Detailed Surface Water Drainage Strategy, Northeast Parcel, Malvern View, Stanford Bishop

Draft Report

April 2022

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Revision history

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S03-P01 / April 2022	Draft Report	Wendy Sockett, WS Planning

Contract

This report describes work commissioned by Heidi Beattie from WS Planning, on behalf of Park Leisure 2000 Ltd, by an email dated 28th September 2020.

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Purpose

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Abbreviations

CC	Climate Change
ha	Hectares
JBA	Jeremy Benn Associates
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
m	metres
mm	millimetres
mAOD	metres Above Ordnance Datum (Newlyn)
NGR	National Grid Reference
OS	Ordnance Survey
SuDS	Sustainable Drainage System

1 Introduction

JBA Consulting was commissioned by WS Planning, on behalf of Park Leisure 2000 Ltd in September 2020 to undertake a Detailed Surface Water Drainage Strategy (SWDS) to discharge drainage related conditions for a proposed caravan site at Malvern View, near Stanford Bishop, Herefordshire. The planning conditions in the JBA fee proposal are described as follows:

• A detailed surface water drainage strategy with supporting calculations that demonstrates there will be no surface water flooding up to the 1 in 30-year event, and no increased risk of flooding as a result of development between the 1 in 1 year event and up to the 1 in 100-year event and allowing for the potential effects of climate change;

• Further detail for the north-east parcel to demonstrate how the combined runoff from this area will not increase flood risk during smaller rainfall events;

• Results of infiltration testing undertaken in accordance with BRE365 guidance;

• Drawings showing cross sections through the proposed attenuation basins, demonstrating appropriate freeboard and overflow provision in the event of exceedance or blockage;

• Confirmation of groundwater levels to demonstrate that the invert level of any unlined attenuation features can be located at minimum of 1m above groundwater levels;

• Details of the proposed outfalls to the watercourses.

This report addresses the north-eastern parcel, which comprises an extension to the existing site and includes 54 static caravans within the site.

2 Site details

2.1 Site description

The area of the northeast parcel is 2.55 ha and comprises a grassed field bounded with the unnamed watercourse running along the northern and eastern boundary. The site is surrounded by greenfield land besides its western border adjusted to an existing caravan site. Malvern View Park Leisure is located between Stanford Bishop village to the southwest and Linley Green to the northwest. The current access to the site is via a local road located to the west which connects Malvern Road with Linley Green Road and an internal unnamed road running through the middle of the Malvern View Holiday Park. Table 2-1 below presents the key site details.

Site address	Malvern View, Stanford Bishop, Worcester
Site name	Malvern View Park Leisure
Site area	2.55 ha
Existing Land-use	Greenfield
Purpose	Extension to the existing caravan park within the Malvern View Leisure Park with associated roads and car parking infrastructure.
OS NGR	SO 69839 52723
County	Herefordshire
LPA/LLFA Authority	Herefordshire Council

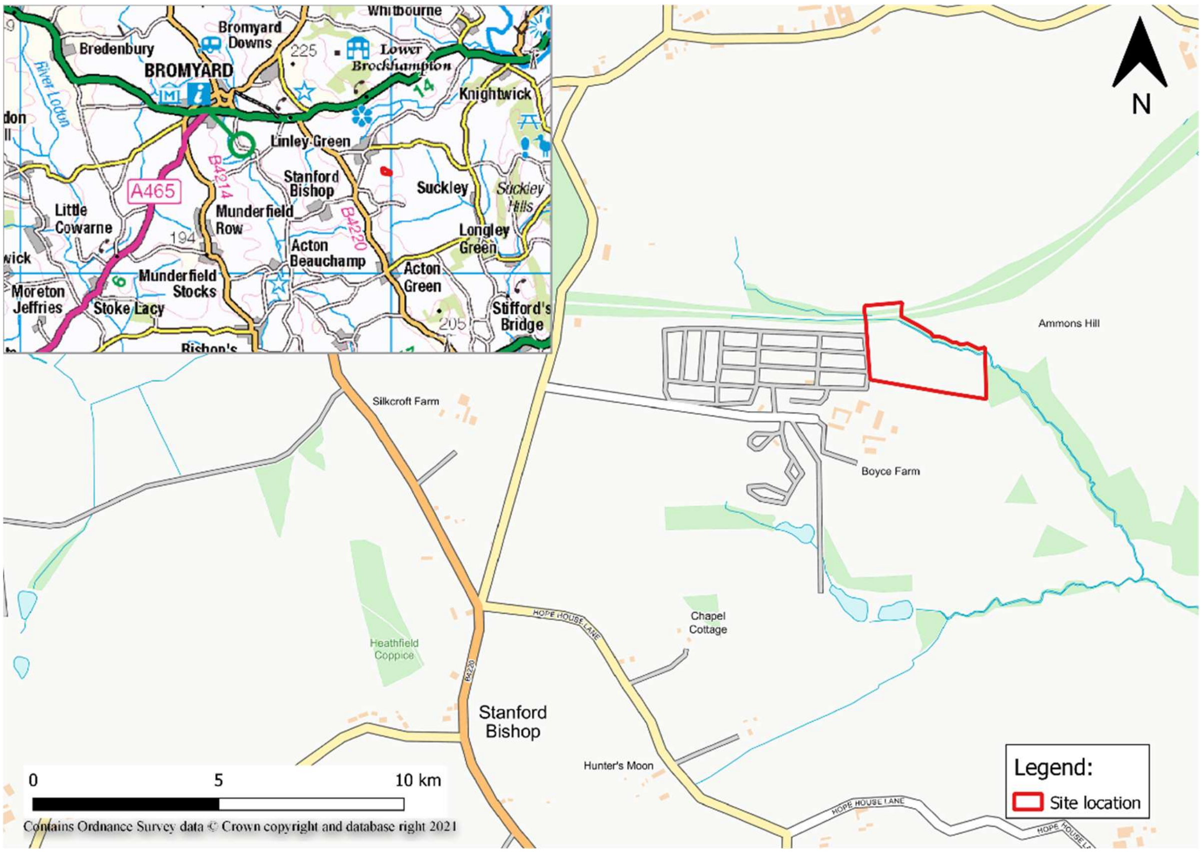

Table 2-1: Site details

2.2 Proposed development

The proposed development comprises the north-eastern parcel which forms an extension to the existing Malvern View Park Leisure site. The proposed development includes 54 new static caravans with associated car parking and access roads.

The proposed site layout is included in Appendix A.

2.3 Existing site topography

A site-specific topographic survey was carried out by A&M Architectural Partnership LLP in September 2020. The survey shows that the site is generally steeply sloping in a north-easterly direction. Ground levels within the developable part of the site vary between approximately 134.28 mAOD in the south-western corner to approximately 119.00 mAOD in the corner located the furthest north. Due to a proposed pond location outside of the site boundary, an additional survey has been undertaken to allow for the pond design. The survey has been carried out by Digital Terrain Surveys LLP in September 2021.

A copy of the topographical survey drawings is included in Appendix B.

2.4 Existing site geology and hydrogeology

The proposed site parcel is located within Maughans bedrock formation comprising sedimentary rocks fluvial in origin (sandstone, mudstone).

A site-specific ground investigation was undertaken in October 2020 by Socotec. Four trial pits located in the site proximity, within the Malvern View Leisure Park revealed brown and grey sandy/slightly sandy clay layers down to the bottom of trial pits ranging between 1 to 3.2 m in their depths. Soakaway testing was abandoned after 240 minutes duration as there was almost no infiltration noted, therefore the ground on the site is considered to be highly impermeable. There are no additional British Geological Survey borehole records available within the site boundary and its neighbourhood.

Groundwater was recorded within Trial Pit no. 4 at approximately 2.90 m below existing ground level. A copy of the GI investigation, boreholes, soakage pit and trial pit records is included in Appendix C.

2.5 Existing hydrology and drainage conditions

The nearest significant watercourse to the site is called Leigh Brook which flows north to the south and discharges into the Teme River. The site is located between two unnamed ordinary watercourses bounding the site to the north and south, merging into one larger watercourse approximately 400 m from the existing Leisure Park.

The site is currently greenfield and drains by a combination of an infiltration to the ground and overland flow to the unnamed watercourse bounding the site to the north.

The existing facilities area is understood to drain via an underground piped system to the existing pond located in the southeast part of a parcel which then discharges to the unnamed watercourse.

3 Design criteria

3.1 Design guidance

The drainage strategy has been produced in line with the latest guidance in relation to surface water drainage for development sites as follows:

Herefordshire Council, Sustainable Drainage Systems Handbook; June 2017[1];

CIRIA 753 "The Suds Manual", November 2015;

Building Regulations, part H;

Flood Risk Assessment: climate change allowances, Environment Agency, February 2016 (Updated June 2021).

3.2 Water quantity (runoff flows and volumes)

In line with the industry standards pipes should be designed without surcharge during a 1-year / 2-year storm event, depending on the site slopes. Any flows up to the 30-year storm event should be accommodated underground (with no surface flooding) unless overground storage facilities are provided as part of the design. Any exceedance flows beyond the 30-year storm event and including the 100-year storm event plus climate change should be managed in a safe manner on site to reduce the risk of flooding to the development and elsewhere. A dedicated overland flow route should be provided through the development to convey any exceedance flows beyond the 100-year plus climate change event in a safe manner.

Peak rates of runoff can be readily managed and reduced using flow control and attenuation techniques. The reduction of runoff volume can however be more difficult to achieve as it relies upon infiltration, evapo-transpiration, or re-use. Where these SuDS techniques are not viable then the alternative is to provide appropriate attenuation in underground (e.g., oversized pipes, tanks) and/or over ground (e.g., detention basins, retention ponds, swales) storage facilities by restricting the runoff rates to the greenfield equivalent.

To mitigate against increased downstream flooding due to the additional volume of runoff alternative approaches should be considered as follows:

Segregation of the Long-Term Storage Volume (LTS), the difference between the pre- and post-development runoff volumes from the main peak flow attenuation. The LTS is then discharged at very low rates (less than 2l/s/ha) and the remaining peak flow attenuation can be discharged at equivalent greenfield runoff rates with suitable deductions made for the discharge from the LTS. In practice, this arrangement is quite complex and depends on catchment size, site layout, topography, number of outfalls and viable runoff management options.

Restricting discharges for all return period storms up to the 100-year plus climate change storm event to the pre-development QBAR flow rate. Effectively, surface water is managed collectively and discharged at low rates to extend the runoff hydrograph from the site.

The second approach has been adopted for this drainage strategy.

3.3 Water quality (runoff treatment)

To mitigate against adverse impacts on water quality in the receiving water environment CIRIA 753 'The SuDS Manual' recommends the following steps to determine the required water quality management for discharges to surface waters and groundwater:

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[1] https://www.herefordshire.gov.uk/downloads/file/14026/sustainable-drainage-systems-handbook

Plan land use to prevent runoff and associated pollutants for most rainfall events up to 5mm in depth,

Identify the pollution hazard level associated with the given type of development,

Select risk assessment approach based on receiving water environment and the pollution hazard level,

Carry out the risk assessment for each outfall considering the pollution hazard level, the status of the receiving water environment and effectiveness of the proposed SuDS techniques.

Residual/leisure estates present low pollution hazard level and therefore the risk of contamination to the receiving surface or groundwaters can be decreased using SuDS features whose efficiency in pollutant removal can be assessed using the Simple Index method described in the SuDS Manual chapter 26.7.1.

3.4 Climate change impact

The 100-year peak rainfall intensity has been increased by 40% to account for the future climate change impact to represent the design event. The 40% increase reflects the upper end peak river flow climate change allowance within the Severn River Basin District for the 2050s scenario (2040 to 2069)[2], which has been selected as appropriate for this type of development and its lifespan.

[2] Flood Risk Assessment: climate change allowances, Environment Agency, February 2016 (Updated July 2021), p.5

4 Proposed drainage regime

4.1 Discharge hierarchy

Herefordshire County Council's 'Sustainable Drainage Systems Handbook' chapter 7.1 states that for surface water disposal a SuDS hierarchy should be followed. Therefore, the discharge hierarchy given in CIRIA 753 'The SuDS Manual' chapter 3.2.3 has been considered during the detailed design process in following order:

Discharge through infiltration – this solution has been discounted as the ground investigation results show clay as the main ground strata (clay as per SuDS Manual Chapter 25.2.1 is considered as a very poor infiltration medium) and BRE 365 soakaway test results reveal very poor infiltration rates.

Discharge to the existing watercourse or ditch – this solution has been considered as suitable for the site - based on the existing local topography, the site currently drains towards the watercourse bounding the proposed development to the north and east. It is therefore proposed to discharge the post-development surface water runoff to the watercourse via two separate outfalls discharging water from two proposed networks.

Discharge to the surface water highway drain or combined sewer– these solutions have been discounted as the second option is being used.

4.2 Runoff rate and volume control

4.3 Runoff rate

The considered existing runoff rates have been presented in the previously prepared Outline Drainage Strategy and calculated using the FEH method (embedded in Micro Drainage) based on the following parameters:

Rainfall data derived from FEH CD-ROM v3.0 (for the unnamed watercourse)

SAAR – 711 mm

SOIL (SPRHOST) – 40.100

BFIHOST – 0.560

FARL – 1.000

Site area – 2.550 ha

Urban - 0

The estimated runoff rates are as follows:

QMED - 9.90 l/s

QBAR = 1.08 * QMED = 1.08 * 9.90 = 10.69 l/s

The QMED calculation sheet is included in Appendix D.

The post-development 100-year+40%CC flow will be restricted to the maximum permissible discharge rate proposed in the Outline Drainage Strategy and will equal 5 l/s (3 l/s – network A, 2 l/s – network B) using a Hydro-Brake Optimum unit (ref. MD-SHE-0076-3000-1450-3000 [Network A] and MD-SHE-0054-2000-2500-2000 [Network B] accordingly).

The source control module within the MicroDrainage software package has been used to estimate the required 100-year plus 40% climate change attenuation volume for the proposed development part discharging via Network A. The following design parameters have been used:

Rainfall data derived from FEH CD-ROM v3.0

Urban creep factor – 10%

Impermeable area (Network A) – 0.529 ha (this includes the urban creep factor)

Maximum total flow rate from the considered part of the site - 3 l/s

The required 100-year+40%CC attenuation volume has been estimated as 367.6 m^3. For the reference see the Source Control calculation outputs included in Appendix E.

The required attenuation storage will be provided within permeable paving and underground geocellular tanks located under parking areas and a proposed basin located within the adjacent parcel located to the southeast.

The attenuation for Network B will be sufficiently provided via geocellular storage and permeable paving, as the impermeable area for this part of the site is significantly smaller and equals approximately 0.169ha (this includes the urban creep factor).

4.4 Runoff treatment

The roof runoff from the static caravans is proposed to be collected via traditional roof gutters to the attenuation storage located underneath permeable pavement areas. The proposed storage structure will consist of geocellular crates, and a crushed stone layer placed below. The surface water infiltrating via the permeable pavement from the parking areas and collected from the roofs will therefore receive the necessary treatment by filtering through the stone layer, with the geocellular tanks providing additional storage in extreme events, before reaching the main pipe network located within the site access roads. Based on the Simple Index method described in the SuDS Manual chapter 26.7.1 this will sufficiently decrease the amount of transported metals, hydrocarbons, and suspended soil particles.

From table 26.2 of the CIRIA SuDS Manual (excerpt given below) the pollution hazard level is deemed to be low:

Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro-carbons
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

From table 26.3 of the CIRIA SuDS Manual (excerpt given below) the pollution mitigation index of all ponds, permeable paving and swale are each more than adequate to address the pollution index of the site:

	Mitigation indices[1]		
Permeable pavement	0.7	0.6	0.7
Pond[4]	0.7[3]	0.7	0.5
Swale	0.5	0.6	0.6

Using the simple index approach calculated Total SuDS Mitigation Index is considerably higher than Pollution Hazard Index.

The calculated Total SuDS Mitigation Indices are shown in the table below:

Table 4-1: Total SuDS mitigation indices

SuDS Features	TSS Total SuDS Mitigation Index	Metals Total SuDS Mitigation Index	Hydrocarbons Total SuDS Mitigation Index
NETWORK 'A' -Permeable Pavement + Pond +Swale	1.3	1.3	1.15
NETWORK 'B' - Permeable Pavement	0.7	0.6	0.7

Therefore, the proposed SuDS elements are sufficient to provide treatment to flows prior to discharge to the existing watercourses.

Additionally, the proposed pond and proposed swale will enhance the treatment process through mechanical and biological processes e.g., by settlement of suspended solids in the forebay, removal of hydrocarbons and removal of metals through plant uptake.

4.5 Drainage network hydraulic modelling approach

The strategic surface water drainage network has been designed using WINDES MicroDrainage software. MicroDrainage is the industry standard software for designing and simulation of drainage systems.

The modelling has been based on the proposed ground levels shown on drawing 'H2 Malvern Planting Plan 171105' (Appendix A). The drainage network has been divided into two separate networks (A and B) due to the existing site topography and designed as a gravity system.

The conveyance system has been designed for 2-year in pipe flow and based on an outfall rate restricted to 5 l/s (3 l/s – Network A, 2 l/s – Network B) using a Hydro-Brake units installed in the flow restriction chambers. The storage pond for the Network A has been incorporated into the model and simulations run for both Network A and B for a set of return period events (2-year, 30-year, 100-year + 40%CC) and the full range of durations (from 15 minutes to 1 week) to check the system has sufficient capacity to convey and attenuate the design flows. The system will operate with no surface flooding up to and including the 30-year storm event. However, water levels in some manholes will rise to within the freeboard allowance in the 100-year+40%CC storm event and its short durations. Any shallow temporary flooding which may occur during short duration rainfall events would be associated with the conveyance capacity of the drainage system (e.g., the pipework is not normally designed to convey exceptionally high flows such as the 100-year event) rather than inadequate attenuation storage provision (the proposed storage has been designed to store surface water volumes up to the 100year+40%CC event with a 150mm freeboard allowance and a proposed emergency spillway providing a safe exceedance route in the event of blockage or extreme flows).

The MicroDrainage hydraulic model outputs are included in Appendix F.

The proposed strategic drainage layout and the relevant typical details are shown on drawings EJW-JBAU-XX-XX-DR-C-2001 (Appendix H), EJW-JBAU-XX-XX-DR-C-2002 (Appendix I) and EJW-JBAU-XX-XX-DR-C-2003 (Appendix J).

It should be noted that the drainage strategy has been based on the design criteria and parameters described in this report. If any of the parameters, including the site layout, change the strategy will need to be revisited to ensure its viability.

4.6 Network A

Network A covers the southern and north-western parts of the site and discharges firstly to the proposed basin, which is expected to provide up to 426.7 m^3 attenuation storage and to be located within the adjacent parcel located to the south-east and then through the proposed swale into the adjacent watercourse. The outfall to the proposed basin has been set at 124.546 mAOD and the proposed basin base level at 121.850mAOD. Therefore, it has been proposed to install timber sleeper check dams at the inlet to the pond. This will reduce the velocity of the water entering the basin's forebay and enhance sediment removal. Before entering the swale, the discharge rate from the network will be reduced to 3 l/s by a Hydro-Brake installed in a flow control chamber. The proposed basin will also enhance treatment processes of the surface water before its disposal to an existing pond located nearby. A low flow channel will be cut into the basin invert to convey flows in smaller events and prevent frequent waterlogging of the basin, which will have a permanent water level and will form a habitat area for wildlife.

The proposed swale will have a depth of approximately 600mm and will slope towards the existing watercourse with an approximate longitudinal slope of 1 in 90. To help reduce water velocity and erosion during more intense rainfall events it has been proposed to install timber check dams along the swale's length which will also enhance pollution removal processes (SSP removal). The maximum water depth at the upstream side of each of the dams is designed to be 400mm. The swale's side slopes are proposed to be 1 in 2 due to the site topography resulting in significant cut earthworks if a 1 in 3 slope were to be used. The swale itself is designed to be relatively shallow which should reduce the risk to site users.

4.7 Network B

Network B will discharge at a reduced flow rate (hydro-brake in flow control chamber reducing the discharge rate to 2 l/s) directly to the watercourse via another timber sleeper check dam.

The steeper site topography next to the assumed points of discharge into watercourses for both networks would require installation of further timber sleeper check dams.

4.8 Permeable paving attenuation and flow restriction arrangement

Table 4-2: Car parking area storage

For both networks surface water runoff from the roof will be intercepted by downpipes positioned along the front and rear of the building and routed to permeable paving placed within the car parking spaces. Then all runoff including the runoff from the car parking areas infiltrating through the permeable paving is proposed to be attenuated within geocellular storage and an underlying crushed stone layer to receive the necessary storage and treatment. Each of the geocellular tanks underneath the permeable paving will provide approximately 2.06 m^3 of attenuation storage. This will be achieved using a 450 mm crate layer with a 95% void ratio and a 100 mm crushed stone layer with a 30% void ratio placed below. The summary of the storage calculation for car parking areas is shown in Table 4-2 below.

Storage layers	Thickness [m]	Void ratio [-]	Area 1.5m x 3.0m [m^2]	Storage [m^3]	Total storage per one car parking space [m^3]
Geocellular crates (3x150mm)	0.45	0.95	4.50	1.92	2.06
Crushed stone layer	0.10	0.30	4.50	0.14	

The infiltrating surface water will be collected in the bottom permeable paving layer by a 100mm diameter pipe and discharged into a manhole structure restricting flow rates using a 15 mm orifice, which is the minimum size in accordance with the SuDS manual. The small size of the orifice is acceptable as the flows will be filtered by the crushed stone layer in the permeable paving, therefore risk of blockage is minimal. To mitigate the risk of flooding within the permeable pavement car parking spaces a weir wall will be used in each of the aforementioned structures. The permeable pavement and geocellular attenuation storage detail can be found on the drawing no. EJW-JBAU-XX-XX-DR-C-2003 in Appendix J.

The proposed roads within the site area discharging through the Network A will be drained using a traditional underground drainage system conveying the surface water collected using road gully inlets. However, the surface water runoff for the roads located within the Network B extent will be directed towards the proposed permeable paving structures by appropriate roads slopes/surfacing represented on the Appendix H Proposed layout drawing by 'surface water runoff direction arrows'.

4.9 Design for exceedance

The outline strategy allowed for storage of flood events up to the 1 in 100-year plus 40% climate change design event within the SuDS features and areas of the road which are designed to flood. However, as was mentioned in the preceding section, exceedance of the system may occur in events exceeding the design event or in the event of a blockage.

In these cases, water would be expected to flow overland following the local topography sloping towards existing watercourses. Additionally, the proposed development is for mobile houses which prevents the surface water runoff from entering the caravans.

The overland flow route, based on the proposed and existing ground levels in the area is shown on drawing EJW-JBAU-XX-XX-DR-C-2001 included in Appendix H.

4.10 Groundwater impact assessment

However, there was a groundwater level noted for the trial pit located in the southeast corner of the adjacent parcel in the place of proposed basin location. The groundwater level has been notified approximately 2.9 m below the existing ground level. Considering depth of the proposed basin (see detail drawing no. EJW-JBAU-00-

00-DR-C-2002 in Appendix I) there is a possibility of groundwater entering future excavation and impacting water levels within the pond during long rainfall durations (subject of further future investigation during construction

4.11 Long term management

It is understood that the surface water drainage system will remain private and the responsibility for its long-term management will lie with the landowner/ occupier.

A maintenance plan will need to be prepared prior to the site being occupied to ensure the drainage system remains operational and effective for the lifetime of the development.

The general operation and maintenance requirements for underground attenuation tanks and filter drains are summarised in Tables 21.3 of CIRIA 753 "The SuDS Manual", quoted below.

Table 4-3: Permeable paving maintenance requirements

SuDS Feature	Maintenance Schedule	Required Action	Frequency
Permeable paving	Regular maintenance	Brushing (standard cosmetic sweep over whole surface).	Annually/As required (after Autumn leaf fall)
	Occasional Maintenance	Stabilise and mow contributing and adjacent areas	As required
		Removal of weeds or management using glyphosate applied directly (not spraying).	Annually/As required
	Remedial Actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50mm of the level of the gravel surface.	As required
		Remedial work to any depressions, rutting or cracks considered detrimental to the structural performance or a hazard to users and replace lost material.	As required
		Rehabilitation of surface and upper substructure by remedial sweeping.	As required (every 10-15 years)

SuDS Feature	Maintenance Schedule	Required Action	Frequency
Permeable paving	Remedial Actions	Relevel uneven surfaces and reinstate design levels.	As required
	Monitoring	Initial inspection	Monthly for three years after installation
		Inspect for evidence of poor operation and/or weed growth – if required, take remedial action	Three-monthly, 48h after large storms in first six months
		Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
		Monitor inspection chambers	Annually

Table 4-4: Pond maintenance requirements

SuDS Feature	Maintenance Schedule	Required Action	Frequency
Ponds and Wetlands	Regular Maintenance	Remove litter and debris	Monthly/As required
		Cut grass – public areas	Monthly (during growing season)/ As required
		Cut the meadow grass	Half yearly (spring, before nesting season, and autumn)
		Inspect marginal and bankside vegetation and remove nuisance plants (for first 3 years)	Monthly (at start, then as required)
		Inspect inlets, outlets, banksides, structures, pipework etc for evidence of blockage and/or physical damage	Monthly
		Inspect silt accumulation rates in the forebay and in the main body of the pond and establish appropriate removal frequencies; undertake contamination testing once some build-up has occurred, to inform management and disposal options	Half yearly
		Check any mechanical devices, e.g., flow control	Half yearly
		Hand cut submerged and emergent aquatic plants (at minimum of 0.1m above pond base; include max 25 % of pond surface)	Annually

SuDS Feature	Maintenance Schedule	Required Action	Frequency
Ponds and Wetlands		Remove 25% of bank vegetation from water's edge to a minimum of 1 m above water level	Annually
		Tidy all dead growth (scrub clearance) before start of growing season (Note: tree maintenance is usually part of overall landscape management contract)	Annually
		Remove sediment from any forebay	Every 1-5 years, or as required
		Remove sediment and planting from one quadrant of the main body of ponds without sediment forebays	Every 5 years or as required
	Occasional Maintenance	Remove sediment from the main body of big ponds when pool volume is reduced by 20%	With effective pre-treatment, this will only be required rarely, e.g., every 25-50 years
	Remedial Actions	Repair erosion or other damage by re-turfing or re-seeding	As required
		Replant, where necessary	As required
		Aerate pond when signs of eutrophication are detected	As required
		Realign rip-rap or repair other damage	As required
		Repair/rehabilitate inlets, outlets, and overflows	As required

Table 4-5: Swale maintenance requirements

SuDS Feature	Maintenance Schedule	Required Action	Frequency
Swale	Regular Maintenance	Remove litter and debris	Monthly/As required
		Cut grass – to retain grass height within specified design range	Monthly (during growing season)/ As required
		Manage other vegetation and remove nuisance plants	Monthly (at the start)/ As required
		Inspect inlets, outlets, and overflows for blockages, clear if required	Monthly
		Inspect infiltration surfaces for ponding, compaction, silt accumulation, record areas where water is ponding for >48 hours	Monthly (at the start)/ As required
		Inspect vegetation coverage.	Monthly/ Quarterly
		Inspect inlets and surface for silt accumulation, establish appropriate silt removal frequencies	Monthly
	Occasional Maintenance	Re-seed areas of poor vegetation growth; alter plant types to better suit conditions, if required	Every six months
	Remedial Actions	Repair erosion or other damage by re-turfing or re-seeding	As required (or if 10% bare soil)
		Relevel uneven surfaces and reinstate design levels	As required
		Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface	As required
		Remove build-up of sediment on upstream gravel trench, flow spreader or at top of filter strip	As required
		Remove and dispose of oils or petrol residues using safe standard practices.	As required

Furthermore, the envisaged requirements for other components of the drainage system are noted in Table 4-6.

Table 4-6: Maintenance requirements for underground pipe drainage

Element	Activity	Frequency
Conveyance pipes and manholes	Visual inspection and jetting /cleaning	Every five years or as required
	Visual inspection for physical damage and remediation	Annually or as required
Catchpits	Visual inspection and jetting /cleaning	Annually or as required
	Visual inspection and replacement/ re-setting covers and gratings if damaged and/or dislodged	Annually or as required
Outlet control chamber with flow device	Visual inspection and remediation of any faults	Annually or as required following significant storm event

In addition, the maintaining party of the drainage system should adhere to all the relevant manufacturers' recommendations in relation to operation of the specific drainage elements.

Notes:

1. Jetting of pipes should only be carried out after removal of larger debris, as jetting alone may dislodge the debris further downstream leading to an increased flood risk elsewhere.

2. The removed waste material (both solids and liquids) from the drainage conveyance/ storage system should be treated as contaminated and disposed of at a licenced waste management facility. It should not be re-used within the development or outside its boundary to minimise the risk of pollution to the environment.

5 Construction (Design and Management) review

Under the Construction (Design and Management) Regulations 2015 (CDM 2015) it is the designer's duty to:

Eliminate foreseeable health and safety risks to anyone affected by the project;

Take steps to reduce or control any risks that cannot be eliminated;

Communicate, cooperate, and coordinate with the client, other designers and contractors involved in the project so that designs are compatible, and health and safety risks are accounted for during the project and beyond.

The potential significant hazards and risks associated with the construction, operation, and maintenance of the proposed drainage system, have been identified during the design process. The information on the identified hazards and potential mitigation measures of the risks presented by the hazards is summarised in the 'Designer's Risk Assessment', included in Appendix K.

Appendices

A Proposed site layout

B Topographical Survey

C GI and soakaway test report

D QMED Calculations

E Source control pond sizing calculations

F MicroDrainage results – Network A

G MicroDrainage results – Network B

H DSWDS layout

I Proposed basin layout and sections

J Typical details

K Designer’s risk assessment

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