Gordonbush Wind Farm Extension

Route Survey Report – 66.7m Blade

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Contents

1 INTRODUCTION

Report Purpose

1.1 WYG has been commissioned by SSE Renewables (hereafter to be known as SSE) to undertake a route review for the delivery of abnormal loads associated with Gordonbush Wind Farm Extension, located west of Brora, Sutherland.

1.2 WYG has been commissioned to prepare this route survey report as a source of guidance. The report identifies the key points and issues associated with the route that may require remedial works to accommodate the predicted loads. The detailed designs of these remedial works, however, are beyond the agreed scope of works. It is the responsibility of the turbine supplier (depending upon contractual arrangements) to ensure that the access route from the POE to the road transfer point is fit for purpose and that appropriate consideration for all road users has been made in accordance with the relevant health and safety legislation and ruling transport requirements.

1.3 This report has been prepared in accordance with instructions from SSE Renewables on the above project details. No liability is accepted for the use of all or part of this report by third parties.

Report Structure

1.5 Following this introduction, the proceeding chapters of the report are structured as follows:

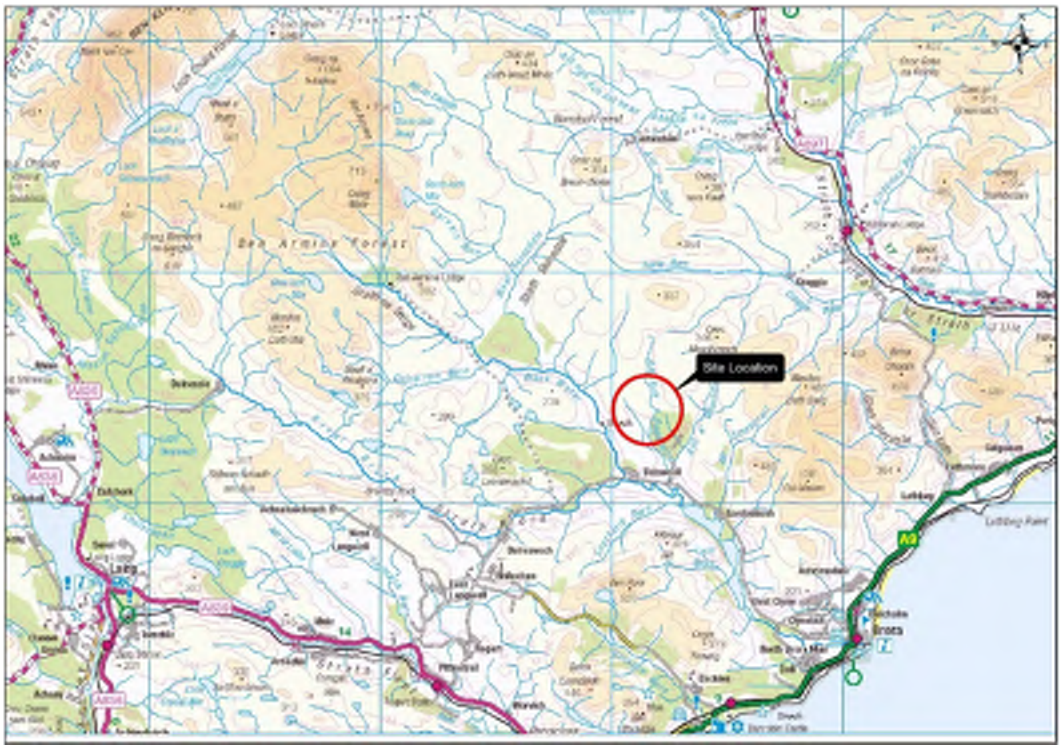
- **Chapter Two** describes the location of the proposed wind farm development;
- **Chapter Three** describes the route option along with areas of potential significant constraints;
- **Chapter Four** details a framework for the Abnormal Load Traffic Management Plan; and
- **Chapter Five** provides a summary of the report and an outline of suggested further works, actions and recommendations for consideration by SSE.

2 PROPOSED SITE AND ACCESS STRATEGY

Site Description and Location

2.1 The proposed Gordonbush Wind Farm Extension is located to the west of Brora, Sutherland. The site location is illustrated below in Figure 2.1.

Figure 2.1: Site Location



Candidate Turbine

2.2 SSE indicated that they wish to assess the worst-case components from the dimensions stated in Table 2.1. No specific turbine has been identified at this stage.

Table 2.1: Worst Case Turbine Loads and Dimensions

Component	Length (m)	Width (m)	Height (m)	Weight (T)
Tower Base Section	19.64	Ø4.31	Ø4.03	72
Tower Mid 1 Section	29.96	Ø4.03	Ø3.67	62
Tower Top Section	30.00	Ø3.67	Ø3.26	44
Hub	5.5	4.0	3.8	33.8
Nacelle	12.8	4.2	3.4	70
Blade	66.7	4.3	2.60	13.6

2.3 WYG has assumed the worst case loads to be the 66.7m blade carried in a Super Wing Carrier type trailer with the worst case tower (mid section) carried in a 4+7 axle clamp trailer. At this point in time, no assessment of the erection crane has been undertaken.

2.4 WYG has assumed that all loads will follow the turbine manufacturer transport guidelines and that the detailed design of the on-site infrastructure will be undertaken to the turbine manufacturer standards by the Balance of Plant (BoP) contractor.

2.5 The internal design of the access track and supporting infrastructure is the responsibility of the client and any divergence from turbine manufacturer standards needs to be agreed in writing with SSE prior to deliveries occurring. WYG cannot advise on the internal layout of the site or on pinch points located within the site.

2.6 The components can be delivered on a variety of transport platforms all of which feature independent rear wheel steering and would be provided with both Police and civilian escorts.

2.7 Photos 2.1 and 2.2 illustrate similar sized components being delivered.

Photo 2.1: Superwing Blade Delivery Vehicle

Photo 2.2: Tower Delivery

3 ROUTE REVIEW

3.1 A route review has been undertaken by video survey from both the Port of Invergordon and the Port of Nigg through to the proposed site access. This method allows a full record of the route to be undertaken, with notes recorded following completion of the survey. Not only is this process efficient, it also provides a much safer working environment for staff. The video survey allows a full record of the route to be kept for future reference. To accompany the video survey, various Points of Interest (POI) were recorded using a Global Positioning System (GPS) tracker that logs the locations of points on the routes to Ordnance Survey (OS) co-ordinates.

3.2 Invergordon has been extensively used by the abnormal load and wind farm industries in the past. All wind farms to the north of Inverness, excluding Caithness sites, have used Invergordon. The port was utilised for deliveries to Lairg, Gordonbush and Lochluchart Wind Farms.

3.3 The Port of Nigg is a major hub for the offshore wind market however it has no experience of onshore turbine projects. There are large areas for component storage at the port which are currently in use for offshore developments.

3.4 The site visit did not include any geotechnical, utility or environmental reviews and as such the information provided in this report is based solely on the observations noted on the site visit and subsequent swept path assessments.

3.5 Plans illustrating the location of the constraints and a detailed list of POIs are provided in Appendix A.

Route Description

3.6 It is proposed that all loads will depart Invergordon Port before approaching the site from the south. The proposed access route from the docks is illustrated in Figure 3.1.

Figure 3-1: Abnormal Load Route

Proposed Route

3.7 The route from the Port of Invergordon to site has been presented as follows:

- Loads would exit the port and enter the B817. Loads will proceed eastbound;
- Loads will turn left and bypass Invergordon. At the junction with Academy Street, loads will turn right;
- Loads will continue northbound and will turn right onto the A9;
- Loads will proceed northbound on the A9;
- Loads will continue on the A9 to the north of Brora where they will turn left onto the C1098 Clynelish Road;
- Loads will continue west on the C1098 before turning right onto the C1022 Gordonbush Road; and
- Loads will continue north west on the C1022 Gordonbush Road to the existing Gordonbush Wind Farm site entrance.

3.8 Loads could also be landed at the Port of Nigg. The route would see them leave the port and travel north on the B9175 prior to joining the Invergordon route at the A9 Nigg Roundabout for continuation to site.

Network Constraints

Port of Invergordon to POI 7

3.9 Table 3.1 details the potential constraint point locations along the route from the POE through to POI 7, Nigg Roundabout.

3.10 Where street furniture is to be removed to allow movement, it is suggested that socket foundations are used. All elements can be reinstated following the manoeuvre.

Table 3-1: Port of Invergordon Constraint Point

POI	Key Constraint	Details
1		**Invergordon Port Access Gate – Western Exit** Two exit options have been presented at Invergordon. Option 1 illustrates the western exit and Option 2 the eastern exit. Loads will exit the port and turn right onto the B817 proceeding eastbound. All loads will exit the port in forward gear and turn right onto the B817. Loads will oversail the north western and southern eastern verges of the exit from the port. The port fence and wire and post fences will need to be altered on both sides of the junction to enable the manoeuvre. All obstacles and lighting columns should be removed from the area. Discussions should be held with the Port Authority to ensure that the required land is available. Swept path assessment drawing SPA001 is included in Appendix B.

POI	Key Constraint	Details
2		**Invergordon Port Access Gate – Eastern Exit** Blade and longer loads would reverse out of the port before continuing east on the B817. Works would be required to enable the loads to negotiate bends within the port and the port authority should confirm that the required works are feasible. Loads will oversail the western verge on the inside of the reversing manoeuvre where one road sign should be removed and vegetation cleared. It should be confirmed that this area is available for use. Loads will overrun and oversail the northern verge and footway of the B817 where a load bearing surface should be laid and two lighting columns removed. Trees and vegetation should be cleared within the oversail area and the blade tip will oversail 8 bollards. Parking should be prevented within the turning area. Tower loads will oversail the inside verge of the right turn onto the B817 where two signs and a bike storage facility should be removed. Trees and vegetation should be cleared. Bollards to be removed. The port authority should be consulted regarding the feasibility of utilising the port car park. Swept path assessment drawing SPA002 is included in Appendix B.

POI	Key Constraint	Details
3		**B817 / Unclassified Road Junction** Loads will turn left at the junction and would proceed northbound. Loads will oversail the south eastern footway on approach to the junction. Loads will oversail the north western footway through the left turn onto the unclassified road. Loads will overrun and oversail the western edge of the two splitter islands where load bearing surfaces should be laid and all street furniture should be removed. Existing utilities should be protected. Swept path assessment drawing SPA003 is included in Appendix B.
4		**Rail Overbridge** Loads will proceed across the bridge. Loads should proceed ahead at a crawl and should straddle the centre line to avoid adverse loading on the structure. Loads should not accelerate or brake whilst on the bridge. The road surface was noted to be deteriorating and early discussions are recommended with the local roads authority to ensure that repairs are completed prior to delivery. Swept path assessment drawing SPA004 is included in Appendix B.

POI	Key Constraint	Details
5		**Academy Road Junction** Loads will turn right at the junction and will proceed towards the A9 junction. Loads will oversail the southern verge on approach to the junction where one lighting column and road sign should be removed. Vegetation should be trimmed and it is recommended that the extent of adopted boundary be confirmed. Loads will overrun and oversail the inside of the right turn where **third party land will be required**. A load bearing surface should be laid and the land reprofiled. Vegetation and trees should be removed. Loads will overrun and oversail the western verge where a load bearing surface should be laid and the tree foliage should be trimmed. Swept path assessment drawing SPA005 is included in Appendix B.

POI	Key Constraint	Details
6		**Academy Road / A9 Junction** Loads will turn right onto the A9. On approach to the junction, loads will oversail the western verge. It is recommended that a topographical survey of the junction / test run is completed to confirm if the mature trees will need to be removed to facilitate the oversail. Two road signs should be removed. Loads will oversail the verge on the inside of the right turn. Loads will need to overrun and oversail land to the north of the A9 onto the old road alignment. The land should be reprofiled and a load bearing surface laid. A land search is recommended at this location to confirm the extents of adopted boundary. One utility pole and a set of directional signs will need to be removed. Swept path assessment drawing SPA006 is included in Appendix B.
7A		**A9 Nigg Roundabout – Option 1** Loads will take the first exit at the junction and will continue northbound on the A9. Loads will oversail the southern verge where one road sign should be removed. Loads will oversail the splitter island on approach and the western verge on the inside of the left bend. One bollard will be oversailed by the blade tip. Loads will oversail the western verge of the roundabout island. Swept path assessment drawing SPA007 is included in Appendix B.

Nigg Port to POI 10

3.11 Table 3.2 details the potential constraint point locations along the route from POI 8 at Nigg Port through to the A9 Nigg Roundabout.

3.12 Where street furniture is to be removed to allow movement, it is suggested that socket foundations are used. All elements can be reinstated following the manoeuvre.

Table 3-2: Nigg Port Constraint Points

POI	Key Constraint	Details
8		**Port of Nigg Exit** Loads would exit the port and turn left onto the B9175. It is proposed that this gate would be used for abnormal loads to exit the port. Loads would have to approach the junction from the existing parking areas within the port and this should be cleared of all street furniture and obstacles including lighting columns, signs and fencing. The exit splitter island should be provided with a load bearing surface and two bollards should be removed. Loads will overrun and oversail the eastern verge of the B9175 where a load bearing surface should be laid and the land reprofiled to carriageway level. Vegetation should be cleared. **Third party land will be required.** Discussions should be held with the Port Authority to ensure that the required land is available. All street furniture should be cleared from these areas. Swept path assessment drawing SPA008 is included in Appendix B.

POI	Key Constraint	Details
9		**A9 Lower Pitcalzean** It is strongly recommended that a full overhead utility search is carried out along the route to ensure that height clearances are suitable for normal temperature ranges.
10		**B9175 East of Glastullich** Escorts to seek permission to transit through the level crossing from Network Rail.
7		**A9 Nigg Roundabout – Option 2** Loads will undertake a **contra flow manoeuvre** through the roundabout. Loads will oversail the north eastern verge on approach to and exit from the roundabout. Loads will overrun and oversail the north eastern edge of the roundabout island where a load bearing surface should be laid and one lit chevron sign should be removed. Swept path assessment drawing SPA009 is included in Appendix B.

POI 11 to POI 31 A9 / Clynelish Road Junction

3.13 Table 3.3 details the potential constraint point locations along the route from the A9 through to the proposed site entrance.

3.14 Where street furniture is to be removed to allow movement, it is suggested that socket foundations are used. All elements can be reinstated following the manoeuvre.

Table 3-3: Combined Route Constraint Points

POI	Key Constraint	Details
11		**A9 / A836 Roundabout** Loads will take the second exit at the junction and will continue northbound on the A9. A **contraflow manoeuvre** of the junction is required. Loads will oversail the southern verge and north eastern verge on entry and exit from the roundabout. Loads will overrun and oversail the northern edge of the approach road splitter island where a load bearing surface should be laid and one bollard and one road sign should be removed. Loads will overrun and oversail the north eastern edge of the roundabout island where a load bearing surface should be laid and vegetation and trees should be removed. Bear Scotland have requested that vehicles should not cross Dornoch Bridge in close convoy. Swept path assessment drawing SPA010 is included in Appendix B.
12		**A9 / A949 Junction Right Bend** Vehicles should be banned from making the right turn from the A9 onto the A949 when the convoy is passing as loads will oversail into the right turn lane.

POI	Key Constraint	Details
		**A9 Evelix New Bridge** As per the ESDAL response from Bear Scotland, it is requested that loads are restricted to the centreline and cross the bridge at a slow speed. **OSGR: 276820, 890450**
13		**A9 Right Bend Evelix** Loads will occupy the entire carriageway through the bend. Loads will oversail the western verge on entry to the bend where one road sign should be removed and the south eastern verge on exit from the bend to improve overall clearances. Swept path assessment drawing SPA010-3 is included in Appendix B.
14		**A9 Poles** Loads will occupy the entire carriageway through the bend. Escorts should hold oncoming traffic back at least 60m in advance of the bend.

POI	Key Constraint	Details
15		**A9 Right Bend South of Cambusavie** Loads will proceed ahead around the bend. Loads will overrun and oversail the western verge where a load bearing surface should be laid and two road signs and all traffic bollards should be removed. All underground utilities should be protected. Loads will oversail the verge on the inside of the bend where vegetation should be cleared. Swept path assessment drawing SPA011 is included in Appendix B.
16		**A9 Right Bend Near Cambusavie** Loads will proceed ahead through this section of road. Loads will overrun and oversail the verge on the outside of the right bend where a load bearing surface should be laid and **third party land** may be required for the necessary works. Six chevron signs and seven bollards will need to be removed for this area. The blade tip will oversail eight bollards. The tree canopy should be trimmed to allow load oversail of the verge on the inside of the bend. Loads will oversail the verge on the inside of the bend into **third party land** where trees and a section of wall should be removed. It is recommended that due to the constrained nature of the bend, a topographical survey is completed and the swept path assessment repeated. Swept path assessment drawing SPA012 is included in Appendix B.

POI	Key Constraint	Details
17		**A9 Left Bend North of Cambusavie Cottage** Loads will oversail the verge on the inside and outside of the left bend where one road sign should be removed. Swept path assessment drawing SPA013 is included in Appendix B.
18		**A9 Gatehouse** Loads will proceed ahead through this section of road. No mitigation measures are required to negotiate the bend. Swept path assessment drawing SPA014 is included in Appendix B.
19		**A9 Right Bend South of Cambusmore Lodge** Loads will proceed ahead through this section of road. Loads will oversail the inside verge through the bend. No physical mitigation measures are required. Swept path assessment drawing SPA015 is included in Appendix B.
20		**A9 Cambusmore Lodge** Loads will proceed ahead through this section of road. Loads will oversail the inside verge through the bend. No physical mitigation measures are required. Bear Scotland have requested that loads don't cross Fleet New Bridge in close convoy (OSGR 277560, 898190). Swept path assessment drawing SPA016 is included in Appendix B.

POI	Key Constraint	Details
21		**A9 East of A839 Junction** Throughout the route, the tree canopy needs to be trimmed to provide a clear 5m head height. Trimming of the tree canopy can be subject to ecological constraints and it is suggested that early consultation with Transport Scotland is undertaken to agree cutting times and permits required.
22		**A9 West of Kirkton** Loads will proceed ahead through this section of road. No mitigation measures are required to negotiate the bend. Swept path assessment drawing SPA017 is included in Appendix B.
23		**A9 Entering Golspie** It is recommended that the vertical clearance through this section is assessed during the test run to ensure adequate ground clearance is available.
24		**A9 Right Bend Golspie** Loads will continue through the right hand bend. Loads will oversail the northern footway on approach to the bend where one lighting column and one lit traffic sign should be removed. Loads will overrun and oversail **third party land** on the inside of the right bend where a load bearing surface should be laid and two lighting columns and two road signs should be removed. Swept path assessment drawing SPA018 is included in Appendix B.

POI	Key Constraint	Details
25		**A9 Left Bend Golspie** Escorts should develop a traffic management plan for the movement of loads through the village of Golspie. Loads will oversail and overrun the southern footway on approach and through the left bend where a load bearing surface should be laid. Five lighting columns will need to be removed and existing utilities should be protected. Loads will overrun and oversail the northern footway through the bend where a load bearing surface should be laid. Parking should be prohibited during deliveries and it is strongly recommended that a land search is completed to confirm the extents of adopted boundary. Existing utilities should be protected. The clearances to both the wall to the south on approach and the building to the north on exit are minimal and as such it is strongly recommended that a topographical survey is completed, and the swept path assessment repeated. The clearance to the northern building is shown as 0.7m on the available OS mapping. Swept path assessment drawing SPA019 is included in Appendix B.

POI	Key Constraint	Details
26		**A9 Left Bend Leaving Golspie** Loads will continue through the left bend leaving Golspie. Two options have been presented. Both options will require similar mitigation measures but the clearances on the inside of the left bend will vary between 0.4m to 0.9m based on the OS base mapping. Loads will oversail the southern footway on approach to the bend where one lighting column and one lit road sign should be removed. Loads will oversail into **potential third party land** to the south of the road. The location of a number of trees should be identified to clarify whether it is necessary for them to be removed. Loads will oversail the northern footway on the inside of the left bend. Loads will overrun and oversail the eastern footway where a load bearing surface should be laid and the clearance to the lighting column should be confirmed through a test run. Existing utilities should be protected. It is strongly recommended that a topographical survey is completed, and the swept path assessment repeated. The topographical survey should ensure that the location of the trees in the southern verge is identified. Swept path assessment drawing SPA020 is included in Appendix B.
27		**A9 Double Right Bend Dunrobin** Loads will continue through the bends past Dunrobin Castle. Loads will oversail the inside verge through the bends where vegetation should be trimmed. Swept path assessment drawing SPA021 is included in Appendix B.

POI	Key Constraint	Details
28		**A9 Strathsteven Cottage** It is strongly recommended that a full overhead utility search is carried out along the route to ensure that height clearances are suitable for normal temperature ranges.
29		**A9 Right Bend Brora** Escorts should develop a traffic management plan for the movement of loads through the village of Brora. Loads will oversail the southern footway on the inside of the right bend and the north western footway on approach. Swept path assessment drawing SPA022 is included in Appendix B.

POI	Key Constraint	Details
30	   	**A9 Bridge Over River Brora** Loads will continue over the River Brora on the A9. Loads will oversail and overrun the southern and eastern footway and **potential third party land** through the left bend crossing the bridge. A load bearing surface should be laid and two lighting columns and road sign should be removed. A section of guard rail should be removed on approach and the ground clearance of the blade tip over a small wall and the bridge parapet should be confirmed during the test run. It may be necessary for the bridge parapet to be lowered. Loads will overrun and oversail the footway and into **third party land** to the north west of the bridge where a load bearing surface should be laid. The bridge parapet should be lowered to allow oversail. As can be seen in the photos, the parapet was measured onsite as 700mm of wall with a 700mm guard rail. There are a number of pillars which measured 1800mm high. It is not possible for all loads to oversail these heights without further topographical confirmation. A discussion with BEAR Scotland should be held regarding the loads running on the bridge footway. Loads will oversail the western footway on exit from the bridge. It is recommended that due to the constrained nature of this section, a topographical survey is completed and the swept path assessment repeated. Swept path assessment drawing SPA023 is included in Appendix B.

POI	Key Constraint	Details
31-1	   	**A9 / Clynelish Road Junction – Option 1** Four options have been presented to negotiate the left turn onto the C1098 Clynelish Road. Option 1, 3 & 4 utilise the existing junction whilst Option 2 involves a new offline track in advance of the junction. Loads will oversail the eastern footway and verge into **third party land** on approach to the left turn. One telegraph pole and one bus shelter should be removed. Vegetation / trees and wall / fence to be removed. Loads will overrun and oversail into **third party land** on the inside of the left turn. The existing works that were completed to widen the junction for the existing turbine deliveries are not large enough. A load bearing surface will need to be laid. One lighting column, one telegraph pole, one road sign and a large section of the private dwellings perimeter wall will need to be removed. Detailed design is required to confirm the extent of mitigation. Early discussions with the land owner are strongly recommended. Swept path assessment drawing SPA024 is included in Appendix B.

POI	Key Constraint	Details
31-2		**A9 / Clynelish Road Junction – Option 2** Option 2 would involve the creation of two new junctions and a new offline track in advance of the existing left turn. This track would take the loads to the south of the private dwelling. The gated offline track should be constructed to turbine manufacturers standards and should be constructed to avoid the utility pole located in the middle of the field. One lighting column will need to be removed at the beginning of the track and vegetation and sections of wall should be removed. Detailed design will be required to confirm the design of the track and junctions. **Third party land** will need to be secured for the route. Swept path assessment drawing SPA024-4 is included in Appendix B.

POI	Key Constraint	Details
31-3	  	**A9 / Clynelish Road Junction – Option 3** Option 3 would see the loads oversail into **third party land** to the east of the A9. Loads will overrun the eastern verge where a load bearing surface should be laid. One telegraph pole and one bus shelter should be removed. The boundary wall / fence will need to be removed along with trees and vegetation. It is strongly recommended that early discussions are held with the land owners involved. Loads will oversail into **third party land** on the inside of the left turn where a load bearing surface should be laid. One lighting column, one telegraph pole, one road sign and a large section of wall and fencing will need to be removed. Detailed design is required to confirm the proposed mitigation. Existing utilities should be protected. The clearance to the building to the east of the A9 is shown as 2.65m. Swept path assessment drawing SPA024 is included in Appendix B.

POI	Key Constraint	Details
31-4	  	**A9 / Clynelish Road Junction – Option 4** Option 4 would see the loads oversail into **third party land** to the east of the road. One telegraph pole and one bus shelter should be removed. The trees and vegetation should be cleared. It is strongly recommended that early discussions are held with the land owners involved. Loads will oversail into **third party land** on the inside of the left turn where a load bearing surface should be laid. One lighting column, one telegraph pole and one road sign and a large section of wall and fencing will need to be removed. Existing utilities should be protected. Loads will overrun and oversail into **third party land** to the north west of the junction where a load bearing surface should be laid. One lighting column, one telegraph pole, two road signs, one post box, one pillar box and a large section of wall to be removed. Detailed design is required to confirm all works. The clearance to the building to the east of the A9 is shown as 3.05m. Swept path assessment drawing SPA024 is included in Appendix B.

POI 32 to Existing Site Entrance

3.15 Table 3.4 details the potential constraint point locations along the route from POI 32 at the A9 / Clynelish Road Junction through to the Existing Site Entrance.

3.16 Where street furniture is to be removed to allow movement, it is suggested that socket foundations are used. All elements can be reinstated following the manoeuvre.

3.17 The existing road width along Clynelish Road was measured at 3.1m from this point to the site entrance which is below the required minimum running width stated by turbine manufacturers. For the purposes of the swept path assessments, an indicative 4.5m widening line has been applied to the drawing base maps. Marking up of the oversail and overrun areas has been shown beyond this 4.5m widening line. **Third Party Land** may be required along the route subject to land searches to introduce the 4.5m widening alone. Manufacturers require a clearance envelope of 5.5m along the route.

3.18 The constraint point details in Table 3-4 describe the works required in addition to the stated 4.5m widening. The OS base mapping does not provide enough detail for the constrained route from POI 31 to site. It is recommended that a topographical survey of the route is completed as this will be required to complete the detailed design of the proposed mitigation.

Table 3-4: Clynelish Road Constraint Points

POI	Key Constraint	Details
32		**C1098 Clynelish Distillery** Loads will continue west past the Clynelish Distillery entrance. Loads will oversail the southern verge on approach to the bend section where vegetation should be trimmed. Loads will oversail into **third party land** on the inside of the right bend at the distillery entrance where the stone wall and gate will need to be removed along with one telegraph pole. Loads will oversail into **third party land** to the north on the outside of the left bend where one telegraph pole and a section of stone wall should be removed. One road sign should be removed from the northern verge. Loads will oversail the inside verge of the left bend where vegetation and tree canopy should be removed along with one road sign. The stone wall should be removed. Swept path assessment drawing SPA025 is included in Appendix B.
33		**C1098 West of Clynelish Distillery** Loads will continue west on the C1098. Loads will overrun and oversail into **third party land** to the north of the left bend where the stone wall should be removed, and a load bearing surface should be laid and one road sign removed. Vegetation to be cleared. Vegetation to be trimmed and one road sign to be removed from the inside of the left bend to allow oversail. Swept path assessment drawing SPA026 is included in Appendix B.

34		**C1098 Allt Rairidh Crossing** Loads will continue west crossing Allt Rairidh. Road widening will be required on both the approach and exit from the bridge. The bridge was measured on site as 3.5m between the parapets and the parapets were 0.7m high. As the bridge is straight at this location and has a short span no road widening is required. Hauliers to confirm upon selection that their proposed load setup will allow them to oversail this. Alternatively, it may be necessary for the parapet to be lowered on both sides. Loads will oversail into **third party land**. Swept path assessment drawing SPA027 is included in Appendix B.
35		**C1098 Clynelish Moss** It is recommended that the vertical clearance through this section is assessed during the test run to ensure adequate ground clearance is available. Loads should be set on their highest suspension settings, noting overhead utility like constraints on the wider route.
36		**C1098 Clynelish Moss Left Bend** Loads will continue west on the C1098. Loads will oversail **third party land** on the inside and outside of the bend where trees and vegetation should be cleared. The verge on the inside of the bend should be reprofiled to allow oversail. Swept path assessment drawing SPA028 is included in Appendix B.

37, 38	 	**C1098 / C1022 Junction and following right bend** Loads will turn right at the junction and continue west on the C1022. There is evidence of previous works at this location however they are in poor condition and not substantial enough to meet the requirements of the proposed loads. Loads will oversail the eastern verge on approach to the junction into **third party land**. Trees and vegetation should be cleared from this area. Loads will overrun and oversail into **third party land** on the inside of the right turn where a load bearing surface should be laid, and the trees and vegetation cleared. Loads will continue to oversail the northern verge through to the following right bend where an overrun area will also be required. A load bearing surface should be laid and trees and vegetation should be cleared. **Third party land** will be required. Swept path assessment drawing SPA029 is included in Appendix B.
39		**C1022 Gordonbush Road** Loads will continue north west on the C1022. Loads will oversail both sides of the road throughout the section with **third party land** required into the northern verge. Embankment reprofiling to the north may be required subject to detailed design. Trees and vegetation should be removed. Swept path assessment drawing SPA030 is included in Appendix B.

40		**C1022 Double Bend South of Killin Rock** Loads will continue west on the C1022. Loads will oversail both verges with an overrun area required into **third party land** to the north of the road where a load bearing surface should be laid. The ditch should be culverted and verge reprofiling will be required. Trees and vegetation should be cleared. Swept path assessment drawing SPA031 is included in Appendix B.
41	 	**C1022 Series of Bends Southwest of Killin Rock** Loads will continue through the cattle grid southwest of Killin Rock. Loads will oversail both verges through the section. Vegetation to be cleared and the tree canopy should be trimmed. The load bearing capacity of the cattle grid should be reviewed and the gate and fence will need to be removed. One road sign should be removed. Swept path assessment drawing SPA032 is included in Appendix B.

42	 	**C1022 Series of Bends Southwest of Killin Rock** Loads will continue west on the C1022 to the southwest of Killin Rock. Loads will oversail both verges through the section. Vegetation to be cleared and the tree canopy should be trimmed. The extents of adopted boundary should be confirmed through the initial right bend. A load bearing surface should be laid into the southern verge on the outside of the right bend where trees should be cleared. Loads will continue to oversail both verges through the following right bend where **third party land** will be required to the north east and the verge should be reprofiled and trees and vegetation cleared. Swept path assessment drawing SPA033 is included in Appendix B.
43		**C1022 Series of Bends West of Killin Rock** Loads will continue west on the C1022 to the west of Killin Rock. Loads will oversail both verges through the section. Vegetation to be cleared and the tree canopy should be trimmed. Swept path assessment drawing SPA034 is included in Appendix B.
44		**C1022 Series of Bends East of Eilean nam Faoileag** Loads will continue north on the C1022. Loads will oversail both verges through the section. The eastern verge should be reprofiled to allow oversail. Swept path assessment drawing SPA035 is included in Appendix B.

45		**C1022 Series of Bends Northeast of Eilean nam Faoileag** Loads will continue north on the C1022. Loads will oversail into **third party land** to the west and east of the road through the bends. The eastern verge should be reprofiled and one road sign should be removed from the western verge. Swept path assessment drawing SPA036 is included in Appendix B.
46		**C1022 Double Right Bend South of Killin** Loads will oversail into **third party land** to the east of the road. A rock was noted on the inside of the second right bend where loads are oversailing. Clearances to the rock should be confirmed during the detailed design stage. The is a potential requirement for this to be cleared. Swept path assessment drawing SPA037 is included in Appendix B.
47	 	**C1022 Double Right Bend Killin** It is strongly recommended that a full overhead utility search is carried out along the route to ensure that height clearances are suitable for normal temperature ranges. Loads will oversail both the western and eastern verges through the bends. One road sign should be removed. It is recommended that a land search is completed to confirm the extents of adopted boundary through the section. Swept path assessment drawing SPA038 is included in Appendix B.

48		**C1022 Double Right Bend North of Killin** A review of the cattle grid's structural capacity should be completed to ensure that it is suitable for the proposed loads. The gate and fence at the grid should be removed. Loads will oversail both verges through the section with **third party land** required on both sides of the carriageway. One road sign should be setback from the oversail. Swept path assessment drawing SPA039 is included in Appendix B.
49	  	**C1022 Series of Bends and Bridge East of Loch Brora** Loads will oversail both verges through the constrained section where **third party land** will be required on both sides of the road. Trees and vegetation should be trimmed. The distance between the parapet walls was measured on site as 4.8m with a parapet height of 1.2m. The eastern parapet should be lowered during deliveries to allow oversail. Swept path assessment drawing SPA040 is included in Appendix B.

50		**C1022 Series of Bends West of Hut Circle Loch Brora** Loads will oversail the inside and outside verges through the initial right bend where **third party land** will be required on both sides. The verge will need to be reprofiled to the east of the road. Swept path assessment drawing SPA041 is included in Appendix B.

51	 	**C1022 Series of Bends South of Sheaneval** Loads will continue north on the C1022. Loads will oversail both verges through the section and verge reprofiling will be required to enable load oversail. **Third party land** will be required to facilitate the works. Trees and vegetation should be cleared. One passing place sign and pole should be removed. Swept path assessment drawing SPA042 is included in Appendix B.

52	 	**C1022 Series of Bends and Bridge Sheaneval** The previous widening that was created for the original turbine deliveries exists in part. This will now need to be upgraded and extended to accommodate the larger proposed turbines. Permission to be sought to utilise the existing area. Loads will utilise the existing overrun areas and additional **third party land** will be required into the eastern embankment to facilitate further blade oversail. The embankment will need to be regraded subject to detailed design. Trees and vegetation will need to be cleared. All vegetation to be cleared from the 'island' within the existing buildout and a load bearing surface should be laid. Loads will oversail the inside of the left bend when crossing the bridge into **third party land**. One road sign should be removed and the bridge parapet will need to be lowered to allow oversail. Loads should be raised to maximum height settings. Traffic bollards to be removed. Loads will need to oversail the northern verge on exit from the bridge into **third party land** where the verge should be reprofiled and the bridge parapet will need to be lowered. A load bearing surface should be laid in the southern verge. Swept path assessment drawing SPA043 is included in Appendix B.

53		**C1022 South of Gordonbush Lodge** It is recommended that the vertical clearance through this section is assessed during the test run to ensure adequate ground clearance is available. Throughout the route, the tree canopy needs to be trimmed to provide a clear 5m head height. Trimming of the tree canopy can be subject to ecological constraints and it is suggested that early consultation with The Highland Council is undertaken to agree cutting times and permits required. Loads will oversail the eastern and western verges through the section where the proximity to existing trees and embankments should be confirmed through a topographical survey. Swept path assessment drawing SPA044 is included in Appendix B.
54	 	**C1022 Gordonbush Lodge** It is recommended that the swept path assessment is rerun on a topographical base to confirm the extent of mitigation through the section. Loads will oversail both verges into **third party land**. Detailed design of the works is required. Trees and vegetation should be removed and alterations to fencing will be required. Traffic bollards should be removed from all areas and embankment reprofiling will be required. The cattle grid should be assessed to ensure it has suitable load bearing capacity for the proposed loads. Associated fencing and gates should be removed. Swept path assessment drawing SPA04 is included in Appendix B.

55		**C1022 Allt Smeorail Bridge** The bridge has been previously upgraded. Loads should be raised to highest settings for movement across the bridge. Upon selection of the haulier and confirmation of the carriage method, it should be confirmed via a test run that adequate clearances to the bridge parapet are available.
56		**C1022 Series of Bends West of Gordonbush** Evidence of previous works into the northern verge for original deliveries. These works should be made available for the proposed deliveries. Loads will oversail the northern and southern verges through the bends. Embankment reprofiling will be required to allow oversail and vegetation should be cleared. **Third party land** will be required to the north and south of the road. A revised assessment on a topographical base is recommended The tree canopy should be cut back and all traffic bollards and traffic signs should be removed. Swept path assessment drawing SPA046 is included in Appendix B.
57		**C1022 Series of Bends North of Loch Brora** Loads will oversail the northern and southern verges into **third party land**. Vegetation and trees should be cleared and verge reprofiling will be required subject to detailed design. Swept path assessment drawing SPA047 is included in Appendix B.

58	 	**C1022 Series of Bends South of Ascoilebeg** Loads will oversail both verges when travelling north through the section. One tree should be removed and the verge reprofiled to allow oversail. **Third party land** required. The tree canopy on the inside of the left bend should be trimmed. Swept path assessment drawing SPA048 is included in Appendix B.
59		**C1022 Left Bend Ascoilebeg** Loads will oversail into **third party land** on both the inside and outside of the bend where vegetation should be cleared and one road sign should be removed. Swept path assessment drawing SPA049 is included in Appendix B.
60	 	**C1022 SSE Gordonbush Site Entrance** The existing site entrance should be upgraded to meet manufacturer standards.

Swept Path Assessments

3.19 The detailed swept path drawings for the locations noted in Tables 3.1, 3.2, 3.3 & 3.4 are provided in Appendix B for review.

3.20 The drawings in Appendix B illustrate tracking undertaken for the worst case loads including the blade and tower section along the route. The drawings are for information only and should not be scaled from. The colours provided on the swept paths are:

- Green – vehicle/trailer outline (body swept path);
- Red – wheel tracked pathway (wheel swept path); and
- Purple – load over-sail tracked path (load swept path).

3.21 Where mitigation works are required, the locations are illustrated on the swept path drawings. Please note that any alterations to the specified load or vehicle details will invalidate the assessment results.

3.22 It is important to note that the swept path assessments undertaken for all points from the ports of Invergordon and Nigg to site have been based on OS data.

3.23 The drawings illustrate the street furniture modifications required to enable transit. The exact individual location of all street furniture in the vicinity of the POIs is not shown as these cannot be accurately plotted on the OS data without recourse to the various road authorities. Please note that WYG cannot accept any liability for errors on the data source.

3.24 It is a requirement by the turbine supply firms that a trial run be undertaken to further proof the route and test proposed traffic management measures.

Land Ownership and Utilities

3.25 The limits of road adoption can vary depending upon the location of the site and the history of the adopting agency. In general, the adopted area is that contained within a defined boundary where the local authority or Transport Scotland holds the maintenance rights for the land from the original land owner. In urban areas, this is usually defined as the area from the edge of the footway across the road to the opposing footway back edge.

3.26 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 / hedges lines or a maximum 2m from the road edge. This can vary between areas and every location can be different.

3.27 The road north of Lairg requires widening and an engineering review of the land implications of this should be reviewed prior to land deals being finalised.

Route Overview

3.28 The route for the proposed components identifies a number of areas of **third party land** requirements. These should be reviewed and confirmed by the developer and any necessary land rights obtained.

3.29 SSE guidelines set the minimum road width for all section of track as being a minimum for 4.5m in width. Where sections of public road fall below this standard, indicative road widening areas have been illustrated for the purposes of the swept path assessments.

3.30 WYG are unable to vary the turbine manufacturer minimum road guidelines as published and as such have assessed the route in strict accordance with these standards. SSE however may wish to undertake a cost / risk benefit review of the section of public road (C1098 & C1022) west of Brora.

3.31 Topographical survey of the C1098 and C1022 has been suggested to confirm the extent of mitigation required. It is recommended that these are completed, and the swept path assessments repeated to confirm mitigation requirements once the final turbine selection has been completed.

3.32 Access from the Port of Nigg has been considered. The access arrangements associated with Invergordon are considered more appropriate and access from Invergordon is recommended.

General Comments

3.33 WYG has undertaken a review of the potential access route from Invergordon docks through to the proposed site access. WYG would strongly suggest that a review of the following is undertaken prior to the delivery of the abnormal loads, to ensure load and road user safety:

- A review of maximum 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 (maximum height of the loads is expected to be no greater than 4.9m with the exception of any specialist towers). The chosen haulier is recommended to ensure with utility providers that there is sufficient clearance with an appropriate safety factor (especially with respect to power lines);
- That any vegetation which may foul the loads is trimmed back to allow passage (this is of concern once the load is on the local road network and should be assessed for summer conditions);
- That there are no roadworks or closures that could affect the passage of the loads. A check with the Transport Scotland and The Highland Council should be made before the transit of the first abnormal load;
- That a test run is completed to further assess the routes for all components and confirm findings of the swept path assessments;
- Vertical assessments are carried out to confirm ground clearance;
- That there are no new or diverted underground services on the access route that are at risk from the abnormal loads; and
- That a condition survey is undertaken to ascertain the extents of any road defects and that this is agreed in advance of any load movements with the roads agencies to protect the client group from unrelated damage claims. This is to be undertaken in conjunction with Transport Scotland and The Highland Council.

ESDAL Review

3.34 WYG has undertaken an ESDAL (Electronic Service Delivery for Abnormal Loads) review for the proposed loads using the Highways Agency website www.esdal.com.

3.35 The review identified the following key contacts for the route option amongst the various transport agencies and road authorities along the proposed route. Table 3.2 summarises the various consultees, with comments received to date attached in Appendix C.

Table 3-2: ESDAL Consultee List

Organisation	Email Address
The Highland Council	abnormal.loads@highland.gov.uk
Police Scotland	OSDAbnormalLoadsScotland@scotland.pnn.police.uk
Transport Scotland	paul.winn@transport.gov.scot
Network Rail LC & Rail over Road	abnormalloadscontact@networkrail.co.uk
Abnormal Loads Jacobs	RSGBRB@jacobs.com
National Grid - Gas Distribution - Utility Company	plantprotection@nationalgrid.com
Scotland Gas Networks (Scotia) – Utility Company	customer@sgn.co.uk

3.36 Responses received to date can be found in Appendix C.

4 ABNORMAL LOADS MANAGEMENT PLAN

Introduction

4.1 This chapter introduces a number of traffic management measures that could help reduce the impact of the abnormal load convoys. These measures are currently presented as indicative and should be confirmed with Transport Scotland and The Highland Council closer to the construction date.

Advance Warning Signage

4.2 Advance warning signs would be installed on the approaches to the affected roads network. Temporary signage advising drivers that abnormal loads will be operating could be erected on the sections of the selected route such as the C1098 and C1022. Signs such as the example shown in Figure 4-1 and 4-2 could be installed to help assist drivers. Flip up panels (shown in grey) can be used to mask over days where convoys would not be operating. Figure 4-2 illustrates a cover panel secured by clips that would alert drivers that no convoys were operating during that week.

Figure 4-1: Indicative Information Sign

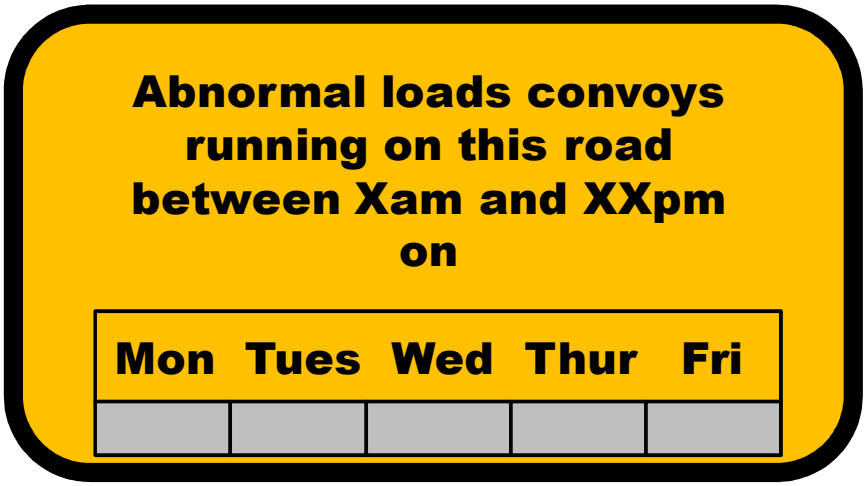
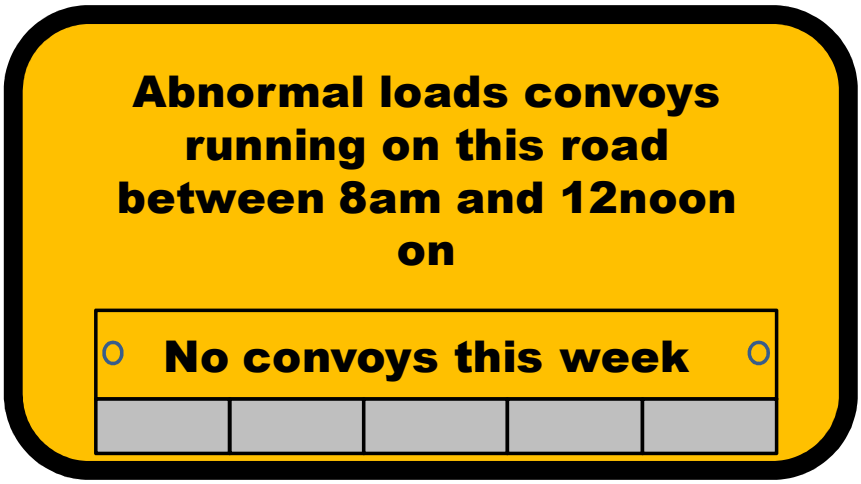


Figure 4-2: Indicative Information Sign



4.3 The purpose of this type of signage is to help improve driver information and allow drivers of oncoming traffic to be aware of the potential for wide loads.

Public Information

4.4 Information on the movement of abnormal load convoys should be provided to local media outlets to help assist the public. Information could be provided to local newspapers and radio stations that relate to expected vehicle movements along the proposed route. It is hoped that this level of information will make residents aware of convoy movements and help reduce any potential conflicts.

4.5 WYG also suggest that SSE may wish to consider producing a local newsletter for distribution to properties along the most affected sections of the proposed access route, advising of convoy movements and the measures put in place to ensure the safe and efficient operation of the road network.

Convoy System

4.6 A police escort will be required to facilitate the delivery of the predicted loads. The police escort would be further supplemented by a civilian pilot car to assist with the escort duty. It is proposed that an advanced 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.

4.7 The abnormal load convoys should be no more than three HGVs long, to permit safe transit along the delivery route and to allow limited overtaking opportunities for following traffic where it is safe to do so.

4.8 The times in which the convoys would travel will need to be agreed with the local constabularies. Typical delivery times for similar projects has seen the early morning periods used in constrained sections, as traffic levels are generally lighter than those found in the afternoon.

4.9 A full convoy operation plan for the route will require to be developed in consultation with Transport Scotland and The Highland Council before deliveries commence to the site.

5 SUMMARY AND FURTHER WORKS

Summary

5.1.1 WYG has been commissioned by SSE to undertake a route review for the delivery of abnormal loads associated with the potential Gordonbush Wind Farm Extension located to the west of Brora, Sutherland.

5.1.2 This report identifies the key points and issues associated with the proposed route from Invergordon Docks through to the site access. An assessment of loads exiting the Port of Nigg has been included to provide flexibility of choice for the Port of Entry, however it is not considered to be an optimum access solution.

5.1.3 The route to site is presented for consideration by SSE. The key section is the road network from Brora to the site. Subject to land reviews, provision of the physical works and the results of the weight checks, the route is considered feasible for turbine delivery.

Initial Considerations and Further Work

5.1.4 From this review, WYG would suggest any mitigation works are designed to be permanent to ensure that future wind farm maintenance can be undertaken without the need to re-open land and access rights on site.

5.1.5 The following work is recommended to SSE for consideration in relation to the proposed access route:

- Detailed design review of the proposed mitigation works;
- Completion of topographical surveys at identified locations and rerun swept path assessments;
- Review of land options; and
- Traffic Management Plan - a detailed Traffic Management Plan (TMP) will be essential for this project given the level of constraint in a number of areas.