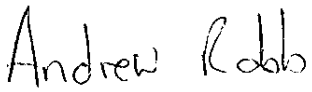
Caithness Internal Transport Connectivity Study

Final Report

Prepared by:  .....
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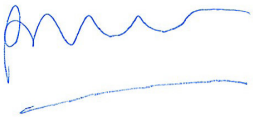
Checked by:  .....
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Caithness Internal Transport Connectivity Study

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Executive Summary

Executive Summary

The study was commissioned by HITRANS and The Highland Council to examine the constraints that the internal transport infrastructure within Caithness is placing on growth in the developing economy of Caithness and the Orkney Isles. The objectives of the study were:

- Identify specific constraints;
- Assess the impact of these transport constraints on the development of the marine and offshore renewables industries including grid infrastructure and also decommissioning at Dounreay;
- Provide costed solutions where applicable; and
- A prioritised action list of possible interventions.

The overall aim of the project is to identify the constraints in order to help maximise the area's attractiveness for renewable-related development and maximise opportunities for growth.

At the outset of the study there was an assumption from many stakeholders that the internal roads network represented a potential constraint on economic development in Caithness.

The study approach focussed on a process of site visits, consultation with infrastructure managers and engineering companies and a forecast of future demands of the renewables sector. It also included a desk-top assessment of route capabilities (based on The Highland Council's database of abnormal load movements) and swept path analysis within the town centres of Wick and Thurso.

The key study findings are that the principal limitations to the movement of loads in Caithness are imposed by the physical layout of the roads and buildings in the town centre of Thurso, and to a lesser extent some route options in Wick. However, when the forecast future demands of the marine renewables sector are considered, it is found that these physical limitations would not place a constraint on the movement of components around the County.

In order to secure maximum benefit for Caithness, and to minimise future adverse amenity impacts, the attention needs to be placed on:

- Public and private sector working together to facilitate the development and expansion of the area's principal ports at Scrabster and Wick, recognising that this growth will be principally developer led and funded.
- Allocation of industrial land in the forthcoming Development Plan in the immediate vicinity of the area's ports, and to the West of Thurso town centre.
- Introduction of a Strategic Infrastructure Funding Process, that can help bring these potential sites to the market earlier than might be possible if they were entirely developer led and funded.
- Ensuring that the external transport issues on the A9 are progressed, as well as seeking to improve the level of service offered by internal air connections to Caithness at Wick Airport, where led by customer demand.

Introduction and Background

1 Introduction and Background

1.1 The Commission

AECOM has been commissioned by HITRANS and The Highland Council to undertake a study to examine the constraints that the internal transport infrastructure within Caithness is placing on growth in the developing economy of Caithness and the Orkney Isles. The study was commissioned to allow Caithness to be in the best possible place to make the most of the expected growth in the emerging marine renewables industry. The objectives of the study are to:

- Identify specific constraints;
- Assess the impact of these transport constraints on the development of the marine and offshore renewables industries including grid infrastructure and also decommissioning at Dounreay;
- Provide costed solutions where applicable; and
- Develop a prioritised action list of possible interventions.

The overall aim of the project is to identify the constraints in order to help maximise the area's attractiveness for renewable-related development and maximise opportunities for growth.

This work supports the 'Caithness Transport Vision', a document prepared by the Caithness Transport Forum which sets out the key transport objectives for the Caithness area.

1.2 Study Approach

The study has been undertaken using available published information, stakeholder consultation, site visits, along with input from specialist renewables sub-consultant BVG Associates.

Figure 1.1 illustrates the steps undertaken in the study. Initially, desktop analysis was undertaken of available information on key routes, specific sites of interest, along with interrogation of The Highland Council's abnormal loadings database.

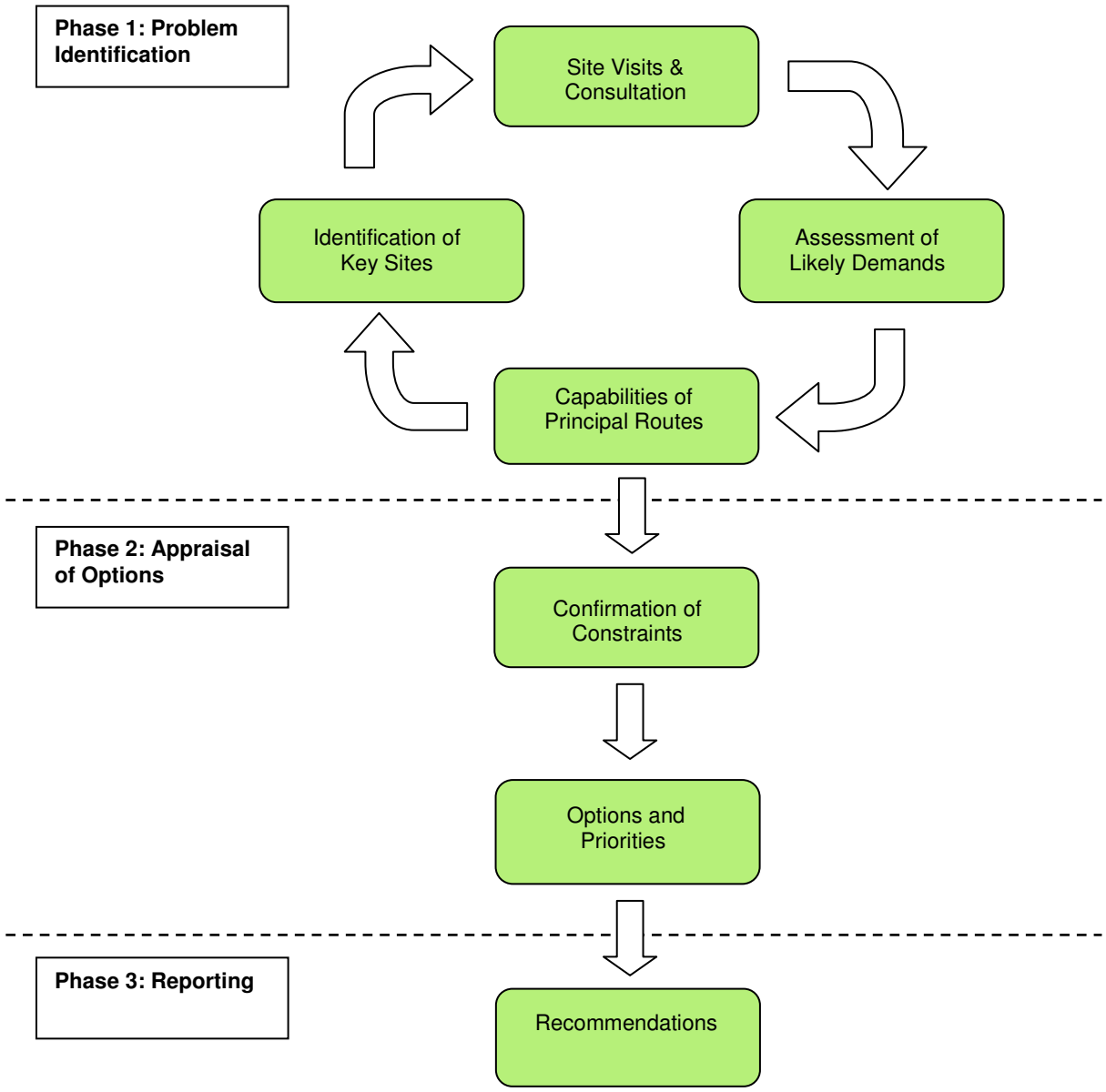
Thereafter, consultation was undertaken by way of a group workshop in Caithness, face to face discussions with local authority roads officers, and telephone discussion with ports, hauliers and other stakeholders. Finally, questionnaire surveys with key engineering companies in the area were also undertaken.

BVG Associates provided detailed information on the likely interaction of the marine renewables industry on the Caithness transport network during construction and operations/maintenance phases. They also provided details of anticipated component sizes and weights which could be expected to be transported on the local road network.

During the analysis stage of the study, we considered the specific locations or relevance to the study (ports / engineering companies / rail hubs / manufacturing sites) and the network of key connecting routes. We then studied the actual constraints on these routes, and their weight/height/width/length capacities (as extracted from The Highland Council's abnormal loadings database) This enabled us to pin point where the constraints would be, relative to the likely demands from the renewables industry. The study then considered the possible mitigation options, and their costs. Options were then prioritised.

The reporting stage drew all elements of the study together, to present a coherent range of recommendations to take forward the objectives of the study.

Figure 1.1 – Study Approach



1.3 The Study Area

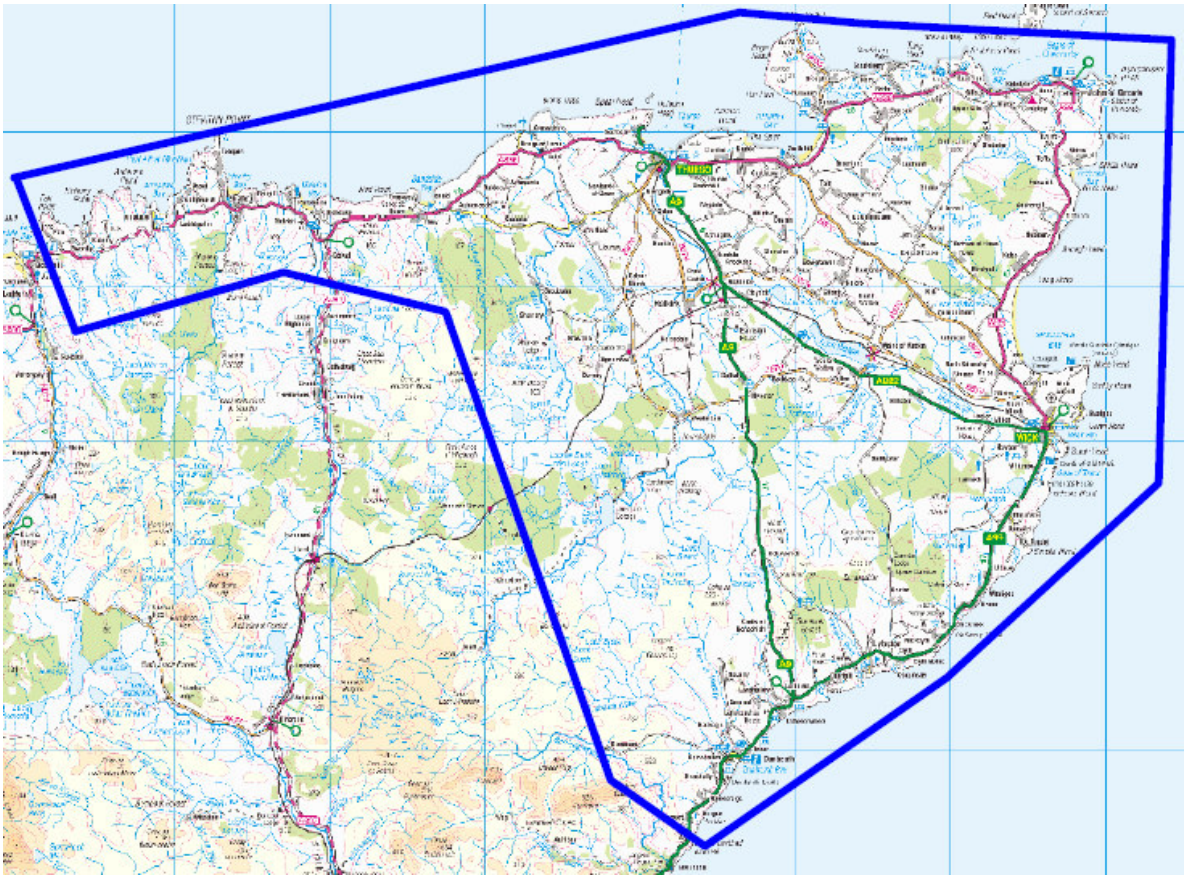
1.3.1 Study Area

Situated in the north-east corner of northern Scotland, Caithness is one of the most remotely populated areas in the UK. Unlike other areas of the Highlands, the topography of Caithness is relatively flat. The area is bordered by the Pentland Firth to the north, the North Sea to the east, and Sutherland to the south and west.

The two main settlements in the area, Wick and Thurso (population of around 8,000 each) together comprise a large proportion of Caithness' total population of around 25,000.

For this commission, the study area extends from Bettyhill (in Sutherland) along the coast to Gills Bay/John O'Groats, and south to Dunbeath. The areas incorporated by the study therefore includes Dounreay, Scrabster, Thurso, Halkirk, Georgemas Junction, Wick and Wester. It is noted that Berriedale Braes does not form part of the study area.

Figure 1.2 – Study Area



1.3.2 Socio-Economic Profile

The socio-economic profile of the area is dominated by the role of the Dounreay nuclear plant, the emerging renewables industry, alongside traditional farming, tourism and fishing.

The commissioning of Dounreay led to an increase in the number of skilled labourers in the region, and an increase in the population of Caithness. The significance of Dounreay on the local economy has been previously estimated as supporting around a third of all jobs in the Caithness area. However, going forward, the area will face challenges as operations at Dounreay progress through the decommissioning process.

The key opportunity moving forward is that presented by the renewables industry, potentially as operations and maintenance hubs, logistics terminals, as well as onshore and offshore construction.

1.3.3 Transport Links

Caithness is heavily dependent on the A9 trunk road, which is the principal link between the area and Inverness, and the rest of Scotland. It also provides the key link through to Orkney, with the main ferries departing from the north Caithness Coast at Scrabster and Gills Bay. The road is a standard All Purpose Trunk, and travellers frequently suffer delays behind slower moving vehicles. There are few overtaking opportunities, and in places there are sub-standard vertical and horizontal alignments.

The village of Latheron is located at the junction of the A9 and the A99 road, which provides the main road link through to Wick. From Wick, the A99 continues northwards, before connecting to the A836 west of John O'Groats to Thurso. The A882 provides the most direct link between Wick and Thurso, where it links into the A9 at Georgemas Junction.

The Far North Rail Line extends to Thurso, but overall, passenger services between Caithness and Inverness are limited, and journey times are long. The freight terminal at Georgemas Junction is used for timber and pipe movements, and proposals have been made to develop this for transport of nuclear fuel products.

With regard to air transport, services operate from Wick Airport to both Aberdeen and Edinburgh, providing a quicker and more direct route to these key locations than is possible by road or rail.

1.4 Previous Studies

A number of transport studies have been undertaken in Caithness in recent years. One of the most significant for this study was completed by MVA Consultancy in 2008, and was undertaken with a view to prioritising the future transport requirements of Caithness. Of those measures proposed for prioritisation, the following are considered to have direct relevance to this study[1]:

- Upgraded/expanded facilities at Scrabster and Wick;
- Improvements to the A9;
- Improved freight handling capabilities; and
- Opportunities to improve flight reliability and service level at Wick Airport.

A more recent study for HITRANS, which considered the whole of the HITRANS area, was undertaken with regards to the transport infrastructure requirements of the marine renewable sector in the HITRANS area. (Scott Wilson, 2010)[2]

[1] *Transport for Development* – Caithness Transport Infrastructure Study, 2008
[2] *Renewable Energy Infrastructure Study,* Scott Wilson Ltd*,* May 2010

This study aimed to:

- Assess the transport needs of the marine renewable energy sector (specifically offshore wind) and the constraints imposed by the HITRANS transport network;
- Identify the level of investment required to improve transport links to ports in the HITRANS area; and
- Appraise investment options.

The study identified both Wick and Scrabster Harbours in a list of sites appraised on the basis of their suitability for the assembly of offshore wind equipment and the maintenance of equipment. This highlighted the potential of both Scrabster Harbour and Wick Harbour for future roles in the marine renewable sector, particularly operations and maintenance.

Since the publication of the above studies, it is now considered that sufficient knowledge exists on the external transport constraints on the area. However, with significant potential arising from the renewables sector, there is a need to specifically assess the impact of internal infrastructure constraints within Caithness itself.

1.5 Some Key Assumptions

In preparing the figures, data and discussion of this report the following underlying assumptions have been made:

- It has been assumed that the study's timeframe is for activity between 2011 and 2020.
- The Pentland Firth and Orkney waters (PF&OW) leasing round for marine energy projects has been taken as the sole source of demand for devices up to 2020. For simplicity and to remove subjectivity it is assumed that all PF&OW projects are built according to agreed leasing milestones to achieve 100% of lease capacity by 2020.
- It is noted that other testing and demonstration scale projects are likely in this timeframe but that these are insignificant in terms of overall activity in comparison with the PF&OW projects. Ignoring these projects also acts to reduce the optimistic bias of assuming 100% build-out of the PF&OW projects by 2020.
- No specific structural assessments have been undertaken as part of the study, which has principally been based on developing forecasts of future demand, and comparing to route capacities as revealed by records of abnormal loads maintained by The Highland Council.

1.6 Structure of Report

The remainder of this report is structured as follows:

- Chapter 2 – The Renewables Opportunity for Caithness;
- Chapter 3 – Overview of Principal Sites;
- Chapter 4 – Key Routes and their Capabilities;
- Chapter 5 – Future Anticipated Load Demands;
- Chapter 6 – Constraints and Mitigation Options; and
- Chapter 7 – Recommendations.

This report is also supported by a series of appendices as follows:

- Appendix A – Pentland Firth and Orkney Waters Round 1 Development Sites (Sourced from The Crown Estate);
- Appendix B – Existing and Potential Development Sites;
- Appendix C – Principal Routes and their Capabilities;
- Appendix D – Swept Path Diagrams for Thurso and Wick Town Centres
- Appendix E – Proposed Interventions
- Appendix F – Approved Route of Thurso Bypass / Development Road

The Renewables Opportunity for Caithness

2 The Renewables Opportunity for Caithness

2.1 Introduction

This chapter provides an assessment of the developing marine renewables industry, and how this emerging industry might impact upon Caithness's internal transport network. The industry is still at a relatively early stage in its development, and no full-scale, commercial implementation has yet occurred. Accordingly, there remains uncertainty as to how the industry will develop locally. However, sufficient information is available that enables some key assumptions to be developed and presented. These feed into later stages of the study, when the potential transport demands generated by the renewables industry are compared to the capacity of the local network, and hence specific constraints identified.

2.2 The Policy

2.2.1 National Policy Approach

In July 2011, The Scottish Government published its 2020 Routemap for Renewable Energy in Scotland[3]. Within this it made the following commitments:

- 100% electricity demand equivalent from renewables by 2020; and
- New target of at least 30% overall energy demand from renewables by 2020.

The expectation is that at least 30% of all energy demand (heat and transport as well as electricity) will be met by renewables by 2020. This will take Scotland to twice the UK's share of the European target[4], highlighting Scotland's leadership in Europe on renewable energy. The targets have been established to reduce greenhouse gas emissions, and realise the multi-billion pound economic investment that could arise from Scotland's comparative advantage in natural resources. Offshore wind, wave and tidal energy in Scotland's seas has a key role to play in delivering a large share of renewable energy generation in Scotland. As a result, the Scottish Government supports the sustainable development of offshore energy in its territorial waters.

The National Renewables Infrastructure Plan Part 2 (NRIP 2)[5] highlights the importance of timely investment in infrastructure to secure the benefits of renewables industry; "*key to government decision making, and any support to port owners, is recognition that to secure industry use sites will need to be ready by 2013/14 and earlier for some users. 2014/15 is currently seen to be the key year in which installation will begin for Round 3 and Scottish Territorial Water sites. Funding decisions by Government triggered by site owners' business cases will recognise the importance of ensuring investment is made early enough to secure users.*"

The NRIP 2 defines a number of aspects of Enabling Investment: *this is investment in a range of basic elements of the site to make them fit for use by the offshore wind industry.* Aspects relevant to this report include:

- **Quayside Infrastructure** Including creation, renewal and strengthening of quaysides for load out of equipment. This is required in sites to enable both a construction / installation use and to support load out from manufacturing locations which are not used for direct installation. The weight bearing

[3] *2020 Routemap for Renewable Energy in Scotland,* Scottish Government, July 2011
[4] European target is to produce 20% of energy from renewable targets by 2020 (*20 20 by 2020, European Climate Change Opportunities, COM, 2008)*. The UK Share of the European Target has been set at 15% *(2009 European Renewable Energy Directive)*.
[5] *National Renewables Infrastructure Plan Stage 2,* Report from Scottish Enterprise and Highlands and Islands Enterprise, July 2010.

requirements and quantum of quayside required will depend on the use and assumptions of potential uses that have been made for each site.

- **Improving Water Depth at Quayside(s)** Locations may require dredging to ensure that vessels are able to load up from the quayside.
- **Site Access** Some sites require internal access to be improved / created to enable movement within the site. In addition there is a need to ensure that those components that cannot be moved to a particular site by sea can be done so by land.

The NRIP 2 notes that for manufacturing supply chain companies (turbines, towers, jackets, blades, cables), practical locations that have modern fit for purpose quayside and load out capacity are at a premium in the UK and a finite resource around the North Sea. The Plan notes that investment by Scottish port owners, with support from the public sector where appropriate, will expand the range of potential locations.

2.2.2 Local Policy Approach

With regard to the future economic potential of Caithness, the ability to move products between a number of key existing and potential development sites including the grid infrastructure network, local fabrication sites and internal transport hubs is essential.

The Highland Council is currently taking forward the **North Highland Onshore Visioning,** which is supported by an Action Plan setting out key pieces of work to facilitate the delivery of on-shore development for the marine renewables industry in this area of the Highlands. In partnership with the Council, Highlands and Islands Enterprise and Scottish Government, the Prince's Foundation for the Built Environment (PFBE) has undertaken work to inform the Action Plan. This work has helped to shape the key themes and locations which could take advantage of the renewable energy opportunities afforded by the Caithness area.

Actions within the Plan where **transport** will have a key role are:

- Action 2 – Call for Sites: for sites capable of supporting the development of marine renewables;
- Action 5 – Siting and Design Guidance;
- Action 6 – Masterplan for Scrabster / Thurso West; and
- Action 7 – Masterplan for Wick Harbour and Lower Pulteneytown.

Furthermore, there are a number of current issues and developments which have direct relevance to this study. These include:

- Plans for transferring spent nuclear fuels from Dounreay to Sellafield by rail; and
- Opportunities for new road infrastructure in Thurso.

2.3 The Scale of the Potential Benefit

Recent reports have pointed towards the potential scale of benefit for Scotland that arises from the renewables energy industry.

2.3.1 Economic Recovery Plan

The Scottish Government's "Scottish Economic Recovery Plan" (March 2010), notes that "*Scotland's primary new economic opportunity lies in the development of a low carbon economy*". It continues to confirm that "*Offshore wind is the biggest near-to-market opportunity in Scotland's low carbon economy.*" and that the

Scottish Government will "*detail the steps to create tens of thousands of new Scottish jobs and over £20 billion of investment by 2020.*"

2.3.2 Scottish Offshore Energy – Creating an Industry

In August 2010, Scottish Renewables and IPA published research "Scottish Offshore Wind: Creating an Industry". Outlining four potential scenarios for Scotland, it outlined how the range of jobs created could vary between just over 28,000 by 2020, to as little as just below 1,000. Critical to realising the success was the extent to which the manufacturing, installation and servicing opportunities are provided within Scotland, or provided by imports from elsewhere in Europe.

In considering the range of barriers to industry, the report found a number of key messages from industry. In terms of manufacturing and supply:

- Encouraging and facilitating coordination between Research & Development and industry (including on- and offshore test and demonstration sites);
- Developing suitable manufacturing sites for tier 1 manufacturers and creating technology hubs;
- Strengthening supply chain coordination; and
- Developing port facilities (as investigated under the NRIP).

2.4 Marine Renewables Sites Adjacent to Caithness

A number of both wave and tidal development sites have been established in the waters of the Pentland Firth. Eleven projects were identified in the Crown Estate's first leasing round, with a total potential capacity of up to 1,600MW. Whilst official statements confirm that the entire capacity should be installed and operating by 2020, others anticipate that this is perhaps an optimistic timescale. Appendix A is sourced from The Crown Estate, and shows the key sites of interest for this study.

A review of information that is currently available from the developers suggests that a range of different technologies will be used. Details for the five sites closest to Caithness are highlighted below.

Table 2.1 – Caithness Area Sites

Site Name	Capacity MW	Tenant Name	Technology
Farr Point (Wave)	50MW	Ocean Power Delivery Ltd	Pelamis
Inner Sound (Tidal)	400MW	MeyGen Ltd	Atlantis (AK1000) Tidal Generation Limited (TGL – 1MW)
Ness of Duncansby	100MW	ScottishPower Renewables UK Ltd	Hammerfest Strom (HS1000)
Brough Ness	100MW	Marine Current Turbines Ltd	SeaGen
Cantick Head	200MW	Cantick Head Tidal Development Ltd	Open Centre Turbine

Overall, with a typical marine turbine providing about 1MW of installed capacity, the requirement for 1600 devices to be manufactured, installed, and then maintained and operated close to the Caithness shoreline clearly demonstrates the potential to the local economy, provided that it positions itself now to take advantage.

The Pentland Firth and Orkney waters projects are likely to be defining landmarks in the sector's transition from one of potential to one of significance in the UK energy mix. Figure 2.1 indicates the number of wave and tidal devices that will be deployed in order to achieve the 1.6GW target by 2020. Given the spread of project locations and overall port capacity in the area only a proportion of the devices would be deployed from Caithness. Determining the exact number of relevant devices would require addition investigation and assessment.

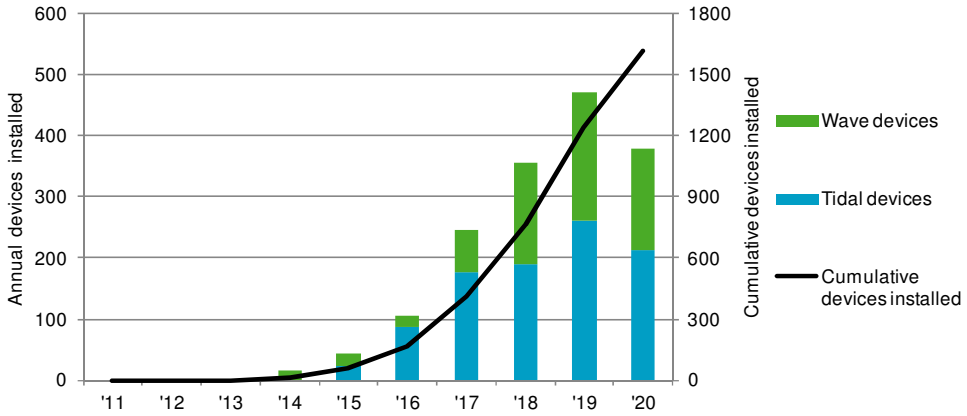


Figure 2.1 – Potential Total Annual Device Deployment Rate for Pentland Firth and Orkney Water Projects[6]

Figure 2.2 indicates the number of wave and tidal devices that could be returned to shore for servicing annually from 2011 to 2030. These devices returned to shore will go to their nearest Operations and Maintenance base, a port located either in Caithness or the Orkney Islands. In some cases the devices will be returned to shore and require the onward transportation of components by road to other facilities.

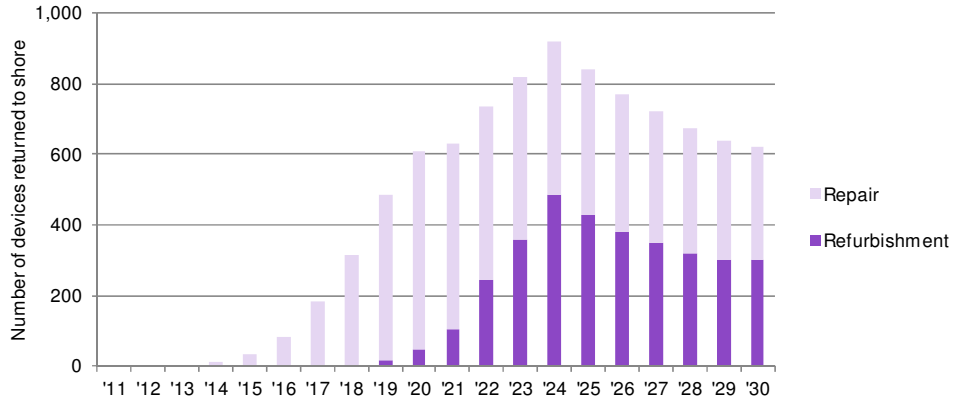


Figure 2.2: Potential Annual Device Numbers Returned to Shore During Operation for Pentland Firth and Orkney Waters projects

[6] *Wave and tidal energy in the Pentland Firth and Orkney waters: How the projects could be built*, The Crown Estate, 2011

2.5 Other Associated Opportunities

This section considers some additional economic opportunities for the Caithness area, in addition to those provided by the marine renewables industry. In some instances, these opportunities are complementary activities, but others may compete for available resources and port capacity.

- Onshore Wind

Onshore wind is now well-established within Caithness, with the most significant and operational sites at Forss, Achairn, and Causeymire. Construction is ongoing at Camster and Stroupster. Turbine blades, nacelles and tower sections have been successfully transported through the area's ports at Wick and Scrabster, and transferred on the local road network to each specific construction site. This element of renewables activity is currently active.

- Offshore Wind

The most significant site adjacent to Caithness is that being prepared for the outer Moray Firth, located adjacent to the Beatrice Oil Platform, where two offshore turbines are currently operational. There is potential for harbours such as Wick to be used as an operational base for this development, which could see up to 300 wind turbines installed around 22km from the Caithness Shore line. With construction anticipated to commence in 2015, it is possible that this could coincide with early phases of construction for marine and tidal devices.

- West of Shetland Oil and Gas

Ports in Caithness provide the nearest suitable Mainland UK port for these new Oil and Gas fields which are being exploited to the West of Shetland. Whilst it is recognised that established off-shore energy ports at Aberdeen and Peterhead will remain a core asset for this sector, there is significant potential (given their locational advantage) for expansion of oil and gas port activity at Scrabster and Wick. This activity will most likely compete with renewables activity.

- Biomass

Local company New Park Ltd have received start up funding to develop a business case and funding package for a biomass plant, proposed to be located adjacent to Georgemas Junction rail station / freight yard. This would utilise local timber arriving by road and rail, as well as imported timber, most likely imported via Scrabster.

- Electrical Grid Strengthening

A consequence of the development of local wind farm development, local marine renewable energy projects, as well as power lines importing electricity from Orkney and Shetland, is a requirement for strengthening of the power supply grid through Caithness. This includes local sub-station upgrades at Cannisbay, Thurso, Achvarashal, a Converter Station at Mybster, and replacement sub-station at Dounreay. Complementary to sub-station upgrades are electricity line reinforcements which are again planned along existing power line corridors within Caithness (A897 and A9).

- Timber Extraction

A significant proportion of timber is now due for harvesting to the west of Caithness and there is considerable constraint on haulage options, due to weak roads surrounding the forests adjacent to the plantations. Options include using rail freight line side loading, transport by sea, as well as utilising internal forestry and wind farm tracks. This activity will give rise to increased activity at Georgemas Junction

(probably marshalling / storage of timber rail wagons), increased timber wagons on the principal road routes within and to/from Caithness, and potentially timber shipment from Scrabster and Wick Harbours.

- Nuclear Decommissioning

Plans have recently been confirmed for the movement of nuclear flasks containing spent fuel between Dounreay and Sellafield utilising a new rail freight loading facility at Georgemas Junction. The material will first be required to travel by road between Dounreay and Georgemas via Thurso, and thereafter loaded onto special trains operated by Direct Rail Services (DRS). Whilst the movements are anticipated to have a frequency of about once a month, it has been indicated that the service could also enable the transport of other multi-modal shipping containers to Caithness at the same time.

As well as the transport of spent fuel from Dounreay, the decommissioning of the site is leading to movement and removal of large elements of materials from the site, as well as the construction of a low level waste store on site. In addition, over the course of three to four years, more than 150 tonnes of intermediate level waste is also to leave Dounreay going to a storage site in Belgium, most probably shipped via Scrabster.

- Oil and Gas Decommissioning

The final issue that has some impact on the study is the requirement for the North Sea oil and gas industry to commence decommissioning of redundant platforms over the next 10 to 20 years. Again, this activity coincides with the developing renewables industry, and could create pressures at local ports, and nearby fabrication yards. However, due to the size of components, it is most likely that decommissioned elements would be transported by sea and not the local road network.

2.6 Summary

This chapter has highlighted the significant opportunity that arises for Caithness, owing to the adjacent activity that is occurring due to the marine renewable energy sector.

However, it has also highlighted a number of other important developments for the local economy, which highlight the need for early and pro-active planning for the resource available in Caithness.

Overview of Principal Sites

3 Overview of Principal Sites

3.1 Introduction

This chapter provides an overview of the principal sites of interest to the Caithness Internal Transport Connectivity Study.

It is recognised that the area's ports will perform the role of key hubs for the future economic opportunities available to Caithness, and form a particular focus for the study. Principally these are Wick and Scrabster, alongside the currently smaller and less developed Gills Bay facility.

Complementing these ports is the area's rail freight facility at Georgemas Junction. This is currently used for steel pipe transport for the offshore oil and gas sector. With a future requirement for a regular and predictable supply of spares and consumables for the renewable devices, rail may have increased importance in the future. However, this mode would not be suitable for larger components or "just-in-time" deliveries. Possible future development opportunities are also available adjacent to Wick Railway Station.

With the ports providing key nodes of activity, the core benefits to Caithness will arise from ensuring that the principal engineering sites in the County can be readily connected to these hubs. These include existing sites (principally at Janetstown, Halkirk, Bower, Castletown, Dunbeath and Lybster), as well as future potential development sites.

It is noted Wick Airport is a key transport hub for the area, but as the focus is placed on internal connections, and the movement of goods rather than people, the study does not consider this element.

Each specific site is highlighted in the plan included in Appendix B, and an overview of the key characteristics of each site are detailed below.

3.2 Ports and Harbours

3.2.1 Wick Harbour

- Location – Wick Harbour occupies a strategic location within Caithness, and is located around 15 miles from the Pentland Firth. It is well positioned for off-shore wind farm development. It is principally situated to the south of the River Wick and immediately adjacent to the town centre. Quays extend to the north side of the River.
- Ownership – Wick Harbour is owned and managed by Wick Harbour Authority.
- Key Capabilities – The harbour has the capability to handle renewable sector related traffic, including 45m long wind turbine blades, towers and nacelles. The port is used for the import of towheads for the nearby Wester sites, of 300T (27m long, 6m wide and 10m high).[7] The next arrival of on-shore wind farm equipment at the port is expected in 2012. The total quay length is 1,366m, with an operational area of 24,400 sqm.
- Access Arrangements – Principal road access to the site is via the A99 Cliff Road / B9159 River Street Junction. A secondary access is provided to the north of the harbour for the Heavy Lift Quay. For normal traffic this would be via the Wick Harbour Service Bridge. An alternative route via Scalesburn is utilised for all heavy lift equipment such as Towheads.
- Future Plans / Opportunities – Wick Harbour is currently finalising feasibility studies which could see growth and expansion of the harbour, both to the north and south of the River Wick. These studies are due to be shortly completed, and will set out alternative options for the harbour to take full advantage of forthcoming energy related opportunities within Caithness. During consultations, Wick Harbour have confirmed developer interest in these proposals, as well as areas of development land within the harbour, and adjacent to it. These emerging plans are still under preparation.

Photo 3.1 – Wick Harbour

Photo 3.2 – Heavy Lift Quay, Wick

[7] Source: Wick Harbour Authority (www.wickharbour.co.uk)

3.2.2 Scrabster Harbour

- Location – Scrabster Harbour is located two miles west of Thurso town centre, on the north Caithness Coast.
- Ownership – The Port is owned and operated by Scrabster Harbour Trust.
- Key Capabilities – The Port provides several key functions, and plays a key role in the economy of Caithness. It is the principal Mainland Port of the NorthLink service to Orkney (Stromness), and regularly accommodates cruise ships. In the coming years, the current level of traffic at Scrabster will remain as the forthcoming re-tender for the NorthLink ferry service will continue to operate the service out of Scrabster to Stromness in Orkney. It is one of the top four landing ports in the UK for fishing, including pelagic, whitefish and shellfish. The port is ideally situated for exploiting its location close to West of Shetland oil fields. It is currently undertaking improvements to the central quay to improve the ports heavy lift capability, and provide increased capability for the renewable energy sector.
- Access arrangements – The Port is accessed directly from the A9 Trunk Road, which terminates at the port entrance. The main route descends from the A9/A836 junction to the west of Thurso, and is bordered by the cliff face that forms the bay in which the harbour is located within.
- Future Plans / Opportunities – Current work on the central quay forms the first phase of development plans for the Port. A possible second phase of work would involve new Quays within the Deep Water Quay at the Eastern End of the Harbour. It is anticipated that these proposals will be developed in partnership with potential offshore developers. The Port has acquired land adjacent to the Port at Scrabster Farm, and it is envisaged that this (although on top of the surrounding Braes) will provide significant and important added value to the harbour, particularly in terms of future operations and maintenance activities for the energy sector.

Photo 3.3 – Scrabster Harbour

Photo 3.4 – Phase 1 Improvement Works

3.2.3 Gills Bay

- Location – A small harbour is situated at Gills Bay, which is located around four miles west of John O'Groats on the north coast of Caithness.
- Ownership – Gills Harbour Limited, which is a community owned trading facility.
- Key Capabilities – Provides the Mainland Ferry Terminal for Pentland Ferries services to St Margaret's Hope in Orkney. It also provides slipway access, and is regularly used by smaller crafts associated with survey vessels used for the renewable energy sector.
- Access Arrangements – The Harbour is accessed from a junction on the A836 road between John O' Groats and Dunnet. A short council adopted road extends from the junction down to the main harbour and ferry marshalling area.
- Future Plans / Opportunities – The site provides a large "Greenfield" opportunity for development, however, the site would require significant developer investment in both port side and shore side facilities to provide a suitable operations/maintenance base. Nevertheless, due to the anticipated pressures on facilities at Wick and Scrabster, the location may be able to respond to opportunities from displaced activity.

Photo 3.5 – Gills Bay, Approach Road

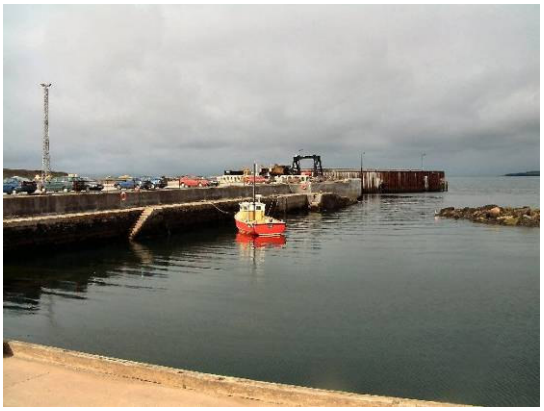


Photo 3.6 – Gills Bay, Quayside

3.2.4 Wester (Subsea 7)

- Location – The site is located on the east Caithness coast, approximately 6 miles north of Wick. It is a pipeline assembly site, and from here significant lengths of pipe are towed out from Wester Beach for use in the oil and gas sector. The linear site extends from Wester inland to Hastigrow on the B876.
- Ownership – The site is in the ownership of Subsea 7.
- Key Capabilities – At their base at Wester, north of Wick, Subsea 7 has launched a range of equipment to the sea (towheads and pipelines). Construction tracks are used to push fabricated pipeline bundles on special bogies, over lengths of around 7km. These tracks extend from Sinclair's Bay to the B876 near Hastigrow, with the McKelvie lifting bridge located at the point where the A99 road crosses the tracks. This bridge, which was opened in 1994, is operated by Subsea 7 and was installed in response to increasing bundle sizes. This is an example of where the road infrastructure has been modified to suit the fabrication work. To date, over sixty pipeline bundles have been launched from the site since its opening in 1978.
- Access Arrangements – Access to the site is provided direct from the A99 at Wester, and direct from the B876 at Hastigrow. There are proven abnormal load routes to Wester, for the towhead manifolds which are hauled from Wick Harbour. Typically, these weight up to 340T, and are up to 6.6m in height, 7.2m in width. Additionally, regular long loads of 27m long steel pipes are transferred from Georgemas Junction to Wester via Wick town centre.
- Future Plans / Opportunities – Discussions with Subsea 7 revealed the potential for the site to be used to assist with the commissioning of certain offshore energy components, particularly those which were designed to have internal buoyancy and be submersible. The commissioning of such equipment at Wester could be facilitated by additional development adjacent to the shoreline. However, planning and development constraints imposed by the coastal environment would have to be overcome.

Photo 3.7 – Wester (Subsea 7)

Photo 3.8 – Tow Head at Wester

3.3 Rail Freight Hubs

3.3.1 Georgemas Junction

- Location – Located on the A9, adjacent to the A9/A882 junction, 6 miles south of Thurso, and 14 miles north-west of Wick. The rail freight facility is adjacent to the passenger station, which is situated at the rail junction for the Thurso branch on the Inverness to Wick Far North Line.
- Ownership and Operation – Land to either side of the rail sidings is understood to be in different private ownership. Simpsons Haulage operate the pipe storage area to the north of the site. Direct Rail Sevices (DRS) are planning to develop a rail terminal to the south of the site to handle spent nuclear product from Dounreay.
- Key Capabilities – An area to the north west of the passenger platforms (to the west of the A9) is currently used by Simpsons Haulage to stockpile 27m long pipes, which are hauled to Georgemas by DB Schenker, and off loaded by mobile crane direct from the “up loop”. An area to the south west of the passenger station (again to the west of the A9) is shown on railway track diagrams as the “Safeway Pad”, previously being used for multi-modal freight services to the far north from Inverness. Two sidings separate from the main line are provided at this location, but neither are in regular operational use for rail freight. The site has previously been in use for timber transport.
- Access Arrangements – Direct access from the A9.
- Future Plans / Opportunities – Alongside the pipe handing operations at the site, it has been confirmed that spent nuclear fuels from Dounreay will shortly be transferred to rail freight at Georgemas, starting in spring 2012. The service will be operated by Direct Rail Services, and there is the possibility for this service (which will run on a monthly basis) to also carry multi-modal container traffic. The site is strategically important for future timber transport, with timber either being loaded at the site, or perhaps used for marshalling and storage of timber wagons used for line side loading at other locations in Caithness/Sutherland. There is also a proposal for the development of a timber pellet biomass plant being developed at the site.

Photo 3.9 – Georgemas Junction

Photo 3.10 – Pipe Storage, North Side

3.3.2 Wick Railway Station

It is noted that there is currently an area of land located to the south of Wick Station which contains railway sidings, which appear to be currently disused. Whilst no rail freight activity has occurred in this location in the recent past, and it is not recognised as a formal active rail freight facility, there may be some future potential for development at this location if there was a strong demand from energy operations and maintenance activity at the adjacent Wick Harbour.

3.4 Existing Engineering Sites

Due to the legacy of the Dounreay site, a number of engineering companies have developed and grown across Caithness in recent decades. Focussing on the larger engineering companies with fabrication and manufacturing capabilities that have been specifically highlighted by stakeholders, below we briefly list relevant details of the key sites used by these companies. Locations are shown in Appendix B.

3.4.1 JGC Engineering, Janetstown, Thurso

JGC Engineering and Technical Services Ltd (http://www.jgc.co.uk/) are located at Janetstown approximately two miles to the south-west of Thurso, accessed via the B874. Land to the front of JGC buildings appears to be currently available for development, forming part of a small but vacant industrial site.

The majority of inward and outward goods handled by JGC are currently transported southbound by road on the A9, with only a small proportion currently transferred through Scrabster Harbour/Wick Airport. On occasion, the company is involved in the transfer of abnormal loads, which are subject to assessment and approval, and undertaken by specialist contractors.

Photo 3.11 – Janetstown (JGC Engineering and Technical Services Ltd)

Regarding future opportunities, it is understood that JGC envisage the movement of large loads from their sites to Scrabster in anticipation of increased marine renewable projects. It is understood that JGC have assisted in the fabrication of an installation cradle for prototype tidal devices during the summer of 2011, with this work being undertaken at Scrabster Harbour.

It is considered that JGC are one company which would have immediate potential for involvement in fabrication / assembly of larger components related to the offshore renewables sector.

3.4.2 JGC Engineering, Harpsdale, Halkirk

JGC operate a second facility in Caithness located some two miles south of Halkirk at Harpsdale, on an unclassified road. Although roads surrounding the site are characterised by relatively narrow access roads (4 to 5m width), these clearly do not restrict movement of goods between the Harpsdale and Janetstown site, nor access to the nearby A9. This facility provides shot-blasting and painting workshops.

3.4.3 *Numax Engineering, Bower*

Numax Group (http://numaxgroup.com/) have a facility at Bower. The site has direct access onto the B876 between Castletown and Wick. Numax also have facilities outwith Caithness at Invergordon. There are no access restrictions relating to access to the site from the B876.

The group is understood to offer fabrication, pipe assembly, and composites services. To date it has provided services to the renewable energy industry for sites in the Pentland and Orkney Waters.

This company is also considered to have immediate potential for involvement in fabrication / assembly activity related to offshore renewables.

Photo 3.12 – Bower (Numax Group Facility)

3.4.4 *NorFrost (Icetech Freezers) Castletown*

NorFrost (http://www.norfrost.co.uk/) have a facility in Caithness located on the A836 at Castletown, between Thurso and John O'Groats. Access from the manufacturing site onto the A836 is not suited to abnormal load movements.

Whilst their focus is currently placed on the manufacturing of chest freezers for the UK and European markets, it is conceivable that in the future some small scale engineering / servicing work could be undertaken at this location for the renewables industry, if the company wished to diversify into such activity.

3.4.5 *Dunbeath Engineering*

Dunbeath Engineering (http://www.dunbeathengineering.com/) have workshops located directly off the A9 at Dunbeath. Their facility is connected to the trunk road by a side road which would be unsuitable for loads greater than 4m in width.

Information on the company website confirms that the company provide precision engineering of components, rather than large scale fabrication.

Photo 3.13 – Dunbeath Engineering

3.4.6 Gows, Lybster

Gows of Lybster (http://www.gowslybster.co.uk/) is located to the east of the A99 at Lybster. The site is accessed from relatively narrow unclassified side roads.

The company provide mechanical engineering and small scale fabrication services to the nuclear, renewable and oil and gas sectors, as well as general engineering services.

Information on the company website confirms that the company typically are involved with small to medium scale manufacturing and fabrication works.

3.5 Possible Future Engineering Sites

The potential changes in economic activity in Caithness may lead to the demand for the development of new manufacturing / engineering sites. The opportunity for this is currently being drawn up as part of the new development plan process. Consultation with stakeholders have identified a number of possible sites which could in the future host engineering / manufacturing sites of relevance to the renewable energy sector.

3.5.1 Dounreay

Photo 3.14 – Dounreay

Photo 3.15 – Aerial View of Site

Dounreay is currently the base for significant work on nuclear decommissioning. There are also plans for long term storage of waste at the site. Given the nature of the site, it is feasible that in the future areas of the land could be used for the renewable energy industry, potentially for storage or workshops for operations / maintenance phases of work. The site is attractive as there is a proven route for abnormal loads between the site and Scrabster which avoids the constraints associated with Thurso town centre. The main constraint associated with the site is the timescale for site availability, as land may not be available for re-development within the next 5 years.

3.5.2 Scrabster Farm

Scrabster Harbour Trust have plans to develop the current Scrabster Farm site as an extension of the operational area of the Harbour. This presents an ideal opportunity to develop a range of uses (storage, workshops, re-distribution of current activity at quay side). However, due to the change in elevation between the Farm site, and the quayside, it will be important to ensure that there are suitable access arrangements from both the Scrabster Braes, and also from the A9/A836. This site could be available in the short term.

3.5.3 Sites to West of Thurso

The current Local Plan identifies a Thurso Western Expansion Framework plan, identifying both the route of new Western Distributor, as well as associated land for industrial development and possible future housing phases. There is potential for further industrial development to be focussed along this route, which could

potentially enable the long term realisation of the Western Distributor Route / Thurso Bypass. These sites could be available in the short to medium term, perhaps to accommodate growth beyond that at Scrabster Farm.

3.5.4 Sites to North and South of Wick Harbour

Wick Harbour Authority are currently considering opportunities for harbour expansion both north and south of the existing site. Five small individual sites are currently available for development in the short term within the harbour, and along the south side of Wick Bay, which have been identified in literature produced by Wick Harbour[8] . However, they are limited in size, ranging from 0.17 ha to 0.56 ha. A sixth site is also available for development (1.5ha) and is adjacent to land held by Wick Habour Authority, but owned by Highland Council.

It is understood that the harbour expansion feasibility plans which are currently being worked up by the Harbour Authority could facilitate additional development sites to the north and south of the harbour, beyond those currently identified. Given significant investment in Harbour Works (particularly breakwaters and quays), it is possible to envisage a future demand for industrial type uses to the north of the harbour, alongside the River Wick, to the East and West of existing Heavy Lift Quay. This in turn could point towards a requirement for new development access from the North of the Harbour through to the existing Tesco site. An alternative option for securing access to such sites could be achieved by the replacement and strengthening of the Wick Harbour Service Bridge. This bridge is identified for replacement and is not currently suitable for abnormal loads beyond 44 Tonnes.

Similarly, there are land opportunities which extend along the coastline south of Wick Harbour. Bringing these sites into development for industrial land would also require investment in appropriate access arrangements, either through the current harbour area, or a new link to the south of Wick. Whilst development could be feasible in engineering terms, some planning restrictions may apply in this area. The site is adjacent to the Pulteneytown area, which forms part of the Conservation Area Regeneration Scheme (CARS).

3.5.5 Gills Bay Area

It is known that there are aspirations for operations and maintenance activity at Gills Bay. If significant developer interest was expressed with the facility, there is the possibility of industrial units being constructed in this location for servicing and maintenance.

3.5.6 Other Sites Included in Current Local Plan

Of the other sites included in the existing Local Plan, the only site of significant size is the one at Murkle Bay, located north of the A836 road between Castletown and Thurso. This area is currently identified for major strategic business and industrial purposes in the existing Caithness Local Development Plan..

However, no development has yet taken place at this location, and it is understood that there has been limited developer interest in the site. Furthermore, natural environment designations would constrain the potential for developing this area, and any future proposals would require to be the subject of a full Environmental Impact Assessment.

3.6 Summary

This chapter has provided an overview of the principal sites of interest to the study. Chapter 4 provides an assessment of the key routes and capabilities associated with the main transport routes within Caithness.

[8] *Wick Harbour and Energy Support,* Produced by Wick Harbour Authority, accessed from http://www.wickharbour.co.uk/energy-support.pdf

Key Routes and their Capabilities

4 Key Routes and their Capabilities

4.1 Introduction

This chapter provides an overview of the key routes in the Caithness study area, and any identified issues that are associated with these. Routes have been split into sections to facilitate analysis, as shown in Table 4.1 below.

Table 4.1 – Principal Caithness Routes

Route Number	Route Description
1	A9 Dunbeath-Scrabster
2	A99 Latheron-Wick
3	A882 Thurso/Scrabster-Wick
4	A836 Thurso/Scrabster-Dounreay
5	A99 Wick-Wester-(John O'Groats-Gills Bay)
6	A836 (Gills Bay)-Castletown-Thurso
7	B874 Thurso-Halkirk-(A9)
8	B876 Castletown-Wick

In addition to the above routes, the town centres of Thurso and Wick are also considered in detail, along with any further known issues on minor roads within the Caithness area. Each of the above routes is shown within Appendix C.

4.2 Consultation

To inform the identification of the principal routes in Caithness, discussions were held with roads authorities to confirm key route characteristics.

Table 4.2 – Key Routes and Capabilities: Consultations

Name	Organisation	Responsibility
Iain Moncrieff	The Highland Council	Local Roads
Dave MacKenzie	The Highland Council	Structures
Keith Wrigley	Scotland Transerv	Trunk Road Network (A9 and A99)

The discussions with the Local Roads and Structures managers at The Highland Council confirmed that a hierarchical primary-secondary-tertiary system categorises the local road network in Caithness. A number of bridge structures on the road network traverse rivers and the railway lines, There are no bridges or other structures that cross over the road network in Caithness None of the roads managers considered that the primary routes within Caithness would constrain economic activity in the area, taking into account:

- the anticipated future demands from the renewables sectors;
- the proven abnormal load capabilities of the routes; and
- the lack of specific constraint such as low bridges, weak bridges, or pinch points.

The discussion with Scotland Transerv confirmed that, on average, the trunk roads in Caithness are of a width of 6.0m to 7.2m. It was noted that the trunk roads in the area all accommodate two lanes. Scotland Transerv and the Local Roads Manager also confirmed that they have not received any reports of problems from any of the Caithness based hauliers who regularly utilise the road network in the area.

4.3 Assessment of The Highland Council Structures Database

An assessment was also undertaken of The Highland Council's structures database. This confirmed that there are no special height, width or weight restrictions associated with any structures in the area. All structures are designated as "construction and use", confirming that standard HGVs can be accommodated.

Discussions with the Trunk Road management agents confirmed that the situation was the same for the Trunk Road network, and that the nearest height restriction on the Trunk Road network was located at Invergordon on the A9.

4.4 Abnormal Loads Assessments

Utilising the database of abnormal load movements provided by The Highland Council, AECOM has reviewed each of the recorded movements to ascertain the maximum recorded weight, height, width and length that has been moved on the principal routes and structures on the Caithness transport network. These are highlighted within Appendix C.

These maxima should not be relied upon for future engineering assessments of route capacities, which should continue to be assessed on a case by case basis dependent upon the specific circumstances of each load. However, the analysis does provide a useful initial illustration of likely route capacities, subject to issues such as axle weights and spacings, and the individual configurations of load, length, weight and vehicle type.

Building upon the analysis of the abnormal loads database, further swept path analysis of a series of abnormal load configurations has been undertaken, specifically on key junctions within Thurso and Wick. Outcomes of this work are discussed in section 4.13 below, with sample swept path diagrams provided in Appendix D.

4.5 Route 1 – A9 Dunbeath-Scrabster

Dunbeath on the A9 marks the southern boundary of the study area. From this point, the road is typically of a standard 7.6m width, and the Dunbeath Bridge, which is a relatively new structure, has full highway capacity. As a result, there are no particular constraints imposed by this section of the A9.

From Latheron at the junction of the A9 and A99, the A9 extends a further 25 miles north to Scrabster. At Georgemas Junction, the A9 meets the A882 Wick-Thurso road.

Photo 4.1 – Pipe Storage, Georgemas Junction

Georgemas Junction is the principal rail freight interchange in the area, and road access to the site is available direct from the A9, both north and south of the rail over-bridge. The northern site is regularly used to transport 27m pipe sections, and no specific problems are apparent. The southern site has historically been used for container transport, and again, no specific problems have been reported.

Between Georgemas and Thurso, there are no specific issues other than a number of High Voltage Power lines that cross the route in the vicinity of Geiselittle, south of Thurso. The minimum distance between the cable and the ground for such power lines is 6.7m clearance.[9]

Beyond Thurso town centre (see Section 4.11), the route continues to Scrabster Harbour. Stakeholders reported that historically this stretch of road has been at risk of slope instability, although no specific concerns regarding this were raised by Trunk Road management agents or the Harbour Authority.

Analysis of the abnormal loads database highlights the following maximum dimensions / weights that have been recorded on the route:

- Weight: 127T;
- Height: 5m;
- Width: 4.8m;
- Length: 27.5m; and
- Maximum Axle Load: 16.32T.

[9] *Shock Horror – Safe Working Near Overhead Power Lines (Leaflet INDG389*), Health and Safety Executive, Accessed from http://www.hse.gov.uk/pubns/indg389.pdf

4.6 Route 2 – A99 Latheron-Wick

From the Latheron junction on the A9, the A99 links to Wick.

Between Latheron and Wick, there are no significant infrastructure related issues with the exception of a retaining wall at Ulbster (between Lybster and Wick). This does not tend to cause any problems as abnormal heavy vehicles utilising the route are notified of this and are told to straddle the centre line.

The condition of the road surface between Lybster and Wick was cited as a minor issue by some stakeholders consulted as part of this study. However, a site visit to this stretch of road did not identify any particularly problematic stretches.

Photo 4.2 – A99, Lybster

Analysis of the abnormal loads database highlights the following maximum dimensions / weights that have been recorded on the route:

- Weight: 125T;
- Height: 5m;
- Width: 4.9m;
- Length: 28m; and
- Maximum Axle Load: 13T.

All bridges on the A99 have small spans, and thus carry only a couple of axles at one time. Accordingly, this would indicate they would have sufficient weight bearing capacity for loads,up to at least 125T.

The only possible future issue that was identified would relate to the access onto the A9/A99 from the engineering companies located in Dunbeath and Lybster. These are situated on minor side roads, which are approximately 4 to 5m in width. The movement of any very large loads being transported from these sites could be constrained.

4.7 Route 3 – A882 Thurso/Scrabster-Wick

The A882 provides a direct road link between Wick and Thurso.

Few issues have been identified on this route. Perhaps, the most notable historic event on the route was related to Watten Bridge. In 2006, the structure was damaged by flooding, and the route was severed. Repairs have since been undertaken, but it remains a possible future risk that any significant flooding in the area could again cause problems at this specific location.

Photo 4.3 – A882, Wick-Thurso

Analysis of the abnormal loads database highlights the following maximum dimensions / weights that have been recorded on the route:

- Weight: 114T;
- Height: 5.6m;
- Width: 6.1m; and
- Length: 29.8m.

In addition, for parts of the route, it is understood that wind farm components of 45m length have been successfully moved from Wick Harbour to wind farm sites west of Wick, and also to sites south of the town.

4.8 Route 4 – A836 Thurso/Scrabster-Dounreay

West of Thurso, the A836 travels towards Dounreay. The road is of a good standard. There is a narrow bridge at Forss, and at the culvert to the east of the bridge. One half of the culvert has been reinforced, and abnormal loads are instructed to cross over the culvert on the side which has been strengthened. Consultation with the local roads manager confirmed that the bridge itself is in a reasonable condition and that it has previously supported the carriage of five wind turbines (nacelles, blades and tower sections) with no reported sign of any problems. Recently a 190T load was cleared to be transported from Scrabster to Dounreay between 24/11/11 and 01/12/11 over the Brims culvert and Bridge of Forss.

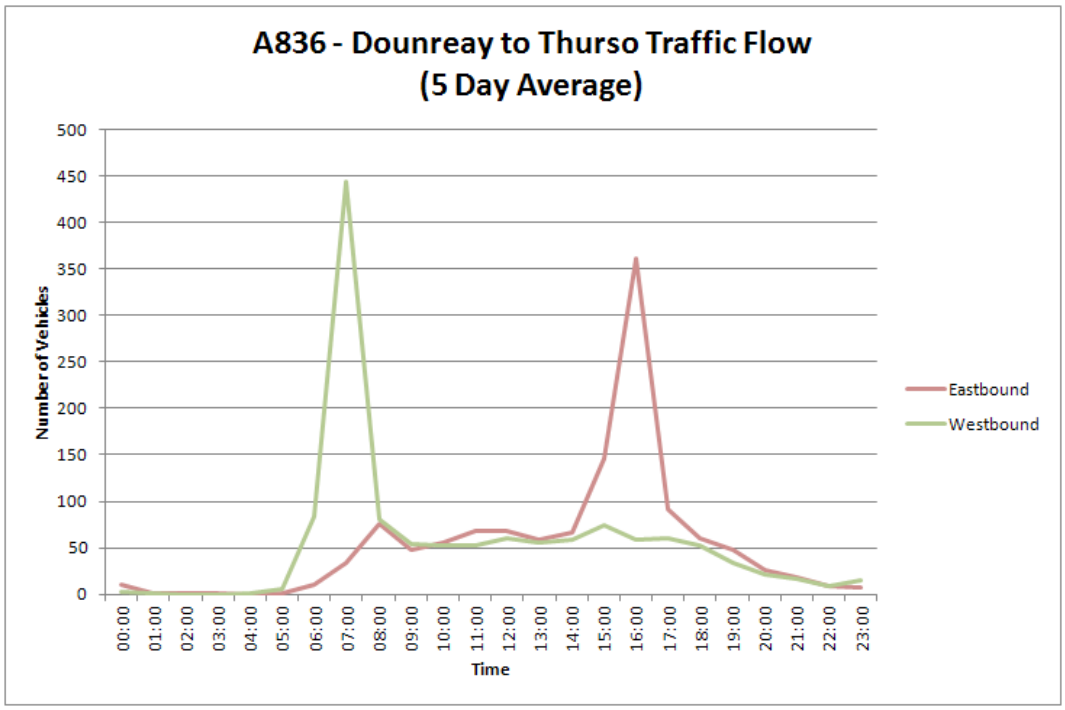
Dounreay causes a platooning of traffic on the A836 between the facility and Thurso at peak times. This is demonstrated in analysis of the data generated by the ATC counter located on the A836 just west of the Henderson Park junction. (Figure 4.1 below).

A series of High Voltage cables cross the A836 adjacent to Dounreay. These cables would have a minimum clearance of 6.7m.

Analysis of the abnormal loads database highlights the following maximum dimensions / weights that have been recorded on the route:

- Weight: 190T;
- Height: 5m;
- Width: 4.3m; and
- Length: 50m.

Figure 4.1 – A836 – Dounreay to Thurso Traffic Flow (5 Day Average)



West of Dounreay, the standard of the A836 begins to deteriorate, and in many places the road is single track, including at Bettyhill (the western periphery of the study area). It also experiences sub-standard vertical and horizontal alignments. It would be particularly challenging to accommodate abnormal loads on this route, although standard HGV vehicles would not necessarily be constrained.

This section of the route was included in the study area due to the wave energy site located at Farr Point. However, there is no particular location on this stretch of coastline for a port / quay, and it is anticipated that all servicing etc would be undertaken at the established ports within the study area. Accordingly there would be no impact on the road network in this location.

Photos 4.4 and 4.5 – A836 at Bettyhill

4.9 Route 5 – A99 Wick-Wester-(John O'Groats-Gills Bay)

Beyond Wick, the A99 is the principal road link to the Subsea 7 pipeline bundle fabrication site at Wester. As noted in Chapter 3, the McKelvie lifting bridge is located at the point where the A99 crosses the construction tracks. While overall, the road between Wick and Wester is of a consistent width, it is noted that The Highland Council has committed to the widening of the road at Keiss (close to the Subsea 7 site) next year where the road is narrower.

Low voltage power lines on this stretch of the A99 have previously been relocated underground to facilitate the transport of tow heads between Wick Harbour and the site at Wester.

Analysis of the abnormal loads database highlights the following maximum dimensions / weights that have been recorded on the route:

- Weight: 341T;
- Height: 6.6m;
- Width: 7.2m;
- Length: 36.1m; and
- Maximum Axle Load: 18T.

Photo 4.6 – A99, Wester

From Wester, the A99 continues northwards to John O'Groats, before linking into the A836 towards Gills Bay. Analysis of the abnormal loads database highlights the following maximum dimensions / weights that have been recorded on the route:

- Weight: 110T;
- Height: 4.9m;
- Width: 3.7m;
- Length: 19.8m; and
- Maximum Axle Load: 12T.

4.10 Route 6 – A836 (Gills Bay)-Castletown-Thurso

From Gills Bay, the A836 runs in a westerly direction to Castletown and Thurso.

Although not heavily trafficked by heavy goods vehicles, there are no specific constraints on freight movement on the A836 between Gills Bay and Thurso, until the route reaches Thurso.

Analysis of the abnormal loads database highlights the following maximum dimensions / weights that have been recorded on the route:

- Weight: 95T;
- Height: 4.9m;
- Width: 3.7m; and
- Length: 17.7m.

The access road from the A836 to Gills Bay is adopted by the Council, and is approximately 5m wide. However, it suffers from a tight right angled turn as the road approaches the coast. This configuration would act as a constraint to larger abnormal load movements, such as wind turbine equipment. The placing of lamp-posts in this location would also restrict any long loads.

4.11 Route 7 – B874 Thurso-Halkirk-(A9)

Halkirk is located six miles south of Thurso on the B874. This road is reported to be frequently used by HGVs, potentially associated with the JGC workshops located on this route, and the industrial area at Janetstown. The only specific issues on this route are that the road width is narrower than the primary road network, and there are more instances of low voltage electricity cables crossing the road. These cables would be installed with a minimum ground to cable clearance of 5.2m.

Analysis of the abnormal loads database highlights the following maximum dimensions / weights that have been recorded on the route:

- Weight: 71T;
- Height: 4.8m;
- Width: 3.8m; and
- Length: 18.7m.

From the centre of Halkirk, the B874 links into the A9 close to Georgemas Junction.

To the south of Halkirk village, beyond the B874, Bridge Street is bisected by a level crossing.

4.12 Route 8 – B876 Castletown-Wick

The B876 runs in a south-easterly direction from Castletown to Wick.

The most significant issue on this road is at Killimster Moss (between Kirk and Killimster). The road is laid on peat, and although it has been strengthened, it now needs significant work, for which there is no funding.

Analysis of the abnormal loads database highlights the following maximum dimensions / weights that have been recorded on the route:

- Weight: 80T;
- Height: 4.8m;
- Width: 4.91m; and
- Length: 24.57m.

Photo 4.7 – B876, between Kirk and Killimster

A discussion with the Local Roads Manager for the area also confirmed Ground Penetrating Radar work (which demonstrates where roads on the local network could fail) is currently being undertaken on the B876.

4.13 Town Centre Assessments – Thurso

4.13.1 A9 Olrig Street / Traill Street

In Thurso town centre, the street layout of the A9 route imposes geometric limitations at the following locations:

- A9 Olrig Street / A9 Traill Street (right angle turn);
- A9 Olrig Street / B874 Princes Street; and
- A9 Traill Street / A9 George Street.

Photo 4.8 – A9, Thurso Town Centre (Olrig Street and Traill Street)

Photo 4.9 – Wide Load Negotiating Junction (Courtesy of Caithness & North Sutherland Partnership)

To fully assess whether certain movements could be constrained in Thurso town centre, swept path analysis has been undertaken to track abnormal load movements of varying dimensions to assess whether their passage would be possible

This has confirmed that a long articulated vehicle of dimensions of 3m x 25m can negotiate the A9 Olrig Street/ Traill Street turn within kerb lines. This is illustrated in Appendix D.

A similar capability exists for the A9 Olrig Street / B874 Princess Street junction, which provides access to the JGC facilities at Janetstown and Harpsdale.

However, the analysis also demonstrates that it would not be possible to transport 45m wind turbine blades through either of the junctions highlighted above.

Discussions with abnormal loads hauliers have confirmed that the A9 Traill Street / A9 George Street junction is less constrained than Olrig Street / Traill Street, despite the presence of traffic signal equipment on George Street and Traill Street.

Photo 4.10 – A9, Thurso Town Centre (Traill Street and George Street)

Photo 4.11 – A9, Thurso Town Centre (Traill Street and George Street)

4.13.2 Thurso, Mount Pleasant (A836)

During site visits, it was also noted that on the A836 at Mount Pleasant to the east of Thurso, pedestrian guard rails have been installed on either side of the carriageway. This imposes a "hard" width restriction at this location. There are no traffic islands on this stretch of road.

4.14 Town Centre Assessments – Wick

Unlike Thurso, where there are a limited number of possible through routes for abnormal loads, within Wick there are up to five different routes used by abnormal loads.

4.14.1 Wick Harbour (South Side) to A99/A9 South

The route has been used by windfarm construction traffic, and thus has been proven to accommodate 45m turbine blades. The critical junction is the B9159 River Street onto A99 Cliff Street.

This movement requires negotiation of the B9159 River Street onto A99 Cliff Street. This is a 5 arm mini roundabout junction, located on an incline. An alternative option is to use the Sinclair Terrace / A99 Cliff Road junction, which has also been used by abnormal loads.

Swept path analysis confirms that vehicles of 3.25m x 25m can be accommodated at this junction within kerb lines, with a direct left turn. Longer loads (including 45m wind turbine blades) would require case by case by assessment, dependent on the vehicle and load arrangement. Negotiation of the junction in two stages (River Street to Station Road, Station Road – Cliff Road), would allow longer loads to be accommodated.

Photo 4.12 – B9159 River Street and A99 Cliff Street (From Cliff Street)

Photo 4.13 – B9159 River Street and A99 Cliff Street (From River Street)

4.14.2 Wick Harbour (South Side) to Thurso Georgemas (A882)

Following on from the River Street / Cliff Road junction, the movement onto the A882 requires traffic to negotiate the A99 Cliff Street / A882 Thurso Street junction. This junction is less constrained than the Cliff Street/River Street junction. Long articulated lorries carrying 27m pipe lengths are understood to be able to negotiate this junction in a single movement.

4.14.3 Wick Harbour (South Side) to A99 North

This route necessitates a right turn from River Street (B9159) onto A99 Cliff Road, at Wick River Bridge, and also the subsequent right hand turn within Wick town centre, at High Street. Both junctions impose a geometrical constraint, and the movement of 27m pipe lengths would represent the typical limits of laden length. Swept path diagrams for High Street / Bridge Street junction is provided in Appendix D.

Photo 4.14 – A99 High Street and Bridge Street

Photo 4.15 – A99 Bridge Street

4.14.4 A882 Thurso Street to A99 Wick (Wester)

Stakeholders have confirmed that this route is regularly used by articulated vehicles transporting 27m pipe lengths. All junctions can accommodate these movements (Thurso Street/Cliff Road, A99 High Street), although the A99 High Street junction would be the most constrained.

4.14.5 Wick Harbour (North) to A99 Wick Wester

This route is used by Tow Heads which are unloaded on the north side of Wick Harbour. They then are transported through the housing areas to the North of Wick Harbour, and then onto the A99 north of Wick.

The route requires traffic to negotiate the following junctions, which are the most critical in terms of their geometry.

- Scalesburn / Willowbank,
- Willowbank / Girnigoe Street; and
- Girnigoe Street / Henrietta Street.

Special project loads have been over 6m wide, 7m high with a rigid length of 36m (length including tractor units up to 68m). It would be anticipated that increases in load dimensions beyond the current maxima would require specific works to accommodate the loads, with the Willowbank / Girnigoe Street junction being the most constrained junction. The geometric constraint at these locations is typically imposed by boundary and property walls and kerblines.

Photo 4.16 – Scalesburn, Wick

Photo 4.17 – Willowbank, Wick

4.15 Minor Roads

This section provides an overview of other identified constraints on the Caithness transport network, which are not located on the A or B class roads identified above.

Table 4.3 – Additional Issues on the Caithness Transport Network, Minor Roads

Location	Additional Comment
Between Freswick (A99) and Canisbay	Road signed as unsuitable for HGVs 7.5T limit for 2 $^{1}/_{3}$ miles
Between Upper Gills and B876 east of Hastigrow	Reported issues with HGV traffic from Gills Bay ferry using this route, which is not suited to such traffic.
Link road between B870 and B876	Signed 7.5T limit – except for access Extends on to B876, prior to introduction of improved surfacing to the east
Between Killimster (B876) and A99	Signed 7.5T limit – except for access
Between Mains of Watten and Sibster (B874)	Identified as a weak road.
South of Watten (off B870)	Dead end road – unlikely to be utilised by HGVs
Between Watten (A882) and Lybster (A99)	Road signed as unsuitable for HGVs Signed 7.5T weight limit 1.5 miles from A882 junction/3 miles from A99 junction
Between Haster (A882) and Thrumster (A99)	This road is signed as being unsuitable for coaches at the A882 and A99 junctions
South of B870 at Westerdale: Tormsdale – Lochmore Cottage	Dead end road – unlikely to be utilised by HGVs

4.16 Power Lines

Within the Caithness area, high voltage power lines cross the local and trunk road network at several locations, as shown in Table 4.4 below. These provide a minimum ground to cable clearance of 6.7m.

Table 4.4 – Caithness Road Network: Power Line Crossing Points

Area	Route	Description
Reay/Dounreay	A836	Crosses A836 by Isauld
Reay/Dounreay	A836	Crosses A836 east of Gunnscroft
Glengolly	B870	Crosses B870
Glengolly	B874	Crosses B874 by Geise
Thurso	A9	Crosses A9 south of Geiselittle access
Thurso	A9	Crosses A9 north of Geiselittle access
Halkirk	B874	Crosses B874 between Halkirk and A9 (west of level crossing)
Harpsdale	Unclassified	Crosses unclassified road near Achalone[10]
Mybster	A9	Crosses A9 by Achkeepster
Latheron	A9	Crosses A9 at Crofts of Benachielt

[10] Included as JGC Engineering have a facility at Harpsdale and this road is a potential route to the A9

Across the whole of the County, numerous low voltage electricity and telephone cables cross each of the identified routes. It was noted during site visits that these were often more frequent on the minor roads, such as B874 and B876. A minimum 5.2m ground to cable clearance is typically provided for these low voltage cables.

4.17 Summary

This chapter has confirmed the key routes in the Caithness area, and the extent of constraints associated with these.

Chapter 5 sets out the future anticipated load demands for the internal Caithness transport network, based on the renewables sectors, and other economic opportunities.

Future Anticipated Load Demands

5 Future Anticipated Load Demands

5.1 Introduction

This chapter considers the likely load demand on the trunk and local road network arising from the renewable energy industry, and other related opportunities. Specifically for marine renewables, it reflects on the following likely different phases of development activity:

- Fabrication;
- Installation; and
- Maintenance.

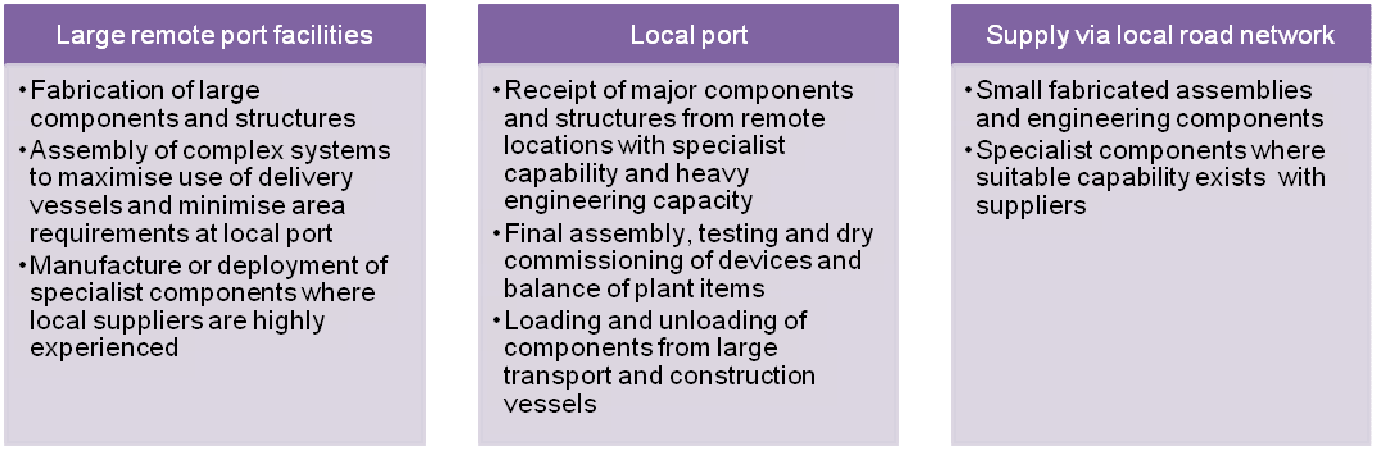
The analysis is based on the information that is currently available, and on the outcomes of discussions with developers. However, it is highlighted that technologies and construction methods can change within the implementation timescales anticipated for the Pentland Firth and Orkney Waters projects. Furthermore, consideration of Operations and Maintenance requirements are still at very early stages for wave and tidal devices.

5.2 Fabrication

During construction activities the likely approach taken by developers is to rely on large port facilities and specialist suppliers to manufacture the majority of components. The fully assembled devices and larger sub assemblies can have footprints of over 400m^2 and heights of over 40m, making them unsuitable for road transport. It is essential, therefore, that some manufacture and all final assembly is done at or adjacent to a quayside facility. These devices and assemblies will be transported by sea to a local port where they will either be transferred directly to a construction vessel or onto the quayside for final assembly and deployment. The scale of components and services required at this stage means that road transport will be limited to smaller component supply unless a specific capability exists locally or a device manufacturer has a local facility.

Currently, there is no dedicated fabrication assembly yard in Caithness for the size, weight, and volume of equipment that is being proposed by the marine renewables sector. The nearest suitable sites are at Invergordon, Nigg, Ardersier and Arnish.

Figure 5.1 – Activities carried out during construction by location



5.3 Installation

The Pentland Firth offers some of the highest potential for tidal and wave energy generation in Europe, due to particularly strong tidal currents and wave activity. However, these strong tidal currents and wave activity clearly presents a challenge in terms of installing the range of equipment necessary to harvest this energy. The local marine environment necessitates the deployment of specialist equipment to enable installation, as well as imposing specific tidal and weather windows. .

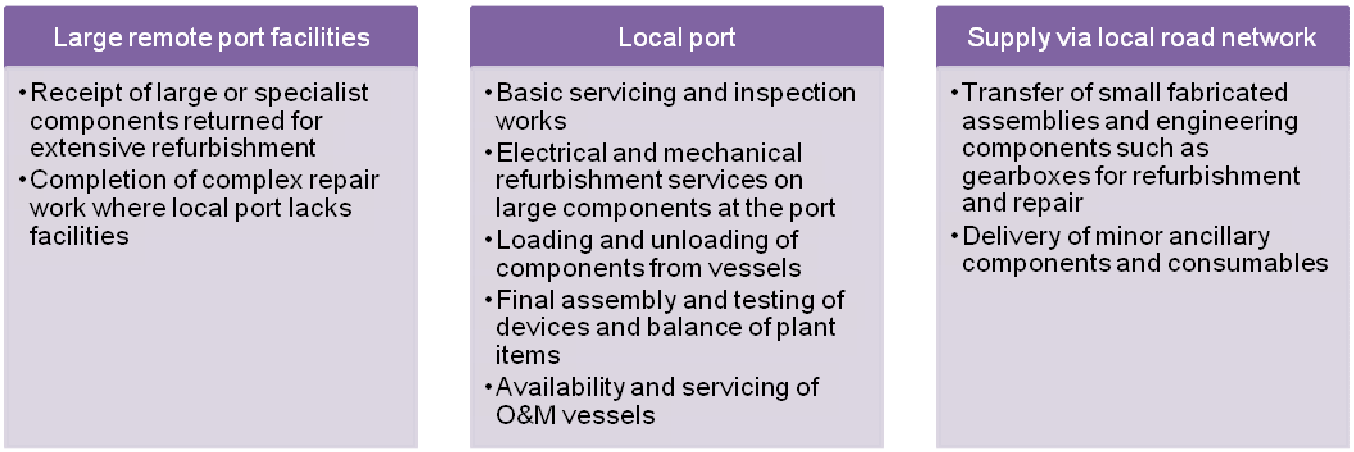
The use of specialist dynamic positioning (DP) vessels is anticipated, particularly for accurate piling in the fast flowing waters of the Pentland Firth. Specialist barges and cranes would also be expected for installation of gravity structures. Adequate local Port capacity may be required to accommodate these specialist vessels during the installation process due to periods of unsuitable tidal , wave or weather conditions.

5.4 Maintenance

During the operation and maintenance period the availability of port facilities and engineering capability within close proximity to projects is essential. The requirement for transport onshore will depend on the type of maintenance activity being undertaken, this will include:

- **Scheduled refurbishment –** This will be periodic (annual or five yearly for example) retrieval of devices for both inspection and replacement of consumables such as oil, or a planned major overhaul of the device. The latter will involve stripping down the device into its components and utilising local engineering capability to carry out remedial works and testing.
- **Minor repairs –** These constitute unplanned retrievals of devices to carry out minor work such as manually resetting and inspecting systems or replacing minor parts. This can be carried out at the port with spares potentially supplied by road.
- **Major repairs –** Where devices have experienced a failure to a major component or suffered external damage they will be returned to shore. Once at the local port they will be inspected to determine the extent of damage and components may have to be transported by road or sea to suitable facilities for repair work or manufacture of replacement parts. Large and specialist components are likely to be repaired at remote locations unless specialist facilities are available locally.

Figure 5.2 – Activities carried out during O&M by location



There would be an advantage in having maintenance and overhaul facilities available as close as possible to the off-shore energy sites to minimise the downtime of the machines, and the transport costs. This would be most economically achieved by locating these facilities at or near to the quayside of the area's harbours, emphasising the need for sufficient quayside space, lay-down areas, and lifting capabilities at these locations

5.5 Possible Impact on Transport Network

As noted above, sea based transport and port operations will be heavily relied on, particularly for larger components and fully assembled devices. There will be, however, some reliance on road transport for smaller items, where suitable facilities are not available at the port and sea transport is otherwise not practicable.

The key nodes on the transport network are the ports, as they have an important role to play in enabling installation – for example by basing specialist vessels, and enabling a holding area prior to installation.

Scrabster Harbour in particular would offer a base for maintenance, and it was recently reported that the harbour has agreed a link-up with a marine energy developer to service traffic from the wave and tidal turbine projects in the Pentland Firth.

Wick Harbour is understood to be in discussions with a tidal generation company, regarding the use of the harbour as a construction, operations and maintenance base.

Beyond the immediate hinterland of the ports it is apparent that the principal access routes to and from the harbours will be particularly relied upon for the transfer of supplies and components.

Finally, it will be important that local suppliers and engineering companies have ready access to the ports for the provision of engineering services. However, it is most likely that these services will relate to individual components of the energy devices, rather than the fully assembled devices themselves.

5.6 Major Components

The following tables describe major components in terms of their size and weight along with comments on the likelihood of requiring road transport. The assessment of major components and their likely road transport potential implies that road transport demands are all likely to be within current route capabilities across Caithness.

Table 5.1 – Submerged Tidal Device

Submerged tidal device
Examples: Marine Current Turbines
Tidal Generation Ltd
Atlantis Resources
OpenHydro


Marine Current Turbines Limited


Tidal Generation Ltd

OpenHydro

Component	Description	Typical maximum dimensions	Approximate maximum Weight (tonnes)	Skills needed	Likely road transportation
Blades	Extracts energy from the tidal current through rotational movement. Commonly of composite construction with steel spar reinforcement.	8m length 2m width (at root) 300mm thick	4 for composite based blades	Composites design and process development, production of blade moulds, assembly / curing and finishing of blades, surface protection and steel fabrication.	No, unless there is blade manufacturing capacity in Caithness
Rotor hub	Connects the blades to the power train and incorporates the pitch system (to enable adjustment of the angle of the blades). Made from cast SG iron.	2m diameter 2m depth	5	Casting, machining and painting	Yes, could be transported where repair of the pitch system is required.
Nacelle	Houses the mechanical and electrical systems to convert rotational motion into electrical power.	25m length 5m width 5m depth	60	Casting, machining, assembly and painting	No, internal components removed for remote repair and structural work at port
Gearbox	Provides speed and torque conversions to transfer the rotating movement of the blades to the generator	2m length 2m width 2m depth	15	Casting, machining and gear cutting, bearings, painting, assembly and test	Yes, where refurbishment work is required.
Generator	Converts the kinetic energy of the rotor into electrical energy	2m length 2m diameter (for geared machines) 3m length 4m diameter (for direct drive machines)	10 or 25 for geared or direct drive respectively	Medium voltage component supply, bearings, windings, generator manufacture and painting	Yes, where testing and refurbishment is required.

Capabilities on project:
Transportation

Component	Description	Typical maximum dimensions	Approximate maximum Weight (tonnes)	Skills needed	Likely road transportation
Transformer	Steps up output voltage from generator to 33kV array cabling to substation or shore.	1.5m length 1.5m width 2m depth	5	High voltage switchgear and component supply, specialist casting and assembly.	Yes, could be manufactured or refurbished locally.
Substructure	Support structure, normally constructed from steel or iron parts, which act as foundation and connection to nacelle.	30m length 30m width 40m height	700	Supply of steel plate and cast components, rolling, welding, fabrication, shot blast and paint	No, too large.
Piles	Anchors the foundation and device to the sea bed	14m length 1m diameter	15	Supply of steel, rolling and welding	Yes, could be fabricated and refurbished

Table 5.2 – Floating Wave Device

Floating wave device
Example: Pelamis Wave Power
OPT Powerbuoy


Pelamis Wave Power


Ocean Power Technology

Component	Description	Typical maximum dimensions	Approximate maximum Weight (tonnes)	Skills needed	Likely road transportation
Hydrodynamic (buoyant) structure	Typically cylindrical steel or iron structure that reacts to wave movement and houses power take off equipment	40m length 6m diameter	200 each	Supply of steel plate and cast components, rolling, welding, fabrication, shot blast and paint	No, too large.
Hydraulic system	System made up of hydraulic motors, accumulators, oil reservoirs and control valves that transmit wave movement into hydraulic pressure	Total system: 10m length 2m height 2m width	50	Hydraulic system design, pressure vessels and mechanical control systems	Yes, manufacture or refurbishment would be possible
Electrical generators	Rotational or linear generators that convert wave motion into electrical power	2m length 2m diameter (for rotational) 10m length 2m diameter (for linear)	10 or 20 For rotational and linear system respectively	Medium voltage component supply, bearings, windings, generator manufacture and painting	Yes, linear system may be too large but manufacture or refurbish would be possible

Capabilities on project:
Transportation

Table 5.3 – Submerged Wave Device

Submerged wave device
Example: Aquamarine Power, Oyster

Component	Description	Dimensions	Weight	Skills needed	Road transportation
Hydrofoil (buoyant) structure	Hinged 'flap' constructed of hollow cast iron cylinders within a fabricated frame.	26m length 20m width 5m height	400	Supply of steel plate and cast components, rolling, welding, fabrication, shot blast and paint	No, too large.
Reaction (foundation) structure	Fabricated base structure that houses hydraulic system and enables connection to seabed	26m length 20m width 5m height	400 unballasted	Supply of steel plate and cast components, rolling, welding, fabrication, shot blast and paint	No, too large.
Hydraulic system	System made up of hydraulic motors, accumulators, oil reservoirs and control valves that transmit wave movement into hydraulic pressure to pump fluid to onshore	Total system (modular): 10m length 2m height 10m width	50	Hydraulic system design, pressure vessels and mechanical control systems	Yes, manufacture or refurbishment would be possible
Electrical generators	Rotational generators located onshore that convert hydraulic pressure into electrical power	2m length 2m diameter (for rotational)	10	Medium voltage component supply, bearings, windings, generator manufacture and painting	Yes, manufacture or refurbish would be possible

5.7 Other Demands

5.7.1 Onshore Wind

Demands are typically for 45m turbine blade sections, accompanied by turbine nacelles, and tower sections (up to 3.8m wide, 4.8m height, 35m long). Each project is associated with the development of approved transport plans, which take into account route capability, and also address any specific localised requirement for strengthening or widening.

5.7.2 Offshore Wind

Around 300 offshore wind turbines are due to be erected in the Outer Moray Firth, commencing in around 2015. Discussions with one of the development companies involved with the project confirmed that offshore wind developments are anticipated to follow similar construction and build-out processes for wave and tidal devices. Fabrication and assembly will mostly be undertaken at large fabrication yards remote from Caithness. Nigg and Ardersier are potential sites for this fabrication. Components would then be shipped directly to site for installation. Accordingly, there is anticipated to be no impact on the internal road network of Caithness during this phase of works.

There is no specific guarantee that operations and maintenance bases will be established in Caithness for the Moray Firth off-shore wind developments, although Wick Harbour is a candidate location. Such a base would focus on servicing the maintenance vessels and personnel support, with the local road network being used to supplying small components / consumables. Larger components (blades etc) would most probably be shipped to suitable installation / assembly facilities. Accordingly, it is forecast that during operations and maintenance phases, the road network within Caithness would be suitable for demands places upon it.

5.7.3 Oil and Gas

If Wick or Scrabster were successful in hosting a support role for these oil and gas developments, the impact on the local road network would principally be for transfer of supplies and equipment from the established oil supply bases in north east Scotland. Experience from Aberdeen and Peterhead confirms that the majority of loads can be accommodated on standard 44T flatbed vehicles.

5.7.4 Biomass

In the context of Caithness, the Biomass opportunity is associated with burning timber pellets and brushwood at a proposed new plant at Georgemas Junction. This would increase HGV movements through Thurso, and on the surrounding roads. Whilst this would impose an amenity impact, there would be sufficient capacity to accommodate the increased traffic, which would typically utilise on standard 44T timber haulage vehicles.

5.7.5 Electrical Grid Strengthening

Local sub-station upgrades at Cannisbay, Thurso, Achvarashal are planned, as well as a Converter Station at Mybster. A replacement sub-station at Dounreay is also being constructed. Complementary to sub-station upgrades are electricity line reinforcement which is again planned along existing power line corridors within Caithness, principally along the A897 and A9 routes.

Key components will be transformers and switchgear. As a one-off bespoke project, loads will be designed around the capabilities of the transport routes, or where it is more economically efficient, modifications to the road network could be undertaken by the developer.

It is understood that the individual components required for the upgrade work would be likely to be over 100T in weight, although with dimensions that are typically within current maxima that have been experienced on the Caithness Road network.

5.7.6 Timber Extraction

Future demands for Timber extraction in Caithness will lead to increased numbers of timber lorries on the local road network, subject to agreed extraction routes and volumes. It is also anticipated that there will be increased use of line-side loading for movement of timber by rail freight. Whilst individual vehicle size and weight can be accommodated within the study area, there is specific concern regarding the impact of the total volumes of timber that requires extraction and the capability of the network of roads to accommodate this.

5.7.7 Decommissioning

Work continues to be undertaken at Dounreay to decommission existing plant, and construct new low-level radiation storage facilities. Work is also being undertaken to renew and upgrade electricity sub-stations at the site. The principal route for the largest items is between Dounreay and Scrabster. The route has recently accommodated a 190 T load. Overall, it is anticipated that future load movements will not be constrained by the current route.

It is proposed that spent nuclear fuels will shortly be transported from Dounreay to Sellafield by rail, via a loading facility at Georgemas junction, most probably via Thurso town centre, on a roughly monthly frequency. Existing spent nuclear fuel flasks typically weight up to 50T, and have dimensions 2.56m x 2.18m x 1.91m high. Accordingly, they can be accommodated on the proposed route between Dounreay and Georgemas Junction.

5.7.8 Oil and Gas Decommissioning

This activity is not likely to generate direct demands on the Caithness Local Road network.

5.8 Summary

Assessment work has been undertaken considering the likely forecast future demands on the road network arising from the renewables industry and other future economic opportunities.

This work reveals that the ports within the study area will play a key role in determining the future development of marine renewables in Caithness. It has also revealed that there is likely to be high demand for servicing and maintenance facilities in close proximity to the quayside.

Major component assembly and fabrication is likely to be undertaken outwith Caithness in existing fabrication yards.

It is anticipated that local engineering companies will be able to compete for a place on the supply chain. This includes a significant role in the future servicing and maintenance of device components.

The assessment of the weight and sizes of key components has highlighted that the demands from marine renewables will not necessarily be any greater than current demands that are being placed on Caithness's road network.

Other economic opportunities may place project specific demands on the network. However, it would be expected that for these one off projects, the requirement to either adjust the road network, or adjust the transport approach, would fall to project developers, not the public sector.

Constraints and Mitigation Options

6 Constraints and Mitigation Options

6.1 Introduction

Previous chapters have considered the specific sites of interest for the study, the key routes linking these key sites and their capabilities, and the demands which are anticipated to be placed on the road network from the renewable and other opportunities. This chapter considers locations where the forecast demands placed on each route could possibly exceed the dimensional or maximum previous recorded load weight which has used that route, and hence constrain potential future activity. It also considers wider amenity or economic factors which may also arise in this context.

6.2 Approach

A variety of approaches have been used to identify potential constraints, including:

- Discussions with road managers / structural engineers;
- Site visits along each identified key route / key location; and
- Comparison of potential future demands with previous abnormal loads.

The combination of approaches helped to ensure a broad coverage of potential constraints on the internal road network.

6.3 Assessment of Constraints

Table 6.1 lists the full range of issues that have been identified during the study process, and considers the extent to which the identified issue will place a constraint on future development opportunities. Any identified issues have been considered in the following categories:

- Ports and harbours;
- Town centres;
- Structures;
- Roads;
- Rail freight; and
- Power lines.

Overall, it is considered that the future development of ports and harbours in the area is the principal potential constraint, as this affects the prospects for any marine renewable activity in the area. It is understood that plans are being progressed at all principal ports for development options.

The town centres impose geometric limitations, however, assessment of potential load demands illustrate that the anticipated loads which would be transported on the road network for the marine renewables sector would not be constrained by these limitations.

Our desktop assessment of structural capacities based on interrogation of The Highland Council's abnormal loads database, and discussion with roads and structures managers, did not identify particular constraints imposed by the structures in the area. This is subject to load assessments continuing to being undertaken for the largest of loads. Similarly, no specific road width or height constraints were identified for the forecast future load demands. .

Rail freight provides an opportunity, should this mode be chosen by the renewable sector suppliers, but future development at Georgemas could constrain this potential.

Low voltage electricity cables passing over some routes impose a height limitation, but other than for ad hoc project loads, these are not considered a constraint to renewables activity.

Table 6.1 – Review of Key of Issues

Location	Issue	Comment
1. Ports and Harbours		
1.1 Scrabster Harbour	Current layout and capacity would limit renewables O&M activity. Options being developed to accommodate future growth.	Although ideally situated to provide O&M and servicing base for marine renewables, a current lack of quayside space, and workshops etc in the vicinity of the port constrains opportunity. Phase 1 works are currently being constructed to be completed during 2012, and options for phase 2 in the deep water basin are also being developed. Scrabster Farm provides development opportunity in the immediate vicinity of the port.
1.2 Wick Harbour	Current layout and capacity would limit renewables O&M activity. Options being developed to accommodate future growth.	Again, ideally located to provide an O&M and servicing base for marine renewables. However, a current lack of quayside space, and workshops etc in the vicinity of the port constrains opportunity. Feasibility studies are underway for expansion options beyond existing available sites, which are understood to be considering options to north and south of the harbour. This work is still being finalised.
1.3 Gills Bay	Requires significant investment to extend current capabilities.	Current layout and capacity would provide functionality only for smaller vessels. No significant constraint on future development, although would require long term and high levels of investment in port and land side infrastructure, and improvement in the road connection between the port and A836.
2. Town Centres		
2. 1 Thurso Town Centre (A9 Olrig Street / A9 Traill Street)	Street layout imposes geometric limitations.	This corner imposes a length and width constraint for the route between Scrabster and the A9 South – approx 25m long by 3.5m wide. The constraint is imposed by buildings in the town centre. However, it is unlikely that currently forecast marine renewables will impose demands greater than this on the network, with movement of anything larger being focussed at the quayside. The movement of abnormal loads presents a potential amenity issue for residents of Thurso, as it holds up traffic and disrupts town centre activity. Any requirement for specialist articulated trailers to enable load movements imposes an additional cost for the haulage of abnormal loads.
2.2 Thurso Town Centre (A9 Olrig Street / B874 Princes Street)	Street layout imposes geometric limitations.	Similar issue to 2.1, imposed on the Halkirk/Thurso route. However, marine renewables forecast demands are likely to be met within available geometric allowances.
2.3 Thurso Town Centre (A9 Traill Street / A9 George Street)	Street layout imposes geometric limitations.	Less restrictive than 2.1 and 2.2 – if loads can negotiate Olrig Street/Traill Street then this junction does not restrict movement.

Capabilities on project:
Transportation

Location	Issue	Comment
2.4 Wick Town Centre (A99 High Street / Bridge Street)	Street layout imposes geometric limitations.	Route regularly used for 27m pipe lengths to Wester. Swept path analysis suggests that this load length is towards the maximum that can be accommodated.
2.5 Wick Town Centre (B9159 River Street / A99 Bridge Street / A99 Cliff Road)	Street layout imposes geometric limitations.	Wind turbine blades of 45m length, and other wind turbine equipment up to 35m long, 3.5m wide has been accommodated at this junction (from River Street to Cliff Road). Northbound, limit is imposed by A99 High Street/Bridge Street Corner (2.4 above).
2.6 Wick Town Centre (A99 Cliff Road / A882 Thurso Street)	Street layout imposes geometric limitations.	Wind turbine blades of 45m length, and other wind turbine equipment up to 35m long, 3.5m wide has been accommodated at this junction. 27m pipe lengths have been transported from Georgemas Junction to Wester north of Wick via this junction.
2.7 Wick Town Centre (Various corners within housing area to north of Wick (Scalesburn / Willowbank, Willowbank / Girnigoe Street; Girnigoe Street / Henrietta Street)	Street layout imposes geometric limitations.	Route used for transfer of tow heads between Wick Harbour and Wester. If larger tow heads were required, then street layout would be a constraint, typically caused by kerblines and garden walls.
3. Structures		
3.1 A9 Georgemas Rail Bridge	Consultation identified structure as a potential weakness.	Not considered a constraint. Consultation revealed no evidence of problems, and anticipated loads would be less than historical maximum loadings.
3.2 A836 Bridge of Forss / Culvert	Consultation identified structure as a potential weakness.	Not considered a constraint. Consultation revealed no evidence of problems, and anticipated loads would be less than historical maximum loadings.
3.3 A882 Clayock Rail Bridge	Consultation identified structure as a potential weakness.	Not considered a constraint. Consultation revealed no evidence of problems, and anticipated loads would be less than historical maximum loadings.
3.4 A882 Watten Bridge	Consultation identified structure as a potential weakness. Previous problem at this location due to flood damage.	Not considered a constraint. Consultation revealed no evidence of problems, and anticipated loads would be less than historical maximum loadings.
3.5 A99 Ulbster Retaining Wall	Consultation identified structure as a potential weakness.	Not considered a constraint. Consultation revealed no evidence of problems, and anticipated loads would be less than historical maximum loadings.
3.6 Thurso River Bridge	Consultation identified structure as a potential weakness.	Not considered a constraint. Consultation revealed no evidence of problems, and anticipated loads would be less than historical maximum loadings.

Capabilities on project:
Transportation

Location	Issue	Comment
3.7 Wick River Bridge	Consultation identified structure as a potential weakness.	Not considered a constraint. Consultation revealed no evidence of problems, and anticipated loads would be less than historical maximum loadings.
3.8 Wick Harbour Service Bridge	Consultation identified structure as a potential weakness.	Currently considered to be at end of practical design life. Any possible replacement would need to take into account any opportunities arising from any confirmed expansion plans for Wick Harbour. Not currently used for any abnormal loads.
4. Roads		
4.1 B876 Killimster Moss	Structural problem with this stretch of road, due to it passing over peat bog.	Any future deterioration could affect the direct route between Bower and Wick Harbour, particularly for abnormal loads.
4.2 A99 Keiss	Narrow stretch of road through village.	Located to the North of Wester, stretch of road unlikely to be significant for marine renewables, unless investment in Gills Bay is progressed. Road widening proposals contained in forthcoming capital programme from Highland Council.
4.3 A9 Scrabster Braes	Port access road has historically experienced slope stability issues.	Not currently a constraint.
5. Rail Freight at Georgemas Junction		
5.1 Georgemas Junction	Potential future issue due to current and future proposals for Nuclear Fuel transfer / possible future expanded multi-modal freight facility / biomass plant.	Requirement for individual proposals to be carefully planned to as to ensure that the possible long term opportunities of the site are not constrained by more immediate proposals.
6. Power Lines		
6.1 LV Power Lines	Imposes a height restriction on road network of 5.2m.	Tow heads between Wick and Wester are the only load to have breached this height limit, and cables have been placed underground on this route. Unlikely that renewables will regularly create demand for loads of this height.
6.2 HV Power Lines	Imposes a height restriction of 6.7m.	Specific locations would be limited by heights of up to 6.7m. Imposes a constraint that cannot easily be overcome, however, no evidence to suggest a forecast demand for transportation of such high loads.

6.4 Constraint Mitigation Options

Following the assessment of specific constraints, an assessment of specific options for overcoming these potential constraints has been undertaken, presented within Table 6.2. This highlights any direct cost implications where this is appropriate or possible. Options for overcoming potential constraints or issues have been considered. These include a Do Minimum Option, along with a range of alternative options, typically ranging from low-cost / short term management options, to longer term / higher capital cost options. Key outcomes of the assessment are considered in the sections below.

6.4.1 Ports and Harbours

It is vital that harbour authorities, developers, and public sector partners work together to ensure that the full potential is realised for each location. A Do Minimum approach would see key opportunities for the Caithness economy lost to competing sites. To capitalise on the potential benefits for the area, it is important that local master-planning exercises, and the subsequent allocation of suitable development land adjacent to the ports, are undertaken at the present time.

6.4.2 Town Centres

Given that anticipated loads from the renewables industry can be accommodated within current geometric limitations, it is difficult to justify additional intervention. In Thurso and Wick, longer term development opportunities associated with the renewables sectors may facilitate development of by-pass routes. However this may be over a long period of time, and may require start up enabling infrastructure support from public sector.

In the specific case of Thurso, the careful allocation of new development sites to the West of Thurso town centre (such as Scrabster Farm, Thurso Business Park area, and possibly Dounreay), will help to reduce future amenity impacts on the town centre arising from the renewables sector.

6.4.3 Structures

There is no particular evidence to support additional intervention over and above the inspection and maintenance that is currently undertaken. Future options for Wick Harbour Service Bridge need to take account of emerging options for the harbour, but these are not yet available or confirmed.

6.4.4 Roads

There is no particular evidence to support additional intervention over and above what is currently planned. B876 Killimster Moss is a weakness on the road network, but abnormal loads can be routed to avoid this stretch of road if necessary. The committed scheme at Keiss will provide a standard 6.0m road width on the A99 north of Wick to John O'Groats.

6.4.5 Georgemas Junction

There appears to be sufficient justification to undertake a consultation / master-planning process to ensure that current plans for the location will not compromise the future potential of this location.

6.4.6 Power Lines

There is no current justification, given anticipated load heights arising from the renewables industry, to undertaken a programme of altering low voltage cables along specific routes in the County. Individual projects may in the future require this to be undertaken on a project specific basis, but it is considered that this can be undertaken relatively easily and cheaply as any future need arises.

There is also no justification for seeking to alter high voltage cables.

Table 6.2 – Constraint Mitigation Options

Mitigation Option	Commentary	Advantages	Disadvantages	Cost
Scrabster Harbour				
a. Do Minimum	Option implies no significant expansion / reorganisation after current Phase 1 works. Led by Scrabster Harbour Trust.	Affordable.	Will constrain renewable opportunities in Caithness. This will significantly hinder the build out of Orkney and Pentland Waters Marine Renewable sites.	£20m Phase 1 works promoted by Scrabster Harbour Trust, funded by variety of partners.,
b. Harbour Expansion Option	Implies ongoing development works, including Phase 2 in Deep Water Basin, and industrial land development at Scrabster Farm. Likely to be developer led.	Enables wider range of development opportunities. Facilitates possible future reorganisation of activities at the Harbour.	Growth implies some separation of activity between quayside and future units at Scrabster Farm.	Likely to be part developer funded. Costs dependent on final configurations. Currently at feasibility/scoping Stages, no costs available.
Wick Harbour				
a. Do Minimum	Option implies no significant expansion, beyond current sites in and around existing harbour.	Affordable.	Will constrain renewable opportunities in Caithness. Will significantly hinder the build out of Orkney and Pentland Waters Marine Renewable sites.	Low cost option
b. Harbour Expansion Option	Enables growth beyond current harbour, to north and south of Wick Bay.	Enables growth in number of energy sectors.	Scoping work still ongoing, and thus there is current uncertainty regarding scale, costs and feasibility of different configurations.	No costs available. Dependent on outcomes of feasibility studies, and on options taken forward. Likely to be significant, although developer led.

Gills Bay				
a. Do Minimum	No significant growth or expansion.	Affordable.	Does not facilitate any significant increased activity, either from renewables sector, or displacement from Wick/Thurso.	No cost.
b. Harbour Expansion Option	Would provide for growth. Possible future plans still at concept level.	Greenfield site allows for development growth options. Harbour is situated closest to majority of marine renewables sites in the Pentland Firth.	Significant investment required within bay, and also on-shore.	Significant costs.
Mitigation Option	**Commentary**	**Advantages**	**Disadvantages**	**Cost**
Thurso Town Centre				
a. Do Minimum	Implies ongoing requirement to work around geometric limitations. However, marine renewables industry unlikely to demand transport of loads in excess of current capabilities.	No cost. No specific intervention required.	Continued amenity impacts on Thurso town centre. Additional costs imposed on industry if specialist articulated vehicles were required to transport specific loads.	No costs to public sector.
b. Installation of Demountable Street Furniture	Does not provide benefit, as constraint imposed by Olrig Street / Traill Street Junction, not Traill Street / George Street Junction.	No specific advantage.	Does not provide any significant benefit.	£75k - £100k for traffic signal replacement.
c. Demolition of Properties to Facilitate Abnormal Loads	Unacceptable on Planning Grounds.	Allows longer/wider loads through Thurso town centre.	Significant negative impact on town centre. Continues to impose negative amenity impacts on town centre. Considered unfeasible.	Considered unfeasible.
d. Construction of Thurso Development Road / Bypass	New route to West of Thurso, providing an alternative to the town centre. Long term option, possibly funded by incremental development.	Allows development of alternative route, designed to allow for full range of anticipated future loads. Enables future development opportunities to West of Thurso.	High cost. Long term and very uncertain implementation path. No support from Transport Scotland.	No formal costings have been developed. Estimate of £10m phase 1 (A836 to B874); £50m for full bypass (A836 to A9). .

Mitigation Option	Commentary	Advantages	Disadvantages	Cost
e. Review of Industrial Land Allocation in and around Thurso	Allocation of new marine renewable onshore O&M servicing developments adjacent to port, West of Thurso, or at Dounreay.	Encourages future engineering / servicing developments in appropriate locations. Development located on routes which avoid need to transport abnormal loads through Thurso town centre, and on routes capable of accommodating full range of anticipated loads.	Depends on development demand and commercial take up. Does not necessarily provide immediate solution.	Limited direct public sector cost. Potential requirement to support portion of enabling infrastructure.
Wick Town Centre				
a. Do Minimum	Implies ongoing requirement to work around length and width constraint. However, marine renewables industry unlikely to demand transport of loads in excess of current capabilities.	No additional cost. No specific intervention required.	Continued amenity impacts on Wick town centre. Additional costs imposed on industry if specialist articulated vehicles were required to transport specific loads.	No costs to public sector.
b. Installation of Demountable Street Furniture	No specific location where it might be useful in Wick town centre.	NA	NA	NA
c. Demolition of Properties to Facilitate Abnormal Loads	Unacceptable on Planning Grounds.	Allows longer/wider loads through Wick town centre, although constraints at other locations would continue, e.g. River Street/Bridge Street.	Significant negative impact on town centre. Continues to impose negative amenity impacts on town centre. Considered unfeasible.	Considered unfeasible.
d. Construction of Development Roads / Review of Industrial Land Allocations in and Around Wick Harbour	Long term options could be developed for new development roads to north and south of Wick, linking to possible future harbour expansion plans. Future local plan allocations need to tie into outcomes of feasibility work being undertaken by Wick Harbour.	Encourages future engineering / servicing developments in appropriate locations. Development located on routes which avoid need to transport abnormal loads through Wick town centre, and on routes capable of accommodating full range of anticipated loads.	Long term, high cost. Dependent on commercial developer investment.	No plans available to develop costs.

Mitigation Option	Commentary	Advantages	Disadvantages	Cost
Structures				
a. Do Minimum	Continuation of current monitoring and assessment, and abnormal loads management / assessments.	No additional cost. Continuation of established practice.	No significant disadvantages.	No additional cost.
b. Enhanced Monitoring and Assessment of Structures	Increased monitoring and assessments of specific structures.	Provides a pro-active response to structures which may be considered to be critical to Caithness network.	Additional costs. No evidence to suggest that current structures are not coping with existing loadings. Future loadings anticipated to be no greater than current demands.	Up to £60k per annum.
c. Targeted Investment in Specific Structures	Specific investment on key structures or culverts. Examples could include culvert at Bridge of Forss. Wick Harbour Service Bridge replacement would need to be tied into emerging master-plan for harbour.	Investment may provide additional assurance of route capabilities.	No evidence to suggest that current structures are not coping with existing loadings. Future loadings anticipated to be no greater than current demands.	£50k culvert at Bridge of Forss. £2.1m for Wick Harbour Service Bridge. Included in Capital Plan, but no start date.
Roads				
a. Do Minimum	Continuation of current maintenance and replacement programmes. Implies developer led roads investment in and around new development sites.	No additional cost. Continuation of established practice.	Does not provide any significant route upgrades. Does not address B876 Killimster Moss.	No additional cost. Includes Keiss improvements which are currently in capital plan at cost of £550k, programmed for 2012/13.

Mitigation Option	Commentary	Advantages	Disadvantages	Cost
b. Targeted Investment in specific stretches of Road Network	Possible advanced enabling infrastructure works at: • Scrabster Farm • West Thurso • North / South of Wick Harbour	Provides infrastructure to enable development in identified industrial locations. Helps to shorten implementation timescale.	Imposes investment cost on public sector, not developers. No firm plans currently available to develop requirements or extent of demand. Timing/phasing critical to ensure that any advanced investment meets business needs.	Possible roads investment cost greater than £50m could be envisaged. Significant potential to attract developer contributions through planning process.
Georgemas Junction				
a. Do Minimum	Developer led approach to the possible future expansion at the site.	No additional cost.	Risks compromising future potential of this site as a transport hub.	No additional cost.
b. Master-planning for future Potential Development	Identified as future growth area for development, associated with master-planning exercise.	Secures agreement with landowners/developers for phased development of the sites to north and south of rail line.	Requires specific planning input. There is some risk that future demand may not be realised to justify such an exercise.	Up to £100k master-planning exercise.
Low Voltage Power Lines				
a. Adaption	Option implies no programme of altering LV power lines, with emphasis placed on adapting loads to fit 5.2m height constraint.	No additional cost. Majority of future anticipated demand would be less than 5.2m in height.	May constrain possible future ad-hoc loads, or specific project loads.	No additional cost.
b. Under-grounding of LV Power Lines	Programme of under-grounding LV power lines along selected key routes, e.g. B874, B876, A836, A882. Some under-grounding work for LV lines proposed as part of grid upgrading.	Provides unrestricted height clearance on specific routes, subject to other height limits.	No specific demand currently identified for height clearance greater than 5.2m.	Estimate of £50k per route (£2k per cable, 25 cables per route).

Mitigation Option	Commentary	Advantages	Disadvantages	Cost
High Voltage Power Lines				
a. Adaption	Option implies no programme of altering HV power lines, with emphasis placed on adapting loads to fit 6.7m height constraint.	No additional cost. No future anticipated demand would be greater than 6.7m in height.	No disadvantages.	No additional cost.
b. Alteration of HV Power Lines	Implies changing HV routes, or burying cables.	Not considered feasible or necessary.	Not considered feasible or necessary.	Not applicable.
Support for Future Infrastructure Requirement				
a. Funding Allocations for Small Scale Infrastructure Alterations	Implementation of renewables sector still at early stage, and some uncertainty remains regarding the pattern of build out / Maintenance. Public sector funding could be provided to overcome specific constraint interventions that might be identified at a future stage on existing road network. This would be used to facilitate development, with a requirement to be linked to, and leveraged by, developer funds.	Provides a mechanism for allocation of capital funding (subject to specific criteria) to facilitate renewables development on the road network. Provides confidence to investors.	May not be taken up immediately or within specific timescales.	Suggestion of £250k, to be used to lever other funding, up to £500k, with 5 year time period.
b. Strategic Funding Packages	As above, but established to facilitate larger scale infrastructure development on the road network, such as new development roads / making key development sites ready for investment. Probably in the form of up front funding, to be recouped by developers as new investment comes on stream, via Section 75 processes.	Process for bringing identified local plan sites into development, dependent on agreed masterplans and committed developer interest. Similar to "Future Infrastructure Requirements" process established in NE Scotland. Opens mechanism for leveraging central Government funding, advance funding by public sector, recouped by subsequent developer contributions.	Feasibility depends on commercial demand for sites, opportunity to negotiate Section 75 agreements, as well as obtaining up front capital to progress schemes. Introduces Up Front funding risk to public sector.	£m's required up front, with aim to recover costs when development comes on stream.

6.5 Prioritisation of Interventions

Key factors for prioritisation are considered to be ***effectiveness***, ***affordability for public sector***, and ***timescales***. Each measure which is considered to be most appropriate to take forward has been scored on each of these three criteria, from 5 (high impact) to 1 (low impact). The sum of these scores has been used to inform the relative priority for each of these measures. These have been grouped into High Priority (Red), Medium Priority (Orange) and Low Priority (Green), as set out in Table 6.3 below.

Table 6.3 – Prioritisation of Interventions

Measure	Effectiveness (5 'very effective' to 1 'no impact')	Affordability for public sector (5 'very affordable' to 1 'unaffordable')	Timescales (5 'immediate implementation' to 1 'very long term')	Priority
Scrabster Harbour				
Expansion Options	5	4	4	13
Wick Harbour				
Expansion Options	5	4	4	13
Gills Bay				
Option Development	4	3	3	10
Thurso Town Centre				
Do Minimum	3	5	4	12
Development Road/Bypass	2	1	1	4
Development Allocations	4	5	4	13
Wick Town Centre				
Do Minimum	3	5	4	12
Development Allocations	4	5	4	13
Structures				
Do Minimum	3	5	4	12
Wick Harbour Service Bridge	2	2	2	6
Forss Culvert	2	3	3	8
Roads				
Do Minimum	3	5	4	12
Georgemas Junction				
Masterplanning	4	4	3	11
Power Lines				
Do Minimum	3	5	4	12
Strategic Funding				
Small Scale Fund	4	3	4	11
Strategic Infrastructure Funding	5	2	4	11*

** Necessity to provide a mechanism to promote advanced infrastructure at key development sites, potentially in a short timescale means that this measure is allocated a high priority rating.*

The outcome of the prioritisation process highlights three groupings of priorities (High, Medium and Low), which in turn reflect the outcomes of the study.

High priority interventions place a focus on The Highland Council and its regional public sector partners undertaking the following actions:

- Continuing to work with, and engage with Scrabster Harbour and Wick Harbour, with respect to their development plans and forthcoming investment options. This recognises that in the short term these two locations are going to the principal hubs and drivers of the renewables sector in Caithness. All other inventions are necessarily of less principal importance than development of the ports.
- Progressing development plans to facilitate industrial development in the vicinity of the ports, and in areas that avoid potential future town centre impacts/limitations in Thurso and Wick.
- Consideration of the establishment of a strategic infrastructure funding process that can, with funding leverage from developers and central government, facilitate the bringing to the market of the key industrial sites in the vicinity of the ports.

Medium priority interventions can be split into four categories:

- Engagement with the operators of Gills Bay to facilitate its longer term development, recognising the importance of all port facilities in the area.
- A number of Do Minimum actions on the road network – town centres, road network, power lines and structures, recognising that on current evidence there is no strong justification for intervention, over and above current management and maintenance routines. Future anticipated demands are predicted to be within current route capabilities.
- Consideration could also be given to a limited budget to facilitate small scale road improvements which might arise in the future, but cannot be identified at present due to the current understanding that is available of how the renewables sector will develop in Caithness.
- Master-planning exercise at Georgemas Junction, in order to ensure that short term development proposals do not compromise longer term options at this strategic site.

Low priority interventions include recommendations for the Thurso Bypass / Western Distributor road, although this could be facilitated by an incremental development process. Similarly, options for replacement of Wick Harbour Service Bridge need to be developed alongside the master-planning process for Wick Harbour. Structures such as Forss Culvert are currently a low priority for intervention.

6.6 The Relevance of Other Interventions

The scope of the study has been clearly focussed on the internal transport network of Caithness and in overcoming the potential constraints that this may place on the future development of the renewables sector. During the study process, and through consultation with stakeholders, it has become apparent that a number of the most significant constraints are those which are external to Caithness, and that these potentially could have the most impact on activity within Caithness.

Two principal issues have been specifically highlighted.

- A9 between Inverness and Caithness – This is a standard two lane all purpose carriageway, with limited overtaking opportunities. Berriedale Braes imposes constraints on abnormal loads due to the horizontal and vertical alignments. Limited diversions make the route vulnerable to serious disruptions.

- Air Services – Reliable and attractive air service connections at Wick Airport are required to counter the perceived peripherality of Caithness, and help make the area more attractive for inward investment. Air freight into Wick may be important for just-in-time deliveries of key components for the marine renewables sector.

Accordingly, in terms of priorities, it is important that these additional elements are also considered alongside those identified within Caithness.

6.7 Summary

This chapter has considered the range of options that are available for overcoming the variety of constraints and potential issues that have been identified during the course of the study.

The study outcomes, which have considered the capabilities of each key route and site, as well as anticipated future demands that will be required by the renewables sector, point toward the importance of the future development of the area's ports as the principal priority.

There is also recognition of the importance of making sites available for the renewables sector in close proximity to the ports to facilitate operations and maintenance activities. Supporting this land allocation process, should be the development of funding mechanisms that can bring these sites to implementation in an accelerated timescale. This should take account of possible future developer contributions, and funding potentially available from the wider public sector.

The capabilities of routes linking specific local engineering companies to the ports have been assessed. It has been found that the recorded maximum load weights and dimensions on these routes are greater than the forecast the anticipated loads that will be required in the future for the renewables sector. Rather than transporting large devices between inland workshops and quayside, it is anticipated that inland workshops will have a key role in the servicing and maintenance of key internal components.

The following chapter presents the key recommendations arising from the study.

Recommendations

7 Recommendations

7.1 Key Study Findings

The study was commissioned by HITRANS and The Highland Council to examine the constraints that the internal transport infrastructure within Caithness is placing on growth in the developing economy of Caithness and the Orkney Isles. The study was commissioned to allow Caithness to be in the best possible place to make the most of the expected growth in the emerging marine renewables industry.

The objectives of the study were to:

- Identify specific constraints;
- Assess the impact of these transport constraints on the development of the marine and offshore renewables industries including grid infrastructure and also decommissioning at Dounreay;
- Provide costed solutions where applicable; and
- Develop a prioritised action list of possible interventions.

At the outset of the study there was an assumption from many stakeholders that the internal roads network represented a potential constraint on economic development in Caithness.

The study approach focussed on a process of site visits, consultation with infrastructure managers and engineering companies and an assessment of future demands of the renewables sector. It also included an assessment of route capabilities (based on recent abnormal load movements) and swept path analysis within the town centres of Wick and Thurso.

The key study findings are that the principal limitations to the movement of loads in Caithness are imposed by the physical layout of the roads and building in the town centre of Thurso, and to a lesser extent some route options in Wick. However, when the future demands of the marine renewables sector are considered, it is found that these limitations would not place a constraint on the movement of components around the County.

In order to secure maximum benefit for Caithness, and to minimise future adverse amenity impacts, attention needs to be placed on:

- Public sector bodies working together to facilitate the development and expansion of the area's principal ports at Scrabster and Wick, recognising that this growth will be principally developer led and funded.
- Allocation of industrial development in the forthcoming Development Plan in the immediate vicinity of the area's ports, and to the West of Thurso town centre.
- Introduction of a Strategic Infrastructure Funding process, that can help bring these potential sites to the market earlier than might be possible if they were entirely developer led and funded.
- Ensuring that the external transport issues on the A9 are progressed, as well as seeking to improve the level of service offered by air connections to Caithness, in response to customer demand.

7.2 Recommendation 1 – Scrabster and Wick Harbours
High Priority

Without ongoing development and expansion of the principal ports in the area, the future opportunity for Caithness arising from wave, tidal and offshore wind renewable implementation in the Pentland Firth and Orkney Waters will be very limited. It is understood that developer interest is being expressed in the area's principal ports, and in line with the National Renewables Infrastructure Plan. As a result, it is anticipated that expansion works will be developer led.

It would be highly beneficial that bodies with local and regional transport and development responsibilities continue to fully engage and work with the Port Authorities to:

- Understand the most likely future development scenarios;
- Assist with master-planning the future development of the Harbours;
- Take account of options for timescales and phasing; and
- Enable information to be provided for future infrastructure demands outwith the port boundaries.

This action is about engagement, co-ordinated partnership working, and seeking to identify at an early stage barriers within the planning and implementation process.

7.3 Recommendation 2 – Development Plan Allocations
High Priority

Whilst fabrication and assembly of renewable energy devices are most likely to be undertaken at sites outwith Caithness, the area's ports are in a competitive location for future operations and maintenance roles. Our understanding is that this role will require sufficient quayside space/laydown areas, and workshops / storage facilities located in close proximity to the quayside. Appropriate location of such facilities can also overcome potential future issues with loads being transported through Thurso and Wick town centres.

Sites that should be specifically considered for inclusion in the Development Plan for such uses would be as follows:

- Scrabster Farm;
- Sites in West Thurso Development Corridor;
- Any future land released at Dounreay which may become available in the next 5 years.
- Sites to South of Wick Harbour, subject to emerging development plans for the Harbour
- Sites to North of Wick Harbour, subject to emerging development plans for the Harbour.

7.4 Recommendation 3 – Strategic Infrastructure Funding
High Priority

Enabling support may be required to bring the above industrial sites to a state of readiness within the timescales required by the renewables sector. It is considered that public sector bodies could consider funding mechanisms to enable initial infrastructure to be put in place, subject to reclaiming contributions from developers at a later date. Such mechanisms could be vital for facilitating suitable access arrangements to the sites above in a timely manner.

7.5 Recommendation 4 – Gills Bay
Medium Priority

The area's third port is currently less developed than either Wick or Scrabster, however, it is closest to a number of the future tidal energy sites located in the Pentland Firth Waters. The area surrounding Gills Bay is also relatively undeveloped. Significant investment would be required to improve both port side and land side facilities to fulfil future roles for operations and maintenance.

It is recommended that public sector bodies continue to engage with the operators of the facility to understand future development opportunities, timing and phasing, and subsequent resulting infrastructure demand outwith the port area.

7.6 Recommendation 5 – Georgemas Junction
Medium Priority

If operations and maintenance facilities were developed within Caithness, then there is a potential future requirement for a regular and reliable supply of spare parts and consumables. While most components will most likely be transported by road, it is conceivable that rail freight could provide a competitive supply chain solution for certain supplies, along with road freight / air freight for just-in-time and specialist components.

Given the possible future growth of the rail freight hub for the area, it is recommended that a master-planning exercise is undertaken to ensure that short term development proposals do not constrain future options for the site.

7.7 Recommendation 6 – Do Minimum Approach to Road Network / Power Cables
Medium Priority

The study has found that a Do Minimum approach to the road network (town centres, road network, structures) is appropriate, given that future anticipated demands are within historic recorded route capabilities. This includes the links between local inland engineering company locations, and the area's ports.

It is important that ongoing monitoring and assessment procedures are maintained for the areas structures, and management and maintenance regimes are continued for the road network.

The work has not found there to be a case for a programme of under-grounding low voltage power cables, and neither is there a case for altering high voltage power cables.

7.8 Recommendation 7 – Small Scale Scheme Fund
Medium Priority

The build out, and subsequent operations and maintenance of the renewables sector is still at an early stage. Whilst our analysis confirms that based on available information, the road network will not constrain renewable activity, there remains some ongoing uncertainty. To mitigate against the risk of constraints becoming apparent as the development pattern becomes clearer, and to avoid this delaying implementation timescales, it is recommended that consideration be given to small scale scheme funding. This would help to support any necessary improvement of road network/structures that were identified on the network, but were remote from individual development sites.

This fund would be used to lever additional funding and facilitate accelerated implementation of any necessary infrastructure works which provide a wider economic benefit to the area.

7.9 Recommendation 8 – Capital Improvement Schemes
Low Priority

Road widening at Keiss is included in the current Highland Council capital plan, and will provide a consistent road width of 6.0m on the A99 between Wick and John O'Groats.

Replacement of the Wick Harbour Service Bridge is also identified in The Highland Council's programme for Structures Works, although this is not associated with a future date. It is recommended that this scheme is considered within the context of future development options for Wick Harbour, specifically the advantages of providing an abnormal load connection between north and south of the Harbour without diverting through the town centre.

Other possible schemes could include strengthening of culverts, such as that at Bridge of Forss. However, at present there is no immediate justification for such intervention. This may change if there were to be significant change in current pattern of load demands.

7.10 Recommendation 9 – Thurso Bypass / Western Development Road
Low Priority

A Thurso Bypass is noted as a long-standing local aspiration. It is envisaged that such a route would enable easier access between the A9 and Scrabster, and reduce adverse amenity impacts of heavy and abnormal loads routing through Thurso. The route would also facilitate development opportunities to the west of Thurso.

While a route for a bypass of Thurso has been designated in the Caithness Local Plan (shown in Appendix F), the scheme is not currently supported by Transport Scotland, and funding is not available from either local or central government.

This study has confirmed that Thurso town centre places a limitation on the sizes of loads that can be transported between Scrabster and the A9 / A836. However, it is noted that future anticipated demands arising from the marine renewables sectors are within this size limitation. Accordingly, the lack of a bypass will not constrain economic development from marine renewables.

The requirement to transport large loads through Thurso town centre imposes adverse amenity impacts on the town centre, and causes some disruption to town centre activity. These adverse amenity impacts are likely to increase in the future, in line with increased development in and around Scrabster Harbour,

associated with the renewables sector. Neither the magnitude or impact of these impacts has been considered in this report, but this would be a requirement of the assessment of any future development applications.

for loads that are approaching the geometric limitations of the town centre, specialist haulage solutions may be required (such as trailers with rear wheel steering, or vehicles with specialist articulation). Such vehicles are unlikely to be available locally, and may be required to be supplied from either Inverness or the Central Belt, and thus impose additional haulage costs on the sector.

With no funding available for progression of the bypass, it is suggested that a strategy of developing the route in an incremental basis is pursued, linked to future development in the West Thurso area.

7.11 Recommendation 10 – External Links

The scope of the study has focussed on the internal transport links within Caithness, and excluded issues outwith the County. As a result, a level of priority has not been assigned to this recommendation. However, the significant role of external links, which is recognised in the Vision of the Caithness Transport Forum, and the 2008 MVA Consultancy report, should continue to be borne in mind for planning for future development in Caithness, as they are equally significant, if not more significant to the area. In particular, key issues relate to:

- Upgrading the A9, particularly at the Berriedale Braes; and
- Future development and expansion of Wick Airport.

The Berriedale Braes are a long standing constraint on the A9 north of Inverness due to steep gradients and hairpin bends. Thus, passage for heavy goods vehicles can be particularly challenging. A Geotechnical, Design and Construction Assessment of the route was completed in July 2011 and considered re-alignment of the road, and a local widening option. It recommended that further survey work was required, but costed the re-alignment option at £2.3m. HITRANS and The Highland Council, with the support of the Caithness Transport Forum, should continue to lobby for improvements to the Berriedale Braes to improve journey efficiency for key flows of traffic on the A9.

Opportunities for developing and expanding the level of service at Wick Airport related to customer need should continue to be explored. Route development will necessarily be demand led, but a growing renewables sector in Caithness will provide the opportunities for growth in service levels. Other opportunities such as GPS based landing systems have previously been suggested as a means of improving the reliability of air services to Wick,[11] and should continue to be reviewed as technology improves.

[11] *Caithness Vision* (Caithness Transport Forum)