



Infrastruct CS Ltd
The Stables
High Cogges Farm
High Cogges
Nr Witney
Oxon
OX29 6UN

SuDS MAINTENANCE GUIDE

OWNERS MANUAL

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Report Prepared By:

Mateo Blanco

MEng GMICE

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CONTENTS

PAGE NO.

1.	Introduction	3
1.1	Who is responsible for maintenance of the suds features used for this scheme	3
1.2	Owner's manual	3
1.4	SUDS techniques used on this scheme:.....	3
1.5	Summary of how the techniques work for the scheme	3
1.6	Maintenance requirements	4
1.7	Areas where activities are prohibited	4
1.8	Accidental spillages	4
1.9	Alterations.....	4
1.10	Health and safety	4
2.	Operation and maintenance activity categories.....	5
2.1	Regular maintenance activities	7
2.2	Irregular maintenance activities	8
2.3	Remedial maintenance.....	8
3.	Applications of the principles of landscape maintenance	8
3.1	Frequency of maintenance tasks	10
3.2	Operation and maintenance costs.....	11
3.3	Design life	12
4.	References	13
	Pervious pavements	14
	Geocellular/modular systems	16
	Silt traps and catchpits	17
	Appendix A - Monitoring and maintenance record.....	18
	Appendix B - Accident and incident record.....	19
	Appendix C - Key site and emergency contacts.....	20

1. Introduction

This guidance provides best practice guidance on the maintenance of Sustainable Drainage Systems (SuDS) to facilitate their effective implementation within the 470-478 Oxford Road development in Reading.

Unlike conventional drainage systems, SuDS features are often visible and their function should be easily understood by those responsible for maintenance. When problems occur, they are generally obvious and can be remedied simply, using standard landscaping practice. If systems are properly monitored and maintained, any deterioration in performance can often be managed out.

Like any drainage system maintenance is a necessary and important consideration of SuDS design and sufficient thought should be given to long-term maintenance and its funding during feasibility and planning stages. In particular, the following requirements should be given full consideration:

1.1 Who is responsible for maintenance of the suds features used for this scheme

The cellular soakaways and permeable paving features associated with the flats are to be maintained by a management company appointed by the flat owners.

Following construction but prior to the completion of the initial sale of each property, the responsibility for maintenance shall lie with the developer.

1.2 Owner's manual

SuDS are different from conventional drainage and require different maintenance regimes. This manual details the following:

- location of all SuDS techniques in a site
- brief summary of how the techniques work, their purpose and how they can be damaged
- maintenance requirements (a maintenance plan) and a maintenance record
- explanation of the consequences of not carrying out the maintenance that is specified
- identification of areas where certain activities are prohibited (for example stockpiling materials on pervious surfaces)
- an action plan for dealing with accidental spillages
- advice on what to do if alterations are to be made to a development, if service companies undertake excavations or other similar works carried out that could affect the SuDS.

1.3 Location of SuDS techniques used on the scheme

The location of the SuDS features is shown on drawing 2016-D1261-SK300 attached at the back of this document.

1.4 SUDS techniques used on this scheme:

- Pervious Pavements
- Geocellular/Modular Systems
- Silt traps and catchpits

1.5 Summary of how the techniques work for the scheme

The roof runoff from both buildings discharge via a piped system into a soakaway located beneath the shared amenity area, to the northwest of the site. The vehicle driveway and the parking bays will be permeable, allowing water runoff to percolate into the ground.

Water quality is improved by the implementation of various treatment features/devices.

Cellular soakaways – The cellular soakaways collect runoff from the roof areas and disperse the water into the ground. Roof runoff is discharged via a piped system into a plastic cellular 'crates'. These crates are wrapped in a filtration 'wrap' to prevent the ingress of soil and fines. The soakaways are sized to accommodate a peak storm event for a 1 in 100-year storm with an additional allowance of 40% for climate change. The piped drainage system will have silt traps to intercept suspended solids.

Permeable paving – The permeable paving allows rain water to pass through the surfacing blocks and discharge into the open graded stone sub-base. The open graded nature of the sub-base means that there are no fines and this provides voids in which the peak storm can be accommodated until it disperses into the underlying strata.

1.6 Maintenance requirements

These are detailed in the appropriate section of this document.

1.7 Areas where activities are prohibited

Heavy loads should not be allowed in areas where cellular soakaways are located. Failure to do so may cause structural damage and collapse of the cellular limits.

Permeable paving – No stock piling of materials should take place on areas of permeable paving as this will cause the surface to block and prevent the through flow of rainwater.

1.8 Accidental spillages

Health and safety consideration are a priority and addressing accidental spillages should only be attempted if the nature of the spillage is known and its potential hazardous properties understood. The source of the spillage should be stopped and excess surface spillage removed by suction tank or absorption mats. Silt traps and sumps should be emptied by suction tanker. Areas of affected permeable paving should have the surface and laying course removed. The surfacing blocks should be cleaned and re-laid on new bedding material. Heavy pollution of the sub-base will require removal and replacement of the sub-base.

1.9 Alterations

If any alterations are proposed to the development, the design Engineer must be notified so that the impact/implications of the work can be assessed. Utilities should be restricted in the designated service zone areas.

1.10 Health and safety

To comply with the Construction (Design and Management) Regulations (CDM) 2015, designers must assess all foreseeable risks during construction and maintenance and the design must minimise them by the following (in order of preference):

- 1. Avoid.**
- 2. Reduce.**
- 3. Identify and mitigate residual risks.**

CDM 2015 requires designers to ensure that all maintenance risks have been identified, eliminated, reduced and/or controlled where appropriate. This information will be required as part of the health and safety file.

2. Operation and maintenance activity categories

There are likely to be three categories of maintenance activities:

1. **Regular maintenance** (including inspections and monitoring).
2. **Occasional maintenance.**
3. **Remedial maintenance.**

Regular maintenance consists of basic tasks done on a frequent and predictable schedule, including vegetation management, litter and debris removal, and inspections.

Occasional maintenance comprises tasks that are likely to be required periodically, but on a much less frequent and predictable basis than the regular tasks (e.g. sediment removal or filter replacement). Table 2 summarises the likely maintenance activities required for each SuDS component and guidance on specific maintenance activities is given in the following sections.

Remedial maintenance describes the intermittent tasks that may be required to rectify faults associated with the system, although the likelihood of faults can be minimised by good design, construction and regular maintenance activities. Where remedial work is found to be necessary, it is likely to be due to site-specific characteristics or unforeseen events, and so timings are difficult to predict. Remedial maintenance can comprise activities such as:

- inlet/outlet repairs
- erosion repairs
- reinstatement or realignment of edgings, barriers, rip-rap or other erosion control
- infiltration surface rehabilitation
- replacement of blocked filter fabrics
- construction stage sediment removal (although this activity should have been undertaken before the start of the maintenance contract)
- system rehabilitation immediately following a pollution event.

It is important to note that these remedial activities will not be required for all systems, but for the purpose of estimating whole life maintenance costs, a contingency sum of 15-20% should be added to the annual regular and occasional maintenance costs to cover the risk of these activities being required.

Table 2 - Typical key SuDS components operation and maintenance activities
For full specifications, see individual chapters.

O & M activity	SuDS component																	
	Pond/wetland	Detention basin	Infiltration basin	Silt traps and catchpits	Soakaway	Infiltration trench	Filter trench	Modular storage	Pervious pavement	Swale/bioretention/green roofs	Filter strip	Sand filter	Pre-treatment systems	Perforated ring soakaways	Bio retention areas	Rain gardens	Oil interceptors	Flow control devices
Regular maintenance																		
Inspection	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Litter/debris removal	■	■	■	□	□	■	■	□	■	■	■	■	■	■	■	■	□	□
Grass cutting	■	■	■	□	□	■	■	□	□	■	■	□	□		■		□	□
Weed/invasive plant control	□	□	□			□	□		□	□	□	□	□		□	■		
Shrub management	□	□	□						□	□	□		□		□	■		
Shoreline vegetation management	■	□											□					
Aquatic vegetation management	■	□											□					
Sediment management (*)	■	■	■	■	■	■	■	■	■	■	■	■	■		■	■	■	■
Vegetation/plant replacement	□	□	□							□	□		□		□	□		
Vacumn sweeping and brushing										■								
Structure rehabilitation/repair	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
Infiltration surface reconditioning			□		□	□	□		□	□	□	□		□	□	□		

■ Will be required

□ May be required

* Sediment should be collected and managed in pre-treatment systems, upstream of the main device.

The maintenance regime of a site also needs to consider the response to extreme pollution events. A response action plan should be developed and communicated to all those involved in the operation of a site, so that if a spillage occurs it can be prevented from causing pollution to receiving waters.

2.1 Regular maintenance activities

Inspections and reporting

Regular SuDS scheme inspections will:

- help determine optimum future maintenance activities
- confirm hydraulic, water quality, amenity and ecological performance
- allow identification of potential system failures, e.g. blockage, poor infiltration, poor water quality etc.

Inspections can generally be required at monthly site visits (e.g. for grass cutting) for little additional cost, and should, therefore, be subsumed into regular maintenance requirements. During the first year of operation, inspections should ideally be carried out after every significant storm event to ensure proper functioning, but in practice this may be difficult or impractical to arrange.

Typical routine inspection questions that will indicate when occasional or remedial maintenance activities are required, and/or when water quality requires investigation include:

- are inlets or outlets blocked?
- does any part of the system appear to be leaking (especially ponds and wetlands)?
- is the vegetation healthy?
- is there evidence of poor water quality (e.g. algae, oils, milky froth, odour, unusual colourings)?
- is there evidence of sediment build-up?
- is there evidence of ponding above an infiltration surface?
- is there any evidence of structural damage that requires repair?
- are there areas of erosion or channelling over vegetated surfaces?

Litter/debris removal

This is an integral part of SuDS maintenance and reduces the risks of inlet and outlet blockages, retains amenity value and minimises pollution risks. High litter removal frequencies may be required at high profile commercial/retail parks where aesthetics are a major driver.

Grass cutting

It is recommended that grass cutting be minimised around SuDS facilities, apart from swales and filter strips and structural embankments where a height of 100–150 mm is recommended to prevent the plants falling over, or “lodging”, when water flows across the surface. In general, allowing grass to grow tends to enhance water quality performance. Short grass around a wet system such as pond or wetland provides an ideal habitat for nuisance species such as geese; allowing the grass to grow is an effective means of discouraging them. Grass around wet pond or wetland systems should not be cut to the edge of the permanent water.

Grass cutting is an activity undertaken primarily to enhance the perceived aesthetics of the facility. The frequency of cutting will tend to depend on surrounding land uses, and public requirements. Therefore, grass cutting should be done as infrequently as possible, recognising the aesthetic concerns of local residents. However, grass around inlet and outlet infrastructure should be trimmed closely to reduce risks to system performance. If a manicured, parkland effect is required, then cutting will need to be undertaken more regularly than for meadow type grass areas, which aim to maximise habitat and biodiversity potential.

Shrub management

Shrubs tend to be densely planted and are likely to require weeding at the base, especially during the first year to ensure that they get enough water. Shrubs should be selected so they can grow to their maximum natural height without pruning.

Vacuum sweeping and brushing

Pervious surfaces need to be regularly cleaned of silt and other sediments to preserve their infiltration capacity. Advice issued with permeable pre-cast concrete paving suggests a minimum of three sweepings per year.

2.2 Irregular maintenance activities

Sediment removal

To ensure long-term effectiveness, the sediment that accumulates in SuDS should be removed periodically. The required frequency of sediment removal is dependent on many factors including:

- design of upstream drainage system
- type of system
- design storage volume
- characteristics of upstream catchment area (eg land use, level of imperviousness, upstream construction activities, erosion control management and effectiveness of upstream pre-treatment).

Sediment accumulation will typically be rapid for the entire construction period (including time required for the building, turfing and landscaping of all upstream development plots). Once a catchment is completely developed and all vegetation is well-established, sediment mobility and accumulation is likely to drop significantly.

2.3 Remedial maintenance

Structure rehabilitation/repair

There will come a time with most SuDS techniques when a major overhaul of the system is required to remove clogged filters, geotextiles, gravel etc. This will typically be between 10 and 25 years, depending on the technique and factors such as the type of catchment and sediment load. The SuDS design allows for vehicle access to undertake this work and consider the need for the overhaul without causing major disruption. For example, the use of geotextiles close to the surface in pervious surfaces traps the majority of sediment in a relatively easily accessible location. Reconstruction of the surface layer and bedding layer is all that is required, rather than reconstruction of the whole pavement depth.

Major overhaul is most likely to be required on techniques that rely on filtration through soils or aggregates, such as sand filters and infiltration devices. Other SuDS techniques are unlikely to need major overhaul if routine maintenance is undertaken as required (for example ponds and wetlands). Rehabilitation activities for each SuDS component are described in the individual component chapters. The requirements should be identified in the owner's manual.

3. Applications of the principles of landscape maintenance

In contrast to conventional drainage, which comprises mainly sub-surface pipework and associated infrastructure, SuDS are predominantly surface systems. A key feature of SuDS is their integration within the local landscape and their amenity contribution, and it is appropriate therefore that landscape maintenance practice is applied to their management.

Landscape maintenance documentation

Typical landscape maintenance documentation and its potential relevance to SuDS systems is summarised below:

(A) Management plan – describing the management objectives for a site over time, and the management strategies that should be employed to realise these objectives and reconcile any potential conflicts that may arise.

Management plans are most appropriate for application in major parks and open spaces, wherever there are alternative choices for future action, and potential conflicts of purpose and priorities that need to be resolved. The following extract from *A guide to management plans for parks and open spaces* (Barber, 1991) sets out the types of management plans that can be prepared:

(i) Management plan

This predicts a degree of physical change, and therefore should present design proposals in its recommendations. It puts the emphasis on the presentation of anticipated physical change with much of the documentation being in support.

(ii) Outline plan

This is generally accepted as a more appropriate title for a management plan that wishes to establish the guiding principles, without providing detailed proposals which might constrain future options for achieving the outline objectives.

(iii) Maintenance plan

This is appropriate if the principal interest is in establishing the best way of maintaining an area, or where there is a need to match maintenance aspirations to a secure financial base. Planned maintenance programmes over longer timescales can be made more secure by the more public exposure of the need and the commitment that the Maintenance Plan should be able to guarantee. A Maintenance Plan can also establish changes in maintenance regimes that may be required to match a change in objectives e.g. the need to adapt operation and maintenance practices to accommodate specific wildlife habitats that may develop.

For a SuDS scheme, the maintenance plan will generally be the most appropriate type of management plan to use. The document should include an explanation of the function of the SuDS scheme and why it is being used on the site.

Where the drainage system has an impact on the wildlife value or public use of a site, it would be prudent to develop this simple explanation further to explain habitat enhancement goals, health and safety issues and long-term management implications.

Sites with special wildlife or amenity interest may require detailed management plans, which monitor habitat development, infrastructure changes or damage to sites and ensure rapid responses to such changes, should they occur.

It is common for smaller commercial, industrial and housing sites to have a simple maintenance statement. In this case, a single page explaining the site management (including the sustainable drainage system) would be useful for all parties involved in the care of the development.

(B) Conditions of contract – appropriate conditions will be required. Advice can be sought from the Landscape Institute. Guidance is also provided in CIRIA publication C625 (Shaffer *et al*, 2004).

(C) Specification – detailing the materials to be used and the standard of work required.

A specification, usually preceded by preliminaries, details how work shall be carried out and contains clauses that give general instructions to the contractor. Specific SuDS maintenance clauses may be included in a general specification or as a separate "Sustainable drainage maintenance specification" section.

(D) Schedule of work – itemising the tasks to be undertaken and the frequency at which they will be performed.

The tasks required to maintain the site and the frequency necessary to achieve an acceptable standard should be set out in the schedule of work.

Smaller sites will usually have simple specification notes given to a contractor as a basis for maintenance on a performance basis. Examples of performance criteria are items such as:

- length of grass
- tidiness
- extent of weed growth, etc.

This document will often form the basis of a pricing mechanism and can also act as a checklist to ensure the work has been carried out satisfactorily.

For additional information on the development of appropriate schedules, reference should be made to *the operation and maintenance of sustainable drainage systems* (HR Wallingford, 2004).

3.1 Frequency of maintenance tasks

Landscape maintenance contract periods are usually of one to three years' duration. The three-year period is increasingly common to ensure continuity and commitment to long-term landscape care. The frequency of regular landscape maintenance tasks in a contract period can range from daily to once in the contract period. In practice most site tasks are based on monthly or fortnightly site visits, except where grass or weed growth requires a higher frequency of work. In many cases a performance specification is used with terms such as "beds shall be maintained weed-free" or "grass shall be cut to a height of 50 mm with a minimum height of 25 mm and a maximum height of 100 mm" to obtain the required standards.

Frequency can be specified within the schedule to include irregular items such as "'meadow grass' cut two times annually in July and September to a height of 50 mm, all arisings raked off and removed to wildlife features, compost facility or to tip", which provides flexibility for work that is not critical to the management of the site.

Maintenance tasks which suit a performance approach commonly include plant growth, grass cutting, pruning and tree maintenance. However, work tasks such as sweeping paths, regular litter collection and cleaning road surfaces will require work at an agreed frequency with more specific timings such as weekly, monthly or annually.

Where the frequency and timing of tasks is critical, a mixture of performance and frequency specification is necessary to provide effective maintenance.

SuDS maintenance generally tends towards a frequency requirement to ensure a predictable standard of care which can be recorded on site and which provides a reasonable basis for pricing work. A convenient frequency for many tasks is at a monthly inspection as this is the usual minimum site attendance required in a landscape specification. The monthly frequency should provide for an inspection of all SuDS features and checking all inlets and outlets.

Certain SuDS maintenance tasks however fall outside this monthly cycle and need to be accommodated in the contract. The two most obvious are:

- wetland vegetation maintenance
- silt management.

There are other tasks associated with ensuring the long-term performance of the systems that may be more difficult to predict and could even fall outside any contract period. It may therefore be more appropriate to review requirements for system rehabilitation at interim periods, when contracts are falling due for renewal.

3.2 Operation and maintenance costs

Although the greatest part of the total cost for a scheme is usually the capital cost, SuDS schemes also require a finance stream to cover long-term operation and maintenance costs (as does a below-ground piped system). An estimate has to be made regarding what these costs are likely to be, and funding requirements need to be agreed by the parties involved.

As many SuDS schemes utilise natural planting and are designed to support ecosystems and biodiversity, there needs to be a period of intensive maintenance of the emerging vegetation to ensure that it grows and provides the expected service. This will usually require specialist horticultural expertise and will incur costs beyond the construction phase. It is recommended that this is included in the construction contract and is the responsibility of the contractor (Chapter 29). Where the SuDS have more than one use, such as for recreation, there may also be a period of initial setting up and commissioning of the recreational area that will incur costs, although these costs would be expected to accrue to the operators of the recreational facilities rather than the developer. At the end of its design life, it is likely that a SuDS scheme would either be:

- a) fully rehabilitated, in which case the cost would be borne by the drainage owner or adoption body, or
- b) redeveloped, in which case the disposal and decommissioning costs would be accepted by the next developer.

The following table indicates possible annual maintenance cost ranges, based on a review of literature and some UK costs, undertaken in 2004 by HR Wallingford. This has been extended through additional literature reviews to cover additional SUDS components:

Option	Annual maintenance costs	Source
Green roofs	£2,500 per year for first 2 years for covered roof with sedum mat, £600 per year after. £1,250 per year for first 2 years for covered roof with biodiverse roof, £150 per year after.	Bamfield (2005) Bamfield (2005)
Simple rainwater harvesting (water butts)	Negligible	
Advanced rainwater harvesting	£250 per year per property for external maintenance contract	RainCycle
Permeable paving	£0.5 - £1 / m ³ of storage volume	HR Wallingford, 2004
Filter drain / perforated pipes	£0.2 - £1 / m ² of filter surface area	HR Wallingford, 2004
Swales	£0.1 / m ² of swale surface area £350 per year	HR Wallingford, 2004 Ellis, 2003
Infiltration basin	£0.1 - £0.3 / m ² of detention basin area £0.25 - £1 / m ³ of detention volume	HR Wallingford, 2004
Soakaways	£0.1 / m ² of treated area	HR Wallingford, 2004
Infiltration trench	£0.2 - £1 / m ² of filter surface area	HR Wallingford, 2004
Filter strip	£0.1 / m ² of filter surface area	HR Wallingford, 2004
Constructed wetland	£0.1 / m ² of wetland surface area Annual maintenance of £200-250/yr for first 5 years (declining to £80 - £100/yr after 3 years).	HR Wallingford, 2004 Ellis, 2003
Retention (wet) pond	£0.5 - £1.5 / m ² of retention pond surface area £0.1 - £2 / m ³ of pond volume	HR Wallingford, 2004 HR Wallingford, 2004 Ellis, 2003
Detention basin	£0.1 - £0.3 / m ² of detention basin area £0.25 - £1 / m ³ of detention volume £250-£1000 per basin	HR Wallingford, 2004 HR Wallingford, 2004 Ellis, 2003

Indicative annual maintenance activities and unit costs for various SUDS features

Measure	Frequency	Rate and activity	Source
Advanced rainwater harvesting	5-7 years	£500 for pump replacement	RainCycle
Swale	3	£250 for removal of silt	SUDS Manual (C697)
	3	£250 for surface treatments to encourage infiltration	SUDS Manual (C697)
	25	£2,000 for replacement of topsoil and disposal of silts	SUDS Manual (C697)
Filter drain / filter strip	3	£250 for removal of silt	SUDS Manual (C697)
	3	£50 for limited weed control	SUDS Manual (C697)
	25	£1,000 for removal and cleaning of stone and the removal, disposal and replacement of geotextile.	SUDS Manual (C697)
Ponds and wetlands	3	£500 for partial silt removal and disposal to land	SUDS Manual (C697)

Indicative intermittent maintenance activities and unit rates for various SUDS features

3.3 Design life

The design life is typically defined as the minimum length of time that a scheme is required to perform its intended function. The design life for appraisals is typically taken to be 100 years, although alternative periods can be used. The design life is also an important consideration in whole life costing as component assets may have a shorter service life than the design life.

Design life for SUDS systems may be very long assuming appropriate construction and long-term maintenance is undertaken over the system life. There is a low risk of structural failure of SUDS components that can help to extend the structural design life.

Whilst this is the case, regular maintenance and inspections may be required to ensure that the SUDS components are delivering the required attenuation and water quality benefits. This requirement may limit the operational life of the assets or a component of a system that requires some level of intermittent maintenance or rehabilitation. This highlights the two elements of design life:

- Design life of the system as a whole.
- Component life of a system element, the failure of which may reduce the system's ability to achieve the stated function.

A review of available design lives for various SUDS measures are provided in the table below, based on a review of literature undertaken in 2004 as part of HR Wallingford's work for the DTI on whole life costing for SUDS components.

Option	Design life	Component life
Green roofs	Unlimited design life	N/A
Simple rainwater harvesting (water butts)	Unlimited design life	No reliable information
Advanced rainwater harvesting	Unlimited design life	No reliable information.
Permeable paving	Unlimited design life	20-25 years before replacement of filter material
Filter drain / perforated pipes	Unlimited design life	10 – 15 years before replacement of filter material
Swales	Unlimited design life	5 – 20 years before deep tilling required and replacement of infiltration surface
Infiltration basin	Unlimited design life	5 – 10 years before deep tilling required and replacement of infiltration surface
Soakaways	No available information	
Infiltration trench	Unlimited design life	10 – 15 years before replacement of filter material
Filter strip	Unlimited design life	20 – 50 years before replacement of the filter surface
Constructed wetland	20 – 50 years	sediment disposal after 10-15 years
Retention (wet) pond	20 – 50 years	
Detention basin	20 – 50 years	sediment disposal after 10-15 years

Design life estimates for SUDS measures

4. References

- CIRIA C753 (2015) – The SuDS Manual
- Wildfowl & Wetlands Trust guidance (2012) – Maximising the potential for people and wildlife
- HR WALLINGFORD (2004). Whole Life Costing for Sustainable Drainage. Report SR 627.
- DEFRA (2010). Surface Water Management Plan Technical Guidance.
- Environment Agency (2015) - Cost estimation for SUDS. Summary of evidence.

PERVIOUS PAVEMENTS

DESCRIPTION

Pervious pavements provide a pavement suitable for pedestrian and/or vehicular traffic, while allowing rainwater to infiltrate through the surface and into the underlying layers. The water is temporarily stored before infiltration to the ground, reuse, or discharge to a watercourse or other drainage system. Pavements with aggregate sub-bases can provide good water quality treatment.

OPERATION AND MAINTENANCE REQUIREMENTS

Regular inspection and maintenance is important for the effective operation of pervious pavements. Maintenance responsibility for a pervious pavement and its surrounding area should be placed with an appropriate responsible organisation. Before handing over the facility to the client, it should be inspected for clogging, litter, weeds and water ponding and all failures should be rectified. After handover, the facility should be inspected regularly, preferably during and after heavy rainfall to check effective operation and to identify any areas of ponding.

Pervious surfaces need to be regularly cleaned of silt and other sediments to preserve their infiltration capability. Experience in the UK is limited, but advice issued with permeable precast concrete paving has suggested a minimum of three surface sweepings per year. Manufacturers' recommendations should always be followed.

A brush and suction cleaner, which can be a lorry-mounted device or a smaller precinct sweeper, should be used and the sweeping regime should be as follows:

1. End of winter (April) – to collect winter debris.
2. Mid-summer (July/August) – to collect dust, flower and grass-type deposits.
3. After autumn leaf fall (November).

Care should be taken in adjusting vacuuming equipment to avoid removal of jointing material. Any lost material should be replaced.

The likely design life (or period before pavement rehabilitation is required) has yet to be established for the UK. However, it should be no different from standard paving assuming that an effective maintenance regime is in place to minimise risks of infiltration clogging.

If reconstruction is necessary, the following procedure should be followed:

1. Lift surface layer and laying course.
2. Remove any geotextile filter layer.
3. Inspect sub-base and remove, wash and replace if required.
4. Renew any geotextile layer.
5. Renew laying course, jointing material and concrete block paving.

The reconstruction of failed areas of concrete block pavement should be less costly and disruptive than the rehabilitation of continuous concrete or asphalt porous surfaces due to the reduced area that is likely to be affected. Materials removed from the voids or the layers below the surface may contain heavy metals and hydrocarbons and may need to be disposed of as controlled waste. Sediment testing should be carried out before disposal to confirm its classification and appropriate disposal methods. Guidance on waste management is provided in Chapter 33 of CIRIA C753.

Pervious pavement operation and maintenance requirements

Maintenance schedule	Required action	Frequency
Regular maintenance	Brushing and vacuuming.	Three times/year at end of winter, mid-summer, after autumn leaf fall, or as required based on site-specific observations of clogging or manufacturers' recommendations.
Occasional maintenance	Stabilise and mow contributing and adjacent areas.	As required.
	Removal of weed.	As required.
	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50 mm of the level of the paving.	As required.
Remedial actions	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users.	As required.
	Rehabilitation of surface and upper sub-structure.	As required (if infiltration performance is reduced as a result of significant clogging).
	Initial inspection.	Monthly for 3 months after installation
Monitoring	Inspect for evidence of poor operation and/or weed growth. If required, take remedial action.	3-monthly, 48 h after large storms.
	Inspect silt accumulation rates and establish appropriate brushing frequencies.	Annually.
	Monitor inspection chambers.	Annually.

Implementation of the CDM Regulations (DETR, 1994) and generic health and safety criteria are presented in Sections 2.5.10 and 3.4.2 of CIRIA C697 respectively. Maintenance activities should be detailed in the Health and Safety Plan and a risk assessment should be undertaken.

GEOCELLULAR/MODULAR SYSTEMS

DESCRIPTION

Modular plastic geocellular systems with a high void ratio, that can be used to create a below ground infiltration (soakaway) or storage structure.

OPERATION AND MAINTENANCE REQUIREMENTS

Regular inspection and maintenance is required to ensure the effective long-term operation of below ground modular storage systems. Maintenance responsibility for systems should be placed with a responsible organization. Maintenance requirements for modular systems are described in the table below. Maintenance plans and schedules should be developed during the design phase. Specific maintenance needs of the system should be monitored, and maintenance schedules adjusted to suit requirements.

Modular systems – operation and maintenance requirements

Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then six monthly
	Debris removal from catchment surface (where may cause risks to performance)	Monthly
	Where rainfall infiltrates into blocks from above, check surface of filter for blockage by silt, algae or other matter. Remove and replace surface infiltration medium as necessary.	Monthly (and after large storms)
	Remove sediment from pre-treatment structures	Annually, or as required
Remedial actions	Repair/rehabilitation of inlets, outlet, overflows and vents	As required
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed	Annually and after large storms

SILT TRAPS AND CATCHPITS

DESCRIPTION

Silt traps and catchpits are circular or rectangular manholes and /or chambers with a sump in them to collect suspended solids. Some chambers have removeable silt buckets to assist with the removal of accumulated silt deposits. Catchpits are usually concrete ring or segment structures and silt traps preformed plastic chambers.

OPERATION AND MAINTENANCE REQUIREMENTS

Regular inspection and maintenance is required to ensure the effective long-term operation of below ground silt traps and catchpits systems. Maintenance responsibility for systems should be placed with a responsible organization. Maintenance requirements are described in the table below. Maintenance plans and schedules should be developed during the design phase. Specific maintenance needs of the system should be monitored, and maintenance schedules adjusted to suit requirements.

Silt traps and catchpits – operation and maintenance requirements

Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then six monthly
	Debris removal from catchment surface (where may cause risks to performance)	Monthly
	Inspection of silt traps and catchpits to assess silt accumulation	Monthly (and after large storms)
	Removal of accumulated silt from silt trap and catchpit sumps	Annually, or as required
Remedial actions	Repair/rehabilitation of inlets, outlet, overflows and vents	As required
Monitoring	Inspect/check all inlets, outlets, and overflows to ensure that they are in good condition and operating as designed	Annually and after large storms

APPENDIX A - MONITORING AND MAINTENANCE RECORD

You need to keep a record of the checks you have completed that are set out in the checklist below along with any additional checks you have made.

If you have a maintenance contract with a contractor, keep a record of any work carried out on your pond system by them. If invoices state the work carried out, these will be sufficient.

If you do the checks you should enter:

- The check or maintenance job
- Who did it;
- The result (for example when abnormal noise heard, called in specialist to investigate).

Action	Date and Time	Carried out by	Result
For example, inlet and outlet pipes checked	06/04/2012 09.30	Mr A N Other	Obstruction cleared.

APPENDIX B - ACCIDENT AND INCIDENT RECORD

You should record any accidents, other incidents or near misses relating to the operation of the SUDS system for example untreated sewage being released into the ponds. The form could also be used to record health and safety incidents.

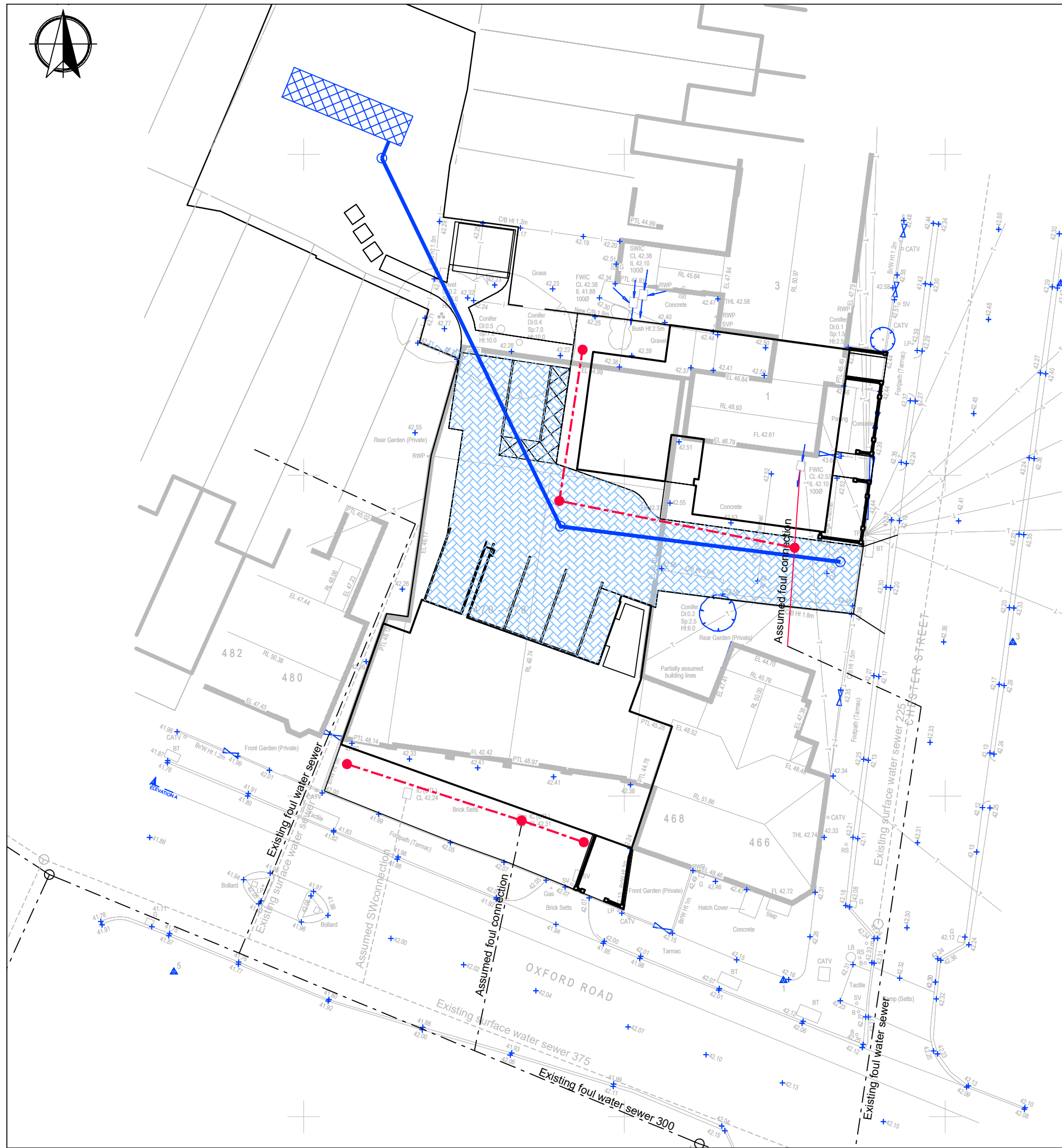
"Other incidents" covers impacts on the environment that are not accidents, such as failing to maintain the system, or vandals causing damage to the detention pond.

Date and time of the incident	
What happened, what was it about?	
Was anyone else aware of this – other witnesses? If so who?	
What caused it?	
What action did you take to fix the problem?	
What have you done to make sure that it does not happen again?	
Was there any significant pollution – for example: untreated sewage being discharged into a drain, river or stream? Yes / No If yes, what pollution occurred?	
If there was significant pollution then you must notify the Environment Agency on 0800 807060 as soon as possible. Have you done so?	Yes/No/not applicable At what time did you phone? EA Incident reference no.
You must also write or send an email to confirm this to the local office (see your accident management plan for the address). Have you done so?	Yes/No/not applicable
Please print your name, sign and date.	

APPENDIX C - KEY SITE AND EMERGENCY CONTACTS

This table contains information and contacts you may need in an emergency

SITE DETAILS		
Address:		
Postcode:		
Site access grid reference:		
SITE CONTACTS	Office Hours (specify)	Out of hours
Owner:		
General manager:		
Site manager:		
Site supervisor:		
Security contact:		
Landowner / agent:		
EMERGENCY SERVICES	Office Hours	Out of hours
Emergency		
Medical:		
Police:		
Fire:		
REGULATORS	Office Hours	Out of hours
Health and Safety Executive (HSE):		
Local Authority:		
Environment Agency	General number:	08708 506 506
	24 hour emergency hotline:	0800 80 70 60
Natural England/Countryside Council for Wales		
OTHER KEY CONTACTS	Office Hours	Out of hours
Adjacent landowners:		
Neighbours:		
Specialist advisors:		



DRAINAGE KEY

Existing Foul Water Drain/Sewer

Existing Surface Water Drain/Sewer

Storm Water (Private Drain/Public Sewer)

Permeable block paving (infiltration).
Designed to drain its own area. 1 in 100
yr + 40% critical storm based on
infiltration rate of 1x10-4m/s. Permeable
paving system to incorporate pollution
control geotextiles.

Cellular soakaway (infiltration).
Designed to drain proposed roofs. 1 in
100 yr + 40% critical storm based on
infiltration rate of 1x10-4m/s.

Foul Water (Private Drain/Public Sewer)

NOTES

1.

This drawing is to be read in conjunction with all other RGP drawings, and with all relevant Architect's and Engineer's drawings and specification. Any discrepancies found are to be reported immediately to the Engineer.

2.

RGP accepts no responsibility for inaccuracies in data provided by third parties such as topographic surveys or Ordnance Survey mapping.

3.

Do not scale, work to figured dimensions only. All dimensions are in millimeters unless noted otherwise and all levels are in metres from the topographic survey datum.

4.

Any information given regarding existing underground services is given in good faith after consultation with the relevant authority, however accuracy is not certain.

PLANNING APPLICATION

	26/07/2016	Original Issue	RAA
Rev.	Date	Amendments	Drawn

rgp

Design

Transport Planning and Infrastructure Design Consultants

Metro House, Northgate, Chichester, West Sussex. PO19 1BE

Tel: 01243 410418 Fax: 01483 861682

www.rgp.co.uk

Client	Prestige Properties Limited		
Project	470-478 Oxford Road Reading		
Drawing Title	Proposed Drainage Strategy		
Scale	1:250	Drawn By LDF	Checked By - Approved By -
Date March 2017	Drawing No. 2016-D1261-300	Rev. -	