Appendix 10.1 Planning Policy Screening

Scotland's National Marine Plan Policies Screening Assessment

From: https://www.gov.scot/publications/scotlands-national-marine-plan/pages/1/

Marine Plan Policy Listing and Screening in Relation to the Proposed Development

Policy ID	Policy Title	Policy Text	Screening Rationale	Relevant Section of the AEE
GEN 1	General planning principle	There is a presumption in favour of sustainable development and use of the marine environment when consistent with the policies and objectives of this Plan.	Policy screened for consideration in AEE	Chapter 10
GEN 2	Economic benefit	Sustainable development and use which provides economic benefit to Scottish communities is encouraged when consistent with the objectives and policies of this Plan.	Policy screened for consideration in AEE	Chapter 10
GEN 3	Social benefit	Sustainable development and use which provides social benefits is encouraged when consistent with the objectives and policies of this Plan.	Policy screened for consideration in AEE	Chapter 10
GEN 4	Co-existence	Proposals which enable coexistence with other development sectors and activities within the Scottish marine area are encouraged in planning and decision making processes, when consistent with policies and objectives of this Plan.	Policy screened for consideration in AEE	Chapter 10
GEN 5	Climate change	Marine planners and decision makers must act in the way best calculated to mitigate, and adapt to, climate change.	Policy screened for consideration in AEE	Section 10.12
GEN 6	Historic environment	Development and use of the marine environment should protect and, where appropriate, enhance heritage assets in a manner proportionate to their significance.	Policy screened for consideration in AEE	Section 10.12, Sections 10.10.104 - 10.10.112
GEN 7	Landscape/seascape	Marine planners and decision makers should ensure that development and use of the marine environment take seascape, landscape and visual impacts into account.	Policy screened for consideration in AEE	Section 10.12
GEN 8	Coastal process and flooding	Developments and activities in the marine environment should be resilient to coastal change and flooding, and not have unacceptable adverse impact on coastal processes or contribute to coastal flooding.	Policy screened for consideration in AEE	Section 10.12
GEN 9	Natural heritage	Development and use of the marine environment must: (a) Comply with legal requirements for protected areas and protected species. (b) Not result in significant impact on the national status of Priority Marine Features. (c) Protect and, where appropriate, enhance the health of the marine area.	Policy screened for consideration in AEE	Section 10.12
GEN 10	Invasive non-native species	Opportunities to reduce the introduction of invasive non-native species to a minimum or proactively improve the practice of existing activity should be taken when decisions are being made.	Policy screened for consideration in AEE	Section 10.12
GEN 11	Marine litter	Developers, users and those accessing the marine environment must take measures to address marine litter where appropriate. Reduction of litter must be taken into account by decision makers.	Policy screened for consideration in AEE	Section 10.12
GEN 12	Water quality and resource	Developments and activities should not result in a deterioration of the quality of waters to which the Water Framework Directive, Marine Strategy Framework Directive or other related Directives apply.	Policy screened for consideration in AEE	Section 10.12
GEN 13	Noise	Development and use in the marine environment should avoid significant adverse effects of man-made noise and vibration, especially on species sensitive to such effects.	Policy screened for consideration in AEE	Section 10.12
GEN 14	Air quality	Development and use of the marine environment should not result in the deterioration of air quality and should not breach any statutory air quality limits.	Policy screened for consideration in AEE	Section 10.12
GEN 15	Planning alignment A	Marine and terrestrial plans should align to support marine and land-based components required by development and seek to facilitate appropriate access to the shore and sea.	Policy screened for consideration in AEE	Chapter 10
GEN 16	Planning alignment B	Marine plans should align and comply where possible with other statutory plans and should consider objectives and policies of relevant non-statutory plans where appropriate to do so. <applies to inshore waters only>	Policy screened for consideration in AEE	Section 10.12
GEN 17	Fairness	All marine interests will be treated with fairness and in a transparent manner when decisions are being made in the marine environment.	Policy screened for consideration in AEE	Chapter 10
GEN 18	Engagement	Early and effective engagement should be undertaken with the general public and all interested stakeholders to facilitate planning and consenting processes.	Policy screened for consideration in AEE	Section 10.3.1
GEN 19	Sound evidence	Decision making in the marine environment will be based on sound scientific and socio-economic evidence.	Policy screened for consideration in AEE	Chapter 10
GEN 20	Adaptive management	Adaptive management practices should take account of new data and information in decision making, informing future decisions and future iterations of policy.	Policy screened for consideration in AEE	Chapter 10
GEN 21	Cumulative impacts	Cumulative impacts affecting the ecosystem of the marine plan area should be addressed in decision making and plan implementation.	Policy screened for consideration in AEE	Section 10.13
FISHERIES 1		Taking account of the EU's Common Fisheries Policy, Habitats Directive, Birds Directive and Marine Strategy Framework Directive, marine planners and decision makers should aim to ensure: - Existing fishing opportunities and activities are safeguarded wherever possible. - An ecosystem-based approach to the management of fishing which ensures sustainable and resilient fish stocks and avoids damage to fragile habitats. - Protection for vulnerable stocks (in particular for juvenile and spawning stocks through continuation of sea area closures where appropriate). - Improved protection of the seabed and historical and archaeological remains requiring protection through effective identification of high-risk areas and management measures to mitigate the impacts of fishing, where appropriate. - That other sectors take into account the need to protect fish stocks and sustain healthy fisheries for both economic and conservation reasons. - Delivery of Scotland's international commitments in fisheries, including the ban on discards. - Mechanisms for managing conflicts between fishermen and/or between the fishing sector and other users of the marine environment.	Policy screened for consideration in AEE	Sections 10.10.141 - 10.10 .149
FISHERIES 2		The following key factors should be taken into account when deciding on uses of the marine environment and the potential impact on fishing: - The cultural and economic importance of fishing, in particular to vulnerable coastal communities. - The potential impact (positive and negative) of marine developments on the sustainability of fish and shellfish stocks and resultant fishing opportunities in any given area. - The environmental impact on fishing grounds (such as nursery, spawning areas), commercially fished species, habitats and species more generally. - The potential effect of displacement on: fish stocks; the wider environment; use of fuel; socio-economic costs to fishers and their communities and other marine users.	Policy screened for consideration in AEE	Sections 10.10.141 - 10.10 .149

FISHERIES 3		Where existing fishing opportunities or activity cannot be safeguarded, a Fisheries Management and Mitigation Strategy should be prepared by the proposer of development or use, involving full engagement with local fishing interests (and other interests as appropriate) in the development of the Strategy. All efforts should be made to agree the Strategy with those interests. Those interests should also undertake to engage with the proposer and provide transparent and accurate information and data to help complete the Strategy. The Strategy should be drawn up as part of the discharge of conditions of permissions granted. The content of the Strategy should be relevant to the particular circumstances and could include: - An assessment of the potential impact of the development or use on the affected fishery or fisheries, both in socio-economic terms and in terms of environmental sustainability. - A recognition that the disruption to existing fishing opportunities/activity should be minimised as far as possible. - Reasonable measures to mitigate any constraints which the proposed development or use may place on existing or proposed fishing activity. - Reasonable measures to mitigate any potential impacts on sustainability of fish stocks (e.g. impacts on spawning grounds or areas of fish or shellfish abundance) and any socio-economic impacts. Where it does not prove possible to agree the Strategy with all interests, the reasons for any divergence of views between the parties should be fully explained in the Strategy and dissenting views should be given a platform within the Strategy to make their case.	Policy screened for consideration in AEE	Sections 13.10.141 - 13.10 .149
FISHERIES 4		Ports and harbours should seek to engage with fishing and other relevant stakeholders at an early stage to discuss any changes in infrastructure that may affect them. Any port or harbour developments should take account of the needs of the dependent fishing fleets with a view to avoiding commercial harm where possible. Where a port or harbour has reached a minimum level of infrastructure required to support a viable fishing fleet, there should be a presumption in favour of maintaining this infrastructure, provided there is an ongoing requirement for it to remain in place and that it continues to be fit for purpose.	Policy not relevant to the Proposed Development (sector specific policy)	N/A
FISHERIES 5		Inshore Fisheries Groups (IFGs) should work with all local stakeholders with an interest to agree joint fisheries management measures. These measures should inform and reflect the objectives of regional marine plans. <applies to inshore waters>	Policy not relevant to the Proposed Development (geographic policy)	N/A
AQUACULTURE 1		Marine planners and decision makers should seek to identify appropriate locations for future aquaculture development and use, including the potential use of development planning briefs as appropriate. System carrying capacity (at the scale of a water body or loch system) should be a key consideration.	Policy screened for consideration in AEE	N/A
AQUACULTURE 2		Marine and terrestrial development plans should jointly identify areas which are potentially suitable and sensitive areas which are unlikely to be appropriate for such development, reflecting Scottish Planning Policy and any Scottish Government guidance on the issue. There is a continuing presumption against further marine finfish farm developments on the north and east coasts to safeguard migratory fish species.	Policy screened for consideration in AEE	N/A
AQUACULTURE 3		In relation to nutrient enhancement and benthic impacts, as set out under Locational Guidelines for the Authorisation of Marine Fish Farms in Scottish Waters, fish farm development is likely to be acceptable in Category 3 areas, subject to other criteria being satisfied. A degree of precaution should be applied to consideration of further fish farming development in Category 2 areas and there will be a presumption against further fish farm development in Category 1 areas.	Policy not relevant to the Proposed Development (sector specific policy)	N/A
AQUACULTURE 4		There is a presumption that further sustainable expansion of shellfish farms should be located in designated shellfish waters if these have sufficient capacity to support such development.	Policy not relevant to the Proposed Development (sector specific policy)	N/A
AQUACULTURE 5		Aquaculture developments should avoid and/or mitigate adverse impacts upon the seascape, landscape and visual amenity of an area, following SNH guidance on the siting and design of aquaculture.	Policy not relevant to the Proposed Development (sector specific policy)	N/A
AQUACULTURE 6		New aquaculture sites should not bridge Disease Management Areas although boundaries may be revised by Marine Scotland to take account of any changes in fish farm location, subject to the continued management of risk.	Policy not relevant to the Proposed Development (sector specific policy)	N/A
AQUACULTURE 7		Operators and regulators should continue to utilise a risk based approach to the location of fish farms and potential impacts on wild fish.	Policy not relevant to the Proposed Development (sector specific policy)	N/A
AQUACULTURE 8		Guidance on harassment at designated seal haul out sites should be taken into account and seal conservation areas should also be taken into account in site selection and operation. Seal licences will only be granted where other management options are precluded or have proven unsuccessful in deterrence.	Policy not relevant to the Proposed Development (sector specific policy)	N/A
AQUACULTURE 9		Consenting and licensing authorities should be satisfied that appropriate emergency response plans are in place.	Policy not relevant to the Proposed Development (sector specific policy)	N/A
AQUACULTURE 10		Operators should carry out pre-application discussion and consultation, and engage with local communities and others who may be affected, to identify and, where possible, address any concerns in advance of submitting an application.	Policy not relevant to the Proposed Development (sector specific policy)	N/A
AQUACULTURE 11		Aquaculture equipment, including but not limited to installations, facilities, moorings, pens and nets must be fit for purpose for the site conditions, subject to future climate change. Any statutory technical standard must be adhered to. Equipment and activities should be optimised in order to reduce greenhouse gas emissions.	Policy not relevant to the Proposed Development (sector specific policy)	N/A
AQUACULTURE 12		Applications which promote the use of sustainable biological controls for sea lice (such as farmed wrasse) will be encouraged.	Policy not relevant to the Proposed Development (sector specific policy)	N/A
AQUACULTURE 13		Proposals that contribute to the diversification of farmed species will be supported, subject to other objectives and policies being satisfied.	Policy not relevant to the Proposed Development (sector specific policy)	N/A
AQUACULTURE 14		The Scottish Government, aquaculture companies and Local Authorities should work together to maximise benefit to communities from aquaculture development.	Policy not relevant to the Proposed Development (sector specific policy)	N/A
WILD FISH 1		The impact of development and use of the marine environment on diadromous fish species should be considered in marine planning and decision making processes. Where evidence of impacts on salmon and other diadromous species is inconclusive, mitigation should be adopted where possible and information on impacts on diadromous species from monitoring of developments should be used to inform subsequent marine decision making.	Policy screened for consideration in AEE	Sections 10.10.141 - 10.10.149
OIL & GAS 1		The Scottish Government will work with DECC, the new Oil and Gas Authority and the industry to maximise and prolong oil and gas exploration and production whilst ensuring that the level of environmental risks associated with these activities are regulated. Activity should be carried out using the principles of Best Available Technology (BAT) and Best Environmental Practice. Consideration will be given to key environmental risks including the impacts of noise, oil and chemical contamination and habitat change.	Policy not relevant to the Proposed Development (sector specific policy)	N/A
OIL & GAS 2		Where re-use of oil and gas infrastructure is not practicable, either as part of oil and gas activity or by other sectors such as carbon capture and storage, decommissioning must take place in line with standard practice, and as allowed by international obligations. Re-use or removal of decommissioned assets from the seabed will be fully supported where practicable and adhering to relevant regulatory process.	Policy not relevant to the Proposed Development (sector specific policy)	N/A
OIL & GAS 3		Supporting marine and coastal infrastructure for oil and gas developments, including for storage, should utilise the minimum space needed for activity and should take into account environmental and socio-economic constraints.	Policy not relevant to the Proposed Development (sector specific policy)	N/A
OIL & GAS 4		All oil and gas platforms will be subject to 9 nautical mile consultation zones in line with Civil Aviation Authority guidance.	Policy screened for consideration in AEE	Sections 10.10.76 - 10.10.83
OIL & GAS 5		Consenting and licensing authorities should have regard to the potential risks, both now and under future climates, to oil and gas operations in Scottish waters, and be satisfied that installations are appropriately sited and designed to take account of current and future conditions.	Policy screened for consideration in AEE	Sections 10.10.76 - 10.10.83
OIL & GAS 6		Consenting and licensing authorities should be satisfied that adequate risk reduction measures are in place, and that operators should have sufficient emergency response and contingency strategies in place that are compatible with the National Contingency Plan and the Offshore Safety Directive.	Policy screened for consideration in AEE	Sections 10.10.76 - 10.10.83
CCS 1		CCS commercialisation projects or developments should be supported through an alignment of marine and terrestrial planning processes, particularly where proposals allow timely deployment of CCS to re-use suitable existing redundant oil and gas infrastructure.	Policy not relevant to the Proposed Development (sector specific policy)	N/A
CCS 2		Consideration should be given to the development of marine utility corridors which will allow CCS to capitalise, where possible, on current infrastructure in the North Sea, including shared use of spatial corridors and pipelines.	Policy screened for consideration in AEE	N/A

RENEWABLES 1		Proposals for commercial scale offshore wind and marine renewable energy development should be sited in the Plan Option areas identified through the Sectoral Marine Plan process. Plan Options are considered the preferred strategic locations for the sustainable development of offshore wind and marine renewables. This preference should be taken into account by marine planners and decision makers if alternative development or use of these areas is being considered. Proposals are subject to licensing and consenting processes.	Policy not relevant to the Proposed Development (sector specific policy)	N/A
RENEWABLES 2		Sites with agreements for lease for wave and tidal energy development in the Pentland Firth Strategic Area must be taken into account by marine planners and decision makers if alternative use of these areas, or use which would affect access to these areas, is being considered. Proposals are subject to licensing and consenting processes. Regional Locational Guidance and the Pentland Firth and Orkney Waters Marine Spatial Plans should also be taken into account when reaching decisions.	Policy not relevant to the Proposed Development (geographic policy)	N/A
RENEWABLES 3		Marine planners and decision makers should consider proposals for sustainable development of test and demonstration for offshore wind and marine renewable energy development on a case-by-case basis where sites are identified. This preference should be taken into account by marine planners and decision makers if alternative development or use of these areas is being considered. Regional Locational Guidance should be taken into account and proposals are subject to licensing and consenting processes.	Policy not relevant to the Proposed Development (sector specific policy)	N/A
RENEWABLES 4		Applications for marine licences and consents relating to offshore wind and marine renewable energy projects should be made in accordance with the Marine Licensing Manual and Marine Scotland's Licensing Policy Guidance.	Policy not relevant to the Proposed Development (sector specific policy)	N/A
RENEWABLES 5		Marine planners and decision makers must ensure that renewable energy projects demonstrate compliance with Environmental Impact Assessment and Habitats Regulations Appraisal legislative requirements.	Policy not relevant to the Proposed Development (sector specific policy)	N/A
RENEWABLES 6		New and future planned grid connections should align with relevant sectoral and other marine spatial planning processes, where appropriate, to ensure a co-ordinated and strategic approach to grid planning. Cable and network owners and marine users should also take a joined-up approach to development and activity to minimise impacts on the marine historic and natural environment and other users.	Policy not relevant to the Proposed Development (sector specific policy)	N/A
RENEWABLES 7		Marine planners and decision makers should ensure infrastructure is fit for purpose now and in future. Consideration should be given to the potential for climate change impacts on coasts vulnerable to erosion.	Policy not relevant to the Proposed Development (sector specific policy)	N/A
RENEWABLES 8		Developers bringing forward proposals for new developments must actively engage at an early stage with the general public and interested stakeholders of the area to which the proposal relates and of adjoining areas which may be affected.	Policy not relevant to the Proposed Development (sector specific policy)	N/A
RENEWABLES 9		Marine planners and decision makers should support the development of joint research and monitoring programmes for offshore wind and marine renewables energy development.	Policy not relevant to the Proposed Development (sector specific policy)	N/A
RENEWABLES 10		Good practice guidance for community benefit from offshore wind and renewable energy development should be followed by developers, where appropriate.	Policy not relevant to the Proposed Development (sector specific policy)	N/A
REC & TOURISM 1		Opportunities to promote sustainable development of marine recreation and tourism should be supported.	Policy screened for consideration in AEE	Sections 10.10.160 - 10.10.168
REC & TOURISM 2		The following key factors should be taken into account when deciding on uses of the marine environment and the potential impact on recreation and tourism: - The extent to which the proposal is likely to adversely affect the qualities important to recreational users, including the extent to which proposals may interfere with the physical infrastructure that underpins a recreational activity. - The extent to which any proposal interferes with access to and along the shore, to the water, use of the resource for recreation or tourism purposes and existing navigational routes or navigational safety. - Where significant impacts are likely, whether reasonable alternatives can be identified for the proposed activity or development. - Where significant impacts are likely and there are no reasonable alternatives, whether mitigation, through recognised and effective measures, can be achieved at no significant cost to the marine recreation or tourism sector interests.	Policy screened for consideration in AEE	Sections 10.10.160 - 10.10.168
REC & TOURISM 3		Regional marine plans should identify areas that are of recreational and tourism value and identify where prospects for significant development exist, including opportunities to link to the National Long Distance Walking and Cycle Routes, and more localised and/or bespoke recreational opportunities and visitor attractions.	Policy screened for consideration in AEE	Sections 10.10.160 - 10.10.168
REC & TOURISM 4		Marine and terrestrial planners, marine decision makers and developers should give consideration to the facility requirements of marine recreation and tourism activities, including a focus on support for participation and development in sport. Co-operation and sharing infrastructure and/or facilities, where appropriate, with complementary sectors should be supported as should provision of low carbon transport options.	Policy screened for consideration in AEE	Sections 10.10.160 - 10.10.168
REC & TOURISM 5		Marine planners and decision makers should support enhancement to the aesthetic qualities, coastal character and wildlife experience of Scotland's marine and coastal areas, to the mutual benefit of the natural environment, human quality of life and the recreation and tourism sectors.	Policy screened for consideration in AEE	Sections 10.10.160 - 10.10.168
REC & TOURISM 6		Codes of practice for invasive non-native species and Marine Wildlife Watching should be complied with.	Policy screened for consideration in AEE	Sections 10.10.160 - 10.10.168
TRANSPORT 1		Navigational safety in relevant areas used by shipping now and in the future will be protected, adhering to the rights of innocent passage and freedom of navigation contained in UN Convention on the Law of the Sea (UNCLOS). The following factors will be taken into account when reaching decisions regarding development and use: - The extent to which the locational decision interferes with existing or planned routes used by shipping, access to ports and harbours and navigational safety. This includes commercial anchorages and defined approaches to ports. - Where interference is likely, whether reasonable alternatives can be identified. - Where there are no reasonable alternatives, whether mitigation through measures adopted in accordance with the principles and procedures established by the International Maritime Organization can be achieved at no significant cost to the shipping or ports sector.	Policy screened for consideration in AEE	Sections 10.10.160 - 10.10.168
TRANSPORT 2		Marine development and use should not be permitted where it will restrict access to, or future expansion of, major commercial ports or existing or proposed ports and harbours which are identified as National Developments in the current NPF or as priorities in the National Renewables Infrastructure Plan. Regional marine plans should identify regionally important ports and harbours, giving consideration to social and economic aspects of the port or harbour and the users of the facility subject to policies and objectives of this Plan. Regional plans should consider setting out criteria against which proposed activities and developments should be evaluated. <applies to inshore waters only>	Policy not relevant to the Proposed Development (sector specific policy)	N/A
TRANSPORT 3		Ferry routes and maritime transport to island and remote mainland areas provide essential connections and should be safeguarded from inappropriate marine development and use that would significantly interfere with their operation. Developments will not be consented where they will unacceptably interfere with lifeline ferry services.	Policy screened for consideration in AEE	Sections 10.10.94 - 10.10.103, Sections 10.10.150 - 10.10.159
TRANSPORT 4		Maintenance, repair and sustainable development of port and harbour facilities in support of other sectors should be supported in marine planning and decision making. <applies to inshore waters only>	Policy not relevant to the Proposed Development (sector specific policy)	N/A
TRANSPORT 5		Port and harbour operators should take into account future climate change and extreme water level projections, and where appropriate take the necessary steps to ensure their ports and harbours remain viable and resilient to a changing climate. Climate and sea level projections should also be taken into account in the design of any new ports and harbours, or of improvements to existing facilities. <applies to inshore waters only>	Policy not relevant to the Proposed Development (sector specific policy)	N/A
TRANSPORT 6		Marine planners and decision makers and developers should ensure displacement of shipping is avoided where possible to mitigate against potential increased journey lengths (and associated fuel costs, emissions and impact on journey frequency) and potential impacts on other users and ecologically sensitive areas.	Policy screened for consideration in AEE	Sections 10.10.94 - 10.10.103, Sections 10.10.150 - 10.10.159
TRANSPORT 7		Marine and terrestrial planning processes should co-ordinate to: - Provide co-ordinated support to ports, harbours and ferry terminals to ensure they can respond to market influences and provide support to other sectors with necessary facilities and transport links. - Consider spatial co-ordination of ferries and other modes of transport to promote integrated and sustainable travel options.	Policy not relevant to the Proposed Development (sector specific policy)	N/A

CABLES 1		Cable and network owners should engage with decision makers at the early planning stage to notify of any intention to lay, repair or replace cables before routes are selected and agreed. When making proposals, cable and network owners and marine users should evidence that they have taken a joined-up approach to development and activity to minimise impacts, where possible, on the marine historic and natural environment, the assets, infrastructures and other users. Appropriate and proportionate environmental considertion and risk assessments should be provided which may include cable protection measures and mitigation plans. Any deposit, removal or dredging carried out for the purpose of executing emergency inspection or repair works to any cable is exempt from the marine licensing regime with approval by Scottish Ministers. However, cable replacement requires a marine licence. Marine Licensing Guidance should be followed when considering any cable development and activity.	Policy not relevant to the Proposed Development (sector specific policy)	N/A
CABLES 2		The following factors will be taken into account on a case by case basis when reaching decisions regarding submarine cable development and activities: - Cables should be suitably routed to provide sufficient requirements for installation and cable protection. - New cables should implement methods to minimise impacts on the environment, seabed and other users, where operationally possible and in accordance with relevant industry practice. - Cables should be buried to maximise protection where there are safety or seabed stability risks and to reduce conflict with other marine users and to protect the assets and infrastructure. - Where burial is demonstrated not to be feasible, cables may be suitably protected through recognised and approved measures (such as rock or mattress placement or cable armouring) where practicable and cost-effective and as risk assessments direct. - Consideration of the need to reinstate the seabed, undertake post-lay surveys and monitoring and carry out remedial action where required.	Policy not relevant to the Proposed Development (sector specific policy)	N/A
CABLES 3		A risk-based approach should be applied by network owners and decision makers to the removal of redundant submarine cables, with consideration given to cables being left in situ where this would minimise impacts on the marine historic and natural environment and other users.	Policy not relevant to the Proposed Development (sector specific policy)	N/A
CABLES 4		When selecting locations for land-fall of power and telecommunications equipment and cabling, developers and decision makers should consider the policies pertaining to flooding and coastal protection in Chapter 4, and align with those in Scottish Planning Policy and Local Development Plans.	Policy not relevant to the Proposed Development (sector specific policy)	N/A
DEFENCE 1		To maintain operational effectiveness in Scottish waters used by the armed services, development and use will be managed in these areas: - Naval areas including bases and ports: Safety of navigation and access to naval bases and ports will be maintained. The extent to which a development or use interferes with access or safety of navigation, and whether reasonable alternatives can be identified, will be taken into account by consenting bodies. Proposals for development and use should be discussed with the MOD at an early stage in the process. - Firing Danger Areas (Map 13): Development of new permanent infrastructure is unlikely to be compatible with the use of Firing Danger Areas by the MOD. Permitted activities may have temporal restrictions imposed. Proposals for development and use should be discussed with the MOD at an early stage in the process. - Exercise Areas (Map 13): Within Exercise Areas, activities may be subject to temporal restrictions. Development and use that either individually or cumulatively obstructs or otherwise prevents the defence activities supported by an exercise area may not be permitted. Proposals for development and use should be discussed with the MOD at an early stage in the process. - Communications: Navigations and surveillance including radar: Development and use which causes unacceptable interference with radar and other systems necessary for national defence may be prohibited if mitigation cannot be determined. Proposals for development and use should be discussed with the MOD at an early stage in the process.	Policy not relevant to the Proposed Development (geographic policy)	N/A
DEFENCE 2		For the purposes of national defence, the MOD may establish by-laws for exclusions and closures of sea areas. In most areas this will mean temporary exclusive use of areas by the MOD. Where potential for conflict with other users is identified, appropriate mitigation will be identified and agreed with the MOD, prior to planning permission, a marine licence, or other consent being granted.	Policy not relevant to the Proposed Development (sector specific policy)	N/A
DEFENCE 3		The established code of conduct for managing fishing and military activity detailed in the documents 'Fishing Vessels Operating in Submarine Exercise Areas' [155] and 'Fishing Vessel Avoidance: The UK Code of Practice Fishing Vessel Avoidance' [156] will be adhered to.	Policy not relevant to the Proposed Development (sector specific policy)	N/A
AGGREGATES 1		Marine planners and decision makers should consider the impacts of other development or activity on areas of marine aggregate or mineral resource. Where an interaction is identified, consideration should be given to whether there are permissions for aggregate or mineral extraction and whether they require any degree of safeguarding.	Policy not relevant to the Proposed Development (geographic policy)	N/A
AGGREGATES 2		Decision makers should ensure all the necessary environmental issues are considered and safeguards are in place when determining whether any proposed marine aggregate dredging is considered to be environmentally acceptable and is in accordance with the other policies and objectives of this Plan.	Policy not relevant to the Proposed Development (sector specific policy)	N/A

Shetland Local Development Plan Policies Screening Assessment

From: https://www.shetland.gov.uk/downloads/file/1930/local-development-plan-2014

Local Development Plan Listing and Screening in Relation to the Proposed Development

Policy ID	Policy Title	Policy Text	Screening Rationale	Relevant Section of the AEE
GP 1	Sustainable Development	Development will be planned to meet the economic and social needs of Shetland in a manner that does not compromise the ability of future generations to meet their own needs and to enjoy the area's high quality environment. Tackling climate change and associated risks is a major consideration for all development proposals. New residential, employment, cultural, educational and community developments should be in or adjacent to existing settlements that have basic services and infrastructure in order to enhance their viability and vitality and facilitate ease of access for all. This will be achieved through Allocations, Sites with Development Potential and Areas of Best Fit.	Policy screened for consideration in AEE	Chapter 10

GP 2	General Requirements for All Development	Applications for new buildings or for the conversion of existing buildings should meet all of the following General Requirements: a. Developments should not adversely affect the integrity or viability of sites designated for their landscape and natural heritage value. b. Development should not occur any lower than 5 metres Above Ordnance Datum (Newlyn) unless the development meets the requirements of Policy WD1; c. Development should be located, constructed and designed so as to minimise the use of energy and to adapt to impacts arising from climate change, such as the increased probability of flooding; water stress, such as water supply; health or community impacts as a result of extreme climatic events; and a change in richness of biodiversity. d. Suitable water, waste water and surface water drainage must be provided; e. All new buildings shall avoid a specified and rising proportion of the projected greenhouse gas emissions from their use, through the installation and operation of low and zero-carbon generating technologies (LZCGT). The proportion of such emissions shall be specified in the council's Supplementary Guidance – Design. That guidance will also set out the approach to existing buildings which are being altered or extended, including historic buildings, and the approach to applications where developers are able to demonstrate that there are significant technical constraints to using on-site low and zero carbon generating technologies. f. Suitable access, car parking and turning should be provided; g. Development should not adversely affect areas, buildings or structures of archaeological, architectural or historic interest; h. Development should not sterilise mineral reserves; i. Development should not sterilise allocated sites as identified within the Shetland Local Development Plan; j. Development should not have a significant adverse effect on existing uses; k. Development should not compromise acceptable health and safety standards or levels; l. Development should be consistent with National Planning Policy, other Local Development Plan policies and Supplementary Guidance.	Policy screened for consideration in AEE	Chapter 10
GP 3	All Development: Layout and Design	All new development should be sited and designed to respect the character and local distinctiveness of the site and its surroundings. The proposed development should make a positive contribution to: • maintaining identity and character • ensuring a safe and pleasant space • ensuring ease of movement and access for all • a sense of welcome • long term adaptability, and • good use of resources The Planning Authority may request a Masterplan and/ or Design and Access Statement in support of development proposals. A Masterplan should be submitted with applications where Major Development is proposed; Major Development is defined in the Town and Country Planning (Hierarchy of Developments) (Scotland) Regulations 2009, Reg 2 (1). Further details for these requirements are set out in Supplementary Guidance.	Policy screened for consideration in AEE	Chapter 10
NH 1	International and National Designations	Any development proposal that is likely to have a significant effect on an internationally important site, (Special Area of Conservation (SAC), Special Protection Areas (SPA) or Ramsar Sites) and is not directly connected with or necessary to the conservation management of that site will be subject to an assessment of the implications for the site's conservation objectives. Development that could have a significant effect on a site will only be permitted where: • An appropriate assessment has demonstrated that it will not adversely affect the integrity of the site, or • There are no alternative solutions, and • There are imperative reasons of over-riding public interest that may, for sites not hosting a priority habitat type and/or priority species, be of a social or economic nature. Development that affects a National Scenic Area (NSA), National Nature Reserve (NNR) or a Site of Special Scientific Interest (SSSI) will only be permitted where: • It will not adversely affect the integrity of the area or the qualities or protected features for which it has been designated, or • Any such adverse effects are clearly outweighed by social, environmental or economic benefits of national importance.	Policy screened for consideration in AEE	Section 10.12
NH 2	Protected Species	Where there is good reason to suggest that a species protected under the Wildlife and Countryside Act 1981 (as amended), Annex IV of the Habitats Directive or Annex 1 of the Birds Directive is present on site, or may be affected by a proposed development, the Council will require any such presence to be established. If such a species is present, a plan should be provided to avoid or mitigate any adverse impacts on the species, prior to determining the application. Planning permission will not be granted for development that would be likely to have an adverse effect on a European Protected Species unless the Council is satisfied that: • The development is required for preserving public health or public safety or for other imperative reasons of overriding public interest including those of a social or economic nature and beneficial consequences of primary importance for the environment; and • There is no satisfactory alternative; and • The development will not be detrimental to the maintenance of the population of the European Protected Species concerned at a favourable conservation status in their natural range. Planning permission will not be granted for development that would be likely to have an adverse effect on a species protected under Schedule 5 (animals) or 8 (plants) of the Wildlife and Countryside Act 1981 (as amended) unless the Council is satisfied that: • Undertaking the development will give rise to, or contribute towards the achievement of, a significant social, economic or environmental benefit; and • There is no satisfactory solution. Planning permission will not be granted for development that would be likely to have an adverse effect on a species protected under Schedules 1, 1A or A1 (birds) of the Wildlife and Countryside Act 1981 (as amended), unless the Council is satisfied that: o The development is required for preserving public health or public safety; and o There is no other satisfactory solution. Applicants should submit supporting evidence for any development meeting these criteria, demonstrating both the need for the development and that a full range of possible alternative courses of action have been properly examined and none found to acceptably meet the need identified. The Council will apply the precautionary principle where the impacts of a proposed development on natural heritage are uncertain but potentially significant. Where development is constrained on the grounds of uncertainty, the potential for research, surveys or assessments to remove or reduce uncertainty should be considered.	Policy screened for consideration in AEE	Section 10.12

NH 3	Furthering the Conservation of Biodiversity	Development will be considered against the Council's obligation to further the conservation of biodiversity and the ecosystem services it delivers. The extent of these measures should be relevant and proportionate to the scale of the development. Proposals for development that would have a significant adverse effect on habitats or species identified in the Shetland Local Biodiversity Action Plan, Scottish Biodiversity List, UK Biodiversity Action Plan, Annexes I and II of the Habitats Directive, Annex I of the Birds Directive (if not included in Schedule 1 of the Wildlife and Countryside Act) or on the ecosystem services of biodiversity, including any cumulative impact, will only be permitted where it has been demonstrated by the developer that; • The development will have benefits of overriding public interest including those of a social or economic nature that outweigh the local, national or international contribution of the affected area in terms of habitat or populations of species; and • Any harm or disturbance to the ecosystem services, continuity and integrity of the habitats or species is avoided, or reduced to acceptable levels by mitigation.	Policy screened for consideration in AEE	Section 10.12
NH 4	Local Designations	Development that affects a Local Nature Conservation Site or Local Landscape Area will only be permitted where: • It will not adversely affect the integrity of the area or the qualities for which it has been identified; or • Any such effects are clearly outweighed by social, environmental or economic benefits.	Policy screened for consideration in AEE	Section 10.12
NH 6	Geodiversity	Development will only be permitted where appropriate measures are taken to protect and/or enhance important geological and geomorphological resources and sites, including those of educational or research value. Proposals that will have an unavoidable effect on geodiversity will only be permitted where it has been demonstrated that: • The development will have benefits of overriding public interest including those of a social or economic nature that outweigh the local, national or international contribution of the affected area in terms of its geodiversity; • Any loss of geodiversity is reduced to acceptable levels by mitigation, and a record is made prior to any loss. For certain scales of development where a soil management plan is required, reference should also be made to geodiversity on site.	Policy screened for consideration in AEE	Section 10.12
NH 7	Water Environment	Development will only be permitted where appropriate measures are taken to protect the marine and freshwater environments to an extent that is relevant and proportionate to the scale of development. Development adjacent to a watercourse or water body must be accompanied by sufficient information to enable a full assessment of the likely effects. Where there is potential for the development to have an adverse impact the applicant/developer must demonstrate that: • There will be no deterioration in the ecological status of the watercourse or water body; • It does not encroach on any existing buffer strips and that access to these buffer strips has been maintained; and • Both during the construction phase and after completion it would not significantly affect: o Water quality flows in adjacent watercourses or areas downstream o Natural flow patterns and sediment transport processes in all water bodies or watercourses.	Policy screened for consideration in AEE	Section 10.12
HE 1	Historic Environment	The Council should presume in favour of the protection, conservation and enhancement of all elements of Shetland's historic environment, which includes buildings, monuments, landscapes and areas.	Policy screened for consideration in AEE	Section 10.12, Sections 10.10.104 - 10.10.114
HE 4	Archaeology	Scheduled monuments, designated wrecks and other identified nationally important archaeological resources should be preserved in situ, and within an appropriate setting. Developments that have an adverse effect on scheduled monuments and designated wrecks or the integrity of their settings should not be permitted unless there are exceptional circumstances. All other significant archaeological resources should be preserved in situ wherever feasible. Where preservation in situ is not possible the planning authority should ensure that developers undertake appropriate archaeological excavation, recording, analysis, publication and archiving in advance of and/ or during development.	Policy screened for consideration in AEE	Section 10.12, Sections 10.10.104 - 10.10.114
CST 1	Coastal Development	Proposals for developments and infrastructure in the coastal zone (above Mean Low Water Mark of Ordinary Spring Tides) will only be permitted where the proposal can demonstrate that: • It will not have a significant impact, either individually or cumulatively, on the natural, built environment and cultural heritage resources either in the sea or on land; • The location, scale and design are such that it will not have a significant adverse impact. • It does not result in any deterioration in ecological status or potential for any water body or prevent it from achieving good ecological status in the future; • There is no significant adverse impact on other users of marine resources, and/or neighbouring land. Proposals for marine aquaculture developments or amendments to existing fish farm developments will require to have regard to the foregoing criteria and will be assessed against the Supplementary Guidance Policy for Aquaculture. All proposals will be assessed against the Shetland Islands Marine Spatial Plan that sets out a spatial strategy and policy framework to guide marine developments in the coastal waters around Shetland. The Marine Spatial Plan identifies the constraints developers are required to consider when contemplating development in the coastal area and will form supplementary guidance to this plan.	Policy screened for consideration in AEE	Section 10.12

Appendix 10.2 Marine and Transboundary Effects – Baseline Conditions

Environmental Zone of Influence

The sections below characterise the water quality, biodiversity and human receptors with likely presence in the EZI, based on a review of available published and unpublished literature, alongside resources from advisors and regulators.

Water Quality

Contaminants

Contaminants are chemical substances that are atypically found in the marine environment and have the potential to cause harm to marine life. Contaminants can be either anthropogenic or natural in origin. As stated by ICES (2003), there are four main groups of contaminants:

- Trace metals: heavy metals such as cadmium and mercury, from metallurgic industries, and copper, from anti-foulant;
- Organic compounds: from agricultural run-off;
- Oil: from marine activities and hydrocarbon extraction;
- Radioactive elements: from nuclear operations.

Oil pollution in the EZI is likely to be lower than other marine regions due to the low overall level of development and anthropogenic presence. The small amounts of exploration and drilling of oil in the Arctic has so far been limited to Russia, North America and west Greenland (i.e. none in the vicinity of the EZI) (NPC, 2015). The Arctic has received significant interest from the petroleum industry, and it is possible that exploration will become more widespread in the future. Marine traffic in the EZI typically decreases with distance from the coast, though there is an offshore convergence zone of traffic routes between Norway and Iceland (see Section 10.5). Though there have no doubt been occurrences of hydrocarbons entering the water from vessels, there had not been a major oil spill in the Arctic until June 2020 when one occurred from an energy plant in eastern Russia (though this is significantly outwith the EZI). The baseline level of hydrocarbons in the EZI is considered to be very low.

OSPAR have assessed the level of contaminants across different parts of the OSPAR maritime area as part of their 2017 Intermediate Assessment (OSPAR, 2017). The level of polycyclic aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs) in shellfish and sediments in the Northern North Sea (overlapping the southern extent of the EZI) is below levels likely to harm marine species. The level of polybrominated diphenyl ethers (PBDEs) in shellfish and sediment in the Northern North Sea is decreasing annually. Heavy metal (mercury Hg; cadmium Cd; and lead, Pb) concentrations in the fish and shellfish and sediments of the Northern North Sea are above background levels, but most are below the level at which effects would occur (with the exception of lead in sediments which are above levels where adverse ecological effects cannot be ruled out). Note that the Northern North Sea has potentially the highest level of anthropogenic pressure in the EZI as it is more proximate to land where anthropogenic sources of contaminants are higher.

In comparison to the North Sea, the Arctic is relatively unpolluted. Based on the OSPAR Commission Quality Status Report 2010, the Arctic (Region 1) has the lowest percentages of monitoring sites that have unacceptable levels of cadmium, mercury, lead, PAHs, and PCBs, out of all OSPAR regions (OSPAR, 2010). Of these, PAHs and PCBs are present in unacceptable levels in the highest percentages of sites (~30%), whereas for the heavy metals this is typically <10%. The monitoring sites included are restricted to coastal waters and so represent the worst-case scenario for pollutants as they are closer to the anthropogenic sources. It is likely that levels of pollutants offshore are lower than that reported at the coast. The release of most contaminants is controlled by legislative measures that aim to cease their production, and as a result there has been a general decrease in the number of pollutants in the Arctic which is predicted to continue.

There has been a historic decrease in the concentration of most anthropogenic radionuclides in the Eurasian Arctic (Josefsson, 1998). Concentration of radionuclides decreases with depth in the water column. The concentrations in the sediments of the deep Arctic Ocean are much lower than the concentrations on the shelf, primarily due to the low particle flux in the open ocean (Josefsson, 1998). There are no nuclear facilities

in the EZI (OSPAR, 2016), therefore input of radionuclides is limited to transport from distant sources and global fallout. In summary there are likely to be negligible concentrations of radionuclides in the EZI.

Microplastics

Microplastics, described as plastic particles or fragments less than 5 mm in length (NOAA, 2020a), are present in most marine systems around the world (Barceló and Picó, 2019). Although the Arctic is remote and difficult to study, there has been an increase in the focus on plastic pollution in this region. Microplastics have been found both in the water and the marine organisms such as fish in the Arctic, with the most common types being polyethylene and polyester (Morgana *et al.,* 2018). The concentration of microplastics is greater than most seas at lower latitude, indicating that the Arctic regions is a hotspot for plastic pollution (e.g., Obbard *et al.,* 2014). Plastic pollution can originate from local sources such as vessel discharge or more distant sources, which enter the region via sea surface and sub-surface currents. Given the comparatively few direct sources in the region, it is likely that most microplastics originate outside the Arctic. The amount of microplastics in the Arctic is predicted to increase in the coming years, due to the increase in anthropogenic presence and pressure as climate change increases accessibility to the region.

Biodiversity

Physical features

The physical features of the marine environment directly influence the biodiversity found in the surrounding waters. The EZI comprises predominantly deep waters up to ~4,000 m below relative sea level with some shallower areas adjacent to nearby land masses including Iceland, Faroe Islands and Jan Mayen (Figure A10.1). The area is characterised by bathymetric features including plateaus, basins, rises, and ridges, including segments of the Mid-Atlantic Ridge (Figure A10.2).

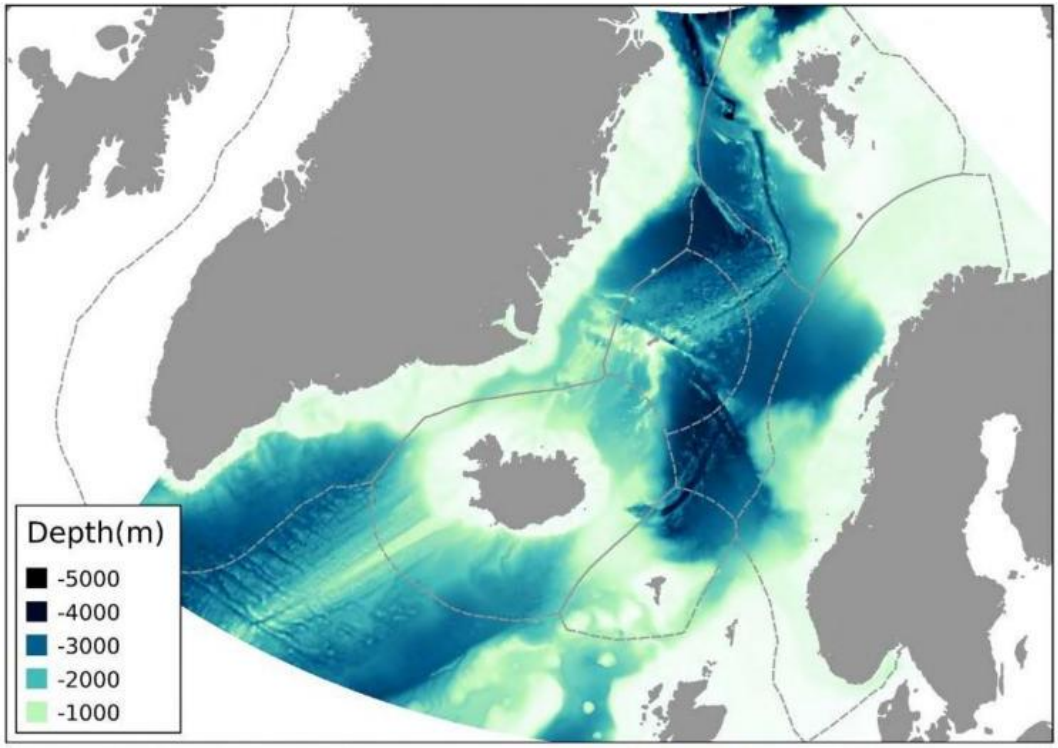


Figure A10.1 Water depth in the northeast Atlantic and Arctic regions (From: Buhl-Mortensen et al.*, 2019)*

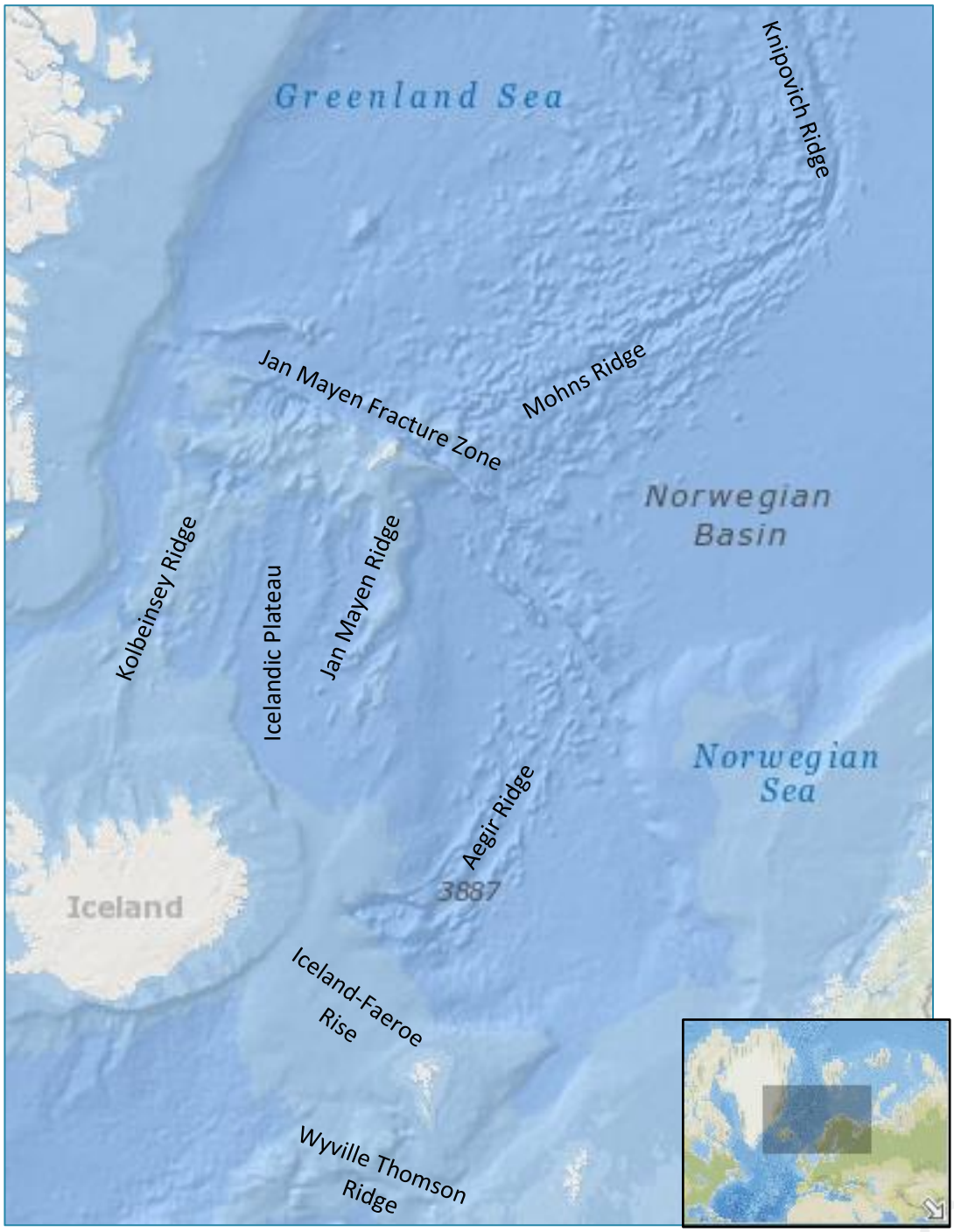


Figure A10.2 Bathymetry and bathymetric features in the vicinity of the EZI (Source: NOAA, 2020b)

Surface sea currents in the EZI comprise a mix of warm currents and cold currents (ICES, 2003). Travelling in a north-east direction, the North Atlantic Drift traverses between the UK and the Faroe Islands, through the Norwegian Sea and continues to the Arctic. Offshoots of this current travel between the Faroe Islands and Norway, south into the North Sea, and also circulate anti-clockwise from the Norwegian Sea towards Jan Mayen. Cold currents travel in a south/southwesterly direction from the Arctic; the East Greenland Current travels down the east coast of Greenland, with offshoots circulating clockwise towards Jan Mayen and north of Iceland (East Icelandic Current). The centre of the EZI comprises a convergence of cold and warm surface currents, resulting in gyres such as the Icelandic Gyre and Greenland Sea Gyre.

The highest annual mean sea surface temperature (SST) in the region is approximately 9-10°C, in the south and southeast of the EZI (NOAA, 2020c), as these waters are most influenced by the warm surface waters. Influence of the Arctic-derived sea surface currents in the north and west of the EZI lead to minimum annual mean SST of 0-3°C. The temperature is typically 2-3° below and above average in the winter and summer, respectively (NOAA, 2020c). Temperature at the sea-bottom is -1°C throughout much of the offshore waters of the EZI (Buhl-Mortensen *et al.,* 2019). Warmer sea-bottom temperatures of 6.8-9.4°C are present across the areas of continental shelf that extend around the Faroe Islands and north of Shetland (Buhl-Mortensen *et al.,* 2019). Annual salinity in the EZI is 35-36 with minimal seasonal variation (NOAA, 2020d).

The maximum Arctic sea ice extent does not extend into the EZI except for a very small portion in the northwest corner near to Greenland (NOAA, 2012). As this represents such a small portion of the EZI it is considered to have negligible effects on the biodiversity of the EZI.

The seabed sediments in waters beyond the continental shelf, which comprises the majority of the EZI, are characterised as A6.5 Deep-sea mud (EMODnet, 2019). The seabed sediments in the areas beyond national jurisdiction are described on EMODnet as A.6 Deep-sea bed with no further information on the sediments themselves. Other seabed sediments that are present on the continental shelf adjacent to the Faroe Islands include A5.27 Deep circalittoral sand, A6.3 Deep-sea sand or A6.4 Deep-sea muddy sand, and A5.45 Deep circalittoral mixed sediment. A similar range of deep-sea sediments are also present on the continental shelf that extends north of Shetland, with the addition of A5.15 Deep circalittoral coarse sediment.

Plankton

Plankton, comprising bacteria, Archaea, phytoplankton, protists and zooplankton, form the base of the food web in cold waters such as the EZI and so are extremely important to the ecosystem as a whole (CAFF, 2017). Despite this, the plankton community in this region is poorly known. A summary of the knowledge of plankton in Arctic waters, which encompasses the majority of waters in the EZI, is provided in CAFF's (2017) State of the Arctic Marine Biodiversity Report. Monitoring of plankton in the Arctic has been most frequent in the waters of Jan Mayen, Iceland, and Greenland.

Phytoplankton are the only primary producers in cold waters such as the EZI and so form the base of the food web (CAFF, 2017). The Atlantic Arctic comprises the highest diversity of phytoplankton of all Arctic regions, as it contains a mixture of Arctic and North Atlantic species (CAFF, 2017). Dinoflagellates and diatoms are the most common functional groups (as found by microscopy) in the Atlantic Arctic (CAFF, 2017). Phytoplankton and other single-celled plankton are the main food for larger zooplankton such as copepods.

The zooplankton community comprises single and multi-celled organisms and is highly diverse in the Arctic, with over 350 species recorded (CAFF, 2017). Multicellular zooplankton include a wide range of invertebrates and larvae of other marine organisms such as fish (CAFF, 2017). Their longer life spans have led to the development of strategies, such as vertical migrations on daily and seasonal cycles, and preferred depth niches (CAFF, 2017). Copepods are the most abundant and well-studied species group of zooplankton, accounting for 80-90% of zooplankton biomass in the Arctic (CAFF, 2017). Copepods are highly diverse as over 150 species have been recorded in Arctic waters (CAFF, 2017). The copepod *Calanus finmarchicus* is the most common copepod species in sub-Arctic waters (CAFF, 2017). Copepods and other zooplankton such as hyperiid amphipods and euphausiids, are important prey items for other marine species including fish, seabirds, and baleen whales.

Plankton are strongly affected by environmental conditions such as water depth, current patterns, salinity, and temperature. The cyclic variation of these environmental factors leads to a predictable series of seasonal blooms by different components of the plankton community. Phytoplankton bloom in the spring, followed by an increase in zooplankton in that extends through to summer and is closely linked to availability of food as well as warmer temperatures.

Benthic Species and Habitats

Benthic invertebrates are an important part of the food web and form part of the diet of fish, marine mammals, and seabirds (CAFF, 2017). Despite their importance, they remain relatively poorly understood. In the Arctic, monitoring has been focussed on macro- and mega-benthic species (species >1 mm and species identifiable through imagery techniques, respectively), with comparatively less monitoring effort on

meiofauna (0.1-1.0 mm) and microfauna (<0.1 mm) (CAFF, 2017). There has been an increase in benthic monitoring around Iceland, Greenland and the Norwegian Sea, though many Arctic areas remain poorly understood.

The benthos is influenced by a variety of environmental factors including water depth, currents, temperature, food availability, and seabed sediments. The degree to which these environmental factors influence the benthos depends on their life strategies. For example, benthic fauna can be mobile or sessile, with sessile organisms more heavily influenced by local environmental conditions than mobile species which can move to areas of suitable habitat. Similarly, relative influence of conditions will vary by the species' position in relation to the sediment i.e. in the sediment (infauna), on the sediment (epifauna), or just above the sediment (hyperbenthos).

Over 4,000 benthic species have been recorded in Arctic waters, accounting for the majority of marine diversity in the Arctic (CAFF, 2017). The most numerous species group in the Arctic, including the EZI, is arthropods (Figure A10.3). Other species of high richness in the several Arctic regions that overlap the EZI (Iceland, Faroe Islands, Norway West, and Greenland) are polychaetes and molluscs. Beyond these top three groups there are localised differences between the regions: in the Faroe Islands and Greenland foraminifera are the fourth most rich species; this position is held by echinoderms in Norway West; and in Iceland there are several different groups, including 'other', which contribute notable percentages of the total species richness. The total number of species in these regions range from 1,807-2,345.

There is a paucity of trawl stations in the offshore waters of the EZI in comparison to other regions of the Arctic. Nevertheless, the few trawl stations show that typically fewer than 20 benthic megafaunal species/taxa have been recorded at each trawl station in the EZI, which is low compared to other regions of the Arctic (CAFF, 2017).

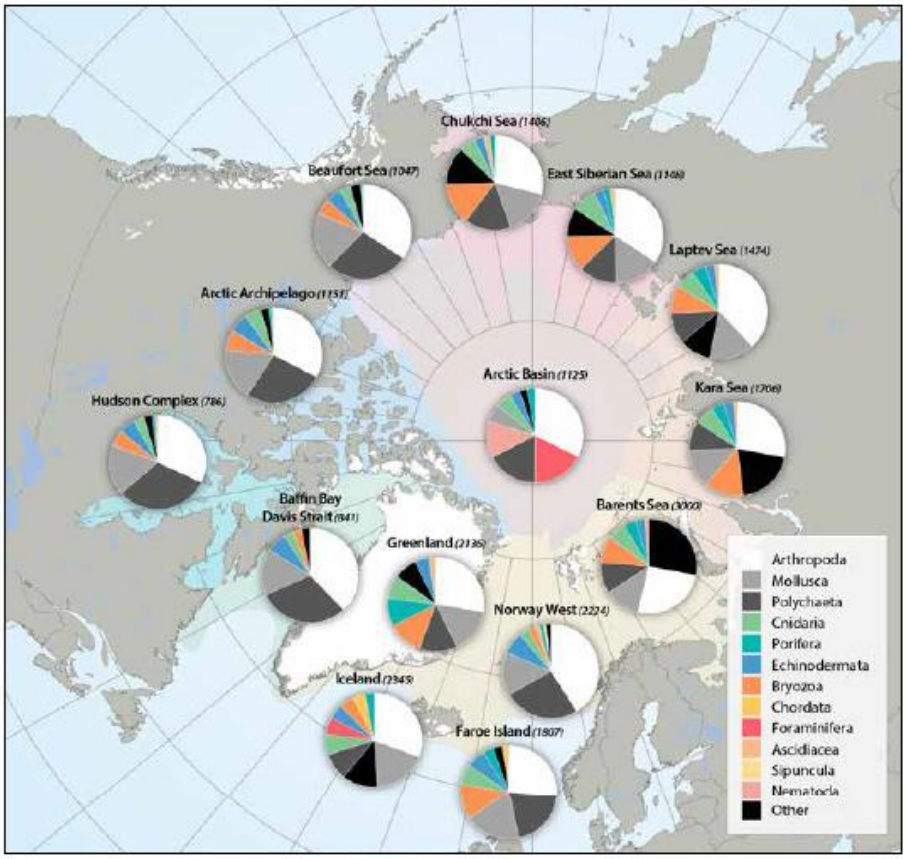


Figure A10.3 Regional pie charts showing the species/taxon number (in brackets) per region and the relative proportion of certain taxa in species richness (From: CAFF, 2017)

Certain benthic habitats, created by habitat-forming species, are especially sensitive to anthropogenic effects; these are known as Vulnerable Marine Ecosystems (VMEs). The FAO define VMEs as those areas that may be vulnerable to impacts from fishing activities (Buhl-Mortensen et al., 2019), though for the purpose of this study this definition is extended to include any anthropogenic activity that may interact with the seabed, which includes the proposed operations at SSC.

There are seven VME habitat types listed by the North East Atlantic Fisheries Commission (NEAFC): cold-water coral reef; coral garden; deep-sea sponge aggregations; seapen fields; tube-dwelling anemone patches; mud- and sand-emergent fauna; and bryozoan patches (FAO, 2020a). As shown in Figure A10.4, there are records of VMEs in the EZI, though comparatively fewer than the numbers recorded around the coast of Iceland, Norway, and the Faroe Islands (Buhl-Mortensen et al., 2019). The distribution of records is likely to be compounded by the amount of survey effort in each area. To overcome this, Buhl-Mortensen et al. (2019) modelled the predicted suitability of habitats throughout the Arctic and sub-Arctic for VMEs. The results of the modelling showed that the number of VMEs is negatively correlated with water depth and positively correlated with water temperature at the sea-bottom. The majority of the EZI is not predicted to provide conditions for VMEs, except for localised areas around the Faroes and the Faroe-Shetland belt.

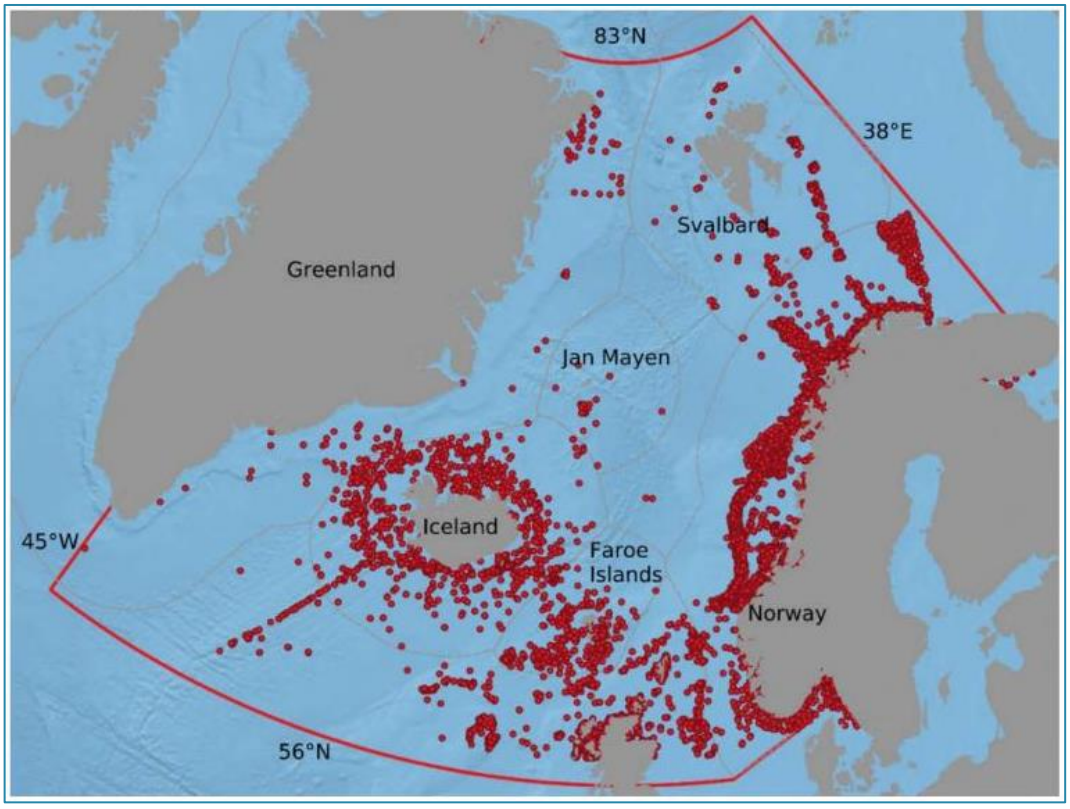


Figure A10.4 The location of Vulnerable Marine Ecosystem (VME) records in the northeast Atlantic (From: Buhl-Mortensen et al.*, 2019)*

Fish

The Arctic waters of the EZI are highly productive and support a diverse fish community. A total of 633 species of marine fish have been recorded in the Arctic Ocean and adjacent seas (CAFF, 2017). Approximately 10% of these species are targeted commercially and so are subjected to stock assessments and are well-understood. Due to the lack of knowledge on the remaining 90%, this discussion focuses on the commercially important stocks.

According to OSPAR (2020), the Arctic waters support six fish species of major commercial importance: Atlantic cod *Gadus morhua*, saithe/pollock *Pollachius virens*, haddock *Melanogrammus aeglefinus*, blue whiting *Micromesistius poutassou*, Atlantic herring *Clupea harengus*, and capelin *Mallotus villosus*. The

analysis of commercial fisheries data from ICES presented in this section indicates that Atlantic mackerel *Scomber scombrus* are also of commercial importance.

Atlantic cod, saithe, haddock, and blue whiting are benthopelagic, feeding at or near the seabed, whereas Atlantic herring and capelin are pelagic mid-water column fish.

An overview of the distribution of these species and their spawning activity is presented in Table A10.1. Spawning grounds are not prevalent in the EZI due to its offshore location away from most coastal areas where spawning occurs. The exception are saithe and blue whiting which spawn offshore over deep waters. There may be minor overlap with spawning grounds at the southern extent of the EZI due to overlap with the northern North Sea. The key spawning period for most fish species is spring, though some Atlantic herring stocks in the EZI also spawn in autumn and summer.

Table A10.1 Overview of the key commercial fish species in the EZI (From: Johnson, 1977; Holste and Slotte, 1995; Jakobsson and Stefansson, 1999; Dickey-Collas et al., 2010; ICES, 2005; FishSource, 2019; FAO, 2020b)

Species	Spatial Distribution In The EZI	Spawning Activity
Atlantic cod *Gadus morhua*	Atlantic cod is present in discrete stocks around Norway, the Faroe Islands, Iceland, and the North Sea	Spawning typically occurs in discrete areas near the coasts of the country within the stock's home range, except for the North Sea where spawning activity is widespread. Spawning occurs from January to April
Saithe/pollock *Pollachius virens*	Saithe are widespread in the northeast Atlantic. They occur in three separate stock areas: Icelandic, Faroese, and Continental	Saithe spawn offshore, have nursery grounds in coastal waters, then migrate offshore as adults. They have spawning areas in the Norwegian Sea. Spawning occurs between January-March
Haddock *Melanogrammus aeglefinus*	Haddock stocks are present around Iceland, Faroe Islands and North Sea	Key spawning grounds are along Iceland, Norway and Shetland coasts, mostly outside of the EZI. Peak spawning occurs in March-April
Blue whiting *Micromesistius poutassou*	Blue whiting occurs in a single stock widespread in the northeast Atlantic	Spawning in northeast Atlantic occurs in deep water along the Faroe-Shetland channel. Spawning occurs in in spring
Atlantic herring *Clupea harengus*	The EZI overlaps considerably with the large northeast Atlantic/Norwegian stock of herring, as well as small distinct stocks around Iceland and the North Sea	These stocks spawn along the coast (of Norway, Iceland, and southern Shetland), outside of the EZI. Spawning occurs during autumn for the North Sea stock, in summer for the Icelandic stock, and in spring for the NE Atlantic stock
Capelin *Mallotus villosus*	The capelin stock that occurs in the EZI occurs in the waters between Jan Mayen and Iceland	Spawning grounds occur off southern Iceland, outside the EZI. Spawning occurs in spring
Atlantic mackerel *Scomber scombrus*	Atlantic mackerel occurs as a single stock throughout northeast Atlantic waters and are widespread	Spawning occurs in summer in warmer waters to the south of the EZI (though there is minor overlap with low density spawning at the southern limit of the EZI i.e. the northern North Sea)

Marine Ornithology

The cold northern regions of the North Atlantic are highly productive and support large numbers of breeding and visiting seabirds.

The EZI overlaps ICES region E1 (Barents and Norwegian Seas), which has a seabird community comprising 69% auks, 18% gulls, 10% petrels, and ≤2% eiders, terns and Pelecaniformes (Barrett *et al.,* 2006). There is not a single estimate for the number of species that may occur in the EZI. In Jan Mayen, over 98 bird species have been recorded (Gabrielsen and Strøm, 2004); 64 seabird species are recognised as part of the Arctic ecosystem (CAFF, 2017); and approximately 60 seabird species have been recorded in the Faroe Islands. It is clear that the EZI supports a highly diverse seabird community.

There are approximately 7.4 million breeding pairs, and 25.5 million seabirds total, in region E1 (Barrett *et al.,* 2006). Of the breeding birds, approximately 70% are auk species. The Faroe Islands, which lie adjacent to the study area, have recorded at least 21 species of seabird are reported to breed (Visit Faroe Islands, 2020). The most abundant breeding seabirds are northern fulmar *Fulmarus glacialis*, European storm-petrel *Hydrobates pelagicus*, Atlantic puffin *Fratercula arctica*, black-legged kittiwake *Rissa tridactyla*, and common guillemot *Uria aalge*. On Jan Mayen, 27 birds have been reported to breed, most of which are related to the marine environment (Gabrielsen and Strøm, 2004). The most common breeding species here are northern fulmar, black-legged kittiwake, Brünnich's guillemot *Uria lomvia*, and little auk *Alle alle*. Skov *et al*. (1995) reported that the most common seabirds during summer in the southern portion of the EZI was northern fulmar and Atlantic puffin.

Table A10.2 provides an overview of the seabird species groups that are likely to be present within the EZI, detailing example species, their distribution and feeding ecology. From the available data it is apparent that there is the potential for multiple species to be present in the EZI at all times of the year, either on a resident, breeding, wintering or migratory basis. The numbers of seabirds present will vary seasonally and also across different locations in the EZI.

Seabird species establish nests and rear chicks on land, therefore there are only a few locations in the EZI where breeding may occur. Some species breed throughout all land-based locations in the EZI and may be seen in the region most of the year-round. Other species' breeding is limited to the Arctic, in the northern part of the EZI, however these species may be seen at-sea in the southern part of the EZI during winter. Most seabird species breed on the sea cliffs, though some also use areas further inland such as heathlands (Visit Faroe Islands, 2020). The breeding season for seabird runs from May through September (Visit Faroe Islands, 2020), and so during this summer period seabirds are present in the highest numbers. During the breeding season seabirds will undertake at-sea foraging trips whilst at the colony. The distances to which they forage varies greatly between species, from 25 km for great cormorant to up to several hundreds of kilometres for northern gannet and northern fulmar (Woodward *et al.,* 2019).

The distribution of seabirds outside the breeding season is comparatively less well-known. It is hypothesised that seabird abundance in winter is linked to areas of high productivity, such as the waters southwest of Greenland, which is used by seabirds from both European and North American colonies (Boertmann *et al.,* 2004; Fredericksen *et al.,* 2012).

The SEATRACK project presents tracking data of seabirds from northwest Europe colonies during the non-breeding season (autumn through spring, August to April) from 2009-2019 (SEAPOP, 2020). Seabird distribution during the winter varies greatly depending on the species' strategy. Species including Atlantic puffin, black-legged kittiwake, common guillemot, and northern fulmar are widely distributed in the EZI during the non-breeding season. Brünnich's guillemot and little auk distribution is restricted to the northerly portion, bounded to the south by Iceland. Some species like common eider, European shag, glaucous gull herring gull remain close to their breeding colonies year-round. Lesser black-backed gull are concentrated around their breeding colonies but also have significant hotspots along southerly migration corridors to the equator.

The seabird community is diverse in form, comprising species that occupy a range of feeding niches, including surface-feeders like the gulls, sub-surface divers like auks, gannets and divers, and bottom feeders such as

sea ducks (Barrett *et al.,* 2006; CAFF, 2017). Many seabirds feed exclusively in the marine environment, however, some also opportunistically scavenge or feed off the land, such as gulls and geese.

Table A10.2 Seabird groups, representative species with likely presence in the EZI and their autecology (From: Virtual Hebrides, 2014; CAFF, 2017; Oceanwide Expeditions, 2020; RSPB, 2020; Visit Faroe Islands, 2020)

Species Group	Representative Species	Spatiotemporal Distribution In The EZI	Feeding Ecology
Gaviformes	Great northern diver *Gavia immer*, red-throated diver *G. stellata*	Summers in Scotland and Iceland, which coincides with their breeding season (April-May). Great northern diver breeds in more northerly latitudes than red-throated diver. Once summer has passed, they move to warm waters further south. During the breeding season divers occupy sheltered water bodies, whereas outside the breeding season they spend time at sea.	Undertakes dives, up to 60 m in depth (for the great northern diver), to catch fish and crustaceans.
Sea ducks	Long-tailed duck *Clangula hyemalis*, common eider *Somateria mollissima*, velvet scoter *Melanitta fusca*, red-breasted merganser *Mergus serrator*	Some species of sea duck, like common eider and red-breasted merganser, breed in the EZI. Others, like the long-tailed duck and velvet scoter, do not as they breed along Arctic coasts. Those species that breed in the EZI do not typically reside there in winter, whereas the long-tailed duck and velvet scoter can be found in Iceland and Britain in winter.	Sea ducks dive to locate prey, taking aquatic invertebrates, fish, and plant matter. The extent of their diving nature varies; the best diver is the long-tailed duck, which can dive to 60 m.
Geese	Pink-footed goose *Anser brachyrhnychus*, barnacle goose *Branta leucopsis*, brent goose *B. bernicla*	These geese species typically breed in the northern part of the EZI such as Iceland, though barnacle geese have a small breeding population in the UK (south of the EZI). They are more common in the southern part of the EZI whilst migrating and during winter.	Geese feed off the land, eating grain, winter cereals, potatoes and grass
Pelecaniformes	Great cormorant *Phalacrocorax carbo*, European shag *P. aristotelis*, northern gannet *Morus bassanus*	European shag, great cormorant and gannets have been known to breed at coastal sites in the EZI, as well as having presence in other seasons in lower numbers	Pelecaniformes are piscivores and are well-adapted to visual hunting of fish. Shags and cormorants hunt in shallower waters as they target prey at the seabed, whereas gannets hunt shoaling fish near the surface

Species Group	Representative Species	Spatiotemporal Distribution In The EZI	Feeding Ecology
Petrels	Northern fulmar *Fulmarus glacialis*, Arctic skua *Stercorarius parasiticus*, great skua *Stercorarius skua*, Manx shearwater *Puffinus puffinus*, European storm-petrel *Hydrobates pelagicus*	The skuas, Manx shearwater and European storm-petrel visit the EZI during the warmer months; they breed here in summer and can also been seen in spring and autumn. Fulmar also breed here though they can be seen year-round in the EZI	Skuas are parasitic feeders in that they steal food from other seabirds, as well as scavenging off dead animals. Fulmars are opportunistic feeders, taking fish and invertebrates but also rubbish and carrion. Manx shearwater and European storm-petrel feed on small fish and invertebrates, and offal at the surface
Gulls	Black-legged kittiwake *Rissa tridactyla*, common gull *Larus canus*, herring gull *Larus argentatus*, glaucous gull *Larus hyperboreus*, great black-backed gull *Larus marinus*, lesser black-backed gull *Larus fuscus*, ivory gull *Pagophila eburnea*, black-headed gull *Chroicocephalus ridibundus*	Most gull species can be seen year-round in the EZI, with the exception of lesser black-backed gull which is absent in winter. Many species breed in the EZI, such as black-legged kittiwake, great black-backed gull, and glaucous gull, and so are more numerous in the warmer months. Iceland gull and glaucous gull are predominantly winter visitors.	Kittiwakes are exclusive marine feeders in that they eat small fish or the remains of fish, caught at the sea surface. Other gull species will also take land-based prey, carrion and rubbish, with less importance on marine prey
Terns	Arctic tern *Sterna paradisea*, common tern *Sterna hirundo*	Arctic tern is a common breeder in the EZI, and common tern breeds in low numbers on Shetland. Both species can be found in the warmer summer months, following which they migrate south in winter	Terns predominantly get their food from marine sources, eating small fish and pelagic invertebrates. They visually scan the sea for food at or just beneath the surface
Auks	Atlantic puffin *Fratercula arctica*, little auk *Alle alle*, common guillemot *Uria aalge*, Brünnich's guillemot *Uria lomvia*, black guillemot *Cepphus grylle*, razorbill *Alca torda*	Auks are the most abundant and the most abundantly breeding seabird species group in the EZI. Outside the breeding season auks are scarcer. Some species like Brünnich's guillemot and little auk only breed in the northern region of the EZI, and winter at sea in the southern portion.	Auk species feed on fish and crustaceans. Auks are characterised by their short wings which they use to propel themselves on whilst diving for food

Marine Megafauna

A number of marine mammal species (cetaceans, including whales, dolphins and porpoises, and pinnipeds, including seals and walrus) have been recorded within the EZI. Information from several sources that report on areas overlapping the EZI have been reviewed, including OSPAR (2020) and the North Atlantic Marine Mammal Commission (NAMMCO, 2020), a body that comprises representatives from Faroe Islands, Greenland, Iceland and Norway.

Seven species of pinniped, including six species of true seal and the walrus, are found in the waters of the Arctic and the North-east Atlantic (NAMMCO, 2020; OSPAR, 2020). Of these, four species of seal and the walrus are considered to be associated with the sea ice and do not have any management areas that are within the EZI (NAMMCO, 2019), therefore these species are not considered further. The two remaining seal species, harbour seal *Phoca vitulina* and grey seal *Halichoerus grypus*, are described as coastal and are likely to be present in the EZI.

Sixteen species of cetacean, including six species of baleen whale and 10 species of toothed whale, are common permanent residents in the North Atlantic region (NAMMCO, 2020). Of these, three species are associated with the sea ice, namely bowhead whale *Balaena mysticetus*, beluga *Delphinapterus leucas*, and narwhal *Monodon monoceros*, and shall not be considered further. The remaining species have movement patterns which overlap the EZI.

Table A10.3 provides an overview of the marine mammal species that are likely to be present within the EZI, detailing their distribution and feeding ecology. From the available data it is apparent that there is the potential for multiple species to be present in the EZI at all times of the year. The numbers of marine mammal's present will vary seasonally and also across different locations in the EZI.

A survey conducted in summer 1987 and 1989 reported that the most abundant species were long-finned pilot whale *Globicephala melas*, Atlantic white-sided dolphin *Lagenorhynchus acutus*, and common dolphin *Delphinus delphis*, which accounted for 93% of the cetacean abundance observed (Skov *et al.,* 1995).

Other species of megafauna that may be present in the EZI include common sunfish *Mola mola* and basking shark *Cetorhinus maximus* (CMS, 2020; Ocean Sunfish, 2020). These species have been included as part of the megafauna because their behavioural trait, of often remaining just below the sea surface, is more similar to marine mammals than other fish species.

Table A10.3 Overview of the marine mammal species with likely presence in the EZI (Source: NatureScot, 2019; SCOS, 2019; NAMMCO, 2020; NBN Atlas, 2020)

Marine Mammal Species	Abundance	Distribution	Habitat	Key Seasons	Prey
Harbour seal *Phoca vitulina*	The combined populations in Norway, Shetland and Iceland are approximately 23,500	There are several distinct populations in the EZI; Ireland-Scotland, Faroe Islands (historical), Iceland, and West Coast Norway	Harbour seals typically remain within 50 km of their coastal haul out sites	Harbour seal breeding season across their range occurs from February to July, though breeding colonies will differ in their timing	They are generalist predator, taking predominantly small to medium sized fish including cod, herring, sandeel and flatfish
Grey seal *Halichoerus grypus*	The combined populations in Norway, Faroe Islands, Shetland and Iceland is approximately 16,500	There are 2 distinct populations in the EZI; the northeast Atlantic which occurs in the waters of Scotland, Faroe Islands and Norway; and the Icelandic population	Grey seal haul out on islands, isolated beaches or on the pack ice. From these haul out sites they undertake foraging trips which can be 1-30 days, and up to several hundred kilometres from their haul out sites	Grey seal breeding season runs from late September until February/March, with peak activity in October/November	They are generalist feeders, taking a wide variety of prey usually near the sea bottom (demersal and benthic fish)
Polar bear *Ursus maritimus*	The total population is approximately 20,000 to 25,000. Around the Arctic basin the population trend is data deficient. Iceland has 700. 5 populations are stable, 2 are increasing	They have a circumpolar distribution, living in Canada, Alaska, Greenland, the Russian Arctic, the Norwegian Arctic and on the ice,	Primary habitat is the North Polar Basin. Encompassing Arctic Ocean. Using annual sea ice fields/coverage attached to	Migratory patterns: recede northward in spring and southward in the fall due to ice coverage. Breeding can take place from late January to February, but usually from March to	Carnivorous. Primary food source is Ringed Seals *Phoca hispida*, bearded seals *Erignathus barbatus,* hooded seals

Marine Mammal Species	Abundance	Distribution	Habitat	Key Seasons	Prey
	4 are in decline and 8 are data deficient.	shelves surrounding the North Pole.	shorelines. Summer habitat is surrounding land masses. They have a very large range and have been found 100km from the coastline.	June on sea ice. April to May is peak breeding time. Implantation of fertilised eggs doesn't occur until October/November due to the females' nutrition. Female hibernation takes place from October/November until January, through March or April. Pups are born from late November/January. Peak pupping is in mid-December.	*Cystophora cristata,* Harp Seals *Pagophilus groenlandicus* (especially newborn pups) and beluga whales *Delphinapterus leucas.* Occasionally eats small mammals, birds, eggs, kelp, berries, and grass. Eating skin and blubber leaving meat for scavengers.
Blue whale *Balaenoptera musculus*	Abundance of blue whale in the North Atlantic is low, estimated to be 2,490 in the Central North Atlantic	The species is rare in the northeast Atlantic except for in the waters around Iceland. There have also been sightings around Jan Mayen. The species undertakes extensive migrations each year, and are present in North Atlantic waters during summer months only, for feeding	Generally, occur in offshore waters	Very little is known of blue whale mating and calving. Calving generally occurs in the winter, whilst the species is in warm waters	Blue whale feed almost exclusively on euphausiids (krill)

Marine Mammal Species	Abundance	Distribution	Habitat	Key Seasons	Prey
Common minke whale *Balaenoptera acutorostrata*	Minke whales in the EZI comprise the northeast Atlantic stock, which has most recently been estimated as having an abundance of approximately 90,000 individuals	The species is common in the northeast Atlantic, particularly in Icelandic waters. Like other baleen whales, common minke whale undertakes extensive migrations each year, summering in the cool North Atlantic waters that comprise their feeding areas	Generally, occur in offshore waters though occasionally recorded in productive inshore waters e.g. upwelling zones	Calving of common minke whale generally occurs in the winter, whilst the species is in warm waters	Common minke whales feed on a variety of fish and invertebrates. In Arctic waters their diet comprises mostly krill, with increasing importance of fish with distance south
Fin whale *Balaenoptera physalus*	There are two fin whale management areas within the EZI; East Iceland and Faroe Islands, and North-West Norway. These two populations comprise approximately 30,500 individuals	Fin whale is distribution through the North Atlantic with peak numbers west of Iceland. Like other baleen whales, fin whale undertakes extensive migrations each year, summering in the cool North Atlantic waters that comprise their feeding areas	Fin whales are largely pelagic, but may occasionally be seen in coastal waters	Mating and calving occur in the warm breeding grounds during winter	Fin whale feed on euphausiids (krill) and small pelagic fish
Humpback whale *Megaptera novaeangliae*	There are two discrete humpback whale areas in the EZI; the Iceland/Faroes, and Norway. Abundance in these two areas is	Humpback whales in the northeast Atlantic are most common in Icelandic waters, with fewer sightings in offshore areas. Most	Humpback whales are largely pelagic, though during the feeding season they occur in highly	Mating and calving occur in the warm breeding grounds during winter	Feed mainly on euphausiids (krill) and small schooling fish

Marine Mammal Species	Abundance	Distribution	Habitat	Key Seasons	Prey
	estimated at 20,500 individuals	humpback whales undertake extensive migrations each year, though some remain in the cool waters of the North Atlantic year-round	productive upwelling zones		
Sei whale *Balaenoptera borealis*	The most recent surveys indicate an abundance of ~4,000 animals in the Central North Atlantic and European Atlantic	Sei whale distribution is poorly understood due to their offshore nature. Most sightings in summer are between Greenland and Iceland, with some in the Faroe-Shetland Channel. Scarce in UK and Norwegian waters	Sei whale prefers offshore and warmer waters than other baleen whales. They are often associated with bathymetric features like rises, due to prey abundance	Mating and calving occur in the warm breeding grounds during winter	The diet will vary depending on what is locally available. Preferred prey includes copepods, euphausiids (krill), other crustaceans and fish
Atlantic white-sided dolphin *Lagenorhynchus acutus*	Likely to be a single stock across the North Atlantic. Most recent surveys indicate 130,000 animals in this region	In the northeast Atlantic they are found in waters between East Greenland, Iceland, UK and Norway	They are found throughout the EZI, over steep areas of the continental shelf and open oceanic waters. They have a large home range that they move throughout, following seasonal movements of their prey	Birthing occurs in the summer months, from May to August with a peak in June and July	They have a varied diet, feeding opportunistically on schooling fish and occasionally cephalopods

Marine Mammal Species	Abundance	Distribution	Habitat	Key Seasons	Prey
Common bottlenose dolphin *Tursiops truncatus*	There have been several estimates of common bottlenose dolphin abundance in the wider European Atlantic waters, ranging from 19,000-28,000	Common bottlenose are found in waters across the Atlantic Ocean, as far north as Scotland, Faroe Islands and Norway	Common bottlenose dolphin inhabits a wide range habitats, from inshore sheltered areas to open oceans	Calving occurs during the warmer months, from May to October, peaking when sea temperatures are warmest	Common bottlenose dolphin varies their diet depending on location and season. They take pelagic and demersal fish, cephalopods and crustaceans
Harbour porpoise *Phocoena phocoena*	An estimated 22,800 animals occur in the European waters north of the UK	Harbour porpoise are mostly associated with the coasts of Iceland, Norway, Faroe Islands, and the UK. They have been known to make seasonal movements depending on habitat and prey requirements	Harbour porpoise is found in coastal areas, though they may sometimes be observed over deeper waters offshore	Mating and birthing occurs in summer, from May to July	Harbour porpoise diet varies by season and location. They can take a wide variety of benthic and pelagic prey, though only take two or three species at a time
Killer whale *Orcinus orca*	Up to 14,000 killer whales are estimated to use the waters of Iceland and Norway; these likely move within the wider northeast Atlantic	In the northeast Atlantic, killer whale may be found off the coast of Shetland, Iceland, and Norway	Killer whales can be found both inshore and offshore, in association with their prey. They undertake long-distance movements throughout their range	Calving of killer whales is poorly understood, but it is thought that there is no distinct season	Killer whales are generalist feeders, taking a range of marine species, though can become specialised in local areas

Marine Mammal Species	Abundance	Distribution	Habitat	Key Seasons	Prey
Long-finned pilot whale *Globicephala melas*	The most recent survey centred around the Faroe Islands indicated a population abundance of 344,000	The species is widely distributed in the northeast Atlantic. They are frequently found in the waters around the Faroe Islands, though do not typically go further north than Iceland	The species utilises both coastal and offshore habitats. Movements coincide with movements of prey	Breeding and mating usually takes place between April and September	Diet primarily consists of schooling squid, small pelagic fish also taken
Northern bottlenose whale *Hyperoodon ampullatus*	Approximately 28,000 individuals have been estimated for the North Sea, Norwegian Sea, and the waters around Iceland and the Faroe Islands	The species only occurs in the cool, northern parts of the North Atlantic. They are regularly seen in the Norwegian Sea and off the Faroe Islands	These whales prefer deep waters seaward of the continental shelf. Migration strategies vary between individuals	The breeding of northern bottlenose whale is not well understood. Calving is thought to occur in spring to early summer	The species feeds on deep-water squid only
Risso's dolphin *Grampus griseus*	There is an estimated abundance of 11,000 individuals in the northeast Atlantic	The species prefers warmer waters of the North Atlantic, hence it is only an occasional visitor to the EZI	Risso's dolphin are primarily found over continental slope, outer shelf, and oceanic areas. They do not undertake migrations, but will move to follow prey distribution	Risso's dolphin calve year-round, with a peak in summer between March and July	Their diet comprises cephalopods, with variable importance of species dependent on location
Sperm whale *Physeter macrocephalus*	The most recent survey around Iceland/Faroes created an abundance estimate of 23,200 individuals	Sperm whales are found throughout the world's oceans, right up to the ice edge at the poles.	Sperm whales are found in the open ocean though increase in numbers around the	Sperm whales breed and calve in the summer months in tropical waters	Their diet comprises mostly deep-sea cephalopods, with

Marine Mammal Species	Abundance	Distribution	Habitat	Key Seasons	Prey
			continental shelf and seamounts. Migrations are sec-specific, with predominantly males found at higher latitudes		some fish species also taken
Striped dolphin *Stenella coeruleoalba*	In the European Atlantic waters it is estimated that there are 372,000 striped dolphin	Striped dolphin are found in warm waters; the observations in Norway, Faroe Islands and Iceland are considered extra-limital	The species' distribution is linked to prey availability	Calving of striped dolphins occurs in summer or autumn	Their diet comprises mostly oceanic pelagic fish, particularly lanternfish and cod
White-beaked dolphin *Lagenorhynchus albirostris*	In excess of 100,000 individuals are estimated to occur in the North Atlantic Ocean	White-beaked dolphin are found in the cold waters of the North Atlantic. The species is common around Iceland, Norway, and the UK	The species shows a preference for water depths <200m, though it can be found both on and off the continental shelf	Both mating and calving is thought to occur in the summer months, between June and September	The species feeds mostly on fish species, but occasionally cephalopods and crustaceans too
Beaked whales Ziphiidae	The most recent surveys indicate that at least 14,500 individuals occur in European waters (closest extent to The EZI)	Beaked whales are found in all oceans of the world, though some species have restricted distribution	Generally found in deep waters area off continental shelves, often associated with areas of steep bathymetric relief	The reproduction of beaked whales is unknown	Beaked whales take deep water species of squid a fish, which they detect using echolocation

Marine Protected Areas

The EZI supports several Marine Protected Areas (MPAs) of different designations and under different jurisdictions. There are also a range of MPAs in coastal waters of the countries in the vicinity of the EZI, such as Iceland, Greenland, and Norway. Further details on the MPAs that have direct spatial overlap with the EZI are provided in Table A10.4.

Table A10.4 Details of marine protected areas that overlap the EZI (Source: JNCC, 2020a; Scottish Natural Heritage, 2020)

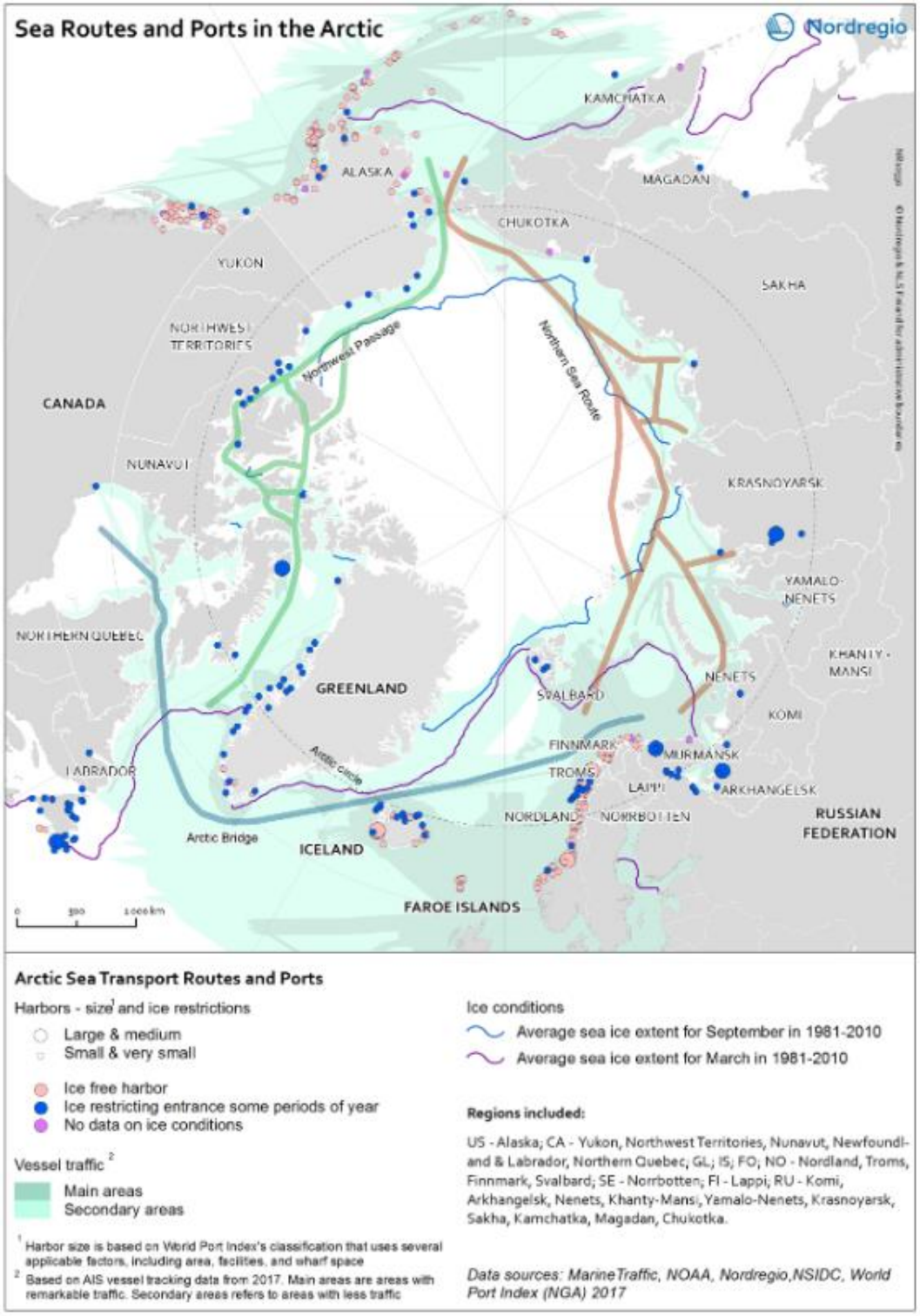
Marine Protected Area	Designated Features
Faroe-Shetland Sponge Belt Nature Conservation Marine Protected Area	Deep sea sponge aggregations Offshore subtidal sands and gravels Ocean quahog aggregations Continental slope Quaternary of Scotland - continental slope channels; iceberg ploughmark fields, prograding wedges Submarine Mass Movement - slide deposits Marine Geomorphology of the Scottish Deep Ocean Seabed - sand wave field, sediment wave field
North-east Faroe-Shetland Channel Nature Conservation Marine Protected Area	Deep sea sponge aggregations Offshore dee- sea muds Offshore subtidal sands and gravels Continental slope Quaternary of Scotland - prograding wedge; Submarine Mass Movement - slide deposits Marine Geomorphology of the Scottish Deep Ocean Seabed - contourite sand/silt Cenozoic Structures of the Atlantic Margin - mud diapirs
West Shetland Shelf Nature Conservation Marine Protected Area	Offshore subtidal sands and gravels
Hermaness, Saxa Vord and Valla Field Special Protection Area	Fulmar *Fulmarus glacialis*, breeding Gannet *Morus bassanus*, breeding Great skua *Stercorarius skua*, breeding Guillemot *Uria aalge*, breeding Kittiwake *Rissa tridactyla*, breeding Puffin *Fratercula arctica*, breeding Red-throated diver *Gavia stellata*, breeding Seabird assemblage, breeding Shag *Phalacrocorax aristotelis*, breeding
Fetlar Special Protection Area	Arctic skua *Stercorarius parasiticus*, breeding Arctic tern *Sterna paradisaea*, breeding Dunlin *Calidris alpina schinzii*, breeding Fulmar, breeding Great skua, breeding Red-necked phalarope *Phalaropus lobatus*, breeding Seabird assemblage, breeding Whimbrel *Numenius phaeopus*, breeding

Marine Protected Area	Designated Features
Fetlar to Haroldswick Nature Conservation Marine Protected Area	Black guillemot *Cepphus grylle* Circalittoral sand and coarse sediment communities Horse mussel beds Kelp and seaweed communities on sublittoral sediments Maerl beds Shallow tide-swept coarse sands with burrowing bivalves Marine Geomorphology of the Scottish Shelf Seabed
Pobie Bank Reef Special Area of Conservation	Reefs
Jan Mayen Strict Nature Reserve	The whole island and up to 12 nautical miles from the coastline

Humans/Human Activities

Shipping and Navigation

As the EZI encompasses mostly open ocean, there are very few ports in the EZI itself. Ports are present along of the coasts of adjacent countries such as Shetland, Iceland, Faroe Islands, and Norway, though these are mostly small (Figure A10.5). The majority of the EZI lies within the main area of vessel traffic in the Arctic, with the waters around Jan Mayen and Greenland form part of the secondary areas of traffic (Figure A10.5). The EZI does not overlap any of the three main Arctic Sea transport routes (Figure A10.5). As displayed for the wider region in Figure A10.6, vessel density is highest adjacent to the coasts where there are ports (Iceland, Norway, the Faroe Islands) which is mostly outside the EZI. Vessel density in the EZI can be characterised as low.



FigureA10.5 Sea routes and ports in the Arctic (From: Nordregio, 2020)

Figure A10.6 Ship traffic density in the vicinity of The EZI (From: EMODnet, 2020)

Oil and gas

Oil and gas infrastructure are present in high density in the UK Exclusive Economic Zone (EEZ) portion of the Study Area, and to a lesser extent in Norwegian waters. Many boreholes have been drilled in these areas; the majority of boreholes are located within active licence areas for hydrocarbon exploration. Installations are restricted to the west of Shetland and northeast of Shetland (in UK/Norwegian waters) and these are mostly operational with some being decommissioned (EMODnet, 2020). In the waters of Jan Mayen several deep-sea boreholes were drilled in 1974 but these have not been further exploited (Orkustofnun, 2008). Drilling campaigns have also occurred in the Faroe Islands with mixed success (Offshore Mag, 2004), and at present there are no installations.

There is significant interest by the petroleum industry in extraction of the potential hydrocarbon reserves located in The EZI, particularly in the offshore areas of the Faroe Islands, Iceland, and Norway. It is likely that hydrocarbon extraction in the area will increase in the coming years, therefore the potential risk to new developments will need to be taken into account for future launches from the SSC.

Cables and pipelines

Several subsea cables traverse the southern section of The EZI in UK and Faroese waters. These are (TeleGeography, 2020):

- FARICE-1: this cable connects Iceland, the Faroe Islands and Scotland and is owned by Icelandic company Farice. Landfall points are Dunnet Bay, Scotland, Funningsfjordur, Faroe Islands, and Seydisfjordur, Iceland;
- SHEFA-2: this cable connects the Faroe Islands with Shetland and north Scotland and is operated by the Faroese company Shefa. The cable makes landfall at Torshavn, Faroe Islands, Sandwick and Maywick in Shetland, Ayre of Cara in Orkney, and Banff in Scotland. There is also a cross-cable which connects Glen Lyon and BP Clair Ridge offshore;
- CANTAT-3: this cable connects Vestmannaeyjar, Iceland, Tjornuvik, Faroe Islands, and several locations in the North Sea and Denmark. It is also operated by Shefa;
- DANICE: this cable connects Landeyjasandur, Iceland, to Denmark, and is operated by Farice.

In addition to subsea cables, oil and gas pipelines are present in the southern portion of The EZI in UK and Norwegian waters. There are four pipelines that connect the various platforms in the oil and gas fields to the west of Shetland and those to the northeast of Shetland to onshore stations on Shetland such as the Sullom Voe Terminal. There is also a network of interconnecting pipelines between the numerous platforms in the oil and gas field to the northeast of Shetland.

Military

The EZI is used for military exercises by the North Atlantic Treaty Organization (NATO) and Russia. The EZI lies within Russia's bastion defence area, an area in the Norwegian Sea in which Russia has undertaken complex military exercises, including as recent as June 2020 (The Barents Observer, 2020). The EZI is also overlapped by the NATO sea exercise areas, which has been used for large exercises such as the Trident Juncture in 2018 (DW, 2018). Military exercises occur intermittently in these areas and can comprise both marine and aviation operations. There is potential for military activity to increase in The EZI in the future with increasing accessibility to the Arctic.

Other sea users

Other sea users include marine renewables (wave, wind, and tidal), aquaculture areas, marine aggregate dredging and disposal sites, carbon capture and storage, natural gas storage and minerals evaporites areas . There appear to be three other users of the marine environment in the EZI; aquaculture, waste disposal sites and marine renewable energy. There are many aquaculture sites located on the coast of Shetland. Aquaculture is of extreme economic importance to Shetland; in conjunction with fisheries it accounts for £300 million a year of revenue (Fish Farming Expert, 2020). The two waste disposal sites, located offshore in Faroese and Norwegian waters, have been utilised for dumping munitions (EMODnet, 2020). There are two marine renewable energy installations in The EZI, at the coast of Shetland, which are Shetland Tidal Array and the NOVA 30 Demonstrator (EMODnet, 2020). Though there are no offshore wind farms within the EZI, one offshore wind farm, Hywind Tampen, is located adjacent to the southeast corner (4C Offshore, 2020). There are no marine aggregate dredging sites, carbon capture and storage, or natural gas storage and mineral evaporites areas in The EZI (EMODnet, 2020).

Socioeconomics/Tourism

Due to the offshore location of the EZI, there are minimal sources of marine tourism. Perhaps the only source is cruise liners, which may be present in The EZI whilst transiting between ports in the wider region (Marine Vessel Traffic, 2020). As passengers do not disembark in the EZI, cruise ships can be considered as part of shipping and navigation.

For further consideration of the socioeconomics and tourism of Shetland, please see Chapter 14 of this EIA Report.

Marine Archaeology

There is a paucity of readily available information on the marine archaeological features in offshore waters across several countries' jurisdiction. Information on marine archaeological data is likely held by the countries that overlap The EZI, namely Scotland, Denmark, Iceland, and Norway. The difficulty of acquiring this data has been determined to be disproportionate to the level of information required to provide a preliminary characterisation.

Information on the location of shipwrecks in Scottish waters is available to view on Marine Scotland's National Marine Plan interactive (NMPi) website. There are numerous wrecks in the Scottish extent of The EZI; to illustrate, see Figure A10.17 for the location of wrecks within 90 km of the launch site. It can be inferred from the NMPi that the number of wrecks decreases with distance from the coast and increasing water depth. The potential for maritime wrecks is greater closer to land, notably ports and historic transit passages, but there is still potential outside of this. It is understood that there were several notable battles that occurred in The EZI which may provide discrete areas where a greater number of finds would be located. Aviation and prehistory are likely to have a different spatial distribution. It is therefore logical to assume that the number of wrecks present in The EZI will be low.

There is limited palaoelandscape potential where glacial, though there may be a few discrete areas closer to land and in sheltered locations.

Commercial Fisheries

The EZI overlaps the territorial fishing waters of several countries: Scotland, Norway, Denmark (Greenland and Faroe Islands). Beyond these territorial waters fishing rights are controlled by the NEAFC.

The estimated fishing effort in The EZI is variable. Based on Figure A10.7, fishing effort in the southern portion of The EZI (between Scotland and the Faroe Islands) is high (~1.0h/km^2), and decreases with increasing distance north through The EZI. With exception of south of Faroe Islands, fishing in most countries' waters is concentrated around the coast and so has minimal effort overlap with The EZI (Kroodsma et al., 2018; ICES, 2019a; 2019b). An assessment of estimated fishing effort in the NEAFC area indicated that fishing effort in 2005 was at or below 750 signals in each 0.5° × 0.5° grid cell for the portion of the NEAFC area that overlaps The EZI (FIRMS, 2009). The gear type that corresponded to the highest amount of effort in The EZI is pelagic trawls and seines, with bottom otter trawls used in highly localised areas also (Kroodsma et al., 2018; ICES, 2019a; 2019b).

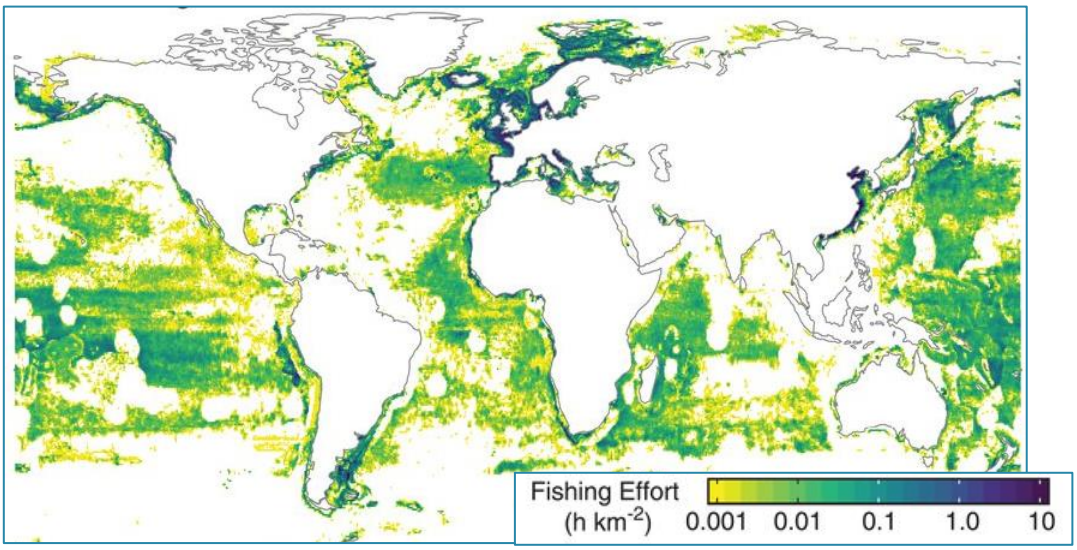


Figure A10.7: Total global fishing effort [hours fished per square kilometre (h/km^2)] in 2016 by all vessels with automatic identification system enabled (From: Kroodsma et al.*, 2018)*

The EZI overlaps the following ICES Statistical Areas: IIa (Norwegian Sea), IVa (Northern North Sea), Va (Iceland Grounds), Vb (Faroes Grounds), and XIVa (North-East Greenland) (EC, 2020). ICES report on the annual nominal catches for all ICES regions submitted by the 20 ICES member countries (ICES, 2020). Data from the period 2013-2017 has been analysed for the purposes of characterising fishing in these areas.

Across all years in the period 2013-2017, the ICES area with the highest landings was Area IIa, which averaged approximately 3 mega tonnes (Mt) live weight per year. Landings in Area IIa have increased on a near-yearly basis. Area Va has traditionally been the second most productive, though in 2017 the amount landed here was slightly lower than in Area Vb, as this area has seen a near doubling in the total live weight landed across the timeframe analysed. Area IVa has consistently reported approximately 1 Mt each year. Landings in North-East Greenland are notably lower than the other regions.

Table A10.5 Total annual catch landed in each ICES Statistical Area overlapped by The EZI

Region	2013	2014	2015	2016	2017
IIa Norwegian Sea	2,949,560	3,111,124	3,132,679	2,878,558	3,596,486
IVa Northern North Sea	872,379	1,012,761	962,860	1,013,493	997,513
Va Iceland Grounds	2,561,050	1,747,167	2,352,502	1,765,015	1,914,735
Vb Faroes Grounds	1,158,214	1,234,380	1,618,992	1,559,118	1,960,229
XIVa North-East Greenland	2,493	56,624	11,079	19,354	10,500

Through analysis of the catch data it is also possible to comment on the relative contribution of different species to the overall landings in each area (as displayed in Figure A10.8-Figure A10.12). In Area IIa, Atlantic herring, Atlantic cod and Atlantic mackerel were the three most landed species for the period 2013-2017. A total of 4.2 Mt, 4.0 Mt, and 3.8 Mt were landed of Atlantic herring, Atlantic cod, and Atlantic mackerel, respectively. Atlantic herring and Atlantic mackerel were the two most commercially important species in Area IVa, with 1.8 Mt and 1.5 Mt landed, respectively. In Area Va, the following species comprised the most live weight landed (in decreasing order): capelin, Atlantic cod, Atlantic mackerel, Atlantic herring. Blue whiting dominated the landings in with over 5.7 Mt landed, an order of magnitude greater than the next most landed species. The two major species landed in Area XIVa are Atlantic herring and capelin, though the amount landed is much smaller than in other areas. In summary, the most commercially important species across the region are Atlantic cod, Atlantic mackerel, Atlantic herring, capelin, and blue whiting.

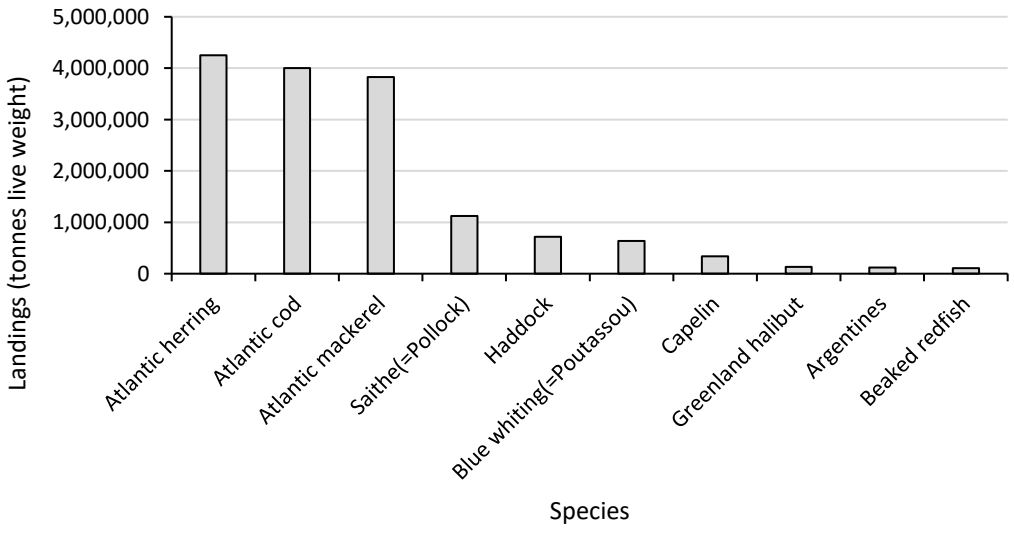


Figure A10.8 Landings weight of the top 10 species landed in Area IIa

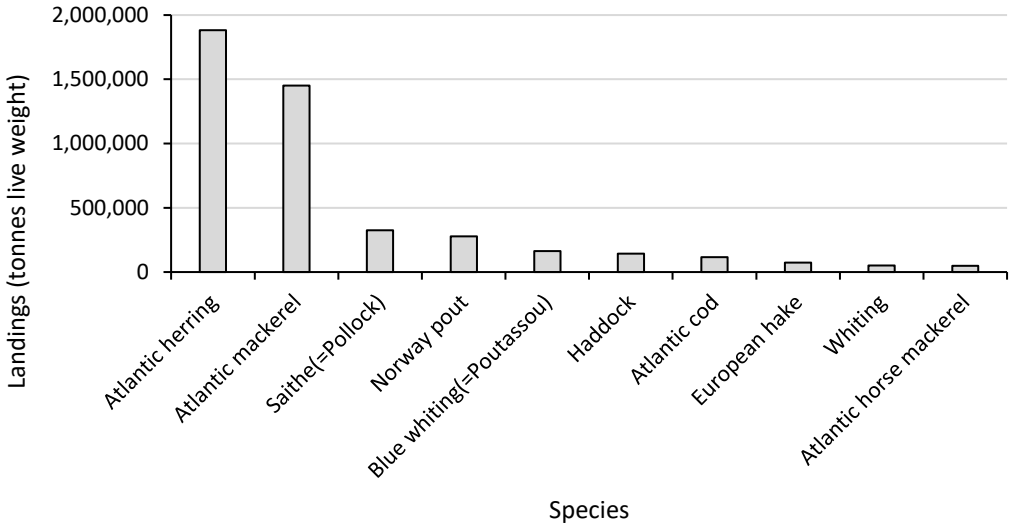


Figure A10.9 Landings weight of the top 10 species landed in Area IVa

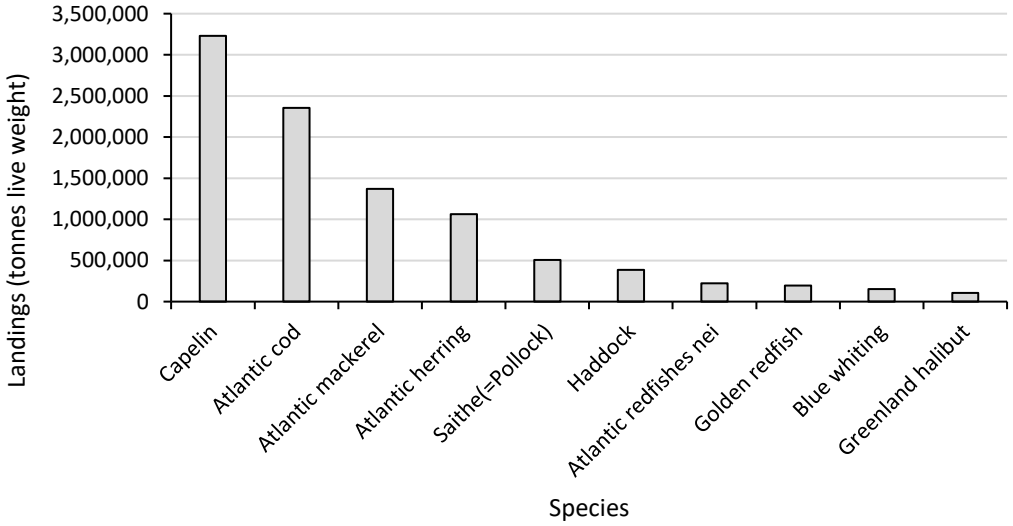


Figure A10.10 Landings weight of the top 10 species landed in Area Va

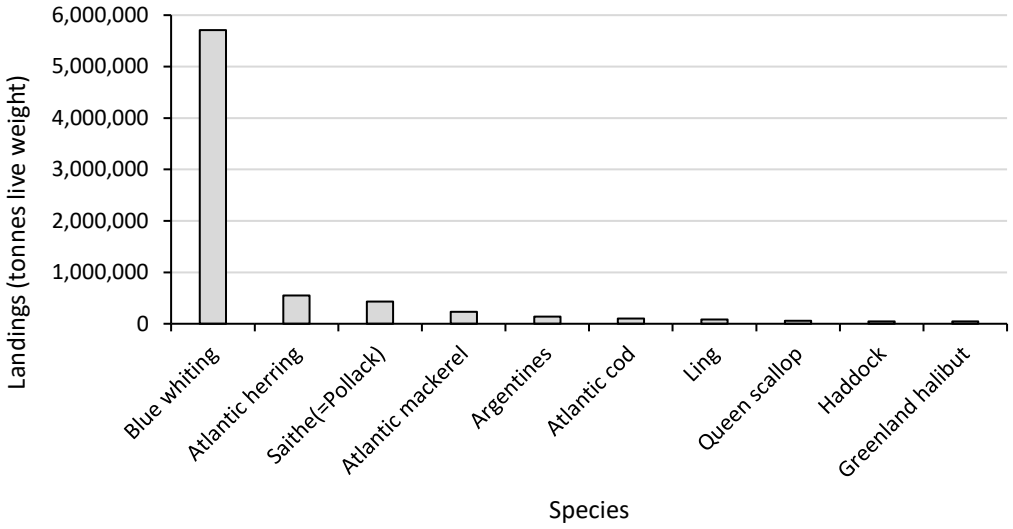
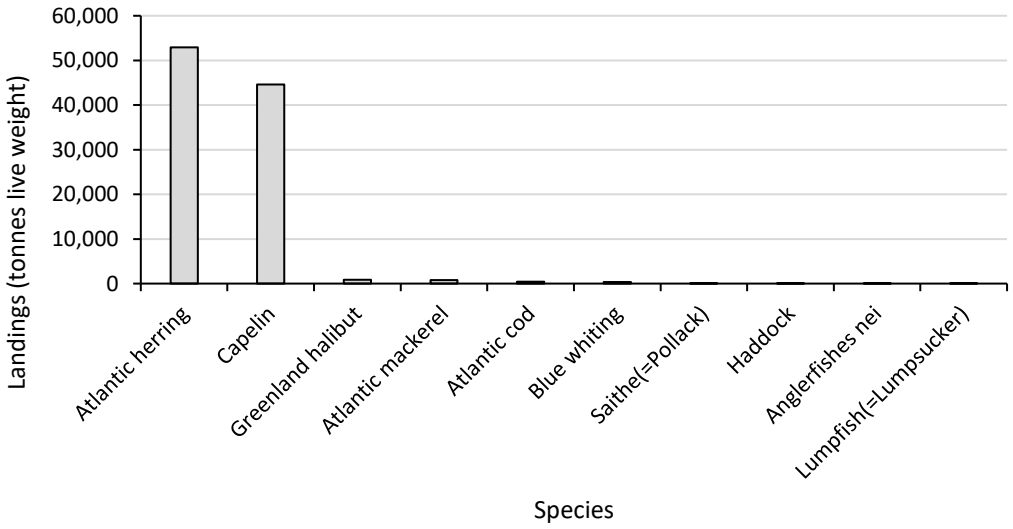


Figure A10.11 Landings weight of the top 10 species landed in Area Vb



FigureA10.12 Landings weight of the top 10 species landed in Area XIVa

Appendix 10.3 Water Quality Risk Matrix

SaxaVord AEE Report Technical Appendix 10.3 - water quality risk matrix

Receptor	**Water quality**
Pressure Pathway/Impact	**Effects from Fuel Spillage**

Sensitivity of the Receptor

Value (importance, rarity, quality) of receptor	Qualifying Statement	Consideration	Classification
0	Receptor has no measurable financial, environmental or cultural value		
1	Receptor has a low financial, environmental or cultural value		
2	Receptor has a medium financial, environmental or cultural value		
3	Receptor has a high financial, environmental or cultural value	The water quality of an area is of high environmental value and underpins the surrounding marine environment.	3

Tolerance of receptor	Qualifying Statement	Consideration	Classification
0	Receptor is entirely tolerant of the impact and will not exhibit change if exposed		
1	Receptor is very tolerant of the impact and will exhibit marginal change if exposed		
2	Receptor is slightly tolerant of the impact and will exhibit noticeable change if exposed	Sea water exposed to hydrocarbons will lead to local increases in hydrocarbon concentration which could lead to notable changes to the water's properties.	2
3	Receptor is intolerant of the impact and will exhibit substantial change if exposed		

Adaptability of receptor	Qualifying Statement	Consideration	Classification
0	Receptor is entirely adaptable and as such will be unaffected by exposure		
1	Receptor is very adaptable and as such will be marginally affected by exposure		
2	Receptor is slightly adaptable and as such will be noticeably affected by exposure	Sea water exposed to hydrocarbons will lead to local increases in hydrocarbon concentration which could affect the water's properties.	2
3	Receptor is not adaptable and as such will be substantially affected by exposure		

Recoverability of receptor	Qualifying Statement	Consideration	Classification
0	Receptor will recover entirely within short timescales (<1 year)	The source of hydrocarbons (LVs) will pass through the water column and then rest on the seabed. It is anticipated that any residual fuel will be released into the marine environment immediately upon entering it, following which it'll disperse. Given the small amount of residual fuel expected, it is anticipated that hydrocarbon levels local to the LV will reach background levesl over a short time scale.	0
1	Receptor will recover entirely within medium timescales (1-5 years)		
2	Receptor will recover entirely within long timescales (>5 years)		
3	Receptor will not entirely recover over any timescale		

Overall Sensitivity of the Receptor	**7**	**1**

Exposure of Receptor to Impact

Exposure to the impact (time)	Qualifying Statement	Consideration	Classification
0	Receptor is not exposed to impact		
1	Receptor is exposed to impact over limited periods of time		
2	Receptor is exposed to impact over considerable periods of time		
3	Receptor is exposed to impact over extensive periods of time	The water quality receptor is likely to be exposed to impacts over considerable periods of time, i.e. the duration of the 30 year licence.	3

Exposure to the impact (frequency)	Qualifying Statement	Consideration	Classification
0	Receptor is very infrequently exposed to impact over limited periods of time (<1 event per month for the duration of the licence)	There is expected to be up to a maximum of 30 launches per year. However, the occurrence of residual fuel is anticipated to be rare as under normal circumstances all fuel it utilised during the launch.	0
1	Receptor is infrequently exposed to impact over limited periods of time (1-5 events per month for the duration of the licence)		
2	Receptor is frequently exposed to impact over considerable periods of time (5-15 events per month for the duration of the licence)		
3	Receptor is constantly exposed to impact over considerable periods of time (>15 events per month for the duration of the licence)		

Exposure to the impact (space)	Qualifying Statement	Consideration	Classification
0	Receptor is not exposed to impact		
1	Receptor is exposed to impact over limited spatial scales	Due to the highly limited impact zone at the waters surface as a result of hydrocarbon spill (<0.5 km^2), impacts will be low.	1
2	Receptor is exposed to impact over considerable spatial scales		
3	Receptor is exposed to impact over extensive and unconfined spatial scales		

Overall Exposure of Receptor to Impact	**4**	**1**

Magnitude of Impact

Magnitude of the impact (in the context of natural variability)	Qualifying Statement	Consideration	Classification
0	Impact is not measurable above natural variability		
1	Impact is measurable above natural variability (0-5% change in contaminant concentration)	Direct impacts to the hydrocarbon concentration of the sea water is likely to be measureable above natural variability, as there are limited other sources of hydrocarbons in the marine environment.	1
2	Impact is measurable above natural variability (6-10% change in contaminant concentration)		
3	Impact is measurable above natural variability (>10% change in contaminant concentration)		

Magnitude of the impact (in the context of environmental baseline conditions)	Qualifying Statement	Consideration	Classification
0	Impact is not measurable above present baseline conditions		
1	Impact is measurable above present baseline conditions (0-5% change in contaminant concentration)	Direct impacts to the hydrocarbon concentration of the sea water is likely to slightly detectable above the baseline (at a very localised scale), as there are limited other sources of hydrocarbons in the marine environment.	1
2	Impact is measurable above present baseline conditions (6-10% change in contaminant concentration)		
3	Impact is measurable above present baseline conditions (>10% change in contaminant concentration)		

Overall Magnitude of Impact	**2**	**1**

Overall Risk (sensitivity x exposure x magnitude)	**Low**	**1**

Receptor	**Water quality**
Pressure Pathway/Impact	**Effects from Metal Corrosion**

Sensitivity of the Receptor

Value (importance, rarity, quality) of receptor	Qualifying Statement	Consideration	Classification
0	Receptor has no measurable financial, environmental or cultural value		
1	Receptor has a low financial, environmental or cultural value		
2	Receptor has a medium financial, environmental or cultural value		
3	Receptor has a high financial, environmental or cultural value	The water quality of an area is of high environmental value and underpins the surrounding marine environment.	3

Tolerance of receptor	Qualifying Statement	Consideration	Classification
0	Receptor is entirely tolerant of the impact and will not exhibit change if exposed		
1	Receptor is very tolerant of the impact and will exhibit marginal change if exposed		
2	Receptor is slightly tolerant of the impact and will exhibit noticeable change if exposed	Sea water exposed to metal corrosion will lead to local increases in metal concentration which could lead to notable changes to the water's properties.	2
3	Receptor is intolerant of the impact and will exhibit substantial change if exposed		

Adaptability of receptor	Qualifying Statement	Consideration	Classification
0	Receptor is entirely adaptable and as such will be unaffected by exposure		
1	Receptor is very adaptable and as such will be marginally affected by exposure		
2	Receptor is slightly adaptable and as such will be noticeably affected by exposure	Sea water exposed to metal corrosion will lead to local increases in metal concentration which could affect the water's properties.	2
3	Receptor is not adaptable and as such will be substantially affected by exposure		

Recoverability of receptor	Qualifying Statement	Consideration	Classification
0	Receptor will recover entirely within short timescales (<1 year)		
1	Receptor will recover entirely within medium timescales (1-5 years)		
2	Receptor will recover entirely within long timescales (>5 years)	The source of metals (LVs) will pass through the water column and then rest on the seabed. Metal corrision could happen throughout this passage, though it is anticipated to be highest at the seabed due to longevity in this environment. The LV has only small amounts of metals, predominantly aluminium, which is one of the least corrosive in the marine environment. Given the longevity of aluminium in the marine environment, water quality will recover over a long time scale.	2
3	Receptor will not entirely recover over any timescale		

Overall Sensitivity of the Receptor	**9**	**2**

Exposure of Receptor to Impact

Exposure to the impact (time)	Qualifying Statement	Consideration	Classification
0	Receptor is not exposed to impact		
1	Receptor is exposed to impact over limited periods of time		
2	Receptor is exposed to impact over considerable periods of time		
3	Receptor is exposed to impact over extensive periods of time	The water quality receptor is likely to be exposed to impacts over considerable periods of time, i.e. the duration of the 30 year licence.	3

Exposure to the impact (frequency)	Qualifying Statement	Consideration	Classification
0	Receptor is very infrequently exposed to impact over limited periods of time (<1 event per month for the duration of the licence)		
1	Receptor is infrequently exposed to impact over limited periods of time (1-5 events per month for the duration of the licence)	There is expected to be up to 10 launches per year in the initial years, rising to a maximum of 30 launches per year.	1
2	Receptor is frequently exposed to impact over considerable periods of time (5-15 events per month for the duration of the licence)		
3	Receptor is constantly exposed to impact over considerable periods of time (>15 events per month for the duration of the licence)		

Exposure to the impact (space)	Qualifying Statement	Consideration	Classification
0	Receptor is not exposed to impact		
1	Receptor is exposed to impact over limited spatial scales	Due to the highly limited impact zone around LVs as they pass through the water column and rest at the seabed, impacts will be low.	1
2	Receptor is exposed to impact over considerable spatial scales		
3	Receptor is exposed to impact over extensive and unconfined spatial scales		

Overall Exposure of Receptor to Impact	5	2

Magnitude of Impact

Magnitude of the impact (in the context of natural variability)	Qualifying Statement	Consideration	Classification
0	Impact is not measurable above natural variability		
1	Impact is measurable above natural variability (0-5% change in contaminant concentration)	Direct impacts to the metal concentration of the sea water is likely to be measureable above natural variability. Aluminium is the main metal which is occurs naturally in the marine environment but in low concentration.	1
2	Impact is measurable above natural variability (6-10% change in contaminant concentration)		
3	Impact is measurable above natural variability (>10% change in contaminant concentration)		

Magnitude of the impact (in the context of environmental baseline conditions)	Qualifying Statement	Consideration	Classification
0	Impact is not measurable above present baseline conditions		0
1	Impact is measurable above present baseline conditions (0-5% change in contaminant concentration)	Direct impacts to the metal concentration of the sea water is likely to be measureable above the baseline. Aluminium is the main metal which is occurs naturally in the marine environment but in low concentration.	
2	Impact is measurable above present baseline conditions (6-10% change in contaminant concentration)		
3	Impact is measurable above present baseline conditions (>10% change in contaminant concentration)		

Overall Magnitude of Impact	1	1

Overall Risk (sensitivity x exposure x magnitude)	Low	4

Receptor	Water quality
Pressure Pathway/Impact	Effects from Microplastics and Debris

Sensitivity of the Receptor

Value (importance, rarity, quality) of receptor	Qualifying Statement	Consideration	Classification
0	Receptor has no measurable financial, environmental or cultural value		
1	Receptor has a low financial, environmental or cultural value		
2	Receptor has a medium financial, environmental or cultural value		
3	Receptor has a high financial, environmental or cultural value	The water quality of an area is of high environmental value and underpins the surrounding marine environment.	3

Tolerance of receptor	Qualifying Statement	Consideration	Classification
0	Receptor is entirely tolerant of the impact and will not exhibit change if exposed		
1	Receptor is very tolerant of the impact and will exhibit marginal change if exposed		
2	Receptor is slightly tolerant of the impact and will exhibit noticeable change if exposed	Microplastic exposure will lead to local increases in microplastic concentration which could lead to notable changes to the water's properties.	2
3	Receptor is intolerant of the impact and will exhibit substantial change if exposed		

Adaptability of receptor	Qualifying Statement	Consideration	Classification
0	Receptor is entirely adaptable and as such will be unaffected by exposure		
1	Receptor is very adaptable and as such will be marginally affected by exposure		
2	Receptor is slightly adaptable and as such will be noticeably affected by exposure	Microplastic exposure will lead to local increases in microplastic concentration which could affect the water's properties.	2
3	Receptor is not adaptable and as such will be substantially affected by exposure		

Recoverability of receptor	Qualifying Statement	Consideration	Classification

0	Receptor will recover entirely within short timescales (<1 year)	The source of microplastics (LVs) will pass through the water column and then rest on the seabed. Microplastics have the potential to be released throughout this passage. Given the small amount of plastics expected, it is anticipated that microplastic levels local to the LV will reach background levesl over a short time scale.	0
1	Receptor will recover entirely within medium timescales (1-5 years)		
2	Receptor will recover entirely within long timescales (>5 years)		
3	Receptor will not entirely recover over any timescale		

Overall Sensitivity of the Receptor	**7**	**1**

Exposure of Receptor to Impact

Exposure to the impact (time)	Qualifying Statement	Consideration	Classification
0	Receptor is not exposed to impact		
1	Receptor is exposed to impact over limited periods of time		
2	Receptor is exposed to impact over considerable periods of time		
3	Receptor is exposed to impact over extensive periods of time	The water quality receptor is likely to be exposed to impacts over considerable periods of time, i.e. the duration of the 30 year licence.	3

Exposure to the impact (frequency)	Qualifying Statement	Consideration	Classification
0	Receptor is very infrequently exposed to impact over limited periods of time (<1 event per month for the duration of the licence)		
1	Receptor is infrequently exposed to impact over limited periods of time (1-5 events per month for the duration of the licence)	There is expected to be up to a maximum of 30 launches per year. It is noted that, based on our current understanding, not all of the rockets launched from the SSC site will contain plastics (so far, 1 of 3 clients' rockets has been identified as utilising plastic).	1
2	Receptor is frequently exposed to impact over considerable periods of time (5-15 events per month for the duration of the licence)		
3	Receptor is constantly exposed to impact over considerable periods of time (>15 events per month for the duration of the licence)		

Exposure to the impact (space)	Qualifying Statement	Consideration	Classification
0	Receptor is not exposed to impact		
1	Receptor is exposed to impact over limited spatial scales	Due to the limited impact zone around LVs as they sink through the water column, impacts will be low.	1
2	Receptor is exposed to impact over considerable spatial scales		
3	Receptor is exposed to impact over extensive and unconfined spatial scales		

Overall Exposure of Receptor to Impact	**5**	**2**

Magnitude of Impact

Magnitude of the impact (in the context of natural variability)	Qualifying Statement	Consideration	Classification
0	Impact is not measurable above natural variability		0
1	Impact is measurable above natural variability (0-5% change in contaminant concentration)	Direct impacts to the microplastic concentration of the sea water is likely to be slightly measureable above natural variability.	1
2	Impact is measurable above natural variability (6-10% change in contaminant concentration)		
3	Impact is measurable above natural variability (>10% change in contaminant concentration)		

Magnitude of the impact (in the context of environmental baseline conditions)	Qualifying Statement	Consideration	Classification
0	Impact is not measurable above present baseline conditions		0
1	Impact is measurable above present baseline conditions (0-5% change in contaminant concentration)	Direct impacts to the microplastic concentration of the sea water is likely to be slightly measureable above the baseline (at a highly local scale).	1
2	Impact is measurable above present baseline conditions (6-10% change in contaminant concentration)		
3	Impact is measurable above present baseline conditions (>10% change in contaminant concentration)		

Overall Magnitude of Impact	**2**	**1**

Overall Risk (sensitivity x exposure x magnitude)	**Low**	**2**

Appendix 10.4 Biodiversity Risk Matrix

SaxaVord AEE Report Technical Appendix 10.4 - biodiversity risk matrix - plankton

Receptor	**Plankton**
Pressure Pathway/Impact	**Effects from Fuel Spillage/Metal Corrosion/Debris and Microplastics**

Sensitivity of the Receptor

Value (importance, rarity, quality) of receptor	Qualifying Statement	Consideration	Classification
0	Receptor has no measurable financial, environmental or cultural value		
1	Receptor has a low financial, environmental or cultural value	Plankton themselves are not financially or cultural important, but they support other receptors that are.	1
2	Receptor has a medium financial, environmental or cultural value		
3	Receptor has a high financial, environmental or cultural value		

Tolerance of receptor	Qualifying Statement	Consideration	Classification
0	Receptor is entirely tolerant of the impact and will not exhibit change if exposed		
1	Receptor is very tolerant of the impact and will exhibit marginal change if exposed		
2	Receptor is slightly tolerant of the impact and will exhibit noticeable change if exposed		
3	Receptor is intolerant of the impact and will exhibit substantial change if exposed	The worst-case scenario of plankton being exposed to hydrocarbons could have lethal effects on individuals in the immediate vicinity of hydrocarbon spills.	3

Adaptability of receptor	Qualifying Statement	Consideration	Classification
0	Receptor is entirely adaptable and as such will be unaffected by exposure		
1	Receptor is very adaptable and as such will be marginally affected by exposure		
2	Receptor is slightly adaptable and as such will be noticeably affected by exposure		
3	Receptor is not adaptable and as such will be substantially affected by exposure	The worst-case scenario of plankton being exposed to hydrocarbons could have lethal effects on individuals in the immediate vicinity of hydrocarbon spills.	3

Recoverability of receptor	Qualifying Statement	Consideration	Classification
0	Receptor will recover entirely within short timescales (<1 year)	The source of contaminants (LVs) will pass through the water column and then rest on the seabed. Plankton will predominantly be exposed whilst the LV is in the water column. Given the high turnover of plankton in the ocean and the very small proportion of total plankton in the area predicted to be exposed, it is anticipated that plankton will recover within short timescales.	0
1	Receptor will recover entirely within medium timescales (1-5 years)		
2	Receptor will recover entirely within long timescales (>5 years)		
3	Receptor will not entirely recover over any timescale		

Overall Sensitivity of the Receptor	**7**	**2**

Exposure of Receptor to Impact

Exposure to the impact (time)	Qualifying Statement	Consideration	Classification
0	Receptor is not exposed to impact		
1	Receptor is exposed to impact over limited periods of time		
2	Receptor is exposed to impact over considerable periods of time		
3	Receptor is exposed to impact over extensive periods of time	Plankton are likely to be exposed to impacts over considerable periods of time, i.e. the duration of the 30 year licence.	3

Exposure to the impact (frequency)	Qualifying Statement	Consideration	Classification
0	Receptor is very infrequently exposed to impact over limited periods of time (<1 event per month for the duration of the licence)		
1	Receptor is infrequently exposed to impact over limited periods of time (1-5 events per month for the duration of the licence)	There is expected to be up to a maximum of 30 launches per year.	1
2	Receptor is frequently exposed to impact over considerable periods of time (5-15 events per month for the duration of the licence)		
3	Receptor is constantly exposed to impact over considerable periods of time (>15 events per month for the duration of the licence)		

Exposure to the impact (space)	Qualifying Statement	Consideration	Classification
0	Receptor is not exposed to impact		
1	Receptor is exposed to impact over limited spatial scales	Due to the highly limited impact zone around LVs as they sink through the water column, impacts will be low.	1
2	Receptor is exposed to impact over considerable spatial scales		
3	Receptor is exposed to impact over extensive and unconfined spatial scales		

Overall Exposure of Receptor to Impact	**5**	**2**

Magnitude of Impact

Magnitude of the impact (in the context of natural variability)	Qualifying Statement	Consideration	Classification
0	Impact is not measurable above natural variability		
1	Impact is measurable above natural variability (0-5% change)	Direct impacts to the contaminant levels of plankton are likely to be measureable above natural variability.	1
2	Impact is measurable above natural variability (6-10% change)		
3	Impact is measurable above natural variability (>10% change)		

Magnitude of the impact (in the context of environmental baseline conditions)	Qualifying Statement	Consideration	Classification
0	Impact is not measurable above present baseline conditions	Direct impacts to the contaminant levels of plankton are not likely to affect the plankton baseline, when taking into account the very small spatial scale of effect in the context of the entire EZI and the abundance and high turnover of plankton.	0
1	Impact is measurable above present baseline conditions (0-5% change in baseline population)		

2	Impact is measurable above present baseline conditions (6-10% change in baseline population)		
3	Impact is measurable above present baseline conditions (>10% change principle in baseline population)		

Overall Magnitude of Impact	**1**	**1**

Overall Risk (sensitivity x exposure x magnitude)	**Low**	**4**

Receptor	**Plankton**
Pressure Pathway/Impact	**Disturbance Effects from the Return of Launch Parts**

Sensitivity of the Receptor

Value (importance, rarity, quality) of receptor	Qualifying Statement	Consideration	Classification
0	Receptor has no measurable financial, environmental or cultural value		
1	Receptor has a low financial, environmental or cultural value	Plankton themselves are not financially or cultural important, but they support other receptors that are.	1
2	Receptor has a medium financial, environmental or cultural value		
3	Receptor has a high financial, environmental or cultural value		

Tolerance of receptor	Qualifying Statement	Consideration	Classification
0	Receptor is entirely tolerant of the impact and will not exhibit change if exposed		
1	Receptor is very tolerant of the impact and will exhibit marginal change if exposed		
2	Receptor is slightly tolerant of the impact and will exhibit noticeable change if exposed		
3	Receptor is intolerant of the impact and will exhibit substantial change if exposed	The worst-case scenario of plankton being exposed to the noise of impact could have lethal effects on individuals in the immediate vicinity.	3

Adaptability of receptor	Qualifying Statement	Consideration	Classification
0	Receptor is entirely adaptable and as such will be unaffected by exposure		
1	Receptor is very adaptable and as such will be marginally affected by exposure		
2	Receptor is slightly adaptable and as such will be noticeably affected by exposure		
3	Receptor is not adaptable and as such will be substantially affected by exposure	The worst-case scenario of plankton being exposed to the noise of impact could have lethal effects on individuals in the immediate vicinity.	3

Recoverability of receptor	Qualifying Statement	Consideration	Classification
0	Receptor will recover entirely within short timescales (<1 year)		
1	Receptor will recover entirely within medium timescales (1-5 years)		
2	Receptor will recover entirely within long timescales (>5 years)		
3	Receptor will not entirely recover over any timescale	The worst-case scenario of plankton being exposed to the noise of impact could have lethal effects on individuals in the immediate vicinity. At an individual level the receptor would not be able to recover from this.	3

Overall Sensitivity of the Receptor	**10**	**3**

Exposure of Receptor to Impact

Exposure to the impact (time)	Qualifying Statement	Consideration	Classification
0	Receptor is not exposed to impact		
1	Receptor is exposed to impact over limited periods of time		
2	Receptor is exposed to impact over considerable periods of time		
3	Receptor is exposed to impact over extensive periods of time	Plankton are likely to be exposed to impacts over considerable periods of time, i.e. the duration of the 30 year licence.	3

Exposure to the impact (frequency)	Qualifying Statement	Consideration	Classification
0	Receptor is very infrequently exposed to impact over limited periods of time (<1 event per month for the duration of the licence)		
1	Receptor is infrequently exposed to impact over limited periods of time (1-5 events per month for the duration of the licence)	There is expected to be up a maximum of 30 launches per year.	1
2	Receptor is frequently exposed to impact over considerable periods of time (5-15 events per month for the duration of the licence)		
3	Receptor is constantly exposed to impact over considerable periods of time (>15 events per month for the duration of the licence)		

Exposure to the impact (space)	Qualifying Statement	Consideration	Classification
0	Receptor is not exposed to impact		
1	Receptor is exposed to impact over limited spatial scales	Due to the limited impact zone around LVs as they enter the marine environment (up to 1.2 km), impacts will be low.	1
2	Receptor is exposed to impact over considerable spatial scales		
3	Receptor is exposed to impact over extensive and unconfined spatial scales		

Overall Exposure of Receptor to Impact	**5**	**2**

Magnitude of Impact

Magnitude of the impact (in the context of natural variability)	Qualifying Statement	Consideration	Classification
0	Impact is not measurable above natural variability	Direct impacts to the mortality rate of plankton will not be measureable above natural variability.	0
1	Impact is measurable above natural variability (0-5% change)		
2	Impact is measurable above natural variability (6-10% change)		
3	Impact is measurable above natural variability (>10% change)		

Magnitude of the impact (in the context of environmental baseline conditions)	Qualifying Statement	Consideration	Classification
0	Impact is not measurable above present baseline conditions	Direct impacts to the mortality rate of plankton will not cause a measurable change in the baseline.	0
1	Impact is measurable above present baseline conditions (0-5% change in baseline population)		
2	Impact is measurable above present baseline conditions (6-10% change in baseline population)		
3	Impact is measurable above present baseline conditions (>10% change principle in baseline population)		

Overall Magnitude of Impact	**0**	**0**

Overall Risk (sensitivity x exposure x magnitude)	**Low**	**0**

SaxaVord AEE Report Technical Appendix 10.4 - biodiversity risk matrix - benthics

Receptor	**Benthic Habitats**
Pressure Pathway/Impact	**Effects from Fuel Spillage/Metal Corrosion/Debris and Microplastics**

Sensitivity of the Receptor

Value (importance, rarity, quality) of receptor	Qualifying Statement	Consideration	Classification
0	Receptor has no measurable financial, environmental or cultural value		
1	Receptor has a low financial, environmental or cultural value		
2	Receptor has a medium financial, environmental or cultural value		
3	Receptor has a high financial, environmental or cultural value	The seabed habitats within the EZI are well represented in the wider region. There is likely presence of VMEs in the EZI, though these are only protected from the impacts of fishing and not other seabed impacts. There are designated benthic habitat features of MPAs in the region.	3

Tolerance of receptor	Qualifying Statement	Consideration	Classification
0	Receptor is entirely tolerant of the impact and will not exhibit change if exposed		
1	Receptor is very tolerant of the impact and will exhibit marginal change if exposed		
2	Receptor is slightly tolerant of the impact and will exhibit noticeable change if exposed	The benthic communities are likely to be sensitive to change as they have had limited exposure to anthropogenic activities and the introduction of contaminants.	2
3	Receptor is intolerant of the impact and will exhibit substantial change if exposed		

Adaptability of receptor	Qualifying Statement	Consideration	Classification
0	Receptor is entirely adaptable and as such will be unaffected by exposure		
1	Receptor is very adaptable and as such will be marginally affected by exposure		
2	Receptor is slightly adaptable and as such will be noticeably affected by exposure	Benthic habitats are adaptable to changes in contaminant levels as they can accumulate a certain level before experiencing physiological effects	2
3	Receptor is not adaptable and as such will be substantially affected by exposure		

Recoverability of receptor	Qualifying Statement	Consideration	Classification
0	Receptor will recover entirely within short timescales (<1 year)		
1	Receptor will recover entirely within medium timescales (1-5 years)		
2	Receptor will recover entirely within long timescales (>5 years)	The source of contaminants will be present for different lengths of time, the longest being the metal and associated corrosion, which will be present for extended periods. Once the source of contaminants has broken down benthic habitats will be able to fully recover. The contaminants may remain in the system of benthic species for a notable amount of time.	2
3	Receptor will not entirely recover over any timescale		

Overall Sensitivity of the Receptor	**9**	**2**

Exposure of Receptor to Impact

Exposure to the impact (time)	Qualifying Statement	Consideration	Classification
0	Receptor is not exposed to impact		
1	Receptor is exposed to impact over limited periods of time		
2	Receptor is exposed to impact over considerable periods of time		2
3	Receptor is exposed to impact over extensive periods of time	Benthic habitats are likely to be exposed to impacts over considerable periods of time, i.e. the duration of the 30 year licence.	

Exposure to the impact (frequency)	Qualifying Statement	Consideration	Classification
0	Receptor is very infrequently exposed to impact over limited periods of time (<1 event per month for the duration of the licence)		
1	Receptor is infrequently exposed to impact over limited periods of time (1-5 events per month for the duration of the licence)	There is expected to be up a maximum of 30 launches per year.	
2	Receptor is frequently exposed to impact over considerable periods of time (5-15 events per month for the duration of the licence)		2
3	Receptor is constantly exposed to impact over considerable periods of time (>15 events per month for the duration of the licence)		

Exposure to the impact (space)	Qualifying Statement	Consideration	Classification
0	Receptor is not exposed to impact		
1	Receptor is exposed to impact over limited spatial scales	Due to the highly limited impact zone around LVs at the seabed, impacts will be low.	1
2	Receptor is exposed to impact over considerable spatial scales		
3	Receptor is exposed to impact over extensive and unconfined spatial scales		

Overall Exposure of Receptor to Impact	**5**	**2**

Magnitude of Impact

Magnitude of the impact (in the context of natural variability)	Qualifying Statement	Consideration	Classification
0	Impact is not measurable above natural variability		
1	Impact is measurable above natural variability (0-5% change)	Direct impacts to the contaminant levels of benthic habitats are likely to be measureable above natural variability.	1

2	Impact is measurable above natural variability (6-10% change)		
3	Impact is measurable above natural variability (>10% change)		

Magnitude of the impact (in the context of environmental baseline conditions)	Qualifying Statement	Consideration	Classification
0	Impact is not measurable above present baseline conditions	Direct impacts to the contaminant levels of benthic habitats are not likely to affect the benthic habitat baseline, when taking into account the very small spatial scale of effect in the context of the entire EZI.	0
1	Impact is measurable above present baseline conditions (0-5% change in baseline population)		
2	Impact is measurable above present baseline conditions (6-10% change in baseline population)		
3	Impact is measurable above present baseline conditions (>10% change in baseline population)		

Overall Magnitude of Impact	**1**	**1**
Overall Risk (sensitivity x exposure x magnitude)	**Low**	**4**

Receptor	**Benthic Habitats**
Pressure Pathway/Impact	**Direct loss of seabed habitat via deposition of material on the seabed**

Sensitivity of the Receptor

Value (importance, rarity, quality) of receptor	Qualifying Statement	Consideration	Classification
0	Receptor has no measurable financial, environmental or cultural value		
1	Receptor has a low financial, environmental or cultural value		
2	Receptor has a medium financial, environmental or cultural value		
3	Receptor has a high financial, environmental or cultural value	The seabed habitats within the EZI are well represented in the wider region. There is likely presence of VMEs in the EZI, though these are only protected from the impacts of fishing and not other seabed impacts. There are designated benthic habitat features of MPAs in the region.	3

Tolerance of receptor	Qualifying Statement	Consideration	Classification
0	Receptor is entirely tolerant of the impact and will not exhibit change if exposed		
1	Receptor is very tolerant of the impact and will exhibit marginal change if exposed		
2	Receptor is slightly tolerant of the impact and will exhibit noticeable change if exposed		
3	Receptor is intolerant of the impact and will exhibit substantial change if exposed	The worst-case example of VMEs are intolerant of direction deposition of material on them and would experience substantial change.	3

Adaptability of receptor	Qualifying Statement	Consideration	Classification
0	Receptor is entirely adaptable and as such will be unaffected by exposure		
1	Receptor is very adaptable and as such will be marginally affected by exposure		
2	Receptor is slightly adaptable and as such will be noticeably affected by exposure		
3	Receptor is not adaptable and as such will be substantially affected by exposure	The worst-case example of VMEs are not adaptable to direction deposition of material on them and would be susbstantially affected.	3

Recoverability of receptor	Qualifying Statement	Consideration	Classification
0	Receptor will recover entirely within short timescales (<1 year)		
1	Receptor will recover entirely within medium timescales (1-5 years)		
2	Receptor will recover entirely within long timescales (>5 years)	The LV will likely break down in the marine environment. Once this occurs, the receptor will be able to recover i.e. recolonise that area. Given the size of the LV in comparison to the size of the habitat, only a small proportion will be affected so recolonisation from surrounding habtiats is possible.	2
3	Receptor will not entirely recover over any timescale		

Overall Sensitivity of the Receptor	**11**	**3**

Exposure of Receptor to Impact

Exposure to the impact (time)	Qualifying Statement	Consideration	Classification
0	Receptor is not exposed to impact		
1	Receptor is exposed to impact over limited periods of time		
2	Receptor is exposed to impact over considerable periods of time		
3	Receptor is exposed to impact over extensive periods of time	Benthic habitats are likely to be exposed to impacts over considerable periods of time, i.e. the duration of the 30 year licence.	3

Exposure to the impact (frequency)	Qualifying Statement	Consideration	Classification
0	Receptor is very infrequently exposed to impact over limited periods of time (<1 event per month for the duration of the licence)	There is expected to be up to a maximum of 30 launches per year. However, the likelihood of LVs repeatedly encountering an MPA with designated benthic feature or a VME is extemely low, taking into account the extent of the study area.	0
1	Receptor is infrequently exposed to impact over limited periods of time (1-5 events per month for the duration of the licence)		

2	Receptor is frequently exposed to impact over considerable periods of time (5-15 events per month for the duration of the licence)		
3	Receptor is constantly exposed to impact over considerable periods of time (>15 events per month for the duration of the licence)		

Exposure to the impact (space)	Qualifying Statement	Consideration	Classification
0	Receptor is not exposed to impact		
1	Receptor is exposed to impact over limited spatial scales	Due to the highly limited impact zone around LVs at the seabed, impacts will be low.	1
2	Receptor is exposed to impact over considerable spatial scales		
3	Receptor is exposed to impact over extensive and unconfined spatial scales		

Overall Exposure of Receptor to Impact	**4**	**1**

Magnitude of Impact

Magnitude of the impact (in the context of natural va	Qualifying Statement	Consideration	Classification
0	Impact is not measurable above natural variability		
1	Impact is measurable above natural variability (0-5% change)	Direct impacts to the benthic habitats are likely to be measureable above natural variability as there is not element of natural variability and the most sensitive habitats are long-lived.	1
2	Impact is measurable above natural variability (6-10% change)		
3	Impact is measurable above natural variability (>10% change)		

Magnitude of the impact (in the context of environm	Qualifying Statement	Consideration	Classification
0	Impact is not measurable above present baseline conditions		
1	Impact is measurable above present baseline conditions (0-5% change in baseline population)	Direct impacts to the benthic habitats are only likely to have a small effect on the baseline, when taking into account the very small spatial scale of effect in the context of the extent of benthic habitats in the EZI.	1
2	Impact is measurable above present baseline conditions (6-10% change in baseline population)		
3	Impact is measurable above present baseline conditions (>10% change in baseline population)		

Overall Magnitude of Impact	**2**	**1**

Overall Risk (sensitivity x exposure x magnitude)	**Low**	**3**

SaxaVord AEE Report Technical Appendix 10.4 - biodiversity risk matrix - fish

Receptor	**Fish**
Pressure Pathway/Impact	**Effects from Fuel Spillage/Metal Corrosion/Debris and Microplastics**

Sensitivity of the Receptor

Value (importance, rarity, quality) of receptor	Qualifying Statement	Consideration	Classification
0	Receptor has no measurable financial, environmental or cultural value		
1	Receptor has a low financial, environmental or cultural value		
2	Receptor has a medium financial, environmental or cultural value		
3	Receptor has a high financial, environmental or cultural value	The number of fish species in the study area is very high. Several of these species are commercially important.	3

Tolerance of receptor	Qualifying Statement	Consideration	Classification
0	Receptor is entirely tolerant of the impact and will not exhibit change if exposed		
1	Receptor is very tolerant of the impact and will exhibit marginal change if exposed	Fish species exposed to increased contaminants may accumulate them, though only in low amounts due to the low amounts predicted to be released and the high mobility of fish species.	1
2	Receptor is slightly tolerant of the impact and will exhibit noticeable change if exposed		
3	Receptor is intolerant of the impact and will exhibit substantial change if exposed		

Adaptability of receptor	Qualifying Statement	Consideration	Classification
0	Receptor is entirely adaptable and as such will be unaffected by exposure		
1	Receptor is very adaptable and as such will be marginally affected by exposure	Fish species that accumulate low levels of contaminants will only be marginally affected and show minimal physiological effects at worst.	1
2	Receptor is slightly adaptable and as such will be noticeably affected by exposure		
3	Receptor is not adaptable and as such will be substantially affected by exposure		

Recoverability of receptor	Qualifying Statement	Consideration	Classification
0	Receptor will recover entirely within short timescales (<1 year)	The source of contaminants (LVs) will pass through the water column and then rest on the seabed. The most persistent source of contamination is the metal and associated corrosion, which will be present for extended periods on the seabed. However, given the very small amount of exposure predicted, it is expected that fish species can recover within short timescales.	0
1	Receptor will recover entirely within medium timescales (1-5 years)		
2	Receptor will recover entirely within long timescales (>5 years)		
3	Receptor will not entirely recover over any timescale		

Overall Sensitivity of the Receptor	**5**	**1**

Exposure of Receptor to Impact

Exposure to the impact (time)	Qualifying Statement	Consideration	Classification
0	Receptor is not exposed to impact		
1	Receptor is exposed to impact over limited periods of time		
2	Receptor is exposed to impact over considerable periods of time		
3	Receptor is exposed to impact over extensive periods of time	Fish are likely to be exposed to impacts over considerable periods of time, i.e. the duration of the 30 year licence.	3

Exposure to the impact (frequency)	Qualifying Statement	Consideration	Classification
0	Receptor is very infrequently exposed to impact over limited periods of time (<1 event per month for the duration of the licence)		
1	Receptor is infrequently exposed to impact over limited periods of time (1-5 events per month for the duration of the licence)	There is expected to be a maximum of 30 launches per year.	1
2	Receptor is frequently exposed to impact over considerable periods of time (5-15 events per month for the duration of the licence)		
3	Receptor is constantly exposed to impact over considerable periods of time (>15 events per month for the duration of the licence)		

Exposure to the impact (space)	Qualifying Statement	Consideration	Classification
0	Receptor is not exposed to impact		
1	Receptor is exposed to impact over limited spatial scales	Due to the highly limited impact zone around LVs as they pass through the water column and rest at the seabed, impacts will be low.	1
2	Receptor is exposed to impact over considerable spatial scales		
3	Receptor is exposed to impact over extensive and unconfined spatial scales		

Overall Exposure of Receptor to Impact	**5**	**2**

Magnitude of Impact

Magnitude of the impact (in the context of natural variability)	Qualifying Statement	Consideration	Classification
0	Impact is not measurable above natural variability		
1	Impact is measurable above natural variability (0-5% change)	Direct impacts to the contaminant levels of fish are likely to be measureable above natural variability.	1

2	Impact is measurable above natural variability (6-10% change)		
3	Impact is measurable above natural variability (>10% change)		

Magnitude of the impact (in the context of environmental baseline conditions)	Qualifying Statement	Consideration	Classification
0	Impact is not measurable above present baseline conditions	Direct impacts to the contaminant levels of fish are not likely to affect the fish baseline, when taking into account the very small spatial scale of effect in the context of the entire EZI and the high mobility of fish.	0
1	Impact is measurable above present baseline conditions (0-5% change in baseline population)		
2	Impact is measurable above present baseline conditions (6-10% change in baseline population)		
3	Impact is measurable above present baseline conditions (>10% change in baseline population)		

Overall Magnitude of Impact	**1**	**1**

Overall Risk (sensitivity x exposure x magnitude)	**Low**	**2**

Receptor	**Fish**
Pressure Pathway/Impact	**Disturbance Effects from the Return of Launch Parts**

Sensitivity of the Receptor

Value (importance, rarity, quality) of receptor	Qualifying Statement	Consideration	Classification
0	Receptor has no measurable financial, environmental or cultural value		
1	Receptor has a low financial, environmental or cultural value		
2	Receptor has a medium financial, environmental or cultural value		
3	Receptor has a high financial, environmental or cultural value	The number of fish species in the study area is very high. Several of these species are commercially important.	3

Tolerance of receptor	Qualifying Statement	Consideration	Classification
0	Receptor is entirely tolerant of the impact and will not exhibit change if exposed		
1	Receptor is very tolerant of the impact and will exhibit marginal change if exposed		
2	Receptor is slightly tolerant of the impact and will exhibit noticeable change if exposed		
3	Receptor is intolerant of the impact and will exhibit substantial change if exposed	The worst-case scenario of fish being exposed to the noise of impact could have injury effects on individuals in the immediate vicinity, which would cause a substantial change.	3

Adaptability of receptor	Qualifying Statement	Consideration	Classification
0	Receptor is entirely adaptable and as such will be unaffected by exposure		
1	Receptor is very adaptable and as such will be marginally affected by exposure		
2	Receptor is slightly adaptable and as such will be noticeably affected by exposure		
3	Receptor is not adaptable and as such will be substantially affected by exposure	The worst-case scenario of fish being exposed to the noise of impact could have injury effect on individuals in the immediate vicinity, which would affect them substantially.	3

Recoverability of receptor	Qualifying Statement	Consideration	Classification
0	Receptor will recover entirely within short timescales (<1 year)		
1	Receptor will recover entirely within medium timescales (1-5 years)		
2	Receptor will recover entirely within long timescales (>5 years)		
3	Receptor will not entirely recover over any timescale	The worst-case scenario of fish being exposed to the noise of impact could have injury effects on individuals in the immediate vicinity. At an individual level the receptor would not be able to recover from this.	3

Overall Sensitivity of the Receptor	**12**	**3**

Exposure of Receptor to Impact

Exposure to the impact (time)	Qualifying Statement	Consideration	Classification
0	Receptor is not exposed to impact		
1	Receptor is exposed to impact over limited periods of time		
2	Receptor is exposed to impact over considerable periods of time		
3	Receptor is exposed to impact over extensive periods of time	Fish are likely to be exposed to impacts over considerable periods of time, i.e. the duration of the 30 year licence.	3

Exposure to the impact (frequency)	Qualifying Statement	Consideration	Classification
0	Receptor is very infrequently exposed to impact over limited periods of time (<1 event per month for the duration of the licence)		
1	Receptor is infrequently exposed to impact over limited periods of time (1-5 events per month for the duration of the licence)	There is expected to be up to a maximum of 30 launches per year.	1
2	Receptor is frequently exposed to impact over considerable periods of time (5-15 events per month for the duration of the licence)		

3	Receptor is constantly exposed to impact over considerable periods of time (>15 events per month for the duration of the licence)		

Exposure to the impact (space)	Qualifying Statement	Consideration	Classification
0	Receptor is not exposed to impact		
1	Receptor is exposed to impact over limited spatial scales	Due to the limited impact zone of noise and visual disturbance around the LV stages/vessel, impacts will be low.	1
2	Receptor is exposed to impact over considerable spatial scales		
3	Receptor is exposed to impact over extensive and unconfined spatial scales		

Overall Exposure of Receptor to Impact	**5**	**2**

Magnitude of Impact

Magnitude of the impact (in the context of natural variability)	Qualifying Statement	Consideration	Classification
0	Impact is not measurable above natural variability	Direct impacts to fish will not be measureable above natural variability.	0
1	Impact is measurable above natural variability (0-5% change)		
2	Impact is measurable above natural variability (6-10% change)		
3	Impact is measurable above natural variability (>10% change)		

Magnitude of the impact (in the context of environmental baseline conditions)	Qualifying Statement	Consideration	Classification
0	Impact is not measurable above present baseline conditions	Direct impacts to fish will not cause a measurable change in the baseline.	0
1	Impact is measurable above present baseline conditions (0-5% change in baseline population)		
2	Impact is measurable above present baseline conditions (6-10% change in baseline population)		
3	Impact is measurable above present baseline conditions (>10% change principle in baseline population)		

Overall Magnitude of Impact	**0**	**0**

Overall Risk (sensitivity x exposure x magnitude)	**Low**	**0**

SaxaVord AEE Report Technical Appendix 10.4 - biodiversity risk matrix - marine megafauna

Receptor	Marine Megafauna
Pressure Pathway/Impact	Effects from Fuel Spillage/Metal Corrosion/Debris and Microplastics - indirect effects to prey

Sensitivity of the Receptor

Value (importance, rarity, quality) of receptor	Qualifying Statement	Consideration	Classification
0	Receptor has no measurable financial, environmental or cultural value		
1	Receptor has a low financial, environmental or cultural value		
2	Receptor has a medium financial, environmental or cultural value		
3	Receptor has a high financial, environmental or cultural value	Marine megafauna have a high cultural value and many species are protected by international law. The Arctic Region region is likely to have presence of marine megafauna, though it is not considered a special habitat. There are not anticipated to be any calving or nursery grounds for cetaceans due to the latitude. There is the presence of pupping areas for pinnipeds, but only on land.	3

Tolerance of receptor	Qualifying Statement	Consideration	Classification
0	Receptor is entirely tolerant of the impact and will not exhibit change if exposed		
1	Receptor is very tolerant of the impact and will exhibit marginal change if exposed	Marine megafauna are very tolerant of impacts as they range over a wide area and alternative feeding areas are available to them.	1
2	Receptor is slightly tolerant of the impact and will exhibit noticeable change if exposed		
3	Receptor is intolerant of the impact and will exhibit substantial change if exposed		

Adaptability of receptor	Qualifying Statement	Consideration	Classification
0	Receptor is entirely adaptable and as such will be unaffected by exposure		
1	Receptor is very adaptable and as such will be marginally affected by exposure	Marine megafauna are considered very adaptable by virtue of their considerable mobility and ability to forage over wide ranges.	1
2	Receptor is slightly adaptable and as such will be noticeably affected by exposure		
3	Receptor is not adaptable and as such will be substantially affected by exposure		

Recoverability of receptor	Qualifying Statement	Consideration	Classification
0	Receptor will recover entirely within short timescales (<1 year)	Species that target that area would be able to return as soon as the LV had passed through the water column (predicted to be <1 year)	0
1	Receptor will recover entirely within medium timescales (1-5 years)		
2	Receptor will recover entirely within long timescales (>5 years)		
3	Receptor will not entirely recover over any timescale		

Overall Sensitivity of the Receptor	**5**	**1**

Exposure of Receptor to Impact

Exposure to the impact (time)	Qualifying Statement	Consideration	Classification
0	Receptor is not exposed to impact		
1	Receptor is exposed to impact over limited periods of time		
2	Receptor is exposed to impact over considerable periods of time		
3	Receptor is exposed to impact over extensive periods of time	Species are likely to be exposed to impacts over considerable periods of time, i.e. the duration of the 30 year licence.	3

Exposure to the impact (frequency)	Qualifying Statement	Consideration	Classification
0	Receptor is very infrequently exposed to impact over limited periods of time (<1 event per month for the duration of the licence)		
1	Receptor is infrequently exposed to impact over limited periods of time (1-5 events per month for the duration of the licence)	There is expected to be up to a maximum of 30 launches per year.	1
2	Receptor is frequently exposed to impact over considerable periods of time (5-15 events per month for the duration of the licence)		
3	Receptor is constantly exposed to impact over considerable periods of time (>15 events per month for the duration of the licence)		

Exposure to the impact (space)	Qualifying Statement	Consideration	Classification
0	Receptor is not exposed to impact		
1	Receptor is exposed to impact over limited spatial scales	Due to the limited impact zone from the returning LVs and wide foraging ranges of marine megafauna exposure to impacts will be low.	1
2	Receptor is exposed to impact over considerable spatial scales		
3	Receptor is exposed to impact over extensive and unconfined spatial scales		

Overall Exposure of Receptor to Impact	**5**	**2**

Magnitude of Impact

Magnitude of the impact (in the context of natural variability)	Qualifying Statement	Consideration	Classification
0	Impact is not measurable above natural variability	The magnitude of the impact (i.e. any changes at a population scale) will not be detectable above natural variability.	0
1	Impact is measurable above natural variability (0-5% change)		
2	Impact is measurable above natural variability (6-10% change)		
3	Impact is measurable above natural variability (>10% change)		

Magnitude of the impact (in the context of environmental baseline conditions)	Qualifying Statement	Consideration	Classification
0	Impact is not measurable above present baseline conditions	The magnitude of the impact (i.e. the amount of feeding habitat that becomes unvailable on the short timescale) will not be detectable above the baseline.	0
1	Impact is measurable above present baseline conditions (0-5% change in baseline population)		
2	Impact is measurable above present baseline conditions (6-10% change in baseline population)		
3	Impact is measurable above present baseline conditions (>10% change in baseline population)		

Overall Magnitude of Impact	**0**	**0**

Overall Risk (sensitivity x exposure x magnitude)	Negligible	**0**

Receptor	Marine Megafauna
Pressure Pathway/Impact	Direct stike causing mortality/serious injury

Sensitivity of the Receptor

Value (importance, rarity, quality) of receptor	Qualifying Statement	Consideration	Classification
0	Receptor has no measurable financial, environmental or cultural value		
1	Receptor has a low financial, environmental or cultural value		
2	Receptor has a medium financial, environmental or cultural value		
3	Receptor has a high financial, environmental or cultural value	Marine megafauna have a high cultural value and many species are protected by international law. The Arctic Region region is likely to have presence of marine megafauna, though it is not considered a special habitat. There are not anticipated to be any calving or nursery grounds for cetaceans due to the latitude. There is the presence of pupping areas for pinnipeds, but only on land.	3

Tolerance of receptor	Qualifying Statement	Consideration	Classification
0	Receptor is entirely tolerant of the impact and will not exhibit change if exposed		
1	Receptor is very tolerant of the impact and will exhibit marginal change if exposed		
2	Receptor is slightly tolerant of the impact and will exhibit noticeable change if exposed		
3	Receptor is intolerant of the impact and will exhibit substantial change if exposed	If an individual marine megafauna is struck by returning parts of the LV it will likely have lethal or serious injury consequences	3

Adaptability of receptor	Qualifying Statement	Consideration	Classification
0	Receptor is entirely adaptable and as such will be unaffected by exposure		
1	Receptor is very adaptable and as such will be marginally affected by exposure		
2	Receptor is slightly adaptable and as such will be noticeably affected by exposure		
3	Receptor is not adaptable and as such will be substantially affected by exposure	If an individual marine megafauna is struck by returning parts of the LV it will likely have lethal or serious injury consequences	3

Recoverability of receptor	Qualifying Statement	Consideration	Classification
0	Receptor will recover entirely within short timescales (<1 year)		
1	Receptor will recover entirely within medium timescales (1-5 years)		
2	Receptor will recover entirely within long timescales (>5 years)		
3	Receptor will not entirely recover over any timescale	If an individual marine megafauna is struck by returning parts of the LV it will likely have lethal or serious injury consequences which are not recoverable	3

Overall Sensitivity of the Receptor	12	3

Exposure of Receptor to Impact

Exposure to the impact (time)	Qualifying Statement	Consideration	Classification
0	Receptor is not exposed to impact		
1	Receptor is exposed to impact over limited periods of time		
2	Receptor is exposed to impact over considerable periods of time		
3	Receptor is exposed to impact over extensive periods of time	Species are likely to be exposed to impacts over considerable periods of time, i.e. the duration of the 30 year licence.	3

Exposure to the impact (frequency)	Qualifying Statement	Consideration	Classification
0	Receptor is very infrequently exposed to impact over limited periods of time (<1 event per month for the duration of the licence)	There is expected to be up to a maximum of 30 launches per year. However, the likelihood of such an event occurring is very low, a single individual will only be exposed to this impact pathway a maximum of one time during it's lifetime.	0
1	Receptor is infrequently exposed to impact over limited periods of time (1-5 events per month for the duration of the licence)		
2	Receptor is frequently exposed to impact over considerable periods of time (5-15 events per month for the duration of the licence)		
3	Receptor is constantly exposed to impact over considerable periods of time (>15 events per month for the duration of the licence)		

Exposure to the impact (space)	Qualifying Statement	Consideration	Classification
0	Receptor is not exposed to impact		
1	Receptor is exposed to impact over limited spatial scales	Due to the highly spatially limited impact zone from the returning LVs and wide foraging ranges of Marine megafauna exposure to impacts will be low.	1
2	Receptor is exposed to impact over considerable spatial scales		
3	Receptor is exposed to impact over extensive and unconfined spatial scales		

Overall Exposure of Receptor to Impact	4	1

Magnitude of Impact

Magnitude of the impact (in the context of natural variability)	Qualifying Statement	Consideration	Classification
0	Impact is not measurable above natural variability	The very low level of effects on Marine megafauna will not be measurable above natural variability.	0
1	Impact is measurable above natural variability (0-5% change)		
2	Impact is measurable above natural variability (6-10% change)		
3	Impact is measurable above natural variability (>10% change)		

Magnitude of the impact (in the context of environmental baseline conditions)	Qualifying Statement	Consideration	Classification
0	Impact is not measurable above present baseline conditions	The very low level of effects on Marine megafauna will not be measurable above the baseline.	0
1	Impact is measurable above present baseline conditions (0-5% change in baseline population)		
2	Impact is measurable above present baseline conditions (6-10% change in baseline population)		
3	Impact is measurable above present baseline conditions (>10% change in baseline population)		

Overall Magnitude of Impact	0	0

Overall Risk (sensitivity x exposure x magnitude)	Negligible	0

Receptor	**Marine Megafauna**
Pressure Pathway/Impact	**Disturbance Effects from the Return of Launch Parts**

Sensitivity of the Receptor

Value (importance, rarity, quality) of receptor	Qualifying Statement	Consideration	Classification
0	Receptor has no measurable financial, environmental or cultural value		
1	Receptor has a low financial, environmental or cultural value		
2	Receptor has a medium financial, environmental or cultural value		
3	Receptor has a high financial, environmental or cultural value	Marine megafauna have a high cultural value and many species are protected by international law. The Arctic Region region is likely to have presence of marine megafauna, though it is not considered a special habitat. There are not anticipated to be any calving or nursery grounds for cetaceans due to the latitude. There is the presence of pupping areas for pinnipeds, but only on land.	3

Tolerance of receptor	Qualifying Statement	Consideration	Classification
0	Receptor is entirely tolerant of the impact and will not exhibit change if exposed		
1	Receptor is very tolerant of the impact and will exhibit marginal change if exposed		
2	Receptor is slightly tolerant of the impact and will exhibit noticeable change if exposed		
3	Receptor is intolerant of the impact and will exhibit substantial change if exposed	The worst-case scenario of marine megafauna being exposed to the noise of impact could have injury effects on individuals in the immediate vicinity, which would cause a substantial change.	3

Adaptability of receptor	Qualifying Statement	Consideration	Classification
0	Receptor is entirely adaptable and as such will be unaffected by exposure		
1	Receptor is very adaptable and as such will be marginally affected by exposure		
2	Receptor is slightly adaptable and as such will be noticeably affected by exposure		
3	Receptor is not adaptable and as such will be substantially affected by exposure	The worst-case scenario of marine megafauna being exposed to the noise of impact could have injury effects on individuals in the immediate vicinity, which would affect them substantially.	3

Recoverability of receptor	Qualifying Statement	Consideration	Classification
0	Receptor will recover entirely within short timescales (<1 year)		
1	Receptor will recover entirely within medium timescales (1-5 years)		
2	Receptor will recover entirely within long timescales (>5 years)		
3	Receptor will not entirely recover over any timescale	The worst-case scenario of marine megafauna being exposed to the noise of impact could have injury effects on individuals in the immediate vicinity. At an individual level the receptor would not be able to recover from this.	3

Overall Sensitivity of the Receptor	**12**	**3**

Exposure of Receptor to Impact

Exposure to the impact (time)	Qualifying Statement	Consideration	Classification
0	Receptor is not exposed to impact		
1	Receptor is exposed to impact over limited periods of time		
2	Receptor is exposed to impact over considerable periods of time		
3	Receptor is exposed to impact over extensive periods of time	Marine megafauna are likely to be exposed to impacts over considerable periods of time, i.e. the duration of the 30 year licence.	3

Exposure to the impact (frequency)	Qualifying Statement	Consideration	Classification
0	Receptor is very infrequently exposed to impact over limited periods of time (<1 event per month for the duration of the licence)		
1	Receptor is infrequently exposed to impact over limited periods of time (1-5 events per month for the duration of the licence)	There is expected to be up to a maximum of 30 launches per year.	1
2	Receptor is frequently exposed to impact over considerable periods of time (5-15 events per month for the duration of the licence)		
3	Receptor is constantly exposed to impact over considerable periods of time (>15 events per month for the duration of the licence)		

Exposure to the impact (space)	Qualifying Statement	Consideration	Classification
0	Receptor is not exposed to impact		
1	Receptor is exposed to impact over limited spatial scales	Due to the limited impact zone of noise and visual disturbance around the LV stages/vessel, impacts will be low.	1
2	Receptor is exposed to impact over considerable spatial scales		
3	Receptor is exposed to impact over extensive and unconfined spatial scales		

Overall Exposure of Receptor to Impact	**5**	**2**

Magnitude of Impact

Magnitude of the impact (in the context of natural variability)	Qualifying Statement	Consideration	Classification
0	Impact is not measurable above natural variability	Direct impacts to marine megafauna will not be measureable above natural variability.	0
1	Impact is measurable above natural variability (0-5% change)		
2	Impact is measurable above natural variability (6-10% change)		
3	Impact is measurable above natural variability (>10% change)		

Magnitude of the impact (in the context of environmental baseline conditions)	Qualifying Statement	Consideration	Classification
0	Impact is not measurable above present baseline conditions	Direct impacts to marine megafauna will not cause a measurable change in the baseline.	0
1	Impact is measurable above present baseline conditions (0-5% change in baseline population)		
2	Impact is measurable above present baseline conditions (6-10% change in baseline population)		
3	Impact is measurable above present baseline conditions (>10% change principle in baseline population)		

Overall Magnitude of Impact	**0**	**0**

Overall Risk (sensitivity x exposure x magnitude)	**Low**	**0**

SaxaVord AEE Report Technical Appendix 10.4 - biodiversity risk matrix - marine ornithology

Receptor	Marine Ornithology
Pressure Pathway/Impact	Effects from Fuel Spillage/Metal Corrosion/Debris and Microplastics - indirect effects to prey

Sensitivity of the Receptor

Value (importance, rarity, quality) of receptor	Qualifying Statement	Consideration	Classification
0	Receptor has no measurable financial, environmental or cultural value		
1	Receptor has a low financial, environmental or cultural value		
2	Receptor has a medium financial, environmental or cultural value		
3	Receptor has a high financial, environmental or cultural value	Marine ornithological receptors have a high cultural value and many species are protected by international law. The Arctic Region region has notable presence of marine ornithological features, though it is not considered a special habitat. There is the presence of breeding colonies for seabirds, but only on land.	3

Tolerance of receptor	Qualifying Statement	Consideration	Classification
0	Receptor is entirely tolerant of the impact and will not exhibit change if exposed		
1	Receptor is very tolerant of the impact and will exhibit marginal change if exposed	Marine ornithological features are very tolerant of impacts as they range over a wide area and alternative feeding areas are available to them.	1
2	Receptor is slightly tolerant of the impact and will exhibit noticeable change if exposed		
3	Receptor is intolerant of the impact and will exhibit substantial change if exposed		

Adaptability of receptor	Qualifying Statement	Consideration	Classification
0	Receptor is entirely adaptable and as such will be unaffected by exposure		
1	Receptor is very adaptable and as such will be marginally affected by exposure	Marine ornithological features are considered very adaptable by virtue of their ability to forage over wide ranges and take a variety of prey.	1
2	Receptor is slightly adaptable and as such will be noticeably affected by exposure		
3	Receptor is not adaptable and as such will be substantially affected by exposure		

Recoverability of receptor	Qualifying Statement	Consideration	Classification
0	Receptor will recover entirely within short timescales (<1 year)	Species that target that area would be able to return as soon as the LV had passed through the water column (predicted to be <1 year)	0
1	Receptor will recover entirely within medium timescales (1-5 years)		
2	Receptor will recover entirely within long timescales (>5 years)		
3	Receptor will not entirely recover over any timescale		

Overall Sensitivity of the Receptor	5	1

Exposure of Receptor to Impact

Exposure to the impact (time)	Qualifying Statement	Consideration	Classification
0	Receptor is not exposed to impact		
1	Receptor is exposed to impact over limited periods of time		
2	Receptor is exposed to impact over considerable periods of time		
3	Receptor is exposed to impact over extensive periods of time	Species are likely to be exposed to impacts over considerable periods of time, i.e. the duration of the 30 year licence.	3

Exposure to the impact (frequency)	Qualifying Statement	Consideration	Classification
0	Receptor is very infrequently exposed to impact over limited periods of time (<1 event per month for the duration of the licence)		
1	Receptor is infrequently exposed to impact over limited periods of time (1-5 events per month for the duration of the licence)	There is expected to be up to a maximum of 30 launches per year.	1
2	Receptor is frequently exposed to impact over considerable periods of time (5-15 events per month for the duration of the licence)		
3	Receptor is constantly exposed to impact over considerable periods of time (>15 events per month for the duration of the licence)		

Exposure to the impact (space)	Qualifying Statement	Consideration	Classification
0	Receptor is not exposed to impact		
1	Receptor is exposed to impact over limited spatial scales	Due to the limited impact zone from the returning LVs and wide foraging ranges of seabirds exposure to impacts will be low.	1
2	Receptor is exposed to impact over considerable spatial scales		
3	Receptor is exposed to impact over extensive and unconfined spatial scales		

Overall Exposure of Receptor to Impact	5	2

Magnitude of Impact

Magnitude of the impact (in the context of natural variability)	Qualifying Statement	Consideration	Classification
0	Impact is not measurable above natural variability	The magnitude of the impact (i.e. any changes at a population scale) will not be detectable above natural variability.	0
1	Impact is measurable above natural variability (0-5% change)		
2	Impact is measurable above natural variability (6-10% change)		
3	Impact is measurable above natural variability (>10% change)		

Magnitude of the impact (in the context of environmental baseline conditions)	Qualifying Statement	Consideration	Classification
0	Impact is not measurable above present baseline conditions	The magnitude of the impact (i.e. the amount of feeding habitat that becomes unvailable on the short timescale) will not be detectable above the baseline.	0
1	Impact is measurable above present baseline conditions (0-5% change in baseline population)		
2	Impact is measurable above present baseline conditions (6-10% change in baseline population)		
3	Impact is measurable above present baseline conditions (>10% change in baseline population)		

Overall Magnitude of Impact	0	0

Overall Risk (sensitivity x exposure x magnitude)	Negligible	0

Receptor	Marine Ornithology
Pressure Pathway/Impact	Direct stike causing mortality/serious injury - whilst loafing/flying

Sensitivity of the Receptor

Value (importance, rarity, quality) of receptor	Qualifying Statement	Consideration	Classification
0	Receptor has no measurable financial, environmental or cultural value		
1	Receptor has a low financial, environmental or cultural value		
2	Receptor has a medium financial, environmental or cultural value		
3	Receptor has a high financial, environmental or cultural value	Marine ornithological receptors have a high cultural value and many species are protected by international law. The Arctic Region region has notable presence of marine ornithological features, though it is not considered a special habitat. There is the presence of breeding colonies for seabirds, but only on land.	3

Tolerance of receptor	Qualifying Statement	Consideration	Classification
0	Receptor is entirely tolerant of the impact and will not exhibit change if exposed		
1	Receptor is very tolerant of the impact and will exhibit marginal change if exposed		
2	Receptor is slightly tolerant of the impact and will exhibit noticeable change if exposed		
3	Receptor is intolerant of the impact and will exhibit substantial change if exposed	If a seabird is struck by returning parts of the LV it will likely have lethal or serious injury consequences	3

Adaptability of receptor	Qualifying Statement	Consideration	Classification
0	Receptor is entirely adaptable and as such will be unaffected by exposure		
1	Receptor is very adaptable and as such will be marginally affected by exposure		
2	Receptor is slightly adaptable and as such will be noticeably affected by exposure		
3	Receptor is not adaptable and as such will be substantially affected by exposure	If a seabird is struck by returning parts of the LV it will likely have lethal or serious injury consequences to which it cannot adapt	3

Recoverability of receptor	Qualifying Statement	Consideration	Classification
0	Receptor will recover entirely within short timescales (<1 year)		
1	Receptor will recover entirely within medium timescales (1-5 years)		
2	Receptor will recover entirely within long timescales (>5 years)		
3	Receptor will not entirely recover over any timescale	If a seabird is struck by returning parts of the LV it will likely have lethal or serious injury consequences which are not recoverable	3

Overall Sensitivity of the Receptor	12	3

Exposure of Receptor to Impact

Exposure to the impact (time)	Qualifying Statement	Consideration	Classification
0	Receptor is not exposed to impact		
1	Receptor is exposed to impact over limited periods of time		
2	Receptor is exposed to impact over considerable periods of time		
3	Receptor is exposed to impact over extensive periods of time	Species are likely to be exposed to impacts over considerable periods of time, i.e. the duration of the 30 year licence.	3

Exposure to the impact (frequency)	Qualifying Statement	Consideration	Classification
0	Receptor is very infrequently exposed to impact over limited periods of time (<1 event per month for the duration of the licence)	There is expected to be up to a maximum of 30 launches per year. However, a single individual will only be exposed to this impact pathway a maximum of one time during it's lifetime.	0
1	Receptor is infrequently exposed to impact over limited periods of time (1-5 events per month for the duration of the licence)		
2	Receptor is frequently exposed to impact over considerable periods of time (5-15 events per month for the duration of the licence)		
3	Receptor is constantly exposed to impact over considerable periods of time (>15 events per month for the duration of the licence)		

Exposure to the impact (space)	Qualifying Statement	Consideration	Classification
0	Receptor is not exposed to impact		
1	Receptor is exposed to impact over limited spatial scales	Due to the highly spatially limited impact zone from the returning LVs and wide habitat usage by seabirds exposure to impacts will be low.	1
2	Receptor is exposed to impact over considerable spatial scales		
3	Receptor is exposed to impact over extensive and unconfined spatial scales		

Overall Exposure of Receptor to Impact	4	1

Magnitude of Impact

Magnitude of the impact (in the context of natural variability)	Qualifying Statement	Consideration	Classification
0	Impact is not measurable above natural variability	The very low level of effects on seabirds will not be measurable above natural variability.	0
1	Impact is measurable above natural variability (0-5% change)		
2	Impact is measurable above natural variability (6-10% change)		
3	Impact is measurable above natural variability (>10% change)		

Magnitude of the impact (in the context of environmental baseline conditions)	Qualifying Statement	Consideration	Classification
0	Impact is not measurable above present baseline conditions	The very low level of effects on seabirds will not be measurable above the baseline.	0
1	Impact is measurable above present baseline conditions (0-5% change in baseline population)		
2	Impact is measurable above present baseline conditions (6-10% change in baseline population)		
3	Impact is measurable above present baseline conditions (>10% change in baseline population)		

Overall Magnitude of Impact	0	0

Overall Risk (sensitivity x exposure x magnitude)	Negligible	0

Receptor	**Marine Ornithology**
Pressure Pathway/Impact	**Disturbance Effects from the Return of Launch Parts**

Sensitivity of the Receptor

Value (importance, rarity, quality) of receptor	Qualifying Statement	Consideration	Classification
0	Receptor has no measurable financial, environmental or cultural value		
1	Receptor has a low financial, environmental or cultural value		
2	Receptor has a medium financial, environmental or cultural value		
3	Receptor has a high financial, environmental or cultural value	Marine ornithological receptors have a high cultural value and many species are protected by international law. The Arctic Region region has notable presence of marine ornithological features, though it is not considered a special habitat. There is the presence of breeding colonies for seabirds, but only on land.	3

Tolerance of receptor	Qualifying Statement	Consideration	Classification
0	Receptor is entirely tolerant of the impact and will not exhibit change if exposed		
1	Receptor is very tolerant of the impact and will exhibit marginal change if exposed		
2	Receptor is slightly tolerant of the impact and will exhibit noticeable change if exposed	Seabirds are predicted to be entirely tolerant of the disturbance effect from the presence of an LV and recovery vessel at the sea surface.	2
3	Receptor is intolerant of the impact and will exhibit substantial change if exposed		

Adaptability of receptor	Qualifying Statement	Consideration	Classification
0	Receptor is entirely adaptable and as such will be unaffected by exposure		
1	Receptor is very adaptable and as such will be marginally affected by exposure	Seabirds are predicted to have a high adaptability to the disturbance effect from the presence of an LV and recovery vessel at the sea surface.	1
2	Receptor is slightly adaptable and as such will be noticeably affected by exposure		
3	Receptor is not adaptable and as such will be substantially affected by exposure		

Recoverability of receptor	Qualifying Statement	Consideration	Classification
0	Receptor will recover entirely within short timescales (<1 year)	As seabirds are predicted to not be changed or affected by the disturbance effect, they will reocver instantly.	0
1	Receptor will recover entirely within medium timescales (1-5 years)		
2	Receptor will recover entirely within long timescales (>5 years)		
3	Receptor will not entirely recover over any timescale		

Overall Sensitivity of the Receptor	**6**	**2**

Exposure of Receptor to Impact

Exposure to the impact (time)	Qualifying Statement	Consideration	Classification
0	Receptor is not exposed to impact		
1	Receptor is exposed to impact over limited periods of time	Marine ornithology features are likely to be exposed to impacts over considerable periods of time, i.e. the duration of the 30 year licence, however disturbance events will only occur for a minimal period of time (up to 45 minutes per launch)	1
2	Receptor is exposed to impact over considerable periods of time		
3	Receptor is exposed to impact over extensive periods of time		

Exposure to the impact (frequency)	Qualifying Statement	Consideration	Classification
0	Receptor is very infrequently exposed to impact over limited periods of time (<1 event per month for the duration of the licence)		
1	Receptor is infrequently exposed to impact over limited periods of time (1-5 events per month for the duration of the licence)	There is expected to be up to a maximum of 30 launches per year.	1
2	Receptor is frequently exposed to impact over considerable periods of time (5-15 events per month for the duration of the licence)		
3	Receptor is constantly exposed to impact over considerable periods of time (>15 events per month for the duration of the licence)		

Exposure to the impact (space)	Qualifying Statement	Consideration	Classification
0	Receptor is not exposed to impact		
1	Receptor is exposed to impact over limited spatial scales	Due to the limited impact zone of noise and visual disturbance around the LV stages/vessel, impacts will be low.	1
2	Receptor is exposed to impact over considerable spatial scales		
3	Receptor is exposed to impact over extensive and unconfined spatial scales		

Overall Exposure of Receptor to Impact	**3**	**1**

Magnitude of Impact

Magnitude of the impact (in the context of natural variability)	Qualifying Statement	Consideration	Classification
0	Impact is not measurable above natural variability	Direct impacts to marine ornithology will not be measureable above natural variability.	0
1	Impact is measurable above natural variability (0-5% change)		
2	Impact is measurable above natural variability (6-10% change)		
3	Impact is measurable above natural variability (>10% change)		

Magnitude of the impact (in the context of environmental baseline conditions)	Qualifying Statement	Consideration	Classification
0	Impact is not measurable above present baseline conditions	Direct impacts to marine ornithology will not cause a measurable change in the baseline.	0
1	Impact is measurable above present baseline conditions (0-5% change in baseline population)		
2	Impact is measurable above present baseline conditions (6-10% change in baseline population)		
3	Impact is measurable above present baseline conditions (>10% change principle in baseline population)		

Overall Magnitude of Impact	**0**	**0**

Overall Risk (sensitivity x exposure x magnitude)	**Negligible**	**0**

SaxaVord AEE Report Technical Appendix 10.4 - biodiversity risk matrix - marine protected areas

Receptor	Marine Protected Areas	
Pressure Pathway/Impact	Effects from Fuel Spillage/Metal Corrosion/Debris and Microplastics	See the risk matrix for water quality, benthic habitats, and marine ornithology for effects to designated marine ecological and water quality features of the MPAs.

Receptor	Marine Protected Areas	
Pressure Pathway/Impact	Direct loss of seabed habitat via deposition of material on the seabed	See the risk matrix for benthics for effects to designated marine ecological and water quality features of the MPAs.

Receptor	Marine Protected Areas	
Pressure Pathway/Impact	Direct strike causing mortality/serious injury	See the risk matrix for marine ornithology for effects to designated marine ecological features of the MPAs.

Receptor	Marine Protected Areas	
Pressure Pathway/Impact	Disturbance Effects from the Return of Launch Parts	See the risk matrix for plankton, fish, marine megafauna and marine ornithology for effects to designated marine ecological features of the MPAs.

Appendix 10.5 Humans and Human Activities Risk Matrix

SSC AEE report Appendix 10.5 - humans and human activities risk matrix

Receptor	**Commercial and Recreational Fishing**
Pressure Pathway/Impact	**Displacement of fishing stock**

Sensitivity of the Receptor

Value (importance, rarity, quality) of receptor	Qualifying Statement	Consideration	Classification
0	Receptor has no measurable financial, environmental or cultural value		
1	Receptor has a low financial, environmental or cultural value		
2	Receptor has a medium financial, environmental or cultural value		
3	Receptor has a high financial, environmental or cultural value	The study area supports commercially important fisheries for several nations.	3

Tolerance of receptor	Qualifying Statement	Consideration	Classification
0	Receptor is entirely tolerant of the impact and will not exhibit change if exposed		
1	Receptor is very tolerant of the impact and will exhibit marginal change if exposed	Fishing vessels in the study areas are predominantly mobile, due to their mostly offshore location, and therefore are able to move to follow displaced fishing stocks.	1
2	Receptor is slightly tolerant of the impact and will exhibit noticeable change if exposed		
3	Receptor is intolerant of the impact and will exhibit substantial change if exposed		

Adaptability of receptor	Qualifying Statement	Consideration	Classification
0	Receptor is entirely adaptable and as such will be unaffected by exposure		
1	Receptor is very adaptable and as such will be marginally affected by exposure	Adaptability is high as most fishing vessels will be able to move to follow displaced fishing stocks.	1
2	Receptor is slightly adaptable and as such will be noticeably affected by exposure		
3	Receptor is not adaptable and as such will be substantially affected by exposure		

Recoverability of receptor	Qualifying Statement	Consideration	Classification
0	Receptor will recover entirely within short timescales (<1 year)	Fish are highly mobile and will be able to return to an area once an LV has passed, predicted to occur on the short-term scale. Fishing vessels are adaptable and would also be able to return to the area where fish were.	0
1	Receptor will recover entirely within medium timescales (1-5 years)		
2	Receptor will recover entirely within long timescales (>5 years)		
3	Receptor will not entirely recover over any timescale		

Overall Sensitivity of the Receptor	**5**	**1**

Exposure of Receptor to Impact

Exposure to the impact (time)	Qualifying Statement	Consideration	Classification
0	Receptor is not exposed to impact		
1	Receptor is exposed to impact over limited periods of time		
2	Receptor is exposed to impact over considerable periods of time	Fish are likely to be exposed to impacts over considerable periods of time, i.e. the duration of the 30 year licence. However, given the short duration of the proposed impact, the longevity of the exposure is reduced.	2
3	Receptor is exposed to impact over extensive periods of time		

Exposure to the impact (frequency)	Qualifying Statement	Consideration	Classification
0	Receptor is very infrequently exposed to impact over limited periods of time (<1 event per month for the duration of the licence)		
1	Receptor is infrequently exposed to impact over limited periods of time (1-5 events per month for the duration of the licence)	There is expected to be up to 10 launches per year in the initial years, rising to a maximum of 30 launches per year.	1
2	Receptor is frequently exposed to impact over considerable periods of time (5-15 events per month for the duration of the licence)		
3	Receptor is constantly exposed to impact over considerable periods of time (>15 events per month for the duration of the licence)		

Exposure to the impact (space)	Qualifying Statement	Consideration	Classification
0	Receptor is not exposed to impact		
1	Receptor is exposed to impact over limited spatial scales	Due to the highly limited impact zone around LVs as they pass through the water column and rest at the seabed, impacts will be low.	1
2	Receptor is exposed to impact over considerable spatial scales		
3	Receptor is exposed to impact over extensive and unconfined spatial scales		

Overall Exposure of Receptor to Impact	**4**	**1**

Magnitude of Impact

Magnitude of the impact (in the context of natural variability)	Qualifying Statement	Consideration	Classification
0	Impact is not measurable above natural variability	The displacement of fish as a result of LVs entering the marine environment will not be detectable above natural variation.	0
1	Impact is measurable above natural variability (0-5% change in fishing stock)		
2	Impact is measurable above natural variability (6-10% change in fishing stock)		
3	Impact is measurable above natural variability (>10% change in fishing stock)		

Magnitude of the impact (in the context of environmental baseline conditions)	Qualifying Statement	Consideration	Classification
0	Impact is not measurable above present baseline conditions	The fish stock baseline will not change as a result of the LVs entering the marine environment.	0
1	Impact is measurable above present baseline conditions (0-5% change in fishing stock)		
2	Impact is measurable above present baseline conditions (6-10% change in fishing stock)		
3	Impact is measurable above present baseline conditions (>10% change in fishing stock)		

Overall Magnitude of Impact	**0**	**0**

Overall Risk (sensitivity x exposure x magnitude)	**Negligible**	**0**

Receptor	Commercial and Recreational Fishing
Pressure Pathway/Impact	Vessel displacement

Sensitivity of the Receptor

Value (importance, rarity, quality) of receptor	Qualifying Statement	Consideration	Classification
0	Receptor has no measurable financial, environmental or cultural value		
1	Receptor has a low financial, environmental or cultural value		
2	Receptor has a medium financial, environmental or cultural value		
3	Receptor has a high financial, environmental or cultural value	The study area supports commercially important fisheries for several nations.	3

Tolerance of receptor	Qualifying Statement	Consideration	Classification
0	Receptor is entirely tolerant of the impact and will not exhibit change if exposed		
1	Receptor is very tolerant of the impact and will exhibit marginal change if exposed	Vessels will receive communications wrt to the location of exclusion zones around the predicting landing area of LVs. Vessels are highly mobile and will be able to move away from these locations if required. Given the highly localised nature of the impact zones in comparison to the distribution of target species, fishing vessels are considered very tolerant of the impact.	1
2	Receptor is slightly tolerant of the impact and will exhibit noticeable change if exposed		
3	Receptor is intolerant of the impact and will exhibit substantial change if exposed		

Adaptability of receptor	Qualifying Statement	Consideration	Classification
0	Receptor is entirely adaptable and as such will be unaffected by exposure		
1	Receptor is very adaptable and as such will be marginally affected by exposure	Adaptability is high as most fishing vessels will be able to move to areas outside the impact zone.	1
2	Receptor is slightly adaptable and as such will be noticeably affected by exposure		
3	Receptor is not adaptable and as such will be substantially affected by exposure		

Recoverability of receptor	Qualifying Statement	Consideration	Classification
0	Receptor will recover entirely within short timescales (<1 year)	Fishing vessels are highly mobile and will be able to return to an area once an LV has passed, predicted to occur on the short-term scale (i.e. hours).	0
1	Receptor will recover entirely within medium timescales (1-5 years)		
2	Receptor will recover entirely within long timescales (>5 years)		
3	Receptor will not entirely recover over any timescale		

Overall Sensitivity of the Receptor	5	1

Exposure of Receptor to Impact

Exposure to the impact (time)	Qualifying Statement	Consideration	Classification
0	Receptor is not exposed to impact		
1	Receptor is exposed to impact over limited periods of time		
2	Receptor is exposed to impact over considerable periods of time		
3	Receptor is exposed to impact over extensive periods of time	Fishing vessels are likely to be exposed to impacts over considerable periods of time, i.e. the duration of the 30 year licence.	3

Exposure to the impact (frequency)	Qualifying Statement	Consideration	Classification
0	Receptor is very infrequently exposed to impact over limited periods of time (<1 event per month for the duration of the licence)		
1	Receptor is infrequently exposed to impact over limited periods of time (1-5 events per month for the duration of the licence)	There is expected to be up to 10 launches per year in the initial years, rising to a maximum of 30 launches per year.	1
2	Receptor is frequently exposed to impact over considerable periods of time (5-15 events per month for the duration of the licence)		
3	Receptor is constantly exposed to impact over considerable periods of time (>15 events per month for the duration of the licence)		

Exposure to the impact (space)	Qualifying Statement	Consideration	Classification
0	Receptor is not exposed to impact		
1	Receptor is exposed to impact over limited spatial scales	Due to the small spatial extent of the impact zone around returning LVs, impacts will be low.	1
2	Receptor is exposed to impact over considerable spatial scales		
3	Receptor is exposed to impact over extensive and unconfined spatial scales		

Overall Exposure of Receptor to Impact	5	2

Magnitude of Impact

Magnitude of the impact (in the context of natural variability)	Qualifying Statement	Consideration	Classification
0	Impact is not measurable above natural variability		
1	Impact is measurable above natural variability (0-5% change in distribution of fishing vessels)	The displacement of fishing vessels as a result of LVs entering the marine environment will be slightly detectable above natural variation.	1
2	Impact is measurable above natural variability (6-10% change in distribution of fishing vessels)		
3	Impact is measurable above natural variability (>10% change in distribution of fishing vessels)		

Magnitude of the impact (in the context of environmental baseline conditions)	Qualifying Statement	Consideration	Classification
0	Impact is not measurable above present baseline conditions	The fishing vessel presence baseline will not change as a result of the exclusion zones around LVs entering the marine environment.	0
1	Impact is measurable above present baseline conditions (0-5% change in distribution of fishing vessels)		
2	Impact is measurable above present baseline conditions (6-10% change in distribution of fishing vessels)		
3	Impact is measurable above present baseline conditions (>10% change in distribution of fishing vessels)		

Overall Magnitude of Impact	1	1

Overall Risk (sensitivity x exposure x magnitude)	Low	2

SSC AEE report Appendix 10.5 - humans and human activities risk matrix

Receptor	**Human infrastructure (subsea cables/pipelines)**
Pressure Pathway/Impact	**Direct impact as a result of LVs returning**

Sensitivity of the Receptor

Value (importance, rarity, quality) of receptor	Qualifying Statement	Consideration	Classification
0	Receptor has no measurable financial, environmental or cultural value		
1	Receptor has a low financial, environmental or cultural value		
2	Receptor has a medium financial, environmental or cultural value		
3	Receptor has a high financial, environmental or cultural value	Subsea cables and pipelines are of high financial value.	3

Tolerance of receptor	Qualifying Statement	Consideration	Classification
0	Receptor is entirely tolerant of the impact and will not exhibit change if exposed		
1	Receptor is very tolerant of the impact and will exhibit marginal change if exposed		
2	Receptor is slightly tolerant of the impact and will exhibit noticeable change if exposed		
3	Receptor is intolerant of the impact and will exhibit substantial change if exposed	Subsea cables and pipelines would potentially be intolerant of the impact of an LV as it could cause significant structural damage.	3

Adaptability of receptor	Qualifying Statement	Consideration	Classification
0	Receptor is entirely adaptable and as such will be unaffected by exposure		
1	Receptor is very adaptable and as such will be marginally affected by exposure		
2	Receptor is slightly adaptable and as such will be noticeably affected by exposure		
3	Receptor is not adaptable and as such will be substantially affected by exposure	Subsea cables and pipelines would potentially be not adapble to the impact of an LV as it could cause significant structural damage.	3

Recoverability of receptor	Qualifying Statement	Consideration	Classification
0	Receptor will recover entirely within short timescales (<1 year)		
1	Receptor will recover entirely within medium timescales (1-5 years)		
2	Receptor will recover entirely within long timescales (>5 years)		
3	Receptor will not entirely recover over any timescale	Subsea cables and pipelines could potentially not recover from the impact of an LV if it caused significant structural damage.	3

Overall Sensitivity of the Receptor	**12**	3

Exposure of Receptor to Impact

Exposure to the impact (frequency)	Qualifying Statement	Consideration	Classification
0	Receptor is very infrequently exposed to impact over limited periods of time (<1 event per month for the duration of the licence)	There is expected to be up to 10 launches per year in the initial years, rising to a maximum of 30 launches per year. However, the likelihood of LVs repeatedly encountering any given human infrastructure is extemely low, taking into account the extent of the study area.	0
1	Receptor is infrequently exposed to impact over limited periods of time (1-5 events per month for the duration of the licence)		
2	Receptor is frequently exposed to impact over considerable periods of time (5-15 events per month for the duration of the licence)		
3	Receptor is constantly exposed to impact over considerable periods of time (>15 events per month for the duration of the licence)		

Exposure to the impact (space)	Qualifying Statement	Consideration	Classification
0	Receptor is not exposed to impact		
1	Receptor is exposed to impact over limited spatial scales	Due to the highly limited impact zone around LVs, impacts will be low.	1
2	Receptor is exposed to impact over considerable spatial scales		
3	Receptor is exposed to impact over extensive and unconfined spatial scales		

Overall Exposure of Receptor to Impact	**4**	**1**

Magnitude of Impact

Magnitude of the impact (in the context of natural variability)	Qualifying Statement	Consideration	Classification
0	Impact is not measurable above natural variability		N/A
1	Impact is measurable above natural variability (0-5% change in total numbers of individuals)		N/A
2	Impact is measurable above natural variability (6-10% change in total numbers of individuals)		N/A
3	Impact is measurable above natural variability (>10% change in total numbers of individuals)		N/A

Magnitude of the impact (in the context of environmental baseline conditions)	Qualifying Statement	Consideration	Classification
0	Impact is not measurable above present baseline conditions		
1	Impact is measurable above present baseline conditions (0-5% change in total undisturbed available habitat)	If the impact was to occur then the magnitude of the impact would be high. However, it is considered that the likelihood of such an impact is negligible, hence the overall magnitude has been reduced	1
2	Impact is measurable above present baseline conditions (6-10% change in total undisturbed available habitat)		
3	Impact is measurable above present baseline conditions (>10% change in total undisturbed available habitat)		

Overall Magnitude of Impact	**1**	**1**

Overall Risk (sensitivity x exposure x magnitude)	**Low**	**3**

SSC AEE report Appendix 10.5 - humans and human activities risk matrix

Receptor	**Marine and Coastal Tourism**
Pressure Pathway/Impact	**Interference/Displacement**

Sensitivity of the Receptor

Value (importance, rarity, quality) of receptor	Qualifying Statement	Consideration	Classification
0	Receptor has no measurable financial, environmental or cultural value		
1	Receptor has a low financial, environmental or cultural value		
2	Receptor has a medium financial, environmental or cultural value	The study area supports a moderate amount of tourism and recreation activitly, which are mostly concentrated at the coast.	2
3	Receptor has a high financial, environmental or cultural value		

Tolerance of receptor	Qualifying Statement	Consideration	Classification
0	Receptor is entirely tolerant of the impact and will not exhibit change if exposed		
1	Receptor is very tolerant of the impact and will exhibit marginal change if exposed	Notices will be given out prior to launches from the Shetland Space Centre, which will allow many tourism/recreational activities to temporarily alter location or pause for the duration of the launch.	1
2	Receptor is slightly tolerant of the impact and will exhibit noticeable change if exposed		
3	Receptor is intolerant of the impact and will exhibit substantial change if exposed		

Adaptability of receptor	Qualifying Statement	Consideration	Classification
0	Receptor is entirely adaptable and as such will be unaffected by exposure		
1	Receptor is very adaptable and as such will be marginally affected by exposure	Most vessels are highly mobile and will be able to adapt if required to move away, with only small vessels that are slightly less adaptable.	1
2	Receptor is slightly adaptable and as such will be noticeably affected by exposure		
3	Receptor is not adaptable and as such will be substantially affected by exposure		

Recoverability of receptor	Qualifying Statement	Consideration	Classification
0	Receptor will recover entirely within short timescales (<1 year)	All vessels are highly mobile and will be able to return to an area once an LV has passed, predicted to occur on the short-term scale (i.e. hours).	0
1	Receptor will recover entirely within medium timescales (1-5 years)		
2	Receptor will recover entirely within long timescales (>5 years)		
3	Receptor will not entirely recover over any timescale		

Overall Sensitivity of the Receptor	**4**	**1**

Exposure of Receptor to Impact

Exposure to the impact (time)	Qualifying Statement	Consideration	Classification
0	Receptor is not exposed to impact		
1	Receptor is exposed to impact over limited periods of time	Tourism activities are likely to be exposed to impacts over considerable periods of time, i.e. the duration of the 30 year licence, however only for a short period per launch (45 minutes), up to a maximum of 11.25 hours over the licence term (30 launches per year × 30 years × 0.75 hours).	1
2	Receptor is exposed to impact over considerable periods of time		
3	Receptor is exposed to impact over extensive periods of time		

Exposure to the impact (frequency)	Qualifying Statement	Consideration	Classification
0	Receptor is very infrequently exposed to impact over limited periods of time (<1 event per month for the duration of the licence)		
1	Receptor is infrequently exposed to impact over limited periods of time (1-5 events per month for the duration of the licence)	There is expected to be up to 10 launches per year in the initial years, rising to a maximum of 30 launches per year.	1
2	Receptor is frequently exposed to impact over considerable periods of time (5-15 events per month for the duration of the licence)		
3	Receptor is constantly exposed to impact over considerable periods of time (>15 events per month for the duration of the licence)		

Exposure to the impact (space)	Qualifying Statement	Consideration	Classification
0	Receptor is not exposed to impact		
1	Receptor is exposed to impact over limited spatial scales	Due to the small spatial extent of the impact zone around returning LVs and the concentration of most tourist activities around the coast, impacts will be low.	1
2	Receptor is exposed to impact over considerable spatial scales		
3	Receptor is exposed to impact over extensive and unconfined spatial scales		

Overall Exposure of Receptor to Impact	**3**	**0**

Magnitude of Impact

Magnitude of the impact (in the context of natural variability)	Qualifying Statement	Consideration	Classification
0	Impact is not measurable above natural variability	N/A	N/A
1	Impact is measurable above natural variability (0-5% change in total numbers of individuals)	N/A	N/A
2	Impact is measurable above natural variability (6-10% change in total numbers of individuals)	N/A	N/A
3	Impact is measurable above natural variability (>10% change in total numbers of individuals)	N/A	N/A

Magnitude of the impact (in the context of environmental baseline conditions)	Qualifying Statement	Consideration	Classification
0	Impact is not measurable above present baseline conditions	The current tourism baseline will not impacted by the temporary implementation of small exclusion zones.	0
1	Impact is measurable above present baseline conditions (0-5% change in total undisturbed available habitat)		
2	Impact is measurable above present baseline conditions (6-10% change in total undisturbed available habitat)		
3	Impact is measurable above present baseline conditions (>10% change in total undisturbed available habitat)		

Overall Magnitude of Impact	**0**	**0**

Overall Risk (sensitivity x exposure x magnitude)	**Negligible**	**0**

SSC AEE report Appendix 10.5 - humans and human activities risk matrix

Receptor	**Navigation and Shipping**
Pressure Pathway/Impact	**Vessel displacement**

Sensitivity of the Receptor

Value (importance, rarity, quality) of receptor	Qualifying Statement	Consideration	Classification
0	Receptor has no measurable financial, environmental or cultural value		
1	Receptor has a low financial, environmental or cultural value		
2	Receptor has a medium financial, environmental or cultural value	The study area supports a moderate density of shipping traffic, which is mostly concentrated at the coast.	2
3	Receptor has a high financial, environmental or cultural value		

Tolerance of receptor	Qualifying Statement	Consideration	Classification
0	Receptor is entirely tolerant of the impact and will not exhibit change if exposed		
1	Receptor is very tolerant of the impact and will exhibit marginal change if exposed	Vessels will receive communications wrt to the location of exclusion zones around the predicting landing area of LVs. Most vessels are highly mobile and will be able to move away from these locations if required. There are no shipping lanes from which vessels could not move.	1
2	Receptor is slightly tolerant of the impact and will exhibit noticeable change if exposed		
3	Receptor is intolerant of the impact and will exhibit substantial change if exposed		

Adaptability of receptor	Qualifying Statement	Consideration	Classification
0	Receptor is entirely adaptable and as such will be unaffected by exposure		
1	Receptor is very adaptable and as such will be marginally affected by exposure	Most vessels are highly mobile and will be able to adapt if required to move away, with only small vessels that are slightly less adaptable.	1
2	Receptor is slightly adaptable and as such will be noticeably affected by exposure		
3	Receptor is not adaptable and as such will be substantially affected by exposure		

Recoverability of receptor	Qualifying Statement	Consideration	Classification
0	Receptor will recover entirely within short timescales (<1 year)	All vessels are highly mobile and will be able to return to an area once an LV has passed, predicted to occur on the short-term scale (i.e. hours).	0
1	Receptor will recover entirely within medium timescales (1-5 years)		
2	Receptor will recover entirely within long timescales (>5 years)		
3	Receptor will not entirely recover over any timescale		

Overall Sensitivity of the Receptor	**4**	**1**

Exposure of Receptor to Impact

Exposure to the impact (time)	Qualifying Statement	Consideration	Classification
0	Receptor is not exposed to impact		
1	Receptor is exposed to impact over limited periods of time		
2	Receptor is exposed to impact over considerable periods of time		
3	Receptor is exposed to impact over extensive periods of time	Vessels are likely to be exposed to impacts over considerable periods of time, i.e. the duration of the 30 year licence.	3

Exposure to the impact (frequency)	Qualifying Statement	Consideration	Classification
0	Receptor is very infrequently exposed to impact over limited periods of time (<1 event per month for the duration of the licence)		
1	Receptor is infrequently exposed to impact over limited periods of time (1-5 events per month for the duration of the licence)	There is expected to be up to 10 launches per year in the initial years, rising to a maximum of 30 launches per year.	1
2	Receptor is frequently exposed to impact over considerable periods of time (5-15 events per month for the duration of the licence)		
3	Receptor is constantly exposed to impact over considerable periods of time (>15 events per month for the duration of the licence)		

Exposure to the impact (space)	Qualifying Statement	Consideration	Classification
0	Receptor is not exposed to impact		
1	Receptor is exposed to impact over limited spatial scales	Due to the small spatial extent of the impact zone around returning LVs, impacts will be low.	1
2	Receptor is exposed to impact over considerable spatial scales		
3	Receptor is exposed to impact over extensive and unconfined spatial scales		

Overall Exposure of Receptor to Impact	**5**	**2**

Magnitude of Impact

Magnitude of the impact (in the context of natural variability)	Qualifying Statement	Consideration	Classification
0	Impact is not measurable above natural variability	N/A	N/A
1	Impact is measurable above natural variability (0-5% change in total numbers of individuals)	N/A	N/A
2	Impact is measurable above natural variability (6-10% change in total numbers of individuals)	N/A	N/A
3	Impact is measurable above natural variability (>10% change in total numbers of individuals)	N/A	N/A

Magnitude of the impact (in the context of environmental baseline conditions)	Qualifying Statement	Consideration	Classification
0	Impact is not measurable above present baseline conditions	The current shipping baseline will not impacted by the temporary implementation of small exclusion zones.	0
1	Impact is measurable above present baseline conditions (0-5% change in total undisturbed available habitat)		
2	Impact is measurable above present baseline conditions (6-10% change in total undisturbed available habitat)		
3	Impact is measurable above present baseline conditions (>10% change in total undisturbed available habitat)		

Overall Magnitude of Impact	**0**	**0**

Overall Risk (sensitivity x exposure x magnitude)	**Negligible**	**0**

SSC AEE report Appendix 10.5 - humans and human activities risk matrix

Receptor	**Military Activities**
Pressure Pathway/Impact	**Vessel displacement**

Sensitivity of the Receptor

Value (importance, rarity, quality) of receptor	Qualifying Statement	Consideration	Classification
0	Receptor has no measurable financial, environmental or cultural value		
1	Receptor has a low financial, environmental or cultural value		
2	Receptor has a medium financial, environmental or cultural value		
3	Receptor has a high financial, environmental or cultural value	Military activities are important in terms of economics and defence. Military activities occur intermittently in the study area.	3

Tolerance of receptor	Qualifying Statement	Consideration	Classification
0	Receptor is entirely tolerant of the impact and will not exhibit change if exposed		
1	Receptor is very tolerant of the impact and will exhibit marginal change if exposed	There will be communications wrt to the location of exclusion zones around the predicting landing area of LVs. Military vessels are highly mobile and will be able to move away from these locations if required.	1
2	Receptor is slightly tolerant of the impact and will exhibit noticeable change if exposed		
3	Receptor is intolerant of the impact and will exhibit substantial change if exposed		

Adaptability of receptor	Qualifying Statement	Consideration	Classification
0	Receptor is entirely adaptable and as such will be unaffected by exposure		
1	Receptor is very adaptable and as such will be marginally affected by exposure	Military vessels are highly mobile and will be able to adapt if required to move away, with only small vessels that are slightly less adaptable.	1
2	Receptor is slightly adaptable and as such will be noticeably affected by exposure		
3	Receptor is not adaptable and as such will be substantially affected by exposure		

Recoverability of receptor	Qualifying Statement	Consideration	Classification
0	Receptor will recover entirely within short timescales (<1 year)	Military vessels are highly mobile and will be able to return to an area once an LV has passed, predicted to occur on the short-term scale (i.e. hours).	0
1	Receptor will recover entirely within medium timescales (1-5 years)		
2	Receptor will recover entirely within long timescales (>5 years)		
3	Receptor will not entirely recover over any timescale		

Overall Sensitivity of the Receptor	**5**	**1**

Exposure of Receptor to Impact

Exposure to the impact (time)	Qualifying Statement	Consideration	Classification
0	Receptor is not exposed to impact		
1	Receptor is exposed to impact over limited periods of time		
2	Receptor is exposed to impact over considerable periods of time		
3	Receptor is exposed to impact over extensive periods of time	Vessels are likely to be exposed to impacts over considerable periods of time, i.e. the duration of the 30 year licence.	3

Exposure to the impact (frequency)	Qualifying Statement	Consideration	Classification
0	Receptor is very infrequently exposed to impact over limited periods of time (<1 event per month for the duration of the licence)	There is expected to be up to 10 launches per year in the initial years, rising to a maximum of 30 launches per year. Howver, military exercises occur on an intermittent basis i.e. not every month.	0
1	Receptor is infrequently exposed to impact over limited periods of time (1-5 events per month for the duration of the licence)		
2	Receptor is frequently exposed to impact over considerable periods of time (5-15 events per month for the duration of the licence)		
3	Receptor is constantly exposed to impact over considerable periods of time (>15 events per month for the duration of the licence)		

Exposure to the impact (space)	Qualifying Statement	Consideration	Classification
0	Receptor is not exposed to impact		
1	Receptor is exposed to impact over limited spatial scales	Due to the small spatial extent of the impact zone around returning LVs, impacts will be low.	1
2	Receptor is exposed to impact over considerable spatial scales		
3	Receptor is exposed to impact over extensive and unconfined spatial scales		

Overall Exposure of Receptor to Impact	**4**	**1**

Magnitude of Impact

Magnitude of the impact (in the context of natural variability)	Qualifying Statement	Consideration	Classification
0	Impact is not measurable above natural variability	N/A	N/A
1	Impact is measurable above natural variability (0-5% change in total numbers of individuals)	N/A	N/A
2	Impact is measurable above natural variability (6-10% change in total numbers of individuals)	N/A	N/A
3	Impact is measurable above natural variability (>10% change in total numbers of individuals)	N/A	N/A

Magnitude of the impact (in the context of environmental baseline conditions)	Qualifying Statement	Consideration	Classification
0	Impact is not measurable above present baseline conditions	The baseline military exercise in the study area is highly intermittent. Therefore the baseline will not change as a result of short-term implementation of ex	0
1	Impact is measurable above present baseline conditions (0-5% change in total undisturbed available habitat)		
2	Impact is measurable above present baseline conditions (6-10% change in total undisturbed available habitat)		
3	Impact is measurable above present baseline conditions (>10% change in total undisturbed available habitat)		

Overall Magnitude of Impact	**0**	**0**

Overall Risk (sensitivity x exposure x magnitude)	**Negligible**	**0**

SSC AEE report Appendix 10.5 - humans and human activities risk matrix

Receptor	**Maritime archaeology**
Pressure Pathway/Impact	**Direct impacts - damage**

Sensitivity of the Receptor

Value (importance, rarity, quality) of receptor	Qualifying Statement	Consideration	Classification
0	Receptor has no measurable financial, environmental or cultural value		
1	Receptor has a low financial, environmental or cultural value		
2	Receptor has a medium financial, environmental or cultural value		
3	Receptor has a high financial, environmental or cultural value	Any marine archaeological site in the study area is likely to have a high value associated, dependent on the items era.	3

Tolerance of receptor	Qualifying Statement	Consideration	Classification
0	Receptor is entirely tolerant of the impact and will not exhibit change if exposed		
1	Receptor is very tolerant of the impact and will exhibit marginal change if exposed		
2	Receptor is slightly tolerant of the impact and will exhibit noticeable change if exposed		
3	Receptor is intolerant of the impact and will exhibit substantial change if exposed	The tolerance of any archaeological sites in the area are considered relatively vulnerable via impact.	3

Adaptability of receptor	Qualifying Statement	Consideration	Classification
0	Receptor is entirely adaptable and as such will be unaffected by exposure		
1	Receptor is very adaptable and as such will be marginally affected by exposure		
2	Receptor is slightly adaptable and as such will be noticeably affected by exposure		
3	Receptor is not adaptable and as such will be substantially affected by exposure	There is no adaptability of any archaeological items or sites.	3

Recoverability of receptor	Qualifying Statement	Consideration	Classification
0	Receptor will recover entirely within short timescales (<1 year)		
1	Receptor will recover entirely within medium timescales (1-5 years)		
2	Receptor will recover entirely within long timescales (>5 years)		
3	Receptor will not entirely recover over any timescale	As any archaeological finds are anthropogenic items or sites, they are unable to recover.	3

Overall Sensitivity of the Receptor	**12**	3

Exposure of Receptor to Impact

Exposure to the impact (time)	Qualifying Statement	Consideration	Classification
0	Receptor is not exposed to impact		
1	Receptor is exposed to impact over limited periods of time		
2	Receptor is exposed to impact over considerable periods of time		
3	Receptor is exposed to impact over extensive periods of time	Marine archaeological sites are likely to be exposed to impacts over considerable periods of time, i.e. the duration of the 30 year licence.	3

Exposure to the impact (frequency)	Qualifying Statement	Consideration	Classification
0	Receptor is very infrequently exposed to impact over limited periods of time (<1 event per month for the duration of the licence)	There is expected to be up to 10 launches per year in the initial years, rising to a maximum of 30 launches per year. However, the likelihood of LVs repeatedly impacting any given marine archaeological site is extemely low, taking into account the extent of the study area.	0
1	Receptor is infrequently exposed to impact over limited periods of time (1-5 events per month for the duration of the licence)		
2	Receptor is frequently exposed to impact over considerable periods of time (5-15 events per month for the duration of the licence)		
3	Receptor is constantly exposed to impact over considerable periods of time (>15 events per month for the duration of the licence)		

Exposure to the impact (space)	Qualifying Statement	Consideration	Classification
0	Receptor is not exposed to impact		
1	Receptor is exposed to impact over limited spatial scales	Due to the small spatial extent of the impact zone around LVs reaching the seabed, impacts will be low.	1
2	Receptor is exposed to impact over considerable spatial scales		
3	Receptor is exposed to impact over extensive and unconfined spatial scales		

Overall Exposure of Receptor to Impact	**4**	**1**

Magnitude of Impact

Magnitude of the impact (in the context of natural variability)	Qualifying Statement	Consideration	Classification
0	Impact is not measurable above natural variability		N/A
1	Impact is measurable above natural variability (0-5% change in total numbers of individuals)		N/A
2	Impact is measurable above natural variability (6-10% change in total numbers of individuals)		N/A
3	Impact is measurable above natural variability (>10% change in total numbers of individuals)		N/A

Magnitude of the impact (in the context of environmental baseline conditions)	Qualifying Statement	Consideration	Classification
0	Impact is not measurable above present baseline conditions		
1	Impact is measurable above present baseline conditions (0-5% change in total undisturbed available habitat)	There is a very low likelihood that LVs reaching the seabed will have known impact on marine archaeological sites, but if this did occur it would affect the b	1
2	Impact is measurable above present baseline conditions (6-10% change in total undisturbed available habitat)		
3	Impact is measurable above present baseline conditions (>10% change in total undisturbed available habitat)		

Overall Magnitude of Impact	**1**	**1**

Overall Risk (sensitivity x exposure x magnitude)	**Low**	**3**

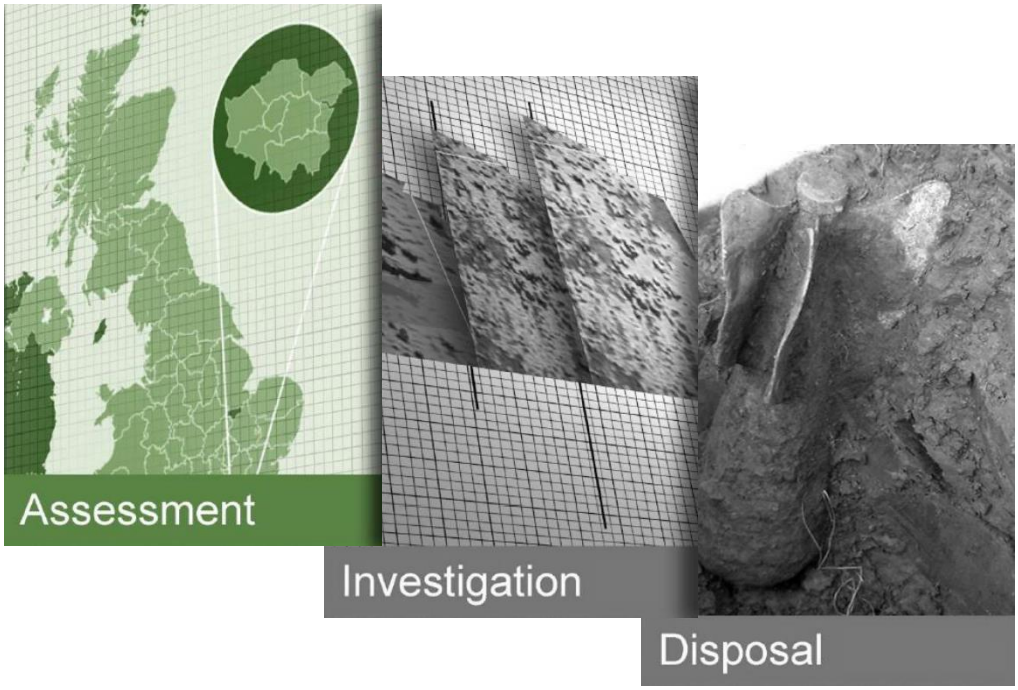
Appendix 11.1 Emissions Factors and Benchmarks

Appendix 11.1 Emission Factors and Benchmarks

Electricity			
Buildings	**Building Type (CIBSE benchmarks)**	**$kgCO_2$ per m^2 annual electricity consumption**	**Source**
Launch site processing facility, hazard store, gate house, pyrotechnic store, transporter holding building	Storage facility (storage warehouse or depot)	19.3	CIBSE 2008 Energy Benchmarks > Table 1 > Category 28 > Electricity typical benchmark
Administration building, control rooms, control centre	General office (general office and commercial working areas)	52.3	CIBSE 2008 Energy Benchmarks > Table 1 > Category 1 > Electricity typical benchmark
Saxa Vord Resort	Accommodation (general accommodation)	33	CIBSE 2008 Energy Benchmarks > Table 1 > Category 9 > Electricity typical benchmark
Natural gas			
Buildings	**Building Type (CIBSE benchmarks)**	**$kgCO_2$ per m^2 annual fuel consumption**	**Source**
Launch site processing facility, hazard store, gate house, pyrotechnic store, transporter holding building	Storage facility (storage warehouse or depot)	30.4	CIBSE 2008 Energy Benchmarks > Table 1 > Category 28 > Fossil fuel typical benchmark
Administration building, control rooms, control centre	General office (general office and commercial working areas)	22.8	CIBSE 2008 Energy Benchmarks > Table 1 > Category 1 > Fossil fuel typical benchmark
Saxa Vord resort	Accommodation (general accommodation)	57	CIBSE 2008 Energy Benchmarks > Table 1 > Category 9 > Fossil fuel typical benchmark

Launch Emissions			
Fuel	**Fuel (DEFRA emission factors)**	**kg CO_2e per tonne**	**Source**
Kerosene	Aviation turbine fuel	3,181	DEFRA 2020 Emissions Factors > Fuels > Liquid Fuels > Aviation Turbine Fuel > Tonnes > E54
Transport			**Phase: Operation and Construction**
Vehicle	**Vehicle (DEFRA emission factors)**	**kg CO_2e per km**	**Source of emissions factor**
HGV	Average HGV (diesel)	0.8654	DEFRA Conversion Factors 2020 > Freighting Goods > Q64
Car	Average car (unknown fuel)	0.1714	DEFRA Conversion Factors 2020 > Business travel-land > Y53
Light vehicle	Average van (unknown fuel)	0.24621	DEFRA Conversion Factors 2020 > Freighting Goods > U36
Vehicle	**Vehicle (DEFRA emission factors)**	**kg CO_2e per tonne transported 1km**	**Source of emissions factor**
Ferry	Ferry (average RoRo Ferry)	0.05166	DEFRA Conversion Factors 2020 > Freighting Goods > RoRo Ferry > Average > Tonne.km > F165
Vehicle	**Vehicle (DEFRA emission factors)**	**kg CO_2e per passenger transported 1km**	**Source of emissions factor**
Plane	Domestic to/from UK, with radiative forcing	0.02674	DEFRA Conversion Factors 2020 > WTT - business travel - air > WTT - flights > domestic to/from UK, average passenger > passenger.km > F20
Sea freight	Average cargo ship	0.01323 kgCO_2e/ tonne km	Cargo Ship - General Cargo - average

Appendix 12.1 ZETICA UXO Report



Shetland Space Centre - UXO Desk Study & Risk Assessment

Drafted by Maciej Wencel
Checked by Sven Leman
Authorised by Stefan Lang

Document Title	**UXO Desk Study & Risk Assessment**
Document Ref.	**P9238-19-R1**
Revision	**C**
Project Location	**Shetland Space Centre**
Client	**AECOM**
Date	**16th November 2020**

UXO DESK STUDY & RISK ASSESSMENT

EXECUTIVE SUMMARY

Key findings: No significant sources of Unexploded Ordnance (UXO) hazard have been identified on the Site.

Key actions: UXO awareness briefing.

UXO Hazard Assessment

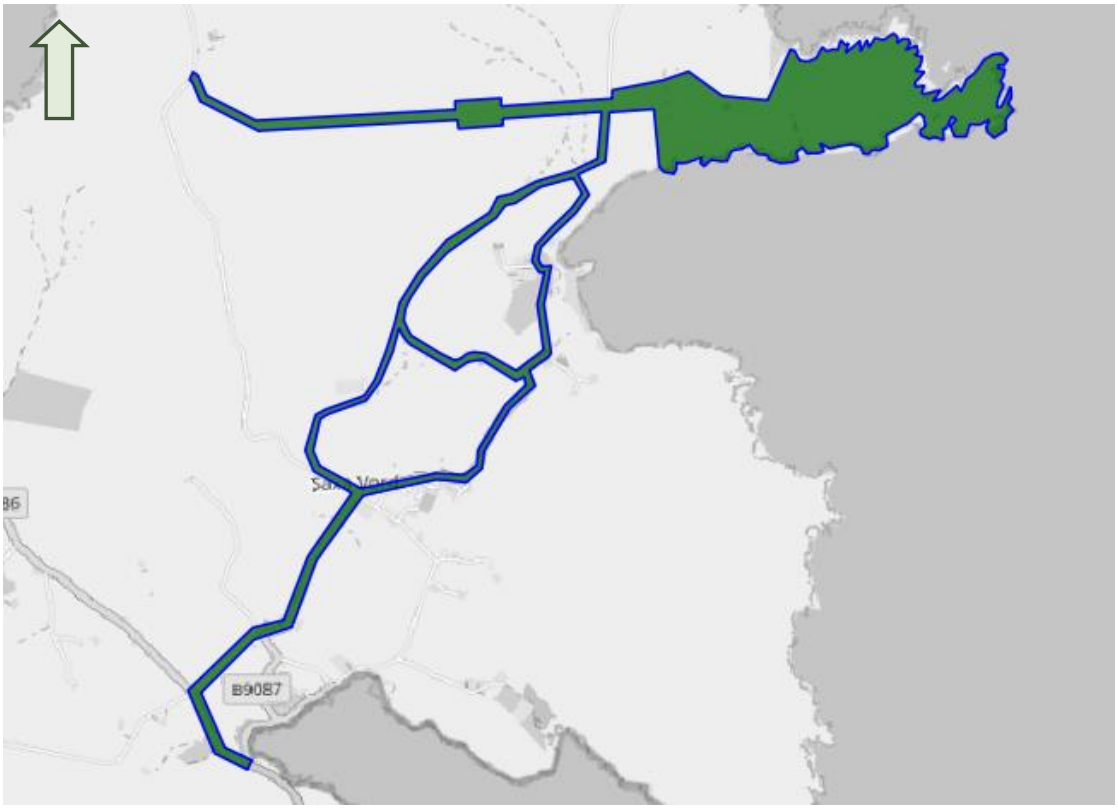
During WWII, Royal Air Force (RAF) Skaw, a radar station, was located on the eastern part of the Site.

No records of significant HE bombing or military activity associated with RAF Skaw likely to provide a significant source of UXO hazard has been found.

Given this, it is considered that the Site has a low UXO hazard level, as shown in the following Figure, reproduced as Figure 5 in the report.

The UXO hazard zone plan of the Site is also given in the accompanying P9238-19-R1-MAP01-B.

Figure UXO hazard zone plan of the Site



Source: OpenStreetMap *Not to Scale*

Legend					
	Very Low		Low		Moderate
	High		Very High		Site boundary

It should be noted that the potential for encountering Small Arms Ammunition (SAA) or close combat munitions on any former military establishment as a result of localised disposal or spillage cannot be totally discounted. As such, staff should be suitably sensitised to the risk of encountering UXO.

The main findings of the report are summarised below.

- No records of bombing or military activity on the Site during World War One (WWI) have been found.
- In 1940, RAF Skaw was established on the eastern part of the Site to detect and track enemy aircraft over the North Sea. Associated Anti-Aircraft (AA) gun emplacements, anti-invasion defences and ammunition stores were also established on the Site.
- During WWII, RAF Skaw was a strategic target.
- Records have been found indicating that 8No. High Explosive (HE) bombs fell on the Site during WWII, causing minimal damage. 1No. of these was recorded as an Unexploded Bomb (UXB) and was removed.
- RAF Skaw closed in 1947. No records of other military activity on the Site post-WWII have been found.

Data Confidence Level

In general, there is a good level of confidence in the researched information sources used for this report.

Proposed Works

It is understood that initial works on the Site will include intrusive ground investigation, including excavated trial pits and peat probing.

Risk Assessment

The Table below, reproduced as Table 3 in the main report, provides a UXO risk assessment for the proposed works on the Site.

Further details on the methodology for the risk assessment are provided in Section 7.2 of the main report.

Table UXO risk assessment for the Site

Potential UXO Hazard	Anticipated Works	PE	PD	P = PE x PD	Likelihood	Severity	Risk Rating	UXO Risk
UXB	Excavations	1	1	1	1	5	5	Low
	Ground Investigations	1	1	1	1	4	4	Low
Close Combat Munitions	Excavations	1	1	1	1	4	4	Low
	Ground Investigations	1	1	1	1	3	3	Low
Other UXO	Excavations	1	1	1	1	4	4	Low
	Ground Investigations	1	1	1	1	3	3	Low
SAA	Excavations	1	1	1	1	2	2	Low
	Ground Investigations	1	1	1	1	2	2	Low

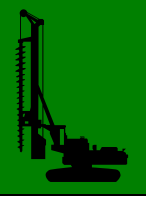
PE (Probability of Encounter), PD (Probability of Detonation), P (Overall Probability)

SAA (Small Arms Ammunition)

Risk Mitigation Plan

The Table below, reproduced as Table 4 in the main report, summarises the UXO risk for proposed works on the Site and recommended actions.

Table	Summary of UXO risk and mitigation recommendations

Proposed Works	UXO Risk	Recommended Mitigation
Excavations		**UXO awareness briefing -** Given the Site's military history it is recommended that a formal UXO awareness briefing is provided to staff involved in excavation.
Ground Investigations		**UXO awareness briefing** – as above

In summary, no additional measures are considered essential to reduce the UXO risk on the Site to As Low As is Reasonably Practicable (ALARP).

What Do I Do Next?

If you wish to proceed with UXO risk mitigation, Zetica would be happy to assist. Just contact us via phone (01993 886682) or email (uxo@zetica.com) and we can provide a proposal with options and prices.

If you have requirements to identify other buried hazards (such as mapping utilities or obstructions) we can provide these surveys.

If proposed works on the Site change, or additional works are planned, contact Zetica for a re-assessment of the UXO risk and the risk mitigation requirements.

CONTENTS

Figures, Plates, Tables & Drawings

Accompanying GIS Data

P9238-20-R1-MAP01-A (UXO Desk Study)

ABBREVIATIONS

AA	Anti-Aircraft
ACH	Advanced Chain Home
AES	Admiralty Experimental Station
ALARP	As Low As Reasonably Practicable
ARP	Air Raid Precaution
AXO	Abandoned Explosive Ordnance
BD	Bomb Disposal
BDO	Bomb Disposal Officer
BDU	Bomb Disposal Unit
CH	Chain Home
CMD	Conventional Munitions Disposal
DCLG	Department of Communities and Local Government
EO	Explosive Ordnance
EOC	Explosive Ordnance Clearance
EOR	Explosive Ordnance Reconnaissance
ERW	Explosive Remnants of War
ESA	Explosive Substances and Articles
FFE	Free From Explosives
HAA	Heavy Anti-Aircraft
HE	High Explosive
HSE	Health and Safety Executive
IB	Incendiary Bomb
IED	Improvised Explosive Device
IEDD	Improvised Explosive Device Disposal
JSEODOC	Joint Services EOD Operations Centre
LAA	Light Anti-Aircraft
MoD	Ministry of Defence
OB	Oil Bomb
PM	Parachute Mine
PUCA	Pick Up and Carry Away
RA	Royal Artillery
RAF	Royal Air Force
RCAF	Royal Canadian Air Force
RFC	Royal Flying Corps
RE	Royal Engineers
RN	Royal Navy
RRH	Remote Radar Head
TEP	Time Expired Pyrotechnics
UXAA	Unexploded Anti-Aircraft
UXB	Unexploded Bomb
UXO	Unexploded Ordnance
WWI	World War One
WWII	World War Two

UXO DESK STUDY & RISK ASSESSMENT

Please read: Zetica has colour coded each paragraph. Paragraphs with black text on a white background are paragraphs that provide site-specific information or information specifically researched as part of this project.

Boxed paragraphs in a dark green text with a green background are paragraphs providing general information and, where appropriate, links to online resources giving further detail. These are all available at www.zeticauxo.com. If you cannot gain access to these resources, Zetica can forward them on request.

1 INTRODUCTION

1.1 Project Outline

Zetica Ltd was commissioned by AECOM to carry out a detailed Unexploded Ordnance (UXO) Desk Study and Risk Assessment for an area of approximately 133.9 hectares (ha) at Skaw on Unst, Shetland (the 'Site').

The aim of this report is to gain a fair and representative view of the UXO hazard for the Site and its immediate surrounding area in accordance with the Construction Industry Research and Information Association (CIRIA) C681 'Unexploded Ordnance (UXO), a Guide for the Construction Industry'.

Where appropriate, this hazard assessment includes:

- Likelihood of ordnance being present.
- Type of ordnance (size, filling, fuze mechanisms).
- Quantity of ordnance.
- Potential for live ordnance.
- Probable location.
- Ordnance condition.

It should be noted that some military activity providing a source of UXO hazard may not be recorded and therefore there cannot be any guarantee that all UXO hazards affecting the Site have been identified in this report.

1.2 Sources of Information

Zetica Ltd researched the military history of the Site and its surrounding area using a range of information sources. The main sources of information are detailed in the following sections and referenced at the end of this report.

1.2.1 Zetica Ltd Defence Related Site Records

Zetica Ltd's in-house records were consulted, including reference books and archived materials from past work in the region. Relevant documents have been cited within the bibliography of this report.

1.2.2 Zetica Ltd Bombing Density Records and Maps

Reference has been made to the Zetica Ltd bomb risk maps located on Zetica's website (http://zeticauxo.com/downloads-and-resources/risk-maps/)

1.2.3 Ministry of Defence and Government Records

Government departments and units within the Ministry of Defence (MoD) were approached for information of past and present military activity in the area. These included the Department of Communities and Local Government (DCLG) records of abandoned bombs.

1.2.4 Other Historical Records, Maps and Drawings

Numerous reference documents including historical maps, aerial photographs and drawings have been consulted from sources such as the National Archives, the Scottish Government, the National Collection of Aerial Photography (NCAP), the US National Archives & Records Administration (NARA), the Imperial War Museum (IWM), Historic Environment Scotland (HES) and the Defence of Britain Project.

The British Geological Survey (BGS) was consulted for borehole information.

1.2.5 Local Authority Records

Information was obtained from Shetland Islands Council.

1.2.6 Local Record Offices and Libraries

Shetland Museum & Archives were consulted for records.

1.2.7 Local Historical and Other Groups

Local history groups and archaeological bodies were consulted, including the Shetlands Historic Environmental Record (HER), A History of Saxa Vord blog, and Shetland Flyer Aerial Aerial Media.

1.3 Data Confidence Level

In general, there is a good level of confidence in the researched information sources used for this report.

2 THE SITE

2.1 Site Location

The Site is centred on Ordnance Survey National Grid Reference (OSNGR) HP 650142. It is located approximately 3.3km northeast of Beltasound and approximately 72.7km north-northeast of Lerwick.

The Site comprises the footprint of the former Royal Air Force (RAF) Skaw and country roads between Haroldswick and Skaw. It is primarily bounded on the north, west and south by open fields, and to the east by the North Sea.

Figure 1 is a Site location map and Plate 1 is a recent aerial photograph of the Site.

Figure 1	Site location map

Source: OpenStreetMap *Not to Scale*

Legend	Site boundary

Plate 1	Recent aerial photograph of the Site

Source: Google Earth *Not to Scale*

Legend	Site boundary

3 MILITARY ACTIVITY

The following sections outline the recorded military activity in the vicinity of the Site. The potential UXO hazard from WWI and WWII bombing is detailed in Section 4.

Each sub-section provides hyperlinks to further information on potential sources of UXO hazard. These are also available at www.zeticauxo.com. If you cannot gain access to these resources, Zetica can forward them on request.

3.1 RAF Skaw

Between 1940 and 1947, RAF Skaw was located on the eastern part of the Site. A brief operational history of the station is given below.

3.1.1 Operational History of RAF Skaw

Between January and April 1940, the Lamba Ness peninsula was surveyed and chosen as the location of a radar station, part of a network established on Scotland's eastern coast to defend against a potential German invasion from Norway.

The station opened as an Advanced Chain Home (ACH) establishment, with military accommodation buildings and wooden radar towers constructed on the eastern part of the Site. In November 1940, the first RAF personnel arrived on the Site and ACH Skaw was operational from January 1941.

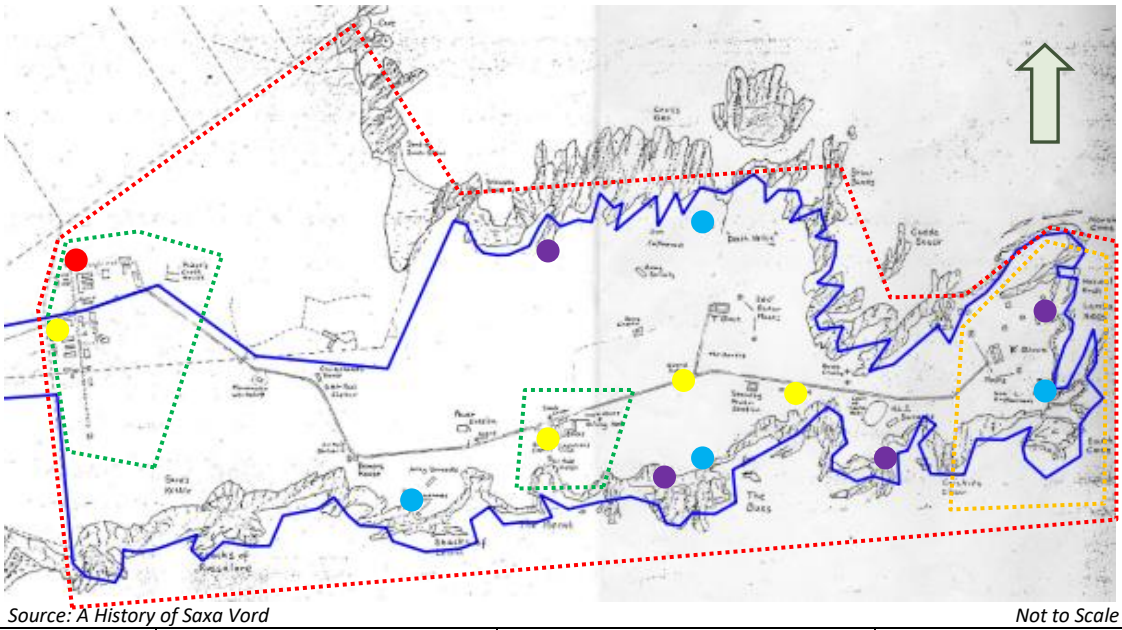
From 1941, RAF Skaw was engaged in plotting the movements of enemy aircraft over the Shetland Islands.

In April 1941, the command of ACH Skaw was transferred to No. 71 Wing RAF.

Between 1941 and 1942, the station expanded with the construction of steel radar towers, as well as 2No. accommodation and administrative camps constructed on the western part of Lamba Ness, on the Site. In May 1942, the station was upgraded to a Chain Home (CH) station.

Figure 2 is a plan of RAF Skaw, dating from WWII, at its greatest extent. The plan shows the location of radar and accommodation facilities, as well as the station's defences.

Figure 2	Plan of RAF Skaw, WWII

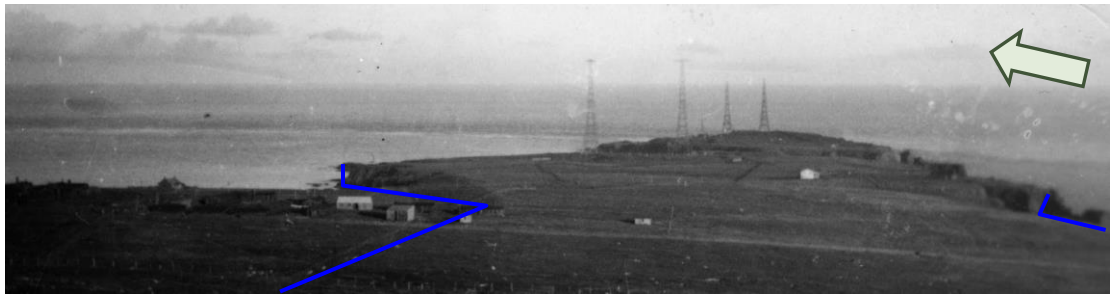


Source: A History of Saxa Vord *Not to Scale*

Legend	Site boundary	ACH Site	RAF Skaw
	Domestic sites	Machine gun emplacements	Bofors guns
	Guard hut	Ammunition store	

Plate 2 is an oblique aerial photograph of RAF Skaw, dating from 1944/1945.

Plate 2	Oblique aerial photograph of RAF Skaw, 1944/1945



Source: A History of Saxa Vord *Not to Scale*

Legend	Site boundary

As the danger posed by enemy aircraft over Shetland receded, the operations of the radar station were gradually downscaled and by April 1944 the steel radar towers had been dismantled. Until August 1944, the station's main duty was to support the operations of Royal Navy (RN) Saxa Vord, located approximately 0.8km north of the Site (see Section 3.2).

In August 1945, the station was ordered to cease operations and was put into care and maintenance until its final closure in 1947.

The remaining radar facilities and military equipment was removed, and the remaining buildings and defences were abandoned. Records indicate that after 1947, empty buildings on the Site were occasionally used for fire-fighting practice by both RAF and civilian fire departments.

Details of activities at RAF Skaw that may provide a source of UXO hazard are given in the Sections below.

3.1.2 Military activities at RAF Skaw

The following sections provide details about potential sources of UXO hazard associated with military activities at RAF Skaw.

Ordnance Stores

Records indicate that 1No. ammunition store was established at RAF Skaw, north of the main residential camp, approximately 80m north of the Site (see Figure 2). Records indicate that this contained primarily SAA and Type 36M grenades.

Additionally, 4No. guard huts were established across the Site which were equipped with ammunition lockers for SAA. Records indicate that these stores were removed after the closure of RAF Skaw.

Ordnance stores are not considered to provide a source of UXO hazard to the Site.

Station Defences

In 1940, 3No. Light Anti-Aircraft (LAA) guns were established at RAF Skaw, on the Site, to defend against low-flying enemy aircraft. These comprised Browning machine guns and were manned and operated by troops from the Argyle and Sutherland Highlanders.

These defences could also be used to defend against an attack from the land.

Plate 3 is a recent photograph of a machine gun emplacement on the Site.

Plate 3	Photograph of a machine gun emplacement on the Site

Source: A History of Saxa Vord *Not to Scale*

By January 1942, 4No. additional LAA emplacements were constructed on the Site. These housed 40mm Bofors guns and had associated ammunition stores.

Plate 4 is a recent photograph of an LAA emplacement on the Site.

Plate 4	Photograph of LAA emplacement on the Site

Source: A History of Saxa Vord *Not to Scale*

By August 1942, additional machine gun posts were established on the Site (see Figure 2) which could be used as AA defences and against a ground attack if necessary.

After the closure of RAF Skaw in 1945, the station was disarmed. Records indicate that some of the LAA guns were relocated to the RN Saxa Vord station.

Potential UXO Hazard

Station defences had associated ammunition caches which would have stored Small Arms Ammunition (SAA), in addition to close combat munitions such as grenades. 4No. LAA guns on the Site had associated ammunition huts to store 40mm shells.

Records indicate that these munitions caches were removed after RAF Skaw closed, though the possibility of localised spillage around station defences cannot be totally discounted.

SAA is not considered to provide a significant source of UXO hazard (see Appendix 1).

3.2 Firing Ranges and Military Training Areas

For further information on firing ranges and military training areas, and the potential UXO hazards associated with them, follow the links below:

- Artillery Ranges
- Bombing Ranges
- Military Training Areas
- Small Arms Ranges

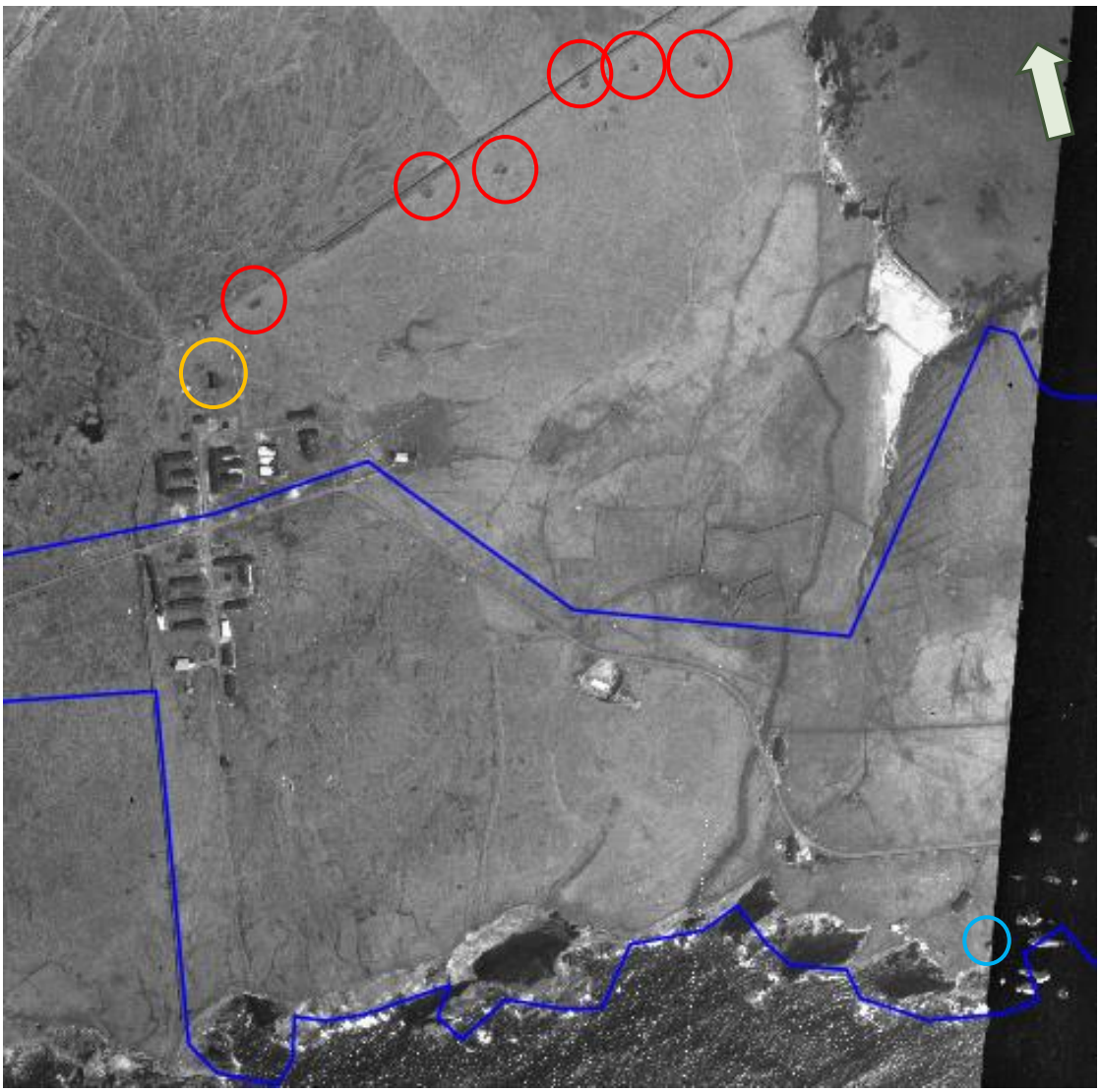
No records of artillery or bombing ranges on or in close proximity to the Site have been found.

Records have been found indicating that rifle practice took place at RAF Skaw at an undisclosed location. No dedicated ranges or training areas have been identified on the Site and it is considered possible that firing was directed out to sea.

Plate 5 is an aerial photograph of the western part of RAF Skaw, dated the 18th May 1946. No evidence of disturbed ground typical of military training or ordnance disposal have been identified.

The locations of the ammunition store and a machine gun emplacement are shown. Possible bomb craters have also been highlighted (see Section 4).

Plate 5	Aerial photograph of the western part of RAF Skaw, 18th May 1946



Source: NCAP *Not to Scale*

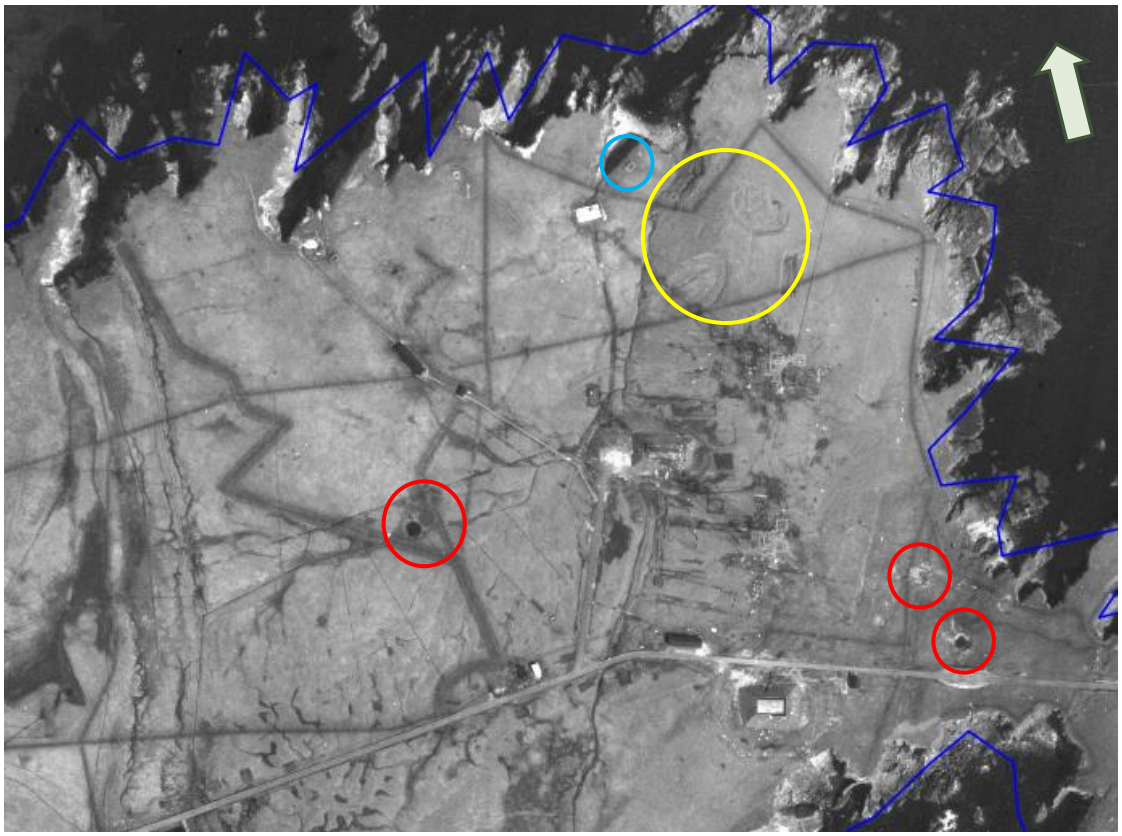
Legend	Site boundary	Machine gun emplacement	Ammunition store
	Possible bomb damage		

Plate 6 is an aerial photograph of the central part of RAF Skaw, dated the 18th May 1946. No evidence of disturbed ground typical of military training or ordnance disposal have been identified.

AA and anti-invasion defences have been highlighted, as well as an area of possible historic peat excavation.

Bomb craters have also been highlighted (see Section 4).

Plate 6	Aerial photograph of the central part of RAF Skaw, 18th May 1946



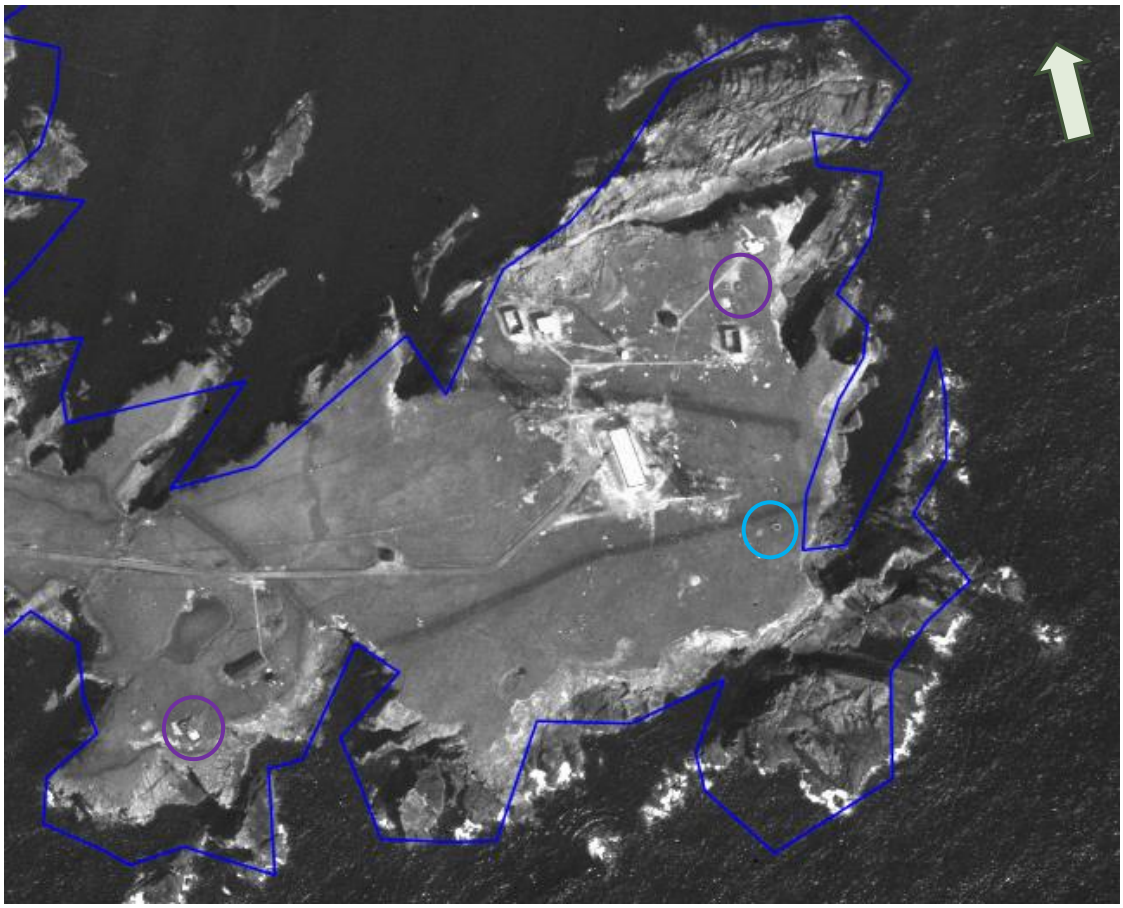
Source: NCAP *Not to Scale*

Legend		
	Site boundary	Machine gun emplacement
	Possible bomb damage	Possible peat excavations

Plate 7 is an aerial photograph of the eastern part of RAF Skaw, dated the 18th May 1946. No evidence of disturbed ground typical of military training or ordnance disposal have been identified.

AA and anti-invasion defences have been highlighted.

Plate 7	Aerial photograph of the eastern part of RAF Skaw, 18th May 1946



Source: NCAP *Not to Scale*

Legend	Site boundary	Machine gun emplacement
	Bofors guns	

Potential UXO Hazard

No obvious evidence of significant military training has been identified on historical aerial photography.

Given the history of RAF Skaw and intensive military use of the area during WWII, the possibility that training was conducted on the Site cannot be totally discounted.

3.3 Explosives Factories, Munitions Depots and Disposal Areas

For further information on explosives factories, munitions depots and disposal areas, and the potential UXO hazards associated with them, follow the links below:

- Explosives Factories
- Munitions Depots
- Munitions Disposal Areas

Other than those detailed in Section 3.1, no records of any explosives factories or munitions depots on or in close proximity to the Site have been found.

3.3.1 Munitions Disposal Areas

No records of any formal munitions disposal areas at RAF Skaw have been found.

Records indicate that the official procedure for dealing with defective munitions was to return them to a central ordnance depot located in the vicinity of Lerwick, Shetland, approximately 70km southwest of the Site.

Potential UXO Hazard

No evidence of features typical of munitions disposal areas, such as disturbed ground and burning pits, have been identified on historical aerial photographs.

As with any military establishment during WWII, the possibility that surplus or faulty munitions were disposed of locally cannot be totally discounted.

This would typically occur at remote and uninhabited locations nearby and it is possible that nearby beaches may have presented a convenient location for disposal operations.

Recent photographs provided by the Client indicate that domestic waste has been regularly disposed of over the sea cliffs surrounding the Site at RAF Skaw. It is possible that excess or faulty munitions were similarly disposed of in this manner during WWII.

3.4 Other Military Establishments

3.4.1 Royal Navy (RN) Saxa Vord

In September 1940, a Royal Navy (RN) radar station was established approximately 0.8km north of the Site, known as both No. 4 Admiralty Experimental Station (AES) and His Majesty's Ship (HMS) Fox.

RN Saxa Vord was one of 6No. naval radar stations established across the Shetland Islands during WWII whose main purpose was mapping the movements of German U-boats. RN Saxa Vord was operated by navy personnel, supported by the RAF personnel of RAF Skaw.

In the summer of 1940, Royal Marines engaged in the construction of an air strip in the vicinity of the Baltasound Pier, approximately 2.9km south of the Site, were stationed at the residential quarters of RN Saxa Vord.

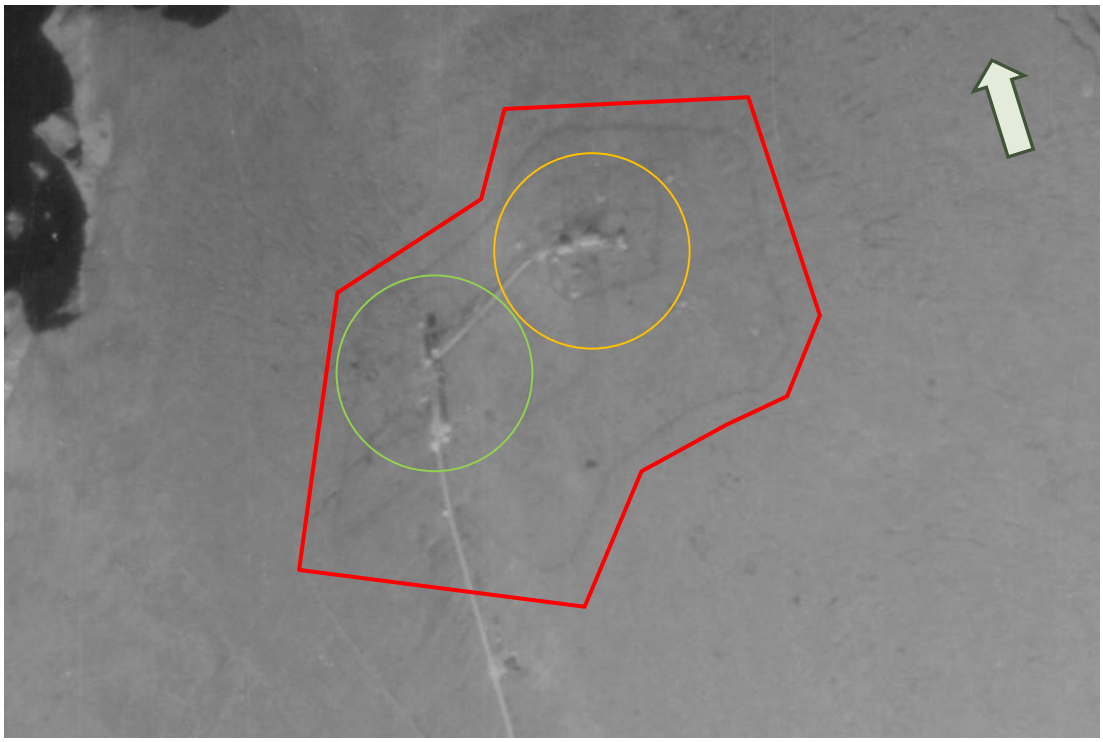
Records have been found indicating that Royal Canadian Air Force (RCAF) personnel were present at RN Saxa Vord.

The station comprised a lower site with accommodation buildings and power generators, and an upper site containing radar equipment. These had been developed further by 1942.

Records indicate that the defences at RN Saxa Vord included 2No. Hotchkiss machine guns.

Plate 8 is an aerial photograph dating from 1944, showing the accommodation and radar sites of RN Saxa Vord, protected by a wire fence.

Plate 8	Aerial photograph of RN Saxa Vord, 1944



Source: NCAP *Not to Scale*

Legend	RN Saxa Vord	Accommodation site	Radar site

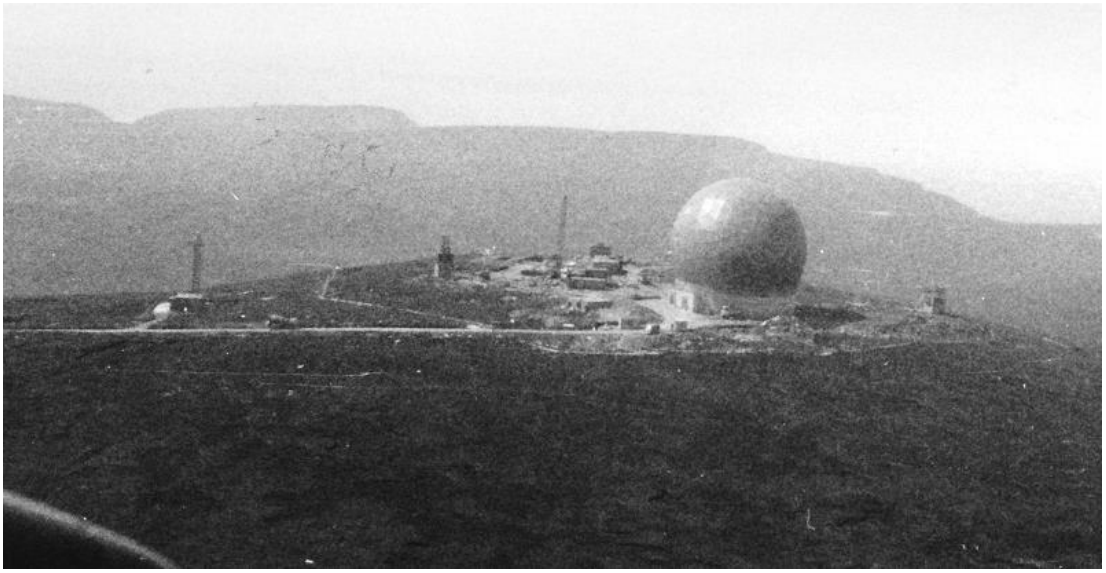
In 1946, RN Saxa Vord ceased operations and was put into care and maintenance until 1954, when it re-opened as No. 91 Signal Unit to provide radar coverage over the North Sea during the Cold War. Approximately 150-200No. personnel were present at the station.

During the 1950s, married quarters were established on Settler`s Hill, adjacent to the central part of the Site.

During the 1960s, units from the Royal Engineers (RE) constructed an airstrip at Ordale, approximately 4.2km south of the Site. Records indicate that RE personnel visited No. 91 Signal Unit at Saxa Vord at this time and were equipped with explosives.

Plate 9 is an oblique aerial photograph, dating from 1976-1977, showing the No. 91 Signal Unit at Saxa Vord.

Plate 9	Aerial photograph of No. 91 Signal Unit Saxa Vord, 1976-1977



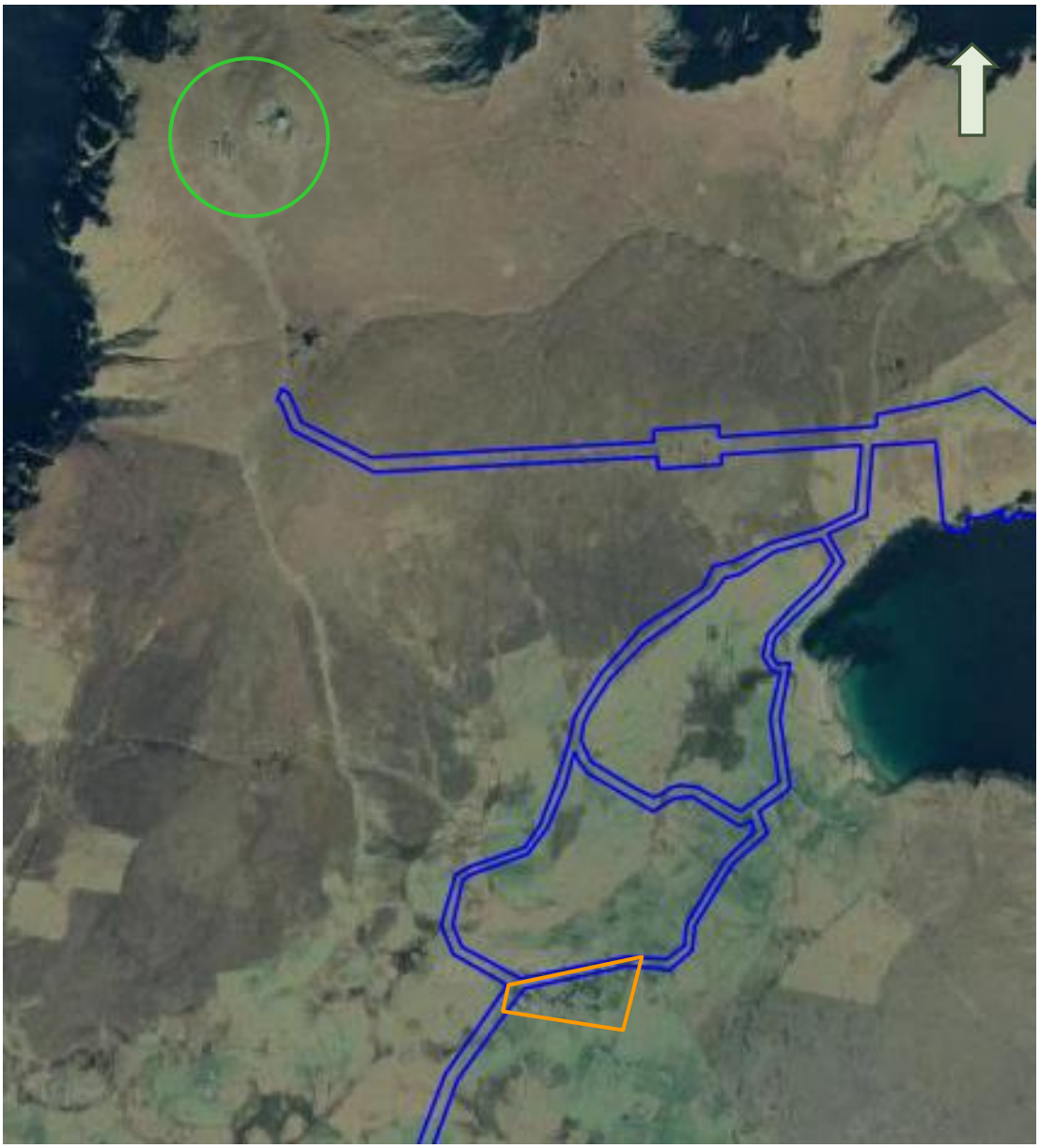
Source: A History of Saxa Vord *Not to Scale*

In 1987, the station was renamed to RAF Saxa Vord.

In 2000, the radar station was downscaled to Remote Radar Head (RRH) Saxa Vord. It was put in care and maintenance again in 2015. A re-opening was announced in 2017.

Plate 10 is a recent aerial photograph showing the location of RRH Saxa Vord and the former accommodation Site in Settler's Hill.

Plate 10	Aerial photograph of RRH Saxa Vord



Source: Google Earth *Not to Scale*

Legend	Site boundary	RRH Saxa Vord	Accommodation site

RN Saxa Vord is not considered to provide a source of UXO hazard to the Site.

3.5 Defences

For further information on military defences, and the potential UXO hazards associated with them, follow the links below:

- Anti-Aircraft Guns
- Anti-Invasion Defences
- Barrage Balloons
- Bombing Decoys

- Home Guard
- Mined Locations
- Mortar & Gun Emplacements
- Pillboxes

During WWII, approximately 20,000No. troops were stationed across the Shetland Islands to maintain ant-invasion defences and for training.

Records indicate that several Highland Light Infantry, Black Watch Home Defence, and Royal Artillery (RA) units were stationed on the island of Unst, manning the defences at RAF Skaw and RN Saxa Vord.

Other than those discussed in Section 3.1, no further military defences have been identified on or in the vicinity of the Site.

3.6 Military Airfields

For further information on military airfields, and the potential UXO hazards associated with them, follow the links below:

- Military Airfields

No records of any military airfields on or in close proximity to the Site have been found.

During WWI, there was a seaplane station at Cat Firth, Shetland (HU 458524), approximately 61.7km southwest of the Site.

The nearest operational airfield during WWII was Royal Air Force (RAF) Sullom Voe (HU 411747), approximately 44.3km west-southwest of the Site. This was a sea plane station.

Records indicate that during WWII, a temporary landing strip was established near the Baltasound Pier, approximately 2.7km south of the Site. This serviced mainly Walrus seaplanes delivering supplies and personnel to Unst.

Military airfields are not considered to provide a source of UXO hazard to the Site.

3.7 Aircraft Crashes

For further information on military aircraft crashes, and the potential UXO hazards associated with them, follow the links below:

- Aircraft Crashes

No records of any aircraft crashes on or in close proximity to the Site have been found.

4 BOMBING

4.1 WWI Bombing

For further information on WWI bombing in the UK, and the potential UXO hazard associated with it, see Appendix 2.1. Alternatively, use the following link.

- WWI Bombing

No records have been found indicating that the Site was bombed during WWI.

4.2 WWII Bombing

For further information on WWII bombing in the UK, and the potential UXO hazard associated with it, see Appendix 2.2. Alternatively, use the following link.

- WWII Bombing

Records have been found indicating that several bombs fell on the Site during WWII. Details of WWII bombing in the vicinity of the Site are provided in the following sections.

4.2.1 Bombing in Shetland

From prior to the declaration of war in 1939, Britain, including Shetland, was subjected to reconnaissance flights by the Luftwaffe which was building up a photographic record of potential targets.

This northerly part of the British Isles was strategically important to both sides. The Allied forces needed the bases to be able to control the sea passages to the north and west of Britain, whilst it was believed that the Germans considered invading Britain from Norway through Shetland.

Lerwick, the capital was a major port which was subject to attack by mining the approaches and bombing the town and its defences.

4.2.2 Strategic Targets

RAF Skaw, on the Site, was a potential target of opportunity for Luftwaffe bombers passing overhead. Other strategic targets in the vicinity of the Site included other military establishments such as RN Saxa Vord, approximately 0.8km north of the Site.

Plate 11 is a Luftwaffe target photograph of RAF Scatsa, Shetland, dating from February 1941, approximately 4.6km southwest of the Site.

Plate 11	Luftwaffe target photograph of RAF Scatsa, February 1941

Source: NARA *Not to Scale*

4.2.3 Bombing Densities and Incidents

Table 1 gives details of the overall bombing statistics recorded for the Local Authority (LA) Districts of the Site and surrounding districts. These were categorised as Small Burghs (SB), Large Burghs (LB) and County LAs. WWII bomb density levels are defined below:

<5 bombs per 405ha is a Very Low regional bombing density.

5-15 bombs per 405ha is Low.

15-50 bombs per 405ha is Moderate.

50-250 bombs per 405ha is High.

>250 bombs per 405ha is Very High.

Table 1	Bombing statistics

Area	Bombs Recorded				
	High Explosive	Parachute Mines	Other	Total	Bombs per 405ha (1000 acres)
Zetland LA	**72**	**0**	**0**	**72**	**0.2**

Note that Table 1 excludes the figures for Incendiary Bombs (IBs). Discrepancies between this list and other records, such as bomb clearance records, demonstrate that this data is likely to under-represent actual bombing.

Details of the nearest recorded bombing incidents to the Site are given in the following section.

1940 (date unspecified)

1No. HE bomb fell on RN Saxa Vord, approximately 0.8km north of the Site.

24th February 1941

2No. HE bombs fell near the Loch of Lamba Ness, on the Site.

2No. HE bombs fell near the RAF Skaw camp entrance, on the Site. 1No. of these was recorded as an Unexploded Bomb (UXB) and removed.

26th March 1941

4No. HE bombs fell in the sea off Lamba Ness, approximately 0.1km north of the Site.

27th March 1941

2No. 250kg HE bombs fell on open ground at RAF Skaw, on the north-central part of the Site.

15th October 1941

2No. 500kg HE bombs fell on open ground near the RAF Skaw accommodation camp, on the Site.

4th January 1942

2No. HE bombs fell in sea near Lamba Ness, approximately 0.1km south of the Site.

Plate 12 is an aerial photograph of the southern part of the Site, dated the 19th September 1944. No bomb damage has been identified on or in the vicinity of the southern part of the Site.

Plate 12	Aerial photograph of the southern part of the Site, 19th September 1944

Source: NCAP *Not to Scale*

Legend	Site boundary

Plate 13 is an aerial photograph of the central part of the Site, dated the 19th September 1944. No bomb damage has been identified on or in the vicinity of the central part of the Site.

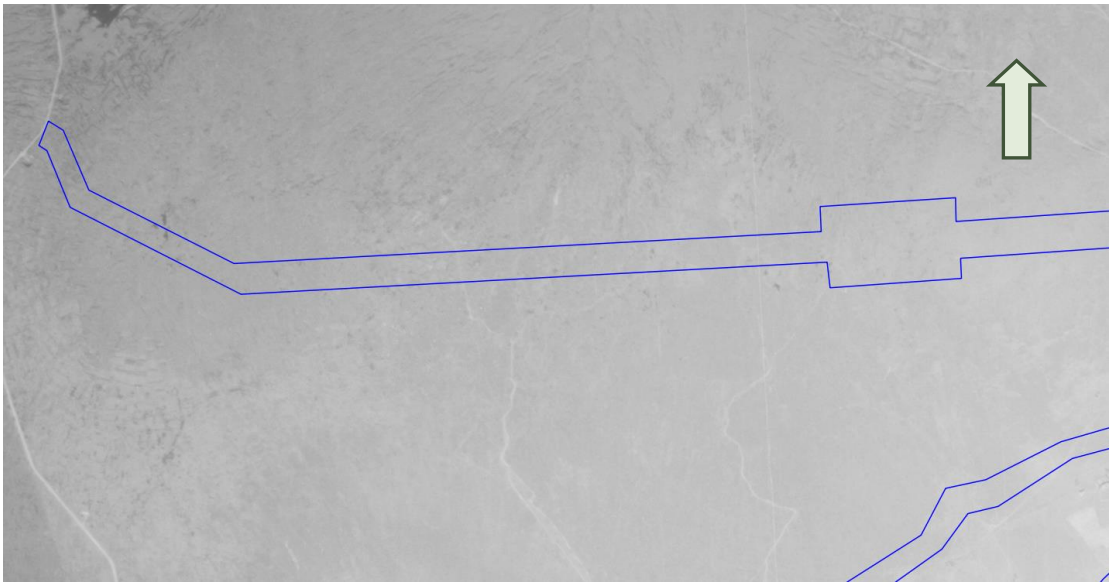
Plate 13	Aerial photograph of the central part of the Site, 19th September 1944

Source: NCAP *Not to Scale*

Legend	Site boundary

Plate 14 is an aerial photograph of the western part of the Site, dated the 19th September 1944. No bomb damage has been identified on or in the vicinity of the western part of the Site.

Plate 14	Aerial photograph of the western part of the Site, 19th September 1944



Source: NCAP *Not to Scale*

Legend	Site boundary

Isolated bomb damage was identified on and in the vicinity of the Site at RAF Skaw (see Plates 3-5).

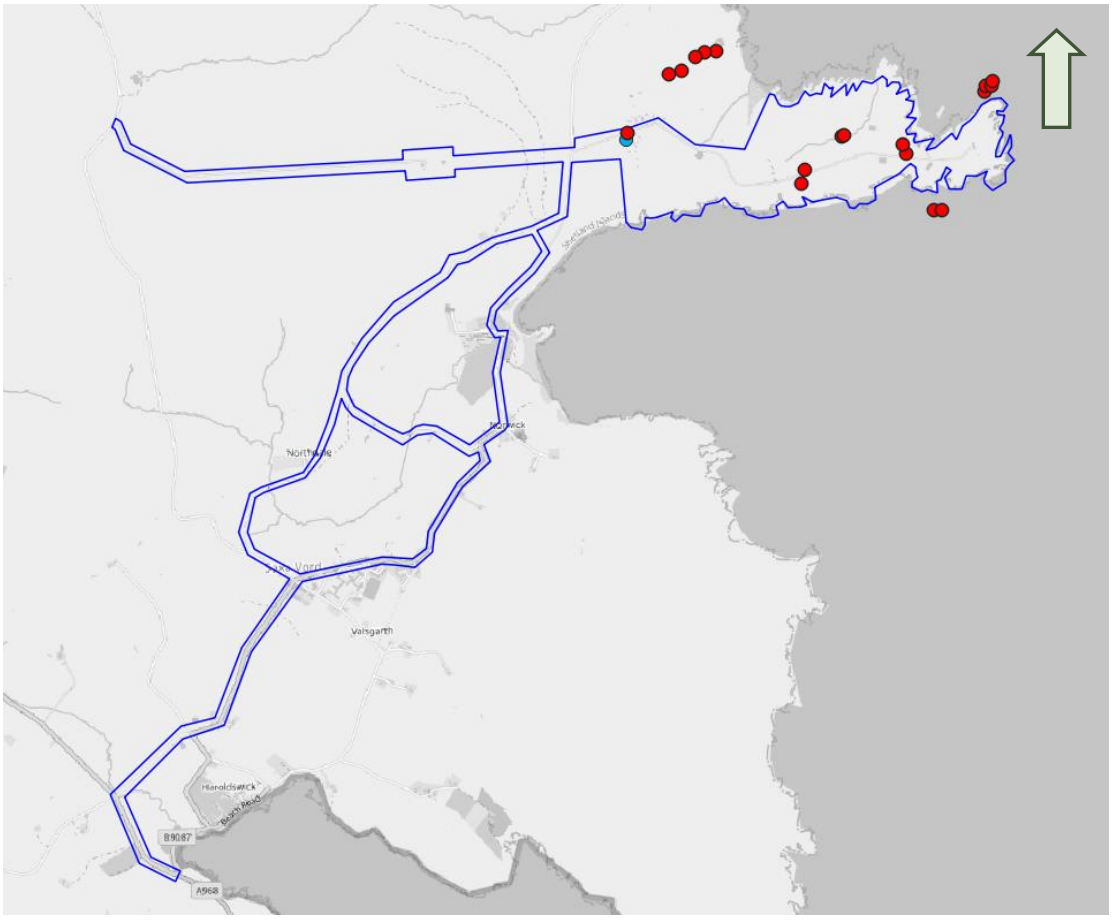
It should be noted that during WWII, many Unexploded Bombs (UXBs) were mapped and subsequently removed as and when conditions and demands on Bomb Disposal teams allowed. Their removal was not always accurately recorded and sometimes records were later destroyed. In practice, most UXB were probably removed and only a much smaller number were actually registered as officially abandoned bombs.

Figure 3 is a map showing the approximate location of recorded bomb impacts in the immediate vicinity of the Site.

The map has been compiled from a number of different sources, including air raid incident reports, historical aerial photographs and bomb census maps.

The bomb map is also given in the accompanying P9238-20-R1-MAP01-A.

Figure 3 Compiled bomb impact map for the vicinity of the Site

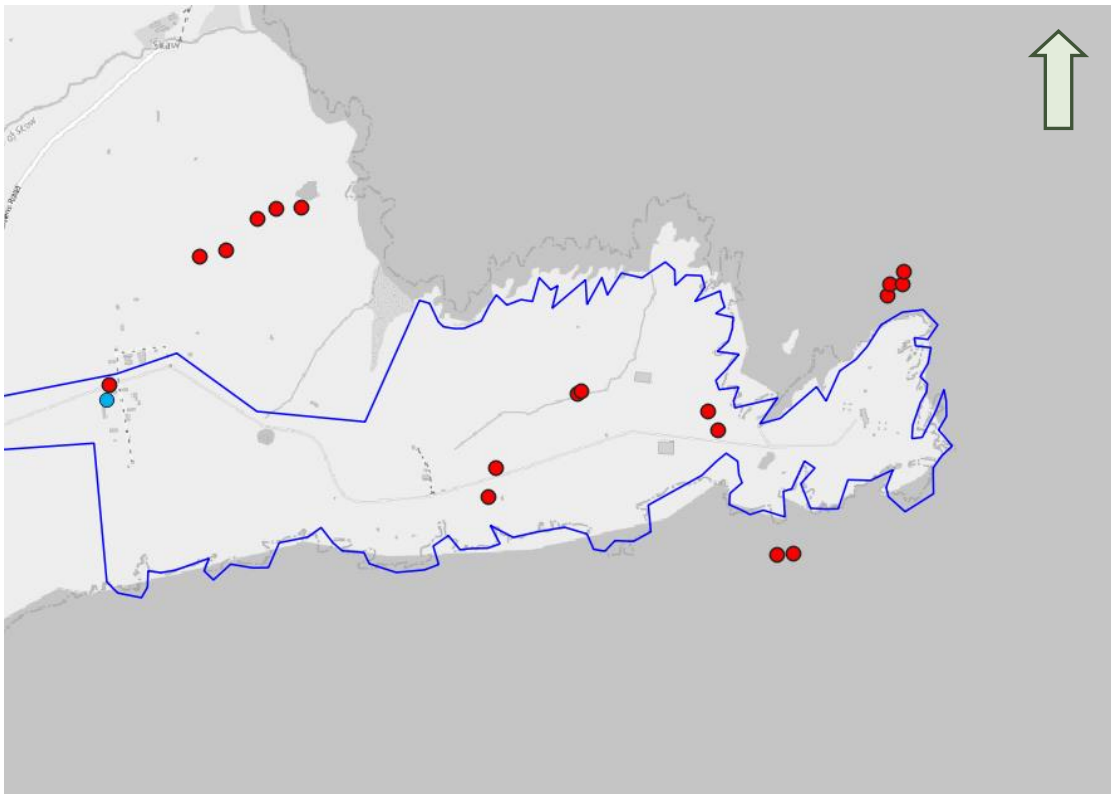


Source: OpenStreetMap *Not to Scale*

Legend	Site boundary	HE bomb	UXB

Figure 4 is a compiled bomb map showing the approximate location of recorded bomb impacts in the immediate vicinity of the eastern part of the Site.

Figure 4	Compiled bomb impact map for the vicinity of the Site (detail)



Source: OpenStreetMap *Not to Scale*

Legend	Site boundary	HE bomb	UXB

Potential UXO Hazard

Records have been found indicating that 8No. HE bombs fell on the Site. 1No. was recorded as a UXB and was removed.

No significant bomb damage or cratering likely to mask the impact of a UXB has been identified on the Site on historical aerial photography.

Raids involved single aircraft dropping small numbers of bombs and no significant damage was recorded to the Station. Given the continuous military presence on the eastern part of the Site during WWII, it is considered unlikely that a UXB would have fallen unnoticed.

WWII bombing is not considered to provide a source of UXO hazard to the Site.

4.2.4 Geology and Bomb Penetration Depths

It is important to consider the geological materials present at the time that a bomb was dropped in order to establish its maximum penetration depth.

At the time of writing, no Site-specific ground investigation data was available.

British Geological Survey (BGS) 1:50,000 Sheet 131 Unst and Fetlar (Solid & Drift) and BGS borehole records from nearby investigations have been consulted to get an indicative overview of the Site geology.

The geology of the Site is understood to consist of Blown Sand, Diamicton, and Lacustrine Deposits, overlying the Skaw Intrusion, Norwick Phyllite Formation, and Shetland Ophiolate Complex.

Table 2 provides an estimate of average maximum bomb penetration depths for the Site assuming WWII ground conditions of 0.5m of sand, over more than 20m of weak rock.

Table 2	Estimated average maximum bomb penetration depths	
Estimated average bomb penetration depths for anticipated geology		
Bomb Weight	50kg	2.5m
	250kg	3.5m
	500kg	6.0m

These calculations can be refined on receipt of Site-specific information.

The estimated bomb penetration depths given in Table 2 are from the WWII ground level and are based on the following assumptions:

a) High level release of the bomb resulting in an impact velocity of 260m/s (>5,000m altitude).

b) A strike angle of 10 to 15 degrees to the vertical.

c) That the bomb is stable, both in flight and on penetration.

d) That no retarding units are fitted to the bomb.

e) That the soil type is homogenous.

A high altitude release of a bomb will result in ground entry at between 10° and 15° to the vertical with the bomb travelling on this trajectory until momentum is nearly lost. The bomb will then turn abruptly to the horizontal before coming to rest. The distance between the centre of the entry hole and the centre of the bomb at rest is known as the 'offset'. A marked lateral movement from the original line of entry is common.

Low-level attacks may have an impact angle of 45° or more, which will frequently lead to a much greater amount of offset movement during soil penetration.

The average offset is one third of the penetration depth, i.e. an offset of 2m may be expected for a 50kg bomb in dry silts and clays. If hard standings or Made Ground were present during WWII, bomb penetration depths would have been significantly reduced but offset distances may have been up to four times greater.

5 EXPLOSIVE ORDNANCE CLEARANCE ACTIVITIES

Official UK bombing statistics have been compiled from both British and German sources. There were differences in the way the figures were originally reported and collated which has led to discrepancies in the summary data.

Based on data from 1939 to 1945, War Office statistics indicate that 200,195No. HE bombs exploded within Great Britain. Additionally, 25,195No. HE bombs (representing 11%) were recorded as UXBs. However, records from the Royal Engineers who were responsible for bomb disposal at the time indicate that as of 27th February 1946 upwards of 45,000No. UXBs were disposed of.

On average 8.5% of UXBs later self-exploded. In some cases the bombs had delayed action fuzes or were never intended to explode, their purpose being to cause inconvenience and fear. Given the discrepancy in records and the fact that UXBs are still being found unexpectedly, it is clear that the original figures are understated and provide only an approximation of the number of potential UXBs in the UK.

War Office statistics also show that between October 1940 and May 1941 most of the UXBs (93%) were either 50kg or 250kg. It should be noted that details of the recovery and the size of the UXB were not always accurately reported.

The larger WWII UXBs are often difficult to recover due to both penetration depths and the presence of two or more fuzes, combined with more sensitive fillings of explosive mixtures including Amatol and Trialen.

5.1 Abandoned Bombs

For further information on abandoned bombs, and the potential UXO hazard associated with them, follow the link below:

- Abandoned Bombs

No records have been found indicating that any officially abandoned bombs are located on the Site.

5.2 EOC Tasks

Zetica holds no records of post-WWII EOC tasks having taken place in the vicinity of the Site.

6 UXO HAZARD ASSESSMENT

6.1 UXO Hazard Level

The definitions for the levels of UXO hazard are provided below.

Definitions of UXO Hazard Level for a Site	
Hazard Level	**Definition**
Very Low	There is positive evidence that UXO is not present, e.g. through physical constraints or removal.
Low	There is no positive evidence that UXO is present, but its occurrence cannot be totally discounted.
Moderate	There is positive evidence that ordnance was present or that other uncharted ordnance may be present as UXO.
High	There is positive evidence that UXO is present.
Very High	As high, but requires immediate or special attention due to the potential hazard.

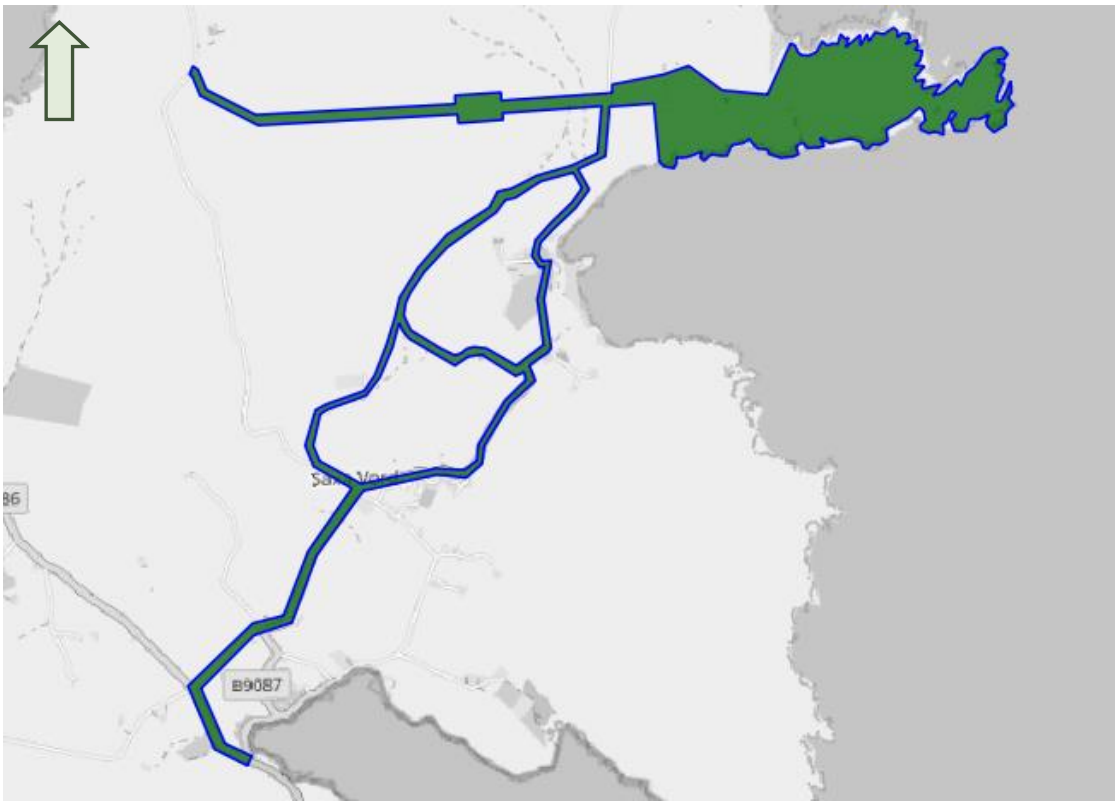
During WWII, RAF Skaw, a radar station, was located on the eastern part of the Site.

No records of significant HE bombing or military activity associated with RAF Skaw likely to provide a significant source of UXO hazard has been found.

Given this, it is considered that the Site has a low UXO hazard level, as shown in Figure 5 below.

The UXO hazard zone plan of the Site is also given in the accompanying P9238-19-R1-MAP01-B.

Figure 5	UXO hazard zone plan of the Site



Source: OpenStreetMap *Not to Scale*

Legend	Very Low	Low	Moderate
	High	Very High	Site boundary

It should be noted that the potential for encountering Small Arms Ammunition (SAA) or close combat munitions on any former military establishment as a result of localised disposal or spillage cannot be totally discounted. As such, staff should be suitably sensitised to the risk of encountering UXO.

7 UXO RISK ASSESSMENT

7.1 Proposed Works

It is understood that initial works on the Site will include intrusive ground investigation, including excavated trial pits and peat probing.

7.2 Risk Assessment Methodology

A UXO risk assessment has been undertaken for the proposed works, taking into consideration the identified UXO hazard.

Firstly, the probability of encountering UXO (PE) has been considered and rated for the different construction techniques, as detailed below.

Probability of Encounter (PE)	Rating
Frequent, highly likely, almost certain.	5
Probable, more likely to happen than not.	4
Occasional, increased chance or probability.	3
Remote, unlikely to happen but could.	2
Improbable, highly unlikely.	1
Impossible	0

Secondly, the probability of detonating a UXO (PD) has been considered and rated for the different construction techniques, as detailed below.

Probability of Detonation (PD)	Rating
Frequent, highly likely, almost certain.	5
Probable, more likely to happen than not.	4
Occasional, increased chance or probability.	3
Remote, unlikely to happen but could.	2
Improbable, highly unlikely.	1
Impossible	0

Next, the probability of encountering and detonating the UXO (PE x PD) have been used to generate an overall likelihood rating (P).

P = PE x PD	LIKELIHOOD of Encounter and Detonation	Rating
21 to 25	Frequent, highly likely, almost certain.	5
16 to 20	Probable, more likely to happen than not.	4
6 to 15	Occasional, increased chance or probability.	3
2 to 5	Remote, unlikely to happen but could.	2
1	Improbable, highly unlikely.	1
0	Impossible	0
P ranges from 25, a certainty of UXO being encountered and detonated on the Site by engineering activity, to 0, a certainty that UXO does not occur on the Site and will not be detonated by engineering activity.		

The likelihood of encountering and detonating UXO during site works is multiplied by the severity of such an event occurring (P x S), in order to provide a risk level using the following matrix.

Severity (S)	Rating
Multiple fatalities	5
Major injury, long term health issues, single fatality.	4
Minor injury, short term health issues, no fatalities.	3
First aid case but no lost time or ill health.	2
Minor injuries, no first aid.	1
No injuries.	0

UXO Risk Matrix							
	SEVERITY (S)						
LIKELIHOOD (P)		5	4	3	2	1	0
	5	25	20	15	10	5	0
	4	20	16	12	8	4	0
	3	15	12	9	6	3	0
	2	10	8	6	4	2	0
	1	5	4	3	2	1	0
	0	0	0	0	0	0	0

7.3 UXO Risk Level

The UXO risk assessment for proposed works on the Site is given in Table 3.

Table 3 UXO risk assessment for the Site

Potential UXO Hazard	Anticipated Works	PE	PD	P = PE x PD	Likelihood	Severity	Risk Rating	UXO Risk
UXB	Excavations	1	1	1	1	5	5	Low
	Ground Investigations	1	1	1	1	4	4	Low
Close Combat Munitions	Excavations	1	1	1	1	4	4	Low
	Ground Investigations	1	1	1	1	3	3	Low
Other UXO	Excavations	1	1	1	1	4	4	Low
	Ground Investigations	1	1	1	1	3	3	Low
SAA	Excavations	1	1	1	1	2	2	Low
	Ground Investigations	1	1	1	1	2	2	Low

PE (Probability of Encounter), PD (Probability of Detonation), P (Overall Probability)

SAA (Small Arms Ammunition)

8 RISK MITIGATION PLAN

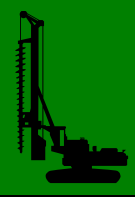
Key findings: No significant sources of UXO hazard have been identified on the Site.

Key actions: UXO awareness briefing.

8.1 UXO Risk Summary

Table 4 summarises the UXO risk for proposed works on the Site and recommended actions.

Table 4 Summary of UXO risk and mitigation recommendations

Proposed Works	UXO Risk	Recommended Mitigation
Excavations		**UXO awareness briefing -** Given the Site's military history it is recommended that a formal UXO awareness briefing is provided to staff involved in excavation.
Ground Investigations		**UXO awareness briefing** – as above

In summary, it is recommended that staff involved in site works are provided with a formal UXO awareness briefing so that they take appropriate action in the event of a suspect find.

8.2 Risk Mitigation Techniques

Should you wish to provide staff involved in site works with increased awareness regarding the potential (albeit low) for UXO encounter, this can be done through a formal briefing.

8.2.1 UXO Awareness Briefing

Typically ~1hour in duration, these briefings will be expected to provide site workers with:-

- Background to the potential UXO hazards that could be encountered.
- Awareness of how the UXO hazard could present a risk.
- Knowledge of what to do in the event that a suspect item is encountered.

The briefing is to be provided along with back-up materials such as UXO awareness posters, emergency contact numbers and other background information to assist site workers in becoming familiar with what potential UXO can look like.

The materials can also be used by key staff to pass on the relevant points of the induction to others who visit or work on the Site.

By providing the UXO awareness briefing, it ensures that in the unlikely event that UXO is encountered:-

- All site staff take appropriate action.
- A support mechanism and points of contact are established.
- The likelihood of harm to people or property is reduced.
- Significant delays to site work are prevented.

8.3 What Do I Do Next?

If you wish to proceed with UXO risk mitigation, Zetica would be happy to assist. Just contact us via phone (01993 886682) or email (uxo@zetica.com) and we can provide a proposal with options and prices.

If you have requirements to identify other buried hazards (such as mapping utilities or obstructions) we can provide these surveys.

If proposed works on the Site change, or additional works are planned, contact Zetica for a re-assessment of the UXO risk and the risk mitigation requirements.

APPENDICES

Appendix 1 Anticipated Ordnance Types

The probability of encountering UXO on the Site is considered to be low. As with any similar site in the UK, there is always a background risk of finding ordnance and potential types to be encountered are detailed below. For a more comprehensive set of ordnance data sheets, see http://zeticauxo.com/downloads-and-resources/ordnance-data-sheets/.

Information Data Sheet

Category Small Arms Ammunition
Type Various

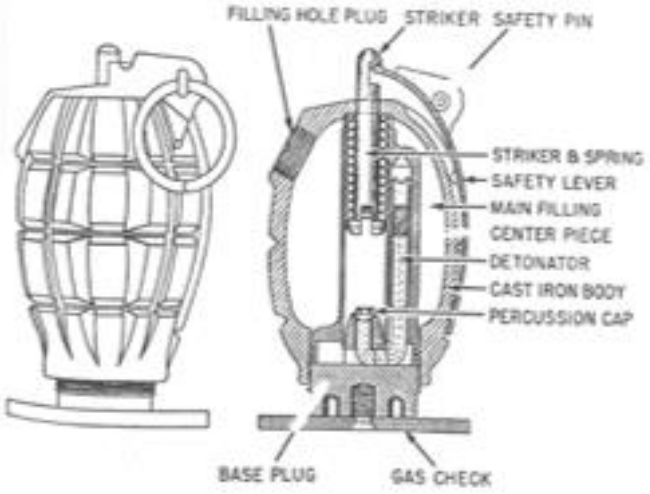
Description Small Arms Ammunition (SAA) is one of the more recognisable categories of ordnance which is primarily designed for anti-personnel use. SAA include items such as bullets, generally up to a calibre (diameter) of 20mm.

Generally small arms ordnance has a relatively low risk as UXO, although the larger calibre categories may have the same detonation risk as larger high explosive ordnance.

SAA is often associated with discarded ammunition boxes around firing practice ranges and training areas and is often found scattered across former military airfields as a result of aircraft crashes and localised disposal

Information Data Sheet

Category Grenades (British)
Type No. 36 Hand Grenade ('Mills Bomb')



Variants	-	**Dimensions**	101.6mm x 61mm (4" x 2.4")
Weight	2 lbs	**Delay**	4 seconds
Filling	Baratol	**Material**	Cast Iron

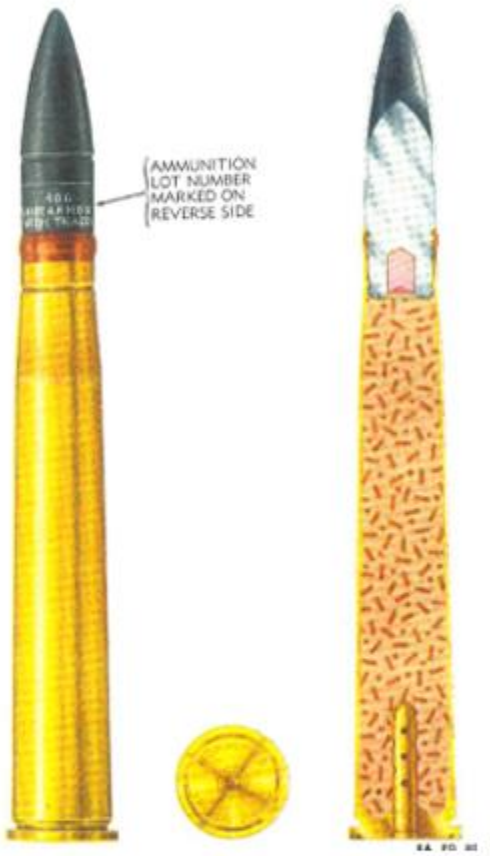
Description Lemon-shaped, cast-iron body filled with high explosive. Three holes in the body; one in the base for priming, one near the top for filling; one on the top holding striker.

Function Used as a defence against enemy personnel.

Information Data Sheet

Category Projectiles (British)
Type 40mm Shell

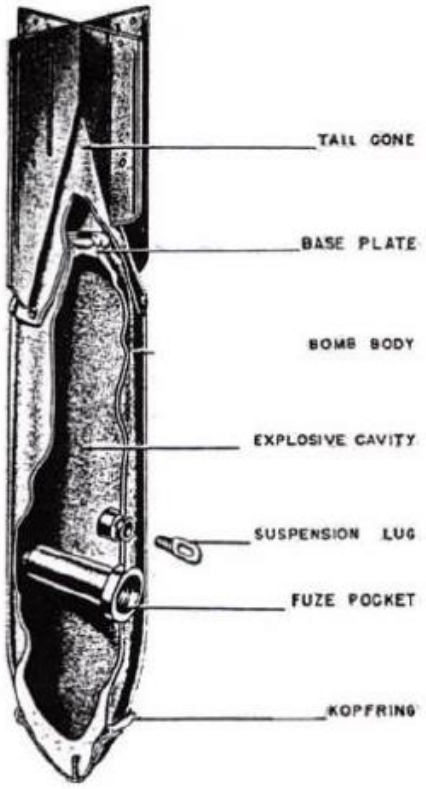
Variants	-
Body Dimensions	40mm x 310mm (1.6" x 12.2")
Weight	4.57lb (1.96lb for projectile)
Fuze	Point-detonating fuze
Composition	Steel casing
Description	Steel-cased cartridge and projectile with copper expansion ring around base of projectile to allow release on firing.
Function	Used as a rapid-fire defence against enemy aircraft, fired from fixed batteries and mobile mountings.



Information Data Sheet

Category Bomb (Luftwaffe)
Type Sprengbombe-Cylindrisch (SC) 50kg

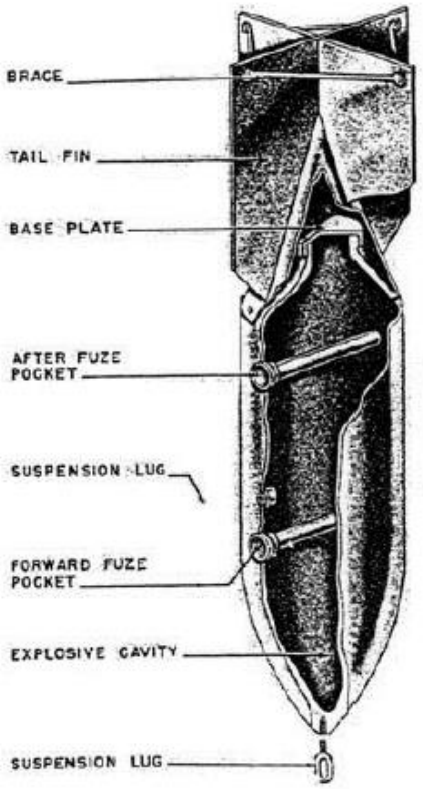
Variants	8
Body Dimensions	762 x 200mm (30" x 7.9")
Weight	55kg (122lbs)
Charge Weight	25kg (54lbs)
Fuze	Single electric impact fuze. Some have short time delay
Composition	Sheet steel
Description	Thick nose welded to a steel body. Nose may be attached to Kopfring (a triangular section steel ring) or spike. Suspension bolt in eye/body and sheet metal tail attached to body with rivets/screws. Originally painted green-grey with a yellow stripe on the tail. Cast TNT, Amatol or Trialen filling.
Function	Designed to maximise shock waves through air, water and earth and for general demolition. Used against easily damageable targets, including roads, aircraft hangars, rolling stock and small buildings. Spike bombs/ 'Stabo' (SC 50 with spikes attached to nose) were used against rail lines and country roads, with Kopfring used against naval targets.



Information Data Sheet

Category Bomb
Type Sprengbombe-Cylindrisch (SC) 250kg

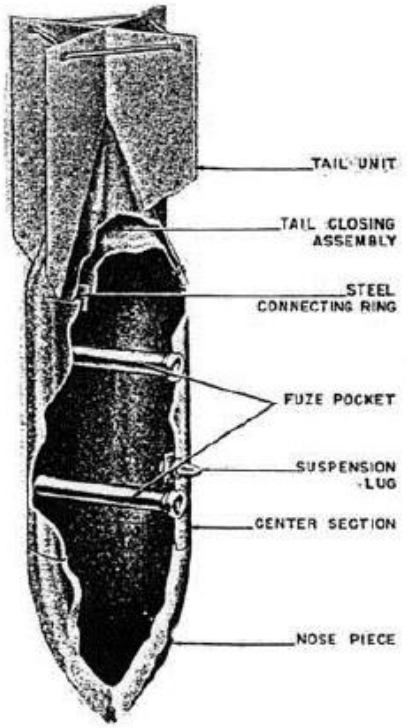
Variants	8
Body Dimensions	1194mm x 368mm (47" x 14.5")
Weight	249-264 kg (548-582lbs)
Charge Weight	130-145 kg (287-320lbs)
Fuze	Electric impact fuze/electric clockwork time fuse & electric anti-disturbance fuze
Composition	Sheet steel with stays
Description	Thick nose welded to steel body. Nose may be attached to Kopfring (triangular section steel ring) or spike. Sheet metal tail attached to body with rivets/ screws. Suspension eye bolt in the nose/body. Originally painted green-grey with a yellow stripe on the tail. TNT; amatol; TNT and aluminium powder, naphthalene, ammonium nitrate and wax/ wood meal filling.
Function	Designed to maximise shock waves through air, water and earth and general demolition. Used against railway installations, large buildings, ammunition depots and below-ground installations (to 8m). Spike bombs/ 'Stabo' (SC 50 with spikes attached to nose) used against rail lines and country roads.



Information Data Sheet

Category Bomb
Type Sprengbombe-Cylindrisch (SC) 500kg

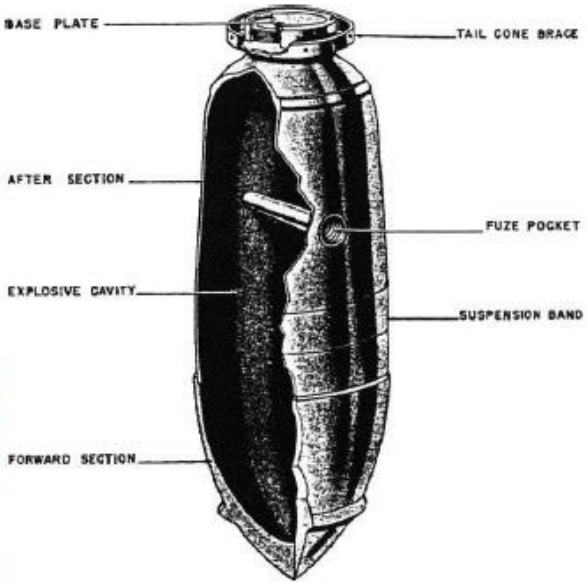
Variants	-
Body Dimensions	1414–1486mm x 470mm (55.7-58.5" x 18.5")
Weight	500kg (1,100lbs)
Charge Weight	220kg (484lbs)
Fuze	Electric impact fuze/electric clockwork time fuse & electric anti-disturbance fuze.
Composition	Sheet steel with stays or drum
Description	Thick nose welded to steel body. Nose may be attached to Kopfring (triangular section steel ring). Tail either steel sheet or drum-shaped. Suspension band. Originally painted green-grey/ buff (some later versions sky blue) with yellow stripe on tail. Filled with amatol, TNT or trialen.
Function	Designed to maximise shock waves through air, water and earth and for general demolition. Used against railway property, large buildings, shipping and below-ground installations.

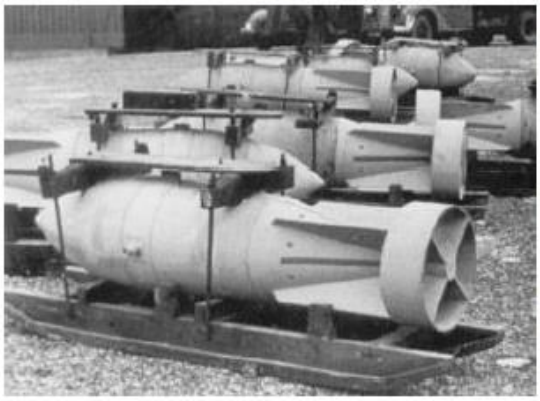


Information Data Sheet

Category Bomb
Type Sprengbombe-Cylindrisch (SC) 1,000kg (HERMANN)

Variants	3
Body Dimensions	1742-1905mm x 648–660mm (68.6-75" x 25.5-26")
Weight	1,000-1,088kg (2,204-2,398lbs)
Charge Weight	529-619kg (1,166-1,364lbs)
Fuze	Electric impact fuze/ electric clockwork time fuze & electric anti-disturbance fuze
Composition	Magnesium alloy with drum
Description	Thick nose welded to steel body. Nose attached to Kopfring (triangular section steel ring). Drum-shaped tail made of magnesium alloy. Suspension band. Originally painted sky-blue. Filled with amatol, TNT/aluminium/wood meal or trialen.
Function	Designed to maximise shock waves through air, water and earth and for general demolition.

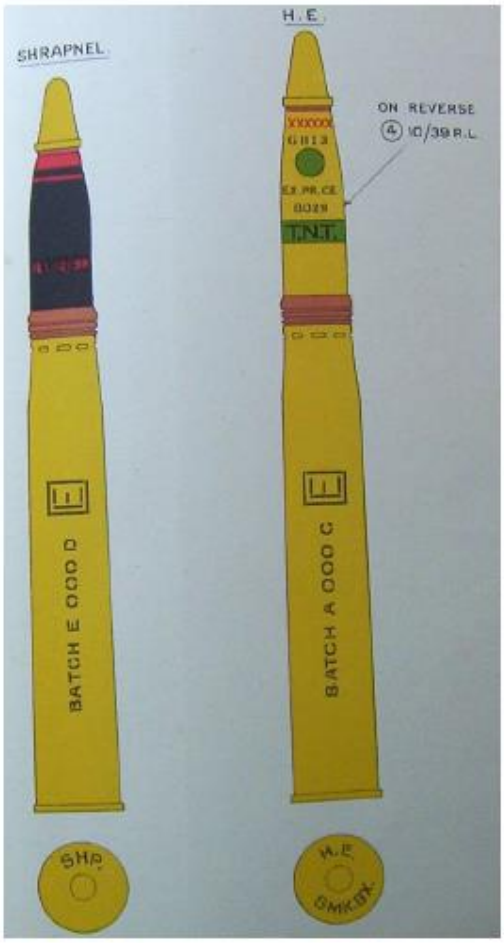




Information Data Sheet

Category Projectile
Type 3.7" Anti-Aircraft Shell

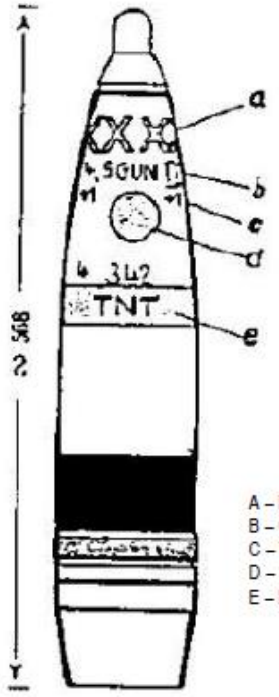
Variants	6
Body Dimensions	94mm x 360mm (3.7 x 14.7")
Weight	12.7kg (28lb)
Fuze	Mechanical time fuze
Composition	Cast steel
Description	Brass cartridge case. Square-based shell with tapered nose, filled with Amatol, TNT or RDX/TNT. MK6 had forward centring bands and a wider driving band.
Function	Used as a defence against enemy aircraft, fired from fixed batteries and mobile mountings. Could fire approximately 20 rounds per minute with a maximum ceiling of 41,000ft and horizontal range of 20,600 yards.



Information Data Sheet

Category Projectile
Type 4.5" Shell (Mark II – Anti-Aircraft)

Variants	-
Body Dimensions	114mm x 566mm (4.5" x 21.9")
Weight	24.9kg (55lb)
Fuze	Mechanical time fuze
Composition	Cast steel
Description	Square-based, tapered-nosed shell filled with TNT or Amatol. Steel casing, rotating band of either copper or gilding metal located 3.5" in front of the base end with single groove.
Function	Used as field artillery and adapted for use in anti-aircraft defence from fixed batteries. Rate of fire of 8 rounds per minute, maximum ceiling of 44,000ft and horizontal range of 22,800 yards.



A – Missile Identification
B – Gun and Bullet Type
C – Weight
D – Smoke pot
E – Explosives Ring

Appendix 2 Sources of UXO Hazard

The sections below provide background information on the potential sources of UXO hazard (albeit low) affecting the Site. For a more comprehensive set of UXO information sheets, see http://zeticauxo.com/downloads-and-resources/uxo-information-sheets/.

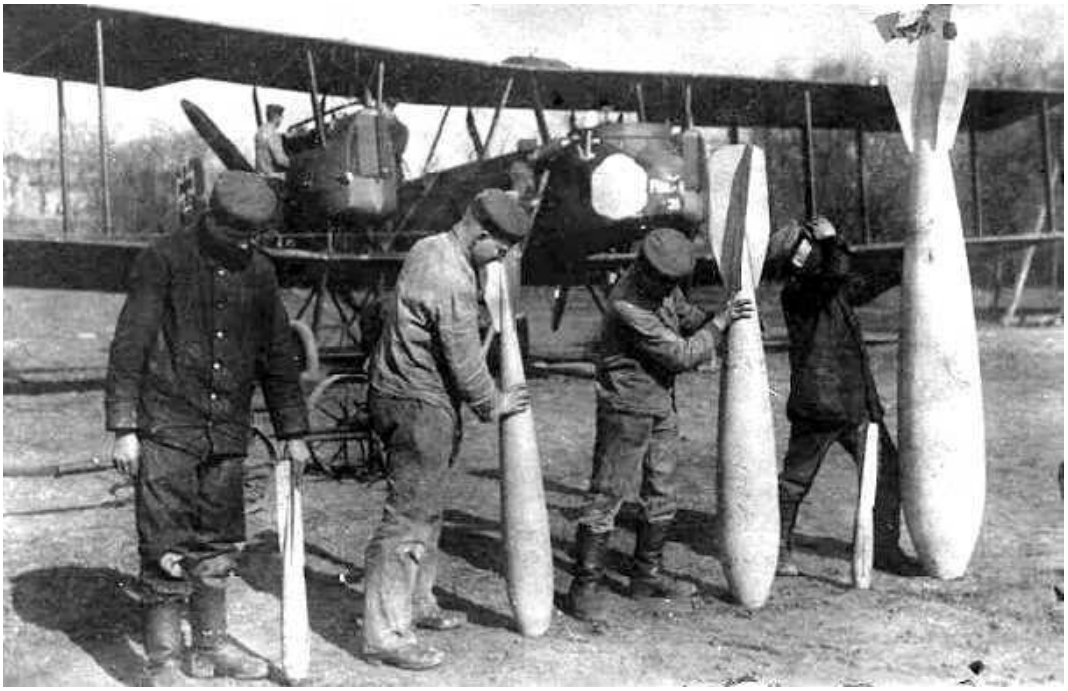
Appendix 2.1 WWI Bombing

It is not generally realised that during World War One (WWI) significant bombing took place across some areas of the UK. An estimated 9,000No. German bombs were dropped on Britain during the course of 51No. airship and 52No. aircraft raids. It was the first time that strategic aerial bombardment had been used. More than 1,400No. people were killed during these raids.

Most air raids were carried out on London and Southeast England. Areas along the East Coast were also targeted regularly due to their proximity to the European continent. Bombing raids further inland were rare and West England and Wales were out of reach for German aircraft of the time.

Aerial bombing during WWI initially relied on visual aiming, with bombsights not developed until later in the war. The inaccuracy inherent in this method meant that bombs often fell some way from their intended targets.

The first recorded raid against England occurred on the 21st December 1914 when 2No. high explosive bombs fell near the Admiralty Pier at Dover. Zeppelin raids intensified during 1915 and 1916, with aircraft raids becoming more frequent after 1917. The last raid of WWI took place on the 19th May 1918, when 38 Gotha and 3 Giant aircraft bombed London and surrounding districts, dropping a total of more than 2,500lbs of bombs.



The potential of coming across an Unexploded Bomb (UXB) from WWI is far less likely than a WWII UXB given the lower bombing densities during raids in the Great War.

Some areas which were subjected to sustained bombing raids, such as parts of London and coastal towns, recorded a higher number of UXB. In these areas, where there has been no significant development for the last century, the potential of a UXB remaining from WWI cannot be totally discounted.

Appendix 2.2 WWII Bombing

Bombing raids began in the summer of 1940 and continued until the end of WWII. Bombing densities generally increased towards major cities or strategic targets such as docks, harbours, industrial premises, power stations and airfields. In addition to London, industrial cities and ports, including Birmingham, Coventry, Southampton, Liverpool, Hull and Glasgow, were heavily targeted, as well as seaside towns such as Eastbourne and cathedral cities such as Canterbury.

The German bombing campaign saw the extensive use of both High Explosive (HE) bombs and Incendiary Bombs (IBs). The most common HE bombs were the 50kg and 250kg bombs, although 500kg were also used to a lesser extent. More rarely 1,000kg, 1,400kg and 1,800kg bombs were dropped.

The HE bombs tended to contain about half of their weight in explosives and were fitted with one or sometimes two fuzes. Not all HE bombs were intended to explode on impact. Some contained timing mechanisms where detonation could occur more than 70 hours after impact.

Incendiary devices ranged from small 1kg thermite filled, magnesium bodied Incendiary Bombs (IBs) to a 250kg 'Oil Bomb' (OB) and a 500kg 'C300' IB. In some cases the IBs were fitted with a bursting charge. This exploded after the bomb had been alight for a few minutes causing burning debris to be scattered over a greater area. The C300 bombs were similar in appearance to 500kg HE bombs, although their design was sufficiently different to warrant a specially trained unit of the Royal Engineers to deal with their disposal.

Anti-Personnel (AP) bombs and Parachute Mines (PMs) were also deployed. 2No. types of anti-personnel bombs were in common use, the 2kg and the 12kg bomb. The 2kg bomb could inflict injury across an area up to 150m away from the impact. PMs (which were up to 4m in length) could be detonated either magnetically or by noise/vibration.

Anti-shipping parachute mines were commonly dropped over navigable rivers, dockland areas and coastlines. The Royal Navy was responsible for ensuring that the bombs were made safe. Removal and disposal was still the responsibility of the Bomb Disposal Unit of the Royal Engineers.

In 1944, the Germans introduced new weapons; the V1, a 'flying bomb' and guided missile, and the V2, a ballistic missile rocket that travelled at such speed that no one could see or hear its approach. London was the main target for these attacks.

WWII bomb targeting was inaccurate, especially in the first year of the war. A typical bomb load of 50kg HE bombs mixed with IBs which was aimed at a specific location might not just miss the intended target but fall some considerable distance away.

It is understood that the local Civil Defence authorities in urban areas had a comprehensive system for reporting bomb incidents and dealing with any Unexploded Bombs (UXB) or other UXO. In more rural areas, fewer bombing raids occurred. It is known that Air Raid Precaution (ARP) records under-represent the number and frequency of bombs falling in rural and coastal areas. Bombs were either released over targets or as part of 'tip and run' raids where bomber crews would drop their bombs to avoid anti-aircraft fire or Allied fighter aircraft on the route to and from other strategic targets. Bombs dropped as a result of poor targeting or 'tip and run' raids on rural and coastal areas often went unrecorded or entered as 'fell in open country' or 'fell in the sea'. The Luftwaffe are thought to have dropped approximately 75,000 tons of bombs on Britain throughout the Second World War and an estimated 11% of all bombs dropped during the war failed to detonate.

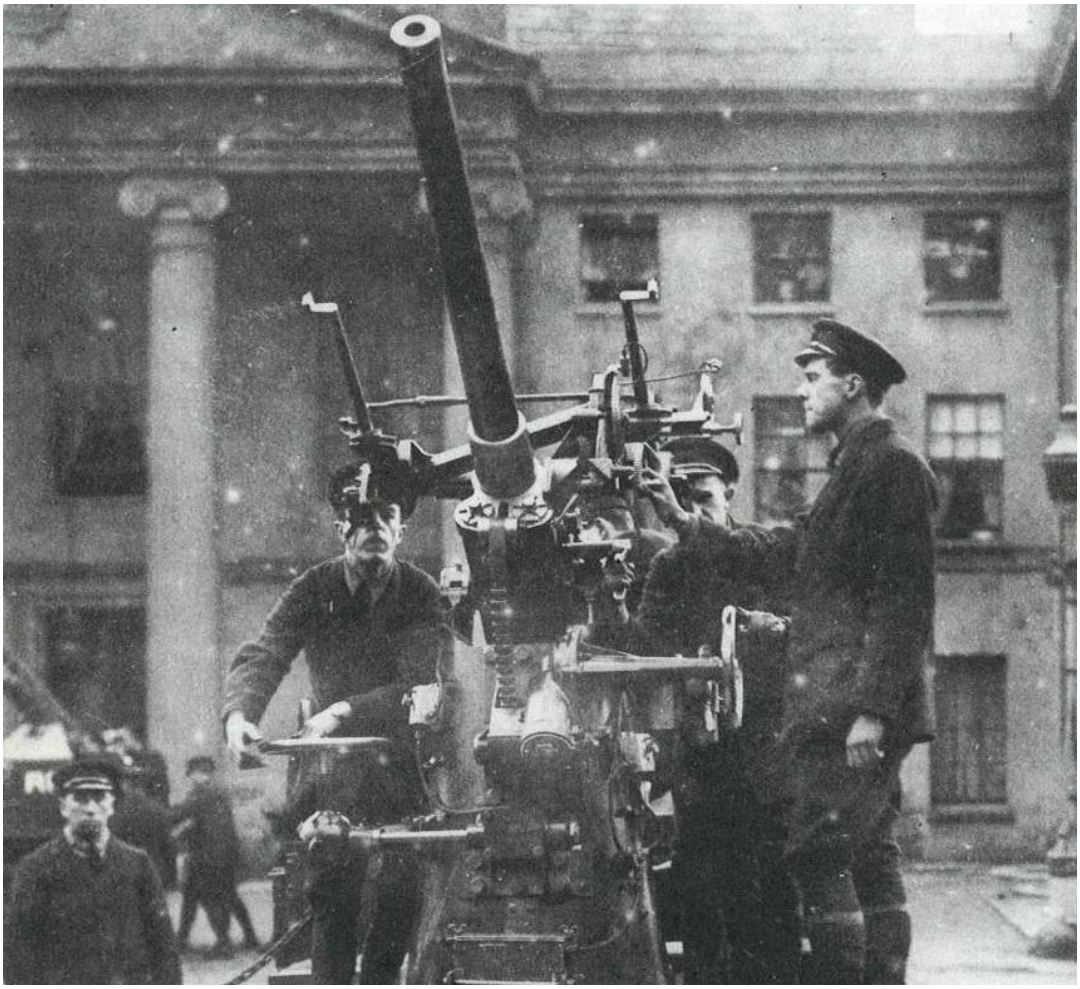
The potential for a UXB hazard to exist on a site depends on a variety of factors. Were there strategic targets in the surrounding area? Was the site bombed? Could a UXB impact have been missed? Even in rural areas, the potential for UXB cannot be totally discounted and therefore it is essential that detailed local bombing records are obtained when assessing the UXB hazard on any site.

Appendix 2.3 Anti-Aircraft Guns

As aerial bombardment first began during WWI, Anti-Aircraft (AA) gun batteries were established were gradually established throughout much of England to counter German bombing raids. By June 1916, there were approximately 271No. AA guns and 258No. searchlight installations defending London alone.

Common AA defences during WWI included 3-inch, 75 millimetre, 6-pounder and 1-pounder guns. Many of these guns were mobile, being mounted on lorry chassis. They were driven about following the course of an airship and fired from any area of open land.

During WWI, Unexploded AA (UXAA) shells, could land up to 13km from the firing point, although more typically fell within 10km.



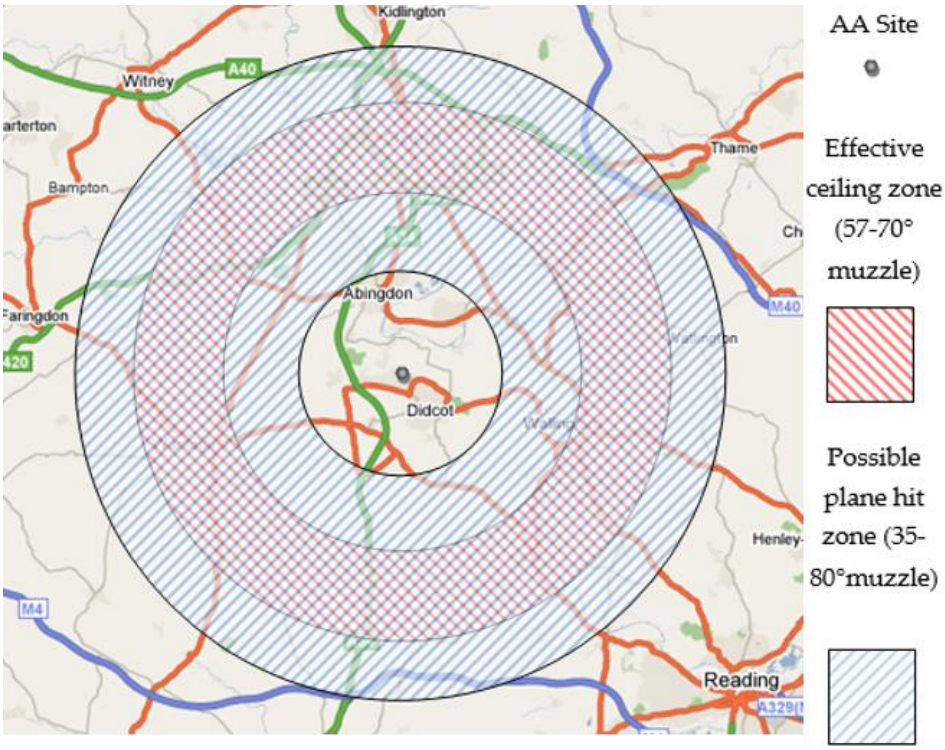
AA gun batteries were used extensively during WWII to counter the threat posed by enemy aircraft. In many instances, AA shells caused damage to Allied territory and in some areas caused significant numbers of civilian fatalities.

During WWII, AA shells could land up to 27km from the firing point, although more typically fell within 15km. These could be distributed over a wide area.

3No. types of AA batteries existed:

- **Heavy Anti-Aircraft (HAA)** batteries of large guns (typically 3.7", 4.5" and 5.25" calibre) designed to engage high flying bomber aircraft. These tended to be relatively permanent gun emplacements.
- **Light Anti-Aircraft (LAA)** weaponry, designed to counter low flying aircraft. These were often mobile and were moved periodically to new locations around strategic targets such as airfields. They typically fired 40mm shells and machine gun ammunition.
- **Rocket batteries (ZAA)** firing 3" or 3.7" AA rockets with a maximum altitude of 5,800m and a ground range of 9km were typically permanent emplacements.

Unexploded AA (UXAA) shells were a common occurrence during WWII. As the figure below demonstrates, shells were unlikely to fall in the immediate vicinity of a gun battery but in the surrounding area. This would be dependent upon the angle of fire and the flight height of the attacking aircraft.



AA batteries were deliberately targeted by the Luftwaffe and therefore areas surrounding a gun battery may have a greater risk of UXB being present.

Munitions stores were also established around AA batteries. These stored the shells for the batteries and small arms ammunition for troops manning the position. Such stores were typically removed at the end of WWII, although some disposal may have occurred in the immediate vicinity of the gun battery.

Appendix 3 Recent UXO Finds

UXO finds in the UK are a regular occurrence, although they almost never result in an accidental detonation.

It is still important to note that explosives rarely lose effectiveness with age. In some instances, mechanisms such as fuzes and gaines can become more sensitive and more prone to detonation, regardless of whether the device has been submersed in water or embedded in silt, clay or similar materials.

The effects of an accidental UXO detonation are usually extremely fast, often catastrophic and invariably traumatic to any personnel involved. Such occurrences are largely restricted to current theatres of war and overseas minefields, with occasional events in mainland Europe.

The sections below provide a brief summary of recent significant UXO finds in the UK. To keep up to date with the latest UXO finds, visit http://zeticauxo.com/news/.

On the 4th September 2017, 1No. 50kg UXB was found in a ragstone quarry at Kings Hill near West Malling in Kent. It was destroyed in situ in a controlled explosion by an EOD team.

On the 11th February 2018, 1No. 500kg UXB was found in King George V Dock in London, resulting in the temporary closure of the adjacent London City Airport. The UXB was freed from a silt bed and towed along the River Thames to Shoeburyness where it was destroyed in a controlled explosion.

On the 26th February 2018, an EOD team destroyed numerous items of ordnance including shells and 20mm ammunition which had been exposed by storms on Selsey beach. A similar operation was required after more UXO finds on the beach in April 2018.

On the 31st March 2018, 2No. 870lb British PMs were found in waters off Guernsey. They were destroyed in controlled explosions.

On the 20th May 2018, a 1,000kg German sea mine washed ashore at Elmer beach near Bognor Regis, West Sussex. A 1 mile exclusion zone was enforced before an EOD team towed the device out to sea for a controlled explosion.

On the 24th May 2018, numerous ordnance-related items were found on a proposed residential development in Burntwood, Staffordshire.

On the 10th July 2018, a suspected 1,000kg German UXB was found by scuba divers near Teignmouth Pier in Devon. The UXB was towed out into open sea by a RN EOD team for a controlled explosion.

On the 30th August 2018, a 2,000lb German PM was trawled up by a fishing vessel off Mersea in Essex. The PM was moved to an area of open sea where it was destroyed in a controlled explosion by a RN EOD team.

On the 29th November 2018 a large naval projectile was found at Wembury Point, Plymouth. It was destroyed in a controlled explosion.

During January and February 2019 a military EOD was called out to deal with several items of UXO washed up at Medmerry Beach in Selsey. The site of a former gunnery range, it followed on from several similar incidents in 2018.

On the 21st January 2019 a suspected 1,000lb torpedo was brought into Brixham Harbour by a fishing trawler. It was towed back out to sea and destroyed by a Naval EOD team.

On the 6th February 2019 3No. WWII projectiles were found on Chalkwell Beach near Southend-on-Sea, Essex. They were destroyed in a controlled explosion.

On the 19th February 2019 6No. projectiles were found on the beach at Lilstock, Somerset.

On the 14th March 2019 an unexploded pipe mine was found at the former RAF Manston airfield near Ramsgate, Kent. It was destroyed in a controlled explosion.

On the 21st March 2019 2No. unexploded shells were found on a building site in Brighton. They were removed by an EOD team.

On the 25th March 2019 an unexploded shell was found in Stechford, Birmingham. It was removed to a field and destroyed in a controlled explosion.

On the 22nd May 2019 70No. Self-Igniting Phosphorus (SIP) grenades were found during development works at Tongland Dam in Dumfries & Galloway, Scotland. They were destroyed in a controlled explosion.

On the 23rd May 2019 a 250kg German UXB was found by workers on a building site at Kingston University in London (see plate below). The UXB could not be safely removed and was consequently destroyed in situ by an EOD team.

On the 27th May 2019 24No. SIP grenades were found in a field near Sibton in Suffolk. An EOD team constructed a 2ft deep trench into which the grenades were placed before being destroyed in a controlled explosion.

On the 7th June 2019 a 50kg German fragmentation UXB was found at a building site in Kings Hill at the former RAF West Malling airfield. It was destroyed in a controlled explosion by an EOD team the following day. On the 26th September 2019 another 50kg German UXB was found at Kings Hill and was destroyed in a controlled explosion the next day.

On the 20th September 2019 a suspected 250kg German UXB was found on a construction site in Bordon, Hampshire. It was destroyed in a controlled explosion by an EOD team.

In September 2019 a German PM was found by divers off Southend-on-Sea, Essex. It was towed out to open water off Shoeburyness by a Royal Navy EOD team and destroyed in a controlled explosion.

On the 3rd February 2020, a 500kg German UXB was found on a building site in Soho, London. It was removed by an EOD team.

Appendix 4 Glossary and Definitions

Abandoned Explosive Ordnance (AXO)	Abandoned Explosive Ordnance is explosive ordnance that has not been used during an armed conflict, that has been left behind or disposed of by a party to an armed conflict, and which is no longer under control of that party. Abandoned explosive ordnance may or may not have been primed, fuzed, armed or otherwise prepared for use.
Close Combat Munitions	Items of ordnance thrown, propelled or placed during land warfare, to include grenades, mortars, projectiles, rockets and land mines.
Demil	Derived from the term 'Demilitarisation', it refers to the break down and the recycling or disposal of ordnance components.
Detonation	The high-speed chemical breakdown of an energetic material producing heat, pressure, flame and a shock wave.
Device	This term is used for any component, sub-assembly or completed ordnance, which may or may not have an explosive risk. It can apply to detonators, primers, gaines, fuzes, shells or bombs.
Explosive	The term explosive refers to compounds forming energetic materials that under certain conditions chemically react, rapidly producing gas, heat and pressure. Obviously, these are extremely dangerous and should only be handled by qualified professionals.
Explosive Ordnance (EO)	Explosive Ordnance is all munitions containing explosives, nuclear fission or fusion materials and biological and chemical agents. This includes bombs and warheads, guided and ballistic missiles, artillery, mortar, rocket, small arms ammunition, mines, torpedoes, depth charges, pyrotechnics, cluster bombs & dispensers, cartridge & propellant actuated devices, electro-explosive devices, clandestine & improvised explosive devices, and all similar or related items or components explosive in nature.
Explosive Ordnance Clearance (EOC)	Explosive Ordnance Clearance is a term used to describe the operation of ordnance detection, investigation, identification and removal, with EOD being a separate operation.
Explosive Ordnance Disposal (EOD)	Explosive Ordnance Disposal is the detection, identification, on-site evaluation, rendering safe, recovery and final disposal of unexploded explosive ordnance.
Explosive Ordnance Reconnaissance (EOR)	Explosive Ordnance Reconnaissance is the detection, identification and on-site evaluation of unexploded explosive ordnance before Explosive Ordnance Disposal.
Explosive Remnants of War (ERW)	Explosive Remnants of War are Unexploded Ordnance (UXO) and Abandoned Explosive Ordnance (AXO), excluding landmines.

Explosive Substances and Articles (ESA)	Explosive substances are solid or liquid substances (or a mixture of substances), which are either: • capable by chemical reaction in itself of producing gas at such a temperature and pressure and at such a speed as to cause damage to the surroundings. • designed to produce an effect by heat, light, sound, gas or smoke, or a combination of these as a result of a non-detonative, self-sustaining, exothermic reaction. Explosive article is an article containing one or more explosive substances.
Fuze	A fuze is the part of an explosive device that initiates the main explosive charge to function. In common usage, the word fuze is used indiscriminately, but when being specific (and in particular in a military context), fuze is used to mean a more complicated device, such as a device within military ordnance.
Gaine	Small explosive charge that is sometimes placed between the detonator and the main charge to ensure ignition.
Geophysical survey	A geophysical survey is essentially a range of methods that can be used to detect objects or identify ground conditions without the need for intrusive methods (such as excavation or drilling). This is particularly suited to ordnance as disturbance of ordnance items is to be avoided where ever possible.
Gold line	This is the estimated limit of blast damage from an explosive storage magazine. It usually means that development within this zone is restricted.
High Explosive	Secondary explosives (commonly known as High Explosives (HE)) make up the main charge or filling of an ordnance device. They are usually less sensitive than primary explosives. Examples of secondary explosives are: Nitro glycerine (NG), Trinitrotoluene (TNT), AMATOL (Ammonia nitrate + TNT), Gunpowder (GP), and Cyclotrimethylenetrinitramine (RDX).
Munition	Munition is the complete device charged with explosives, propellants, pyrotechnics, initiating composition, or nuclear, biological or chemical material for use in military operations, including demolitions. This includes those munitions that have been suitably modified for use in training, ceremonial or non-operational purposes. These fall into three distinct categories:- • inert - contain no explosives whatsoever. • live - contain explosives and have not been fired. • blind - have fired but failed to function as intended.

Primary Explosive	Primary explosives are usually extremely sensitive to friction, heat, and pressure. These are used to initiate less sensitive explosives. Examples of primary explosives are: Lead Azide, Lead Styphnate, and Mercury Fulminate. Primary explosive are commonly found in detonators.
Propellants	Propellants provide ordnance with the ability to travel in a controlled manner and deliver the ordnance to a predetermined target. Propellants burn rapidly producing gas, pressure and flame. Although usually in solid form they can be produced in liquid form. Examples of propellants are: Ballistite often found in a flake form and Cordite used in small arms ammunition.
Pyrotechnic	A pyrotechnic is an explosive article or substance designed to produce an effect by heat, light, sound, gas or smoke, or a combination of any of these, as a result of non-detonative, self-sustaining, exothermic chemical reactions.
Small Arms Ammunition (SAA)	SAA includes projectiles around 12mm or less in calibre and no longer than approximately 100mm. They are fired from a variety of weapons, including rifles, pistols, shotguns and machine guns.
Unexploded Anti-Aircraft (UXAA) Shell	UXAA shells are army ordnance commonly containing HE, though they can also contain pyrotechnic compounds that produce smoke. Most commonly, these were 3.7” and 4.5” HE shells, although they ranged from 2” to 5.25” calibre.
Unexploded Bomb (UXB)	UXB is a common term for unexploded air-dropped munitions.
Unexploded Ordnance (UXO)	UXO is explosive ordnance that has been either primed, fuzed, armed or prepared for use and has been subsequently fired, dropped, launched, projected or placed in such a manner as to present a hazard to operations, persons or objects and remains unexploded either by malfunction or design.
V1	The Vergeltungswaffe-1, V-1, also designated Fieseler Fi 103/FZG-76, known colloquially in English as the Flying Bomb, Buzz Bomb or Doodlebug, was the first guided missile used in WWII and the forerunner of today's cruise missile.
V2	The Vergeltungswaffe 2 (V-2) (‘Reprisal Weapon 2’) was the first ballistic missile. It was used by the German Army primarily against Belgian and British targets during the later stages of WWII. The V-2 was the first man-made object launched into space, during test flights that reached an altitude of 189km (117 miles) in 1944.

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Appendix 13.1 Landscape and Visual Impact Assessment Methodology

Appendix 13.1 Landscape and Visual Impact Assessment Methodology

Introduction

13.1.1 The Landscape and Visual Impact Assessment method follows good practice guidance and advice on the assessment of the impacts of development on landscape and visual resources contained in the following documents:

- Guidelines for Landscape and Visual Assessment (Landscape Institute and Institute of Environmental Assessment, 3rd Edition 2013) (GLVIA 3);
- Landscape Character Assessment: Guidance for England and Scotland, The Countryside Agency and NatureScot, 2002;
- Landscape Character Assessment Guidance for England and Scotland. Topic Paper 6: Techniques and Criteria for Judging Capacity and Sensitivity, The Countryside Agency and Scottish Natural Heritage, 2004; and
- Scottish Planning Policy, 2014;
- Visual Representation of Windfarms: Guidance, Version 2.2, NatureScot, 2017;
- Working Draft 11 – Guidance for Assessing the Effects on Special Landscape Qualities of National Scenic Areas, NatureScot, (November 2018); and
- Visual Representation of Development Proposals, The Landscape Institute, Technical Guidance Note 09/19 (17th September 2019).

13.1.2 The general approach to the LVIA includes the following tasks:

- Scoping;
- Baseline Assessment (comprising desk study, field survey and reporting); and
- Assessment and Reporting.

13.1.3 These tasks are described in detail below.

Scoping

13.1.4 The scope of the LVIA was agreed through written communication with NatureScot and Shetland Islands Council during 2020 including confirmation of the viewpoints to be included in the assessment (further details are provided in Chapter 13).

The Landscape and Visual Baseline

13.1.5 The first stage of the assessment reviews the existing landscape and visual resource of the Environmental Zone of Influence (EZI) in terms of its character, quality (i.e., the baseline condition) and establishes sensitivity of the resources/receptors. The baseline assessment forms the basis against which to assess the magnitude and significance of the predicted landscape and visual effects arising from the Proposed Project.

13.1.6 The EZI for the LVIA is defined by a 15 km radius offset from the centre of the launch site at Lamba Ness, as shown in Figure 13.1.1. This extent of EZI was determined as appropriate, given the heights of the separate elements of the Proposed Project, accepted best practice, and was agreed in consultation with NatureScot and Shetland Islands Council.

13.1.7 The baseline assessment has three elements:

- Description – the process of collecting and presenting information about landscape and visual resources in a systematic manner;

- Classification – the more analytical activity whereby landscape and visual resources are refined into units of distinct and recognisable character; and
- Evaluation – the process of attributing a sensitivity rating to a given landscape or visual resource, by reference to specified criteria.

13.1.8 In determining these elements, the baseline assessment process comprises three stages: desk study, field survey and analysis. These are described below.

Future Baseline

13.1.9 In the absence of the Proposed Project, the land within the application boundary is expected to remain in its current state. No other changes are expected to occur.

Desk Study

13.1.10 The location of the Proposed Project and the extent of the application boundary is shown in Figure 13.1.1. This is also detailed in Chapter 3 (Proposed Project). As part of the desk study, existing map and written data regarding the Proposed Project site and its environs were reviewed, including:

- Scottish Planning Policy (SPP), 2014;
- The Shetland Local Development Plan (LDP) 2014;
- Onshore Wind Energy, Supplementary Guidance, Shetland Local Development Plan, 2014 (Adopted February 2018);
- Local Landscape Areas, Supplementary Guidance, Shetland Local Development Plan, Consultation Draft 2014
- Shetland Coastal Character Assessment, NAFC Marine Centre, University of the Highlands and Islands, 2016;
- An assessment of the sensitivity and capacity of the Scottish seascape in relation to offshore windfarms, Scottish Natural Heritage Commissioned Report No.103, 2005
- Scottish Landscape Character Types Map and Descriptions (NatureScot, 2019)
- Inventory of Historic Gardens and Designed Landscapes in Scotland, Historic Scotland; and
- Ordnance Survey Maps.

13.1.11 The desk study enabled the definition of the baseline landscape and visual resource within the EZI and the main users of the area, key viewpoints and key features were identified (these were subsequently confirmed as part of the field studies).

13.1.12 The aim of the baseline visual assessment was to ensure that a representative range of viewpoints were included in the visual assessment in order to represent the identified receptors. The potential extent of visibility of the Proposed Project was identified by reference to Ordnance Survey map data, the draft zone of theoretical visibility mapping, and observations made in the field. Following this, potential visual receptors likely to be affected by the Proposed Project were identified.

13.1.13 The viewpoints were selected to ensure that the visual assessment included a representative range in relation to the following criteria:

- Type of receptor - including different landscape character areas if appropriate;
- Distance of receptor from Proposed Project - to a maximum distance of a 15 km radius offset from the launch site at Lamba Ness, as shown in Figure 13.1.1; and
- Direction of receptor from Proposed Project, with the aim of achieving an even distribution from different compass points around the site.

13.1.14 The desk study provides the basis for subsequent field survey work. It informs the description of the Landscape, Seascape and Coastal Character Areas (LCAs, SCAs and CCAs) for the EZI, the definition of the potential extent of visibility and the identification of the principal viewpoints and receptors, which were subsequently confirmed during the field survey.

Field Survey

13.1.15 The baseline landscape assessment included field survey work, carried out to verify the landscape, seascape and coastal character areas identified within the EZI and gain a full appreciation of the relationship between the Proposed Project and the landscape.

13.1.16 Field survey work also verified the appropriateness of the proposed viewpoints. This involved checking the initial viewpoint selection on the ground, to ensure that there will be views of the Proposed Project from these locations. In some instances, this can be remedied by slight adjustments of the location, although this has to remain relevant to the particular receptor(s) for which the viewpoint was selected. It is also important to ensure that the selected viewpoints are a representative view, and demonstrate potential visibility of the Proposed Project for the selected location. The fieldwork was supported by analysis of Ordnance Survey maps, and observations were recorded with photographs.

Analysis and Reporting

13.1.17 Analysis and reporting of the baseline assessment took place after completion of the desk and field surveys. The baseline landscape assessment provided a description, classification and evaluation of the landscape, seascape and coastal character of the EZI from which to assess the potential landscape effects of the Proposed Project. The baseline visual assessment provided an initial list of viewpoints for the viewpoint assessment, with brief commentary on viewpoint location, distance from the Proposed Project, receptors and rationale for selection, from which to assess the potential visual effects of the Proposed Project.

13.1.18 The baseline assessment is supported by Figure 13.1.1, LVIA EZI, Figure 13.1.2, Landscape Designations (including National Cycle Routes), Figure 13.1.3, Landscape (Seascape and Coastal) Character Areas, Figure 13.1.4, Viewpoint Locations, Figures 13.2.1a - 13.2.1b Zone of Theoretical Visibility (ZTV) maps.

13.1.19 The baseline assessment provided a description of the landscape and visual resource from which an assessment of the landscape and visual effects of the Proposed Project can be undertaken to determine the development's acceptability in principle and the appropriate mitigation measures.

Assessment of Landscape and Visual Effects

13.1.20 The assessment describes the changes in the character and quality of the landscape and visual resources that are expected to result from the Proposed Project.

13.1.21 In assessing landscape impacts, the potential direct effects on the fabric of the landscape are considered, together with the potential effects on the perception of landscape character. The latter depends on a number of factors:

- the nature of the landscape area, including factors such as the nature of views and sense of enclosure;
- the extent of the potential visibility of the Proposed Project (e.g., the number of potential viewpoints and extent of the Proposed Project seen);
- the proportion of the character area with potential visibility; and
- the distance to the Proposed Project.

13.1.22 The baseline landscape character assessment together with an assessment of the potential effects on each character area is included in the assessment, along with consideration of the extent of potential significant effects.

13.1.23 A viewpoint analysis has been carried out to identify and evaluate the potential effects on visual amenity arising from the Proposed Project at specific representative locations in the EZI. The viewpoints selected are considered to be representative of the spectrum of receptors in the EZI, located at different distances, directions and elevations relative to the Proposed Project. The viewpoints were identified and agreed through consultation with Shetland Islands Council and NatureScot.

13.1.24 The assessment involved the preparation of existing photographs and photomontages from representative viewpoints to illustrate existing views, to predict the extent of views of the Proposed Project and to assist, together with field work, in the assessment of effects. These are shown in Figures 13.3.1.1 - 13.3.3.2.

Assessment Criteria

13.1.25 The aim of the LVIA is to identify, predict and evaluate likely significant landscape and visual effects associated with a Proposed Project. Wherever reasonably possible, identified effects are quantified, however, the nature of LVIA requires an element of interpretation using professional judgement. In order to provide a level of consistency to the assessment, the prediction of magnitude and assessment of significance of the landscape and visual effects have been based on pre-defined criteria.

Sensitivity of the Landscape and Magnitude of Change

13.1.26 The capacity of the landscape to accommodate change of the type and scale involved in the formation of the Proposed Project is assessed. Part of this process involves an assessment of landscape sensitivity, and susceptibility to change, in the context of these proposals.

13.1.27 The sensitivity of the landscape is not absolute and varies according to the existing landscape, the nature of the Proposed Project and the type of change being considered. The determination of the sensitivity of the landscape resource to changes associated with the Proposed Project is defined as high, medium, low or negligible - or intermediate bands between these. It is developed from guidance within GLVIA 3, and based on professional interpretation of a combination of parameters as follows:

- Key landscape characteristics - a professional evaluation informed by an understanding of the key characteristics of the landscape and existing character assessments, describing the elements that make up the landscape including:
  - Landscape value, as reflected by local, regional or national landscape designation;
  - Landscape scale – which is the relative size of the main landscape elements and components;
  - Physical influences such as landform;
  - Land cover, including different types of vegetation; and
  - The nature of views - whether open, closed, long or short distance, simple or diverse.

13.1.28 GLVIA 3 advises that the two components of 'value' and 'susceptibility' to change are taken into account in assigning sensitivity to change from the Proposed Project to landscape and visual receptors. The two factors are described and explained in greater detail below.

Landscape Value

13.1.29 Establishing landscape value requires an understanding of how society values different Landscapes. This is used to inform judgements on the significance of effects. Value is most often expressed through designation; however, undesignated landscapes and components of individual landscapes also need to be examined. As part of the baseline the following factors are considered when developing an understanding of landscape value:

- Landscape quality/condition - the physical state of the landscape;
- Scenic quality - aspects of the landscape that appeal to the senses;
- Rarity - presence of unusual or rare features;
- Recreation values - particularly where landscape experience is important;
- Perceptual aspects - value for particular experience such as tranquillity; and
- Cultural associations - with people such as writers or artists, events, etc.

13.1.30 Information on landscape value is included in the baseline descriptions of landscape character, and in information included in the citations for designated landscapes. This information has been reviewed and refined through survey and analysis.

Susceptibility to Change

13.1.31 GLVIA 3 defines susceptibility to change as *'the ability of the landscape to accommodate the proposed project without undue consequences for the maintenance of the baseline situation and/or the achievement of landscape planning policies and strategies.'*

13.1.32 The degree to which a particular landscape type or area can accommodate change will vary with:

- existing land use;
- the pattern and scale of the landscape;
- visual enclosure/openness of views, and distribution of visual receptors; and
- the scope for mitigation, which will be in character with the existing landscape.

13.1.33 Key characteristics likely to be affected by the Proposed Project are evaluated, taking into account *'quality, value, contribution to landscape character, and the degree to which the particular element or characteristic can be replaced or substituted'.*

Landscape Sensitivity

13.1.34 In order to evaluate the sensitivity of the landscape receptor the criteria outlined in Table 13.1.1 below have been used, combining an understanding of the landscape value and susceptibility to change, based on GLVIA 3.

13.1.35 In some instances, a landscape with important components and high quality may be of a lower sensitivity as a result of its potential tolerance to change and opportunities for mitigation. Conversely a landscape with few features of interest may be of a higher sensitivity because it is vulnerable to change with little opportunity to mitigate change.

13.1.36 Having described the landscape resource and the key components that contribute to the character of the landscape character areas, and categorised the sensitivity of each landscape type to change, the probable magnitude of change sustained as a result of the Proposed Project is assessed. This change could be adverse, neutral or beneficial. The assessment of the magnitude of change is described below.

Table 13.1.1 - Landscape Sensitivity

Description	Sensitivity
Landscape with important components, usually of particularly distinctive character and high quality, susceptible to relatively small changes and for which mitigation will be difficult or not possible. Some less distinctive or lower quality landscapes may also fall into this category where characteristics are such that mitigation of negative changes will be difficult. Landscape is often recognised through designation.	High Sensitivity
Landscape with characteristics reasonably tolerant of changes or for which mitigation is likely to be possible. These landscapes may be of high quality or of distinctive character but will usually be relatively ordinary and moderately valued.	Medium Sensitivity
A less distinctive or relatively poor landscape with few features of quality or interest, potentially tolerant of substantial change and with scope for mitigation of any negative changes.	
Considerably modified or degraded landscape, with few/no features of quality or interest e.g. heavily industrialised landscapes.	Low Sensitivity

Magnitude of Change on Landscape Receptors

13.1.37 Each effect on landscape needs to be assessed in terms of its size or scale, the geographical extent of the area influenced, and its duration and reversibility.

Size or Scale (including nature of influence on landscape character)

13.1.38 Judgements are made about the size or scale of the change in the landscape that are likely to be experienced as a result of the Proposed Project. The judgements take account of:

- the extent to which landscape elements will be lost, the proportion of the total extent that this represents and the contribution of that element to the character of the landscape;
- the degree to which aesthetic or perceptual aspects of the landscape are altered either by removal of existing components of the landscape or by addition of new ones; and
- whether the effect changes the key characteristics of the landscape which are critical to its distinctive character.

Geographic Extent

13.1.39 The geographic extent over which landscape effects are considered to be distinct from size or scale, the extent of effects will vary according to the nature of the proposal. The effect of a development may have an influence at the following scales:

- at site level, within the development site itself;
- at the level of the immediate setting of the site;
- at the scale of the landscape character area within which the proposal lies; or
- at a larger scale influencing several landscape character areas.

Table 13.1.2 – Judgement on Magnitude

Level of Magnitude	Definition of Magnitude
Substantial	Total loss or major alteration to key elements/features/ characteristics of the baseline (pre-development) conditions such that post development character/composition of baseline will be fundamentally changed.
Moderate	Partial loss or alteration to one or more key elements/features/ characteristics of the baseline (pre-development) conditions such that post development character/ composition/ attributes of baseline will be partially changed.
Slight	Minor loss of or alteration to one or more key elements/features/ characteristics of the baseline (pre-development) conditions. Change arising from the loss/alteration will be discernible but underlying character/composition of the baseline condition will be similar to pre-development circumstances/patterns.
Negligible	Very minor loss or alteration to one or more key elements/features/ characteristics of the baseline (pre-development) conditions. Change barely distinguishable, approximating to the "no change" situation.
None	No change.

Visual Receptor Sensitivity and Magnitude of Change

13.1.40 The sensitivity of visual receptors depends upon:

- the location of the viewpoint;
- the context of the view;
- the activity of the receptor; and
- frequency and duration of the view.

Value attached to Views

13.1.41 Judgements are also made about the value attached to views experienced taking account of:

- Recognition of the value attached to particular views, for example in relation to heritage assets, or through planning designations.
- Indication of value attached to particular locations as a distinctive view through appearance in guide books, provision of formal facilities such as a car park and sign board, references in art and literature.

Susceptibility of Visual Receptors to Change

13.1.42 The susceptibility of different visual receptors to changes in views is a function of:

- the occupation or activity of people experiencing the view at particular locations; and
- the extent to which their attention or interest may therefore be focussed on the views and visual amenity they experience at particular locations.

13.1.43 Visual receptor susceptibility is defined as high, medium, or low, or a gradation of these, as set out in Table 13.1.3.

Table 13.1.3 – Judgement on Sensitivity

Level of Sensitivity	Definition of Visual Receptor Sensitivity
High	Users of outdoor recreational facilities including strategic recreational footpaths, cycle routes or rights of way, whose attention may be focused on the landscape; important landscape features with physical, cultural or historic attributes; views from principal settlements; visitors to beauty spots and picnic areas.
Medium	Other footpaths; people travelling through or past the landscape on roads, train lines, boats or other transport routes, views from minor settlements.
	People engaged in outdoor sports or recreation (other than appreciation of the landscape), those whose attention may be focused on their work or activity rather than the wider landscape.
Low	Views from heavily industrialised or densely built up areas.

Magnitude of Change on Visual Receptors

13.1.44 The magnitude of visual change arising from the Proposed Project is described as substantial, moderate, slight, or negligible/none based on the overall extent of visibility. For individual viewpoints it will depend upon:

- distance of the viewpoint from the development;
- duration of effect;
- angle of view in relation to main receptor activity;
- proportion of the field of view occupied by the development;
- background to the development; and
- the extent of other built development visible, particularly vertical, elements.

Size or Scale

13.1.45 Judging magnitude of visual effects identified needs to take account of:

- The scale of change in the view with respect to the loss or addition of features in the view and changes in its composition, including the proportion of the view occupied by the Proposed Project.
- The degree of contrast or integration of any new features or changes in the landscape with the existing or remaining landscape elements and characteristics in terms of form, scale and mass, line, height, colour and texture.
- The nature of the Proposed Project, in terms of the relative amount of time over which it will be experienced and whether views will be full, partial or glimpses.

Geographical Extent

13.1.46 The geographical extent of a visual effect will vary with different viewpoints and is likely to reflect:

- the angle of the view in relation to the main activity of the receptor;
- the distance of the viewpoint from the Proposed Project; and
- the extent of the area over which the changes would be visible.

Duration and Reversibility of Landscape Effects

13.1.47 The effects on the landscape will continue for the permitted life of the wind farm. Following this time period, in the absence of a renewed planning permission, the Proposed Project will be removed and the landscape reinstated with the majority of the proposed changes being fully reversible following de-commissioning.

Level and Significance of Effects

13.1.48 The significance of any identified landscape or visual effect has been assessed as major, moderate, minor or no effect. These categories have been determined by consideration of viewpoint sensitivity (combining susceptibility and value) and predicted magnitude of change (size, scale, geographical extent, duration) as described above, with the following matrix in Table 4 used as a guide to correlating sensitivity and magnitude to determine significance of effects.

Table13.1.4 – Significance of Effects on Landscape and Visual Receptors

Sensitivity	**Magnitude of Change**			
	Substantial	**Moderate**	**Slight**	**Negligible**
High	Major	Major to Moderate	Moderate	Moderate to Minor
Medium	Major to Moderate	Moderate	Moderate to Minor	Minor
Low	Moderate	Moderate to Minor	Minor	Minor to None
Negligible	Moderate to Minor	Minor	Minor to None	Minor to None

13.1.49 This assessment has been calibrated such that the threshold of significance is major to moderate. In this assessment, moderate level effects, and those below this level are not considered to be significant. Where, for the purpose of this assessment, the landscape or visual effect has been classified as major or major/moderate, this is considered to be a significant effect in terms of the Guidance for the Assessment of Environmental Effects, 2021. It is recognised that in some landscape and visual assessment methodologies a moderate level may be considered to be significant, but this is due to assessors calibrating their scale of effects differently, rather than because the threshold has been set high here. Essentially in an assessment where moderate is considered significant, the level of effect will be broadly similar to that which is described as major/moderate here. The Guidelines for Landscape and Visual Impact Assessment require that each assessor develops and explains their methodology but do not set out a prescriptive approach. Variation between assessors is therefore common. It should be noted that effects are not always adverse and may also be beneficial, however this chapter assumes that the effect is adverse unless otherwise stated.

13.1.50 The table is not used as a prescriptive tool, and the methodology and analysis of potential effects at any particular location must make allowance for the exercise of professional judgement. Thus, in some instances, a particular parameter may be considered as having a determining effect on the analysis.

Supporting Graphics

Approach

13.1.51 The LVIA is supported by a range of figures including viewpoint photography. These have been prepared in adherence to the principles presented in the Guidelines for Landscape and Visual Impact Assessment (Landscape Institute and Institute of Environmental Assessment, 3rd Edition 2013), the Landscape Institute's Advice Note Technical Guidance Note 06/19 Visualisation of Development Proposals, and the Visual Representation of Windfarms: Guidance, Version 2.2, NatureScot, 2017.

Photography

13.1.52 All photography was undertaken through the use of a full frame digital Single Lens Reflex (dSLR) (Canon EOS 5d) camera mounted with a 50 millimetre (mm) 'fixed' lens (Canon EF 50mm - f/1.4 USM). The camera was mounted on a tripod with a panoramic head in order to obtain a stable platform for the single frame and panoramic views. The position of the tripod was recorded with a handheld GPS device. In addition to recording the location of the viewpoint, observations with regard to time of day, weather, cloud cover, and visibility were recorded.

13.1.53 Following completion of the fieldwork, the photography was reviewed, and the clearest images selected for the production of panoramic images. In some cases, small adjustments are made to the images through the use of Adobe Photoshop/CS3 software in order to improve clarity.

13.1.54 The panoramas were then prepared through the joining of two or more images (typically three) in Photoshop.

Visualisations

13.1.55 The visualisations supporting the LVIA have been presented in order to provide a view of the Proposed Project within its landscape context and assist the assessor in determining the change and resultant effect on the viewpoint location.

13.1.56 The photomontages have been prepared through the use of Adobe Photoshop and Resoft Windfarm software. Use of Windfarm allows the Proposed Project to be accurately positioned in the photograph/panorama and rendered so as to account for cloud cover, sun position and colour of the Proposed Project. While every effort is undertaken to render the Proposed Project to account for the prevailing lighting conditions, where the Proposed Project may appear indistinct to the background, manipulation of the rendering of the Proposed Project has been applied in order to make the Proposed Project appear more distinct.

13.1.57 The presentation of graphics material requires careful consideration in order to prepare a visualisation that provides an accurately scaled depiction of the Proposed Project for use at the viewpoint location. In this instance, where a photomontage has been prepared for a viewpoint, the photomontage has been presented at A3 height and A1 width. These comprise:

- 1) Baseline panorama and matching photomontage. A panorama, using an angle of view of 90°, illustrating the existing view presented alongside an identically sized matching photomontage. The size of the image and matching wireframe is 820mm by 130mm, with a 90° horizontal field of view and a 14.2° vertical field of view. To accommodate the required field of view the image is presented as a cylindrical projection. This format shows the wider landscape context within which the Proposed Project will sit and allows direct comparison of the changes to be made in addition to providing a useful aid memoire. The recommended viewing distance for these visualisations is at a comfortable arm's length, as set out on the visualisation figure.

13.1.58 In views where a photomontage has not been prepared, a wireframe view has been submitted. As with the photomontages, the Proposed Project has been accurately positioned and the wireframe outputted so as to match the field of view to the panorama/photograph.

13.1.59 It should be noted that the LVIA has not been solely conducted on the visualisations presented within the ES but has included analysis of a range of wireframe views and other visualisations in addition to review of computer modelling of the site in addition to other materials not presented in this assessment.

Visibility Mapping

13.1.60 The visibility mapping or Zones of Theoretical Visibility (ZTVs) maps have been prepared through the use of Resoft's Windfarm computer software. The ZTV uses the Ordnance Survey's OS Terrain 5 digital terrain data which provides a representation of the bare-earth ground surface, in combination with a model of the tidal device. The terrain model does not account for areas of tall vegetation and buildings which may in actuality screen the development, and in this regard, the model may overstate visibility of the Proposed Project.

13.1.61 When calculating the extent of visibility, the software accounts for earth curvature and atmospheric refraction and provides the results in bands of colour. These are set to be clearly recognisable and distinct.

13.1.62 View height is also factored into the calculation, for the purposes of this assessment; the view height has been set at 1.5 m above ground level.

13.1.63 While the ZTV provides a useful indication of where visibility of the Proposed Project might be experienced, it should be noted that a very small portion of the Proposed Project model used in the modelling may give rise to the indication of visibility, i.e. visibility to a small component of the Proposed Project might indicate greater visibility. In some instances, it may be useful to confirm the nature of visibility with wireframe views as part of the analysis of the visibility mapping.

Appendix 13.2 Landscape Character Areas within the EZI

Appendix 13.2 Landscape Character Types within the 15 km Environmental Zone of Influence

Introduction

13.1.1 Using accepted, systematic methods of landscape character assessment, the surrounding landscape has been subdivided into different landscape character types, each with a distinctive character based upon local patterns of geology, land form, land use, cultural and ecological features. These provide baseline information which can be used to guide landscape change and provide a baseline against which to make judgements on the likely effects of the Proposed Project upon landscape character.

13.1.2 Within the 15 km Environmental Zone of Influence (EZI), the relevant landscape character assessment is the NatureScot web-based dataset, the 2019 Landscape Character Type map and associated Landscape Character Type Descriptions.

13.1.3 This dataset provides an assessment of the landscape character of the area, and considers the likely pressures and opportunities for change in the landscape. The Landscape Character Types (LCTs) which fall within the 15 km radius EZI are illustrated in Figure 13.1.3 and listed below:

- 349. Major Uplands
- 350. Peatland and Moorland
- 352. Inland Valleys
- 353. Farmed and Settled Lowlands and Coast
- 354. Farmed and Settled Voes and Sounds
- 355. Coastal Edge

Landscape Character Area Descriptions

13.1.4 This section describes Landscape Character Areas that coincide with the 15 km radius study area. The descriptions and the assessment of sensitivity of the Landscape Character Areas form the baseline to the assessment of effects on Landscape Character.

13.1.5 There are six LCAs within the detailed EZI all of which would potentially be affected to some degree by the Development, as identified through analysis of the ZTV plans. The launch site is situated within the 'Coastal Edge' LCA, the section of new link road spans the Major Uplands and Farmed and Settled Voes and Sounds LCA, and the Launch/Range Control Building is located within the Farmed and Settled Voes and Sounds LCA.

Table 1 – Major Uplands

Key Characteristics
The Shetland Islands are generally low-lying, such that distinct areas of high land are more prominent. The landcover is dominated by peatland and heather moorland peaty mires.
➢ Rounded hills, occurring either in series connected by high level rounded ridges along a linear band, or as isolated single hills or hill groups. ➢ Often steep slopes at the coast, or cliff edges with dramatic natural coastal landforms.

Key Characteristics	
➢ Mainly simple landcover of peat bog and heather moorland grading to rough grassland on some lower slopes, contrasting with the ordered fields of adjoining lowlands and the intricate coastline. ➢ Hill grazing and low-key peat cutting. ➢ Mainly uninhabited and often difficult to access on foot or by road, with roads mainly absent on higher land. ➢ In some areas tracks ascend to hillside or hilltop features such as masts, wind turbines, isolated farms and peat cuttings. ➢ Exposed high land with panoramic views, forming landmark features which themselves are often visible for miles. ➢ Relatively expansive, although scale is difficult to discern and reduced by the presence of manmade structures. ➢ A sense of remoteness and wild character in places.	
Landscape Character Description	
Landform	Major Uplands consist of the highest land in Shetland which forms the main physical structure of the islands. They occur in long bands aligned with the main north-south fault lines. Here the metamorphic bedrock has been sliced into north-south strips by fault movements. Along these tracts a series of rounded hills, connected by high land or rounded ridges, rises up to 208 metres above sea level, above surrounding lower land. On Unst, the high points of Hermaness Hill and Saxa Vord provide important landmark features signalling the northernmost point of the Shetland Isles.
Landcover	The main superficial deposits of the hills are boulder clay and other glacial deposits, and peat. The poor, peaty and often waterlogged soils give rise to landcover dominated by heather moorland and bog with occasional lochans. Rough grassland tends to occur on lower slopes in some areas and the coastal areas of Unst support maritime grasslands. Hermaness and Saxa Vord are both significant in respect of their colonies of sea birds and natural vegetation. Unimproved, unenclosed rough hill grazing is the main land-use, along with peat cutting. The lower margins of this type include inbye crofting land. Military uses occupy the strategic location at Saxa Vord in the north.
Settlement	This Landscape Character Type is mainly uninhabited. The often-uneven ground of tussocky grass, bogs and peat hags is a barrier to foot access. Small crofting settlements sometimes occur on the edges of this type at low levels. Roads tend to skirt the hill land, following more amendable routes in adjoining valleys and farmed areas, crossing the type only where there is no alternative to passing over highland. Several masts and aerials are sited on these hills as the high land provides ideal locations with line of sight to many settlements and the islands' road network. Several of these structures have been abandoned and left standing. The RAF radar dome and aerials at Saxa Vord forms a distinctive landmark. "Vord" is an Old Norse word for a heap of stones, or cairn, which is often associated with watch towers or convenient lookout points on hills.

Key Characteristics	
	Evidence of previous occupation includes cairns and abandoned military sites of prehistoric and historic dates. There is evidence of prehistoric settlement and land use in these areas. On Unst, the uplands have significant folkloric associations including stories relating to trows, creatures of Norse folklore,) and to two giants (Herman and Saxi).
Perception	The uniform texture and colour across most of these landscapes is apparent when viewed from a distance. The scattering of road and track scars, peat cuttings and quarries introduce detailed features and breaks up the expanse of moorland, reducing the sense of naturalness. Where many of these features occur together in one area, this results in a haphazard and jumbled appearance which undermines the simplicity of the landcover and landform. Hill tracks and roads usually present a functional appearance - they can be seen directly to connect with the point of destination and their reason for being built. These upland landscapes are exposed to the full force of Atlantic weather. They are relatively expansive, with sweeping slopes and hills, the sense of scale being enhanced by the contrast with adjoining farmed landscapes. The peatland, lochans and erosion scars provide a subtle interplay of texture, with muted colours. This contrasts with the more rich and varied colours and textures of ordered, green pastures of the lowlands and the intricate, coastline of voes and sounds and islands. The apparent scale of the landscape is sometimes difficult to discern due to the moorland vegetation with little diversity in colour or texture. Occasional manmade structures introduce an element of scale, and often make the hills appear smaller and less extensive. Wild character is reduced in the vicinity of manmade structures, particularly where these occur in clusters as they are often very prominent in the open moorland landscape.
Overall sensitivity to the Proposed Project	The landscape is large scale, with a generally simple skyline. The existing infrastructure visible at Saxa vord is a landmark feature in local views. Given the presence of existing development it has an overall **High to Moderate sensitivity** to the Proposed Project.

Table 2 – Peatland and Moorland

Key Characteristics
The Peatland and Moorland Landscape Character Type on Shetland consist of lower-lying undulating ground dominated by low moorland vegetation, usually forming a backdrop to farmed and settled coasts.
➢ Broadly undulating moorlands with occasional small hills, some areas with smaller scale undulations. ➢ Expanses of smooth or hummocky heather moorland and boggy heather grassland. ➢ Stony, rough textured heathland communities Unst and Fetlar.

- Rough, mainly unenclosed hill grazing.
- Mainly uninhabited, with few roads and man-made structures.
- Many visible archaeological relics indicating stages in historic land use.
- Prominent, linear stone dykes in places.
- Simple composition forms a contrasting backdrop to farmed lowlands, often marked by an abrupt boundary at the hill dyke.
- High land provides vantage points for views.
- Wild character in larger, remote areas.

Landscape Character Description	
Landform	The areas of Peatland and Moorland on Shetland rise gently from the farmed coastal lowlands to between 20 and 150 metres above sea level. The location, geology and landform of this type vary, resulting in subtle differences in character. Peatland and Moorland occurs on a variety of sedimentary, metamorphic and igneous bedrock. The landform is mainly of low relief with gentle slopes, with local variation in the scale of undulations and surface texture. In the east of the northern islands the serpentine bedrock has an upper layer of shattered rock and glacial drift creating a broadly undulating landform. Small areas of standing water, rock, boulders and hummocky heather form a rough textured surface. Here, the drainage pattern radiates outwards from higher land in a relatively simple pattern. The landform tends to be of low, gently rounded hills, or hummocky with small scale undulations.
Landcover	Landcover is mainly heather moorland and grassland on peaty soils, varying in species composition according to the underlying substrate and local conditions. On Unst glacial deposits are more widespread and the underlying serpentine rocks are usually free of peat and give rise to a stony surface and base-rich soils which support an unusual hummocky heathland vegetation cover with grasslands. The features of this landscape are clearly exhibited at Keen of Hamar on Unst, where the surface is sorted into stone stripes, and thinner soils on lower slopes support rare heathland flower communities. Land use consists mainly of rough grazing on hill land. Although this type usually lacks fences and recent stone walls, long drystane (dry stone) dykes are significant features on Unst, providing strong linear patterns across the natural landform. Mostly non-commercial peat cutting occurs on the edges of this type close to the surrounding crofts and settlements.
Settlement	These areas are mainly uninhabited. Roads and tracks are largely absent, and where present they are routed purposely through the landscape to connect coastal settlements which are separated by the moorland. Other manmade structures are limited to electricity poles and occasional communications masts and beacons. Several wind turbines are present, with more proposed, adding further built structures in this landscape. The archaeology of these areas is mostly evident on the lower margins and consists of many abandoned and ruined structures such as crofts and planticrubs (traditional small stone enclosures for growing young plants, usually kale), earlier farms and enclosures, and several horizontal water mills, as well as prehistoric burnt mounds.

Perception	The low-relief landform and unvarying landcover in many areas of this type results in a relatively simple composition. In this subtle landscape of mainly muted colours, interest is provided by the small-scale diversity in texture provided by exposed rock. In some parts of Unst and Fetlar the texture is dominated by fractured stones and the special plant communities here create a distinct colour and texture. These moorlands usually form a simple, expansive back drop and contrast to the adjoining enclosed lowland pastures and cultivated fields. The boundary between these two landscape types is often abrupt, along the hill dyke, and emphasises the differences in scale, texture and colour. The more remote parts of this type have wild character due to the general lack of habitation and man-made structures, and their relative isolation from main settlements.
Overall sensitivity to the Proposed Project	This landscape includes areas of varied scale with a generally undulating landform and occasional man-made features. The smooth, convex land cover with a lack of structures, undifferentiated landcover and wide horizons lends a **moderate to high** sensitivity to the Proposed Project.

Table 3 – Inland Valleys

Key Characteristics	
The Inland Valleys Landscape Character Type on Shetland consists of low lying, narrow channels cutting through Major Uplands, and often aligned with fault lines.	
➢ Long, narrow channels cut through major uplands, mainly located inland and often associated with the erosion of fault lines. ➢ Relatively level valley floors and steep mid-slopes rising to concave upper slopes ➢ Fertile soils in lower, accessible areas with enclosed fields, contrasting with upper moorland slopes, the boundary usually abruptly delineated at the inbye/outbye boundary. ➢ Settled in accessible, lower areas with farms and crofts and connected by roads following the line of the valley. ➢ Abundant archaeological remains visible in the low ground cover. ➢ Enclosed views along the valley and up to skylines, occasionally opening to the sea and adjoining coastal farmland. ➢ Inland and enclosed larger valleys with few sea views.	
Landscape Character Description	
Landform	Inland Valleys on Shetland consist of low-lying, narrow channels running between major uplands. The landform is mainly the result of erosion by ancient water courses. The valley and enclosing landforms are usually large scale and well defined. The slopes tend to be concave falling to convex and are relatively steep at the midpoint, particularly if within a major fault line. Valley floors are relatively flat or broadly undulating, and rise gently to

	merge with side slopes. In places there is an abrupt change of slope where the level valley floor surface meets the thrust of the side slope, for example on Unst. Drainage patterns consist of small tributary burns descending perpendicular to the side slopes into a central burn running the length of the valley, occasionally collecting in linear lochs and small lochans. Burns are often straightened in agricultural land.
Landcover	The valleys contain boulder clay drifts and alluvium, and peat deposits occur on slopes. The low-lying, sheltered areas with fertile soils support a landcover of mainly improved grass land, with rough grassland and heather moorland on higher ground. The valleys are dominated by extensive peat deposits and moorland vegetation. These areas are often associated with patches of standing water, eroded and exposed peat, peat slides, small inland lochs and wetlands. Here, the areas which have been improved to grassland contrast sharply with the surrounding moorland vegetation. The land use is mainly farming and clusters of crofts located in lower, sheltered and accessible areas. Domestic peat cutting occurs at lower levels near settlements. Hill land of rough grazing tends to dominate the larger areas of this Landscape Character Type.
Settlement	The drier, lower land is settled with occasional farms and crofting settlements. Fields are mainly geometric pastures of different sizes which extend up the slopes of the valley. Individual fields are often difficult to discern due to the widespread use of stock proof fencing and the equal grazing levels across adjoining pastures. The inbye boundary is clearly defined by changes in grazing pressure and is sometimes bounded by a stone dyke. These long-settled, fertile areas contain many archaeological sites, including cairns and mounds, the ruins of townships and farmsteads, enclosures, planticrubs (traditional small stone enclosures for growing young plants, usually kale) and horizontal mills. At Petester there is an extensive and complex field system, of roughly rectangular enclosures and terraces.
Perception	There is often great diversity in colour and texture provided by the combination of improved land, heathland, rough grassland and water bodies. The muted colours and simple landcover of moorland contrast with the ordered landscape of crofting, emphasising the differences in intensity of land use between inbye and outbye land. These valleys are unusual in Shetland, being a mainly inland landscape with few views of the sea. Views are contained by the adjoining uplands and channelled along the valley or drawn up to nearby skylines. In a few areas, views extend to adjoining coastal farmland and to the sea. The more remote areas of this Landscape Character Type have a sense of isolation,

	enhanced by the simple moorland landscapes and the sense of historical time depth from the ruins of earlier occupation.
Overall sensitivity to the Proposed Project	This landscape is of a medium scale with a concave landform and simple predictable skylines. The relative absence of settlement lends this area a **moderate** sensitivity to the Proposed Project.

Table 4 – Farmed and Settled Lowlands and Coast

Key Characteristics	
Much of Shetland's farmland lies in a narrow strip between the uplands and the coast. The Character Type is located in exposed parts of this strip. These landscapes are dominated by rough grassland and pasture resulting from long established crofting.	
➢ Mainly narrow tracts of low lying, gently sloping or undulating landform adjoining the sea, with some areas of flat coastal plain and occasional small rounded hillocks. ➢ Natural and varied coastal edge with indented, low coastal cliffs and occasional beaches and bays. ➢ A variable patchwork of landcover mainly consisting of rough grassland, mixed with pastures, arable fields, heather and machair, occasional wetlands, beaches and dunes. ➢ Predominantly farmed and settled with a high proportion of traditional croft land. ➢ A varying pattern of fields, crofts and farms according to location, landform, productivity, agricultural practices and the character of settlement and farm buildings. ➢ Many archaeological sites and historic buildings providing visible evidence of the history of settlement since prehistoric times. ➢ The field and settlement patterns from human intervention in some traditional crofting areas, enhanced by the contrasting coastal and upland setting. ➢ Open, windswept landscapes with little shelter and constant views of the coastline, and across voes and sounds to other land.	
Landscape Character Description	
Landform	The Farmed and Settled Lowland and Coast - Shetland Landscape Character Type occurs as many mainly narrow tracts of productive land, usually adjacent to the coast, generally consisting of low-lying land, usually under 50 metres above sea level, with a gently sloping or undulating landform, and some areas of flat coastal plain. Occasional very small, rounded hillocks rise to around 90 metres above sea level. The coastal edge consists mainly of low, deeply indented, rocky cliffs and headlands, with occasional sandy or pebbly bays. Variations in this Landscape Character Type reflect subtle differences in landform, landcover and land use. The productivity, management and

	agricultural practices undertaken, the character and pattern of settlement, the artefacts of past and present agricultural practices all strongly influence character. Subtle landform variations interact with a number of other factors to influence character. Larger areas of flat land are often associated with the good calcareous soils, greener pastures and larger more intensively farmed fields with an open character, close to broader bays. The presence of occasional low hills tends to be linked to heather moorland, and this higher ground provides a measure of enclosure and allows for elevated views. The shape of the coastal edge may be abrupt, rocky and exposed, as along the indented low cliffs, or gently sloping flat and relatively sheltered next to inlets and beaches.
Landcover	These landscapes occur on a variety of soils, derived from blown sand, peat, and glacial drift materials. The sloping land assists with surface water drainage, and areas of peat bog are relatively uncommon except in lowland basins. The nature of the vegetative cover varies according to the relative productivity of the land, its underlying geology and soils, and the management practices undertaken. Trees and woodlands are absent from these exposed landscapes. Rough pasture is the dominant landcover overall, which is mixed with varying amounts of arable land, improved grassland, maritime grassland, and occasionally machair in more productive areas, and heather moorland on less productive land, usually associated with higher elevations. At the coast natural features include sand dunes, slacks and marshland. This mix of vegetation cover occurs as an integrated patchwork within each tract. Differences in the proportion and balance of vegetation types between tracts lead to variation of character.
Settlement	These areas have generally been farmed and settled for a long period and their character is a result of successive settlement and land use in the same area. Agriculture is the main land use consisting predominantly of grazing and small areas of arable land, mainly under a crofting system. Crofted lands vary from broad areas of well-managed traditional fields of good quality grazing on fertile ground, to more exposed, narrow and marginal areas of abandoned fields and degraded heather moorland. These areas are some of the most settled rural landscapes in Shetland. The balance between settlement and farmland, and the style and pattern of development, vary. Overall, settlement patterns are mainly sparsely scattered individual crofts and dwellings, crofting townships and occasional small nucleated settlements. In more intensively farmed areas small, distinct, nucleated settlements occur on elevated ground, avoiding the best growing land, and include larger farms with associated large agricultural buildings.

	This landscape character type has been densely occupied for thousands of years, and typically has visible sites and buildings of all periods of prehistory and history.
Perception	The overall perception of these landscapes varies according to several factors such as the level of land management and productivity, settlement pattern and new development, and the location and setting. The pattern of human intervention in some traditional crofting areas reflects the strong relationship between landform, settlement and land use, and is enhanced by the contrasting coastal and upland setting. This contrasts with areas characterised by derelict crofts, abandoned fields, and degraded moorland, and other areas of intensive use with larger scale field sizes and large scale farm buildings. Elsewhere the style and pattern of new development does not reflect the character of the landscape, and sometimes leaves fields as left over space between scattered developments. The variety and richness of colour and texture varies according to the level of productivity and land management. Areas of arable land and improved or maritime grassland can be particularly rich in colour contrasting strongly with areas of rough pasture or moorland and natural coastlines. Similarly, texture can vary greatly from the coarse nature of rough pasture to close cropped improved grassland or the fine texture and seasonal flowers of machair. Most of this Landscape Character Type consists of narrow coastal tracts which are strongly influenced by the coastline and sea. The coastal location of this Landscape Character Type results in a mainly open landscape and constant but ever-changing views of the coastline, and across voes and sounds to other land. Areas, such as coastal crofts on Unst, are characterised by the striking contrast between the ordered fields of well managed traditional grazings and the natural coastal scenery.
Overall sensitivity to the Proposed Project	This landscape is of a small scale with occasional settlements maintaining the traditional pattern of crofting settlement. There is a strong association with the coastal fringe and significant historic interest. Overall, the LCA has a **medium** sensitivity to development.

Table 5 – Farmed and Settled Voes and Sounds

Key Characteristics
The Farmed and Settled Voes and Sounds Landscape Character Type, dominated by pasture and rough grassland resulting from long established farming, occurs around the enclosed coastal waters.

- Narrow, low lying coastal strips of gently sloping or undulating land around enclosed waters.
- Complex, indented coastline which provides shelter.
- Mainly agricultural land use on improved and unimproved pastures with heathland, wetland and wet pastures which add variety.
- Unusual grassland and heathland on base-rich soils on Unst.
- Scarce broadleaf tree cover found in very small remnant woodland patches and recent plantations.
- Mostly traditional crofting in linear or scattered patterns, with some estates.
- Larger settlements around harbours with historic built heritage.
- Mainly inland, minor road network with branches to beaches and harbours.
- Abundant archaeology across all periods of human settlement.
- Rural areas provide a contrasting backdrop and setting for settlements.
- Rural areas and settlements contrast with the surrounding, large scale hill land.
- Views are ever-changing due to the complex coastline and interlocking landforms.
- Remote settlements have a strong sense of isolation and tranquillity.

Landscape Character Description	
Landform	Farmed and Settled Voes and Sounds are found around Shetland's enclosed and sheltered coastal waters, occurring as many, mainly narrow, coastal bands of productive land and some larger nucleated settlements. These areas are usually less than 150 metres above sea level. The low, complex coastal edge consists of many inlets with rocky headlands, low cliffs and small sandy or shingle bays. The landform is often gently sloping towards the sea or gently undulating, with few areas of open water. Small burns usually fall directly to the coast. Flatter, wetter land is often found at the head of voes. Boulder clay is usually found in valleys with peat deposits on higher ground. In Unst and Fetlar, magnesian gley soils are formed over serpentine rocks.
Landcover	Landcover varies according to the relative productivity of the land, the underlying geology, management practices undertaken and the degree of shelter afforded by location. The species mixes of heath and grassland cover vary according to soil types, exposure to salt spray and the degree of management, and subtly alters their colour and texture. The dominant forms of landcover are improved pastures, which highlight the location of better soils, and rough grassland. This grazed land is interspersed with patches of wetland and flush vegetation. There are some areas of arable land, and small numbers of wind-blown trees and shrubs beside some of the more sheltered voes and sounds, usually planted close to buildings.

Settlement	As a result of the favourable conditions, there is a long history of successive periods of settlement and agricultural land use. Consequently, the character, pattern and extent of settlement and farming in these areas are the major factors influencing landscape character. Settlement patterns are related to agricultural land use, which has been practised over many centuries. There is extensive evidence of medieval and post-medieval agriculture in most settled voes. Subtle differences in geology, soils and agricultural practices affect the character of rural areas. Settlement usually consists of scattered crofts and dwellings in sheltered locations, associated with an ordered landscape of improved and unimproved grazing land. Fields are usually geometric and divided by fencing, although this varies. On Unst and Fetlar the underlying geology of serpentine rocks, magnesium rich soils, exposure to salt spray and heavy grazing produce a mosaic of herb rich heaths and sedge patches with a characteristic patchwork appearance. This remote area is relatively undeveloped and maintains a strong traditional pattern of crofting. The character of the Farmed and Settled Voes and Sounds is greatly influenced by the relationship between the development and the land or sea. Harbour areas relate to the depth of sea, shape of the coastline and shelter provided by the landform. Crofted landscapes tend to be located away from the coast, except near beaches, and fields run down slope terminating abruptly at the coastal edge where there are often signs of the crofters' use of marine resources in the form of boat nousts and kelp kilns. The road network links settlements and often travels inland to avoid the indentations of the coastline, branching off to harbours and beaches. Most roads are minor and follow the slope or undulations of the land. For many of the crofting landscapes within this Landscape Character Type there is a rational relationship between the main elements of dwellings, grazing land and landform which reflect traditional crofting practices and requirements for shelter and better soils, with a clear distinction between inbye and outbye.
Perception	In rural areas the mosaic of improved and unimproved grasslands and wetlands creates a subtle variation of colour and texture. The small-scale landscapes of traditional crofting patterns and clusters of buildings around harbours are in sharp contrast to the adjoining uninhabited expanses of rough grazing, heather moorland and natural coastal scenery. Human activity in farmed landscapes and the busy nature of settlements, particularly harbours and ferry terminals, emphasises these differences. The indented coastline creates a strong sense of enclosure in many areas, either around a narrow voe or within a series of indented bays and headlands. The rough, natural features and organic shapes of the coastline provide a contrasting fringe to the smooth green pastures. Moving through

	this landscape there is a constant change in orientation and composition of views, as headlands overlap and interlock with voes, sounds and the open sea.
Overall sensitivity to the Proposed Project	This landscape is of a small scale with occasional settlements maintaining the traditional pattern of crofting settlement. There is a strong association with the coastal fringe and significant historic interest, lending a **higher** degree of sensitivity to the Proposed Project.

Table 6 – Coastal Edge

Key Characteristics	
The dramatic Coastal Edge Landscape Character Type occurs in several narrow strips around the exposed, mainly rocky coastline of Shetland. It forms the edge of upland and lowland Landscape Character Types, and includes dramatic coastal features, including towering sea cliffs, stacks and natural arches.	
➢ Narrow, indented coastal edge of rocky headlands, inlets and promontories on exposed parts of the coast. ➢ Mainly high to moderately high cliffs with frequent features of coastal erosion including stacks, arches, blowholes, caves and storm beaches. ➢ Diversity of colour and rock forms derived from the wide variety of bedrock. ➢ Short, colourful swards of maritime heath and grasslands on cliff tops and some sheltered cliffs, with bare, scoured rock in exposed locations. ➢ Undeveloped and uninhabited, and mostly inaccessible by road. ➢ Modern man-made structures limited to a few lighthouses and a radar station. ➢ Many prehistoric and wartime archaeological relics revealed in short grassy landcover. ➢ Diverse and dramatic coastal scenery with a variety of coastal views. ➢ Remote, exposed, open and highly natural landscape with wild character.	
Landscape Character Description	
Landform	The Coastal Edge Landscape Character Type forms the narrow coastal edge of adjoining upland and lowland Landscape Character Types on Shetland. The height of coastline varies from high cliffs to low beaches and inlets. The majority of the coastline is of high to moderately high indented rocky headlands, with inlets and promontories, and occasional small beaches and rocky bays. The underlying bedrock consists of granites, schists and gneiss. This varied geology sits on some of the most exposed coasts of Britain, and has been eroded to form a highly fractured coastline consisting of towering sea cliffs, stacks, geos (clefts), gloups (blow holes), caves, natural arches, skerries (small rocky islands), wave scoured platforms and waterfalls. The underlying bedrock influences the height, texture and colour of exposed rock and the type of feature formed. The coastline of Burrafirth, Unst is impressive, with cliffs of ochre-coloured metamorphic rock. At Unst, the western edge of the ridge

	has cliffs and stacks terminating to the north with Hermaness Hill and out to the sloping, pointed rocks of Muckle Flugga.
Landcover	Landcover in these narrow coastal strips relates to the surrounding inland character type and varies from heather moorland to closely grazed pastures. At the coast, the soils and vegetation are influenced by sea spray, and support short swards of maritime grasslands and heath. The colourful, diverse flora includes fine grasses, Spring Squill and Sea Pink, which are protected from grazing on cliffs. Exposed cliff edges are stripped of soil and vegetation by wave action and sea spray.
Settlement	These exposed landscapes are mainly uninhabited and most of the coastline is undeveloped. Much of the coastline is inaccessible by road, except at small bays and inlets. The coastal features are popular with visitors and for scientific study, and some parts of the coastline have interpretation signs and parking facilities. Man-made structures are rare, and include wartime defences and occasional lighthouses. 20th Century defence sites include radio and radar stations at Saxa Vord, Skaw and Unst.
Perception	The diversity of coastal scenery allows for a wide variety of coastal views of distant horizons, nearby islands and shore lines. Coastal features are often best seen from opposite coastlines or promontories. The undulating land and lack of coastal roads often results in the coastal edge being hidden from view or difficult to access. Having approached through heathland or farmland, when coastal features come into view their dramatic form is surprising and invites further exploration. A few cliff top paths provide intimate views of coastal features, revealing their detailed structure and true scale. These extensive, complex coastal areas with the variety of outstanding and dramatic natural features, birds and marine life, together with the colour of maritime flora and movement of the sea combine to create a highly natural landscape. There is a strong sense of openness and exposure, and the sea is rarely calm. The sight, sound and smell of the sea, lack of man-made structures and difficulty of access create a strong wild character. Adding to this experience, the cliffs provide vantage points for observing migrating whales, passing dolphins and harbour porpoises.
Overall sensitivity to the Proposed Project	This landscape has a rugged and irregular landform made up of complex coastal features. There is an absence of settlement and modern development that lends a higher degree of sensitivity. However locally at Skaw and Lambaness the presence of disused radar and defence infrastructure it has a locally **low to moderate sensitivity** to the Proposed Project.

Appendix 13.3 Coastal Character Areas within the EZI

Appendix 13.3 Coastal Character Areas within the 15km Environmental Zone of Influence

Introduction

13.1.1 The Shetland Coastal Character Assessment (CCA) was prepared by the NAFC Marine Centre (NAFC) in 2016 with guidance from NatureScot, as part of the development of the Shetland Island's Marine Spatial Plan.

13.1.2 It provides information about the various coastal character types (CCTs) found around Shetland, the experiences the coast currently offers to local people and visitors and identifies sensitivity to development.

13.1.3 The report identifies and maps different coastal character types, describes the key features and character of each area and identifies any areas around the coast which are considered to be sensitive to onshore and/or offshore development. The report was developed so that it relates to the Shetland Landscape Character Assessment.

13.1.4 The four Coastal Character Areas (CCAs) which fall within the 15 km Environmental Zone of Influence (EZI) are illustrated in Figure 13.1.3 Volume III and listed below:

- 13. Burrafirth
- 16. East Unst
- 19. Hermaness
- 20. Skaw

Coastal Character Area Descriptions

13.1.5 This section describes Coastal Character Areas that coincide with the 15km radius EZI. The descriptions and the assessment of sensitivity of the Landscape Character Areas form the baseline to the assessment of effects on Landscape Character.

13.1.6 There are two CCAs within the detailed EZI all which would be affected by the Proposed Project, as identified through analysis of the ZTV plans. The launch site is surrounded to the north by the within the 'Skaw' CCA, and the to the south by the 'East Unst' CCA.

13.1.7 A short description of each of the CCAs, taken from the Shetland Coastal Character Assessment, is provided in the baseline assessment tables below. These describe the main features, key characteristics and sensitivity of the coastal character area to the Proposed Project.

Table 13.3.1 – East Unst CCA

Key Characteristics
The East Unst Coastal Character Area runs from Lamba Ness in the north to Mu Ness in the south. There is some aquaculture in the area confined to Basta Voe. It is also a busy fishing area and shipping area. The landscape is characterised by moorland ending in cliffs and steep terrain along the coast. There are a few areas of special interest such as the Keen of Hamar.
➢ *Large sandy bays* ➢ *Historic landscapes such as Sand Wick* ➢ *Busy shipping area* ➢ *Low levels of aquaculture*

Coastal Character Description	
Coastal Experience	The East Unst CCC is an interesting area with a rich history. To the north the attractive Norwick beach is a popular area in summer. Various tourist attractions can be found around Haroldswick and Baltasound. The Keen of Hamar has an almost other worldly feel, being compared to a lunar landscape. Sand Wick is another appealing area with a large sandy beach and Muness Castle has a commanding view over the Ham of Muness.
Overall sensitivity to the Proposed Project	Much of the East Unst CCA is devoid of modern development and many areas are important internationally. The coast is of **high sensitivity** to the Proposed Project.

Table 13.3.2 – Skaw CCA

Key Characteristics	
The Skaw Coastal Character Area runs from the Noup to Lamba Ness characterised by a rocky exposed coastline with small bays. The landscape is mainly heather moorland ending in cliffs.	
➢ *Cliff scenery* ➢ *Small beaches* ➢ *Most northerly house in Britain*	
Coastal Character Description	
Coastal Experience	The Skaw CCA is a dramatic coastline with panoramic views. It has a remote feel with the remains of the Radar Station which reflect the strategic importance of the coastline during the second world war. The beach at the Wick of Skaw is secluded, one of the only places in Shetland where the oyster plant can be found. There are dramatic views from the point of Lamba Ness looking back across Saxa Vord and the tall sea cliffs.
Overall sensitivity to the Proposed Project	The Skaw CCA is valued for its scenic qualities. The coast is of **high sensitivity** to the Proposed Project.

Appendix 13.4 Seascape Character Areas within the EZI

Appendix 13.4 Seascape Character Areas within the 15 km Environmental Zone of Influence

Introduction

13.1.1 The NatureScot commissioned report 103, Commissioned Report No. 103, An assessment of the sensitivity and capacity of the Scottish seascape in relation to windfarms, 2005, provides baseline information relevant to the EZI. It was prepared to assess the seascape issues with regard to offshore wind energy developments, and a request for the inclusion of seascape units from this document was made in the scoping response received from Shetland Islands Council.

13.1.2 The report defines seascape character around the Scottish Coastline. Seascape character is made up of physical characteristics of hinterland, coast and sea plus a range of perceptual responses to the seascape, as well as visual aspects. Seascape sensitivity is defined as *'the measure of how vulnerable or robust seascape character is to change'.*

13.1.3 One Seascape Character Area (SCA) falls within the 15 km EZI, Seascape Area 33, Shetland. The seascape area, which is described below, includes two Seascape Types as illustrated on Figure 13.1.3 Volume III and listed below:

- Seascape Character Type 1: Remote High Cliffs
- Seascape Character Type 13 D: Islands, Sounds and Voes

Seascape Character Area Descriptions

13.1.4 This section describes the Seascape Character Area and the Seascape Types that coincide with the 15km radius EZI. The descriptions and the assessment of sensitivity of the Seascape Character Areas form the baseline to the assessment of effects on Seascape Character.

13.1.5 The following table sets out the main features, key characteristics and sensitivity of the Shetland Seascape Character Area to development of the type proposed. Short descriptions of the Seascape Character types are also set out below.

Table 13.4.1 – Area 33: Shetland

Key Characteristics	
➢ indented coastline of fragmented islands, skerries, sounds and voes; ➢ generally low, often rocky, edge with landscape often appearing 'submerged' but with some high cliffs, over 200m, tall in places; ➢ voes and Sounds form sheltered narrow channels of coastal waters with open sloping hinterland of pasture, rough grazing and scattered crofting; ➢ views over small islands to open sea are a feature; ➢ a dramatic, exposed seascape.	
Coastal Character Description	
Scale and Openness	Undulating landform can often contain views and the indented nature of the coastline reduces scale. Overall scale is large however, outwith voes and sounds, due to openness of landscape and close presence of sea.
Form	A very fragmented landform with numerous islands and deeply indented coastline of voes and headlands. Some dramatic high cliffs on exposed coasts. Landform is

	generally simple, with smooth broadly rounded low hills and often insignificant rocky coastline and has some vertical emphasis.
Settlement	Generally, sparsely settled, with the main settlement of Lerwick on the coast. Buildings tend to be small and low. Sullom Voe Oil Terminal only large-scale industrial feature present. Aquaculture has a significant visual impact in many sheltered areas with most voes now containing some form of fish farm development.
Lighting	Very low levels of lighting due to sparse settlement although the Sullom Voe oil terminal and commercial part of Lerwick harbour are illuminated.
Modification/ Remoteness/ Sense of Naturalness	Modified to some extent by small scale farming/crofting often in narrow strip along sheltered coasts. Keen sense of remoteness on many outlying islands and unsettled coasts. Perception is of a generally undeveloped area with a strong sense of history and distinctive culture although the oil industry is also associated with Shetland.
Overall sensitivity to the Proposed Project	Development may affect the intricate land/sea relationship and views of outlying islands and the appreciation of the vertical scale of high cliffs where these are present. The perception of remoteness and wildland qualities of some coastal areas and the highly natural character of the outlying islands may also be affected by development. The coast is of **high sensitivity** to the Proposed Project.

Table 13.4.2 – Seascape Character Type 1: Remote High Cliffs

Physical Characteristics
High cliffs, often over 200 m tall, with occasional small sandy or stony bays at their base, contained by rocky headlands. Stacks, caves and collapsed cliffs are often features of this coastline. There is a strong contrast of line and form arising between the sheer verticality of cliffs and wide horizontal expanse of the sea. This type usually has a high moorland, or occasionally, mountainous, hinterland where semi-natural heathland is the dominant landcover. Settlement is generally absent although occasional small villages can be found tucked in bays and inlets or extensive crofting on tops within Highland areas. Light houses can be prominent features on headlands. This type has a remote, wild character due to the absence of roads and settlement. Access and views to the coast from the hinterland are restricted due to the cliffs. Wide elevated views are directed along the coast and out to open sea. Views of rigs or boats can be a focus within the maritime component of this type. The Northern quality of light often gives intense clarity in views.
Experiential Qualities
The Atlantic coast of Shetland coast has a particularly exposed character and are physically remote from settlement. The coast is difficult to access, and the water's edge is often blocked by impassable steep cliffs. These are exhilarating and awe-inspiring coastlines due to the great height of cliffs giving elevated and distant views and being particularly dramatic when the sea is turbulent. The noise of sea birds nesting on cliffs and waves add to the attraction and excitement of this seascape type.

Table 13.4.3 – Seascape Character Type 13D: Low, rocky island coasts – Islands, sounds and voes

Physical Characteristics
Generally low rocky coastline, rising to cliffs in places. Moorland, either rocky, 'Stepped' or boggy, tends to back a narrow sparsely settled open coastal fringe, usually some crofting and few settlements. Views of open Atlantic Ocean in the main. This sub type comprises the farmed and settled coastal lowlands of Shetland where a deeply indented coastline creates sounds and voes with fragmented islands. This sub type generally has an insignificant low, hard coastal edge, often appearing smooth and 'submerged'. Voes and sounds form sheltered narrow channels of coastal waters with open, gently sloping hinterland of pasture, rough grazing and scattered crofting. Views over small islands to open sea are often a feature.
Experiential Qualities
These island seascapes can feel very remote due to the sparse settlement, moorland or low-key crofting hinterland and exposure to open sea. Strong sense of being on an island due to close proximity of sea often with 'all round' views and little distance from the sea.

Appendix 13.5 Special Landscape Qualities Assessment

Appendix 13.5 Special Landscape Qualities Assessment – Shetland National Scenic Areas

Introduction

13.1.1 This appendix provides a detailed assessment of effects on the Special Landscape Qualities of the Shetland National Scenic Area. The assessment is based on emerging guidance prepared by NatureScot on assessing how special landscape qualities may be affected by development proposals.

Policy Context

13.1.2 National Scenic Area (NSA) is a conservation designation used in Scotland and administered by NatureScot. The designation's purpose is to identify areas of exceptional scenery and to protect them from inappropriate development. NSAs were first established in 1980, under planning legislation, by order of the Secretary of State. Part 10 of the Planning etc. (Scotland) Act 2006 gave NSAs a statutory basis. The Town and Country Planning (National Scenic Areas) (Scotland) Designation Directions 2010 then brought this into force. In December 2010, NSAs were designated under this new legislation.

13.1.3 Scottish Planning Policy (SPP) is a statement of Scottish Government policy on how nationally important land use planning matters should be addressed. With regard to National Designations, SPP states that:

"Development that affects a National Park, National Scenic Area, Site of Special Scientific Interest or a National Nature Reserve should only be permitted where:

the objectives of designation and the overall integrity of the area will not be compromised; or

any significant adverse effects on the qualities for which the area has been designated are clearly outweighed by social, environmental or economic benefits of national importance."

(paragraph 212, emphasis added).

Methodology

13.1.4 The assessment is based on the following draft NatureScot methodology: Working Draft 11 – Guidance for Assessing the Effects on Special Landscape Qualities (November 2018), including the parameters for levels of effect.

13.1.5 The guidance advocates a narrative approach, to provide transparency when drawing conclusions and making judgements of effect on experiential and perceptual qualities, taking four steps as summarised in the following bullets.

- Step 1 The Proposal – Gain as full an understanding of the proposal as possible.
- Step 2 Define the Study Area and Scope of the Assessment identifying the area likely to be affected.
- Step 3 The Analysis of Impacts and Effects on SLQs.
- Step 4 Summary of Impacts on the SLQs, implications for the NSA and possible future effects on SLQs and recommendations for mitigation.

13.1.6 The aim of the assessment is to understand the effects of Proposed Project on the NSA's defined special landscape qualities and to determine whether these effects will compromise the overall integrity of the NSA, or undermine the objectives of designation.

Shetland NSA – identification of relevant special landscape qualities

13.1.7 The following text sets out the overall special landscape qualities of the Shetland NSA and those special landscape qualities identified for the relevant constituent sub units, which will be indirectly influenced by the Proposed Project.

13.1.8 The Shetland NSA includes seven separate small areas of coastal landscape, which have been identified as being of outstanding scenic interest. Of these, the Hermaness sub-area falls into the zone of theoretical visibility within 15km of the Proposed Project. This area, situated in the north Unst, is the focus of the assessment.

13.1.9 The overall special qualities of the Shetland NSA are described within The Special Qualities of the NSAs, SNH commissioned report, 2010, as:

- "The stunning variety of the extensive coastline;
- Coastal views both close and distant;
- Coastal settlement and fertility within a large hinterland of unsettled moorland and coast;
- The hidden coasts;
- The effects and co-existence of wind and shelter;
- A sense of remoteness, solitude and tranquillity;
- The notable and memorable coastal stacks, promontories and cliffs;
- The distinctive cultural landmarks; and
- Northern light."

13.1.10 Some special qualities are generic to all the identified NSA areas, whereas others are specific to sub areas within the NSA. For the Hermaness sub area of the NSA *"a sense of remoteness, solitude and tranquillity"* special quality is highlighted, as discussed below.

Hermaness sub area of the Shetland NSA

13.1.11 The Hermaness sub area of the Shetland NSA includes the following specific special qualities, which are described within the SNH report:

- *"At Hermaness on Unst, the coastal topography varies from the 175m high cliffs at the Neap, to the sandy beach and machair at the head of the narrow Burrafirth.*
- *Cultural landmarks include the western edge of the Hermaness area which contains the northerly military installations in the British Isles at Saxa Vord."*

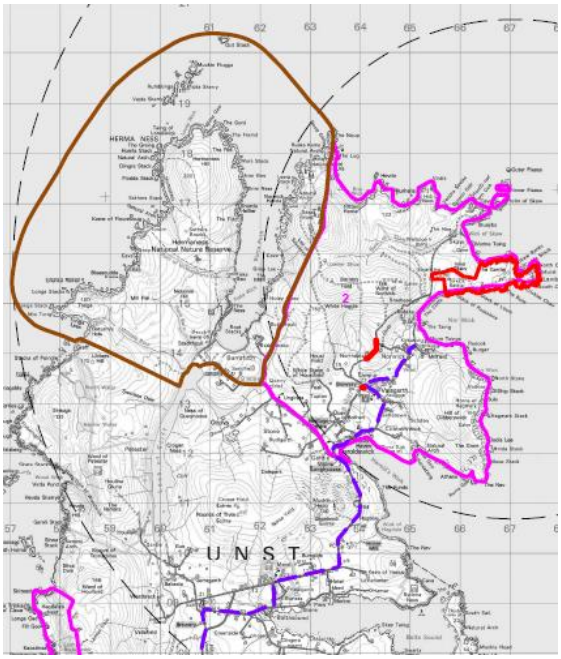
13.1.12 Figures 13.2.1a to 13.2.2b illustrate the extent of theoretical visibility of the Proposed Project, indicating a small area of visibility at the summit of Saxa Vord Hill over a distance of 2.5 km and partial visibility to the extended lightning masts only on Launch Pad Three from the headland to the north of Saxa Vord Hill at a distance of 4.7 km. Viewpoint 1.8, Headland to the north of Saxa Vord radar station, Figure 13.3.1.8 illustrates the very limited visibility from the headland to the north of Saxa Vord Hill, within the NSA; and Viewpoint 1.9, Hermaness Hill, Figure 13.3.19 illustrates the absence of visibility from the headland at Hermaness.

Assessment of Effects on the Shetland National Scenic Area

13.1.13 The following staged assessment follows the draft SNH guidance set out in the following document: *Working Draft 11 – Guidance for Assessing the Effects on Special Landscape Qualities (November 2018).*

Step 1: The Proposal

Table 13.5.1 Assessment of Effects on the Shetland National Scenic Area – Step 1: The Proposal

The Proposed Project	
The Proposed Project comprises three seprate components: The Launch Site between Inner Skaw and Lamba Ness peninsula to the north east of Unst; a new section of link Road at Northdale, Unst; and the conversion of the former Valhalla Brewery at Saxa Vord Resort to the Launch Control Centre. A detailed description of the Proposed Project is set out in Chapter 3:. The site is located within the north eastern part of the island of Unst. The Shetland NSA includes seven designated areas. Of these the Hermaness sub-area falls into the very edge of the zone of theoretical visibility within 2.5 km of the Proposed Project. The adjacent plan extract from Figure 13.1.2 illustrates the position of the Proposed Project and the Hermaness sub area of the NSA to the north east and the Fethaland sub unit of the NSA to the south west, denoted with the brown boundary line.	

Step 2: Define the Study Area and Scope of the Assessment identifying the area likely to be affected

13.1.14 The following extracts from Figure 13.2.1 illustrates visibility of the Launch Site ZTV overlaid with the Hermaness NSA sub unit. Only c.200m² of the Hill summit at Saxa Vord Hill indicates visibility to the Launch Site and a similar extent of the headland to the north of Saxa Vord Hill indicates visibility to the extended lightning masts on Launch Pad Three.

13.1.15 The boundaries of the component landscape character units/coastal character units are indicated on these plan extracts.

Table 13.5.2 Hermaness Sub Area of the Shetland NSA: Theoretical Visibility of the Launch Site

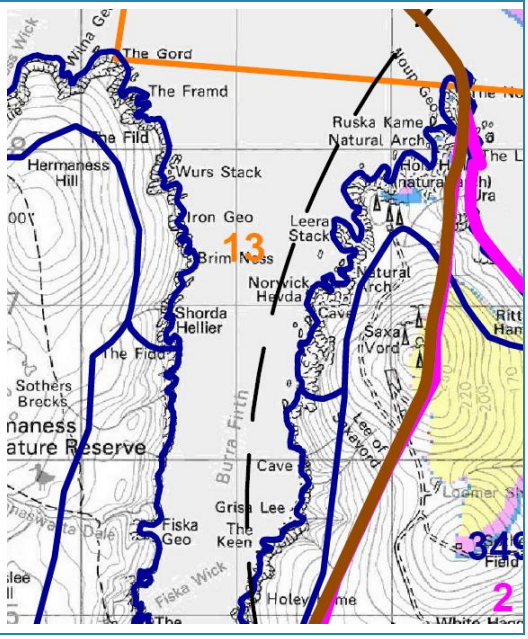
The Proposed Project	
National Scenic Areas (Herma Ness) Local Landscape Areas Visibility of Site Visibility of baseline built form only Visibility of lightning masts only Combined visibility of baseline built form and lightning masts Combined visibility of lightning masts and rocket launch sites Combined visibility of baseline built form, lightning masts and rocket launch sites The component Landscape Character Areas and Coastal Character Areas indirectly influenced are as follows: ▪ LCT 349 Major Uplands ▪ CCA 13, Burra Firth	

Table 13.5.3 Assessment of Effects on the Shetland National Scenic Area: how the area is used by people

How the area is used and experienced by people
Hermaness Sub Area Crofting settlement with associated pastures lie at the head of Burra Firth. To the north east, the hill at Saxa Vord is the location of the Saxa Vord radar station, housed within distinctive spherical radar domes. Hermaness is home to the Hermaness National Nature Reserve, a haven for thousands of populations of seabirds during the breeding season. As such the area is frequently visited by tourists and ornithologists. Hermaness Hill is also the most northerly headland of the Shetland Islands. The car parking at Burrafirth provides access to the core path network which leads to Hermaness Hill, facilitating access to the dramatic coastal scenery. The seaward area of the NSA attracts people engaged in recreational sailing and a trip along the eastern coast of Unst can be included as part of a multi-day trip for the experienced sea kayaker in good conditions. However, fast tidal movement, tidal races, overfalls and ocean swell limit activity. There are no ferry routes passing through this area though fishing vessels, cruise ships and other shipping will pass close to the NSA. Permanent settlement is limited to the Lighthouse Station, Upper and Lower Sotland, Sanfield and Buddabrake at the southern extent of Burrafirth. Residents of this scattered settlement will not experience views to the Proposed Project. Hermaness is a popular focus for walking and ornithology with access formalised along a route leading from Burra Firth via Winnswarta Dale to the north west coastline at Humlataes and on to Herma Ness and Hermaness Hill.

Table 13.5.4 Hermaness Sub Unit – Typical Views

Hermaness Sub Unit

View to Saxa Vord Radar Radome and access road, grid reference 462970, 1217656

View to the headland at Virdik and the Holm of Skaw, grid reference 462970, 1217656

View towards Baltasound from Hermaness Hill, grid reference 460648, 1217592

View towards the cliffs at Tonga and to Valla Field to the south from Hermaness Hill, grid reference 460648, 1217592

Step 3: Effects on the Special Landscape Qualities

13.1.16 The following table sets out the special landscape qualities (SLQs) relevant to the NSA sub unit at Hermaness and considers the effect of the Proposed Project on the key characteristics and SLQs.

13.1.17 It should be noted that the Proposed Project is not located within the NSA and effects will be indirect, with only a visual influence, and no direct physical effects.

13.1.18 The Proposed Project will be experienced against a baseline which is already influenced by human activity and development, for example the existing settlement pattern and road network, the prominently sited radar facilities at Saxa Vord and the lighthouse at Muckle Flagga and the associated (former) shore station in Burrafirth.

Table13.5.5 Assessment of Effects on the Shetland National Scenic Area – Step 3: The Assessment

Assessment of effect and risk	
SLQs identified at scoping and refined during subsequent study, including detailed SLQ descriptions / underpinning landscape characteristics	**Effects of the Proposed Project on key characteristics and SLQs**
Generic Special Landscape Quality: *"The stunning variety of the extensive coastline"* *"Shetland's long, extensive coastline is highly varied: from fissured and fragmented hard rock coasts, to gentler formations of accumulated gravels, sands, spits and bars; from remarkably steep cliffs to sloping bays; from long, sheltered voes to cliffs exposed to the full fury of the Atlantic Ocean."* *"The landscape is an intimate mix of sea and land. The sea reaches far inland by way of voes, firths and sounds, an inland coast in marked contrast to the dynamic outer coast of wild Atlantic 'oceanscapes'. Here the land reaches into the open sea on many points and promontories."*	The Proposed Project would not have had a direct effect on the "*stunning variety of the extensive coastline"* of the NSA because the Proposed Project is not located in the NSA, being located at a distance beyond 2.5 km from the closest NSA boundary. The limited areas with visibility within the Hermaness sub unit of the NSA include: the summit area of Saxa Vord Hill within the dominating influence of the Saxa Vord Radar Station Radome and associated infrastructure; with a further small area of partial visibility to the extend lightning masts only on Launch Pad Three, from a small area of the headland to the north of

Assessment of effect and risk	
"This huge variety has arisen from the interaction between geology, glaciation and sea level changes, and results in the dramatic coastal scenery as encapsulated within the seven areas of the NSA."	Saxa Vord Hill, seen in the context of dismantled radar equipment and broken fencing. The influence of the Proposed Project will be well separated from the foreground intensity of the coastal experience and the special qualities of the sub areas of the NSA would not be affected. **Risk of damage / loss to SLQ:** No Change to SLQ
Generic Special Landscape Quality: *"Coastal settlement and fertility within a large hinterland of unsettled moorland and coast"* *"Thousands of years of human occupation has given the landscape a rich archaeological heritage, including ancient brochs and modern crofts."* *"Settlement has always been constrained by the nature of the land, largely confined to strips of ground rarely out of sight of the sea. Houses are concentrated at the heads of voes or in sheltered bays, well placed to make use of the sea and coastal resources."* *"The green, inbye land of the crofts and farms contrasts with the common grazings of wild, unimproved and uninhabited moorland and bog. There are also long lengths of remote and uninhabited coast."*	Settlement within Hermaness sub area is set within the sheltered setting of Burra Firth. The surrounding landform prevents any inter-visibility with the Proposed Project. **Risk of damage / loss to SLQ:** No Change to SLQ
Generic Special Landscape Quality: *"The hidden coasts"* *"Because the land is undulating, markedly so in the western mainland, the actual brink of the coastal edge may be hidden or difficult of access. This brings an element of surprise when caves, geos and gloups are suddenly encountered, inviting further exploration."*	The immediate coastlines of Hermaness are predominantly inaccessible, with walking access restricted to the coastal path above the cliffs. Routes follow closely around the indented terrain, and the foreground changes constantly. The SLQ relates to the immediate coastline of the NSA and the Proposed Project would only have indirect effects on wider views and visibility is extremely limited. **Risk of damage / loss to SLQ:** No Change to SLQ
Generic Special Quality: *"The effects and co-existence of wind and shelter"* *"The wind appears ever-present and the absence of trees, or even shrubs, gives an open and exposed feel to much of the landscape. The frequent gales can be awe-inspiring, and in high seas fröde (sea-foam) can fleck the coastal grasslands, well-inland from the coastal edge."* *"Weather, skies and light are rarely static, with continual movement of clouds, waves, sea-spray*	The Proposed Project would not have a significant influence on *"the effects and co-existence of wind and shelter".* **Risk of damage / loss to SLQ:** No Change to SLQ

Assessment of effect and risk	
and grasses. The interplay of light and shade moving across the sea, the coastal grasslands or the interior moorland adds a special dynamism." *"With wind a determining force, so the presence of shelter is acutely perceived. Hence, an awareness of both wind and shelter is a particular quality of these areas. There may be the distant sound of stormy seas pounding the mouth of a bay or voe, while inland waters or a sheltered hollow remain still and calm."*	
Generic Special Landscape Quality: *"A sense of remoteness, solitude and tranquillity"* *"The feeling of being at the northern limits of the British Isles is marked. The Shetland Isles are remote in themselves, and within the archipelago there are also degrees of remoteness."* *"Most of the coastline is undeveloped and natural, and long-stretches can be traversed without seeing anyone or any human influence."* *"Hence solitude and tranquillity underpin much of the NSA coast, and it is easy to wander with only the seabirds for company. However, tranquillity can give way to alarm as the wind picks up, the rain begins and an Atlantic storm sets in."* *"Muckle Flugga, within the Hermaness section of the NSA, is further from the Scottish/English border than Lands End."*	The Proposed Project would not have a direct effect on *"A sense of remoteness, solitude and tranquillity"*. However, the presence of the Proposed Project in distant views would have an indirect effect owing to the very slight (occasional) increase presence of man-made artefacts in views. The landscape remains very exposed, wild and dynamic and the *"sense of remoteness, solitude and tranquillity"* will remain intact. **Risk of damage / loss to SLQ:** Negligible, limited to indirect effects.
Generic Special Landscape Quality: *"The notable and memorable coastal stacks, promontories and cliffs."* *"Where open to the full fury of the Atlantic Ocean, the sea has carved impressive cliffs, forming spectacular, towering, vertical scenery, varying greatly in colour according to the complex geology."* *"The coast also contains many distinctive stacks, promontories and other features that form memorable images. Within the NSA these include:"* • *"Muckle Flugga with its distinctive sloping, pointed rocks"* • *"The imposing cliffs of Hermaness itself, with its nesting seabirds."*	The Proposed Project will not have a direct effect on *"the notable and memorable coastal stacks, promontories and cliffs."* as it is located in a geographically separate area. The Proposed Project is set back from the distinctive *"coastal stacks, promontories and cliffs"* of the NSA and would not interrupt direct views to these features. **Risk of damage / loss to SLQ:** Negligible, limited to indirect effects.

Step 4: Summary of Effects on the SLQs

Table 13.5.6 Assessment of Effects on the Shetland National Scenic Area – Step 3: The Assessment

Assessment of effect and risk
The Proposed Project is located beyond the Shetland NSA, however, the Proposed Project has a minor indirect influence on the Hermaness sub area on north Unst. The Proposed Project will be visible from the summit area of Saxa Vord Hill in the context of the dominating influence of the Saxa Vord Radar Radome. A further small area of visibility is recorded on the remote headland to the north of Saxa Vord Hill, across a very small area, with visibility of the extended lightning masts on Launch Pad 3 appearing a distant minor element visible in the context of coastal views, set back from foreground coastal features. Many of the SLQs relate to the physical attributes of the NSA and the experience of these from within the NSA and the Proposed Project will only affect the wider setting of the NSA. As such the Special Landscape Qualities of the Hermaness sub-unit of the Shetland NSA will not be at risk or compromised by the Proposed Project and the overall integrity and objectives of the Shetland NSA will be maintained.