SuDS strategy report

For the Approved development at

23 Wilmar Close, Uxbridge

Prepared by

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Innervision Design Ltd

September 2019

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Contents

Contents . . . . . **i**

List of Figures . . . . . **ii**

List of Tables . . . . . **iii**

1 Executive Summary **1**

2 Introduction **2**
2.1 Site location 2
2.2 Approved development description 3
2.3 Site geology 3
2.3.1 Infiltration rates 3
2.3.2 Water table 3
2.4 Existing flow paths 3
2.5 Estimation of existing run-off rates 4
2.5.1 Variables 4
2.5.2 Impermeable area run-off rate for pre-developed site 4
2.6 Green field rates 4
2.6.1 Formula 4
2.6.2 Variables 5
2.6.3 Calculations 5
2.6.4 Peak run-off rates 6

3 SuDS Principles **6**
3.1 SuDS design philosophy 6
3.2 Source control 7
3.3 “End of pipe” solutions 7

4 Appraisal of SuDS options **8**
4.1 Site constraints impacting on SuDS 8
4.2 Sedum/green roofs. 8
4.3 Infiltration devices 8
4.4 Bio-retention 8
4.5 Permeable hard standing 9
4.5.1 Permeable paving 9
4.6 Rainwater harvesting 9
4.6.1 For external use 10
4.7 “End of pipe” solutions 11

5 Proposed surface water disposal strategy . . . **12**
5.1 Domestic roofs . . . 12
5.1.1 Soakaways . . . 12
5.1.2 Sedimentation risk . . . 13
5.1.3 Minimising sedimentation risk . . . 13
5.1.4 Construction detail . . . 13
5.2 Rainwater Harvesting . . . 14
5.3 Driveways and hard standing . . . 14
5.4 Landscaped areas . . . 17
5.5 Drainage layout . . . 17
5.6 Exceedence flow routes . . . 18
5.7 Overland flow . . . 18
5.8 Timetable for implementation . . . 19
5.8.1 Construction phase . . . 19
5.8.2 Post construction phase . . . 19

6 Maintenance of SuDS . . . **20**
6.1 Soakaways (and pre treatment sediment sumps) . . . 20
6.2 Permeable pavements . . . 20
6.3 Water butts . . . 21
6.4 Summary . . . 21

References . . . **21**

Appendix

A Approved plans . . . **22**
A.1 Proposal plans . . . 22
A.2 Indicative SuDS layout . . . 23

B Site Investigation . . . **24**

List of Figures

1 Site location plan . . . 2
2 Use for water butts . . . 10
3 Standard rainwater diverter . . . 10
4 Soakaway section detail suitable for this site . . . 13
5 1 in 1 year critical storm event . . . 16
6 1 in 30 year critical storm event . . . 16

7 1 in 100 year critical storm event 17
8 Part H drainage design chart 18
9 Maintenance operations for soakaway 20

List of Tables

1 BRE 365 Calculation results 12
2 Storage volume design summary 15

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1 Executive Summary

A All surface water arising can be managed on site.

B All surface water arising from roofed areas is controlled by direct infiltration through a soakaway.

C Water butts provide additional SuDS on site.

D All areas of hard standing on the site will be constructed using a permeable medium.

E There is no design exceedence outfall away from the site.

F All SuDS on site will be installed with full consideration to long term maintenance.

G Exceedence flows and flows arising from system failure can be accommodated on site.

H The use of SuDS techniques on site will mitigate and treat the run-off volumes.

2 Introduction

2.1 Site location

The development is on land at 23 Wilmar Close, Uxbridge, UB8 1AS (see Figure 1).



Figure 1: Site location plan, as indicated (source: EA flood mapping)

2.2 Approved development description

The Approval (72934/APP/2018/3628) is for a pair of semi-detached dwellings following the demolition of an existing dwelling, see proposal plans at Appendix A.

The curtailment of the entire site encloses an area of approximately 300m^2 of which, pre-development, 100m^2 is classed as being impermeable (100m^2 roofs, 0m^2 impermeable hard-standing and paths), with the remaining 200m^2 classed as permeable planting. The new development decreases the impermeable area from 100m^2 to 90m^2 (90m^2 roof area).

2.3 Site geology

A site investigation report is to be submitted under separate cover however relevant extracts are at Appendix B. The soils on site are classed as having a "medium to high" infiltration potential. Medium to High rates range from circa 1.0 x 10^{-5} up to 1.0 x 10^{-4} ms^{-1}. High would be values greater than 1.0 x 10^{-4} ms^{-1}.

2.3.1 Infiltration rates

Infiltration rates for the site are based on documented figures for the low end of medium infiltration potential and as such a conservative value of 9.0 x10^{-6} ms^{-1} is used for soakaway design (circa 30mmhr^{-1}).

2.3.2 Water table

Ground water was not encountered in the trial hole (site of soakaway).

2.4 Existing flow paths

The existing site drains to what is assumed to be a "combined" system within the adjacent highway.

2.5 Estimation of existing run-off rates

2.5.1 Variables

i_1 = 50.4[1] mm hr^{-1}

i_{100} = 153 mm hr^{-1}

A = 100 m^2

Cr = 1.3

Cv = 0.9

2.5.2 Impermeable area run-off rate for pre-developed site

$$Q_{BF1} = \frac{1.17 * 50.4 * 100}{3600}$$
$$= 1.6ls^{-1}$$

$$Q_{BF100} = \frac{1.17 * 153 * 100}{3600}$$
$$= 5.0ls^{-1}$$

Existing runff rates from the impermeable areas of the site are calculated as 1.64ls^{-1} (based on 50.4mm hr^{-1}, 1 in 1 yr summer storm).

2.6 Green field rates

This site is less than 50 ha therefore runoff rate calculations have been carried out in accordance with the IH Report 124 'Flood estimation for small catchments'[1]. The pro rata method on the size of catchment detailed in table 4.2 of the SuDS manual[2] has been used.

2.6.1 Formula

For catchments less than 50ha:

$$Q_{BAR50ha} = 1.08\,(50/100)^{0.89} * SAAR^{1.17} * SPR^{2.17} \quad (1)$$

[1] 50.4mm hr^{-1} is the mean intensity of a 1 in 1yr 6min duration summer storm, calculated to be the worst case, using standard IDF formula.

$$Q_{BAR} = Q_{BAR50ha} * \frac{A}{50} \tag{2}$$

$$Q_{1yr} = Q_{BAR} * 0.85 \tag{3}$$

$$Q_{100yr} = Q_{BAR} * GC_{100} \tag{4}$$

2.6.2 Variables

Qbar/Qmed =0.85

SAAR = 616mm

Hydrological Region 6

Growth curve factors: 30 yr = 2.3; 100 yr = 3.19

SPR = 0.47

2.6.3 Calculations

$$\begin{aligned} Q_{BAR50ha} =& 1.08 * 0.5^{0.89} * 616^{1.17} * 0.47^{2.17} \\ =& 0.58 * 1835.73 * 0.19 \\ =& 207.86 \end{aligned}$$

Using Equation 2:

$$\begin{aligned} Q_{BAR} =& \frac{207.86 * 0.03}{50} \\ =& 0.12 ls^{-1} \end{aligned}$$

Using Equation 3:

$$\begin{aligned} Q_1 =& 0.12 * 0.85 \\ =& 0.11 ls^{-1} \end{aligned}$$

Using Equation 4:

$$\begin{aligned} Q_{100} &= 0.12 * 3.19 \\ &= 0.40 ls^{-1} \end{aligned}$$

2.6.4 Peak run-off rates

For the 1 year Return Period event the peak runoff calculates to 0.11 ls^{-1}
For the 30 year Return Period event the peak runoff calculates to 0.29 ls^{-1}
For the 100 year Return Period event the peak runoff calculates to 0.40 ls^{-1}

3 SuDS Principles

In line with the SuDS management train, the following hierarchy has been considered in applying the use of SuDS into the proposed development scheme.

3.1 SuDS design philosophy

The CIRIA SuDS[2] manual provides the design philosophy:

> "SuDS design should, as much as possible, be based around the following:
>
> - using surface water runoff as a resource
> - managing rainwater close to where it falls
> - managing runoff at the surface
> - allowing rainwater to soak into the ground
> - promoting evapotranspiration
> - slowing and storing run-off to mimic natural runoff characteristics
> - reducing contamination of runoff through pollution prevention and controlling the runoff at source
> - treating runoff to reduce the risk of urban contaminants causing environmental pollution."

3.2 Source control

- Sedum roofing.
- Infiltration devices. Typically soakaways.
- Rainwater harvesting.
- Bio-retention planting, rain gardens.
- Permeable paving, porous asphalt. These provide both infiltration and short term storage volumes thus reducing overall un-mitigated run-off volumes.

3.3 "End of pipe" solutions

To be considered only after implementation of the above options.

- Retention tanks with outfall controlled by hydraulic means to limiting discharge rates and volumes to discharge to existing SW flow pathways.

Sections 4.3 to 4.7 consider the viability of a range of these SuDS devices.

4 Appraisal of SuDS options

The primary aim is to meet the requirements of the Local Plan core policies and the SuDS hierarchy so as to manage SW on site.

4.1 Site constraints impacting on SuDS

- No access to adjacent water course or ditch.
- Approved pitched roof design.
- Approved site layout.
- Small site.
- Root protection zone.

4.2 Sedum/green roofs.

Due to site constraints, as per Section 4.1, these are not found suitable for this site.

4.3 Infiltration devices

With reference to Section 3.1, soakaways promote the following SuDS design criteria:

- manages rainwater close to where it falls
- allows rainwater to soak into the ground
- slows and stores run-off to mimic natural run-off characteristics
- treats run-off to reduce the risk of urban contaminants causing environmental pollution.

Due to the reasonable infiltration rates expected with the local geology, Section 2.3, infiltration devices appear suited for this site and can be designed to accommodate design rainfall events (designed in line with BRE365 and Part H of the Building Regulations and at least 5m away from any structure).

4.4 Bio-retention

Due to site constraints, as per Section 4.1, these are not found suitable for this site.

4.5 Permeable hard standing

With reference to Section 3.1, permeable paving promotes the following SuDS design criteria:

- manages rainwater close to where it falls
- manages runoff at the surface
- allows rainwater to soak into the ground
- slows and stores run-off to mimic natural runoff characteristics
- treats runoff to reduce the risk of urban contaminants causing environmental pollution.

4.5.1 Permeable paving

A 30% void ratio is assumed through a 350mm sub-base. This is appropriate for a DOT Type 3 Sub-base hence the storage capacity equates to circa 105mm per $1m^2$ therefore based on a M6 100hr + cc storm of 87mm rainfall the paving offers, without any allowance for infiltration, a circa 1:1.2 drained volume:storage volume capacity. Hence there is no anticipated exceedence flow from the areas of permeable paving.

Note: where attenuation cells or soakaways are located under areas of permeable paving the perimeter of each attenuation tank or soakaway will be bunded within the sub-base with an appropriate up-stand or kerbing so as to prevent the sub-base draining directly into the attenuation tanks or soakaways.

TSS 0.7, Metals 0.6, Hydrocarbons 0.7 = suitable for trafficked areas

All permeable paving offers sufficient storage volume to accommodate the 5mm event.

4.6 Rainwater harvesting

With reference to Section 3.1, Rainwater harvesting promotes the following SuDS design criteria:

- uses surface water runoff as a resource
- manages rainwater close to where it falls

and:

- stores rainwater for later use

4.6.1 For external use

Rain water harvesting / water butts: These provide additional, "off line[2]" SuDS, and are deemed a suitable SuDS component for small plots[2], extract at Figure 2. The image shows a water butt in "off-line" configuration using a standard diverter.

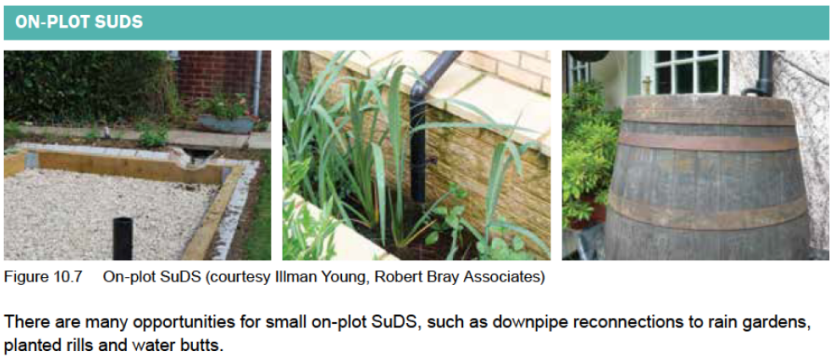


Figure 2: Use of water butts as provided in the SuDS manual

The collection and re-use of water can reduce run off volumes arising from roofs. The collected water, via readily available diverters (e.g. Web link: Standard diverter example, as per Figure 3), being used for external uses.



Figure 3: Standard rainwater diverter

Rainwater butts can, in part, accommodate the 5mm event dependent on manual drawdown and evaporation.

[2]The term "off-line" refers to the fact that a water butt is a harvesting device that is not "in-line" in the same manner that a pipe is in-line. Water is collected (harvested) until the water butt is full. When full, the rainwater continues down the rainwater pipe. Outflow from the tank is not "automatic" since this would negate the reason to harvest rainwater. Instead, manual drawdown occurs with the harvested water being used for external uses. Since a water butt may be full, the useful volume is not accounted for in storage and run-off calculations.

4.7 "End of pipe" solutions

To be considered only after implementation of the above options.

- Retention tanks with outfall controlled by hydraulic means (e.g. hydrobrakes, pipe sizing, orifice plate etc.) to limiting rates and volumes to discharge to existing flow pathways.

5 Proposed surface water disposal strategy

The following sections consider the strategy for water arising from the roof areas, driveways and hard standing and areas of landscaping.

5.1 Domestic roofs

With Reference to Table 26.2 of the SuDS Manual, pollution hazard indices for:

Domestic Roofs are 0.2 (TSS), 0.2 Metals & 0.05 Hydrocarbons.

5.1.1 Soakaways

All surface water arising from roofed areas is controlled by direct infiltration through a soakaway. Notes:

- For this report the drained area to the soakaway(s) arises from the area of roof plus a 1.1 allowance for urban creep.
- The soakaway is designed for all events up to and including the M100 6hr event.
- An allowance of x1.4 is made for climate change in line with current best practice.

Designed to BRE365, and to accommodate all surface water arising from a drained area of 90m^2 requires 2 , open void (i.e. 95%), soakaway(s) of 1.5m wide x 1.6m long with a 1.5m effective depth. See Table 1.

Permeability	9.00E-06	ms^{-1}
Urban Creep	1.1	
Drained area	90	m^2
Designed drained area	99	m^2
Return Period	100	yr
% voids	95	%
Climate change	1.4	

Design Width, m	1.5
Design Depth$_{eff}$, m	1.5
Design Qty	2

Duration, mins	5	10	15	30	60	120	240	360	600	1440
Rainfall, mm	19.1	28.6	34.5	45.4	56.7	68.5	80.3	87.5	97.4	116.1
Volume in, m^3	0.9	1.4	1.7	2.2	2.8	3.4	4	4.3	4.8	5.7
Length req'd, m	0.4	0.6	0.8	1	1.2	1.5	1.6	1.6	1.6	1.2

Crit Length, m	1.6
Crit Duration, mins	240
Empty to 50%, hrs	11.32

Table 1: BRE 365 Calculation results

5.1.2 Sedimentation risk

Domestic roofing carries a very low sediment loading. Worst case 216 kg.ha^{-1}yr^{-1} - so for this site that equates to circa 1.9kg.yr^{-1} in the worst case. Generally this would reduce the attenuation capacity by circa 2% over 50yrs (all data from the SuDS maunual). The design allows for this amount with extra capacity provided to a 100yr design life. The BRE 365 method acknowledges this sedimentation and hence the base area is not considered in the sizing calculations.

5.1.3 Minimising sedimentation risk

However, the developer will fit accessible sumped rainwater gulleys at the base of all RWP's so as to reduce the amount of any sediment entering the soakaway.

The developer will also fit downpipe leaf guards to all outfalls from the roof (or "hedgehog" gutter guards).

5.1.4 Construction detail

For a typical soakaway section detail suitable for this site see Figure 4

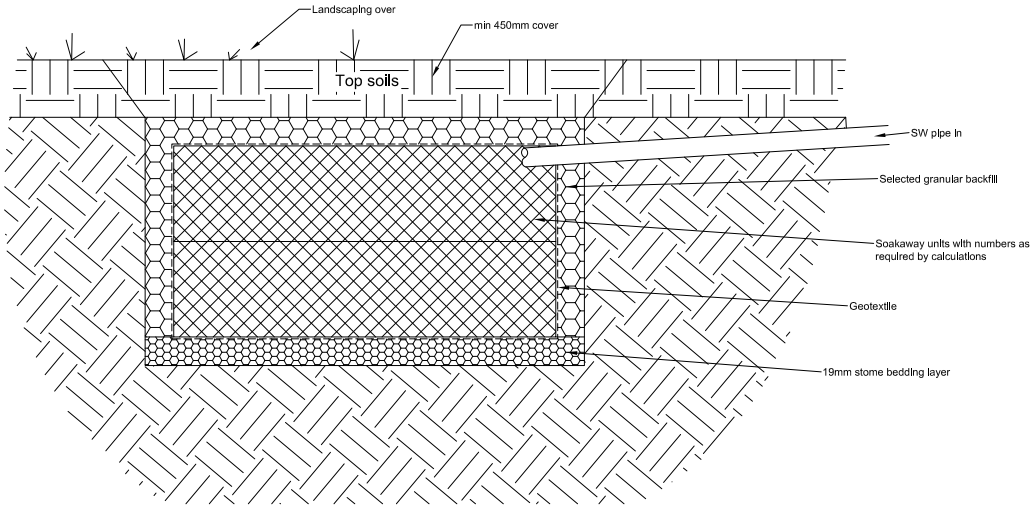


Figure 4: Soakaway section detail suitable for this site

5.2 Rainwater Harvesting

The project team have detailed an "off line" rainwater butt to collect water for external use primarily to reduce potable water demand. This also serves however as an additional SuDS feature. Since this is in off-line configuration any exceedence flows are automatically directed back to the downpipes.

5.3 Driveways and hard standing

All areas of hard standing on the site will be constructed using a permeable medium on a DOT/MOT 3 sub-base of 350mm depth (refer to Section 4.5).

The perimeter of these areas will be considered for expansive planting to accommodate any exceedence flows. Residual exceedence will be surface channelled onwards towards a small nominal sized soakaway cell set within the landscaping at the front - size is to be 0.8m x 0.4m x 0.4m crate depth.

For a check on the capacity of the permeable paving to function an infiltration rate of 5mm.hr^{-1} has been used below.

Over 100m^2 plan area, 5mm.hr^{-1} equates to a total outflow rate of 0.138ls^{-1}

Designed to accomodate all surface water arising from a design drained area of 100m^2 requires a minimum attenuation volume of 6 m^3. This can be achieved using an overall storage volume of 35.0 m^3 formed within a 100m^2 x 0.35m deep 30% void ratio sub-base. See Table 2.

Drained area	$100m^2$	
Urban Creep	1	
Designed drained area	$100m^2$	
Return periods considered	1yr, 30yr, 100yr	
Storm profiles used	50% Summer	75% Winter
Storm coeffs	a = 0.1, b = 0.815	a = 0.06, b = 1.026
Storm range, storm increments	From 5 minutes duration in further 2 min. intervals until critical storm reached	
M5-60	20mm	
r	0.4	
Rainfall model	FSR	
Critical design storm	221 mins, Winter	
Climate change	1.4	
Storm mean intensity	$15.1mm.hr^{-1}$	
Design mean intensity	$21.1mm.hr^{-1}$	
Storm peak intensity	$40.3mm.hr^{-1}$	
Design peak intensity	$56.5mm.hr^{-1}$	
Design maximum head	0.25m	
Calculated maximum head	0.20m	
Minimum attenuation volume required	$5.99m^3$	
Void ratio	30%	
Design attenuation volume	$8m^3$	(0.3 x $100m^2$ x 0.25m)
Provided attenuation volume	$11m^3$	(0.3 x $100m^2$ x 0.35m)
Factor of Safety	1.40	
1 in 1yr maximum outfall rate	$0.1ls^{-1}$	(See Figure 5.)
1 in 30yr maximum outfall rate	$0.1ls^{-1}$	(See Figure 6.)
1 in 100yr maximum outfall rate	$0.1ls^{-1}$	(See Figure 7.)
1 in 100yr Time to peak	211 mins	
Design head: Time to drop to 50%	6.03 hrs	
Time to 50% total capacity	4.53 hrs	
Outfall control method	Nominal GF outflow	

Table 2: Storage volume design summary

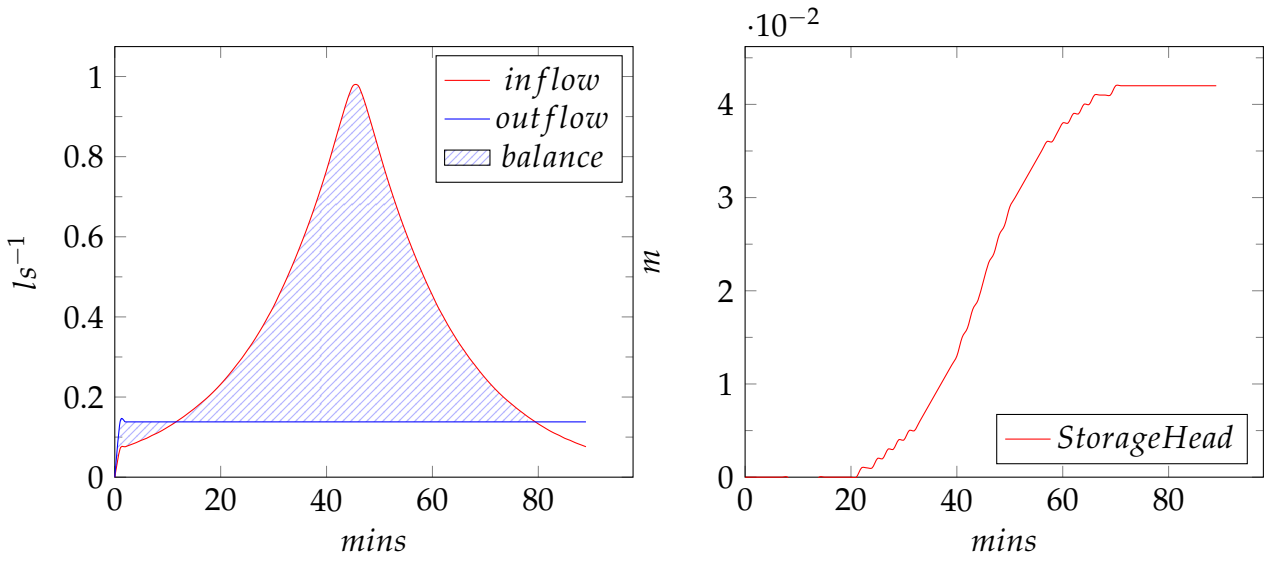


Figure 5: 1 in 1 year critical storm event

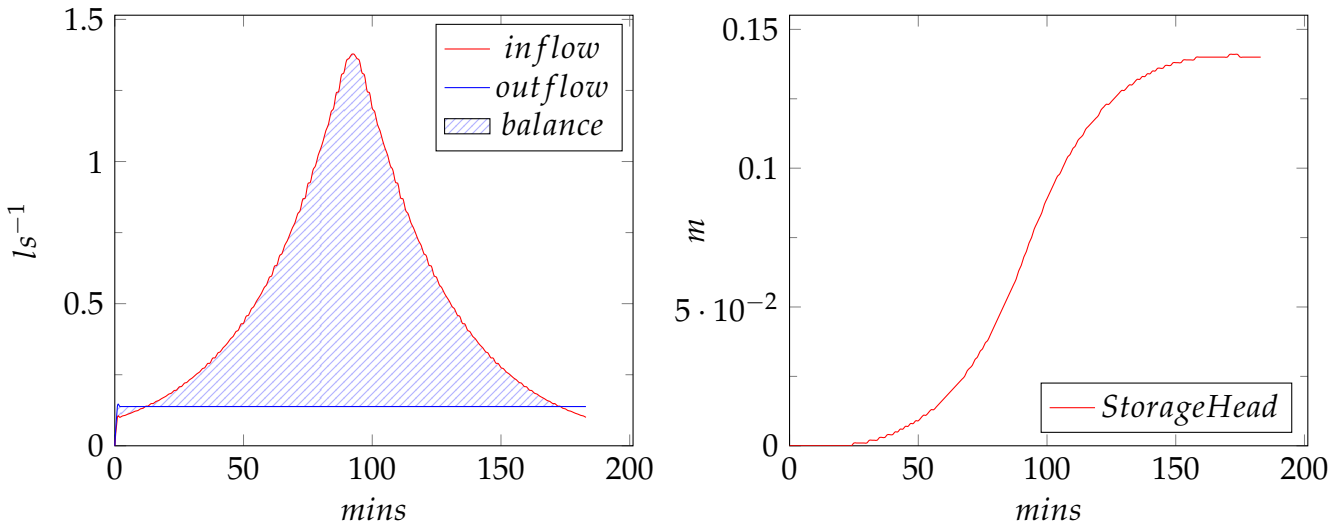


Figure 6: 1 in 30 year critical storm event

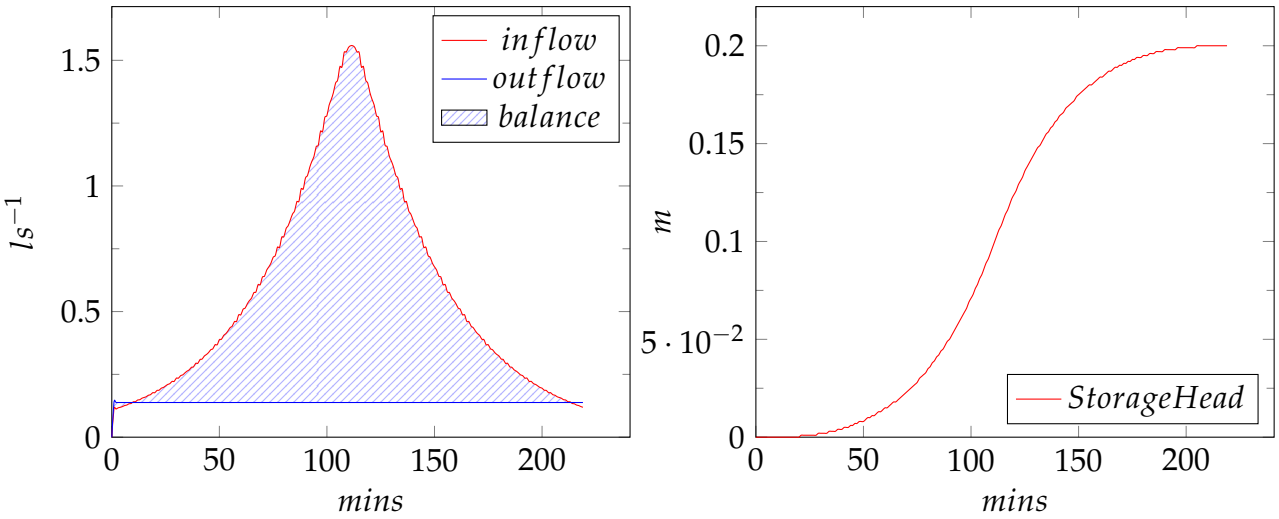


Figure 7: 1 in 100 year critical storm event

The areas of permeable paving are primarily disconnected from the proposed SW network on site, i.e. they are not primarily designed to drain to the soakaway. Surface water retained in the sub-base matrix is lost through evaporation and infiltration at or greater than 1.0 x 10^{-4} ms^{-1}, at shallow depths, into the surrounding naturally fissured sub-soils (due to action of freeze-thaw, roots, earthworms and the proposed local re-grading following any site clearance). In doing so it mimics as close as possible the natural hydrological process of water falling onto the ground and finding natural flow paths for dispersion.

Exceedence flows (flows over the 1.2 x M1006hr + CC event) will be conveyed at the surface via channels (e.g. ACO channels) to the proposed soakaway.

5.4 Landscaped areas

Typical domestic planting.

5.5 Drainage layout

Please refer to the drainage layout showing SuDS features at Appendix A.

1 in 100yr max mean intensity storm = 153mmhr^{-1}

Drained area to one pipe = 45m^2

Required pipe capacity = 45 x 0.153 / 3.6 = 2.0 ls^{-1}

Water from the roofs will be conveyed at gutter level to RWPs. Flow from the RWPs will be conveyed to the soakaway via 100mm diam UPVC drainage runs laid at no less than 1:80 fall giving a minimum design capacity of 7ls^{-1}(Part H design chart, Figure 8).

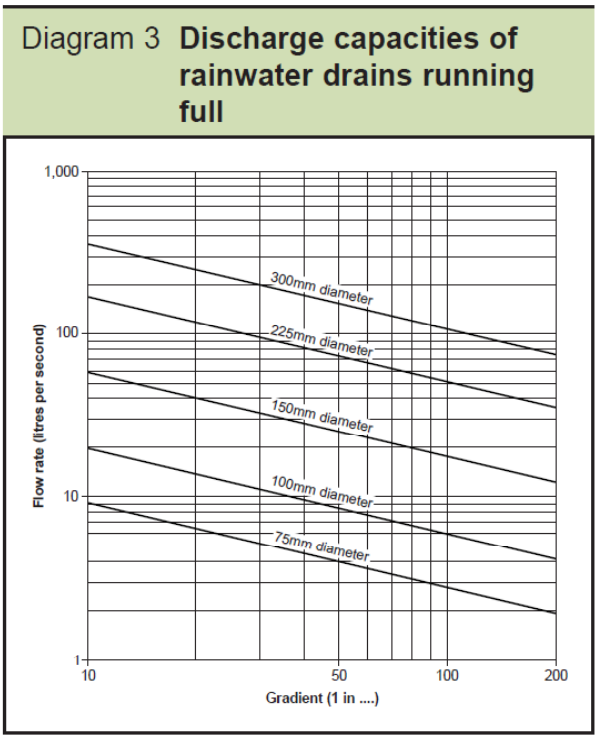


Figure 8: Part H drainage design chart

5.6 Exceedence flow routes

To the front, a surface mounted channel will be used adjacent to the dwelling to intercept exceedence surface flows from the driveway. The outfall from this will be directed to a nominal sized soakaway.

5.7 Overland flow

There is no other overland flow other than the exceedence routes noted above.

5.8 Timetable for implementation

5.8.1 Construction phase

Soakaways/attenuation cells will be installed early in the project under the remit of the ground-works operations. Access retained for post construction cleaning.

Areas of landscaping and boundary planting will be undertaken as the project nears completion.

Permeable paving will only be installed when all construction activities are either complete, or near completion so as to minimise blockage of the surface.

5.8.2 Post construction phase

Water butts will be installed prior to final completion as part of the final landscaping.

Attenuation cells pumped and cleaned out.

6 Maintenance of SuDS

Ultimate responsibility for the long term maintenance with SuDS in this environment lay with the land owner/management company.

All SuDS on site will be installed with full consideration to long term maintenance. The following guidance applies:

6.1 Soakaways (and pre treatment sediment sumps)

Figure 9[2] provides details maintenance operations required for a soakaway system.

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Inspect for sediment and debris in pre-treatment components and floor of inspection tube or chamber and inside of concrete manhole rings	Annually
	Cleaning of gutters and any filters on downpipes	Annually (or as required based on inspections)
	Trimming any roots that may be causing blockages	Annually (or as required)
Occasional maintenance	Remove sediment and debris from pre-treatment components and floor of inspection tube or chamber and inside of concrete manhole rings	As required, based on inspections
Remedial actions	Reconstruct soakaway and/or replace or clean void fill, if performance deteriorates or failure occurs	As required
	Replacement of clogged geotextile (will require reconstruction of soakaway)	As required
Monitoring	Inspect silt traps and note rate of sediment accumulation	Monthly in the first year and then annually
	Check soakaway to ensure emptying is occurring	Annually

Figure 9: Maintenance operations for soakaway

6.2 Permeable pavements

The maintenance plan for rainwater harvesting devices will include:

- Monthly litter removal;
- Bi-Annual suction sweeping.
- Annual inspection and repairs as/if required.

6.3 Water butts

A maintenance plan for water butts should include:

- Regular inspection of silt traps and filters.
- Removal of sediments and debris as required.

6.4 Summary

All surface water arising can be managed on site using SuDS. There is no design exceedence outfall away from the site. Exceedence flows and flows arising from system failure can be accommodated on site within the soakaway crates and the sub-base to the hard standing.

The use of SuDS techniques on site, as detailed above and when installed in line with best practice (I.e. CIRIA 753 & CIRIA 768), will reduce and treat the run-off volumes in line with the core policies.

Signed: 

Dr Robin Saunders CEng, C. Build E, MCABE, BEng(Hons), PhD

Date: 10th September, 2019

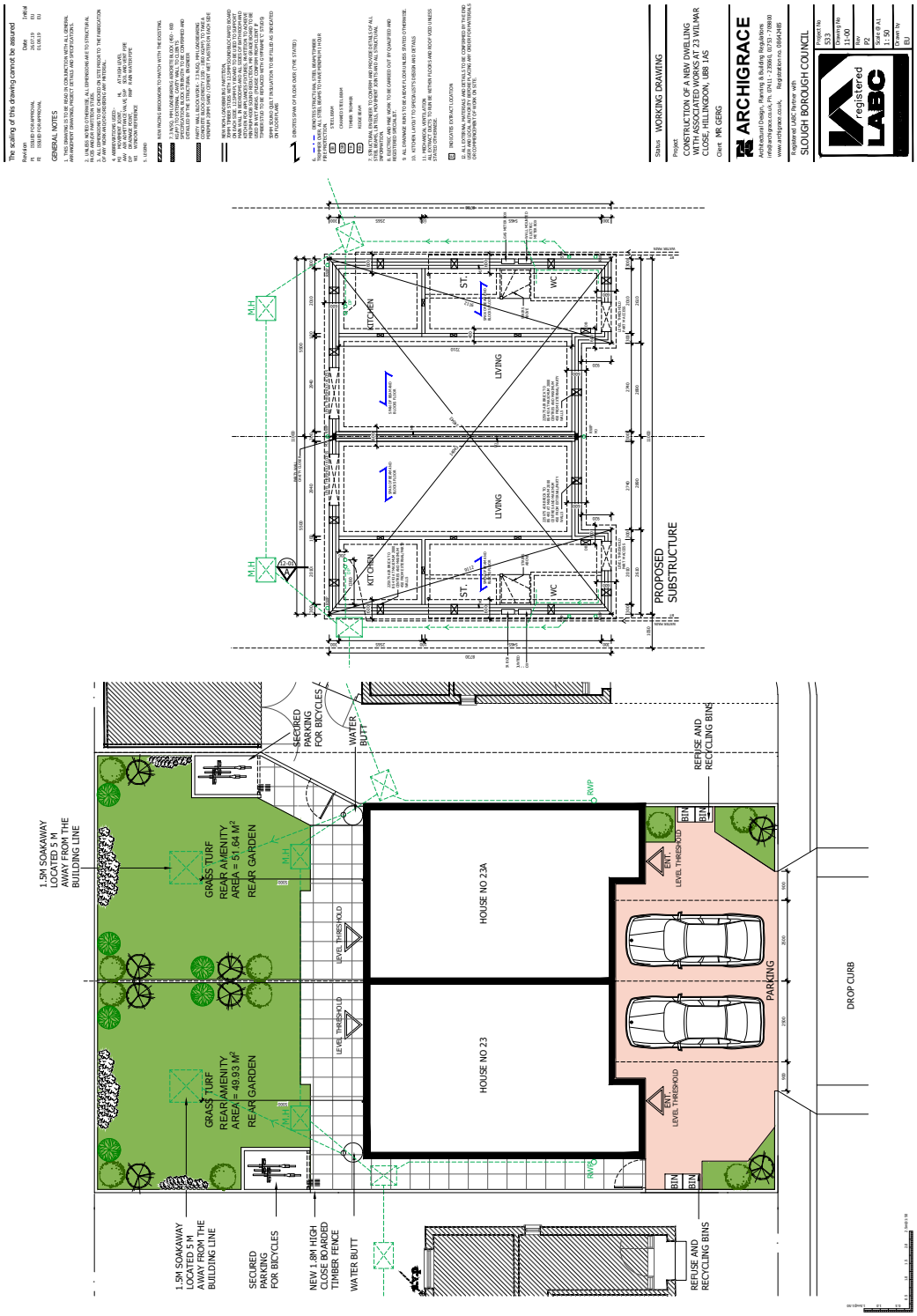
References

[1] DCW Marshall & AC Bayliss. Flood estimation for small catchments. Technical Report No. 124, Institute of Hydrology, June 1994.

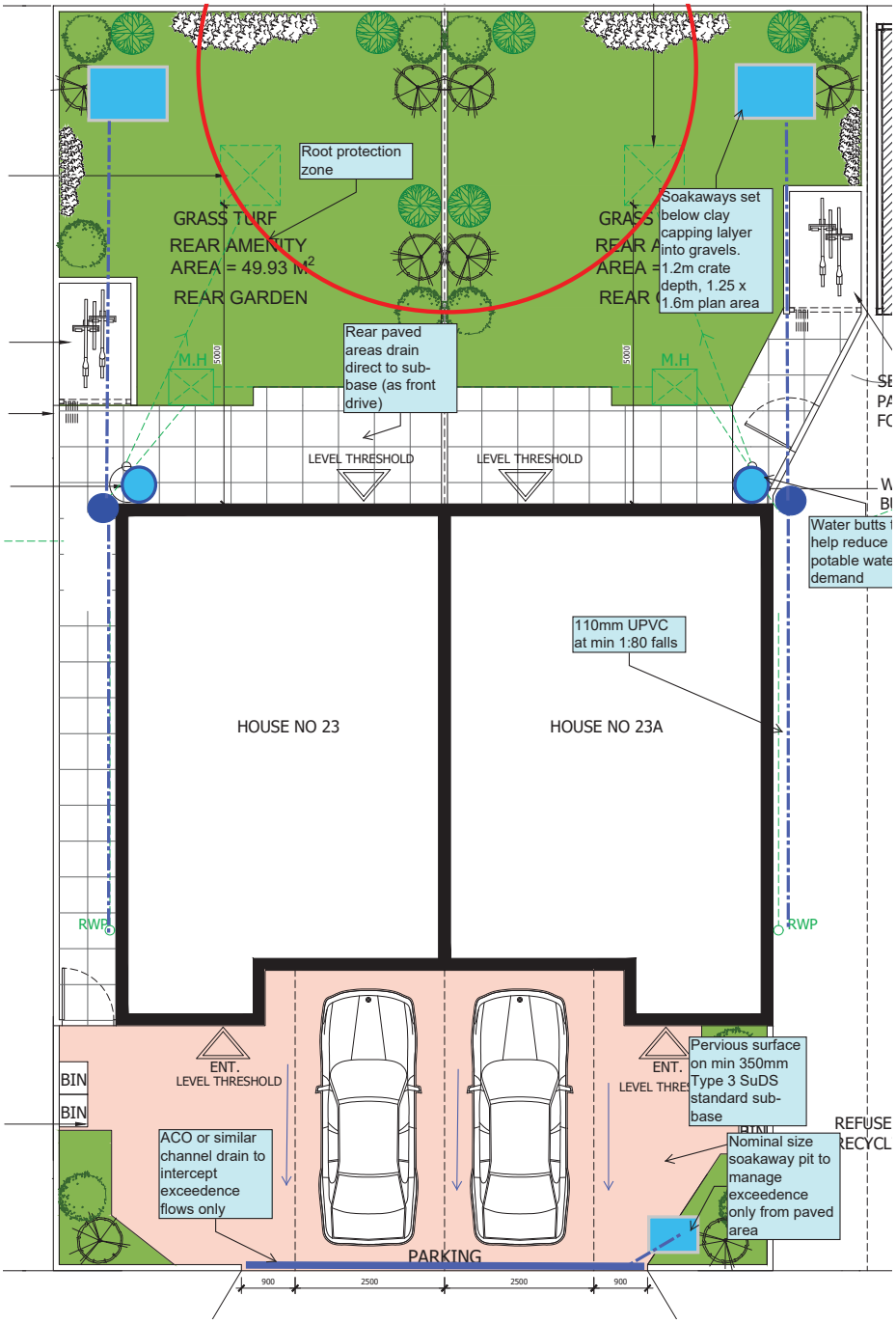
[2] CIRIA. The SUDS manual. Technical report, CIRIA, 2015.

A Approved plans

A.1 Proposal plans



A.2 Indicative SuDS layout



B Site Investigation

SOCOTEC

23 WILMAR CLOSE, HILLINGDON

INTERPRETATIVE GEOTECHNICAL REPORT ON GROUND INVESTIGATION

Report No. G9016-19

May 2019

Carried out for:
Ms Anita Jandu

Engineer:
SOCOTEC UK Ltd

A series of Atterberg Limits tests were carried out on selected samples of the Made Ground recovered from all exploratory holes. Liquid Limits (LL) were measured in the range LL = 36 to 41 and Plasticity Index (Ip) values were recorded in the range Ip = 12 to 15 confirming the soil typically to be of a low plasticity (CL) and intermediate plasticity (CI).

Lynch Hill Gravel Member

Superficial deposits were encountered beneath the Made Ground at all borehole locations. The base of the deposit was proved to 4.00m bgl in WS03 only, due to the refusal of the hand held window sampling equipment to penetrate further in WS01 and WS02.

The superficial deposits typically consisted of slightly sandy, slightly gravelly CLAY at the top of the stratum. The upper clay varies in thickness from 0.30m to 0.70m. Where conditions allowed, pocket penetrometer tests were undertaken in the clay, typically towards the top of the deposit the approximate indicative shear strengths in these clays varied from 87 kPa to 222 kPa. Atterberg Limit tests were carried out on samples recovered from the boreholes. The Liquid Limits (LL) were measured to be between LL = 29 and 38 and Plasticity Index (Ip) values were recorded in the range of Ip = 11 to 19 confirming the soil to be of a low plasticity (CL) and intermediate plasticity (CI).

Below the clay the Lynch Hill Gravel Member consists of locally sandy and clayey GRAVEL. The gravels were typically chert.

Shrinkable Soils

As defined by the National House Building Council (NHBC) Standards Chapter 4.2 'Building near Trees' shrinkable soils are subject to changes in volume as their moisture content is altered. The resulting shrinkage or swelling can cause damage to foundations by way of subsidence or heave.

A series of Atterberg Limits tests were conducted on selected samples of the Made Ground and the upper Lynch Hill Gravel Member clays, from the exploration window sample holes. Within the Made Ground, Liquid Limits (LL) were measured in the range LL = 36 to 41 and Modified Plasticity Index (I'p) values of between 7 and 12. Within the superficial deposits, LL were measured to be LL = 29 to 38 and I'p values of between I'p = 8 and 12.

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In line with NHBC guidance, the I'p values suggest the clays are categorised to be of Low Volume Change Potential (I'p >10%) to non-shrinkable. However, given the presence of a large Oak tree in the garden of the property, it is recommended that the soils are classified as Low Volume Change Potential (VCP).

In view of the presence of shrinkable soils on the site it is recommended that reference is made to NHBC Standards Chapter 4.2, Building near Trees with regard to shrinking and swelling precautionary measures for foundations and substructures including minimum foundation depths. Due consideration should also be given to the effects of proposed tree planting, trees recently removed and any existing trees.

5.2 Groundwater

No groundwater was encountered in any of the hand held window sampler boreholes during drilling. However, it should be appreciated that these observations may not reflect equilibrium conditions given the short time that the exploratory holes were open. Furthermore ground water levels can vary with time both seasonally and in the longer term.

6 PROPOSED WORKS

It is proposed to redevelop the site at Wilmar Close, Hillingdon, for residential purposes, which will include the demolition of the current building and construction of two, two storey semi-detached properties.

Full details of the development have not been provided and for the purposes of this report it has been assumed that the construction will comprise lightly loaded masonry walls typical of a two storey house.

7 GEOTECHNICAL ENGINEERING ASSESSMENT

7.1 Foundations

The choice of foundation for the buildings will largely depend on the imposed loadings and the ability of the particular structure to tolerate differential settlement. The near surface ground

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permits the excavations may be battered at a safe angle commensurate with the soils encountered.

No groundwater was encountered during the ground investigation, and as such, shallow ground water ingress is considered unlikely.

7.4 Surface Water Drainage

Sand and gravels of the Lynch Hill Gravel Member would be expected to have a medium to high permeability and infiltration potential. If soakaways are being considered it is recommended that further investigation is carried out relating to soakaway testing prior to any soakaway chambers being installed. BRE 365 trial pit soakage tests may be carried out in the rear garden following demolition of the existing house when access is available for plant and equipment.

7.5 Car Park Pavement

The exploratory holes indicate that the subgrade for a car park pavement is likely to be clay. On the basis of the Atterberg limits test results a CBR value of 3% is considered appropriate for preliminary pavement design.

7.6 Buried Concrete

Water soluble sulphate and pH tests were performed on soil samples recovered from the boreholes. The pH values indicate near neutral conditions and relatively low water soluble sulphate levels were recorded in all samples. A design sulphate class of DS-1 and an ACEC class of AC-1s buried concrete classification is recommended as outlined in BRE Special Digest 1, Concrete in Aggressive Ground.

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