Flood Risk Statement and Drainage Impact Assessment

Contullich Energy Storage Project

Ref	05196-7060406

Revision History

Issue	Date	Name	Latest changes
01	22.12.23	William Miskelly	First created
02	25.03.24	William Miskelly	Additional pluvial flood risk drawing provided. Climate change value increased. More detail provided on surface water drainage solution. Additional maintenance information provided.
03	03.06.24	William Miskelly	Appendices updated to reflect additional access.

Contents

1 Overview

1.1 Introduction

Contullich Energy Storage Project is a proposed battery-based energy storage system located just Northwest of the town of Alness, Ross-shire, Scotland.

This report sets out the flood risk screening and surface water management plan for the proposed Contullich battery energy storage system, which will house battery enclosures along with associated infrastructure and electrical equipment.

The battery storage system comprises battery enclosures with associated power conversion systems, transformers and grid compliance equipment. All electrical equipment will be set on concrete foundations.

Drawing 05196-RES-LAY-DR-PT-001 included in Appendix A, shows the proposed project layout. The compound area within the fence measures 1.11 hectares, the total area enclosed by the red line boundary measures 6.3 hectares.

Relevant compliance certification is included in Appendix E.

2 Relevant Guidance and Legislation Requirements

This report uses best practice and conforms with the requirements of the relevant regulatory authorities.

The key legislation and guidance adhered to are as follows:

- The EU Water Framework Directive (2000/60/EC).
- Scottish Planning Policy.
- The Water Environment (Controlled Activities) (Scotland) Regulations 2011.
- SEPA Guidance for Pollution Prevention (GPPs).
- Engineering in the Water Environment, Good Practice Guide, Temporary Construction Methods, First Edition, March 2009.
- Sewers for Scotland 3rd Edition.
- Flood Risk & Drainage Impact Assessment Supplementary Guidance (The Highland Council).
- Construction Environmental Management Process for Large Scale Projects.
- The Sustainable Urban Drainage Scottish Working Party (SUDSWP) Water Assessment and Drainage Assessment Guide.
- Control of Water Pollution on Construction Sites, CIRIA C532.
- The SUDS Manual 2015. CIRIA C753.
- British Geological Survey (BGS) Maps.
- Climate Change Allowances for Flood Risk Assessment in Land use Planning, SEPA, Version 4, November 2023.

3 Existing Information

3.1 Site Location

The proposed site sits c.2km North-West of Alness town, along the B9176 Struie Road. The site is located 300m West of Alness substation. Refer to Appendix A for the Site Location Plan.

Access will be taken off Struie Road to the West of the site.

3.2 Existing Land Use and Topography

A walkover survey of the site has been undertaken, and a topographical survey of the site extents carried out to confirm the existing land use and topography. The existing site land use is for arable agricultural purposes, confirmed by the landowner during a site walkover.

Ground levels on the site compound fall from West to East across the site, with the levels at the highest point of the site in Northwest corner being 79m AOD and the lowest point 74.5m AOD in the Northeast corner. The gradient is flatter at the Southern end of the compound.

3.3 Ground Conditions

The BGS map indicates that the site is overlain by glaciofluvial deposits showing the presence of gravel, sand and silt.

3.4 Existing Hydrology / Drainage

The site appears to drain into the river Averon, which runs approx. 700m to the East. SEPA classify the river Averon as a ‘good’ quality surface water body.

SEPA mapping classify the quality of groundwater underneath and around site as ‘good’. The site does not fall in a protected area as defined by SEPA.

A site visit was conducted during summer. Some water ponding was observed in the adjacent fields to site, indicating the ground on site has limited infiltration potential.

In discussions during a site visit, the landowner stated there are land drains present on the site, however their location and condition was unknown. No land drains were found in a topographic survey (including buried services) undertaken in July 2023.

A topographic survey was commissioned for the proposed development, including in its extents a section of Struie Road and the extents of field required for the proposed development. The topographic survey is included in Appendix D.

4 Flood Risk Screening

4.1 Overview

The proposed development is deemed not at risk from flooding as set out in this flood screening section.

4.2 Flooding from Fluvial Sources and Surface Water

Figure 1 below depicts the SEPA flood risk map, with the proposed site red line boundary overlaid. As can be observed in Figure 1 the site does not lie in an area at risk of flooding from fluvial sources (blue zones). There are surface water flooding zones (purple zones) within the site boundary, however construction will not take place in these areas of the site. Refer to drawing 05196-RES-DRN-DR-PT-002 included in Appendix A showing the proposed infrastructure outside the area of flooding indicated on SEPA flood maps. Furthermore, the validity of the pluvial flooding zone has also been checked with the following observations:

- The topographical survey, included in Appendix D, shows no evidence of channels or low spots within the flood area highlighted on the SEPA flood mapping. The are no channels in the vicinity of the flood area or within the site bounds.
- Discussions with the landowner – no record of historical flooding on site.
- Site visit, no visible evidence of flooding on site.

Based on the above, it has been concluded that the site is not at risk of pluvial flooding.

Figure 1 - Excerpt from SEPA surface water and fluvial flood risk map, with proposed site boundary overlaid.

4.3 Flooding from Groundwater

SEPA flood risk mapping shows the proposed development site lies in an area with a low likelihood of groundwater flooding.

4.4 Flooding from Tidal or Sea Flooding

The development site is located outside of any area of tidal influence based on its ground elevation above ordnance datum of >50m AOD. The proposed development is therefore not considered at risk of tidal or sea flooding.

4.5 Flooding from Overland Sheet Flow

Overland sheet flow into the site will be intercepted by a drainage channel which will convey the overland sheet flow coming from the high ground above the site around the site and then discharging downstream of the site in a way that mimics the existing flow regime, this is detailed in sections 5 & 6.

4.6 Flooding from Sewers

There are no surface water sewers or highway drains in the vicinity of the development. Therefore, the development is not considered at risk of flooding from sewers.

4.7 Flooding as a Result of the Development

The development is not considered to exacerbate the flood risk of the surrounding area as runoff rates will not exceed the greenfield conditions as discussed in sections 5 & 6.

4.8 Historic Flooding

There are no known records of historic flooding to the knowledge of the Landowner.

5 Drainage Design Options

5.1 Foul Drainage

There will be no permanent foul drainage from the proposed development.

Any foul drainage from the temporary welfare facilities will be self-contained and disposed off-site appropriately.

5.2 Surface Water Drainage Discharge Options

5.2.1 General

As per The Highland Council's Planning Policy as described in 'Flood Risk and Drainage Impact Assessment Supplementary Guidance', the proposed development should be drained by a sustainable urban drainage system. As such, the SUDS Hierarchy as enclosed in Building Regulations Part H will be applied, and adequate infiltration testing to BRE 365 Digest will be undertaken to determine the viability of an infiltration-based drainage solution.

In accordance with the SEPA guidance: 'Climate Change Allowances for Flood Risk Assessment in Land Use Planning', 42% will be applied to peak rainfall intensity allowances when calculated the surface water storage volume.

5.2.2 Rainwater Re-Use

Rainwater re-use is not applicable to this project; there are no facilities within the proposed development that have a demand for water.

5.2.3 Infiltration

Based on the hierarchy identified in Section 5.2.1, the preferred method of surface water discharge is via infiltration to the ground. However, the ground on site is not anticipated to support drainage by infiltration due to the following:

- Greenfield runoff rate estimation tool created by HR Wallingford supports this assumption as it identifies the land as soil type 5 indicating a clay soil and therefore lack of suitability of infiltration methods.
- Standing water observed on ground during site visit during summer.
- Existing drainage systems in place in fields around site comprise field ditch, indicating the need to convey overland flows during storm events.

5.2.4 Attenuate Rainwater in Ponds for Gradual Release

Refer to the infrastructure layout provided in Appendix A for details of the drainage layout.

If infiltration testing shows an infiltration-based drainage solution is not possible, the next preference in the SUDS Hierarchy is to attenuate flows in an on-site basin, discharging from site at a rate that does not exceed that of pre-existing greenfield conditions. Due to the low probability of infiltration capacity on site, it is assumed for design purposes that attenuation basin is the highest option on the SUDS Hierarchy that is viable for the proposed development site.

The surface water drainage will be designed in accordance with the guidance in Section 2 and Section 5.2.1. Flows will be restricted to Qbar, and the attenuation basin will be sized to contain the 1 in 200 rainfall event plus a 42% allowance for climate change.

6 Development Proposal

6.1 Site Preparation

As part of site preparation, existing topsoil on site will be scraped off and set aside for re-use in the landscaping scheme. For the proposed areas of permanent hardstanding on site (inside the compound) and the proposed tracks, the preferred surfacing will comprise permeable unbound granular material.

The compound and tracks will facilitate construction traffic and allow safe installation of the electrical infrastructure.

The compound and surrounding temporary hardstanding area will be graded appropriately in line with existing falls, ensuring a fall within the compound does not exceed 2%.

6.2 Management of Surface Water Flows

6.2.1 Post Development Surface Water Runoff

The proposed compound on the development will result in a permanent hardstanding area of in the order of 1.11 ha. To ensure adequate allowances are made at this stage in the project, it is assumed for storage calculations that permanent hardstanding will comprise asphalt, entirely impermeable with a runoff coefficient of 1.

During the construction phase, it is expected that unbound granular material will be used to create all temporary hardstanding areas. During the operational phase, the unbound granular material will be covered by 100mm of topsoil. On this basis, post development runoff characteristics for the temporary hardstanding areas will be considered equivalent to greenfield conditions.

Stormwater uphill of the site on the Northwestern side will be intercepted by a drainage channel which will run parallel to the site boundary. Check dams will be installed in the drainage channel to slow flows and provide water quality treatment. From this drainage channel, water will be conveyed to the overland flow control and discharged overland. No change in ground permeability is proposed on the land located uphill of this filter drain therefore no increase in storm flows is expected. Therefore, water intercepted by this Northwestern drainage channel can discharge overland without passing through the flow control device (see Appendix A for drawing).

Any land drainage encountered during the construction works will be diverted or removed as necessary.

6.2.2 Proposed Attenuation Basin Design

It is proposed to use an attenuation basin to limit off-site surface water runoff from the permanent hardstanding areas on site. Ground levels on site fall to the Southeast. The proposed attenuation basin extends partially along the site’s southeastern boundary, such that surface water in the compound area can be conveyed into the basin via a filter drain. This approach allows an extra stage of water quality to remove pollutants compared with other methods of flow conveyance.

The attenuation basin will discharge overland to the Southeast of the site to match the existing greenfield conditions.

The overarching strategy of the surface water drainage system is to mimic the existing flow regime and have no greater impact on the downstream catchment as the previous greenfield situation. Flows from the compound will be restricted by means of the flow control device with excess flows up to the 1 in 200-year event + climate change being stored in the attenuation pond. Pass forward flows will be trickle fed into the 140m long overland flow control ditch. The top of the lower bank will be set at a constant level to ensure any overtopping flows are spread across the full width of the channel. Downstream of the channel is a wooded area which will act to intercept flows.

The impact on the downstream catchment is considered to be no greater than the existing greenfield scenario. Irrespective of this project, any development downstream of the site would be expected to incorporate a cut off drain to intercept any flows running off the higher ground in a significant storm scenario.

The Contullich Energy Storage Project Infrastructure Plan (included in Appendix A) shows the proposed attenuation basin design. The basin has been designed with a plan area and depth sufficient to accommodate storm flows generated on site during a 200-year event including an additional 42% allowance for climate change. To mitigate ground stability risk and slip / trip risk, basin slopes are limited to 1:3.

Attenuation calculations are summarised in Section 7 and included in Appendix B. Interception losses, such as those provided by on-site topsoil / grass, hedgerows, and vegetation, are neglected from these calculations as a conservative measure.

6.2.3 Water Quality and Treatment

In line with the requirements noted in the Highland Council flood risk & drainage impact supplementary guidance document listed in Section 2, a Simple Index Approach is undertaken to ensure the proposed drainage strategy provides adequate water quality treatment, as per Section 26.7.1 of the SUDS Manual 2015 (CIRIA C753).

The proposed development is considered a medium pollution hazard level based on land use definitions provided in Table 26.2 of the SUDS Manual. The corresponding pollution hazard indices are denoted in Table 1.

Surface water within the proposed development will receive minimum three stages of treatment before being discharged overland. The three main stages are listed below:

1. Filtration of water through filter drain stone upstream of basin; mitigation indices for filter drain: TSS = 0.4, metals = 0.4, hydrocarbons = 0.4.

2. Settlement in attenuation basin; mitigation indices for detention basin: TSS = 0.5, metals = 0.5, hydrocarbons = 0.6.

3. Filtration of water through overland flow control channel (see appendix A for drawing); mitigation indices for filter strip: TSS = 0.4, metals = 0.4, hydrocarbons = 0.5.

Table 1 below demonstrates how the pollution hazard index for each contaminant is satisfied by the three stages of water treatment provided as part of the proposed drainage strategy.

Table 1 – Simple Index Calculation

Contaminant Type	Stage 1	Stage 2	Stage 3	Total SUDS Mitigation Index	Pollution Hazard Index	Utilisation
TSS	0.4	0.5(0.5)=0.25	0.5(0.4)=0.2	0.85	0.7	1.21
Metals	0.4	0.5(0.5)=0.25	0.5(0.4)=0.2	0.85	0.6	1.42
Hydrocarbons	0.4	0.5(0.6)=0.3	0.5(0.5)=0.25	0.95	0.7	1.36

During the construction phase, temporary silts fences will be installed, providing an additional treatment stage of water filtration (see Appendix A for drawing).

6.2.4 Exceedance Flow Design

In accordance with CIRIA Report 753, an exceedance route should be considered as part of the SUDS design.

The exceedance route will remain as per the existing scenario, i.e., overland across existing vegetation and away from the battery energy storage compound.

To mitigate flood risk in the event of an exceedance, the attenuation basin will be located downslope of the energy storage facility. The resultant site levels will be such that surface water from any extreme events will flow over the banks of the attenuation basin away from the energy storage facility and then downslope overland away from the site. The edges of the attenuation basin will be vegetated to reduce the risk of scour during an extreme event.

6.2.5 SUDS Layout and Typical Details

Refer to Appendix A for indicative details and layout of the SUDS proposed across the site.

7 Hydraulic Assessment

A preliminary runoff and attenuation calculation for the compound has been undertaken using a HR Wallingford online design tool available from:

https://www.uksuds.com/tools/greenfield-runoff-rate-estimation

The inputs taken have been assumed as "worst case" and as such has determined the maximum drainage component extents required for the project. This includes assuming all permanent infrastructure (other than the access track) has an asphalt surface, and that drainage by infiltration is not possible.

A detailed drainage design will be performed following the ground investigation and compound earthing design (to determine surface finishes).

All methods and inputs are taken in accordance with the relevant guidance documents provided in Section 2.

7.1 Greenfield Peak Runoff Rates from Site

Current and future greenfield runoff rates for the development have been estimated using the IH124 Method. Using the rainfall data from the UK Centre for Ecology & Hydrology and the mapping software within HR Wallingford Design Tool, the site-specific parameters have been established:

- Standard average annual rainfall (SAAR6190): 816mm;
- Standard percentage run-off: 53%;
- Total drained area: 1.11ha;
- M5-60 rainfall depth: 14mm;
- Ratio M5-60 / M5-2day: 0.2.

Total drained area is defined as the catchment area for the attenuation basin, which comprises the area inside the compound (1.11ha). The extents of both areas are shown on the Infrastructure Layout in Appendix A, where each area is defined by a hatch pattern.

Refer to Appendix B for the Qbar design tool calculation summary.

The peak runoff rate calculated for a Qbar (1 in 2.3) rainfall event is 8.32 l/s. It is proposed to match this discharge rate through use of a flow control device installed in a manhole positioned immediately downstream of the basin.

7.2 Attenuation Storage Required Post Development

The surface water storage volume estimation tool uses a storage assessment method developed by HR Wallingford based on correlations between storage requirements and hydrological and hydraulic characteristics of sites.

Attenuation storage will be provided to accommodate the peak runoff rate calculated up to the critical 1 in 200 storm plus a 42% allowance for climate change.

Refer to Appendix B for the storage volume calculation summary.

As per the calculation described in Section 7.1, allowable discharge from the basin is set to the calculated greenfield runoff rate of 8.32 l/s.

Due to site levels and basin positioning as described in Section 6.2.2, the catchment area for the basin is defined as the compound area, 1.11ha. In the permanent case, any area defined as temporary hardstanding will be grassed, comprising a layer of topsoil minimum 100mm in thickness. This area is therefore considered a permeable.

The attenuation volume calculated based on the above criteria is approximately 895m^3. 3D modelling has been carried out to prove this volume can be accommodated within the site boundary. The attenuation volume should be considered a maximum volume, this assumes that all permanent infrastructure (other than the access track) has an asphalt surface and that drainage by infiltration methods is not possible.

As per the Highland Council planning guidance shown in Appendix C, it is required that following the critical 1 in 30-year event (including 42% climate change), any proposed attenuation basin can empty within 24 hours. From the storage volume calculation included in Appendix B; it can be observed that for the 30-year return period calculation of a 10-hour storm event, a maximum attenuation volume of 546m^3 is required. Based on an outfall rate of 8.32 l/s, 546m^3 would take 18.23 hours to drain completely.

8 Operation and Maintenance Requirements

8.1 General

All surface water drainage and pollution control features associated with the site will remain private and will be maintained by the site operator.

The following section outlines the proposed maintenance for the various aspects of the drainage system. If necessary, these outline maintenance proposals will be refined when the site is operational to suit specific conditions.

A maintenance record log will be maintained for all maintenance work carried out. Where problems persist on each six-monthly inspection, advice will be sought from the SUDS designer on an alternative drainage solution.

8.2 Post Storm Event Inspection and Maintenance

The drainage system will be inspected following a significant storm event when the likelihood of system blockage due to siltation or debris is most prevalent.

All manholes will be lifted and inspected to check for blockages, inlets and outlets will be visually inspected and the filter drain checked for areas of standing water to ensure its functionality. Where drainage infrastructure is clogged, debris / sediment will be removed as required.

8.3 Discharge Pipe

The anticipated maintenance plan for the attenuation basin discharge pipe & outfall is outlined in Table 2.

Table 2 - Typical Discharge Pipe Operation and Maintenance Requirements

Discharge Pipe Maintenance Schedule	
Maintenance Action	**Minimum Frequency**
Inspect manhole / pipe. Where pipe has become clogged with silt, the pipe will be cleared out	Half yearly and after a significant storm event
Remove litter and debris	Half yearly and after a significant storm event
Inspect inlets and outlets for blockages, and clear (if required)	Half yearly and after a significant storm event

8.4 Filter Drain

The anticipated maintenance plan for the filter drain is outlined in Table 3.

Table 3 – Typical Filter Drain Operation and Maintenance Requirements

Filter Drain Maintenance Schedule	
Maintenance Action	**Minimum Frequency**
Inspect filter drain for standing water. Where filter media has become clogged with silt, remove filter media, clear silt, and replace.	Half yearly and after a significant storm event
Inspect manhole / pipe. Where pipe has become clogged with silt, the pipe will be cleared out	Half yearly and after a significant storm event
Remove litter and debris	Half yearly and after a significant storm event
Inspect inlets and outlets for blockages, and clear (if required)	Half yearly and after a significant storm event

8.5 Infiltration / Attenuation Basin

The anticipated maintenance plan for the basin at the site is outlined in Table 4.

Table - Typical Basin Operation and Maintenance Requirements

Basin Maintenance Schedule	
Maintenance Action	**Minimum Frequency**
Remove litter and debris	Half yearly and after a significant storm event
Inspect inlets and outlets for blockages, and clear (if required).	Half yearly and after a significant storm event
Inspect inlets and outlets for noticeable effects of erosion, suitable erosion protection measures such as reno-mattress or placement of large stones (>150mm) to dissipate water energy levels will be installed at the area affected.	Half yearly and after a significant storm event
Inspect silt accumulation rates in any forebay and in main body of the pond and establish appropriate removal frequencies	Half yearly and after a significant storm event
Reseed areas of poor vegetation growth, alter plant types to better suit conditions (if required).	As required, or if bare soil is exposed over 10% or more of the basin treatment area

9 Conclusion

A flood risk assessment has been undertaken across the site. The site has been deemed at low risk of flooding.

An assessment of the drainage options has also been undertaken, and it has been concluded that drainage by infiltration is unlikely to be a viable option. As such, the current proposal is to drain the site via an attenuation basin, with a restricted discharge rate, discharging overland to match its existing drainage condition. Infiltration testing will be undertaken on site prior to detail design, and should acceptable infiltration rates be found, an infiltration solution will be adopted during detail design. The location and condition of land drains will also be determined prior to detailed design to determine if an alternative discharge method can adopted.

The required attenuation volume has been calculated as approximately 895m^3. This should be considered a maximum volume, based on the assumption that all permanent infrastructure (other than the access track) has an asphalt surface and that drainage by infiltration methods is not possible.

A site investigation, 3D earthworks design, earthing design, and a further assessment of the proposed discharge will be undertaken to inform the detailed design of the site drainage.

The drainage strategy proposed will provide sufficient water quality treatment as demonstrated using the Simple Index Approach.

Appendix A Project Drawings

A.1 Location Plan – 05196-RES-MAP-DR-XX-002_Rev 01

A.2 Infrastructure Layout – 05196-RES-LAY-DR-PT-001_Rev 03

A.3 Typical Drainage Details – 05196-RES-DRN-DR-PT-001_Rev 02

A.4 SEPA Pluvial Flooding and Infrastructure Layout – 05196-RES-DRN-DR-PT-002_Rev 02

Appendix B Calculations

B.1 Greenfield runoff rate estimation – 05196-6668170

B.2 Contullich Energy Storage Project- Storage Calculation – 05196-7060255

B.3 Rainfall Point Data – 05196-7059216

Appendix C Correspondence with The Highland Council

C.1 Relevant Response from The Highland Council

Appendix D Surveys

D.1 Topographical Survey – 05196-7026608

Appendix E Compliance Documents

E.1 The Highland Council Self Certification