

DATE: 30th November 2022
TO: James Hewit
FROM: Michael Stewart & Michael MacDonald
SUBJECT: Hendersyde Drive, Kelso

Technical Memo: Flood Risk Assessment – Hendersyde Drive, Kelso

Introduction

Kaya Consulting Limited was commissioned by James Hewit through Ferguson Planning Ltd to undertake a Flood Risk Assessment for a proposed residential development at Hendersyde Drive, Kelso. This technical memo summarises the results of the assessment.

The site measures approximately 0.08 hectares in area and is located in Kelso, in the Scottish Borders Council area. The site currently consists of greenfield land on the outskirts of a residential area.

Site Overview

The site location is shown in **Figure 1**. The site is shown in **Photo 1**.

The site is bounded to the north and west by existing residential development. On all other sides, the site is bounded by a wooded area with a small surface water drain. The site lies on an area of flat to gently sloping ground. Ground levels within the site range between 48 and 50m AOD (Above Ordnance Datum).

There is an informal ditch/drain to the south-east of the site; this feature is marked on Ordnance Survey mapping – see **Figure 1** and **Photo 2**. It should be noted that the ditch did not contain water when the site was visited. The approximate minimum overtopping level of the drain is 49.1m AOD, based on 1.0m LiDAR DTM data.

The River Tweed, the closest large watercourse, is located ~700m south-east of the site (**Figure 2**).

Consultation of the SEPA Flood Map indicates that part of the site lies within an area of predicted surface water flooding. Under SPP and SEPA guidance the development would need to be assessed up to the 1 in 200-year event with consideration of climate change ^{ab}.

Figure 1: Site location map



Reproduced by permission of Ordnance Survey on behalf of The Controller of Her Majesty's Stationery Office. © Crown copyright. All rights reserved. Licence number 100045301.

Figure 2: Site Topography



Figure 3: Cross-Section of Site



Photo 1: Looking at the proposed development



Photo 2: Photo of the land drain



Fluvial Flood Risk

The River Tweed is located ~700m to the south-east of the site (**Figure 3**). Consultation with the SEPA Flood Map indicates that the site is not at risk of fluvial flooding from the River Tweed.

Figure 3 shows that the River Tweed is located at 26.46m AOD. There is a local high of 58.25m AOD between the river and the site; ~31.8m higher than the river level.

Therefore, the site is not considered to be at significant risk of fluvial flooding.

Surface Water Flood Risk

Consultation of the SEPA Flood Map indicates that there is an area of predicted surface water (pluvial) flooding around the site.

A detailed watershed analysis was undertaken in GIS software using available 1m resolution LiDAR data. The analysis highlighted a 28.2ha surface water catchment (**Figure 4**) that could flow towards the site. The surrounding topography suggests that surface water could flow towards the site from the west and south-west. Ground levels to the east and west of the site are broadly similar to the site meaning surface water in these areas would also tend north towards local low areas.

To better understand the flood risk from surface water, rainfall-runoff modelling was undertaken in Flood Modeller Pro software. The model was constructed using a representative rainfall hyetograph was estimated using ReFH2.3 software with FEH Web-service catchment descriptors. To account for urban drainage within the contributing catchment, the 1 in 5-year storm was subtracted from the design rainfall events.

Model runs included the 1-, 3- and 5-hour storm duration events for the 200-year and 200-year + climate change return periods to test the sensitivity of the model under different parameters.

An account for climate change has been made whereby a 59% uplift in rainfall intensity was applied, consistent with SEPA guidance.

Figures 5 and **6** show the critical 3-hour, 200-year and 200-year + climate change flood depth maps. The maps indicate some predicted surface water ponding within the site but most of the site lies outside of the flooded area.

Figure 5: 3 Hour 200 Year Flood Map

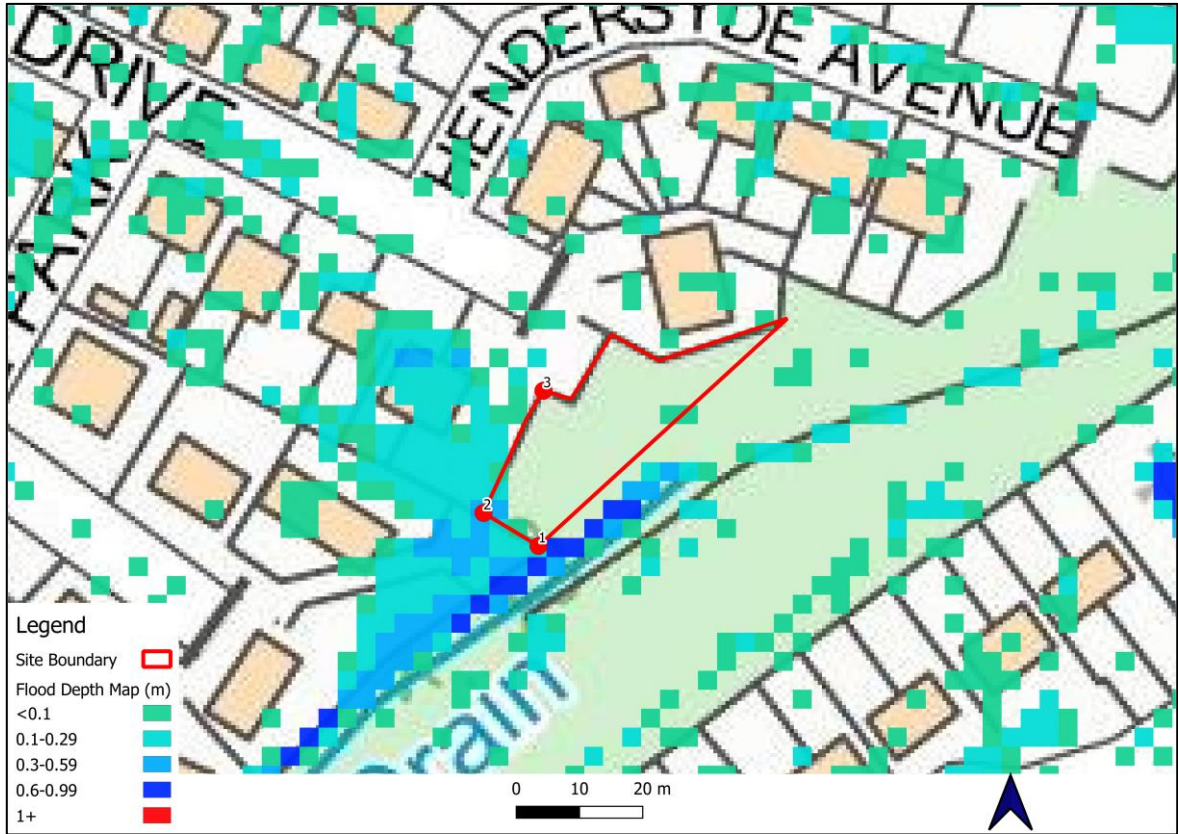


Figure 6: 3 Hour 200 Year + Climate Change Flood Map

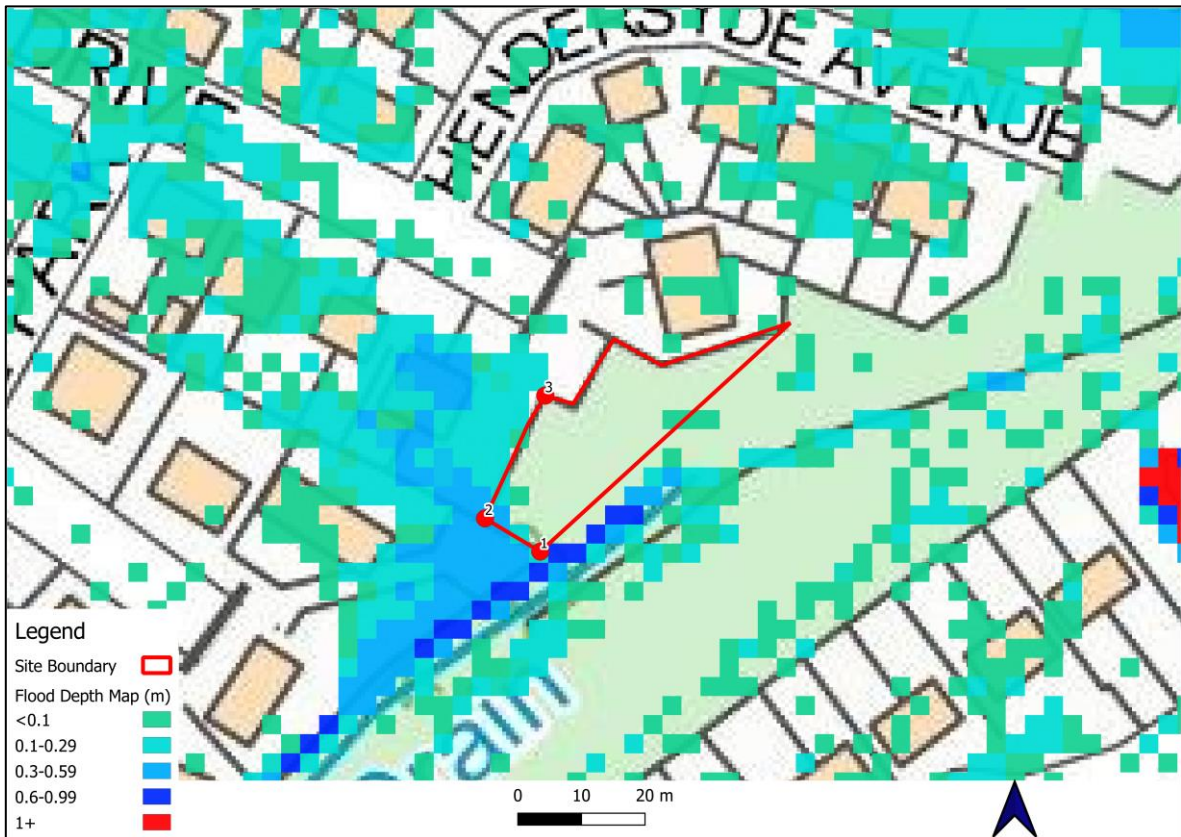


Table 1 shows a series of water surface elevations (WSE) to inform the finished floor levels of the development.

The 200-year + climate change flood level helps to determine Finished Floor Levels at the site. SBC follows SEPA guidance, suggesting a freeboard of 0.6m.

The recommended Finished Floor Levels for this development are **49.67m AOD**.

Table 1: Table of Water Surface Elevations

| Reference Point (see Figure 5) | 1 in 200 Year + Climate Change Water Surface Elevation (m AOD) |
|-----------------------------------|---|
| 1 | 49.02 |
| 2 | 48.02 |
| 3 | 49.07 |

Figure 2 indicates that levels within the site fall to the south-west, which is the lowest point in the site itself. The rest of the site lies at a relatively higher elevation, constraining surface water levels.

Photo 3 shows that water is not likely to be able to pond to depths of 0.59m as ground levels would not permit this.

Photo 3: View of where surface water flooding is predicted



Other Sources of Flood Risk

The SEPA Flood Map show that the site is not predicted to be at risk of groundwater flooding. Risks from groundwater as a primary source in Scotland are generally low.

Any flood waters emerging from the residual risk of surcharging sewers in the site area would follow surface water pathways. Mitigation of surface water flooding should help protect the development from surcharging sewers.

Consultation with the SEPA reservoirs flood map indicates that there are no reservoir breach scenarios which are predicted to have an impact on the site.

The site is not located in close proximity to a canal or the coast and is therefore not at significant risk of flooding from these sources.

The surface water modelling predicts a surface water pathway flowing from west to east along Hendersyde Drive towards the site at a rate of 0.045l/s. The surface water is predicted to be at a depth of less than 0.1m; therefore, vehicular, and pedestrian access should be possible during the 1 in 200-year event.

Summary

Kaya Consulting Limited was commissioned by James Hewit through Ferguson Design Ltd to undertake a Flood Risk Assessment in support of a development of a single residential unit in Kelso.

The site is currently a greenfield piece of land which lies on the outskirts of residential development., measuring 0.8ha in area. Most of the site is situated above 49m AOD which is above some of the surrounding ground levels, however the site is at a similar level to existing residential buildings. A nearby drain is located just outwith the site, with an approximate overtopping level of 49.1m AOD which lies below most of the existing ground levels, of which a freeboard would be applied post-development.

The River Tweed lies ~700m to the south east of the site and there is higher land between them (**Figure 3**) which would require the river to rise over 37m to overtop this land and flood the site. Therefore, the site is not considered to be at risk of fluvial flooding

The SEPA pluvial flood maps indicated that some surface water ponding may occur within the area of the site. Rainfall-runoff modelling agreed with the SEPA flood maps; however, a site walkover has shown that it is unlikely that the surface water could pond to the predicted depths of up to 0.59m due to the local topography (**Photo 3**).

The house should be located outside of the floodplain area shown in **Figure 6**. Finished Floor Levels (FFLs) at the site would need to consider surface water flooding. Based on **Table 1**, FFLs for the site could be: 49.67 AOD based on the maximum predicted water surface elevation (3-hour, 200-year + climate change return period) + a 0.6m freeboard recommendation. Surface water velocities in the site reach a maximum of 0.025l/s in the south-west corner.

It is recommended that developed site levels intercept surface water and channel it into the existing sewer system.

Based on the surface water modelling, vehicular and pedestrian access can be achieved by Hendersyde Drive because surface water depths are predicted to be up to 0.1m at a surface water velocity of 0.045l/s.

We trust the above satisfy your current requirements. If you have any queries regarding this response, please do not hesitate to contact the undersigned.

Yours faithfully,

Michael Stewart
Director

REFERENCES

^a SEPA, *Flood Risk and Land Use Vulnerability Guidance*, July 2018.

<https://www.sepa.org.uk/media/143416/land-use-vulnerability-guidance.pdf>

^b SEPA, *Technical Flood Risk Guidance for Stakeholders - SEPA requirements for undertaking a Flood Risk Assessment*, May 2019. <https://www.sepa.org.uk/media/162602/ss-nfr-p-002-technical-flood-risk-guidance-for-stakeholders.pdf>