FEHILY TIMONEY

CONSULTANTS IN ENGINEERING, ENVIRONMENTAL SCIENCE & PLANNING

BALLYNAHONE LONG DURATION BATTERY STORAGE

Construction and Environmental Management Plan (CEMP)

Prepared for:

FuturEnergy Ireland Development DAC

FuturEnergy Ireland

Date: **September 2024**

Document No:

P24117-FT-ZZ-XX-MP-ZZ-0001

Core House, Pouladuff Road, Cork, T12 D773, Ireland

T: +353 21 496 4133 | E: info@ftco.ie

CORK | DUBLIN | CARLOW

www.fehilytimoney.ie

CONSTRUCTION AND ENVIRONMENTAL MANAGEMENT PLAN

REVISION CONTROL TABLE, CLIENT, KEYWORDS AND ABSTRACT

User is responsible for Checking the Revision Status of This Document

Rev. No.	Description of Changes	Prepared by:	Checked by:	Approved by:	Date:
1	Final	IW/NSC	TB	TB	18/09/2024

Client: FuturEnergy Ireland Development DAC

Keywords: Construction and Environmental Management Plan, CEMP, Planning Application, Energy, Grid, Storage, Battery

Abstract: This document is the Construction and Environmental Management Plan (CEMP) for a proposed Long Duration Energy Storage (LDES) Facility near Buncrana, Co. Donegal. This CEMP has been developed specifically for this project and outlines construction practices and environmental management measures which will be implemented during the construction phase, in order to minimize potential adverse effects on the surrounding environment. This document should be read in conjunction with the Project Planning and Environmental Report.

TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF FIGURES

Page

LIST OF FIGURES

1. INTRODUCTION

This document is the Construction and Environmental Management Plan (CEMP) for a proposed Long Duration Energy Storage (LDES) Facility comprising a battery energy storage container compound and transformer compound and all associated access roads, hard standings, drainage, cabling, landscaping and biodiversity enhancement measures adjacent to the existing 110kv Trillick network substation within the townlands of Ballynahone and Trillick near Buncrana, Co. Donegal. The purpose of the LDES Facility will be to provide long duration energy storage to support the penetration of renewable energy generation onto the national grid.

This CEMP has been developed specifically for this project and outlines construction practices and environmental management measures which will be implemented during the construction phase, in order to ensure that the project is built in accordance with best practice and mitigation measures identified in the project's Planning and Environmental Report in order to minimize impacts on the surrounding environment. This document should be read in conjunction with the Project Planning and Environmental Report.

Prior to construction, the Appointed Main Contractor will prepare a detailed CEMP taking into account methods/requirements outlined in this report. This CEMP will form the basis of the construction management approach on site, while the works are being completed; ensuring environmental management measures are in place, which will be implemented during the construction phase, in order to ensure that the project is constructed in accordance with best practice, with the minimum impact on the surrounding environment.

1.1 General Introduction and Purpose

This CEMP sets out the key environmental management issues typically associated with the construction and operation of a Long Duration Energy Storage Facility, to ensure that during the construction and operation of the development, the impacts on the environment are minimised. It is anticipated that the CEMP will be a 'live' document under ownership of the Applicant and managed by the Contractor once appointed up to and throughout the period of construction. This CEMP will form the basis for the appointed contractor's Construction and Environmental Management Plan.

1.2 The Applicant

The applicant for this development is FuturEnergy Ireland Development DAC .

1.3 The Site

The proposed LDES facility development is located within the townland of Ballynahone, near the town of Buncrana Co. Donegal, on lands adjacent to the existing Trillick 110 kV Substation. The subject site is easily accessible by public roadways to the south and east.

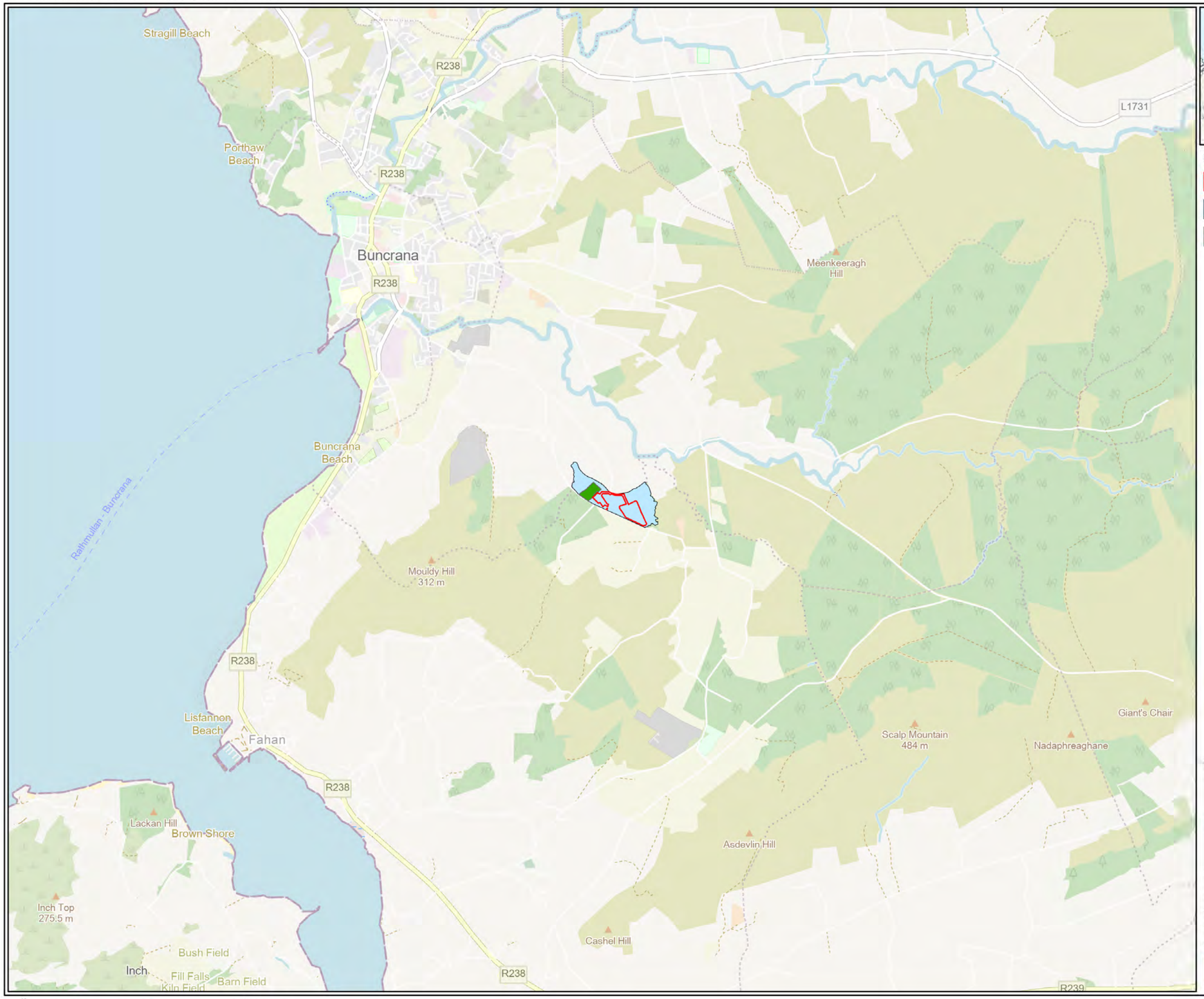
The surrounding landscape is mostly used as farmland and forestry with inland peat bogs located to the east of the subject site. The subject site is set out in a semi-mature coniferous forestry plantation. There are several one-off rural dwellings located near the subject site, in addition to a farm/construction yard and a gun club.

This subject site's topography slopes gently from west to east. The subject site's natural drainage pattern flows into a tributary of the Owenkillew River, which runs adjacent to the eastern edge of the Site flowing from south to north eventually passing through Buncrana Town to the sea. The coastal area where the river meets the sea is part of the Lough Swilly SAC.

The location of the site is shown in Figure 1-1 below.

The general arrangement of the site is shown on Figure 3.1 and 0100 series planning application site layout drawings.

Path: R:\Map Production\2023\P23-117\Workspaces\P23-117_Figure_1_1_Site_Location - CEMP.aprx



Legend

- Proposed Development Boundary
- Landowner Folio Boundary
- Trillick 110kV Substation

N W E S

0 0.5 1 2 Kilometers

TITLE:	Site Location Plan		
PROJECT:	Ballynahone Long Duration Battery Storage Planning and Environmental Services		
FIGURE NO:	1.1		
CLIENT:	FuturEnergy Ireland		
SCALE:	1:40,000	**REVISION:**	0
DATE:	9/18/2024	**PAGE SIZE:**	A3

FEHILY TIMONEY
Cork | Dublin | Carlow
www.fehilytimoney.ie

2. EXISTING ENVIRONMENTAL CONDITIONS

The site of the proposed development is comprised of 5.8 hectares and is situated within a privately owned forestry plantation. The site is bounded by agricultural lands to the north, coniferous forestry and the Mill Donegal_020 River to the east, public roads to the south, and coniferous forestry plantations to the south-west. Directly adjacent to the north-western portion of the site is the Trillick 110kV Substation.

The surrounding landscape is mostly used as farmland and forestry with inland peat bogs located to the east of the site. The Site is easily accessible by public roadways to the south and is bisected by a local road from the either the unnamed local access route to the west from Buncrana or to the east from Tooban.

There are no European sites within or directly adjacent to the Ballynahone Long Duration Energy Storage proposed development. However, the Mill River to the east of the site flows in a northerly direction, and enters the Lough Swilly SAC 5.2km, and the Lough Swilly SPA 7.3 km downstream of the proposed development. There are no recorded Monuments on the site.

Detailed information on the existing site environment can be found in the Planning and Environmental Report accompanying the planning application for the proposed development.

3. OVERVIEW OF THE CONSTRUCTION WORKS

3.1 Description of the Proposed Development

3.1.1 Development description

The proposed development, on an overall site of c.5.8 hectares, comprises the following:

- Long Duration Energy Storage (LDES) Compound with a total surface area of c.2.9 hectares with associated internal access roads;
- Installation of onsite transformer compound (c. 3,600 sq m) to facilitate an under-the fence connection to the adjacent Trillick substation. The transformer compound will include an Independent Power Producer Building of c. 27 sq m, a 110 kV transformer, an up to 18 m high lightning monopole mast, boundary fence and associated ancillary development;
- Battery Energy Storage Units comprising metal shipping containers housing batteries [approximately 12.2 m (L) x 2.6 m (W) and 2.9 m (H) each] and associated ancillary control and ventilation units within an area of c.1.9 hectares;
- A temporary construction compound hard standing with a total surface area of c.1,500 sq m and associated access from the L-7231 public road;
- c.515 m of new and upgraded access tracks;
- Upgrade of 1 no. existing entrance and creation of 1 no. new permanent access from the L-7231 public road for construction and operation of the facility;
- Underground electrical and communications cabling;
- Security lighting, CCTV and communications mast;
- A new mains fresh water connection, on-site freshwater storage tank and reverse osmosis water treatment unit;
- Storage container;
- Sound reflective barriers;
- Security fencing and gates;
- Drainage system including on-site surface water attenuation pond;
- Tree felling and site clearance works;
- Landscaping and planting.

Please refer to the Planning and Environmental Report for detailed descriptions of the proposed infrastructure.

3.2 Site Layout

The general arrangement of the site is shown on 0100 series planning application drawings and in Figure 3-1.

Path: R:\Map Production\2023\P23-117\Workspaces\P23-117_Figure_3_1_Site_Layout - CEMP.aprx

TRILLICK

L-7231

L-7221

Indicative Trillick Substation Compound Expansion

UTF Transformer Compound

Temporary Construction Compound and Laydown Area

Legend

- Proposed Development Boundary
- Surface Water Attenuation Pond
- Indicative Trillick Substation Compound Expansion
- Temporary Construction Compound and Laydown Area
- UTF Transformer Compound
- Existing Trillick Substation Compound
- Proposed Native Woodland
- Embankments
- Access Roads
- Battery Storage Unit
- Fresh Water Storage Tank
- Reverse Osmosis Water Treatment Unit
- Storage Container
- Sound Barrier
- Security Fence
- Access Track

Note: Please refer to Landscape Plan for proposed landscaping and planting.

TITLE:	Site Layout Plan		
PROJECT:	Ballynahone Long Duration Battery Storage Planning and Environmental Services		
FIGURE NO:	3.1		
CLIENT:	FuturEnergy Ireland		
SCALE:	1:2,500	**REVISION:**	0
DATE:	9/18/2024	**PAGE SIZE:**	A3

FEHILY TIMONEY Cork | Dublin | Carlow www.fehilytimoney.ie

N W E S

0 50 100 200 Meters

3.3 Construction Period

The construction period for the proposed development is estimated at 12-months.

3.3.1 Overview of the Construction Sequence (Preliminary Only)

The indicative construction programme for the proposed project is shown below.

Construction Activity	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
Mobilisation												
Felling												
Onsite Access Tracks and Hard Standings												
LDES Compound Equipment Installations												
Utility Connection												
UTF Transformer Compound												
Grid Connection & Internal Private Network												
Testing and Commissioning												
Landscaping and Reinstatement												
Demobilisation												

Figure 3-2: Indicative Construction Programme

If planning permission is secured for the proposed development, construction of site access tracks will precede all other activities. Hardstanding and material storage areas will be constructed at this time also. Drainage infrastructure will be constructed in parallel with the track construction. Site security fencing will be erected as necessary around the proposed site.

3.3.2 Overview of the Construction Methodology (Preliminary Only)

The proposed construction methodology for key activities are summarised under the following headings:

- Pre-construction activities and pre-construction surveys;
- Site access;
- Temporary site compound;
- Felling;
- New Site Access Tracks and Hard Standings;
- Drainage;
- Building and equipment installation;
- Cable Trenching;
- Fencing and boundary treatments;

3.3.2.1 Pre-Construction Activities

Before works commences a number of preparatory activities will be carried out. The following key works will be undertaken as part of the site preparation and pre-development activities:

Pre-Commencement Surveys

- Prior to any commencement of any physical works, demarcation works and benchmarks on site will be established.
- Any detailed ground investigations required to support the site regrading process will be carried out and finalised.
- Pre- commencement ecological surveys.

Enabling Works

- Any surface water management, bunding, waste management measures etc. will be put in place at the outset.
- Part of the pre-commencement activities will be the installation of suitable protection (e.g. temporary drain/berm/silt curtain) around the site boundaries to control and treat any run-off during the works.
- Prior to commencement of construction works, silt fencing or other appropriate silt retention measures will be installed, where there is a risk of erosion runoff to the drain from construction related activities. Temporary ditches settlement ponds will be installed and will remain in operation until construction and landscaping has been completed.
- Pre-commencement activities will also include the erection of signage and information boards for the general public, site employees and trucks transporting materials to/from the site.
- A traffic management plan will be completed prior to the works commencing and this will be agreed between the Applicant, the Contractor and Donegal County Council to ensure that traffic is managed during the works safely and with minimal impact.

3.3.2.2 Site Access

Prior to the commencement of on-site construction works, the proposed site entrances will be constructed or upgraded and widened. Visibility Splays will be provided in accordance with TII Design Standard DN-GEO-03060 Geometric Design of Junctions.

The locations of 3 no. proposed site access points are shown in the proposed site layout plan which was submitted as part of the proposed development's planning application.

The project includes the use and upgrade of an existing forestry entrance to access the LDES Compound for construction and operational purposes.

A new construction and operational access shall be created across the road from the above location to serve the UTF Transformer compound.

A temporary access shall be created directly to the south of the UTF Transformer Compound access to provide construction stage access only to the proposed temporary construction compound and laydown area as shown on the site layout plan. This access shall be permanently closed off and fully reinstated at the end of the construction stage.

A road sweeper will be made available to keep the surrounding road network free from soiling if required.

Site entrances will be secured and locked when not in use.

3.3.2.3 Temporary Site Compound

During the construction phase, it will be necessary to provide temporary facilities for construction personnel. The location of the temporary site compound is shown on 0100 series planning application drawings and Figure 3-1.

Facilities to be provided in the temporary site compounds will typically include the following:

- Site office, of portacabin type construction
- Toilets
- Potable water supply
- Water tanker
- First aid facilities
- Employee parking
- Bunded fuel storage area
- Contractor lock-up facility
- Diesel generator

The temporary facilities will be removed on completion of the construction phase.

3.3.2.4 Felling

Permanent felling of coniferous forestry is required within and around the infrastructure to accommodate the construction of hardstands and access tracks. In advance of other construction works, clearance felling will commence on site.

To ensure a tree clearance method that reduces the potential for sediment and nutrient runoff, the construction methodology will follow the specifications set out in the Forest Service Forestry and Water Quality Guidelines (2000) and Forest Harvesting and Environmental Guidelines (2000).

In this regard, before any felling works commence on site all personnel, particularly machine operators, will be made aware of the following and will have copies of relevant documentation, including:

- The felling plan, surface water management, construction management, emergency plans and contingency plans;
- Environmental constraints relating to the site;
- The outer perimeter of all buffer and exclusion zones;
- All health & safety issues relating to the site.

3.3.2.5 New Site Access Tracks and Hard Standings

Access tracks will be of standard traditional aggregate road construction and the general method of construction will be as follows:

- Establish alignment of the new site tracks from the construction drawings and mark out centrelines.
- Topsoil/subsoil will be stripped back to required levels. All material will be bunded and stored separately.
- The soil will be excavated down to a suitable formation layer of either firm subsoil or rock.
- The formation will be prepared to receive the geotextile membrane.
- Well-graded granular fill will be spread and compacted in layers to provide a homogeneous running surface.

The access tracks will be constructed in accordance with site layout plans and associated construction details.

Refer to planning 0300 series planning application drawings for design details.

3.3.2.6 Drainage

A site-specific drainage system has been designed taking account of ground and hydrological conditions at the site. The proposed construction and operational stage drainage system is shown on 0100 series site layout plan drawings.

Please refer to Section 4.2 for details on proposed surface water management and drainage system design.

3.3.2.7 Building and Equipment Installations

Equipment associated with both the LDES and UTF compound shall be of pre-fabricated or steel container construction. Units will be lifted into place using a suitable crane onto concrete plinths. Lifting operations will follow a lifting plan agreed between the crane operator and contractor. A suitable hard standing area will be provided by the contractor adjacent to each proposed lifting position to the requirements of the crane operator.

Inverters, transformers and switchgear units will be lifted into place using a suitably sized crane, telehandler or HIAB. Any lifting operations will adhere to a specific lift plan, issued by the contractor responsible for the installation. Switchgear, electrical cabinets and control equipment will be lifted directly onto support plinths and bolted down if necessary. The installation of major electrical equipment such as inverters, transformers, switchgear etc. will typically be followed by small control equipment, LV fit out for light, DC and communications cabling, earth installations, CCTV network cabling.

Following installation of electrical equipment, cable jointing and terminations will be carried out followed by testing and commissioning works. Following the construction of the equipment plinths, an earth mat will typically be installed in the compound. This will be connected to earth rings around each plinth and foundation and connected to the earth protection system as per the electrical protection design. Earth electrodes will be typically buried at a depth of approximately 0.6 m - 1 m below finished ground level and will be offsite from structures by approximately 1 m.

3.3.2.8 Cable Trenching

The specification for cable trenches will vary slightly depending on cable voltage, location and existing land use. The maximum depth of cable trenches is typically 1.2 m.

Buried cables shall follow internal road and access track corridors. In advance of construction, detailed desk studies and site investigations will be carried out to find the optimal location to place cables within these corridors. Records of services such as water mains, sewers, gas mains, communications cables and other power cables will be obtained from the relevant service providers. Cable detection tools, ground penetrating radar and slit trenches will be used by the contractor, as appropriate, to find the exact locations of existing services.

The typical method of construction involves the following:

- The contractor initially excavates the trench to the specified depth using a mechanical excavator.
- A bedding of sand or approved CBM (cement bound material) is placed in the bottom of the trench.
- The cable is laid in the trench from a ground or vehicle mounted cable drum reel.
- If specified, the contractor will lay ducting in the trench. If so, a rope will be inserted into the ducts to facilitate cable-pulling later.
- Communication cables and respective ducts will also be laid where required.
- Cable marker strips will be placed at a specified distance above the cables/ducts.
- The trench is back-filled using as-dug material and topsoil reinstated with vegetated side up where possible.
- Back-filling and reinstatement in public roads will be to a specification to be agreed with the relevant road authority.

3.3.2.9 Fencing and Boundary Treatments

Each compound will be surrounded by a 2.6m galvanized steel fence in accordance with the details shown on planning application drawings.

In addition to security fences, sound reflective barriers shall be constructed in accordance with the design as shown on site layout plans and associated details.

All boundary treatments and landscape planting shall be carried out in accordance with the Landscape Plan.

3.4 Construction Working Hours

The hours of construction activity will avoid unsociable hours. It is anticipated that this will restrict working hours at the site during the installation phase to be limited to 07:00 to 19:00 Monday to Friday inclusive and 7:00 – 16:00 Saturday.

Work on Sundays or public holidays will only be conducted in exceptional circumstances and subject to prior notification insofar as possible with the local community.

4. ENVIRONMENTAL MANAGEMENT PLAN

4.1 Project Obligations

The construction of the Ballynahone Long Duration Energy Storage facility will impose safety management obligations on the Applicant, designer and contractor. Responsibilities and obligations are comprehensively set-out in health and safety at work legislation listed below. As well as statutory obligations, there may be specific obligations set out in the planning conditions for the proposed synchronous compensator, should it be granted consent.

The contractor for the main construction works and all of its sub-contractors are to ensure that they are fully aware of and in compliance with these safety obligations.

4.1.1 Planning Permission Obligations

Should the proposed development be granted consent, the planning conditions will be complied with and will be read in conjunction with the project CEMP and other related reports prepared by and on behalf of the Applicant.

4.1.2 Felling License

Permanent felling of approximately 4.7 ha of commercial forestry is required to accommodate the construction of development.

The felling area proposed is the minimum necessary to construct the proposed project. In advance of other construction works, clearance felling will commence on site and is expected to take up to 12 weeks.

The felling will be the subject of a Felling Licence Application to the Forest Service prior to construction.

Where feasible, no scrub clearance, tree felling will occur during the bird breeding season from 1st March to 31st August. Hedgerows may need to be managed during this season, but careful consideration will be given to in the management of any hedgerows during this season. Pre-construction bird surveys shall be undertaken prior to works commencing where works during the breeding season are unavoidable.

If felling is reauired during breeding season, any works will take place under exemption afforded for consented development under the Wildlife Act and subject to a pre-clearance survey by a qualified ecologist.

4.1.3 Other Obligations

The Safety, Health and Welfare at Work Act 2005 and the Safety, Health and Welfare at Work (Construction) Regulations 2013 place a responsibility on the Aplicant as the “Client”, the Designer, the Project Supervisors and the Contractor.

The Client must:

- Appoint a competent and adequately resourced Project Supervisor for the Design Phase (PSDP)
- Appoint a competent and adequately resourced Supervisor for the Construction Stage (PSCS)
- Be satisfied that each designer and contractor appointed has adequate training, knowledge, experience and resources for the work to be performed

- Co-operate with the project supervisor and supply necessary information
- Keep and make available the safety file for the completed structure
- Provide a copy of the safety and health plan prepared by the PSDP to every person tendering for the project.
- Notify the Authority of the appointment of the PSDP.

Designers must:

- Identify any hazards that their design may present during construction and subsequent maintenance;
- Eliminate the hazards or reduce the risk;
- Communicate necessary control measures, design assumptions or remaining risks to the PSDP so they can be dealt with in the safety and health plan;
- Co-operate with other designers and the PSDP or PSCP;
- Take account of any existing safety and health plan or safety file;
- Comply with directions issued by the PSDP or PSCS.

The PSDP must:

- Identify hazards arising from the design or from the technical, organisational, planning or time related aspects of the project;
- Where possible, eliminate the hazards or reduce the risks;
- Communicate necessary control measure, design assumptions or remaining risks to the PSCS so they can be dealt with in the safety and health plan;
- Ensure that the work of designers is coordinated to ensure safety;
- Organise co-operation between designers;
- Prepare a written safety and health plan for any project and deliver it to the client prior to tender;
- Prepare a safety file for the completed structure and give it to the client.

The PSCS must:

- Co-ordinate the identification of hazards, the elimination of the hazards or the reduction of risks during construction;
- Develop the Safety and Health Plan initially prepared by the PSDP before construction commences;
- Co-ordinate the implementation of the construction regulations by contractors;
- Organise cooperation between contractors and the provision of information;
- Co-ordinate the reporting of accidents to the Authority;
- Notify the Authority before construction commences;
- Provide information to the site safety representative;
- Co-ordinate the checking of sage working procedures;

- Co-ordinate measures to restrict entry on to the site;
- Co-ordinate the provision and maintenance of welfare facilities;
- Co-ordinate arrangements to ensure that craft, general construction workers and security workers have a Safety Awareness card, e.g. Safe Pass and a Construction Skills card where required;
- Co-ordinate the appointment of a site safety representative where there are more than 20 persons on site;
- Appoint a safety adviser where there are more than 100 on site;
- Provide all necessary safety file information to the PSDP;
- Monitor the compliance of contractors and others and take corrective action where necessary;
- Notify the Authority and the client of non-compliance with any written directions issued.

The Contractor must:

- Co-operate with the PSCS;
- Promptly provide the PSCS with information required for the safety file;
- Comply with directions of the project supervisors;
- Report accidents to the Authority and to the PSCS where an employee cannot perform their normal work for more than 3 days;
- Comply with site rules and the safety and health plan and ensure that your employees comply;
- Identify hazards, eliminate the hazards or reduce risks during construction;
- Facilitate the site safety representative;
- Ensure that relevant workers have a safety awareness card and a construction skills card where required
- Provide workers with site specific induction;
- Appoint a safety officer where there are more than 20 on site or 30 employed;
- Consult workers with site specific induction;
- Monitor compliance and take corrective action.

Consequently, at all stages of the project there are statutory requirements for the management of safety, health and welfare of all involved in or affected by the development.

4.2 Environmental Management Programme

The Contractor's Project Manager will be responsible for the delivery of all elements of the Environmental Management Plan.

The Contractor's Project Manager will retain all responsibility for issuing, changing and monitoring the Environmental Management Plan throughout.

4.2.1 Surface Water Management Plan

4.2.1.1 Drainage of the Site During Construction and Operation

A drainage design has been prepared for the site as shown on 0100 Series planning application drawings. The drainage design has been designed to take account of existing topography, land cover and existing hydrological features. Existing small forestry drains are present on the site draining towards the river (MILL (DONEGAL)_020). A number of these drains shall be removed as part of the construction of the proposed project and replaced by the proposed drainage system.

A key design philosophy employed for surface water management is the use of existing forestry tracks where available alongside the implementation of Sustainable Drainage Systems (SuDS). This design approach ensures that existing drainage patterns will be maintained throughout the site.

An appropriate drainage design is the primary mitigation measure for the protection of waterbodies, incorporating silt protection infrastructure and control measures to reduce the rate of surface water runoff from the site.

The drainage system will be constructed alongside compound hard standings and internal access tracks. Existing track drainage shall be retained.

As standard and best practice approach, surface water runoff attenuation and drainage management are key elements in terms of mitigation against impacts on surface water bodies.

Two distinct methods will be employed in the management of construction surface water runoff. The first method involves keeping clean water clean by avoiding disturbance to natural drainage features, minimising any works in or around drainage features, and diverting clean surface water flow around excavations and construction areas. The second method involves collecting any drainage waste from works areas within the site that might carry silt or sediment, and to route them towards settlement ponds prior to controlled diffuse release over vegetated natural surfaces. There will be no direct discharge to surface water.

'Clean' water is separated from 'dirty' water utilizing interceptor drains. The interceptor drains will be installed on the upslope side of the construction areas. This will reduce the amount of water from construction area that will need to be treated before it can be safely discharged into the environment.

Collected clean water will be carried under infrastructures by cross drains at regular intervals to ensure the original flow is not impeded. The maximum distance between the cross drains will be 250m. Cross drains will be connected to existing downslope forestry drainage or diffuse outfalls to allow collected water to infiltrate naturally.

Access tracks and compound hard standings will be constructed from a permeable aggregate material to allow the runoff to infiltrate. The excess water will drain into swales which will be connected, during the construction stage, to the settlement ponds.

Proposed access roads and associated drainage infrastructure follow contours as much as possible to reduce the gradient of the road and road drains (swales). This will reduce velocities within the swales, and consequently erosion.

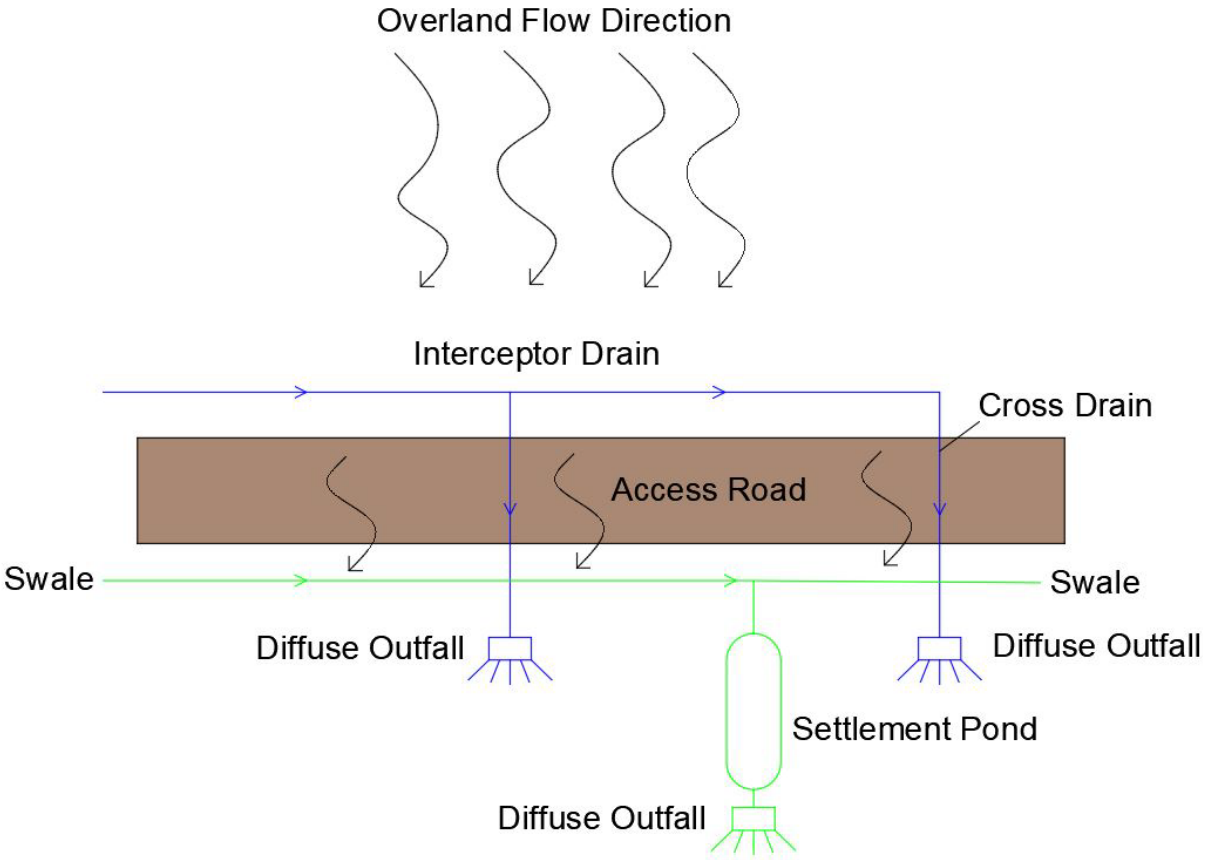


Figure 4-1: Drainage System Diagram

Settlement ponds will be designed in the accordance with CIRIA C648. The volume of a settlement pond is related to the area draining into it. Any upslope runoff from site will be diverted from ponds.

The Contractor will implement temporary control measures such as silt fences, silt bags, temporary settlement tanks, as required.

4.2.1.2 Mitigation Measures

Mitigation Measures for Pollution Control to Protect Water Quality in Downstream Receptors

- All personnel working on site will be trained in pollution incident control response. An emergency response procedure is prepared herein which will ensure that appropriate information will be available on site outlining the spillage response procedure and a contingency plan to contain silt.
- It is not proposed to cross watercourses with access tracks or electrical cables as part of this development. However, Silt Protection Controls (SPCs) shall be implemented at the location of drain crossings and where haul roads pass close to watercourses, silt fencing will be used to protect the streams.
- Silt traps will also be provided at outfalls from roadside swales. Silt traps will be kept upstream of outfalls to allow a buffer zone to the outfall. Additional silt fencing will be kept on site in case of an emergency break out of silt laden run-off.

- Settlement ponds will be put in place in advance as construction progresses across the site. The settlement ponds with a diffuse outflow detail will mitigate any increase in runoff and treat suspended solids in the surface water runoff. Erosion control and retention facilities, including settlement ponds will be regularly maintained during the construction phase.
- All stockpile material will be bunded adequately and protected from heavy rainfall to reduce silt runoff, where necessary. Adequate security will be provided to prevent spillage as a result of vandalism.
- Suitably sized cross-drains will be provided for drainage crossings to convey flows from agricultural drains and forestry drains across the access tracks, to prevent a risk of clogging.
- Tracks will be capped as soon as practicably possible to cover exposed subsoils and as such reduce the concentration of suspended solids in the run-off.
- Additional protection will be provided in the form of silt fencing downslope where required and at existing stream crossings during construction, to further ensure that there is no impact from the development to streams and rivers.
- Refuelling of plant during construction will be carried out at the construction compound, which will be located a minimum of 50m from any watercourse. The station will be fully equipped for a spill response and a specially trained and dedicated environmental and emergency spill response team will be appointed before commencement on site. In addition to the above, onsite re-fuelling of machinery will be carried out 50m from watercourses using a mobile double skinned fuel bowser.
- Drip trays and spill kits will be kept available on site, to ensure that any spills from vehicles are contained and removed off site.
- Any diesel, fuel or hydraulic oils stored at the temporary site compounds will be bunded. The bund capacity will be sufficient to contain 110% of the tank's maximum capacity.
- Concrete washout will be carried out in designated areas. Only the washing of chutes will be permitted. Chutes will be washed out at the designated area with a settlement lagoon provided to receive all run-off.
- Vehicles entering the site shall be in good working order, free from leakage of fuel or hydraulic fluid.
- Portaloos and/or containerised toilets and welfare units will be used to provide toilet facilities for site personnel during construction. Sanitary waste will be removed from site via a licenced waste disposal contractor.
- The works programme for the initial construction stage of the proposed development will take account of weather forecasts and predicted rainfall in particular. Large excavations and movements of subsoil or vegetation stripping will be suspended or scaled back if heavy rain is forecast. The extent to which works will be scaled back or suspended will relate directly to the amount of rainfall forecast.

Operational Phase Mitigation Measures and Monitoring

The drainage system will be visually inspected on a daily basis during construction works to ensure that it is working optimally. The frequency of inspection will be increased at settlement ponds adjacent to areas where earthworks are being carried out. Where issues arise, construction works will be stopped immediately, and the source of the issue will be investigated and remedied. Records of all maintenance and monitoring activities associated with the surface water network will be retained by the Contractor on-site, including results of any discharge testing requirements.

A detailed water quality monitoring programme will be undertaken during the construction phase of the proposed development, in addition to the visual inspections outlined above, so as to ensure the effective implementation of the proposed mitigation measures.

It is not envisaged that the operation of the site will result in significant impacts on the hydrological regime or water quality of the area, as there will be no further disturbance of soils post-construction, and minimum traffic movement.

Oil used in transformers and storage of oils in tanks at the substation could leak during the operational phase and impact on groundwater quality. The substation transformer and oil storage tanks will be in a concrete bund capable of holding 110% of the oil in the transformer and storage tanks.

The maintenance of the development will incorporate effective maintenance of the drainage system. Visual inspections will be undertaken during the maintenance period in accordance with maintenance schedule in CIRIA C753. The maintenance regime will include inspecting the following:

- Drains, cross-drains and culverts for any blockages,
- Outfalls to existing field drains and watercourses,
- Existing roadside swales for any obstructions,
- Swales,
- Progress of the re-establishment of vegetation.

The maintenance regime will also include implementing appropriate remedial measures as required after the above inspections and testing the water quality at the outfalls at appropriate intervals.

4.2.2 Noise, Vibration, Dust and Air Quality

Noise will be generated temporarily during the construction phase from earthmoving plant. The main control measures will be the phasing of works so that noisier items of plant do not operate simultaneously and the suppression of noise at source by the use of plant and equipment in good working order. All plant operatives will contact their foremen in the event that their machine becomes defective with resulting high noise emissions. Plant will be inspected regularly and defective plant will be kept out of service until necessary repairs are done.

Construction works will be carried out in accordance with best practice and in line with recommendations contained within BS 5228: Part 1:20092. Working hours will be planned and will take account of the effects of noise upon persons in areas surrounding site operations and upon persons working on site.

[2] British Standards. BS 5228-2-2009+A1-2014: Code of practice for noise and vibration control on construction and open sites.

To mitigate against the impacts of noise on the local community during construction, the following measures are proposed:

- A pre-construction commitment to managing nuisance noise will be agreed through notification and consultation with affected parties, if deemed necessary;
- Working hours at the site during the installation phase will be limited to hours set out in Section 3.4.
- Construction contractors will be required to comply with the requirements of the European Communities (Construction Plant and Equipment) (Permissible Noise Levels) Regulations, 1988 as amended in 1990 and 1996 (S.I. No. 320 of 1988, S.I. No. 297 of 1990 and S.I. No. 359 of 1996), and the Safety, Health and Welfare at Work (Control of Noise at Work) Regulations, 2006 (S.I. No. 371 of 2006).

The main control measures will be control of noise at source using the following methods in line with Clause 8 'Control of noise' of BS 5228:2009:

- Operators of all mobile equipment will be instructed to avoid unnecessary revving of machinery (Clause 8.2.1 General);
- Use of appropriate plant and equipment where possible with low noise level generation where possible (Clause 8.2.2 Specification and substitution);
- All construction plant to be used on site should have effective well-maintained silencers (Clause 8.2.3 Modification of existing plant and equipment);
- Noise generating equipment will be located as far as possible away from local noise sensitive areas identified (Clause 8.2.5 Use and siting of equipment); and Regular and effective maintenance of site machinery including a full maintenance schedule to ensure that all pieces of equipment are in good working order. With efficient use of well-maintained mobile equipment, considerably lower noise levels than those predicted can be attained (clause 8.2.6 Maintenance).

In addition, the following best practice measures are proposed:

- Training of site staff in the proper use and maintenance of tools and equipment;
- Avoidance of unnecessary noise when carrying out manual operations and when operating plant and equipment;
- Machines that could be in intermittent use will be shut down between work periods or will be throttled down to a minimum;
- Plant start-up will be sequential rather than all together;
- Internal access tracks to be well maintained;
- All equipment onsite will be of good working order & any substandard equipment likely to cause excessive noise will not be permitted onsite;
- Drop heights for materials such as gravels will be minimised whenever practicable.

Mitigation measures to reduce dust nuisance will be employed during the construction phase of the proposed development. These mitigation measures will include the following:

- A water bowser will be available to spray work areas and access tracks, with particular attention given during periods where works coincide with dry periods of weather. This will suppress dust migration from the site;
- All loads with potential to cause dust nuisance will be covered to minimise the potential for fugitive emissions during transport;
- All other stockpiles will be kept damp and covered to prevent windblown dust emissions;
- The access and egress of construction vehicles will be restricted to designated locations, along defined routes and all vehicles will be required to comply with on-site speed limits.
- A road sweeper will be employed as required

4.2.3 Soil Management

Topsoil will be used for landscaping and reinstatement purposes where feasible. Surplus peat and spoil shall be removed from site to a licensed facility.

No spoil stockpiles will be left on site after construction is completed. Surplus excavated material will be used on-site for landscaping purposes.

Temporary spoil heaps will be used in the backfilling of trenches.

Trenching for underground cabling will be undertaken using controlled methods, with excavation and backfilling taking place over short lengths.

Cable trenches could provide preferential pathways for groundwater and contaminant movement. To avoid the cable trenches becoming preferential pathways, clay plugs (or other low permeability material) will be installed at intervals along the trench to stop / inhibit water movement.

Care will be taken to ensure that all watercourses are avoided when depositing any excess soil, no deposition of excavated material will be placed within at least 50m from watercourses. Excavation works will be monitored by suitably qualified and experienced geotechnical personnel.

4.2.4 Ecological Management Plan

Mitigation measures for water quality and the protection of the aquatic environment are provided in Section 4.2.1.

Ecological mitigation measures for the construction and operation of the proposed development shall be carried out in accordance with the ecological mitigation measures contained the Ecological Impact Assessment Report submitted with the planning application and this CEMP.

All ecological enhancement measure identified in the Ecological Impact Assessment Report submitted with the planning application and this CEMP shall be implemented on site.

Woodcock

Potential Impacts

This species was selected as a Key Ecological Receptor. Although approximately 14 ha of suitable habitat for this species will be retained, there is potential for the Proposed Development to impact wintering woodcock. During the construction phase of the Proposed Development, this species may be disturbed from foraging or roosting habitats, due to increased human presence as well as noise generated by the use of machinery and vehicles.

The mitigation prescribed to protect this species as well as the retention of available suitable habitat is in accordance with BIO-P-2 of the Donegal County Development Plan, which ensures species protected under the Wildlife Acts - in this case, woodcock - are protected. The following mitigation has been prescribed for this species:

Mitigation Measures

- Any removal or cutting back of vegetation will be carried out outside of the bird breeding season (March 1st – August 31st).
- In the event that vegetation clearance during the bird breeding season is unavoidable, an ECoW will be appointed to examine the area of construction/clearance for nests no more than 48 hours in advance of works. They will have the authority to include a buffer zone if needed until the species has moved location.
- Given that woodcock are using the site during the winter, pre-clearance surveys will be carried out by a suitably qualified ornithologist to identify the roosting locations and these will be avoided until such time as the birds have left the area.

Badger

Potential Impacts

Whilst there are no badger setts within the Proposed Development, under a precautionary basis, mitigation is prescribed below.

The below mitigation will be implemented, and is in line with BIO-P-2 of the County Donegal Development Plan, whereby species protected under the Wildlife Act - in this case, badgers - will be protected.

Mitigation Measures

- A mammal survey will be carried out prior to construction works to reconfirm the findings of the ecology surveys.
- In the event that a new badger sett should be encountered at any point, the NPWS will be informed and NRA Guidelines for the Treatment of Badgers Prior To the Construction of National Road Schemes will be followed. The sett will be assessed by an ECoW, and the type of sett will be determined. If badgers are to be excluded from a sett, the ECoW must ensure that there are alternative setts nearby that badgers can relocate to. One-way badger gates will then be installed at the sett entrance for at least 21 days from the last sign of badgers accessing the sett. Once the ECoW confirms that the badgers have been excluded from the sett, the sett should be destroyed immediately and securely proofed against re-entry.

4.2.5 Archaeology

There are no archaeological sites listed on the Record of Monuments and Places (RMP) within the boundaries of the site or within 500m of the site boundaries. The proposed development does not encroach on any archaeological Zones of Notification.

No mitigation is required.

More information is provided in the Archaeology section in the Environmental and Planning Report.

4.2.6 Waste Management Plan

It will be the objective of the Applicant in conjunction with appointed contractor to prevent, reduce, reuse and recover as much of the waste generated on site as practicable and to ensure the appropriate transport and disposal of residual waste off site. This is in line with the relevant National Waste Management Guidelines and the European Waste Management Hierarchy, as enshrined in the Waste Management Act 1996, as amended.

Any waste generated during the development construction phase will be collected, source separated and stored in dedicated receptacles at the temporary compounds during construction.

Typical categories of waste generated during the construction of this type of project:

- Municipal solid waste (MSW) from the office and canteen
- Construction and demolition waste
- Waste oil/hydrocarbons
- Paper/cardboard/plastic wrapping
- Timber
- Steel.

It will be the responsibility of the contractor for the main construction works (when appointed) to nominate a suitable site representative such as a Project Manager, Site Manager or Site Engineer as Waste Manager who will have overall responsibility for the management of waste. The waste manager will have responsibility to instruct all site personnel including sub-contractors to comply with on-site requirements.

Where waste is generated, every effort will be made to separate and segregate the different waste streams.

Table 4-1: Principal wastes generated during the construction phase

Waste	Source
Timber	Temporary supports and packaging waste
Miscellaneous materials	Surplus materials from installation works
Lubricating oils, diesel	Unused quantities at end of installation period
Plastics	Packaging waste

Waste	Source
Paper/cardboard	Packaging waste
Non-hazardous Office and Canteen Waste	Temporary welfare facilities
Food waste	Temporary welfare facilities
Sanitary waste	Temporary welfare facilities

Installation Waste Reduction

The appointed contractor will make all reasonable effort to minimise the creation of waste throughout the installation stage. This will be achieved through the following measures:

- The ordering of material will be optimised to ensure that only the necessary levels are delivered to site;
- All plant will be serviced before arriving on site. This will reduce the risk of breakdown and the possible generation of water oil on site;
- All operators will be instructed in measures to cut back on the amount of wastage for trimming of materials etc.;
- Prefabrication of design elements will be used where suitable to eliminate waste generation on site; and;
- Where materials such as concrete are being ordered, care will be taken when calculating required quantities to reduce wastage.

Construction Waste Re-use

Where possible, materials will be re-used onsite for other suitable purposes such as:

- Re-use of shuttering etc. where suitable and where it is safe to do so; and;
- Re-use of excavated stone etc. as suitable fill elsewhere where suitable.
- Excavated soils not required for back filling or track construction will be utilised for landscaping at identified locations for ecological enhancement, screening and hedgerow construction as identified in the site layout plans.

Construction Waste Re-cycling

Where waste is generated, every effort will be made to recycle. In order to optimally recycle, waste source segregation of recyclable materials will be undertaken.

Suitable containers will be provided for the storage and collection of source segregated materials. These containers will be clearly labelled and signposted.

The following sourced segregated materials containers will be made available on site at a suitable location:

- Timber;
- Ferrous metals;
- Aluminium;
- Dry mixed recyclables; and
- Packaging waste.

Construction Waste Disposal

Where waste disposal is unavoidable, waste will be disposed of in a manner not likely to cause environmental damage:

- All waste materials will be stored in suitable locations and enclosed containers where suitable to avoid pollution and generation of wind-blown debris;
- All waste will be collected by a suitably competent and permitted waste collection contractor; and,
- No material be burned on site under any circumstances.

Table 4-2: Construction Waste Management

Waste	Source	Waste Management Proposal
Timber	Temporary supports and packaging waste	Timber waste will be kept to a minimum through the re-use of shutters etc. throughout the installation phase. At the end of the installation phase, every effort will be made to ensure that timber is sent onto a new site for re-use where possible.
Miscellaneous materials	Surplus materials from installation works	This waste will be stockpiled carefully on site and will be transported off-site by a permitted waste contractor.
Lubricating oils, diesel	Unused quantities at end of installation period	Waste oil (where generated) will be stored on site in labelled containers in suitable bunded areas. These waste oils will be removed from the site and disposed of by an approved waste contractor in accordance with the European Communities (Waste Oil) Regulations, 1992 (S.I. No. 399 of 1992). The appointed contractor for the installation works will be responsible for maintaining records of the volumes of waste oil generated. The CEMP to be drawn up by the appointed contractor for the installation works will provide further detail in relation to the control of oils and fuels.
Plastics	Packaging waste	All recyclable plastics waste will be stored and collected by a licensed company for recycling. Suitable dry mixed recycling containers will be available.
Paper/cardboard	Packaging waste	All office paper will be collected in a confidential bin and collected by a licensed company for recycling. Suitable dry mixed recycling containers will be available for paper and cardboard packaging waste.

Waste	Source	Waste Management Proposal
Non-hazardous Office and Canteen Waste	Temporary welfare facilities unit	A permitted waste disposal contractor will transport this waste to an appropriately permitted or licensed waste management facility. Records will be maintained of the quantity of domestic waste generated.
Food waste	Temporary welfare facilities unit	A permitted waste disposal contractor will transport this waste to an appropriately permitted or licensed waste management facility. Records will be maintained of the quantity of domestic waste generated.
Sanitary waste	Temporary welfare facilities unit	Welfare facilities will be available for site personnel at the site of the proposed development. Foul drainage from these facilities will be properly treated and removed to a suitable treatment facility by licenced contractors. Sanitary waste will be removed from site by a licensed waste disposal contractor. The mobile welfare facilities unit located on site during the installation phase will be operated and maintained in accordance with the manufacturer's instructions and will be serviced under contract with the supplier. This unit will be removed off-site following completion of the installation stage.

Operational Phase Impacts and Mitigation

There will be no waste produced during the operational phase.

4.2.7 Traffic Management Plan

This document is intended to act as an outline Traffic Management Plan (TMP) for the proposed Ballynahone Long Duration Energy Storage project. A construction stage TMP shall be finalised in accordance with this plan following the appointment of the Contractor for the construction works. The appointed contractor will prepare a site-specific TMP prior to the construction works commencing.

Some items in this plan can only be finalised with appropriate input from the contractor who will be appointed to carry out and schedule the works. Furthermore, it is appropriate that the Project Supervisor Construction Stage (PSCS), when appointed, should have an active role in the preparation/review of the Traffic Management Plan.

As with any construction development project, the transport of materials onto the site will give rise to increased traffic and associated impacts.

The contractor is required to prepare the necessary Site-Specific Traffic Management Plans prior to the construction works commencing in accordance with Chapter 8 of the Traffic Signs Manual 2019 and subject to load permits.

The contractor will be responsible for the implementation of all agreements between the Applicant and the County Council and local residents with the objective that the transportation needs for the proposed project will have a minimal impact on the road network and local communities.

Construction traffic will require regular access to the site at varying times throughout the construction phase. The aim of this TMP is to put in place procedures to manage traffic effectively on site and in the immediate vicinity of the proposed project, to ensure the continued movement of traffic on the public roads and to minimise disturbance during transportation of materials particularly oversize loads. The correct implementation of this TMP will ensure that appropriate procedures are in place to minimise any effects on the safety and movement of the general public.

Prior to the commencement of construction, the TMP will be reviewed by the main contractor (and any sub-contractors) and will be updated as necessary.

4.2.7.1 Construction Stage Traffic Management Measures

The contractor will be responsible for the implementation of all agreements between the Applicant and Donegal County Council with the objective that the transportation needs for the Proposed Development will have a minimal impact on the road network and local communities.

All vehicles hauling materials to and from the Site will only use agreed transport routes shown in Figure 4-2.

The proposed accesses will be created allowing adequate visibility sightlines in accordance with TII Standards DN-GEO-03060: Geometric Design of Junctions (priority junctions, direct accesses, roundabouts, grade separated, and compact grade separated junctions), May 2023, DN-GEO-03031: Rural Road Link Design, May 2023, and in accordance with County Development Plan. Required sightlines will be maintained in both directions at the site entrance and existing hedgerows will be trimmed and removed as necessary.

Public roads shall be kept free of mud, dust, spillages and debris from the construction site, construction plant or haulage vehicles. Any necessary measures shall be put in place at the Site entry/exit points.

Adequate signage shall be installed on approach to the proposed site entrance advising of the presence of a ‘site access ahead’ and ‘construction traffic ahead’. The above signage shall be removed following completion of the construction phase.

All construction related parking shall be accommodated within the site. Construction related vehicles will not be permitted to park on public roads. Turning space will be provided in the temporary site compound and within the LDES compound hardstanding areas.

Traffic movements for the construction of the development will be discussed with local community representatives and where necessary and off-peak deliveries will be accommodated where possible.

4.2.7.2 General Traffic Management Measures

General measures that shall be addressed in the TMP shall include:

Traffic Management Co-Ordinator: A dedicated Traffic Management Coordinator will be appointed for the duration of the project and this person will be the main point of contact for all matters relating to traffic management on the project.

Roads and Routes: The final TMP will clearly identify roads that will be used to access the project site and roads that are not to be used.

Road Condition Survey: a pre-condition survey will be carried out on all public roads that will be used in connection with the development to record the condition of the public roads in advance of construction commencing. A post-construction survey will also be carried out after the works are completed. The specification and timing of the surveys will be agreed with the roads authority. Joint surveys shall be completed if the roads authority requests.

Road Reinstatement: All roads will be reinstated expeditiously on completion of the construction works. Roads will be reinstated to their pre-works condition or better and to the satisfaction of the roads authority.

Site Inductions: All workers will receive a comprehensive site induction which will include a section on traffic management and clear guidance on the routes to be used/not used to access the site.

24-Hour Emergency Contact: a 24-hour emergency phone number will be maintained for the duration of the construction works and the number will be noted on temporary signage at each works area.

Traffic Management Guidance: all necessary temporary traffic management will be planned and executed in accordance with best practice, including Chapter 8 of the Traffic Signs Manual published by the Department of Transport in 2019.

Community Liaison: A community liaison will be appointed by the contractor in advance of the commencement of the construction phase who will have responsibility for consulting with members of the public and act as a first point of contact for the project management team. Letter drops will be carried out to notify members of the public living near the proposed site and cable route to advise them of any particular upcoming traffic related matters e.g. temporary lane/road closures.

Signage: Clear signage relating to the development, both temporary and permanent, will be provided for accessing the site.

Road Sweeping: Appropriate steps will be taken to prevent soil/dirt generated during the works from being transported on the public road. When, if necessary, a road sweeper will be used to maintain the public roads in a clean condition during the construction activities of the project.

Site Entrances: The entrances to the site will be secured when the site is not in use. When necessary, a flagman will be used to assist traffic movements at the site entrance or in other areas as required. For example, during oversize load deliveries.

Temporary Road Crossing Point: Site entrances from and to the site will be secured and locked when not in use. Where required, the entrances will be controlled by flagmen to assist traffic movements. The proposed crossing point will be managed appropriately to allow the safe passage of construction vehicles in, out and across the public road Priority will be maintained for public traffic.

Mitigation measures proposed for the trenching works in public roads:

Road Opening Licence: The road works associated with the water mains connection and grid connection cabling will be completed in line with the requirements of a road opening license as agreed with the local authority.

Route Proofing: In advance of the trenching works an assessment will be carried out to define the precise alignment of the cable route within the corridor which has been assessed. This will include slit trenching with the aim of minimising the construction impacts and avoiding existing services in the road.

Maintaining Local Access: reasonable access to local houses, farms and businesses will be maintained at all times during any road closures associated with the trenching works. The details of this will be agreed with the roads authority in advance of the works commencing.

Road Cleanliness: Appropriate steps will be taken to prevent soil/dirt generated during the works from being transported on the public road. Road sweeping vehicles will be used, when necessary, to ensure that the public road network remains clean.

Trench Reinstatement: Trenches on public roads, once backfilled, will be reinstated to the satisfaction of the roads authority.

4.2.7.3 Construction Plant and Vehicles

Plant operators will be responsible for the upkeep and maintenance of construction plant and vehicles, ensuring good working order prior to use.

4.2.7.4 Consultation and Notification

An Garda Síochána

The contractor will liaise directly with an Garda Síochána in relation to the plan. Any concerns/requirements they have will be incorporated into the plan. This may include details in relation to the escorting of oversized loads.

The necessary permits (including approved route permits) will be applied for and obtained from an Garda Síochána.

Donegal County Council

The contractor will liaise directly with the County Council in relation to the plan. Any concerns/requirements they have will be incorporated into the plan.

The necessary permits (including standard permits) will be applied for and obtained from the relevant local authorities.

Construction commencement dates will be made known to the Planning Authority by way of formal Commencement Notice.

Local Residents

The following measures will be used to communicate the necessary information to the households along the local road to be used as a haul road:

- Information signs will be erected in advance of the construction/transportation works.
- A flyer drop will be carried out to advise households along the local road leading to the site in relation to the programme of construction works and especially in relation to oversized load movements.
- Residents will be consulted with regarding the development of plans for the project.
- Contact details for a Liaison Officer will be provided so that any concerns can raised, logged and be easily channelled to the Applicant to be dealt with.

Complaints will be entered into the site complaints log and the relevant site environmental officer will arrange to meet with those affected. The situation will be acted upon immediately and reviewed by the Project Manager.

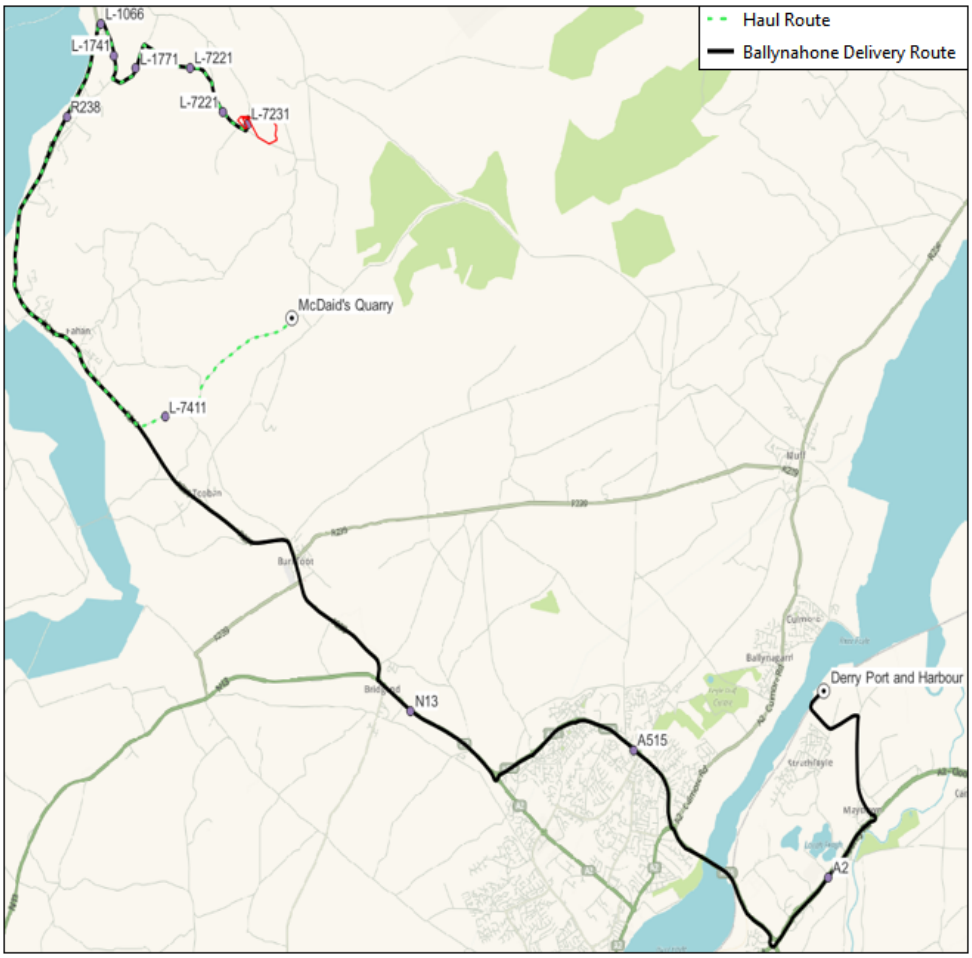


Figure 4-2: Transport Routes

4.2.7.5 Key Personnel and Responsibility

Typically, the following members of the contractors' staff will have responsibility for adherence to the TMP as follows:

Traffic Management Coordinator

The Traffic Management Coordinator will be responsible for maintaining regular contact with an Garda Síochána, The local County Council, the statutory bodies and the client concerning traffic control, interference with services and co-ordination of crossings at roads, rivers and railways.

The Traffic Management Coordinator will contact the relevant bodies in relation to develop method statements prior to the work taking place. The Transport Officer will be responsible for instructing the Construction Manager, Foreman and all other personnel on the information in the agreed method statement prior to the work commencing and ensuring that the method statement is adhered to.

The Traffic Management Coordinator will be responsible for ensuring that the Traffic Management Plan will be implemented in full.

Safety Officer

The Safety Officer will be responsible for implementing all safety requirements detailed in the Project Safety Plan. Ensure that all operatives receive site safety induction prior to commencing work on site. They will ensure that all plant, particularly lifting equipment, on site has the relevant certification and are checked regularly by a competent person. The Safety Officer will carry out safety audits and checks on a regular basis and amend procedures where necessary.

Construction Manager

The Construction Manager will be responsible for overall supervision of the operations to ensure they are constructed in a safe and efficient manner. He will ensure that sufficient resources are available to meet the programme and that the necessary information is provided to the appropriate staff.

Supervisors

The supervisor is responsible for ensuring that the crew carry out the work in accordance with the method statement and contract specifications and drawings using good working practices in a safe manner. They will supervise construction personnel ensuring their competence. They will check all plant and equipment on a regular basis ensuring it is maintained and in good working order.

4.2.7.6 Restricted Public Road Use by Construction Traffic

It is not expected that the construction of the project will create any restrictions to public road users with the exception of the following activities:

- Trenching in the public road associated with mains water connection;
- Trenching across the local road between the LDES Compound and UTF Compound site entrances to facilitate electrical and communcitaions cables;
- Delivery of oversize load associated with the transformer to the UFT compound.

It is proposed to maintain local access at all times during this element of the water main trenching works. It is proposed that all access points (domestic, business, farm) are considered when finalising the temporary road closures and diversions. Diversion signage will also be included.

The extent of the proposed water main trenching is shown on 0100 series planning application drawings.

Temporary signage and traffic management for works in rural single carriageway roads in accordance with Chapter 8 of the Traffic Signs Manual is shown in Figure 4-3 and Figure 4-4.

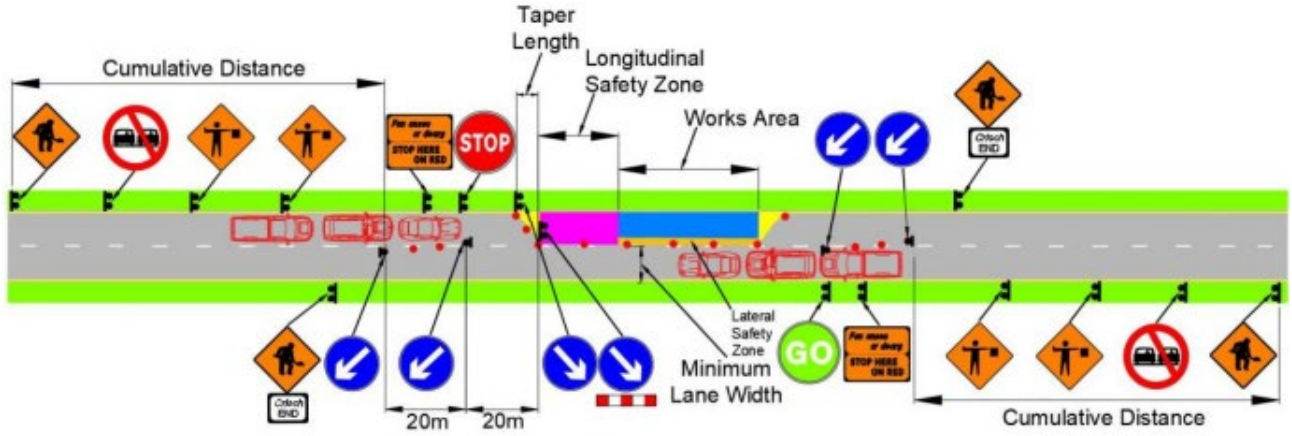


Figure 4-3: Stop and Go Traffic Control Signage for Single Carriageway Rural Road

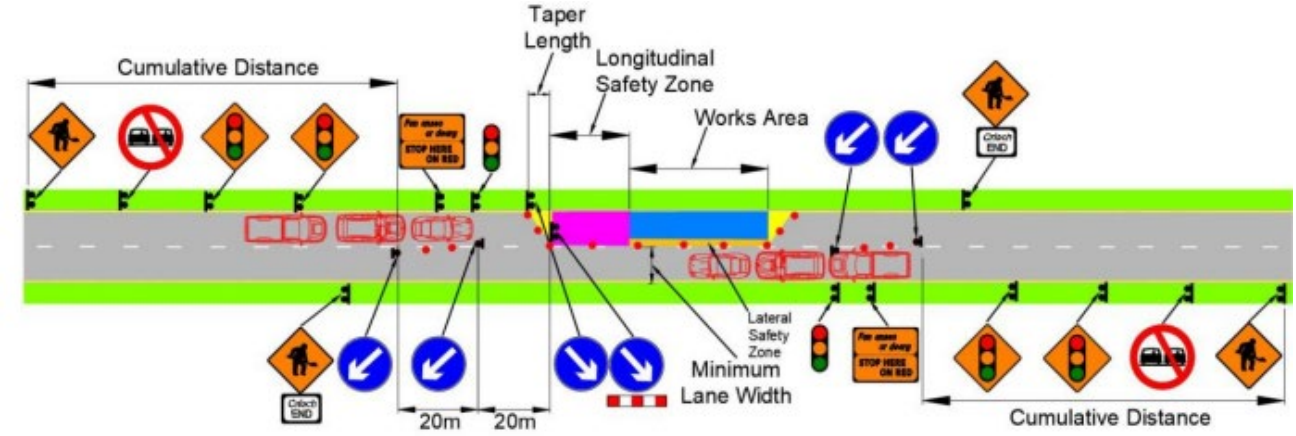


Figure 4-4: Temporary Traffic Signals Control for Works in Single Carriageway Rural Roads

Access points will be secured and locked when not in use. The proposed crossing point will be managed appropriately to allow the safe passage of construction vehicles in, out and across the public road. Priority will be maintained for public traffic.

Stop and Go discs will be used to control the crossing point. See Figure 4-5 for acceptable type in accordance with Chapter 8 of the Traffic Signs Manual. If it is required to stop both streams of traffic at the one time, then a disc displaying Stop on both sides shall be used.

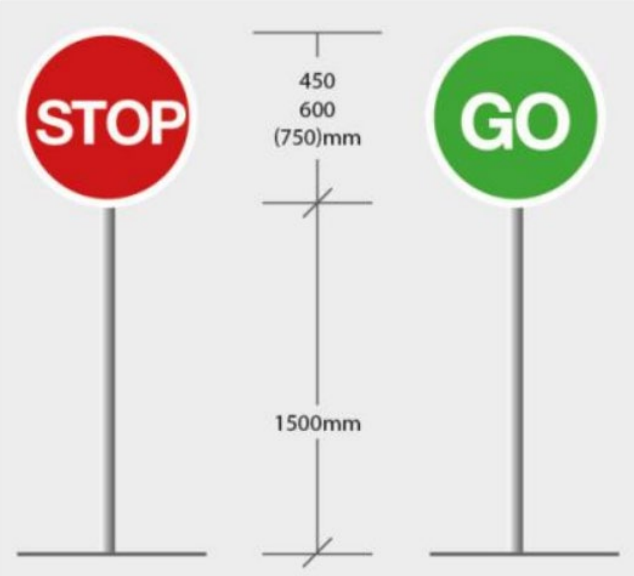


Figure 4-5: Acceptable Stop-Go Discs

4.2.7.7 Road Cleaning

Public roads shall be kept free of mud, dust, spillages and debris from the construction site, construction plant or haulage vehicles. Any necessary measures shall be put in place at the site entry/exit points.

4.2.7.8 Carriageway/ Road Reinstatement

It is anticipated that the proposed haul routes will be capable of accommodating the construction traffic associated with the project.

A pre-condition survey of haul routes, consisting of a video survey and photographs shall be carried out and a copy submitted to Donegal County Council.

Any damage caused to the road shall be repaired to its previous condition, to the satisfaction of Donegal County Council. Any defects that appear during the haulage period shall be rectified by the project owner.

4.3 Training, Awareness and Competence

All site personnel will receive environmental awareness information as part of their initial site briefing. The detail of the information should be tailored to the scope of their work on site. The contractor for the main construction works may decide to conduct the environmental awareness training at the same time as Health and Safety Training (often referred to as Site Inductions).

This will ensure that personnel are familiar with the environmental aspects and impacts associated with their activities, the procedures in place to control these impacts and the consequences of departure from these procedures.

Relevant information relating to environmental management of the site will be posted on the main site notice board during the project. Two-way communication will be encouraged by inviting all personnel to offer their comments on environmental performance at the site.

4.4 Environmental Policy & Legislation

The contractor is responsible for preparing and maintaining an Environmental Policy for the site. The policy should be appropriate to the project, commit to continuous improvement and compliance with legal requirements and provide a framework for objectives and targets. This will be communicated to all site personnel and will be available on site notice boards.

The contractor is responsible for preparing and maintaining a register of key environmental legislation pertaining to the site. This register will reference all current environmental legislation and will be inspected, reviewed and updated regularly to ensure compliance.

4.5 Objectives and Targets

Objectives and targets should be set to ensure that the project can be constructed and operated in full accordance with the planning conditions and legislative requirements, with minimal impact on the environment.

Environmental objectives are the broad goals that the contractor must set in order to improve environmental performance. Environmental targets are set performance measurements (key performance indicators or KPI's) that must be met in order to realise a given objective.

The contractor will set objectives based on each significant environmental impact. Key objectives are likely to include the following:

- To ensure that the rivers and streams are not negatively impacted by construction works;
- To ensure that humans are not negatively impacted by dust generated by construction works;
- To ensure that humans are not negatively impacted by noise or vibration generated by construction works;
- To ensure that impacts to habitats and wildlife are minimised during works;
- To ensure that a waste management plan for this site will be fully implemented;
- To ensure that the visual impact during the construction work is minimized;
- To ensure the development is constructed in compliance with planning conditions.

4.6 Health and Safety

The contractor for the main construction works will implement a site safety management system (SMS) on this project to meet the specified contractual, regulatory and statutory requirements, environmental impact statement mitigation measures and planning conditions. It is the contractor's responsibility to implement an effective safety management system to ensure that the developer's safety requirements for the construction of this project are met. Any SMS will incorporate and develop upon any preliminary plans prepared for the project by the Project Supervisor for the Design Process.

The selection criteria for the Contractor for the works will be based on the ability to construct the works in a manner that will not endanger the safety, health and welfare of any parties and competence to fulfil the role of PSCS.

All site personnel will be required to be familiar with the requirements of the Safety and Health Management Plan for the construction phase of the project as related to their role on site. The plan will describe the project organisation and sets out the health and safety procedures that will be adopted on site.

The Safety and Health Plan is a controlled document and will be reviewed and revised as necessary. A copy of the Safety and Health Plan will be located on/near the site H&S notice board. All employees, suppliers and contractors whose work activities cause/could cause impacts on the environment will be made aware of the SHMP and its contents.

FÁS Safe Pass registration cards are required for all construction, delivery and security staff. Construction operatives will hold a valid Construction Skills Certificate Scheme card where required.

Public safety will be addressed by restricting site access during construction. Appropriate warning signs will be posted, directing all visitors to the site office.

All personnel on site will wear adequate personal protective equipment (PPE), appropriate for their activity while on site.

4.7 Control of Documents

The Contractor will establish, implement and maintain a procedure to control project documents and records so they are clearly identifiable, organised, current, easily located and revised when necessary.

5. EMERGENCY RESPONSE

An Emergency Response Plan shall be produced following the appointment of the contractor for the main construction works and following detailed design development.

An emergency is any disruptive or harmful event that endangers people, environment, property or assets. Emergencies can be small, as in a fire contained by employees using firefighting equipment or large, as in a disaster resulting from a storm.

Examples of Emergency Response Plan emergency events are:

- Medical emergency
- Explosion
- Overheated equipment
- Chemical and fuel spill
- Fire
- Loss of power
- Vehicle incidents.

Example sources of emergency or disaster events are:

- Unstable/inappropriate stockpiles on site
- Faulty or incorrect use of equipment
- Falls from height
- Smoking
- Storm/adverse weather
- Power failure
- Fuel spill
- Road failure
- Serious vehicle collisions or overturning.

An emergency response plan deals with the immediate physical effects of a disaster and outlines the initial response.

The Emergency Response Plan should contain predetermined guidelines and procedures to ensure the safety, health and welfare of everybody involved in the project and to protect the environment during the construction phase. It should clearly outline the immediate response to an emergency or disaster situation by the main construction works contractor and PSCS as part of their construction stage Safety and Health Plan.

5.1 Emergency Response Plan

An emergency response plan deals with the immediate physical effects of a disaster and outlines the initial response.

The plan should include provisions for the following:

- Emergency response liaison and reporting
- Procedure for reporting emergencies and raising the alarm
- Procedure for Oil Spillages and Concrete Spillages
- Location of emergency spill kits
- Designated responder
- Location and contact information for the nearest emergency services, ambulance and Accident & Emergency (A&E) facilities including:
  - Accident & Emergency (A&E)
  - Ambulance Service
  - Fire Services
  - Local Garda Station, district and divisional headquarters
- Medical protocol
- Escape and evacuation procedure
- Prevention of illness/injury of site staff due to weather/elements
- Environmental emergency procedure
- Emergency response plan for the haul route

5.1.1 Emergency Response Liaison

The Contractor/PSCS will designate an individual to serve as the Emergency Response Liaison for this project. The emergency response liaison will coordinate the emergency response for the duration of any emergency at or nearby the project site.

The local County Council, An Garda Síochána and the HSE Ambulance Co-ordinator will be provided with the construction programme and the onsite contact information from the Emergency Response Liaison prior to construction.

The Emergency Response Liaison will be immediately reachable at all times during project construction. The Liaison will coordinate with the above agencies to establish emergency procedures for access to and within the site in the event of an emergency.

5.1.2 Reporting Emergencies

In the event of fire, storm, flood, serious injury or other emergency, contact:

ALL ON SITE EMERGENCIES DIAL 999

5.1.3 Designated Responder

A map depicting tower locations with the emergency meeting point will be furnished to Donegal County Council Fire Department and HSE ambulance co-ordinators.

Upon arrival on the scene, the senior EMS Officer will set up the incident command structure. The Emergency Response Liaison and all contractor's personnel will cooperate with directions of the incident commander and assist as directed.

The nearest emergency services, ambulance and Accident & Emergency (A&E) facilities are:

Service:	Contact Details:	
Accident & Emergency (A&E)	Letterkenny University Hospital, Kilmacrennan Rd, Ballyboe Glencar, Letterkenny, Co. Donegal, F92 AE81	(074) 912 3537
Ambulance Service	Dial 112 or 999	

Service:	Contact Details:	
Fire Services	Dial 112 or 999	
Garda Station	Buncrana District Headquarters Garda Station, Mc Carter's Road, Buncrana Garda Station, Ardaravan, Buncrana, Co. Donegal	(074) 932 0540
District HQ:	Buncrana District Headquarters Garda Station, Mc Carter's Road, Buncrana Garda Station, Ardaravan, Buncrana, Co. Donegal	(074) 932 0540
Divisional HQ:	Letterkenny Garda Station, New Line Road, Letterkenny, Co. Donegal, F92 PC03	(074) 9167100

Each member of the contractor's site team who are First-Aid and Cardiopulmonary Resuscitation (CPR) trained personnel will be identifiable with a hard hat sticker indicating their training.

5.1.4 Emergency Alarm

The emergency alarm will be raised on site as soon as an emergency situation is detected, the alarm will be identified (contractor to check those that apply):

	Air Horn		Radio		Voice		Hand Signals		Siren

5.1.5 Emergency Reporting

In the event of an emergency the nearest supervisor with radio equipment/mobile phone will be notified. The degree of emergency will be reported to the Emergency Response Liaison who will contact the Emergency Services and request the appropriate emergency service.

5.1.6 Medical Protocol

In the event of a major medical emergency, the emergency centre (999) will be notified and an ambulance and emergency medical team will respond to the scene. All major medical cases require professional (ambulance) transportation. In the event of a minor medical case, the affected employee can be transported via company vehicle in the escort of a foreman or site engineer (with first aid training).

5.1.7 Emergency Response Procedure

Upon notification, the Emergency Response Liaison will respond to the emergency scene and manage emergency operations in the followng way:

1. Assess hazards and make the area safe – If you cannot enter the area without risking your safety, don't do it, call the Emergency Services immediately and wait for them. If you think you can safety enter the area, look around the emergency scene for anything that can be dangerous or hazardous to you, the casualty, or anyone else at the scene. Bystanders can help with making the area safe.

First aid kits will be available on site. Operators that have been first aid/CPR/AED trained will be listed on site and easily identifiable by a hard hat sticker.

2. Take charge of the situation – if you are the first-aid provider on the scene act fast. If someone is already in charge, briefly introduce yourself and see if that person needs any help. If there is any chance the casualty could have a head or spinal injury, tell them not to move.

3. Get Consent – always identify yourself as a first-aid provider and offer to help. Always ask for consent before touching a conscious adult casualty and always ask for consent from a parent or guardian before touching an unconscious or conscious child or infant. With an unconscious adult casualty consent is implied as it is generally accepted that most people want to live. Remember to protect yourself first by wearing gloves and eye protection.

4. Assess Responsiveness – is the casualty conscious or unconscious? Note their response while you are asking them for their consent. If they respond, continue with the primary survey, and if they don't respond, be aware that an unconscious casualty is or has the potential of being a breathing emergency.

5. Call out for help – this will attract bystanders. Help is always useful in an emergency situation. Someone can be called over to phone for medical help. Others can bring blankets if needed, get water, etc. a bystander can help with any of the following:

- Make the area safe.
- Find all the casualties.
- Find the first aid kit, or any useful medical supplies.
- Control the crowd.
- Call for medical help.
- Help give first aid, under your direction.
- Gather and protect the casualty's belongings.
- Take notes, gather information, be a witness.
- Reassure the casualty's relatives.
- Lead the ambulance attendants to the scene of the emergency.
- Notify Emergency Services as soon as you can. Either send a bystander or call yourself.

In the event of a major medical emergency the Emergency Response Liaison, as the person-in-charge of the emergency scene, will dispatch someone to the site access point nearest the emergency scene to direct and lead arriving outside responders to the emergency scene. The designated meeting point will be agreed prior to the commencement of construction. Emergency personnel will be met at this meeting point communicated by management during the 999 call. The emergency personnel escort will use the hazard lights on their vehicle so they are easily identified.

5.1.8 Escape and Evacuation Procedure

Dependent upon the degree of the emergency and if safe to do so, employees will evacuate to the designated assembly area where the designated wardens shall account for all employees and determine if anyone still remains within the emergency scene.

5.1.9 Prevention of Illness/Injury Due to Weather/Elements

- All employees will have access to shelter and heat in the event of inclement weather.
- Employees will have access to at least a litre of water at all times.
- High wind warnings and weather forecast will be discussed every morning with the crews. Weather conditions and forecast will be monitored regularly by management.
- No Employee will work alone. A buddy system will be used so employees can contact a supervisor in case of an emergency.

5.1.10 Environmental Emergency Procedure

An emergency preparedness and response procedure is required to prevent environmental pollution incidents. Emergency Silt Control and Spillage Response Procedures are included in Section 4 of this CEMP.

Suitable spill kits and absorbent material for dealing with oil spills will be maintained on site. In the event of pollution or potential risk of pollution the Local Authority should be informed immediately.

In the case of water pollution in addition to the Local Authority, Inland Fisheries Ireland should also be informed immediately.

During commissioning, each battery cell is filled with a water-based, non-flammable electrolyte, similar to that found in primary alkaline batteries. There is inherent redundancy built in the system design for electrolyte containment. The cell serves as the primary containment of the electrolyte. The battery enclosure acts as the secondary containment, with the base of the enclosure serving as a basin to retain electrolyte in event of a battery electrolyte leak and thus preventing such a leak from resulting in a release to the environment. In addition, the enclosures will include leak detection and monitoring, with associated faults and alarms from the Battery Management System that will send alerts to the Power Plant Controller and the Customers Supervisory Control and Data Acquisition (SCADA) system. Upon detecting a leak, the system will automatically cut off power and move the affected enclosure to a safe state. As needed, personnel will address any issues according to the site-specific emergency response plan.

5.1.11 Emergency Response Plan – Haul Routes

Emergency Response Procedure relating to transportation of plant, equipment and materials to site to be developed by the main contractor during the construction phase of the development.

5.1.12 Fire Safety

Safety systems associated with the proposed battery energy storage systems can be found in the Technology & Safety Overview report contained in Appendix 1.

Regular visual inspections and testing of battery system equipment shall be incorporated into the project's operation and maintenance schedule as per manufacturers requirements.

Fire safety measures and equipment in the facility must be kept in effective working order. This includes all fixtures and fittings such as fire doors, staircases, corridors, fire detection and alarm systems, fire-fighting equipment, notices and emergency lighting. Regular checks, periodic servicing and maintenance must be carried out, whatever the size of the workplace. Any defects should be put right as quickly as possible.

A nominated competent person shall carry out checks and routine maintenance work to ensure the reliability and safe operation of fire-fighting equipment and installed systems such as fire alarms and emergency lighting. A record of the work carried out on such equipment and systems will kept on site at all times.

An on-site supply of water for fire fighting shall be maintained on site in the form of on-site water storage tanks located within the LDES compound as shown on the site layout.

FEHILY TIMONEY

CONSULTANTS IN ENGINEERING,
ENVIRONMENTAL SCIENCE
& PLANNING

APPENDIX 1

Technology & Safety Overview

Form Energy Iron-Air Multi-Day Storage System Technology & Compliance Overview

Background

Form Energy, Inc. (“Form”) was founded by energy storage veterans who came together in 2017 with a unified mission to reshape the global electric system by creating a new class of low-cost, multi-day energy storage. Form has grown to over 800 employees across four locations in Massachusetts, California, Pennsylvania, and West Virginia. The company has also raised over $820 million in venture capital from prominent investors such as Breakthrough Energy Ventures, TPG, Coatue, Energy Impact Partners, MIT’s the Engine, and ArcelorMittal.

Form’s multi-day storage solution (MDS) is a rechargeable iron-air battery capable of continuously dispatching for 100 hours with one-tenth the installed energy cost of lithium ion (<$20/kWh). Form’s iron-air system uses the lowest cost active materials available: iron, water, and air. There are no heavy or rare earth metals in Form’s MDS solution, and no pathway for thermal runaway or dendrite formation. The principle of operation is reversible rusting.

When paired with wind and solar resources, Form’s iron-air system provides a zero-carbon, firm capacity resource to the electric grid, enabling an affordable, reliable electric grid capable of running on renewable energy year-round. Form MDS can also support the broader resiliency of the electric grid to combat the adverse impacts of catastrophic weather events exacerbated by climate change.

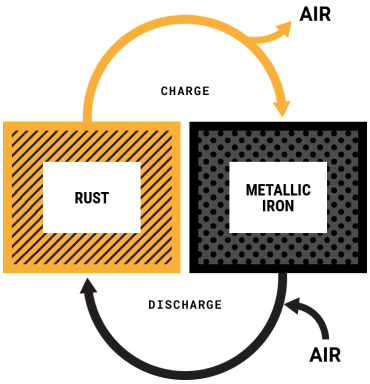
Form has received significant commercial traction from a wide range of customers with aggressive decarbonization targets. Form’s first commercial project will be deployed in Minnesota with utility partner Great River Energy, and this pilot demonstration will be followed by a series of additional commercial projects in 2025 and 2026, including two deployments with Xcel Energy, one with Dominion Energy, and one with Georgia Power. Form has also been awarded funding from the state of California and New York for demonstration projects, with operations anticipated in 2025 and 2026 respectively. Form was also selected by the US Department of Energy to deploy an 85 MW / 8500 MWh multi-day storage system in Maine, the largest energy storage project by energy capacity announced to date in the world.

Table 1. Form Energy Commercial Projects

Project	Location	System Size	Commercial Operation Date
Great River Energy	Minnesota	1.5 MW / 150 MWh	2025
Xcel Energy	Minnesota	10 MW / 1000 MWh	2025
Dominion Energy	Virginia	5 MW / 500 MWh	2025
California Energy Commission	California	5 MW / 500 MWh	2026
Xcel Energy	Colorado	10 MW / 1000 MWh	2026
NYSERDA	New York	10 MW / 1000 MWh	2026
Georgia Power	Georgia	15 MW / 1500 MWh	2026
Power Up New England	Maine	85 MW / 8500 MWh	2027 - 2028

Technology Description

Form's multi-day storage solution (MDS) is a rechargeable iron-air battery capable of continuously dispatching for 100 hours with one-tenth the installed energy cost of lithium ion (<$20/kWh). Made from iron, one of the most abundant materials, this front-of-the-meter turnkey battery system enables a cost-effective renewable grid year-round. Form's iron-air system uses the lowest cost active materials available: iron, water, and air. There are no heavy metals in MDS, and no pathway for thermal runaway or dendrite formation. The principle of operation is reversible rusting.

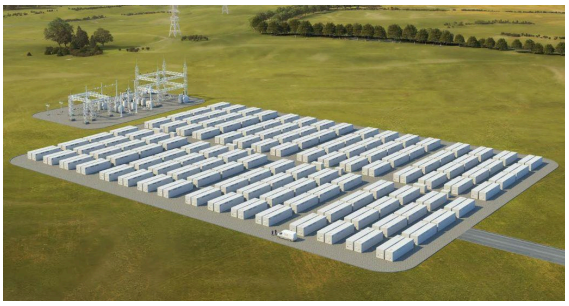


Each cell consists of iron anodes and commercially proven air cathodes submerged in water-based, non-flammable alkaline electrolyte (similar to the electrolyte used in primary alkaline batteries). While discharging, the battery "breathes in" oxygen from the air and converts iron metal to rust. While charging, the application of an electrical current converts the rust back to iron and the battery "breathes out" oxygen.

Iron-air has the lowest active materials cost entitlement (<$1/kWh) of any known rechargeable battery chemistry. Iron-air chemistry performance, durability, and cyclability had been demonstrated for decades. In the 1970s, Siemens, Westinghouse (with financial support

from the US Department of Energy), and the Swedish National Development Company conducted industrial R&D for 1-7 hour iron-air batteries for automotive traction applications. In the 2010s, the University of Southern California led an ARPA-E supported program conducting R&D on 1-2 hour duration iron-air systems for grid storage applications. Form is reinventing this known chemistry for a new, reliable, resilient, and secure electric grid and Form is the first company to commercialize iron-air for long-duration, grid-scale storage.

Fully Integrated Modular System



The system is a turnkey 100-hour energy storage system that can scale from 10 MW (1 GWh) to 500 MW (50 GWh), deployable anywhere on the grid, depending on each project's unique site, space, and power requirements. The smallest DC building block is the battery module, which is the size of a side-by-side washer/dryer set and contains a stack of approximately 30 one meter-tall cells. The cells include iron and air electrodes, the parts of the battery that enable the electrochemical reactions to store and discharge electricity. Each of these cells are filled with water-based, non-flammable electrolyte, like the electrolyte used in primary alkaline batteries.

Battery modules are housed in factory-assembled, weatherized enclosures. In addition to pre-installing modules, battery enclosures come pre-integrated with commercially available auxiliary systems including air handling, thermal management, and water management to support charge and discharge operations.

Approximately 64 battery enclosures are connected via a DC voltage network and aggregated up to a single utility-grade, bi-directional inverter to form an AC power block. Depending on the system size, tens or hundreds of these AC power blocks can then be connected to the electric grid. For reference, the Ballynahone Project will consist of four AC power blocks, with a total capacity of 10 MW, similar to what is shown in the image above.

Iron-Air Safety Features

Iron-air is a fundamentally stable and safe battery chemistry that eliminates the risk of thermal runaway. Thermal runaway is typically caused by an internal short, external short, overcharging, overdischarging, and overtemperature conditions of the battery cell. While these factors can lead to thermal runaway in other battery chemistries, they do not cause uncontrolled destructive reactions in iron-air batteries.

The primary safety risks to mitigate for during operation of the Form Battery System is (1) hydrogen evolution on charge (as a side reaction) and (2) the spill of caustic electrolyte.

Hydrogen Management

When the battery is charged during normal operation , a minimal amount of hydrogen gas may be produced. This is similar to other aqueous batteries such as lead-acid. Hydrogen is not toxic. The primary safety issue is to ensure that hydrogen does not build up in a confined space to a concentration where it could become flammable or an explosion risk.

The Form battery enclosures include a functional safety subsystem for monitoring and limiting the production of hydrogen gas as well as venting it to the atmosphere to reliably maintain the concentration in the system below 25% of the Lower Flammability Limit. The vented gas poses no health or safety risk to the local community. It is odorless, non-toxic, and non-flammable at these concentrations.

Prior to deployment in Ireland, Form will conduct rigorous safety testing as part of its product certification with Underwriters Laboratories, a leading global independent science safety company. This testing will validate the product safety across a number of worst-case conditions, including proving that cell fault conditions do not lead to thermal runaway, and that worst case hydrogen saturated conditions (comparable to those found in a typical lead-acid or nickel-cadmium battery cell) do not pose any safety concerns.

Electrolyte Containment

During system commissioning, each battery cell is filled with a water-based, non-flammable electrolyte, similar to that found in primary alkaline batteries. There is inherent redundancy in electrolyte containment. The cell serves as the primary containment of the electrolyte. The battery enclosure acts as the secondary containment, with the base of the enclosure serving as a basin to retain electrolyte in event of a battery electrolyte leak and thus preventing such a leak from resulting in a release to the environment. In addition, Form's enclosures will include leak detection and monitoring, with associated faults and alarms from the Battery Management System that will send alerts to the Energy Management System and Future Energy Ireland’s Supervisory Control and Data Acquisition (SCADA) system. Upon detecting a leak, the system will automatically cut off power and move the affected enclosure to a safe state. As needed, designated personnel will address any issues according to the site-specific emergency response plan.

Fire Safety Considerations & Mitigation Strategies

As part of the project detailed design, a licensed fire protection engineer will review local code requirements to ensure compliance. The Form Battery Equipment will be designed to meet the required installation codes. Prior to permitting, Form Energy and Future Energy Ireland will have a pre-alignment meeting with the local fire department to discuss the project and any potential impacts on their jurisdiction. This early engagement will help align expectations and inform the project's design. As the design is finalized, site-specific emergency response plans will be developed, incorporating Form equipment product recommendations. Near project completion, the on-site team will host the local fire department for a walkthrough and review of the response protocol.

Code Compliance

Iron-air is widely recognized as a fundamentally stable and safe battery chemistry that eliminates the risk of thermal runaway, which is typically caused by internal or external shorts, or battery overcharging. While these issues can trigger thermal runaway in other chemistries, iron-air batteries are designed to prevent uncontrolled reactions. The system is being developed to meet all leading safety standards, with the goal of obtaining necessary certifications. However, these certifications are seen as minimum safety benchmarks. Form aims to exceed these standards, ensuring the highest possible safety. In addition to addressing single-fault scenarios, the approach involves rigorous testing for multiple faults, including rare, low-probability events. This thorough testing strategy is designed to mitigate all types of risk, ensuring unparalleled safety for the systems.

The Form battery system will be designed and manufactured in strict compliance with applicable codes and standards governing energy storage system safety and performance. To ensure the highest level of safety and reliability, Form has collaborated closely with industry-leading entities such as DNV, EPRI, and UL throughout the development process.

Form completed the New & Innovative Program with Underwriters' Laboratories in 2023. The intent of this program was to develop a system design, test, and compliance strategy targeted to the unique safety profile of the Form iron-air battery. Through this program, Underwriters' Laboratories identified product certification standards that would be required for iron-air systems. These product certification standards included UL 1973 and UL 9540. Additionally, the system would also be required to complete UL 9540A testing.

Form is in the process of completing these certifications in preparation for the deployment of our first demonstration project with Great River Energy in 2025, and we anticipate having

them finalized well before the project at Ballynahone. More information on each certification is provided in the following sections.

Table 2. System Certification Standards

Certification Standard	Applicable System	Description	Completion Timeline
UL 1973	Cell, Module	Cell and module level standard designed to ensure the safety and reliability of the electrical, thermal, mechanical, and fire safety systems.	2024
UL 9540A	Cell, Module, Enclosure	Test method for evaluating thermal runaway fire propagation in battery systems.	2024
UL 9540	System	System level standard designed to ensure the safety and reliability of the electrical, thermal, mechanical, and fire safety systems.	2025

UL 1973

UL 1973 is one of the main battery safety standards designed to ensure batteries are safe and reliable for real-world applications. It defines specific requirements that manufacturers must meet to achieve safety certification.

To comply with UL 1973, the Form Battery System must meet stringent construction standards. These include the durability of the metal enclosure, its ability to withstand mechanical loads, protection against water and debris ingress, corrosion resistance, and proper electrical bonding to ground. Additionally, non-enclosure requirements involve evaluating insulating materials that support live parts, ensuring they meet UL 746C standards for fire resistance, tracking resistance, temperature ratings, and compatibility with the system's aqueous electrolyte. The Form Battery System must also comply with standard electrical insulation ratings and internal spacing requirements.

Other tests that are required by UL1973 include the Overcharge Test, the High Rate Charge Test, the Short Circuit Test, the Overload Under Discharge test, and the Overdischarge Protection Test. The unique characteristics of the Form Battery System allow it a certain level of inherent safety in these tests relative to a lithium-ion, since the iron-air charge and

discharge reactions occur at a much slower rate than the charging and discharging reactions internal to lithium-ion.

UL 9540

UL9540 is a system level standard for evaluating the safety of energy storage systems, including battery systems but also other technologies like flywheel or thermal energy storage. It requires the completion of a holistic hazard analysis and a corresponding Functional Safety System, which is designed to prevent or control specific safety concerns. It also applies many prescriptive construction requirements and test methods which are similar to those in UL1973, as well as some additional system level considerations, like a minimum level and corresponding unit level test of electrical isolation for isolated circuits.

UL9540 applies additional safety requirements for systems installed inside habitable structures or buildings and for systems designed to be walk-in for service personnel. It is important to note that the Form Battery Enclosure is not designed to be entered by persons. It is to be installed in an access controlled location and maintained only by specially trained personnel.

UL 9540A

UL9540A is a test method standard. As part of the test, Form will demonstrate that “thermal runaway” is impossible for iron-air systems. Thermal runaway is the most concerning failure mode in other battery energy storage systems (especially lithium-ion), and is defined in UL9540A as “when an electrochemical cell increases its temperature through self-heating in an uncontrollable fashion. The thermal runaway progresses when the cell's generation of heat is at a higher rate than the heat it can dissipate. This may lead to fire, explosion and gas evolution.”

Form’s iron-air battery technology is novel and has an inherent safety advantage with respect to the hazard of thermal runaway. Form’s UL9540A testing will prove this through a series of severe battery abuse tests which normally induce thermal runaway in lithium-ion cells.

FEHILY TIMONEY

**CONSULTANTS IN ENGINEERING,
ENVIRONMENTAL SCIENCE
& PLANNING**

www.fehilytimoney.ie

Cork Dublin Carlow