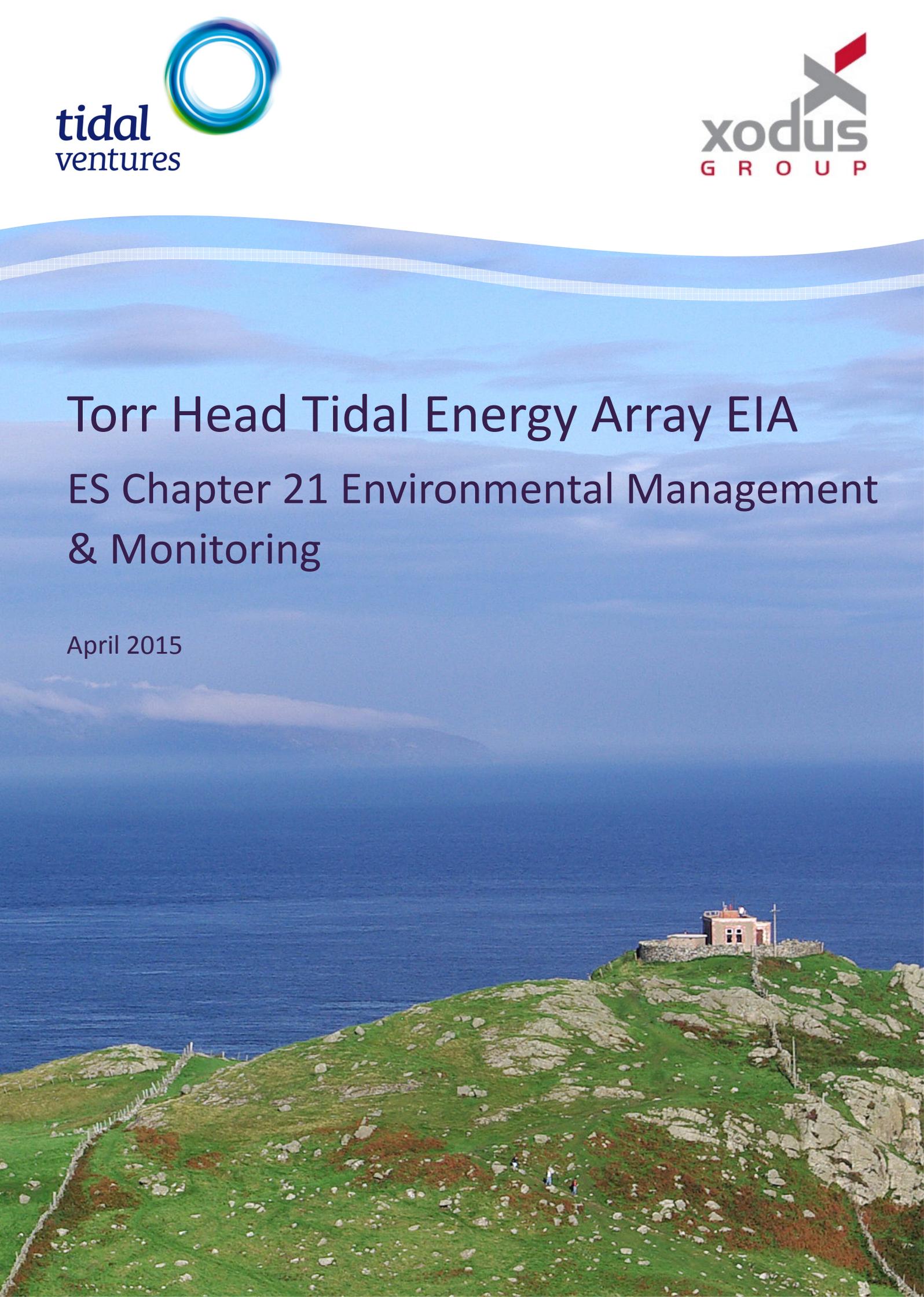




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Torr Head Tidal Energy Array EIA

ES Chapter 21 Environmental Management & Monitoring

April 2015

21 ENVIRONMENTAL MANAGEMENT AND MONITORING

21.1 Introduction

This chapter of the Environmental Statement (ES) provides a summary of all topic specific mitigation, monitoring and management measures identified through the impact assessment process.

The potential impacts of the Torr Head Tidal Energy Array Project on the environment have been assessed through the Environmental Impact Assessment (EIA) and Navigation Risk Assessment (NRA). The results are presented in this ES and accompanying NRA report. Both the EIA and NRA have indicated that it is necessary to manage the Project and implement specific mitigation measures to ensure the Project is sustainable in addition to avoiding or reducing any on-going effects on the environment resulting from the Project.

21.2 Environmental Management Plan (EMP)

EIA, including consultation with stakeholders, is an iterative process that will continue beyond ES submission. The primary mechanism for ensuring that the environmental assessment continues and that all environmental issues are addressed throughout the lifetime of the Project is through the Project Environmental Management Plan (EMP) which will be implemented as part of the overall Operational Management System for the Project.

The EMP will provide the overarching framework for on-site environmental management for the protection of environmental interests. It will be a working document which details consent conditions, the commitments outlined in the ES and compliance monitoring requirements (i.e. monitoring required to assess the performance of mitigation measures and any monitoring required to confirm impact predictions). It will also highlight the parties responsible for the implementation of the contents of the EMP.

The EMP will be developed and implemented in agreement with the relevant stakeholders, including the DoENI and their statutory advisors following the successful award of project consents. This is necessary to ensure that all ES mitigation commitments, consent conditions and environmental monitoring requirements are implemented as required.

21.2.1 Proposed structure and content of EMP

The EMP will be based on information (baseline and mitigation measures) included in this ES and conditions of the Marine Licence and Article 39 consent. It will include the following:

- > Outline management and reporting structure, policies, roles and responsibilities for all licensee (TVL) personnel. It will also cover, contractors and sub-contractors including for example pre-mobilisation audits for vessels, vehicles and equipment to be used in the Project; audits and monitoring of contractors environmental procedures and environmental awareness training;
- > Mitigation measures as identified in the ES;
- > Topic specific management plans setting out how mitigation measures will be implemented/adhered to during construction and operation including relevant sections of the Construction Method Statement (CMS);
- > Pollution prevention measures and contingency plans;
- > Waste management measures;
- > Measures to prevent introduction of non-native marine species; and
- > Reporting mechanisms including updates on construction activity, any environmental issues encountered and how these have been addressed.

As a working document, any updates or amendments to the EMP will need to be submitted to the regulator (DoENI Marine Division and DETI) for agreement.

21.2.2 Mitigation

Where the EIA has identified potentially significant impacts that cannot be avoided, mitigation measures have been proposed. Such measures should remove, reduce or manage the effect to a point where the residual significance of that impact is reduced to an acceptable level. For some EIA topics where the assessment concluded that certain impacts would not be significant, some mitigation has also been recommended in order to ensure that the impacts remain insignificant.

All mitigation measures committed to during the EIA and detailed in topic specific chapters of the ES are summarised in Table 21.1.

These commitments will be implemented as part of the Project through communication with the Project Team and any contractors with whom TVL engages. The EMP will be included in the overall Construction Environment Management Plan (CEMP). Contractors will implement the requirements of the overall CEMP through their own Construction Environment Management Plan (CEMP).

Table 21.1 Mitigation measures

EIA topic	Mitigation
Benthic and intertidal ecology	<p>Most impacts were concluded to be not significant. Therefore no specific mitigation has been identified for these impacts.</p> <p>Mitigation for impacts relating to accidental pollution are listed under water environment and accidental events.</p> <p>Potential significant impacts were identified for Marine Non-Native Species (MNNS). Mitigation measure identified to minimise the risk and uncertainty associated with the introduction of MNNS include:</p> <ul style="list-style-type: none"> > All vessels associated with Project operations will comply with all relevant guidance (including IMO guidelines) regarding ballast water and transfer of non-native species; > Should it be necessary for the installation vessel(s) to jettison any ballast water, appropriate measures and procedures; and > As far as is practicable, the vessels will be sourced from the UK to minimise the potential of transporting MNNS from further afield. UK based vessels will still be subject to risk assessment to help prevent the spread of species already established elsewhere in the UK. <p>Once the source of vessels to be used in the Project is known, a full MNNS risk assessment will be undertaken in order to identify whether any further mitigation measures are necessary to ensure there are no significant impacts.</p>
Marine mammals	<p>Although all impacts were concluded to be not significant, mitigation has been proposed with regard potential corkscrew injuries and collision risk impacts. Mitigation measures have also been identified for impacts relating to accidental pollution. These are listed under water environment and accidental events.</p> <p>With regard to corkscrew injuries, recent evidence (SMRU, 2015) indicates that these injuries are caused by seals themselves rather than vessels with ducted propellers. However, at this stage impacts caused by vessels cannot be ruled out completely given that previous studies have indicated that vessels could cause such injuries. In terms of mitigation, TVL will commit to undertaking frequent reviews of the literature regarding this topic and to regularly discuss advances in understanding of this topic with relevant regulatory and advisory bodies.</p> <p>Although this new evidence suggests that vessels are unlikely to be the main cause of corkscrew injuries, if such reviews and discussions determine that impacts from vessels cannot be ruled out then it may still be necessary to apply some form of mitigation. This could be delivered through, for example a corkscrew injury management plan, or a vessel management plan.</p> <p>In terms of potential collision risk impacts, while the results from the encounter modelling have assessed these to be not significant, it is acknowledged that there remains some uncertainty with regard to how different marine mammals interact with operational submerged turbines. In light of this uncertainty, TVL therefore plans to develop an appropriate and practical adaptive monitoring plan in consultation with DoENI and other key stakeholders in order to ensure that potential impacts on marine mammals from collision risk remain to be not significant as predicted.</p>
Ornithology	All impacts were concluded to be not significant. Therefore no specific mitigation has been identified for

EIA topic	Mitigation
	<p>these impacts.</p> <p>Mitigation for impacts relating to accidental pollution (even though these were assessed as not significant) are listed under water environment and accidental events.</p>
Fish ecology	<p>All impacts were concluded to be not significant. Therefore no specific mitigation has been identified for these impacts.</p> <p>Mitigation for impacts relating to accidental pollution (even though these were assessed as not significant) are listed under water environment and accidental events.</p>
Commercial fisheries	<p>Although significant impacts were only identified for long term displacement to fishing ground specific measures were identified with respect to temporary displacement from the AfL area and along the export cable corridor due to the safety aspect of these impacts (implementation of safety zones within which fishing is not permitted). These measures include:</p> <ul style="list-style-type: none"> > The developer will work to ensure that access to more inshore fishing grounds is kept open for as long as possible during the installation period; > Discussions will be held with local marine users in advance of any works commencing to review procedures associated with the construction stage to ensure that they address local concerns as far as possible; > Fishermen will be notified of the schedule works taking place, location of safety zones and partially installed infrastructure, which will involve the appointment of a FLO; and > Partially installed infrastructure will be marked and lit appropriately. <p>With respect to impacts on local fisheries as a result of long term displacement for fishing grounds the following mitigation measures will be put in place to minimise any potential significant impacts. These measures are based on recognised industry good practice and include.</p> <ul style="list-style-type: none"> > TVL will work with all those involved in the fishing industry to ensure minimal impact to anyone working in the area. Where genuine financial loss can be demonstrated compensation will be considered on the basis of factually accurate and justifiable claims; > TVL understands the importance of community commitment initiatives, and supports the provision of financial contributions from operating developments to local communities. It is TVLs intention to establish a community fund to benefit both the local and fishing community; and > Throughout the Project TVL will maintain on-going consultation and liaison with the fishing community through the FLO in accordance with the FLOWW Best Practice Guidance for Offshore Renewables Developments: Recommendations for Fisheries Liaison (January 2014). <p>While TVL do not anticipate any significant impacts from the Project on the Portaleen Salmon Fishery, considering the proximity of the salmon fishery to the Project area and the gaps in knowledge with regard collision risk and EMF impacts on migratory fish, TVL is also committed to remaining in dialogue with the owner of Portaleen Salmon Fishery post consent submission. TVL will consult and agree a proposed monitoring plan with the owner should the fishery become operational again during the lifetime of the tidal array operation. This will be with a view to confirm that findings of the impact assessment outlined above. Where genuine financial loss can be demonstrated as a result of the project activities compensation will be considered on the basis of factually accurate and justifiable claims.</p>
Coastal processes and seabed conditions	<p>All impacts were concluded to be not significant. Therefore no specific mitigation has been identified for these impacts.</p>
Marine archaeology	<p>Where significant impacts have been identified the following steps will be taken as part of Project mitigation. This mitigation strategy will be informed by results from a geophysical survey of the Project area that will be carried out to inform detailed design.</p> <p>The mitigation strategy, which will include a written scheme of investigation and will set out an agreed reporting protocol for the accidental discovery of cultural remains in line with The Crown Estate (2014) Protocol for Archaeological Discoveries: Offshore Renewables Projects, http://www.thecrownestate.co.uk/media/148964/ei-protocol-for-archaeological-discoveries-offshore-renewables-projects.pdf, will be based on:</p> <ol style="list-style-type: none"> 1. Avoidance – where possible sites of potential archaeological or cultural heritage importance will be avoided through Project design e.g. placement of TSSs and location of inter-array cables and export

EIA topic	Mitigation
	<p>cable routes.</p> <ol style="list-style-type: none"> 2. Where avoidance is not possible, sites of potential archaeological or cultural heritage importance affected by the Project will be examined in more detail by drop down camera or Remote Operated Vehicle (ROV) under archaeological direction. The data from the investigation will be assessed by a marine archaeologist. 3. Depending on the results from the examination an appropriate management and mitigation strategy will be developed in consultation with DoE, the Centre for Maritime Archaeology (CMA) and Northern Ireland Environment Agency (NIEA): Historic Monuments Unit (HMU). This will include specific measures that are considered to be appropriate, and practical for a site of this nature (e.g. challenging and highly dynamic) such as: <ul style="list-style-type: none"> > Layout redesign to avoid highly sensitive remains; and > Where avoidance is not possible, targeted very high resolution remote sensing survey to identify and record any remains. <p>The difficult conditions off Torr Head mean that the requirement for more detailed archaeological investigations such as intrusive works, wreck recovery or archaeological excavations will need to be considered on a case by case basis in close consultation with DoE and CMA if the need arises.</p>
Shipping and navigation	<p>The shipping and navigation impact assessment assumes the following standard industry practice will be applied to minimise potential impacts. This standard industry practice is presented below:</p> <ul style="list-style-type: none"> > Adverse weather – there will be adverse weather working policies and procedures for periods of construction and maintenance; > Cable inspection - periodic surveys of the cable will be carried out to ensure protection measures remain effective; > Cable protection - appropriate cable protection to be installed along the cable route, informed by a Burial Protection Index (BPI) study which will be submitted to the MCA prior to installation; > Chart depiction - the Project will be depicted on Admiralty Charts produced by the UKHO; > Emergency Response Cooperation Plan (ERCoP) - an ERCoP will be prepared for the Project following the template provided by the MCA in MGN 371. This will be submitted to the MCA for approval prior to construction; > Equipment and training for site personnel - site personnel will be suitably equipped and trained for work offshore meeting RenewablesUK Health and Safety Executive (HSE) guidelines; > Fisheries Liaison Officer (FLO) - a FLO will be in place; > Fishing awareness - details of the Project will be included in fishermen’s awareness charts; > Guard vessel during construction - when there are work vessel(s) on site, one vessel will be nominated as a guard vessel with appropriate procedures for traffic monitoring and collision risk management; > Inspection and maintenance - there will be appropriate inspection and maintenance procedures in place for all elements of the Project; > Maritime Safety Information (MSI) broadcasts - HM Coastguard will be informed of work at the site to allow them to issue MSI broadcasts as appropriate; > Marking and lighting - the Project will be marked and lit according to CIL and MCA requirements; > Notice to Mariners - Notices to Mariners will be issued prior to the start of construction and where necessary during work at the site; > Search and Rescue: The MCA will be consulted on the final layout to ensure it complies with SAR requirements. It will also be ensured the emergency services are provided with all the details they need about the site in order to respond appropriately to any future incident in or near the area using SAR helicopter and/or lifeboat; > Safety Management System (SMS) - a SMS will be in place throughout the project; and > Safety zones - mandatory safety zones will be applied for during the construction work.

EIA topic	Mitigation
	<ul style="list-style-type: none"> > In addition to standard industry practice 'enhanced' mitigation measures have also been identified for specific impacts: > AIS Aid to Navigation (AtoN) - use of AIS as an AtoN (virtual) to mark site boundary and/or subsea turbines to be discussed and agreed with CIL; > AIS monitoring - AIS coverage of the site will allow traffic to be monitored remotely and replay of data in the event of an incident or near-miss; > AIS on vessels - AIS to be fitted on all workboats working at the site; > Lessons learned - experience and lessons learned from incidents, accidents and near-misses at other marine renewables projects will be taken into account; > Phased development - the phased approach to development will ensure impacts can be monitored before full build-out, allowing adaptive management of risks; > Safety zones - the size of construction safety zones will take into account the sea room available in the area. Appropriate radius will be agreed with DECC / MCA; > Sailing directions and almanacs - details of the Project will be circulated to relevant organisations for inclusion in updated sailing directions and almanacs; > Targeted information - information on the Project will be circulated directly to local ports, ship operators, fishermen and recreational organisations; > Alerting system – a control system will produce an alert in the event of a failure of a turbine or component part; > VHF - methods to improve VHF reception at the site will be investigated.
Seascape, Landscape and Visual Assessment (SLVIA)	All impacts were concluded to be not significant. Therefore no specific mitigation has been identified for these impacts.
Socio-economic	<p>No significant adverse impacts were identified. Therefore no specific mitigation has been identified for these impacts.</p> <p>Where positive impacts were identified the following measure will be put in place in order to maximise the positive benefits of the Project in terms of local and national economy (GVA) and employment:</p> <ul style="list-style-type: none"> > There are a number of national, regional and local initiatives involving NI Government Departments, InvestNI and other regional and local development agencies, notably Moyle LGD and InvestNI, with the aim of identifying and enhancing supply chain opportunities in the marine renewables industry. These will assist in realising and maximising the opportunities locally and nationally and where appropriate TVL will support these initiatives; and > TVL also understands the importance of community commitment initiatives, and supports the provision of financial contributions from operating developments to local communities. It is TVLs intention to establish a community fund to benefit both the local and fishing community.
Water environment and accidental events	<p>Although this impact is predicted to be not significant due to the extreme unlikelihood of it occurring, because of the high sensitivity of the Northern Irish coast, the following mitigation measures have been recommended with relation to accidental spills from vessels:</p> <ul style="list-style-type: none"> > An Emergency Response Corporation Plan (ERCoP) will be prepared for the Project in line with guidance set out by the MCA in MGN 371. This will be submitted to MCA for comment and approval; > Notices to Mariners will be issued advising other vessels in the area of activities within the Project area; > Vessels associated with all Project operations will comply with IMO/MCA codes for prevention of oil pollution and any vessels over 400GT will have on board SOPEP; > Vessels associated with all Project operations will carry on-board oil and chemical spill mop up kits; and

EIA topic	Mitigation
	<ul style="list-style-type: none"> > Installation activities will only take place during suitable weather windows. <p>The following mitigation measures are also recommended with respect to minimising potential risk of significant impacts from accidental leakage of fluids from turbines during installation and operation:</p> <ul style="list-style-type: none"> > Only recognised marine standard fluids and substances will be used in the turbine hydraulic systems; > Hydraulic fluids will be mostly water based, biodegradable and be of low aquatic toxicity; > Consideration will be given to CIRIA guidance on the use of concrete in maritime engineering – a good practice guide (C674); and > Turbine sensors will detect loss of fluid pressure and leaks; enabling maintenance operatives to reduce the risk of further leaks. <p>These measures are relevant to a number of ES chapters including in particular benthic ecology, fish ecology, ornithology and marine mammals.</p>
Other sea users	All impacts were concluded to be not significant. Therefore no specific mitigation has been identified for these impacts.

21.2.3 Compliance monitoring

A monitoring programme will be designed by TVL to track and assess the performance of the mitigation measures to ensure that they meet their regulatory and corporate requirements and to update and improve the programme where necessary.

21.3 Environmental Monitoring Strategy (EMS)

Due to the emerging and ever evolving nature of the tidal energy industry there are some potential impacts that have yet to be verified by operational monitoring in the industry. Where single turbines have been installed and potential environmental impacts monitored, TVL has made use of available data e.g. post installation monitoring studies carried for turbines installed at the European Marine Energy Centre (EMEC) and at the Fundy Open Research Centre for Energy (FORCE). However, TVL recognises that there is little data currently available and its application to the assessment of tidal arrays is limited.

Through the EIA process for the Torr Head Project, TVL recognise that being one of the first applications for a commercial tidal energy array in Northern Ireland to seek consent to date, means there is some uncertainty with the impact assessment due to the nascent status of the industry. For example potential collisions between marine mammal species and tidal turbines represents a significant knowledge gap in the industry. This uncertainty needs to be addressed across the industry and is not regarded as something that individual developers are able to adequately resource.

The current situation means that TVL has identified two approaches to monitoring:

- > Where TVL identifies monitoring requirements for the Project, specific issue monitoring protocols will be developed in consultation with the regulators and their advisors.
- > Where uncertainties in the assessment are identified that are considered of strategic importance to the development of the tidal energy industry, TVL would wish to engage with the wider industry, regulators, their advisors and stakeholders through involvement on working groups or similar forums in order to assist with developing strategic monitoring programmes for the benefit of future projects in Northern Ireland and elsewhere in the UK. For example OpenHydro sits on the Pentland Firth and Orkney Waters (PFOW) Developers Forum and would be interested in having a similar role as part of a Northern Ireland Working Group that would involve developers, regulators and other key stakeholders.

21.3.1 Overview of monitoring carried out for test / demonstration projects

At the time of ES submission, OpenHydro had deployed tidal turbines in three locations including seven iterations of the OpenCentre design at a platform at EMEC, Orkney, one at Paimpol Brehat in France, and one at the FORCE test facility, in the Bay of Fundy, Nova Scotia. As part of these deployments various post installation monitoring studies have been undertaken in order to develop a better understanding the interactions between the turbines and the marine environment in which they are located. These monitoring studies include:

- > Benthic monitoring in the Bay of Fundy and a small scale study looking at spatial and temporal benthic species assemblage responses with a deployed marine tidal energy device (Broadhurst and Orme, 2014);
- > An observational pilot study looking at in-situ ecological interactions with a deployed tidal energy device (Broadhurst *et al.*, 2014); and
- > Development of a marine mammal monitoring programme and killer whale monitoring, operation and protection plan in the Puget Sound, Seattle.

A summary of these studies is provided below:

Benthic monitoring study

OpenHydro has previously assessed and developed a number of tidal energy project sites, including the deployment of a 10 m Open-Centre turbine in the Bay of Fundy in 2009. The Environmental Effects Monitoring Report 2011 had the following to say about the interaction between the 10 m Open Centre Turbine and the benthic environment. *'The turbine was successfully deployed and recovered without environmental consequences and no bio-fouling or damage to the turbine structure resulting from the deployment occurred. A side-scan sonar and towed video survey completed after turbine recovery, indicated no changes in bottom characteristics at the turbine and reference sites, with the exception of 1-m diameter pits in the bedrock surface caused by two legs of the turbine support structure, and some unidentified debris on the seabed thought to be part of the damaged turbine.'*

An examination of species biodiversity, composition and habitat type surrounding the OpenHydro turbine installed at the EMEC test site, Orkney was carried out using commercial fishing and towed video camera techniques over three temporal periods from 2009 to 2010. The examination found increased species diversity and compositional differences within the device site compared to a control site. Both sites largely comprised of crustacean species, omnivore and predatory feeding regimes and marine tide wept EUNIS habitat types which varied over time. The study concluded that the device could act as a localised artificial reef structure, but that further investigations are required. Results from this study were reported by Broadhurst and Orme (2014) in the paper: *Spatial and temporal benthic assemblage response with a deployed marine tidal energy device: A small scale study.*

Fish

OpenHydro have previously conducted fish behaviour research in the vicinity of the Open Centre Turbine research platform at EMEC. Underwater video footage from a camera installed on the turbine was compared with nearby Acoustic Doppler Current Profiler (ADCP) data to assess the behavioural response of Pollack to a deployed Open Centre Turbine. Results showed that Pollack would aggregate around the deployed Open Centre Turbine temporarily during periods of low flow (<1.8 m/s). Tidal velocity was seen to be a direct influence on the presence of these fish aggregations, with increasing tidal velocities seen to clearly reduce the numbers of fish aggregating. Results from this study are presented in the paper prepared by Broadhurst *et al.*, (2014): *In-situ ecological interactions with a deployed tidal energy device; and observational pilot study.*

OpenHydro has also previously been involved in research into the potential effects of noise generated by a tidal turbine in our SnoPUD project. This project investigated the consequences on juvenile Chinook salmon from long-duration exposure to a simulated tidal turbine sound. The results indicated low levels of tissue injury and no effects on hearing of the salmon species. This suggests that Chinook salmon may be at a relatively low risk of injury from tidal turbines located in or near their migration path.

Marine mammals/collision risk

OpenHydro has previously had to design a marine mammal monitoring plan and Southern Resident Killer Whale monitoring, operation and protection plan to fulfil specific conditions of a licence as part of an EIA for their SnoPUD project in the Puget Sound, Seattle. Both plans were agreed with relevant authorities as part of such conditions.

OpenHydro was also involved in carrying out research into marine mammal behaviour as part of the same project in the Puget Sound. In this instance the National Oceanic and Atmospheric Administration (NOAA Fisheries) had expressed concerns that the turbines may cause a risk for the highly endangered Southern Resident Killer Whale (SRKW) population if struck by an operating turbine. OpenHydro, in conjunction with Pacific Northwest National Laboratory (PNNL) and Sandia National Laboratories (SNL) developed a model to provide insights into the potential risk of encounter to a SRKW with an OpenHydro tidal turbine. Analyses using this approach determined that a SRKW was not likely to experience significant tissue injury from impact by an OpenHydro turbine blade.

OpenHydro also has experience carrying out investigations into the potential impacts of underwater sound from operating turbines on a range of marine mammal species as part of the same project in Puget Sound (SnoPUD). Similar work has also been carried out at their EMEC research platform. The study in the Puget Sound combined available measurements of turbine noise from EMEC and under water ambient noise in the Puget Sound to evaluate the effectiveness of studies to characterize turbine noise and the marine mammal response to this noise.

Results show that the warning distance (i.e., minimum distance to detection of turbine noise) is a strong function of both ambient noise and current velocity for all receiver classes. Because the turbine source level is expected to increase with increasing current velocity, the warning distance also increases with current velocity. This suggests an inherent mitigation measure for the risk of blade strike – as blade rotation rate increases and the consequences of strike become potentially audible at increasingly greater distances. Significantly, warning distance increases as a power of current velocity, meaning that the window of time that a fish or marine mammal can react to turbine noise is greater during periods of strong currents.

In EMEC, the measured data indicates a source level noise that is considerably below levels of noise that may cause lethal, physical injury or hearing impairment to the species of marine mammal according to existing literature. At ranges beyond 200 m the turbine noise was difficult to identify above the ambient tidal water flow noise. The extent of any behavioural impact to marine species due to the loudness of the noise from the turbine operation is therefore limited to this range.

Behavioural avoidance to the underwater sound was been assessed by comparing the measured noise with the published hearing threshold of marine species. The data indicates that unless fish or marine mammals are in the immediate vicinity of the turbine, behavioural disturbance is unlikely.

21.3.2 Proposed monitoring for the Torr Head Tidal Energy Array Project

For most EIA topics where it is concluded that there will be no significant impacts, no specific monitoring has been proposed. Where significant impacts have been identified e.g. for commercial fisheries and marine archaeology, proposals to monitor these potential impacts and the effectiveness of proposed mitigation have been set out in the relevant ES chapters and are summarised below.

Although no significant impacts were identified for marine mammals, there is still a level of uncertainty surrounding interactions between marine mammals and tidal turbines. TVL recognises the importance of monitoring marine mammal interactions with tidal devices not only to confirm the predictions that there would be no significant impacts and also to help increase knowledge and understanding of these interactions in order to help inform the continuing development of the tidal energy Projects worldwide.

Table 21.2 Proposed monitoring

EIA topic	Monitoring
Benthic and intertidal ecology	No monitoring proposed
Marine mammals	<p>The majority of potential impacts on marine mammals have been assessed as being negligible or minor. However, there is still some uncertainty around the potential for impacts from collision with operating turbines and TVL recognises the need for monitoring in order to confirm the predictions made on collision. TVL is committed therefore to developing an adaptive marine mammal monitoring programme in order to confirm that the predicted impacts are not significant.</p> <p>Where strategic monitoring is appropriate, TVL would look to a collaborative effort between the Project, wider industry, regulators and stakeholders to take this forward in the most efficient way for the interest of the Project and future projects elsewhere. TVL will work with the regulator and its advisory bodies (as part of a regulator led working science group) to agree the details of</p>

EIA topic	Monitoring
	<p>appropriate monitoring and will ensure that the monitoring programme is aligned with industry best practice. Where monitoring indicates that specific mitigating measures may be reasonably required, TVL is committed to put these in place. Any monitoring strategy will also be informed by results available from already operational tidal projects (e.g. MeyGen).</p> <p>Collection of underwater noise measurements of the selected tidal turbine. The data collected will be used to validate the underwater noise modelling completed to inform the impact assessment.</p>
Ornithology	No monitoring proposed
Fish ecology	<p>TVL recognises that there also remains some uncertainty as how fish interact with operational tidal turbines and the effects of EMF on migratory fish species. Therefore, additional monitoring will be incorporated into the proposed adaptive monitoring strategy that will developed for marine mammals in order to also monitor interactions between fish and operational turbines in order to confirm that the predicted impacts are not significant.</p> <p>Collection of underwater noise measurements of the selected tidal turbine. The data collected will be used to validate the underwater noise modelling completed to inform the impact assessment.</p>
Commercial fisheries	<p>Significant impacts were identified with respect to impacts on local fishermen of long term displacement from fishing grounds. As part of the proposed mitigation TVL intends to continue consultation with local fishermen for the duration of the Project to ensure impacts resulting from long term displacement from fishing grounds are minimised where possible. The effectiveness of this on-going consultation will also be monitored for the duration of the Project. The proposed consultation and observations from monitoring will also help to inform the decommissioning phase of the Project, ensuring disruption to commercial fisheries in the area are kept to a minimum.</p> <p>Monitoring outlined for fish ecology above will also be used to inform on-going consultation with the Portaleen Salmon Fishery should the fishery become operational again during the lifetime of the tidal array operation with a view to confirming that there are no significant impacts on the fishery.</p>
Coastal processes and seabed conditions	Project-specific modelling of hydrodynamic effects is planned to investigate the potential for the turbines to cause localised turbulence on the sea surface. This has been identified as a navigational issue and is discussed specifically as part of Chapter 16: Shipping and Navigation.
Marine archaeology	A reporting protocol will be implemented to manage the potential discovery of previously unknown marine archaeology and cultural heritage material in line with the Protocol for Archaeological Discoveries: Offshore Renewables Projects (The Crown Estate, 2014) and in discussion with DoE, CMA and NIEA: HMU. In the event that any unknown marine cultural heritage material is discovered as a result of this Protocol, the significance of the find will be assessed and there may be a requirement for further investigation in line with the mitigation proposed in Chapter 15 and discussions with NIEA:HMU.
Shipping and navigation	<p>Vessel traffic will be monitored on AIS during construction and operation to assess the effect of the Project on vessel traffic in the area.</p> <p>Modelling of other Projects has been carried out to investigate whether turbines could cause localised turbulence, e.g., eddies, which has been raised as an issue by navigational stakeholders. This indicated there would be some disturbance to the flow at depth, but this was not significant for surface navigation in the water column above or in the vicinity of the turbines. Project-specific modelling of hydrodynamic effects is planned to investigate this issue for Torr Head.</p>
Seascape, Landscape and Visual Assessment (SLVIA)	No monitoring proposed
Socio-economic	No monitoring proposed
Water environment and accidental events	No monitoring proposed

EIA topic	Monitoring
Other sea users	No monitoring proposed

21.4 Interface with contractors

Contractor management is an important element of the Project and TVL expect contractors to demonstrate a high level of environmental awareness, including suitable environmental management.

The EMP and responsibilities for environmental standards and procedures will be included as part of Contractor’s invitations to tender. This will ensure all contractors adhere to the requirements of the EMP.

Pre mobilisation audits will also be carried out as standard for all vessels, vehicles or equipment that will be used in the Project. This will ensure compliance with TVL’s environmental management procedures and documentation.

Environmental commitments, objectives and targets identified for the Project will be communicated to all Contractors through contractual conditions. Contractor performance will be measured against these commitments.

21.5 Environmental awareness and training

TVL is committed to ensuring that all personnel who perform or manage Project work that has the potential to have significant effects on the environment receive appropriate training. All personnel, including contractors, engaged in work that also has the potential to impact the environment will be fully audited and monitored to ensure that they have the appropriate procedures in place to manage their environmental responsibilities.