diameters and lengths of augured pile. However, when sizing piles from these results all applied actions must be factored in accordance with the UK National Annex to Eurocode 7.

It should be noted that the carrying capacity of a pile group is usually less than the sum of the individual piles. Therefore it is recommended that a detailed pile group analysis is carried out when all loads and serviceability limits are known.

Other Geotechnical Considerations

Ground bearing floor slabs are considered appropriate for this site.



KEY:

- BOREHOLE LOCATION
- WINDOW SAMPLE LOCATION
- TRL PROBE LOCATION

10.07	PRELIMINARY	DAP	AP
REF	DATE	REVISION	DRAWN/CHECKED

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PROJECT
HOLYBOURNE ROAD
HAVANT

RIDGE

PARTNERSHIP HOUSE
MOORSIDE ROAD
WINCHESTER
HAMPSHIRE, SO23 7RD
Also at Reading, Bristol, London and Leicester

TEL: 01962 834400
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CLIENT
PORTSMOUTH CITY COUNCIL

DRAWING

151239 - SITE INVESTIGATION LOCATIONS

SCALE
NTS @ A4

DATE
10.07.15

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DAP

CHECKED BY
AP

FIGURE 2

REV

BOREHOLE LOG

Project Holybourne Rd				BOREHOLE No BH1
Job No Holybourne Rd	Date 01-06-15 01-06-15	Ground Level (m)	Co-Ordinates ()	
Contractor DJ Drilling				Sheet 1 of 2

SAMPLES & TESTS			Water	STRATA			Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)		
0.30	D1	30 blows				0.10	Brown silty clayey fine SAND with frequent rootlets	
0.30-0.50	ESA					(1.80)	Brown silty clayey fine SAND	
0.50-0.70	B2					1.90		
1.20-1.55	U3							
1.55	D4	N49			(1.30)	Dense silty clayey fine to coarse angular to sub angular flint GRAVEL		
2.00-2.45	D5				3.20			
2.00					(1.00)	Firm brown grey silty CLAY		
3.00-3.45	D6				4.20			
3.00		35 blows			(0.70)	Brown silty clayey fine SAND		
4.00-4.45	U7				4.90			
4.45	D8							
5.00	D9					Firm to stiff grey CLAY		
5.00		N12						
6.00	D10							
6.50-7.00	B11							
7.00-7.50	B12							
8.00-8.20	D13	N19			(7.10)			
8.50	D14							
8.50								
9.50	D15							

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:62.5			Client PCC			Method/ Plant Used Dando 2000			Logged By DAP		

BOREHOLE LOG

Project Holybourne Rd				BOREHOLE No BH1	
Job No Holybourne Rd	Date 01-06-15 01-06-15	Ground Level (m)	Co-Ordinates ()		
Contractor DJ Drilling				Sheet 2 of 2	

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION		
10.00-10.35	U16	55 blows					Firm to stiff grey CLAY (continued)		
10.35	D17								
11.00	D18								
11.50-11.95	D19								
11.50		N28				12.00			

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Dia. mm	Water Depth	From	To	Hours	From	To	

All dimensions in metres
Scale 1:62.5

Client PCC

Method/
Plant Used

Dando 2000

Logged By

DAP

BOREHOLE LOG

Project Holybourne Rd				BOREHOLE No BH2	
Job No Holybourne Rd	Date 02-06-15 02-06-15	Ground Level (m)	Co-Ordinates ()		
Contractor DJ Drilling				Sheet 1 of 2	

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION		
0.30	D1					0.10	Brown silty clayey fine SAND with frequent rootlets		
0.50-0.70	B2						Brown silty clayey gravelly fine SAND. Gravel is of fine to medium angular flint		
0.50	ESA					(1.60)			
1.20-1.40	U3	45 blows				1.70			
1.40	D4					2.00	Brown silty clayey sandy fine to medium angular flint GRAVEL		
2.00-2.50	B5	N50/ 225 mm				(1.30)	Dense silty sandy medium to coarse angular to sub angular flint GRAVEL		
2.00						3.30			
3.00-3.50	B6	N14				(1.00)	Firm brown silty CLAY		
3.00						4.30			
4.00-4.45	U7					(0.80)	Brown silty gravelly fine SAND. Gravel is of fine to medium angular flint		
4.45	D8					5.10			
5.00	D9	N6				(0.90)	Soft to firm grey silty CLAY		
5.00						6.00			
6.00	D10					(6.00)	Firm to stiff grey CLAY		
6.50-6.85	U11								
6.85	D12								
7.50	D13								
8.00	D14	N22							
8.00									
9.00	D15								
9.50	B16								

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 Project: HOLYBOURNE RD.GPJ ||

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:62.5			Client PCC			Method/ Plant Used Dando 2000			Logged By DAP		

BOREHOLE LOG

Project Holybourne Rd				BOREHOLE No BH2
Job No Holybourne Rd	Date 02-06-15 02-06-15	Ground Level (m)	Co-Ordinates ()	
Contractor DJ Drilling				Sheet 2 of 2

[illegible]

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:62.5			Client PCC				Method/ Plant Used Dando 2000				Logged By DAP

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Moorside Road

BOREHOLE LOG

Project Holybourne Rd				BOREHOLE No BH3	
Job No Holybourne Rd	Date 03-06-15 03-06-15	Ground Level (m)	Co-Ordinates ()		
Contractor DJ Drilling				Sheet 1 of 2	

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION		
0.30	D1					0.10	Brown silty clayey SAND with frequent rootlets		
0.30	ESA						Brown silty clayey fine SAND		
0.50-0.70	B2					(1.70)			
1.20-1.70	B3								
1.80-2.30	B4					1.80			
1.80		N50/ 210 mm				2.00	Brown silty clayey gravelly fine SAND. Gravel is of fine to medium angular to sub angular flint		
							Dense silty slightly sandy clayey fine to coarse angular to sub rounded flint GRAVEL		
2.80-3.30	B5					(2.10)			
2.80		N28							
3.90-4.40	B6					4.10			
3.90		N7				(0.70)	Firm brown CLAY		
						4.80			
5.00-5.45	D7					(0.50)	Brown silty fine SAND		
5.00		N6				5.30			
							Firm grey silty CLAY		
6.00	D8					(1.10)			
						6.40			
6.50-7.00	B9						Firm to stiff grey CLAY		
7.00-7.35	U10								
7.35	D11								
8.00	D12								
8.50-8.95	D13								
8.50		N26				(5.60)			
9.50	D14								

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:62.5			Client PCC			Method/ Plant Used Dando 2000			Logged By DAP		

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Moorside Road

BOREHOLE LOG

Project Holybourne Rd				BOREHOLE No BH3
Job No Holybourne Rd	Date 03-06-15 03-06-15	Ground Level (m)	Co-Ordinates ()	
Contractor DJ Drilling				Sheet 2 of 2

[illegible]

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:62.5			Client PCC			Method/ Plant Used Dando 2000			Logged By DAP		

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BOREHOLE LOG

Project Holybourne Rd				BOREHOLE No WS1	
Job No Holybourne Rd	Date 01-06-15 01-06-15	Ground Level (m)	Co-Ordinates ()		
Contractor DJ Drilling				Sheet 1 of 1	

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION		
0.20	ES1	N7				0.30	Light brown clayey silty fine SAND with occasional rootlets and small brick fragments (TOPSOIL)		
0.45	ES2					0.50	Firm to stiff orange brown slightly sand silty CLAY		
1.00						(1.10)	Stiff orange brown silty clay		
						1.60			
		N50/ 70 mm				2.00	Dense coarse angular flint GRAVEL		
2.00									

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To	

All dimensions in metres Scale 1:62.5	Client PCC	Method/ Plant Used Terrier	Logged By DAP
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BOREHOLE LOG

Project Holybourne Rd				BOREHOLE No WS2	
Job No Holybourne Rd	Date 01-06-15 01-06-15	Ground Level (m)	Co-Ordinates ()		
Contractor DJ Drilling				Sheet 1 of 1	

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION		
0.20	ES1	N8				0.40	Brown silty clayey gravelly fine SAND with frequent rootlets and small brick fragments		
0.40	ES2						Firm to stiff orange brown slightly sandy silty CLAY		
0.50-1.00	U3					(1.10)			
1.00	ES4	N50/ 110 mm				1.50			
1.30-1.60						1.80	Dense silty clayey fine to coarse angular flint GRAVEL		
1.80									

Boring Progress and Water Observations

Chiselling

Water Added

GENERAL REMARKS

Depth	Date	Time	Casing Depth	Dia. mm	Water Depth	From	To	Hours	From	To	GENERAL REMARKS

All dimensions in metres
Scale 1:62.5

Client PCC

Method/
Plant Used

Terrier

Logged By

DAP

BOREHOLE LOG

Project Holybourne Rd				BOREHOLE No WS3
Job No Holybourne Rd	Date 01-06-15 01-06-15	Ground Level (m)	Co-Ordinates ()	
Contractor DJ Drilling				Sheet 1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION		
0.10-0.30	ES1					0.35	Light brown silty slightly clayey gravelly fine SAND. Gravel is of fine to medium angular flint		
0.50-0.60	ES2				(1.15)		Firm to stiff orange brown slightly sandy silty CLAY		
1.00		N7				1.50			
						1.90	Dense slightly clayey fine to coarse angular flint GRAVEL.		
1.90		N50/ 170 mm							

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:62.5			Client PCC			Method/ Plant Used Terrier			Logged By DAP		

BOREHOLE LOG

Project Holybourne Rd				BOREHOLE No WS4
Job No Holybourne Rd	Date 01-06-15 02-06-15	Ground Level (m)	Co-Ordinates ()	
Contractor DJ Drilling				Sheet 1 of 1

[illegible]

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:62.5			Client PCC			Method/ Plant Used Terrier					Logged By DAP

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BOREHOLE LOG

Project Holybourne Rd				BOREHOLE No WS5	
Job No Holybourne Rd	Date 01-06-15 02-06-15	Ground Level (m)	Co-Ordinates ()		
Contractor DJ Drilling				Sheet 1 of 1	

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION		
0.10-0.40	ES1					(0.60) 0.60	Light brown silty gravelly fine SAND. Gravel is of medium to coarse angular to sub angular flint		
0.60-0.80	ES2					(1.00) 1.60	Firm to stiff orange brown silty slightly sandy CLAY		
1.00		N9				1.80	Dense clayey fine to coarse angular flint GRAVEL		
1.80		N50/ 165 mm							

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Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Dia. mm	Water Depth	From	To	Hours	From	To	
All dimensions in metres Scale 1:62.5			Client PCC			Method/ Plant Used Terrier			Logged By DAP		

APPENDIX 4

Extracts from SuDs Manual re Water Quality Managment

TABLE 4.3 Minimum water quality management requirements for discharges to receiving surface waters and groundwater

Land use	Pollution hazard level	Requirements for discharge to surface waters, including coasts and estuaries ²	Requirements for discharge to groundwater
Residential roofs	Very low	Removal of gross solids and sediments only	
Individual property driveways, roofs (excluding residential), residential car parks, low traffic roads (eg cul de sacs, home zones, general access roads), non-residential car parking with infrequent change (eg schools, offices)	Low	Simple index approach ³ <i>Note: extra measures may be required for discharges to protected resources¹</i>	
Commercial yard and delivery areas, non-residential car parking with frequent change (eg hospitals, retail), all roads except low traffic roads and trunk roads/motorways	Medium	Simple index approach ³ <i>Note: extra measures may be required for discharges to protected resources¹</i>	Simple index approach ³ <i>Note: extra measures may be required for discharges to protected resources¹</i> In England and Wales, Risk Screening ⁴ must be undertaken first to determine whether consultation with the environmental regulator is required. In Northern Ireland, the need for risk screening should be agreed with the environmental regulator.
Trunk roads and motorways	High	Follow the guidance and risk assessment process set out in HA (2009)	
Sites with heavy pollution (eg haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured, industrial sites	High	Discharges may require an environmental licence or permit ⁵ . Obtain pre-permitting advice from the environmental regulator. Risk assessment is likely to be required ⁵ .	

Notes

The minimum water quality management requirements for discharges to receiving surface waters and groundwater are presented here. (For Northern Ireland, this guidance should be considered as interim until such time as Northern Ireland publishes its own legislation/policy/guidance.)

- 1 These are not required in Scotland and Northern Ireland. For England and Wales, see Step 3 of the simple index approach (Section 26.7.1).

Protected surface water resources will include those designated for drinking water abstraction or for other environmental protection reasons. Protected groundwater resources are represented by SPZ1s in England and Wales.

- 2 In Scotland, the Water Environment (Controlled Activities) (Scotland) Regulations (CAR) 2011 General Binding Rules, Rule 10 (d) (iv) effectively provides an exemption from requiring SuDS for coastal discharges. However, control of any contaminants likely to be present in surface water runoff is still required, but can be delivered using alternative methods such as proprietary treatment products. As the term 'SuDS' in this manual includes proprietary treatment products, this exemption is not valid in this context.

- 3 The application of the simple index approach should follow the approach outlined in Section 26.7.1 (or equivalent approved).

- 4 Risk screening is an assessment to identify high risk scenarios where the Environment Agency or Natural Resources Wales (NRW) would wish to be consulted regarding infiltration of water from surface runoff in order to agree the proposed design approach. The risk screening method is provided in Section 26.7.2.

- 5 The risk assessment should determine the appropriate design approach to mitigate risk to acceptable levels following the guidance outlined in Section 26.7.3. This assessment should be approved by the environmental regulator.

- detailed risk assessment methods
- process-based treatment modelling methods (which, where used, are likely to form part of a detailed risk assessment).

Each of these methods is summarised in **Table 26.1** and described in more detail in the subsequent sections.

TABLE 26.1 Approaches to water quality risk management

Design method	Hazard characterisation	Risk reduction	
		For surface water	For groundwater
Simple index approach	Simple pollution hazard indices based on land use (eg Table 26.2 or equivalent)	Simple SuDS hazard mitigation indices (eg Table 26.3 or equivalent)	Simple SuDS hazard mitigation indices (eg Table 26.4 or equivalent)
Risk screening ¹	Factors characterising traffic density and extent of infiltration likely to occur (eg Table 26.5 or equivalent)	N/A	Factors characterising unsaturated soil depth and type, and predominant flow type through the soils (eg Table 26.5 or equivalent)
Detailed risk assessment	Site specific information used to define likely pollutants and their significance	More detailed, component specific performance information used to demonstrate that the proposed SuDS components reduce the hazard to acceptable levels	
Process-based treatment modelling	Time series rainfall used with generic pollution characteristics to determine statistical distributions of likely concentrations and loadings in the runoff	Models that represent the treatment processes in the proposed SuDS components give estimates of reductions in event mean discharge concentrations and total annual load reductions delivered by the system	

Note

¹ Risk assessment may be required as a result of the risk screening process.

Table 4.3 (Chapter 4) sets out which of these methods is required – for different generic land use types and receiving waters. Process-based modelling is not currently readily available for SuDS design in the UK, and is not therefore specified as a requirement. However, where robust models can be developed by designers, this approach should not be discounted as a future option for SuDS design.

It is important to ensure that risks to both surface and groundwater are managed effectively, and the approach taken should be agreed with the drainage approving body and/or environmental regulator in advance of the design, as local differences in requirements may exist.

Approaches that consider a number of key pollutant types are recommended because:

- receiving water quality standards tend to be specified in terms of individual pollutant thresholds (**Section 26.4**)
- different components tend to have different capacities to remove different types of pollutants (**Section 26.6**)
- any component (proprietary product or otherwise) will need to demonstrate performance across a range of pollutants, or where this is not possible, different types of component will be needed to remove different pollutants. A series of sediment removal components, such as gulley pots, would be unlikely to meet the performance requirements for the full suite of pollutants.

26.7.1 Simple index approach

The simple method described in this section, and summarised in **Box 26.2**, has been developed from that set out in Ellis *et al* (2012), a summary of which is presented in **Annex 5**.

TABLE 26.2 Pollution hazard indices for different land use classifications

Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro-carbons
Residential roofs	Very low	0.2	0.2	0.05
Other roofs (typically commercial/ industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (eg cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change (eg schools, offices) ie < 300 traffic movements/day	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change (eg hospitals, retail), all roads except low traffic roads and trunk roads/motorways ¹	Medium	0.7	0.6	0.7
Sites with heavy pollution (eg haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways ¹	High	0.8 ²	0.8 ²	0.9 ²

Notes

- 1 Motorways and trunk roads should follow the guidance and risk assessment process set out in Highways Agency (2009).
- 2 These should only be used if considered appropriate as part of a detailed risk assessment – required for all these land use types (Table 4.3). When dealing with high hazard sites, the environmental regulator should first be consulted for pre-permitting advice. This will help determine the most appropriate approach to the development of a design solution.

Where a site land use falls outside the defined categories, the indices should be adapted (and agreed with the drainage approving body) or else the more detailed risk assessment method should be adopted.

Where nutrient or bacteria and pathogen removal is important for a particular receiving water, equivalent indices should be developed for these pollutants (if acceptable to the drainage approving body) or the risk assessment method adopted.

Where the mitigation index of an individual component is insufficient, two components (or more) in series will be required, where:

$$\text{Total SuDS mitigation index} = \text{mitigation index}_1 + 0.5 (\text{mitigation index}_2)$$

Where:

$$\text{mitigation Index}_n = \text{mitigation index for component } n$$

A factor of 0.5 is used to account for the reduced performance of secondary or tertiary components associated with already reduced inflow concentrations.

TABLE 26.4 Indicative SuDS mitigation indices for discharges to groundwater

Characteristics of the material overlying the proposed infiltration surface, through which the runoff percolates ¹	TSS	Metals	Hydrocarbons
A layer of dense vegetation underlain by a soil with good contaminant attenuation potential ² of at least 300 mm in depth ³	0.6 ⁴	0.5	0.6
A soil with good contaminant attenuation potential ² of at least 300 mm in depth ³	0.4 ⁴	0.3	0.3
Infiltration trench (where a suitable depth of filtration material is included that provides treatment, ie graded gravel with sufficient smaller particles but not single size coarse aggregate such as 20 mm gravel) underlain by a soil with good contaminant attenuation potential ² of at least 300 mm in depth ³	0.4 ⁴	0.4	0.4
Constructed permeable pavement (where a suitable filtration layer is included that provides treatment, and including a geotextile at the base separating the foundation from the subgrade) underlain by a soil with good contaminant attenuation potential ² of at least 300 mm in depth ³	0.7	0.6	0.7
Bioretention underlain by a soil with good contaminant attenuation potential ² of at least 300 mm in depth ³	0.8 ⁴	0.8	0.8
Proprietary treatment systems ^{5,6}	These must demonstrate that they can address each of the contaminant types to acceptable levels for inflow concentrations relevant to the contributing drainage area.		

Notes

- 1 All designs must include a minimum of 1 m unsaturated depth of aquifer material between the infiltration surface and the maximum likely groundwater level (as required in infiltration design – **Chapter 25**).
- 2 For example as recommended in Sniffer (2008a and 2008b), Scott Wilson (2010) or other appropriate guidance.
- 3 Alternative depths may be considered where it can be demonstrated that the combination of the proposed depth and soil characteristics will provide equivalent protection to the underlying groundwater – see note 1.
- 4 If significant volumes of sediment are allowed to enter an infiltration system, there will be a high risk of rapid clogging and subsequent system failure.
- 5 See **Chapter 14** for approaches to demonstrate product performance. Note: a British Water/Environment Agency assessment code of practice is currently under development that will allow manufacturers to complete an agreed test protocol for systems intended to treat contaminated surface water runoff. Full details can be found at: www.britishwater.co.uk/Publications/codes-of-practise.aspx
- 6 SEPA only considers proprietary treatment systems as appropriate in exceptional circumstances where other types of SuDS component are not practicable. Proprietary treatment systems may also be considered appropriate for existing sites that are causing pollution, where there is a requirement to retrofit treatment. WAT-RM-08 (SEPA, 2014) also provides a flowchart with a summary of checks on suitability of a proprietary system.

The following should be noted:

- Where the indices are not considered representative by the designer, a risk assessment can be undertaken (**Section 26.7.3**).
- Components should always be designed for treatment, as described in the design guidance set out in the individual component chapters. If they are undersized, incorrectly designed or constructed or inadequately maintained, their treatment performance could be significantly affected. Component checklists (**Appendix B**) can be used to confirm design and construction adequacy and set appropriate maintenance regimes.
- Where the infiltration component itself does not provide sufficient pollution mitigation, the design should include upstream SuDS components that are lined to prevent infiltration from occurring. The mitigation indices set out in **Table 26.3** (for discharges to surface water) should be used for any upstream treatment.

APPENDIX 5

Drawings :

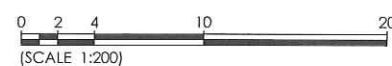
- a) **Architect's Site Plan**

- b) **PMC 239 – 500- Drainage Strategy**
PMC 239 – 551- Drainage Strategy Details (sheet 1)
PMC 239 – 552- Drainage Strategy Details (sheet 2)

- c) **Topographical Survey**



Site Plan 1:200



- GENERAL NOTES:
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 2. Any discrepancies in dimensions or details between the various drawings should be reported immediately.
 3. All dimensions are in millimetres and all levels are in metres.
 4. Do not scale from this drawing, if in doubt ASK.

Rev.	Description	Date	Dim	Ch'd
A	Parking amended.	03.06.16	RL	DK
B	Culvert and easement shown	15.04.16	RL	DK
C	Alterations due to planning comments	29.06.16	RL	DK
D	Changes to boundary treatments	30.06.16	RL	DK
E	Changes to boundary treatments	01.07.16	RL	DK

SCHEDULE OF ACCOMMODATION

5	no. 3B/6P Houses @ 108m ²
2	no. 2B/4P Flats @ 71.8m ²
2	no. 1B/2P Flats @ 52.5-57.8m ²
9	no. Units Total

PARKING

10	no. Allocated parking spaces
10	no. Unallocated parking spaces
20	no. Total spaces



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SITE LOCATION PLAN SCALE 1:1250



CONCEPT HOUSE, 35 KINGSTON CRESCENT, NORTH END, PORTSMOUTH, HAMPSHIRE, PO2 8AA
T - 023 9267 3618 F - 023 9267 9819 www.kscaddan.co.uk info@kscaddan.co.uk

PROJECT

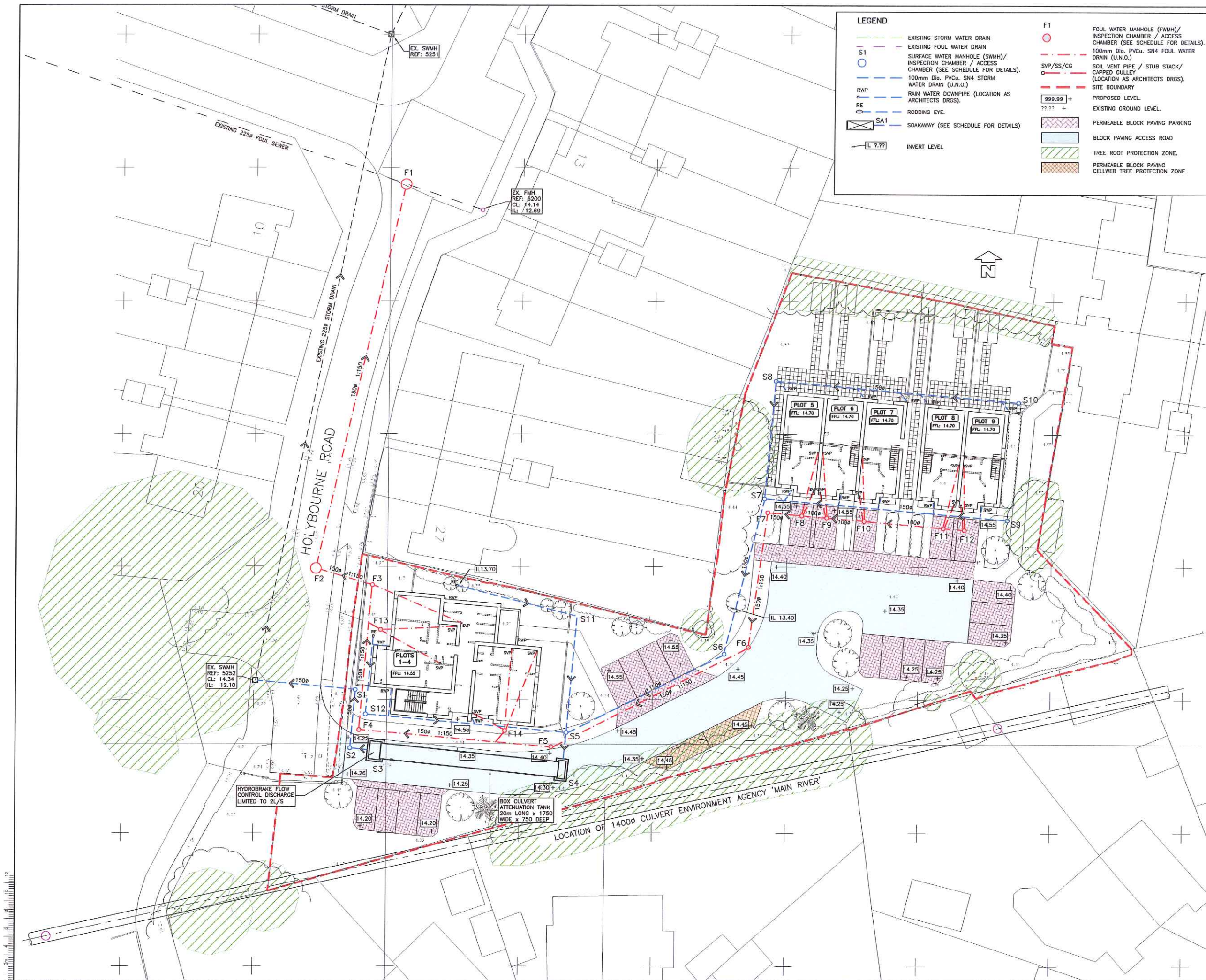
HOLYBOURNE ROAD

DRAWING TITLE

SITE PLAN

Date	Drawn by	Scale	AI	Drawing No.	Rev.
JAN. 15	PJ/RL	1:200	AI	1103-PD101	E

architecture planning design project management



LEGEND

- EXISTING STORM WATER DRAIN
- EXISTING FOUL WATER DRAIN
- SURFACE WATER MANHOLE (SWMH)/ INSPECTION CHAMBER / ACCESS CHAMBER (SEE SCHEDULE FOR DETAILS).
- 100mm Dia. PVCu. SN4 STORM WATER DRAIN (U.N.O.)
- RAIN WATER DOWNPIPE (LOCATION AS ARCHITECTS DRGS).
- RODDING EYE.
- SA1 SOAKAWAY (SEE SCHEDULE FOR DETAILS)
- INVERT LEVEL
- F1 FOUL WATER MANHOLE (FWMH)/ INSPECTION CHAMBER / ACCESS CHAMBER (SEE SCHEDULE FOR DETAILS).
- 100mm Dia. PVCu. SN4 FOUL WATER DRAIN (U.N.O.)
- SVP/SS/CG SOIL VENT PIPE / STUB STACK/ CAPPED GULLEY (LOCATION AS ARCHITECTS DRGS).
- SITE BOUNDARY
- PROPOSED LEVEL
- EXISTING GROUND LEVEL
- PERMEABLE BLOCK PAVING PARKING
- BLOCK PAVING ACCESS ROAD
- TREE ROOT PROTECTION ZONE.
- PERMEABLE BLOCK PAVING CELLWEB TREE PROTECTION ZONE

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 4. CONCRETE ENCASUREMENT, MINIMUM 150 BED AND HAUNCH, TO BE USED ON PIPEWORK UNDER ROADS WITH LESS THAN 1200 COVER TO CROWN.
 5. UNLESS OTHERWISE STATED, ALL PIPEWORK TO BE BEDDED AND SURROUNDED IN 10mm SINGLE SIZE AGGREGATE UP TO 450mm DIAMETER. FOR LARGER PIPEWORK, 20mm SHALL BE USED.
 6. REFER TO MANHOLE SCHEDULE FOR SIZES, COVERS ETC.
 7. ALL MATERIALS TO COMPLY WITH THE RELEVANT BS-EN, LATEST EDITION, FOR PIPEWORK AND FITTINGS.
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P4	20.08.16	STORMWATER REVISED.	PJM
P3	15.04.16	LAYOUT REVISED TO SUIT ARCHITECTS LATEST SITE PLAN.	PJM
P2	23.03.16	LAYOUT AMENDED & LEVELS ADDED.	PJM
P1	18.02.16	PRELIMINARY ISSUE FOR COMMENT	PJM
MS	Date	Revision	By

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accredited engineering solutions environment
Client
PMC CONSTRUCTION
Architect
KENN SCADDAN ASSOCIATES
Project Title
HOLYBOURNE ROAD LEIGH PARK

Drawing Title
DRAINAGE STRATEGY

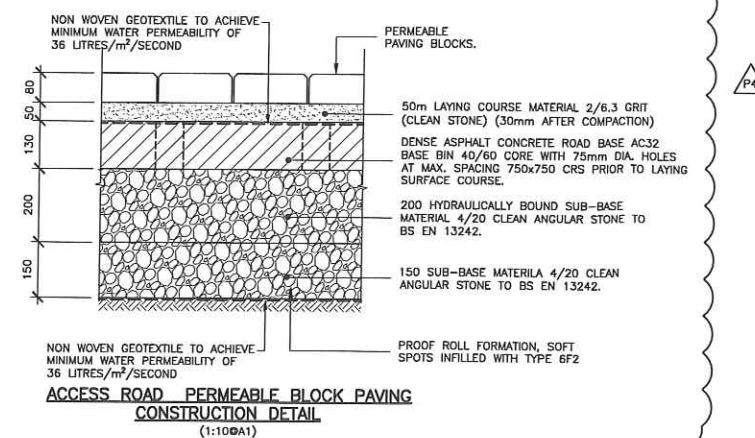
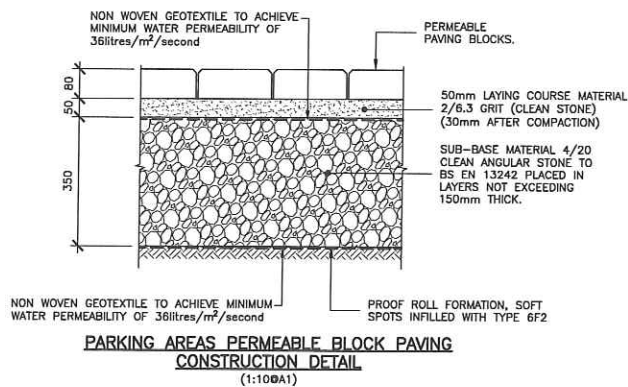
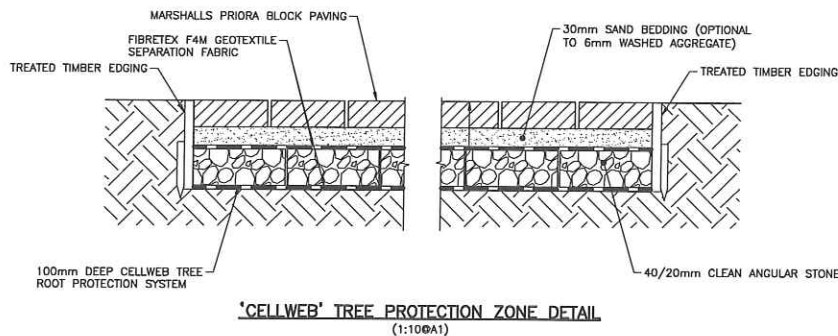
Scale	Paper Size	Date	Drawn by	Check by
1:200	A1	JAN. 2016	PJM	ARW

Project No.	Drawing No.	Rev.
PMC239	500	0001

FOUL MANHOLE SCHEDULE							
REF	COVER LEVEL	INVERT LEVEL	DEPTH TO INVERT	SIZE	TYPE	COVER	COMMENTS
F1	14.00 APPROX.	12.65 APPROX.	1.350	1200# PCC	TYPE 2	D400 675x675	TO BE ADOPTED
F2	13.850	13.090	0.760	1200# PCC	TYPE 2	D400 675x675	TO BE ADOPTED
F3	14.300	13.130	1.170	500#	TYPE 3	B125 450x450	
F4	14.320	13.240	1.080	500#	TYPE 3	B125 450x450	
F5	14.400	13.380	1.020	500#	TYPE 3	B125 450x450	
F6	14.450	13.540	0.910	500#	TYPE 3	B125 450x450	
F7	14.450	13.640	0.810	500#	TYPE 3	B125 450x450	
F8	14.530	13.750	0.780	500#	TYPE 3	C250 450x450	
F9	14.530	13.780	0.750	500#	TYPE 3	C250 450x450	
F10	14.530	13.840	0.690	500#	TYPE 3	C250 450x450	
F11	14.530	13.950	0.580	500#	TYPE 3	C250 450x450	
F12	14.530	14.000	0.530	500#	TYPE 3	C250 450x450	
F13	14.400	13.600	0.800	500#	TYPE 3	B125 450x450	
F14	14.500	13.800	0.700	500#	TYPE 3	B125 450x450	

SURFACE WATER MANHOLE SCHEDULE							
REF	COVER LEVEL	INVERT LEVEL	DEPTH TO INVERT	SIZE	TYPE	COVER	COMMENTS
S1	14.470	12.300	2.170	500#	TYPE 3	B125 450x450	RESTRICTED ACCESS
S2	14.230	12.350	1.880	1200# PCC	TYPE 2	D400 675x675	
S3	14.230	12.400	1.830	2025 x 1350	BRICK	D400 675x675	
S4	14.380	12.500	1.880	2025 x 1000	BRICK	D400 675x675	RESTRICTED ACCESS
S5	14.500	13.300	1.200	500#	TYPE 3	B125 450x450	SILT TRAP 300 DEEP SUMP
S6	14.550	13.430	1.120	500#	TYPE 3	B125 450x450	
S7	14.550	13.550	1.000	500#	TYPE 3	B125 450x450	
S8	14.550	13.650	0.900	500#	TYPE 3	B125 450x450	
S9	14.500	13.750	0.750	500#	TYPE 3	B125 450x450	
S10	14.550	13.850	0.700	500#	TYPE 3	B125 450x450	
S11	14.400	13.450	0.950	500#	TYPE 3	B125 450x450	
S12	14.400	13.600	0.800	500#	TYPE 3	B125 450x450	

OPERATION AND MAINTENANCE REQUIREMENTS FOR PERMEABLE PAVING		
MAINTENANCE SCHEDULE	REQUIRED ACTION	TYPICAL FREQUENCY
REGULAR MAINTENANCE	BRUSHING AND VACUUMING (STANDARD COSMETIC SWEEP OVER WHOLE SURFACE)	ONCE A YEAR, AFTER AUTUMN LEAF FALL, OR REDUCED FREQUENCY AS REQUIRED, BASED ON SITE-SPECIFIC OBSERVATIONS OF CLOGGING OR MANUFACTURER'S RECOMMENDATIONS - PAY PARTICULAR ATTENTION TO AREAS WHERE WATER RUNS ONTO PAVEMENT SURFACE FROM ADJACENT IMPERMEABLE AREAS AS THIS AREA IS MOST LIKELY TO COLLECT THE MOST SEDIMENT
	STABILISE AND MOW CONTRIBUTING AND ADJACENT AREAS	AS REQUIRED
OCCASIONAL MAINTENANCE	REMOVAL OF WEEDS OR MANAGEMENT USING GLYPHOSATE APPLIED DIRECTLY INTO THE WEEDS BY AN APPLICATOR RATHER THAN SPRAYING	AS REQUIRED - ONCE PER YEAR ON LESS FREQUENTLY USED PAVEMENTS
REMEDIAL ACTIONS	REMEDIAL ANY LANDSCAPING WHICH, THROUGH VEGETATION MAINTENANCE OR SOIL SLIP, HAS BEEN RAISED TO WITHIN 50mm OF THE LEVEL OF THE PAVING	AS REQUIRED
	REMEDIAL WORK TO ANY DEPRESSIONS, RUTTING AND CRACKED OR BROKEN BLOCKS CONSIDERED DETRIMENTAL TO THE STRUCTURAL PERFORMANCE OR A HAZARD TO USERS, AND REPLACE LOST JOINTING MATERIAL	AS REQUIRED
MONITORING	REHABILITATION OF SURFACE AND UPPER SUB-STRUCTURES BY REMEDIAL SWEEPING	EVERY 10 TO 15 YEARS OR AS REQUIRED (IF INFILTRATION PERFORMANCE IS REDUCED DUE TO SIGNIFICANT CLOGGING)
	INITIAL INSPECTION	MONTHLY FOR THREE MONTHS AFTER INSTALLATION
	INSPECT FOR EVIDENCE OF POOR OPERATION AND/OR WEED GROWTH - IF REQUIRED, TAKE REMEDIAL ACTION	THREE-MONTHLY, 48 HOURS AFTER LARGE STORMS IN FIRST SIX MONTHS
	INSPECT SILT ACCUMULATION RATES AND ESTABLISH APPROPRIATE BRUSHING FREQUENCIES	ANNUALLY
	MONITOR INSPECTION CHAMBERS	ANNUALLY



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DRAINAGE

- ALL MATERIALS AND WORKMANSHIP TO 'SEWERS FOR ADOPTION, 7th EDITION'
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P4	20.06.16	SCHEDULES AMENDED. ACCESS ROAD DETAIL ADDED.	PJM
P3	15.04.16	SW SCHEDULE AMENDED.	PJM
P2	23.03.16	SW SCHEDULE AMENDED.	PJM
P1	18.03.16	PRELIMINARY ISSUE FOR COMMENT	PJM
Ms.	Date	Revision	By

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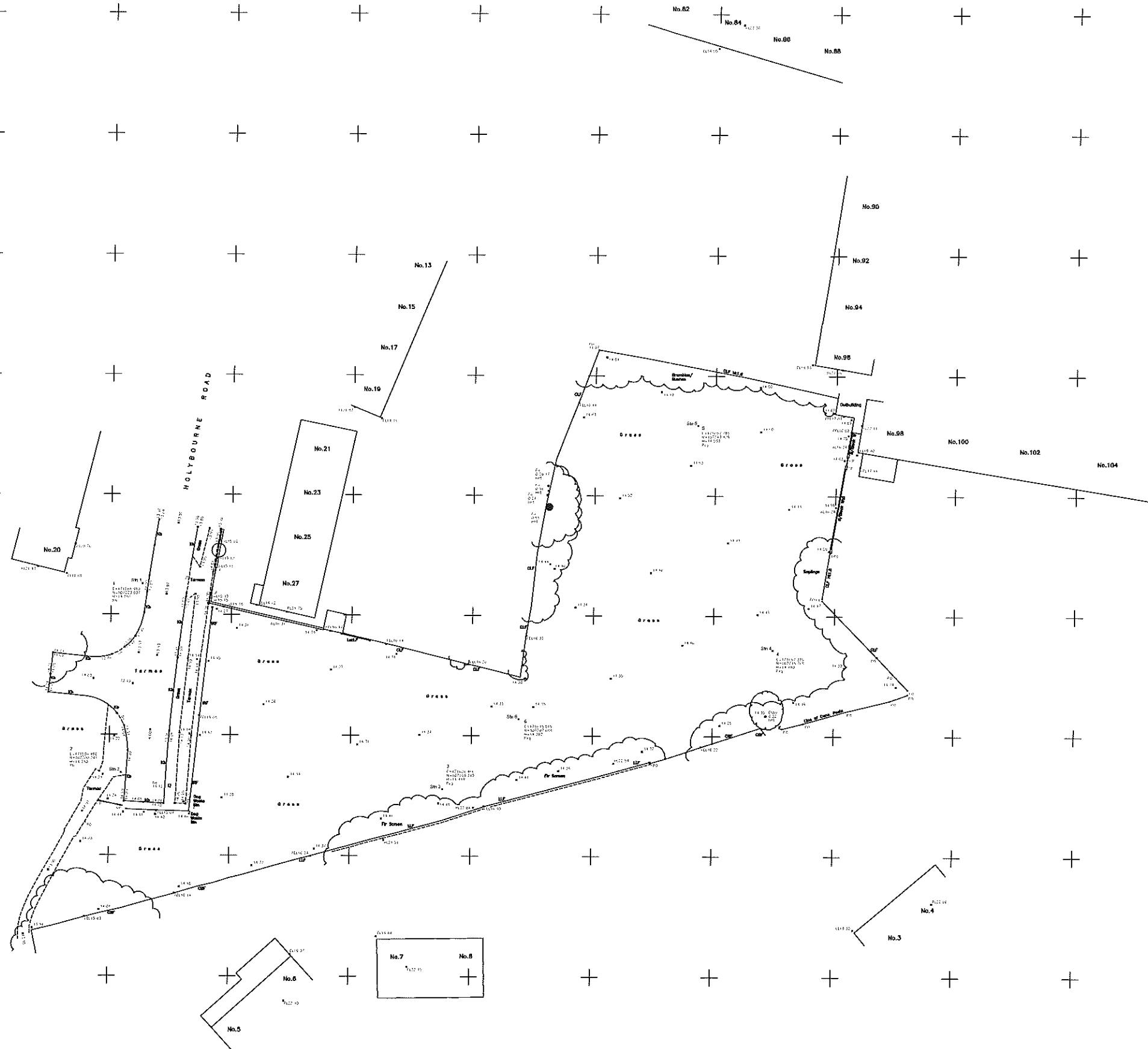
Architect
KENN SCADDAN ASSOCIATES

Project Title
HOLYBOURNE ROAD LEIGH PARK

Drawing Title
DRAINAGE STRATEGY DETAILS SHEET 1

Scale	Paper Size	Date	Drawn by	Check by
AS SHOWN	A1	JAN. 2016	PJM	ARW

Project No.	Drawing No.	Rev.																				
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1	2	3	4	5	6	7	8	9	10													



NOTES

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NOTES:

ALL MEASUREMENTS ARE TAKEN TO EXISTING
SURFACE FINISHES UNLESS STATED OTHERWISE

ALL HEIGHTS ARE IN M

ALL ARROWS POINT UP

ALL LEVELS IN METRES AND RELATE TO
GPS CONTROL (06)

[illegible][illegible]

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PROJECT No. HLS 1777		
TITLE		
Holybourne Road Havant, PO9 2BN Site Survey Existing		
		
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