

MERIDIAN

CIVIL ENGINEERING CONSULTANCY

LITTLE ACRES,
LONGFIELD AVENUE,
LONGFIELD,
DA3 7LA

SURFACE WATER DRAINAGE SUDS STRATEGY

FEBRUARY 2022

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Client : William Cook and Eddie Powell

Rev	Date	Prepared by	Checked by	Approved by
-	04/02/2022	Sam Lee	MN	MN

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1.0 INTRODUCTIONS

- 1.1 Meridian Civil Engineering Consultancy LTD (MCEC) has been instructed by William Cook and Eddie Powell to prepare a Surface Water Drainage Strategy for the development of The Land at Little Acres, Longfield Avenue, Longfield, DA3 7LA.
- 1.2 It is understood the development is for the demolition of garage, outbuildings and equestrian areas and the removal of two mobile homes and the erection of up to 16 static homes with associated access road, parking and landscaping.
- 1.3 The Environment Agency (EA) Flood Map for Planning (figure 2), shows the site located within Flood Zone 1 (low risk of fluvial or tidal flooding). Areas deemed to be in flood zone 1 have been shown to be at less than 0.1% (1 in 1000) chance of flooding in any year.
- 1.4 According to the EA Long Term Flood Risk map, the site may have areas that are at low risk from surface water flooding. Low risk means that each year this area has a chance of flooding of between 0.1% and 1%.
- 1.5 Bedrock geology at the site is shown to be Lewes Nodular Chalk formation and Newhaven Chalk Formation (undifferentiated) comprising of chalk with no superficial deposits recorded, as published by the British Geological Survey online.
- 1.6 Infiltration testing has not yet been undertaken on site therefore Meridian have assumed a conservative infiltration rate of 3.1×10^{-5} based on the indicated chalk geology for the purposes of the calculations. Infiltration rates on site are to be confirmed by infiltration testing at a later design stage.
- 1.7 This drainage strategy shows all hardstanding (roof areas, access road and car ports) to drain to a soakaway placed in the northwest low-lying area of the site. All hardstanding areas on site (parking areas and car ports) are to be of permeable construction however due to the slope on site, and to be conservative, for the purpose of the calculations, 100% of hardstanding area runoff is proposed to go to the soakaway. This may be altered at detailed design stage once more site investigation and shallow infiltration testing has been undertaken.
- 1.8 Causeway Flow calculations undertaken by MCEC show the soakaway to have an area of 196m² with a crate depth of 2m and a necessary storage volume of 281.7m³. The half drain time is shown to be 1319mins which is acceptable.
- 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 This report has been produced broadly in accordance with the National Planning Policy Framework (NPPF), Kent County Council (KCC) and Dartford Borough local SuDS policies and associated Local Planning Authority technical guidance.

2.0 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)
- Dartford Borough Level 1 and 2 Strategic Flood Risk Assessment (2021)
- Kent County Council Local Flood Risk Management Strategy LFRMS (2013)
- DEFRA Sustainable drainage systems: non-statutory technical standards
- Ciria SuDS Manual C753

3.0 SITE LOCATION

3.1 The site is located at the Land at Little Acres, Longfield Avenue, Longfield, DA3 7LA.

3.2 The site is currently brownfield (part landscape part developed). It is understood the development is for the demolition of all buildings and the erection of up to 16 static homes with associated parking and landscaping. Proposed Architects plans are included in Appendix I.

3.3 The site redline boundary shown on the architect's plans is approximately 10370sqm. According to LiDAR data, ground levels range from 78mAOD on the south-eastern boundary to approximately 68mAOD on the north-western boundary. The contours (2m intervals) can be seen in the figure below.



Figure 1 - Site Location

4.0 SOURCES OF FLOODING

4.1 Tidal and Fluvial

- 4.1.1 The Environment Agency (EA) Flood Map for Planning (figure 2), shows the site located within Flood Zone 1 (low risk of fluvial or tidal flooding). Areas deemed to be in flood zone 1 have been shown to be at less than 0.1% (1 in 1000) chance of flooding in any year.

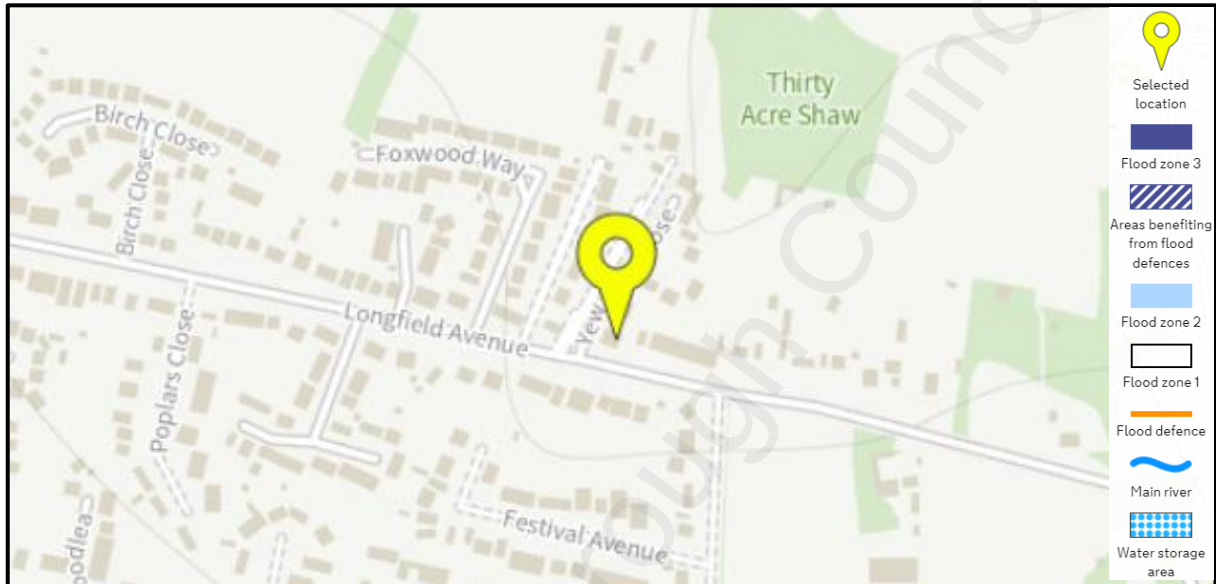


Figure 2 - EA Flood Map for Planning Extract

4.2 EA Long Term Flood Risk Map

- 4.2.1 According to the EA Long Term Flood Risk map, the site may have areas that are at low risk from surface water flooding. Low risk means that each year this area has a chance of flooding of between 0.1% and 1%.

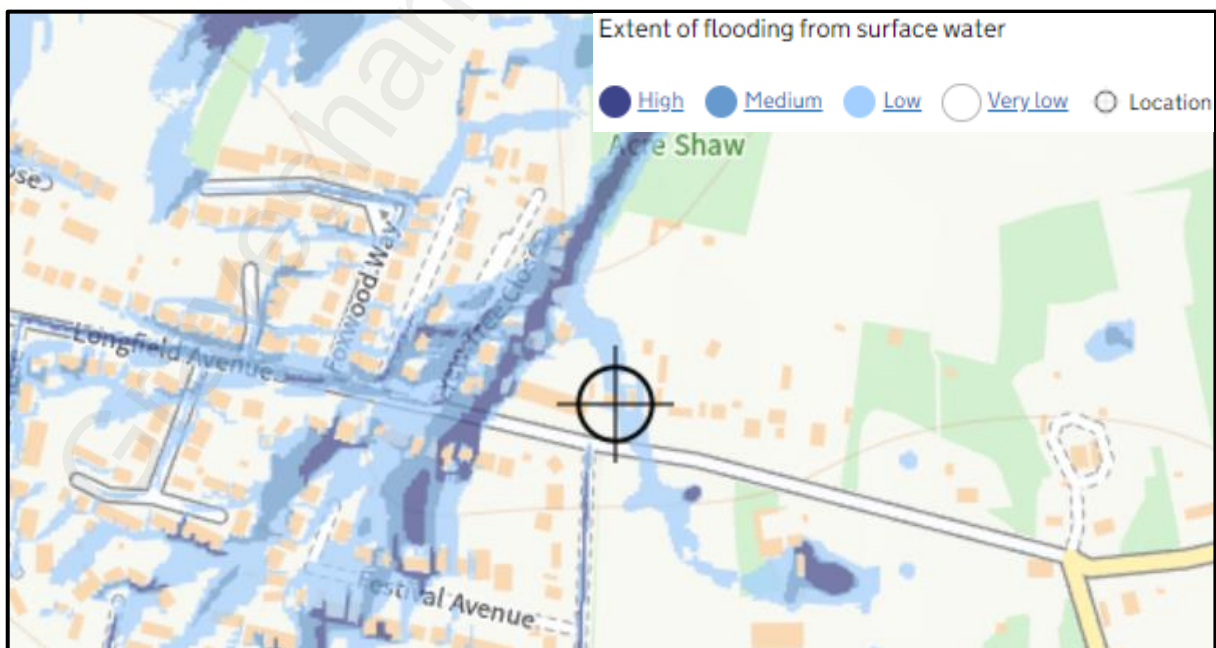


Figure 3 - EA Long Term Flood Risk Map Extract

5.0 GEOLOGY AND INFILTRATION POTENTIAL

- 5.1 Bedrock geology at the site is shown to be Lewes Nodular Chalk formation and Newhaven Chalk Formation (undifferentiated) comprising of chalk with no superficial deposits recorded, as published by the British Geological Survey online.

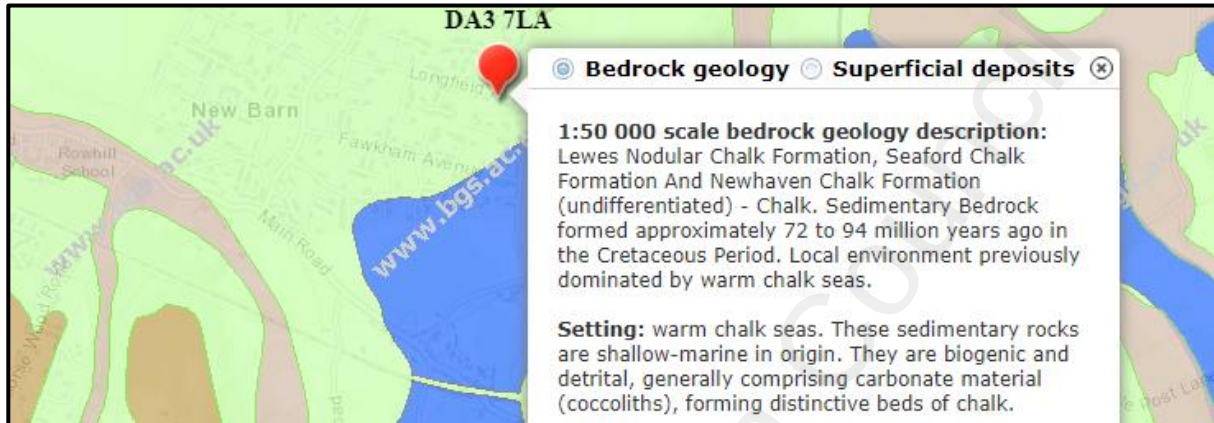


Figure 4 - BGS online mapping extract showing geology on site

- 5.2 Infiltration test has not yet been undertaken on site therefore Meridian have assumed a conservative infiltration rate of 3.1×10^{-5} based on the indicated chalk geology for the purposes of the calculations. Infiltration rates on site are to be confirmed by infiltration testing at a later design stage.
- 5.3 A review of DEFRA's Magic Map online resource indicates that the formation underneath the site is a Principal bedrock aquifer. A review of DEFRA's Magic Map online resource also indicates the site is not within a Source Protection Zone.

6.0 DRAINAGE INFRASTRUCTURE

- 6.1 Details of existing drainage arrangements on site are unknown at this time and should be confirmed by a CCTV survey. It is assumed that due to the chalk subgrade that the site storm runoff drains through infiltration.
- 6.2 Due to scope of proposed development, it is assumed new drainage infrastructure will need to be implemented.

7.0 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.

8.0 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	✓	Infiltration is assumed to be viable as per geology on site – this is to be confirmed by infiltration testing.
	3.	Attenuate rainwater in ponds or open water features for gradual release	x	-
	4.	Attenuate rainwater by storing in tanks or sealed water features for gradual release	x	-
	5.	Discharge rainwater direct to a watercourse	x	-
	6.	Discharge rainwater to a surface water sewer/drain	x	-
	7.	Discharge rainwater to Combined Sewer	x	-

Table 1: SuDS Drainage Hierarchy

- 8.3 Following the SuDS drainage hierarchy, infiltration has been considered. As per the section Geology and Infiltration Potential, the site is likely to be suitable for full infiltration methods. Infiltration rates are to be confirmed by BRE365 infiltration tests or similar.
- 8.4 It is proposed to provide water butts to the new dwellings to collect rain water for re-use in garden and amenity areas.
- 8.5 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.
- 8.6 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.

SUITABILITY OF SUDS COMPONENTS		
SuDS Component	Comment	Suitability
Infiltrating SuDS	Infiltration test has not yet been undertaken on site therefore Meridian have assumed a conservative infiltration rate of 3.1×10^{-5} based on the indicated chalk geology for the purposes of the calculations. Infiltration rates on site are to be confirmed by infiltration testing at a later design stage.	✓
Permeable Pavement	Permeable paving (type B) is suitable on site and is recommended to be utilised for all new hardstanding areas on site to infiltrate surface water.	✓
Green / Blue Roofs	Roofs of static homes are currently to be biodiverse roofs – any storage has not been included within calculations.	x
Rainwater Harvesting	It is recommended that Water Butts be implemented, where feasible and where there is space to do so.	✓
Swales	Slope on site prevents implementation of such conveyancing SuDS techniques	x
Rills and Channels	Slope would reduce effectiveness but could potentially be incorporated if client required.	x
Bioretention Systems	Slope would reduce effectiveness but could potentially be incorporated if client required.	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	Could be utilised adjacent to the road to capture runoff – to be confirmed at detailed design stage.	x/✓

Table 2: Suitability of SuDS Components

8.6.1 Rainwater Harvesting

8.6.1.1. 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.

8.6.2 Permeable Pavement

8.6.2.1. 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 B (part infiltration) as these areas will be used to both convey rainfall

and infiltrate. The non-trafficked areas to the side and rear should be Type B (part infiltration). The paving would be formed by the following layers:

- Permeable surfacing (such as gravel, permeable block paving or permeable tarmac).
- Laying Course Material (typically 2-6mm clean crushed stone)
- Geotextile filter.
- Sub-Base: 6-20mm Clean Crushed Stone – depth varies.
- Geotextile filter (for type A and B infiltration paving) or Impermeable membrane (for Type C non infiltration paving)

8.6.2.2. 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.

8.6.3 Geocellular System

8.6.3.1. 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.

8.6.3.2. 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.

9.0 SURFACE WATER DRAINAGE STRATEGY

9.1 In accordance with Kent County Council and Dartford Borough 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.

9.2 This drainage strategy shows all hardstanding (roof areas, access road and car ports) to drain to a soakaway placed in the northwest low-lying area of the site. All hardstanding areas on site (parking areas and car ports) are to be of permeable construction however due to the slope on site and to be conservative, for the purpose of the calculations, 100% of hardstanding area runoff is proposed to go to the soakaway. This may be altered at detailed design stage once more site investigation has been undertaken.

9.3 All surface water runoff from the new development is proposed to infiltrate for rainfall events up to and including the 1 in 100yr+40%CC rainfall event.

9.4 Surface water discharge rates have been calculated below and supporting calculations are included in Appendix II.

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	0.12	0.15	0.33	0.46
Greenfield Rates	0.345	0.041	0.052	0.114	0.159
Proposed Runoff Rates	0.345	0.0 – Drain storms up to 1in100+40% via infiltration			

Table 3: Calculated Runoff rates

9.5 Infiltration testing has not yet been undertaken on site therefore Meridian have assumed a conservative infiltration rate of 3.1×10^{-5} based on the indicated chalk geology for the purposes of the calculations. Infiltration rates on site are to be confirmed by infiltration testing at a later design stage.

- 9.6 Causeway Flow calculations undertaken by MCEC show the soakaway to have an area of 196m² with a crate depth of 2m and a necessary storage volume of 281.7m³. The half drain time is shown to be 1319mins which is acceptable.
- 9.7 Current Sustainable drainage guidance is to achieve as close to greenfield runoff rates as feasible for storm runoff from new developments. Given proposals are to infiltrate runoff for rainfall events up to and including the 1in100yr+40% rainfall event - this criteria can be seen to be achieved through the proposed infiltration scheme.
- 9.8 A proposed storm drainage strategy plan layout is included in Appendix III.

10.0 WATER QUALITY

- 10.1 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).
- 10.2 The plans included in Appendix III shows permeable pavement is proposed to be provided for all external trafficked areas to treat the runoff from the driveway area.
- 10.3 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

- 10.4 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:

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

- 10.5 The Mitigation Indices of the proposed SuDS techniques are summarised in Table 6 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.

- 10.6 It can be seen that the Total SuDS Mitigation Index $\geq$ Pollution Hazard Index therefore the water treatment provided by this SuDS train is enough to remove the potential pollutants.
- 10.7 Sediment traps are also proposed in order to catch sediment prior to entering the soakaways.

11.0 SCHEDULE OF MAINTENANCE

- 11.1 All onsite SuDS and drainage systems will be privately maintained. A long-term maintenance regime should be agreed with the site owners before adoption.
- 11.2 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.
- 11.3 The property owner will be responsible for the management and maintenance of SuDS devices.
- 11.4 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/Bioretentation	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 6: General Maintenance Requirements (Source: CIRIA SuDS Manual C753)

11.5 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
Soakaways and catchpits	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.

Table 7: Schedule of maintenance for below ground drainage

12.0 CONCLUSION

- 12.1 Meridian Civil Engineering Consultancy LTD (MCEC) has been instructed by William Cook and Eddie Powell to prepare a Surface Water Drainage Strategy for the development of The Land at Little Acres, Longfield Avenue, Longfield, DA3 7LA.
- 12.2 It is understood the development is for the demolition of garage, outbuildings and equestrian areas and the removal of two mobile homes and the erection of up to 16 static homes with associated access road, parking and landscaping.
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APPENDIX I Architects plans

Gravesham Borough Council

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Location Plan
1:1250

REV:	DESCRIPTION:	BY:	DATE:
STATUS: Planning			



Target Carbon
Management
info@targetc.co.uk
www.TargetCarbonManagement.co.uk

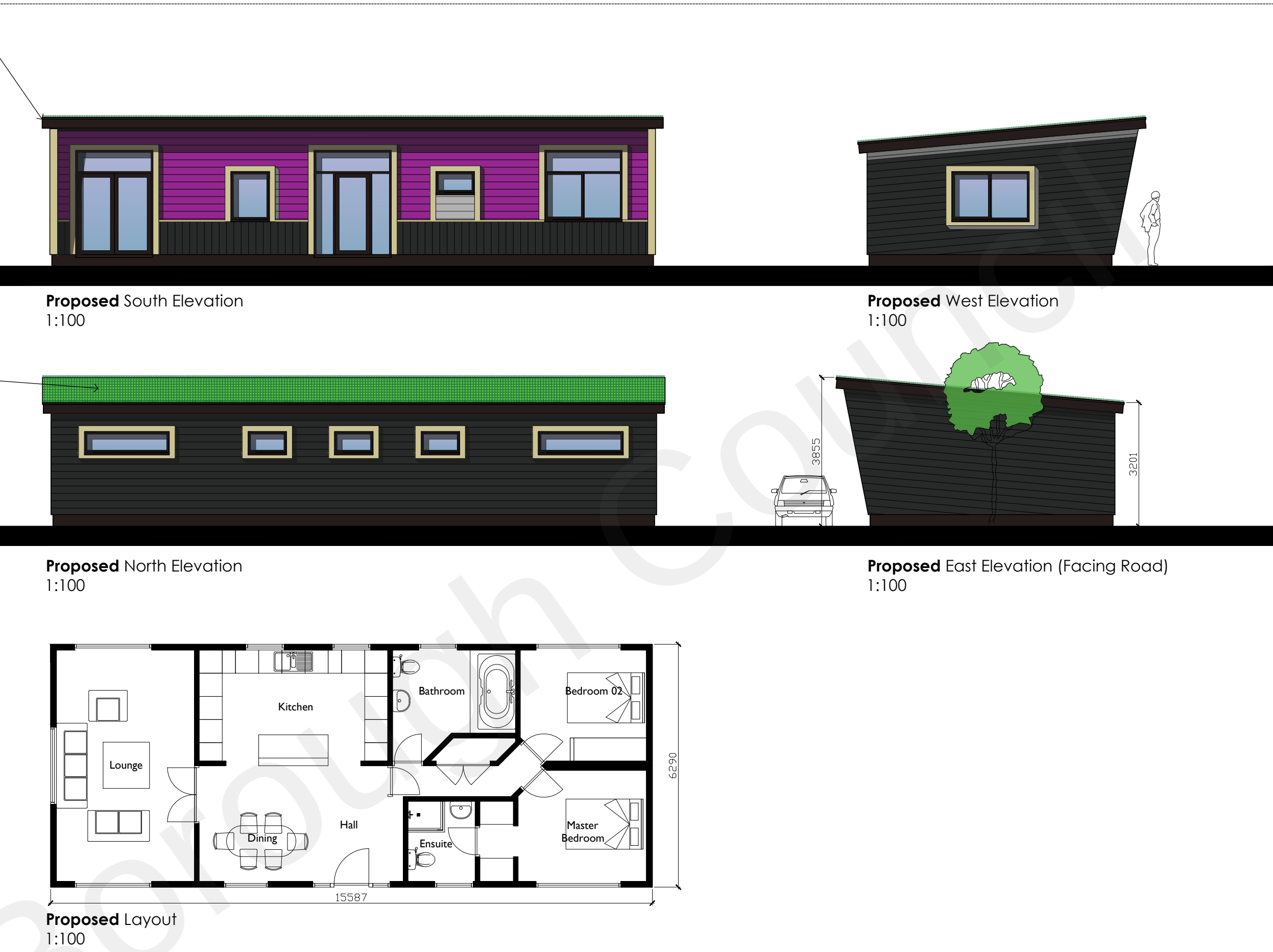
CLIENT:	
ARCHITECT:	Target Carbon Management

SITE:	Small Acres, Longfeild Ave Longfield		
TITLE:	Location Plan		
SCALE:	1/1250	DATE:	19.11.20
PROJECT NO:	2040	DRAWING NO:	P_100
		CHECKED:	//
		REVISION:	/



Fabric Description
Roof - Mono pitch flat roof with sedum 'Green' Roofing to encourage bio-diversity
Wall - Single story timber frame with sustainable timber cladding. Target u_value = 0.16wm2k
The front cladding of each Dwelling will be painted a different colour by the resident.
Windows - Double glazed aluminium with aspect orientation South to private alfresco area.

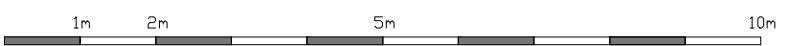
Type 01: Dwelling
16m x 7m (52" x 23")



Type 02: Dwelling
16m x 7m (52" x 16.5")



- Proposed - Native hedge & tree planting
- Proposed - Tree planting
- Proposed - Residential Garden
- Primary Access Road - 5m wide with traffic calming measures.
- Private Drive
- Proposed - Foul Drainage
- Close Boarded Fence 1.8m High
- Existing Hedge
- Existing Tree



REV:	DESCRIPTION:	BY:	DATE:
STATUS:	Planning		

Target Carbon Management
info@targetc.co.uk
www.TargetCarbonManagement.co.uk

CLIENT:

ARCHITECT: Target Carbon Management

SITE: Small Acres, Longfeild Ave Longfield

TITLE: Proposed Site Plan

SCALE:	DATE:	DRAWN:	CHECKED:
1/500	19.11.20	WRJ	//
PROJECT NO:	DRAWING NO:	REVISION:	
2040	P_201	E	

APPENDIX II Calculations

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)
Soakaway 1			69.500		64.187	68.565	1.300
2	0.059	4.00	69.300	1350	67.414	68.252	1.000
4	0.059	4.00	72.000	1200	67.955	59.219	0.900
6	0.059	4.00	74.670	1200	68.187	51.309	0.900
3	0.059	4.00	70.700	1200	67.793	63.436	0.900
5	0.059	4.00	73.340	1200	68.125	54.216	0.700
7	0.059	4.00	76.000	1200	68.416	48.020	0.900

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)
1.001	17.000	15.0	300	Circular	74.670	73.770	0.600	73.340	72.640	0.400
1.002	24.000	15.6	300	Circular	73.340	72.640	0.400	72.000	71.100	0.600
1.003	26.000	20.0	300	Circular	72.000	71.100	0.600	70.700	69.800	0.600
1.004	17.000	12.6	300	Circular	70.700	69.800	0.600	69.300	68.450	0.550
1.005	10.000	100.0	450	Circular	69.300	68.300	0.550	69.500	68.200	0.850
1.000	25.000	18.8	300	Circular	76.000	75.100	0.600	74.670	73.770	0.600

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.001	6	1200	Manhole	Adoptable	5	1200	Manhole	Adoptable
1.002	5	1200	Manhole	Adoptable	4	1200	Manhole	Adoptable
1.003	4	1200	Manhole	Adoptable	3	1200	Manhole	Adoptable
1.004	3	1200	Manhole	Adoptable	2	1350	Manhole	Adoptable
1.005	2	1350	Manhole	Adoptable	Soakaway 1		Junction	
1.000	7	1200	Manhole	Adoptable	6	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
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Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
30	0	0	0
100	0	0	0
100	40	0	0

Node Soakaway 1 Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.05500	Invert Level (m)	67.000	Depth (m)	2.000
Side Inf Coefficient (m/hr)	0.11000	Time to half empty (mins)	1319	Inf Depth (m)	
Safety Factor	2.0	Pit Width (m)	14.000	Number Required	1
Porosity	0.95	Pit Length (m)	14.000		

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.98%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute winter	Soakaway 1	228	67.255	-0.945	11.4	47.5273	0.0000	OK
15 minute summer	2	10	68.430	0.130	54.0	0.1864	0.0000	OK
15 minute winter	4	10	71.179	0.079	36.0	0.0889	0.0000	OK
15 minute winter	6	10	73.821	0.051	18.0	0.0572	0.0000	OK
15 minute summer	3	10	69.881	0.081	45.0	0.0912	0.0000	OK
15 minute winter	5	10	72.702	0.062	27.0	0.0703	0.0000	OK
15 minute winter	7	10	75.138	0.038	9.0	0.0432	0.0000	OK
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	
240 minute winter	Soakaway 1	Infiltration		1.7				
15 minute summer	2	1.005	Soakaway 1	54.0	1.484	0.167	0.3643	
15 minute winter	4	1.003	3	36.0	2.409	0.144	0.3886	
15 minute winter	6	1.001	5	18.0	1.967	0.063	0.1560	
15 minute summer	3	1.004	2	45.0	3.078	0.143	0.2487	
15 minute winter	5	1.002	4	27.0	2.150	0.095	0.3025	
15 minute winter	7	1.000	6	9.0	1.390	0.035	0.1628	

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.98%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
480 minute winter	Soakaway 1	464	67.708	-0.492	15.6	131.8938	0.0000	OK
15 minute winter	2	10	68.527	0.227	145.7	0.3253	0.0000	OK
15 minute winter	4	10	71.236	0.136	97.2	0.1534	0.0000	OK
15 minute winter	6	10	73.854	0.084	48.6	0.0953	0.0000	OK
15 minute winter	3	10	69.943	0.143	121.4	0.1613	0.0000	OK
15 minute summer	5	10	72.743	0.103	72.9	0.1168	0.0000	OK
15 minute winter	7	10	75.162	0.062	24.3	0.0699	0.0000	OK
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	
480 minute winter	Soakaway 1	Infiltration		2.1				
15 minute winter	2	1.005	Soakaway 1	145.8	1.921	0.451	0.7593	
15 minute winter	4	1.003	3	97.2	3.041	0.389	0.8308	
15 minute winter	6	1.001	5	48.6	2.587	0.169	0.3201	
15 minute winter	3	1.004	2	121.5	3.938	0.386	0.5245	
15 minute summer	5	1.002	4	72.9	2.790	0.258	0.6285	
15 minute winter	7	1.000	6	24.3	1.835	0.094	0.3331	

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.98%

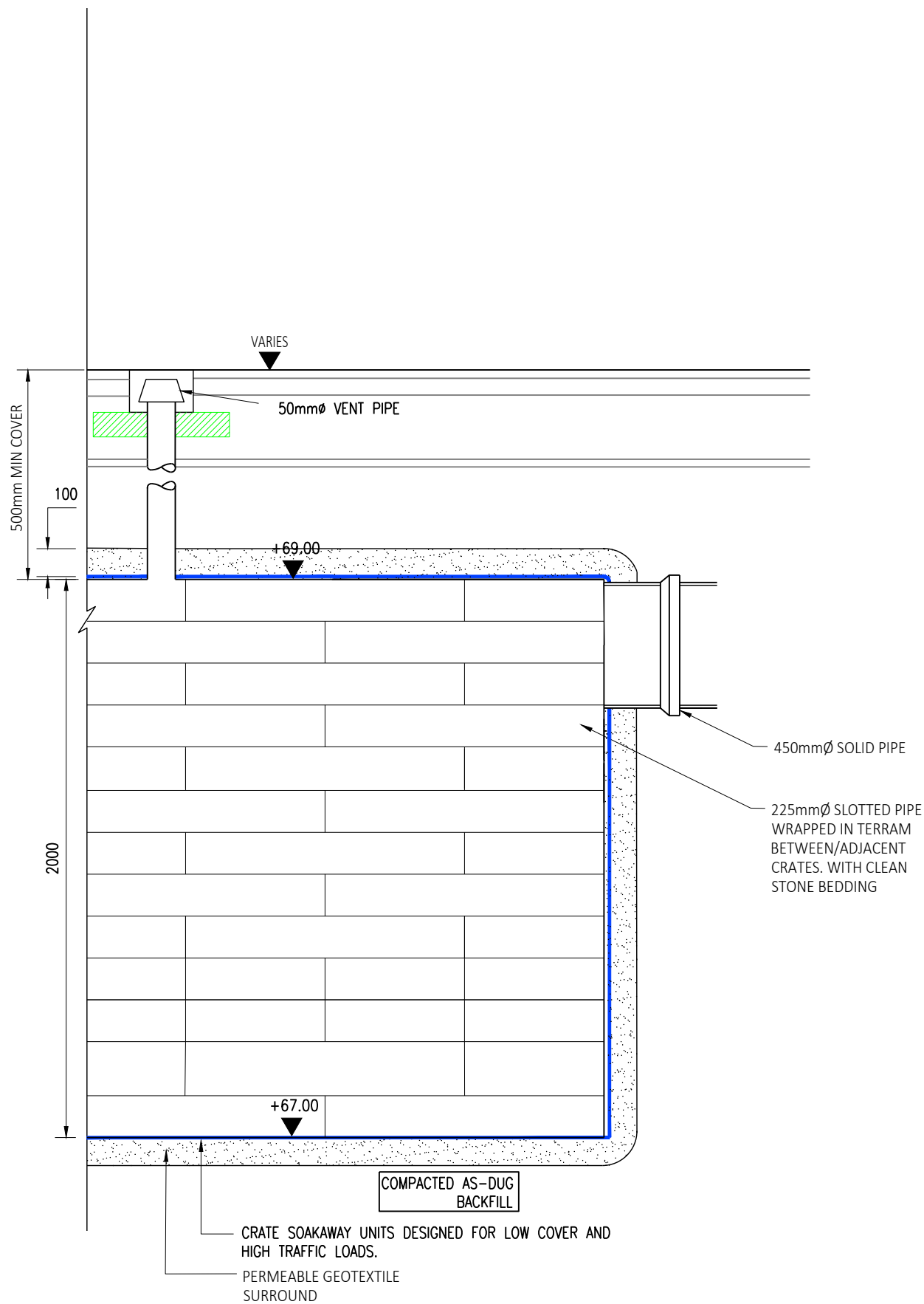
Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
480 minute winter	Soakaway 1	464	68.024	-0.176	21.0	190.7579	0.0000	OK
15 minute winter	2	10	68.568	0.268	190.1	0.3836	0.0000	OK
15 minute winter	4	10	71.260	0.160	126.8	0.1805	0.0000	OK
15 minute winter	6	10	73.868	0.098	63.4	0.1103	0.0000	OK
15 minute winter	3	10	69.970	0.170	158.4	0.1917	0.0000	OK
15 minute winter	5	10	72.760	0.120	95.1	0.1357	0.0000	OK
15 minute winter	7	10	75.171	0.071	31.7	0.0799	0.0000	OK
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	
480 minute winter	Soakaway 1	Infiltration		2.4				
15 minute winter	2	1.005	Soakaway 1	190.2	2.047	0.588	0.9290	
15 minute winter	4	1.003	3	126.7	3.204	0.508	1.0285	
15 minute winter	6	1.001	5	63.4	2.753	0.220	0.3922	
15 minute winter	3	1.004	2	158.4	4.169	0.503	0.6460	
15 minute winter	5	1.002	4	95.1	2.958	0.336	0.7724	
15 minute winter	7	1.000	6	31.7	1.964	0.123	0.4058	

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.98%

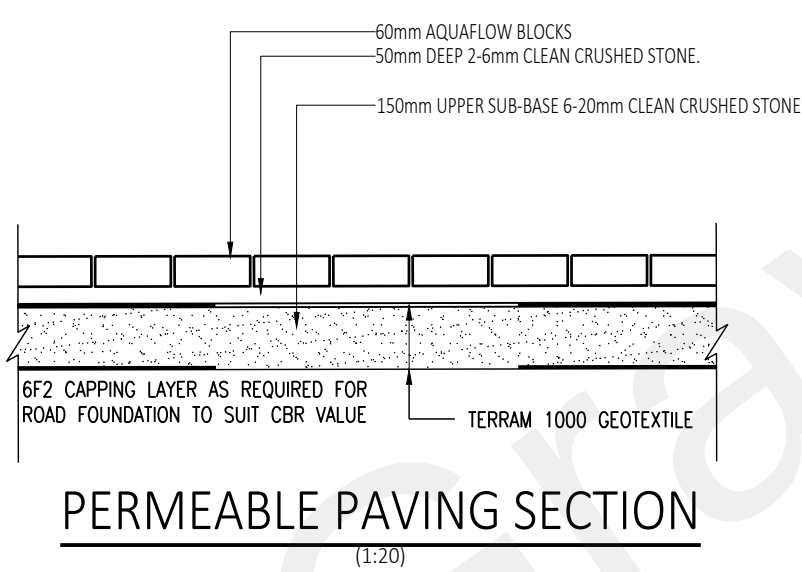
Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
480 minute winter	Soakaway 1	472	68.512	0.312	30.0	281.6111	0.0000	OK
15 minute winter	2	10	68.638	0.338	266.1	0.4842	0.0000	OK
15 minute summer	4	10	71.301	0.201	177.6	0.2276	0.0000	OK
15 minute summer	6	10	73.888	0.118	88.8	0.1337	0.0000	OK
15 minute winter	3	10	70.017	0.217	221.9	0.2453	0.0000	OK
15 minute summer	5	10	72.787	0.147	133.2	0.1657	0.0000	OK
15 minute summer	7	10	75.184	0.084	44.4	0.0947	0.0000	OK
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	
480 minute winter	Soakaway 1	Infiltration		2.8				
15 minute winter	2	1.005	Soakaway 1	266.2	2.202	0.823	1.2078	
15 minute summer	4	1.003	3	177.6	3.388	0.711	1.3620	
15 minute summer	6	1.001	5	88.8	2.965	0.308	0.5095	
15 minute winter	3	1.004	2	221.8	4.381	0.705	0.8594	
15 minute summer	5	1.002	4	133.2	3.148	0.471	1.0129	
15 minute summer	7	1.000	6	44.4	2.135	0.172	0.5226	

APPENDIX III Proposed SuDS Strategy

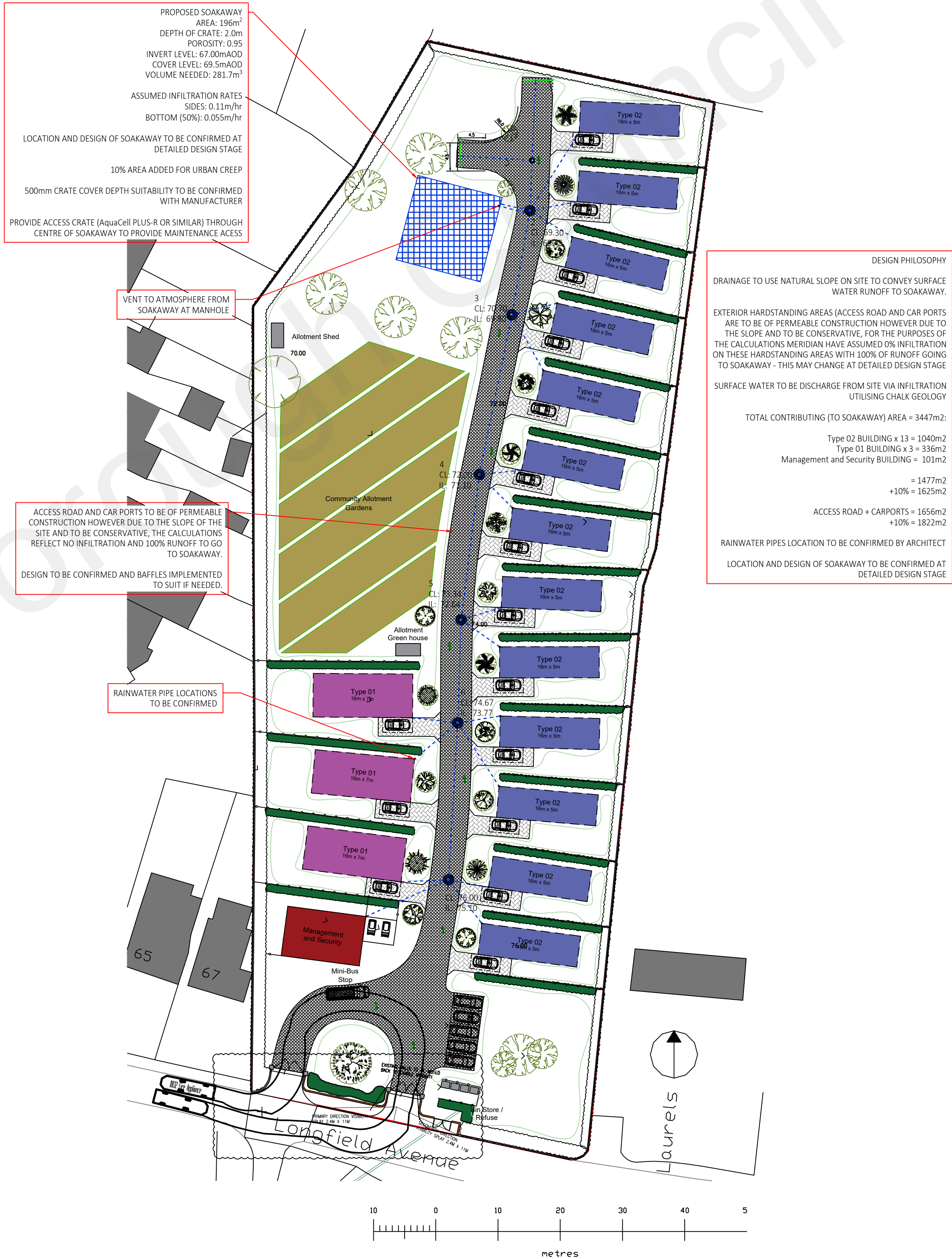
Gravesham Borough Council



TYPICAL CRATE SOAKAWAY.
(1:20)



PERMEABLE PAVING SECTION
(1:20)



PROPOSED SOAKAWAY
AREA: 196m²
DEPTH OF CRATE: 2.0m
POROSITY: 0.95
INVERT LEVEL: 67.00m AOD
COVER LEVEL: 69.5m AOD
VOLUME NEEDED: 281.7m³

ASSUMED INFILTRATION RATES
SIDES: 0.11m/hr
BOTTOM (50%): 0.055m/hr

LOCATION AND DESIGN OF SOAKAWAY TO BE CONFIRMED AT DETAILED DESIGN STAGE

10% AREA ADDED FOR URBAN CREEP

500mm CRATE COVER DEPTH SUITABILITY TO BE CONFIRMED WITH MANUFACTURER

PROVIDE ACCESS CRATE (AquaCell PLUS-R OR SIMILAR) THROUGH CENTRE OF SOAKAWAY TO PROVIDE MAINTENANCE ACCESS

VENT TO ATMOSPHERE FROM SOAKAWAY AT MANHOLE

ACCESS ROAD AND CAR PORTS TO BE OF PERMEABLE CONSTRUCTION HOWEVER DUE TO THE SLOPE OF THE SITE AND TO BE CONSERVATIVE, THE CALCULATIONS REFLECT NO INFILTRATION AND 100% RUNOFF TO GO TO SOAKAWAY.
DESIGN TO BE CONFIRMED AND BAFFLES IMPLEMENTED TO SUIT IF NEEDED.

RAINWATER PIPE LOCATIONS TO BE CONFIRMED

DESIGN PHILOSOPHY
DRAINAGE TO USE NATURAL SLOPE ON SITE TO CONVEY SURFACE WATER RUNOFF TO SOAKAWAY.

EXTERIOR HARDSTANDING AREAS (ACCESS ROAD AND CAR PORTS ARE TO BE OF PERMEABLE CONSTRUCTION HOWEVER DUE TO THE SLOPE AND TO BE CONSERVATIVE, FOR THE PURPOSES OF THE CALCULATIONS MERIDIAN HAVE ASSUMED 0% INFILTRATION ON THESE HARDSTANDING AREAS WITH 100% OF RUNOFF GOING TO SOAKAWAY - THIS MAY CHANGE AT DETAILED DESIGN STAGE

SURFACE WATER TO BE DISCHARGE FROM SITE VIA INFILTRATION UTILISING CHALK GEOLOGY

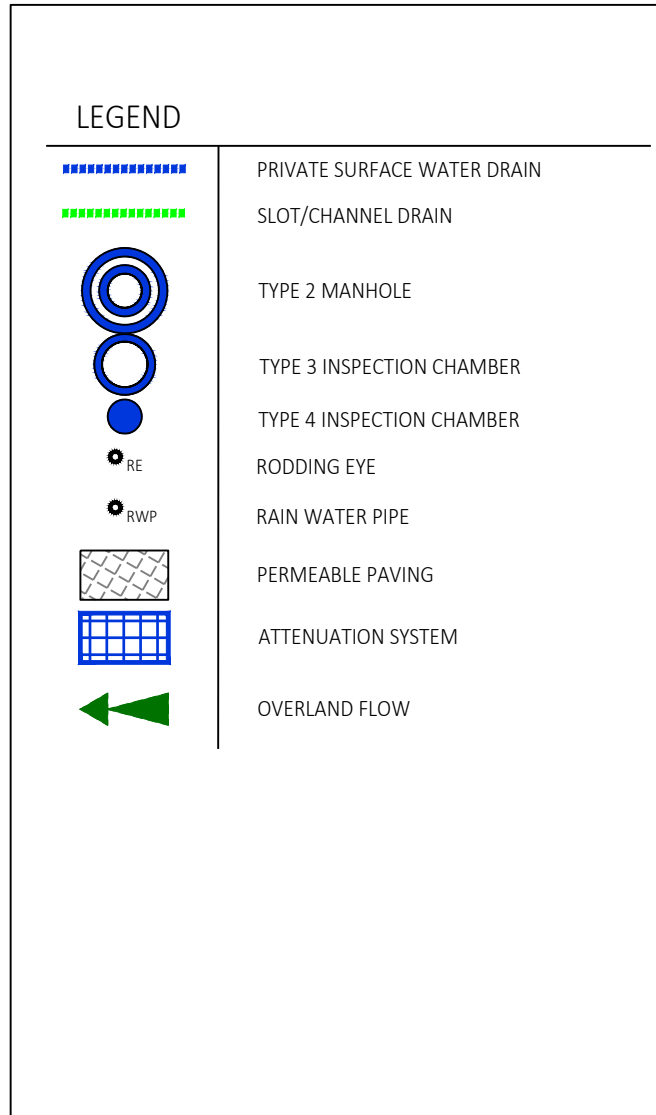
TOTAL CONTRIBUTING (TO SOAKAWAY) AREA = 3447m²

Type 02 BUILDING x 13 = 1040m²
Type 01 BUILDING x 3 = 336m²
Management and Security BUILDING = 101m²
= 1477m²
+ 10% = 1625m²

ACCESS ROAD + CARPORTS = 1656m²
+ 10% = 1822m²

RAINWATER PIPES LOCATION TO BE CONFIRMED BY ARCHITECT
LOCATION AND DESIGN OF SOAKAWAY TO BE CONFIRMED AT DETAILED DESIGN STAGE

- GENERAL
a. THIS DRAWING IS NOT TO BE SCALED, WORK TO FIGURED DIMENSIONS ONLY, CONFIRMED ON SITE.
b. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTURAL DRAWINGS, DETAILED SPECIFICATIONS WHERE APPLICABLE AND ALL ASSOCIATED DRAWINGS IN THIS SERIES.
c. ANY DISCREPANCY ON THIS DRAWING IS TO BE REPORTED IMMEDIATELY TO THE PARTNERSHIP FOR CLARIFICATION.
d. THE CONTRACTOR IS RESPONSIBLE FOR ALL TEMPORARY WORKS AND FOR THE STABILITY OF THE WORKS IN PROGRESS.
e. 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.
f. CDM REGULATIONS 2015. FOR GENERIC MAINTENANCE AND MANAGEMENT RISKS REFER TO CHAPTER 36 OF CIRIA 752 SUDS MANUAL. FOR PROPRIETARY SYSTEMS SEE MANUFACTURER'S MANAGEMENT AND MAINTENANCE DETAILS AND RISK ASSESSMENT WITH REGARDS TO MAINTENANCE OF PROPRIETARY SYSTEMS.
- CONSTRUCTION NOTE
a. 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.
b. THE MAIN CONTRACTOR IS RESPONSIBLE FOR ALL OCCURRENCES OF GROUND WATER DURING THE CONSTRUCTION PERIOD.
c. 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.
d. THE CONTRACTOR MUST COMPLY WITH ALL CURRENT LEGISLATION RELATING TO HEALTH & SAFETY.
e. 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
- BELOW GROUND DRAINAGE
a. UPVC-U PIPES TO BS 46607: 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
b. ALL ADAPTABLE DRAINAGE TO BE CONSTRUCTED IN ACCORDANCE WITH SEWERAGE SECTOR GUIDANCE App C - DESIGN AND CONSTRUCTION GUIDANCE AND THE RELEVANT COUNCIL DESIGN GUIDE.
c. 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.
d. 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.
e. ALL PRIVATE SURFACE WATER SEWERS TO BE LAID AT 1 IN 100 UNLESS OTHERWISE STATED ON THE DRAWING.
f. ALL PRIVATE SURFACE WATER SEWER PIPES TO BE 100mm DIAMETER FROM DOWNPIPES AND 150mm DIAMETER ELSEWHERE UNLESS OTHERWISE STATED ON THE DRAWING.
g. ALLOW FOR RODDING ACCESS ABOVE GROUND WHERE RAINWATER DOWNPIPES OR SOIL STACKS DO NOT HAVE A DIRECT CONNECTION TO AN INSPECTION CHAMBER.
h. EXISTING SEWER PIPE TO BE RE-USED TO BE SURVEYED AND LEVELED PRIOR TO COMMENCEMENT OF THE DRAINAGE WORKS AND REBURNISHED IF NECESSARY.
i. CONNECTIONS TO AN ADOPTED SEWER ONLY TO BE MADE FOLLOWING APPROVAL FROM THE RELEVANT ADOPTING AUTHORITY.
j. ALL DRAINS, SEWER PIPES AND MANHOLES TO BE CLEANED AND TESTED FOR WATER TIGHTNESS ON COMPLETION OF CONSTRUCTION.
- MANHOLE COVERS AND FRAMES
a. MANHOLE COVERS TO BE CLASS D400 IN HIGHWAYS, CLASS B125 IN FOOTWAYS AND VERGES, CLASS A15 IN NON-TRAFFICKED AREAS.
b. MANHOLE COVER AND FRAME TO BE BEDDED AND SURROUNDED IN 1:3 MORTAR.



REV:	DESCRIPTION:	BY:	DATE:
STATUS:			

MERIDIAN
CIVIL ENGINEERING CONSULTANCY

CLIENT: William Cook & Eddie Powell

SITE: Little Acres, Longfield Avenue, Longfield, DA3 7LA.

TITLE: Surface Water Drainage Strategy - Proposed Layout

SCALE AT A1: 1:500	DATE: 07/02/2022	DRAWN: SL	CHECKED: MN
PROJECT NO: MC0062	DRAWING NO: CIV01	REVISION:	-

APPENDIX IV Supplementary Documents