Surface Water Drainage Design

Enabling Development of Three Detached Houses

Land adjacent to

Lower Island House

Island Wall

Whitstable

CT5 1EE

Kapra Developments Ltd

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1. Introduction

The following surface water drainage design has been produced for enabling development of three detached houses on land adjacent to Lower Island House, Island Wall, Whitstable, CT5 1EE. The design provides details for the discharge of Condition 10 of Planning Permission CA/15/02180/OUT.

Condition 10
Before the development is commenced, details shall be submitted to the Local Planning Authority for its approval of the proposed means of disposing of surface water. The development shall not be carried out other than in accordance with such details as may be approved.

If a Sustainable Drainage System (SUDS) is used the submitted details shall:

a) Specify the responsibilities of each party for the implementation of the SUDS scheme,
b) Specify a timetable for implementation,
c) and Provide a management and maintenance plan of the SUDS for the lifetime of the development.

REASON: Pursuant to Articles 35 (1) and (2) of the Town and Country Planning (Development Management Procedure) (England) Order 2015, the local planning authority is satisfied that the requirements of this condition (including the timing of compliance) are so fundamental to the development permitted that, if not imposed, it would have been necessary to refuse permission for the development. This is because, at the time of granting permission, full details of the drainage scheme for the development to allow an assessment of the implication for surrounding development were not yet available but this information is necessary to ensure the development complies with Canterbury District Local Plan 2006 Policy C31 and Draft Canterbury District Local Plan 2014 Policy CC11. To ensure the development is satisfactorily drained and to prevent localised flooding.

2. Hydrology

Geology and Soils - The bedrock geology consists of the London Clay Formation, clay and silt. Superficial deposits consist of Alluvium, clay, silty, peaty and sandy. Soils are classified as loamy and clayey soils of coastal flats with naturally high groundwater.

Topographical Survey - A detailed topographical survey has been carried out. The site slopes from west to east from a high point of 4.5mAOD (Above Ordnance Datum) to a low point of 2.1mAOD, Figure 1.

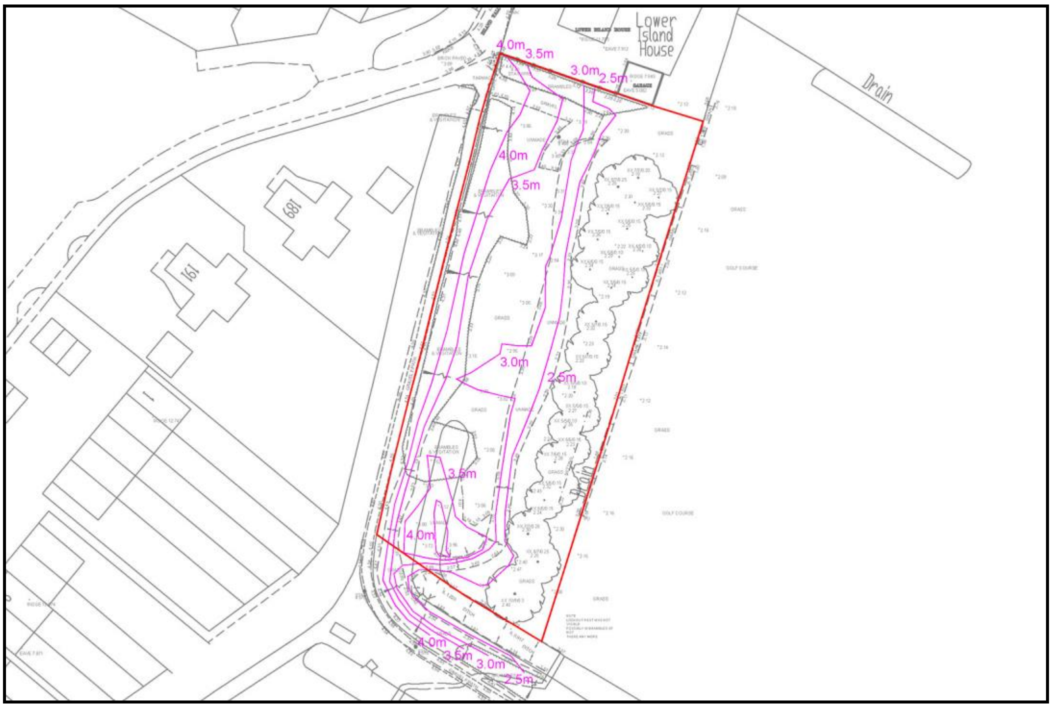

Figure 1. Local topography.

Groundwater - The site lies outside any groundwater source protection zones. Records of borehole sunk near the site indicate a groundwater level of 2.3mAOD. Groundwater levels at the site are therefore high and likely to be within 1m of the lowest points on the site.

Infiltration Rates - Soakage testing has not been carried out at the site. The presence of London Clay, local drainage ditches and the high groundwater level means that a surface water drainage strategy based on discharge to a watercourse is the most appropriate with any storage structures constructed at a shallow level.

Existing Surface Water Drainage Patterns - The existing site drains to a ditch running along the eastern boundary. This in turn drains to a ditch along the southern boundary, Figure 2.

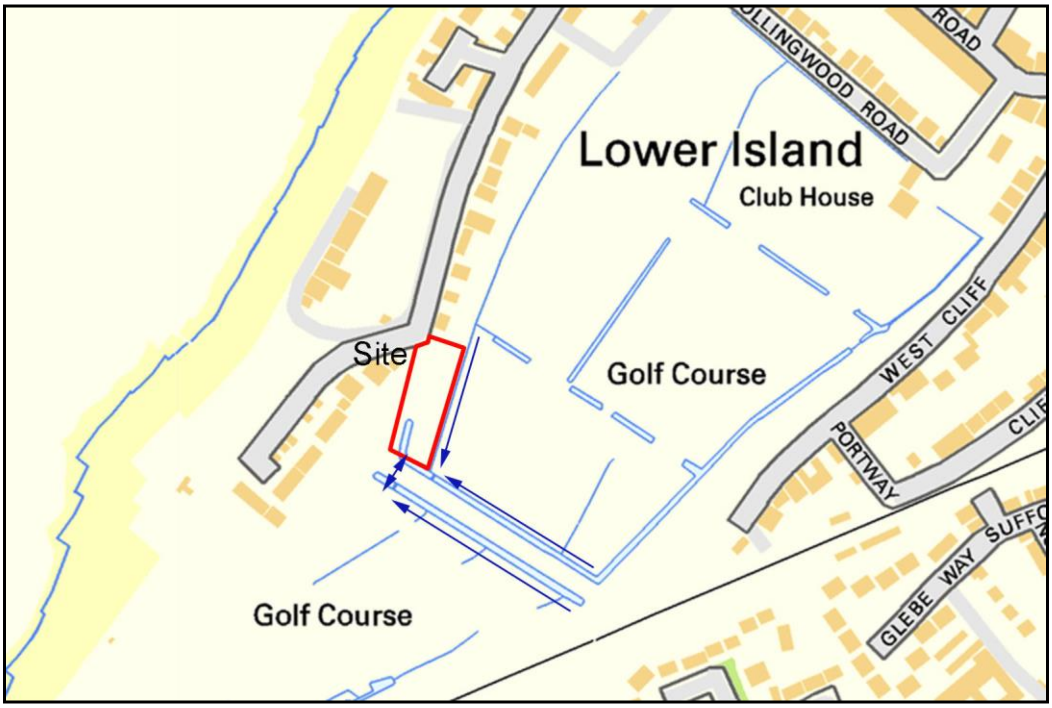

Figure 2. Local Hydrology.

Sewer Record - A surface water sewer runs between the two drains from east to west, Figure 3. It is not known if the ditches discharge to the surface water sewer but is considered likely as this offers the only outlet for surface water in the area.

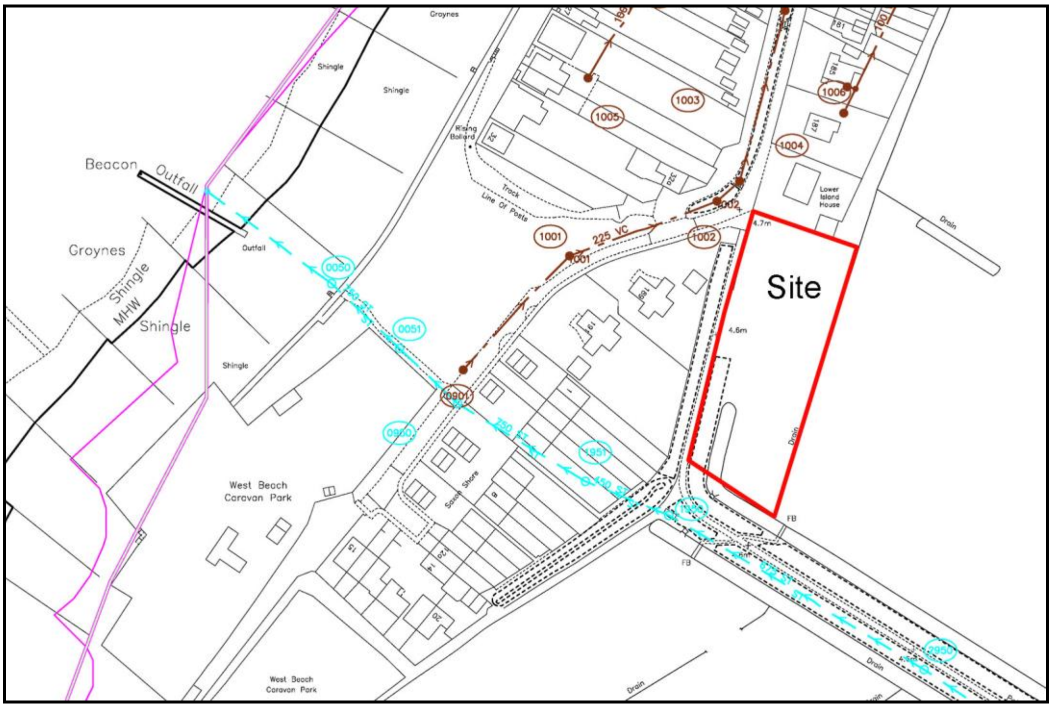

Figure 3. Sewer record. (© Southern Water)

Existing Site - The site is a greenfield site, covering 0.28ha. The peak greenfield runoff for the critical storm duration for the pre-development site has been calculated using the IH124 method from the greenfield runoff rate estimation tool published online by HR Wallingford at uksuds.com. The peak runoff is shown in Table 1.

Return Period	**Runoff Rate Q l/s**	
	per ha.	**Site (0.28 ha)**
QBar	3.9	1.1
1	3.3	0.9
30	8.9	2.5
100	12.4	3.5

Table 1. Pre-development greenfield runoff rate for the site.

3. Surface Water Management Strategy

The presence of London Clay, local drainage ditches and the high groundwater level means that a surface water drainage strategy based on discharge to the local drainage ditch is the most appropriate, using shallow attenuation structures to limit the peak rate of surface water discharge.

The proposed site is covered with 1,080m^2 of potentially impermeable materials consisting of 500m^2 of roof area, of which 100m^2 will be green roof, and 580m^2 of paved area, Figure 4.

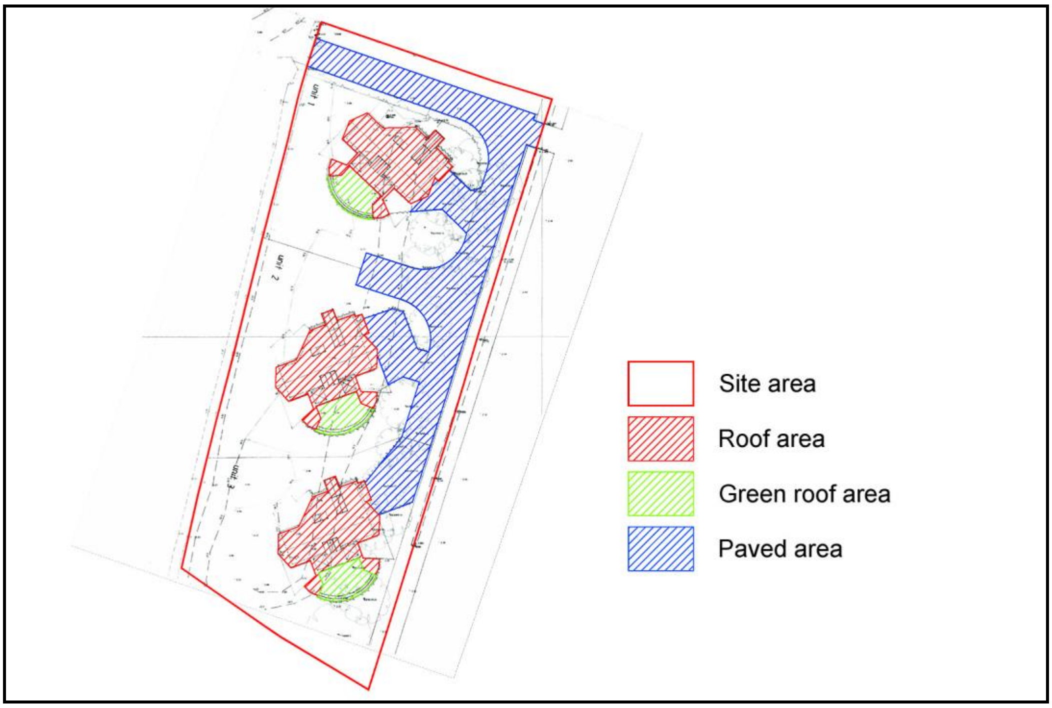

Figure 4. Proposed impermeable areas.

The peak rate of runoff and volume of runoff for the critical storm duration for the existing and proposed site, is shown in Table 2.

Storm Return Period (years)	Peak Runoff (Q l/s)		Volume of Runoff 360 minute duration storm (m^3)	
	Existing (greenfield 1,080m^2)	Proposed (1,080m^2)	Existing (greenfield 1,080m^2)	Proposed (1,080m^2)
1	0.4	8.5	9.0	19.0
30	1.0	20.7	20.9	41.9
100	1.3	27.0	28.4	54.4
100 + 20%	1.6	32.4	34.1	65.3
100 + 40%	1.9	37.8		

Table 2. Peak rate of runoff and volume of runoff from the existing and proposed site.

The aim of the surface water management strategy is to replicate the existing drainage patterns by providing storage to limit peak runoff from the site to existing rates. This is in line with the Defra and DCLG Non-Statutory Technical Standards which state:

Peak flow control

S2 *For greenfield developments, the peak runoff rate from the development to any highway drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event should never exceed the peak greenfield runoff rate for the same event.*

Given the small development area the peak runoff for the 1 year rainfall event is only 0.4 l/s.

A discharge of 2 l/s from the site is considered to be the minimum achievable. A flow rate less than this would require orifice plates that are too small and would be liable to block, increasing flood risk.

The surface water management strategy is to use permeable paving to attenuate surface water runoff from roofs and paving before discharging to the ditch, Figure 5. The paving will provided storage only and will be lined as infiltration is not feasible.

The design parameters for the permeable paving are shown in Table 3. The structures have been analysed using MicroDrainage Source Control published by XP Solutions. The analysis is shown in Appendix A.

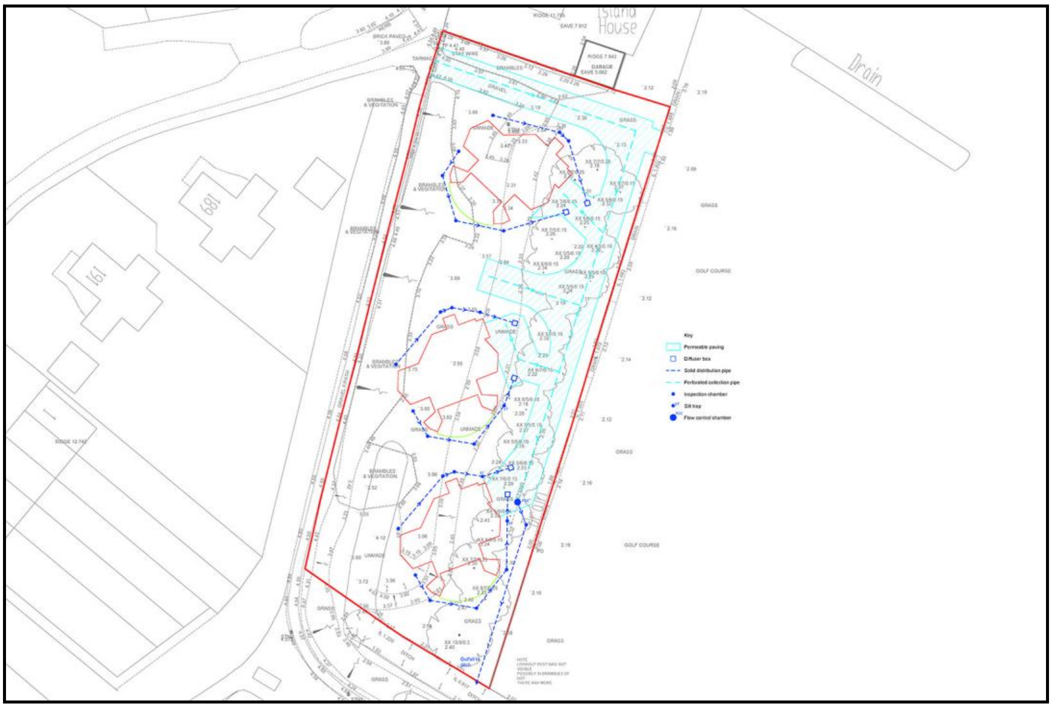

Figure 5. Surface water management strategy.

With these structures in place peak runoff from the development is limited to 2 l/s under all rainfall events up to the 1 in 100 year, plus an allowance of 20% for climate change, event.

The drainage layout is shown on drawing 731/102 Surface Water Drainage Layout.

Parameter	Permeable Paving
Rainfall return period	1 in 100 year + 20%
Permeable paving area	480m^2
Permeable paving depth	300mm
Contributing area (paved)	580m^2
Contributing area (roofs)	500m^2
Controlled discharge	2 l/s
Orifice diameter	34mm
Maximum water depth	265mm
Half drain time	174 minutes

Table 3. Design parameters for the permeable paving.

Under the 1 in 100 year, plus 40% allowance for climate change, event, the permeable paving floods with a flooded volume of 3m^3. This volume will discharge to the ditch or overflow onto the golf course and not affect the proposed development or adjacent properties.

4. Water Quality

The SuDS Manual gives the following as standards of good practice for water quality:

Water quality standard 1: Prevent runoff from the site to receiving surface waters for the majority of small rainfall events.

No runoff should be discharged from the site to receiving surface waters or sewers for the majority of small (eg < 5 mm) rainfall events. This is termed Interception.

Water quality standard 2: Treat runoff to prevent negative impacts on the receiving water quality.

Runoff should be adequately treated to protect the receiving water body from:

1. Short-term acute pollution that may result from accidental spills or temporary high pollution loadings within the catchment area.
2. Long-term chronic pollution from the spectrum of runoff pollutant sources within the urban environment.

Water Quality Standard 1 - Interception

The permeable paving will act as interception storage. Runoff from smaller events will be retained within the permeable paving, maximising evapo-transpiration. Runoff from rainfall events up to 5mm is unlikely to discharge from the site. The proposed strategy therefore meets the interception standard.

Water Quality Standard 2 - Treatment

The extent of treatment required depends on the land use, the level of pollution prevention in the catchment and for groundwater the natural protection afforded by underlying soil layers. High hazard sites will have a higher potential pollution load and higher potential maximum pollution concentrations. They therefore tend to require more treatment than low hazard sites in order to deliver discharges of an acceptable quality.

The SuDS Manual sets out minimum water quality management requirements for discharges to receiving surface waters and groundwater for various land use types, Table 4. The site consists of two land use types:

1. Roofs to buildings classed as *residential roofs*, very low pollution hazard.
2. The low traffic access road and drives classed as *property driveways/low traffic roads*, low pollution hazard.

<table>
<tr><th rowspan="2">Land use</th><th rowspan="2">Pollution hazard level</th><th colspan="2">Requirements for discharge to:</th></tr>
<tr><th>surface waters</th><th>groundwater</th></tr>
<tr><td>Residential roofs</td><td>Very low</td><td colspan="2">Removal of gross solids and sediments only</td></tr>
<tr><td>Individual property driveways, roofs (excluding residential), residential car parks, low traffic roads (eg cul de sacs, home zones, general access roads), non-residential car parking with infrequent change (eg schools, offices)</td><td>Low</td><td colspan="2">Simple index approach
Note: extra measures may be required for discharges to protected resources</td></tr>
<tr><td rowspan="2">Commercial yard and delivery areas, non-residential car parking with frequent change (eg hospitals, retail), all roads except low traffic roads and trunk roads/motorways</td><td rowspan="2">Medium</td><td colspan="2">Simple index approach
Note: extra measures may be required for discharges to protected resources</td></tr>
<tr><td></td><td>In England and Wales, Risk Screening must be undertaken first to determine whether consultation with the environmental regulator is required.</td></tr>
<tr><td>Trunk roads and motorways</td><td>High</td><td colspan="2">Follow the guidance and risk assessment process set out in HA (2009)</td></tr>
<tr><td>Sites with heavy pollution (eg haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels are to be delivered, handled, stored, used or manufactured, industrial sites</td><td>High</td><td colspan="2">Discharges may require an environmental licence or permit. Obtain pre-permitting advice from the environmental regulator. Risk assessment is likely to be required.</td></tr>
<tr><td colspan="4">Note 1. Filter drains can remove coarse sediments, but their use for this purpose will have significant implications with respect to maintenance requirements, and this should be taken into account in the design and Maintenance Plan.
Note 2. Ponds and wetlands can remove coarse sediments, but their use for this purpose will have significant implications with respect to the maintenance requirements and amenity value of the system. Sediment should normally be removed upstream, unless they are specifically designed to retain sediment in a separate part of the component, where it cannot easily migrate to the main body of water.
Note 3. Where a wetland is not specifically designed to provide significantly enhanced treatment, it should be considered as having the same mitigation indices as a pond.</td></tr>
</table>

Table 4. Indicative SuDS mitigation indices for discharge to surface waters and groundwater.

For each land use type a simple index approach is appropriate which involves the following steps:

1. Allocate suitable pollution hazard indices for the proposed land use, Table 5.
2. Select SuDS with a total pollution mitigation index that equals or exceeds the pollution hazard index, Table 6.

Land Use	**Pollution hazard level**	**Total suspended solids**	**Metals**	**Hydro-carbons**
Residential Roofs	Very low	0.2	0.2	0.05
Other roofs (commercial/industrial)	Low	0.3	0.2[1]	0.05
Individual property driveways, residential car parks, low traffic roads and non-residential car parking with infrequent change (eg schools, offices) <300 traffic movements/day	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change (eg hospitals, retail), all roads except low traffic roads and trunk roads/motorways	Medium	0.7	0.6	0.7
Sites with heavy pollution (eg haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites, sites where chemicals and fuels are to be delivered, handled, stored, used or manufactured, industrial sites, trunk roads and motorways[2]	High	0.8[3]	0.8[3]	0.9[3]

Note 1. Up to 0.8 where there is potential for metals to leach from the roof.

Note 2. Motorways and trunk roads should follow the guidance and risk assessment process set out in Highways Agency (2009)

Note 3. These should only be used if considered appropriate as part of a detailed risk assessment.

Table 5. Pollution hazard indices for different land use classifications.

To deliver adequate treatment, the selected SuDS components should have a total pollution mitigation index, for each contaminant type, that equals or exceeds the pollution hazard index, for each contaminant type. Where the mitigation index of an individual component is insufficient, two components, or more, in series will be required. A factor of 0.5 is used to account for the reduced performance of secondary or tertiary components.

Type of SuDS component	Total suspended solids	Metals	Hydro-carbons
Filter strip	0.4	0.4	0.5
Filter drain	0.4[1]	0.4	0.4
Swale	0.5	0.6	0.6
Bioretention system	0.8	0.8	0.8
Permeable pavement	0.7	0.6	0.7
Detention basin	0.5	0.5	0.5
Pond	0.7[2]	0.7	0.5
Wetland[3]	0.8[2]	0.8	0.8
Proprietary treatment system	These must demonstrate that they can address each of the contaminant types to acceptable levels for frequent events up to approximately the 1in 1 year return period event, for inflow concentrations relevant to the contributing drainage area.		
Note 1. Filter drains can remove coarse sediments, but their use for this purpose will have significant implications with respect to maintenance requirements, and this should be taken into account in the design and Maintenance Plan. Note 2. Ponds and wetlands can remove coarse sediments, but their use for this purpose will have significant implications with respect to the maintenance requirements and amenity value of the system. Sediment should normally be removed upstream, unless they are specifically designed to retain sediment in a separate part of the component, where it cannot easily migrate to the main body of water. Note 3. Where a wetland is not specifically designed to provide significantly enhanced treatment, it should be considered as having the same mitigation indices as a pond.			

Table 6. Indicative SuDS mitigation indices for discharge to surface waters.

All runoff will pass through the permeable paving. The total pollution mitigation index will be equal or greater than the pollution hazard index for all pollutants, Table 7. All runoff from the site will therefore receive an appropriate level of water quality treatment.

Indices	Total suspended solids	Metals	Hydro-carbons
Residential roofs			
Maximum hazard index	0.2	0.2	0.05
Minimum SuDS mitigation index (permeable paving)	0.7	0.6	0.7
Appropriate treatment	✓	✓	✓
Access road/car parking areas			
Maximum hazard index	0.5	0.4	0.4
Minimum SuDS mitigation index (permeable paving)	0.7	0.6	0.7
Appropriate treatment	✓	✓	✓

Table 7. Pollution hazard indices and SuDS mitigation indices for the development.

5. Timetable for implementation

The permeable paving will be constructed following initial groundworks and before any impermeable surfaces are constructed to prevent mud and silt from blocking the paving during groundworks.

6. Management and Maintenance

A Sustainable Urban Drainage Systems Management and Maintenance Plan is attached at Appendix B.

7. Kent County Council Drainage Summary

Kent County Council as Lead Local Flood Authority has published a Drainage Strategy Summary form to accompany planning applications. The completed form is attached at Appendix C.

Appendix A - Permeable Paving Design

Summary of Results for 100 year Return Period (+20%)

Half Drain Time : 174 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	1.957	0.127	0.0	1.7	1.7	18.3	O K
30 min Summer	2.001	0.171	0.0	1.8	1.8	24.6	O K
60 min Summer	2.039	0.209	0.0	1.9	1.9	30.1	O K
120 min Summer	2.057	0.227	0.0	1.9	1.9	32.8	O K
180 min Summer	2.055	0.225	0.0	1.9	1.9	32.3	O K
240 min Summer	2.047	0.217	0.0	1.9	1.9	31.3	O K
360 min Summer	2.032	0.202	0.0	1.8	1.8	29.1	O K
480 min Summer	2.019	0.189	0.0	1.8	1.8	27.2	O K
600 min Summer	2.006	0.176	0.0	1.8	1.8	25.4	O K
720 min Summer	1.994	0.164	0.0	1.8	1.8	23.7	O K
960 min Summer	1.971	0.141	0.0	1.7	1.7	20.3	O K
1440 min Summer	1.931	0.101	0.0	1.7	1.7	14.5	O K
2160 min Summer	1.884	0.054	0.0	1.6	1.6	7.8	O K
2880 min Summer	1.854	0.024	0.0	1.5	1.5	3.4	O K
4320 min Summer	1.830	0.000	0.0	1.4	1.4	0.0	O K
5760 min Summer	1.830	0.000	0.0	1.1	1.1	0.0	O K
7200 min Summer	1.830	0.000	0.0	0.9	0.9	0.0	O K
8640 min Summer	1.830	0.000	0.0	0.8	0.8	0.0	O K
10080 min Summer	1.830	0.000	0.0	0.7	0.7	0.0	O K
15 min Winter	1.975	0.145	0.0	1.8	1.8	20.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	116.472	0.0	20.6	25
30 min Summer	76.493	0.0	27.9	39
60 min Summer	47.860	0.0	35.5	64
120 min Summer	28.933	0.0	43.3	120
180 min Summer	21.268	0.0	48.1	158
240 min Summer	16.995	0.0	51.2	190
360 min Summer	12.340	0.0	56.0	256
480 min Summer	9.835	0.0	59.5	324
600 min Summer	8.241	0.0	62.4	392
720 min Summer	7.130	0.0	64.9	460
960 min Summer	5.669	0.0	68.7	592
1440 min Summer	4.097	0.0	74.3	850
2160 min Summer	2.956	0.0	80.1	1208
2880 min Summer	2.342	0.0	84.1	1544
4320 min Summer	1.685	0.0	89.7	0
5760 min Summer	1.333	0.0	93.6	0
7200 min Summer	1.111	0.0	96.4	0
8640 min Summer	0.956	0.0	98.5	0
10080 min Summer	0.843	0.0	100.1	0
15 min Winter	116.472	0.0	23.4	25

Summary of Results for 100 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	2.025	0.195	0.0	1.8	1.8	28.1	O K
60 min Winter	2.068	0.238	0.0	1.9	1.9	34.3	O K
120 min Winter	2.094	0.264	0.0	1.9	1.9	38.1	O K
180 min Winter	2.095	0.265	0.0	1.9	1.9	38.1	O K
240 min Winter	2.086	0.256	0.0	1.9	1.9	36.8	O K
360 min Winter	2.066	0.236	0.0	1.9	1.9	34.0	O K
480 min Winter	2.047	0.217	0.0	1.9	1.9	31.3	O K
600 min Winter	2.028	0.198	0.0	1.8	1.8	28.6	O K
720 min Winter	2.010	0.180	0.0	1.8	1.8	25.9	O K
960 min Winter	1.975	0.145	0.0	1.8	1.8	20.9	O K
1440 min Winter	1.916	0.086	0.0	1.7	1.7	12.4	O K
2160 min Winter	1.855	0.025	0.0	1.5	1.5	3.6	O K
2880 min Winter	1.830	0.000	0.0	1.4	1.4	0.0	O K
4320 min Winter	1.830	0.000	0.0	1.0	1.0	0.0	O K
5760 min Winter	1.830	0.000	0.0	0.8	0.8	0.0	O K
7200 min Winter	1.830	0.000	0.0	0.7	0.7	0.0	O K
8640 min Winter	1.830	0.000	0.0	0.6	0.6	0.0	O K
10080 min Winter	1.830	0.000	0.0	0.5	0.5	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	76.493	0.0	31.5	39
60 min Winter	47.860	0.0	40.1	64
120 min Winter	28.933	0.0	48.9	120
180 min Winter	21.268	0.0	54.2	174
240 min Winter	16.995	0.0	57.7	202
360 min Winter	12.340	0.0	63.1	276
480 min Winter	9.835	0.0	67.1	352
600 min Winter	8.241	0.0	70.3	426
720 min Winter	7.130	0.0	72.9	498
960 min Winter	5.669	0.0	77.3	636
1440 min Winter	4.097	0.0	83.6	896
2160 min Winter	2.956	0.0	90.1	1232
2880 min Winter	2.342	0.0	94.8	0
4320 min Winter	1.685	0.0	101.3	0
5760 min Winter	1.333	0.0	105.8	0
7200 min Winter	1.111	0.0	109.1	0
8640 min Winter	0.956	0.0	111.7	0
10080 min Winter	0.843	0.0	113.7	0

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.700	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+20

Time Area Diagram

Total Area (ha) 0.106

Time From:	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**
0	4	0.060	8	12	0.021	16	20	0.001	24	28	0.001
4	8	0.021	12	16	0.001	20	24	0.001			

Model Details

Storage is Online Cover Level (m) 2.280

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	8.0
Membrane Percolation (mm/hr)	1000	Length (m)	60.0
Max Percolation (l/s)	133.3	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	1.830	Cap Volume Depth (m)	0.300

Orifice Outflow Control

Diameter (m) 0.034 Discharge Coefficient 0.600 Invert Level (m) 1.430

Appendix B - Sustainable Urban Drainage Systems Management and Maintenance Plan

Land adjacent to Lower Island House, Island Wall, Whitstable, CT5 1EE
Sustainable Urban Drainage Systems Management and Maintenance Plan

1. Introduction

This Sustainable Urban Drainage Systems (SuDS) Management and Maintenance Plan has been produced for SuDS elements at Land adjacent to Lower Island House, Island Wall, Whitstable, CT5 1EE.

The following SuDS elements are proposed within the development.

- Permeable paving
- Orifice control structures
- Ditches

2. Management

A management company will be set up and will be responsible for the maintenance of the drainage structures.

3. Maintenance

The following maintenance plans will be put in place for each of the SuDS elements present within the development.

Permeable Paving

SUDS Element	**Permeable Paving**	
Maintenance Issues	Pervious surfaces are susceptible to silt blockage.	
Maintenance Period	**Maintenance Task**	**Frequency**
Regular	Surface brushing to reduce silt accumulation.	Monthly
	Brushing and jet wash in autumn after leaf fall.	Annually
	Mow grass edges to paving at 35-50mm and remove weeds and leaves.	As required
Occasional tasks	Jetting where silt has accumulated in joints or voids. Replace grit and vibrate surface to lock.	As required
Remedial Work	Where shrinkage or surface damage occurs, uplift paving, remove grit bedding layer and geotextile if present and reinstate to design profile.	As required

Orifice Control Structures

SUDS Element	Orifice Control Structure	
Maintenance Issues	Debris blocking orifice control structure.	
Maintenance Period	**Maintenance Task**	**Frequency**
Regular	Inspect chamber and remove any debris from control device.	Quarterly and following heavy rainfall
Remedial Work	Repair or replace orifice control device if it is damaged.	As required

Ditches

SUDS Element	Ditch	
Maintenance Issues	Erosion, siltation and excessive vegetation growth	
Maintenance Period	**Maintenance Task**	**Frequency**
Regular	Vegetation removal Tree and hedge trimming	As required
	Inspect and clear inlets and outlets	Quarterly
Occasional tasks	Remove leaf accumulation and dead vegetation	Annually in the autumn
Remedial Work	Repair erosion, level uneven surfaces or damage by re-turfing or seeding	As required
	Remove silt and spread locally outside design profile and reinstate surface	As required
	Repair inlets and outlets	As required

Appendix C - Drainage Strategy Summary

Drainage Strategy Summary

1. Site details	
Site/development name	Land adjacent to Lower Island House
Address including post code	Island Wall Whitstable CT5 1EE
Grid reference	E 610173 N 165998
LPA reference	n/a
Type of application	Outline ☐ Full ☒ Discharge of Conditions ☐ Other ☐
Site condition	Greenfield ☒ Brownfield ☐

2. Existing drainage			Document/Plan where information is stated:
Total site area (ha)	0.28		Surface Water Drainage Design
Impermeable area (ha)	0.00		
Final discharge location	Infiltration ☐ Watercourse ☒ Sewer ☐ Tidal reach/sea ☐		
Greenfield discharge rate (l/s) for existing site area	QBAR (l/s)	1.1	Surface Water Drainage Design
	1 in 1 year (l/s)	0.9	
	1 in 30 year (l/s)	2.5	
	1 in 100 year (l/s)	3.5	
3. Proposed drainage areas			**Document/Plan where information is stated:**
Impermeable area (ha)	Roof	0.050	Surface Water Drainage Design
	Highway/road		
	Other paved areas	0.058	
	Total	0.108	
Permeable area (ha)	Open space	0.172	
	Other permeable areas		
	Total	0.280	
Final discharge location	Infiltration ☐ Infiltration rate ____________m/s Watercourse ☒ Sewer ☐ Tidal reach/sea ☐		Surface Water Drainage Design
Climate change allowance included in design	20% ☒ 30% ☐ 40% ☐		

4. Post-Development Discharge rates, without mitigation			**Document/Plan where information is stated:**
Developed discharge rates (l/s)	1 in 1 year	8.5	Surface Water Drainage Design
	1 in 30 year	20.7	
	1 in 100 year	27.0	
	1 in 100 year + CC	32.4	

5. Post-Development Discharge rates, with mitigation			**Document/Plan where information is stated:**
Describe development drainage strategy in general terms: Permeable paving to attenuate runoff with discharge to watercourse.			Surface Water Drainage Design
(a) No control required, all flows infiltrating		☐	
(b) Controlled developed discharge rates (l/s)	1 in 1 year	2.0	Surface Water Drainage Design
	1 in 30 year	2.0	
	1 in 100 year	2.0	
	1 in 100 year + CC	2.0	

6. Discharge Volumes			**Document/Plan where information is stated:**
	Existing volume (m^3)	Proposed volume (m^3)	Surface Water Drainage Design
1 in 1 year	9.0	19.0	
1 in 30 year	20.9	41.9	
1 in 100 year	28.4	54.4	
1 in 100 year + CC	34.1	65.3	

All information presented above should be contained within the attached Flood Risk Assessment, Drainage Strategy or Statement and be substantiated through plans and appropriate calculations.

Form completed by	Robert Beck
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On behalf of (client's details)	Kapra Developments Ltd
Date	07/05/17