

**Flood Risk and Drainage  
Site Appraisal**  
February 2020

The logo for EAS (Environmental Assessment Services) is a dark blue square with the letters 'EAS' in white, sans-serif font.

**Land to the west of  
Papworth (Site B)**  
Papworth Everard, Cambridgeshire

**Varrier-Jones Foundation**

## Document History

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## Contents

<b>1</b>	<b>Introduction</b>	<b>2</b>	<b>4</b>	<b>Surface Water Drainage</b>	<b>9</b>
<b>2</b>	<b>Policy Background</b>	<b>3</b>	<b>5</b>	<b>Foul Water Drainage Assessment</b>	<b>11</b>
	Introduction	3	<b>6</b>	<b>Summary and Conclusions</b>	<b>12</b>
	South Cambridgeshire and Cambridge City			<b>Appendices</b>	<b>13</b>
	Level 1 Strategic Flood Risk Assessment			Appendix: A - Location Plan	14
	(SFRA) September 2010	5		Appendix: B – EA Flood Map for Planning	15
	Cambridgeshire County Council Surface			Appendix: C – EA Surface Water Flood Map	16
	Water Management Plan (SWMP) August			Appendix: D – Anglian Water Sewer Records	17
	2011 and County Wide Update (2014)	5			
<b>3.</b>	<b>Flood Risk Assessment</b>	<b>7</b>			
	Local Policy	7			
	Sources of Flooding	7			

## 1 Introduction

- 1.1 EAS has been commissioned by the Varrier-Jones Foundation to prepare a Site Appraisal for land to the west of Papworth Everard, Cambridgeshire. This document has been prepared to inform site representations to the Greater Cambridge Local Plan Regulation 18 Issues and Options consultation.
- 1.2 The contents of this report form a preliminary assessment of the site in terms of flood risk and drainage.
- 1.3 The site is located to the north west of the Papworth and immediately north of Pendragon Community Primary School.
- 1.4 The 3ha site (Site B) is currently greenfield, a location plan is contained within Appendix A. For the purposes of this report it is proposed that the site will comprise of an extension to the school grounds.
- 1.5 The site falls wholly within Flood Zone 1 of the Environment Agency (EA) Flood Zone maps . It is also shown to be predominantly at very low risk of surface water flooding with two narrow channels of low risk which both represent overland flow paths to the watercourse on the eastern boundary. This document will review the above risks further and provide advice to support the site representation and future masterplanning of the site.
- 1.6 This report is based on EA Flood Maps, South Cambs Strategic Flood Risk Assessment (SFRA), Cambridgeshire County Council Surface Water Management Plan (SWMP), BGS geological information and Anglian Water sewer records.
- 1.7 The report is set out as follows:
  - Section 2 – sets out the relevant flood risk and drainage policy background.
  - Section 3 – reviews and discusses the flood risk to the development and the future development drainage.
  - Section 4 – provides a brief review of surface water drainage requirements
  - Section 5 – provides a brief review of foul drainage solutions.
  - Section 6 – summarises the findings of the report.

## 2 Policy Background

### Introduction

- 2.1 This section sets out the current local policy and examines the local strategic documents for flood risk and drainage matters.

### Adopted South Cambridgeshire Local Plan (2018)

#### Policy CC/9: Managing Flood Risk

- 2.2 The policy states that:

1. "In order to minimise flood risk, development will only be permitted where:
  - a. The sequential test and exception tests established by the National Planning Policy Framework demonstrate the development is acceptable (where required).
  - b. Floor levels are 300mm above the 1 in 100 year flood level plus an allowance for climate change where appropriate and practicable also 300mm above adjacent highway levels.
  - c. Suitable flood protection/mitigation measures are incorporated as appropriate to the level and nature of flood risk, which can be satisfactorily implemented to ensure safe occupation, access and egress. Management and maintenance plans will be required, including arrangements for adoption by any public authority of statutory undertaker and any other arrangements to secure the operation of the scheme throughout its lifetime;
  - d. There would be no increase to flood risk elsewhere, and opportunities to reduce flood risk elsewhere have been explored and taken (where appropriate), including limiting discharge of surface water (post development volume and peak rate) to natural greenfield rates or low, and
  - e. The destination of the discharge obeys the following priority order:
    - I. Firstly, to the ground via infiltration;
    - II. Then, to a water body;
    - III. Then, to a surface water sewer
    - IV. Discharge to a foul water or combined sewer is unacceptable.
2. Site specific Flood Risk Assessments (FRAs) appropriate to the scale and nature of the development and the risks involved, and which takes account of future climate change, will be required for the following:
  - f. Development proposals over 1ha in size;
  - g. Any other development proposals in flood zones 2 and 3;
  - h. Any other development proposals in flood zone 1 where evidence, in particular the Strategic Flood Risk Assessment or Surface Water Management Plans, indicates there

are records of historic flooding or other sources of flooding, and/or a need for more detailed analysis.

3. FRAs will need to meet national standards and local guidance (including recommendations of the South Cambridgeshire and Cambridge City Strategic Flood Risk Assessment (2010) and the Phase 1 and 2 Water Cycle Strategy or successor documents)."

#### Policy CC/8: Sustainable Drainage Systems

##### 2.3 The policy is as follows:

"Development proposals must incorporate appropriate sustainable surface water drainage systems (SuDS) appropriate to the nature of the site. Development proposals will be required to demonstrate that:

- a. Surface water drainage schemes comply with the Sustainable Drainage Systems: Non-statutory technical standards for sustainable drainage systems and the Cambridgeshire Flood and Water Supplementary Planning Document or successor documents;
- b. Opportunities have been taken to integrate sustainable drainage with the development, create amenity, enhance biodiversity, and contribute to a network of green (and blue) open space;
- c. Surface water is managed close to its source and on the surface where it practicable to do so;
- d. Maximum use has been made of low land take drainage measures, such as rain water recycling, green roofs, permeable surfaces and water butts;
- e. Appropriate pollution control measures have been incorporated, including multiple component treatment trains; and
- f. Arrangements have been established for the whole life management and maintenance of surface water drainage systems."

#### Policy CC/7: Water Quality

##### 2.4 The policy states:

1. "In order to protect and enhance water quality, all development proposals must demonstrate that:
  - a. There are adequate water supply sewerage and land drainage systems (including water sources, water and waste water infrastructure) to serve the whole development, or an agreement with the relevant service provide to ensure the provision of the necessary infrastructure prior to the occupation of the development. Where development is being phased, each phase must demonstrate sufficient water supply and waste water conveyance, treatment and discharge capacity;
  - b. The quality of ground, surface or water bodies will not be harmed and opportunities have been explored and taken for improvements to water quality, including renaturalisation of river morphology, and ecology;

- c. Appropriate consideration is given to sources of pollution, and appropriate Sustainable Drainage Systems (SuDS) measures incorporated to protect water quality from polluted surface water runoff.
2. Foul drainage to a public sewer should be provided wherever possible, but where it is demonstrated that it is not feasible, alternative facilities must not pose unacceptable risk to water quality or quantity.”

### **South Cambridgeshire and Cambridge City Level 1 Strategic Flood Risk Assessment (SFRA) September 2010**

- 2.5 The SFRA objectives are to:
  - Assess the risks from all forms of flooding affecting the SCDS and CCC area;
  - Provide a reference and policy document to inform the preparation of future LDF documents;
  - Ensure that SCDC and CCC meet their obligations under the current PPS25 and Local Development Framework Policy guidelines and standards;
  - Inform the Sustainability Appraisal so that flood risk is taken into account when considering options and in the preparation of land use policies;
  - Provide a sufficient level of detail to allow SCDC and CCC to undertake the Sequential Test;
  - Advise and inform private and commercial developers of their obligations under PPS25 in relation to sustainable development and flood risk.
- 2.6 Appendix C2 and C2.1 illustrate that there is low potential for infiltration at this site.
- 2.7 Appendix C3 confirms that the site is not within a Source Protection Zone.
- 2.8 Appendix D1.1 shows that the site is at risk of fluvial flooding.
- 2.9 Tables 4a and 4b from the SFRA contain historic flood records from sources including rivers, highway drainage and sewers. There are no reported incidents of flooding within the site or on Stirling Way, the only recorded incident in Papworth Everard was blocked highway drains in Ermine Street which did not cause flooding.
- 2.10 In summary no evidence is presented within the SFRA which indicates that the development site is at a risk of flooding from any source.

### **Cambridgeshire County Council Surface Water Management Plan (SWMP) August 2011 and County Wide Update (2014)**

- 2.11 The SWMP was originally published in 2011 and was updated in 2014.
- 2.12 The objectives of the SWMP are to:
  - Engage with partners and stakeholders
  - Map historical flood incident data

- Map surface water influenced flooding locations
  - Identify areas at risk of surface water flooding referred to as “wetspots”
  - Identify measures, assess options and confirm preferred options to mitigate against surface water flooding in the prioritised “wetspots”
  - Make recommendations for next steps
- 2.13 The update was to ensure that flooding incidents between 2011 and 2014 were taken in to consideration due to instances of surface water flooding across the County.



### 3. Flood Risk Assessment

- 3.1 A copy of the Environment Agency's current Flood Map included in Appendix B shows the development site to be located within Flood Zone 1 to the north and south of the site but there is an area within the middle of the site surrounding an ordinary watercourse that falls within Flood Zones 2 and 3.
- 3.2 The NPPF requires that for a development site located within Flood Zone 1 which is larger than one hectare and for any new development in Flood Zone 2 and 3, an FRA must accompany the planning application which demonstrates that the proposals would not be exposed to an unsatisfactory level of flood risk, and would not result in an increase in the existing level of flood risk to the surrounding area.
- 3.3 In addition to the requirements of the NPPF and as a result of changes to the roles of Lead Flood Authorities, from 15 April 2015 all major applications (over 10 dwellings) submitted to the Lead Local Flood Authority (LLFA) which for this site is Cambridgeshire County Council and must include a 'Surface Water Drainage Strategy' which will set out the appropriateness of SuDS to manage surface water run-off, including the provision of the maintenance for the lifetime of the development which they serve. Major applications which do not meet this requirement will not be made valid.
- 3.4 The site is not within an area managed by an Internal Drainage Board (IDB).

#### Local Policy

- 3.5 From a review of the South Cambridgeshire and Cambridge City Council SFRA undertaken in Section 2 of this report, there were no sources of flooding identified which would impact on the development site nor historic flooding incidents associated with the site.

#### Sources of Flooding

- 3.6 **Fluvial Watercourses:** A copy of the Environment Agency's Flood Map for the area is included in Appendix B. The mapping shows that the site is located within Flood Zone 1 in the north and south sections of the site however there is a swathe of Flood Zones 2 and 3 running through the middle of the site. All areas within Flood Zones 2 and 3 should avoid built development. It is essential that a flood warning system is put into place and at a minimum signing up to the EA Flood Warning System. All areas at risk of flooding are strictly avoided during a flood warning and remain so at least until a 'no longer in force' alert has been issued by the EA.
- 3.7 **Groundwater:** The site has a bedrock geology of Oxford Clay formation (mudstone) with no recorded superficial deposits. The area is shown to have unproductive groundwater vulnerability in DEFRA's Magic Map.
- 3.8 Appendix C2 and C2.1 of the SFRA show that there is low potential for infiltration whilst appendix B3 confirms that there are no recorded incidents of groundwater flooding at this location. The Flood Incidents Register contained within the 2015 Cambridgeshire County Council Surface Water Management Plan also shows include any records of groundwater flooding. The register held no records of groundwater flooding at this location.

- 3.9 BGS borehole data shows a significant number of records within close proximity of the site many of which are confidential however, there are 4 publicly available borehole records within the Papworth Everard Playground. All of the boreholes are shallow with the deepest borehole 7.5m below ground level, however ground water was not encountered in any of these boreholes. As such, the risk of groundwater flooding at the site is considered to be low.
- 3.10 **Sewer Flooding:** Anglian Water sewer records show that there is a 450mm diameter foul sewer running through the middle of the site in close proximity to the ordinary watercourse. There is also a decommissioned sewer that runs adjacent to the 450mm sewer. Table 4b of the SFRA does indicate any sewer flooding incidents close to the site. As any further built development will be outside of this area and there are no other sewers in close proximity, sewer flooding is not considered to be a significant flood risk to the development site.
- 3.11 **Surface Water/Overland Flow:** The EA surface water flood map shows the majority of the site to be at risk of flooding from surface water. The mapping shows the potential for a build up of water in the north west corner of the site adjacent to the A1198. The high risk event (greater than 3.33% annual probability) shows that flood depths could exceed 900mm in the north west corner and most of the top half of the site is showing depths between 300-900mm. The low risk event (0.1-1% annual probability) shows that the majority of the site is at risk of flooding with depths between 300-900mm and the area of depths over 900mm have extended further east in to the site.
- 3.12 It is recommended that where possible no built development is included within the areas at risk of surface water flooding but these areas are suitable for recreation, amenity open space, nature conservation and biodiversity which would all be suitable for the extension of the school grounds without any built development and would provide excellent educational opportunities.
- 3.13 Surface water flooding is unpredictable and there is no formal advanced warning system therefore it is essential that a system is put in place to ensure that staff members are aware of the risks and any activities that occur within this land have taken account of the current and expected weather conditions and should err on the side of caution if staff are unsure.
- 3.14 There are a number of reported highway flooding incidents within the SWMP for Papworth Everard however, there are no reported incidents within the site or within close proximity to the site. The risk of surface water flooding is high but with the correct land use, knowledge of the risks and guidelines for use there is no reason that this land can not be used for the extension of the existing school grounds.
- 3.15 It is important that an effective surface water drainage system is included in the proposed development to ensure surface water runoff does not pose a significant flood risk to the development or to adjacent land and properties. This has been discussed further in the next section.
- 3.16 **Artificial Sources:** The EA flood map shows that there is no risk of flooding from reservoirs.

## 4 Surface Water Drainage

- 4.1 The NPPF states that “developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area and beyond through the layout and form of the development, and the appropriate application of sustainable drainage techniques (SuDS)”.
- 4.2 SuDS mimic the natural drainage system and provide a method of surface water drainage which can decrease the quantity of water discharged, and hence reduce the risk of flooding. In addition to reducing flood risk, these features can improve water quality and provide biodiversity and amenity benefits.
- 4.3 The SuDS management train incorporates a hierarchy of techniques and considers all three SUDS criteria of flood reduction, pollution reduction, and landscape and wildlife benefit. In decreasing order of preference, the preferred means of disposal of surface water runoff is:
- Discharge to ground.
  - Discharge to a surface water body.
  - Discharge to a surface water sewer.
  - Discharge to a combined sewer.
- 4.4 The philosophy of SUDS is to replicate as closely as possible the natural drainage from a site pre-development and to treat runoff to remove pollutants, resulting in a reduced impact on the receiving watercourses. The benefits of this approach are as follows:
- Reducing runoff rates, thus reducing the flood risk downstream.
  - Reducing pollutant concentrations, thus protecting the quality of the receiving water body.
  - Groundwater recharge.
  - Contributing to the enhanced amenity and aesthetic value of development areas.
  - Providing habitats for wildlife in developed areas, and opportunity for biodiversity enhancement.

### Site-Specific SuDS

- 4.5 The site geology is a Oxford Clay formation (mudstone) with no recorded superficial deposits (taken from BGS geology mapping) and therefore infiltration drainage is unlikely to be suitable as emphasised within Appendix C2 and C2.1 of the SFRA.
- 4.6 The site falls south east to north west and has an unnamed ordinary watercourse which runs through the site. Therefore it is likely that all drainage from any built development will be provided in a new drainage system that will discharge in to the watercourse at the 1 in 1 year greenfield runoff rate where possible or the lowest feasible rate that doesn't provide unnecessary risk due to the size of the flow control device. Storage will be provided on site for all events up to and including the 1 in 100 year + 40% climate change allowance.

- 4.7 The sustainable drainage system (SuDS) should be integrated within the site layout and priority must be given to features that provide multiple benefits such as multi-functional spaces, biodiversity, amenity, water quality and reducing water consumption.
- 4.8 Features such as rainwater harvesting, green roofs and rain gardens should all be considered for the built development as they provide multiple benefits and also provide educational opportunities to the students.
- 4.9 Previous experience working with Cambridgeshire County Council (CCC) has identified the requirement for source control measures to be included across the site. The use of permeable paving, bioretention areas, green roofs and rainwater harvesting are all considered to be source control measures and therefore would need to be included in any drainage strategy to satisfy CCC when submitting a planning application.

## 5 Foul Water Drainage Assessment

- 5.1 There are two foul sewers which run adjacent to the watercourse within the middle of the site, one of which has been decommissioned. It is unclear where the existing school currently connects to the public sewer but there will be an existing connection which should be utilised where possible.
- 5.2 Due to the close proximity of the sewer, it would not be suitable to connect to non-mains drainage given the proximity of the public foul sewer.
- 5.3 Whilst it is assumed that the existing drainage from the site connects to the public sewer, further investigation should be carried out to confirm this.
- 5.4 It is recommended that consultation with Anglian Water is carried out to determine if it is feasible to connect to the sewer and the level of upgrades required, where necessary.

## 6 Summary and Conclusions

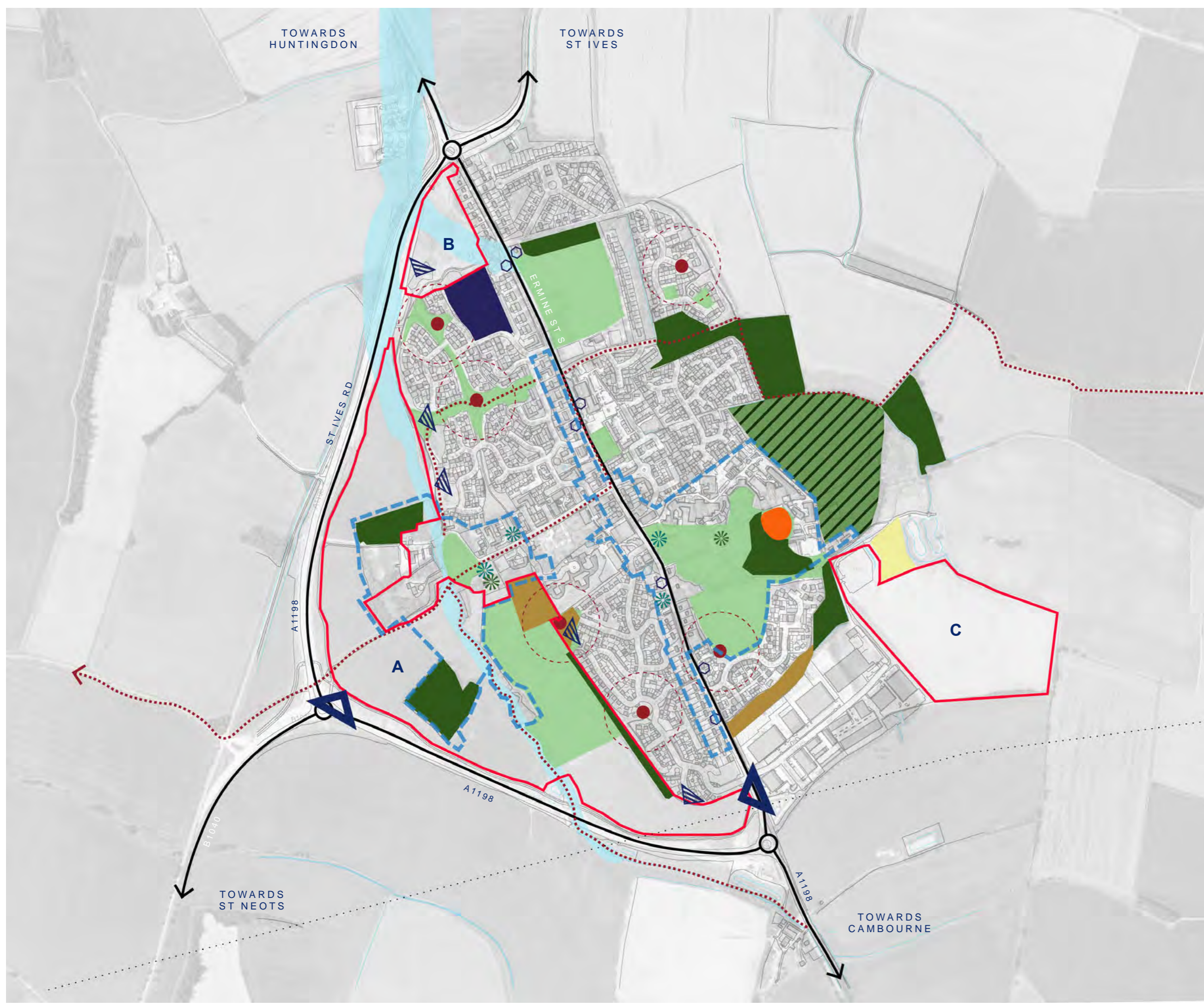
- 6.1 This report has dealt with a proposed development which will comprise of the extension of the existing Pendragon Community Primary School grounds.
- 6.2 The site falls within Flood Zone 1 of the Environment Agency (EA) Flood Zone maps to the north and south of the plot but the middle of the site is in Flood Zones 2 and 3. It is also shown to be at risk of surface water flooding due to the embankment created by the A1198. A flood warning system must be incorporated in to any development.
- 6.3 The surface water drainage will likely discharge to the watercourse within the site with a restricted discharge to the 1 in 1 year greenfield runoff rate or as close as practicably possible with storage provided for all events up to and including the 1 in 100 year + 40% climate change.
- 6.4 The following recommendations are made as a result of this assessment in order to demonstrate the feasibility of the proposals at a planning application stage:
- A) All sources of flooding have been considered by means of a desktop assessment and significant risks have been identified but can be mitigated against by selecting an appropriate land use and introducing a flood warning system.
- B) Where possible no built development should be located in areas at risk of surface water or fluvial flooding but this land can be used for recreational activities, open space, biodiversity and nature conservation which can all be used for educational purposes. Should built development fall within the areas at risk of flooding (potentially within the area at a low risk of surface water flooding), then suitable mitigation measures such as raising finished floor levels should be considered at an early stage.
- C) The clay geology is unlikely to be suitable for infiltration drainage and therefore an attenuation strategy would be required.
- D) The drainage strategy will be restricted to the 1 in 1 year greenfield runoff rate or where this is not practicable the lowest alternative rate and storage will be provided for all events up to and including the 1 in 100 year + 40% climate change event.
- E) There are two foul sewers within the site, however it is not clear where the existing school drainage discharges but this should be utilised where possible. It is recommended that consultation with Anglian Water is carried out to determine if it is feasible to connect to the sewer and the level of upgrades required, where necessary.
- 6.5 In conclusion, the site is suitable for the extension of the school however, all built development should be in the area around of the existing building and the majority of the red line boundary should be used for amenity/recreation. There are suitable options for both foul and surface water disposal and the proposals would not increase flood risk off site.

## Appendices

Appendix: A - Location Plan	14
Appendix: B – EA Flood Map for Planning	15
Appendix: C – EA Surface Water Flood Map	16
Appendix: D – Anglian Water Sewer Records	17

**Appendix: A - Location Plan**





- LEGEND**
- Red line boundaries (A,B and C)
  - Existing roads
  - Drainage channel
  - Existing Public Rights of Way
  - Conservation Area
  - Existing woodland
  - Existing significant woodland / SSSI
  - Existing informal open space
  - Scheduled ancient monument
  - Overhead electricity line
  - Existing allotments
  - Protected amenity
  - Pendragon Community Primary School
  - Existing LAP and 100m isochrone
  - ✱ Grade II Listed Building
  - ✱ Grade II\* Listed Building
  - Existing bus stop
  - ▶ Potential vehicular access
  - ▶ Potential pedestrian / cycle access

Rev.	Date.	Details.

Do not scale from this drawing. All dimensions to be checked on site. This plan is to be read with all accompanying documentation. © Bidwells 2019



**PAPWORTH ESTATE  
VARRIER JONES FOUNDATION  
PAPWORTH EVERARD CONTEXT**

Job Code: 57516	OS License Number: 100017734	
Drawing Scale: NTS	Date: 14.02.20	Drawn By: HD
Drawing Number: UDS57516-A3-0101	Checked By: DP	Revision: -



**LEGEND**

- Proposed Site Boundary
- Existing Road Network
- Drainage Channel
- Existing Public Right of Way
- Overhead Electricity Line
- Existing Woodland
- Proposed woodland
- Proposed Green Links / Corridors
- Proposed Public Open Space
- Proposed Developable Area
- Proposed Developable within Areas Sensitive to Heritage
- ▲ Proposed Vehicular Access
- ▼ Proposed Pedestrian / Cycle Access
- Proposed Primary Vehicular Route
- Proposed Pedestrian Routes
- Open Links between Existing Settlement and Proposed Development

A	14.02.20	Developable Amends
Rev.	Date.	Details.

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 All dimensions to be checked on site.  
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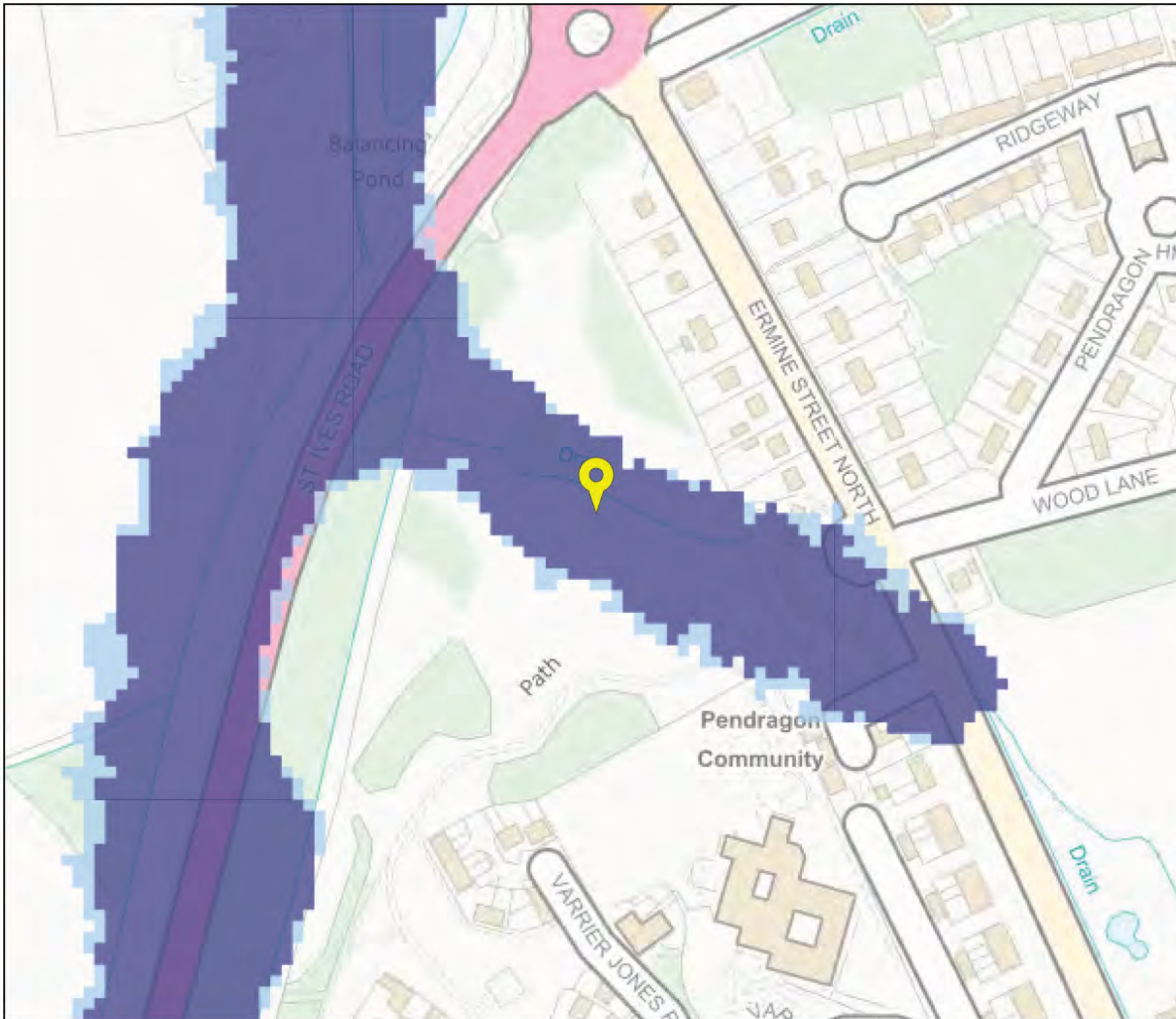


**PAPWORTH ESTATE  
 VARRIER JONES FOUNDATION  
 CONCEPT STRATEGY**

Job Code: 57516	OS License Number: 100017734
Drawing Scale: NTS	Date: 14.02.20
Drawn By: HD	Checked By: MS
Drawing Number: UDS57516-A3-0102	Revision: A

**Appendix: B – EA Flood Map for Planning**





**Flood map for planning**

Your reference

**Papworth B**

Location (easting/northing)

**528173/263505**

Scale

**1:2500**

Created

**24 Jan 2020 12:41**

-  Selected point
-  Flood zone 3
-  Flood zone 3: areas benefiting from flood defences
-  Flood zone 2
-  Flood zone 1
-  Flood defence
-  Main river
-  Flood storage area

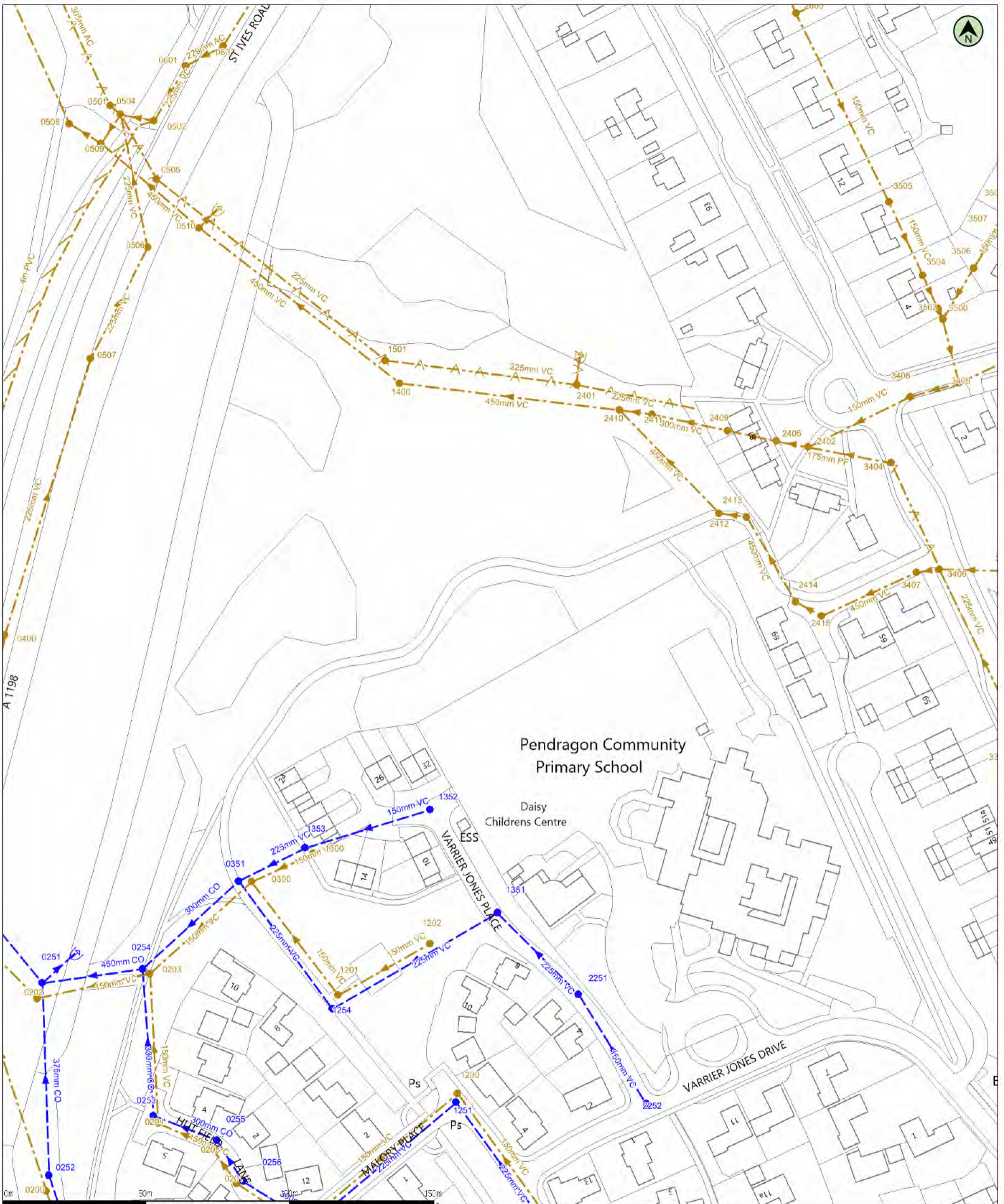


**Appendix: C – EA Surface Water Flood Map**



Source: Long Term Flood Risk Map (<https://flood-warning-information.service.gov.uk/long-term-flood-risk/map>)

**Appendix: D – Anglian Water Sewer Records**



Foul Sewer		Outfall*		Sewage Treatment Works	
Surface Sewer		Inlet*		Public Pumping Station	
Combined Sewer		Manhole*		Decommissioned Pumping Station	
Final Effluent					
Rising Main*					
Private Sewer*					
Decommissioned Sewer*					

\*(Colour denotes effluent type)

Papworth B

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