

AMBI^{ENT}AL

ENVIRONMENTAL ASSESSMENT

Flood Risk Assessment, Surface Water Drainage Strategy & Foul Water Strategy 4594_FRA_SWDS

The French House, Aldington Road,
Port Lympne, CT21 4PA

Document Issue Record

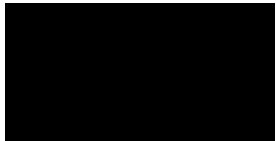
Project: Phase 1 Flood Risk Assessment

Prepared for: Howletts and Port Lympne Estates Ltd

Reference: 4594_FRA_SWDS

Site Location: The French House, Aldington Road, Port Lympne, CT21 4PA

Proposed Development: Change of use of the French House from Class C3 residential dwelling to a 10 bed boutique hotel Class C1; partial demolition, reconstruction and conversion of outbuildings; erection of 5 new build bedroom pods; erection of new social canopy; erection of check-in building; extension to existing restaurant; creation of new link pathways and a new access road; erection of an Event building; new refuse store; and creation of a new car park for 100 car spaces.

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Amendments V2.0	Mark Naumann	28/02/2020	

Amendments V2.0: Following general comments against the events building and the size of the car park the client has decided to remove the events building and 50 proposed car park spaces (a reduction of 50%). The coach turning pint has also bee removed.

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1. Summary

- 1.1 Ambiental Environmental Assessment has been appointed by Howletts and Port Lympne Estates Ltd to undertake a National Planning Policy Framework (NPPF) compliant Flood Risk Assessment (FRA) for the proposed development at The French House, Port Lympne, Kent, CT21 4PA.
- 1.2 The wider site is currently a Hotel and Animal Reserve. The development site features a Grade II* Listed building, The French House. It is understood that the proposed development is for the change of use of the French House from Class C3 residential dwelling to a 10 bed boutique hotel Class C1; partial demolition, reconstruction and conversion of outbuildings; erection of 5 new build bedroom pods; erection of new social canopy; erection of check-in building; extension to existing restaurant; creation of new link pathways and a new access road; new refuse store; and creation of a new car park for 50 car spaces.
- 1.3 The proposed developments are split across three key areas as follows:

Area A = 12,172m² (1.2172ha):

 - Conversion of The French House from residential (C3) to guest house (C1) use;
 - Conversion of outbuildings to ancillary storage/support use with a proposed canopy link plus wind screen to the main building;
 - Construction of five new build 'Garden Pods' (C1 use);
 - Adaptation of garden to include new social canopy;
 - Construction of a new pathway linking the French House & pods to social canopy and Area C;
 - Construction of pathways suitable for both guests and giraffe routes linking adjacent areas with Port Lympne wildlife park.

Area B = 139,521m² (13.9521ha):

 - Construction of a new access road from the existing entrance gate along Aldington Road;
 - The construction of a new car park suitable for 50 spaces;

Area C = 13,645m² (1.3645ha):

 - Construction of a restaurant extension adjacent to the existing restaurant.
- 1.4 With reference to the Environment Agency (EA) Flood Map for Planning, the proposed development is shown to be located within Flood Zone 1. The proposed development is considered a 'major development' and has an area of over 1 hectare. As such, a Flood Risk Assessment (FRA) and Surface Water Drainage Strategy (SWDS) is required to show that the development can be achieved in a sustainable manner.
- 1.5 In accordance with the NPPF, the different aspects of the proposed development at Port Lympne Hotel and Animal Reserve subsequently vary in their vulnerability classifications. Some of the proposed developments, such as the proposed car park could be considered as 'Water-Compatible', whilst other aspects of the development such as the conversion of The French House to a guest house (C1 use) could be considered as 'More Vulnerable' (please refer to *Table 3* displayed later in this report).
- 1.6 Following assessment of the EA Risk of Flooding from Surface Water dataset, the proposed development is to be located within an area considered to be largely at 'Very Low' risk with the northern extent of Area B being at 'Low' risk from surface water depths, that are below 300mm, spilling into the site from Aldington Road.
- 1.7 With reference to the Shepway District Council SFRA (2015), the document states that *"for sites greater than 1ha it will be necessary to demonstrate that all surface water flows associated with the 100 year event*

(including an appropriate allowance for climate change) can be contained within the site. For previously undeveloped sites, the maximum rate of surface water run-off will need to be controlled such that it does not exceed the pre-developed greenfield run-off rate. For brownfield sites, the rate of run-off shall not exceed the existing rate."

- 1.8 Infiltration testing has yet to be undertaken on site but is assumed to be suitable until proven otherwise. With reference to the British Geological Survey (BGS) database of borehole studies, surveys on site report the presence of more porous limestones and sandstones, of the Hythe Formation, towards the north of the redline site boundary, whilst clays have been identified towards the southern limit.
- 1.9 As existing within Area A, The French House is considered a Grade II* Listed Heritage Asset. As such, it is proposed that the majority of the building is to remain unchanged with only internal conversion taking place (conversion of C3 residential use to C1 guest house use) and external renovations. As such, any increase in surface water runoff could be considered negligible. *It should be noted that given that the building is a Grade II* Listed Heritage Asset, drainage infrastructure will remain unchanged post-development.* Infiltration techniques are recommended around the site to discharge any additional runoff that may be generated.
- 1.10 It is understood that the five proposed garden pods in Area A are to be raised above ground and that rain falling on each pod will runoff and flow/infiltrate via the sheltered rain shadow area underneath.
- 1.11 The proposed conversion of the existing outbuildings within Area A to ancillary storage/ support use is considered a change of use and as such any increase in runoff generated post-development could be considered negligible. Infiltration methods are proposed to discharge additional drainage generated from the proposed canopy link and wind shield to The French House, as well as the proposed social canopy elsewhere on Area A.
- 1.12 Within Area B, the combination of the proposed car park, the new access road and the various pathways (suitable for both guests and giraffe routes) account for the vast majority of the increase in proposed hardstanding area at approximately 3,800m². Infiltrating permeable paving and surrounding green space/soft landscaping should be considered within these areas to treat and drain the runoff.
- 1.13 A new restaurant extension is proposed at Area C. The proposed development will result in an extension to the existing building of approximately 174m². As part of the proposed works, an existing marquee (with a footprint of approximately 43m²) is to be demolished, resulting in a net increase in built footprint of 131m² post-development. Infiltration methods are recommended to be considered to drain any additional runoff, should the existing drainage system not be available for connection or be at risk of surcharge.
- 1.14 It is understood that the current French House foul drainage system currently drains to a septic tank/cess pool arrangement and may not be suitable for re-use following the proposed refurbishments. The addition of the garden pods will boost population to a maximum of 40 persons and as such a new foul treatment plan has been proposed. The treatment plant would also accommodate the runoff from the new social canopy in the garden. Foul flows from the French house and social canopy may need to be pumped to suit the preferred location of the foul treatment plant. The final location of the plant needs to be agreed with the client.
- 1.15 As such, and given that:
 - with reference to the EA Flood Map for Planning, the proposed development is located within Flood Zone 1;

- Areas A and C have been shown to be located in areas at very low risk of surface water flooding whilst Area B has been shown to be located in an area at low risk;
- a combination of various infiltration and storage techniques are to be recommended in order to attenuate the maximum surface water runoff rates to greenfield rates whilst also demonstrating that all surface water flows associated with the 100 year event +CC can be contained on site;
- Foul runoff can be captured, treated and infiltrated on site.
- Management and maintenance can be implemented by the park as currently undertaken on the wider site.

Following the guidelines contained within the NPPF, the proposed development is considered to be suitable assuming appropriate mitigation (including adequate warning procedures) can be maintained for the lifetime of the development.

Development Description	Existing	Proposed
Development Type:	Hotel and Animal Reserve	It is understood that the proposed development is for the change of use of the French House from Class C3 residential dwelling to a 10 bed boutique hotel Class C1; partial demolition, reconstruction and conversion of outbuildings; erection of 5 new build bedroom pods; erection of new social canopy; erection of check-in building; extension to existing restaurant; creation of new link pathways and a new access road; new refuse store; and creation of a new car park for 50 car spaces.
Number of Bedrooms:	The French House - 7	The French House – 10 Garden Pods – 5 (1 per pod)
EA Vulnerability Classification:	Mixed-use development	No change
Ground Floor Level:	Elevations on site vary between approximately 66.56mAOD and 107.75mAOD (2m LiDAR data).	No change
Level of Sleeping Accommodation:	First floor	Ground floor and above
Impermeable Surface Area:	Increase	See Section 5 and 6 of the Report
Surface Water Drainage:	N/A ¹	See Section 5 and 6 of the Report
Site Size:	Area A = Approx. 12,172m ² Area B = Approx. 139,521m ² Area C = Approx. 13,645m ²	No change
Risk to Development	Summary	Comment
EA Flood Zone:	1	First Government Drain and Royal Military Canal Site lies in Flood Zone 1
Flood Source:	Fluvial	
1:100 Year Flood Level		
1:100 Year Flood Level & Climate Change		
1:1000 Year Flood Level		
Recorded Flood Events in Area:	No	Neither the EA nor Shepway District Council have provided any historic flood events that show the site or the surrounding area to have been previously affected by fluvial flooding.
Recorded Flood Events at Site:	No	
SFRA Available:	Yes	Shepway District Council Strategic Flood Risk Assessment (SFRA) 2015
Management Measures	Summary	Comment
Ground floor level above extreme flood levels:	Yes	Site lies in Flood Zone 1
Safe Access/Egress Route:	Yes	Site lies in Flood Zone 1
Flood Resilient Design:	Yes	See Section 4 of the report
Site Drainage Plan:	Yes	See Section 5 and 6 of the Report
Flood Warning & Evacuation Plan:	No	Site lies in Flood Zone 1
Offsite Impacts	Summary	Comment
Displacement of floodwater:	Negligible	Site lies in Flood Zone 1
Increase in surface run-off generation:	Increase	See Section 5 and 6 of the Report
Impact on hydraulic performance of channels:	None	Does not affect channel

Table 1 Summary of flood risks, impacts and proposed flood mitigation measures.
 N/A¹ not required for this assessment; N/A² data not available.

2. Policy Compliance

- 2.1 Kent County Council (KCC), in their role as Lead Local Flood Authority (LLFA), have published local guidance intended to assist developers in the design of all sustainable drainage systems, and to support Local Planning Authorities in considering drainage proposals for new development in Kent. The guide '*Water. People. Places. A guide for master planning sustainable drainage into developments*' sets out the standards that should be applied in assessing all surface water drainage proposals and has been used to inform the SUDS and surface water section of this report.
- 2.2 The Strategic Flood Risk Assessment (SFRA) 2015 has been commissioned by Shepway District Council. This report outlines the risks from all flooding sources in the study area and contains guidance aimed at both planners and developers regarding flooding and development. It is important to recognise that the SFRA has been developed using the best available information at the time of preparation. This relates both to the current risk of flooding from rivers, and the potential impacts of future climate change.
- 2.3 The NPPF was issued on 27 March 2012 and updated on 24 July 2018, and on 19 February 2019, to, firstly, make the planning system less complex and more accessible, and secondly, to protect the environment, promote sustainable growth and replace most of the previously issued Planning Policy Guidance Notes (PPGs) and Planning Policy Statements (PPSs). The NPPF is a source of guidance for local planning authorities to assist in preparation of Local Plans, as well as for applicants preparing planning applications.
- 2.4 The web-based Planning Practice Guidance on Flood Risk and Coastal Change (referred to as 'the Planning Practice Guidance') was published alongside the NPPF and was most recently updated in November 2016. The guidance sets out how the policy should be implemented and has been used to define the flood risk element of this report.

3. Development Description and Site Area

Proposed Development and Location

- 3.1 The proposed development is located at Port Lympe Hotel and Animal Reserve, Port Lympe, Kent, CT21 4PA (*Figure 1*).
- 3.2 The wider site is currently a Hotel and Animal Reserve. The site also features a Grade II* Listed building, The French House. It is understood that the proposed development is for the change of use of the French House from Class C3 residential dwelling to a 10 bed boutique hotel Class C1; partial demolition, reconstruction and conversion of outbuildings; erection of 5 new build bedroom pods; erection of new social canopy; erection of check-in building; extension to existing restaurant; creation of new link pathways and a new access road; new refuse store; and creation of a new car park for 50 car spaces.
- 3.3 Architectural proposals for each element are included in Appendix I.
- 3.4 Elevations on site vary between approximately 66.56mAOD and 107.75mAOD (2m LiDAR data). Analysis of topographic levels indicates that the site generally slopes to the south.

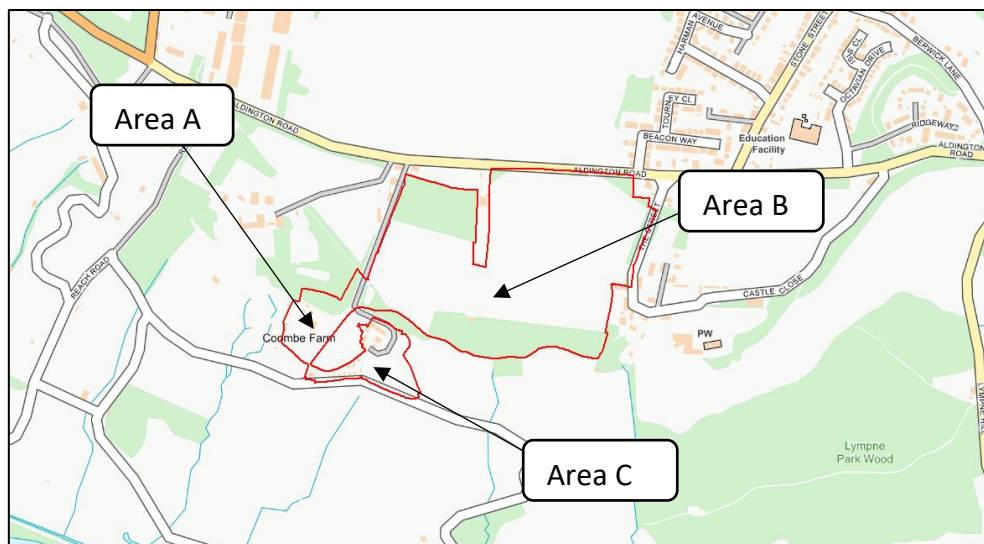


Figure 1 Location Map, identifying the location of the proposed development (Source: OS)

- 3.5 Proposals are to manage and store rainwater from each new development area (e.g. French House, car park etc.) to infiltrate to ground where feasible. The existing storm drainage to the Grade II* Listed French House would be maintained as existing.
- 3.6 It is understood that the foul drainage to the existing French House drains to an existing cess pool or septic tank. Proposals are to update this to a new package treatment system and infiltrate treated runoff in accordance with the requirements of KCC and Building regulations in a new drainage field to the rear of the French house.

Flood Risk and Vulnerability Classification

- 3.7 The published EA Flood Map for Planning demonstrates that the proposed development lies within Fluvial Flood Zone 1 with a low probability of less than 1 in 1,000 (0.1%) of river flooding in any year (*Figure 2*).
- 3.8 According to NPPF guidelines, the existing site is classified as a mixed-use development whereby various features on site have different vulnerability classifications. For example, as existing The French House is

used for C3 residential use and would therefore be classified as 'More Vulnerable'. Whilst additionally there are car parks on site (that could be considered as 'Water-Compatible') as well as land and outbuildings used for animal enclosure that would be classified under the NPPF as 'Less Vulnerable'. The proposed development features the conversion of The French House from C3 residential use to be used as a guest house (C1 use). As such, the vulnerability classification would remain unchanged as 'More Vulnerable' post-development. It is also proposed that new access roads and a car park will be constructed which could be considered as 'Water-Compatible' post-development given that these are open spaces that will remain floodable. As such, post-development, the site use will remain unchanged.

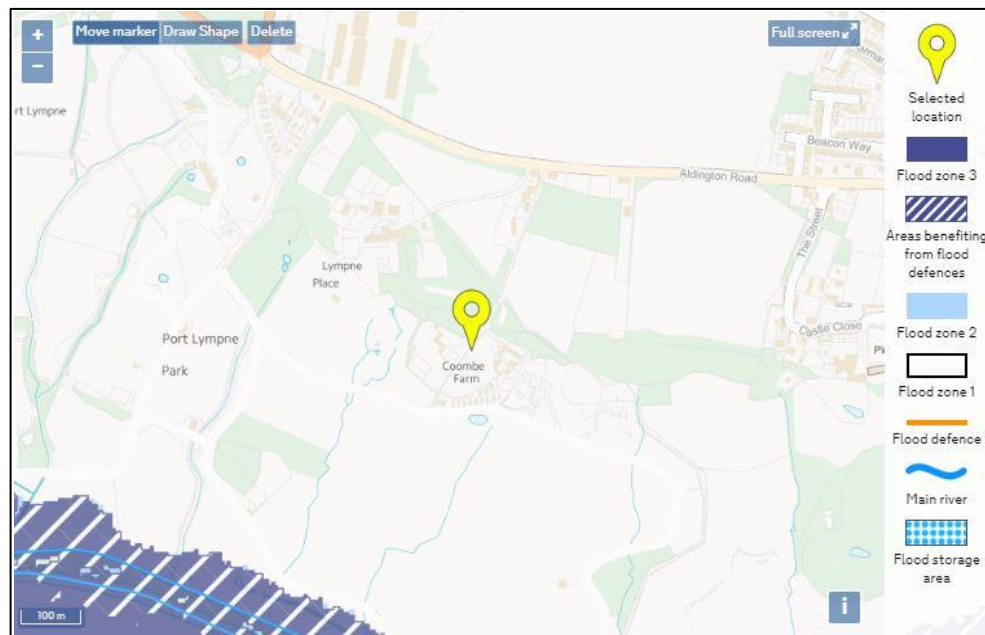


Figure 2 EA Flood Map for Planning

Geology

- 3.9 The British Geological Survey (BGS) Geology of Britain Viewer indicates that the bedrock underlying the site is a mix of the Atherfield Clay Formation (Mudstone, Sandy. Sedimentary Bedrock) at the French house location (Figure 3), Weald Clay Formation south of this (Figure 5) and Hythe Formation (comprising of interbedded sandstone and limestone) to the north under the access road and car park development areas (Figure 4).
- 3.10 The British Geological Survey (BGS) Geology of Britain Viewer indicates that there are no superficial deposits underlying the site.
- 3.11 Given the sandy, sedimentary nature of the geology expected at the development locations **infiltration is likely to be feasible**. Infiltration testing to BRE365 (or similar) should be carried out to confirm suitability and allow detailed design of drainage solutions.

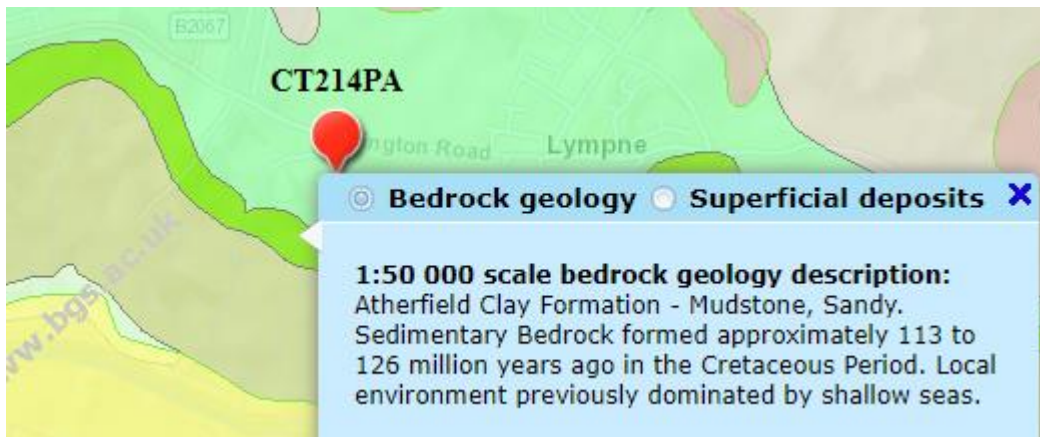


Figure 3 Geology at French House Location

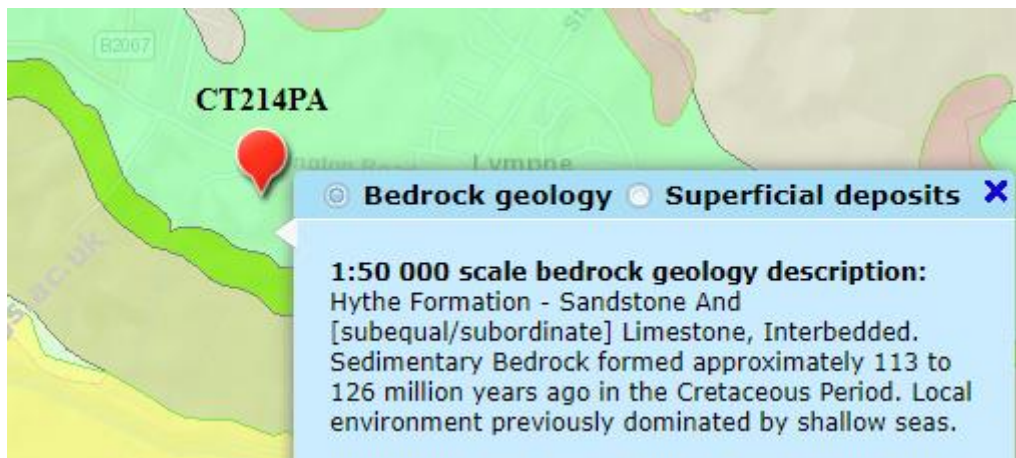


Figure 4 Geology at Car Park/Access Road location

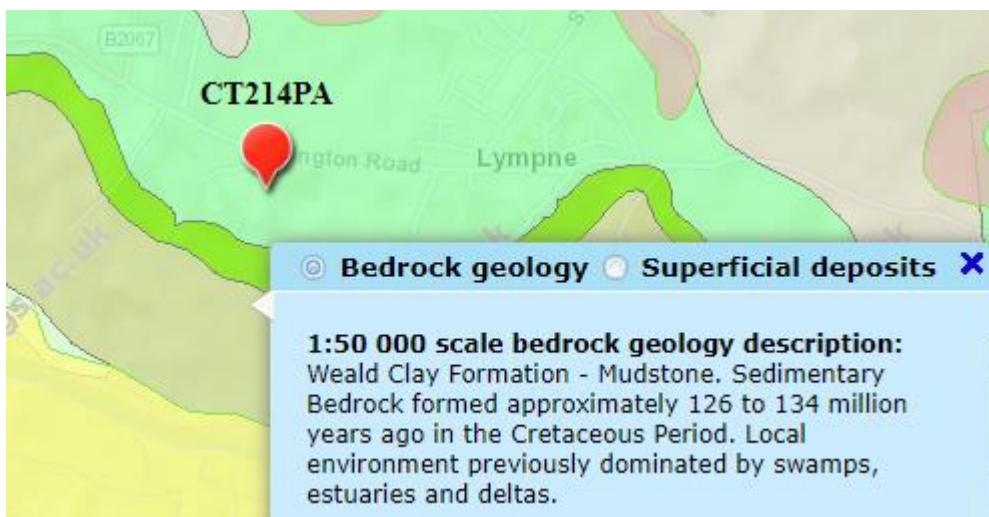


Figure 5 Geology south of proposed developments

4. Flood Risk Assessment

Sequential Test/Exception Test

- 4.1 Under the NPPF, all new planning applications should undergo a *Sequential Test*. This test should be implemented by local planning authorities with a view to locating particularly vulnerable new developments (e.g. residential, hospitals, mobile homes etc.) outside of the floodplain.

- 4.2 The NPPF *Sequential Test: Flood Risk Vulnerability and Flood Zone 'Compatibility' Table* is reproduced below;

Flood Risk Vulnerability Classification		Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test Required	✓	✓
	Zone 3a	Exception Test Required	✓	✗	Exception Test Required	✓
	Zone 3b <i>Functional Floodplain</i>	Exception Test Required	✓	✗	✗	✗

*Table 2 The Sequential Test: Flood Risk Vulnerability and Flood Zone 'Compatibility' Table as specified by NPPF.
Please note: ✓ means development is appropriate; ✗ means the development should not be permitted.*

- 4.3 Using the principles of the Sequential Test outlined above, the proposed mixed-use development could be considered under several vulnerability classifications according to the NPPF. Displayed in *Table 3* (overleaf) are each of the proposed individual developments as part of these works with their respective vulnerability classifications post-development.
- 4.4 As the entire site is sequentially located within Flood Zone 1 (as defined by the EA) the proposed developments are considered appropriate for this flood zone and therefore, under the NPPF, does not require the application of either the Sequential Test or the Exception Test.
- 4.5 Given that the proposed development is considered a major development that is over 1 hectare in size, and is located within Flood Zone 1, the planning application submitted by the client is required to be accompanied by an FRA which shows the development can be achieved in a sustainable manner, with an overall reduction of flood risk to the site and the surrounding area.
- 4.6 Table 3 following outlines the development types, the vulnerability classification to each form of development and a brief description of the form of development.

Area	Proposed Development	NPPF Vulnerability Classification	Comments
A	Conversion of The French House from C3 use to C1 use	More Vulnerable	Development continues to provide overnight accommodation. No change in vulnerability.
A	Conversion of outbuildings to provide ancillary storage/support use with a proposed canopy link to the main building	Less Vulnerable	Storage use. No change in vulnerability.
A	Construction of five garden pod buildings (C1 use)	More Vulnerable	Garden pod units to be used for overnight accommodation.
A	Construction of new pathways between sites suitable for both guests and as giraffe routes	Water-Compatible	The proposed development is an open space that will remain floodable post-development.
A	Construction of a new pathway linking the French House and pods to social canopy and Area C.	Water-Compatible	The proposed development is an open space that will remain floodable post-development.
A	Construction of a new social canopy to be added to the garden	More Vulnerable	Proposed development is anticipated to be serving/selling alcohol and as such is considered a More Vulnerable development.
B	Construction of a new access road	Water-Compatible	The proposed development is an open space that will remain floodable post-development.
B	Construction of a new car park	Water-Compatible	The proposed development is an open space that will remain floodable post-development.
C	Construction of a new restaurant	More Vulnerable	Proposed development is anticipated to be serving/selling alcohol and as such is considered a More Vulnerable development.

Table 3 Summary of NPPF vulnerability classifications for each proposed development at each site

Sources of Flooding

4.7 The proposed mixed-use development is located within Flood Zone 1 (low risk of flooding) and is considered to be of mixed vulnerability (Water-Compatible, Less Vulnerable and More Vulnerable) according to NPPF guidelines. *Table 4* summarises the potential sources of flooding to the site:

Source	Description
Fluvial	Low Risk
Surface	The site remains largely unaffected for all events.
Groundwater	Low risk on site and in surrounding area.
Sewer	N/A

Table 4 Summary of flood sources.

Fluvial

- 4.8 With reference to the EA Flood Map for Planning (extracted in Figure 2), the proposed development is located in EA Flood Zone 1 (low risk of flooding).
- 4.9 The First Government drain is located approximately 435m to the south of the development site whilst the Royal Military Canal is located marginally further, approximately 480m south. Both of these are classified as EA Main Rivers. Furthermore, three unknown drains are present surrounding the southern border of the site, these are located approximately 30m west, 30m south and 140m east of the redline site boundaries at their closest proximity.
- 4.10 Following a review of topographic levels at the site using EA open source 2m LiDAR data, on site elevations range from between 66.56mAOD and 107.75mAOD. Topographic levels are shown to fall steeply southwards from Aldington Road towards the First Government Drain as displayed in *Figure 6*.
- 4.11 At its closest proximity, the nearest EA Flood Zone to the site is located approximately 390m south of the redline site boundary and a significantly lower topographical level. As such, the risk of flooding from fluvial sources could be deemed to be **low**.

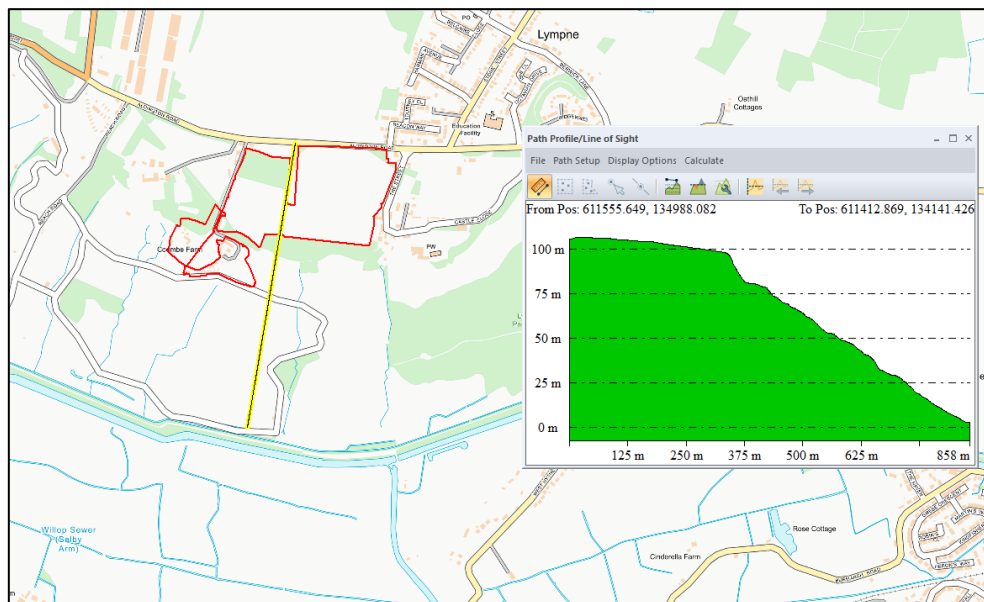


Figure 6 Review of topographic levels around the site. Levels fall southwards towards the First Government Drain.

Surface Water (Pluvial)

- 4.12 The Environment Agency Flood Risk from Surface Water web site shows the proposed development to be largely within an area of 'Very Low' risk of flooding from surface water (*Figure 7*). Areas identified to be at 'Very Low' risk have a less than 0.1% annual risk of flooding from this source.
- 4.13 The northern boundary of Area B is located within an area of 'Low' risk, as predicted depths along Aldington Road are estimated to encroach into the northern limit of the redline boundary. Areas identified to be at 'Low' risk have between a 0.1% and 1% annual risk of flooding from this source.

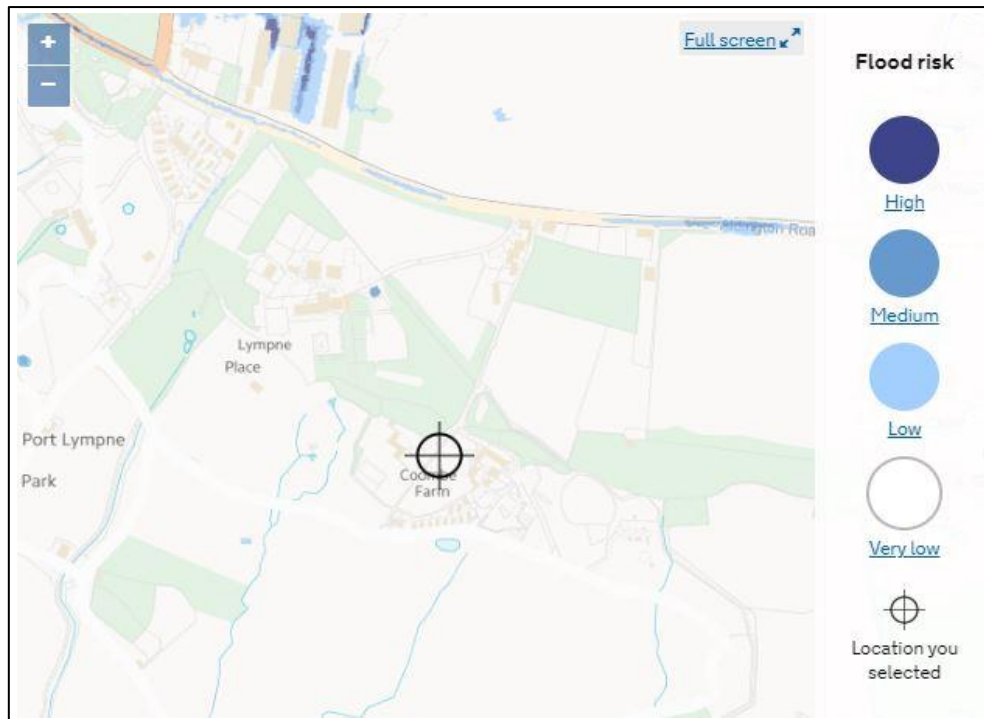


Figure 7 EA Surface Water Flood Risk Map. (Source: EA)

- 4.14 Neither the EA nor the Shepway District Council Strategic Flood Risk Assessment (2015) have provided any historic surface water flood extents that indicate that the site has been previously affected by this source of flooding.
- 4.15 As such, the risk of flooding from fluvial sources could be deemed to be **low**.

Groundwater

- 4.16 With reference to the DEFRA Magic Map online resource, the site is located outside of an EA Groundwater Source Protection Zone.
- 4.17 However, the site has been shown to be identified partly above a major aquifer of intermediate groundwater vulnerability (Figure 8). This aquifer is considered to be an intermediate vulnerability principal aquifer. Soils have moderate ability to attenuate pollutants and therefore pollutants may reach groundwater.

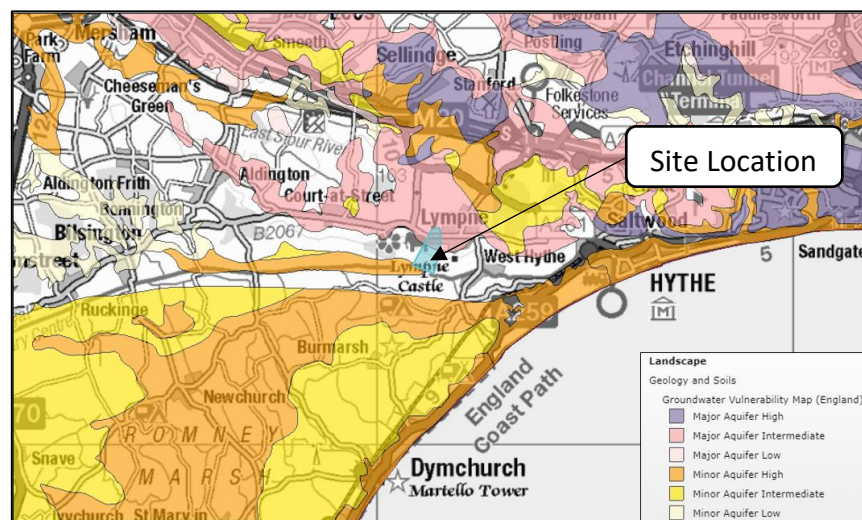


Figure 8 EA Groundwater Vulnerability Map (Source: EA)

- 4.18 The soils in the surrounding area are identified by Soilsmap to be freely draining soils. As such, the soils are thought to absorb rainfall readily, allowing it to drain through to the underlying geology easily whereby there are several quite porous layers.
- 4.19 Neither the EA nor the Shepway District Council Strategic Flood Risk Assessment (2015) have provided any historic groundwater surface water flood extents that indicate that the site has been previously affected by this source of flooding.
- 4.20 As such, the risk of flooding from groundwater sources could be deemed to be **relatively low**.

Sewer

- 4.21 Southern Water is responsible for the sewer network in this area. Records show that the sewers within the Folkestone and Hythe area are predominantly combined sewers.
- 4.22 Furthermore, the Shepway District Council SFRA identifies that many parts of the district are served by combined sewers and that subsequently there is an inherent risk that these could become surcharged during an extreme rainfall event. However, detailed information on flood risk from this source is not available on a district-wide scale and therefore further investigations are required at a site-specific scale.
- 4.23 It is subsequently recommended that any new sewer connection from the site should be discussed with the local sewer provider and fitted with non-return valves to mitigate against any potential risk of sewer flooding.

Records of Historic Flooding

- 4.24 The Shepway District Council SFRA (2015) shows the site to be located in an area with no recorded historic flooding incidents (*Figure 9*). Furthermore, the EA have also not provided any other extents that suggest that the site has been previously affected by any sort of flood event.

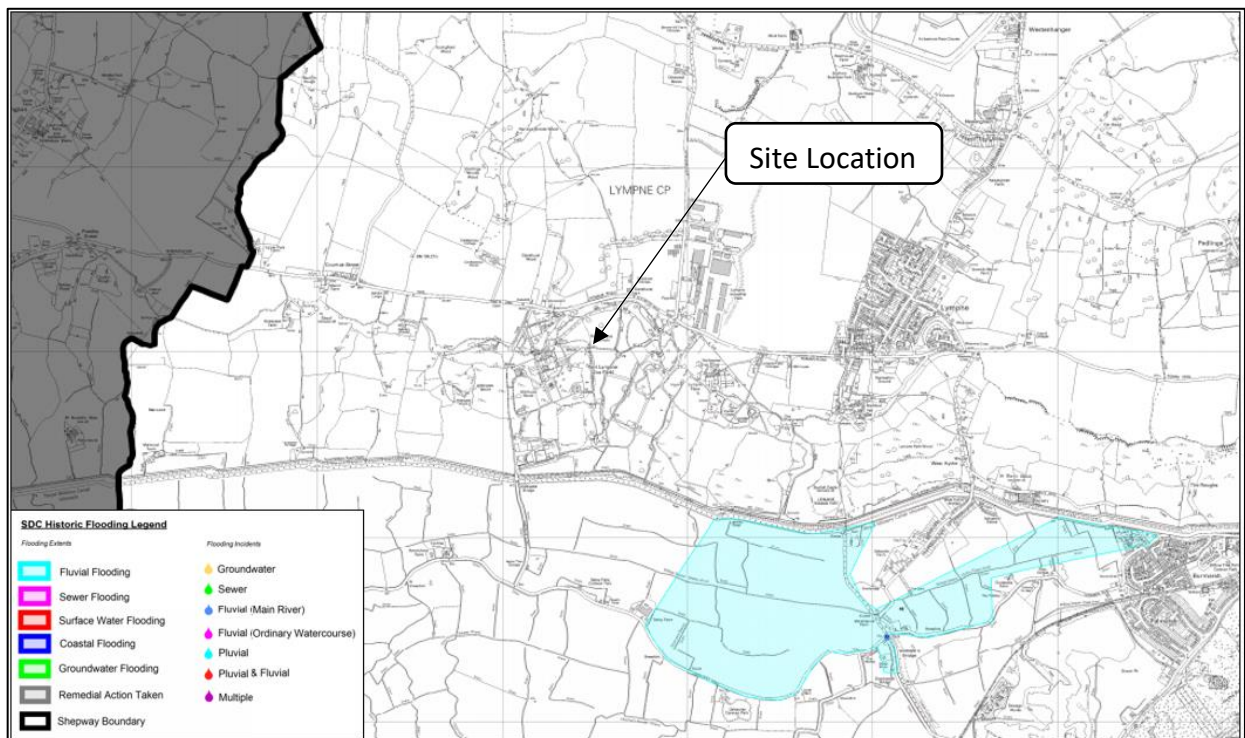


Figure 9 Historic Flooding Map (Source: Shepway District Council SFRA 2015)

Flood Zones

4.25 According to the EA Flood Map for Planning, the site is located within Flood Zone 1 (low risk of flooding).

The EA Flood Map for Planning has been produced in part using a relatively coarse, national scale flood modelling strategy, and in part by detailed modelling. It is important to note that only the potential floodplain is modelled; **the mitigating effects of any flood defences currently in place are not considered**. For reference, the definition of the NPPF flood risk zones is included in *Table 5*.

Zone	Description
1	Low Probability. This zone comprises land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%).
2	Medium Probability. This zone comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% – 0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% – 0.1%) in any year.
3a	High Probability. This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.
3b	The Functional Floodplain. This zone comprises land where water has to flow or be stored in times of flood. SFRA's should identify this Flood Zone (land which would flood with an annual probability of 1 in 20 (5%) or greater in any year or is designed to flood in an extreme (0.1%) flood, or at another probability to be agreed between the LPA and the EA, including water conveyance routes).

Table 5 Definition of the NPPF Flood Zones. (Source: EA)

Climate Change on Site

4.26 The design lifetime of a residential site is 100 years and an allowance for climate change should be considered in accordance with published guidance within the NPPF 2018. The climate change criteria are reproduced below, and it is likely that the 'upper end' allowance for 2070 to 2115 is deemed suitable for the proposed development. To provide a worst-case scenario, the 'upper end' 40% climate change allowance will be used (*Table 6*).

PEAK RAINFALL INTENSITY ALLOWANCE IN SMALL AND URBAN CATCHMENTS			
Applies across all of England	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Upper End	10%	20%	40%
Central	5%	10%	20%

Table 6: Peak rainfall intensity allowance in small and urban catchments

Residual Risks

4.27 Residual risks are those remaining after applying the sequential approach to the location of development and taking mitigating actions. Examples of residual flood risk include:

- the failure of flood management infrastructure such as a breach of a raised flood defence, blockage of a surface water conveyance system, overtopping of an upstream storage area, or failure of a pumped drainage system;
- failure of a reservoir, or;
- a severe flood event that exceeds a flood management design standard, such as a flood that overtops a raised flood defence, or an intense rainfall event which the drainage system cannot cope with.

Defence Breach

- 4.28 The site has been identified by EA Flood Map for Planning to be located outside all extreme modelled flood extents (Flood Zone 1) and as such there is no residual risk of defence failure or overtopping to the site.

Reservoir Failure

- 4.29 The EA Risk from Reservoir Map demonstrates that the site is outside flood extents in the event of reservoir flooding.

Drainage Exceedance

- 4.30 In the event of drainage system failure under extreme rainfall events or blockage, overland flow may occur within the site. In the event of the development's drainage system failure, the runoff flow will be dictated by topography on site. External levels should be designed to direct overland flow away from buildings and thresholds.

Flood Risk Management Measures

- 4.31 The wider site is currently a Hotel and Animal Reserve. The site also features a Grade II* Listed building, The French House. Ambiental Environmental Assessment has been appointed by Howletts and Port Lympne Estates Ltd to undertake a National Planning Policy Framework (NPPF) compliant Flood Risk Assessment (FRA) for the proposed development at The French House, Port Lympne, Kent, CT21 4PA.

- 4.32 The wider site is currently a Hotel and Animal Reserve. The development site features a Grade II* Listed building, The French House. It is understood that the proposed development is for the change of use of the French House from Class C3 residential dwelling to a 10 bed boutique hotel Class C1; partial demolition, reconstruction and conversion of outbuildings; erection of 5 new build bedroom pods; erection of new social canopy; erection of check-in building; extension to existing restaurant; creation of new link pathways and a new access road; new refuse store; and creation of a new car park for 50 car spaces.

- 4.33 The proposed developments are split across three key areas as follows:

Area A = 12,172m² (1.2172ha):

- Conversion of The French House from residential (C3) to guest house (C1) use;
- Conversion of outbuildings to ancillary storage/support use with a proposed canopy link plus wind screen to the main building;
- Construction of five new build 'Garden Pods' (C1 use);
- Adaptation of garden to include new social canopy;
- Construction of a new pathway linking the French House & pods to social canopy and Area C;
- Construction of pathways suitable for both guests and giraffe routes linking adjacent areas with Port Lympne wildlife park.

Area B = 139,521m² (13.9521ha):

- Construction of a new access road from the existing entrance gate along Aldington Road;
- The construction of a new car park suitable for 50 spaces;

Area C = 13,645m² (1.3645ha):

- Construction of a restaurant extension adjacent to the existing restaurant.

- 4.34 With reference to the Environment Agency (EA) Flood Map for Planning, the proposed development is shown to be located within Flood Zone 1. The proposed development is considered a 'major development'

and has an area of over 1 hectare. As such, a Flood Risk Assessment (FRA) and Surface Water Drainage Strategy (SWDS) is required to show that the development can be achieved in a sustainable manner.

- 4.35 In accordance with the NPPF, the different aspects of the proposed development at Port Lympne Hotel and Animal Reserve subsequently vary in their vulnerability classifications. Some of the proposed developments, such as the proposed car park could be considered as 'Water-Compatible', whilst other aspects of the development such as the conversion of The French House to a guest house (C1 use) could be considered as 'More Vulnerable' (please refer to *Table 3* displayed later in this report).
- 4.36 Following assessment of the EA Risk of Flooding from Surface Water dataset, the proposed development is to be located within an area considered to be largely at 'Very Low' risk with the northern extent of Area B being at 'Low' risk from surface water depths, that are below 300mm, spilling into the site from Aldington Road.
- 4.37 With reference to the Shepway District Council SFRA (2015), the document states that *"for sites greater than 1ha it will be necessary to demonstrate that all surface water flows associated with the 100 year event (including an appropriate allowance for climate change) can be contained within the site. For previously undeveloped sites, the maximum rate of surface water run-off will need to be controlled such that it does not exceed the pre-developed greenfield run-off rate. For brownfield sites, the rate of run-off shall not exceed the existing rate."*
- 4.38 Infiltration testing has yet to be undertaken on site but is assumed to be suitable until proven otherwise. With reference to the British Geological Survey (BGS) database of borehole studies, surveys on site report the presence of more porous limestones and sandstones, of the Hythe Formation, towards the north of the redline site boundary, whilst clays have been identified towards the southern limit.
- 4.39 As existing within Area A, The French House is considered a Grade II* Listed Heritage Asset. As such, it is proposed that the majority of the building is to remain unchanged with only internal conversion taking place (conversion of C3 residential use to C1 guest house use) and external renovations. As such, any increase in surface water runoff could be considered negligible. *It should be noted that given that the building is a Grade II* Listed Heritage Asset, drainage infrastructure will remain unchanged post-development.* Infiltration techniques are recommended around the site to discharge any additional runoff that may be generated.
- 4.40 It is understood that the five proposed garden pods in Area A are to be raised above ground and that rain falling on each pod will runoff and flow/infiltrate via the sheltered rain shadow area underneath.
- 4.41 The proposed conversion of the existing outbuildings within Area A to ancillary storage/ support use is considered a change of use and as such any increase in runoff generated post-development could be considered negligible. Infiltration methods are proposed to discharge additional drainage generated from the proposed canopy link and wind shield to The French House, as well as the proposed social canopy elsewhere on Area A.
- 4.42 Within Area B, the combination of the proposed car park, the new access road and the various pathways (suitable for both guests and giraffe routes) account for the vast majority of the increase in proposed hardstanding area at approximately 3,800m². Infiltrating permeable paving and surrounding green space/soft landscaping should be considered within these areas to treat and drain the runoff.
- 4.43 A new restaurant extension is proposed at Area C. The proposed development will result in an extension to the existing building of approximately 174m². As part of the proposed works, an existing marquee (with a footprint of approximately 43m²) is to be demolished, resulting in a net increase in built footprint of 131m²

post-development. Infiltration methods are recommended to be considered to drain any additional runoff, should the existing drainage system not be available for connection or be at risk of surcharge.

4.44 It is understood that the current French House foul drainage system currently drains to a septic tank/cess pool arrangement and may not be suitable for re-use following the proposed refurbishments. The addition of the garden pods will boost population to a maximum of 40 persons and as such a new foul treatment plan has been proposed. The treatment plant would also accommodate the runoff from the new social canopy in the garden. Foul flows from the French house and social canopy may need to be pumped to suit the preferred location of the foul treatment plant. The final location of the plant needs to be agreed with the client.

4.45 As such, and given that:

- with reference to the EA Flood Map for Planning, the proposed development is located within Flood Zone 1;
- sites A and C have been shown to be located in areas at very low risk of surface water flooding whilst Area B has been shown to be located in an area at low risk;
- a combination of various infiltration and storage techniques are to be recommended in order to attenuate the maximum surface water runoff rates to greenfield rates whilst also demonstrating that all surface water flows associated with the 100 year event +CC can be contained on site;
- Foul runoff can be captured, treated and infiltrated on site.
- Management and maintenance can be implemented by the park as currently undertaken on the wider site.

Following the guidelines contained within the NPPF, the proposed development is considered to be suitable assuming appropriate mitigation (including adequate warning procedures) can be maintained for the lifetime of the development.

4.46 With reference to the EA Flood Map for Planning, the proposed development is located in EA Flood Zone 1 (low risk of flooding).

4.47 The remaining risk is that of surface water generated by the development itself. Flood risk to others can be mitigated by managing water on site, which is to be discharged at a reduced rate for rainfall events up to and including the 1in100yr+CC rainfall event in accordance with Local SuDS policy and the Ciria SuDS manual.

Flood Warning Service

4.48 The EA operates a 24-hour telephone service on 0345 988 1188 that provides frequently updated flood warnings and associated floodplain information. Further information can be found on www.environment-agency.gov.uk/floodline. Floodline Warnings Direct is a free service operated by the EA that provides flood warnings direct to occupants by telephone, mobile phone, fax or pager.

4.49 The proposed development is located within Flood Zone 1 and approximately 390m away from the nearest EA Flood Zone. As such, the development is not currently located within a Flood Warning Area.

Flood Evacuation Plan

- 4.50 The EA Flood Map for Planning demonstrates that the proposed development lies within Fluvial Flood Zone 1 with a low probability of less than 1 in 1,000 (0.1%) of river flooding in any year. No specific flood evacuation plan is required.

Off Site Impacts

Impact to Flood Risk Elsewhere

- 4.51 The EA Flood Map for Planning demonstrates that the proposed development lies within Fluvial Flood Zone 1 with a low probability of less than 1 in 1,000 (0.1%) of river flooding in any year. No specific flood plain mitigation is required.
- 4.52 As such, post-development any change in floodwater displacement could be considered negligible.

Generation of Runoff

- 4.53 The remaining risk is that of surface water generated by the development itself. Flood risk to others can be mitigated by managing water on site to be discharged at a reduced rate for rainfall events up to and including the 1in100yr+CC rainfall event in accordance with Local SuDS policy and the Ciria SuDS manual.
- 4.54 The following SuDS surface water drainage strategy outlines how surface water can be managed and accommodated on site to mitigate risk to others as a result of development.

5. SUDS Assessment

- 5.1 In accordance with the SuDS management train approach, the use of various SuDS measures to reduce and control surface water flows have been considered in detail for the development.
- 5.2 The wider site is currently a Hotel and Animal Reserve. The site also features a Grade II* Listed building, The French House. It is understood that the proposed development is for the change of use of the French House from Class C3 residential dwelling to a 10 bed boutique hotel Class C1; partial demolition, reconstruction and conversion of outbuildings; erection of 5 new build bedroom pods; erection of new social canopy; erection of check-in building; extension to existing restaurant; creation of new link pathways and a new access road; new refuse store; and creation of a new car park for 50 car spaces.
- 5.3 Paragraph 80 of the Planning Practice Guidance of the National Planning Policy Framework (NPPF) states that: generally, the aim should be to discharge surface run off as high up the following hierarchy of drainage options as reasonably practicable, see *Table 7*.
- 5.4 The management of surface water has been considered in respect to the SuDS hierarchy (below) (as detailed in Building Regulations Part H and within the the CIRIA 753 'The SUDS Manual', Section 3.2.3):

SuDS Drainage Hierarchy				
			Suitability	Comment
	1.	Infiltration	✓	Infiltration testing has yet to be undertaken on site and as such this method is considered to be otherwise suitable assuming a depth of 300mm for construction purposes until proven otherwise.
	2.	Discharge to Surface Water	✓	No watercourses have been identified on site as of yet.
	3.	Discharge to Surface Water Sewer, Highway Drain or another Drainage System	-	Use existing storm drainage on site if one is available. Otherwise, discharge to surface water sewers/ highway drains
	4.	Discharge to Combined Sewer	-	

Table 7: SuDS Hierarchy

- 5.5 Infiltration testing has yet to be undertaken on site and as such this method is considered to be otherwise suitable assuming a depth of 300mm for construction purposes until proven otherwise.
- 5.6 With reference to the British Geological Survey (BGS) database of borehole studies, surveys on site report the presence of more porous limestones and sandstones, of the Hythe Formation, towards the north of the redline site boundary, whilst clays have been identified towards the southern limit.
- 5.7 With reference to the EA Main Rivers and Detailed River Network shapefiles, no watercourse is located on site. There are several drains surrounding the site however and a more detailed investigation maybe required for the presence of small drains on site if infiltration techniques are considered unsuitable.
- 5.8 Where suitable, it is recommended that runoff should be drained to the existing storm drainage system on site where one is already available, such as at The French House, and where the existing restaurant building is present. Otherwise, depending on the sewer network in the surrounding area, it is recommended that runoff rates are discharged via surface water and highway sewers or via a combined sewer system.

5.9 The suitability of SuDS components has been assessed (based on *Table 8* below) and deemed appropriate to be used in the following SuDS management train.

Suitability of SuDS Components		
SuDS Component	Description	Suitability
Permeable Pavement	Pervious surfaces can be used in combination with aggregate sub-base and/or geocellular/modular storage to attenuate and/or infiltrate runoff from surrounding surfaces and roofs. Liners can be used where ground conditions are not suitable for infiltration.	✓
Green Roofs	Green Roofs provide areas of visual benefit, ecological value, enhanced building performance and the reduction of surface water runoff. They are generally more costly to install and maintain than conventional roofs but can provide many long-term benefits and reduce the on-site storage volumes.	x
Rainwater Harvesting	Rainwater Harvesting is the collection of rainwater runoff for use. It can be collected from roofs or other impermeable area, stored, treated (where required) and then used as a supply of water for domestic, commercial and industrial properties.	✓
Swales	Swales are designed to convey, treat and attenuate surface water runoff and provide aesthetic and biodiversity benefits. They can replace conventional pipework as a means of conveying runoff, however space constraints of some sites can make it difficult incorporating them into the design.	✓
Rills and Channels	Rills and Channels keep runoff on the surface and convey runoff along the surface to downstream SuDS components. They can be incorporated into the design to provide a visually appealing method of conveyance, they also provide effectiveness in pre-treatment removal of silts.	x
Bioretention Systems	Bioretention systems can reduce runoff rates and volumes and treat pollution through the use of engineer soils and vegetation. They are particularly effective in delivering interception, but can also be an attractive landscape feature whilst providing habitat and biodiversity.	x
Retention Ponds and Wetlands	Ponds and Wetlands are features with a permanent pool of water that provide both attenuation and treatment of surface water runoff. They enhance treatment processes and have great amenity and biodiversity benefits. Often a flow control system at the outfall controls the rates of discharge for a range of water levels during storm events.	x
Detention Basins	Detention Basins are landscaped depressions that are usually dry except during and immediately following storm events, and can be used as a recreational or other amenity facility. They generally appropriate to manage high volumes of surface water from larger sites such as a neighbourhoods.	x
Geocellular Systems	Attenuation storage tanks are used to create a below-ground void space for the temporary storage of surface water before infiltration, controlled release or use. The inherent flexibility in size and shape means they can be tailored to suit the specific characteristics and requirements of any site.	✓
Proprietary Treatment Systems	Proprietary treatment systems are manufactured products that remove specific pollutants from surface water runoff. They are especially useful where site constraints preclude the use of other methods and can be useful in reducing the maintenance requirements of downstream SuDS	x
Filter Drains and Filter Strips	Filter drains are shallow trenches filled with stone, gravel that create temporary subsurface storage for the attenuation, conveyance and filtration of surface water runoff. Filter strips are uniformly graded and gently sloping strips of grass or dense vegetation, designed to treat runoff from adjacent impermeable areas by promoting sedimentation, filtration and infiltration.	✓

Table 8: Suitability of SuDS Components

5.10 It has been indicated in *Table 8* above, that several SuDS components are deemed appropriate to be used in the following SuDS management train.

5.11 With reference to the Shepway District Council SFRA (2015), the document states that “for sites greater than 1ha it will be necessary to demonstrate that all surface water flows associated with the 100 year event (including an appropriate allowance for climate change) can be contained within the site. For previously undeveloped sites, the maximum rate of surface water run-off will need to be controlled such that it does not exceed the pre-developed greenfield run-off rate. For brownfield sites, the rate of run-off shall not exceed the existing rate.”

5.12 Given the permeable geology reflected in the BGS Geology Viewer infiltration of rainwater is proposed to best mimic the existing situations post development.

5.13 Infiltration devices would be formed of:

- Filter drains and discharge to ground for the Pods and social canopy proposed for Area A;
- Permeable Pavement and/or filter drains and swales for the access road and parking area in Area B and all new footpaths proposed in all development areas;
- Geocellular storage and permeable pavement for the restaurant extension in Area C.

5.14 The French House forming the major development within Area A is existing and it is proposed that the existing storm drainage arrangement for this is re-used. Conversion of outbuildings is also proposed to re-use the existing drainage in place for these elements.

5.15 SuDS components should subsequently be designed to accommodate and dispose of runoff from storms up to and including the 1:100 year +40% climate change event without flooding.

Permeable Paving

5.16 Where hardstanding surfaces are proposed around the building, permeable paving type A is proposed to treat and drain the runoff. It would only provide self-drainage and as such the distance from the building would not be a limiting factor for the implantation of Type A (full infiltration) permeable pavement. The paving would be formed by the following layers:

- Permeable surfacing (form to be confirmed)
- Laying Course Material
- Geotextile filter
- Sub-Base: Clean Stone (Depth: subject to CBR testing)
- Geotextile filter

5.17 Feasibility of type A permeable paving to be confirmed with geotechnical engineer. If groundwater table is shown to be too high, this approach is to be reviewed.

Rain Shadows

5.18 Rain shadows are sheltered areas resulting from construction of each of the five proposed garden pod units. It is anticipated that rain falling on the dome-shaped pod unit will runoff the structures and flow/infiltrate into the rain shadow area located beneath. Potentially filter trenches could be employed depending on the final size of the pods proposed and infiltration rates.

Rainwater Harvesting

5.19 Additionally, Rainwater Harvesting (RWH) Systems should be considered for rainwater re-use. Rainwater harvesting can take various forms including simple water butts to utilise runoff for watering and irrigation, or more complex pumped RWH systems to be used in grey water uses. Rainwater harvesting should be designed by specialists for grey water re-use within the building.

Filter Drains

5.20 Filter trenches are shallow excavations filled with rubble or stone that create temporary subsurface storage of stormwater runoff. These trenches can be used to filter and convey stormwater to downstream SuDS components.

- 5.21 Ideally they should receive lateral inflow from an adjacent impermeable surface, but point source inflows may be acceptable.

Swales

- 5.22 Swales are shallow, broad and vegetated channels designed to store and/or convey runoff and remove pollutants. They may be used as conveyance structures to pass the runoff to the next stage of the treatment train and can be designed to promote infiltration where soil and groundwater conditions allow.
- 5.23 Check dams and berms also can be installed across the flow path of a swale in order to promote settling and infiltration.

6. Surface Water Drainage Strategy

- 6.1 In order to mitigate flood risk posed by the proposed development and to control the maximum rate of surface water run-off to greenfield rates, adequate control measures are required to be considered. This will ensure that surface water runoff is dealt with at the source and that flood risk on, and off, site is not increased over the lifetime of the development.
- 6.2 Based on the residential nature of the proposed developments proposed drainage would need to be designed to accommodate the 1in100yr rainfall event plus climate change allowances. Rainfall has been modelled using the 2013 FEH rainfall data.
- 6.3 Following review of the proposed site plan, it has been predicted that there will be an increase in impermeable hard surface area of approximately 7,172m². An approximate breakdown of these increases is displayed in *Table 9* below and forms the basis of the following calculations.

Area	Proposed Development	Net Increase in Hard Standing Surface Area (m ²)
A	Conversion of The French House from C3 to C1 use	N/A – Change of use
A	Removal of north ancillary buildings and construction of proposed new ancillary building at Giraffe Hall	23
A	Construction of five garden pod buildings (C1 use)	380
A	Construction of new pathways between sites suitable for both guests and as giraffe routes	323
A	Construction of a new pathway linking the French House and pods to social canopy and Area C.	337
A	Construction of a new social canopy to be added to the garden	122
B	Construction of a new access road	2,300
B	Construction of a new car park	1,600
B	Check-in building	54
C	Construction of a new restaurant extension	131
Total		7,172

Table 9: Increase in hard standing surface area per proposed development

- 6.4 As existing within Area A, The French House is considered a Grade II* Listed Heritage Asset. As such, it is proposed that the majority of the building is to remain unchanged with only internal conversion taking place (conversion of C3 residential use to C1 guest house use) and external renovations. As such, any increase in surface water runoff could be considered negligible. *It should be noted that given that the building is a Grade II* Listed Heritage Asset, drainage infrastructure will remain unchanged post-development.* Infiltration techniques are recommended around the site to discharge any additional runoff that may be generated.

- 6.5 It is understood that the five proposed garden pods in Area A are to be raised above ground and that rain falling on each pod will runoff and flow/infiltrate via the sheltered rain shadow area underneath. Potentially filter trenches could be employed depending on the final size of the pods proposed.
- 6.6 The proposed conversion of the existing outbuildings within Area A to ancillary storage/ support use is considered a change of use and as such any increase in runoff generated post-development could be considered negligible. Infiltration methods are proposed to discharge additional drainage generated from the proposed canopy link and wind shield to The French House, as well as the proposed social canopy elsewhere on Area A.
- 6.7 Within Area B, the combination of the proposed car park, the new access road and the various pathways (suitable for both guests and giraffe routes) account for the vast majority of the increase in proposed hardstanding area at approximately 3,800m². Infiltrating permeable paving and surrounding green space/soft landscaping should be considered within these areas to treat and drain the runoff.
- 6.8 A new restaurant extension is proposed at Area C. The proposed development will result in an extension to the existing building of approximately 174m². As part of the proposed works, an existing marquee (with a footprint of approximately 43m²) is to be demolished, resulting in a net increase in built footprint of 107m² post-development. Infiltration methods are recommended to be considered to drain any additional runoff, should the existing drainage system not be available for connection or be at risk of surcharge.
- 6.9 Proposed site drainage strategy plans are included in Appendix III.

Runoff rates

- 6.10 According to the plans provided by the client, the total increase in hardstanding area within the redline application boundaries is approximately 7,172m². This area is associated with a Greenfield Runoff Rate (Qbar) of 1.0l/s. A summary of the rainfall runoff rates for the Site is provided in *Table 10*. Calculations are included in Appendix II.

Surface Water Discharge Rates Summary					
	Area (ha)	Discharge Rates (l/s)			
		1 year	2 year/QBAR	30 year	100 year
Greenfield Rates Area A	0.1185	0.2	0.2	0.5	0.7
Greenfield Rates Area B	0.5807	0.9	1.1	2.4	3.4
Greenfield Rates Area C	0.0131	0.0	0.0	0.1	0.1
Whole development area greenfield runoff	0.7172	1.1	1.3	3.0	4.2
Proposed site runoff 1in100yr +40%CC	0.7172	0	0	0	0

Table 10: Surface water discharge rates for Area A summary - *The minimum outflow rate to prevent blockages

On Site Drainage and Storage Systems

Area A

- 6.11 Permeable paving is proposed for all footpaths. Infiltration rates are to be confirmed but nominal thickness of 150mm permeable paving sub base should be used under the surfacing to provide a medium for capture and infiltration into the sub grade.
- 6.12 The 5 proposed garden pods total 380sqm hard surface area. It is proposed that each pod drains to the ground within the rain shadow created by each pod. Should the pods be installed flush with the ground a filter drain should be employed to infiltrate runoff for each individual pod (76sqm). Based on an assumed infiltration rate of 1×10^{-5} m/s the infiltration trench would need to be 11x1.0x1.2m deep to accept and infiltrate runoff generated by the 1in100yr+40% rainfall event. This trench could be installed in adjacent soft landscaping. Alternatively, a small geocellular soakaway offering similar storage volume could be employed. Calculations are included in Appendix II.
- 6.13 For the social canopy in the garden this has a proposed area of 122sqm. A geocellular soakaway should be employed to infiltrate runoff. Based on an assumed infiltration rate of 1×10^{-5} m/s the infiltration geocellular device would need to be 11.5x1.0x0.8m deep to accept and infiltrate runoff generated by the 1in100yr+40% rainfall event. This soakaway could be installed in adjacent soft landscaping. Calculations are included in Appendix II.

Area B

- 6.14 Permeable paving is proposed for all footpaths. Infiltration rates are to be confirmed but nominal thickness of 150mm permeable paving sub base should be used under the surfacing to provide a medium for capture and infiltration into the sub grade.
- 6.15 Permeable paving is proposed for the parking area and access road. The final surfaces for these elements have yet to be confirmed.
- 6.16 Based on an assumed infiltration rate of 1×10^{-5} m/s and a sub base cell size of a nominal 100sqm the permeable pavement sub base thickness would need to be 175mm deep to accept and infiltrate runoff generated by the 1in100yr+40% rainfall event. A factor of safety of 5 has been used due to the extent of paving increasing risk to others should it not work effectively. Calculations are included in Appendix II.

Area C

- 6.17 Permeable paving is proposed for all footpaths. Infiltration rates are to be confirmed but nominal thickness of 150mm permeable paving sub base should be used under the surfacing to provide a medium for capture and infiltration into the sub grade.
- 6.18 The restaurant extension in this has a proposed area of 174m². A geocellular soakaway should be employed to infiltrate runoff. Based on an assumed infiltration rate of 1×10^{-5} m/s the infiltration geocellular device would need to be 10.5x1.5x0.91m deep to accept and infiltrate runoff generated by the 1in100yr+40% rainfall event. This soakaway could be installed in adjacent soft landscaping, the dimensions of the soakaway may need to be amended to suit available locations. Calculations are included in Appendix II.

Design Exceedance

- 6.19 In the event of drainage system failure under extreme rainfall events or blockage, flooding may occur within the site. In the event of the development's drainage system failure, the runoff flow will be dictated by topography on site. It is advised that the external ground levels, where possible, are laid to fall away from building thresholds.
- 6.20 It is noted that the site falls to the south. Where possible, ground levels should be designed to direct runoff southwards, towards to First Government Drain, away from any of the proposed or existing buildings.
- 6.21 In terms of drainage mechanisms to mitigate the impacts of exceedance events on the site, it is advised non-return valves should be provided to prevent the ingress/egress of surface and foul waters should the wider sewer network become surcharged.

Water Quality

- 6.22 Adequate treatment must be delivered to the water runoff to remove pollutants through SuDS devices, which are able to provide pollution mitigation. Pollution Hazards and the SuDS Mitigation have been indexed in the CIRIA 753 'The SUDS Manual'.
- 6.23 The Pollution Hazard Indices are summarized in *Table 11* below:

Pollution Hazard Indices for Different Land Use Classifications				
LAND USE	Pollution Hazard Level	Total suspended Solids (TSS)	Metals	Hydrocarbons
Roofs	Very Low	0.2	0.2	0.05
Driveways, car parks, low traffic roads i.e. < 300 traffic movements/day	Low	0.5	0.4	0.4

Table 11: Summary of Pollution Hazard Indices for Different Land Use

- 6.24 Approximately 1,287m² of the proposed site is comprised of roof areas, which is considered to be clean runoff. Runoff to the new access drive and associated car park is proposed to be laid in permeable paving which offers treatment of potential contamination.
- 6.25 The Mitigation Indices of the proposed SuDS techniques are summarised in the *Table 12 - Indicative SuDS Mitigation Indices* below. It can be seen the water treatment provided by this SuDS train for the access drive and car park is enough to remove the potential pollutants.

INDICATIVE SuDS MITIGATION INDICES FOR DISCHARGES TO SURFACE WATER			
SuDS Component	Total suspended Solids (TSS)	Metals	Hydrocarbons
Permeable Pavement	0.7	0.6	0.7

Table 12: Indicative SuDS Mitigation Indices

7. Foul Water Drainage Strategy

- 7.1 It is understood that the current French House foul drainage system currently drains to a septic tank/cess pool arrangement and may not be suitable for re-use following the proposed refurbishments. The addition of the garden pods will boost population to a maximum of 40 persons and as such a new foul treatment plan has been proposed. The treatment plant would also accommodate the runoff from the new social canopy in the garden. Foul flows from the French house and social canopy may need to be pumped to suit the preferred location of the foul treatment plant.
- 7.2 A permanent WC block has been proposed adjacent to the proposed car park to be connected to the foul plant.
- 7.3 The final location of the treatment plant is to be confirmed. Ideally outflow from the plant would be infiltrated in a suitable sized drainage field. This may need to be located in the area of the proposed parking within Area C as this is located over the most permeable subgrade suitable for infiltration.
- 7.4 The proposed treatment plant would be a Klargester BioFicient Commercial Sewerage Treatment plant type 34H, or similar approved, with an assumed population of 75 (to be confirmed by the client). Final design to be confirmed by specialist provider to meet local design criteria, any client confirmed inflows and policy.

8. Management and Maintenance

- 8.1 All onsite SuDS and drainage systems will be privately maintained. A long-term maintenance regime should be agreed with the site owners before adoption. In addition to a long-term maintenance regime, it is recommended that all drainage elements implemented on site should be inspected following the first rainfall event post construction and monthly for the first quarter following construction.

GENERAL REQUIREMENTS		RESPONSIBILITY
Generally	Frequency	Site Owner
Pipes and Litter: collect all litter or other debris and remove from site at each visit	Monthly	Yes, where drains serve the one property only or within property boundary
INLETS, OUTLETS, CONTROLS, GULLIES, CHANNEL DRAINS, GEOCELLULAR ATTENUATION TANKS AND INSPECTION CHAMBERS		
Regular Maintenance	Frequency	
Inspect surface structures removing obstructions, sediment, oil/grease and floating debris and silt as necessary. Check there is no physical damage. Strim vegetation 1m min. surround to structures and keep hard aprons free from silt and debris.	Monthly	Yes, where drains serve the one property only or within property boundary
Flow Control Devices (Hydrobrake): Inspect and remove blockages, hose down as required, check flow.	Six monthly	
Inspection chambers, Gullies, Channel Drains: Remove cover and inspect ensuring water is flowing freely and that the exit route for water is unobstructed. Remove debris and silt. Undertake inspection after leaf fall in autumn and major storm events	Annually	Yes, where drains serve the one property only or within property boundary
Attenuation Tank (Geocellular): Inspect and remove blockages, Jet and camera as required, check flow. CCTV inspection at every inspection point is recommended: — after every major storm — at regular intervals. Silt traps prior to inlet pipework should be routinely inspected and cleaned out to minimise debris reaching the tank	Annually	
Occasional Maintenance		
Cleaning of the system if necessary. CCTV Survey and Jetting	As necessary	Yes, where drains serve the one property only or within property boundary
Remedial work		
Inspect and remove baskets or similar silt-traps, clean and replace. Repair physical damage if necessary.	As necessary	Yes, where drains serve the one property only or within property boundary
PERMEABLE AND POROUS SURFACES		
Regular Maintenance		
Cleaning Brush regularly and remove sweepings from all hard surfaces	Monthly	Yes, private driveways
Occasional Maintenance		
Permeable Pavements. Brush and vacuum surface once a year to prevent silt blockage and enhance design life.	Annually	Yes, private driveways

Remedial work		
Monitor effectiveness of permeable pavement and when water does not infiltrate immediately advise Client of possible need for reinstatement of top layers or specialist cleaning. Recent experience suggests jet washing and suction cleaning will substantially reinstate pavement to 90% efficiency.	As required	Yes, private driveways
OVERLAND FLOW AND DESIGNED FLOODABLE AREAS		
Regular Maintenance		
Ensure flood flow routes or areas that are design to temporarily store flood water are not obstructed. Remove obstructions from site	Monthly	Maintenance Company in communal areas, home owners in private areas.
OVERLAND FLOW AND DESIGNED FLOODABLE AREAS		
Regular Maintenance		
Inspect surface structures removing obstructions, sediment, oil/grease and floating debris and silt as necessary. Check there is no physical damage. Strim vegetation 1m min. surround to structures and keep hard aprons free from silt and debris.	Monthly	Yes, where draining more than one property or located in communal areas
Inspection chambers, Gullies, Drains: Remove cover and inspect ensuring water is flowing freely and that the exit route for water is unobstructed. Remove debris and silt.	Annually	Yes, where draining more than one property or located in communal areas
Pumping station: Inspect and remove blockages, hose down as required, check flow.	Six monthly	Yes
Sewerage treatment plant: Inspect and remove blockages, hose down as required, check flow.	Six monthly or as per manufacturers requirements	

Table 13: Proposed Schedule of Maintenance for Below Ground Drainage.

9. Conclusion

9.1 Ambiantal Environmental Assessment has been appointed by Howletts and Port Lympne Estates Ltd to undertake a National Planning Policy Framework (NPPF) compliant Flood Risk Assessment (FRA) for the proposed development at The French House, Port Lympne, Kent, CT21 4PA.

9.2 The wider site is currently a Hotel and Animal Reserve. The development site features a Grade II* Listed building, The French House. It is understood that the proposed development is for the change of use of the French House from Class C3 residential dwelling to a 10 bed boutique hotel Class C1; partial demolition, reconstruction and conversion of outbuildings; erection of 5 new build bedroom pods; erection of new social canopy; erection of check-in building; extension to existing restaurant; creation of new link pathways and a new access road;; new refuse store; and creation of a new car park for 50 car spaces.

9.3 The proposed developments are split across three key areas as follows:

Area A = 12,172m² (1.2172ha):

- Conversion of The French House from residential (C3) to guest house (C1) use;
- Conversion of outbuildings to ancillary storage/support use with a proposed canopy link plus wind screen to the main building;
- Construction of five new build 'Garden Pods' (C1 use);
- Adaptation of garden to include new social canopy;
- Construction of a new pathway linking the French House & pods to social canopy and Area C;
- Construction of pathways suitable for both guests and giraffe routes linking adjacent areas with Port Lympne wildlife park.

Area B = 139,521m² (13.9521ha):

- Construction of a new access road from the existing entrance gate along Aldington Road;
- The construction of a new car park suitable for 50 spaces;

Area C = 13,645m² (1.3645ha):

- Construction of a restaurant extension adjacent to the existing restaurant.

9.4 With reference to the Environment Agency (EA) Flood Map for Planning, the proposed development is shown to be located within Flood Zone 1. The proposed development is considered a 'major development' and has an area of over 1 hectare. As such, a Flood Risk Assessment (FRA) and Surface Water Drainage Strategy (SWDS) is required to show that the development can be achieved in a sustainable manner.

9.5 In accordance with the NPPF, the different aspects of the proposed development at Port Lympne Hotel and Animal Reserve subsequently vary in their vulnerability classifications. Some of the proposed developments, such as the proposed car park could be considered as 'Water-Compatible', whilst other aspects of the development such as the conversion of The French House to a guest house (C1 use) could be considered as 'More Vulnerable' (please refer to *Table 3* displayed later in this report).

9.6 Following assessment of the EA Risk of Flooding from Surface Water dataset, the proposed development is to be located within an area considered to be largely at 'Very Low' risk with the northern extent of Area B being at 'Low' risk from surface water depths, that are below 300mm, spilling into the site from Aldington Road.

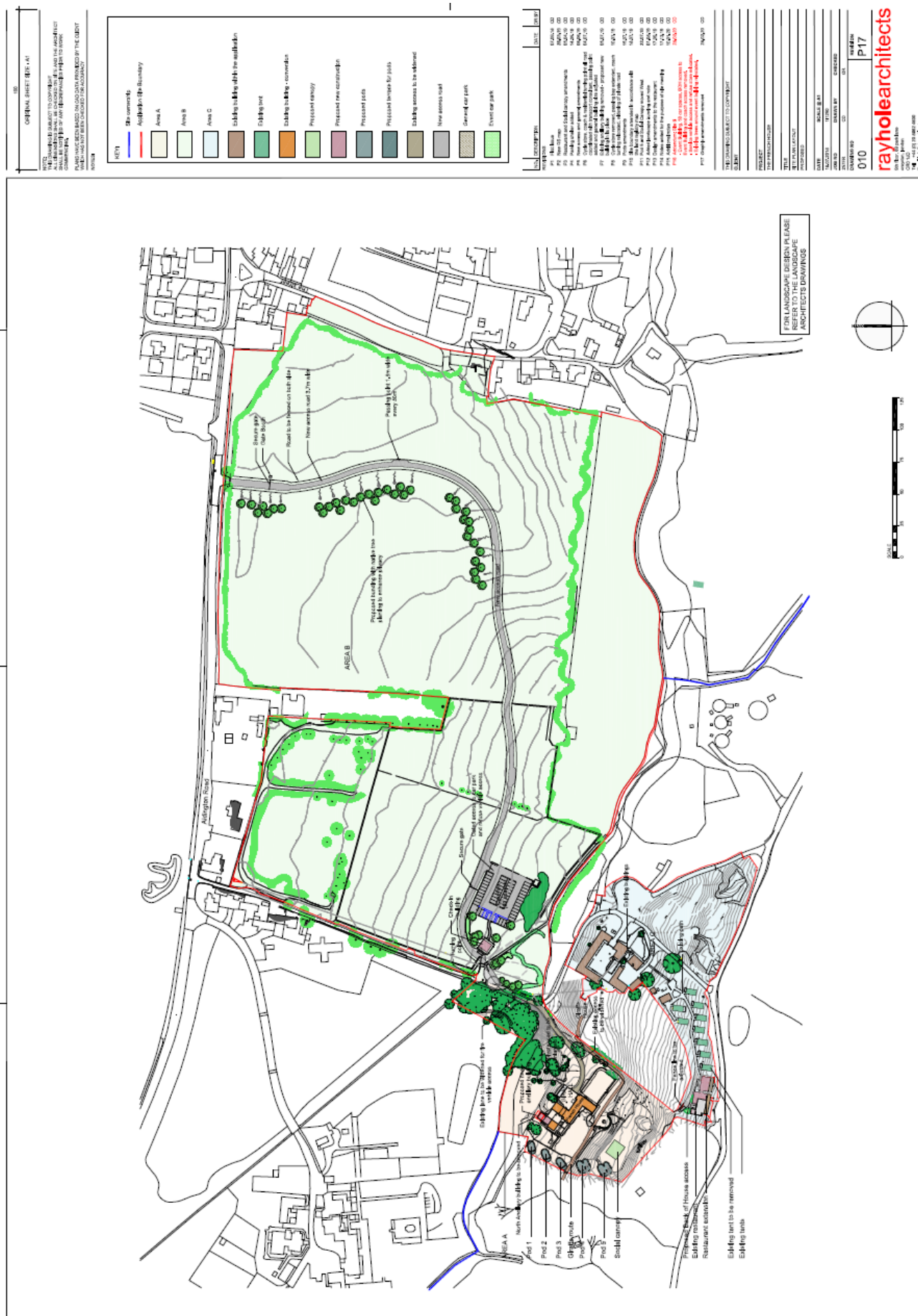
- 9.7 With reference to the Shepway District Council SFRA (2015), the document states that *“for sites greater than 1ha it will be necessary to demonstrate that all surface water flows associated with the 100 year event (including an appropriate allowance for climate change) can be contained within the site. For previously undeveloped sites, the maximum rate of surface water run-off will need to be controlled such that it does not exceed the pre-developed greenfield run-off rate. For brownfield sites, the rate of run-off shall not exceed the existing rate.”*
- 9.8 Infiltration testing has yet to be undertaken on site but is assumed to be suitable until proven otherwise. With reference to the British Geological Survey (BGS) database of borehole studies, surveys on site report the presence of more porous limestones and sandstones, of the Hythe Formation, towards the north of the redline site boundary, whilst clays have been identified towards the southern limit.
- 9.9 As existing within Area A, The French House is considered a Grade II* Listed Heritage Asset. As such, it is proposed that the majority of the building is to remain unchanged with only internal conversion taking place (conversion of C3 residential use to C1 guest house use) and external renovations. As such, any increase in surface water runoff could be considered negligible. *It should be noted that given that the building is a Grade II* Listed Heritage Asset, drainage infrastructure will remain unchanged post-development.* Infiltration techniques are recommended around the site to discharge any additional runoff that may be generated.
- 9.10 It is understood that the five proposed garden pods in Area A are to be raised above ground and that rain falling on each pod will runoff and flow/infiltrate via the sheltered rain shadow area underneath.
- 9.11 The proposed conversion of the existing outbuildings within Area A to ancillary storage/ support use is considered a change of use and as such any increase in runoff generated post-development could be considered negligible. Infiltration methods are proposed to discharge additional drainage generated from the proposed canopy link and wind shield to The French House, as well as the proposed social canopy elsewhere on Area A.
- 9.12 Within Area B, the combination of the proposed car park, the new access road and the various pathways (suitable for both guests and giraffe routes) account for the vast majority of the increase in proposed hardstanding area at approximately 3,800m². Infiltrating permeable paving and surrounding green space/soft landscaping should be considered within these areas to treat and drain the runoff.
- 9.13 A new restaurant extension is proposed at Area C. The proposed development will result in an extension to the existing building of approximately 174m². As part of the proposed works, an existing marquee (with a footprint of approximately 43m²) is to be demolished, resulting in a net increase in built footprint of 131m² post-development. Infiltration methods are recommended to be considered to drain any additional runoff, should the existing drainage system not be available for connection or be at risk of surcharge.
- 9.14 It is understood that the current French House foul drainage system currently drains to a septic tank/cess pool arrangement and may not be suitable for re-use following the proposed refurbishments. The addition of the garden pods will boost population to a maximum of 40 persons and as such a new foul treatment plan has been proposed. The treatment plant would also accommodate the runoff from the new social canopy in the garden. Foul flows from the French house and social canopy may need to be pumped to suit the preferred location of the foul treatment plant. The final location of the plant needs to be agreed with the client.

9.15 As such, and given that:

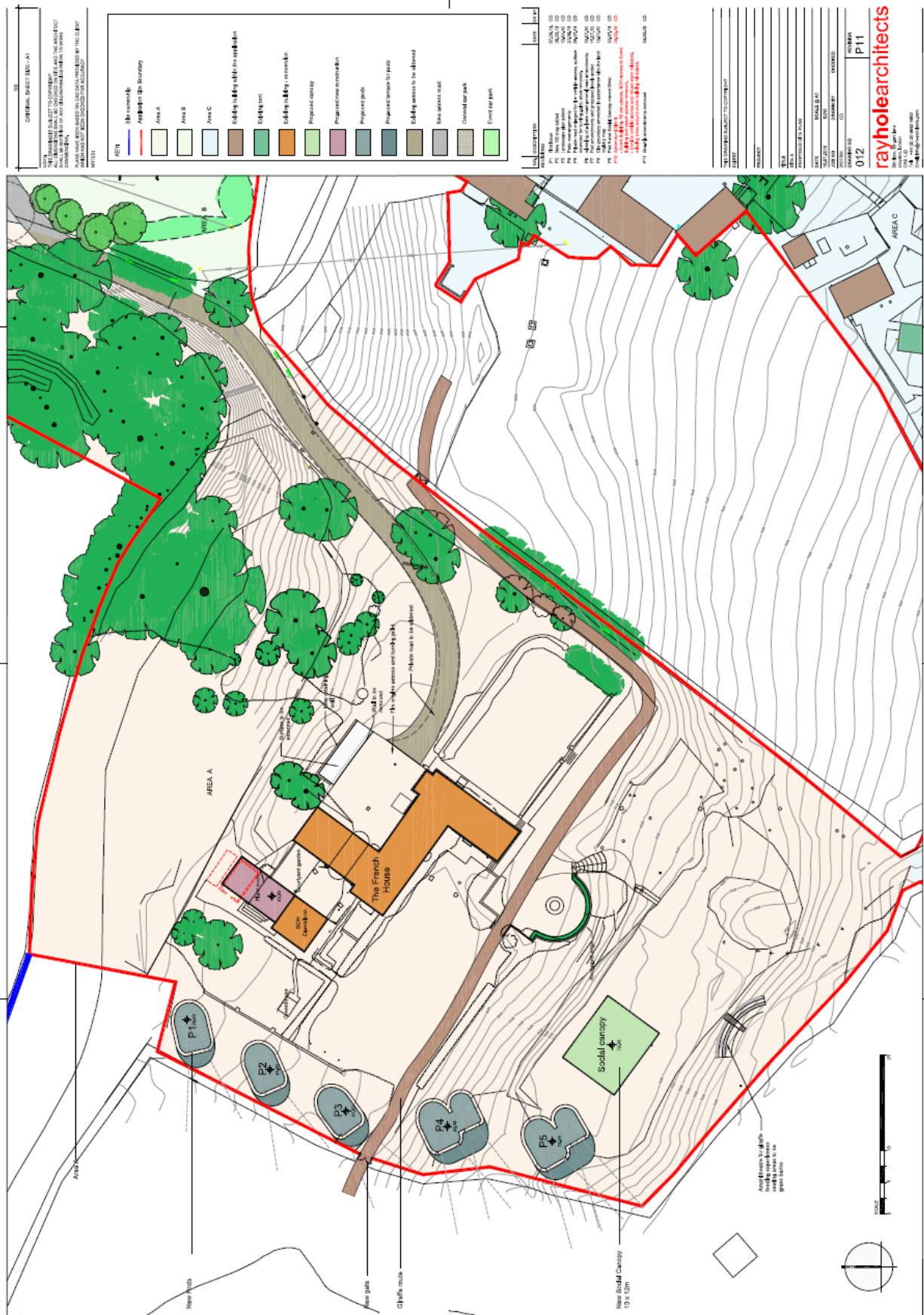
- with reference to the EA Flood Map for Planning, the proposed development is located within Flood Zone 1;
- Areas A and C have been shown to be located in areas at very low risk of surface water flooding whilst Area B has been shown to be located in an area at low risk;
- a combination of various infiltration and storage techniques are to be recommended in order to attenuate the maximum surface water runoff rates to greenfield rates whilst also demonstrating that all surface water flows associated with the 100 year event +CC can be contained on site;
- Foul runoff can be captured, treated and infiltrated on site.
- Management and maintenance can be implemented by the park as currently undertaken on the wider site.

Following the guidelines contained within the NPPF, the proposed development is considered to be suitable assuming appropriate mitigation (including adequate warning procedures) can be maintained for the lifetime of the development.

Appendix I - Site Plans



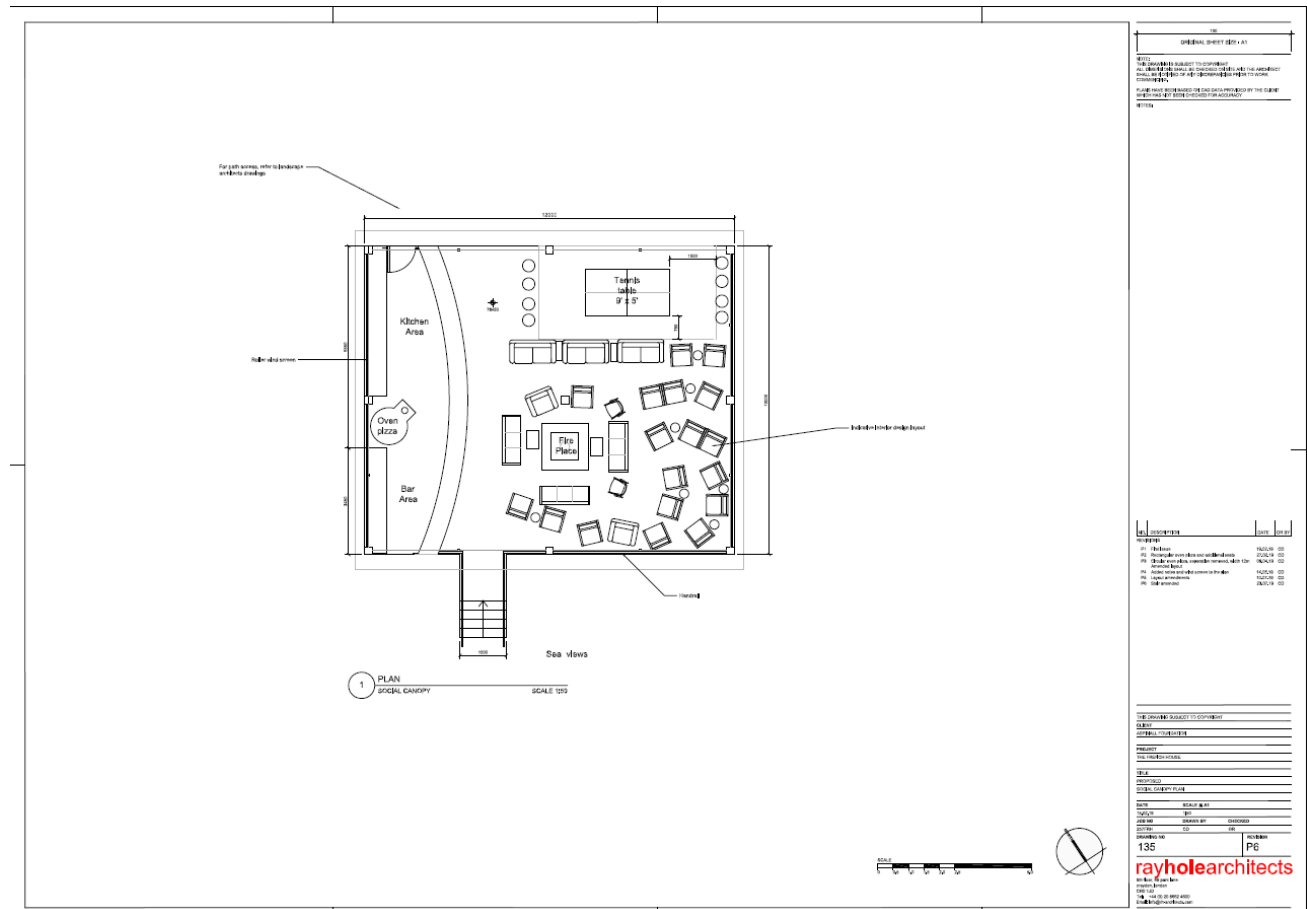


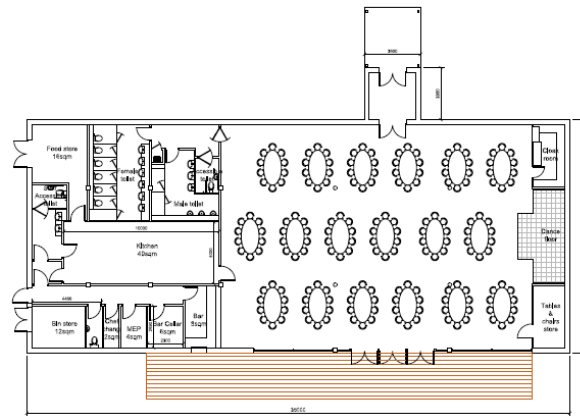












1 GROUND FLOOR PLAN
EVENT BUILDING SCALE 1/100



180

~~CONFIDENTIAL - SECURITY INDEX - A1~~

NETS2

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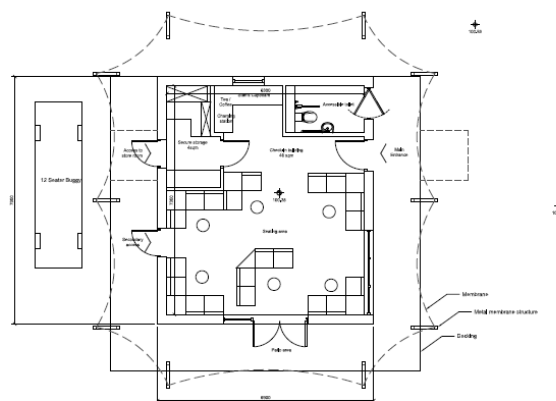
~~WHICH HAS NOT BEEN CHECKED FOR ACCURACY~~

1800000

INSTRUMENT	DESCRIPTION	DATE	DR BY
01	The house	14/06/10	GD
02	South windows, back room & kitchen entrance	15/06/10	GD

THE OFFICIAL SUBJECT TO COMPLY	
CLIENT	
THE OFFICIAL PROJECT	
PROJECT	
DRAWING TITLE	
DATE	
DRAWING SCALE	
DRAWING NO.	
DATE	SCALE
1/24/2018	1/24/18
ASB MD	DRWING BY
2018/01	CD
DRAWING NO	REVISION
140	P2

rayholearchitects
201 New, 100-year-old
masonry building
CRO 1.02
Tel: +44 (0) 20 9952 4500
Email: info@rayholearchitects.com



1 PLAN
CHECK-IN BUILDING SCALE 1/8" @ A1



OPTIONAL SHEET SIZE: A1

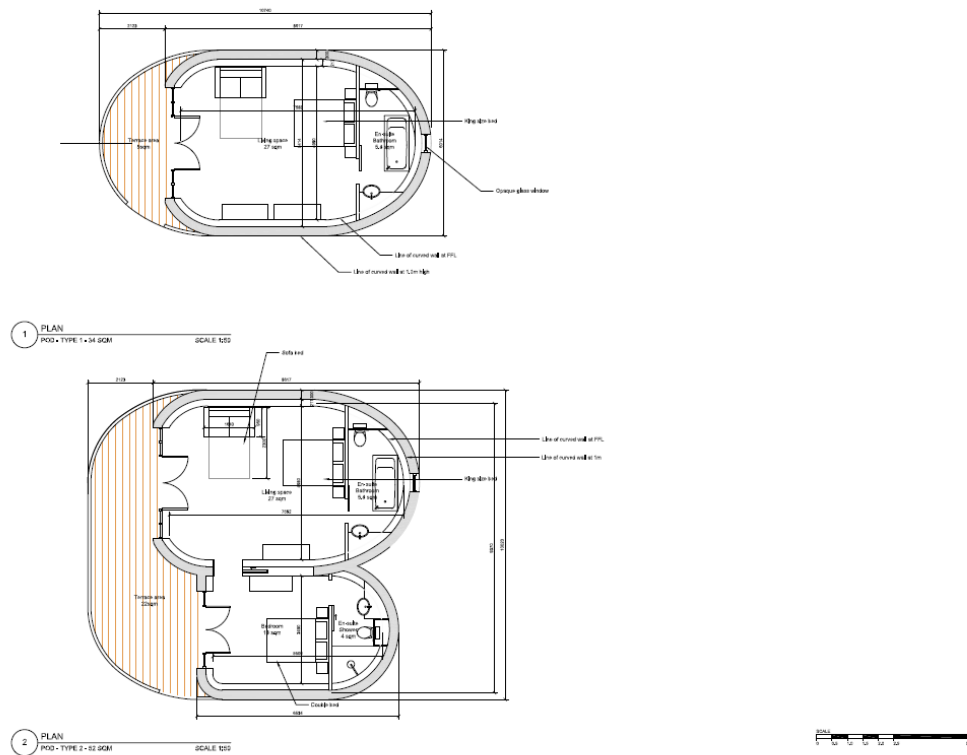
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CONSTRUCTION.

PLANS HAVE BEEN REPRODUCED ON CD DATA PROVIDED BY THE CLIENT
AND ARE NOT BEING CHECKED FOR ACCURACY

[illegible]

T-82 DRAWING SUBJECT TO DISPOSITION	
CLIENT AIR FORCE FOUNDATION	
PROJECT CENTRO VALL	
TITLE CHECKING D.D. 000 PROPOSED PLAN	
DATE SCALE @ BY JULY 79 1/8"	
JOB NO.	DRAWN BY CHECKED
REVISED (C)	
DRAWN BY	SUPERVISOR

150 P2
rayholearchitects
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 Columbia
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 Email: info@rayhole.com



FBI

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WHEN HAVING BEEN CHECKED FOR ACCURACY

NOTES:

REF	DESCRIPTION	DATE	DR BY
PR	11/20/2005	26/06/18	GD
PR	Design amendments	11/07/18	GD

[illegible]

DATE	SCALE	BY
11/11/2010	1/8"	
JOB NO	DRAWN BY	CHECKED
2017-001	CD	
DRAWING NO	REVISION	
160	P2	

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8th Floor, 100 Park Lane
London, W1K 1PF
UK
Tel: +44 (0) 20 9952 4000

Appendix II - Calculations

Greenfield runoff rates

AEA - Ambiental		Page 1												
Science Park Square Brighton East Sussex	Area A													
Date 26/07/2019 10:49	Designed by Mark.Naumann													
File site c restaurant exten...	Checked by													
XP Solutions	Source Control 2018.1													
<u>ICP SUDS Mean Annual Flood</u> Input <table> <tr> <td>Return Period (years)</td> <td>100</td> <td>Soil</td> <td>0.300</td> </tr> <tr> <td>Area (ha)</td> <td>0.119</td> <td>Urban</td> <td>0.000</td> </tr> <tr> <td>SAAR (mm)</td> <td>704</td> <td>Region Number</td> <td>Region 7</td> </tr> </table> Results 1/s QBAR Rural 0.2 QBAR Urban 0.2 Q100 years 0.7 Q1 year 0.2 Q30 years 0.5 Q100 years 0.7			Return Period (years)	100	Soil	0.300	Area (ha)	0.119	Urban	0.000	SAAR (mm)	704	Region Number	Region 7
Return Period (years)	100	Soil	0.300											
Area (ha)	0.119	Urban	0.000											
SAAR (mm)	704	Region Number	Region 7											
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AEA - Ambiental		Page 1												
Science Park Square Brighton East Sussex	Area B													
Date 26/07/2019 10:50	Designed by Mark.Naumann													
File site c restaurant exten...	Checked by													
XP Solutions	Source Control 2018.1													
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Return Period (years)	100	Soil	0.300											
Area (ha)	0.581	Urban	0.000											
SAAR (mm)	704	Region Number	Region 7											
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AEA - Ambiental		Page 1												
Science Park Square Brighton East Sussex	Area C													
Date 26/07/2019 10:51 File site c restaurant exten...	Designed by Mark.Naumann Checked by													
XP Solutions		Source Control 2018.1												
<u>ICP SUDS Mean Annual Flood</u> Input <table style="margin: auto;"> <tr> <td>Return Period (years)</td> <td>100</td> <td>Soil</td> <td>0.300</td> </tr> <tr> <td>Area (ha)</td> <td>0.013</td> <td>Urban</td> <td>0.000</td> </tr> <tr> <td>SAAR (mm)</td> <td>704</td> <td>Region Number</td> <td>Region 7</td> </tr> </table> Results 1/s QBAR Rural 0.0 QBAR Urban 0.0 Q100 years 0.1 Q1 year 0.0 Q30 years 0.1 Q100 years 0.1			Return Period (years)	100	Soil	0.300	Area (ha)	0.013	Urban	0.000	SAAR (mm)	704	Region Number	Region 7
Return Period (years)	100	Soil	0.300											
Area (ha)	0.013	Urban	0.000											
SAAR (mm)	704	Region Number	Region 7											
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Area A Infiltration designs

AEA - Ambiental		Page 1																																																																																																																																																																																																																		
Science Park Square Brighton East Sussex	Port Lympne Greenfield pod infiltration trench																																																																																																																																																																																																																			
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<u>Summary of Results for 100 year Return Period (+40%)</u> Half Drain Time : 216 minutes. <table><thead><tr><th>Storm Event</th><th>Max Level (m)</th><th>Max Depth (m)</th><th>Max Infiltration (l/s)</th><th>Max Volume (m³)</th><th>Status</th></tr></thead><tbody><tr><td>15 min Summer</td><td>0.611</td><td>0.611</td><td>0.1</td><td>2.0</td><td>O K</td></tr><tr><td>30 min Summer</td><td>0.782</td><td>0.782</td><td>0.1</td><td>2.6</td><td>O K</td></tr><tr><td>60 min Summer</td><td>0.925</td><td>0.925</td><td>0.2</td><td>3.1</td><td>O K</td></tr><tr><td>120 min Summer</td><td>1.031</td><td>1.031</td><td>0.2</td><td>3.4</td><td>O K</td></tr><tr><td>180 min Summer</td><td>1.073</td><td>1.073</td><td>0.2</td><td>3.5</td><td>O K</td></tr><tr><td>240 min Summer</td><td>1.100</td><td>1.100</td><td>0.2</td><td>3.6</td><td>O K</td></tr><tr><td>360 min Summer</td><td>1.131</td><td>1.131</td><td>0.2</td><td>3.7</td><td>O K</td></tr><tr><td>480 min 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Summer</td><td>0.209</td><td>0.209</td><td>0.1</td><td>0.7</td><td>O K</td></tr><tr><td>10080 min Summer</td><td>0.159</td><td>0.159</td><td>0.1</td><td>0.5</td><td>O K</td></tr><tr><td>15 min Winter</td><td>0.687</td><td>0.687</td><td>0.1</td><td>2.3</td><td>O K</td></tr></tbody></table> <table><thead><tr><th>Storm Event</th><th>Rain (mm/hr)</th><th>Flooded Volume (m³)</th><th>Time-Peak (mins)</th></tr></thead><tbody><tr><td>15 min Summer</td><td>140.560</td><td>0.0</td><td>18</td></tr><tr><td>30 min Summer</td><td>92.400</td><td>0.0</td><td>33</td></tr><tr><td>60 min Summer</td><td>57.540</td><td>0.0</td><td>62</td></tr><tr><td>120 min Summer</td><td>35.420</td><td>0.0</td><td>120</td></tr><tr><td>180 min Summer</td><td>26.762</td><td>0.0</td><td>154</td></tr><tr><td>240 min Summer</td><td>21.980</td><td>0.0</td><td>184</td></tr><tr><td>360 min Summer</td><td>16.707</td><td>0.0</td><td>252</td></tr><tr><td>480 min Summer</td><td>13.785</td><td>0.0</td><td>322</td></tr><tr><td>600 min Summer</td><td>11.852</td><td>0.0</td><td>392</td></tr><tr><td>720 min Summer</td><td>10.453</td><td>0.0</td><td>460</td></tr><tr><td>960 min Summer</td><td>8.513</td><td>0.0</td><td>598</td></tr><tr><td>1440 min Summer</td><td>6.283</td><td>0.0</td><td>866</td></tr><tr><td>2160 min Summer</td><td>4.555</td><td>0.0</td><td>1252</td></tr><tr><td>2880 min Summer</td><td>3.605</td><td>0.0</td><td>1640</td></tr><tr><td>4320 min Summer</td><td>2.578</td><td>0.0</td><td>2376</td></tr><tr><td>5760 min Summer</td><td>2.034</td><td>0.0</td><td>3112</td></tr><tr><td>7200 min Summer</td><td>1.699</td><td>0.0</td><td>3824</td></tr><tr><td>8640 min Summer</td><td>1.471</td><td>0.0</td><td>4576</td></tr><tr><td>10080 min Summer</td><td>1.306</td><td>0.0</td><td>5248</td></tr><tr><td>15 min Winter</td><td>140.560</td><td>0.0</td><td>18</td></tr></tbody></table>			Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status	15 min Summer	0.611	0.611	0.1	2.0	O K	30 min Summer	0.782	0.782	0.1	2.6	O K	60 min Summer	0.925	0.925	0.2	3.1	O K	120 min Summer	1.031	1.031	0.2	3.4	O K	180 min Summer	1.073	1.073	0.2	3.5	O K	240 min Summer	1.100	1.100	0.2	3.6	O K	360 min Summer	1.131	1.131	0.2	3.7	O K	480 min Summer	1.141	1.141	0.2	3.8	O K	600 min Summer	1.136	1.136	0.2	3.7	O K	720 min Summer	1.120	1.120	0.2	3.7	O K	960 min Summer	1.073	1.073	0.2	3.5	O K	1440 min Summer	0.963	0.963	0.2	3.2	O K	2160 min Summer	0.808	0.808	0.2	2.7	O K	2880 min Summer	0.682	0.682	0.1	2.2	O K	4320 min Summer	0.496	0.496	0.1	1.6	O K	5760 min Summer	0.369	0.369	0.1	1.2	O K	7200 min Summer	0.278	0.278	0.1	0.9	O K	8640 min Summer	0.209	0.209	0.1	0.7	O K	10080 min Summer	0.159	0.159	0.1	0.5	O K	15 min Winter	0.687	0.687	0.1	2.3	O K	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)	15 min Summer	140.560	0.0	18	30 min Summer	92.400	0.0	33	60 min Summer	57.540	0.0	62	120 min Summer	35.420	0.0	120	180 min Summer	26.762	0.0	154	240 min Summer	21.980	0.0	184	360 min Summer	16.707	0.0	252	480 min Summer	13.785	0.0	322	600 min Summer	11.852	0.0	392	720 min Summer	10.453	0.0	460	960 min Summer	8.513	0.0	598	1440 min Summer	6.283	0.0	866	2160 min Summer	4.555	0.0	1252	2880 min Summer	3.605	0.0	1640	4320 min Summer	2.578	0.0	2376	5760 min Summer	2.034	0.0	3112	7200 min Summer	1.699	0.0	3824	8640 min Summer	1.471	0.0	4576	10080 min Summer	1.306	0.0	5248	15 min Winter	140.560	0.0	18
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AEA - Ambiental

Page 2

Science Park Square
Brighton
East Sussex

Port Lympe
Greenfield
pod infiltration trench

Date 26/07/2019
File pod infiltration trench...

Designed by MN
Checked by

XP Solutions

Source Control 2018.1

Micro Drainage

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	0.881	0.881	0.2	2.9	O K
60 min Winter	1.045	1.045	0.2	3.4	O K
120 min Winter	1.175	1.175	0.2	3.9	O K
180 min Winter	1.266	1.266	0.2	4.0	Flood Risk
240 min Winter	1.377	1.377	0.2	4.1	Flood Risk
360 min Winter	1.477	1.477	0.2	4.2	Flood Risk
480 min Winter	1.482	1.482	0.2	4.2	Flood Risk
600 min Winter	1.416	1.416	0.2	4.2	Flood Risk
720 min Winter	1.310	1.310	0.2	4.1	Flood Risk
960 min Winter	1.153	1.153	0.2	3.8	O K
1440 min Winter	0.990	0.990	0.2	3.3	O K
2160 min Winter	0.782	0.782	0.1	2.6	O K
2880 min Winter	0.622	0.622	0.1	2.1	O K
4320 min Winter	0.400	0.400	0.1	1.3	O K
5760 min Winter	0.258	0.258	0.1	0.9	O K
7200 min Winter	0.162	0.162	0.1	0.5	O K
8640 min Winter	0.095	0.095	0.1	0.3	O K
10080 min Winter	0.052	0.052	0.1	0.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	92.400	0.0	32
60 min Winter	57.540	0.0	60
120 min Winter	35.420	0.0	116
180 min Winter	26.762	0.0	170
240 min Winter	21.980	0.0	194
360 min Winter	16.707	0.0	272
480 min Winter	13.785	0.0	348
600 min Winter	11.852	0.0	422
720 min Winter	10.453	0.0	496
960 min Winter	8.513	0.0	638
1440 min Winter	6.283	0.0	912
2160 min Winter	4.555	0.0	1316
2880 min Winter	3.605	0.0	1700
4320 min Winter	2.578	0.0	2464
5760 min Winter	2.034	0.0	3176
7200 min Winter	1.699	0.0	3896
8640 min Winter	1.471	0.0	4584
10080 min Winter	1.306	0.0	5144

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AEA - Ambiental		Page 3
Science Park Square	Port Lympe	
Brighton	Greenfield	
East Sussex	pod infiltration trench	
Date 26/07/2019	Designed by MN	
File pod infiltration trench...	Checked by	
XP Solutions	Source Control 2018.1	

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 611100 134200 TR 11100 34200
Data Type	Catchment
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.008

Time (mins)	Area	
From:	To:	(ha)
0	4	0.008

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AEA - Ambiental		Page 4																				
Science Park Square Brighton East Sussex	Port Lympne Greenfield pod infiltration trench																					
Date 26/07/2019 File pod infiltration trench...	Designed by MN Checked by																					
XP Solutions Source Control 2018.1																						
<u>Model Details</u> Storage is Online Cover Level (m) 1.500 <u>Infiltration Trench Structure</u> <table style="margin-left: auto; margin-right: auto;"> <tr> <td>Infiltration Coefficient Base (m/hr)</td> <td>0.03600</td> <td>Trench Width (m)</td> <td>1.0</td> </tr> <tr> <td>Infiltration Coefficient Side (m/hr)</td> <td>0.03600</td> <td>Trench Length (m)</td> <td>11.0</td> </tr> <tr> <td>Safety Factor</td> <td>2.0</td> <td>Slope (1:X)</td> <td>0.0</td> </tr> <tr> <td>Porosity</td> <td>0.30</td> <td>Cap Volume Depth (m)</td> <td>1.200</td> </tr> <tr> <td>Invert Level (m)</td> <td>0.000</td> <td>Cap Infiltration Depth (m)</td> <td>1.200</td> </tr> </table>			Infiltration Coefficient Base (m/hr)	0.03600	Trench Width (m)	1.0	Infiltration Coefficient Side (m/hr)	0.03600	Trench Length (m)	11.0	Safety Factor	2.0	Slope (1:X)	0.0	Porosity	0.30	Cap Volume Depth (m)	1.200	Invert Level (m)	0.000	Cap Infiltration Depth (m)	1.200
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©1982-2018 Innovyze																						

AEA - Ambiental		Page 1																																																																																																																																																																																																																		
Science Park Square Brighton East Sussex	Port Lympe Site A proposed Social canopy																																																																																																																																																																																																																			
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<u>Summary of Results for 100 year Return Period (+40%)</u> Half Drain Time : 546 minutes. <table><tr><th>Storm Event</th><th>Max Level (m)</th><th>Max Depth (m)</th><th>Max Infiltration (l/s)</th><th>Max Volume (m³)</th><th>Status</th></tr><tr><td>15 min Summer</td><td>0.283</td><td>0.283</td><td>0.1</td><td>3.1</td><td>O K</td></tr><tr><td>30 min Summer</td><td>0.368</td><td>0.368</td><td>0.1</td><td>4.0</td><td>O K</td></tr><tr><td>60 min Summer</td><td>0.447</td><td>0.447</td><td>0.1</td><td>4.9</td><td>O K</td></tr><tr><td>120 min Summer</td><td>0.527</td><td>0.527</td><td>0.1</td><td>5.8</td><td>O K</td></tr><tr><td>180 min Summer</td><td>0.574</td><td>0.574</td><td>0.1</td><td>6.3</td><td>O K</td></tr><tr><td>240 min Summer</td><td>0.604</td><td>0.604</td><td>0.1</td><td>6.6</td><td>O K</td></tr><tr><td>360 min Summer</td><td>0.639</td><td>0.639</td><td>0.1</td><td>7.0</td><td>O K</td></tr><tr><td>480 min Summer</td><td>0.660</td><td>0.660</td><td>0.1</td><td>7.2</td><td>O K</td></tr><tr><td>600 min Summer</td><td>0.673</td><td>0.673</td><td>0.1</td><td>7.4</td><td>O K</td></tr><tr><td>720 min Summer</td><td>0.680</td><td>0.680</td><td>0.1</td><td>7.4</td><td>O K</td></tr><tr><td>960 min Summer</td><td>0.681</td><td>0.681</td><td>0.1</td><td>7.4</td><td>O K</td></tr><tr><td>1440 min Summer</td><td>0.656</td><td>0.656</td><td>0.1</td><td>7.2</td><td>O K</td></tr><tr><td>2160 min Summer</td><td>0.599</td><td>0.599</td><td>0.1</td><td>6.5</td><td>O K</td></tr><tr><td>2880 min Summer</td><td>0.544</td><td>0.544</td><td>0.1</td><td>5.9</td><td>O K</td></tr><tr><td>4320 min Summer</td><td>0.450</td><td>0.450</td><td>0.1</td><td>4.9</td><td>O K</td></tr><tr><td>5760 min Summer</td><td>0.376</td><td>0.376</td><td>0.1</td><td>4.1</td><td>O K</td></tr><tr><td>7200 min Summer</td><td>0.318</td><td>0.318</td><td>0.1</td><td>3.5</td><td>O K</td></tr><tr><td>8640 min Summer</td><td>0.270</td><td>0.270</td><td>0.1</td><td>3.0</td><td>O K</td></tr><tr><td>10080 min Summer</td><td>0.232</td><td>0.232</td><td>0.1</td><td>2.5</td><td>O K</td></tr><tr><td>15 min Winter</td><td>0.318</td><td>0.318</td><td>0.1</td><td>3.5</td><td>O K</td></tr></table> <table><tr><th>Storm Event</th><th>Rain (mm/hr)</th><th>Flooded Volume (m³)</th><th>Time-Peak (mins)</th></tr><tr><td>15 min Summer</td><td>140.560</td><td>0.0</td><td>19</td></tr><tr><td>30 min Summer</td><td>92.400</td><td>0.0</td><td>33</td></tr><tr><td>60 min Summer</td><td>57.540</td><td>0.0</td><td>64</td></tr><tr><td>120 min Summer</td><td>35.420</td><td>0.0</td><td>122</td></tr><tr><td>180 min Summer</td><td>26.762</td><td>0.0</td><td>182</td></tr><tr><td>240 min Summer</td><td>21.980</td><td>0.0</td><td>242</td></tr><tr><td>360 min Summer</td><td>16.707</td><td>0.0</td><td>356</td></tr><tr><td>480 min Summer</td><td>13.785</td><td>0.0</td><td>410</td></tr><tr><td>600 min Summer</td><td>11.852</td><td>0.0</td><td>474</td></tr><tr><td>720 min Summer</td><td>10.453</td><td>0.0</td><td>536</td></tr><tr><td>960 min Summer</td><td>8.513</td><td>0.0</td><td>672</td></tr><tr><td>1440 min Summer</td><td>6.283</td><td>0.0</td><td>952</td></tr><tr><td>2160 min Summer</td><td>4.555</td><td>0.0</td><td>1364</td></tr><tr><td>2880 min Summer</td><td>3.605</td><td>0.0</td><td>1760</td></tr><tr><td>4320 min Summer</td><td>2.578</td><td>0.0</td><td>2552</td></tr><tr><td>5760 min Summer</td><td>2.034</td><td>0.0</td><td>3336</td></tr><tr><td>7200 min Summer</td><td>1.699</td><td>0.0</td><td>4040</td></tr><tr><td>8640 min Summer</td><td>1.471</td><td>0.0</td><td>4832</td></tr><tr><td>10080 min Summer</td><td>1.306</td><td>0.0</td><td>5544</td></tr><tr><td>15 min Winter</td><td>140.560</td><td>0.0</td><td>19</td></tr></table>			Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status	15 min Summer	0.283	0.283	0.1	3.1	O K	30 min Summer	0.368	0.368	0.1	4.0	O K	60 min Summer	0.447	0.447	0.1	4.9	O K	120 min Summer	0.527	0.527	0.1	5.8	O K	180 min Summer	0.574	0.574	0.1	6.3	O K	240 min Summer	0.604	0.604	0.1	6.6	O K	360 min Summer	0.639	0.639	0.1	7.0	O K	480 min Summer	0.660	0.660	0.1	7.2	O K	600 min Summer	0.673	0.673	0.1	7.4	O K	720 min Summer	0.680	0.680	0.1	7.4	O K	960 min Summer	0.681	0.681	0.1	7.4	O K	1440 min Summer	0.656	0.656	0.1	7.2	O K	2160 min Summer	0.599	0.599	0.1	6.5	O K	2880 min Summer	0.544	0.544	0.1	5.9	O K	4320 min Summer	0.450	0.450	0.1	4.9	O K	5760 min Summer	0.376	0.376	0.1	4.1	O K	7200 min Summer	0.318	0.318	0.1	3.5	O K	8640 min Summer	0.270	0.270	0.1	3.0	O K	10080 min Summer	0.232	0.232	0.1	2.5	O K	15 min Winter	0.318	0.318	0.1	3.5	O K	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)	15 min Summer	140.560	0.0	19	30 min Summer	92.400	0.0	33	60 min Summer	57.540	0.0	64	120 min Summer	35.420	0.0	122	180 min Summer	26.762	0.0	182	240 min Summer	21.980	0.0	242	360 min Summer	16.707	0.0	356	480 min Summer	13.785	0.0	410	600 min Summer	11.852	0.0	474	720 min Summer	10.453	0.0	536	960 min Summer	8.513	0.0	672	1440 min Summer	6.283	0.0	952	2160 min Summer	4.555	0.0	1364	2880 min Summer	3.605	0.0	1760	4320 min Summer	2.578	0.0	2552	5760 min Summer	2.034	0.0	3336	7200 min Summer	1.699	0.0	4040	8640 min Summer	1.471	0.0	4832	10080 min Summer	1.306	0.0	5544	15 min Winter	140.560	0.0	19
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30 min Summer	0.368	0.368	0.1	4.0	O K																																																																																																																																																																																																															
60 min Summer	0.447	0.447	0.1	4.9	O K																																																																																																																																																																																																															
120 min Summer	0.527	0.527	0.1	5.8	O K																																																																																																																																																																																																															
180 min Summer	0.574	0.574	0.1	6.3	O K																																																																																																																																																																																																															
240 min Summer	0.604	0.604	0.1	6.6	O K																																																																																																																																																																																																															
360 min Summer	0.639	0.639	0.1	7.0	O K																																																																																																																																																																																																															
480 min Summer	0.660	0.660	0.1	7.2	O K																																																																																																																																																																																																															
600 min Summer	0.673	0.673	0.1	7.4	O K																																																																																																																																																																																																															
720 min Summer	0.680	0.680	0.1	7.4	O K																																																																																																																																																																																																															
960 min Summer	0.681	0.681	0.1	7.4	O K																																																																																																																																																																																																															
1440 min Summer	0.656	0.656	0.1	7.2	O K																																																																																																																																																																																																															
2160 min Summer	0.599	0.599	0.1	6.5	O K																																																																																																																																																																																																															
2880 min Summer	0.544	0.544	0.1	5.9	O K																																																																																																																																																																																																															
4320 min Summer	0.450	0.450	0.1	4.9	O K																																																																																																																																																																																																															
5760 min Summer	0.376	0.376	0.1	4.1	O K																																																																																																																																																																																																															
7200 min Summer	0.318	0.318	0.1	3.5	O K																																																																																																																																																																																																															
8640 min Summer	0.270	0.270	0.1	3.0	O K																																																																																																																																																																																																															
10080 min Summer	0.232	0.232	0.1	2.5	O K																																																																																																																																																																																																															
15 min Winter	0.318	0.318	0.1	3.5	O K																																																																																																																																																																																																															
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)																																																																																																																																																																																																																	
15 min Summer	140.560	0.0	19																																																																																																																																																																																																																	
30 min Summer	92.400	0.0	33																																																																																																																																																																																																																	
60 min Summer	57.540	0.0	64																																																																																																																																																																																																																	
120 min Summer	35.420	0.0	122																																																																																																																																																																																																																	
180 min Summer	26.762	0.0	182																																																																																																																																																																																																																	
240 min Summer	21.980	0.0	242																																																																																																																																																																																																																	
360 min Summer	16.707	0.0	356																																																																																																																																																																																																																	
480 min Summer	13.785	0.0	410																																																																																																																																																																																																																	
600 min Summer	11.852	0.0	474																																																																																																																																																																																																																	
720 min Summer	10.453	0.0	536																																																																																																																																																																																																																	
960 min Summer	8.513	0.0	672																																																																																																																																																																																																																	
1440 min Summer	6.283	0.0	952																																																																																																																																																																																																																	
2160 min Summer	4.555	0.0	1364																																																																																																																																																																																																																	
2880 min Summer	3.605	0.0	1760																																																																																																																																																																																																																	
4320 min Summer	2.578	0.0	2552																																																																																																																																																																																																																	
5760 min Summer	2.034	0.0	3336																																																																																																																																																																																																																	
7200 min Summer	1.699	0.0	4040																																																																																																																																																																																																																	
8640 min Summer	1.471	0.0	4832																																																																																																																																																																																																																	
10080 min Summer	1.306	0.0	5544																																																																																																																																																																																																																	
15 min Winter	140.560	0.0	19																																																																																																																																																																																																																	
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AEA - Ambiental

Page 2

Science Park Square	Port Lympne
Brighton	Site A proposed
East Sussex	Social canopy
Date 10/06/2019 11:17	Designed by MN
File site a canopy infiltrat...	Checked by
Innovyze	Source Control 2018.1



Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	0.413	0.413	0.1	4.5	O K
60 min Winter	0.503	0.503	0.1	5.5	O K
120 min Winter	0.595	0.595	0.1	6.5	O K
180 min Winter	0.650	0.650	0.1	7.1	O K
240 min Winter	0.687	0.687	0.1	7.5	O K
360 min Winter	0.732	0.732	0.1	8.0	O K
480 min Winter	0.757	0.757	0.2	8.3	O K
600 min Winter	0.768	0.768	0.2	8.4	O K
720 min Winter	0.777	0.777	0.2	8.5	O K
960 min Winter	0.775	0.775	0.2	8.5	O K
1440 min Winter	0.736	0.736	0.1	8.0	O K
2160 min Winter	0.653	0.653	0.1	7.1	O K
2880 min Winter	0.576	0.576	0.1	6.3	O K
4320 min Winter	0.446	0.446	0.1	4.9	O K
5760 min Winter	0.348	0.348	0.1	3.8	O K
7200 min Winter	0.273	0.273	0.1	3.0	O K
8640 min Winter	0.214	0.214	0.1	2.3	O K
10080 min Winter	0.167	0.167	0.1	1.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	92.400	0.0	33
60 min Winter	57.540	0.0	62
120 min Winter	35.420	0.0	120
180 min Winter	26.762	0.0	178
240 min Winter	21.980	0.0	234
360 min Winter	16.707	0.0	346
480 min Winter	13.785	0.0	450
600 min Winter	11.852	0.0	490
720 min Winter	10.453	0.0	562
960 min Winter	8.513	0.0	720
1440 min Winter	6.283	0.0	1024
2160 min Winter	4.555	0.0	1468
2880 min Winter	3.605	0.0	1900
4320 min Winter	2.578	0.0	2720
5760 min Winter	2.034	0.0	3512
7200 min Winter	1.699	0.0	4256
8640 min Winter	1.471	0.0	5008
10080 min Winter	1.306	0.0	5744

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AEA - Ambiental		Page 3
Science Park Square	Port Lympne	
Brighton	Site A proposed	
East Sussex	Social canopy	
Date 10/06/2019 11:17	Designed by MN	
File site a canopy infiltrat...	Checked by	
Innovyze	Source Control 2018.1	

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 611100 134200 TR 11100 34200
Data Type	Catchment
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.012

Time (mins)	Area	
From:	To:	(ha)
0	4	0.012

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AEA - Ambiental		Page 4																				
Science Park Square	Port Lympne																					
Brighton	Site A proposed																					
East Sussex	Social canopy																					
Date 10/06/2019 11:17	Designed by MN																					
File site a canopy infiltrat...	Checked by																					
Innovyze	Source Control 2018.1																					
<u>Model Details</u> Storage is Online Cover Level (m) 1.500 <u>Infiltration Trench Structure</u> <table> <tr> <td>Infiltration Coefficient Base (m/hr)</td> <td>0.03600</td> <td>Trench Width (m)</td> <td>1.0</td> </tr> <tr> <td>Infiltration Coefficient Side (m/hr)</td> <td>0.03600</td> <td>Trench Length (m)</td> <td>11.5</td> </tr> <tr> <td>Safety Factor</td> <td>2.0</td> <td>Slope (1:X)</td> <td>0.0</td> </tr> <tr> <td>Porosity</td> <td>0.95</td> <td>Cap Volume Depth (m)</td> <td>1.200</td> </tr> <tr> <td>Invert Level (m)</td> <td>0.000</td> <td>Cap Infiltration Depth (m)</td> <td>1.200</td> </tr> </table>			Infiltration Coefficient Base (m/hr)	0.03600	Trench Width (m)	1.0	Infiltration Coefficient Side (m/hr)	0.03600	Trench Length (m)	11.5	Safety Factor	2.0	Slope (1:X)	0.0	Porosity	0.95	Cap Volume Depth (m)	1.200	Invert Level (m)	0.000	Cap Infiltration Depth (m)	1.200
Infiltration Coefficient Base (m/hr)	0.03600	Trench Width (m)	1.0																			
Infiltration Coefficient Side (m/hr)	0.03600	Trench Length (m)	11.5																			
Safety Factor	2.0	Slope (1:X)	0.0																			
Porosity	0.95	Cap Volume Depth (m)	1.200																			
Invert Level (m)	0.000	Cap Infiltration Depth (m)	1.200																			
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Area B Infiltration designs

AEA - Ambiental				Page 1	
Science Park Square		Port Lympe			
Brighton		Site B- Access and parking			
East Sussex		Permeable Pavement			
Date 10/06/2019 11:27		Designed by MN			
File access permeable.SRCX		Checked by			
Innovyze		Source Control 2018.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Half Drain Time : 221 minutes.					
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	0.067	0.067	0.2	2.0	O K
30 min Summer	0.091	0.091	0.2	2.7	O K
60 min Summer	0.112	0.112	0.2	3.4	O K
120 min Summer	0.130	0.130	0.2	3.9	O K
180 min Summer	0.138	0.138	0.2	4.2	O K
240 min Summer	0.144	0.144	0.2	4.3	O K
360 min Summer	0.150	0.150	0.2	4.5	O K
480 min Summer	0.153	0.153	0.2	4.6	O K
600 min Summer	0.153	0.153	0.2	4.6	O K
720 min Summer	0.151	0.151	0.2	4.5	O K
960 min Summer	0.143	0.143	0.2	4.3	O K
1440 min Summer	0.122	0.122	0.2	3.7	O K
2160 min Summer	0.091	0.091	0.2	2.7	O K
2880 min Summer	0.067	0.067	0.2	2.0	O K
4320 min Summer	0.046	0.046	0.2	1.4	O K
5760 min Summer	0.037	0.037	0.1	1.1	O K
7200 min Summer	0.032	0.032	0.1	1.0	O K
8640 min Summer	0.028	0.028	0.1	0.8	O K
10080 min Summer	0.025	0.025	0.1	0.7	O K
15 min Winter	0.078	0.078	0.2	2.3	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
15 min Summer	140.560	0.0	18		
30 min Summer	92.400	0.0	33		
60 min Summer	57.540	0.0	62		
120 min Summer	35.420	0.0	120		
180 min Summer	26.762	0.0	166		
240 min Summer	21.980	0.0	196		
360 min Summer	16.707	0.0	262		
480 min Summer	13.785	0.0	332		
600 min Summer	11.852	0.0	404		
720 min Summer	10.453	0.0	470		
960 min Summer	8.513	0.0	608		
1440 min Summer	6.283	0.0	868		
2160 min Summer	4.555	0.0	1236		
2880 min Summer	3.605	0.0	1584		
4320 min Summer	2.578	0.0	2248		
5760 min Summer	2.034	0.0	2952		
7200 min Summer	1.699	0.0	3680		
8640 min Summer	1.471	0.0	4408		
10080 min Summer	1.306	0.0	5144		
15 min Winter	140.560	0.0	18		
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AEA - Ambiental					Page 2
Science Park Square Brighton East Sussex		Port Lympne Site B- Access and parking Permeable Pavement			
Date 10/06/2019 11:27		Designed by MN			
File access permeable.SRCX		Checked by			
Innovyze		Source Control 2018.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	0.105	0.105	0.2	3.2	O K
60 min Winter	0.129	0.129	0.2	3.9	O K
120 min Winter	0.151	0.151	0.2	4.5	O K
180 min Winter	0.161	0.161	0.2	4.8	O K
240 min Winter	0.166	0.166	0.2	5.0	O K
360 min Winter	0.171	0.171	0.2	5.1	O K
480 min Winter	0.173	0.173	0.2	5.2	O K
600 min Winter	0.171	0.171	0.2	5.1	O K
720 min Winter	0.167	0.167	0.2	5.0	O K
960 min Winter	0.153	0.153	0.2	4.6	O K
1440 min Winter	0.120	0.120	0.2	3.6	O K
2160 min Winter	0.074	0.074	0.2	2.2	O K
2880 min Winter	0.049	0.049	0.2	1.5	O K
4320 min Winter	0.036	0.036	0.1	1.1	O K
5760 min Winter	0.029	0.029	0.1	0.9	O K
7200 min Winter	0.024	0.024	0.1	0.7	O K
8640 min Winter	0.021	0.021	0.1	0.6	O K
10080 min Winter	0.018	0.018	0.1	0.5	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
30 min Winter	92.400	0.0	32		
60 min Winter	57.540	0.0	62		
120 min Winter	35.420	0.0	118		
180 min Winter	26.762	0.0	174		
240 min Winter	21.980	0.0	226		
360 min Winter	16.707	0.0	282		
480 min Winter	13.785	0.0	362		
600 min Winter	11.852	0.0	440		
720 min Winter	10.453	0.0	514		
960 min Winter	8.513	0.0	662		
1440 min Winter	6.283	0.0	926		
2160 min Winter	4.555	0.0	1276		
2880 min Winter	3.605	0.0	1552		
4320 min Winter	2.578	0.0	2268		
5760 min Winter	2.034	0.0	3008		
7200 min Winter	1.699	0.0	3744		
8640 min Winter	1.471	0.0	4408		
10080 min Winter	1.306	0.0	5144		
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AEA - Ambiental		Page 3																								
Science Park Square	Port Lympne																									
Brighton	Site B- Access and parking																									
East Sussex	Permeable Pavement																									
Date 10/06/2019 11:27	Designed by MN																									
File access permeable.SRCX	Checked by																									
Innovyze	Source Control 2018.1																									
<u>Rainfall Details</u>																										
<table style="width: 100%; border: none;"> <tr> <td style="text-align: right;">Rainfall Model</td> <td>FEH</td> </tr> <tr> <td style="text-align: right;">Return Period (years)</td> <td>100</td> </tr> <tr> <td style="text-align: right;">FEH Rainfall Version</td> <td>2013</td> </tr> <tr> <td style="text-align: right;">Site Location</td> <td>GB 611100 134200 TR 11100 34200</td> </tr> <tr> <td style="text-align: right;">Data Type</td> <td>Catchment</td> </tr> <tr> <td style="text-align: right;">Summer Storms</td> <td>Yes</td> </tr> <tr> <td style="text-align: right;">Winter Storms</td> <td>Yes</td> </tr> <tr> <td style="text-align: right;">Cv (Summer)</td> <td>0.750</td> </tr> <tr> <td style="text-align: right;">Cv (Winter)</td> <td>0.840</td> </tr> <tr> <td style="text-align: right;">Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td style="text-align: right;">Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td style="text-align: right;">Climate Change %</td> <td>+40</td> </tr> </table>			Rainfall Model	FEH	Return Period (years)	100	FEH Rainfall Version	2013	Site Location	GB 611100 134200 TR 11100 34200	Data Type	Catchment	Summer Storms	Yes	Winter Storms	Yes	Cv (Summer)	0.750	Cv (Winter)	0.840	Shortest Storm (mins)	15	Longest Storm (mins)	10080	Climate Change %	+40
Rainfall Model	FEH																									
Return Period (years)	100																									
FEH Rainfall Version	2013																									
Site Location	GB 611100 134200 TR 11100 34200																									
Data Type	Catchment																									
Summer Storms	Yes																									
Winter Storms	Yes																									
Cv (Summer)	0.750																									
Cv (Winter)	0.840																									
Shortest Storm (mins)	15																									
Longest Storm (mins)	10080																									
Climate Change %	+40																									
<u>Time Area Diagram</u>																										
Total Area (ha) 0.010																										
<table style="width: 100%; border: none;"> <tr> <td style="text-align: right;">Time (mins)</td> <td>Area</td> </tr> <tr> <td style="text-align: right;">From: To:</td> <td>(ha)</td> </tr> <tr> <td style="text-align: right;">0</td> <td>4 0.010</td> </tr> </table>			Time (mins)	Area	From: To:	(ha)	0	4 0.010																		
Time (mins)	Area																									
From: To:	(ha)																									
0	4 0.010																									
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AEA - Ambiental		Page 4																								
Science Park Square Brighton East Sussex	Port Lympne Site B- Access and parking Permeable Pavement																									
Date 10/06/2019 11:27 File access permeable.SRCX	Designed by MN Checked by																									
Innovyze Source Control 2018.1																										
<u>Model Details</u> Storage is Online Cover Level (m) 0.600 <u>Porous Car Park Structure</u> <table style="margin: auto; border: none;"> <tr> <td style="padding: 2px;">Infiltration Coefficient Base (m/hr)</td> <td style="padding: 2px;">0.03600</td> <td style="padding: 2px;">Width (m)</td> <td style="padding: 2px;">10.0</td> </tr> <tr> <td style="padding: 2px;">Membrane Percolation (mm/hr)</td> <td style="padding: 2px;">1000</td> <td style="padding: 2px;">Length (m)</td> <td style="padding: 2px;">10.0</td> </tr> <tr> <td style="padding: 2px;">Max Percolation (l/s)</td> <td style="padding: 2px;">27.8</td> <td style="padding: 2px;">Slope (1:X)</td> <td style="padding: 2px;">0.0</td> </tr> <tr> <td style="padding: 2px;">Safety Factor</td> <td style="padding: 2px;">5.0</td> <td style="padding: 2px;">Depression Storage (mm)</td> <td style="padding: 2px;">5</td> </tr> <tr> <td style="padding: 2px;">Porosity</td> <td style="padding: 2px;">0.30</td> <td style="padding: 2px;">Evaporation (mm/day)</td> <td style="padding: 2px;">3</td> </tr> <tr> <td style="padding: 2px;">Invert Level (m)</td> <td style="padding: 2px;">0.000</td> <td style="padding: 2px;">Membrane Depth (m)</td> <td style="padding: 2px;">150</td> </tr> </table>			Infiltration Coefficient Base (m/hr)	0.03600	Width (m)	10.0	Membrane Percolation (mm/hr)	1000	Length (m)	10.0	Max Percolation (l/s)	27.8	Slope (1:X)	0.0	Safety Factor	5.0	Depression Storage (mm)	5	Porosity	0.30	Evaporation (mm/day)	3	Invert Level (m)	0.000	Membrane Depth (m)	150
Infiltration Coefficient Base (m/hr)	0.03600	Width (m)	10.0																							
Membrane Percolation (mm/hr)	1000	Length (m)	10.0																							
Max Percolation (l/s)	27.8	Slope (1:X)	0.0																							
Safety Factor	5.0	Depression Storage (mm)	5																							
Porosity	0.30	Evaporation (mm/day)	3																							
Invert Level (m)	0.000	Membrane Depth (m)	150																							
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Area C Infiltration designs

AEA - Ambiental					Page 1
Science Park Square		Port Lympne			
Brighton		Site C proposed			
East Sussex		Restaurant Extension			
Date 26/07/2019 10:02		Designed by MN			
File site c restaurant exten...		Checked by			
XP Solutions		Source Control 2018.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Half Drain Time : 707 minutes.					
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	0.311	0.311	0.1	4.7	O K
30 min Summer	0.405	0.405	0.1	6.1	O K
60 min Summer	0.494	0.494	0.1	7.4	O K
120 min Summer	0.587	0.587	0.1	8.8	O K
180 min Summer	0.644	0.644	0.2	9.6	O K
240 min Summer	0.684	0.684	0.2	10.2	O K
360 min Summer	0.734	0.734	0.2	11.0	O K
480 min Summer	0.763	0.763	0.2	11.4	O K
600 min Summer	0.779	0.779	0.2	11.7	O K
720 min Summer	0.790	0.790	0.2	11.8	O K
960 min Summer	0.796	0.796	0.2	11.9	O K
1440 min Summer	0.776	0.776	0.2	11.6	O K
2160 min Summer	0.720	0.720	0.2	10.8	O K
2880 min Summer	0.664	0.664	0.2	9.9	O K
4320 min Summer	0.564	0.564	0.1	8.4	O K
5760 min Summer	0.483	0.483	0.1	7.2	O K
7200 min Summer	0.417	0.417	0.1	6.2	O K
8640 min Summer	0.363	0.363	0.1	5.4	O K
10080 min Summer	0.317	0.317	0.1	4.7	O K
15 min Winter	0.349	0.349	0.1	5.2	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
15 min Summer	140.560	0.0	19		
30 min Summer	92.400	0.0	34		
60 min Summer	57.540	0.0	64		
120 min Summer	35.420	0.0	122		
180 min Summer	26.762	0.0	182		
240 min Summer	21.980	0.0	242		
360 min Summer	16.707	0.0	360		
480 min Summer	13.785	0.0	474		
600 min Summer	11.852	0.0	522		
720 min Summer	10.453	0.0	586		
960 min Summer	8.513	0.0	714		
1440 min Summer	6.283	0.0	982		
2160 min Summer	4.555	0.0	1404		
2880 min Summer	3.605	0.0	1816		
4320 min Summer	2.578	0.0	2632		
5760 min Summer	2.034	0.0	3400		
7200 min Summer	1.699	0.0	4176		
8640 min Summer	1.471	0.0	4928		
10080 min Summer	1.306	0.0	5648		
15 min Winter	140.560	0.0	19		
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XP Solutions	Source Control 2018.1	

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	0.455	0.455	0.1	6.8	O K
60 min Winter	0.556	0.556	0.1	8.3	O K
120 min Winter	0.663	0.663	0.2	9.9	O K
180 min Winter	0.729	0.729	0.2	10.9	O K
240 min Winter	0.776	0.776	0.2	11.6	O K
360 min Winter	0.838	0.838	0.2	12.5	O K
480 min Winter	0.876	0.876	0.2	13.1	O K
600 min Winter	0.897	0.897	0.2	13.4	O K
720 min Winter	0.906	0.906	0.2	13.6	O K
960 min Winter	0.911	0.911	0.2	13.6	O K
1440 min Winter	0.884	0.884	0.2	13.2	O K
2160 min Winter	0.804	0.804	0.2	12.0	O K
2880 min Winter	0.724	0.724	0.2	10.8	O K
4320 min Winter	0.584	0.584	0.1	8.7	O K
5760 min Winter	0.472	0.472	0.1	7.1	O K
7200 min Winter	0.384	0.384	0.1	5.7	O K
8640 min Winter	0.312	0.312	0.1	4.7	O K
10080 min Winter	0.253	0.253	0.1	3.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	92.400	0.0	33
60 min Winter	57.540	0.0	62
120 min Winter	35.420	0.0	120
180 min Winter	26.762	0.0	178
240 min Winter	21.980	0.0	236
360 min Winter	16.707	0.0	350
480 min Winter	13.785	0.0	460
600 min Winter	11.852	0.0	566
720 min Winter	10.453	0.0	662
960 min Winter	8.513	0.0	750
1440 min Winter	6.283	0.0	1056
2160 min Winter	4.555	0.0	1516
2880 min Winter	3.605	0.0	1960
4320 min Winter	2.578	0.0	2808
5760 min Winter	2.034	0.0	3584
7200 min Winter	1.699	0.0	4392
8640 min Winter	1.471	0.0	5112
10080 min Winter	1.306	0.0	5856

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 611100 134200 TR 11100 34200
Data Type	Catchment
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.018

Time (mins)	Area
From:	To: (ha)
0	4 0.018

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Science Park Square Brighton East Sussex	Port Lympne Site C proposed Restaurant Extension																					
Date 26/07/2019 10:02 File site c restaurant exten...	Designed by MN Checked by																					
XP Solutions		Source Control 2018.1																				
<u>Model Details</u> Storage is Online Cover Level (m) 1.500 <u>Infiltration Trench Structure</u> <table style="margin-left: auto; margin-right: auto;"> <tr> <td>Infiltration Coefficient Base (m/hr)</td> <td>0.03600</td> <td>Trench Width (m)</td> <td>1.5</td> </tr> <tr> <td>Infiltration Coefficient Side (m/hr)</td> <td>0.03600</td> <td>Trench Length (m)</td> <td>10.5</td> </tr> <tr> <td>Safety Factor</td> <td>2.0</td> <td>Slope (1:X)</td> <td>0.0</td> </tr> <tr> <td>Porosity</td> <td>0.95</td> <td>Cap Volume Depth (m)</td> <td>1.200</td> </tr> <tr> <td>Invert Level (m)</td> <td>0.000</td> <td>Cap Infiltration Depth (m)</td> <td>1.200</td> </tr> </table>			Infiltration Coefficient Base (m/hr)	0.03600	Trench Width (m)	1.5	Infiltration Coefficient Side (m/hr)	0.03600	Trench Length (m)	10.5	Safety Factor	2.0	Slope (1:X)	0.0	Porosity	0.95	Cap Volume Depth (m)	1.200	Invert Level (m)	0.000	Cap Infiltration Depth (m)	1.200
Infiltration Coefficient Base (m/hr)	0.03600	Trench Width (m)	1.5																			
Infiltration Coefficient Side (m/hr)	0.03600	Trench Length (m)	10.5																			
Safety Factor	2.0	Slope (1:X)	0.0																			
Porosity	0.95	Cap Volume Depth (m)	1.200																			
Invert Level (m)	0.000	Cap Infiltration Depth (m)	1.200																			
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Appendix III - Drainage Strategy Plans



