MEYGEN

THE TIDE OF CHANGE IN CAITHNESS

Marine Licence Variation Environmental Statement

THE MEYGEN PROJECT PHASE 1 MARINE LICENCE VARIATION APPLICATION FOR MOORED BARGE AND JACK-UP VESSELS

Rev	Prepared	Sign Off	Checked	Sign Off	Approved	Sign Off	Date of Issue
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2							

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1 INTRODUCTION

MeyGen Ltd. ("MeyGen") was granted consent under Section 36 of the Electricity (Scotland) Act 1989[1] and Marine Licence under the Marine (Scotland) Act 2010[2] for the MeyGen Tidal Energy Project Phase 1 (the "Development"). The application was supported by an Environmental Statement (ES) and a Supplementary Environmental Information Statement (SEIS).

The consented Development will have a permitted generating capacity not exceeding 86 MW and shall comprise a tidal-powered electricity generating station including:

- not more than 61 three-bladed single rotor horizontal axis turbines each with a rotor diameter of no less than 16 metres and no more than 20 metres;
- all foundations and scour protection;
- inter array cabling and export cables to the shore; and
- all as specified in the Application, ES and SEIS.

The Development is in the Inner Sound of the Pentland Firth, between the north coast of Scotland and the island of Stroma (as shown Figure 1).

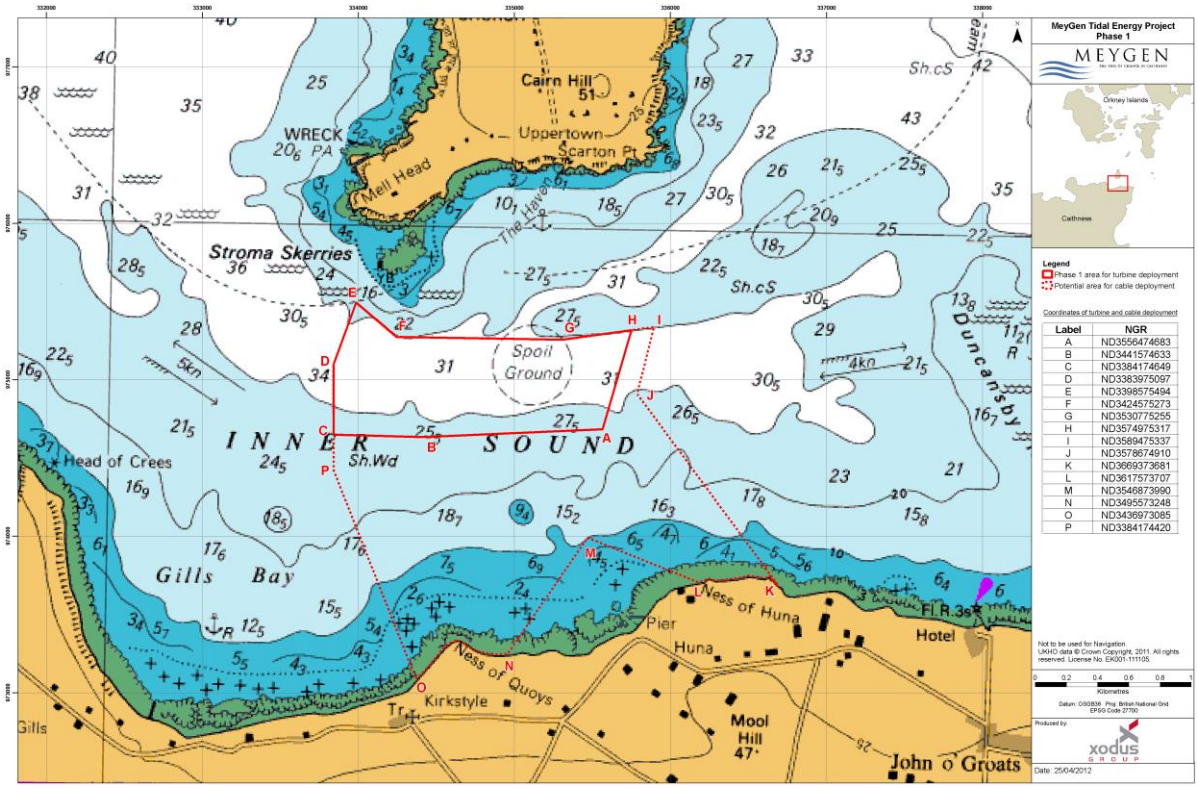

Figure 1 The Development, Inner Sound, Pentland Firth

[1] Dated 9th October 2013 http://www.gov.scot/Topics/marine/Licensing/marine/scoping/MeyGen

[2] Licence no. 04577/14/0 (31/01/14) http://www.gov.scot/Topics/marine/Licensing/marine/scoping/MeyGen

1.1 Document Purpose

The original application only considered Dynamic Positioning (DP) vessels for the construction, operations and maintenance, and decommissioning works. MeyGen requires to vary the Marine Licence to include jack-up vessels and moored barges.

Since the consent was awarded for the Development, there have been further improvements in vessel capabilities in high tidal energy environments. Both moored barge and jack-up type vessels have successfully conducted operations in high tidal environments.

Both vessel options provide an opportunity to significantly reduce the cost of energy for the MeyGen project, whilst it is important for the Development to remain commercially competitive by having access to all vessels capable of completed works in high tidal environments. Further details on jack-up and moored barges are available in Section 2.

MeyGen is submitting an application to vary the Marine Licence in accordance with Section 30(7) of the Marine (Scotland) Act 2010. There is no specific guidance for Marine Licence variations so this application has considered guidance on Section 36 Variations (Scottish Government, 2015) to identify best practice.

The original Marine Licence application was considered an Environmental Impact Assessment (EIA) project under the EU Directive 2011/92/EU (the "EIA Directive"). The EIA Directive is transposed into UK law for Marine Licence applications by the Marine Works (Environmental Impact Assessment) Regulations 2007[3] ("the 2007 Regulations"). This ES will support the application to vary the Marine Licence and meets the requirements of the 2007 Regulations.

The ES is designed to focus on the main aspects that have potential to give rise to significant environmental effects. MeyGen has been through a scoping exercise with the Marine Scotland Licensing Operations Team (MSLOT), Maritime Coastguard Agency (MCA), Northern Lighthouse Board (NLB), Marine Scotland Science (MSS) and Scottish Natural Heritage (SNH) to agree the contents of the assessment.

[3] http://www.legislation.gov.uk/uksi/2007/1518/contents/made

2 THE PROPOSED DEVELOPMENT

2.1 Vessel Options

The following subsections summarise the vessel options considered for both the original application (DP vessel) and this Marine Licence variation application (moored barge and jack-up vessel).

2.1.1 Dynamic Positioning Vessel

In the original application only Dynamic Positioning (DP) type vessels were considered for use during the construction, operations and maintenance and decommissioning phases of the Development.

DP vessels have a computer system to automatically maintain accurate position using a number of thrusters. Cable laying and heavy lifts can then be carried out from the deck of the DP vessel.

It was previously assessed that installation activities will be carried out by a single DP vessel during years one and two and if other small vessels were also to be used, no concurrent multiple vessel activities were to take place, i.e. no more than one vessel on site at any one time. During year three installation a maximum of two DP vessels (which could operate concurrently) for turbine support structure installation was assessed.

In terms of maintenance it was assessed that one DP vessel would be on site a maximum of 130 times per year, approximately every 2.8 days, based on a maximum 61 turbine array. A support vessel (multicat) was also assumed to be present during maintenance works.

2.1.2 Moored Barge

The Green Marine GM700 gantry barge, illustrated in Figure 2, is an example of a moored barge that could be used should this option be chosen for use during the construction, operations and maintenance and decommissioning activities. The GM700 measures 55 x 26.1m with a loaded draught of 2.5m.

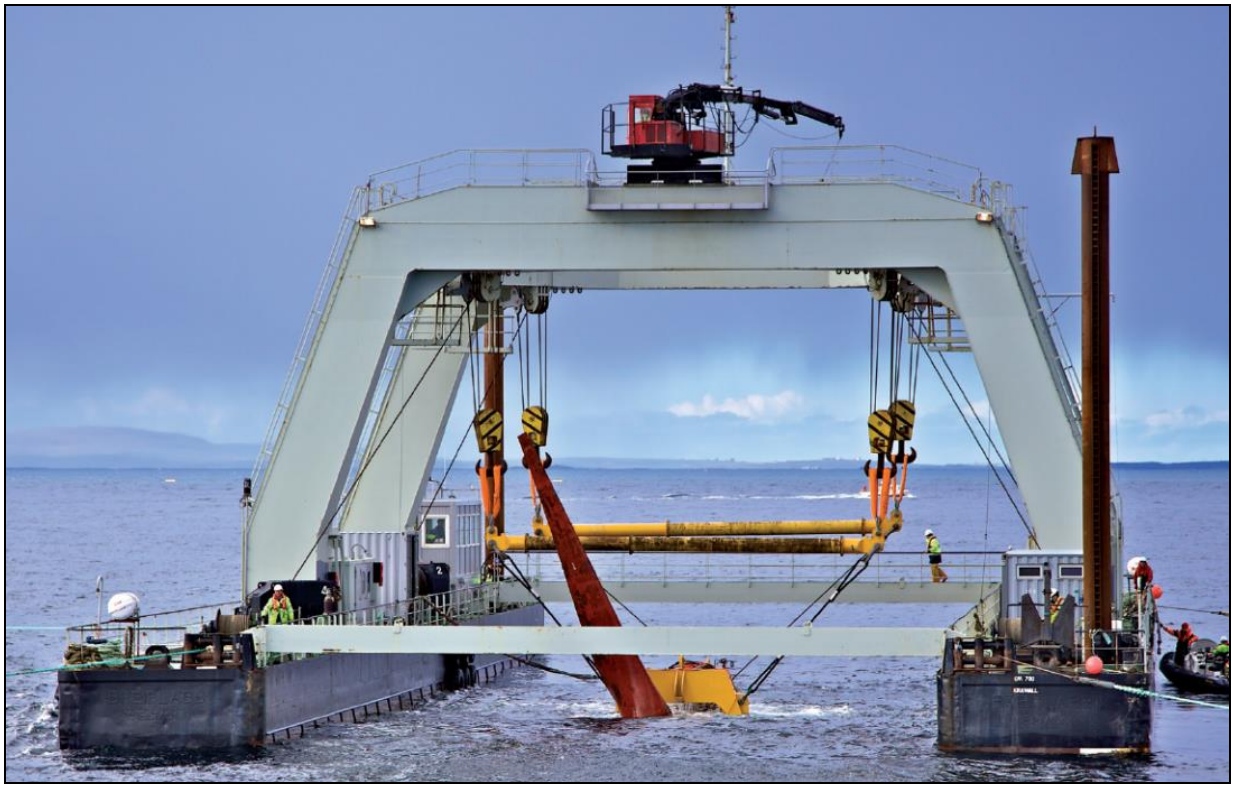

Figure 2 GM700 Gantry Barge (image courtesy of Green Marine)

The GM700 is fixed to the seabed via a four / six point mooring system. Moorings are installed on the seabed at the required position by a multicat prior to arrival of the barge on site. The mooring system comprises heavy chain clumps with a ground chain leading to a wire riser and a surface mooring buoy.

The GM700 is towed to the site and moved into position by two support vessels- a tug and multicat. Each mooring leg tends to be 150-200m long depending on the site and seabed conditions. The mooring procedure takes between 15-30 minutes to complete and is achievable in tidal flow speeds up to two knots.

Moored barges and their support vessels do not have DP systems, so it is expected that vessel noise and the risk of collision for marine species with propellers/thrusters is reduced.

2.1.3 Jack-up Vessel

Jack-up vessels have a number of movable legs that gives it the capability to raise the hull (of the vessel) above the sea surface. Depending on the jack-up vessel used it will either be able to transit to the site under its own power (and DP system) or under tow assisted by tugs, potentially up to two with the towage capability dependent on site conditions and tug availability.

The DEME Group offshore heavy lift jack-up vessel *DP2 Goliath*, illustrated in Figure 3, is an example of a jack-up vessel that could be used should this option be chosen for use during the construction,

operations and maintenance and decommissioning activities. The *DP2 Goliath* measures 60 x 38m with a maximum operational draught of 3.8m.

Whilst some jack-up vessels use DP systems to hold position before it deploys the legs, the use of the DP system in this scenario is significantly less than for DP vessel, which will use the system throughout the operation. It is therefore expected that vessel noise and the risk of collision for marine species with propellers/thrusters is reduced.

Figure 3 DP2 Goliath Jack-Up (Image courtesy of Deme Group)

2.2 Proposed Development Description

The "Proposed Development" is defined as the works the applicant would be authorised to construct or the way in which the works are constructed or extended if the licence was varied as requested in the variation application. The following changes to the Marine Licence and original ES (MeyGen 2012) are proposed.

2.2.1 Marine Licence

The description of the works (Section 2.2 of the Marine Licence) does not specifically include vessel types, the following changes have been drafted for the Marine Licence for the Proposed Development description (additions have been made in **bold** or struck through):

1.1 Interpretation

b) "the Application" means the Application for a marine licence and Environmental Statement submitted by the licensee to the licensing authority on 19th July 2012**;** ~~and~~

the Supplementary Environmental Information Statement submitted by the licensee to the licensing authority on 15th April 2013 **and the Marine Licence Environment Statement submitted by the licensee to the licensing authority on [ ]**;

s) **the Marine Licence Variation Environmental Statement means the Environmental Statement submitted in addition to the Supplementary Environmental Information Statement, Environmental Statement and Application by the licensee to the licensing authority on [ ].**

2.2.2 Environmental Statement

The proposed updates to the key project parameters from the original ES for the Proposed Development are shown in Table 1. The full table can be found in the original ES (MeyGen 2012).

Key project characteristics		
Parameter	**Consented Development**	**Proposed Development**
Marine operations	Planned to take place during the spring, summer and autumn months when weather conditions are most favourable and operations likely to be confined to periods when the tidal flows are lowest. Installation vessel requirements will include: ▪ a dynamically positioned installation vessel to install the turbine support structures; ▪ a dynamically positioned vessel or cable lay vessel with support ROV, to install the cables; and ▪ a dynamically positioned vessel or tug to install the turbines on the turbine support structure. During year 1 and 2 of installation there will not be more than one large dynamically positioned vessel on site at any one time. During year 3 there may be the requirement for two dynamically positioned vessels on site.	Planned to take place during the spring, summer and autumn months when weather conditions are most favourable and operations likely to be confined to periods when the tidal flows are lowest. Installation vessel options for all offshore operations will include: ▪ dynamically positioned installation vessel; ▪ moored barge; using a 4-6 point mooring system. The barge will be towed to/from site and positioned on the moorings by two support vessels (multicat / tug type); and ▪ jack-up vessel; either towed to site by a tug or using it's own dynamic positioning system. The vessel will jack-up out of the water on 4-6 legs to provide a stable platform. All operations will include supporting ROVs. During year 1 and 2 of installation there will not be more than one large dynamically positioned vessel on site at any one time. During year 3 there may be the requirement for two vessels on site. Operation and maintenance and decommissioning works will consist of similar

Key project characteristics		
Parameter	**Consented Development**	**Proposed Development**
		offshore operations to construction and will utilise the same vessel options.

Table 1 Proposed Development parameters

3 STAKEHOLDER CONSULTATION

3.1 Pre-Application

MeyGen has carried out a pre-application scoping exercise with MSLOT, MCA, NLB, MSS and SNH to determine the structure of the application. Further details of that exercise can be found in Section 4.

Further consultation meetings were held with the MCA, NLB, Scottish Fishermen's Federations (SFF), Royal Yachting Association (RYA), Caithness Kayak Club, Pentland Ferries, Scrabster Harbour Ltd. and Gills Harbour Ltd. Meetings were also sought with a group of local creel fishermen who are known to use the Inner Sound and John o' Groats Ferry, however, no response has been forthcoming to date. Details of the consultation can be found in the Table 3.

3.2 Application Consultation

Once MeyGen has received agreement from the regulator (MSLOT) that the variation application is suitable, MeyGen will formally submit the variation application. MSLOT will start a 28-day consultation period with selected stakeholders including MCA and NLB.

4 POTENTIAL ENVIRONMENTAL IMPACTS

4.1 Scoping Exercise

A scoping exercise was carried out with MSLOT, MCA, NLB, MSS and SNH to determine the extent of the assessment required for the Proposed Development. Table 2 provides details of the assessment of the original ES topics and how the proposed inclusion of jack-up vessels and moored barge would impact the conclusions. Where the Proposed Development is likely to have a significant environmental impact outwith that previously assessed or there is uncertainty, further information on the potential impacts is provided in this document.

The scoping exercise identified the Proposed Development may have an impact on Shipping and Navigation. Pre-application consultation confirmed the requirements for the updated information of the Navigation Risk Assessment (NRA). Stakeholders were presented with the Proposed Development prior to the meeting and discussed the potential risks of the changes, content and methods for the NRA addendum.

Stakeholder responses and meeting minutes are summarised in Table 3.

ES Chapter	Potential Change to Assessment	Justification	Further Assessment
Physical Environments and Sediment Dynamics	No potential change to any impact.	Use of jack-up vessel / moored barge does not change the assessment of all impacts.	✘
Benthic Habitats and Ecology	Direct physical impact and loss of habitat.	Potential increase in habitat loss due to temporary positioning of jack-up vessel legs or barge moorings. The potential temporary impact on benthic habitat is deemed unlikely to have any adverse impact.	✘
Marine Mammals	Noise (vessels); Ship strike (ducted propellers); Disturbance due to physical presence of vessels.	Construction noise will be the same or less than the DP vessel originally assessed. Ducted propellers will only be used when positioning vessel to jack-up, therefore less time than a DP vessel. Disturbance due to vessel presence will be the same or less than originally assessed.	✘
Ornithology	Disturbance / displacement due to increased boat traffic.	Disturbance due to vessel presence will be the same or less than originally assessed.	✘
Fish Ecology	Loss of spawning grounds; Loss of nursery grounds; Loss of habitats.	Potential increase in spawning / nursery grounds loss due to temporary positioning of jack-up legs or moorings. The potential impact is deemed unlikely to have any adverse impact.	✘

ES Chapter	Potential Change to Assessment	Justification	Further Assessment
Commercial Fisheries	Temporary exclusion from fishing grounds.	The only gear types used in the Inner Sound are static and predominantly take the form of pots (commonly known as creeling) targeting shellfish species such as brown crab, velvet crab and lobster. Consultation with local creelers has previously indicated that there is minimal use of the turbine deployment area. The small increase in vessel footprint due to barge mooring spreads is unlikely to result in any increase in restriction from fishing grounds. The consideration of transiting fishing vessels will be considered in the Shipping and Navigation section.	✗
Shipping and Navigation	Collision risk with work vessel; traffic re-routing due to work vessels; work vessel gets into difficulty.	Potential increase in risk to other vessel traffic in the area due to jack-up vessel / moored barge. Further assessment required	✓
Marine Cultural Heritage	Damage to undiscovered cultural material.	Potential increase in risk to undiscovered cultural material. Small footprint of jack-up vessel / moored barge means the risk is negligible. Same mitigation applied to vessel use and reporting protocol in place.	✗
Geology, Hydrology and Hydrogeology	No potential change to any impact.	Use of jack-up vessel / moored barge does not change the assessment of onshore project parameters.	✗
Terrestrial Habitats and Ecology	No potential change to any impact.	Use of jack-up vessel / moored barge does not change the assessment of onshore project parameters.	✗

ES Chapter	Potential Change to Assessment	Justification	Further Assessment
Landscape, Seascape and Visual Impacts	No potential change to any impact.	Use of jack-up vessel / moored barge does not change the assessment of onshore project parameters.	✘
Onshore Cultural Heritage	No potential change to any impact.	Use of jack-up vessel / moored barge does not change the assessment of onshore project parameters.	✘
Socio-economic Tourism and Recreation	Tourism and recreation impacts.	The potential impact on recreation craft is included in the assessment of navigation risk.	✘
Onshore Transportation and Access	No potential change to any impact.	Use of jack-up vessel / moored barge does not change the assessment of onshore project parameters.	✘
Onshore Noise and Dust	No potential change to any impact.	Use of jack-up vessel / moored barge does not change the assessment of onshore project parameters.	✘
Accidental Events	No potential change to any impact.	Use of jack-up vessel / moored barge does not change the assessment of all impacts.	✘

Table 2 Scoping of potential environmental impacts

Stakeholder (Date)	Comment
Gills and Scrabster Harbours (10/02/2016)	i. No navigational issues indicated considering the use of moored barge / jack-up vessel. ii. Dialogue held regarding harbour involvement and logistics around this.
Pentland Canoe Club (15/02/2016)	i. DP vessel is perceived to be a greater hazard for paddlers (large vessel footprint which can suddenly move) ii. The moored barge (*GM700*) is less likely to be a risk because it is static and as such easier to plan around

Stakeholder (Date)	Comment
	and predict when navigating. iii. There is a small risk of entanglement with the mooring lines of the moored barge. iv. The jack-up vessel is slightly higher risk compared to the moored barge, due to larger footprint. v. Support / guard vessels more likely to be hazard as movements will be difficult to predict. However, this should be manageable via communication with guard vessel prior to setting out. vi. Pentland Canoe Club highlighted use of club Facebook page as source of information for planning trips. vii. Club would not plan to undertake trip in wind speeds greater than Beaufort Force 4 in the Pentland Firth. viii. The use of the Inner Sound is uncertain / variable. However, it is known that Glenmore Lodge (a national outdoor training centre) recently spent two weeks (one week May and one week September) in the Pentland Firth area.
Northern Lighthouse Board (16/02/2016)	i. NLB noted that there had been issues with retrieving the moorings used at EMEC Fall of Warness. NLB queried if the barge moorings in the Inner Sound would be left in-situ. ii. A dedicated guard vessel was suggested for use. iii. NLB consider it appropriate that the barge and support vessels broadcast on AIS (as vessels). NLB also stated that it would be beneficial for the jack-up vessel to broadcast its position and status over AIS when working in the Inner Sound. iv. NLB noted that the Aberdeen Maritime Operations Centre (MOC) operate a voluntary reporting scheme for vessels using the Pentland Firth. NLB recommended agreeing a communications plan with the MCA regarding what report vessels working in the area should make, and also whether Aberdeen MOC could notify vessels transiting the Pentland Firth about MeyGen in advance. v. It was agreed that standard 500m safety zones during construction would be impracticable for the Inner Sound due to the available sea room. A mandatory safety zone with legal states would arguably offer added benefit when communicating with passing vessels and requesting they keep clear of the barge (plus

Stakeholder (Date)	Comment
	mooring lines) or jack-up vessel. NLB indicated they would be comfortable with a safety zone radius of c.100-150m. This safety zone would encompass the mooring lines of the barge to more than 8m below LAT. vi. NLB highlighted that as soon as (or before) the first device is installed, mariners need to be made aware of the subsurface risk from tidal devices, in addition to the temporary surface collision risk during the installation works. vii. NLB queried if a Marine Coordinator would be on site.
Northern Lighthouse Board (Letter 17/02/2016)	i. We agree that the scoping exercise has correctly identified that only the change of vessel type impacts on shipping and navigation. ii. In addition to the information provided in the original ES we would require that Atlantis Resources/MeyGen submit an updated Navigational Risk Assessment incorporating the latest vessel traffic data as this will allow stakeholders to consider the impacts on navigational safety of these changes, prior to a variation being issued. iii. We have identified that use of moored barges or jack-up vessels will impact on collision risk mitigation, however, we do not foresee that this would prevent the issue of an s36 variation if required.
Royal Yachting Association Scotland (16/02/2016)	i. RYA estimated that the proportion of recreational vessels carrying AIS may have increased to 25%, i.e. 1 in 4 of larger, longer distance cruising yachts. ii. RYA noted that more recreational vessels receive AIS than broadcast. iii. RYA stated that their preference would be for an advisory safety zone. iv. RYA recommend including Wick, Scrabster, Orkney Marinas and Stornoway harbours in the information circulation. The RYA is also happy to include information in its monthly newsletter. v. RYA have contacted the Commodore of the Pentland Firth Yacht Club who has confirmed their members have no issues with the proposed works.

Stakeholder (Date)	Comment
	vi. RYA queried the VHF coverage in the area. vii. RYA confirmed that they have no issues with the potential use of moored barges / jack-up vessels in the area, in addition to DP vessels considered in the original NRA.
Maritime and Coastguard Agency (18/02/2016)	i. MCA queried if the mooring line buoys would be moved when the barge moves onto the next turbine location. ii. MCA highlighted the importance of the UKHO being kept informed to ensure they can issue notices and chart corrections. iii. Discussions were held on the status (advisory or mandatory) and size (maximum of 500m) of safety zones. During the cable works undertaken in 2015 no safety zone was in place but mariners were asked to maintain a “suitably wide berth”. iv. It was questioned whether a mandatory safety zone with legal status would offer any additional risk benefit over an advisory safety zone, both of which would be ‘guarded’ by a support vessel.
Maritime and Coastguard Agency (email 18/02/2016)	i. MCA confirmed the proposals for the above project have been discussed with MeyGen and Anatec. Content of their NRA agreed, in advance of the addendum submission. MCA suggested a Variation is appropriate on this occasion, and therefore had no further comments to make at this stage.
Pentland Ferries (19/02/2016)	i. Indicated they have no significant concerns with the use of either a moored barge or jack-up vessel as long as they were kept informed of the planned works and the vessels being used before each operation.
Scottish Fishermen’s Federation (29/02/2016)	i. SFF requested further detail (including charts) on the maximum extent of the mooring pattern, i.e. the touchdown points on the seabed. ii. SFF stated that most vessels generally keep to the deeper water in the centre of the Inner Sound, except if they encountered another vessel and had to move off-centre. iii. SFF suggested that the high number of east-west vessels (11) recorded on the busiest day may be due to reports of good fishing off the west coast, and hence finishing in the North Sea and heading west via the

Stakeholder (Date)	Comment
	Inner Sound. iv. SFF's experience was that orders would normally be in place such that the skipper would be called to the bridge when a vessel was about to navigate the Inner Sound. Therefore, the most experienced crew member would normally be in the wheelhouse. v. SFF confirmed that Kingfisher should be contacted to ensure details or included within their fortnightly bulletins. vi. It was agreed that standard 500m safety zones during construction would be impracticable for the Inner Sound due to the available sea room. SFF stated that it is important the option to pass north of the site without getting too close to Stroma was maintained. A circa 150m safety zones would be appropriate and provide a suitable buffer beyond the mooring lines near the water surface. vii. SFF queried what support vessels would be on site. SFF commented that if support vessels were engaged in other duties they may not be able to dedicate themselves to guarding. viii. SFF highlighted the advantages of involving local people with local knowledge of the vessels in the area for watchkeeping.
Marine Scotland Science (letter 24/02/2016)	i. MSS stated they have no concerns over the change to the arrangements for installing turbines.
Scottish Natural Heritage (letter 15/02/2016)	i. For the MeyGen Phase 1 application in 2012, the Environmental Statement (ES) only assessed the use of dynamic positioning (DP) and tug vessels. For the installation of the StreamTec devices, MeyGen are proposing to use either a moored barge or jack-up vessel. In terms of vessel noise the proposed moored barge or jack-up vessel is within the project envelope already assessed. Both a moored barge and jack-up vessel will have a footprint on the seabed, which is outwith the project envelope. However, this footprint is likely to be small and temporary (for the installation of the devices and any maintenance). It is considered, therefore, that the proposed use of a moored barge or jack-up vessel is unlikely to have any adverse

Stakeholder (Date)	Comment
	impact on the benthic habitat.

Table 3 Pre-application Consultation

5 PROPOSED DEVELOPMENT ASSESSMENT

5.1 Introduction

The pre-application consultation process identified that the inclusion of jack-up vessel and moored barge in the Proposed Development could have a potential change to the impacts associated with Shipping and Navigation.

Table 4 provides a summary of the original ES Shipping and Navigation chapter assessment, which highlights the impacts with a potential change of risk that could occur. The assessment of these risks and potential new risks associated with the Proposed Development are included in the MeyGen Tidal Energy Project Navigation Risk Assessment Addendum – Vessel Options (Appendix A).

The NRA Addendum includes:

- Project overview;
- Stakeholder consultation;
- Marine traffic and maritime incident review;
- Impact assessment methodology and criteria;
- Impact assessment; and
- Conclusions and mitigation measures.

Impact (ES reference)	Frequency	Consequence	Risk	Significance	Potential Change to Assessment
15.1: Collision risk with work vessel	Extremely unlikely	Moderate	Low (Broadly acceptable)	Not Significant	**Potential change due to addition of moored barge and jack up vessel**
15.2: Traffic re-routeing due to work vessels and associated safety zones	Remote	Moderate	Tolerable (moderate risk)	Significant	**Potential change due to addition of moored barge and jack up vessel**
15.3: Working vessel gets into difficulty	Reasonably probable	Minor	Tolerable (moderate risk)	Significant	**Potential change due to addition of moored barge and jack up vessel**

Impact (ES reference)	Frequency	Consequence	Risk	Significance	Potential Change to Assessment
15.4: Powered collision with subsea turbine (<3m draught)	Negligible	Moderate	Low (broadly acceptable)	Not Significant	No change
15.4: Powered collision with subsea turbine (3-8m draught)	Extremely unlikely	Moderate	Low (broadly acceptable)	Not Significant	No change
15.5: Drifting vessel collision with subsea turbine (<3m draught)	Negligible	Moderate	Low (broadly acceptable)	Not Significant	No change
15.5: Drifting vessel collision with subsea turbine (3-8m draught)	Negligible	Moderate	Low (broadly acceptable)	Not Significant	No change
15.6: Increase in vessel-to-vessel collision risk due to re-routeing (via Inner Sound)	Negligible	Moderate	Low (broadly acceptable)	Not Significant	No change
15.6: Increase in vessel-to-vessel collision risk due to re-routeing (via Outer Sound)	Extremely unlikely	Moderate	Low (broadly acceptable)	Not Significant	No change
15.7: Loss of station	Reasonably probable	Minor	Moderate (tolerable)	Significant	No change
15.8: Anchor interaction	Extremely unlikely	Minor	Low (broadly acceptable)	Not Significant	No change

Impact (ES reference)	Frequency	Consequence	Risk	Significance	Potential Change to Assessment
Decommissioning	No significant impacts				No change
Cumulative	No significant impacts				No change

Table 4 Original ES Shipping and Navigation Assessment Summary

5.2 NRA Addendum Summary

5.2.1 Marine traffic and Maritime incident data

The original NRA and the NRA Addendum have followed the EIA Regulations which are the only legislation directly relevant to this assessment.

As per the original NRA, the addendum also follows the available guidance on conducting Navigation Risk Assessment for offshore renewables projects in the UK. The latest primary guidance is as follows:

- Maritime and Coastguard Agency, Marine Guidance Note 543, Safety of Navigation: Offshore Renewable Energy Installations (OREIs) - Guidance on UK Navigational Practice, Safety and Emergency Response, January 2016; and
- Maritime and Coastguard Agency, Methodology for Assessing the Marine Navigational Safety & Emergency Response Risks of Offshore Renewable Energy Installations (OREI), 7th September 2005.

The original assessment included Automatic Information System (AIS) and radar data from 2011/2012. The NRA Addendum included up to date AIS data from the following periods:

- 1st-28th March 2015 (28 days); and
- 1st-28th July 2015 (28 days).

The NRA also reviews the maritime incident data from the Marine Accident Investigation Branch (MIAB) and Royal National Lifeboat Institute (RNLI) for the area for the period 2011-2014 to compare to incident data from the original assessment from 2001 - 2010.

An increase in the number of east-west transits was recorded on AIS, with an average of 1.5 transits per day recorded compared with an average of 0.6 transits per day recorded during the original NRA. This increase is considered to be due to two reasons:

1. Increased uptake of AIS on transiting vessels, for example, due to the extension of the EU Directive mandating AIS carriage on fishing vessels. Fishing vessels of 15m length and over are now required to carry AIS compared to 45m length and above at the time of the previous surveys (2010-11).

2. The data periods assessed in the marine traffic validation exercise were targeted to specifically capture the peak period of fishing (March) and recreational (July) vessel activity.

Overall, the numbers are in-line with the estimates made in the original NRA, taking into account the contribution from (non-AIS) radar targets.

In terms of commercial ferries operating in the area, the transits of the *Pentalina*, did not differ significantly from those reviewed in the original NRA. The *Pentland Venture* did not broadcast on AIS at the time of the original NRA but the transits now recorded agree with the information received from John O'Groats Ferries during the original consultation.

5.2.2 Assessment Methodology

The same impact assessment methodology (International Maritime Organisation's Formal Safety Assessment process and Department of Energy and Climate Change (DECC) / MCA guidelines, used in the original NRA/ES has been used for the NRA addendum.

5.2.3 Re-assessment of NRA/ES Impacts

The following impacts have been re-assessed for the NRA addendum:

- Collision risk with work vessels (Construction)
- Traffic re-routing due to work vessels and associated safety zones (Construction)
- Working vessels gets into difficulties (Construction)

The following new identified impacts have been included in the NRA addendum:

- Allision (Drifting) Risk with work vessels (Construction)
- Loss of station of moored barge (Construction)
- Fishing gear interaction with subsea mooring lines (Construction)

5.2.4 Conclusions

The re-assessment of impacts from the original NRA/ES and newly identified impacts concluded that all impacts were tolerably or broadly acceptable following the implementation of mitigation measures. The conclusion that the overall risk to shipping and navigation is not significantly higher than originally assessed when using jack-up vessel or moored barge is supported by consultation carried out with national and local stakeholders.

Further mitigation measures to reduce the overall risk considering use of a moored barge / jack-up vessel are summarised below:

- Safety zone of appropriate dimensions will be implemented to protect working vessels on the site when restricted in manoeuvrability. An advisory safety zone radius of 150m is planned, based on the consensus arising from the stakeholder consultation.

- Operating procedures will be established to ensure work vessels do not block the channel when they are not actively working on the site.
- Collision risk management procedures will be developed by working vessels specifying traffic monitoring and emergency response procedures.
- Guarding against potential collision will take place during the construction phase whilst the moored barge / jack-up vessel are onsite.
- Provision of towage capability by support vessels (if and when present).
- Undertake periodic drills and testing of emergency procedures in the event of a required re-positioning of moored barge / jack-up vessel.

6 REFERENCES

Scottish Government (2015) Applying for Variation for Section36 Consents of the Electricity Act for Generating Stations in Scotland. Scottish Government Energy Consents and Deployment Unit. http://www.gov.scot/Topics/Business-Industry/Energy/Infrastructure/Energy-Consents/Guidance/VariationGuidanceNotesSeptember2015

MeyGen (2012) MeyGen Tidal Energy Project Phase 1 Environmental Statement

Anatec (2012) Navigation Risk Assessment - MeyGen Inner Sound

APPENDIX A – NAVIGATION RISK ASSESSMENT ADDENDUM

MeyGen Tidal Energy Project

Navigation Risk Assessment Addendum - Vessel Options

Prepared by:	Anatec Limited
Presented to:	MeyGen Ltd
Date:	24.03.2016
Revision No.:	02
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Revision Number	Date	Summary of Change
00	02.03.2016	Initial Draft
01	23.03.2016	First Revision
02	24.03.2016	Final Revision

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Abbreviations

AIS	-	Automatic Identification System
DECC	-	Department of Energy and Climate Change
DP	-	Dynamic Positioning
DSC	-	Digital Selective Calling
ES	-	Environmental Statement
MAIB	-	Maritime Accident Investigation Branch
MW	-	Megawatt
m	-	Metre
MCA	-	Maritime and Coastguard Agency
MGN	-	Marine Guidance Note
NLB	-	Northern Lighthouse Board
nm	-	Nautical Mile (1nm = 1,852m)
NRA	-	Navigational Risk Assessment
PFOW	-	Pentland Firth and Orkney Waters
RIB	-	Rigid Inflatable Boat
RNLI	-	Royal National Lifeboat Institution
RYA	-	Royal Yachting Association
SAR	-	Search and Rescue
SFF	-	Scottish Fishermen's Federation
TSS	-	Turbine Support Structure
UK	-	United Kingdom
UKHO	-	United Kingdom Hydrographic Office
VHF	-	Very High Frequency
VTS	-	Vessel Traffic Service

1. Introduction

Anatec have been commissioned by MeyGen to review the potential variance in impact of the MeyGen Tidal Energy Project on shipping and navigation considering the use of additional vessel types not considered in the original Navigational Risk Assessment (NRA) (Ref. i).

Phase 1 of the MeyGen Tidal Energy Project has been granted consent by the Scottish Government for the development of up to a maximum capacity of up to 86 megawatts. The original NRA considered the use of a Dynamic Positioning (DP) vessel supported by multicats. MeyGen are currently seeking to vary the consent to incorporate a wider range of vessel options. Therefore this review shall assess the different vessel options, as listed below, for use during the construction, operations and maintenance and decommissioning phases of the Project, taking the form of an addendum to the original NRA.

1. Moored barge; and
2. Jack-Up vessel.

All relevant impacts identified in the original NRA shall be re-assessed considering the use of these additional vessel types (moored barge / jack-up vessel). Furthermore, a review shall be undertaken to identify any potential new impacts that could arise. Appropriate mitigation measures shall also be advised to help minimise the overall risk to shipping and navigation.

2. Legislation and Guidance

The original work, and this update, has followed the EIA Regulations which are the only legislation directly relevant to this assessment.

As per the original NRA, this addendum also follows the available guidance on conducting Navigation Risk Assessment for offshore renewables projects in the UK. The latest primary guidance is as follows:

- Maritime and Coastguard Agency, Marine Guidance Note 543, Safety of Navigation: Offshore Renewable Energy Installations (OREIs) - Guidance on UK Navigational Practice, Safety and Emergency Response, January 2016; and

- Maritime and Coastguard Agency, Methodology for Assessing the Marine Navigational Safety & Emergency Response Risks of Offshore Renewable Energy Installations (OREI), 7th September 2005.

Other guidance considered in this assessment are listed below:

- MCA Marine Guidance Notice 372 (MGN 372 M+F) Offshore Renewable Energy Installations (OREIs) Guidance to Mariners Operating in the Vicinity of UK OREIs (2008);

- Department of Environment and Climate Change (DECC) Guidance Notes on Applying for Safety Zones around Offshore Renewable Energy Installations, November 2011 (Revised);

- International Maritime Organisation (IMO), Guidelines for Formal Safety Assessment (FSA) (2002); and

- IALA Recommendation O-139 on The Marking of Man-Made Offshore Structures, Edition 2, December 2013.

3. Baseline Data Review and Data Gaps

A review of the baseline data used in the original NRA / ES was carried out when deciding the scope of this NRA Addendum.

In order to inform the re-assessment of potential impacts a marine traffic validation exercise has been undertaken to identify any changes in marine traffic since the original NRA was undertaken. As such, recent (28 days March 2015 and 28 days July 2015) Automatic Identification System (AIS) data have been reviewed. This exceeds the minimum 28 days specified by MGN 543.

In addition, recent (2011 onwards) maritime incident data has been reviewed in order to provide a general indication as to whether the area of the development is a low or high risk area in terms of maritime incidents. A comparison with the maritime incident data reviewed in the original NRA (2001 – 2010) has also been undertaken to identify if the frequency and/or severity of maritime incidents has increased in recent years. This review of more recent maritime data has been used to inform the risk assessment considering the use of additional vessel options.

A high-level review of other baseline data, including navigational features, metocean data and Search and Rescue facilities, was carried out and no major changes were identified.

The original NRA also analysed radar data from Orkney VTS to identify the levels of non-AIS traffic using the Inner Sound. Equivalent data was not available for the NRA Addendum, but it is noted that, due to the nature of the traffic using the Inner Sound, more of the traffic previously only recorded by radar is now broadcasting on AIS, i.e., all fishing vessels 15m length and above as well as an increasing proportion of recreational craft.

4. Project Overview

4.1 Location

The MeyGen Tidal Energy Project is located within the Inner Sound of the Pentland Firth, as illustrated in Figure 4.1. As previously stated Phase 1 of the Project has been granted consent for the development of a maximum capacity of up to 86 megawatts (61 turbines).

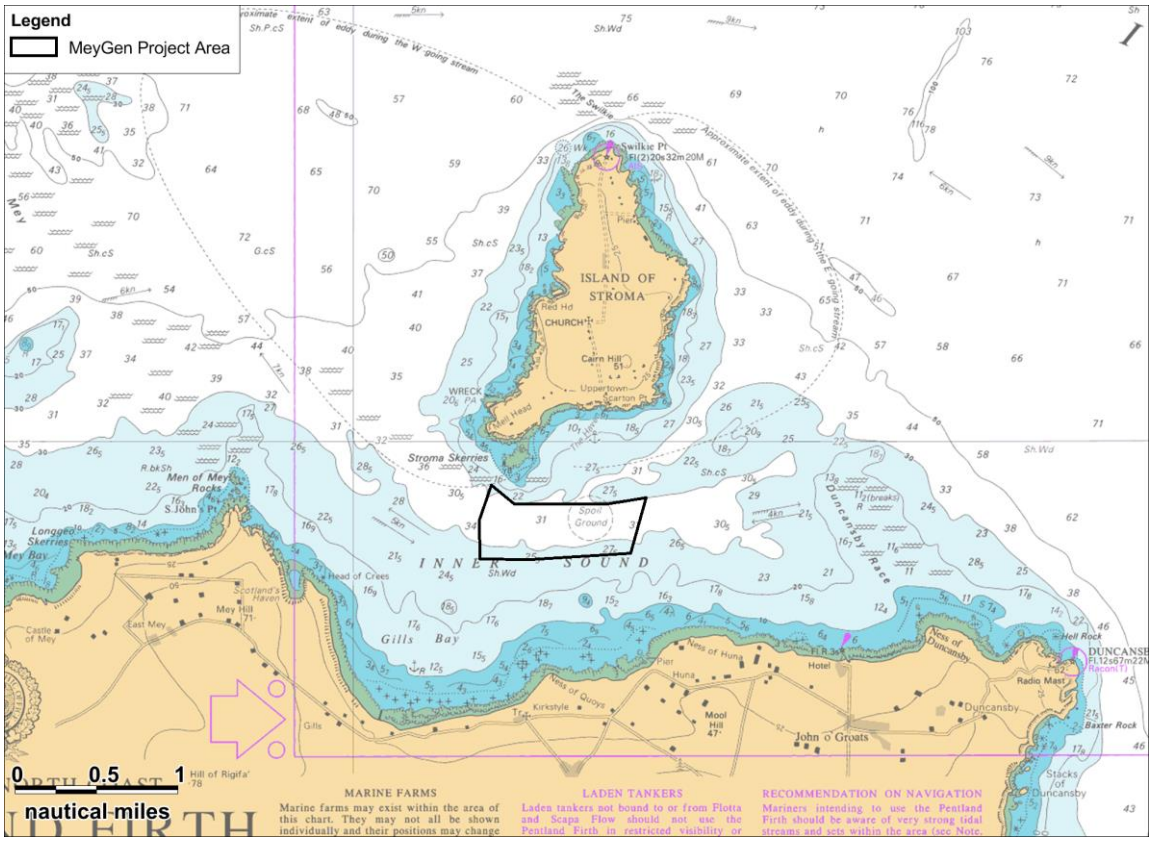

Figure 4.1 Project Location (MeyGen Phase 1)

4.2 Indicative Layout

Phase 1a of the project is currently under construction, with four turbines due to be installed during the second half of 2016. Phase 1a will compromise of one Atlantis and three Andritz Hydro Hammerfest turbines (1.5MW turbines, total capacity of 6 megawatts) on gravity base support structures, the locations of which are illustrated in Figure 4.2. Positions of all other turbines in the indicative Phase 1 layout are also illustrated in Figure 4.2.

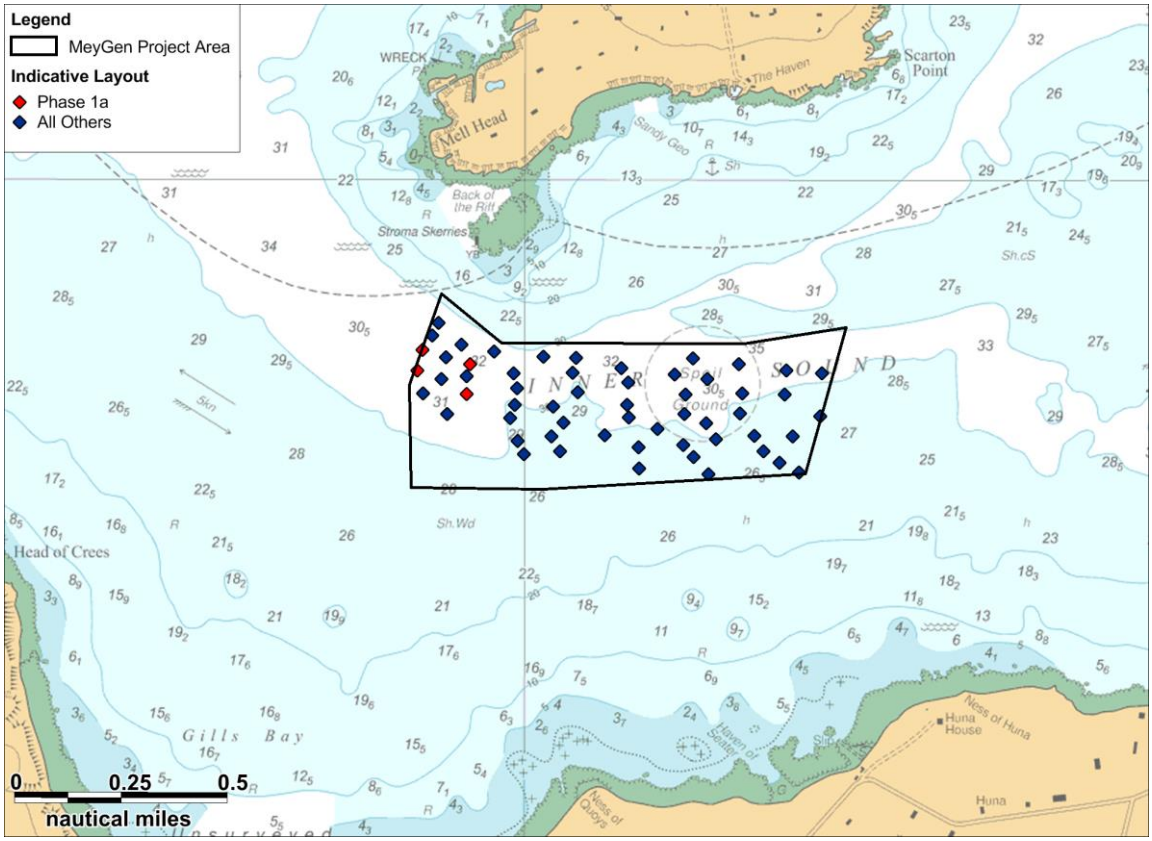

Figure 4.2 Phase 1a – Indicative Turbine Layout

Phase 1b, located approximately 500m south east of Phase 1a, of the project is likely to comprise of four 1.5MW turbines supported by two StreamTec support structures (two turbines per support structure) with a total capacity of 6MW, due for installation during summer 2017. Streamtec is a steel structure that is fixed to the seabed with two drilled piles. All turbines will be a minimum of 8m below the water depth at LAT, which is in-line with the original NRA and therefore it has been agreed that it requires no further consideration in the NRA addendum.

5. Vessel Options

The following subsections summarise the vessel options considered for both the original NRA (DP vessel, Section 5.1) and this NRA Addendum (moored barge and jack-up vessel, Sections 5.2 and 5.3).

5.1 Dynamic Positioning

In the original NRA (Anatec, 2012) the use of a Dynamic Positioning (DP) vessel was considered for use during the construction, operations and maintenance and decommissioning phases of the Project.

The intended installation sequence (assessed throughout the original NRA) involved the use of a DP vessel during the following stages:

- Turbine Support Structure (TSS) installation;
- Export cable installation; and
- Turbine installation.

It was previously assessed that installation activities will be carried out by a single DP vessel during years one and two and if other small vessels were also to be used, no concurrent multiple vessel activities were to take place, i.e. no more than one vessel on site at any one time. During year three installation a maximum of two DP vessels (which could operate concurrently) for turbine support structure installation was assessed.

In terms of maintenance it was assessed that one DP vessel would be on site a maximum of 130 times per year, approximately every 2.8 days, based on a maximum 86 turbine array. A support vessel (multicat) was also assumed to be present during maintenance works in the original NRA.

5.2 Moored Barge

The Green Marine *GM700* gantry barge, illustrated in Figure 5.1, is an example of a moored barge that could be used were this option chosen for use during the construction, operations and maintenance and decommissioning of the Project. The *GM700* measures 55 x 26.1m with a loaded draught of 2.5m.

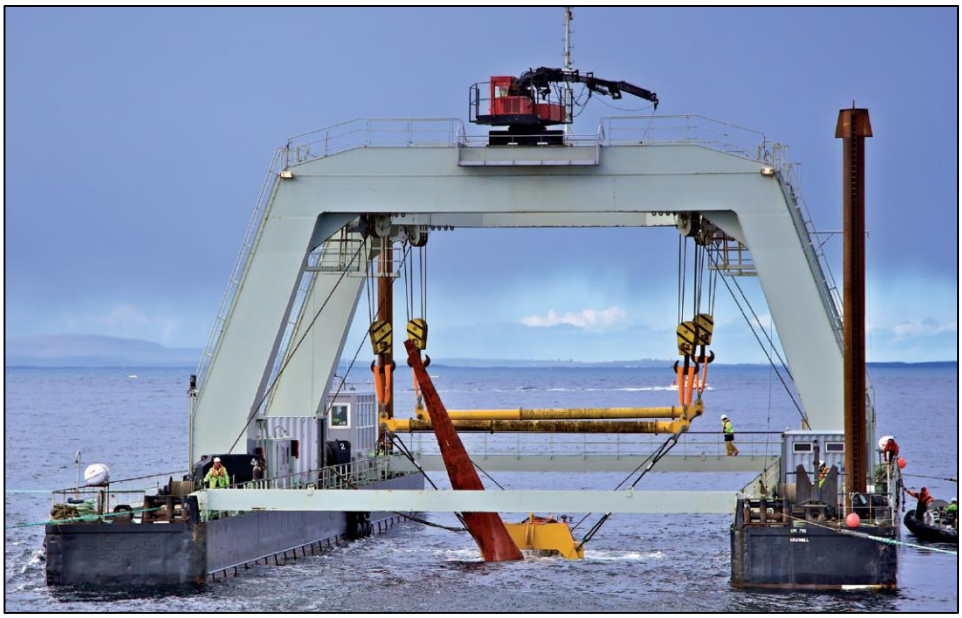

Figure 5.1 GM700 Gantry Barge (image courtesy of Green Marine)

The *GM700* is fixed to the seabed via a four / six point mooring system. Moorings are installed at the required position by a multicat prior to arrival of the barge on site. The mooring system comprises heavy chain clumps with a ground chain leading to a wire riser and a surface mooring buoy.

The *GM700* is towed to the site and moved into position by two support vessels- a tug and multicat. The order in which the moorings are connected is dependent on tidal flow and weather conditions on site. The tow vessels are used to hold the *GM700* in position on site whilst a Rigid Inflatable Boat (RIB) connects the barge mooring lines to each of the pre-installed mooring surface buoys. Each mooring leg tends to be 150-200m long depending on the site and seabed conditions. The specific mooring design for the Project shall be completed prior to installation of the moorings. The mooring procedure takes between 15-30 minutes to complete and is achievable in tidal flow speeds up to two knots.

A typical mooring spread of the *GM700* is illustrated in Figure 5.2. The surface mooring buoys are located at a radius of 85m from the centre point of the *GM700*, indicated by the blue line. The mooring lines reach a depth of 8m at a radius of 92.5m from the centre point of the *GM700*, indicated by the red line. The radius at which the mooring line depth exceeds 8m is therefore not significantly greater (7.5m) than the surface mooring buoy radius.

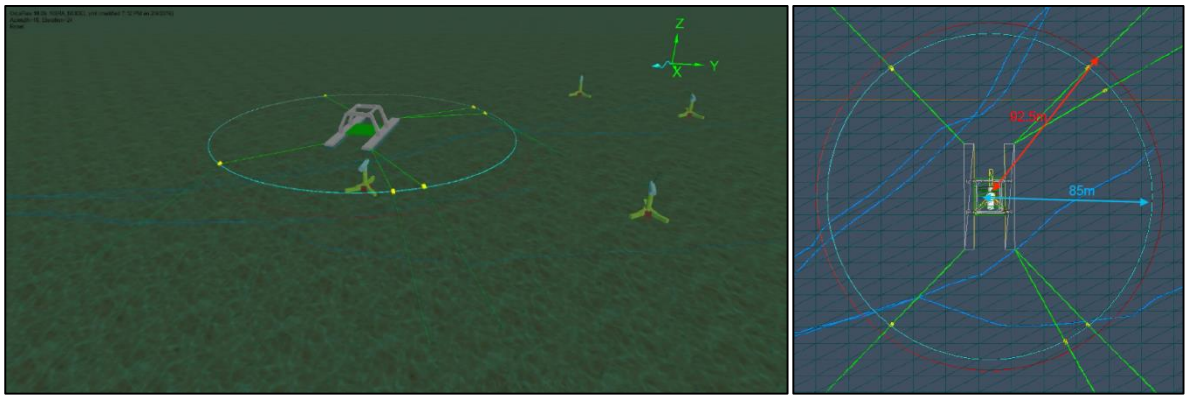

Figure 5.2 GM700 Mooring Spread

Working limits for the *GM700* are typically: 6 knots tidal flow, 3m significant wave height and Beaufort Force 6 wind speeds. Whilst the *GM700* is moored on site, the support vessels act as guard vessels monitoring all traffic and are in contact with Orkney Marine Services Vessel Traffic System (VTS). The *GM700* will also be extensively lit during operations to increase the overall visibility. Notice to mariners are also issued (as standard) prior to commencement of operations.

The *GM700* is capable of carrying one turbine support structure and one tidal turbine generator or two turbine support structure ballast blocks. It is anticipated that the complete installation of one turbine will take in the order of five days on site. However additional transits to base ports (likely to be Scrabster and Nigg) would be required to pick up components.

Figure 5.3 presents the vessel footprint at each of the Phase 1a turbine locations based on the dimensions of the *GM700.* The maximum mooring spread of 200m is also illustrated from the barge to the seabed. (Note: No consideration has been given to the positioning of the barge and its mooring with respect to tidal streams within Figure 5.3).

It should be noted that for Phase 1a, installation work shall only be undertaken at one turbine location at any given time. Foundation ballast is proposed to be mobilised from Scrabster and turbine support structures / tidal turbine generators from Nigg.

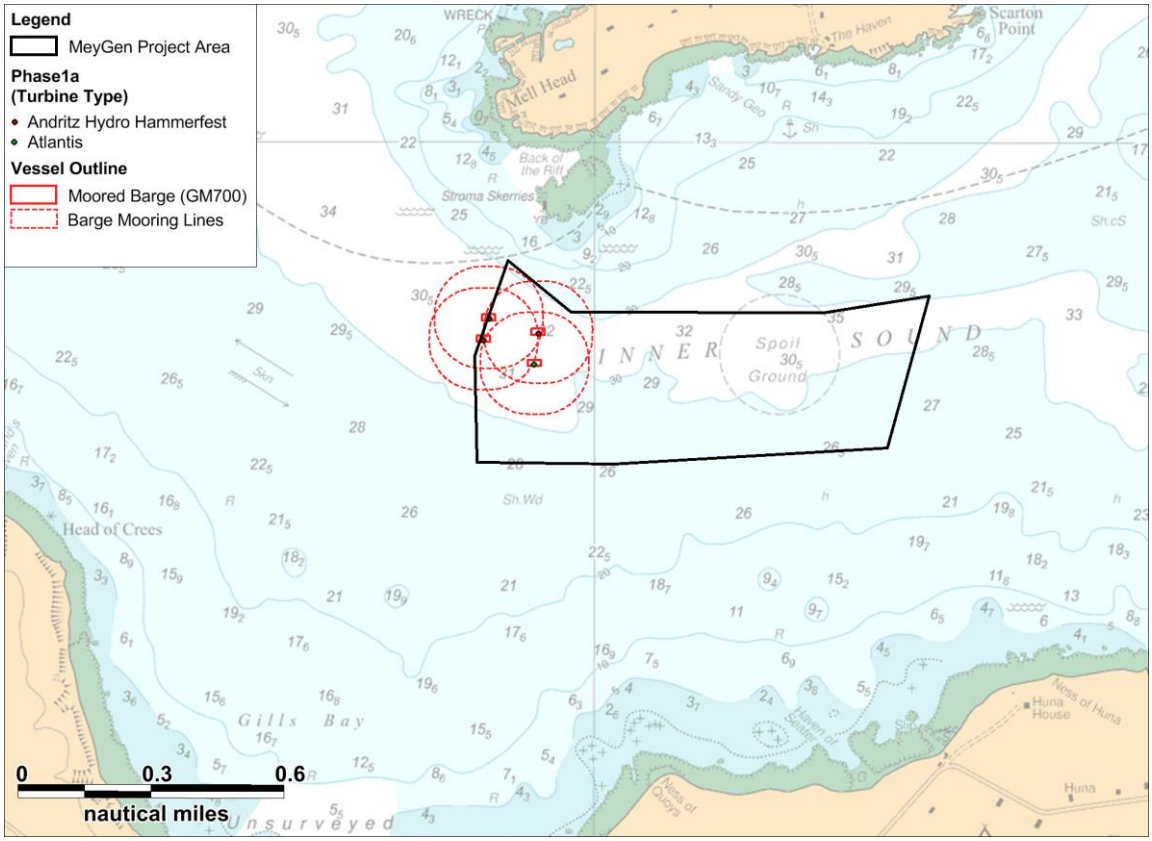

Figure 5.3 Scale Drawing of Example Barge Option – Phase 1a

5.3 Jack-Up

Jack-up vessels have a number of movable legs that gives it the capability to raise the hull above the sea surface. Depending on the jack-up vessel used it will either be able to transit to the site under its own power or under tow assisted by tugs, potentially up to two with the towage capability dependent on site conditions and tug availability. Once on site, the jack-up vessel will position itself in the correct location using its own DP system and legs will be lowered to the seabed.

The DEME Group offshore heavy lift jack-up vessel *DP2 Goliath*, illustrated in Figure 5.4, is an example of a jack-up vessel that could be used were this option chosen for use during the construction, operations and maintenance and decommissioning of the Project. The *DP2 Goliath* measures 60 x 38m with a maximum operational draught of 3.8m. The jacking system of the *DP2 Goliath* is capable of speeds of 0.5m per minute. Therefore assuming a jacked-up height of 35-40m, the jack-up vessel will take in the order of 60 minutes to elevate. A support vessel will be on hand to assist the jack-up vessel getting into position. The jack-up vessel is capable of carrying a minimum of two tidal turbine generators / two turbine support structures / six ballast blocks. The installation of one turbine is scheduled to take approximately five days on site.

Figure 5.4 DP2 Goliath Jack-Up (Image courtesy of DEME Group)

The dimensions of the *DP2 Goliath* jack-up vessel are of a similar size to the *GM700* barge, the outline of which is illustrated in Figure 5.3. It should be noted that no mooring lines are required for the jack-up vessel.

6. Stakeholder Consultation

6.1 General Feedback

As part of this NRA addendum both national and local stakeholders have been consulted in order to inform the risk assessment of the inclusion of a moored barge and / or jack-up vessel throughout the lifetime of the Project. Table 6.1 summarises the consultation responses received as part of this addendum only, ordered chronologically.

A number of other local stakeholders (including local fishermen and John O'Groats Ferries) were sent information about the alternative vessel options but had not provided feedback at the time of writing. All parties were previously consulted during the full NRA process (Anatec, 2012).

Table 6.1 Summary of Consultation on NRA Addendum

Consultee (Date)	Comment	Response / where addressed
Gills and Scrabster Harbours (10/02/2016)	i. No navigational issues indicated considering the use of moored barge / jack-up vessel. ii. Dialogue held regarding harbour involvement and logistics around this.	i. Noted. ii. Noted.
Pentland Canoe Club (15/02/2016)	i. DP vessel is perceived to be a greater hazard for paddlers (large vessel footprint which can suddenly move) ii. The moored barge (*GM700*) is less likely to be a risk because it is static and as such easier to plan around and predict when navigating. iii. There is a small risk of entanglement with the mooring lines of the moored barge. iv. The jack-up vessel is slightly higher risk compared to the moored barge, due to larger footprint. v. Support / guard vessels more likely to be hazard as movements will be difficult to predict. However, this should be manageable via communication with guard vessel prior to setting out. vi. Pentland Canoe Club highlighted use of club Facebook page as source of information for planning trips. vii. Club would not plan to undertake trip in wind speeds greater than Beaufort Force 4 in the Pentland Firth.	i. Noted and considered in impact assessment (Section 9). ii. Noted and considered in impact assessment (Section 9). iii. Noted and considered in impact assessment (Section 9). iv. Noted and considered in impact assessment (Section 9). v. Noted and considered in impact assessment (Section 9). vi. MeyGen to provide chart of turbine locations (Phase 1a) so that the positions can be avoided during trips. vii. Noted. viii. Noted.

Consultee (Date)	Comment	Response / where addressed
	viii. The use of the Inner Sound is uncertain / variable. However, it is known that Glenmore Lodge (a national outdoor training centre) recently spent two weeks (one week May and one week September) in the Pentland Firth area.	
Northern Lighthouse Board (16/02/2016)	i. NLB noted that there had been issues with retrieving the moorings used at EMEC Fall of Warness. NLB queried if the moorings in the Inner Sound would be left in-situ. ii. A dedicated guard vessel was suggested for use but it was agreed that, provided a support vessel was available to 'intercept' approaching vessels, a separate vessel was unnecessary. For any periods when a support vessel was unavailable, e.g., occupied in assisting the Barge / Jack-up vessel, a separate guard vessel, e.g., RIB, should be utilised. iii. NLB consider it appropriate that the barge and support vessels broadcast on AIS (as vessels). NLB also stated that it would be beneficial for the jack-up vessel to broadcast its position and status over AIS when working in the Inner Sound. iv. NLB noted that the Aberdeen Maritime Operations Centre (MOC) operate a voluntary reporting scheme for vessels using the Pentland Firth. NLB	i. MeyGen confirm that the moorings shall not be left in place when no work is going on. The intention is for moorings to be installed immediately prior to the operation commencing and removed promptly afterwards. ii. For the Barge option, support vessel(s) will be available to act as guard vessel(s). However, the Jack-up vessels may not require a support vessel. Instead there will be dedicated watch-keeping from the Jack-up vessel using traffic monitoring equipment (radar and AIS) and communication equipment (VHF DSC) equivalent to a guard vessel. If and when support vessels are available, they will be used for guard duties. iii. Post meeting confirmation that the example barge (*GM700*) operates AIS. If it is not equipped with a vessel AIS then an AIS AtoN shall be fitted to the jack-up vessel for the MeyGen works. iv. A Navigation Safety Plan has already been

Consultee (Date)	Comment	Response / where addressed
	recommended agreeing a communications plan with the MCA regarding what report vessels working in the area should make, and also whether Aberdeen MOC could notify vessels transiting the Pentland Firth about MeyGen in advance. v. It was agreed that standard 500m safety zones during construction would be impracticable for the Inner Sound due to the available sea room. A mandatory safety zone with legal states would arguably offer added benefit when communicating with passing vessels and requesting they keep clear of the barge (plus mooring lines) or jack-up vessel . NLB indicated they would be comfortable with a safety zone radius of c.100-150m. This safety zone would encompass the mooring lines of the barge to more than 8m below LAT. vi. NLB highlighted that as soon as (or before) the first device is installed, mariners need to be made aware of the subsurface risk from tidal devices, in addition to the temporary surface collision risk during the installation works. vii. NLB queried if a Marine Coordinator would be on site.	prepared. If necessary this plan shall be updated. v. MeyGen have considered this point (in conjunction with construction vessel contractors) and have decided to progress with advisory safety zones of 150m during the construction phase. vi. MeyGen will ensure that UKHO have been provided with the necessary information in advance. vii. MeyGen can confirm a Marine Coordinator shall be onsite during works.
Royal Yachting Association	i. RYA estimated that the proportion of recreational vessels carrying AIS may have increased to 25%, i.e. 1	i. Noted. ii. Agreed that AIS broadcasts from the installation

Consultee (Date)	Comment	Response / where addressed
Scotland (16/02/2016)	in 4 of larger, longer distance cruising yachts. ii. RYA noted that more recreational vessels receive AIS than broadcast. iii. RYA stated that their preference would be for an advisory safety zone. iv. RYA recommend including Wick, Scrabster, Orkney Marinas and Stornoway harbours in the information circulation. The RYA is also happy to include information in its monthly newsletter. v. RYA have contacted the Commodore of the Pentland Firth Yacht Club who has confirmed their members have no issues with the proposed works. vi. RYA queried the VHF coverage in the area. vii. RYA confirmed that they have no issues with the potential use of moored barge / jack-up vessels in the area, in addition to DP vessels considered in the original NRA.	vessel would be useful so as to allow identification at a greater range. iii. MeyGen have considered this point (in conjunction with construction vessel contractors) and have decided to progress with advisory safety zones during the construction phase of 150m radius. iv. Noted. v. Noted. vi. MCA have VHF stations at Dunnet Head and Noss Head which should provide comprehensive VHF coverage of the Inner Sound. vii. Noted.
Maritime and Coastguard Agency (18/02/2016)	i. MCA queried if the mooring line buoys would be moved when the barge moves onto the next turbine location. ii. MCA highlighted the importance of the UKHO being kept informed to ensure they can issue notices and chart corrections. iii. Discussions were held on the status (advisory or	i. MeyGen confirm that a support vessel (multicat) would move the moorings to the next turbine location. ii. MeyGen will ensure UKHO are contacted in advance of the works. iii. It was agreed that a standard 500m radius safety zone during construction would be impracticable

Consultee (Date)	Comment	Response / where addressed
	mandatory) and size (maximum of 500m) of safety zones. During the cable works undertaken in 2015 no safety zone was in place but mariners were asked to maintain a "suitably wide berth". iv. It was questioned whether a mandatory safety zone with legal status would offer any additional risk benefit over an advisory safety zone, both of which would be 'guarded' by a support vessel.	for the Inner Sound due to restrictions on sea room. MCA indicated that a safety zone of c. 100m radius seemed appropriate, which would encompass the mooring lines on or near the surface. MeyGen have decided to progress with a 150m radius zone. iv. MeyGen have considered this point (in conjunction with construction vessel contractors) and have decided to progress with advisory safety zones during the construction phase.
Pentland Ferries (19/02/2016)	i. Indicated they have no significant concerns with the use of either a moored barge or jack-up vessel as long as they were kept informed of the planned works and the vessels being used before each operation.	i. Noted. Pentland Ferries shall be kept informed of all works and vessels employed.
Scottish Fishermen's Federation (29/02/2016)	i. SFF requested further detail (including charts) on the maximum extent of the mooring pattern, i.e. the touchdown points on the seabed. ii. SFF stated that most vessels generally keep to the deeper water in the centre of the Inner Sound, except if they encountered another vessel and had to move off-centre. iii. SFF suggested that the high number of east-west vessels (11) recorded on the busiest day may be due to reports of good fishing off the west coast, and hence finishing in the North Sea and heading west via the	i. Further information provided post-meeting. ii. Noted. iii. Further analysis has been carried out to ascertain the temporal distribution and transit direction of vessels, see Section 7.4. iv. Noted. v. MeyGen shall provide all relevant details to Kingfisher prior to commencement of works. vi. MeyGen have considered this point (in conjunction with construction vessel contractors) and have decided to progress with an advisory safety zone of

Consultee (Date)	Comment	Response / where addressed
	Inner Sound. iv. SFF's experience was that orders would normally be in place such that the skipper would be called to the bridge when a vessel was about to navigate the Inner Sound. Therefore, the most experienced crew member would normally be in the wheelhouse. v. SFF confirmed that Kingfisher should be contacted to ensure details or included within their fortnightly bulletins. vi. It was agreed that standard 500m safety zones during construction would be impracticable for the Inner Sound due to the available sea room. SFF stated that it is important the option to pass north of the site without getting too close to Stroma was maintained. A c. 150m safety zones would be appropriate and provide a suitable buffer beyond the mooring lines near the water surface. vii. SFF queried what support vessels would be on site. SFF commented that if support vessels were engaged in other duties they may not be able to dedicate themselves to guarding. viii. SFF highlighted the advantages of involving local people with local knowledge of the vessels in the area for watchkeeping.	150m radius during the construction phase. vii. Dedicated watchkeepers will be used to provide 24/7 coverage. viii. Noted and will be considered during the selection process. The barge being considered is an Orkney-based vessel.

6.2 Specific Feedback relating to Safety Zones

It has been identified, and agreed with stakeholders during consultation (see Section 6.1), that standard 500m construction safety zones would be impracticable for the Inner Sound due to the restricted sea room in the channel for east-west transiting vessels. Recommendations were made by stakeholders with regards to the extent of construction safety zone which should be applied for, as below:

- Northern Lighthouse Board - 100-150m;
- Maritime and Coastguard Agency - 100m; and
- Scottish Fishermen's Federation - 150m.

It was agreed that the safety zones should be large enough to encompass the mooring lines of the moored barge to a depth of greater than 8m below LAT, which occurs at 92.5m. This under water clearance would match that of the devices once installed. Hence the 100m safety zone is seen as a minimum for the barge.

Taking into consideration the consultation feedback, the marine traffic validation and impact assessment, and following discussions between MeyGen and its contractors, it is planned that advisory construction safety zones of 150m will be implemented. This shall help ensure that:

a) A safe passing distance is maintained by transiting vessels;
b) The risk to vessels, and their personnel, engaged in the works is minimised; and
c) Adequate sea room remains in the Inner Sound due to the limited spatial extent of the safety zones, helping minimise the impact on vessel navigation.

An illustration of the area occupied by safety zones of 150m using the Phase 1a turbine locations is presented in Figure 6.1.

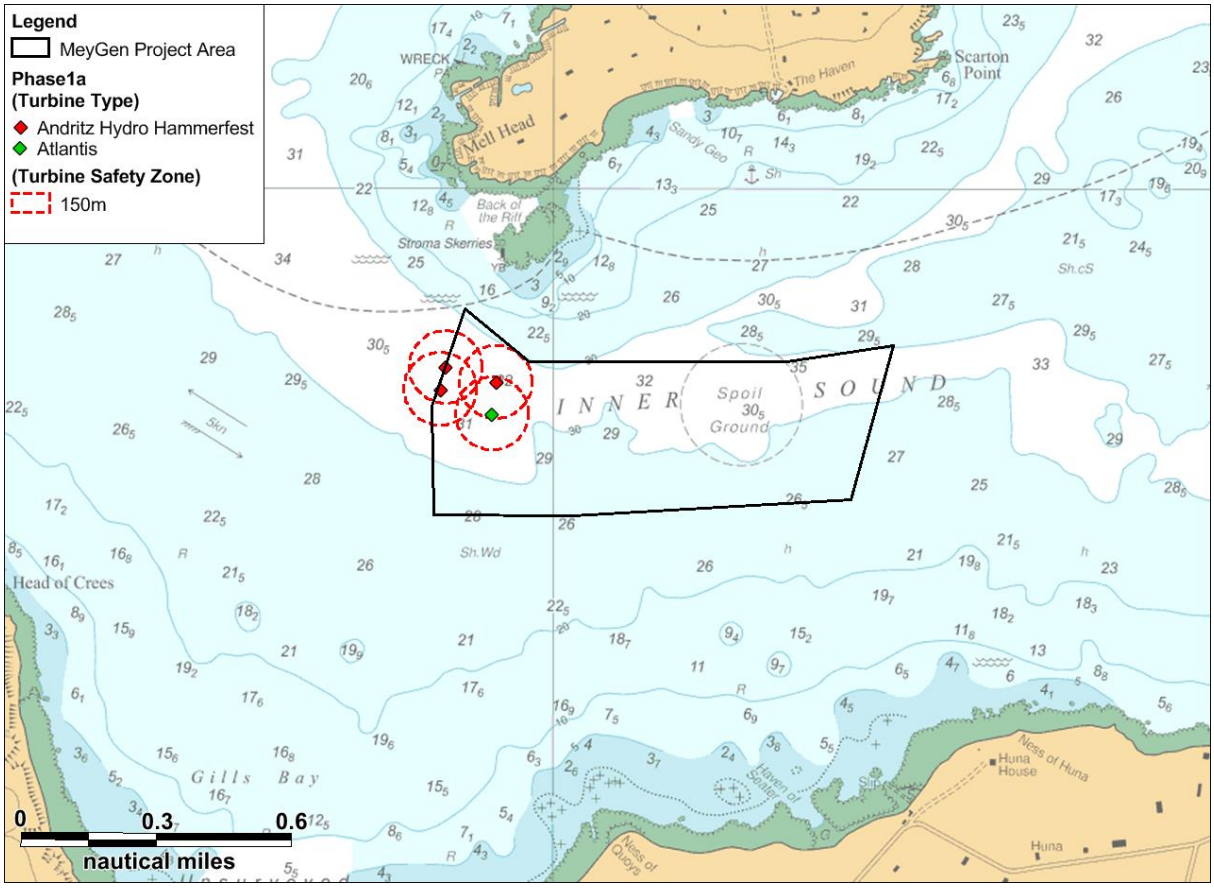

Figure 6.1 Potential Area occupied by 150m Safety Zones – Phase 1a

7. Marine Traffic Validation

7.1 Introduction

This section presents analysis of recent AIS tracking data for the Inner Sound of the Pentland Firth.

AIS is fitted on the vast majority of commercial ships operating in UK waters including all ships of 300 gross tonnage and upwards engaged on international voyages, all passenger ships, and fishing vessels of 15m length and over. AIS is also carried by a proportion of smaller vessels on a voluntary basis, including fishing and recreational vessels.

From the previous NRA traffic surveys and stakeholder consultation, it is known that usage of the Inner Sound varies due to tides, weather, seasons and other factors such as fishing quotas. Therefore, AIS data totalling eight weeks has been used in the analysis divided into two, four week periods. The periods were chosen to overlap with the installation work, which is expected to be between March and September. March was chosen as a busy period for fishing vessel transits (though unlikely to see much project activity due to weather risk), and July was chosen because ferry and recreational vessel activity peaks in summer (including wildlife cruises by the *Pentland Venture*).

The following periods have therefore been used in the analysis:

- 1st-28th March 2015 (28 days)
- 1st-28th July 2015 (28 days)

Type and length information broadcast on AIS has been checked against literature and in some cases updated to provide greater definition.

7.2 Overview of AIS Tracks

Plots of the AIS tracks for each of the 28 day periods, colour-coded by vessel type as broadcast on AIS, are presented in Figure 7.1 and Figure 7.2.

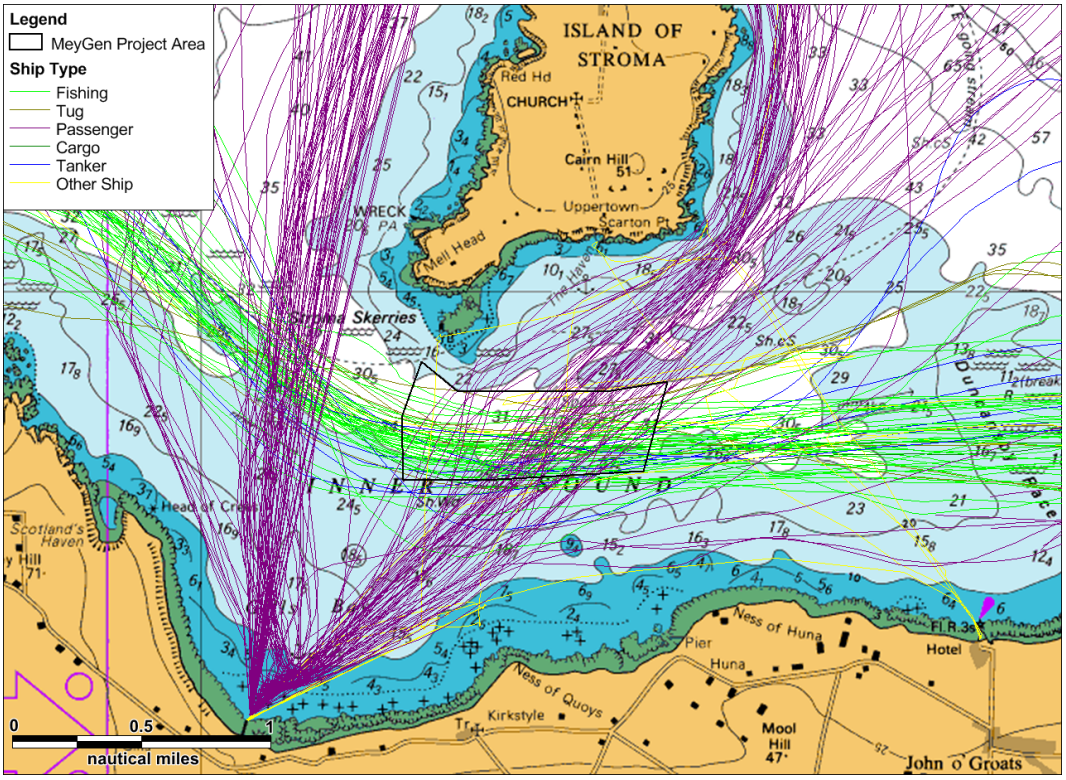

Figure 7.1 March 2015 AIS Data (28 Days)

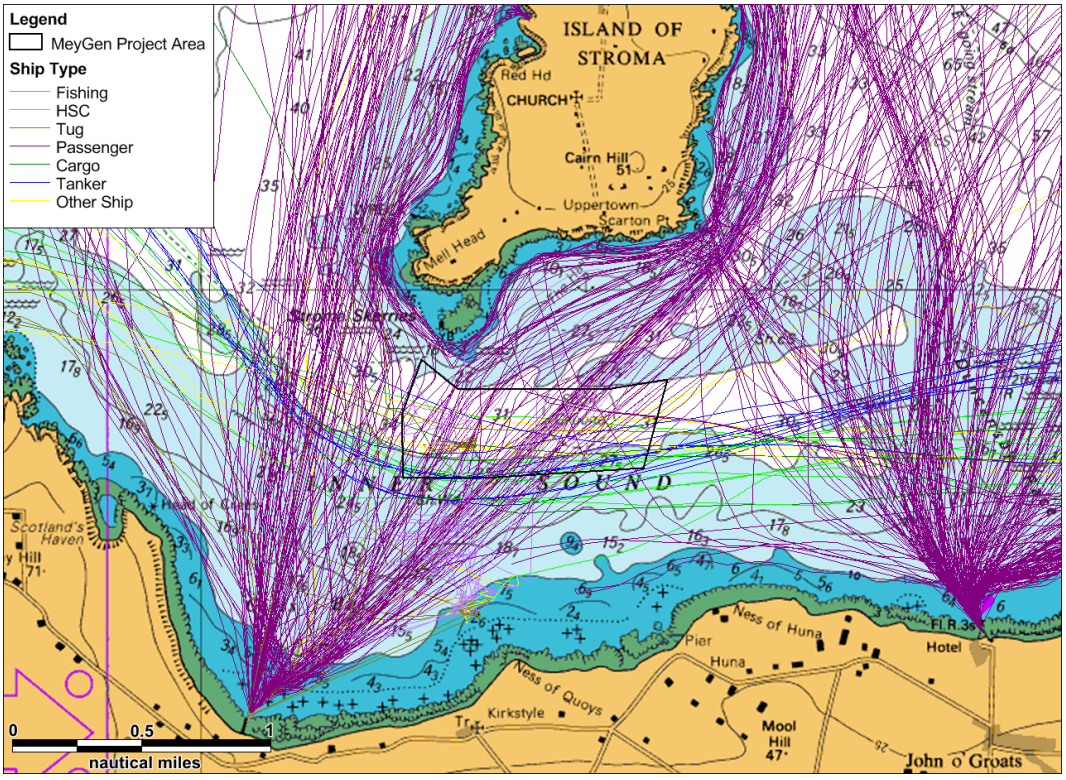

Figure 7.2 July 2015 AIS Data (28 Days)

The traffic in the area can be divided into three main categories:

- East-west traffic via the Inner Sound;
- Ferry traffic – the *Pentalina* to / from Gills Bay and the *Pentland Venture* to / from John o'Groats; and
- Other / miscellaneous activity within the Inner Sound (including vessels involved in the Project).

Each of these categories are analysed further in the following subsections.

7.3 Inner Sound East-West Traffic Analysis

More detailed plots of the east-west transiting vessels through the Inner Sound during each of the 28 day survey periods are presented in Figure 7.3 and Figure 7.4.

In total there were 83 vessels over the 56 days (average of 1-2 per day). The number of vessels varied between the periods with 58 during March 2015 compared to 25 during July 2015. The busiest day was 13th March with 11 transits, whilst there were 16 days with no transits. Overall, 88% of east-west transiting vessels crossed part of the Project area.

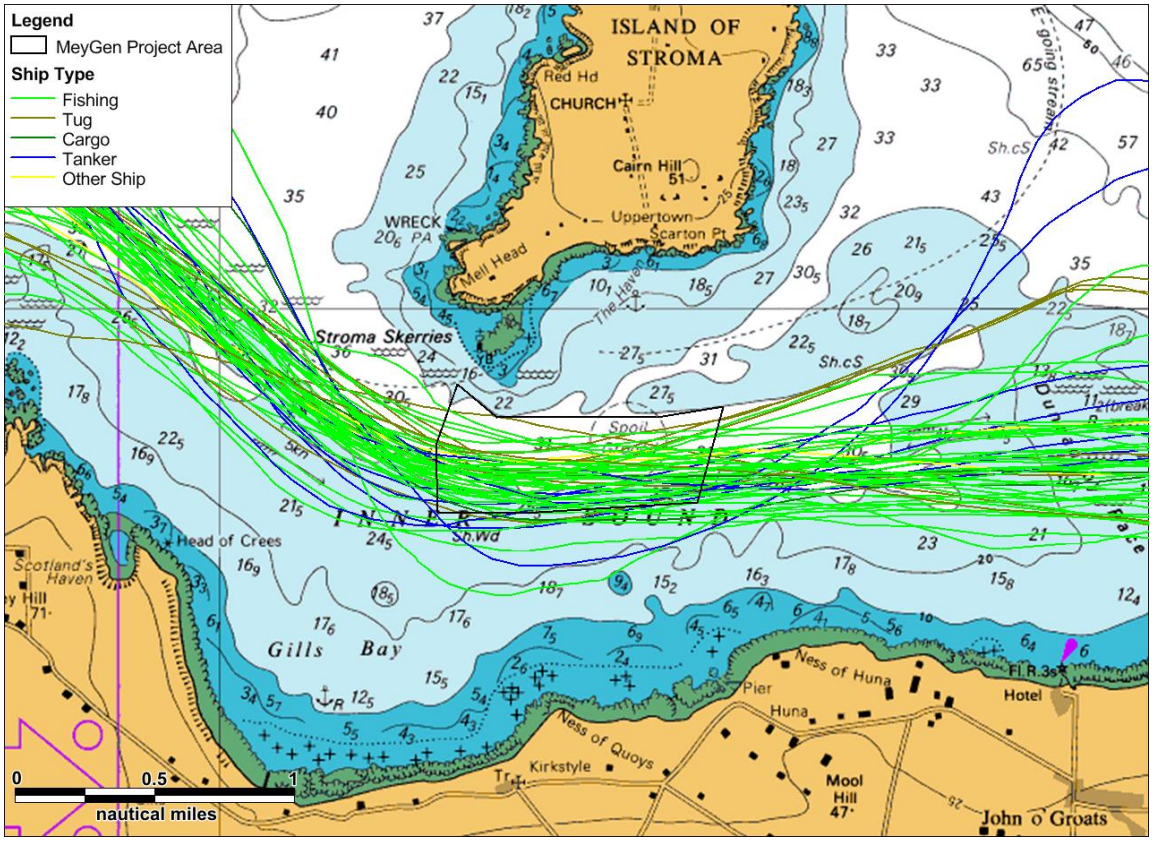

Figure 7.3 March 2015 AIS Data (East-West Traffic)

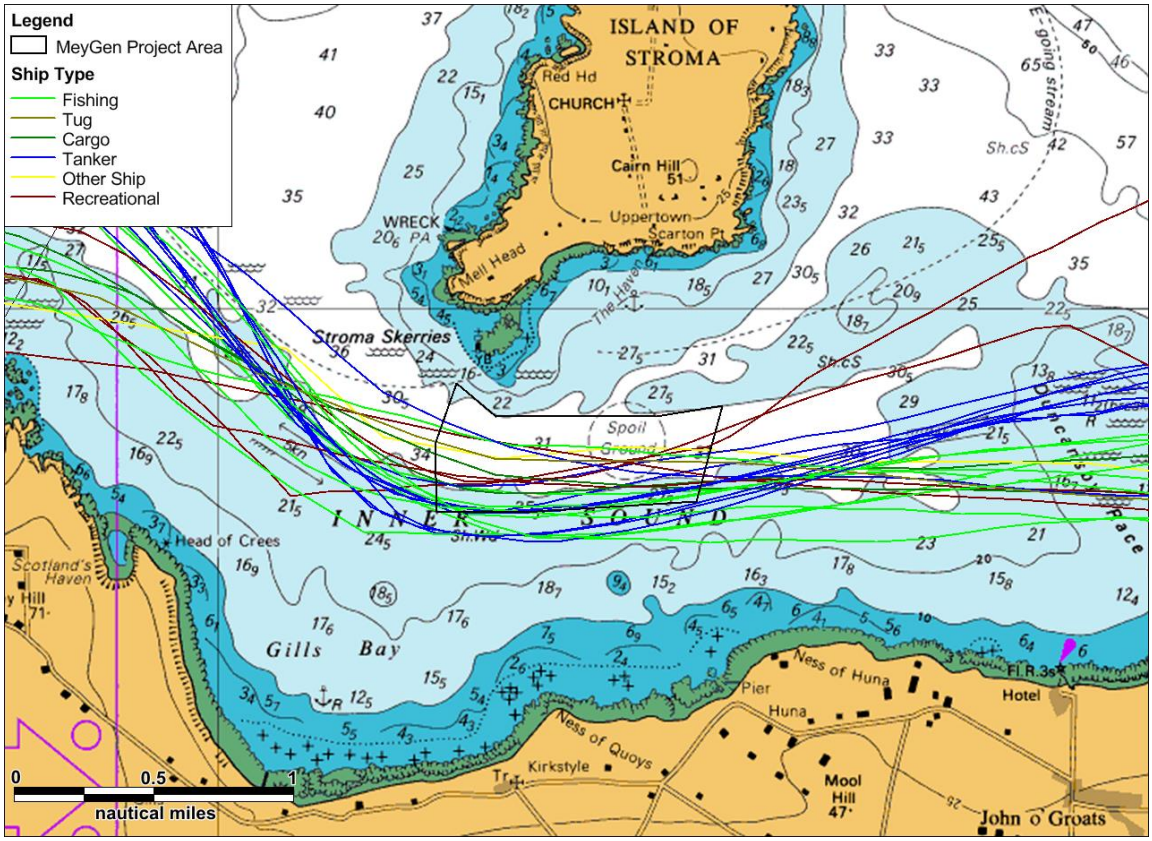

Figure 7.4 July 2015 AIS Data (East-West Traffic)

The vessel type distribution of vessels transiting east-west through the Inner Sound for each 4 week period is presented in Figure 7.5. A much larger number of fishing vessels transited the Inner Sound during March 2015 due to this being the peak fishing season.

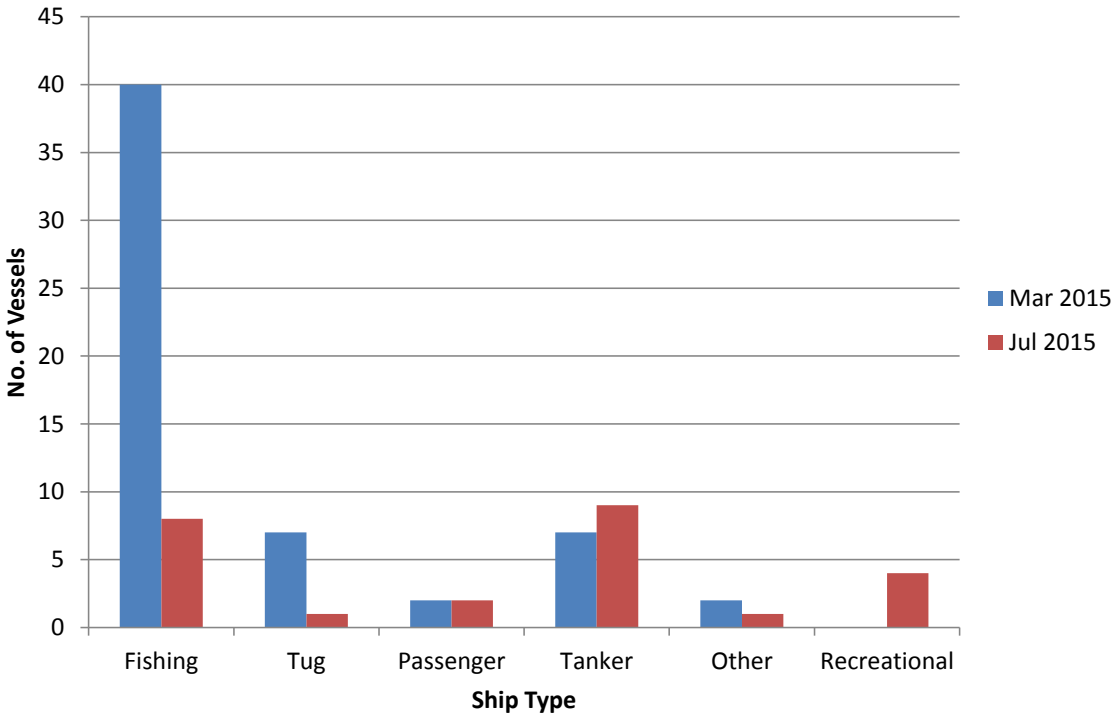

Figure 7.5 Vessel Type Distribution within Inner Sound (East-West Traffic)

A combined plot (8 weeks) of the transiting traffic by length is presented in Figure 7.6. The average length was 28m and the longest vessel was the general cargo ship *Nordic* en route to Inverness (92m).

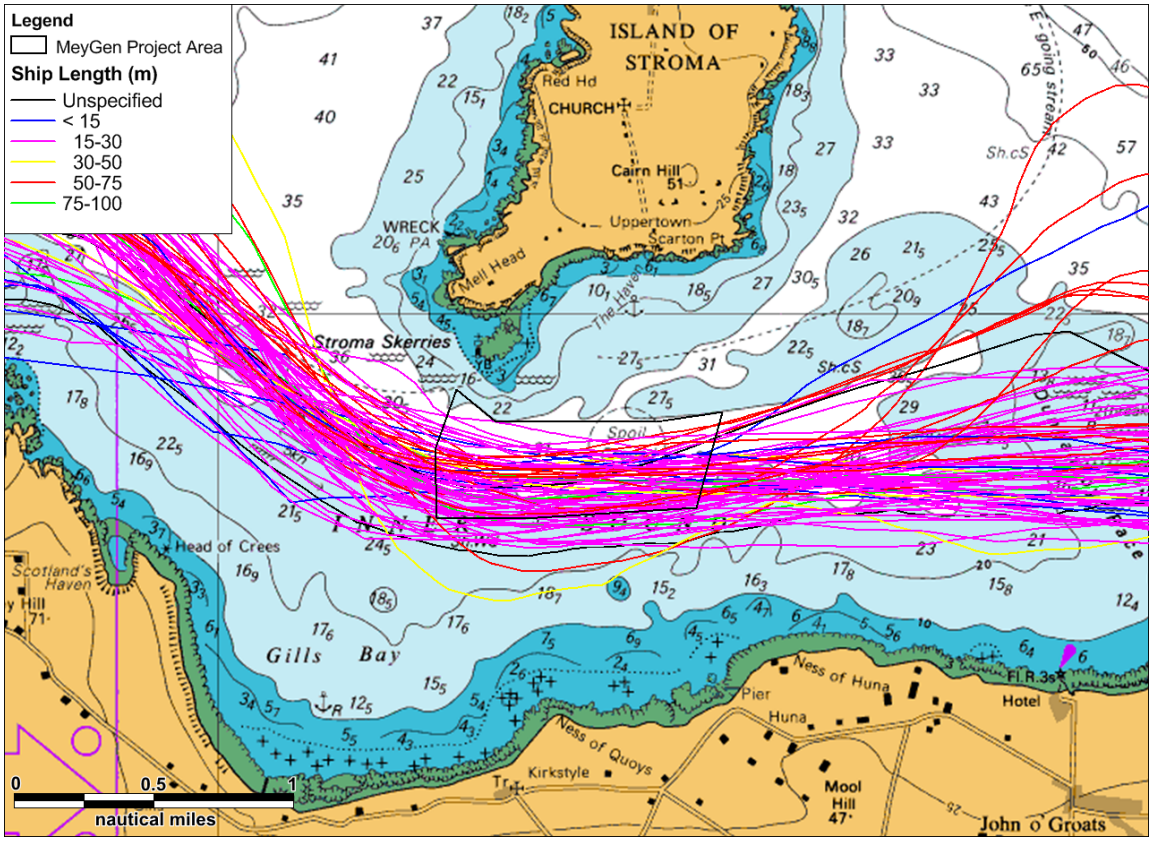

Figure 7.6 Combined East-West Tracks by Length

A total of 32 of the 83 tracks were broadcasting their draught on AIS over the two periods. The draughts of a further 16 tracks were estimated based on researching their design draught or, if unavailable, their depth (both of which should be conservative). A combined plot of the transiting traffic by draught is presented in Figure 7.7.

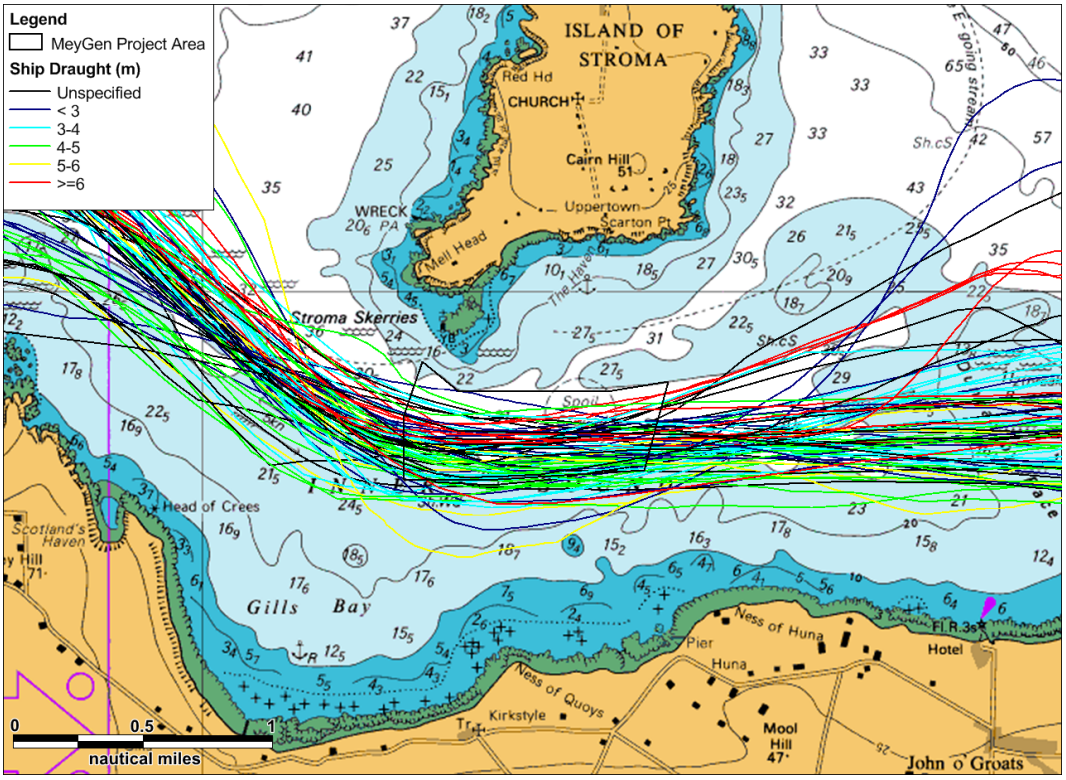

Figure 7.7 Combined East-West Tracks by Draught

The estimated draught distribution of east-west vessels in the Inner Sound, excluding unspecified, is presented in Figure 7.8.

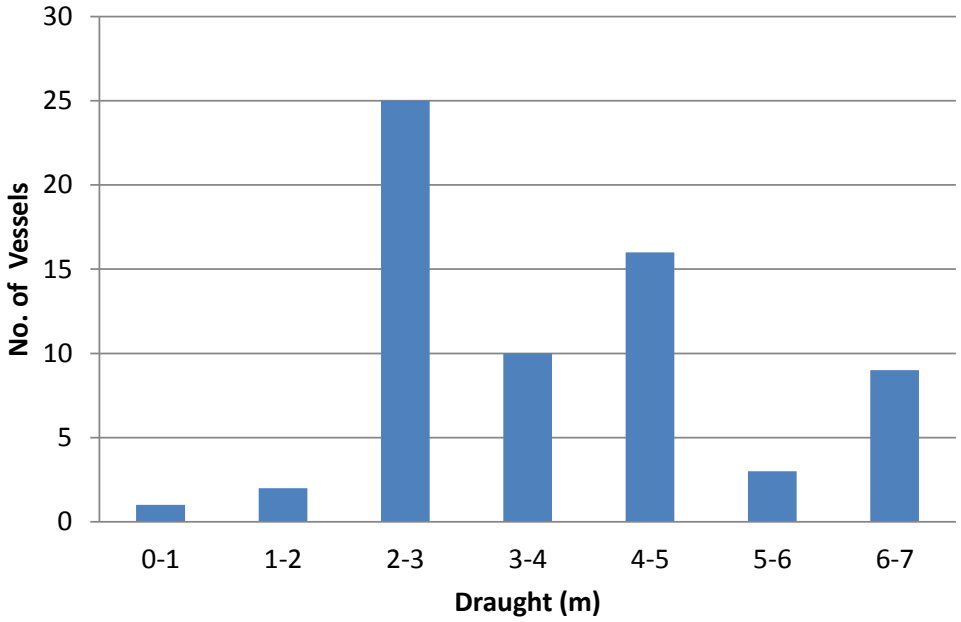

Figure 7.8 Combined East-West Tracks Draught Distribution within Inner Sound

The average draught was 4.1m. The deepest draught vessels were the trawlers *Aakeroy* and *Chris Andra*, both with a draught of 7.0m.

The tracks colour-coded by direction are presented in Figure 7.9. One third of vessels were heading eastbound compared to two-thirds heading westbound. This may be due to the tendency for fishing vessels to use the Outer Sound when returning to Peterhead and Fraserburgh. There was no significant difference in track position by direction.

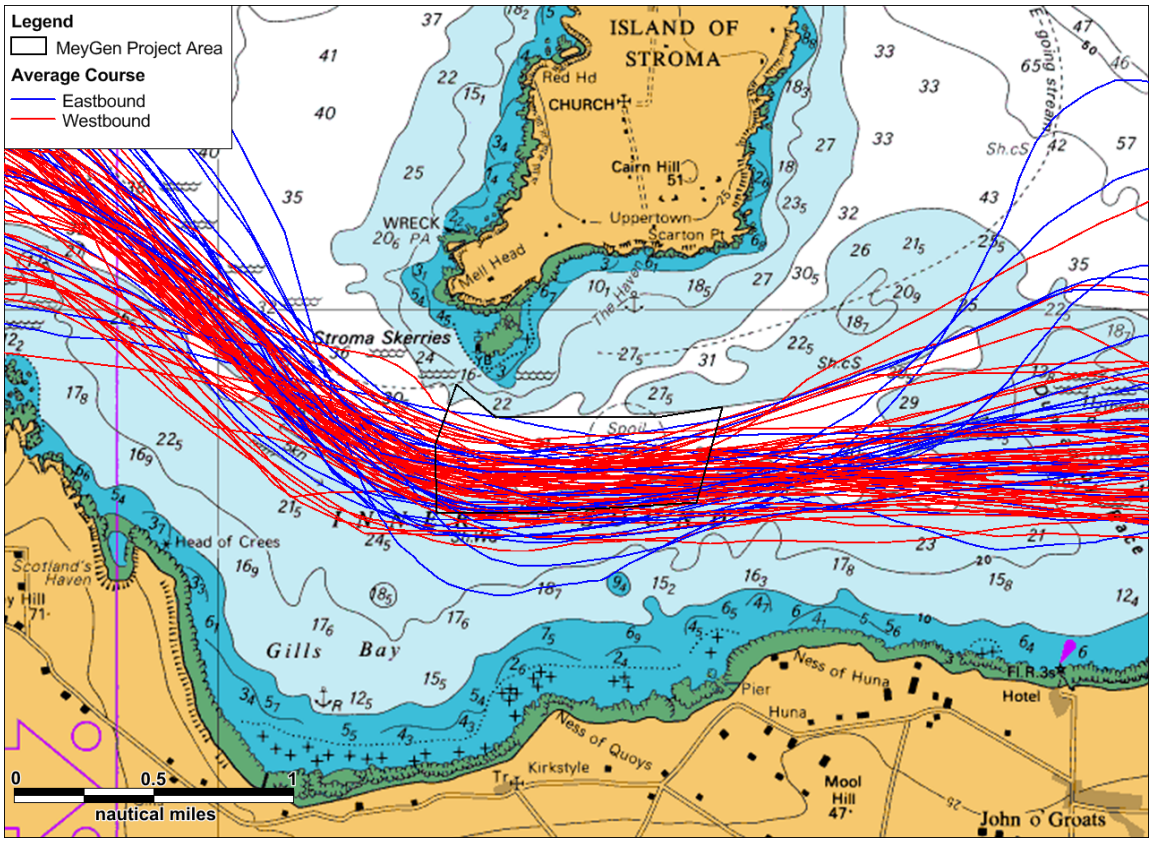

Figure 7.9 Combined East-West Tracks by Average Course

The main destinations broadcast by the vessels heading east-west within the Inner Sound are summarised in Figure 7.10. Note that 36% of vessels did not broadcast a destination. These were mainly fishing vessels.

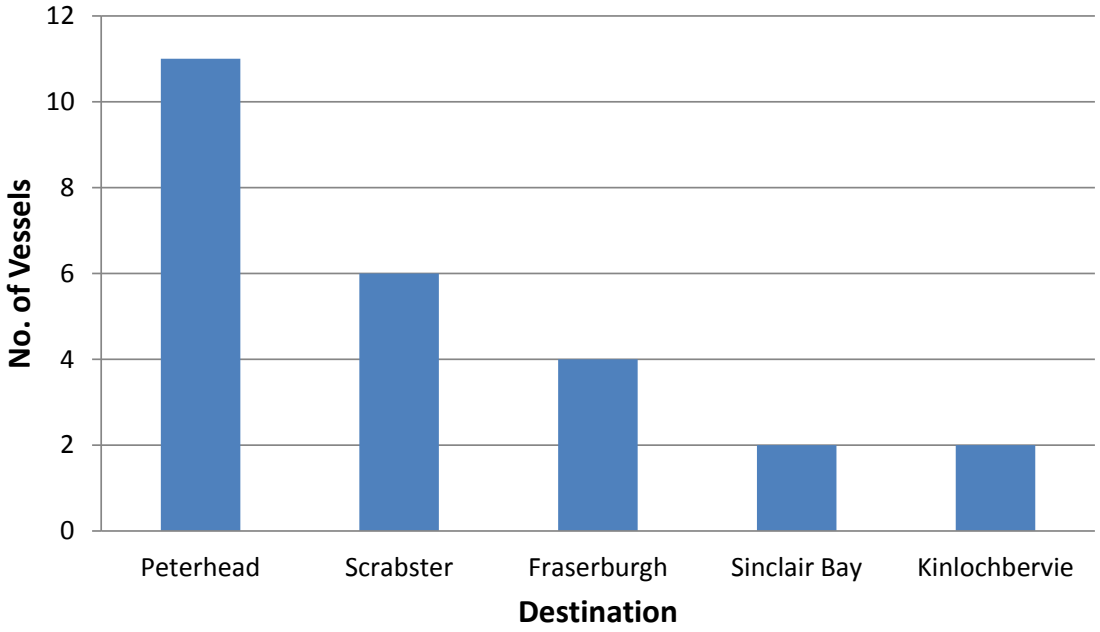

Figure 7.10 Main Destinations for Vessels transiting Inner Sound

Details on all the vessels identified to transit the Inner Sound, including the number of transits made, are presented in Table 7.1.

Table 7.1 Vessels Transiting the Inner Sound (AIS 56 Days)

Name	Type	Destinations	Length (m)	Draught(s) (m)	Transits
Erin Wood	Tanker	Scrabster / Peterhead / Kinlochbervie	24	2.8-3	12
John Wood	Tanker	Peterhead / Lochinver	40	2.8	4
Boy Andrew	Fishing	--	25	4.4	4
BB Worker	Tug	Scrabster / Sinclair Bay	35	6.2	3
Lunar Bow	Fishing	Peterhead	71	6.3	2
Deeside	Fishing	--	24	3.5	2
Forth Jouster	Tug	Invergordon / Liverpool	26	2.3	2
Ocean Maid	Fishing	--	17	3.5	1
Whalsa Lass	Tug	Wick	26	2.5	1
Kaylana	Fishing	--	17	--	1
Pathway	Fishing	--	66	--	1
Harvest Reaper	Fishing	--	16	4.3	1
Karinya	Fishing	--	16	--	1

Name	Type	Destinations	Length (m)	Draught(s) (m)	Transits
Pleiades	Fishing	--	20	--	1
Lisa	Cargo	Scrabster	90	6.5	1
Aubretia	Fishing	--	22	4.2	1
Contest	Fishing	--	17	3	1
Adorne II	Tug	Fishing	27	4	1
Audacious	Fishing	--	0	5	1
Achieve	Fishing	--	25	5.6	1
Shekinah	Fishing	--	18	4.4	1
Blue Sky	Fishing	--	14	2.6	1
Daystar	Fishing	--	20	4.5	1
Rebecca	Fishing	Fraserburgh	21	4.5	1
Challenger	Fishing	Fraserburgh	19	5	1
Jacqueline Anne	Fishing	Fraserburgh	23	4.6	1
Horizon II	Fishing	--	15	4.2	1
Sharona	Fishing	--	15	--	1
Antaries	Fishing	--	10	2.8	1
Endeavour	Fishing	--	16	3.8	1
Oceanus	Fishing	Fishing	18	3.5	1
Aurelia	Fishing	--	18	4.8	1
Charlotte Ann	Fishing	--	15	--	1
Charmel	Fishing	--	17	4	1
Vision	Fishing	--	22	--	1
Scot Explorer	Cargo	Boston	82	4	1
Chris Andra	Fishing	Fraserburgh	70	7	1
Naomi Jennifer	Other	Uig	25	2	1
Carina	Fishing	--	32	5.2	1
Onward	Fishing	--	17	3.8	1
Kiroan PD23	Fishing	Fishing Grounds	22	3.5	1
Mia Jane W	Fishing	--	24	--	1
Aakeroey	Fishing	Skagen	70	8	1
Maracestina	Fishing	--	20	3	1
Accord	Fishing	--	74	--	1
Harvester	Fishing	Fishing Grounds	25	5.2	1
Cameron	Other	Ullapool	33	2.2	1
Lock Inchard II	Fishing	--	18	--	1
Discovery	Fishing	--	24	2.5	1
Conquest	Fishing	--	23	4.2	1

Name	Type	Destinations	Length (m)	Draught(s) (m)	Transits
Nordic	Cargo	Inverness	92	4.3	1
Rescue LIV	Other	--	12	0.9	1
Ailsa Craig	Tug	--	15	--	1
Black Adder	Recreational	--	8	--	1
Sparkling Star IV	Fishing	--	18	--	1
Endeavour IV	Fishing	--	28	6.2	1
Fryd	Recreational	--	0	--	1
Carly	Cargo	Gairloch	34	1.5	1
Radiance INS240	Fishing	Peterhead	19	--	1
Upshot	Recreational	--	11	--	1
Anser Anser	Recreational	--	11	--	1

In total, 61 different vessels were recorded using the Inner Sound heading east-west, making a total of 83 transits. The *Erin Wood* made the most transits during the period with a total of 12. She is a small coastal fuel oil tanker (which incidentally was involved in a collision with the general cargo vessel *Daroja* off Peterhead on 29th August 2015).

7.4 Busiest Day

The busiest day was 13th March 2015 with 11 transits, nine of which were by fishing vessels, as shown in Figure 7.11. All fishing vessels were recorded transiting westbound on this day. The other two vessels were tugs which were transiting eastbound.

Figure 7.12 presents the hours that vessels transited the Inner Sound (crossing south of Stroma). In the busiest hour between 04:00 and 05:00, three fishing vessels were recorded heading westbound. The findings concur with the SFF consultation feedback that several vessels may have headed from the North Sea to the west coast following reports of productive fishing grounds.

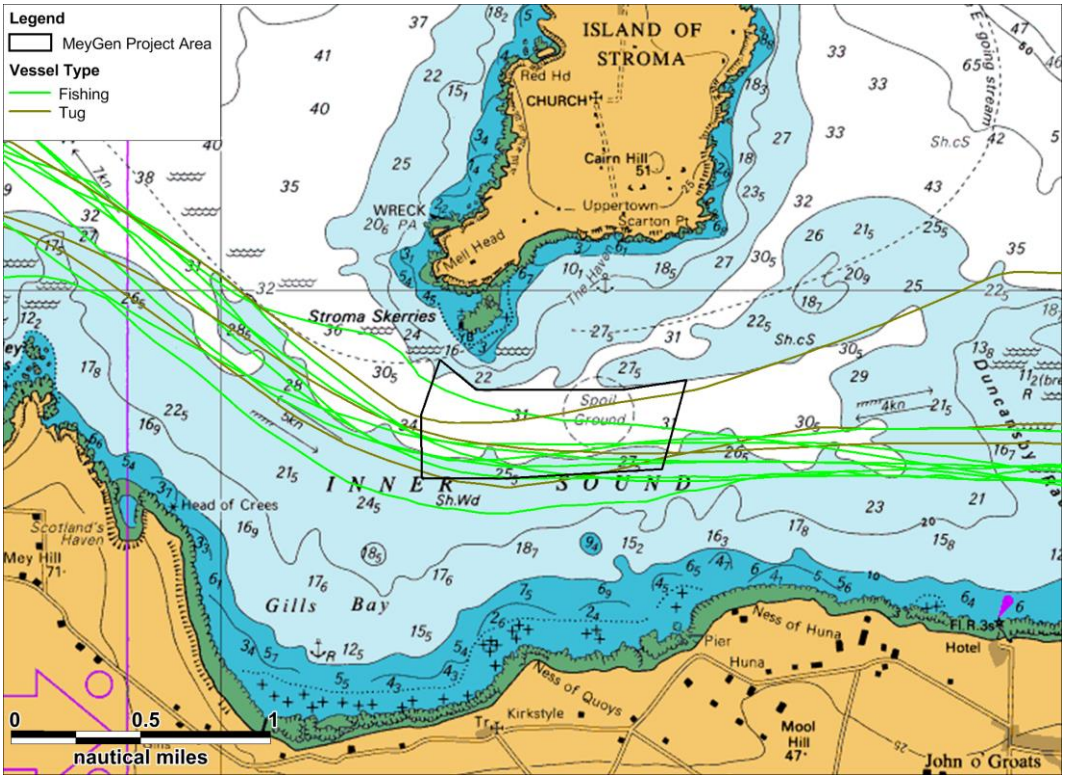

Figure 7.11 Busiest Day – 13th March 2015 (East – West Traffic)

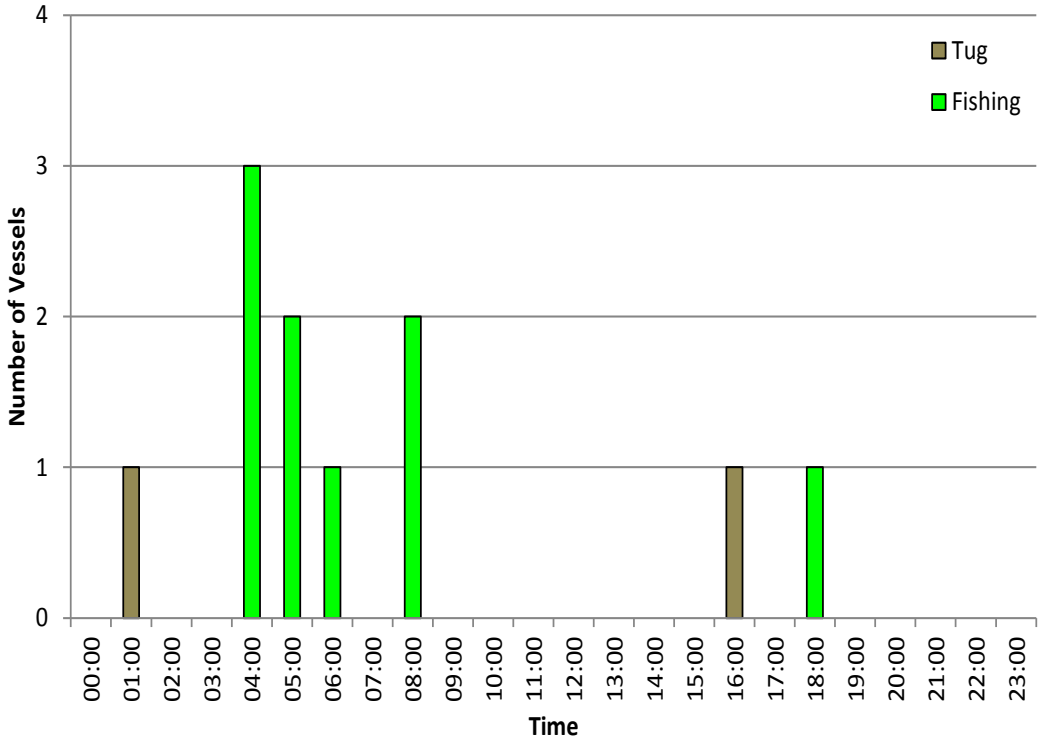

Figure 7.12 Busiest Day – Time of Transits

7.5 Passenger Ferries

7.5.1 Pentland Ferries

The *Pentalina* catamaran ferry is operated by Pentland Ferries between Gills Bay and St Margaret's Hope. The ferry can accommodate nine articulated lorries, over 30 cars and 250 passengers. There are three or four return sailings per day (weather and season dependent). The crossing time is approximately 60 minutes at speeds of up to 19 knots.

A plot of the *Pentalina* tracks over the 8 weeks is presented in Figure 7.13.

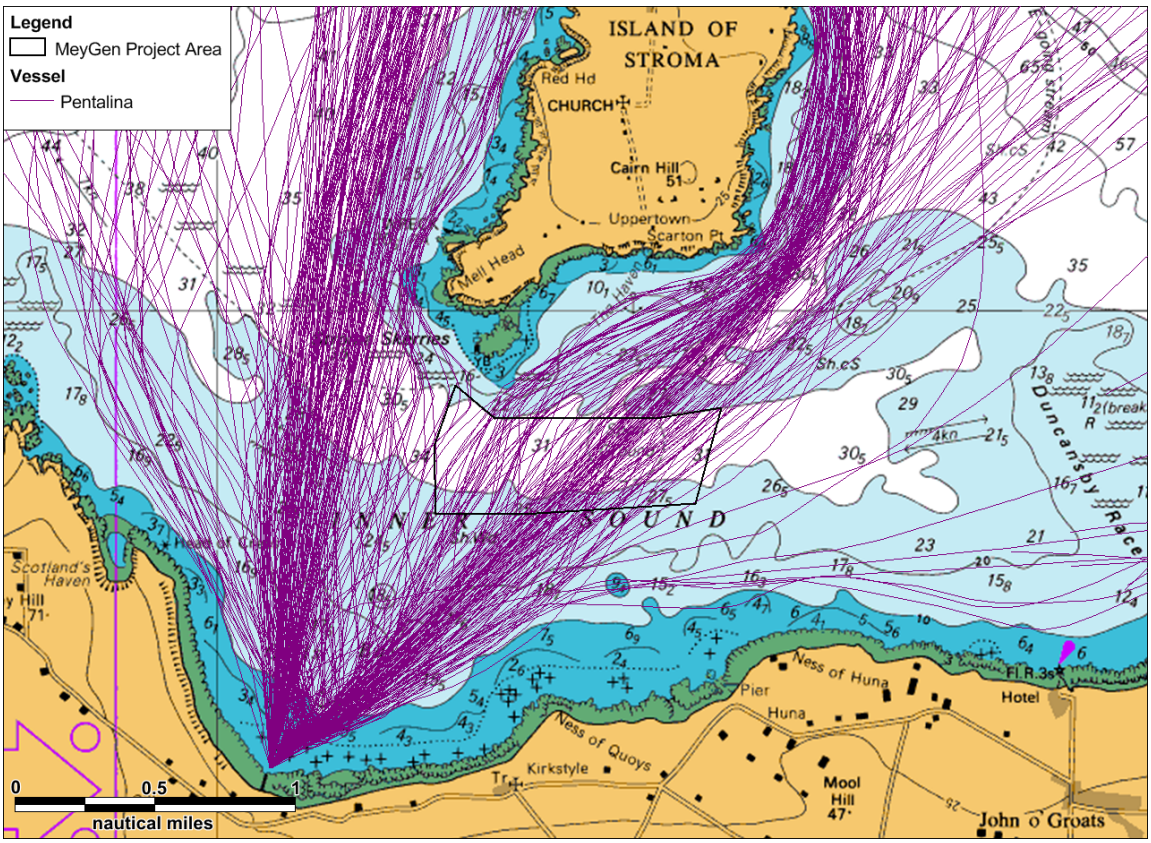

Figure 7.13 Combined Tracks of *Pentalina* (8 Weeks 2015)

The routes east and west of Stroma are seen from the AIS data to be used approximately equally. During the NRA consultation, the Master indicated that the choice is influenced by the wind and tidal conditions. In easterlies the ferry will tend to pass west of Stroma whilst in westerlies the route east of Stroma is preferred. On the sailings east of Stroma the ferry crossed over the Project area on most occasions.

In a flood (east-going) tide and strong SE winds they will set a course further west of Stroma to avoid the risk of drifting towards the coast (also the tide pushes them back on course). In an ebb (west-going) tide and SE winds they will keep closer into Stroma when passing west.

This route is reversed for strong westerly winds, so that the vessel would pass to the east and closer to Stroma in a flood tide and further out in an ebb tide.

7.5.2 John O'Groats Ferries

The *Pentland Venture* ferry operates on the John o'Groats-Burwick route from May to September. There are two or three return sailings per day (weather and season dependent). The crossing time is approximately 40 minutes at speeds of up to 12 knots.

A plot of the *Pentland Venture* tracks over the 8 weeks is presented in Figure 7.14.

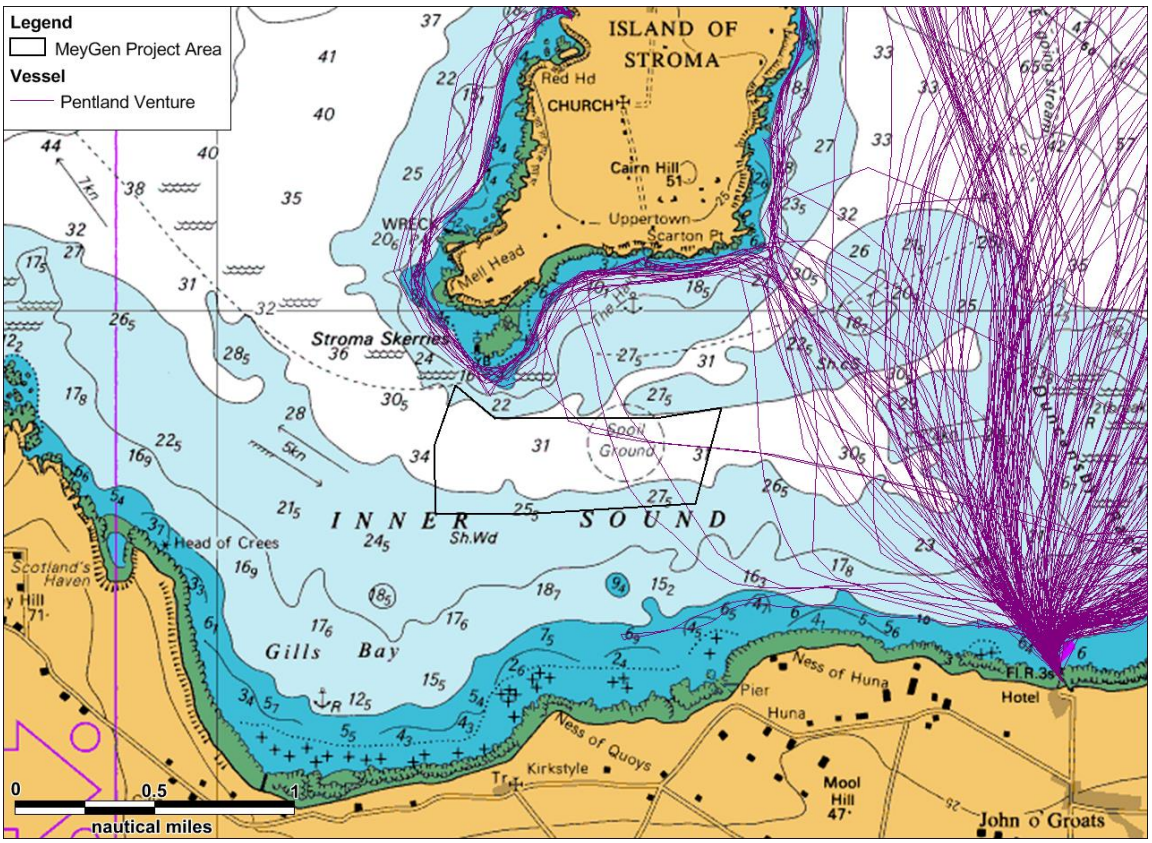

Figure 7.14 Combined Tracks of *Pentland Venture* (8 Weeks 2015)

The route east of Stroma from John o'Groats to/from Burwick varied over a wide area but did not cross over the Project area. There was also a route around the coast of Stroma forming part of a wildlife tour which runs from June to August, which kept near the coast of Stroma and hence passed north of the Project area. Finally, there were four occasions when the ferry crossed over the Project area as part of an alternative tour route taking in only the south coast of Stroma before heading east past Duncansby Head. As with the *Pentalina*, the choice of route is influenced by the wind and tidal conditions.

7.6 Other / Miscellaneous Vessels

Across both periods, five vessels were seen to be involved in activity relating to the MeyGen project as presented in Figure 7.15.

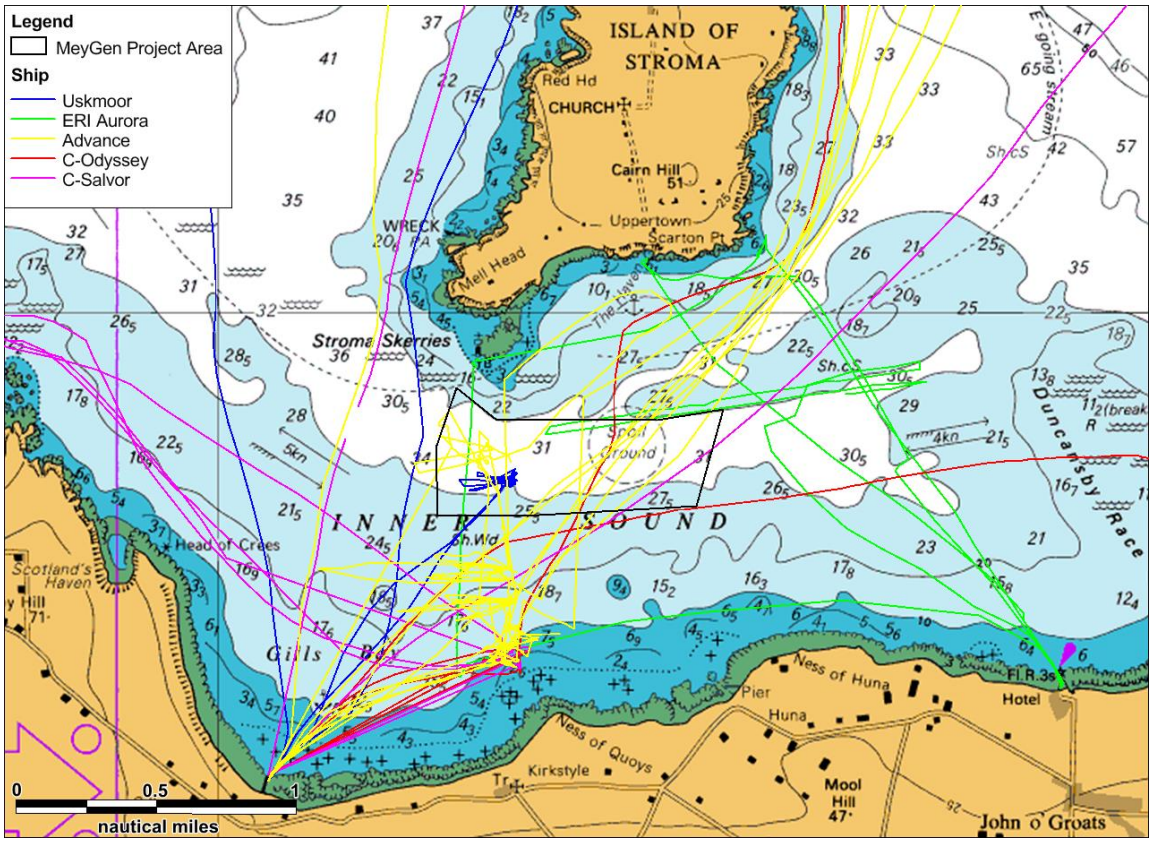

Figure 7.15 Combined Project-related Traffic within Inner Sound

Details of these vessels are presented in Table 7.2.

Table 7.2 Project-related Vessels within the Inner Sound (AIS 56 Days)

Name	Vessel Type	Length (m)	Draught (m)
Advance	High Speed Craft	15	1.2
C-Odyssey	Utility Vessel	26	--
C-Salvor	Tug	24	2.2
ERI Aurora	Research Ship	7	--
Uskmoor	Tug	16	--

7.7 Review of Recreational Vessels

Four recreational vessels passed through the Inner Sound as shown in Figure 7.16. They all transited during the July 2015 period.

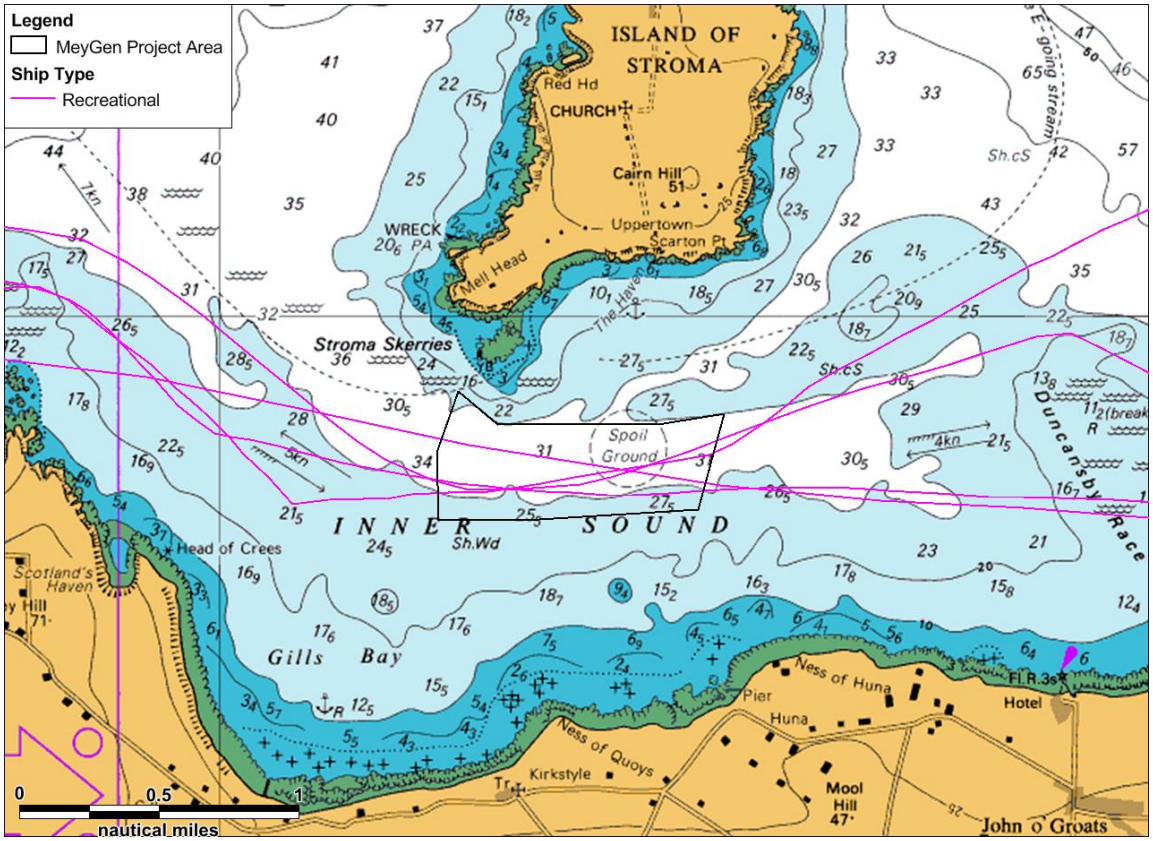

Figure 7.16 Combined Recreational Traffic within Inner Sound

As part of a Marine Scotland Pentland Firth and Orkney Waters (PFOW) shipping review (Ref. ii) longer term AIS data was reviewed in order to gain a greater understanding of recreational vessel movements. Figure 7.17 presents the tracks of recreational vessels recorded and Figure 7.18 presents the recreational vessel density.

Overall it can be concluded that the Inner Sound is lightly trafficked by recreational vessels, with the majority using the Outer Sound.

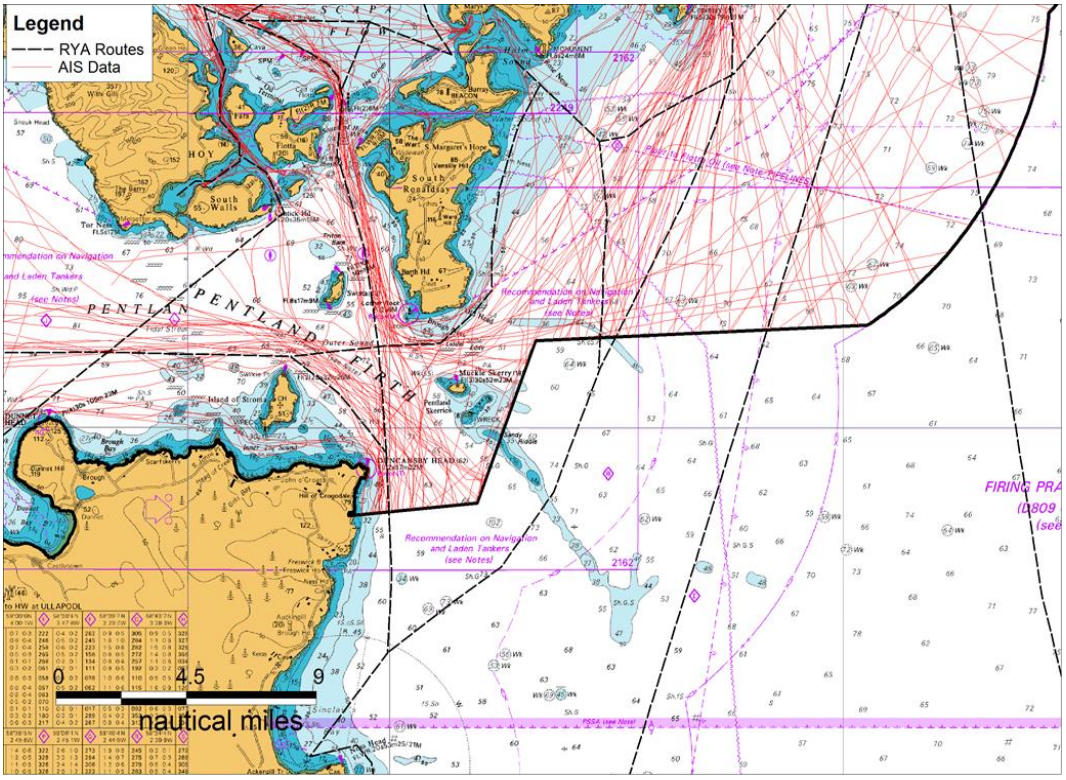

Figure 7.17 PFOW Recreational Vessel Tracks (Ref. ii)

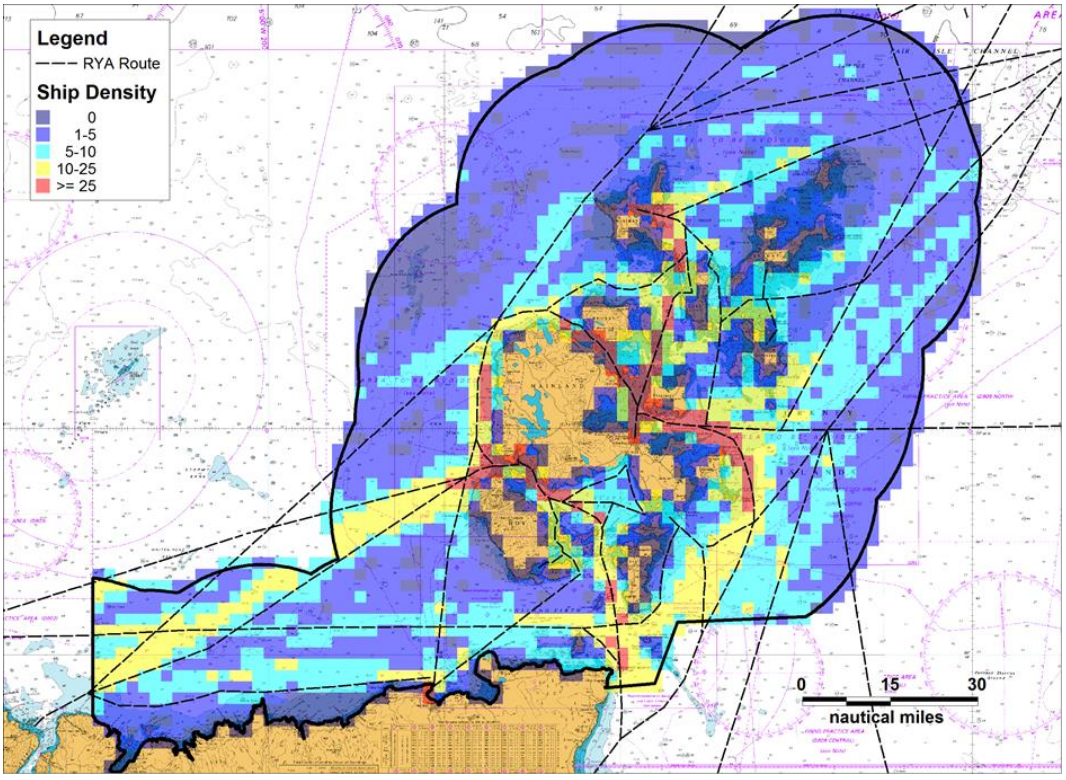

Figure 7.18 PFOW Recreational Vessel Density (Ref. ii)

7.8 Comparison with NRA

Figure 7.19 presents the tracks of vessels transiting the Inner Sound east-west from the original NRA AIS survey data. The tracks taken by vessels transiting the Inner Sound have not altered significantly, with the vast majority of vessels recorded transiting within the deeper water in the centre of the channel.

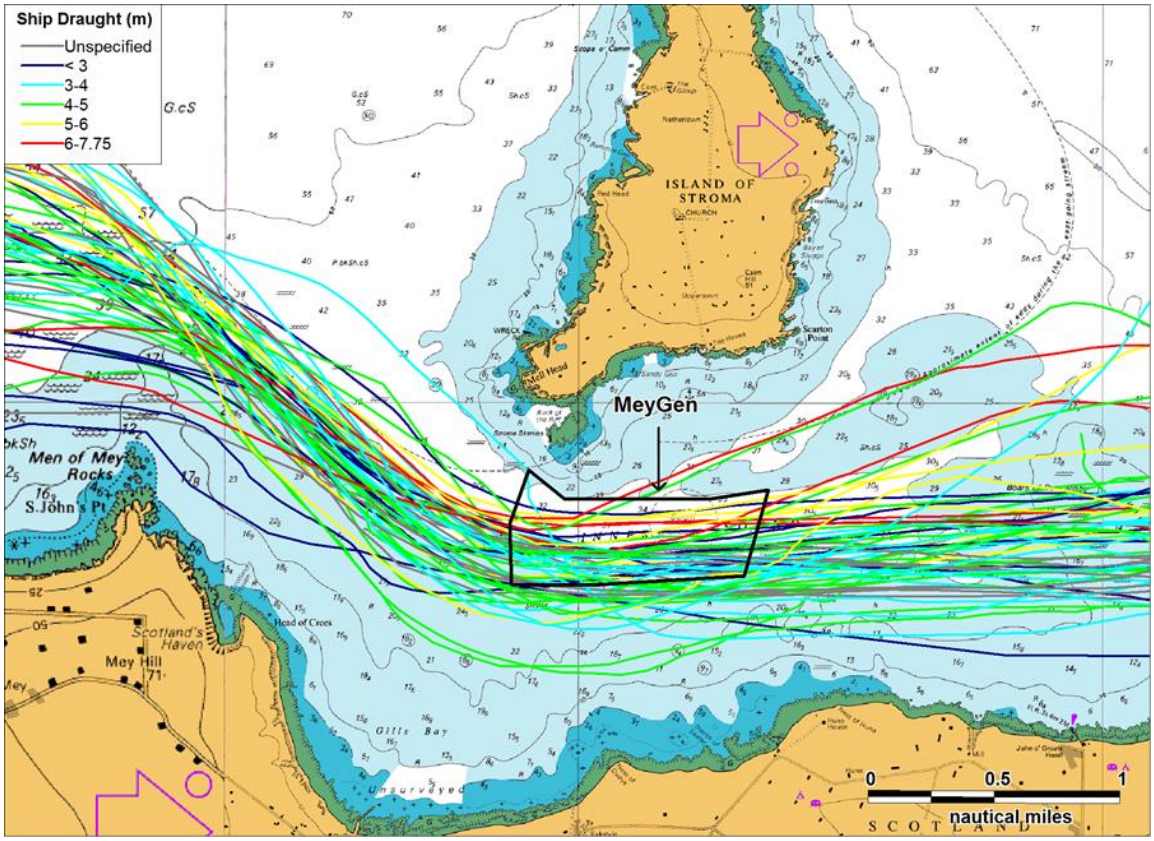

Figure 7.19 Original NRA AIS Survey Data

An increase in the number of east-west transits was recorded on AIS, with an average of 1.5 transits per day recorded during the validation exercise compared with an average of 0.6 transits per day recorded during the original NRA. This increase is considered to be due to two reasons:

1. Increased uptake of AIS on transiting vessels, for example, due to the extension of the EU Directive mandating AIS carriage on fishing vessels. Fishing vessels of 15m length and over are now required to carry AIS compared to 45m length and above at the time of the previous surveys (2010-11).
2. The data periods assessed in the marine traffic validation exercise were targeted to specifically capture the peak period of fishing (March) and recreational (July) vessel activity.

Overall, the numbers are in-line with the estimates made in the original NRA, taking into account the contribution from (non-AIS) radar targets.

In terms of commercial ferries operating in the area, the transits of the *Pentalina* did not differ significantly from those reviewed in the original NRA. The *Pentland Venture* did not broadcast on AIS at the time of the original NRA but the transits now recorded agree with the information received from John O'Groats Ferries during the original consultation.

It can therefore be concluded that the volume and nature of marine traffic within the Inner Sound has not differed significantly from the data assessed during the original NRA. This consideration shall be taken into account within the impact assessment for the moored barge and jack-up vessel.

8. Maritime Incident Review

8.1 Introduction

As part of the original NRA that was undertaken for the MeyGen Inner Sound (Anatec, 2012) maritime incident data was reviewed in order to provide a general indication as to whether the area of the development was a low or high risk area in terms of maritime incidents. Data was analysed from both the Marine Accident Investigation Branch (MAIB) and the Royal National Lifeboat Institution (RNLI) from 2001 – 2010. In addition, high profile incidents that were raised during stakeholder consultation were also summarised.

The purpose of this section is to undertake a review of the more recent maritime incidents (2011 – 2014) that have occurred in the sea area adjacent to the MeyGen development in order to inform the risk assessment considering the use of other vessel options (moored barges / jack-up vessels).

Therefore, this technical note shall review both the MAIB and RNLI data from 2011-2014 (full annual analysis). In addition, high profile incidents that have occurred from January 2015 onwards but are not within the latest official data sets shall also be summarised.

8.2 MAIB (2011 – 2014)

Figure 8.1 presents the locations of maritime incidents, colour-coded by incident type, recorded by the MAIB between 2011 and 2014 in the vicinity of the MeyGen project area. Following this, Table 8.1 provides a summary of each of these incidents. The "ID" column of Table 8.1 corresponds to the digit adjacent to each incident in Figure 8.1.

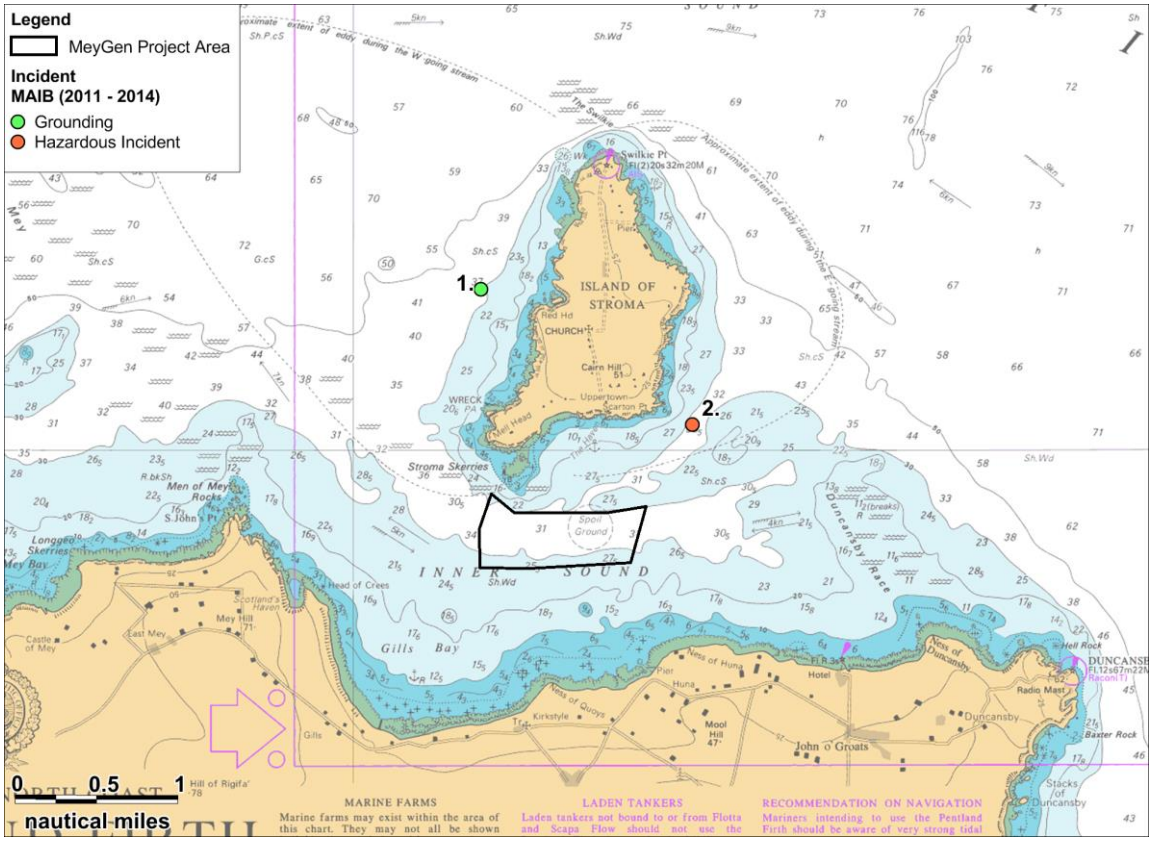

Figure 8.1 MAIB Incident Locations (2011 – 2014)

Table 8.1 Summary of MAIB Incidents (2011 – 2014)

ID	Incident Type	Date	Casualty	Incident Summary
1.[1]	Grounding	07/09/2011	Fishing Vessel	The UK-registered scallop dredger *Golden Promise* grounded on the Island of Stroma while on passage from Scrabster to her intended fishing grounds. Thurso and Longhope all weather lifeboats and a rescue helicopter from RAF Lossiemouth deployed, and the crew were airlifted off the vessel. There were no injuries and there was no pollution. The vessel was subsequently declared a constructive total loss. The MAIB investigation established that the skipper, who had been alone on watch in the wheelhouse, had fallen asleep and failed to make an intended course alteration, see Figure 8.2 below. A watch alarm was fitted in the wheelhouse, but this

[1] https://assets.digital.cabinet-office.gov.uk/media/547c6f7ae5274a429000002f/GoldenPromise.pdf

ID	Incident Type	Date	Casualty	Incident Summary
				was ineffective and probably was not functioning at the time of the accident. No formal passage plans were prepared for the vessel. The practice was instead to follow historical tracks on the chart plotters, without the use of waypoints or cross track error alarms. A recommendation has been made to the owner of the *Golden Promise* to enhance safety management of its vessels by applying the watchkeeping and navigational best practice guidance promoted in Marine Guidance Note (MGN) 313 (F), and to ensure that crews employed on its vessels have all completed the mandatory safety training courses.
2.	Hazardous Incident	04/11/2011	Fishing Vessel	Fouled propeller (fouled on own trawl wire) on UK-registered scallop dredger (11.5m in length and 22 years old at time of incident) whilst towing fishing gear with two crew members onboard. Longhope lifeboat responded to call out at 15:04hrs, during daylight hours. The lifeboat towed the fishing vessel to safety and the two crew members onboard rescued. Conditions at the time were poor: rough seas and moderate winds.

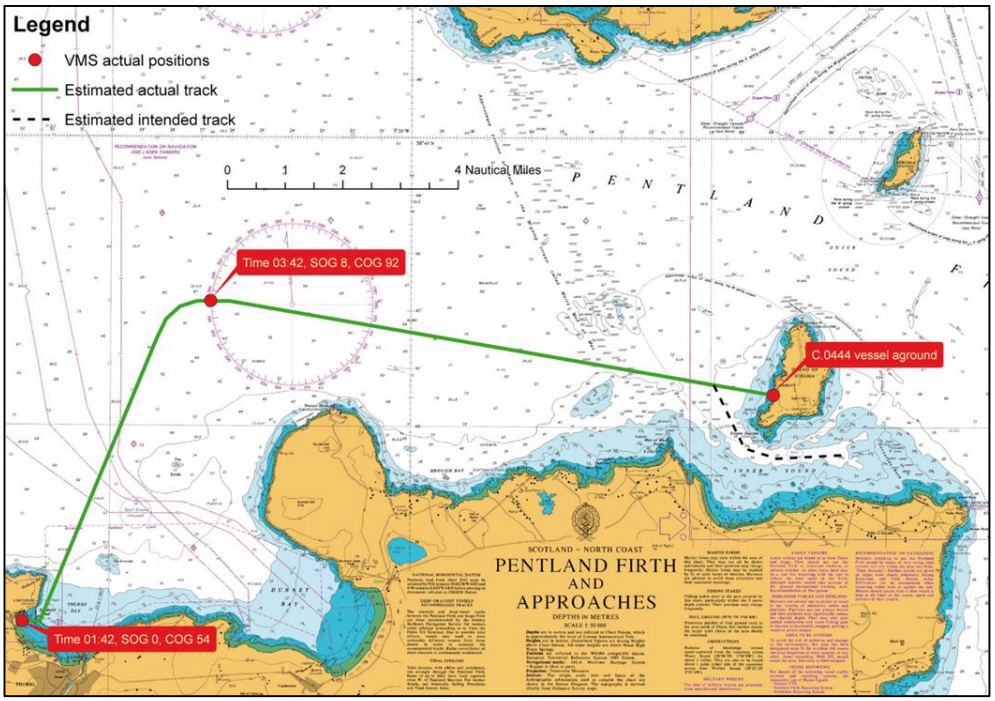

Figure 8.2 *Golden Promise* Grounding – Estimated Course

8.3 RNLI (2011 – 2014)

Figure 8.3 presents the locations of maritime incidents, colour-coded by incident type, responded to by the RNLI between 2011 and 2014 in the vicinity of the MeyGen project area. Following this, Table 8.2 provides a summary of each of these incidents. The "ID" column of Table 8.2 corresponds to the digit adjacent to each incident in Figure 8.3.

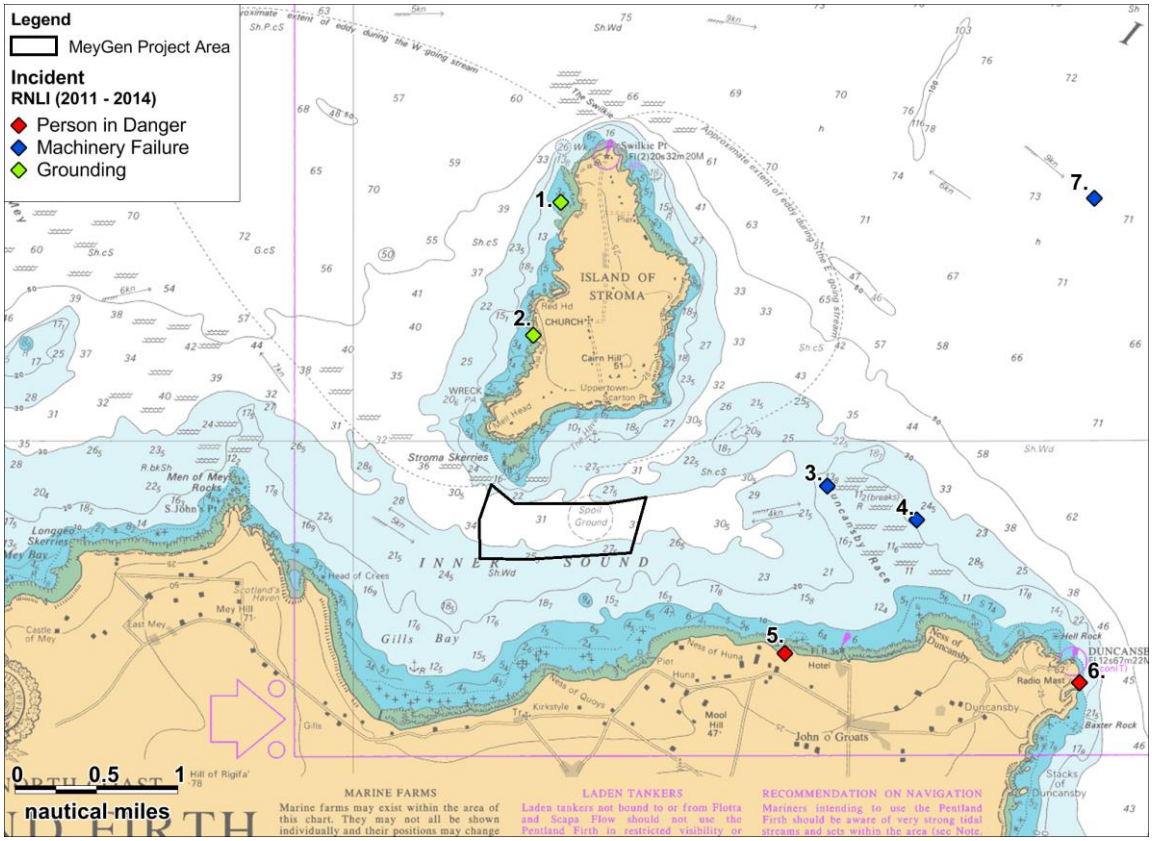

Figure 8.3 RNLI Incident Locations (2011 – 2014)

Table 8.2 Summary of RNLI Incidents (2011 – 2014)

ID	Incident Type	Date	Casualty	Incident Summary
1.[1]	Grounding	26/07/2011	Passenger (Recreational) Vessel	Thurso RNLI lifeboat aided the *North Coast Explorer* (a small RIB), which had got into difficulties while on a trip around Stroma. The RIB (which had a crew of two with ten passengers onboard) entered a sea cave called "The Gloup" but her crew were unable to reverse the boat back out of the cave. All 12 crew / passengers were transferred from sea cliffs (where they had sought refuge) to all-weather lifeboat using small inflatable Y-boat kept aboard the main lifeboat. The stricken *North Coast Explorer* vessel was not recovered.

[1] http://rnli.org/NewsCentre/Pages/Thurso-lifeboat-volunteers-rescue-12-from-pleasure-boat-trapped-in-cave.aspx

ID	Incident Type	Date	Casualty	Incident Summary
				Lifeboat was launched at 15:08hrs with conditions at the time favourable: slight seas and light wind.
2.	Grounding	07/09/2011	Fishing Vessel	Grounding of scallop dredger *Golden Promise*. See incident **1** of Table 8.1.
3.[1]	Machinery Failure	28/08/2014	Recreational (Sail Training Vessel)	Wick lifeboat was called to assist the Polish sail training vessel *Roztocze* that had lost its engine in poor conditions (rough seas and strong winds) off Wick. Conditions were unsuitable to enter Wick harbour and the vessel was taken to Duncansby Head where the vessel was transferred to Thurso lifeboat and towed to Thurso. The location marking this incident (3) within the Inner Sound is most likely the location where towing of the vessel was transferred from the Wick to Thurso lifeboat.
4.	Machinery Failure	04/11/2011	Fishing Vessel	Fouled propeller of scallop dredger. See incident **2** of Table 8.1.
5.	Person in Danger	11/08/2013	Person	Wick lifeboat responded to call out of an injured person - injury occurred whilst walking / running along coast. Conditions at the time were favourable: smooth seas and light winds. Others provided assistance to the casualty prior to the arrival of the lifeboat.
6.	Person in Danger	16/07/2014 & 17/07/2014	Person	Wick lifeboat responded to a call out on the 16th following sightings a vehicle in the water off the shore at Duncansby Bay. The vehicle was sited approximately 2m below the water however the swell carried the vehicle out of site. On the 17th the Wick lifeboat provided assistance during the recovery of a body from the vehicle.
7.	Machinery Failure	25/05/2014	Passenger Vessel	Wick lifeboat responded to a call out of a machinery failure onboard a passenger vessel and rendered assistance. No further detail of the nature of the machinery failure is available. Lifeboat was launched

[1] https://www.rnli.org/Pages/Video-Details.aspx?VideoItemID=f75f137d-6b20-4a49-bbcc-3e81a3f1d155

ID	Incident Type	Date	Casualty	Incident Summary
				at approximately 15:00hrs. Conditions at the time were moderate: slight seas and moderate winds.

8.4 High Profile Incidents (2015 – Present)

8.4.1 *Cemfjord* (Cargo Vessel) – Jan. 2015[1]

The Cyprus-registered cement carrier *Cemfjord* foundered in the Pentland Firth (Outer Sound) on the 2nd January 2015 (last sighting) whilst transiting between Aalborg (Denmark) and Runcorn (UK). At 14:30 on 3rd January 2015, the *Cemfjord's* upturned hull was sighted 11nm east of the Pentland Skerries, only the bow was visible above the waterline. No distress call had been received and poor weather conditions prevailed (high winds). The Longhope, Scrabster, Stromness and Wick lifeboats were launched to assist in the search for the crew. Two SAR helicopters and an aircraft also joined the search. By mid-afternoon on the 4th January 2015 the *Cemfjord* had sunk entirely.

An MAIB investigation is currently taking place and underwater surveys of the *Cemfjord* have been undertaken. The wreck was found to be intact but inverted and resting on its superstructure; no evidence was observed of structural failure. All eight crew members were lost, with no bodies recovered. The wreck has been left in place and designated as a sea grave.

8.4.2 *Advance* (Survey Vessel) – Jul. 2015[2]

Longhope lifeboat was launched at approximately 14:15 on July 2nd 2015 to aid the crew of a survey vessel *Advance* (with four crew members onboard) which had broken down in the Pentland Firth. The *Advance* was being held off the shore west of Brims by a smaller vessel. The Longhope lifeboat took the *Advance* under tow and headed for Stromness, through Scapa Flow.

8.4.3 *Skog* (Cargo Vessel) – Nov. 2015[3]

The Barbados-registered cargo vessel *Skog* started drifting and taking on water west of mainland Orkney on the 24th November 2015 after encountering engine problems. The MCA's emergency towing vessel *Herakles,* Stromness and Kirkwall all-weather lifeboats, a SAR helicopter and the *VOS Hera* (oil and gas standby vessel) responded to the incident. The ten crew members remained onboard and pumps were transferred to the *Skog* by the SAR helicopter. The *Skog* was taken under tow from the *Herakles* and was towed to port for repairs.

[1] http://www.bbc.co.uk/news/uk-scotland-north-east-orkney-shetland-31370811
[2] http://www.orcadian.co.uk/2015/07/longhope-lifeboat-in-pentland-firth-rescue/
[3] http://www.bbc.co.uk/news/uk-scotland-north-east-orkney-shetland-34910679

8.4.4 *Schokland* (Cargo Vessel) – Feb. 2016[1]

The Dutch-registered cargo vessel (*Schokland*) started drifting within the Pentland Firth on 6th February 2016 after encountering engine failure. The *Schokland* drifted (not under command) to within approximately 2nm south of Hoy (Orkney). The MCA's emergency towing vessel *Herakles*, Longhope lifeboat and the Orkney towage tug *Einar* responded. The *Schokland* was towed by the *Einar* and the *Herakles* accompanied until the tow was clear of the Pentland Firth.

8.4.5 *Frem* (Fishing Vessel) – Feb. 2016[2]

The UK-registered fishing vessel (*Frem*) with two crew members onboard was towed to safety by the Thurso lifeboat after taking on water in the Pentland Firth. The *Frem* started taking on water off Dunnet Head at approximately 04:00 on the 11th February 2016. The Thurso lifeboat and Sumburgh helicopter transferred pumps to the vessel to stem the flow of water. The lifeboat of the *Frem* was deployed as a precautionary measure if the crew were forced to abandon ship. The vessel was towed by the Thurso lifeboat to Scrabster harbour.

8.5 Comparison with NRA

From the review of newer maritime incident data, a number of high profile incidents have been recorded in proximity to the MeyGen development area. Some of these incidents have been of a serious nature, e.g. the grounding of the *Golden Promise* fishing vessel. However, the overall type of incident (in terms of severity) and frequency of incidents has not altered significantly from the maritime incident data assessed in the original NRA.

It can therefore be concluded that the overall risk of the sea area in which the MeyGen development is to be installed has not altered significantly since the NRA was completed. This consideration shall be taken into account within the assessment of potential impacts for the moored barge and jack-up vessel.

[1] http://www.orcadian.co.uk/2016/02/dutch-cargo-vessel-towed-to-kirkwall-for-repairs/
[2] http://www.bbc.co.uk/news/uk-scotland-highlands-islands-35547457

9. Impact Assessment

9.1 Introduction

A hazard review and risk ranking exercise was carried out as part of the original NRA. This review was based on baseline data analysis, stakeholder consultation and discussion at the hazard review workshop. The hazard review workshop was held at the Wick RNLI station in September 2011 and attended by a range of stakeholders. Following the workshop, meeting minutes and a hazard ranking spreadsheet were circulated to attendees for comment and review. Full results of the hazard workshop are presented in Section 13 of the original NRA.

As previously stated, the hazard review workshop was used as the basis (in addition to other data sources) of the shipping and navigation impact assessment. Additional mitigation measures for each impact (if deemed necessary) were also identified.

9.2 Significance Criteria

The same impact assessment methodology (International Maritime Organisation's Formal Safety Assessment process and DECC / MCA guidelines) used throughout the original NRA / ES (summarised in Section 15.4 of the ES) has been used for this reassessment exercise.

Hazards (impacts) have been categorised using the frequency and consequence categories below.

Rank	Description	Definition
1	Negligible	< 1 occurrence per 10,000 years
2	Extremely Unlikely	1 per 100 to 10,000 years
3	Remote	1 per 10 to 100 years
4	Reasonably Probable	1 per 1 to 10 years
5	Frequent	Yearly

Rank	Description	Definition			
		People	Environment	Property	Business
1	Negligible	No injury	<£10k	<£10k	<10k
2	Minor	Slight injury(s)	Tier 1: Local assistance required	£10k-£100k	£10k-£100k
3	Moderate	Multiple moderate or Single serious injury	Tier 2: Limited external assistance required	£100k-£1M	£100k-£1M Local publicity
4	Serious	Serious injury or single fatality	Tier 2: Regional assistance required	£1M-£10M	£1M-£10M National publicity
5	Major	More than 1 fatality	Tier 3: National assistance required	>£10M	>£10M International publicity

The consequence scores are averaged (for a single impact there could be a range of potential consequences) and multiplied by the frequency to obtain an overall ranking (or score) which determined the hazard's position within the risk matrix shown below.

Consequence						
	5					
	4					
	3					
	2					
	1					
		1	2	3	4	5
		Frequency				

where:

	Broadly Acceptable Region (Low Risk)	Generally regarded as insignificant and adequately controlled. Nonetheless the law still requires further risk reductions if it is reasonably practicable. However, at these levels the opportunity for further risk reduction is much more limited.
	Tolerable Region (Moderate Risk)	Typical of the risks from activities which people are prepared to tolerate to secure benefits. There is however an expectation that such risks are properly assessed, appropriate control measures are in place, residual risks are as low as is reasonably practicable (ALARP) and that risks are periodically reviewed to see if further controls are appropriate.
	Unacceptable Region (High Risk)	Generally regarded as unacceptable whatever the level of benefit associated with the activity.

For the purposes of EIA impact significance ranking, hazards in the Broadly Acceptable (Low Risk) region are not considered to result in significant impacts. Hazards in the Tolerable (Moderate Risk) and Unacceptable (High Risk) regions are considered to result in significant impacts.

9.3 Relevant Hazards

When considering the potential use of both a moored barge / jack-up vessel the impacts assessed in the NRA / ES deemed to require re-assessment are as follows:

- Collision risk with work vessel (Construction);
- Traffic re-routeing due to work vessels and associated safety zones (Construction); and
- Working vessel gets into difficulty (Construction).

New impacts, previously not considered in the original NRA, deemed to arise considering the use of a moored barge / jack-up vessel, are listed below:

- Allision (drifting) risk with work vessel (Construction);
- Loss of station, applicable for moored barge only (Construction); and

- Fishing gear interaction with subsea mooring lines, applicable for moored barge only (Construction).

The following subsections assess the potential impact of the aforementioned hazards considering the potential use of a moored barge / jack-up vessel, the findings of the marine traffic validation exercise and the updated maritime incident review.

Impacts associated with vessel options during O&M and decommissioning are considered to be no greater than those experienced during the construction phase of the Project, except that the Project should be well known to all vessels using the area by that time. The mitigation would be the same as that presented.

In terms of cumulative impacts, these were reviewed in the NRA / ES and the alternative vessel options are not considered to significant affect this discussion, especially as the planned safety zone for the moored barge / jack-up vessel of 150m radius is in-line with that recommended in the ES to minimise potential cumulative impacts.

9.4 Embedded Mitigation Measures

The following embedded (industry standard) mitigation measures have been assumed as in place during the impact assessment exercise.

- Marking and lighting of all vessels / structures;
- AIS broadcasts by moored barge / jack-up vessel and support vessels;
- Charting of the construction area (construction phase) and turbine locations (operational phase) on UKHO Admiralty Charts;
- Promulgation of information, e.g. Notice to Mariners, Kingfisher fortnightly bulletins, local harbours and marinas;
- Hourly VHF radio broadcasts from vessel on-site. Three-hourly VHF radio broadcasts from Coastguard.
- Activity planned to take place in suitable weather and tides.

9.5 Re-Assessment of NRA / ES Impacts

9.5.1 Collision Risk with Work Vessel (Construction)

During the original NRA / ES the potential residual impact (considering the implementation of multiple mitigation measures and assuming industry good practice) was assessed as **Broadly Acceptable (low risk)** based on ‘moderate’ consequence and ‘extremely unlikely’ frequency.

For the moored barge and potentially the jack-up vessel during the construction phase a number of additional support vessels (summarised in Section 5.2 and Section 5.3) may be required to position the barge / jack-up vessel and secure the vessel in position. The original NRA / ES, when considering the use of a DP vessel, assumed that no concurrent multiple

vessel activities were to take place, i.e. no more than one vessel would be on site at any one time.

The overall mobility of a moored barge / jack-up vessel will be lower than the mobility of a DP vessel. Therefore, a moored barge / jack-up vessel would be less able to manoeuvre in response to other vessel movements, including in the case of a vessel approaching on a potential collision course, when compared to a DP vessel.

It is noted the construction activity will only be planned in good weather and neap tides, so the prevailing conditions for transiting vessels should not be as challenging as it could be at other times of year within the Inner Sound. Also the planned information circulation about the activity should mean that approaching vessels are already aware of the work.

The potential increase in work vessel activity and reduced ability to move out of the way when considering the use of a moored barge / jack-up vessel, result in the overall frequency of occurrence increasing for this impact. Hence the overall risk is assessed as **Tolerable (moderate risk)** as summarised below:

Consequence	Frequency	Risk	Is the impact significant or not significant?
Moderate	Remote	Tolerable (moderate risk)	Significant

Further mitigation measures to reduce the risk considering use of a moored barge / jack-up vessel are summarised below. It should be noted that a number of these measures are an expansion of measures listed in the original NRA / ES. Original mitigation measures are *italicised.*

- "*Safety zone of appropriate dimensions will be implemented to protect working vessels on the site when restricted in manoeuvrability*." Consideration has been given to the navigable channel width when designating the extent of a safety zone, and a 150m radius advisory zone is considered to be appropriate.

- "*Operating procedures will be established to ensure work vessels do not block the channel when they are not actively working on the site*." This should apply to all work vessels (including any support vessels present) to ensure that a clear (unobstructed) channel is presented to vessels transiting the Inner Sound, i.e. all work vessels should align (as far as practicable) to minimise obstruction.

- "*Collision risk management procedures will be developed by working vessels specifying traffic monitoring and emergency response procedures*." Again this should apply to all work vessels (including support vessels) to ensure each individual work vessel is aware of collision risk management responsibilities. A form of direct

communication between work vessels, e.g., working VHF channel, to allow transfer of real-time collision risk information is encouraged.

- Guarding against potential collision will take place during the construction phase whilst the moored barge / jack-up vessel are onsite. For the barge, the support vessel(s) present throughout construction will act as guard vessel(s). These support vessels will be positioned to ensure that traffic monitoring duties are effective, taking the direction of the tide into account. For the jack-up vessel, the same will apply when a support vessel is present. If working alone, guarding will be provided by watchkeepers on the jack-up vessel. Watchkeeping (using visual lookout, radar and AIS) will be a dedicated function carried out 24/7.

Based on applying the aforementioned mitigation measures, the overall frequency of occurrence is expected to reduce. Therefore, the overall residual risk with mitigation is **Broadly Acceptable (low risk)** as summarised below (this applies for both the moored barge and/or jack-up vessel option):

Consequence	Frequency	Risk	Is the impact significant or not significant?
Moderate	Extremely unlikely	Broadly Acceptable (low risk)	Not Significant

9.5.2 Traffic Re-Routeing Due to Work Vessels and Associated Safety Zones (Construction)

During the original NRA / ES the potential impact was assessed as **Tolerable (moderate risk)** based on 'moderate' consequence and 'remote' frequency.

The original NRA assumed full development (up to 86 turbines) of Phase 1 of the Development. The use of construction safety zones was also considered during the original NRA. The current indicative layout, see Section 4.2, assumes development of 57 turbines within the Phase 1 development area. The overall footprint of turbine positioning and safety zone usage has not differed significantly from the layout assessed during the original NRA.

Overall, re-routeing of vessels is not expected to differ significantly from the pattern predicted during the original NRA. The overall risk is therefore not assessed to alter from that of the original NRA when considering the use of a moored barge / jack-up vessel, as summarised below:

Consequence	Frequency	Risk	Is the impact significant or not significant?
Moderate	Remote	Tolerable (moderate risk)	Significant

Mitigation measures to reduce this impact are noted below:

- "*Safety zone of appropriate dimensions will be implemented to protect working vessels on the site when restricted in manoeuvrability*." The dimensions of safety zones will take into account the sea room within the Inner Sound and therefore be reduced from the standard dimensions of 500m. An advisory safety zone radius of 150m is planned, based on the consensus arising from the stakeholder consultation.

- "*Operating procedures will be established to ensure work vessels do not block the channel when they are not actively working on the site*." This should apply to all work vessels (including support vessels) to ensure that a clear (unobstructed) channel is presented to vessels transiting the Inner Sound, i.e. all work vessels should align (as far as practicable) to minimise obstruction.

These measures are considered to have a positive effect but the rankings remain in the same bands, which are consistent with the original NRA for this impact.

9.5.3 Working Vessel gets into Difficulty (Construction)

During the original NRA / ES the potential impact was assessed as **Tolerable (moderate risk)** based on 'minor' consequence and 'frequent' frequency:

As previously stated, use of the moored barge / jack-up vessel during the construction phase may require additional support vessel(s) (summarised in Section 5.2 and Section 5.3) to assist in positioning the barge / jack-up vessel. Depending on the final option selected, there could be an increase in work vessel activity. However, the overall frequency of a work vessel encountering difficulties is assessed to remain within the same band. This takes into account any work of this type will be planned to take place in good weather and suitable tides.

The potential increase in work vessel activity onsite could also have a positive impact in terms of SAR response capability, with a work vessel likely to act as the primary responder during an emergency situation, if present. Any tugs / workboats used for positioning of the barge / jack-up vessel could also be used as an emergency towing vessel (dependent on size of stricken vessel and towage capability of tug / workboat). However, the overall consequence is assessed to remain within the same band.

Therefore, the risk (considering the use of a moored barge / jack-up vessel) remains **Tolerable (moderate risk)**, in-line with the original NRA / ES, as summarised below:

Consequence	Frequency	Risk	Is the impact significant or not significant?
Minor	Frequent	Tolerable (moderate risk)	Significant

9.6 Assessment of Newly Identified Impacts

9.6.1 Allision (Drifting) Risk with Work Vessel (Construction)

During the original NRA the risk of a vessel (under power) colliding with a work vessel was assessed (see Section 9.5.1). However, the risk of a drifting vessel (not under command) alliding with a work vessel was not assessed. Due to the inclusion of a moored barge / jack-up vessel, which are restricted in their ability to manoeuvre to a greater extent than a DP vessel, the risk of a vessel which has lost power (drifting) alliding with the moored barge / jack-up must be assessed.

Assuming the preparation times for the moored barge / jack-up (summarised in Section 5) a significant proportion of time (approximately 15-30 minutes for barge and 60 minutes for jack-up vessel) is required to ready the moored barge / jack-up vessel for transit. It is also possible that transit of the moored barge / jack-up vessel may not be possible at certain times, e.g. when tidal flow speeds exceed the capability of mooring retrieval. Furthermore, the high speed of tidal flows within the Inner Sound shall increase the drift speed of an incapacitated vessel thus increasing the risk of a drifting vessel allision.

From review of the marine traffic validation data, a number of vessels were recorded using the Inner Sound, including vessels transiting east – west as well as ferries north-south. A number of incidents which involved machinery failure and vessels adrift were also recorded in proximity to the Project development area during the maritime incident review, see Section 8.

The consequence of a drifting vessel allision is considered to be **moderate** though may not be as severe as a powered collision as vessels may be travelling at lower speed, with vessels potentially being less severely damaged. The frequency is considered to be **remote** given the number of drifting vessels in recent years and the fact external recovery may be possible. The potential impact is therefore assessed as **Tolerable (moderate risk)** as summarised below.

Consequence	Frequency	Risk	Is the impact significant or not significant?
Moderate	Remote	Tolerable (moderate risk)	Significant

Further mitigation to reduce the risk considering use of a moored barge / jack-up vessel are summarised below. It should be noted that a number of these measures are an expansion of measures listed in the original NRA / ES. Original mitigation measures are *italicised*.

- "*Operating procedures will be established to ensure work vessels do not block the channel when they are not actively working on the site*." This should apply to all work vessels (including support vessels) to ensure that a clear (unobstructed) channel is

presented to vessels transiting the Inner Sound, i.e. all work vessels should align (as far as practicable) to minimise obstruction.

- "*Collision risk management procedures will be developed by working vessels specifying traffic monitoring and emergency response procedures*." Again this should apply to all work vessels (including support vessels) to ensure each individual work vessel is aware of responsibilities regarding evacuation procedures. A form of direct communication between work vessels, e.g., working VHF Channel, to allow transfer of real-time collision risk information, is encouraged.

- Provision of towage capability by support vessels (if and when present). Any tugs / workboats used for positioning of the barge / jack-up vessel could also be used as an emergency towing vessel (dependent on size of stricken vessel and towage capability of tug / workboat).

- Undertake periodic drills and testing of emergency procedures in the event of a required re-positioning of moored barge / jack-up vessel. Such drills will encourage familiarity with the procedures. The estimated time to mobilise shall provide a reference point for real scenarios and influence the emergency action initiated in the event of a drifting vessel on a collision course.

Based on applying the aforementioned mitigation measures, the overall frequency of occurrence is expected to reduce. This is primarily based on the adequate provision of towage capability by support vessels. Therefore, the overall residual risk (considering the use of a moored barge / jack-up vessel) is **Broadly Acceptable (low risk)** as summarised below:

Consequence	Frequency	Risk	Is the impact significant or not significant?
Moderate	Extremely unlikely	Broadly Acceptable (low risk)	Not Significant

9.6.2 Loss of Station of Moored Barge (Construction)

When the moored barge is in position, there is potential for it to lose station (and begin to drift) e.g. following mooring line failure. Given the dominant tidal streams (east / west) in the area there is potential for the barge to drift in proximity to areas of commercial traffic, e.g. within the Pentland Firth. Therefore, the overall severity of consequence has been assessed as **minor**. The overall frequency of occurrence has been assessed as **extremely unlikely**, given the anticipated high level of redundancy within the barge mooring lines. The potential impact is assessed to be **Broadly Acceptable (low risk)** as summarised below:

Consequence	Frequency	Risk	Is the impact significant or not significant?
Minor	Extremely unlikely	Broadly Acceptable (low risk)	Not Significant

Further mitigation to reduce the risk are summarised below:

- Guard vessel employment during construction phase whilst moored barge onsite. It is proposed that the support vessels present throughout the construction phase (whilst utilising a moored barge) fulfil the guard vessel duty. If the barge were to lose station the guard vessel could alert transiting vessels to the incident, thereby reducing the likelihood of a transiting vessel colliding with the drifting barge.

- Provision of towage capability by support vessels. The presence of tugs / workboats used for positioning of the barge could also be used as an emergency towing vessel.

Based on applying the aforementioned mitigation measures, the overall frequency of occurrence is expected to reduce but remain within the same bands; mitigation measures have been provided as a precautionary approach to ensure that this remains the case. Therefore, the overall residual risk (considering the use of a moored barge) is **Broadly Acceptable (low risk)**.

9.6.3 Fishing Gear Interaction with Subsea Mooring Lines (Construction)

When the moored barge is in position, there is potential for fishing gear to interact with the subsea mooring lines. It was concluded from the NRA that no trawling activity takes place within the Phase 1 area and fishing activity is limited to local creel vessels operating from John o'Groats. Consultation (undertaken as part of the original NRA) with the skippers of these creel vessels indicated they would avoid fishing within the turbine array due to the danger of snagging. The most likely consequence is damage or loss of gear rather than capsize of the fishing vessel. Therefore, the overall severity of consequence has been assessed as **minor**. The overall frequency of occurrence has been assessed as **extremely unlikely.** The potential impact is assessed to be **Broadly Acceptable (low risk)** as summarised below:

Consequence	Frequency	Risk	Is the impact significant or not significant?
Minor	Extremely unlikely	Broadly Acceptable (low risk)	Not Significant

Further mitigation to reduce the risk are summarised below:

- "*Safety zone of appropriate dimensions will be implemented to protect working vessels on the site when restricted in manoeuvrability*." Consideration should be given

to the navigable channel width when designating the extent of safety zones. An advisory safety zone radius of 150m is planned, based on the consensus arising from the stakeholder consultation.

- Guard vessel employment during construction phase whilst moored barge onsite. It is proposed that the support vessels present throughout the construction phase (whilst utilising a moored barge) fulfil the guard vessel duty. The guard vessel could alert fishing vessels to the presence of subsea mooring lines, thereby reducing the likelihood of fishing gear / mooring line interaction.

Based on applying the aforementioned mitigation measures, the overall frequency of occurrence is expected to reduce but remain within the same bands; mitigation measures have been provided as a precautionary approach to ensure that this remains the case. Therefore, the overall residual risk (considering the use of a moored barge) is **Broadly Acceptable (low risk)**.

9.7 Summary of Impacts

Table 9.1 provides a summary of both the re-assessed impacts and newly identified impacts considering the use of a moored barge and/or jack-up vessel. The same frequency and consequence bands as used in the original NRA / ES have been applied in this addendum.

Of the re-assessed impacts, no impact was assessed to increase in overall risk when compared to the original NRA, taking into account the planned mitigation. All re-assessed impacts were assessed as **Tolerable (moderate risk)** or **Broadly Acceptable (low risk)** following the implementation of mitigation measures. All of the newly identified impacts were assessed as **Broadly Acceptable (low risk)** following the implementation of mitigation measures.

A number of proposed mitigation measures are an expansion of measures listed in the original NRA / ES and a number of new mitigation measures have been proposed to specifically mitigate the risk of using a moored barge / jack-up vessel. Mitigation measures are summarised further in Section 10.

Table 9.1 Summary of Impacts (using same Impact Criteria as the Original NRA / ES)

Potential Impact	Severity of Consequence	Frequency of Occurrence	Impact	Mitigation	Residual Impact
Re-Assessment of NRA / ES Impacts					
Collision risk with work vessel. (Construction)	Moderate	Remote	Tolerable (moderate risk)	• Construction safety zone. • Operating procedure to ensure work vessels do not block channel. • Collision risk management procedures specifying traffic monitoring and emergency response procedures. • Watchkeeping and collision risk management procedures.	Broadly Acceptable (low risk)
Traffic re-routeing due to work vessels and associated safety zones. (Construction)	Moderate	Remote	Tolerable (moderate risk)	• Construction safety zone of limited extents (not maximum 500m). • Operating procedure to ensure work vessels do not block channel.	Tolerable (moderate risk)
Working vessel gets into difficulty. (Construction)	Minor	Frequent	Tolerable (moderate risk)	No further mitigation identified or required.	Tolerable (moderate risk)
Assessment of Newly Identified Impacts					
Allision (drifting) risk with work vessel. (Construction)	Moderate	Remote	Tolerable (moderate risk)	• Operating procedure to ensure work vessels do not block channel. • Collision risk management	Broadly Acceptable (low risk)

Potential Impact	Severity of Consequence	Frequency of Occurrence	Impact	Mitigation	Residual Impact
				procedures specifying traffic monitoring and emergency response procedures. • Provision of towage capability by support vessels (if and when present). • Undertake drills and testing of emergency re-positioning.	
Loss of station of moored barge. (Construction)	Minor	Extremely Unlikely	Broadly Acceptable (low risk)	• Guard vessel employment. • Provision of towage capability by support vessels.	Broadly Acceptable (low risk)
Fishing gear interaction with subsea mooring lines. (Construction)	Minor	Extremely Unlikely	Broadly Acceptable (low risk)	• Construction safety zone. • Guard vessel employment.	Broadly Acceptable (low risk)

10. Conclusions and Mitigation Measures

10.1 Conclusions

Following assessment of the addition vessel options (moored barge / jack-up vessel) for which MeyGen are currently seeking to vary the consent, it can be concluded that the overall risk to shipping and navigation is not significantly higher than assessed during the original NRA.

This assessment is supported by the consultation carried out with national and local stakeholders. There was a consensus that use of a moored barge / jack-up vessel would not significantly alter the navigational risk associated with the Project.

All impacts assessed for the use of a moored barge / jack-up vessel (impacts from the original NRA which have been re-assessed and newly identified impacts) were tolerable or broadly acceptable following the implementation of additional mitigation measures. Required mitigation measures are summarised in Section 10.2.

10.2 Mitigation Measures Summary

Further mitigation to reduce the overall risk considering use of a moored barge / jack-up vessel are summarised below. It should be noted that a number of these measures are an expansion of measures listed in the original NRA / ES. Original mitigation measures are *italicised*.

- "*Safety zone of appropriate dimensions will be implemented to protect working vessels on the site when restricted in manoeuvrability*." Consideration should be given to the afforded navigable channel width when designating the extent of safety zones. An advisory safety zone radius of 150m is planned, based on the consensus arising from the stakeholder consultation.

- "*Operating procedures will be established to ensure work vessels do not block the channel when they are not actively working on the site*." This should apply to all work vessels (including support vessels) to ensure that a clear (unobstructed) channel is presented to vessels transiting the Inner Sound, i.e. all work vessels should align (as far as practicable) to minimise obstruction.

- "*Collision risk management procedures will be developed by working vessels specifying traffic monitoring and emergency response procedures*." Again this should apply to all work vessels (including support vessels) as to ensure each individual work vessel is aware of collision risk management responsibilities. A form of direct communication between work vessels, to allow transfer of real-time collision risk information, is encouraged.

- Guarding against potential collision will take place during the construction phase whilst the moored barge / jack-up vessel are onsite. For the barge, the support

vessel(s) present throughout construction will act as guard vessel(s). These support vessels will be positioned to ensure that traffic monitoring duties are effective, taking the direction of the tide into account. For the jack-up vessel, the same will apply when a support vessel is present. If working alone, guarding will be provided by watchkeepers on the jack-up vessel. Watchkeeping (using visual lookout, radar and AIS) will be a dedicated function carried out 24/7.

- Provision of towage capability by support vessels (if and when present). Any tugs / workboats used for positioning of the barge / jack-up vessel could also be used as an emergency towing vessel (dependant on size of stricken vessel and towage capability of tug / workboat). Therefore, emergency towing equipment should be held on the support vessels.

- Undertake periodic drills and testing of emergency procedures in the event of a required re-positioning of moored barge / jack-up vessel. Such drills will encourage familiarity with the procedures. The estimated time to mobilise shall provide a reference point for real scenarios and influence the emergency action initiated in the event of a drifting vessel on a collision course.

11. References

i Anatec Limited, Navigation Risk Assessment - MeyGen Inner Sound (2012).

ii Marine Scotland, Shipping Study of the Pentland Firth and Orkney Waters (2012).