

Technical Note

Project: Great Ashby, Stevenage

Subject: Surface Water Flow Route Diversion

Client:	Picture Estates Ltd	Version:	P0
Project No:	08006	Author:	AB
Date:	5 April 2024	Approved:	AC

I Introduction

I.1 Terms of Reference

- 1.1.1 PJA was commissioned by Picture Estates Ltd to undertake a preliminary catchment analysis and high-level flow calculations to enhance understanding of an existing identified surface water flow route, as shown on the publicly available Long Term Flood Risk Information, Flood Risk from Surface Water map. This preliminary analysis and high-level calculations have informed an initial estimate of the potential diversion channel capacity and associated cross-sectional requirements.
- 1.1.2 This Technical Note summarises the works undertaken to date.

I.2 Context

- 1.2.1 An existing surface water flow route has been identified following east to west upstream of, and through, the Site within the publicly available Long Term Flood Risk Information, Risk of Flooding from Surface Water Flood Map, and is shown in Figure 1 .

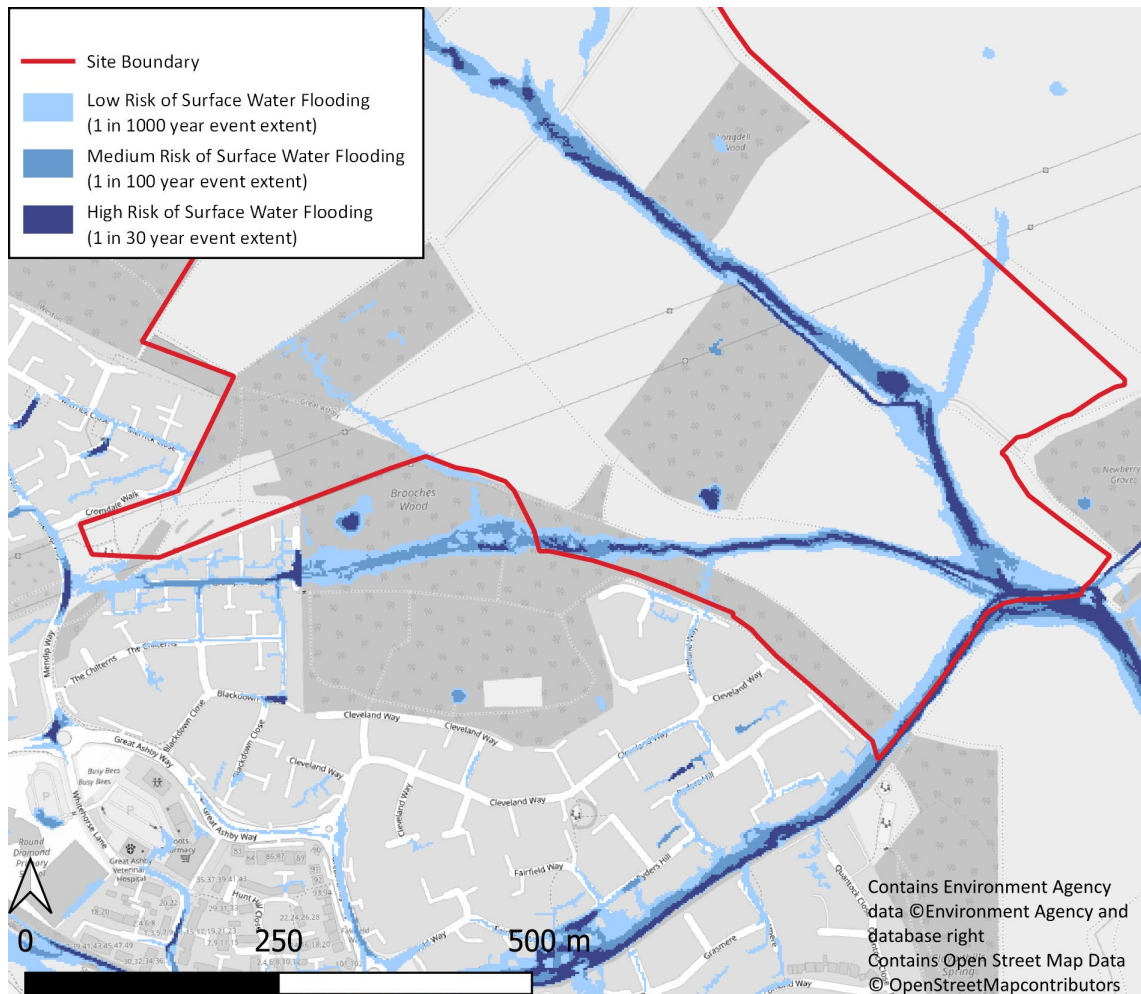


Figure 1: Existing Surface Water Flow Route

- 1.2.2 It is understood that the existing surface water flow route conveys surface water from agricultural land, existing residential development, and woodland, upstream of the Site. The surface water flow route is understood to currently discharge to an unnamed ordinary watercourse to the southeast of the Site, which is understood to be a tributary of the River Beane. Nonetheless, it is not clear from publicly available mapping how this unnamed, ordinary watercourse connects to the River Beane.
- 1.2.3 It is understood that the proposed surface water flow route is proposed to be diverted along the western boundary of the Site to facilitate the proposed residential development. It should be noted that the proposed diversion maintains the downstream connectivity with the unnamed, ordinary watercourse.
- 1.2.4 The proposed diversion is shown in Figure 2 .

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2 Catchment Analysis

2.1.1 The catchment of the existing surface water flow route was calculated using LiDAR Digital Terrain Model (DTM) data obtained from the Defra Data Services Platform. The LiDAR DTM data was used to map the contributing catchment draining to the existing ditch. Figure 3 shows the extents of the contributing catchment, which was calculated to be approximately 40.39 ha. The existing catchment contains currently developed land (i.e. existing residential development), which was calculated to be approximately 14.06 ha. The remainder of the catchment area is undeveloped, greenfield land, which was calculated to be approximately 33.33 ha.

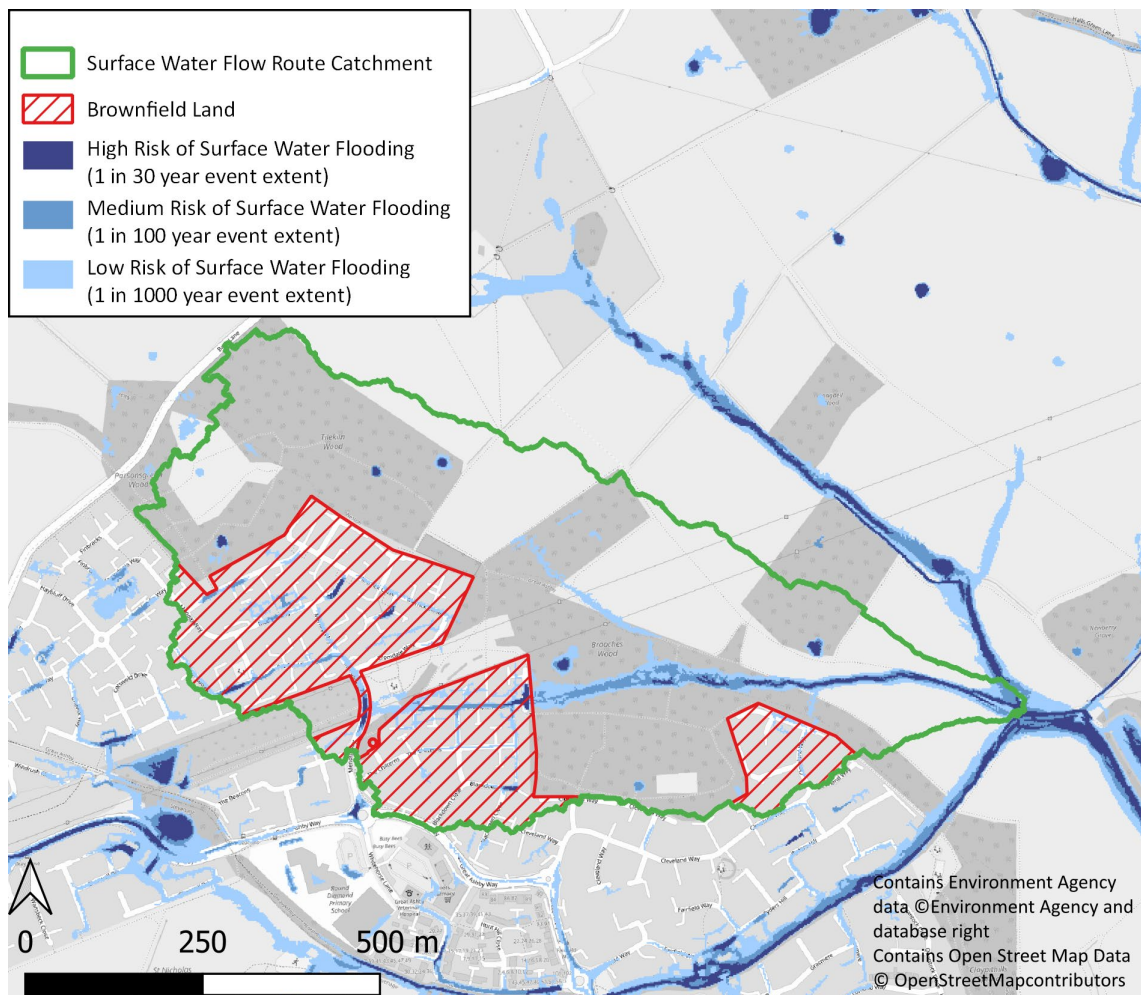


Figure 3: Existing Surface Water Flow Route Catchment

3 High Level Flow Calculations

- 3.1.1 The rate of greenfield run-off conveyed by the existing surface water flow route for a range of return periods was determined using the HR Wallingford Greenfield runoff rate estimation tool. Flood Estimation Handbook (FEH) catchment descriptors for the site were obtained through the FEH web service. A 40% uplift has been applied to the 1 in 100-year rate to account for climate change.
- 3.1.2 The run-off rates were determined for the following return periods:
- 1-year;
 - 30-year;
 - 100-years;
 - 100-year-year + 40% climate change allowance (design event).
- 3.1.3 An indicative run-off rate has been calculated in Causeway Flow software to determine a likely potential discharge rate for the existing residential development within the catchment. The existing residential development of 14.06 ha has been assumed to be 60% impermeable.
- 3.1.4 A 40% climate change allowance has been applied in accordance with national peak rainfall allowances for the Upper Lee Management Catchment (which the Site falls within) for the 1% annual exceedance rainfall event and the 2070s epoch upper end allowance. A 40% uplift has been applied to the rainfall data within the Causeway Flow model for the existing residential development and for consistency a 40% uplift has been applied to the greenfield 1 in 100-year flow rate.
- 3.1.5 The peak flow rates from the above assessment are summarised in Table 1.

Table 1: Peak Run-Off Rates

Catchment	1 in 1-year (l/s)	1 in 30-year (l/s)	1 in 100-year (l/s)	1 in 100-year plus 40% Climate Change (l/s)
Greenfield	47.18	130.05	188.97	264.56
Existing Residential	n/a	3,581.70	4,481.60	6,323.70
Total	n/a	3,711.75	4,670.57	6,588.26

4 Diversion Channel

- 4.1.1 The trapezoidal cross-sectional area of the proposed ditch diversion has been calculated using Manning's equation, based on the flow rate for the 1 in 100-year storm even plus 40% climate change for the entire catchment. The Manning's equation is stated below:

$$q = A v = A (k_n / n) R_h^{2/3} S^{1/2} \quad (3)$$

where:

q = volume flow (ft^3/s , m^3/s)

A = cross-sectional area of flow (ft^2 , m^2)

v = cross-sectional mean velocity (ft/s , m/s)

$k_n = 1.0$ for SI units

n = Manning coefficient of roughness- ranging from 0.01 (a clean and smooth channel) to 0.06 (a channel with stones and debris, 1/3 of vegetation)

R_h = hydraulic radius (ft , m)

S = slope - or gradient - of pipe (ft/ft , m/m)

- 4.1.2 The Manning's roughness coefficient has been assumed to be 0.04, which sits within the logical range of main channel that is clean, winding, some pools and shallows, or a main channel with stones and weeds (Chow, 1949¹).
- 4.1.3 The slope of the proposed channel has been calculated to be 1 in 42, based on the existing topography. The proposed channel is approximately 240 m in length.
- 4.1.4 Assuming a channel base width of 1.0 m, with 1 in 3 sides slopes and a maximum peak flow rate of $6.5959 \text{ m}^3/\text{s}$, maximum peak water levels are estimated to be 0.82 m. This is demonstrated below:

¹ https://www.fsl.orst.edu/geowater/FX3/help/8_Hydraulic_Reference/Mannings_n_Tables.htm

$$Q = \frac{A^{5/3} S^{1/2}}{nP^{2/3}}$$

$$6.58826 = ((1 + 3y)y)^{5/3} \times \frac{\sqrt{0.02381}}{0.04(1 + 2y(1 + 3^2)^{0.5})^{2/3}}$$

$$y = 0.824331$$

- 4.1.5 Based on these calculations, an indicative channel cross section capacity of 4.92 m² has been determined to convey the maximum peak water level and associated maximum peak flow rate, including a 300 mm freeboard, for the 1 in 100-year plus climate change event.
- 4.1.6 An indicative cross section for the proposed channel is included in Appendix A.

Limitations

Purpose

This document has been prepared for Picture Estates Ltd for their sole and specific use.

PJA Civil Engineering Ltd. accepts no responsibility or liability for any use that is made of this document other than by Picture Estates Ltd for the purposes for which it was originally commissioned and prepared.

The conclusions and recommendations contained herein are limited by the availability of information.

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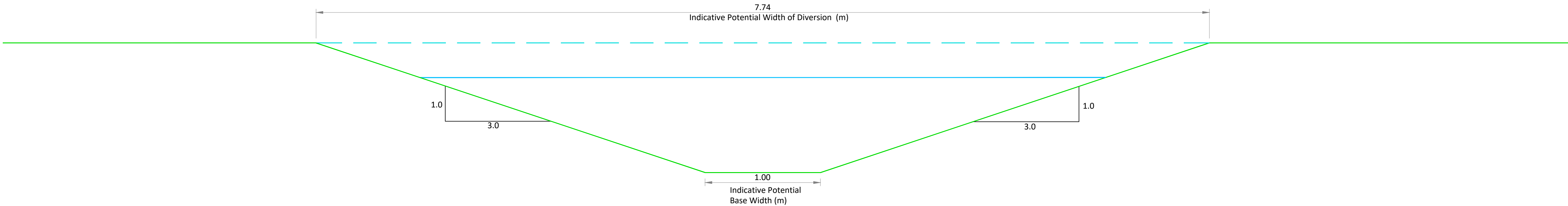
CDM

The revised Construction (Design and Management) Regulations 2015 (CDM Regulations) came into force on April 2015 to update certain duties on all parties involved in a construction project, including those promoting the development. One of the designer's responsibilities under clause 9 (1) is to ensure that the client organisation, in this instance Bloor Homes, is made aware of their duties under the CDM Regulations.

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Appendix A Proposed Cross Section



CDM Note

These drawings have been produced with reference to the CDM Regulations 2015. Please note that these are pre-construction phase drawings and should be subject to further design risk management as required in accordance with Regulation 9.

GENERAL NOTES:

1. This drawing is to be read in conjunction with all other relevant Engineering and Architect's details.
2. The design details presented must be reviewed in conjunction with the wider site information and site constraints which may not be evident on drawing and must be requested if not already provided. This includes, but not limited to, ground conditions (geotechnical and geo-environmental), groundwater levels, buried services, remnant obstructions, ecology, tree protection and topography.
3. The Engineer shall be notified immediately, in writing, should any errors or discrepancies be found prior to the commencement or continuation of any works.
4. All work is to be carried out in accordance with current British Standards, Building Regulations and NHBC Standards.
5. It is the responsibility of the Contractor to execute the works at all times in strict accordance with the requirements of the Health and Safety at Work Act 1974, and the C.D.M. Regulations 2015. The Contractor will be deemed to have allowed for full compliance, including full liaison with the CDM Co-ordinator, within his rates.
6. Any existing details which are shown on this drawing are for guidance only and are to be checked on site by the contractor. Any variations are to be recorded and reported to the engineer immediately.
7. Before work commences contractor should consult the engineer and the SI report regarding any contamination issues. All necessary Health and Safety measures to be taken
8. Plan to be read in conjunction with 08006-TN-001-PO.
9. Works undertaken are indicative and high level in nature. These are subject to refinement during the next design stage.
10. No hydraulic modeling has been undertaken to inform these works
11. No earthworks or level assessment has been undertaken to inform these works.

Key:

— Indicative Maximum Peak Water Level

— Indicative Freeboard Level

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Rev	Date	Revision Note		Drw	Chk	App

transport ● engineering ● placemaking

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Client

Picture Estates Ltd

Project

Great Ashby, Stevenage

Title

Indicative Potential Surface Water Flow Route Diversion Channel Cross-Section

Drawing Issue Status

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08006

Scale @ A1
20

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08006-WR-0500

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