Blackford Renewables Ltd

500MW Battery Storage, Rothienorman, Aberdeenshire

Flood Risk Assessment

May 2025

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Document Information and History

Project:	Blackford Energy Park, Rothienorman, Aberdeenshire
Client:	Blackford Renewables Ltd
Client Representative:	Stephen Doll
Kaya Consulting Job Number:	KC2155
Filename:	2155 - Blackford Energy Park, Rothienorman, FRA, May25
Project Director:	Callum Anderson
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This document has been issued and amended as follows:

Version	Date	Description	Created by:	Verified by:	Approved by:
V1.0	21/03/2025	DRAFT	JS	CA	MS
V1.1	01/04/2025	Final	JS	CA	MS
V1.2	11/04/2025	Boundary Update	JS	CA	MS
V1.3	08/05/2025	Minor Updates Following Drainage Strategy Submission	JS	CA	MS
V1.4	13/05/2025	Update of Client Details	JS	CA	MS

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1 Introduction

A 500MW battery storage system (BESS) is proposed on land near the existing Rothienorman Substation (**Figure 1**) within the Aberdeenshire Council Area.

Kaya Consulting Limited was commissioned by Blackford Renewables Ltd to undertake a flood risk assessment for the proposed development site.

The site is currently greenfield and currently used for arable agriculture. The proposed development is for battery storage and solar with associated grid infrastructure. The overall vulnerability of the land use is “essential infrastructure” under the SEPA Land Use Vulnerability criteria.

To undertake the assessment, we would propose the following work:

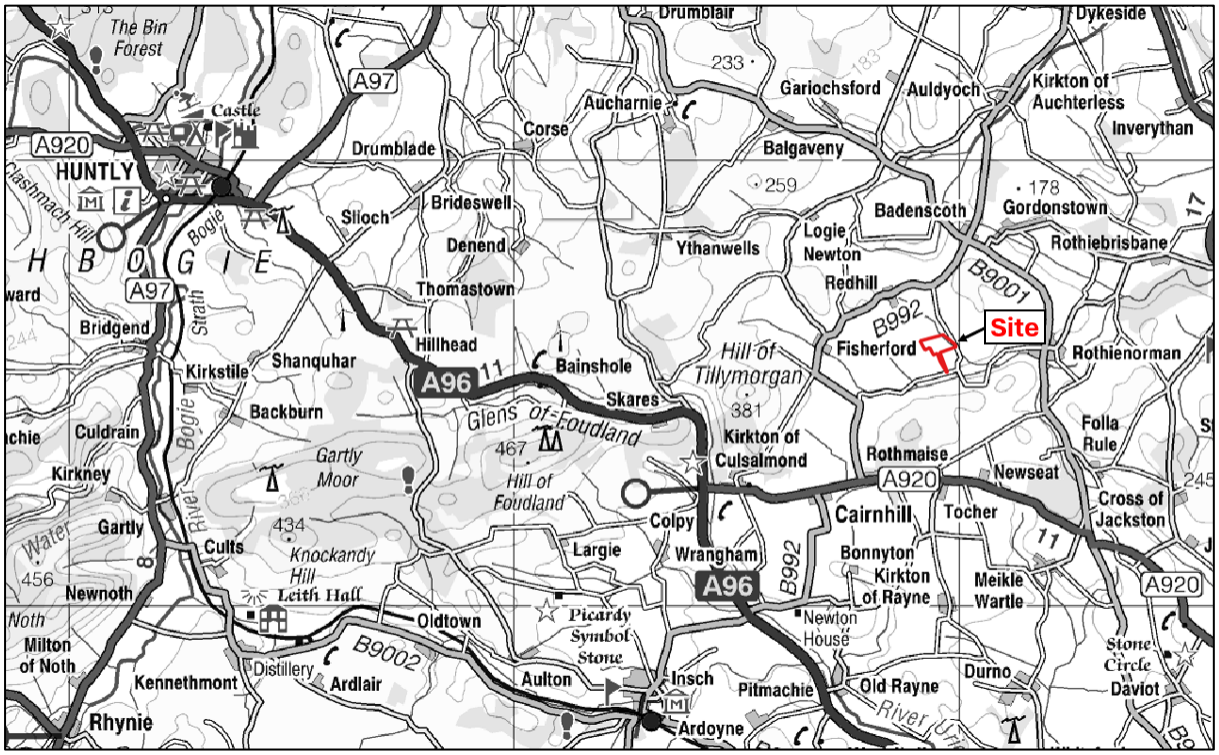
- Walkover site visit;
- Review of historical maps and available information to assess if there have been historical flooding issues;
- Hydrological analysis to estimate 200-year + climate change flows;
- Hydraulic calculations on the capacity of both channels;
- Assess flood risk from both channels including blockages;
- Assessment of flooding from other sources including; groundwater, surface water and any relevant infrastructure; &
- Preparation of a technical report summarising the above assuming all risks can be mitigated.

Information made available to Kaya Consulting Ltd for the study includes the following:

- Site location map;
- Site layout;
- Topographical survey; &
- 0.25m resolution Photogrammetry DSM data of the site and surrounding area.

The work undertaken to assess flood risk to the site and the findings of the study are summarised in the following sections.

Figure 1: General Site Location



2 Legislative and Policy Aspects

2.1 National Planning Framework

National Planning Framework 4 (NPF4) was released in early 2023. This is the planning policy for new development. Relevant policies are described below:

2.1.1 National Planning Framework 4

Under NPF4 Flood Risk Management requires explicit consideration of climate change, consistent with the key over-arching policies of NPF4, for example;

Climate mitigation and adaptation – Policy 2

Under 2b) NPF4 notes 'Development proposals will be sited and designed to adapt to current and future risks from climate change'

In addition, development leading to improvements to channels and river habitats should be encouraged as shown by;

Biodiversity – Policy 3

Under 3a NPF4 notes 'Development proposals will contribute to the enhancement of biodiversity, including where relevant, restoring degraded habitats and building and strengthening nature networks and the connections between them. Proposals should also integrate nature-based solutions where possible'

Furthermore, numerous policies point towards assisting in the re-development of brownfield and other previously developed sites.

In terms of Flood Risk the definition of Flood Risk Area or at risk of flooding is:

For planning purposes, at risk of flooding or 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.

This risk of flooding is indicated on SEPA's future flood maps or may need to be assessed in a flood risk assessment. An appropriate allowance for climate change should be taken from the latest available guidance and evidence available for application in Scotland. The calculated risk of flooding can take account of any existing, formal flood protection schemes in determining the risk to the site. Where the risk of flooding is less than this threshold, areas will not be considered 'at risk of flooding' for planning purposes, but this does not mean there is no risk at all, just that the risk is sufficiently low to be acceptable for the purpose of planning. This includes areas where the risk of flooding is reduced below this threshold due to a formal flood protection scheme.

NPF4 defines a flood risk area as one that lies within the 200-year plus climate change flood extent.

Assessments need to consider flooding from all sources including:

- *Watercourse/Fluvial Flooding*
- *Pluvial Flooding*
- *Sewer Flooding*
- *Groundwater Flooding*

- *Coastal Flooding*

Access to sites during flooding is defined as:

Egress (safe, flood free pedestrian access and egress), A route for the movement of people (not vehicles) of all abilities (on foot or with mobility assistance) between the development and a place of safety outwith the design flood level.

The key policy related to flood risk management is:

Flood Risk and Water Management – Policy 22

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

a) Development proposals at risk of flooding or in a flood risk area 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 LDP has identified a need to bring these into positive use and where proposals demonstrate that longterm safety and resilience can be secured in accordance with relevant SEPA advice

The protection offered by an existing formal flood protection scheme or one under construction can be taken into account when determining flood risk.

In such cases, it will be demonstrated by the applicant that:

• all risks of flooding are understood and addressed;
• there is no reduction in floodplain capacity, increased risk for others, or a need for future flood protection schemes;
• the development remains safe and operational during floods;
• flood resistant and resilient materials and construction methods are used; and
• future adaptations can be made to accommodate the effects of climate change.

Additionally, for development proposals meeting criteria part iv), where flood risk is managed at the site rather than avoided these will also require:

• the first occupied/utilised floor, and the underside of the development if relevant, to be above the flood risk level and have an additional allowance for freeboard; and
• that the proposal does not create an island of development and that safe access/ egress can be achieved.

b) Small scale extensions and alterations to existing buildings will only be supported where they will not significantly increase flood risk.

c) 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 urban drainage systems (SUDS), which should form part of and integrate with proposed and existing bluegreen infrastructure. All proposals should presume no surface water connection to the combined sewer;
iii. seek to minimise the area of impermeable surface.

d) Development proposals will be supported if they can be connected to the public water mains. If connection is not feasible, the applicant will need to demonstrate that water for drinking water purposes will be sourced from a sustainable water source that is resilient to periods of water scarcity.
e) Development proposals which create, expand or enhance opportunities for natural flood risk management, including blue and green infrastructure, will be supported

2.2 Local Authority Policy and Guidance with Respect to Flood Risk

Section SG LSD8 of Aberdeenshire Council's Local Development Plan states that:

We will refuse any new development on land at risk from flooding, including on any functional flood plain, or on land that may be required for long term managed retreat or that is at risk from erosion, unless:

1) a hydrological, drainage impact and/or flood risk assessment or geomorphology assessment, which includes an allowance for freeboard and climate change where appropriate, is provided at the applicant's expense, and demonstrates that the risk is neither medium nor high risk; OR

2) it is for flood or erosion prevention measures; OR

3) it is development that is consistent with the flood storage function of flood plains or would otherwise be unaffected by flooding; OR

4) it would be for essential infrastructure or otherwise inappropriate to locate it elsewhere; OR

5) it is within a built-up area and flood prevention or erosion measures to the appropriate standard will exist at the time the development is occupied.

In these cases and if development is to be permitted on land at risk from flooding, then, subject to other policies, it must be designed:

a) to incorporate flood resilient design measures, water resistant materials and construction methods to assist in the evacuation of people and to minimise damage from flooding; AND

b) not to impede the ability of any flood plain to store water or flood naturally, nor to reduce the capacity of flood defences or of any other arrangement for flood management; AND

c) not to result in a significant increase in the risk or severity of flooding elsewhere through altering flood storage capacity or the pattern of flow of flood waters; AND

d) to avoid any water courses being culverted, unless there is no practicable alternative and it will not impede the passage of amphibians or fish species; AND

e) to provide for maintenance buffer strips for any water body; AND

f) to include land-raising and/or excavations with the proposal, only if:

i) it is for a flood alleviation measure; and

ii) it is linked to the provision and maintenance of direct or indirect compensatory flood water storage to replace the lost capacity of the functional flood plain; and
iii) it will not create a need for flood prevention measures elsewhere; and
iv) it will not create any island or islands of development within the functional flood plain that could become inaccessible during a flood.

Due to the continuing changes in climatic patterns, the precautionary principle will apply when reviewing any application for development in an area at risk from inundation by flood water or erosion.

2.3 SEPA Technical Flood Risk Guidance

SEPA are a statutory consultee to the planning process concerning flood risk. To support its role and to give guidance to practitioners and local authorities SEPA has published a series of guidance documents. The key documents with direct relevance to flood risk assessment are;

1. SEPA (2024), *Flood Risk and Land Use Vulnerability Guidance*, July 2024. https://www.sepa.org.uk%2Fmedia%2Fnvnotwqd%2Fland-use-vulnerability-guidance.docx
2. SEPA (2022), *Technical Flood Risk Guidance for Stakeholders - SEPA requirements for undertaking a Flood Risk Assessment*, June 2022. https://www.sepa.org.uk/media/162602/ss-nfr-p-002-technical-flood-risk-guidance-for-stakeholders.pdf
3. SEPA (2024b), *Climate change allowances for flood risk assessment in land use planning V5*, August 2024. https://www.sepa.org.uk/media/fxjgfjmf/climate-change-allowances-guidance.docx
4. SEPA (2018), *Land Use Planning System, SEPA Development Plan Guidance Note 2a*, July 2018. https://www.sepa.org.uk/media/143247/lups-dp-gu2a-development-plan-guidance-on-flood-risk.pdf
5. SEPA (2024c) *Position Statement on Development Protected by Formal Flood Protection Schemes.* https://www.sepa.org.uk/media/nlyfx2v3/development-behind-defences.docx
6. SEPA (2022b), *SEPA's Triage Framework. Guidance for Planning Authorities & SEPA. December 2022.* https://www.sepa.org.uk/media/594101/sepa-triage-framework-and-standing-advice.pdf
7. SEPA (2024d), *SEPA Flood Risk Standing Advice for Planning Authorities*, July 2024 https://www.sepa.org.uk/media/hbghpr1p/flood-risk-standing-advice.docx
8. SEPA (2024e), *SEPA Recommended Riparian Corridor Layer for use in Land Use Planning*, July 2024. https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fwww.sepa.org.uk%2Fmedia%2Fpuqhuwhn%2Frecommended-riparian-corridor-note.docx&wdOrigin=BROWSELINK

Reference 1 provides SEPA's assessment of land use vulnerability which allows the identification of the appropriate return period to be considered in any flood risk assessment, based on the type of development proposed.

Reference 2 is a technical guidance document intended to outline methodologies that may be appropriate for hydrological and hydraulic modelling and sets out what information SEPA requires to be submitted as part of a Flood Risk Assessment.

Reference 3 outlines the most recent SEPA guidance in terms of flow, rainfall and sea level uplifts for climate change.

Reference 4 provides additional planning guidance with respect to flood risk.

Reference 5 provides additional planning guidance with respect to built-development behind flood defences.

Reference 6 provides standing advice for developments where SEPA aren't normally consulted, such as surface water only modelling and extensions.

Reference 7 provides standing advice for Planning Authorities and Developers for lower risk applications, including category 1 exemptions (where there is no land raising or loss of floodplain capacity), category 2 (Development proposals at flood risk solely from surface water) and category 3 (Development proposals at flood risk solely from groundwater).

Reference 8 provides the SEPA recommended riparian buffers from watercourses.

In addition, The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended) (CAR) describes requirements for any works at or near watercourses that require licensing. SEPA are responsible for the implementation of the Regulations. SEPA's CAR Practical Guide (SEPA, 2021) provides an overview of the regulations, definition of the regimes, levels of authorisation for activities and outlines the General Binding Rules (GBRs). The latest version of the CAR Practical is available online and is regularly updated (https://www.sepa.org.uk/media/34761/car_a_practical_guide.pdf).

With relevance to all developments, the Regulations include a requirement that surface water discharge must not result in pollution of the water environment. It also makes Sustainable Drainage Systems (SuDS) a requirement for new development, except for runoff from a single dwelling and discharges to coastal waters.

SEPA has published guidance on recommended riparian corridors that allow space for natural fluvial processes to occur in riparian areas (as well as other attendant environmental benefits including biodiversity, open space, channel maintenance opportunities, pollution reduction and river restoration).

The guidance recommends a minimum riparian corridor width of 10 to 30 m from bank top along both banks of all watercourses depending on channel width (SEPA, 2024e). It is important to highlight that buffer strips do not mitigate any identified flood risk that may exist at a site.

SEPA-Recommended Riparian Corridors

Channel Width	Recommended buffer (each side of channel)
<2 m	10 m
2-15 m	15 m
>15 m	30 m

2.4 Guidance and Policy Constraints with Relevance to Current Site

Based on relevant policies and guidance the following sections outline the principles and constraints under which the flood risk assessment is undertaken.

2.4.1 Land Use Vulnerability and Design Event

The proposed development is for essential infrastructure that is subject to planning control.

Based on SEPA (2024), residential accommodation is considered a 'Highly Vulnerable' land use. These developments are considered suitable for land outside the 1 in 200-year plus climate change flood risk area.

The design event for this development is a 1 in 200-year plus climate change event.

2.4.2 Constraints on Developable Area

2.4.2.1 Surface Water Flooding

Land affected by surface water flooding can generally be developed assuming the surface water flood risk can be managed through the development of the site drainage system and land drainage to manage surface water entering the site from outside its boundaries. However, in some cases, where sites currently act to store surface water, development could displace surface water and increase flood risk elsewhere. In these cases, there may be a need to leave areas of surface water storage undeveloped and/or provide storage of equivalent volumes of surface water elsewhere in the site.

The assessment will consider surface water flooding risks for the 1 in 200-year plus climate change event.

2.4.3 Climate Change Considerations

The development should be resilient against the impacts of climate change, such that properties are not predicted to flood for the design event plus climate change.

SEPA (2024b) recommends climate change allowances based on UKCP18. For the study area the impact of climate change is a 37% increase in rainfall total (North East Scotland) for catchments smaller than 30km²/50km² and a 34% peak river flow (North East Scotland) for catchments larger than 30km²/50km². Where a catchment is between 30km² and 50km², the higher of the two methods should be used.

The assessment will consider increases in rainfall due to climate change of 37%. It will assess the resilience of the site to the impact of climate change on flows. It is noted that these increases may not be consistent with increases considered by Scottish Water for drainage design.

2.4.4 Development Levels and Finished Floor Levels

SEPA (2022) notes that adequate freeboard should be provided for developments involving the erection of new buildings and in the majority of cases, an adequate freeboard allowance would be 600mm above the design flood level (separate from any climate change allowance that may be applied). It is noted that other freeboards can be recommended if supported by appropriate modelling. For re-development of existing buildings, the freeboard allowance is considered a recommendation and should be applied as far as practicable.

The assessment will consider Finished Floor Levels for residential developments based on the 1 in 200-year plus climate change design flood level.

2.4.5 Site Access Considerations

It is important that developments can be accessed and left during flood events, so that developments do not form islands within flooded areas.

NPF4 identifies 'Egress (safe flood free pedestrian access and egress)' as "A route for the movement of people (not vehicles) of all abilities (on foot or with mobility assistance) between the development and a place of safety outwith the design flood event)". NPF4 recommends that for sites where flood risk cannot be avoided that 'the proposal does not create an island of development and that safe access/egress can be achieved'.

Access requirements with respect to flooding will be considered in this assessment.

It is noted that this assessment can only consider the local access restrictions to the site and cannot consider wider, regional access issues, e.g., access to hospitals remote to the site. These wider access issues need to be considered by the appropriate local authority within local plans.

2.4.6 Other Flooding Risks

2.4.6.1 Coastal Flooding

This site is not considered to be at risk of coastal flooding.

2.4.6.2 Reservoir Flooding

Reservoir inundation maps prepared by SEPA (https://map.sepa.org.uk/reservoirsfloodmap/Map.htm) suggest that there is no risk of inundation due to an "*uncontrolled release of water from all possible dam failure scenarios*".

Reservoirs are subject to strict regulation and maintenance in Scotland according to their risk category. Therefore, flooding of this type is highly unlikely in Scotland and the risk of flooding from reservoir breach or failure at the site is considered low.

2.4.6.3 Site Drainage and Sewer Flooding

The design of the site drainage system is undertaken in the site drainage strategy which forms a separate report.

2.4.6.4 Culverts and Watercourses

Most councils require that existing access points/routes to culverts and watercourses are maintained or repositioned in agreement with the council's Flood Team. Most councils also reserve the right to request the construction of additional access points/routes to a watercourse to enable the council to meet its statutory responsibilities.

There are not thought to be any culverts that run through the site itself.

2.4.6.5 Existing Flood Defences

SEPA (2024b) provides guidance with respect to development behind flood prevention schemes.

This site is not thought to be protected by any existing formal flood defences.

2.4.6.6 Canal Flooding

Canals in Scotland are operated and managed by Scottish Canals. Failures and overtopping of canals are rare and areas at risk are generally known by Scottish Canals who should be consulted for developments located close to any canal.

No canals run in the vicinity of the site and the site is not considered to be at risk of flooding from this source.

2.4.6.7 CAR Regulations

Any crossings or changes to watercourses within the site may require a CAR licence. CAR licences are not required as part of a planning application and are generally conditioned as part of planning consent. However, during the planning process, sufficient information should be provided in a planning application so SEPA can identify whether it is likely that a CAR licence would be granted.

There are no new crossings proposed over watercourses. Crossings may be necessary over overland flow pathways, but these will not likely require a CAR licence.

3 Site Location and Description

The site is located north of Wood of Middleton, some 2km to the west of the village of Rothienorman, and adjacent to Rothienorman Substation. It is 16ha in area. **Photo 1** shows the site in its current state. **Figure 2** shows the site and surrounding area in more detail. The site is bounded by Rothienorman Substation to the west (**Photo 2**), Wood of Middleton to the south and agricultural land to the north and east. The proposed access is by a new track off the unnamed road to the south.

Figure 2 also shows the topography of the site and surrounding area. The site slopes to the east, with ground levels falling 25.26m from a high point of 161.23m AOD (Above Ordnance Datum) in the south-west, to a low point of 139.73m AOD in the east at a relatively steady slope of 0.05 (around 1 in 20). The site access slopes south.

Two small watercourses lie near the site. A small drain highlighted in **Figure 2** as 'Unnamed Drain 1' flows east beyond the northern boundary of the site (**Photo 3**). This heavily overgrown drain has its confluence with a second, larger drain referred to here as 'Unnamed Drain 2' to the north east of the site. This larger drain flows south-east parallel to the eastern boundary of the site (**Photo 4**) towards the Black Burn. A field crossing passes over this drain immediately upstream of the site and it is culverted a driveway some 100m downstream of the site.

Historical Mapping viewed on 18/03/2025 from the National Library of Scotland do not show any additional water features at the location of the site.

Scottish Water Drawings do not show any sewers within or bounding the site.

Figure 2: Detailed Site Location

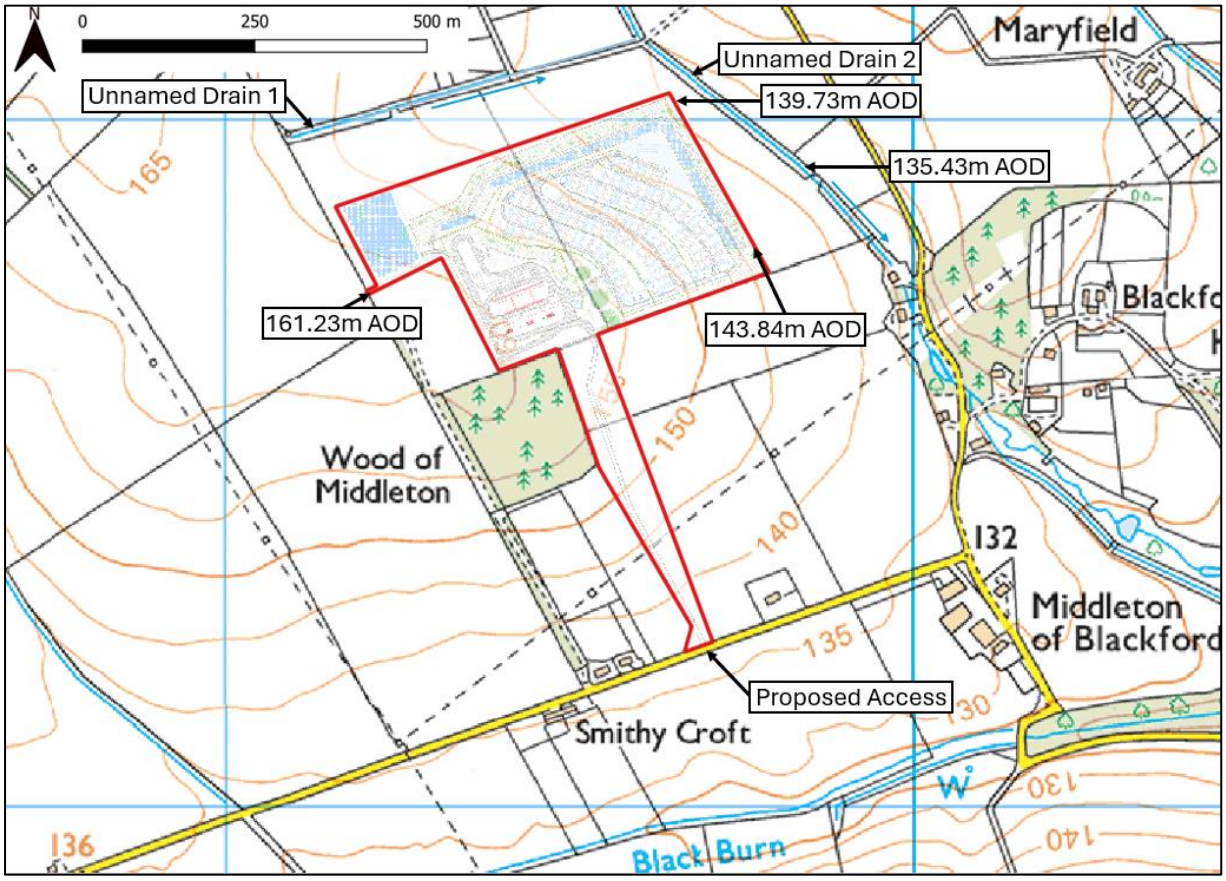


Photo 1: Existing Site Condition (looking south-west towards unnamed drain and site from minor road)

Photo 2: Western Site Boundary Embankment with Rothienorman Substation Beyond

Photo 3: Unnamed Drain 1 North of Site (looking east)

Photo 4: Unnamed Drain 2 at South-Eastern Corner of Site (looking west towards site)

4 Hydrology

Unnamed Drain 1 drains an area of approximately 0.17km^2 to its confluence with Unnamed Drain 2, as shown below in **Figure 3**. This catchment was delineated based on OS contour data, topographical survey and site observations. The drain has an average gradient of 1 in 20 and is 1.8m to 3.1m wide and 0.75m to 1.2m deep.

Unnamed Drain 2 drains a larger area of agricultural land, and the catchment details were downloaded from the FEH web service. This was checked against the available OS data and site observations to produce a total catchment of 2.40km^2 to the culvert downstream of the site. The 1 in 200-year + climate change flow for this catchment were calculated using FEH Rainfall-Runoff and ReFH 2.3 with a climate change uplift of 37% applied to the rainfall totals as per SEPA guidance. This flow was scaled by catchment area to provide an estimate of the 1 in 200-year + climate change flow in Unnamed Drain 1 (**Table 1**). The flow estimates for Unnamed Drain 2 are shown in **Table 2**.

Table 1: Unnamed Drain 1 Flow Estimates (Scaled by Catchment Area from Unnamed Drain 2)

Method	QMED	200-year	200-year + Climate Change
FEH*	0.07	0.22	0.32
ReFH 2.3**	0.06	0.23	0.34

*4.5hr Critical Storm Duration
**4.5hr Critical Storm Duration

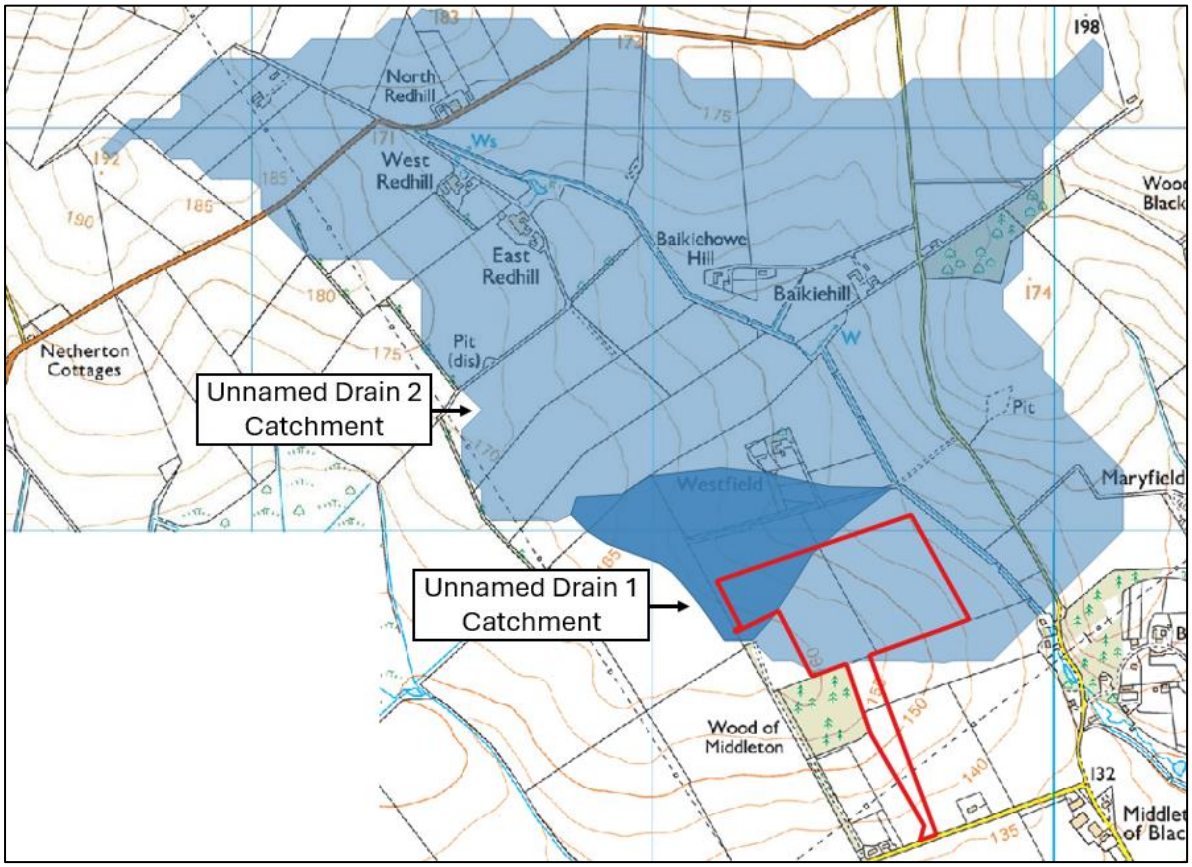
Table 2: Unnamed Drain 2 Flow Estimate

Method	QMED	200-year	200-year + Climate Change
FEH*	0.99	3.07	4.51
ReFH 2.3**	0.78	3.27	4.80

* 4.5hr Critical Storm Duration
**4.5hr Critical Storm Duration

ReFH2.3 produced the most conservative estimate and this was taken forward in the assessment.

Figure 3: Catchment Areas



5 Modelling

5.1 Unnamed Drain 1

Unnamed Drain 1 runs east to the north of the site and lies at least 1m below the minimum ground levels along the northern edge of the area proposed for development and therefore poses no risk to the proposed development itself. Bed levels of the drain drop at a 1 in 20 gradient, offering little opportunity for standing water to form in the adjacent fields.

Due to its small size the channel is poorly represented in the available photogrammetry data. The channel capacity of Unnamed Drain 1 was calculated by inputting conservative channel characteristics obtained from the topographical survey and site observations into a standard manning's equation. The 1 in 200-year + climate change design flow was calculated in **Section 4**. The input parameters and results are shown in **Tables 3 and 4** below. No overtopping of the channel adjacent to the site is predicted in the 1 in 200-year + climate change event, with 88% of the channel depth utilised.

Table 3: Unnamed Drain 1: Modelled Channel Characteristics

Invert Width (m)	Depth of Channel (m)	Width at Top (m)	Slope (m/m)	Roughness (Manning's n)	Design Flow (m^3s)
0.5	**0.5**	**1.5**	**0.04**	**0.070**	**0.34**

Table 4: Unnamed Drain 1: Channel Model Results

Flow Volume (m^3s)	Flow Velocity (m/s)	Flow Depth (m)	Flow Depth (%)	Maximum Flow Volume (m^3s)
0.34	**1.04**	**0.44**	**88**	**0.40**

As the surrounding land slopes north-east at a slope of 0.04, any flows spilling out of bank due to a blockage of the drain would flow east towards Unnamed Drain 2 parallel to the channel. The proposed development is situated atleast 120m to the south and is not at risk from this drainage feature.

5.2 Unnamed Drain 2

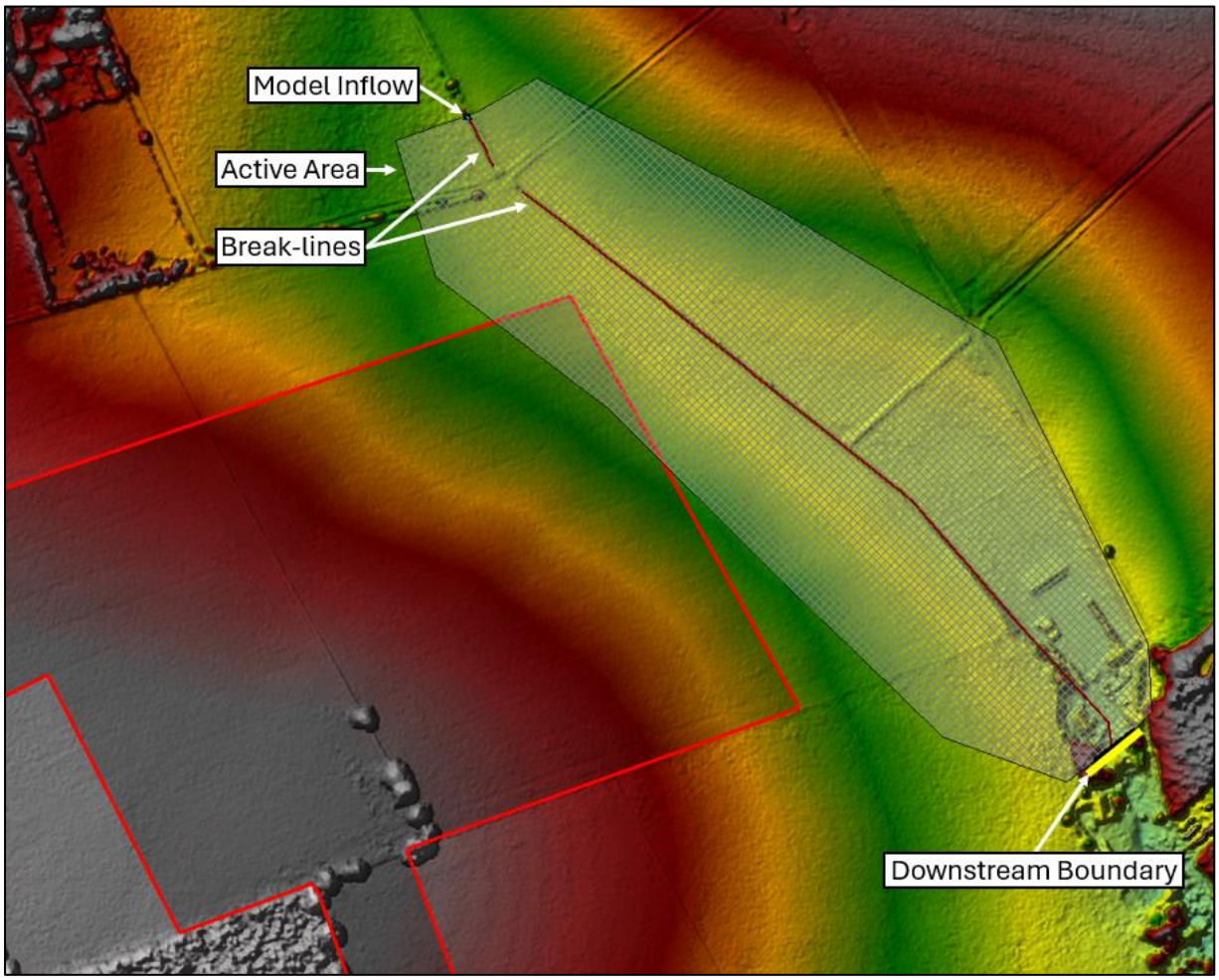
Unnamed Drain 2 runs south-east to the east of the site and drains a larger catchment of 2.4km^2 to the culvert downstream of the site. The flood risk posed by this larger drainage feature was modelled in 2D using a HecRas 6.3.1. The model setup is shown in **Figure 4**.

It should be noted that the underlying topography data was a photogrammetry-based DSM. Actual bed levels in the channel adjacent to the site are likely lower and as such the result of this modelling is conservative.

The following model parameters were used:

- SWE-ELM solver;
- Variable 0.5-2m grid cell resolution;
- 3 second timestep;
- Conservative friction value (Manning's n) of 0.06 across the 2D model domain;
- Normal depth downstream boundary of 0.001;
- Break-lines to align cells to channels and key topographic features;
- Culverts in the model domain were modelled as fully blocked; &
- Inflow based on those estimated in **Section 4**.

Figure 4: 2D Model Setup



The result of the modelling is shown in **Figure 5** and illustrate that flooding out of bank from Unnamed Burn 2 in the modelled event does not affect the site.

Figure 5: 1 in 200-year + Climate Change Flood Extent (Unnamed Drain 2)

6 Flood Risk Assessment

The flood risk assessment considers the risk from:

- Fluvial flooding;
- Surface water flooding;
- Groundwater flooding; and
- Flooding from drainage systems and other infrastructure.

It also considers risks associated with the site access.

6.1 Risk of Fluvial Flooding

As calculated in **Section 5.1** Unnamed Drain 1 drains a small catchment area and is sufficiently sized to convey the runoff draining to it in a 1 in 200-year + climate change event. If this feature were to overtop in the event of a blockage of the channel, flows would follow the slope of the land north-eastwards, parallel to the channel towards Unnamed Drain 2. The proposed development is set back from this drain by approximately 120m. The proposed development is not at flood risk from this drain.

The flood risk posed by Unnamed Drain 2 was modelled in **Section 5.2**. **Figure 5** illustrates the modelled flood risk posed by this drain. In the conservative model scenario considered, there is some risk of ponding along the eastern edge of the site. The proposed development is set back from this drain by at least 40m. The proposed development is not at flood risk from this drain.

6.2 Risk of Surface Water Flooding

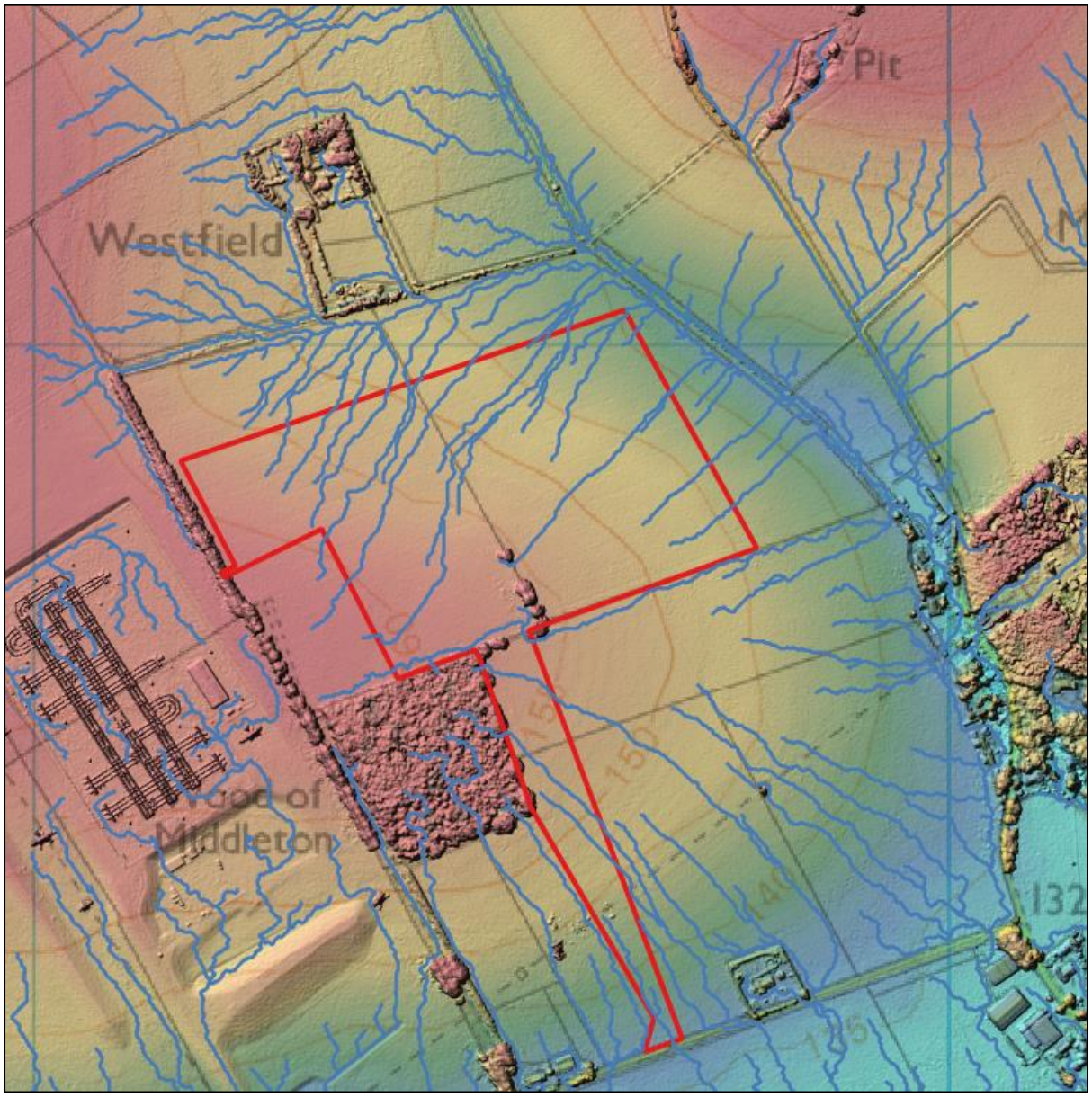
A flow pathway analysis using the available topographic data (**Figure 6**) indicates the site is not at risk of surface water flooding from out with the site.

An area measuring approximately 3ha to the south-west of the site drains to the site's western boundary. It should be noted that a BESS site has been approved for development in this area and all surface water runoff will be managed within that development.

The land to the north and east of the site drains to the unnamed drains which run parallel to the site boundary. The risk posed by these is discussed in **Section 6.1**. The land to the south of the main site area drains south-east towards the road. Surface water largely flows parallel to the proposed access.

The site presently drains to the unnamed drain in the east. This is a suitable sink for surface water runoff post development, provided this is attenuated to the greenfield runoff rate.

Figure 6: Surface Water Flow Pathways



6.3 Risk of Groundwater Flooding

The SEPA flood map does not suggest that the site is at risk groundwater flooding. Further, flooding from groundwater as a primary source is uncommon in Scotland.

Groundwater monitoring is generally undertaken as part of the geotechnical investigation. If it is determined that there is a high groundwater table in this area, suitable mitigation measures should be employed to mitigate against the risk from flooding. Alterations to the foundation and the positioning of SuDS so that they can operate effectively may be necessary if the groundwater table is high.

6.4 Flooding from Infrastructure

The site is not nor will be serviced by the Scottish Water wastewater network. Flooding from combined drainage is therefore not of concern.

The site drainage system should be designed such that, in the event of overtopping, excess runoff can be safely routed to the Unnamed Burn.

As mentioned in **Section 6.2**, post development drainage at the site should be managed to the greenfield runoff rate.

6.5 Site Drainage

Development has the potential to increase hard-standing areas within the site and increase surface water runoff. Therefore, the development will require a positive drainage system and SuDS (Sustainable Drainage System) to attenuate surface water runoff to greenfield conditions and to manage the quality of surface water runoff from the site. Runoff from the site currently flows to the drain along the eastern edge of the site. This would be an appropriate sink for site runoff post-development.

A drainage strategy has been developed for the site and incorporates filter trenches and an infiltration basin for managing water quality and providing attenuation.

6.6 Site Access

As previously illustrated in **Figure 2**, the site access track slopes up towards the site. It joins an Unnamed Road between Smithy Croft and Middleford Grange. The road sits some 11m above the Black Burn at this location. A flood event search also identified no surface water flooding issues on the existing road.

7 Summary & Conclusions

Kaya Consulting Ltd was commissioned by Blackford Renewables Ltd to undertake a Flood Risk Assessment in support of a proposed battery storage facility at Rothienorman, Aberdeenshire.

Two unnamed drains run to the north and east of the site. Calculations and modelling in **Section 5** indicate these features do not pose a risk to the proposed development.

The site is not at risk of surface water flooding, with the small 3ha catchment draining towards the site already approved for BESS development. Runoff from this area will be managed as part of the development.

The development could discharge to the unnamed drain adjacent to the site, provided flows are limited to the greenfield runoff rate to ensure flood risk is not increased downstream. Proposals are for infiltration drainage at the site. Recommendations are provided in **Section 6.5** for site drainage.

The available information indicates the site access is not at risk of flooding.

It should be noted that the risk of flooding can be reduced, but not totally eliminated, given the potential for events exceeding design conditions and the inherent uncertainty associated with estimating hydrological parameters for any given site.

8 Appendix A: SEPA Checklist

Flood Risk Assessment (FRA) Checklist

(SS-NFR-F-001 - Version 14 - Last updated 28/05/2019

This document must be attached within the front cover of any Flood Risk Assessments issued to Local Planning Authorities (LPA) in support of a development proposal which may be at risk of flooding. The document will take only a few minutes to complete and will assist SEPA in reviewing FRAs, when consulted by LPAs. This document should not be a substitute for a FRA.

Development Proposal Summary							
Site Name:		Blackford Energy Park					
Grid Reference:	Easting:	369495.7	Northing:	835838.1			
Local Authority:		Aberdeenshire Council					
Planning Reference number (if known):							
Nature of the development:		Utility Infrastructure		If residential, state type:			
Size of the development site:		16	Ha				
Identified Flood Risk:	Source:	Fluvial		Source name:	Unnamed Drain		
Land Use Planning							
Is any of the site within the functional floodplain? (refer to SPP para 255)		No		If yes, what is the net loss of storage?		m^3	
Is the site identified within the local development plan?		No		Local Development Plan Name:		Year of Publication:	
				Allocation Number / Reference:			
If yes, what is the proposed use for the site as identified in the local plan?		Select from List		If Other please specify:			
Does the local development plan and/or any pre-application advice, identify any flood risk issues with or requirements for the site.		No		If so, please specify:			
What is the proposed land use vulnerability?		Essential Infrastructure		the proposals represent an increase in land use vulnerability?	Yes		
Supporting Information							
Have clear maps / plans been provided within the FRA (including topographic and flood inundation plans)?		Yes					
Has sufficient supporting information, in line with our Technical Guidance, been provided? For example: site plans, photos, topographic information, structure information and other site specific information.		Yes					
Has a historic flood search been undertaken?		Yes		If flood records in vicinity of the site please provide details:			
Is a formal flood prevention scheme present?		No		If known, state the standard of protection offered:			
Current / historical site use:		Agricultural					
Is the site considered vacant or derelict?		No					
Development Requirements							
Freeboard on design water level:		0.6	m				
Is safe / dry access and egress available?		Vehicular and Pedestrian		Min access/egress level:		m AOD	
Design levels:	Ground level:		m AOD	Min FFL:		mAOD	
Mitigation							
Can development be designed to avoid all areas at risk of flooding?		Yes					
Is mitigation proposed?		Yes					
If yes, is compenstory storage necessary?		No					
Demonstration of compensatory storage on a "like for like" basis?		No					
Should water resistant materials and forms of construction be used?		No					

Hydrology						
Is there a requirement to consider fluvial flooding?		Yes				
Area of catchment:		2.4	km^2	Is a map of catchment area included in FRA?	Yes	
Estimation method(s) used (please select all that apply):		Pooled Analysis ☐		If Pooled analysis have group details been included?	No	
		Single Site Analysis ☐				
		Enhanced Single Site ☐				
		ReFH2 ☑				
		FEH RRM ☑				
		Other ☐		If other (please specify methodology used):		
Estimate of 200 year design flood flow:		3.27	m^3/s			
Qmed estimate:		0.78	m^3/s	Method:	Catchment Descriptors	
Statistical Distribution Selected:		N/A		Reasons for selection:	Most conservative	
Hydraulics						
Hydraulic modelling method:		2D		Software used:	HEC-RAS	
				If other please specify:		
Number of cross sections:						
Source of data (i.e. topographic survey, LiDAR etc):		Photogrammetric DSM		Date obtained / surveyed:	Jan-25	
Modelled reach length:		600	m			
Any changes to default simulation parameters?		No		If yes please provide details:		
Model timestep:		3				
Model grid size:		0.5-2				
Any structures within the modelled length?		Culvert		Specify, if combination:		
Maximum observed velocity:		2	m/s			
Brief summary of sensitivity tests, and range:						
variation on flow (%)		37	%	Please specify climate change scenario considered:	37% increase in rainfall intensity	
variation on channel roughness (%)			%			
blockage of structure (range of % blocked)		100	%			
boundary conditions:		**Upstream**			**Downstream**	
(1) type		Flow			Other	
	Specify if other			Specify if other:	Spill level of downstream crossing.	
(2) does it influence water levels at the site?		Yes			No	
Has model been calibrated (gauge data / flood records)?		No				
Is the hydraulic model available to SEPA?		No				
Design flood levels:	200-year		m AOD*	200 year plus climate change		m AOD
Cross section results provided?		No				
Long section results provided?		No				
Cross section ratings provided?		No				
Tabular output provided (i.e. levels, velocities)?		No				
Mass balance error:		<0.1	%			
Coastal						
Is there a requirement to consider coastal / tidal flooding?		No				
Estimate of 200 year design flood level:			m AOD			
Estimation method(s) used:				If other please specify methodology used:		
Allowance for climate change (m):			m			
Allowance for wave action etc (m):			m			
Overall design flood level:			m AOD			
Comments						
Any additional comments:						
Approved by:	**M Stewart**					
Organisation:	**Kaya Consulting Ltd.**					
Date:	**24-Jan-25**					