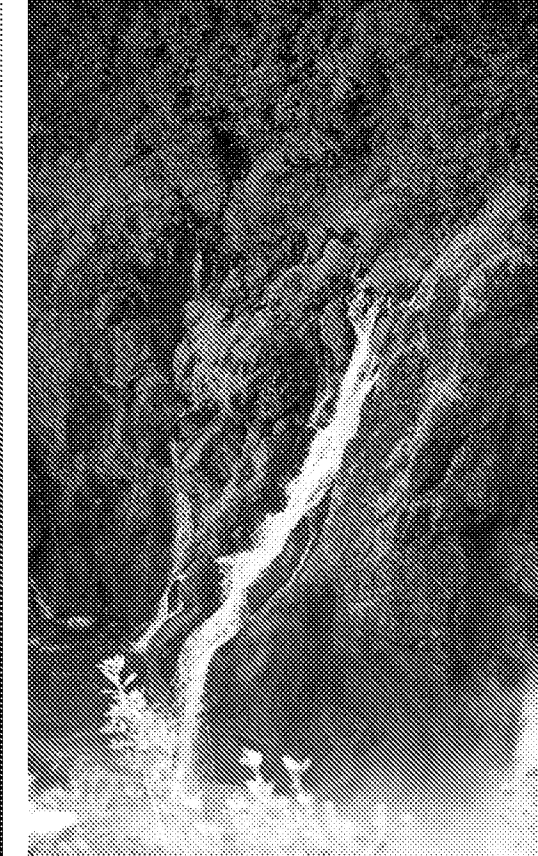
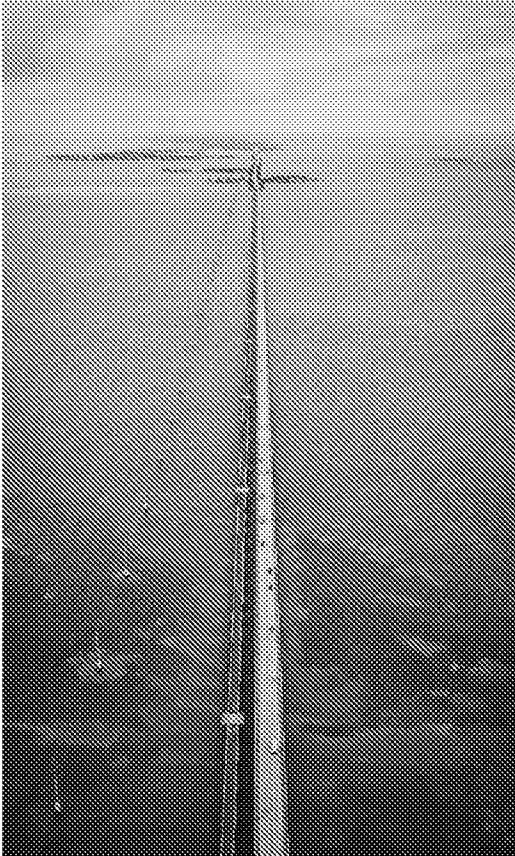
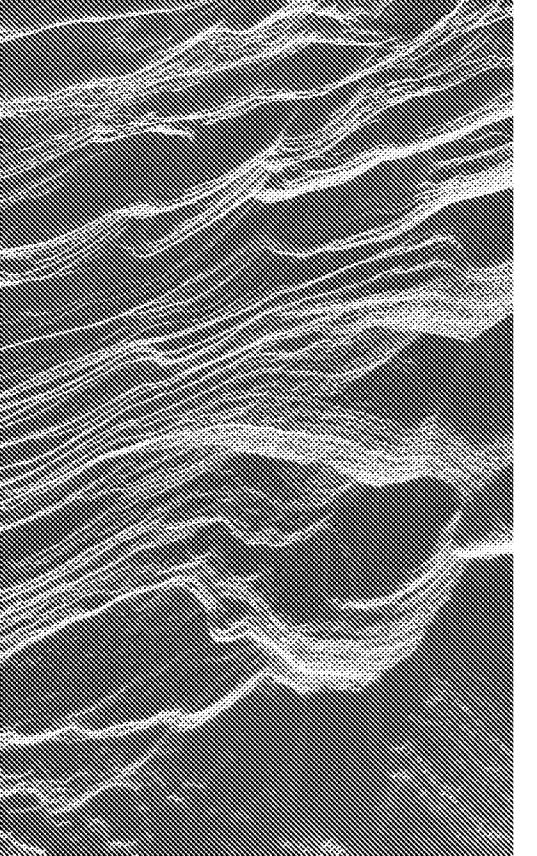




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Flood risk, water and environment

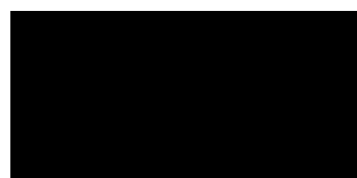
Surface Water Drainage Strategy

Site Address: 46A & 47 PIER ROAD,
LITTLEHAMPTON,
BN17 5LW

UK Experts in Flood Modelling, Flood Risk
Assessments, and Surface Water Drainage
Strategies

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ARUN DISTRICT COUNCIL LU/8/2019 Flood risk, water and environment



Document Issue Record

Project: Surface Water Drainage Strategy

Reference: AEG0281_BN17_Littlehampton_06

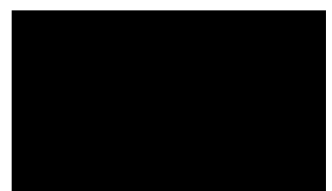
Site Location: 46A & 47 PIER ROAD, LITTLEHAMPTON, BN17 5LW

Proposed Development: The development is for the demolition of existing buildings, change of use & erection of 1 No. building incorporate office (B1) at ground floor & 8 No. dwellings at first and second floor.

Consultant		Date
Author	Sam Lee	January 2022
Document Check	Mark Naumann	January 2022
Authorisation	Mark Naumann / Daniel Cook	January 2022

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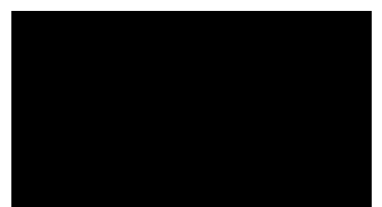
Introduction

- 1.1 Meridian Civil Engineering Consultancy LTD (MCEC) has been instructed by AEGAEA to prepare a Surface Water Drainage Strategy for the development of 46a & 47 & Land North of Clifton Road 46a Pier Road Littlehampton BN17 5LW.
- 1.2 It is understood the development is for the demolition of existing buildings, change of use & erection of 1 No. building incorporate office (B1) at ground floor & 8 No. dwellings at first and second floor.
- 1.3 The site is brownfield and it is assumed there are both foul and storm (potentially combined) existing drainage infrastructure on site, however this is to be confirmed via a CCTV drain survey of the existing storm and foul drain connections to determine the route and connectivity of the existing drainage to inform the final design.
- 1.4 The Environment Agency (EA) mapping for Flood Risk (Figure 3), shows the site located within Flood Zone 3 (high risk of fluvial or tidal flooding). Areas within flood zone 3 have been shown to be at a 1% or greater probability of flooding from rivers or 0.5% or greater probability of flooding from the sea.
- 1.5 The Environment Agency Long Term Flood Risk map (Figure 4) shows the site to have areas at medium risk from surface water flooding. means that each year this area has a chance of flooding of between 1% and 3.3%.
- 1.6 Geology at the site is shown to comprise of multiple chalk formations. superficial deposits on site are shown to be raised beach deposits comprising of sand and gravel, as published by the British Geological Survey online. Although the geology may allow for infiltration, Due to the space constraints on site - infiltration has been deemed unsuitable at this time.
- 1.7 Surface water from all hardstanding area on site are to drain into the permeable paving in the courtyard area as per the attached drawing within appendix IV. According to Causeway Flow calculations attached in appendix III, the permeable paving will have an area of 56m² with a sub-base depth of 0.8m giving a storage volume of 13.44m³. If permeable pavement is not viable then crate storage and/or blue roof may be feasible offering the same volume but may be subject to the existing site drainage levels being deep enough to allow a connection offsite to be feasible.
- 1.8 Proposals are to limit discharge to 1.1l/s from the sub-base to the existing drainage on site via a hydrobrake with a minimum 50mm aperture. This is in line with the Design and Construction Guidance for foul and surface water sewers which states "where the design of the upstream system will prevent debris entering the system (e.g., underground systems where the inlets are pervious pavement systems), static controls should have a minimum opening size of 50 mm".
- 1.9 In order to mitigate the potential flood risk posed by the proposed development, adequate control measures are required to be considered. This will ensure that surface water runoff can be managed at source and the flood risk off site is not increased.
- 1.10 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 around and between the new blocks. Nevertheless, the finished floor levels or thresholds of the buildings should be raised at least 150mm above adjacent proposed ground levels (where feasible), to mitigate against surface water flows entering the building in an exceedance event.
- 1.11 This report has been produced broadly in accordance with the National Planning Policy Framework (NPPF) and West Sussex and Littlehampton local SuDS policies and associated Local Planning Authority technical guidance.

2. Policy Compliance

2.1 The purpose of this assessment is to demonstrate that the development proposal outlined above can be satisfactorily accommodated without worsening flood risk for the area and without placing the development itself at risk of flooding, as per the:

- National Planning Policy Framework (NPPF)
- The National Planning Policy Guidance (NPPG)
- West Sussex LLFA Policy for the Managements of Surface Water (2018)
- West Sussex Local Flood Risk Management Strategy (LFRMS)
- DEFRA Sustainable drainage systems: non-statutory technical standards
- Ciria SuDS Manual C753

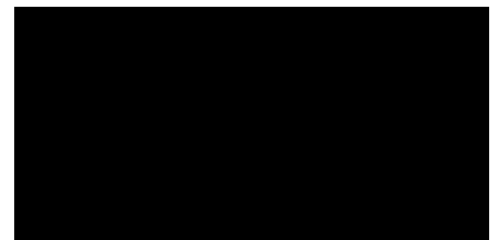


3. Site Location

- 3.1 The location of the proposed development is 46a & 47 & Land North of Clifton Road 46a Pier Road Littlehampton BN17 5LW.
- 3.2 The site is currently brownfield. It is understood the development is for the demolition of existing buildings, change of use & erection of 1 No. building incorporate office (B1) at ground floor & 8 No. dwellings at first and second floor. Proposed Architects plans are included in Appendix I.
- 3.3 The site redline boundary shown on the architect's plans is approximately 200sqm and the built area is approximately 185sqm.



Figure 1 - Site Location red line boundary



4. Sources of Flooding

Tidal and Fluvial

- 4.1 The Environment Agency (EA) mapping for Flood Risk (Figure 3), shows the site located within Flood Zone 3 (high risk of fluvial or tidal flooding). Areas within flood zone 3 have been shown to be at a 1% or greater probability of flooding from rivers or 0.5% or greater probability of flooding from the sea.

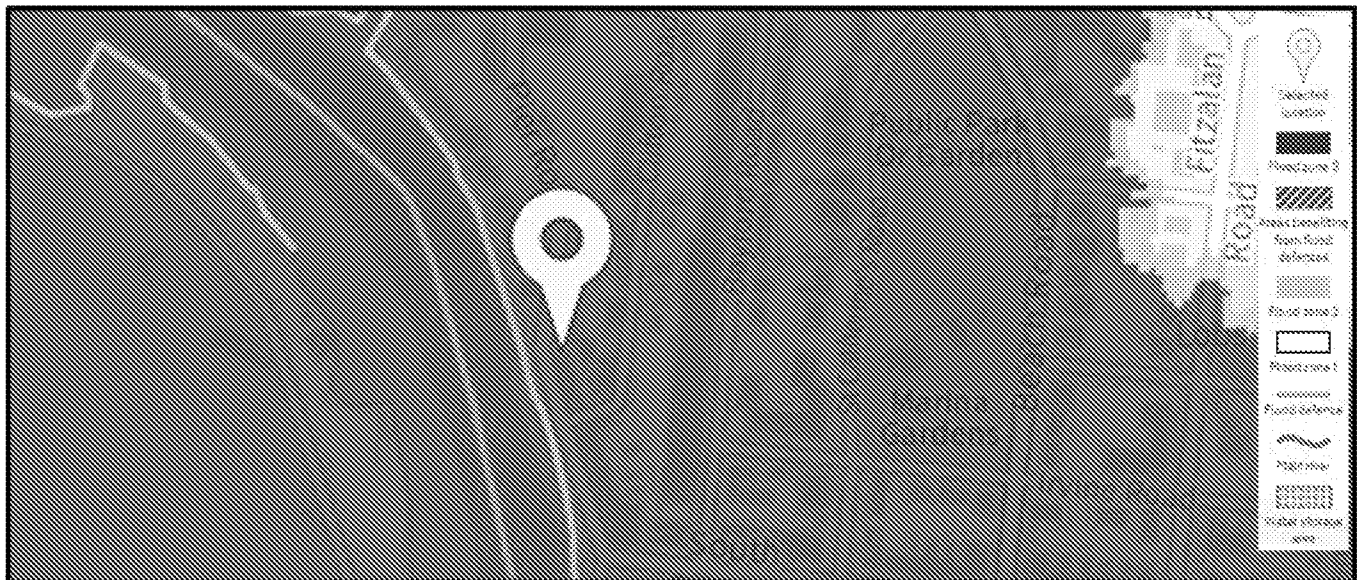


Figure 2 - Extract from EA Flood Map for Planning showing the site to be in Flood Zone 3

Surface Water (Pluvial)

- 4.2 The Environment Agency Long Term Flood Risk map (Figure 4) shows the site to have areas at medium risk from surface water flooding. means that each year this area has a chance of flooding of between 1% and 3.

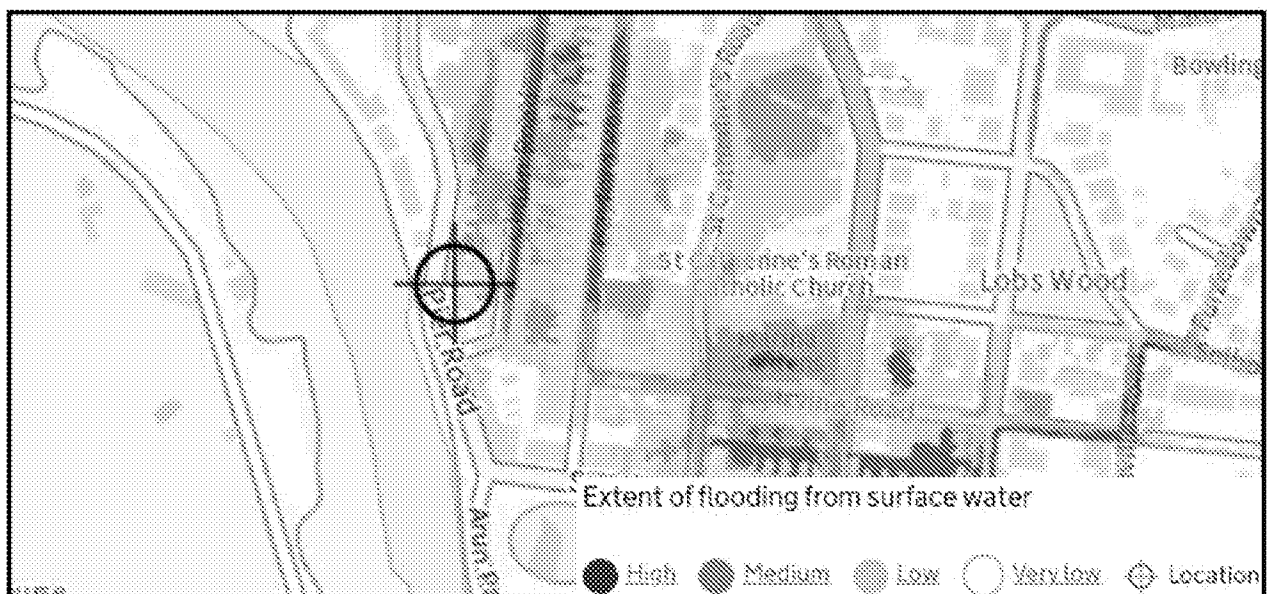


Figure 3 - Long Term Flood Risk map showing extent of surface water flooding

- 4.3 As such, the risk of flooding from surface water sources to the proposed development could be considered to be medium.

5. Geology and Infiltration Potential

- 5.1 Geology at the site is shown to comprise of multiple chalk formations. superficial deposits on site are shown to be raised beach deposits comprising of sand and gravel, as published by the British Geological Survey online. Although the geology may allow for infiltration, Due to the space constraints on site – infiltration has been deemed unsuitable at this time.

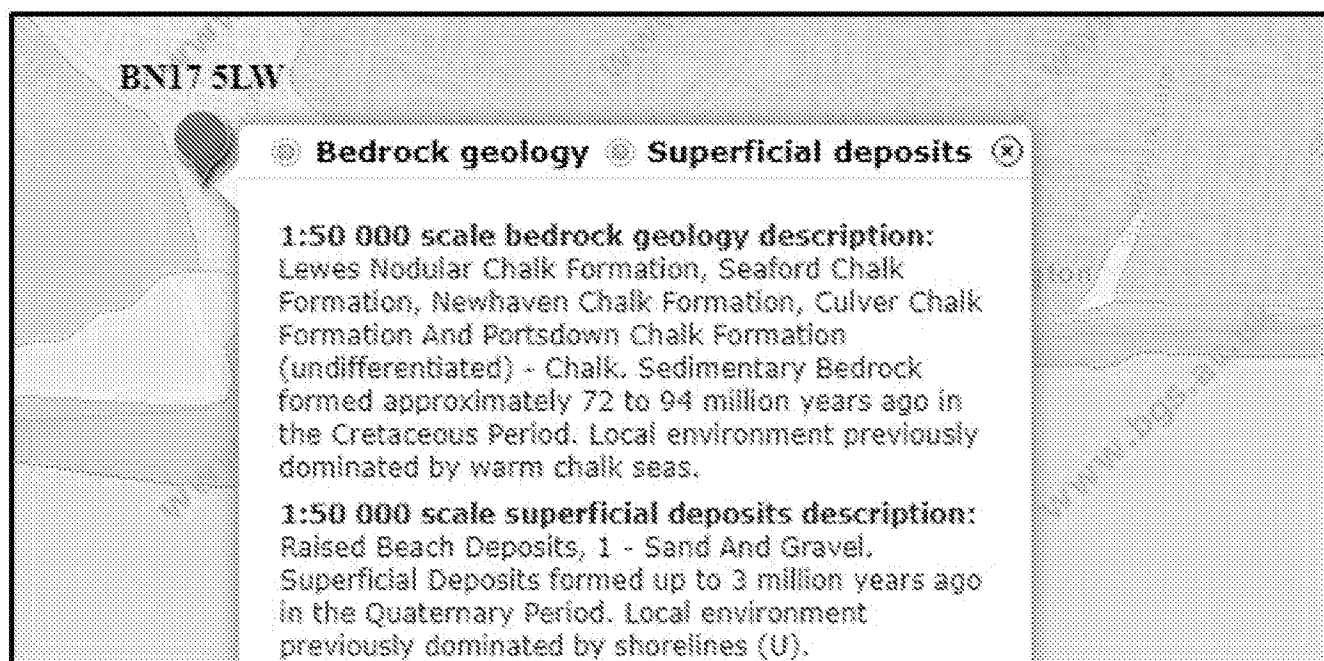


Figure 4 - BGS Online mapping extract

- 5.2 A review of DEFRA's Magic Map online resource indicates that the formation underneath the site is a principal (bedrock) aquifer. Magic Map also shows the formation beneath the site is a secondary A (superficial) aquifer.
- 5.3 A review of DEFRA's Magic Map online resource indicates the site is not within a Source Protection Zone.

6. Drainage Infrastructure

- 6.1 The site is brownfield and it is assumed there is both foul and storm (potentially combined) existing drainage infrastructure on site, however this is to be confirmed via a CCTV drain survey of the existing storm and foul drain connections.

7. Climate Change Allowances

- 7.1 Making an allowance for climate change in the design of surface water drainage systems will help to minimise vulnerability and provide resilience to flooding and coastal change in the future. Climate Change allowances vary across the UK subject to catchment conditions and are based on climate change projections and different scenarios of carbon dioxide (CO₂) emissions to the atmosphere.
- 7.2 Climate change already seen in the UK is consistent with the UKCP02 scenarios. These suggested that winters would become wetter over the whole of the UK, by as much as 20% by the 2050's and upwards of 40% for epoch to 2115. Therefore a 40% allowance for climate change has been considered for all design storm events.

8. Sustainable urban drainage (SUDS) assessment

- 8.1 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.
- 8.2 The management of surface water has been considered in respect to the SuDS hierarchy below as detailed in the CIRIA 753 'The SUDS Manual', Section 3.2.3:

SUDS DRAINAGE HIERARCHY				
			Suitability	Comment
	1.	Store rainwater for later use	✓	Rainwater harvesting is being considered by the developer and could be used around the wider site where feasible.
	2.	Use infiltration techniques, such as porous surfaces in non-clay areas	x	Due to the space constraints on site – infiltration has been deemed unsuitable at this time.
	3.	Attenuate rainwater in ponds or open water features for gradual release	x	Space constraints on site mean that it isn't feasible to implement open water SuDS.
	4.	Attenuate rainwater by storing in tanks or sealed water features for gradual release	✓	Below-ground attenuation is necessary on site to meet local policy.
	5.	Discharge rainwater direct to a watercourse	x	It is assumed there is existing drainage infrastructure on site. There are obstructions between the site and the River Arun, as such it is deemed unsuitable at this time.
	6.	Discharge rainwater to a surface water sewer/drain	✓/x	There are surface water sewers beneath Clifton Road however it is unknown whether the existing drainage discharges to this at this time. Discharge location is to be confirmed by CCTV drain survey.
	7.	Discharge rainwater to Combined Sewer	✓/x	There are combined sewers beneath Clifton Road however it is unknown whether the existing drainage discharges to this at this time. Discharge location is to be confirmed by CCTV drain survey.

Table 1: SuDS Drainage Hierarchy

- 8.3 Following the SuDS drainage hierarchy, infiltration has been considered however due to space constraints on site, it has been deemed unsuitable at this time.
- 8.4 The standard position taken by regulators, is that the storage provided within water butts or rainfall harvesting measures does not normally count towards the attenuation storage requirements as there is no guarantee that these devices would be empty at the time that a rainfall event occurs. The principle which allows rainwater systems to be designed to provide surface water control (prevent runoff) is based on demand being greater (on average over a period of time) than the supply to it. As such, rainwater harvesting can be considered around the site, but has been excluded from any storage calculations.
- 8.5 The site is brownfield and it is assumed there is both foul and storm (potentially combined) existing drainage infrastructure on site, however this is to be confirmed via a CCTV drain survey of the existing storm and foul drain connections. The existing drain connections are proposed to be re-used at this time in line with the SUDS hierarchy methodology.
- 8.6 The suitability of SuDS components has been assessed in order to provide a sustainable means of providing the required attenuation volumes. The following components have been assessed as follows in Table 2, below.

9. SUITABILITY OF SUDS COMPONENTS		
SuDS Component	Comment	Suitability
Infiltrating SuDS	infiltration has been considered however due to space constraints on site, it has been deemed unsuitable at this time.	x
Permeable Pavement	Permeable paving (Lined - no infiltration type C) is proposed in order to provide storage in the courtyard area. No infiltration is proposed due to space constraints not allowing infiltration 5m from buildings.	✓
Green / Blue Roofs	Blue roof may be suitable on one building. May not be required if underground storage can be accommodated	✓/x
Rainwater Harvesting	The standard position taken by regulators is that the storage provided within water butts or rainfall harvesting measures does not normally count towards the attenuation storage requirements as there is no guarantee that these devices would be empty at the time that a rainfall event occurs. The principle which allows rainwater systems to be designed to provide surface water control (prevent runoff) is based on demand being greater (on average over a period of time) than the supply to it. As such, rainwater harvesting can be considered around the site, but has been excluded from any storage calculations. It is recommended that Water Butts be implemented, where feasible and where there is space to do so.	✓
Swales	Insufficient space to implement such conveyancing SuDS techniques	x
Rills and Channels	Insufficient space to implement such conveyancing SuDS techniques and would provide little benefit overall.	x
Bioretention Systems	Insufficient space to implement such conveyancing SuDS techniques and would provide little benefit overall.	x
Retention Ponds and Wetlands	Insufficient space on site to implement large scale SuDS techniques such as ponds/wetlands. These SuDS measures are better suited to large scale developments.	x
Detention Basins	Insufficient space on site to implement large scale SuDS techniques such as detention basins. These SuDS measures are better suited to large scale developments.	x
Geocellular Systems	Geocellular systems can be configured to suit almost every site/development. Given the space constraints on site this has been deemed a suitable alternative to provide attenuation on site.	✓
Proprietary Treatment Systems	Roof runoff is considered to be largely uncontaminated and there will permeable pavement to treat and drain hardsurfaced areas.	x
Filter Drains and Filter Strips	Insufficient space on site and poor infiltration would result in filter drains/strips providing little overall benefit.	x

Table 2: Suitability of SuDS Components

Rainwater Harvesting

- 9.1 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, to more complex pumped RWH systems to be used in grey water uses, such as toilet flushing.
- 9.2 As such, downpipes could be routed through a RWH system prior to overflow discharge to the underground system if the client wished to adopt this approach. The siting and dimensions of such a tank could be established at detailed stage involving a rainwater harvesting specialist.

Permeable Pavement

- 9.3 Permeable pavements are efficient in treating oils and metals but also in intercepting debris and silt. The permeable paving to external paved surfaces (i.e. external paved areas) would be Type A as these areas will be used to simply manage rainfall directly to these areas:
- Permeable Concrete blocks (or similar such as permeable resin bound gravel).
 - Laying Course Material.
 - Geotextile filter.
 - Sub-Base: 6-20mm Clean Crushed Stone (Depth: 200mm min. for attenuation storage).
 - For Type C only - Impermeable membrane (where designed for attenuation in the parking area).
- 9.4 Guidance about proper use, installation and maintenance of any proprietary system should be provided by the supplier and incorporated into the site proposals at detailed design stage.

Geocellular System (if permeable pavement not feasible)

- 9.5 Geocellular systems can be used to control and manage rainwater surface water runoff either as a soakaway or as a storage tank. The modular/honeycomb nature of geocellular systems means that they can be tailored to suit the specific requirements of any site.
- 9.6 Guidance about proper use, installation and maintenance of any proprietary system should be provided by the supplier and incorporated into the site proposals at detailed design stage.

10. SURFACE WATER DRAINAGE STRATEGY

- 10.1 In accordance with West Sussex Sustainable Urban Drainage and Flood Risk Policies, developments are required to use SuDS to reduce both the volume and runoff rates to the drainage system.
- 10.2 Current relevant Sustainable drainage guidance is to achieve as close to greenfield runoff rates as feasible for storm runoff from new developments.
- 10.3 This drainage strategy proposes all hardstanding and built areas to drain to permeable paving (Type C) with 0.8m sub-base placed in the central courtyard area of the site. All surface water runoff from the new development is proposed to drain to the existing sewer for rainfall events up to and including the 1 in 100yr+40%CC rainfall event.
- 10.4 Details of the existing drainage are to be confirmed by a CCTV survey.
- 10.5 Surface water discharge rates have been calculated below and supporting calculations are included in Appendix III.

SURFACE WATER DISCHARGE RATES SUMMARY					
	Area (ha)	Discharge Rates (l/s)			
		1 year	2 year/ Q_{BAR}	30 year	100 year
Greenfield Rates	1.0	2.45	2.88	8.63	9.39
Greenfield Rates	0.03	0.07	0.09	0.2	0.28
Brownfield Rates	0.03	-	4.8	12.1	15.2
Proposed Runoff Rates	0.03	-	1.0	1.1	1.1
Betterment	0.03	-	79.2%	90.9%	92.8%
Proposed Runoff Rates + 40%CC	0.03	-	1.0	1.1	1.1

Table 3: Calculated Runoff rates

- 10.6 Surface water from all hardstanding area on site are to drain into the permeable paving in the courtyard area as per the attached drawing within appendix IV. According to Causeway Flow calculations attached in appendix III, the permeable paving will have an area of 56m² with a sub-base depth of 0.8m giving a storage volume of 13.44m³.
- 10.7 If permeable pavement is not viable then crate storage and/or blue roof may be feasible offering the same volume but may be subject to the existing site drainage levels being deep enough to allow a connection offsite to be feasible. A CCTV drain survey may be required to determine the final surface water storage solution.
- 10.8 Proposals are to limit discharge to 1.1l/s from the sub-base to the existing drainage on site via a hydrobrake with a minimum 50mm aperture. This is in line with the Design and Construction Guidance for foul and surface water sewers which states "where the design of the upstream system will prevent debris entering the system (e.g., underground systems where the inlets are pervious pavement systems), static controls should have a minimum opening size of 50 mm".
- 10.9 A proposed storm drainage strategy plan layout is included in Appendix IV.

11. Water Quality

- 11.1 Given the site is shown to be located with a Water Quality Source Protection Zone 1 adequate and robust treatment of runoff should occur prior to infiltration into the subgrade.
- 11.2 The primary risk to water quality is from the trafficked areas (i.e. the Driveway). This can be treated through providing permeable paving across the trafficked areas or through proprietary treatment devices (such as smart sponge passive skimmers).
- 11.3 The plans included in Appendix IV shows permeable pavement is proposed to be provided for all external trafficked areas to treat the runoff from the driveway area.
- 11.4 The Pollution Hazard Indices are summarised in Table 4 – Summary of Pollution Hazard Indices for different Land Use below (based on Table 26.2 of The SuDS Manual):

POLLUTION HAZARD INDICES FOR DIFFERENT LAND USE CLASSIFICATIONS				
LAND USE	Pollution Hazard Level	Total Suspended Solids	Metals	Hydrocarbons
Residential Roofs	Very Low	0.2	0.2	0.05
Individual property driveways, residential car parks, low traffic roads.	Low	0.5	0.4	0.4
TOTAL POLLUTION HAZARD INDEX		0.7	0.6	0.45

Table 4: Summary of Pollution hazard Indices for different Land Use

- 11.5 When designing suitable treatment trains to deliver adequate treatment prior to discharging to sewers, watercourse or groundwater, consideration of the treatment properties of each SuDS component specified should be reviewed. With the total mitigation potential of a SuDS treatment train determined by:

$$SuDS_1 + 0.5 * SuDS_2 + 0.5 * SuDS_3 ... = Total SuDS Mitigation Index$$

- 11.6 The Mitigation Indices of the proposed SuDS techniques are summarised in Table 5 below.

INDICATIVE SuDS MITIGATION INDICES FOR DISCHARGES TO SURFACE WATER			
SuDS Component	Total Suspended Solids	Metals	Hydrocarbons
Permeable Paving/Proprietary Treatment	0.7	0.6	0.7
TOTAL SuDS MITIGATION INDEX	0.7	0.6	0.7

Table 5: Indicative SuDS Mitigation Indices.

- 11.7 It can be seen that the Total SuDS Mitigation Index ≥ Pollution Hazard Index therefore the water treatment provided by this SuDS train is enough to remove the potential pollutants.

12. Schedule of Maintenance

- 12.1 All onsite SuDS and drainage systems will be privately maintained. A long-term maintenance regime should be agreed with the site owners before adoption.
- 12.2 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.
- 12.3 The property owner will be responsible for the management and maintenance of SuDS devices.
- 12.4 Typical key suds components operation and maintenance activities are provided below.

TYPICAL KEY SUDS COMPONENTS OPERATION AND MAINTENANCE ACITIVIES													
Operation and Maintenance Activity	SuDS Component												
	Pond	Wetlands	Detention Basin	Infiltration Basin	Soakaway	Infiltration Trench	Filter Drain	Modular Storage	Pervious pavement	Swale/Bioretenention	Filter Strip	Green Roofs	Proprietary Treatment
Regular Maintenance													
Inspection		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Litter/debris removal	✓	✓	✓	✓	-	✓	✓	-	✓	✓	✓	x	-
Grass cutting	✓	✓	✓	✓	-	✓	✓	-	-	✓	✓	x	x
Weed/invasive plant control	-	-	-	-	x	-	-	x	-	x	-	✓	x
Shrub management	-	-	-	-	x	x	x	x	-	-	-	x	x
Shoreline vegetation management	✓	✓	-	x	x	x	x	x	x	x	x	x	x
Aquatic vegetation management	✓	✓	-	x	x	x	x	x	x	x	x	x	x
Occasional Maintenance													
Sediment management	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Vegetation replacement	-	-	-	-	x	x	x	x	x	-	-	✓	x
Vacuum sweeping and brushing	x	x	x	x	x	x	x	x	✓	x	x	x	x
Remedial Maintenance													
Structure rehabilitation/repair	-	-	-	-	-	-	-	-	-	-	-	-	x
Infiltration surface reconditioning	x	x	x	-	-	-	-	x	-	-	-	x	x
Key:													
Will be Required		May be Required					Not Normally Required						

Table 5: General Maintenance Requirements (Source: CIRIA SuDS Manual C753)

12.5 General maintenance of key SuDS components are provided below.

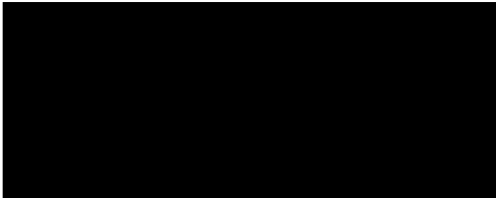
PROPOSED SCHEDULE OF MAINTENANCE FOR BELOW GROUND DRAINAGE				
Item	Visual Inspection	Cleanse / De-sludge	CCTV Survey	Comments
Foul Drainage System (pipework, chambers etc.)	5 years	10 years	10 years	Cleansing to be carried as necessary
Surface Water Drainage System (pipework, chambers etc.)	5 years	10 years	10 years	Cleansing to be carried as necessary
Gullies/Channels	1 year	1 year	N/A	Cleansing to be carried as necessary
Permeable Block Paving	1 year	'Swept' clean of debris every 2 years.	N/A	Refer to block manufacturers guidance for long term maintenance requirements.
Geocellular Tanks	Yearly	As required	5 years	Remove sediment from pre-treatment structures; Inspect inside of tank for sediment build-up and remove as necessary.
Hydrobrakes	Every month for the first 3 months and every 6 months thereafter	As necessary & 1 year	10 years	Cleansing to be carried as necessary and at least every year. Refer to manufacturers

Table 7: Schedule of maintenance for below ground drainage

13. CONCLUSION

- 13.1 Meridian Civil Engineering Consultancy LTD (MCEC) has been instructed by AEGAEA to prepare a Surface Water Drainage Strategy for the development of 46a & 47 & Land North of Clifton Road 46a Pier Road Littlehampton BN17 5LW.
- 13.2 It is understood the development is for the demolition of existing buildings, change of use & erection of 1 No. building incorporate office (B1) at ground floor & 8 No. dwellings at first and second floor.
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- 13.5 The Environment Agency Long Term Flood Risk map (Figure 4) shows the site to have areas at medium risk from surface water flooding. means that each year this area has a chance of flooding of between 1% and 3.3%.
- 13.6 Geology at the site is shown to comprise of multiple chalk formations. superficial deposits on site are shown to be raised beach deposits comprising of sand and gravel, as published by the British Geological Survey online. Although the geology may allow for infiltration, Due to the space constraints on site - infiltration has been deemed unsuitable at this time.
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- 13.8 Proposals are to limit discharge to 1.1l/s from the sub-base to the existing drainage on site via a hydrobrake with a minimum 50mm aperture. This is in line with the Design and Construction Guidance for foul and surface water sewers which states "where the design of the upstream system will prevent debris entering the system (e.g., underground systems where the inlets are pervious pavement systems), static controls should have a minimum opening size of 50 mm".
- 13.9 In order to mitigate the potential flood risk posed by the proposed development, adequate control measures are required to be considered. This will ensure that surface water runoff can be managed at source and the flood risk off site is not increased.
- 13.10 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 around and between the new blocks. Nevertheless, the finished floor levels or thresholds of the buildings should be raised at least 150mm above adjacent proposed ground levels (where feasible), to mitigate against surface water flows entering the building in an exceedance event.
- 13.11 This report has been produced broadly in accordance with the National Planning Policy Framework (NPPF) and West Sussex and Littlehampton local SuDS policies and associated Local Planning Authority technical guidance.

APPENDIX I Architects plans

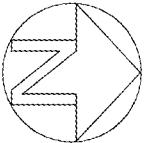




Proposed block plan Scale 1:500 @A3



Site location plan Scale 1:1250 @A3



Planning issue

rev.	date

These drawings should be approved by local Authority
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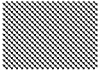
client Ermsdale Residential Limited

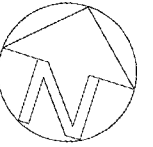
project 46A Pier Road
 Littlehampton

drawing Block & site location plans

scale	Shown@A3	date	Feb 2018
	drawn	MDONCIE	

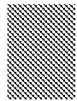
19a Wilbury Avenue tel: 01273 203230
Hove, East Sussex fax: 01273 321087
BN3 6HS email:info@turnerassociates.co.uk

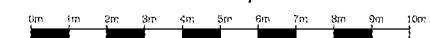
**Turner Associates**
Architects, Town Planners, Project Managers, Quantity Surveyors



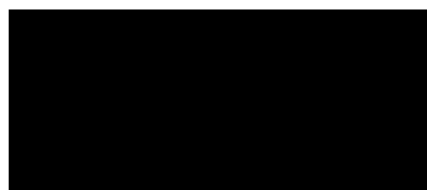
Existing survey Scale 1:200 @A3

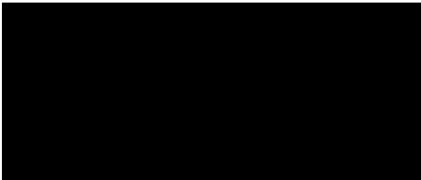
Planning issue

rev.	date
These drawings should be approved by local Authority	
No dimensions to be scaled from this drawing. All dimensions to be checked on site. This drawing is copyright and should not be reproduced without the permission of the Architects.	
client	Emsdale Residential Limited
project	46A Pier Road Littlehampton, BN17 5LW
drawing	Existing survey
scale	1:200@A3
date	FEB 18
drawn	JN
2d St Johns Road Hove, East Sussex BN3 2FB	
tel: 01273 203230 email: info@taarchitects.co.uk	
 Turner Associates Architects and Planning Consultants	
TA 1098 /02	
rev.	



APPENDIX II Sewer Record Plans





Calculated by: Sam Lee

Site name: 46a & 47 Pier Road

Site location: BN17 5LW

Site Details

Latitude: 50.80589° N

Longitude: 0.54316° W

Reference: 2802736970

Date: Jan 26 2022 15:25

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

Runoff estimation approach: IH124

Site characteristics

Total site area (ha): 1

Methodology

Q_{BAR} estimation method: Calculate from SPR and SAAR

SPR estimation method: Calculate from SOIL type

Soil characteristics	Default	Edited
SOIL type:	3	3
HOST class:	N/A	N/A
SPR/SPRHOST:	0.37	0.37

Hydrological characteristics	Default	Edited
SAAR (mm):	702	702
Hydrological region:	7	7
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

Notes

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

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

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

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

(3) Is $SPR/SPRHOST \leq 0.3$?

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

Greenfield runoff rates	Default	Edited
Q_{BAR} (l/s):	2.88	2.88
1 in 1 year (l/s):	2.45	2.45
1 in 30 years (l/s):	6.63	6.63
1 in 100 year (l/s):	9.19	9.19
1 in 200 years (l/s):	10.78	10.78

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

Design Settings

Rainfall Methodology	FEH-13	Minimum Velocity (m/s)	1.00
Return Period (years)	100	Connection Type	Level Soffits
Additional Flow (%)	40	Minimum Backdrop Height (m)	0.500
CV	0.750	Preferred Cover Depth (m)	0.900
Time of Entry (mins)	4.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.015	4.00	2.500	1200	61.257	58.981	0.400
2	0.015	4.00	2.500	1200	82.240	58.761	0.400
Carpark 1			2.500		71.308	58.320	0.950
3			2.500	1200	71.088	50.341	1.050

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
2.000	10.073	80.0	100	Circular	2.500	2.100	0.300	2.500	1.974	0.426
1.000	10.941	80.0	100	Circular	2.500	2.100	0.300	2.500	1.963	0.437
1.001	7.982	80.0	100	Circular	2.500	1.550	0.850	2.500	1.450	0.950

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
2.000	1	1200	Manhole	Adoptable	Carpark 1		Junction	
1.000	2	1200	Manhole	Adoptable	Carpark 1		Junction	
1.001	Carpark 1		Junction		3	1200	Manhole	Adoptable

Simulation Settings

Rainfall Methodology	FEH-13	Analysis Speed	Normal	Additional Storage (m³/ha)	0.0
Summer CV	0.750	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	0.840	Drain Down Time (mins)	1440	Check Discharge Volume	x

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440
----	----	----	-----	-----	-----	-----	-----	-----	-----	-----	------

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

Node Carpark 1 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Downstream Link	1.001	Sump Available	✓
Replaces Downstream Link	✓	Product Number	CTL-SHE-0050-8000-0400-8000
Invert Level (m)	1.550	Min Outlet Diameter (m)	0.075
Design Depth (m)	0.400	Min Node Diameter (mm)	1200
Design Flow (l/s)	0.8		

Node Carpark 1 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	1.550	Slope (1:X)	999.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	150	Depth (m)	0.800
Safety Factor	2.0	Width (m)	8.000	Inf Depth (m)	
Porosity	0.30	Length (m)	7.000		

Results for 2 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	2.142	0.042	2.4	0.0474	0.0000	OK
15 minute winter	2	10	2.142	0.042	2.4	0.0473	0.0000	OK
60 minute winter	Carpark 1	45	1.665	0.115	2.4	1.8752	0.0000	SURCHARGED
15 minute summer	3	1	1.450	0.000	0.8	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	2.000	Carpark 1	2.4	0.781	0.355	0.0309	
15 minute winter	2	1.000	Carpark 1	2.4	0.782	0.354	0.0335	
60 minute winter	Carpark 1	Hydro-Brake®	3	0.8				3.4

Results for 2 year +40% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	2.150	0.050	3.3	0.0570	0.0000	OK
15 minute winter	2	10	2.150	0.050	3.3	0.0569	0.0000	OK
120 minute winter	Carpark 1	88	1.742	0.192	2.2	3.1596	0.0000	SURCHARGED
15 minute summer	3	1	1.450	0.000	0.8	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	2.000	Carpark 1	3.3	0.847	0.488	0.0392	
15 minute winter	2	1.000	Carpark 1	3.3	0.848	0.488	0.0425	
120 minute winter	Carpark 1	Hydro-Brake®	3	0.8				6.5

Results for 30 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	2.176	0.076	6.0	0.0859	0.0000	OK
15 minute winter	2	10	2.176	0.076	6.0	0.0856	0.0000	OK
60 minute winter	Carpark 1	60	1.945	0.395	6.0	6.5801	0.0000	SURCHARGED
15 minute summer	3	1	1.450	0.000	0.8	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	2.000	Carpark 1	6.0	0.958	0.886	0.0630	
15 minute winter	2	1.000	Carpark 1	6.0	0.959	0.886	0.0683	
60 minute winter	Carpark 1	Hydro-Brake®	3	0.8				8.8

Results for 30 year +40% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	2.249	0.149	8.4	0.1689	0.0000	FLOOD RISK
15 minute winter	2	10	2.250	0.150	8.4	0.1698	0.0000	FLOOD RISK
120 minute winter	Carpark 1	110	2.132	0.582	5.2	9.7100	0.0000	SURCHARGED
15 minute summer	3	1	1.450	0.000	0.8	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	2.000	Carpark 1	8.0	1.022	1.182	0.0765	
15 minute winter	2	1.000	Carpark 1	7.9	1.017	1.176	0.0831	
120 minute winter	Carpark 1	Hydro-Brake®	3	0.9				14.8

Results for 100 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	2.213	0.113	7.6	0.1277	0.0000	FLOOD RISK
15 minute winter	2	10	2.212	0.112	7.6	0.1269	0.0000	FLOOD RISK
60 minute winter	Carpark 1	60	2.079	0.529	7.8	8.8306	0.0000	SURCHARGED
15 minute summer	3	1	1.450	0.000	0.8	0.0000	0.0000	OK

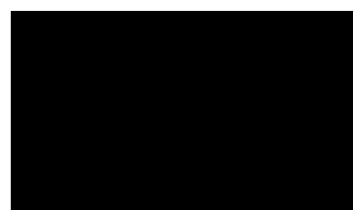
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	2.000	Carpark 1	7.3	0.958	1.078	0.0756	
15 minute winter	2	1.000	Carpark 1	7.3	0.962	1.075	0.0820	
60 minute winter	Carpark 1	Hydro-Brake®	3	0.9				11.4

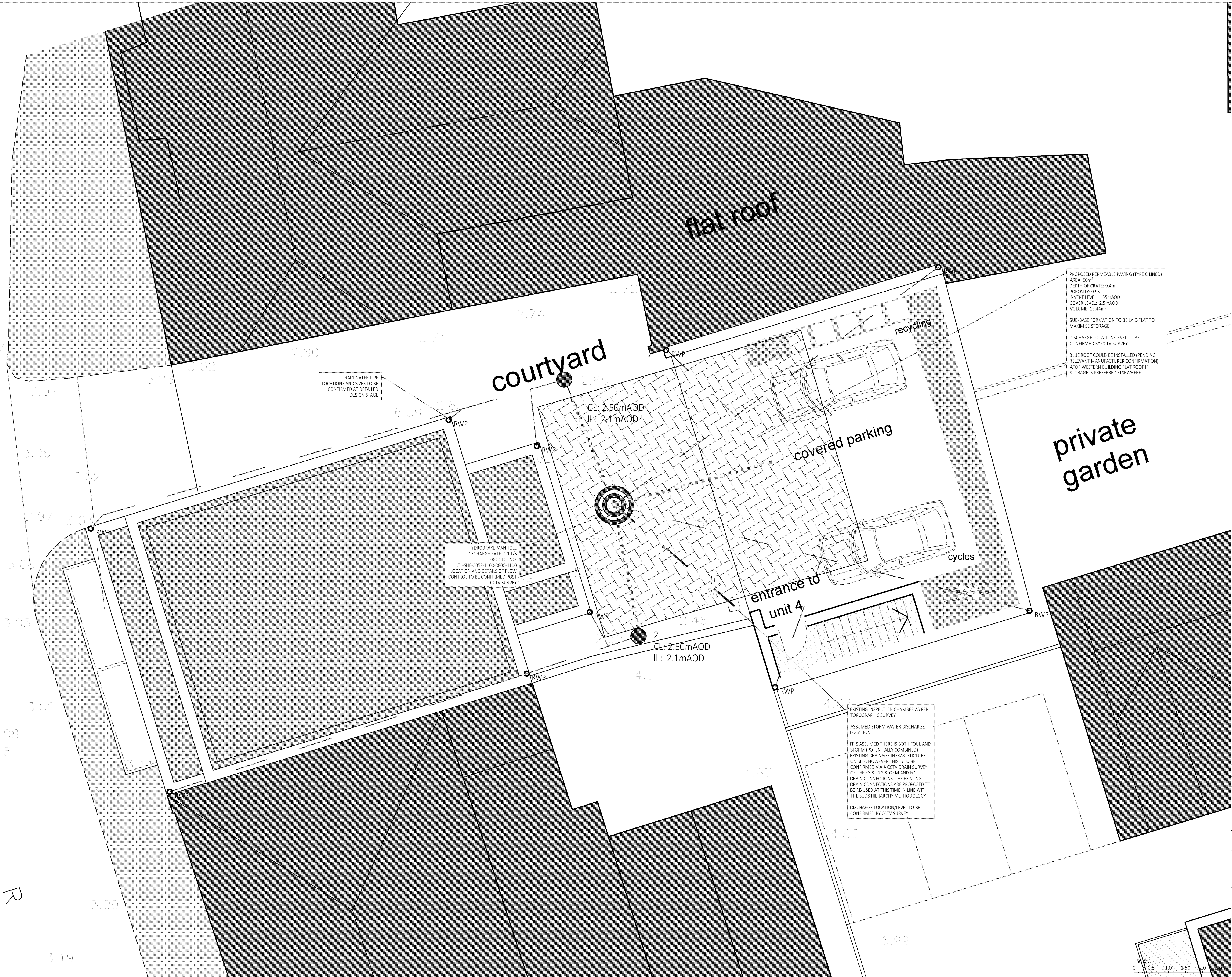
Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	2.372	0.272	10.7	0.3078	0.0000	FLOOD RISK
15 minute winter	2	10	2.379	0.279	10.7	0.3156	0.0000	FLOOD RISK
120 minute winter	Carpark 1	112	2.300	0.750	6.6	12.5294	0.0000	FLOOD RISK
15 minute summer	3	1	1.450	0.000	0.8	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	2.000	Carpark 1	10.0	1.273	1.473	0.0779	
15 minute winter	2	1.000	Carpark 1	9.9	1.261	1.460	0.0846	
120 minute winter	Carpark 1	Hydro-Brake®	3	1.1				18.7

APPENDIX IV Proposed SuDS Strategy





1. GENERAL

THIS DRAWING IS NOT TO BE SCALED, WORK TO FIGURED DIMENSIONS ONLY, CONFIRMED ON SITE.

THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTURAL DRAWINGS, DETAILED SPECIFICATIONS WHERE APPLICABLE AND ALL ASSOCIATED DRAWINGS IN THIS SERIES.

ANY DISCREPANCY ON THIS DRAWING IS TO BE REPORTED IMMEDIATELY TO THE PARTNERSHIP FOR CLARIFICATION.

THE CONTRACTOR IS RESPONSIBLE FOR ALL TEMPORARY WORKS AND FOR THE STABILITY OF THE WORKS IN PROGRESS.

CDM REGULATIONS 2015: ALL CURRENT DRAWINGS AND SPECIFICATIONS MUST BE READ IN CONJUNCTION WITH THE DESIGNER'S HAZARD RISK AND ENVIRONMENT ASSESSMENT RECORD. DESIGN HAS BEEN PRODUCED BASED ON INFORMATION PROVIDED BY THE CLIENT/PRINCIPLE DESIGNER AVAILABLE AT TIME OF ISSUE. CONTRACTOR TO REVIEW DRAWING AND SPECIFICATION IN CONTEXT WITH THE WIDER SITE AND SPECIFIC SITE INVESTIGATION, CONTAMINATION ASSESSMENT, ASBESTOS SURVEY, ENVIRONMENTAL SURVEY, UXO SURVEY AND ANY OTHER RELEVANT INFORMATION AND MANAGE RISKS RELATING TO THE WORKS OUTLINED IN THE DRAWINGS AND SPECIFICATION. PRINCIPLE CONTRACTOR TO MAKE DESIGNER AND CLIENT AWARE OF SITE SPECIFIC RISKS THAT MAY AFFECT THE DRAWING AND SPECIFICATION.

CDM REGULATIONS 2015: FOR GENERIC MAINTENANCE AND MANAGEMENT RISKS REFER TO CHAPTER 36 OF CDM 752 SUDS MANUAL. FOR PROPRIETARY SYSTEMS SEE MANUFACTURER'S MANAGEMENT AND MAINTENANCE DETAILS AND RISK ASSESSMENT WITH REGARDS TO MAINTENANCE OF PROPRIETARY SYSTEMS.

2. CONSTRUCTION NOTE

THE MAIN CONTRACTOR IS RESPONSIBLE FOR THE DESIGN OF ALL TEMPORARY WORKS, AND IS ALSO RESPONSIBLE FOR THE SAFE MAINTENANCE AND STABILITY OF EXISTING BUILDINGS AT ALL TIMES.

THE MAIN CONTRACTOR IS RESPONSIBLE FOR ALL OCCURRENCES OF GROUND WATER DURING THE CONSTRUCTION PERIOD.

ANY INFORMATION GIVEN REGARDING EXISTING UNDERGROUND SERVICES IS GIVEN IN GOOD FAITH AFTER CONSULTATION WITH THE RELEVANT AUTHORITY, HOWEVER ACCURACY IS NOT CERTAIN. THE MAIN CONTRACTOR IS RESPONSIBLE FOR CHECKING ALL INFORMATION ON SITE PRIOR TO WORK COMMENCING AND TAKING DUE CARE AND ATTENTION WHILST UNDERTAKING THE WORKS.

THE CONTRACTOR MUST COMPLY WITH ALL CURRENT LEGISLATION RELATING TO HEALTH & SAFETY.

ALL PRODUCTS SPECIFIED SHALL BE INSTALLED IN STRICT ACCORDANCE WITH THE MANUFACTURERS RECOMMENDATIONS AND INSTRUCTIONS. IF THERE ARE DISCREPANCIES BETWEEN THAT INFORMATION AND THE DETAILS ON ANY MERIDIAN DRAWINGS, THE MANUFACTURERS INSTRUCTIONS MUST BE USED.

3. BELOW GROUND DRAINAGE

UPVC-U PIPES TO BS 4660: 2000 AND PLASTIC INSPECTION CHAMBERS AND FITTINGS TO BS EN 13598-1:2020. CLAY PIPES TO BS EN 295-1:2013. CONCRETE MANHOLE AND INSPECTION CHAMBERS TO BS EN 1917:2002.

ALL ADAPTABLE DRAINAGE TO BE CONSTRUCTED IN ACCORDANCE WITH SEWERAGE SECTOR GUIDANCE App C - DESIGN AND CONSTRUCTION GUIDANCE AND THE RELEVANT COUNCIL DESIGN GUIDE.

ALL PRIVATE FOUL WATER SEWERS TO BE LAID AT 1 IN 40 AT THE HEAD OF PIPE RUNS AND 1 IN 80 ELSEWHERE UNLESS OTHERWISE STATED.

ALL PRIVATE FOUL SEWER PIPES TO BE 100mm DIAMETER FROM SOIL STACKS UNLESS OTHERWISE STATED ON THE DRAWING AND 150mm WHERE SERVING MORE THAN 9 PROPERTIES.

ALL PRIVATE SURFACE WATER SEWERS TO BE LAID AT 1 IN 100 UNLESS OTHERWISE STATED ON THE DRAWING.

ALL PRIVATE SURFACE WATER SEWER PIPES TO BE 100mm DIAMETER FROM DOWNPIPES AND 150mm DIAMETER ELSEWHERE UNLESS OTHERWISE STATED ON THE DRAWING.

ALLOW FOR RODDING ACCESS ABOVE GROUND WHERE RAINWATER DOWNPIPES OR SOIL STACKS DO NOT HAVE A DIRECT CONNECTION TO AN INSPECTION CHAMBER.

EXISTING SEWER PIPE TO BE RE-USED TO BE SURVEYED AND LEVELED PRIOR TO COMMENCEMENT OF THE DRAINAGE WORKS AND REBURNISHED IF NECESSARY.

CONNECTIONS TO AN ADOPTED SEWER ONLY TO BE MADE FOLLOWING APPROVAL FROM THE RELEVANT ADOPTING AUTHORITY.

ALL DRAINS, SEWER PIPES AND MANHOLES TO BE CLEANED AND TESTED FOR WATER TIGHTNESS ON COMPLETION OF CONSTRUCTION.

4. MANHOLE COVERS AND FRAMES

MANHOLE COVERS TO BE CLASS D400 IN HIGHWAYS, CLASS B125 IN FOOTWAYS AND VERGES, CLASS A15 IN NON-TRAFFICKED AREAS.

MANHOLE COVER AND FRAME TO BE BEDDED AND SURROUNDED IN 1:3 MORTAR.

LEGEND

PRIVATE SURFACE WATER DRAIN

PERFORATED SURFACE WATER DRAIN

EXISTING SURFACE WATER DRAIN

PUBLIC SURFACE WATER DRAIN

HIGHWAY DRAIN

SLOT/CHANNEL DRAIN

TYPE 2 MANHOLE

TYPE 3 INSPECTION CHAMBER

TYPE 4 INSPECTION CHAMBER

RODDING EYE

RAIN WATER PIPE

ROAD GULLY

BOTTLE GULLY

PERMEABLE PAVING

ATTENUATION SYSTEM

OVERLAND FLOW

REV:	DESCRIPTION:	BY:	DATE:
	status		

MERIDIAN

CIVIL ENGINEERING CONSULTANCY

CLIENT:

AEGAEA

SITE:

46a & 47 Pier Road,
Littlehampton, BN17 5LW

TITLE:

Surface Water Drainage
Strategy - Proposed Layout

SCALE AT A1:	DATE:	DRAWN:	CHECKED:
1:50	26/01/2022	SL	MN
PROJECT NO:	DRAWING NO:	REVISION:	
MC0059	CIV01	-	

