TECHNICAL APPENDIX 10.3: BORROW PIT APPRAISAL

Uisenis Wind Farm

Prepared for: Eurowind Energy Ltd.

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SLR

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ANNEX

Annex A: Materials Calculator

1.0 Introduction

This Borrow Pit Appraisal (BPA) has been undertaken by SLR Consulting Ltd (SLR).

The proposed Uisenis Wind Farm (the proposed development) is located on moorland approximately 20km south west of Stornoway, on land within the Eisgein (Eishken) Estate on the Isle of Lewis (The Site). The Site is currently accessed via an unnamed existing road (Eishken Road) off the A859 between Balallan and Kintarvie. The road spans approximately 12.1km from the A859 to Eishken Estate and Lodge.

The proposed development comprises 25 wind turbines with associated infrastructure. The proposed development is shown on **Figure 10.3.1** and would include the following key components:

- 25 wind turbines;
- turbine foundations and hardstanding areas;
- on-site tracks with associated turning heads;
- underground cabling along access tracks;
- one on-site substation compound;
- up to five borrow pits;
- two meteorological (Met) masts;
- two temporary construction compounds; and
- associated ancillary works.

1.1 Scope of Report

There has been a substantial amount of survey work undertaken to date at the Site to inform the proposed development layout, including Site reconnaissance and several phases of peat probing. The principal objective of this report is to provide an initial assessment of the aggregate requirements for the proposed development and identify potential borrow pits suitable for providing this aggregate.

This report provides details of the proposed borrow pits, which would be necessary to provide the aggregates required to construct the proposed development.

There are five proposed borrow pit search areas reviewed within this report. Selected because of their morphology, accessibility from proposed tracks, orientation and the expected proximity to suitable rock close to the surface. The proposed borrow pits are in areas where peat coverage is anticipated to be minimal and where bedrock may outcrop and potential aggregate reserves are expected to occur near the surface.

1.2 Sources of Information

The following sources of information have been reviewed and assessed:

- British Geological Survey (BGS) online map viewer and Geoindex[1];
- Scotland's Environment website[2]; and
- information gathered during Site visits by experienced geologists.

[1] British Geological Survey (BGS) Geoindex website http://mapapps.bgs.ac.uk/geologyofbritain/home.html; http://www.bgs.ac.uk/geoindex/
[2] Scotland's Environment Website www.environment.scotland.gov.uk

2.0 Geological Setting

2.1 Superficial Geology

The British Geological Survey (BGS) indicates that superficial geology within the Site area has not been officially mapped by BGS, however, the carbon and peatland map 2016 provides useful information regarding peat and soil coverage within the Site boundary.

Peat is present throughout the majority of the Site. The Site is comprised of peaty soils and localised areas of deep peat. Published priority peatland mapping by NatureScot indicates that most of the Site is located within Class 1 and Class 2 peatland which is considered to be of high conservation value with some localised areas of Class 5 peatland.

In areas of higher elevation and steeper gradients, there are no superficial deposits present and shallow bedrock is exposed throughout the Site. The superficial geology of the Site is detailed in **Figure 10.3.2**.

2.2 Bedrock Geology

The BGS indicates that the site is predominantly underlain by the Outer Hebrides Thrust Zone Mylonites Complex. This formation is comprised of Precambrian (4000 to 541Ma) metamorphic fault rocks including mylonites, protocataclasite, cataclasite and pseudotachylite. Fault rocks consist of compressed fragments of rock material produced by the grinding and brittle deformation forces associated with fault activity.

A small area within the north of the Site is underlain by Precambrian Amphibolite which is a coarse-grained metamorphic rock belonging to the Lewisian Complex. Some of the access tracks and turbines, T5 and T7, are proposed for construction in this area.

There are several inferred faults present within the Site boundary. There is a major thrust fault in the west of site trending north to south east. There is another major fault in the south of the Site trending east to west through Loch Eisgein and the river valley where Abhainn Cheothadail is present. In addition, there are two thrust faults present in the east and south of the Site, trending north east - south west that appear to be offset by the major fault in the south.

Based on recent Site observations from August 2022, November 2022 and January 2023, the bedrock encountered on Site is predominantly coarse, granular and strong.

The bedrock geology of the Site is detailed in **Figure 10.3.3**. Details of the geological units present on-site and immediately adjacent to Site are detailed in **Table 2-1**.

Table 2-1: Bedrock Geology Summary

<table>
<tr><th colspan="2">Age</th><th>Stratigraphic Group</th><th>Unit</th><th>Description</th></tr>
<tr><td rowspan="2">Precambrian</td><td rowspan="2">Archaean (4000 to 2500Ma) to Proterozoic (2500 to 541Ma)</td><td>Outer Hebrides Thrust Zone Mylonites Complex</td><td>Protocataclasite</td><td>Fault-related granular metamorphic rock that maintained primary cohesion during deformation, with matrix comprising 10-50% of total rock mass</td></tr>
<tr><td>Outer Hebrides Thrust Zone Mylonites Complex</td><td>Mylonite</td><td>Fine-grained metamorphic fault rock with reduced grain size due to dynamic recrystallisation of the constituent minerals.</td></tr>
</table>

Age		Stratigraphic Group	Unit	Description
		Outer Hebrides Thrust Zone Mylonites Complex	Cataclasite	Fault-related metamorphic rock that maintained primary cohesion during deformation, with matrix comprising greater than 10% of total rock mass
		Outer Hebrides Thrust Zone Mylonites Complex	Pseudotachylite	Very fine-grained, glassy fault rock
		Lewisian Complex	Amphibolite	Coarse-grained metamorphic rock containing amphibole.

2.3 Mining and Quarrying

Following review of publicly available records, there is no history of large scale commercial mineral extraction within the Site boundary and immediate area. Review of the BGS Geoindex indicates that there are road pits present alongside the existing road within the Site boundary indicating small scale extraction for road construction.

2.4 Hydrology

The Site exhibits a dense network of surface water features with numerous water courses and lochs noted throughout the area.

The majority of the Site is located within the surface water catchment of Loch Sealg, in particular the Abhainn Cheothadail sub catchment. The Abhainn Cheothadail flows generally eastward through the centre of the southern half of the Site before discharging into Loch Sealg near Eisgein (Eishken) which is situated in the south east of the Site. The Abhainn Gleann Airighan Domhnall, another catchment of Loch Shell, is situated in the south west heading eastward before discharging into Loch Sealg along the southern boundary of the Site.

The north eastern extent of the proposed development is located within the surface water catchment of the Abhainn Ghlas which is part of the larger Seaforth River catchment. The Abhainn Glas generally flows northwards before discharging into the Abhainn Ghleann Quirn approximately 1km north of the Site. The River flows westwards within the centre of the Site before discharging into Loch Seaford approximately 100m south of the proposed access track.

The central section of the proposed access track also drains to the Loch Seaford whilst the northern extent of the access track is located within the catchment of the Abhainn Mhor, which drains to the Loch Erisort approximately 1km north west of the proposed access point.

2.5 Hydrogeology

The solid geology underlying the Site is classified as fault zone rocks and a low productivity aquifer, where mylonitic rock and fault breccias yield small amounts of groundwater resulting in flow occurring predominantly through fractures and discontinuities. Small amounts of groundwater may be present within near surface fractures and weathered rock and from springs locally.

2.6 Aerial Photography

Review of the aerial photography indicate the borrow pit locations are largely covered by vegetation with exposed bedrock clearly visible.

3.0 Borrow Pit Assessment

This section of the report provides an assessment of the potential borrow pits with an evaluation of their potential to meet the proposed development's aggregate requirements.

The assessment has been completed through a desk-based review of geological maps and memoirs and is supported by several site visits from SLR geologists. Potential borrow pit locations were inspected visually with a view to assess ground conditions and help determine the borrow pits suitability for use during construction of the Site.

In exploring the five potential borrow pit locations, as defined on **Figure 10.3.1**, consideration has been given with regards to the practical aspects of each borrow pit. The main aspects to consider are as follows:

- ease of access;
- rock type;
- overburden thickness;
- topography;
- current and historical uses;
- proximity to construction activities;
- visual impact; and
- impact on environmentally sensitive areas.

Steeper topography is preferable for quarrying, where peat and soils coverage will be limited. Careful consideration was given to landscape and visual impacts, other considerations included proximity to watercourses and places of archaeological interest. The proposed borrow pits are in areas where the peat cover is typically thinner or vacant and aggregate reserves are expected to occur near the surface.

No intrusive site investigation works have been undertaken into the quality of rock that might be recovered at the time of preparing this BPA. However, it is anticipated that a full ground investigation will take place in advance of construction at the site. The investigation will include the testing of material from within the proposed borrow pit areas to assess its suitability for re-use.

3.1 Aggregate Requirements

The proposed turbine locations and their subsequent maintenance would require the construction of a purpose-built network of access tracks. These tracks would be single track with occasional passing places, un-metalled and would be constructed to the turbine suppliers' specifications conforming to the Specification for Highway Works[3].

As indicated above, a site investigation would be required to investigate each borrow pit location to confirm the material suitability and re-use potential of the bedrock with bedrock samples recovered from the borrow pits and subjected to detailed geotechnical testing.

The indicative volumes of rock required for site infrastructure are summarised in **Table 3-1** and based on the materials calculator provided in **Annex A**.

[3] Highways Agency, Manual of Contract Documents for Highway Works Volume 1 Specification for Highway Works, Series 600 Earthworks, Published February 2017.

Table 3-1: Aggregate Requirement Summary

Infrastructure Element	Volume of Aggregate Required (m^3)
New Excavated Access Track	49,440
Existing / Upgraded Access Track	18,105
New Floating Access Track	13,320
Turning Heads	2,520
Turbine Bases - formation only	5,191
Fill above Turbine Bases	19,075
Permanent Hardstandings	37,750
Temporary Hardstandings	55,000
Substation	7,500
Temporary Construction Compound North	7,200
Temporary Construction Compound South	6,300
Total	**221,401**

It has been estimated that approximately 221,401m^3 of suitable quality rock would be required to construct the proposed development. This includes SHW[4] classes 6F2, 6N/ 6P and concrete aggregate. If rock quality is not suitable for each of these engineered materials then there may be a requirement for imported materials.

No account has been taken in the calculations for the fortuitous 'winning' of rock during the construction phase for example during infrastructure excavations. If such rock was available, the amount extracted from the borrow pits would be reduced.

3.2 Borrow Pit Appraisal

This section of the report provides an assessment of the five potential borrow pits with an evaluation of their potential to meet the proposed development's aggregate requirements.

A total of five potential search areas were selected as possible borrow pit locations, shown on **Figure 10.3.1**. Each location is reviewed in the sections below. Potential search areas have been highlighted with indicative excavation areas identified at each borrow pit location. All borrow pits could be extended or reduced in size depending on review of aggregate requirements and/or ground investigation data.

These rock types have been assumed for the borrow pits where there were no rock exposures at the surface. The geology encountered on Site is supported by BGS geological maps for the Site. Dimensions of the borrow pits, volume of superficial material to be removed and volumes of site won rock for each borrow pit have been estimated based on cross-sections developed through a digital terrain model. These are required to be confirmed by future intrusive ground investigation works.

[4] The Manual of Contract Documents for Highway Works (MCHW), Volume 1 Specification for Highways Works, Series 600 Earthworks, February 2016

3.2.1 Borrow Pit 1

Borrow Pit 1 (BP1) would be in the north of the Site, adjacent to T6, at approximately NGR 132483, 914307, shown on **Figure 10.3.1** with further details in **Table 3-2**.

Photo 3-1: View east from NGR 132682 914350 showing BP1

Table 3-2: Borrow Pit 1

Borrow Pit 1	
Excavation Area	Approximately 9,254 m^2
Height of Excavation	Approximately 7.2 m
Gradient	Slope increasing gently towards the south
Details of Likely Extraction	Combination of digging, drilling and blasting
Likely Overburden Type and Depth	Peat / glacial cover
Extent of Aggregate Extraction	Approximately 33,882 m^3
Aggregate Composition	Outer Hebrides Thrust Zone Mylonites Complex - Pseudotachylite, very fine-grained, glassy fault rock.

3.2.2 Borrow Pit 2

Borrow Pit 2 (BP2) would be in the north of the Site, adjacent to T5, at approximately NGR 131887, 914066 shown on **Figure 10.3.1** with further details in **Table 3-3**.

Photo 3-2: View southeast from NGR 131821 914101 showing BP2

Table 3-3: Borrow Pit 2

Borrow Pit 2	
Excavation Area	Approximately 7,926 m^2
Height of Excavation	Approximately 8.1 m
Gradient	Slope increasing gently towards the east
Details of Likely Extraction	Combination of digging, drilling and blasting
Likely Overburden Type and Depth	Peat / glacial cover
Extent of Aggregate Extraction	Approximately 18,459 m^3
Aggregate Composition	Lewisian Complex - Amphibolite, Coarse-grained metamorphic rock containing amphibole.

3.2.3 Borrow Pit 3

Borrow Pit 3 (BP3) would be in the north of the Site, adjacent to T8, at approximately NGR 132321, 913825 shown on **Figure 10.3.1** with further details in **Table 3-4**.

Photo 3-3: View north from NGR 132270 913694 showing BP3

Table 3-4: Borrow Pit 3

Borrow Pit 3	
Excavation Area	Approximately 20,023 m^2
Height of Excavation	Approximately 8.8 m
Gradient	Slope increasing gently towards the east
Details of Likely Extraction	Combination of digging, drilling and blasting
Likely Overburden Type and Depth	Peaty soil
Extent of Aggregate Extraction	Approximately 58,922 m^3
Aggregate Composition	Lewisian Complex - Amphibolite, Coarse-grained metamorphic rock containing amphibole.

3.2.4 Borrow Pit 4

Borrow Pit 4 (BP4) would be in the east of the Site, to the south of T17, at approximately NGR 132911, 913061 shown on **Figure 10.3.1** with further details in **Table 3-5**.

Photo 3-4: View southwest from NGR 133267 913155 showing BP4

Table 3-5: Borrow Pit 4

Borrow Pit 4	
Excavation Area	Approximately 8,514 m^2
Height of Excavation	Approximately 5.7 m
Gradient	Slope increasing gently towards the east
Details of Likely Extraction	Combination of digging, drilling and blasting
Likely Overburden Type and Depth	Peaty soil
Extent of Aggregate Extraction	Approximately 16,797 m^3
Aggregate Composition	Outer Hebrides Thrust Zone Mylonites Complex - Pseudotachylite, very fine-grained, glassy fault rock.

3.2.5 Borrow Pit 5

Borrow Pit 5 (BP5) would be in the south west of the Site, adjacent to T21, at approximately NGR 130433, 911607 shown on **Figure 10.3.1** with further details in **Table 3-6**.

Photo 3-5: View southeast from NGR 130357 911703 showing BP5

Table 3-6: Borrow Pit 5

Borrow Pit 5	
Excavation Area	Approximately 22,498 m^2
Height of Excavation	Approximately 14.5 m
Gradient	Slope increasing gently towards the east
Details of Likely Extraction	Combination of digging, drilling and blasting
Likely Overburden Type and Depth	Peaty soil
Extent of Aggregate Extraction	Approximately 106,040 m^3
Aggregate Composition	Outer Hebrides Thrust Zone Mylonites Complex - Pseudotachylite, very fine-grained, glassy fault rock.

4.0 Proposed Borrow Pit Design

The indicative borrow pit volumes are presented in **Table 3-2 to Table 3-6**. The design of the borrow pits anticipates extracting a net stone volume suitable for the requirements onsite, excluding imported top surface dressing which would require importing. This target capacity has been determined based on the estimated requirements for construction materials together with additional allowances for overburden material. It is envisaged that overburden/soils together with processing waste would be carefully stored adjacent to the excavation void for eventual use in the restoration process.

4.1 Marking Out and Overburden Stripping

The permitted extents of the borrow pit would be marked out with pegs, and overburden, including topsoil, subsoil and weathered rock horizons, would be stripped from within this delineated area.

The overburden and weathered rock horizons would be stripped using a combination of crawler tractor dozers and backtrackers with the material loaded by loading shovels. The overburden (including surface vegetation turves) would be carefully stripped and stored as a series of separate turves, topsoil, subsoil and weathered rock storage mounds to be used for reinstatement purposes.

4.2 Excavations within Rock

Once overburden and weathered rock horizons have been stripped, and stored, a suitably qualified geotechnical engineer/blasting engineer would assess the nature of the underlying solid rock strata. The engineer would provide advice on suitable extraction techniques including; extraction method, bench and cut face design parameters, and blasting design (if required).

If blasting is required, blasting would be undertaken in accordance with the Quarries Regulations 1999[5] and Annex D PAN 50[6].

A combination of digging, ripping and blasting would be utilised to excavate rock (subject to the nature of the material encountered, depth of weathering and level of fracturing) which would be processed using a mobile crushing and screening plant, which would be sited within the base of the working borrow pit.

4.3 Stockpiling of Materials

The initial overburden strip would be stored within temporary screening mounds around the perimeter of the borrow pit. The screening mounds would be at least 1.5m in height.

The remaining unsuitable materials (weathered/unsuitable rock horizons) would be stockpiled within the base of the working borrow pit. The stockpiles would have a maximum height of 5m, with maximum side-slope gradients of 1(Vertical (V)) in 2.5(Horizontal (H)) and be in full compliance with the Quarries Regulations 1999[5] and Quarries National Joint Advisory Committee (QNJAC) Guidelines[7]. This material would be used as part of the restoration profiling on the cut faces.

4.4 Access Tracks/Haulage Routes

The proposed access to the borrow pit(s) would involve constructing access tracks from the main wind farm access track. The access tracks would include suitable roadside drainage ditches, with soakaways located, where appropriate.

[5] Health and Safety Executive (2014)., Health and Safety at Quarries, Quarries Regulations 1999, Approved Code of Practice and Guidance (Second Edition).

[6] Scottish Government (2000)., PAN 50 Annex D: Controlling the Environmental Effects of Surface Mineral Works.

[7] Quarries National Joint Advisory Committee (2020), Available at: http://qnjac.co.uk/what-is-qnjac/. Last accessed April 2020.

The tracks (haulage routes) within the borrow pit would have a gradient of no steeper than 1(V) in 10(H).

4.5 Water Management/Drainage

The borrow pit(s) would feature a perimeter surface drain, which would aim to prevent water in-flow into the borrow pit. The water collected within the surface drains would be discharged either into the surrounding vegetation, or into suitably located settlement lagoons.

Where necessary, surface settlement lagoons would be constructed within the borrow pit. These would be constructed with the aim of containing any surface water collection within the excavation voids, and from collection of water from the perimeter surface drains. The lagoons would be contained within a bunded area at the base of the borrow pit, with suitable pumping systems installed allowing water to be pumped to soakaways as required. For further details on drainage.

4.6 Restoration

Upon completion of extraction at the borrow pit(s), surface profile restoration would be undertaken using the stockpiled overburden materials and other suitable materials excavated onsite (including peat) subject to review by the Ecological Clerk of Works (ECoW).

General fill material would be sourced from the stockpiles located within the borrow pit void. These would comprise of materials with unsuitable engineering properties for the proposed development construction such as weathered rock and unsuitable/poor quality rock horizons, and unsuitable materials arising from the crusher/blasting operations. This material would be utilised to provide the basis of the restoration profile.

The fill materials would be used as general fill to soften the benched profile of the excavations and provide a gentler sloping gradient than near vertical working face slope designs. The fill materials would also be used to provide a suitable gradient on the borrow pit floor to prevent ponding.

The stripped soils, and subsoil horizons which would be stored within perimeter screening mounds would be utilised as the surface dressing layer in which to provide a suitable medium for seeding and planting as appropriate.

The restoration of the borrow pit sites would not involve importing any material onto site. Only materials arising from the excavations would be utilised as part of the restoration scheme. The base of the borrow pit would re-use existing stockpiled materials/soils generated from the site excavations to create a habitat on the floor of the borrow pit, which would be a maximum of 2m thick across the floor area and if suitable, some of these soils could be used to ‘dress’ shallower side slopes but not on the steeper faces.

An ECoW would be in place, to monitor the restoration and aftercare of the borrow pits.

4.7 Best Practice Guidance Documents

A number of general pollution prevention measures would be employed to minimise the risks to ground and surface waters during the creation and use of the borrow pits. Extraction operations would be carried out in accordance with relevant SEPA Guidance for Pollution Prevention[8] and other codes of best practice, to ensure that both ground and surface waters are not contaminated. These would include relevant codes of best practice relevant to the site, including:

- European Commission (EC) Water Framework Directive (2000/60/EC);
- Planning Advice Note (PAN) 50, Controlling the Environmental Effects of Surface Mineral Workings Scottish Government(2000)[6];

[8] SEPA (2019)., *Guidance for Pollution Prevention (GPPs).* Available at https://www.netregs.org.uk/environmental-topics/pollution-prevention-guidelines-ppgs-and-replacement-series/guidance-for-pollution-prevention-gpps-full-list/

- Good Practice on Controlling the Effects of Surface Mineral Working on the Water Environment, Department of the Communities and Local Government and Mineral Industry Research Organisation. (2008);
- Guidance for Pollution Prevention (GPPs) (various dates and references), SEPA; and
- Environmental Good Practice on Site C692, CIRIA, (2010).

5.0 Conclusion

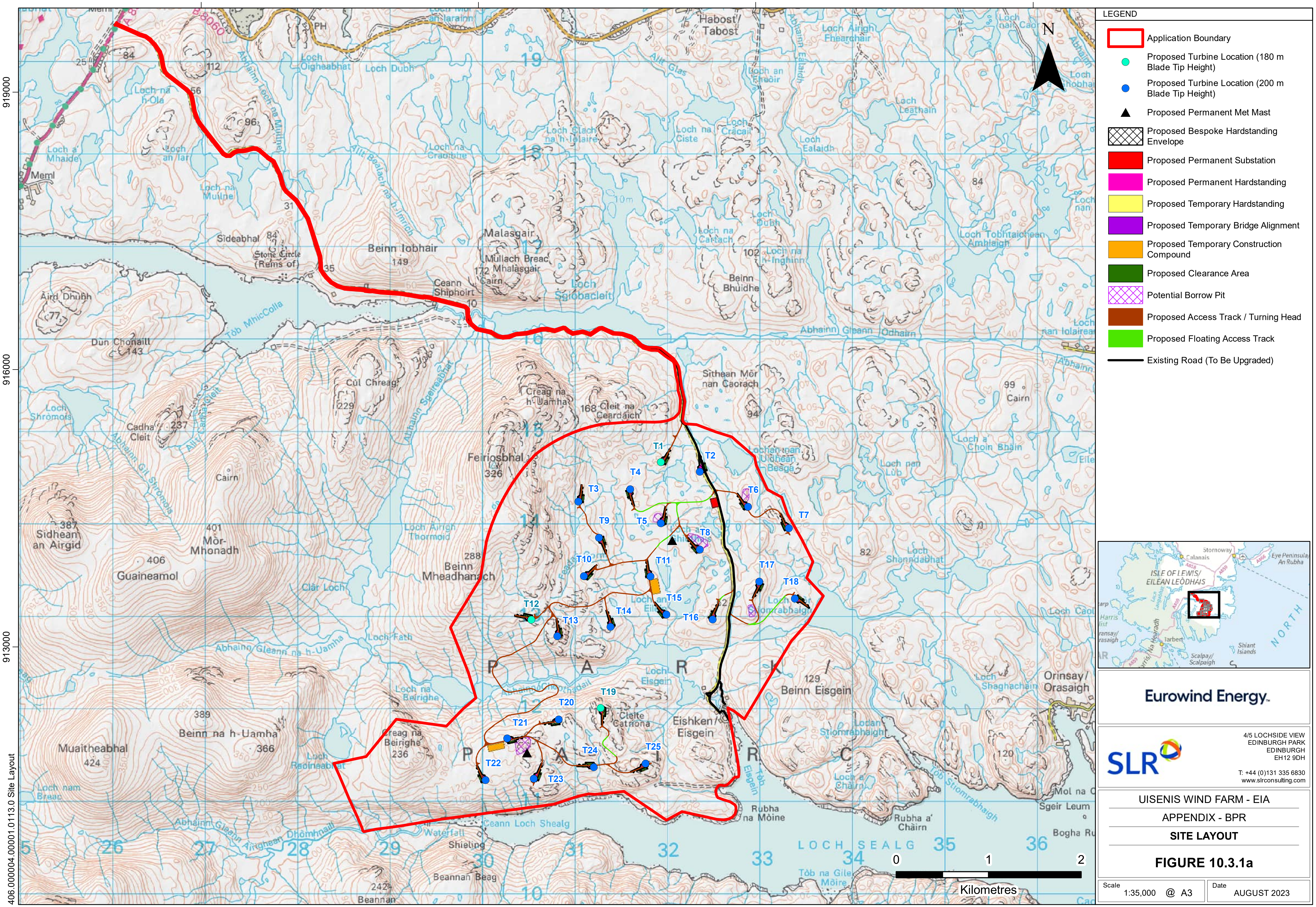
In summary, five borrow pits have been assessed as being capable of supplying all the aggregate required for the site, excluding the concrete for the turbine bases and a surface road dressing. The locations and methods of working would be managed to cause minimal impact to the ground conditions and water environment.

An approximate volume of excavated materials has been calculated for each of the proposed borrow pit locations, these volumes are based on initial calculations based on assumptions for the proposed development. These calculations would be verified by detailed intrusive investigation at the proposed locations, post-consent. Calculations do not take into consideration the 'winning' of materials along the route. Each of the proposed borrow pits selected could be increased or decreased in size, depending on the aggregate requirements or following an assessment of the suitability of aggregate materials following detailed ground investigation.

The quality of rock anticipated onsite is inferred from a visual assessment of rock outcrops and published information. An intrusive ground investigation, sampling and material laboratory testing will be required to confirm ground conditions onsite.

Prior to the construction of the proposed development, design and best practices, and any required mitigation measures, would be set out in full within a Construction Environmental Management Plan (CEMP) and agreed with the statutory bodies. An Outline CEMP is included in **Technical Appendix 3.1**.

FIGURES



LEGEND
Application Boundary
Proposed Turbine Location (180 m Blade Tip Height)
Proposed Turbine Location (200 m Blade Tip Height)
Proposed Permanent Met Mast
Proposed Bespoke Hardstanding Envelope
Proposed Permanent Substation
Proposed Permanent Hardstanding
Proposed Temporary Hardstanding
Proposed Temporary Bridge Alignment
Proposed Temporary Construction Compound
Proposed Clearance Area
Potential Borrow Pit
Proposed Access Track / Turning Head
Proposed Floating Access Track
Existing Road (To Be Upgraded)
N
T1
T2
T3
T4
T5
T6
T7
T8
T9
T10
T11
T12
T13
T14
T15
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Kilometres
Eurowind Energy
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4/5 LOCHSIDE VIEW
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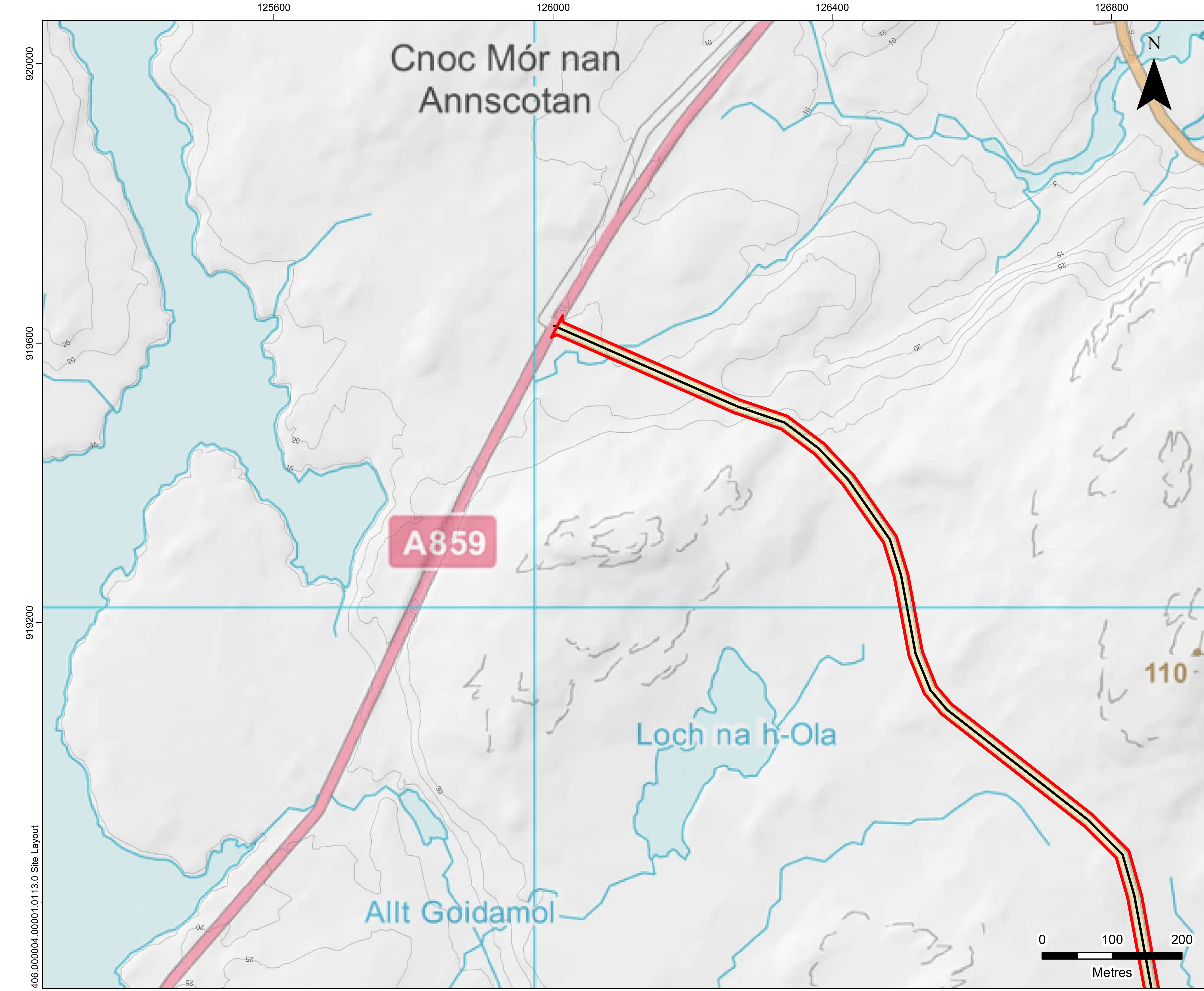
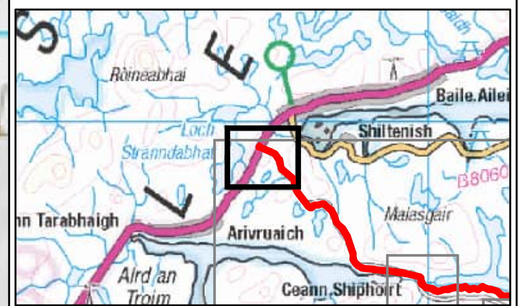
UISENIS WIND FARM - EIA
APPENDIX - BPR
SITE LAYOUT
FIGURE 10.3.1a
Scale
1:35,000 @ A3
Date
AUGUST 2023
406.000004.00001.0113.0 Site Layout



LEGEND

Application Boundary

Existing Road (To Be Upgraded)



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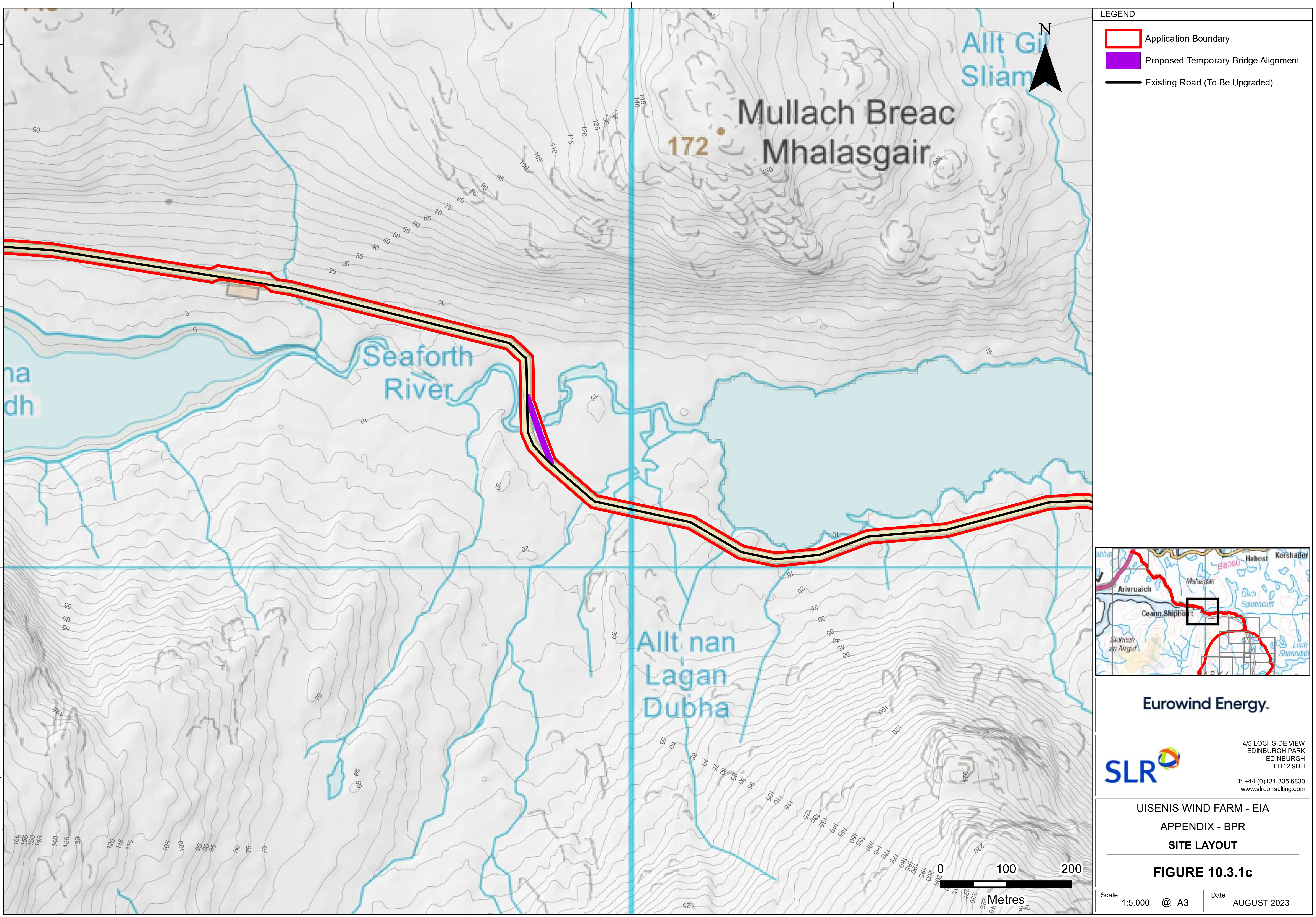
UISENIS WIND FARM - EIA

APPENDIX - BPR

SITE LAYOUT

FIGURE 10.3.1b

Scale	Date
1:5,000 @ A3	AUGUST 2023



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130400
916800
916400
916000
Mullach Breac Mhalasgair
172
Allt Gil Sliam
Seaforth River
Allt nan Lagan Dubha
N
LEGEND
Application Boundary
Proposed Temporary Bridge Alignment
Existing Road (To Be Upgraded)
0
100
200
Metres
Arivruaich
Ceann Shiphoirt
Habost
Kershader
Eurowind Energy
SLR
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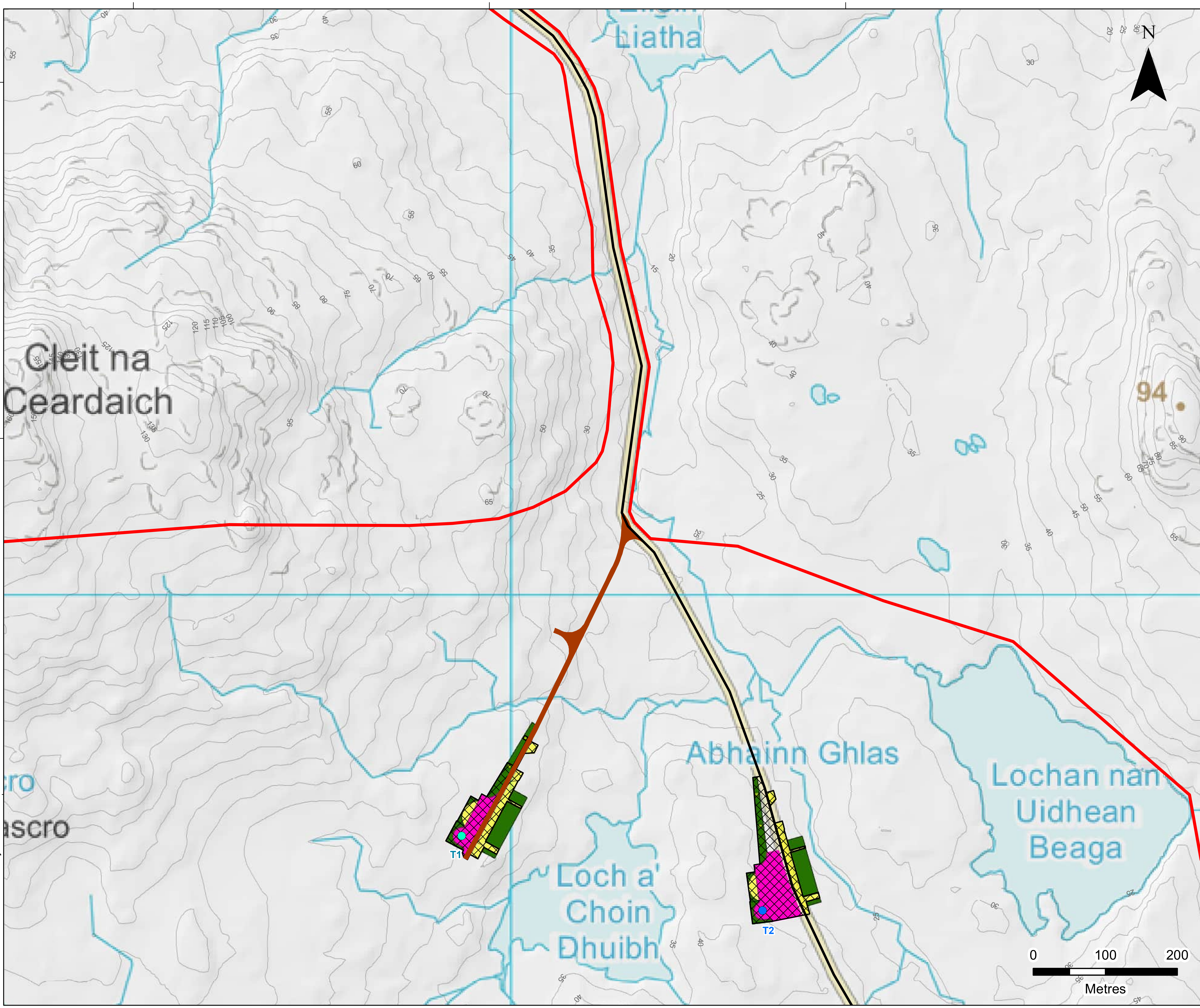
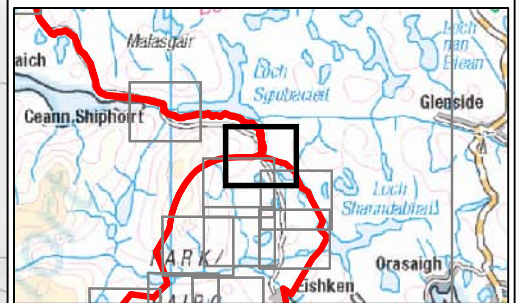
APPENDIX - BPR
SITE LAYOUT
FIGURE 10.3.1c
Scale
1:5,000 @ A3
Date
AUGUST 2023
406.000004.00001.0113.0 Site Layout





LEGEND

- Application Boundary
- Proposed Turbine Location (180 m Blade Tip Height)
- Proposed Turbine Location (200 m Blade Tip Height)
- Proposed Bespoke Hardstanding Envelope
- Proposed Permanent Hardstanding
- Proposed Temporary Hardstanding
- Proposed Clearance Area
- Proposed Access Track / Turning Head
- Existing Road (To Be Upgraded)

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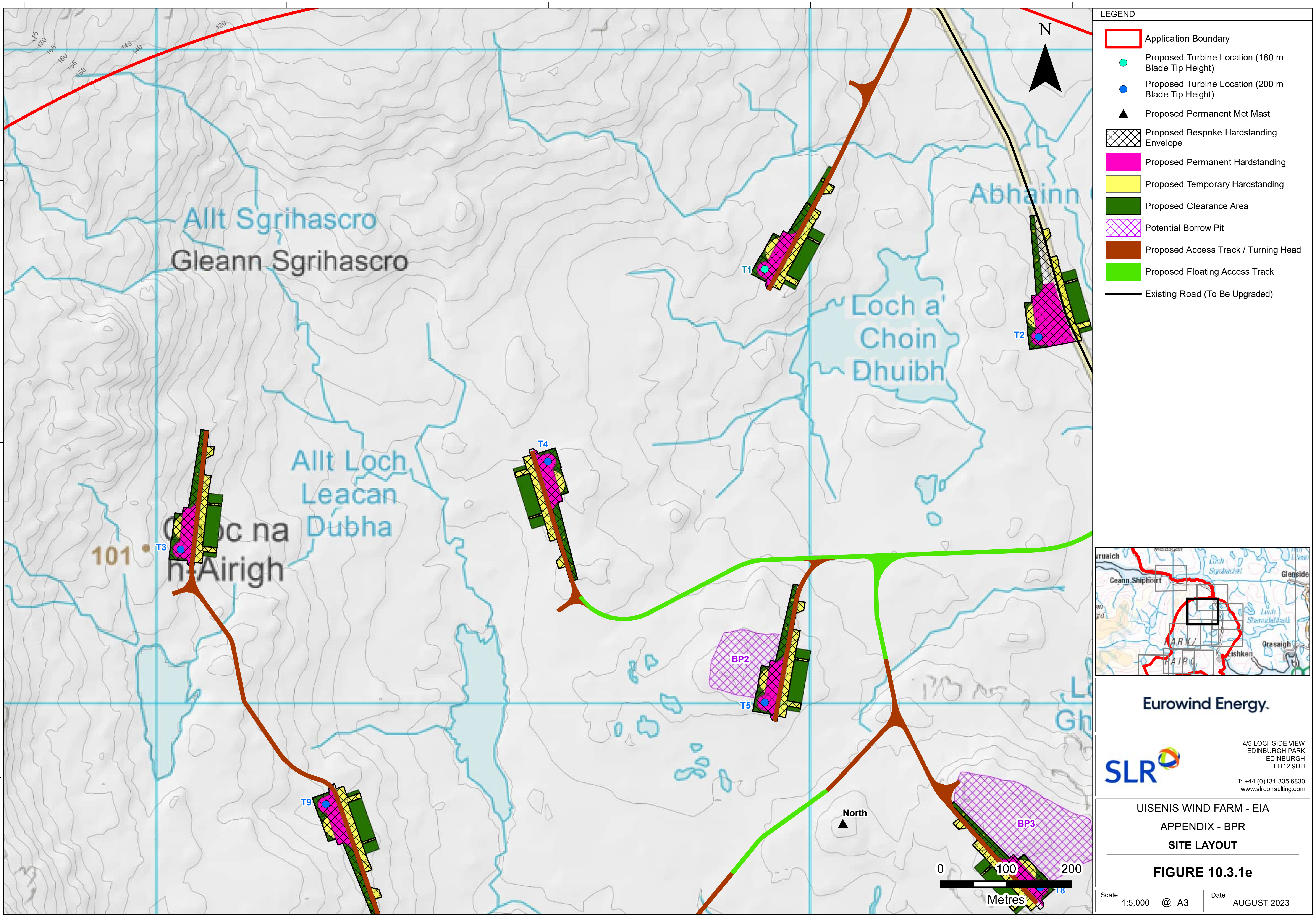
APPENDIX - BPR

SITE LAYOUT

FIGURE 10.3.1d

Scale	Date
1:5,000 @ A3	AUGUST 2023

406.00004.00001.0113.0 Site Layout



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APPENDIX - BPR

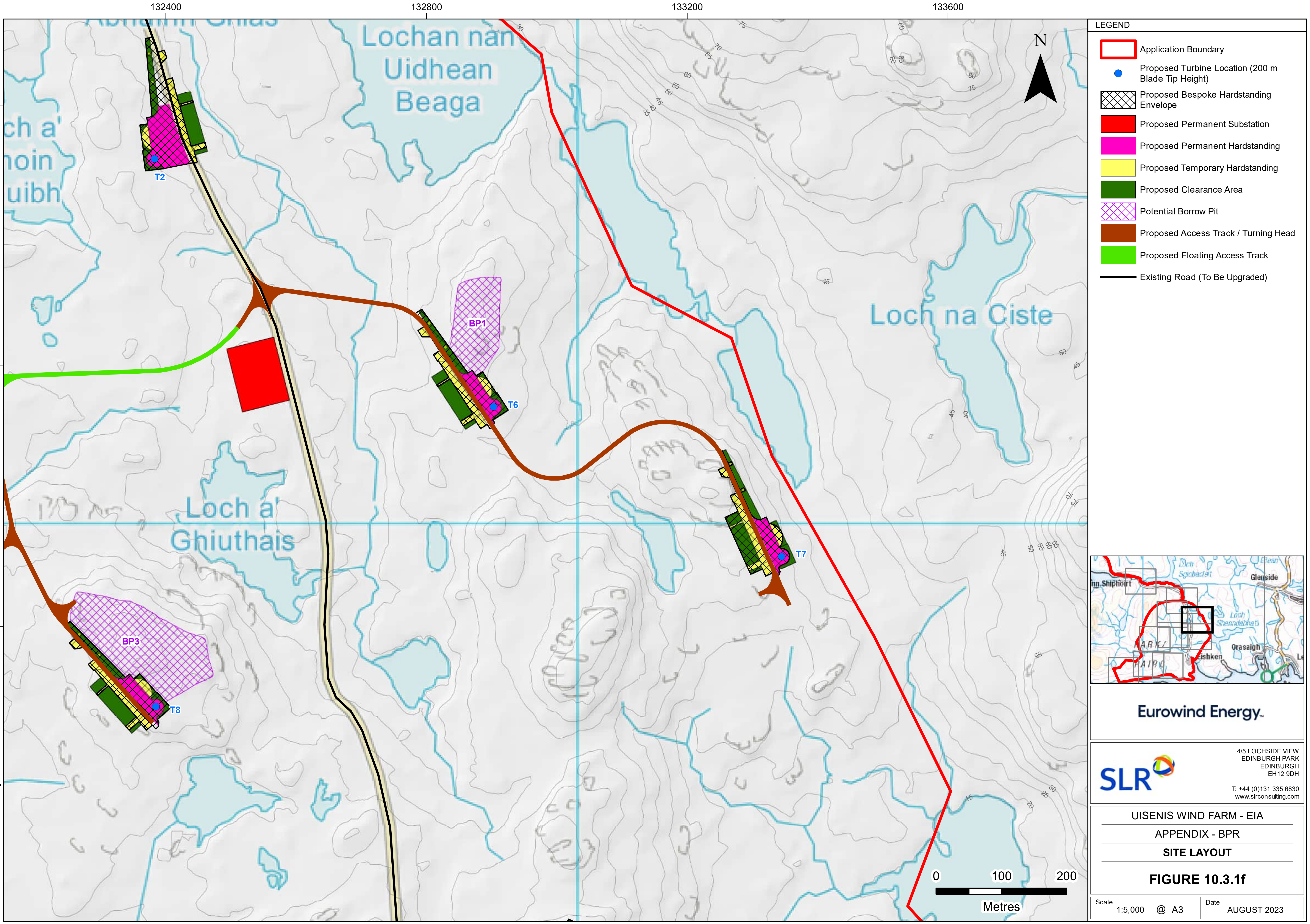
SITE LAYOUT

FIGURE 10.3.1e

Scale 1:5,000 @ A3

Date AUGUST 2023

406.00004.00001.0113.0 Site Layout



132400
132800
133200
133600
914400
914000
913600
Lochan nan Uidhean Beaga
Loch na Ciste
Loch a' Ghiuthais
T2
T6
T7
T8
BP1
BP3
N
0
100
200
Metres
LEGEND
Application Boundary
Proposed Turbine Location (200 m Blade Tip Height)
Proposed Bespoke Hardstanding Envelope
Proposed Permanent Substation
Proposed Permanent Hardstanding
Proposed Temporary Hardstanding
Proposed Clearance Area
Potential Borrow Pit
Proposed Access Track / Turning Head
Proposed Floating Access Track
Existing Road (To Be Upgraded)
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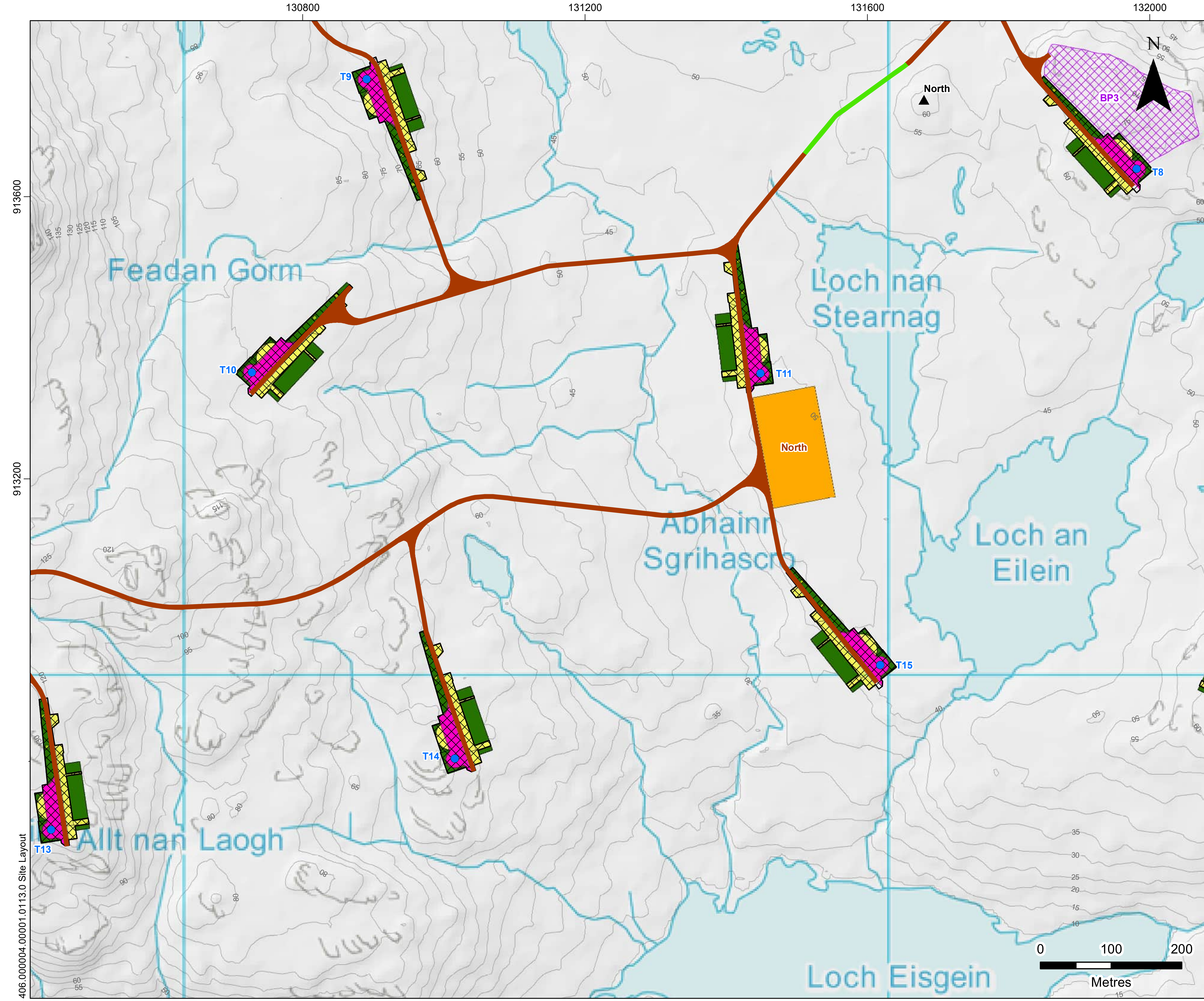
SITE LAYOUT
FIGURE 10.3.1f
Scale 1:5,000 @ A3
Date AUGUST 2023
406.00004.00001.0113.0 Site Layout



LEGEND

- Application Boundary
- Proposed Turbine Location (200 m Blade Tip Height)
- Proposed Permanent Met Mast
- Proposed Bespoke Hardstanding Envelope
- Proposed Permanent Hardstanding
- Proposed Temporary Hardstanding
- Proposed Temporary Construction Compound
- Proposed Clearance Area
- Potential Borrow Pit
- Proposed Access Track / Turning Head
- Proposed Floating Access Track

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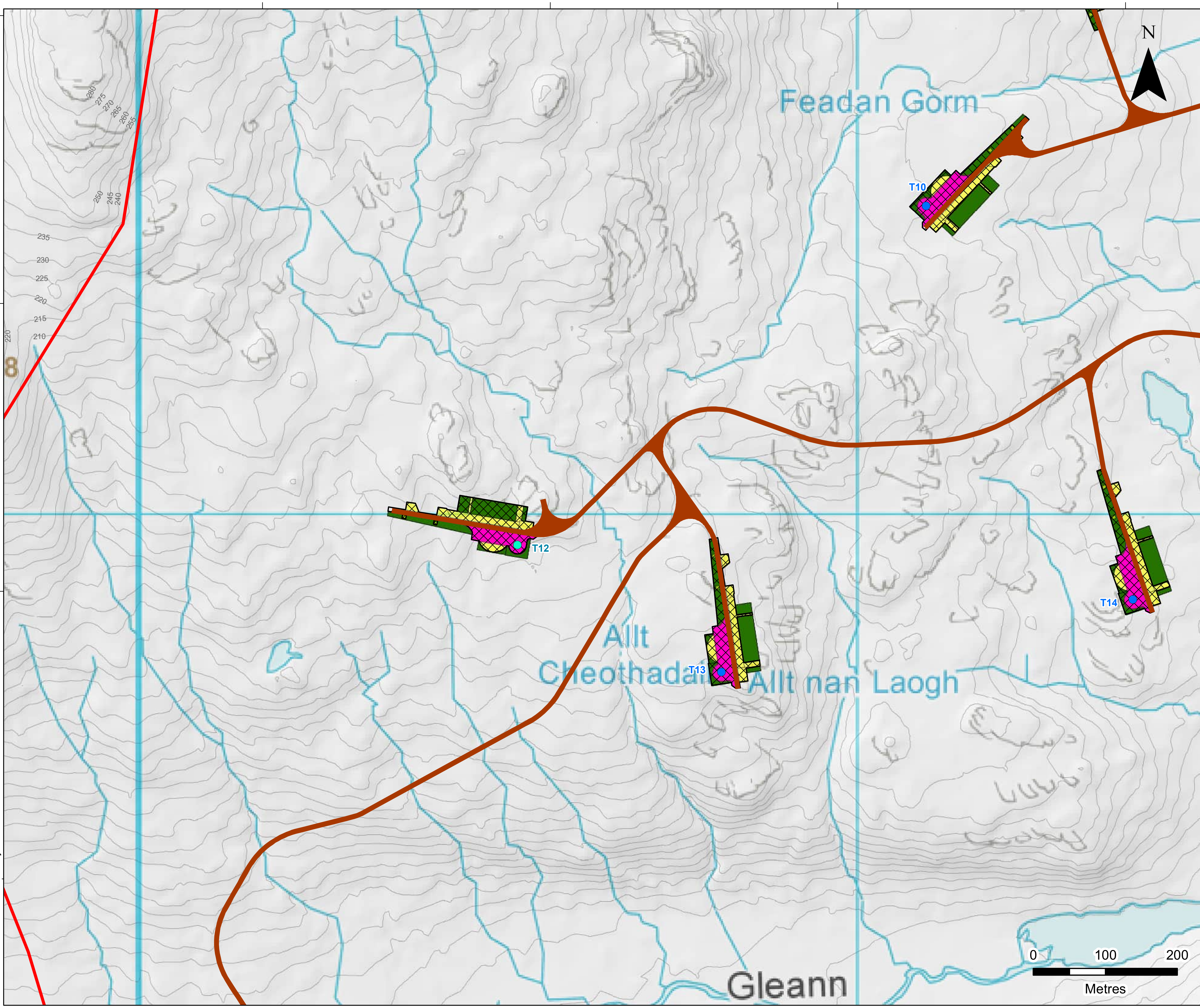
SITE LAYOUT

FIGURE 10.3.1g

Scale	Date
1:5,000 @ A3	AUGUST 2023

406.000004.00001.0113.0 Site Layout



LEGEND

- Application Boundary
- Proposed Turbine Location (180 m Blade Tip Height)
- Proposed Turbine Location (200 m Blade Tip Height)
- Proposed Bespoke Hardstanding Envelope
- Proposed Permanent Hardstanding
- Proposed Temporary Hardstanding
- Proposed Clearance Area
- Proposed Access Track / Turning Head

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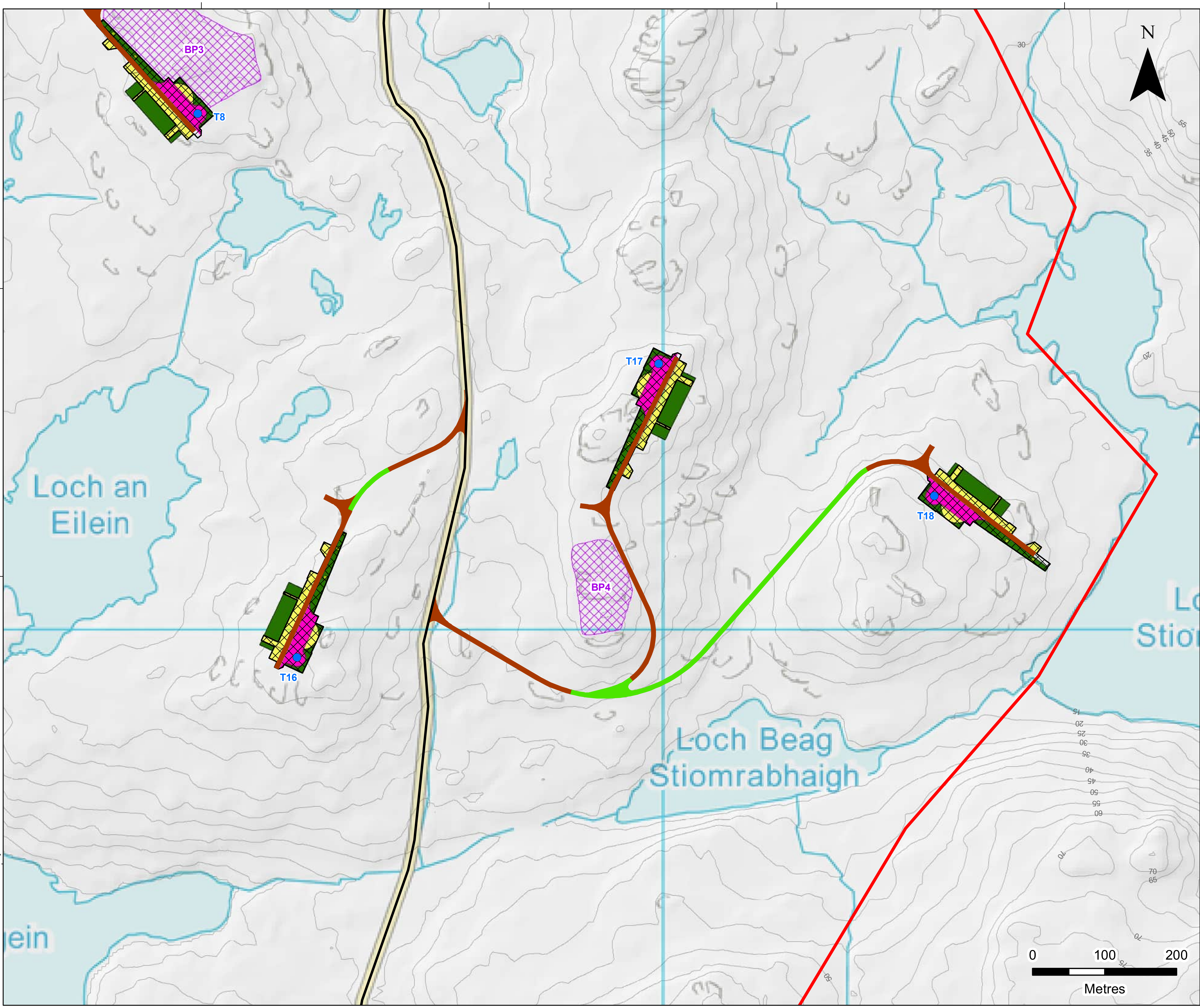
APPENDIX - BPR

SITE LAYOUT

FIGURE 10.3.1h

Scale	Date
1:5,000 @ A3	AUGUST 2023

406.000004.00001.0113.0 Site Layout



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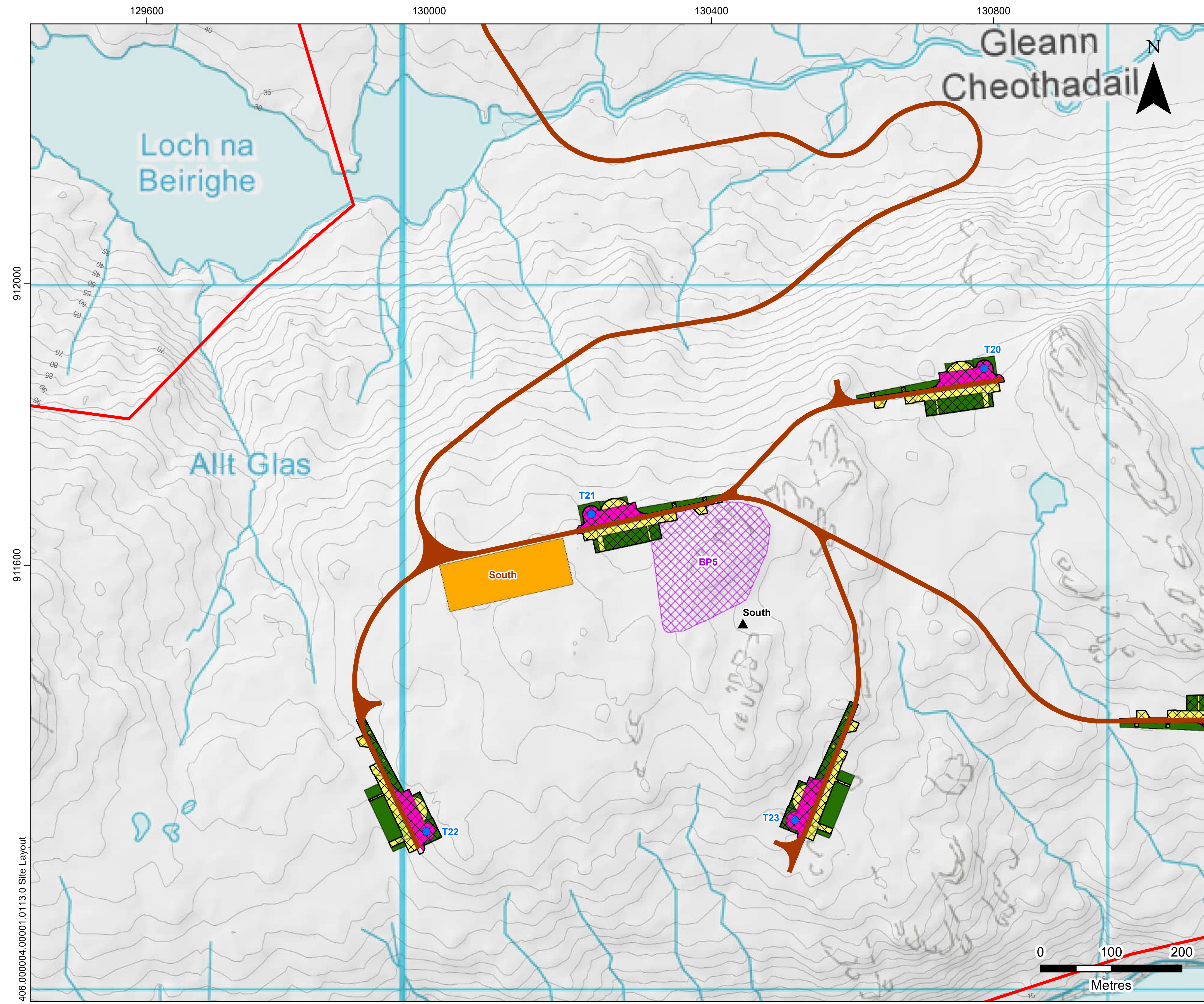
SITE LAYOUT

FIGURE 10.3.1i

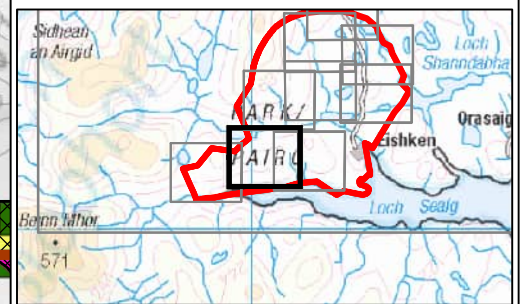
Scale	Date
1:5,000 @ A3	AUGUST 2023

406.000004.00001.0113.0 Site Layout



LEGEND

- Application Boundary
- Proposed Turbine Location (200 m Blade Tip Height)
- Proposed Permanent Met Mast
- Proposed Bespoke Hardstanding Envelope
- Proposed Permanent Hardstanding
- Proposed Temporary Hardstanding
- Proposed Temporary Construction Compound
- Proposed Clearance Area
- Potential Borrow Pit
- Proposed Access Track / Turning Head



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UISENIS WIND FARM - EIA

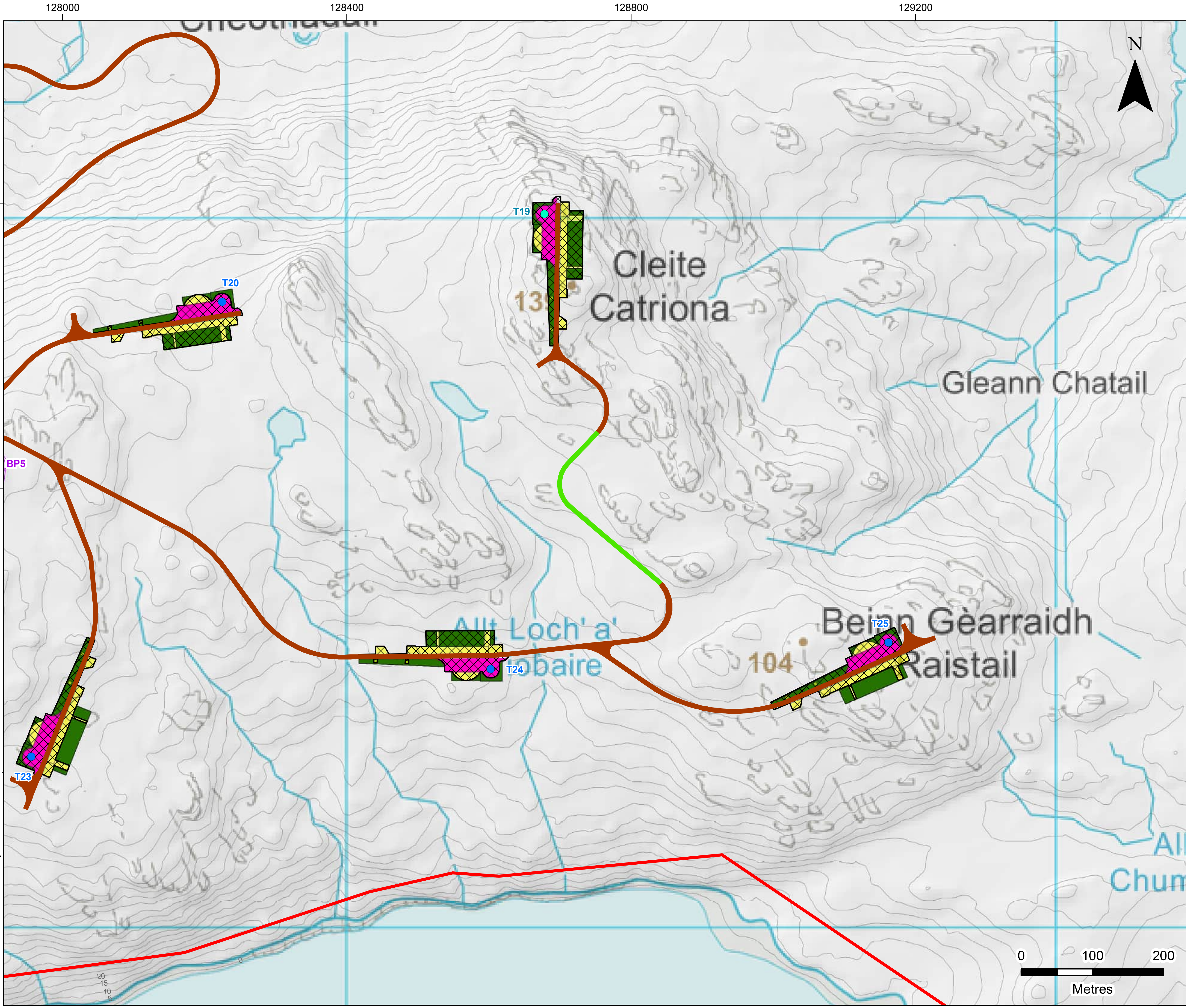
APPENDIX - BPR

SITE LAYOUT

FIGURE 10.3.1j

Scale	Date
1:5,000 @ A3	AUGUST 2023

406.00004.00001.0113.0 Site Layout



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APPENDIX - BPR

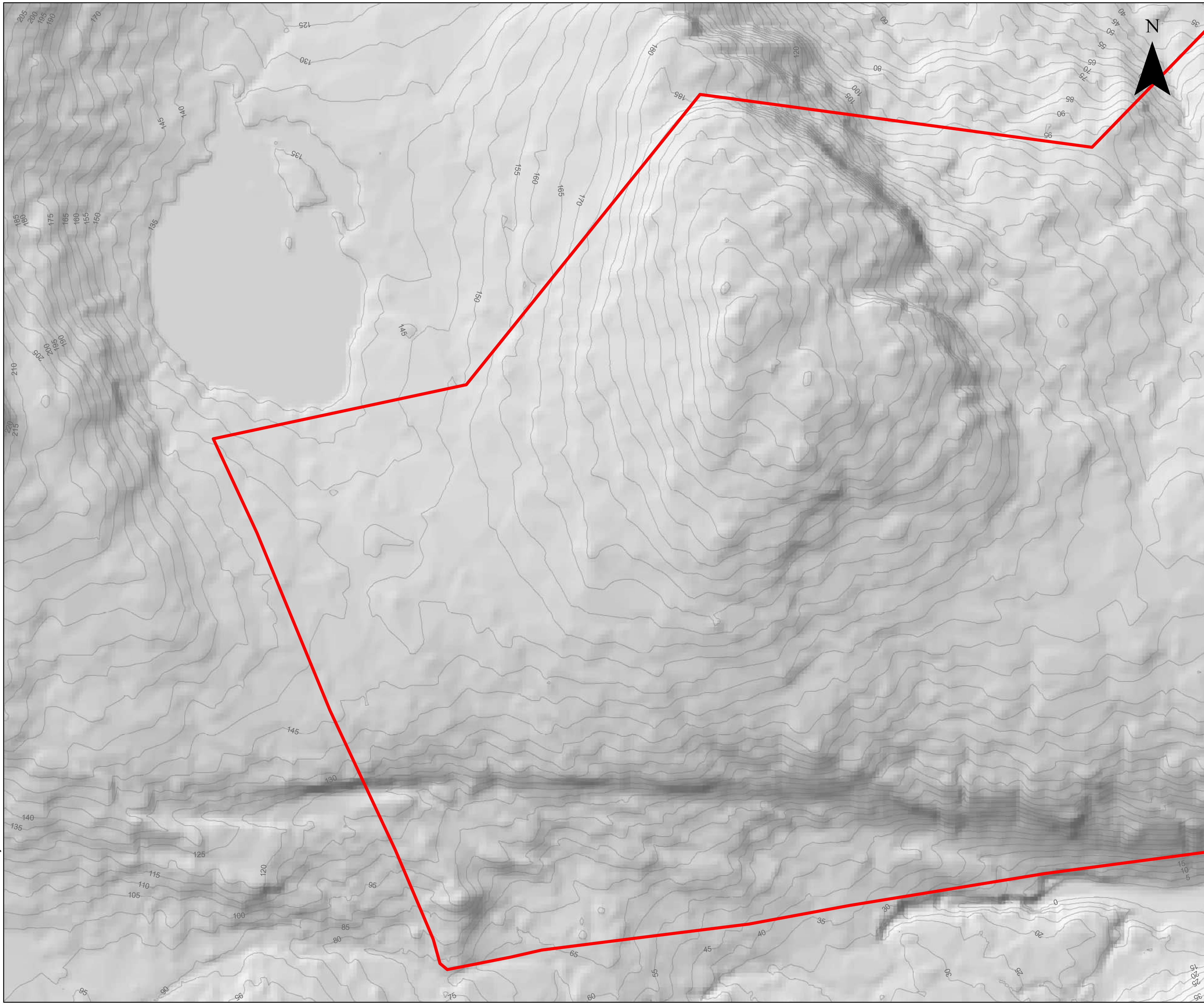
SITE LAYOUT

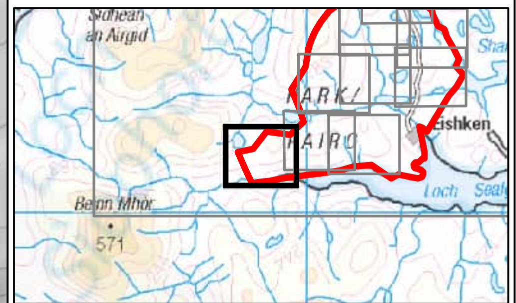
FIGURE 10.3.1k

Scale 1:5,000 @ A3

Date AUGUST 2023

406.00004.00001.0113.0 Site Layout





LEGEND

Application Boundary

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APPENDIX - BPR

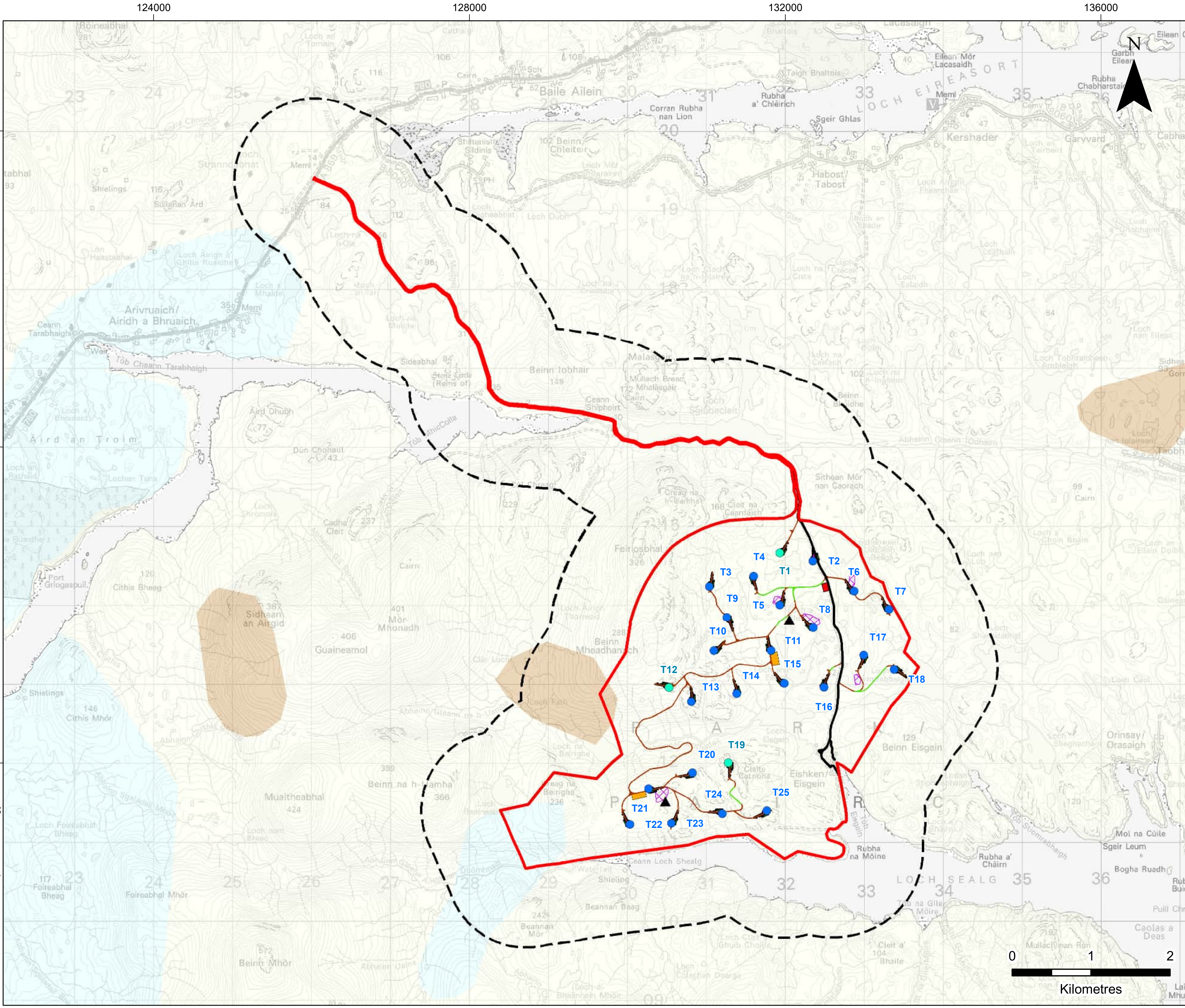
SITE LAYOUT

FIGURE 10.3.1I

Scale 1:5,000 @ A3

Date AUGUST 2023

406.000004.00001.0113.0 Site Layout



LEGEND

- Application Boundary
- Proposed Turbine Location (180 m Blade Tip Height)
- Proposed Turbine Location (200 m Blade Tip Height)
- Proposed Permanent Met Mast
- Application Boundary 1 km Buffer
- Proposed Bespoke Hardstanding Envelope
- Proposed Permanent Substation
- Proposed Permanent Hardstanding
- Proposed Temporary Hardstanding
- Proposed Temporary Bridge Alignment
- Proposed Temporary Construction Compound
- Proposed Clearance Area
- Potential Borrow Pit
- Proposed Access Track / Turning Head
- Proposed Floating Access Track
- Existing Road (To Be Upgraded)

Superficial Geology

- Peat
- Till - Diamicton
- No Mapped Superficial Deposit

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UISENIS WIND FARM - EIA

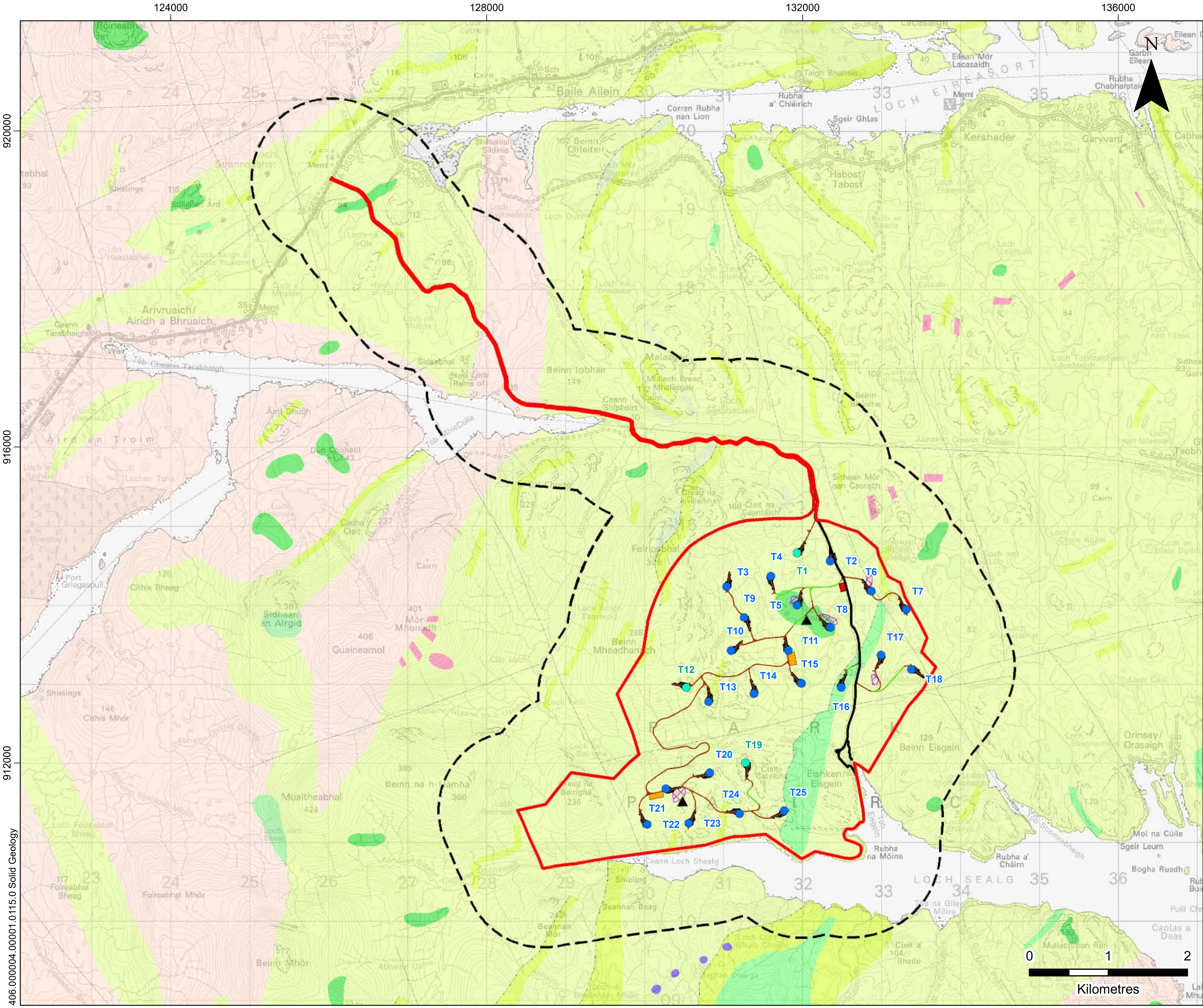
APPENDIX - BPR

SUPERFICIAL GEOLOGY

FIGURE 10.3.2

Scale 1:45,000 @ A3 | Date AUGUST 2023

406.000004.00001.0114.0 Superficial Geology



LEGEND

- Application Boundary
- Proposed Turbine Location (180 m Blade Tip Height)
- Proposed Turbine Location (200 m Blade Tip Height)
- Proposed Permanent Met Mast
- Application Boundary 1 km Buffer
- Proposed Bespoke Hardstanding Envelope
- Proposed Permanent Substation
- Proposed Permanent Hardstanding
- Proposed Temporary Hardstanding
- Proposed Temporary Bridge Alignment
- Proposed Temporary Construction Compound
- Proposed Clearance Area
- Potential Borrow Pit
- Proposed Access Track / Turning Head
- Proposed Floating Access Track
- Existing Road (To Be Upgraded)

Igneous Rock

- Uig Hills - Harris Igneous Complex - Granite

Metamorphic Rock

- Scourie Dyke Swarm - Ortho-Amphibolite
- Lewisian Complex - Amphibolite
- Lewisian Complex - Gneiss
- Lewisian Complex - Ultramafic Rock
- Outer Hebrides Thrust Zone Mylonites Complex – Cataclasite
- Outer Hebrides Thrust Zone Mylonites Complex – Mylonite
- Outer Hebrides Thrust Zone Mylonites Complex – Pseudotachylite

PALEO - PROTEROZOIC

ARCHEAN - PROTEROZOIC

Linear Geology

- Fault Line
- Thrust Fault Line

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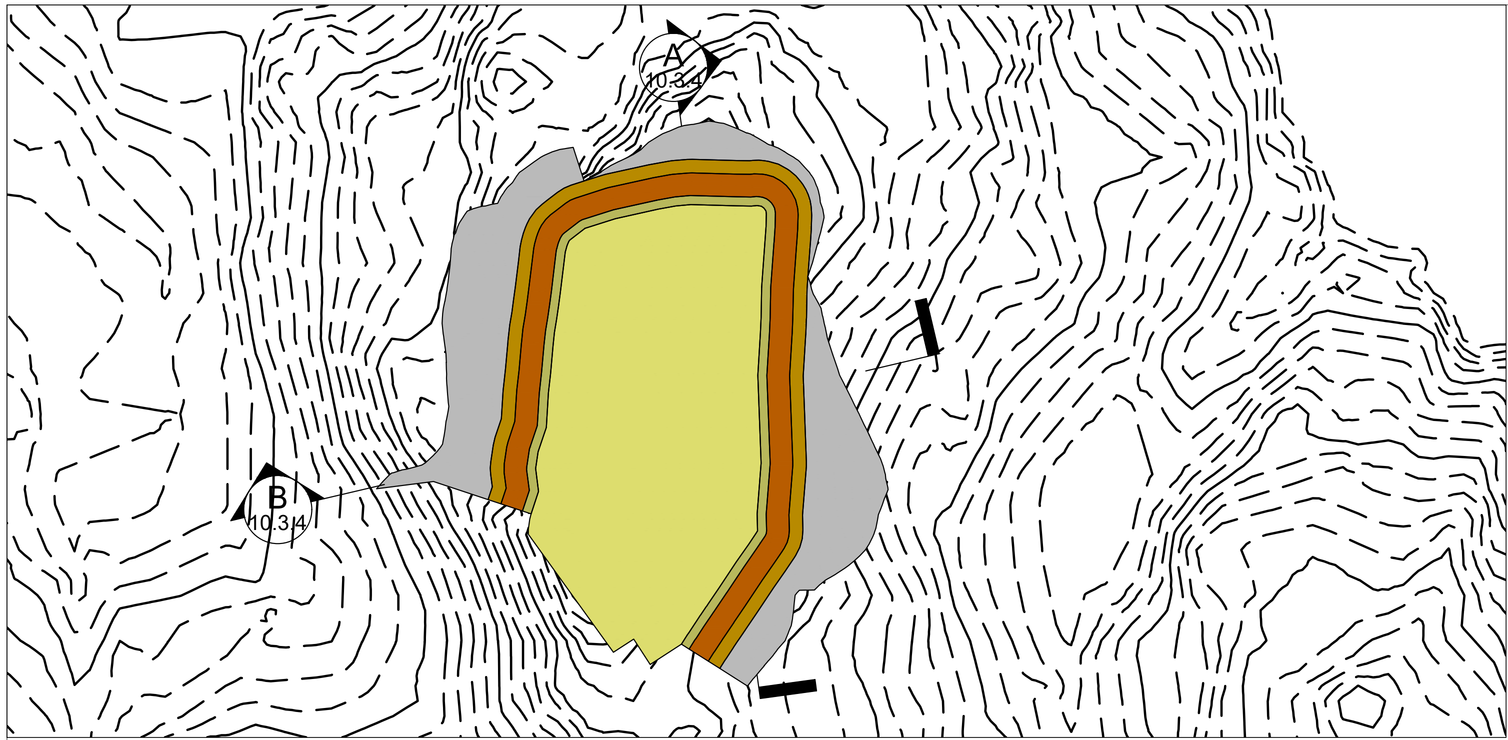
SOLID GEOLOGY

FIGURE 10.3.3

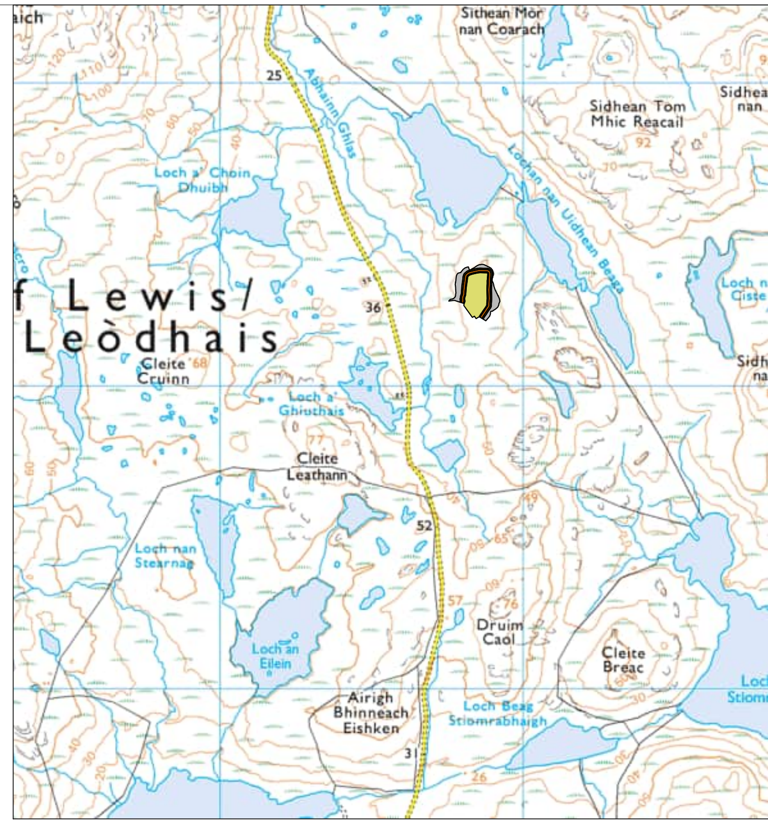
Scale 1:45,000 @ A3

Date AUGUST 2023



01 PLAN OF BORROW PIT
SCALE: 1:2500

0 80m 200
Metres 1:2500



N

02 LOCATION PLAN
SCALE: 1:25000

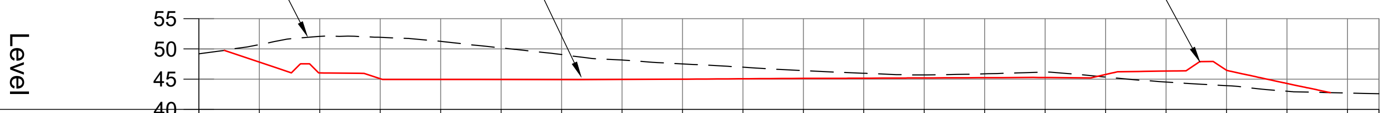
0 800m 2000
Metres 1:25,000

NOTES

1. OVERBURDEN ASSUMED TO BE CIRCA 0.5m IN THICKNESS COMPRISING SOILS AND WEATHERED ROCK.
2. INITIAL STRIPPED OVERBURDEN TO BE PLACED IN PERIPHERAL BUND, WITH SUBSEQUENT OVERBURDEN AND WASTE MATERIALS TO BE STOCKPILED WITHIN FLAT BASAL AREA OF BORROW PIT PRIOR TO BEING USED IN RESTORATION.
3. DESIGN PARAMETERS ARE INDICATIVE AND SHOULD BE REFINED BASED UPON FINDINGS OF GROUND INVESTIGATIONS AND OR INITIAL EXCAVATIONS, TAKING INTO ACCOUNT GROUND CONDITIONS AND HYDROLOGICAL ISSUES.
4. ASSUMES INSITU CONVERSION FACTOR OF 2 TONNES PER m^3.

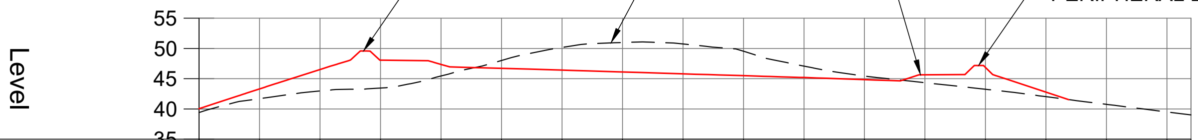
LEGEND

- BENCH/BASE OF EXCAVATION
- EXCAVATION BATTER
- PERIPHERAL BUND
- BENCH
- EARTHWORK SLOPES



Chainage	00.00	10.00	20.00	30.00	40.00	50.00	60.00	70.00	80.00	90.00	100.00	110.00	120.00	130.00	140.00	150.00	160.00	170.00	180.00	190.00	195.22
Existing Ground Levels	49.186	50.703	52.060	51.908	51.250	50.162	49.071	48.165	47.514	46.976	46.399	45.974	45.686	45.880	46.160	45.338	44.524	43.926	42.994	42.699	42.590
Proposed Levels	49.750	47.819	46.029	45.070	44.940	44.947	44.931	44.952	44.991	45.056	45.122	45.152	45.200	45.237	45.263	45.767	46.336	46.463	44.282	42.768	

SECTION A
Scale: H 1:1250,V 1:1250. Datum: 40.000



Chainage	00.00	10.00	20.00	30.00	40.00	50.00	60.00	70.00	80.00	90.00	100.00	110.00	120.00	130.00	140.00	150.00	160.00	163.96
Existing Ground Levels	39.410	41.703	42.972	43.462	45.458	48.014	50.171	50.985	50.747	49.547	47.082	45.437	44.342	43.258	42.029	40.764	39.510	39.015
Proposed Levels	40.044	43.309	46.524	49.583 48.069	47.371	46.713	46.432	46.118	45.807	45.501	45.200	44.852	45.644	46.860	42.782 41.544			

SECTION B
Scale: H 1:1250,V 1:1250. Datum: 35.000

TOTAL EXCAVATION VOLUME	38,509m^3
OVERBURDEN VOLUME	4,627m^3
NET STONE VOLUME	33,882m^3
PERIPHERAL BUND FILL	4,864m^3
NET STONE TONNAGE	67,764T
EXCAVATION AREA	9,254m^2
EXCAVATION METHOD REQUIRED	DIGGING, DRILLING AND BLASTING
INFERRED DESIGN PARAMETERS	63 DEGREE FACES THROUGH COMPETENT ROCK MAXIMUM FACE HEIGHT OF 7.2m FINAL BENCH WIDTH OF 7.5m 1.5m HIGH PERIPHERAL BUND
CO-ORDINATES FOR CENTRE OF BORROW PIT	E: 132843 N: 914307

0 10 20 30 40m 60 80 100
Metres 1:1250

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UISENIS WIND FARM

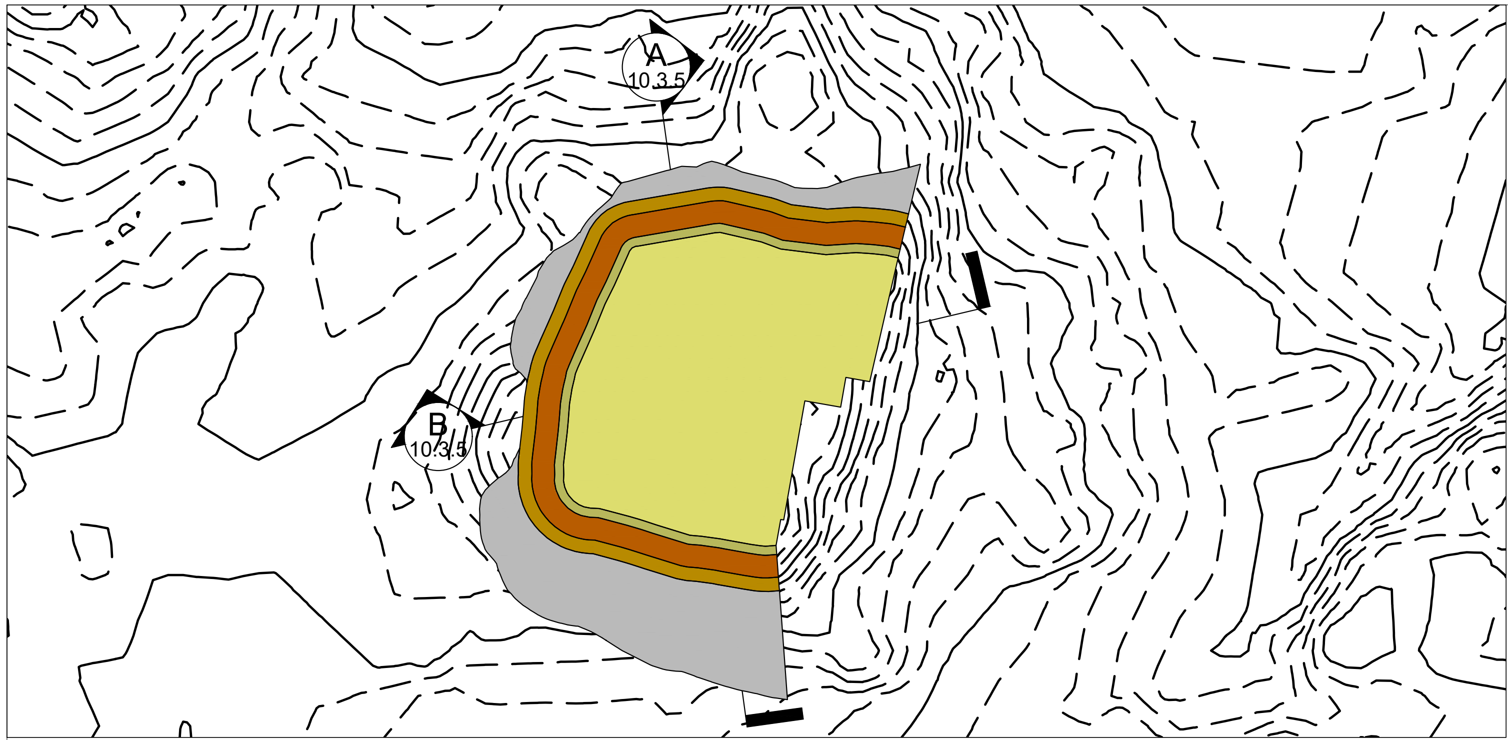
TA 10.3 BORROW PIT APPRAISAL

BORROW PIT 1

FIGURE 10.3.4

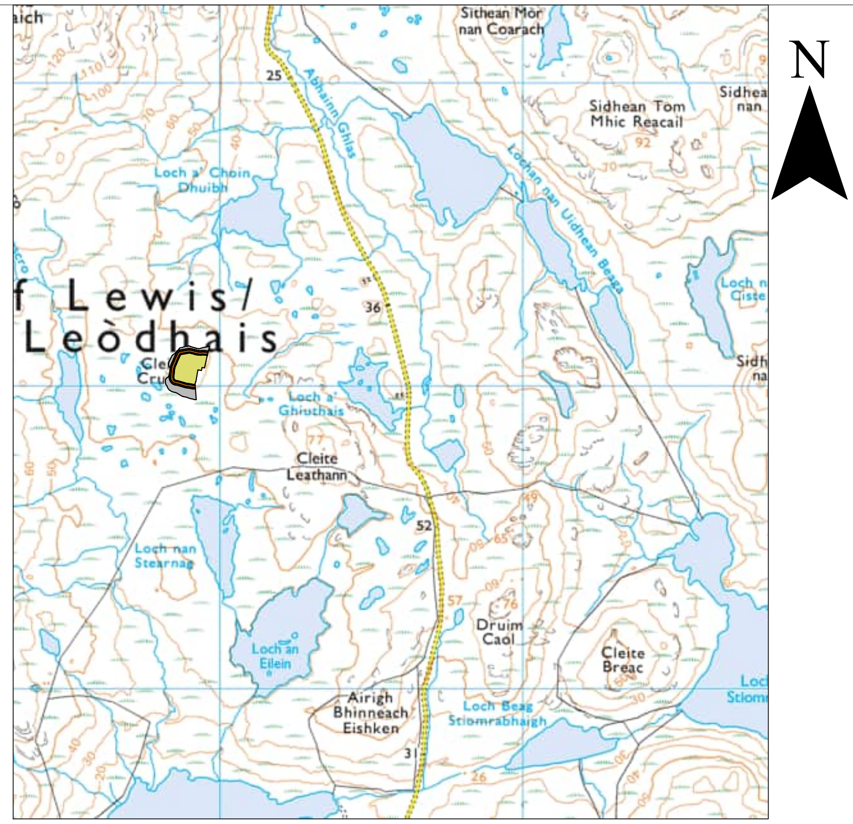
Scale	Date
AS NOTED @ A3	AUGUST 2023

Figure 10.3.4 - Borrow Pit 1.dwg



01 | PLAN OF BORROW PIT
SCALE: 1:2500

0 80m 200
Metres 1:2500



02 | LOCATION PLAN
SCALE: 1:25000

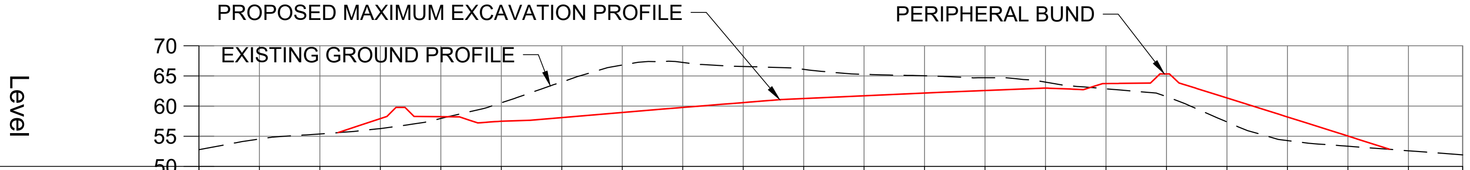
0 800m 2000
Metres 1:25,000

NOTES

1. OVERBURDEN ASSUMED TO BE CIRCA 0.5m IN THICKNESS COMPRISING SOILS AND WEATHERED ROCK.
2. INITIAL STRIPPED OVERBURDEN TO BE PLACED IN PERIPHERAL BUND, WITH SUBSEQUENT OVERBURDEN AND WASTE MATERIALS TO BE STOCKPILED WITHIN FLAT BASAL AREA OF BORROW PIT PRIOR TO BEING USED IN RESTORATION.
3. DESIGN PARAMETERS ARE INDICATIVE AND SHOULD BE REFINED BASED UPON FINDINGS OF GROUND INVESTIGATIONS AND OR INITIAL EXCAVATIONS, TAKING INTO ACCOUNT GROUND CONDITIONS AND HYDROLOGICAL ISSUES.
4. ASSUMES INSITU CONVERSION FACTOR OF 2 TONNES PER m³.

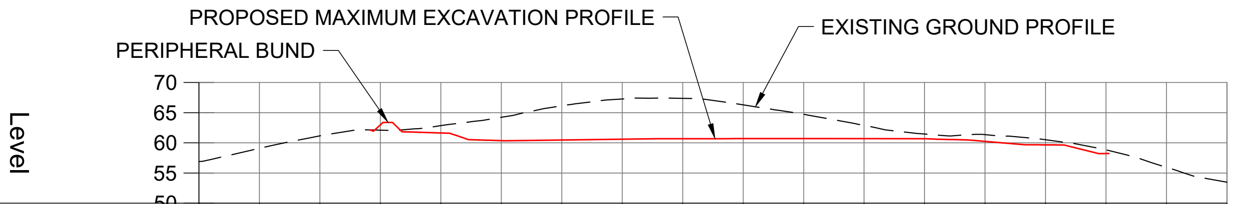
LEGEND

- BENCH/BASE OF EXCAVATION
- EXCAVATION BATTER
- PERIPHERAL BUND
- BENCH
- EARTHWORK SLOPES



Chainage	00.00	10.00	20.00	30.00	40.00	50.00	60.00	70.00	80.00	90.00	100.00	110.00	120.00	130.00	140.00	150.00	160.00	170.00	180.00	190.00	200.00	208.97
Existing Ground Levels	52.763	54.538	55.375	56.265	57.937	60.537	63.993	66.807	67.226	66.568	66.087	65.264	65.020	64.696	63.963	62.852	61.558	57.372	54.276	53.342	52.591	51.912
Proposed Levels			55.597	57.920	58.236	57.491	58.095	58.936	59.772	60.574	61.241	61.700	62.160	62.583	62.973	63.731	65.332 65.392	61.344	58.195	55.031	52.827	

SECTION A
Scale: H 1:1250,V 1:1250. Datum: 50.000



Chainage	00.00	10.00	20.00	30.00	40.00	50.00	60.00	70.00	80.00	90.00	100.00	110.00	120.00	130.00	140.00	150.00	160.00	170.00
Existing Ground Levels	56.891	59.097	61.156	62.102	62.854	64.239	66.135	67.280	67.377	66.294	64.726	62.887	61.472	61.359	60.526	58.837	55.938	53.487
Proposed Levels				62.145 [illegible]	61.644	60.365	60.467	60.602	60.689	60.702	60.719	60.708	60.688	60.251	59.675	58.2[illegible]		

SECTION B
Scale: H 1:1250,V 1:1250. Datum: 50.000

TOTAL EXCAVATION VOLUME	22,422m³
OVERBURDEN VOLUME	3,963m³
NET STONE VOLUME	18,459m³
PERIPHERAL BUND FILL	4,559
NET STONE TONNAGE	36,918T
EXCAVATION AREA	7,926m²
EXCAVATION METHOD REQUIRED	DIGGING, DRILLING AND BLASTING
INFERRED DESIGN PARAMETERS	63 DEGREE FACES THROUGH COMPETENT ROCK MAXIMUM FACE HEIGHT OF 8.1m FINAL BENCH WIDTH OF 7.5m 1.5m HIGH PERIPHERAL BUND
CO-ORDINATES FOR CENTRE OF BORROW PIT	E: 131887 N: 914066

0 10 20 30 40m 60 80 100
Metres 1:1250

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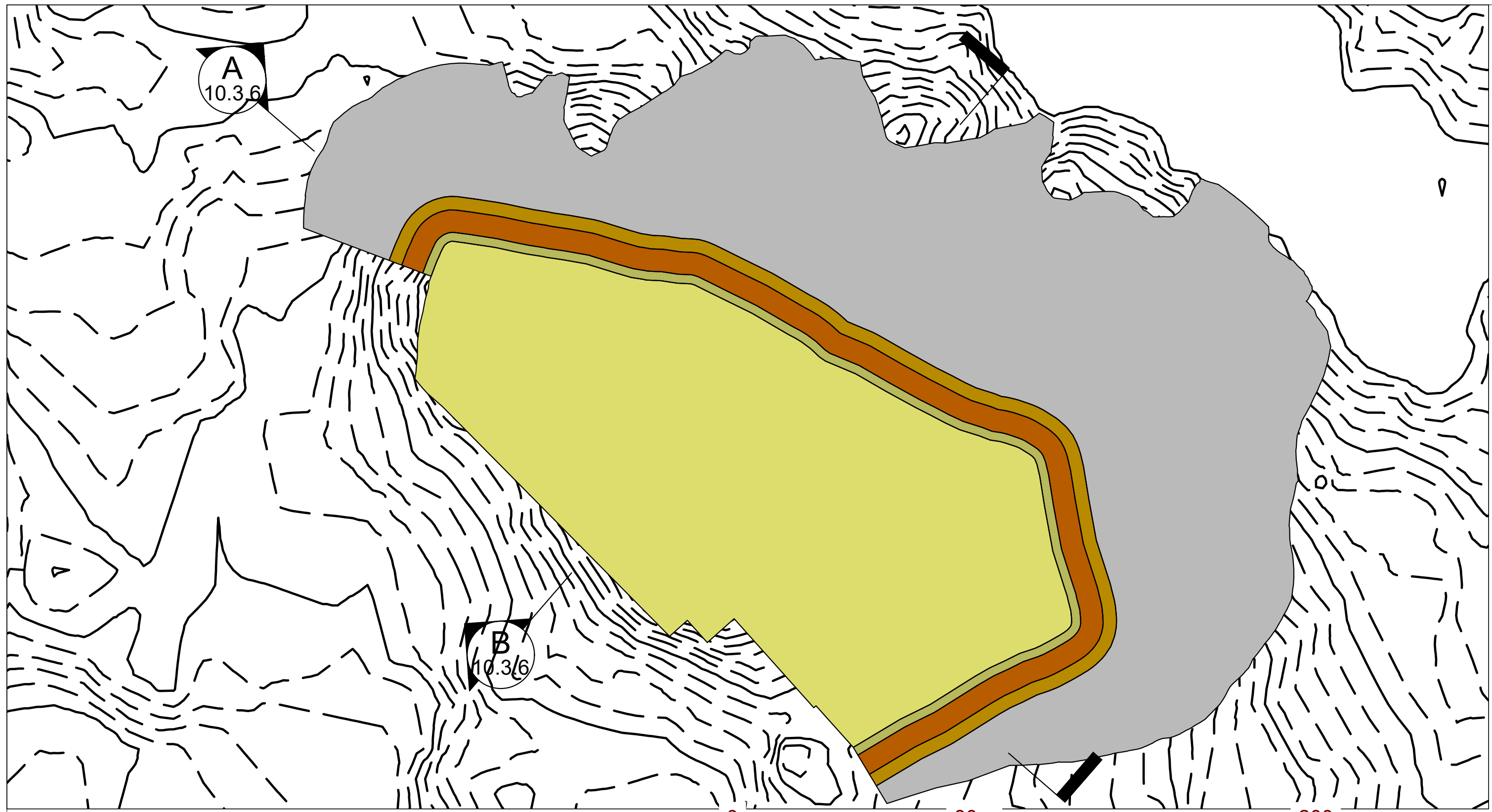
TA 10.3 BORROW PIT APPRAISAL

BORROW PIT 2

FIGURE 10.3.5

Scale	Date
AS NOTED @ A3	AUGUST 2023

Figure 10.3.5 - Borrow Pit 2.dwg

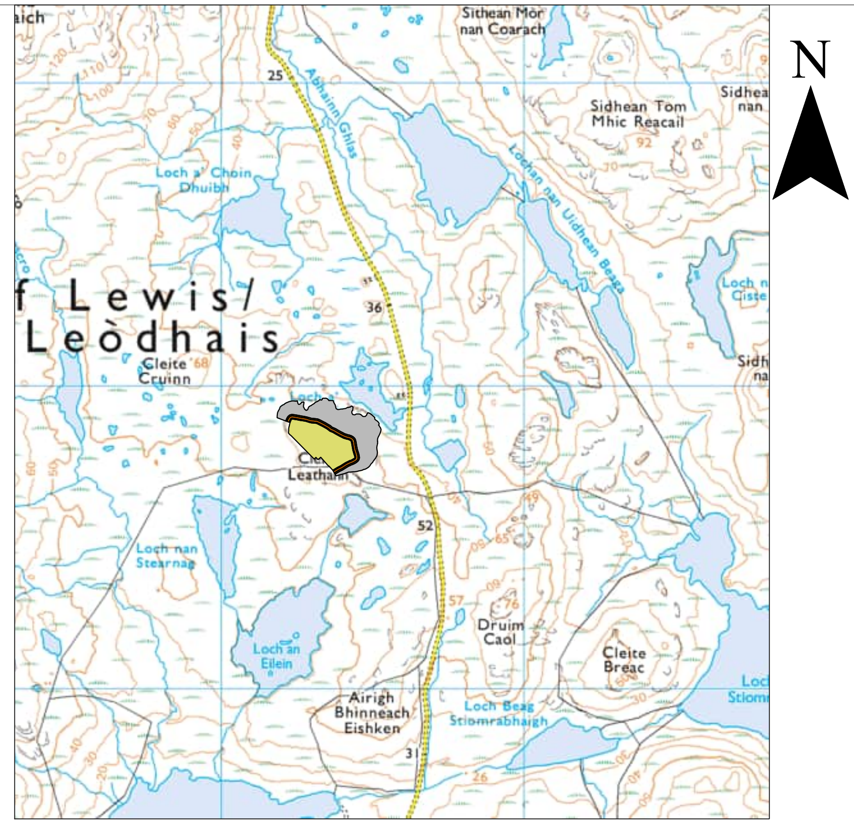


01 PLAN OF BORROW PIT

SCALE: 1:2500

0 80m 200

Metres 1:2500



02 LOCATION PLAN

SCALE: 1:25000

0 800m 2000

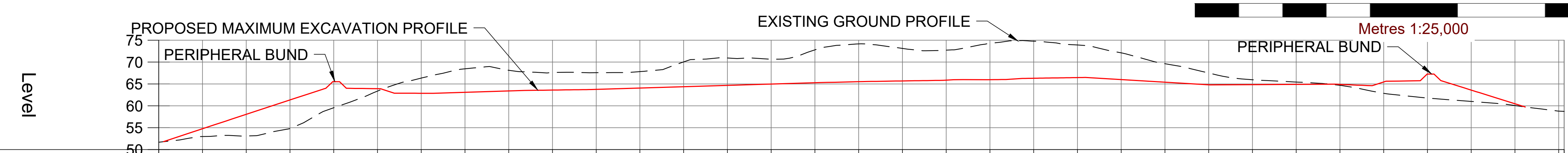
Metres 1:25,000

NOTES

1. OVERBURDEN ASSUMED TO BE CIRCA 0.5m IN THICKNESS COMPRISING SOILS AND WEATHERED ROCK.
2. INITIAL STRIPPED OVERBURDEN TO BE PLACED IN PERIPHERAL BUND, WITH SUBSEQUENT OVERBURDEN AND WASTE MATERIALS TO BE STOCKPILED WITHIN FLAT BASAL AREA OF BORROW PIT PRIOR TO BEING USED IN RESTORATION.
3. DESIGN PARAMETERS ARE INDICATIVE AND SHOULD BE REFINED BASED UPON FINDINGS OF GROUND INVESTIGATIONS AND OR INITIAL EXCAVATIONS, TAKING INTO ACCOUNT GROUND CONDITIONS AND HYDROLOGICAL ISSUES.
4. ASSUMES INSITU CONVERSION FACTOR OF 2 TONNES PER m³.

LEGEND

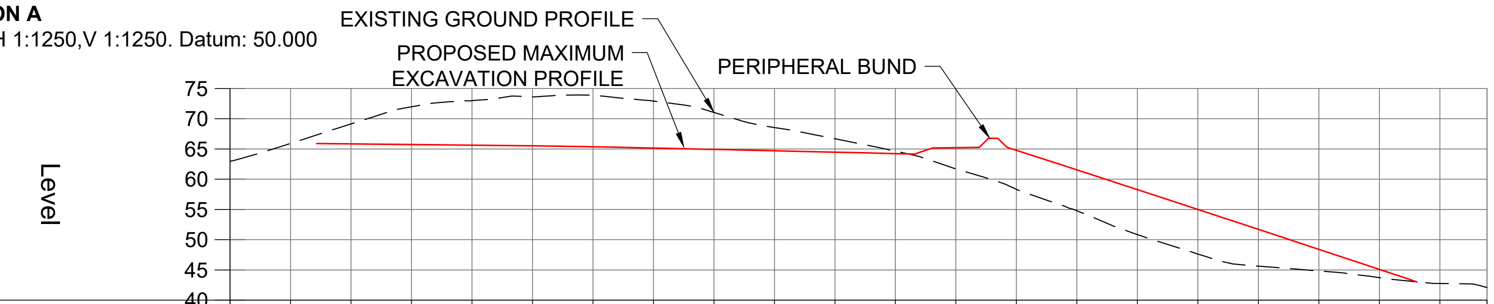
- BENCH/BASE OF EXCAVATION
- EXCAVATION BATTER
- PERIPHERAL BUND
- BENCH
- EARTHWORK SLOPES



Chainage	Existing Ground Levels	Proposed Levels
00.00	51.676	51.809
10.00	52.986	54.761
20.00	53.110	58.054
30.00	54.810	61.349
40.00	59.564	65.528
50.00	63.364	63.910
60.00	66.333	62.872
70.00	68.462	63.094
80.00	68.134	63.401
90.00	67.594	63.607
100.00	67.568	63.761
110.00	67.824	64.063
120.00	70.048	64.366
130.00	70.939	64.668
140.00	70.675	64.970
150.00	72.800	65.273
160.00	74.156	65.519
170.00	73.128	65.690
180.00	72.725	65.866
190.00	74.305	65.981
200.00	74.775	66.302
210.00	73.902	66.460
220.00	72.112	66.002
230.00	69.635	65.406
240.00	67.498	64.809
250.00	65.958	64.847
260.00	65.439	64.901
270.00	64.677	64.889
280.00	62.863	65.447
290.00	61.792	67.252 67.262
300.00	61.011	63.603
310.00	60.064	60.475 59.733
320.00 321.25	58.891 58.732	

SECTION A

Scale: H 1:1250,V 1:1250. Datum: 50.000



Chainage	Existing Ground Levels	Proposed Levels
00.00	62.983	
10.00	65.920	
		65.896
20.00	69.135	65.838
30.00	71.978	65.736
40.00	72.995	65.633
50.00	73.619	65.531
60.00	73.906	65.369
70.00	72.923	65.159
80.00	71.050	64.934
90.00	68.545	64.709
100.00	66.697	64.476
110.00	64.651	64.243
120.00	61.711	65.218
130.00	58.334	66.769 64.780
140.00	54.782	61.552
150.00	50.858	58.281
160.00	47.618	55.009
170.00	45.635	51.712
180.00	44.831	48.405
190.00	43.737	45.092
		43.034
200.00	42.767	
207.80	42.090	

SECTION B

Scale: H 1:1250,V 1:1250. Datum: 40.000

TOTAL EXCAVATION VOLUME	68,934m³
OVERBURDEN VOLUME	10,012m³
NET STONE VOLUME	58,922m³
PERIPHERAL BUND FILL	11,915m³
NET STONE TONNAGE	117,844T
EXCAVATION AREA	20,023m²
EXCAVATION METHOD REQUIRED	DIGGING, DRILLING AND BLASTING
INFERRED DESIGN PARAMETERS	63 DEGREE FACES THROUGH COMPETENT ROCK MAXIMUM FACE HEIGHT OF 8.8m FINAL BENCH WIDTH OF 7.5m 1.5m HIGH PERIPHERAL BUND
CO-ORDINATES FOR CENTRE OF BORROW PIT	E: 132321 N: 913825

0 10 20 30 40m 60 80 100

Metres 1:1250

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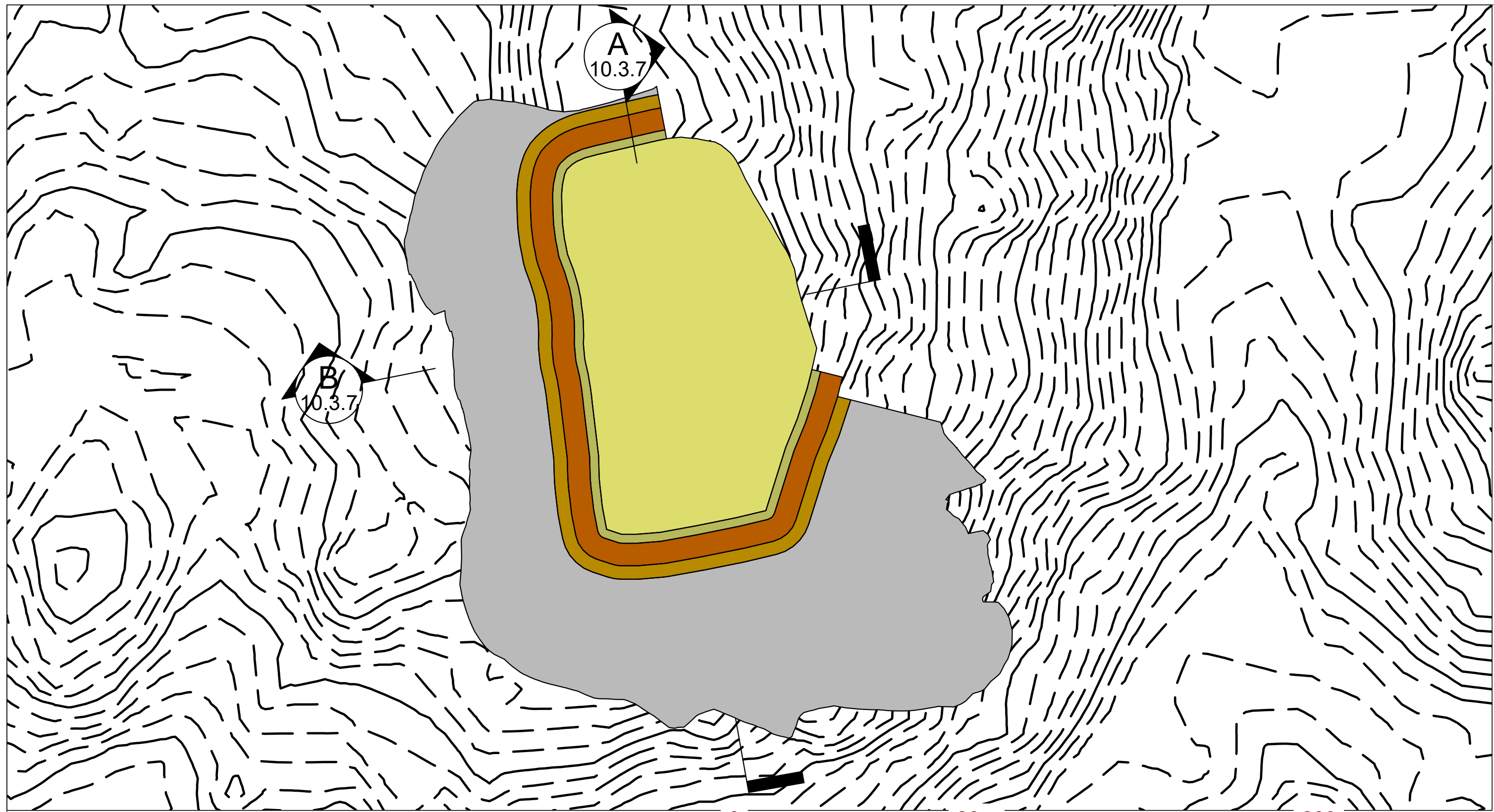
BORROW PIT 3

FIGURE 10.3.6

Scale: AS NOTED @ A3

Date: AUGUST 2023

Figure 10.3.6 - Borrow Pit 3.dwg

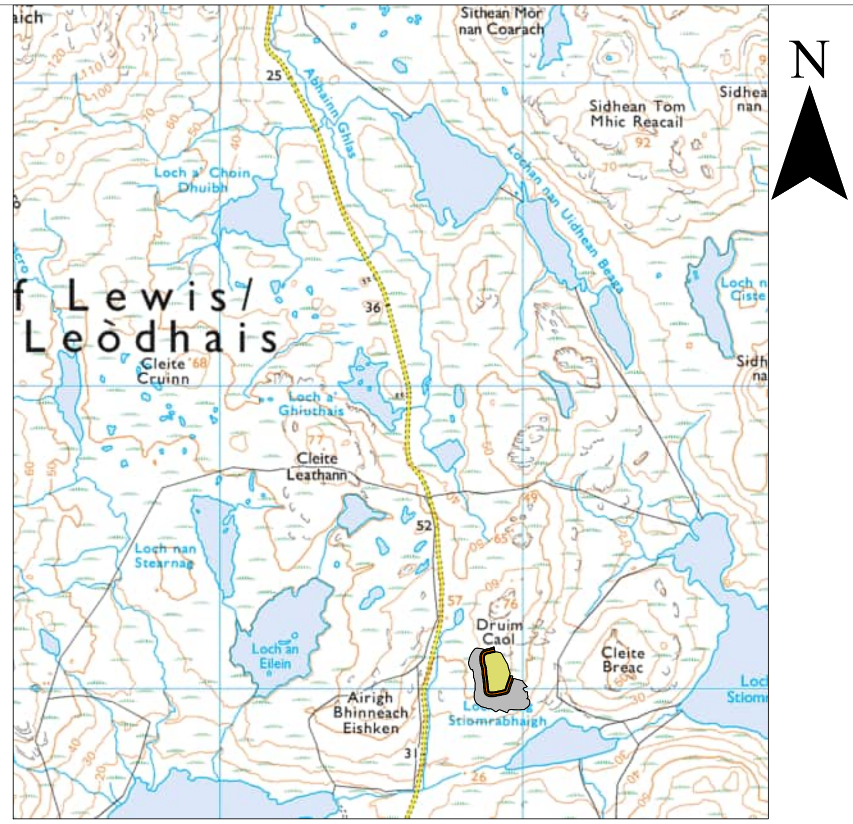


01 PLAN OF BORROW PIT

SCALE: 1:2500

0 80m 200

Metres 1:2500



02 LOCATION PLAN

SCALE: 1:25000

0 800m 2000

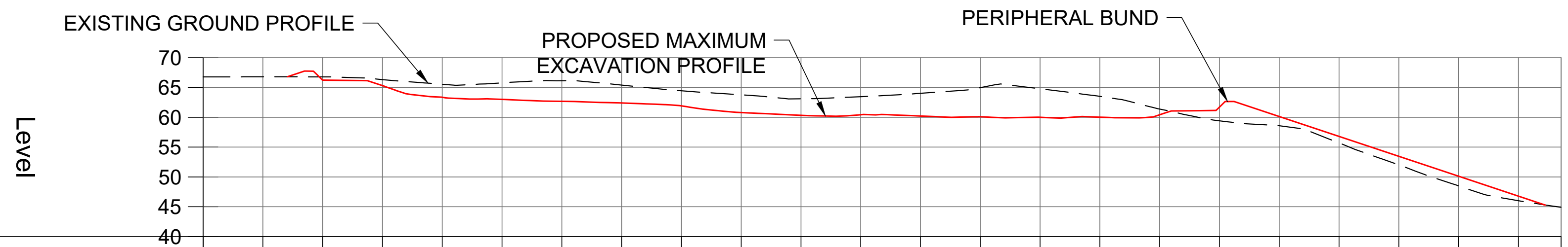
Metres 1:25,000

NOTES

1. OVERBURDEN ASSUMED TO BE CIRCA 0.5m IN THICKNESS COMPRISING SOILS AND WEATHERED ROCK.
2. INITIAL STRIPPED OVERBURDEN TO BE PLACED IN PERIPHERAL BUND, WITH SUBSEQUENT OVERBURDEN AND WASTE MATERIALS TO BE STOCKPILED WITHIN FLAT BASAL AREA OF BORROW PIT PRIOR TO BEING USED IN RESTORATION.
3. DESIGN PARAMETERS ARE INDICATIVE AND SHOULD BE REFINED BASED UPON FINDINGS OF GROUND INVESTIGATIONS AND OR INITIAL EXCAVATIONS, TAKING INTO ACCOUNT GROUND CONDITIONS AND HYDROLOGICAL ISSUES.
4. ASSUMES INSITU CONVERSION FACTOR OF 2 TONNES PER m³.

LEGEND

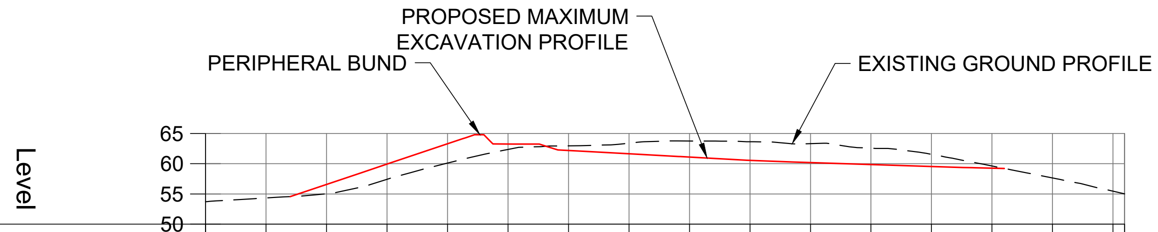
- BENCH/BASE OF EXCAVATION
- EXCAVATION BATTER
- PERIPHERAL BUND
- BENCH
- EARTHWORK SLOPES



Chainage	00.00	10.00	20.00	30.00	40.00	50.00	60.00	70.00	80.00	90.00	100.00	110.00	120.00	130.00	140.00	150.00	160.00	170.00	180.00	190.00	200.00	210.00	220.00	227.12
Existing Ground Levels	66.763	66.788	66.769	66.312	65.540	65.776	66.136	65.406	64.441	63.761	63.099	63.454	64.014	64.960	64.775	63.505	61.379	59.405	58.574	55.700	52.006	48.496	46.001	44.902
Proposed Levels			66.787 / 67.738 / 66.233	65.305	63.354	63.003	62.672	62.396	61.904	60.790	60.323	60.427	60.211	60.081	59.993	60.017	60.422	61.701	60.117	56.782	53.447	50.113	46.778	45.282

SECTION A

Scale: H 1:1250,V 1:1250. Datum: 40.000



Chainage	00.00	10.00	20.00	30.00	40.00	50.00	60.00	70.00	80.00	90.00	100.00	110.00	120.00	130.00	140.00	150.00 / 151.91
Existing Ground Levels	53.719	54.343	55.038	57.427	60.109	62.356	62.963	63.399	63.763	63.646	63.314	62.582	61.556	59.618	57.639	55.455 / 55.028
Proposed Levels		54.565	56.576	59.932	63.288	64.782 / 63.257	62.181	61.642	61.101	60.558	60.185	59.865	59.542	59.258 / 59.208		

SECTION B

Scale: H 1:1250,V 1:1250. Datum: 50.000

TOTAL EXCAVATION VOLUME	21,054m³
OVERBURDEN VOLUME	4,257m³
NET STONE VOLUME	16,797m³
PERIPHERAL BUND FILL	5,489m³
NET STONE TONNAGE	33,594T
EXCAVATION AREA	8,514m²
EXCAVATION METHOD REQUIRED	DIGGING, DRILLING AND BLASTING
INFERRED DESIGN PARAMETERS	63 DEGREE FACES THROUGH COMPETENT ROCK MAXIMUM FACE HEIGHT OF 5.7m FINAL BENCH WIDTH OF 7.5m 1.5m HIGH PERIPHERAL BUND
CO-ORDINATES FOR CENTRE OF BORROW PIT	E: 132911 N: 913061

0 10 20 30 40m 60 80 100

Metres 1:1250

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TA 10.3 BORROW PIT APPRAISAL

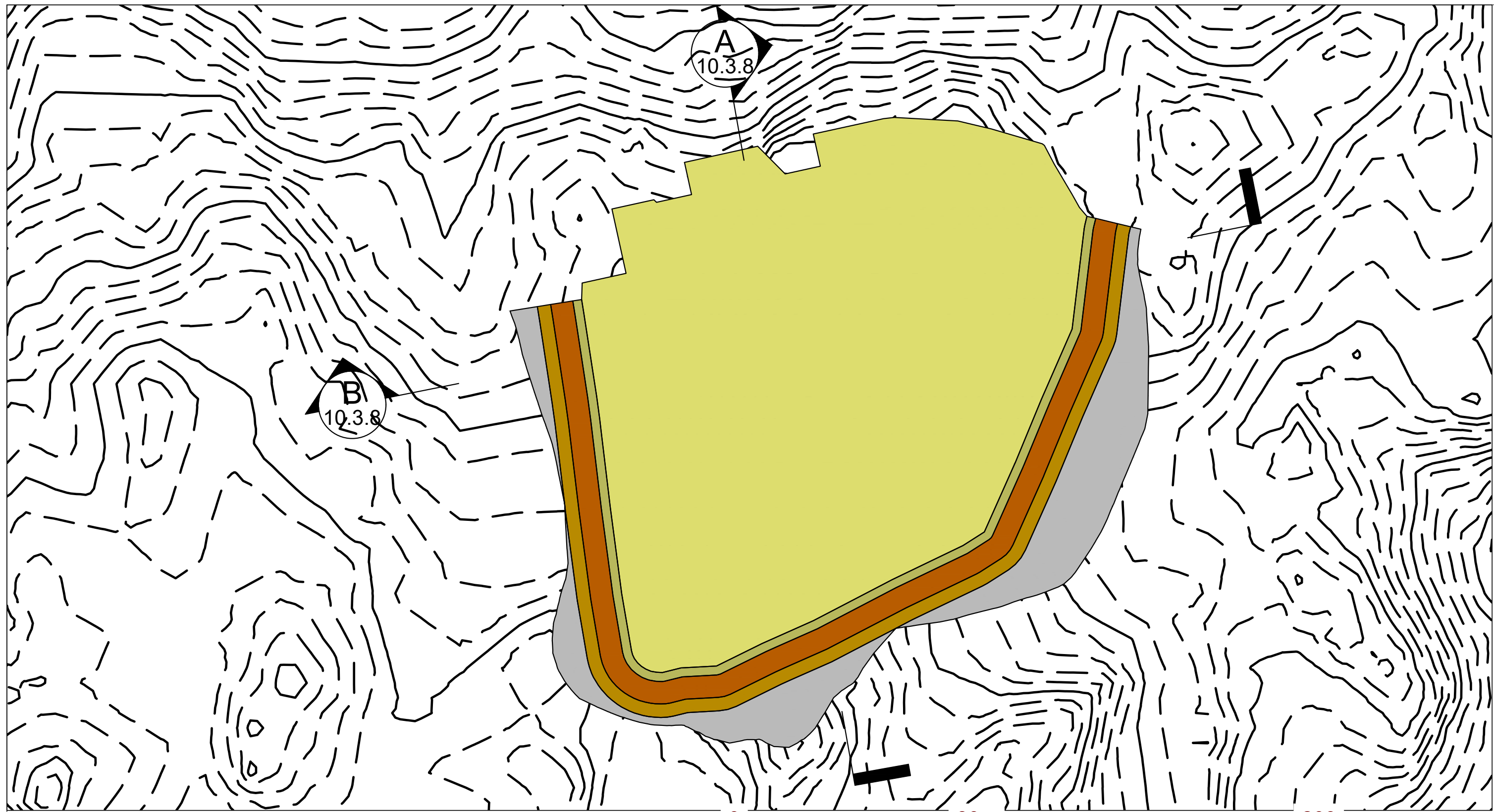
BORROW PIT 4

FIGURE 10.3.7

Scale: AS NOTED @ A3

Date: AUGUST 2023

Figure 10.3.7 - Borrow Pit 4.dwg

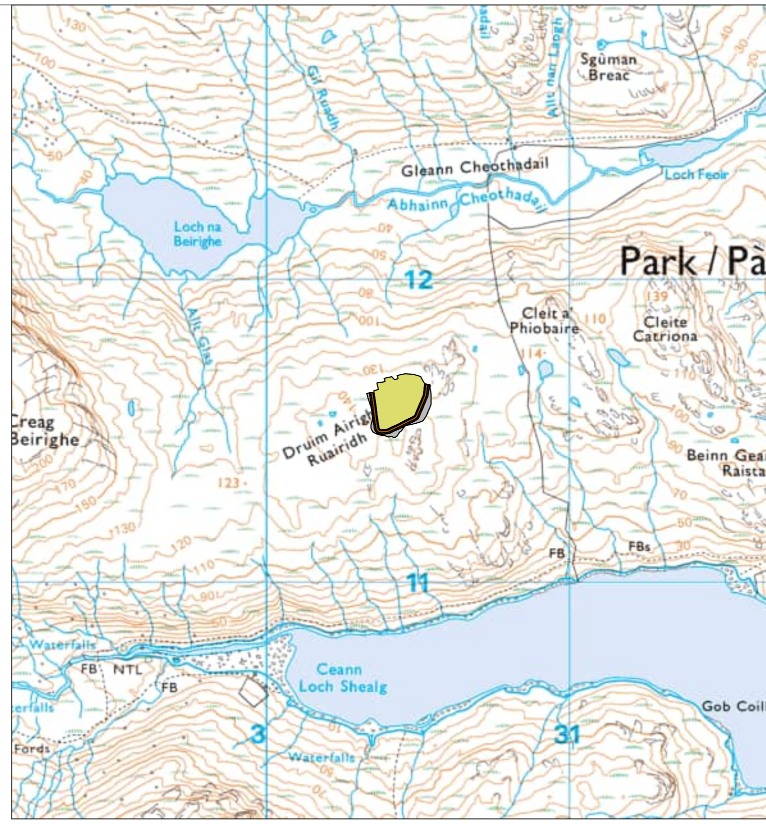


01 PLAN OF BORROW PIT

SCALE: 1:2500

0 80m 200

Metres 1:2500



N

02 LOCATION PLAN

SCALE: 1:25000

0 800m 2000

Metres 1:25,000

NOTES

1. OVERBURDEN ASSUMED TO BE CIRCA 0.5m IN THICKNESS COMPRISING SOILS AND WEATHERED ROCK.
2. INITIAL STRIPPED OVERBURDEN TO BE PLACED IN PERIPHERAL BUND, WITH SUBSEQUENT OVERBURDEN AND WASTE MATERIALS TO BE STOCKPILED WITHIN FLAT BASAL AREA OF BORROW PIT PRIOR TO BEING USED IN RESTORATION.
3. DESIGN PARAMETERS ARE INDICATIVE AND SHOULD BE REFINED BASED UPON FINDINGS OF GROUND INVESTIGATIONS AND OR INITIAL EXCAVATIONS, TAKING INTO ACCOUNT GROUND CONDITIONS AND HYDROLOGICAL ISSUES.
4. ASSUMES INSITU CONVERSION FACTOR OF 2 TONNES PER m³.

LEGEND

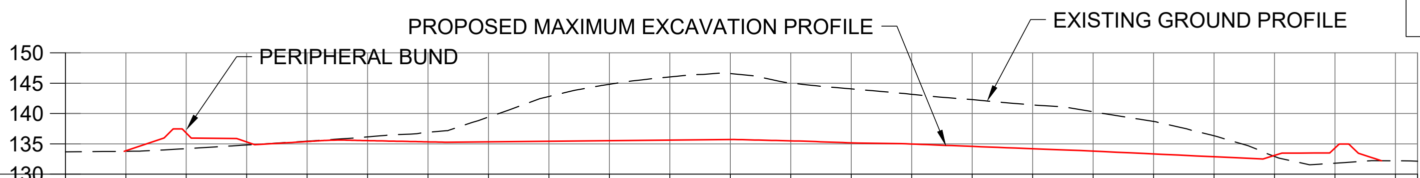
- BENCH/BASE OF EXCAVATION
- EXCAVATION BATTER
- PERIPHERAL BUND
- BENCH
- EARTHWORK SLOPES

Chainage	00.00	10.00	20.00	30.00	40.00	50.00	60.00	70.00	80.00	90.00	100.00	110.00	120.00	130.00	140.00	150.00	160.00	170.00	180.00	190.00	200.00	210.00	220.00
Existing Ground Levels	125.895	127.143	128.653	131.006	133.964	135.600	136.438	138.530	142.426	145.163	147.162	148.438	149.453	149.607	148.015	145.073	142.993	141.476	140.232	139.614	139.958	140.408	140.547
Proposed Levels				132.111	133.722	135.837	135.768	135.698	135.629	135.559	135.490	135.421	135.351	135.282	135.216	135.328	135.440	135.551	135.663	135.775	136.905	138.230	140.514

SECTION A

Scale: H 1:1250,V 1:1250. Datum: 125.000

TOTAL EXCAVATION VOLUME	117,289m³
OVERBURDEN VOLUME	11,249m³
NET STONE VOLUME	106,040m³
PERIPHERAL BUND FILL	4,678m³
NET STONE TONNAGE	212,080T
EXCAVATION AREA	22,498m²
EXCAVATION METHOD REQUIRED	DIGGING, DRILLING AND BLASTING
INFERRED DESIGN PARAMETERS	63 DEGREE FACES THROUGH COMPETENT ROCK MAXIMUM FACE HEIGHT OF 14.5m FINAL BENCH WIDTH OF 7.5m 1.5m HIGH PERIPHERAL BUND
CO-ORDINATES FOR CENTRE OF BORROW PIT	E: 130433 N: 911607



Chainage	00.00	10.00	20.00	30.00	40.00	50.00	60.00	70.00	80.00	90.00	100.00	110.00	120.00	130.00	140.00	150.00	160.00	170.00	180.00	190.00	200.00	210.00	220.00	223.67
Existing Ground Levels	133.685	133.774	134.216	134.815	135.450	136.150	136.896	139.424	142.819	144.825	146.044	146.593	145.027	144.069	143.174	142.298	141.426	140.285	138.694	136.334	132.925	131.812	132.203	132.137
Proposed Levels		[illegible]	137.458 136.783	135.316	135.383	135.531	135.330	135.330	135.427	135.523	135.620	135.716	135.495	135.163	134.971	134.583	134.201	133.801	133.339	132.876	133.093	134.303	132.216	

SECTION B

Scale: H 1:1250,V 1:1250. Datum: 130.000

0 10 20 30 40m 60 80 100

Metres 1:1250

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TA 10.3 BORROW PIT APPRAISAL

BORROW PIT 5

FIGURE 10.3.8

Scale	Date
AS NOTED @ A3	AUGUST 2023

Figure 10.3.8 - Borrow Pit 5.dwg

ANNEX A: MATERIALS CALCULATOR

Infrastructure	Length m	As built surface width m	As built area m2	Thickness m	Number	Volume m3	Final Volume m3	Notes:
New Excavated Access Track	16480	6	98880	0.5	1	49440	49440	
Existing / Upgraded Access Track	12070	3	36210	0.5	1	18105	18105	
New Floating Access Track	2220	6	13320	1	1	13320	13320	
Turning Heads	60	6	360	0.5	14	2520	2520	
Turbine Bases - formation only	23	23	415	0.5	25	5191	5191	
Fill above Turbine Bases	30	30	707	2	25	35325	19075	Less volume of bases 25*650m3 = 16,250m3
Permanent Hardstandings	50	38	1900	1	25	47500	37750	
Temporary Hardstandings	50	44	2200	1	25	55000	55000	
Substation	100	75	7500	1	1	7500	7500	
Temporary Construction Compound North	160	90	14400	0.5	1	7200	7200	
Temporary Construction Compound South	180	70	12600	0.5	1	6300	6300	
TOTAL REQUIREMENT						247401	221401	All volume measurements in m^3

Potential Volume of Rock to be sourced on site	
BP1	33,882
BP2	18,459
BP3	58,922
BP4	16,797
BP5	106,040
Total Volume from Site	234,100
Import requirements (shortfall)	-12699
Total import	-12699
plus 10% contingency	-13969

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TECHNICAL APPENDIX 10.4: SCHEDULE OF WATERCOURSE CROSSINGS

Uisenis Wind Farm

Prepared for: Uisenis Power Limited

SLR Ref: 405.64341.00001
Version No: 1
August 2023

BASIS OF REPORT

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1.0 Introduction

This Technical Appendix should be read in conjunction with **Chapter 10: Hydrology, Hydrogeology and Geology** of the EIA Report which contains a detailed description of the local hydrology and hydrogeology, flow mechanisms and hydraulic properties of the soils and geology, the embedded mitigation incorporated in the development design, and an assessment of impacts on groundwater and surface water flows and quality.

This Technical Appendix contains information relating to the proposed and existing watercourse crossings at the proposed development.

This report presents photographs and dimensions for each proposed new crossing point and existing crossings which are scheduled to be upgraded. The report also details the likely form of the track crossing solution (e.g., culvert, arch culvert, or bridge), however, the final design of each crossing solution would be agreed with Scottish Environment Protection Agency (SEPA) prior to construction and be determined as part of the detailed site design.

A survey of proposed new watercourse crossings was undertaken in November 2022 and January 2023 by an experienced SLR Hydrologist.

The location of the watercourse crossings is shown on **Figure 10.1** of the EIA Report.

Following consultation with SEPA an outline design, informed by hydraulic modelling, has been prepared for the crossing over the Abhainn Cheothadail watercourse (WX49).

1.1 Relevant Legislation

The Water Framework Directive (2000/60/EC) (WFD) has been transposed into Scottish legislation as the Water Environment and Water Services (Scotland) Act 2003[1] (or WEWS) and has given Scottish ministers powers to introduce regulatory controls over activities in order to protect and improve Scotland's water environment. The water environment includes wetlands, rivers, lochs, transitional waters (estuaries), coastal waters and groundwater. These regulatory controls, known as the Water Environment (Controlled Activities) (Scotland) Regulations 2011[2] (CAR) came into force in 2011 and have since been amended in 2013, 2017, and 2021.

With respect to watercourse crossings, CAR requires that all engineering works in inland surface waters and wetlands are subject to authorisation and allow for proportionate risk-based regulation which is outlined in the CAR Practical Guide[3]. The authorisation process operates at three levels:

- General Binding Rules (GBR);
    - Minor bridges with no construction on bed or banks;
- Registration:
    - Bridges across rivers and lochs where no part of the structure encroaches on the bed (e.g. no piers or in-channel supports). In addition, the total length of the structures on both banks should not be more than 20m. This category includes bottomless arch culverts; and
    - Closed culverts used for single-track tracks, footpaths and/or cycle routes, where the affected river is not more than 2m wide.
- Licence (Simple/Complex):

[1] Water Environment and Water Services (Scotland) Act 2003, https://www.legislation.gov.uk/asp/2003/3/contents [Accessed May 2023]
[2] Water Environment (Controlled Activities) (Scotland) Regulations 2011, https://www.legislation.gov.uk/ssi/2011/209/contents/made [Accessed May 2023]
[3] SEPA (December 2022) The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended), A Practical Guide, https://www.sepa.org.uk/media/34761/car_a_practical_guide.pdf [Accessed May 2023]

- All other bridges, fords or causeways; and
- This category would include bridges affecting more than 20m total bank lengths, bridges with in-stream supports or closed culverts for crossings not specified above.

SEPA provide authorisation for watercourse crossings shown on the 1:50,000 scale Ordnance Survey (OS) maps (Landranger Series). All other watercourses are classed as a “minor watercourse” and are exempt under CAR. Likely authorisation levels for the proposed crossings are provided in this report.

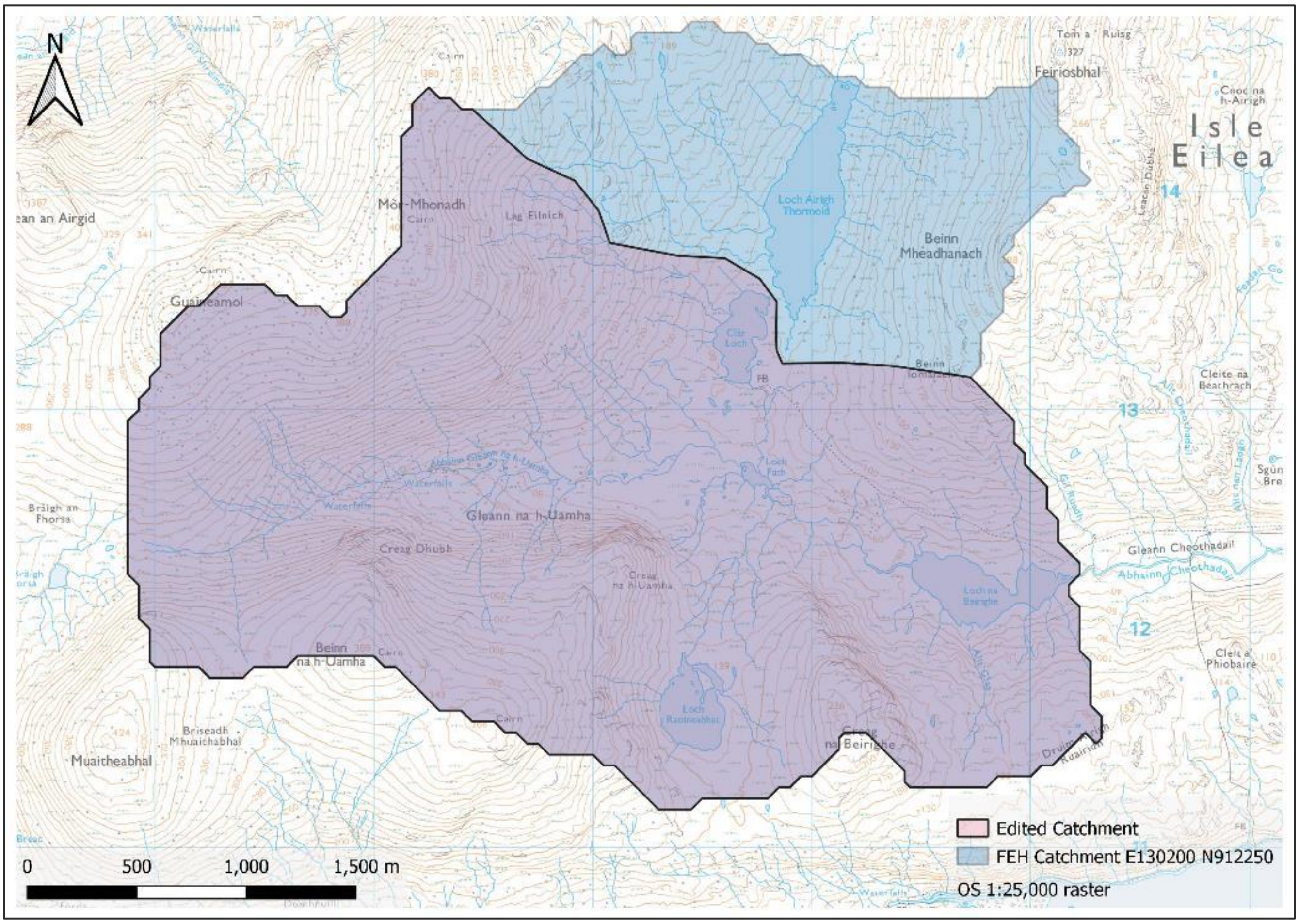
2.0 Hydrology

As discussed above, an assessment of potential flows which the crossing over the Abhainn Cheothadail will need to convey has been calculated.

2.1 Catchment Area

The catchment area for the Abhainn Cheothadail is shown on **Plate 2-1**.

Plate 2-1: Abhainn Cheothadail Catchment



Contains OS data © Crown copyright [and database right] [2023].

The catchment used is largely based on the Flood Estimation Handbook (FEH) catchment obtained from the FEH website[4]. The FEH catchment has been amended to exclude the sub-catchment which drains to Loch Airigh Thormaid (shown in light blue on **Plate 2-1**). Review of OS Mapping shows that the watercourses in this area flow northwards, away from the Clar Loch and the Abhainn Cheothadail and therefore not in the catchment that drains to the proposed crossing point.

[4] UK Centre for Ecology and Hydrology, Flood Estimation Handbook (FEH) Web Service, available online at https://fehweb.ceh.ac.uk/ [Accessed June 2023]

2.2 Design Flood Event

Guidance in SEPA's "Flood Risk and Land Use Vulnerability Guidance"[5] indicates that the proposed development is part of "essential infrastructure" and for which SEPA advise that the design event of 1:200 AEP (Annual Exceedance Probability) should be used.

The latest SEPA guidance on climate change allowances[6] recommends that for river catchments smaller than 30km^2, an allowance for a peak rainfall intensity should be applied. For Western Isles the peak rainfall intensity allowance has been determined as 48%. Therefore, a design flood event of 1:200 + 48% CC has been adopted for the rainfall runoff model.

Peak river flow allowance for the Western Isles Region is 58% and this has been applied to the statistical method peak flow despite the catchment being below 30km^2. This is due to the catchment having characteristics of a larger watercourse (well drained, large attenuation and significant main watercourse) and therefore responds more appropriately to a direct increase in flows rather than an increase in peak rainfall, which would likely be well attenuated.

2.3 Hydrology and Estimation of the Peak Flow Rates

There are no publicly available flow gauges on the Abhainn Cheothadail. Therefore, ungauged FEH methodologies have been applied.

2.3.1 Approach 1 - Rainfall-Runoff Method

The Revitalised Flood Hydrograph (ReFH2 v3.3)[7] software package has been used to apply the FEH Rainfall-Runoff methods to assess the response of the catchment to the required design rainfall events.

The FEH2013 Depth Duration Frequency (DDF) model has been used to generate the design storm rainfall profile. Climate change uplift has been applied to the rainfall profile based upon the latest SEPA guidance as discussed above. The critical storm duration has been estimated in ReFH2 based on the catchment descriptors, as summarised in **Table 2-1**.

The FEH catchment at Abhainn Cheothadail has been used, with edits made to area and mean drainage path length (DPLBAR). It should be noted that there is a high attenuation, due to a number of lochs in the catchment. The Flood Attenuation by Reservoirs and Lakes (FARL) index has been edited to account for removal of Loch Airigh Thormaid. It is noted that since the rainfall-runoff method does not consider the FARL parameter, the resultant flow hydrographs for these catchments may be more responsive and have a higher peak than if the lochs were represented in the model.

Table 2-1: ReFH2 and Catchment Parameters

Watercourse Crossing	Watercourse Name	Catch Area km²	FEH Delineation	DONOR CATCHMENT	FARL	Storm Duration	Model Timescale
E 130198, N 912236	Abhainn Cheothadail	8.78(FEH)	Edited to remove Loch Airigh Thormaid	N/A	Edited value - 0.798	3.25	00.25

The outcomes of the hydrological analysis, in terms of peak flowrates, are shown in **Table 2-2**.

---

[5] Scottish Environment Protection Agency (July 2018). Flood Risk and Land Use Vulnerability Guidance, V4
[6] Scottish Environment Protection Agency (April 2023). Climate change allowances for flood risk assessments in land use planning, V3
[7] Revitalised Flood Hydrograph Model 2.3 (ReFH) as defined in "The Revitalised Flood Hydrograph Model REFH2 Technical Guidance, CEH 2016"

Table 2-2: ReFH2 Flowrates

Location	Annual Exceedance Probability (yrs)	Calculated Peak Flowrate (m^3/s)
E 130198, N 912236	1:30	27.69
	1:200	44.67
	1:200+48%CC	71.35

2.3.2 Approach 2 - Statistical Method

The FEH Statistical Method[8] estimates peak flow for a catchment for a given AEP event using historic peak flow gauging station data from analogous catchments that are selected based on catchment descriptors/hydrological similarity.

There is gauging station on Harris *(106002 - Laxdale at Laxdale Bridge)* which is suitable for median annual maximum flood (QMED) and Pooling methods. The gauge drains a similar small (10.6km^2) upland rural catchment to the study site, with a high level of attenuation. Another local gauge on Isle of Lewis, *106001 - Creed at Creed Bridge,* has been discounted as it is not suitable for QMED or Pooling Group inclusion, due to only being a theoretical rating.

Due to the availability of a gauging station close to the catchment of interest combined with the limitation of rainfall-runoff method to represent the high attenuation, it is deemed appropriate to also apply the statistical method to the study catchment.

Derivation of QMED

2022 FEH guidance states for small catchments (<25km^2) to: *"Use the standard FEH regression for QMED. Adjust QMED using a single donor catchment, chosen on the basis of proximity. On average there is no advantage in choosing a small donor catchment."*[9] QMED has therefore been adjusted using only 106002 - Laxdale at Laxdale Bridge, giving a value of QMED Adjusted ($QMED_{adj}$) of 8.023. QMED from Catchment Descriptors ($QMED_{cds}$) is 7.509.

Derivation of Pooling Group and Growth Curves

Pooling group gauging stations have been selected based upon National River Flow Archive (NRFA) Peak Flow dataset 11.0 which was the most recent version at the time of calculation[10]. The default growth curves and pooling groups have been selected based upon the similarity distance measure (SDM) calculated using the small catchments method described in Stewart et. al., 2019[11]. This means that the high FARL is not used to calculate the SDM, which is a key descriptor for this catchment with many significant lochs.

Default methods of pooling group selection, based upon SDM as a representation of hydrologic similarity through catchment descriptors (area and standardised average annual rainfall (SAAR), were found to be unrepresentative for Abhainn Cheothadail catchment. The default pooling group generated in WINFAP 5 software provided a strongly heterogenous pooling group. It is believed this is due to the distinctive nature of Abhainn Cheothadail catchment, which contains many lochs and has a high cover of peat. Pooling group catchments without those characteristics, found in the default pooling group, did not make for a good pooling group (as in the default pooling groups).

[8] As described in FEH Volume 3 of the Flood Estimate Handbook and implemented via WINFAP-FEH 5 software
[9] Environment Agency, 2022. LIT-11832-Flood-estimation-guidelines
[10] National River Flow Archive, Accessed 2023 06.01.2023 at *https://nrfa.ceh.ac.uk/peak-flow-dataset*
[11] Environment Agency, 2019. Report SC090031/R0 - Estimating flood peaks and hydrograph for small catchments (Phase 2).

The pooling group which was manually generated for Abhainn Cheothadail by selecting gauging stations with catchments which contain high levels of water body attenuation and peat coverage have been used for the Abhainn Cheothadail catchment.

Geographic locality was prioritised in this pooling group so that the unique characteristics of Abhainn Cheothadail catchment was maintained. Local catchments along the north coast Sutherland were found to have similar aspect, peat coverage, altitude and attention. A small number of catchments outside of this locality were added which were also deemed representative. Unfortunately, catchments in the Peak District (England), which would have been suitable for inclusion were not rated for high flows so could not be included. This led to the cumulative years of gauging data being 250 years, below the recommended 500 years of pooling group data for the required return periods required in this analysis. However, a smaller number of more representative catchments was more deemed more appropriate.

The edited group has a standardised test value H2 value of -1.5871. WINFAP 5 software categorises this as *"The pooling group is acceptably homogeneous and a review of the pooling group is not required."*

The results of peak flowrates using the Generalised Logistic (GL) distribution is as follows. Despite not giving the lowest absolute Z-value, the fit is still classed as acceptable and is slightly conservative when compared to the GEV.

Table 2-3: FEH Statistical Method Flowrates

Exceedance Probability (years)	Peak Flowrate (m^3/s)
1:30	15.42
1:200	22.34
1:200+CC	35.30

Review of **Table 2-2** and **Table 2-3** indicates that the FEH approach calculated lower peak flowrate in comparison to the ReFH2.

2.3.3 Selected Method

A review of **Table 2-3** indicates that the FEH statistical method approach calculated lower peak flowrates in comparison to the ReFH2 rainfall-runoff method (**Table 2-2**). This is expected due to the accounting for the large degree of attenuation the lochs and peat coverage within the catchment. The statistical method is deemed more appropriate in this case due to presence of a peak flow rated gauging station on a local and very hydrologically similar gauging station. The unique nature of the of the catchment can best be accounted by pooled statistical analysis. The ReFH2 output hydrographs have therefore been scaled to the peak flows from the statistical method. These are used in the hydraulic analysis presented in the Section 4.0.

3.0 Watercourse Crossing Details

3.1 Existing Watercourse Crossings

Watercourse Crossing ID (refer to Figure 10.1 of EIA Report for location)	WX01
Watercourse Crossing Details	**Watercourse Crossing:** WX01 **NGR:** NB 26114 19365 **Status:** Existing **Notes:** Not surveyed

Watercourse Crossing ID	WX02
Watercourse Crossing Details	**Watercourse Crossing:** WX02 **NGR:** NB 26948 18313 **Status:** Existing **Notes:** Not surveyed

Watercourse Crossing ID	WX03
Watercourse Crossing Details	**Watercourse Crossing:** WX03 **NGR:** NB 27720 17929 **Status:** Existing **Notes:** Not surveyed

Watercourse Crossing ID	WX04
Watercourse Crossing Details	**Watercourse Crossing:** WX04 **NGR:** NB 27894 17577 **Status:** Existing **Notes:** Not surveyed

Watercourse Crossing ID	WX05
Watercourse Crossing Details	**Watercourse Crossing:** WX05 **NGR:** NB 27931 17549 **Status:** Existing **Notes:** Not surveyed

Watercourse Crossing ID	WX06
Watercourse Crossing Details	**Watercourse Crossing:** WX06 **NGR:** NB 28082 17341 **Status:** Existing **Notes:** Not surveyed

Watercourse Crossing ID	WX07
Watercourse Crossing Details	**Watercourse Crossing:** WX07 **NGR:** NB 28179 17096 **Status:** Existing **Notes:** Not surveyed

Watercourse Crossing ID	WX08
Watercourse Crossing Details	**Watercourse Crossing:** WX08 **NGR:** NB 28190 17056 **Status:** Existing **Notes:** Not surveyed

Watercourse Crossing ID	WX09
Watercourse Crossing Details	**Watercourse Crossing:** WX09 **NGR:** NB 28802 16516 **Status:** Existing **Culvert Dimensions:** 0.3m wide 0.5m high **Culvert Construction Type:** Two stone box culverts **Watercourse Width**: 0.6m **Watercourse Depth**: 0.2m **Notes:** One of the two stone culverts was blocked with a bucket during the survey.
Photograph Looking at Crossing Entrance from Upstream	
Photograph Looking at Crossing Exit from Downstream	

Watercourse Crossing ID	WX10
Watercourse Crossing Details	**Watercourse Crossing:** WX10 **NGR:** NB 29482 16426 **Status:** Existing **Culvert Dimensions:** Width 0.3m Height 0.4m **Culvert Construction Type:** Single stone box culvert **Watercourse Width**: 0.2m **Watercourse Depth**: 0.3m **Notes:** Watercourse passes under wall immediately downstream of existing track
Photograph Looking at Crossing Entrance from Upstream	
Photograph Looking at Crossing Exit from Downstream	

Watercourse Crossing ID	WX11
Watercourse Crossing Details	**Watercourse Crossing:** WX11 **NGR:** NB 29843 16214 **Status:** Existing **Bridge Dimensions:** 1.5m high, 2.5m wide, 3.5m long **Bridge Construction Type:** Open span bridge **Watercourse Width**: 3.5m **Watercourse Depth**: 0.6m **Notes:** Large river with reinforced banks noted at the bridge.
Photograph Looking at Crossing Entrance from Upstream	
Photograph Looking at Crossing Exit from Downstream	

Watercourse Crossing ID	WX12
Watercourse Crossing Details	**Watercourse Crossing:** WX12 **NGR:** NB 29932 16109 **Status:** Existing **Bridge Dimensions:** 1.3m high, 2.5m wide, 4.2m long **Bridge Construction Type:** Three 1.2m diameter concrete circular culverts **Watercourse Width**: 4.2m **Watercourse Depth**: 0.4m
Photograph Looking at Crossing Entrance from Upstream	
Photograph Looking at Crossing Exit from Downstream	

Watercourse Crossing ID	WX13
Watercourse Crossing Details	**Watercourse Crossing:** WX13 **NGR:** NB 29976 16093 **Status:** Existing **Culvert Diameter:** 0.5m **Culvert Construction Type:** Twin circular plastic culverts **Watercourse Width**: 0.7m to 1.3m **Watercourse Depth**: 0.3m **Note:** Watercourse widens downstream of crossing
Photograph Looking at Crossing Entrance from Upstream	
Photograph Looking at Crossing Exit from Downstream	

Watercourse Crossing ID	WX14
Watercourse Crossing Details	**Watercourse Crossing:** WX14 **NGR:** NB 30048 16083 **Status:** Existing **Culvert Construction Type:** Single stone culvert **Watercourse Width**: 0.5 to 0.7m **Watercourse Depth**: 0.4m **Note:** Watercourse wider upstream of crossing
Photograph Looking at Crossing Entrance from Upstream	
Photograph Looking at Crossing Exit from Downstream	

<table>
<tr><th>Watercourse Crossing ID</th><th>WX15</th></tr>
<tr><td>Watercourse Crossing Details</td><td>Watercourse Crossing: WX15
NGR: NB 30146 16036
Status: Existing
Culvert Construction Type: Single stone culvert
Watercourse Width: 0.4m
Watercourse Depth: 1.2m</td></tr>
<tr><td>Photograph Looking at Crossing Entrance from Upstream</td><td></td></tr>
<tr><td>Photograph Looking at Crossing Exit from Downstream</td><td></td></tr>
</table>

Watercourse Crossing ID	WX16
Watercourse Crossing Details	**Watercourse Crossing**: WX16 **NGR**: NB 30245 16004 **Status:** Existing **Culvert Dimensions:** 0.6m wide 0.4m high **Culvert Construction Type:** Single stone culvert **Watercourse Width**: 0.6m to 1.1m **Watercourse Depth**: 0.4m to 0.7m **Note:** Depth and width of watercourse increases downstream of existing crossing
Photograph Looking at Crossing Entrance from Upstream	
Photograph Looking at Crossing Exit from Downstream	

Watercourse Crossing ID	WX17
Watercourse Crossing Details	**Watercourse Crossing**: WX17 **NGR**: NB 30386 16050 **Status:** Existing **Culvert Diameter:** 0.3m **Culvert Construction Type:** Twin circular plastic culverts **Watercourse Width**: 0.5m **Watercourse Depth**: 0.2m
Photograph Looking at Crossing Entrance from Upstream	
Photograph Looking at Crossing Exit from Downstream	

Watercourse Crossing ID	WX18
Watercourse Crossing Details	**Watercourse Crossing**: WX18 **NGR**: NB 30475 16057 **Status:** Existing **Culvert Diameter:** 0.3m **Culvert Construction Type:** Single circular plastic culvert **Watercourse Width**: 1m **Watercourse Depth**: 0.2m
Photograph Looking at Crossing Entrance from Upstream	
Photograph Looking at Crossing Exit from Downstream	

<table>
<tr><th>Watercourse Crossing ID</th><th>WX19</th></tr>
<tr><td>Watercourse Crossing Details</td><td>Watercourse Crossing: WX19
NGR: NB 30641 16100
Status: Existing
Culvert Dimensions: 0.4m wide 0.9m high
Culvert Construction Type: Singule stone culvert
Watercourse Width: 0.4m
Watercourse Depth: 0.7m</td></tr>
<tr><td>Photograph Looking at Crossing Entrance from Upstream</td><td></td></tr>
<tr><td>Photograph Looking at Crossing Exit from Downstream</td><td></td></tr>
</table>

Watercourse Crossing ID	WX20
Watercourse Crossing Details	**Watercourse Crossing**: WX20 **NGR**: NB 30971 16056 **Status:** Existing **Culvert Dimensions:** 0.5m wide 0.4m high **Culvert Construction Type:** Two stone box culverts **Watercourse Width**: 1.6m **Watercourse Depth**: 0.3m **Notes:** Two drainage ditches meet upstream of the crossing
Photograph Looking at Crossing Entrance from Upstream	
Photograph Looking at Crossing Exit from Downstream	

<table>
<tr><th>Watercourse Crossing ID</th><th>WX21</th></tr>
<tr><td>Watercourse Crossing Details</td><td>Watercourse Crossing: WX21
NGR: NB 31159 16046
Status: Existing
Culvert Diameter: 0.4m
Culvert Construction Type: Single circular plastic culvert
Watercourse Width: 0.4m to 1m
Watercourse Depth: 0.2m to 0.4m
Notes: Depth and width of watercourse increases downstream of the crossing</td></tr>
<tr><td>Photograph Looking at Crossing Entrance from Upstream</td><td></td></tr>
<tr><td>Photograph Looking at Crossing Exit from Downstream</td><td></td></tr>
</table>

Watercourse Crossing ID	WX22
Watercourse Crossing Details	**Watercourse Crossing**: WX22 **NGR**: NB 31465 16051 **Status:** Existing **Culvert Dimensions:** 0.3m wide 0.3m high **Culvert Construction Type:** Single stone culvert **Watercourse Width:** 0.5 to 1.6m **Watercourse Depth**: 0.2m **Notes:** Watercourse widens immediately downstream of crossing.
Photograph Looking at Crossing Entrance from Upstream	
Photograph Looking at Crossing Exit from Downstream	

Watercourse Crossing ID	WX23
Watercourse Crossing Details	**Watercourse Crossing**: WX23 **NGR**: NB 31707 15931 **Status:** Existing **Culvert Dimensions:** 0.5m wide 0.6m high **Culvert Construction Type:** Single stone culvert **Watercourse Width**: 0.8m **Watercourse Depth**: 0.2m
Photograph Looking at Crossing Entrance from Upstream	
Photograph Looking at Crossing Exit from Downstream	

Watercourse Crossing ID	WX24
Watercourse Crossing Details	**Watercourse Crossing**: WX24 **NGR**: NB 32095 15721 **Status:** Existing **Culvert Diameter:** 0.4m **Culvert Construction Type:** Single circular plastic culvert **Watercourse Width:** 0.4m to 1.2m **Watercourse Depth:** 0.2m to 0.4m **Notes:** Width and depth of watercourse increases immediately downstream of crossing. Culvert appears to be damaged.
Photograph Looking at Crossing Entrance from Upstream	
Photograph Looking at Crossing Exit from Downstream	

Watercourse Crossing ID	WX25
Watercourse Crossing Details	**Watercourse Crossing**: WX25 **NGR**: NB 32149 15458 **Status:** Existing **Culvert Diameter:** 0.5m **Culvert Construction Type:** Single circular plastic culvert **Watercourse Width**: 0.5m **Watercourse Depth**: 0.2m **Notes:** Two drainage ditches join upstream of crossing
Photograph Looking at Crossing Entrance from Upstream	
Photograph Looking at Crossing Exit from Downstream	

Watercourse Crossing ID	WX26
Watercourse Crossing Details	**Watercourse Crossing**: WX26 **NGR**: NB 32315 14842 **Status:** Existing **Culvert Diameter:** 0.5m **Culvert Construction Type: two circular plastic culverts** **Watercourse Width:** 1m to 2.8m **Watercourse Depth**: 0.5m **Notes:** Water flows through two culverts and outfalls into one wider watercourse before narrowing into a channel. Only righthand culvert has visible outflow downstream.
Photograph Looking at Crossing Entrance from Upstream	
Photograph Looking at Crossing Exit from Downstream	

Watercourse Crossing ID	WX27
Watercourse Crossing Details	**Watercourse Crossing**: WX27 **NGR**: NB 32478 14421 **Status:** Existing **Culvert Dimensions:** 0.4m wide 0.5m high **Culvert Construction Type:** Single stone culvert **Watercourse Width**: 0.4m **Watercourse Depth**: 0.3m
Photograph Looking at Crossing Entrance from Upstream	
Photograph Looking at Crossing Exit from Downstream	

Watercourse Crossing ID	WX28
Watercourse Crossing Details	**Watercourse Crossing**: WX28 **NGR**: NB 32621 13923 **Status:** Existing **Culvert Diameter:** 0.5m **Culvert Construction Type:** Circular metal culvert **Watercourse Width**: 1m **Watercourse Depth**: 0.3m **Notes:** Water flows from loch under existing road creating small stream.
Photograph Looking at Crossing Entrance from Upstream	
Photograph Looking at Crossing Exit from Downstream	

Watercourse Crossing ID	WX29
Watercourse Crossing Details	**Watercourse Crossing:** WX29 **NGR:** NB 32645 12662 **Status:** Existing **Notes:** Not surveyed

Watercourse Crossing ID	WX30
Watercourse Crossing Details	**Watercourse Crossing:** WX30 **NGR:** NB 32555 12272 **Status:** Existing **Notes:** Not surveyed

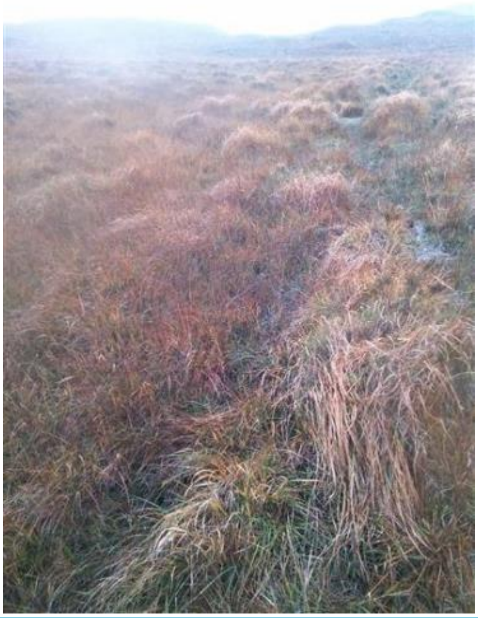
Watercourse Crossing ID	WX31
Watercourse Crossing Details	**Watercourse Crossing:** WX31 **NGR:** NB 32580 12227 **Status:** Existing **Notes:** Not surveyed

Watercourse Crossing ID	WX32
Watercourse Crossing Details	**Watercourse Crossing:** WX32 **NGR:** NB 32458 12111 **Status:** Existing **Notes:** Not surveyed

Watercourse Crossing ID	WX33
Watercourse Crossing Details	**Watercourse Crossing:** WX33 **NGR:** NB 32508 12016 **Status:** Existing **Notes:** Not surveyed

3.2 New Crossings

Watercourse Crossing ID	WX34
Watercourse Crossing Details	**Watercourse Crossing**: WX34 **NGR**: NB 32054 14857 **Status:** New (surveyed at existing crossing) **Watercourse Width**: 1m **Watercourse Depth**: 0.5m **Notes:** Surveyed at NB 32311 14840 (250m downstream of proposed crossing).
Photograph Looking Upstream	
Photograph Looking Downstream	

Watercourse Crossing ID	WX35
Watercourse Crossing Details	**Watercourse Crossing**: WX35 **NGR**: NB 32686 14340 **Status:** New **Watercourse Width**: 0.5m **Watercourse Depth**: 0.7m **Notes:** Surveyed at NB 32687 14357 (14m upstream of proposed crossing)
Photograph Looking Upstream	
Photograph Looking Downstream	
Proposed Crossing Type Likely Required CAR Authorisation	Culvert Registration

Watercourse Crossing ID	WX36
Watercourse Crossing Details	**Watercourse Crossing:** WX36 **NGR:** NB 32121 14046 **Status:** New **Notes:** Not surveyed

Watercourse Crossing ID	WX37
Watercourse Crossing Details	**Watercourse Crossing**: WX37 **NGR**: NB 31100 14118 **Status:** New **Watercourse Width**: 0.4m **Watercourse Depth**: 1.2m **Notes:** Evidence of larger sediment bank. Surveyed at NB 31243 14510 (500m upstream of proposed crossing)
Photograph Looking Upstream	
Photograph Looking Downstream	
Proposed Crossing Type Likely Required CAR Authorisation	Open span bridge Registration

Watercourse Crossing ID	WX38
Watercourse Crossing Details	**Watercourse Crossing**: WX38 **NGR**: NB 31364 13609 **Status:** New **Watercourse Width**: 0.8m **Watercourse Depth**: 0.2m **Note:** Surveyed at NB 30973 13514 (500m upstream of proposed crossing)
Photograph Looking Upstream	
Photograph Looking Downstream	
Proposed Crossing Type Likely Required CAR Authorisation	Culvert or arch culvert Registration

Watercourse Crossing ID	WX39
Watercourse Crossing Details	**Watercourse Crossing**: WX39 **NGR**: NB 31639 13592 **Status:** New **Watercourse Width**: 2.8m **Watercourse Depth**: 0.4m **Note:** Surveyed at NB 31637 13298 (300m downstream of proposed crossing)
Photograph Looking Upstream	
Photograph Looking Downstream	
Proposed Crossing Type Likely Required CAR Authorisation	Open span bridge Registration

Watercourse Crossing ID	WX40
Watercourse Crossing Details	**Watercourse Crossing:** WX40 **NGR:** NB 31839 13690 **Status:** New **Notes:** Not surveyed

Watercourse Crossing ID	WX41
Watercourse Crossing Details	**Watercourse Crossing**: WX41 **NGR**: NB 31754 13244 **Status:** New **Watercourse Width**: 2.8m **Watercourse Depth**: 0.4m **Note:** Surveyed at NB 31637 13298 (125m upstream of proposed crossing)
Photograph Looking Upstream	
Photograph Looking Downstream	
Proposed Crossing Type Likely Required CAR Authorisation	Open span bridge Registration

Watercourse Crossing ID	WX42
Watercourse Crossing Details	**Watercourse Crossing**: WX42 **NGR**: NB 32691 13014 **Status:** New **Watercourse Width**: 0.5m **Watercourse Depth**: 0.2m **Notes:** Watercourse disappears into bog. Surveyed at NB 32719 13144 (130m upstream of proposed crossing).
Photograph Looking Upstream	
Photograph Looking Downstream	
Proposed Crossing Type Likely Required CAR Authorisation	Culvert Registration

Watercourse Crossing ID	WX43
Watercourse Crossing Details	**Watercourse Crossing**: WX43 **NGR**: NB 30635 13022 **Status:** New **Watercourse Width**: 1.3m **Watercourse Depth**: 0.7m **Notes:** Surveyed at NB 30677 12888 (130m downstream of proposed crossing)
Photograph Looking Upstream	
Photograph Looking Downstream	
Proposed Crossing Type Likely Required CAR Authorisation	Bridge or arch culvert Registration

Watercourse Crossing ID	WX44
Watercourse Crossing Details	**Watercourse Crossing**: WX44 **NGR**: NB 30674 12902 **Status:** New **Watercourse Width**: 1.3m **Watercourse Depth**: 0.7m
Photograph Looking Upstream	
Photograph Looking Downstream	
Proposed Crossing Type Likely Required CAR Authorisation	Bridge or arch culvert Registration

Watercourse Crossing ID	WX45
Watercourse Crossing Details	**Watercourse Crossing**: WX45 **NGR**: NB 30528 12703 **Status:** New **Watercourse Width**: 0.2m **Watercourse Depth**: 0.1m
Photograph Looking Upstream	
Photograph Looking Downstream	
Proposed Crossing Type Likely Required CAR Authorisation	Culvert Registration

Watercourse Crossing ID	WX46
Watercourse Crossing Details	**Watercourse Crossing**: WX46 **NGR**: NB 30480 12678 **Status:** New **Watercourse Width**: 0.2m **Watercourse Depth**: 0.1m
Photograph Looking Upstream	
Photograph Looking Downstream	
Proposed Crossing Type Likely Required CAR Authorisation	Culvert Registration

Watercourse Crossing ID	WX47
Watercourse Crossing Details	**Watercourse Crossing**: WX47 **NGR**: NB 30379 12622 **Status:** New **Watercourse Width**: 0.3m **Watercourse Depth**: 0.3m
Photograph Looking Upstream	
Photograph Looking Downstream	
Proposed Crossing Type Likely Required CAR Authorisation	Culvert Registration

Watercourse Crossing ID	WX48
Watercourse Crossing Details	**Watercourse Crossing**: WX48 **NGR**: NB 30172 12533 **Status:** New **Watercourse Width**: 1.5m **Watercourse Depth**: 0.4m
Photograph Looking Upstream	
Photograph Looking Downstream	
Proposed Crossing Type Likely Required CAR Authorisation	Arch culvert Registration

Watercourse Crossing ID	WX49
Watercourse Crossing Details	**Watercourse Crossing**: WX49 **NGR:** NB 30198 12237 **Status:** New **Watercourse Width**: 10.5m **Watercourse Depth:** 0.35 to 0.45m
Photograph Looking Upstream	
Photograph Looking Downstream	
Proposed Crossing Type Likely Required CAR Authorisation	Open Span Bridge Registration or Simple Licence Crossing has been modelled – See Section 4.

Watercourse Crossing ID	WX50
Watercourse Crossing Details	**Watercourse Crossing**: WX50 **NGR**: NB 30589 12189 **Status:** New **Watercourse Width**: 0.9m **Watercourse Depth**: 0.4m **Note:** Surveyed at NB 30601 12229 (40m downstream of proposed crossing).
Photograph Looking Upstream	
Photograph Looking Downstream	
Proposed Crossing Type Likely Required CAR Authorisation	Culvert or arch culvert Registration

Watercourse Crossing ID	WX51
Watercourse Crossing Details	**Watercourse Crossing**: WX51 **NGR**: NB 30389 11943 **Status:** New **Watercourse Width**: 0.4m **Watercourse Depth**: 0.2m **Notes:** Surveyed at NB 30476 11940 (35m upstream of proposed crossing).
Photograph Looking Upstream	
Photograph Looking Downstream	
Proposed Crossing Type Likely Required CAR Authorisation	Culvert Registration

<table>
<tr><th>Watercourse Crossing ID</th><th>WX52</th></tr>
<tr><td>Watercourse Crossing Details</td><td>Watercourse Crossing: WX52
NGR: NB 30229 11890
Status: New
Watercourse Width: 0.2m
Watercourse Depth: 0.1m</td></tr>
<tr><td>Photograph Looking Upstream</td><td></td></tr>
<tr><td>Photograph Looking Downstream</td><td></td></tr>
<tr><td>Proposed Crossing Type
Likely Required CAR Authorisation</td><td>Culvert
Registration</td></tr>
</table>

Watercourse Crossing ID	WX53
Watercourse Crossing Details	**Watercourse Crossing**: WX47 **NGR**: NB 31001 11381 **Status:** New **Watercourse Width**: 0.8m **Watercourse Depth**: 0.2m **Note:** Surveyed at NB 30953 11423 (65m upstream of proposed crossing).
Photograph Looking Upstream	
Photograph Looking Downstream	
Proposed Crossing Type Likely Required CAR Authorisation	Arch culvert Registration

Watercourse Crossing ID	WX54
Watercourse Crossing Details	**Watercourse Crossing**: WX54 **NGR**: NB 31268 11390 **Status:** New **Watercourse Width**: 1m **Watercourse Depth**: 0.2m
Photograph Looking Upstream	
Photograph Looking Downstream	
Proposed Crossing Type Likely Required CAR Authorisation	Bridge or arch culvert Registration

4.0 Abhainn Cheothadail Bridge Crossing

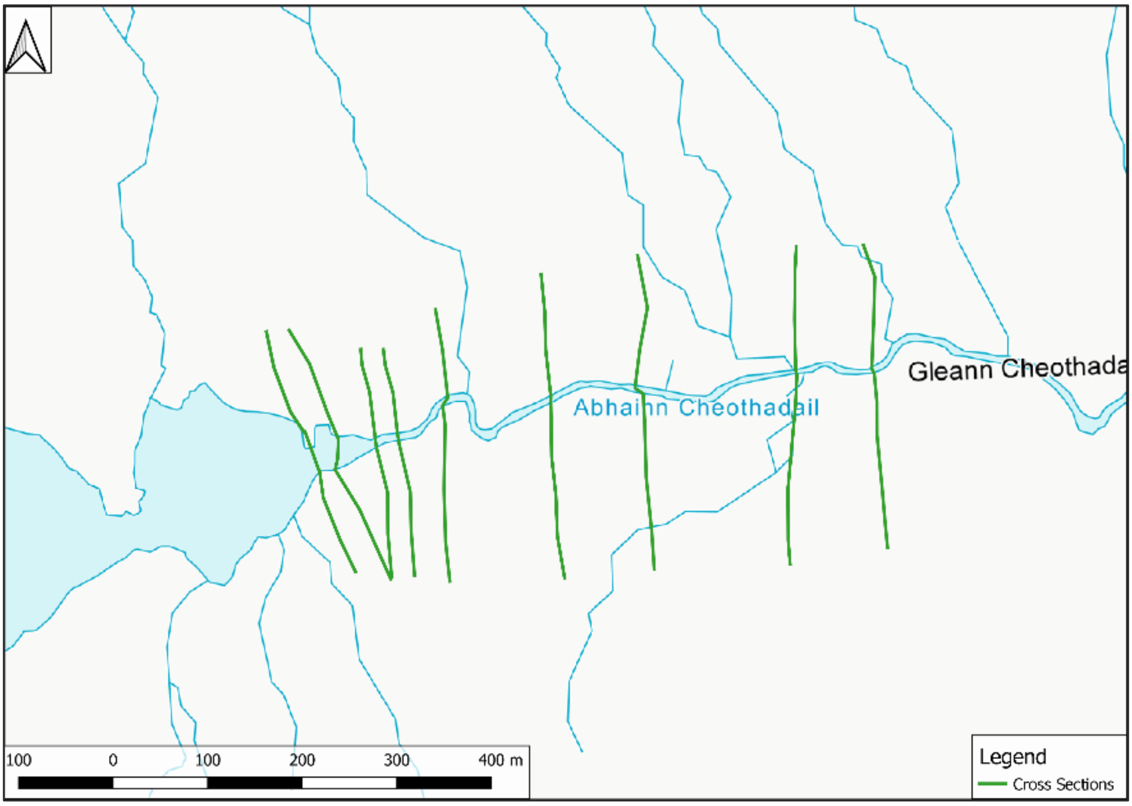
As part of the proposed development it will be necessary to create a bridge crossing over the Abhainn Cheothadail. To inform the detailed design of this crossing (which will be undertaken at a later date should planning consent be secured) a concept design for the crossing has been developed and is reported in this Section. A simple hydraulic model has been constructed to complete the assessment.

The final design of the crossing will be agreed with SEPA, and a CAR application made.

4.1 Modelling Approach

Given the topography and characteristics of the Abhainn Cheothadail, a 1D modelling approach was adopted, using HEC-RAS software as the modelling platform. The geometry of the model is shown in **Plate 4-1**.

Plate 4-1: Model Geometry



Contains OS data © Crown copyright [and database right] [2023].

The upstream boundary of the modelled reach was taken to be approximately 50m upstream of the existing bridge and the downstream boundary was taken approximately 520m downstream of the proposed bridge. This allows the effects of the bridge to be reflected in the model.

The tailwater condition was taken to be a normal depth throughout each run. Generally, a tailwater slope of 0.01 was modelled, which reflects the surveyed slope of the watercourse and overbank areas in this reach. However, to assess the sensitivity of the resultant flood levels at the points of interest to the tailwater conditions, a different tailwater normal depth slope was included in the sensitivity runs.

A steady state modelling approach was used due to the gradient of the channel. A 'mixed flow regime' was adopted, which allowed both sub-and super-critical flow to be adequately represented.

The topography of the watercourse was based on a series of cross sections obtained from a topographic survey completed during the site visit. The sections were visually assessed, and small fluctuations (that can result in model instabilities) were removed.

4.2 Modelling Parameters

In general, default parameters (loss factors, etc.) were used in the modelling. The default expansion and contraction losses for cross-sections were amended (increased) for the sections close to the bridge in the post-development model, reflecting the additional turbulence and resultant effects on energy losses through the bridge.

Based on observations from site visits, roughness values for the channel were set at between 0.043 and 0.047, and for overbank areas at between 0.05 and 0.07. Whilst these were set based on the hydrologist's experience, and were considered to be adequately conservative, sensitivity analysis was used to assess the global effects of these choices.

4.3 Sensitivity Analysis

The model response to various key assumptions and parameters was reviewed by a set of runs, with each parameter varied across an appropriate envelope of feasible values. The parameters reviewed, and the outcomes in terms of response in peak water level, are discussed below:

- Roughness values.
  - These were varied by a global increase of 20%, with up to 120mm of effect.
  - Mannings n values were also varied in accordance with Jared's equation for mannings, which is suitable for steep mountain streams[12]. This varied mannings n values across the reach according to the energy slope and hydraulic radius at each cross section, allowing manning n of up to 0.13 to be modelled. This had a global effect of up to 430mm and 300mm of effect noted at the proposed crossing.
- The tailwater slope was varied to 0.001, with up to 600mm of effect observed at the tailwater and negligible effect was noted at the proposed crossing itself.
- Flow. These were varied by an increase of 20%, with up to 140mm of effect.
- ReFH2 Flows. The higher flows had up to 550mm of effect with the maximum effect noted upstream of the proposed crossing.

4.4 Modelling Outcomes

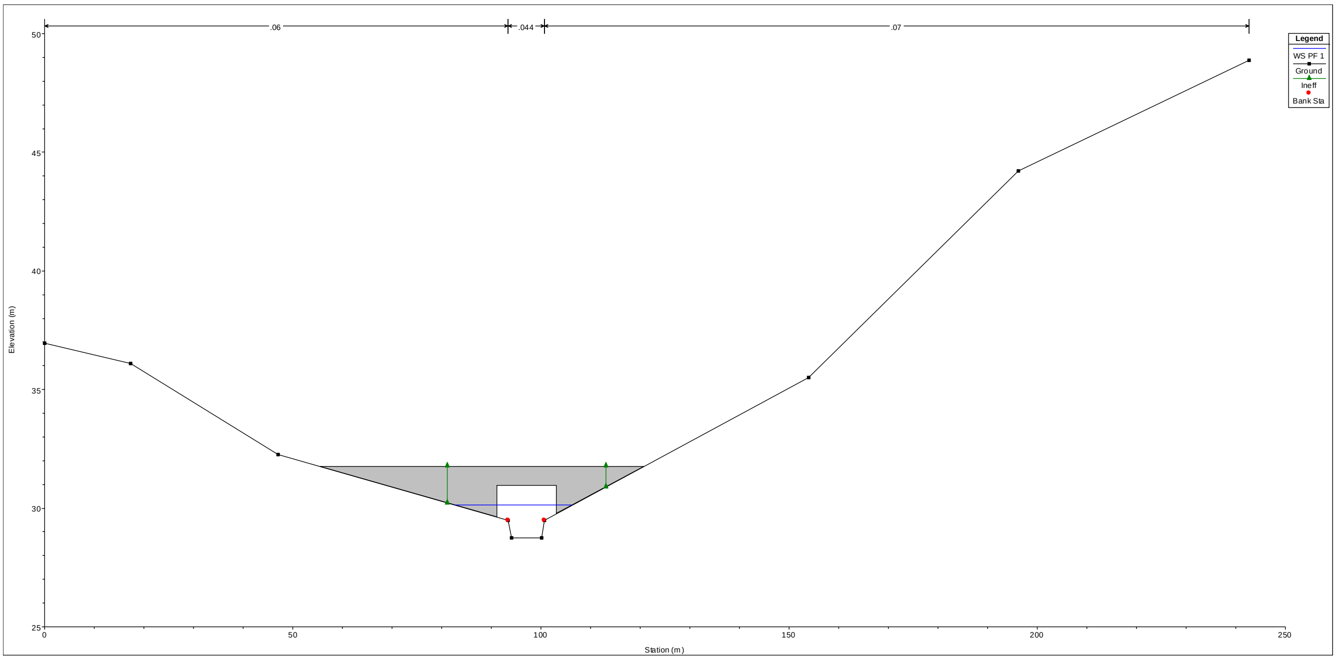
An outline design for a new bridge has been developed and modelled and has included the following:

- A bridge span of approximately 12m wide, with the bridge abutments set back 2m from the channel.
- The soffit of the bridge and associated deck level at 30.95m AOD and 31.75m AOD respectively.

Plate 4-2 shows the proposed / modelled bridge in cross section and the 200-year (+CC) flood level.

[12] Jarret's equation, as detailed in [n-values in steep streams - Kleinschmidt (kleinschmidtgroup.com)]

Plate 4-2: Cross Section – Proposed Bridge – 1:200+CC



It is considered that this outline design represents a reasonable and proportionate solution and that the proposed crossing can be tied into the proposed track; however, this will need to be reviewed, and confirmed with CnES and SEPA, as part of the detailed design.

An extract of the modelling outcomes for the proposed bridge is shown in **Plate 4-3**.

Table 4-1 shows the modelled peak water levels at the proposed bridge compared to the base scenario. It is noted that the model assumes a conservative approach that forces all the water through the bridge itself.

Plate 4-3: Profile Plot – Proposed Bridge – 1:200+CC

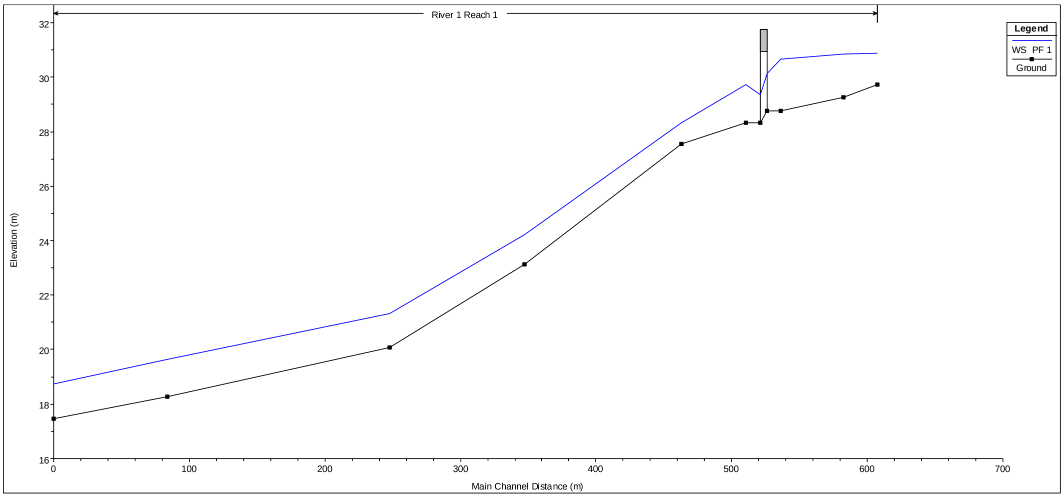


Table 4-1: Maximum Flood Levels – 1:200+CC

Model Section	Peak Water Level (m AOD)		Difference (m)
	Base Scenario	Proposed Bridge	
668	30.81	30.88	0.07
643	30.75	30.84	0.09
600	30.19	30.65	0.46
576	29.54	29.74	0.2
528	28.44	28.32	-0.12
412	24.1	24.22	0.12
313	21.33	21.33	0
150	19.63	19.63	0
66	18.75	18.75	0

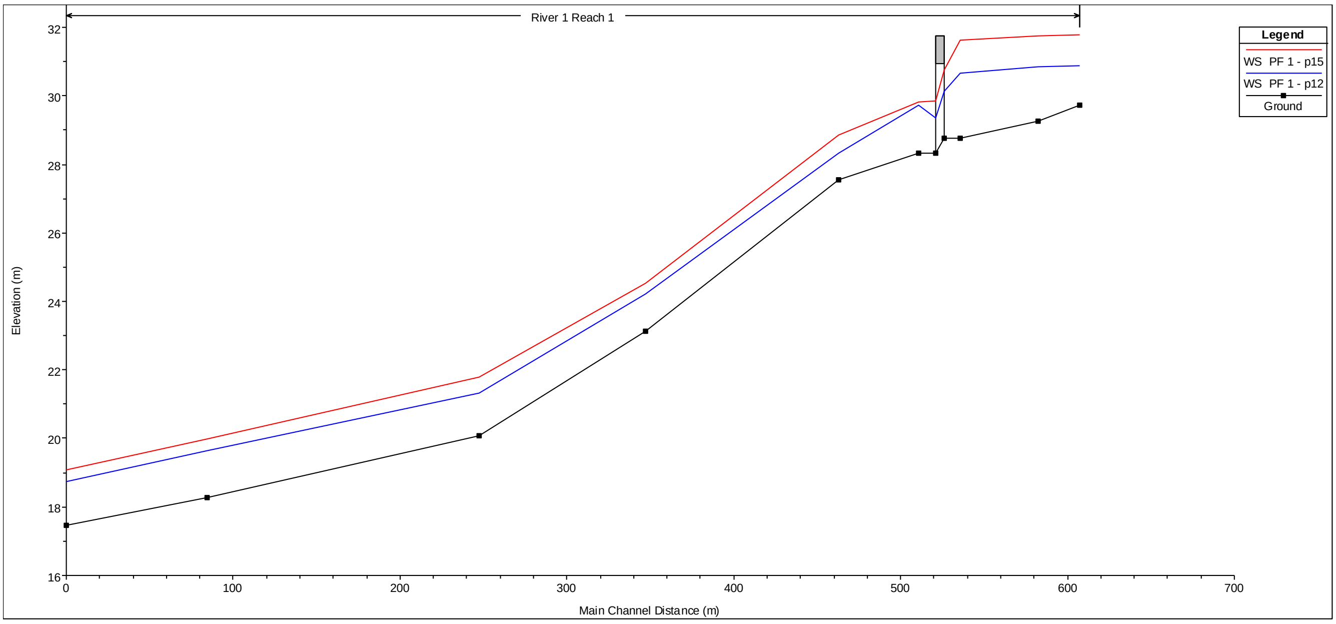
Review of **Plate 4-3** and **Table 4-1**, indicates that the proposed bridge reduces the flood water levels in the vicinity of the bridge. A slight ponding effect is noted upstream of the proposed bridge which is some 460mm higher than the existing conditions.

A freeboard should be applied to the adopted design flood level to arrive at a suitable design development level. Freeboard allows for both uncertainty in the hydrology and hydraulic modelling that is used to derive flood levels and other physical processes not allowed for in the design flood estimation such as minor wave or wind effects, super-elevation of water surfaces, and settlement of defence structures.

The maximum flood level in the post-development scenario just upstream of the bridge for the 1:200+CC event is estimated to be 30.65m AOD. The proposed bridge soffit level should be set at a minimum of 30.95m AOD, which allows for a 300mm of freeboard which is considered adequate for this type of development.

As a sensitivity check, the proposed bridge was also modelled using the higher ReFH2 flows, the results of which are shown in **Plate 4-4**.

Plate 4-4: Profile Plot – Proposed Bridge 1:200+CC (FEH and ReFH2 comparison)



The profile indicates that during the higher ReFH2 simulation there is potential for water to pond upstream of the bridge at a maximum elevation of 31.64m AOD, which is some 690mm higher than the proposed bridge soffit levels, however, this remains lower than the proposed bridge deck level (31.75m AOD).

As discussed in Section 2, the ReFH2 flows are an overestimate of flows within the Abhainn Cheothadail catchment, however, details of the design will be finalised as part of the detailed design stage, post determination and agreed with SEPA as part of a CAR application.

The assessment has shown, however, that it is possible to construct a bridge over the Abhainn Cheothadail that maintains access / egress to site in times of flood, and that does not increase flood risk to third parties. It is noted that the final design will need to consider fisheries, ecological and geomorphological interests to ensure these are safeguarded. Again, this can be secured by a subsequent CAR application.

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TECHNICAL APPENDIX 10.5: PRIVATE WATER SUPPLY RISK ASSESSMENT

Uisenis Wind Farm

Prepared for: Uisenis Power Limited

SLR Ref: 405.V64341.00001
Version No: 1
August 2023

SLR

BASIS OF REPORT

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1.0 Introduction

This Technical Appendix should be read in conjunction with **Chapter 10: Hydrology, Hydrogeology and Geology** of the EIA Report which contains a detailed description of the local hydrology and hydrogeology, flow mechanisms and hydraulic properties of the soils and geology, the embedded mitigation incorporated in the development design, and an assessment of impacts on groundwater and surface water flows and quality.

This Technical Appendix contains information relating to private water supplies (PWS) within the study area, and the potential effects the proposed development might have on these. To complete the assessment a conceptual Site model is presented which uses a source-pathway-receptor linkage to assess the risk to each PWS.

Comhairle nan Eilean Siar (CnES) provided details of PWS sources within the study area, which has been reviewed and augmented by review of Ordnance Survey mapping and aerial photography.

Additional properties, and potential water uses, were also identified following a programme of Site-specific field investigation that involved visiting the properties, enquiring about their water use and source, and mapping water abstraction locations. The locations of water sources and tanks etc. were recorded using a handheld GPS. Where residents were unavailable questionnaires were left at properties requesting details of their water source or PWS.

The field investigation was completed in November 2022 by the author of this report. The results of the PWS survey and assessment are presented in Section 2 of this report.

This Technical Appendix is structured as follows:

- Section 2 presents the results of the PWS survey and assessment; and
- Section 3 details a potential water monitoring schedule and parameter list that could be used to monitor water quality at PWS sources that have a hydraulic linkage (e.g., pathway) to the proposed development. The monitoring frequency, parameter list and reporting programme would be subject to agreement with CnES and Scottish Environment Protection Agency (SEPA) should planning permission be granted, and it is expected would be secured by an appropriately worded pre-commencement planning condition.

The PWS locations are shown on **Figure 10.1**.

2.0 Private Water Supply Risk Assessment

Table 2-1 presents information collected from CnES the PWS survey, returned questionnaires, and desk study. If a source is assessed to have a hydraulic connection (e.g. there is a pathway) to the proposed development, mitigation measures have been proposed.

Review of **Table 2-1** indicates the following:

- one PWS source is potentially at risk from the proposed development (highlighted in red);
- one distribution pipe associated with PWS source is potentially at risk from the proposed development (highlighted in orange); and
- one PWS source is not at risk from the proposed development (highlighted in green).

Table 2-1: Private Water Supply Screening – Properties with Private Water Supply

PWS ID (Figure 10.1)	Property Name	PWS Source Type	Location of PWS	Details	Potential Complete Source – Pathway – Receptor Linkage	Mitigation and Monitoring
PWS01	Sideabhal	Spring	E 128163 N 916735 Approximately 80m west from the existing road (to be upgraded).	Residents confirmed that the property is served by a spring which feeds two holding tanks located approximately 55m north of the property. Water is gravity fed from the holding tanks to the property. The PWS source is located downstream of an existing track which is proposed to be upgraded as part of the proposed development.	✓ PWS source potentially at risk	Controls will be required to safeguard the PWS from the proposed development (including access to facilitate the proposed development) to ensure the water source is not impaired. The spring, holding tanks and pipelines between these will need to be clearly marked and protected. It is proposed that no excavation works are undertaken upstream of the spring or within 250m of the spring to ensure that existing drainage routes to the spring are not impaired. Any track

PWS ID (Figure 10.1)	Property Name	PWS Source Type	Location of PWS	Details	Potential Complete Source – Pathway – Receptor Linkage	Mitigation and Monitoring
						improvements should be undertaken by ground raising not excavation within this 250m buffer. Baseline and confirmatory water quality monitoring should be undertaken to assess the efficacy of these controls (see Section 3).
PWS02	Kinloch Seaforth	Spring	E 129442 N 916458 Approximately 10m north from the existing road (to be upgraded).	Residents confirmed that the property is served by a spring which feds a holding tank located approximately 60m north east of the property before it is gravity fed to the property. The property was also served by a stream abstraction (E 129488 N 916547) located on a minor watercourse to the north east of the property however this no longer in use. No development is proposed upgradient of the spring / holding tank or stream abstraction however the pipework between the PWS source and the property may be at risk from the proposed development.	✓ Distribution pipework only.	Where water distribution pipework is crossed by the proposed development this will be marked and structural analysis competed to ensure the distribution pipework is not impaired. If required reinforcement will be provided to ensure the integrity of the pipework. Baseline and confirmatory water quality monitoring should be undertaken to assess the efficacy of these controls (see Section 3).
PWS03	Eishken Estate (eight	Spring / Hill runoff	E 132564 N 911710	Landowner confirmed that the estate is served by a spring and surface water runoff from the northern slopes of Sidhean nan Caorach. Water is collected	× PWS source and pipework not	N/A

PWS ID (Figure 10.1)	Property Name	PWS Source Type	Location of PWS	Details	Potential Complete Source – Pathway – Receptor Linkage	Mitigation and Monitoring
	properties in total)		Approximately 800m from nearest turbine (T25).	into an open reservoir which has been cut into the peat and then passed to two holding tanks located east of the reservoir (E 132587 N 911722 and E 132589 N911717 respectively). Water is then gravity fed from the holding tanks to the properties within the estate. No development is proposed within 250m of the reservoir and the development does not cross the distribution pipework between the sources, holding tank and estate properties. Therefore, the PWS is not considered to be at risk.	considered to be at risk.	

3.0 Example Monitoring Protocol and Intervention Strategy

As identified in Section 2 of this Technical Appendix, monitoring is proposed at properties that maintain a PWS source where there is a source-pathway-receptor linkage to the proposed development (e.g. PWSs considered at risk).

Pre-development monitoring data can be used to establish baseline water levels and quality, and assessment or trigger values to which routine monitoring data collected during construction can be compared against.

The monitoring suite, monitoring locations, monitoring frequency and intervention strategy would be agreed with CnES and SEPA prior to any works being undertaken. It is anticipated that this would be secured by an appropriately worded pre-commencement planning condition agreed between the applicant, CnES and SEPA. **Table 3-1** however shows an example protocol which could be used as a basis to agree a water monitoring protocol with relevant consultees.

Table 3-1: Example Monitoring Protocol

Location	Frequency	Determinand Suite
PWS02 - Kinloch Seaforth (Spring Source) PWS03 - Eishken Estate (Spring / Hill runoff). Sample location downstream of proposed site access to ensure distribution pipework is not impaired.	Monthly prior to and during construction.	Field Sampling • pH • Redox • Conductivity • Dissolved Oxygen Extractive Samples • pH • Alkalinity (total and bicarbonate) • Suspended solids • Colour • Organic carbon (total and dissolved) • Electrical conductivity • Chloride • Orthophosphate • Sulphate • Nitrate, nitrite and ammonium • Hydrocarbons • Aluminium (total + dissolved) • Calcium (total + dissolved) • Iron (total + dissolved) • Copper (total + dissolved) • Magnesium (total + dissolved) • Manganese (total + dissolved) • Potassium (total + dissolved) • Sodium (total + dissolved) • Total Coliforms (PWS only) • E Coli (PWS only) • Enterococci (PWS only)

3.1 Monitoring and Reporting Personnel

The monitoring and reporting would be undertaken by appropriately experienced and trained staff.

3.2 Monitoring Methodology

Water samples would be collected following guidance within SEPA, July 2003, Guidance on Monitoring of Landfill Leachate, Groundwater and Surface Water, v2 (specifically Section 9 thereof).

Prevailing weather conditions, qualitative flow conditions as well as other visual indicators would be recorded in order to aid the sample reporting.

The water samples would be placed directly into appropriate sterile bottles, which would be labelled and dispatched to a UKAS accredited laboratory, under chilled conditions and accompanied by the relevant chain of custody documentation.

3.3 Example Intervention Strategy

In the unlikely event that the routine monitoring data recorded potential pollution at a private water supply an investigation and intervention strategy would be agreed with CnES. Again, the details of which would be agreed prior to any construction and be secured by an appropriately worded pre-commencement planning condition.

3.3.1 Alerting Potentially Affected Properties

Contact details (land and mobile numbers / email addresses) for the private water supply users would be maintained by site management at all times.

In the event that monitoring data collected at any private water supply is above the baseline monitoring record and above prescribed regulatory standards then the property owners would be advised and repeat water sampling undertaken (if agreed with the property owners). Notification would occur within 24 hours of receipt of monitoring results. Repeat water sampling would be undertaken as soon as reasonably practicable and within 72 hours.

Details of any affected property would be reported to CnES within a timeframe agreed with CnES when the monitoring programme is agreed and finalised.

3.4 Provision of Alternative Water Supplies

The Applicant commits to maintaining the yield and wholesomeness of water supplies. The following measures may be deployed in the unlikely event a water supply is impaired by the works:

- provision of bottled potable water in the event of a short or transient derogation of a water supply (bottled water would be retained on site ready for quick dispatch to any effected property); and
- provision of an alternative water source (e.g. spring, borehole, alternative surface water abstraction location) in the event of a permanent derogation of a water supply.

In the event of an alternative water source being implemented CnES would be advised as soon as is practical.

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TECHNICAL APPENDIX 10.6: GROUNDWATER DEPENDENT TERRESTRIAL ECOSYSTEMS (GWDTE) ASSESSMENT

Uisenis Wind Farm

Prepared for: Uisenis Power Limited

SLR Ref: 405.V64341.00001
Version No: 1
August 2023

BASIS OF REPORT

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1.0 Introduction

This Technical Appendix presents an assessment of potential areas of Groundwater Dependent Terrestrial Ecosystems (GWDTE) at the proposed Uisenis Wind Farm, hereafter referred to as the 'proposed development'.

A number of surveys, including a programme of peat depth probing and a National Vegetation Classification Survey (NVC) survey have been undertaken and which have been used to inform this assessment.

This Technical Appendix should be read in conjunction with the following Chapters and Technical Appendices of the Environmental Impact Assessment (EIA) Report:

- **Chapter 8: Ecology**, which contains detailed description of the NVC survey undertaken and survey methodology;
- **Chapter 10: Hydrology, Hydrogeology and Geology**, which contains detailed description of the superficial and bedrock geology, local hydrology and hydrogeology, flow mechanisms and hydraulic properties of the soils and geology; and
- **Technical Appendix 10.1: Peat Landslide Hazard Risk Assessment** (PLHRA), which contains details of the peat survey and depths.

1.1 Conceptual Hydrological Site Model

The following conceptual hydrological Site model has been developed, following a review of the Site setting as outlined in the Chapters referenced above:

- the proposed development is located in an area that receives frequent rainfall and has a high annual rainfall total;
- the proposed development is located in an area which contains a dense network of surface water features;
- where there are no drift deposits present, there is potential for some shallow groundwater to be present in the upper weathered surface of the bedrock. This is however generally on elevated sloping ground where rainfall would preferentially form surface water runoff and thus limit the production of groundwater;
- where shallow groundwater flow does occur in the weathered bedrock deposits it will follow topography; and
- the potential for rainwater recharge to groundwater within the bedrock will be limited by the presence regionally of peat and clays associated with glacial till deposits. Incident rainfall is likely to preferentially pond on the ground surface and where surface gradients allow form surface runoff or shallow interflow within the acrotelm (top) layer of the peat rather than infiltrate and form significant groundwater recharge.

The absence of significant quantities of groundwater in the superficial and bedrock deposits is confirmed by published mapping (see **Chapter 10**, **Figure 10.6** and **Figure 10.7**).

2.0 NVC Mapping and Occurrence of Potential GWDTE

2.1 NVC Mapping

The survey methodology and findings are discussed in detail in **Chapter 8: Ecology** of the EIA Report.

In total 21 NVC communities were recorded within the survey area.

Due to variability in vegetation communities and the presence of transitional habitats within the survey area, some polygons represent complex mosaics of two or more NVC communities. Where polygons have been mapped as mosaics, an approximate percentage coverage of each NVC community within the polygon has been provided so that the dominant community could still be ascertained.

2.2 Occurrence of Potential GWDTE

The assessment of GWDTE began with identifying the NVC communities which are cited in SEPA guidance[1] as potential moderate or high groundwater dependent, as shown on **Figure 10.8**.

The particular characteristics of these communities were then subject to further site-specific scrutiny in terms of topography and hydro-ecological context and are discussed in the sections below.

2.2.1 Habitats with Potential Moderate Groundwater Dependency

Table**Table 2-1** details areas of potential moderate groundwater dependent habitats and discusses whether these habitats are likely to be sustained by groundwater.

As shown on **Figure 10.8**, generally the areas designated as potential moderate groundwater dependent habitats cover large areas over a range of elevations and slopes or in areas adjacent to lochs and watercourse channels. This distribution is not typical of that which is sustained by emerging groundwater, such as springs or seepage lines.

Table 2-1: Moderately Groundwater Dependent Habitats

Habitat	Location	Discussion
M15	Extensive areas across the entire Site	The habitat is typically located on sloped ground which is largely underlain low permeability peat deposits. Habitat is not rare and is present across large areas of Scotland. Given this distribution and location it is considered that this habitat is sustained by the high average annual rainfall, surface water runoff and surface water ponding rather than by groundwater. Buffers specified in SEPA guidance to this habitat therefore need not apply, but safeguards will be required during construction to maintain existing surface water flow paths to this habitat during and following dismantling/construction.
M25	Small areas across the entire Site	The habitat is typically localised and situated on sloping ground which is adjacent to lochs and watercourse channels.

[1] SEPA (2017) Land Use Planning System SEPA Guidance Note 31, Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems. Version 3.

Habitat	Location	Discussion
U6	Polygon adjacent to unnamed tributary of Loch Eisgein	The distribution is not typical of that attributable to a dominant groundwater discharge and it is considered that rainfall and surface water sustains this habitat. Rainwater and runoff will pond on the low permeability geology which will result in waterlogging of the soils. Buffers specified in SEPA's guidance to this habitat therefore need not apply, but safeguards will be required during construction to maintain existing surface water flow paths. Works in these areas should be supervised by the project Ecological Clerk of Works (ECoW).

2.2.2 Habitats with Potential High Groundwater Dependency

Table 2-2 details communities determined to be potentially Highly groundwater dominant and discusses whether they are likely to be sustained by groundwater. As shown on **Figure 10.8**, generally the areas classified as Highly Dominant are localised largely coincide with watercourse channels or areas immediately adjacent to the watercourses.

Table 2-2: Highly Groundwater Dependent Habitats

<table>
<tr><th>Habitat</th><th>Location</th><th>Discussion</th></tr>
<tr><td>M6</td><td>Small areas near the banks of Loch Sealg</td><td rowspan="3">The habitat is typically localised and situated on sloping ground which is either adjacent to lochs and watercourse channels or on sloped ground upstream of the watercourse or lochs.

The distribution is not typical of that attributable to a dominant groundwater discharge and it is considered that rainfall and surface water sustain these habitats. Rainwater and runoff will pond on the low permeability geology which will result in waterlogging of the soils.

Buffers specified in SEPA's guidance to this habitat therefore need not apply, but safeguards will be required during dismantling/construction to maintain existing surface water flow paths. Works in these areas should be supervised by the project Ecological Clerk of Works (ECoW).</td></tr>
<tr><td>M23</td><td>Small areas near Loch-na h-Ola, River Eishken and Loch Seaforth.</td></tr>
<tr><td>M29</td><td>Small area at the beginning of unnamed tributary of Loch a'Choin Dhuibh</td></tr>
<tr><td>M10</td><td>Areas adjacent to Abhainn Ghlas and Lochan nan Uidhean Beaga</td><td>It is noted that the M10 community comprises a small proportion (less than 20%) of the overall polygon and therefore represents a relatively small area within a larger community which is not sustained by potential groundwater.

This habitat is typically classified as a flush feature and tends to be supported by a level of base-rich waters. Across the proposed development, these polygons which contain this habitat are localised and situated on sloping ground which is adjacent to watercourse channels.

The distribution is not typical of that attributable to a dominant groundwater discharge. It is considered that rainfall and surface water are the dominant water source that sustain these habitats, although a small element of groundwater may also be present.

Buffers specified in SEPA's guidance to this habitat therefore need not apply, but safeguards will be required during construction to maintain</td></tr>
</table>

Habitat	Location	Discussion
		existing surface water flow paths. Works in these areas should be supervised by the project Ecological Clerk of Works (ECoW).

M15 and M10 flushes are also recorded by a number of target notes, as shown on **Figure 10.8,** particularly within the north western extent of the Site. As noted above M10 habitats are typically classified as flush features that tend to be supported by a contribution of base-rich waters associated with water sourced from areas of erosion/subsidence of shallow peat on sloping ground. Works in near these communities should be supervised by the project Ecological Clerk of Works (ECoW) to ensure potential groundwater and surface water flow paths are maintained.

2.2.3 Summary

After review of **Figure 10.8**, and **Table 2-1** and **Table 2-2** above, it is evident that typically potential groundwater dependent habitats are located over large areas or in/adjacent to watercourse corridors. This distribution is not consistent with habitats sustained by groundwater but rather habitats predominantly sustained by the high average annual rainfall, surface water runoff and surface water ponding.

No permanent dewatering or groundwater management is required as part of the proposed development and therefore no permanent change to groundwater levels and flow direction will occur. Any existing groundwater contribution to habitats will therefore continue.

It is concluded therefore that buffers to potential High and Moderate GWDTE specified in SEPA guidance[1] need not apply, but safeguards will be required during construction to maintain existing surface water flow paths to these habitats. Micro-siting (for example of tracks and foundations) will also be required under direction of the project ECoW to safeguard valuable habitats, such as flushes.

Examples of proposed safeguards are provided in **Chapter 10: Hydrology, Hydrogeology and Geology** of the EIA Report which will be included in the final CEMP. It also includes the provision of an ECoW to supervise construction works and whom would have the authority or approve drainage measures, and ensure their efficacy, deployed during the project.

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TECHNICAL APPENDIX 10.7: CONSULTATION

Uisenis Wind Farm

Prepared for: Uisenis Power Limited

SLR Ref: 405.V64341.00001
Version No: 1
August 2023

SEPA response 8826

Dear Gordon

Uisenis Wind Farm - Post Gatecheck further review

Thanks for below and this further engagement. The amendments you have made seem to be positive from our perspective and I have provided a further response to the examples I highlighted previously below. I emphasise that in this case I had only provided *examples* of the types of issues I had noted and there is a need to go through the whole layout and consider whether the issues I highlighted applied to those areas as well.

<u>Layout in relation to buffers to the water environment</u>

- I welcome the amendments made to T1 and T24 (which was T19) to increase the buffer between any works and the top of the bank of the watercourses. If the measurements you refer to below are from the top of the bank of the watercourse (and not from the edge of the water) and the ground is not steep sloping then we could accept buffers of 30 m and 36 m between any excavation works and the top of the banks of the water. I understand that there will be vegetation clearing closer to the watercourses than this. As you suggest, make sure this point in picked up in the EIA Report, include specific mitigation to address the high risk of pollution.

<u>General layout issues / hydrology</u>

- I think you probably meant to include a new layout picture for me with your comments on the track to T4, in the vicinity of T5 and the T-junction near the construction compounds (the first three in the table). Your comments do sound positive…

- Access to T5, T9 and T12 – comments noted.

- Length of track between T16 and T22/T20 – comments noted.

- Track to T17 – a little bit difficult to tell from the pictures but I think that the track to T17 has been moved outwith the 50 m watercourse buffers, which would be welcomed and an improvement.

Layout in relation to impacts on peat

-
- All the amendments you have suggested below look positive and are very welcome; please apply a similar approach to any other infrastructure located on deeper peat (or best quality habitat, which should also be avoided).

GWDTE

-
- Happy to comment on finalised assessment before formal submission if this would be helpful.

Just so there is no misconception, I highlight that my welcoming of the above amendments doesn't mean that the layout is necessarily now acceptable to SEPA. Very happy to look again at the revised overall layout against the background hydrology, peat probing and GWDTE/best quality habitat information prior to submission if this would be helpful.

Kind regards

Susan

[redacted]

From: [redacted]
Sent: 12 April 2023 13:49
To: [redacted]
Cc: [redacted]

[redacted]

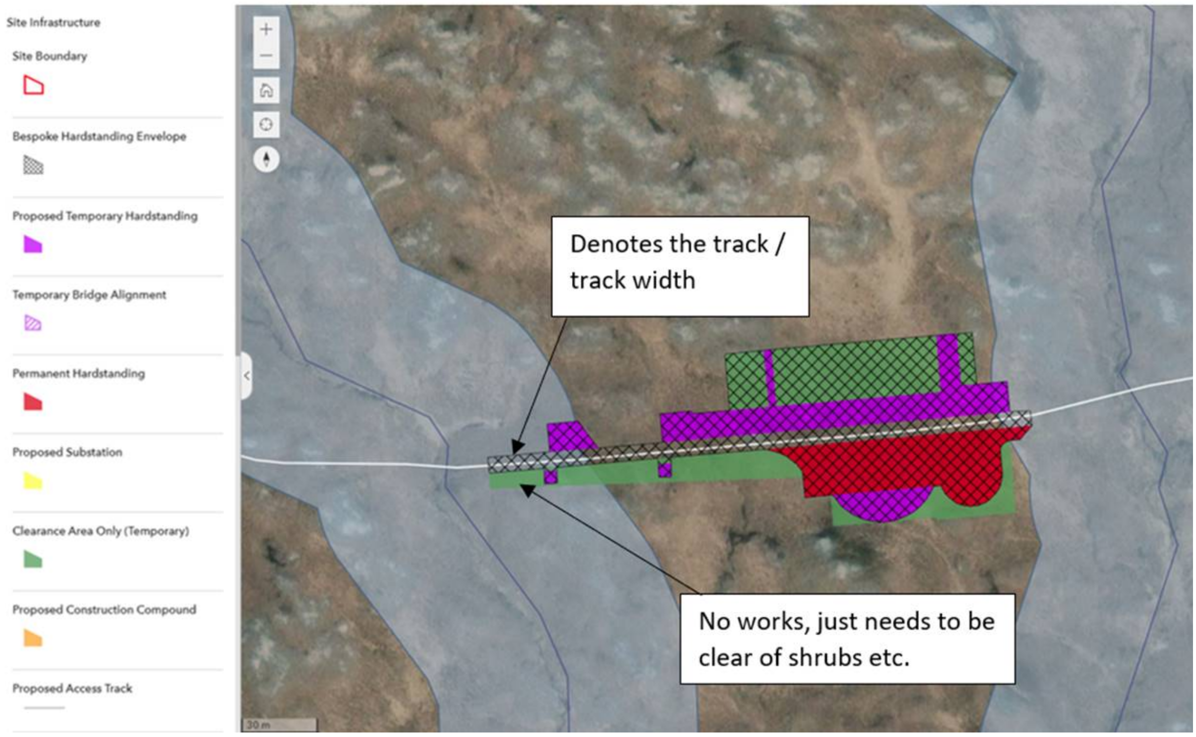
Subject: RE: Uisenis Wind Farm - Post Gatecheck review - SEPA response 8540

Dear Susan,

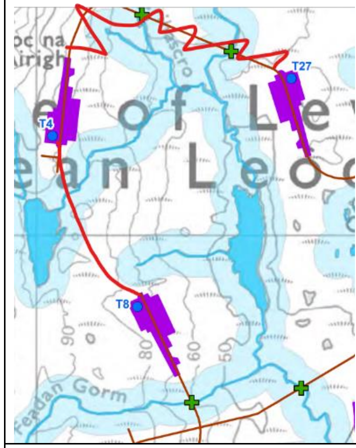
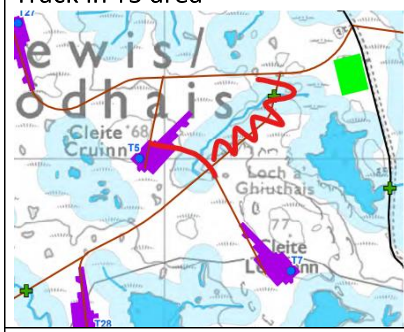
Trust you had a good Easter break.

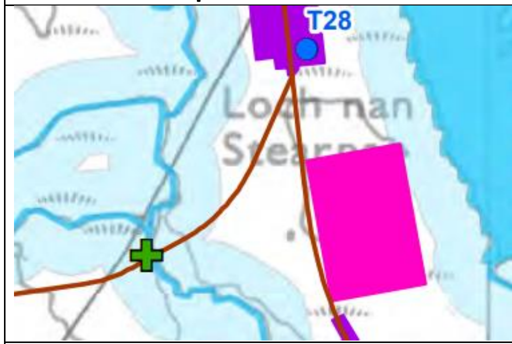
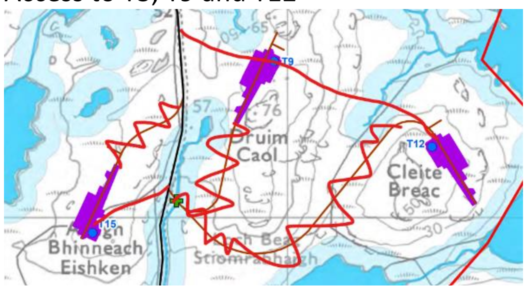
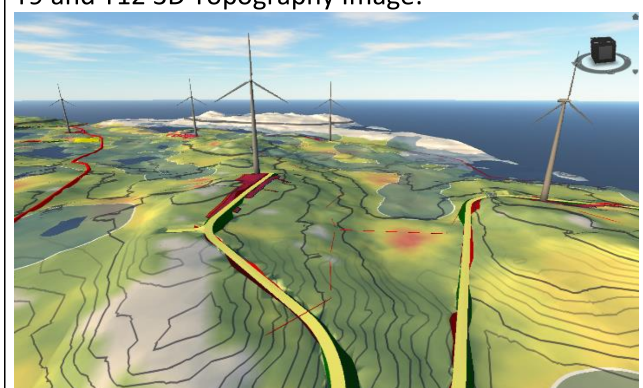
Thank you very much for your comments on the proposed Uisenis Wind Farm layout, they are very helpful. There has been quite a considerable amount of effort that has gone into the design of the site layout (wind turbines / tracks / crane pads etc.) and balancing the competing site constraints, whilst ensuring that the site is efficient and produces as much energy as possible. However, your comments have been very useful in helping us to look closer at how we can further mitigate potentially negative effects on peat and hydrology through amendments to the design. The majority of the below text sets out how we have addressed the concerns / suggestions in your two tables. We have taken this opportunity to also rationalise the turbine numbering and so please see attached an excel spreadsheet clarifying the new turbine numbering compared to the previous iteration you commented on.

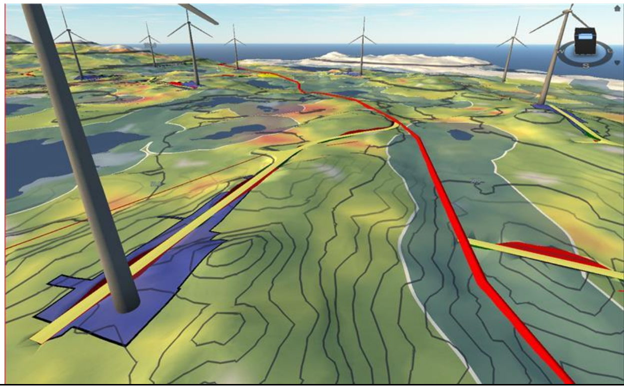
With regards to T1 (still T1) and T19 (now T24) it has been advised that SEPA would not accept any proposals which resulted in engineering works within the banks of a watercourse (other than watercourse crossings). As part of our final application, we will be submitting within the EIA Report additional information on the crane pads, and specifically which parts of the crane pad require works and whether this would be temporary or permanent. For T1 and T19 the part of the crane pad closest to the watercourse would actually not require any works and would only need to be clear / free from obstruction e.g. shrubs and bushes. An image showing the detailed breakdown of a crane pad (T19) is provided below. Despite this, we have taken on board your comments and moved / reorientated the infrastructure associated with these two turbines so that they do not come so close to watercourses: 1) we are now approximately 16m from the watercourse at T19, however when measuring from the watercourse to the nearest section of crane pad that will need works (hardstanding / cut / fill etc) this becomes approximately 36m. 2) we are now approximately 30m from the watercourse at T1. It is confirmed that with the exception of watercourse crossings (the number of which we have tried to minimise) no engineering works are required within the banks of watercourses. Where temporary or permanent works are required within the 50m buffer to watercourses (for example, as shown in the image below) we will state these locations in the EIAR and confirm why it is necessary (e.g. a technical justification) and what additional mitigation measures would be adopted to safeguard water resources.

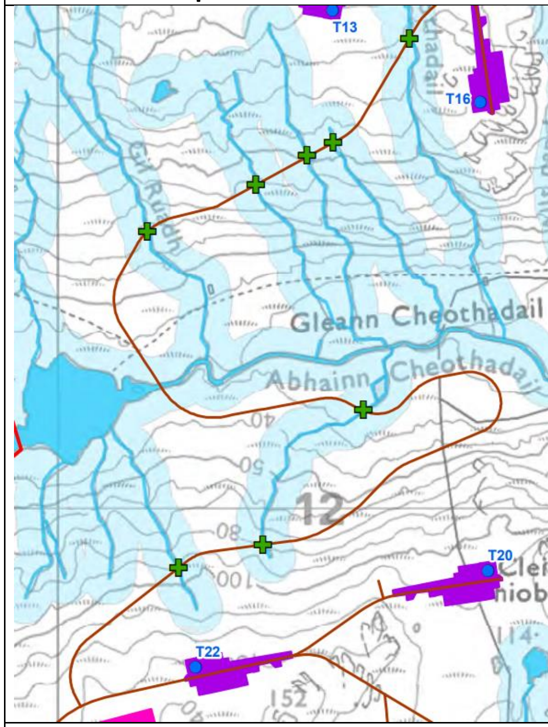

Site Infrastructure
Site Boundary
Bespoke Hardstanding Envelope
Proposed Temporary Hardstanding
Temporary Bridge Alignment
Permanent Hardstanding
Proposed Substation
Clearance Area Only (Temporary)
Proposed Construction Compound
Proposed Access Track
Denotes the track / track width
No works, just needs to be clear of shrubs etc.
30 m

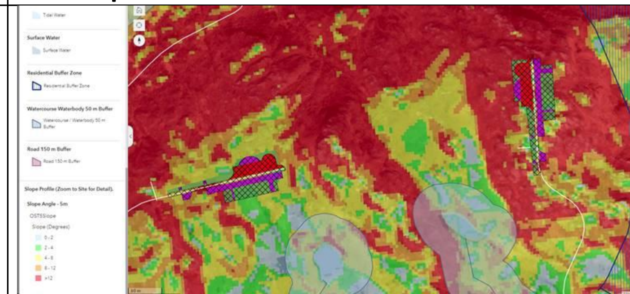
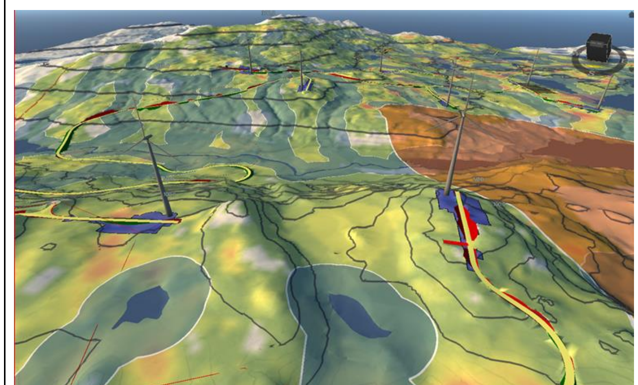
Hydrology:

Area of Development	Issue/SEPA Comment	SLR Response
Track to T4 	Accessing T4 from T8 would reduce the length of tracks and number of watercourse crossings. Probing shows peat depth is similar.	Agreed, there are some challenges in terms of track orientation, slope and avoiding deeper peat when accessing T4 from T8, including the crane pad for T8 being orientated in the wrong direction (than would be preferred). However, these challenges can be overcome and as such we have amended this area of track as can be seen on the Figures provided.
Track in T5 area 	An alternative configuration such as accessing T7 from T5 would reduce the length of track and number of watercourse crossings	The track alignments in this area have been amended in order to better avoid peat and watercourses. The amendments are not completely in line with the suggestions made here due to topography and challenges in having the crane pad alignment and track alignment as shown in the image here (ideally the track follows the crane pad alignment into the turbine)
T -junction near construction compound	A T-junction would reduce track length	Agreed. Our original design was to follow a more preferable slope / gradient, however, a T-junction can also be made to work and so we have amended this accordingly.

Area of Development	Issue/SEPA Comment	SLR Response
		
Access to T5, T9 and T12 	A more direct access from the existing road to T15 would reduce the length of track. A more direct access to T9 and then T12 would significantly reduce track length	Unfortunately due to topography, slope and also peat slide risk, we would not be able to amend the tracks as suggested here. If the track were amended as shown here, the crane pad for T9 would need repositioned in an orientation following the track, which due to the topography would result in the need to build up the crane pad 10+ metres in order to achieve a level surface. The below images show the challenging topography in the area. T9 and T12 3D Topography Image:  T15 3D Topography Image:

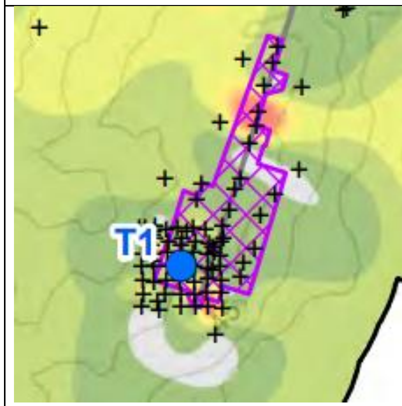
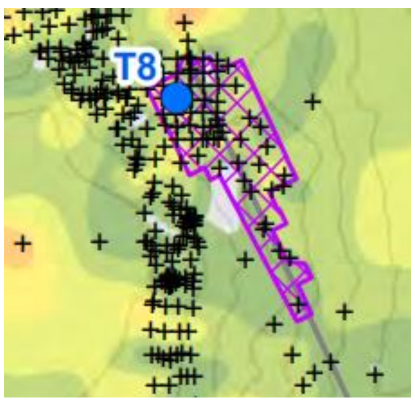
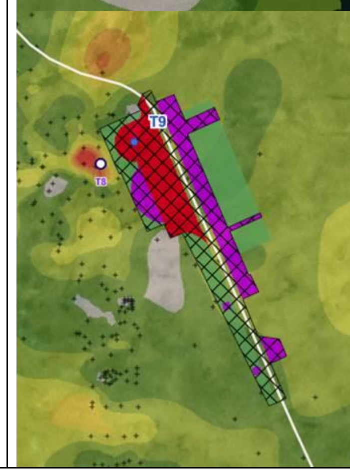
Area of Development	Issue/SEPA Comment	SLR Response
		
Length of track between T16 and T22/T20	While it's appreciated that track need to be below a specified slope – and a similar approach was taken with the last application - there is a very long track to join T16 to T22/T20. Are there opportunities to make it shorter and what alternative options were considered in this area. Could this track be removed and access to this array taken from the existing road via T18. Comment regarding info on the significant crossing in your letter noted – as a quick reminder NPF4 will require climate change to be taken into consideration when sizing the structure.	We have considered the suggestions here and looked to see if there are any other options for getting to the southern turbines. We are of the opinion that there is no realistic / better alternative currently available for this section of track. There is no possibility of using the existing road as it passes through the Eishken lodge area as this is currently an 'exclusion' zone for the wind farm infrastructure. Comment noted regarding NPF4, thank you, and will be included in the assessment.

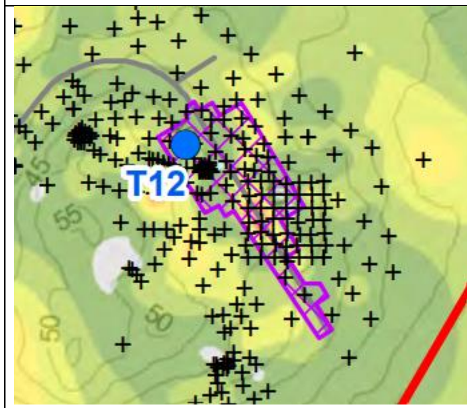
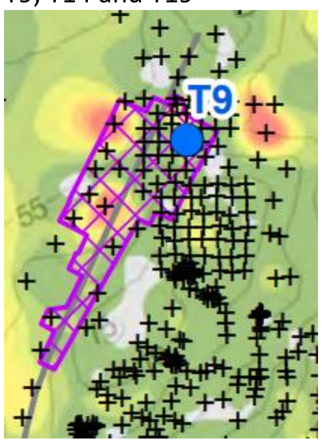
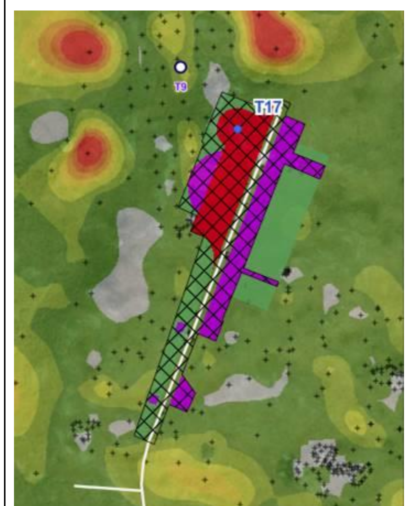
Area of Development	Issue/SEPA Comment	SLR Response
		
Track to T17 	The track from T19 to T17 is proposed within the buffer zone to three watercourses, on steep slopes and therefore in a high risk area. Access to T17 from T20 would result in a shorter track in a less sensitive area.	We have moved T17 further west and have also amended the access track. The new track is not from T20 to T17 due to the topography and steep slopes in the area, however, does now avoid the watercourses highlighted here. Below image shows the new alignment and also shows the challenges of running track from T20 to T17. T20 and T17 Slope / Topography Image:

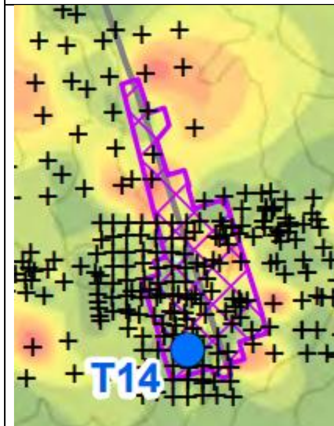
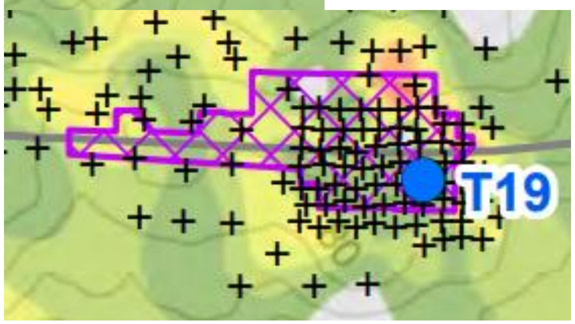
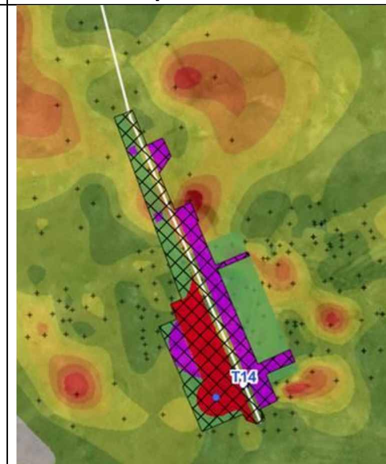
Area of Development	Issue/SEPA Comment	SLR Response
		 T20 and T17 3D Topography Image: 

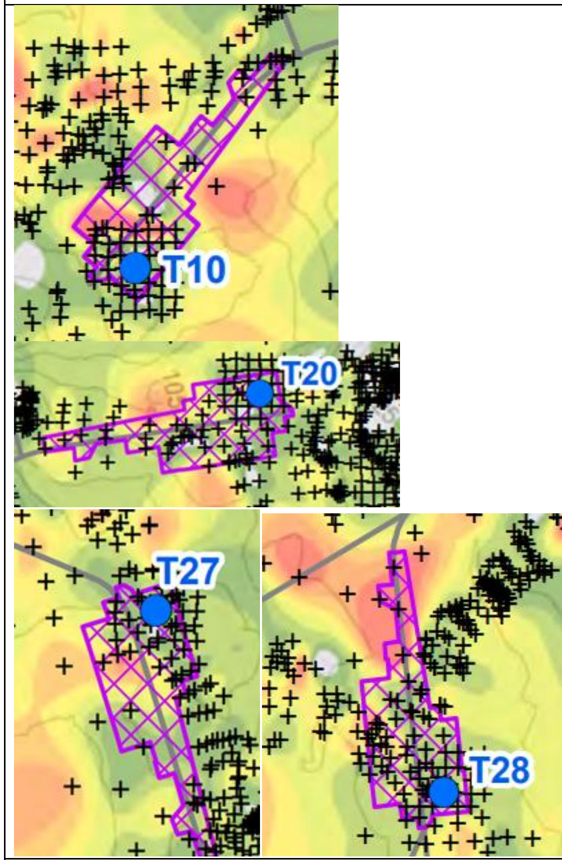
Peat:

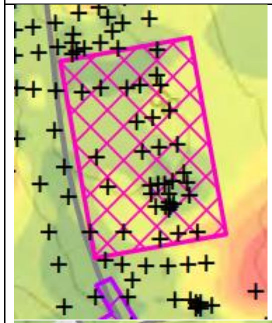
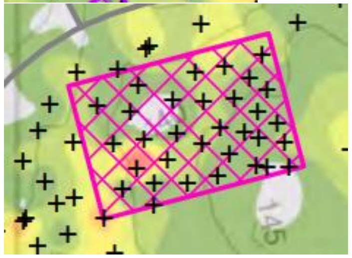
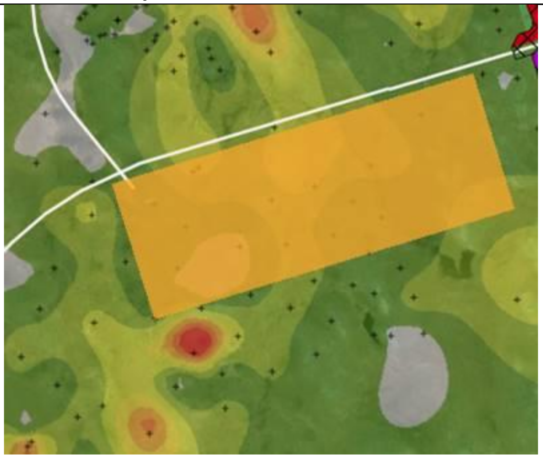
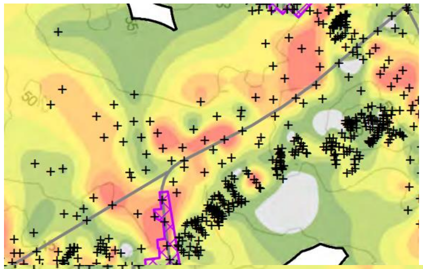
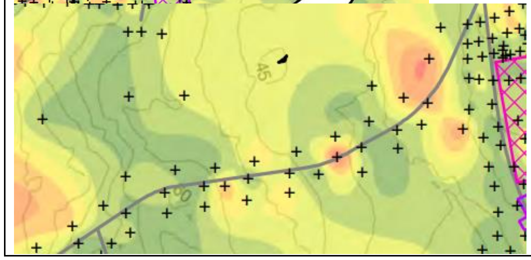
Example of area of development	Issue/SEPA Comment	SLR Response (screenshot of new locations / orientation)
T1, T8 and T12	Infrastructure needs to be moved to avoid the only areas of deeper peat in the vicinity	T1, T8 (now T9), T12 (now T18)

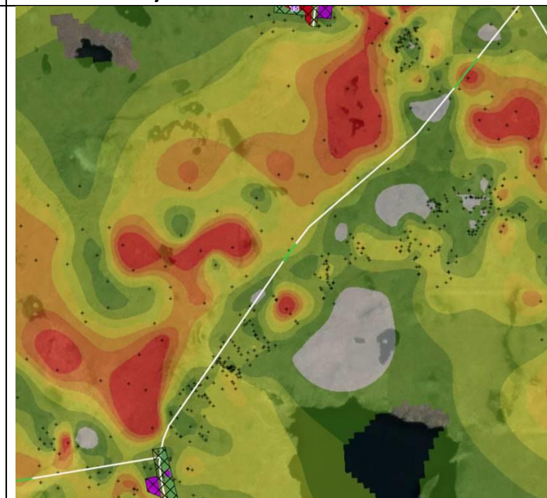
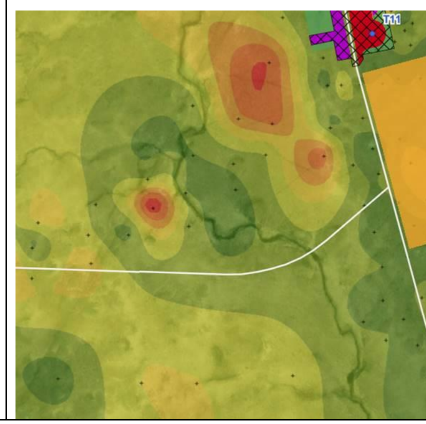
Example of area of development	Issue/SEPA Comment	SLR Response (screenshot of new locations / orientation)
 		 

Example of area of development	**Issue/SEPA Comment**	**SLR Response (screenshot of new locations / orientation)**
		
T9, T14 and T19 	Supporting infrastructure needs to be flipped to avoid the areas of deepest peat	T9 (now T17), T14, T19 (now 24) 

Example of area of development	Issue/SEPA Comment	SLR Response (screenshot of new locations / orientation)
 		 
T10, T20 , T27 and T28	Supporting infrastructure needs to be moved out of the deeper peat – turbine may need to be moved to achieve this.	T10, T28 (now T11), T27 (now T4)

Example of area of development	Issue/SEPA Comment	SLR Response (screenshot of new locations / orientation)
		 
Construction compounds	Shape needs to be changed to avoid deep peat or locations moved	Southernmost construction compound

Example of area of development	Issue/SEPA Comment	SLR Response (screenshot of new locations / orientation)
 		
Track to T10 and between T28 and T14  	The track to T10 is on an extensive area of peat > 3 m deep but there is shallow peat to the south. The track west of T28 goes over small pockets of deep peat – which could be avoided by moving north or south.	Track to T10 and between T28 (now T11) and T14

Example of area of development	Issue/SEPA Comment	SLR Response (screenshot of new locations / orientation)
		 

GWDTE:
The amendments to the proposed wind farm design have not placed additional infrastructure into areas of high potential GWDTE. A draft of the GWDTE assessment is currently being finalised and we can forward a copy of this when complete, if you would like.

Hopefully the above is helpful and shows that we have taken on board your comments and recommendations where possible. Should you have any further comments, following your review, we'd be pleased to receive them.

Thank you again,

[redacted]

d [redacted]
o [redacted]
m [redacted]
e [redacted]

[redacted]

From: [redacted]
Sent: Thursday, March 30, 2023 1:22 PM
To: [redacted]
Cc: [redacted]
Subject: Uisenis Wind Farm - Post Gatecheck review - SEPA response 8540

OFFICIAL

<u>SEPA email response 8540</u>

Dear Gordon

Uisenis Wind Farm – SEPA comments on proposed layout

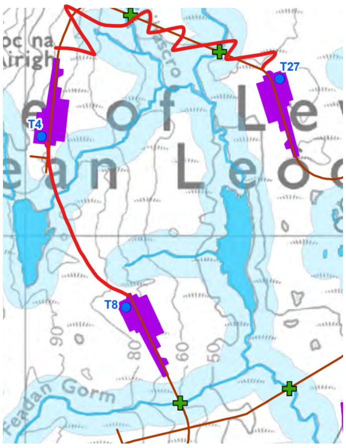
Thank you for consulting us further on the above development prior to the application being submitted. We welcome this engagement. I appreciate that a huge amount of time and effort will have gone into determining the revised layout but unfortunately from SEPA's perspective the currently layout would not be acceptable to us due the impacts it would have on the water environment and on peat.

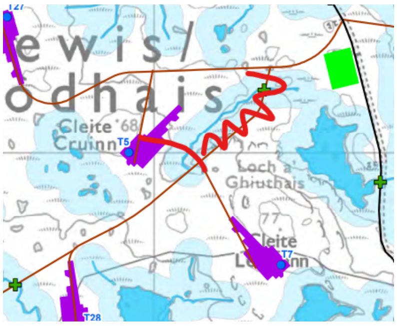
There are many areas where infrastructure is proposed on deeper peat which could be avoided, in some locations by changing the orientation of the supporting infrastructure and in other locations turbines would need to be moved as well. There are a number of areas where an alternative track layout would avoid or minimise impacts on issues within our interests and there are a couple of locations where turbine infrastructure would seem to have a direct impact on watercourses, which we would not accept.

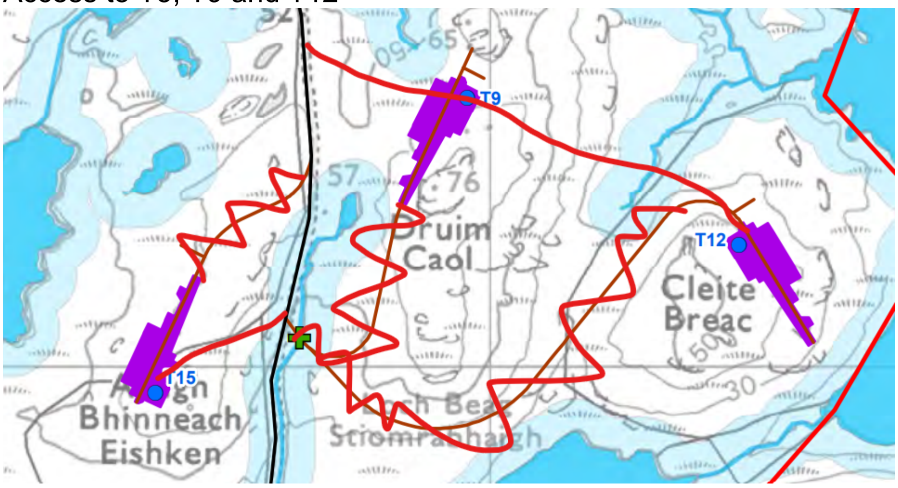
Below I have provided *examples of the types of issue* I have identified while looking at the layout; from SEPA's perspective there is a need to consider further many of the individual aspects of the infrastructure and I would encourage you to do that prior to formal submission to try and avoid an objection from us. I am very happy to provide more detailed comments at a later stage if that would be helpful, once the GWDTE issues are fully bottomed out (although I do not foresee that being an issue) and consideration is also given to habitat quality.

<u>General layout comments</u>

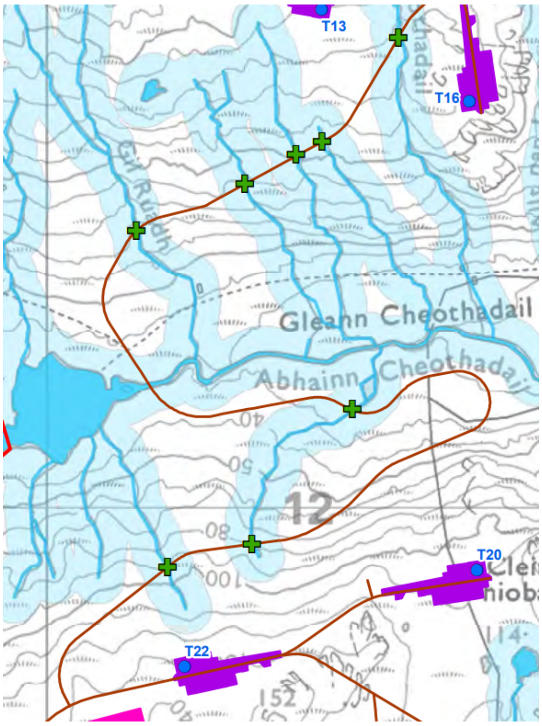
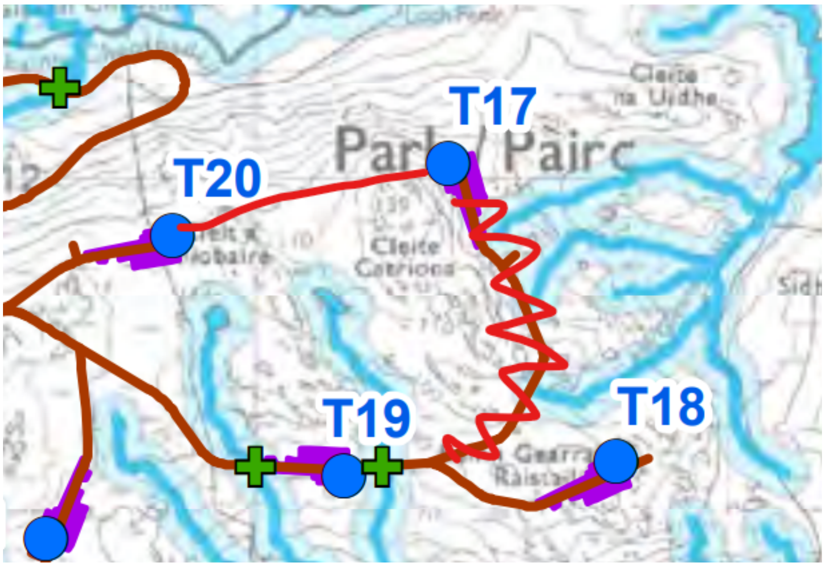
In general terms the shorter the track the less environmental impacts in relation to our interests. While it's appreciated that gradient dictates track routes, as well as there being a need for larger turning circles to move bigger infrastructure there seems to be a number of locations where an alternative layout would reduce impacts on peat (although I acknowledge that condition hasn't been taken into consideration yet by me) and the water environment. Below are examples of areas of the development of concern in this regard.

Area of development	Issue
Track to T4 	Accessing T4 from T8 would reduce the length of tracks and number of watercourse crossings. Probing shows peat depth is similar.
Track in T5 area	An alternative configuration such as accessing T7

<table>
<tr>
<td>
</td>
<td>from T5 would reduce the length of track and number of watercourse crossings</td>
</tr>
<tr>
<td>T-junction near construction compound

</td>
<td>A T-junction would reduce track length</td>
</tr>
<tr>
<td>Access to T5, T9 and T12

</td>
<td>A more direct access from the existing road to T15 would reduce the length of track.

A more direct access to T9 and then T12 would significantly reduce track length</td>
</tr>
<tr>
<td>Length of track between T16 and T22/T20</td>
<td>While it’s appreciated that track need to be below a specified slope – and a similar approach was taken with the last application - there is a very long track to join T16 to T22/T20. Are there opportunities to make it shorter and what alternative options were considered in this area. Could</td>
</tr>
</table>

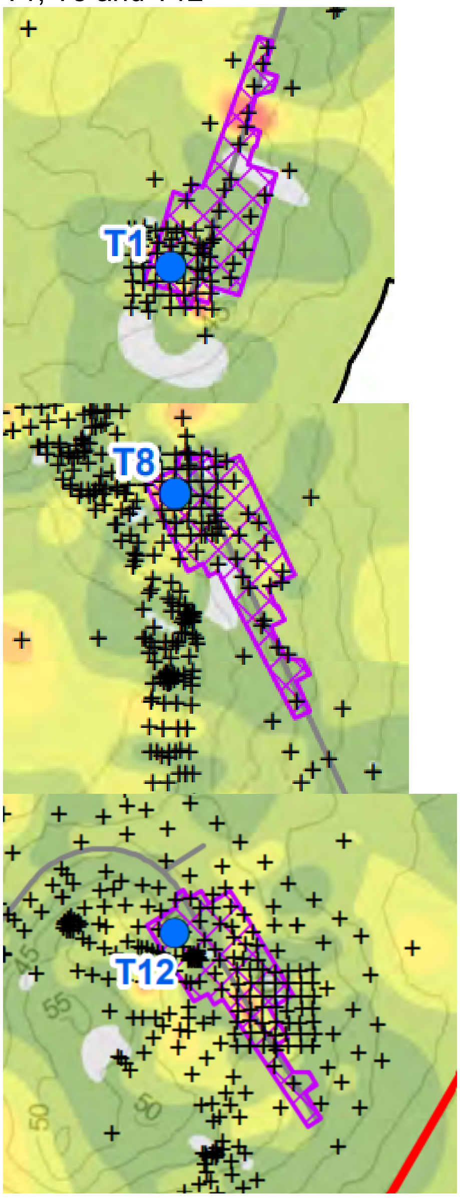
	this track be removed and access to this array taken from the existing road via T18. Comment regarding info on the significant crossing in your letter noted – as a quick reminder NPF4 will require climate change to be taken into consideration when sizing the structure.
Track to T17 	The track from T19 to T17 is proposed within the buffer zone to three watercourses, on steep slopes and therefore in a high risk area. Access to T17 from T20 would result in a shorter track in a less sensitive area.

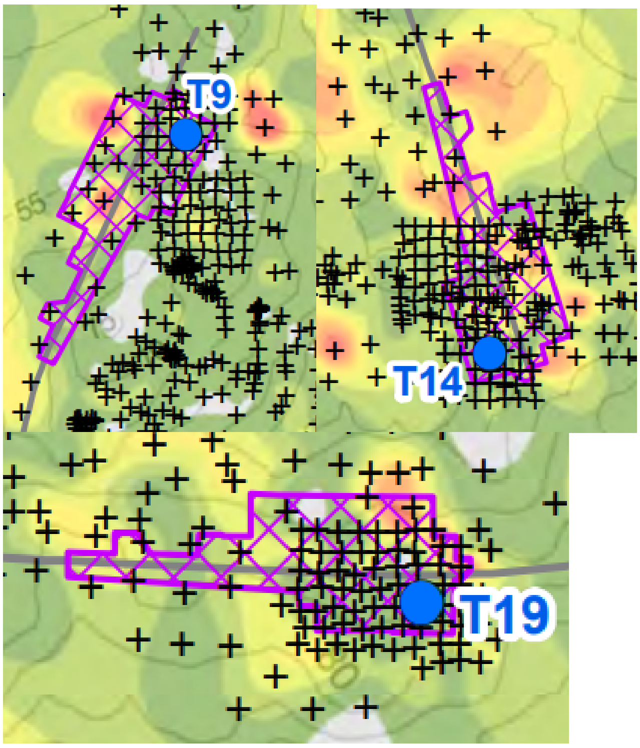
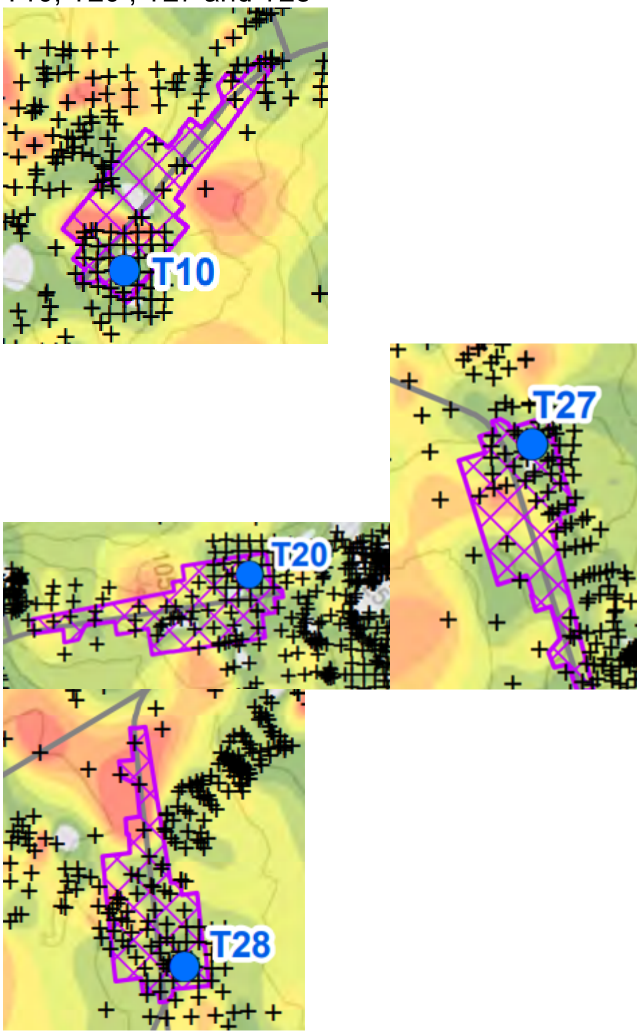
<u>Layout in relation to buffers to the water environment</u>

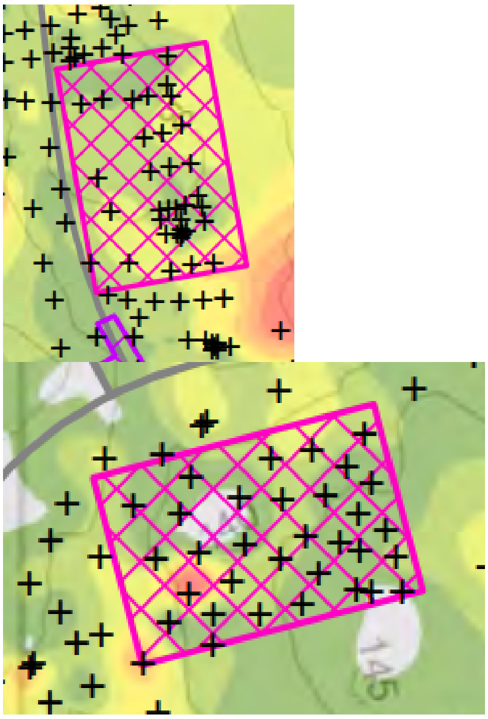
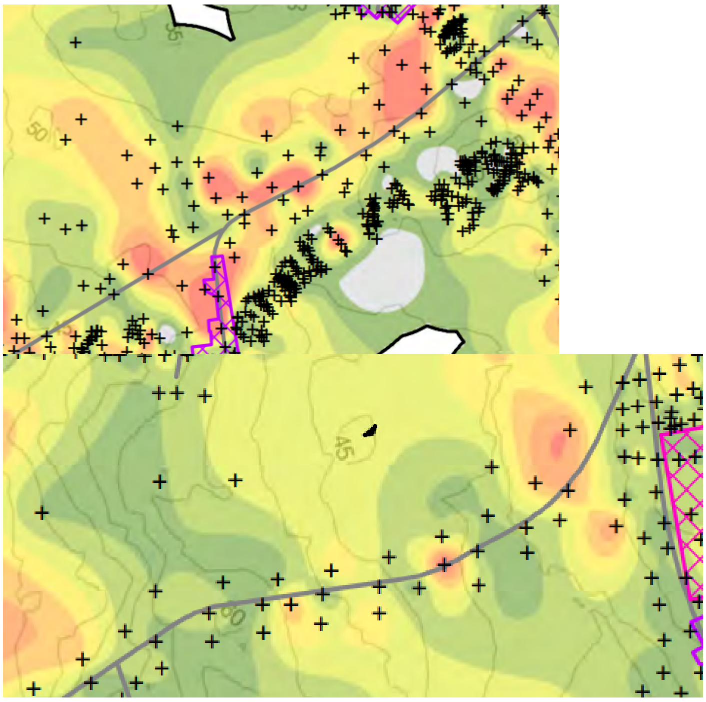
We note that you have indicated that its not possible to observe the 50 buffer in all infrastructure locations. Smaller buffers may be acceptable to us on a site-specific case where suitable site-specific mitigation is identified and there are no specific downstream sensitives (we would be happy to provide comments on a draft of this element prior to submission if that would be helpful). However with the obvious exception of watercourse crossings we would not accept any proposals which resulted in engineering works within the banks of a watercourse and in this regard the supporting infrastructure for T1 and T19 will need to be modified to ensure a suitable buffer to the water.

<u>Layout in relation to impacts on peat</u>

As we known from the last application much if not all of the development is on peat. The peat probing information which has been collected, which I acknowledge is extensive, shows that much of the site is shallower peat but there are a number of relatively large areas of deeper peat (greater than 3 m - if you could identify how deep the > 3 m deep probes are on the final version of the plans that would be very helpful) as well as smaller pockets. It is not clear from the current layout that project design has applied the mitigation hierarchy outlined in NPF4 policy 5, avoiding and minimising impacts on peat. Example of issues below. Again at this stage I acknowledge I have not taken into consideration any measures you may have taken to avoid near natural/good quality habitat, which would influence SEPA’s final position.

Example of area of development	Issue
T1, T8 and T12  	Infrastructure needs to be moved to avoid the only areas of deeper peat in the vicinity
T9, T14 and T19	Supporting infrastructure needs to be flipped to avoid the areas of deepest peat

	
T10, T20 , T27 and T28 	Supporting infrastructure needs to be moved out of the deeper peat – turbine may need to be moved to achieve this.

Construction compounds 	Shape needs to be changed to avoid deep peat or locations moved
Track to T10 and between T28 and T14 	The track to T10 is on an extensive area of peat > 3 m deep but there is shallow peat to the south. The track west of T28 goes over small pockets of deep peat – which could be avoided by moving north or south.

GWDTE

It looks like you have collected good baseline habitat information and as we knew already much of the site is potentially groundwater dependant. I note that it is considered that all of the potentially dependant habitats are not groundwater dependant in this location, and you'll forward that assessment for our consideration when its ready. I'll send to our ecologists at that stage and provide detailed comments then.

Even if we disagree that all the habitats are not groundwater dependant, I note that no new development is proposed in a habitat of potentially high groundwater dependence (there are some impacts from the upgrade of the road/track) and the development will directly impact on only a small number of flushes, so hopefully not a significant issue. I recommend that your final submission highlight that the proposal is to include flush mitigation to maintain hydrology whether groundwater dependant or not. If that's the case, and the detailed target notes don't indicate any specific unusual habitats, hopefully we will not have any significant issues.

I'm about to go on holiday but after Easter I'm very happy for us to Teams meet to discuss the proposals further if that would be helpful. I've copied in Debbie so she is aware of this correspondence.

Kind regards

Susan

[redacted]

TECHNICAL APPENDIX 11.1: CULTURAL HERITAGE ASSETS GAZETTEER

Uisenis Wind Farm

Prepared for: Uisenis Power Limited

SLR Ref: 405.V64341.00001
Version No: 1
August 2023

DESIGNATED CULTURAL HEIRTAGE ASSETS

Designation Reference	Asset Title	Designation Type	Category
LB12766	Bridge, Aline, Harris	Listed Building	C
LB13331	Park Free Church, Grabhir, Lewis	Listed Building	C
LB13332	Former School And Schoolhouse, Gravir, Lewis	Listed Building	B
LB13333	Kinloch Church	Listed Building	C
LB13335	Planasker Primary School And Schoolhouse, Marvig, Lochs	Listed Building	B
LB49675	Ardvourlie Castle, Harris	Listed Building	B
LB49675	Bridge, Ardvourlie Castle, Harris	Listed Building	B
SM5351	Sideval,stone circle 400m S of	Scheduled Monument	
SM5345	St Columb's Church,Eilean Chaluim Chille	Scheduled Monument	
SM1670	Dun Cromore,broch,Loch Cromore	Scheduled Monument	
SM90054	Calanais or Callanish Standing Stones	Scheduled Monument	

NON-DESIGNATED HERITAGE ASSETS

MonUID	Period	MonTypes	GridRef	SLR Number
MWE133917	Undated	TOWN?	NB 29090 16150	SLR32
MWE133918	Undated	CORN MILL, MILL?	NB 29870 16000	SLR33
MWE133919	Undated	SHIELING?	NB 29980 15890	SLR34
MWE133920	Post Medieval	TOWN	NB 27900 16600	SLR35
MWE133921	Undated	TOWN	NB 28400 16400	SLR36
MWE133922	Undated	BUILDING, ENCLOSURE, WALL?	NB 29100 16570	SLR37
MWE133975	Undated	FIELD SYSTEM	NB 28200 16000	SLR38
MWE133976	Undated	ENCLOSURE	NB 28450 16070	SLR39
MWE133980	Post Medieval	BUILDING, SITE, BLACK HOUSE	NB 27460 16650	SLR40
MWE134013	Undated	SHIELING?	NB 32900 16100	SLR41
MWE144532	Post Medieval	FIELD BOUNDARY, WALL	NB 28044 18906	SLR42

MonUID	Period	MonTypes	GridRef	SLR Number
MWE144533	Crofting	DAM	NB 28040 18875	SLR43
MWE144534	Undated	ISLAND, CAUSEWAY, CRANNOG?	NB 27925 18792	SLR44
MWE144535	Post Medieval	FIELD BOUNDARY, WALL	NB 27967 18625	SLR45
MWE144561	Later Prehistoric	ISLAND, JETTY, CRANNOG?	NB 27886 17783	SLR46
MWE144562	Post Medieval	FIELD BOUNDARY, WALL, DYKE	NB 28419 18380	SLR47
MWE144563	Post Medieval	FIELD BOUNDARY, DYKE	NB 28106 18502	SLR48
MWE144564	Post Medieval	FIELD BOUNDARY, WALL, DYKE	NB 27893 18606	SLR49
MWE144567	Post Medieval	FIELD BOUNDARY, WALL, DYKE, DRAINAGE DITCH	NB 28075 17785	SLR50
MWE144577	Early Prehistoric	CAIRN, KERB CAIRN	NB 28399 17616	SLR51
MWE144578	Post Medieval	FIELD BOUNDARY, WALL, DYKE, DRAINAGE DITCH	NB 28550 17650	SLR52
MWE144580	Lower Palaeolithic to Crofting	WALL?, CAUSEWAY?, FISH GARTH?	NB 28073 17745	SLR53
MWE144581	Post Medieval	FIELD BOUNDARY, WALL, DYKE	NB 27877 17847	SLR54
MWE144582	Medieval to Crofting	ROAD BRIDGE, CLAPPER BRIDGE?, BRIDGE	NB 27720 17929	SLR55
MWE144583	Post Medieval	FIELD BOUNDARY, DYKE, DRAINAGE DITCH	NB 27996 17695	SLR56
MWE144584	Post Medieval	FIELD BOUNDARY, DYKE	NB 27898 17607	SLR57
MWE144585	Post Medieval	FIELD BOUNDARY, WALL, DYKE	NB 28855 17686	SLR58
MWE144586	Post Medieval	HORIZONTAL MILL	NB 27759 18012	SLR59
MWE144591	Post Medieval	FIELD BOUNDARY, WALL, DYKE	NB 27849 17553	SLR60
MWE144592	Early Prehistoric	FIELD BOUNDARY, WALL	NB 27514 17426	SLR61
MWE144593	Crofting	FISH GARTH	NB 27500 17525	SLR62
MWE144594	Early Prehistoric	FIELD BOUNDARY, WALL, FIELD SYSTEM	NB 27497 17696	SLR63
MWE144595	Early Prehistoric	FIELD BOUNDARY, WALL, FIELD SYSTEM	NB 27501 17726	SLR64
MWE144596	Crofting	MILL RACE	NB 27724 17962	SLR65
MWE144598	Undated	CAIRN, MARKER CAIRN?	NB 28268 17095	SLR66
MWE144599	Undated	CAIRN, MARKER CAIRN	NB 29146 16867	SLR67
MWE144600	Post Medieval	FIELD SYSTEM	NB 27648 16643	SLR68

MonUID	Period	MonTypes	GridRef	SLR Number
MWE144601	Prehistoric	STANDING STONE, CARVED STONE?	NB 27909 17407	SLR69
MWE144602	Early Prehistoric	WALL	NB 28052 17064	SLR70
MWE144603	Early Prehistoric	ENCLOSURE	NB 27573 16611	SLR71
MWE144604	Post Medieval	FIELD SYSTEM	NB 28301 16882	SLR72
MWE144605	Post Medieval	HOUSE, BLACK HOUSE	NB 27990 17035	SLR73
MWE144606	Medieval to Post Medieval	SHIELING	NB 28071 17161	SLR74
MWE144607	Post Medieval	SHIELING	NB 27814 17366	SLR75
MWE144608	Post Medieval	SHIELING	NB 27855 17349	SLR76
MWE144609	Lower Palaeolithic to Post Medieval	SHIELING?, KERB CAIRN?	NB 27948 17032	SLR77
MWE144610	Early Prehistoric		NB 27651 17204	SLR78
MWE144611	Crofting	SCHOOL, SCHOOL HOUSE, PREFABRICATED BUILDING, GARDEN	NB 28767 16534	SLR79
MWE144612	Crofting	BLACK HOUSE, TEACHERS HOUSE, HOUSE	NB 28760 16536	SLR80
MWE144613	Modern	DAM, FLOOD DEFENCES?	NB 29487 16532	SLR81
MWE144614	Medieval to Post Medieval	SHIELING	NB 28786 16541	SLR82
MWE144615	Crofting	BLACK HOUSE, SHED	NB 28772 16528	SLR83
MWE144616	Post Medieval	FIELD SYSTEM	NB 28226 16674	SLR84
MWE144617	Post Medieval to Crofting	ENCLOSURE, STACK YARD	NB 28202 16607	SLR85
MWE144618	Crofting	HOUSE, BLACK HOUSE, LONGHOUSE	NB 28197 16600	SLR86
MWE144619	Post Medieval to Crofting	FIELD BOUNDARY, WALL, DYKE	NB 28348 16477	SLR87
MWE144620	Crofting	HOUSE?, BLACK HOUSE?	NB 28144 16611	SLR88
MWE144621	Post Medieval	HOUSE, BLACK HOUSE, SMOKE HOUSE?	NB 28020 16623	SLR89
MWE144622	Post Medieval	ENCLOSURE, STACK YARD	NB 28139 16606	SLR90
MWE144623	Crofting	SHED?, BOTHY?, ENCLOSURE?, STOCK ENCLOSURE?	NB 27882 16636	SLR91
MWE144624	Post Medieval	FIELD BOUNDARY, WALL, DYKE	NB 28078 16615	SLR92

MonUID	Period	MonTypes	GridRef	SLR Number
MWE144625	Crofting	HOUSE, BLACK HOUSE, COW HOUSE, LONGHOUSE	NB 27927 16610	SLR93
MWE144626	Crofting to Modern	HOUSE, BLACK HOUSE, COW HOUSE, SHEEP DIP, SHEEP FOLD, LONGHOUSE	NB 27838 16634	SLR94
MWE144627	Crofting	ENCLOSURE, STACK YARD	NB 27831 16625	SLR95
MWE144628	Crofting	FIELD BOUNDARY, WALL, DYKE, HEAD DYKE	NB 28216 16716	SLR96
MWE144629	Crofting	FIELD BOUNDARY, WALL, DYKE	NB 27692 16646	SLR97
MWE144630	Crofting	FIELD BOUNDARY, WALL, DYKE	NB 27889 16676	SLR98
MWE144631	Early Prehistoric	CAIRN, KERB CAIRN	NB 28025 16709	SLR99
MWE144632	Crofting	HOUSE, BLACK HOUSE, COW HOUSE, LONGHOUSE	NB 28414 16477	SLR100
MWE144633	Post Medieval to Crofting	HOUSE, BLACK HOUSE, COW HOUSE, LONGHOUSE, BARN?	NB 28445 16453	SLR177
MWE144634	Post Medieval to Crofting	ENCLOSURE, STACK YARD	NB 28449 16450	SLR178
MWE144635	Post Medieval to Crofting	HOUSE, BLACK HOUSE, COW HOUSE, LONGHOUSE, BARN?	NB 28409 16455	SLR103
MWE144636	Post Medieval to Crofting	ENCLOSURE, STACK YARD	NB 28407 16453	SLR104
MWE144637	Crofting	ENCLOSURE, STACK YARD	NB 28412 16468	SLR105
MWE144638	Post Medieval to Crofting	FIELD BOUNDARY, WALL, DYKE	NB 28467 16380	SLR106
MWE144639	Post Medieval to Crofting	WELL	NB 28491 16381	SLR107
MWE144640	Crofting	NAUST, SLIPWAY	NB 28509 16351	SLR108
MWE144641	Crofting	FIELD BOUNDARY?, WALL, PIER?, DYKE	NB 28846 16376	SLR109
MWE144642	Undated	WALL, DYKE	NB 28590 16337	SLR110
MWE144643	Early Prehistoric		NB 28760 16386	SLR111
MWE144644	Post Medieval to Crofting	FIELD SYSTEM	NB 28562 16517	SLR112
MWE144645	Post Medieval	FIELD BOUNDARY, WALL, DYKE	NB 29077 16567	SLR113
MWE144646	Post Medieval	FIELD SYSTEM	NB 29177 16467	SLR114
MWE144647	Crofting	FIELD BOUNDARY, WALL, DYKE	NB 29249 16339	SLR115

MonUID	Period	MonTypes	GridRef	SLR Number
MWE144648	Post Medieval	BARN?, BOTHY?, SHIELING?, SMOKE HOUSE?	NB 29110 16361	SLR116
MWE144649	Post Medieval	BLACK HOUSE, BARN?, SMOKE HOUSE?	NB 29109 16362	SLR117
MWE144650	Undated	SMOKE HOUSE?	NB 29115 16358	SLR118
MWE144651	Undated	WALL, DYKE	NB 29125 16367	SLR119
MWE144653	Crofting	TOILET, PREFABRICATED BUILDING, DRAIN	NB 29498 16355	SLR120
MWE144654	Crofting to Modern	HOUSE, BLACK HOUSE	NB 29419 16391	SLR121
MWE144655	Crofting	ENCLOSURE, STACK YARD	NB 29421 16385	SLR122
MWE144656	Crofting	BRIDGE	NB 29501 16400	SLR123
MWE144657	Modern	BRIDGE	NB 29520 16321	SLR124
MWE144658	Crofting	FIELD BOUNDARY, WALL, DYKE	NB 29617 16363	SLR125
MWE144659	Undated	DAM, FISH TRAP?	NB 29294 16345	SLR126
MWE144660	Undated	CAIRN, MARKER CAIRN	NB 30129 16701	SLR127
MWE144661	Medieval to Post Medieval	SHIELING	NB 30163 16371	SLR128
MWE144662	Post Medieval to Crofting	SHIELING	NB 30113 16369	SLR129
MWE144663	Medieval to Post Medieval	SHIELING	NB 30075 16330	SLR130
MWE144664	Medieval to Post Medieval	SHIELING	NB 30149 16373	SLR131
MWE144665	Post Medieval	SHIELING	NB 30236 16368	SLR132
MWE144666	Early Neolithic to Norse	SHIELING	NB 30267 16370	SLR133
MWE144667	Crofting	FIELD BOUNDARY, WALL, DYKE	NB 30141 16264	SLR134
MWE144994	Post Medieval	FIELD SYSTEM	NB 28482 16556	SLR135
MWE144995	Post Medieval	BLACK HOUSE, HOUSE, COW HOUSE, LONGHOUSE	NB 28444 16559	SLR136
MWE144996	Post Medieval	WELL	NB 28426 16555	SLR137
MWE144997	Post Medieval	BLACK HOUSE, HOUSE, COW HOUSE, LONGHOUSE	NB 28483 16542	SLR138
MWE144998	Post Medieval	FIELD BOUNDARY, WALL, DYKE	NB 28419 16576	SLR139

MonUID	Period	MonTypes	GridRef	SLR Number
MWE144999	Crofting	SHIELING?, SMOKE HOUSE?	NB 27470 16633	SLR140
MWE145000	Norse	HOUSE	NB 27465 16642	SLR141
MWE145001	Post Medieval to Crofting	KILN?, KELP KILN?	NB 27467 16608	SLR142
MWE145002	Post Medieval to Crofting	KILN?, KELP KILN?	NB 27464 16607	SLR143
MWE145003	Post Medieval to Crofting	KILN?, KELP KILN?	NB 27489 16614	SLR144
MWE145004	Post Medieval to Crofting	KILN?, KELP KILN?	NB 27483 16614	SLR145
MWE145005	Post Medieval to Crofting	STRUCTURE, HUT?	NB 27466 16630	SLR146
MWE145006	Post Medieval to Crofting	STRUCTURE, HUT?	NB 27464 16630	SLR147
MWE145007	Undated	STRUCTURE	NB 27491 16623	SLR148
MWE145008	Post Medieval	FIELD SYSTEM	NB 27499 16636	SLR149
MWE145009	Undated	KILN?, KELP KILN?	NB 27499 16610	SLR150
MWE145011	Medieval to Post Medieval	ENCLOSURE, PROMONTORY ENCLOSURE	NB 27463 16600	SLR151
MWE145012	Medieval	STRUCTURE, HOUSE?	NB 27486 16613	SLR152
MWE145013	Medieval	STRUCTURE	NB 27475 16605	SLR153
MWE145014	Medieval	STRUCTURE	NB 27504 16601	SLR154
MWE145015	Medieval	WALL, DYKE	NB 27508 16606	SLR155
MWE145016	Medieval to Post Medieval	BLACK HOUSE, HOUSE, COW HOUSE, LONGHOUSE	NB 29144 16439	SLR156
MWE145017	Post Medieval	FIELD SYSTEM	NB 28741 16538	SLR157
MWE145018	Post Medieval	FIELD BOUNDARY, WALL, DYKE	NB 29194 16467	SLR158
MWE145573	Undated	BRIDGE	NB 27724 17921	SLR159
MWE145574	Undated	MILL, LEAT	NB 27768 18009	SLR160
MWE145575	Undated	DYKE	NB 27690 17850	SLR161
MWE145576	Undated	DYKE	NB 27520 17410	SLR162
MWE145577	Undated	STANDING STONE	NB 27984 17345	SLR163
MWE145579	Undated	BLACK HOUSE	NB 28088 17026	SLR164

MonUID	Period	MonTypes	GridRef	SLR Number
MWE145580	Undated	CAIRN	NB 28258 17013	SLR165
MWE145582	Undated	HEAD DYKE	NB 28250 16710	SLR166
MWE145583	Undated	FIELD SYSTEM	NB 27710 16710	SLR167
MWE145584	Undated	BLACK HOUSE, DYKE, WELL	NB 28455 16586	SLR168
MWE145585	Undated	FIELD SYSTEM	NB 28562 16517	SLR169
MWE145589	Undated	BLACK HOUSE, ENCLOSURE	NB 29416 16394	SLR173
MWE145590	Undated	BRIDGE	NB 29506 16384	SLR174
MWE145591	Undated	DYKE	NB 29615 16365	SLR175
MWE145692	Pre Clearance	HEAD DYKE	NB 279 175	SLR176
MWE146004	Prehistoric	KERB CAIRN	NB 2827 1655	SLR172
MWE149816	Undated		NB 27919 18794	SLR171
MWE4135	Undated	STONE CIRCLE	NB 27810 16620	SLR170
MWE71058	Crofting	SHIELING?, SMOKE HOUSE?, SHED?	NB 28660 16340	SLR168
MWE144582	Medieval to Crofting	ROAD BRIDGE, CLAPPER BRIDGE?, BRIDGE	NB 27720 17929	SLR55
MWE144646	Post Medieval	FIELD SYSTEM	NB 29177 16467	SLR114
MWE144994	Post Medieval	FIELD SYSTEM	NB 28482 16556	SLR135
MWE144995	Post Medieval	BLACK HOUSE, HOUSE, COW HOUSE, LONGHOUSE	NB 28444 16559	SLR136
MWE144997	Post Medieval	BLACK HOUSE, HOUSE, COW HOUSE, LONGHOUSE	NB 28483 16542	SLR138
MWE144998	Post Medieval	FIELD BOUNDARY, WALL, DYKE	NB 28419 16576	SLR139
MWE145018	Post Medieval	FIELD BOUNDARY, WALL, DYKE	NB 29194 16467	SLR158
MWE145573	Undated	BRIDGE	NB 27724 17921	SLR159
N/A	Undated	Potential remains of Clan Mackenzie at Seaforth	N/A	SLR179
N/A	Likely post-medieval	Weir, 1m tall, 8m long. Concrete and rock, woodenbottom		SLR101
N/A	Likely	Lines of stones, 1m apartish, seem more modern, 8 ish in total		SLR102

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TECHNICAL APPENDIX 11.2: FIELDWORK WALKOVER REPORT AND SETTINGS ASSESSMENT

Uisenis Wind Farm

Prepared for: Uisenis Power Limited

SLR Ref: 405.V64341.00001
Version No: 1
August 2023

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1.0 Introduction

An archaeological and cultural heritage walkover survey was undertaken for Uisenis Wind Farm between 31 October and 03 November 2022. The turbine locations have moved, although within the same extent, since the visit to the Site. The photographs are within the vicinity of the proposed turbines, but no longer centred on the turbine locations.

The walkover survey was targeted to the proposed turbine locations at the time of the walkover survey, as well as any recorded heritage assets within the Site that were identified as having a potential direct impact from the proposed development. An exclusion zone was applied to the southeast corner of the Site, in the area surrounding the Eishken hunting lodge, due to the area being actively used as part of the active shooting and sporting estate.

2.0 Heritage Assets

2.1 SLR11

SLR11 is a set of two shielings, which sit on the northeast and southwestern banks of the Allt Sgrihascro burn. These assets are visible on the OS 125000 Map and aerial photographs. At the time of the walkover survey, the proposed trackway passes through the middle of the shielings. The southwestern shieling (Plate 1) is comprised of two cells, identifiable by their walls. The walls are mainly rubble and are a single course high in most places. This shieling is approximately 6m in length, 2m in width and 0.3m in height. The north-eastern shieling (Plate 2) comprises a single cell, approximately 2m in width and 2m in length. The walls of the shieling to the north are approximately 4 courses in height, with those to the south being approximately 1.

Plate 1 – SLR11, southwestern shieling.

Plate 3 – SLR11, north eastern shieling.

Plate 2 – SLR11 looking to the north, with Allt Sgrihascro running through the centre

2.2 SLR19

SLR19 is a collection of shielings which lie within Gleann Cheothadail. There are four obvious shielings, lying to the north and south of the track, as well as an area to the west that may have contained further shielings but now comprises rubble. In addition, there is a small drystone bridge spanning a burn, which may be contemporaneous with the shielings. The majority of the shielings are rubble and comprise a single course at most. They measure approximately 2m by 2m. The shieling to the northeast (Plate 4) is most complete, with 5 visible courses and four easily identifiable walls. At the time of the walkover survey, this asset was not at risk of direct impact from the proposed development.

Plate 4 – SLR19, north eastern shieling.

2.3 SLR20

SLR20 comprises 2 shielings within Gleann Cheothadail, to the north and south of the track. The northern shieling is identifiable on the OS 25000 Mapping. Both shielings were identifiable within the surrounding landscape, they are mostly rubble. At the time of the walkover survey they were not identified as being at risk of direct impact from the proposed development.

Plate 5 – SLR20, northern shieling

2.4 SLR23

SLR23 is a singular shieling on a east facing slope. The asset comprises four walls that with one visible course, approximately 0.5m. The asset is approximately 1.5m by 1.5m in size. At the time of the walkover survey, the asset is not at risk of direct impact from the proposed development.

Plate 6 – SLR23, view west looking toward SLR23.

2.5 SLR24

SLR24 is a potential shieling, located approximately 100m southwest of Turbine 10. The shieling is more circular in shape, with one visible course. The asset is approximately 1.5m in diameter.

Plate 7 – SLR24 looking to the north

2.6 SLR101

SLR101 is a weir located at the source of Abhainn Cheothadail, where it exits Loch na Beirighe and flows to the east. The weir is split into two sections, with the northern section comprising a solid weir, approximately 1m in height and 8m in length. The weir comprised a wooden base, with the main part being made of rock and concrete. The northern section was made of similar attributes, but had two gaps within to control the flow of the water. The asset is post-medieval in date, however an earlier weir may have existed at the site.

Plate 8 – SLR101, the northern portion of the weir

2.7 SLR102

A number of lines of stones were identified to the west of the pre-existing track. These lines of stones were all approximately 1m to 1.5m in length and approximately 1m apart. There are two rows of these stones and there are approximately 10 visible lines of stones. The precise date and function of these stones is unknown, but they may be used for drainage.

Plate 9 – SLR102, a portion of the lines of stones.

3.0 Turbines

All proposed turbine locations were visited as part of the Site walkover. Photographs were taken at all proposed turbine locations (as of October – November 2022) with a selection seen in Plates 10-36. It should be noted that turbine locations have moved as a result of the iterative design process, from their coordinates at the time of the cultural heritage Site walkover.

Plate 10 – Turbine 1

Plate 11 – Turbine 2

Plate 12 – Turbine 6

Plate 13 – Turbine 3

Plate 14 – Turbine 5

Plate 15 – Turbine 3

Plate 16 – Turbine 8

Plate 17 – Turbine 8 (Now removed)

Plate 18 – Turbine 17

Plate 19 – Turbine 10

Plate 20 – Turbine 15

Plate 21 – Turbine 18

Plate 22 – Turbine 12

Plate 23 – Turbine 14

Plate 24 – Turbine 16

Plate 25 – Turbine 13

Plate 26 – Turbine 19

Plate 27 – Turbine 20

Plate 28 – Turbine 21

Plate 29 – Turbine 25

Plate 30 – Turbine 21 (Now removed)

Plate 31 – Turbine 22 (Now removed)

Plate 32 – Turbine 24

Plate 33 – Turbine 22

Plate 34 – Turbine 25 (Now removed)

Plate 36 – Turbine 26 (Now removed).

Plate 35 – Turbine 27 (Now removed).

Plate 37 – View south from Sideval Stone Circle (SM5351).

Plate 38 – View southeast from Sideval Stone Circle (SM5351).

Plate 39 – View south facing the main circle of the Calanais Stone Circle (SM90054).

Plate 40 – View southwest facing the Calanais Stone Circle (SM90054).

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Uisenis Wind Farm

Technical Appendix 12.1: Transport Assessment

August 2023

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1 Introduction

1.1 Purpose of the Report

Pell Frischmann Consultants Ltd (PF) has been commissioned by Eurowind Energy Ltd (the applicant) to undertake a Transport Assessment (TA) for the proposed Uisenis Wind Farm (the proposed development), within the Eisgein (Eishken) Estate on the Isle of Lewis located approximately 20 kilometres (km) south west of Stornoway, within the administrative boundary of Comhairle nan Eilean Siar (CnES) / Western Isles Council.

The report identifies the key transport and access issues associated with the proposed development, including the route for abnormal loads. The TA identifies where the proposed development may require mitigation works to accommodate the predicted traffic; however, the detailed design of these remedial works is beyond the agreed scope of this report. Any mitigations works will be agreed with CnES prior to construction and deliveries taking place.

1.2 Report Structure

Following this introduction, the TA report is structured as follows:

- Section 2 describes the proposed development;
- Section 3 reviews the relevant transport and planning policies;
- Section 4 sets out the methodology used within this assessment;
- Section 5 describes the baseline transport conditions;
- Section 6 describes the trip generation and distribution of traffic in the Study Area;
- Section 7 summarises the traffic impact assessment;
- Section 8 considers mitigation proposals for development related traffic within the study network; and
- Section 9 summarises the findings of the TA and outlines the key conclusions.

2 Proposed Development

2.1 Site Location

The proposed development Site is located within the Eishken Estate on the Isle of Lewis located approximately 20km southwest of Stornoway. The location of the Site is shown in Image 12.1.

Image 12.1 Site Location

© Crown copyright and/or database right 2023 OS.

2.2 Proposed Development

The proposed development will comprise the following:

- 25 wind turbines, each up to a maximum tip height of 200 metre (m) with associated foundations and hardstanding areas;
- a network of on-site access tracks and associated watercourse crossings;
- a network of underground cables to connect the turbines to the proposed substation;
- temporary works, including borrow pits, construction compound(s), laydown area(s) and car park; and
- permanent anemometer equipment to measure wind speed and wind direction.

A complete description of the proposed development for the purposes of the Environmental Impact Assessment (EIA) regulations is provided in EIA Report Volume 2: Chapter 3: Description of Development.

At the time of writing, the proposed method and route used to transport the AILs to the Site has yet to be confirmed. There are currently two options being considered, namely Arnish Point Dock or a potential berthing facility on Loch Sealg at the south of the Site. For the purposes of preparing the TA and the Site Access, Traffic and Transport Chapter of the EIA Report (Volume 2: Chapter 12), it has been assumed that Arnish Point Docks would be used as the Port of Entry (POE) to ensure a robust assessment has been undertaken and the full potential impact on the local road network can be considered.

Should the Loch Sealg berthing facility be progressed as the preferred option at a later date, this would be progressed under a separate planning application.

2.3 Candidate Turbine

The Siemens Gamesa (SG) 155 was selected by the applicant as the candidate turbine for the purposes of this transport assessment. Details of the SG155 turbine have been obtained directly from SG. The details of the components are summarised in Table 1.

Table 1 Turbine Size Summary

Component	Length (m)	Width (m)	Height (m)	Weight (t)
Blade	76.571	4.424	3.000	25.600
Base Tower	14.034	4.800	4.800	84.400
Mid Tower 1	19.880	4.800	4.800	84.300
Mid Tower 2	22.400	4.800	4.794	73.900
Mid Tower 3	28.560	4.794	4.102	72.000
Top Tower	35.040	4.102	3.574	70.300

A detailed Route Survey Report detailing the turbine components in detail and the proposed access route is attached as Appendix A.

The selection of the final turbine model and specification will subject to a commercial procurement process following consent of the application. The assumed dimensions may therefore vary slightly from those assumed as part of this assessment.

To provide an accurate assessment scenario based upon the known issues along the access route, it has been assumed that all blades would be carried on a Super Wing Carrier trailer to reduce the need for physical mitigation in constrained sections of the route.

Given the sizes of the proposed mid and top tower sections, these along with other loads such as the hub and nacelle housing would be carried on a six-axle step frame trailer. The base tower would be carried in a 4+7 clamp trailer.

Examples of the vehicles and trailers are shown in Image 12.2 and 12.3.

Image 12.2 Super Wing Trailer

Image 12.3 Tower Trailer

3 Policy Context

3.1 Introduction

An overview of relevant transport planning policies has been undertaken and is summarised below for national and local government policies.

3.2 National Policy and Guidance

3.2.1 National Planning Framework (NPF4)

The National Planning Framework (NPF) is a long-term plan for Scotland that sets out where development and infrastructure is needed in the country. NPF4 sets out the Government's plan looking forward to 2045 that will guide spatial development, set out national planning policies, designate national developments and highlight regional spatial priorities. It is part of the development plan, and so influences planning decisions across Scotland.

Policy 11: Energy within the RDNPF4 notes that:

"*Development proposals for all forms of renewable, low-carbon and zero emissions technologies will be supported. These include:*

- *wind farms including repowering, extending, expanding and extending the life of existing wind farms;*
- *energy storage, such as battery storage and pumped storage hydro.*

- *In addition, project design and mitigation will demonstrate how the following impacts are addressed:*

    - *impacts on communities and individual dwellings, including, residential amenity, visual impact, noise and shadow flicker;*
    - *public access, including impact on long distance walking and cycling routes and scenic routes;*
    - *impacts on road traffic and on adjacent trunk roads, including during construction; and*
    - *cumulative impacts.*

NPF4 puts the climate and nature crises at the heart of the Scottish planning system and was adopted in February 2023.

The assessment undertaken as part of this TA and the associated EIAR has taken cognisance of this and provided appropriate mitigation where necessary.

3.2.2 Planning Advice Note (PAN) 75

Planning Advice Note (PAN) 75: Planning for Transport provides advice on the requirements for Transport Assessments. The document notes that:

"… transport assessment to be produced for significant travel generating developments. Transport Assessment is a tool that enables delivery of policy aiming to integrate transport and land use planning."

"All planning applications that involve the generation of person trips should provide information which covers the transport implications of the development. The level of detail will be proportionate to the complexity and scale of the impact of the proposal...For smaller developments the information on transport implications will enable local authorities to monitor potential cumulative impact and for larger developments it will form part of a scoping exercise for a full transport assessment. Development applications will therefore be assessed by relevant parties at levels of detail corresponding to their potential impact."

3.2.3 Transport Assessment Guidance (2012)

Transport Scotland's (TS) Transport Assessment Guidance was published in 2012. It aims to assist in the preparation of Transport Assessments (TA) for development proposals in Scotland such that the likely transport impacts can be identified and dealt with as early as possible in the planning process. The document sets out requirements according to the scale of development being proposed.

The document notes that a TA will be required where a development is likely to have significant transport impacts but that the specific scope and contents of a TA will vary for developments, depending on location, scale and type of development.

3.2.4 Onshore Wind Turbines; Online Renewables Planning Advice (May 2014)

The most recent Scottish Government advice note regarding onshore wind turbines was published in 2014. The advice note identifies the typical planning considerations in determining applications for onshore wind turbines including landscape impact, impacts on wildlife and ecology, shadow flicker, noise, ice throw, aviation, road traffic impacts, cumulative impacts and decommissioning.

In terms of road traffic impacts, the guidance notes that in siting wind turbines close to major roads, pre-application discussions are advisable. This is important for the movement of abnormal indivisible loads during the construction period, ongoing planned maintenance and for the decommissioning phase.

3.3 Local Policy and Guidance

3.3.1 Outer Hebrides Local Development Plan (2018)

The Outer Hebrides Local Development Plan (LPD) was adopted in November 2018, which sets out the planning policies of CnES to facilitate growth on the Islands.

Policy EI 8: Energy and Heat Resources states that:

"Proposals for all other renewable energy projects and oil and gas operations (including land-based infrastructure associated with offshore projects) will be required to demonstrate all the following:

- *a) appropriate location, siting and design including the technical rationale for the choice of site;*
- *b) no significant adverse impact (including cumulative) on: landscape, townscape and visual aspects; natural, built and cultural heritage resources; the water environment; peatlands; aviation, defence and telecommunications transmitting and receiving systems, e.g., broadband; public health and safety, and amenity (including noise); neighbouring land uses, transport management and core paths;*
- *c) appropriate decommissioning and site reinstatement arrangements;*
- *d) phasing arrangements, where appropriate;*
- *e) the contribution towards meeting national energy supply targets and local economic impact."*

"The type, scale and size of the proposed development will have a significant effect on the way the Comhairle will consider an application and the level of accompanying information that will be required. Conditions and, where necessary, a planning agreement may be used to control the detail of the development. Non-permanent elements of a development will be granted permission consistent with their lifespan and/or projected period of use."

Policy EI 9: Transport Infrastructure states that:

"The priority areas for the upgrading and development of the transport infrastructure within, and serving the Outer Hebrides, are:

- *a) the spinal and inter island routes;*
- *b) the airports at Barra, Balivanich and Stornoway; and*
- *c) ports and harbours, including ferry facilities for mainland and inter island connections.*

Development proposals associated with new or improved transport infrastructure and traffic management measures will be required to meet all the following:

1. *fit with the character of the area in relation to the Development Strategy and the immediate surrounding area and include a landscaping plan;*
2. *utilise a sustainable drainage system (SuDS) to deal with surface water; and*
3. *accommodate pedestrians (within settlements) and cyclists, and secure improved road safety related to the proposal, in particular around schools, community or leisure facilities.*

The Comhairle will support the provision of electric car charging points in new development (subject to appropriate design and layout)."

3.4 Policy and Guidance Summary

The proposed development can align with the stated traffic and transport policy objectives and the design of the Site and proposed mitigation measures will ensure compliance with national and local objectives.

4 Study Methodology

4.1 Introduction

There are three phases of the proposed development, all of which have been considered within the assessment and are as follows:

- the construction phase;
- the operational phase; and
- the decommissioning phase.

4.2 Project Phases – Transport Overview

Of the three phases, the construction phase is considered to have the greatest impact in terms of transport and potential impacts on the road network and sensitive receptors. Construction plant, bulk materials and wind turbine components will be transported to Site, potentially resulting in a significant increase in traffic on the study network. It should be noted however the construction effects are short lived and transitory in nature.

The operational phase is restricted to occasional maintenance operations which generate significantly lower volumes of traffic that are not considered to be in excess of daily traffic variation levels on the road network.

The decommissioning phase involves fewer trips on the road network than the construction phase, as minor elements of infrastructure are likely to be left in place, adding to local infrastructure that can potentially be used for further agricultural or leisure uses in the future.

4.3 Scoping Discussions

The applicant submitted a request for scoping opinion to the Scottish Ministers in respect of the EIA which included a section considering traffic and transport. A full review of that scoping opinion and other correspondence relating to the scope of the study including pre-application advice is provided in the Site Access, Traffic and Transport Chapter of the EIA Report (Volume 2: Chapter 12).

5 Baseline Conditions

5.1 Access Arrangement

The main road providing strategic access to the proposed development is the A859 which runs from Stornoway to the northeast to Tarbert, Leverburgh and Rodel to the south. Turbines may be delivered to a Site specific berthing station or to the port at Arnish and transported along the A859.

Access to the proposed development from the A859 will be taken from the unclassified Eishken Road just to the southwest of the A859/B8060 junction. The Eishken Road is a single-track road with passing places and runs southeast from the A859 into the site with some isolated dwellings accessed from the road. Construction traffic associated with the development will approach from the A859 using the Eishken Road that will be upgraded, where required, to suit the proposed traffic volumes and composition.

5.2 Study Determination

The Study Area has been based on those roads that are expected to experience increased traffic flows associated with the construction of the proposed development. The geographic scope was determined through a review of the other developments in the area, Ordnance Survey (OS) plans and an assessment of the potential origin locations of construction staff and supply locations for construction materials.

Access opportunities and routing options are limited given the road network available on the island. Access for construction materials would be predominantly from the north and south via the A859. Materials would be sourced where available from suppliers located on the island or alternatively brought from the mainland to one of the ports.

Access for Abnormal Indivisible Loads (AIL) associated with turbine component delivery will be taken either via Eishken Road or from a future marine facility located at the Site. A full description of the route is described in later sections with details of the constraints.

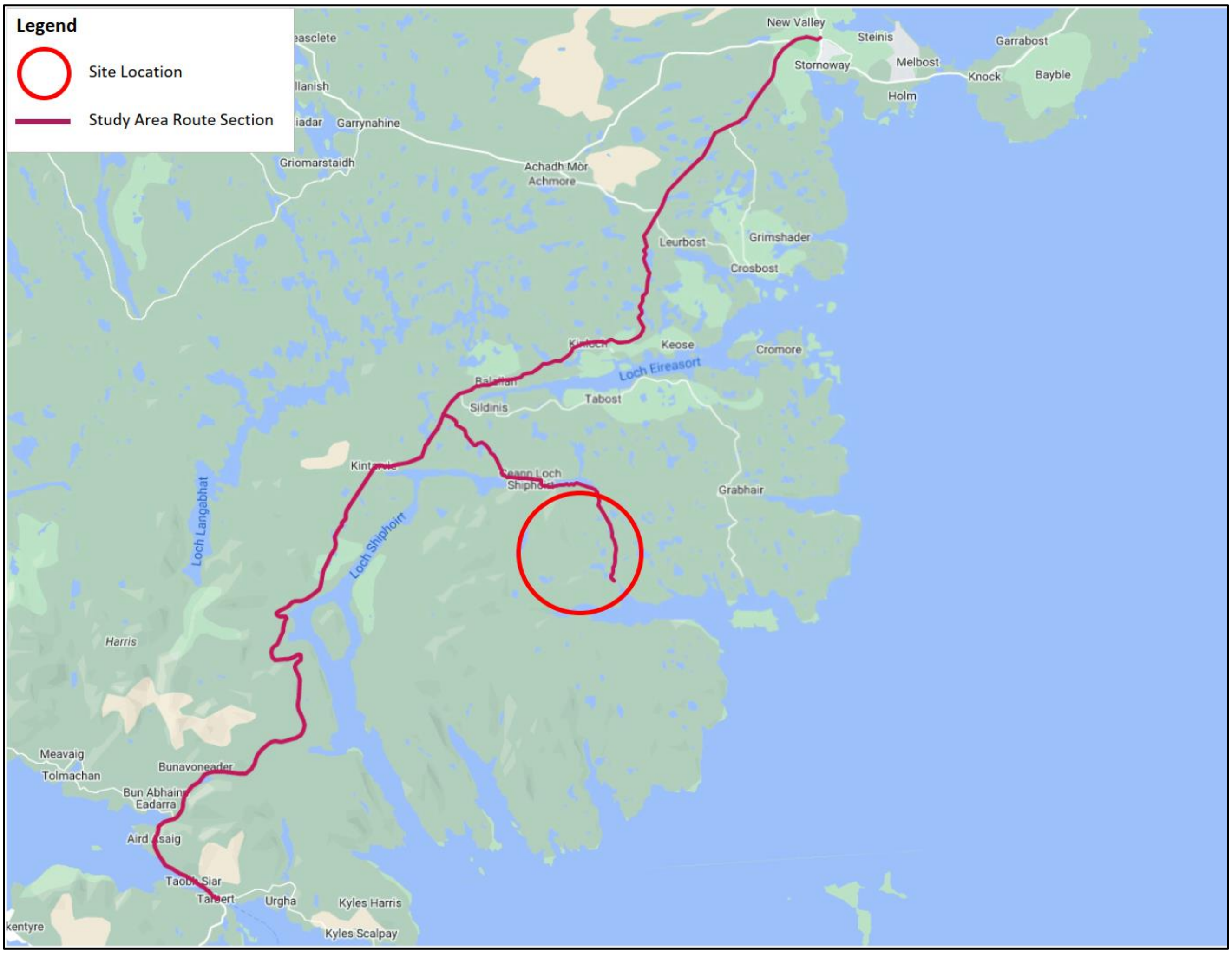
The Study Area for the assessment has therefore been assumed to be:

- the A859 between Tarbert and Stornoway; and
- the Eishken Road from its junction with the A859 to Eishken Lodge.

Effects associated with construction traffic generated by the proposed development, would be most pronounced in close proximity to the Site access junction and on the final approaches to the Site. As vehicles travel away from the proposed development, they would disperse across the wider road network, thus diluting any potential effects. It is therefore expected that the effects relating to construction traffic are unlikely to be significant beyond the Study Area identified above.

The Study Area is shown in Image 12.4.

Image 12.4 Transport Assessment Study Area



5.3 Pedestrian and Cyclist Networks

There are no pedestrian facilities in the immediate vicinity of the proposed development, reflecting the rural nature of the Site.

A review of the Core Paths Plan on the CnES website (https://www.cne-siar.gov.uk/leisure-sport-and-culture/community-life-and-leisure/countryside-access/core-paths-planning-in-the-hebrides/) indicates that the following Core Paths detailed in Table 2 are located within the vicinity of the proposed development or in close proximity to the road network likely to be used during the construction period.

Only those paths with the potential to be impacted by construction vehicles have been included, with those Core Paths sufficiently set back from the road network excluded.

Table 2 Core Paths in the vicinity of the Proposed Development

Path No.	Path Name	Selection Criteria	Surface Type	Length (km)
6	Lewis Castle Grounds Paths	Circular, landscape, cultural, natural	Metalled road, surfaced path, unsurfaced path	23.30
10	Miabhaig - Bhiogiadail Route	Landscape, cultural, natural	Rough track, rough surfaced path, unsurfaced path	16.90
11	Urgha - Maraig PROW	Public Right of Way, landscape, cultural, natural	Rough surfaced track	6.13

Away from the proposed development within the wider Study Area, including the A859 there are pedestrian facilities within the larger settlements, including Stornoway and Tarbert. These generally include footways either on one side or both sides of the carriageway.

The level of pedestrian infrastructure is commensurate with the scale of the local settlements and their rural setting.

A review of Sustrans' National Cycle Route (NCR) map[1], shows The Hebridean Way, which is an on-road cycle route that is located within the study area on the A859 and is designated as National Cycle Route (NCR) 780. NCR 780 is approximately 298km (185 miles) in length and runs from Vatersay and Barra to Lewis. The route involves taking two ferry journeys, which links the islands.

5.4 Road Access

The A859 is the main road which connects Stornoway, in the north-east, to Rodel, in the south. The A859 is a single carriageway which is generally subject to the national speed limit, however, this reduces going through towns and villages and is maintained by the CnES. There are no trunk roads on the island.

Eishken Road is an unclassified single-track road, running from its junction with the A859 to Eishken Lodge intersecting the Site. The road is approximately 12km in length and has passing places throughout its length. In the vicinity of the junction with the A859, the road is signposted as having an 8-tonne maximum gross weight limit in place for vehicles.

Arnish Point Access Road (potential to be used for AILs) routes between the Arnish Point Dock, which includes the Arnish Fabrication Facility and the A859. The road is a two-way single track road measuring approximately 3.3m – 3.8m in width, with passing places located along its length.

5.5 Existing Traffic Conditions

In order to assess the impact of construction traffic within the Study Area, Annual Average Daily Traffic (AADT) flows were obtained from the UK Department for Transport (DfT) traffic database[2]. Available 2019 flow information was obtained for all locations, as these flows would be unaffected by Covid-related travel restrictions. The traffic counts sites used were as follows:

1. A859 at Loch Sanndahat (Count Site Reference 91285);
2. A859 east of Kinloch (Count Site Reference 80413);
3. A859 at Loch Seaforth (Count Site Reference 30948); and
4. A859 at Tarbert (Count Site Reference 10948).

The above counts were all estimated counts, using previous years count information from the DfT database.

DfT traffic data allow the traffic flows to be split in vehicle classes. The data was summarised into Cars/Light Goods Vehicles (LGVs) and HGVs (all goods vehicles >3.5tonnes gross maximum weight).

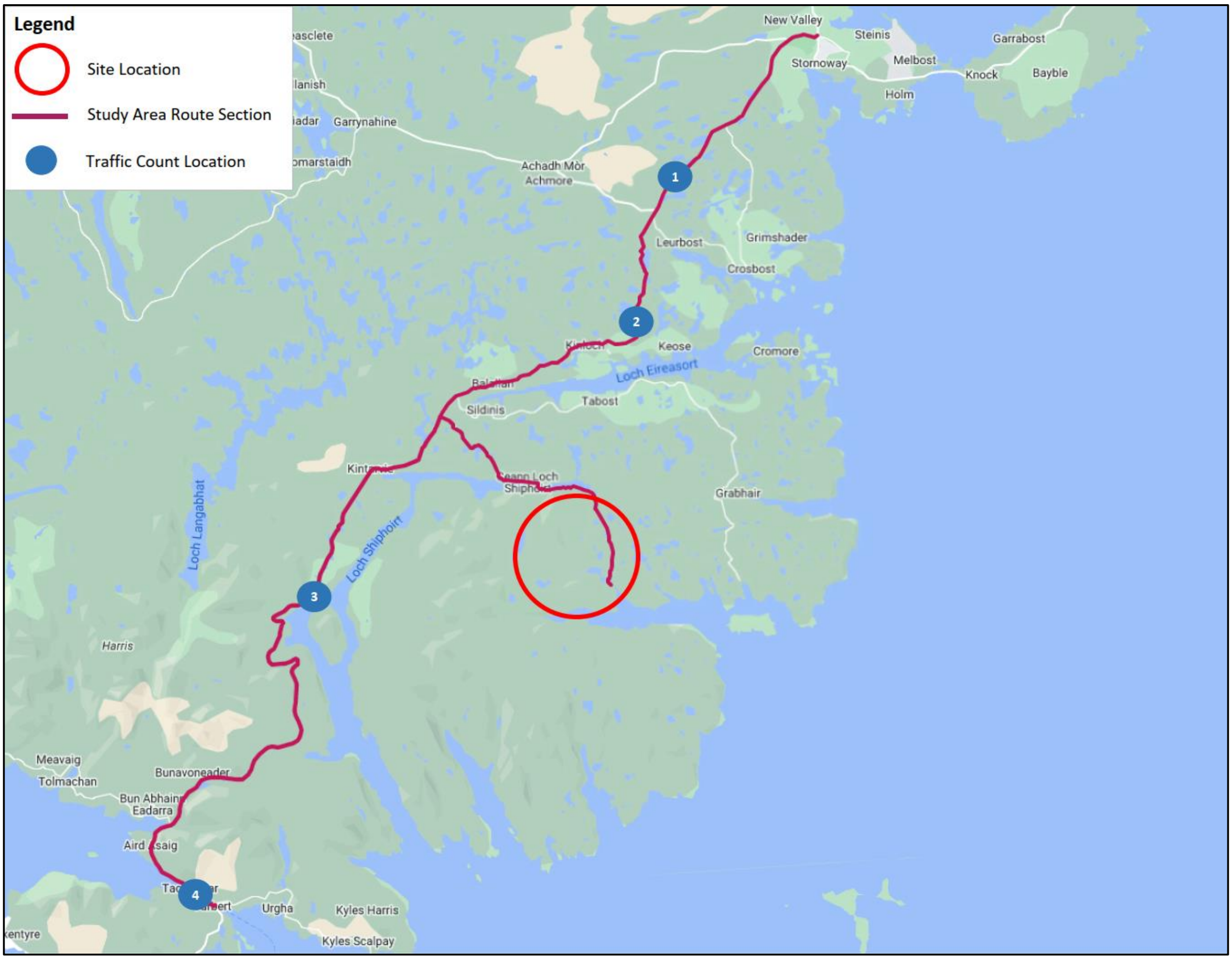
These traffic count sites were identified following a desk study and review of online mapping resources along the access routes to determine the location of sensitive receptors. A full receptor sensitivity and effect review is prepared in the Site Access, Traffic and Transport Chapter of the EIA Report (Volume 1: Chapter 9).

With regards to Eishken Road, as previously discussed, this is a single-track road with passing places, serving a small number of isolated dwellings and providing access to areas used for agricultural purposes. The road is very lightly trafficked and given that all traffic used in the construction of the proposed development will use it to access the Site, the percentage increase will be significant. As such rather than use the base flows to determine if an assessment is required, one has been undertaken regardless.

Image 12.5 shows the location of the surveys, while Table 3 summarises the AADT traffic data collected and used in this assessment.

[1] https://www.sustrans.org.uk/national-cycle-network
[2] https://roadtraffic.dft.gov.uk/#6/55.254/-6.053/basemap-regions-countpoints

Image 12.5 Traffic Count Locations



Contains Google Map data © 2023 Google

Table 3 summarises the AADT traffic data collected and used in the assessment.

Table 3 24-hour Average Traffic Data (2019)

Survey Location Number	Survey Location	Cars / LGV	HGV	Total	% HGVs
1	A859 at Loch Sanndahat	3,571	114	3,685	3.09%
2	A859 east of Kinloch	1,874	267	2,141	12.47%
3	A859 at Loch Seaforth	798	58	856	6.78%
4	A859 at Tarbert	1,028	328	1,356	24.19%

Please note that variances may occur due to rounding.

5.6 Accident Review

Personal Injury Accident (PIA) data for the five-year period covering 2017 to 2021 was obtained from the online resource crashmap.co.uk[3] which uses data collected by the police about road traffic crashes occurring on British roads, where someone is injured.

[3] https://www.crashmap.co.uk/

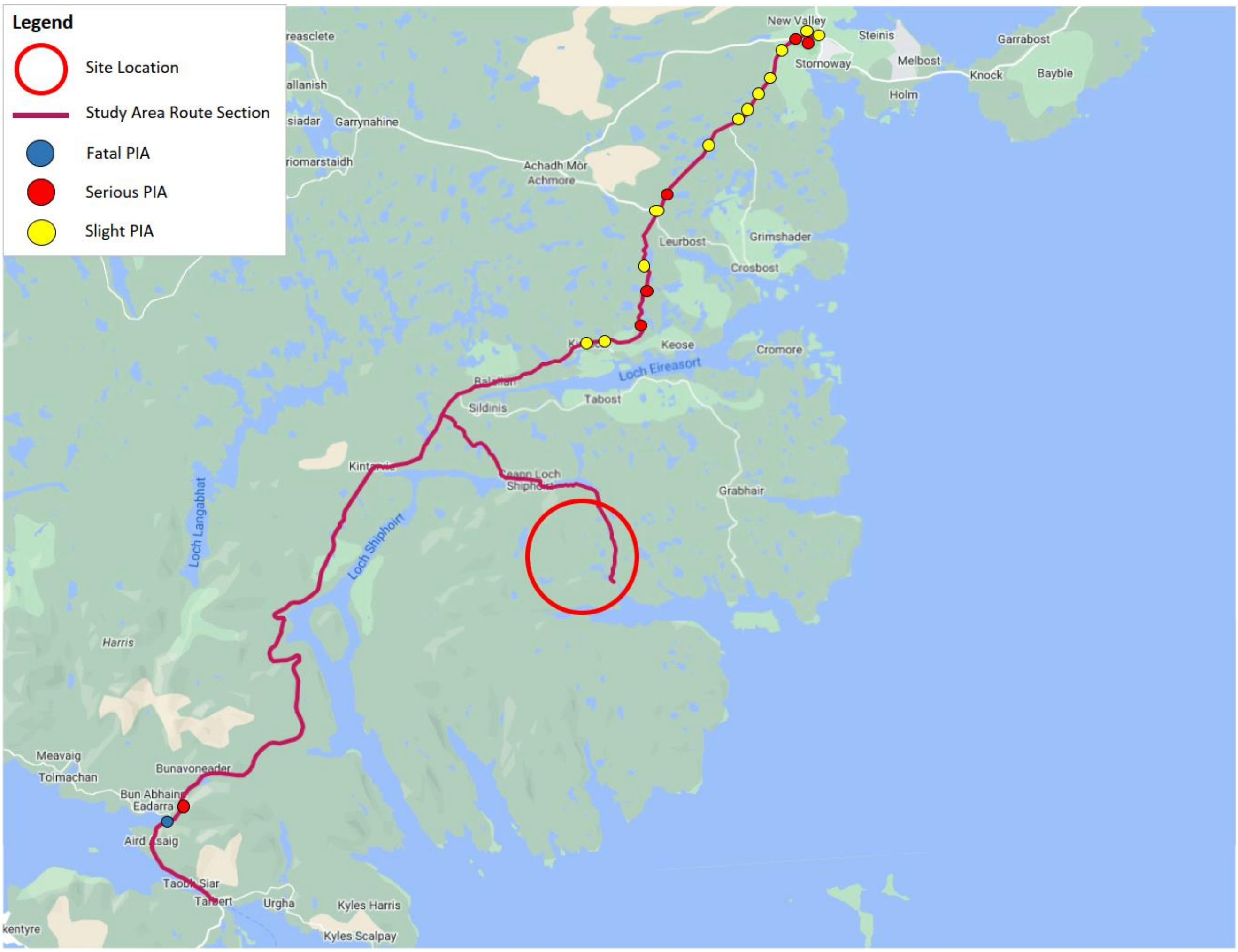
TA Guidance[4] requires an analysis of the PIA on the road network in the vicinity of any development to be undertaken for at least the most recent 3-year period, or preferably a 5-year period, particularly if the site has been identified as being within a high accident area.

The statistics are categorised into three categories, namely “Slight”, “Serious” and “Fatal” for accidents that result in a death. The locations and severity of the recorded accidents along the A859 within the Study Area are summarised in Table 4, while Image 12.6 shows their locations (it should be noted that there is only provisional data currently available for the latter part of 2021).

Table 4 Recorded PIAs

Year	Severity		
	Slight	**Serious**	**Fatal**
2021	2	1	-
2020	2	1	1
2019	2	3	-
2018	2	1	-
2017	4	-	-
Total	**12**	**6**	**1**

Image 12.6 Personal Injury Accident Locations



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A summary analysis of the incidents indicates that:

[4] https://www.transport.gov.scot/media/4589/planning_reform_-_dpmtag_-_development_management__dpmtag_ref__17__-_transport_assessment_guidance_final_-_june_2012.pdf

- 19 PIAs were recorded within the Study Area within the last five-year period.
- Of those 11 PIAs, 12 were "Slight" (63%), 6 were "Serious" (32%) and 1 was "Fatal" (5%).
- The single 'Fatal' PIA involved an HGV, no other vehicles were involved.
- 2 PIAs involved a motorbike, 1 'Serious' and 1 'Slight'.
- 1 PIA involved a pedestrian and occurred at a junction on the A859 in Stornoway. The PIA was 'Slight' and involved a car.
- 1 PIA involved a pedal cycle and occurred in the vicinity of a junction on the A859. The PIA was 'Slight' and involved a car.
- 2 of the recorded PIAs involved child casualties in the vehicles. Both of these were 'Slight' and involved cars.
- Young drivers (16-20) were involved in 3 accidents, 1 "Slight" and 2 "Serious".
- No accidents were recorded on the A859 in the vicinity of the Site access junction.

Based on the information available, it has been established that there are no specific road safety issues within the immediate vicinity of the proposed development Site that currently require to be addressed or would be exacerbated by the construction of the proposed development. There are no clusters of PIAs at any location on the study network and there is only one recorded accident involving HGV, which was a single vehicle accident.

5.7 Future Baseline Traffic Conditions

5.7.1 2027 Traffic Flows, excluding Committed Development Trips

Construction of the proposed development could commence during 2027 if consent is granted and is anticipated to take up to 36 months depending on weather conditions and ecological considerations.

To assess the likely effects during the construction, base year traffic flows were determined by applying a National Road Traffic Forecast (NRTF) low growth factor to the surveyed traffic flows. The NRTF low growth factor for 2019 to 2027 is 1.049. This factor has been applied to the survey data to estimate the 2027 Base traffic flows shown in Table 4.

This will be used in the Construction Peak Traffic Impact Assessment.

Table 5 24-hour Average Traffic Data (2027)

Survey Location	Cars / LGV	HGV	Total	% HGV
A859 at Loch Sanndahat	3,746	120	3,866	3.09%
A859 east of Kinloch	1,966	280	2,246	12.47%
A859 at Loch Seaforth	837	61	898	6.78%
A859 at Tarbert	1,078	344	1,422	24.19%

Please note that variances may occur due to rounding.

5.8 Committed Developments

A review of surrounding planning applications has been undertaken on the CnES online planning portal[5] and a number of consented schemes (i.e., developments with planning permission) were noted. A summary of these is provided in Table 6.

Table 6 Committed Development Schemes

Development	Included as Committed Development
Balallan – Stornoway 132kV Overhead Line Replacement	No – no traffic information details in the public planning record, traffic accounted for in the use of Low NRTF growth factors.
Stornoway Deep Water Port Development	No – minor traffic generating development, traffic accounted for in the use of Low NRTF growth factors.
Ardvourlie Mountain Bike Trails, Scaladale, Isle of Harris	No – no traffic information details in the public planning record.
Marybank Quarry Extension	No – no traffic information details in the public planning record. The proposals are for an extension to the existing quarry (i.e. to allow it to remain operational) and as such, traffic generated by

[5] https://planning.cne-siar.gov.uk/PublicAccess/

Development	Included as Committed Development
	the development will already be accounted for on the local road network.

Beinn Thulabaigh Wind Farm was consented for one turbine with a tip height of up to 150m. A review of the online planning application documents note that a total of 106 deliveries are expected, of which 100 deliveries are associated with concrete deliveries. The nearest concrete plant to the Beinn Thulabaigh Wind Farm site is Breedon Marybank Quarry, which is located to the southwest of Stornoway. It is therefore considered that delivery vehicles will not significantly impact on the study area to the south of Breedon Marybank Quarry, as such Beinn Thulabaigh Wind Farm is not included as committed development in the study area.

Stornoway Wind Farm is to comprise 33 wind turbines with a maximum tip height of 180m. A review of the planning application documents indicates that the concrete will be likely be delivered from Breedon Marybank Quarry and stone will be delivered from existing quarries on Lewis. From a review of local quarries in the area, Breedon Marybank is the nearest quarry to provide aggregate material. As such, it is not expected that the construction traffic vehicles will impact on the proposed development’s study area to the south of Breedon Marybank Quarry, and as such Stornoway Wind Farm is not included as committed development within the study area.

Druim Leathann Wind Farm is to comprise 14 wind turbines with a maximum tip height of 140m. A review of the planning application documents indicates that materials are expected to be sourced from the Stornoway area, with stone delivered existing quarries on Lewis, however it is expected that onsite borrow pits will provide the majority of aggregate materials. From a review of local quarries in the area, Breedon Marybank is the nearest quarry to provide aggregate material. As such, it is not expected that the construction traffic vehicles will impact on the proposed development’s study area to the south of Breedon Marybank Quarry, and as such Druim Leathann Wind Farm is not included as committed development within the study area.

It should be noted that it is unlikely that peak periods of the consented developments described above will coincide with peak periods of the proposed development due to demand on construction materials and supplies. Furthermore, should any crossover of traffic with the proposed development flows occur, these would be addressed via the CTMP, secured by planning condition on the proposed development consent.

In addition, the applicant would welcome the opportunity to engage with other developers in consultation with CnES to ensure appropriate traffic management measures would be implemented to minimise any potential cumulative impacts.

Projects in scoping or not yet determined cannot be included in cumulative assessments as they have yet to be determined. As traffic impacts are short lived for construction projects, the potential traffic impact is highly speculative and as such, cannot be included in the assessment.

It should be noted that the use of Low NRTF growth assumptions has provided a basis for general local development growth within the Study Area.

6 Trip Generation and Distribution

6.1 Construction Phase

6.1.1 Trip Derivation

During the 36-month construction period, the following traffic will require access to the Site:

- staff transport, in either cars or staff minibuses;
- construction equipment and materials, deliveries of machinery and supplies such as concrete, sand and crushed rock;
- components relating to the substation element and associated infrastructure; and
- abnormal loads consisting of the wind turbine sections and a heavy lift crane.

Average monthly traffic flow data were used to establish the construction trips associated with the proposed development, based on the assumptions detailed in the following sections.

6.1.2 Construction Staff

Staff would arrive in non-HGV vehicles and where possible will be encouraged to car share. The workforce on Site will depend on the activities undertaken, but, based on previous wind farm construction Site experience for a project of this scale which suggests three staff per turbine during the short peak period of construction is likely, the maximum number of staff expected on Site could be around 75 per day.

For the purposes of estimating traffic movements, it was assumed that 40% of staff would be transported by minibus and 60% would arrive by car (single car occupancy was assumed as the worst case at this stage with potentially fewer movements through car sharing).

Based on these assumptions, staff transport cars and light vehicles would account for a maximum of 104 vehicle trips (52 inbound trips and 52 outbound trips) per day during the peak period of construction.

6.1.3 Abnormal Indivisible Load and Turbine Component Deliveries

The turbines are broken down into components for transport to the Site. The nacelle, blade and tower sections are classified as AILs due to their weight, length, width and height when loaded. For the purposes of the report, the 'worst case' numbers of components requiring transport are illustrated in Table 7.

Table 7 Turbine Components

Components	Number of Components per turbine
Rotor Blades	3
Tower Sections	4
Nacelle	1
Hub	1
Drive Train	1
Nose Cone	1
Transformer	1
Ancillary	1
Site Parts	0.2

In addition to the turbine deliveries, up to two high-capacity erection cranes would be needed to offload a number of components and erect the turbines. The cranes are likely to be mobile cranes with a capacity up to 1,000 tonnes that are escorted by boom and ballast trucks to allow full mobilisation on Site. Smaller erector cranes would also be present to allow the assembly of the main cranes and to ease the overall erection of the turbines.

A total of 504 abnormal load movements are predicted, including cranes and it is expected that up to 3 AIL turbine components would be delivered per convoy. Up to 3 escort vehicles will be required with each convoy, resulting in an additional 504 movements (252 trips in and 252 trips out). Turbine components that do not classify as AILs, would be delivered in addition to these, resulting in a further 160 movements (80 trips in and 80 trips out). All of these deliveries are expected to occur over a period of approximately 8 months.

The escort vehicles have been assumed to be police cars and light goods vehicles. Motorcycles may be deployed, depending upon Police resources.

6.1.4 General Deliveries

Throughout the construction phase, general deliveries will be made to Site via HGV. These would include fuel, Site office supplies and staff welfare etc. At the height of construction, it is assumed that up to 40 journeys to Site are made (20 in and 20 out) per month.

6.1.5 Material Deliveries

Various materials will need to be delivered to Site to construct the site-based infrastructure. At the outset of the construction works, HGV deliveries will deliver plant and initial material deliveries to the Site to enable the formation of the site compound and to deliver construction machinery.

The Site is large enough to warrant onsite batching of concrete. All turbine and substation foundation concrete will be mixed on site, with deliveries of cement powder, water and sand being delivered by HGV tankers. For the purpose of this assessment, it is assumed that the cement powder and water will be delivered from concrete suppliers off the A859 most likely to the north, from suppliers located on the outskirts of Stornoway.

Sand and aggregate not sourced from on-site borrow pits will be delivered by tipper HGV and is expected to come from local quarries, the closest of which are located near Aird Asaig, to the northwest of Tarbert, and to the west of Stornoway, via the A859.

The estimated total volume of concrete required on Site is 52,580m³, based upon expected turbine foundation, substation foundation, meteorological mast bases and miscellaneous uses across the site. The individual deliveries associated with the raw materials have been estimated and result in inbound trips of 116 cement tankers, 1,107 sand & aggregate tippers and 667 water tankers. Based on preliminary investigations, it is estimated that it will be possible to extract all of aggregate materials for use in concrete production from borrow pits within the site, however 50% of the aggregate has been assumed in the assessment to present a worst-case scenario.

Foundation calculations for the turbine bases and the substations are detailed in Table 8.

Table 8 Steel Reinforcement Deliveries

Element	Weight / Installation (t)	Total Weight (t)	Lorry Capacity (t)	Inbound Trips	Total Journeys
Turbine Foundation	235 per turbine	5,875	30	196	392
Substation and Met Mast Foundation	500	500	30	17	34

The onsite access tracks and crane hardstands will be constructed from crushed rock and the material would be obtained from the site via the proposed five borrow pits or when creating the cuttings and other earthworks.

The access tracks would generally be 6m in width and would be designed to accommodate 16tonne axle loads. In addition to the roads, crane pads will be constructed to enable the turbine erection process. The tracks, crane pads and compounds will require geotextile in the foundations.

To provide a robust assessment of potential traffic impact, it has been assumed that 50% of the material for road upgrades, tracks, hardstandings and compound areas will be imported to the Site. This represents an overestimate, with the expectation that the on-site borrow pits will be more than adequate as a source for material. The assessment is therefore an over-estimate and is considered robust.

The estimate of imported material is detailed in Table 9.

Table 9 Road Upgrade and Track Material Deliveries

Element	Volume / Installation (m³)	Total Weight (t)	Lorry Capacity (t)	Inbound Trips	Total Journeys
Assumed 50% of required stone	85,749	188,647	20	9,433	18,866

Geotextile will be delivered to Site in rolls. A total of 397 large rolls may be required on Site and would be delivered by HGV which will result in 80 journeys (40 trips in and 40 trips out).

Cables would connect each turbine to the internal substation and control building. Trip estimates for the cable materials and ducting are provided in Tables 10 to 12. Three cables are to be provided within each cable trench and would be backfilled with cable sand. Geotextiles would be used to shield the trench and ducting would be used to protect the cable when it runs under roadways. The cable materials would be likely be delivered from the north, either from local suppliers or from the mainland.

Table 10 Cable Trip Estimate

Element	Total Cable Length (m)	Length per Drum (m)	Number of Drums	Inbound Trips	Total Journeys
Cables	24,770	500	149	17	34

Table 11 Cable Sand Trip Estimate

Element	Volume (m³)	Total Weight (t)	Lorry Capacity (t)	Inbound Trips	Total Journeys
Cable Sand	7,267	11,628	20	582	1,164

Table 12 Ducting Trip Estimate

Element	Total Cable Length (m)	Length per Drum (m)	Number of Drums	Inbound Trips	Total Journeys
Ducting	2000	5	400	20	40

One substation building will be constructed on the Site. This will require deliveries of building materials and structural elements and would result in 270 journeys (135 trips in and 135 trips out).

The resulting traffic generation estimates have been plotted onto the indicative construction programme to illustrate the peak journeys on the network. Table 13 illustrates the trip generation throughout the construction programme.

The peak of construction occurs in month 23 with a total of 200 journeys (108 Car / Lights and 92 HGV journeys).

Table 13 Construction Traffic Profile

Activity	Class	Month																	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Site Establishment & Remediation	HGV	20	20						29	29	29	29	29	29	29				
Plant Deliveries	HGV	20	20						30	30									
General Site Deliveries	HGV	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
Off-site Access Road Works	HGV	121	121	121	121	121	121	121	121	121	121	121	121						
Access Track / Hardstanding Area Works	HGV												1,452	1,452	1,452	1,452	1,452	1,452	1,452
Reinforcement Deliveries	HGV														71	71		71	71
Concrete Deliveries	HGV															315	315	315	315
Cable and Ducting Deliveries	HGV																		7
Cabling Sand	HGV																		
Geotextile Deliveries	HGV								13	13				13	13				13
Substation Works	HGV																		
Cranage	HGV																		
Reinstatement	HGV																		
AIL Deliveries	HGV																		
AIL Escorts	HGV/AIL																		
Commissioning & Demobilisation	Car & LGV																		
Staff	Car & LGV	264	704	1,144	1,408	1,760	1,760	1,848	2,288	2,288	2,288	2,288	2,288	2,288	2,288	2,288	2,288	2,288	2,288
Total HGV		201	201	161	161	161	161	161	232	232	189	189	1,641	1,533	1,604	1,878	1,807	1,878	1,898
Total Cars / LGV		264	704	1,144	1,408	1,760	1,760	1,848	2,288	2,288	2,288	2,288	2,288	2,288	2,288	2,288	2,288	2,288	2,288
Total Movements		465	905	1,305	1,569	1,921	1,921	2,009	2,520	2,520	2,477	2,477	3,929	3,821	3,892	4,166	4,095	4,166	4,186
Total HGV per Day		10	10	8	8	8	8	8	12	12	10	10	76	70	74	86	84	86	88
Total Cars / LGV per Day		12	32	52	64	80	80	84	104	104	104	104	104	104	104	104	104	104	104
Total per Day		22	42	60	72	88	88	92	116	116	114	114	180	174	178	190	188	190	192

Continues over the page.

Activity	Class	Month																	
		19	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**
Site Establishment & Remediation	HGV																80	80	80
Plant Deliveries	HGV																	50	50
General Site Deliveries	HGV	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
Off-site Access Road Works	HGV																		
Access Track / Hardstanding Area Works	HGV	1,452	1,452	1,452	1,452	1,452													
Reinforcement Deliveries	HGV		71	71															
Concrete Deliveries	HGV	315	315	315	315	315	315	315	315										
Cable and Ducting Deliveries	HGV	7	7	7	7	7	7	7	7	7									
Cabling Sand	HGV	106	106	106	106	106	106	106	106	106	106	106							
Geotextile Deliveries	HGV	13																	
Substation Works	HGV			18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	
Cranage	HGV					20	20											20	20
Reinstatement	HGV																40	40	40
AIL Deliveries	HGV					66	66	66	66	66	66	66	66	66	66				
AIL Escorts	HGV/AIL					50	50	50	50	50	50	50	50	50	50				
Commissioning & Demobilisation	Car & LGV																40	40	40
Staff	Car & LGV	2,288	2,288	2,288	2,288	2,288	2,288	2,288	2,288	2,288	2,288	2,288	2,288	2,288	2,112	1,760	1,144	264	264
Total HGV		1,933	1,991	2,009	1,938	2,024	572	552	552	237	230	230	124	124	124	58	178	248	230
Total Cars / LGV		2,288	2,288	2,288	2,288	2,338	2,338	2,338	2,338	2,338	2,338	2,338	2,338	2,338	2,162	1,760	1,184	304	304
Total Movements		4,221	4,279	4,297	4,226	4,362	2,910	2,890	2,890	2,575	2,568	2,568	2,462	2,462	2,286	1,818	1,362	552	534
Total HGV per Day		88	92	92	90	92	28	26	26	12	12	12	6	6	6	4	10	12	12
Total Cars / LGV per Day		104	104	104	104	108	108	108	108	108	108	108	108	108	100	80	54	14	14
Total per Day		192	196	196	194	200	134	132	132	118	118	118	112	112	104	84	62	26	26

Please note variances due to rounding may occur
Assumes that 50% of total estimated stone aggregate requirements will be imported to site.

6.1.6 Distribution of Construction Trips

The distribution of proposed development construction traffic on the network would vary depending on the types of loads being transported. The assumptions for the distribution of construction traffic during the peak months are as follows:

- all construction traffic enters the Site via the existing access junction on the A859;
- deliveries associated with the delivery of concrete batching materials and other would be from the north, from the closest supplier, namely Breedon Marybank Quarry;
- While it is anticipated that onsite borrow pits will be able to meet aggregate requirements, for the purpose of this assessment it is proposed that 50% of track and hardstanding aggregate requirements will be sourced from local quarries, with 50% coming from Breedon Marybank Quarry to the north and 50% from Breedon Ceann an Ora Quarry to the south. The BoP contractor will confirm final quarry and material sourcing with CnES in the final CTMP.
- HGV deliveries associated with the substation installation, cabling and associated materials, etc. will arrive via the A859 to the north, likely from Arnish Point Docks;
- staff working at the Site are likely to be based locally. It is assumed that 70% will come from Stornoway and 30% from Tarbert; and
- general Site deliveries will be via the A859 from the north.

At the time of writing, the proposed method and route used to transport the AILs to the Site has yet to be confirmed. There are currently two options being considered, namely:

Arnish Point Dock

- Turbine components would be shipped to the Arnish Point Dock, which offers a deep-water quay with unrestricted access to the Atlantic Ocean and North Channel. Arnish Point has previously been used for the shipment of materials and completed fabricated components used on the island.
- AILs would route along Arnish Point Access Road for approximately 3.2km before reaching the priority junction with the A859. At the junction, the loads would turn left on to the A859 and travel southbound for approximately 22.2km to its junction with Eishken Road. At the junction, the loads would turn left on to Eishken Road and travel eastbound through to the Site.

Loch Sealg Marine Facility

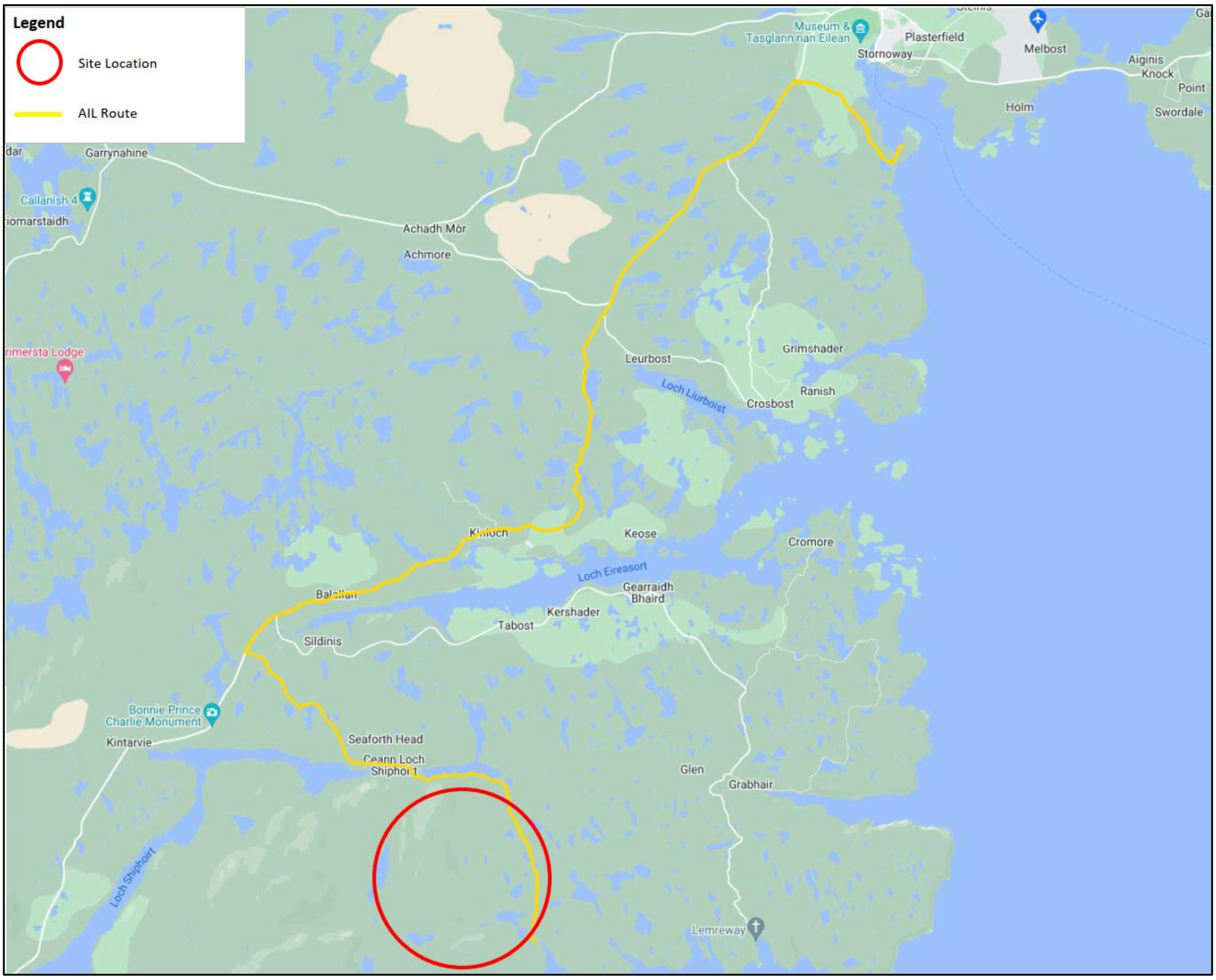
- A new marine facility would be built to the south of the proposed Site on the shore of Loch Sealg, allowing turbine components to be off-loaded directly on to Eishken Road before being transported within the Site.

For the purposes of preparing the TA and the Site Access, Traffic and Transport Chapter of the EIA Report (Volume 2: Chapter 12), it has been assumed that Arnish Point Docks would be used to ensure a robust assessment has been undertaken and the full potential impact on the local road network can be considered. The final choice of access route will be agreed prior to works commencing on site and it is proposed that this is secured by planning condition and set out in the CTMP.

Furthermore, should the Loch Sealg berthing facility be progressed as the preferred option, this would be progressed under a separate planning application.

Image 12.7 illustrates the proposed AIL access route from Arnish Point Docks.

Image 12.7 AIL Component Delivery Route



Contains Google Map data © 2023 Google

The above route has been considered in full, within the AIL Route Survey Report (RSR), provided in Appendix A.

6.1.7 Peak Construction Traffic

Following the distribution and assignment of traffic flows to the Study Area network, the resultant daily traffic during the peak of construction are summarised in Table 14.

Table 14 Peak Construction Traffic

Survey Location	Cars / LGV	HGV	Total	%HGV
A859 at Loch Sanndahat	76	58	134	43.28%
A859 east of Kinloch	76	58	134	43.28%
A859 at Loch Seaforth	32	36	68	52.94%
A859 at Tarbert	32	-	32	0.00%

Please note that variances may occur due to rounding.

6.2 Decommissioning Phase

Prior to decommissioning of the Site, a traffic assessment would be undertaken, and appropriate traffic management procedures followed.

The decommissioning phase would result in fewer trips on the road network than the construction or operational phases as it is considered likely that elements of infrastructure such as access tracks would be left in place and structures may be broken up on Site to allow transport by a reduced number of HGVs.

7 Traffic Impact Assessment

7.1 Construction Impact

The peak month traffic data was combined with the future year (2027) traffic data to allow a comparison between the baseline results to be made. The increase in traffic volumes is illustrated in percentage increases for each class of vehicle. This is illustrated in Table 15.

Table 15 Peak Construction Traffic Network Impact

Survey Location	Cars / LGV	HGV	Total	Cars / LGV % Increase	HGV % Increase	Total % Increase
A859 at Loch Sanndahat	3,822	178	4,000	2.03%	48.50%	3.47%
A859 east of Kinloch	2,042	338	2,380	3.87%	20.71%	5.97%
A859 at Loch Seaforth	869	97	966	3.82%	59.17%	7.57%
A859 at Tarbert	1,110	344	1,454	2.97%	0.00%	2.25%

Please note that variances may occur due to rounding.

The total traffic movements are not predicted to increase by more than 10% on all of the study network, with the highest being on the A859 at Loch Seaforth, with an increase of 7.57%. It is however assumed that the total traffic increase on the unclassified Eishken Road which leads through to the Site will be in excess of 10% due to the extremely low level of existing traffic using this road.

The highest total HGV traffic movements increase will be on the A859 at Loch Seaforth, with an increase of 59.17%. Whilst this increase could be considered high, it is generally caused by the relatively low HGV flows on the A859 at this location. The increase would see an additional 58 HGV journeys per day (29 inbound and 29 outbound). Over the course of a typical 12-hour day on Site, this would equate to approximately 5 movements per hour, which is not considered significant in operational terms.

With regards to the unclassified Eishken Road which leads through to the Site, all HGV traffic accessing the Site will be required to use this road. This would result in approximately 92 HGV journeys per day (46 inbound and 46 outbound), which would equate to approximately 8 movements per hour over the course of a typical 12-hour day on Site.

It should also be noted the construction phase is transitory in nature and the peak of construction activities is short lived, occurring over a relatively short timeframe when taking account of the whole construction programme.

A review of existing theoretical road capacity has been undertaken using the Design Manual for Roads and Bridges, Volume 15, Part 5 “The NESA Manual”. The theoretical road capacity has been estimated for each of the road links for a 12-hour period that makes up the Study Area. The results are summarised in Table 16.

Table 16 Theoretical Road Capacity

Survey Location	2027 Baseline Flow	2027 Base + Development Flows	Theoretical Road Capacity (12hr)	Spare Road Capacity %
A859 at Loch Sanndahat	3,866	4,000	19,200	79.17%
A859 east of Kinloch	2,246	2,380	19,200	87.60%
A859 at Loch Seaforth	898	966	19,200	94.97%
A859 at Tarbert	1,422	1,454	19,200	92.42%

Please note that variances may occur due to rounding.

The results indicate there are no road capacity issues with the addition of construction traffic associated with the proposed development and significant spare capacity exists within the local road network to accommodate all construction phase traffic.

8 Proposed Traffic Mitigation Measures

8.1 Construction Phase

8.1.1 Construction Traffic Management Plan (CTMP)

During the construction period, a project website, blog or Twitter feed would be regularly updated to provide the latest information relating to traffic movements associated with vehicles accessing the site. This would be agreed with CnES

The following measures would be implemented during the construction phase through the CTMP:

- Agree AIL route modifications and improvements with CnES and other relevant stakeholders. Works which will be required to facilitate turbine deliveries are outlined in the RSR, presented in Appendix A.
- Where possible, the detailed design process would minimise the volume of material to be imported to Site to help reduce HGV numbers;
- A site worker transport and travel arrangement plan, including transport modes to and from the worksite (including pick up and drop off times);
- A Transport Management Plan for AIL deliveries;
- All materials delivery lorries (dry materials) should be sheeted to reduce dust and stop spillage on public roads;
- Specific training and disciplinary measures should be established to ensure the highest standards are maintained to prevent construction vehicles from carrying mud and debris onto the carriageway;
- Wheel cleaning facilities may be established at the site entrance, depending on the views of CnES;
- Normal site working hours would be limited to between 0700 and 1900 (Monday to Friday and 0700 and 1600 (Saturday), though component delivery and turbine erection may take place outside these hours;
- Appropriate traffic management measures would be put in place on the A859 and Eishken Road to avoid conflict with general traffic, subject to the agreement of CnES. Typical measures would include HGV turning and crossing signs and/ or banksmen at the site access and warning signs;
- Provide construction updates on the project website and or a newsletter to be distributed to residents within an agreed distance of the site;
- Adoption of a voluntary reduced speed limits at locations to be agreed with CnES;
- All drivers would be required to attend an induction to include:
    - A toolbox talk safety briefing;
    - The need for appropriate care and speed control;
    - A briefing on driver speed reduction agreements (to slow site traffic at sensitive locations through the villages); and
    - Identification of the required access routes and the controls to ensure no departure from these routes.

CnES through the Scoping process has requested that an agreement to cover the cost of abnormal wear on its network is made.

Video footage of the pre-construction phase condition of the abnormal loads access route and the construction vehicles route would be recorded to provide a baseline of the condition of the road prior to any construction work commencing. This baseline would provide evidence of any change in the road condition during the construction phase. Any necessary repairs would be coordinated with CnES's roads team. Any damage caused by traffic associated with the proposed development during the construction period, that would be hazardous to public traffic, would be repaired immediately.

Damage to road infrastructure caused directly by construction traffic would be remediated, and street furniture that is removed on a temporary basis would be fully reinstated.

There would be a regular road review, and any debris and mud would be removed from the carriageway using an onsite road sweeper to ensure road safety for all road users.

Before the AILs traverse the route, the following tasks would be undertaken to ensure load and road user safety:

- Ensure any vegetation which may foul the loads is trimmed back to allow passage;

- Confirm there are no roadworks or closures that could affect the passage of the loads;
- Check no new or diverted underground services on the proposed route are at risk from the abnormal loads; and
- Confirm the police are satisfied with the proposed movement strategy.

8.2 Off-site Mitigation Works

With regards to off-site mitigation works to accommodate both general construction vehicles and AILs, a scheme of improvements are proposed at the junction between the A859 and Eishken Road and on Eishken Road.

The improvement works at the junction will include widening to allow AILs to negotiate the junction in a safe and efficient manner.

On Eishken Road, widening works are likely to be required, to bring the existing carriageway up to a minimum of 4.5m on straight sections, with improved or new passing places provided. In addition, there may be requirements for carriageway regrading and creation of over-run areas for AILs, together with the provision of a new bridge at Seaforth Head. Confirmation on the type of structure will be confirmed following additional on-site investigations.

All of the above works would be undertaken in full consultation with CnES.

8.3 Abnormal Load Management Plan

There are a number of traffic management measures that could help reduce the effect of abnormal load convoys.

All abnormal load deliveries would be undertaken at appropriate times (to be discussed and agreed with the local authority and police) with the aim to minimise the effect on the local road network. It is likely that the abnormal load convoys would travel in the early morning periods before peak times while general construction traffic would generally avoid the morning and evening peak periods.

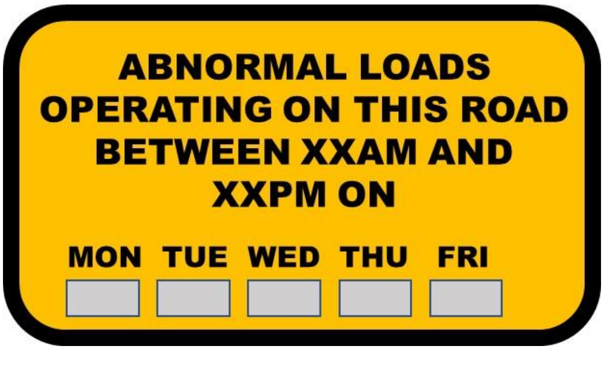
The majority of potential conflicts between construction traffic and other road users will occur with abnormal load traffic. General construction traffic is not likely to come into conflict with other road users as the vehicles are smaller and road users are generally more accustomed to them.

Potential conflicts between the abnormal loads and other road users can occur at a variety of locations and circumstances. The main potential conflicts are likely to occur:

- on Fabrication Yard Road, the A859 and Eishken Road, where the loads may straddle the centre line, where fast moving oncoming traffic may be encountered, etc.;
- where traffic turns at a road junctions, requiring other traffic to be restrained on other approach arms; and
- in locations where high speeds of general traffic are predicted.

Advance warning signs would be installed on the approaches to the affected road network. Information signage could be installed to help assist drivers and an example is illustrated in Image 12.8. Flip up panels (shown in grey) would be used to mask over days where convoys would not be operating. When no convoys are moving, the sign would be bagged over by the Traffic Management contractor.

Image 12.8 Example Information Sign



This signage will assist in helping improve driver information and allow other road users to consider alternative routes or times for their journey (where such options exist).

The location and numbers of signs would be agreed post consent and would form part of the wider Traffic Management Proposal for the project.

The Abnormal Load Transport Management Plan would also include:

- procedures for liaising with the emergency services to ensure that police, fire and ambulance vehicles are not impeded by the loads. This is normally undertaken by informing the emergency services of delivery times and dates and agreeing communication protocols and lay over areas to allow overtaking;
- a diary of proposed delivery movements to liaise with the communities to avoid key dates such as local events;
- a protocol for working with local businesses to ensure the construction traffic does not interfere with deliveries or normal business traffic; and
- proposals to establish a construction liaison committee to ensure the smooth management of the project / public interface with the applicant, the construction contractors, the local community, and if appropriate, the police forming the committee. This committee would form a means of communicating and updating on forthcoming activities and dealing with any potential issues arising.

8.4 Public Information

Information on the turbine convoys would be provided to local media outlets such as local papers and local radio to help assist the public.

Information would relate to expected vehicle movements from the port of entry through to the Site access junction. This will assist residents becoming aware of the convoy movements and may help reduce any potential conflicts.

The applicant would also ensure information was distributed through its communication team via the project website, local newsletters, and social media.

8.5 Convoy System

A police escort would be required to facilitate the delivery of the predicted AILs. The police escort would be further supplemented by a civilian pilot car to assist with the escort duty. It is proposed that an advance escort would warn oncoming vehicles ahead of the convoy, with one escort staying with the convoy at all times. The escorts and convoy would remain in radio contact at all times where possible.

The abnormal loads convoys would be no more than three AILs long, or as advised by the police, to permit safe transit along the delivery route and to allow limited overtaking opportunities for following traffic where it is safe to do so.

The times in which the convoys would travel will need to be agreed with Police Scotland who have sole discretion on when loads can be moved.

8.6 Onsite Measures delivered using a Path Management Plan (OPMP)

Within the Site, consideration has been given to pedestrians and cyclists alike due to potential interactions between construction traffic and users of the paths and public roads. If required, a Path Planning Study will be conducted post consent and will be secured through a planning condition. Findings from the study will be used to formulate a set of measures into an Onsite Path Management Plan (OPMP).

Users of the Rights of Way will be separated from construction traffic through the use of barriers. Crossing points will be provided where required, with path users having right of way. Appropriate Traffic Signs Manual Chapter 8 compliant temporary road signage would be provided to assist at these crossing for the benefit of all users.

The principal contractor will ensure that speed limits are always adhered to by their drivers and associated subcontractors. This is particularly important within close proximity to the Rights of Way and at crossing points. Advisory speed limit signage will also be installed on approaches to areas where path users may interact with construction traffic.

Signage will be installed on the Site exits that makes drivers aware of local speed limits and reminding drivers of the potential presence of pedestrians and cyclists in the area. This will also be emphasised in the weekly toolbox talks.

No response has been received from The British Horse Society, however measures implemented on similar schemes will be given consideration as part of the proposed development. These measures are predominantly focused around the interactions between HGV traffic and horses. Horses are normally nervous of large vehicles, particularly when they do not often meet them. Horses are flight animals and will run away in panic if really frightened. Riders will do all they can to prevent this but, should it happen, it could cause a serious accident for other road users, as well as for the horse and rider.

The main factors causing fear in horses in this situation are:

- Something approaching them, which is unfamiliar and intimidating;
- A large moving object, especially if it is noisy;
- Lack of space between the horse and the vehicle;
- The sound of air brakes; and
- Anxiety on the part of the rider.

The British Horse Society has previously recommended the following actions that will be included in the site training for all HGV staff:

- On seeing riders approaching, drivers must slow down and stop, minimising the sound of air brakes, if possible;
- If the horse still shows signs of nervousness while approaching the vehicle, the engine should be shut down (if it is safe to do so);
- The vehicle should not move off until the riders are well clear of the back of the HGV;
- If drivers are wishing to overtake riders, please approach slowly or even stop in order to give riders time to find a gateway or lay by where they can take refuge and create sufficient space between the horse and the vehicle. Because of the position of their eyes, horses are very aware of things coming up behind them; and
- All drivers delivering to the site must be patient. Riders will be doing their best to reassure their horses while often feeling a high degree of anxiety themselves.

8.7 Staff Travel Plan

A Staff Travel Plan will be deployed where necessary, to manage the arrival and departure profile of staff and to encourage sustainable modes of transport, especially car-sharing. A package of measures could include:

- Appointment of a Travel Plan Coordinator (TPC);
- Provision of public transport information;
- Mini-bus service for transport of site staff;
- Promotion of a car sharing scheme; and
- Car parking management.

8.8 Operational Phase Mitigation

Site entrance roads will be well maintained and monitored during the operational life of the proposed development. Regular maintenance will be undertaken to keep the Site access track drainage systems fully operation and to ensure there are no run-off issues onto the public road network.

9 Summary & Conclusions

Pell Frischmann Consultants Limited has been commissioned by Eurowind Energy Limited to undertake a Transport Assessment for the proposed Uisenis Wind Farm, located within the Eishken Estate on the Isle of Lewis, south west of Stornoway, within the administrative boundary of Comhairle nan Eilean Siar, Western Isles Council.

The Site will be accessed from Eishken Road, which forms a junction with the A859 to the west of the Site.

Existing traffic data established a base point for determining the impact during the construction phase and was factored to future levels to help determine the effect of construction traffic on the local road network.

The construction traffic would result in a temporary increase in traffic flows on the road network surrounding the proposed development. The maximum traffic effect associated with construction of the proposed development is predicted to occur in month 23 with a total of 200 journeys (108 Car / Lights and 92 HGV journeys).

A series of mitigation measures and management plans have been proposed to help mitigate and offset the impacts of both the construction and operational phase traffic flows.

No link capacity issues are expected on any of the roads assessed due to the additional movements associated with the proposed development. The effects of construction traffic are temporary in nature and are transitory.

Appendix A Route Survey Report

Appendix B Indicative Site Access Junction Layout

Pell Frischmann

Uisenis Wind Farm

Abnormal Indivisible Load Route Survey

May 2023

106154

Report Ref.	**Uisenis RSR.Docx**					
File Path	**https://pellf.sharepoint.com/sites/EdinburghOfficeTeam/Shared Documents/General/Projects/106154 Eurowind Uisenis/01 - WIP/Reports/Uisenis RSR.docx**					
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1 Introduction

1.1 Purpose of the Report

Pell Frischmann (PF) has been commissioned by Eurowind to undertake a route access review of the delivery route for wind turbine Abnormal Indivisible Loads (AIL) associated with the construction and development of Uisenis Wind Farm, located to the north of Eishken, Isle of Lewis.

The Route Survey Report (RSR) has been prepared to help inform Eurowind on the likely issues associated with the development of the site with regards to off-site transport and access for AIL traffic. The report identifies the key issues associated with AIL deliveries and notes that remedial works, either in the form of physical works or as traffic management interventions will be required to accommodate the predicted loads.

The detailed assessment and subsequent designs of any remedial works are beyond the agreed scope of works between PF and Eurowind at this point in time.

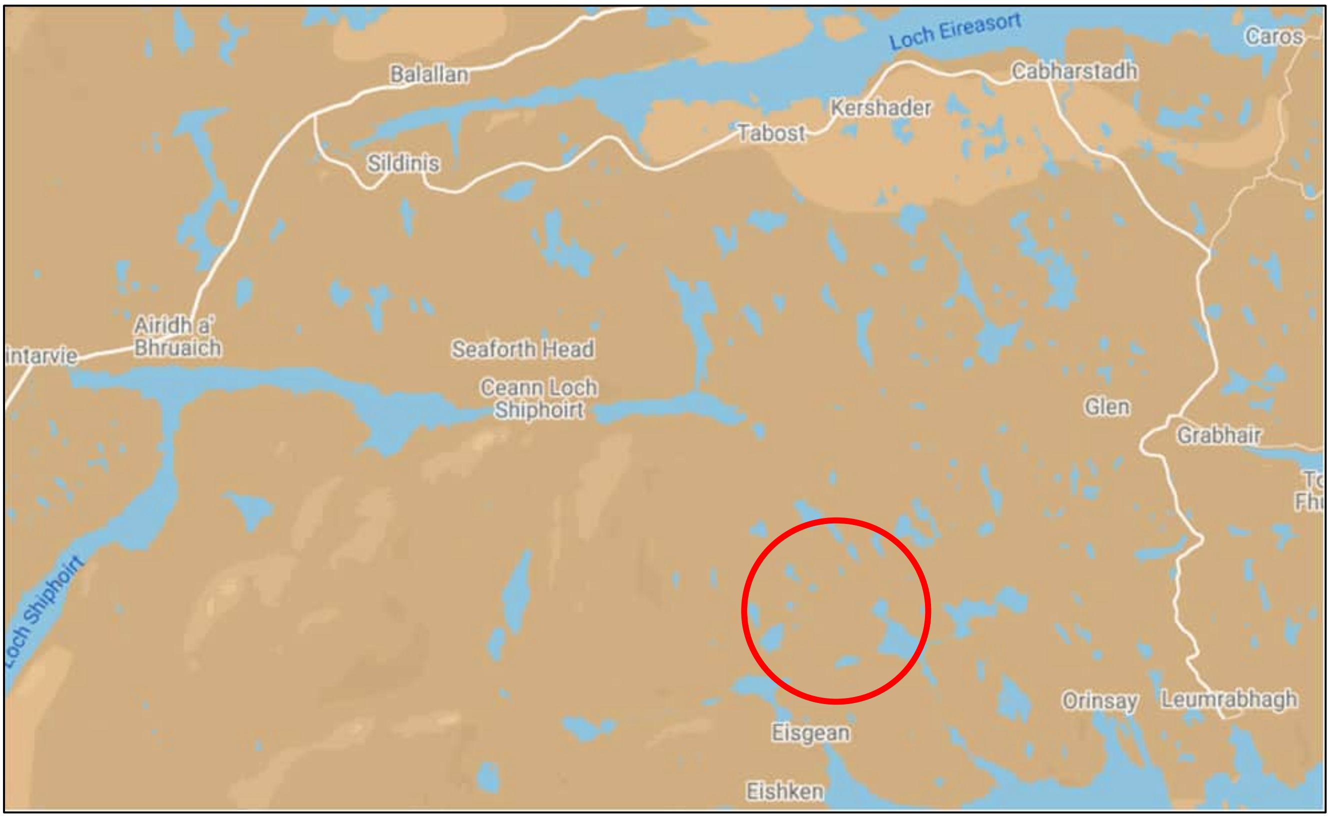
It is the responsibility of the wind turbine supplier to ensure that the entirety of the proposed access route is suitable and meets with their satisfaction. The turbine supplier will be responsible for ensuring that the finalised proposals meet with the appropriate levels of health and safety consideration for all road users has been made in accordance with the relevant legislation at the time of delivery.

2 Site Background

2.1 Site Location

The development site is located to the north of Eishken, Isle of Lewis. Figure 2-1 illustrates the general site location.

Figure 2-1: Site Location Plan



2.2 Candidate Turbine

Eurowind have indicated that they wish to consider the worst-case components from a Siemens Gamesa SGRE155 turbine at a maximum tip height of 200m.

The details of the components have been provided by Siemens and are detailed in Table 2-1.

Table 2-1: Turbine Components Summary

Component	Length (m)	Width (m)	Height / Min Diameter (m)	Weight (t)
Blade	76.571	4.424	3.000	25.600
Base Tower	14.034	4.800	4.800	84.400
Mid Tower 1	19.880	4.800	4.800	84.300
Mid Tower 2	22.400	4.800	4.794	73.900
Mid Tower 3	28.560	4.794	4.102	72.000
Top Tower	35.040	4.102	3.574	70.300

2.3 Proposed Delivery Equipment

To provide a robust assessment scenario based upon the known issues along the access route, it has been assumed that all blades would be carried on a Superwing Carrier trailer to reduce the need for mitigation in constrained sections of the route.

The base and mid towers would be carried on a 4+7 clamp trailer. The hub, nacelle housing, and top towers would be carried on a six-axle step frame trailer.

Figure 2-2: Superwing Carrier Trailer

Figure 2-3: Tower Trailer

3 Access Route Review

3.1 Port of Entry

The proposed Port of Entry (PoE) is Arnish Port within Stornoway Harbour authority. The port has been used in the past for a number of local wind farms and has adequate facilities for the import of the proposed loads. The port has 100m of quayside within a 119 acre estate.

The layout of the port is illustrated below.

Figure 3-1: Port Layout

A new deepwater port facility is currently under construction to the north of the existing facility and could be potentially used for the import of turbine equipment. A final review on the use of this facility will be made prior to the final turbine supply agreement being signed.

The new facility is illustrated in Figure 3-2.

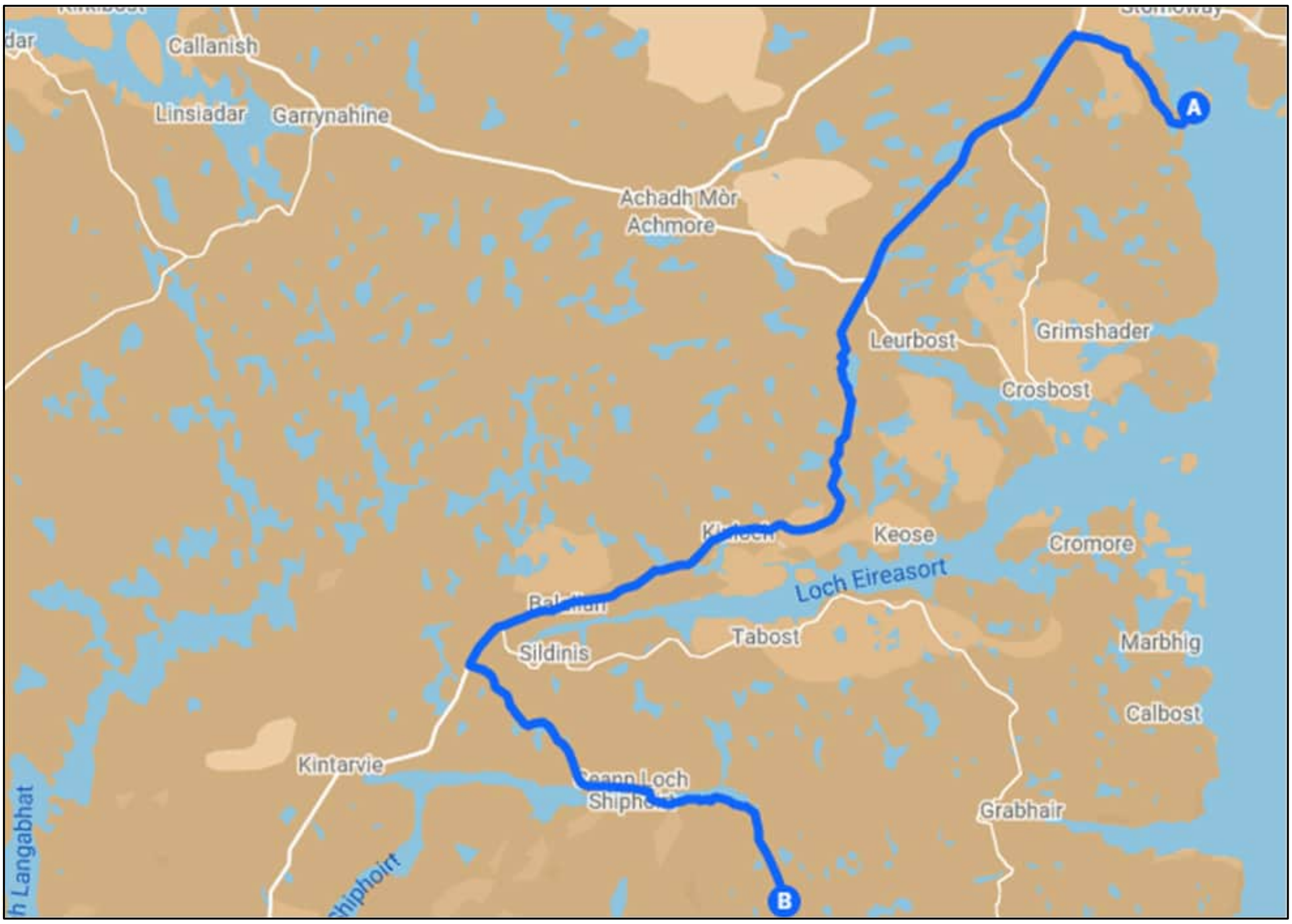
3.2 Proposed Access Route

The proposed access route to site is detailed below:

- Loads would exit Arnish Port and proceed northbound on the Arnish Road;
- Loads would turn left onto the A859 and proceed southbound; and
- Loads would turn left into the proposed site access junction leading towards Eisgean.

Figure 3-2: New Deep Water Facility

Figure 3-3: Proposed Access Route



3.3 Route Constraints

The constraints noted on the desktop review are provided in the table below. These cover all constraints from the port access gate through to the site access junction. No consideration of the transport issues within the port or development site have been undertaken and this includes the design of the site access junction.

Plans illustrating the location of the constraints are provided in Appendix A.

Table 3-1: Constraint Points and Details

POI	Key Constraint	Details
1	**Exit from Arnish Port** 	Loads will exit Arnish Port and proceed on The Arnish Road northbound. A swept path assessment has been undertaken and indicates that the blade tip will over-sail the eastern verge at the first right-hand bend where all obstructions should be cleared. Loads will over-run and over-sail the inside verge of the bend where a load bearing surface should be laid and all obstructions cleared. Parking should be suspended during deliveries. Loads will over-sail both verges through the following right-hand bend where all obstructions should be cleared. Swept path assessment SK01 is included in Appendix B.
2	**The Arnish Road northeast of Cnoc Airinis** 	Loads will continue on The Arnish Road northbound. A swept path assessment has been undertaken and indicates that loads will over-sail both verges through the section where all obstructions should be cleared. Swept path assessment SK02 is included in Appendix B.
3, 4	**The Arnish Road East of Cala Ghlumaig**  	Loads will continue on The Arnish Road northbound. A swept path assessment has been undertaken and indicates that loads will over-sail both verges through the section where all obstructions should be cleared. Loads should be set on higher suspension settings to avoid the need for physical works in this section. Swept path assessment SK03 is included in Appendix B.

POI	Key Constraint	Details
5	**The Arnish Road southwest of Poll a' Choire** 	Loads will continue on The Arnish Road northbound. A swept path assessment has been undertaken and indicates that loads will over-sail both verges through the section where all obstructions should be cleared. A new port exit is currently being constructed (May 2023). The completion date is unknown and engagement with the port authority is recommended prior to movements commencing. Swept path assessment SK04 is included in Appendix B.
6	**The Arnish Road south of Memorial Fountain** 	Loads will continue on The Arnish Road northbound. A swept path assessment has been undertaken and indicates that loads will over-sail both verges through the section where all obstructions should be cleared. Loads should be set on higher suspension settings to avoid the need for physical works in this section. Swept path assessment SK05 is included in Appendix B.
7	**The Arnish Road southwest of Memorial Fountain** 	Loads will continue on The Arnish Road northbound. A swept path assessment has been undertaken and indicates that loads will over-sail both verges through the section where vegetation trimming is required. Swept path assessment SK06 is included in Appendix B.

POI	Key Constraint	Details
8, 9	**The Arnish Road / A859 Junction**  	Loads will turn left at the junction to exit The Arnish Road and join the A859 southbound. A swept path assessment has been undertaken and indicates that the blade tip will over-sail the southern verge prior to the junction where the vertical clearance to the hillside should be confirmed during the test run and all obstructions should be cleared. Loads will over-sail the northern verge where all obstructions should be cleared. Loads should be set on higher suspension settings to avoid the need for physical works in this section. Loads will over-run and over-sail the inside verge of the turn where a load bearing surface should be laid and verge strengthening will be required. The fence and all street furniture should be removed, and the vegetation should be cleared. **Third party land** will be required. Loads will over-run and over-sail the north-western verge on joining the A859 where a load bearing surface should be laid, and one road sign should be removed. Swept path assessment SK07 is included in Appendix B.
10	**A859 East of B897 Junction** 	Loads will continue on the A859 southbound. The blade tip is expected to over-sail the bollards on the outside verge of the bend and loads will over-sail the inside verge, though no physical mitigation measures will be required.
11	**A859 at The Vauntie** 	Loads will continue on the A859 southbound. Loads are expected to over-sail the inside verge of the bend, though no physical mitigation measures will be required.
12	**A859 East of Loch na Creige Glais** 	Loads will continue on the A859 southbound. Loads are expected to over-sail the inside verge of the bend, though no physical mitigation measures will be required.

POI	Key Constraint	Details
13	**A859 Creag Ghlas** 	Loads will continue on the A859 southbound. A swept path assessment has been undertaken and indicates that the blade tip will over-sail the bollards on the outside verge of the bend. Loads will over-sail the inside verge, though no physical mitigation measures will be required. Swept path assessment SK08 is included in Appendix B.
14	**A859 southeast of Creag Ghlas** 	Loads will continue on the A859 southbound. A swept path assessment has been undertaken and indicates that loads will over-sail the inside verge of the first left-hand bend. Loads will over-sail both verges of the following right-hand bend, though no physical mitigation measures will be required. Loads will then over-sail both verges of the final left-hand bend, though no physical mitigation measures will be required. Swept path assessment SK09 is included in Appendix B.
15	**A859 West of Loch Shobhail** 	Loads will continue on the A859 southbound. Loads are expected to over-sail both verges through the section, though no physical mitigation measures will be required.
16	**A859 Loidse Shobhail** 	Loads will continue on the A859 southbound. A swept path assessment has been undertaken and indicates that loads will over-sail the inside verge of the first left-hand bend where three road signs should be removed. The blade tip will over-sail the safety barrier on the outside verge of the following right-hand bend where one mirror and a tree should be removed. Loads will over-sail the inside verge, though no physical mitigation measures will be required. Swept path assessment SK10 is included in Appendix B.
17	**A859 East of Loch na Creige Fraoich** 	Loads will continue on the A859 southbound. Loads are expected to over-sail both verges through the bends, though no physical mitigation measures will be required.

POI	Key Constraint	Details
18	**A859 southwest of Creagan na Coille** 	Loads will continue on the A859 southbound. A swept path assessment has been undertaken and indicates that the blade tip will over-sail the outside verge of the bend where the vegetation should be trimmed. Loads will over-sail the inside verge, though no physical mitigation measures will be required. Swept path assessment SK11 is included in Appendix B.
19	**A859 North of Loch Cnoc Lain Duibh** 	Loads will continue on the A859 southbound. Loads are expected to over-sail both verges through the bend, though no physical mitigation measures will be required.
20	**A859 southwest of Cnoc a' Bhlair Bhain** 	Loads will continue on the A859 southbound. A swept path assessment has been undertaken and indicates that the blade tip will over-sail the bollards on the outside verge of the bend. Loads will over-run and over-sail the inside verge where a load bearing surface should be laid and the proximity to the rock face should be confirmed during the test run. A land search is recommended to confirm the extent of the adopted land boundary. Swept path assessment SK12 is included in Appendix B.
21	**A859 at Cnoc Glas** 	Loads will continue on the A859 southbound. Loads are expected to over-sail both verges through the bend where the vegetation should be trimmed.

POI	Key Constraint	Details
22	**A859 East of Loch Nabhar**  	Loads will continue on the A859 southbound. A swept path assessment has been undertaken and indicates that loads will over-sail both verges through the section. One road sign should be removed from the inside verge of the right-hand bend. Swept path assessment SK13 is included in Appendix B.
23	**A859 North of Laxay/ Lacasaigh** 	Loads will continue on the A859 westbound. Loads are expected to over-sail both verges through the section, though no physical mitigation measures will be required.
24	**A859 Southwest of Nabhar** 	Loads will continue on the A859 westbound. Loads are expected to over-sail both verges through the bends, though no physical mitigation measures will be required.

<table>
<tr><th>POI</th><th>Key Constraint</th><th>Details</th></tr>
<tr><td>25</td><td>A859 at Laxay Bridge

</td><td>Loads will continue on the A859 southbound.

Loads are expected to over-sail both verges through the bend, though no physical mitigation measures will be required.</td></tr>
<tr><td>26</td><td>A859 Loch Bhaltois
</td><td>Loads will continue on the A859 westbound.

Loads should be set on higher suspension settings to avoid the need for physical works in this section.

The vertical profile of the road at this location is pronounced and should be reviewed during the test run stage, to ascertain if tar wedges will be required to prevent grounding.</td></tr>
<tr><td>27</td><td>A859 West of Loch Bhaltois
</td><td>Loads will continue on the A859 westbound.

Loads are expected to over-sail both verges through the bend, though no physical mitigation measures will be required.</td></tr>
<tr><td>28</td><td>A859 Mircill Mhor
</td><td>Loads will continue on the A859 westbound.

A swept path assessment has been undertaken and indicates that loads will over-sail both verges of the first left-hand bend, though no physical mitigation measures will be required.

The blade tip will over-sail the outside verge of the following right-hand bend where one road sign should be removed. Loads will over-sail the inside verge where one lighting column should be removed and vegetation cleared.

The blade tip will over-sail the outside verge of the final left-hand bend where one private sign and two lighting columns should be removed. Loads will over-sail the inside verge, though no physical mitigation measures will be required.

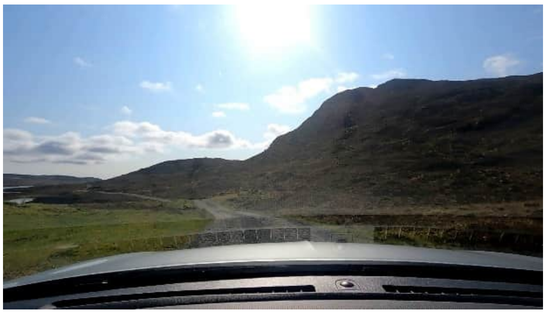
Swept path assessment SK14 is included in Appendix B.</td></tr>
</table>

POI	Key Constraint	Details
29	**A859 South of Doire Bhail' Ailein** 	Loads will continue on the A859 westbound. A swept path assessment has been undertaken and indicates that the blade tip will over-sail the outside verge of the first slight right-hand bend, though no physical mitigation measures will be required. Loads will over-sail the inside verge where one lighting column should be removed. Loads will over-sail the southern verge through the section, though no physical mitigation measures will be required. Swept path assessment SK15 is included in Appendix B.
30	**A859 Beinn Bhuidhe** 	Loads will continue on the A859 westbound. A swept path assessment has been undertaken and indicates that the blade tip will over-sail the outside verge of the first right-hand bend where one road sign should be removed and the trees trimmed. Loads will over-sail the inside verge where one lighting column should be removed. The proximity to the rock face should be confirmed on a topographical base survey. Loads will over-sail the inside verge of the following slight right-hand bend, though no physical mitigation measures will be required. Swept path assessment SK16 is included in Appendix B.
31	**A859 Baile Ailein** 	Loads will continue on the A859 westbound. The blade tip is expected to over-sail the outside verge of the bend, though no physical mitigation measures will be required.
32	**A859 West of Baile Ailein**  	Loads will continue on the A859 westbound. The blade tip is expected to over-sail the outside verge of the first right-hand bend, though no physical mitigation measures will be required.

POI	Key Constraint	Details
33	**A859 East of B8060 Junction** 	Loads will continue on the A859 westbound. Loads are expected to over-sail both verges of the bend, though no physical mitigation measures will be required.
34, 35	**A859 / Eisgean Road Junction**  	Loads will turn left from the A859 onto the road leading to Eisgean Lodge. A swept path assessment has been undertaken and indicates that the blade tip will oversail the western verge of the A859 on approach to the junction although no works are required. Loads will overrun and oversail the inside of the junction where a load bearing surface should be laid. The ditch should be culverted and **third party land** is required. The Eisgean Road should be widened to a minimum of 4.5m. The existing culvert should be extended. The vertical profile of the road at this location is pronounced and should be reviewed during the test run stage, to ascertain if tar wedges will be required to prevent grounding. Swept path assessment SK17 is included in Appendix B.
36, 37	**Eisgean Road, Goidamol**  	Loads will continue along the Eisgean Road eastbound. A swept path assessment has been undertaken and indicates that loads will oversail both verges of the carriageway throughout this location. One road sign should be removed on the southern verge prior to the first bend. The cattlegrid should be extended and reinforced to accommodate the proposed loads. The Eisgean Road should be widened to a minimum of 4.5m and embankment works are required to accommodate the widening and oversail. The vertical profile of the road at this location is pronounced and should be reviewed during the test run stage, to ascertain if tar wedges will be required to prevent grounding. Swept path assessment SK18 is included in Appendix B.

POI	Key Constraint	Details
38	**Eisgean Road, Beinn a' Mhula** 	Loads will continue along the Eisgean Road southbound. A swept path assessment has been undertaken and indicates that loads will oversail both verges of the carriageway throughout this location. A land search is recommended to confirm the extent of the adopted boundary at this location. The Eisgean Road should be widened to a minimum of 4.5m. The existing culvert should be extended. The vertical profile of the road at this location is pronounced and should be reviewed during the test run stage, to ascertain if tar wedges will be required to prevent grounding. Swept path assessment SK19 is included in Appendix B.
39	**Eisgean Road, North of Loch an Iar** 	Loads will continue along the Eisgean Road southeast bound. The vertical profile of the road at this location is pronounced and should be reviewed during the test run stage, to ascertain if tar wedges will be required to prevent grounding.
40, 41	**Eisgean Road, Loch na Muilne**  	Loads will continue along the Eisgean Road southbound. A swept path assessment has been undertaken and indicates that loads will oversail both verges of the carriageway throughout this location. The Eisgean Road should be widened to a minimum of 4.5m and all ditches should be culverted where widening is proposed. All existing watercourse culverts should be extended with road widening. Embankment works are required through both left bends. **Third party land** is required on both sides of the carriageway through this location. The vertical profile of the road at this location is pronounced and should be reviewed during the test run stage, to ascertain if tar wedges will be required to prevent grounding. Swept path assessment SK20 is included in Appendix B.
42	**Eisgean Road, North of Sideabhal** 	Loads will continue along the Eisgean Road southbound. A swept path assessment has been undertaken and indicates that loads will oversail both verges of the carriageway throughout this location. A land search is recommended to confirm the extent of the adopted boundary at this location. The Eisgean Road should be widened to a minimum of 4.5m and embankment works are required to accommodate the widening. The existing watercourse culverts should be extended. Swept path assessment SK21 is included in Appendix B.

POI	Key Constraint	Details
43	**Eisgean Road, East of Sideabhal** 	Loads will continue along the Eisgean Road southbound. A swept path assessment has been undertaken and indicates that loads will oversail both verges of the carriageway throughout this location. A land search is recommended to confirm the extent of the adopted boundary at this location. The Eisgean Road should be widened to a minimum of 4.5m and the existing culvert should be extended. Swept path assessment SK22 is included in Appendix B.
44	**Eisgean Road, Ceann Shiphoirt**  	Loads will continue along the Eisgean Road southbound. A swept path assessment has been undertaken and indicates that loads will oversail both verges of the carriageway throughout this location. The blade tip will oversail the western fence through the first right bend. **Third party land** is required. The Eisgean Road should be widened to a minimum of 4.5m and embankment works are required to accommodate the widening. The ditch should be culverted where widening is proposed. **Third party land** is required on both verges of the carriageway. The vertical profile of the road at this location is pronounced and should be reviewed during the test run stage, to ascertain if tar wedges will be required to prevent grounding. Swept path assessment SK23 is included in Appendix B.
45	**Eisgean Road, North of Linne na h-Athadh** 	Loads will continue along the Eisgean Road eastbound. The vertical profile of the road at this location is pronounced and should be reviewed during the test run stage, to ascertain if tar wedges will be required to prevent grounding.
46	**Eisgean Road, Beinn Lobhair** 	Loads will continue along the Eisgean Road eastbound. A swept path assessment has been undertaken and indicates that loads will oversail both verges of the carriageway throughout this location. A section of wall should be removed on the northern verge where **third party land** is required. The Eisgean Road should be widened to a minimum of 4.5m. Swept path assessment SK24 is included in Appendix B.

POI	Key Constraint	Details
47, 48	**Eisgean Road, Leathad nan Carnaichean**  	Loads will continue along the Eisgean Road southbound. A swept path assessment has been undertaken and indicates that loads will oversail both verges of the carriageway throughout this location. The fence on the inside verge through the first bend should be removed and **third party land** is required. The Eisgean Road should be widened to a minimum of 4.5m. All existing watercourse culverts should be extended with the proposed widening. **Third party land** is required on both verges of the carriageway. The cattle grid north of the bridge should be extended and reinforced. The fence and gate should be removed. A new bridge should be constructed over the watercourse to allow abnormal load movements. This structure could be permanent of a temporary structure depending upon the view of the Council. Swept path assessment SK25 is included in Appendix B.
49, 50	**Eisgean Road, Northeast of Gearraidh Sgeiravat**  	Loads will continue along the Eisgean Road eastbound. A swept path assessment has been undertaken and indicates that loads will oversail both verges of the carriageway throughout this location. The Eisgean Road should be widened to a minimum of 4.5m and embankment works are required to accommodate the widening. The ditch should be culverted where widening is proposed. **Third party land** is required on both verges of the carriageway. The vertical profile of the road at this location is pronounced and should be reviewed during the test run stage, to ascertain if tar wedges will be required to prevent grounding. Swept path assessment SK26 is included in Appendix B.

POI	Key Constraint	Details
51	**Eisgean Road, Cleit na h-Uamha**     	Loads will continue along the Eisgean Road eastbound. A swept path assessment has been undertaken and indicates that loads will oversail both verges of the carriageway throughout this location. The Eisgean Road should be widened to a minimum of 4.5m and embankment works are required to accommodate the widening. The existing ditch should be culverted where widening is proposed. All existing watercourse culverts should be extended with the proposed widening. **Third party land** is required on both verges of the carriageway. The vertical profile of the road at this location is pronounced and should be reviewed during the test run stage, to ascertain if tar wedges will be required to prevent grounding. Swept path assessment SK27 is included in Appendix B.

<table>
<tr><th>POI</th><th>Key Constraint</th><th>Details</th></tr>
<tr><td>53</td><td>Eisgean Road, Cleit na h-Airigh



</td><td>Loads will continue along the Eisgean Road eastbound.

A swept path assessment has been undertaken and indicates that loads will oversail both verges of the carriageway throughout this location.

The Eisgean Road should be widened to a minimum of 4.5m. All existing watercourse culverts should be extended with the proposed widening.

Third party land is required on both verges of the carriageway.

Swept path assessment SK28 is included in Appendix B.</td></tr>
<tr><td>54</td><td>Eisgean Road, Loch an Eilein Liatha
</td><td>Loads will continue along the Eisgean Road southbound.

A swept path assessment has been undertaken and indicates that loads will oversail both verges of the carriageway throughout this location.

The Eisgean Road should be widened to a minimum of 4.5m. The ditch should be culverted where widening is proposed. All existing watercourse culverts should be extended with the proposed widening.

Swept path assessment SK29 is included in Appendix B.</td></tr>
</table>

POI	Key Constraint	Details
55	**Eisgean Road, North of Loch a' Choin Dhuibh**  	Loads will continue along the Eisgean Road southbound. A swept path assessment has been undertaken and indicates that loads will oversail both verges of the carriageway throughout this location. The Eisgean Road should be widened to a minimum of 4.5m and embankment works are required to accommodate the widening. The ditch should be culverted where widening is proposed. All existing watercourse culverts should be extended with the proposed widening. **Third party land** is required on both verges of the carriageway. The vertical profile of the road at this location is pronounced and should be reviewed during the test run stage, to ascertain if tar wedges will be required to prevent grounding. Swept path assessment SK30 is included in Appendix B.
56	**Eisgean Road, North of Loch a' Choin Dhuibh** 	Loads will continue along the Eisgean Road southbound. The existing watercourse culvert should be extended with the proposed widening.
57	**Eisgean Road, East of Lochan nan Uidhean Beaga** 	Loads will continue along the Eisgean Road southbound. The existing watercourse culvert should be extended with the proposed widening.
58	**Eisgean Road, Southeast of Loch a' Choin Dhuibh** 	Loads will continue along the Eisgean Road southbound. The existing watercourse culvert should be extended with the proposed widening.

POI	Key Constraint	Details
59	**Eisgean Road, Loch a' Ghiuthais**    	Loads will continue along the Eisgean Road southbound. A swept path assessment has been undertaken and indicates that loads will oversail both verges of the carriageway throughout this location. The Eisgean Road should be widened to a minimum of 4.5m and embankment works are required to accommodate the widening. The ditch should be culverted where widening is proposed. All existing watercourse culverts should be extended with the proposed widening. **Third party land** is required on both verges of the carriageway. The fence, stone gate posts and the gate should be removed at the cattle grid crossing. The cattle grid itself should be extended and reinforced to accommodate the proposed loads. **Third party land** is required. Swept path assessment SK31 is included in Appendix B.
60	**Eisgean Road, West of Druim Caol** 	Loads will continue along the Eisgean Road southbound. The existing watercourse culvert should be extended with the proposed widening.

POI	Key Constraint	Details
61	**Eisgean Road, East of Cleite Leathann** 	Loads will depart from the public road at this location, utilising a newly proposed junction or one of the preceding newly proposed junctions to access different sections of the development area.

3.4 Swept Path Assessment Results and Summary

The detailed swept path drawings for the locations assessed are provided in Appendix B for review. The drawings in Appendix B illustrate tracking undertaken for the worst-case loads at each location.

The colours illustrated on the swept paths are:

- Grey / Black – OS / Topographical Base Mapping;
- Green – Vehicle body outline (body swept path);
- Red – Tracked pathway of the wheels (wheel swept path); and
- Purple – The over-sail tracked path of the load where it encroaches out with the trailer (load swept path).

Where mitigation works are required, the extents of over-run and over-sail areas are illustrated on the swept path drawings.

Please note that where assessments have been undertaken using Ordnance Survey (OS) base mapping, there can be errors in this data source.

Where provided by the client, topographical data has been utilised. Please note that PF cannot accept liability for errors on the data source, be that OS base mapping or client supplied data.

3.5 Land Ownership

The limits of road adoption can vary depending upon the location of the site and the history of the road agencies involved. The adopted area is generally defined as land contained within a defined boundary where the road agency holds the maintenance rights for the land. In urban areas, this usually defined as the area from the edge of the footway across the road to the opposing footway back edge.

In rural areas the area of adoption can be open to greater interpretation as defined boundaries may not be readily visible. In these locations, the general rule is that the area of adoption is between established fence / hedge lines or a maximum 2m from the road edge. This can vary between areas and location.

3.6 Summary Issues

It is strongly suggested that following a review of the RSR, Eurowind should undertake the following prior to the delivery of the first abnormal loads, to ensure load and road user safety:

- That any necessary topographical surveys are undertaken and the swept path results completed;
- A review of axle loading on structures along the entire access route with the various road agencies is undertaken immediately prior to the loads being transported in case of last-minute changes to structures;

- A review of clear heights with utility providers and the transport agencies along the route to ensure that there is sufficient space to allow for loads plus sufficient flashover protection (to electrical installations);
- That any verge vegetation and tree canopies which may foul loads is trimmed prior to loads moving;
- That a review of potential roadworks and or closures is undertaken once the delivery schedule is established in draft form;
- That a test run is completed to confirm the route and review any vertical clearance issues; and
- That a condition survey is undertaken to ascertain the extents of road defects prior to loads commencing to protect the developer from spurious damage claims.

4 Summary

4.1 Summary of Access Review

PF has been commissioned by Eurowind to prepare a Route Survey Report to examine the issues associated with the transport of AIL turbine components to Uisenis Wind Farm.

This report identifies the key points and issues associated with the proposed route and outlines the issues that will need to be considered for successful delivery of components.

This report has been based upon a worst case of Siemens Gamesa SGRE155 turbine sections and has been undertaken on the basis of a Superwing Carrier blade trailer.

The report is presented for consideration to Eurowind. Various road modifications, structural reviews, and interventions are required to successfully access the site. If these are undertaken, access to the consented wind farm site is considered feasible.

4.2 Further Actions

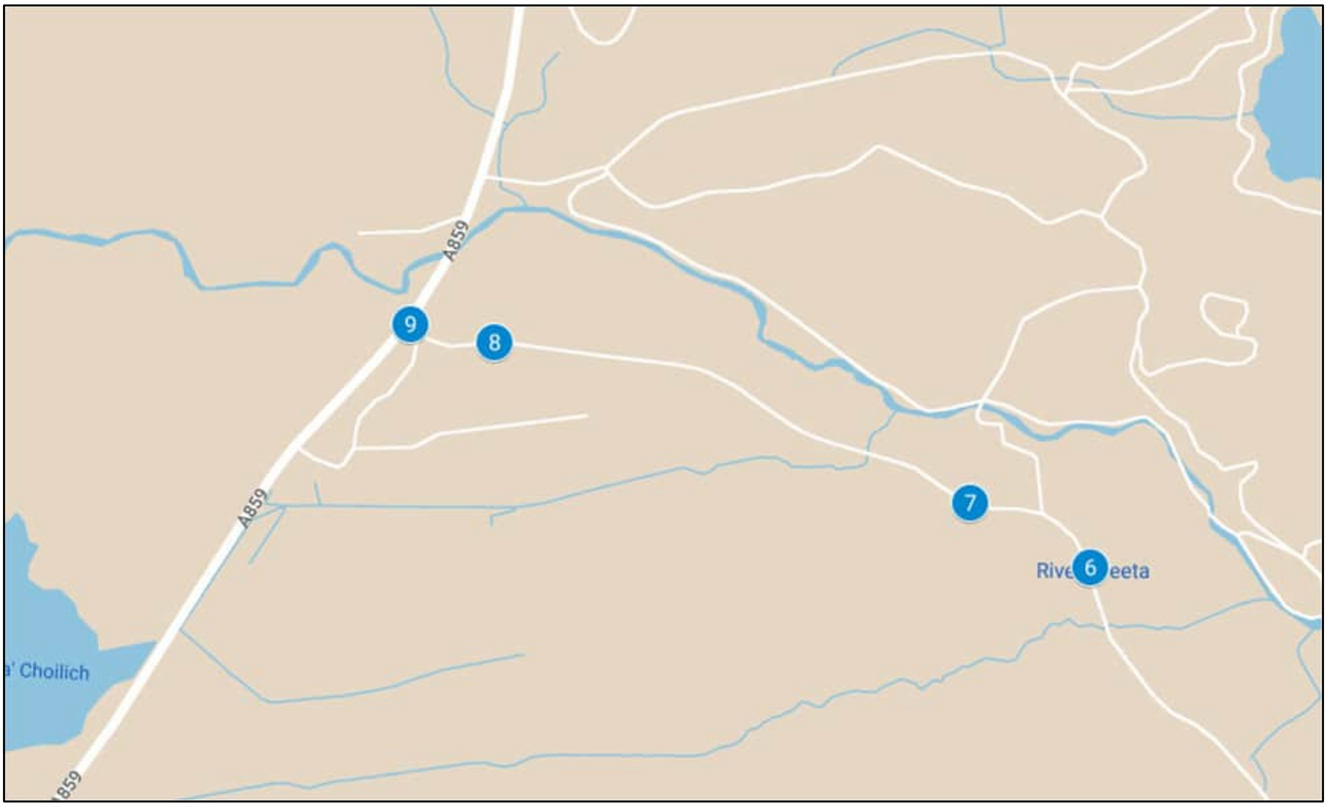
The following actions are recommended to pursue the transport and access issues further:

- Prepare detailed mitigation design proposals to help inform the land option / consultee discussions;
- Obtain the necessary land options;
- Undertake discussion with the affected utility providers and roads agencies;
- Obtain the necessary statutory licences to enable the mitigation measures; and
- Develop a detailed operational Transport Management Plan to assist in transporting the proposed loads.

Appendix A Points of Interest

An electronic version of the POI plan can be found here:

https://www.google.com/maps/d/edit?mid=1VU8YDGSVjM546LjhowrZJX-h9WI4rNU&usp=sharing

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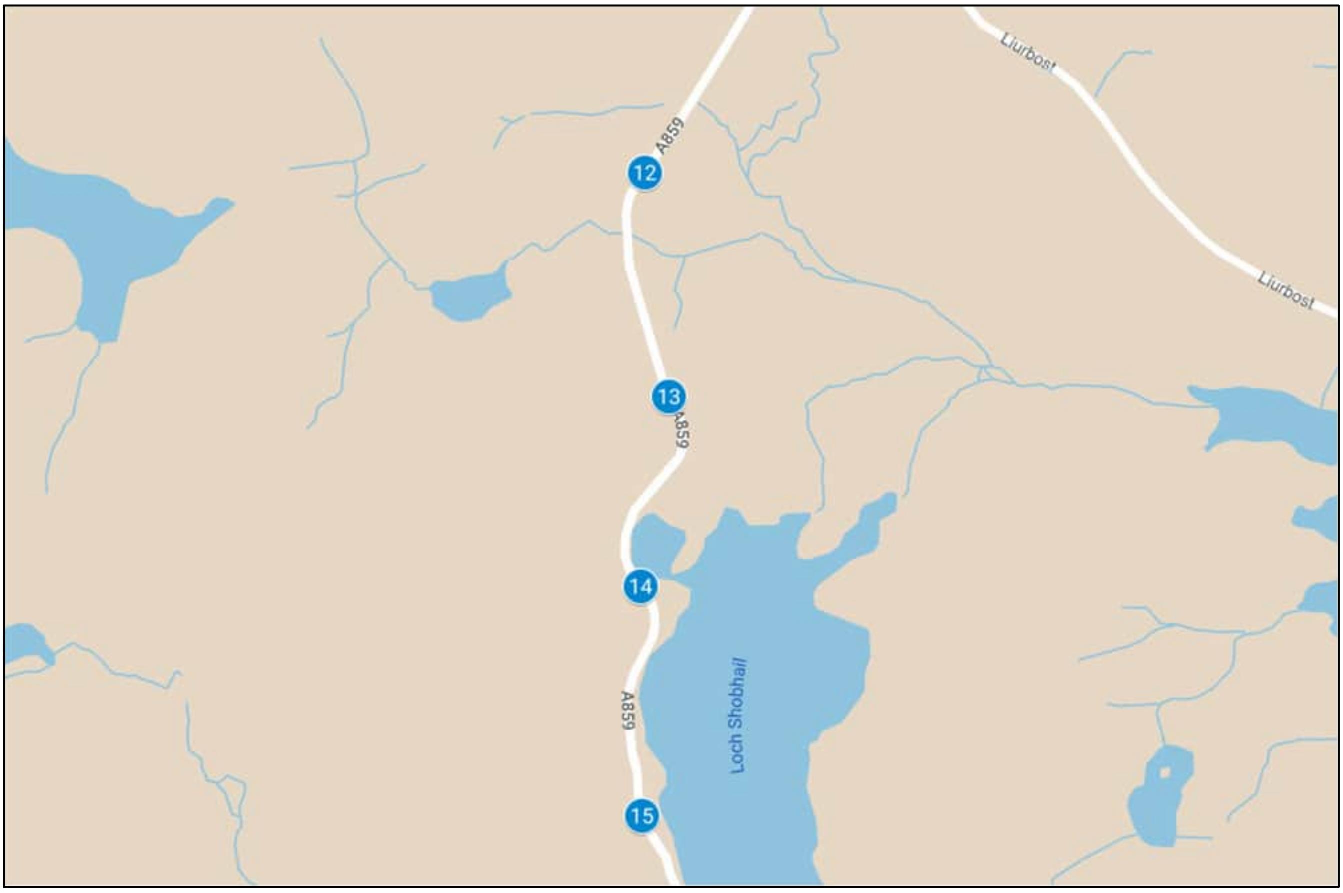
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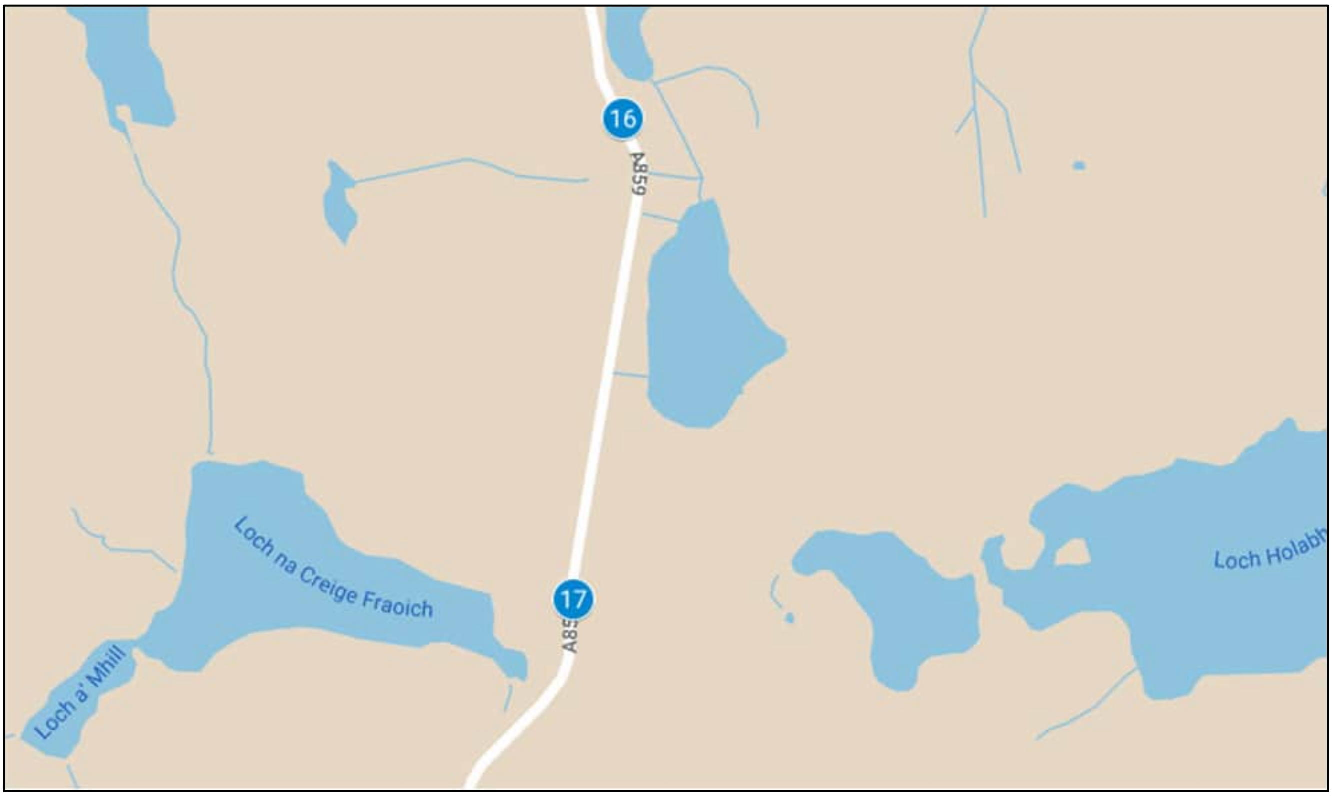
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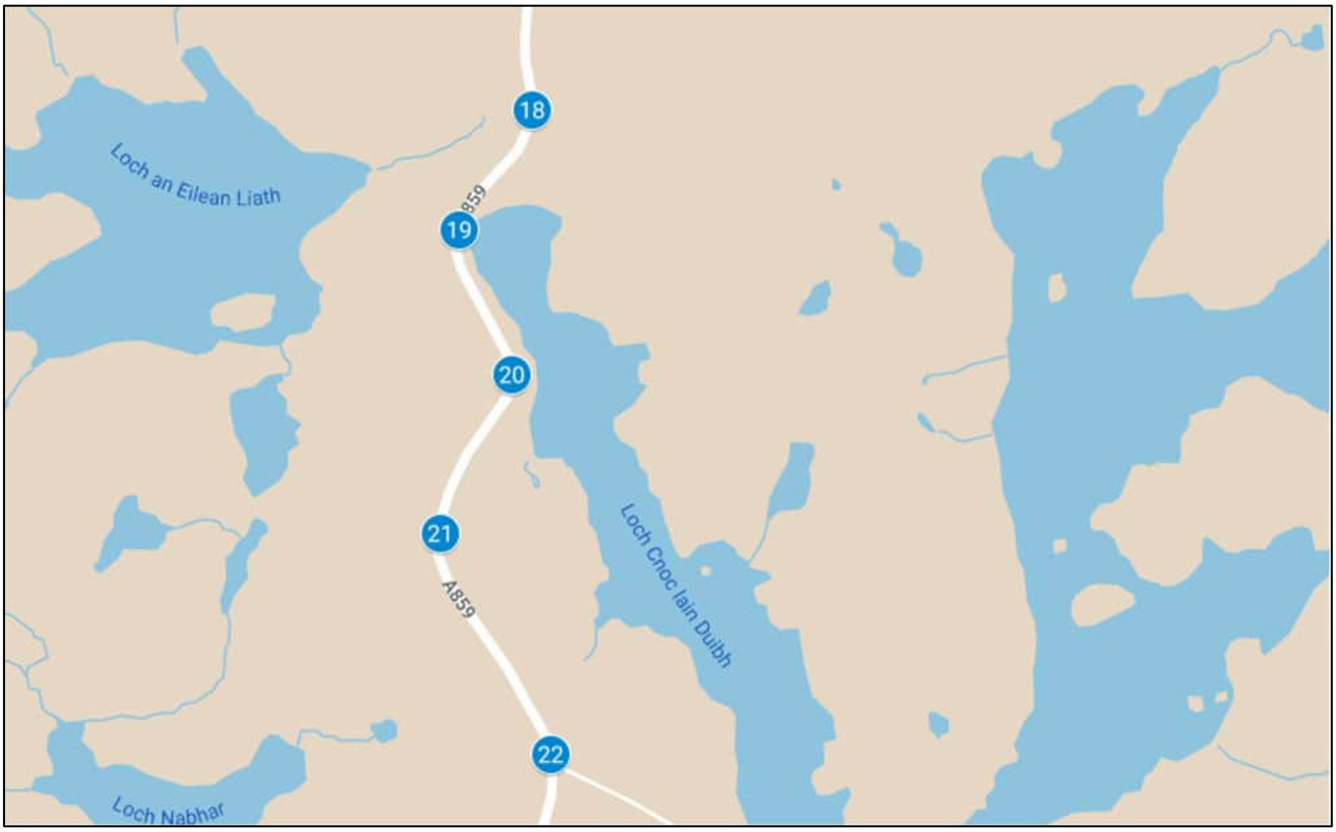
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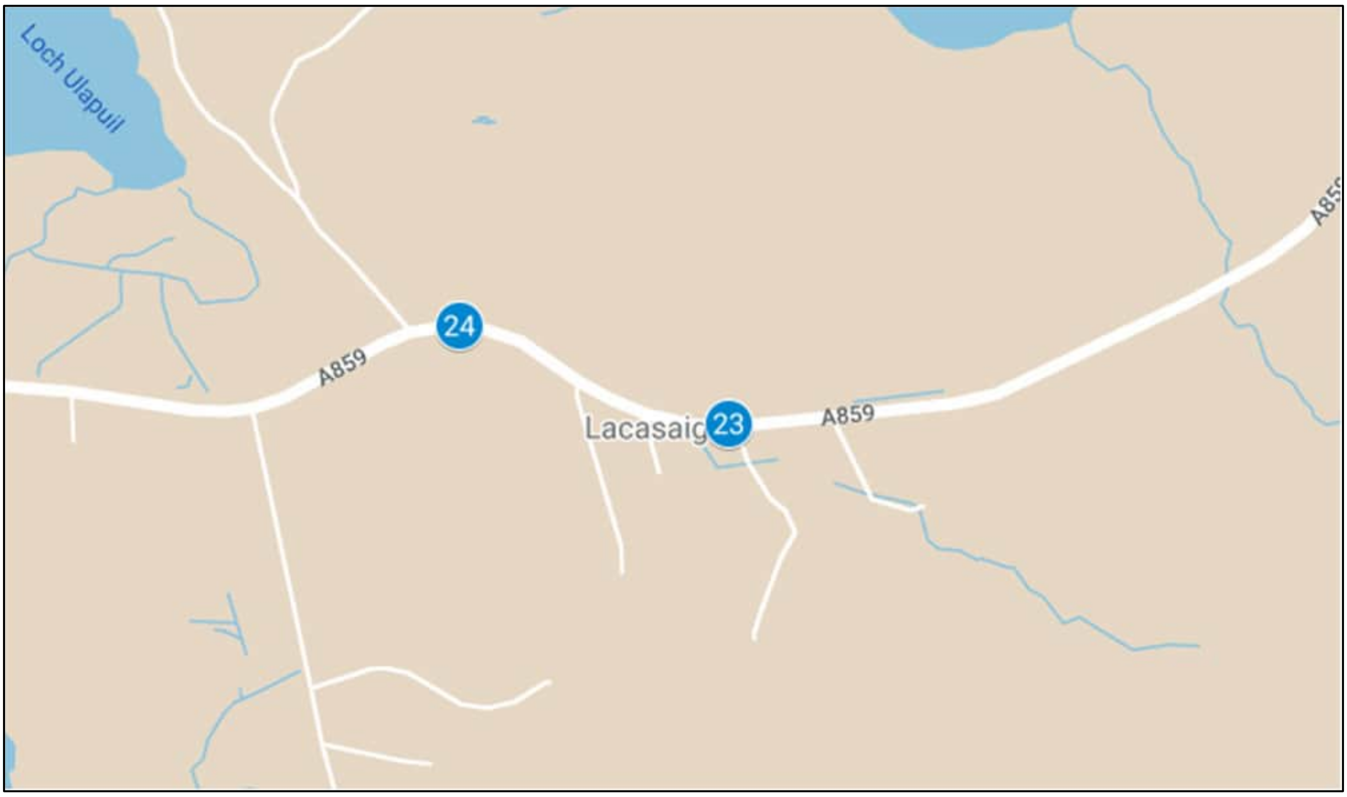
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School Ln
Allt nan Each


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A859
W End
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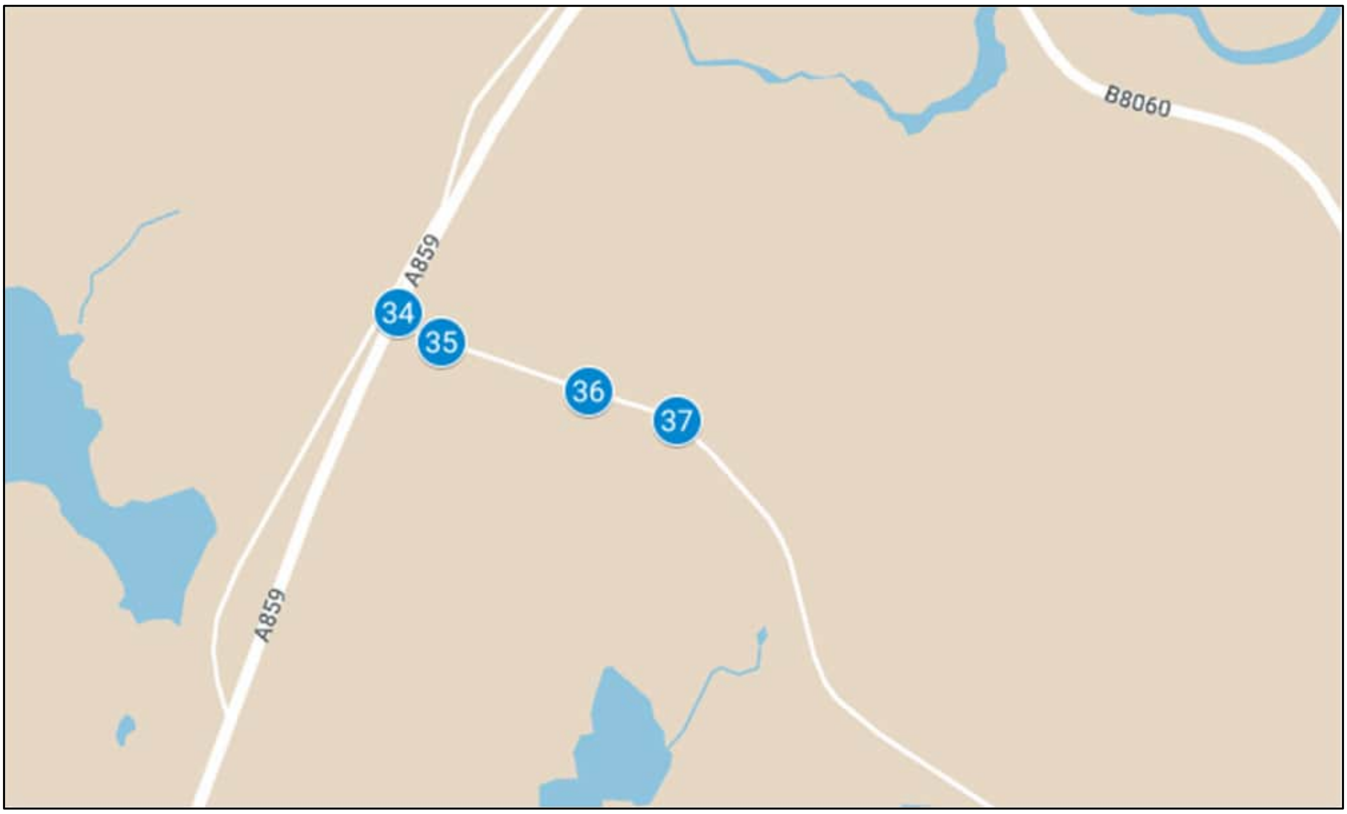
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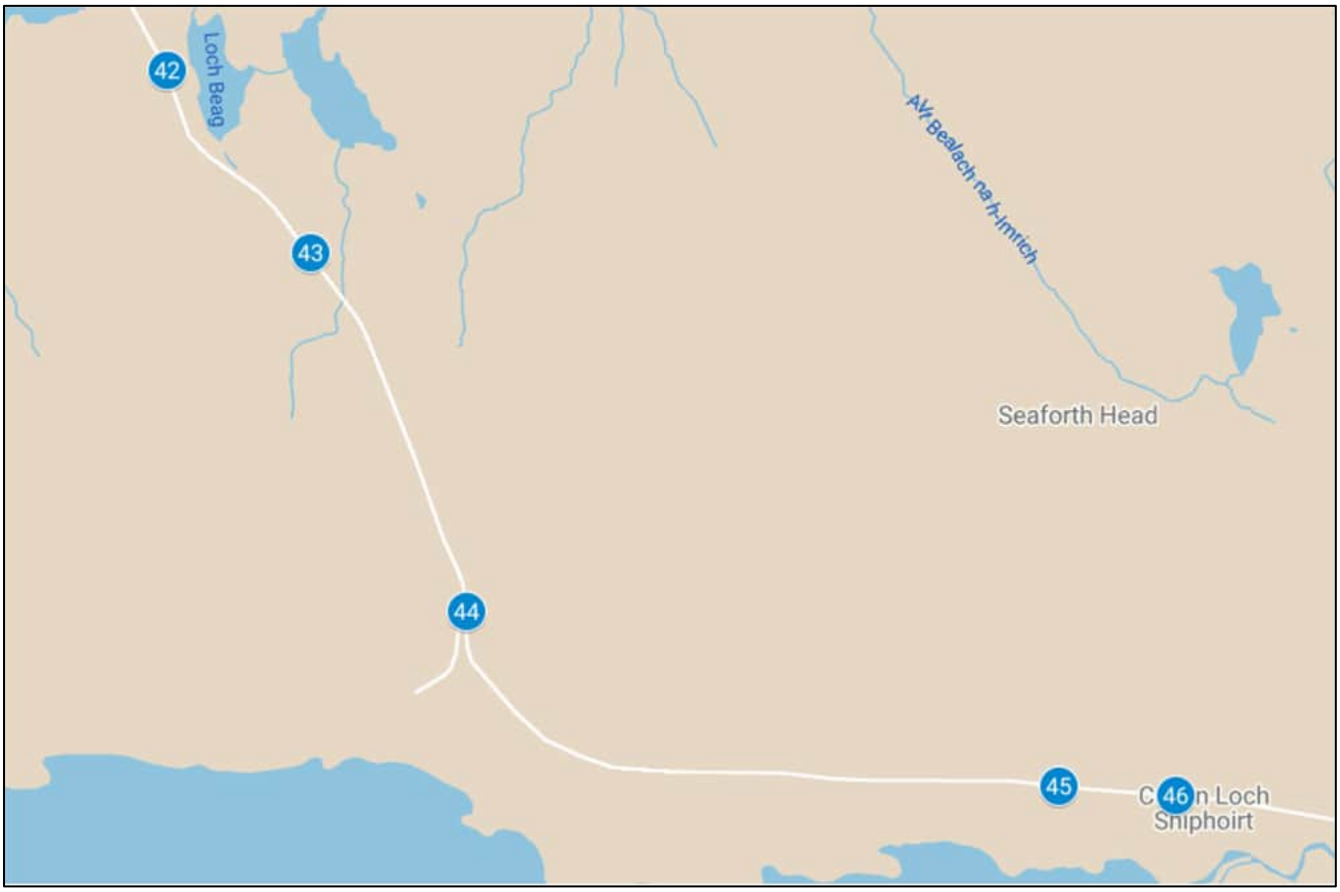
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Allt Bealach na h-Imrich
Seaforth Head
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Ceann Loch Shiphoirt


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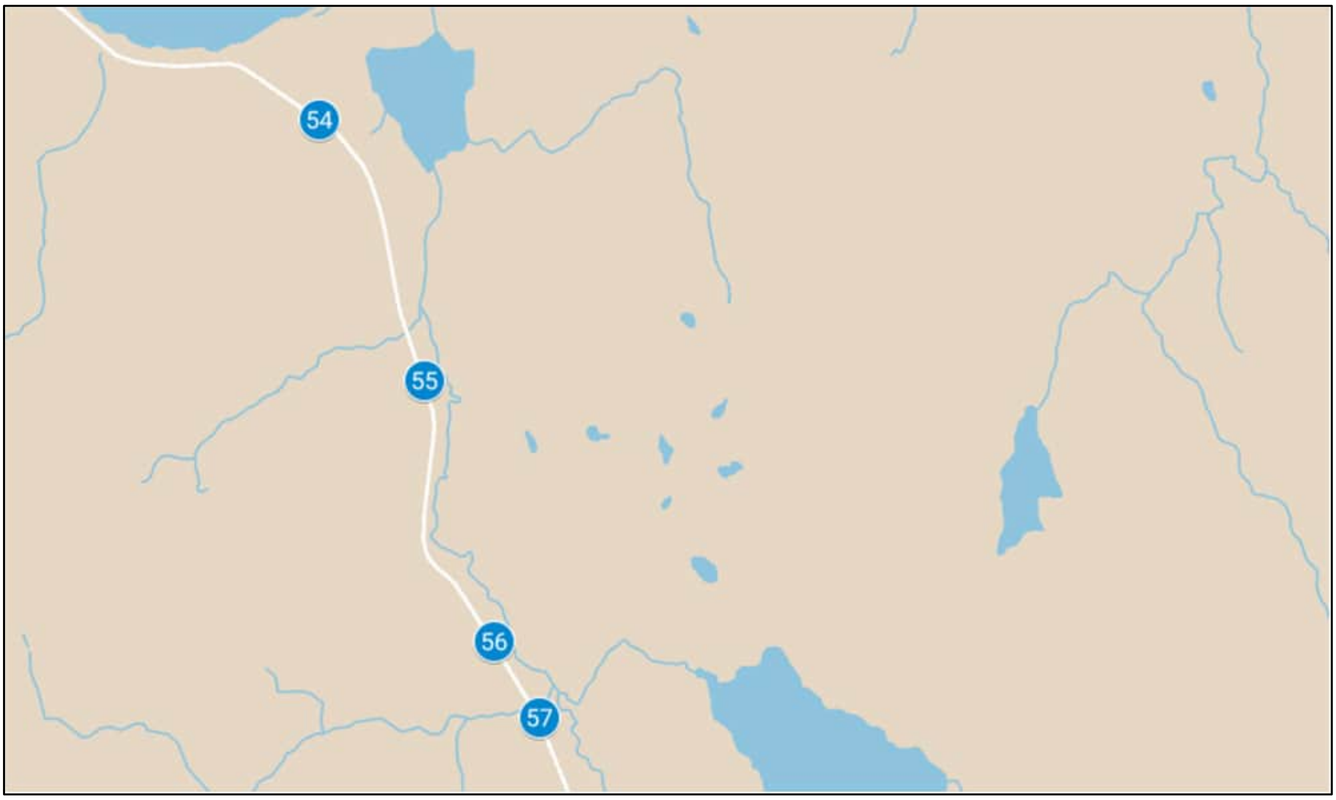
Loch Sgiobacleit
Allt nan Lagan Dubha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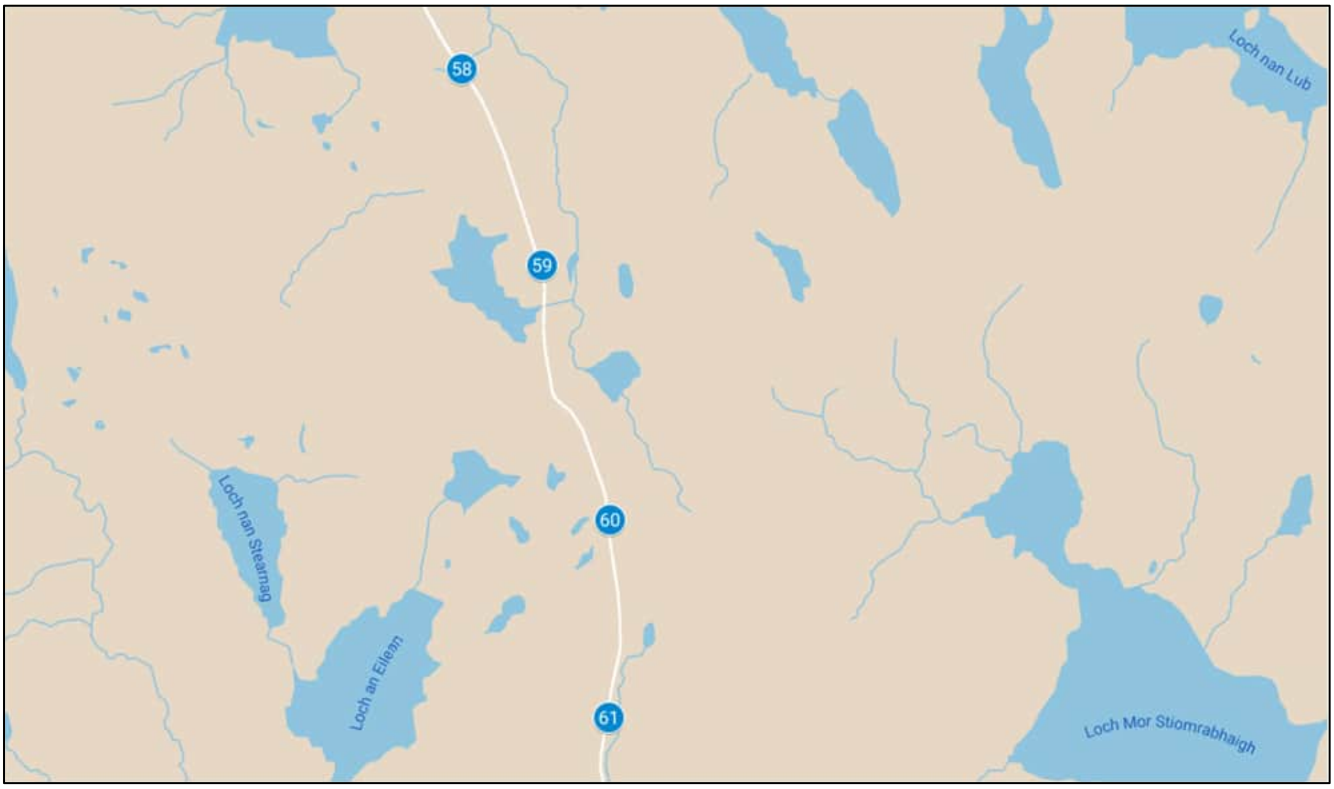
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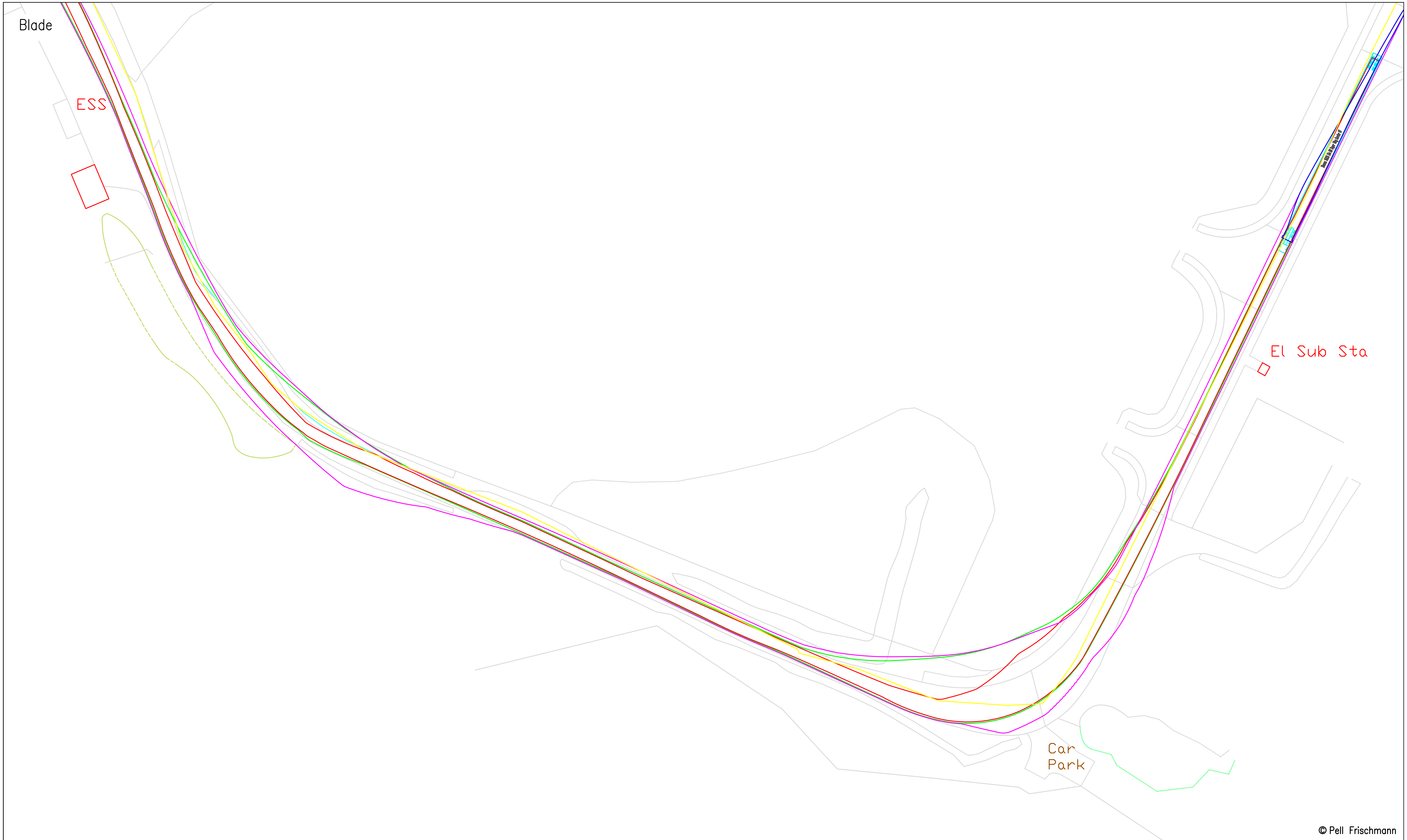
Loch an Eilean
Loch Mor Stiomrabhaigh

Appendix B Swept Path Assessments



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Client: Eurowind

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Over–run | Over–sail

Project: Uisenis Wind Farm

Drawing Title: Siemens SGRE155 Blade & Tower

SPA Location: Exit from Arnish Port

	Name	Date
Drawn	JS	30/05/2023
Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest		1

Scale: 1:1000 @ A3

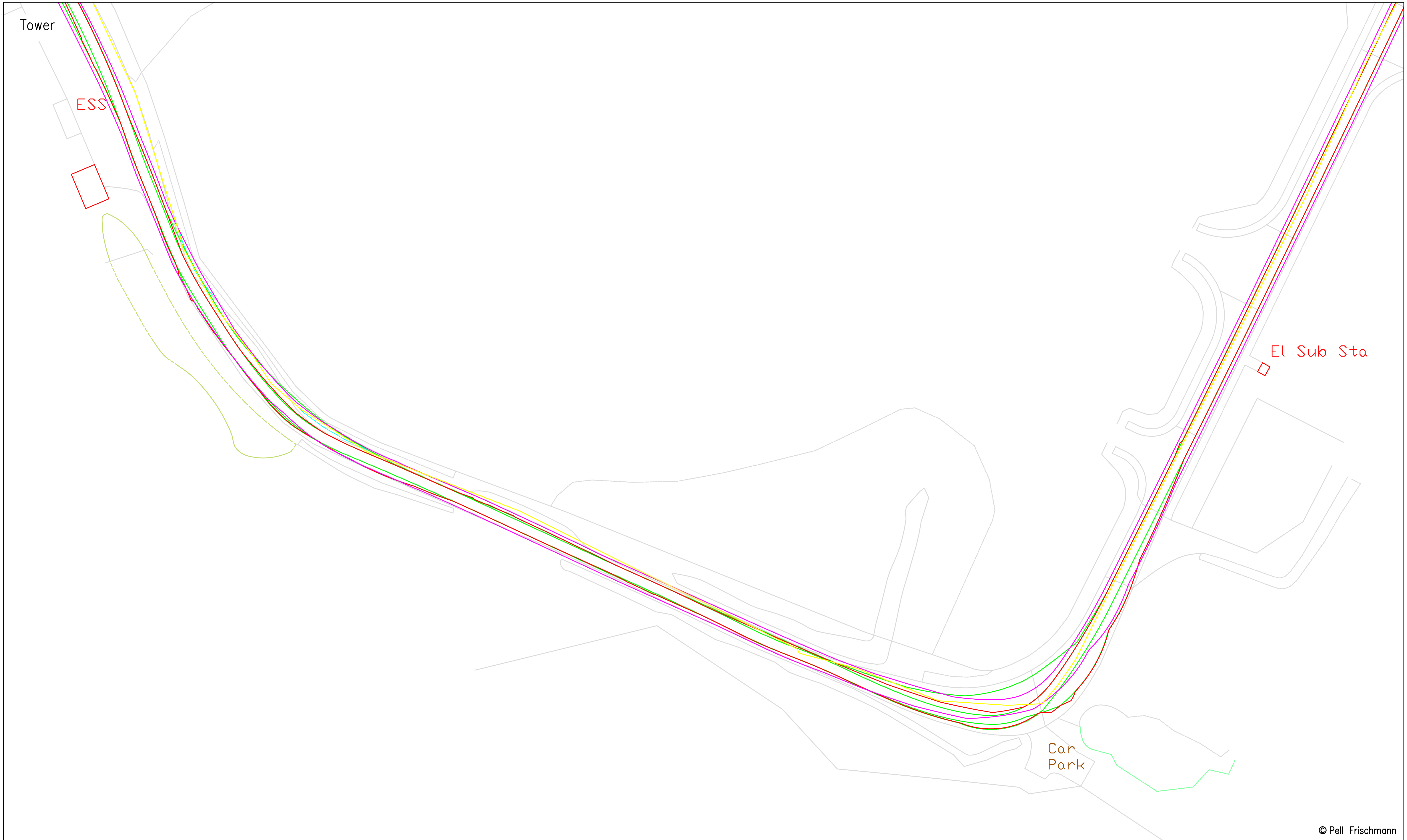
File No.: 230525 Uisenis SPA.dwg

Drawing Status: Draft

Drawing No.: SK01

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 1



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Client: Eurowind

Key: Wheel SPA, Body SPA, Load SPA, Indicative, Over–run, Over–sail

Project: Uisenis Wind Farm

Drawing Title: Siemens SGRE155 Blade & Tower

SPA Location: Exit from Arnish Port

	Name	Date
Drawn	JS	30/05/2023
Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest		1

Scale: 1:1000 @ A3

File No.: 230525 Uisenis SPA.dwg

Drawing Status: Draft

Drawing No.: SK01A

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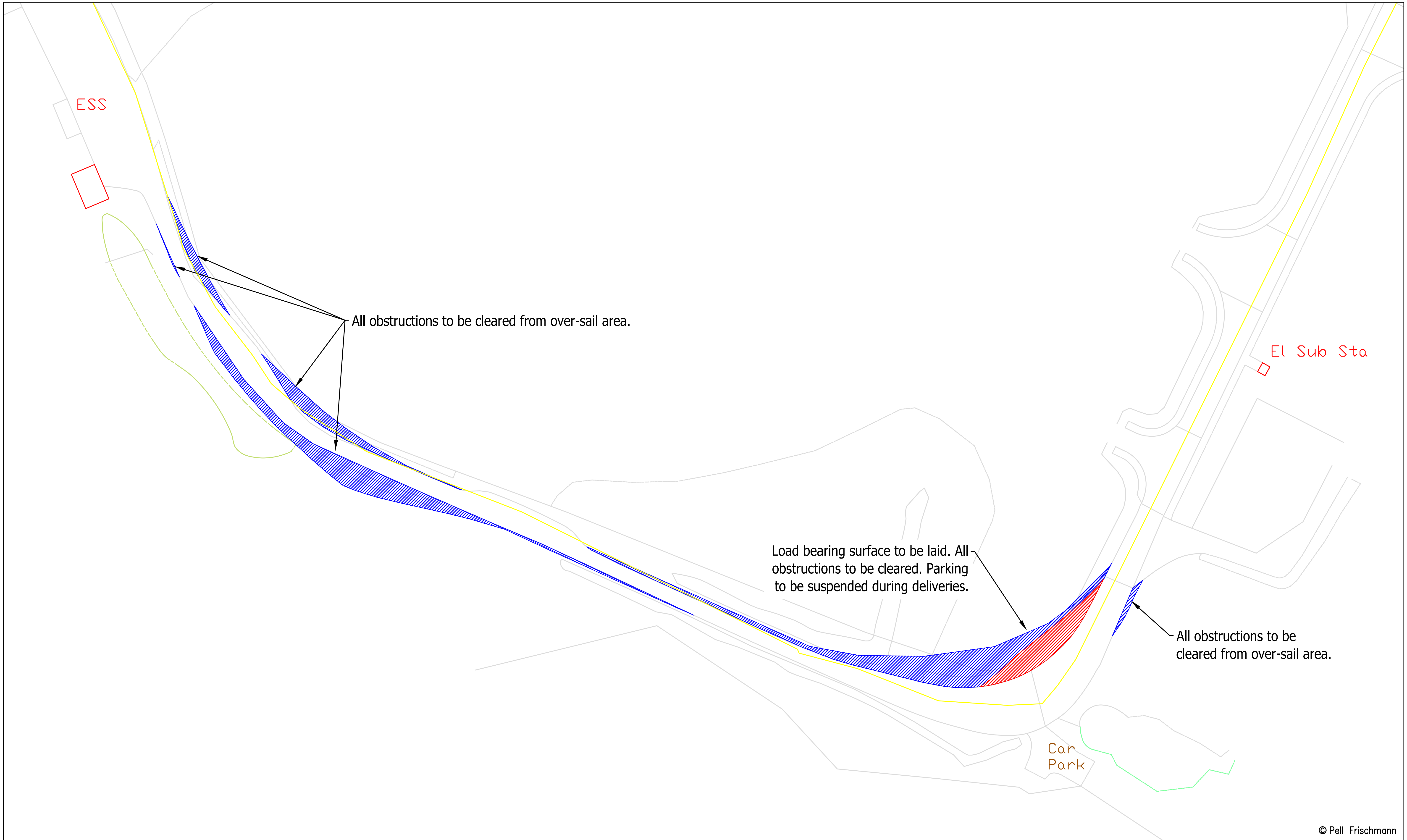

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Client: Eurowind

Project: Uisenis Wind Farm

Drawing Title: Siemens SGRE155 Blade & Tower

SPA Location: Exit from Arnish Port

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Over–run | Over–sail

	Name	Date
Drawn	JS	30/05/2023
Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest	1	

Scale: 1:1000 @ A3

File No. 230525 Uisenis SPA.dwg

Drawing Status: Draft

Drawing No. SK01B

Notes:
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Project: Uisenis Wind Farm

Client: Eurowind

Drawing Title: Siemens SGRE155 Blade & Tower

SPA Location: The Arnish Road northeast of Cnoc Airinis

Key: Wheel SPA, Body SPA, Load SPA, Indicative, Over–run, Over–sail

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Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest		2

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File No.: 230525 Uisenis SPA.dwg

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Drawing No.: SK02

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2. This is not a construction drawing and is intended for illustration purposes only.

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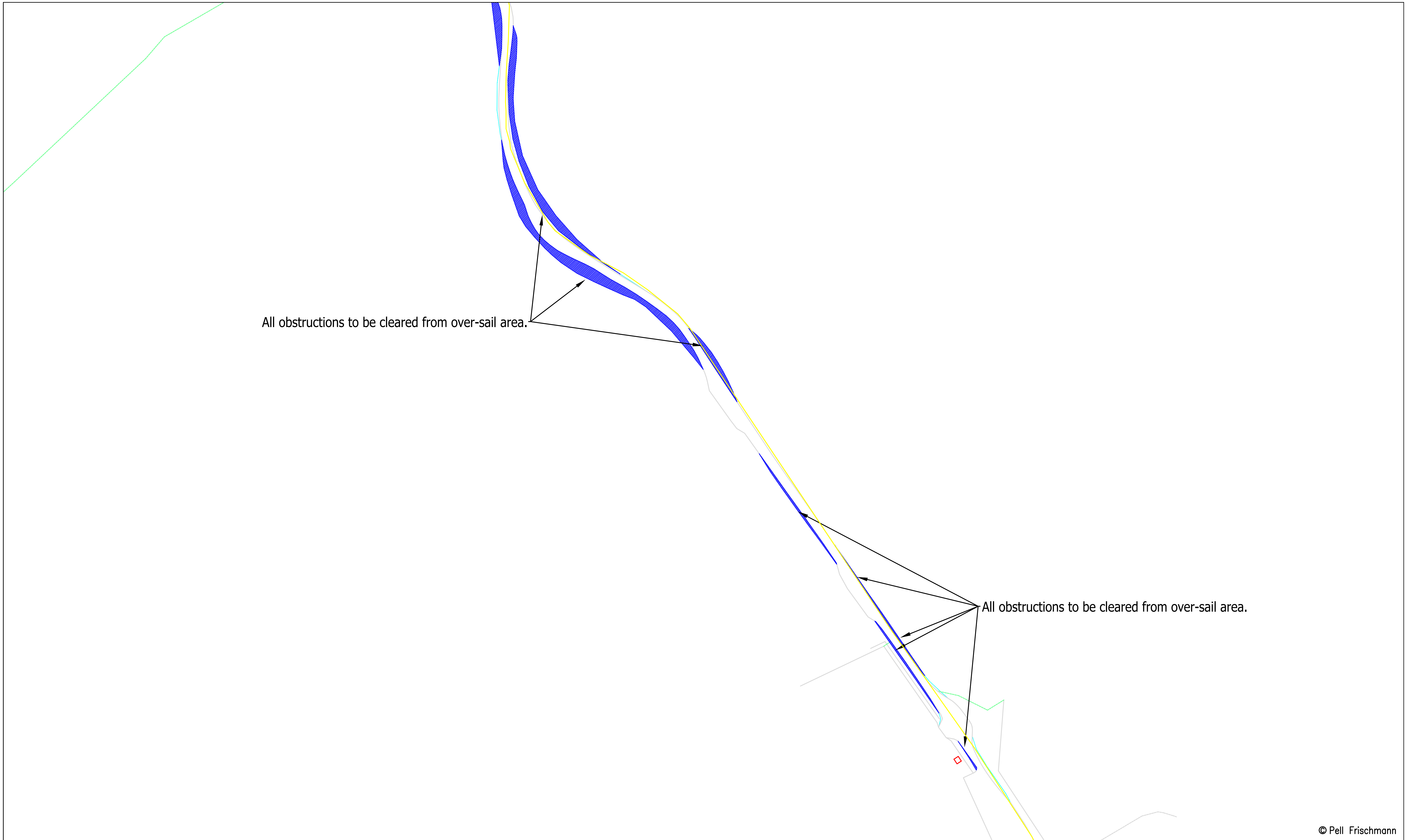

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Client: Eurowind

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Over-run | Over-sail

Project: Uisenis Wind Farm

Drawing Title: Siemens SGRE155 Blade & Tower

SPA Location: The Arnish Road northeast of Cnoc Airinis

	Name	Date
Drawn	JS	30/05/2023
Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest		2

Scale: 1:1750 @ A3

File No.: 230525 Uisenis SPA.dwg

Drawing Status: Draft

Drawing No.: SK02A

Notes:
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Client: Eurowind

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Over–run | Over–sail

Project: Uisenis Wind Farm

Drawing Title: Siemens SGRE155 Blade & Tower

SPA Location: The Arnish Road east of Loch a' Chrotaich

	Name	Date
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Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest		3,4

Scale: 1:2000 @ A3

File No.: 230525 Uisenis SPA.dwg

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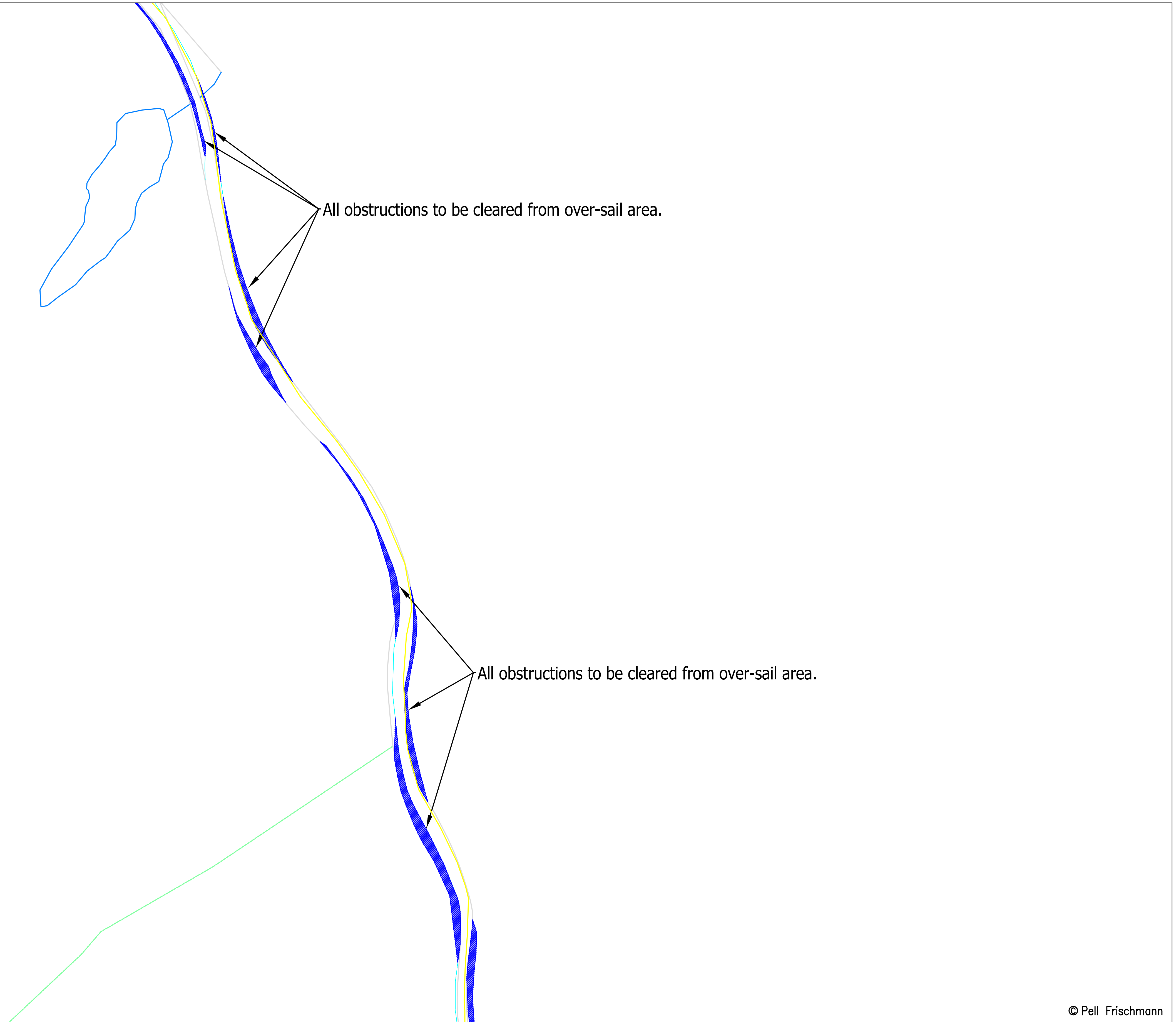

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Client: Eurowind

Project: Uisenis Wind Farm

Drawing Title: Siemens SGRE155 Blade & Tower

SPA Location: The Arnish Road east of Loch a' Chrotaich

Key: Wheel SPA, Body SPA, Load SPA, Indicative, Over-run, Over-sail

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Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest		3,4

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Drawing Status: Draft

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Notes:
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Client: Eurowind

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Over-run | Over-sail

Project: Uisenis Wind Farm

Drawing Title: Siemens SGRE155 Blade & Tower

SPA Location: The Arnish Road southwest of Poll a' Choire

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Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest		5

Scale: 1:2000 @ A3

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Drawing No.: SK04

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2. This is not a construction drawing and is intended for illustration purposes only.

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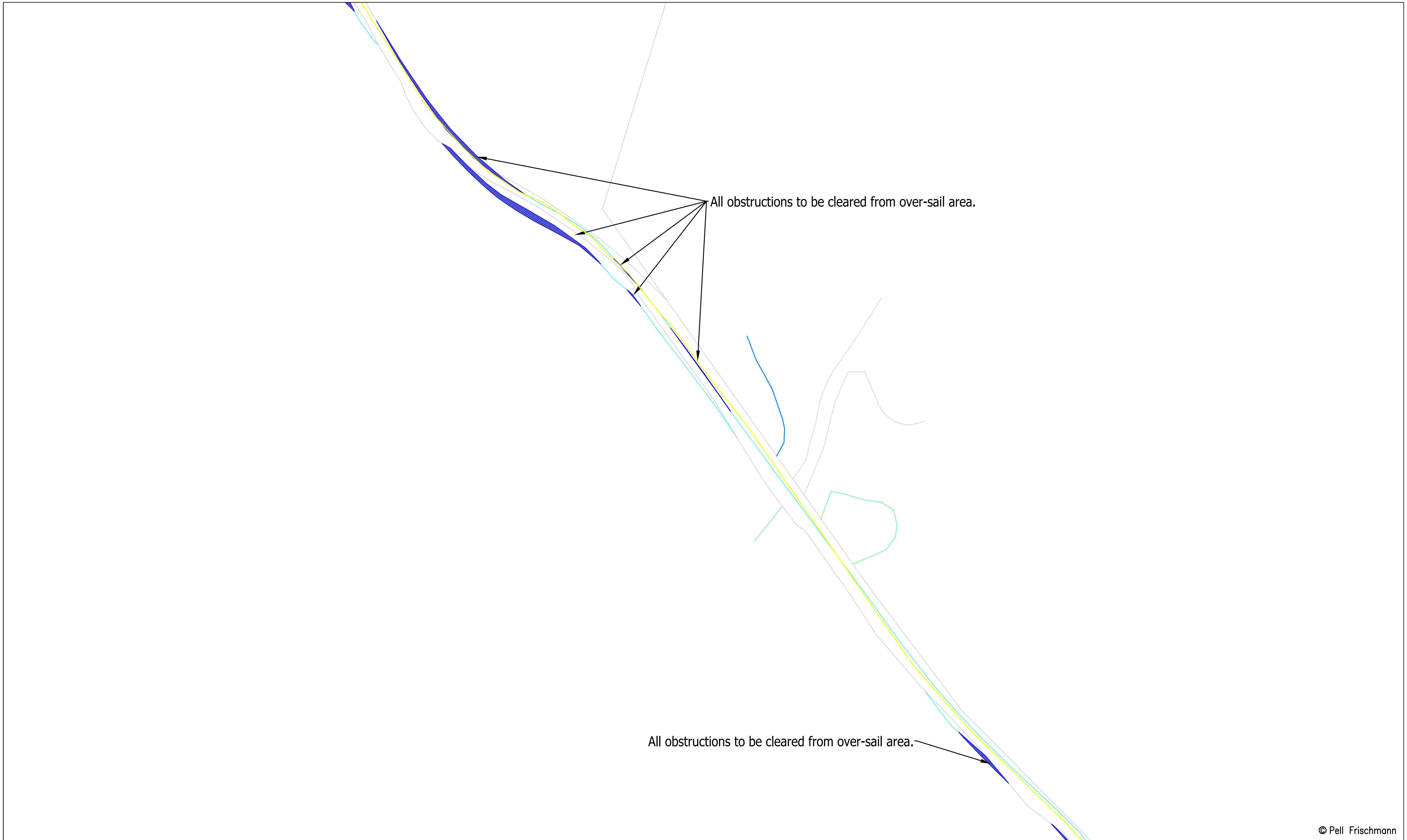

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Client: Eurowind

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Over–run | Over–sail

Project: Uisenis Wind Farm

Drawing Title: Siemens SGRE155 Blade & Tower

SPA Location: The Arnish Road southwest of Poll a' Choire

	Name	Date
Drawn	JS	30/05/2023
Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest		5

Scale: 1:1750 @ A3

File No.: 230525 Uisenis SPA.dwg

Drawing Status: Draft

Drawing No.: SK04A

Notes:
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2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 1

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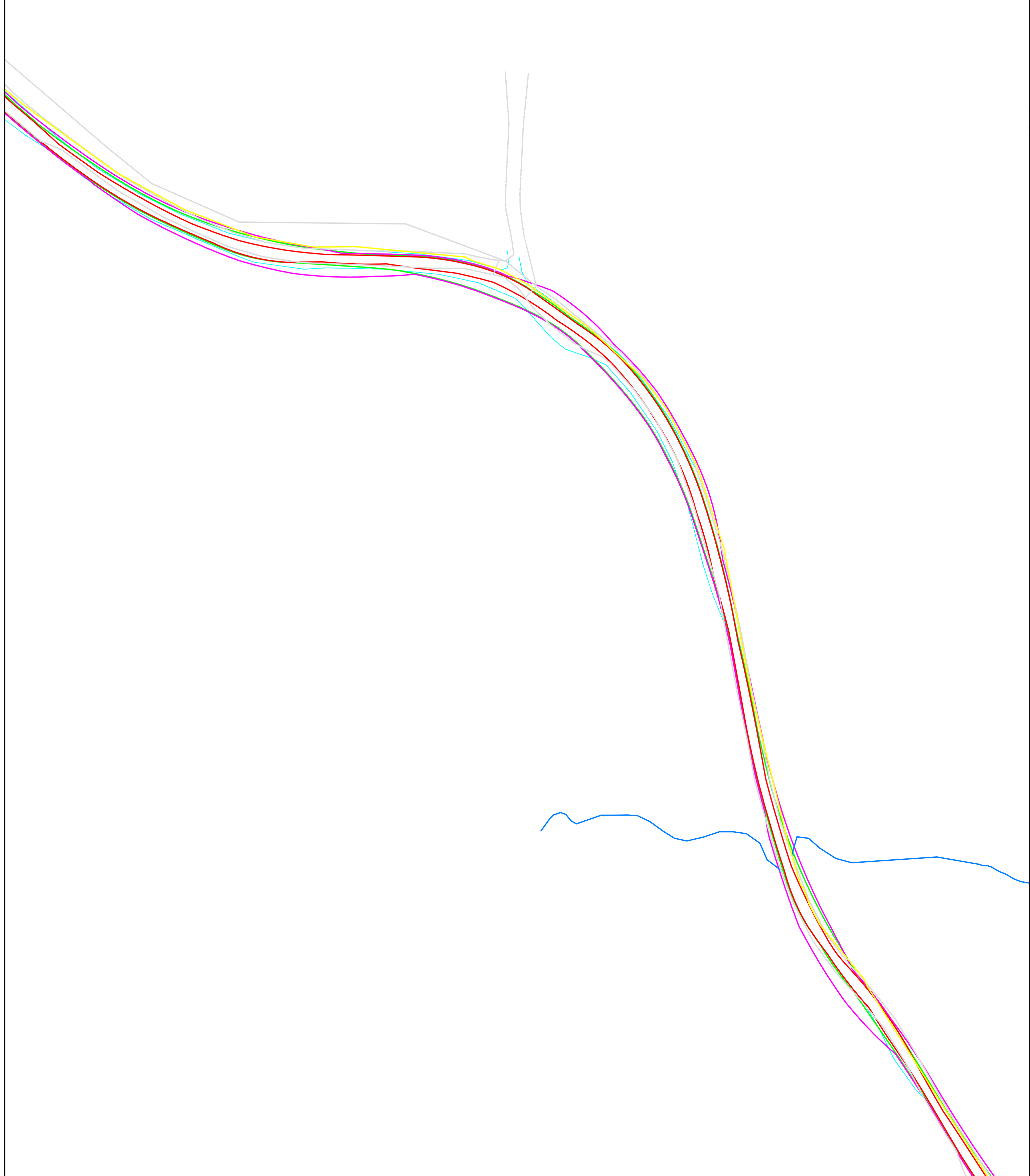

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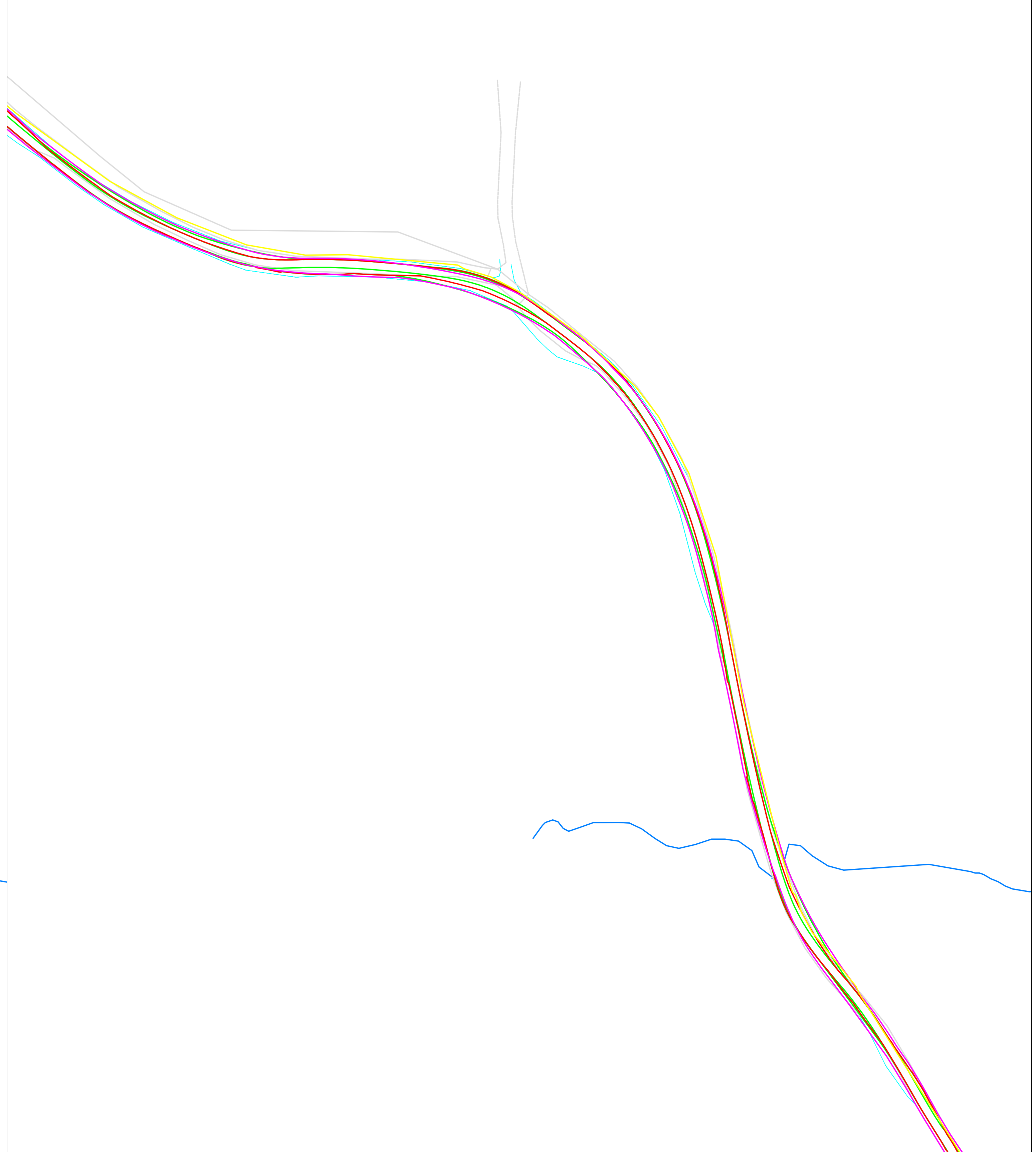

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Client: Eurowind

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Over–run | Over–sail

Project: Uisenis Wind Farm

Drawing Title: Siemens SGRE155 Blade & Tower

SPA Location: The Arnish Road south of Memorial Fountain

	Name	Date
Drawn	JS	30/05/2023
Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest		6

Scale: 1:1750 @ A3

File No.: 230525 Uisenis SPA.dwg

Drawing Status: Draft

Drawing No.: SK05

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1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

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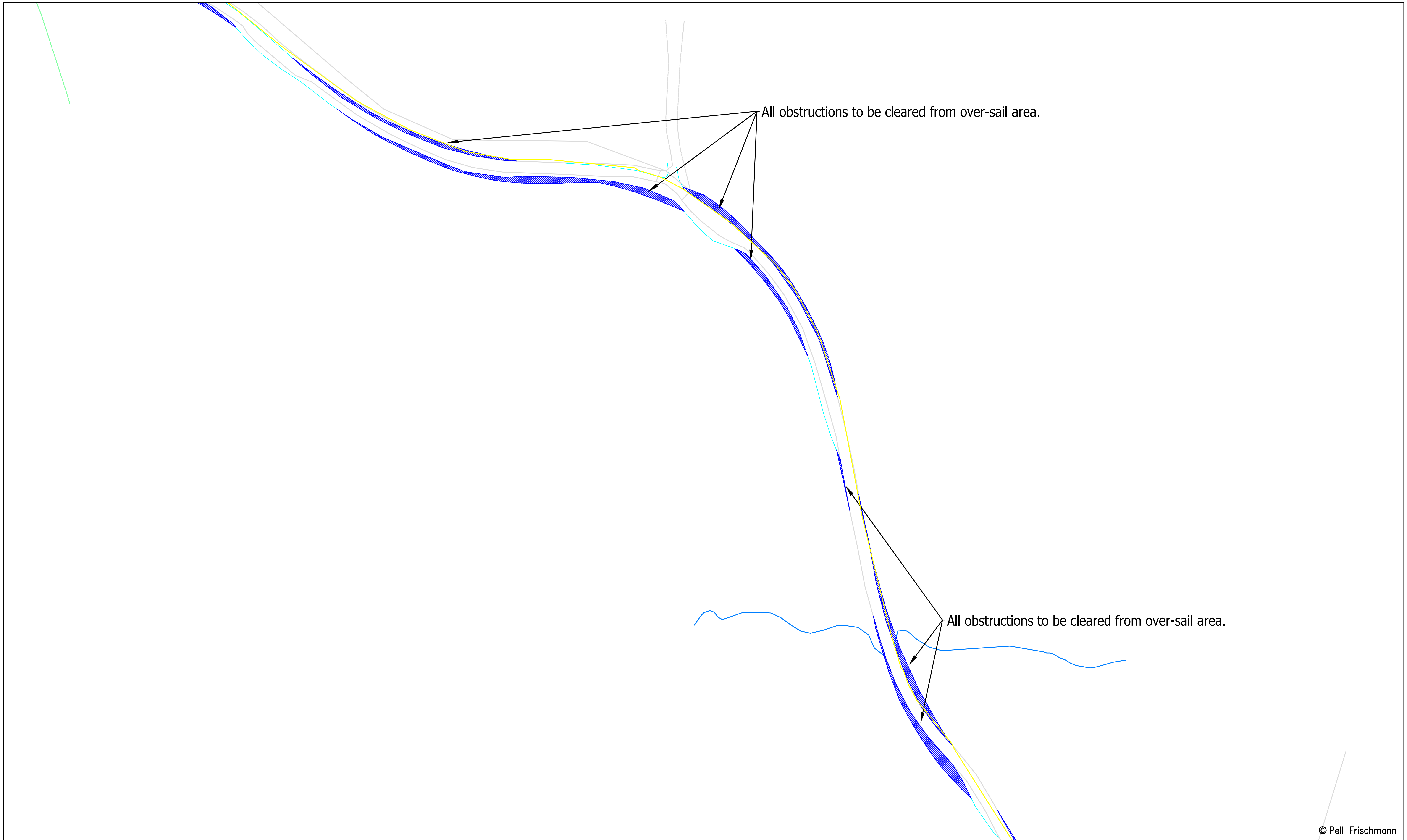

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Client: Eurowind

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Over-run | Over-sail

Project: Uisenis Wind Farm

Drawing Title: Siemens SGRE155 Blade & Tower

SPA Location: The Arnish Road south of Memorial Fountain

	Name	Date
Drawn	JS	30/05/2023
Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest		6

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File No.: 230525 Uisenis SPA.dwg

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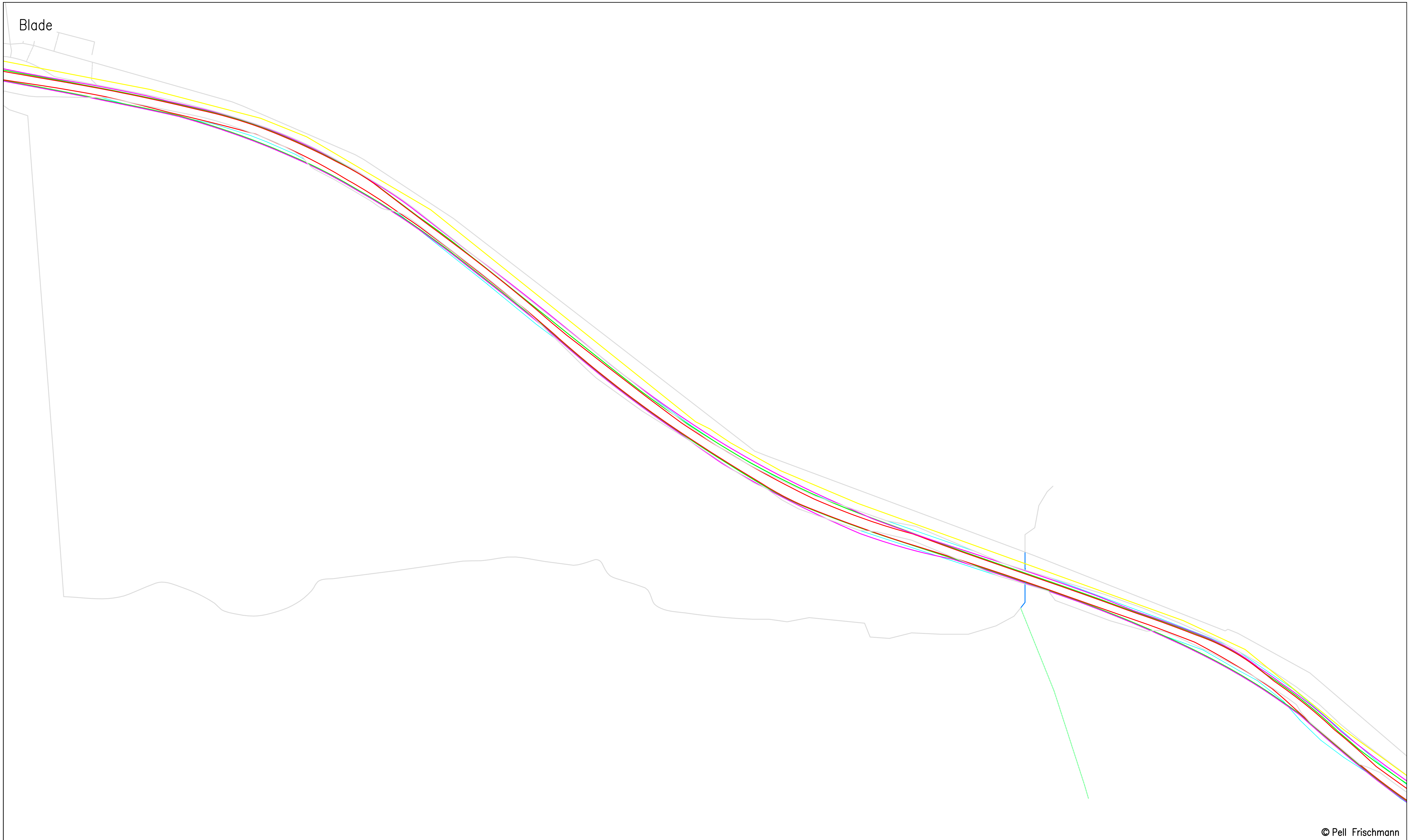

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www.pellfrischmann.com

Client: Eurowind

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Over-run | Over-sail

Project: Uisenis Wind Farm

Drawing Title: Siemens SGRE155 Blade & Tower

SPA Location: The Arnish Road southwest of Memorial Fountain

	Name	Date
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Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest		7

Scale: 1:1250 @ A3

File No.: 230525 Uisenis SPA.dwg

Drawing Status: Draft

Drawing No.: SK06

Notes:
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2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 1

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Project	Uisenis Wind Farm
Client	Eurowind
Drawing Title	Siemens SGRE155 Blade & Tower
SPA Location	The Arnish Road southwest of Memorial Fountain

Key: Wheel SPA, Body SPA, Load SPA, Indicative, Over–run, Over–sail

	Name	Date
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Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest		7

Scale	1:1250 @ A3
File No.	230525 Uisenis SPA.dwg
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Drawing No.	SK06A
Revision	1

Notes:
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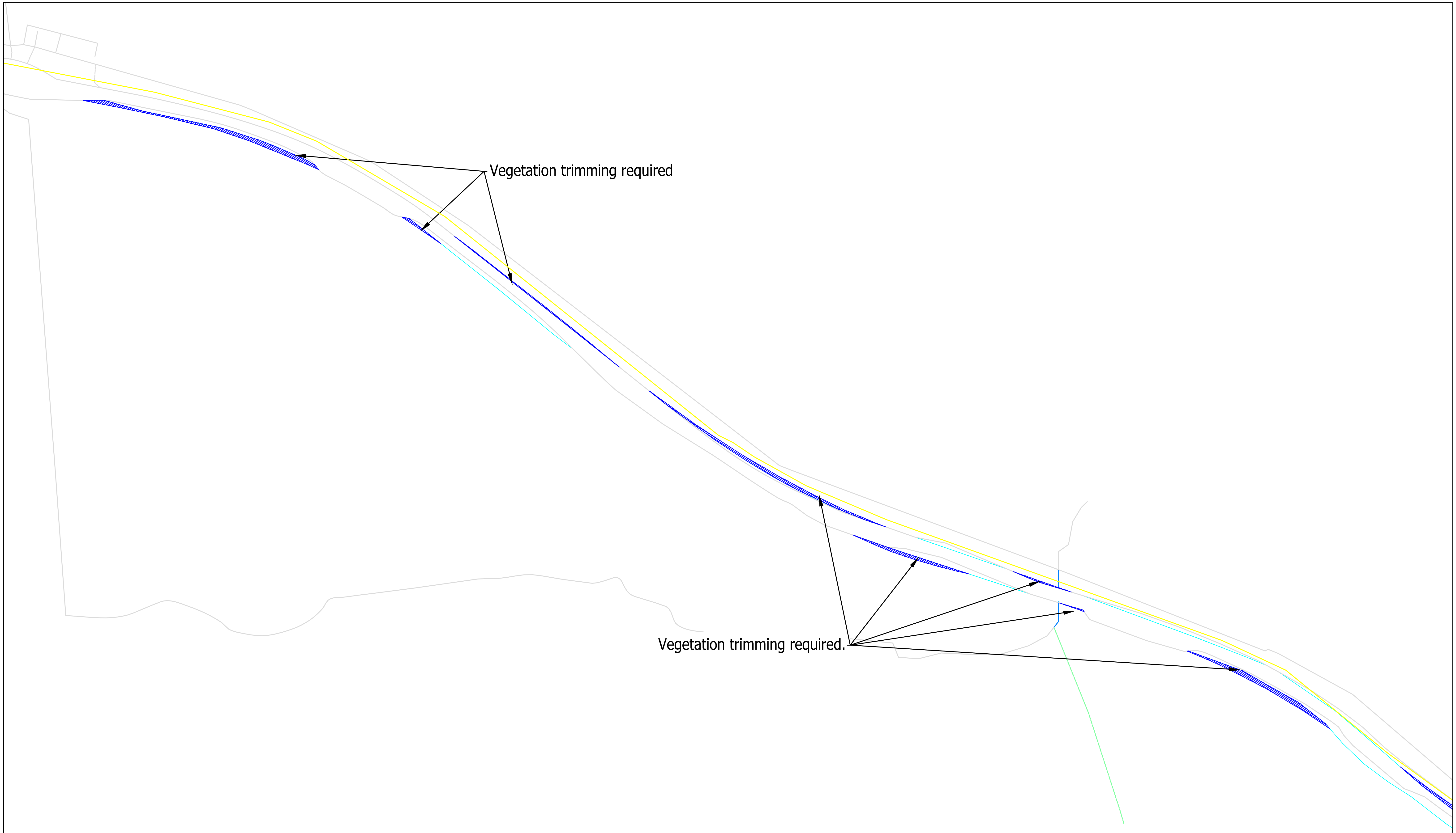

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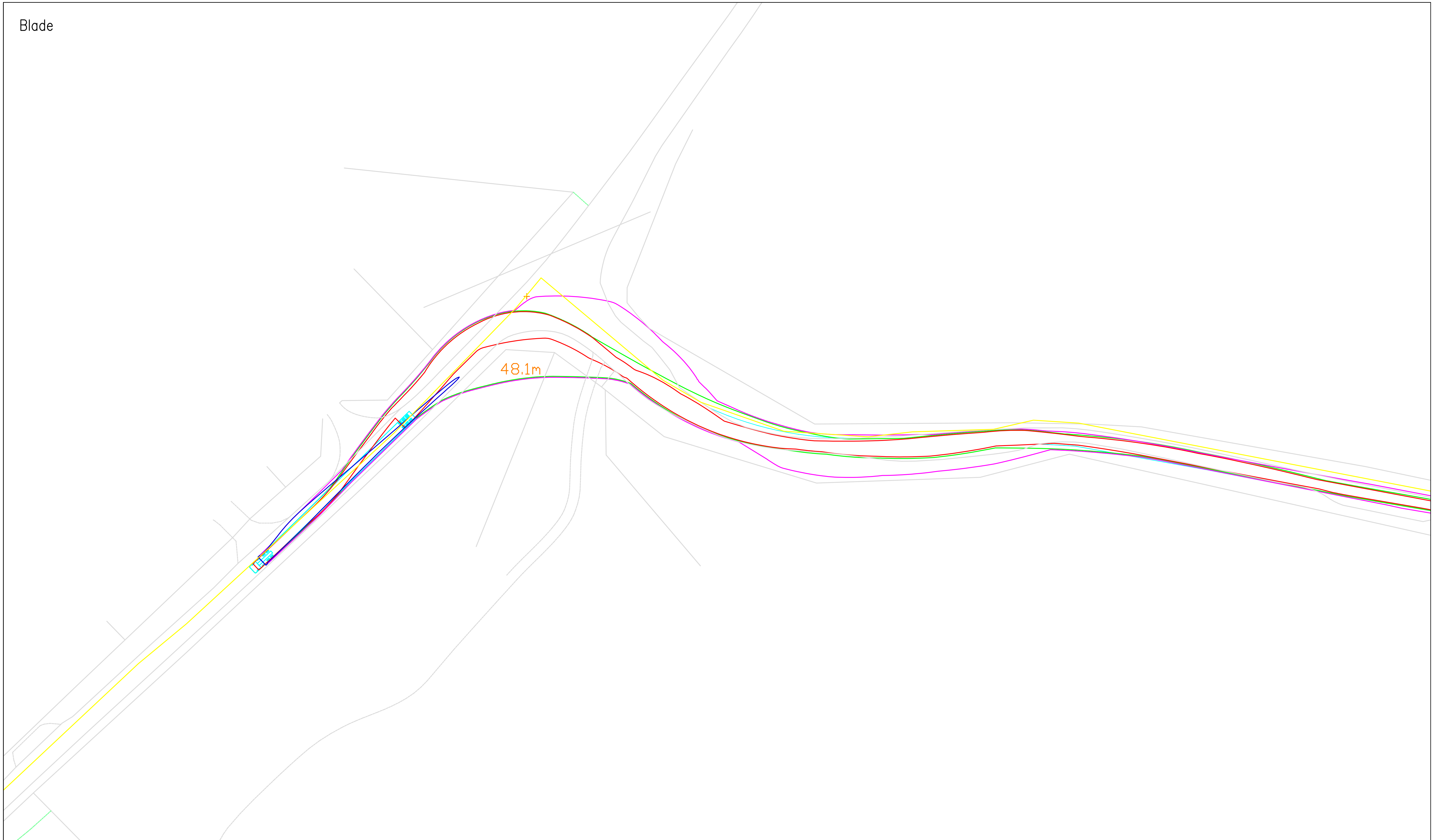
Project	Uisenis Wind Farm		
Client	Eurowind		
Drawing Title	Siemens SGRE155 Blade & Tower		
SPA Location	The Arnish Road southwest of Memorial Fountain		

Key: Wheel SPA, Body SPA, Load SPA, Indicative, Over–run, Over–sail

	Name	Date
Drawn	JS	30/05/2023
Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest		7

Scale	1:1250 @ A3
File No.	230525 Uisenis SPA.dwg
Drawing Status	Draft
Drawing No.	SK06B
Revision	1

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.



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www.pellfrischmann.com

Client: Eurowind

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Over-run | Over-sail

Project: Uisenis Wind Farm

Drawing Title: Siemens SGRE155 Blade & Tower

SPA Location: The Arnish Road / A859 Junction

	Name	Date
Drawn	JS	30/05/2023
Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest		8,9

Scale: 1:1000 @ A3

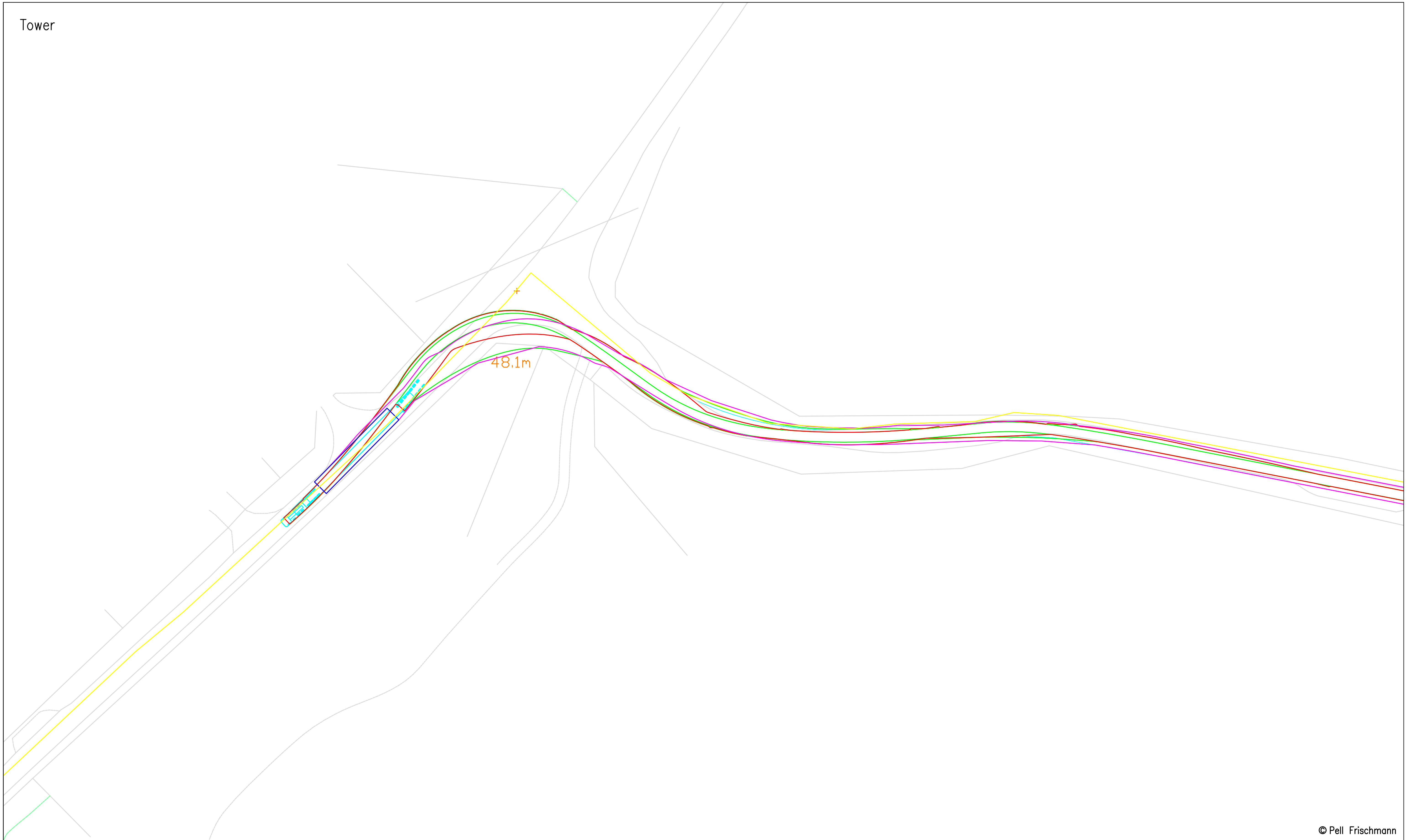
File No.: 230525 Uisenis SPA.dwg

Drawing Status: Draft

Drawing No.: SK07

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 1



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Client: Eurowind

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Over-run | Over-sail

Project: Uisenis Wind Farm

Drawing Title: Siemens SGRE155 Blade & Tower

SPA Location: The Arnish Road / A859 Junction

	Name	Date
Drawn	JS	30/05/2023
Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest	8,9	

Scale: 1:1000 @ A3

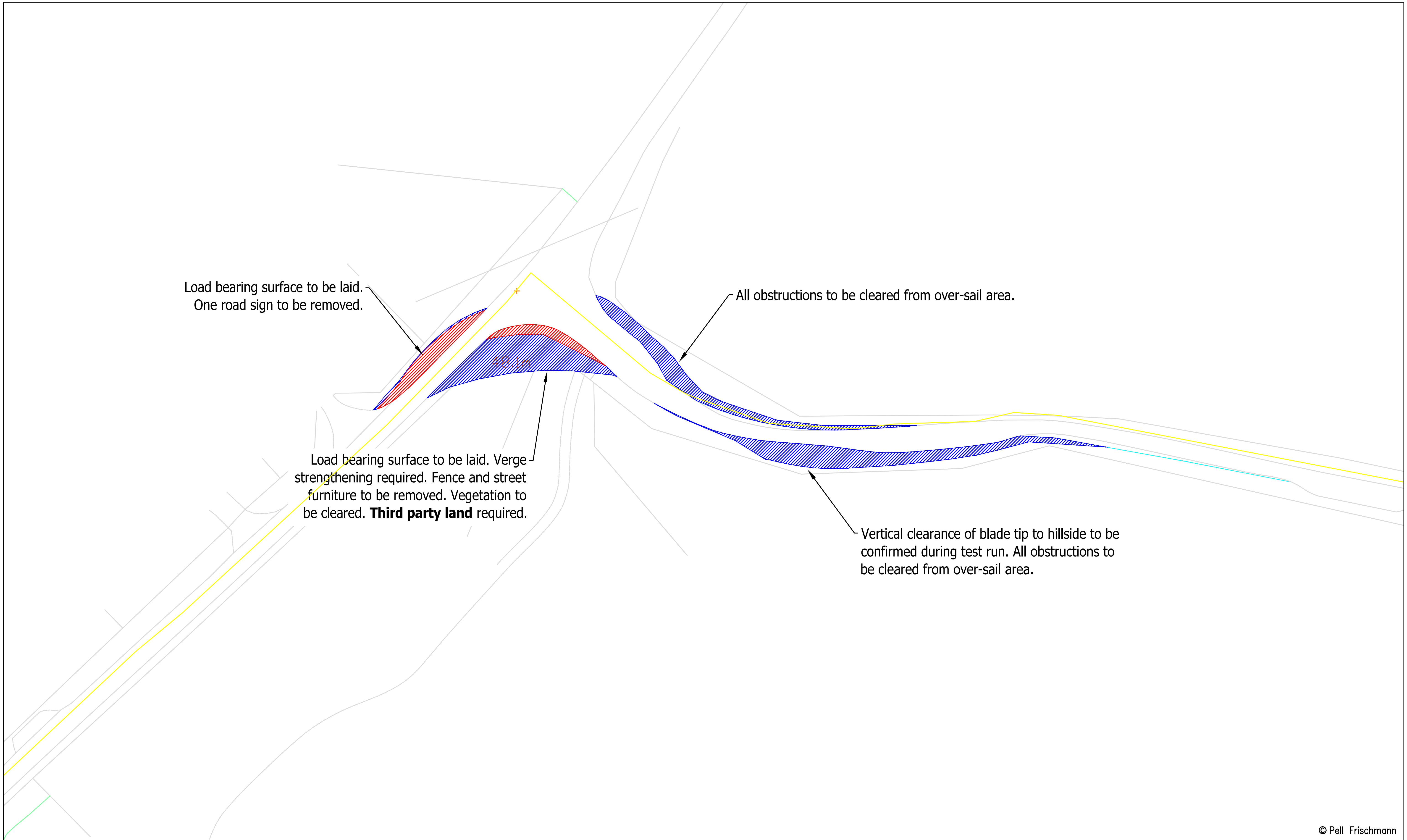
File No.: 230525 Uisenis SPA.dwg

Drawing Status: Draft

Drawing No.: SK07A

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 1



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Client: Eurowind

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Over-run | Over-sail

Project: Uisenis Wind Farm

Drawing Title: Siemens SGRE155 Blade & Tower

SPA Location: The Arnish Road / A859 Junction

	Name	Date
Drawn	JS	30/05/2023
Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest		8,9

Scale: 1:1000 @ A3

File No.: 230525 Uisenis SPA.dwg

Drawing Status: Draft

Drawing No.: SK07B

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 1

Blade

Tower

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Client: Eurowind

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Over-run | Over-sail

Project: Uisenis Wind Farm

Drawing Title: Siemens SGRE155 Blade & Tower

SPA Location: A859 Creag Ghlas

	Name	Date
Drawn	JS	30/05/2023
Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest		13

Scale: 1:1000 @ A3

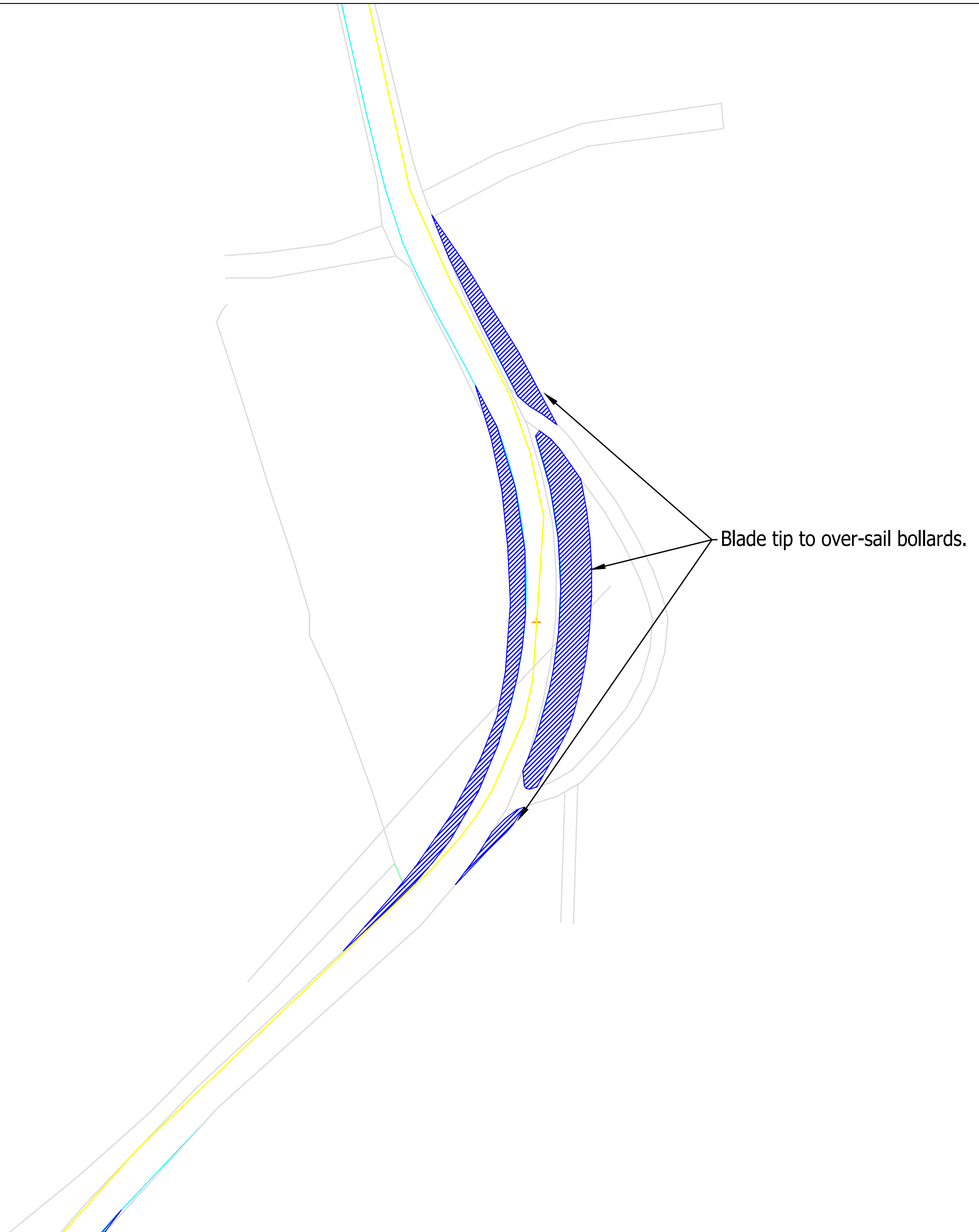
File No.: 230525 Uisenis SPA.dwg

Drawing Status: Draft

Drawing No.: SK08

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 1



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Client: Eurowind

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Over–run | Over–sail

Project: Uisenis Wind Farm

Drawing Title: Siemens SGRE155 Blade & Tower

SPA Location: A859 Creag Ghlas

	Name	Date
Drawn	JS	30/05/2023
Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest	13	

Scale: 1:1000 @ A3

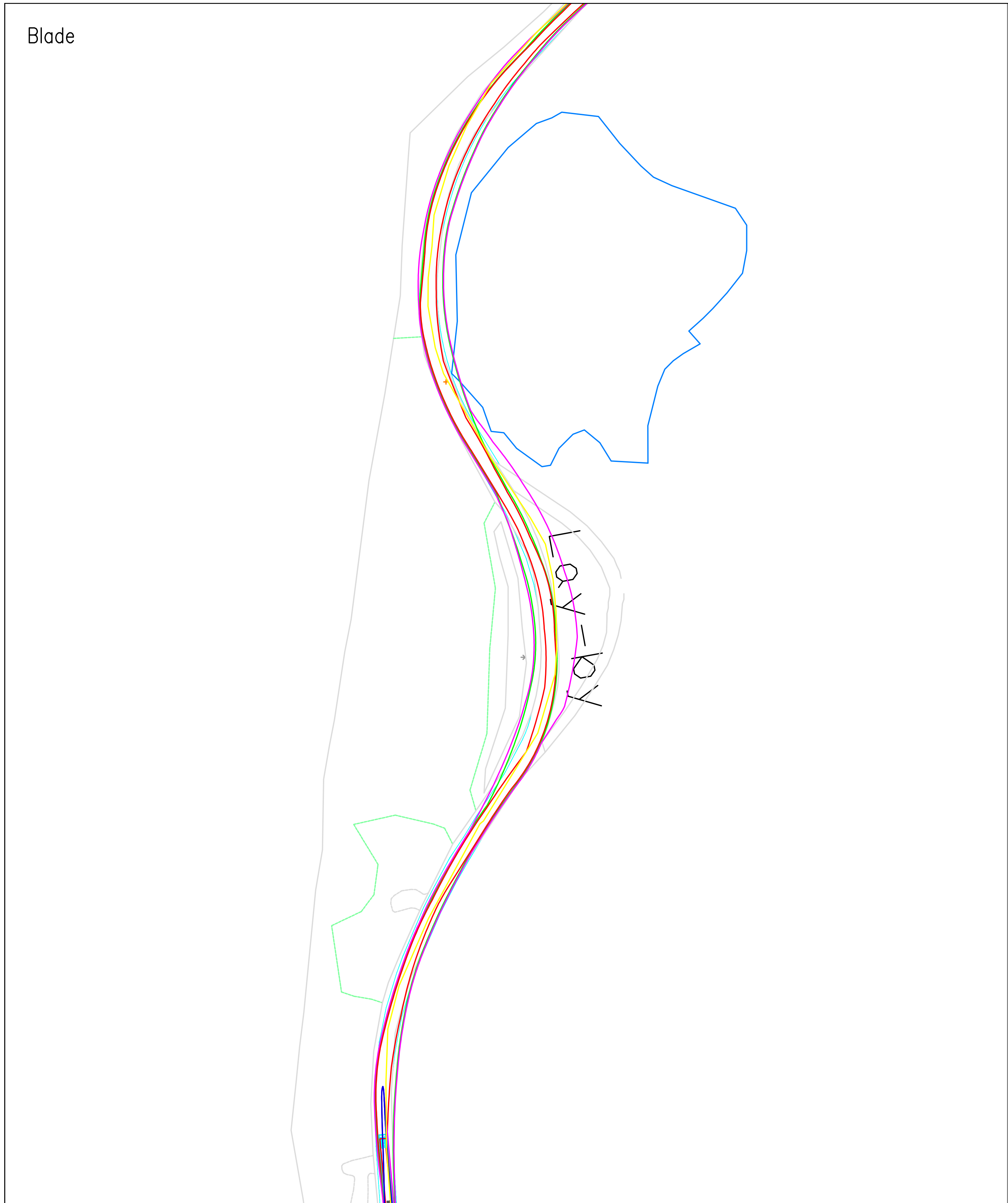
File No.: 230525 Uisenis SPA.dwg

Drawing Status: Draft

Drawing No.: SK08A

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 1



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Client: Eurowind

Key: Wheel SPA, Body SPA, Load SPA, Indicative, Over-run, Over-sail

Project: Uisenis Wind Farm

Drawing Title: Siemens SGRE155 Blade & Tower

SPA Location: A859 southeast of Creag Ghlas

	Name	Date
Drawn	JS	30/05/2023
Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest		14

Scale: 1:1750 @ A3

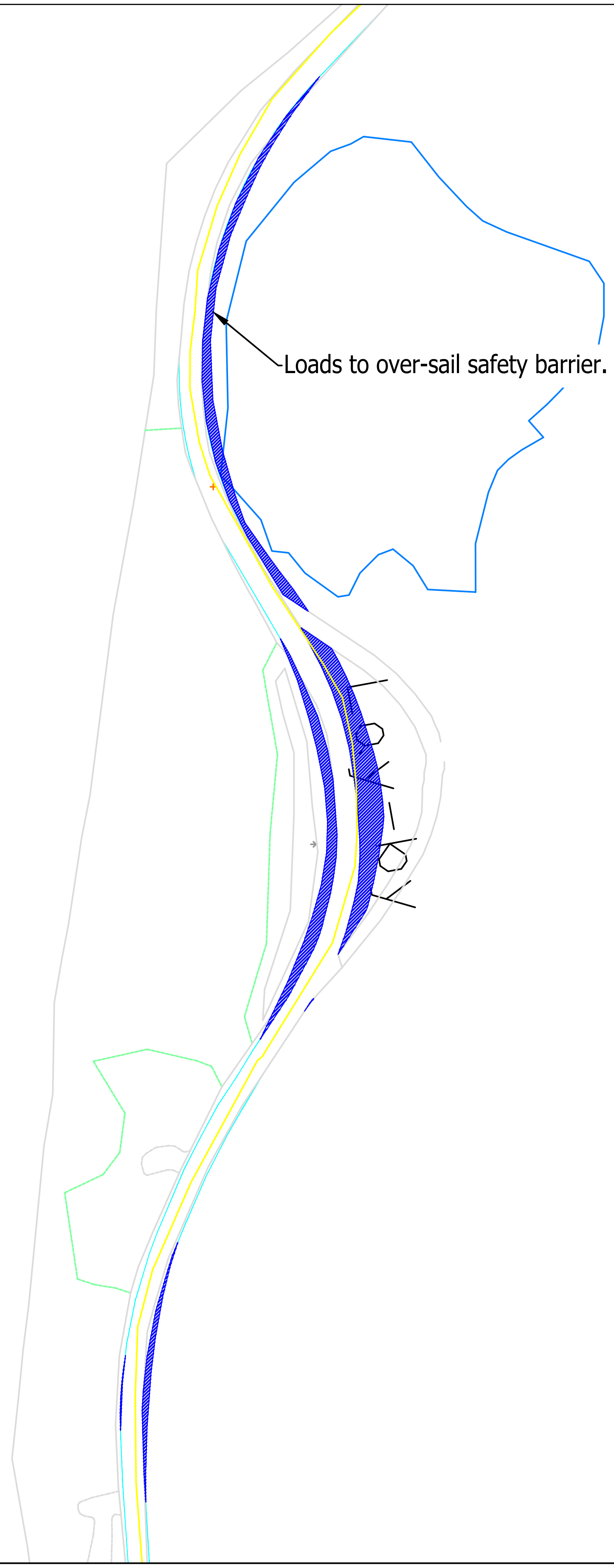
File No.: 230525 Uisenis SPA.dwg

Drawing Status: Draft

Drawing No.: SK09

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 1



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Project	Uisenis Wind Farm
Client	Eurowind
Drawing Title	Siemens SGRE155 Blade & Tower
SPA Location	A859 southeast of Creag Ghlas

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Over–run | Over–sail

	Name	Date
Drawn	JS	30/05/2023
Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest		14

Scale: 1:1750 @ A3

File No.: 230525 Uisenis SPA.dwg

Drawing Status: Draft

Drawing No.: SK09A

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 1

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Client: Eurowind

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Over–run | Over–sail

Project: Uisenis Wind Farm

Drawing Title: Siemens SGRE155 Blade & Tower

SPA Location: A859 Loidse Shobhail

	Name	Date
Drawn	JS	30/05/2023
Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest		16

Scale: 1:1250 @ A3

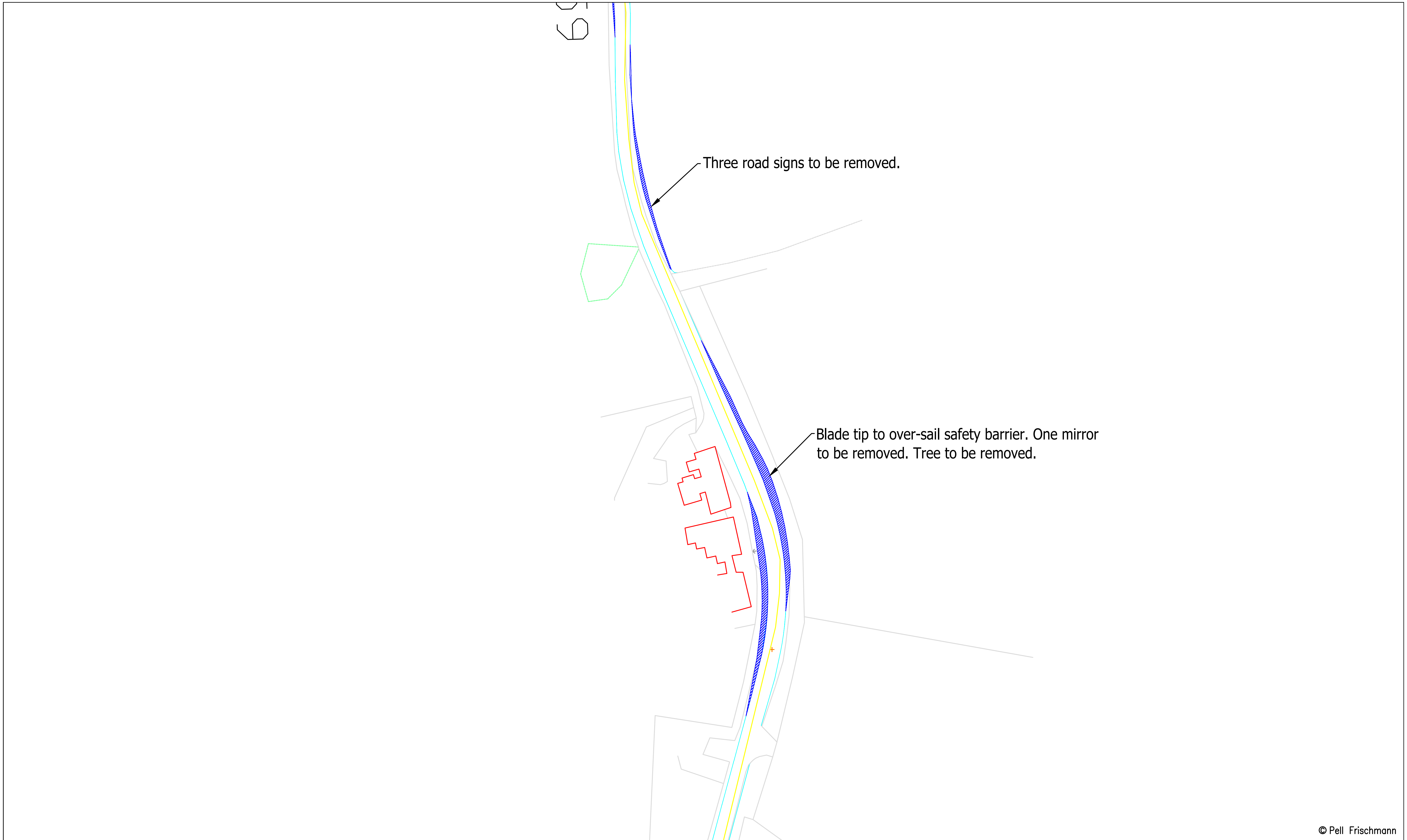
File No.: 230525 Uisenis SPA.dwg

Drawing Status: Draft

Drawing No.: SK10

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 1



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Client: Eurowind

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Over–run | Over–sail

Project: Uisenis Wind Farm

Drawing Title: Siemens SGRE155 Blade & Tower

SPA Location: A859 Loidse Shobhail

	Name	Date
Drawn	JS	30/05/2023
Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest		16

Scale: 1:1250 @ A3

File No.: 230525 Uisenis SPA.dwg

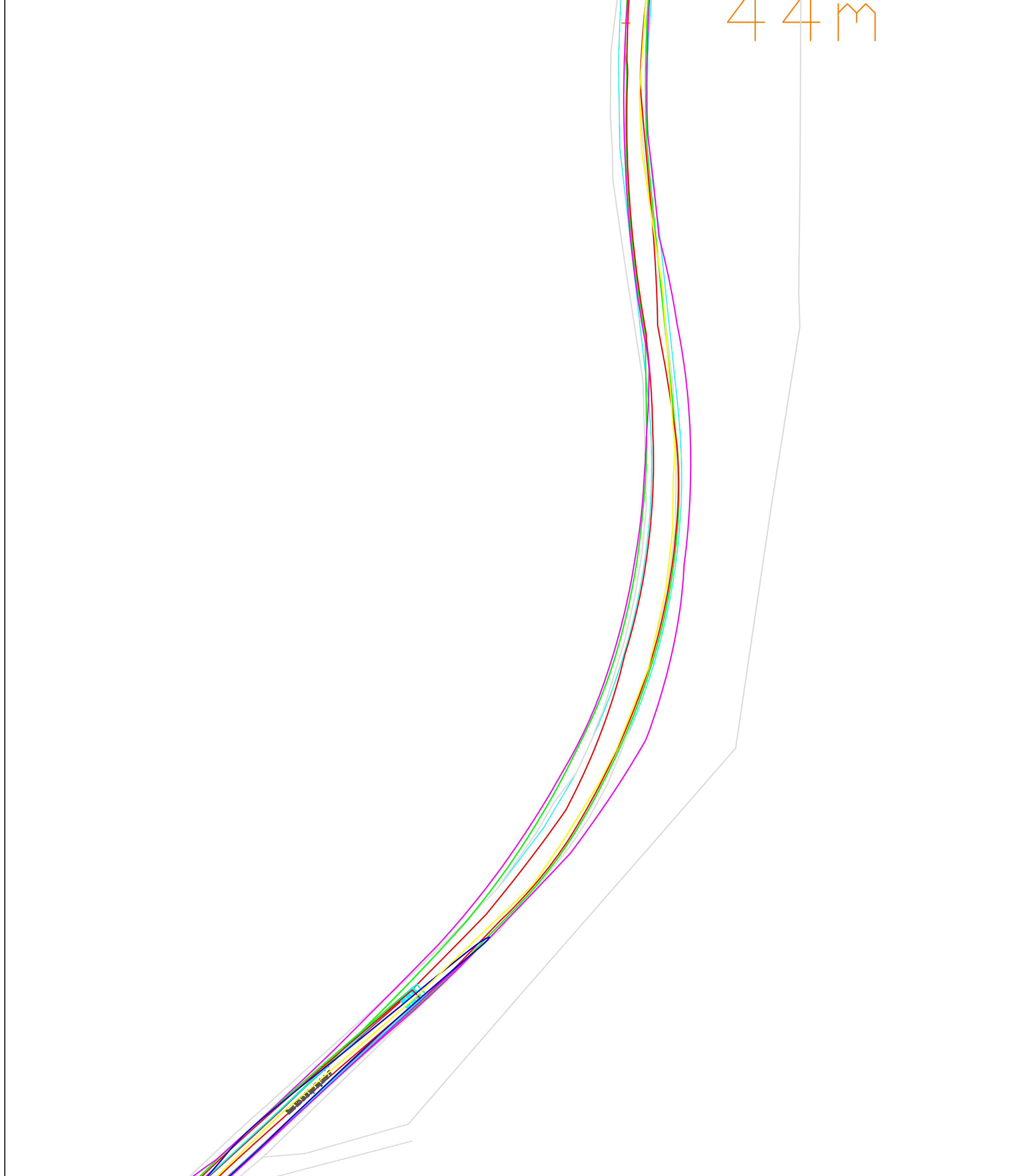
Drawing Status: Draft

Drawing No.: SK10A

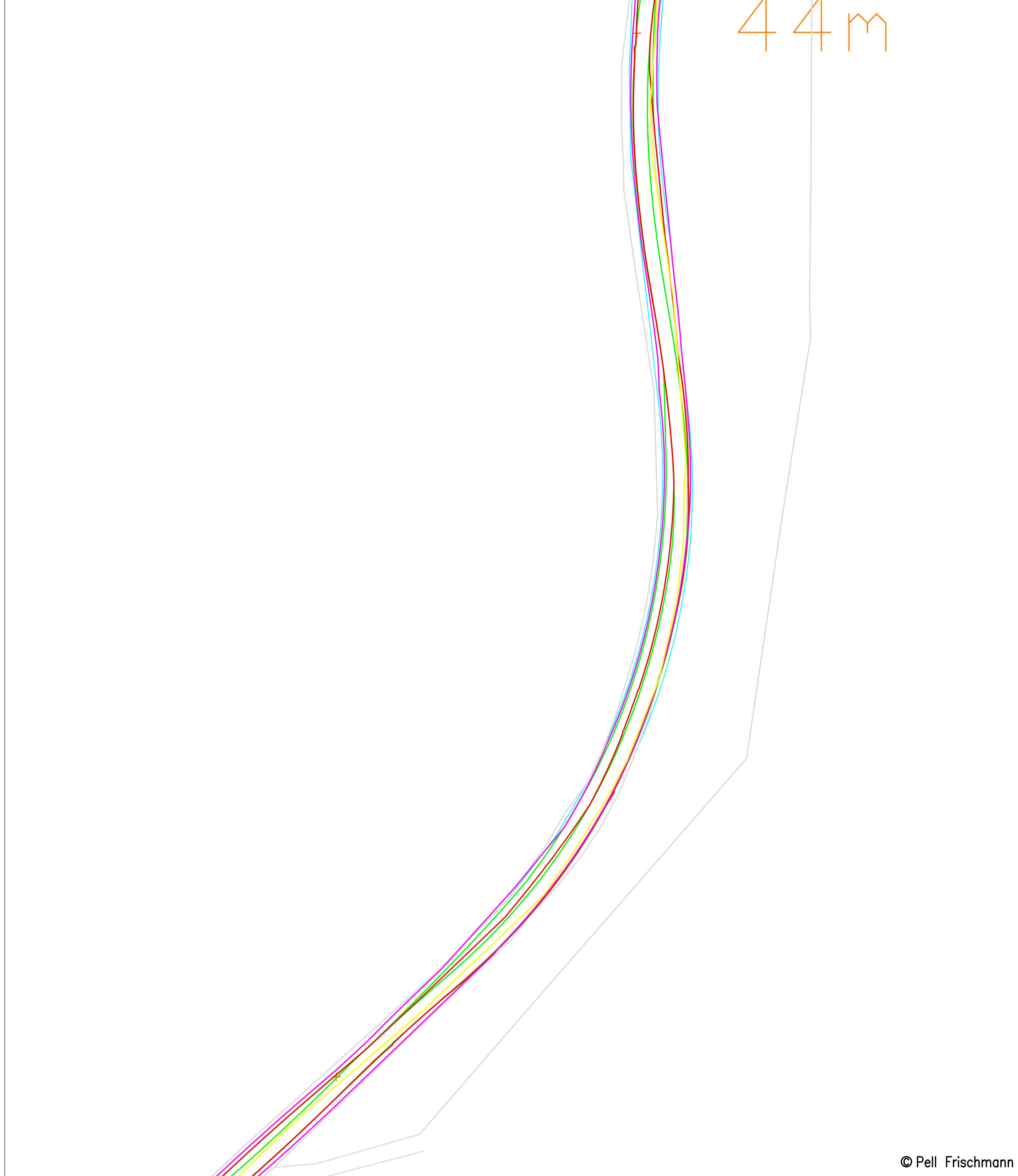
Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 1

Blade



Tower



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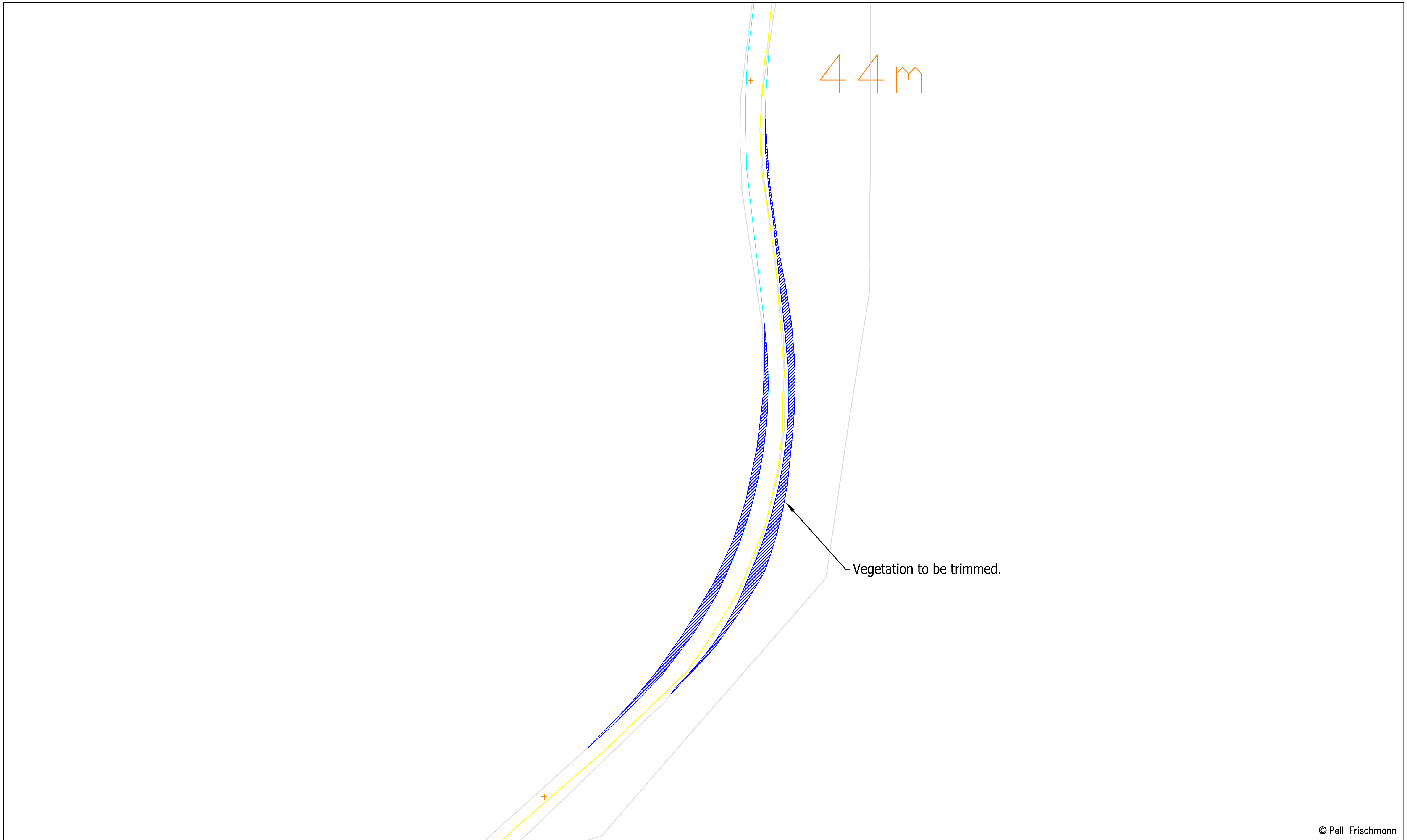
Client	Eurowind
Project	Uisenis Wind Farm
Drawing Title	Siemens SGRE155 Blade & Tower
SPA Location	A859 southwest of Creagan na Coille

Key: Wheel SPA, Body SPA, Load SPA, Indicative, Over−run, Over−sail

	Name	Date
Drawn	JS	30/05/2023
Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest	18	

Scale	1:1000 @ A3
File No.	230525 Uisenis SPA.dwg
Drawing Status	Draft
Drawing No.	SK11
Revision	1

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.



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Client: Eurowind

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Over–run | Over–sail

Project: Uisenis Wind Farm

Drawing Title: Siemens SGRE155 Blade & Tower

SPA Location: A859 southwest of Creagan na Coille

	Name	Date
Drawn	JS	30/05/2023
Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest		18

Scale: 1:1000 @ A3

File No.: 230525 Uisenis SPA.dwg

Drawing Status: Draft

Drawing No.: SK11A

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 1

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Client: Eurowind

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Over−run | Over−sail

Project: Uisenis Wind Farm

Drawing Title: Siemens SGRE155 Blade & Tower

SPA Location: A859 southwest of Cnoc a' Bhlair Bhain

	Name	Date
Drawn	JS	30/05/2023
Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest		20

Scale: 1:1000 @ A3

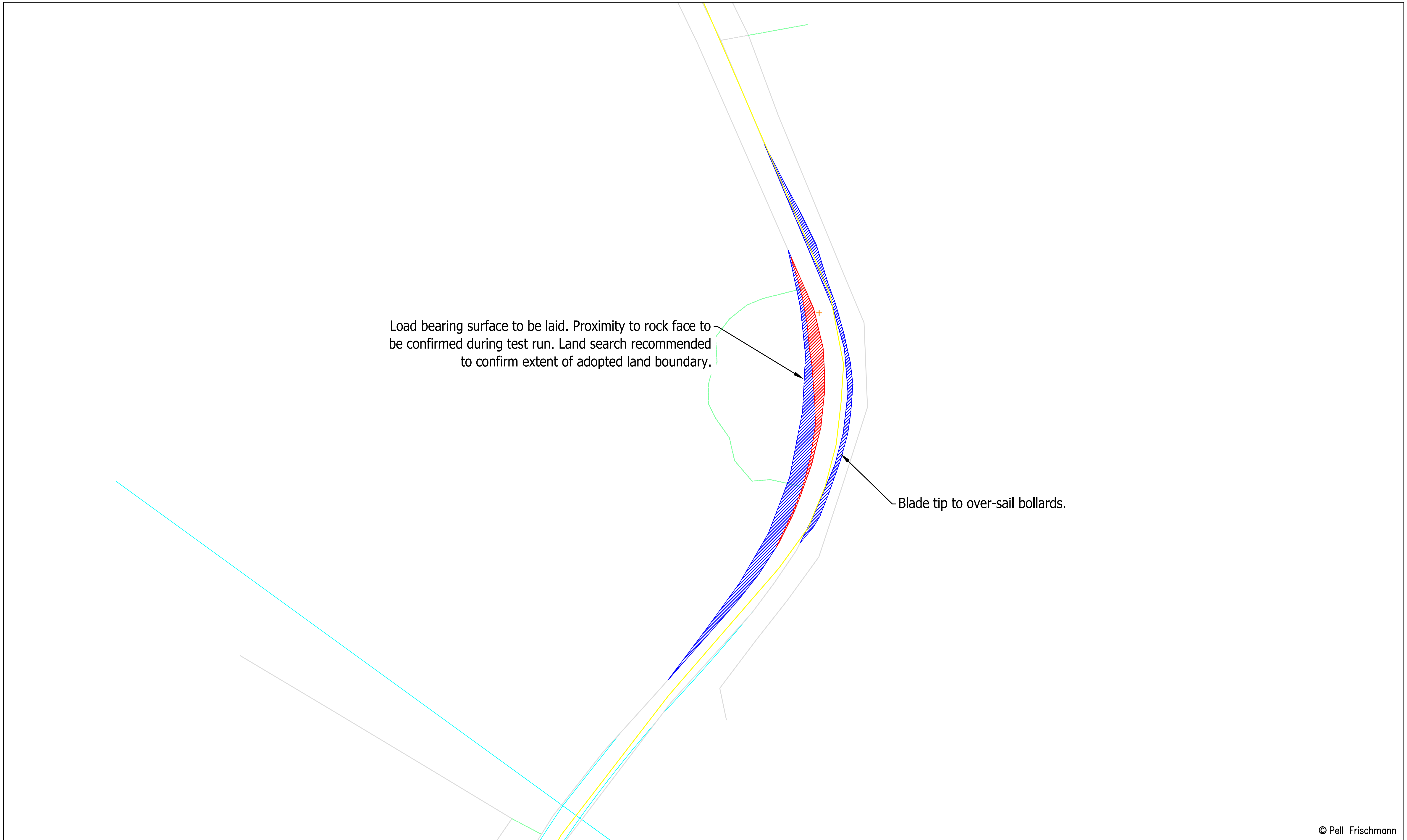
File No.: 230525 Uisenis SPA.dwg

Drawing Status: Draft

Drawing No.: SK12

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 1



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Client: Eurowind

Key: Wheel SPA, Body SPA, Load SPA, Indicative, Over–run, Over–sail

Project: Uisenis Wind Farm

Drawing Title: Siemens SGRE155 Blade & Tower

SPA Location: A859 southwest of Cnoc a' Bhlair Bhain

	Name	Date
Drawn	JS	30/05/2023
Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest		20

Scale: 1:1000 @ A3

File No.: 230525 Uisenis SPA.dwg

Drawing Status: Draft

Drawing No.: SK12A

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 1

Blade

Tower

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Project	Uisenis Wind Farm		
Client	Eurowind		
Drawing Title	Siemens SGRE155 Blade & Tower		
SPA Location	A859 East of Loch Nabhar		

	Name	Date
Drawn	JS	30/05/2023
Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest		22

Scale: 1:1500 @ A3

File No.: 230525 Uisenis SPA.dwg

Drawing Status: Draft

Drawing No.: SK13

Revision: 1

Key: Wheel SPA, Body SPA, Load SPA, Indicative, Over–run, Over–sail

Notes:
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Client: Eurowind

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Over–run | Over–sail

Project: Uisenis Wind Farm

Drawing Title: Siemens SGRE155 Blade & Tower

SPA Location: A859 East of Loch Nabhar

	Name	Date
Drawn	JS	30/05/2023
Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest		22

Scale: 1:1250 @ A3

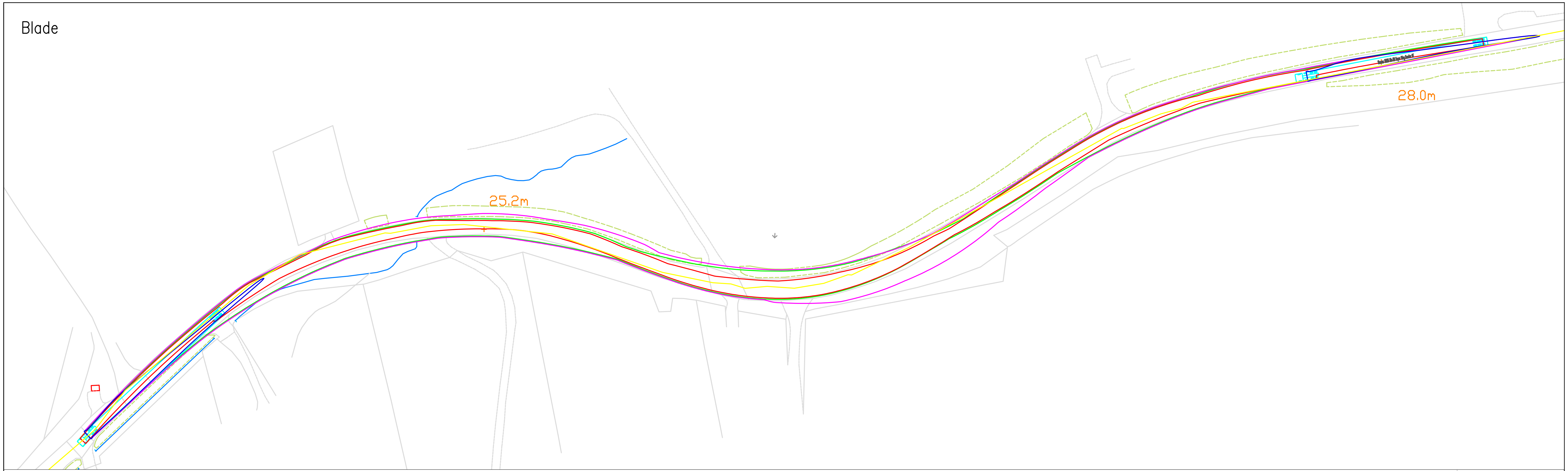
File No. 230525 Uisenis SPA.dwg

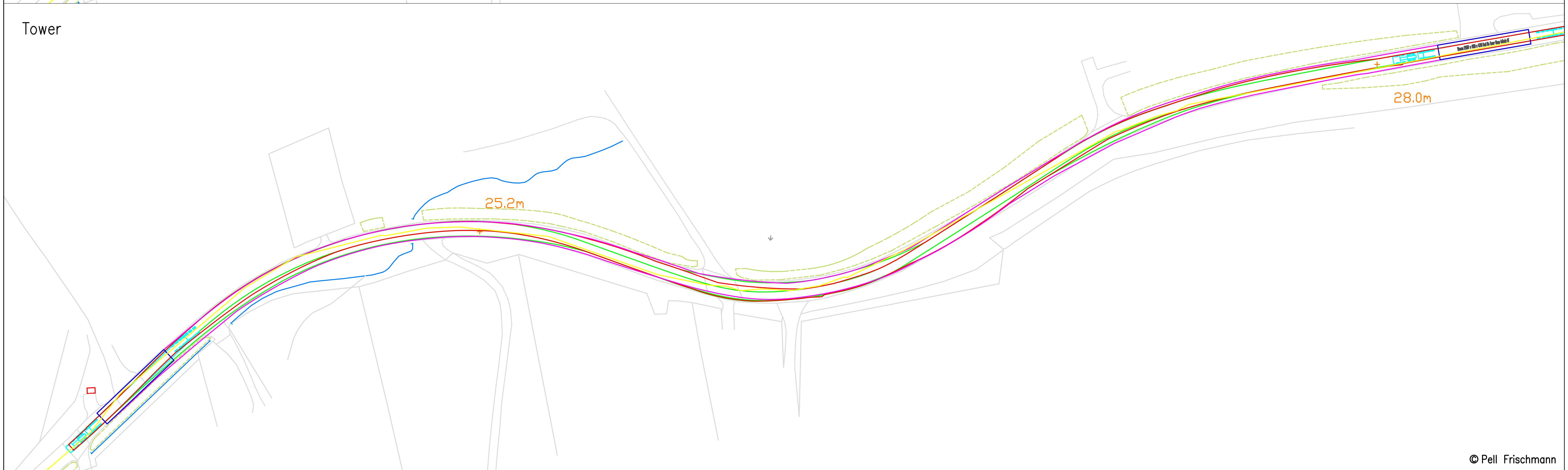
Drawing Status: Draft

Drawing No. SK13A

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 1





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Client: Eurowind

Key: Wheel SPA, Body SPA, Load SPA, Indicative, Over-run, Over-sail

Project: Uisenis Wind Farm

Drawing Title: Siemens SGRE155 Blade & Tower

SPA Location: A859 Mircill Mhor

	Name	Date
Drawn	JS	30/05/2023
Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest		28

Scale: 1:1250 @ A3

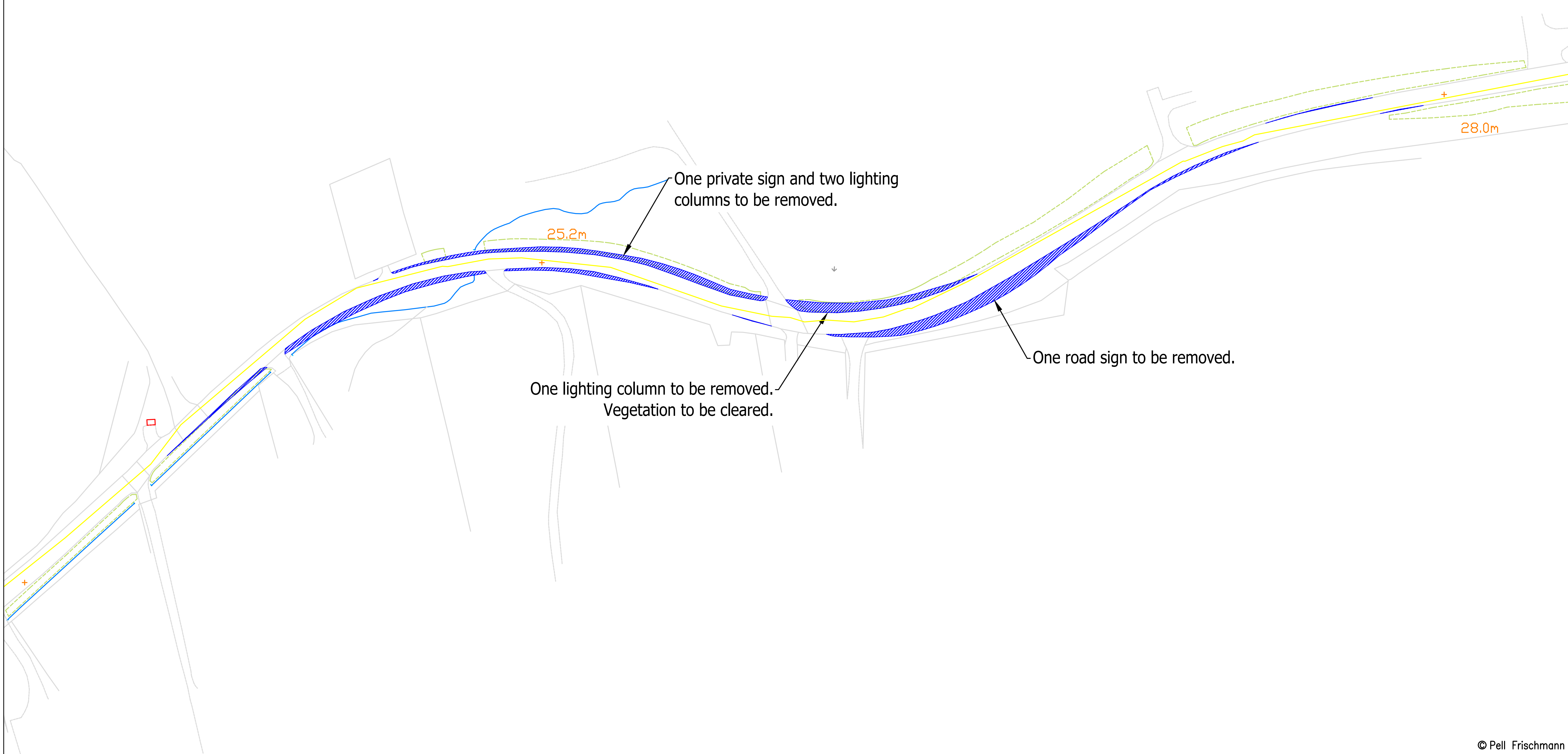
File No. 230525 Uisenis SPA.dwg

Drawing Status: Draft

Drawing No. SK14

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 1



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Client: Eurowind

Key: Wheel SPA, Body SPA, Load SPA, Indicative, Over–run, Over–sail

Project: Uisenis Wind Farm

Drawing Title: Siemens SGRE155 Blade & Tower

SPA Location: A859 Mircill Mhor

	Name	Date
Drawn	JS	30/05/2023
Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest		28

Scale: 1:1250 @ A3

File No. 230525 Uisenis SPA.dwg

Drawing Status: Draft

Drawing No. SK14A

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 1

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Project: Uisenis Wind Farm

Client: Eurowind

Drawing Title: Siemens SGRE155 Blade & Tower

SPA Location: A859 west of Mircill Glas

Key: Wheel SPA, Body SPA, Load SPA, Indicative, Over–run, Over–sail

	Name	Date
Drawn	JS	30/05/2023
Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest		29

Scale: 1:1500 @ A3

File No.: 230525 Uisenis SPA.dwg

Drawing Status: Draft

Drawing No.: SK15

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 1

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Client: Eurowind

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Over-run | Over-sail

Project: Uisenis Wind Farm

Drawing Title: Siemens SGRE155 Blade & Tower

SPA Location: A859 west of Mircill Glas

	Name	Date
Drawn	JS	30/05/2023
Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest		29

Scale: 1:1250 @ A3

File No.: 230525 Uisenis SPA.dwg

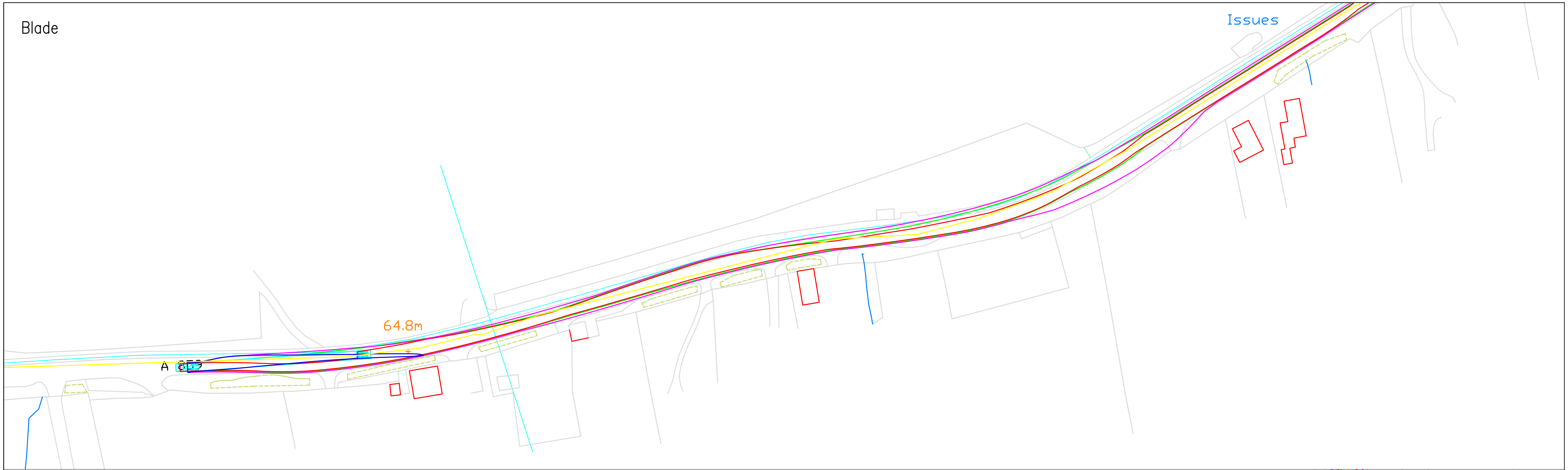
Drawing Status: Draft

Drawing No.: SK15A

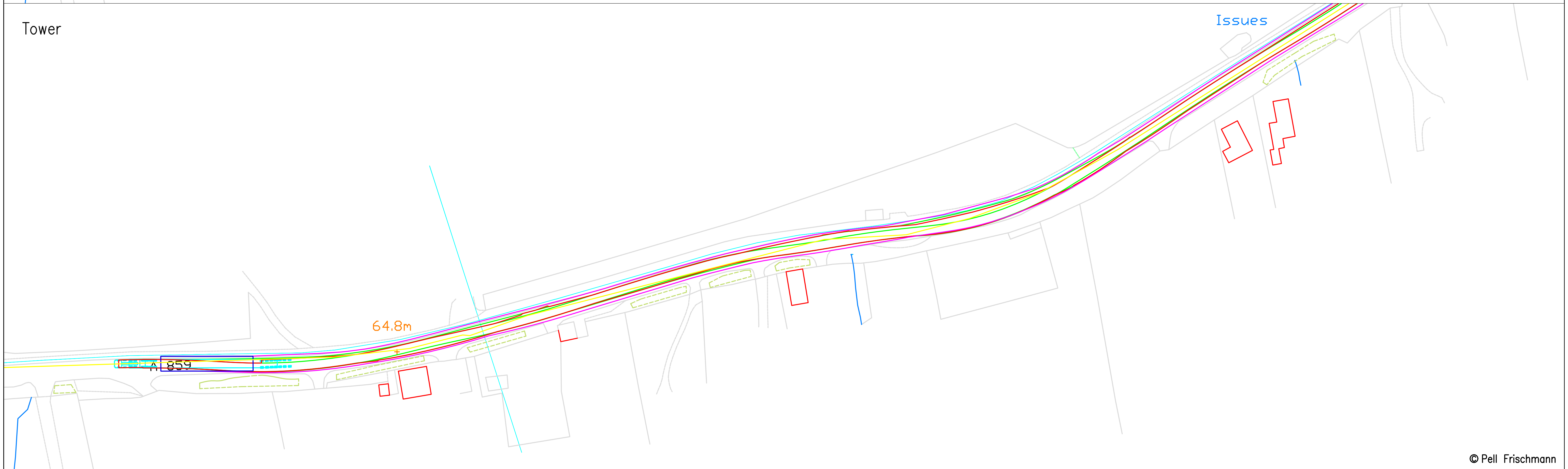
Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 1

Blade



Tower



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Client: Eurowind

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Over–run | Over–sail

Project: Uisenis Wind Farm

Drawing Title: Siemens SGRE155 Blade & Tower

SPA Location: A859 Beinn Bhuidhe

	Name	Date
Drawn	JS	30/05/2023
Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest		30

Scale: 1:1250 @ A3

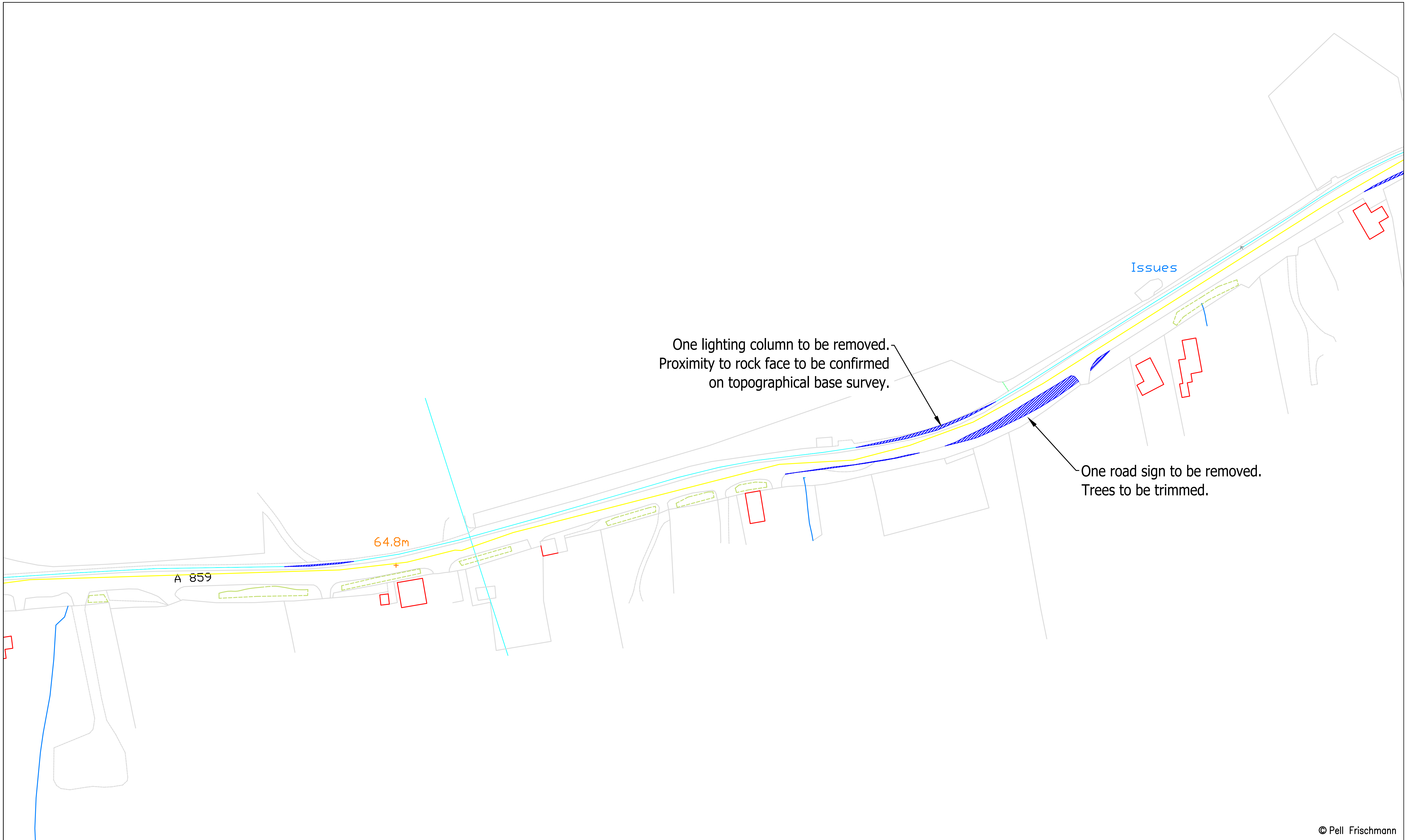
File No.: 230525 Uisenis SPA.dwg

Drawing Status: Draft

Drawing No.: SK16

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 1



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Client: Eurowind

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Over–run | Over–sail

Project: Uisenis Wind Farm

Drawing Title: Siemens SGRE155 Blade & Tower

SPA Location: A859 Beinn Bhuidhe

	Name	Date
Drawn	JS	30/05/2023
Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest		30

Scale: 1:1250 @ A3

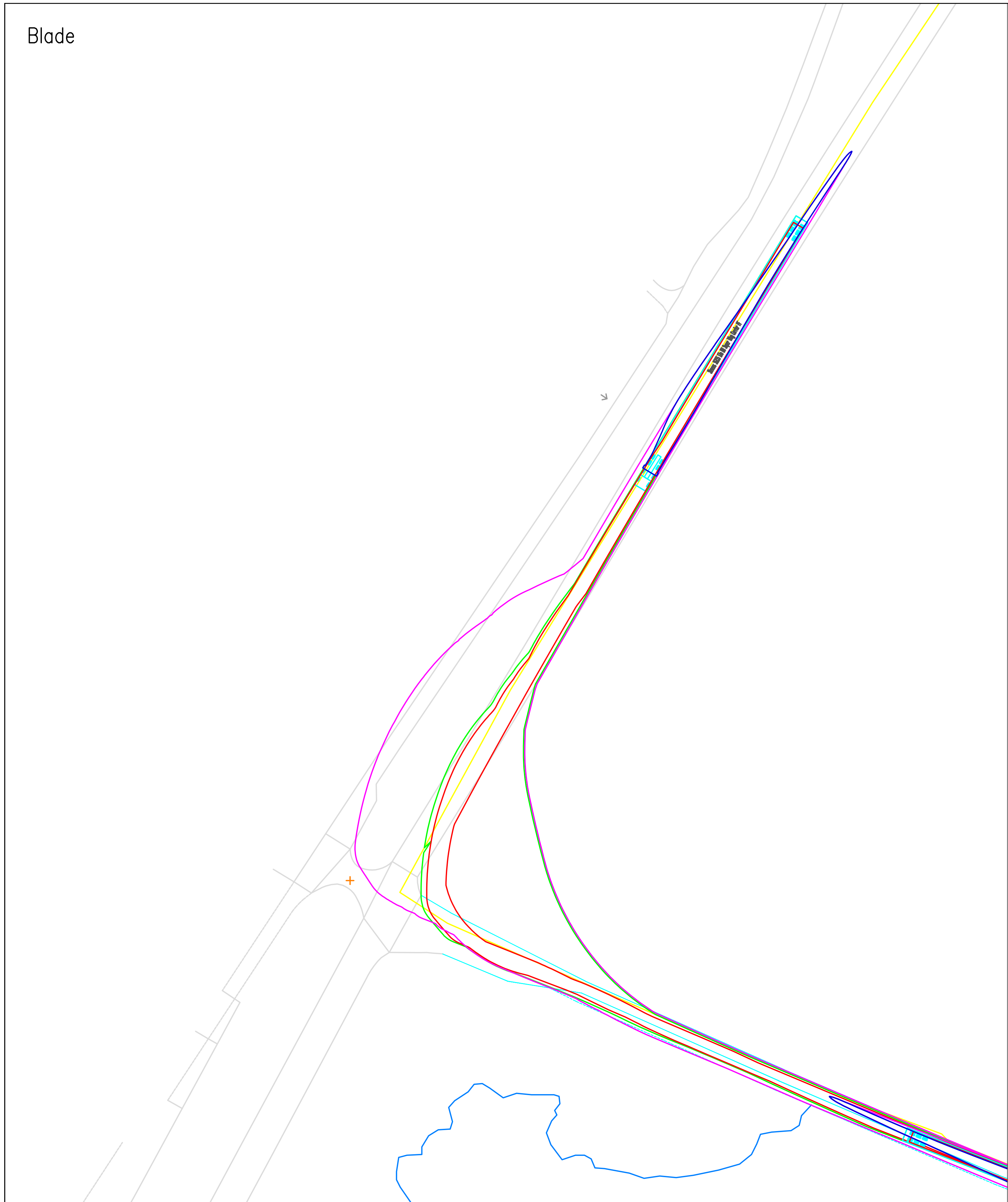
File No.: 230525 Uisenis SPA.dwg

Drawing Status: Draft

Drawing No.: SK16A

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 1



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Email: pfedinburgh@pellfrischmann.com
www.pellfrischmann.com

Project	Uisenis Wind Farm
Client	Eurowind
Drawing Title	Siemens SGRE155 Blade & Tower
SPA Location	A859 / Eisgean Road Junction

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Over–run | Over–sail

	Name	Date
Drawn	JS	30/05/2023
Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest		34,35

Scale	1:1000 @ A3
File No.	230525 Uisenis SPA.dwg
Drawing Status	Draft
Drawing No.	SK17
Revision	1

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

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Email: pfedinburgh@pellfrischmann.com
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Project: Uisenis Wind Farm

Client: Eurowind

Drawing Title: Siemens SGRE155 Blade & Tower

SPA Location: A859 / Eisgean Road Junction

Key: Wheel SPA, Body SPA, Load SPA, Indicative, Over-run, Over-sail

	Name	Date
Drawn	JS	30/05/2023
Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest		34,35

Scale: 1:500 @ A3

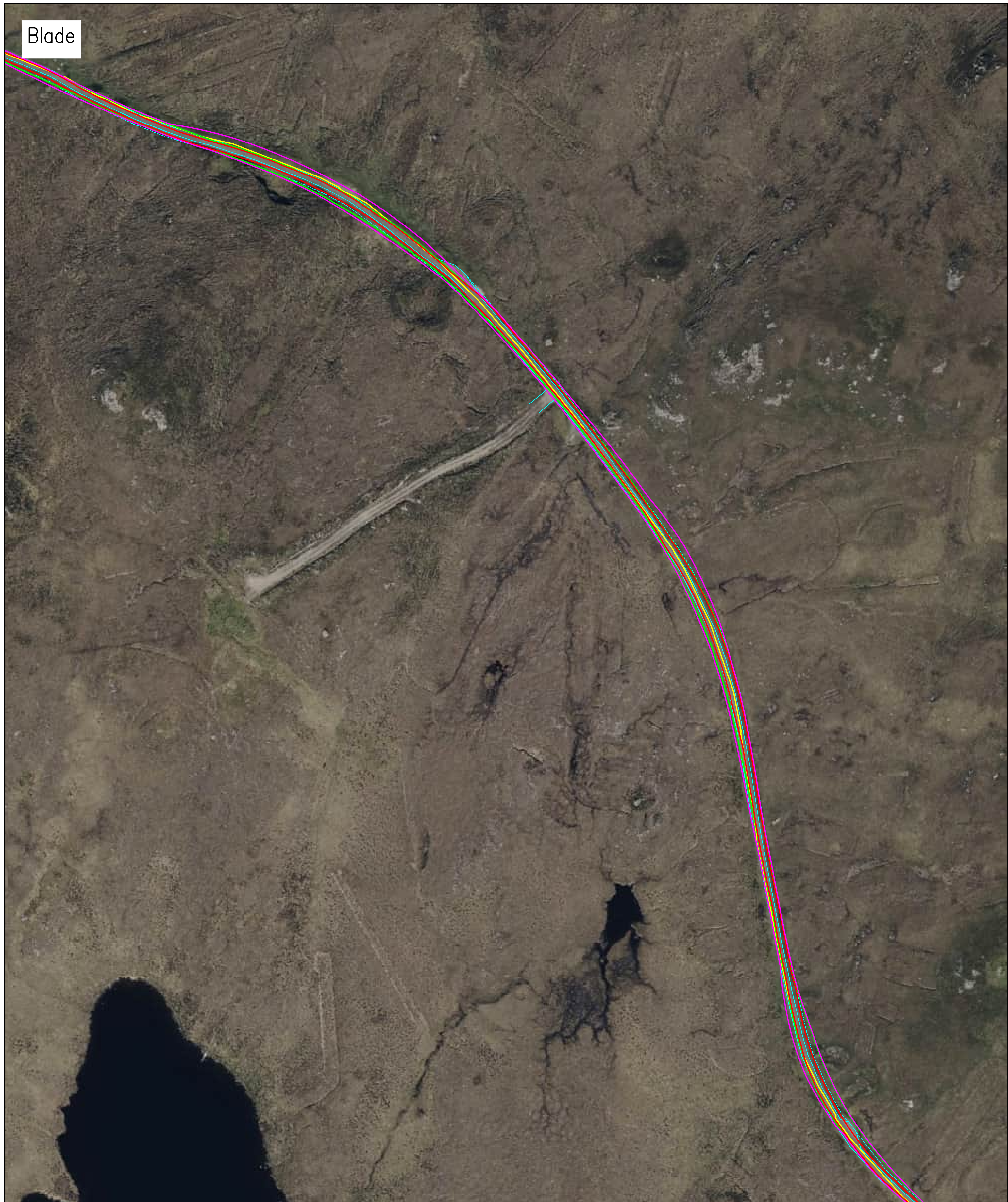
File No.: 230525 Uisenis SPA.dwg

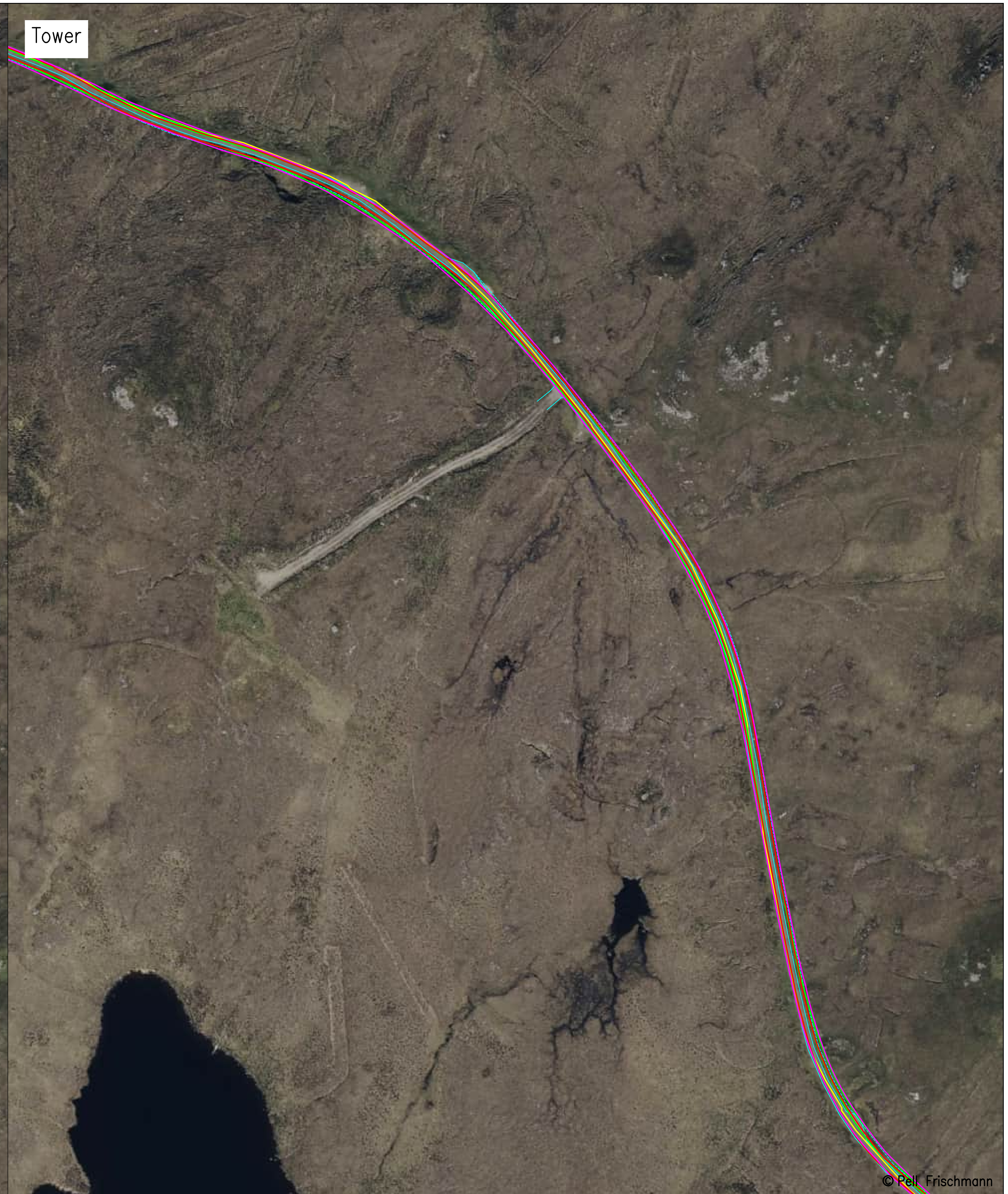
Drawing Status: Draft

Drawing No.: SK17A

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 1





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Client: Eurowind

Key: Wheel SPA, Body SPA, Load SPA, Indicative, Over–run, Over–sail

Project: Uisenis Wind Farm

Drawing Title: Siemens SGRE155 Blade & Tower

SPA Location: Eisgean Road, Goidamol

	Name	Date
Drawn	JS	30/05/2023
Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest		36,37

Scale: 1:2000 @ A3

File No.: 230525 Uisenis SPA.dwg

Drawing Status: Draft

Drawing No.: SK18

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 1

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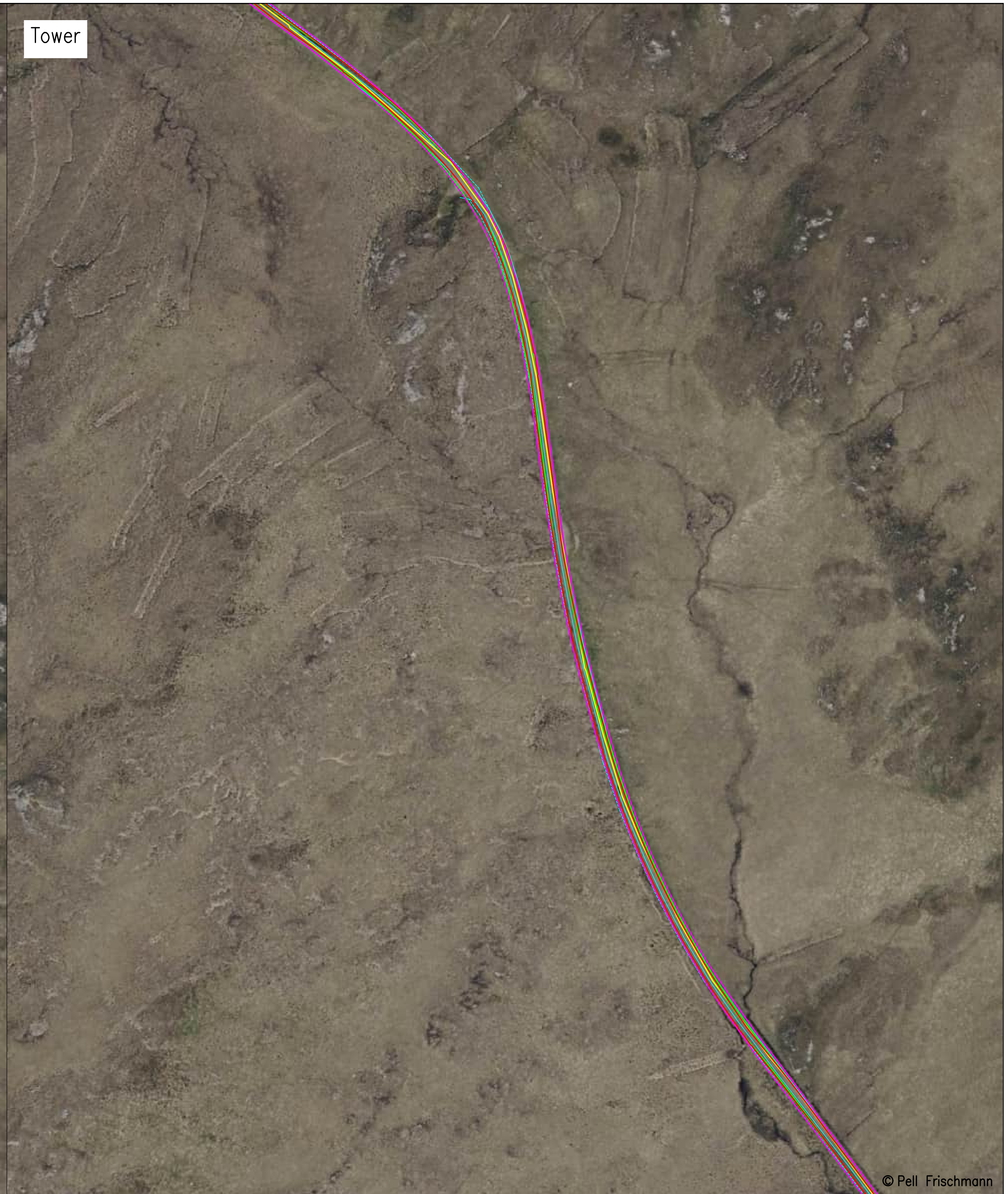
Project	Uisenis Wind Farm		
Client	Eurowind		
Drawing Title	Siemens SGRE155 Blade & Tower		
SPA Location	Eisgean Road, Goidamol		
	Name	Date	
Drawn	JS	30/05/2023	
Designed	GB	30/05/2023	
Checked	GB	30/05/2023	
Point of Interest		36,37	
Scale	1:2000 @ A3		
File No.	230525 Uisenis SPA.dwg		
Drawing Status	Draft		
Drawing No.	SK18A		
Revision	1		

Key: Wheel SPA, Body SPA, Load SPA, Indicative, Over–run, Over–sail

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.



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Client: Eurowind

Key: Wheel SPA · Body SPA · Load SPA · Indicative · Over–run · Over–sail

Project: Uisenis Wind Farm

Drawing Title: Siemens SGRE155 Blade & Tower

SPA Location: Eisgean Road, Beinn a' Mhula

	Name	Date
Drawn	JS	30/05/2023
Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest		38

Scale: 1:2000 @ A3

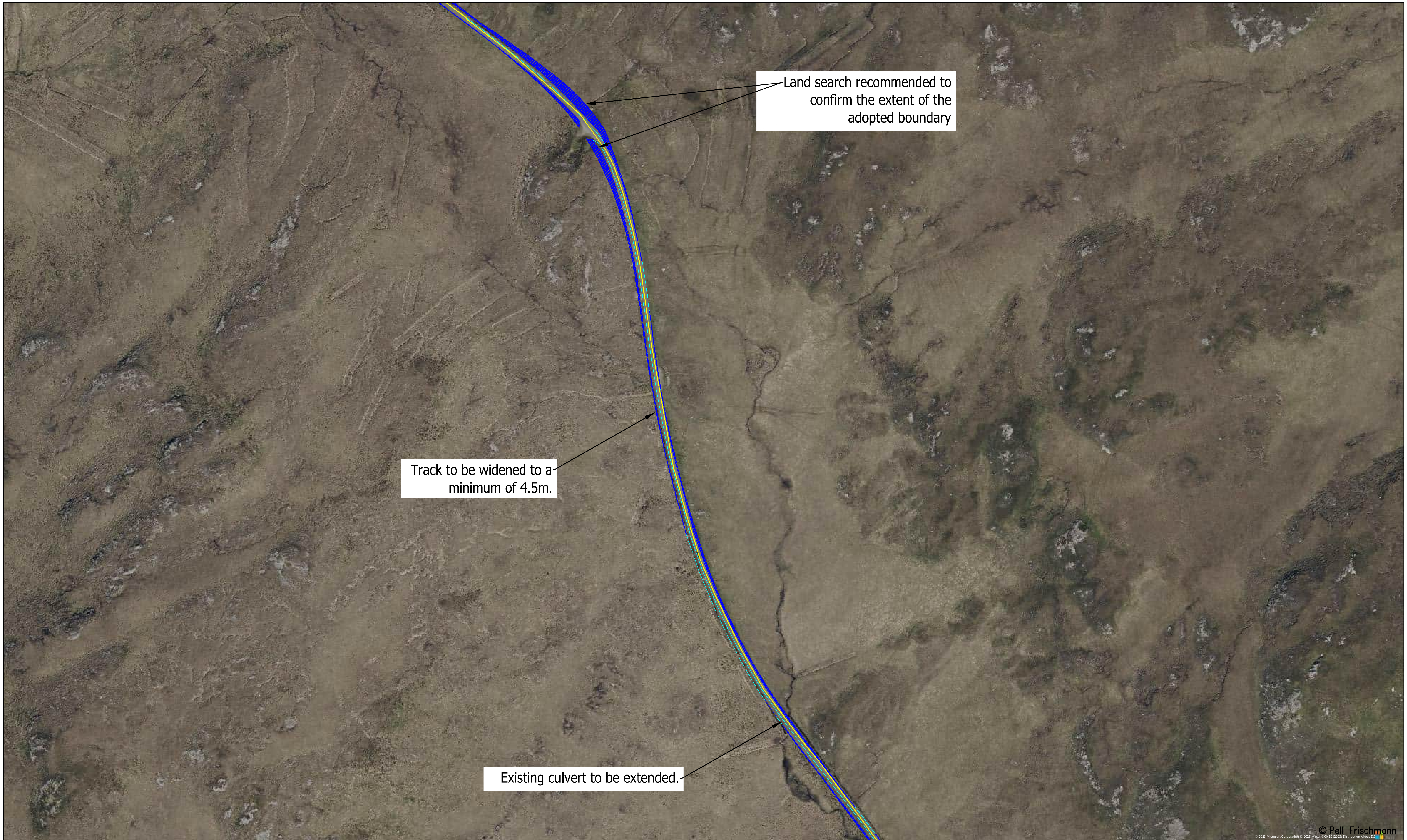
File No.: 230525 Uisenis SPA.dwg

Drawing Status: Draft

Drawing No.: SK19

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 1



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Project: Uisenis Wind Farm

Client: Eurowind

Drawing Title: Siemens SGRE155 Blade & Tower

SPA Location: Eisgean Road, Beinn a' Mhula

Key: Wheel SPA, Body SPA, Load SPA, Indicative, Over–run, Over–sail

	Name	Date
Drawn	JS	30/05/2023
Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest		38

Scale: 1:2000 @ A3

File No.: 230525 Uisenis SPA.dwg

Drawing Status: Draft

Drawing No.: SK19A

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 1

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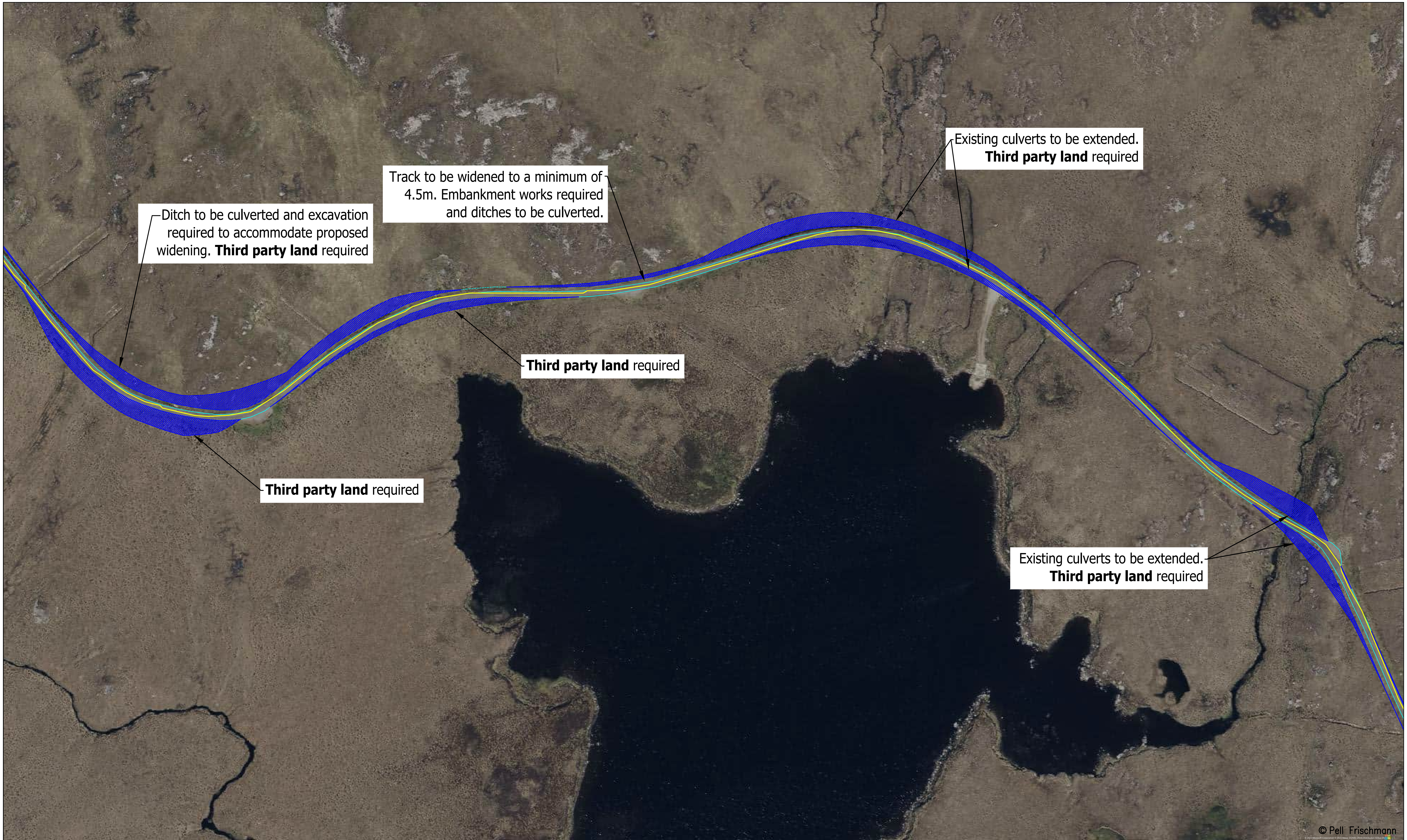
Client	Eurowind
Project	Uisenis Wind Farm
Drawing Title	Siemens SGRE155 Blade & Tower
SPA Location	Eisgean Road, Loch na Muilne

Key: Wheel SPA — Body SPA — Load SPA — Indicative — Over-run — Over-sail

	Name	Date
Drawn	JS	30/05/2023
Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest		40,41

Scale	1:1500 @ A3
File No.	230525 Uisenis SPA.dwg
Drawing Status	Draft
Drawing No.	SK20
Revision	1

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.



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Client: Eurowind

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Over-run | Over-sail

Project: Uisenis Wind Farm

Drawing Title: Siemens SGRE155 Blade & Tower

SPA Location: Eisgean Road, Loch na Muilne

	Name	Date
Drawn	JS	30/05/2023
Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest		40,41

Scale: 1:1500 @ A3

File No. 230525 Uisenis SPA.dwg

Drawing Status: Draft

Drawing No. SK20A

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 1

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Client: Eurowind

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Over–run | Over–sail

Project: Uisenis Wind Farm

Drawing Title: Siemens SGRE155 Blade & Tower

SPA Location: Eisgean Road, North of Sideabhal

	Name	Date
Drawn	JS	30/05/2023
Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest		42

Scale: 1:1250 @ A3

File No.: 230525 Uisenis SPA.dwg

Drawing Status: Draft

Drawing No.: SK21

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 1

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Client: Eurowind

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Over-run | Over-sail

Project: Uisenis Wind Farm

Drawing Title: Siemens SGRE155 Blade & Tower

SPA Location: Eisgean Road, North of Sideabhal

	Name	Date
Drawn	JS	30/05/2023
Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest		42

Scale: 1:1250 @ A3

File No.: 230525 Uisenis SPA.dwg

Drawing Status: Draft

Drawing No.: SK21A

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 1

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Client	Eurowind
Project	Uisenis Wind Farm
Drawing Title	Siemens SGRE155 Blade & Tower
SPA Location	Eisgean Road, East of Sideabhal

Key: Wheel SPA, Body SPA, Load SPA, Indicative, Over–run, Over–sail

	Name	Date
Drawn	JS	30/05/2023
Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest		43

Scale	1:1000 @ A3
File No.	230525 Uisenis SPA.dwg
Drawing Status	Draft
Drawing No.	SK22
Revision	1

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

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Client: Eurowind

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Over–run | Over–sail

Project: Uisenis Wind Farm

Drawing Title: Siemens SGRE155 Blade & Tower

SPA Location: Eisgean Road, East of Sideabhal

	Name	Date
Drawn	JS	30/05/2023
Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest		43

Scale: 1:1000 @ A3

File No. 230525 Uisenis SPA.dwg

Drawing Status: Draft

Drawing No. SK22A

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 1

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Project: Uisenis Wind Farm

Client: Eurowind

Drawing Title: Siemens SGRE155 Blade & Tower

SPA Location: Eisgean Road, Ceann Shiphoirt

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Over−run | Over−sail

	Name	Date
Drawn	JS	30/05/2023
Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest		44

Scale: 1:2000 @ A3

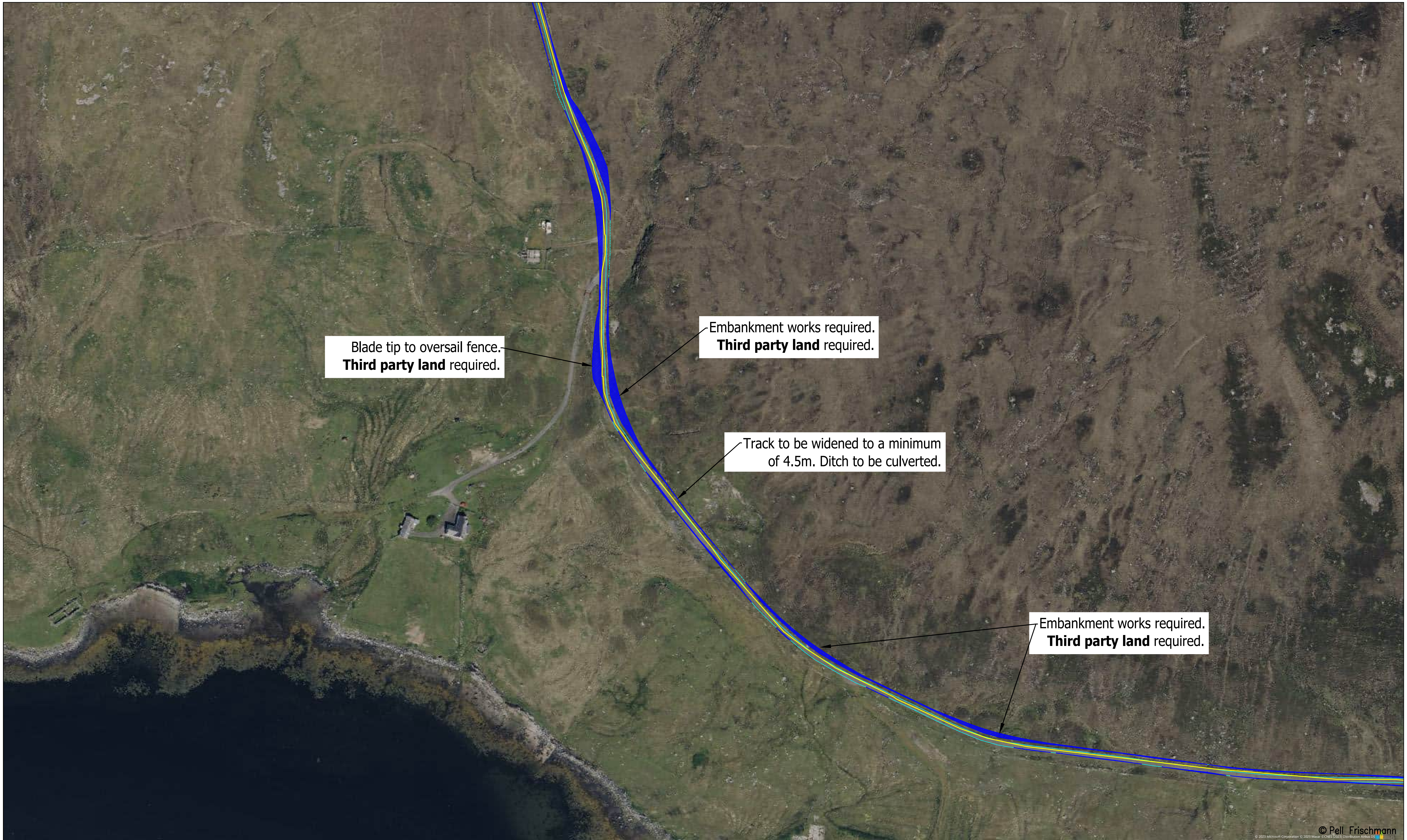
File No. 230525 Uisenis SPA.dwg

Drawing Status: Draft

Drawing No. SK23

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 1



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Client: Eurowind

Key: Wheel SPA, Body SPA, Load SPA, Indicative, Over–run, Over–sail

Project: Uisenis Wind Farm

Drawing Title: Siemens SGRE155 Blade & Tower

SPA Location: Eisgean Road, Ceann Shiphoirt

	Name	Date
Drawn	JS	30/05/2023
Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest		44

Scale: 1:2000 @ A3

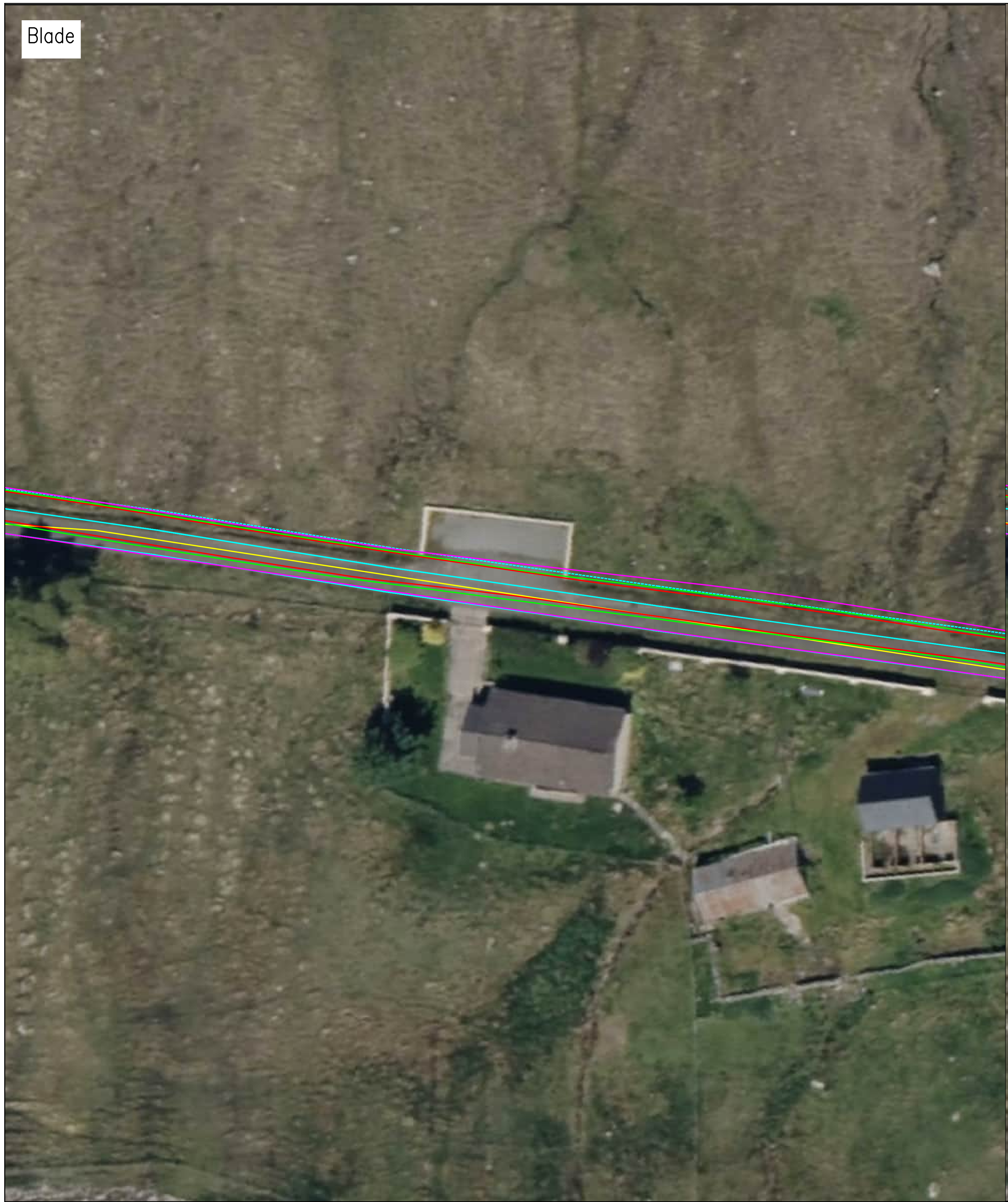
File No.: 230525 Uisenis SPA.dwg

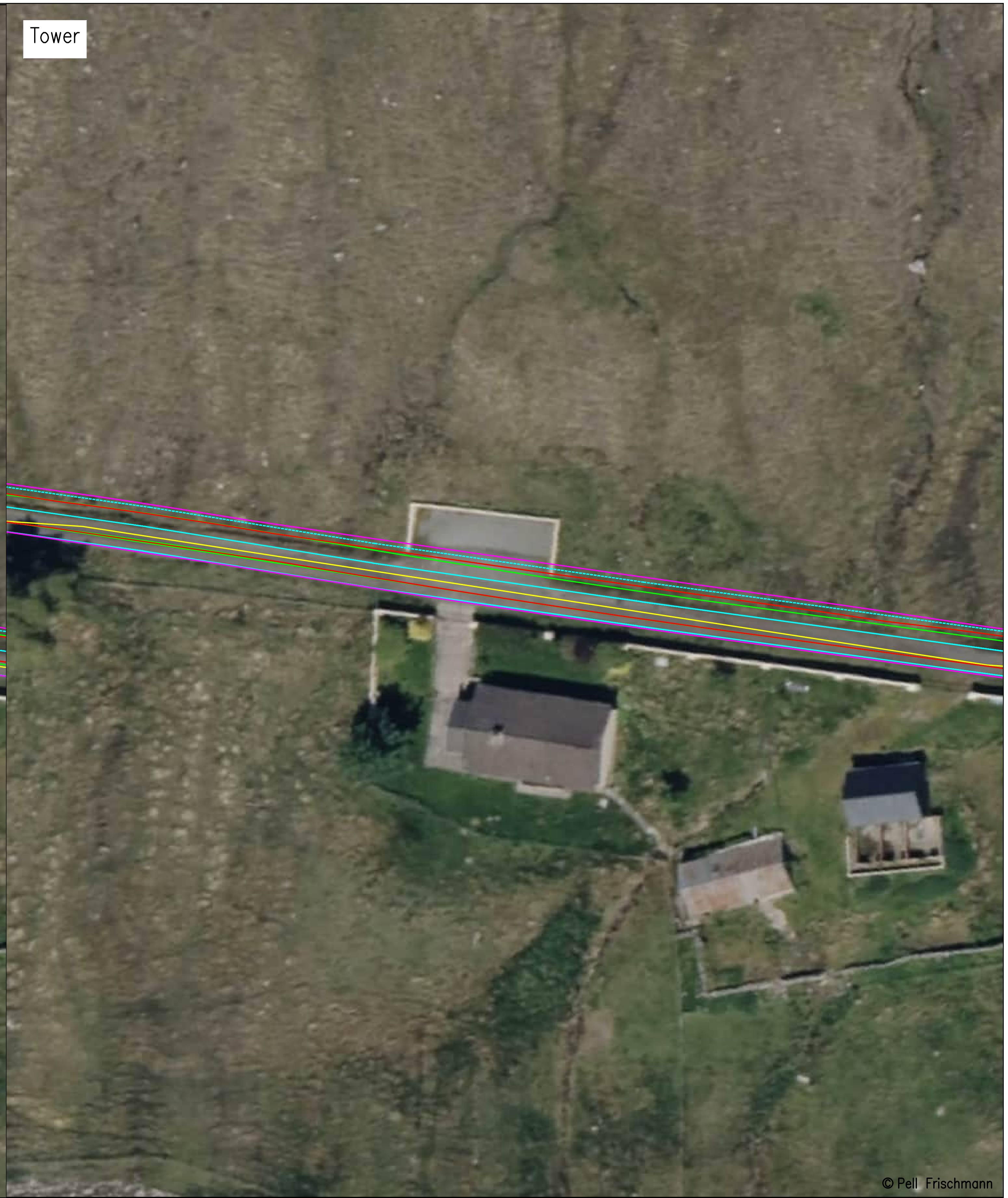
Drawing Status: Draft

Drawing No.: SK23A

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 1





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Client	Eurowind	
Project	Uisenis Wind Farm	
Drawing Title	Siemens SGRE155 Blade & Tower	
SPA Location	Eisgean Road, Beinn Lobhair	

Key: Wheel SPA, Body SPA, Load SPA, Indicative, Over–run, Over–sail

	Name	Date
Drawn	JS	30/05/2023
Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest	46	

Scale: 1:500 @ A3

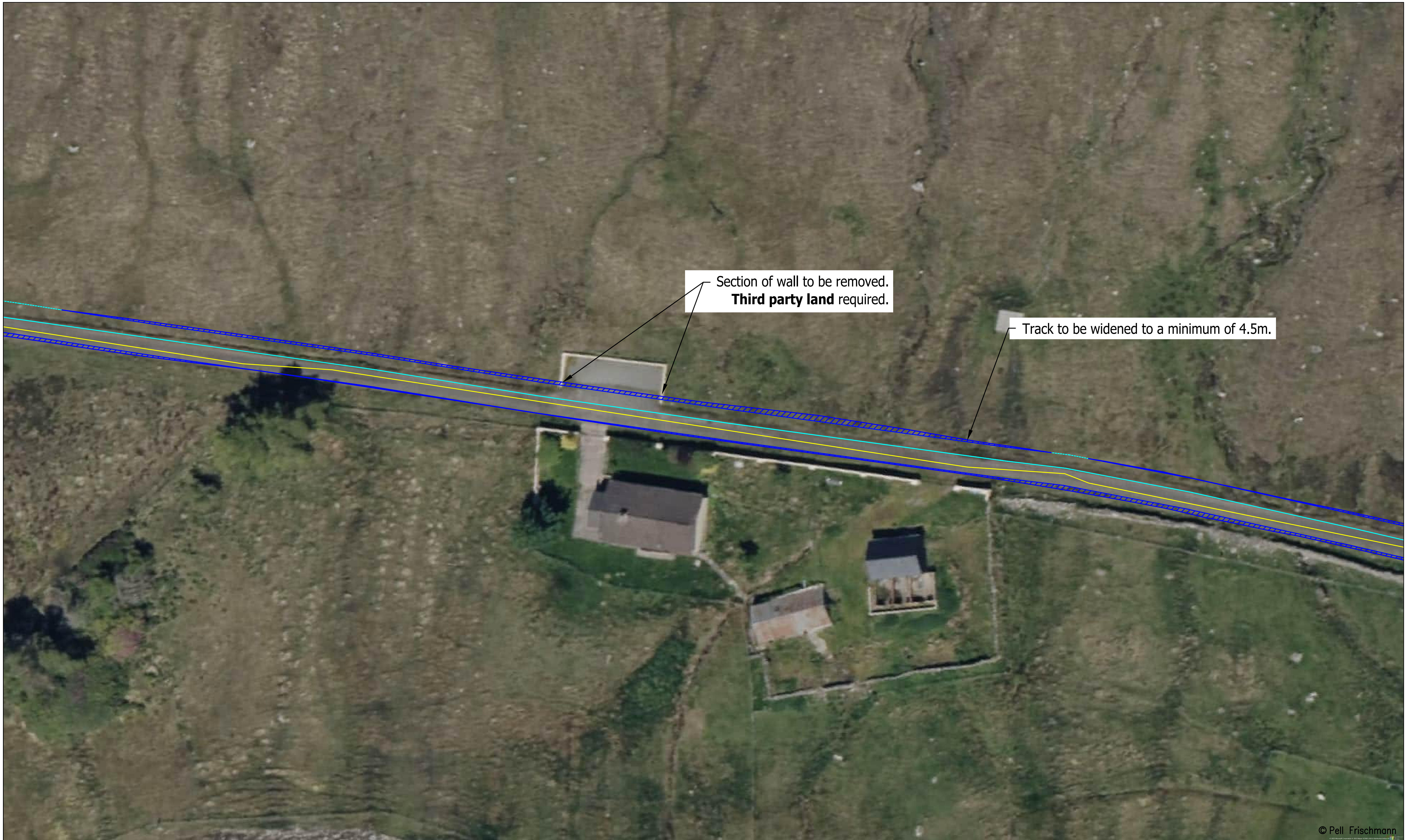
File No. 230525 Uisenis SPA.dwg

Drawing Status: Draft

Drawing No. SK24

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 1



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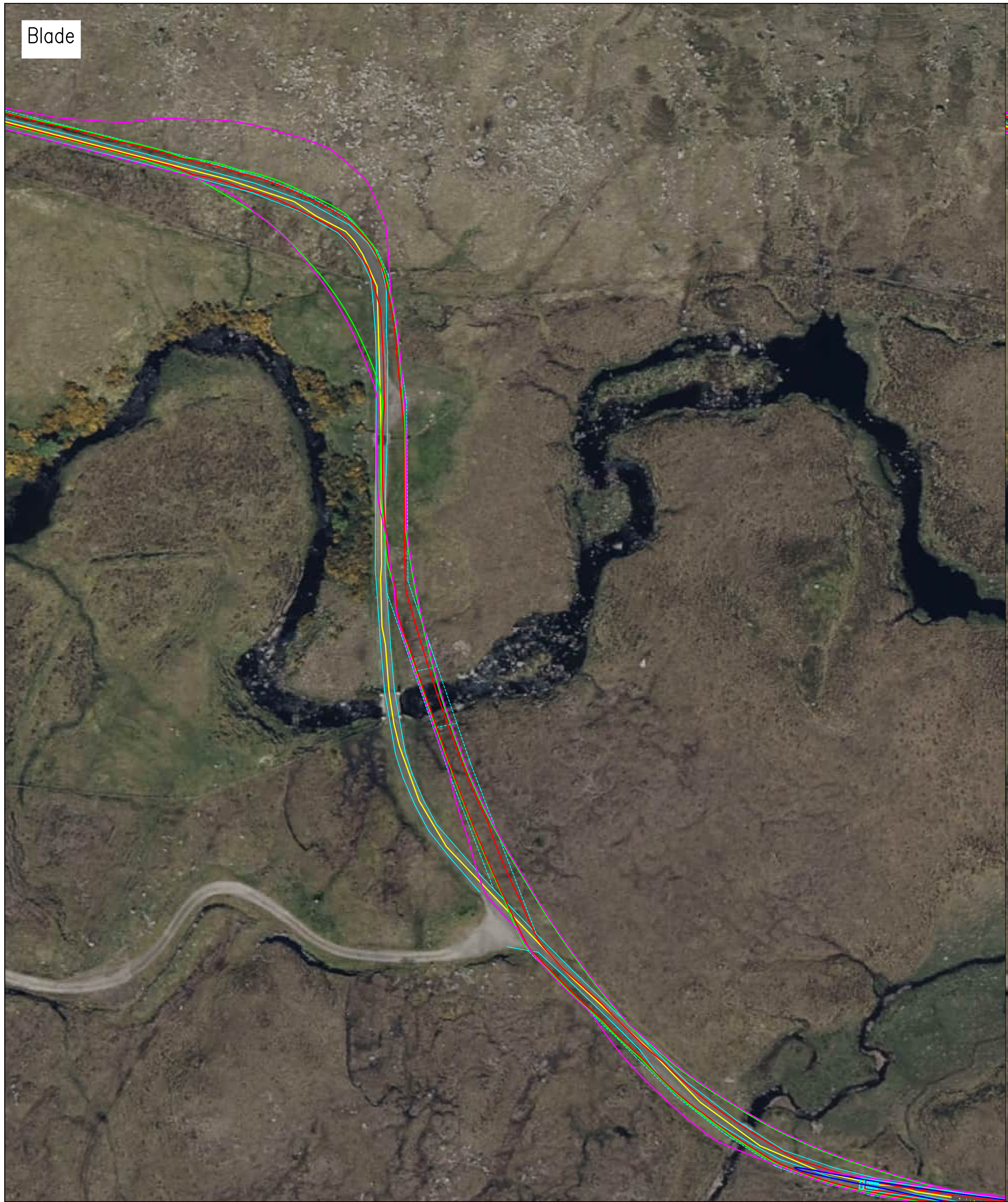
Client	Eurowind
Project	Uisenis Wind Farm
Drawing Title	Siemens SGRE155 Blade & Tower
SPA Location	Eisgean Road, Beinn Lobhair

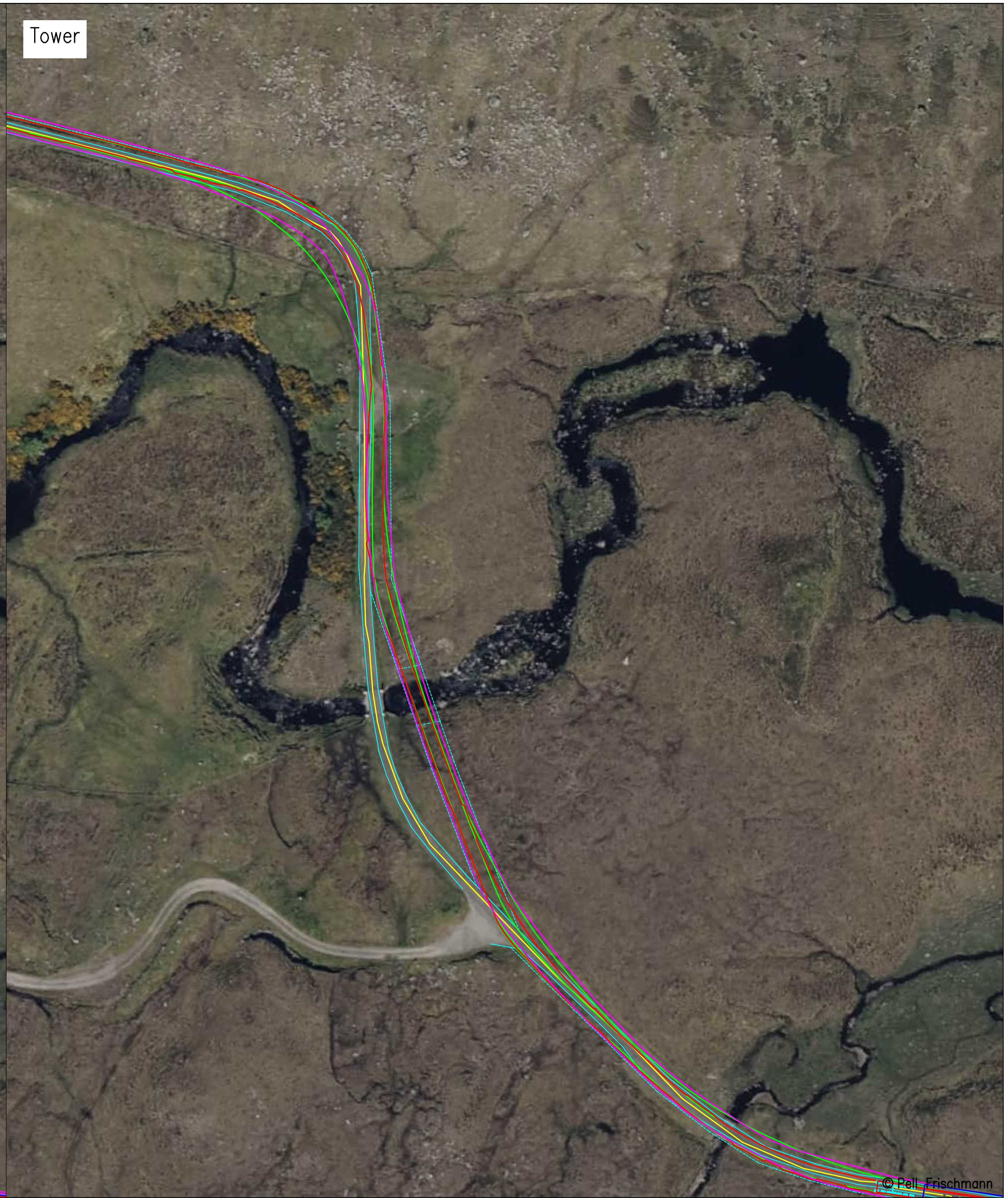
Key: Wheel SPA, Body SPA, Load SPA, Indicative, Over–run, Over–sail

	Name	Date
Drawn	JS	30/05/2023
Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest		46

Scale	1:500 @ A3
File No.	230525 Uisenis SPA.dwg
Drawing Status	Draft
Drawing No.	SK24A
Revision	1

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.





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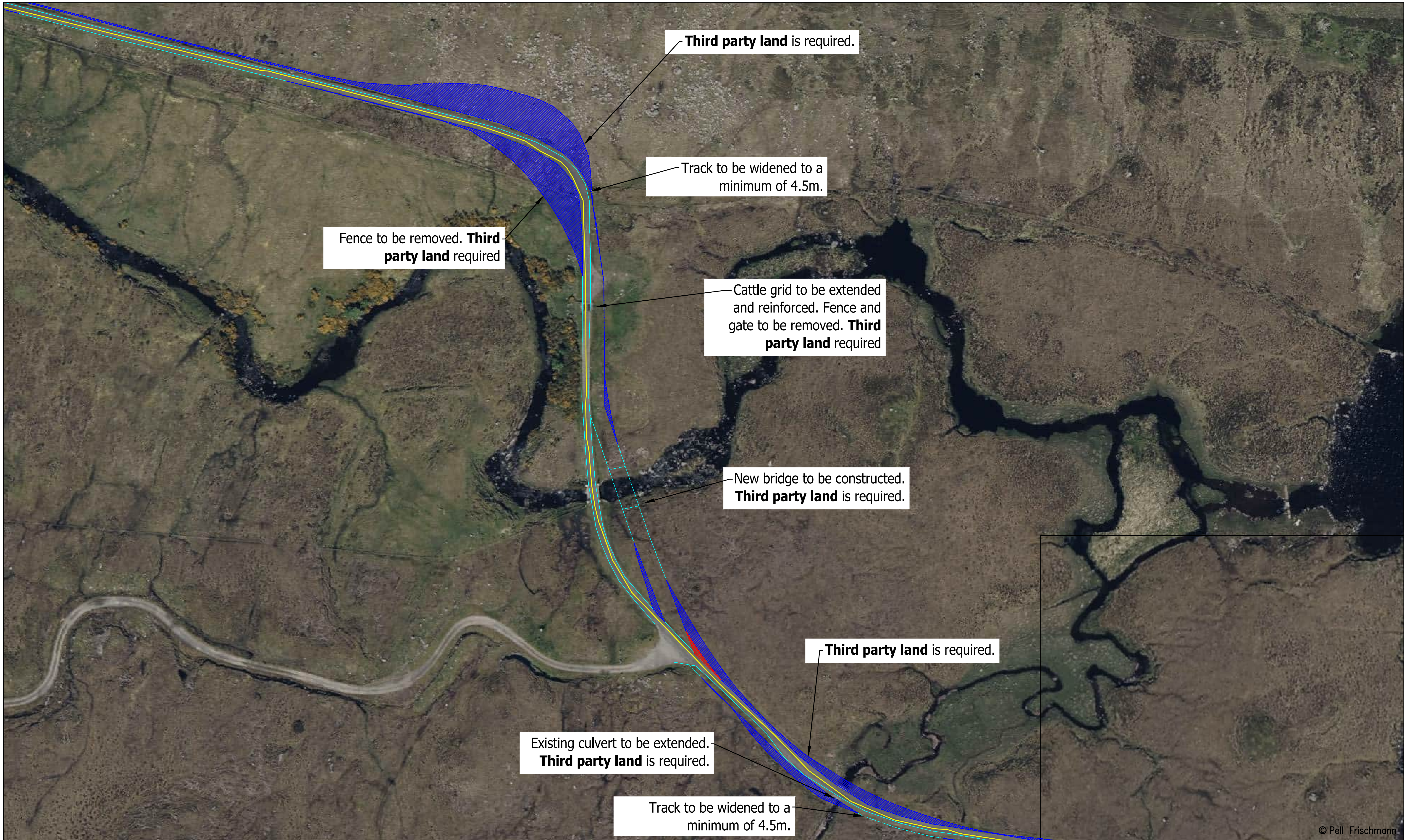
Project	Uisenis Wind Farm
Client	Eurowind
Drawing Title	Siemens SGRE155 Blade & Tower
SPA Location	Eisgean Road, Leathad nan Carnaichean

Key: Wheel SPA, Body SPA, Load SPA, Indicative, Over–run, Over–sail

	Name	Date
Drawn	JS	30/05/2023
Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest		47,48

Scale	1:1250 @ A3
File No.	230525 Uisenis SPA.dwg
Drawing Status	Draft
Drawing No.	SK25
Revision	1

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.



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Project: Uisenis Wind Farm

Client: Eurowind

Drawing Title: Siemens SGRE155 Blade & Tower

SPA Location: Eisgean Road, Leathad nan Carnaichean

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Over–run | Over–sail

	Name	Date
Drawn	JS	30/05/2023
Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest		47,48

Scale: 1:1250 @ A3

File No.: 230525 Uisenis SPA.dwg

Drawing Status: Draft

Drawing No.: SK25A

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 1

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Client: Eurowind

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Over-run | Over-sail

Project: Uisenis Wind Farm

Drawing Title: Siemens SGRE155 Blade & Tower

SPA Location: Eisgean Road, Northeast of Gearraidh Sgeiravat

	Name	Date
Drawn	JS	30/05/2023
Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest		49,50

Scale: 1:1250 @ A3

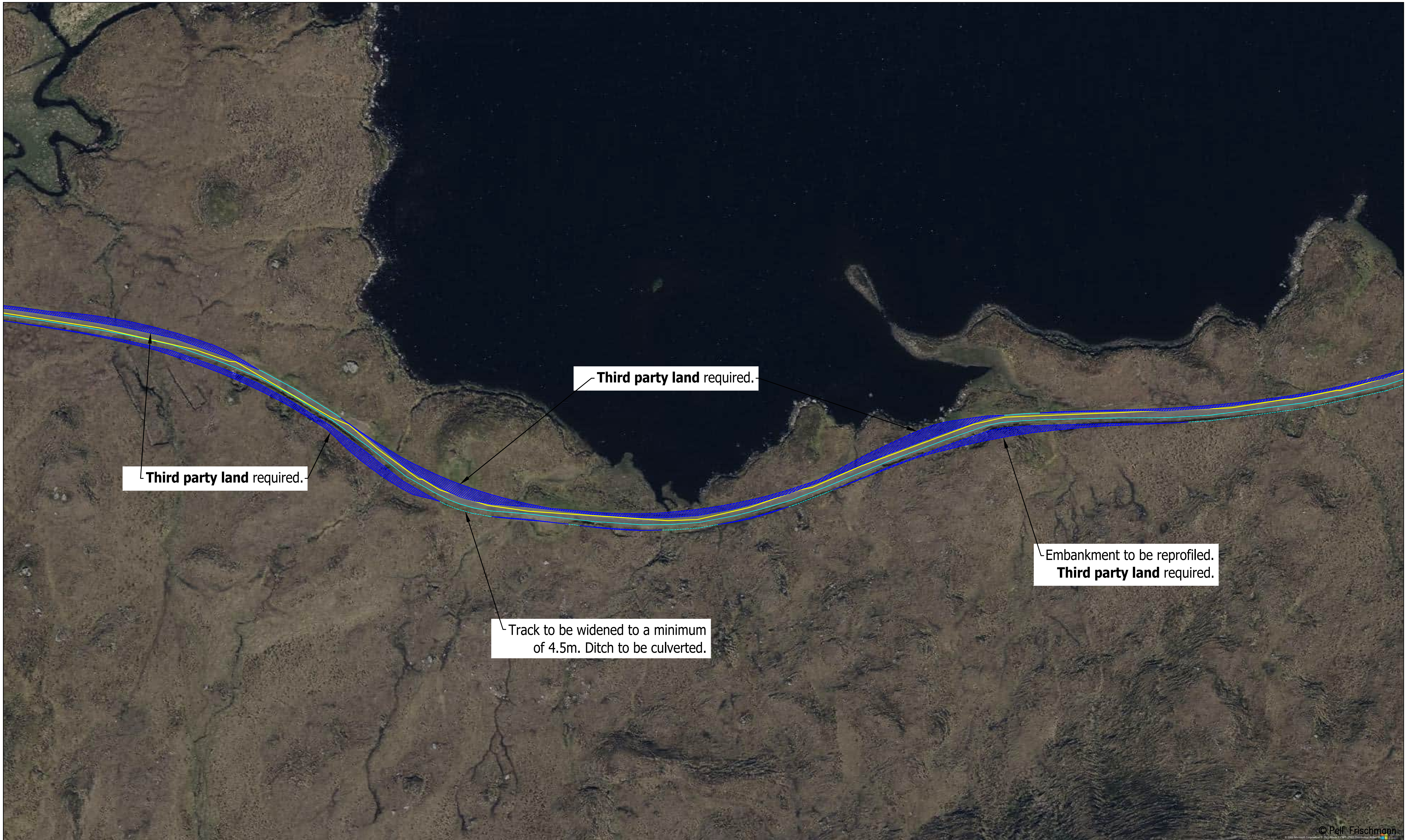
File No.: 230525 Uisenis SPA.dwg

Drawing Status: Draft

Drawing No.: SK26

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 1



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Client: Eurowind

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Over–run | Over–sail

Project: Uisenis Wind Farm

Drawing Title: Siemens SGRE155 Blade & Tower

SPA Location: Eisgean Road, Northeast of Gearraidh Sgeiravat

	Name	Date
Drawn	JS	30/05/2023
Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest		49,50

Scale: 1:1250 @ A3

File No.: 230525 Uisenis SPA.dwg

Drawing Status: Draft

Drawing No.: SK26A

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 1

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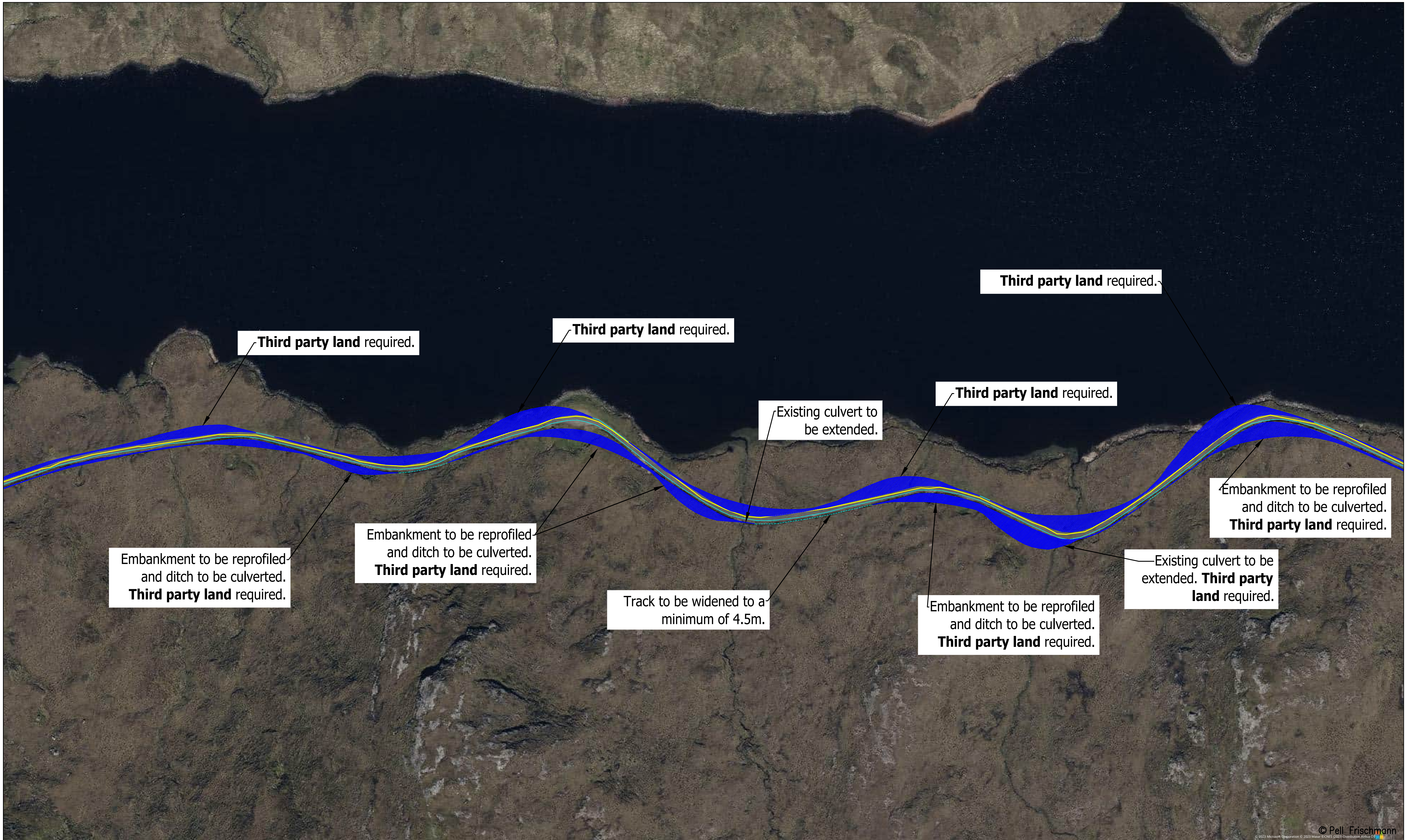
Client	Eurowind
Project	Uisenis Wind Farm
Drawing Title	Siemens SGRE155 Blade & Tower
SPA Location	Eisgean Road, Cleit na h-Uamha

Key: Wheel SPA, Body SPA, Load SPA, Indicative, Over-run, Over-sail

	Name	Date
Drawn	JS	30/05/2023
Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest		51,52

Scale: 1:2000 @ A3
File No.: 230525 Uisenis SPA.dwg
Drawing Status: Draft
Drawing No.: SK27
Revision: 1

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.



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Project	Uisenis Wind Farm
Client	Eurowind
Drawing Title	Siemens SGRE155 Blade & Tower
SPA Location	Eisgean Road, Cleit na h-Uamha

Key: Wheel SPA, Body SPA, Load SPA, Indicative, Over-run, Over-sail

	Name	Date
Drawn	JS	30/05/2023
Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest		51,52

Scale	1:2000 @ A3
File No.	230525 Uisenis SPA.dwg
Drawing Status	Draft
Drawing No.	SK27A
Revision	1

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

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Client: Eurowind

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Over–run | Over–sail

Project: Uisenis Wind Farm

Drawing Title: Siemens SGRE155 Blade & Tower

SPA Location: Eisgean Road, Cleit na h–Airigh

	Name	Date
Drawn	JS	30/05/2023
Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest		53

Drawing No. SK28

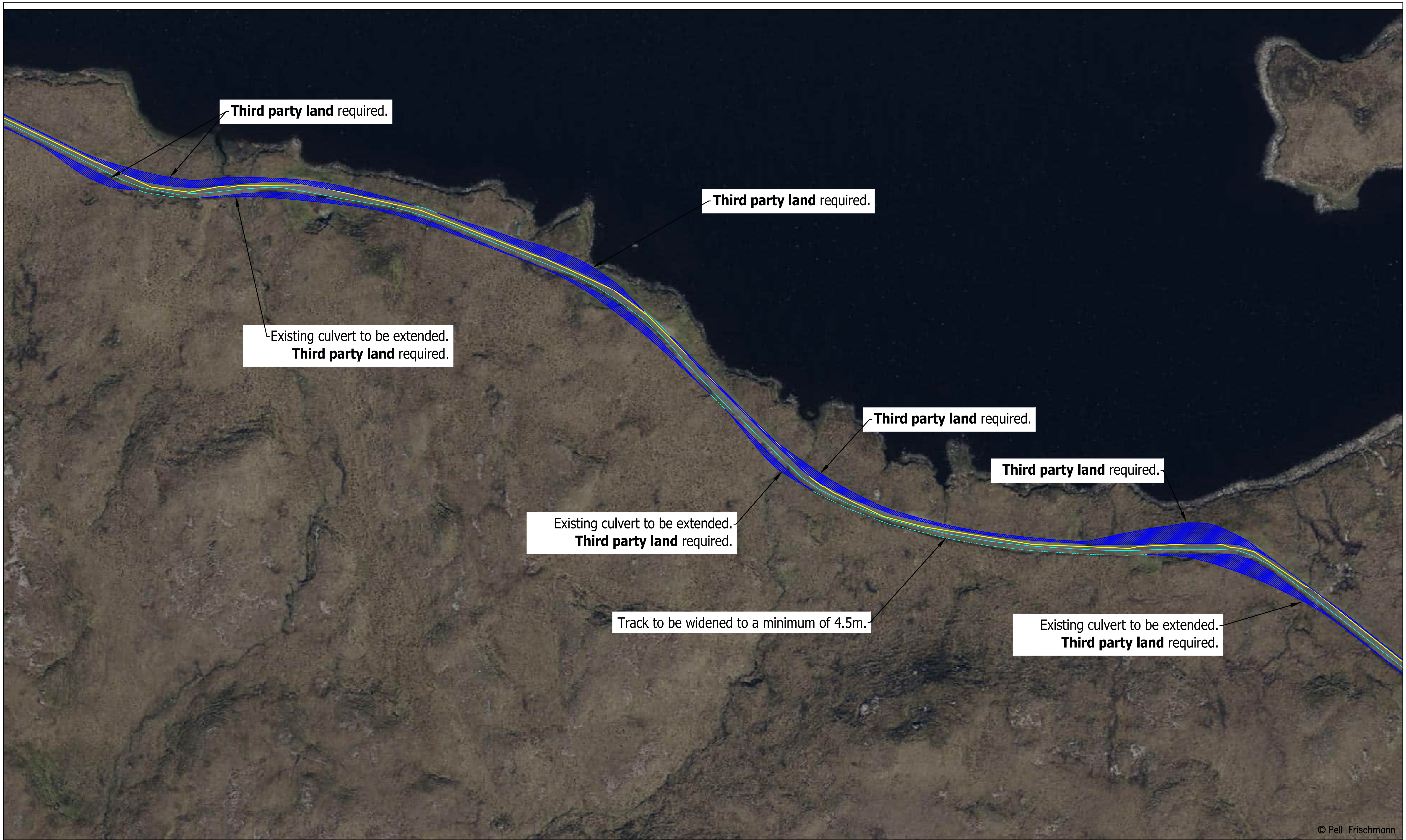
Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Scale: 1:2000 @ A3

File No. 230525 Uisenis SPA.dwg

Drawing Status: Draft

Revision: 1



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Client: Eurowind

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Over–run | Over–sail

Project: Uisenis Wind Farm

Drawing Title: Siemens SGRE155 Blade & Tower

SPA Location: Eisgean Road, Cleit na h–Airigh

	Name	Date
Drawn	JS	30/05/2023
Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest		53

Scale: 1:1500 @ A3

File No.: 230525 Uisenis SPA.dwg

Drawing Status: Draft

Drawing No.: SK28A

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 1

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Project	Uisenis Wind Farm
Client	Eurowind
Drawing Title	Siemens SGRE155 Blade & Tower
SPA Location	Eisgean Road, Loch an Eilein Liatha

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Over−run | Over−sail

	Name	Date
Drawn	JS	30/05/2023
Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest		54

Scale: 1:1000 @ A3

File No.: 230525 Uisenis SPA.dwg

Drawing Status: Draft

Drawing No.: SK29

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 1

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Project	Uisenis Wind Farm		Name	Date	Scale: 1:1000 @ A3
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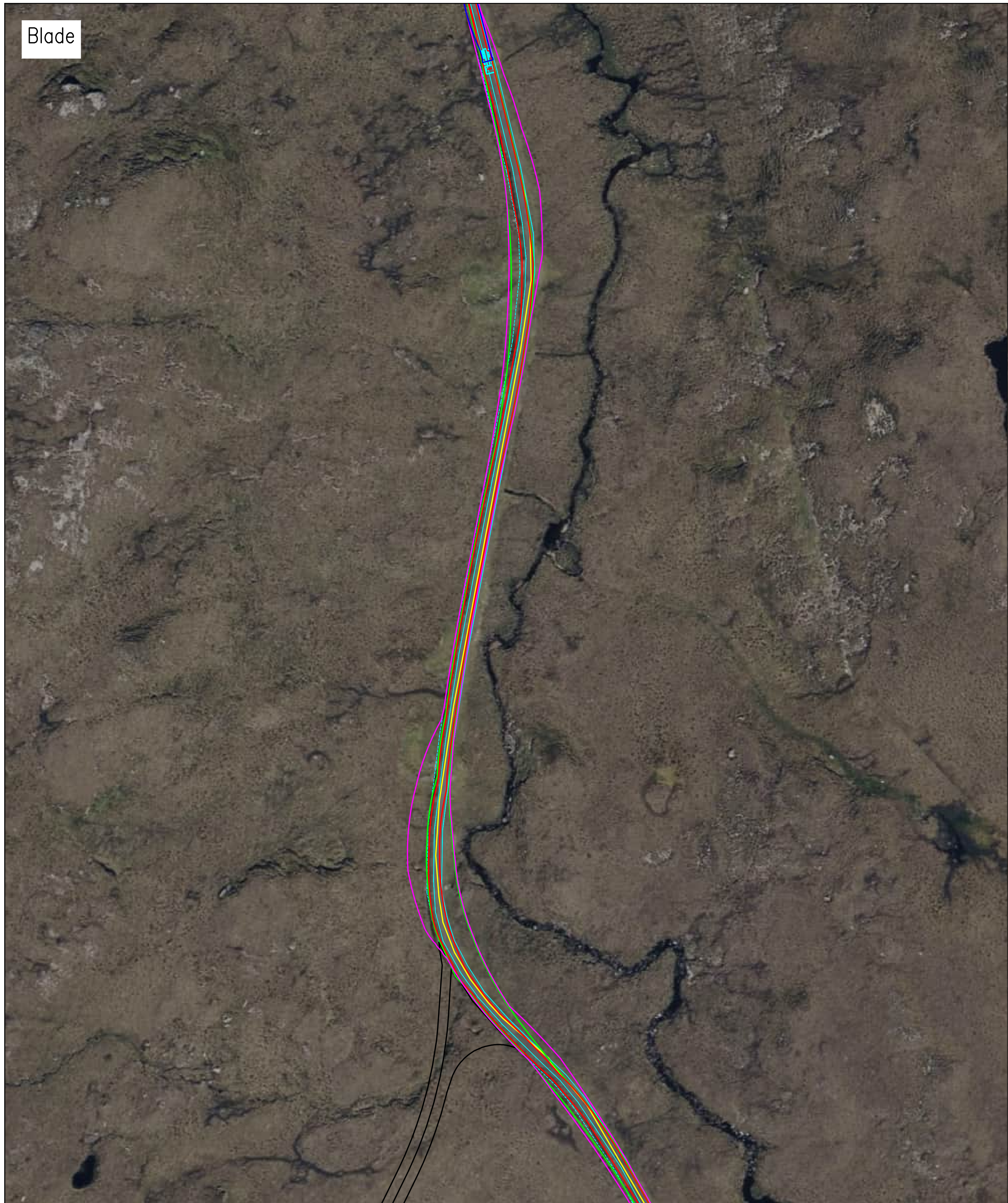
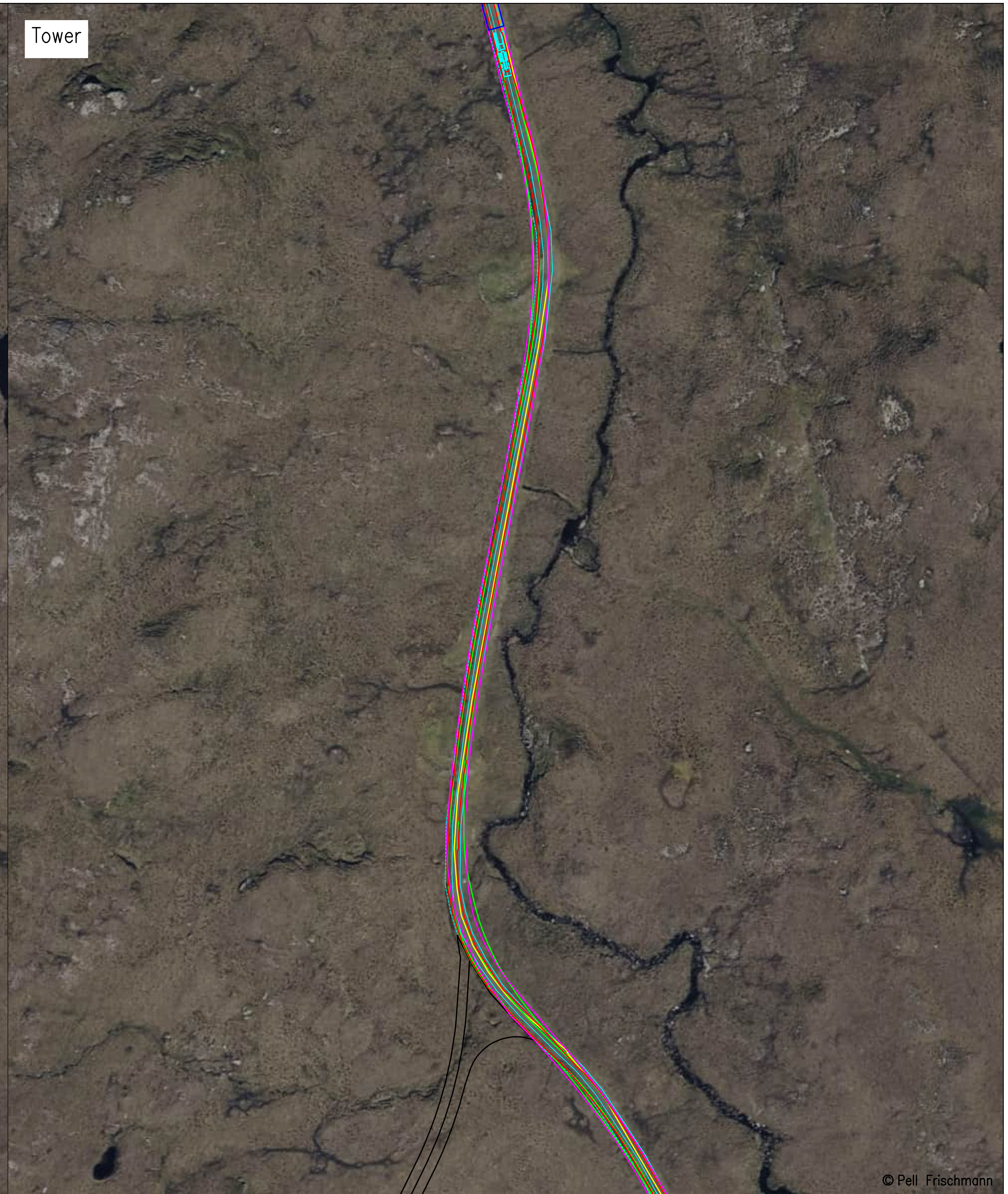
		Designed	GB	30/05/2023	
		Checked	GB	30/05/2023	Drawing Status: Draft
Client	Eurowind	Point of Interest	54		
Drawing Title	Siemens SGRE155 Blade & Tower	Drawing No.	SK29A		Revision: 1
SPA Location	Eisgean Road, Loch an Eilein Liatha				

Key: Wheel SPA, Body SPA, Load SPA, Indicative, Over–run, Over–sail

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.





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Client: Eurowind

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Over–run | Over–sail

Project: Uisenis Wind Farm

Drawing Title: Siemens SGRE155 Blade & Tower

SPA Location: Eisgean Road, North of Loch a' Choin Dhuibh

	Name	Date
Drawn	JS	30/05/2023
Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest		55

Scale: 1:1500 @ A3

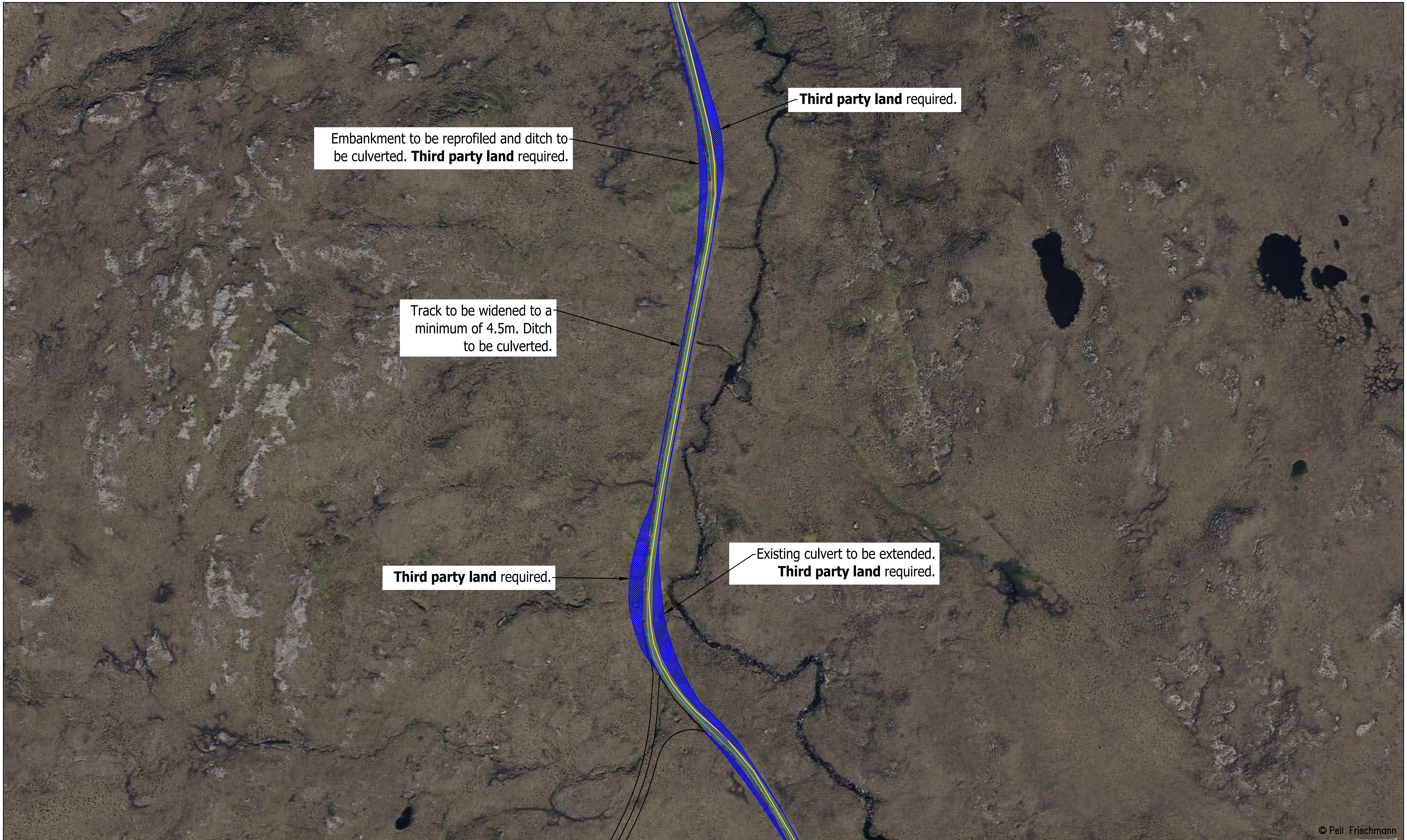
File No.: 230525 Uisenis SPA.dwg

Drawing Status: Draft

Drawing No.: SK30

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 1



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Client: Eurowind

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Over–run | Over–sail

Project: Uisenis Wind Farm

Drawing Title: Siemens SGRE155 Blade & Tower

SPA Location: Eisgean Road, North of Loch a' Choin Dhuibh

	Name	Date
Drawn	JS	30/05/2023
Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest		55

Scale	1:1500 @ A3
File No.	230525 Uisenis SPA.dwg
Drawing Status	Draft
Drawing No.	SK30A
Revision	1

Notes:
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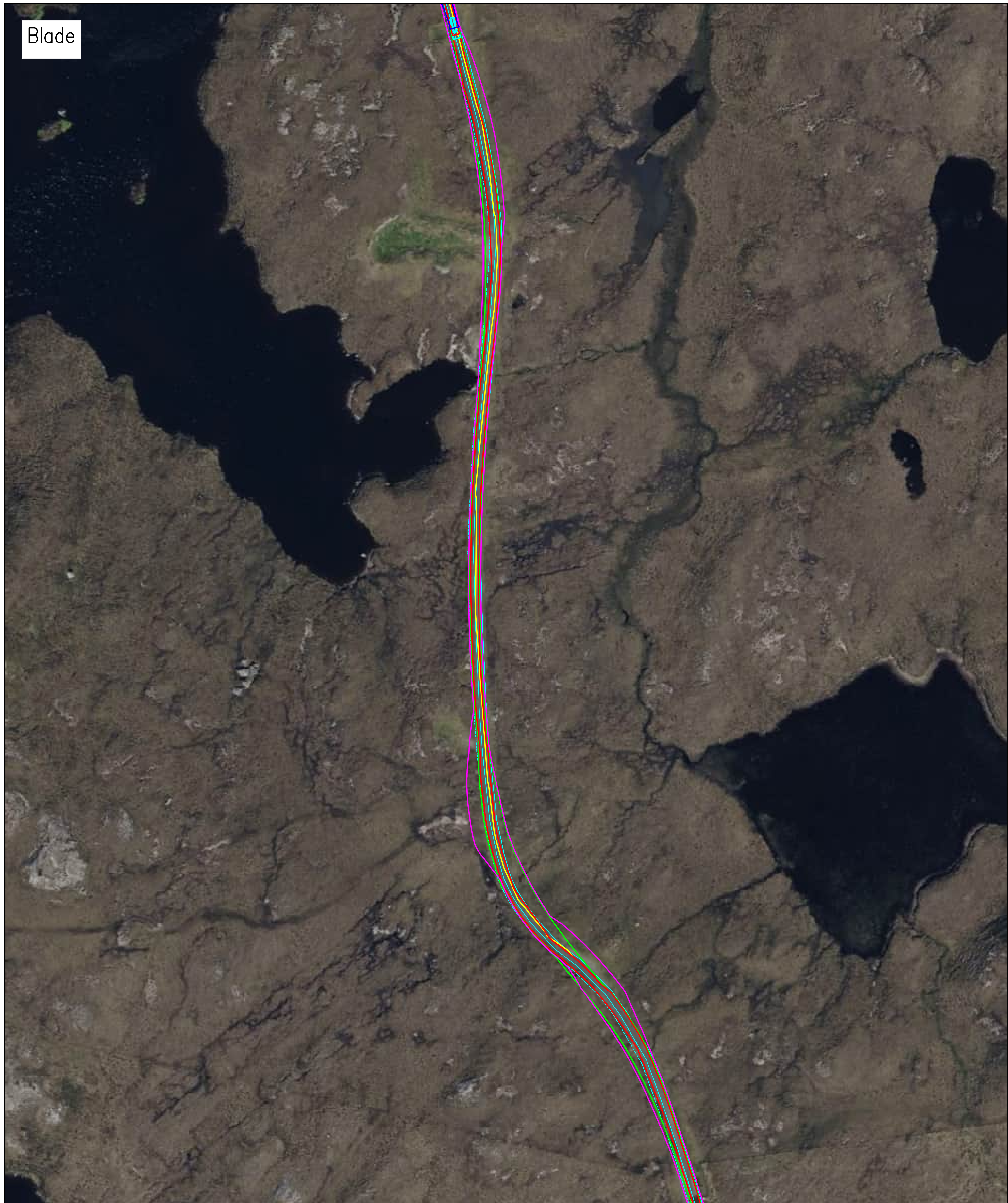

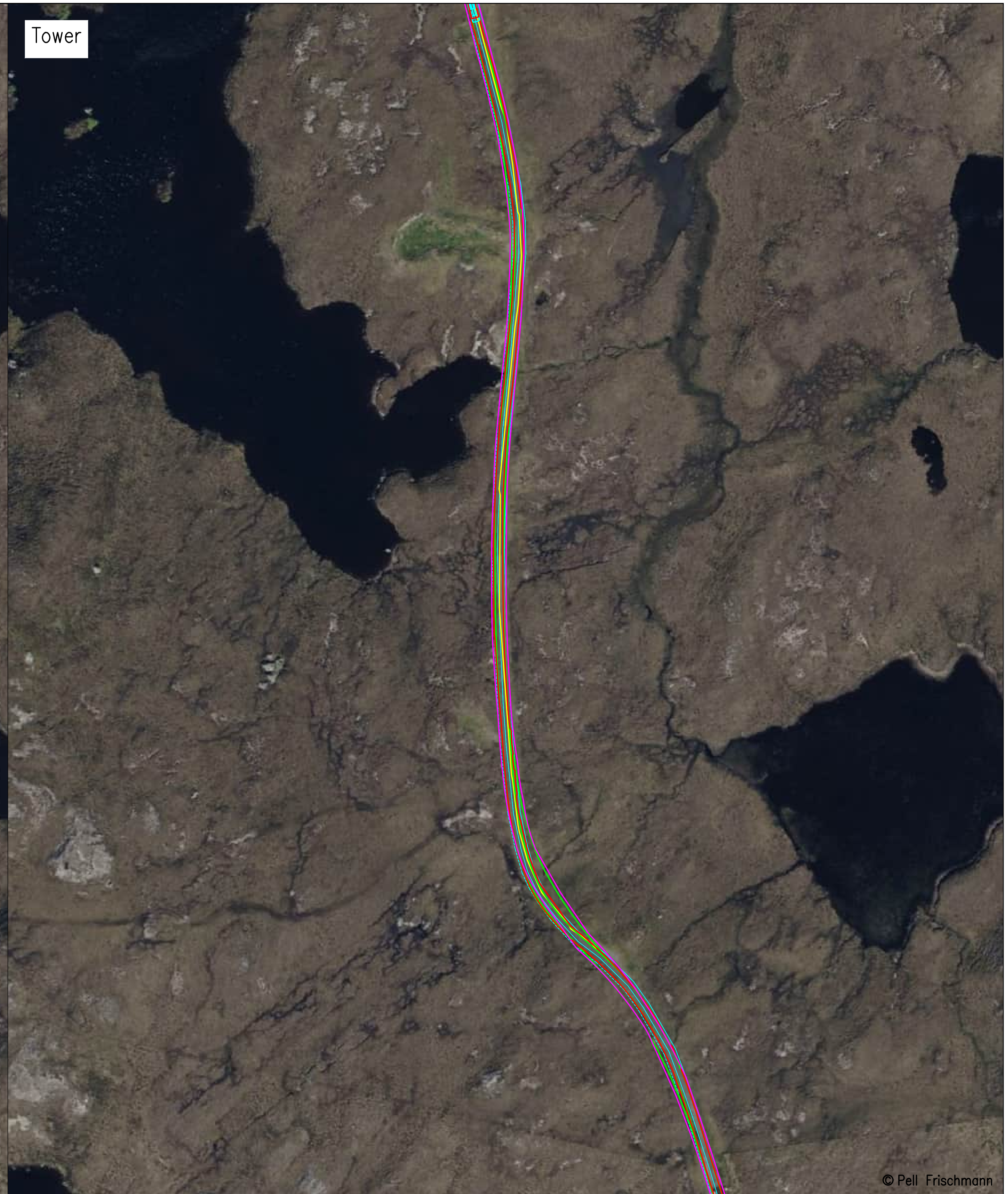

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Project: Uisenis Wind Farm

Client: Eurowind

Drawing Title: Siemens SGRE155 Blade & Tower

SPA Location: Eisgean Road, Loch a' Ghiuthais

Key: Wheel SPA, Body SPA, Load SPA, Indicative, Over–run, Over–sail

	Name	Date
Drawn	JS	30/05/2023
Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest		59

Scale: 1:1750 @ A3

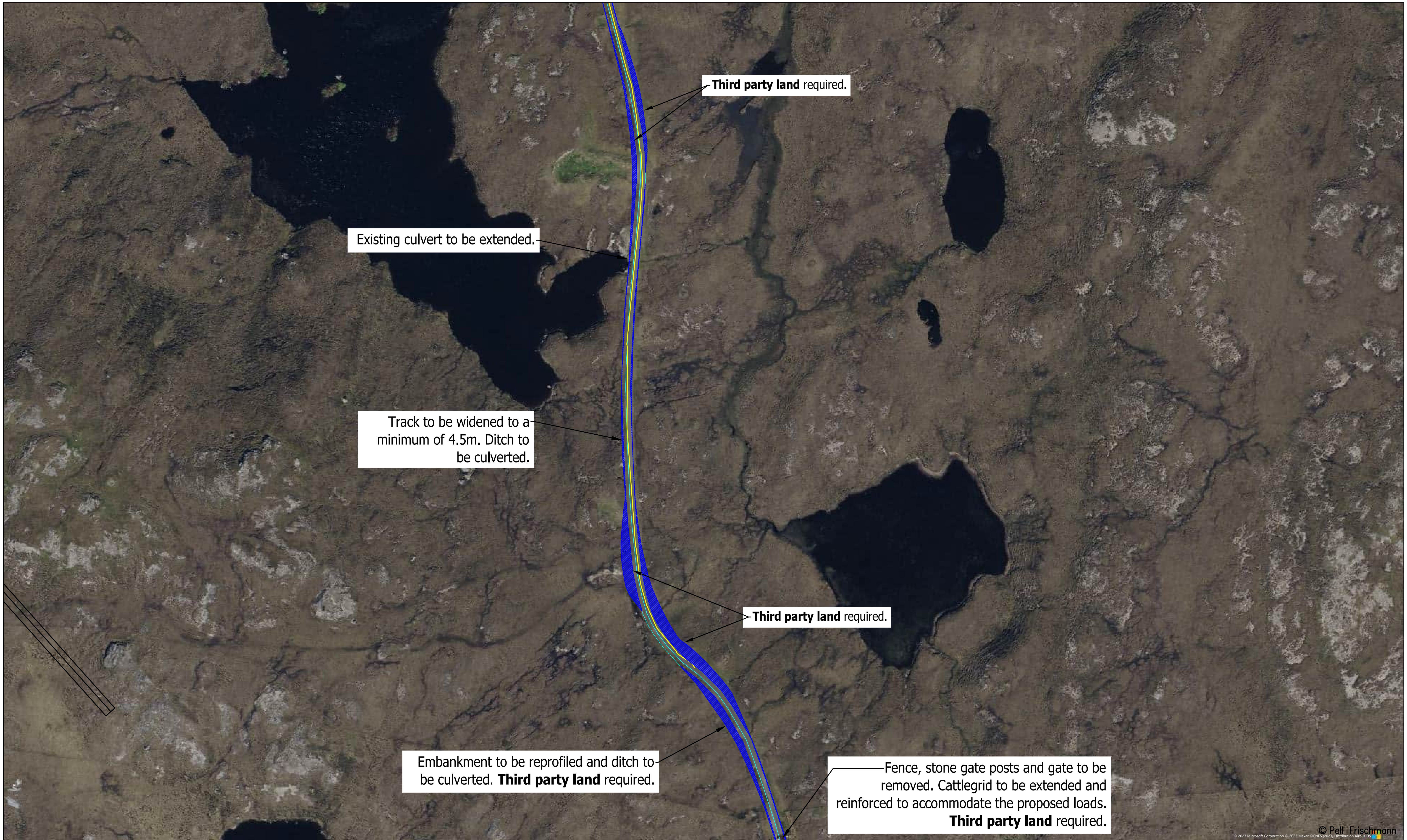
File No.: 230525 Uisenis SPA.dwg

Drawing Status: Draft

Drawing No.: SK31

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 1



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Client: Eurowind

Key: Wheel SPA | Body SPA | Load SPA | Indicative | Over-run | Over-sail

Project: Uisenis Wind Farm

Drawing Title: Siemens SGRE155 Blade & Tower

SPA Location: Eisgean Road, Loch a' Ghiuthais

	Name	Date
Drawn	JS	30/05/2023
Designed	GB	30/05/2023
Checked	GB	30/05/2023
Point of Interest		59

Scale: 1:1750 @ A3

File No.: 230525 Uisenis SPA.dwg

Drawing Status: Draft

Drawing No.: SK31A

Notes:
1. All mitigation is subject to confirmation through a test run.
2. This is not a construction drawing and is intended for illustration purposes only.

Revision: 1

NOTE:

1. ALL DRAWINGS ARE TO BE READ IN CONJUNCTION WITH THE SPECIFICATION FOR HIGHWAY WORKS AND THE TURBINE MANUFACTURERS STANDARDS AND ALL RELEVANT DRAWINGS WITHIN THE PROJECT DESIGN PACKAGE.
2. ALL WORKS TO BE EXECUTED IN ACCORDANCE WITH THE DMRB, THE MANUAL OF CONTRACT DOCUMENTS FOR HIGHWAY WORKS, DESIGN MANUAL FOR ROADS AND BRIDGES, AND TRAFFIC SIGNS MANUAL.
3. ALL DIMENSIONS ARE IN METRES UNLESS STATED OTHERWISE. ALL LEVELS ARE IN METRES AND RELATE TO ORDNANCE DATUM.
4. DO NOT SCALE FROM ANY DRAWING. WORK TO FIGURED DIMENSIONS ONLY. ANY DISCREPANCIES IN DIMENSIONS ARE TO BE REFERRED TO THE DESIGNER BEFORE WORK IS PUT TO HAND.
5. ALL DIMENSIONS AND LEVELS ARE TO BE CHECKED ON SITE BY THE CONTRACTOR PRIOR TO PREPARING ANY WORKING DRAWINGS OR COMMENCING ON SITE.
6. ALL WORKS BY THE CONTRACTOR MUST BE CARRIED OUT IS SUCH A WAY THAT ALL REQUIREMENTS UNDER THE HEALTH AND SAFETY AT WORK ACT ARE SATISFIED.
7. ALL WORKS ARE TO BE CARRIED OUT IN COMPLIANCE WITH THE REQUIREMENT OF THE STATUTORY AUTHORITIES AND CONSTRUCTION DESIGN MANAGEMENT REGULATIONS.

KEY:

- Proposed junction widening
- Indicative existing road edge
- Indicative widening (4.5m)

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Client
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Project
UISENIS WIND FARM

Drawing Title
A859 / Eishken Road Junction
General Arrangement

	Name	Date	
Designed	CN	01.08.2023	Scale: 1:200 @ A1 / File: Uisenis Access Junction
Checked	SC	03.08.2023	Drawing Status: DRAFT

Drawing No.: SK01 | Revision: P1

NOTE:

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2. ALL WORKS TO BE EXECUTED IN ACCORDANCE WITH THE DMRB, THE MANUAL OF CONTRACT DOCUMENTS FOR HIGHWAY WORKS, DESIGN MANUAL FOR ROADS AND BRIDGES, AND TRAFFIC SIGNS MANUAL.
3. ALL DIMENSIONS ARE IN METRES UNLESS STATED OTHERWISE. ALL LEVELS ARE IN METRES AND RELATE TO ORDNANCE DATUM.
4. DO NOT SCALE FROM ANY DRAWING. WORK TO FIGURED DIMENSIONS ONLY. ANY DISCREPANCIES IN DIMENSIONS ARE TO BE REFERRED TO THE DESIGNER BEFORE WORK IS PUT TO HAND.
5. ALL DIMENSIONS AND LEVELS ARE TO BE CHECKED ON SITE BY THE CONTRACTOR PRIOR TO PREPARING ANY WORKING DRAWINGS OR COMMENCING ON SITE.
6. ALL WORKS BY THE CONTRACTOR MUST BE CARRIED OUT IS SUCH A WAY THAT ALL REQUIREMENTS UNDER THE HEALTH AND SAFETY AT WORK ACT ARE SATISFIED.
7. ALL WORKS ARE TO BE CARRIED OUT IN COMPLIANCE WITH THE REQUIREMENT OF THE STATUTORY AUTHORITIES AND CONSTRUCTION DESIGN MANAGEMENT REGULATIONS.

KEY:

- Proposed junction widening
- Indicative existing road edge
- Indicative widening (4.5m)
- 4.5m x 215m Visibility splay

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Client

EUROWIND ENERGY LTD

Project

UISENIS WIND FARM

Drawing Title

A859 / Eishken Road Junction
Visibility Splay

	Name	Date	
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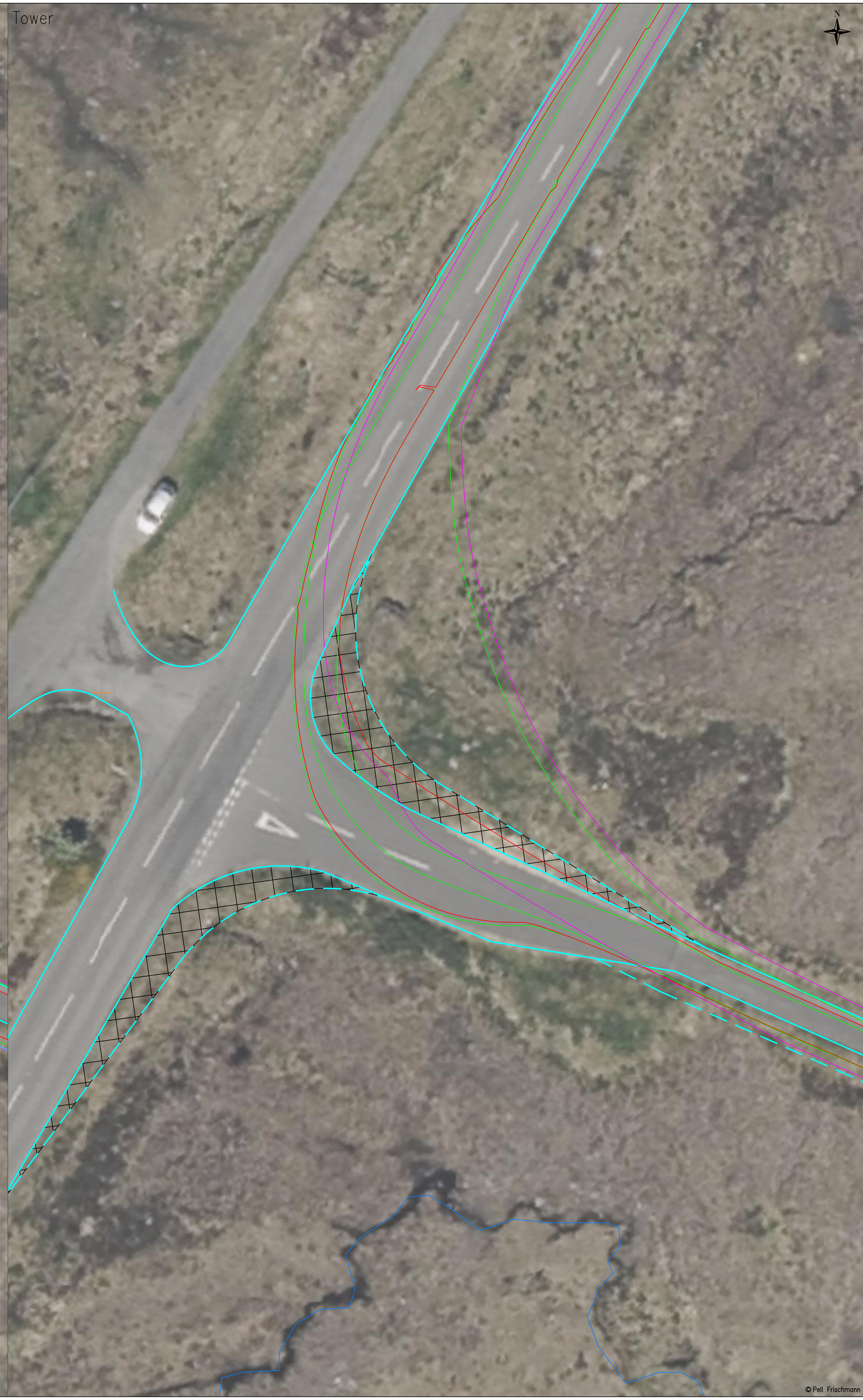
Designed	CN	01.08.2023	File Uisenis Access Junction
Checked	SC	03.08.2023	Drawing Status DRAFT

Drawing No. SK02

Revision P1



NOTE:

1. ALL DRAWINGS ARE TO BE READ IN CONJUNCTION WITH THE SPECIFICATION FOR HIGHWAY WORKS AND THE TURBINE MANUFACTURERS STANDARDS AND ALL RELEVANT DRAWINGS WITHIN THE PROJECT DESIGN PACKAGE.
2. ALL WORKS TO BE EXECUTED IN ACCORDANCE WITH THE DMRB, THE MANUAL OF CONTRACT DOCUMENTS FOR HIGHWAY WORKS, DESIGN MANUAL FOR ROADS AND BRIDGES, AND TRAFFIC SIGNS MANUAL.
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7. ALL WORKS ARE TO BE CARRIED OUT IN COMPLIANCE WITH THE REQUIREMENT OF THE STATUTORY AUTHORITIES AND CONSTRUCTION DESIGN MANAGEMENT REGULATIONS.

KEY:

- Proposed junction widening
- Indicative existing road edge
- Indicative widening (4.5m)
- Wheel SPA
- Body SPA
- Load SPA

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Client
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Project
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Drawing Title
A859 / Eishken Road Junction
Siemens SGRE155 Blade & Tower
Swept Path Assessment

	Name	Date
Designed	CN	01.08.2023
Checked	SC	03.08.2023

Scale: 1:200 @ A1
File: Uisenis Access Junction
Drawing Status: DRAFT

Drawing No.: SK03
Revision: P1

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Technical Appendix 13.1
Glossary of Terms

Project Number:	**22108**
Document Reference:	**22108-R1 V1**
Document Date:	**03/05/2023**

Terminology	Description
A-weighting	a filter that weights individual frequencies of sound to better represent the frequency response of the human ear when assessing the likely effects of noise on humans
acoustic character	one or more distinctive features of a sound (e.g. tones, whines, whistles, impulses) that set it apart from the background noise against which it is being judged, possibly leading to a greater subjective effect than the level of the sound alone might suggest
ambient noise	all-encompassing noise associated with a given environment, usually a composite of sounds from many sources both far and near, often with no particular sound being dominant
attenuation	the reduction in level of a sound between the source and a receiver due to any combination of effects including: distance, atmospheric absorption, acoustic screening, the presence of a building façade, etc.
background noise	the noise level rarely fallen below in any given location over any given time period. The L_{A90} indices is often used to represent the background noise level.
daytime hours	07.00 to 23.00 any day of the week. Different to the quiet daytime hours
dB	abbreviation for 'decibel'
dB(A)	abbreviation for the decibel level of a sound that has been A-weighted
decibel	the unit normally employed to measure the magnitude of sound
directivity	the property of a sound source that causes more sound to be radiated in one direction than another
equivalent continuous sound pressure level	the steady sound level which has the same energy as a time varying sound signal when averaged over the same time interval, T, denoted by $L_{Aeq,T}$
frequency	the number of acoustic pressure fluctuations per second occurring about the atmospheric mean pressure (also known as the 'pitch' of a sound)
ground effects	the modification of sound at a receiver location due to the interaction of the sound wave with the ground along its propagation path from source to receiver. Described using the term 'G', and ranges between 0 (hard), 0.5 (mixed) and 1 (soft).

Terminology	Description
Hertz (Hz)	the unit used to measure the frequency of a sound, equal to cycles per second of acoustic pressure fluctuations about the atmospheric mean pressure
L_{Aeq}	the abbreviation of the A-weighted equivalent continuous sound pressure level
L_{A10}	the abbreviation of the 10-percentile exceeded sound level, often used for the measurement of road traffic noise
L_{A90}	the abbreviation of the 90-percentile exceeded sound level, often used for the measurement of background noise
noise	physically: a regular and ordered oscillation of air molecules that travels away from the source of vibration and creates fluctuating positive and negative acoustic pressure above and below atmospheric pressure. Subjectively: sound that evokes a feeling of displeasure in the environment in which it is heard, and is therefore unwelcomed by the receiver
noise emission	the noise emitted by a source of sound
noise immission	the sound pressure level at a receiver
night-time hours	defined by ETSU-R-97 as the hours between 23.00 and 07.00, any day
percentile exceeded sound level	the noise level exceeded for n% of the time over a given time period, T, denoted by $L_{An,T}$
quiet daytime hours	defined by ETSU-R-97 as the hours between 18.00 and 23.00 Monday to Friday, 13.00 and 23.00 Saturdays and 07.00 and 23.00 Sundays
receiver	a person or property exposed to the noise being considered
respite	a period of reduced wind turbine noise immission level occurring during certain wind conditions
sound	physically: a regular and ordered oscillation of air molecules that travels away from the source of vibration and creates fluctuating positive and negative acoustic pressure above and below atmospheric pressure subjectively: the sensation of hearing excited by the acoustic oscillations described above (see also ‘noise’)
sound level meter	an instrument for measuring sound pressure level
sound power level	the total sound power radiated by a source, in decibels

Terminology	Description
sound pressure level	a measure of the sound pressure at a point, in decibels
spectrum	a description of the amplitude of a sound as a function of frequency
standardised wind speed	values of wind speed at hub height corrected to a standardised height of ten metres using the same procedure as used in wind turbine emission testing
tone	the concentration of acoustic energy into a very narrow frequency range
wind shear	the change in wind speed with height above ground

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Technical Appendix 13.2
Amplitude Modulation, Low Frequency Noise and Tonal Noise

Project Number:	**22108**
Document Reference:	**22108-R2 V1**
Document Date:	**03/05/2023**

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1 INTRODUCTION 2

2 AMPLITUDE MODULATION 2

3 INFRASOUND AND LOW FREQUENCY NOISE 3

4 TONAL NOISE 3

5 REFERENCES 4

1 Introduction

1.1.1 This Technical Appendix provides a brief overview of published studies into Amplitude Modulation (AM), as well as low frequency and tonal noise. These are topics which have been scoped out of the assessment of effects from operational noise.

2 Amplitude Modulation

2.1.1 Amplitude modulation (AM) is the periodic variation in the amplitude of aerodynamic noise generated during the operation of a wind turbine. The noise assessment methodology presented in ETSU-R-97, sets out noise limits which already account for typically encountered levels of amplitude modulation from wind turbines.

2.1.2 A study was carried out on behalf of the Department for Business, Enterprise and Regulatory Reform (BERR) by the University of Salford, which investigated the incidence of noise complaints associated with wind farms and whether these were associated with AM (University of Salford, 2007). This report defined AM as aerodynamic noise fluctuations from wind turbines at blade passing frequency. Its aims were to ascertain the prevalence of AM on UK wind farm sites, to try to gain a better understanding of the likely causes, and to establish whether further research into AM is required.

2.1.3 The study concluded that AM with a greater degree of fluctuation than normal had occurred at only a small number of wind farms in the UK (4 of 133), and only for between 7% and 15% of the time. It also states that, at the time of writing, the causes of this were not well understood and that prediction of the effect was not currently possible.

2.1.4 This research was updated in 2013 by an in-depth study undertaken by Renewable UK, which considered 'other AM' (OAM) defined as AM with atypical characteristics which could not be explained by standard causal factors. The study identified that many of the previously suggested causes of OAM have little or no association to the occurrence of OAM in practice. The generation of OAM was likely based upon the interaction of several factors, the combination and contributions of which are unique to each site. With the current knowledge, it is not possible to predict whether any particular site is more or less likely to give rise to OAM.

2.1.5 In 2016, the IOA proposed a measurement technique to quantify the level of AM present in any particular sample of wind farm noise (Institute of Acoustics, 2016). This technique is supported by the Department of Business, Energy & Industrial Strategy (BEIS, formerly the Department of Energy & Climate Change) who have published guidance, which follows on from the conclusions of the IOA study in order to define an appropriate assessment method for AM, including a penalty scheme and an outline planning condition (BEIS, 2016).

2.1.6 Section 7.2.1 of the Institute of Acoustics document Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise (IOA 2013) remains current, stating: *"The evidence in relation to 'Excess' or 'Other' Amplitude Modulation (AM) is still developing. At the time of writing, current practice is not to assign a planning condition to deal with AM".*

2.1.7 In 2022, WSP undertook a review of UK noise guidance for onshore wind turbines on behalf of the Department for Business, Energy and Industrial Strategy, which included AM. The review concluded that whilst it has been possible to simulate AM occurring at long ranges using computationally intensive numerical and analytical methods, detailed information on a wide range of parametric inputs is required, and the results are likely to be very sensitive to the model assumptions. It is therefore confirmed that reliable predictions of AM in the context of development planning and noise assessment guidance are unlikely to be practically feasible in the near future.

2.1.8 At present there is no reliable method for predicting OAM and as such it is current practice to not carry out an AM assessment.

3 Infrasound and Low Frequency Noise

3.1.1 Low frequency noise is noise that occurs within the frequency range of 10 Hz to 160 Hz. Infrasound is noise occurring at frequencies below that at which sound is normally audible, that is, less than about 20 Hz, due to the significantly reduced sensitivity of the ear at such frequencies. In this frequency range, for sound to be perceptible, it must be at very high amplitude, and it is generally considered that when such sounds are perceptible then they can cause considerable annoyance.

3.1.2 A study, published in 2006 by acoustic consultants Hayes McKenzie on the behalf of the Department of Trade and Industry (DTI), investigated low frequency noise from wind farms (Hayes McKenzie, 2006). This study concluded that there is no evidence of health effects arising from infrasound or low frequency noise generated by wind turbines.

3.1.3 Further, in February 2013, the Environmental Protection Authority of South Australia published the results of a study into infrasound levels near wind farms (Environment Protection Authority, 2013). This study measured infrasound levels at urban locations, rural locations with wind turbines close by, and rural locations with no wind turbines in the vicinity. It found that infrasound levels near wind farms are comparable to levels away from wind farms in both urban and rural locations. Infrasound levels were also measured during organised shut downs of the wind farms; the results showed that there was no noticeable difference in infrasound levels whether the turbines were active or inactive.

3.1.4 Bowdler et al. (2009) concludes that*: "...there is no robust evidence that low frequency noise (including 'infrasound') or ground-borne vibration from wind farms generally has adverse effects on wind farm neighbours."*

4 Tonal Noise

4.1.1 Tonal noise is the concentrations of acoustic energy over relatively small bands of frequency. Tonality found in wind turbine sound is most often of mechanical origin, which over the years has been engineered out of modern machines, and is generally caused by structural resonances in the mechanical parts of the turbine. Modern day wind turbines are highly unlikely to generate tonal noise unless there is a fault with a mechanical component such as the gearbox, as a result of poor maintenance.

4.1.2 The Environmental Impact Assessment (**Chapter 13: Noise**) does not take into account any tonal penalty for the candidate wind turbine. During the selection process for the final turbine choice, it would be confirmed by the manufacturer that there is either no tonal component that would require a penalty in accordance with ETSU-R-97, or that with the inclusion of any such penalty the derived noise limits within the assessment would still be achieved.

5 References

UK Department of Trade and Industry (DTI), ETSU-R-97, the Assessment and Rating of Noise from Wind Farms, 1996

Research into aerodynamic modulation of wind turbine noise: final report, Moorhouse, AT, Hayes, M, von Hünerbein, S, Piper BJ and Adams, MD, University of Salford 2007

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Institute of Acoustics, (IoA) Noise Working Group (Wind Turbine Noise), Amplitude Modulation Working Group, A Method for Rating Amplitude Modulation in Wind Turbine Noise (Final Report), 9 August 2016 Version 1

UK Institute of Acoustics', Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise, May 2013

Department for Business, Energy and Industrial Strategy, A Review of Noise Guidance for Onshore Wind Turbines, October 2022

W/45/00656/00/00, The Measurement of Low Frequency Noise at Three UK Windfarms, Department of Trade and Industry, 2006

Environmental Protection Authority of South Australia, Infrasound levels near windfarms and in other environments, January 2013

Bowdler et al. (2009). Prediction and Assessment of Wind Turbine Noise: Agreement about relevant factors for noise assessment from wind energy projects. Acoustic Bulletin, Vol 34 No2 March/April 2009, Institute of Acoustics

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Technical Appendix 13.3
ETSU-R-97 Assessment Graphs

Project Number:	**22108**
Document Reference:	**22108-R3 V1**
Document Date:	**03/05/2023**

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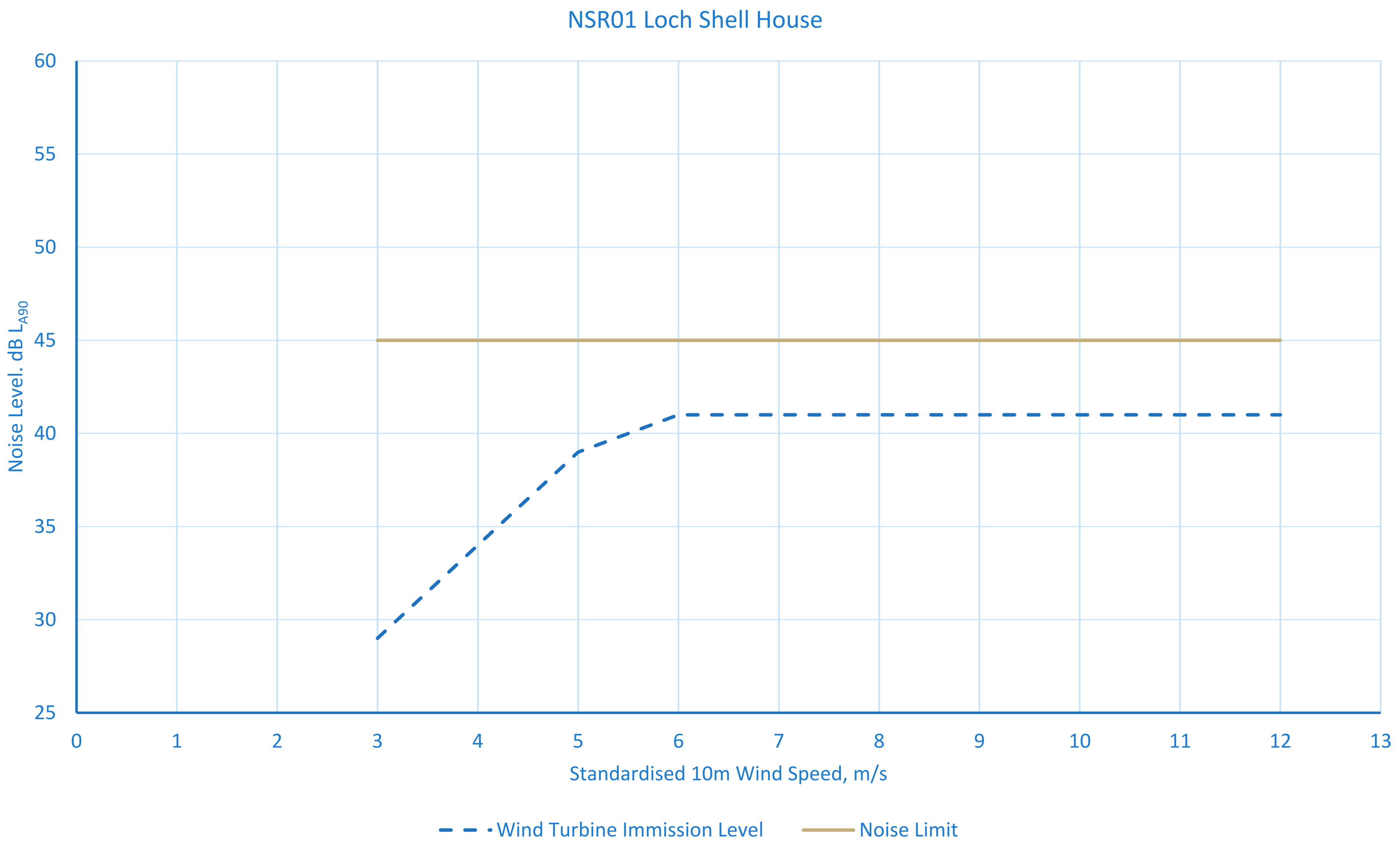
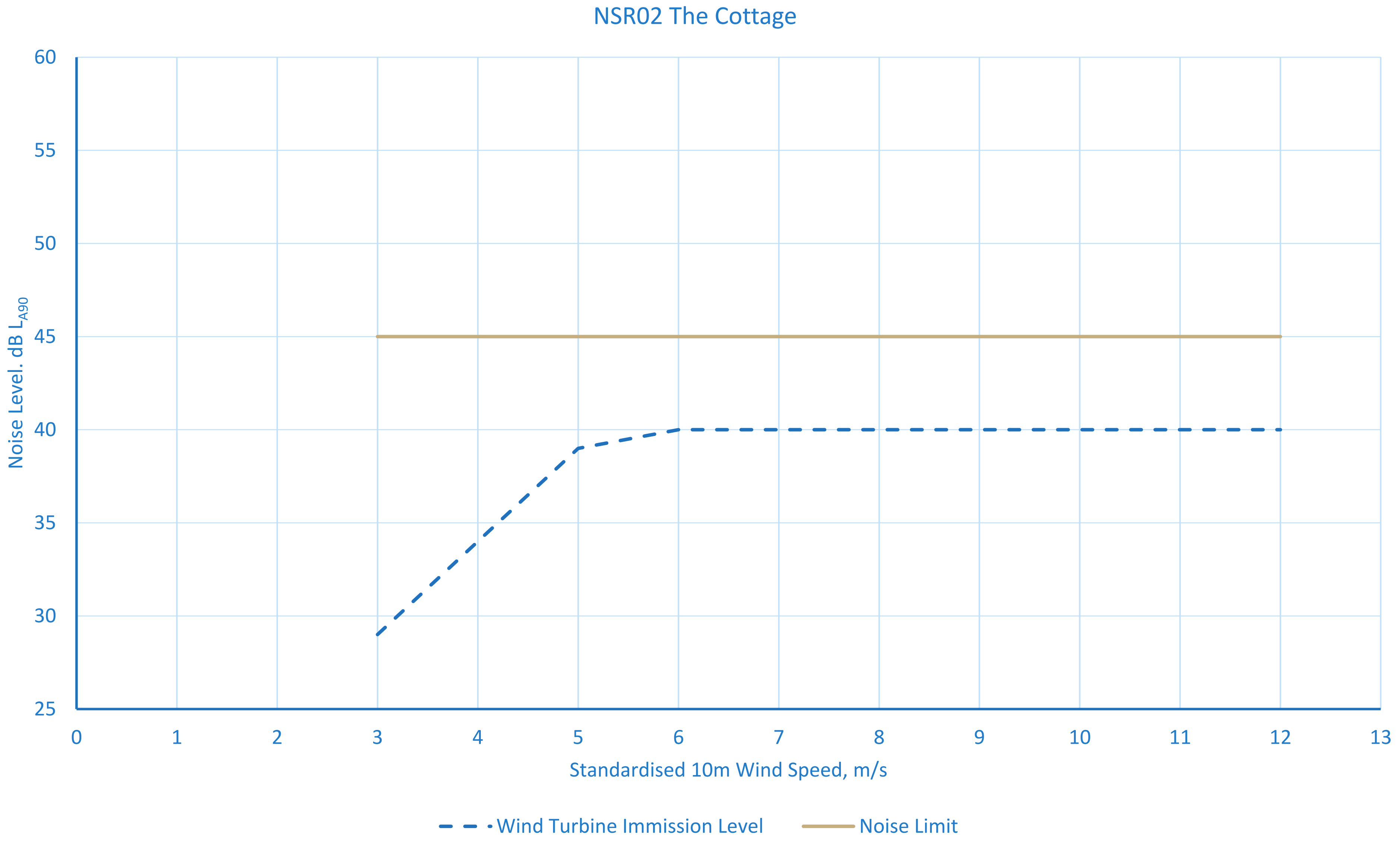

NSR01 Loch Shell House
Noise Level. dB L_{A90}
60
55
50
45
40
35
30
25
0 1 2 3 4 5 6 7 8 9 10 11 12 13
Standardised 10m Wind Speed, m/s
Wind Turbine Immission Level
Noise Limit


NSR02 The Cottage
Noise Level. dB L_{A90}
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50
45
40
35
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25
0
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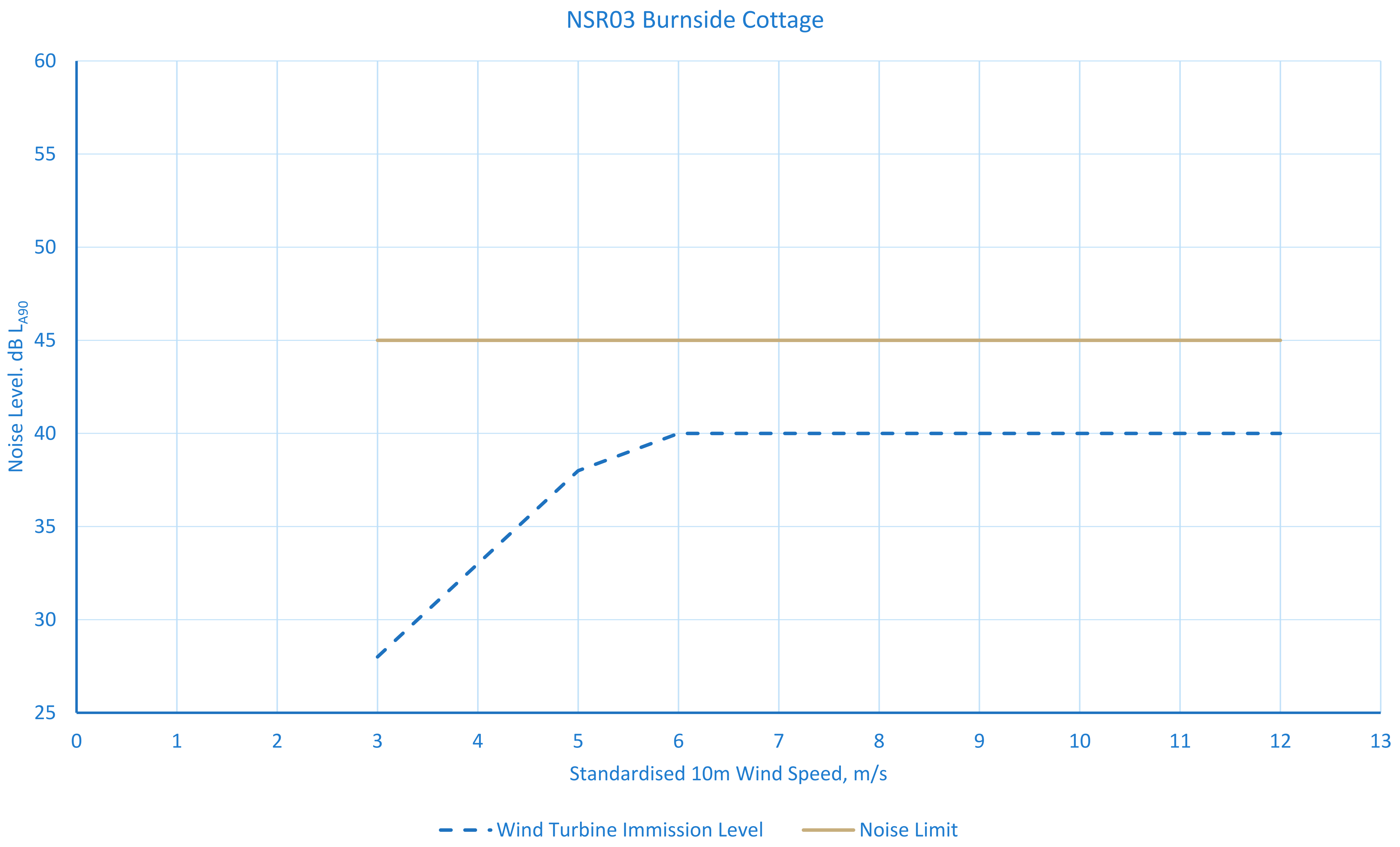
12
13
Standardised 10m Wind Speed, m/s
Wind Turbine Immission Level
Noise Limit


NSR03 Burnside Cottage
60
55
50
45
40
35
30
25
Noise Level. dB L_{A90}
0
1
2
3
4
5
6
7
8
9
10
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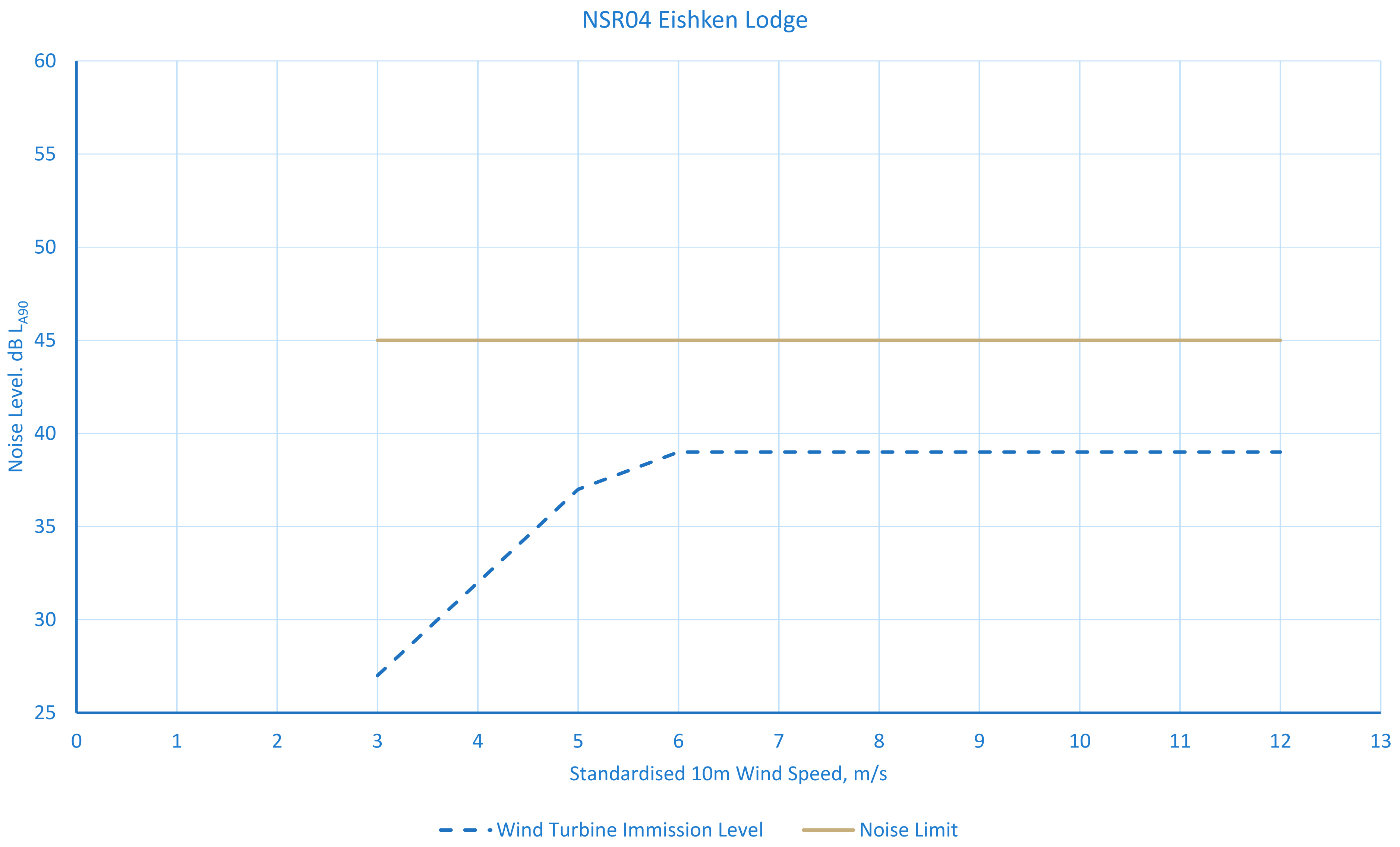
12
13
Standardised 10m Wind Speed, m/s
Wind Turbine Immission Level
Noise Limit


NSR04 Eishken Lodge
60
55
50
45
40
35
30
25
Noise Level. dB L_{A90}
0
1
2
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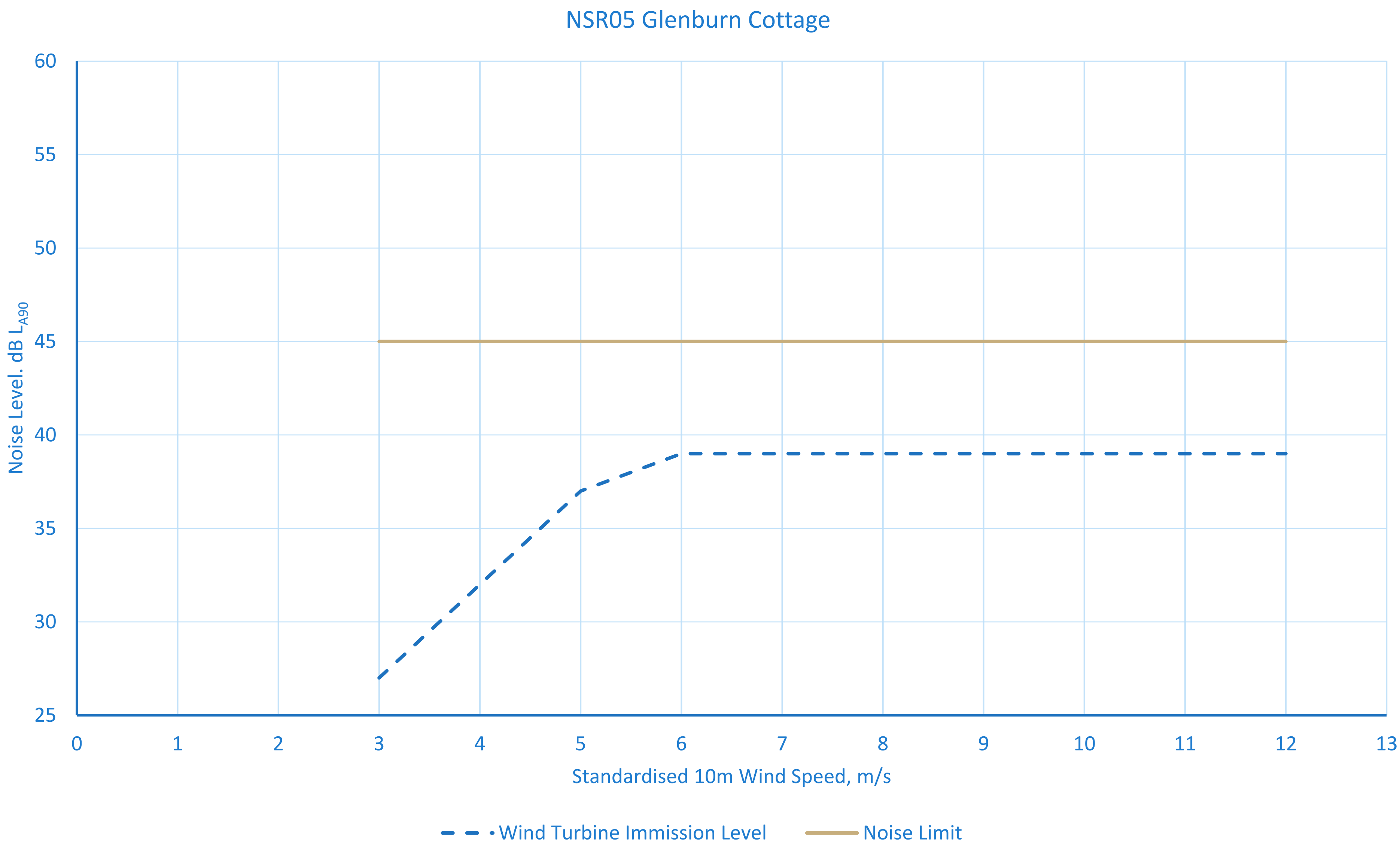
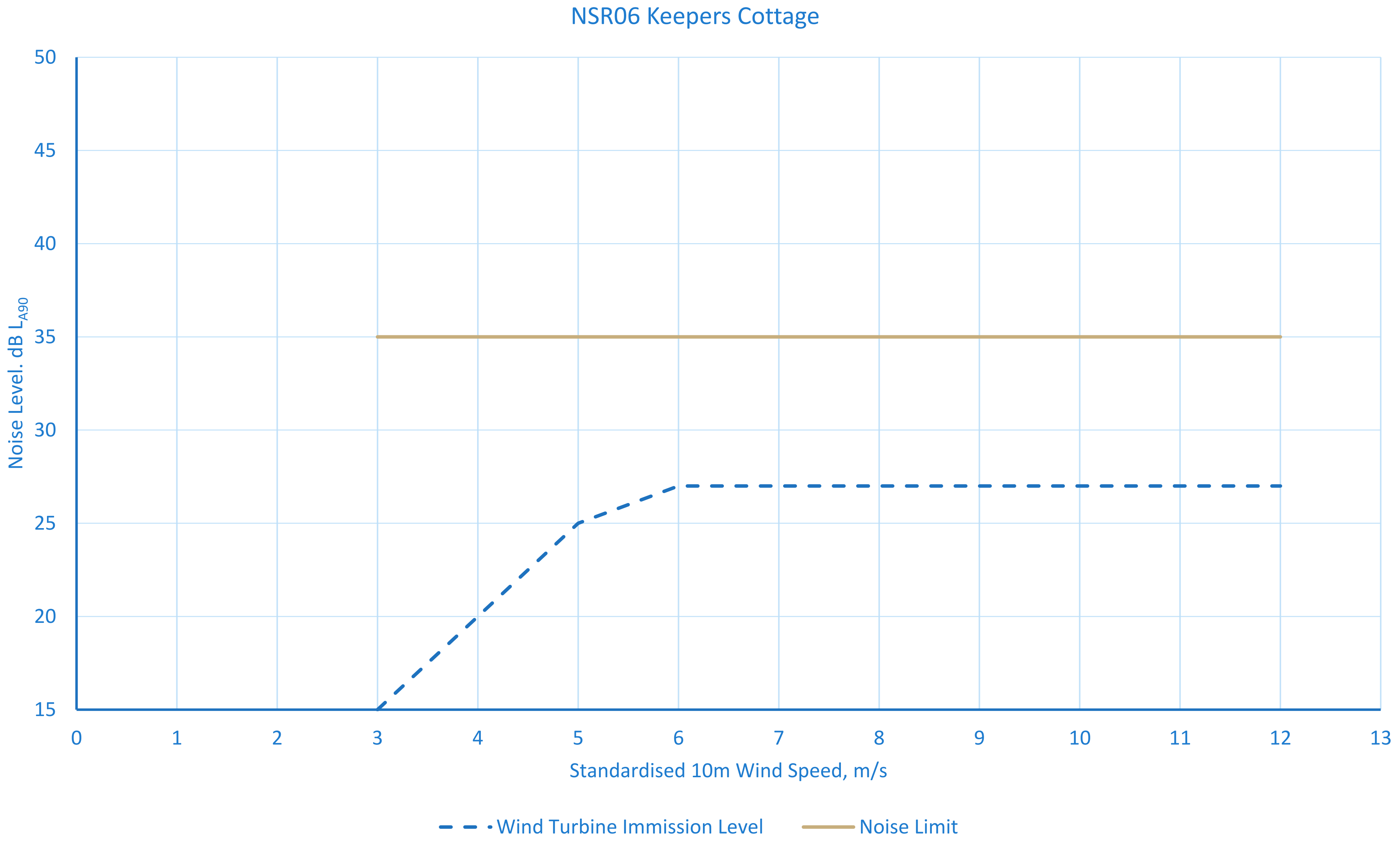
4
5
6
7
8
9
10
11
12
13
Standardised 10m Wind Speed, m/s
Wind Turbine Immission Level
Noise Limit


NSR05 Glenburn Cottage
Noise Level. dB L_{A90}
60
55
50
45
40
35
30
25
0
1
2
3
4
5
6
7
8
9
10
11
12
13
Standardised 10m Wind Speed, m/s
Wind Turbine Immission Level
Noise Limit


NSR06 Keepers Cottage
50
45
40
35
30
25
20
15
Noise Level. dB L_{A90}
0
1
2
3
4
5
6
7
8
9
10
11
12
13
Standardised 10m Wind Speed, m/s
Wind Turbine Immission Level
Noise Limit

Uisenis Power Ltd

Uisenis Wind Farm

Technical Appendix 13.4
Wind Turbine Data

Project Number:	**22108**
Document Reference:	**22108-R4 V1**
Document Date:	**03/05/2023**

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1 Introduction

1.1.1 This Technical Appendix provides the sound power data and coordinates used for the turbines within the proposed development.

2 Sound Power Data

2.1 Siemens Gamesa 155 - 6.6 MW

2.1.1 The Siemens Gamesa SG155-6.6 turbine data has been used for the proposed development. The wind turbines are proposed to have a mixture of hub heights, either 122.5m or 102.5m, as set out in Table 3-1.

2.1.2 Overall sound power data has been provided by Siemens Gamesa for the SG155 6.6 MW turbine in document D2359800/004 dated 29 July 2021 which represent the values that the manufacturer specify will not be exceeded in practice. Relevant extracts of this document are included below. The document does not specify the appropriate allowance necessary to account for uncertainty; therefore, a correction factor of +2 dB was added to the specification data in line with advice in the IOA GPG.

2.1.3 Octave band sound power data is also been provided in the above document for the SG155 6.6 MW turbine. Relevant extracts are included below.

Standard Acoustic Emission

SG 6.6-155, AM 0 – AM-8, N1 – N6

Document ID and revision	Status	Date (yyyy-mm-dd)	Language
D2359800/004		2021-07-29	en-US

Original or translation of
Original

File name
D2359800-004 SGRE ON SG 6.6-155 Standard Acoustic Emission/.pdf

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1. Acoustic Emission

Typical Sound Power Levels

The sound power levels are presented with reference to the code IEC 61400-11 ed. 3.0 (2012). The sound power levels (L_{WA}) presented are valid for the corresponding wind speeds referenced to the hub height.

Wind speed [m/s]	3	4	5	6	7	8	9	10	11	12	Up to cut-out
AM0	92	92	94.8	98.8	102.1	105.0	105.0	105.0	105.0	105.0	105.0
AM-1	92	92	94.8	98.8	102.1	105.0	105.0	105.0	105.0	105.0	105.0
AM-2	92	92	94.8	98.8	102.1	105.0	105.0	105.0	105.0	105.0	105.0
AM-3	92	92	94.8	98.8	102.1	105.0	105.0	105.0	105.0	105.0	105.0
AM-4	92	92	94.8	98.8	102.1	105.0	105.0	105.0	105.0	105.0	105.0
AM-5	92	92	94.8	98.8	102.1	105.0	105.0	105.0	105.0	105.0	105.0
AM-6	92	92	94.8	98.8	102.1	105.0	105.0	105.0	105.0	105.0	105.0
AM-7	92	92	94.8	98.8	102.1	105.0	105.0	105.0	105.0	105.0	105.0
AM-8	92	92	94.8	98.8	102.1	105.0	105.0	105.0	105.0	105.0	105.0
N1	92	92	94.8	98.8	102.1	104.0	104.0	104.0	104.0	104.0	104.0
N2	92	92	94.8	98.8	102.1	103.5	103.5	103.5	103.5	103.5	103.5
N3	92	92	94.8	98.8	102.0	102.0	102.0	102.0	102.0	102.0	102.0
N4	92	92	94.8	98.8	101.0	101.0	101.0	101.0	101.0	101.0	101.0
N5	92	92	94.8	98.8	100.0	100.0	100.0	100.0	100.0	100.0	100.0
N6	92	92	94.8	98.8	99.0	99.0	99.0	99.0	99.0	99.0	99.0

Table 1: Acoustic emission. L_{WA} [dB(A) re 1 pW] (10 Hz to 10 kHz)

Low Noise Operations (NRS ®)

The lower sound power level is also available and can be achieved by adjusting the turbines controller settings. i.e. an optimization of rpm and pitch. The noise settings are not static and can be applied to optimize the operational output of the turbine. Noise settings can be tailored to time of day as well as wind direction to offer the most suitable solution for a specific location. This functionality is controlled via the WebWPS SCADA system and is described further in the white paper on Noise Reduction System ® Operations. Furthermore. tailored power curves can be provided which take wind speed into consideration allowing for management of the turbine output power and noise emission level to comply with site specific noise requirements. Tailored power curves are project and turbine specific and will therefore require Siemens Gamesa Siting involvement to provide the optimal solutions. The lower sound power levels may not be applicable to all tower variants. Please contact Siemens Gamesa for further information.

AM 0	84.6	92.0	96.6	98.9	98.7	99.0	92.4	77.4
AM-1	84.6	92.0	96.6	98.9	98.7	99.0	92.4	77.4
AM-2	84.6	92.0	96.6	98.9	98.7	99.0	92.4	77.4
AM-3	84.6	92.0	96.6	98.9	98.7	99.0	92.4	77.4
AM-4	84.6	92.0	96.6	98.9	98.7	99.0	92.4	77.4
AM-5	84.6	92.0	96.6	98.9	98.7	99.0	92.4	77.4
AM-6	84.6	92.0	96.6	98.9	98.7	99.0	92.4	77.4
AM-7	84.6	92.0	96.6	98.9	98.7	99.0	92.4	77.4
AM-8	84.6	92.0	96.6	98.9	98.7	99.0	92.4	77.4
N1	84.0	91.1	95.6	97.9	97.7	98.0	91.4	76.4
N2	83.8	90.7	95.1	97.4	97.2	97.5	90.9	75.9
N3	83.0	89.3	93.6	95.9	95.7	96.0	89.4	74.4
N4	82.5	88.3	92.6	94.9	94.7	95.0	88.4	73.4
N5	82.0	87.4	91.6	93.9	93.7	94.0	87.4	72.4
N6	81.4	86.3	90.5	92.8	92.6	92.9	86.3	71.3

Table 4: Typical 1/1 octave band spectrum for 63 Hz to 8 kHz at rated power level at 8m/s

3 Turbine Coordinates

3.1 Proposed Development

3.1.1 The coordinates of the wind turbines modelled within the proposed development are listed in Table 3-1.

Table 3-1: Proposed Development Wind Turbine Coordinates

Turbine Reference	Easting	Northing	Hub Height, m
T1	131931	914665	102.5
T2	132350	914561	122.5
T3	131037	914236	122.5
T4	131599	914371	122.5
T5	131931	914002	122.5
T6	132871	914180	122.5
T7	133314	913950	122.5
T8	132352	913719	122.5

Turbine Reference	Easting	Northing	Hub Height, m
T9	131259	913846	122.5
T10	131096	913430	122.5
T11	131818	913429	122.5
T12	130527	912958	102.5
T13	130811	912781	122.5
T14	131384	912882	122.5
T15	131988	913015	122.5
T16	132490	912962	122.5
T17	132994	913371	122.5
T18	133378	913187	122.5
T19	131279	912006	102.5
T20	130825	911882	122.5
T21	130267	911675	122.5
T22	130033	911225	122.5
T23	130556	911241	122.5
T24	131203	911364	122.5
T25	131764	911402	122.5

TECHNICAL APPENDIX 14.1: ACCOMODATION ASSETS

Uiseniss Wind Farm

Prepared for: Uisenis Power Limited

SLR Ref: 405.V64341.00001
Version No: V1
August 2023

Name	Type	Postcode	X (Easting)	Y (Northing)
1 Anderson Court	Self-Catering	HS1 2PG	143472	933408
10 Berisay Place	Self-Catering	HS1 2TF	142968	933389
10 Redcliff	Self-Catering	HS2 0FS	142729	934640
12 North Street	Self-Catering	HS2 0AD	144475	932714
16 East Street	Self-Catering	HS2 0AG	144368	932274
21 Ivorhill	Self-Catering	HS1 2UL	144037	933283
3 Sail Loft	Self-Catering	HS1 2XN	142121	932816
35 Newvalley	Self-Catering	HS2 0DN	141543	935204
44 Inaclete Road	Self-Catering	HS1 2RN	143086	932403
A Chuil Bheag	Self-Catering	HS1 2DZ	142515	933463
An Airigh	Self-Catering	HS1 2UN	144008	933168
Aurora	Self-Catering	HS1 2DH	142366	932977
Bayview	Self-Catering	HS1 2UT	143931	933307
Belle Vue Cottage	Self-Catering	HS1 2PA	143313	933105
Benside Cottage	Self-Catering	HS2 0DZ	142244	935333
Bonhill bothy	Self-Catering	HS1 2DR	142393	932865
Bungalow in Na h-Eileanan an lar	Self-Catering	HS1 2RN	143158	932416
Cabarfeidh Hotel	Hotel	HS1 2EU	142400	934032
Caladh Inn	Hotel	HS1 2QN	142725	932760
Carin Dhu	Self-Catering	HS1 2LP	142711	933256
Castle View Flat	Self-Catering	HS1 2XY	142157	932716
Chapman’s	Self-Catering	HS2 0AD	144275	932440
Cosy Studio Flat	Self-Catering	HS1 2DH	142394	932970
County Hotel	Hotel	HS1 2XB	142411	932823
Discover Lewis and Harris	Self-Catering	HS1 2PG	143383	933440
Dunard Villa	Self-Catering	HS1 2NP	142086	934087
East Cottage	Self-Catering	HS2 0AG	144435	932222
Fisherman’s Cottage	Self-Catering	HS1 2RB	142973	932444
Flat 14c Bayhead	Self-Catering	HS1 2DU	142380	933207
Flat 14d Bayhead	Self-Catering	HS1 2DU	142396	933202
Flat in Na h-Eileanan an lar	Self-Catering	HS1 2RR	143161	932346
Flat in Stornoway	Self-Catering	HS1 2SD	143407	932529

Name	Type	Postcode	X (Easting)	Y (Northing)
Hal O The Wynd Guest House	Bed & Breakfast	HS1 2RE	142641	932549
Happy Jacks	Self-Catering	HS1 2DX	142351	933149
Harris – UK34048	Self-Catering	HS2 0DD	141052	933776
Heb Hostel	Bed & Breakfast	HS1 2DR	142395	932850
Hebridean Guest House	Hotel	HS1 2DZ	142531	933522
Jannel Bed & Breakfast	Bed & Breakfast	HS1 2TX	142269	934202
Jardine Apartments	Self-Catering	HS1 2LA	142605	933343
Jovie Apartment	Self-Catering	HS1 2JE	142503	933015
Kennedy Terrace	Self-Catering	HS1 2LG	142753	933434
Lews Castle	Self-Catering	HS2 0XP	142007	933174
Lido Flats	Self-Catering	HS1 2DB	142350	932795
Logan Home	Self-Catering	HS1 2JS	142607	933193
Marie’s Hoose	Self-Catering	HS1 2RW	143004	932371
Marie’s House	Self-Catering	HS1 2RW	143072	932345
Na h-Eileanan an Iar Cottage	Self-Catering	HS1 2SD	143319	932391
No. Three	Self-Catering	HS1 2UB	142212	934281
No.10	Self-Catering	HS1 2XA	142148	932774
No.5 Esplanade Court	Self-Catering	HS1 2XA	142147	932796
No.8	Bed & Breakfast	HS1 2DH	142337	932967
North Beach House	Self-Catering	HS1 2XN	142156	932847
Royal Hotel	Hotel	HS1 2DG	142325	933033
Salmon House	Self-Catering	HS1 2RX	143453	932280
Sandwick Bay Guest House	Bed & Breakfast	HS1 2RX	143504	932317
Shore Lodge	Self-Catering	HS2 0AE	144071	931954
Stoneyfield South Cottage	Self-Catering	HS2 0AQ	144298	932326
Stornoway Apartments	Self-Catering	HS1 2LA	142591	933417
Stornoway Barony Square	Self-Catering	HS1 2TQ	143139	933577
Stornoway Bed and Breakfast	Bed & Breakfast	HS1 2DR	142391	932876
Stornoway Holiday Apartments	Self-Catering	HS1 2DA	142318	932844
Stornoway Holiday Let	Self-Catering	HS1 2LG	142841	933438
Taigh Geal	Self-Catering	HS2 0DW	141315	935084
The Corner Cottage	Self-Catering	HS2 0AD	144276	932394

Name	Type	Postcode	X (Easting)	Y (Northing)
The Crown Inn	Hotel	HS1 2BD	142201	932814
The Gallafield	Self-Catering	HS2 0AD	144569	932770
The Haven	Self-Catering	HS1 2TU	142079	934253
The Park Guest House	Hotel	HS1 2QN	142708	932808
Tigh Murdag	Self- Catering	HS2 0DT	142754	935212
Townhouse Flat	Self-Catering	HS1 2XD	142365	932818
Twenty Seven	Bed & Breakfast	HS1 2RW	142908	932423
Westview Accommodation	Self-Catering	HS1 2LD	142897	933671
Woodside Guest House	Bed & Breakfast	HS2 0DD	140974	933725

Version 1
01/06/2023
Author: Ian Fletcher

WIND BUSINESS SUPPORT

UISENIS WIND FARM

AVIATION LIGHTING

DESIGN AND CONSULTATION

STUDY REPORT

COMMERCIAL-IN-CONFIDENCE

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INTRODUCTION

A wind farm is proposed on the Isle of Lewis, details below. The proposed development was the subject of a scoping submission, ECU reference ECU00004568, with a full planning application anticipated later this year.

An important aspect of the design is the aviation obstruction lighting; both in terms of air safety and of visual impacts. The purpose of this document is to provide information on the proposed development and of the proposed aviation lighting scheme, in order to get feedback from key aviation stakeholders and airspace users. The feedback will be used to amend the lighting design as needed.

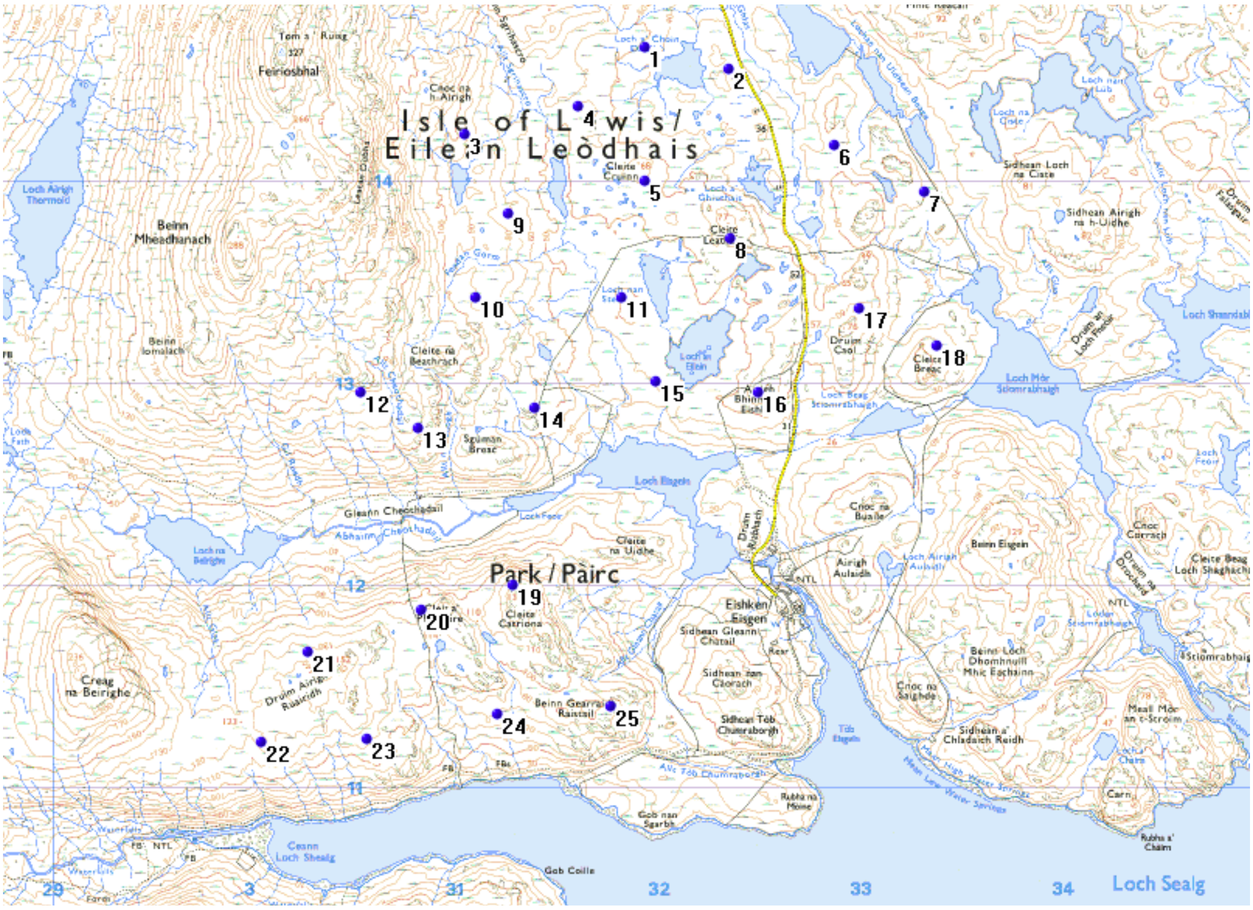
Having collected the views of the stakeholders and reviewed the lighting design, a final scheme will be lodged with the UK CAA for their approval, along with all the feedback provided through this consultation process.

Please consider this document as confidential ahead of the full planning application.

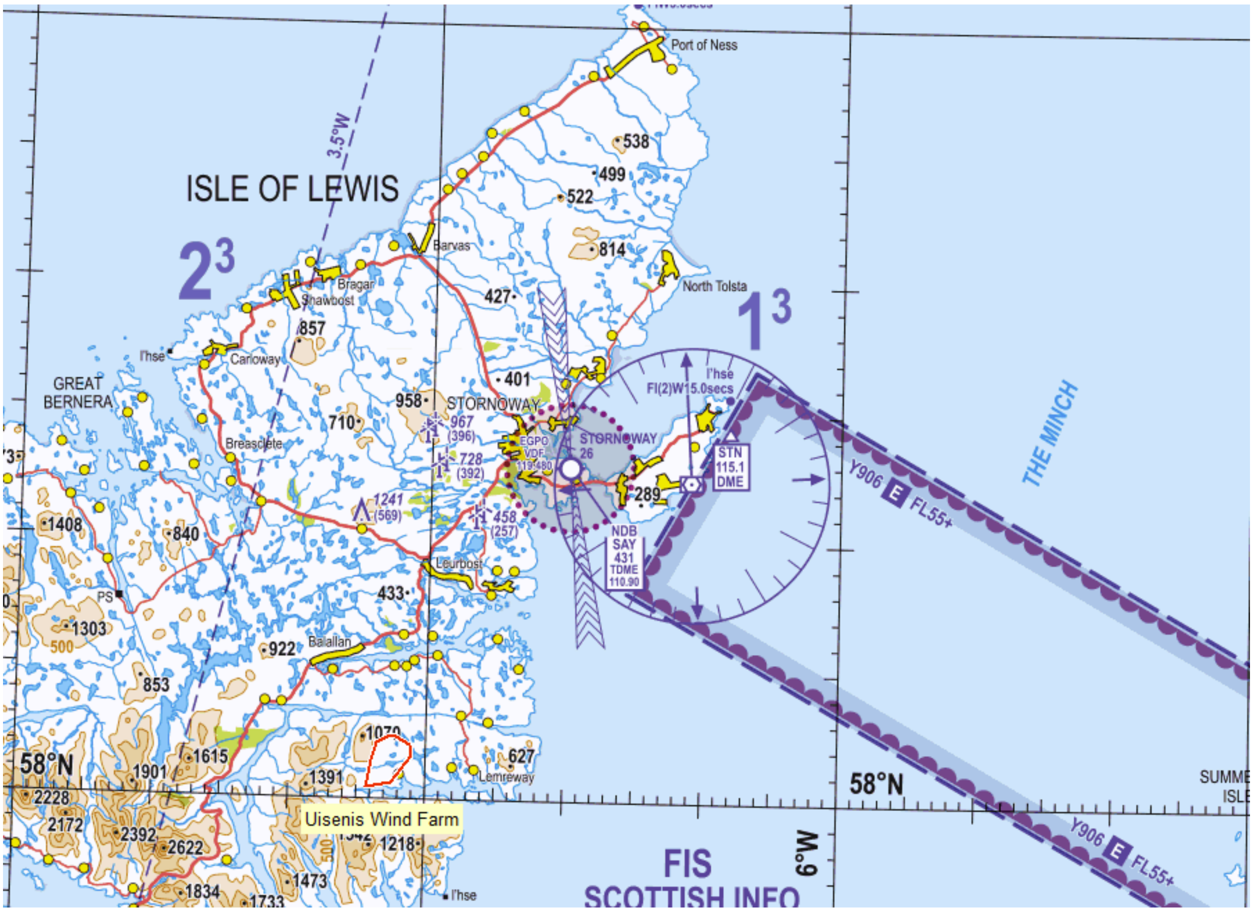
THE PROPOSED WIND FARM

The submission will be for a development comprising 25 turbines, with tip heights of 180m (turbines 1, 12 and 19) and 200m (all other turbines).

No.	**Easting**	**Northing**	**NGR**	**Base Elevation m**	**Tip Height m**	**Tip Elevation m AOD**
1	131931	914665	NB 31931 14665	47	**180**	227
2	132350	914561	NB 32350 14561	35	200	235
3	131037	914236	NB 31037 14236	89	200	289
4	131599	914371	NB 31599 14371	57	200	257
5	131931	914002	NB 31931 14002	56	200	256
6	132871	914180	NB 32871 14180	42	200	242
7	133314	913950	NB 33314 13950	38	200	238
8	132352	913719	NB 32352 13719	63	200	263
9	131259	913846	NB 31259 13846	68	200	268
10	131096	913430	NB 31096 13430	89	200	289
11	131818	913429	NB 31818 13429	50	200	250
12	130527	912958	NB 30527 12958	140	**180**	320
13	130811	912781	NB 30811 12781	117	200	317
14	131384	912882	NB 31384 12882	58	200	258
15	131988	913015	NB 31988 13015	42	200	242
16	132490	912962	NB 32490 12962	64	200	264
17	132994	913371	NB 32994 13371	63	200	263
18	133378	913187	NB 33378 13187	40	200	240
19	131279	912006	NB 31279 12006	127	**180**	307
20	130825	911882	NB 30825 11882	106	200	306
21	130267	911675	NB 30267 11675	131	200	331
22	130033	911225	NB 30033 11225	123	200	323
23	130556	911241	NB 30556 11241	112	200	312
24	131203	911364	NB 31203 11364	76	200	276
25	131764	911402	NB 31764 11402	91	200	291



Turbine location OS 1:25,000;



Site location on CAA Aviation chart

LEGISLATION AND GUIDANCE

LEGISLATION

The treatment of land-based obstacles to air navigation is covered by existing legislation. Obstacles located close to licensed aerodromes are covered under Section 47 of the Civil Aviation Act 1982. Government aerodromes are similarly covered under the Town & Country Planning Act (General Permitted Development) Order 2000. Article 222 of the ANO 2016 details the requirement for the lighting of land-based tall structures located outside of the safeguarded areas of licensed and government aerodromes.

Onshore Obstacle Lighting Requirement ICAO regulations (Annex 14 Chapter 6) and article 222 of the ANO 2016 require that structures away from the immediate vicinity of an aerodrome, which have a height of 150 m (492 ft) or more AGL are:

1. Fitted with medium intensity steady red lights* positioned as close as possible to the top of the obstacle, and also equally spaced at intermediate levels, so far as practicable, between the top lights and ground level with an interval not exceeding 52 m;

2. Illuminated at night, visible in all directions and any lighting failure is rectified as soon as is reasonably practicable;

* 'Medium intensity steady red light' means a light that complies with the characteristics described for a medium intensity type C light as specified in Volume 1 (Aerodrome Design and Operations) of Annex 14 (Third edition November 1999) to the Chicago Convention.

POLICY

The CAA issued a Policy Statement in June 2017 called "Lighting of Onshore Wind Turbine Generators in the United Kingdom with a maximum blade tip height at or in excess of 150 m Above Ground Level".

This policy statement highlights and clarifies the requirements set out in the Air Navigation Order, for the lighting of onshore turbines.

Lights should be operated by an acceptable control device (e.g., photocell, timer, etc.) adjusted so the lights will be turned on whenever illuminance reaching a vertical surface falls below 500 LUX. The control device should turn the lights off when the illuminance rises to a level of 500 LUX or more.

If the horizontal meteorological visibility in all directions from every wind turbine generator in a group is more than 5 km, the intensity for the light positioned as close as practicable to the top of the fixed structure required to be fitted to any generator in the windfarm and displayed may be reduced to not less than 10% of the minimum peak intensity specified for a light of this type.

In practice the CAA considers every proposed development on a case by case basis, taking into account the specific environment, including the existing developments and lighting as well as the benefits of reduced lighting schemes where light pollution is an issue. Where supported by appropriate studies and consultations the CAA may agree to a variation to the lighting requirements specified in the ANO, under provisions given in the Air Navigation Order (ANO) Article 222 section 6.

GUIDANCE

In respect of an Aircraft Detection Lighting System, the Department for Transport published guidance on 26 October 2021 stating that "the Department for Transport and the Civil Aviation Authority will convene a task force...to develop and publish electronic conspicuity (EC) specifications to enable interoperability between airspace users. The adoption of EC specifications will not be mandated UK-wide. However, compliance with the established EC specifications will be required in mandatory airspace to ensure interoperability between airspace users." While you note that the most promising direction for ADLS is a system that exploits electronic conspicuity as a means to trigger obstacle lighting, we are aware of certain developers who are keen to use ADLS with active detection from the ground as well as the need to better understand aviation operations and equipage levels at night in the airspace over the Scottish mainland. We will consider what additional activity is required for this and keep the wind industry advised accordingly.

https://www.gov.uk/government/publications/electronic-conspicuity-specifications/electronic-conspicuity-specifications-enabling-interoperability-between-airspace-users

DESIGN CONSIDERATIONS

AIRSPACE ENVIRONMENT

The nearest aerodrome is Stornoway Airport, approximately 22km away to the nearest runway threshold. Stornoway Airport is the main air link to the Isle of Lewis, operated by HIAL, supporting both business and leisure travel. Loganair operate flights to Stornoway from Glasgow, Edinburgh and Inverness. Flights from Stornoway to Aberdeen are run by Eastern Airways. There is also a HM Coastguard UK Search and Rescue helicopter service, operated by Bristow Helicopters.

The site lies underneath class G airspace, remote from lower airspace ATS routes. It is also in an area marked as low priority for military low flying training. Infrequent GA traffic is likely to fly VFR in the area of the wind farm in exploring the Island and in travelling between Stornoway and Benbecular or Skye.

Police, ambulance and Search and Rescue helicopters may occasionally operate in the area.

Local area on CAA VFR 1:25,000 chart

The most elevated turbine tip is at 1086ft.

LIGHTING ENVIRONMENT

There are currently no lit turbines in the area and no other lit obstacles. The site is remote from major light sources.

LIGHT POLLUTION / DARK SKIES

The area has no major conurbations and the background light levels will be very low. There is not any specific mention of dark night skies in the citations for the South Lewis, Harris and North Uist NSA/Eishken WLA or NatureScot Landscape Character Types.

LIGHTING REQUIREMENT

The turbines proposed have ground to tip heights of up to 200m. Because they are over 150m tall, there is a statutory requirement for en-route aeronautical obstacle lighting, under the Air Navigation Order (ANO) Article 219 .

SCOPING RESPONSES

MOD

To address the impact up on low flying given the location and scale of the development, the MOD would require that conditions are added to any consent issued requiring that the development is fitted with aviation safety lighting and that sufficient data is submitted to ensure that structures can be accurately charted to allow deconfliction. As a minimum the MOD would require that the development be fitted with MOD accredited aviation safety lighting in accordance with the Air Navigation Order 2016.

HIAL

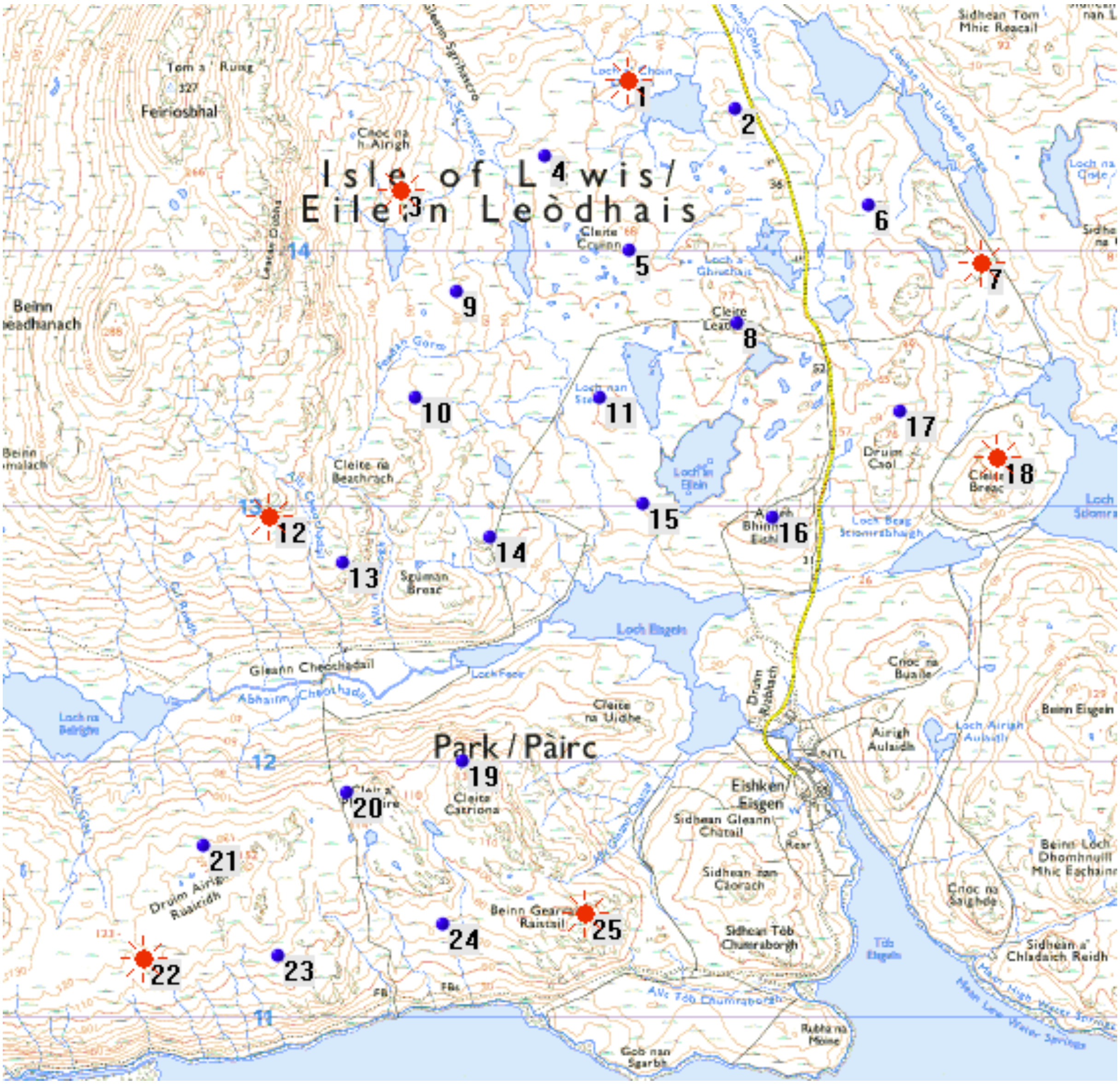
With respect to lighting, the HIAL response highlighted "Aviation Lighting Requirements (see Article 222 of the ANO, CAP168 & CAP764) requirements."

THE PROPOSED LIGHTING SCHEME

There is a statutory requirement to light the wind farm because the turbines are over 150m tall. However, because of the nature of the area, light pollution from aviation obstacle lighting is of concern. In balancing these two requirements it is considered appropriate to use a reduced lighting scheme, with not all turbines being lit. This can be acceptable where the night time use of the airspace is only very rarely low flying VFR (Visual Flight Rules) traffic with no NVGs (Night Vision Goggles).

In consideration of the combination of the legislation and the local design considerations, it is proposed to use a cardinal lighting scheme. This requires visible spectrum obstacle lights on the turbines that define the geographical footprint of the wind farm.

In this case, the proposal is for 7 turbines to have nacelle mounted, medium intensity, visible spectrum, steady red obstacle lights, specifically turbines 1, 3, 7, 12, 18, 22 and 25; illustrated on the map below. The lights to operate from dusk until dawn.



Proposed Lit Turbines – 1, 3, 7, 12, 18, 22&25

EXPLANATORY NOTES

The lit turbines will define the principle corners and the wind farm geographical foot-print. The lit turbines have been selected to provide fairly regular spacing between lit turbines, which can improve pilot visual acquisition of the nature and extent of the development.

Whilst turbine 21 has the most elevated tip, the elevation is very similar to that of the adjacent turbine 22, which will be lit. It is more important to clearly define the extent of the development, than to pick out a marginally higher turbine. Lighting both turbines 21 and 22 would cause an irregular spacing of the lights and increase light pollution.

All remaining turbines are effectively within the area defined by the corner turbines identified above. Whilst turbine 2 lies outside of the line between the lit turbines 1 and 7, the extent of the deviation is insufficient to warrant additional lighting. Similarly the deviation of turbine 23 is insufficient to warrant additional lighting.

There are no internal, unlit turbines which are exceptionally elevated relative to lit turbines in their immediate proximity.

The above lighting scheme meets the scoping response requirements, subject to CAA approval.

Turbines listed in decreasing tip elevation order

T_NO	**Base elevation m**	**Blade Tip Height m**	**Tip Elevation m**	**Tip Elevation ft**
21	131	200	331	1086
22	123	200	323	1060
12	140	180	320	1050
13	117	200	317	1040
23	112	200	312	1024
19	127	180	307	1007
20	106	200	306	1004
25	91	200	291	955
3	89	200	289	948
10	89	200	289	948
24	76	200	276	906
9	68	200	268	879
16	64	200	264	866
8	63	200	263	863
17	63	200	263	863
14	58	200	258	846
4	57	200	257	843
5	56	200	256	840
11	50	200	250	820
6	42	200	242	794
15	42	200	242	794
18	40	200	240	787
7	38	200	238	781
2	35	200	235	771
1	47	180	227	745

The turbines with red text are proposed to be lit.

LIGHTING SPECIFICATION

Visible spectrum obstacle lighting must consist of one medium intensity (2000 candela) steady red light, mounted on the top of the nacelle, and a second alternative 2000 candela red light provided in case of failure of the operating light. No intermediate level lights to be fitted on the turbine towers.

Visible lights can be dimmed to 10% of peak intensity when the visibility as measured at the wind farm exceeds 5km in all directions.

Summary of lighting specification:

- Medium intensity steady red (2000 candela) lights on the nacelles of turbines 1, 3, 7, 12, 18, 22&25 (7 in total);
- a second 2000 candela light on the nacelles of the above turbines to act as alternatives in the event of a failure of the main light;
- the lights on these turbines to be capable of being dimmed to 10% of peak intensity when the visibility as measured at the wind farm exceeds 5km;

Note on ADLS

The UK CAA, together with the UK Wind Sector is exploring the future use of Aircraft Detection Lighting Systems (ADLS). The most promising direction widely considered to be a system that exploits electronic conspicuity as a means to trigger obstacle lighting. Such systems are unable to be used within the current regulatory environment, with changes offering the potential alongside UK airspace modernisation. Whilst this proposal is unable to specify ADLS within the coming submission, the time-scale to implementation may allow for the use of ADLS and this would be welcomed. The lighting scheme must have CAA approval prior to implementation.

CONSULTATIONS

The following consultees are considered to be relevant to this location.

Consultee	Reason
HIAL	As the operators of Stornoway Airport, noting that it also hosts a coastguard helicopter base.
MOD	Having specified an aviation lighting requirement
Police Scotland	Use of helicopters, flying low on visual flight rules
Scottish Air Ambulance	Use of helicopters, flying low on visual flight rules
Bristow SAR service division for HM Coastguard	Use of helicopters, flying SAR on visual flight rules

Following feedback from the above consultees, the lighting design will be reviewed. The design evolution and a final design will be proposed to the CAA for their consideration and approval. The views expressed by the consultees will be shared with the CAA.

CONSULTEE RESPONSES

The following tables lists the consultees and their responses to the proposed lighting scheme. The full responses are included as an appendix.

Note that this ‘Aviation Lighting Design and Consultation’ document, was presented to the aviation consultees in eliciting their responses. The only sections added are those of this section ‘Consultee Responses’ and below. These sections being added after the responses were received, in order to present a complete study to the CAA for their consideration.

Consultee	Response
MOD	The MOD acknowledge engagement held with the developer’s aviation consultant and can confirm that the lighting proposal submitted for review has been deemed acceptable. It is noted that this lighting brief submitted for review only provides details of lighting for the completed development and does not cover construction equipment and temporal structures.
Police Scotland	I don't envisage any issues regarding our operations in support of Police Scotland.
Scottish Air Ambulance	I’ve reviewed the proposed lighting scheme for the windfarm development on the Isle of Lewis. The proposed cardinal lighting scheme using visible spectrum lighting on 7 of the turbines, with all the turbines falling within this area, would be acceptable from a Babcock Air Ambulance perspective.
HIAL	Thank you for your email and attached lighting design. I can confirm that HIAL approve the lighting design for Uisenis.
Bristow SAR service division for HM Coastguard	No response received at the time of compiling this report.

DESIGN AMENDMENTS AS A RESULT OF CONSULTEE FEEDBACK

No amendments are required.

APPENDIX A – CONSULTEE RESPONSES

HIAL

From: Safeguarding [redacted]
Sent: 05 May 2023 13:13
To: Ian Fletcher
Cc: Safeguarding; [redacted]
Subject: RE: Uisenis Wind Farm Aviation Obstruction Lighting - Consultation

Hi Ian,

Thank you for your email and attached lighting design. I can confirm that HIAL approve the lighting design for Uisenis.

Kind regards,

Nyree

Nyree Millar-Bell

Aerodrome Safeguarding and Operational Support Officer
Highlands and Islands Airports Limited
[redacted]

SCOTTISH POLICE

From: Young, Dave [[redacted]
Sent: 19 May 2023 15:53
To: Ian Fletcher; Winn, Peter
Cc: Thomson, Nigel
Subject: Re: CAUTION: External email - Uisenis Wind Farm Aviation Obstruction Lighting - Consultation (UNCLASSIFIED)

Hi Ian,

I don't envisage any issues regarding our operations in support of Police Scotland.

Regards,

Dave

Dave Young FRAeS
Unit Chief Pilot Police Scotland
UK Aviation | Aviation
[redacted]

SCOTTISH AMBULANCE SERVICE

From: Winn, Peter [redacted]
Sent: 04 May 2023 12:01
To: Ian Fletcher; Young, Dave
Cc: Thomson, Nigel
Subject: RE: CAUTION: External email - Uisenis Wind Farm Aviation Obstruction Lighting - Consultation (UNCLASSIFIED)

Classification:UNCLASSIFIED

Good morning Ian,

I've reviewed the proposed lighting scheme for the windfarm development on the Isle of Lewis. The proposed cardinal lighting scheme using visible spectrum lighting on 7 of the turbines, with all the turbines falling within this area, would be acceptable from a Babcock Air Ambulance perspective.

Kindest regards

Pete

Peter Winn BSc | Pilot : Aberdeen
UK Aviation | Aviation
[redacted]

MOD

Defence Infrastructure Organisation

Kaye Noble
Assistant Safeguarding Manager
Ministry of Defence
Safeguarding Department
St George's House
DIO Headquarters
DMS Whittington
Lichfield
Staffordshire
WS14 9PY

Telephone [MOD]: [redacted]

E-mail: [redacted]

Your Reference:

Our Reference: [redacted]

Ian Fletcher
[redacted]

By email only

31 May 2023

Dear Ian,

Application reference:	
Site Name:	Uisenis Wind Farm
Proposal:	Lighting Proposal
Site address:	Southeast of Lewis, approximately 20km south of Stornoway, located in the planning authority area of Comhairle nan Eilean Siar (Western Isles Council)

Thank you for consulting the Ministry of Defence (MOD) in relation to the Lighting Proposal through your communication dated 4th May 2023.

The Defence Infrastructure Organisation (DIO) Safeguarding Team represents the MOD as a consultee in UK planning and energy consenting systems to ensure that development does not compromise or degrade the operation of defence sites such as aerodromes, explosives storage sites, air weapon ranges, and technical sites or training resources such as the Military Low Flying System.

I am writing to advise you that the MOD has concerns with the proposal.

The proposal concerns a development of 25 turbines, 3 of the wind turbines will have a maximum blade tip height of 180.00 metres above ground level, and 22 of the Wind Turbines will have a maximum blade tip height of 200.00 metres above ground level. The proposed development has been assessed using the location data (Grid References) below provided in "Lighting Proposal" dated May 2023.

Turbine no.	Easting	Northing
1	131931	914665
2	132350	914561
3	131037	914236
4	131599	914371

5	131931	914002
6	132871	914180
7	133314	913950
8	132352	913719
9	131259	913846
10	131096	913430
11	131818	913429
12	130527	912958
13	130811	912781
14	131384	912882
15	131988	913015
16	132490	912962
17	132994	913371
18	133378	913187
19	131279	912006
20	130825	911882
21	130267	911675
22	130033	911225
23	130556	911241
24	131203	911364
25	131764	911402

The principal safeguarding concerns of the MOD with respect to this development of wind turbines relates to their potential to create a physical obstruction to air traffic movements.

Physical Obstruction

In this case the development falls within Low Flying Area 14 (LFA 14), an area within which fixed wing aircraft may operate as low as 250 feet or 76.2 metres above ground level to conduct low level flight training. The addition of turbines in this location has the potential to introduce a physical obstruction to low flying aircraft operating in the area.

To address the impact up on low flying given the location and scale of the development, the MOD would require that conditions are added to any consent issued requiring that the development is fitted with aviation safety lighting and that sufficient data is submitted to ensure that structures can be accurately charted to allow deconfliction.

The development proposed includes wind turbine generators and/or meteorological mast(s) that exceed a height of 150m agl and are therefore subject to the lighting requirements set out in the Air Navigation Order 2016. In addition to CAA requirements, the MOD will require the submission, approval, and implementation of an aviation safety lighting specification that details the installation of MOD accredited aviation safety lighting.

The MOD acknowledge engagement held with the developer's aviation consultant and can confirm that the lighting proposal submitted for review has been deemed acceptable. It is noted that this lighting brief submitted for review only provides details of lighting for the completed development and does not cover construction equipment and temporal structures.

Summary

The MOD has concerns with this proposal of wind turbines relating to their potential to create a physical obstruction to air traffic movements.

The MOD must emphasise that the advice provided within this letter is in response to the data and information detailed in the developer's document titled "Lighting Proposal" dated May 2023. Any variation of the parameters (which include the location, dimensions, form, and finishing materials) detailed may significantly alter how the development relates to MOD safeguarding requirements and cause adverse impacts to safeguarded defence assets or capabilities. In the event that any amendment, whether considered material or not by the determining authority, is submitted for approval, the MOD should be consulted and provided with adequate time to carry out assessments and provide a formal response.

I hope this adequately explains our position on the matter. If you require further information or would like to discuss this matter further, please do not hesitate to contact me.

Further information about the effects of wind turbines on MOD interests can be obtained from the following websites:

[redacted]

Yours sincerely

[redacted]

Kaye Noble
Assistant Safeguarding Manager
DIO Safeguarding

BRISTOW SAR SERVICE DIVISION FOR HM COASTGUARD

From: John Fyall [redacted]
Sent: 22 May 2023 11:36
To: Ian Fletcher
Subject: RE: Uisenis Wind Farm Aviation Obstruction Lighting - Consultation

Hi Ian – that is received – I am chasing the appropriate folks at our end regarding this.

Thanks for this.

John

John Fyall
EAMEA Communications and Marketing Manager

Bristow Helicopters Ltd
[redacted]

Global Leader in Vertical Flight

From: Ian Fletcher [redacted]
Sent: 22 May 2023 11:29
To: John Fyall [redacted]
Subject: RE: Uisenis Wind Farm Aviation Obstruction Lighting - Consultation

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Hi John,

I did receive an out of office response from the below.

I just wanted to check now that you are aware of this and if you wish to respond?

Kind regards

Ian

From: Ian Fletcher
Sent: 04 May 2023 10:57
To: 'Gillian George'
Cc: 'John Fyall'
Subject: RE: Uisenis Wind Farm Aviation Obstruction Lighting - Consultation

Thanks Gillian, that is very helpful.

John, I look forward to hearing from you. I have attached the consultation report.

Kind regards

Ian

Odstone
Westcot Lane
[redacted]-----------------
[redacted]

TECHNICAL APPENDIX 16.1: CARBON CALCULATOR

Uisenis Wind Farm

Prepared for: Uisenis Power Limited

SLR Ref: 405.V64341.00001
Version No: 1
August 2023

BASIS OF REPORT

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ANNEX A 9

1.0 Introduction

SLR has been commissioned by Eurowind Energy Ltd. ('the applicant') to calculate the carbon balance and pay-back period for the proposed Uisenis Wind Farm (the 'proposed development') using the Scottish Government Carbon Calculator Tool[1] in accordance with the associated guidance[2].

The proposed development comprises up to 25 turbines and will have a generation capacity in the region of 165MW. The Site is located approximately 20km south west of Stornoway, on land within the Eisgen (Eishken) Estate on the Isle of Lewis.

In Scotland, applications submitted under Section 36 of the Electricity Act 1989 are required to undertake the carbon balance assessment using the Scottish Government's carbon calculator tool. The Carbon Calculator Tool has been developed by the Scottish Government to support the process of determining the carbon pay-back period for wind farm developments in Scotland. The carbon payback period is derived by comparing the carbon costs of wind farm developments (particularly during construction) with the carbon savings likely to be achieved through their operation.

The Carbon Calculator Tool v1.7.0 uses methods given in Nayak et al, 2008 (http://www.scotland.gov.uk/Publications/2008/06/25114657/0) and revised equations for GHG emissions (Nayak, D.R., Miller, D., Nolan, A., Smith, P. and Smith, J.U., 2010 & 2011, and Wind Farm and Carbon Savings – Technical Note v.2 2.10.0. Input Parameters). The proposed development's carbon calculator reference number is 4OVO-24G1-R94Z v4.

To calculate the pay-back period, the Scottish Government's Carbon Calculator Tool considers the following carbon saving and carbon loss parameters, as shown in **Annex A**:

- carbon emissions savings, based on emissions from different power sources;
- loss of carbon due to production, transportation, erection, operation and decommissioning of the wind farm;
- loss of carbon from backup power generation;
- loss of carbon-fixing potential of peatland;
- loss and/or saving of carbon stored in peatland (by peat removal or changes in drainage); and
- carbon saving due to improvement of habitat.

[1] Scottish Government Wind Farm Developments on Peat Land: Carbon Calculator Tool v1.7.0 https://informatics.sepa.org.uk/CarbonCalculator/

[2] Calculating Carbon Savings from Wind Farms on Scottish Peatlands – A New Approach (Nayak et al., 2008; Nayak et al., 2010 and Smith et al,. 2011)

2.0 Context

By 2030, the Scottish Government aims to have reduced greenhouse gas emissions by at least 75% compared to 1990 levels and generate 50% of Scotland's overall energy consumption from renewable sources, with aims to have decarbonised Scotland's energy system and economy completely by 2050[3].

Large scale wind farm development in Scotland has raised concerns about the reliability of methods used to calculate the time taken for these proposals to reduce greenhouse gas emissions, largely due to the potential siting of wind farms on peatland which represent large stores of carbon. The implication for carbon emissions is therefore a factor that should be included in the consideration of proposed wind farm development.

Applications for wind farms (or extensions of wind farms) submitted under Section 36 of the Electricity Act (50 MW capacity or above) are screened to establish whether they are on deep peat sites (i.e. greater than 0.5 metres) and where loss or disturbance to peat could occur. Where they do, applicants are expected to use the Carbon Calculator to determine the pay-back period of the proposal and submit this with the Section 36 application.

The calculation of the carbon balance of a proposed wind farm provides a mechanism by which the carbon costs of a wind farm development can be weighed against the carbon savings attributable to the wind farm during its lifetime. This calculation is summarised as the length of time (in years) it will take the carbon savings to amount to the carbon costs and is referred to as the 'payback period'. This information can then inform decision makers of the viability of a wind farm development in terms of overall carbon savings.

Calculations are provided for expected, best case and worst-case scenarios of Development. The expected scenario is based on the layout of 25 turbines and candidate turbine (Siemens Gamesa SG 6.6 MW 155) described in **Chapter 3: Description of Development**, and has an estimated installed capacity in the region of 165MW. The other scenarios are based on varying assumptions regarding wind energy capacity factor, characteristics of peatland and the Proposed Development land-take.

The assessment was informed by an iterative peat probing process, as described in **Chapter 10: Hydrology, Hydrogeology and Geology.**

[3] Scottish Government, Climate Change Policy, Reducing greenhouse gas emissions

3.0 Input Data

The data inputs for the online calculator tool have been extracted from the sources listed below:

- Uisenis Wind Farm EIA Report **Chapter 3: Description of Development**;
- Uisenis Wind Farm EIA Report **Technical Appendix 10.1: Peat Landslide Hazard and Risk Assessment** (PLHRA); and
- Uisenis Wind Farm EIA Report **Technical Appendix 10.2: Peat Management Plan** (PMP).

The calculation spreadsheet within the Carbon Calculator Tool (online version reference number 4OVO-24G1-R94Z_v4) allows a range of data to be input in order to utilise expected, minimum and maximum values, where relevant and applicable. The input data is presented within Annex A of this report. However, if several parameters are varied together, this can have the effect of 'cancelling out' a single parameter change. For this reason, the approach for this assessment, has been to include 'maximum values' as those values which would result in the longest (maximum) payback period; and 'minimum values' as those values which would result in the shortest (minimum) payback period. The expected value is based on the most realistic option for the proposed development.

4.0 Results

The model calculates carbon emissions savings and losses from the various aspects of the model; and also calculates a payback period based on the three counterfactual emission factors, coal-fired plant, normal grid mix and fossil fuel mix. The counterfactual emission factors are fixed within the calculator tool, the coal-fired and fossil fuel mix emission values are based on DUKES[4] data for which the UK is annually updated. The grid mix emission factor is the list of emission factors used to report on 2016 greenhouse gas emissions as published by DECC[5].

It should be noted that the average capacity factor of 40% is likely to represent an underestimation when compared to the actual capacity factor experienced at the Site. Consequently, carbon savings are also likely to be conservative.

This shows that even if the wind farm is replacing the normal fossil fuel sourced grid mix of electricity generation, the proposed development would produce a CO_2 savings as detailed in **Table 4-1** below:

Table 4-1: Estimate of CO_2 Emission Savings

Wind Farm CO_2 emission saving over…	Exp.	Min.	Max.
…coal-fired electricity generation (t CO_2/yr)	579,316	564,833	593,799
…grid-mix of electricity generation (t CO_2/yr))	111,805	109,009	114,600
…fossil fuel – mix of electricity generation (t CO_2/yr)	249,765	243,521	256,009
Energy output from Wind Farm over lifetime (MWh)	**17,344,800**	**16,347,474**	**18,371,034**

Table 4-2 and **Table 4-3** present the estimated losses and gains from the various aspects of the wind farm construction and operation.

As detailed within the Scottish Government's Technical Note Version 2.10.0[6] on Calculating potential carbon losses and savings from wind farms on Scottish peatlands, the manufacturing, construction and installation of the wind turbines on Site has an associated carbon cost, and carbon losses are also generated by the requirement for extra capacity to back up wind power generation. Carbon losses associated with reduced carbon fixing potential and loss of soil organic matter occurs through drainage effects and excavation of peat for construction. Carbon losses at this site may also be associated with felling of existing forestry.

Organic soils (peatlands) in Scotland act as carbon sinks, whereby they absorb carbon dioxide in their formation. They may also release carbon due to land use change, such as drainage for agriculture or the establishment of forestry. The Proposed Development is located within a Site where limited peat deposits are present, as per survey findings discussed in **Chapter 10: Hydrology, Hydrogeology and Geology** of this EIA Report.

[4] Department for Business, Energy & Industrial Strategy, Digest of UK Energy Statistics (DUKES)
[5] Department for Business, Energy & Industrial Strategy, Greenhouse gas reporting – Conversion Factors 2016
6 Scottish Government, Technical Note Version 2.10.0, Calculating potential carbon losses and savings from wind farms on Scottish peatlands

Table 4-2: Estimated CO_2 Losses

Total CO2 losses due to wind farm (tCO2 eq.)	Exp.	Min.	Max.
Losses due to turbine life (eg. manufacture, construction, decommissioning)	156,304	156,304	156,304
Losses due to backup	93,662	90,540	96,784
Losses due to reduced carbon fixing potential	4,268	1,439	19,741
Losses from soil organic matter	117,355	11,008	362,047
Losses due to DOC & POC leaching	32	0	586
Losses due to felling forestry	0	0	0
Total losses of carbon dioxide	**371,621**	**259,291**	**635,462**

Table 4-3: Estimated CO_2 Gains

Total CO2 gains due to improvement of site (t CO2 eq.)	Exp.	Min.	Max.
Change in emissions due to improvement of degraded bogs	0	0	0
Change in emissions due to improvement of felled forestry	0	0	0
Change in emissions due to restoration of peat from borrow pits	0	0	-111
Change in emissions due to removal of drainage from foundations & hardstanding	-3,969	0	-43,512
Total change in emissions due to improvements	**-3,969**	**0**	**-43,623**

The carbon payback period is a measurement/indicator to help assess a proposal. The shorter the payback the greater benefit the proposed development will have in displacing emissions associated with electricity generated by burning fossil fuels.

The payback period is calculated taking the total carbon cost (carbon losses) associated with the proposed development and dividing by the annual carbon gains from displaced fossil fuel power generation and any site improvements.

Table 4-4 demonstrates that the net emissions of carbon dioxide are estimated at 367,651 tonnes of CO_2, with an estimated payback period of 0.8 to 2.6 years. Therefore, the proposed development will produce a reduction in emissions from the electricity grid of around 249,765 tonnes of CO_2 per year (this assumes that the wind farm replaces grid electricity generated from a fossil fuel mix).

Over the 30 year lifetime of the proposed development, 11,029,530 tonnes of CO_2 will be displacing fossil fuel mix electricity generation. Given the total net emissions of CO_2 due to the construction of the wind farm, there will be a total net saving of 10,657,909 tonnes of CO_2 over the lifetime of the wind farm.

A summary of the anticipated carbon emissions and carbon payback of the proposed development are provided below:

Table 4-4: CO_2 Emissions and Payback Time

Results	Exp.	Min.	Max.
Net emissions of carbon dioxide (t $CO_{2\ eq}$) (carbon losses minus carbon gains)	**367,651**	**215,668**	**635,462**
Carbon Payback Time			
…coal-fired electricity generation (years)	0.6	0.4	1.1
…grid-mix of electricity generation (years)	3.3	1.9	5.8
…fossil fuel – mix of electricity generation (years)	**1.5**	**0.8**	**2.6**
Ratio of CO_2 eq. emissions to power generation (g/kWh) (Target ratio by 2030 (electricity generation) <50 g/kWh)	**21.2**	**11.74**	**38.87**

5.0 Conclusions

The calculations of total carbon dioxide emission savings and payback time for the proposed development indicates that the overall payback period will be around 1.5 years (approximately 18 months) when compared to the grid fuel mix of electricity generation. This means that the proposed development is anticipated to take around 1.5 years to repay the carbon exchange to the atmosphere (the CO_2 debt) through construction; the Site would in effect be in a net gain situation following this time period and can then claim to contribute to national emissions reduction objectives thereafter for its remaining operational life.

6.0 References

Carbon Calculator Tool v1.7.0. Available at https://informatics.sepa.org.uk/CarbonCalculator/

Carbon Calculator Tool User Guidance. Available at https://informatics.sepa.org.uk/CarbonCalculator/assets/Carbon_calculator_User_Guidance.pdf

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Scottish Government. 2020. Update to the Climate Change Plan 2018 – 2032 Securing a Green Recovery on a Path to Net Zero. Available at: https://www.gov.scot/binaries/content/documents/govscot/publications/strategy-plan/2020/12/securing-green-recovery-path-net-zero-update-climate-change-plan-20182032/documents/update-climate-change-plan-2018-2032-securing-green-recovery-path-net-zero/update-climate-change-plan-2018-2032-securing-green-recovery-path-net-zero/govscot%3Adocument/update-climate-change-plan-2018-2032-securing-green-recovery-path-net-zero.pdf

ANNEX A

Carbon Calculator v1.7.0
Uisenis Wind Farm Location: 58.034598 -6.561181
Eurowind Energy Ltd.

Core input data

Input data	Expected value	Minimum value	Maximum value	Source of data
Windfarm characteristics				
Dimensions				
No. of turbines	25	25	25	EIA Chapter 3: Description of the Development
Duration of consent (years)	30	29	31	EIA Chapter 3: Description of the Development
Performance				
Power rating of 1 turbine (MW)	6.6	6.6	6.6	EIA Chapter 3: Description of the Development
Capacity factor	40	39	41	EIA Chapter 3: Description of the Development
Backup				
Fraction of output to backup (%)	5	5	5	Dale et al 2004
Additional emissions due to reduced thermal efficiency of the reserve generation (%)	10	10	10	Fixed
Total CO2 emission from turbine life (tCO2 MW^{-1}) (eg. manufacture, construction, decommissioning)	Calculate wrt installed capacity	Calculate wrt installed capacity	Calculate wrt installed capacity	
Characteristics of peatland before windfarm development				
Type of peatland	Acid bog	Acid bog	Acid bog	EIA
Average annual air temperature at site (°C)	8.8	2.4	15	https://www.metoffice.gov.uk/research/climate/maps-and-data/uk-climate-averages/gf7e0jd30
Average depth of peat at site (m)	0.56	0.1	5	Site visit
C Content of dry peat (% by weight)	55.5	49	62	Birnie et al. 1991
Average extent of drainage around drainage features at site (m)	10	5	50	Generic precautionary values
Average water table depth at site (m)	0.1	0.05	0.3	Typical intact peat values
Dry soil bulk density (g cm^{-3})	0.2	0.15	0.25	Default value taken from Lilly et al., 2010

Input data	Expected value	Minimum value	Maximum value	Source of data
Characteristics of bog plants				
Time required for regeneration of bog plants after restoration (years)	10	10	15	Conservative estimate
Carbon accumulation due to C fixation by bog plants in undrained peats (tC ha^{-1} yr^{-1})	0.25	0.12	0.31	Default values
Forestry Plantation Characteristics				
Area of forestry plantation to be felled (ha)	0	0	0	EIA Chapter 3: Description of the Development
Average rate of carbon sequestration in timber (tC ha^{-1} yr^{-1})	3.6	3.4	3.8	Default values (Cannell, 1999)
Counterfactual emission factors				
Coal-fired plant emission factor (t CO2 MWh^{-1})	1.002	1.002	1.002	
Grid-mix emission factor (t CO2 MWh^{-1})	0.19338	0.19338	0.19338	
Fossil fuel-mix emission factor (t CO2 MWh^{-1})	0.432	0.432	0.432	
Borrow pits				
Number of borrow pits	5	5	5	EIA Chapter 3: Description of the Development
Average length of pits (m)	158.6	98	243	EIA Chapter 3: Description of the Development
Average width of pits (m)	94.4	65	159	EIA Chapter 3: Description of the Development
Average depth of peat removed from pit (m)	0.27	0.03	0.5	TA 10.2: PMP
Foundations and hard-standing area associated with each turbine				
Average length of turbine foundations (m)	0	0	0	
Average width of turbine foundations (m)	0	0	0	
Average depth of peat removed from turbine foundations(m)	0	0	0	
Average length of hard-standing (m)	0	0	0	
Average width of hard-standing (m)	0	0	0	
Average depth of peat removed from hard-standing (m)	0	0	0	
Volume of concrete used in construction of the ENTIRE windfarm				

Input data	Expected value	Minimum value	Maximum value	Source of data
Volume of concrete (m^3)	0	0	0	
Access tracks				
Total length of access track (m)	30770	30670	30870	EIA Chapter 3: Description of the Development
Existing track length (m)	12070	12070	12070	EIA Chapter 3: Description of the Development
Length of access track that is floating road (m)	2220	2200	2300	EIA Chapter 3: Description of the Development
Floating road width (m)	6	5	7	EIA Chapter 3: Description of the Development
Floating road depth (m)	0	0	0	EIA Chapter 3: Description of the Development
Length of floating road that is drained (m)	0	0	0	EIA Chapter 3: Description of the Development
Average depth of drains associated with floating roads (m)	0.5	0.5	0.5	EIA Chapter 3: Description of the Development
Length of access track that is excavated road (m)	16480	16400	16500	EIA Chapter 3: Description of the Development
Excavated road width (m)	6	6	6	EIA Chapter 3: Description of the Development
Average depth of peat excavated for road (m)	0.55	0.54	0.56	TA 10.2 PMP
Length of access track that is rock filled road (m)	0	0	0	Not applicable
Rock filled road width (m)	5	5	5	Not applicable
Rock filled road depth (m)	0	0	0	Not applicable
Length of rock filled road that is drained (m)	0	0	0	Not applicable
Average depth of drains associated with rock filled roads (m)	0	0	0	Not applicable
Cable trenches				
Length of any cable trench on peat that does not follow access tracks and is lined with a permeable medium (eg. sand) (m)	0	0	0	EIA Chapter 3: Description of the Development
Average depth of peat cut for cable trenches (m)	0	0	0	EIA Chapter 3: Description of the Development
Additional peat excavated (not already accounted for above)				
Volume of additional peat excavated (m^3)	23790	23789	23791	TA 10.2 PMP, Turning Heads, Substation and Temporary Compounds

Input data	Expected value	Minimum value	Maximum value	Source of data
Area of additional peat excavated (m^2)	39540	39539	39541	TA 10.2 PMP, Turning Heads, Substation and Temporary Compounds
Peat Landslide Hazard				
Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments	negligible	negligible	negligible	Fixed
Improvement of C sequestration at site by blocking drains, restoration of habitat etc				
Improvement of degraded bog				
Area of degraded bog to be improved (ha)	0	0	0	Not applicable
Water table depth in degraded bog before improvement (m)	0	0	0	Not applicable
Water table depth in degraded bog after improvement (m)	0	0	0	Not applicable
Time required for hydrology and habitat of bog to return to its previous state on improvement (years)	2	2	4	Not applicable
Period of time when effectiveness of the improvement in degraded bog can be guaranteed (years)	2	2	4	Not applicable
Improvement of felled plantation land				
Area of felled plantation to be improved (ha)	0	0	0	Not applicable
Water table depth in felled area before improvement (m)	0	0	0	Not applicable
Water table depth in felled area after improvement (m)	0	0	0	Not applicable
Time required for hydrology and habitat of felled plantation to return to its previous state on improvement (years)	2	2	4	Not applicable
Period of time when effectiveness of the improvement in felled plantation can be guaranteed (years)	2	2	4	Not applicable

Input data	Expected value	Minimum value	Maximum value	Source of data
Restoration of peat removed from borrow pits				
Area of borrow pits to be restored (ha)	7.7	7.6	7.8	TA 10.2 PMP
Depth of water table in borrow pit before restoration with respect to the restored surface (m)	0.3	0.1	0.5	Typical values used
Depth of water table in borrow pit after restoration with respect to the restored surface (m)	0.1	0.05	0.3	Typical values used
Time required for hydrology and habitat of borrow pit to return to its previous state on restoration (years)	6	4	8	Typical values used
Period of time when effectiveness of the restoration of peat removed from borrow pits can be guaranteed (years)	5	5	5	Typical values used
Early removal of drainage from foundations and hardstanding				
Water table depth around foundations and hardstanding before restoration (m)	0.3	0.1	0.5	Typical values used
Water table depth around foundations and hardstanding after restoration (m)	0.1	0.05	0.3	Typical values used
Time to completion of backfilling, removal of any surface drains, and full restoration of the hydrology (years)	1.5	1	3	Typical values used
Restoration of site after decomissioning				
Will the hydrology of the site be restored on decommissioning?	Yes	Yes	Yes	
Will you attempt to block any gullies that have formed due to the windfarm?	Yes	Yes	Yes	EIA Chapter 3: Description of the Development
Will you attempt to block all artificial ditches and facilitate rewetting?	Yes	Yes	Yes	EIA Chapter 3: Description of the Development
Will the habitat of the site be restored on decommissioning?	No	No	No	
Will you control grazing on degraded areas?	No	No	No	EIA Chapter 3: Description of the Development

Input data	Expected value	Minimum value	Maximum value	Source of data
Will you manage areas to favour reintroduction of species	Yes	Yes	Yes	EIA Chapter 3: Description of the Development
Methodology				
Choice of methodology for calculating emission factors	Site specific (required for planning applications)			

Forestry input data

N/A

Construction input data

Input data	Expected value	Minimum value	Maximum value	Source of data
Uisenis				
Number of turbines in this area	25	25	25	EIA Chapter 3: Description of the Development
Turbine foundations				
Depth of hole dug when constructing foundations (m)	0.4	0.05	0.9	TA 10.2 PMP
Aproximate geometric shape of whole dug when constructing foundations	Circular	Circular	Circular	EIA Chapter 3: Description of the Development
Diameter at bottom	30	30	30	
Diameter at surface	30	30	30	
Hardstanding				
Depth of hole dug when constructing hardstanding (m)	0.56	0.1	1	TA 10.2 PMP
Aproximate geometric shape of whole dug when constructing hardstanding	Rectangular	Rectangular	Rectangular	EIA Chapter 3: Description of the Development
Length at surface	210.23	210.23	210.23	
Width at surface	71.87	71.87	71.87	
Length at bottom	210.23	210.23	210.23	
Width at bottom	71.87	71.87	71.87	

Input data	Expected value	Minimum value	Maximum value	Source of data
Uisenis				
Piling				
Is piling used?	No	No	No	EIA Chapter 3: Description of the Development
Volume of Concrete				
Volume of concrete used (m^3) in the entire area	43750	43750	43750	EIA Chapter 3: Description of the Development

Payback Time

1. Windfarm CO2 emission saving over...	Exp.	Min.	Max.
...coal-fired electricity generation (t CO2 / yr)	579,316	564,833	593,799
...grid-mix of electricity generation (t CO2 / yr)	111,805	109,009	114,600
...fossil fuel-mix of electricity generation (t CO2 / yr)	249,765	243,521	256,009
Energy output from windfarm over lifetime (MWh)	17,344,800	16,347,474	18,371,034

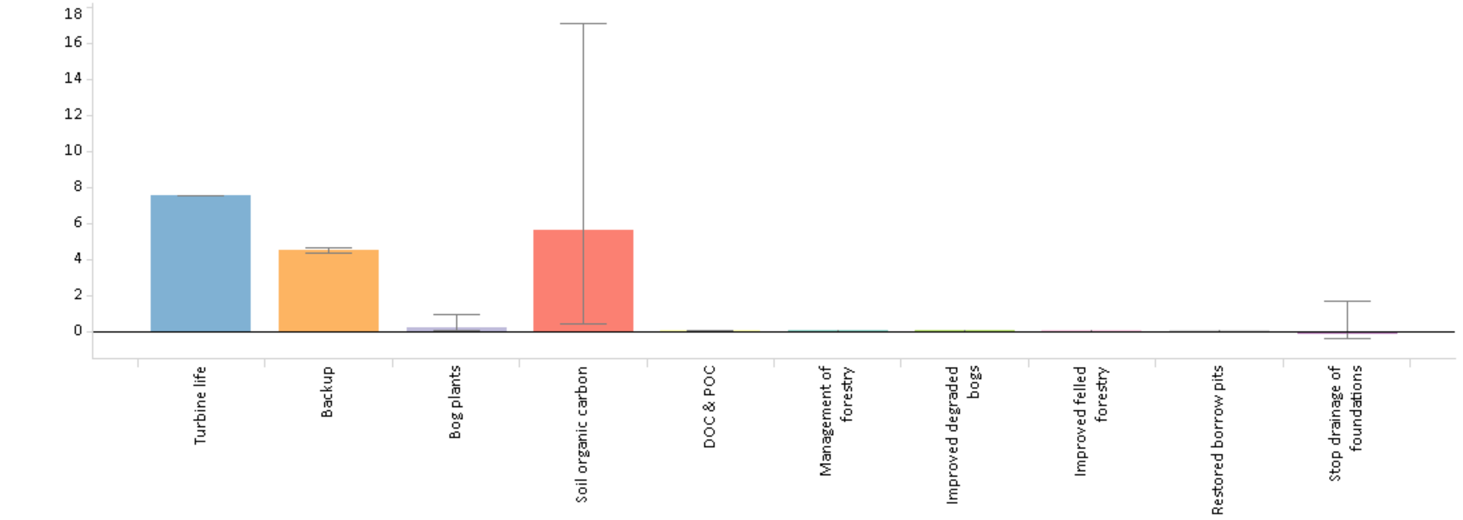
Total CO2 losses due to wind farm (tCO2 eq.)	Exp.	Min.	Max.
2. Losses due to turbine life (eg. manufacture, construction, decomissioning)	156,304	156,304	156,304
3. Losses due to backup	93,662	90,540	96,784
4. Lossess due to reduced carbon fixing potential	4,268	1,439	19,741
5. Losses from soil organic matter	117,355	11,008	362,047
6. Losses due to DOC & POC leaching	32	0	586
7. Losses due to felling forestry	0	0	0
Total losses of carbon dioxide	371,621	259,291	635,462

8. Total CO2 gains due to improvement of site (t CO2 eq.)	Exp.	Min.	Max.
8a. Change in emissions due to improvement of degraded bogs	0	0	0
8b. Change in emissions due to improvement of felled forestry	0	0	0
8c. Change in emissions due to restoration of peat from borrow pits	0	0	-111
8d. Change in emissions due to removal of drainage from foundations & hardstanding	-3,969	0	-43,512
Total change in emissions due to improvements	-3,969	0	-43,623

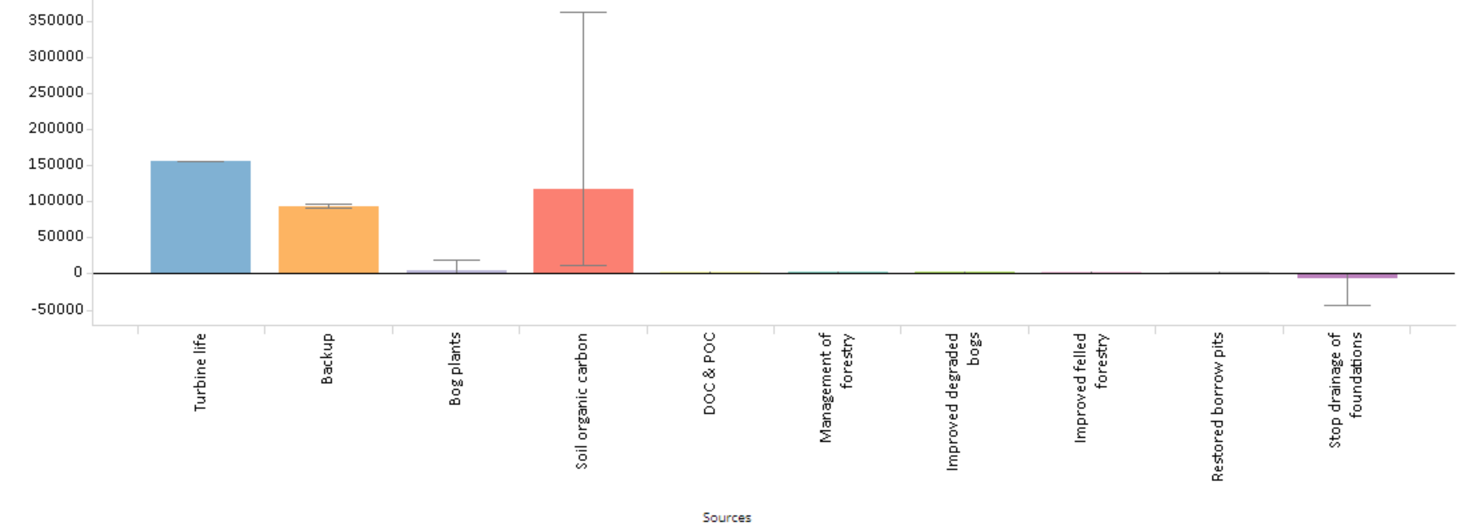
RESULTS	Exp.	Min.	Max.
Net emissions of carbon dioxide (t CO2 eq.)	367,651	215,668	635,462
Carbon Payback Time			
...coal-fired electricity generation (years)	0.6	0.4	1.1
...grid-mix of electricity generation (years)	3.3	1.9	5.8
...fossil fuel-mix of electricity generation (years)	1.5	0.8	2.6
Ratio of soil carbon loss to gain by restoration (not used in Scottish applications)	29.57	0.25	No gains!
Ratio of CO2 eq. emissions to power generation (g/kWh) (for info. only)	21.20	11.74	38.87

Payback Time and CO_2 emissions • 4OVO-24G1-R94Z v4

Carbon payback time (months) using fossil-fuel mix as conterfactual



Greenhouse gas emissions (t CO2 eq.)



Proportions of greenhouse gas emissions from different sources