enzygo
environmental consultants

Detailed Drainage Strategy

Bowland Fell Park, Skipton

Park Holidays UK

SHF.201.136.HY.R.001.B

'Experience and expertise working in union'

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Bowland Fell Park, Skipton

Project:	Drainage Strategy
For:	Park Holidays UK
Status:	Issued
Date:	December 2021
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Approver:	Liz Austin BSc (Hons) – Principal Engineer

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1.0 Introduction

1.1 Background

1.1.1 Enzygo Ltd was commissioned by Park Holidays UK to carry out a Detailed Drainage Strategy to overcome the pre-commencement conditions for a proposed extension to the Bowland Fell caravan park located at Tosside, Skipton ('the Site').

1.1.2 The permitted development comprises 51 static holiday caravan bases, with associated access way and parking areas.

1.1.3 Access into the site is via a private track, which connects to the existing caravan park.

1.1.4 A copy of the layout is included in Appendix 1.

1.2 Purpose

1.2.1 The purpose of the drainage strategy is to address pre-commencement conditions 7 in the Craven District Council decision notice (Application No. 2018/19292/FUL, 5th November 2018). An extract of the conditions is included below.

6. No above ground works shall take place until a scheme for the disposal of foul and surface water from the site has been submitted to and approved in writing by the Local Planning Authority. Unless otherwise agreed in writing with the Local Planning Authority, the scheme shall include:

(i) separate systems for the disposal of foul and surface water.

(ii) a detailed drainage strategy to demonstrate that the post-development surface water discharge rate to any soakaway, watercourse or sewer does not exceed the pre-development (greenfield) rate. The drainage strategy shall include details of the peak surface water runoff rate from the development for the 1 in 1 year rainfall event and the 1 in 100-year (+30% climate change allowance) rainfall event and shall demonstrate that the peak post-development runoff rate does not exceed the peak pre-development greenfield runoff rate for the same event.

(iii) details of any necessary flow attenuation measures, including the use of SUDS where appropriate.

(iv) details of the measures taken to prevent flooding and pollution of any receiving groundwater and/or surface waters (including watercourses) and any off-site works required to ensure adequate discharge of surface water without causing flooding or pollution (including refurbishment of existing culverts and headwalls or removal of unused culverts where applicable).

(v) flood water exceedance routes, both on and off site.

(vi) means of access for maintenance and easements (where applicable).

(vii) a timetable for implementation, including any phasing of works.

The duly approved scheme shall be implemented before any of the caravan units hereby approved are first occupied, or within any other timescale first agreed in writing with the Local Planning Authority.

Reason: To ensure that the development is not at risk of flooding and does not increase flood risk elsewhere, and that adequate measures are put in place for the disposal of foul and surface

water in accordance with the requirements of the Local Plan saved policies EMP16 and the National Planning Policy Framework.

2.0 Drainage Strategy

2.1 Surface Water Drainage

Introduction

2.1.1 A surface water management strategy for the development is proposed to manage and reduce the flood risk posed by surface water runoff from the Site. The developer will be required to ensure that any scheme for surface water should build in sufficient capacity for the entire Site.

2.1.2 The surface water drainage arrangements for any development Site should be such that the volume and peak flow rates of surface water leaving a developed Site are no greater than the rates prior to the proposed development unless specific off-Site arrangements are made and result in the same net effect.

2.1.3 An assessment of the surface water runoff rates was undertaken to determine the surface water options and attenuation requirements for the Site.

Existing Drainage System

2.1.4 The 2.606ha Site is comprised of an agricultural (grassed) field.

2.1.5 The Site is underlain by silty clay soils with naturally high groundwater.

2.1.6 It is likely that drainage is predominantly overland to watercourse with minimal infiltration.

Impermeable Areas

2.1.7 An impermeable area 0.196ha was measured from the drawing for the concrete caravan bases, which accounts for 7.5% of the total 2.606ha Site area.

2.1.8 The proposed development will increase the impermeable surfaces and so increase the amount of runoff.

Greenfield Runoff Rates

2.1.9 An assessment of greenfield runoff rates was undertaken to determine the attenuation requirements for the proposed development.

2.1.10 The runoff rates were calculated using the online Wallingford greenfield runoff rate estimation tool (using the FEH method with inputs descriptors obtained from the FEH webservice[1]). This is a recommended methodology for Sites up to 50ha in area and the approach is in line with the current 'industry best practice' guidelines as outlined in the Interim Code of Practice for SuDS [2], and Environment Agency Report SC030219 – Rainfall runoff management for developments.

2.1.11 The following parameters were used in the runoff calculations:

- Developable Area: 2.606ha
- Average Annual Rainfall (SAAR): 1368mm/year
- BFIHOST: 0.322
- Region No.: 10

[1] Centre for Ecology and Hydrology, Flood Estimation Handbook Web Service [https://fehweb.ceh.ac.uk/].
[2] Office of the Deputy Prime Minister, National SuDS Working Group (July 2004) Interim Code of Practice for Sustainable Drainage Systems [https://www.susdrain.org/files/resources/other-guidance/nswg_icop_for_suds_0704.pdf].

2.1.12 BFIHOST was updated to BFIHOST19 (November 2019) since several issues were identified with BFIHOST, which including a tendency to underestimate BFI in clay-dominated catchments.

2.1.13 BFIHOST19 value assigned by the FEH webservice is considered to replicate on-site conditions.

2.1.14 Table 2.1 shows the calculated greenfield runoff rates. Extracts from runoff calculations are included in Appendix 5.

Table 2.1: Greenfield Runoff Rates

Annual Probability (Return Period, years)	Greenfield Runoff (l/s)
QBAR	35.8
100% (1)	31.1
3.33% (30)	60.8
1% (100)	74.4
1% Plus Climate Change	104.2

Note: *30% added to the data to account for long-term climate change as stated in 'Flood Risk Assessment: Climate Change Allowance'. The 1 in 1-year, 30-year and 100-year annual probability events are of importance to the Water Companies and the Environment Agency when looking at sewage discharge and flood risk.*

Sustainable Drainage Options (SUDS)

Choice of SuDS Options

2.1.15 Sustainable water management measures should be used to control the surface water runoff from the proposed development Site, thereby managing the flood risk to the Site and surrounding areas from surface water runoff. These measures will also improve the quality of water discharged from the Site.

2.1.16 Current guidance promotes sustainable water management using SuDS. Options applicable to this Site are identified in Table 2.2.

Table 2.2: SUDS Options

Green roofs	Infiltration basins
Water butts	Detention basins
Permeable paving	Oversized pipes
Rainwater harvesting	Brown roofs
Filter strips	Swales
Wetland Areas	Cellular Storage

Note: *SUDS appropriate to the development are highlighted green*

Hierarchy of Discharge

2.1.17 In accordance with requirement H3 of the Building Regulations 2010[3] rainwater runoff must discharge to one of the following, listed in order of priority:

1. **An adequate soakaway or some other adequate infiltration system:** The use of infiltration-based SUDs is not feasible due to low infiltration potential demonstrated through soakaway testing.
2. **A watercourse:** There is a watercourse along the eastern boundary the Site.
3. **A sewer:** There are no public surface water sewers in the immediate vicinity of the Site.

2.1.18 The route to discharge from the Site will be to the watercourse.

Drainage Design

2.1.19 A SuDS drainage scheme is proposed to manage excess runoff from the development, managing both volume and water quality.

2.1.20 Surface water will be stored within an attenuation basin sized for the 1 in 100-year (plus 30% climate change) storm event. The calculated attenuation volume is 40m^3, calculations are included in Appendix 3.

2.1.21 The driveways and access roads will be permeable to facilitate infiltration at source. These will be lined with a permeable geotextile membrane to capture any oil and sediment.

2.2 Exceedance

2.2.1 During storm events that would cause the onsite attenuation and drainage network to overtop, surface water would shed overland following the topography to the watercourse on the western boundary, as per existing conditions (see Drawing 101).

2.2.2 The existing topography and levels will remain unchanged except for the concrete bases for the caravans which require to be level.

2.2.3 Caravan floor levels will be approximately 600mm above finished external levels, which will mitigate the risk of overtopping.

[3] Office of the Deputy Prime Minister, The Building Regulations 2010 amended 2016.

3.0 SUDS Maintenance and Management Plan

3.1 Purpose

3.1.1 The purpose of the maintenance and management plan is to ensure the ongoing monitoring and maintenance to ensure the effectiveness of the drainage strategy for the lifetime of development.

3.2 Drainage Design Principles

3.2.1 The drainage principles are described in Section 6.

3.3 Operation Phase

3.3.1 The following considered access, the anticipated maintenance activities, and who might be responsible for the maintenance.

3.3.2 Note, it is standard for SuDS features within a new development to be maintained by a private maintenance company. If the maintenance company goes into administration, the Site will be contracted to a new maintenance company. The Site owner will pay a surcharge to the maintenance company, which will ensure maintenance throughout the lifetime of the development.

3.3.3 The schedule should be a living document as it may change, where inspections advise changes to the scheme maintenance requirements.

SuDS Features

3.3.4 The detention basin will be the responsibility of the owner of Bowland Fell Holiday Park and will be maintained by their on-site maintenance team. The SuDS features should be designed in line with design guidance by the LLFA as well as the manufacturers guidance.

Detention Basin

3.3.5 The detention basin has been 3D cut into the topography using a survey ground model and is scaled to accurately determine the footprint required to accommodate the calculated volume and batter gradients. The basin batter gradient (1:4) allows access in and out of the features to undertake maintenance works.

3.3.6 The detention basin will be the responsibility of a private management company, unless adopted. The SuDS attenuation features were designed in line with design guidance by the LLFA.

3.3.7 Typical maintenance activities and frequency are summarised in Tables 3.1.

Table 3.1: Detention Basin Maintenance Activities

Maintenance Frequency	Required Action	Maintenance Frequency
Regular Maintenance	Litter and debris removal from Site. Clear organic materials in the autumn.	Monitoring monthly for the first year, then adapt the frequency thereafter (i.e. April to remove winter debris, August when vegetation growth is at its peak, then November following leaf drop).
	Grass cutting on sides and bed of the basin to 35-50mm lengths except access paths which require 75-100mm length.	Every 2 months in the growing season.
	Inspect and if necessary clear inlet, outlet and overflow openings.	Quarterly with litter removal.
	Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies.	Every 6 months (i.e. before and after winter or following major storm events).
	Pruning and trimming of trees.	Every 2 years.
	Spiking, scarifying and thatch removal.	Every 3 years (when mulching).
Occasional Maintenance	Remove silt from basin outlet and invert.	Every 6 months (i.e. before and after winter or following major storm events)
	Weeding.	As required (i.e. November, at end of the growing season).
Remedial Works and Repairs	Inspect and repair any damage to the formal inlets and outlets from the basin	As required (i.e. following major storm events or where vandalised).
	Sediment removal and rehabilitation. Removal of damaged or silt covered vegetation to a depth 50mm below original design level	Every 5 years.
	Treatment of diseased trees.	Three times per year, if required.
	Treatment and restoration of eroded areas.	Bi-annually
	Re-turfing.	Three times per year, if required.
	Reinstatement of design levels and silt removal.	Three times per year, if required.

Headwalls (Outlets)

3.3.8 The outlet to the existing southern boundary ditch will be set above the ditch bed level (level to be confirmed) and fitted with a flap valve to prevent surcharging during a flood event, so that it remains operational between periods of maintenance.

3.3.9 The outlet from the basin will be fitted with a trash screen to prevent debris from entering pump chamber.

3.3.10 Typical maintenance activities and frequency are summarised in Table 3.2.

Table 3.2: Headwall (Inlet and Outlet) Maintenance Activities

Maintenance Frequency	Required Action	Maintenance Frequency
Regular Maintenance	Inspect inlets, outlets, and overflows for blockages, and clear if required.	Monitoring monthly for the first year, then adapt the frequency thereafter (i.e. April to remove winter debris, August when vegetation growth is at its peak, then November following leaf drop).
Occasional Maintenance	Inspect inlets, outlets and overflows for sediment and blockages, and clear if required.	Monitoring monthly for the first year, then adapt the frequency thereafter (i.e. April to remove winter material, August when vegetation growth is at its peak, then November following leaf drop). Also, following major storm events.
Reactive Actions	Replace controls if damaged or modify when shown to be performing incorrectly.	As required (i.e. following major storm events or where vandalised).

Pervious Paving

3.3.11 Typical maintenance activities and frequency are summarised in Table 3.3.

Table 3.3: Pervious Paving

Maintenance Frequency	Required Action	Maintenance Frequency
Regular Maintenance	Brushing and vacuuming to remove silt and detritus.	Annually after autumn leaf fall, and at other times as required.
	Weed and grass removal.	As required.
Remedial Work	Remedial work to repair any depressions or rutting which may affect performance or a hazard to users.	As required.
Monitoring	Inspect for poor performance and/or weed growth.	48 hours after a large storm event in the first six months, then three monthly.
	Inspect silt accumulation rates.	Annually.

Below Ground Drainage Pipes

3.3.12 Typical maintenance activities and frequency are summarised in Table 3.4.

Table 3.4: Below Ground Drainage Pipes

Maintenance Frequency	Required Action	Maintenance Frequency
Regular Maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then annually.
	Remove debris from the catchment surface where it can cause risks to performance.	Monthly for 3 months, then Quarterly
	Remove sediment from pre-treatment inlet structures and inspection chambers.	Quarterly/as required.

Maintenance Frequency	Required Action	Maintenance Frequency
	Maintain vegetation to design limits within the vicinity of the below ground drainage pipes/soakaways to avoid damage to the system.	Monthly/As required.
Remedial Work	Repair physical damage if necessary.	As required.
Monitoring	Inspect all inlets, outlets, and wets to ensure that they are in good condition and operating as designed.	Annually.
	Survey inside of pipe runs for sediment build up and remove if necessary.	Every 5 years/as required.

Inlet and Inspection Chambers

3.3.13 Typical maintenance activities and frequency are summarised in Table 3.5.

Table 3.5: Inlet Structures and Inspection Chambers

Maintenance Frequency	Required Action	Maintenance Frequency
Regular Maintenance	Inspect rainwater down pipes, channel drainage and road gullies, removing obstruction and silt as necessary	Monthly
	Check for physical damage	Monthly
	Remove covers and inspect, ensuring that water is flowing freely and that the exit route for water is unobstructed. Remove debris and silt	Annually
	Undertake inspection after leaf fall in Autumn	Annually
Remedial Work	Repair physical damage if necessary.	As required.
Monitoring	Check topsoil levels are 20mm above edges of chambers to avoid mower damage.	Annually.

3.4 Construction Phase

3.4.1 A summary of the mitigation measures during the construction phase, timetable for implementation and validation of the final drainage design is considered below.

Mitigation Measures

3.4.2 Mitigation measures are designed in to reduce the potential for impacts on hydrology, flood risk and water quality and are listed below:

- Good environmental practice based on legal responsibilities and guidance in accordance with the general overarching guidance on good environmental management in PPG1 (Environment Agency, 2013) and more specific guidance including:
  - CIRIA C650 (2005) Control of Water Pollution from Construction Sites - Guidance for Consultants and Contractors.
  - CIRIA C648 (2006) Control of Water Pollution from Linear Construction Projects.
  - PPG21: Pollution Prevention Guidelines. Incident Response Planning.
- Minimise where practicable the production of silt and contaminated water by minimising:
  - Dewatering and pumping of excavations and subsequent disposal of water.
  - Runoff from exposed ground and stockpiles.
  - Plant and wheel washing.
  - Site roads.
  - Fuel spillages.
  - Waste storage and disposal. Mitigation in accordance with PPG5 guidance on works and maintenance in or near water (Environment Agency, 2014) and CIRIA C650 and as set out in the project Code of Construction Practice (CoCP).
- Surface Water Management (SuDS) Scheme. The development will result in the construction of low permeability surfacing, increasing the rate of surface water run-off. The surface water drainage scheme ensures the runoff rates to the surrounding water environment are maintained at pre-development greenfield rates incorporating the effects of climate change.

3.4.3 The maintenance and management of the developing SuDS during the construction phase is essential in managing runoff on and from the Site. It is also key in ensuring the prevention of sediment and pollutants entering nearby watercourses.

3.4.4 A separate Construction Environmental Management Plan (CEMP) will be required to control environmental issues during the construction process. The CEMP forms part of the Project Management Plan, which integrates the core arrangements for health and safety, quality, and environmental management for the construction phase. This integrated approach ensures that environmental aspects are considered at all stages of the design and construction process.

3.4.5 The construction phase will be undertaken in accordance with the following good practice guidelines on hydrology, flood risk and water quality for consultants and contractors:

- CIRIA Environmental Good Practice on Site (C502) (1999).

- CIRIA Control of Water Pollution from Construction Sites (C532) (2001).
- Environment Agency Pollution Prevention Guidelines.

Timetable for Implementation

3.4.6 The SuDS attenuation and conveyance features will be constructed before development begins, so that they are ready to accept runoff from impermeable areas as they are constructed.

4.0 Summary and Conclusions

4.1 Introduction

4.1.1 A Drainage Strategy has been undertaken for a proposed extension to the Bowland Fell caravan park located at Tosside, Skipton.

4.2 Site Drainage

4.2.1 The proposed development will increase the area of impermeable surfaces and therefore increase the amount of runoff without mitigation.

4.2.2 A SuDS drainage scheme is proposed to manage excess runoff from the development. The driveways and access roads will be permeable to facilitate infiltration at source.

4.2.3 Surface water will be stored within an attenuation basin which has been sized for the 1 in 100-year (plus 30% climate change) storm event.

4.2.4 The proposed maintenance and management plan will ensure the effectiveness of the drainage strategy for the lifetime of development.

4.3 Conclusion

4.3.1 This Drainage Stagey (inclusive of a Flood Risk Statement), demonstrates that the proposed development will closely mimic existing surface water runoff conditions therefore with minimal risk from flooding, will not increase flood risk elsewhere and is compliant with the requirements of national policy and guidance.

APPENDICES

Appendix 1 – Proposed Layout

SPECIFICATION

TOPSOIL

Planting is to take place in the existing in situ topsoil. Any stockpiled topsoil shall be spread in even layers and be thoroughly cultivated prior to planting. Any machine work to topsoil shall only take place when conditions are suitable i.e. not when the ground is very wet or is frozen.
All areas shall have any compaction thoroughly relieved prior to topsoiling

PLANT MATERIAL

All plant material shall as a minimum conform to the most recent of the following BS's or the equivalent European Standards: BS3936 Pt. 1 1992 (Trees & shrubs); Pt.4 1984 C 89 (Forest trees). The plant material should also meet the National Plant Specification standards.

Packaging & delivery
Packaging and delivery of plant material shall be in accordance with the Code of Practice published by the JCLI and the HTA 'Handling and Establishing Landscape Plants' and shall be adequately stored and protected prior to planting. Any bare rooted stock shall be kept covered at all times until planted and shall be protected from drying winds or frost.

Species
Species and size of plant material is to comply with the accompanying schedule. The contractor is to obtain approval before substituting any of the species listed, otherwise the substitutes may be rejected.

Trees
All trees shall have a sturdy, reasonably straight stem and an evenly balanced head with a clearly defined leader and well balanced root system. Any rootballed or bare rooted stock is to be planted in the recognised planting season (Nov-March).
Outside the planting season only container grown trees may be planted

Tree pits
Tree pits shall be sufficiently large to accommodate the spread root system of bare rooted plants. Generally tree pits shall be 600mm depth and 600 x 600 mm for feathered trees. Pits shall be backfilled with topsoil and compost mix as described.
Transplants shall be notch planted ensuring that the root is well spread in the notch, is planted at the same height as it was in the nursery and is well firmed in.

Tree support and protection
Feathered trees shall be supported with a single 1200mm stake driven 600mm into the ground and secured with a single proprietary rubber tree tie. All planting will be rabbit protected with either plastic spiral guards for feathered trees, tree tubes for single stem transplants and cylinders for shrubby species all as per plant schedule.

All planting is to conform to the current BS 4428 (1989 A1 91), and be guaranteed for the first growing season and a show of leaf in the second.

Maintenance
The contractor is to carry out maintenance to the planted areas for the first 12 months after Practical Completion.This will involve two visits to apply herbicide ensuring that all planted areas are completely treated with glyphosate herbicide strictly to manufacturers recommendations and line with “Pesticides - Code of Practice for Using Plant Protection Products”. Any weed not responding to herbicide will be removed by hand including the root.
All stakes, tubes and spiral guards will be checked at each maintenance visit and repaired and/or replaced as necessary.

SEEDING

Seeded areas are to be thoroughly cultivated with all rubbish, weeds, roots and stones over 30mm removed to contractors own tip. The ground surface is to be brought to a smooth firm fine tilth free from humps and hollows to finish 25mm above surrounding hard surfaces.
Seed is to be spread in 2 no. batches in transverse directions and raked into the soil. An appropriate fertiliser is to be spread at the manufacturers recommended rate at the time of the first cut.
The first cut shall be made when growth has reached 100mm and the height reduced to 25mm Subsequent cuts shall be made when growth has reached 50mm and height reduced to 25mm. Seed is to be a low maintenance amenity mix spread at manufacturers recommended rate and to be ARCADE certified, complying with requirements of BS4428 (1989 A1 91)

Maintenance
The Contractor is to carry out maintenance and grass cutting to the sward for 12 months after Practical Completion. This shall include fortnightly cuts reducing sward height to 25mm between March and October and once monthly from November and February inclusive. Any areas of poor germination shall be treated as necessary and over seeded at the contractors expense. The sward will be considered complete when all areas are covered with growing grass.

Individual Planting

Feathered Trees - 200-250cm bare rooted in positions designated; supported with a single 1200mm stake driven 600mm into the ground and secured with a single proprietary tree tie; protected with a plastic spiral rabbit guard.

AG	Alnus glutinosa
BP	Betula pendula
PT	Populus tremula
PA	Prunus avium
PP	Prunus padus
QP	Quercus petraea
SAU	Sorbus aucuparia

CLIENT M & S Carroll.

PROJECT Bowland Fell Park.

TITLE Proposed Extension - Layout and Landscape

REVISIONS

SCALE 1:500 @ A1
DATE 07.18
DWG No 0269-6

Landcare
LANDSCAPE ARCHITECTS

Birchwood
Kirkbridge Lane
New Mill
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Tel.:01484 686462
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Appendix 2 – Soakaway Results

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Matt Purdom
Park Holidays UK Ltd
Glovers House
Glovers End
Bexhill-On-Sea
East Sussex
TN39 5ES

SHF.201.136.GE.L.001

02 November 2021

Dear Matt

RE: Bowland Fell Holiday Park, Skipton, BD23 4SD

Soakaway testing was carried out at the above-named site on. Three trial pits were excavated on Wednesday 27th October and two trial pits were excavated on Thursday 28th October. Trial pits were excavated to depths between of 1.00m and 2.15 below ground level (bgl). Tests were undertaken at depths between 0.50 and 1.00m bgl.

A tracked excavator was used to excavate the trial pits and a high flow output pump was used to allow water to accumulate within the pits. No groundwater seepages were encountered prior to commencement of soakaway testing. Following completion of testing, trial pits were backfilled with material arisings.

One test was attempted within each location and insufficient uptake was encountered to allow for the infiltration rates to be calculated. The soakaway results are summarised in Table 1 overleaf. Soakaway result sheets, exploratory hole logs and a soakaway location plan are included.

Yours sincerely,

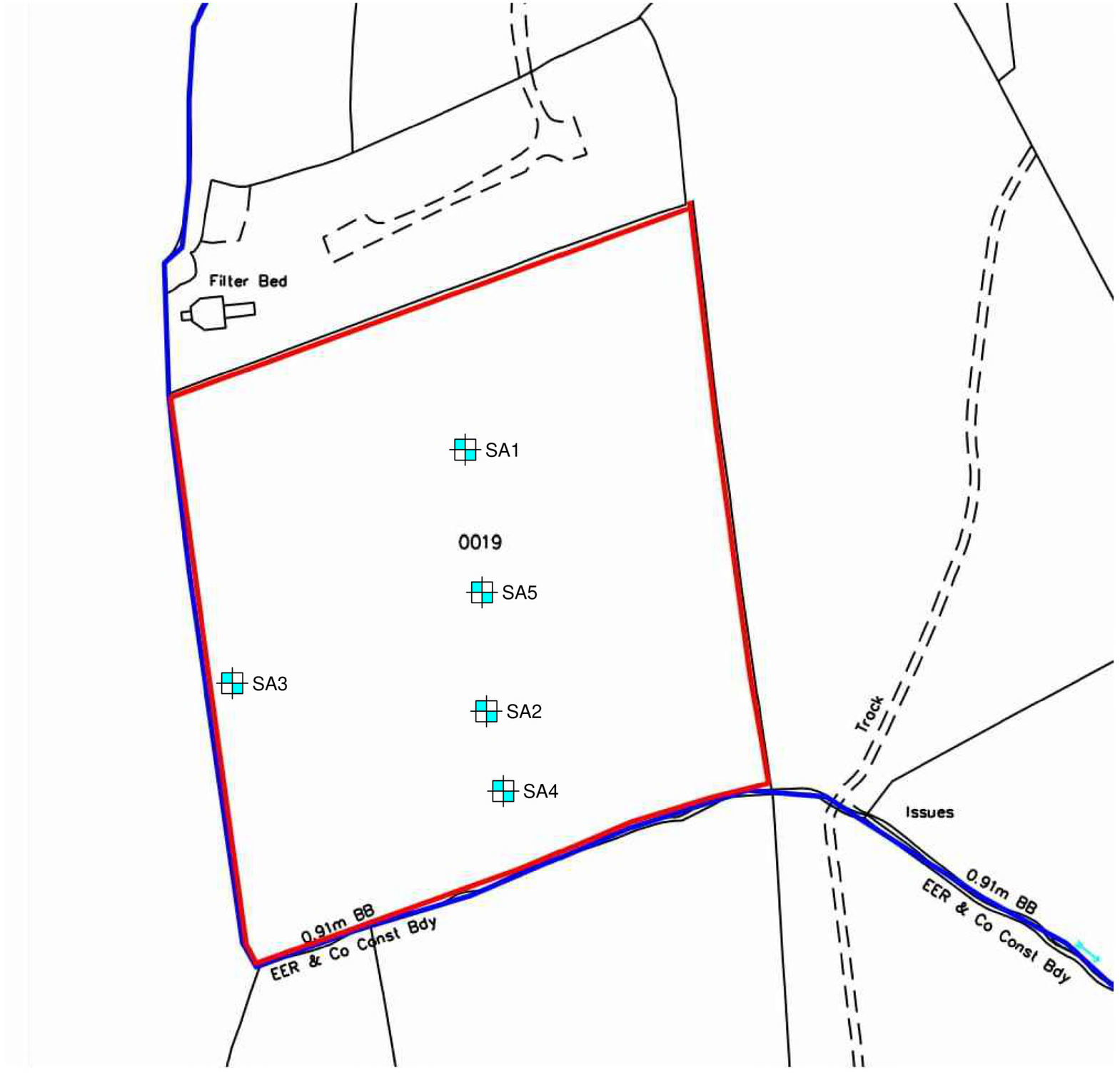
For and on behalf of Enzygo Geoenvironmental Limited

Greg Parr

Senior Consultant

Table 1

Exploratory Hole	Depth (m bgl)	Test No	Soil Infiltration Rate (m/s)	Design Soil Infiltration Rate (m/s)
SA1	2.15	1	**n/a**	**n/a**
SA2	2	1	**n/a**	**n/a**
SA3	1.20	1	**n/a**	**n/a**
SA4	1	0.50	**n/a**	**n/a**
SA5	1	0.50	**n/a**	**n/a**



0 20 40 60 80 100m

Scale 1:1,250@A3

Key

Site Boundary

Soakaway Locations (SA)
(SA1 - SA5)

enzygo
environmental consultants
Samuel House, 5 Fox Valley Way, Stocksbridge, Sheffield, S36 2AA

CLIENT: Park Holidays UK

SCALE: 1:1,250@A3

PROJECT REF: SHF.201.136

DRAWN: MG

CHECKED: GP

DATE: Oct 2021

PROJECT: Bowland Fell Park

TITLE: Site Plan

DRAWING NO: SHF.201.136.001.GE.D.001

Enzygo Ltd
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Site
Bowlands Fell Holiday Park, Tosside, Skipton BD23 4SD

SA1

Job No	Dates	Ground Level (m)	Co-Ordinates
SHF.201.136	Start 27-10-21 Finish 28-10-21		

Client
Park Holidays UK

Sheet
1 of 1

Water Levels	Samples & In Situ Testing: Depth (m)	Samples & In Situ Testing: No/Type	Samples & In Situ Testing: Results	Depth (m)	Level (mAD)	Legend	Stratum Description
				0.30			TOPSOIL: Dark brown slightly sandy organic CLAY with frequent roots and rootlets (up to 3mm diameter).
				1.05			(Stiff) greyish brown slightly sandy SILT.
				1.55			(Stiff) dark grey CLAY.
				2.00			(Stiff) dark grey CLAY with frequent boulders (up to 0.50 x 0.50m).
				{4.00}			Trial Pit completed at 2.00m.

0
1
2
3
4

General Remarks

Dimensions: 2.00x0.50x2.00
1. Machine excavated pit from ground level to 2.00m begl.
2. Groundwater not encountered.
3. Trial pit sides remained vertical and stable.
4. On completion, trial pit was backfilled with arisings.

All dimensions in metres
Scale 1:25

Logged By
JM

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Site
Bowlands Fell Holiday Park, Tosside, Skipton BD23 4SD

SA2

Job No	Dates	Ground Level (m)	Co-Ordinates
SHF.201.136	Start 27-10-21 Finish 28-10-21		

Client
Park Holidays UK

Sheet
1 of 1

Water Levels	Samples & In Situ Testing: Depth (m)	Samples & In Situ Testing: No/Type	Samples & In Situ Testing: Results	Depth (m)	Level (mAD)	Legend	Stratum Description
				0.30			TOPSOIL: Dark brown slightly sandy organic CLAY with frequent roots and rootlets (up to 3mm diameter).
				1.10			(Stiff) greyish brown slightly sandy SILT.
				1.90			(Stiff) dark grey CLAY with occasional boulders.
				{4.00}			Trial Pit completed at 1.90m.

0 1 2 3 4

General Remarks

Dimensions: 2.15x0.50x1.90
1. Machine excavated pit from ground level to 1.90m begl.
2. Groundwater not encountered.
3. Trial pit sides remained vertical and stable.
4. On completion, trial pit was backfilled with arisings.

All dimensions in metres
Scale 1:25

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Site
Bowlands Fell Holiday Park, Tosside, Skipton BD23 4SD

SA3

Job No	Dates	Ground Level (m)	Co-Ordinates
SHF.201.136	Start 27-10-21 Finish 28-10-21		

Client
Park Holidays UK

Sheet
1 of 1

Water Levels	Samples & In Situ Testing: Depth (m)	Samples & In Situ Testing: No/Type	Samples & In Situ Testing: Results	Depth (m)	Level (mAD)	Legend	Stratum Description
							TOPSOIL: Dark brown slightly sandy organic CLAY with frequent roots and rootlets (up to 3mm diameter).
				0.30			(Stiff) greyish brown slightly sandy SILT.
				1.20			(Stiff) dark grey CLAY with occasional boulders. Trial Pit completed at 1.20m.
				{4.00}			

0
1
2
3
4

General Remarks

Dimensions: 1.95x0.50x1.20
1. Machine excavated pit from ground level to 1.20m begl.
2. Groundwater not encountered.
3. Trial pit sides remained vertical and stable.
4. On completion, trial pit was backfilled with arisings.

All dimensions in metres
Scale 1:25

Logged By
JM

Enzygo Ltd
Tel: 01454 269237
Fax: 01454 269760
Web: www.enzygo.com

Site				
Bowlands Fell Holiday Park, Tosside, Skipton BD23 4SD				**SA4**
Job No: SHF.201.136	Dates: Start 28-10-21, Finish 28-10-21	Ground Level (m)	Co-Ordinates	
Client: Park Holidays UK				Sheet: 1 of 1

Water Levels	Samples & In Situ Testing: Depth (m)	No/Type	Results	Depth (m)	Level (mAD)	Legend	Stratum Description
				0.30			Dark brown slightly sandy organic CLAY with frequent roots and rootlets (up to 3mm diameter).
				1.00			(Stiff) greyish brown slightly sandy SILT.
				{4.00}			Trial Pit completed at 1.00m.

General Remarks

Dimensions: 1.60x0.50x1.00
1. Machine excavated pit from ground level to 1.00m begl.
2. Groundwater not encountered.
3. Trial pit sides remained vertical and stable.
4. On completion, trial pit was backfilled with arisings.

All dimensions in metres Scale 1:25		Logged By JM

Enzygo Ltd
Tel: 01454 269237
Fax: 01454 269760
Web: www.enzygo.com

Site
Bowlands Fell Holiday Park, Tosside, Skipton BD23 4SD

SA5

Job No	Dates	Ground Level (m)	Co-Ordinates
SHF.201.136	Start 28-10-21 Finish 28-10-21		

Client
Park Holidays UK

Sheet
1 of 1

Water Levels	Samples & In Situ Testing: Depth (m)	Samples & In Situ Testing: No/Type	Samples & In Situ Testing: Results	Depth (m)	Level (mAD)	Legend	Stratum Description
				0.30			TOPSOIL: Dark brown slightly sandy organic CLAY with frequent roots and rootlets (up to 3mm diameter).
				1.00			(Stiff) greyish brown slightly sandy SILT.
				{4.00}			Trial Pit completed at 1.00m.

0
1
2
3
4

General Remarks

Dimensions: 1.20x0.50x1.00
1. Machine excavated pit from ground level to 1.00m begl.
2. Groundwater not encountered.
3. Trial pit sides remained vertical and stable.
4. On completion, trial pit was backfilled with arisings.

All dimensions in metres
Scale 1:25

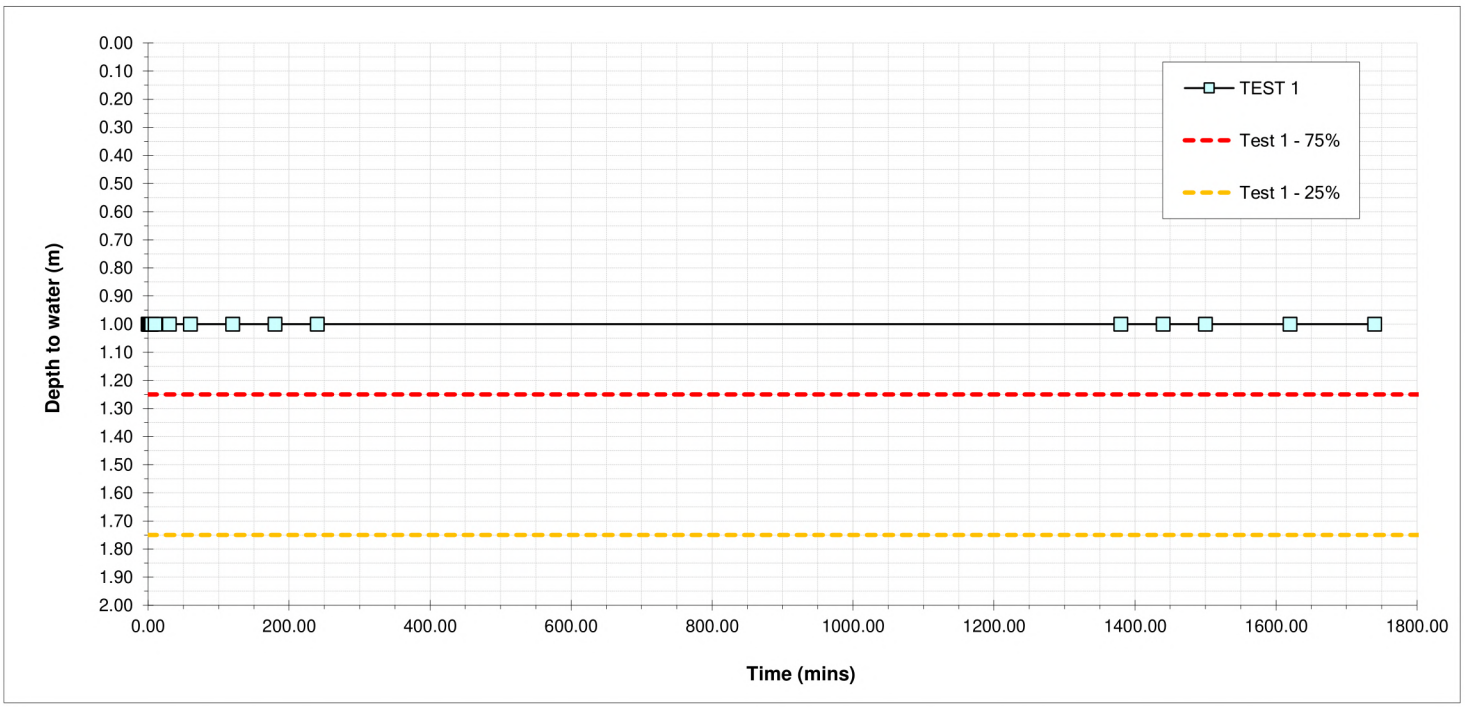
Logged By
JM

Site..... Bowland Fell Holiday Park Job Number..... SHF.201.136 Date of Test..... 27.10.21 and 28.10.21	Soakaway Number..... SA1 Length..... 2.00 m Width..... 0.50 m Depth..... 2.00 m	
SOIL INFILTRATION RATE TEST See B.R.E. Digest 365, 1991, Soakaway Design.	Groundwater Level..... Dry m	

Remarks -

	TEST 1		TEST 2		TEST 3	
	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
	0.0	1.00				
	1.0	1.00				
	2.0	1.00				
	3.0	1.00				
	4.0	1.00				
	5.0	1.00				
	10.0	1.00				
	30.0	1.00				
	60.0	1.00				
	120.0	1.00				
	180.0	1.00				
	240.0	1.00				
	1380.0	1.00				
	1440.00	1.00				
	1500.00	1.00				
	1620.00	1.00				
	1740.00	1.00				
Effective Storage Depth m		1.00				
75% Effective Storage Depth m		0.75				
(i.e. depth below GL) m		**1.25**				
25% Effective Storage Depth m		0.25				
(i.e. depth below GL) m		**1.75**				
Effective Storage Depth 75%-25% m		0.50				
Time to fall to 75% effective depth mins						
Time to fall to 25% effective depth mins						
V (75%-25%) m3		0.50				
a (50%) m2		3.50				
t (75%-25%) mins		0.00				
SOIL INFILTRATION RATE m/s		**N/A**				

DESIGN SOIL INFILTRATION RATE, f Insufficient uptake to calculate infiltration rate m/s



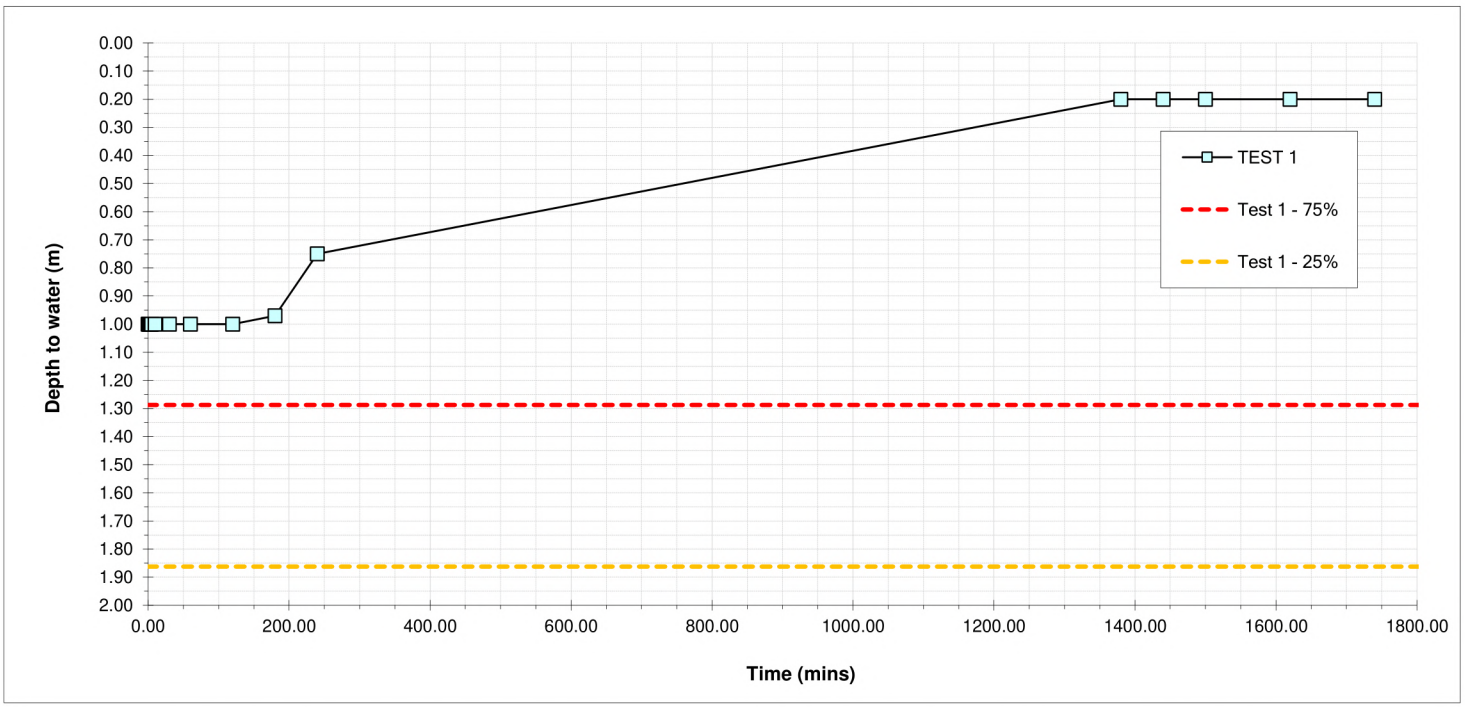
Compiled By:	Date:	Checked By:	Date:	Approved By:	Date:
G.Parr [redacted]	29.10.21	R.Hamilton [redacted]	29.10.21	S.Rhodes [redacted]	29.10.21

Site..... Bowland Fell Holiday Park Job Number..... SHF.201.136 Date of Test..... 27.10.21 and 28.10.21	Soakaway Number..... SA2 Length..... 1.90 m Width..... 0.50 m Depth..... 2.15 m	
SOIL INFILTRATION RATE TEST See B.R.E. Digest 365, 1991, Soakaway Design.	Groundwater Level..... Dry m	

Remarks -

		TEST 1		TEST 2		TEST 3	
		Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
		0.0	1.00				
		1.0	1.00				
		2.0	1.00				
		3.0	1.00				
		4.0	1.00				
		5.0	1.00				
		10.0	1.00				
		30.0	1.00				
		60.0	1.00				
		120.0	1.00				
		180.0	0.97				
		240.0	0.75				
		1380.0	0.20				
		1440.00	0.20				
		1500.00	0.20				
		1620.00	0.20				
		1740.00	0.20				
Effective Storage Depth	m		1.15				
75% Effective Storage Depth	m		0.86				
(i.e. depth below GL)	m		**1.29**				
25% Effective Storage Depth	m		0.29				
(i.e. depth below GL)	m		**1.86**				
Effective Storage Depth 75%-25%	m		0.58				
Time to fall to 75% effective depth	mins						
Time to fall to 25% effective depth	mins						
V (75%-25%)	m3		0.55				
a (50%)	m2		3.71				
t (75%-25%)	mins		0.00				
SOIL INFILTRATION RATE	m/s		**N/A**				

DESIGN SOIL INFILTRATION RATE, f Insufficient uptake to calculate infiltration rate m/s



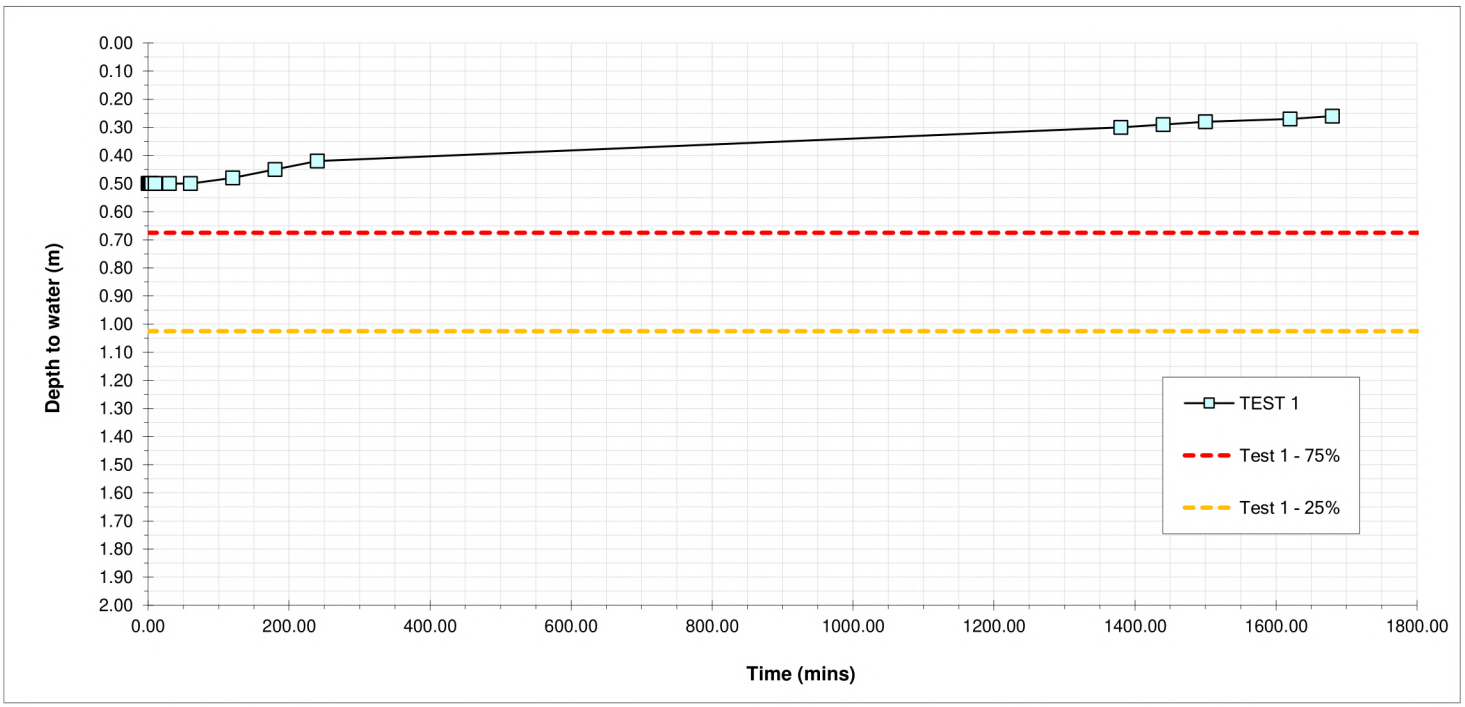
Compiled By:	Date:	Checked By:	Date:	Approved By:	Date:
G.Parr [redacted]	29.10.21	R.Hamilton [redacted]	29.10.21	S.Rhodes [redacted]	29.10.21

Site..... Bowland Fell Holiday Park Job Number..... SHF.201.136 Date of Test..... 27.10.21 and 28.10.21	Soakaway Number..... SA3 Length..... 1.95 m Width..... 0.50 m Depth..... 1.20 m	
SOIL INFILTRATION RATE TEST See B.R.E. Digest 365, 1991, Soakaway Design.	Groundwater Level..... Dry m	

Remarks -

		TEST 1		TEST 2		TEST 3	
		Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
		0.0	0.50				
		1.0	0.50				
		2.0	0.50				
		3.0	0.50				
		4.0	0.50				
		5.0	0.50				
		10.0	0.50				
		30.0	0.50				
		60.0	0.50				
		120.0	0.48				
		180.0	0.45				
		240.0	0.42				
		1380.0	0.30				
		1440.00	0.29				
		1500.00	0.28				
		1620.00	0.27				
		1680.00	0.26				
Effective Storage Depth	m		0.70				
75% Effective Storage Depth	m		0.53				
(i.e. depth below GL)	m		**0.68**				
25% Effective Storage Depth	m		0.18				
(i.e. depth below GL)	m		**1.03**				
Effective Storage Depth 75%-25%	m		0.35				
Time to fall to 75% effective depth	mins						
Time to fall to 25% effective depth	mins						
V (75%-25%)	m3		0.34				
a (50%)	m2		2.69				
t (75%-25%)	mins		0.00				
SOIL INFILTRATION RATE	m/s		**N/A**				

DESIGN SOIL INFILTRATION RATE, f Insufficient uptake to calculate infiltration rate m/s



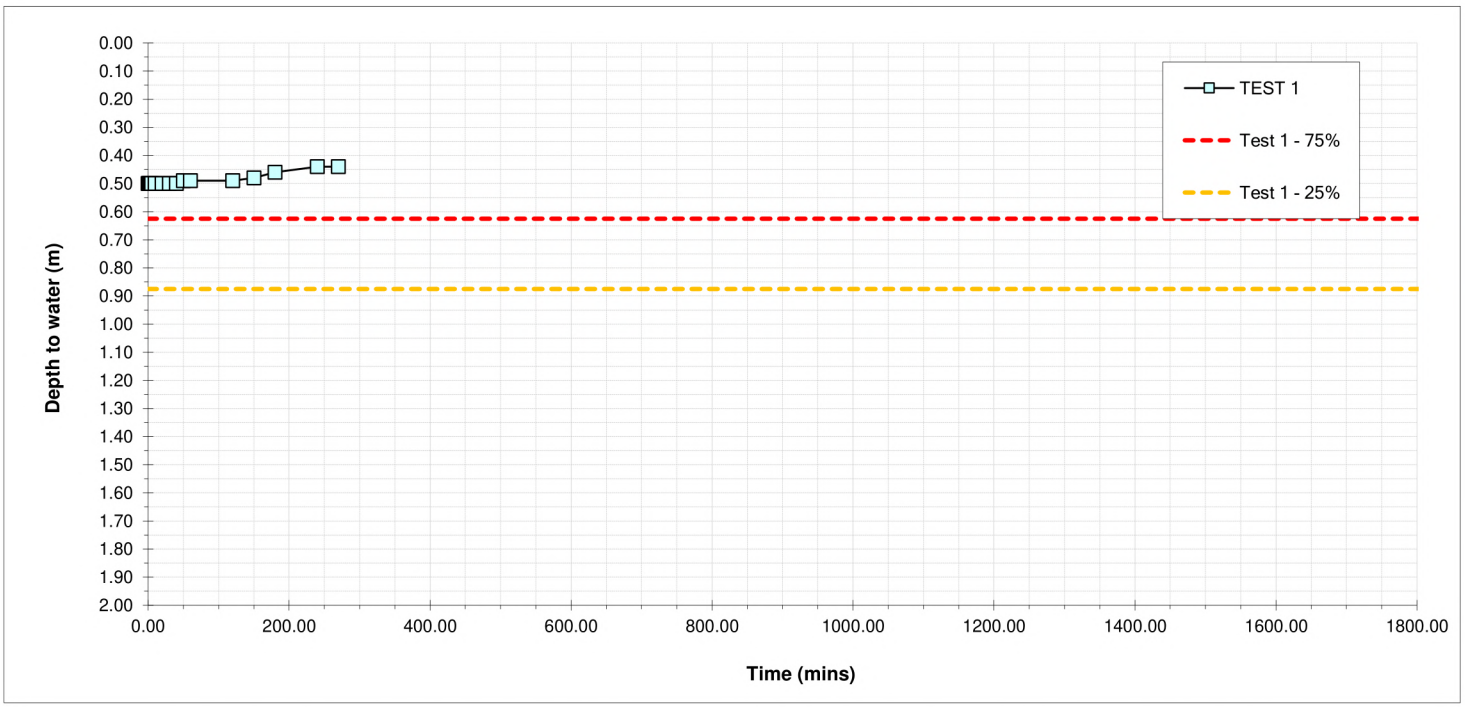
Compiled By:	Date:	Checked By:	Date:	Approved By:	Date:
G.Parr [redacted]	29.10.21	R.Hamilton [redacted]	29.10.21	S.Rhodes [redacted]	29.10.21

Site..... Bowland Fell Holiday Park Job Number..... SHF.201.136 Date of Test..... 228.10.21	Soakaway Number..... SA4 Length..... 1.60 m Width.....0.50 m Depth..... 1.00 m	
SOIL INFILTRATION RATE TEST See B.R.E. Digest 365, 1991, Soakaway Design.	Groundwater Level..... Dry m	

Remarks -

		TEST 1		TEST 2		TEST 3	
		Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
		0.0	0.50				
		1.0	0.50				
		2.0	0.50				
		3.0	0.50				
		4.0	0.50				
		5.0	0.50				
		10.0	0.50				
		20.0	0.50				
		30.0	0.50				
		40.0	0.50				
		50.0	0.49				
		60.0	0.49				
		120.0	0.49				
		150.00	0.48				
		180.00	0.46				
		240.00	0.44				
		270.00	0.44				
Effective Storage Depth	m		0.50				
75% Effective Storage Depth	m		0.38				
(i.e. depth below GL)	m		**0.63**				
25% Effective Storage Depth	m		0.13				
(i.e. depth below GL)	m		**0.88**				
Effective Storage Depth 75%-25%	m		0.25				
Time to fall to 75% effective depth	mins						
Time to fall to 25% effective depth	mins						
V (75%-25%)	m3		0.20				
a (50%)	m2		1.85				
t (75%-25%)	mins		0.00				
SOIL INFILTRATION RATE	m/s		**N/A**				

DESIGN SOIL INFILTRATION RATE, f Insufficient uptake to calculate infiltration rate m/s



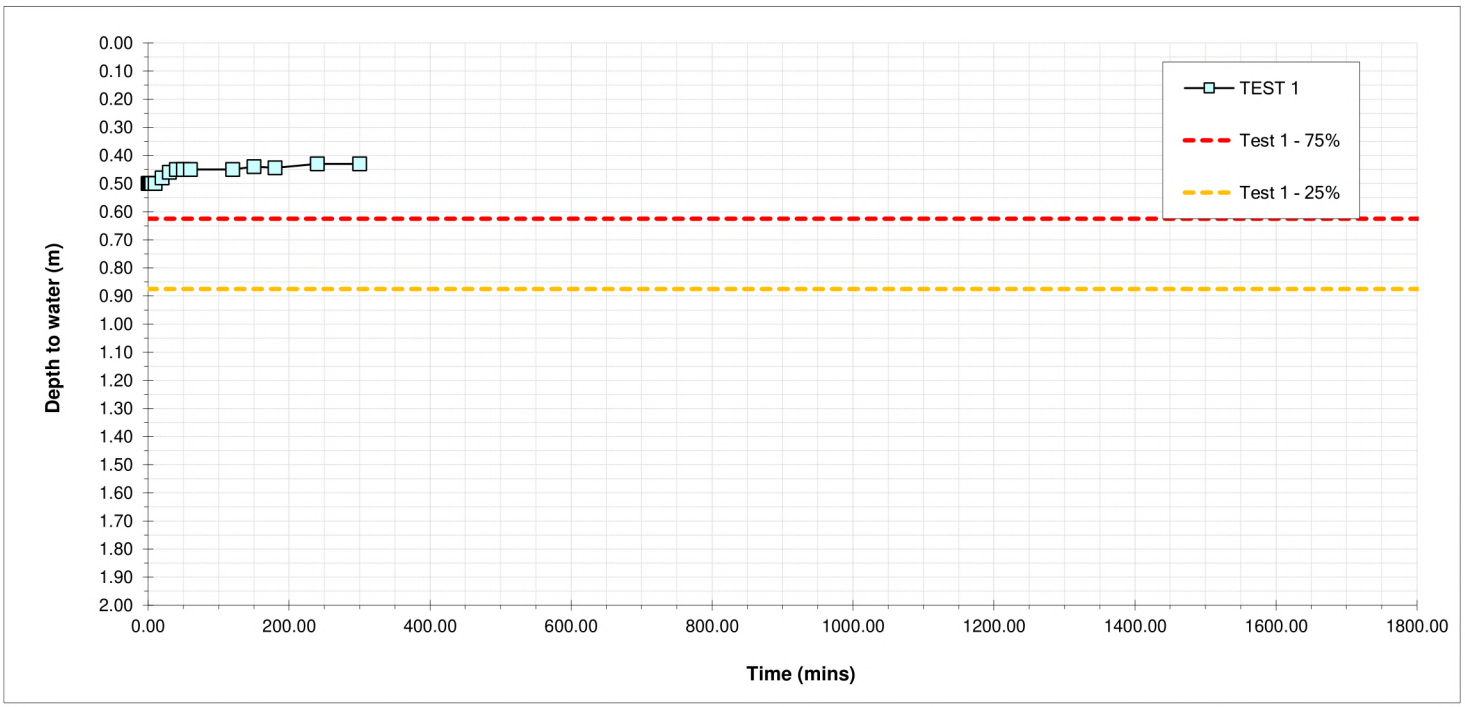
Compiled By:	Date:	Checked By:	Date:	Approved By:	Date:
G.Parr [redacted]	29.10.21	R.Hamilton [redacted]	29.10.21	S.Rhodes [redacted]	29.10.21

Site..... Bowland Fell Holiday Park Job Number..... SHF.201.136 Date of Test..... 28.10.21	Soakaway Number..... SA5 Length..... 1.20 m Width.....0.50 m Depth..... 1.00 m	
SOIL INFILTRATION RATE TEST See B.R.E. Digest 365, 1991, Soakaway Design.	Groundwater Level..... Dry m	

Remarks -

		TEST 1		TEST 2		TEST 3	
		Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
		0.0	0.50				
		1.0	0.50				
		2.0	0.50				
		3.0	0.50				
		4.0	0.50				
		5.0	0.50				
		10.0	0.50				
		20.0	0.48				
		30.0	0.46				
		40.0	0.45				
		50.0	0.45				
		60.0	0.45				
		120.0	0.45				
		150.00	0.44				
		180.00	0.44				
		240.00	0.43				
		300.00	0.43				
Effective Storage Depth	m		0.50				
75% Effective Storage Depth	m		0.38				
(i.e. depth below GL)	m		**0.63**				
25% Effective Storage Depth	m		0.13				
(i.e. depth below GL)	m		**0.88**				
Effective Storage Depth 75%-25%	m		0.25				
Time to fall to 75% effective depth	mins						
Time to fall to 25% effective depth	mins						
V (75%-25%)	m3		0.15				
a (50%)	m2		1.45				
t (75%-25%)	mins		0.00				
SOIL INFILTRATION RATE	m/s		**N/A**				

DESIGN SOIL INFILTRATION RATE, f Insufficient uptake to calculate infiltration rate m/s



Compiled By:	Date:	Checked By:	Date:	Approved By:	Date:
G.Parr [redacted]	29.10.21	R.Hamilton [redacted]	29.10.21	S.Rhodes [redacted]	29.10.21

Appendix 3 - Drainage Calculations

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

Return Period (years)	2
FEH Rainfall Version	2013
Site Location	GB 377983 455164 SD 77983 55164
Data Type	Point
Maximum Rainfall (mm/hr)	50
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	1.000
PIMP (%)	100
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.200
Maximum Backdrop Height (m)	1.500
Min Design Depth for Optimisation (m)	1.200
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	300

Designed with Level Inverts

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	16.822	0.210	80.1	0.022	5.00	0.0	0.600	o	150	Pipe/Conduit	
1.001	39.401	0.493	79.9	0.029	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.002	18.546	0.232	79.9	0.012	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.003	19.841	0.148	134.1	0.018	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.004	25.576	0.256	99.9	0.008	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.005	14.935	0.149	100.2	0.015	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.000	41.100	2.100	19.6	0.018	5.00	0.0	0.600	o	150	Pipe/Conduit	
2.001	17.868	0.750	23.8	0.022	0.00	0.0	0.600	o	150	Pipe/Conduit	
2.002	27.120	0.363	74.7	0.022	0.00	0.0	0.600	o	150	Pipe/Conduit	
2.003	30.822	0.308	100.1	0.022	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	49.97	5.25	206.667	0.022	0.0	0.0	0.0	1.12	19.9	4.0
1.001	47.99	5.83	206.457	0.051	0.0	0.0	0.0	1.13	19.9	8.8
1.002	47.12	6.11	205.964	0.063	0.0	0.0	0.0	1.13	19.9	10.7
1.003	45.98	6.49	205.732	0.081	0.0	0.0	0.0	0.87	15.3	13.4
1.004	44.78	6.91	205.584	0.089	0.0	0.0	0.0	1.01	17.8	14.4
1.005	44.27	7.10	205.328	0.104	0.0	0.0	0.0	1.31	51.9	16.6
2.000	49.79	5.30	208.650	0.018	0.0	0.0	0.0	2.29	40.4	3.2
2.001	49.29	5.44	206.550	0.040	0.0	0.0	0.0	2.07	36.6	7.1
2.002	47.99	5.83	205.800	0.062	0.0	0.0	0.0	1.16	20.6	10.7
2.003	46.76	6.22	205.437	0.084	0.0	0.0	0.0	1.31	52.0	14.2

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.006	21.953	0.729	30.1	0.008	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.007	38.532	0.257	149.9	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.008	6.696	1.200	5.6	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.009	46.410	4.800	9.7	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.006	43.87	7.26	205.129	0.196	0.0	0.0	0.0	2.39	95.1	31.0
1.007	42.62	7.76	204.400	0.196	0.0	0.0	0.0	1.28	90.6	31.0
1.008	42.58	7.77	203.500	0.196	0.0	0.0	0.0	6.70	473.4	31.0
1.009	42.21	7.93	202.300	0.196	0.0	0.0	0.0	5.09	359.4	31.0

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
S01	210.000	3.333	Open Manhole	1200	1.000	206.667	150				
S02	209.700	3.243	Open Manhole	1200	1.001	206.457	150	1.000	206.457	150	
S03	209.050	3.086	Open Manhole	1200	1.002	205.964	150	1.001	205.964	150	
S04	208.425	2.693	Open Manhole	1200	1.003	205.732	150	1.002	205.732	150	
S05	207.800	2.216	Open Manhole	1200	1.004	205.584	150	1.003	205.584	150	
S06	207.100	1.772	Open Manhole	1200	1.005	205.328	225	1.004	205.328	150	
S07	210.000	1.350	Open Manhole	1200	2.000	208.650	150				
S08	207.600	1.050	Open Manhole	1200	2.001	206.550	150	2.000	206.550	150	
S09	206.850	1.050	Open Manhole	1200	2.002	205.800	150	2.001	205.800	150	
S10	206.487	1.050	Open Manhole	1200	2.003	205.437	225	2.002	205.437	150	
S11	206.460	1.331	Open Manhole	1200	1.006	205.129	225	1.005	205.179	225	50
								2.003	205.129	225	
S12	205.450	1.050	Open Manhole	1200	1.007	204.400	300	1.006	204.400	225	
Basin	204.600	1.100	Open Manhole	1200	1.008	203.500	300	1.007	204.143	300	643
S14	203.500	1.200	Open Manhole	1200	1.009	202.300	300	1.008	202.300	300	
	198.400	0.900	Open Manhole	0		OUTFALL		1.009	197.500	300	

No coordinates have been specified, layout information cannot be produced.

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	150	S01	210.000	206.667	3.183	Open Manhole	1200
1.001	o	150	S02	209.700	206.457	3.093	Open Manhole	1200
1.002	o	150	S03	209.050	205.964	2.936	Open Manhole	1200
1.003	o	150	S04	208.425	205.732	2.543	Open Manhole	1200
1.004	o	150	S05	207.800	205.584	2.066	Open Manhole	1200
1.005	o	225	S06	207.100	205.328	1.547	Open Manhole	1200
2.000	o	150	S07	210.000	208.650	1.200	Open Manhole	1200
2.001	o	150	S08	207.600	206.550	0.900	Open Manhole	1200
2.002	o	150	S09	206.850	205.800	0.900	Open Manhole	1200
2.003	o	225	S10	206.487	205.437	0.825	Open Manhole	1200
1.006	o	225	S11	206.460	205.129	1.106	Open Manhole	1200
1.007	o	300	S12	205.450	204.400	0.750	Open Manhole	1200
1.008	o	300	Basin	204.600	203.500	0.800	Open Manhole	1200
1.009	o	300	S14	203.500	202.300	0.900	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	16.822	80.1	S02	209.700	206.457	3.093	Open Manhole	1200
1.001	39.401	79.9	S03	209.050	205.964	2.936	Open Manhole	1200
1.002	18.546	79.9	S04	208.425	205.732	2.543	Open Manhole	1200
1.003	19.841	134.1	S05	207.800	205.584	2.066	Open Manhole	1200
1.004	25.576	99.9	S06	207.100	205.328	1.622	Open Manhole	1200
1.005	14.935	100.2	S11	206.460	205.179	1.056	Open Manhole	1200
2.000	41.100	19.6	S08	207.600	206.550	0.900	Open Manhole	1200
2.001	17.868	23.8	S09	206.850	205.800	0.900	Open Manhole	1200
2.002	27.120	74.7	S10	206.487	205.437	0.900	Open Manhole	1200
2.003	30.822	100.1	S11	206.460	205.129	1.106	Open Manhole	1200
1.006	21.953	30.1	S12	205.450	204.400	0.825	Open Manhole	1200
1.007	38.532	149.9	Basin	204.600	204.143	0.157	Open Manhole	1200
1.008	6.696	5.6	S14	203.500	202.300	0.900	Open Manhole	1200
1.009	46.410	9.7		198.400	197.500	0.600	Open Manhole	0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.009		198.400	197.500	0.000	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	1.000	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs 0	Number of Offline Controls 0	Number of Time/Area Diagrams 0
Number of Online Controls 1	Number of Storage Structures 1	Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH	Summer Storms	Yes
Return Period (years)	2	Winter Storms	No
FEH Rainfall Version	2013	Cv (Summer)	1.000
Site Location	GB 377983 455164 SD 77983 55164	Cv (Winter)	1.000
Data Type	Point	Storm Duration (mins)	30

Online Controls for Storm

Hydro-Brake® Optimum Manhole: Basin, DS/PN: 1.008, Volume (m³): 3.9

Unit Reference	MD-SHE-0258-3580-0800-3580
Design Head (m)	0.800
Design Flow (l/s)	35.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	258
Invert Level (m)	203.500
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.800	35.8	Kick-Flo®	0.643	32.2
Flush-Flo™	0.380	35.8	Mean Flow over Head Range	-	28.3

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	8.3	0.800	35.8	2.000	55.6	4.000	77.9	7.000	102.3
0.200	26.5	1.000	39.8	2.200	58.3	4.500	82.5	7.500	105.8
0.300	35.3	1.200	43.5	2.400	60.8	5.000	86.8	8.000	109.2
0.400	35.7	1.400	46.8	2.600	63.2	5.500	91.0	8.500	111.7
0.500	35.1	1.600	50.0	3.000	67.7	6.000	94.9	9.000	115.0
0.600	33.4	1.800	52.9	3.500	73.0	6.500	98.7	9.500	118.2

Storage Structures for Storm

Tank or Pond Manhole: Basin, DS/PN: 1.008

Invert Level (m) 203.500

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	16.0	0.400	47.0	0.800	95.0
0.200	30.0	0.600	69.0	0.801	0.0

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model		FEH	Data Type Point
FEH Rainfall Version		2013	Cv (Summer) 1.000
Site Location	GB 377983 455164 SD 77983 55164		Cv (Winter) 1.000

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	OFF
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
1.000	S01	15 Summer	2	+0%	30/15 Summer				206.714	-0.103
1.001	S02	15 Summer	2	+0%	30/15 Summer				206.526	-0.081
1.002	S03	15 Summer	2	+0%	30/15 Summer				206.042	-0.072
1.003	S04	15 Summer	2	+0%	30/15 Summer				205.839	-0.043
1.004	S05	15 Summer	2	+0%	30/15 Summer				205.685	-0.049
1.005	S06	15 Summer	2	+0%					205.418	-0.135
2.000	S07	15 Summer	2	+0%					208.679	-0.121
2.001	S08	15 Summer	2	+0%	100/15 Summer				206.594	-0.106
2.002	S09	15 Summer	2	+0%	30/15 Summer	100/15 Summer			205.875	-0.075
2.003	S10	15 Summer	2	+0%	100/15 Summer				205.516	-0.146
1.006	S11	15 Summer	2	+0%	100/15 Summer				205.218	-0.136
1.007	S12	15 Summer	2	+0%	100/30 Summer				204.521	-0.179
1.008	Basin	30 Summer	2	+0%	30/15 Summer				203.692	-0.108
1.009	S14	30 Summer	2	+0%					202.354	-0.246

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S01	0.000	0.21			3.9	OK	
1.001	S02	0.000	0.42			8.1	OK	
1.002	S03	0.000	0.53			9.8	OK	
1.003	S04	0.000	0.84			12.1	OK	
1.004	S05	0.000	0.78			13.2	OK	
1.005	S06	0.000	0.33			15.1	OK	
2.000	S07	0.000	0.08			3.2	OK	

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
2.001	S08	0.000	0.19			6.4	OK	
2.002	S09	0.000	0.49			9.7	OK	1
2.003	S10	0.000	0.26			12.8	OK	
1.006	S11	0.000	0.33			28.5	OK	
1.007	S12	0.000	0.34			28.6	OK	
1.008	Basin	0.000	0.09			24.9	OK	
1.009	S14	0.000	0.07			24.8	OK	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model		FEH	Data Type Point
FEH Rainfall Version		2013	Cv (Summer) 1.000
Site Location	GB 377983 455164 SD 77983 55164		Cv (Winter) 1.000

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	OFF
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
1.000	S01	15 Summer	30	+0%	30/15 Summer				206.819	0.002
1.001	S02	15 Summer	30	+0%	30/15 Summer				206.790	0.183
1.002	S03	30 Summer	30	+0%	30/15 Summer				206.488	0.374
1.003	S04	30 Summer	30	+0%	30/15 Summer				206.293	0.411
1.004	S05	30 Summer	30	+0%	30/15 Summer				205.959	0.225
1.005	S06	15 Summer	30	+0%					205.455	-0.098
2.000	S07	15 Summer	30	+0%					208.693	-0.107
2.001	S08	15 Summer	30	+0%	100/15 Summer				206.624	-0.076
2.002	S09	15 Summer	30	+0%	30/15 Summer	100/15 Summer			206.130	0.180
2.003	S10	15 Summer	30	+0%	100/15 Summer				205.573	-0.089
1.006	S11	15 Summer	30	+0%	100/15 Summer				205.270	-0.084
1.007	S12	15 Summer	30	+0%	100/30 Summer				204.592	-0.108
1.008	Basin	30 Summer	30	+0%	30/15 Summer				203.904	0.104
1.009	S14	60 Summer	30	+0%					202.365	-0.235

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S01	0.000	0.45			8.3	SURCHARGED	
1.001	S02	0.000	0.88			17.0	SURCHARGED	
1.002	S03	0.000	0.94			17.4	SURCHARGED	
1.003	S04	0.000	1.49			21.5	SURCHARGED	
1.004	S05	0.000	1.37			23.3	SURCHARGED	
1.005	S06	0.000	0.58			26.6	OK	
2.000	S07	0.000	0.18			6.9	OK	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
2.001	S08	0.000	0.48			16.5	OK	
2.002	S09	0.000	1.22			24.0	SURCHARGED	1
2.003	S10	0.000	0.66			32.1	OK	
1.006	S11	0.000	0.71			61.3	OK	
1.007	S12	0.000	0.73			61.6	OK	
1.008	Basin	0.000	0.13			35.8	SURCHARGED	
1.009	S14	0.000	0.11			35.8	OK	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model		FEH	Data Type Point
FEH Rainfall Version		2013	Cv (Summer) 1.000
Site Location	GB 377983 455164 SD 77983 55164		Cv (Winter) 1.000

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	OFF
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 0, 40

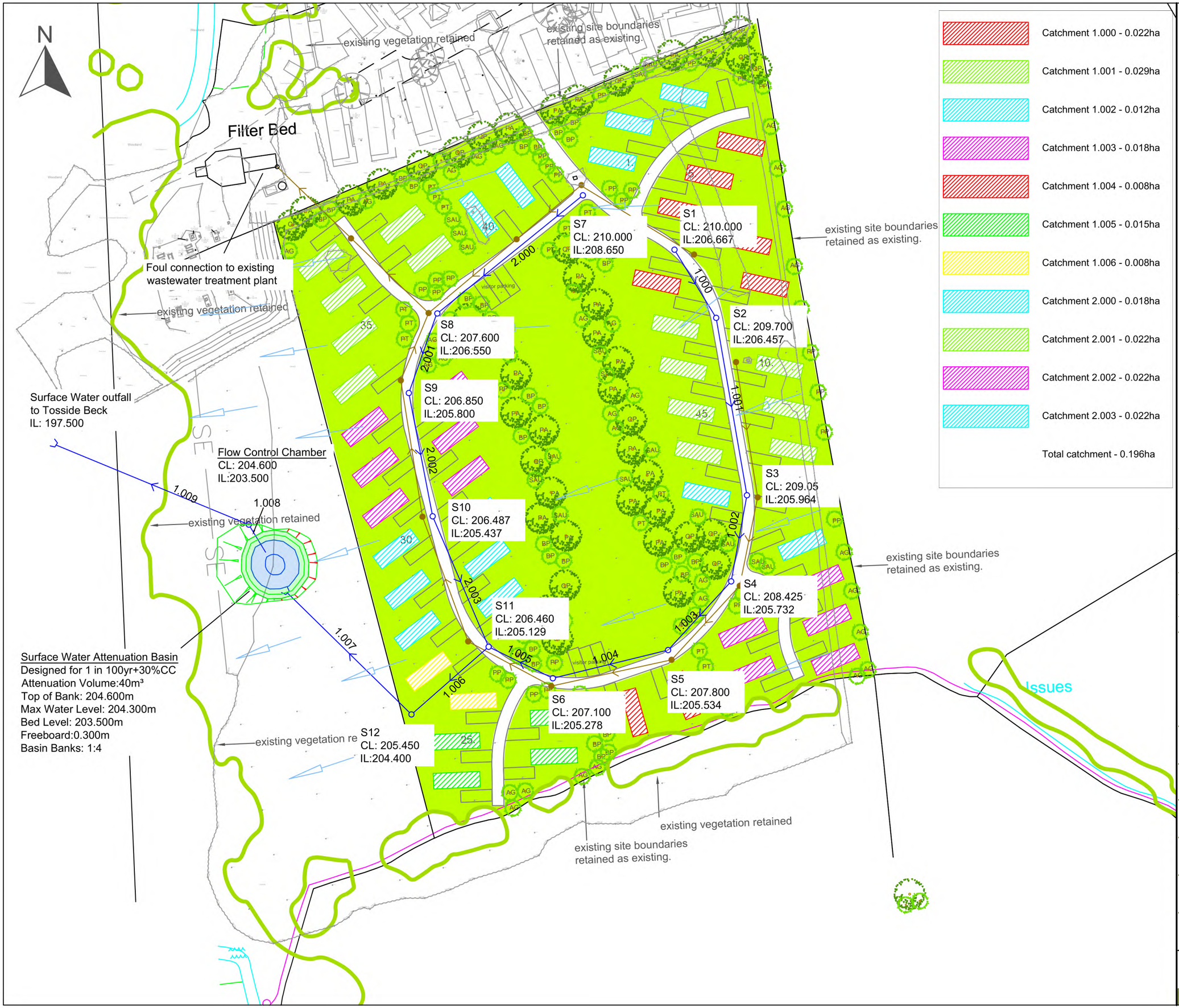
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
1.000	S01	30 Summer	100	+40%	30/15 Summer				208.276	1.459
1.001	S02	30 Summer	100	+40%	30/15 Summer				208.216	1.609
1.002	S03	30 Summer	100	+40%	30/15 Summer				207.639	1.525
1.003	S04	30 Summer	100	+40%	30/15 Summer				207.231	1.349
1.004	S05	30 Summer	100	+40%	30/15 Summer				206.545	0.811
1.005	S06	30 Summer	100	+40%					205.541	-0.012
2.000	S07	15 Summer	100	+40%					208.709	-0.091
2.001	S08	15 Summer	100	+40%	100/15 Summer				207.226	0.526
2.002	S09	15 Summer	100	+40%	30/15 Summer	100/15 Summer			206.850	0.900
2.003	S10	30 Summer	100	+40%	100/15 Summer				205.698	0.036
1.006	S11	30 Summer	100	+40%	100/15 Summer				205.430	0.076
1.007	S12	30 Summer	100	+40%	100/30 Summer				204.702	0.002
1.008	Basin	60 Summer	100	+40%	30/15 Summer				204.273	0.473
1.009	S14	240 Summer	100	+40%					202.365	-0.235

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S01	0.000	0.53			9.9	SURCHARGED	
1.001	S02	0.000	1.08			20.8	SURCHARGED	
1.002	S03	0.000	1.33			24.8	SURCHARGED	
1.003	S04	0.000	2.14			30.9	SURCHARGED	
1.004	S05	0.000	1.98			33.5	SURCHARGED	
1.005	S06	0.000	0.86			39.2	OK	
2.000	S07	0.000	0.32			12.7	OK	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
2.001	S08	0.000	0.69			23.5	SURCHARGED	
2.002	S09	0.042	1.78			35.1	FLOOD	1
2.003	S10	0.000	0.96			46.6	SURCHARGED	
1.006	S11	0.000	1.00			86.6	SURCHARGED	
1.007	S12	0.000	1.03			86.6	SURCHARGED	
1.008	Basin	0.000	0.13			35.7	SURCHARGED	
1.009	S14	0.000	0.11			35.8	OK	

Appendix 4 – Detailed Drainage Drawing



NOTES

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3. This drawing is to be read in conjunction with all relevant drawings and documents associated with this project.
4. All surveyed information including levels and layout is provided by others
5. All existing and proposed dimensions, levels and locations to be checked and verified by the main contractor on site prior to the commencement of the works and any anomalies reported to the engineer.
6. All works, workmanship and materials on private drainage to be in accordance with the civil engineering specification for water industry 7th edition published by the water research council.

Key

- Foul Water Sewer
- Surface Water Sewer
- Foul Water Manhole
- Surface Water Manhole
- Headwall with Pipework
- Pond
- Surface Water Flow Path

REV:	DATE:	DETAIL:	DES:	CHK:	APP:
D03	08/12/21	Attenuation details updated, catchment areas added.	RB	EA	EA
D02	04/11/21	SW details added	EA	SD	SD
D01	09/09/21	First Issue	CW	EA	EA

enzygo environmental consultants
Samuel House, 5 Fox Valley Way, Stocksbridge, Sheffield, S36 2AA

CLIENT: Park Holidays UK

PROJECT: Bowland Fell Holiday Park

DRAWING TITLE: Surface and Foul Water Drainage Strategy

DRAWN:	DESIGNED:	CHECKED:	APPROVED:
CW	CW	EA	EA

DATE:	SCALE @ A3:
09/09/2021	NTS
PROJECT NO.:	DRAWING NO.:
SHF.201.136	101
DRAWING STATUS:	ISSUE:
For Information	D03

Appendix 5 – Greenfield Runoff Calculations

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Elizabeth Austin
Site name:	Bowland Fell Park
Site location:	Tosside, Skipton

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	53.99233° N
Longitude:	2.33754° W
Reference:	3363633996
Date:	Sep 09 2021 14:33

Runoff estimation approach

FEH Statistical

Site characteristics

Total site area (ha):	2.606

Methodology

Q_{MED} estimation method:	Calculate from BFI and SAAR
BFI and SPR method:	Specify BFI manually
HOST class:	N/A
BFI / BFIHOST:	0.322
Q_{MED} (l/s):	
Q_{BAR} / Q_{MED} factor:	1.08

Hydrological characteristics

	Default	Edited
SAAR (mm):	1368	1368
Hydrological region:	10	10
Growth curve factor 1 year:	0.87	0.87
Growth curve factor 30 years:	1.7	1.7
Growth curve factor 100 years:	2.08	2.08
Growth curve factor 200 years:	2.37	2.37

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

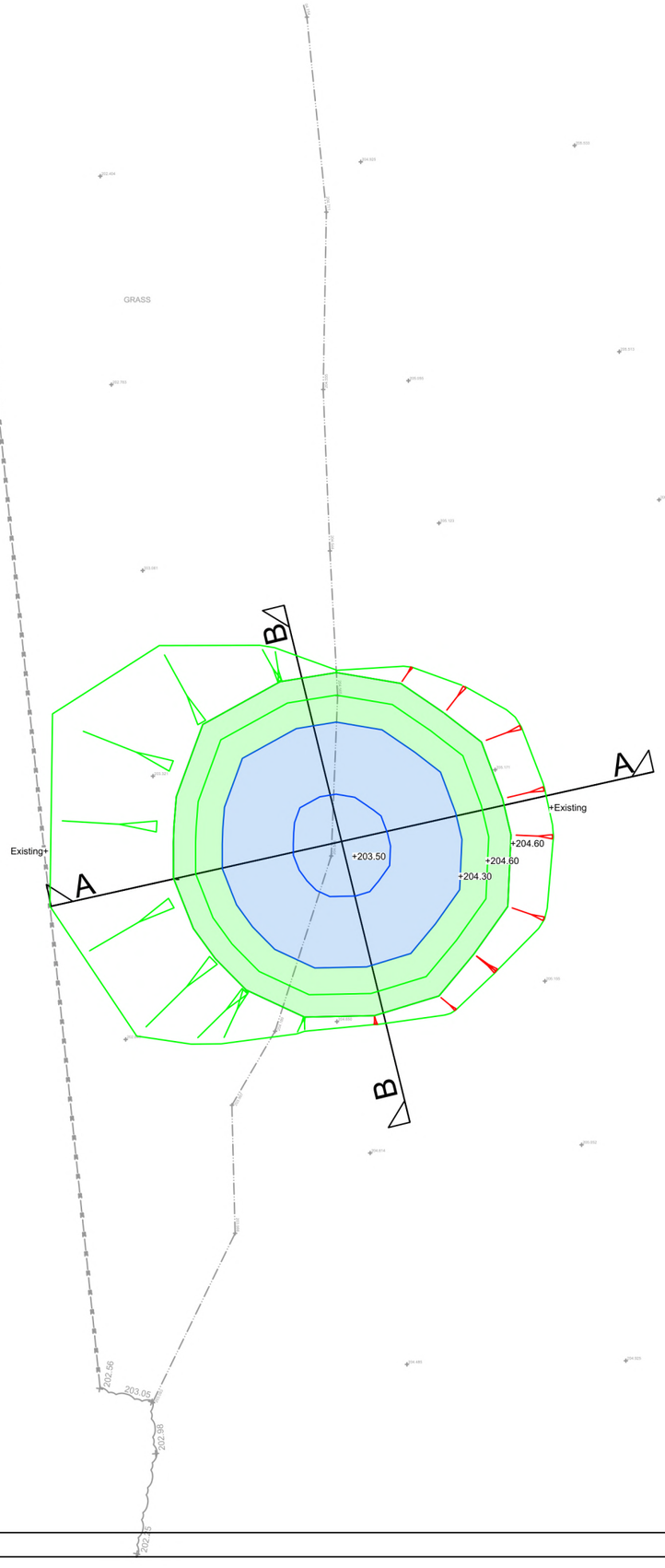
(3) Is SPR/SPRHOST ≤ 0.3?

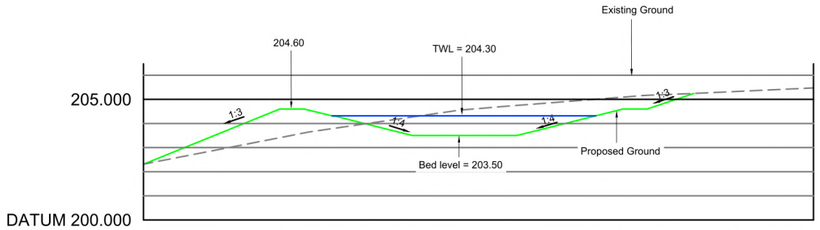
Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):		47.67
1 in 1 year (l/s):		41.47
1 in 30 years (l/s):		81.04
1 in 100 year (l/s):		99.15
1 in 200 years (l/s):		112.98

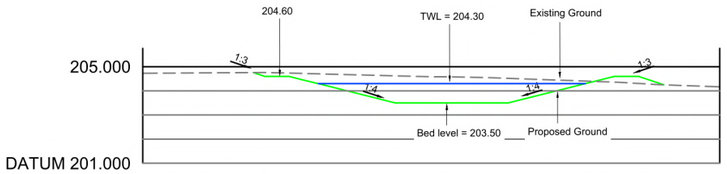
Appendix 6 – Basin Detail





CHAINAGE	0.000	4.171	4.348	5.000	10.000	15.000	20.000	22.842	25.000	27.800
BASIN LEVEL		203.157		203.885	203.789	203.500	204.600	205.246		
EXISTING LEVEL		203.122		203.283	204.102	204.710	205.100		205.345	205.474

A-A



CHAINAGE	0.000	4.587	5.000	10.000	15.000	20.000	21.623	23.940
BASIN LEVEL		204.759	204.622	203.620	203.500	204.600	204.250	
EXISTING LEVEL	204.728	204.762	204.636	204.526	204.340		204.167	

B-B

NOTES

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- All existing and proposed dimensions, levels and locations to be checked and verified by the main contractor on site prior to the commencement of the works and any anomalies reported to the engineer.

REV:	DATE:	DETAIL:	DES:	CHK:	APP:
D01	08/12/21	First Issue	RB	EA	EA

enzygo environmental consultants
Samuel House, 5 Fox Valley Way, Stocksbridge, Sheffield, S36 2AA

CLIENT: Park Holidays UK

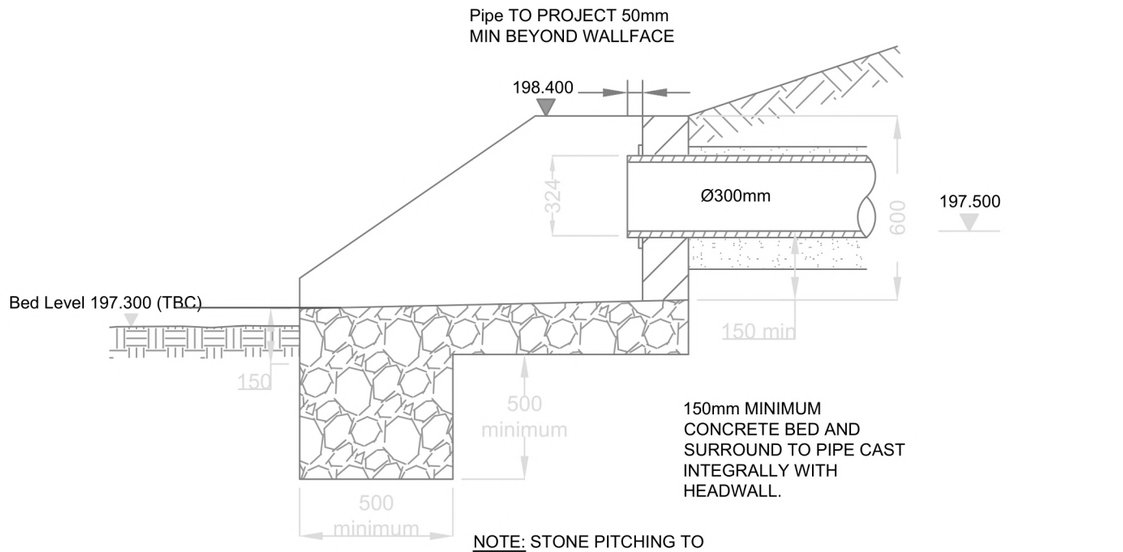
PROJECT: Bowland Fell Holiday Park

DRAWING TITLE: Basin Sections

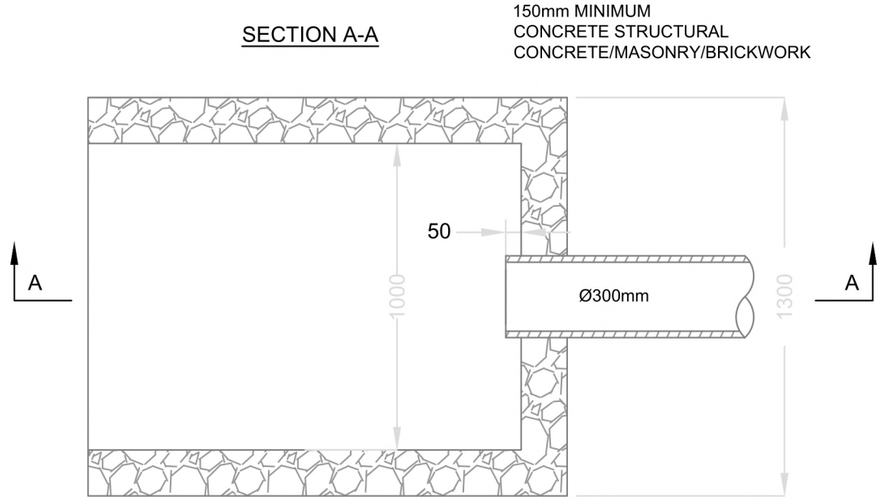
DRAWN:	DESIGNED:	CHECKED:	APPROVED:
RB	RB	EA	EA

DATE:	SCALE @ A3:
08/12/2021	1:250
PROJECT NO.:	DRAWING NO.:
SHF.201.136	102
DRAWING STATUS:	ISSUE:
For Information	D01

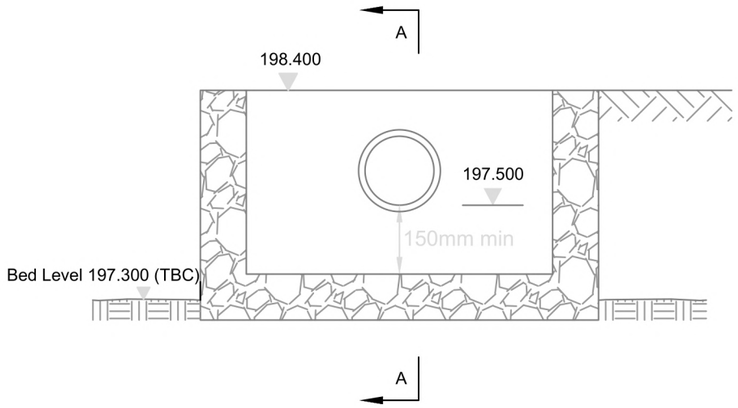
Appendix 7 – Headwall Detail



SECTION A-A



PLAN



FRONT ELEVATION

TYPICAL HEADWALL DETAIL
(OUTFALL TO WATERCOURSE)
SUITABLE FOR OUTFALL PIPES LESS THAN 350mm
SCALE 1:20

NOTES

1. Do not scale from this drawing
2. All dimensions are in meters unless stated otherwise
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4. All surveyed information including levels and layout is provided by others
5. All existing and proposed dimensions, levels and locations to be checked and verified by the main contractor on site prior to the commencement of the works and any anomalies reported to the engineer.
6. All works, workmanship and materials on private drainage to be in accordance with the civil engineering specification for water industry 7th edition published by the water research council.

REV:	DATE:	DETAIL:	DES:	CHK:	APP:
D01	09/12/21	First Issue	RB	EA	EA

enzygo environmental consultants
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