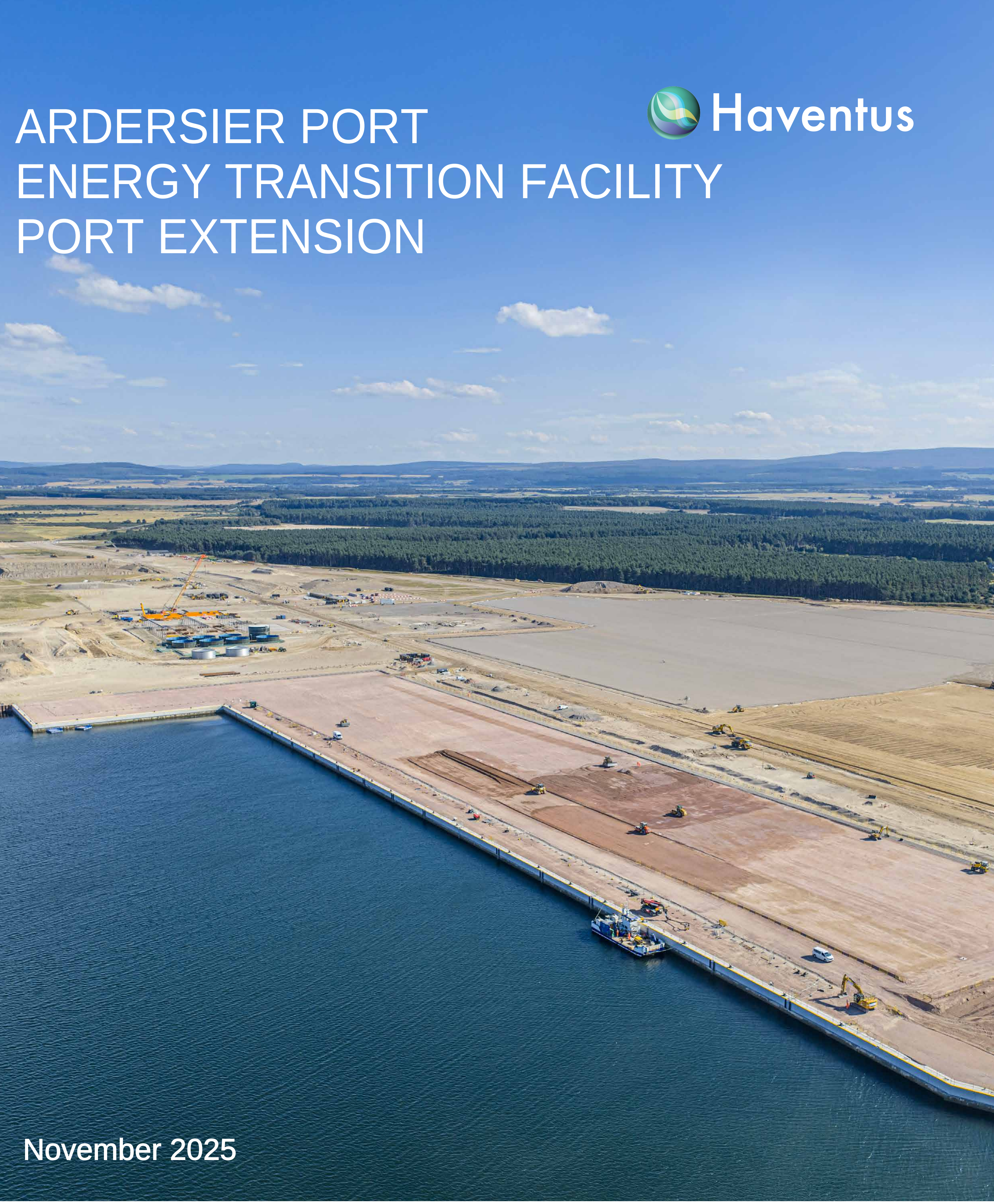
Haventus

ARDERSIER PORT
ENERGY TRANSITION FACILITY
PORT EXTENSION



November 2025

Appendix 9.1: Legislation, Policy and Guidance

Appendix 9.1: Legislation, Policy and Guidance

The purpose of this appendix is to support Chapter 9 (Hydrology and Hydrogeology) of the Environmental Impact Assessment Report (EIAR).

The proposed development description is provided in Chapter 3 (Project Description). The Indicative Masterplan is provided in Chapter 3. An Environmental Constraints Plan is provided in Figure 1.4 of Chapter 1 (Introduction).

The assessment for the hydrology and hydrogeology has been undertaken with reference to the following relevant legislation, planning policy and guidance presented below.

Legislation

Relevant legislation and guidance documents have been reviewed and taken into account as part of this assessment. Of particular relevance are:

- Water Framework Directive (WFD) 2000/60/EC of the European Parliament;
- The Conservation (Natural Habitats, &c.) Regulations 1994 (N.0 2716)
- Water Environment and Water Services (Scotland) Act 2003;
- Water Environment (Controlled Activities) (Scotland) Regulations 2011, as amended (CAR);
- Water Environment (Miscellaneous) (Scotland) Regulations 2017;
- Flood Risk Management (Scotland) Act 2009;
- The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations.

Planning Policy

- UK Marine Policy Statement (DEFRA, 2011);
- National Planning Framework (NPF4) (The Scottish Government, 2023);
- Scotland's National Marine Plan (The Scottish Government, 2015); and
- The Highland Council Highland Wide Local Development Plan (THC, 2012);

Guidance

Consideration has been taken of the following best practice guidelines/guidance:

- NetRegs Guidance for Pollution Prevention (GPP) Documents. Available at: https://www.netregs.org.uk/environmental-topics/guidance-for-pollution-prevention-gpp-documents/
    - GPP1 1: Understanding your environmental responsibilities – good environmental practices
    - GPP 2: Above ground oil storage;
    - GPP 3: Use and design of oil separators in surface water drainage systems;
    - GPP 5: Works and maintenance in or near water;
    - GPP 6: Working at construction and demolition sites;
    - GPP 8: Safe storage and disposal of used oils;
    - GPP 13: Vehicle washing and cleaning;
    - GPP 21: Pollution incident response planning;
    - GPP 22: Dealing with spills;
    - GPP 26 Safe storage - drums and intermediate bulk containers;

- SEPA, 2006. Guidelines for Water Pollution Prevention from Civil Engineering Contracts. Available at: https://www.sepa.org.uk/media/152220/wat_sg_31.pdf ;
- SEPA, 2009. Engineering in the Water Environment Good Practice Guide – Temporary Construction Methods. Available at: https://www.sepa.org.uk/media/150997/wat_sg_29.pdf
- SEPA, 2014. Land Use Planning System SEPA Guidance Note 31. Available at: https://www.sepa.org.uk/media/143868/lupsgu31_planning_guidance_on_groundwater_abstractions.pdf
- SEPA, 2024. Flood Risk and Land Use Vulnerability Guidance.
- SEPA. 2024 Guidance on assessing the impacts of developments on groundwater dependant terrestrial ecosystems;
- SEPA, 2024. Guidance on assessing the impacts of developments on groundwater abstractions;
- SEPA, 2025. Climate change allowances for flood risk assessment in land use planning (V6). Available at: https://www.sepa.org.uk/media/jjwpxuso/climate-change-allowances-guidance_v6.pdf

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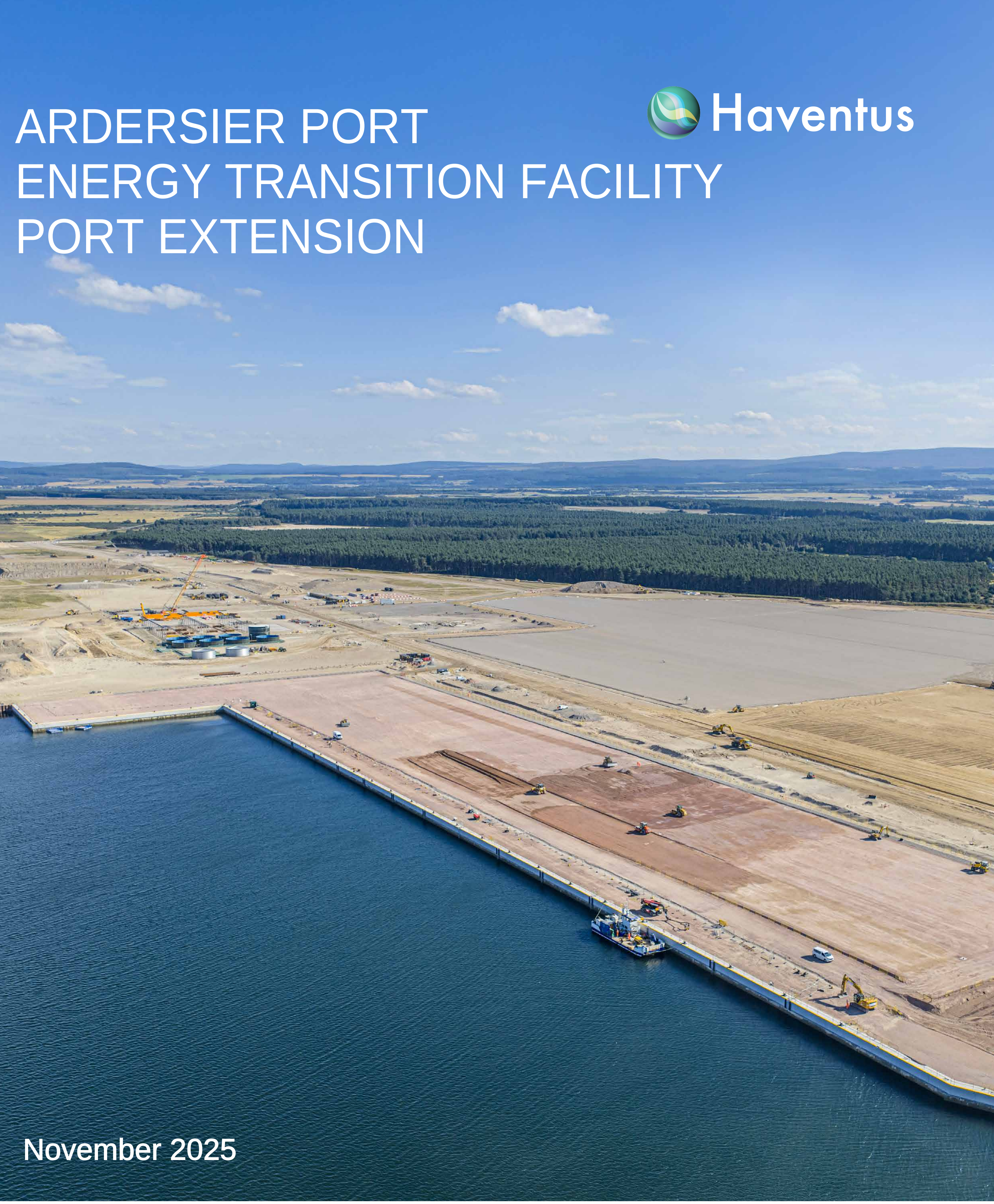


November 2025

Appendix 9.2: Assessment Methodology

Appendix 9.2: Assessment Methodology

1.1 Introduction

The purpose of this appendix is to support Chapter 9 (Hydrology and Hydrogeology) of the Environmental Impact Assessment Report (EIAR). This appendix presents the assessment methodology applied within Chapter 9.

The methodology follows standard Environmental Impact Assessment (EIA) procedures, in accordance with the Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017, and involves the following:

- Consultation with key stakeholders;
- Desk based study establishing the existing baseline conditions;
- Identification of sensitive receptors and environmental constraints;
- Identification of potential environmental impacts including cumulative impacts;
- Assessment of impact magnitude;
- Identification and assessment of mitigation, enhancement, and monitoring measures; and
- Statement of significance of residual effects.

1.2 Study Area

The study areas for the different components were as follows:

- Surface water hydrology, flood risk and drainage, hydrogeology and water quality: the assessment focused on surface water hydrology within the application site, including external areas to the south of the site which are within the hydrological catchment area of land drains within the site and the saltmarsh area to the east of the site that receives discharge from some of the site's internal land drains. Characteristics of the wider catchment areas have been considered up to a 1km buffer where relevant, including the receiving coastal water bodies, and impacts within a 2km buffer have been considered for designated sites;
- Groundwater Dependant Terrestrial Ecosystems (GWDTEs): Within the Site and up to 250m from the proposed location of excavations over 1m depth and within 100m of excavations under 1m depth;
- Abstractions: This assessment focused on abstraction such as Private Water Supplies (PWS) and Scottish Environment Protection Agency (SEPA) abstractions registered under controlled Activities Regulation (CAR) within the application site and wider 2km buffer; and
- Geology, soils and peat: Assessment focused on the area within the application site.
- Intra-project effects: The assessment focused on effects within the application site for the various construction phases (marine and terrestrial);
- Cumulative impacts: The assessment focused on developments within a 15 km of the application site. For hydrology and hydrogeology the zone of influence (ZOI) for assessment focuses on the wider catchment area of the site, lagoon, saltmarsh and the receiving coastal waterbody (Hilton of Cadboll to Whiteness Head coastal water body) as shown within Figure 1: Zone of Influence and Figure 2: Zone of Influence at the Site. The ZOI covers an area of 15,302 ha.

Figure 1: Zone of Influence

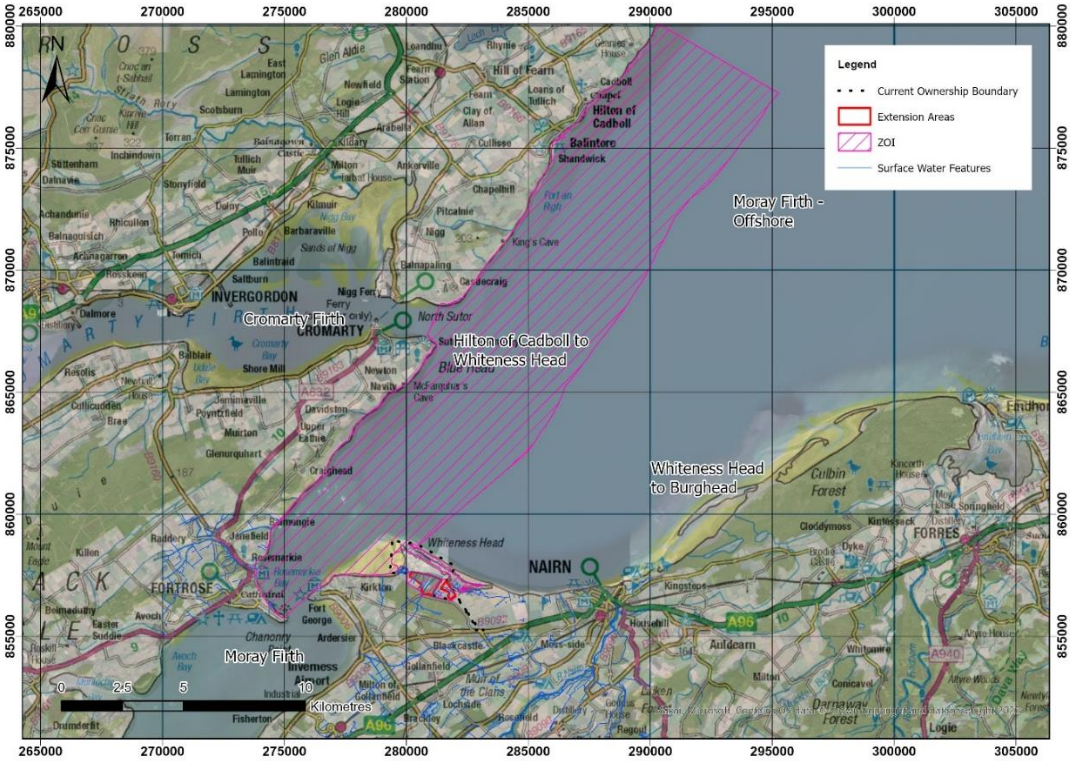
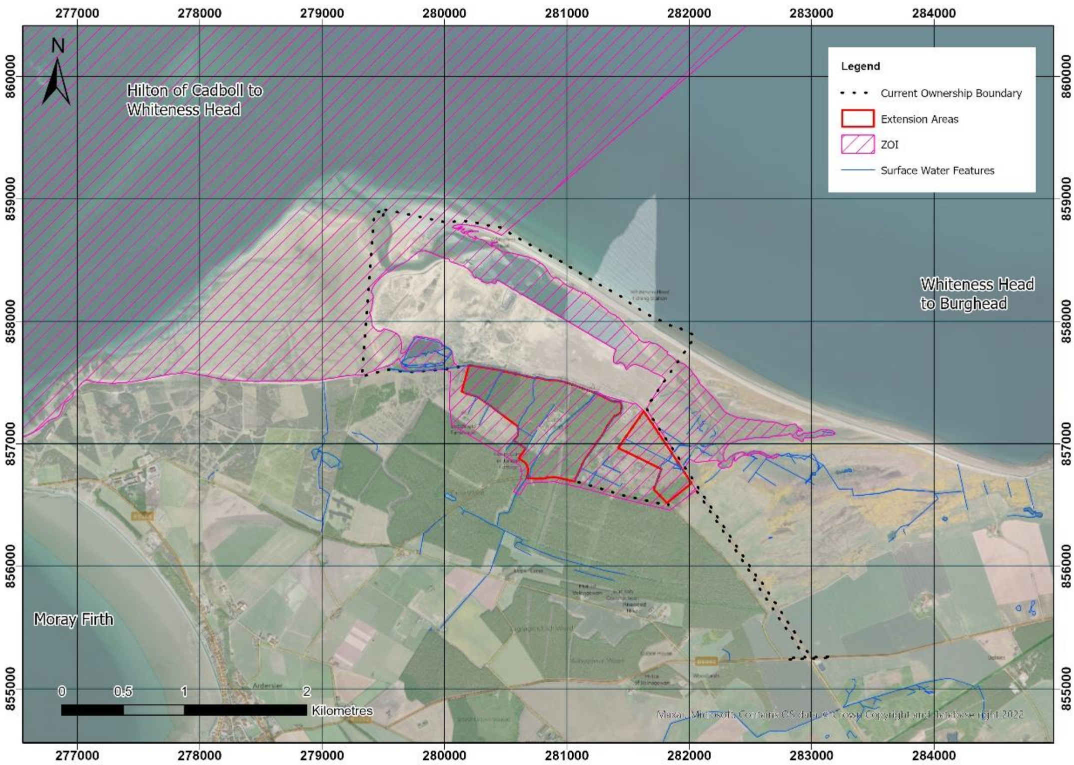


Figure 2: Zone of Influence at the Site



1.3 Data Sources

The following published data sources have been used:

- Ordnance Survey (OS) 1:25,000 digital mapping to provide topographical data and information about water features and land forms;
- British Geological Survey (BGS) 1:50,000 digital map data (BGS, 2016) has been used to establish the baseline environment for assessment of the underlying solid and superficial geology;
- Aquifer Productivity and Vulnerability maps have been used to establish the baseline environment for the underlying superficial and bedrock hydrogeology (Dochartaigh, et al. 2011);
- The River Basin Management Plan (RBMP) Interactive Map has been used to establish the baseline water quality status for surface water and coastal water bodies (SEPA, 2015);
- The James Hutton Institute (JHI) soil maps (James Hutton Institute, 2018) have been used to establish the baseline environment for assessment of the underlying soils;
- SEPA Flood Maps (Scotland) (SEPA, 2025) have been used to assess baseline flood fluvial, surface and coastal flood risk;
- SEPA (2017). Land Use Planning System Guidance Note 31 has been used to establish habitat potential for groundwater dependency;
- Climates change allowance have been established from SEPA (2025) online web map for the northeast Scotland region;
- LiDAR for Scotland Phase 1 DTM data (2011-12), obtained from the Scottish Remote Sensing Portal, has been used to extend coverage of ground elevation information, for areas not covered by privately commissioned LiDAR and topographic survey.

Additionally, the following technical reports have been reviewed as part of this assessment which are provided in relevant appendices of this EIAR:

- Appendix 12.14 Botanaeco (2025). Haventus Extension Area. Habitats, vegetation and GWDTE.

Baseline information on PWS and abstractions was also sought directly through consultation with The Highland Council and SEPA, respectively.

A hydrological site walkover was undertaken by EnviroCentre on 1-2 May 2025, to confirm routes, flow directions, connectivity and general characteristics of existing land drainage channels within and draining towards the site, and to inform specification of topographic survey of these drainage channels for subsequent representation in flood modelling. Further details are presented in the Flood Risk Assessment report (Appendix 9.3).

1.4 Methodology

The assessment follows standard EIA procedures which include:

- Desk based review of the design of the proposed development in relation to the local water environment, soils and geology;
- Consultation with key stakeholders to obtain relevant information and to ensure their concerns are addressed within the study;
- Establishing the existing baseline conditions:
    - Review topography, soils, geology and ground conditions at the application site and wider study area;

  - Review of hydrology, catchment characteristics, and water quality conditions;
  - Review of ecological habitats;
  - Review of detailed flood risk assessment provided within Appendix 9.3
  - Review of drainage design statement provided within Appendix 9.4;
  - Reporting of baseline conditions to provide a basis for assessment of the potential impact.
- Impact assessment:
  - Identification of sensitive receptors and environmental constraints;
  - Identification of potential impacts;
  - Assessment of impact magnitude;
  - Identification and assessment of mitigation measures to reduce or avoid any potential impacts of the proposed development; and
  - Statement of residual effects.

Potential impacts arising from the proposed development have been predicted and evaluated. The observed baseline data was used along with professional opinion to qualitatively assess the potential impacts and the significance to receptors.

1.5 Assessment Criteria

The assessment criteria set out in Table 1 and **Error! Reference source not found.** have been used to develop a matrix to assess the significance of effects from the proposed development on the local water environment (Table 3).

The assessment considers whether the impact is positive or negative. The assessment of residual effects takes into consideration the probability of the effect occurring within the following probabilities:

- Certain;
- Likely;
- Possible; or
- Unlikely

The duration of the effect is assessed within the following durations:

- Short (less than 2 years);
- Medium (2 – 5 years);
- Long term (more than 5 years); or
- Permanent

All direct and indirect impacts causing moderate or major effects are considered to be significant.

Table 1: Criteria for Assessing Receptor Sensitivity

Receptor Sensitivity	Description
High	Receptors with a low capacity to accommodate change, high value or condition and significant use, for example: • Receptor is an internationally or nationally designated site. • Surface / coastal water body supports sensitive aquatic ecological receptors e.g. freshwater pearl mussels. • Surface / coastal water body used for public water supply or large scale industrial/ agricultural abstractions. • Surface / coastal water body important for recreation directly related to water quality e.g. swimming, watersports, angling. • High or very high productivity aquifer. • Groundwater body supports public water supply or large scale industrial/ agricultural abstractions.
Medium	Receptors with a moderate capacity to accommodate change, medium value or condition and limited use, for example: • Receptor is not an internationally or nationally designated site. May be a locally designated site. • Salmonid species may be present and surface / coastal water body may be locally important for spawning. No other sensitive aquatic ecological receptors e.g. freshwater pearl mussels. • Surface / coastal water body used for private water supply or medium scale industrial/ agricultural abstractions. • Surface / coastal water body used for occasional or local recreation e.g. local angling clubs. • Navigable surface / coastal water body used by commercial or recreational vessels. • Moderate productivity aquifer. • Groundwater body supports identified private water supplies or medium scale industrial/ agricultural abstractions.
Low	Receptors with a high capacity to accommodate change, low value or poor condition and no significant uses, for example: • Receptor is not an internationally, nationally or locally designated site. • Not classified as a surface / coastal water body for the River Basin Management Plan (RBMP). • Surface / coastal water body not significant in terms of fish spawning and no other sensitive aquatic ecological receptors e.g. freshwater pearl mussels. • Surface / coastal water body not used for abstraction. • Surface / coastal water body not used for recreation directly related to water quality e.g. angling, swimming, watersports. • Surface / coastal water body not used by commercial or recreational vessels. • Low or very low productivity aquifer with no identified abstractions.

Table 2: Criteria for Assessing Impact Magnitude

Receptor Sensitivity	Description
Negligible	Very light change from baseline conditions. Change barely distinguishable, approximating to the 'no change' situation.
Low	Minor shift away from baseline conditions. Change arising from the loss/alteration will be discernible but underlying character/composition/attributes of the baseline condition will be similar to pre-development circumstances/patterns.
Medium	Loss or alteration to one or more key elements/features of the baseline conditions such that post-development character/ composition/ attributes of baseline will be partially changed.
High	Total loss or major alteration to key elements/features of the baseline (pre-development) conditions such that post-development character/composition/attributes will be fundamentally changed.

Table 3: Criteria for Assessing Effects

		Magnitude of Impact			
		Negligible Impact	**Low Impact**	**Medium Impact**	**High Impact**
Receptor Sensitivity	**High Sensitivity**	Negligible Effect	Moderate Effect	Major Effect	Major Effect
	Medium Sensitivity	Negligible Effect	Minor Effect	Moderate Effect	Major Effect
	Low Sensitivity	Negligible Effect	Minor Effect	Minor Effect	Moderate Effect

1.6 Assumptions and Limitations

The assessment of flood risk, presented as Appendix 9.3, assumes progression of consented development of the port site to a platform level exceeding the 1 in 200 year plus climate change extreme stillwater level of 4.24 mAOD or above, as per the consented design proposal, such that assessment of (baseline) coastal and land drainage flood risk accounts for this platform. No revised/repeat assessment of flood risk to the consented site is undertaken as part of this assessment.

The drainage impact assessment and associated drainage design proposals, presented as Appendix 9.4, similarly focusses on the extension site only, with no revised/repeat assessment of drainage for the consented site except where elements of drainage design proposals overlap the boundaries of both sites.

1.7 Assessor Information

Martin Nichols BSc (Hons) MSc MCIWEM C.WEM

Martin is an Associate Director with over 14 years consultancy experience in EIA, geomorphology, geology, hydrology and flood risk, within both the private and public sectors. Martin has geomorphology field survey experience in upland, river and coastal systems, and has undertaken hydraulic modelling in support of a range of projects, including river restoration and flood risk assessments. He has extensive GIS experience, including mapping, data, spatial and 3D analysis in relation to a range of projects, including large scale EIA development projects, renewable energy developments, river and peatland restoration, peat landslide risk assessments, peat management plans and coastal developments and quarry developments. Martin is a chartered water and environmental manager (C.WEM) through CIWEM, and an experienced project manager.

Jennifer Smith BSc (Hons) MSc MCIWEM

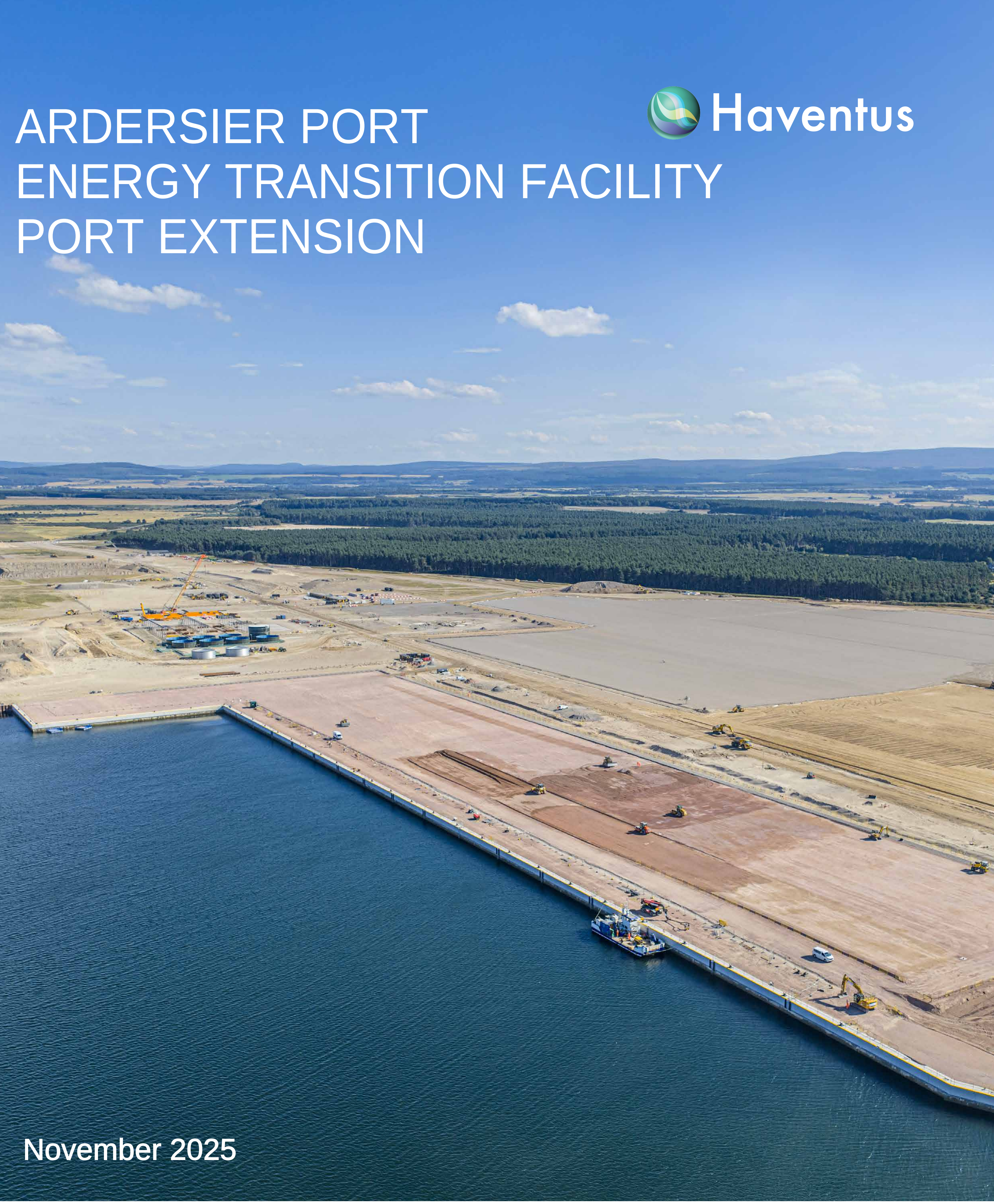
Jennifer Smith is a Senior Environmental Consultant with EnviroCentre. She has gained over 5 years' experience of consultancy whilst working on a range of projects including peat surveys and assessments, hydrological assessments, coastal assessments, EIA development projects surface water management and environmental monitoring. Jennifer has gained valuable skills in GIS, including spatial and 3D analysis techniques. Jennifer has undertaken various assessment and written several EIA chapters for a range of development including windfarms, OHL, pier and peat extraction sites. Jennifer is a non-chartered member of CIWEM.

Dr Iain Struthers BSc BEng (Hons) PhD

Iain has over 21 years of experience in hydrological and hydrodynamic model development and application within consultancy and academia in the UK, Australia and Japan. Iain has expertise in flood risk assessment, surface water management planning, sustainable drainage (SuDS) design, and the development and application of hydraulic models of rivers and sewer networks. In addition to leading technical delivery of large and small flooding projects, Iain has experience in project management, including client liaison and management, statutory consultation and reporting, in both flood risk management and multi-disciplinary projects.

Charlotte Hewson BSc (Hons) MSc

Charlotte is an Environmental Consultant with EnviroCentre. She has gained over 3 years' experience in consultancy and regulator roles, following a BSc in Oceanography & Coastal Processes and an MSc in Hydrology and Water Management. Charlotte has project experience in coastal and terrestrial EIAR's, coastal assessments, private water supply assessments, and peat assessments. Charlotte has developed skills in GIS including spatial and 3D analysis techniques, and has field survey experience including environmental monitoring, hydrology walkovers and peat surveys.



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November 2025

Appendix 9.3 Ardersier Extension Site Flood Risk Assessment

Ardersier Extension Site
Flood Risk Assessment

October 2025

CONTROL SHEET

Client: Haventus
Project Title: Ardersier Extension Site
Report Title: Flood Risk Assessment
Document number: 15463
Project number: 681962

Issue Record

Issue	Status	Author	Reviewer	Approver	Issue Date
1	DRAFT	IS	MN	MN	21/08/2025
2	FINAL	IS	MN	MN	22/10/2025

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Contents

Appendices

Figures

Tables

1 INTRODUCTION

1.1 Terms of Reference

EnviroCentre Ltd were commissioned by Haventus to undertake a Flood Risk Assessment (FRA) for the proposed extension to the Ardersier Energy Transition Facility (Ardersier ETF), located on the Carse of Ardersier. The following report details the methodology and findings of the FRA and recommendations for flood risk management for the site.

1.2 Scope of Report

The report assesses flood risk to the site from all sources. Screening outcomes identify that coastal flood risk, as well as flood risk posed by land drainage channels within and adjacent to the site, are material considerations. As proposals will entail platforming over existing land drainage pathways, a critical element of flood risk assessment will be understanding the impact proposed development may have upon altering flood risk, to ensure that development does not cause flood risk detriment to any potential receptors.

1.3 Report Usage

The information and recommendations contained within this report have been prepared in the specific context stated above and should not be utilised in any other context without prior written permission from EnviroCentre Limited.

If this report is to be submitted for regulatory approval more than 12 months following the report date, it is recommended that it is referred to EnviroCentre Limited for review to ensure that any relevant changes in data, best practice, guidance or legislation in the intervening period are integrated into an updated version of the report.

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EnviroCentre Limited accepts no liability for use of the report for purposes other than those for which it was originally provided, or where EnviroCentre Limited has confirmed it is appropriate for the new context.

1.4 Terminology & Glossary

There are two ways of expressing the likelihood of a flood event with a certain magnitude: one is quantifying as a percentage using the concept of Annual Exceedance Probability (AEP) and the other method is to express flood risk using the concept of Return Period (RP) measured in years. The relationship between AEP and RP is presented in Appendix A. In this report the two concepts are used interchangeably, as appropriate.

The Council/THC	The Highland Council
CC	Climate change
GIS	Geographic Information System
LiDAR DTM	A digital terrain model (DTM) of gridded ground elevations, obtained by remotely sensed measurements of distance (usually by aircraft) using laser light (LiDAR)
NGR	National Grid Reference; a geographic grid reference system used in the UK, also referred to as British National Grid
mAOD	Elevation, in metres above Ordnance Datum (where the Ordnance Datum is the mean sea level at Newlyn in Cornwall)
NPF4	National Planning Framework 4 (Scottish Government, 2023)
OS	Ordnance Survey
SEPA	Scottish Environment Protection Agency

1.5 Regulatory Framework

1.5.1 National Planning Framework 4 (NPF4)

NPF4 was adopted by Scottish Ministers on 13 February 2023, replacing Scottish Planning Policy (2014). In relation to flood risk and water management, the intent of NPF4 is:

"To strengthen resilience to flood risk by promoting avoidance as a first principle and reducing the vulnerability of existing and future development to flooding."

Where development cannot avoid areas of flood risk, proposals will only be supported if they are for:

i. essential infrastructure where the location is required for operational reasons;
ii. water compatible uses;
iii. redevelopment of an existing building or site for an equal or less vulnerable use; or.
iv. redevelopment of previously used sites in built up areas where the Local Development Plan (LDP) has identified a need to bring these into positive use and where proposals demonstrate that long-term safety and resilience can be secured in accordance with relevant SEPA advice.

In relation to surface water flood risk, development proposals will:

i. not increase the risk of surface water flooding to others, or itself be at risk.
ii. manage all rain and surface water through sustainable drainage systems (SuDS), which should form part of and integrate with proposed and existing blue-green infrastructure. All proposals should presume no surface water connection to the combined sewer;
iii. seek to minimise the area of impermeable surface.

For planning purposes, "at risk of flooding" and "in a flood risk area" means land or built form with an annual probability of being flooded of greater than 0.5% which must include an appropriate allowance for future climate change.

1.5.2 SEPA Guidance

SEPA's *Technical Flood Risk Guidance for Stakeholders* (v13) (SEPA, 2022)[1] details the requirements for undertaking flood risk assessments in relation to proposed developments. These requirements depend upon the complexity of the site, with more complex or high-risk sites requiring detailed assessments. In summary, FRAs must include the following:

- Background site data, including suitable plans and/or photographs;
- Historic flood information;
- Description of methodologies used;
- Identification of relevant flood sources;
- In case of river flooding: assessment of river flows, flood levels, depths, extents, displaced flood storage volumes, etc.;
- Assessment of culverts, sewers or other structures affecting flood risk;
- Consideration of climate change impacts;
- Details of required flood mitigation measures; and
- Conclusions on flood risk related to relevant national and local policies.

Technical guidance on Flood Estimation Handbook (FEH) (CEH, 2008) methodologies and on land raising and compensatory storage are also provided as part of this guidance.

[1] https://www.sepa.org.uk/media/162602/ss-nfr-p-002-technical-flood-risk-guidance-for-stakeholders.pdf

2 SITE DETAILS

2.1 Site Location & Water Features

The site is located on the Carse of Ardersier. The location and extents of the site are shown in Figure 2.1, along with land drain locations and a tidally influenced lagoon within the western area of the site. Land drains as shown on the map generally flow from south to north.

Figure 2.1: Site location, extents and terrestrial (i.e. non-coastal) water features

2.2 Topography

Figure 2.2 presents topography in the site vicinity, noting that ground elevation has been obtained from multiple sources (noting that sources later on the list are considered to supersede those earlier in the list, where coverage overlaps):

- LiDAR for Scotland Phase 1 DTM data (flown between 2011-12).
- A "Saltmarsh LiDAR Survey" (flown in 2024) of the eastern areas of the site, and areas beyond the eastern boundary.
- A "Woodland LiDAR Survey" (flown in 2024) of the central and southern area of the site.

- A “Complete Site LiDAR Survey” (flown in May 2025) of the full site, excluding the site access road (noting that this almost entirely supersedes the Woodland survey, excepting for small patches beyond the southern boundary of the site).

The area outwith the application site generally slopes from south to north towards the coastal boundary. The northern parts of the application site are elevated above southern areas of the application site as part of previously consented development for the port site within the site boundary, with a perimeter drain along the southern boundary of this platformed area, which discharges by culvert to coastal waters. The southeastern area also discharges by culvert, eastwards under the site access road and by further land drainage channels to eventually discharge into the lower-lying saltmarsh area to the east of the site.

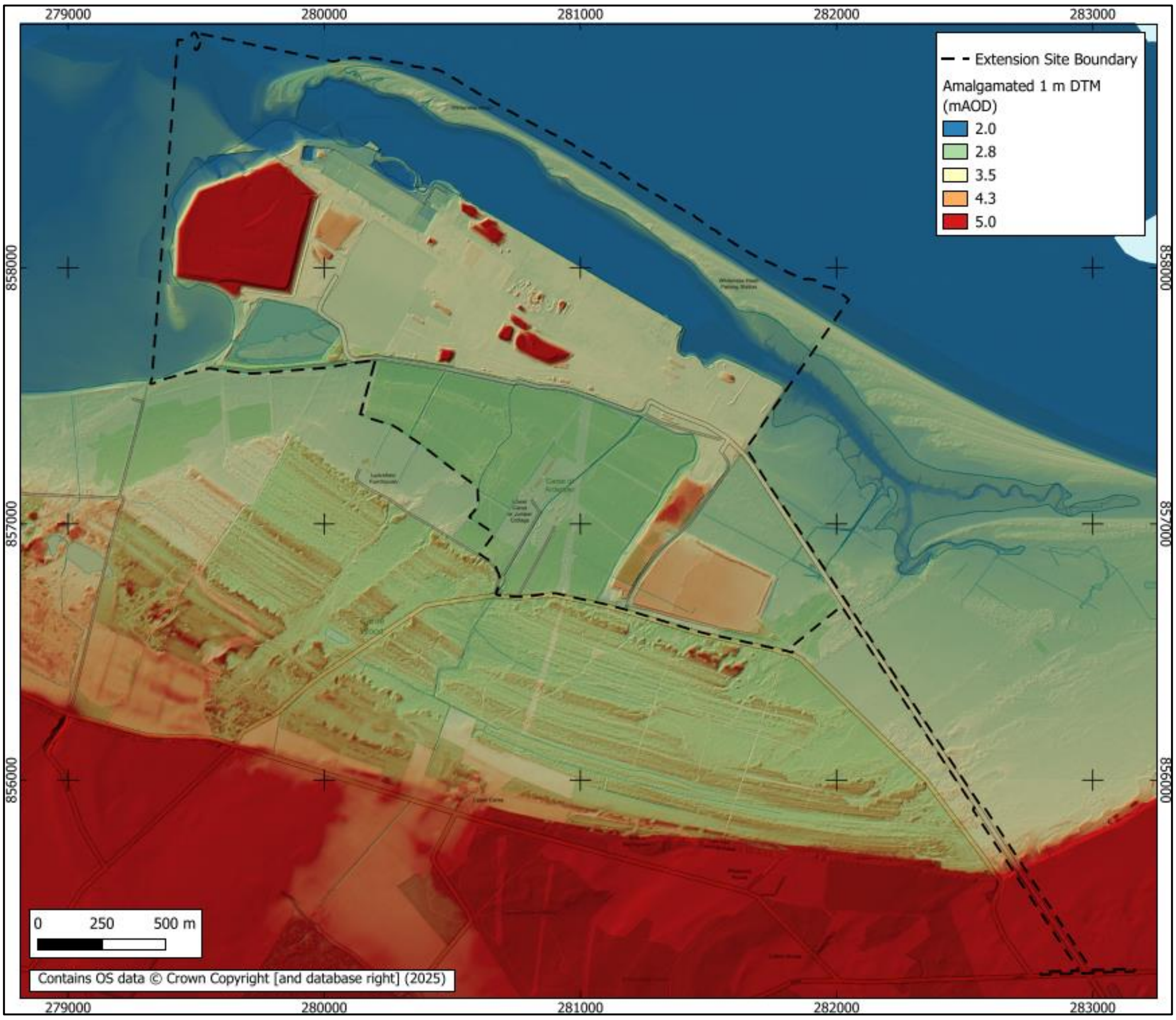

Figure 2.2: Amalgamated pre-development ground elevation model (as of May 2025)

3 FLOOD RISK SCREENING

SEPA's technical guidance (SEPA, 2022) advises that a site-specific FRA should be undertaken where any available information indicates there may be a risk of flooding (from any source) to the site, and/or where the development of the site may increase flood risk elsewhere. Where a site-specific FRA may be required, screening will determine the scope of the assessment and may also be used to inform an appropriate and proportionate approach for the assessment.

3.1 Screening By Source

3.1.1 Fluvial Flood Risk

SEPA flood mapping indicates fluvial flood risk impacting large areas of the western half of the application site. However, indicated extents are anomalous, and seem to be based on the incorrect assumption that local land drainage channels are watercourses discharging westwards into the Moray Firth; in reality, the land drainage channel network discharges via twin culvert pipes northwards into the Inner Harbour.

Flooding associated with land drainage channels is assessed in detail as part of surface water flood risk assessment.

3.1.2 Coastal Flood Risk

SEPA flood mapping indicates coastal flood risk impacting all but the previously consented port site element of the site. Further consideration of coastal flood risk is therefore required.

3.1.3 Surface Water / Land Drainage Flood Risk

SEPA's "Surface Water and Small Watercourses" flood mapping layer indicates a substantial number of disconnected small patches of flooding, as well as linear areas of flooding corresponding with land drainage channels within and adjacent to the application site.

The proposed development entails platforming the application site above design coastal flood levels, including infilling of existing land drainage channels within the application site. This will have the impact of protecting the site against externally-generated surface water flood risk, with internally-generated surface water flood risk to be managed via appropriate (infiltration) drainage provision. As such, the site will not itself be at risk of surface water / land drainage flooding.

However, infilling of existing land drainage channels will cut off existing pathways for drainage of land to the south of the application site, with the risk that development could therefore increase flood risk to areas external to the application site, including the public road which runs along the southern perimeter of the site boundary. As such, a detailed consideration of pre- and post-development flood risk is required in relation to those drains which serve an external area, which will include development and assessment of proposed diversion watercourse features to receive and convey land drainage from south of the application site and ensure no flood risk detriment is caused by development proposals.

3.1.4 Asset Failure Flood Risk

The SEPA Reservoirs Inundation Map[2] does not identify any reservoirs that could result in flooding of the application site in the event of failure.

3.1.5 Groundwater Flood Risk

Groundwater flooding, as a primary source, is uncommon in Scotland, due to the nature of the underlying geology. Groundwater levels tend to correspond with water levels in adjacent watercourses. This means that recommendations to mitigate against flood risk from coastal sources, such as setting minimum Finished Floor/Threshold Levels would be anticipated to provide adequate mitigation against potential groundwater flooding.

3.2 Scoping Summary

Table 3-1 presents the scoping outcomes for flood risk to the application site.

Table 3.1: Summary of Flood Risk Scoping

Flooding Source	Preliminary Risk Classification	Comments/Explanation	Scoping Outcome
Fluvial (River)	No risk	Parts of the application site are within SEPA-defined medium likelihood flood extents, but these are anomalous.	Not considered further
Coastal	Medium to High Risk	The majority of the application site, excepting the consented port element, are indicated to be at coastal flood risk.	Site-specific assessment required.
Surface Water / Land Drainage	Medium to High Risk	While SEPA mapping is inconclusive, site knowledge indicates land drainage pathways through the application site, receiving flows from areas further south. A site-specific assessment of pre- and post-development land drainage flood risk is required to ensure development does not cause detriment.	Site-specific assessment required.
Infrastructure	Low or No Risk	There are no reservoirs shown on the SEPA Reservoirs Inundation Map that could impact on the application site in the event of failure.	Not considered further.
Groundwater	Low or No Risk	Groundwater levels in Scotland tend to correspond with water levels in adjacent watercourses. This means that recommendations to mitigate against flood risk from coastal sources, would be anticipated to provide adequate mitigation against potential groundwater flooding.	Not considered further.

[2] https://map.sepa.org.uk/reservoirsfloodmap/Map.htm

4 COASTAL FLOOD RISK ASSESSMENT

4.1 Extreme Stillwater Level Estimation

Extreme sea levels have been predicted around the whole UK coastline and published by the Environment Agency and Department for Environmental Food and Rural Affairs (DEFRA)[3]. These extreme sea levels include the effect of both tides and storm surges but not the effect of amplification within estuaries or sea lochs. In order to provide better estimates around the Scottish coastline, the coastal estimates have been updated to account for amplification within estuaries.

Extreme sea levels are predicted at a point approximately 2.4 km offshore, north of the proposed development and are summarised in Table 4.1. The 1 in 200 year coastal flood level is 3.35 mAOD, whilst the 1 in 1,000 year level is 3.5 mAOD.

Table 4.1: Extreme sea levels at Ardersier Port (CFB dataset, UK Mainland chainage 3012)

Return Period (yrs)	Ordnance Datum (mAOD)	Chart Datum (mCD)
5	3.01	5.15
10	3.08	5.22
50	3.22	5.36
200	3.35	5.49
1,000	3.50	5.64

Based on the standard Coastal Flood Boundary (CFB) method, the estimated 1 in 200 year extreme stillwater coastal flood level at the nearest datapoint (UK Mainland chainage 3012) is 3.35 mAOD.

4.2 Sea Level Rise

SEPA's current guidance (as of June 2025)[4] advises that an 890 mm increase should be applied to coastal flood level estimates in the North Highland region to represent projected sea level rise due to climate change to the year 2100. Applied to the CFB estimate, the predicted 1 in 200 year stillwater coastal flood level accounting for climate change is therefore **4.24 mAOD**.

4.3 Predicted Pre-Development Coastal Flood Extents

Figure 4.1 indicates locations with existing ground levels (as per Figure 2.2) below 4.24 mAOD with direct connection to coastal waters, noting the following:

- Coastal flooding is predicted to inundate areas surrounding the application site on all sides, with exception of the raised site access road which has a minimum level exceeding 4.6 mAOD and remains flood-free.
- Coastal flooding is shown to inundate the port-side areas of the application site, noting that consent has already been granted to raise ground levels in these areas above coastal flood

[3] Environment Agency. (2018). Coastal Design Sea Levels – Coastal Flood Boundary Extreme Sea Levels
[4] https://www.sepa.org.uk/media/jjwpxuso/climate-change-allowances-guidance_v6.pdf

levels (with this platforming not yet complete at the time the latest survey was undertaken in May 2025).

- Southern areas of the application site are predicted to inundate from the west, noting that eastern areas of the application site are also at risk of coastal inundation via two existing culverts under the site access road.

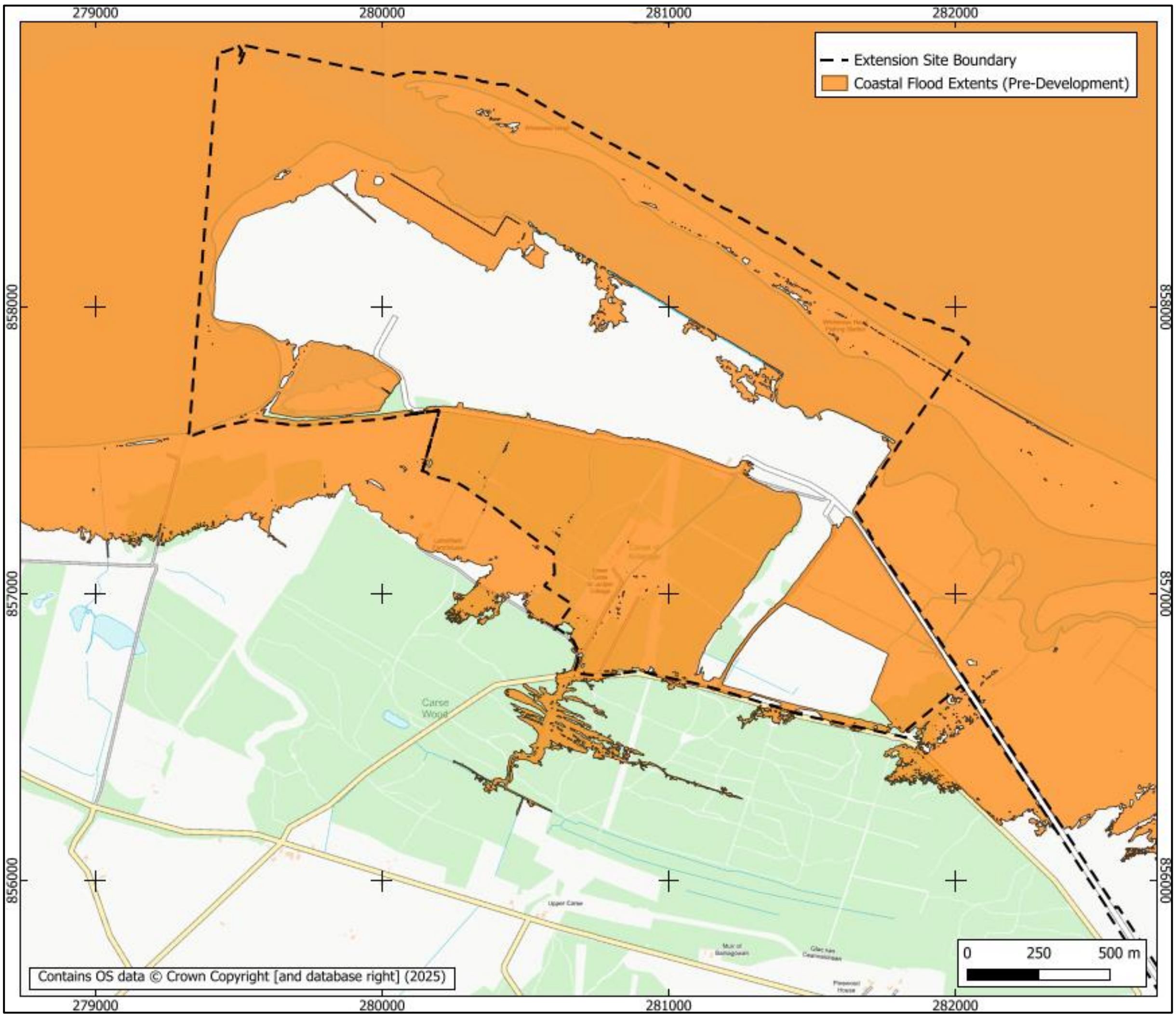

Figure 4.1: Projected design coastal flood extents, based on current ground elevations (as of May 2025)

4.4 Waves

Inundation mapping shown in Figure 4.1 does not account for wave action. Waves will act to cause transient increases in sea levels above the extreme stillwater level, with the potential to cause transient inundation (with associated risk of damage due to wave impact and spray) beyond the mapped extents in areas in close proximity to the coastal interface - particularly along the northern and northwestern edge of the mapped extents. Any future development in close proximity to these interfaces should be designed with consideration of the potential risk of wave action, by (for example):

- Setting development as far back from the interface as is practicable, allowing waves to break in the area between the interface and development.
- Placing any pedestrian access routes on the landward side of buildings.
- Avoiding or minimising window placement on the side of buildings facing the interface, and otherwise cladding the lower section of buildings near the interface to offer resilience against wave and spray impact.
- Designing post-development ground levels to fall away towards the coastal interface (such that building floor levels are raised above ground levels at the coastal interface, and to ensure any overtopping water passively returns to the sea).
- Avoiding creation of local topographic depressions in the vicinity of the interface, where overtopping waves may cause ponding.

4.5 Impact of Coastal Flood Risk Upon Development

Proposals entail platforming the majority of the application site to a level exceeding the 4.24 mAOD design coastal flood level, thereby protecting the application site from coastal inundation. Any future development in areas of the site platform in close proximity to the coastal interface should account for the risk of wave impact.

4.6 Impact of Development Upon Coastal Flood Risk

Landraising (platforming) of land in direct connection with the open coast is extremely unlikely to detrimentally impact coastal flood risk to surrounding areas and receptors via displacement. This principle was accepted for the consented port development component of the site and will also apply to the extension site.

Proposed amendments to ground levels may, however, alter connectivity between areas of low ground, with the potential to either increase or decrease the extent of coastal flooding associated with a given extreme sea level. Figure 4.2 through Figure 4.6 presents a comparison of pre- and post-development projected coastal flood extents associated with extreme sea levels of between 3 and 4 mAOD at 0.25 m elevation increments, with Figure 4.7 presenting a comparison for the design (1 in 200 year plus climate change) extreme sea level of 4.24 mAOD. All figures employ a transparency to the post-development layer, such that:

- Areas shaded yellow are only predicted to inundate for pre-development conditions.
- Areas shaded blue are only predicted to inundate for post-development conditions.
- Areas shaded green are predicted to inundate for both pre- and post-development conditions.

These maps indicate that:

- Development proposals will result in the lagoon inundating at lower sea levels, via lowered spill levels along the western perimeter of the lagoon (as proposals include restoration of historical coastal connectivity for the lagoon).
- Site platforming will generally reduce flood extents within the extension site, excepting along proposed diversion watercourses (see Chapter 9), which create an additional low-elevation pathway for coastal flood intrusion, unless the outlets to these watercourses employ flap valves (for the purpose of the presented maps, an open boundary is assumed, as this represents a worst-case).

- While proposed diversion watercourses create an additional pathway for coastal flood intrusion, the projected impact is limited to areas within the site boundary, with no detriment to areas outwith the site boundary.

On this basis, it is concluded that the development will not detrimentally impact coastal flood risk to areas outwith the site boundary.

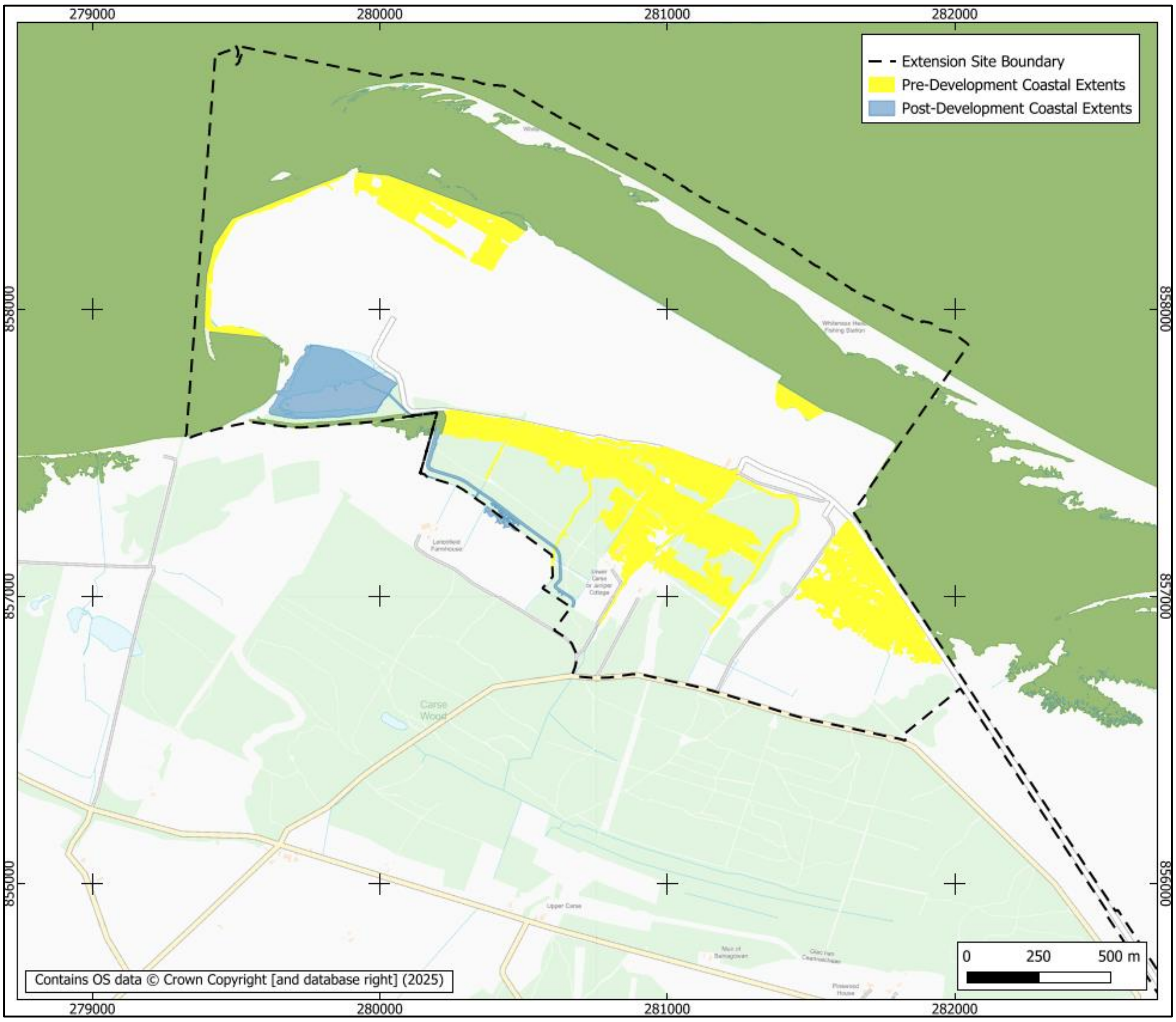

Figure 4.2: Projected pre- versus post-development coastal flood extents for a 3.00 mAOD sea level

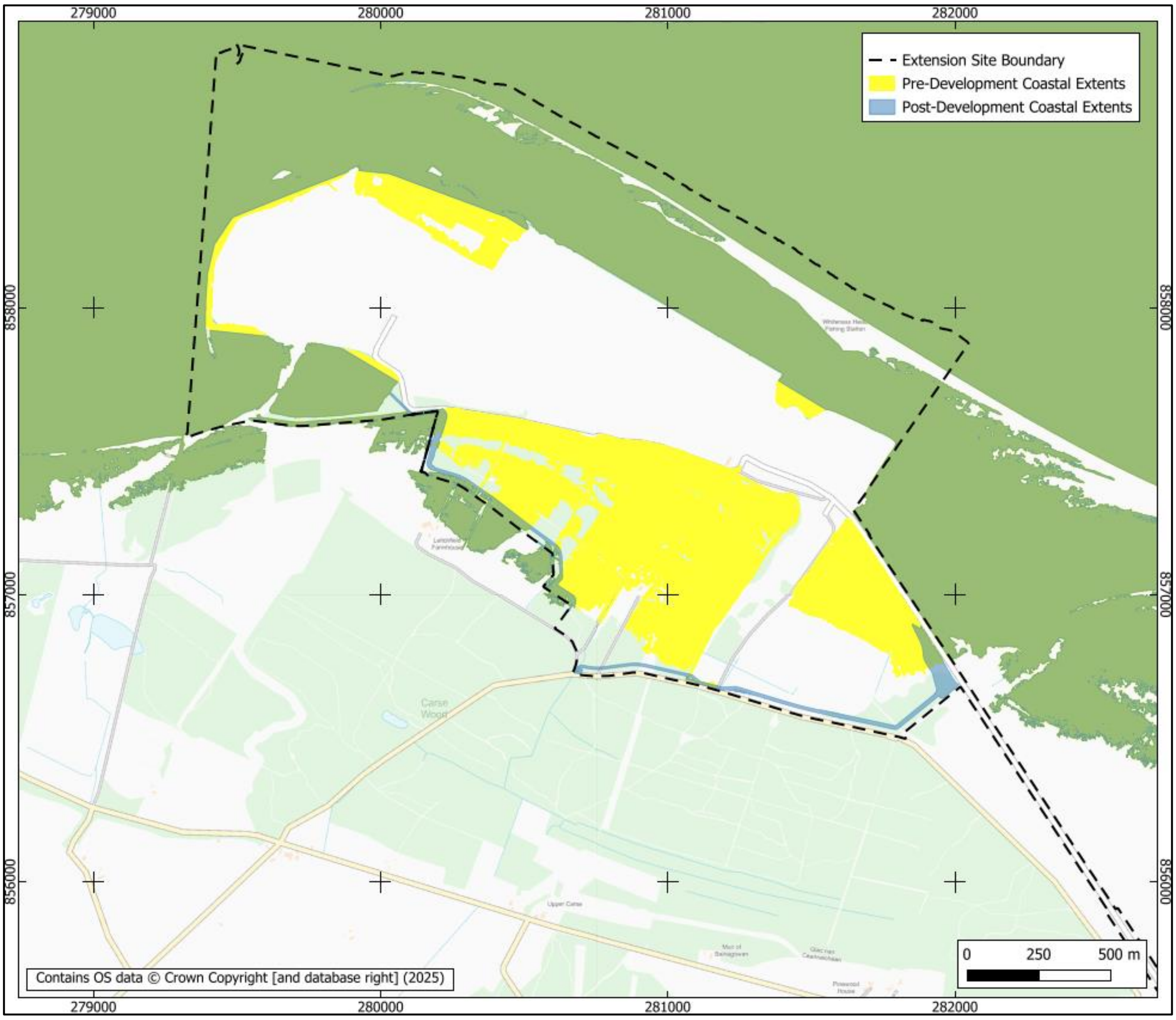

Figure 4.3: Projected pre- versus post-development coastal flood extents for a 3.25 mAOD sea level

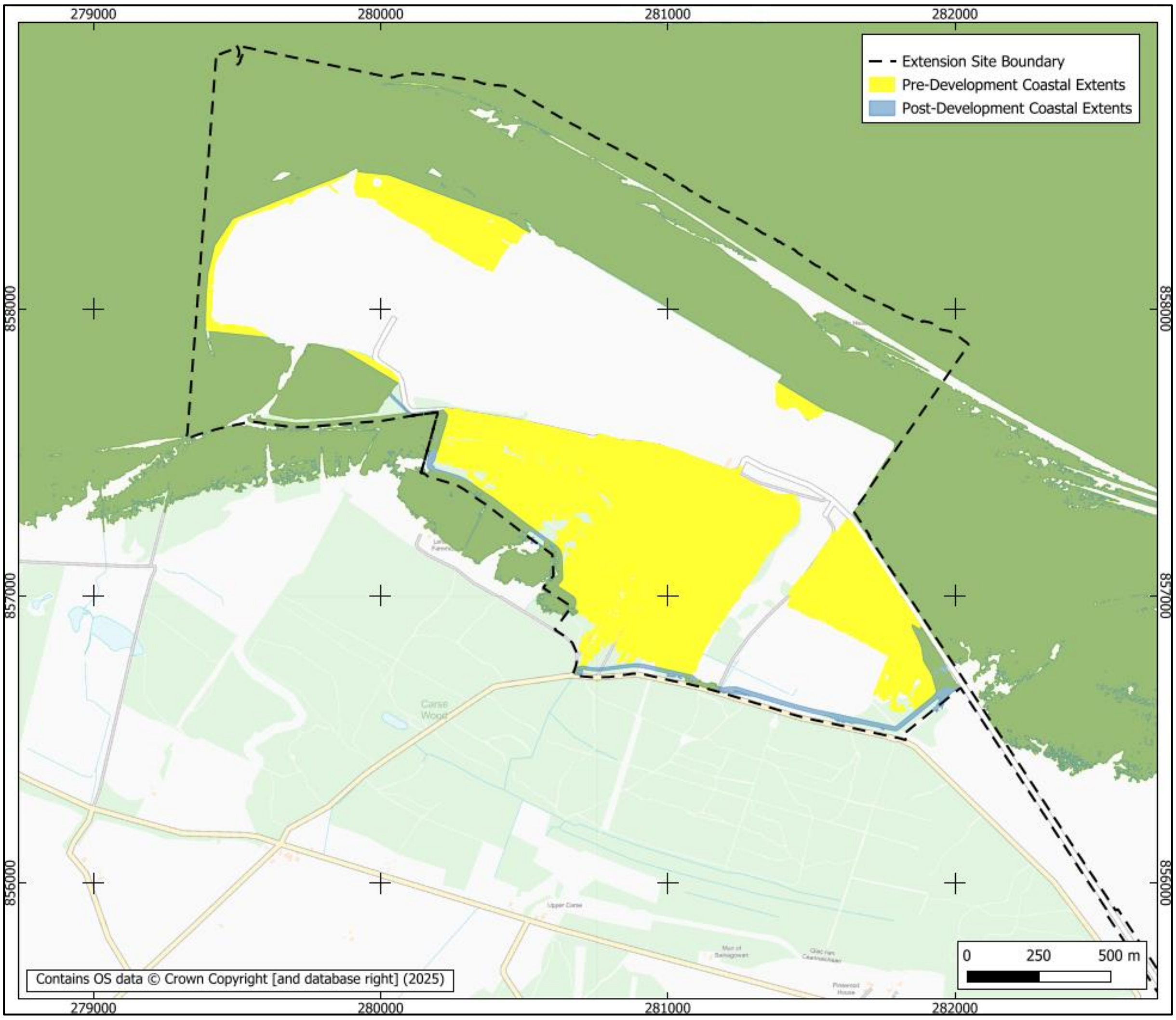

Figure 4.4: Projected pre- versus post-development coastal flood extents for a 3.50 mAOD sea level

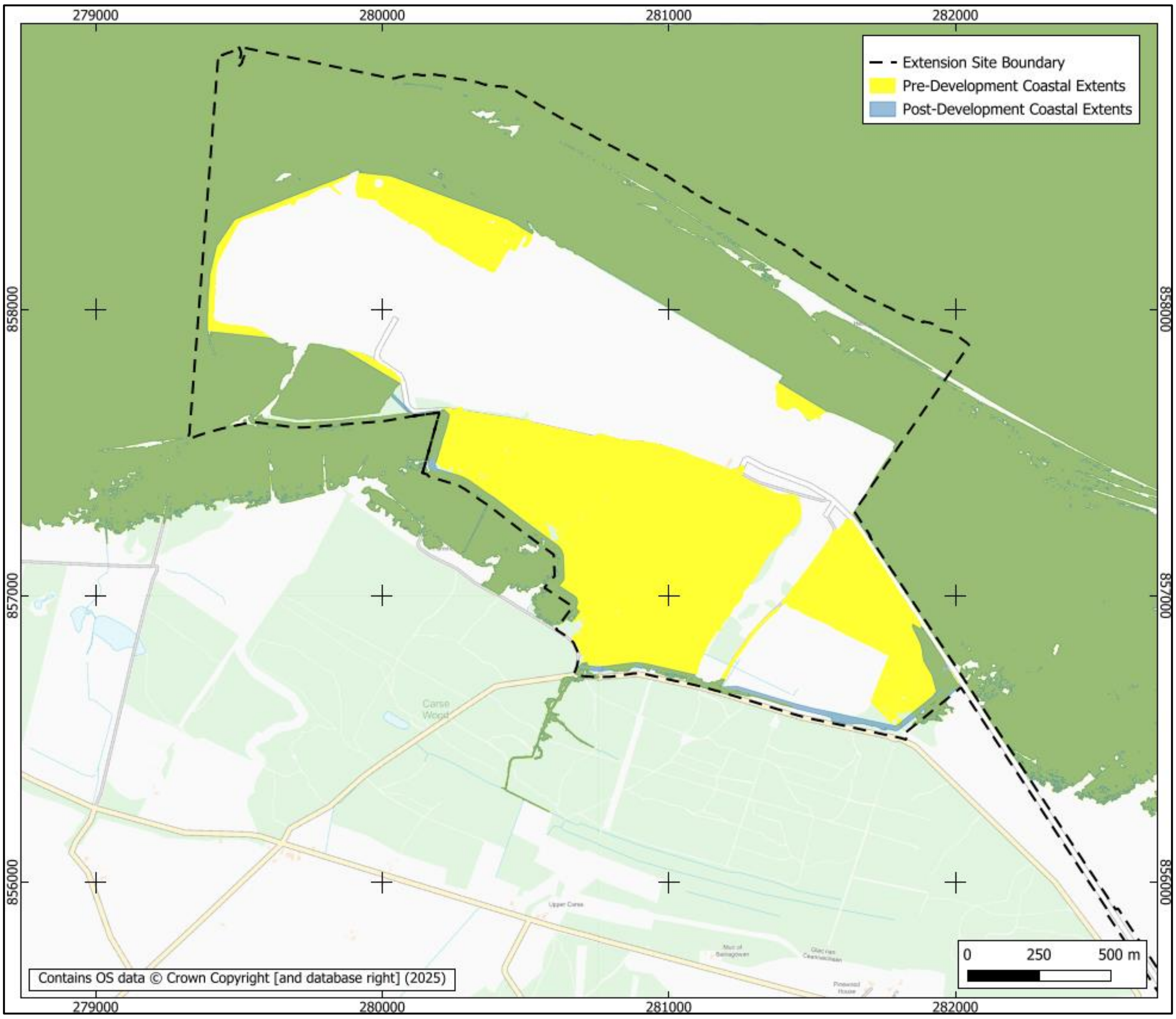

Figure 4.5: Projected pre- versus post-development coastal flood extents for a 3.75 mAOD sea level

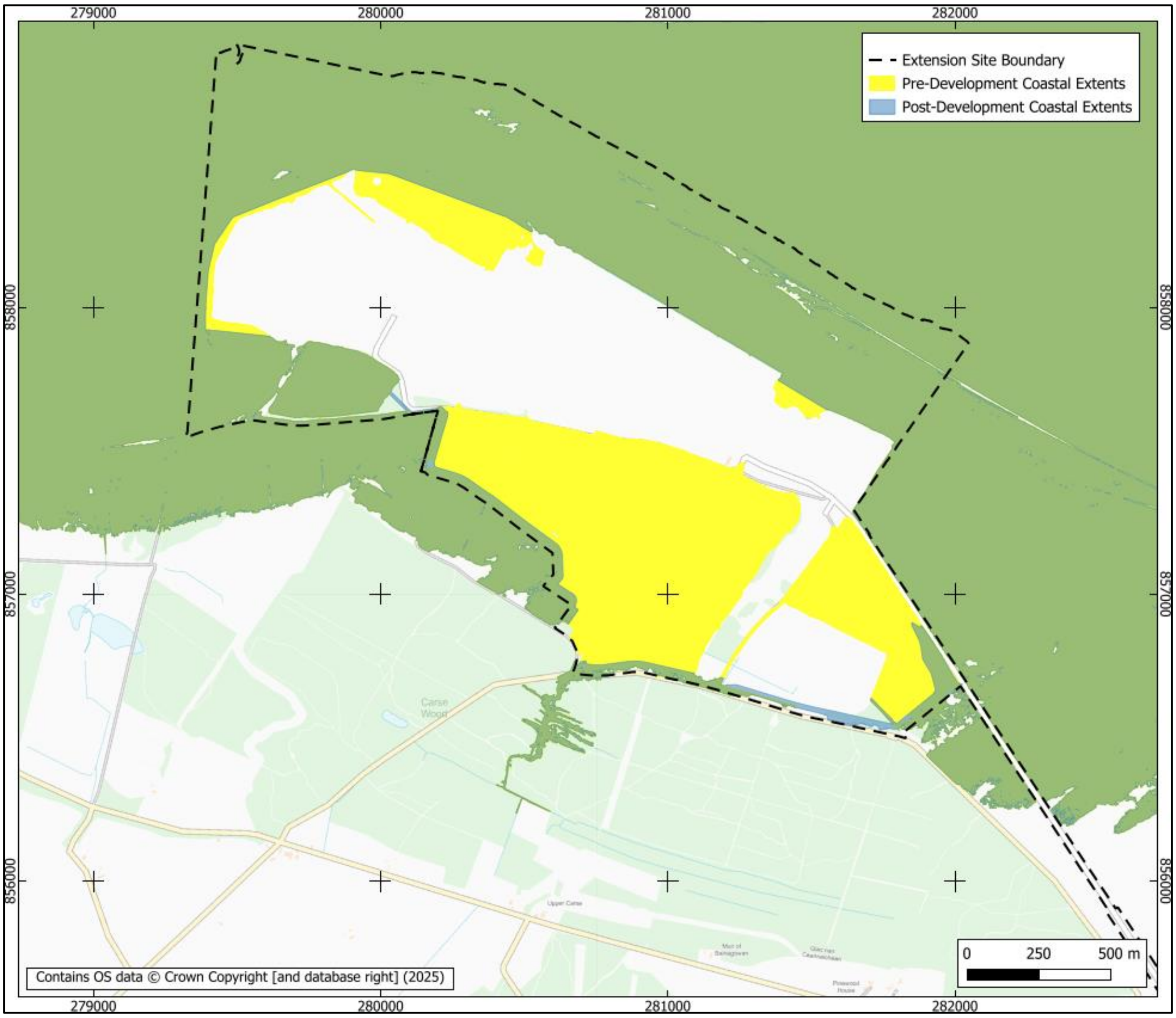

Figure 4.6: Projected pre- versus post-development coastal flood extents for a 4.00 mAOD sea level

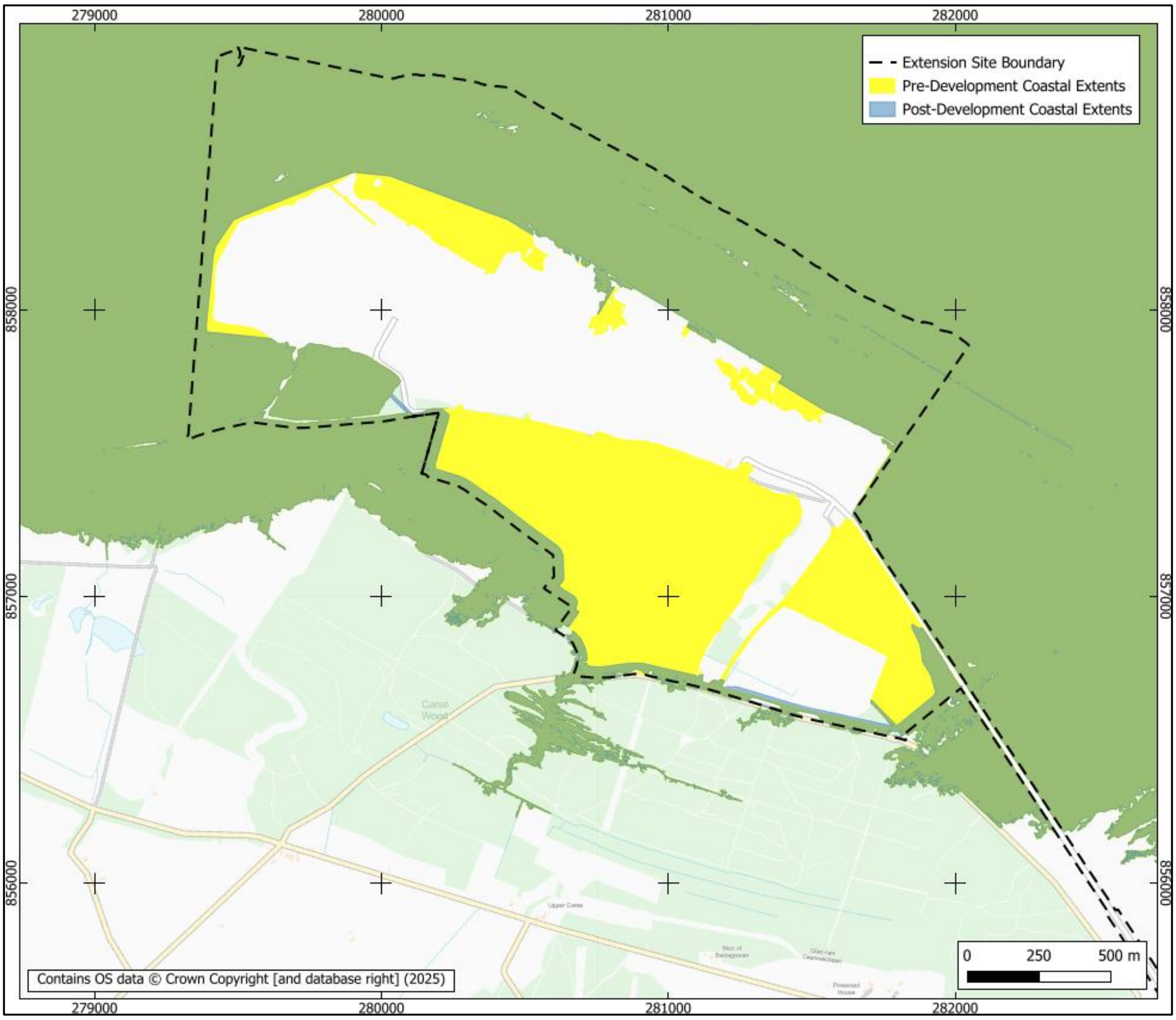

Figure 4.7: Projected pre- versus post-development coastal flood extents for a 4.24 mAOD sea level

5 PRE-DEVELOPMENT LAND DRAINAGE FLOOD RISK

5.1 Donor Catchment Hydrology

The FEH web service defines a 2.28 km^2 catchment approximately representative of the main land drain entering the southern boundary of the site (Figure 5.1). This catchment was used as a donor catchment for the derivation of design hydrology used in all subsequent modelling. Catchment descriptors for the donor catchment are presented in Appendix B.

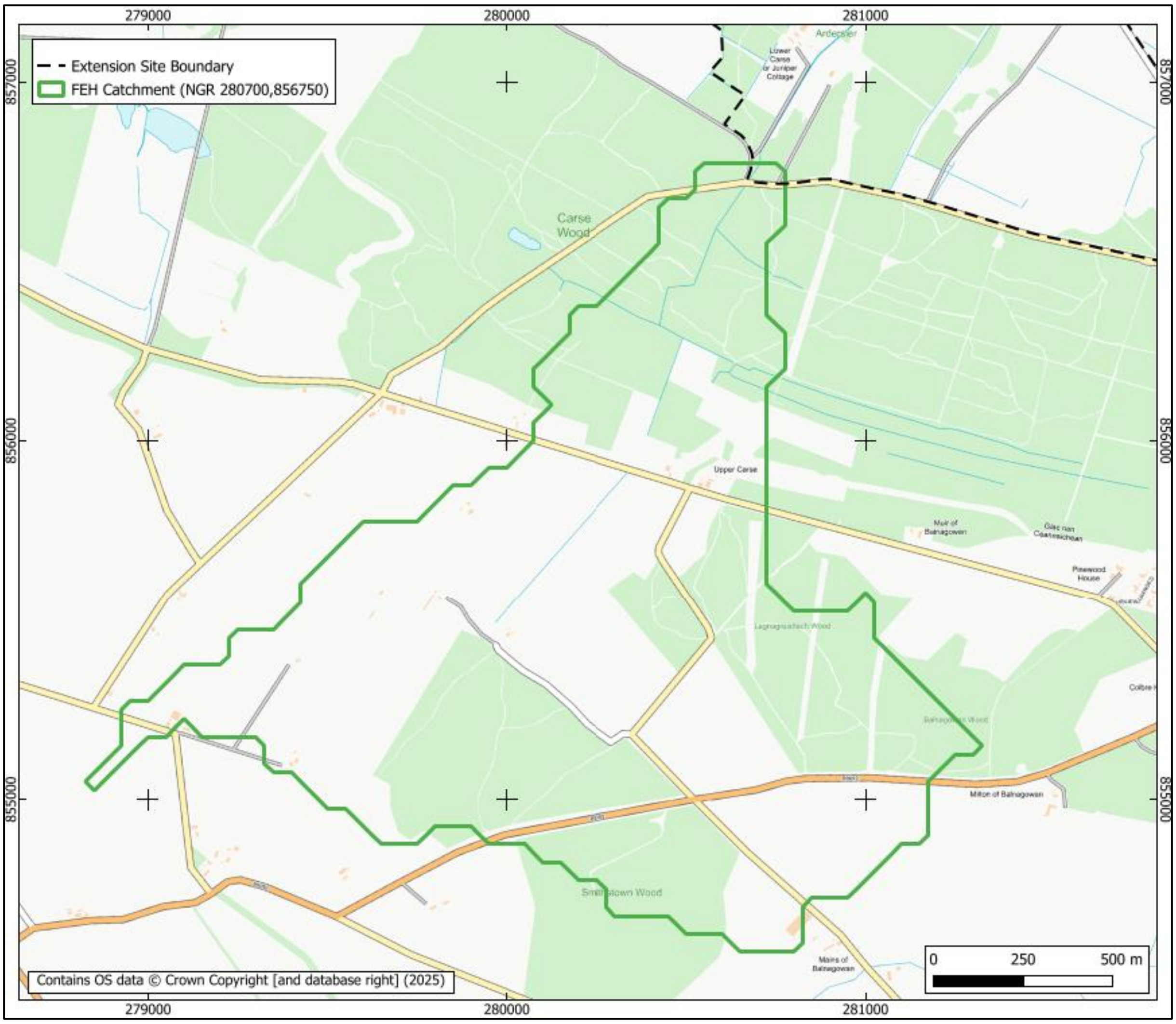

Figure 5.1: FEH catchment extent for the main land drain as it enters the southern boundary of the site

Standard ungauged methodologies were employed to estimate design 1 in 200 year plus climate change flows for the donor catchment:

- The FEH rainfall-runoff method, based on a calculated critical storm duration of 7.215 hrs (calculated using a 7.2 hr event at a 0.05 hr time interval).
- The Revitalised Flood Hydrograph (ReFH2) method, employing the latest FEH22 design rainfall and the default recommended storm duration of 6.5 hrs.

- As a small catchment in the North Highland region, a 42% uplift was applied to design rainfall used in calculations, to represent projected climate change to the year 2100.

Hydrological analysis input and output is presented in Appendix C, with predictions summarised in Table 5.1. The FEH rainfall-runoff method provides significantly more conservative design flow estimates in comparison to ReFH2 and is therefore used in all subsequent analysis.

Table 5.1: Donor catchment design flow estimation (m^3/s)

Method	200 yr (with climate change)
FEH RR	1.28
ReFH2	0.72

5.2 Catchment Delineation

The (sub)catchments associated with the main drain, and all other minor land drains, within and discharging through the application site were delineated using the following methodology:

- The LiDAR for Scotland Phase 1 DTM covering the application site was modified manually to account for culverted sections of land drain, and to join sections of drain separated by areas of poor coverage (usually associated with heavy vegetation cover). Modifications ensure that drain representation is continuous, prior to performing subsequent analysis steps.
- Sink filling, based on a very shallow gradient of 0.001 (given the lack of gradient, particularly within the extension site), was applied to the DTM. The “Fill Sinks (wang & liu)” tool within QGIS was used for this purpose.
- Channel networks and drainage basins were derived using the filled DTM, using the “Channel network and drainage basins” tool within QGIS.
- Individual drainage basin polygons were then grouped where they drain to a common point, to form a catchment. Catchments were delineated, as close as possible, to locations where land drains confluence.
- For catchments crossing the site boundary, catchments were split into internal catchments (which will be replaced by site surface water drainage provision) and external catchments (which will remain for post-development conditions).

Delineated subcatchments of the main drain are presented in Figure 5.2, with those of other land drains within and adjacent to the site boundary presented in Figure 5.3.

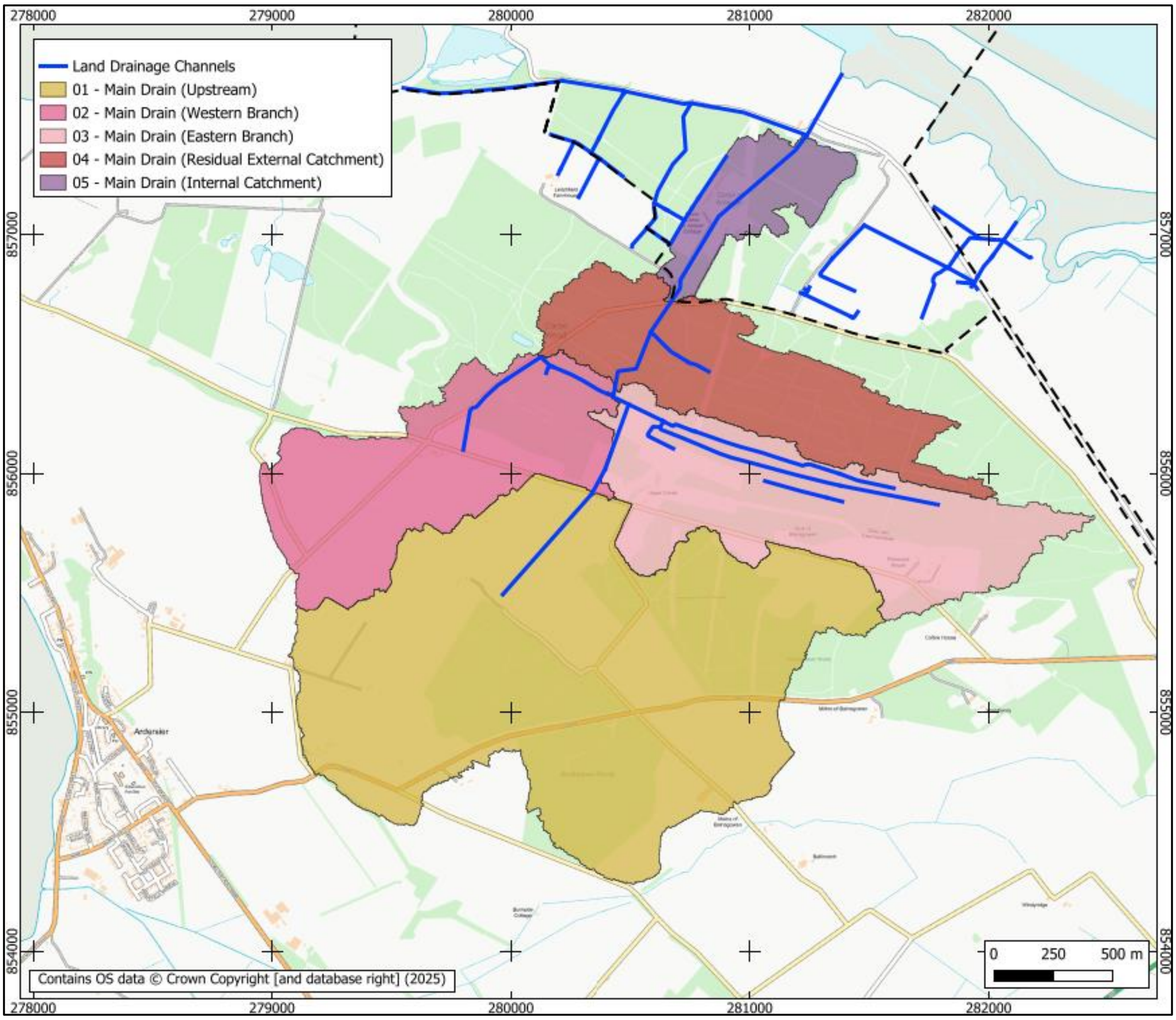

Figure 5.2: Subcatchments of the main land drainage channel through the site

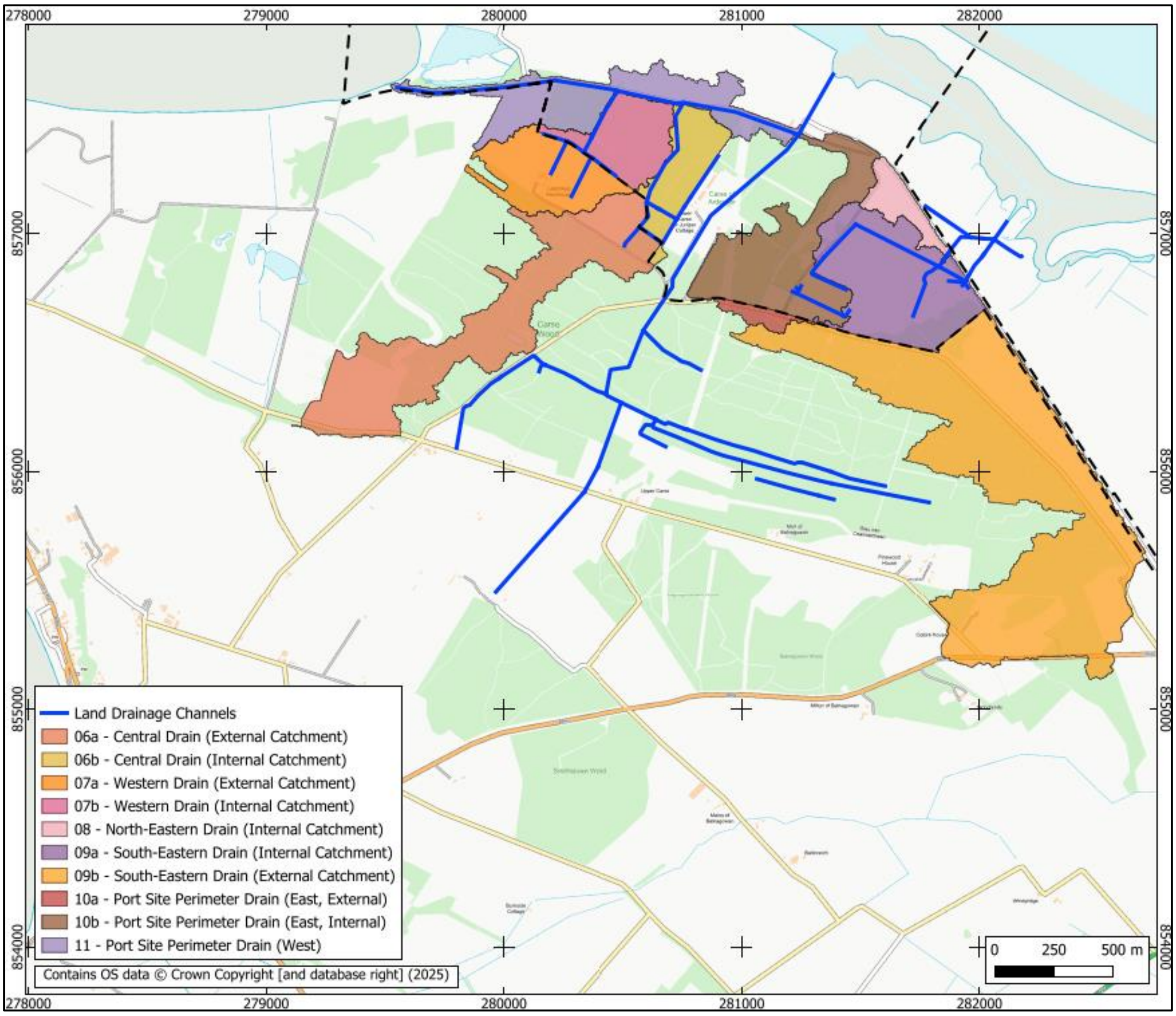

Figure 5.3: Subcatchments of other land drainage channels within and adjacent to the site

5.3 Design Flow Estimation

Design flows for the main drain were derived from donor descriptor (Section 5.1 and Appendix B) as follows:

- Area was replaced with the calculated total area of all subcatchments of the main drain (4.85 km^2).
- Catchment descriptor DPLBAR is considered to scale with area, with DPLBAR = $Area^x$. Solving for donor catchment area of 2.28 km^2 and DPLBAR of 1.91 km, and main drain area of 4.85 km^2, the scaled DPLBAR value is 3.45 km.
- The revised critical storm duration using these descriptors is 9.915 hrs (with a value of 9.9 hrs at a 0.05 hr interval used in calculations).
- Applying a 42% climate change uplift to the calculated 9.9 hr, 1 in 200 year rainfall depth of 72.99 mm yields a 1 in 200 year plus climate change rainfall depth of 103.6 mm and a 1 in 200 year plus climate change peak flow of **2.267 m^3/s** for the main drain. The design flow hydrograph for the full main drain catchment is presented in Figure 5.4.

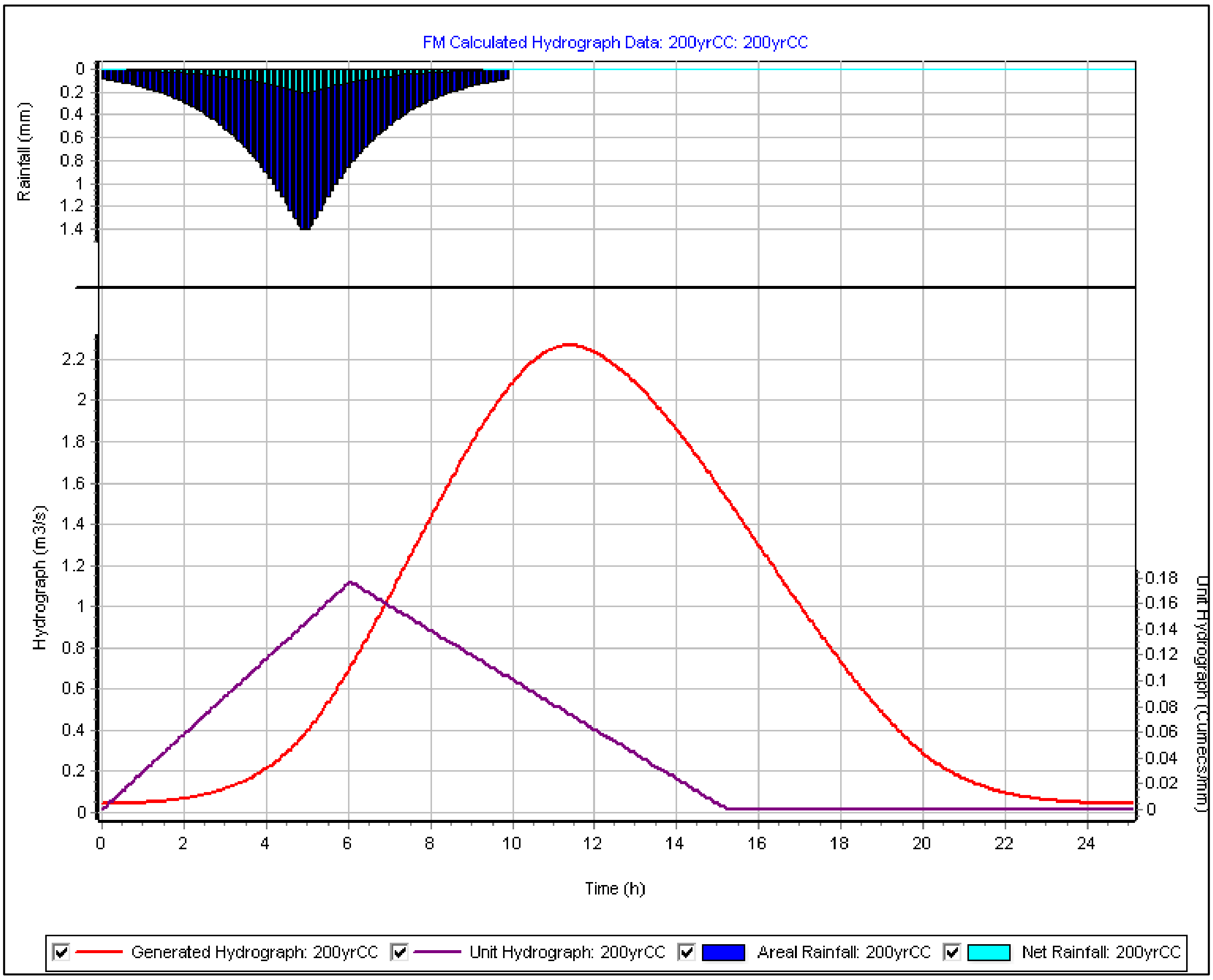

Figure 5.4: Design flow hydrograph for the full main drain catchment area of 4.85 km²

Thereafter, in modelling, inflow hydrographs for each subcatchment were scaled by area from the design hydrograph presented in Figure 5.4.

Peak flows for the main drain subcatchments are presented in Table 5.2, with those of other land drains which confluence with the main drain before discharging (via existing twin culvert) northwards to coastal outfall presented in Table 5.3. Subcatchments in the eastern area of the application site discharge eastwards via existing access road culverts to ultimately discharge into the saltmarsh area further east; peak flows for these subcatchments are presented in Table 5.4.

Table 5.2: Peak flow values for subcatchments of the main drain

Subcatchment	Model Node	Area (km^2)	Peak 200 year plus climate change flow (m^3/s)
01 – Main Drain (Upstream)	MainUUS_000	2.455	1.147
02 – Main Drain (Western Branch)	M_W00	0.898	0.419
03 – Main Drain (Eastern Branch)	M_E00	0.827	0.386
04 – Main Drain (Residual External Catchment)	Main_Lat*	0.675	0.315
05 – Main Drain (Internal Catchment)	MainDS_Lat*	2.455	1.147
Total		**4.854**	**2.267**

** Indicates inflows that are input laterally (distributed over a reach length) within modelling.*

Table 5.3: Peak flow values for other subcatchments confluencing with the main drain

Subcatchment	Model Node	Area (km^2)	Peak 200 year plus climate change flow (m^3/s)
06a – Central Drain (External Catchment)	C_001	0.421	0.197
06b – Central Drain (Internal Catchment)	C_Lat*	0.108	0.051
07a – Western Drain (External Catchment)	W_S01	0.149	0.070
07b – Western Drain (Internal Catchment)	W_S_Lat	0.116	0.054
10a – Port Site Perimeter Drain (East, External)	SE_001	0.023	0.011
10b – Port Site Perimeter Drain (East, Internal)	SE_Lat*	0.242	0.113
11 – Port Site Perimeter Drain (West)	50% at W_001 50% at W_Lat*	0.217	0.101

* *Indicates inflows that are input laterally (distributed over a reach length) within modelling.*

Table 5.4: Peak flow values for subcatchments draining eastwards via the site access road culverts

Subcatchment	Model Node	Area (km^2)	Peak 200 year plus climate change flow (m^3/s)
08 – Northeastern Drain (Internal Catchment)		0.050	0.023
09a – Southeastern Drain (Internal Catchment)		0.278	0.130
09b – Southeastern Drain (External Catchment)		0.890	0.416

* *Indicates inflows that are input laterally (distributed over a reach length) within modelling.*

5.4 1D Model Construction

A site visit was undertaken to inform survey specification, with a 1D model constructed to represent all land drainage channels within and draining towards the application site, along the culverts and other structures within the modelled reach. To improve model stability, additional sections were added via interpolation from surveyed sections; as bank elevations are more variable between sections than bed levels and shape, bank levels were subsequently modified for interpolated sections to ensure tie-in with LiDAR ground levels in the bankside area.

5.4.1 Extents

Modelling was undertaken only for those land drains with channel elements external to the application site; namely the port site perimeter drain and its tributary drains, including the main drain. The eastern drainage system has not been modelled, as it does not receive flows from any identified land drain that will be “cut off” by proposed development, noting that areas external to the site boundary capable of contributing flows to the proposed Eastern Watercourse (via overland or subsurface pathways) are accounted for in post-development modelling of the proposed Eastern Watercourse presented in Chapter 9.

5.4.2 Model Roughness

Drainage channels within the modelled reach are, in all cases, excavated earthen channels with clean beds and banks, with negligible in-channel vegetation, with no meandering. A uniform Manning's roughness of 0.035 was therefore used for all in-channel areas.

Bankside areas are more variable, consisting of a mix of short grasses and scattered brush and trees. A uniform Manning's roughness of 0.055 was used for all out-of-bank areas within the 1D domain.

5.4.3 Model Boundaries

Inflow boundary conditions were applied at all model upstream boundaries, as described in Section 5.3. Inflows associated with non-headwater catchment areas are applied as lateral inflows along an appropriate reach of the model.

All drains share a common point of discharge, via the twin 1 m diameter culverts at the downstream end of the Main Drain. These culverts discharge into coastal waters, with a fixed level boundary applied at their downstream end, the value of which varies depending upon the scenario being simulated:

- A free-draining boundary condition was represented using a fixed downstream boundary level of 1.5 mAOD.
- Tidally-constrained scenarios employ a fixed downstream boundary level of 2.95 mAOD, corresponding to the mean high water spring (MHWS) tidal level inclusive of (0.89 m) sea level rise.

5.4.4 Representation of Structures

Based on pre-application advice from SEPA, existing structures upstream of the application site that may act to throttle flows, thereby reducing flows and hence flood risk in the vicinity of the site, were enlarged in modelling to ensure that they provide minimal throttling, to ensure that modelling is precautionary with respect to potential future resolution of these throttles. Specifically:

- A 600 mm diameter culvert under a public road at the upstream end of the modelled reach of the Main Drain was represented in modelling as a 1 m diameter orifice.
- A 300 mm diameter culvert immediately downstream of the aforementioned culvert, which runs for approximately 80 m under fields, was represented in modelling as a 1 m diameter orifice.

The following structures within and in close proximity to the application site were represented as surveyed:

- A 650 mm diameter culvert of the Main Drain on the under the public road which runs along the southern boundary of the site (represented with a Manning's roughness of 0.02 below axis and 0.01 above axis, to account for suspected debris intrusion into this culvert).
- The twin 1 m diameter culverts at the downstream end of the Main Drain, which drain flows from the Main Drain, Central Drain, Western Drain and Port Site Perimeter Drain (represented with Manning's roughness of 0.012).

Various minor footbridge and small culvert crossings within the application site were not represented within modelling; while some of these structures may impact local flooding behaviour within the application site, they will not impact flooding outwith or near the perimeter of the application site.

5.4.5 Model Schematic

An unlabelled schematic of the 1D pre-development model is presented in Figure 5.5, with the site boundary shown as a black dashed line.

Figure 5.5: Pre-development 1D model schematic, with LiDAR-based ground elevations

5.5 2D Model Construction

5.5.1 2D Model Extents

For computational efficiency, the 2D domain was limited to an “active area” polygon derived from preliminary iterative modelling, as shown in Figure 5.6. This area is sufficient to cover the predicted inundation extent for all modelled (pre-development) scenarios.

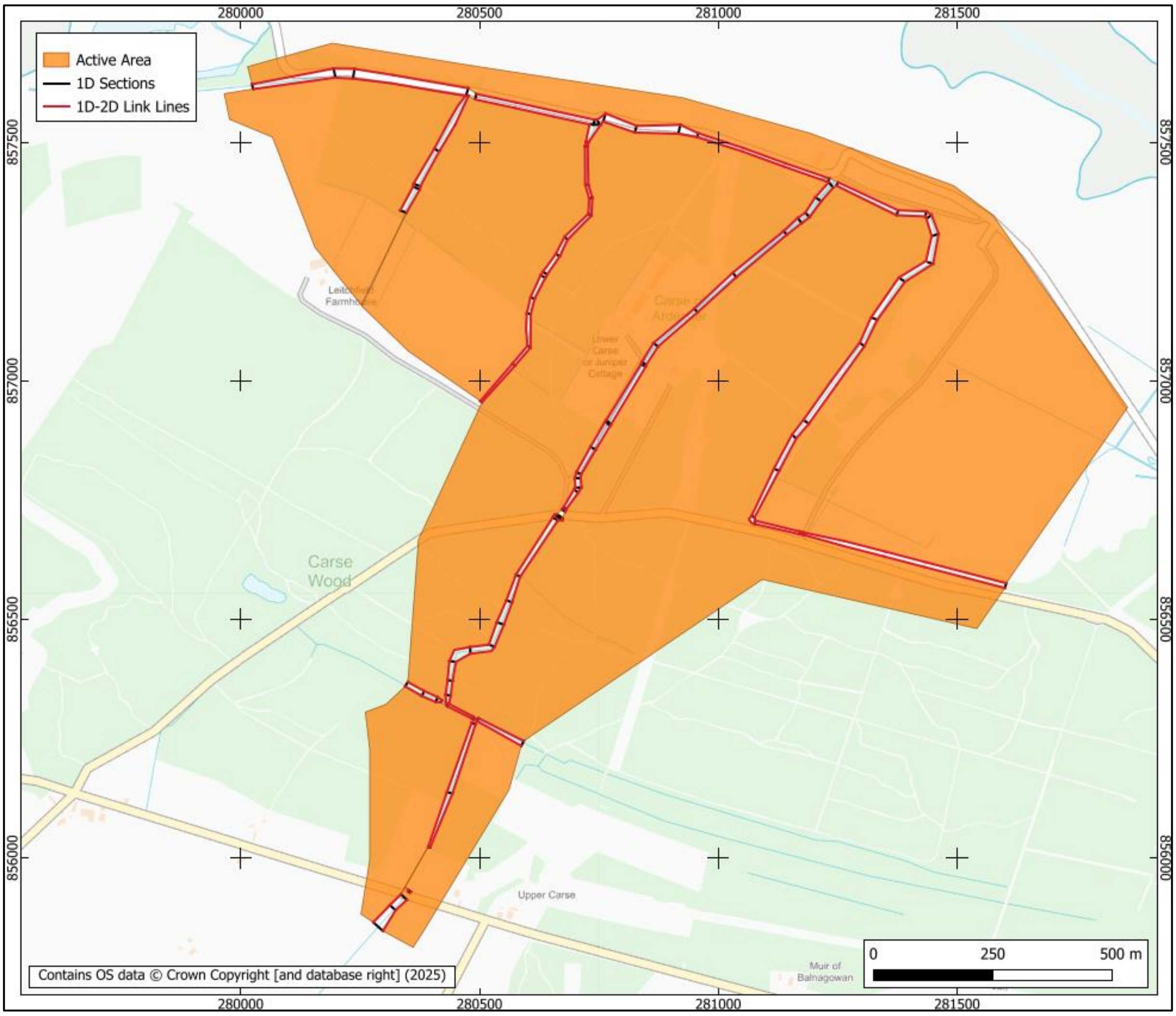

Figure 5.6: Pre-development 2D model extents, showing 1D-2D boundaries and 1D sections

5.5.2 2D Ground Elevation Representation

Pre-development ground elevations were based upon a mosaicked overlay of the following datasets, with the most recent data taking precedent in areas of overlapping coverage:

- LiDAR for Scotland Phase 1 DTM data (flown 2011-2012), which covers the full 2D active area and beyond.
- “Woodland Survey”; LiDAR survey of then-accessible areas of the extension site, flown in 2023-2024.
- “Saltmarsh Survey”; LiDAR survey of the salt marsh area to the east of the application site and eastern areas of the extension site, flown in 2023-2024.
- “Full Site Survey”; LiDAR survey of all landward areas of the application site excluding the existing site access road, flown in 2025.

Extents of the constituent datasets used to derive 2D ground elevations is illustrated in Figure 5.7.

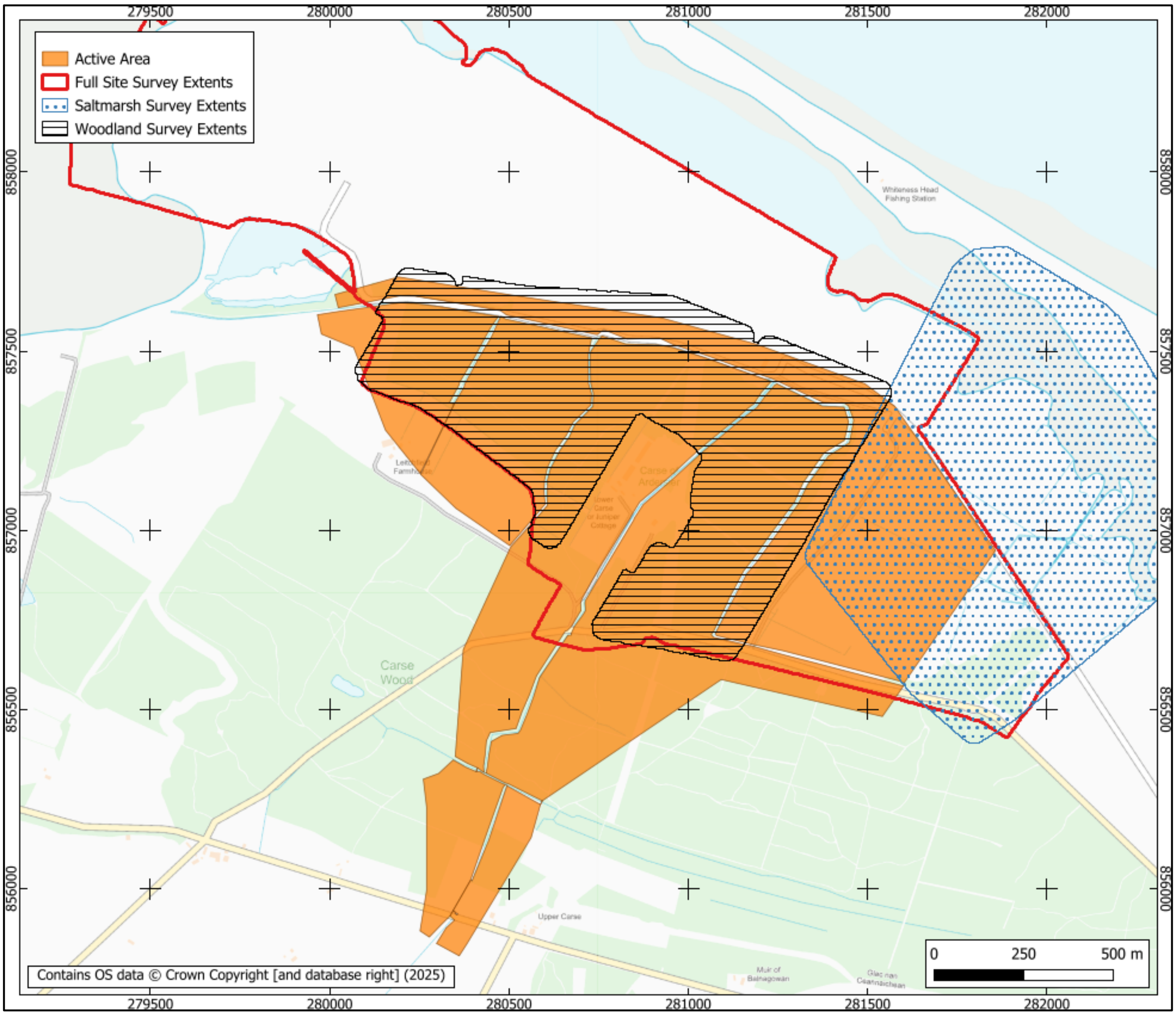

Figure 5.7: Extents of DTMs used to define ground elevations within the model's active area

5.5.3 2D Roughness

Surface roughness values for the 2D domain were derived from OS Open Map Local surface type information. This data source represents roads using a centre line only; roads and associated footpaths are assumed to have a 6 m width (i.e. 3 m buffer either side of the OS centre line) for the purpose of 2D roughness definition. Manning's roughness values used for each surface type are summarised in Table 5.5, with a default value of 0.03 (corresponding to the greenspace value) used for areas unallocated on the OS Open Map Local dataset. Surface types within the 2D domain are shown in Figure 5.8.

Table 5.5: 2D roughness parameterisation

Surface Type	Manning's n value
Road & Hardstand	0.016
Surface Water	0.022
Greenspace (default value)	0.030
Woodland	0.070
Buildings	3.000

Figure 5.8: Surface types used in 2D roughness parameterisation

5.5.4 1D-2D Linkage

The 1D and 2D domains of the model were dynamically linked using "link lines", which define a sloping spill or weir profile for exchange of water (in either direction) between the domains. Elevations for all link lines were sampled from the 2D ground model at the locations of link line ends. H-type links are considered most suitable for representing flooding over unwalled banks and were used in all cases. All link lines employed default parameterisation (i.e. weir discharge coefficient of 1.2 and modular limit of 0.9).

5.5.5 2D Model Boundaries

Default ("glass wall") boundary parameterisation was employed for the external boundaries of the active area (i.e. those boundaries not interfacing with the 1D model domain by link lines), noting that 2D flooding is not predicted to reach these boundaries for any modelled scenario.

5.6 Run Parameters

All simulations employ a 0.75 s 1D timestep and 0.375 s 2D timestep. Modelling employs a 5 m 2D grid resolution.

5.7 Model Scenarios

Three pre-development scenarios were modelled:

A. A free-draining scenario, in which the tidal downstream boundary of the model was fixed at 1.5 mAOD.
B. A tidally constrained scenario, in which the tidal downstream boundary of the model was fixed at 2.95 mAOD (i.e. the estimated MHWS+CC water level). It should be noted that predictions based upon a fixed tidal level are conservative, as tidal peaks will be transient, but this assumption avoids the need to perform iterative modelling to determine the critical time lag between inflow and tidal peaks producing worst-case peak water level predictions (which may vary within the tidally impacted extent of the model).
C. A free-draining scenario, as per Scenario A, in which the twin coastal outfall culverts are represented as partially (50%) blocked at their inlets.

While flood predictions will be sensitive to blockage of the public road culvert, this scenario was not considered in modelling, as an unblocked representation of this culvert represents a worst case for design of diversion watercourses and assessment of flood risk impact.

5.8 Model Predictions

For the free-draining scenario, design (1 in 200 year plus climate change) flows are predicted to largely remain within-bank, with exception of the following locations:

- The public road culvert surcharges, causing flooding over the local section of road as well as out-of-bank flows from the channel upstream (south) of the culvert, including out-of-bank flows from multiple feeder channels. Peak flood levels over the public road vary between 3.95 mAOD (at the western end of the section of flooded road) and 3.8 mAOD (at the eastern end of the section of flooded road).
- Flooding is predicted over the western bank in the reach of the main drain downstream (north) of Juniper Cottage.
- A small area of flooding is predicted in the vicinity of the twin outfall culverts, associated with transient culvert surcharge.

Peak inundation extents and depths for Scenario A are presented in Figure 5.9, with tabular peak predictions for this scenario presented in Appendix D. Predicted maximum velocities vary between 0.025 and 1.65 m/s, with Froude numbers between 0.015 and 0.821. Tabulated peak water level (stage) predictions for all pre-development scenarios are also presented in Appendix D.

Relative to Scenario A, the impact of tidally constrained discharge (i.e. Scenario B) substantially increases predicted flooding extents and depths (Figure 5.10), essentially inundating all areas adjoining the land drainage network with ground elevations below 3.15 mAOD. However, predicted flooding behaviour in the vicinity of the public road culvert and further upstream is unaltered, as flood levels in these locations are much higher than the (2.95 mAOD) tidal downstream boundary level and are not impacted by it.

Relative to Scenario A, partial blockage of the twin outfall culverts (i.e. Scenario C) increases predicted flood extents and depths within the application site (Figure 5.11). However, as for Scenario B, predicted flooding in the vicinity of the public road culvert and further upstream is unaltered.

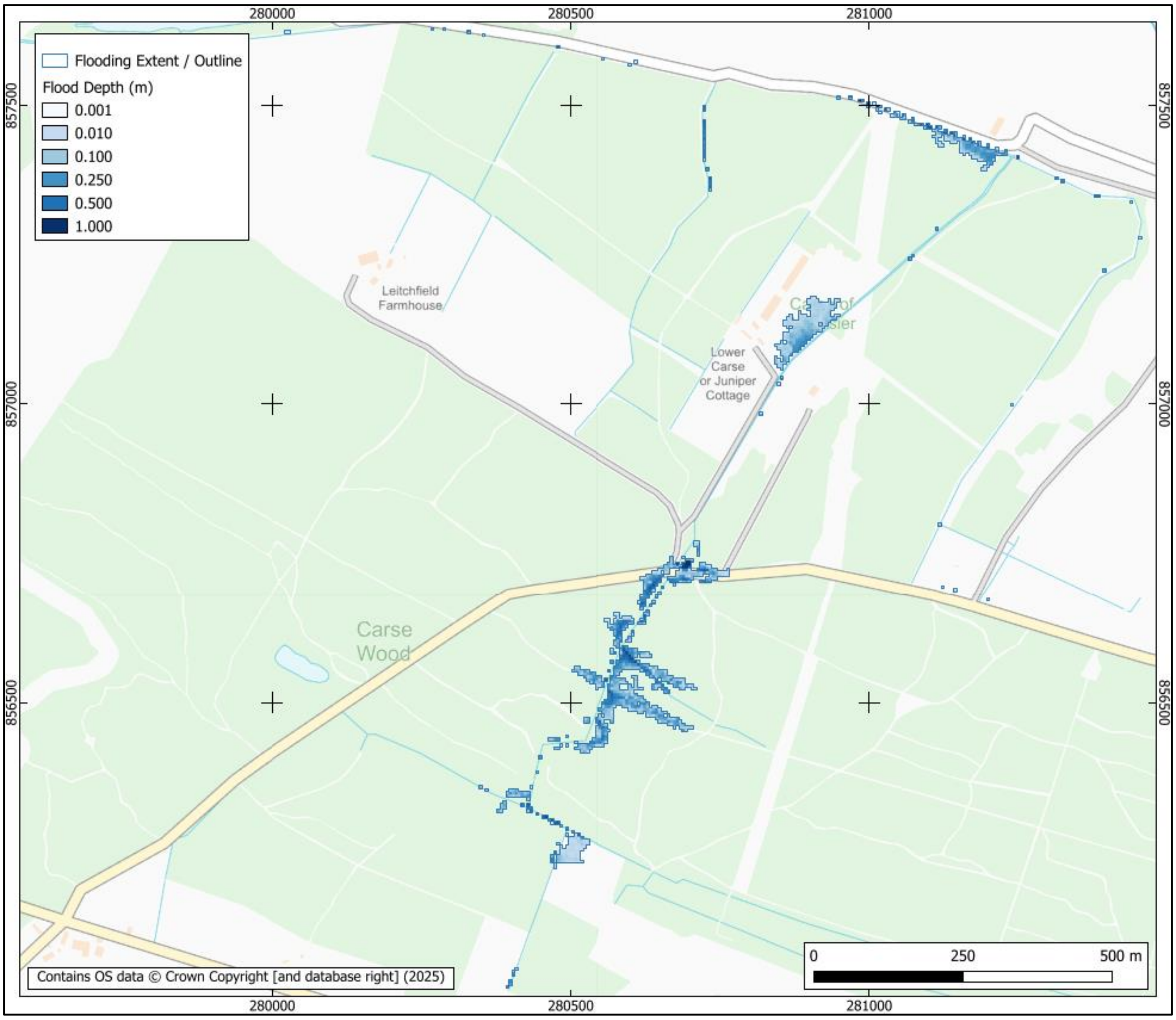

Figure 5.9: Scenario A predicted 2D flood extents and maximum depths

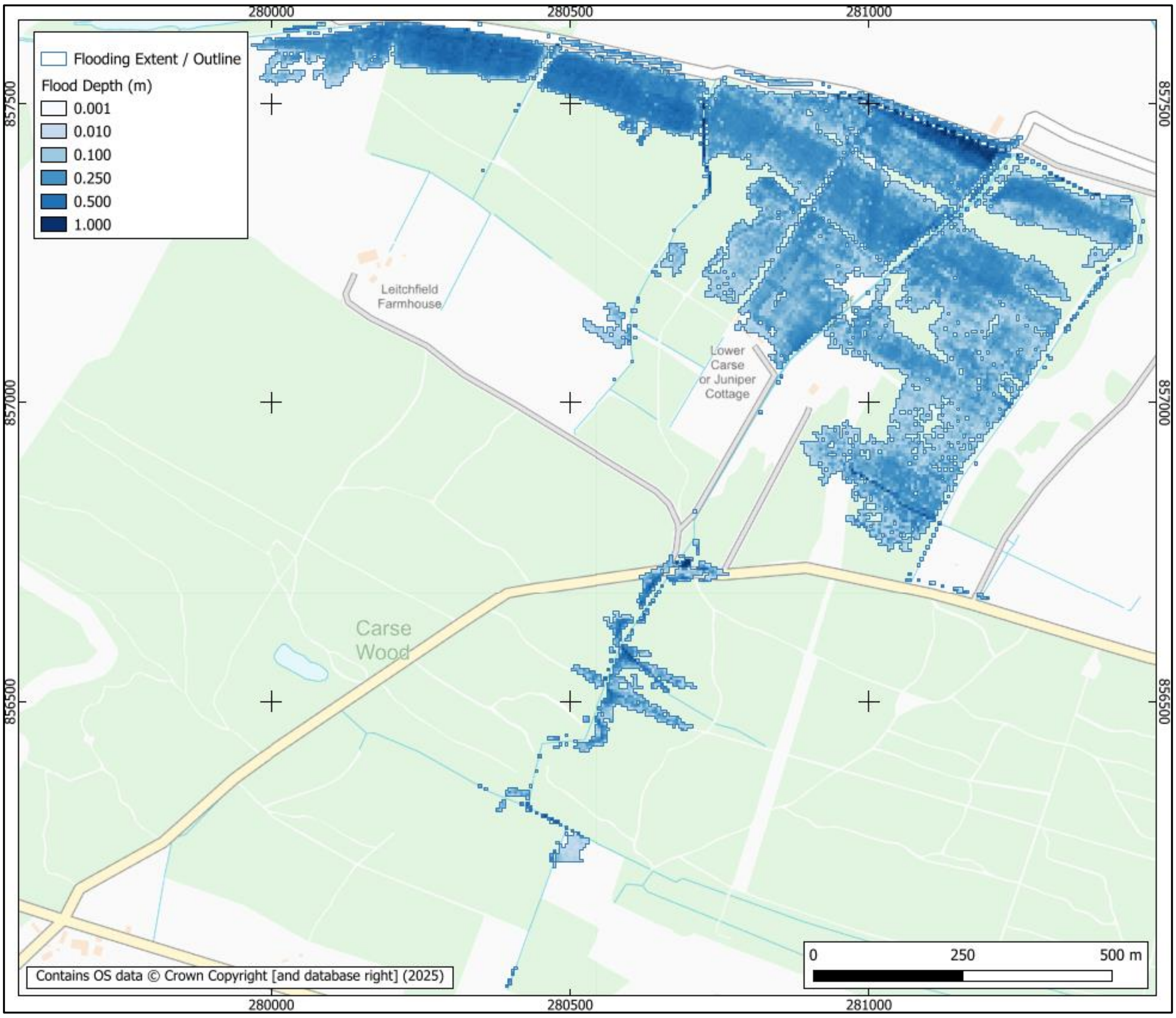

Figure 5.10: Scenario B predicted 2D flood extents and maximum depths

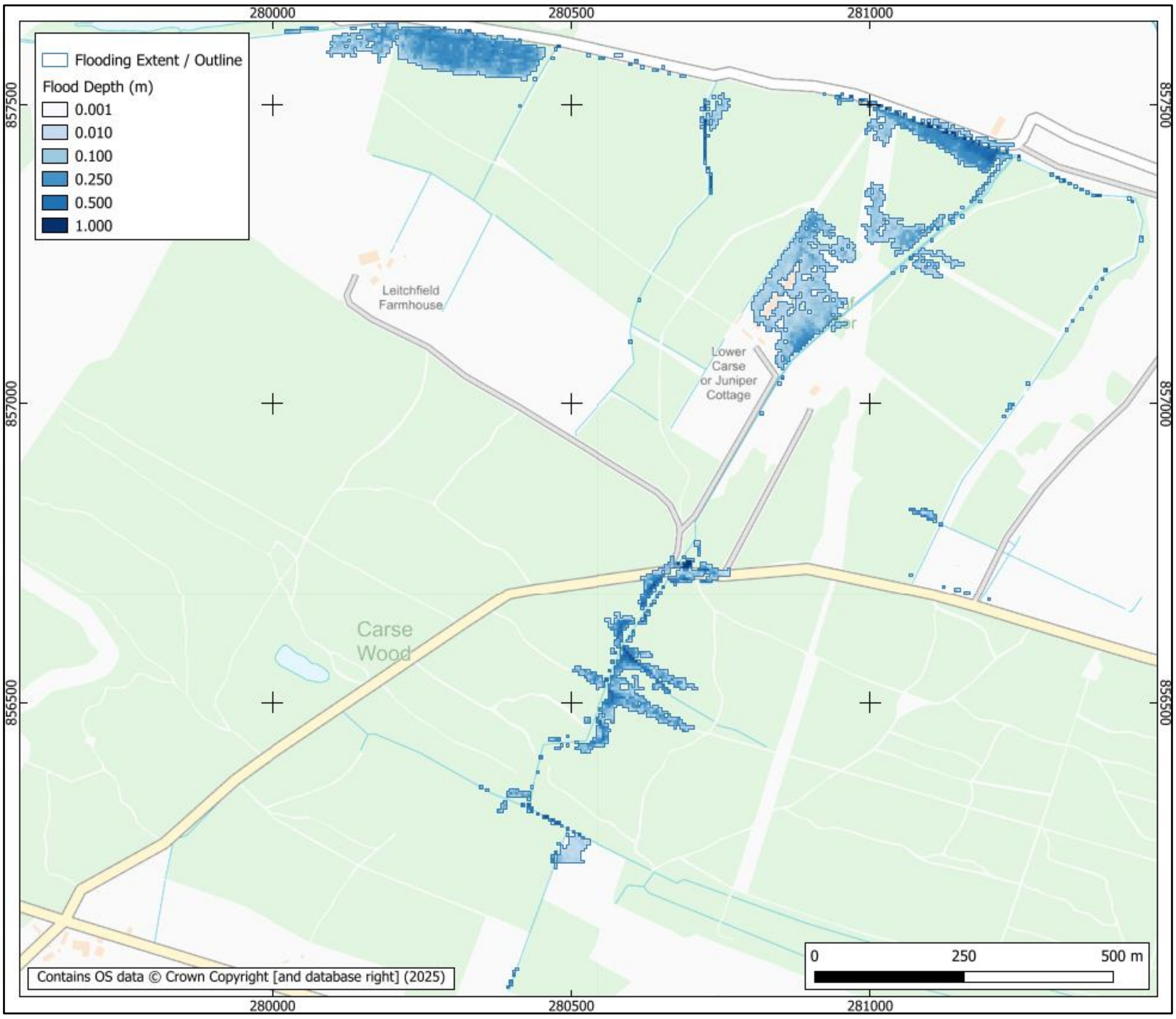

Figure 5.11: Scenario C predicted 2D flood extents and maximum depths

5.9 Mass Balance

The reported cumulative mass balance error for Scenario A is 454.5 m^3 or 2.61%. For Scenario C, the error is 353.5 m^3 or 1.26%. For Scenario B, the mass balance error increases beyond the predicted flood peak to excessive values (exceeding 8%); however, at the point predicted flood peaks (in the 1D and 2D domain) are reached (calculated at t=20 hrs into the 30 hr simulation run) the cumulative mass balance error is -191.7 m^3 or -0.19%.

6 POST-DEVELOPMENT LAND DRAINAGE FLOOD RISK

6.1 Conceptual Approach

Following preliminary appraisal of options for intercepting and diverting land drainage flows around the site platform (to avoid the need for culverting under the application site or the retention of land drainage channels through the application site, which would inhibit the movement of heavy vehicles), the following conceptual approach for land drainage management was adopted:

- A newly created Western Watercourse will intercept and divert land drainage flows arriving at the site boundary to the west of the existing main drain for discharge into the existing lagoon, with preliminary analysis indicating that design flows from the main drain cannot be conveyed westwards due to the lack of hydraulic gradient between the public road culvert outlet of the main drain and lagoon levels without inducing flooding.
- A newly created Eastern Watercourse will intercept and divert land drainage flows from the main drain, as well as land drainage flows arriving at the site boundary to the east of this drain, for discharge via the existing site access road culverts and land drainage channels into the saltmarsh to the east of the application site. A wetland pond is proposed upstream of the existing site access road culverts, to provide wetland habitat and to facilitate settlement of any suspended and entrained material prior to discharge.

To comply with scoping response requirements, both created watercourses will employ a two-stage design, consisting of an inner channel sized to accommodate typical flows and an outer channel capable of accommodating design (1 in 200 year plus climate change) flows.

6.2 Eastern Watercourse Model

Proposed conceptual design details for the Eastern Watercourse are presented in Appendix E. Note that, while the conceptual design used for the purpose of hydraulic modelling uses straight reaches of consistent cross-section, the final design of this watercourse will incorporate meanders and other variations to achieve a more naturalised water feature without materially altering flood predictions.

6.2.1 1D Model Construction

A triangulated 3D ground model for post-development conditions, including representation of the Eastern Watercourse, was created by Fairhurst for use in analysis. A centreline was created following the lowest point of the proposed channel, extending from the outlet of the public road culvert of the main drain to the inlet of the proposed wetland pond, which was used within Flood Modeller to sample cross-sections at 100 m intervals to create a 1D cross-sectional representation of the watercourse.

The proposed wetland pond was represented as a reservoir unit, with elevation-area relationship derived from the 3D ground model. The pond is drained by the two existing (900 mm diameter concrete) site access road culverts, discharging into feeder channels within the salt marsh. A fixed level downstream boundary is applied, the value of which varies depending upon the scenario being simulated: either 1.5 mAOD for the free-draining scenarios (Scenario A and, with culvert blockage, Scenario C) or 2.95 mAOD for the tidally-constrained scenario (Scenario B), as per pre-development modelling (Section 5.4.3).

The main drain to the outlet of the public road culvert is retained in the model, along with all inflows to this point. Lateral contributing catchment areas and calculated design flows entering the Eastern Drain along its length are summarised in Table 6.1.

Table 6.1: Peak flow values for subcatchments discharging into the proposed Eastern Watercourse

Subcatchment	Model Node	Area (km^2)	Peak 200 year plus climate change flow (m^3/s)
10a – Port Site Perimeter Drain (East, External) + Portion of 09b – Southeastern Drain (External Catchment) entering in upper reach of drain	SE_001*	0.023 + 0.148	0.080
Remaining portion of 09b – Southeastern Drain (External Catchment) entering in upper reach of drain	SE_002*	0.742	0.347
08 – Northeastern Drain (Internal Catchment) + 09a – Southeastern Drain (Internal Catchment)	SE_003*	0.050 + 0.278	0.153

** Indicates inflows that are input laterally (distributed over a reach length) within modelling.*

The inner (low-flow) channel of the watercourse is represented to have a Manning's roughness of 0.035, with the bench and outer channel assumed to have a roughness of 0.05 to account for planting and vegetation growth outwith the low-flow channel.

The proposed site layout includes for two road crossings of the Eastern Watercourse:

- A secondary site access road.
- An access track to the existing wastewater pumping station.

These are assumed to be designed as clearspan bridge crossings, with design to be informed by model predictions, with the crossings themselves not constraining flow within the drain.

Figure 6.1: Eastern Watercourse 1D model schematic, with LiDAR-based ground elevations (external to site) and proposed platform elevations (within the site)

6.2.2 2D Model Construction

The 2D domain of the Eastern Watercourse model was constructed using the same methods and assumptions as for the pre-development model (Section 5.5), with 2D extents indicated in Figure 6.2. The site platform, beyond the northern bank of the channel, is too elevated to be at risk of flooding and therefore is not included within the active area. Note the following additional complexity in relation to representation of the salt marsh area to the east of the site access road:

- For free-draining scenarios (Scenarios A and C), the downstream 2D boundaries will also be free-draining into the tidal salt marsh channel, represented as a normal boundary condition with assumed gradient of 0.2.
- For the tidally-constrained scenario (Scenario B), for computational efficiency/stability, the 1D-2D link lines to the east of the access road are deactivated, thereby also deactivating the portion of the active area to the east of the access road.

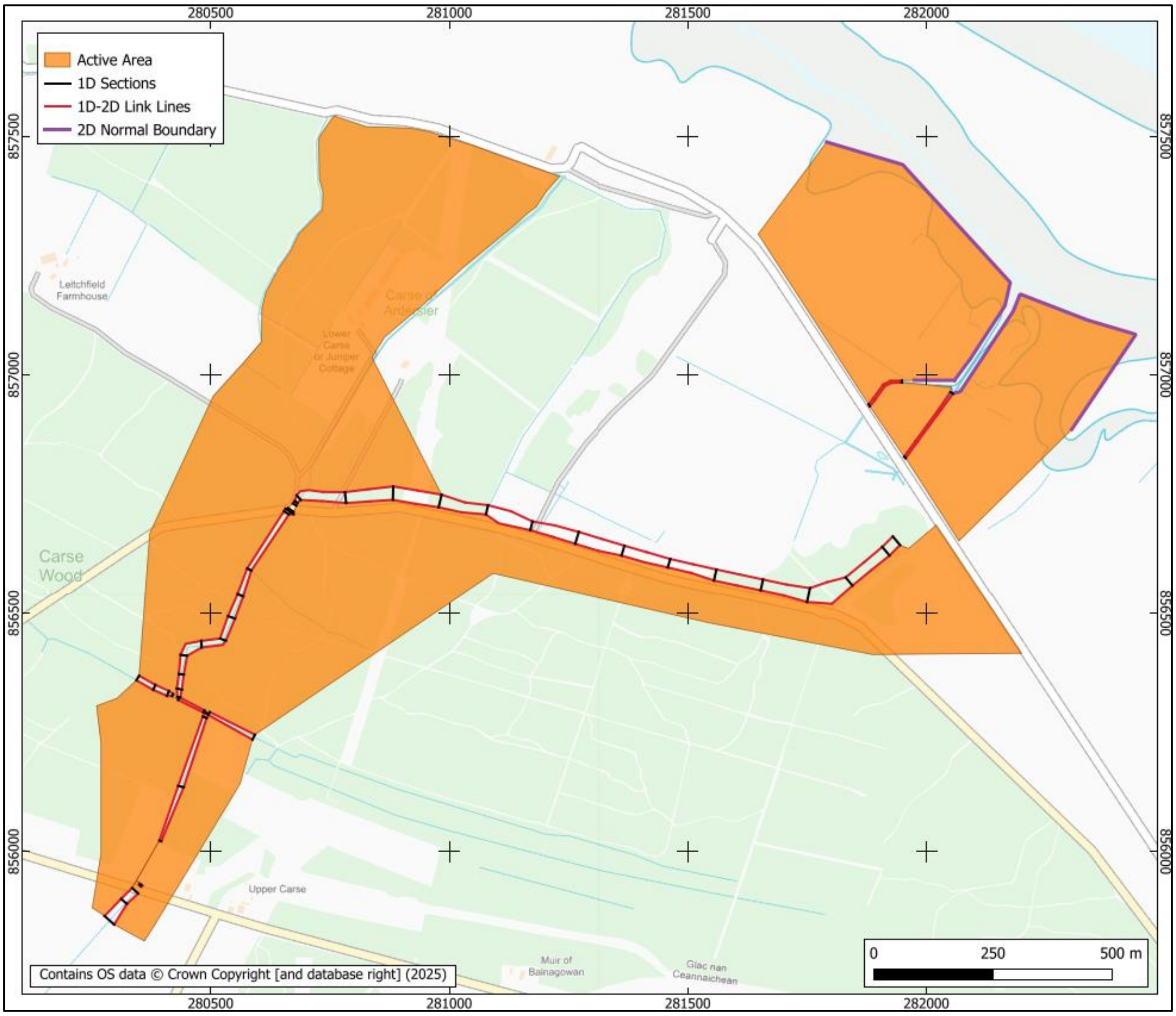

Figure 6.2: Eastern Watercourse 2D model extents, showing 1D-2D boundaries, 1D sections and 2D boundaries within the salt marsh

6.2.3 Model Scenarios & Run Parameters

The Eastern Watercourse model was run using the same parameters as the pre-development model (Section 5.6) and for the same scenarios (Section 5.7), to allow comparative assessment of predicted flooding. Note that, for the purposes of this comparison, Scenario C is based upon 50% blockage of both site access road culverts for post-development conditions.

6.2.4 Model Predictions

Predicted peak 1 in 200 year plus climate change flood depths and extents are presented for Scenarios A, B and C as Figure 6.3, Figure 6.4 and Figure 6.5, respectively. The following tabulated output is also presented in Appendix F:

- Peak predictions of 1D stage, flow, velocity and Froude number for Scenario A.
- Comparative values of predicted 1D peak stage for Scenarios B and C relative to A.
- Comparative values of predicted 1D peak stage upstream of the public road for all scenarios relative to equivalent pre-development scenarios (noting that only the reach upstream of the public road is common to pre- and post-development scenarios).

The spatial pattern of flooding at and upstream of the public road culvert is indistinguishable from the pre-development scenario, with 1D peak stage predictions varying between -1 mm and +2 mm relative to equivalent pre-development predictions (Appendix D); given the high degree of similarity, a comparative assessment of predictive differences in 2D flood predictions was undertaken and is presented in Section 6.2.5. For Scenarios A and C, out-of-bank flooding is predicted downstream of the northern site access road culvert, noting that the area of predicted inundation is outwith the designated saltmarsh site.

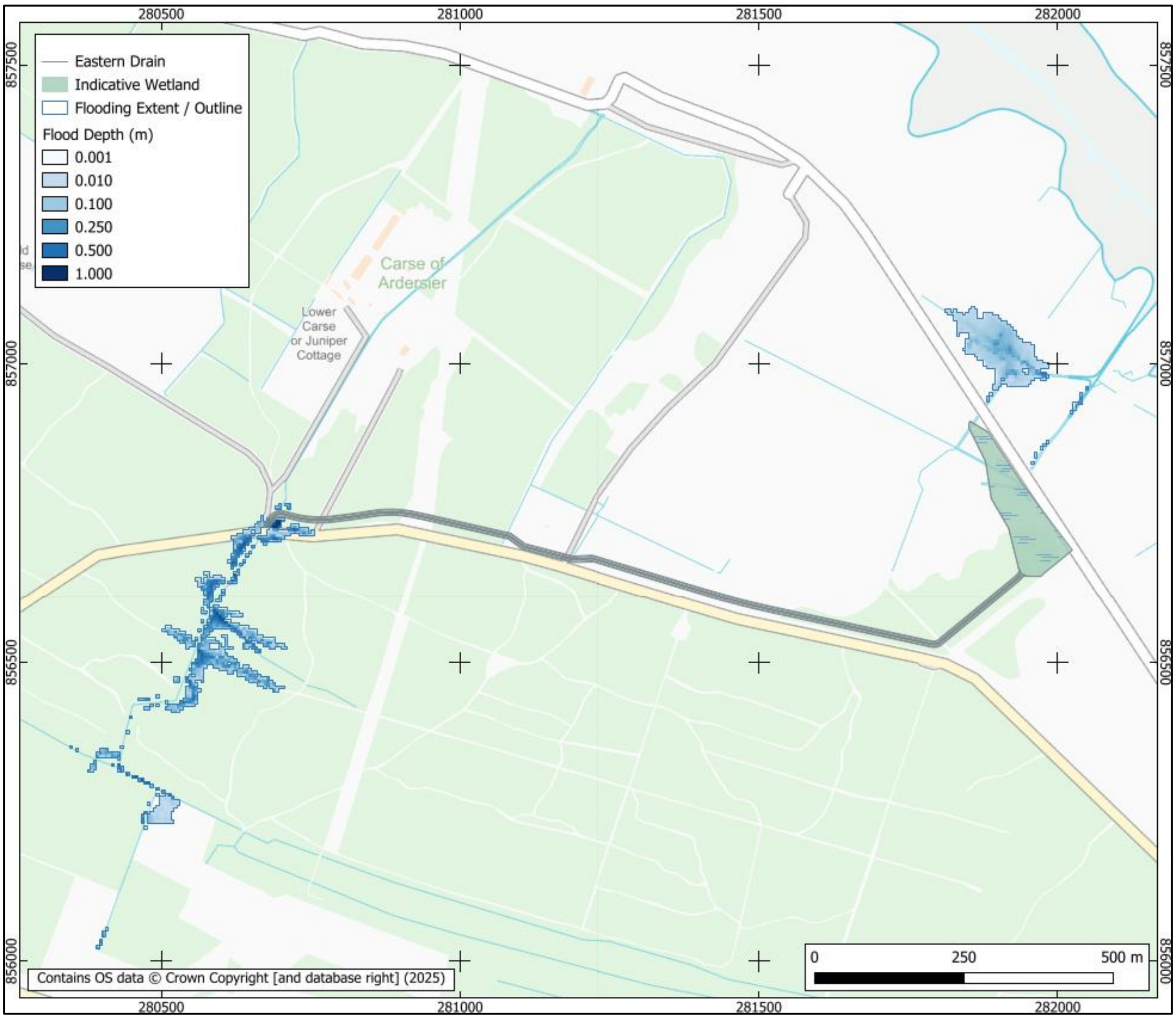

Figure 6.3: Scenario A predicted 2D flood extents and maximum depths

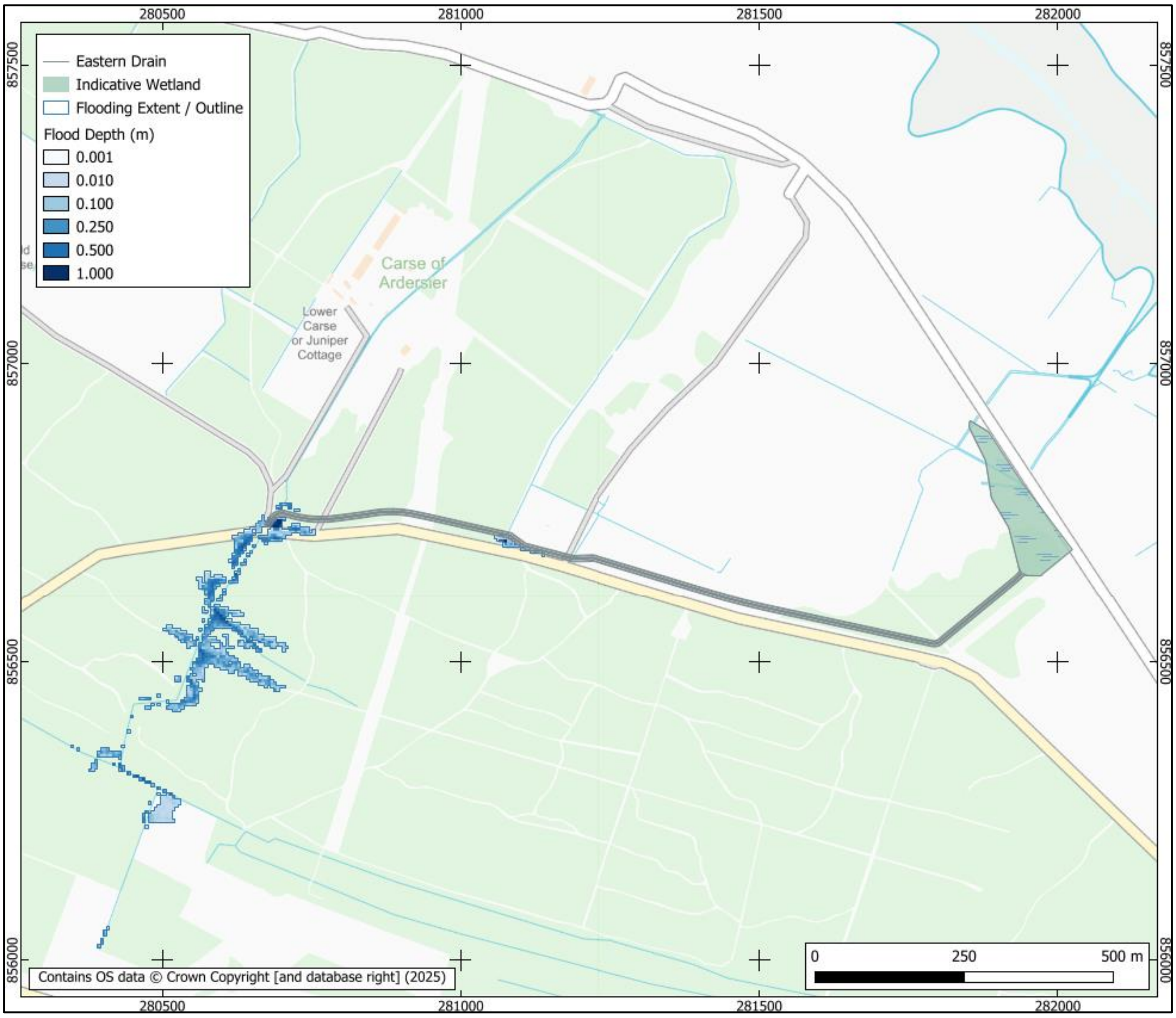

Figure 6.4: Scenario B predicted 2D flood extents and maximum depths (noting that flooding to the east of the site access road was not simulated for this scenario)

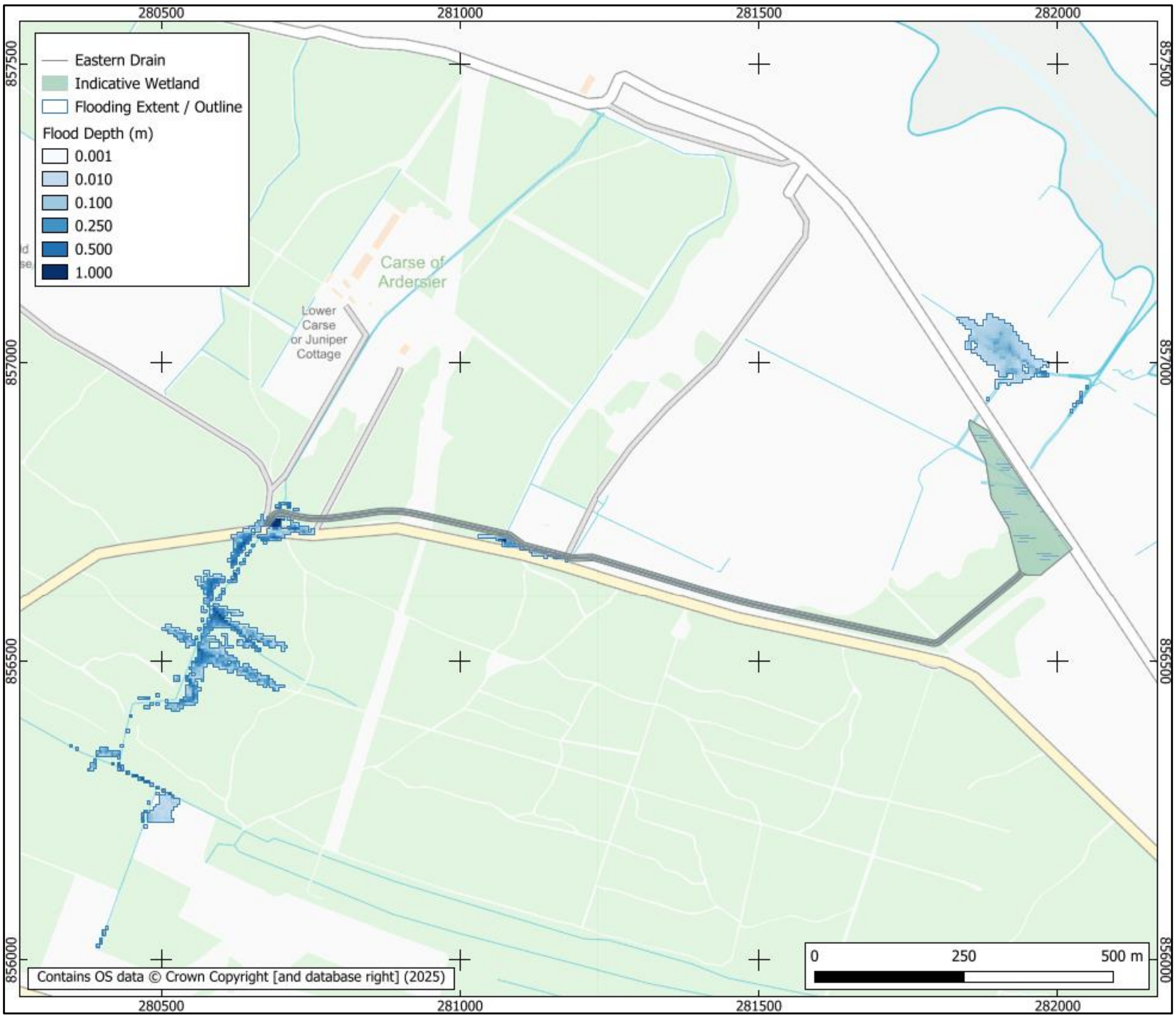

Figure 6.5: Scenario C predicted 2D flood extents and maximum depths

6.2.5 Flood Risk Impact

The impact of development proposals (including land drainage diversion) upon altering predicted flood risk was assessed by subtracting peak post-development flood levels from pre-development flood levels, to generate difference maps for each modelled scenario:

- For Scenario A, development is predicted to have no impact upon predicted flooding at and upstream of the public road culvert, with some minor reductions in predicted peak flood depths upon the inundated section of road (Figure 6.6).
- For Scenario B, development is predicted to have negligible impact upon predicted flooding at and upstream of the public road culvert, albeit with some isolated numerical instability causing small areas of new flooding or slightly deeper flooding around the edges of the inundated extent (Figure 6.7). A small area of flooding is predicted over the southern bank of the diversion watercourse near the WWPS, but this flooding (to levels of ~3.6 mAOD) remains below the level of the public road (~3.7 mAOD). Additional scenarios testing employing a more realistic time-varying tidal downstream boundary with the same 2.95 mAOD peak (not presented) predicts peak flows approximately 300 mm lower at this location, with flows remaining within-bank.

- For Scenario C, as for Scenario B, development is predicted to have negligible impact upon predicted flooding at and upstream of the public road culvert, albeit with some isolated numerical instability causing small areas of new flooding or slightly deeper flooding around the edges of the inundated extent (Figure 6.8). A small area of flooding is predicted over the southern bank of the diversion watercourse near the WWPS, with predicted flood levels marginally below adjacent road levels (~3.7 mAOD). Additional scenarios testing (not presented) indicates design (200 year plus climate change) flows remain within-bank at this location where the proportion of blockage is below 30%.

It is concluded that the proposed eastern diversion watercourse is capable of achieving neutral flood risk impact, or even potential reduction in flood risk compared to existing conditions, subject to the following recommendations:

- As part of proposed works, the inlets of the existing site access road culverts should be screened to protect against blockage by debris (noting that the proposed wetland upstream of the inlets will provide protection against entrained debris, by reducing flow velocities upstream of the culvert inlets, but floating debris may still pose a blockage risk without appropriate inlet screening).
- Flap valves should be installed at the culvert outlets, to reduce the risk of coastal flood inundation to the public road via culvert backflow, noting that flooding to the road may still occur where extreme tides are coincident with high land drainage flows (noting that such conditions will pose flood risk to the road for both pre- and post-development conditions).

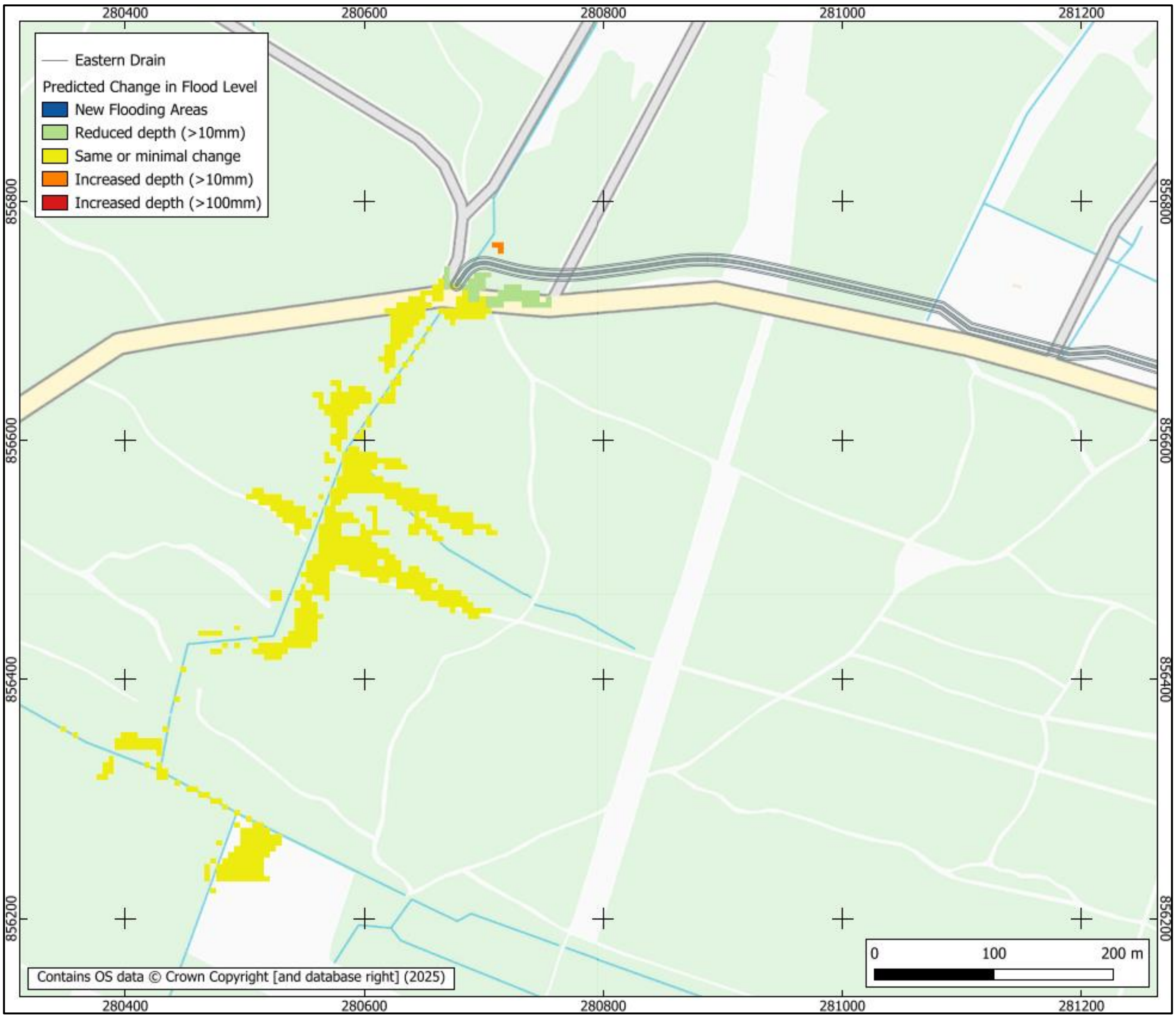

Figure 6.6: Change in predicted peak flood level due to proposals (Scenario A)

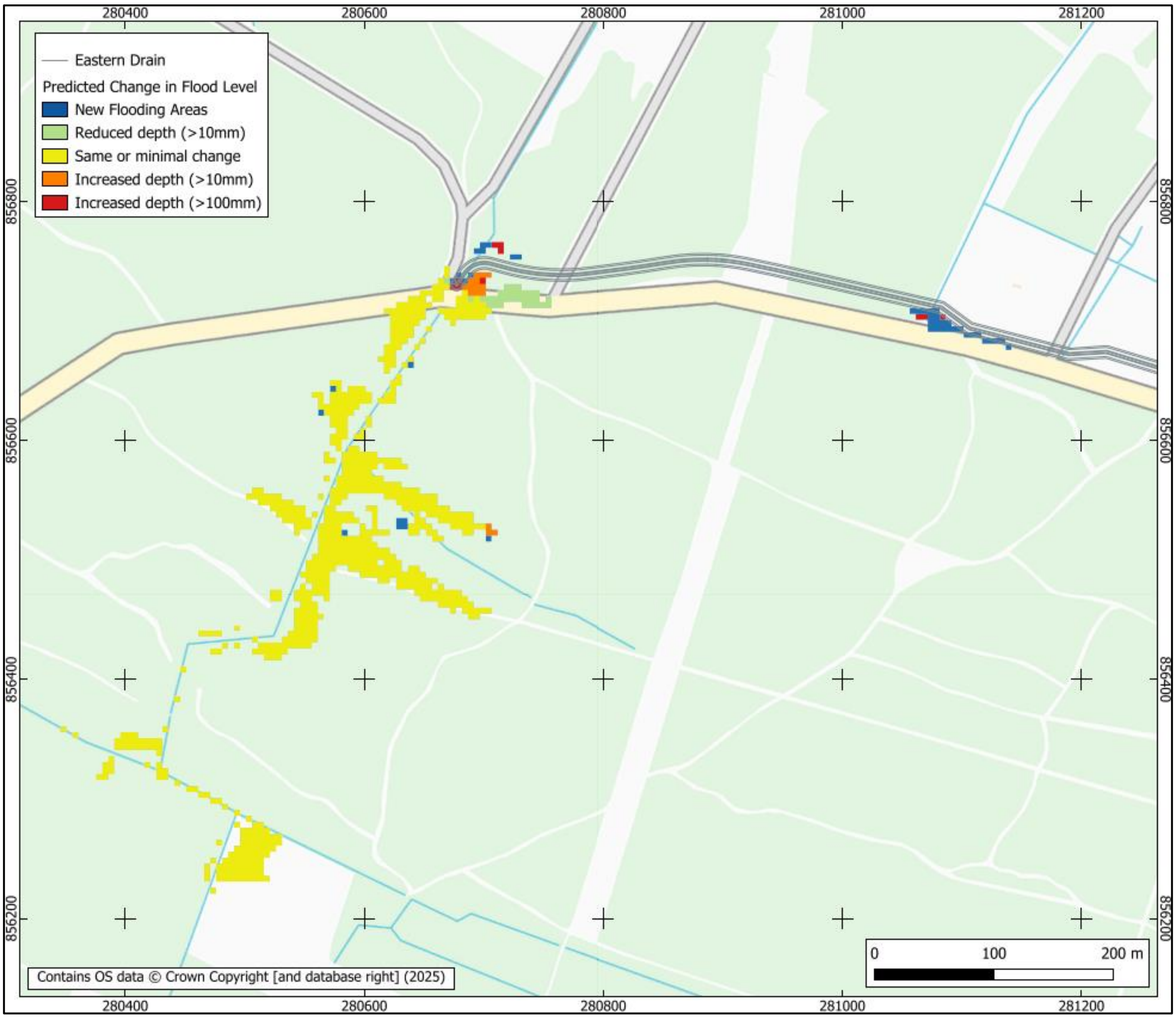

Figure 6.7: Change in predicted peak flood level due to proposals (Scenario B)

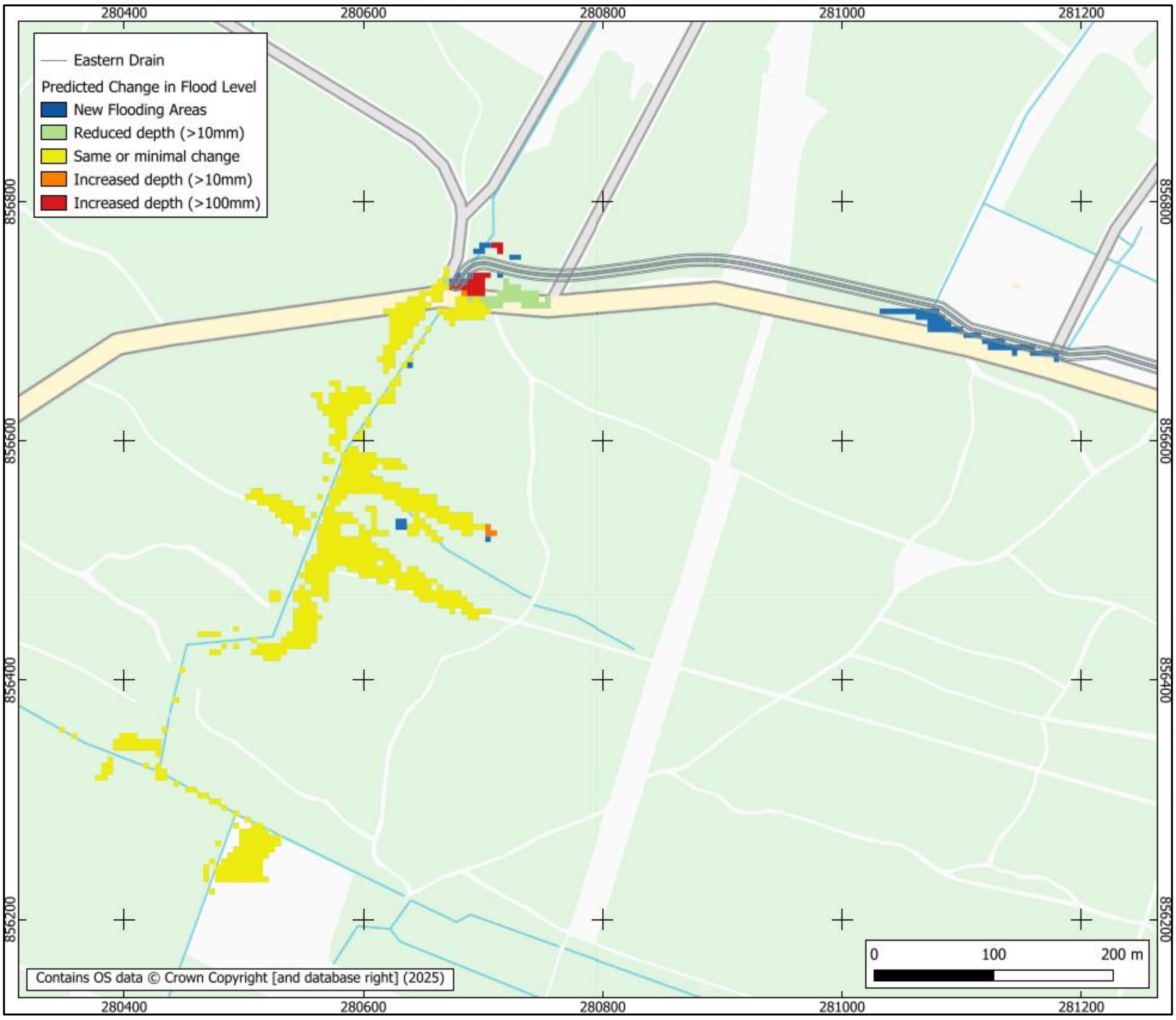

Figure 6.8: Change in predicted peak flood level due to proposals (Scenario C)

6.3 Western Watercourse Model

Proposed design details for the Western Watercourse are presented in Appendix E. Note that, while the conceptual design used for the purpose of hydraulic modelling uses straight reaches of consistent cross-section, the final design of this watercourse will incorporate meanders and other variations to achieve a more naturalised water feature without materially altering flood predictions.

6.3.1 1D Model Construction

A triangulated 3D ground model for post-development conditions, including representation of the Western Watercourse, was created by Fairhurst for use in analysis. A centreline was created following the lowest point of the proposed channel, extending from the southeasternmost extent of the Central Drain system westwards around the site perimeter to drain into the existing lagoon, which was used within Flood Modeller to sample cross-sections at 50 m intervals to create a 1D cross-sectional representation of the watercourse.

The downstream end of the watercourse is assumed to connect to the lagoon via a (nominal) 1 m x 1 m rectangular orifice plate with invert level of 2.16 mAOD. The downstream boundary condition varies for the modelled scenarios as detailed in Section 6.3.3.

Flows from the external catchment of the Central Drain will discharge into the head of the Western Watercourse, with flows from the external catchment of the Western Watercourse entering approximately halfway along the length of the watercourse. Modelling assumes the western portions of the Port Site Perimeter Drain (West) catchment may contribute flows at the downstream end of the watercourse. Modelled inflows are summarised in Table 6.2.

Table 6.2: Peak flow values for subcatchments discharging into the proposed Western Watercourse

Subcatchment	Model Node	Area (km^2)	Peak 200 year plus climate change flow (m^3/s)
06a – Central Drain (External Catchment)	C_001	0.421	0.197
07a – Western Drain (External Catchment)	W_0_012	0.149	0.070
11 – Approximately 50% of Port Site Perimeter Drain (West) Catchment	W_0_022	0.108	0.050

The inner (low-flow) channel of the watercourse is represented to have a Manning's roughness of 0.035, with the bench and outer channel assumed to have a roughness of 0.05 to account for planting and vegetation growth outwith the low-flow channel.

There are no proposed crossings along the length of the watercourse.

Figure 6.9: Western Watercourse 1D model schematic, with LiDAR-based ground elevations (external to site) and proposed platform elevations (within the site)

6.3.2 2D Model Construction

The 2D domain of the Eastern Watercourse model was constructed using the same methods and assumptions as for the pre-development model (Section 5.5), with 2D extents indicated in Figure 6.10. The site platform, beyond the northern bank of the watercourse, is too elevated to be at risk of flooding and therefore is not included within the active area.

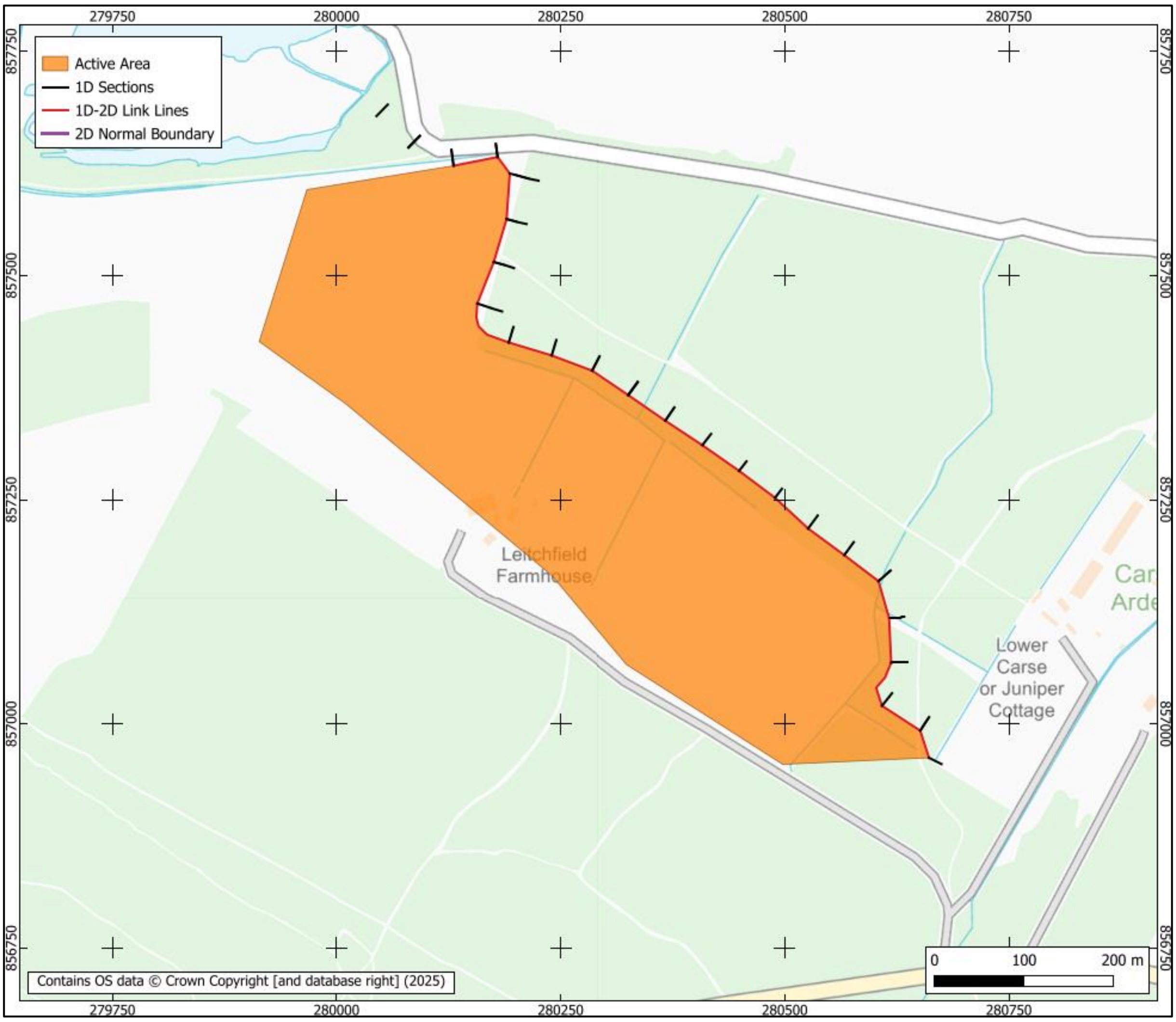

Figure 6.10: Western Watercourse 2D model extents, showing 1D-2D boundaries and 1D sections

6.3.3 Model Scenarios & Run Parameters

The Western Watercourse model was run using the same parameters as the pre-development model (Section 5.6). Two scenarios were assessed:

A. A free-draining scenario, in which the tidal downstream boundary of the model was fixed at 2.4 mAOD, as per pre-development modelling.
B. A tidally constrained scenario, in which the tidal downstream boundary of the model was fixed at 2.95 mAOD (i.e. the estimated MHWS+CC water level).

There are no proposed culverts along the length of the Western Watercourse, such that no culvert blockage scenario was undertaken.

6.3.4 Model Predictions

For Scenario A, predicted peak water levels remain within-bank at all modelled cross-sections, such that there are no predicted 2D flood extents. Figure 6.11 through Figure 6.20 illustrates the peak water level prediction for every second cross-section (i.e. at 100 m intervals along the Western Watercourse) for this scenario, with tabulated 1D peak predictions for both scenarios presented in Appendix G.

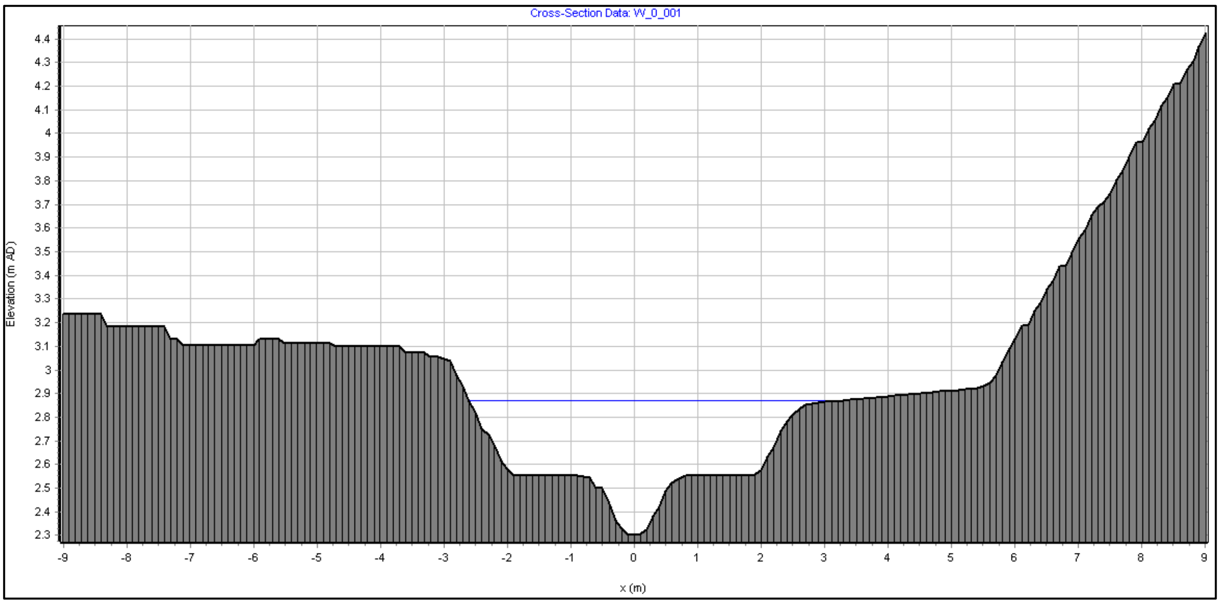

Figure 6.11: Scenario A predictions (Section W_0_001)

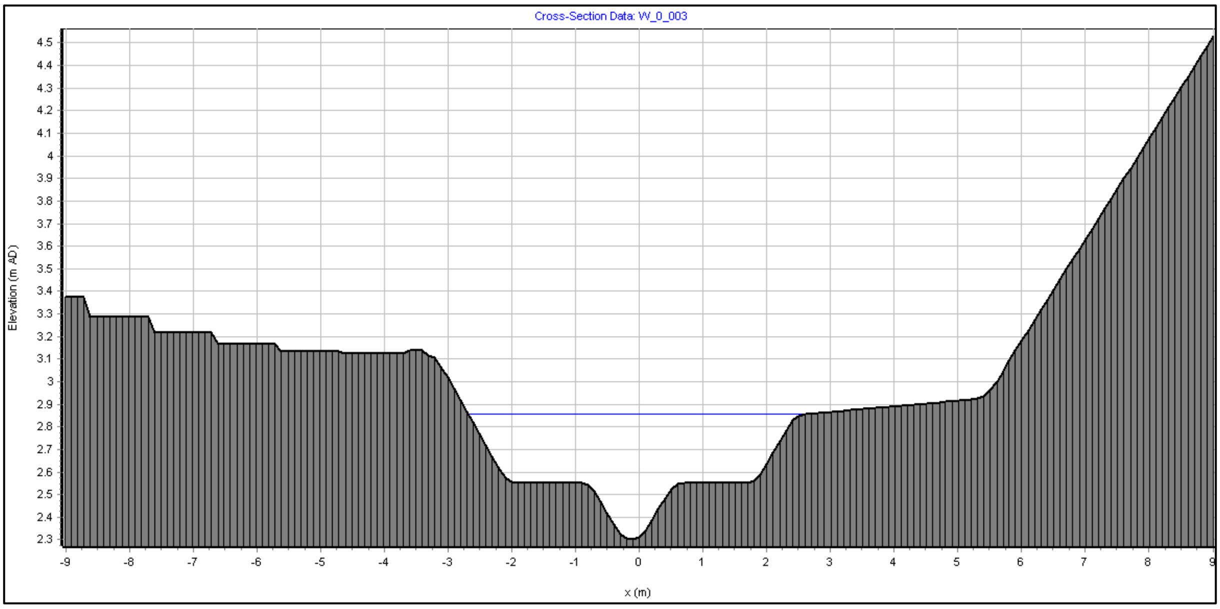

Figure 6.12: Scenario A predictions (Section W_0_003)

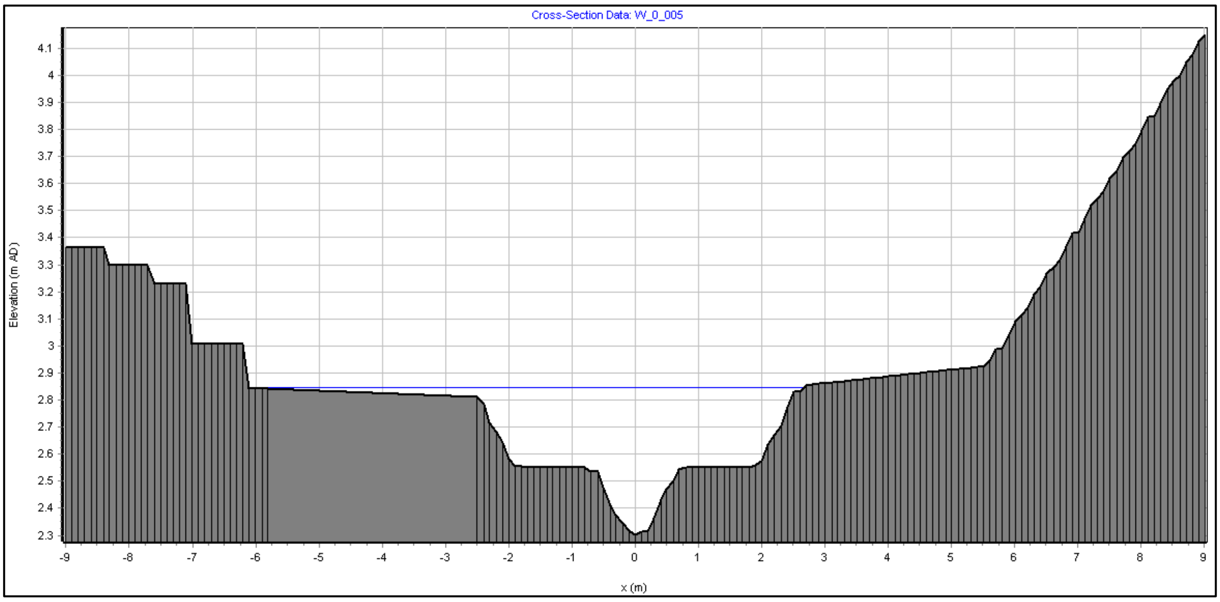

Figure 6.13: Scenario A predictions (Section W_0_005)

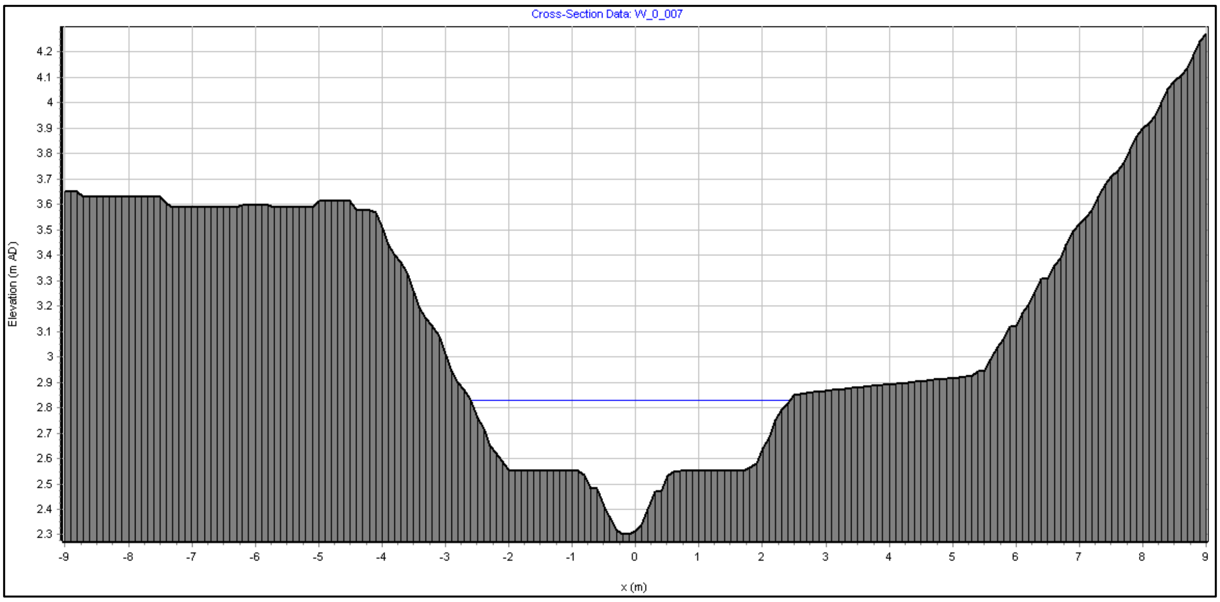

Figure 6.14: Scenario A predictions (Section W_0_007)

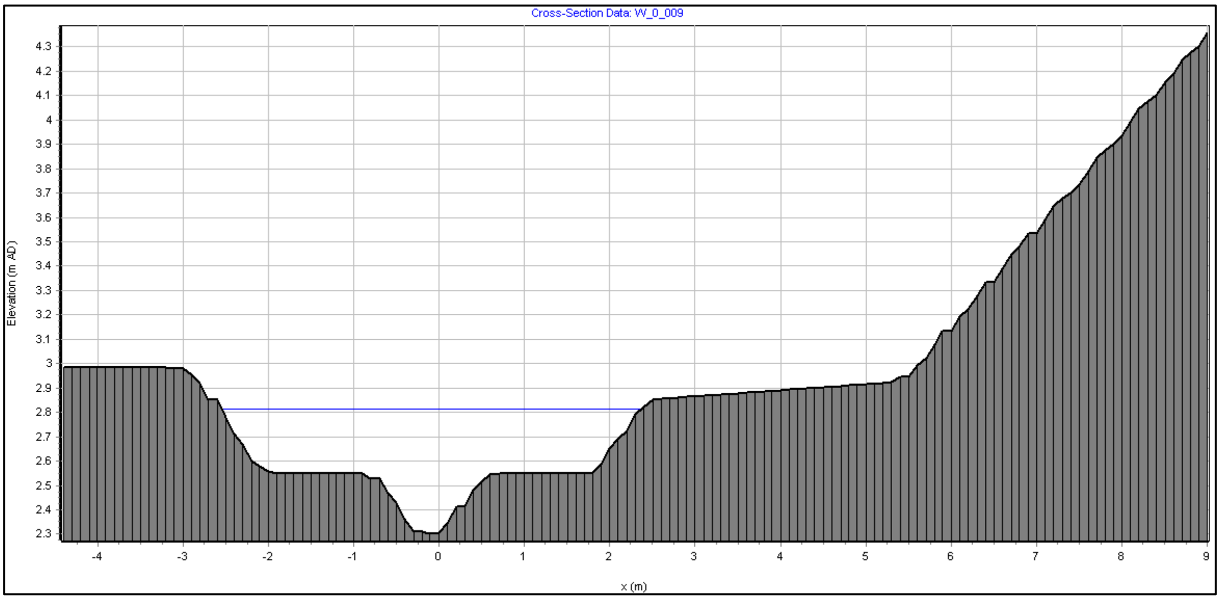

Figure 6.15: Scenario A predictions (Section W_0_009)

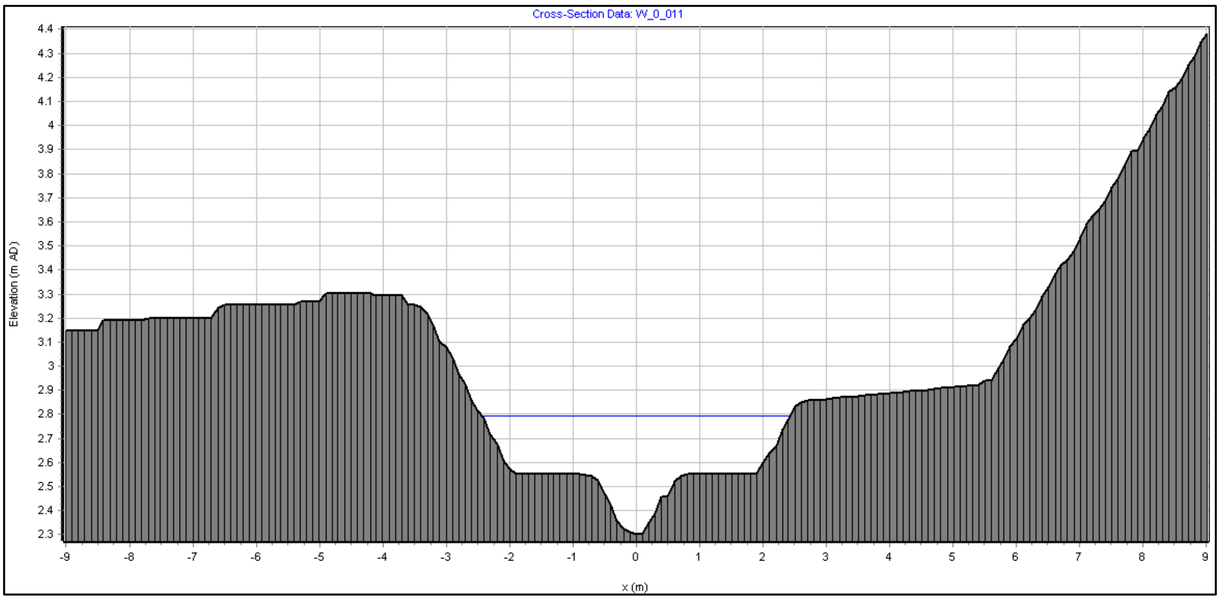

Figure 6.16: Scenario A predictions (Section W_0_011)

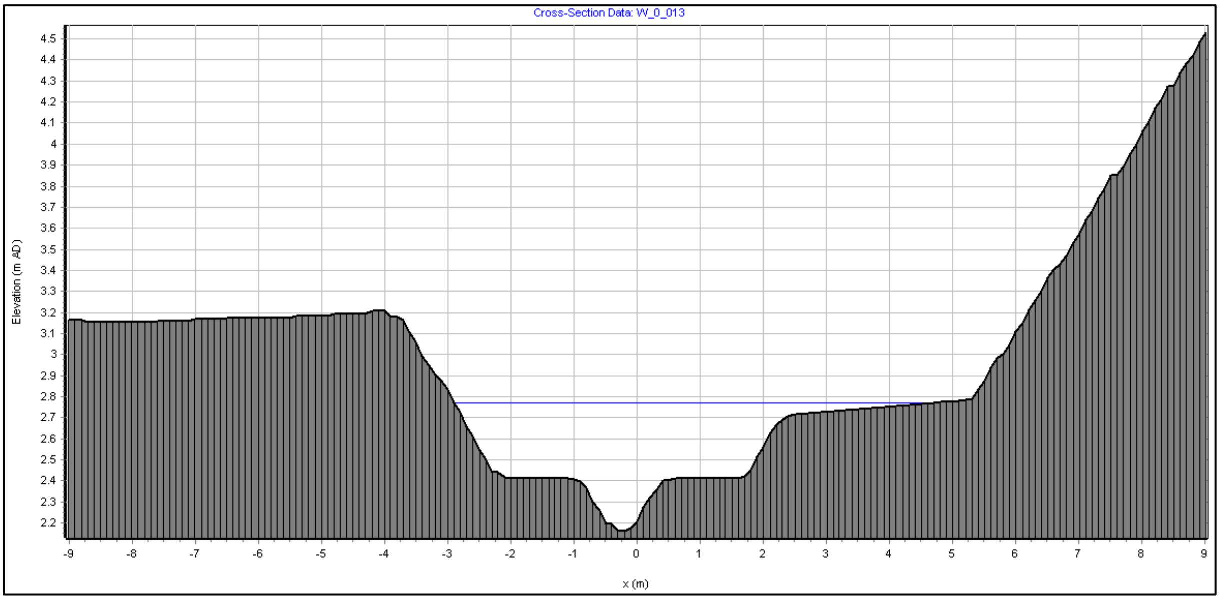

Figure 6.17: Scenario A predictions (Section W_0_013)

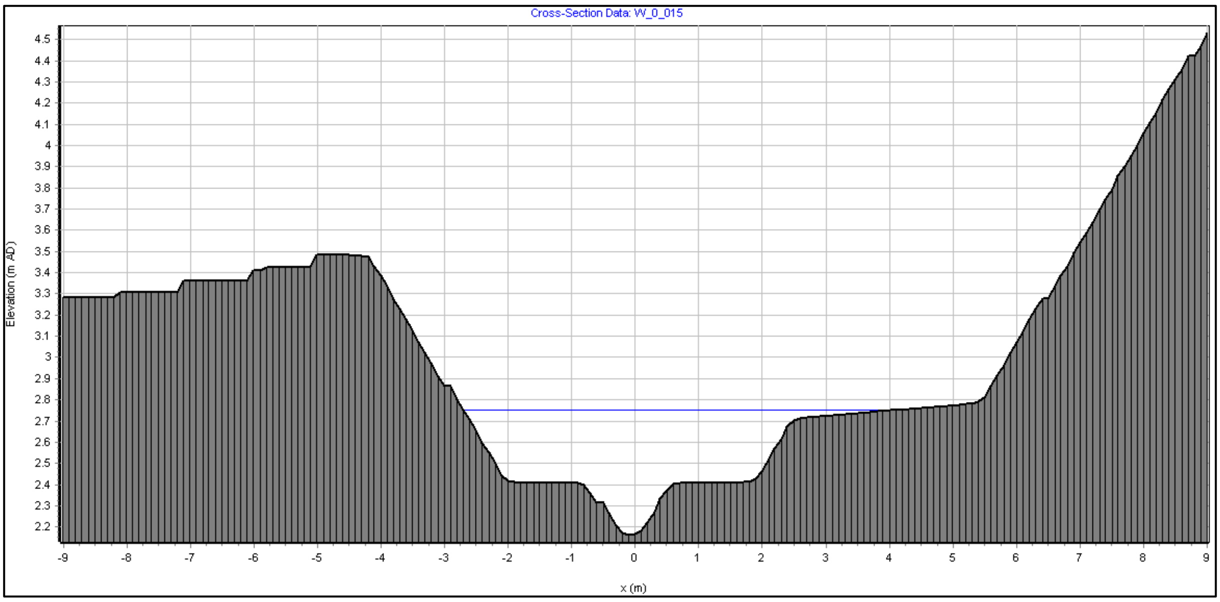

Figure 6.18: Scenario A predictions (Section W_0_015)

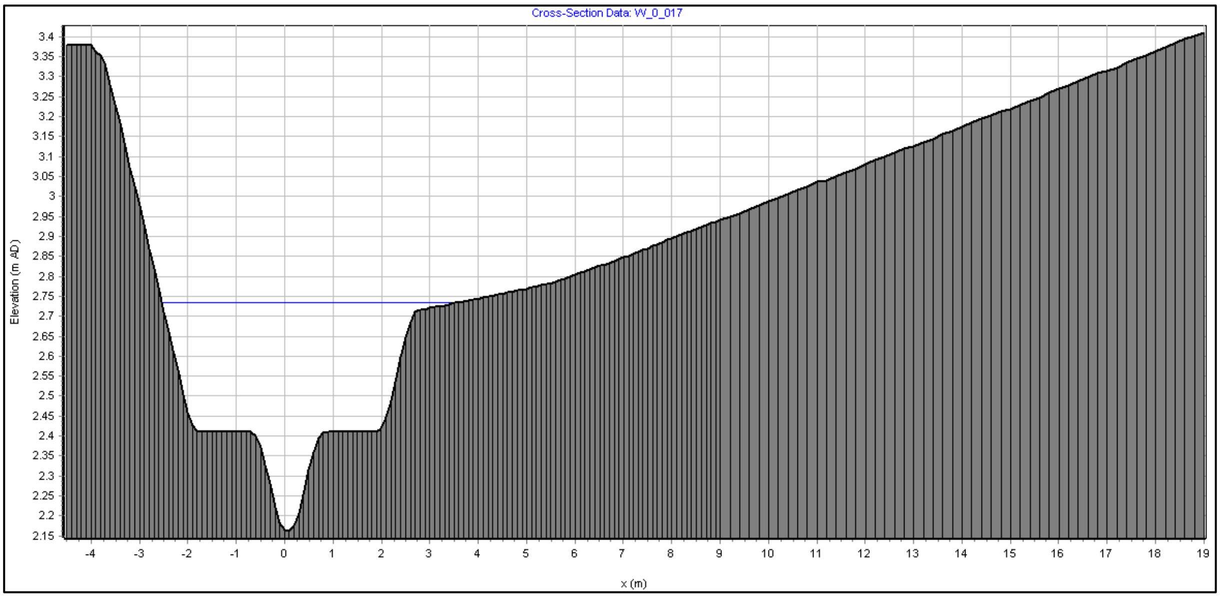

Figure 6.19: Scenario A predictions (Section W_0_017)

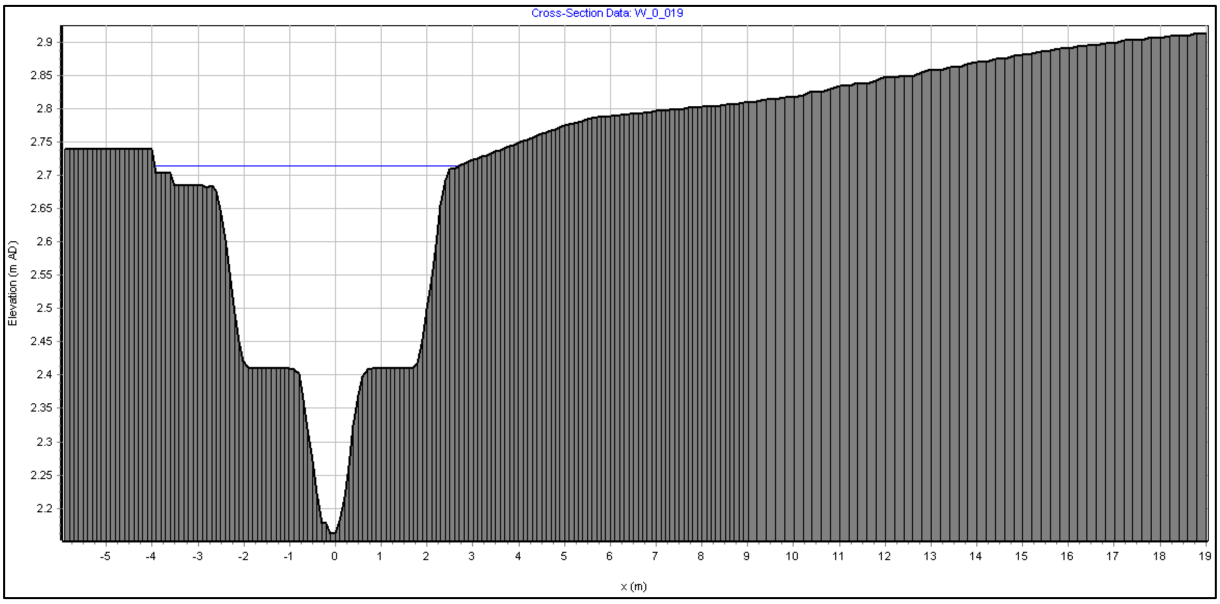

Figure 6.20: Scenario A predictions (Section W_0_019)

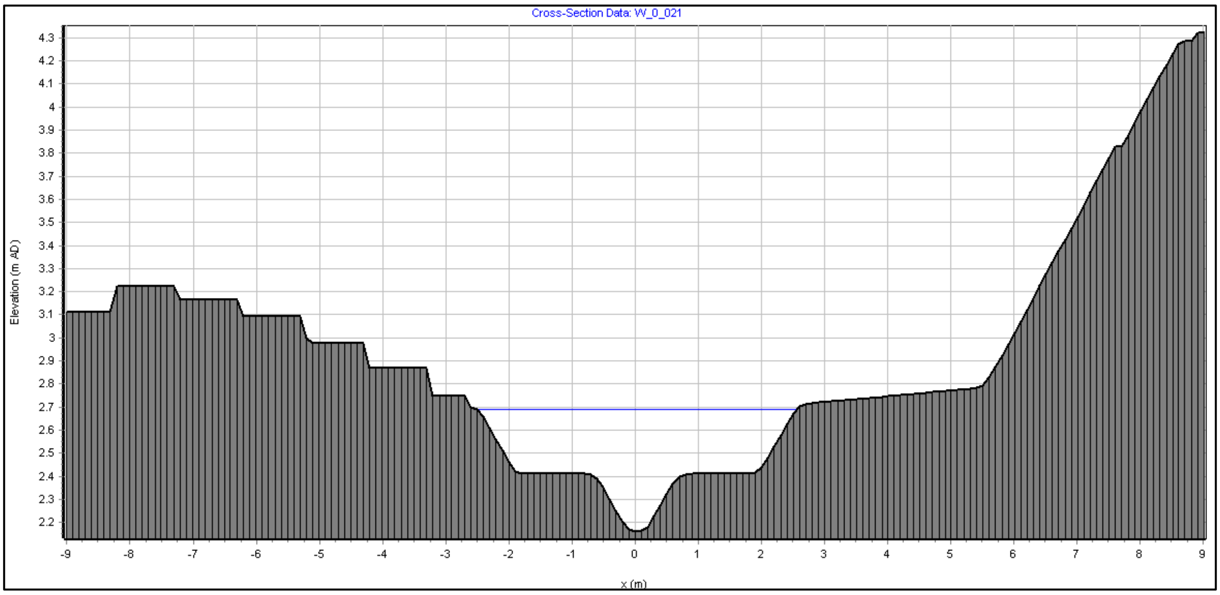

Figure 6.21: Scenario A predictions (Section W_0_021)

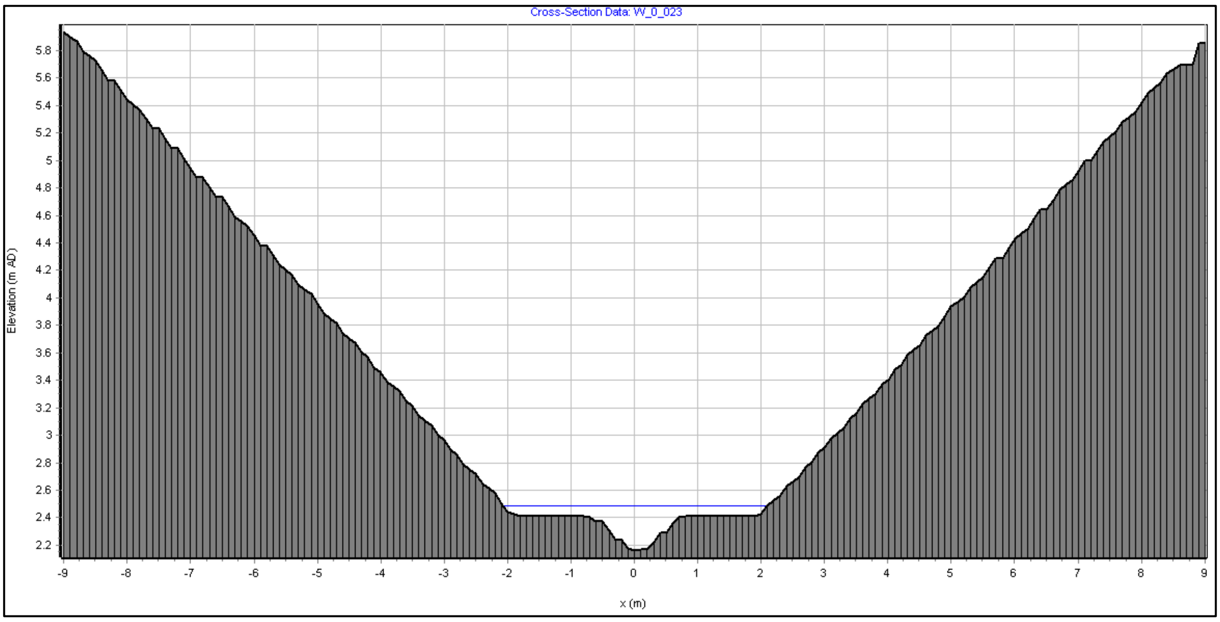

Figure 6.22: Scenario A predictions (Section W_0_023)

For Scenario B, peak water levels remain within-bank at most locations, except in the vicinity of W_0_019, near the final bend on the watercourse before its outfall into the lagoon, where flooding over the western bank is predicted (Figure 6.23). Predicted flooding in this location is less extensive and shallower than for equivalent pre-development conditions (i.e. Figure 5.10), with local peak flood levels of approximately 2.98 mAOD compared to 3.15 mAOD for pre-development conditions.

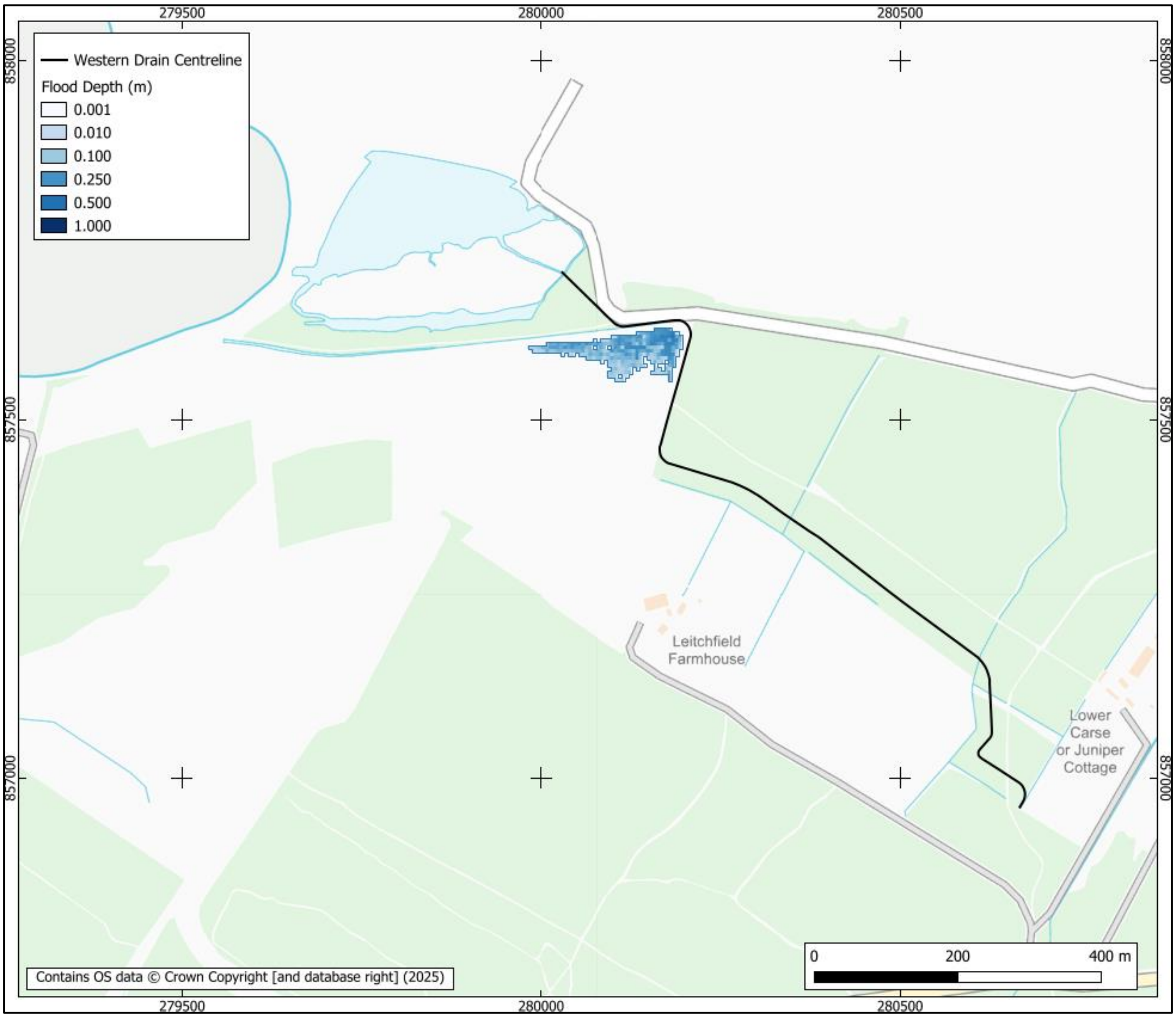

Figure 6.23: Scenario B predicted 2D flood extents and maximum depths

6.3.5 Flood Risk Impact

It is concluded that the proposed western diversion watercourse is capable of achieving neutral flood risk impact, or even potential reduction in flood risk, compared to existing conditions. A flap valve should be installed at the discharge point from the watercourse into the lagoon, to reduce the risk of coastal flood inundation via backflow, noting that extreme tides coincident with high land drainage flows may induce out-of-bank flows over the western and southern banks of the watercourse and thereby pose flood risk external to the application site (although such conditions will pose flood risk for both pre- and post-development conditions).

7 FLOOD RISK IMPACT & MANAGEMENT

7.1 Impact of Flood Risk Upon the Development

Table 7.1 provides a summary of flood risk from all sources, incorporating the outcomes of site-specific assessment of flood risk and proposed management measures within development proposals. The proposed development will be elevated above coastal flood risk (with exception of wave action along the northern and western site boundary) and will not otherwise be at risk of flooding. Proposed diversion watercourses around the site perimeter are demonstrated by modelling to be capable of conveying land drainage from areas south of the application site, ensuring that the development causes no detrimental increase in flood risk to other potential receptors.

Table 7.1: Summary of flood risk

Flood source or mechanism	Post-Development Risk Classification	Proposed Management Measures
Fluvial	No risk	None
Coastal	Low risk (wave action only)	The site will be platformed to above the estimated 1 in 200 year plus climate change extreme stillwater sea level (4.24 mAOD). This will protect the application site against direct coastal inundation, although the northern and western perimeters will be exposed to wave action during extreme sea level conditions.
Surface Runoff	Little or no risk	Proposed watercourse features will direct existing land drainage which drains towards the southern site boundary either eastwards (to discharge via existing culverts under the site access road towards the saltmarsh area) or westwards (to discharge into the lagoon). It is recommended that diversion watercourse outlets are fitted with non-return (flap) valves, to offer protection against backflow from extreme tides. In relation to the Eastern Watercourse, it is recommended that inlet trash screens (or pre-screens) are installed at or upstream of the existing site access road culvert inlets to protect against blockage by floating debris. Runoff due to rainfall onto the site platform will be managed by infiltration SuDS, as described in the accompanying Drainage Impact Assessment.
Infrastructure Failure	Little to no risk	None
Groundwater	Little or no risk	None

7.2 Compliance with Development Management Guidance

7.2.1 Flood Risk Context

Development proposals are considered essential infrastructure[5], which must be located adjacent to the consented port for operational reasons, associated with offshore wind generation. As such, proposals satisfy exception (i) of NPF4 Policy 22(a), and may be located within a flood risk area.

7.2.2 Flood Impacts

Screening responses indicate that The Highland Council and SEPA accept that platforming is required to adequately protect the application site from coastal inundation, with this not considered to pose a risk of displacement and consequent detriment to other receptors.

It is also accepted that diversion of external land drains that currently discharge into the application site is necessary, with proposed diversion watercourses demonstrated by this assessment to be adequate for conveying flows from events up to and including the 1 in 200 year plus climate change event without causing flood risk detriment to external receptors relative to pre-development conditions.

7.2.3 Access and Egress

There is no requirement to achieve flood-free access and egress for essential infrastructure proposals. Nonetheless, the primary and secondary access routes to the application site are not predicted to be at flood risk.

7.2.4 Freeboard

There is no requirement to achieve freeboard above predicted flood levels for essential infrastructure proposals. However, to protect against risk from exceedance events and/or wave action, it would be advisable to set any water-sensitive development or assets back from the coastal (northern and western) site boundaries at levels elevated above the general platform level if possible.

7.2.5 Summary

The proposed development is compliant with SEPA's Development Management Guidance on Flood Risk (2018a) and is compliant with National Planning Framework 4, as an exception under Policy 22(a) (i), in terms of flood risk.

[5] https://www.sepa.org.uk/media/ht3bsekc/land-use-vulnerability-guidance.docx

REFERENCES

CEH (2008). *Flood estimation handbook (five volumes)*. Wallingford: Centre for Ecology & Hydrology.

Scottish Government (2014). Scottish Planning Policy. Edinburgh: Scottish Government.

Scottish Government (2023). National Planning Framework 4. Scottish Government.

SEPA (2022). Technical Flood Risk Guidance for Stakeholders. SEPA.

SEPA (2025). Climate Change Allowances for Flood Risk Assessment in Land use Planning. SEPA.

APPENDICES

A ANNUAL EXCEEDANCE PROBABILITY – RETURN PERIOD CONVERSION

Flood Frequency Statistics

The magnitudes of flood flows are typically expressed in terms of their long-term average frequency of recurrence, as 'return periods' (e.g. 1 in 200 year flood) or 'annual exceedance probabilities' (e.g. 0.5% AEP).

The return period (or recurrence interval) of a flood is the long-term average period between flood conditions of such magnitude (or greater). The annual exceedance probability of particular flood conditions is the chance these conditions (or more severe) occur in any given year.

Relationship between return periods and annual exceedance probability

Return period, T (year)	Annual exceedance probability, AEP (%)	Probability of occurrence over a 50 year period (%)	Comment
2	50	100	Median annual flood (also known as **QMED**). In the long-term this occurs every other year, on average. As a rule of thumb, this flow generally equates to 'bankfull' conditions in most natural channels.
5	20	100	
10	10	99	
20	5	92	
30	3.3	82	Typical design standard for urban drainage systems.
50	2	64	
100	1	39	
200	0.5	22	Typical design standard for river or coastal flooding for most developments. NPF4 defines "flooding areas" based on this event, with inclusion of climate change uplift.
500	0.2	10	
1,000	0.1	4.9	Typical design conditions standard for sensitive or vulnerable developments/contexts.

Lifetime Probabilities, or Design Life Probabilities

The probability of a flood event occurring at least once over a set period of time (e.g. an individual's lifetime or the design life of a built structure) can be evaluated against the following table.

Age, or Design Period (years)	Flood Return period (years)				
	2	10	30	200	1000
10	100%	65%	29%	5%	1%
25	100%	93%	57%	12%	2%
80	100%	100%	93%	33%	8%
100	100%	100%	97%	39%	10%

B DONOR CATCHMENT DESCRIPTORS

VERSION	"FEH CD-ROM" Version 5.0.1 exported at 10:09:03 GMT Fri 27-Sep-24	
CATCHMENT	GB	280700 856750 NH 80700 56750
CENTROID	GB	280278 855468 NH 80278 55468
AREA	2.2825	
ALTBAR	13	
ASPBAR	4	
ASPVAR	0.31	
BFIHOST	0.888	
BFIHOST19	0.874	
DPLBAR	1.91	
DPSBAR	18.4	
FARL	1	
FPEXT	0.1667	
FPDBAR	0.763	
FPLOC	0.612	
LDP	3.3	
PROPWET	0.42	
RMED-1H	8.5	
RMED-1D	30.2	
RMED-2D	39.7	
SAAR	640	
SAAR4170	587	
SPRHOST	14.83	
URBEXT1990	0	
URBEXT2000	0	
C	-0.02191	
D1	0.38429	
D2	0.43806	
D3	0.27942	
E	0.27505	
F	2.20091	
C(1 km)	-0.021	
D1(1 km)	0.381	
D2(1 km)	0.424	
D3(1 km)	0.3	
E(1 km)	0.275	
F(1 km)	2.199	

C DONOR CATCHMENT HYDROLOGY

FEH rainfall-runoff method (200yr plus climate change)

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                                                                FILE=35A6.dat Flood Modeller VER=4.5.1.6163
************************************************************
Flood Modeller
************************************************************

HYDROLOGICAL DATA

Catchment: 200yrCC
************************************************************
Catchment Characteristics
************************************************************
Easting        :    280700 Northing       :    856750
Area           :     2.283 km2
DPLBAR         :     1.910 km
DPSBAR         :    18.400 m/km
PROPWET        :     0.420
SAAR           :   640.000 mm
Urban Extent   :     0.000
c              :     0.000
d1             :     0.000
d2             :     0.000
d3             :     0.000
e              :     0.000
f              :     0.000
SPR            :    14.830 %
************************************************************
Summary of estimate using Flood Estimation Handbook rainfall-runoff method
************************************************************
Estimation of T-year flood
==========================
Unit hydrograph time to peak   :     4.399 hours
Instantaneous UH time to peak  :     4.374 hours
Data interval                  :     0.050 hours
Design storm duration          :     7.200 hours
Critical storm duration        :     7.215 hours
Return period for design flood :     0.000 years
requires rain return period    :     0.000 years
ARF                            :     0.000
Design storm depth             :    95.664 mm
CWI                            :    93.200
Standard Percentage Runoff     :    14.830 %
Percentage runoff              :    14.381 %
Snowmelt rate                  :     0.000 mm/day
Unit hydrograph peak           :     0.114 (m3/s/mm)
Quick response hydrograph peak :     1.262 m3/s
Baseflow                       :     0.020 m3/s
Baseflow adjustment            :     0.000 m3/s
Hydrograph peak                :     1.282 m3/s
Hydrograph adjustment factor   :     1.000

Flags
=====
Unit hydrograph flag           : FSRUH
Tp flag                        : FEHTP
Event rainfall flag            : OBSER
Rainfall profile flag          : WINRP
Percentage Runoff flag         : FEHPR
Baseflow flag                  : F16BF
CWI flag                       : FSRCW
************************************************************
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ReFH2 method (200yr plus climate change)

UK Design Flood Estimation

Generated on 13 May 2025 14:06:01 by DHALL
Printed from the ReFH2 Flood Modelling software package, version 4.0.8560.23190

Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH2)

Site details Checksum: 0F6A-547A

Site name: FEH_Catchment_Descriptors_280700_856750_v5_0_1

Easting: 280700

Northing: 856750

Country: Scotland

Catchment Area (km²): 2.28

Using plot scale calculations: No

Model: 2.3

Site description: None

Model run: 200 year 1.42 CC

Summary of results

Rainfall - FEH22 (mm):	120.31	Total runoff (ML):	16.49
Total Rainfall (mm):	79.69	Total flow (ML):	53.08
Peak Rainfall (mm):	15.54	Peak flow (m³/s):	0.72

Parameters

Where the user has overriden a system-generated value, this original value is shown in square brackets after the value used.
** Indicates that the user locked the duration/timestep*

Rainfall parameters (Rainfall - FEH22)

Name	Value	User-defined?
Duration (hh:mm:ss)	06:30:00	No
Timestep (hh:mm:ss)	00:30:00	No
SCF (Seasonal correction factor)	0.68	No
ARF (Areal reduction factor)	0.97	No
Seasonality	Winter	No
Climate change factor	1.42	Yes

Loss model parameters

Name	Value	User-defined?
Cini (mm)	45.34	No
Cmax (mm)	939.83	No
Use alpha correction factor	No	No
Alpha correction factor	n/a	No

Routing model parameters

Name	Value	User-defined?
Tp (hr)	4.17	No
Up	0.65	No
Uk	0.8	No

Baseflow model parameters

Name	Value	User-defined?
BF0 (m^3/s)	0	No
BL (hr)	30.33	No
BR	2.22	No

Urbanisation parameters

Name	Value	User-defined?
Sewer capacity (m^3/s)	0	No
Exporting drained area (km^2)	0	No
Urban area (km^2)	0	No
Urbext 2000	0	No
Impervious runoff factor	0.7	No
Imperviousness factor	0.4	No
Tp scaling factor	0.75	No
Depression storage depth (mm)	0.5	No

Appendix

Catchment descriptors

Name	Value	User-defined value used?
Area (km²)	2.28	No
ALTBAR	13	No
ASPBAR	4	No
ASPVAR	0.31	No
BFIHOST	0.89	No
BFIHOST19	0.87	No
DPLBAR (km)	1.91	No
DPSBAR (mkm-¹)	18.4	No
FARL	1	No
LDP	3.3	No
PROPWET	0.42	No
RMED1H	8.5	No
RMED1D	30.2	No
RMED2D	39.7	No
SAAR (mm)	640	No
SAAR4170 (mm)	587	No
SPRHOST	14.83	No
Urbext2000	0	No
Urbext1990	0	No
URBCONC	0	No
URBLOC	0	No
DDF parameter C	-0.02	No
DDF parameter D1	0.38	No
DDF parameter D2	0.44	No
DDF parameter D3	0.28	No
DDF parameter E	0.28	No
DDF parameter F	2.2	No
DDF parameter C (1km grid value)	-0.02	No
DDF parameter D1 (1km grid value)	0.38	No
DDF parameter D2 (1km grid value)	0.42	No
DDF parameter D3 (1km grid value)	0.3	No
DDF parameter E (1km grid value)	0.28	No
DDF parameter F (1km grid value)	2.2	No

D PRE-DEVELOPMENT TABULAR PREDICTIONS

Predicted peak state variables for Scenario A

System	Label	Stage (mAOD)	Flow (m^3/s)	Velocity (m/s)	Froude
Main Drain	MainUUS_000	8.217	1.147	0.442	0.221
	MainUUS_001	8.146	1.147	0.649	0.558
	MainUUS_002	8.098	1.147	0.596	0.286
	M_001	7.522	1.147	0.826	0.361
	M_002	7.456	1.147	0.927	0.421
	M_003	6.980	1.147	0.610	0.240
	M_004	5.712	1.149	1.650	0.821
	M_005	4.233	1.023	0.660	0.378
	M_005us	4.221	1.024	0.653	0.470
	M_005ds	4.221	1.583	0.819	0.365
	M_006us	4.165	1.581	0.490	0.179
	M_006ds	4.165	1.888	0.566	0.204
	M_006	4.164	1.891	0.404	0.173
	M_007	4.125	1.993	0.676	0.267
	M_007_1	4.100	2.019	0.531	0.223
	M_007_2	4.084	2.051	0.352	0.185
	M_007_3	4.045	2.082	0.560	0.207
	M_007_4	4.013	1.956	0.400	0.180
	M_008	3.984	2.054	0.313	0.154
	M_009	3.976	1.525	0.288	0.129
	MainCulv_000	3.936	2.211	0.330	0.158
	MainCulv_003	3.943	0.916	0.113	0.067
	MainCulv_005	3.944	0.742	0.210	0.113
	MainCulv_012	3.558	0.742	0.649	0.561
	MainCulv_015	3.552	1.345	0.446	0.213
	M_010us1	3.484	2.499	0.620	0.255
	M_010us2	3.477	2.455	0.572	0.251
	M_010us3	3.456	2.439	0.649	0.286
	M_010us4	3.442	2.413	0.707	0.249
	M_010us5	3.379	2.412	0.708	0.261
	M_010	3.321	2.407	0.686	0.271
	M_011	3.313	2.405	0.737	0.299
	M_012	3.113	2.402	0.809	0.349
	M_013	3.083	2.401	1.009	0.442
	M_013_1	3.039	2.318	0.508	0.315
	M_013_2	2.931	2.373	0.616	0.302
	M_014	2.807	2.382	0.748	0.266
	M_014_1	2.653	2.391	0.748	0.297
	M_014_2	2.617	2.392	0.715	0.298
	M_014_3	2.606	2.392	0.683	0.312
	M_014_4	2.583	2.389	0.612	0.288
	M_015	2.565	2.391	0.561	0.257
Western Drain	W_001	2.597	0.050	0.025	0.015
	W_001_1	2.597	0.052	0.038	0.024
	W_001_2	2.597	0.056	0.042	0.027
	W_001_2In1	2.597	0.072	0.052	0.036
	W_001_2In2	2.596	0.085	0.067	0.047
	W_002us	2.596	0.098	0.087	0.066
	W_002	2.596	0.196	0.169	0.135

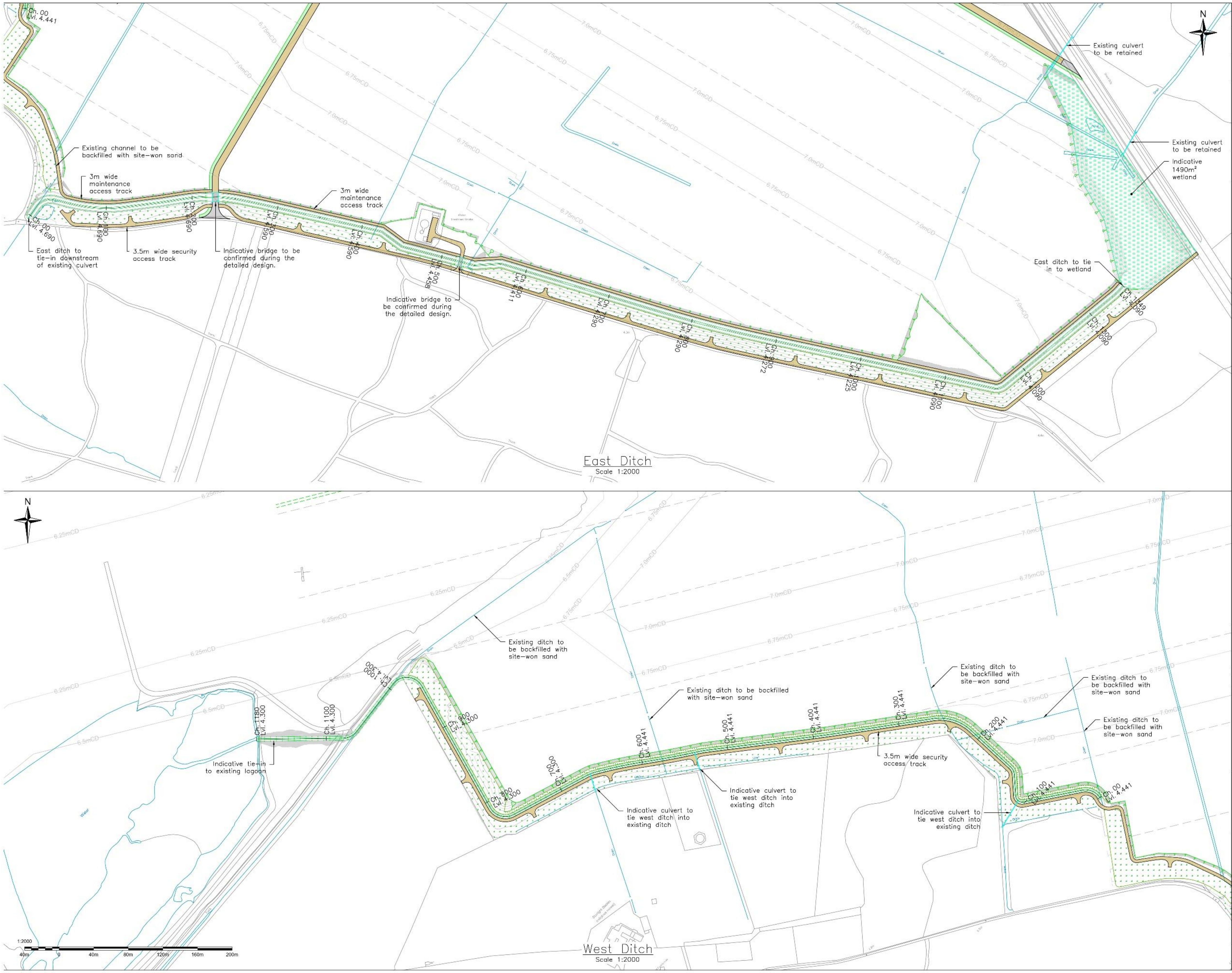
System	Label	Stage (mAOD)	Flow (m^3/s)	Velocity (m/s)	Froude
	W_002In1	2.595	0.209	0.151	0.123
	W_002In2	2.593	0.218	0.130	0.097
	W_002_1	2.592	0.231	0.117	0.073
	W_003	2.592	0.421	0.203	0.110
	W_003_1	2.591	0.423	0.204	0.111
	W_003_2	2.587	0.435	0.210	0.115
	W_003_3	2.582	0.451	0.215	0.115
	W_003_4	2.579	0.459	0.218	0.117
	W_003_4In1	2.574	0.478	0.226	0.122
	W_003_4In2	2.569	0.492	0.231	0.131
	W_004	2.565	0.538	0.278	0.233
Southwestern Drain	W_S01	2.600	0.070	0.063	0.033
	W_S02	2.598	0.083	0.318	0.263
	W_S03	2.598	0.083	0.084	0.058
	W_S04	2.598	0.100	0.062	0.029
	W_S04In1	2.597	0.113	0.086	0.046
	W_S05	2.596	0.109	0.129	0.092
Central Drain	C_001	3.296	0.197	0.660	0.461
	C_002	2.858	0.197	0.393	0.230
	C_002_1	2.788	0.202	0.380	0.236
	C_003	2.729	0.208	0.257	0.156
	C_003_1	2.707	0.210	0.356	0.215
	C_004	2.668	0.214	0.400	0.310
	C_005	2.665	0.214	0.301	0.156
	C_005_1	2.648	0.218	0.325	0.172
	C_005_2	2.634	0.220	0.347	0.196
	C_006	2.613	0.225	0.355	0.220
	C_006_1	2.605	0.226	0.341	0.215
	C_006_2	2.601	0.228	0.324	0.203
	C_006_3	2.594	0.231	0.233	0.151
	C_006_4	2.593	0.232	0.211	0.139
	C_007	2.592	0.234	0.150	0.080
Southeastern Drain	SE_001	3.287	0.068	0.142	0.188
	SE_001In1	3.173	0.068	0.150	0.189
	SE_001In2	3.060	0.068	0.160	0.190
	SE_001In3	2.949	0.068	0.179	0.195
	SE_001In4	2.866	0.068	0.171	0.175
	SE_002	2.811	0.068	0.198	0.140
	SE_003	2.803	0.068	0.234	0.166
	SE_003_1	2.704	0.080	0.235	0.181
	SE_003_2	2.684	0.083	0.236	0.184
	SE_004	2.613	0.096	0.213	0.173
	SE_004_1	2.589	0.103	0.217	0.177
	SE_004_2	2.583	0.108	0.222	0.181
	SE_004_2In1	2.574	0.117	0.223	0.191
	SE_004_3	2.570	0.124	0.197	0.176
	SE_004_4	2.569	0.136	0.196	0.180
	SE_004_5	2.567	0.158	0.182	0.165
	SE_004_6	2.567	0.174	0.163	0.163
	SE_004_7	2.566	0.189	0.153	0.162
	SE_005	2.566	0.199	0.132	0.159
	SE_005_1	2.566	0.201	0.133	0.152
	SE_005_2	2.566	0.215	0.121	0.117
	SE_006	2.565	0.247	0.103	0.047

Predicted peak stage for pre-development scenarios (increase relative to Scenario A)

System	Label	Scenario A	Scenario B	Scenario C
Main Drain	MainUUS_000	8.217	8.217 (0.000)	8.217 (0.000)
	MainUUS_001	8.146	8.146 (0.000)	8.146 (0.000)
	MainUUS_002	8.098	8.098 (0.000)	8.098 (0.000)
	M_001	7.522	7.522 (0.000)	7.522 (0.000)
	M_002	7.456	7.456 (0.000)	7.456 (0.000)
	M_003	6.980	6.980 (0.000)	6.980 (0.000)
	M_004	5.712	5.712 (0.000)	5.712 (0.000)
	M_005	4.233	4.233 (0.000)	4.233 (0.000)
	M_005us	4.221	4.221 (0.000)	4.221 (0.000)
	M_005ds	4.221	4.221 (0.000)	4.221 (0.000)
	M_006us	4.165	4.166 (0.001)	4.166 (0.001)
	M_006ds	4.165	4.166 (0.001)	4.166 (0.001)
	M_006	4.164	4.164 (0.000)	4.164 (0.000)
	M_007	4.125	4.125 (0.000)	4.125 (0.000)
	M_007_1	4.100	4.100 (0.000)	4.100 (0.000)
	M_007_2	4.084	4.084 (0.000)	4.084 (0.000)
	M_007_3	4.045	4.045 (0.000)	4.045 (0.000)
	M_007_4	4.013	4.013 (0.000)	4.013 (0.000)
	M_008	3.984	3.984 (0.000)	3.984 (0.000)
	M_009	3.976	3.976 (0.000)	3.976 (0.000)
	MainCulv_000	3.936	3.936 (0.000)	3.936 (0.000)
	MainCulv_003	3.943	3.943 (0.000)	3.943 (0.000)
	MainCulv_005	3.944	3.944 (0.000)	3.944 (0.000)
	MainCulv_012	3.558	3.564 (0.006)	3.555 (-0.003)
	MainCulv_015	3.552	3.557 (0.005)	3.546 (-0.006)
	M_010us1	3.484	3.497 (0.013)	3.484 (0.000)
	M_010us2	3.477	3.490 (0.013)	3.478 (0.001)
	M_010us3	3.456	3.471 (0.015)	3.457 (0.001)
	M_010us4	3.442	3.456 (0.014)	3.443 (0.001)
	M_010us5	3.379	3.398 (0.019)	3.381 (0.002)
	M_010	3.321	3.346 (0.025)	3.323 (0.002)
	M_011	3.313	3.340 (0.027)	3.315 (0.002)
	M_012	3.113	3.185 (0.072)	3.126 (0.013)
	M_013	3.083	3.177 (0.094)	3.100 (0.017)
	M_013_1	3.039	3.151 (0.112)	3.064 (0.025)
	M_013_2	2.931	3.158 (0.227)	2.988 (0.057)
	M_014	2.807	3.144 (0.337)	2.919 (0.112)
	M_014_1	2.653	3.148 (0.495)	2.871 (0.218)
	M_014_2	2.617	3.149 (0.532)	2.864 (0.247)
	M_014_3	2.606	3.141 (0.535)	2.862 (0.256)
	M_014_4	2.583	3.158 (0.575)	2.857 (0.274)
	M_015	2.565	3.139 (0.574)	2.854 (0.289)
Western Drain	W_001	2.597	3.205 (0.608)	2.859 (0.262)
	W_001_1	2.597	3.151 (0.554)	2.859 (0.262)
	W_001_2	2.597	3.142 (0.545)	2.859 (0.262)
	W_001_2In1	2.597	3.145 (0.548)	2.859 (0.262)
	W_001_2In2	2.596	3.153 (0.557)	2.859 (0.263)
	W_002us	2.596	3.149 (0.553)	2.859 (0.263)
	W_002	2.596	3.149 (0.553)	2.859 (0.263)
	W_002In1	2.595	3.141 (0.546)	2.859 (0.264)
	W_002In2	2.593	3.152 (0.559)	2.858 (0.265)
	W_002_1	2.592	3.157 (0.565)	2.858 (0.266)
	W_003	2.592	3.157 (0.565)	2.858 (0.266)

System	Label	Scenario A	Scenario B	Scenario C
	W_003_1	2.591	3.164 (0.573)	2.858 (0.267)
	W_003_2	2.587	3.173 (0.586)	2.857 (0.270)
	W_003_3	2.582	3.160 (0.578)	2.856 (0.274)
	W_003_4	2.579	3.159 (0.580)	2.856 (0.277)
	W_003_4In1	2.574	3.167 (0.593)	2.855 (0.281)
	W_003_4In2	2.569	3.291 (0.722)	2.855 (0.286)
	W_004	2.565	3.139 (0.574)	2.854 (0.289)
Southwestern Drain	W_S01	2.600	3.226 (0.626)	2.860 (0.260)
	W_S02	2.598	3.183 (0.585)	2.859 (0.261)
	W_S03	2.598	3.195 (0.597)	2.859 (0.261)
	W_S04	2.598	3.177 (0.579)	2.859 (0.261)
	W_S04In1	2.597	3.140 (0.543)	2.859 (0.262)
	W_S05	2.596	3.149 (0.553)	2.859 (0.263)
Central Drain	C_001	3.296	3.337 (0.041)	3.300 (0.004)
	C_002	2.858	3.186 (0.328)	2.915 (0.057)
	C_002_1	2.788	3.184 (0.396)	2.894 (0.106)
	C_003	2.729	3.174 (0.445)	2.880 (0.151)
	C_003_1	2.707	3.163 (0.456)	2.877 (0.170)
	C_004	2.668	3.177 (0.509)	2.870 (0.202)
	C_005	2.665	3.201 (0.536)	2.870 (0.205)
	C_005_1	2.648	3.210 (0.562)	2.867 (0.219)
	C_005_2	2.634	3.170 (0.536)	2.864 (0.230)
	C_006	2.613	3.170 (0.557)	2.861 (0.248)
	C_006_1	2.605	3.168 (0.563)	2.860 (0.255)
	C_006_2	2.601	3.144 (0.543)	2.859 (0.258)
	C_006_3	2.594	3.164 (0.570)	2.858 (0.264)
	C_006_4	2.593	3.160 (0.567)	2.858 (0.265)
	C_007	2.592	3.157 (0.565)	2.858 (0.266)
Southeastern Drain	SE_001	3.287	3.290 (0.003)	3.287 (0.000)
	SE_001In1	3.173	3.171 (-0.002)	3.173 (0.000)
	SE_001In2	3.060	3.161 (0.101)	3.060 (0.000)
	SE_001In3	2.949	3.166 (0.217)	2.949 (0.000)
	SE_001In4	2.866	3.174 (0.308)	2.893 (0.027)
	SE_002	2.811	3.172 (0.361)	2.877 (0.066)
	SE_003	2.803	3.170 (0.367)	2.875 (0.072)
	SE_003_1	2.704	3.152 (0.448)	2.863 (0.159)
	SE_003_2	2.684	3.150 (0.466)	2.862 (0.178)
	SE_004	2.613	3.151 (0.538)	2.858 (0.245)
	SE_004_1	2.589	3.158 (0.569)	2.857 (0.268)
	SE_004_2	2.583	3.153 (0.570)	2.857 (0.274)
	SE_004_2In1	2.574	3.151 (0.577)	2.856 (0.282)
	SE_004_3	2.570	3.163 (0.593)	2.855 (0.285)
	SE_004_4	2.569	3.167 (0.598)	2.855 (0.286)
	SE_004_5	2.567	3.156 (0.589)	2.854 (0.287)
	SE_004_6	2.567	3.152 (0.585)	2.854 (0.287)
	SE_004_7	2.566	3.156 (0.590)	2.854 (0.288)
	SE_005	2.566	3.171 (0.605)	2.854 (0.288)
	SE_005_1	2.566	3.181 (0.615)	2.854 (0.288)
	SE_005_2	2.566	3.189 (0.623)	2.854 (0.288)
	SE_006	2.565	3.139 (0.574)	2.854 (0.289)

E PROPOSED DIVERSION WATERCOURSE DETAILS



Do not scale from this drawing.

SAFETY HEALTH AND ENVIRONMENTAL INFORMATION

IN ADDITION TO THE HAZARD/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING RISKS AND INFORMATION.

RISKS LISTED HERE ARE NOT EXHAUSTIVE. REFER TO DESIGN ASSESSMENT FORM APP2-FHT-XX-YAR-HS-C-000001

CONSTRUCTION:
EXCAVATIONS
SEWAGE
SOIL CONTAMINATION
EXISTING SERVICES

DEMOLITION:
NONE THAT WOULD NOT BE APPARENT TO A COMPETENT CONTRACTOR

IT IS ASSUMED THAT ALL WORKS WILL BE CARRIED OUT BY A COMPETENT CONTRACTOR WORKING, WHERE APPROPRIATE, TO AN APPROVED METHOD STATEMENT.

Notes:

1. All dimensions on this drawing are in metres unless noted otherwise. Do not scale from this drawing, only written dimensions are to be used. All levels and coordinates are given to Chart Datum (OS-2.14m).
2. This drawing is to be read in conjunction with all architectural and engineering drawings, details and specifications. Refer to APP2-FHT-DR-XX-DR-C-022050 for typical cross sections and to drawing APP2-FHT-DR-XX-DR-C-022020 for ditch longitudinal sections. Refer to drawings APP2-FHT-DR-XX-DR-C-022001 to 022005 for the east and west ditch layouts.
3. Any discrepancies should be reported to the engineer immediately so clarification can be sought.
4. For clarity this drawing should only be printed and read in colour.
5. All existing services to be located prior to any construction work being carried out. Underground services must be located in accordance with Health and Safety Executive Guidance note HSG 47.

Legend:

Proposed Type 1 Track Surfacing

Planting/ Tree Buffer Area

Indicative Wetland

Rev.	Date	Description	Drwn.	Chkd.	Appd.
04	31/7/25	Access track along west ditch altered. Drawing updated to suit.	JD	AH	AKF
03	21/7/25	Minor drawing alterations for clarity. Bridges over perimeter ditch added.	HF	AH	AKF
02	3/7/25	Drawing number corrected. Drawing notes updated. Minor alterations made to drawing annotation and views.	HF	AH	AKF
01	27/6/25	First Issue	HF	AH	AKF

FAIRHURST
Barony House
Stoneyfield Business Park
INVERNESS
IV2 7PA

Tel: 01463 724 544

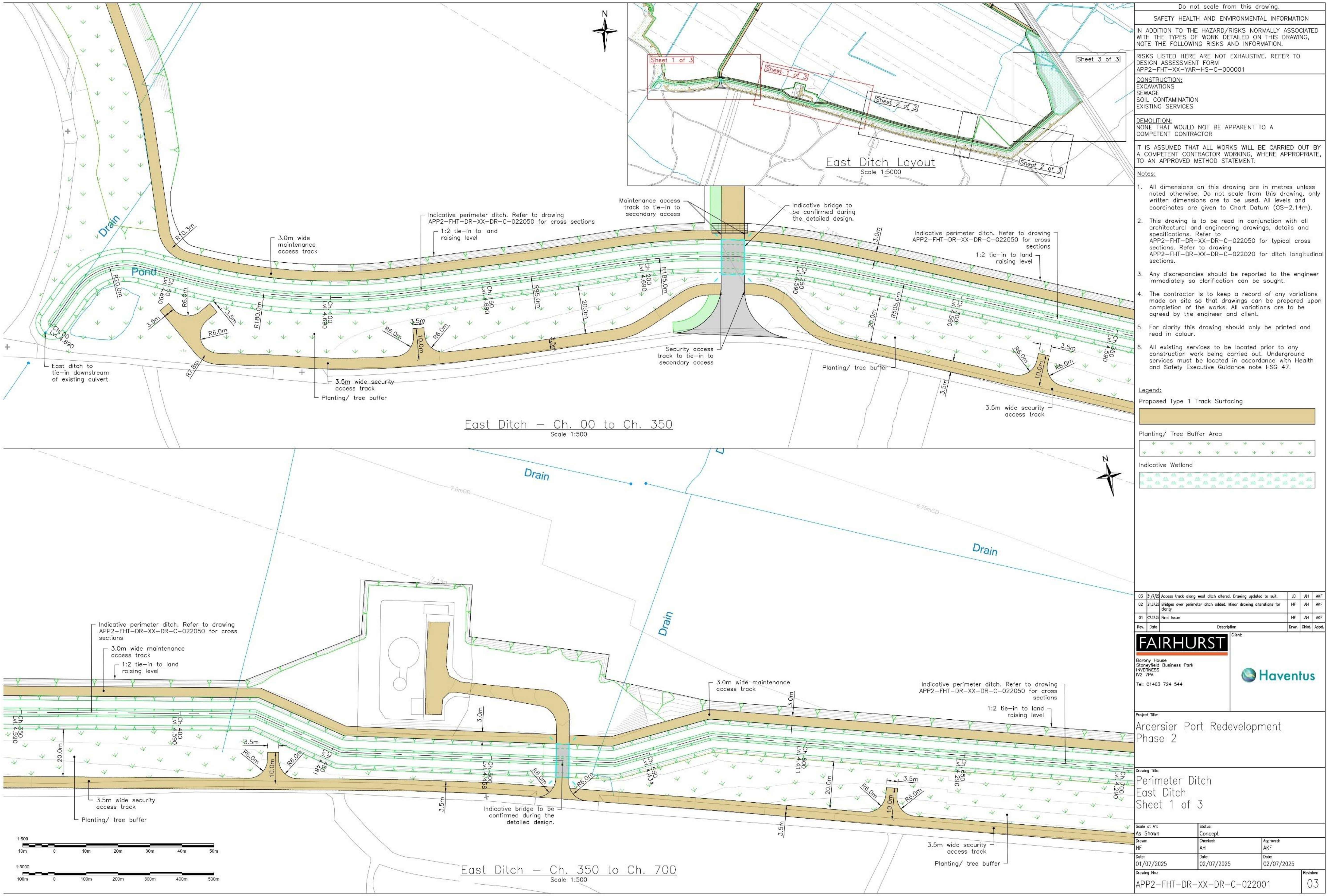
Client: Haventus

Project Title:
Ardersier Port Redevelopment Phase 2

Drawing Title:
Perimeter Ditch General Arrangement

Scale at A1: As Shown	Status: Concept	
Drawn: HF	Checked: AH	Approved: AKF
Date: 27/06/2025	Date: 27/06/2025	Date: 27/06/2025

Drawing No.: APP2-FHT-DR-XX-DR-C-022000
Revision: 04


Do not scale from this drawing.
SAFETY HEALTH AND ENVIRONMENTAL INFORMATION
IN ADDITION TO THE HAZARD/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING RISKS AND INFORMATION.
RISKS LISTED HERE ARE NOT EXHAUSTIVE. REFER TO DESIGN ASSESSMENT FORM APP2-FHT-XX-YAR-HS-C-000001
CONSTRUCTION:
EXCAVATIONS
SEWAGE
SOIL CONTAMINATION
EXISTING SERVICES
DEMOLITION:
NONE THAT WOULD NOT BE APPARENT TO A COMPETENT CONTRACTOR
IT IS ASSUMED THAT ALL WORKS WILL BE CARRIED OUT BY A COMPETENT CONTRACTOR WORKING, WHERE APPROPRIATE, TO AN APPROVED METHOD STATEMENT.
Notes:
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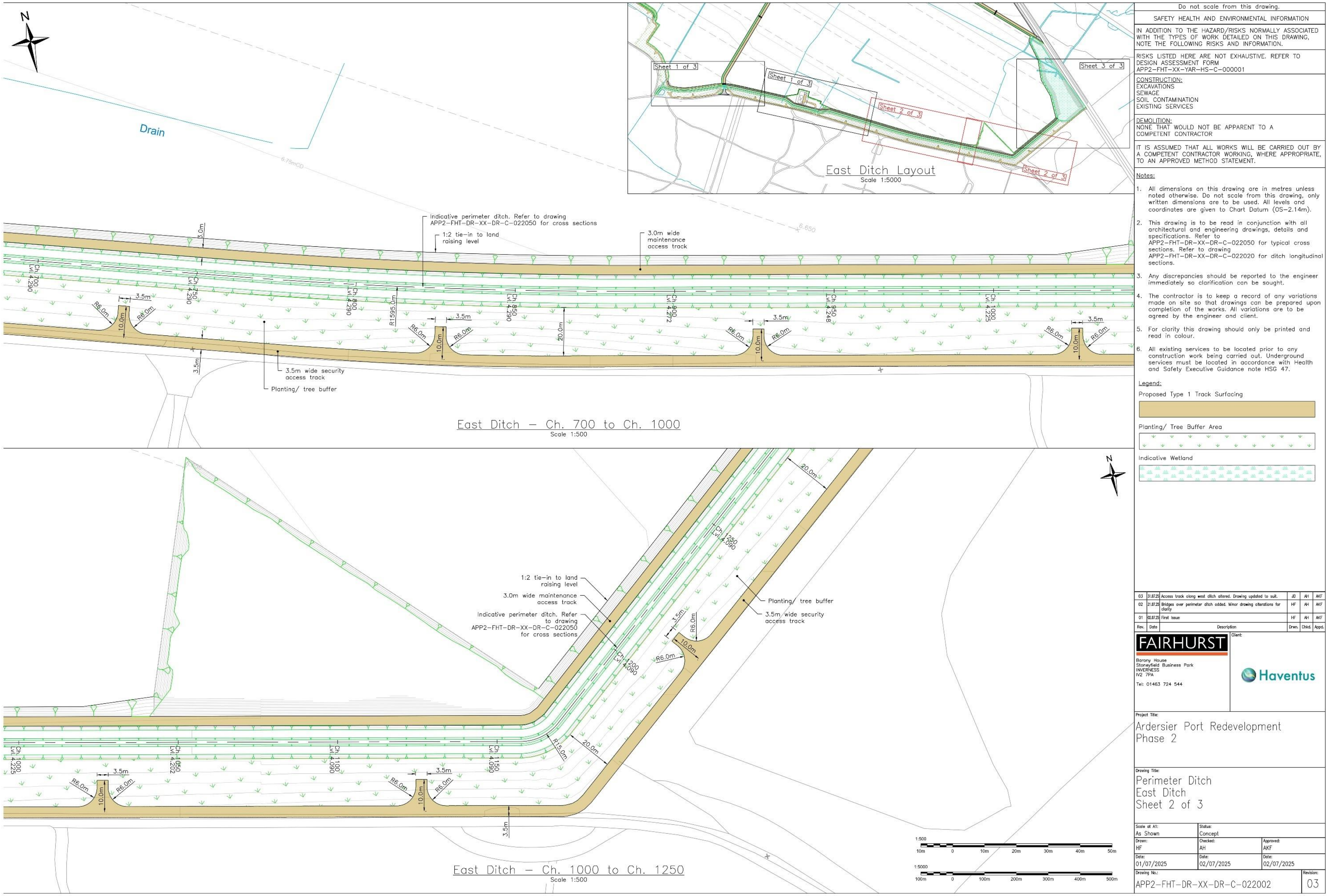
2. This drawing is to be read in conjunction with all architectural and engineering drawings, details and specifications. Refer to APP2-FHT-DR-XX-DR-C-022050 for typical cross sections. Refer to drawing APP2-FHT-DR-XX-DR-C-022020 for ditch longitudinal sections.
3. Any discrepancies should be reported to the engineer immediately so clarification can be sought.
4. The contractor is to keep a record of any variations made on site so that drawings can be prepared upon completion of the works. All variations are to be agreed by the engineer and client.
5. For clarity this drawing should only be printed and read in colour.
6. All existing services to be located prior to any construction work being carried out. Underground services must be located in accordance with Health and Safety Executive Guidance note HSG 47.
Legend:
Proposed Type 1 Track Surfacing
Planting/ Tree Buffer Area
Indicative Wetland
East Ditch Layout
Scale 1:5000
Sheet 1 of 3
Sheet 2 of 3
Sheet 3 of 3
East Ditch - Ch. 00 to Ch. 350
Scale 1:500
East Ditch - Ch. 350 to Ch. 700
Scale 1:500
Drain
Pond
Indicative perimeter ditch. Refer to drawing APP2-FHT-DR-XX-DR-C-022050 for cross sections
1:2 tie-in to land raising level
3.0m wide maintenance access track
3.5m wide security access track
Planting/ tree buffer
Maintenance access track to tie-in to secondary access
Indicative bridge to be confirmed during the detailed design.
Security access track to tie-in to secondary access
East ditch to tie-in downstream of existing culvert
Indicative bridge to be confirmed during the detailed design.
03 | Access track along west ditch altered. Drawing updated to suit.
02 | Bridges over perimeter ditch added. Minor drawing alterations for clarity
01 | First Issue
Rev. | Date | Description | Drwn. | Chkd. | Appd.
FAIRHURST
Barony House
Stoneyfield Business Park
INVERNESS
IV2 7PA
Tel: 01463 724 544
Client:
Haventus
Project Title:
Ardersier Port Redevelopment Phase 2
Drawing Title:
Perimeter Ditch
East Ditch
Sheet 1 of 3
Scale at A1: As Shown
Status: Concept
Drawn: HF
Checked: AH
Approved: AKF
Date: 01/07/2025
Date: 02/07/2025
Date: 02/07/2025
Drawing No.: APP2-FHT-DR-XX-DR-C-022001
Revision: 03


Drain
Indicative perimeter ditch. Refer to drawing APP2-FHT-DR-XX-DR-C-022050 for cross sections
1:2 tie-in to land raising level
3.0m wide maintenance access track
3.5m wide security access track
Planting/ tree buffer
East Ditch – Ch. 700 to Ch. 1000
Scale 1:500
East Ditch – Ch. 1000 to Ch. 1250
Scale 1:500
East Ditch Layout
Scale 1:5000
Sheet 1 of 3
Sheet 2 of 3
Sheet 3 of 3
Do not scale from this drawing.
SAFETY HEALTH AND ENVIRONMENTAL INFORMATION
IN ADDITION TO THE HAZARD/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING RISKS AND INFORMATION.
RISKS LISTED HERE ARE NOT EXHAUSTIVE. REFER TO DESIGN ASSESSMENT FORM APP2-FHT-XX-YAR-HS-C-000001
CONSTRUCTION:
EXCAVATIONS
SEWAGE
SOIL CONTAMINATION
EXISTING SERVICES
DEMOLITION:
NONE THAT WOULD NOT BE APPARENT TO A COMPETENT CONTRACTOR
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Notes:
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3. Any discrepancies should be reported to the engineer immediately so clarification can be sought.
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5. For clarity this drawing should only be printed and read in colour.
6. All existing services to be located prior to any construction work being carried out. Underground services must be located in accordance with Health and Safety Executive Guidance note HSG 47.
Legend:
Proposed Type 1 Track Surfacing
Planting/ Tree Buffer Area
Indicative Wetland
03 31.07.25 Access track along west ditch altered. Drawing updated to suit. JD AH AKF
02 31.07.25 Bridges over perimeter ditch added. Minor drawing alterations for clarity HF AH AKF
01 02.07.25 First Issue HF AH AKF
Rev. Date Description Drwn. Chkd. Appd.
FAIRHURST
Barony House
Stoneyfield Business Park
INVERNESS
IV2 7PA
Tel: 01463 724 544
Client:
Haventus
Project Title:
Ardersier Port Redevelopment Phase 2
Drawing Title:
Perimeter Ditch
East Ditch
Sheet 2 of 3
Scale at A1: As Shown
Status: Concept
Drawn: HF
Checked: AH
Approved: AKF
Date: 01/07/2025
Date: 02/07/2025
Date: 02/07/2025
Drawing No.: APP2-FHT-DR-XX-DR-C-022002
Revision: 03


N
Pond
Drain
Drain
Existing culvert to be retained
Indicative 1490m² wetland
East ditch to tie-in to wetland
1:2 tie-in to land raising level
3.0m wide maintenance access track
Indicative perimeter ditch. Refer to drawing APP2-FHT-DR-XX-DR-C-022050 for cross sections
Planting/ tree buffer
3.5m wide security access track
R66.0m
R6.0m
10.0m
20.0m
3.0m
3.5m
Ch. 1349 Lvl 4.090
Ch. 1300 Lvl 4.090
Ch. 1250 Lvl 4.090
East Ditch – Ch. 1250 to Ch. 1349
Scale 1:500
East Ditch Layout
Scale 1:5000
Sheet 1 of 3
Sheet 2 of 3
Sheet 3 of 3
Existing Culverts
Scale 1:1000
Road 2
Drain
Pond
Do not scale from this drawing.
SAFETY HEALTH AND ENVIRONMENTAL INFORMATION
IN ADDITION TO THE HAZARD/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING RISKS AND INFORMATION.
RISKS LISTED HERE ARE NOT EXHAUSTIVE. REFER TO DESIGN ASSESSMENT FORM APP2-FHT-XX-YAR-HS-C-000001
CONSTRUCTION:
EXCAVATIONS
SEWAGE
SOIL CONTAMINATION
EXISTING SERVICES
DEMOLITION:
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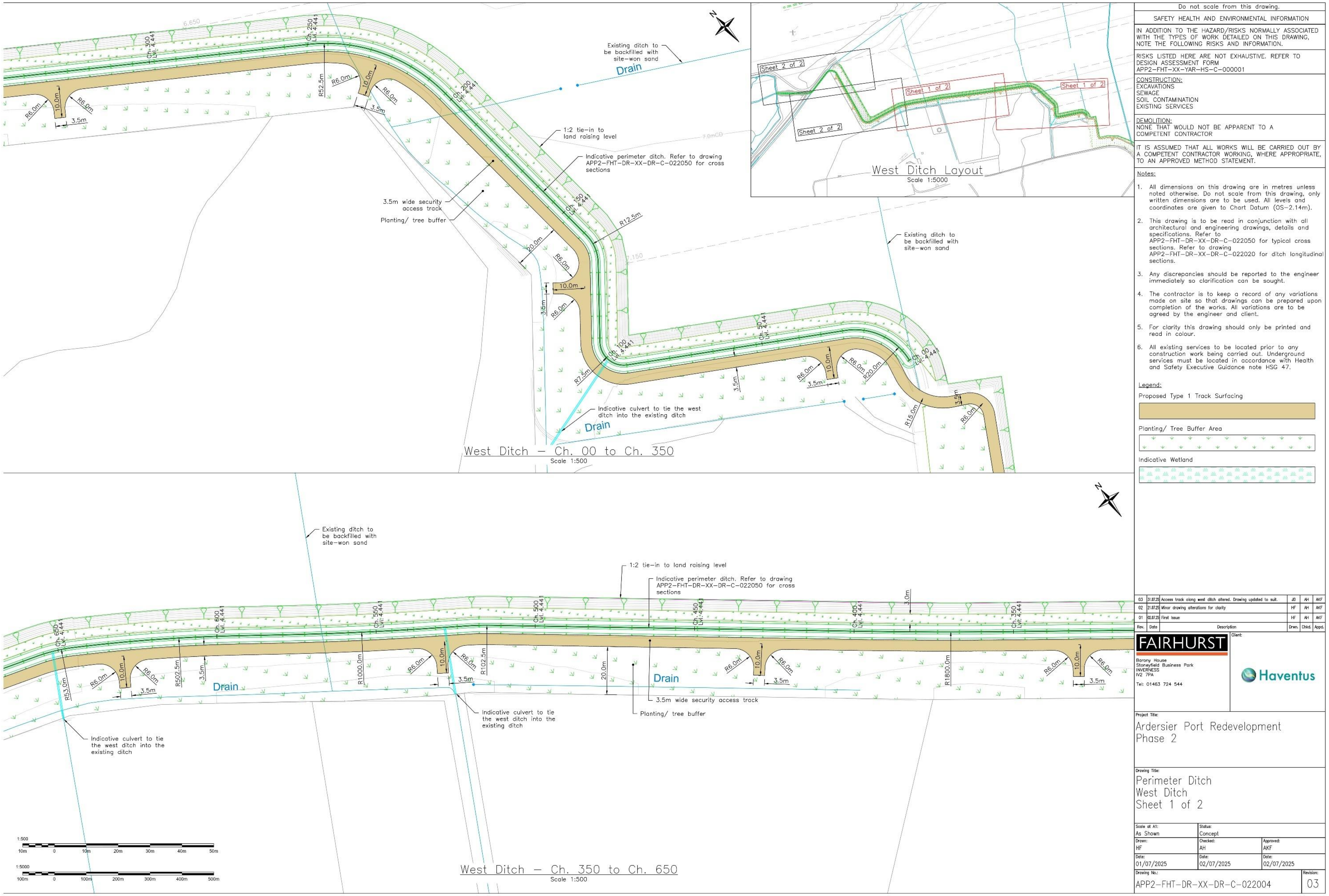
3. Any discrepancies should be reported to the engineer immediately so clarification can be sought.
4. The contractor is to keep a record of any variations made on site so that drawings can be prepared upon completion of the works. All variations are to be agreed by the engineer and client.
5. For clarity this drawing should only be printed and read in colour.
6. All existing services to be located prior to any construction work being carried out. Underground services must be located in accordance with Health and Safety Executive Guidance note HSG 47.
Legend:
Proposed Type 1 Track Surfacing
Planting/ Tree Buffer Area
Indicative Wetland
03 31.07.25 Access track along west ditch altered. Drawing updated to suit. JD AH AKF
02 21.07.25 Bridges over perimeter ditch added. Minor drawing alterations for clarity. Additional drawing view added. HF AH AKF
01 02.07.25 First issue HF AH AKF
Rev. Date Description Drwn. Chkd. Appd.
FAIRHURST
Barony House
Stoneyfield Business Park
INVERNESS
IV2 7PA
Tel: 01463 724 544
Client:
Haventus
Project Title:
Ardersier Port Redevelopment Phase 2
Drawing Title:
Perimeter Ditch
East Ditch
Sheet 3 of 3
Scale at A1: As Shown
Status: Concept
Drawn: HF
Checked: AH
Approved: AKF
Date: 01/07/2025
Date: 02/07/2025
Date: 02/07/2025
Drawing No.: APP2-FHT-DR-XX-DR-C-022003
Revision: 03
1:500
1:1000
1:5000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SAFETY HEALTH AND ENVIRONMENTAL INFORMATION
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CONSTRUCTION:
EXCAVATIONS
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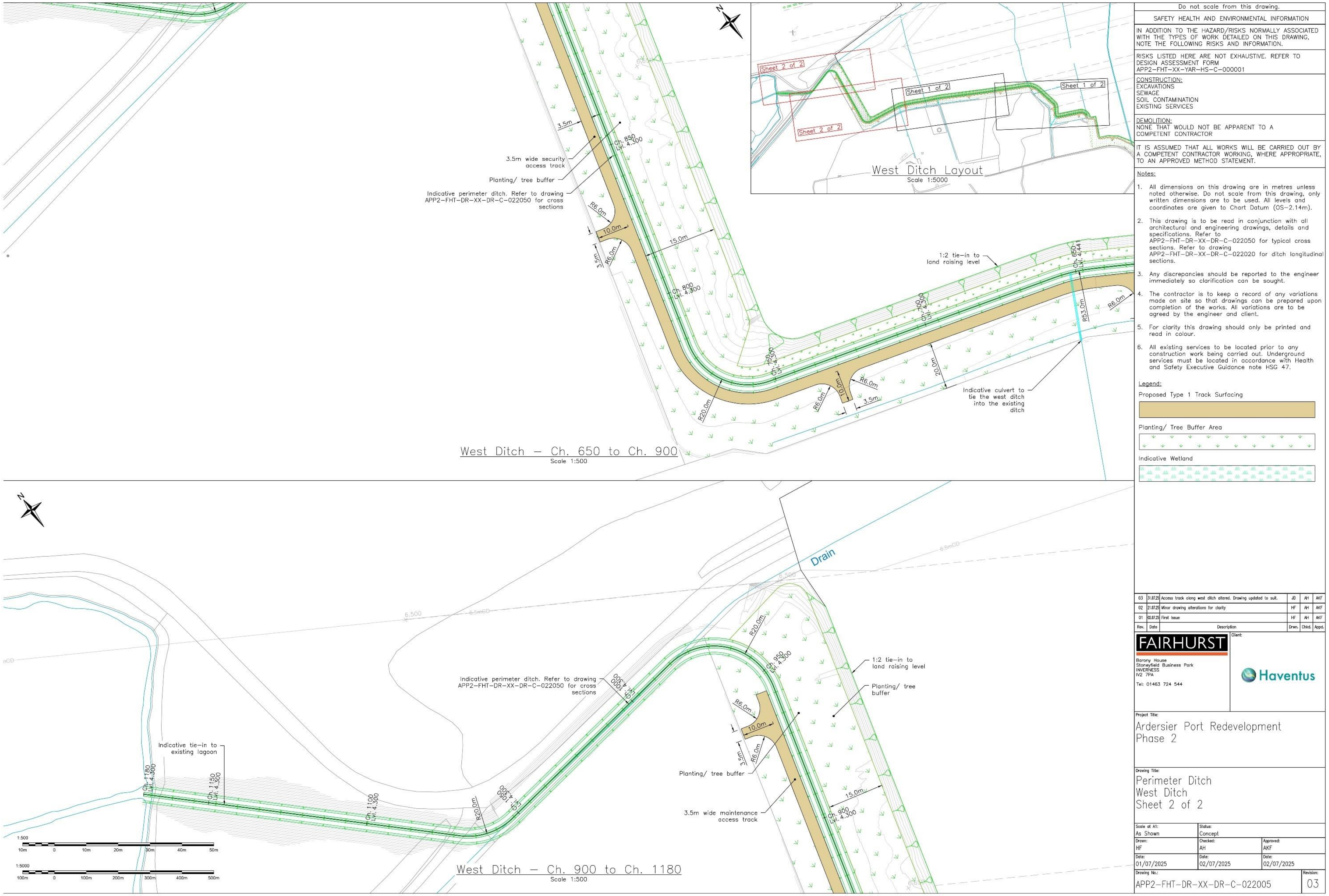
Legend:
Proposed Type 1 Track Surfacing
Planting/ Tree Buffer Area
Indicative Wetland
West Ditch Layout
Scale 1:5000
Sheet 1 of 2
Sheet 2 of 2
West Ditch – Ch. 00 to Ch. 350
Scale 1:500
West Ditch – Ch. 350 to Ch. 650
Scale 1:500
Existing ditch to be backfilled with site-won sand
Drain
1:2 tie-in to land raising level
Indicative perimeter ditch. Refer to drawing APP2-FHT-DR-XX-DR-C-022050 for cross sections
3.5m wide security access track
Planting/ tree buffer
Indicative culvert to tie the west ditch into the existing ditch
03 31.07.25 Access track along west ditch altered. Drawing updated to suit. JD AH AKF
02 21.07.25 Minor drawing alterations for clarity HF AH AKF
01 02.07.25 First Issue HF AH AKF
Rev. Date Description Drwn. Chkd. Appd.
FAIRHURST
Barony House
Stoneyfield Business Park
INVERNESS
IV2 7PA
Tel: 01463 724 544
Client:
Haventus
Project Title:
Ardersier Port Redevelopment Phase 2
Drawing Title:
Perimeter Ditch
West Ditch
Sheet 1 of 2
Scale at A1: As Shown
Status: Concept
Drawn: HF
Checked: AH
Approved: AKF
Date: 01/07/2025
Date: 02/07/2025
Date: 02/07/2025
Drawing No.: APP2-FHT-DR-XX-DR-C-022004
Revision: 03


West Ditch – Ch. 650 to Ch. 900
Scale 1:500
3.5m wide security access track
Planting/ tree buffer
Indicative perimeter ditch. Refer to drawing APP2–FHT–DR–XX–DR–C–022050 for cross sections
1:2 tie–in to land raising level
Indicative culvert to tie the west ditch into the existing ditch
Ch. 650 Lvl. 4.441
Ch. 700 Lvl. 4.300
Ch. 750 Lvl. 4.300
Ch. 800 Lvl. 4.300
Ch. 850 Lvl. 4.300
3.5m
R6.0m
10.0m
15.0m
20.0m
R20.0m
R53.0m
West Ditch Layout
Scale 1:5000
Sheet 1 of 2
Sheet 2 of 2
West Ditch – Ch. 900 to Ch. 1180
Scale 1:500
Drain
Indicative tie–in to existing lagoon
Indicative perimeter ditch. Refer to drawing APP2–FHT–DR–XX–DR–C–022050 for cross sections
1:2 tie–in to land raising level
Planting/ tree buffer
3.5m wide maintenance access track
Ch. 900 Lvl. 4.300
Ch. 950 Lvl. 4.300
Ch. 1000 Lvl. 4.300
Ch. 1050 Lvl. 4.300
Ch. 1100 Lvl. 4.300
Ch. 1150 Lvl. 4.300
Ch. 1180 Lvl. 4.300
6.500
1:500
1:5000
Do not scale from this drawing.
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SEWAGE
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EXISTING SERVICES
DEMOLITION:
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Legend:
Proposed Type 1 Track Surfacing
Planting/ Tree Buffer Area
Indicative Wetland
03 31.07.25 Access track along west ditch altered. Drawing updated to suit. JD AH AKF
02 21.07.25 Minor drawing alterations for clarity HF AH AKF
01 02.07.25 First issue HF AH AKF
Rev. Date Description Drwn. Chkd. Appd.
FAIRHURST
Barony House
Stoneyfield Business Park
INVERNESS
IV2 7PA
Tel: 01463 724 544
Client:
Haventus
Project Title:
Ardersier Port Redevelopment Phase 2
Drawing Title:
Perimeter Ditch
West Ditch
Sheet 2 of 2
Scale at A1: As Shown
Status: Concept
Drawn: HF
Checked: AH
Approved: AKF
Date: 01/07/2025
Date: 02/07/2025
Date: 02/07/2025
Drawing No.: APP2–FHT–DR–XX–DR–C–022005
Revision: 03

F EASTERN WATERCOURSE TABULAR PREDICTIONS

Predicted peak state variables for Scenario A

System	Label	Stage (mAOD)	Flow (m^3/s)	Velocity (m/s)	Froude
Main Drain	MainUUS_000	8.217	1.147	0.442	0.221
	MainUUS_001	8.146	1.147	0.649	0.558
	MainUUS_002	8.098	1.147	0.596	0.286
	M_001	7.522	1.147	0.826	0.361
	M_002	7.456	1.147	0.927	0.421
	M_003	6.980	1.147	0.609	0.240
	M_004	5.711	1.148	1.650	0.821
	M_005	4.233	1.022	0.661	0.346
	M_005us	4.221	1.026	0.629	0.427
	M_005ds	4.221	1.575	0.815	0.352
	M_006us	4.166	1.574	0.488	0.178
	M_006ds	4.166	1.881	0.564	0.203
	M_006	4.165	1.886	0.403	0.173
	M_007	4.125	1.988	0.675	0.268
	M_007_1	4.101	2.014	0.529	0.222
	M_007_2	4.085	2.047	0.351	0.185
	M_007_3	4.047	2.078	0.558	0.207
	M_007_4	4.013	1.983	0.406	0.182
	M_008	3.984	2.048	0.312	0.154
	M_009	3.976	1.494	0.282	0.127
	MainCulv_000	3.935	2.201	0.329	0.158
	MainCulv_003	3.943	0.911	0.118	0.070
	MainCulv_005	3.944	0.733	0.223	0.121
	MainCulv_012	3.549	0.733	0.383	0.186
	MainCulv_015	3.528	1.499	0.516	0.198
Eastern Watercourse (U/S of culverts)	DivE_US	3.534	1.594	0.477	0.321
	DivE_USIn1	3.511	2.335	0.396	0.208
	ED_0_001	3.489	2.334	0.415	0.279
	ED_0_001In1	3.462	2.338	0.454	0.308
	ED_0_002	3.432	2.340	0.511	0.258
	ED_0_002In1	3.404	2.334	0.450	0.216
	ED_0_003	3.380	2.338	0.419	0.239
	ED_0_003In1	3.355	2.336	0.433	0.265
	ED_0_004	3.326	2.336	0.449	0.347
	ED_0_004In1	3.294	2.345	0.503	0.256
	ED_0_005	3.259	2.333	0.568	0.266
	ED_0_005In1	3.232	2.342	0.473	0.229
	ED_0_006	3.211	2.328	0.402	0.271
	ED_0_006In1	3.192	2.330	0.378	0.217
	ED_0_007	3.176	2.329	0.355	0.160
	ED_0_007In1	3.159	2.320	0.374	0.170
	ED_0_008	3.141	2.321	0.392	0.238
	ED_0_008In1	3.123	2.322	0.399	0.240
	ED_0_009	3.105	2.307	0.411	0.262
	ED_0_009In1	3.088	2.310	0.402	0.217
	ED_0_010	3.071	2.296	0.396	0.260
	ED_0_010In1	3.056	2.301	0.356	0.180
	ED_0_011	3.043	2.287	0.324	0.145
	ED_0_011In1	3.027	2.410	0.357	0.162

System	Label	Stage (mAOD)	Flow (m^3/s)	Velocity (m/s)	Froude
	ED_0_012	3.011	2.406	0.377	0.209
	ED_0_012In1	2.992	2.532	0.427	0.217
	ED_0_013	2.973	2.533	0.477	0.312
	ED_0_013DS	2.956	2.757	1.226	1.350
D/S of culverts	E_S03	2.529	1.324	0.805	0.378
	E_S03In1	2.379	1.324	0.792	0.386
	E_S03In2	2.233	1.324	0.770	0.389
	E_S03In3	2.103	1.324	0.721	0.370
	E_S04	2.000	1.324	0.632	0.317
	E_N03	2.561	1.289	0.784	0.343
	E_N03In1	2.469	1.289	0.882	0.412
	E_N03In2	2.384	1.082	0.858	0.443
	E_N03In3	2.393	0.111	0.153	0.119
	E_N04	2.000	0.149	0.784	0.787

Predicted peak stage for post-development scenarios (increase relative to Scenario A)

System	Label	Scenario A	Scenario B	Scenario C
Main Drain	MainUUS_000	8.217	8.217 (0.000)	8.217 (0.000)
	MainUUS_001	8.146	8.146 (0.000)	8.146 (0.000)
	MainUUS_002	8.098	8.098 (0.000)	8.098 (0.000)
	M_001	7.522	7.522 (0.000)	7.522 (0.000)
	M_002	7.456	7.456 (0.000)	7.456 (0.000)
	M_003	6.980	6.980 (0.000)	6.980 (0.000)
	M_004	5.711	5.712 (0.001)	5.712 (0.001)
	M_005	4.233	4.233 (0.000)	4.233 (0.000)
	M_005us	4.221	4.221 (0.000)	4.221 (0.000)
	M_005ds	4.221	4.221 (0.000)	4.221 (0.000)
	M_006us	4.166	4.166 (0.000)	4.166 (0.000)
	M_006ds	4.166	4.166 (0.000)	4.166 (0.000)
	M_006	4.165	4.165 (0.000)	4.165 (0.000)
	M_007	4.125	4.126 (0.001)	4.125 (0.000)
	M_007_1	4.101	4.102 (0.001)	4.101 (0.000)
	M_007_2	4.085	4.085 (0.000)	4.085 (0.000)
	M_007_3	4.047	4.047 (0.000)	4.047 (0.000)
	M_007_4	4.013	4.015 (0.002)	4.014 (0.001)
	M_008	3.984	3.986 (0.002)	3.984 (0.000)
	M_009	3.976	3.978 (0.002)	3.977 (0.001)
	MainCulv_000	3.935	3.938 (0.003)	3.936 (0.001)
	MainCulv_003	3.943	3.944 (0.001)	3.944 (0.001)
	MainCulv_005	3.944	3.944 (0.000)	3.944 (0.000)
	MainCulv_012	3.549	3.704 (0.155)	3.765 (0.216)
	MainCulv_015	3.528	3.677 (0.149)	3.747 (0.219)
Eastern Watercourse (U/S of culverts)	DivE_US	3.534	3.684 (0.150)	3.743 (0.209)
	DivE_USIn1	3.511	3.673 (0.162)	3.735 (0.224)
	ED_0_001	3.489	3.663 (0.174)	3.730 (0.241)
	ED_0_001In1	3.462	3.652 (0.190)	3.724 (0.262)
	ED_0_002	3.432	3.641 (0.209)	3.718 (0.286)
	ED_0_002In1	3.404	3.632 (0.228)	3.715 (0.311)
	ED_0_003	3.380	3.626 (0.246)	3.712 (0.332)
	ED_0_003In1	3.355	3.618 (0.263)	3.711 (0.356)
	ED_0_004	3.326	3.613 (0.287)	3.709 (0.383)
	ED_0_004In1	3.294	3.605 (0.311)	3.704 (0.410)
	ED_0_005	3.259	3.597 (0.338)	3.700 (0.441)

System	Label	Scenario A	Scenario B	Scenario C
	ED_0_005In1	3.232	3.593 (0.361)	3.697 (0.465)
	ED_0_006	3.211	3.589 (0.378)	3.696 (0.485)
	ED_0_006In1	3.192	3.586 (0.394)	3.696 (0.504)
	ED_0_007	3.176	3.583 (0.407)	3.695 (0.519)
	ED_0_007In1	3.159	3.580 (0.421)	3.693 (0.534)
	ED_0_008	3.141	3.577 (0.436)	3.690 (0.549)
	ED_0_008In1	3.123	3.575 (0.452)	3.689 (0.566)
	ED_0_009	3.105	3.572 (0.467)	3.689 (0.584)
	ED_0_009In1	3.088	3.570 (0.482)	3.689 (0.601)
	ED_0_010	3.071	3.568 (0.497)	3.688 (0.617)
	ED_0_010In1	3.056	3.566 (0.510)	3.687 (0.631)
	ED_0_011	3.043	3.565 (0.522)	3.685 (0.642)
	ED_0_011In1	3.027	3.563 (0.536)	3.685 (0.658)
	ED_0_012	3.011	3.561 (0.550)	3.685 (0.674)
	ED_0_012In1	2.992	3.559 (0.567)	3.684 (0.692)
	ED_0_013	2.973	3.557 (0.584)	3.682 (0.709)
	ED_0_013DS	2.956	3.554 (0.598)	3.679 (0.723)
D/S of culverts	E_S03	2.529	2.967 (0.438)	2.404 (-0.125)
	E_S03In1	2.379	2.959 (0.580)	2.260 (-0.119)
	E_S03In2	2.233	2.955 (0.722)	2.138 (-0.095)
	E_S03In3	2.103	2.952 (0.849)	2.051 (-0.052)
	E_S04	2.000	2.950 (0.950)	2.000 (0.000)
	E_N03	2.561	2.976 (0.415)	2.473 (-0.088)
	E_N03In1	2.469	2.969 (0.500)	2.418 (-0.051)
	E_N03In2	2.384	2.962 (0.578)	2.356 (-0.028)
	E_N03In3	2.393	2.956 (0.563)	2.363 (-0.030)
	E_N04	2.000	2.950 (0.950)	2.000 (0.000)

Predicted increase in stage upstream of the public road relative to equivalent pre-development scenario

System	Label	Scenario A	Scenario B	Scenario C
Main Drain (U/S of public road)	MainUUS_000	0.000	0.000	0.000
	MainUUS_001	0.000	0.000	0.000
	MainUUS_002	0.000	0.000	0.000
	M_001	0.000	0.000	0.000
	M_002	0.000	0.000	0.000
	M_003	0.000	0.000	0.000
	M_004	-0.001	0.000	0.000
	M_005	0.000	0.000	0.000
	M_005us	0.000	0.000	0.000
	M_005ds	0.000	0.000	0.000
	M_006us	0.001	0.000	0.000
	M_006ds	0.001	0.000	0.000
	M_006	0.001	0.001	0.001
	M_007	0.000	0.001	0.000
	M_007_1	0.001	0.002	0.001
	M_007_2	0.001	0.001	0.001
	M_007_3	0.002	0.002	0.002
	M_007_4	0.000	0.002	0.001
	M_008	0.000	0.002	0.000
	M_009	0.000	0.002	0.001
	MainCulv_000	-0.001	0.002	0.000
	MainCulv_003	0.000	0.001	0.001

MainCulv_005	0.000	0.000	0.000

G WESTERN WATERCOURSE TABULAR PREDICTIONS

Predicted peak state variables for Scenario A

System	Label	Stage (mAOD)	Flow (m^3/s)	Velocity (m/s)	Froude
Western Watercourse	C_001	2.878	0.197	0.180	0.173
	W_0_001	2.870	0.196	0.118	0.078
	W_0_002	2.864	0.196	0.120	0.080
	W_0_003	2.858	0.195	0.121	0.081
	W_0_004	2.852	0.195	0.123	0.083
	W_0_005	2.845	0.194	0.123	0.100
	W_0_006	2.838	0.193	0.128	0.090
	W_0_007	2.830	0.193	0.130	0.097
	W_0_008	2.822	0.193	0.133	0.101
	W_0_009	2.814	0.193	0.137	0.114
	W_0_010	2.804	0.192	0.142	0.124
	W_0_011	2.794	0.192	0.147	0.141
	W_0_012	2.782	0.192	0.153	0.166
	W_0_012ds	2.782	0.261	0.224	0.267
	W_0_013	2.769	0.261	0.133	0.091
	W_0_014	2.761	0.260	0.137	0.093
	W_0_015	2.752	0.260	0.140	0.094
	W_0_016	2.744	0.260	0.146	0.096
	W_0_017	2.734	0.260	0.150	0.096
	W_0_018	2.724	0.260	0.155	0.097
	W_0_019	2.714	0.260	0.130	0.115
	W_0_020	2.702	0.260	0.168	0.104
	W_0_021	2.689	0.260	0.176	0.110
	W_0_022	2.674	0.260	0.184	0.130
	W_0_022ds	2.674	0.308	0.217	0.138
	W_0_023	2.490	0.308	0.540	0.539
	Outlet_DS	2.400	0.308	0.032	0.019

Predicted peak state variables for Scenario B

System	Label	Stage (mAOD)	Flow (m^3/s)	Velocity (m/s)	Froude
Western Watercourse	C_001	3.009	0.197	0.091	0.058
	W_0_001	3.007	0.197	0.071	0.044
	W_0_002	3.005	0.197	0.070	0.049
	W_0_003	3.003	0.196	0.072	0.045
	W_0_004	3.001	0.196	0.074	0.050
	W_0_005	2.999	0.196	0.067	0.052
	W_0_006	2.998	0.196	0.082	0.056
	W_0_007	2.996	0.195	0.088	0.060
	W_0_008	2.994	0.200	0.092	0.063
	W_0_009	2.991	0.213	0.099	0.068
	W_0_010	2.989	0.230	0.107	0.074
	W_0_011	2.987	0.253	0.119	0.082
	W_0_012	2.985	0.283	0.135	0.094
	W_0_012ds	2.985	0.284	0.136	0.095
	W_0_013	2.983	0.320	0.097	0.055
	W_0_014	2.981	0.376	0.114	0.065
	W_0_015	2.980	0.431	0.133	0.076
	W_0_016	2.979	0.480	0.146	0.091
	W_0_017	2.977	0.542	0.161	0.105
	W_0_018	2.976	0.666	0.199	0.135
	W_0_019	2.975	0.586	0.092	0.078
	W_0_020	2.974	0.264	0.071	0.038
	W_0_021	2.973	0.264	0.068	0.038
	W_0_022	2.971	0.264	0.086	0.041
	W_0_022ds	2.971	0.312	0.102	0.049
	W_0_023	2.968	0.312	0.103	0.049
	Outlet_DS	2.950	0.312	0.032	0.019

Haventus

Ardersier Port – Phase 2

162855 – Drainage Impact Assessment

June 2025

FAIRHURST

CONTROL SHEET

CLIENT: **Haventus**

PROJECT TITLE: **Ardersier Port – Phase 2**

REPORT TITLE: **Drainage Impact Assessment**

PROJECT REFERENCE: **162855**

DOCUMENT NUMBER: **APP2-FHT-DR-XXX-RP-C-000001**

Original Issue	Issue FINAL	Name	Signature	Date
	Prepared by	A Hunte	[Redacted]	13/06/2025
	Checked by	D Eunson	[Redacted]	13/06/2025
	Approved by	A Fleming	[Redacted]	13/06/2025

Revision Record	Rev.	Date	Status	Description	Signature	
	01	17/07/2025	FINAL	DIA updated following EnviroCentre review.	Prepared By	A Hunte
					Checked	D Eunson
					Approved	A Fleming
	02	30/07/2025	FINAL	Typical Drainage Construction Details in Appendix C updated. DIA updated following EnviroCentre review	Prepared By	A Hunte
					Checked	D Eunson
					Approved	A Fleming
	03	22/08/2025	FINAL	Clarity added to Flood Risk Section	Prepared By	A Hunte
					Checked	D Eunson
					Approved	A Fleming

FAIRHURST

Contents

Appendices

1.0 INTRODUCTION

Fairhurst is undertaking engineering consultancy work on behalf of Haventus for the proposed second phase of the redevelopment of Ardersier Port.

This Drainage Impact Assessment presents the design methodology and outlines the proposed surface water and foul water drainage strategies for the planned extension of the existing yard. The extension area encompasses a section of woodland located to the south of the current fabrication yard, as well as an area of gorse situated to the east.

This document will consider appropriate drainage proposals in accordance with the guidance in the following documents:

- *Flood Risk Assessment and Drainage Impact: Highland Council 2013*
- *Planning Advice Note (PAN) 61: Planning and Sustainable Urban Drainage Systems, issued by the Scottish Executive Development Department, July 2001.*
- *Flood Risk Management (Scotland) Act 2009*
- *The SUDS Manual – (CIRIA C753)*
- *Sewers for Scotland 4th Edition*
- *The Water Environment (Controlled Activities) (Scotland) Regulations 2011*
- *Design Manual for Roads and Bridges*

This document has been produced for submission to support the application for the proposals and is to be reviewed by the following relevant statutory authorities (but not limited to):

- Highland Council Flood Risk Management Team
- The Scottish Environmental Protection Agency (SEPA)
- Scottish Water

2.0 CURRENT SITE AND PROPOSALS

The proposed development is located at national grid reference NH 81121 57729 approximately 15 miles east of Inverness and is accessed from the B9092 (Nairn Road) which runs from the B9006 in Ardersier eastwards to the A96. Refer to Appendix A for the location plan.

The site covers an area of approximately 150ha and is located on a former oil rig fabrication yard constructed on land reclaimed in the 1970s, an area of woodland and pheasantry to the south of the former fabrication yard, and an area of gorse to the east of the former fabrication yard.

Figure 1 Current Land-Use Plan

The proposed development shall consist of internal site access roads, plots for the port's clients, and marshalling areas for storage of off-shore wind turbine components. Refer to Appendix A for indicative site general arrangement. The area highlighted in yellow on Figure 1 has already been consented and shall not be detailed in this DIA. The yard extension areas highlighted in green, dark blue (woodland and pheasantry) and light blue (gorse area) are to become part of the port facility.

Access to the site shall be taken from the existing site access road and roundabout on the B9092. A secondary access for emergency service vehicles shall be constructed approximately 290m west of an existing Waste Water Pumping Station access on the U1038, which runs along the southern boundary of the site.

Historical mapping dating back to the 1830s indicates that both the woodland to the south and the gorse area to the east of the former fabrication yard have remained predominantly agricultural, with no significant urban development.

Currently all surface water run-off within the gorse area discharges to groundwater through infiltration; there is no formal surface water drainage systems in this area. The Pheasantry has a small soakaway for roof water, and a private septic tank for foul water only. The woodland area has several ditches which convey run-off to a main ditch along its perimeter which discharges either to groundwater or, via a twin culvert, to Whiteness Head.

There is an existing foul sewer which runs from 281432E ,857193N to an existing Waste Water Pumping Station at 281131E, 856720N constructed in advance of a proposed housing and leisure development on the former fabrication yard site, which did not progress past initial enabling works. The existing foul sewer and pumping station are outside the two development areas discussed in this DIA; however, the port's clients may require a connection to this foul sewer to service their welfare facilities.

3.0 SITE INVESTIGATION

An intrusive site investigation is currently being undertaken by Solmek Ltd to determine the existing ground conditions and engineering properties. Historical ground investigation for the first phase of the development, including infiltration testing to BRE 365, has been provided by the client for use in preliminary design.

A review of the historic ground investigation and interim results from the current ground investigation indicates the subsoils are predominantly SAND, and SAND and GRAVEL of varying densities. Interim borehole logs from Solmek Ltd show similar ground conditions within the Phase 2 boundary. Infiltration testing of the subsoils in Phase 1 resulted in an average infiltration rate of 5.3×10^{-5}m/s. Table 25.1 of the CIRIA SuDS Manual provides typical infiltration rates for different soil types. Based on the description of soils provided by Solmek Ltd in their interim borehole logs, an estimated infiltration rate of 5×10^{-5}m/s is to be used for the preliminary design of the infiltration devices throughout the site. Infiltration testing shall be undertaken as part of the detailed design to confirm the specific infiltration rates of the subsoils within the extension site boundary. Refer to Appendix D for existing ground investigation information.

4.0 PROPOSED SURFACE WATER DRAINAGE NETWORK

In line with current policy and best practice, foul and surface water are to be kept separate. Surface water run-off is to be collected and treated by a Sustainable Drainage System (SuDS). Refer to Appendix B for plan of areas showing the design return periods and Appendix C for drainage strategy layout and typical details.

Internal Site Roads and Yard Areas

Drainage to yard areas and internal site roads is to be designed in accordance with CD 531 - Reservoir pavements for drainage attenuation. All surface water run-off from internal site roads and client/ marshalling areas not adjacent to proposed buildings or other critical infrastructure is to be discharged into the water environment through infiltration devices sized to accommodate storm events up to 1 in 10 years (10% Annual Exceedance Probability (AEP)) plus 42% climate change allowance. There are no current proposals in the extension site master plan to construct buildings or additional critical infrastructure. Minor surface water ponding in these areas shall have no detrimental effect on the surrounding road network or operation of the plots/ marshalling areas until the long-term land-use determines otherwise.

The port's future clients will be responsible for developing suitable surface water drainage to suit development proposals for the areas that they lease.

Site Critical Infrastructure

Surface Water run-off from the proposed internal site road adjoining the public road (U1038) on the southern boundary is to be discharged into the water environment through infiltration devices sized to accommodate storm events up to 1 in 30 years (3.33%AEP) plus 42% climate change allowance in accordance with the Highland Council's Roads and Transport Guidelines for new Developments.

5.0 PROPOSED SUDS TREATMENT TO SURFACE WATER RUN-OFF

A groundwater risk screening assessment (Refer to Appendix E) has been undertaken based on the available ground information and site use in accordance with Chapter 26 of the CIRIA SuDS Manual. The risk screening has shown groundwater to be at low to medium risk; therefore, the Simple Index Approach (SIA) in the CIRIA SuDS Manual can be used for assessment of pollution hazard mitigation measures.

The majority of the site is to be used for industrial purposes and shall be subject to traffic from large heavy vehicles; however, the number of vehicle movements along the internal site access roads is considered to be low. In addition to the anticipated low traffic volumes, there are to be no refuelling or other activities associated with industrial sites on the internal site roads.

In accordance with the Simple Index Approach in CIRIA document C753 (The SuDS Manual), the risk posed by surface water run-off to the receiving environment is a function of the land use, the effectiveness of SuDS treatment components and the sensitivity of the receiving waterbody.

Determining the hazard posed by the land use activities at a site can be established by allocating pollution hazard indices for the proposed land use from Table 26.2 of The SuDS Manual, replicated in Table 1 below.

Land use	Pollution Hazard Level	Total Suspended Solids	Metals	Hydrocarbons
Low Traffic Roads (<300 vehicles per day)	Low	0.5	0.4	0.4
Commercial Yard/ Delivery Area	Medium	0.7	0.6	0.7

Table 1 Pollution Hazard Indices for Different Land Use Classifications

The mitigation indices of different SuDS components discharging to groundwater are indicated in Table 26.4 of the SuDS manual. To deliver adequate treatment, the selected SuDS components should have a total pollution mitigation index (for each contaminant type) that equates to or exceeds the corresponding pollution hazard index specified in Table 1.

Treatment of surface water is to be provided by permeable pavements of unbound granular material.

Where the mitigation index of an individual component is insufficient on its own, two (or more) components can be used in series where required. A factor of 0.5 is then used to account for the reduced performance of the secondary (or tertiary) components associated with the already reduced inflow concentrates.

The mitigation indices for the treatment train are outlined in the following table.

Type of SUDS Component	TSS	Metals	Hydrocarbons
Permeable Pavement	0.7	0.6	0.7
Total	0.7	0.6	0.7

Table 2 Treatment Train 1 - Indicative SuDS Mitigation Indices for Discharge to Groundwater

A comparison between the hazard indices in Table 1 and the mitigation indices in Table 2 shows that the permeable pavement shall provide sufficient mitigation to suspended solids metals and hydrocarbons. The proposed development is to be upfilled with marine sand arising from dredging of the port navigation channel. There will be a minimum of 1m unsaturated soils between the underside of the permeable pavement and water table of to protect groundwater from contaminates per the recommendations in Chapter 13 of the SuDS Manual.

6.0 FLOOD RISK

Per section 4.0, the permeable pavement of the internal site roads is designed to accommodate storm events of 1 in 10 years (10% AEP) plus 42% climate change allowance. Sensitivity checks for storm events up to and including 1 in 200 years (0.5% AEP) plus 42% climate change allowance shows there is sufficient capacity to attenuate flows from these exceedance events within the permeable pavement.

The permeable pavement adjacent to the secondary access road to the U1038 is designed to accommodate storm events up to and including 1 in 30 years plus 42% climate change allowance. Sensitivity checks for storm events up to and including 1 in 200 years (0.5% AEP) plus 42% climate change shows there is sufficient capacity to attenuate flows from these exceedance events within the permeable pavement.

The permeable pavement located within the yard area has been designed to manage surface water run-off from storm events with a return period of up to 1 in 10 years (10% AEP) plus 42% climate change allowance. This ensures effective drainage under typical rainfall conditions. Sensitivity checks for storm events up to and including 1 in 100 years (1% AEP) plus 42% climate change allowance in accordance with CG 501 – Design of Highway Drainage Systems, indicate that permeable pavements have sufficient capacity to attenuate run-off from exceedance events.

The permeable pavements are to be surfaced with Type 1 sub-base to clause 803 of the Specification for Highway Works. In addition to the permeable pavement, infiltration trenches will be installed at the low points within the yard/marshalling areas, as well as along the lower edge of the proposed roads. These trenches are designed to provide additional drainage capacity during extreme rainfall events and compensate for the potential reduction in permeability of the sub-base over time. Refer to Appendix E for design calculations

A detailed Flood Risk Assessment (FRA) has been undertaken and accompanies this DIA. FRA recommendations are used to inform final site levels and will, thereafter, be used to inform the level of site drainage elements within detailed design.

The proposed development of the site will result in in-filling of existing land drainage channels within the site, some of which receive flows from areas external to the site. Continuity of land drainage (to discharge to coastal waters) will be achieved by provision of 2 No. two-stage perimeter cut-off drains, which will divert incoming flows either eastwards or westwards around the southern boundary of the site platform. The design basis and flood risk management performance of these cut-off drains is presented and assessed within the accompanying Flood Risk Assessment.

7.0 FOUL DRAINAGE PROPOSALS

All on-site foul drainage is to remain private. Foul flow shall be conveyed to the existing Waste Water Pumping Station (WWPS) on the southern boundary of the site (Refer to Appendix F for Scottish Water GIS Excerpt). The existing WWPS was constructed circa 2005 to adoptable standards at the time of construction, but was never vested by Scottish Water. There is an existing ø250mm rising main from the WWPS to the Ardersier Waste Water Treatment Works, which has also remained unadopted by Scottish Water. Scottish Water has confirmed the WWPS and rising main has capacity for approximately 2000 domestic properties. The anticipated flow from the proposed development site is the equivalent to 600 domestic properties; therefore, the existing WWPS will have sufficient capacity to lift foul effluent from the proposed development site to the public sewer. A pre-development enquiry has been lodged with Scottish Water to confirm capacity within their existing infrastructure and a survey for the existing pumping station and rising main has been commissioned to confirm its condition. Any remediation works or upgrades required to the existing infrastructure shall be completed before any additional foul connections are made to the existing WWPS.

Internal site pumping stations are to positioned throughout the site to lift effluent into the gravity foul sewer leading to the existing WWPS on the southern boundary. Refer to Appendix C for drainage strategy layout. The final positions of these are to be determined by Haventus' client's requirements.

8.0 CONSTRUCTION

The measures for controlling surface water run-off will be continually reviewed in line with each stage of construction and any influencing factors. Construction methodologies will be in line with the recommendations given in *CIRIA C532, Control of Water Pollution from Construction Sites,* and best practice. All works will be subject to a Construction Environmental Management Plan.

Surface water run-off is to be discharged to groundwater via direct infiltration. Stripping of topsoil and vegetation is to be limited wherever possible and undertaken immediately before the construction in that particular area. This is to minimise the risk of soil/ sediment being eroded and transported in run-off, and to aid natural absorption into the soils. Silt fences and temporary bunds are to be installed around open or exposed ground and stockpiles to minimise the risk of significant overland flow during heavy rainfall events.

9.0 FUTURE MAINTENANCE

All surface water and foul water drainage systems within the development are to remain private and be the maintenance responsibility of Haventus of their appointed factor. The Waste Water Pumping Station and rising main shall also be the maintenance responsibly of Haventus or their appointed factor until such time that the pumping station and rising main are adopted by Scottish Water.

All SuDS components shall be subject to regular inspections and maintenance in accordance with the recommendations given in the CIRIA SuDS Manual (Refer to Appendix G).

APPENDIX A – Location Plan, Topographic Survey
&
Indicative Site General Arrangement

1:10000
200m 0 200m 400m 600m 800m 1000m

Do not scale from this drawing.

SAFETY HEALTH AND ENVIRONMENTAL INFORMATION

IN ADDITION TO THE HAZARD/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING RISKS AND INFORMATION.

RISKS LISTED HERE ARE NOT EXHAUSTIVE. REFER TO DESIGN ASSESSMENT FORM NO. APP2–FHT–XX–YAR–HS–C–000001

CONSTRUCTION:
SOIL CONTAMINATION
EXISTING SERVICES
EXCAVATIONS
SEWAGE

DEMOLITION:
NONE THAT WOULD NOT BE APPARENT TO A COMPETENT CONTRACTOR

FOR INFORMATION RELATING TO USE, CLEANING AND MAINTENANCE SEE THE HEALTH AND SAFETY FILE.

IT IS ASSUMED THAT ALL WORKS WILL BE CARRIED OUT BY A COMPETENT CONTRACTOR WORKING, WHERE APPROPRIATE, TO AN APPROVED METHOD STATEMENT.

Notes:

1. Do not scale from this drawing, only written dimensions are to be used.
2. All dimensions in this drawing are in millimetres, unless noted otherwise.
3. This drawing is to be read in conjunction with all architectural and engineering drawings, details and specifications.
4. Any discrepancies should be reported to the engineer immediately so clarification can be sought.
5. For clarity this drawing should only be printed and read in colour.
6. All manhole to be constructed in all Specifications for Highway Works.

Rev.	Date	Description	Drawn	Chkd.	Appd.

FAIRHURST
Barony House
Stoneyfield Business Park
INVERNESS
IV2 7PA
Tel: 01463 724 544

Client: Haventus

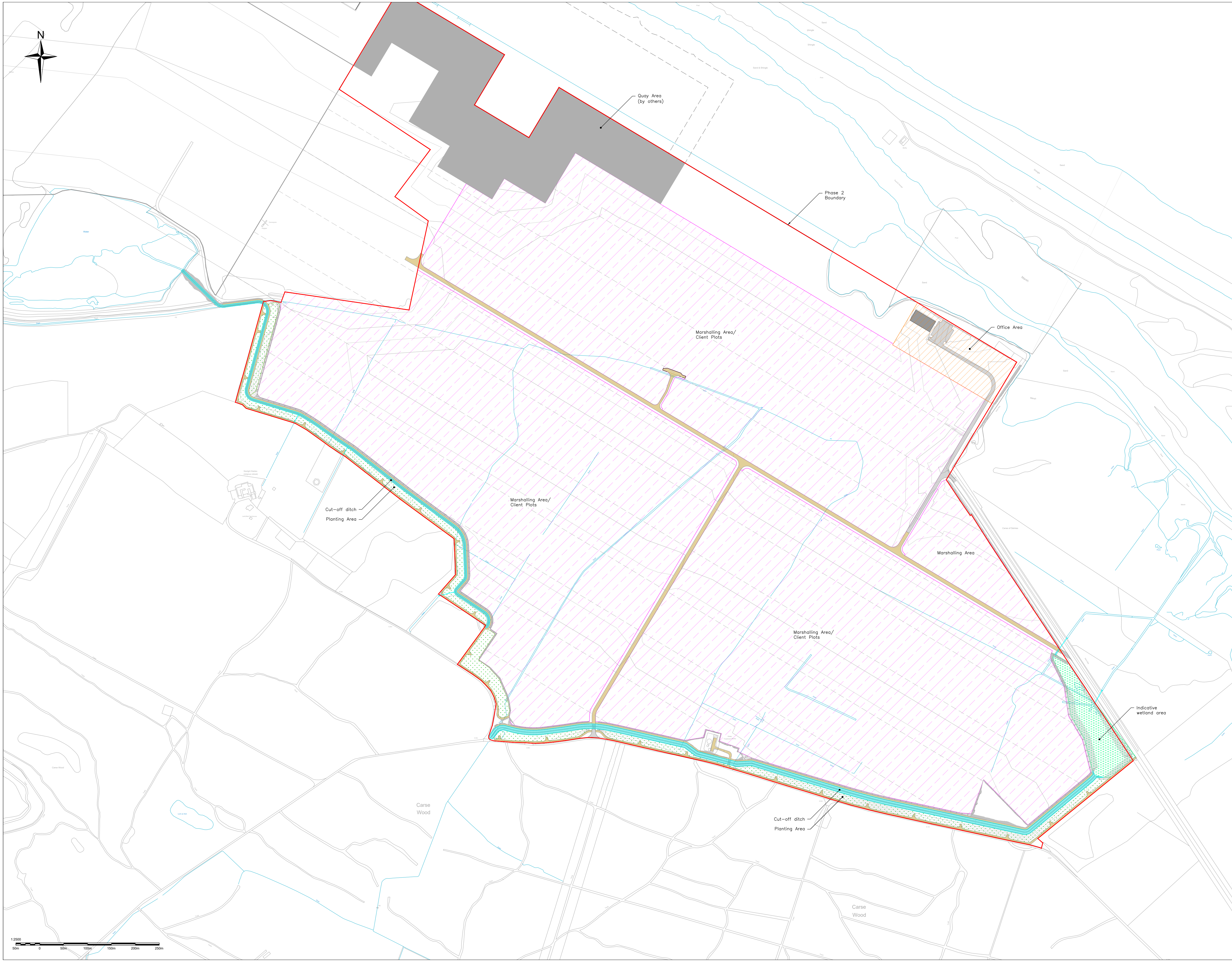
Project Title:
Ardersier Port Redevelopment Phase 2

Drawing Title:
Location Plan

Scale at A1:	Status:	
1:10000	Information	
Drawn:	Checked:	Approved:
LB	AH	AKF
Date:	Date:	Date:
12.06.2025	13.06.2025	13.06.2025

Drawing No.: APP2–FHT–XX–XXX–DR–C–000000

Revision: 00



Do not scale from this drawing.

SAFETY HEALTH AND ENVIRONMENTAL INFORMATION

IN ADDITION TO THE HAZARD/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING RISKS AND INFORMATION.

RISKS LISTED HERE ARE NOT EXHAUSTIVE. REFER TO DESIGN ASSESSMENT FORM NO. APP2–FHT–XX–YAR–HS–C–000001

CONSTRUCTION:
SOIL CONTAMINATION
EXISTING SERVICES
SEWAGE
EXCAVATION

DEMOLITION:
NONE THAT WOULD NOT BE APPARENT TO A COMPETENT CONTRACTOR

FOR INFORMATION RELATING TO USE, CLEANING AND MAINTENANCE SEE THE HEALTH AND SAFETY FILE.

IT IS ASSUMED THAT ALL WORKS WILL BE CARRIED OUT BY A COMPETENT CONTRACTOR WORKING, WHERE APPROPRIATE, TO AN APPROVED METHOD STATEMENT.

Notes:

1. All dimensions on this drawing are in metres unless noted otherwise. Do not scale from this drawing, only written dimensions are to be used. All levels and coordinates are given to Ordnance Survey Datum
2. This drawing is to be read in conjunction with all architectural and engineering drawings, details and specifications.
3. Any discrepancies should be reported to the engineer immediately so clarification can be sought.
4. The contractor is to keep a record of any variations made on site so that 'As–Built' drawings can be prepared upon completion of the works. All variations are to be agreed by the engineer and client.
5. For clarity this drawing should only be printed and read in colour.

Legend:

- Type 1 Road Surfacing
- Asphalt Road Surfacing
- Marshalling Area/ Client Plots
- Office Area
- Planting Area
- Indicative Wetland Area
- Cut–Off Ditch

Rev.	Date	Description	Drwn.	Chkd.	Appd.
01	18.07.25	Wetland area added. Minor drawing alterations for clarity.	HF	AH	AKF

FAIRHURST
Barony House
Stoneyfield Business Park
INVERNESS
IV2 7PA

Tel: 01463 724 544

Client: Haventus

Project Title:
Ardersier Port Development
Phase 2

Drawing Title:
Site General Arrangement

Scale at A0:	Status:	
1:2500	Information	
Drawn: LB	Checked: AH	Approved: AKF
Date: 12.06.2025	Date: 13.06.2025	Date: 13.06.2025

Drawing No.: APP2–FHT–XX–XXX–DR–C–000100

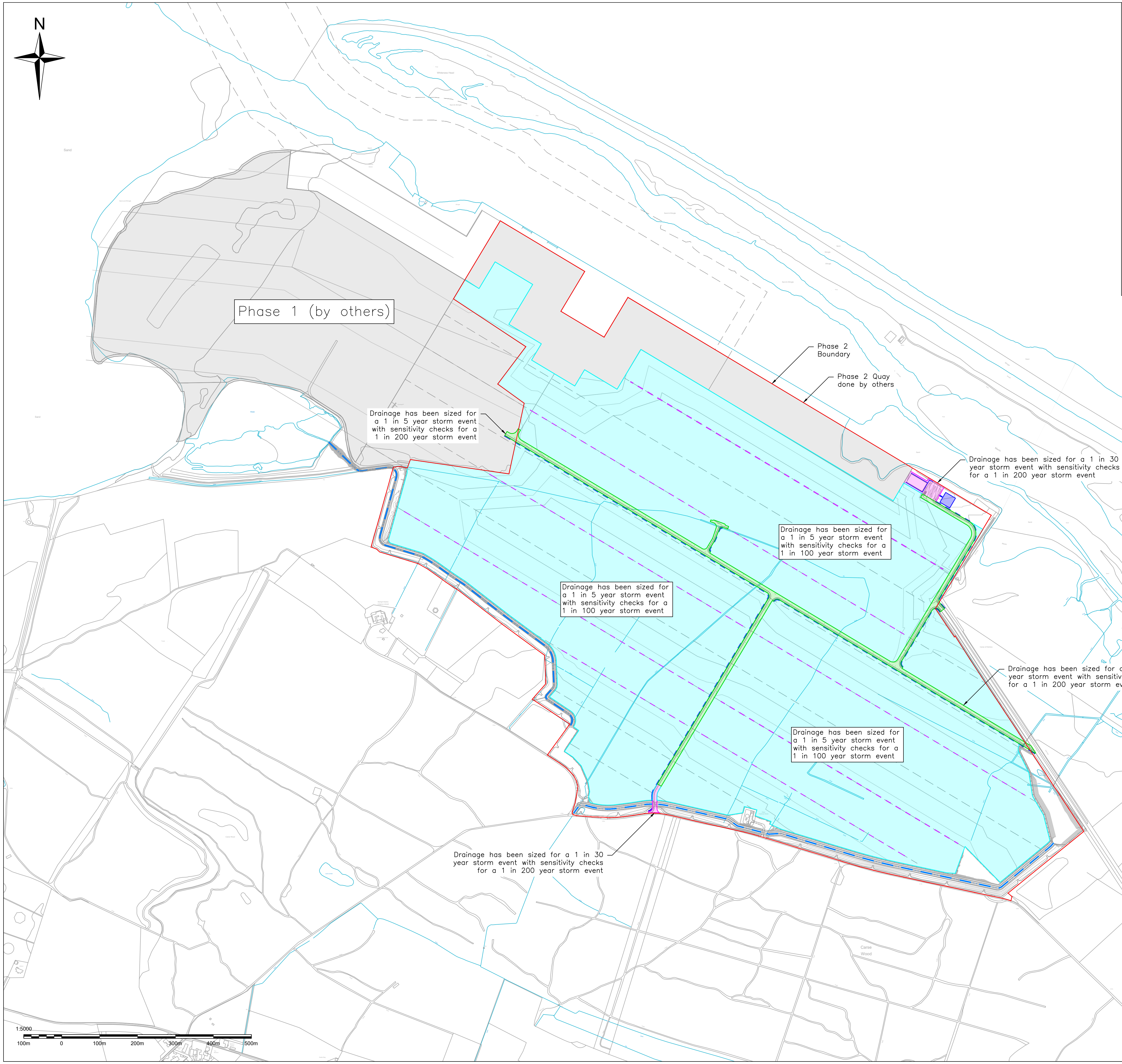
Revision: 01

Zenith Topo Survey
Received 05/06/2025

Scale 1:5000

Note: All levels in this drawing are to Chart Datum (Chart Datum= OS – 2.14m)

APPENDIX B – Drainage Design Areas



Surface Water Legend (Strategy View):

Proposed 2.0m Wide Filter Drain

Proposed 1.0m Wide Roadside Infiltration Trenches

Proposed Yard Infiltration Trenches

Proposed Perimeter Cut-Off Ditch

Legend:

Proposed drainage designed for 1 in 30 yr storm events with sensitivity checks for 1 in 200 yr storm events.

Proposed drainage designed for 1 in 5 yr storm events with sensitivity checks for 1 in 100 yr storm events

Proposed drainage designed for 1 in 5 yr storm events with sensitivity checks for 1 in 200 yr storm events

Phase 2 Quay (by others)

Do not scale from this drawing.

SAFETY HEALTH AND ENVIRONMENTAL INFORMATION

IN ADDITION TO THE HAZARD/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING RISKS AND INFORMATION.

RISKS LISTED HERE ARE NOT EXHAUSTIVE. REFER TO DESIGN ASSESSMENT FORM APP2-FHT-XX-YAR-HS-C-000001

CONSTRUCTION:
SEWAGE
EXCAVATIONS
SOIL CONTAMINATION
EXISTING SERVICES

DEMOLITION:
NONE THAT WOULD NOT BE APPARENT TO A COMPETENT CONTRACTOR

FOR INFORMATION RELATING TO USE, CLEANING AND MAINTENANCE SEE THE HEALTH AND SAFETY FILE.

IT IS ASSUMED THAT ALL WORKS WILL BE CARRIED OUT BY A COMPETENT CONTRACTOR WORKING, WHERE APPROPRIATE, TO AN APPROVED METHOD STATEMENT.

Notes:

1. All dimensions on this drawing are in metres unless noted otherwise. Do not scale from this drawing, only written dimensions are to be used. All levels and coordinates are given to Chart Datum (OS-2.14m).
2. This drawing is to be read in conjunction with all architectural and engineering drawings, details and specifications. Refer to drawing APP2-FHT-DR-YAR-DR-C-002001 for Surface Water Drainage General Arrangement.
3. Any discrepancies should be reported to the engineer immediately so clarification can be sought.
4. For clarity this drawing should only be printed and read in colour.
5. All sewers to be constructed in accordance with the Specification for Highway Works
6. Curtilage drainage to be constructed, installed & tested in accordance with the recommendations in BS EN 752:2018, BS EN 1610:2015, BS 6297:2007, BS EN12056-1:2000. 'The SUDS Manual - Ciria C753' and C.A.R GBR10B.
7. A minimum of 1500mm cover to be provided to all pipework unless otherwise stated. Sewers with cover less than these values are to be provided with concrete protection. Refer to detail.
8. All inspection chambers in trafficked areas to be fitted with F900 covers. All covers to be manufactured to BS EN 124:2015
9. All existing services to be located prior to any construction work being carried out. Underground services must be located in accordance with Health and Safety Executive Guidance note HSG 47.

Rev.	Date	Description	Drwn.	Chkd.	Appd.
01	18.07.25	Details on storm event simulations and sensitivity checks updated. Minor drawing alterations for clarity.	HF	AH	AKF

FAIRHURST
Barony House
Stoneyfield Business Park
INVERNESS
IV2 7PA
Tel: 01463 724 544

Client: Haventus

Project Title:
Ardersier Port Redevelopment Phase 2

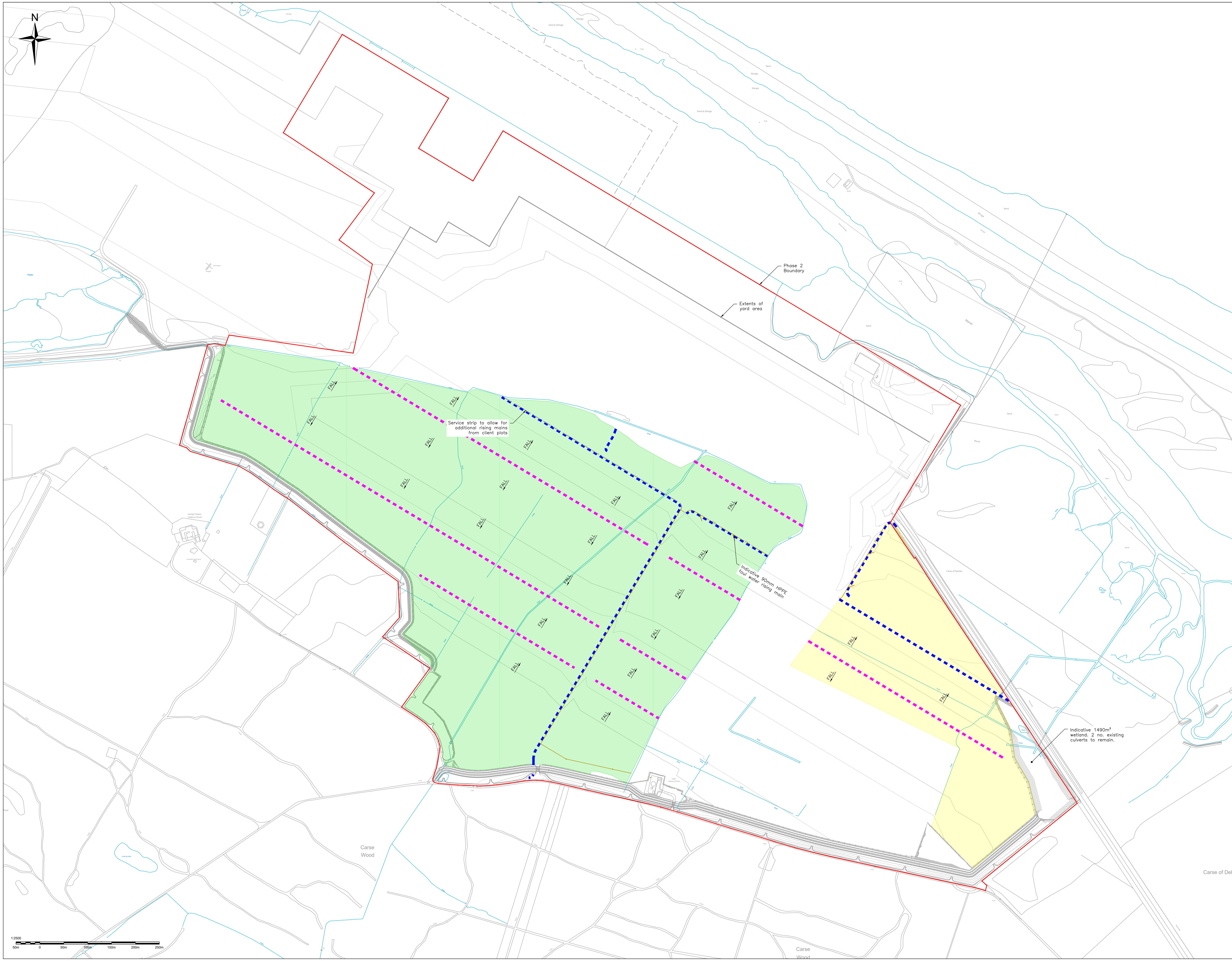
Drawing Title:
Yard Area
Drainage Design Areas

Scale at A1: 1:5000	Status: Information	
Drawn: CM	Checked: AH	Approved: AKF
Date: 10/06/2025	Date: 10/06/2025	Date: 10/06/2025

Drawing No.: APP2-FHT-RD-YAR-DR-C-002052

Revision: 01

APPENDIX C – Drainage Layout and Typical Details



Do not scale from this drawing.

SAFETY HEALTH AND ENVIRONMENTAL INFORMATION

IN ADDITION TO THE HAZARD/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING RISKS AND INFORMATION.

RISKS LISTED HERE ARE NOT EXHAUSTIVE. REFER TO DESIGN ASSESSMENT FORM APP2–FHT–XX–YAR–HS–C–000001

CONSTRUCTION:
SEWAGE
EXCAVATIONS
SOIL CONTAMINATION
EXISTING SERVICES

DEMOLITION:
NONE THAT WOULD NOT BE APPARENT TO A COMPETENT CONTRACTOR

FOR INFORMATION RELATING TO USE, CLEANING AND MAINTENANCE SEE THE HEALTH AND SAFETY FILE.

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Notes:

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2. This drawing is to be read in conjunction with all architectural and engineering drawings, details and specifications. Refer to drawing APP2–FHT–DR–YAR–DR–C–002001 for Yard Area Surface Water Drainage Layout Plan and drawing APP2–FHT–DR–YAR–DR–C–002100 for Yard Area Foul Drainage Layout Plan.
3. Any discrepancies should be reported to the engineer immediately so clarification can be sought.
4. For clarity this drawing should only be printed and read in colour.
5. All sewers to be constructed in accordance with the Specification for Highway Works
6. Curtilage drainage to be constructed, installed & tested in accordance with the recommendations in BS EN 752:2018, BS EN 1610:2015, BS 6297:2007, BS EN12056–1:2000. 'The SUDS Manual – Ciria C753' and C.A.R GBR10B.
7. A minimum of 1500mm cover to be provided to all pipework unless otherwise stated. Sewers with cover less than these values are to be provided with concrete protection. Refer to detail.
8. All inspection chambers in trafficked areas to be fitted with F900 covers. All covers to be manufactured to BS EN 124:2015
9. All existing services to be located prior to any construction work being carried out. Underground services must be located in accordance with Health and Safety Executive Guidance note HSG 47.

Legend:

Gorse Area to be upfilled with porous paving

Wooded Area to be upfilled with porous paving

Roadside Infiltration Trench

Yard Infiltration Trench

Foul Water Drainage Legend:

Proposed Foul Water Rising Main FW

Space Allocated for Future Rising Main Installation

Proposed Foul Water Sewer FW

Rev.	Date	Description	Drwn.	Chkd.	Appd.

FAIRHURST
Barony House
Stoneyfield Business Park
INVERNESS
IV2 7PA

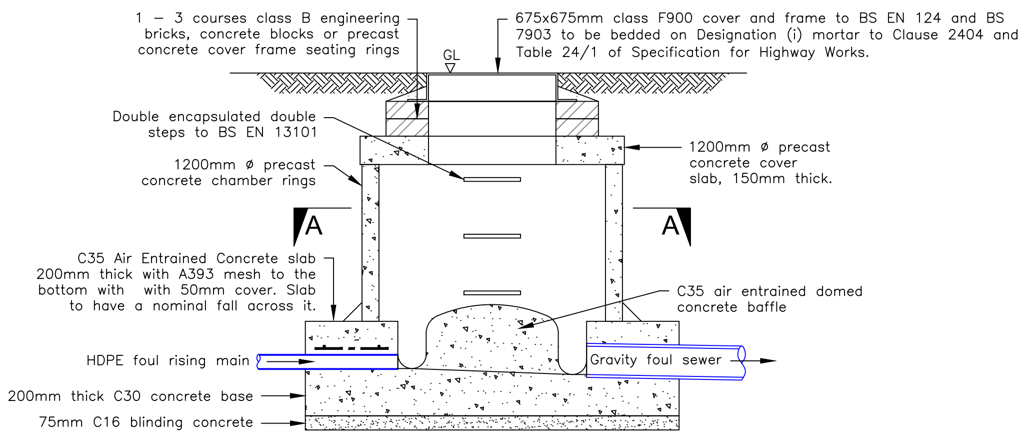
Tel: 01463 724 544

Client: Haventus

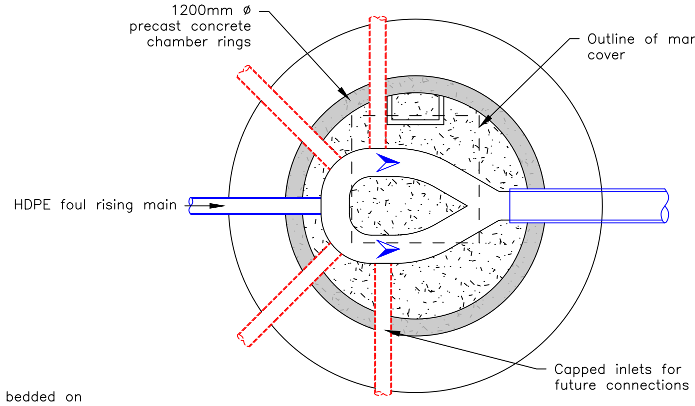
Project Title:
Ardersier Port Redevelopment Phase 2

Drawing Title:
Yard Area
Drainage Strategy
Gorse and Wooded Area

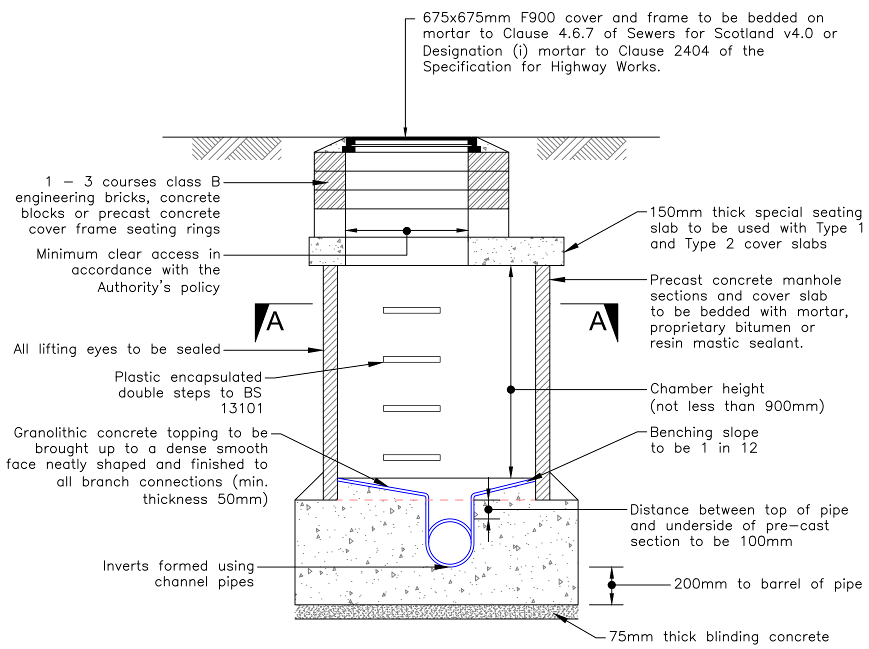
Scale at A0: 1:2500	Status: Concept	
Drawn: LB	Checked:	Approved:
Date: 29.07.2025	Date:	Date:
Drawing No.: APP2–FHT–DR–YAR–SK–C–002000	Revision: 01	



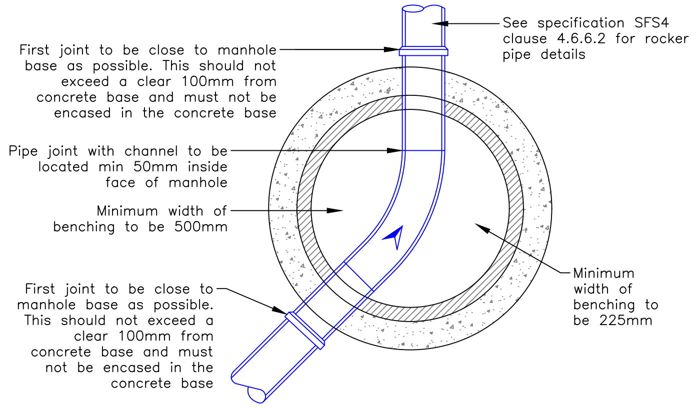
Typical Break Pressure Chamber Detail
Scale 1:20



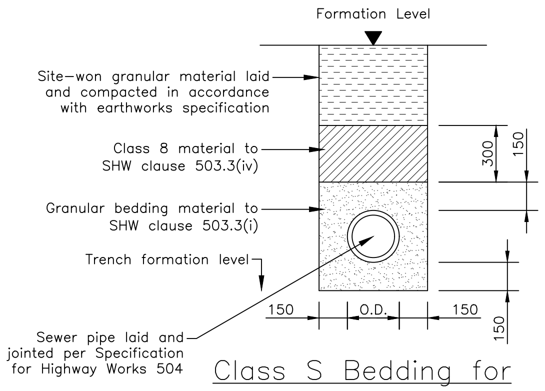
Sectional plan A – A
Scale 1:20



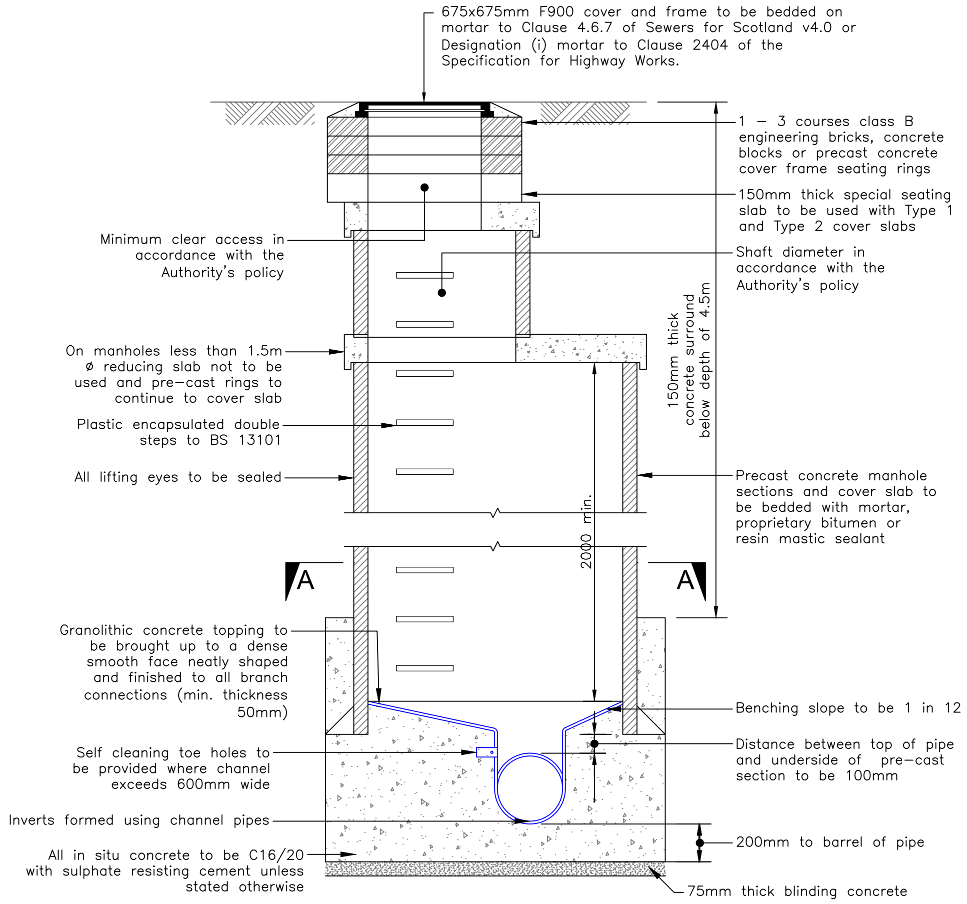
Typical Manhole Detail – Type B1
Scale 1:20



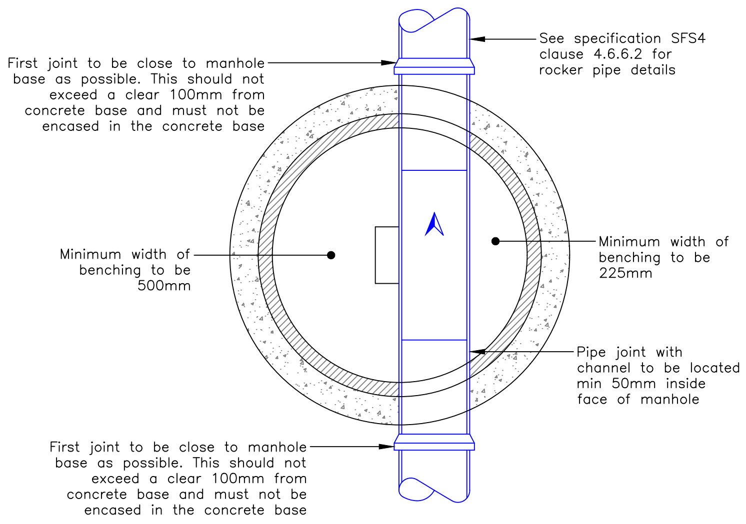
Sectional Plan A – A
Scale 1:20



Class S Bedding for UPVC Pipes
Scale 1:20



Typical Manhole Detail – Type A1
scale 1:20



Sectional Plan A – A
Scale 1:20

Manhole Diameters

Diameter of Largest Pipe in Manhole (mm)	Internal Diameter of Manhole (mm)
Less than 375	1200
375–450	1350
450–700	1500
750–1050	1800
1125–1500	2100
>1500	Consult Scottish Water

Do not scale from this drawing.

SAFETY HEALTH AND ENVIRONMENTAL INFORMATION

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CONSTRUCTION:
SOIL CONTAMINATION
EXISTING SERVICES
EXCAVATIONS
SEWAGE

DEMOLITION:
NONE THAT WOULD NOT BE APPARENT TO A COMPETENT CONTRACTOR

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2. All dimensions in this drawing are in millimetres, unless noted otherwise.
3. This drawing is to be read in conjunction with all architectural and engineering drawings, details and specifications. Refer to drawing APP2-FHT-RD-YAR-DR-C-002051 for Typical Drainage Construction Details Sheet 2. Refer to drawing APP2-FHT-DR-YAR-DR-C-002001 for the Surface Water Drainage Layout and drawing APP2-FHT-DR-YAR-DR-C-002100 for the Foul Drainage Layout .
4. Any discrepancies should be reported to the engineer immediately so clarification can be sought.
5. For clarity this drawing should only be printed and read in colour.
6. All manholes to be constructed in all Specifications for Highway Works.

Rev.	Date	Description	Drwn.	Chkd.	Appd.
03	13.08.25	Catchpit details removed.	LB	AH	AKF
02	18.07.25	Capped inlets added to Break Pressure Chamber detail. Type 3 manhole detail removed.. Bedding detail added from drawing APP2-FHT-DR-YAR-DR-C-002051	LB	AH	AKF
01	06.06.25	Drainage details updated. D400 cover specification updated to F900	LB	AH	AKF

FAIRHURST

Barony House
Stoneyfield Business Park
INVERNESS
IV2 7PA

Tel: 01463 724 544

Client: Haventus

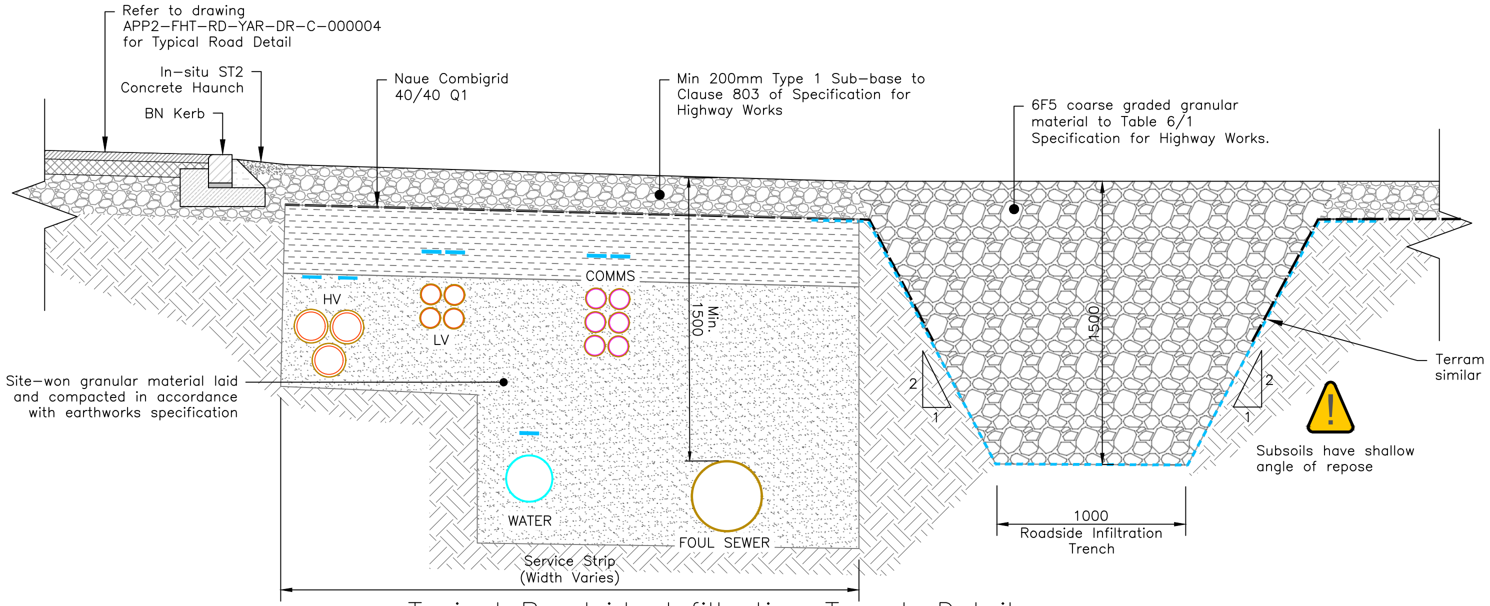
Project Title:
Ardersier Port Redevelopment Phase 2

Drawing Title:
Typical Drainage Construction Details Sheet 1 of 2

Scale at A1: As shown	Status: Concept	
Drawn: LB	Checked: AH	Approved: AKF
Date: 08.05.2025	Date: 27.05.2025	Date: 29.05.2025

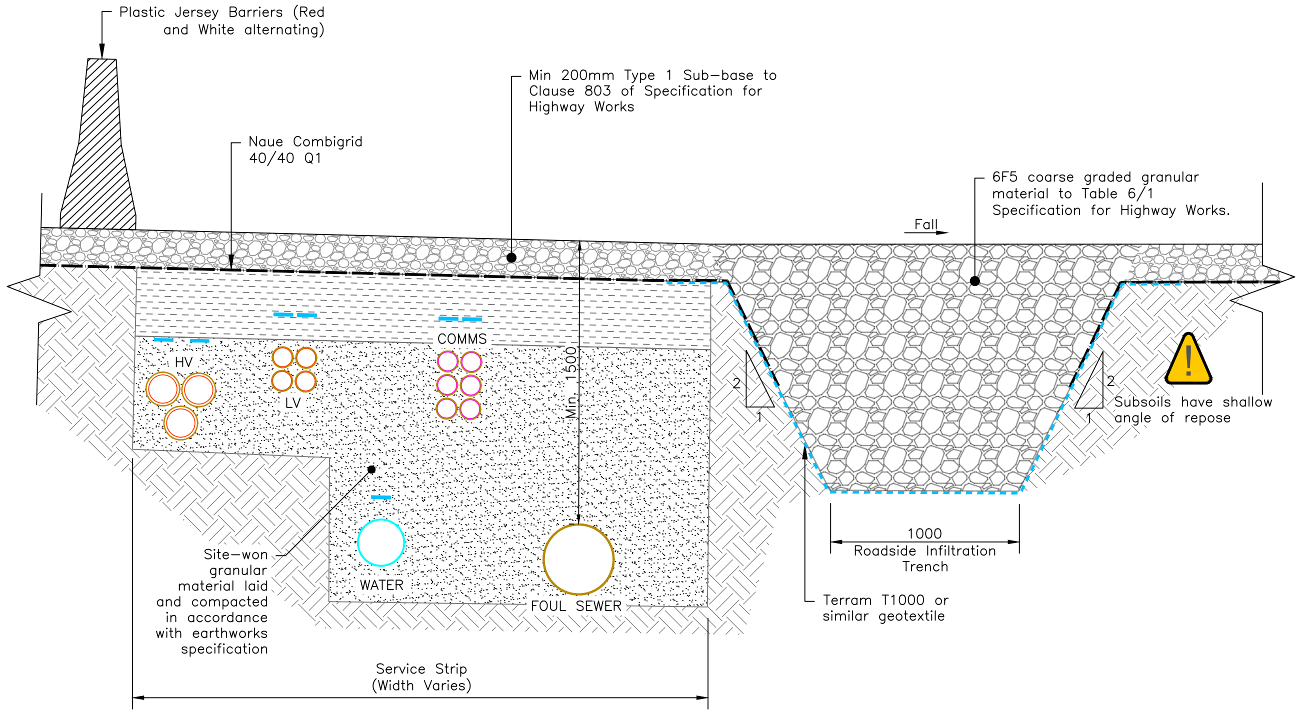
Drawing No.: APP2-FHT-DR-YAR-DR-C-002050

Revision: 03



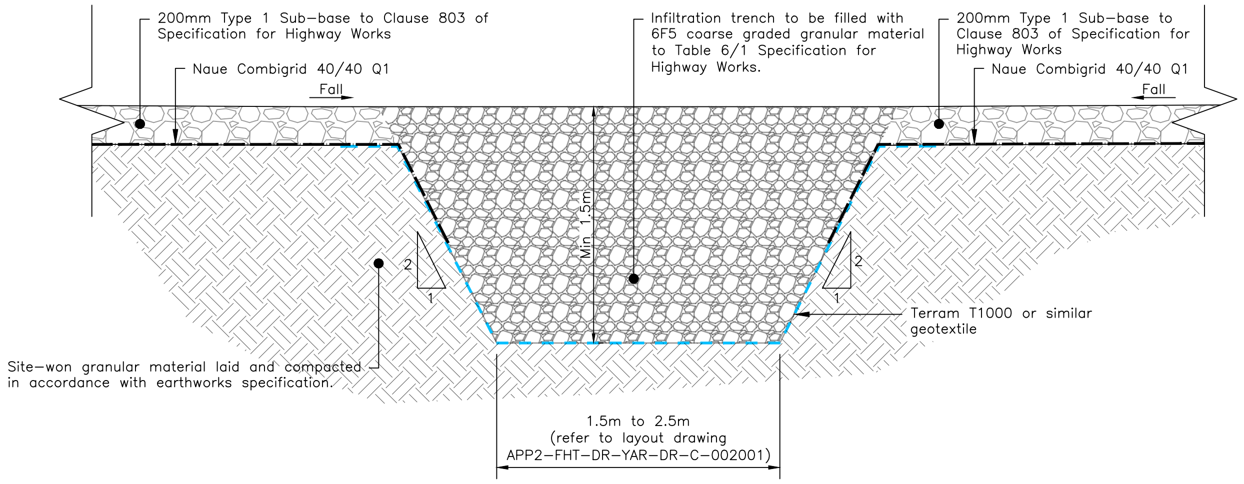
Typical Roadside Infiltration Trench Detail

Scale 1:20



Typical Roadside Infiltration Trench Detail

Scale 1:20



Typical Infiltration Trench Detail

Scale 1:20

Do not scale from this drawing.

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CONSTRUCTION:
SOIL CONTAMINATION
EXISTING SERVICES
EXCAVATIONS
SEWAGE

DEMOLITION:
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2. All dimensions in this drawing are in millimetres, unless noted otherwise.
3. This drawing is to be read in conjunction with all architectural and engineering drawings, details and specifications.
4. Any discrepancies should be reported to the engineer immediately so clarification can be sought.
5. For clarity this drawing should only be printed and read in colour.
6. All manhole to be constructed in all Specifications for Highway Works.
7. Refer to Fairhurst drawing APP2-FHTRD-YAR-DR-C-002050 for Sheet 1 of Typical Drainage Construction Details.
8. Refer to Fairhurst drawing APP2-FHT-DR-YAR-DR-C-002001 for Surface Water Drainage Layout Plan.
9. Refer to Fairhurst drawing APP2-FHT-DR-YAR-DR-C-002100 for Foul Drainage Layout Plan.

Rev.	Date	Description	Drwn.	Chkd.	Appd.
03	13.08.25	Car Park Filter Drain and Soakaway details removed.	LB	AH	AKF
02	18.07.25	Combigrid notes added. Service strip details updated. Soakaway annotation added. Typical infiltration trench detail added. Bedding detail moved to drawing APP2-FHT-DR-YAR-DR-C-002050	HF	AH	AKF
01	13.06.25	Roadside filter drain and concrete slab pipe protection details removed. Service strip added to roadside infiltration trench detail.	GM	AH	AKF

FAIRHURST
Barony House
Stoneyfield Business Park
INVERNESS
IV2 7PA
Tel: 01463 724 544

Client: Haventus

Project Title:
Ardersier Port Redevelopment Phase 2

Drawing Title:
Typical Drainage Construction Details Sheet 2 of 2

Scale at A1: As shown	Status: Concept	
Drawn: GM	Checked: AH	Approved: AKF
Date: 27/05/2025	Date: 28/05/2025	Date: 29/05/2025
Drawing No.: APP2-FHT-DR-YAR-DR-C-002051		Revision: 03

APPENDIX D – Ground Investigation

Historic and Current Uses of Ardersier Port, Inverness

Ardersier Port is situated on the southern shore of the Moray Firth near Inverness. The site was originally developed in the 1970s to support the construction of offshore oil platforms, with the establishment of the McDermott fabrication yard. Following the downturn in oil platform construction, the site was decommissioned and subsequently fell into disuse. In recent years, Ardersier Port has been proposed for redevelopment to support renewable energy projects and the offshore decommissioning sector. The port is currently being redeveloped as a strategic hub for the energy transition, including offshore wind development, subsea infrastructure support, and large-scale industrial use.

The proposed Phase 2 Yard Space development, the focus of this assessment, includes areas of both former port infrastructure in the north and an area of Forestry Commission managed woodland to the south of the port.

Site Geology and Ground Conditions

In the northern former fabrication yard area, ground conditions have been previously established by historic phases of post decommissioning/demolition ground investigation works undertaken in 2007 (*Envirocentre Ltd.*) consisting of boreholes and trial pit excavations across the site. More recent ground investigations have also been undertaken in 2023-2024 (*Solmek Ltd.*) associated with the new Quay Wall construction at the northern edges of the port, which are located to the north and west of the proposed Phase 2 yard space, consisting of deep boreholes and in-situ CPT and soil infiltration testing in trial pit excavations.

A review this historic investigation information identifies that in much of the former fabrication yard area of the site Made Ground and Fill deposits are present at surface, generally described as reworked natural Sand deposits (Raised Marine Deposits) with some localised areas of deeper made ground which includes anthropogenic content. These deposits, which vary in thickness and composition, are a result of the historic industrial uses and subsequent decommissioning and demolition activities. Underlying the granular Fill and Made Ground layers at site surface, the natural superficial geology comprises Raised Marine Deposits, primarily *medium dense to dense slightly silty slightly gravelly fine to coarse Sands*.

Boreholes drilled to depths of >60.0mbgl within the port site have not encountered bedrock, confirming the solid geology is present at significant depth beneath the site.

Groundwater was encountered at approximate depths between 3.00 to 5.00mbgl. The groundwater within this depth range is subject to tidal influence, consistent with the site's coastal location adjacent to the Moray Firth. Previous data logging of the groundwater level has indicated hydraulic connection between the underlying natural Sands and the nearby coastal/estuarine waters, which will lead to fluctuations in groundwater levels in response to tidal cycles. Previous data logging of the groundwater level has indicated approximately 0.4m of groundwater level fluctuation.

To the south, the proposed Phase 2 yard space will extend into an area of largely previously undeveloped forestry land. There is not extensive previous ground investigation information available for this southern area of the site however historic BGS borehole information and the historic use of this area indicate the ground conditions are less disturbed, with a topsoil layer overlying natural Raised Marine Sands at shallow depth, reflecting the land’s long-term use as woodland. Access tracks and surface water drainage ditches are present throughout the woodland.

Soil Infiltration Testing

Previous phases of site investigation carried out by *Solmek Ltd.* and *MAT test Site Services Ltd* included in-situ soil infiltration testing in close proximity to the northern section of the proposed Phase 2 Yard Space. These tests were conducted within areas of made ground overlying natural Raised Marine Sand deposits, which are consistent with the ground conditions identified across the northern part of the proposed Phase 2 yard space development area. As such, the results of this testing are considered relevant to the current development plans.

The infiltration data obtained allows an assessment of the permeability characteristics of the superficial soils, supporting the assessment of surface water drainage strategies and the feasibility of sustainable drainage systems (SuDS) within the Phase 2 area. Three tests per test location were undertaken and all testing was completed in accordance with BRE Digest 365. Refer to the Infiltration Testing Results Summary for the testing results.

CALCULATION

FAIRHURST

Contract:	Ardersier Port Phase 2	Sheet No.	1 of 1 Rev
Title:	Infiltration Testing Results Summary	Contract No.	162855
		Date:	13/06/2025
		Designer:	HF
		Checker:	AH

Author	Report/ Document	Test Reference	Average Infiltration Rate (m/s)
Solmek	S231026 - Factual Site Investigation Report Quay Wall Phase 3, Ardersier Port, Inverness	BHAWA02	1.77E-04
Solmek	S231026 - Factual Site Investigation Report Quay Wall Phase 3, Ardersier Port, Inverness	BHFWA03	2.10E-04
MATTest	Summary of Percolation Tests Haventus, Ardersier Port	Trial Pit 2	3.72E-05
MATTest	Summary of Percolation Tests Haventus, Ardersier Port	Trial Pit 4	8.57E-05
MATTest	Summary of Percolation Tests Haventus, Ardersier Port	Trial Pit 5	2.41E-05
MATTest	Summary of Percolation Tests Haventus, Ardersier Port	Trial Pit 6	3.55E-05
MATTest	Summary of Percolation Tests Haventus, Ardersier Port	Trial Pit 7	1.57E-05
MATTest	Summary of Percolation Tests Haventus, Ardersier Port	Trial Pit 8	5.13E-05
MATTest	Summary of Percolation Tests Haventus, Ardersier Port	Trial Pit E1	1.02E-04
MATTest	Summary of Percolation Tests Haventus, Ardersier Port	Trial Pit E2	7.56E-05

APPENDIX E – Design Calculations

CALCULATION

Contract	Port of Ardersier Phase 2
Part of Structure	Existing WWPS Inflow Capacity Estimate

Sheet No.	1 of 1	Rev	-
Contract No.	162855		
Date	07/05/2025		
Designer	AH		
Checker	DE		

Foul Discharge Calculations

Equivalent No. of Properties : H = 2000 Per Scottish Water meeting 07/05/2025

Demand per property: $Q_{f,base}$ = 400 litres/property/day (PDE form Guidance, 3.5 - Foul Discharge - Domestic)

Flow Calculations

Average Flow Demand : $Q_{f,avg} = (Q_{f,base} \times H) / 86400 =$ ***9.259 l/s***

Maximum Flow Demand : $Q_{f,max} = 2.5 \times Q_{f,avg} =$ ***23.148 l/s***

CALCULATION

FAIRHURST

Contract:	Port of Ardersier - Phase 2	Sheet No.	1 of 1 Rev -
Title:	Groundwater Risk Screening Matrix	Contract No.	162855
		Date:	22/04/2025
		Designer:	AH
		Checker:	AKF

Element Number	Element Description	Risk Description	Risk Score (RS)	Weighting Factor (WF)	Risk Score (RS x WF)
1	Pollution Hazard Traffic Density	All standard urban land use types (excluding high hazard and trunk roads/motorways) All standard urban land use types (excluding high hazard and trunk roads/motorways)	1	15	15
2	Standard Average Annual Rainfall	<740mm	1	15	15
3	Type of SuDS	Continuous unlined linear collection and conveyance components (eg filter strips, swales)	1	15	15
4	Unsaturated Zone Depth	1-5m	3	20	60
5	Predominant Flow Type Through Toils	Intergranular flow (occurs in unconsolidated or non-fractured consolidated deposits and fine or medium sands)	1	20	20
6	Unsaturated Zone Material	<1% Clay	3	5	15
7	Unsaturated Zone Organic Carbon Content : soil organic matter (SOM) content	<1% SOM	3	5	15
8	Unsaturated Zone pH	>8	1	5	5
			Total Risk Score		160

Low or Medium - Use Simple Index Approach. Note: For discharges to protected groundwater bodies, implement an upstream treatment component that will provide groundwater protection in the event of an unexpected pollution event or poor system performance.

Note: Sub-soil information based on interim borehole logs and Phase 1 Ground Investigation report. Final risk screening to be undertaken upon completion of Phase 2 Ground Investigation.

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
RES01		5.00	4.210		281550.554	857599.425	0.725
ICS01			4.210	500	281594.048	857573.764	1.062
RES02		5.00	4.505		281564.782	857623.541	1.025
ICS02	0.134	5.00	4.210	500	281608.276	857597.880	1.248
ICS03			4.393	500	281612.951	857605.803	1.493
MHS01	0.044	5.00	4.444	1200	281621.994	857600.468	1.614
Jct 01			4.113		281643.096	857588.018	1.405
Jct 02			4.031		281639.793	857582.420	1.356
Jct 03	0.027	5.00	4.025		281644.960	857579.371	1.380
MHS04	0.080	5.00	4.088	1200	281629.971	857553.965	0.924
MHS02			4.016	1200	281637.211	857566.237	1.447
MHS03			4.491	1200	281642.810	857562.934	1.965
SOAKAWAY			4.495		281649.192	857559.168	2.006

Links (Input)

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	RES01	ICS01	50.500	0.600	3.485	3.148	0.337	149.9	225	5.79	50.0
1.001	ICS01	ICS02	28.000	0.600	3.148	2.962	0.186	150.5	225	6.23	50.0
2.000	RES02	ICS02	50.500	0.600	3.480	2.962	0.518	97.5	225	5.64	50.0
1.002	ICS02	ICS03	9.200	0.600	2.962	2.900	0.062	148.4	225	6.37	50.0
1.003	ICS03	MHS01	10.500	0.600	2.900	2.830	0.070	150.0	225	6.54	50.0
1.004	MHS01	Jct 01	24.500	0.600	2.830	2.708	0.122	200.8	225	6.98	50.0
1.005	Jct 01	Jct 02	6.500	0.600	2.708	2.675	0.033	197.0	225	7.10	50.0
1.006	Jct 02	Jct 03	6.000	0.600	2.675	2.645	0.030	200.0	225	7.21	50.0
1.007	Jct 03	MHS02	15.250	0.600	2.645	2.569	0.076	200.7	300	7.44	50.0
3.000	MHS04	MHS02	14.248	0.600	3.164	2.569	0.595	23.9	225	5.09	50.0
1.008	MHS02	MHS03	6.500	0.600	2.569	2.526	0.043	151.2	300	7.52	50.0
1.009	MHS03	SOAKAWAY	7.411	0.600	2.526	2.489	0.037	200.3	300	7.63	50.0

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Detailed	Starting Level (m)	
Rainfall Events	Singular	Skip Steady State	x	Check Discharge Rate(s)	x
Summer CV	1.000	Drain Down Time (mins)	1440	Check Discharge Volume	x
Winter CV	1.000	Additional Storage (m³/ha)	0.0		

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	42	0	0
30	42	0	0
200	42	0	0

Node SOAKAWAY Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.18000	Invert Level (m)	2.489	Depth (m)	
Side Inf Coefficient (m/hr)	0.18000	Time to half empty (mins)	383	Inf Depth (m)	
Safety Factor	5.0	Pit Width (m)	30.000	Number Required	1
Porosity	0.30	Pit Length (m)	30.000		

Node Jct 01 Link Surround Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Link	1.004
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	2.708	Surround Shape	(Trench)
Safety Factor	1.0	Time to half empty (mins)	136	Diameter (mm)	2000

Node Jct 02 Link Surround Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Link	1.005
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	2.675	Surround Shape	(Trench)
Safety Factor	1.0	Time to half empty (mins)	177	Diameter (mm)	2000

Node Jct 03 Link Surround Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Link	1.006
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	2.645	Surround Shape	(Trench)
Safety Factor	1.0	Time to half empty (mins)	196	Diameter (mm)	2000

Node MHS02 Link Surround Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Link	1.007
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	2.569	Surround Shape	(Trench)
Safety Factor	1.0	Time to half empty (mins)	248	Diameter (mm)	2000

Node MHS02 Link Surround Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Link	3.000
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	2.569	Surround Shape	(Trench)
Safety Factor	1.0	Time to half empty (mins)	188	Diameter (mm)	2000

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
2 year +42% CC 15 minute summer	106.618	30.169	2 year +42% CC 8640 minute winter	1.440	0.569
2 year +42% CC 15 minute winter	74.820	30.169	2 year +42% CC 10080 minute summer	2.032	0.518
2 year +42% CC 30 minute summer	72.168	20.421	2 year +42% CC 10080 minute winter	1.312	0.518
2 year +42% CC 30 minute winter	50.644	20.421	30 year +42% CC 15 minute summer	305.935	86.569
2 year +42% CC 60 minute summer	51.108	13.506	30 year +42% CC 15 minute winter	214.691	86.569
2 year +42% CC 60 minute winter	33.955	13.506	30 year +42% CC 30 minute summer	214.708	60.755
2 year +42% CC 120 minute summer	36.592	9.670	30 year +42% CC 30 minute winter	150.672	60.755
2 year +42% CC 120 minute winter	24.311	9.670	30 year +42% CC 60 minute summer	154.412	40.807
2 year +42% CC 180 minute summer	30.257	7.786	30 year +42% CC 60 minute winter	102.588	40.807
2 year +42% CC 180 minute winter	19.668	7.786	30 year +42% CC 120 minute summer	99.020	26.168
2 year +42% CC 240 minute summer	25.039	6.617	30 year +42% CC 120 minute winter	65.786	26.168
2 year +42% CC 240 minute winter	16.636	6.617	30 year +42% CC 180 minute summer	78.492	20.199
2 year +42% CC 360 minute summer	20.166	5.190	30 year +42% CC 180 minute winter	51.022	20.199
2 year +42% CC 360 minute winter	13.109	5.190	30 year +42% CC 240 minute summer	63.360	16.744
2 year +42% CC 480 minute summer	16.380	4.329	30 year +42% CC 240 minute winter	42.095	16.744
2 year +42% CC 480 minute winter	10.882	4.329	30 year +42% CC 360 minute summer	49.348	12.699
2 year +42% CC 600 minute summer	13.676	3.741	30 year +42% CC 360 minute winter	32.077	12.699
2 year +42% CC 600 minute winter	9.345	3.741	30 year +42% CC 480 minute summer	39.093	10.331
2 year +42% CC 720 minute summer	12.348	3.309	30 year +42% CC 480 minute winter	25.972	10.331
2 year +42% CC 720 minute winter	8.299	3.309	30 year +42% CC 600 minute summer	31.998	8.752
2 year +42% CC 960 minute summer	10.290	2.710	30 year +42% CC 600 minute winter	21.863	8.752
2 year +42% CC 960 minute winter	6.816	2.710	30 year +42% CC 720 minute summer	28.417	7.616
2 year +42% CC 1440 minute summer	7.571	2.029	30 year +42% CC 720 minute winter	19.098	7.616
2 year +42% CC 1440 minute winter	5.088	2.029	30 year +42% CC 960 minute summer	23.064	6.073
2 year +42% CC 2160 minute summer	5.441	1.504	30 year +42% CC 960 minute winter	15.278	6.073
2 year +42% CC 2160 minute winter	3.749	1.504	30 year +42% CC 1440 minute summer	16.361	4.385
2 year +42% CC 2880 minute summer	4.535	1.215	30 year +42% CC 1440 minute winter	10.996	4.385
2 year +42% CC 2880 minute winter	3.047	1.215	30 year +42% CC 2160 minute summer	11.407	3.152
2 year +42% CC 4320 minute summer	3.466	0.906	30 year +42% CC 2160 minute winter	7.860	3.152
2 year +42% CC 4320 minute winter	2.283	0.906	30 year +42% CC 2880 minute summer	9.332	2.501
2 year +42% CC 5760 minute summer	2.896	0.741	30 year +42% CC 2880 minute winter	6.272	2.501
2 year +42% CC 5760 minute winter	1.874	0.741	30 year +42% CC 4320 minute summer	6.983	1.826
2 year +42% CC 7200 minute summer	2.505	0.639	30 year +42% CC 4320 minute winter	4.598	1.826
2 year +42% CC 7200 minute winter	1.617	0.639	30 year +42% CC 5760 minute summer	5.765	1.476
2 year +42% CC 8640 minute summer	2.231	0.569	30 year +42% CC 5760 minute winter	3.731	1.476

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
30 year +42% CC 7200 minute summer	4.958	1.265	200 year +42% CC 600 minute summer	47.847	13.087
30 year +42% CC 7200 minute winter	3.200	1.265	200 year +42% CC 600 minute winter	32.692	13.087
30 year +42% CC 8640 minute summer	4.402	1.123	200 year +42% CC 720 minute summer	42.158	11.299
30 year +42% CC 8640 minute winter	2.841	1.123	200 year +42% CC 720 minute winter	28.333	11.299
30 year +42% CC 10080 minute summer	4.005	1.022	200 year +42% CC 960 minute summer	33.819	8.905
30 year +42% CC 10080 minute winter	2.585	1.022	200 year +42% CC 960 minute winter	22.402	8.905
200 year +42% CC 15 minute summer	472.106	133.590	200 year +42% CC 1440 minute summer	23.664	6.342
200 year +42% CC 15 minute winter	331.302	133.590	200 year +42% CC 1440 minute winter	15.904	6.342
200 year +42% CC 30 minute summer	337.163	95.405	200 year +42% CC 2160 minute summer	16.276	4.498
200 year +42% CC 30 minute winter	236.606	95.405	200 year +42% CC 2160 minute winter	11.214	4.498
200 year +42% CC 60 minute summer	246.430	65.124	200 year +42% CC 2880 minute summer	13.184	3.533
200 year +42% CC 60 minute winter	163.722	65.124	200 year +42% CC 2880 minute winter	8.860	3.533
200 year +42% CC 120 minute summer	156.812	41.441	200 year +42% CC 4320 minute summer	9.724	2.542
200 year +42% CC 120 minute winter	104.182	41.441	200 year +42% CC 4320 minute winter	6.404	2.542
200 year +42% CC 180 minute summer	123.209	31.706	200 year +42% CC 5760 minute summer	7.943	2.033
200 year +42% CC 180 minute winter	80.089	31.706	200 year +42% CC 5760 minute winter	5.141	2.033
200 year +42% CC 240 minute summer	98.565	26.048	200 year +42% CC 7200 minute summer	6.770	1.727
200 year +42% CC 240 minute winter	65.485	26.048	200 year +42% CC 7200 minute winter	4.369	1.727
200 year +42% CC 360 minute summer	75.501	19.429	200 year +42% CC 8640 minute summer	5.965	1.522
200 year +42% CC 360 minute winter	49.077	19.429	200 year +42% CC 8640 minute winter	3.850	1.522
200 year +42% CC 480 minute summer	59.042	15.603	200 year +42% CC 10080 minute summer	5.391	1.375
200 year +42% CC 480 minute winter	39.226	15.603	200 year +42% CC 10080 minute winter	3.480	1.375

Results for 2 year +42% CC Critical Storm Duration. Lowest mass balance: 98.79%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	RES01	1	3.485	0.000	0.0	0.0000	0.0000	OK
15 minute summer	ICS01	1	3.148	0.000	0.0	0.0000	0.0000	OK
15 minute summer	RES02	1	3.480	0.000	0.0	0.0000	0.0000	OK
15 minute summer	ICS02	11	3.095	0.133	23.4	0.0260	0.0000	OK
15 minute summer	ICS03	11	3.035	0.135	22.6	0.0264	0.0000	OK
15 minute summer	MHS01	11	2.986	0.156	29.8	0.1759	0.0000	OK
15 minute summer	Jct 01	12	2.854	0.146	29.7	1.1330	0.0000	OK
15 minute summer	Jct 02	12	2.820	0.145	28.5	0.4558	0.0000	OK
15 minute summer	Jct 03	12	2.788	0.143	32.2	0.4188	0.0000	OK
15 minute summer	MHS04	10	3.219	0.055	14.0	0.0619	0.0000	OK
15 minute summer	MHS02	12	2.738	0.169	43.5	1.4447	0.0000	OK
15 minute summer	MHS03	12	2.682	0.156	42.9	0.1763	0.0000	OK
120 minute summer	SOAKAWAY	82	2.581	0.092	26.9	24.8683	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
15 minute summer	RES01	1.000	ICS01	0.0	0.000	0.000	0.0000
15 minute summer	ICS01	1.001	ICS02	0.0	0.000	0.000	0.3411
15 minute summer	RES02	2.000	ICS02	0.0	0.000	0.000	0.6151
15 minute summer	ICS02	1.002	ICS03	22.6	0.922	0.531	0.2263
15 minute summer	ICS03	1.003	MHS01	22.6	0.836	0.534	0.2840
15 minute summer	MHS01	1.004	Jct 01	29.7	1.098	0.813	0.6811
15 minute summer	Jct 01	1.005	Jct 02	28.5	1.052	0.773	0.1761
15 minute summer	Jct 02	1.006	Jct 03	28.5	1.066	0.778	0.1609
15 minute summer	Jct 03	1.007	MHS02	32.1	0.866	0.411	0.5653
15 minute summer	MHS04	3.000	MHS02	13.9	1.046	0.131	0.2740
15 minute summer	MHS02	1.008	MHS03	42.9	1.099	0.475	0.2535
15 minute summer	MHS03	1.009	SOAKAWAY	42.7	2.421	0.546	0.1524
120 minute summer	SOAKAWAY	Infiltration		9.1			

Results for 30 year +42% CC Critical Storm Duration. Lowest mass balance: 98.79%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute summer	RES01	21	3.624	0.139	9.0	0.0000	0.0000	OK
30 minute summer	ICS01	20	3.608	0.460	20.6	0.0901	0.0000	SURCHARGED
30 minute summer	RES02	20	3.619	0.139	9.9	0.0000	0.0000	OK
30 minute summer	ICS02	20	3.603	0.641	64.5	0.1256	0.0000	SURCHARGED
30 minute summer	ICS03	20	3.508	0.608	42.8	0.1191	0.0000	SURCHARGED
30 minute summer	MHS01	19	3.408	0.578	61.1	0.6535	0.0000	SURCHARGED
30 minute summer	Jct 01	21	3.079	0.371	59.2	4.2716	0.0000	SURCHARGED
30 minute summer	Jct 02	20	3.001	0.326	57.3	1.1287	0.0000	SURCHARGED
30 minute summer	Jct 03	20	2.934	0.289	63.9	0.9155	0.0000	OK
15 minute summer	MHS04	10	3.259	0.095	40.2	0.1075	0.0000	OK
30 minute summer	MHS02	19	2.880	0.311	94.8	3.1957	0.0000	SURCHARGED
240 minute summer	MHS03	168	2.835	0.309	47.8	0.3493	0.0000	SURCHARGED
240 minute summer	SOAKAWAY	172	2.834	0.345	47.6	93.1856	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
30 minute summer	RES01	1.000	ICS01	-9.0	-0.290	-0.213	1.6536
30 minute summer	ICS01	1.001	ICS02	-20.6	-0.519	-0.487	1.1136
30 minute summer	RES02	2.000	ICS02	-9.9	-0.303	-0.188	1.6564
30 minute summer	ICS02	1.002	ICS03	42.8	1.076	1.005	0.3659
30 minute summer	ICS03	1.003	MHS01	43.5	1.094	1.028	0.4176
30 minute summer	MHS01	1.004	Jct 01	59.2	1.490	1.622	0.9744
30 minute summer	Jct 01	1.005	Jct 02	57.3	1.440	1.552	0.2585
30 minute summer	Jct 02	1.006	Jct 03	58.5	1.471	1.598	0.2386
30 minute summer	Jct 03	1.007	MHS02	65.3	1.011	0.835	1.0679
15 minute summer	MHS04	3.000	MHS02	40.1	1.260	0.376	0.3968
30 minute summer	MHS02	1.008	MHS03	93.1	1.368	1.032	0.4345
240 minute summer	MHS03	1.009	SOAKAWAY	47.6	1.393	0.608	0.5219
240 minute summer	SOAKAWAY	Infiltration		9.4			

Results for 200 year +42% CC Critical Storm Duration. Lowest mass balance: 98.79%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	RES01	11	4.210	0.725	23.5	0.0000	0.0000	FLOOD RISK
60 minute summer	ICS01	33	4.210	1.062	23.8	0.2082	1.1197	FLOOD
30 minute summer	RES02	18	4.274	0.794	21.9	0.0000	0.0000	FLOOD RISK
30 minute summer	ICS02	18	4.210	1.248	101.3	0.2446	4.5577	FLOOD
30 minute summer	ICS03	19	4.080	1.180	54.1	0.2313	0.0000	SURCHARGED
30 minute summer	MHS01	19	3.938	1.108	84.7	1.2533	0.0000	SURCHARGED
60 minute summer	Jct 01	38	3.350	0.642	78.9	8.2489	0.0000	SURCHARGED
60 minute summer	Jct 02	38	3.228	0.553	69.6	2.0151	0.0000	SURCHARGED
60 minute summer	Jct 03	37	3.116	0.471	79.4	1.5687	0.0000	SURCHARGED
30 minute summer	MHS04	18	3.311	0.147	60.7	0.1668	0.0000	OK
180 minute winter	MHS02	172	3.100	0.531	58.6	6.7386	0.0000	SURCHARGED
180 minute winter	MHS03	172	3.099	0.573	55.8	0.6481	0.0000	SURCHARGED
180 minute winter	SOAKAWAY	172	3.098	0.609	55.5	164.4814	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
15 minute summer	RES01	1.000	ICS01	-23.5	-0.643	-0.555	2.0084
60 minute summer	ICS01	1.001	ICS02	-23.8	-0.598	-0.562	1.1136
30 minute summer	RES02	2.000	ICS02	-21.9	-0.550	-0.416	2.0084
30 minute summer	ICS02	1.002	ICS03	54.1	1.360	1.270	0.3659
30 minute summer	ICS03	1.003	MHS01	54.4	1.368	1.285	0.4176
30 minute summer	MHS01	1.004	Jct 01	83.6	2.103	2.289	0.9744
60 minute summer	Jct 01	1.005	Jct 02	69.6	1.750	1.887	0.2585
60 minute summer	Jct 02	1.006	Jct 03	69.8	1.756	1.908	0.2386
60 minute summer	Jct 03	1.007	MHS02	79.4	1.128	1.016	1.0739
30 minute summer	MHS04	3.000	MHS02	60.5	1.643	0.567	0.4797
180 minute winter	MHS02	1.008	MHS03	55.8	1.058	0.619	0.4577
180 minute winter	MHS03	1.009	SOAKAWAY	55.5	1.713	0.709	0.5219
180 minute winter	SOAKAWAY	Infiltration		9.7			

CALCULATION

FAIRHURST

Contract	Port of Ardersier Phase 2
Calculations For	Population Equivalent for Non-Domestic Foul Drainage System

Sheet No.	1 of 1 Rev -
Contract No.	162855
Date	01/05/2025
Designer	AH
Checker	DE

1.0 - Number of people, N: **4000 people per day** (Haventus)

2.0 - Per SEPA's How to Apply for a Licence to Discharge Sewage Effluent, the population equivalent(PE) for non-domestic sites can be calculated by multiplying the number of people using the system BOD (g/day) and dividing by 60.

Activity/ Building
Open Industrial Site

BOD = **25 g/day** (Flows and Load 4 - Table of Loadings for Sewage Treatment Systems)

PE ≈ (No. of people x BOD)/ 60 ≈ **1666.7**

3.0 - Foul treatment system to be suitable for PE = **1667**

4.0 - CAR Licence/ Registration Requirements

Licence - Per SEPA's CAR a Practical Guide, a Simple licence is required for a PE of >15-100

5.0 - Maximum Daily Loading (Flows and Loads 4)

Flow (L) Per Person per day = **60**
Average flow = N x L = **240000 L/day** **(240.00 m³/day)**
Assume **24** hour working day = **86400 seconds per work day**
Flow per second = Average Flow/ Seconds per work day = **2.8 L/s**
Max BOD = N x BOD = **100000 g/day** **(100.00 kg/day)**

6.0 - Flow Estimation to Sewers for Scotland 4th Edition

Per Sewers for Scotland 4th Edition, domestic flow from industrial sites can be calculated by multiplying the area of the developable land (ha) by 0.6 litres per second.

Total site area = **219 ha**
Estimated Flow = Total site area x 0.6 = **131 L/s**

7.0 - Design Foul Flow

Proposed development site is to be open industrial with shift working. Estimated flow rate derived from Sewer for Scotland 4th edition method is equivalent to average flow rate approximately 7050 domestic properties. Flow rate estimation derived from SEPA's guidance document is equivalent to approximately 470 domestic properties. It is, therefore, considered that the flow rate estimation derived from SEPA's guidance document is more proportionate to the proposed development site's intended use and equivalent population.

Design average foul flow rate = **2.8 L/s**

Design peak foul flow rate (x2.5) = **6.9 L/s**

CALCULATION

FAIRHURST

Contract	Ardersier Port Phase 2
Part of Structure	Yard Infiltration Trench Size Calculation Infiltration Trench 01

Sheet No.	1 of 9	Rev A
Contract No.	162855	
Date	17/07/2025	
Designer	HF	
Checker	AH	

Design Rainfall

Climate Change Allowance **42 %**

From Wallingford Procedure, Volume 3 - Maps

From Wallingford Procedure, Volume 3 - Maps - Rainfall Depths (M5 - 60minutes) **M5_60=** **13 mm**

From BRE Digest 365, fig. 1 **rainfall ratio r =** **0.250**

Design Storm Return Period **P=** **5 yrs**

D mins	M5_D	Z2	R = MP_D	Rainfall Intensity
5	3.8 mm	1.448	5.5 mm	55 mm/hr
10	5.7 mm	1.450	8.3 mm	50 mm/hr
15	7.0 mm	1.454	10.2 mm	41 mm/hr
30	9.7 mm	1.462	14.2 mm	28 mm/hr
60	13.0 mm	1.463	19.0 mm	19 mm/hr
120	17.1 mm	1.457	24.9 mm	12 mm/hr
240	22.2 mm	1.448	32.1 mm	8 mm/hr
360	25.8 mm	1.448	37.3 mm	6 mm/hr
600	31.1 mm	1.448	45.0 mm	5 mm/hr
1440	42.8 mm	1.448	62.0 mm	3 mm/hr
2880	55.1 mm	1.448	79.8 mm	2 mm/hr

Infiltration Rate

Measured Infiltration Rate = ***5.00E-05 m/s***

OR Outlet Flow Rate =

Impermeable Area = ***178427 m²***

Runoff Coefficient, C: ***0.3***

Contributing Area = ***53528 m²***

Trench Properties

Width = ***2.5 m***

Trench Depth = ***1.5 m***

(Optional) Fixed Length = ***961.0 m***

Gravel free volume = 30%

(Trench fill material)

D	Length	Inflow	Outflow	Storage Req	t_{s50} (hrs)	Storage Prov	Overflow
5	961	293.2	21.7	271.5	0.52	1081.1 m³	
10	961	443.1	43.4	399.7	0.77	1081.1 m³	
15	961	548.5	65.0	483.4	0.93	1081.1 m³	
30	961	761.1	130.1	631.0	1.21	1081.1 m³	
60	961	1017.8	260.1	757.6	1.46	1081.1 m³	
120	961	1330.3	520.3	810.0	1.56	1081.1 m³	
240	961	1718.3	1040.6	677.7	1.30	1081.1 m³	
360	961	1997.6	1560.9	436.7	0.84	1081.1 m³	
600	961	2411.0	2601.5	0.0	0.00	1081.1 m³	
1440	961	3320.4	6243.5	0.0	0.00	1081.1 m³	
2880	961	4273.5	12487.0	0.0	0.00	1081.1 m³	

Time until system can cope with additional influx of 50% design storage volume < 24 hrs ~ OK

- **Provide gravel filled a trench that is a minimum of 961 m x 2.5 m x 1.5 m deep**
- **Minimum Gravel Free Volume = 30%**
- **Total Pit Volume = 3603.8m³**

(Note that the depth is measured below the inlet pipe invert)

CALCULATION

FAIRHURST

Contract	Ardersier Port Phase 2
Part of Structure	Yard Infiltration Trench Size Calculation Infiltration Trench 02

Sheet No.	2 of 9	Rev	A
Contract No.	162855		
Date	17/07/2025		
Designer	HF		
Checker	AH		

Design Rainfall

Climate Change Allowance **42 %**

From Wallingford Procedure, Volume 3 - Maps

From Wallingford Procedure, Volume 3 - Maps - Rainfall Depths (M5 - 60minutes) **M5_60=** **13 mm**

From BRE Digest 365, fig. 1 **rainfall ratio r =** **0.250**

Design Storm Return Period **P=** **5 yrs**

D mins	M5_D	Z2	R = MP_D	Rainfall Intensity
5	3.8 mm	1.448	5.5 mm	55 mm/hr
10	5.7 mm	1.450	8.3 mm	50 mm/hr
15	7.0 mm	1.454	10.2 mm	41 mm/hr
30	9.7 mm	1.462	14.2 mm	28 mm/hr
60	13.0 mm	1.463	19.0 mm	19 mm/hr
120	17.1 mm	1.457	24.9 mm	12 mm/hr
240	22.2 mm	1.448	32.1 mm	8 mm/hr
360	25.8 mm	1.448	37.3 mm	6 mm/hr
600	31.1 mm	1.448	45.0 mm	5 mm/hr
1440	42.8 mm	1.448	62.0 mm	3 mm/hr
2880	55.1 mm	1.448	79.8 mm	2 mm/hr

Infiltration Rate

Measured Infiltration Rate = ***5.00E-05 m/s***

OR Outlet Flow Rate =

Impermeable Area = *78333 m²*

Runoff Coefficient, C: *0.3*

Contributing Area = *23500 m²*

Trench Properties

Width = *1.5 m*

Trench Depth = *1.5 m*

(Optional) Fixed Length = *538.0 m*

Gravel free volume = 30%

(Trench fill material)

D	Length	Inflow	Outflow	Storage Req	t_{s50} (hrs)	Storage Prov	Overflow
5	538	128.7	12.1	116.6	0.40	363.2 m³	
10	538	194.5	24.3	170.2	0.58	363.2 m³	
15	538	240.8	36.4	204.4	0.70	363.2 m³	
30	538	334.1	72.8	261.3	0.90	363.2 m³	
60	538	446.8	145.7	301.2	1.03	363.2 m³	
120	538	584.0	291.3	292.7	1.00	363.2 m³	
240	538	754.4	582.7	171.7	0.59	363.2 m³	
360	538	877.0	874.0	3.0	0.01	363.2 m³	
600	538	1058.5	1456.7	0.0	0.00	363.2 m³	
1440	538	1457.7	3496.0	0.0	0.00	363.2 m³	
2880	538	1876.1	6991.9	0.0	0.00	363.2 m³	

Time until system can cope with additional influx of 50% design storage volume < 24 hrs ~ OK

- **Provide gravel filled a trench that is a minimum of 538 m x 1.5 m x 1.5 m deep**
- **Minimum Gravel Free Volume = 30%**
- **Total Pit Volume = 1210.5m³**

(Note that the depth is measured below the inlet pipe invert)

CALCULATION

FAIRHURST

Contract	Ardersier Port Phase 2
Part of Structure	Yard Infiltration Trench Size Calculation Infiltration Trench 03

Sheet No.	3 of 9	Rev	A
Contract No.	162855		
Date	17/07/2025		
Designer	HF		
Checker	AH		

Design Rainfall

Climate Change Allowance **42 %**

From Wallingford Procedure, Volume 3 - Maps

From Wallingford Procedure, Volume 3 - Maps - Rainfall Depths (M5 - 60minutes) **M5_60=** **13 mm**

From BRE Digest 365, fig. 1 **rainfall ratio r =** **0.250**

Design Storm Return Period **P=** **5 yrs**

D mins	M5_D	Z2	R = MP_D	Rainfall Intensity
5	3.8 mm	1.448	5.5 mm	55 mm/hr
10	5.7 mm	1.450	8.3 mm	50 mm/hr
15	7.0 mm	1.454	10.2 mm	41 mm/hr
30	9.7 mm	1.462	14.2 mm	28 mm/hr
60	13.0 mm	1.463	19.0 mm	19 mm/hr
120	17.1 mm	1.457	24.9 mm	12 mm/hr
240	22.2 mm	1.448	32.1 mm	8 mm/hr
360	25.8 mm	1.448	37.3 mm	6 mm/hr
600	31.1 mm	1.448	45.0 mm	5 mm/hr
1440	42.8 mm	1.448	62.0 mm	3 mm/hr
2880	55.1 mm	1.448	79.8 mm	2 mm/hr

Infiltration Rate

Measured Infiltration Rate = ***5.00E-05 m/s***

OR Outlet Flow Rate =

Impermeable Area = ***122279 m²***

Runoff Coefficient, C: ***0.3***

Contributing Area = ***36684 m²***

Trench Properties

Width = ***1.5 m***

Trench Depth = ***1.5 m***

(Optional) Fixed Length = ***780.0 m***

Gravel free volume = 30%

(Trench fill material)

D	Length	Inflow	Outflow	Storage Req	t_{s50} (hrs)	Storage Prov	Overflow
5	780	200.9	17.6	183.3	0.43	526.5 m³	
10	780	303.6	35.2	268.5	0.64	526.5 m³	
15	780	375.9	52.8	323.1	0.77	526.5 m³	
30	780	521.6	105.5	416.1	0.99	526.5 m³	
60	780	697.5	211.0	486.5	1.15	526.5 m³	
120	780	911.7	422.0	489.7	1.16	526.5 m³	
240	780	1177.6	844.0	333.6	0.79	526.5 m³	
360	780	1369.0	1266.0	102.9	0.24	526.5 m³	
600	780	1652.3	2110.1	0.0	0.00	526.5 m³	
1440	780	2275.5	5064.1	0.0	0.00	526.5 m³	
2880	780	2928.7	10128.2	0.0	0.00	526.5 m³	

Time until system can cope with additional influx of 50% design storage volume < 24 hrs ~ OK

- **Provide gravel filled a trench that is a minimum of 780 m x 1.5 m x 1.5 m deep**
- **Minimum Gravel Free Volume = 30%**
- **Total Pit Volume = 1755m³**

(Note that the depth is measured below the inlet pipe invert)

CALCULATION

FAIRHURST

Contract	Ardersier Port Phase 2
Part of Structure	Yard Infiltration Trench Size Calculation Infiltration Trench 04

Sheet No.	4 of 9	Rev	A

Contract No.	162855
Date	17/07/2025
Designer	HF
Checker	AH

Design Rainfall

Climate Change Allowance **42 %**

From Wallingford Procedure, Volume 3 - Maps

From Wallingford Procedure, Volume 3 - Maps - Rainfall Depths (M5 - 60minutes) **M5_60=** **13 mm**

From BRE Digest 365, fig. 1 **rainfall ratio r =** **0.250**

Design Storm Return Period **P=** **5 yrs**

D mins	M5_D	Z2	R = MP_D	Rainfall Intensity
5	3.8 mm	1.448	5.5 mm	55 mm/hr
10	5.7 mm	1.450	8.3 mm	50 mm/hr
15	7.0 mm	1.454	10.2 mm	41 mm/hr
30	9.7 mm	1.462	14.2 mm	28 mm/hr
60	13.0 mm	1.463	19.0 mm	19 mm/hr
120	17.1 mm	1.457	24.9 mm	12 mm/hr
240	22.2 mm	1.448	32.1 mm	8 mm/hr
360	25.8 mm	1.448	37.3 mm	6 mm/hr
600	31.1 mm	1.448	45.0 mm	5 mm/hr
1440	42.8 mm	1.448	62.0 mm	3 mm/hr
2880	55.1 mm	1.448	79.8 mm	2 mm/hr

Infiltration Rate

Measured Infiltration Rate = ***5.00E-05 m/s***

OR Outlet Flow Rate =

Impermeable Area = ***143106 m²***

Runoff Coefficient, C: ***0.3***

Contributing Area = ***42932 m²***

Trench Properties

Width = ***1.5 m***

Trench Depth = ***1.5 m***

(Optional) Fixed Length = ***922.0 m***

Gravel free volume = 30%

(Trench fill material)

D	Length	Inflow	Outflow	Storage Req	t_{s50} (hrs)	Storage Prov	Overflow
5	922	235.1	20.8	214.4	0.43	622.4 m³	
10	922	355.4	41.6	313.8	0.63	622.4 m³	
15	922	439.9	62.3	377.6	0.76	622.4 m³	
30	922	610.4	124.7	485.7	0.97	622.4 m³	
60	922	816.3	249.3	567.0	1.14	622.4 m³	
120	922	1067.0	498.7	568.3	1.14	622.4 m³	
240	922	1378.2	997.4	380.8	0.76	622.4 m³	
360	922	1602.1	1496.1	106.1	0.21	622.4 m³	
600	922	1933.7	2493.5	0.0	0.00	622.4 m³	
1440	922	2663.1	5984.3	0.0	0.00	622.4 m³	
2880	922	3427.5	11968.6	0.0	0.00	622.4 m³	

Time until system can cope with additional influx of 50% design storage volume < 24 hrs ~ OK

- **Provide gravel filled a trench that is a minimum of 922 m x 1.5 m x 1.5 m deep**
- **Minimum Gravel Free Volume = 30%**
- **Total Pit Volume = 2074.5m³**

(Note that the depth is measured below the inlet pipe invert)

CALCULATION

FAIRHURST

Contract	Ardersier Port Phase 2
Part of Structure	Yard Infiltration Trench Size Calculation Infiltration Trench 05

Sheet No.	5 of 9	Rev	A
Contract No.	162855		
Date	17/07/2025		
Designer	HF		
Checker	AH		

Design Rainfall

Climate Change Allowance **42 %**

From Wallingford Procedure, Volume 3 - Maps

From Wallingford Procedure, Volume 3 - Maps - Rainfall Depths (M5 - 60minutes) **M5_60=** **13 mm**

From BRE Digest 365, fig. 1 **rainfall ratio r =** **0.250**

Design Storm Return Period **P=** **5 yrs**

D mins	M5_D	Z2	R = MP_D	Rainfall Intensity
5	3.8 mm	1.448	5.5 mm	55 mm/hr
10	5.7 mm	1.450	8.3 mm	50 mm/hr
15	7.0 mm	1.454	10.2 mm	41 mm/hr
30	9.7 mm	1.462	14.2 mm	28 mm/hr
60	13.0 mm	1.463	19.0 mm	19 mm/hr
120	17.1 mm	1.457	24.9 mm	12 mm/hr
240	22.2 mm	1.448	32.1 mm	8 mm/hr
360	25.8 mm	1.448	37.3 mm	6 mm/hr
600	31.1 mm	1.448	45.0 mm	5 mm/hr
1440	42.8 mm	1.448	62.0 mm	3 mm/hr
2880	55.1 mm	1.448	79.8 mm	2 mm/hr

Infiltration Rate

Measured Infiltration Rate = ***5.00E-05 m/s***

OR Outlet Flow Rate =

Impermeable Area = ***52007 m²***

Runoff Coefficient, C: ***0.3***

Contributing Area = ***15602 m²***

Trench Properties

Width = ***1.5 m***

Trench Depth = ***1.5 m***

(Optional) Fixed Length = ***378.0 m***

Gravel free volume = 30%

(Trench fill material)

D	Length	Inflow	Outflow	Storage Req	t_{s50} (hrs)	Storage Prov	Overflow
5	378	85.5	8.5	76.9	0.38	255.2 m³	
10	378	129.1	17.1	112.1	0.55	255.2 m³	
15	378	159.9	25.6	134.2	0.66	255.2 m³	
30	378	221.8	51.2	170.6	0.83	255.2 m³	
60	378	296.7	102.5	194.2	0.95	255.2 m³	
120	378	387.7	204.9	182.8	0.89	255.2 m³	
240	378	500.8	409.9	91.0	0.44	255.2 m³	
360	378	582.2	614.8	0.0	0.00	255.2 m³	
600	378	702.7	1024.7	0.0	0.00	255.2 m³	
1440	378	967.8	2459.2	0.0	0.00	255.2 m³	
2880	378	1245.6	4918.3	0.0	0.00	255.2 m³	

Time until system can cope with additional influx of 50% design storage volume < 24 hrs ~ OK

- **Provide gravel filled a trench that is a minimum of 378 m x 1.5 m x 1.5 m deep**
- **Minimum Gravel Free Volume = 30%**
- **Total Pit Volume = 850.5m³**

(Note that the depth is measured below the inlet pipe invert)

CALCULATION	FAIRHURST

Contract	Ardersier Port Phase 2	Sheet No.	6 of 9 Rev A
Part of Structure	Yard Infiltration Trench Size Calculation Infiltration Trench 06	Contract No.	162855
		Date	17/07/2025
		Designer	HF
		Checker	AH

Design Rainfall

Climate Change Allowance **42 %**

From Wallingford Procedure, Volume 3 - Maps

From Wallingford Procedure, Volume 3 - Maps - Rainfall Depths (M5 - 60minutes) **M5_60=** **13 mm**

From BRE Digest 365, fig. 1 **rainfall ratio r =** **0.250**

Design Storm Return Period **P=** **5 yrs**

D mins	M5_D	Z2	R = MP_D	Rainfall Intensity
5	3.8 mm	1.448	5.5 mm	55 mm/hr
10	5.7 mm	1.450	8.3 mm	50 mm/hr
15	7.0 mm	1.454	10.2 mm	41 mm/hr
30	9.7 mm	1.462	14.2 mm	28 mm/hr
60	13.0 mm	1.463	19.0 mm	19 mm/hr
120	17.1 mm	1.457	24.9 mm	12 mm/hr
240	22.2 mm	1.448	32.1 mm	8 mm/hr
360	25.8 mm	1.448	37.3 mm	6 mm/hr
600	31.1 mm	1.448	45.0 mm	5 mm/hr
1440	42.8 mm	1.448	62.0 mm	3 mm/hr
2880	55.1 mm	1.448	79.8 mm	2 mm/hr

Infiltration Rate

Measured Infiltration Rate = ***5.00E-05 m/s***

OR Outlet Flow Rate =

Impermeable Area = ***72949 m²***

Runoff Coefficient, C: ***0.3***

Contributing Area = ***21885 m²***

Trench Properties

Width = ***1.5 m***

Trench Depth = ***1.5 m***

(Optional) Fixed Length = ***626.0 m***

Gravel free volume = 30%

(Trench fill material)

D	Length	Inflow	Outflow	Storage Req	t_{s50} (hrs)	Storage Prov	Overflow
5	626	119.9	14.1	105.7	0.31	422.6 m³	
10	626	181.1	28.2	152.9	0.45	422.6 m³	
15	626	224.2	42.4	181.9	0.54	422.6 m³	
30	626	311.2	84.7	226.4	0.67	422.6 m³	
60	626	416.1	169.4	246.7	0.73	422.6 m³	
120	626	543.9	338.9	205.0	0.61	422.6 m³	
240	626	702.5	677.7	24.8	0.07	422.6 m³	
360	626	816.7	1016.6	0.0	0.00	422.6 m³	
600	626	985.7	1694.3	0.0	0.00	422.6 m³	
1440	626	1357.5	4066.2	0.0	0.00	422.6 m³	
2880	626	1747.2	8132.4	0.0	0.00	422.6 m³	

Time until system can cope with additional influx of 50% design storage volume < 24 hrs ~ OK

- **Provide gravel filled a trench that is a minimum of 626 m x 1.5 m x 1.5 m deep**
- **Minimum Gravel Free Volume = 30%**
- **Total Pit Volume = 1408.5m³**

(Note that the depth is measured below the inlet pipe invert)

CALCULATION

FAIRHURST

Contract	Ardersier Port Phase 2
Part of Structure	Yard Infiltration Trench Size Calculation Infiltration Trench 07

Sheet No.	7 of 9	Rev	A
Contract No.	162855		
Date	17/07/2025		
Designer	HF		
Checker	AH		

Design Rainfall

Climate Change Allowance **42 %**

From Wallingford Procedure, Volume 3 - Maps

From Wallingford Procedure, Volume 3 - Maps - Rainfall Depths (M5 - 60minutes) **M5_60=** **13 mm**

From BRE Digest 365, fig. 1 **rainfall ratio r =** **0.250**

Design Storm Return Period **P=** **5 yrs**

D mins	M5_D	Z2	R = MP_D	Rainfall Intensity
5	3.8 mm	1.448	5.5 mm	55 mm/hr
10	5.7 mm	1.450	8.3 mm	50 mm/hr
15	7.0 mm	1.454	10.2 mm	41 mm/hr
30	9.7 mm	1.462	14.2 mm	28 mm/hr
60	13.0 mm	1.463	19.0 mm	19 mm/hr
120	17.1 mm	1.457	24.9 mm	12 mm/hr
240	22.2 mm	1.448	32.1 mm	8 mm/hr
360	25.8 mm	1.448	37.3 mm	6 mm/hr
600	31.1 mm	1.448	45.0 mm	5 mm/hr
1440	42.8 mm	1.448	62.0 mm	3 mm/hr
2880	55.1 mm	1.448	79.8 mm	2 mm/hr

Infiltration Rate

Measured Infiltration Rate = ***5.00E-05 m/s***

OR Outlet Flow Rate =

Impermeable Area = ***124389 m²***

Runoff Coefficient, C: ***0.3***

Contributing Area = ***37317 m²***

Trench Properties

Width = ***2.0 m***

Trench Depth = ***1.5 m***

(Optional) Fixed Length = ***730.0 m***

Gravel free volume = 30%

(Trench fill material)

D	Length	Inflow	Outflow	Storage Req	t_{s50} (hrs)	Storage Prov	Overflow
5	730	204.4	16.5	187.9	0.48	657.0 m³	
10	730	308.9	32.9	275.9	0.70	657.0 m³	
15	730	382.4	49.4	332.9	0.84	657.0 m³	
30	730	530.6	98.8	431.7	1.09	657.0 m³	
60	730	709.5	197.6	511.9	1.30	657.0 m³	
120	730	927.4	395.3	532.1	1.35	657.0 m³	
240	730	1197.9	790.6	407.4	1.03	657.0 m³	
360	730	1392.6	1185.8	206.7	0.52	657.0 m³	
600	730	1680.8	1976.4	0.0	0.00	657.0 m³	
1440	730	2314.8	4743.4	0.0	0.00	657.0 m³	
2880	730	2979.2	9486.7	0.0	0.00	657.0 m³	

Time until system can cope with additional influx of 50% design storage volume < 24 hrs ~ OK

- **Provide gravel filled a trench that is a minimum of 730 m x 2 m x 1.5 m deep**
- **Minimum Gravel Free Volume = 30%**
- **Total Pit Volume = 2190m³**

(Note that the depth is measured below the inlet pipe invert)

CALCULATION

FAIRHURST

Contract	Ardersier Port Phase 2
Part of Structure	Yard Infiltration Trench Size Calculation Infiltration Trench 08

Sheet No.	8 of 9	Rev A
Contract No.	162855	
Date	17/07/2025	
Designer	HF	
Checker	AH	

Design Rainfall

Climate Change Allowance **42 %**

From Wallingford Procedure, Volume 3 - Maps

From Wallingford Procedure, Volume 3 - Maps - Rainfall Depths (M5 - 60minutes) **M5_60=** **13 mm**

From BRE Digest 365, fig. 1 **rainfall ratio r =** **0.250**

Design Storm Return Period **P=** **5 yrs**

D mins	M5_D	Z2	R = MP_D	Rainfall Intensity
5	3.8 mm	1.448	5.5 mm	55 mm/hr
10	5.7 mm	1.450	8.3 mm	50 mm/hr
15	7.0 mm	1.454	10.2 mm	41 mm/hr
30	9.7 mm	1.462	14.2 mm	28 mm/hr
60	13.0 mm	1.463	19.0 mm	19 mm/hr
120	17.1 mm	1.457	24.9 mm	12 mm/hr
240	22.2 mm	1.448	32.1 mm	8 mm/hr
360	25.8 mm	1.448	37.3 mm	6 mm/hr
600	31.1 mm	1.448	45.0 mm	5 mm/hr
1440	42.8 mm	1.448	62.0 mm	3 mm/hr
2880	55.1 mm	1.448	79.8 mm	2 mm/hr

Infiltration Rate

Measured Infiltration Rate = ***5.00E-05 m/s***

OR Outlet Flow Rate =

Impermeable Area = ***128822 m²***

Runoff Coefficient, C: ***0.3***

Contributing Area = ***38647 m²***

Trench Properties

Width = ***1.5 m***

Trench Depth = ***1.5 m***

(Optional) Fixed Length = ***814.0 m***

Gravel free volume = 30%

(Trench fill material)

D	Length	Inflow	Outflow	Storage Req	t_{s50} (hrs)	Storage Prov	Overflow
5	814	211.7	18.3	193.3	0.44	549.5 m³	
10	814	319.9	36.7	283.2	0.64	549.5 m³	
15	814	396.0	55.0	340.9	0.77	549.5 m³	
30	814	549.5	110.1	439.4	1.00	549.5 m³	
60	814	734.8	220.2	514.6	1.17	549.5 m³	
120	814	960.5	440.4	520.1	1.18	549.5 m³	
240	814	1240.6	880.7	359.9	0.82	549.5 m³	
360	814	1442.2	1321.1	121.1	0.28	549.5 m³	
600	814	1740.7	2201.9	0.0	0.00	549.5 m³	
1440	814	2397.3	5284.4	0.0	0.00	549.5 m³	
2880	814	3085.4	10568.9	0.0	0.00	549.5 m³	

Time until system can cope with additional influx of 50% design storage volume < 24 hrs ~ OK

- **Provide gravel filled a trench that is a minimum of 814 m x 1.5 m x 1.5 m deep**
- **Minimum Gravel Free Volume = 30%**
- **Total Pit Volume = 1831.5m³**

(Note that the depth is measured below the inlet pipe invert)

CALCULATION

FAIRHURST

Contract	Ardersier Port Phase 2
Part of Structure	Yard Infiltration Trench Size Calculation Infiltration Trench 09

Sheet No.	9 of 9	Rev A
Contract No.	162855	
Date	17/07/2025	
Designer	HF	
Checker	AH	

Design Rainfall

Climate Change Allowance **42 %**

From Wallingford Procedure, Volume 3 - Maps

From Wallingford Procedure, Volume 3 - Maps - Rainfall Depths (M5 - 60minutes) **M5_60=** **13 mm**

From BRE Digest 365, fig. 1 **rainfall ratio r =** **0.250**

Design Storm Return Period **P=** **5 yrs**

D mins	M5_D	Z2	R = MP_D	Rainfall Intensity
5	3.8 mm	1.448	5.5 mm	55 mm/hr
10	5.7 mm	1.450	8.3 mm	50 mm/hr
15	7.0 mm	1.454	10.2 mm	41 mm/hr
30	9.7 mm	1.462	14.2 mm	28 mm/hr
60	13.0 mm	1.463	19.0 mm	19 mm/hr
120	17.1 mm	1.457	24.9 mm	12 mm/hr
240	22.2 mm	1.448	32.1 mm	8 mm/hr
360	25.8 mm	1.448	37.3 mm	6 mm/hr
600	31.1 mm	1.448	45.0 mm	5 mm/hr
1440	42.8 mm	1.448	62.0 mm	3 mm/hr
2880	55.1 mm	1.448	79.8 mm	2 mm/hr

Infiltration Rate

Measured Infiltration Rate = ***5.00E-05 m/s***

OR Outlet Flow Rate =

Impermeable Area = ***75985 m²***

Runoff Coefficient, C: ***0.3***

Contributing Area = ***22796 m²***

Trench Properties

Width = ***1.5 m***

Trench Depth = ***1.5 m***

(Optional) Fixed Length = ***522.0 m***

Gravel free volume = 30%

(Trench fill material)

D	Length	Inflow	Outflow	Storage Req	t_{s50} (hrs)	Storage Prov	Overflow
5	522	124.8	11.8	113.1	0.40	352.4 m³	
10	522	188.7	23.6	165.1	0.58	352.4 m³	
15	522	233.6	35.3	198.2	0.70	352.4 m³	
30	522	324.1	70.7	253.4	0.90	352.4 m³	
60	522	433.4	141.3	292.1	1.03	352.4 m³	
120	522	566.5	282.7	283.8	1.00	352.4 m³	
240	522	731.8	565.4	166.4	0.59	352.4 m³	
360	522	850.7	848.1	2.6	0.01	352.4 m³	
600	522	1026.7	1413.5	0.0	0.00	352.4 m³	
1440	522	1414.0	3392.3	0.0	0.00	352.4 m³	
2880	522	1819.9	6784.6	0.0	0.00	352.4 m³	

Time until system can cope with additional influx of 50% design storage volume < 24 hrs ~ OK

- **Provide gravel filled a trench that is a minimum of 522 m x 1.5 m x 1.5 m deep**
- **Minimum Gravel Free Volume = 30%**
- **Total Pit Volume = 1174.5m³**

(Note that the depth is measured below the inlet pipe invert)

CALCULATION

FAIRHURST

Contract	Ardersier Port Phase 2
Part of Structure	Yard Roadside Infiltration Trench Size Calculation Infiltration Trench 01 Road 1

Sheet No.	1 of 6	Rev	A
Contract No.	162855		
Date	17/07/2025		
Designer	HF		
Checker	AH		

Design Rainfall

Climate Change Allowance **42 %**

From Wallingford Procedure, Volume 3 - Maps

From Wallingford Procedure, Volume 3 - Maps - Rainfall Depths (M5 - 60minutes) **M5_60=** **13 mm**

From BRE Digest 365, fig. 1 **rainfall ratio r =** **0.250**

Design Storm Return Period **P=** **5 yrs**

D mins	M5_D	Z2	R = MP_D	Rainfall Intensity
5	3.8 mm	1.448	5.5 mm	55 mm/hr
10	5.7 mm	1.450	8.3 mm	50 mm/hr
15	7.0 mm	1.454	10.2 mm	41 mm/hr
30	9.7 mm	1.462	14.2 mm	28 mm/hr
60	13.0 mm	1.463	19.0 mm	19 mm/hr
120	17.1 mm	1.457	24.9 mm	12 mm/hr
240	22.2 mm	1.448	32.1 mm	8 mm/hr
360	25.8 mm	1.448	37.3 mm	6 mm/hr
600	31.1 mm	1.448	45.0 mm	5 mm/hr
1440	42.8 mm	1.448	62.0 mm	3 mm/hr
2880	55.1 mm	1.448	79.8 mm	2 mm/hr

Infiltration Rate

Measured Infiltration Rate = ***5.00E-05 m/s***

OR Outlet Flow Rate =

Impermeable Area = ***2580 m²***

Runoff Coefficient, C: ***1***

Contributing Area = ***2580 m²***

Trench Properties

Width = ***1.0 m***

Trench Depth = ***1.0 m***

(Optional) Fixed Length = ***369.5 m***

Gravel free volume = 30%

(Trench fill material)

D	Length	Inflow	Outflow	Storage Req	t_{s50} (hrs)	Storage Prov	Overflow
5	370	14.1	5.6	8.6	0.06	110.9 m³	
10	370	21.4	11.1	10.2	0.08	110.9 m³	
15	370	26.4	16.7	9.8	0.07	110.9 m³	
30	370	36.7	33.3	3.3	0.03	110.9 m³	
60	370	49.1	66.7	0.0	0.00	110.9 m³	
120	370	64.1	133.4	0.0	0.00	110.9 m³	
240	370	82.8	266.8	0.0	0.00	110.9 m³	
360	370	96.3	400.1	0.0	0.00	110.9 m³	
600	370	116.2	666.9	0.0	0.00	110.9 m³	
1440	370	160.0	1600.6	0.0	0.00	110.9 m³	
2880	370	206.0	3201.1	0.0	0.00	110.9 m³	

Time until system can cope with additional influx of 50% design storage volume < 24 hrs ~ OK

- **Provide gravel filled a trench that is a minimum of 369.5 m x 1 m x 1 m deep**
- **Minimum Gravel Free Volume = 30%**
- **Total Pit Volume = 369.5m³**

(Note that the depth is measured below the inlet pipe invert)

CALCULATION

FAIRHURST

Contract	Ardersier Port Phase 2
Part of Structure	Yard Roadside Infiltration Trench Size Calculation Infiltration Trench 02 Road 1

Sheet No.	2 of 6	Rev	A
Contract No.	162855		
Date	17/07/2025		
Designer	HF		
Checker	AH		

Design Rainfall

Climate Change Allowance **42 %**

From Wallingford Procedure, Volume 3 - Maps

From Wallingford Procedure, Volume 3 - Maps - Rainfall Depths (M5 - 60minutes) **M5_60=** **13 mm**

From BRE Digest 365, fig. 1 **rainfall ratio r =** **0.250**

Design Storm Return Period **P=** **5 yrs**

D mins	M5_D	Z2	R = MP_D	Rainfall Intensity
5	3.8 mm	1.448	5.5 mm	55 mm/hr
10	5.7 mm	1.450	8.3 mm	50 mm/hr
15	7.0 mm	1.454	10.2 mm	41 mm/hr
30	9.7 mm	1.462	14.2 mm	28 mm/hr
60	13.0 mm	1.463	19.0 mm	19 mm/hr
120	17.1 mm	1.457	24.9 mm	12 mm/hr
240	22.2 mm	1.448	32.1 mm	8 mm/hr
360	25.8 mm	1.448	37.3 mm	6 mm/hr
600	31.1 mm	1.448	45.0 mm	5 mm/hr
1440	42.8 mm	1.448	62.0 mm	3 mm/hr
2880	55.1 mm	1.448	79.8 mm	2 mm/hr

Infiltration Rate

Measured Infiltration Rate = ***5.00E-05 m/s***

OR Outlet Flow Rate =

Impermeable Area = ***1687 m²***

Runoff Coefficient, C: ***1***

Contributing Area = ***1687 m²***

Trench Properties

Width = ***1.0 m***

Trench Depth = ***1.0 m***

(Optional) Fixed Length = ***207.0 m***

Gravel free volume = 30%

(Trench fill material)

D	Length	Inflow	Outflow	Storage Req	t_{s50} (hrs)	Storage Prov	Overflow
5	207	9.2	3.1	6.1	0.08	62.1 m³	
10	207	14.0	6.2	7.7	0.10	62.1 m³	
15	207	17.3	9.4	7.9	0.11	62.1 m³	
30	207	24.0	18.7	5.3	0.07	62.1 m³	
60	207	32.1	37.4	0.0	0.00	62.1 m³	
120	207	41.9	74.9	0.0	0.00	62.1 m³	
240	207	54.2	149.8	0.0	0.00	62.1 m³	
360	207	63.0	224.6	0.0	0.00	62.1 m³	
600	207	76.0	374.4	0.0	0.00	62.1 m³	
1440	207	104.6	898.6	0.0	0.00	62.1 m³	
2880	207	134.7	1797.1	0.0	0.00	62.1 m³	

Time until system can cope with additional influx of 50% design storage volume < 24 hrs ~ OK

- **Provide gravel filled a trench that is a minimum of 207 m x 1 m x 1 m deep**
- **Minimum Gravel Free Volume = 30%**
- **Total Pit Volume = 207m³**

(Note that the depth is measured below the inlet pipe invert)

CALCULATION

FAIRHURST

Contract	Ardersier Port Phase 2
Part of Structure	Yard Roadside Infiltration Trench Size Calculation Infiltration Trench 03 Road 2

Contract No.	162855
Date	17/07/2025
Designer	HF
Checker	AH

Design Rainfall

Climate Change Allowance **42 %**

From Wallingford Procedure, Volume 3 - Maps

From Wallingford Procedure, Volume 3 - Maps - Rainfall Depths (M5 - 60minutes) **M5_60=** **13 mm**

From BRE Digest 365, fig. 1 **rainfall ratio r =** **0.250**

Design Storm Return Period **P=** **5 yrs**

D mins	M5_D	Z2	R = MP_D	Rainfall Intensity
5	3.8 mm	1.448	5.5 mm	55 mm/hr
10	5.7 mm	1.450	8.3 mm	50 mm/hr
15	7.0 mm	1.454	10.2 mm	41 mm/hr
30	9.7 mm	1.462	14.2 mm	28 mm/hr
60	13.0 mm	1.463	19.0 mm	19 mm/hr
120	17.1 mm	1.457	24.9 mm	12 mm/hr
240	22.2 mm	1.448	32.1 mm	8 mm/hr
360	25.8 mm	1.448	37.3 mm	6 mm/hr
600	31.1 mm	1.448	45.0 mm	5 mm/hr
1440	42.8 mm	1.448	62.0 mm	3 mm/hr
2880	55.1 mm	1.448	79.8 mm	2 mm/hr

Infiltration Rate

Measured Infiltration Rate = ***5.00E-05 m/s***

OR Outlet Flow Rate =

Impermeable Area = ***5896 m²***

Runoff Coefficient, C: ***0.7***

Contributing Area = ***4127 m²***

Trench Properties

Width = ***1.0 m***

Trench Depth = ***1.0 m***

(Optional) Fixed Length = ***806.5 m***

Gravel free volume = 30%

(Trench fill material)

D	Length	Inflow	Outflow	Storage Req	t_{s50} (hrs)	Storage Prov	Overflow
5	807	22.6	12.1	10.5	0.04	242.0 m³	
10	807	34.2	24.2	9.9	0.03	242.0 m³	
15	807	42.3	36.3	6.0	0.02	242.0 m³	
30	807	58.7	72.7	0.0	0.00	242.0 m³	
60	807	78.5	145.4	0.0	0.00	242.0 m³	
120	807	102.6	290.7	0.0	0.00	242.0 m³	
240	807	132.5	581.4	0.0	0.00	242.0 m³	
360	807	154.0	872.1	0.0	0.00	242.0 m³	
600	807	185.9	1453.5	0.0	0.00	242.0 m³	
1440	807	256.0	3488.4	0.0	0.00	242.0 m³	
2880	807	329.5	6976.8	0.0	0.00	242.0 m³	

Time until system can cope with additional influx of 50% design storage volume < 24 hrs ~ OK

- **Provide gravel filled a trench that is a minimum of 806.5 m x 1 m x 1 m deep**
- **Minimum Gravel Free Volume = 30%**
- **Total Pit Volume = 806.5m³**

(Note that the depth is measured below the inlet pipe invert)

CALCULATION

FAIRHURST

Contract	Ardersier Port Phase 2	
Sheet No.	4 of 6	Rev A
Contract No.	162855	
Date	17/07/2025	
Designer	HF	
Checker	AH	

Part of Structure

Yard Roadside Infiltration Trench Size Calculation
Infiltration Trench 04
Road 2 / 3

Design Rainfall

Climate Change Allowance **42 %**

From Wallingford Procedure, Volume 3 - Maps

From Wallingford Procedure, Volume 3 - Maps - Rainfall Depths (M5 - 60minutes) **M5_60=** **13 mm**

From BRE Digest 365, fig. 1 **rainfall ratio r =** **0.250**

Design Storm Return Period **P=** **5 yrs**

D mins	M5_D	Z2	R = MP_D	Rainfall Intensity
5	3.8 mm	1.448	5.5 mm	55 mm/hr
10	5.7 mm	1.450	8.3 mm	50 mm/hr
15	7.0 mm	1.454	10.2 mm	41 mm/hr
30	9.7 mm	1.462	14.2 mm	28 mm/hr
60	13.0 mm	1.463	19.0 mm	19 mm/hr
120	17.1 mm	1.457	24.9 mm	12 mm/hr
240	22.2 mm	1.448	32.1 mm	8 mm/hr
360	25.8 mm	1.448	37.3 mm	6 mm/hr
600	31.1 mm	1.448	45.0 mm	5 mm/hr
1440	42.8 mm	1.448	62.0 mm	3 mm/hr
2880	55.1 mm	1.448	79.8 mm	2 mm/hr

Infiltration Rate

Measured Infiltration Rate = ***5.00E-05 m/s***

OR Outlet Flow Rate =

Impermeable Area = ***10624 m²***

Runoff Coefficient, C: ***0.7***

Contributing Area = ***7437 m²***

Trench Properties

Width = ***1.0 m***

Trench Depth = ***1.0 m***

(Optional) Fixed Length = ***1397.0 m***

Gravel free volume = 30%

(Trench fill material)

D	Length	Inflow	Outflow	Storage Req	t_{s50} (hrs)	Storage Prov	Overflow
5	1397	40.7	21.0	19.8	0.04	419.1 m³	
10	1397	61.6	41.9	19.6	0.04	419.1 m³	
15	1397	76.2	62.9	13.3	0.03	419.1 m³	
30	1397	105.7	125.8	0.0	0.00	419.1 m³	
60	1397	141.4	251.6	0.0	0.00	419.1 m³	
120	1397	184.8	503.3	0.0	0.00	419.1 m³	
240	1397	238.7	1006.6	0.0	0.00	419.1 m³	
360	1397	277.5	1509.8	0.0	0.00	419.1 m³	
600	1397	335.0	2516.4	0.0	0.00	419.1 m³	
1440	1397	461.3	6039.4	0.0	0.00	419.1 m³	
2880	1397	593.7	12078.7	0.0	0.00	419.1 m³	

Time until system can cope with additional influx of 50% design storage volume < 24 hrs ~ OK

- **Provide gravel filled a trench that is a minimum of 1397 m x 1 m x 1 m deep**
- **Minimum Gravel Free Volume = 30%**
- **Total Pit Volume = 1397m³**

(Note that the depth is measured below the inlet pipe invert)

CALCULATION

FAIRHURST

Contract	Ardersier Port Phase 2
Part of Structure	Yard Roadside Infiltration Trench Size Calculation Infiltration Trench 05 Road 05

Sheet No.	5 of 6 Rev A
Contract No.	162855
Date	17/07/2025
Designer	HF
Checker	AH

Design Rainfall

Climate Change Allowance **42 %**

From Wallingford Procedure, Volume 3 - Maps

From Wallingford Procedure, Volume 3 - Maps - Rainfall Depths (M5 - 60minutes) **M5_60=** **13 mm**

From BRE Digest 365, fig. 1 **rainfall ratio r =** **0.250**

Design Storm Return Period **P=** **5 yrs**

D mins	M5_D	Z2	R = MP_D	Rainfall Intensity
5	3.8 mm	1.448	5.5 mm	55 mm/hr
10	5.7 mm	1.450	8.3 mm	50 mm/hr
15	7.0 mm	1.454	10.2 mm	41 mm/hr
30	9.7 mm	1.462	14.2 mm	28 mm/hr
60	13.0 mm	1.463	19.0 mm	19 mm/hr
120	17.1 mm	1.457	24.9 mm	12 mm/hr
240	22.2 mm	1.448	32.1 mm	8 mm/hr
360	25.8 mm	1.448	37.3 mm	6 mm/hr
600	31.1 mm	1.448	45.0 mm	5 mm/hr
1440	42.8 mm	1.448	62.0 mm	3 mm/hr
2880	55.1 mm	1.448	79.8 mm	2 mm/hr

Infiltration Rate

Measured Infiltration Rate = ***5.00E-05 m/s***

OR Outlet Flow Rate =

Impermeable Area = ***611 m²***

Runoff Coefficient, C: ***0.7***

Contributing Area = ***428 m²***

Trench Properties

Width = ***1.0 m***

Trench Depth = ***1.0 m***

(Optional) Fixed Length = ***81.0 m***

Gravel free volume = 30%

(Trench fill material)

D	Length	Inflow	Outflow	Storage Req	t_{s50} (hrs)	Storage Prov	Overflow
5	81	2.3	1.2	1.1	0.04	24.3 m³	
10	81	3.5	2.5	1.1	0.04	24.3 m³	
15	81	4.4	3.7	0.7	0.02	24.3 m³	
30	81	6.1	7.4	0.0	0.00	24.3 m³	
60	81	8.1	14.8	0.0	0.00	24.3 m³	
120	81	10.6	29.5	0.0	0.00	24.3 m³	
240	81	13.7	59.0	0.0	0.00	24.3 m³	
360	81	16.0	88.6	0.0	0.00	24.3 m³	
600	81	19.3	147.6	0.0	0.00	24.3 m³	
1440	81	26.5	354.2	0.0	0.00	24.3 m³	
2880	81	34.1	708.5	0.0	0.00	24.3 m³	

Time until system can cope with additional influx of 50% design storage volume < 24 hrs ~ OK

- **Provide gravel filled a trench that is a minimum of 81 m x 1 m x 1 m deep**
- **Minimum Gravel Free Volume = 30%**
- **Total Pit Volume = 81m³**

(Note that the depth is measured below the inlet pipe invert)

CALCULATION

FAIRHURST

Contract	Ardersier Port Phase 2
Part of Structure	Yard Roadside Infiltration Trench Size Calculation Infiltration Trench 06 Road 3 Access

Sheet No.	6 of 6	Rev	A
Contract No.	162855		
Date	17/07/2025		
Designer	HF		
Checker	AH		

Design Rainfall

Climate Change Allowance **42 %**

From Wallingford Procedure, Volume 3 - Maps

From Wallingford Procedure, Volume 3 - Maps - Rainfall Depths (M5 - 60minutes) **M5_60=** **13 mm**

From BRE Digest 365, fig. 1 **rainfall ratio r =** **0.250**

Design Storm Return Period **P=** **30 yrs**

D mins	M5_D	Z2	R = MP_D	Rainfall Intensity
5	3.8 mm	2.045	7.7 mm	39 mm/hr
10	5.7 mm	2.055	11.7 mm	70 mm/hr
15	7.0 mm	2.073	14.6 mm	58 mm/hr
30	9.7 mm	2.112	20.5 mm	41 mm/hr
60	13.0 mm	2.118	27.5 mm	28 mm/hr
120	17.1 mm	2.109	36.0 mm	18 mm/hr
240	22.2 mm	2.084	46.2 mm	12 mm/hr
360	25.8 mm	2.070	53.3 mm	9 mm/hr
600	31.1 mm	2.045	63.6 mm	6 mm/hr
1440	42.8 mm	1.991	85.3 mm	4 mm/hr
2880	55.1 mm	1.937	106.8 mm	2 mm/hr

Infiltration Rate

Measured Infiltration Rate = ***5.00E-05 m/s***

OR Outlet Flow Rate =

Impermeable Area = ***755 m²***

Runoff Coefficient, C: ***1***

Contributing Area = ***755 m²***

Trench Properties

Width = ***1.0 m***

Trench Depth = ***1.0 m***

(Optional) Fixed Length = ***84.0 m***

Gravel free volume = 30%

(Trench fill material)

D	Length	Inflow	Outflow	Storage Req	t_{s50} (hrs)	Storage Prov	Overflow
5	84	5.8	1.3	4.6	0.15	25.2 m³	
10	84	8.9	2.6	6.3	0.21	25.2 m³	
15	84	11.0	3.8	7.2	0.24	25.2 m³	
30	84	15.5	7.7	7.9	0.26	25.2 m³	
60	84	20.8	15.3	5.5	0.18	25.2 m³	
120	84	27.2	30.6	0.0	0.00	25.2 m³	
240	84	34.9	61.2	0.0	0.00	25.2 m³	
360	84	40.3	91.8	0.0	0.00	25.2 m³	
600	84	48.0	153.0	0.0	0.00	25.2 m³	
1440	84	64.4	367.2	0.0	0.00	25.2 m³	
2880	84	80.6	734.4	0.0	0.00	25.2 m³	

Time until system can cope with additional influx of 50% design storage volume < 24 hrs ~ OK

- **Provide gravel filled a trench that is a minimum of 84 m x 1 m x 1 m deep**
- **Minimum Gravel Free Volume = 30%**
- **Total Pit Volume = 84m³**

(Note that the depth is measured below the inlet pipe invert)

CALCULATION

FAIRHURST

Contract	Port of Ardersier - Phase 2
Calculations For	SUDS Water Quality Simple Index Approach

Sheet No.	1 of 2	Rev	A

Contract No.	162855
Date	02/06/2025
Designer	AH
Checker	DE

Land Use Pollution Hazard

Step 1 - Allocate Suitable pollution hazard indices for the proposed land use from SUDs Manual Table 26.2

Land Use	Hazard Level	TSS	Metals	Hydrocarbons
Non-Residential Car Park (<300 vehicle movements per day)	Low	0.5	0.4	0.4
Low Traffic Roads (<300 vehicles per day)	Low	0.5	0.4	0.4

Where land use varies across the site, the highest pollution hazard indices shall be taken forward to Step 2.

Treatment Systems

Step 2 - Select SUDS components with a total pollution mitigation index that is greater than or equal to the pollution hazard index from SUDS Manual Table 26.3 (Discharge to Surface Water), Table 26.4 (discharge to Groundwater), or indices provided by proprietary treatment system manufactures. Where the mitigation index of an individual component is insufficient, two or more components can be used in series. A factor of **0.5** is used to account for the reduced performance of secondary or tertiary components associated with already reduced inflow concentrations.

Treatment Train 1 - Internal Site Roads

Land Use:	Low Traffic Roads (<300 vehicles per day)		
SUDS Component	**TSS**	**Metals**	**Hydrocarbons**
Infiltration Trench	0.4	0.4	0.4
A Soil with good contamination attenuation potential of at least 300mm in depth	0.4	0.3	0.3
Total Mitigation Index	**0.60**	**0.55**	**0.55**
Treatment Sufficient	✓	✓	✓

Discharge to:

Groundwater

Treatment Train 1 Maintenance

Maintenance inspections to be undertaken monthly and sediment to be cleared as needed per recommendations in CIRA SuDS Manual.

Spill kits to be on-hand to control spillage of fuels/oils. In the event of a spill, the affected section of filter material is to be replaced and contaminated material disposed of appropriately.

CALCULATION

FAIRHURST

Contract	Port of Ardersier - Phase 2
Calculations For	SUDS Water Quality Simple Index Approach

Contract No.	162855
Date	02/06/2025
Designer	AH
Checker	DE

Treatment Systems (Continued)

Treatment Train 2 - Building and Car Park

Land Use:	-Residential Car Park (<300 vehicle movements per		
SUDS Component	**TSS**	**Metals**	**Hydrocarbons**
Filter Drain	0.4	0.4	0.4
Soakway	0.4	0.4	0.4
Total Mitigation Index	**0.60**	**0.60**	**0.60**
Treatment Sufficient	✓	✓	✓

Discharge to:

Groundwater

Treatment Train 2 Maintenance

Maintenance inspections to be undertaken monthly and sediment to be cleared as needed per recommendations in CIRA SuDS Manual.

Spill kits to be on-hand to control spillage of fuels/oils. In the event of a spill, the affected section of filter material is to be replaced and contaminated material disposed of appropriately.

CALCULATION

FAIRHURST

Contract	Ardersier Port Phase 2
Part of Structure	Yard Infiltration Trench Sensitivity Check Infiltration Trench 01

Sheet No.	1 of 9	Rev	-
Contract No.	162855		
Date	17/07/2025		
Designer	LB		
Checker	HF		

Design Rainfall

Climate Change Allowance **42 %**

From Wallingford Procedure, Volume 3 - Maps

From Wallingford Procedure, Volume 3 - Maps - Rainfall Depths (M5 - 60minutes) **M5_60=** **13 mm**

From BRE Digest 365, fig. 1 **rainfall ratio r =** **0.250**

Design Storm Return Period **P=** **100 yrs**

D mins	M5_D	Z2	R = MP_D	Rainfall Intensity
5	3.8 mm	2.641	10.0 mm	30 mm/hr
10	5.7 mm	2.663	15.2 mm	91 mm/hr
15	7.0 mm	2.704	19.1 mm	76 mm/hr
30	9.7 mm	2.788	27.1 mm	54 mm/hr
60	13.0 mm	2.806	36.5 mm	36 mm/hr
120	17.1 mm	2.783	47.5 mm	24 mm/hr
240	22.2 mm	2.717	60.2 mm	15 mm/hr
360	25.8 mm	2.676	68.9 mm	11 mm/hr
600	31.1 mm	2.616	81.3 mm	8 mm/hr
1440	42.8 mm	2.494	106.8 mm	4 mm/hr
2880	55.1 mm	2.414	133.1 mm	3 mm/hr

Infiltration Rate

Measured Infiltration Rate = ***5.00E-05 m/s***

OR Outlet Flow Rate =

Impermeable Area = ***178427 m²***

Runoff Coefficient, C: ***0.3***

Contributing Area = ***53528 m²***

Trench Properties

Width = ***2.5 m***

Trench Depth = ***1.5 m***

(Optional) Fixed Length = ***961.0 m***

Gravel free volume = 30%

(Trench fill material)

D	Length	Inflow	Outflow	Storage Req	t_{s50} (hrs)	Storage Prov	Overflow
5	961	534.6	21.7	512.9	0.99	1081.1 m³	
10	961	813.5	43.4	770.2	1.48	1081.1 m³	
15	961	1019.8	65.0	954.8	1.84	1081.1 m³	
30	961	1451.6	130.1	1321.5	2.54	1081.1 m³	*240.4*
60	961	1952.5	260.1	1692.4	3.25	1081.1 m³	*611.3*
120	961	2541.3	520.3	2021.0	3.88	1081.1 m³	*939.9*
240	961	3223.0	1040.6	2182.5	4.19	1081.1 m³	*1101.3*
360	961	3690.4	1560.9	2129.5	4.09	1081.1 m³	*1048.4*
600	961	4354.0	2601.5	1752.5	3.37	1081.1 m³	*671.4*
1440	961	5716.3	6243.5	0.0	0.00	1081.1 m³	
2880	961	7122.4	12487.0	0.0	0.00	1081.1 m³	

Time until system can cope with additional influx of 50% design storage volume < 24 hrs ~ OK

- **Provide gravel filled a trench that is a minimum of 961 m x 2.5 m x 1.5 m deep**
- **Minimum Gravel Free Volume = 30%**
- **Total Pit Volume = 3603.8m³**

(Note that the depth is measured below the inlet pipe invert)

CALCULATION

FAIRHURST

Contract	Ardersier Port Phase 2
Part of Structure	Yard Infiltration Trench Sensitivity Check Infiltration Trench 02

Sheet No.	2 of 9	Rev -
Contract No.	162855	
Date	17/07/2025	
Designer	LB	
Checker	HF	

Design Rainfall

Climate Change Allowance **42 %**

From Wallingford Procedure, Volume 3 - Maps

From Wallingford Procedure, Volume 3 - Maps - Rainfall Depths (M5 - 60minutes) **M5_60= 13 mm**

From BRE Digest 365, fig. 1 **rainfall ratio r = 0.250**

Design Storm Return Period **P= 100 yrs**

D mins	M5_D	Z2	R = MP_D	Rainfall Intensity
5	3.8 mm	2.641	10.0 mm	30 mm/hr
10	5.7 mm	2.663	15.2 mm	91 mm/hr
15	7.0 mm	2.704	19.1 mm	76 mm/hr
30	9.7 mm	2.788	27.1 mm	54 mm/hr
60	13.0 mm	2.806	36.5 mm	36 mm/hr
120	17.1 mm	2.783	47.5 mm	24 mm/hr
240	22.2 mm	2.717	60.2 mm	15 mm/hr
360	25.8 mm	2.676	68.9 mm	11 mm/hr
600	31.1 mm	2.616	81.3 mm	8 mm/hr
1440	42.8 mm	2.494	106.8 mm	4 mm/hr
2880	55.1 mm	2.414	133.1 mm	3 mm/hr

Infiltration Rate

Measured Infiltration Rate = ***5.00E-05 m/s***

OR Outlet Flow Rate =

Impermeable Area = ***78333 m²***

Runoff Coefficient, C: ***0.3***

Contributing Area = ***23500 m²***

Trench Properties

Width = ***1.5 m***

Trench Depth = ***1.5 m***

(Optional) Fixed Length = ***538.0 m***

Gravel free volume = 30%

(Trench fill material)

D	Length	Inflow	Outflow	Storage Req	t_{s50} (hrs)	Storage Prov	Overflow
5	538	234.7	12.1	222.6	0.76	363.2 m³	
10	538	357.2	24.3	332.9	1.14	363.2 m³	
15	538	447.7	36.4	411.3	1.41	363.2 m³	*48.1*
30	538	637.3	72.8	564.4	1.94	363.2 m³	*201.3*
60	538	857.2	145.7	711.5	2.44	363.2 m³	*348.4*
120	538	1115.7	291.3	824.4	2.83	363.2 m³	*461.2*
240	538	1415.0	582.7	832.3	2.86	363.2 m³	*469.2*
360	538	1620.2	874.0	746.2	2.56	363.2 m³	*383.0*
600	538	1911.5	1456.7	454.8	1.56	363.2 m³	*91.7*
1440	538	2509.6	3496.0	0.0	0.00	363.2 m³	
2880	538	3126.9	6991.9	0.0	0.00	363.2 m³	

Time until system can cope with additional influx of 50% design storage volume < 24 hrs ~ OK

- **Provide gravel filled a trench that is a minimum of 538 m x 1.5 m x 1.5 m deep**
- **Minimum Gravel Free Volume = 30%**
- **Total Pit Volume = 1210.5m³**

(Note that the depth is measured below the inlet pipe invert)

CALCULATION

FAIRHURST

Contract	Ardersier Port Phase 2
Part of Structure	Yard Infiltration Trench Sensitivity Check Infiltration Trench 03

Sheet No.	3 of 9	Rev	-
Contract No.	162855		
Date	17/07/2025		
Designer	LB		
Checker	HF		

Design Rainfall

Climate Change Allowance **42 %**

From Wallingford Procedure, Volume 3 - Maps

From Wallingford Procedure, Volume 3 - Maps - Rainfall Depths (M5 - 60minutes) **M5_60=** **13 mm**

From BRE Digest 365, fig. 1 **rainfall ratio r =** **0.250**

Design Storm Return Period **P=** **100 yrs**

D mins	M5_D	Z2	R = MP_D	Rainfall Intensity
5	3.8 mm	2.641	10.0 mm	30 mm/hr
10	5.7 mm	2.663	15.2 mm	91 mm/hr
15	7.0 mm	2.704	19.1 mm	76 mm/hr
30	9.7 mm	2.788	27.1 mm	54 mm/hr
60	13.0 mm	2.806	36.5 mm	36 mm/hr
120	17.1 mm	2.783	47.5 mm	24 mm/hr
240	22.2 mm	2.717	60.2 mm	15 mm/hr
360	25.8 mm	2.676	68.9 mm	11 mm/hr
600	31.1 mm	2.616	81.3 mm	8 mm/hr
1440	42.8 mm	2.494	106.8 mm	4 mm/hr
2880	55.1 mm	2.414	133.1 mm	3 mm/hr

Infiltration Rate

Measured Infiltration Rate = ***5.00E-05 m/s***

OR Outlet Flow Rate =

Impermeable Area = ***122279 m²***

Runoff Coefficient, C: ***0.3***

Contributing Area = ***36684 m²***

Trench Properties

Width = ***1.5 m***

Trench Depth = ***1.5 m***

(Optional) Fixed Length = ***780.0 m***

Gravel free volume = 30%

(Trench fill material)

D	Length	Inflow	Outflow	Storage Req	t_{s50} (hrs)	Storage Prov	Overflow
5	780	366.4	17.6	348.8	0.83	526.5 m³	
10	780	557.5	35.2	522.3	1.24	526.5 m³	
15	780	698.9	52.8	646.1	1.53	526.5 m³	*119.6*
30	780	994.8	105.5	889.3	2.11	526.5 m³	*362.8*
60	780	1338.1	211.0	1127.1	2.67	526.5 m³	*600.6*
120	780	1741.6	422.0	1319.6	3.13	526.5 m³	*793.1*
240	780	2208.8	844.0	1364.8	3.23	526.5 m³	*838.3*
360	780	2529.1	1266.0	1263.1	2.99	526.5 m³	*736.6*
600	780	2983.9	2110.1	873.8	2.07	526.5 m³	*347.3*
1440	780	3917.5	5064.1	0.0	0.00	526.5 m³	
2880	780	4881.1	10128.2	0.0	0.00	526.5 m³	

Time until system can cope with additional influx of 50% design storage volume < 24 hrs ~ OK

- **Provide gravel filled a trench that is a minimum of 780 m x 1.5 m x 1.5 m deep**
- **Minimum Gravel Free Volume = 30%**
- **Total Pit Volume = 1755m³**

(Note that the depth is measured below the inlet pipe invert)

CALCULATION

FAIRHURST

Contract	Ardersier Port Phase 2
Part of Structure	Yard Infiltration Trench Sensitivity Check Infiltration Trench 04

Sheet No. 4 of 9	Rev -
Contract No.	162855
Date	17/07/2025
Designer	LB
Checker	HF

Design Rainfall

Climate Change Allowance **42 %**

From Wallingford Procedure, Volume 3 - Maps

From Wallingford Procedure, Volume 3 - Maps - Rainfall Depths (M5 - 60minutes) **M5_60=** **13 mm**

From BRE Digest 365, fig. 1 **rainfall ratio r =** **0.250**

Design Storm Return Period **P=** **100 yrs**

D mins	M5_D	Z2	R = MP_D	Rainfall Intensity
5	3.8 mm	2.641	10.0 mm	30 mm/hr
10	5.7 mm	2.663	15.2 mm	91 mm/hr
15	7.0 mm	2.704	19.1 mm	76 mm/hr
30	9.7 mm	2.788	27.1 mm	54 mm/hr
60	13.0 mm	2.806	36.5 mm	36 mm/hr
120	17.1 mm	2.783	47.5 mm	24 mm/hr
240	22.2 mm	2.717	60.2 mm	15 mm/hr
360	25.8 mm	2.676	68.9 mm	11 mm/hr
600	31.1 mm	2.616	81.3 mm	8 mm/hr
1440	42.8 mm	2.494	106.8 mm	4 mm/hr
2880	55.1 mm	2.414	133.1 mm	3 mm/hr

Infiltration Rate

Measured Infiltration Rate = ***5.00E-05 m/s***

OR Outlet Flow Rate =

Impermeable Area = ***143106 m²***

Runoff Coefficient, C: ***0.3***

Contributing Area = ***42932 m²***

Trench Properties

Width = ***1.5 m***

Trench Depth = ***1.5 m***

(Optional) Fixed Length = ***922.0 m***

Gravel free volume = 30%

(Trench fill material)

D	Length	Inflow	Outflow	Storage Req	t_{s50} (hrs)	Storage Prov	Overflow
5	922	428.8	20.8	408.0	0.82	622.4 m³	
10	922	652.5	41.6	610.9	1.23	622.4 m³	
15	922	817.9	62.3	755.6	1.52	622.4 m³	*133.2*
30	922	1164.2	124.7	1039.6	2.08	622.4 m³	*417.2*
60	922	1566.0	249.3	1316.7	2.64	622.4 m³	*694.3*
120	922	2038.2	498.7	1539.5	3.09	622.4 m³	*917.2*
240	922	2585.0	997.4	1587.6	3.18	622.4 m³	*965.3*
360	922	2959.9	1496.1	1463.8	2.94	622.4 m³	*841.4*
600	922	3492.1	2493.5	998.6	2.00	622.4 m³	*376.3*
1440	922	4584.7	5984.3	0.0	0.00	622.4 m³	
2880	922	5712.5	11968.6	0.0	0.00	622.4 m³	

Time until system can cope with additional influx of 50% design storage volume < 24 hrs ~ OK

- **Provide gravel filled a trench that is a minimum of 922 m x 1.5 m x 1.5 m deep**
- **Minimum Gravel Free Volume = 30%**
- **Total Pit Volume = 2074.5m³**

(Note that the depth is measured below the inlet pipe invert)

CALCULATION

FAIRHURST

Contract	Ardersier Port Phase 2
Part of Structure	Yard Infiltration Trench Sensitivity Check Infiltration Trench 05

Sheet No.	5 of 9	Rev	-
Contract No.	162855		
Date	17/07/2025		
Designer	LB		
Checker	HF		

Design Rainfall

Climate Change Allowance **42 %**

From Wallingford Procedure, Volume 3 - Maps

From Wallingford Procedure, Volume 3 - Maps - Rainfall Depths (M5 - 60minutes) **M5_60= 13 mm**

From BRE Digest 365, fig. 1 **rainfall ratio r = 0.250**

Design Storm Return Period **P= 100 yrs**

D mins	M5_D	Z2	R = MP_D	Rainfall Intensity
5	3.8 mm	2.641	10.0 mm	30 mm/hr
10	5.7 mm	2.663	15.2 mm	91 mm/hr
15	7.0 mm	2.704	19.1 mm	76 mm/hr
30	9.7 mm	2.788	27.1 mm	54 mm/hr
60	13.0 mm	2.806	36.5 mm	36 mm/hr
120	17.1 mm	2.783	47.5 mm	24 mm/hr
240	22.2 mm	2.717	60.2 mm	15 mm/hr
360	25.8 mm	2.676	68.9 mm	11 mm/hr
600	31.1 mm	2.616	81.3 mm	8 mm/hr
1440	42.8 mm	2.494	106.8 mm	4 mm/hr
2880	55.1 mm	2.414	133.1 mm	3 mm/hr

Infiltration Rate

Measured Infiltration Rate = ***5.00E-05 m/s***

OR Outlet Flow Rate =

Impermeable Area = ***52007 m²***

Runoff Coefficient, C: ***0.3***

Contributing Area = ***15602 m²***

Trench Properties

Width = ***1.5 m***

Trench Depth = ***1.5 m***

(Optional) Fixed Length = ***378.0 m***

Gravel free volume = 30%

(Trench fill material)

D	Length	Inflow	Outflow	Storage Req	t_{s50} (hrs)	Storage Prov	Overflow
5	378	155.8	8.5	147.3	0.72	255.2 m³	
10	378	237.1	17.1	220.0	1.07	255.2 m³	
15	378	297.2	25.6	271.6	1.33	255.2 m³	*16.5*
30	378	423.1	51.2	371.9	1.81	255.2 m³	*116.7*
60	378	569.1	102.5	466.7	2.28	255.2 m³	*211.5*
120	378	740.7	204.9	535.8	2.61	255.2 m³	*280.6*
240	378	939.4	409.9	529.6	2.58	255.2 m³	*274.4*
360	378	1075.7	614.8	460.9	2.25	255.2 m³	*205.7*
600	378	1269.1	1024.7	244.4	1.19	255.2 m³	
1440	378	1666.2	2459.2	0.0	0.00	255.2 m³	
2880	378	2076.0	4918.3	0.0	0.00	255.2 m³	

Time until system can cope with additional influx of 50% design storage volume < 24 hrs ~ OK

- **Provide gravel filled a trench that is a minimum of 378 m x 1.5 m x 1.5 m deep**
- **Minimum Gravel Free Volume = 30%**
- **Total Pit Volume = 850.5m³**

(Note that the depth is measured below the inlet pipe invert)

CALCULATION

FAIRHURST

Contract	Ardersier Port Phase 2
Part of Structure	Yard Infiltration Trench Sensitivity Check Infiltration Trench 06

Sheet No.	6 of 9	Rev	-
Contract No.	162855		
Date	17/07/2025		
Designer	LB		
Checker	HF		

Design Rainfall

Climate Change Allowance **42 %**

From Wallingford Procedure, Volume 3 - Maps

From Wallingford Procedure, Volume 3 - Maps - Rainfall Depths (M5 - 60minutes) **M5_60= 13 mm**

From BRE Digest 365, fig. 1 **rainfall ratio r = 0.250**

Design Storm Return Period **P= 100 yrs**

D mins	M5_D	Z2	R = MP_D	Rainfall Intensity
5	3.8 mm	2.641	10.0 mm	30 mm/hr
10	5.7 mm	2.663	15.2 mm	91 mm/hr
15	7.0 mm	2.704	19.1 mm	76 mm/hr
30	9.7 mm	2.788	27.1 mm	54 mm/hr
60	13.0 mm	2.806	36.5 mm	36 mm/hr
120	17.1 mm	2.783	47.5 mm	24 mm/hr
240	22.2 mm	2.717	60.2 mm	15 mm/hr
360	25.8 mm	2.676	68.9 mm	11 mm/hr
600	31.1 mm	2.616	81.3 mm	8 mm/hr
1440	42.8 mm	2.494	106.8 mm	4 mm/hr
2880	55.1 mm	2.414	133.1 mm	3 mm/hr

Infiltration Rate

Measured Infiltration Rate = ***5.00E-05 m/s***

OR Outlet Flow Rate =

Impermeable Area = ***72949 m²***

Runoff Coefficient, C: ***0.3***

Contributing Area = ***21885 m²***

Trench Properties

Width = ***1.5 m***

Trench Depth = ***1.5 m***

(Optional) Fixed Length = ***626.0 m***

Gravel free volume = 30%

(Trench fill material)

D	Length	Inflow	Outflow	Storage Req	t_{s50} (hrs)	Storage Prov	Overflow
5	626	218.6	14.1	204.5	0.60	422.6 m³	
10	626	332.6	28.2	304.4	0.90	422.6 m³	
15	626	416.9	42.4	374.6	1.11	422.6 m³	
30	626	593.5	84.7	508.8	1.50	422.6 m³	*86.2*
60	626	798.3	169.4	628.9	1.86	422.6 m³	*206.3*
120	626	1039.0	338.9	700.2	2.07	422.6 m³	*277.6*
240	626	1317.7	677.7	640.0	1.89	422.6 m³	*217.5*
360	626	1508.8	1016.6	492.2	1.45	422.6 m³	*69.7*
600	626	1780.1	1694.3	85.9	0.25	422.6 m³	
1440	626	2337.1	4066.2	0.0	0.00	422.6 m³	
2880	626	2912.0	8132.4	0.0	0.00	422.6 m³	

Time until system can cope with additional influx of 50% design storage volume < 24 hrs ~ OK

- **Provide gravel filled a trench that is a minimum of 626 m x 1.5 m x 1.5 m deep**
- **Minimum Gravel Free Volume = 30%**
- **Total Pit Volume = 1408.5m³**

(Note that the depth is measured below the inlet pipe invert)

CALCULATION

FAIRHURST

Contract	Ardersier Port Phase 2
Part of Structure	Yard Infiltration Trench Sensitivity Check Infiltration Trench 07

Sheet No.	7 of 9	Rev	-

Contract No.	162855
Date	17/07/2025
Designer	LB
Checker	HF

Design Rainfall

Climate Change Allowance **42 %**

From Wallingford Procedure, Volume 3 - Maps

From Wallingford Procedure, Volume 3 - Maps - Rainfall Depths (M5 - 60minutes) **M5_60= 13 mm**

From BRE Digest 365, fig. 1 **rainfall ratio r = 0.250**

Design Storm Return Period **P= 100 yrs**

D mins	M5_D	Z2	R = MP_D	Rainfall Intensity
5	3.8 mm	2.641	10.0 mm	30 mm/hr
10	5.7 mm	2.663	15.2 mm	91 mm/hr
15	7.0 mm	2.704	19.1 mm	76 mm/hr
30	9.7 mm	2.788	27.1 mm	54 mm/hr
60	13.0 mm	2.806	36.5 mm	36 mm/hr
120	17.1 mm	2.783	47.5 mm	24 mm/hr
240	22.2 mm	2.717	60.2 mm	15 mm/hr
360	25.8 mm	2.676	68.9 mm	11 mm/hr
600	31.1 mm	2.616	81.3 mm	8 mm/hr
1440	42.8 mm	2.494	106.8 mm	4 mm/hr
2880	55.1 mm	2.414	133.1 mm	3 mm/hr

Infiltration Rate

Measured Infiltration Rate = ***5.00E-05 m/s***

OR Outlet Flow Rate =

Impermeable Area = ***124389 m²***

Runoff Coefficient, C: ***0.3***

Contributing Area = ***37317 m²***

Trench Properties

Width = ***2.0 m***

Trench Depth = ***1.5 m***

(Optional) Fixed Length = ***730.0 m***

Gravel free volume = 30%

(Trench fill material)

D	Length	Inflow	Outflow	Storage Req	t_{s50} (hrs)	Storage Prov	Overflow
5	730	372.7	16.5	356.2	0.90	657.0 m³	
10	730	567.1	32.9	534.2	1.35	657.0 m³	
15	730	710.9	49.4	661.5	1.67	657.0 m³	*4.5*
30	730	1012.0	98.8	913.1	2.31	657.0 m³	*256.1*
60	730	1361.2	197.6	1163.6	2.94	657.0 m³	*506.6*
120	730	1771.7	395.3	1376.4	3.48	657.0 m³	*719.4*
240	730	2246.9	790.6	1456.4	3.68	657.0 m³	*799.4*
360	730	2572.7	1185.8	1386.9	3.51	657.0 m³	*729.9*
600	730	3035.3	1976.4	1058.9	2.68	657.0 m³	*401.9*
1440	730	3985.1	4743.4	0.0	0.00	657.0 m³	
2880	730	4965.3	9486.7	0.0	0.00	657.0 m³	

Time until system can cope with additional influx of 50% design storage volume < 24 hrs ~ OK

- **Provide gravel filled a trench that is a minimum of 730 m x 2 m x 1.5 m deep**
- **Minimum Gravel Free Volume = 30%**
- **Total Pit Volume = 2190m³**

  (Note that the depth is measured below the inlet pipe invert)

CALCULATION

FAIRHURST

Contract	Ardersier Port Phase 2	Sheet No.	8 of 9 Rev -
Part of Structure	Yard Infiltration Trench Sensitivity Check Infiltration Trench 08	Contract No.	162855
		Date	17/07/2025
		Designer	LB
		Checker	HF

Design Rainfall

Climate Change Allowance **42 %**

From Wallingford Procedure, Volume 3 - Maps

From Wallingford Procedure, Volume 3 - Maps - Rainfall Depths (M5 - 60minutes) **M5_60=** **13 mm**

From BRE Digest 365, fig. 1 **rainfall ratio r =** **0.250**

Design Storm Return Period **P=** **100 yrs**

D mins	M5_D	Z2	R = MP_D	Rainfall Intensity
5	3.8 mm	2.641	10.0 mm	30 mm/hr
10	5.7 mm	2.663	15.2 mm	91 mm/hr
15	7.0 mm	2.704	19.1 mm	76 mm/hr
30	9.7 mm	2.788	27.1 mm	54 mm/hr
60	13.0 mm	2.806	36.5 mm	36 mm/hr
120	17.1 mm	2.783	47.5 mm	24 mm/hr
240	22.2 mm	2.717	60.2 mm	15 mm/hr
360	25.8 mm	2.676	68.9 mm	11 mm/hr
600	31.1 mm	2.616	81.3 mm	8 mm/hr
1440	42.8 mm	2.494	106.8 mm	4 mm/hr
2880	55.1 mm	2.414	133.1 mm	3 mm/hr

Infiltration Rate

Measured Infiltration Rate = ***5.00E-05 m/s***

OR Outlet Flow Rate =

Impermeable Area = ***128822 m²***

Runoff Coefficient, C: ***0.3***

Contributing Area = ***38647 m²***

Trench Properties

Width = ***1.5 m***

Trench Depth = ***1.5 m***

(Optional) Fixed Length = ***814.0 m***

Gravel free volume = 30%

(Trench fill material)

D	Length	Inflow	Outflow	Storage Req	t_{s50} (hrs)	Storage Prov	Overflow
5	814	386.0	18.3	367.6	0.83	549.5 m³	
10	814	587.3	36.7	550.7	1.25	549.5 m³	*1.2*
15	814	736.3	55.0	681.2	1.55	549.5 m³	*131.8*
30	814	1048.0	110.1	937.9	2.13	549.5 m³	*388.5*
60	814	1409.7	220.2	1189.5	2.70	549.5 m³	*640.1*
120	814	1834.8	440.4	1394.4	3.17	549.5 m³	*845.0*
240	814	2327.0	880.7	1446.2	3.28	549.5 m³	*896.8*
360	814	2664.4	1321.1	1343.3	3.05	549.5 m³	*793.9*
600	814	3143.5	2201.9	941.7	2.14	549.5 m³	*392.2*
1440	814	4127.1	5284.4	0.0	0.00	549.5 m³	
2880	814	5142.3	10568.9	0.0	0.00	549.5 m³	

Time until system can cope with additional influx of 50% design storage volume < 24 hrs ~ OK

- **Provide gravel filled a trench that is a minimum of 814 m x 1.5 m x 1.5 m deep**
- **Minimum Gravel Free Volume = 30%**
- **Total Pit Volume = 1831.5m³**

(Note that the depth is measured below the inlet pipe invert)

CALCULATION	FAIRHURST

Contract	Ardersier Port Phase 2	Sheet No.	9 of 9 Rev -
Part of Structure	Yard Infiltration Trench Sensitivity Check Infiltration Trench 09	Contract No.	162855
		Date	17/07/2025
		Designer	LB
		Checker	HF

Design Rainfall

Climate Change Allowance **42 %**

From Wallingford Procedure, Volume 3 - Maps

From Wallingford Procedure, Volume 3 - Maps - Rainfall Depths (M5 - 60minutes) **M5_60=** **13 mm**

From BRE Digest 365, fig. 1 **rainfall ratio r =** **0.250**

Design Storm Return Period **P=** **100 yrs**

D mins	M5_D	Z2	R = MP_D	Rainfall Intensity
5	3.8 mm	2.641	10.0 mm	30 mm/hr
10	5.7 mm	2.663	15.2 mm	91 mm/hr
15	7.0 mm	2.704	19.1 mm	76 mm/hr
30	9.7 mm	2.788	27.1 mm	54 mm/hr
60	13.0 mm	2.806	36.5 mm	36 mm/hr
120	17.1 mm	2.783	47.5 mm	24 mm/hr
240	22.2 mm	2.717	60.2 mm	15 mm/hr
360	25.8 mm	2.676	68.9 mm	11 mm/hr
600	31.1 mm	2.616	81.3 mm	8 mm/hr
1440	42.8 mm	2.494	106.8 mm	4 mm/hr
2880	55.1 mm	2.414	133.1 mm	3 mm/hr

Infiltration Rate

Measured Infiltration Rate = ***5.00E-05 m/s***

OR Outlet Flow Rate =

Impermeable Area = ***75985 m²***

Runoff Coefficient, C: ***0.3***

Contributing Area = ***22796 m²***

Trench Properties

Width = ***1.5 m***

Trench Depth = ***1.5 m***

(Optional) Fixed Length = ***522.0 m***

Gravel free volume = 30%

(Trench fill material)

D	Length	Inflow	Outflow	Storage Req	t_{s50} (hrs)	Storage Prov	Overflow
5	522	227.7	11.8	215.9	0.76	352.4 m³	
10	522	346.4	23.6	322.9	1.14	352.4 m³	
15	522	434.3	35.3	399.0	1.41	352.4 m³	*46.6*
30	522	618.2	70.7	547.5	1.94	352.4 m³	*195.2*
60	522	831.5	141.3	690.2	2.44	352.4 m³	*337.8*
120	522	1082.2	282.7	799.6	2.83	352.4 m³	*447.2*
240	522	1372.6	565.4	807.2	2.86	352.4 m³	*454.8*
360	522	1571.6	848.1	723.5	2.56	352.4 m³	*371.2*
600	522	1854.2	1413.5	440.7	1.56	352.4 m³	*88.4*
1440	522	2434.4	3392.3	0.0	0.00	352.4 m³	
2880	522	3033.2	6784.6	0.0	0.00	352.4 m³	

Time until system can cope with additional influx of 50% design storage volume < 24 hrs ~ OK

- **Provide gravel filled a trench that is a minimum of 522 m x 1.5 m x 1.5 m deep**
- **Minimum Gravel Free Volume = 30%**
- **Total Pit Volume = 1174.5m³**

(Note that the depth is measured below the inlet pipe invert)

CALCULATION

FAIRHURST

Contract	Ardersier Port Phase 2
Part of Structure	Yard Roadside Infiltration Trench Sensitivity Check Infiltration Trench 01 Road 1

Sheet No.	1 of 6	Rev	A
Contract No.	162855		
Date	17/07/2025		
Designer	LB		
Checker	HF		

Design Rainfall

Climate Change Allowance **42 %**

From Wallingford Procedure, Volume 3 - Maps

From Wallingford Procedure, Volume 3 - Maps - Rainfall Depths (M5 - 60minutes) **M5_60=** **13 mm**

From BRE Digest 365, fig. 1 **rainfall ratio r =** **0.250**

Design Storm Return Period **P=** **200 yrs**

D mins	M5_D	Z2	R = MP_D	Rainfall Intensity
5	3.8 mm	2.812	10.6 mm	28 mm/hr
10	5.7 mm	2.838	16.2 mm	97 mm/hr
15	7.0 mm	2.887	20.3 mm	81 mm/hr
30	9.7 mm	2.988	29.1 mm	58 mm/hr
60	13.0 mm	3.009	39.1 mm	39 mm/hr
120	17.1 mm	2.982	50.9 mm	25 mm/hr
240	22.2 mm	2.903	64.3 mm	16 mm/hr
360	25.8 mm	2.855	73.5 mm	12 mm/hr
600	31.1 mm	2.783	86.5 mm	9 mm/hr
1440	42.8 mm	2.639	113.0 mm	5 mm/hr
2880	55.1 mm	2.543	140.2 mm	3 mm/hr

Infiltration Rate

Measured Infiltration Rate = ***5.00E-05 m/s***

OR Outlet Flow Rate =

Impermeable Area = ***2580 m²***

Runoff Coefficient, C: ***1***

Contributing Area = ***2580 m²***

Trench Properties

Width = ***1.0 m***

Trench Depth = ***1.0 m***

(Optional) Fixed Length = ***369.5 m***

Gravel free volume = 30%

(Trench fill material)

D	Length	Inflow	Outflow	Storage Req	t_{s50} (hrs)	Storage Prov	Overflow
5	370	27.4	5.6	21.9	0.16	110.9 m³	
10	370	41.8	11.1	30.7	0.23	110.9 m³	
15	370	52.5	16.7	35.8	0.27	110.9 m³	
30	370	75.0	33.3	41.6	0.31	110.9 m³	
60	370	100.9	66.7	34.2	0.26	110.9 m³	
120	370	131.2	133.4	0.0	0.00	110.9 m³	
240	370	166.0	266.8	0.0	0.00	110.9 m³	
360	370	189.8	400.1	0.0	0.00	110.9 m³	
600	370	223.3	666.9	0.0	0.00	110.9 m³	
1440	370	291.6	1600.6	0.0	0.00	110.9 m³	
2880	370	361.6	3201.1	0.0	0.00	110.9 m³	

Time until system can cope with additional influx of 50% design storage volume < 24 hrs ~ OK

- **Provide gravel filled a trench that is a minimum of 369.5 m x 1 m x 1 m deep**
- **Minimum Gravel Free Volume = 30%**
- **Total Pit Volume = 369.5m³**

(Note that the depth is measured below the inlet pipe invert)

CALCULATION

FAIRHURST

Contract	Ardersier Port Phase 2
Part of Structure	Yard Roadside Infiltration Trench Sensitivity Check Infiltration Trench 02 Road 1

Sheet No.	2 of 6	Rev	A
Contract No.	162855		
Date	17/07/2025		
Designer	LB		
Checker	HF		

Design Rainfall

Climate Change Allowance **42 %**

From Wallingford Procedure, Volume 3 - Maps

From Wallingford Procedure, Volume 3 - Maps - Rainfall Depths (M5 - 60minutes) **M5_60=** **13 mm**

From BRE Digest 365, fig. 1 **rainfall ratio r =** **0.250**

Design Storm Return Period **P=** **200 yrs**

D mins	M5_D	Z2	R = MP_D	Rainfall Intensity
5	3.8 mm	2.812	10.6 mm	28 mm/hr
10	5.7 mm	2.838	16.2 mm	97 mm/hr
15	7.0 mm	2.887	20.3 mm	81 mm/hr
30	9.7 mm	2.988	29.1 mm	58 mm/hr
60	13.0 mm	3.009	39.1 mm	39 mm/hr
120	17.1 mm	2.982	50.9 mm	25 mm/hr
240	22.2 mm	2.903	64.3 mm	16 mm/hr
360	25.8 mm	2.855	73.5 mm	12 mm/hr
600	31.1 mm	2.783	86.5 mm	9 mm/hr
1440	42.8 mm	2.639	113.0 mm	5 mm/hr
2880	55.1 mm	2.543	140.2 mm	3 mm/hr

Infiltration Rate

Measured Infiltration Rate = ***5.00E-05 m/s***

OR Outlet Flow Rate =

Impermeable Area = ***1687 m²***

Runoff Coefficient, C: ***1***

Contributing Area = ***1687 m²***

Trench Properties

Width = ***1.0 m***

Trench Depth = ***1.0 m***

(Optional) Fixed Length = ***207.0 m***

Gravel free volume = 30%

(Trench fill material)

D	Length	Inflow	Outflow	Storage Req	t_{s50} (hrs)	Storage Prov	Overflow
5	207	17.9	3.1	14.8	0.20	62.1 m³	
10	207	27.3	6.2	21.1	0.28	62.1 m³	
15	207	34.3	9.4	25.0	0.33	62.1 m³	
30	207	49.0	18.7	30.3	0.40	62.1 m³	
60	207	66.0	37.4	28.6	0.38	62.1 m³	
120	207	85.8	74.9	10.9	0.15	62.1 m³	
240	207	108.5	149.8	0.0	0.00	62.1 m³	
360	207	124.1	224.6	0.0	0.00	62.1 m³	
600	207	146.0	374.4	0.0	0.00	62.1 m³	
1440	207	190.7	898.6	0.0	0.00	62.1 m³	
2880	207	236.4	1797.1	0.0	0.00	62.1 m³	

Time until system can cope with additional influx of 50% design storage volume < 24 hrs ~ OK

- **Provide gravel filled a trench that is a minimum of 207 m x 1 m x 1 m deep**
- **Minimum Gravel Free Volume = 30%**
- **Total Pit Volume = 207m³**

(Note that the depth is measured below the inlet pipe invert)

CALCULATION

FAIRHURST

Contract	Ardersier Port Phase 2
Part of Structure	Yard Roadside Infiltration Trench Sensitivity Check Infiltration Trench 03 Road 2

Sheet No.	3 of 6	Rev A
Contract No.	162855	
Date	17/07/2025	
Designer	LB	
Checker	HF	

Design Rainfall

Climate Change Allowance **42 %**

From Wallingford Procedure, Volume 3 - Maps

From Wallingford Procedure, Volume 3 - Maps - Rainfall Depths (M5 - 60minutes) **M5_60=** **13 mm**

From BRE Digest 365, fig. 1 **rainfall ratio r =** **0.250**

Design Storm Return Period **P=** **200 yrs**

D mins	M5_D	Z2	R = MP_D	Rainfall Intensity
5	3.8 mm	2.812	10.6 mm	28 mm/hr
10	5.7 mm	2.838	16.2 mm	97 mm/hr
15	7.0 mm	2.887	20.3 mm	81 mm/hr
30	9.7 mm	2.988	29.1 mm	58 mm/hr
60	13.0 mm	3.009	39.1 mm	39 mm/hr
120	17.1 mm	2.982	50.9 mm	25 mm/hr
240	22.2 mm	2.903	64.3 mm	16 mm/hr
360	25.8 mm	2.855	73.5 mm	12 mm/hr
600	31.1 mm	2.783	86.5 mm	9 mm/hr
1440	42.8 mm	2.639	113.0 mm	5 mm/hr
2880	55.1 mm	2.543	140.2 mm	3 mm/hr

Infiltration Rate

Measured Infiltration Rate = ***5.00E-05 m/s***

OR Outlet Flow Rate =

Impermeable Area = ***5896 m²***

Runoff Coefficient, C: ***0.7***

Contributing Area = ***4127 m²***

Trench Properties

Width = ***1.0 m***

Trench Depth = ***1.0 m***

(Optional) Fixed Length = ***806.5 m***

Gravel free volume = 30%

(Trench fill material)

D	Length	Inflow	Outflow	Storage Req	t_{s50} (hrs)	Storage Prov	Overflow
5	807	43.9	12.1	31.8	0.11	242.0 m³	
10	807	66.8	24.2	42.6	0.15	242.0 m³	
15	807	83.9	36.3	47.6	0.16	242.0 m³	
30	807	119.9	72.7	47.3	0.16	242.0 m³	
60	807	161.5	145.4	16.1	0.06	242.0 m³	
120	807	209.9	290.7	0.0	0.00	242.0 m³	
240	807	265.5	581.4	0.0	0.00	242.0 m³	
360	807	303.5	872.1	0.0	0.00	242.0 m³	
600	807	357.2	1453.5	0.0	0.00	242.0 m³	
1440	807	466.5	3488.4	0.0	0.00	242.0 m³	
2880	807	578.4	6976.8	0.0	0.00	242.0 m³	

Time until system can cope with additional influx of 50% design storage volume < 24 hrs ~ OK

- **Provide gravel filled a trench that is a minimum of 806.5 m x 1 m x 1 m deep**
- **Minimum Gravel Free Volume = 30%**
- **Total Pit Volume = 806.5m³**

(Note that the depth is measured below the inlet pipe invert)

CALCULATION

FAIRHURST

Contract	Ardersier Port Phase 2	Sheet No.	4 of 6 Rev A
Part of Structure	Yard Roadside Infiltration Trench Sensitivity Check Infiltration Trench 04 Road 2/3	Contract No.	162855
		Date	17/07/2025
		Designer	LB
		Checker	HF

Design Rainfall

Climate Change Allowance **42 %**

From Wallingford Procedure, Volume 3 - Maps

From Wallingford Procedure, Volume 3 - Maps - Rainfall Depths (M5 - 60minutes) **M5_60=** **13 mm**

From BRE Digest 365, fig. 1 **rainfall ratio r =** **0.250**

Design Storm Return Period **P=** **200 yrs**

D mins	M5_D	Z2	R = MP_D	Rainfall Intensity
5	3.8 mm	2.812	10.6 mm	28 mm/hr
10	5.7 mm	2.838	16.2 mm	97 mm/hr
15	7.0 mm	2.887	20.3 mm	81 mm/hr
30	9.7 mm	2.988	29.1 mm	58 mm/hr
60	13.0 mm	3.009	39.1 mm	39 mm/hr
120	17.1 mm	2.982	50.9 mm	25 mm/hr
240	22.2 mm	2.903	64.3 mm	16 mm/hr
360	25.8 mm	2.855	73.5 mm	12 mm/hr
600	31.1 mm	2.783	86.5 mm	9 mm/hr
1440	42.8 mm	2.639	113.0 mm	5 mm/hr
2880	55.1 mm	2.543	140.2 mm	3 mm/hr

Infiltration Rate

Measured Infiltration Rate = ***5.00E-05 m/s***

OR Outlet Flow Rate =

Impermeable Area = ***10624 m²***

Runoff Coefficient, C: ***0.7***

Contributing Area = ***7437 m²***

Trench Properties

Width = ***1.0 m***

Trench Depth = ***1.0 m***

(Optional) Fixed Length = ***1397.0 m***

Gravel free volume = 30%

(Trench fill material)

D	Length	Inflow	Outflow	Storage Req	t_{s50} (hrs)	Storage Prov	Overflow
5	1397	79.1	21.0	58.1	0.12	419.1 m³	
10	1397	120.4	41.9	78.5	0.16	419.1 m³	
15	1397	151.3	62.9	88.4	0.18	419.1 m³	
30	1397	216.1	125.8	90.3	0.18	419.1 m³	
60	1397	290.9	251.6	39.3	0.08	419.1 m³	
120	1397	378.3	503.3	0.0	0.00	419.1 m³	
240	1397	478.5	1006.6	0.0	0.00	419.1 m³	
360	1397	547.0	1509.8	0.0	0.00	419.1 m³	
600	1397	643.6	2516.4	0.0	0.00	419.1 m³	
1440	1397	840.6	6039.4	0.0	0.00	419.1 m³	
2880	1397	1042.3	12078.7	0.0	0.00	419.1 m³	

Time until system can cope with additional influx of 50% design storage volume < 24 hrs ~ OK

- **Provide gravel filled a trench that is a minimum of 1397 m x 1 m x 1 m deep**
- **Minimum Gravel Free Volume = 30%**
- **Total Pit Volume = 1397m³**

(Note that the depth is measured below the inlet pipe invert)

CALCULATION

FAIRHURST

Contract	Ardersier Port Phase 2
Part of Structure	Yard Roadside Infiltration Trench Sensitivity Check Infiltration Trench 05 Road 5

Sheet No.	5 of 6	Rev	A
Contract No.	162855		
Date	17/07/2025		
Designer	LB		
Checker	HF		

Design Rainfall

Climate Change Allowance 42 %

From Wallingford Procedure, Volume 3 - Maps

From Wallingford Procedure, Volume 3 - Maps - Rainfall Depths (M5 - 60minutes) **M5_60=** 13 mm

From BRE Digest 365, fig. 1 **rainfall ratio r =** 0.250

Design Storm Return Period **P=** 200 yrs

D mins	M5_D	Z2	R = MP_D	Rainfall Intensity
5	3.8 mm	2.812	10.6 mm	28 mm/hr
10	5.7 mm	2.838	16.2 mm	97 mm/hr
15	7.0 mm	2.887	20.3 mm	81 mm/hr
30	9.7 mm	2.988	29.1 mm	58 mm/hr
60	13.0 mm	3.009	39.1 mm	39 mm/hr
120	17.1 mm	2.982	50.9 mm	25 mm/hr
240	22.2 mm	2.903	64.3 mm	16 mm/hr
360	25.8 mm	2.855	73.5 mm	12 mm/hr
600	31.1 mm	2.783	86.5 mm	9 mm/hr
1440	42.8 mm	2.639	113.0 mm	5 mm/hr
2880	55.1 mm	2.543	140.2 mm	3 mm/hr

Infiltration Rate

Measured Infiltration Rate = ***5.00E-05 m/s***

OR Outlet Flow Rate =

Impermeable Area = *611 m²*

Runoff Coefficient, C: *0.7*

Contributing Area = *428 m²*

Trench Properties

Width = *1.0 m*

Trench Depth = *1.0 m*

(Optional) Fixed Length = *81.0 m*

Gravel free volume = 30%

(Trench fill material)

D	Length	Inflow	Outflow	Storage Req	t_{s50} (hrs)	Storage Prov	Overflow
5	81	4.5	1.2	3.3	0.11	24.3 m³	
10	81	6.9	2.5	4.5	0.15	24.3 m³	
15	81	8.7	3.7	5.0	0.17	24.3 m³	
30	81	12.4	7.4	5.0	0.17	24.3 m³	
60	81	16.7	14.8	2.0	0.07	24.3 m³	
120	81	21.8	29.5	0.0	0.00	24.3 m³	
240	81	27.5	59.0	0.0	0.00	24.3 m³	
360	81	31.5	88.6	0.0	0.00	24.3 m³	
600	81	37.0	147.6	0.0	0.00	24.3 m³	
1440	81	48.3	354.2	0.0	0.00	24.3 m³	
2880	81	59.9	708.5	0.0	0.00	24.3 m³	

Time until system can cope with additional influx of 50% design storage volume < 24 hrs ~ OK

- **Provide gravel filled a trench that is a minimum of 81 m x 1 m x 1 m deep**
- **Minimum Gravel Free Volume = 30%**
- **Total Pit Volume = 81m³**

(Note that the depth is measured below the inlet pipe invert)

CALCULATION

FAIRHURST

Contract	Ardersier Port Phase 2
Part of Structure	Yard Roadside Infiltration Trench Size Calculation Infiltration Trench 06 Road 3 Access

Sheet No.	6 of 6	Rev	-
Contract No.	162855		
Date	17/07/2025		
Designer	HF		
Checker	HF		

Design Rainfall

Climate Change Allowance **42 %**

From Wallingford Procedure, Volume 3 - Maps

From Wallingford Procedure, Volume 3 - Maps - Rainfall Depths (M5 - 60minutes) **M5_60=** **13 mm**

From BRE Digest 365, fig. 1 **rainfall ratio r =** **0.250**

Design Storm Return Period **P=** **200 yrs**

D mins	M5_D	Z2	R = MP_D	Rainfall Intensity
5	3.8 mm	2.812	10.6 mm	28 mm/hr
10	5.7 mm	2.838	16.2 mm	97 mm/hr
15	7.0 mm	2.887	20.3 mm	81 mm/hr
30	9.7 mm	2.988	29.1 mm	58 mm/hr
60	13.0 mm	3.009	39.1 mm	39 mm/hr
120	17.1 mm	2.982	50.9 mm	25 mm/hr
240	22.2 mm	2.903	64.3 mm	16 mm/hr
360	25.8 mm	2.855	73.5 mm	12 mm/hr
600	31.1 mm	2.783	86.5 mm	9 mm/hr
1440	42.8 mm	2.639	113.0 mm	5 mm/hr
2880	55.1 mm	2.543	140.2 mm	3 mm/hr

Infiltration Rate

Measured Infiltration Rate = ***5.00E-05 m/s***

OR Outlet Flow Rate =

Impermeable Area = ***755 m²***

Runoff Coefficient, C: ***1***

Contributing Area = ***755 m²***

Trench Properties

Width = ***1.0 m***

Trench Depth = ***1.0 m***

(Optional) Fixed Length = ***84.0 m***

Gravel free volume = 30%

(Trench fill material)

D	Length	Inflow	Outflow	Storage Req	t_{s50} (hrs)	Storage Prov	Overflow
5	84	8.0	1.3	6.8	0.22	25.2 m³	
10	84	12.2	2.6	9.7	0.32	25.2 m³	
15	84	15.4	3.8	11.5	0.38	25.2 m³	
30	84	21.9	7.7	14.3	0.47	25.2 m³	
60	84	29.5	15.3	14.2	0.47	25.2 m³	
120	84	38.4	30.6	7.8	0.26	25.2 m³	
240	84	48.6	61.2	0.0	0.00	25.2 m³	
360	84	55.5	91.8	0.0	0.00	25.2 m³	
600	84	65.3	153.0	0.0	0.00	25.2 m³	
1440	84	85.3	367.2	0.0	0.00	25.2 m³	
2880	84	105.8	734.4	0.0	0.00	25.2 m³	

Time until system can cope with additional influx of 50% design storage volume < 24 hrs ~ OK

- **Provide gravel filled a trench that is a minimum of 84 m x 1 m x 1 m deep**
- **Minimum Gravel Free Volume = 30%**
- **Total Pit Volume = 84m³**

(Note that the depth is measured below the inlet pipe invert)

APPENDIX F – Scottish Water GIS

Warning! Damaging a large diameter trunk main (12"/300mm and above) can result in loss of life and major water supply and water quality problems. If you're planning any extension work in the vicinity of any large diameter mains shown on our maps, you must contact Scottish Water to arrange a site visit 08000 778 778 WELL IN ADVANCE OF THE WORKS.

Plotted By: alvin.hunte@fairhurst.co.uk

N

The representation of physical assets and the boundaries of areas in which Scottish Water and others have an interest does not necessarily imply their true positions. For further details contact the appropriate District office.

Date: 11/06/2025

162855 - Waste Sheet 1 of 3

0 20 40 80 Meters

SCALE: 1:4,810

Scottish Water
Trusted to serve Scotland
The Bridge
6 Buchanan Gate
Stepps
Glasgow
G33 6FB
Tel No: 08000 778 778

Warning! Damaging a large diameter trunk main (12"/300mm and above) can result in loss of life and major water supply and water quality problems. If you're planning any extension work in the vicinity of any large diameter mains shown on our maps, you must contact Scottish Water to arrange a site visit 08000 778 778 WELL IN ADVANCE OF THE WORKS.

Plotted By: alvin.hunte@fairhurst.co.uk

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The representation of physical assets and the boundaries of areas in which Scottish Water and others have an interest does not necessarily imply their true positions. For further details contact the appropriate District office.

Date: 11/06/2025

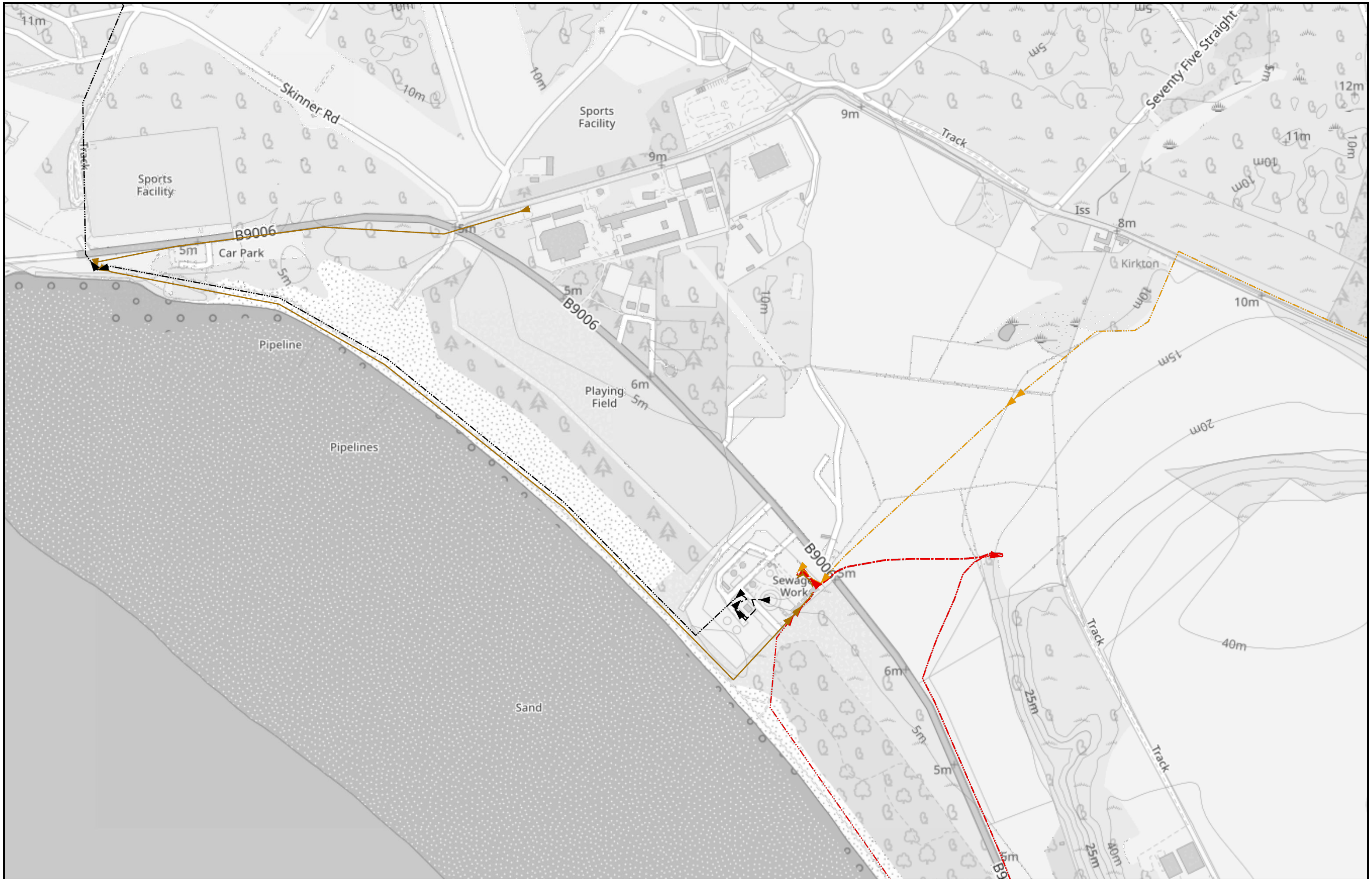
162855 - Waste Sheet 2 of 3

0 20 40 80 Meters

SCALE: 1:4,810

The Bridge
6 Buchanan Gate
Stepps
Glasgow
G33 6FB

Tel No: 08000 778 778



Warning! Damaging a large diameter trunk main (12"/300mm and above) can result in loss of life and major water supply and water quality problems. If you're planning any extension work in the vicinity of any large diameter mains shown on our maps, you must contact Scottish Water to arrange a site visit 08000 778 778 WELL IN ADVANCE OF THE WORKS.

Plotted By: alvin.hunte@fairhurst.co.uk

N

The representation of physical assets and the boundaries of areas in which Scottish Water and others have an interest does not necessarily imply their true positions. For further details contact the appropriate District office.

Date: 11/06/2025

162855 - Waste Sheet 3 of 3

0 20 40 80 Meters

SCALE: 1:4,810

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APPENDIX G – SuDS Maintenance Requirements

Replica of SuDS Manual Table 20.15 - Operation and maintenance requirements for Pervious Pavements

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Annually, and after autumn leaf fall, as required, based onsite-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 mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphospate 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 of the paving	As required
	Remedial work to any depressions and rutting considered detrimental to the structural performance or a hazard to users.	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	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth – if required, take remedial action	Three-monthly, 48 hr after large storms infirst six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

Adapted replica of SuDS Manual Table 16.1 - Operation and maintenance requirements for filter drains (Adapted for Infiltration Trenches)

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter (including leaf litter) and debris from trench surface.	Monthly (or as required)
	Inspect trench surface for blockages, clogging, standing water and structural damage	Monthly
Occasional maintenance	Remove or control tree roots where they are encroaching the sides of the trench, using recommended methods (e.g., NJUG, 2007 or BS 3998:2010)	As required
	At locations with high pollution loads, remove surface geotextile and replace, and wash or replace overlying filter medium	Annually, or as required
Remedial actions	Reconstruct trench and/or replace or clean void fill, if performance deteriorates or failure occurs	As required based on inspections
	Replacement of clogged geotextile (will require reconstruction of trench)	As required

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