Scottish & Southern Electricity Networks

TRANSMISSION

# TECHNICAL APPENDIX 12.3 FLUVIAL GEOMORPHOLOGY ASSESSMENT

# Netherton Hub

## Fluvial Geomorphology Assessment

On behalf of SSEN Transmission

Project Ref: 331201430 | Rev: A | Date: November 2023

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# Document Control Sheet

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| **For and on behalf of Stantec UK Limited** | | | | |

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| | | | | | |

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# 1 Introduction

## 1.1 Project Background

1.1.1 This Fluvial Geomorphology Assessment has been produced by Stantec UK ('Stantec') on behalf of our client, Scottish and Southern Electricity Networks ('SSEN'), to support an outline planning application for a strategic transmission hub ('the proposed development') on land at Flushing, Peterhead, Aberdeenshire ('the Site').

1.1.2 The Scheme involves realigning waterways through the Site and introducing surface water drainage for the proposed buildings.

1.1.3 A review of site characteristics and historic mapping was undertaken to establish if the Site waterways are considered natural or artificial.

## 1.2 Site Location

1.2.1 The site of interest is a broadly square parcel of land approximately 222ha in area, located to the southern edge of Flushing, Aberdeenshire in Scotland (**Figure 1.1**).

1.2.2 The Site is located approximately 7.5 km west of Peterhead. The northern boundary of the Site is the A950 Longside Road which also borders the village of Flushing. The Burn of Faichfield is located approximately 500m to the east and the Burn of Ludquharn is located circa 450m to the west of the Site.

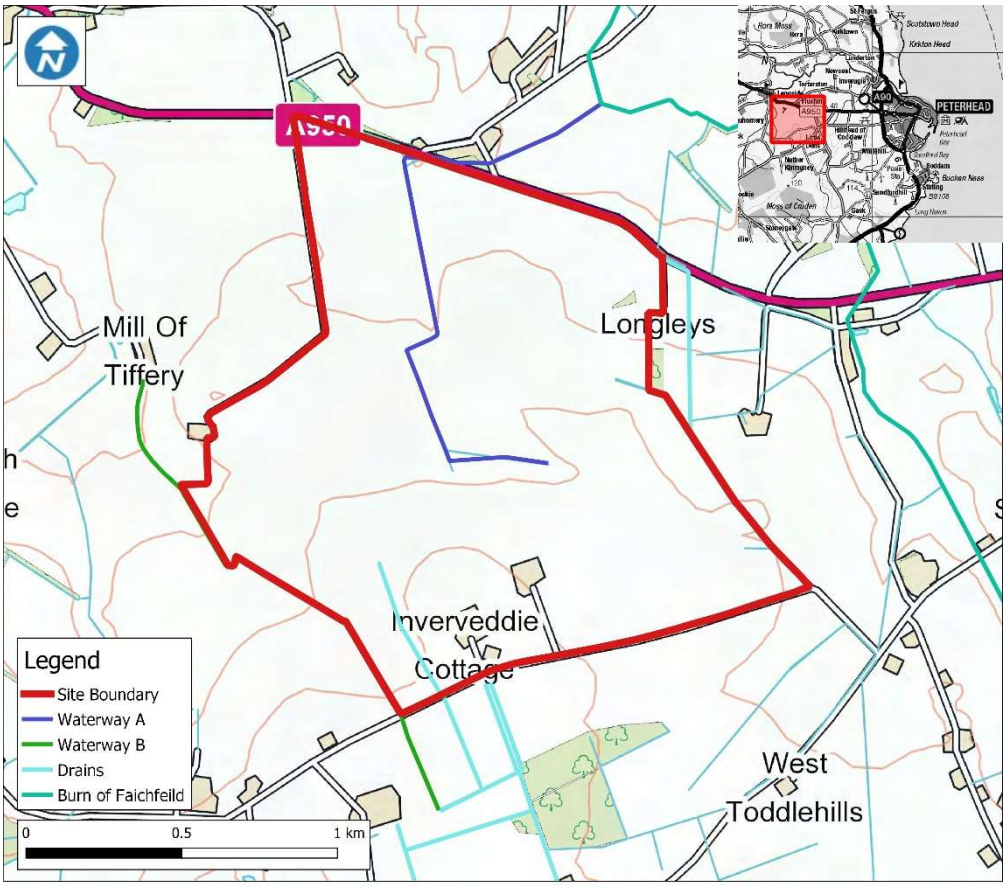


Figure 1.1: SSE Proposed Development Site Boundary

# 2 Geomorphology Characteristics

## 2.1 Overview

2.1.1 The desk-based components involved reviewing a wide range of information available for the Site from sources openly available through the internet (LiDAR, historical maps, WFD, geology and soils). The desk-based component of the study is essential to gain understanding of the wider context of the Site waterways, in order to appreciate the geomorphological characteristics influencing the Site.

## 2.2 Topography

2.2.1 The Site topography is shown in **Figure 2.1** below using survey information undertaken in 2023. The Site generally slopes from south to north varying from ~68mAOD in the south-western corner of the Site, to ~28mAOD in the north. The Site is laterally flat, with the change in elevation confined to the centre of the Site.

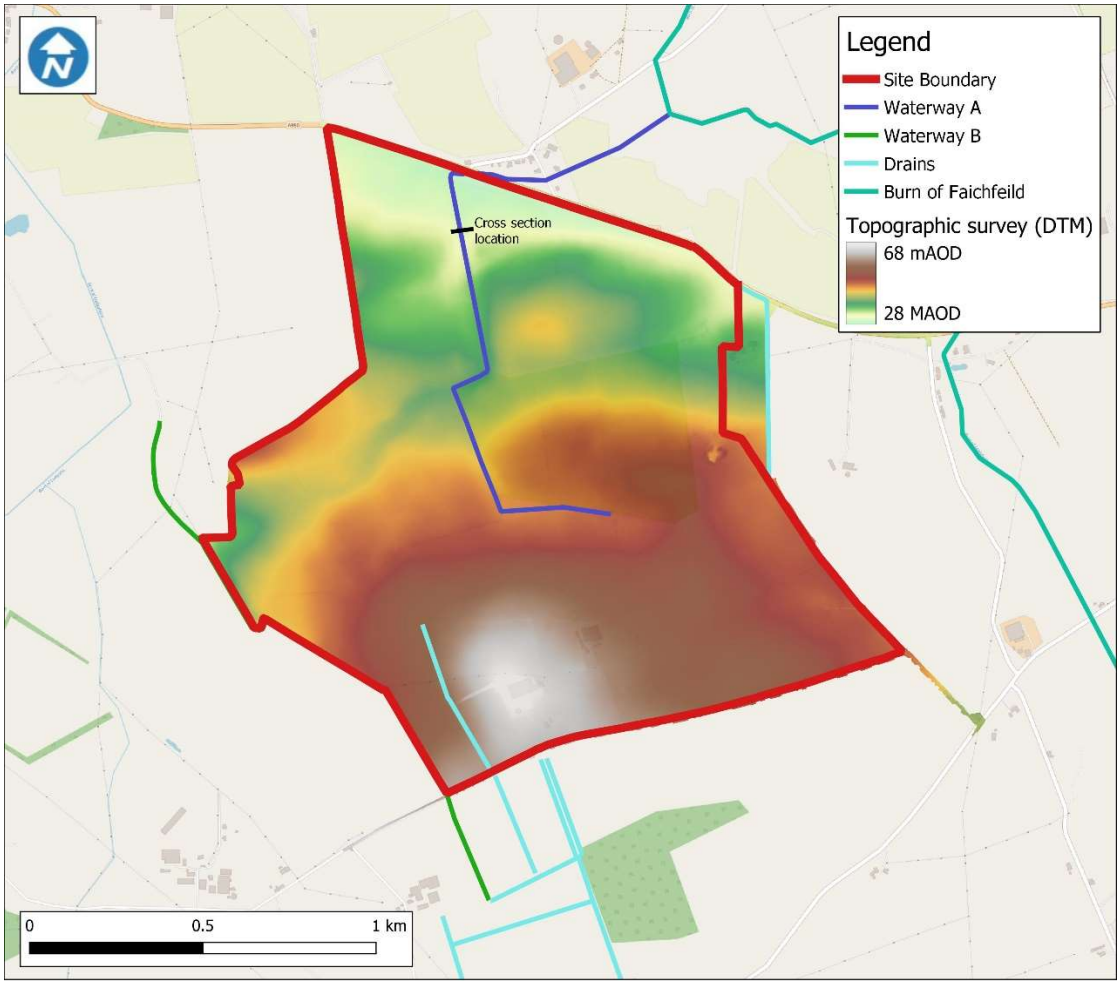


Figure 2.1: Waterways within and around the Site

2.2.2 Waterways A and B have a uniform V-shape channel profile (see **Figure 2.2**) and sit within a lateral planar floodplain, suggesting that the channels are utilised to drain the surrounding area. Waterway A has an embankment on the right bank in the north of the Site. This is likely a result of dredging and material placed on this bank due to the right floodplain being a lower elevation than the channel banks. The embankment removes the floodplain connection.

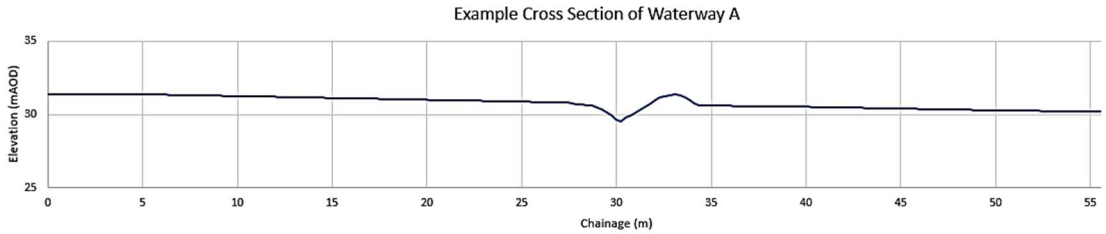


Figure 2.2: Cross section of Waterway A

2.2.3 The long profiles of these waterways highlight different features within the individual channels (**Figure 2.3**). For example, the peak in elevation along waterway A from 1400m to 1650m indicates a culvert.

2.2.4 Waterway B lies on the cusp of the topographical survey as it forms the western boundary of the site, therefore LiDAR has been used to interpolate the gaps in data. Topographical data has been used for the chainages between 314m to 681m and 1409m to 1448m.

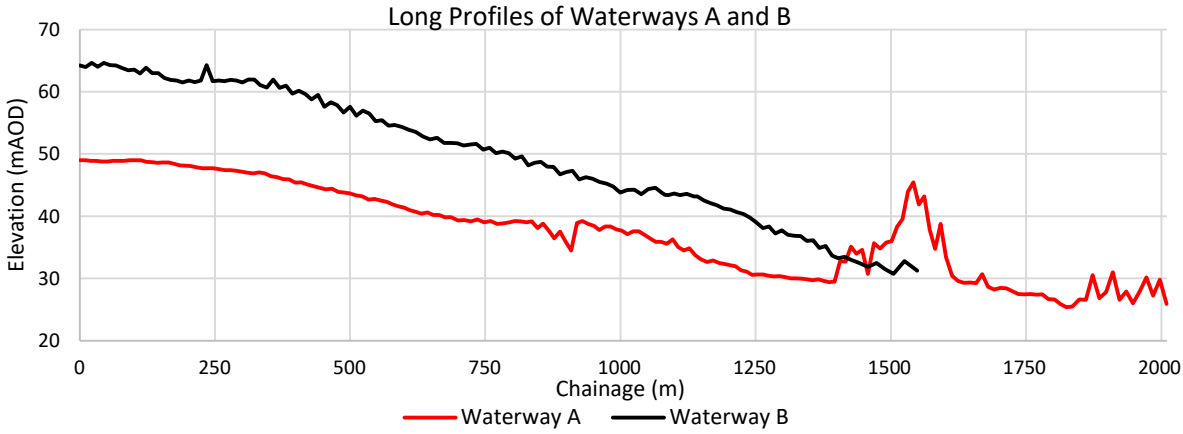


Figure 2.3 Waterway A and B Long Profiles

## 2.3 Land-use

2.3.1 Land cover across the Site is dominated by agriculture, with the majority being arable and horticultural, whilst areas of grassland are also present.

2.3.2 To sustain arable farming, the land needs to drain and not hold water, whilst not infiltrating or running off the land at a rate that removes the nutrients form the soil.

## 2.4 Geology and Soils

2.4.1 The bedrock geology of the Site is defined as Unnamed igneous intrusion (Ordovician to Silurian – felsic rock), whilst the superficial geology of the Site is Till in the south and Glacial Sand and Gravel along the A950.

2.4.2 The majority of the Site consists of Noncalcerous Gleys soils which are defined as being periodically or permanently wet. However, Brown Soils are located in the south western corner of the Site and are defined as moderately acidic.

2.4.3 The Gleys soil holds water and therefore the Waterways are likely to be used to drain the Site, evidenced by the existing land-use being predominantly arable agriculture. The Till and Glacial Superficial deposits will allow infiltrated water to flow through them on top of the impermeable igneous bedrock.

## 2.5 Flow Regime

2.5.1 According to the National Rivers Flow Archive, there are no flow gauges within the catchment. However, inferences on the hydrology of the Site can be made from the topography, geology and land use. The catchment is underlain by waterlogging soils and impermeable bedrock, whilst there is a large change in elevation, the Site is laterally flat, with a steep slope located within the centre of the Site, whilst agricultural land-use dominates. Of these factors, the key influences on flow regime are likely to be the soil, and topography.

2.5.2 Consequently, it is likely that there is a slow response to rainfall events with water slowly draining into the Waterways.

## 2.6 Water Framework Directive

2.6.1 The Site and its waterways lie within the Faichfield Burn and Burn of Ludquharn WFD water bodies. **Table 2-1** summarises the water bodies.

Table 2-1: Current status of WFD water bodies

| Water body name | Faichfield Burn | Burn of Ludquharn |
|---|---|---|
| **Water Body ID** | 23217 | 23225 |
| **Hydromorphological Designation** | Heavily Modified for Agricultural Land Drainage | Heavily Modified for Agricultural Land Drainage |
| **Current status** | Moderate | Moderate |
| **Overall Objective** | Good by 2027 | Good by 2027 |

2.6.2 The current overall status of the Faichfield Burn and Burn of Ludquharn WFD water bodies are both identified as 'Moderate' (2020). The current overall status objective for the water bodies are both to reach 'Good' status by 2027. In 'Reasons for Not Achieving Good Cycle 3 Data' the following are listed:

- Modifications to bed, banks and shores from farming
- Diffuse source from rural sources

2.6.3 Due to the water bodies being classified as Heavily Modified and strongly influenced by farming practices, the waterways within the Site are likely to have the same classifications as these water bodies and therefore are artificial and heavily modified.

## 2.7 Historic Trend Analysis

2.7.1 Analysis of historical maps was undertaken to assess change in channel morphology within the Site. The oldest Ordnance Survey (OS) mapping found of the area was published in 1872 and shows the Site waterways in the same location as present day. All historic maps have the Site waterways labelled as 'Drains'.

2.7.2 Maps between 1902 and 1972 have a Hydraulic Ram marked on Waterway A in the northern portion of the Site. Hydraulic Rams are used to transfer water to an elevation higher than where it enters from. They are used when there is a low-head hydropower or when water needs to be pumped to a higher elevation.

2.7.3 Historic aerial imagery was checked and did not show any distinct watercourses through the Site, confirming the waterways followed the field boundaries as they do in the present day and on the historic OS maps.

2.7.4 A comparison of the existing waterway location with LIDAR was also undertaken to establish if any historic flow path routes had altered the Site topography. The Lidar has no distinct flow paths other than the existing waterways. The waterways follow the topography, aligning with the natural flow routes within the Site, except for the sharp right angle corners within the waterway routes, where the topography is smooth and sweeping. This, and the straight nature of the waterways suggests they align with the field boundaries.

2.7.5 Therefore, the existing waterways within the Site have not changed morphology since 1872 and have followed field boundaries since then. The need for a Hydraulic Ram suggests the waterways are used as field drains with little flow energy, as the waterways align with the Site topography and gradient and therefore water does not need to be moved to a higher elevation.

# 3 Summary

## 3.1 Site location and characteristics

3.1.1 Drains and waterways are located within the Site, which is predominantly used for agriculture.

3.1.2 There is a 40m difference in elevation within the Site, that is underlain with impermeable bedrock and water logging soils. The Historic maps show no change in morphology and have the main waterways labelled as drains.

## 3.2 Conclusion

3.2.1 Due to the nature and characteristics of the Site waterways it is assumed that Waterway A and B are heavily modified and have been artificially formalised for drainage; this has been the case since 1872, when the first detailed recorded map for the Site was found.