Flood Risk Assessment and Drainage Strategy

School Close, Bampton, EX16 9NN

Presented to: ZedPods Ltd

Issued: December 2022

Delta-Simons Project No: 89427.549873

Protecting people and planet

Report Details

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Report Title	Flood Risk Assessment and Drainage Strategy
Site Address	School Close, Bampton EX16 9NN
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Delta-Simons Contact	Alex Perryman [redacted]

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Reference of Terms

Canal Failure

Canal failure can include a breach or overtopping of a canal system due to the effects of a high intensity rainfall event or structural failure that is not associated with a rainfall event. Such failure can be very dangerous as it can involve the rapid release of large volumes of water at high velocity, however, it is typically limited to reaches of canal that are raised above the surrounding ground level on one or both side and where watercourses or other structures pass beneath the canal. The size and nature of canals themselves can also have a hydraulic control on the mechanisms of flooding associated with a failure, resulting in a rapid peak in flow followed by a gradual reduction as the flow becomes restricted by the capacity of the canal itself to rapidly pass flow to the breach or failure point.

Fluvial Flooding

Fluvial flooding typically occurs when a river's capacity is exceeded, and the excess water overtops the river banks. It can also occur when the watercourse has a high level downstream, perhaps due to structures or blockage, thus limiting conveyance. This creates a back-up of water which can overtop the banks. Typical flooding issues occur when the natural floodplain has been urbanised and the river has been confined.

Groundwater Flooding

Groundwater flooding is caused by the emergence of water from beneath the ground at either point or diffuse locations when the natural level of the water table rises above ground level. This can result in deep and long-lasting flooding of low-lying or below-ground infrastructure such as underpasses and basements. Groundwater flooding can cause significant damage to property, especially in urban areas, and can pose further risks to the environment and ground stability.

Reservoirs Failure

Reservoir failure can be a particularly dangerous form of flooding as it results in the sudden release of large volumes of water that can travel at high velocity. This can result in deep and widespread flooding, potentially resulting in significant damage. The likelihood of reservoir flooding occurring is generally extremely low given that all large reservoirs are managed in accordance with the Reservoirs Act 1975. Under the Reservoirs Act 1975, a large, raised reservoir is defined as one that holds over 25,000 cubic metres of water above the level of the surrounding land. The EA's online reservoir inundation map illustrates the maximum flood extents that could potentially occur in the event of a reservoir failure.

Sewer Flooding

Flooding from sewers primarily occurs when flow entering a system exceeds available capacity or if the network capacity has been reduced through blockage or collapse. In the case of surface water sewers that discharge to watercourses, the same effect can be caused as a result of high water levels in the receiving watercourse. As a result, water can begin to surcharge the sewer network, emerging at ground level through gullies and manholes and potentially causing flooding to highways and properties. If this occurs flooding can represent a significant hazard to human health due to the potential for contaminants in flood water.

Surface Water Runoff

Surface water runoff is defined as water flowing over the ground that has not yet entered a drainage channel or similar. It usually occurs as a result of an intense period of rainfall which exceeds the infiltration capacity of the ground. Typically, runoff occurs on sloping land or where the ground surface is relatively impermeable. The ground can be impermeable either naturally due to the soil type or geology, or due to development which places impervious material over the ground surface (e.g. paving and roads).

Tidal Flooding

Tidal flooding is caused by high tides coinciding with a low-pressure storm system which raises sea and tidal water levels, overwhelming coastal and river defences. This may be made worse by gale force winds blowing the raised body of water up tidal river basins some distance from the coast, due to floodwater being forced up the tidal reaches of rivers and estuaries. Such flooding may become more frequent in future years due to rising sea levels.

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Appendices

1.0 Introduction

1.1 Appointment

1.1.1 Delta-Simons Limited ("Delta-Simons") was instructed by ZedPods Ltd (the "Client") to carry out a Flood Risk Assessment (FRA) and Drainage Strategy (DS) of land at School Close, Bampton EX16 9NN (the "Site").

1.1.2 The assessment considers potential flood risks from all sources and provides options for managing any Site-specific flood risks identified, based on the future residential use of the Site.

1.2 Project Understanding

1.2.1 On the Environment Agency (EA) Flood Map for Planning, the Site is shown to be wholly within Flood Zone 1 (Low Probability). The Site is proposing in excess of 10 dwellings and therefore, is considered to be a major application.

1.2.2 The aim of this report is to provide a robust assessment of potential flood risk to the Site, the impact of the proposed development on flood risk elsewhere, and the proposed measures which could be incorporated to mitigate the identified risk. This report has been prepared in accordance with the guidance contained in the National Planning Policy Framework (NPPF) revised in July 2021, and the National Planning Practice Guidance (NPPG) Flood Risk and Coastal Change, revised in August 2022.

1.2.3 Devon County Council (DCC) as Lead Local Flood Authority (LLFA) is a statutory consultee for major planning applications in relation to surface water drainage, requiring that all planning applications are accompanied by a Sustainable Drainage Strategy. The aim of the Sustainable Drainage Strategy is to identify water management measures, including Sustainable Drainage Systems (SuDS), to provide surface water runoff reduction and treatment.

1.3 Scope of Works

1.3.1 The scope of works has been as follows for this FRA:

Assess flood risk from all sources using best available information, including review of EA data and mapping, topography and historical records;

Assess previous relevant available third-party studies, local authority plans or strategies;

Advise on flood mitigation measures and residual risks;

Assess evacuation routes;

Advise on availability of flood warnings;

Identify the requirement for a Sequential Test; and

Prepare FRA report.

1.3.2 The scope of works has been as follows for the DS:

Review existing conditions including sewer plans, British Geological Survey information and topographical information;

Review LLFA (DCC) drainage policies;

Analyse existing and proposed impermeable areas;

Calculate existing runoff rates (excluding existing drainage system modelling);

Assess method of surface water runoff disposal (soakaway/watercourse/sewer);

Establish surface water discharge rate in consultation with the LLFA/sewerage provider;

Estimate required attenuation volume using MicroDrainage or similar;

Assess and advise on suitable forms of SuDS;

Advise on drainage system maintenance measures;

Advise on surface water treatment methods;

Establish method of foul water drainage;

Prepare concept drainage sketch (where development plan is available as dwg. format); and

Prepare DS report.

1.3.3 This report takes into account the following national and local policies:

National Planning Policy Framework (NPPF) (2021)[1];

National Planning Practice Guidance (NPPG) (updated 2022)[2];

CIRIA Guidance: The SuDS Manual (C753) (2017)[3]; and

DCC and Mid Devon District Council Local Development and Planning Policies.

1.4 Sources of Information

1.4.1 The following sources of information have been reviewed and assessed for the purpose of this FRA:

EA Online Flood Maps[4];

British Geological Society (BGS) Interactive Map[5];

MAGIC Interactive Map[6];

DCC Preliminary Flood Risk Assessment (2011 PFRA);

DCC Surface Water Management Plan (2012 SWMP); and

Mid Devon District Council Strategic Flood Risk Assessment (2014 SFRA).

1.5 Project Limitations

1.5.1 The wider Delta-Simons limitations are contained within Appendix A.

1https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1004408/NPPF_JULY_2021.pdf
2 http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change/
3 https://www.ciria.org/Resources/Free_publications/SuDS_manual_C753.aspx
4 https://flood-map-for-planning.service.gov.uk/
5 http://mapapps.bgs.ac.uk/geologyofbritain/home.html
6 http://www.magic.gov.uk/

2.0 Site Description

2.1.1 The aim of this section of the report is to outline key environmental information associated with the baseline environment.

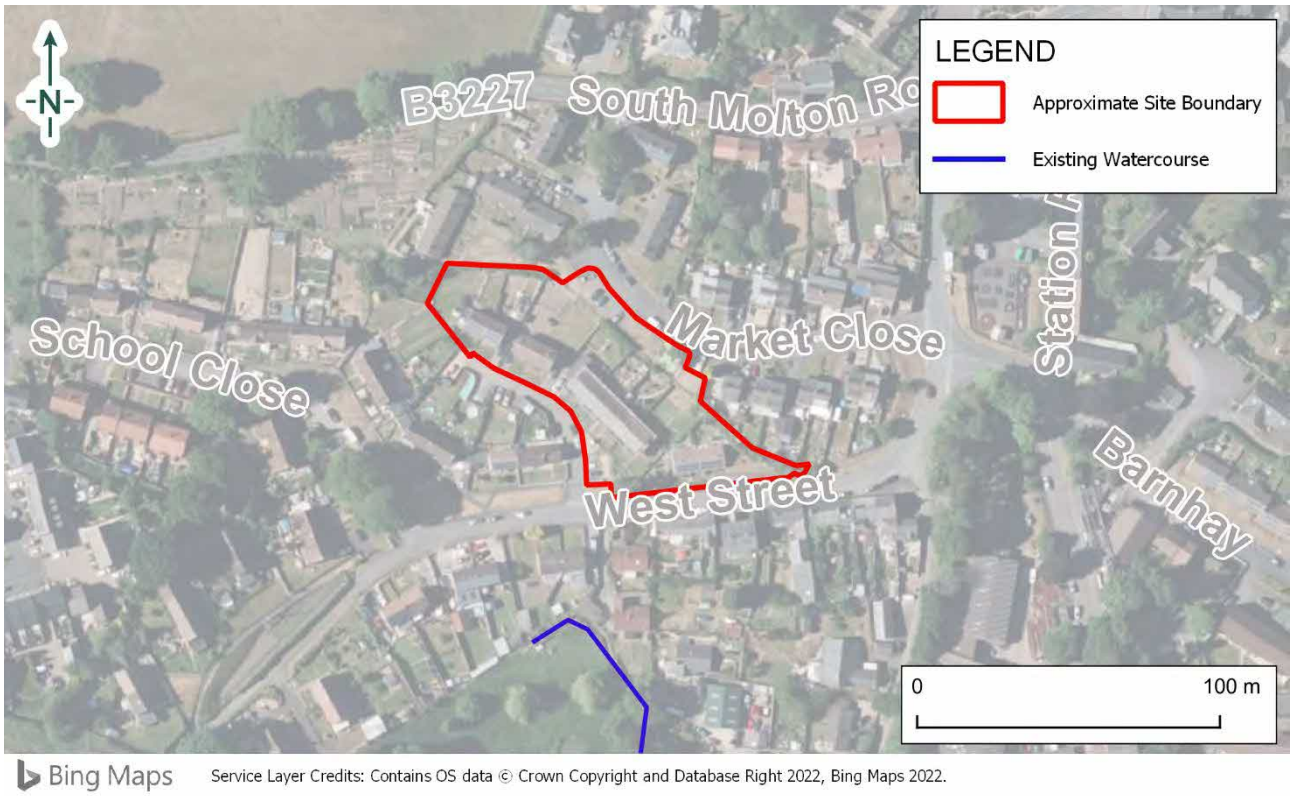


Figure 1: Site Location Plan

Co-ordinates	Centred approximately at National Grid Reference (NGR) 295480, 122140.	**Area (approx.)**	0.46 Ha
Site Location	The Site is located north of West Street within the town of Bampton, Devon and is located approximately 12.2 km north-west of the M5 motorway.		
Existing Site Conditions	An Existing Site Landscaping Plan is included as Appendix B and identifies that the existing Site includes existing buildings which, comprise 10 residential dwellings, and associated soft landscaped areas. The Site is bordered: To the north and east by Market Close and further residential properties; To the south by West Street beyond which lies further residential properties and a land drain; and To the west by residential properties. Access to the Site is provided from West Street to the south and School Close to the west. Hardstanding areas on Site currently occupies approximately 0.09 Ha or 20 % of the total Site area. The remaining permeable, soft landscaped areas occupy 0.36 Ha or 80 % of the total Site area.		

Topography	A topographical survey was undertaken by Clifton Surveys Ltd in December 2022 and is included in Appendix C. The topographical survey shows that the Site slopes from 105.02 metres Above Ordnance Datum (m AOD) in the south-east to 112.32 m AOD in the north. Topographic levels to m AOD have also been derived from a 1 m resolution Environment Agency (EA) composite 'Light Detecting and Ranging' (LiDAR) Digital Terrain Model (DTM). A review of LiDAR ground elevation data shows that the Site slopes from approximately 106 m AOD in the south-east to approximately 112 m AOD in the north. The surrounding area generally slopes up towards the north-east. A LiDAR extract is included in Appendix C.
Hydrology	The nearest watercourse is a land drain which is located approximately 40 m south of the Site. The land drain flows south into the River Batherm, a Main River (under the jurisdiction of the EA) which flows in a south-western direction. Other watercourses in the area include Shuttern Brook located approximately 340 m north-east of the Site which flows in a south-easterly direction.
Geology	Reference to the British Geological Survey (BGS) online mapping (1:50,000 scale) indicates that the Site is underlain by superficial deposits in the central and southern extents described as Colluvium (Diamicton). The superficial deposits are identified as being underlain by bedrock deposits from the Bampton Limestone Formation which is described as comprising limestone. The geological mapping is available at a scale of 1:50,000 and as such may not be accurate on a Site-specific basis. There are no historical boreholes available at the Site or in the vicinity.
Hydrogeology	According to the EA's Aquifer Designation data, obtained from MAGIC Map's online mapping [accessed 09/12/2022], the superficial deposit is classified as Unproductive Strata. Unproductive Strata are 'rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow'. The underlying bedrock deposit is classified as a Secondary A Aquifer. Secondary A Aquifers are 'permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers'. The EA's 'Source Protection Zones' data, obtained from MAGIC Map' mapping [accessed 09/12/2022], indicates that the Site is not located withir Groundwater Source Protection Zone. The Soilscapes mapping obtained from MAGIC Map's online mapping [accessed 09/12/2022] shows the Site to be located in '*freely draining slightly acid loamy soils*'.
Local Drainage	<u>On-Site Drainage</u> The topographic survey within Appendix C indicates the following sewers within and in the vicinity of the Site: A 150 mm diameter surface water passing through the central area of the Site. The sewer is shown to trend in a southerly direction before discharging into a 150 mm diameter beneath School Close. This sewer continues to dra southerly direction towards a further 150 mm diameter surface water sew beneath West Street; Foul effluent from the existing residential dwellings appears to be drained via 100 mm diameter foul sewer which drains in an easterly direction be

	discharging into a 150 mm diameter sewer. This sewer flows in a southe direction beneath School Close. **Off-Site Drainage** Public sewer records have been obtained from South West Water (SWW) and are included in Appendix D. The SWW sewer records show that the following public sewers are within the Site: An existing public surface water sewer is shown to pass through the central area of the Site, draining in a southerly direction. This sewer appears to correlate to the sewer identified within the topographic survey; A 150 mm diameter public surface water sewer is indicated to the front of the existing residential dwellings adjacent to School Close. This sewer appears to correlate to surface water sewer identified on the topographic survey. A public foul sewer runs south-east (diameter unconfirmed) within Market Close within the northern extents of the Site; A public combined sewers are identified to the rear of the existing residential dwellings. The sewers are shown to drain towards the centre of the Site before draining in a southerly direction beneath School Close. In addition to the public sewers described above, the public sewer records also indicate a clean water distribution main located within School Close along the south-western Site boundary, and two abandoned sewer pipes running through tl northern extents and central extents of the Site. Invert levels were not provided for the public sewer records.
Proposed Site Conditions	The proposed development is for the demolition of the existing units on Site and construction of new 2 and 3 storey homes (totalling 18 units), with 38 parking spaces proposed (an increase on the existing 13 car parking spaces). A Proposed Development Plan is included in Appendix E. The proposed development will result in an increase in hardstanding areas in the form of buildings and access. Hardstanding will comprise approximately 0.2 Ha or 33% of the total Site area. The remaining permeable, soft landscaped areas will occupy 0.26 or 67% of the total Site area. These values have been derived from the Proposed Landscaping Plan included as Appendix F.

3.0 Relevant Planning Policy and Guidance

3.1 Introduction

3.1.1 The aim of this section of the report is to discuss the main aspects of the local and national planning policies that are relevant to any proposed development on the Site and relevant guidance and legislation.

3.2 Assessment of Flood Risk

3.2.1 The flood risk from fluvial and coastal flooding is assessed through the use of the EA Flood Map for Planning. This map defines three zones of different flood risk, the third of which is subdivided into two categories:

Zone 1 “Low probability of flooding” –This zone comprises land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%);

Zone 2 “Medium probability of flooding” –This zone comprises land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% –0.1%), or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% –0.1%) in any year;

Zone 3a “High probability of flooding” –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; and

Zone 3b “Functional floodplain” –A sub-part of Zone 3, this zone comprises land where water has to flow or be stored in times of flood. The zone comprises land assessed as having a 1 in 30 or greater annual probability of flooding, with any existing flood risk management infrastructure operating effectively; or land that is designed to flood even if it would only flood in more extreme events. This zone is not normally included within the national Flood Map for Planning and is calculated where necessary using detailed hydraulic modelling.

3.3 National Planning Policy Framework

3.3.1 Flood risk in England is normally considered through the planning process in the NPPF (2021), produced by Ministry of Housing, Communities and Local Government.

3.3.2 The principal aim of the NPPF assessment of flood risk is that:

“Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (whether existing or future). Where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere”.

3.3.3 The NPPF requires a FRA to be produced where development Sites are:

Greater than one hectare in size;

All proposals for new development (including minor development and change of use) in Flood Zones 2 and 3;

Or in an area within Flood Zone 1 which has critical drainage problems (as notified to the local planning authority by the EA);

Identified in a Strategic Flood Risk Assessment as being at increased risk in the future; and

Where proposed development or a change of use to a more vulnerable class may be subject to other sources of flooding.

3.3.4 The NPPF requires that developers consider not just the flood risk to the development but also the impact that the development might have on flood risk elsewhere. As well as Main Rivers and the sea, it is also necessary to consider flood risk from other sources, including surface water, groundwater, Ordinary Watercourses, artificial drainage systems, canals and reservoirs.

Sequential Test

3.3.5 A key part of the NPPF is that a proposed development must first pass a "Sequential Test" to demonstrate that the overall development proposal is appropriate in terms of flood risk. The aim of the Sequential Test is to steer new development toward the areas at lowest risk of flooding from all sources including areas at risk of surface water flooding.

Exception Test

3.3.6 The Exception Test determines whether the benefits of the proposed development will outweigh the potential flood risk. Within the NPPF, the Exception Test states that:

> It must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a SFRA where one has been prepared; and
>
> A Site-specific flood risk assessment must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

3.3.7 Further consideration of the requirements of the Sequential and Exception Test is provided in Section 6 in consideration of the assessment of the sources of flooding described in Section 4.

3.4 Local Policy

3.4.1 The Mid Devon district Council Local Plan 2013-2033 (adopted July 2020) contains the following policies related to flood risk in Tiverton:

Policy S9: Environment

'..C) The provision of measures to reduce the risk of flooding to life and property, requiring sustainable drainage systems including provisions for future maintenance, guiding development to locations of lowest flood risk by applying a sequential test where appropriate, and avoiding an increase in flood risk elsewhere;

3.5 Consultation

Environment Agency

3.5.1 A pre-planning opinion request was submitted to the EA in November 2022. A response was received on the 13/12/22 and has been included in Appendix G. The response from the EA confirms the Site is located within Flood Zone 1.

Lead Local Flood Authority

3.5.2 A consultation request was submitted to the LLFA in December 2022. A response was received and comments from the LLFA are included below:

> '*There is a land drain within the site. This is mapped by SWW as a SWW asset and we would recommend getting in touch with them for full details on this.*
>
> *We hold no records of internal property flooding in this location.*
>
> *DCC's Flood Incident database is primarily concerned with properties/communities affected, so if the land associated with the property has flooded in the past, it is unlikely that it would be recorded on our systems.*

Both DCC and the EA's historic flood databases are not exhaustive datasets. If we have no records of internal property flooding at this address, it does not mean that it has never occurred, as we are reliant upon residents to report flooding to us when it occurs.'

Internal Drainage Board (IDB)

3.5.3 The Site is not located within an IDB District.

4.0 Assessment of Flood Risk

4.1 Tidal Flood Risk

4.1.1 The Site is situated at a minimum of approximately 105 m AOD and is significantly above sea level. The Site is also located approximately 22.5 km from the nearest coastline. Therefore, the risk of tidal flooding is considered to be **Negligible**.

4.2 Fluvial Flood Risk

4.2.1 The nearest watercourse is a land drain which is located approximately 40 m south of the Site and flows south into the River Batherm. According to the EA online Flood Map for Planning (Figure 2), the Site is situated wholly within Flood Zone 1.

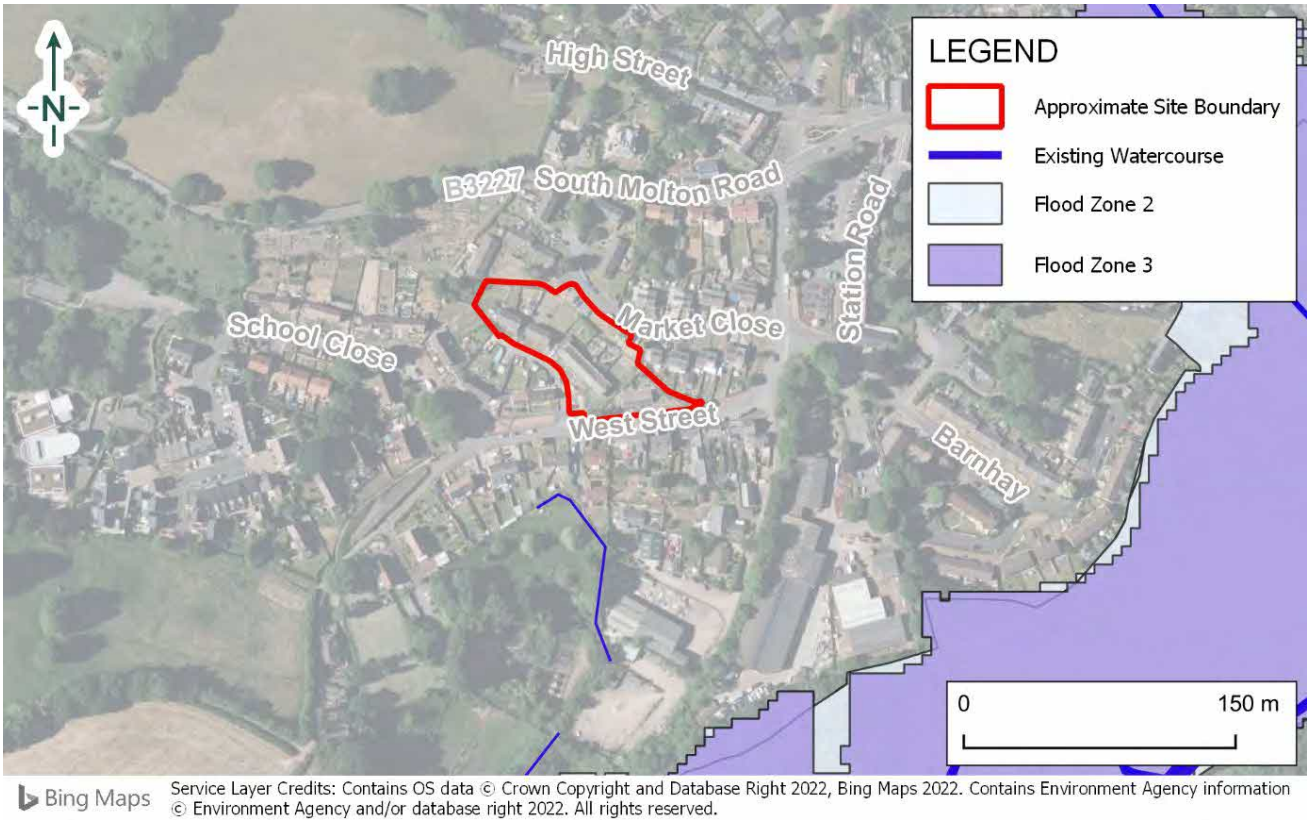


Figure 2: EA's Flood Map for Planning

4.2.2 The EA 'Historical Flood Map' (Appendix H) indicates that the Site has not experienced any historical flooding events. There is no information within relevant third-party reports to suggest the Site has historically flooded.

4.2.3 In July 2021, the EA published updated climate change guidance for peak river flows which require climate change allowances to be considered based on the lifetime and vulnerability of proposed development considering the river catchment management area in which the Site is located.

4.2.4 According to the EA Peak River Flow Map, the Site is located within the East Devon Management Catchment area in which more vulnerable development is required to consider a maximum 46% allowance for climate change which caters for an assumed 100 year design life.

4.2.5 A review of ground elevation indicates the Site is raised a minimum of approximately 8 m above the nearest flood extent and thus it is reasonable to conclude that the Site will continue to remain in Flood Zone 1 considering the impacts of climate change.

4.2.6 Based on the above, the overall risk of fluvial flooding is considered to be **Low**.

4.3 Surface Water Flood Risk

4.3.1 The EA 'Flood Risk from Surface Water' map (Figure 3) indicates that the Site is at predominantly Very Low risk (<0.1% annual probability) of surface water flooding with a small area within the central extents at Low risk (0.1 –1% annual probability).

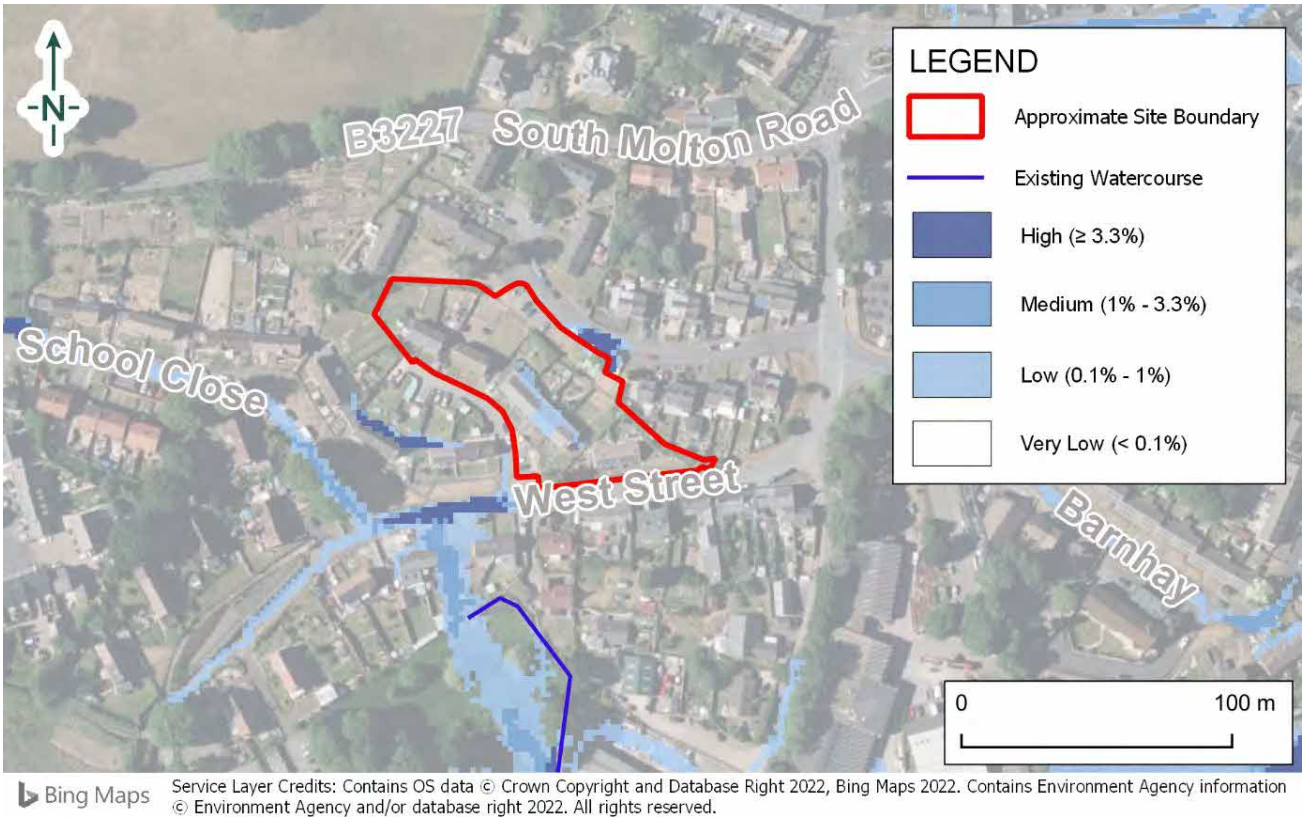


Figure 3: EA's Long-Term Flood Risk Map (Flood Risk from Surface Water)

4.3.2 During the High and Medium risk scenarios, the Site is expected to remain flood free. During the Low risk scenario, the Site is expected to have depths of up to 300 mm which remains passable to people and vehicles. Any potential surface water flooding arising at or near to the Site would be directed south-east, away from the Site, following the local topography. There are no distinct flow routes in the area which would direct any potential surface water flooding towards the Site.

4.3.3 The DCC Environment Viewer[7] indicates that the Site is not within a Critical Drainage Area. There is no information within relevant third-party reports which suggests that the Site has historically flooded.

4.3.4 Based on the above, the overall risk of surface water flooding is considered to be **Low**. The Site is located in an area with a low probability of flooding and therefore development is considered appropriate in this location. The impact of the development on surface water risk is covered in Section 5.0 to ensure that surface water risk is not exacerbated through appropriate SuDS measures.

4.4 Groundwater Flood Risk

4.4.1 Online mapping indicates that the Site is underlain by superficial deposits described as Colluvium which are further underlain by bedrock deposits described as the Bampton Limestone Formation.

[7] https://maptest.devon.gov.uk/portaldvl/apps/webappviewer/index.html?id=82d17ce243be4ab28091ae1f15970924

4.4.2 Area susceptible to Groundwater Flooding mapping contained within the 2011 PFRA identifies the Site is within an area considered to be less than 25 % susceptible to groundwater flooding.

4.4.3 There is no information within relevant third-party reports to suggest the Site has historically flooded. Furthermore, the Site is located approximately 40 m from the nearest watercourse and 1 m above the watercourse which flows away from the Site. Therefore, groundwater levels within the Site are unlikely to be significantly influenced by the fluctuations of nearby river levels. Furthermore, no basement levels are identified on plans.

4.4.4 Based on the above, the overall risk of groundwater flooding is considered to be **Low**.

4.5 Artificial Sources Flood Risk

Sewer Flooding

4.5.1 Any potential flooding arising from the sewers within the Site and its vicinity would be directed in the general south-western direction following the local topography. There are no distinct flow routes in the area which would direct any potential flooding arising from the sewers in the wider vicinity to towards the Site, however the sewers shown to be located within the Site could have the potential to impact the proposed development, should any sewer flooding occur.

4.5.2 There is no information within relevant third-party reports to suggest the Site has historically flooded. SWW were consulted regarding any issues with the public sewer system at the Site and in the surrounding area and a response was received on 16/12/2022, which stated:

'I can confirm that we did have a few sewer floodings in 2018, this was caused by blockages which were cleared. No sewer floodings have been reported for 2021 or 2022 in School Close.'

4.5.3 Based on the above, the overall risk of sewer flooding is considered to be **Low**. Notwithstanding, it is recommended that the finished floor level of the proposed development is raised a minimum of 300 mm above surrounding ground levels in order to reduce the potential for the ingress of water in the event of sewer flooding.

Canal Flooding

4.5.4 There are no canals within the vicinity of the Site. Based on the above, the overall risk of canal flooding is considered to be **Negligible**.

Reservoir Flooding

4.5.5 The EA 'Flood Risk from Reservoirs' map shows that the Site is not within the extents of a breach or overtopping event. The EA state that reservoir flooding is extremely unlikely to happen. All large reservoirs must be inspected and supervised by reservoir panel engineers. As the enforcement authority for the Reservoirs Act 1975 in England, the EA ensure that reservoirs are inspected regularly, and essential safety work is carried out. Based on the above, the overall risk of reservoir flooding is considered to be **Negligible**.

4.6 Mitigation

4.6.1 It can be concluded that the Site is at **Negligible to Low** risk of flooding from all sources. Therefore, no Site-specific mitigation measures are considered necessary. Notwithstanding, it is recommended that finished floor levels of the proposed development are raised a minimum of 300 mm above surrounding ground levels.

4.7 Impact on Flood Risk Elsewhere

4.7.1 The proposed development is for the demolition of the existing units on Site and construction of new 2 and 3 storey homes (totalling 18 units) with 38 parking spaces proposed (an increase on the existing 13 car parking spaces). All buildings will be located outside of the 1 % AEP plus CC flood extent. No ground raising is proposed within the flood extent. The development will therefore not remove flood storage space from the floodplain.

4.7.2 The potential for the inclusion of SuDS is outlined in Section 5.0 below.

5.0 Drainage Strategy

5.1 Introduction

5.1.1 The Site currently comprises brownfield land comprising existing residential dwellings. The proposed development is for the demolition of the existing units on Site and construction of new 2 and 3 storey homes (totalling 18 units) with 38 parking spaces proposed (an increase on the existing 13 car parking spaces), and will result in a hardstanding area of approximately 0.20 Ha and a soft landscaped area of approximately 0.26 Ha.

5.1.2 Consultation with Devon County Council, in its role as LLFA, has been undertaken. Within their response, the LLFA provided a link to their online surface water management guidance which has been considered where applicable within this section of the report. The guidance indicates that Devon County Council requires developments to account for a 10% allowance for urban creep. This considers the potential for future increases in impermeable areas within the Site (i.e. the paving cover of soft landscaped garden areas). For the purposes of this assessment, including the 10% allowance for urban creep, an overall hardstanding area of 0.22 ha has been considered.

5.1.3 Generally, this type of development is considered to have a design life of 100 years, therefore, for the purposes of this assessment, a 45% for peak rainfall intensity has been considered in accordance with the DEFRA Climate Change Allowances for Peak Rainfall in England Guidance updated in May 2022.

5.2 Surface Water Discharge

5.2.1 Based on the current brownfield nature of the Site, existing brownfield runoff rates have been estimated using the Modified Rational Method which is set out as follows:

2.78 ( ) (h)

5.2.2 The existing brownfield runoff rates are summarised in Table 1 below. The existing 1 in 1 year event greenfield rate for the 0.16 ha development Site is 0.91 l/s and the 1 in 1 year event brownfield rate is 5.8 l/s.

Table 1: Runoff Rates

Return Period (Years)	Brownfield Runoff Rate (l/s) estimated using Modified Rational Method
1 in 1	5.8
1 in 2	6.5
1 in 10	10.0
1 in 30	12.4
1 in 100	15.7
1 in 1000	26.9

5.3 Proposed Discharge Rates

5.3.1 it is proposed to restrict surface water runoff during all events up to and including the 1 in 100 year + 45% CC event to 2.9 l/s which represents 50% betterment over the existing brownfield runoff rate. Restricting surface water runoff to 2.9 l/s for all events up to and including the 1 in 100 year plus climate change event will provide significant betterment over the existing brownfield rates as evidenced by the reduction in runoff during the 1 in 1 year event shown in Table 2 below:

Table 2: Reduction in brownfield rates by limiting discharge rate to 2.9 l/s

Return Period (Years)	Reduction (%)
1 in 1	50
1 in 2	55
1 in 10	71
1 in 30	77
1 in 100	82
1 in 1000	89

5.4 Attenuation Storage

5.4.1 In order to achieve a discharge rate of 2.9 l/s, attenuation storage will be required. MicroDrainage Quick Storage Estimates have been undertaken to determine the potential attenuation requirements during the 1 in 100 year plus 45 % climate change events based on a hardstanding area of 0.16 ha. MicroDrainage Quick Storage Estimate calculations are included as Appendix H and summarised in Table 3.

Table 3: Attenuation Storage Volume Requirements

Storm Event	Attenuation Volume (m^3)
1 in 100 year plus 45 % CC	111 - 172

5.4.2 The attenuation volumes are provided for indicative purposes only and should be verified at the detailed design stage.

5.5 Drainage Hierarchy

5.5.1 The recommended surface water drainage hierarchy (Paragraph 080 of the NPPG: Flood Risk and Coastal Change) is to utilise soakaway systems or infiltration as the preferred option, followed by discharging to an appropriate watercourse. If this is not feasible, the final option is to discharge to an existing public sewer.

To ground (infiltration)

5.5.2 The first consideration for the disposal of surface water is infiltration (soakaways and permeable surfaces). As described above the Site is underlain by superficial deposits in the central and southern extents described as Colluvium (Diamicton) which is underlain by bedrock deposits described as Bampton Limestone Formation consisting of limestone across the Site. Soilscapes mapping also describes the Site as '*freely draining*'.

5.5.3 It can be concluded that soakaways may be suitable for the discharge of surface water runoff. Infiltration tests should be undertaken in accordance with the BRE365 specification to determine the suitability of soakaways. For the purposes of this assessment and in lieu of Site specific infiltration rates, alternative surface water discharge locations have been considered to provide a viable surface water solution in the event that infiltration is found to be unsuitable within the Site.

To a surface water body

5.5.4 Where soakaways are not suitable a connection to watercourse is the next consideration.

5.5.5 The Site is separated from the nearest land drain by third party, urbanised land. Therefore, discharge to watercourse is not considered to be feasible.

To a surface water sewer, highway drain or another drainage system

5.5.6 Where disposal of surface water to watercourse is not possible, a connection to the public sewer system is the final consideration. According to the topographic survey, an existing 150 mm diameter is shown to flow through the centre of the Site in a southerly direction towards School Close. This sewer appears to form part of the public surface water sewer network.

5.5.7 Based on the proximity of the sewer to the proposed development, it is proposed to provide a surface water connection to the public surface water sewer network. The connection to the public surface water sewer network should be agreed with South West Water.

To a combined sewer

5.5.8 As described above, a connection to surface water sewer is feasible and therefore, a connection to the public combined sewer is not required.

5.6 Sustainable Drainage Systems

5.6.1 Attenuation storage should be provided in the form of Sustainable Drainage Systems (SuDS) where practical. The following SuDS options have been considered:

Soakaways

5.6.2 As described above, the use of infiltration-based SuDS features has not been considered further at this stage in lieu of Site specific infiltration rates.

Swales, Detention Basins and Ponds

5.6.3 based on the scale and nature of the proposed development, there is limited space available for the provision of large above ground attenuation features.

Rainwater Harvesting

5.6.4 The attenuation benefits provided through the use of rainwater harvesting are considered to be limited and would only be realised when the tanks were not full. However, rainwater harvesting techniques could be incorporated within the final design to provide water for non-potable uses such as toilet flushing and irrigation of soft landscaped areas. Further consideration of the incorporation of rainwater harvesting will be required at the detailed design stage.

Green Roofs

5.6.5 Green roofs are not identified on development plans. Given the nature of the proposed development, the significant additional cost involved in installing and maintaining green roofs and the additional works required to allow for the additional loading on the building, green roofs are not considered a practical option. The benefits achieved through installing a green roof would be disproportionate to the significant ongoing maintenance and construction costs involved.

Porous/Permeable Paving

5.6.6 The Proposed Landscaping Plans included as Appendix F, indicates that the proposed development will include 590 m^2 of permeable paving within external paved areas and 525 m^2 of grasscrete within proposed car parking spaces. Storage will be provided within the sub-grade material prior to controlled release to the receiving sewer. Further consideration of the use of permeable paving is provided in Section 5.7.

Underground Geocellular Storage

5.6.7 Storage could be provided within underground attenuation tanks or within oversized pipes. However, the preferred method is to provide storage within permeable paving therefore the use of underground attenuation tanks has not been considered further at this stage.

5.7 Preferred Drainage Scheme

5.7.1 At this stage, a concept drainage sketch has been prepared and is included as Appendix I. The concept drainage sketch seeks to establish the principles of the proposed drainage strategy to ensure there is no increase in surface water runoff, and thus no increase in downstream flood risk, as a result of the proposed development. Detailed drainage design will be required at the detailed design stage.

5.7.2 As described in Section 5.3, it is proposed to restrict surface water generated by the development to 2.9 l/s during all events up to and including the 1 in 100 year plus 45 % climate change event.

5.7.3 In order to achieve this restriction, it is proposed to provide storage in the form of permeable paving/grasscrete within the parking and pavement areas. The permeable paving will measure 1,115 m^2 and is to have a depth of 0.45 m and a void ratio of 30% thereby providing up to 150.5 m^3 of attenuation.

5.7.4 MicroDrainage source control calculations (included as Appendix K) indicate that the proposed permeable paving will provide the full balance of attenuation required to achieve the proposed discharge rate of 2.9 l/s for up to the 1 in 100 year plus 45% climate change scenario. The location and dimensions of the proposed permeable paving should be confirmed at the detailed design stage.

5.7.5 Surface water runoff will be stored within the permeable paving and is to discharge into the surface water sewer within School Close via a HydroBrake or similar flow control device, subject to agreement with the LLFA and South West Water.

5.8 Event Exceedance

5.8.1 Storage will be provided for the 1 in 100 year plus 45 % CC event. Storm events in excess of the 1 in 100 year plus 45 % CC event should be permitted to produce temporary shallow depth flooding within the car park, access road and landscaped areas. Finished floor levels will be set at a minimum of 300 mm above surrounding ground levels thereby reducing the potential for the ingress of water during an exceedance scenario.

5.9 Surface Water Treatment

5.9.1 An assessment of the potential pollution risks attributed to the proposed development has been undertaken in accordance with the Simple Index Approach (SIA outlined in the CIRIA SuDS Manual C753. In the first instance, the SIA classifies the potential pollution hazards based on the proposed land use within the Site, as outlined in Table 4.

Table 4: Pollution Hazard Indices

Land Use	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Residential Roofs	Very Low	0.2*	0.2	0.05
Low Traffic Roads	Low	0.5	0.4	0.4

Table extract taken from the CIRIA C753 publication 'The SuDS Manual' –Table 26.2
* Indices values range from 0-1.
** up to 0.8 where there is potential for metals to leach from the roof

5.9.2 To ensure adequate treatment of surface water runoff is provided, proposed SuDS components should have a total pollution mitigation index (for each contaminant type) that equals or exceeds the pollution hazard index (for each contaminant type). It is proposed to provide attenuation in the form of permeable paving. The mitigation indices provided by the permeable paving is provided in Table 5.

Table 5: SuDS Mitigation Indices

	Mitigation Indices		
Type of SuDS	**Total Suspended Solids (TSS)**	**Metals**	**Hydrocarbons**
Permeable Pavement	0.7	0.6	0.7

Table extract taken from the CIRIA C753 publication 'The SuDS Manual' –Table 26.3

5.9.3 It can be concluded that the inclusion of permeable paving will provide sufficient treatment.

5.10 Maintenance

5.10.1 Maintenance of proposed SuDS features will be placed with an appropriate organisation. Indicative maintenance schedules for the proposed SuDS features are included as Appendix L.

5.11 Foul Water Discharge

5.11.1 Foul flows should be discharged to the public combined sewer located within the Site which appears to serve the existing units located on-Site, eventually running south and out of the Site. Appendix B also shows the Site to be served by a private foul water drainage system. A connection to the public combined sewer system via the private foul system appears to be a feasible option. The invert level of private Manhole FWS13 has an invert level of 105.46 m AOD and the proposed dwellings on-Site are located at a minimum elevation of approximately 107 m AOD; therefore, a gravity fed connection is feasible, and should be agreed with SWW.

5.12 Other Considerations

5.12.1 A 3 m clearance either side of the public sewers within the Site should be provided.

6.0 Sequential and Exception Test

6.1 Vulnerability Classification

6.1.1 In accordance with Annex 3 of the NPPF, residential developments are considered to be **'more vulnerable'**. Table 2 of the NPPG (reproduced in Section 6), states that '**more vulnerable'** development is considered appropriate within Flood Zones 1 and 2.

6.2 Sequential Test

6.2.1 The aim of the Sequential Test is to steer new development towards areas at the lowest risk of flooding from all sources including surface water.

6.2.2 The aim of the Sequential Test is to steer new development towards areas at the lowest risk of flooding from all sources including surface water. The proposed development is considered to meet the requirements of the Sequential Test as each source of flooding is considered to be a Low and Acceptable risk to the Site. This includes surface water risk which is predominantly Very Low risk to the Site.

6.3 Exception Test

6.3.1 In accordance with Table 3 'Flood Risk Vulnerability and Flood Zone Compatibility' (reproduced as Table 6 below) 'More Vulnerable' developments are considered appropriate within Flood Zone 1 without the requirement to apply the Exception Test.

Table 6: Flood Risk Vulnerability and Flood Zone Compatibility

Flood Zones	Flood Risk Vulnerability Classification				
	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water-Compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a	Exception Test required	✗	Exception Test required	✓	✓
Zone 3b	Exception Test required	✗	✗	✗	✓

✓ development is permitted
✗ development is not permitted

7.0 Conclusions and Recommendations

7.1 Conclusions

7.1.1 The proposed development is for the demolition of the existing units on Site and construction of new 2 and 3 storey homes (totalling 18 units) with 38 parking spaces proposed (an increase on the existing 13 car parking spaces).

7.1.2 The EA 'Flood Map for Planning' map shows that the Site is located within Flood Zone 1. The risk of flooding from all sources has been assessed and the flood risk to the Site is considered to be **Low and Acceptable.**

7.1.3 The proposed development will increase impermeable drainage area in the form of buildings and access. This will result in an increase in surface water runoff. In order to ensure the increase in surface water runoff will not increase flood risk elsewhere, flow control will be used, and attenuation provided on Site to accommodate storm events up to and including the 1 in 100 year plus 45 % climate change event.

7.1.4 All methods of surface water discharge have been assessed. Where soakaways are not possible, discharge of surface water to the public sewer system at a rate of 2.9 l/s appears to be the most practical option, subject to agreement with the LLFA and SWW.

7.1.5 Attenuation storage will be required on Site in order to restrict surface water discharge to 2.9 l/s. Attenuation can be provided within the sub-grade of the proposed permeable paving/grasscrete.

7.1.6 A connection to the public combined sewer system via the private foul system appears to be a feasible option. The invert level of private Manhole FWS13 has an invert level of 105.46 m AOD and the proposed dwellings on-Site are located at a minimum elevation of approximately 107 m AOD; therefore, a gravity fed connection is feasible, this should be agreed with SWW.

7.2 Recommendations

Flood Risk

Set finished floor levels 150 mm above surrounding ground levels.

Drainage Strategy

Undertake BRE 365 infiltration testing to determine the suitability of infiltration techniques;

Verify the attenuation volumes included in this report when undertaking detailed drainage design;

Undertake pre-development enquiry with SWW to confirm capacity within the public sewer network for the development; and

Make provision for sustainable drainage features across the car parking spaces within the Site.

Other

A 3 m clearance either side of the public sewers within the Site should be provided.

Appendix A –Limitations

Limitations

The recommendations contained in this Report represent Delta-Simons professional opinions, based upon the information listed in the Report, exercising the duty of care required of an experienced Environmental Consultant. Delta-Simons does not warrant or guarantee that the Site is free of hazardous or potentially hazardous materials or conditions.

Delta-Simons obtained, reviewed and evaluated information in preparing this Report from the Client and others. Delta-Simons conclusions, opinions and recommendations has been determined using this information. Delta-Simons does not warrant the accuracy of the information provided to it and will not be responsible for any opinions which Delta-Simons has expressed, or conclusions which it has reached in reliance upon information which is subsequently proven to be inaccurate.

This Report was prepared by Delta-Simons for the sole and exclusive use of the Client and for the specific purpose for which Delta-Simons was instructed. Nothing contained in this Report shall be construed to give any rights or benefits to anyone other than the Client and Delta-Simons, and all duties and responsibilities undertaken are for the sole and exclusive benefit of the Client and not for the benefit of any other party. In particular, Delta-Simons does not intend, without its written consent, for this Report to be disseminated to anyone other than the Client or to be used or relied upon by anyone other than the Client. Use of the Report by any other person is unauthorised and such use is at the sole risk of the user. Anyone using or relying upon this Report, other than the Client, agrees by virtue of its use to indemnify and hold harmless Delta-Simons from and against all claims, losses and damages (of whatsoever nature and howsoever or whensoever arising), arising out of or resulting from the performance of the work by the Consultant.

Appendix B –Existing Landscaping Plan

Z27_School Close_EX16 Landscaping Schedule

Key	Existing Surface Cover Type	Area (m^2)	Details
A	Semi-natural vegetation	195	existing semi-mature woodland to west edge of school close site. Trimmed for access and managed
B	Existing Hedges	55	existing mature hedgrow, mixed species
C	Existing Trees	11	existing mature trees, refer to arbocultural report for details
D	Amenity grassland	3375	existing grassland, verges and gardens
E	Sealed surfaces	290	(e.g. concrete, asphalt, waterproofing, stone). No planting
F	Building Footprint	640	No planting

Appendix C –Topographic Information

Legend

- Approximate Site Boundary
- Contours

Elevation (m AOD)

- <= 105.0
- 105.0 - 110.0
- 110.0 - 115.0
- 115.0 - 120.0
- 120.0 - 125.0
- 125.0 - 130.0
- 130.0 - 135.0
- 135.0 - 140.0
- 140.0 - 145.0
- > 145.0

0 10 20 30 40 m

-N-

Figure: LiDAR Plan		
Job: School Close, Bampton		
Client: ZedPods Ltd		
Appendix: C	Revision: A	Date: 14 December 2022
Drawn by: IR	Checked by: LA	Scale: 1:1,000
Job No.: 89427.549873		

Bing Maps DeltaSimons

Site Plan Provided by Client.

C:\Users\bobel\Desktop\Documents\QGIS\89427.549873 ZedPods Bampton\prj\89427.549873 ZedPods Bampton.qgz

122230.00 N

122190.00 N

122150.00 N

122110.00 N

295380.00 E

295420.00 E

295460.00 E

295500.00 E

295540.00 E

NORTH

STANDARD REFERENCES

ABBREVIATIONS

bl	bollard	lp	lamp post
bb	bellsha beacon	mk	marker post
bs	bus stop	mh	manhole
bt	telecoms	nb	notice board
catv	cable TV cover	np	nameplate (road)
cl	cover level	p	post
conc	concrete	pb	post box
cws	combined sewer	ret.	retaining wall
dk	drop kerb	re	rodding eye
elec	electricity ic	rg	road gully
ESS	Elec. Sub-Station	rs	road sign
ep	electricity pole	rwp	rainwater pipe
fb	flower bed	sp	signpost
fh	fire hydrant	sv	stop valve
fl	floor level	svp	soil vent pipe
fp	footpath	sws	storm water sewer
fl.p	flagpole	tcb	telephone callbox
fws	foul water sewer	tp	telegraph pole
g	gully	tl	traffic light
gsv	gas valve	ultr	unable to raise
ic	inspection cover	vp	vent pipe
il	invert level	w'tap	woodlap fence
irf	iron railing fence	wm	water tap
jb	junction box	wp	wood post
ko	kerb outlet	wt	water tap

Notes

1. This survey has been computed and drawn about the Ordnance Survey National Grid.
2. All levels are in metres and relate to the Ordnance Survey active GPS stations.
3. This survey was measured for a scale of 1:200, any subsequent enlargements should be verified on site.

Revisions

Clifton Surveys Ltd
Topographical and Measured Building Surveyors
1 Wellington Park
Clifton
Bristol
BS8 2UR
TEL: (0117) 9735898
e-mail: info@cliftonsurveys.com
web: www.cliftonsurveys.com

Surveyed	S Davies	Date	December 2022
Drawn	S Davies	Checked	December 2022

Drawing Title: Topographical Survey
School Close
Bampton
EX16 9NN

Client: Turley
40 Queen Square
Bristol
BS1 4QP

Drawing No. 989/5521/z27

Scale A0 @ 1:200

Appendix D –South West Water Sewer Plans

Water Colour Codes and Abbreviations

Examples of the abbreviation details above a Water Pipe
(details will be in the same colour as the pipe itself):

Distribution Main
Trunk Main
Communication Pipe

Untreated Main
Private Pipe
Abandoned Main

Cast Iron CI	Spun Iron SI	Ductile Iron DI	Steel ST
Asbestos Cement AC	Plastic UPVC	High Density/ Medium Density Polyethylene HDPE MDPE	High Pressure Polyethylene HPPE

Water Features (shown in common colours)

Washout	Hydrant	Hatchbox	Washout Hydrant
Air Valve (Single)	Air Valve (Double)	Closed Valve Closing Direction: Anti-Clockwise	Closed Valve Closing Direction: Clockwise
Pump	Pumping Station Number of Pumps as indicated 2	Open Valve Opening Direction: Anti-Clockwise	Open Valve Opening Direction: Clockwise
Customer Meter C	EBCO M optional if meter fitted EBCO	Non-Return Valve /Reflux	Stoptap
Mains Meter M M=Normal DMA/WIS B=Boundary Meter; 1010 Optional Readout if location is different from the meter		Relief Valve	End Cap
		Inlet / Outlet	Pipe Reducer
Pressure Reducing Valve	Pressure Sustaining Valve	Abstraction Point AB	Bore Hole BH

Water Pipe Furniture

Anode A	Calgon / Aquarite C/A	Chlorination Point C	Flushing on a Sluice Valve F
Insert Flow Meter IFM	Excavation Location	Strainer	Ferrule

Sewerage Pipe Details

Examples of the abbreviation details above a Sewer Pipe (details will be in the same colour as the pipe itself):

A B C D
Cir / 225 / VC / 82

A: Shape
B: Diameter (replaced by width & length on non-circular pipes
C: Material
D: Gradient (1: number shown)

Public -Foul
Public -Surface
Public -Combined
Public -Treated
Private Sewer
Unverified
Highway
Abandoned Sewer
Pumping Main
Elevated Sewer
Syphon

Shapes

Circular	Cir	Rectangular	Rec	Barrel	Brl	Trapezodial	Trpz
U Shaped	UShp	Horseshoe	Hsho				

Materials

Vitrified Clay	VC	Clay (Salt Glaze)	SG	Pre-cast Concrete	PCO	Concrete	CO
Asbestos Cement	AC	Brick	BR	Stone (Masonry)	MAC	Alkathene	AK
Steel	ST	Concrete Box	CB	Glass Reinforced Plastic	GRP	Plastic	PL
Polypropylene	PP	Unplasticised Polyvinylchloride	UPVC	Polyethylene	PE	Polyvinylchloride	PVC
Concrete Segments Bolted	CSB	Pitch Fibre	PF	Concrete Segments Unbolted	CSU	Medium Density Polyethylene	MDPE
Not Known	NK						

Sewerage Structures (shown in common colours)

Manhole Foul / Trade	Manhole Surface	Manhole Private	Manhole Combined
Soakaway SK	Washout WO	Catchpit CP	Hatchbox HB
Flushing FC	Lamphole LH	Tank Online TN	Tank Offline TO
Septic Tank S	Cesspit C	Header E	Drain LD
Reflux Valve RV	Sluice Valve	Air Valve AV	Venting Pole VP
Storm Overflow SO		Undefined Connection	Side Entry
Outfall OF		Backdrop	

Sewerage Installations

Pumping Station	Treatment Works WWTW

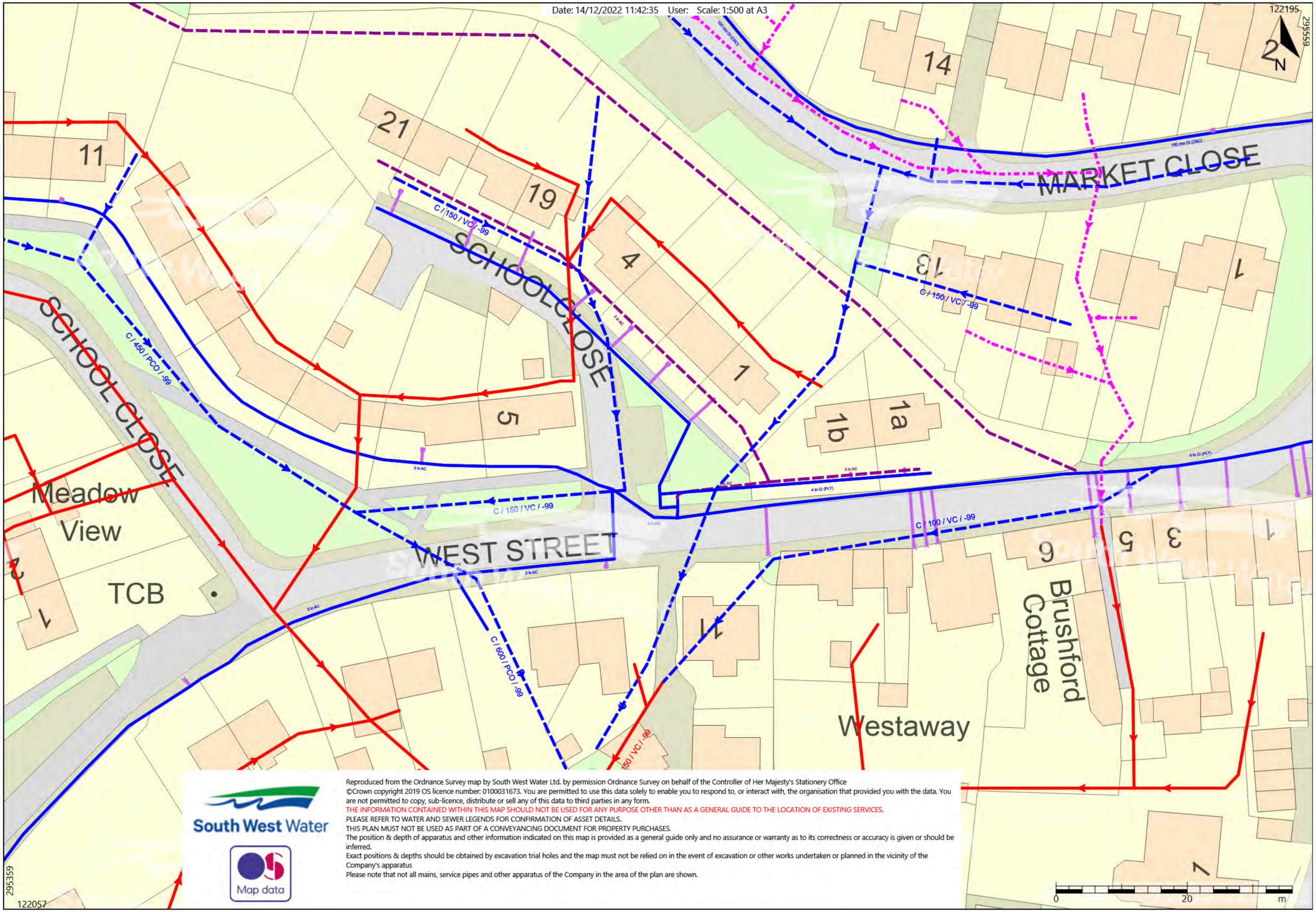
Details on Covers

Lockable k	Gas / Water Tight t	Bolted b

Location

Buried BL	Unable to Locate UL

Date: 14/12/2022 11:42:35 User: Scale: 1:500 at A3



Appendix E –Proposed Development Plans

1 Site

1 : 500

Revision Schedule		
Revision Number	Revision Date	Revision Description

General Notes:

1. All dimensions are in mm.
2. This drawing is the copyright of the ZED Pods Ltd. and may not be reproduced without permission.
3. All drawings must be read in conjunction with the relevant details.
4. All dimensions are to be checked on the site prior to setting out or fabrication of any material by the approved contractor.
5. All work and materials to be in accordance with the Building Regulations and to comply with the relevant codes of practice and British Standards.
6. Do not scale from the drawing, figured dimensions to be worked to at all times.
7. Do not assume any dimension, in case of any discrepancies please inform at your latest to the drawings Issuing authority or ZED Pods Ltd.
8. Where an item is covered by drawings to different scales, the larger scale drawing is to be worked to.
9. The supplier/ manufacturer/ contractor is responsible for checking dimensions, tolerances and reference. Any discrepancies to be checked with ZED Pods before proceeding with the works.
10. All Dimensions are from Finished Floor level and Finished plaster on the walls or otherwise mentioned.

Client: Mid Devon District Council

Project: School Close

Drawing Title:
Z27-ZP-A1-XX-DR-A-010-S01-P01-PROPOSED SITE PLAN

issued for:	drawn by/ updated by:	checked by:
	ON	JH

Drawing Number: Z27-A102- Rev.

Created: 24/11/2022 Scale:

ZED PODS
Floor 3, 6-8 Bonhill Street,
Shoreditch, London EC2A
4BX
T: 020 3983 3114
E: projects@zedpods.uk
W: www.zedpods.com

Do not scale for the purpose of Construction , use figured dimensions only. Unless stated otherwise, these drawings represent design intent only and approved assembly drawings will be required from the Trade Contractor prior to any work and /or procurement being undertaken

Appendix F –Proposed Landscaping Plan

Z27_School Close_EX16 Landscaping Schedule

Key	Proposed Surface Cover Type	Area (m^2)	Details
A	Flower-rich perennial planting	730	planted boarders with mix of native perenial flowering shrubs and plants. wildlife friendly planting of Specimen shrubs to attract bee and bug populations. To be maintained on a seasonal basis through clearing and seeding.
B	Hedges	170	Proposed mixed native hedge, planted in a double staggered row 300mm apart and at 500mm centres in each row. To be maintained at 1.1m height
C	Trees	12 trees	Standard trees planted in pits with a minimum soil volume equivalent to at least two thirds of the projected canopy area of the mature tree.
D	Amenity grassland	1450	Species-poor, regularly mown amenity lawn for communal or private use. Proposed grass areas to receive good quality amenity grass turves laid in line with good horticultural practices
E	Permeable paving	590	Proposed permeable block paving laid in herringbone formation in Harvest to be Tegula Permeable Paving laid in line with manufacturers recommendations
F	Grasscrete	525	paving, vehicle parking, on site cellular reinforced concrete system with voids created by styrene void formers with planted lawn inbetween. Self draining
G	Sealed surfaces	0	(e.g. concrete, asphalt, waterproofing, stone). No planting
H	Building Footprint	860	No planting

Appendix G –EA Consultation Response

Lucy Antell

From: SW_Exeter-PSO <SW_Exeter-PSO@environment-agency.gov.uk>
Sent: 08 December 2022 09:01
To: Nuala Harland <Nuala.Harland@Deltasimons.com>
Cc: DCIS Enquiries <DCISEnquiries@environment-agency.gov.uk>
Subject: 08/12/22 FOI/EIR Ref: 287639 Product 4/6 School Close, Bampton, EX16 9NN.

Dear Nuala Harland,

Provision of FRA Product 4

Thank you for your recent request to use Environment Agency flood data.

Please find attached:

- Flood Map for Planning;
- Historic Flood Map;
- 2022 Climate Change Allowances Guidance;
- FRA Advisory Text; and
- Preliminary Opinion Advice Note.

The site lies outside of Flood Zone 2 & 3. We do not have any specific modelled data that covers this location. We do hold the Bampton Model 2011. However, the extents for this model are the same as our Flood Map for Planning and therefore do not cover your site. The link to access the Product 5 and 6 for this models is here: https://ea.sharefile.com/d-s1a0c7f78abfa459fb33e19fddd1874bc The licence for the use of this information is attached.

We aren't able to display flood defence locations and attributes as there are no formal flood defences in the area of interest.

Surface Water and Risk of Flooding from Rivers and Sea: Use the check your long term flood risk service to find out about the risk of flooding from: surface water, rivers and sea, ordinary watercourses and reservoirs. For information on sewer flooding, contact the relevant water company for the area.

Critical Drainage Areas: Please visit the Devon County Council website Planning and development - Flood Risk Management (devon.gov.uk) to check whether your site is within a Critical Drainage Area.

If you have requested this information to help inform a development proposal, then you should note the information on GOV.UK on the use of Environment Agency Information for Flood Risk Assessments.
https://www.gov.uk/planning-applications-assessing-flood-risk
https://www.gov.uk/government/publications/pre-planning-application-enquiry-form-preliminary-opinion

We respond to requests under the Freedom of Information Act 2000 (FOIA) and Environmental Information Regulations 2004 (EIR).

If you are not satisfied with our response to your request for information you can contact us within 2 calendar months to ask for our decision to be reviewed.

Kind regards,

Tabitha Smith
(Pronouns: she/her) (Why is this here?)

Advisor: Data, Mapping and Modelling
Flood and Coastal Erosion Risk Management
Partnership and Strategic Overview Team (East)
Devon, Cornwall and Isles of Scilly

Team email: SW_Exeter-PSO@environment-agency.gov.uk

Flood Map for Planning centred on Bampton (Rivers and Sea) (07/12/2022)

Environment Agency

Legend

- Statutory Main Rivers
- Defences
- Flood Storage Areas
- Flood Zone 3
- Flood Zone 2

1: 5,000

0 125

Metres

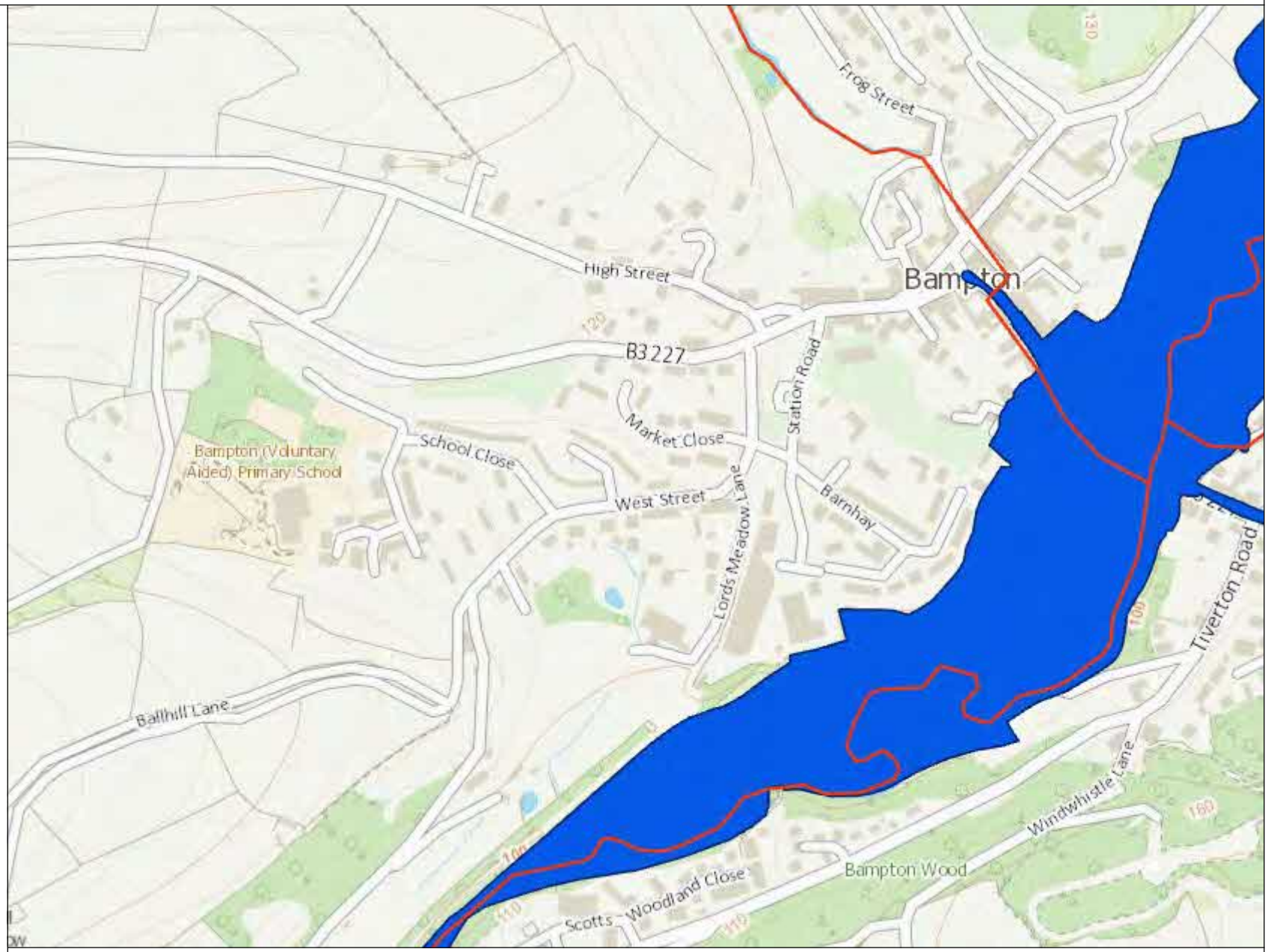
N W E S

Historic Flood Map centred on Bampton (07/12/2022)

Environment Agency

Legend

- Statutory Main Rivers
- Historic Flood Map



1: 5,000

0 125

Metres

N W E S

FIRST

Please check the latest Climate Change allowance :-

Flood risk assessments: climate change allowances - GOV.UK (www.gov.uk)

We expect you to use the scenario values as shown on the adjacent table for the different types of development. You may provide different scenario (i.e. High Cen for SLR) as additional assessment but we will use these values/allowances for our assessments of FRA/Designs

*CFB = Coastal Flood Boundary – available at data.gov.uk

Valid May 2022 – FCRM

DCIS Climate Change Allowances – Strategic and Development Planning

Development Vulnerability NPPG	Rainfall 1% Storms		River Less than 5km2		Fluvial	Sea Level Rise (SLR) Upper End
	Exe & East Devon	All others	Urban	Rural	Use 2080s values for all	Added to CFB* 2017 data
Commercial 60yr lifetime	30%	30%	30%	? - tbc	Central Allowance- See map next page	0.74m (2082 value)
Residential 100yr lifetime	45%	50%	50%	? - tbc	Central Allowance - see map next page	1.445m (2122 value)
Essential Infrastructure	45%	50%	50%	? - tbc	Higher Central - See map next page	Please confirm with EA office

SPDC@environment-agency.gov.uk or SW_Exeter-PSO@environment-agency.gov.uk

Environment Agency

FIRST

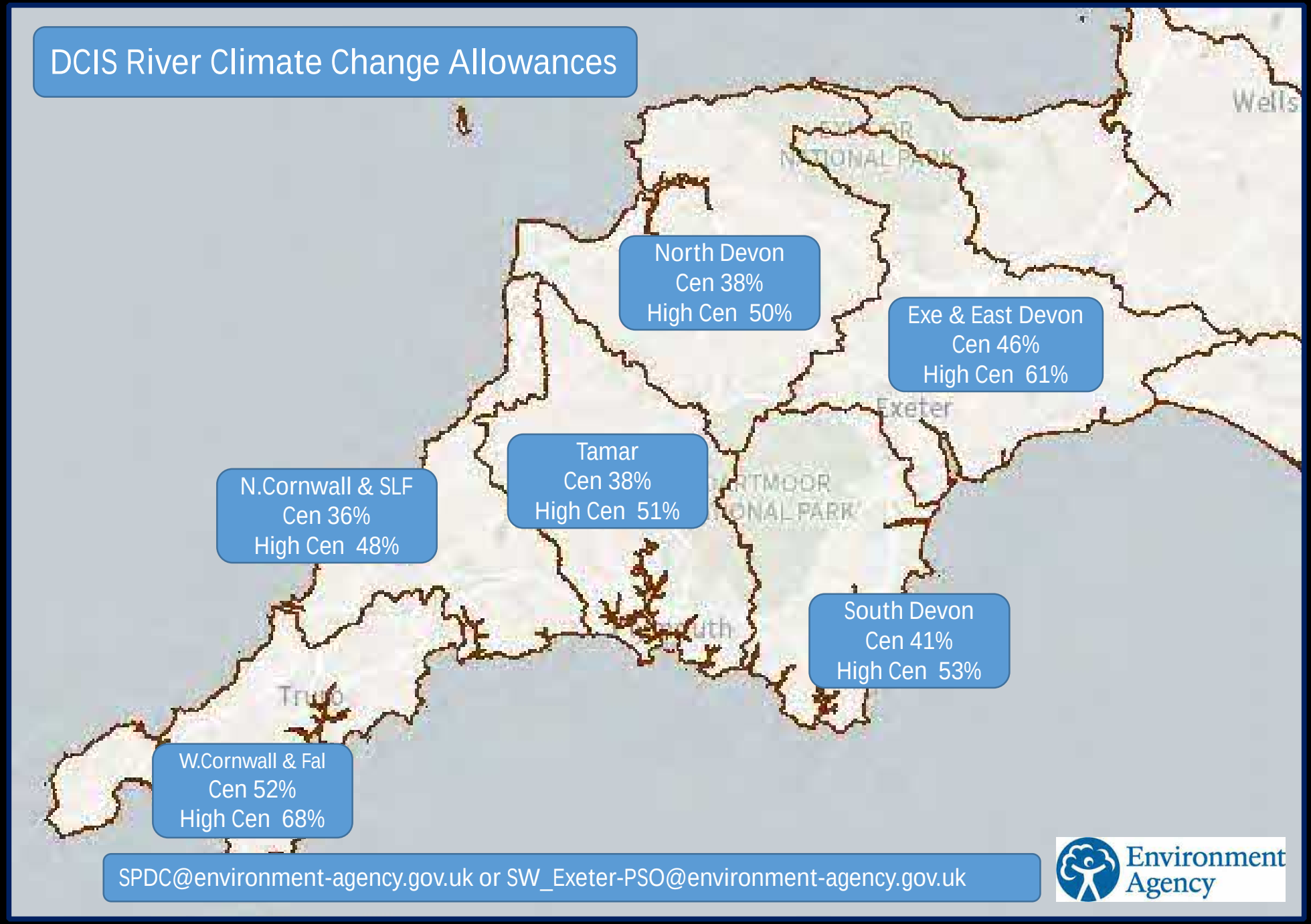
Please check the latest Climate Change allowance :-

[Flood risk assessments: climate change allowances - GOV.UK (www.gov.uk)]

- Wave Actions (Coastal & Estuary) will also have to be considered
- Freeboard will need to be added to set minimum floor or defence levels
- +40%CC Modelled scenarios, may still be used for some catchments (>5% diff from new values).

Valid May 2022 - FCRM

DCIS River Climate Change Allowances



SPDC@environment-agency.gov.uk or SW_Exeter-PSO@environment-agency.gov.uk

Environment Agency

Use of Environment Agency Information for Flood Risk Assessments

Important

The Environment Agency are keen to work with partners to enable development which is resilient to flooding for its lifetime and provides wider benefits to communities. If you have requested this information to help inform a development proposal, then we recommend engaging with us as early as possible by using the pre-application form available from our website:

https://www.gov.uk/government/publications/pre-planning-application-enquiry-form-preliminary-opinion

We recognise the value of early engagement in development planning decisions. This allows complex issues to be discussed, innovative solutions to be developed that both enables new development and protects existing communities. Such engagement can often avoid delays in the planning process following planning application submission, by reaching agreements up-front. We offer a charged pre-application advice service for applicants who wish to discuss a development proposal.

We can also provide a preliminary opinion for free which will identify environmental constraints related to our responsibilities including flooding, waste, land contamination, water quality, biodiversity, navigation, pollution, water resources, foul drainage or Environmental Impact Assessment.

In preparing your planning application submission, you should refer to the Environment Agency's Flood Risk Standing Advice and the Planning Practice Guidance for information about what flood risk assessment is needed for new development in the different Flood Zones. This information can be accessed via:

https://www.gov.uk/flood-risk-assessment-standing-advice
http://planningguidance.planningportal.gov.uk/

You should also consult the Strategic Flood Risk Assessment or other relevant materials produced by your local planning authority.

You should note that:

1. Information supplied by the Environment Agency may be used to assist in producing a Flood Risk Assessment (FRA) where one is required, but does not constitute such an assessment on its own.

2. This information covers flood risk from main rivers and the sea, and you will need to consider other potential sources of flooding, such as groundwater or surface water runoff. Information produced by the local planning authority referred to above may assist here.

3. Where a planning application requires an FRA and this is not submitted or is deficient, the Environment Agency may raise an objection.

Devon Cornwall and Isles of Scilly Area

Preliminary Opinion Advice Note January 2019

This document sets out the environmental issues we will consider when providing our planning application consultation advice to Local Planning Authorities. It can be used by applicants, developers and consultants at the pre-planning stage.

Further pre-application options

We are able to provide detailed and bespoke advice and answer technical questions for a charged fee which equates to £100 per hour plus VAT.

If you are interested in finding out more about this service, please email:

SPDC@environment-agency.gov.uk

We can explain this service and provide you with a bespoke quote for further pre-application advice that you may require.

Fluvial/Tidal Flood Risk

Development must be safe and should not increase the risk of flooding.

You can view a site's flood zone on the Flood Map for Planning on the .gov.uk website

https://flood-warning-information.service.gov.uk/long-term-flood-risk

If your proposed development is located within flood zone 2 or 3 you should consult the Flood Risk and Coastal Change pages of the National Planning Policy Guidance (NPPG)
http://planningguidance.communities.gov.uk/blog/guidance/flood-risk-and-coastal-change/

Here you can determine whether the flood risk vulnerability of your proposed development and the flood zone are compatible. You can also establish if there are flood risk sequential test and exception test requirements for your proposed development.

If your proposed development is located within flood zone 2 or 3 and its vulnerability and flood zone are considered acceptable under the NPPG then a site specific Flood Risk Assessment (FRA) is required to support any subsequent planning application. This is required by paragraph 103 of the National Planning Policy Framework (NPPF)
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/6077/2116950.pdf

Guidance on the content of a site specific FRA can be found on the NPPG and the .gov website:
https://www.gov.uk/guidance/flood-risk-assessment-for-planning-applications

We are in the process of making the majority of our data open source. Flood risk data is available from .gov.uk https://data.gov.uk/data/search?q=Flood&publisher=environment-agency&unpublished=false

However, if you need more detailed flood risk modelling data to help you produce a FRA then please contact our Customers and Engagement team at DCISEnquiries@environment-agency.gov.uk

Climate Change Allowances

On 19 February 2016, we published new guidance for planners and developers on how to use climate change allowances in a site-specific FRA: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

If you have any questions regarding this guidance, please contact our Customers and Engagement team:

DCISEnquiries@environment-agency.gov.uk

Groundwater Quality

Development must not cause pollution to the water environment.

Source Protection Zones

These zones indicate that an area is very sensitive to pollution risks due to the proximity of drinking water sources and the way groundwater flows. In these areas we may consider it inappropriate for development to discharge foul or surface water into the ground.

To see if your proposed development is located within a Source Protection Zone, please use our online map: http://apps.environment-agency.gov.uk/wiyby/37833.aspx

Contaminated land

The NPPF takes a precautionary approach to land contamination. Before the principle of development can be determined, land contamination should be investigated to see whether it could preclude certain development due to environmental risk or cost of remediation.

Where contamination is known or suspected, a desk study, site investigation, remediation and other works may be required to enable safe development (paragraph 121 of the NPPF). Minimum requirements for submission with a planning application are a preliminary risk assessment, such as a site walkover or desk top study.

Site investigation and remediation strategy reports may be required for submission with a planning application for sensitive land use types or where significant contamination, or uncertainty, is found. When dealing with land affected by contamination, developers should follow the risk management framework provided in the CLR11, Model Procedures for the Management of Land Contamination: https://www.gov.uk/guidance/land-contamination-risk-management

Pollution

If the proposed development use has the potential to pollute ground or surface water receptors then an assessment to establish whether the risk of pollution is acceptable or can be satisfactorily mitigated for will be required within any planning application.

Foul Drainage

When drawing up wastewater treatment proposals for any new development, the first presumption is to provide a system of foul drainage discharging into a public sewer to be treated at a public sewage treatment works (those provided and operated by the water and sewerage companies). This should be done in consultation with the sewerage company of the area prior to the submission of a formal planning application.

If connection to the public sewerage system is not feasible, a private foul drainage system may be considered. Under the Environmental Permitting Regulations 2010 any discharge of sewage or trade effluent made to either surface water or groundwater will need to be registered as an exempt discharge activity or hold a permit issued by the Environment Agency, in addition to planning permission. This applies to any discharge to inland freshwaters, coastal waters or relevant territorial waters.

Further guidance is available at:

https://www.gov.uk/government/publications/small-sewage-discharges-in-england-general-binding-rules.

Main Rivers

Ecology

If a Main River is located on or within 8 metres of your proposed development site an ecological survey is required to establish whether development is likely to have a detrimental impact on the biodiversity of the watercourse. We would not support development proposals if there was shown to be a likely detrimental impact on the water environment. In accordance with the National Planning Policy Framework (NPPF), any development proposal should avoid significant harm to biodiversity and seek to protect and enhance it. Opportunities to incorporate biodiversity in and around the development will be encouraged.

Your scheme should be designed with a naturalised buffer zone of at least 8 metres from the main river to protect and enhance the conservation value of the watercourse and ensure access for flood defence maintenance.

This buffer zone should be managed for the benefit of biodiversity for example by the planting of locally appropriate, UK native species. The buffer zone should be undisturbed by development with no fencing, footpaths or other structures. This buffer zone will help provide more space for flood waters, provide improved habitat for local biodiversity and allows access for any maintenance requirements.

To identify any Main Rivers in proximity to your proposed development please see our Main Rivers Consultation Map: http://apps.environment-agency.gov.uk/wiyby/151293.aspx

Water Framework Directive (WFD)

With any development alongside watercourses, consideration should be given to the requirements of the Water Framework Directive (WFD) http://ec.europa.eu/environment/water/water-framework/ . This includes preventing overall deterioration in water quality and promoting improvement in the ecological status of any water body. Actions to achieve this are listed in the South West River Basin Management Plan (RBMP) https://www.gov.uk/search?q=River+Basin+Management+Plans.

Where appropriate, a WFD Assessment (http://planningguidance.communities.gov.uk/blog/guidance/water-supply-wastewater-and-water-quality/water-supply-wastewater-and-water-quality-considerations-for-planning-applications/) should assess any potential impacts on the watercourse and demonstrate that the required enhancements will be delivered. In some cases the requirements of a WFD assessment can be incorporated into an Environmental Impact Assessment (EIA). Any development that has the potential to cause deterioration in classification under WFD or that precludes the recommended actions from being delivered in the future is likely to be considered unacceptable to us.

Environmental Permitting Regulations

To see if your proposed development requires an Environmental Permit under the Environment Permitting Regulations please refer to our website:

https://www.gov.uk/guidance/check-if-you-need-an-environmental-permit

From 6 April 2016 an Environmental Permit is required for any proposed works or structures, in, under, over or within 8 metres of the top of the bank of a designated Main River and within 16 metres of a tidal defence.

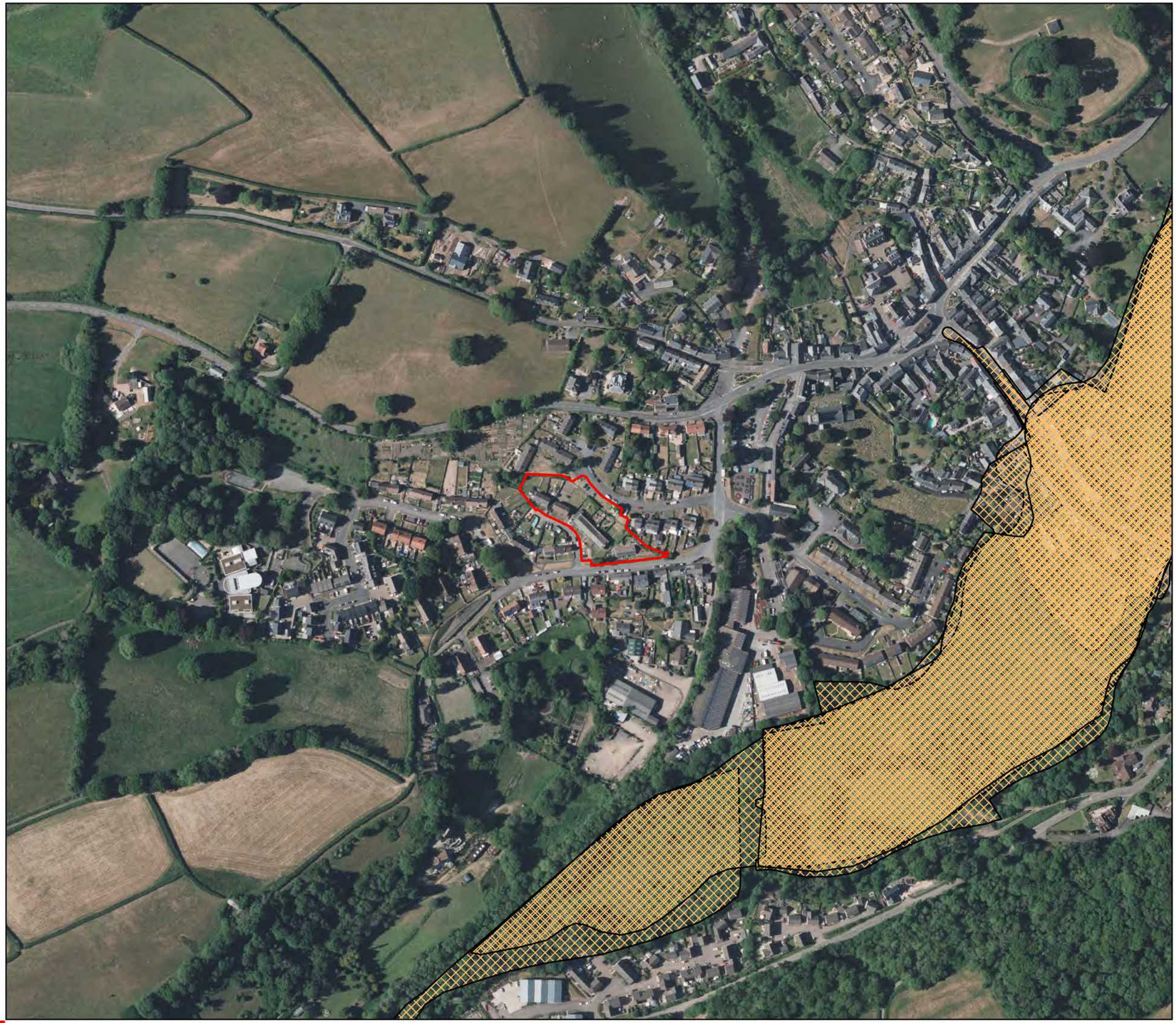
Please note

This document is a response to a pre-application enquiry only and does not represent our final view in relation to any future planning application made in relation to any site. You should seek your own expert advice in relation to technical matters relevant to any planning application before submission.

If you have any questions please contact the Sustainable Places team:

SPDC@environment-agency.gov.uk

Appendix H –EA Historic Flood Map



Legend

- Approximate Site Boundary
- Historical Flooding

0 10 20 30 40 m

-N-

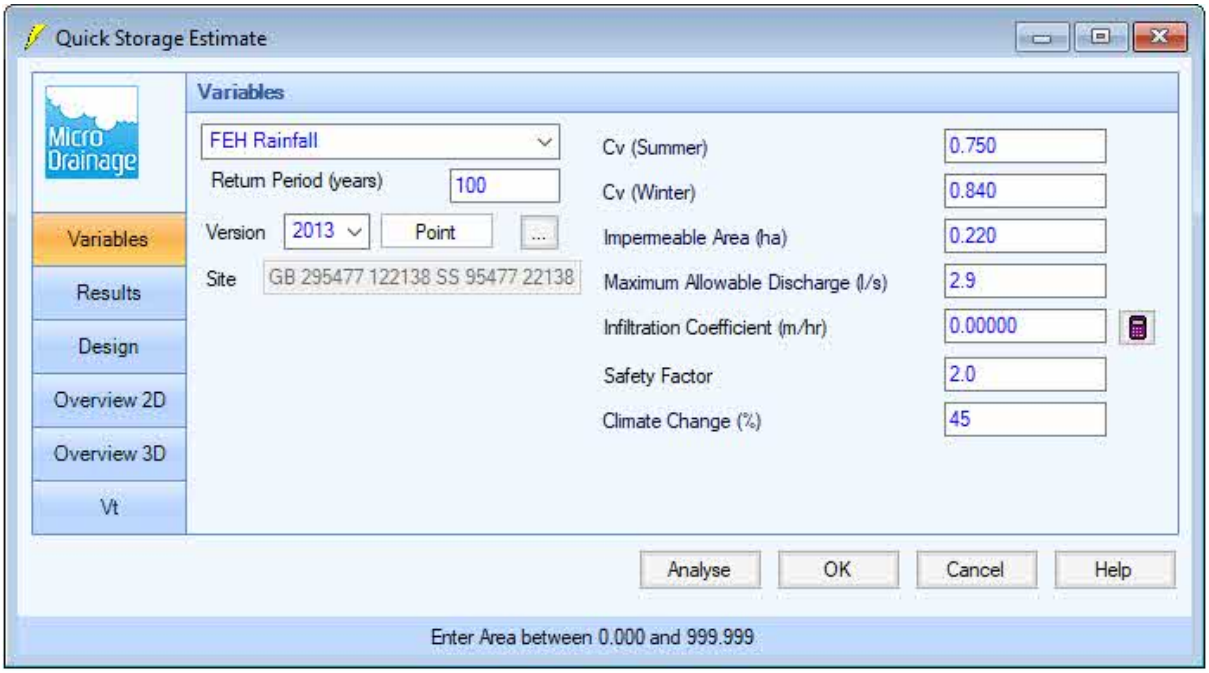
Figure: Historical Flooding		
Job: School Close, Bampton		
Client: ZedPods Ltd		
Appendix: G	Revision: A	Date: 15 December 2022
Drawn by: IR	Checked by: LA	Scale: 1:3,000
Job No.: 89427.549873		

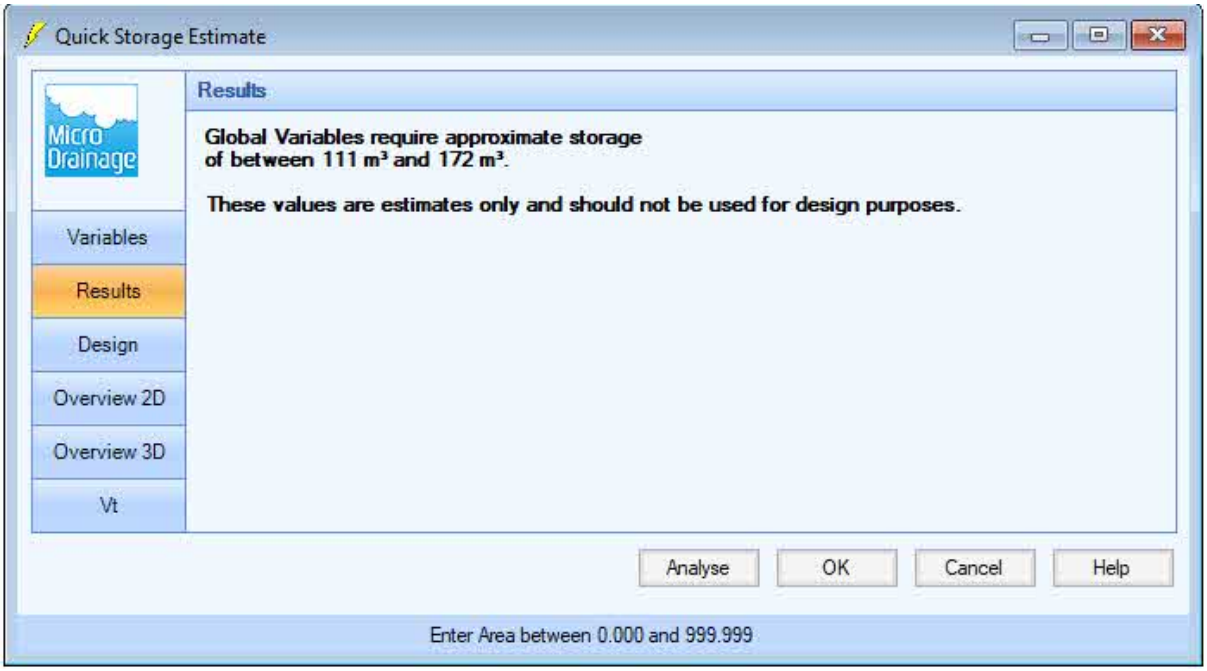
Bing Maps DeltaSimons

Site Plan Provided by Client.

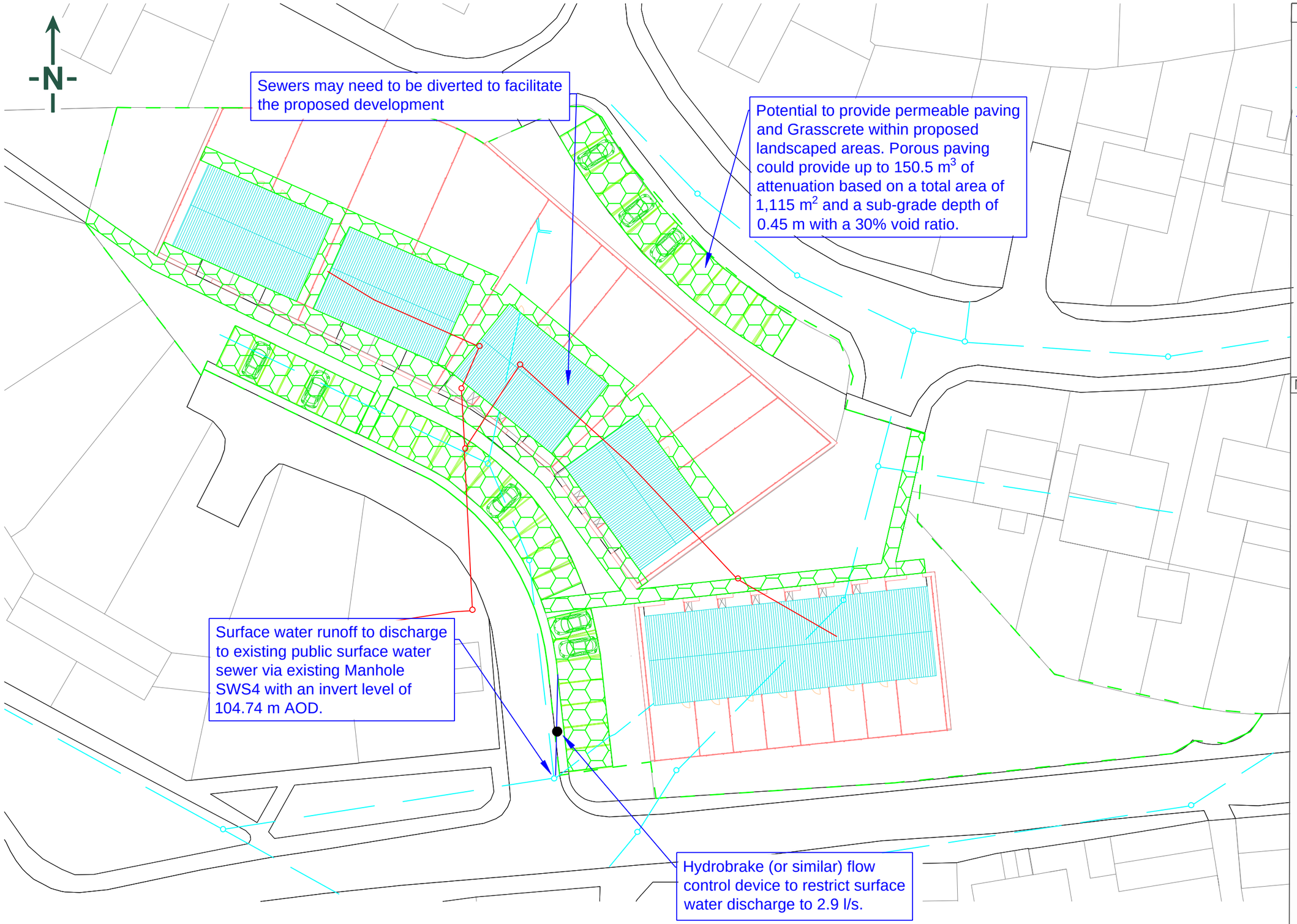
C:\Users\Isobel\Local\Documents\Jobs\89427.549873 ZedPods (Bampton)\pdf\89427.549873 ZedPods (Bampton).pdf

Appendix I –MicroDrainage Quick Storage Estimates


Quick Storage Estimate
Micro Drainage
Variables
Results
Design
Overview 2D
Overview 3D
Vt
Variables
FEH Rainfall
Return Period (years) 100
Version 2013
Point
...
Site GB 295477 122138 SS 95477 22138
Cv (Summer) 0.750
Cv (Winter) 0.840
Impermeable Area (ha) 0.220
Maximum Allowable Discharge (l/s) 2.9
Infiltration Coefficient (m/hr) 0.00000
Safety Factor 2.0
Climate Change (%) 45
Analyse
OK
Cancel
Help
Enter Area between 0.000 and 999.999


Quick Storage Estimate
Micro Drainage
Variables
Results
Design
Overview 2D
Overview 3D
Vt
Results
Global Variables require approximate storage
of between 111 m³ and 172 m³.
These values are estimates only and should not be used for design purposes.
Analyse
OK
Cancel
Help
Enter Area between 0.000 and 999.999

Appendix J –Concept Drainage Sketch



LEGEND

- **Proposed Porous Paving Area / Grasscrete** 1,115 m² with a subgrade depth of 450 mm and a void ratio of 30% providing approx. 150.5 m³ of attenuation
- Approximate Route of Existing Public Surface Water Sewer
- Indicative Proposed Surface Water Drainage
- Approximate Existing Public Combined Sewer
- Proposed Flow Control Device (Hydrobrake or similar)

NOTES

1. All dimensions in millimetres and all levels in metres above ordnance datum unless shown otherwise.

2. This drawing provides a Concept Drainage Sketch and is not intended for detailed design. Detailed drainage design will be required at the detailed design stage.

3. The Concept Drainage Sketch is based on the Proposed Development Plan (drawing ref -Z27-ZP-A1-XX-DR-A-010-S01-P01) provided by ZedPods.

4. Route of existing public sewers are indicative and based on plans provided by South West Water, a Site utility survey and a topographic survey. The location of existing public sewers should be verified on-Site.

5. Attenuation to be provided in the form of permeable paving. Dimensions are to be confirmed at the detailed design stage.

6. Routes and dimensions of proposed surface water drainage to be confirmed at the detailed design stage. Where appropriate, it may be possible to utilise existing drainage runs, subject to further investigation at the detailed design stage.

7. Surface water runoff to discharge into existing public surface water sewer via a Hydrobrake or similar flow control device, subject to agreement with South West Water.

8. Further consideration of proposed ground levels will be required at the detailed design stage.

Site Plan Provided by Client

deltasimons
Environment - Health & Safety - Sustainability

TITLE:
Concept Drainage Sketch
Z27 - School Close, Bampton, EX16 9NN

DRAWN BY:	SCALE:	PROEJCT NO:
LA	Not to Scale	89427.549873
CHECKED BY:	REVISION:	APPENDIX:
DP	A	J
DATE:		
21/12/2022		

Appendix K –MicroDrainage Source Control Calculations

Summary of Results for 100 year Return Period (+45%)

Half Drain Time : 359 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	99.691	0.141	0.0	2.9	46.3	O K
30 min Summer	99.748	0.198	0.0	2.9	65.4	Flood Risk
60 min Summer	99.810	0.260	0.0	2.9	86.3	Flood Risk
120 min Summer	99.840	0.290	0.0	2.9	96.2	Flood Risk
180 min Summer	99.855	0.305	0.0	2.9	101.3	Flood Risk
240 min Summer	99.864	0.314	0.0	2.9	104.1	Flood Risk
360 min Summer	99.870	0.320	0.0	2.9	106.1	Flood Risk
480 min Summer	99.873	0.323	0.0	2.9	107.1	Flood Risk
600 min Summer	99.873	0.323	0.0	2.9	107.3	Flood Risk
720 min Summer	99.872	0.322	0.0	2.9	106.8	Flood Risk
960 min Summer	99.864	0.314	0.0	2.9	104.2	Flood Risk
1440 min Summer	99.840	0.290	0.0	2.9	96.2	Flood Risk
2160 min Summer	99.800	0.250	0.0	2.9	82.8	Flood Risk
2880 min Summer	99.762	0.212	0.0	2.9	70.2	Flood Risk
4320 min Summer	99.703	0.153	0.0	2.9	50.4	Flood Risk
5760 min Summer	99.668	0.118	0.0	2.9	38.6	O K
7200 min Summer	99.651	0.101	0.0	2.8	33.0	O K
8640 min Summer	99.643	0.093	0.0	2.6	30.2	O K
10080 min Summer	99.637	0.087	0.0	2.4	28.2	O K
15 min Winter	99.710	0.160	0.0	2.9	52.7	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	131.062	0.0	46.8	25
30 min Summer	90.611	0.0	67.3	40
60 min Summer	59.809	0.0	92.7	68
120 min Summer	34.800	0.0	108.7	126
180 min Summer	25.499	0.0	119.9	184
240 min Summer	20.506	0.0	128.9	242
360 min Summer	15.137	0.0	143.1	328
480 min Summer	12.259	0.0	154.7	390
600 min Summer	10.422	0.0	164.5	454
720 min Summer	9.132	0.0	173.0	520
960 min Summer	7.406	0.0	187.0	654
1440 min Summer	5.510	0.0	208.2	924
2160 min Summer	4.096	0.0	233.3	1320
2880 min Summer	3.321	0.0	251.3	1684
4320 min Summer	2.468	0.0	277.4	2384
5760 min Summer	2.015	0.0	301.2	3056
7200 min Summer	1.746	0.0	324.4	3744
8640 min Summer	1.565	0.0	347.0	4424
10080 min Summer	1.435	0.0	369.0	5152
15 min Winter	131.062	0.0	53.3	25

Summary of Results for 100 year Return Period (+45%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	99.775	0.225	0.0	2.9	74.3	Flood Risk
60 min Winter	99.846	0.296	0.0	2.9	98.0	Flood Risk
120 min Winter	99.881	0.331	0.0	2.9	110.0	Flood Risk
180 min Winter	99.900	0.350	0.0	2.9	116.2	Flood Risk
240 min Winter	99.911	0.361	0.0	2.9	119.8	Flood Risk
360 min Winter	99.919	0.369	0.0	2.9	122.5	Flood Risk
480 min Winter	99.919	0.369	0.0	2.9	122.5	Flood Risk
600 min Winter	99.917	0.367	0.0	2.9	122.1	Flood Risk
720 min Winter	99.914	0.364	0.0	2.9	121.0	Flood Risk
960 min Winter	99.902	0.352	0.0	2.9	116.9	Flood Risk
1440 min Winter	99.862	0.312	0.0	2.9	103.7	Flood Risk
2160 min Winter	99.795	0.245	0.0	2.9	81.2	Flood Risk
2880 min Winter	99.737	0.187	0.0	2.9	61.6	Flood Risk
4320 min Winter	99.661	0.111	0.0	2.9	36.4	O K
5760 min Winter	99.640	0.090	0.0	2.5	29.3	O K
7200 min Winter	99.630	0.080	0.0	2.2	25.8	O K
8640 min Winter	99.623	0.073	0.0	2.0	23.6	O K
10080 min Winter	99.619	0.069	0.0	1.8	22.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	90.611	0.0	76.2	39
60 min Winter	59.809	0.0	104.5	68
120 min Winter	34.800	0.0	122.5	124
180 min Winter	25.499	0.0	135.0	182
240 min Winter	20.506	0.0	145.1	238
360 min Winter	15.137	0.0	161.0	348
480 min Winter	12.259	0.0	174.1	446
600 min Winter	10.422	0.0	185.1	480
720 min Winter	9.132	0.0	194.6	556
960 min Winter	7.406	0.0	210.4	712
1440 min Winter	5.510	0.0	234.2	1012
2160 min Winter	4.096	0.0	262.6	1408
2880 min Winter	3.321	0.0	283.0	1768
4320 min Winter	2.468	0.0	312.7	2384
5760 min Winter	2.015	0.0	339.6	3048
7200 min Winter	1.746	0.0	366.1	3752
8640 min Winter	1.565	0.0	391.9	4424
10080 min Winter	1.435	0.0	417.2	5152

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 295477 122138 SS 95477 22138
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+45

Time Area Diagram

Total Area (ha) 0.221

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.074	4	8	0.073	8	12	0.073

Model Details

Storage is Online Cover Level (m) 100.000

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	223.0
Membrane Percolation (mm/hr)	2500	Length (m)	5.0
Max Percolation (l/s)	774.3	Slope (1:X)	1000.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	99.550	Membrane Depth (m)	0

Hydro-Brake® Optimum Outflow Control

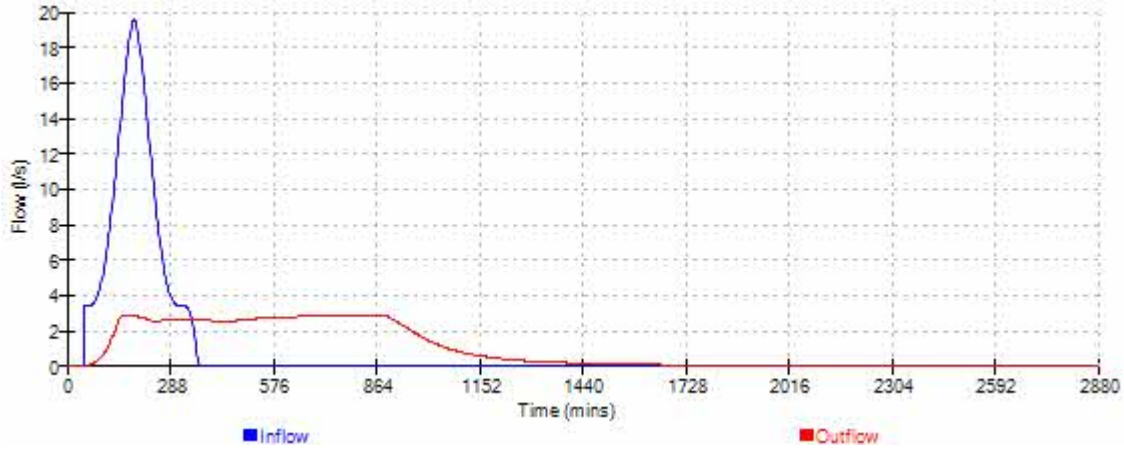
Unit Reference	MD-SHE-0089-2900-0450-2900
Design Head (m)	0.450
Design Flow (l/s)	2.9
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	89
Invert Level (m)	99.550
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

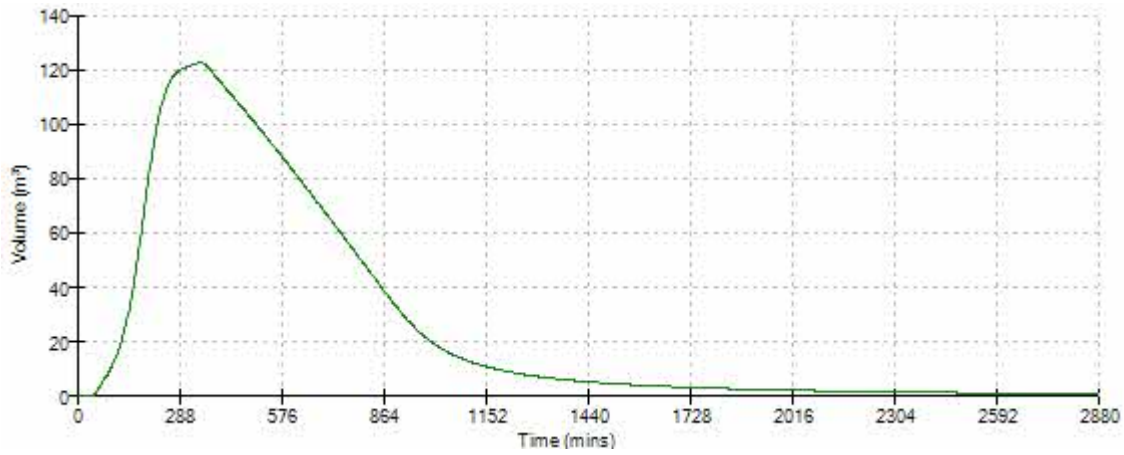
Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.450	2.9
Flush-Flo™	0.147	2.9
Kick-Flo®	0.326	2.5
Mean Flow over Head Range	-	2.4

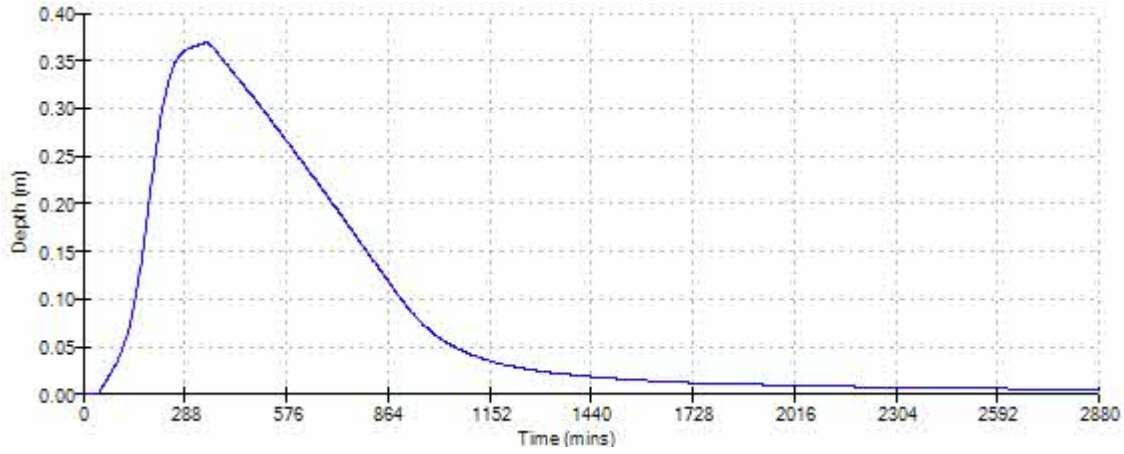
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.7	1.200	4.6	3.000	7.0	7.000	10.5
0.200	2.9	1.400	4.9	3.500	7.5	7.500	10.9
0.300	2.7	1.600	5.2	4.000	8.0	8.000	11.3
0.400	2.7	1.800	5.5	4.500	8.5	8.500	11.6
0.500	3.0	2.000	5.8	5.000	8.9	9.000	12.0
0.600	3.3	2.200	6.0	5.500	9.3	9.500	12.3
0.800	3.8	2.400	6.3	6.000	9.8		
1.000	4.2	2.600	6.5	6.500	10.2		

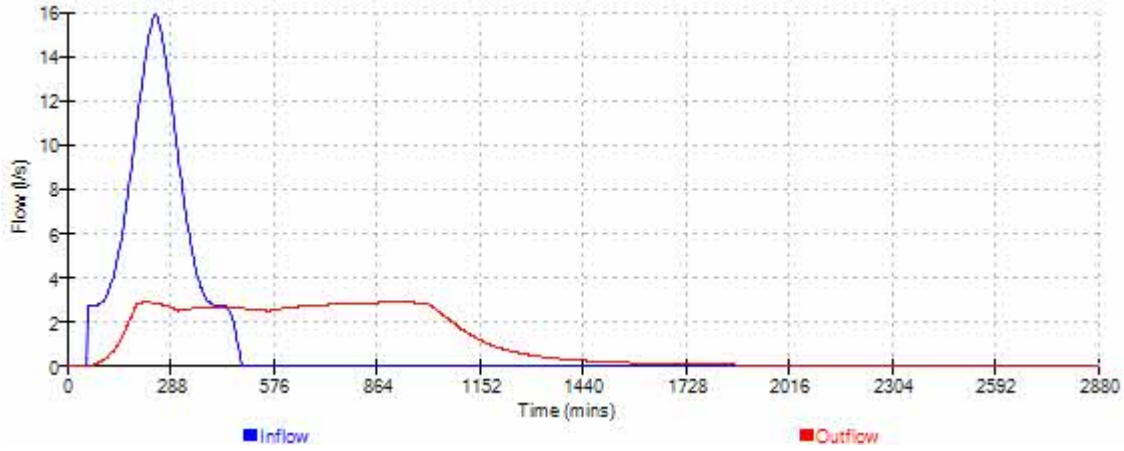
Event: 360 min Winter

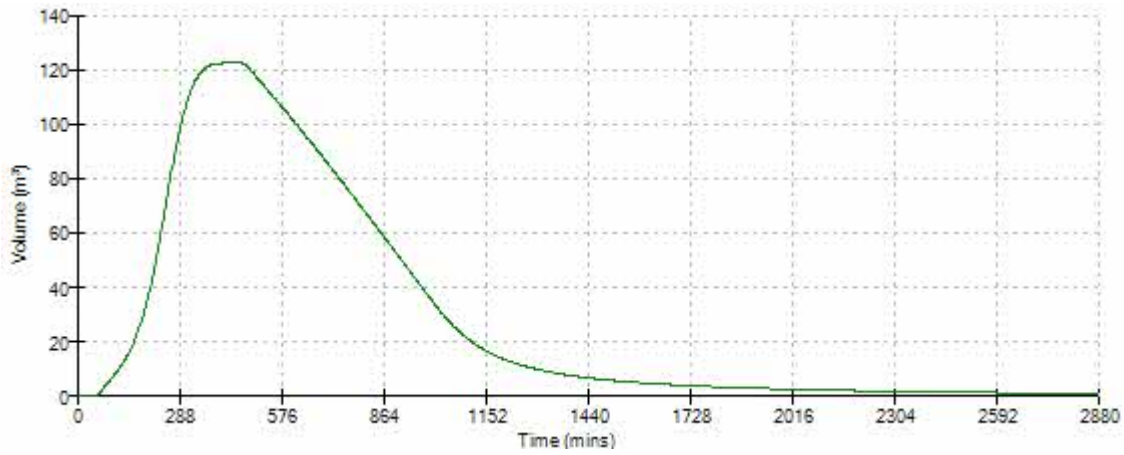


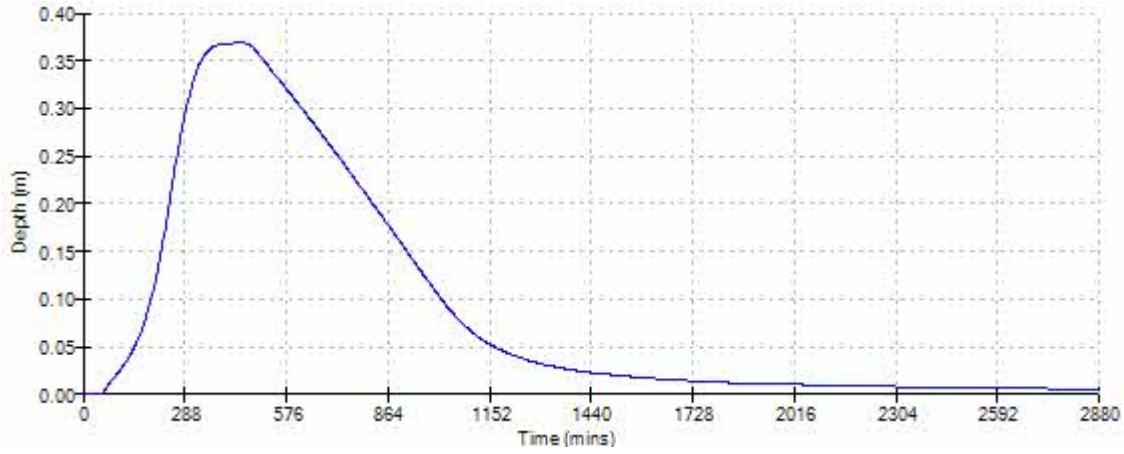




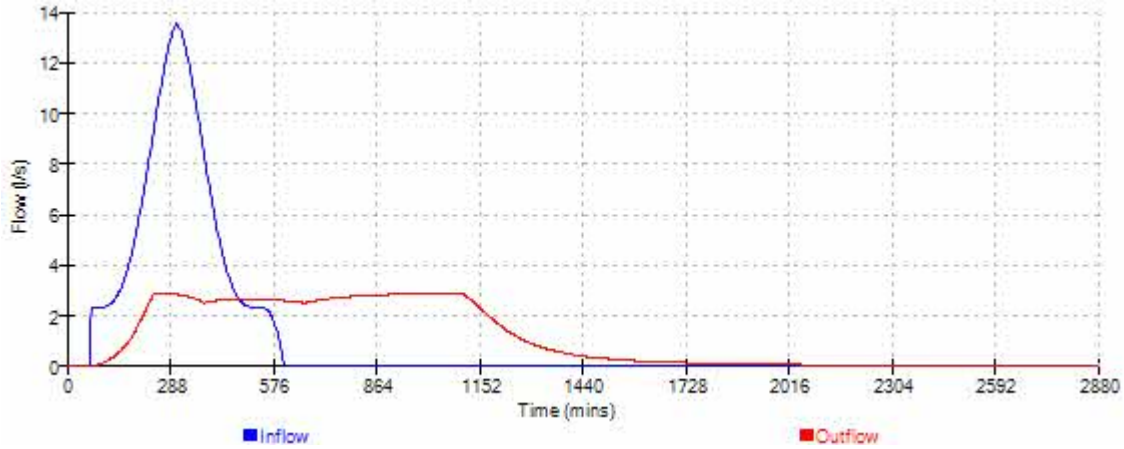
Event: 480 min Winter

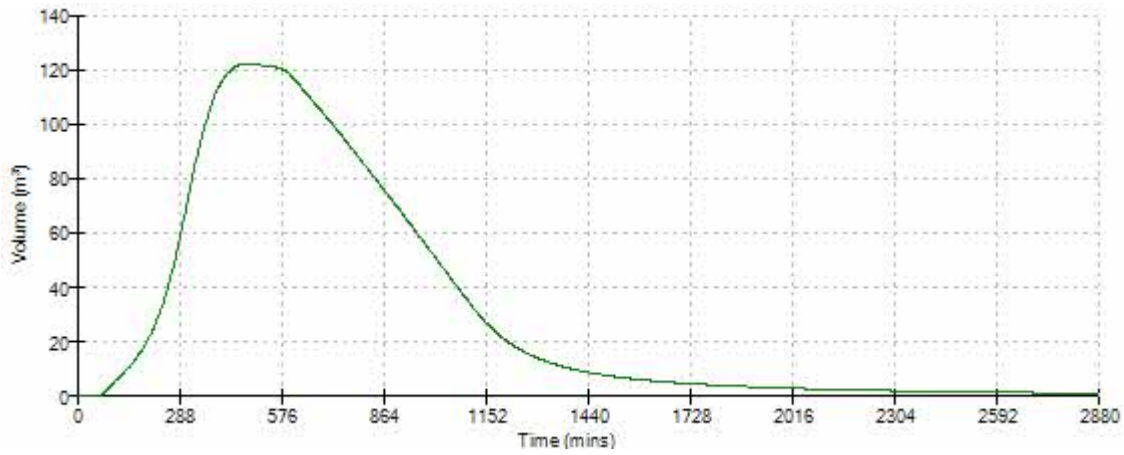


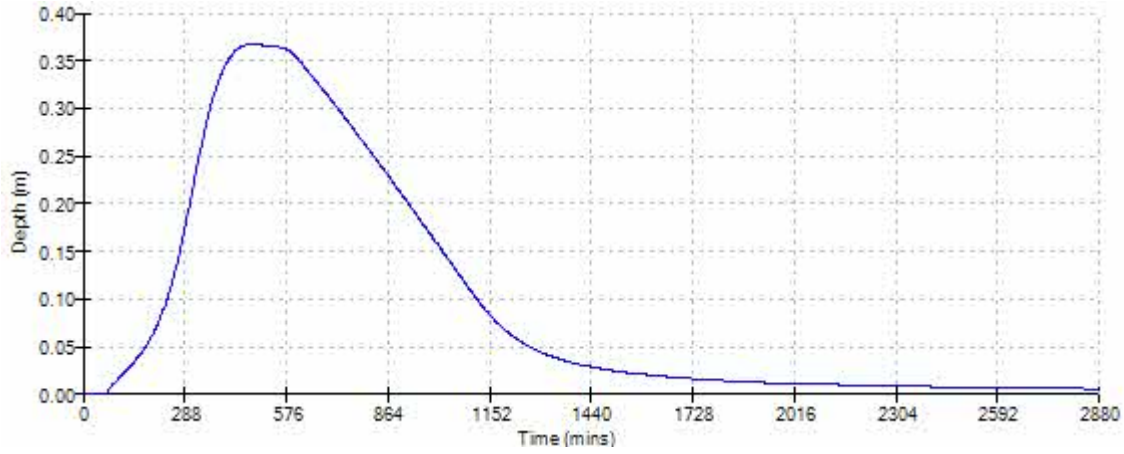




Event: 600 min Winter







Appendix L –Maintenance Schedule

Permeable Paving Maintenance Schedule

Maintenance Schedule	Required Action	Typical Frequency
Regular maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on Site-specific observations of clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment
Occasional maintenance	Stabilise and move contributing and adjacent areas	As required
	Removal of weeds or management using glyphosate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
Remedial actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50mm of the level or the paving	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Inspect for evidence of poor operation and / or weed growth – if required, take remedial action	Three-monthly, 48hr after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

Ref. Table 20.15, CIRIA C753 'The SuDS Manual'