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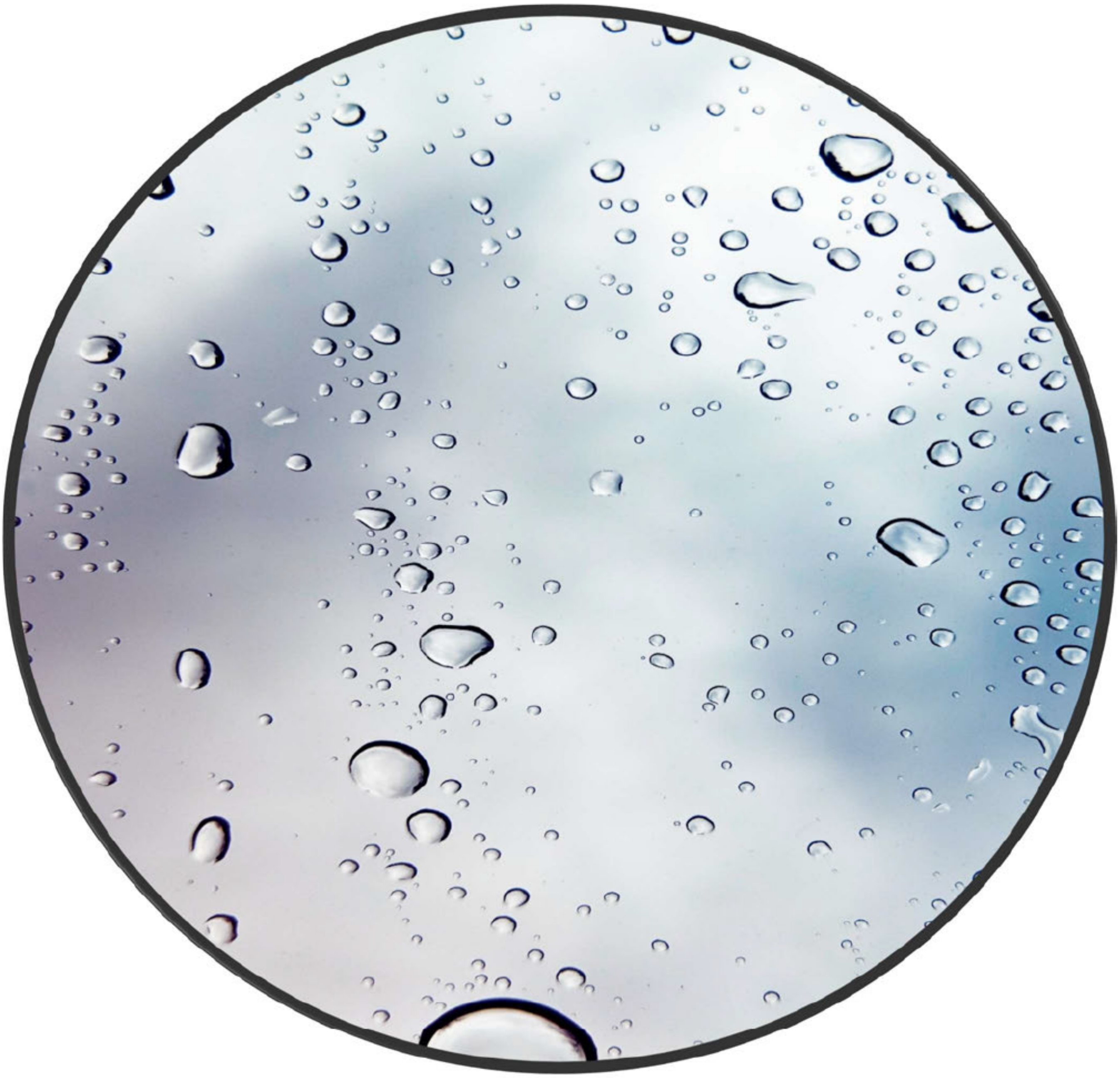
# DRAINAGE STRATEGY REPORT, INCLUDING WASTEWATER STRATEGY

FORMER FRIENDS SCHOOL FIELDS, MOUNT PLEASANT ROAD, SAFFRON WALDEN, ESSEX
ON BEHALF OF CHASE NEW HOMES LIMITED

APRIL 2025

IDL/1162/DS/02



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# DRAINAGE STRATEGY REPORT, INCLUDING WASTEWATER STRATEGY

## IDL/1162/DS/02

### REPORT ISSUE

| Revision | Date | Notes |
|---|---|---|
| P01 | 23/04/2025 | Preliminary Issue |
| P02 | 23/06/2025 | Figure 3 added to address LLFA comments |


### PREPARED BY

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Infrastructure Engineer April 2025

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Director April 2025

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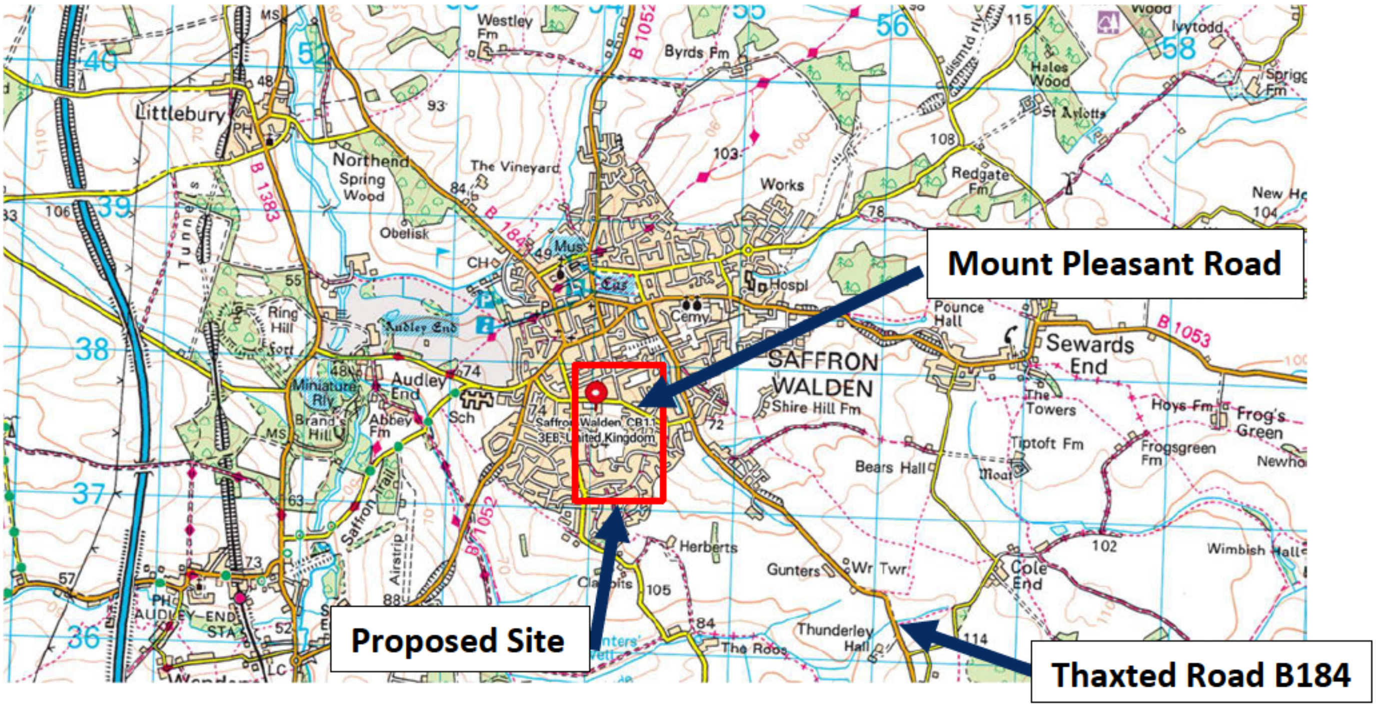
# 1 INTRODUCTION

1.1 Chase New Homes Limited has appointed Infrastructure Design Ltd (IDL) to prepare this Drainage Strategy Summary Report to support their planning application for their proposed residential development site.

1.2 This report has been prepared in accordance with both national and local planning policy and takes guidance from CIRIA 753, The SuDS Manual and The Building Regulations, Approved Document Part H.

1.3 The site is situated off Mount Pleasant Road, Saffron Walden, in the Uttlesford District. The National Grid Reference for the site is TL 54136 37688.

***Figure 1*** *– Site Location Plan*




1.4 Reference Documents:-

- Card Geotechnics Limited Soakaway Test results.
- Anglian Water Utilities Report
- Proposed site layout Plan from Coles Architects.
- Datum Surveys Services Ltd Topographical Survey (Sheets 1 and 2)
- Amazi Flood Risk Assessment report dated 22nd April 2025.
- Sports Turf Consulting report dated 9th April

1.5 The site is an open playing field classified as greenfield open space, covering approximately 6.96 ha. The levels range from approximately 92.59m AOD at the site's eastern boundary to 85m AOD at the northwestern boundary lowest point near Mount Pleasant Road. On the west of the playing field is a former school site, which is currently under development to provide 96 residential units.

1.6 The proposed development of the playing field site will comprise 75 new dwellings (houses and apartments), a new sports facility (comprising marked out football and cricket pitches and a new clubhouse), access roads, shared and private drives, POS and communal landscaping.

The proposed main access to the development site will be from the former Walden School Access Road to the west and will remain private (constructed to standards acceptable to Essex Highways).

1.7 There are no foul or surface water sewers located within the playing field site, however, adopted foul water sewers do exist to the north in Mount Pleasant Road, and to the southwest in The Avenue.

The former school site (located west of the playing field site) discharged to a number of soakaways, and infiltration techniques are being implemented as part of the redevelopment of this site.

Furthermore, the former school site discharges foul water drainage to both the adopted in Mount Pleasant Road and, in part, to a foul sewer in Avenue Road to the south.

Refer to Appendix B for the Anglian Water sewer record map and the Datum topographical survey plans.

1.8 BGS data shows the site is underlain with Seaford Chalk Formation and Newhaven Chalk Formation (undifferentiated), which suggests potential for soakaway drainage.

1.9 Card Geotechnics Limited carried out soakage testing in April 2024, fully in accordance with BRE Digest 365.

1.10 The test results indicated infiltration rates between 7.4 x 10-5 m/s and 4.5 x 10-6 m/s.

1.11 No groundwater was observed during the infiltration testing and is expected to exist at considerable depth within the chalk strata.

***Figure 2**–Summary of Soakaway test results*

| Trial Pit No: | Infiltration rate | Infiltration m/s | m/hr | Lowest results |
|---|---|---|---|---|
| SA01-1 | 8.2X10-5 | 8.20E-05 | 0.2952 | |
| SA01-2 | 7.4X10-5 | 7.40E-05 | 0.2664 | 0.252 |
| SA01-3 | 7.0X10-5 | 7.00E-05 | 0.252 | |
| | | | | |
| SA02-1 | 3.6X10-5 | 3.60E-05 | 0.1296 | |
| SA02-2 | 7.0X10-5 | 3.10E-05 | 0.1116 | |
| SA02-3 | 7.0X10-9 | 1.80E-05 | 0.0648 | 0.0648 |
| | | | | |
| SA03-1 | 7.6X10-6 | 7.60E-06 | 0.02736 | |
| SA03-2 | 4.5X10-6 | 4.50E-06 | 0.0162 | 0.0162 |
| SA03-3 | 5.7X10-6 | 5.70E-06 | 0.02052 | |

| | | | | |
|---|---|---|---|---|
| SA04-1 | 1.9X10-5 | 1.90E-05 | 0.0684 | |
| SA04-2 | 6.5X10-6 | 6.50E-06 | 0.0234 | 0.0234 |
| SA04-3 | 1.9X10-5 | 1.90E-05 | 0.0684 | |
| | | | | |
| SA05-1 | 4.3X10-5 | 4.30E-05 | 0.1548 | |
| SA05-2 | 2.9X10-5 | 2.90E-05 | 0.1044 | 0.1044 |
| SA05-3 | 1.3X10-4 | 1.30E-04 | 0.468 | |

1.12 The north part of the site is within groundwater source protection zone 3 (SPZ3), and the south part of the site is located within groundwater source protection zone 2 (SPZ2).

1.13 The site is located within flood zone 1 and is not considered to be at risk of surface water or groundwater flooding. Refer to the Amazi Flood Risk Assessment report dated 24th June 2024.

## 2 FOUL WATER DRAINAGE

2.1 The proposed residential development's north and central parts of the development will discharge foul drainage via gravity to the existing Anglian Water foul sewer manhole located on Mount Pleasant Road manhole reference 2701. The southern part of the development will discharge via gravity to the Anglian Water foul sewer manhole located in The Avenue manhole reference 9504 via a newly formed lateral provided within the former school site and terminating at the western boundary of the playing fields site. Foul water drainage from the new clubhouse will discharge via a private package pump station to join the western outfall.

2.2 Prior to commencing any onsite drainage works, the exact location and levels of the existing sewer manhole will be recorded, and consent pursuant to Section 106 of The Water Industry Act will be obtained from Anglian Water.

2.3 The drainage strategy layout is included in Appendix C.

## 3 SURFACE WATER DRAINAGE & SUDS

3.1 The total site area extends to approximately 6.96 hectares.

3.2 The total proposed impermeable area for the site is 1503m2(1.503 Ha) with a roof of 0.668Ha, including 10% of urban creep allowances on the roof area added to the overall site area and a porous pavement area of 0.835 Ha. The impermeable area layout is included in Appendix C.

3.3 A hierarchal approach has been taken to selecting SuDS for the surface water drainage system outfalls. In order of priority, the methods of surface water discharge considered are:

i) via infiltration techniques

ii) to the nearest watercourse

iii) and to the nearest sewer.

3.4 As noted in sections 1.8-1.12 and with reference to Appendix A1, infiltration techniques are feasible options for discharging the proposed surface water runoff from the site.

3.5 Given the underlying chalk strata, the cellular soakaway systems are positioned at least 10m from the foundations of any existing or proposed structures. Figure 3 below notes the infiltration rates used in the design and the test location from where the rate was taken from (refer to Figure 2 above).

*Figure 3*

| Soakaway No | Test Location Used (from Fig 2) | Design Infiltration Rate (m/hr) |
|---|---|---|
| SA-01 | SA01 | 0.2520 |
| SA-02 | SA01 | 0.2520 |
| SA-03 | SA02 | 0.0648 |
| SA-04 | SA05 | 0.1044 |
| SA-05 | SA05 | 0.1044 |
| SA-06 | SA05 | 0.1044 |

3.6 Surface water from plot driveways, parking areas and access roads will discharge via porous paving into the ground (System A-full infiltration).

3.7 Any excess surface water runoff from the sports pitches generated during periods of heavy or prolonged rainfall, will be diverted via a land drain located alongside the western boundary of the sports pitches and discharging into the cellular soakaway.

3.8 To summarise, the following SuDs devices will be applied to the scheme;

**Permeable paving** - To access roads, car parking aisles and parking bays.

**Cellular Soakaway (Crate Storage )** - To accommodate the runoff from all storm events, including the peak 1 in 100 years, plus climate change storm events.

3.9 SDS Geolight system is proposed for the construction of the cellular soakaways. The SDS cellular system incorporates granular stone filtration between a perforated pipe and the Geolight units, which filters rainwater prior to discharge to ground. This will also serve to filter rainwater from roofs.

3.10 The permeable paving system incorporating a geotextile-lined subbase will be used to form the new parking areas, communal parking/access roads, and drives. This will serve to improve water quality prior to discharge to the ground. A minimum permeable stone layer of 350mm is required where the sub-base is laid level.

3.11 The proposed sports pitches surface water runoff will be discharged to SA-06 cellular soakaway via a series of 80mm (lateral drains) and 150mm (main drain/carrier) perforated pipe/drain proposed underneath the sports pitches areas. Please note that sports pitches drainage pipes and the cellular storage system has been designed to take 1 in 100 year plus 40% climate change. Refer to Appendix D for sports pitches drainage calculation SA-06.

3.12 In all instances, there will be an absolute minimum of 1m of freeboard between the base of any infiltration device and the seasonally high groundwater level. (Note: Historically, groundwater levels in the chalk strata locally have been circa 45m+ BGL.)

3.13 Given the low risk of pollution that surface water runoff from residential roofs and trafficked areas (via permeable paving) poses to the underlying geology, the groundwater resource within the SPZ's (2 & 3) will remain protected from harm.

3.14 Appendix D provides the *Flow* software results summary for the 1 in 1, 1 in 30 (3.3%) (plus a 35% allowance for 'upper end' climate change) and 1 in 100 (1%) years (plus a 40% allowance for 'upper end' climate change) return period events for the cellular soakaway system.

## 4 ENCLOSURES

4.1 Appendix A1 includes the SuDS Hierarchy and Appendix A2 includes Simple Index Tools.

4.2 Appendix B includes a copy of the Topographical Site Survey and Infiltration test results.

4.3 Appendix C includes a copy of the Drainage Strategy Layouts.

4.4 Appendix D includes the Surface Water / SuDS calculations and simulation results.

4.5 Appendix E Management & Maintenance Regime.

# APPENDIX A1 – SUDS HIERARCHY

| Most Sustainable | SUDS technique | Flood Reduction | Pollution Reduction | Landscape & Wildlife Benefit | Included in the scheme? | Comments |
|---|---|---|---|---|---|---|
| ↑ | Living roofs | √ | √ | √ | √ | The clubhouse roof has a proposal of green roof. This will promote biodiversity and help retain and purify surface water runoff in the system. |
| | Basins and ponds | √ | √ | √ | | Given the site layout, topography, and requirement for sports facilities, this type of above-ground feature is not practicable for use on this development. |
| | Filter strips and swales | √ | √ | √ | √ | Filter strips will deal with excess runoff from the sports fields, however swales are not suited on this scheme. |
| | Infiltration devices | √ | √ | √ | √ | Cellular Soakaway systems are proposed for the scheme. |
| | Permeable surfaces and infiltration blanket | √ | √ | | √ | Permeable paving is proposed to be used extensively across the site. This will assist in pollution reduction |
| ↓ Least Sustainable | Tanked systems-Over size Pipes | √ | √ | | | Not required. |

# APPENDIX A2– SIMPLE INDEX TOOLS

# SIMPLE INDEX APPROACH: TOOL



1. The steps set out in the tool should be applied for each inflow or 'runoff area' (ie each impermeable surface area separately discharging to a SuDS component).

2. The supporting 'Design Conditions' stated by the tool must be fully considered and implemented in all cases.

3. Relevant design examples are included in the SuDS Manual Appendix C.

4. Each of the steps below are part of the process set out in the flowchart on Sheet 3.

5. Sheet 4 summarises the selections made below and indicates the acceptability of the proposed SuDS components.

| | |
|---|---|
| DROP DOWN LIST | RELEVANT INPUTS NEED TO BE SELECTED FROM THESE LISTS, FOR EACH STEP |
| USER ENTRY | USER ENTRY CELLS ARE ONLY REQUIRED WHERE INDICATED BY THE TOOL |

## STEP 1 Determine the Pollution Hazard Index for the runoff area discharging to the proposed SuDS scheme

**This step requires the user to select the appropriate land use type for the area from which the runoff is occurring**

If the land use varies across the 'runoff area', either:

- use the land use type with the highest Pollution Hazard Index
- apply the approach for each of the land use types to determine whether the proposed SuDS design is sufficient for all. If it is not, consider collecting more hazardous runoff separately and providing additional treatment.

If the generic land use types suggested are not applicable, select 'Other' and enter a description of the land use of the runoff area and agreed user defined indices in the row below the drop down lists.

| | *Runoff Area Land Use Description* | *Hazard Level* | *Pollution Hazard Indices* Total Suspended Solids | Metals | Hydrocarbons |
|---|---|---|---|---|---|
| Select land use type from the drop down list (or 'Other' if none applicable): → | Individual driveway | Low | 0.5 | 0.4 | 0.4 |
| If the generic land use types in the drop down list above are not applicable, select 'Other' and enter a description of the land use of the runoff area and agreed user defined indices in this row: | | | | | |
| | **Landuse Pollution Hazard Index** | **Low** | **0.5** | **0.4** | **0.4** |

*DESIGN CONDITIONS*

| 1 | 2 |
|---|---|
| | |

## STEP 2A Determine the Pollution Mitigation Index for the proposed SuDS components

**This step requires the user to select the proposed SuDS components that will be used to treat runoff - before it is discharged to a receiving surface waterbody or downstream infiltration component**

**If the runoff is discharged directly to an infiltration component, without upstream treatment, select 'None' for each of the 3 SuDS components and move to Step 2B**

This step should be applied to evaluate the water quality protection provided by proposed SuDS components for discharges to receiving surface waters or downstream infiltration components (note: in England and Wales this will include components that allow any amount of infiltration, however small, even where infiltration is not specifically accounted for in the design).

If you have fewer than 3 components, select 'None' for the components that are not required

If the proposed component is bespoke and/or a proprietary treatment product and not generally described by the suggested components, then 'Proprietary treatment system' or 'User defined indices' should be selected and a description of the component and agreed user defined indices should be entered in the rows below the drop down lists

| | *SuDS Component Description* | *Pollution Mitigation Indices* Total Suspended Solids | Metals | Hydrocarbons |
|---|---|---|---|---|
| Select SuDS Component 1 (i.e. the upstream SuDS component) from the drop down list: → | None | | | |
| Select SuDS Component 2 (i.e. the second SuDS component in a series) from the drop down list: → | None | | | |
| Select SuDS Component 3 (i.e. the third SuDS component in a series) from the drop down list: → | None | | | |
| If the proposed SuDS components are bespoke/proprietary and/or the generic indices above are not considered appropriate, select 'Proprietary treatment system' or 'User defined indices' and enter component descriptions and agreed user defined indices in these rows: | | | | |
| | | | | |
| | | | | |
| | **Aggregated Surface Water Pollution Mitigation Index** | **0** | **0** | **0** |

*DESIGN CONDITIONS*

| 1 | 2 | 3 |
|---|---|---|
| | | |

Note: If the total aggregated mitigation index is > 1 (which is not a realistic outcome), then the outcome is fixed at ">0.95". In this scenario, the proposed components are likely to have a very high mitigation potential for reducing pollutant levels in the runoff and should be sufficient for any proposed land use (note: where risk assessment is required, this outcome would need more detailed verification).

**Is the runoff now discharged to an infiltration component?**

Yes ? Go to Step 2B
No ? Go to Step 2C

## STEP 2B Determine the Pollution Mitigation Index for the proposed Groundwater Protection

**This step requires the user to select the type of groundwater protection that is either part of the SuDS component or that lies between the component and the groundwater**

This step should be applied where a SuDS component is specifically designed to infiltrate runoff (note: in England and Wales this will include components that allow any amount of infiltration, however small, even where infiltration is not specifically accounted for in the design).

'Groundwater protection' describes the proposed depth of soil or other material through which runoff will flow between the runoff surface and the underlying groundwater.

Where the discharge is to surface waters and risks to groundwater need not be considered, select 'None'

If the proposed groundwater protection is bespoke and/or a proprietary product and not generally described by the suggested measures, then a description of the protection and agreed user defined indices should be entered in the row below the drop down list

| | | *Pollution Mitigation Indices* Total Suspended Solids | Metals | Hydrocarbons |
|---|---|---|---|---|
| Select type of groundwater protection from the drop down list: → | Pervious pavement underlain by 300 mm minimum depth of soils with good contamination attenuation potential | 0.7 | 0.6 | 0.7 |
| If the proposed groundwater protection is bespoke/proprietary and/or the generic indices above are not considered appropriate, select 'Proprietary product' or 'User defined indices' and enter a description of the protection and agreed user defined indices in this row: | | | | |
| | **Groundwater Protection Pollution Mitigation Index** | **0.7** | **0.6** | **0.7** |

*DESIGN CONDITIONS*

| 1 | 2 | 3 | 4 |
|---|---|---|---|
| All designs must include a minimum of 1 m unsaturated depth of subsoil or aquifer material between the infiltration surface and the maximum likely groundwater level. Infiltration components should always be preceded by upstream component(s) that trap(s) silt, or designed specifically to retain sediment in a separate lined zone, easily accessible for maintenance, such that the sediment will not be re-suspended in subsequent events | The permeable pavement must include a suitable filtration layer provides treatment and must include a geotextile at the base separating the foundation from the sub-grade. The underlying soils must provide good contaminant attenuation potential (eg as recommended in Sniffer 2008 (a) and (b) / Scott Wilson (2010) or other appropriate guidance). Alternative depth and soil combinations must provide equivalent protection to the underlying groundwater | | |

## STEP 2C Determine the Combined Pollution Mitigation Indices for the Runoff Area

**This is an automatic step which combines the proposed SuDS Pollution Mitigation Indices with any Groundwater Protection Pollution Mitigation Indices**

| | *Combined Pollution Mitigation Indices* Total Suspended Solids | Metals | Hydrocarbons |
|---|---|---|---|
| **Combined Pollution Mitigation Indices for the Runoff Area** | **0.7** | **0.6** | **0.7** |

Note: If the total aggregated mitigation index is > 1 (which is not a realistic outcome), then the outcome is fixed at ">0.95". In this scenario, the proposed components are likely to have a very high mitigation potential for reducing pollutant levels in the runoff and should be sufficient for any proposed land use (note: where risk assessment is required, this outcome would need more detailed verification).

## STEP 2D Determine Sufficiency of Pollution Mitigation Indices for Selected SuDS Components

**This is an automatic step which compares the Combined Pollution Mitigation Indices with the Land Use Hazard Indices, to determine whether the proposed components are sufficient to manage each pollutant category type**

When the combined mitigation index exceeds the land use pollution hazard index, then the proposed components are considered sufficient in providing pollution risk mitigation.

In England and Wales, where the discharge is to protected surface waters or groundwater, an additional treatment component (ie over and above that required for standard discharges), or other equivalent protection, is required that provides environmental protection in the event of an unexpected pollution event or poor system performance. Protected surface waters are those designated for drinking water abstraction. In England and Wales, protected groundwater resources are defined as Source Protection Zone 1. In Northern Ireland, a more precautionary approach may be required and this should be checked with the environmental regulator on a site by site basis.

| *Sufficiency of Pollution Mitigation Indices* Total Suspended Solids | Metals | Hydrocarbons |
|---|---|---|
| Sufficient | Sufficient | Sufficient |

*DESIGN CONDITIONS*

| 1 |
|---|
| Reference to local planning documents should also be made to identify any additional protection required for sites due to habitat conservation (see *Chapter 7 The SuDS design process*). The implications of developments on or within close proximity to an area with an environmental designation, such as a Site of Special Scientific Interest (SSSI), should be considered via consultation with relevant conservation bodies such as Natural England |

# SIMPLE INDEX APPROACH: TOOL

SEPA HR Wallingford ciria



1. The steps set out in the tool should be applied for each inflow or 'runoff area' (ie each impermeable surface area separately discharging to a SuDS component).

2. The supporting 'Design Conditions' stated by the tool must be fully considered and implemented in all cases.

3. Relevant design examples are included in the SuDS Manual Appendix C.

4. Each of the steps below are part of the process set out in the flowchart on Sheet 3.

5. Sheet 4 summarises the selections made below and indicates the acceptability of the proposed SuDS components.

| | | |
|---|---|---|
| [blue box] | DROP DOWN LIST | RELEVANT INPUTS NEED TO BE SELECTED FROM THESE LISTS, FOR EACH STEP |
| [green box] | USER ENTRY | USER ENTRY CELLS ARE ONLY REQUIRED WHERE INDICATED BY THE TOOL |

**STEP 1** Determine the Pollution Hazard Index for the runoff area discharging to the proposed SuDS scheme

**This step requires the user to select the appropriate land use type for the area from which the runoff is occurring**

If the land use varies across the 'runoff area', either:

- use the land use type with the highest Pollution Hazard Index
- apply the approach for each of the land use types to determine whether the proposed SuDS design is sufficient for all. If it is not, consider collecting more hazardous runoff separately and providing additional treatment.

If the generic land use types suggested are not applicable, select 'Other' and enter a description of the land use of the runoff area and agreed user defined indices in the row below the drop down lists.

| | Runoff Area Land Use Description | Hazard Level | Total Suspended Solids | Metals | Hydrocarbons |
|---|---|---|---|---|---|
| | | | *Pollution Hazard Indices* | | |
| Select land use type from the drop down list (or 'Other' if none applicable): → | Roads (excluding low traffic roads, highly frequented lorry approaches to industrial estates, trunk roads/motorways) | Medium | 0.7 | 0.6 | 0.7 |
| If the generic land use types in the drop down list above are not applicable, select 'Other' and enter a description of the land use of the runoff area and agreed user defined indices in this row: | | | | | |
| | **Landuse Pollution Hazard Index** | **Medium** | **0.7** | **0.6** | **0.7** |

*DESIGN CONDITIONS*

| 1 | 2 |
|---|---|
| | |

**STEP 2A** Determine the Pollution Mitigation Index for the proposed SuDS components

**This step requires the user to select the proposed SuDS components that will be used to treat runoff - before it is discharged to a receiving surface waterbody or downstream infiltration component**

**If the runoff is discharged directly to an infiltration component, without upstream treatment, select 'None' for each of the 3 SuDS components and move to Step 2B**

This step should be applied to evaluate the water quality protection provided by proposed SuDS components for discharges to receiving surface waters or downstream infiltration components (note: in England and Wales this will include components that allow any amount of infiltration, however small, even where infiltration is not specifically accounted for in the design).

If you have fewer than 3 components, select 'None' for the components that are not required

If the proposed component is bespoke and/or a proprietary treatment product and not generically described by the suggested components, then 'Proprietary treatment system' or 'User defined indices' should be selected and a description of the component and agreed user defined indices should be entered in the rows below the drop down lists

| | SuDS Component Description | Total Suspended Solids | Metals | Hydrocarbons |
|---|---|---|---|---|
| | | *Pollution Mitigation Indices* | | |
| Select SuDS Component 1 (i.e. the upstream SuDS component) from the drop down list: → | None | | | |
| Select SuDS Component 2 (i.e. the second SuDS component in a series) from the drop down list: → | None | | | |
| Select SuDS Component 3 (i.e. the third SuDS component in a series) from the drop down list: → | None | | | |
| If the proposed SuDS components are bespoke/proprietary and/or the generic indices above are not considered appropriate, select 'Proprietary treatment system' or 'User defined indices' and enter component descriptions and agreed user defined indices in these rows: | | | | |
| | **Aggregated Surface Water Pollution Mitigation Index** | **0** | **0** | **0** |

*DESIGN CONDITIONS*

| 1 | 2 | 3 |
|---|---|---|
| | | |

Note: If the total aggregated mitigation index is > 1 (which is not a realistic outcome), then the outcome is fixed at ">0.95". In this scenario, the proposed components are likely to have a very high mitigation potential for reducing pollutant levels in the runoff and should be sufficient for any proposed land use (note: where risk assessment is required, this outcome would need more detailed verification).

**Is the runoff now discharged to an infiltration component?**

**Yes ?** Go to Step 2B
**No ?** Go to Step 2C

**STEP 2B** Determine the Pollution Mitigation Index for the proposed Groundwater Protection

**This step requires the user to select the type of groundwater protection that is either part of the SuDS component or that lies between the component and the groundwater**

This step should be applied where a SuDS component is specifically designed to infiltrate runoff (note: in England and Wales this will include components that allow any amount of infiltration, however small, even where infiltration is not specifically accounted for in the design).

'Groundwater protection' describes the proposed depth of soil or other material through which runoff will flow between the runoff surface and the underlying groundwater.

Where the discharge is to surface waters and risks to groundwater need not be considered, select 'None'

If the proposed groundwater protection is bespoke and/or a proprietary product and not generically described by the suggested measures, then a description of the protection and agreed user defined indices should be entered in the row below the drop down list

| | | Total Suspended Solids | Metals | Hydrocarbons |
|---|---|---|---|---|
| | | *Pollution Mitigation Indices* | | |
| Select type of groundwater protection from the drop down list: → | Pervious pavement underlain by 300 mm minimum depth of soils with good contamination attenuation potential | 0.7 | 0.6 | 0.7 |
| If the proposed groundwater protection is bespoke/proprietary and/or the generic indices above are not considered appropriate, select 'Proprietary product' or 'User defined indices' and enter a description of the protection and agreed user defined indices in this row: | | | | |
| | **Groundwater Protection Pollution Mitigation Index** | **0.7** | **0.6** | **0.7** |

*DESIGN CONDITIONS*

| 1 | 2 | 3 | 4 |
|---|---|---|---|
| All designs must include a minimum of 1 m unsaturated depth of subsoil or aquifer material between the infiltration surface and the maximum likely groundwater level. Infiltration components should always be preceded by upstream component(s) that trap(s) silt, or designed specifically to retain sediment in a separate lined zone, easily accessible for maintenance, such that the sediment will not be re-suspended in subsequent events. | The permeable pavement must include a suitable filtration layer provides treatment and must include a geotextile at the base separating the foundation from the sub-grade. The underlying soils must provide good contaminant attenuation potential (eg as recommended in Sniffer 2008 (a) and (b) / Scott Wilson (2010) or other appropriate guidance). Alternative depth and soil combinations must provide equivalent protection to the underlying groundwater | | |

**STEP 2C** Determine the Combined Pollution Mitigation Indices for the Runoff Area

**This is an automatic step which combines the proposed SuDS Pollution Mitigation Indices with any Groundwater Protection Pollution Mitigation Indices**

| | Total Suspended Solids | Metals | Hydrocarbons |
|---|---|---|---|
| | *Combined Pollution Mitigation Indices* | | |
| **Combined Pollution Mitigation Indices for the Runoff Area** | **0.7** | **0.6** | **0.7** |

Note: If the total aggregated mitigation index is > 1 (which is not a realistic outcome), then the outcome is fixed at ">0.95". In this scenario, the proposed components are likely to have a very high mitigation potential for reducing pollutant levels in the runoff and should be sufficient for any proposed land use (note: where risk assessment is required, this outcome would need more detailed verification).

**STEP 2D** Determine Sufficiency of Pollution Mitigation Indices for Selected SuDS Components

**This is an automatic step which compares the Combined Pollution Mitigation Indices with the Land Use Hazard Indices, to determine whether the proposed components are sufficient to manage each pollutant category type**

When the combined mitigation index exceeds the land use pollution hazard index, then the proposed components are considered sufficient in providing pollution risk mitigation.

In England and Wales, where the discharge is to protected surface waters or groundwater, an additional treatment component (ie over and above that required for standard discharges), or other equivalent protection, is required that provides environmental protection in the event of an unexpected pollution event or poor system performance. Protected surface waters are those designated for drinking water abstraction. In England and Wales, protected groundwater resources are defined as Source Protection Zone 1. In Northern Ireland, a more precautionary approach may be required and this should be checked with the environmental regulator on a site by site basis.

| Total Suspended Solids | Metals | Hydrocarbons |
|---|---|---|
| *Sufficiency of Pollution Mitigation Indices* | | |
| Sufficient | Sufficient | Sufficient |

*DESIGN CONDITIONS*

| 1 |
|---|
| Reference to local planning documents should also be made to identify any additional protection required for sites due to habitat conservation (see *Chapter 7 The SuDS design process*). The implications of developments on or within close proximity to an area with an environmental designation, such as a Site of Special Scientific Interest (SSSI), should be considered via consultation with relevant conservation bodies such as Natural England |

## SIMPLE INDEX APPROACH: TOOL



1. The steps set out in the tool should be applied for each inflow or 'runoff area' (ie each impermeable surface area separately discharging to a SuDS component).

2. The supporting 'Design Conditions' stated by the tool must be fully considered and implemented in all cases.

3. Relevant design examples are included in the SuDS Manual Appendix C.

4. Each of the steps below are part of the process set out in the flowchart on Sheet 3.

5. Sheet 4 summarises the selections made below and indicates the acceptability of the proposed SuDS components.

| | | |
|---|---|---|
| [blue cell] | DROP DOWN LIST | RELEVANT INPUTS NEED TO BE SELECTED FROM THESE LISTS, FOR EACH STEP |
| [green cell] | USER ENTRY | USER ENTRY CELLS ARE ONLY REQUIRED WHERE INDICATED BY THE TOOL |

### STEP 1 Determine the Pollution Hazard Index for the runoff area discharging to the proposed SuDS scheme

**This step requires the user to select the appropriate land use type for the area from which the runoff is occurring**

If the land use varies across the 'runoff area', either:

- use the land use type with the highest Pollution Hazard Index
- apply the approach for each of the land use types to determine whether the proposed SuDS design is sufficient for all. If it is not, consider collecting more hazardous runoff separately and providing additional treatment.

If the generic land use types suggested are not applicable, select 'Other' and enter a description of the land use of the runoff area and agreed user defined indices in the row below the drop down lists.

| | Runoff Area Land Use Description | Hazard Level | Pollution Hazard Indices: Total Suspended Solids | Metals | Hydrocarbons |
|---|---|---|---|---|---|
| Select land use type from the drop down list (or 'Other' if none applicable): → | Residential parking | Low | 0.5 | 0.4 | 0.4 |
| If the generic land use types in the drop down list above are not applicable, select 'Other' and enter a description of the land use of the runoff area and agreed user defined indices in this row: | | | | | |
| | **Landuse Pollution Hazard Index** | **Low** | **0.5** | **0.4** | **0.4** |

*DESIGN CONDITIONS*

| 1 | 2 |
|---|---|
| | |

### STEP 2A Determine the Pollution Mitigation Index for the proposed SuDS components

**This step requires the user to select the proposed SuDS components that will be used to treat runoff - before it is discharged to a receiving surface waterbody or downstream infiltration component**

**If the runoff is discharged directly to an infiltration component, without upstream treatment, select 'None' for each of the 3 SuDS components and move to Step 2B**

This step should be applied to evaluate the water quality protection provided by proposed SuDS components for discharges to receiving surface waters or downstream infiltration components (note: in England and Wales this will include components that allow any amount of infiltration, however small, even where infiltration is not specifically accounted for in the design).

If you have fewer than 3 components, select 'None' for the components that are not required

If the proposed component is bespoke and/or a proprietary treatment product and not generally described by the suggested components, then 'Proprietary treatment system' or 'User defined indices' should be selected and a description of the component and agreed user defined indices should be entered in the rows below the drop down lists

| | SuDS Component Description | Pollution Mitigation Indices: Total Suspended Solids | Metals | Hydrocarbons |
|---|---|---|---|---|
| Select SuDS Component 1 (i.e. the upstream SuDS component) from the drop down list: → | None | | | |
| Select SuDS Component 2 (i.e. the second SuDS component in a series) from the drop down list: → | None | | | |
| Select SuDS Component 3 (i.e. the third SuDS component in a series) from the drop down list: → | None | | | |
| If the proposed SuDS components are bespoke/proprietary and/or the generic indices above are not considered appropriate, select 'Proprietary treatment system' or 'User defined indices' and enter component descriptions and agreed user defined indices in these rows: | | | | |
| | **Aggregated Surface Water Pollution Mitigation Index** | **0** | **0** | **0** |

*DESIGN CONDITIONS*

| 1 | 2 | 3 |
|---|---|---|
| | | |

Note: If the total aggregated mitigation index is > 1 (which is not a realistic outcome), then the outcome is fixed at ">0.95". In this scenario, the proposed components are likely to have a very high mitigation potential for reducing pollutant levels in the runoff and should be sufficient for any proposed land use (note: where risk assessment is required, this outcome would need more detailed verification).

**Is the runoff now discharged to an infiltration component?**

Yes ? Go to Step 2B
No ? Go to Step 2C

### STEP 2B Determine the Pollution Mitigation Index for the proposed Groundwater Protection

**This step requires the user to select the type of groundwater protection that is either part of the SuDS component or that lies between the component and the groundwater**

This step should be applied where a SuDS component is specifically designed to infiltrate runoff (note: in England and Wales this will include components that allow any amount of infiltration, however small, even where infiltration is not specifically accounted for in the design).

'Groundwater protection' describes the proposed depth of soil or other material through which runoff will flow between the runoff surface and the underlying groundwater.

Where the discharge is to surface waters and risks to groundwater need not be considered, select 'None'

If the proposed groundwater protection is bespoke and/or a proprietary product and not generally described by the suggested measures, then a description of the protection and agreed user defined indices should be entered in the row below the drop down list

| | | Pollution Mitigation Indices: Total Suspended Solids | Metals | Hydrocarbons |
|---|---|---|---|---|
| Select type of groundwater protection from the drop down list: → | Pervious pavement underlain by 300 mm minimum depth of soils with good contamination attenuation potential | 0.7 | 0.6 | 0.7 |
| If the proposed groundwater protection is bespoke/proprietary and/or the generic indices above are not considered appropriate, select 'Proprietary product' or 'User defined indices' and enter a description of the protection and agreed user defined indices in this row: | | | | |
| | **Groundwater Protection Pollution Mitigation Index** | **0.7** | **0.6** | **0.7** |

*DESIGN CONDITIONS*

| 1 | 2 | 3 | 4 |
|---|---|---|---|
| All designs must include a minimum of 1 m unsaturated depth of subsoil or aquifer material between the infiltration surface and the maximum likely groundwater level. Infiltration components should always be preceded by upstream component(s) that trap(s) silt, or designed specifically to retain sediment in a separate fixed zone, easily accessible for maintenance, such that the sediment will not be re-suspended in subsequent events | The permeable pavement must include a suitable filtration layer provides treatment and must include a geotextile at the base separating the foundation from the sub-grade. The underlying soils must provide good contaminant attenuation potential (eg as recommended in Sniffer 2008 (a) and (b) / Scott Wilson (2010) or other appropriate guidance). Alternative depth and soil combinations must provide equivalent protection to the underlying groundwater | | |

### STEP 2C Determine the Combined Pollution Mitigation Indices for the Runoff Area

**This is an automatic step which combines the proposed SuDS Pollution Mitigation Indices with any Groundwater Protection Pollution Mitigation Indices**

| | Combined Pollution Mitigation Indices: Total Suspended Solids | Metals | Hydrocarbons |
|---|---|---|---|
| **Combined Pollution Mitigation Indices for the Runoff Area** | **0.7** | **0.6** | **0.7** |

Note: If the total aggregated mitigation index is > 1 (which is not a realistic outcome), then the outcome is fixed at ">0.95". In this scenario, the proposed components are likely to have a very high mitigation potential for reducing pollutant levels in the runoff and should be sufficient for any proposed land use (note: where risk assessment is required, this outcome would need more detailed verification).

### STEP 2D Determine Sufficiency of Pollution Mitigation Indices for Selected SuDS Components

**This is an automatic step which compares the Combined Pollution Mitigation Indices with the Land Use Hazard Indices, to determine whether the proposed components are sufficient to manage each pollutant category type**

When the combined mitigation index exceeds the land use pollution hazard index, then the proposed components are considered sufficient in providing pollution risk mitigation.

In England and Wales, where the discharge is to protected surface waters or groundwater, an additional treatment component (ie over and above that required for standard discharges), or other equivalent protection, is required that provides environmental protection in the event of an unexpected pollution event or poor system performance. Protected surface waters are those designated for drinking water abstraction. In England and Wales, protected groundwater resources are defined as Source Protection Zone 1. In Northern Ireland, a more precautionary approach may be required and this should be checked with the environmental regulator on a site by site basis.

| Sufficiency of Pollution Mitigation Indices: Total Suspended Solids | Metals | Hydrocarbons |
|---|---|---|
| Sufficient | Sufficient | Sufficient |

*DESIGN CONDITIONS*

| 1 |
|---|
| Reference to local planning documents should also be made to identify any additional protection required for sites due to habitat conservation (see *Chapter 7 The SuDS design process*). The implications of developments on or within close proximity to an area with an environmental designation, such as a Site of Special Scientific Interest (SSSI), should be considered via consultation with relevant conservation bodies such as Natural England |

## SIMPLE INDEX APPROACH: TOOL

HRW shall not be liable for any direct or indirect damage claim, loss, cost, expense or liability howsoever arising out of the use or impossibility to use the tools, even when HRW has been informed of the possibility of the same. The user hereby indemnifies HRW from and against any damage claim, loss, expense or liability resulting from any action taken against HRW that is related in any way to the use of the tool or any reliance made in respect of the output of such use by any person whatsoever. HRW does not guarantee that the tool's functions meet the requirements of any person, nor that the tool is free from errors.

1. The steps set out in the tool should be applied for each inflow or 'runoff area' (ie each impermeable surface area separately discharging to a SuDS component).

2. The supporting 'Design Conditions' stated by the tool must be fully considered and implemented in all cases.

3. Relevant design examples are included in the SuDS Manual Appendix C.

4. Each of the steps below are part of the process set out in the flowchart on Sheet 3.

5. Sheet 4 summarises the selections made below and indicates the acceptability of the proposed SuDS components.

| | | |
|---|---|---|
| | DROP DOWN LIST | RELEVANT INPUTS NEED TO BE SELECTED FROM THESE LISTS, FOR EACH STEP |
| | USER ENTRY | USER ENTRY CELLS ARE ONLY REQUIRED WHERE INDICATED BY THE TOOL |

**STEP 1** Determine the Pollution Hazard Index for the runoff area discharging to the proposed SuDS scheme

**This step requires the user to select the appropriate land use type for the area from which the runoff is occurring**

If the land use varies across the 'runoff area', either:

- use the land use type with the highest Pollution Hazard Index
- apply the approach for each of the land use types to determine whether the proposed SuDS design is sufficient for all. If it is not, consider collecting more hazardous runoff separately and providing additional treatment.

If the generic land use types suggested are not applicable, select 'Other' and enter a description of the land use of the runoff area and agreed user defined indices in the row below the drop down lists.

| | Runoff Area Land Use Description | Hazard Level | Pollution Hazard Indices: Total Suspended Solids | Metals | Hydrocarbons | DESIGN CONDITIONS 1 | 2 |
|---|---|---|---|---|---|---|---|
| Select land use type from the drop down list (or 'Other' if none applicable): | Residential roofing | Very low | 0.2 | 0.2 | 0.05 | | |
| If the generic land use types in the drop down list above are not applicable, select 'Other' and enter a description of the land use of the runoff area and agreed user defined indices in this row: | | | | | | | |
| | Landuse Pollution Hazard Index | Very low | 0.2 | 0.2 | 0.05 | | |

**STEP 2A** Determine the Pollution Mitigation Index for the proposed SuDS components

**This step requires the user to select the proposed SuDS components that will be used to treat runoff - before it is discharged to a receiving surface waterbody or downstream infiltration component**

**If the runoff is discharged directly to an infiltration component, without upstream treatment, select 'None' for each of the 3 SuDS components and move to Step 2B**

This step should be applied to evaluate the water quality protection provided by proposed SuDS components for discharges to receiving surface waters or downstream infiltration components (note: in England and Wales this will include components that allow any amount of infiltration, however small, even where infiltration is not specifically accounted for in the design).

If you have fewer than 3 components, select 'None' for the components that are not required

If the proposed component is bespoke and/or a proprietary treatment product and not generically described by the suggested components, then 'Proprietary treatment system' or 'User defined indices' should be selected and a description of the component and agreed user defined indices should be entered in the rows below the drop down lists

| | SuDS Component Description | Pollution Mitigation Indices: Total Suspended Solids | Metals | Hydrocarbons | DESIGN CONDITIONS 1 | 2 | 3 |
|---|---|---|---|---|---|---|---|
| Select SuDS Component 1 (i.e. the upstream SuDS component) from the drop down list: | None | | | | | | |
| Select SuDS Component 2 (i.e. the second SuDS component in a series) from the drop down list: | None | | | | | | |
| Select SuDS Component 3 (i.e. the third SuDS component in a series) from the drop down list: | None | | | | | | |
| If the proposed SuDS components are bespoke/proprietary and/or the generic indices above are not considered appropriate, select 'Proprietary treatment system' or 'User defined indices' and enter component descriptions and agreed user defined indices in these rows: | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | Aggregated Surface Water Pollution Mitigation Index | 0 | 0 | 0 | | | |

Note: If the total aggregated mitigation index is > 1 (which is not a realistic outcome), then the outcome is fixed at ">0.95". In this scenario, the proposed components are likely to have a very high mitigation potential for reducing pollutant levels in the runoff and should be sufficient for any proposed land use (note: where risk assessment is required, this outcome would need more detailed verification).

**Is the runoff now discharged to an infiltration component?**

Yes ? Go to Step 2B
No ? Go to Step 2C

**STEP 2B** Determine the Pollution Mitigation Index for the proposed Groundwater Protection

**This step requires the user to select the type of groundwater protection that is either part of the SuDS component or that lies between the component and the groundwater**

This step should be applied where a SuDS component is specifically designed to infiltrate runoff (note: in England and Wales this will include components that allow any amount of infiltration, however small, even where infiltration is not specifically accounted for in the design).

'Groundwater protection' describes the proposed depth of soil or other material through which runoff will flow between the runoff surface and the underlying groundwater.

Where the discharge is to surface waters and risks to groundwater need not be considered, select 'None'

If the proposed groundwater protection is bespoke and/or a proprietary product and not generically described by the suggested measures, then a description of the protection and agreed user defined indices should be entered in the row below the drop down list

| | | Pollution Mitigation Indices: Total Suspended Solids | Metals | Hydrocarbons | DESIGN CONDITIONS 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|---|---|---|
| Select type of groundwater protection from the drop down list: | 300 mm minimum depth of soils with good contamination attenuation potential | 0.4 | 0.3 | 0.3 | All designs must include a minimum of 1 m unsaturated depth of subsoil or aquifer material between the infiltration surface and the maximum likely groundwater level. Infiltration components should always be preceded by upstream component(s) that trap(s) silt, or designed specifically to retain sediment in a separate lined zone, easily accessible for maintenance, such that the sediment will not be re-suspended in subsequent events | The underlying soils must provide good contaminant attenuation potential (eg as recommended in Sniffer 2008 (a) and (b) / Scott Wilson (2010) or other appropriate guidance). Alternative depth and soil combinations must provide equivalent protection to the underlying groundwater | | |
| If the proposed groundwater protection is bespoke/proprietary and/or the generic indices above are not considered appropriate, select 'Proprietary product' or 'User defined indices' and enter a description of the protection and agreed user defined indices in this row: | | | | | | | | |
| | Groundwater Protection Pollution Mitigation Index | 0.4 | 0.3 | 0.3 | | | | |

**STEP 2C** Determine the Combined Pollution Mitigation Indices for the Runoff Area

**This is an automatic step which combines the proposed SuDS Pollution Mitigation Indices with any Groundwater Protection Pollution Mitigation Indices**

| | Combined Pollution Mitigation Indices: Total Suspended Solids | Metals | Hydrocarbons |
|---|---|---|---|
| Combined Pollution Mitigation Indices for the Runoff Area | 0.4 | 0.3 | 0.3 |

Note: If the total aggregated mitigation index is > 1 (which is not a realistic outcome), then the outcome is fixed at ">0.95". In this scenario, the proposed components are likely to have a very high mitigation potential for reducing pollutant levels in the runoff and should be sufficient for any proposed land use (note: where risk assessment is required, this outcome would need more detailed verification).

**STEP 2D** Determine Sufficiency of Pollution Mitigation Indices for Selected SuDS Components

**This is an automatic step which compares the Combined Pollution Mitigation Indices with the Land Use Hazard Indices, to determine whether the proposed components are sufficient to manage each pollutant category type**

When the combined mitigation index exceeds the land use pollution hazard index, then the proposed components are considered sufficient in providing pollution risk mitigation.

In England and Wales, where the discharge is to protected surface waters or groundwater, an additional treatment component (ie over and above that required for standard discharges), or other equivalent protection, is required that provides environmental protection in the event of an unexpected pollution event or poor system performance. Protected surface waters are those designated for drinking water abstraction. In England and Wales, protected groundwater resources are defined as Source Protection Zone 1. In Northern Ireland, a more precautionary approach may be required and this should be checked with the environmental regulator on a site by site basis.

| Sufficiency of Pollution Mitigation Indices: Total Suspended Solids | Metals | Hydrocarbons | DESIGN CONDITIONS 1 |
|---|---|---|---|
| Sufficient | Sufficient | Sufficient | Reference to local planning documents should also be made to identify any additional protection required for sites due to habitat conservation (see *Chapter 7 The SuDS design process*). The implications of developments on or within close proximity to an area with an environmental designation, such as a Site of Special Scientific Interest (SSSI), should be considered via consultation with relevant conservation bodies such as Natural England |

# SIMPLE INDEX APPROACH: TOOL



1. The steps set out in the tool should be applied for each inflow or 'runoff area' (ie each impermeable surface area separately discharging to a SuDS component).

2. The supporting 'Design Conditions' stated by the tool must be fully considered and implemented in all cases.

3. Relevant design examples are included in the SuDS Manual Appendix C.

4. Each of the steps below are part of the process set out in the flowchart on Sheet 3.

5. Sheet 4 summarises the selections made below and indicates the acceptability of the proposed SuDS components.

| | | |
|---|---|---|
| [blue box] | DROP DOWN LIST | RELEVANT INPUTS NEED TO BE SELECTED FROM THESE LISTS, FOR EACH STEP |
| [green box] | USER ENTRY | USER ENTRY CELLS ARE ONLY REQUIRED WHERE INDICATED BY THE TOOL |

## STEP 1 Determine the Pollution Hazard Index for the runoff area discharging to the proposed SuDS scheme

**This step requires the user to select the appropriate land use type for the area from which the runoff is occurring**

If the land use varies across the 'runoff area', either:

- use the land use type with the highest Pollution Hazard Index
- apply the approach for each of the land use types to determine whether the proposed SuDS design is sufficient for all. If it is not, consider collecting more hazardous runoff separately and providing additional treatment.

If the generic land use types suggested are not applicable, select 'Other' and enter a description of the land use of the runoff area and agreed user defined indices in the row below the drop down lists.

| | *Runoff Area Land Use Description* | *Hazard Level* | Total Suspended Solids (*Pollution Hazard Indices*) | Metals | Hydrocarbons |
|---|---|---|---|---|---|
| Select land use type from the drop down list (or 'Other' if none applicable): → | Low traffic roads (e.g. residential roads and general access roads, < 300 traffic movements/day) | Low | 0.5 | 0.4 | 0.4 |
| If the generic land use types in the drop down list above are not applicable, select 'Other' and enter a description of the land use of the runoff area and agreed user defined indices in this row: | | | | | |
| | Landuse Pollution Hazard Index | Low | 0.5 | 0.4 | 0.4 |

*DESIGN CONDITIONS*

| 1 | 2 |
|---|---|
| | |

## STEP 2A Determine the Pollution Mitigation Index for the proposed SuDS components

**This step requires the user to select the proposed SuDS components that will be used to treat runoff - before it is discharged to a receiving surface waterbody or downstream infiltration component**

**If the runoff is discharged directly to an infiltration component, without upstream treatment, select 'None' for each of the 3 SuDS components and move to Step 2B**

This step should be applied to evaluate the water quality protection provided by proposed SuDS components for discharges to receiving surface waters or downstream infiltration components (note: in England and Wales this will include components that allow any amount of infiltration, however small, even where infiltration is not specifically accounted for in the design).

If you have fewer than 3 components, select 'None' for the components that are not required

If the proposed component is bespoke and/or a proprietary treatment product and not generically described by the suggested components, then 'Proprietary treatment system' or 'User defined indices' should be selected and a description of the component and agreed user defined indices should be entered in the rows below the drop down lists

| | *SuDS Component Description* | Total Suspended Solids (*Pollution Mitigation Indices*) | Metals | Hydrocarbons |
|---|---|---|---|---|
| Select SuDS Component 1 (i.e. the upstream SuDS component) from the drop down list: → | None | | | |
| Select SuDS Component 2 (i.e. the second SuDS component in a series) from the drop down list: → | None | | | |
| Select SuDS Component 3 (i.e. the third SuDS component in a series) from the drop down list: → | None | | | |
| If the proposed SuDS components are bespoke/proprietary and/or the generic indices above are not considered appropriate, select 'Proprietary treatment system' or 'User defined indices' and enter component descriptions and agreed user defined indices in these rows: | | | | |
| | Aggregated Surface Water Pollution Mitigation Index | 0 | 0 | 0 |

*DESIGN CONDITIONS*

| 1 | 2 | 3 |
|---|---|---|
| | | |

Note: If the total aggregated mitigation index is > 1 (which is not a realistic outcome), then the outcome is fixed at ">0.95". In this scenario, the proposed components are likely to have a very high mitigation potential for reducing pollutant levels in the runoff and should be sufficient for any proposed land use (note: where risk assessment is required, this outcome would need more detailed verification).

**Is the runoff now discharged to an infiltration component?**

Yes ? Go to Step 2B
No ? Go to Step 2C

## STEP 2B Determine the Pollution Mitigation Index for the proposed Groundwater Protection

**This step requires the user to select the type of groundwater protection that is either part of the SuDS component or that lies between the component and the groundwater**

This step should be applied where a SuDS component is specifically designed to infiltrate runoff (note: in England and Wales this will include components that allow any amount of infiltration, however small, even where infiltration is not specifically accounted for in the design).

'Groundwater protection' describes the proposed depth of soil or other material through which runoff will flow between the runoff surface and the underlying groundwater.

Where the discharge is to surface waters and risks to groundwater need not be considered, select 'None'

If the proposed groundwater protection is bespoke and/or a proprietary product and not generically described by the suggested measures, then a description of the protection and agreed user defined indices should be entered in the row below the drop down list

| | | Total Suspended Solids (*Pollution Mitigation Indices*) | Metals | Hydrocarbons |
|---|---|---|---|---|
| Select type of groundwater protection from the drop down list: → | Pervious pavement underlain by 300 mm minimum depth of soils with good contamination attenuation potential | 0.7 | 0.6 | 0.7 |
| If the proposed groundwater protection is bespoke/proprietary and/or the generic indices above are not considered appropriate, select 'Proprietary product' or 'User defined indices' and enter a description of the protection and agreed user defined indices in this row: | | | | |
| | Groundwater Protection Pollution Mitigation Index | 0.7 | 0.6 | 0.7 |

*DESIGN CONDITIONS*

| 1 | 2 | 3 | 4 |
|---|---|---|---|
| All designs must include a minimum of 1 m unsaturated depth of subsoil or aquifer material between the infiltration surface and the maximum likely groundwater level.<br>Infiltration components should always be preceded by upstream component(s) that trap(s) silt, or designed specifically to retain sediment in a separate lined zone, easily accessible for maintenance, such that the sediment will not be re-suspended in subsequent events. | The permeable pavement must include a suitable filtration layer provides treatment and must include a geotextile at the base separating the foundation from the sub-grade.<br>The underlying soils must provide good contaminant attenuation potential (eg as recommended in Sniffer 2008 (a) and (b) / Scott Wilson (2010) or other appropriate guidance).<br>Alternative depth and soil combinations must provide equivalent protection to the underlying groundwater | | |

## STEP 2C Determine the Combined Pollution Mitigation Indices for the Runoff Area

**This is an automatic step which combines the proposed SuDS Pollution Mitigation Indices with any Groundwater Protection Pollution Mitigation Indices**

| | Total Suspended Solids (*Combined Pollution Mitigation Indices*) | Metals | Hydrocarbons |
|---|---|---|---|
| Combined Pollution Mitigation Indices for the Runoff Area | 0.7 | 0.6 | 0.7 |

Note: If the total aggregated mitigation index is > 1 (which is not a realistic outcome), then the outcome is fixed at ">0.95". In this scenario, the proposed components are likely to have a very high mitigation potential for reducing pollutant levels in the runoff and should be sufficient for any proposed land use (note: where risk assessment is required, this outcome would need more detailed verification).

## STEP 2D Determine Sufficiency of Pollution Mitigation Indices for Selected SuDS Components

**This is an automatic step which compares the Combined Pollution Mitigation Indices with the Land Use Hazard Indices, to determine whether the proposed components are sufficient to manage each pollutant category type**

When the combined mitigation index exceeds the land use pollution hazard index, then the proposed components are considered sufficient in providing pollution risk mitigation.

In England and Wales, where the discharge is to protected surface waters or groundwater, an additional treatment component (ie over and above that required for standard discharges), or other equivalent protection, is required that provides environmental protection in the event of an unexpected pollution event or poor system performance. Protected surface waters are those designated for drinking water abstraction. In England and Wales, protected groundwater resources are defined as Source Protection Zone 1. In Northern Ireland, a more precautionary approach may be required and this should be checked with the environmental regulator on a site by site basis.

| Total Suspended Solids (*Sufficiency of Pollution Mitigation Indices*) | Metals | Hydrocarbons |
|---|---|---|
| Sufficient | Sufficient | Sufficient |

*DESIGN CONDITIONS*

| 1 |
|---|
| Reference to local planning documents should also be made to identify any additional protection required for sites due to habitat conservation (see *Chapter 7 The SuDS design process*). The implications of developments on or within close proximity to an area with an environmental designation, such as a Site of Special Scientific Interest (SSSI), should be considered via consultation with relevant conservation bodies such as Natural England |

# SIMPLE INDEX APPROACH: TOOL



1. The steps set out in the tool should be applied for each inflow or 'runoff area' (ie each impermeable surface area separately discharging to a SuDS component).

2. The supporting 'Design Conditions' stated by the tool must be fully considered and implemented in all cases.

3. Relevant design examples are included in the SuDS Manual Appendix C.

4. Each of the steps below are part of the process set out in the flowchart on Sheet 3.

5. Sheet 4 summarises the selections made below and indicates the acceptability of the proposed SuDS components.

| | | |
|---|---|---|
| [blue box] | DROP DOWN LIST | RELEVANT INPUTS NEED TO BE SELECTED FROM THESE LISTS, FOR EACH STEP |
| [green box] | USER ENTRY | USER ENTRY CELLS ARE ONLY REQUIRED WHERE INDICATED BY THE TOOL |

**STEP 1** **Determine the Pollution Hazard Index for the runoff area discharging to the proposed SuDS scheme**

**This step requires the user to select the appropriate land use type for the area from which the runoff is occurring**

If the land use varies across the 'runoff area', either:

- use the land use type with the highest Pollution Hazard Index
- apply the approach for each of the land use types to determine whether the proposed SuDS design is sufficient for all. If it is not, consider collecting more hazardous runoff separately and providing additional treatment.

If the generic land use types suggested are not applicable, select 'Other' and enter a description of the land use of the runoff area and agreed user defined indices in the row below the drop down lists.

| | *Runoff Area Land Use Description* | *Hazard Level* | Total Suspended Solids | Metals | Hydrocarbons |
|---|---|---|---|---|---|
| Select land use type from the drop down list (or 'Other' if none applicable): → | Non-residential parking with infrequent change (e.g. schools, offices, < 300 traffic movements a day) | Low | 0.5 | 0.4 | 0.4 |
| If the generic land use types in the drop down list above are not applicable, select 'Other' and enter a description of the land use of the runoff area and agreed user defined indices in this row: | | | | | |
| | **Landuse Pollution Hazard Index** | **Low** | **0.5** | **0.4** | **0.4** |

(*Pollution Hazard Indices*: Total Suspended Solids, Metals, Hydrocarbons)

*DESIGN CONDITIONS* 1 2

**STEP 2A** **Determine the Pollution Mitigation Index for the proposed SuDS components**

**This step requires the user to select the proposed SuDS components that will be used to treat runoff - before it is discharged to a receiving surface waterbody or downstream infiltration component**
**If the runoff is discharged directly to an infiltration component, without upstream treatment, select 'None' for each of the 3 SuDS components and move to Step 2B**

This step should be applied to evaluate the water quality protection provided by proposed SuDS components for discharges to receiving surface waters or downstream infiltration components (note: in England and Wales this will include components that allow any amount of infiltration, however small, even where infiltration is not specifically accounted for in the design).

If you have fewer than 3 components, select 'None' for the components that are not required

If the proposed component is bespoke and/or a proprietary treatment product and not generically described by the suggested components, then 'Proprietary treatment system' or 'User defined indices' should be selected and a description of the component and agreed user defined indices should be entered in the rows below the drop down lists

| | *SuDS Component Description* | Total Suspended Solids | Metals | Hydrocarbons |
|---|---|---|---|---|
| Select SuDS Component 1 (i.e. the upstream SuDS component) from the drop down list: → | None | | | |
| Select SuDS Component 2 (i.e. the second SuDS component in a series) from the drop down list: → | None | | | |
| Select SuDS Component 3 (i.e. the third SuDS component in a series) from the drop down list: → | None | | | |
| If the proposed SuDS components are bespoke/proprietary and/or the generic indices above are not considered appropriate, select 'Proprietary treatment system' or 'User defined indices' and enter component descriptions and agreed user defined indices in these rows: | | | | |
| | **Aggregated Surface Water Pollution Mitigation Index** | **0** | **0** | **0** |

(*Pollution Mitigation Indices*: Total Suspended Solids, Metals, Hydrocarbons)

*DESIGN CONDITIONS* 1 2 3

Note: If the total aggregated mitigation index is > 1 (which is not a realistic outcome), then the outcome is fixed at "=0.95". In this scenario, the proposed components are likely to have a very high mitigation potential for reducing pollutant levels in the runoff and should be sufficient for any proposed land use (note: where risk assessment is required, this outcome would need more detailed verification).

**Is the runoff now discharged to an infiltration component?**

Yes ? Go to Step 2B
No ? Go to Step 2C

**STEP 2B** **Determine the Pollution Mitigation Index for the proposed Groundwater Protection**

**This step requires the user to select the type of groundwater protection that is either part of the SuDS component or that lies between the component and the groundwater**

This step should be applied where a SuDS component is specifically designed to infiltrate runoff (note: in England and Wales this will include components that allow any amount of infiltration, however small, even where infiltration is not specifically accounted for in the design).

'Groundwater protection' describes the proposed depth of soil or other material through which runoff will flow between the runoff surface and the underlying groundwater.

Where the discharge is to surface waters and risks to groundwater need not be considered, select 'None'

If the proposed groundwater protection is bespoke and/or a proprietary product and not generically described by the suggested measures, then a description of the protection and agreed user defined indices should be entered in the row below the drop down list

| | | Total Suspended Solids | Metals | Hydrocarbons |
|---|---|---|---|---|
| Select type of groundwater protection from the drop down list: → | Pervious pavement underlain by 300 mm minimum depth of soils with good contaminant attenuation potential | 0.7 | 0.6 | 0.7 |
| If the proposed groundwater protection is bespoke/proprietary and/or the generic indices above are not considered appropriate, select 'Proprietary product' or 'User defined indices' and enter a description of the protection and agreed user defined indices in this row: | | | | |
| | **Groundwater Protection Pollution Mitigation Index** | **0.7** | **0.6** | **0.7** |

(*Pollution Mitigation Indices*: Total Suspended Solids, Metals, Hydrocarbons)

*DESIGN CONDITIONS*

| 1 | 2 | 3 | 4 |
|---|---|---|---|
| All designs must include a minimum of 1 m unsaturated depth of subsoil or aquifer material between the infiltration surface and the maximum likely groundwater level. Infiltration components should always be preceded by upstream component(s) that trap(s) silt, or designed specifically to retain sediment in a separate fixed zone, easily accessible for maintenance, such that the sediment will not be re-suspended in subsequent events | The permeable pavement must include a suitable filtration layer provides treatment and must include a geotextile at the base separating the foundation from the sub-grade. The underlying soils must provide good contaminant attenuation potential (eg as recommended in Sniffer 2008 (a) and (b) / Scott Wilson (2010) or other appropriate guidance). Alternative depth and soil combinations must provide equivalent protection to the underlying groundwater | | |

**STEP 2C** **Determine the Combined Pollution Mitigation Indices for the Runoff Area**

**This is an automatic step which combines the proposed SuDS Pollution Mitigation Indices with any Groundwater Protection Pollution Mitigation Indices**

| | Total Suspended Solids | Metals | Hydrocarbons |
|---|---|---|---|
| **Combined Pollution Mitigation Indices for the Runoff Area** | 0.7 | 0.6 | 0.7 |

(*Combined Pollution Mitigation Indices*: Total Suspended Solids, Metals, Hydrocarbons)

Note: If the total aggregated mitigation index is > 1 (which is not a realistic outcome), then the outcome is fixed at "=0.95". In this scenario, the proposed components are likely to have a very high mitigation potential for reducing pollutant levels in the runoff and should be sufficient for any proposed land use (note: where risk assessment is required, this outcome would need more detailed verification).

**STEP 2D** **Determine Sufficiency of Pollution Mitigation Indices for Selected SuDS Components**

**This is an automatic step which compares the Combined Pollution Mitigation Indices with the Land Use Hazard Indices, to determine whether the proposed components are sufficient to manage each pollutant category type**

When the combined mitigation index exceeds the land use pollution hazard index, then the proposed components are considered sufficient in providing pollution risk mitigation.

In England and Wales, where the discharge is to protected surface waters or groundwater, an additional treatment component (ie over and above that required for standard discharges), or other equivalent protection, is required that provides environmental protection in the event of an unexpected pollution event or poor system performance. Protected surface waters are those designated for drinking water abstraction. In England and Wales, protected groundwater resources are defined as Source Protection Zone 1. In Northern Ireland, a more precautionary approach may be required and this should be checked with the environmental regulator on a site by site basis.

*Sufficiency of Pollution Mitigation Indices*

| Total Suspended Solids | Metals | Hydrocarbons |
|---|---|---|
| Sufficient | Sufficient | Sufficient |

*DESIGN CONDITIONS*

1

Reference to local planning documents should also be made to identify any additional protection required for sites due to habitat conservation (see *Chapter 7 The SuDS design process*). The implications of developments on or within close proximity to an area with an environmental designation, such as a Site of Special Scientific Interest (SSSI), should be considered via consultation with relevant conservation bodies such as Natural England

# APPENDIX C – PROPOSED DRAINAGE STRATEGY LAYOUTS & DRAINAGE AREA PLANS


# CONTRACT DOCUMENT

Notes

| Rev | Description | Date |
|---|---|---|
| 5 | Site Plan and Drainage plan revised | 23.04.25 |
| 4 | Drainage plan revised according to client comments | 11 04 25 |
| 3 | Drainage plan revised to to suit new site plan | 08 04 25 |
| 2 | Drainage plan revised to LLFA comments<br>SA-2 & SA-5 soakaway corrected | 10.10 24 |
| 1 | Preliminary Issue | 20 06 24 |

Status:

Preliminary Issue

Scale : 1:250@A0
Date : Jan 2024
Drawn : IDL
Checked: RM
Approved: PT

Title :

Drainage Layout Sheet 1 of 2

Project :

Playing Fields Site, Saffron Walden

Drg. No: IDL/1229/07/101
Rev: 5
File Ref: 1229-07.dwg
Plot Ref: 1229-07-101 pdf

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# CONTRACT DOCUMENT

Notes


## Drainage Key

- Foul Water Drainage
- Surface Water Drainage
- RM Foul rising Main
- Land drainage (Shingle infill brought to the surface)
- Tree root protective barrier
- 80mm perforated drain/pipe for the sports pitch
- 150mm perforated drain/pipe for the sports pitch
- FWPS Private foul water package pump station
- Foul PCC manhole
- Polypropylene universal inspection chambers 1200 deep max, 450 dia, 100 inlet / outlet connections (6 no. max) or 150 inlet/outlet connections (4 no max) as detailed on private drainage construction details.
- R500 R600 Denotes 500/600 dia ppic, 3000mm deep max with 4 no. max inlets / outlets up to 150mm dia, as detailed on private drainage construction details. Where >1200mm deep, use reduced size access cover. Wavin Range 500/600 or similar.
- st Denotes 500/600 dia ppic silt trap with 300mm nominal sump, as messrs Polypipe Basic Silt Trap or similar.
- re Rodding eye same dia. as downstream drain
- Private access roads in Permeable Block Paving (System A full infiltration) Infiltration into ground
- Parking spaces and drives in Permeable Block Paving (System A full infiltration) infiltration into ground
- st st st Cellular soakaway system (SDS Geolight or similar approved)

| Rev | Description | Date |
|---|---|---|
| 5 | Site Plan and Drainage plan revised | 23 04 25 |
| 4 | Drainage plan revised according to client comments | 11.04.25 |
| 3 | Drainage plan revised to suit new site plan | 08.04.25 |
| 2 | Drainage plan revised to LLFA comments SA-2 & SA-5 soakaway corrected | 10.10.24 |
| 1 | Preliminary Issue | 20.06.24 |

Status: **Preliminary Issue**

Scale : 1:250@A0
Date : June 2024
Drawn : IDL
Checked: BM
Approved: PT

Title : **Drainage Layout Sheet 2 of 2**

Project : Playing Fields Site, Saffron Walden

| Drg. No: | Rev: | File Ref: | 1229-07 dwg |
|---|---|---|---|
| IDL/1229/07/104 | 5 | Plot Ref: | 1229-07-104.pdf |


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# CONTRACT DOCUMENT

Notes


## Drainage Area Key

- Approximately 430m2 + 43m2 **(10%UC)** = 473m2 area discharging to SA-01 Cellular Soakaway
  0.047 Ha area calculated in drainage calculation
- Approximately 1350m2 + 135m2 **(10%UC)** = 1485m2 area discharging to SA-02 Cellular Soakaway
  0.148 Ha area calculated in drainage calculation
- Approximately (825m2 flat area + 2023m2 Houses + 203m2 **(10% UC)** = 3051m2 area discharging to SA-03 Cellular Soakaway
  0.305 Ha area calculated in drainage calculation
- Approximately 1050m2 + 105 **(10%UC)** = 1155m2 area discharging to SA-04 Cellular Soakaway
  0.116 Ha area calculated in drainage calculation
- Approximately 470m2 + 47m2 **(10%UC)** = 517m2 area discharging to SA-05 Cellular Soakaway
  0 052 Ha area calculated in drainage calculation

Total Catchment area discharging to SA-01 TO SA-05 is 6680m2
0.668 Ha (**inc 10%UC**)

Note:-Approximately 0.855 Ha soft area (which is 60% of total Playing Field areas (1.425Ha) discharging to SA-06 Cellular Soakaway

- Private access roads in Permeable Block Paving (System A full infiltration) Infiltration into ground
  Approximate Area 3455m2
  0.346 Ha area calculated in drainage calculation
- Parking spaces and drives in Permeable Block Paving (System A full infiltration) infiltration into ground
  Approximate Area 4887m2
  0.489 Ha area calculated in drainage calculation

Total Catchment area for Porous paving is 0.835 Ha which is calculated in drainage calculation

Total Catchment area for 0.835 Ha + 0.668 Ha = 1.503 Ha (inc 10%UC)

| Rev | Description | Date |
|---|---|---|
| 6 | Site Plan and Drainage plan revised | 23.04 25 |
| 5 | Drainage plan revised according to client comments | 11.04 25 |
| 4 | Drainage plan revised to to suit new site plan | 07.04 25 |
| 3 | Urban Creep Area clarified and urban creep area clearly shown with catchment areas | 10.10 24 |
| 2 | Impermeable Area revised | 19 09 24 |
| 1 | Preliminary Issue | 20 06 24 |

Status: Preliminary Issue

Scale : 1:250@A0
Date : Jun 2024
Drawn : IDL
Checked: BM
Approved: PT

Title : Drainage Area Layout

Project : Playing Fields Site, Saffron Walden

Drg. No: IDL/1229/07/105
Rev: 6
File Ref: 1229-07-DAP.dwg
Plot Ref: 1229-07-105 pdf


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# CONTRACT DOCUMENT

## Notes

Refers to Keen Consultant's tree protection plan for the location of TPO and existing tree removal.

| Rev | Description | Date |
|---|---|---|
| 3 | Site plan and levels revised | 23 04 25 |
| 2 | Site plan and levels revised | 27 03 25 |
| 1 | Preliminary Issue | 20 06 24 |

Status:

Preliminary Issue

Scale : 1:250@A0

Date : Jan 2024

Drawn : IDL

Checked: BM

Approved: PT

Title :

Levels Layout Sheet 1 of 2

Project : Playing Fields Site, Saffron Walden

Drg. No: IDL/1229/05/101

Rev: 3

File Ref: 1229-05.dwg

Plot Ref: 1229-05-101 pdf

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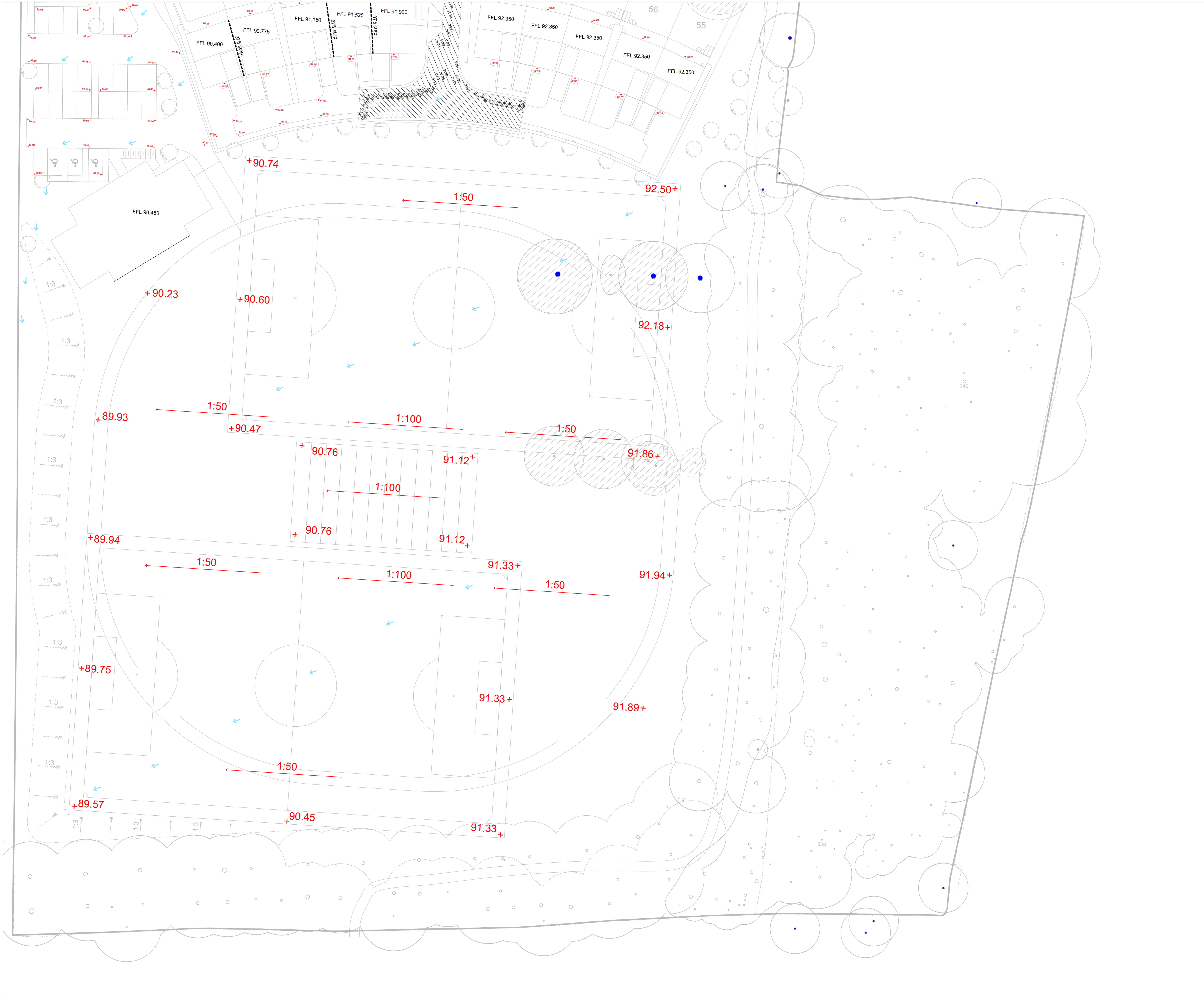
# CONTRACT DOCUMENT

Notes




Key

| | |
|---|---|
| + 90.00 | Proposed finished levels |
| + (90.00) | Interpolated existing spot levels |
| FFL 90.700 | Proposed finished floor level |
| + 90.34 | Existing (pre-demolition) levels |
| | Denotes Retaining Walls |
| | Exceedance flow route |
| 90.700 | Primary Contours |
| 90.725 | Secondary Contours |
| | Tree to be removed (Refers to Keen Consultant's tree protection plan for the location of TPO and existing tree removal) |

| Rev | Description | Date |
|---|---|---|
| 3 | Site plan and levels revised | 23.04.25 |
| 2 | Site plan and levels revised | 27 03 25 |
| 1 | Preliminary Issue | 20.06.24 |

Status: Preliminary Issue

Scale : 1:250@A0
Date : Jan 2024 | Checked: RM | Approved: PT
Drawn : IDL

Title : Levels Layout Sheet 2 of 2

Project : Playing Fields Site, Saffron Walden

Drg. No: IDL/1229/05/102 | Rev: 3 | File Ref: 1229-05 dwg | Plot Ref: 1229-05-102.pdf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# APPENDIX D – SURFACE WATER DRAINAGE CALCULATION

## Design Settings

| | | | |
|---|---|---|---|
| Rainfall Methodology | FEH-22 | Minimum Velocity (m/s) | 1.00 |
| Return Period (years) | 100 | Connection Type | Level Soffits |
| Additional Flow (%) | 0 | Minimum Backdrop Height (m) | 0.200 |
| CV | 1.000 | Preferred Cover Depth (m) | 1.200 |
| Time of Entry (mins) | 5.00 | Include Intermediate Ground | ✓ |
| Maximum Time of Concentration (mins) | 30.00 | Enforce best practice design rules | ✓ |
| Maximum Rainfall (mm/hr) | 150.0 | | |

## Simulation Settings

| | | | | | |
|---|---|---|---|---|---|
| Rainfall Methodology | FEH-22 | Skip Steady State | ✓ | 1 year (l/s) | 0.2 |
| Rainfall Events | Singular | Drain Down Time (mins) | 10080 | 30 year (l/s) | 0.6 |
| Summer CV | 0.950 | Additional Storage ($m^3$/ha) | 0.0 | 100 year (l/s) | 0.8 |
| Winter CV | 0.950 | Starting Level (m) | | Check Discharge Volume | x |
| Analysis Speed | Normal | Check Discharge Rate(s) | ✓ | | |

**Storm Durations**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 15 | 60 | 180 | 360 | 600 | 960 | 2160 | 4320 | 7200 | 10080 |
| 30 | 120 | 240 | 480 | 720 | 1440 | 2880 | 5760 | 8640 | |

| Return Period (years) | Climate Change (CC %) | Additional Area (A %) | Additional Flow (Q %) |
|---|---|---|---|
| 1 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 |
| 30 | 0 | 0 | 0 |
| 30 | 35 | 0 | 0 |
| 100 | 0 | 0 | 0 |
| 100 | 40 | 0 | 0 |

## Pre-development Discharge Rate

| | | | |
|---|---|---|---|
| Site Makeup | Greenfield | Growth Factor 30 year | 2.40 |
| Greenfield Method | IH124 | Growth Factor 100 year | 3.19 |
| Positively Drained Area (ha) | 0.047 | Betterment (%) | 0 |
| SAAR (mm) | 590 | QBar | 0.2 |
| Soil Index | 5 | Q 1 year (l/s) | 0.2 |
| SPR | 0.53 | Q 30 year (l/s) | 0.6 |
| Region | 6 | Q 100 year (l/s) | 0.8 |
| Growth Factor 1 year | 0.85 | | |

## Node SA1 Online Depth/Flow Control

| | | | | | |
|---|---|---|---|---|---|
| Flap Valve | x | Invert Level (m) | 85.650 | Design Flow (l/s) | 0.1 |
| Replaces Downstream Link | ✓ | Design Depth (m) | 2.500 | | |

| Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) |
|---|---|---|---|
| 0.001 | 0.000 | 2.500 | 0.000 |

## Node SA1 Soakaway Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.25200 | Invert Level (m) | 85.650 | Depth (m) | 0.750 |
| Side Inf Coefficient (m/hr) | 0.25200 | Time to half empty (mins) | 128 | Inf Depth (m) | |
| Safety Factor | 2.0 | Pit Width (m) | 2.000 | Number Required | 1 |
| Porosity | 0.95 | Pit Length (m) | 15.000 | | |

**Results for 1 year Critical Storm Duration. Lowest mass balance: 95.15%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 120 minute summer | SA1 | 74 | 85.714 | 0.064 | 2.4 | 1.8231 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | Outflow (l/s) | Discharge Vol (m³) |
|---|---|---|---|---|
| 120 minute summer | SA1 | Depth/Flow | 0.0 | 0.0 |
| 120 minute summer | SA1 | Infiltration | 1.1 | |

**Results for 2 year Critical Storm Duration. Lowest mass balance: 95.15%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 120 minute summer | SA1 | 80 | 85.766 | 0.116 | 3.7 | 3.2949 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | Outflow (l/s) | Discharge Vol (m³) |
|---|---|---|---|---|
| 120 minute summer | SA1 | Depth/Flow | 0.0 | 0.0 |
| 120 minute summer | SA1 | Infiltration | 1.2 | |

**Results for 30 year Critical Storm Duration.  Lowest mass balance: 95.15%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 120 minute summer | SA1 | 90 | 86.027 | 0.377 | 9.0 | 10.7521 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | Outflow (l/s) | Discharge Vol (m³) |
|---|---|---|---|---|
| 120 minute summer | SA1 | Depth/Flow | 0.0 | 0.0 |
| 120 minute summer | SA1 | Infiltration | 1.5 | |

**Results for 30 year +35% CC Critical Storm Duration. Lowest mass balance: 95.15%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 120 minute winter | SA1 | 98 | 86.195 | 0.545 | 8.3 | 15.5233 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | Outflow (l/s) | Discharge Vol (m³) |
|---|---|---|---|---|
| 120 minute winter | SA1 | Depth/Flow | 0.0 | 0.0 |
| 120 minute winter | SA1 | Infiltration | 1.7 | |

**Results for 100 year Critical Storm Duration. Lowest mass balance: 95.15%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 120 minute winter | SA1 | 96 | 86.148 | 0.498 | 7.7 | 14.1803 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | Outflow (l/s) | Discharge Vol (m³) |
|---|---|---|---|---|
| 120 minute winter | SA1 | Depth/Flow | 0.0 | 0.0 |
| 120 minute winter | SA1 | Infiltration | 1.6 | |

**Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 95.15%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 120 minute winter | SA1 | 100 | 86.462 | 0.812 | 10.8 | 21.3893 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | Outflow (l/s) | Discharge Vol (m³) |
|---|---|---|---|---|
| 120 minute winter | SA1 | Depth/Flow | 0.0 | 0.0 |
| 120 minute winter | SA1 | Infiltration | 1.9 | |

## Design Settings

| | | | |
|---|---|---|---|
| Rainfall Methodology | FEH-22 | Minimum Velocity (m/s) | 1.00 |
| Return Period (years) | 100 | Connection Type | Level Soffits |
| Additional Flow (%) | 0 | Minimum Backdrop Height (m) | 0.200 |
| CV | 1.000 | Preferred Cover Depth (m) | 1.200 |
| Time of Entry (mins) | 5.00 | Include Intermediate Ground | ✓ |
| Maximum Time of Concentration (mins) | 30.00 | Enforce best practice design rules | ✓ |
| Maximum Rainfall (mm/hr) | 150.0 | | |

## Simulation Settings

| | | | | | |
|---|---|---|---|---|---|
| Rainfall Methodology | FEH-22 | Skip Steady State | ✓ | 1 year (l/s) | 2.1 |
| Rainfall Events | Singular | Drain Down Time (mins) | 10080 | 30 year (l/s) | 5.9 |
| Summer CV | 0.950 | Additional Storage (m³/ha) | 0.0 | 100 year (l/s) | 7.8 |
| Winter CV | 0.950 | Starting Level (m) | | Check Discharge Volume | x |
| Analysis Speed | Normal | Check Discharge Rate(s) | ✓ | | |

**Storm Durations**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 15 | 60 | 180 | 360 | 600 | 960 | 2160 | 4320 | 7200 | 10080 |
| 30 | 120 | 240 | 480 | 720 | 1440 | 2880 | 5760 | 8640 | |

| Return Period (years) | Climate Change (CC %) | Additional Area (A %) | Additional Flow (Q %) |
|---|---|---|---|
| 1 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 |
| 30 | 0 | 0 | 0 |
| 30 | 35 | 0 | 0 |
| 100 | 0 | 0 | 0 |
| 100 | 40 | 0 | 0 |

## Pre-development Discharge Rate

| | | | |
|---|---|---|---|
| Site Makeup | Greenfield | Growth Factor 30 year | 2.40 |
| Greenfield Method | IH124 | Growth Factor 100 year | 3.19 |
| Positively Drained Area (ha) | 0.478 | Betterment (%) | 0 |
| SAAR (mm) | 590 | QBar | 2.5 |
| Soil Index | 5 | Q 1 year (l/s) | 2.1 |
| SPR | 0.53 | Q 30 year (l/s) | 5.9 |
| Region | 6 | Q 100 year (l/s) | 7.8 |
| Growth Factor 1 year | 0.85 | | |

## Node SA2 Online Depth/Flow Control

| | | | | | |
|---|---|---|---|---|---|
| Flap Valve | x | Invert Level (m) | 85.650 | Design Flow (l/s) | 0.1 |
| Replaces Downstream Link | ✓ | Design Depth (m) | 2.500 | | |

| Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) |
|---|---|---|---|
| 0.001 | 0.000 | 2.500 | 0.000 |

## Node SA2 Soakaway Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.25200 | Invert Level (m) | 85.650 | Depth (m) | 1.500 |
| Side Inf Coefficient (m/hr) | 0.25200 | Time to half empty (mins) | 188 | Inf Depth (m) | |
| Safety Factor | 2.0 | Pit Width (m) | 2.500 | Number Required | 1 |
| Porosity | 0.95 | Pit Length (m) | 24.000 | | |

**Results for 1 year Critical Storm Duration. Lowest mass balance: 97.99%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 180 minute summer | SA2 | 116 | 85.779 | 0.129 | 6.3 | 7.3626 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | Outflow (l/s) | Discharge Vol (m³) |
|---|---|---|---|---|
| 180 minute summer | SA2 | Depth/Flow | 0.0 | 0.0 |
| 180 minute summer | SA2 | Infiltration | 2.3 | |

**Results for 2 year Critical Storm Duration. Lowest mass balance: 97.99%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 180 minute summer | SA2 | 120 | 85.873 | 0.223 | 9.2 | 12.6928 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | Outflow (l/s) | Discharge Vol (m³) |
|---|---|---|---|---|
| 180 minute summer | SA2 | Depth/Flow | 0.0 | 0.0 |
| 180 minute summer | SA2 | Infiltration | 2.5 | |

**Results for 30 year Critical Storm Duration. Lowest mass balance: 97.99%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 120 minute winter | SA2 | 104 | 86.325 | 0.675 | 19.4 | 38.4840 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | Outflow (l/s) | Discharge Vol (m³) |
|---|---|---|---|---|
| 120 minute winter | SA2 | Depth/Flow | 0.0 | 0.0 |
| 120 minute winter | SA2 | Infiltration | 3.4 | |

**Results for 30 year +35% CC Critical Storm Duration. Lowest mass balance: 97.99%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol ($m^3$) | Flood ($m^3$) | Status |
|---|---|---|---|---|---|---|---|---|
| 180 minute winter | SA2 | 148 | 86.630 | 0.980 | 19.7 | 55.8548 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | Outflow (l/s) | Discharge Vol ($m^3$) |
|---|---|---|---|---|
| 180 minute winter | SA2 | Depth/Flow | 0.0 | 0.0 |
| 180 minute winter | SA2 | Infiltration | 3.9 | |

**Results for 100 year Critical Storm Duration. Lowest mass balance: 97.99%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 120 minute winter | SA2 | 116 | 86.542 | 0.892 | 24.3 | 50.8431 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | Outflow (l/s) | Discharge Vol (m³) |
|---|---|---|---|---|
| 120 minute winter | SA2 | Depth/Flow | 0.0 | 0.0 |
| 120 minute winter | SA2 | Infiltration | 3.8 | |

**Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 97.99%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 180 minute winter | SA2 | 152 | 86.981 | 1.331 | 25.3 | 75.8424 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | Outflow (l/s) | Discharge Vol (m³) |
|---|---|---|---|---|
| 180 minute winter | SA2 | Depth/Flow | 0.0 | 0.0 |
| 180 minute winter | SA2 | Infiltration | 4.6 | |

## Design Settings

| | | | |
|---|---|---|---|
| Rainfall Methodology | FEH-22 | Minimum Velocity (m/s) | 1.00 |
| Return Period (years) | 100 | Connection Type | Level Soffits |
| Additional Flow (%) | 0 | Minimum Backdrop Height (m) | 0.200 |
| CV | 1.000 | Preferred Cover Depth (m) | 1.200 |
| Time of Entry (mins) | 5.00 | Include Intermediate Ground | ✓ |
| Maximum Time of Concentration (mins) | 30.00 | Enforce best practice design rules | ✓ |
| Maximum Rainfall (mm/hr) | 150.0 | | |

## Simulation Settings

| | | | | | |
|---|---|---|---|---|---|
| Rainfall Methodology | FEH-22 | Skip Steady State | ✓ | 1 year (l/s) | 1.3 |
| Rainfall Events | Singular | Drain Down Time (mins) | 10080 | 30 year (l/s) | 3.8 |
| Summer CV | 0.950 | Additional Storage (m³/ha) | 0.0 | 100 year (l/s) | 5.0 |
| Winter CV | 0.950 | Starting Level (m) | | Check Discharge Volume | x |
| Analysis Speed | Normal | Check Discharge Rate(s) | ✓ | | |

**Storm Durations**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 15 | 60 | 180 | 360 | 600 | 960 | 2160 | 4320 | 7200 | 10080 |
| 30 | 120 | 240 | 480 | 720 | 1440 | 2880 | 5760 | 8640 | |

| Return Period (years) | Climate Change (CC %) | Additional Area (A %) | Additional Flow (Q %) |
|---|---|---|---|
| 1 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 |
| 30 | 0 | 0 | 0 |
| 30 | 35 | 0 | 0 |
| 100 | 0 | 0 | 0 |
| 100 | 40 | 0 | 0 |

## Pre-development Discharge Rate

| | | | |
|---|---|---|---|
| Site Makeup | Greenfield | Growth Factor 30 year | 2.40 |
| Greenfield Method | IH124 | Growth Factor 100 year | 3.19 |
| Positively Drained Area (ha) | 0.305 | Betterment (%) | 0 |
| SAAR (mm) | 590 | QBar | 1.6 |
| Soil Index | 5 | Q 1 year (l/s) | 1.3 |
| SPR | 0.53 | Q 30 year (l/s) | 3.8 |
| Region | 6 | Q 100 year (l/s) | 5.0 |
| Growth Factor 1 year | 0.85 | | |

## Node SA3 Online Depth/Flow Control

| | | | | | |
|---|---|---|---|---|---|
| Flap Valve | x | Invert Level (m) | 87.800 | Design Flow (l/s) | 0.1 |
| Replaces Downstream Link | ✓ | Design Depth (m) | 2.500 | | |

| Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) |
|---|---|---|---|
| 0.001 | 0.000 | 2.500 | 0.000 |

## Node SA3 Soakaway Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.06480 | Invert Level (m) | 87.800 | Depth (m) | 1.500 |
| Side Inf Coefficient (m/hr) | 0.06480 | Time to half empty (mins) | 896 | Inf Depth (m) | |
| Safety Factor | 2.0 | Pit Width (m) | 11.000 | Number Required | 1 |
| Porosity | 0.95 | Pit Length (m) | 16.500 | | |

**Results for 1 year Critical Storm Duration. Lowest mass balance: 99.03%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 360 minute summer | SA3 | 248 | 87.969 | 0.169 | 9.2 | 29.1712 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | Outflow (l/s) | Discharge Vol (m³) |
| --- | --- | --- | --- | --- |
| 360 minute summer | SA3 | Depth/Flow | 0.0 | 0.0 |
| 360 minute summer | SA3 | Infiltration | 1.7 | |

**Results for 2 year Critical Storm Duration. Lowest mass balance: 99.03%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 360 minute summer | SA3 | 272 | 88.059 | 0.259 | 12.9 | 44.6544 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | Outflow (l/s) | Discharge Vol (m³) |
|---|---|---|---|---|
| 360 minute summer | SA3 | Depth/Flow | 0.0 | 0.0 |
| 360 minute summer | SA3 | Infiltration | 1.8 | |

**Results for 30 year Critical Storm Duration. Lowest mass balance: 99.03%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 360 minute winter | SA3 | 352 | 88.483 | 0.683 | 17.8 | 117.7580 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | Outflow (l/s) | Discharge Vol (m³) |
|---|---|---|---|---|
| 360 minute winter | SA3 | Depth/Flow | 0.0 | 0.0 |
| 360 minute winter | SA3 | Infiltration | 2.0 | |

**Results for 30 year +35% CC Critical Storm Duration. Lowest mass balance: 99.03%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 360 minute winter | SA3 | 352 | 88.777 | 0.977 | 24.1 | 168.4978 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | Outflow (l/s) | Discharge Vol (m³) |
|---|---|---|---|---|
| 360 minute winter | SA3 | Depth/Flow | 0.0 | 0.0 |
| 360 minute winter | SA3 | Infiltration | 2.1 | |

**Results for 100 year Critical Storm Duration. Lowest mass balance: 99.03%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 360 minute winter | SA3 | 352 | 88.679 | 0.879 | 22.0 | 151.6296 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | Outflow (l/s) | Discharge Vol (m³) |
|---|---|---|---|---|
| 360 minute winter | SA3 | Depth/Flow | 0.0 | 0.0 |
| 360 minute winter | SA3 | Infiltration | 2.1 | |

**Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.03%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol ($m^3$) | Flood ($m^3$) | Status |
|---|---|---|---|---|---|---|---|---|
| 480 minute winter | SA3 | 472 | 89.099 | 1.299 | 24.1 | 223.9179 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | Outflow (l/s) | Discharge Vol ($m^3$) |
|---|---|---|---|---|
| 480 minute winter | SA3 | Depth/Flow | 0.0 | 0.0 |
| 480 minute winter | SA3 | Infiltration | 2.3 | |

## Design Settings

| | | | |
|---|---|---|---|
| Rainfall Methodology | FEH-22 | Minimum Velocity (m/s) | 1.00 |
| Return Period (years) | 100 | Connection Type | Level Soffits |
| Additional Flow (%) | 0 | Minimum Backdrop Height (m) | 0.200 |
| CV | 1.000 | Preferred Cover Depth (m) | 1.200 |
| Time of Entry (mins) | 5.00 | Include Intermediate Ground | ✓ |
| Maximum Time of Concentration (mins) | 30.00 | Enforce best practice design rules | ✓ |
| Maximum Rainfall (mm/hr) | 150.0 | | |

## Simulation Settings

| | | | | | |
|---|---|---|---|---|---|
| Rainfall Methodology | FEH-22 | Skip Steady State | ✓ | 1 year (l/s) | 0.5 |
| Rainfall Events | Singular | Drain Down Time (mins) | 10080 | 30 year (l/s) | 1.4 |
| Summer CV | 0.950 | Additional Storage (m³/ha) | 0.0 | 100 year (l/s) | 1.9 |
| Winter CV | 0.950 | Starting Level (m) | | Check Discharge Volume | x |
| Analysis Speed | Normal | Check Discharge Rate(s) | ✓ | | |

**Storm Durations**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 15 | 60 | 180 | 360 | 600 | 960 | 2160 | 4320 | 7200 | 10080 |
| 30 | 120 | 240 | 480 | 720 | 1440 | 2880 | 5760 | 8640 | |

| Return Period (years) | Climate Change (CC %) | Additional Area (A %) | Additional Flow (Q %) |
|---|---|---|---|
| 1 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 |
| 30 | 0 | 0 | 0 |
| 30 | 35 | 0 | 0 |
| 100 | 40 | 0 | 0 |

## Pre-development Discharge Rate

| | | | |
|---|---|---|---|
| Site Makeup | Greenfield | Growth Factor 30 year | 2.40 |
| Greenfield Method | IH124 | Growth Factor 100 year | 3.19 |
| Positively Drained Area (ha) | 0.116 | Betterment (%) | 0 |
| SAAR (mm) | 590 | QBar | 0.6 |
| Soil Index | 5 | Q 1 year (l/s) | 0.5 |
| SPR | 0.53 | Q 30 year (l/s) | 1.4 |
| Region | 6 | Q 100 year (l/s) | 1.9 |
| Growth Factor 1 year | 0.85 | | |

## Node SA4 Online Depth/Flow Control

| | | | | | |
|---|---|---|---|---|---|
| Flap Valve | x | Invert Level (m) | 88.000 | Design Flow (l/s) | 0.1 |
| Replaces Downstream Link | ✓ | Design Depth (m) | 2.500 | | |

| Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) |
|---|---|---|---|
| 0.001 | 0.000 | 2.500 | 0.000 |

## Node SA4 Soakaway Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.10440 | Invert Level (m) | 88.000 | Depth (m) | 0.750 |
| Side Inf Coefficient (m/hr) | 0.10440 | Time to half empty (mins) | 228 | Inf Depth (m) | |
| Safety Factor | 2.0 | Pit Width (m) | 4.000 | Number Required | 1 |
| Porosity | 0.95 | Pit Length (m) | 35.000 | | |

**Results for 1 year Critical Storm Duration. Lowest mass balance: 97.20%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 180 minute summer | SA4 | 112 | 88.052 | 0.052 | 5.0 | 6.8786 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | Outflow (l/s) | Discharge Vol (m³) |
|---|---|---|---|---|
| 180 minute summer | SA4 | Depth/Flow | 0.0 | 0.0 |
| 180 minute summer | SA4 | Infiltration | 2.1 | |

**Results for 2 year Critical Storm Duration. Lowest mass balance: 97.20%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 180 minute summer | SA4 | 120 | 88.083 | 0.083 | 7.2 | 10.9955 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | Outflow (l/s) | Discharge Vol (m³) |
|---|---|---|---|---|
| 180 minute summer | SA4 | Depth/Flow | 0.0 | 0.0 |
| 180 minute summer | SA4 | Infiltration | 2.1 | |

**Results for 30 year Critical Storm Duration. Lowest mass balance: 97.20%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 180 minute summer | SA4 | 140 | 88.241 | 0.241 | 16.6 | 32.0679 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | Outflow (l/s) | Discharge Vol (m³) |
|---|---|---|---|---|
| 180 minute summer | SA4 | Depth/Flow | 0.0 | 0.0 |
| 180 minute summer | SA4 | Infiltration | 2.3 | |

**Results for 30 year +35% CC Critical Storm Duration. Lowest mass balance: 97.20%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 180 minute winter | SA4 | 172 | 88.353 | 0.353 | 15.4 | 46.9457 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | Outflow (l/s) | Discharge Vol (m³) |
|---|---|---|---|---|
| 180 minute winter | SA4 | Depth/Flow | 0.0 | 0.0 |
| 180 minute winter | SA4 | Infiltration | 2.4 | |

**Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 97.20%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 180 minute winter | SA4 | 176 | 88.486 | 0.486 | 19.9 | 64.6004 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | Outflow (l/s) | Discharge Vol (m³) |
|---|---|---|---|---|
| 180 minute winter | SA4 | Depth/Flow | 0.0 | 0.0 |
| 180 minute winter | SA4 | Infiltration | 2.6 | |

## Design Settings

| | | | |
|---|---|---|---|
| Rainfall Methodology | FEH-22 | Minimum Velocity (m/s) | 1.00 |
| Return Period (years) | 100 | Connection Type | Level Soffits |
| Additional Flow (%) | 0 | Minimum Backdrop Height (m) | 0.200 |
| CV | 1.000 | Preferred Cover Depth (m) | 1.200 |
| Time of Entry (mins) | 5.00 | Include Intermediate Ground | ✓ |
| Maximum Time of Concentration (mins) | 30.00 | Enforce best practice design rules | ✓ |
| Maximum Rainfall (mm/hr) | 150.0 | | |

## Simulation Settings

| | | | | | |
|---|---|---|---|---|---|
| Rainfall Methodology | FEH-22 | Skip Steady State | ✓ | 1 year (l/s) | 0.2 |
| Rainfall Events | Singular | Drain Down Time (mins) | 10080 | 30 year (l/s) | 0.6 |
| Summer CV | 0.950 | Additional Storage (m³/ha) | 0.0 | 100 year (l/s) | 0.9 |
| Winter CV | 0.950 | Starting Level (m) | | Check Discharge Volume | x |
| Analysis Speed | Normal | Check Discharge Rate(s) | ✓ | | |

**Storm Durations**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 15 | 60 | 180 | 360 | 600 | 960 | 2160 | 4320 | 7200 | 10080 |
| 30 | 120 | 240 | 480 | 720 | 1440 | 2880 | 5760 | 8640 | |

| Return Period (years) | Climate Change (CC %) | Additional Area (A %) | Additional Flow (Q %) |
|---|---|---|---|
| 1 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 |
| 30 | 0 | 0 | 0 |
| 30 | 35 | 0 | 0 |
| 100 | 0 | 0 | 0 |
| 100 | 40 | 0 | 0 |

## Pre-development Discharge Rate

| | | | |
|---|---|---|---|
| Site Makeup | Greenfield | Growth Factor 30 year | 2.40 |
| Greenfield Method | IH124 | Growth Factor 100 year | 3.19 |
| Positively Drained Area (ha) | 0.052 | Betterment (%) | 0 |
| SAAR (mm) | 590 | QBar | 0.3 |
| Soil Index | 5 | Q 1 year (l/s) | 0.2 |
| SPR | 0.53 | Q 30 year (l/s) | 0.6 |
| Region | 6 | Q 100 year (l/s) | 0.9 |
| Growth Factor 1 year | 0.85 | | |

## Node SA5 Online Depth/Flow Control

| | | | | | |
|---|---|---|---|---|---|
| Flap Valve | x | Invert Level (m) | 86.400 | Design Flow (l/s) | 0.1 |
| Replaces Downstream Link | ✓ | Design Depth (m) | 2.500 | | |

| Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) |
|---|---|---|---|
| 0.001 | 0.000 | 2.500 | 0.000 |

## Node SA5 Soakaway Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.10440 | Invert Level (m) | 86.400 | Depth (m) | 0.750 |
| Side Inf Coefficient (m/hr) | 0.10440 | Time to half empty (mins) | 280 | Inf Depth (m) | |
| Safety Factor | 2.0 | Pit Width (m) | 3.000 | Number Required | 1 |
| Porosity | 0.95 | Pit Length (m) | 15.000 | | |

**Results for 1 year Critical Storm Duration. Lowest mass balance: 95.26%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 240 minute summer | SA5 | 152 | 86.479 | 0.079 | 2.0 | 3.3843 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | Outflow (l/s) | Discharge Vol (m³) |
|---|---|---|---|---|
| 240 minute summer | SA5 | Depth/Flow | 0.0 | 0.0 |
| 240 minute summer | SA5 | Infiltration | 0.7 | |

**Results for 2 year Critical Storm Duration. Lowest mass balance: 95.26%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 240 minute summer | SA5 | 160 | 86.527 | 0.127 | 2.8 | 5.4180 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | Outflow (l/s) | Discharge Vol (m³) |
| --- | --- | --- | --- | --- |
| 240 minute summer | SA5 | Depth/Flow | 0.0 | 0.0 |
| 240 minute summer | SA5 | Infiltration | 0.7 | |

**Results for 30 year Critical Storm Duration. Lowest mass balance: 95.26%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 180 minute winter | SA5 | 172 | 86.763 | 0.363 | 5.1 | 15.5034 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | Outflow (l/s) | Discharge Vol (m³) |
|---|---|---|---|---|
| 180 minute winter | SA5 | Depth/Flow | 0.0 | 0.0 |
| 180 minute winter | SA5 | Infiltration | 0.8 | |

**Results for 30 year +35% CC Critical Storm Duration. Lowest mass balance: 95.26%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 180 minute winter | SA5 | 176 | 86.926 | 0.526 | 6.9 | 22.4934 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | Outflow (l/s) | Discharge Vol (m³) |
|---|---|---|---|---|
| 180 minute winter | SA5 | Depth/Flow | 0.0 | 0.0 |
| 180 minute winter | SA5 | Infiltration | 0.9 | |

**Results for 100 year Critical Storm Duration. Lowest mass balance: 95.26%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 180 minute winter | SA5 | 176 | 86.875 | 0.475 | 6.4 | 20.2986 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | Outflow (l/s) | Discharge Vol (m³) |
|---|---|---|---|---|
| 180 minute winter | SA5 | Depth/Flow | 0.0 | 0.0 |
| 180 minute winter | SA5 | Infiltration | 0.9 | |

**Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 95.26%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 240 minute winter | SA5 | 232 | 87.109 | 0.709 | 7.2 | 30.3093 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | Outflow (l/s) | Discharge Vol (m³) |
|---|---|---|---|---|
| 240 minute winter | SA5 | Depth/Flow | 0.0 | 0.0 |
| 240 minute winter | SA5 | Infiltration | 1.0 | |

## Design Settings

| | | | |
|---|---|---|---|
| Rainfall Methodology | FEH-22 | Minimum Velocity (m/s) | 1.00 |
| Return Period (years) | 100 | Connection Type | Level Soffits |
| Additional Flow (%) | 0 | Minimum Backdrop Height (m) | 0.200 |
| CV | 1.000 | Preferred Cover Depth (m) | 1.200 |
| Time of Entry (mins) | 5.00 | Include Intermediate Ground | ✓ |
| Maximum Time of Concentration (mins) | 30.00 | Enforce best practice design rules | ✓ |
| Maximum Rainfall (mm/hr) | 150.0 | | |

## Simulation Settings

| | | | | | |
|---|---|---|---|---|---|
| Rainfall Methodology | FEH-22 | Skip Steady State | ✓ | 1 year (l/s) | 6.5 |
| Rainfall Events | Singular | Drain Down Time (mins) | 10080 | 30 year (l/s) | 18.5 |
| Summer CV | 0.950 | Additional Storage (m³/ha) | 20.0 | 100 year (l/s) | 24.6 |
| Winter CV | 0.950 | Starting Level (m) | | Check Discharge Volume | x |
| Analysis Speed | Detailed | Check Discharge Rate(s) | ✓ | | |

**Storm Durations**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 15 | 60 | 180 | 360 | 600 | 960 | 2160 | 4320 | 7200 | 10080 |
| 30 | 120 | 240 | 480 | 720 | 1440 | 2880 | 5760 | 8640 | |

| Return Period (years) | Climate Change (CC %) | Additional Area (A %) | Additional Flow (Q %) |
|---|---|---|---|
| 1 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 |
| 30 | 0 | 0 | 0 |
| 100 | 0 | 0 | 0 |
| 100 | 40 | 0 | 0 |

## Pre-development Discharge Rate

| | | | |
|---|---|---|---|
| Site Makeup | Greenfield | Growth Factor 30 year | 2.40 |
| Greenfield Method | IH124 | Growth Factor 100 year | 3.19 |
| Positively Drained Area (ha) | 1.500 | Betterment (%) | 0 |
| SAAR (mm) | 590 | QBar | 7.7 |
| Soil Index | 5 | Q 1 year (l/s) | 6.5 |
| SPR | 0.53 | Q 30 year (l/s) | 18.5 |
| Region | 6 | Q 100 year (l/s) | 24.6 |
| Growth Factor 1 year | 0.85 | | |

## Node SA6 Online Depth/Flow Control

| | | | | | |
|---|---|---|---|---|---|
| Flap Valve | x | Invert Level (m) | 85.750 | Design Flow (l/s) | 0.1 |
| Replaces Downstream Link | ✓ | Design Depth (m) | 2.500 | | |

| Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) |
|---|---|---|---|
| 0.001 | 0.000 | 2.500 | 0.000 |

## Node SA6 Soakaway Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.10440 | Invert Level (m) | 85.750 | Depth (m) | 1.500 |
| Side Inf Coefficient (m/hr) | 0.10440 | Time to half empty (mins) | 776 | Inf Depth (m) | |
| Safety Factor | 2.0 | Pit Width (m) | 10.000 | Number Required | 1 |
| Porosity | 0.95 | Pit Length (m) | 19.000 | | |

**Node SA6 Soakaway Storage Structure**

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.10440 | Invert Level (m) | 89.000 | Depth (m) | 0.500 |
| Side Inf Coefficient (m/hr) | 0.10440 | Time to half empty (mins) | 40 | Inf Depth (m) | |
| Safety Factor | 2.0 | Pit Width (m) | 0.250 | Number Required | 1 |
| Porosity | 0.33 | Pit Length (m) | 390.000 | | |

**Node SA6 Soakaway Storage Structure**

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.10440 | Invert Level (m) | 89.000 | Depth (m) | 0.450 |
| Side Inf Coefficient (m/hr) | 0.10440 | Time to half empty (mins) | 40 | Inf Depth (m) | |
| Safety Factor | 2.0 | Pit Width (m) | 0.150 | Number Required | 1 |
| Porosity | 0.33 | Pit Length (m) | 5337.000 | | |

**Results for 1 year Critical Storm Duration. Lowest mass balance: 98.67%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 360 minute summer | SA6 | 288 | 86.242 | 0.492 | 25.9 | 90.9824 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | Outflow (l/s) | Discharge Vol (m³) |
|---|---|---|---|---|
| 360 minute summer | SA6 | Depth/Flow | 0.0 | 0.0 |
| 360 minute summer | SA6 | Infiltration | 3.2 | |
| 360 minute summer | SA6 | Infiltration | 0.0 | |
| 360 minute summer | SA6 | Infiltration | 0.0 | |

**Results for 2 year Critical Storm Duration. Lowest mass balance: 98.67%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 360 minute winter | SA6 | 344 | 86.516 | 0.766 | 23.5 | 141.6213 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | Outflow (l/s) | Discharge Vol (m³) |
|---|---|---|---|---|
| 360 minute winter | SA6 | Depth/Flow | 0.0 | 0.0 |
| 360 minute winter | SA6 | Infiltration | 3.4 | |
| 360 minute winter | SA6 | Infiltration | 0.0 | |
| 360 minute winter | SA6 | Infiltration | 0.0 | |

**Results for 30 year Critical Storm Duration. Lowest mass balance: 98.67%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 240 minute winter | SA6 | 176 | 89.042 | 3.292 | 68.5 | 297.9203 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | Outflow (l/s) | Discharge Vol (m³) |
|---|---|---|---|---|
| 240 minute winter | SA6 | Depth/Flow | 0.0 | 0.0 |
| 240 minute winter | SA6 | Infiltration | 4.0 | |
| 240 minute winter | SA6 | Infiltration | 1.7 | |
| 240 minute winter | SA6 | Infiltration | 16.3 | |

**Results for 100 year Critical Storm Duration. Lowest mass balance: 98.67%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 240 minute summer | SA6 | 156 | 89.139 | 3.389 | 127.5 | 327.1748 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | Outflow (l/s) | Discharge Vol (m³) |
|---|---|---|---|---|
| 240 minute summer | SA6 | Depth/Flow | 0.0 | 0.0 |
| 240 minute summer | SA6 | Infiltration | 4.0 | |
| 240 minute summer | SA6 | Infiltration | 3.0 | |
| 240 minute summer | SA6 | Infiltration | 33.2 | |

**Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 98.67%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 180 minute summer | SA6 | 116 | 89.389 | 3.639 | 212.7 | 402.1838 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | Outflow (l/s) | Discharge Vol (m³) |
|---|---|---|---|---|
| 180 minute summer | SA6 | Depth/Flow | 0.0 | 0.0 |
| 180 minute summer | SA6 | Infiltration | 4.0 | |
| 180 minute summer | SA6 | Infiltration | 5.8 | |
| 180 minute summer | SA6 | Infiltration | 71.8 | |

## Design Settings

| | | | |
|---|---|---|---|
| Rainfall Methodology | FEH-22 | Minimum Velocity (m/s) | 1.00 |
| Return Period (years) | 100 | Connection Type | Level Soffits |
| Additional Flow (%) | 0 | Minimum Backdrop Height (m) | 0.200 |
| CV | 1.000 | Preferred Cover Depth (m) | 1.200 |
| Time of Entry (mins) | 5.00 | Include Intermediate Ground | ✓ |
| Maximum Time of Concentration (mins) | 30.00 | Enforce best practice design rules | ✓ |
| Maximum Rainfall (mm/hr) | 50.0 | | |

## Nodes

| Name | Area (ha) | Cover Level (m) | Easting (m) | Northing (m) | Depth (m) |
|---|---|---|---|---|---|
| PP | 0.835 | 84.000 | 554102.536 | 237747.849 | 0.350 |

## Simulation Settings

| | | | | | |
|---|---|---|---|---|---|
| Rainfall Methodology | FEH-22 | Skip Steady State | ✓ | 1 year (l/s) | 1.5 |
| Rainfall Events | Singular | Drain Down Time (mins) | 10080 | 30 year (l/s) | 4.3 |
| Summer CV | 0.950 | Additional Storage (m³/ha) | 0.0 | 100 year (l/s) | 5.8 |
| Winter CV | 0.950 | Starting Level (m) | | Check Discharge Volume | x |
| Analysis Speed | Normal | Check Discharge Rate(s) | ✓ | | |

**Storm Durations**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 15 | 60 | 180 | 360 | 600 | 960 | 2160 | 4320 | 7200 | 10080 |
| 30 | 120 | 240 | 480 | 720 | 1440 | 2880 | 5760 | 8640 | |

| Return Period (years) | Climate Change (CC %) | Additional Area (A %) | Additional Flow (Q %) |
|---|---|---|---|
| 2 | 0 | 0 | 0 |
| 30 | 0 | 0 | 0 |
| 30 | 35 | 0 | 0 |
| 100 | 0 | 0 | 0 |
| 100 | 40 | 0 | 0 |

## Pre-development Discharge Rate

| | | | |
|---|---|---|---|
| Site Makeup | Greenfield | Growth Factor 30 year | 2.40 |
| Greenfield Method | IH124 | Growth Factor 100 year | 3.19 |
| Positively Drained Area (ha) | 0.353 | Betterment (%) | 0 |
| SAAR (mm) | 590 | QBar | 1.8 |
| Soil Index | 5 | Q 1 year (l/s) | 1.5 |
| SPR | 0.53 | Q 30 year (l/s) | 4.3 |
| Region | 6 | Q 100 year (l/s) | 5.8 |
| Growth Factor 1 year | 0.85 | | |

## Node PP Online Depth/Flow Control

| | | | | | |
|---|---|---|---|---|---|
| Flap Valve | x | Invert Level (m) | 83.650 | Design Flow (l/s) | 0.1 |
| Replaces Downstream Link | ✓ | Design Depth (m) | 2.500 | | |

| Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) |
|---|---|---|---|
| 0.001 | 0.000 | 2.500 | 0.000 |

**Node PP Carpark Storage Structure**

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.03600 | Invert Level (m) | 83.650 | Slope (1:X) | 1000.0 |
| Side Inf Coefficient (m/hr) | 0.03600 | Time to half empty (mins) | 92 | Depth (m) | 0.350 |
| Safety Factor | 2.0 | Width (m) | 83.500 | Inf Depth (m) | |
| Porosity | 0.33 | Length (m) | 100.000 | | |

**Results for 2 year Critical Storm Duration. Lowest mass balance: 99.04%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 120 minute summer | PP | 76 | 83.711 | 0.061 | 65.0 | 51.7540 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | Outflow (l/s) | Discharge Vol (m³) |
|---|---|---|---|---|
| 120 minute summer | PP | Depth/Flow | 0.0 | 0.0 |
| 120 minute summer | PP | Infiltration | 25.6 | |

**Results for 30 year Critical Storm Duration. Lowest mass balance: 99.04%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 120 minute summer | PP | 82 | 83.759 | 0.109 | 159.2 | 163.0216 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | Outflow (l/s) | Discharge Vol (m³) |
|---|---|---|---|---|
| 120 minute summer | PP | Depth/Flow | 0.0 | 0.0 |
| 120 minute summer | PP | Infiltration | 41.9 | |

**Results for 30 year +35% CC Critical Storm Duration. Lowest mass balance: 99.04%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 120 minute summer | PP | 86 | 83.789 | 0.139 | 214.9 | 244.3928 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | Outflow (l/s) | Discharge Vol (m³) |
| --- | --- | --- | --- | --- |
| 120 minute summer | PP | Depth/Flow | 0.0 | 0.0 |
| 120 minute summer | PP | Infiltration | 41.9 | |

**Results for 100 year Critical Storm Duration. Lowest mass balance: 99.04%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 120 minute summer | PP | 84 | 83.780 | 0.130 | 199.2 | 220.7063 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | Outflow (l/s) | Discharge Vol (m³) |
|---|---|---|---|---|
| 120 minute summer | PP | Depth/Flow | 0.0 | 0.0 |
| 120 minute summer | PP | Infiltration | 41.9 | |

**Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.04%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 120 minute summer | PP | 92 | 83.825 | 0.175 | 278.9 | 345.5663 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | Outflow (l/s) | Discharge Vol (m³) |
|---|---|---|---|---|
| 120 minute summer | PP | Depth/Flow | 0.0 | 0.0 |
| 120 minute summer | PP | Infiltration | 42.0 | |

# APPENDIX E – MANAGEMENT & MAINTENANCE REGIME

## The Management Company

The responsibility for maintenance of all elements of the development remain with Chase New Homes until handed over to the Management Company.

Handover of external works to the Management Company coincides with completion of the final residential unit.

The Management Company employs a specialist Managing Agent to manage the development which includes all aspects of maintenance.

*The Management Company BI registered No. **'tbc'** was incorporated in **'tbc'** and its directors are currently made up of Chase New Homes representatives plus an appointment from the Managing Agent.*

*The Managing Agents are **'tbc'** who have over '**tbc'** years' experience in the industry.*

At handover the Management Company and Managing Agent receive as built information together with operating and maintenance manuals which detail all maintenance protocols.

Approximately 1 year following completion of the final unit the residents will be invited to elect members to become directors of the Management Company, the Chase New Homes appointed directors at that time resign from the Management Company to be replaced by the elected representatives of the residents.

To ensure continuity and a full understanding of the development and the operation and maintenance of its various components the representative of the Managing Agent remains as a director of the Management Company and the appointment of the Managing Agents is fixed for a minimum period of two years following the date of resignation of the last Chase New Homes director.

After that two year period the Management Company have the right to re-tender the Managing Agent services but it is very rare that a change is made as our original appointments provide an excellent service.

Within the first two years from the final unit completion on the development the residents have two ways in which they can report any defects and problems which would include flooding and that is either to our Aftersales department or to the Managing Agents, the residents are issued with telephone numbers for both which include out of hours emergency response.

After two years our Aftersales contacts are normally replaced by members of the Management Company. The residents therefore have the ability to contact them or the Managing Agents which then remains through the life of the development.

## Onsite Surface Water Drainage System (generally)

The Management Company will ensure that the following measures are undertaken to ensure the longevity of the surface water drainage system;

**Every 6 months:**Remove silt build up from ***all*** catchpits and road gullies.

**Annually:** elect approx. 20% of the development's surface water inspection chambers (situated in accessible non-private areas) and inspect for blockages / silt build up. Remove silt and debris. Rotate on a 5 yearly cycle to cover all such chambers over this period.

**Every 2-5 years (depending on outcome of aforementioned inspections)**

Commission a CCTV survey and report on condition of the surface water piped drainage system upstream of the soakaways to check for structural integrity and hydraulic fluidity. Carry out promptly any remedial work as advised by CCTV company.

## Permeable Paving

External parking areas and access roads are to be constructed in permeable block paving in order to;

a) Delay the surface water runoff from these areas, and
b) Enhance the quality of the rainwater prior to discharge into the ground.

The Management Company will ensure that the following measures are undertaken to ensure the longevity of the pervious pavement;

**Quarterly**

i) Inspect the pervious pavement for signs of ponding and ensure there is no migration of soils from adjacent landscaped areas or other deleterious material that may prematurely clog up the jointing stone situated in the gaps between the blocks. Ideally this type of inspection should be undertaken immediately following a heavy rainfall event.

ii) Commission vacuum sweeping and brushing of the pervious pavement to ensure joints are kept free of silt. Minimum 3 sweeping per year, thus;

a) End of Winter (April) – to collect winter debris
b) Mid-Summer (July/August) – to collect dust, flower and grass-type deposits.
c) After Autumn leaf fall (November)

The company commissioned to carry out this work should ensure that their vacuum equipment is adjusted accordingly to avoid the removal of jointing material.

Any lost material should be replaced promptly to avoid the blocks from being dislodged.

**Last Resort Remedial Action**

i) Should a portion of the pervious pavement become substantially impervious due to excessive siltation, the following procedure should be followed;

a) Lift block paving and laying course
b) Break out underlying bitmac base layer and replace with similar compacted depth of course aggregate subbase material to BS EN 13242:2002 Type 4/20, wrapped in geotextile as Terram 1000 or similar.
c) Renew laying course, replace blocks and renew jointing material

NB. Material removed from the voids or the layers below the surface may contain heavy metals and hydrocarbons and as such 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.

Renew laying course, replace blocks and renew jointing material.NB. Material removed from the voids or the layers below the surface may contain heavy metals and hydrocarbons and as such 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.

## Cellular Soakaway Storage

The principle means of surface water attenuation/disposal from the development is by way of cellular soakaways storage.

The Management Company will ensure that the following measures are undertaken to ensure the longevity of the surface water drainage system;

Inspections to identify any areas not operating correctly, pollution, blocked inlets or outlets, standing water etc.

Collect and remove from site all extraneous rubbish that is detrimental to the operation or detracts from the appearance of the site, including paper, bottles, cans and similar debris.