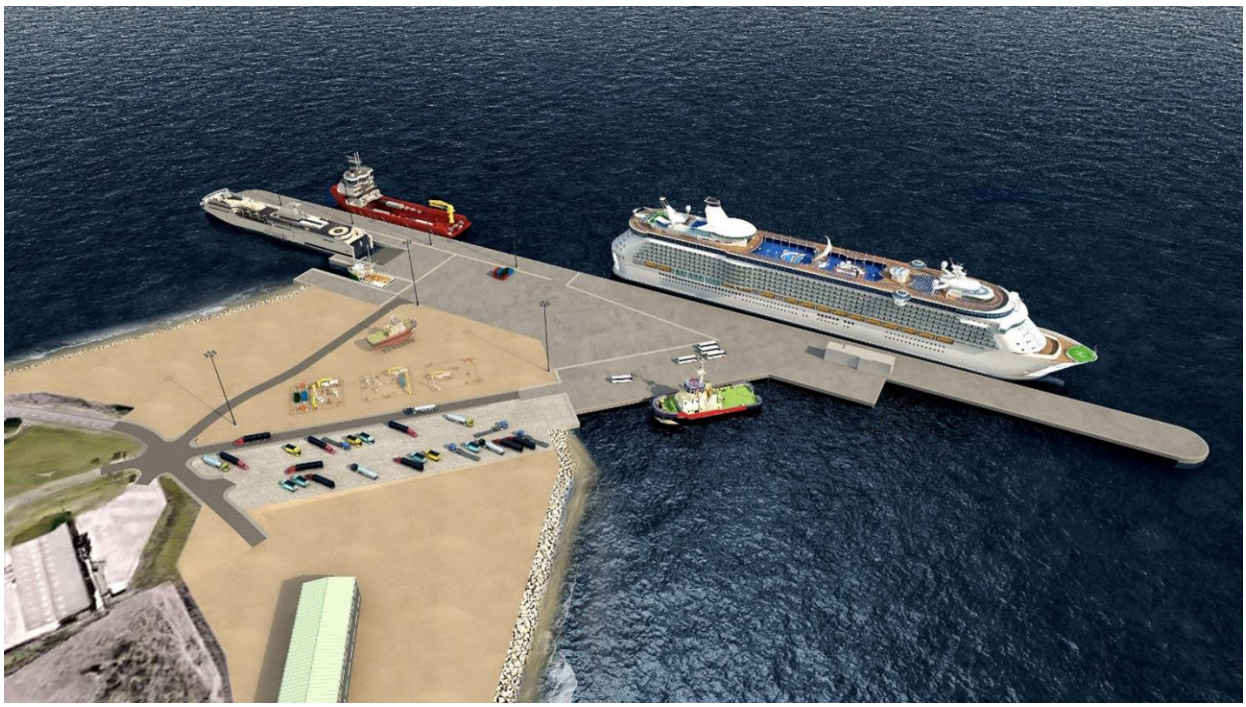
B HABITATS REGULATIONS APPRAISAL

Orkney Logistics Base (Hatston)
Habitats Regulations Appraisal



September 2025

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EXECUTIVE SUMMARY

Envirocentre Limited has been commissioned by Orkney Island Council Harbour Authority to undertake a Habitats Regulation Appraisal (HRA) to determine whether the proposed expansion of Hatston Pier and Harbour works will have any adverse impact on the integrity of any European designated sites.

The potential effects of the proposal on the designated features of the European designated sites were considered as part of a Habitats Regulations Assessment. Likely Significant Effects (LSE) on the North Orkney Special Protection Area (SPA), Orkney Mainland Moors SPA, Scapa Flow SPA, Faray and Holm of Faray Special Area of Conservation (SAC) and Sanday SAC could not be ruled out during the screening stage of the assessment; and so an Appropriate Assessment (AA) has been conducted to ascertain whether the proposed works will adversely affect the integrity of the site's qualifying features.

During the AA process it was possible to rule out adverse effects from impacts to the assessed designated sites. Mitigation to be enacted includes:

- Production of a Vessel Management Plan for both the Construction and Operational phases which will detail vessel routes, speeds etc to minimise, and where possible, avoid any disturbance impacts;
- Adherence to measures set out in the Construction Environmental Management Document (CEMD);
- Deployment of an ornithologist and marine mammal observer to monitor for the presence of qualifying species of the North Orkney SPA, Orkney Mainland Moors SPA (Red-throated Diver) and cetaceans and pinnipeds (in particular harbour seal) in the vicinity of the Proposed Development during piling, blasting and dredging works;
- A soft-start approach to piling works to prevent disturbance;
- Production and adherence to detailed Marine Mammal Protection Plan (MMPP);
- Production and adherence to a detailed Pollution Prevention Plan;
- A silt boom to contain fine sediments will be used whilst reclamation work activities are undertaken.

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1 INTRODUCTION

1.1 Terms of Reference

Envirocentre Limited has been commissioned by Orkney Island Council Harbour Authority (OICHA) to undertake a Habitats Regulation Appraisal (HRA) to determine whether the proposed expansion of Hatston Pier and Harbour works will have any adverse impact on the integrity of any European designated sites.

1.2 Scope of Report

A HRA is required to assess whether the project, alone or in combination with other projects, will have an adverse impact on the integrity of the European designated site. It is the responsibility of the competent authority to conduct the HRA. This document aims to provide the information necessary for them to carry out the HRA assessment by:

- Providing a description of the proposed works;
- Identifying those European designated sites which are connected to and/or could potentially be affected by the proposed works;
- Identifying how the proposed works may impact on the qualifying features of the designated site(s);
- Considering other projects which may have “in combination” effects on the European designated sites; and
- Recommending the designated sites which need to be taken forward for further assessment if impacts on their qualifying features cannot be ruled out.

1.3 Report Usage

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2 METHODOLOGY

2.1 The Habitats Regulations Appraisal Process

The HRA is a four-stage process. An important aspect of the process is that the outcome at each successive stage determines whether a further stage in the process is required. The stages are summarised in Table 2-1. It is stated within the EU guidelines[1] that "where, without any detailed assessment at the screening stage, it can be assumed (because of the size or scale of the project or the characteristics of the national site network) that significant effects are likely, it will be sufficient to move directly to the appropriate assessment (Stage Two) rather than complete the screening assessments explained below."

Table 2.1 Key Stages in the HRA Process

Stage 1	
Screening for Likely Significant Effect (LSE)	- Identify international sites in and around the project area. - Examine conservation objectives of the interest feature(s) (where available). - Review plan policies and proposals and consider potential effects on UK sites (magnitude, duration, location, extent). - Examine other plans and programmes that could contribute to 'in combination' effects.
	- If no effects likely – report no likely significant effect. - If effects are judged likely or uncertainty exists – the precautionary principle applies, proceed to Stage 2. - If following screening the project is reviewed and includes integral mitigation which will ensure no likely significant effects, then no further Appropriate Assessment needed.
Stage 2	
Appropriate Assessment (AA)	- Complete additional scoping work including the collation of further information on sites as necessary to evaluate impact in light of conservation objectives. - Consider how the project 'in combination' with other projects will interact when implemented (the Appropriate Assessment). - Consider how effects on integrity of the site could be avoided by changes to the project and the consideration of alternatives. - Develop mitigation measures (including timescale and mechanisms). - Report outcomes of AA including mitigation measures.
	- If the project will not adversely affect European site integrity proceed with plan. - If effects or uncertainty remain following the consideration of alternatives and development of mitigation proceed to Stage 3.
Stage 3	
Alternative Solutions	- Consider alternative solutions, delete from project or modify. - Consider if priority species/habitats affected - identify 'imperative reasons of overriding public interest' (IROPI), economic, social, environmental, human health, public safety (only applicable in highly exceptional circumstances).
Stage 4	
Imperative Reasons of Overriding Public Interest (IROPI)	- Stage 4 is the main derogation process of Article 6(4) which examines whether there are imperative reasons of overriding public interest (IROPI) for allowing a plan or project that will have adverse effects on the integrity of a UK site to proceed in cases where it has been established that no less damaging alternative solution exists. - The extra protection measures for Annex I priority habitats come into effect when making the IROPI case. Compensatory measures must be proposed and

[1] https://op.europa.eu/en/publication-detail/-/publication/2b6c4b16-e867-42da-b604-f67ee6fe60c3

	assessed. The Commission must be informed of the compensatory measures. Compensatory measures must be practical, implementable, likely to succeed, proportionate and enforceable, and they must be approved by the Minister.

2.2 Screening

Screening determines whether or not the project is likely to (or potentially could) have significant effects on the national site network. A list of all SACs, cSACs, SPAs and potential SPAs (pSPAs) that are within proximity to the site, or sites designated for mobile species which have the potential to be affected by the proposed development, was compiled and the qualifying interest features noted. Following this, the key environmental conditions (conservation objectives) needed to support site integrity were detailed for each site.

With reference to the NatureScot guidance[2] the screening stage determines whether Appropriate Assessment is required, by:

- Determining whether a project (or plan) is directly connected with or necessary to the conservation management of any European sites;
- Describing the details of the project (or plan) proposals and other projects that may cumulatively affect any European sites;
- Describing the characteristics of relevant European sites; and
- Appraising likely significant effects of the proposed project on relevant European sites.

The guidance gives the following definition of LSE:

"The test of significance is where a plan or project could undermine the site's conservation objectives. The assessment of that risk (of 'significance') must be made in the light, amongst other things, of the characteristics and specific environmental conditions of the site concerned."

*"A likely effect is one that cannot be ruled out on the basis of objective information. The test is a 'likelihood' of effects rather than a 'certainty' of effects. Although some dictionary definitions define 'likely' as 'probable' or 'well might happen', in the Waddenzee case the European Court of Justice ruled that a project should be subject to Appropriate Assessment "**if it cannot be excluded, on the basis of objective information, that it will have a significant effect on the site, either individually or in combination with other plans and projects**". Therefore, 'likely', in this context, should not simply be interpreted as 'probable' or 'more likely than not', but rather whether a significant effect can objectively be ruled out."*

2.3 Appropriate Assessment

The Appropriate Assessment establishes whether or not a project's LSE identified during the screening stage will have an adverse effect on the integrity of the affected site with regard to its conservation objectives. Based on the guidance provided by NatureScot guidance the effects of the proposal on the designated sites' qualifying features will determined by:

- Gathering information required to assess impacts (from site documents, scientific literature, EU and UK guidance on impact assessment and impact assessments from similar projects);
- Predicting the type and nature of impacts e.g. direct or indirect, short or long term;
- Assessing whether there will be adverse effects on the integrity of the site as defined by the conservation objectives and the status of the site. The precautionary principle must be applied

[2]NatureScot, formerly SNH guidance available at : https://www.nature.scot/sites/default/files/2019-07/Habitats%20Regulations%20Appraisal%20of%20Plans%20-%20plan-making%20bodies%20in%20Scotland%20-%20Jan%202015.pdf (Accessed 2025)

at this stage. If it cannot be demonstrated with supporting evidence that there will be no adverse effects then adverse effects will be assumed; and
- Ascertaining if it is possible to mitigate adverse effects.

2.4 In-Combination Effects

Under Regulation 48(1)(a) of The Conservation (Natural Habitats, &c) Regulations 1994 (as amended) it is necessary to consider whether a plan or project is likely to have a significant effect on a national site network site "either alone or in combination with other plans or projects."

These should include:

- Approved but as yet uncompleted plans or projects;
- Plans and projects for which an application has been made, and which are currently under consideration but not yet approved by the competent authorities; and
- Permitted ongoing activities such as discharge consents, abstraction licences or consecutive/simultaneous maintenance activities.

3 DESCRIPTION OF THE PROPOSED DEVELOPMENT AND CONSTRUCTION METHODS

3.1 Site Location

The proposed development is located on the eastern shore of the Orkney mainland, approximately 1.9km west of Kirkwall. It is located on the Hatston coastline within the Bay of Kirkwall, 1.7km northwest of the Peerie Sea and 1.8km west of the Bay of Weyland.

3.2 Proposed Works

It is proposed to extend the existing outer quay by 300m (with minimum water depth of 10m CD) which would also form a 125m inner berth. This would create substantially more quayside which would be available for both current and future commercial operations.

In addition to the above, circa 7.5 hectares (Ha) of additional land extending from the current shoreline outwards would be made available for harbour-related operations through reclamation. The design includes additional linkspan and fuel facility and space provision to later accommodate a ship lift.



Above Schematic of the Proposed Development

The development is designed to be built in three phases. These phases should not be considered consecutively but allow for a degree of flexibility which can be adapted to suit the requirements, budget and programme of OICHA. The drawings below give an illustration of the proposed development works for the three phases.

Phase 1

- Reclaim the area by depositing appropriate material to form a platform on the southeastern side of the current pier causeway and thereby create 3Ha of hard-core surfaced marshalling / storage area along with an HGV trailer park for the ferry service which will be covered by a reinforced concrete slab;

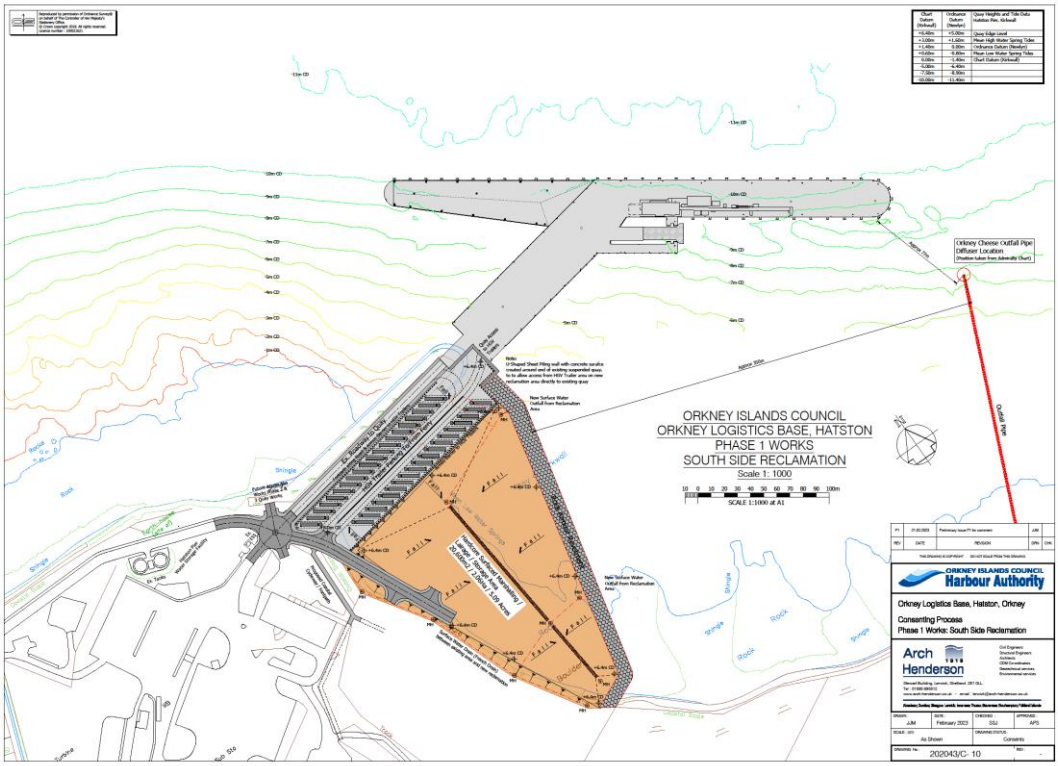
- A sheet pile wall is to be installed to allow a retained interface with the current suspended deck; and
- Place rock armour along the northern and eastern edges of the infill area.

Phase 2

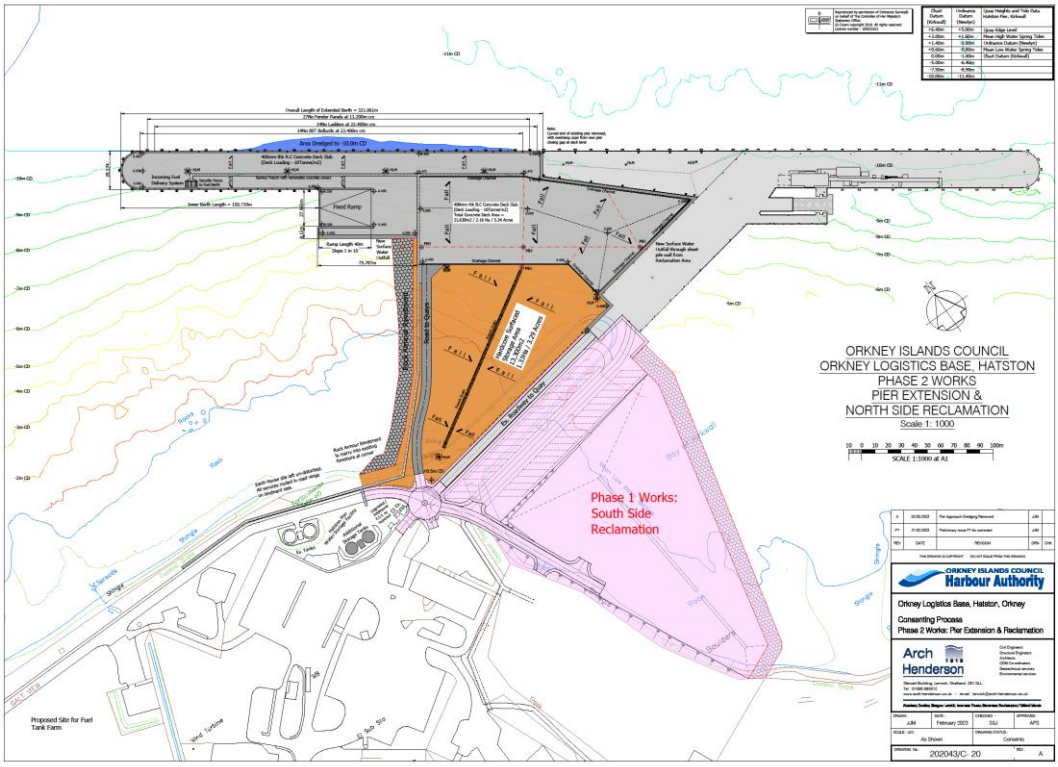
- Extend the current quay to the west by circa 300m with a 25m return and an inner berth to facilitate the proposed linkspan berth and fixed ramp. The extension will comprise a steel sheet pile wall and will initially interface with the alignment of the existing suspended deck on the north-west inner face before forming the new quay extension;
- Reinforced concrete slabs will form the new main deck areas;
- Reclaim the shoreline by depositing appropriate material to form a platform on the southwestern side of the current pier causeway to create an additional 3.71Ha to be used as a multi-use laydown/work area surfaced with hard-core, as well as establish a separate access road to the new quay extension;
- Place rock armour along the western edge of the infill area; and
- Small scale dredging of the approaches to the quay to -10m CD following completion of the quay works.

Phase 3

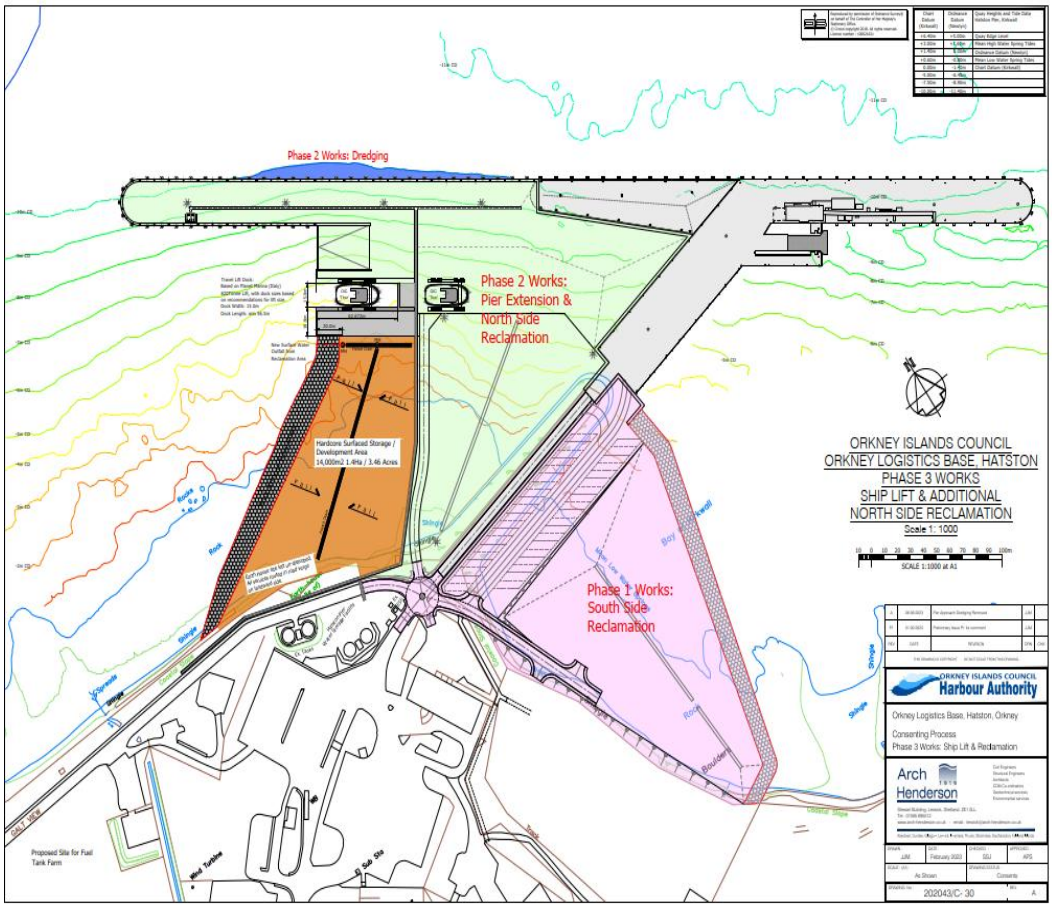
- Reclaim the shoreline to the south-west of Phase 2 to form a platform on the southwestern side of the current pier causeway to be used as a multi-use laydown/work area as well as create a ship lift;
- The ship lift will extend from the linkspan fixed ramp installed in Phase 2 and will comprise piles and reinforced concrete pads designed for the boatlift wheel-loads;
- The rest of the area will be infilled to provide extra yard / storage;
- Place uplifted and re-used rock armour along the western edge of the infill; and
- Small scale dredging in the area around the ship lift to -6m CD



Phase 1 South Side Reclamation



Phase 2 Pier Extension and North Side Reclamation



Phase 3 Ship Lift and Reclamation Layout

3.3 Construction Phase

It is important to note that the contract for construction of the facility may be awarded on a design and build basis. Therefore, while exemplar tender designs have been completed by Arch Henderson (Project Technical Advisors), until the preferred contractor is identified and procurement complete the exact detail of the construction methodologies cannot be confirmed at this stage in the development process. However, based on professional advice, the following construction activities are summarised below. There are three Phases (Phase 1 to Phase 3), with Stages within each Phase also described below.

3.3.1 Phase 1 – South-East Reclamation Area

- Prior to work commencing a silt boom will be moored out from the foreshore and construction drainage works installed;
- On the eastern perimeter a bund will be formed from suitable materials extending from the shoreline outwards to the existing pier causeway. To minimise potential release of suspended solids into the marine environment only inert stone free of all fine clay or organic material will be used in forming the reclamation outer bund;
- The advancing head of the perimeter core bund will be protected by the silt boom which shall advance in front of the work;
- As the bund progresses, geotextile will be placed on the eastern slope to mitigate the migration of fines;
- Secondary armour and primary armour stone to be placed on top of the geotextile;
- Existing rock armour stone shall be uplifted and stored for reuse as outer slope protection for Stage 2.
- Stage 2 works commence with the installation of the sheet pile retaining wall at the boundary with the existing suspended deck using a vibro piling hammer.
- Suitable reclamation fill will be deposited in the area between the newly formed bund and the existing shoreline; and
- Once reclamation works are completed the area will be capped and compacted with graded hard core with the surface falling to a V ditch and French drains

3.3.2 Phase 2

A works access approach will be formed using infill material parallel to the existing causeway in order to ensure complete demarcation of the freight access to the existing Hatston Pier

- The reclamation access will continue to the end of the existing pier.
- Sheet piling will be installed adjacent to the existing suspended deck pier through the reclamation fill.
- The rock strata will then be pre-treated prior to sheet piles being installed by vibro piling to form the new quay walls;
- To install the sheet piles the drill rigs will work over water from temporary piling platforms from the existing pier or a jack up barge;
- Sheet piles will be installed by vibro-hammer to the required depth;
- The new quay form to be infilled and vibro-treated to compact and reduce future consolidation and settlement;
- At all times the piling will progress ahead of filling with silt booms being deployed as required to minimise the release of fines;

- Tie rods will then be installed once the infill reaches the required level and secured between the front face and rear sheet pile wall. Infilling will then continue to deck level and a concrete cope formed;
- The infilling of the reclamation area of Phase 2 will follow in a similar manner of that for Phase 1.

3.3.3 Phase 2: Rock Pre-Treatment

In advance of installing sheet piles it is necessary to pre-treat (drilling and blasting) the bedrock beneath the line of the new quay piles. This activity will be undertaken during the period of April – October and only undertaken during suitable weather windows. This period is also the period when vibro-piling activities will be undertaken. However, if weather delays the programme the work may extend out with this period. Blasting will be undertaken once per day during the works and is likely to occur at the end of the working day.

The work involves the following:

- A barge, carrying a tracked drill rig (with rotary percussive hammer drilling capability) will position itself along the piling line;
- The hole will be drilled (cased to bedrock to prevent any loss of material to the sea) with all cutting collected for onshore disposal;
- A down-the-hole hammer and string will then be lowered into the casing, allowing the driller to open the rock socket to the required depth. The hole will then be flushed to remove any obstructions;
- The drill hole or short series of holes will be loaded using conservative charge weights of explosives;
- The barge will be moved out of position and following audible warning procedures and approval from the port authority, blasting will commence ensuring each hole is fired individually to reduce the maximum instantaneous blast velocity; and
- The jack up barge shall then be repositioned for the next set of drill holes and blasting.



Plate 3-1: Photograph showing a tracked drilling rig set up for pre-treatment of bedrock

3.3.4 Dredging

- Once all Phase 2 & 3 quay works are complete a small amount of dredging is required.
- Dredging will be undertaken by a long reach excavator from land;
- A total of approximately 6,700m^3 of sediment will be dredged;
- Each dredging campaign (there will be two – one in Phase 2 and one in Phase 3) is anticipated to take between 7 to 10 days (therefore a maximum of 20 days in total);
- Sediment dredged will be reused on site as infill material in reclamation works.

Dredging will be undertaken between April and October.

3.3.5 Phase 3 – South-West Reclamation Area

- Phase 3 will extend the laydown area further to the south-west as shown in Figure 2-5 with construction following the methodology described for Phase 1

3.3.6 Site Drainage and Water Management

During the construction phase temporary drainage and water management measures will be implemented to protect the water environment.

During the construction phase the permanent drainage infrastructure will be installed. This permanent infrastructure will be designed to incorporate Sustainable Urban Drainage Systems (SUDS) in accordance with the CIRA SUDS Manual (C697). This includes permeable surfaces with a French drain collection system leading to a SUDS filtration device before outfall discharge to open sea.

3.3.7 Baseline Vessel Movements

For the Navigational Risk Assessment (NRA)(see Appendix A) the baseline traffic conditions at Hatston were established through a combination of Automatic Identification System (AIS) data analysis, historic incident records, and stakeholder consultation. AIS data were obtained for January 2022 (representing winter) and July 2022 (representing summer), providing a seasonally representative dataset of vessel movements within the study area to extrapolate to full years as required. This dataset captured tracks, density, and traffic flows for vessels carrying Class A and Class B transponders, with recognition that smaller fishing and recreational craft are under-represented. The winter / summer snapshot approach ensured that seasonal variations, particularly the high summer cruise ship and leisure traffic, were taken into account for the purposes of assessing any navigational risks.

From this, vessel tracks approaching Hatston Pier show variance between summer and winter periods. For both summer and winter periods, vessel traffic density in the direct vicinity of Hatston Pier is noted as low in the NRA. A traffic route can be seen more clearly in the summer dataset, with the highest density across both periods equating to 61 tracks, or approximately two tracks per day. It was noted in the NRA that this underlines that while Hatston accommodates significant seasonal activity (i.e. cruise), overall traffic levels remain modest in comparison to major commercial harbours.

This seasonal trend is reinforced by actual cruise vessel calls over recent years, which show a steadily increasing volume of traffic through Hatston. In 2022, 106 cruise ships berthed at Hatston Pier and a further 15 anchored off Kirkwall between April and September. In 2023, this increased to 119 at Hatston and 35 at anchor between March and October. Then for 2024, 125 cruise ships used Hatston and a further 30 were at anchor towards Kirkwall Pier, again over the March to October cruise season. This

illustrates the significant seasonal peak in marine traffic and the importance of Hatston as Orkney's primary cruise berth.

The quantitative data were complemented by a programme of stakeholder consultation carried out in November 2022 with OIC Marine Services, Orkney Ferries, NorthLink Ferries, Leask Marine, EMEC, aquaculture operators, fishing representatives, and leisure groups. These discussions validated the AIS findings, provided context on seasonal and operational patterns, and highlighted local concerns such as grounding risks, berth availability for small craft, and cumulative effects of displaced traffic. Together, these sources of evidence formed a robust baseline for assessing navigational risk associated with the Hatston redevelopment project through the NRA.

Table 3.1 below shows the average baseline traffic for Hatston.

Table 3.1: Baseline Traffic

Type of Vessel	Number of Calls	Vessel Movements	Winter (Oct–Mar)	Summer (Apr–Sep)
Cruise	**130**	**260**	**0**	**260**
Ferry	**380**	**760**	342	418
Oil and Gas Supply	**0**	**0**	**0**	**0**
Offshore Wind	**0**	**0**	**0**	**0**
Freight and Cargo	**3**	**6**	**6**	**0**
Boat Repair	**0**	**0**	**0**	**0**
Total	**513**	**1026**	**348**	**678**
Average per day	**1.4**	**2.8**	**2.3**	**4.4**

3.3.8 Vessel Movements During Construction

During construction works, there will only be a small volume of vessel movements, as it is anticipated that the majority of materials will be brought by land from sites within Orkney Mainland. Rock armour import will consist of two shipments at start and halfway through contract, therefore 8 vessel movements in total. These vessel movements will be following existing shipping routes, with no new/novel routes being utilised. Sheet piles and any other material that cannot be sourced on the mainland will be imported through the existing Orkney Northlink freight services, so there will be no increase to current vessel movement baseline levels to deliver these.

3.3.9 Vessel Movements During Operation

Discussions with Orkney Islands Council Harbour Authority (OICHA) have identified the anticipated increase in vessel movements during the operational phase of the proposed development. These projections reflect new demand from oil and gas support, offshore wind, additional freight and cargo, and boat repair, while cruise traffic is expected to remain around current levels.

The overall effect is an additional 108 vessel calls per year, equivalent to 216 vessel movements, split broadly in line with current seasonal patterns (34% winter, 66% summer). That is an increase of in the region of 21 per cent on the baseline of on average 2.8 vessel movements per day to on average 3.4 vessel movements per day.

As described above, vessel activity at Hatston is strongly seasonal. While the NRA indicates an average of around two vessel movements per day across the year, approximately 250 of these annual movements are cruise ships, all occurring between March and October. This concentration means that in the summer period (April–September, around 183 days) cruise calls alone contribute on average more than one movement per day, with overall vessel activity rising to more than three movements per day when routine ferry traffic are included. In contrast, the winter months (October to March, about 182 days) typically see no cruise ship visits, and daily vessel movements drop to about two, primarily consisting of routine ferry services and limited commercial freight operations.

With the 216 new operational vessel movements per year associated with the proposed development, equivalent to about 0.6 additional movements per day on average. Applying the same seasonal split, which is the operational expectation, this equates to roughly 147 new summer movements and 69 new winter movements. As a result, the summer average rises to nearly 4.5 movements per day, while the winter average almost doubles to around 2.3 movements per day.

Table 3.2 summarises the forecast increases above baseline conditions drawing from the most up to date commercial understanding of how the development will be used.

Table 3.2: Predicted Operational Vessel Movements above Baseline Conditions

Type of Vessel	**Number of Calls**	**Vessel Movements**	**Winter (Oct–Mar)**	**Summer (Apr–Sep)**
Cruise and Ferry	No change above baseline	No change above baseline	-	-
Oil and Gas Supply	12	24	8	16
Offshore Wind	24	48	16	32
Freight and Cargo	12	24	8	16
Boat Repair	40	80	25	55
Total	**108**	**216**	**69**	**147**
Average per day	**54**	**108**	**0.5**	**1.0**
Total Vessel Movements during operation (including baseline	**621**	**1242**	**418**	**825**

When comparing baseline vessel activity with the projected traffic associated with the proposed development, it is clear that the majority of larger vessel movements at Hatston are already generated by the existing ferry services, including both passenger and Ro-Ro freight vessels. By contrast, the additional vessel calls associated with the development represent a relatively modest increase. This

highlights that the primary driver for the project is the provision of enhanced landside facilities and operational capacity, rather than a significant change in the scale of marine traffic. The development does not represent the creation of a new ferry berth, but rather an improvement in infrastructure to support more efficient use of the pier.

4 SCREENING FOR LIKELY SIGNIFICANT EFFECT

4.1 Likely Significant Effect

For significant effects to arise, there must be a risk enabled by having a 'source' (e.g. construction works at a proposed development site), a 'receptor' (e.g. a European site or its qualifying interests), and a pathway between the source and the receptor (e.g. mobile marine species travelling between the proposed development site and the designated site). The identification of a pathway does not automatically mean that significant effects will arise. The likelihood for significant effects will depend upon the characteristics of the source (e.g. duration of construction works), the characteristics of the pathway (e.g. what species and the number of individuals travelling between the two sites) and the characteristics of the receptor (e.g. the sensitivities of the European site and its qualifying interests).

NatureScot (2015) guidance states that sites with mobile species should be considered within the screening process where there is a significant ecological link between the designated site and the proposed development site. It also states that for developments which could increase recreational pressures on designated sites, all sites within reasonable travel distance of the development should be considered for screening. It is also necessary to consider sites which are part of the same coastal ecosystem, where the proposed development may affect coastal processes.

4.2 Relevant European Sites

The following sites have been scoped in for assessment due to them being within proximity to the site and/ or considered connected to the site via dispersal of designated mobile species:

- North Orkney SPA
- Orkney Mainland Moors SPA
- Scapa Flow SPA
- Loch of Stenness SAC
- Faray and Holm of Faray SAC
- Sanday SAC

The sites are listed in Table 4-1, along with their screening assessment.

4.2.1 In-Combination Effects

Orkney Islands Council (OIC) identified the following projects which should be considered in-combination with the proposed development:

- Scapa Deep Water Quay;
- Meil Bay Fish Farm;
- Kirk Noust Fish Farm;
- Bay of Vady, Rousay Sound Fish Farm;
- Puldrite Fish Farm;
- Veantrow Bay, Shapinsay Fish Farm;
- Noust Geo Fish Farm;
- Bay of Holland Fish Farm, Stromsay;
- Wyre Fish Farm, Gairnsay Sound;
- Quanterness Fish Farm;
- Quanterness Wind Farm;

- Faray Wind Farm;
- Stymilders/Heddle Hill Substation; and
- Kirkwall Pier.

Table 4.1: List of European Designated Sites within proximity to the site along with their Qualifying Features and Screening Assessment for Likely Significant Effects

Site Name (distance and orientation from works)	**Conservation Objectives**	**Qualifying Features**	**Likely Significant Effect (LSE)**	**Screening Assessment**
North Orkney SPA (On boundary)	To ensure that the qualifying features of the North Orkney SPA are in favourable condition and make an appropriate contribution to achieving Favourable Conservation Status.	Great northern diver (*Gavia immer*), Slavonian grebe (*Podiceps auritus*), Velvet scoter (*Melanitta fusca*), non-breeding	Pathway for LSE identified. There is potential for the species to be subject to disturbance during the construction phase of the proposed development via temporary noise from piling, blasting and dredging and vessel and onshore vehicle movements. Additional vessel movements during the operational phase (an increase of up to 216 movements per year) could result in displacement from the habitat and a reduction in overall foraging habitat. This impact could increase in magnitude and/or duration when considered in-combination with other local development developments.	Scoped in
		Red-throated diver (*Gavia stellata*), breeding	Pathway for LSE identified. It is possible that birds breeding within the SPA could utilise the water within the proposed harbour area for foraging. During the construction phase of the proposed development foraging Red-throated Divers could be impacted temporarily by noise from piling, blasting and dredging and vessel and onshore vehicle movements. Additional vessel movements during the operational phase (an increase of up to 216 movements per year) could result in displacement from the habitat and a reduction in overall foraging habitat This impact could increase in magnitude and/or duration when considered in-combination with other local development developments.	Scoped in

Site Name (distance and orientation from works)	**Conservation Objectives**	**Qualifying Features**	**Likely Significant Effect (LSE)**	**Screening Assessment**
Orkney Mainland Moors SPA (4km south west)	To avoid deterioration of the habitats of the qualifying species or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained.	Hen harrier (*Circus cyaneus*), breeding	Pathway for LSE identified. Pendlebury *et al.* (2011) state that the maximum foraging range from nests is 2km for females and males can travel up to 8.5km from a nest site. Hen harriers can utilise coastal areas to predate waders, therefore it is It possible that birds breeding within the SPA could utilise the water within the proposed harbour area for foraging. During the construction phase of the proposed development foraging Hen Harriers could be impacted temporarily by noise from piling and blasting. This could result in displacement from the habitat and a reduction in overall foraging habitat. However, as Hen harriers favour heather moorland and stream habitat when nesting, and there are plenty of accessible coastal areas outside the working area available, it is unlikely that works associated with the pier will have a significant effect on the foraging success of breeding Hen Harrier. Therefore, no LSE predicted.	Scoped out
		Hen harrier non-breeding	Pathway for LSE identified. It possible that birds within the SPA could utilise the water within the proposed harbour area for foraging. During the construction phase of the proposed development foraging Hen Harriers could be impacted temporarily by noise from piling and blasting. This could result in displacement from the habitat and a reduction in overall foraging habitat. However, as winter foraging Hen Harriers favour open rank habitats for foraging, and there are plenty of accessible coastal areas outside the working area available, it is unlikely that works associated with the pier will have a significant effect on the foraging success of foraging Hen Harrier in the locale. Therefore, no LSE predicted.	Scoped out

Site Name (distance and orientation from works)	**Conservation Objectives**	**Qualifying Features**	**Likely Significant Effect (LSE)**	**Screening Assessment**
		Red-throated diver, breeding	Pathway for LSE identified. Pendlebury *et al*. (2011) state that the maximum foraging range from nests during the breeding season is generally 8km for Red-throated Diver but can be up to 13.5km in the Western Isles. It is possible that birds breeding within the SPA could utilise the water within the proposed harbour area for foraging. During the construction phase of the proposed development foraging Red-throated Divers could be impacted temporarily by noise from piling, dredging and vessel and onshore vehicle movements. This could result in displacement from the habitat and a reduction in overall foraging habitat.	Scoped in
		Short-eared owl (*Asio flammeus),* breeding	No pathway identified. No potential impacts to breeding Short-eared owl or their habitat within the SPA are predicted due to the distance between the SPA and the proposed development and the species not being associated with coastal habitats. No LSE is predicted.	Scoped out
Scapa Flow SPA (4km south)	To ensure that the qualifying features of the Scapa Flow SPA are in favourable condition and make an appropriate contribution to achieving Favourable Conservation Status.	Black-throated diver (*Gavia arctica*), non-breeding	No pathway identified. As there is no works planned across land and given the hydrological distance from the site and Scapa Flow SPA, it is considered unlikely the species will be subject to direct impacts from development activities or indirectly via accidental pollution events. No LSE is predicted.	Scoped out
		Eider (*Somateria mollissima*), non-breeding	No pathway identified. As there is no works planned across land and given the hydrological distance from the site and Scapa Flow SPA, it is considered unlikely the species will be subject to direct impacts from development activities or indirectly via accidental pollution events. No LSE is predicted.	Scoped out

Site Name (distance and orientation from works) **Conservation Objectives**	**Qualifying Features**	**Likely Significant Effect (LSE)**	**Screening Assessment**
	Great northern diver, non-breeding	No pathway identified. There is uncertainty as to whether there is movement between North Orkney SPA and Scapa Flow SPA. As such, it has been assumed that there is an LSE. LSE is predicted.	Scoped in
	Long-tailed duck (*Clangula hyemalis*), non-breeding	No pathway identified. As there is no works planned across land and given the hydrological distance from the site and Scapa Flow SPA, it is considered unlikely the species will be subject to direct impacts from development activities or indirectly via accidental pollution events. No LSE is predicted.	Scoped out
	Red-breasted merganser (*Mergus serrator*), non-breeding	No pathway identified. As there is no works planned across land and given the hydrological distance from the site and Scapa Flow SPA, it is considered unlikely the species will be subject to direct impacts from development activities or indirectly via accidental pollution events. No LSE is predicted.	Scoped out
	Red-throated diver, breeding	No pathway identified. There is uncertainty as to whether there is movement between Noryh Orkney SPA and Scapa Flow SPA. As such, it has been assumed that there is an LSE. LSE is predicted.	Scoped in
	Shag (*Phalacrocorax aristotelis*), non-breeding	No pathway identified. As there is no works planned across land and given the hydrological distance from the site and Scapa Flow SPA, it is considered unlikely the species will be subject to direct impacts from development activities or indirectly via accidental pollution events. No LSE is predicted.	Scoped out

Site Name (distance and orientation from works)	**Conservation Objectives**	**Qualifying Features**	**Likely Significant Effect (LSE)**	**Screening Assessment**
		Slavonian grebe (*Podiceps auritus*), non-breeding	No pathway identified. There is uncertainty as to whether there is movement between North Orkney SPA and Scapa Flow SPA. As such, it has been assumed that there is an LSE. LSE is predicted.	Scoped in
Loch of Stenness SAC (13km west**)**	To maintain the condition of the SAC feature	Lagoons	No pathway for LSE identified The distance between the feature and the works is considered to be too great. In addition, the Loch of Stenness SAC and Hatston are separated by land, with no possible connectivity between the two sites.	Scoped out
Faray and Holm of Faray SAC (23km north)	To avoid deterioration of the habitats of the qualifying species (listed below) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to achieving favourable conservation status for each of the qualifying features; and To ensure for the qualifying species that the following are maintained in the long term.	Grey seal (*Halichoerus grypus*)	Pathway for LSE identified. It is not considered that seals within the SAC will be directly influenced by works due to the distance between the development area and the SAC. There is potential for the species to be directly or indirectly impacted by accidental pollution incidents or increased sedimentation and turbidity during works impacting water quality and potentialy food availability. Grey seals could be subject to death, injury or disturbance through underwater noise or vessel movements during works.	Scoped in

Site Name (distance and orientation from works)	**Conservation Objectives**	**Qualifying Features**	**Likely Significant Effect (LSE)**	**Screening Assessment**
Sanday SAC (30km North east)	To avoid deterioration of the qualifying habitats thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to achieving favourable conservation status for each of the qualifying features; and To ensure for the qualifying habitats are maintained in the long term.	Harbour seal (*Phoca vitulina*)	It is not considered that seals within the SAC will be directly influenced by works due to the distance between the development area and the SAC. There is potential for the species to be directly or indirectly impacted by accidental pollution incidents or increased sedimentation and turbidity during works impacting water quality and potentially food availability. Harbour seals could be subject to death, injury or disturbance through underwater noise or vessels movements during works.	Scoped in
		Intertidal mudflats and sandflats	No pathway for LSE identified. There will be no impact on habitats from the Proposed Development.	Scoped out
		Reefs	No pathway for LSE identified. There will be no impact on habitats from the Proposed Development.	Scoped out
		Subtidal sandbanks	No pathway for LSE identified. There will be no impact on habitats from the Proposed Development.	Scoped out

4.3 Screening Conclusion

The outcome of screening for appropriate assessment is to reach one of the following determinations:

a) A stage 2 AA of the proposed development is required if it is concluded, on the basis of objective information, that the proposed development, individually or in combination with other plans or projects, will have a significant effect on a European site.
b) A stage two AA of the proposed development is not required if it can be concluded, on the basis of objective information, that the proposed development, individually or in combination with other plans or projects, will not have a significant effect on a European site.

Following an examination, analysis and evaluation of the relevant information including, in particular, the nature of the proposed development and the likelihood of significant effects on scoped in designated sites

- North Orkney SPA
- Orkney Mainland Moors SPA (Red-throated Diver)
- Scapa Flow SPA
- Faray and Holm of Faray SAC
- Sanday SAC (harbour seal)

5 APPROPRIATE ASSESSMENT: NORTH ORKNEY SPA

5.1 Site Description

The North Orkney Special Protection Area (SPA) lies to the north of Mainland in the Orkney Islands, extending from Deerness in the east to Eynhallow in the west. The site includes Wide Firth and several large, sheltered bays, such as Deer Sound, Inganess Bay and Bay of Firth. North Orkney SPA also encompasses Shapinsay Sound and tidal channels among the islands of Gairsay, Rousay, Egilsay and Wyre, including Rousay Sound and Eynhallow Sound. Water depths are generally less than 20m. Sediments are primarily mixtures of mud, sand and gravel but become coarser in areas where tidal currents are stronger and there are extensive maerl beds in the sounds around Rousay. The varied marine habitats support a rich and varied invertebrate fauna, including polychaete worms, crustaceans and bivalve molluscs, many of which are important prey species for marine birds. These rich sheltered waters support large numbers of waterfowl, particularly in the winter months when frequent storms affect the surrounding North Sea and eastern Atlantic.

The North Orkney Special Protection Area (SPA) qualifies under **Article 4.1** by regularly supporting a non-breeding population of European importance of the following Annex 1 species:

- Great Northern Diver (*Gavia immer*) - a mean peak annual non-breeding population of 308 birds (12.3% of the Great Britain population) for the years 2006/07 to 2008/09); and
- Slavonian Grebe (*Podiceps auratus*) - a mean peak annual non-breeding population of 120 birds (10.9% of the Great Britain population) for the years 2007/08-2008/9).

The site also qualifies under **Article 4.1** by regularly supporting a population of European importance of the following Annex 1 species during the breeding season:

- Red-throated Diver (*Gavia stellata*) - up to 47 pairs (3.7% of the Great Britain population) for the year of 2006).

The site further qualifies under **Article 4.2** by regularly supporting a population of European importance of the following migratory species:

- Velvet Scoter (*Melanitta fusca*) - a mean peak annual non-breeding population of 147 birds (5.9% of the Great Britain population) for the years of 2006/07 to 2008/09).

5.2 Conservation Objectives

1. To ensure that the qualifying features of the North Orkney SPA are in favourable condition and make an appropriate contribution to achieving Favourable Conservation Status.

2. To ensure that the integrity of the North Orkney SPA is maintained in the context of environmental changes by meeting objectives 2a, 2b and 2c for each qualifying feature:

2a. The populations of qualifying features are viable components of the site.

2b. The distribution of the qualifying features is maintained throughout the site by avoiding significant disturbance of the species.

2c. The supporting habitats and processes relevant to qualifying features and their prey/food resources are maintained.

5.3 Red-throated Diver (*Gavia stellata*), breeding

Baseline surveys were undertaken during the 2023 and 2024 breeding seasons, details of which can be found in the Ornithological Technical Report (Appendix B). A summary of findings is found below.

For most of the year Red-throated Divers were present in very low numbers within 2 km of the existing pier, generally from nought to three birds.

However, there was a distinct peak in the autumn, from mid-August to mid-November with up to 19 birds on 23rd Sept 2023. Some of these autumn birds were seen to be juveniles, twice an adult and juvenile together (26th Aug and 5th Oct 2023), and on 23rd Sept 2023 a group of six included at least one adult in wing moult. It is likely that birds from the local Orkney breeding population were mainly involved early in the autumn, although the highest numbers in late September and early October could also have included birds from further afield (e.g. Shetland).

During the early breeding season of 2023 there were very few sightings and, of the four birds recorded up to early June, two were seen to be immatures.

In the 2024 breeding season, numbers were much lower than in 2023, perhaps an indication of a poor breeding year. Peaks of two birds in June and three in July were recorded. Only two birds were recorded over three survey dates in August. In September, a peak of six birds was recorded on 4th September, falling to two birds over the last two survey dates in September (13th and 17th).

Overall, about 15% of birds were within 500m of the existing pier, 38% at 500m–1km, and 47% at 1–2km. In terms of numbers of birds present within the three distance bands, there are the following:

- 0-500m: A peak of 3 birds (post breeding – 23rd September 2023) and an average of 0.43 birds;
- 500m-1km: A peak of 6 birds (post-breeding – 23rd September 2023) and an average of 1.09 birds: and
- 1-2km: A peak of 10 birds (post-breeding – 23rd September 2023) and an average of 1.78 birds.

During the key breeding period for chick rearing (June to mid - August), small numbers were present within the survey area with numbers ranging between 0 and 5 birds. Overall, with counts of 3 birds, 5 birds, 0 birds, 2 birds and 2 birds recorded during survey within this period, it is considered that although the site potentially supports foraging adults during breeding, it is not considered to be a main foraging site. The Scottish Government marine map details important foraging areas within North Orkney SPA. The Bay of Ibister (>4km from the Proposed Development), the north-west corner of the Bay of Firth (>5km from the Proposed Development) and the area around the Ness of Woodwick (>10km from the Proposed Development) are the most significant foraging areas for this species. Taking the precautionary approach that the peak of 5 birds were all adults foraging for chick rearing, this equates to 10.6% of the SPA citation population (supporting habitats for up to 47 breeding pairs).

The surveys indicate that the site supports significant numbers during post-breeding, with the peak of 19 birds in late September supporting this assumption.

5.3.1.1 Conservation Objective 2a: The population of qualifying species are viable components of the site

In previous correspondence, NatureScot suggested referring to Guidance Note 8: Guidance to support Offshore Wind Applications: Marine Ornithology Advice for assessing the distributional responses, displacement and barrier effects on Marine birds. Specifically, the suggestion was to undertake a matrix-based model to calculate potential displacement and mortality as a result of the Proposed Development on Red-throated Diver. This has been undertaken (see Appendix C).

The matrix table has been populated for Red-throated Diver using the mean peak across the two summers of survey effort (mean peak of 12.5), as per recommendations in Guidance Note 8: Guidance to support Offshore Wind Applications: Marine Ornithology Advice for assessing the distributional responses, displacement and barrier effects of Marine birds.

Sensitivity scales have been obtained from both Guidance Note (referenced above) and Furness et al 2012. The two most relevant sensitivity scales are disturbance susceptibility and habitat specialisation. For disturbance Red-throated Diver scores 5 and for habitats scores 4. As a result, and as per NatureScot's communications, a displacement scale of between 90% as been used, and a mortality scale of 1%.

This gives a mortality figure of 0.1125 deaths/year.

The North Orkney SPA citation level for breeding Red-throated Diver is 47 pairs, therefore 94 adult birds. To determine the number of young and productivity of these birds, an estimate based on past monitoring on Hoy can be used, where there were 56 - 66 pairs during the seven years 2000 - 2006, and annual productivity ranged from 0.53 - 0.95 young per pair, averaging 0.70.

Applying this average productivity to the Orkney SPA citation population of 47 pairs gives 33 young, and a total post-breeding population of 127 birds (adults and young combined). This would correlate with the findings of the 2023 and 2024 breeding bird surveys where the peak counts of 19 (in 2023) and 6 (in 2024) were a combination of adult and juvenile birds.

Taking the precautionary, worst-case scenario (whereby all birds present are adults and zero breeding success), the loss of 0.1125 birds annually represents 0.12% of the SPA citation population. Over a 25-year period, the modelled mortality would be 2.8 birds, or 3% of the SPA citation population.

Using a more realistic value, whereby birds present in a "normal" breeding season (0.7 productivity rate, therefore 127 birds), the loss of 0.1125 birds annually represents 0.09%. Over a 25-year period, the modelled mortality (2.8 birds) would be 2.2% of the SPA citation population.

These figures are considered not significant.

Therefore, it is considered that population of Red-throated Diver as a viable component of the site will be maintained throughout the site.

Other direct effects affecting water quality are dealt with in Conservation Objective 2c and indirect effects (ie disturbance resulting in reduced body condition and survival) are dealt with in Conservation Objective 2b.

With no predicted impacts in either conservation Objectives 2b and 2c, it is considered that the population of Red-throated Diver remain a viable component of the site.

5.3.1.2 Conservation Objective 2b: The distribution of the qualifying features is maintained throughout the site by avoiding significant disturbance of the species.

Disturbance may occur through blasting (and associated drilling), vibro-piling and dredging activities and airborne noise through terrestrial works during the construction phase. Empirical data specifically linking marine bird response to noise disturbance (and underwater noise in particular), separate from other sources of disturbance (e.g. vessel movement or human presence), is limited and this source of disturbance on marine birds is not yet well understood. Recent research generally suggests that diving seabirds could be more sensitive to underwater noise than previously assumed. For example, hearing thresholds for Great Cormorant were found to be comparable to seals and toothed whales in the

frequency band 1 to 4 kHz (Hansen et al., 2017). A number of assessments have, based on the limited information available, and the similar frequency ranges between seabirds and phocid pinniped and cetacean species, applied methodologies developed for pinnipeds or low frequency cetaceans in assessing seabird sensitivity to underwater noise (Teachout, 2012).

Underwater noise modelling (Refer to Seal Risk Assessment in Appendix D) for blasting shows a Temporary Threshold Shift (TTS) range of up to 355m and a Permanent Threshold Shift (PTS) range of 77m per blast. These works are timed to occur during April to October, utilising suitable weather windows during this time. A total of 35 blasts will be undertaken during this period (in daylight hours) to install 500m of piling. Therefore, works will be undertaken during the period when breeding Red-throated Divers are potentially utilising the area for foraging. As detailed section 5.3.1.1 above, a peak of 3 birds and an average of 0.43 birds were present within 500m of the Proposed Development across the 2023 and 2024 survey periods. During the critical chick rearing period (June-mid-August), there was a peak of 2 birds and an average of 0.16 birds across the 2023 and 2024 survey period (a total of 2 birds over 12 survey visits during the chick rearing period).

Vibration piling and drilling activities, which will be undertaken between April and October, also have low acoustic impacts with short risk ranges of PTS and TTS of <50m for 1 hour. The UW noise modelling assumed that there would be active piling maximally 1 hour every 24 hours and drilling for 8 hours, when in reality this is the maximum and may likely be reduced. Mitigation via pre-works checks and slow ramp up of vibration piling and drilling would ensure birds were clear of works areas ahead of works commencing. Also, it is essential to note, that in other UW noise modelling for similar projects, the potential for instantaneous PTS/TTS has been found to occur as a result of vibration piling, thus, the mitigation measures put in place to ensure SPA qualifying species are clear of the area (50m) prior to vibration piling would caveat for this.

There is proposed dredging works within the footprint of the Proposed Development. The estimated dredge volume is small (approximately 6,700m^3 of sediment). Dredging will be undertaken by a long reach from land. The sediment dredged will be used as infill material reused in the reclamation. Dredging will be undertaken between April and October, therefore works will be undertaken during the period when breeding Red-throated Divers are potentially utilising the area for foraging

The noise from dredging, has short risk ranges for PTS of <50m for 8 hours dredging. There is no acute risk of noise related injury related to the dredging, and birds have time to swim away. TTS risk ranges potentially present the highest risk of temporary injury to birds ranging from 195.4m (average range) to 287.5m (maximum range) for 8 hours dredging, however, this is only for birds staying close to the activity for extended periods (prolonged exposure). In addition, the figures quoted are conservative (based on cutter suction dredger), whilst in reality dredging activities will be land-based using a long reach excavator during the daylight hours over a 7-10 day period (per phase so maximum of 20 days).

As detailed section 5.3.1.1 above, a peak of 3 birds and an average of 0.43 birds were present within 500m of the Proposed Development across the 2023 and 2024 survey periods. During the critical chick rearing period (June-mid-August), there was a peak of 2 birds and an average of 0.16 birds across the 2023 and 2024 survey period (a total of 2 birds over 12 survey visits during the chick rearing period).

Given that the dredging works are very localised, undertaken from land and short term in duration (7 - 10 days per dredging regime) it is highly unlikely that significant disturbance will occur.

The Construction activities have been highlighted in the Airborne Noise Report (Appendix E), and noise contour maps have been prepared (see Appendix F) as having noise creation levels of >65dB at source, with noise levels decreasing over distance to below 50dB at 250m. A study compiled by the Institute of Estuarine and Coastal Studies (IECS), University of Hull (2009) found that construction noise emissions below 50 dB had a low effect and no impact on waterbirds.

For all forms of noise (underwater and airborne), an ornithologist will be present to monitor for the presence of Red-throated Diver within 355m of the Proposed Development (largest TTS range) and record behavioural responses within this zone. If impacts are recorded, then the disturbance zone shall be increased. The details of the monitoring protocol will be included in the Construction Environmental Management Document (CEMD). Mitigation via pre-works checks and slow ramp up of vibration piling would also ensure birds were clear of works areas ahead of works commencing.

With these measures in place, it is considered that noise generation, both airborne through construction works and underwater through blasting, drilling, vibro-piling and dredging would not give rise to significant disturbance. Given the location of the works in relation to main foraging areas within North Orkney SPA, there would not be an adverse effect on site integrity.

At Hatston, most of the material (rock etc) required for the development will be transported via the road network. There will only be a small volume of vessel movements, as it is anticipated that the majority of materials will be brought by land from sites within Orkney Mainland. Rock armour import will consist of two shipments at the start and halfway through contract, therefore 8 vessel movements in total. These vessel movements will be following existing shipping routes, with no new/novel routes being utilised. Sheet piles and any other material that cannot be sourced on the mainland will be imported through the existing Orkney Northlink freight services, so there will be no increase to current vessel movement baseline levels to deliver these. As described in section 3.3.7, the existing baseline for vessel movements into and out of Hatston annually is 1026. An increase in 8 vessel movements during the construction phase represents an increase of 0.7%.

For the operational phase, Table 3.2 provides the expected increase in vessel movements, with an increase in 216 movements annually (69 additional vessel movements during the winter and 147 vessel movements during the summer period).

These vessel movements will use existing vessel routes, with no new/novel routes expected (see Appendix A where maps indicate the existing vessel routes). It is expected that there is already some level of habituation by species to these existing vessel routes. Although Red-throated Diver is considered highly sensitive to vessel movements, by using these existing routes, and adhering to accepted speed limits, the increase of 21.7% in vessel movements during the summer and 19.8% increase during the winter, is not likely to cause a significant disturbance impact. The main concentrations of Red-throated Diver around Hatston are to the west of the Proposed Development site, in an area where additional vessel movements will not occur. A Vessel Management Plan will be produced, with input from NatureScot, for both the Construction and Operational phases which will detail vessel routes, speeds etc to minimise, and where possible, avoid any disturbance impacts within established shipping lanes. There will be no barriers to movement, or reduced access to preferred foraging and roosting habitats, resulting in a significant energy expenditure and possible reduction in body condition required for survival and subsequent migration.

Overall, it is considered that there would be no significant disturbance to the species as a result of construction works and vessel movements.

5.3.1.3 Conservation Objective 2c: The supporting habitats and processes relevant to qualifying features and their prey/food resources are maintained

As described in NatureScot's Conservation and Management Advice Document for North Orkney SPA, supporting habitats refer to the characteristics of the seabed and water column relevant to their use by the qualifying features. It relates to wider oceanographic processes such as up-wellings, tidal Flows, hydrological movements which may be necessary for the habitat and could affect nutrient cycling and prey distribution.

As outlined in section 4.5.3, in Volume 1 of the EIAR, the marine deposits within the dredge area comprise of loose to medium dense sands and gravels occasionally with cobbles interspersed with layers of sandy gravelly clay. Dredged material will be used as fill within the reclaimed areas.

Given the relatively coarse nature of the dredge budget, small proposed dredge volume, and the weak tidal currents within the vicinity of the proposed dredge pockets, it is considered that any plumes generated as a result of the dredging works and their reuse in the reclamation will be very localised and short term in duration. Overall, it is considered that prior to mitigation the magnitude of impact of sediment discharge and dispersion from dredging works will be low within the immediate dredge area, and negligible out with this area, thus maintaining the supporting habitats for Red-throated Diver.

Drainage designs to ensure that there are no untreated surface water discharges directly to surrounding coastal waters and the use of a silt booms during land reclamation works will mitigate against pollution spills which could affect the qualifying interests of the SPA and their prey sources. In terms of water pollution from the quay and attendant vessels, adherence to strict Pollution Prevention controls will aim to prevent the release of pollutants to the water environment. With these measures in place, the supporting habitats for Red-throated Diver will be maintained.

5.4 Slavonian Grebe (*Podiceps auritus*), non-breeding

The citation for Slavonian Grebe states the population within North Orkney SPA is a mean peak annual non-breeding population of 120 birds (10.9% of the Great Britain population) for the years 2007/08-2008/9).

Slavonian Grebes are listed under Schedule 1 of the Wildlife and Countryside Act, which recognises their rarity as a breeding species in the UK and affords them extra protection during the nesting period. They are also an Annex I migratory species under the EU Birds Directive (2009/147/EC).

5.4.1 Assessment of Potential Impacts on Conservation Objectives

During the Vantage Point Surveys at Hatston, a peak count of 10 birds was recorded on 5th November 2023, which represents 6% of the non-breeding population of the North Orkney SPA. All birds were exclusively recorded from sectors 3, 4, 7 and 8 to the west of the Proposed Development. These numbers were higher than those recorded during the HiDef surveys of 2021/22 and 2022/23. Surveys undertaken for the entire North Orkney SPA during the winter period of 2017/18 and the HiDef surveys of 2021/22 and 2022/23, found that Slavonian Grebes were largely confined to shallow nearshore waters, with the most notable concentrations in Bay of Firth, Wide Firth, Inganess Bay and Deerness Sound off Orkney Mainland and in Veantrow Bay (Shapinsay). Other notable areas were Eynhallow and Rousay Sounds. With a peak count of 59 birds in the outer Wide Firth to the north of the Proposed Development, it is considered that the wider SPA has the capacity to support a peak of 10 birds present within 2km of the Proposed Development. A map showing the distribution of birds recorded both during the baseline surveys and HiDef surveys from 2021/22 and 2022/23 can be found in Appendix G.

Table 5.1: Average and Peak Monthly Counts for Slavonian Grebe at Hatston

	Month							
	October	November	December	January	February	March	April	May
Average monthly count	1.25	5.25	3.75	4.5	1.5	5.25	0	0
Peak monthly count	5 (25/10/22)	10 (05/11/22)	7 (16/12/22)	8 (05/01/24)	3 (25/02/24)	9 (20/03/24)	-	-

As can be seen from Table 5.1, the core period for Slavonian Grebe was November to March, where average numbers and peak counts were relatively constant. No Slavonian Grebes were recorded in September, before low numbers occur in October before building up and then a reduction from March. No Slavonian Grebe were present between April and September. During the surveys undertaken in 2017/18, it was found that numbers of Slavonian grebe within the SPA increased from November through to January and remained steady in February and March which correlates with the Project survey findings.

5.6.1.1 *Conservation Objective 2a: The population of qualifying species are viable components of the site*

In previous correspondence, NatureScot suggested referring to Guidance Note 8: Guidance to support Offshore Wind Applications: Marine Ornithology Advice for assessing the distributional responses, displacement and barrier effects on Marine birds. Specifically, the suggestion was to undertake a matrix-based model to calculate potential displacement and mortality as a result of the Proposed Development on Slavonian Grebe. This has been undertaken (see Appendix C).

The matrix table has been populated for Slavonian Grebe using the mean peak across the two winters of survey effort (mean peak of 9.5), as per recommendations in Guidance Note 8: Guidance to support Offshore Wind Applications: Marine Ornithology Advice for assessing the distributional responses, displacement and barrier effects of Marine birds.

Sensitivity scales have been obtained from both Guidance Note (referenced above) and Furness et al 2012. The two most relevant sensitivity scales are disturbance susceptibility and habitat specialisation. For disturbance Slavonian Grebe scores 3 and for habitats scores 4. As a result, and as per NatureScot's communications, a displacement scale of between 80% as been used.

It is our assessment that the Proposed Development will result in a 1% mortality increase annually. This equates to 0.076 birds annually, or 0.06% of the SPA population. This is not considered significant. Taken over a 25-year operational period (a period agreed with NatureScot), this would result in a mortality figure of 1.9 birds, or 1.6% of the SPA population. These figures are considered not significant.

Therefore, it is considered that population of Slavonian Grebe as a viable component of the site will be maintained throughout the site.

Other direct effects affecting water quality are dealt with in Conservation Objective 2c and indirect effects (ie disturbance resulting in reduced body condition and survival) are dealt with in Conservation Objective 2b.

With no predicted impacts in either conservation Objectives 2b and 2c, it is considered that the population of Slavonian Grebe remain a viable component of the site.

5.5.1.2 *Conservation Objective 2b: The distribution of the qualifying features is maintained throughout the site by avoiding significant disturbance of the species.*

Disturbance may occur through blasting (and associated drilling), vibro-piling and dredging activities and airborne noise through terrestrial works during the construction phase. Empirical data specifically linking marine bird response to noise disturbance (and underwater noise in particular), separate from other sources of disturbance (e.g. vessel movement or human presence), is limited and this source of disturbance on marine birds is not yet well understood. Recent research generally suggests that diving seabirds could be more sensitive to underwater noise than previously assumed. For example, hearing thresholds for Great Cormorant were found to be comparable to seals and toothed whales in the frequency band 1 to 4 kHz (Hansen et al., 2017). A number of assessments have, based on the limited information available, and the similar frequency ranges between seabirds and phocid pinniped and cetacean species, applied methodologies developed for pinnipeds or low frequency cetaceans in assessing seabird sensitivity to underwater noise (Teachout, 2012).

Underwater noise modelling (Refer to Seal Risk Assessment in Appendix D) for blasting shows a TTS range of up to 355m and a PTS range of 77m per blast.

Vibration piling and drilling activities, which will be undertaken between April and October, also have low acoustic impacts with short risk ranges of PTS and TTS of <50m for 1 hour. The UW noise modelling assumed that there would be active piling maximally 1 hour every 24 hours and drilling for 8 hours, when in reality this is the maximum and may likely be reduced. Mitigation via pre-works checks and slow ramp up of vibration piling and drilling would ensure birds were clear of works areas ahead of works commencing. Also, it is essential to note, that in other UW noise modelling for similar projects, the potential for instantaneous PTS/TTS has been found to occur as a result of vibration piling, thus, the mitigation measures put in place to ensure SPA qualifying species clear of the area (50m) prior to vibration piling would caveat for this.

There is proposed dredging works within the footprint of the Proposed Development. The estimated dredge volume is small (approximately 6,700m^3 of sediment). Dredging will be undertaken by a long reach from land. The sediment dredged will be used as infill material reused in the reclamation. Dredging will be undertaken between April and October, therefore works will be undertaken mainly outwith the period when Slavonian Grebe are present (birds return in mid-September).

The noise from dredging, has short risk ranges for PTS of <50m for 8 hours dredging. There is no acute risk of noise related injury related to the dredging, and birds have time to swim away. TTS risk ranges potentially present the highest risk of temporary injury to birds ranging from 195.4m (average range) to 287.5m (maximum range) for 8 hours dredging, however, this is only for birds staying close to the activity for extended periods (prolonged exposure). In addition, the figures quoted are conservative (based on cutter suction dredger), whilst in reality dredging activities will be land-based using a long reach excavator during the daylight hours over a 7–10 day period (per phase so a maximum of 20 days).

Given that the dredging works are very localised, undertaken from land and short term in duration (7 - 10 days per dredging regime) it is highly unlikely that significant disturbance will occur.

These works are outwith the core period for this species, with the surveys showing the peak counts are between November and March (with smaller numbers present in October). However, there is a small possibility that piling, blasting, drilling and dredging works could occur beyond October if the construction programme slips. Within the survey area, Slavonian Grebe were confined to the inshore waters, particularly to the west of the Proposed Development from the Proposed Development.

The Construction activities have been highlighted in the Airborne Noise Report (Appendix E), and noise contour maps have been prepared (see Appendix F) as having noise creation levels of >65dB at source, with noise levels decreasing over distance to below 50dB at 250m. A study compiled by the Institute of Estuarine and Coastal Studies (IECS), University of Hull (2009) found that construction noise emissions below 50 dB had a low effect and no impact on waterbirds.

For all forms of noise (underwater and airborne), an ornithologist will be present to monitor for the presence of SPA qualifying species within 355m of the Proposed Development (TTS range) and record behavioural responses within this zone. If impacts are recorded, then the disturbance zone shall be increased. The details of the monitoring protocol will be included in the Construction Environmental Management Document (CEMD). Mitigation via pre-works checks and slow ramp up of vibration piling would also ensure birds were clear of works areas ahead of works commencing. For Slavonian Grebe, these larger disturbance zones (for blasting) would only apply if these work activities slip beyond mid-September (although not recorded in September, NatureScot have noted that the non-breeding period for this species within North Orkney SPA is mid-September to April). If not, then the maximum range for TTS from dredging (287.5m) would apply.

With these measures in place, it is considered that noise generation, both airborne through construction works and underwater through blasting, drilling, vibro-piling and dredging would not give rise to significant disturbance. Given the location of the works in relation to main foraging areas within North Orkney SPA, and in particular the Bay of Firth to the north and west of the Proposed Development, there would not be an adverse effect on site integrity.

At Hatston, most of the material (rock etc) required for the development will be transported via the road network. There will only be a small volume of vessel movements, as it is anticipated that the majority of materials will be brought by land from sites within Orkney Mainland. Rock armour import will consist of two shipments at the start and halfway through contract, therefore 8 vessel movements in total. These vessel movements will be following existing shipping routes, with no new/novel routes being utilised. Sheet piles and any other material that cannot be sourced on the mainland will be imported through the existing Orkney Northlink freight services, so there will be no increase to current vessel movement baseline levels to deliver these. As described in section 3.3.7, the existing baseline for vessel movements into and out of Hatston annually is 1026. An increase in 8 vessel movements during the construction phase represents an increase of 0.7%.

For the operational phase, Table 3.2 provides the expected increase in vessel movements, with an increase in 216 movements annually (69 movements in the winter and 147 additional vessel movements in the summer period).

These vessel movements will use existing vessel routes, with no new/novel routes expected (see Appendix G where maps indicate the existing vessel routes). It is expected that there is already some level of habituation by species to these existing vessel routes. Although Slavonian Grebe are considered sensitive to vessel movements, by using these existing routes, and adhering to accepted speed limits, the increase of 19.8% increase (or 0.6 vessel movements a day) during the winter (when Slavonian Grebe are present), is not likely to cause a significant disturbance impact. A Vessel Management Plan will be produced, with input from NatureScot, for both the Construction and Operational phases which will detail vessel routes, speeds etc to minimise, and where possible, avoid any disturbance impacts within established shipping lanes. There will be no barriers to movement, or reduced access to preferred foraging and roosting habitats, resulting in a significant energy expenditure and possible reduction in body condition required for survival and subsequent migration.

5.5.1.3 *Conservation Objective 2c: The supporting habitats and processes relevant to qualifying features and their prey/food resources are maintained*

As described in NatureScot's Conservation and Management Advice Document for North Orkney SPA, supporting habitats refer to the characteristics of the seabed and water column relevant to their use by the qualifying features. It relates to wider oceanographic processes such as up-wellings, tidal Flows, hydrological movements which may be necessary for the habitat and could affect nutrient cycling and prey distribution.

As outlined in section 4.5.3, in Volume 1 of the EIAR, the marine deposits within the dredge area comprise of loose to medium dense sands and gravels occasionally with cobbles interspersed with layers of sandy gravelly clay. Dredged material will be used as fill within the reclaimed areas.

Given the relatively coarse nature of the dredge budget, small proposed dredge volume, and the weak tidal currents within the vicinity of the proposed dredge pockets, it is considered that any plumes generated as a result of the dredging works and their reuse in the reclamation will be very localised and short term in duration. Overall, it is considered that prior to mitigation the magnitude of impact of sediment discharge and dispersion from dredging works will be low within the immediate dredge area, and negligible out with this area, thus maintaining the supporting habitats for Slavonian Grebe.

Drainage designs to ensure that there are no untreated surface water discharges directly to surrounding coastal waters and the use of a silt booms during land reclamation works will mitigate against pollution spills which could affect the qualifying interests of the SPA and their prey sources. In terms of water pollution from the quay and attendant vessels, adherence to strict Pollution Prevention controls will aim to prevent the release of pollutants to the water environment. With these measures in place, the supporting habitats for Slavonian Grebe will be maintained.

5.5 Velvet Scoter (*Melanitta fusca*), non-breeding

The citation for Velvet Scoter states the population within North Orkney SPA is a mean peak annual non-breeding population of 147 birds (5.9% of the Great Britain population) for the years of 2006/07 to 2008/09).

Velvet Scoter are listed under Schedule 1 of the Wildlife and Countryside Act, which recognises their rarity as a breeding species in the UK and affords them extra protection during the nesting period.

5.5.1 Assessment of Potential Impacts on Conservation Objectives

During the Vantage Point Surveys at Hatston, a peak count of 38 birds was recorded on 14th March 2024, which represents 25% of the non-breeding population in North Orkney SPA.

This species was exclusively recorded off the north pier, in the mouth of the Bay of Kirkwall. The sectors where birds were most frequently encountered were Sectors 8, 9 and 10 which are between 1-2km from the Proposed Development. Small numbers were occasionally recorded in Sectors 5 and 6. No Velvet Scoter were recorded in inshore waters.

No Velvet Scoter were recorded within the Bay of Kirkwall during the HiDef surveys over winter 2021/22. During the 2022/23 surveys, ten birds were recorded in December 2022 and 19 birds in January 2023. These birds were located at the mouth of the Bay of Kirkwall, similar to the findings of the project surveys. A map showing the distribution of birds recorded both during the baseline surveys and HiDef surveys from 2021/22 and 2022/23 can be found in Appendix G.

Table 5.2: Average and Peak Monthly Counts for Velvet Scoter at Hatston

	Month							
	October	November	December	January	February	March	April	May
Average monthly count	5.5	18.75	22	30.75	13.25	17.75	13	0
Peak monthly count	21 (29/10/22)	34 (17/11/22)	35 (02/12/22)	37 (20/01/24)	20 (05/02/24)	38 (14/03/24)	13 (29/04/23)	-

As can be seen from Table 5.2, the core period for Velvet Scoter was November to April, where average numbers and peak counts relatively constant (with the exception of a larger peak in January). Low numbers occur in October before building up and then a reduction in number in April. No Velvet Scoter were present between May and September.

5.5.1.1 Conservation Objective 2a: The population of qualifying species are viable components of the site

In previous correspondence, NatureScot suggested referring to Guidance Note 8: Guidance to support Offshore Wind Applications: Marine Ornithology Advice for assessing the distributional responses, displacement and barrier effects on Marine birds. Specifically, the suggestion was to undertake a matrix-based model to calculate potential displacement and mortality as a result of the Proposed Development on Velvet Scoter. This has been undertaken (see Appendix C).

The matrix table has been populated for Velvet Scoter using the mean peak across the two winter seasons of survey effort (35 birds in 2022/23 and 38 birds in 2023/24 – mean peak of 36.5), as per recommendations in Guidance Note 8: Guidance to support Offshore Wind Applications: Marine Ornithology Advice for assessing the distributional responses, displacement and barrier effects of Marine birds.

In the Statutory Nature Conservation Bodies (SNCB's) joint guidance note on displacement and barrier effects[3], the two main sensitivity scores to deduce displacement are disturbance sensitivity and habitat specialisation. For Velvet Scoter, a score of 5 has been marked for disturbance sensitivity and a score of 3 for habitat specialisation. This is slightly lower than that for divers (5 for disturbance sensitivity and 4 for habitat specialisation). This would suggest that displacement rates should be lower than the 90% used for divers.

The results of the surveys shows that Velvet Scoter were primarily recorded in Section 8 and 9, in the 1-2km zones north-west of Hatston pier, and predominately towards the 2km distance band (see Ornithology Technical Report in Appendix B)). This correlates with the HiDef shore-based survey data, which also recorded birds in the 1-2km distance band (Appendix G). Construction works will take place between 500m-1.5km of recorded Velvet Scoters, which is outwith what is considered the upper limits of disturbance distances for this species (although there are not specific disturbance distances for this species, the disturbance buffers for breeding Common Scoter is 300-500m). There will be no new/novel vessel movement routes will occur as a result of the Proposed Development at Hatston, instead using existing routes which Velvet Scoter already tend to avoid (see Appendix G where the HiDef data shows

[3] https://data.jncc.gov.uk/data/9aecb87c-80c5-4cfb-9102-39f0228dcc9a/joint-sncb-interim-displacement-advice-note-2022.pdf

locations of Velvet Scoter relative to current vessel routes). In addition, there will be no barriers to movement for this species.

Sensitivity scales have been obtained from both Guidance Note and Furness et al 2012. As a result, and as per NatureScot's communications, a displacement range scale of between 60-80% as been used, and a mortality scale of 1%.

This gives a mortality range figure of 0.219 - 0.292 deaths/year.

The North Orkney SPA citation level for wintering Velvet Scoter is 147 individuals. Taking the upper displacement limit (80% disturbance and 1% mortality), the loss of 0.292 birds annually represents 0.2% of the SPA citation population. Over a 25-year period, the modelled mortality would be 7.3 birds, or 4.96% of the SPA citation population.

Using the lower displacement limit (60%), the loss of 0.219 birds annually represents 0.15%. Over a 25-year period, the modelled mortality (5.475 birds) would be 3.7% of the SPA citation population.

Therefore, it is considered that population of Velvet Scoter as a viable component of the site will be maintained throughout the site.

Other direct effects affecting water quality are dealt with in Conservation Objective 2c and indirect effects (ie disturbance resulting in reduced body condition and survival) are dealt with in Conservation Objective 2b.

With no predicted impacts in either conservation Objectives 2b and 2c, it is considered that the population of Velvet Scoter remain a viable component of the site.

5.5.1.2 Conservation Objective 2b: The distribution of the qualifying features is maintained throughout the site by avoiding significant disturbance of the species.

Disturbance may occur through blasting (and associated drilling), vibro-piling and dredging activities and airborne noise through terrestrial works during the construction phase. Empirical data specifically linking marine bird response to noise disturbance (and underwater noise in particular), separate from other sources of disturbance (e.g. vessel movement or human presence), is limited and this source of disturbance on marine birds is not yet well understood. Recent research generally suggests that diving seabirds could be more sensitive to underwater noise than previously assumed. For example, hearing thresholds for Great Cormorant were found to be comparable to seals and toothed whales in the frequency band 1 to 4 kHz (Hansen et al., 2017). A number of assessments have, based on the limited information available, and the similar frequency ranges between seabirds and phocid pinniped and cetacean species, applied methodologies developed for pinnipeds or low frequency cetaceans in assessing seabird sensitivity to underwater noise (Teachout, 2012).

Underwater noise modelling (Refer to Seal Risk Assessment in Appendix D) for blasting shows a TTS range of up to 355m and a PTS range of 77m per blast.

Vibration piling and drilling activities, which will be undertaken between April and October, also have low acoustic impacts with short risk ranges of PTS and TTS of <50m for 1 hour. The UW noise modelling assumed that there would be active piling maximally 1 hour every 24 hours and drilling for 8 hours, when in reality this is the maximum and may likely be reduced. Mitigation via pre-works checks and slow ramp up of vibration piling and drilling would ensure birds were clear of works areas ahead of works commencing. Also, it is essential to note, that in other UW noise modelling for similar projects, the potential for instantaneous PTS/TTS has been found to occur as a result of vibration piling, thus, the

mitigation measures put in place to ensure SPA qualifying species clear of the area (50m) prior to vibration piling would caveat for this.

There is proposed dredging works within the footprint of the Proposed Development. The estimated dredge volume is small (approximately 6,700m^3 of sediment). Dredging will be undertaken by a long reach from land. The sediment dredged will be used as infill material reused in the reclamation. Dredging will be undertaken between April and October, therefore works will be undertaken outwith the period when Velvet Scoter are present.

The noise from dredging, has short risk ranges for PTS of <50m for 8 hours dredging. There is no acute risk of noise related injury related to the dredging, and birds have time to swim away. TTS risk ranges potentially present the highest risk of temporary injury to birds ranging from 195.4m (average range) to 287.5m (maximum range) for 8 hours dredging, however, this is only for birds staying close to the activity for extended periods (prolonged exposure). In addition, the figures quoted are conservative (based on cutter suction dredger), whilst in reality dredging activities will be land-based using a long reach excavator during the daylight hours over a 7-10 day period (per phase so a maximum of 20 days).

Given that the dredging works are very localised, undertaken from land and short term in duration (7 - 10 days per dredging regime) it is highly unlikely that significant disturbance will occur.

These works are outwith the core period for this species (should the construction programme remain on time), with the surveys showing the peak counts are between November and April. This corresponds with findings from the 2017/18 surveys, which stated that *"numbers of velvet scoter within the site increased after November and thereafter fluctuated around 200 birds throughout the winter".* Within the survey area, the primary sectors that Velvet Scoter were present in were Sectors 8, 9 and 10. These sectors are located approximately 1-2km from the piling and blasting works which is considered to be a sufficient distance away so as not to cause disturbance to birds should they be present in the months of April and October (and beyond depending on construction programmes) (no Velvet Scoter were recorded between May and September).

The Construction activities have been highlighted in the Airborne Noise Report (Appendix E), and noise contour maps have been prepared (see Appendix F) as having noise creation levels of >65dB at source, with noise levels decreasing over distance to below 50dB at 250m. A study compiled by the Institute of Estuarine and Coastal Studies (IECS), University of Hull (2009) found that construction noise emissions below 50 dB had a low effect and no impact on waterbirds.

For all forms of noise (underwater and airborne), an ornithologist will be present to monitor for the presence of SPA qualifying species within 355m of the Proposed Development (TTS range) and record behavioural responses within this zone. If impacts are recorded, then the disturbance zone shall be increased. The details of the monitoring protocol will be included in the Construction Environmental Management Document (CEMD). Mitigation via pre-works checks and slow ramp up of vibration piling would also ensure birds were clear of works areas ahead of works commencing. For Velvet Scoter, these larger disturbance zones (for blasting, drilling, vibro-piling) would only apply if these work activities slip beyond October. If not, then the maximum range for TTS from dredging (287.5m) would apply.

With these measures in place, it is considered that noise generation, both airborne through construction works and underwater through blasting, drilling, vibro-piling and dredging would not give rise to significant disturbance. Given the location of the works in relation to main foraging areas within North Orkney SPA, and in particular 1-2km north of Proposed Development at the mouth of Bay of Kirkwall, there would not be an adverse effect on site integrity.

At Hatston, most of the material (rock etc) required for the development will be transported via the road network. There will only be a small volume of vessel movements, as it is anticipated that the majority of materials will be brought by land from sites within Orkney Mainland. Rock armour import will consist of

two shipments at the start and halfway through contract, therefore 8 vessel movements in total. These vessel movements will be following existing shipping routes, with no new/novel routes being utilised. Sheet piles and any other material that cannot be sourced on the mainland will be imported through the existing Orkney Northlink freight services, so there will be no increase to current vessel movement baseline levels to deliver these. As described in section 3.3.7, the existing baseline for vessel movements into and out of Hatston annually is 1026. An increase in 8 vessel movements during the construction phase represents an increase of 0.7%.

For the operational phase, Table 3.2 provides the expected increase in vessel movements, with an increase in 216 movements annually (69 movements in the winter and 147 additional vessel movements in the summer period).

These vessel movements will use existing vessel routes, with no new/novel routes expected (see Appendix G where maps indicate the existing vessel routes). It is expected that there is already some level of habituation by species to these existing vessel routes. Although Velvet Scoter are considered sensitive to vessel movements, by using these existing routes, and adhering to accepted speed limits, the increase of 19.8% increase (or 0.6 vessel movements a day) during the winter (when Velvet Scoter are present), is not likely to cause a significant disturbance impact. A Vessel Management Plan will be produced, with input from NatureScot, for both the Construction and Operational phases which will detail vessel routes, speeds etc to minimise, and where possible, avoid any disturbance impacts within established shipping lanes. There will be no barriers to movement, or reduced access to preferred foraging and roosting habitats, resulting in a significant energy expenditure and possible reduction in body condition required for survival and subsequent migration.

5.5.1.3 Conservation Objective 2c: The supporting habitats and processes relevant to qualifying features and their prey/food resources are maintained

As described in NatureScot's Conservation and Management Advice Document for North Orkney SPA, supporting habitats refer to the characteristics of the seabed and water column relevant to their use by the qualifying features. It relates to wider oceanographic processes such as up-wellings, tidal Flows, hydrological movements which may be necessary for the habitat and could affect nutrient cycling and prey distribution.

As outlined in section 4.5.3, in Volume 1 of the EIAR, the marine deposits within the dredge area comprise of loose to medium dense sands and gravels occasionally with cobbles interspersed with layers of sandy gravelly clay. Dredged material will be used as fill within the reclaimed areas.

Given the relatively coarse nature of the dredge budget, small proposed dredge volume, and the weak tidal currents within the vicinity of the proposed dredge pockets, it is considered that any plumes generated as a result of the dredging works and their reuse in the reclamation will be very localised and short term in duration. Overall, it is considered that prior to mitigation the magnitude of impact of sediment discharge and dispersion from dredging works will be low within the immediate dredge area, and negligible out with this area, thus maintaining the supporting habitats for Velvet Scoter.

Drainage designs to ensure that there are no untreated surface water discharges directly to surrounding coastal waters and the use of a silt booms during land reclamation works will mitigate against pollution spills which could affect the qualifying interests of the SPA and their prey sources. In terms of water pollution from the quay and attendant vessels, adherence to strict Pollution Prevention controls will aim to prevent the release of pollutants to the water environment. With these measures in place, the supporting habitats for Velvet Scoter will be maintained.

5.6 Great Northern Diver (*Gavia immer*), non-breeding

The citation for Great Northern Diver states the population within North Orkney SPA a mean peak annual non-breeding population of 308 birds (12.3% of the Great Britain population) for the years 2006/07 to 2008/09)

Great Northern Diver are listed under Schedule 1 of the Wildlife and Countryside Act, which recognises their rarity as a breeding species in the UK and affords them extra protection during the nesting period. They are also an Annex I migratory species under the EU Birds Directive (2009/147/EC).

5.6.1 Assessment of Potential Impacts on Conservation Objectives

During the Vantage Point Surveys at Hatston, a peak count of 31 birds was recorded on 16th December 2022 and 5th January 2024, which represents 10% of the non-breeding population in North Orkney SPA.

From the North Pier vantage point, Great Northern Diver was recorded during all months, peaking with 31 on 16th December 2022. The majority of birds were recorded in the mouth of the Bay of Kirkwall. However, a peak count of 9 was also recorded close to the fish cages.

From the southern pier vantage point, small numbers were recorded, with a peak of 8 birds on 16th December 2022. Birds were predominately recorded out towards Iceland Skerry.

Great Northern Diver was also recorded in all months (except March 2023) during the HiDef shore based surveys over winters 2021/22 and 2022/23, with a peak count of 18 birds in January 2022 and 20 birds in February 2023. As with winter 2022/23, the majority of birds were recorded at the mouth of the Bay of Kirkwall. During aerial surveys, significant foraging areas were noted in Bay of Firth, Gairsay Sounds and Shapinsay Sound. A map showing the distribution of birds recorded both during the baseline surveys and HiDef surveys from 2021/22 and 2022/23 can be found in Appendix G.

Table 5.3: Monthly and Peak Counts for Great Northern Diver at Hatston

	Month							
	October	November	December	January	February	March	April	May
Average monthly count	6.5	12.25	20.75	16.25	13.25	11.75	11	3.5
Peak monthly count	9 (29/10/22, 05/10/23)	17 (17/11/23)	31 (16/12/22)	31 (05/01/24)	21 (05/02/24)	15 (20/03/24)	11 (29/04/23)	7 (21/05/23)

As can be seen from Table 5.3, the core period for Great Northern Diver was November to April, where average numbers and peak counts relatively constant (with the exception of larger peaks in December and January). Low numbers occur in October before building up and then a reduction in number in May. No Great Northern Diver were present between June and September. During the surveys undertaken in 2017/18, it was found that numbers of Great Northern Diver within the SPA increased during November and December suggesting that birds were continuing to arrive from their breeding grounds in this period.

5.6.1.1 Conservation Objective 2a: The population of qualifying species are viable components of the site

In previous correspondence, NatureScot suggested referring to Guidance Note 8: Guidance to support Offshore Wind Applications: Marine Ornithology Advice for assessing the distributional responses, displacement and barrier effects on Marine birds. Specifically, the suggestion was to undertake a matrix-based model to calculate potential displacement and mortality as a result of the Proposed Development on Slavonian Grebe. This has been undertaken (see Appendix C).

The matrix table has been populated for Great Northern Diver using the mean peak across the two winters of survey effort (mean peak of 31), as per recommendations in Guidance Note 8: Guidance to support Offshore Wind Applications: Marine Ornithology Advice for assessing the distributional responses, displacement and barrier effects of Marine birds.

Sensitivity scales have been obtained from both Guidance Note (referenced above) and Furness et al 2012. The two most relevant sensitivity scales are disturbance susceptibility and habitat specialisation. For disturbance Great Northern Diver scores 5 and for habitats scores 3. As a result, and as per NatureScot's communications, a displacement scale of between 90% as been used.

It is our assessment that the Proposed Development will result in a 1% mortality increase annually. This equates to 0.279 birds annually, or 0.09% of the SPA population. This is not considered significant. Taken over a 25-year operational period (a period agreed with NatureScot), this would result in a mortality figure of 7 birds, or 2.2% of the SPA population. These figures are considered not significant.

Therefore, it is considered that population of Great Northern Diver as a viable component of the site will be maintained throughout the site.

Other direct effects affecting water quality are dealt with in Conservation Objective 2c and indirect effects (ie disturbance resulting in reduced body condition and survival) are dealt with in Conservation Objective 2b.

5.5.1.2 *Conservation Objective 2b: The distribution of the qualifying features is maintained throughout the site by avoiding significant disturbance of the species.*

Disturbance may occur through blasting (and associated drilling), vibro-piling and dredging activities and airborne noise through terrestrial works during the construction phase. Empirical data specifically linking marine bird response to noise disturbance (and underwater noise in particular), separate from other sources of disturbance (e.g. vessel movement or human presence), is limited and this source of disturbance on marine birds is not yet well understood. Recent research generally suggests that diving seabirds could be more sensitive to underwater noise than previously assumed. For example, hearing thresholds for Great Cormorant were found to be comparable to seals and toothed whales in the frequency band 1 to 4 kHz (Hansen et al., 2017). A number of assessments have, based on the limited information available, and the similar frequency ranges between seabirds and phocid pinniped and cetacean species, applied methodologies developed for pinnipeds or low frequency cetaceans in assessing seabird sensitivity to underwater noise (Teachout, 2012).

Underwater noise modelling (Refer to Seal Risk Assessment in Appendix D) for blasting shows a TTS range of up to 355m and a PTS range of 77m per blast.

Vibration piling and drilling activities, which will be undertaken between April and October, also have low acoustic impacts with short risk ranges of PTS and TTS of <50m for 1 hour. The UW noise modelling assumed that there would be active piling maximally 1 hour every 24 hours and drilling for 8 hours, when in reality this is the maximum and may likely be reduced. Mitigation via pre-works checks and slow ramp up of vibration piling and drilling would ensure birds were clear of works areas ahead of works commencing. Also, it is essential to note, that in other UW noise modelling for similar projects, the potential for instantaneous PTS/TTS has been found to occur as a result of vibration piling, thus, the

mitigation measures put in place to ensure SPA qualifying species clear of the area (50m) prior to vibration piling would caveat for this.

There is proposed dredging works within the footprint of the Proposed Development. The estimated dredge volume is small (approximately 6,700m^3 of sediment). Dredging will be undertaken by a long reach from land. The sediment dredged will be used as infill material reused in the reclamation. Dredging will be undertaken between April and October, therefore works will be undertaken during the period when breeding Red-throated Divers are potentially utilising the area for foraging

The noise from dredging, has short risk ranges for PTS of <50m for 8 hours dredging. There is no acute risk of noise related injury related to the dredging, and birds have time to swim away. TTS risk ranges potentially present the highest risk of temporary injury to birds ranging from 195.4m (average range) to 287.5m (maximum range) for 8 hours dredging, however, this is only for birds staying close to the activity for extended periods (prolonged exposure). In addition, the figures quoted are conservative (based on cutter suction dredger), whilst in reality dredging activities will be land-based using a long reach excavator during the daylight hours over a 7-10 day period (per phase so a maximum of 20 days).

Given that the dredging works are very localised, undertaken from land and short term in duration (7 - 10 days per dredging regime) it is highly unlikely that significant disturbance will occur.

The Construction activities have been highlighted in the Airborne Noise Report (Appendix E), and noise contour maps have been prepared (see Appendix F) as having noise creation levels of >65dB at source, with noise levels decreasing over distance to below 50dB at 250m. A study compiled by the Institute of Estuarine and Coastal Studies (IECS), University of Hull (2009) found that construction noise emissions below 50 dB had a low effect and no impact on waterbirds.

For all forms of noise (underwater and airborne), an ornithologist will be present to monitor for the presence of SPA qualifying species within 355m of the Proposed Development (TTS range) and record behavioural responses within this zone. If impacts are recorded, then the disturbance zone shall be increased. The details of the monitoring protocol will be included in the Construction Environmental Management Document (CEMD). Mitigation via pre-works checks and slow ramp up of vibration piling would also ensure birds were clear of works areas ahead of works commencing. For Great Northern Diver, these larger disturbance zones (for blasting and vibro-piling) would only apply if these work activities slip beyond October. If not, then the maximum range for TTS from dredging (287.5m) would apply. No Great Northern Divers were recorded within 500m of the Proposed Development during October (in both 2023 and 2024). However, in November a peak of 13 birds and an average of 5 birds were recorded within 500m. Should works continue beyond October, it is important that the numbers and locations of this species are carefully monitored prior to blasting works and that works are put on hold if counts above ten are recorded.

With these measures in place, it is considered that noise generation, both airborne through construction works and underwater through blasting, drilling, vibro-piling and dredging would not give rise to significant disturbance. Given the location of the works in relation to preferred foraging areas within North Orkney SPA, there would not be an adverse effect on site integrity.

At Hatston, most of the material (rock etc) required for the development will be transported via the road network. There will only be a small volume of vessel movements, as it is anticipated that the majority of materials will be brought by land from sites within Orkney Mainland. Rock armour import will consist of two shipments at the start and halfway through contract, therefore 8 vessel movements in total. These vessel movements will be following existing shipping routes, with no new/novel routes being utilised. Sheet piles and any other material that cannot be sourced on the mainland will be imported through the existing Orkney Northlink freight services, so there will be no increase to current vessel movement baseline levels to deliver these. As described in section 3.3.7, the existing baseline for vessel movements

into and out of Hatston annually is 1026. An increase in 8 vessel movements during the construction phase represents an increase of 0.7%.

For the operational phase, Table 3.2 provides the expected increase in vessel movements, with an increase in 216 movements annually (69 movements in the winter and 147 additional vessel movements in the summer period).

These vessel movements will use existing vessel routes, with no new/novel routes expected (see Appendix G where maps indicate the existing vessel routes). It is expected that there is already some level of habituation by species to these existing vessel routes. Although Great Northern Diver are considered sensitive to vessel movements, by using these existing routes, and adhering to accepted speed limits, the increase of 19.8% increase (or 0.6 vessel movements a day) during the winter (when Great Northern Diver are present), is not likely to cause a significant disturbance impact. A Vessel Management Plan will be produced, with input from NatureScot, for both the Construction and Operational phases which will detail vessel routes, speeds etc to minimise, and where possible, avoid any disturbance impacts within established shipping lanes. There will be no barriers to movement, or reduced access to preferred foraging and roosting habitats, resulting in a significant energy expenditure and possible reduction in body condition required for survival and subsequent migration.

5.5.1.3 *Conservation Objective 2c: The supporting habitats and processes relevant to qualifying features and their prey/food resources are maintained*

As described in NatureScot's Conservation and Management Advice Document for North Orkney SPA, supporting habitats refer to the characteristics of the seabed and water column relevant to their use by the qualifying features. It relates to wider oceanographic processes such as up-wellings, tidal Flows, hydrological movements which may be necessary for the habitat and could affect nutrient cycling and prey distribution.

As outlined in section 4.5.3, in Volume 1 of the EIAR, the marine deposits within the dredge area comprise of loose to medium dense sands and gravels occasionally with cobbles interspersed with layers of sandy gravelly clay. Dredged material will be used as fill within the reclaimed areas.

Given the relatively coarse nature of the dredge budget, small proposed dredge volume, and the weak tidal currents within the vicinity of the proposed dredge pockets, it is considered that any plumes generated as a result of the dredging works and their reuse in the reclamation will be very localised and short term in duration. Overall, it is considered that prior to mitigation the magnitude of impact of sediment discharge and dispersion from dredging works will be low within the immediate dredge area, and negligible out with this area, thus maintaining the supporting habitats for Great Northern Diver.

Drainage designs to ensure that there are no untreated surface water discharges directly to surrounding coastal waters and the use of a silt booms during land reclamation works will mitigate against pollution spills which could affect the qualifying interests of the SPA and their prey sources. In terms of water pollution from the quay and attendant vessels, adherence to strict Pollution Prevention controls will aim to prevent the release of pollutants to the water environment. With these measures in place, the supporting habitats for Great Northern Diver will be maintained.

6 APPROPRIATE ASSESSMENT: ORKNEY MAINLAND MOORS SPA

Orkney Mainland Moors SPA comprises four areas of moorland on Mainland; at its closest point, it lies within 5km of Hatston Pier. The predominant habitats include extensive areas of blanket bog, heaths and mires, with these upland areas supporting 5.9% of the UK's breeding and 2% of the UK's overwintering Hen Harrier (*Circus cyaneus*) population, 2% of the UK's breeding Short-eared Owl (Asio flammeus) population. In both cases one of very few sites to support such dense and significant numbers. The area also supports 2% of the UK's breeding Red-throated Diver (*Gavia stellata*) population (18 pairs). This site's boundaries also correspond to Keelylang Hill and Swartaback Burn Site of Special Scientific Interest (SSSI) which is designated for breeding Hen Harrier.

6.1 Assessment of Potential Impacts on Conservation Objectives

It was established during the screening stage that there is no LSE for Short-eared Owl and Hen Harrier. Therefore, this assessment on Orkney Mainland Moors SPA relates to Red-throated Diver only.

Baseline surveys were undertaken during the 2023 and 2024 breeding seasons, details of which can be found in the Ornithological Technical Report (Appendix B). A summary of findings is found below.

For most of the year Red-throated Divers were present in very low numbers within 2 km of the existing pier, generally from nought to three birds.

However, there was a distinct peak in the autumn, from mid-August to mid-November with up to 19 birds on 23rd Sept 2023. Some of these autumn birds were seen to be juveniles, twice an adult and juvenile together (26th Aug and 5th Oct 2023), and on 23rd Sept 2023 a group of six included at least one adult in wing moult. It is likely that birds from the local Orkney breeding population were mainly involved early in the autumn, although the highest numbers in late September and early October could also have included birds from further afield (e.g. Shetland).

During the early breeding season of 2023 there were very few sightings and, of the four birds recorded up to early June, two were seen to be immatures.

In the 2024 breeding season, numbers were much lower than in 2023, perhaps an indication of a poor breeding year. Peaks of two birds in June and three in July were recorded. Only two birds were recorded over three survey dates in August. In September, a peak of six birds was recorded on 4th September, falling to two birds over the last two survey dates in September (13th and 17th).

Overall, about 15% of birds were within 500m of the existing pier, 38% at 500m–1km, and 47% at 1–2km. In terms of numbers of birds present within the three distance bands, there are the following:

- 0-500m: A peak of 3 birds (post breeding – 23rd September 2023) and an average of 0.43 birds;
- 500m-1km: A peak of 6 birds (post-breeding – 23rd September 2023) and an average of 1.09 birds: and
- 1-2km: A peak of 10 birds (post-breeding – 23rd September 2023) and an average of 1.78 birds.

During the key breeding period for chick rearing (June to mid - August), small numbers were present within the survey area with numbers ranging between 0 and 5 birds. Overall, with counts of 3 birds, 5 birds, 0 birds, 2 birds and 2 birds recorded during survey within this period, it is considered that although the site potentially supports foraging adults during breeding, it is not considered to be a main foraging

site. The Scottish Government marine map details important foraging areas within North Orkney SPA. The Bay of Ibister (>4km from the Proposed Development), the north-west corner of the Bay of Firth (>5km from the Proposed Development) and the area around the Ness of Woodwick (>10km from the Proposed Development) are the most significant foraging areas for this species. Taking the precautionary approach that the peak of 5 birds were all adults foraging to chick rearing, this equates to 27% of the SPA citation population (supporting habitats for up to 18 breeding pairs).

The surveys indicate that the site supports significant numbers during post-breeding, with the peak of 19 birds in late September supporting this assumption.

6.1.1.1 Conservation Objective: The population of the species as a viable component of the site

In previous correspondence, NatureScot suggested referring to Guidance Note 8: Guidance to support Offshore Wind Applications: Marine Ornithology Advice for assessing the distributional responses, displacement and barrier effects on Marine birds. Specifically, the suggestion was to undertake a matrix-based model to calculate potential displacement and mortality as a result of the Proposed Development on Red-throated Diver. This has been undertaken (see Appendix C).

The matrix table has been populated for Red-throated Diver using the mean peak across the two summers of survey effort (mean peak of 12.5), as per recommendations in Guidance Note 8: Guidance to support Offshore Wind Applications: Marine Ornithology Advice for assessing the distributional responses, displacement and barrier effects of Marine birds.

Sensitivity scales have been obtained from both Guidance Note (referenced above) and Furness et al 2012. The two most relevant sensitivity scales are disturbance susceptibility and habitat specialisation. For disturbance Red-throated Diver scores 5 and for habitats scores 4. As a result, and as per NatureScot's communications, a displacement scale of between 90% as been used, and a mortality scale of 1%.

This gives a mortality figure of 0.1125 deaths/year.

The SPA citation level for breeding Red-throated Diver is 18 pairs, therefore 36 adult birds. To determine the number of young and productivity of these birds, an estimate based on past monitoring on Hoy can be used, where there were 56 - 66 pairs during the seven years 2000 - 2006, and annual productivity ranged from 0.53 - 0.95 young per pair, averaging 0.70.

Applying this average productivity to the SPA citation population of 18 pairs gives 33 young, and a total post-breeding population of 49 birds (adults and young combined). This would correlate with the findings of the 2023 and 2024 breeding bird surveys where the peak counts of 19 (in 2023) and 6 (in 2024) were a combination of adult and juvenile birds.

Taking the precautionary, worst-case scenario (whereby all birds present are adults and zero breeding success), the loss of 0.1125 birds annually represents 0.3% of the SPA citation population. Over a 25-year period, the modelled mortality would be 2.8 birds, or 7.7% of the SPA citation population.

Using a more realistic value, whereby birds present in a "normal" breeding season (0.7 productivity rate, therefore 49 birds), the loss of 0.1125 birds annually represents 0.2%. Over a 25-year period, the modelled mortality (2.8 birds) would be 5.7% of the SPA citation population.

Therefore, it is considered that population of Red-throated Diver as a viable component of the site will be maintained throughout the site.

6.1.1.2 Conservation Objective: The distribution of the species within the site

Overall, about 15% of birds were within 500m of the existing pier, 38% at 500m–1km, and 47% at 1–2km. In terms of numbers of birds present within the three distance bands, there are the following:

- 0-500m: A peak of 3 birds (post breeding – 23rd September 2023) and an average of 0.43 birds;
- 500m-1km: A peak of 6 birds (post-breeding – 23rd September 2023) and an average of 1.09 birds: and
- 1-2km: A peak of 10 birds (post-breeding – 23rd September 2023) and an average of 1.78 birds.

During the key breeding period for chick rearing (June to mid - August), small numbers were present within the survey area with numbers ranging between 0 and 5 birds.

The average numbers within 2km of the Proposed Development equates to 1.2% - 4.6% of the SPA population (18 pairs, 36 individuals).

During the critical chick rearing stage, the following were recorded:

- 0-500m: A peak of 2 birds and an average of 0.15 birds;
- 500m-1km: A peak of 3 birds and an average of 0.61 birds; and
- 1-2km: A peak of 3 birds and an average of 1.15 birds.

As noted above, the main foraging areas within North Orkney SPA, and therefore potential foraging areas for birds from Orkney Mainland Moors SPA, are the Bay of Ibister (>4km from the Proposed Development), the north-west corner of the Bay of Firth (>5km from the Proposed Development) and the area around the Ness of Woodwick (>10km from the Proposed Development).

Given the small numbers present within 2km of the Proposed Development during the critical chick rearing stage, it is considered that even in the worst case scenario that birds within 2km of the Proposed Development are permanently displaced (an average of 2 birds), the main foraging areas remain intact and the distribution of the species within the site is maintained.

6.1.1.3 Conservation Objective: Distribution and extent of habitats supporting the species

The Proposed Development will not affect the breeding grounds of the Orkney Mainland Moors SPA so the distribution and extent of the breeding grounds is maintained. The Proposed Development will result in a small loss of available habitat for foraging Red-throated Diver; however this is negligible in scale to the available better habitat elsewhere. The main foraging areas remain intact and the distribution of the species within the site is maintained.

6.1.1.4 Structure, function and supporting processes of habitats supporting the species

The structure and function of the breeding habitat will remain unaffected by the Proposed Development, but foraging areas could be impacted. As described in NatureScot's Conservation and Management Advice Document, supporting habitats can include the characteristics of the seabed and water column relevant to their use by the qualifying features. It relates to wider oceanographic processes such as up-wellings, tidal Flows, hydrological movements which may be necessary for the habitat and could affect nutrient cycling and prey distribution.

As outlined in section 4.5.3, in Volume 1 of the EIAR, the marine deposits within the dredge area comprise of loose to medium dense sands and gravels occasionally with cobbles interspersed with layers of sandy gravelly clay. Dredged material will be used as fill within the reclaimed areas.

Given the relatively coarse nature of the dredge budget, small proposed dredge volume, and the weak tidal currents within the vicinity of the proposed dredge pockets, it is considered that any plumes generated as a result of the dredging works and their reuse in the reclamation will be very localised and short term in duration. Overall, it is considered that prior to mitigation the magnitude of impact of sediment discharge and dispersion from dredging works will be low within the immediate dredge area, and negligible out with this area, thus maintaining the supporting habitats for Red-throated Diver.

Drainage designs to ensure that there are no untreated surface water discharges directly to surrounding coastal waters and the use of a silt booms during land reclamation works will mitigate against pollution spills which could affect the qualifying interests of the SPA and their prey sources. In terms of water pollution from the quay and attendant vessels, adherence to strict Pollution Prevention controls will aim to prevent the release of pollutants to the water environment. With these measures in place, the structure and function of supporting habitats for Red-throated Diver will be maintained.

6.1.1.5 Conservation Objective: No significant disturbance of the species

Disturbance may occur through blasting (and associated drilling), vibro-piling and dredging activities and airborne noise through terrestrial works during the construction phase. Empirical data specifically linking marine bird response to noise disturbance (and underwater noise in particular), separate from other sources of disturbance (e.g. vessel movement or human presence), is limited and this source of disturbance on marine birds is not yet well understood. Recent research generally suggests that diving seabirds could be more sensitive to underwater noise than previously assumed. For example, hearing thresholds for Great Cormorant were found to be comparable to seals and toothed whales in the frequency band 1 to 4 kHz (Hansen et al., 2017). A number of assessments have, based on the limited information available, and the similar frequency ranges between seabirds and phocid pinniped and cetacean species, applied methodologies developed for pinnipeds or low frequency cetaceans in assessing seabird sensitivity to underwater noise (Teachout, 2012).

Underwater noise modelling (Refer to Seal Risk Assessment in Appendix D) for blasting shows a TTS range of up to 355m and a PTS range of 77m per blast. These works are timed to occur during April to October, utilising suitable weather windows during this time. Therefore, works will be undertaken during the period when breeding Red-throated Divers are potentially utilising the area for foraging. As detailed section 5.3.1.1 above, A peak of 3 birds and an average of 0.43 birds were present within 500m of the Proposed Development across the 2023 and 2024 survey periods. During the critical chick rearing period (June-mid-August), there was a peak of 2 birds and an average of 0.16 birds across the 2023 and 2024 survey period (a total of 2 birds over 12 survey visits during the chick rearing period).

Vibration piling and drilling activities, which will be undertaken between April and October, also have low acoustic impacts with short risk ranges of PTS and TTS of <50m for 1 hour. The UW noise modelling assumed that there would be active piling maximally 1 hour every 24 hours and drilling for 8 hours, when in reality this is the maximum and may likely be reduced. Mitigation via pre-works checks and slow ramp up of vibration piling and drilling would ensure birds were clear of works areas ahead of works commencing. Also, it is essential to note, that in other UW noise modelling for similar projects, the potential for instantaneous PTS/TTS has been found to occur as a result of vibration piling, thus, the mitigation measures put in place to ensure SPA qualifying species clear of the area (50m) prior to vibration piling would caveat for this.

There is proposed dredging works within the footprint of the Proposed Development. The estimated dredge volume is small (approximately 6,700m^3 of sediment). Dredging will be undertaken by a long reach from land. The sediment dredged will be used as infill material reused in the reclamation. Dredging will be undertaken between April and October, therefore works will be undertaken during the period when breeding Red-throated Divers are potentially utilising the area for foraging

The noise from dredging, has short risk ranges for PTS of <50m for 8 hours dredging. There is no acute risk of noise related injury related to the dredging, and birds have time to swim away. TTS risk ranges potentially present the highest risk of temporary injury to birds ranging from 195.4m (average range) to 287.5m (maximum range) for 8 hours dredging, however, this is only for birds staying close to the activity for extended periods (prolonged exposure). In addition, the figures quoted are conservative (based on cutter suction dredger), whilst in reality dredging activities will be land-based using a long reach excavator during the daylight hours over a 7-10 day period (per phase).

As detailed section 5.3.1.1 above, A peak of 3 birds and an average of 0.43 birds were present within 500m of the Proposed Development across the 2023 and 2024 survey periods. During the critical chick rearing period (June-mid-August), there was a peak of 2 birds and an average of 0.16 birds across the 2023 and 2024 survey period (a total of 2 birds over 12 survey visits during the chick rearing period).

Given that the dredging works are very localised, undertaken from land and short term in duration (7 - 10 days per dredging regime) it is highly unlikely that significant disturbance will occur.

The Construction activities have been highlighted in the Airborne Noise Report (Appendix E), and noise contour maps have been prepared (see Appendix F) as having noise creation levels of >65dB at source, with noise levels decreasing over distance to below 50dB at 250m. A study compiled by the Institute of Estuarine and Coastal Studies (IECS), University of Hull (2009) found that construction noise emissions below 50 dB had a low effect and no impact on waterbirds.

For all forms of noise (underwater and airborne), an ornithologist will be present to monitor for the presence of Red-throated Diver within 355m of the Proposed Development (largest TTS range) and record behavioural responses within this zone. If impacts are recorded, then the disturbance zone shall be increased. The details of the monitoring protocol will be included in the Construction Environmental Management Document (CEMD). Mitigation via pre-works checks and slow ramp up of vibration piling would also ensure birds were clear of works areas ahead of works commencing.

With these measures in place, it is considered that noise generation, both airborne through construction works and underwater through blasting, drilling, vibro-piling and dredging would not give rise to significant disturbance. Given the location of the works in relation to main foraging areas within North Orkney SPA, there would not be an adverse effect on site integrity.

At Hatston, most of the material (rock etc) required for the development will be transported via the road network. There will only be a small volume of vessel movements, as it is anticipated that the majority of materials will be brought by land from sites within Orkney Mainland. Rock armour import will consist of two shipments at the start and halfway through contract, therefore 8 vessel movements in total. These vessel movements will be following existing shipping routes, with no new/novel routes being utilised. Sheet piles and any other material that cannot be sourced on the mainland will be imported through the existing Orkney Northlink freight services, so there will be no increase to current vessel movement baseline levels to deliver these. As described in section 3.3.7, the existing baseline for vessel movements into and out of Hatston annually is 1026. An increase in 8 vessel movements during the construction phase represents an increase of 0.7%.

For the operational phase, Table 3.2 provides the expected increase in vessel movements, with an increase in 216 movements annually (69 additional vessel movements during the winter and 147 vessel movements during the summer period).

These vessel movements will use existing vessel routes, with no new/novel routes expected (see Appendix G where maps indicate the existing vessel routes). It is expected that there is already some level of habituation by species to these existing vessel routes. Although Red-throated Diver is considered highly sensitive to vessel movements, by using these existing routes, and adhering to accepted speed limits, the increase of 21.7% in vessel movements during the summer and 19.8% increase during the winter, is not likely to cause a significant disturbance impact. The main concentrations Red-throated Diver around Hatston is to the west of the Proposed Development site, in an area where additional vessel movements will not occur. A Vessel Management Plan will be produced, with input from NatureScot, for both the Construction and Operational phases which will detail vessel routes, speeds etc to minimise, and where possible, avoid any disturbance impacts within established shipping lanes. There will be no barriers to movement, or reduced access to preferred foraging and roosting habitats, resulting in a significant energy expenditure and possible reduction in body condition required for survival and subsequent migration.

Overall, it is considered that there would be no significant disturbance to the species as a result of construction works and vessel movements.

7 APPROPRIATE ASSESSMENT: SCAPA FLOW SPA

7.1 Site Description

The Scapa Flow SPA comprises a total area of 31819 ha located within Scapa Flow, an enclosed sea area, sheltered by Mainland Orkney to the north, Hoy, South Walls and Flotta to the west and south, and Burray and South Ronaldsay to the east. The Flow is linked to the Pentland Firth in the south through the Sound of Hoxa, and to the Atlantic Ocean in the west through Hoy Sound. The site also includes nearshore waters to the east of Orkney, extending from South Ronaldsay to Deerness, and including the sheltered shallow waters of Holm Sound, between Burray and East Mainland. It encompasses a range sheltered and diverse marine communities which provide a range of food resource for breeding, moulting and roosting sea birds.

The SPA supports the following species:

- The third largest population of wintering Great Northern Diver (c.20% of the GB population or 505 individuals).
- Wintering Black-throated Diver (c. 9.5% of the GB population or 57 individuals).
- Wintering Slavonian Grebe (c.12% of GB population or 135 birds)
- The second largest population of wintering European shag in Scotland (c.3% of GB population or 2927 individuals)
- Wintering Common Eider (3% of GB population or 1997 individuals)
- Wintering Red-breasted Merganser (6% of GB population or 539 individuals)
- Wintering Long-tailed Duck (13% of GB population or 1395 individuals)
- Red-throated Diver (c.6% of GB population or 76 pairs) breeding within fresh water lochans within 10km of the SPA.

All the designated site features are assessed as favourable.

7.2 Conservation Objectives

The conservation objectives for Scapa Flow SPA are as follows:

1. To ensure that the qualifying features of the Scapa Flow SPA are in favourable condition and make an appropriate contribution to achieving Favourable Conservation Status.

2. To ensure that the integrity of the Scapa Flow SPA is maintained in the context of environmental changes by meeting objectives 2a, 2b and 2c for each qualifying feature:

> 2a. The populations of qualifying features are viable components of the site.
>
> 2b. The distribution of the qualifying features is maintained throughout the site by avoiding significant disturbance of the species.
>
> 2c. The supporting habitats and processes relevant to qualifying features and their prey/food resources are maintained.

7.3 Qualifying Features to be Assessed

Although possible, there is no evidence of connectivity between overlapping SPA qualifying features (Great Northern Diver and Slavonian Grebe) of Scapa Flow SPA and North Orkney SPA. Survey data does not show flights of Great Northern Diver and Slavonian Grebe commuting over Kirkwall between sites (albeit it is acknowledged that Slavonian grebe most likely fly at night). Recent NatureScot responses to developments within North Orkney SPA (Quanterness Fish Farm – NatureScot response dated 21st August 2024, and subsequent email dated 26th March 2025) do not mention connectivity between the two SPA sites, highlighting the uncertainty of this.

For the purposes of this assessment, it is unreasonable to assume that all birds present at Scapa Flow SPA could also be birds as part of the North Orkney SPA, even as a precautionary principle. A more realistic precautionary estimate is that 10% of the birds (Great Northern Diver and Slavonian Grebe) cross over between North Orkney SPA and Scapa Flow SPA.

Using this criterion, the peak count of 31 Great Northern Diver would therefore constitute 3.1 birds associated with North Orkney SPA. This represents 0.6% of the Scapa Flow SPA population. Similarly, the peak of 10 Slavonian Grebes would constitute 1 bird associated with Scapa Flow SPA, which equates to 0.8% of the SPA population.

Given these small numbers, and with the mitigation measures in place for North Orkney SPA qualifying species, no adverse effects on the integrity of Scapa Flow SPA are predicted.

8 APPROPRIATE ASSESSMENT: FARAY AND HOLM OF FARAY SAC

During the design team meeting with NatureScot on 19th December 2024 it was agreed that only the construction related phase of the project was to be assessed and therefore no assessments in relation to operational phase are included within this section.

Faray and Holm of Faray SAC comprises 781.33 ha. The Faray and Holm of Faray SAC is designated for grey seal, which currently feature as 'Unfavourable declining' in condition within the SAC. The unfavourable condition of grey seal at the SAC corresponds to a 43% decline in pup production in 2019 since the late 1990s with the SAC now accounting for 10% of the Seal Monitoring Units (SMU) production. The decrease in pup production does not reflect the trend of the North Coast and Orkney SMU with both grey seal population and pup production remaining stable. SMU pup production is stable (decline appearing to be due to changes in movement of pup activities to other locations within the Seal Management Area (SMA)), accessibility of the site for pupping has not changed and disturbance is minimal during the breeding season, meaning no direct conservation measures can be taken at a site level to address the causes of the unfavourable condition of grey seal. Therefore, the focus of the Conservation Objectives for grey seal are ensuring that the conditions on site are suitable to support a recovery.

Faray and Holm of Faray SAC is located 23.5km (via sea) north of the Hatston development site.

8.1 Assessment of Potential Impacts on Conservation Objectives

The conservation objectives are to avoid deterioration of the habitats of qualifying species (Grey seal) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained, and the site makes an appropriate contribution to achieving favourable conservation status for the qualifying interest.

To ensure for the qualifying species that the following are maintained in the long term:

- Population of the species as a viable component of the site;
- Distribution of the species within site;
- Distribution and extent of habitats supporting the species;
- Structure, function and supporting processes of habitats supporting the species; and
- No significant disturbance of the species

The designated site is approx. 23.5km from the proposed development as the seal swims. It is not anticipated that there will be any disturbance to grey seals or their habitats within the designated site itself. In general, grey seals are loyal to a pupping sites and frequent those places for a few months during the breeding season when the females give birth and wean their pups before mating again. Grey seals main pupping times in Orkney are between October and December with moulting until January. During that period, they do not move very far from the breeding sites. However, after the breeding season grey seals are much more mobile and disperse over very large areas and can travel large distances, frequently over 100km, to exploit various haul out sites and forage and prefer offshore feeding areas as well as exposed coasts and islands to come ashore, with the outer fringes of Orkney being classed as suitable. Telemetry studies show a broad-scale distribution, with tagged grey seals utilising both coastal and offshore habitat around Orkney, with the area of the Proposed Development being

included[4]. Therefore, although the Proposed Development works would not likely have a direct impact on grey seals within the SAC, it is possible that individuals from the SAC could be present within the waters surrounding the development site.

Individual seals which form part of the SAC population could potentially feed and forage within the bay of Kirkwall. They could be at risk of temporary disturbance from underwater noise associated with blasting, piling, drilling and dredging operations. In addition, seals are also at risk from collision with vessels and a reduction in water quality.

Blasting, dredging, drilling and vibro-piling works will be undertaken during the construction phase. These works are timed to occur during April to October (although work may occur beyond this should the programme slip), utilising suitable weather windows during this time. The piling works will be vibro-piling, which is less intrusive than hammer piling. There is proposed dredging works within the footprint of the Proposed Development. The estimated dredge volume is small (approximately 6,700m^3 of sediment). Dredging will be undertaken by a long reach from land. The sediment dredged will be used as infill material reused in the reclamation.. Dredging works will be completed within 20 days for phase 2 and 3 and 35 blasts will occur in total over a 6 month period.

8.1.1 Permanent Threshold Shift (PTS) or Temporary Threshold Shift (TTS)

Construction activities within the marine environment (blasting, dredging, vibro-piling and drilling) will result in underwater noise which can cause injuries and result in a Permanent Threshold Shift (PTS) or Temporary Threshold Shift (TTS) in hearing. Prolonged exposure to underwater noise below the PTS and TTS thresholds can reduce individual fitness as it interferes with individuals' ability to communicate with others, feed and navigate in an effect known as masking. In extreme cases, exposure to high levels of underwater noise can result in death.

Underwater noise modelling (See Seal Risk Assessment in Appendix D) for each construction activity shows blasting activities have short PTS ranges for grey seals of 77.1m for 1 blast, with TTS ranges up to 354.4m from unweighted Sound Exposure Level (SEL), with Sound Pressure Level (SPL) peak from one blast equating to maximum PTS range of 285.2m and TTS range of 425.3m, with an average PTS range of 192.6m and TTS range of 330.4m, which is considered more realistic. Auditory injury may occur to grey seals within the vicinity of blasting. The charges (holes) for each blast are estimated by the contractor at 27 kg TNT, therefore the worst-case for blasting is based on the accumulation of 10 x 27kg. However, due to the 5-10 second delay between charges, increasing the number of blasts does not increase an animal's exposure and therefore its risk of auditory injury remains the same should it fail to vacate the area during 1 or more blasts. As the blasting has no slow build-up of noise or soft-start and leaves no time for seals to vacate the area, mitigation (as detailed in Section 11) will be put in place to ensure seals are clear of the area prior to blasting. This would reduce the likelihood of auditory impacts occurring to seals as a result of blasting.

Vibration piling activities also have low acoustic impact upon seals with short risk ranges of PTS and TTS of <50m for 1 hour. The UW noise modelling assumed that there would be active piling maximally 1 hour every 24 hours, when in reality this is the maximum and may likely be reduced. Mitigation via pre-works checks (within a 1.1km mitigation zone) and slow ramp up of vibration piling would ensure seals were clear of works areas ahead of works commencing. Also, it is essential to note, that in other UW noise modelling for similar projects, the potential for instantaneous PTS/TTS has been found to occur as a result of vibration piling, thus, the mitigation measures put in place to ensure seals are clear of the area prior to vibration piling would caveat for this.

[4] Marine Scotland (2016) Fine-scale harbour seal at-sea usage mapping around Orkney and the North coast of Scotland Scottish Marine and Freshwater Science Vol 7 No 27, available at: https://data.marine.gov.scot/sites/default/files/SMFS%200727_0.pdf

The noise from dredging, has short risk ranges for PTS for grey seal of <50m for 8 hours dredging. There is no acute risk of noise related injury related to the dredging, and seals have time to swim away. TTS risk ranges present the highest risk of temporary injury to seals ranging from 195.4m (average range) to 287.5m (maximum range) for 8 hours dredging, however, this is only for animals staying close to the activity for extended periods (prolonged exposure). In addition, the figures quoted are conservative (based on cutter suction dredger), whilst in reality dredging activities will be land-based using a long reach excavator during the daylight hours over a 7-10 day period (per phase). It is acknowledged that despite this, seals could still be displaced or actively avoid the area for the duration of the dredging works (disturbance). Therefore, mitigation (as detailed in Section 11) will be implemented to ensure seals are clear of the area prior to dredging and slow ram up of machinery will be implemented.

Although drilling was screened out in the UW noise modelling, as it was not considered loud enough to be meaningfully assessed in an environment with many vessels and general human activity, drilling through hard sediment can be significantly noisy, and given that the drilling will be part of the wider blasting activity and will occur just in advance of the blasting, the noise from drilling will not be dominated by the acoustic impact of the blasting. The modelling suggests that as the modest broadband level for drilling is 156 dB SPL and the typical background noise for Hatston is 107.2 dB SPL, drilling would equate to meaning an increase of <50 dB from baseline, therefore there is no auditory risk to seals from drilling. Although mitigation to be implemented for other methods of works would likely ensure seals were clear of the works area ahead of drilling commencing.

Grey seals can and do forage considerable distances, however, the Conservation Objectives for grey seal SAC are related to the protection of the breeding colony only. During this sensitive time, grey seals (especially females) do not tend to travel beyond 20km from these sites. Therefore, NatureScot advise screening in grey seal SACs for assessment only where a project site/impact radius is within 20km of the SAC. Based on the distance of PTS and TTS ranges it is considered unlikely that grey seal individuals from the Fary and Holm of Faray SAC would be exposed to auditory related impacts associated with noise when within the SAC. However, as stated above, individuals from the SAC may be present within the water surrounding the Proposed Development.

For all of the noise sources, it is considered that the main effects will most likely be temporary displacement of individuals from the waters surrounding the site. It is not considered that the habitat is important for breeding, mating or resting and that there are sufficient alternative foraging areas for them to utilise.

Given the above, it is considered that there would be no adverse effect on the integrity of Faray and Holm of Faray SAC.

8.1.2 General Disturbance

General disturbance to seals may occur as a result of the construction works (blasting, dredging, drilling and vibro-piling). The most likely disturbance to seals as a result of the noise related activities include both physiological (increased stress and cortisol levels, rapid heartbeat, increased breathing rate, cold water shock (if on land)) and behavioural disturbance (increased vigilance, crash diving, flipper splashing and vocalisation). Seals are considered to be more easily disturbed when on land. However, due to the distance of the Faray and Holm of Faray SAC to the Proposed Development, it is not considered that seals would be disturbed or exhibit behaviours such as tombstoning and stampeding, as the noise levels associated with the works would not extend this far. Therefore, with works occurring predominantly outside the main pupping times (between October and December) and moulting (until January) for grey seal in Orkney this is not considered to result in impacts due to distance. However, it is expected that grey seals would be likely to exhibit a behavioural change as a result of the noise, when in water,

predominantly fleeing away from the noise source, with vocalisations and splashing occurring. In addition, physiological stress is likely to also occur. This could impact seals energy and fitness levels through disturbing foraging or causing avoidance of feeding areas for periods of time.

Quantitative data analysis was undertaken (Appendix D of the Supplementary Environmental Information Report (July 2025): Seal Risk Assessment – Appendix D of this HRA) to obtain an indicative numerical value for the number of individual seals that could be subject to general disturbance when at sea, as a result of development activities. The underwater noise modelling used the level B-Harassment criteria to model potential impacts to behaviour for impulsive and non-impulsive sounds. The maximum range is considered to be the worst-case scenario, with the average range considered more realistic. Absolute seal densities from Carter et al 2025 data 'at sea' within these buffers (ranges) were used to determine the maximum number of grey seals that have the potential to be disturbed from non-impulsive (dredging) and impulsive noise (one blasting event) when using the disturbance criteria.

It is predicted that non-impulsive sounds (dredging) would result in a maximum range of 5.6km, with and average range of 2.3km. Absolute seal densities from Carter et al 2025 data 'at sea' within these buffers (ranges) were used to determine that a maximum of 299 grey seals have the potential to be disturbed from non-impulsive noise (dredging) when using the disturbance criteria (worst-case scenario), with actual numbers more likely to reflect those in the average range; 56 grey seals. The duration of dredging is expected to take 20 days total (10 days in Phase 2 and 10 days in Phase 3) within a 6 month timeframe, and dredging activities will be land-based using a long reach excavator during the daylight hours therefore the number of seals with potential to be disturbed is likely to be lower than predicted.

Impulsive sounds (blasting) were predicted to result in mild disturbance at a maximum range of 6.1km and average range of 1.9km, with strong disturbance predicted at a maximum range of 1.6km and average range of 707m. Absolute seal densities from Carter et al 2025 data 'at sea' within these buffers (ranges) were used to determine that a maximum of 380 grey seals have the potential to be disturbed from impulsive noise (one blasting event) when using the mild disturbance criteria (worst-case scenario), with actual numbers more likely to reflect those in the average range; 45 grey seals. In addition, maximum ranges for strong disturbance would only result in 37 grey seals being impacted. During the 6 months period of works only 35 blasts are to occur, therefore the number of seals with potential to be disturbed is likely to be lower than predicted.

The level B-Harassment maximum ranges are predicted at 6.1km (at the greatest range), which would result in the site/impact radius falling within 20km of the SAC. However, it is considered unlikely that grey seal individuals from Fary and Holm of Faray SAC would be exposed to auditory related impacts and behavioural impacts when within the SAC. Nonetheless, some behaviour changes may occur (vigilance or avoidance) to individuals from the SAC that may be in the waters near the development, up to 6.1km (maximum range) (although more realistically 2.3km (average range)) from the development. Although disturbance could occur out to these ranges, it is unlikely that individual seals from the SAC would be spending all of their time in the development area (or maximum range area), if it is returning to SAC up to 23.5km away and the works to be undertaken are temporary in nature, as such disturbance is likely to be limited.

Given the mitigation which will be employed (as detailed in Section 11) and the temporary nature of the works producing underwater noise, any disturbance which may occur will not fall under the JNCC (2008) definition of significant disturbance. Therefore, it is considered that the Seal Mitigation Plan (SMP) will be sufficient to prevent short term negative effects associated with underwater noise related activities during construction to grey seals.

Given the above, it is considered that there would be no adverse effect on the integrity of Faray and Holm of Faray SAC.

8.1.3 Vessel Movements

Impacts associated with disturbance from increased vessel movements will be temporary during construction, with the increase being relatively small, and it is considered that seals utilising waters around the site will be somewhat habituated to vessel activity associated with the existing Hatston pier and those in the wider Bay of Kirkwall.

The construction phase of the development will only require a small number of vessels that will be of consistent size, speed and operating procedure. This can result in seal collision risk associated with the Hatston development activities. The likelihood of vessel collisions is therefore dependent upon vessel speed, animal behaviour and vessel manoeuvrability[5]. Vessels travelling at slower speeds in general can allow time for seals and vessel operators to react to avoid collisions.

However, the Hatston pier is within a highly trafficked area for vessels, with designated vessel routes being in place and as the development is an extension for the existing pier, it is considered that seals utilising the waters within this area would likely avoid or be accustomed to the regular movements of vessels and thus the likelihood of vessel strike may be lower. Vessel movements associated with construction activities will be fairly self-contained only moving approx. 10m, within the development footprint per day, with no need to extend into existing navigational channels, further reducing the likelihood of vessel impacts on seals.

At Hatston, most of the material (rock etc) required for the development will be transported via the road network. There will only be a small volume of vessel movements, as it is anticipated that the majority of materials will be brought by land from sites within Orkney Mainland. Rock armour import will consist of two shipments at start and halfway through contract, therefore 8 vessel movements in total. These vessel movements will be following existing shipping routes, with no new/novel routes being utilised. Sheet piles and any other material that cannot be sourced on the mainland will be imported through the existing Orkney Northlink freight services, so there will be no increase to current vessel movement baseline levels to deliver these. As described in section 3.3.7, the existing baseline for vessel movements into and out of Hatston annually is 1,026. An increase in 8 vessel movements during the construction phase represents an increase of 0.7%.

Dredging will not require any vessel movements, with a long reach excavator being used from land. Vessels involved with blasting, piling and drilling will include a small barge, small workboat / crew transfer boats and workboat barge with crane, with all vessels only moving approx. 10m, within the development footprint per day, with no need to extend into existing navigational channels. Vessel operations are therefore self-contained to and from shore base further reducing the likelihood of vessel impacts on seals.

These vessel movements during construction will all use existing vessel routes, with no new/novel routes expected. By using these existing routes, and adhering to accepted speed limits, and the implementation of a vessel management plan none of these potential disturbance effects or collision risks will result in significant disturbance to grey seals. If there is some displacement from areas of high activity, it is considered that there is sufficient alternative habitat for foraging and commuting and so there is unlikely to be an effect on the conservation status of populations of Faray and Holm of Faray SAC.

Given the above, it is considered that there would be no adverse effect on the integrity of Faray and Holm of Faray SAC.

[5] SEER U.S. Offshore Wind Synthesis pf Environmental Effects Research: Presence of Vessels: Effects of Vessel Collision on Marine Life (2022): https://tethys.pnnl.gov/sites/default/files/summaries/SEER-Educational-Research-Brief-Effects-of-Vessel-Collision-on-Marine-Life.pdf

8.1.4 Pollution and Sedimentation

As outlined in section 4.5.3, in Volume 1 of the EIAR, the marine deposits within the dredge area comprise of loose to medium dense sands and gravels occasionally with cobbles interspersed with layers of sandy gravelly clay. Dredged material will be used as fill within the reclaimed areas.

Given the relatively coarse nature of the dredge budget, small proposed dredge volume, and the weak tidal currents within the vicinity of the proposed dredge pockets, it is considered that any plumes generated as a result of the dredging works and their reuse in the reclamation will be very localised and short term in duration. Overall, it is considered that prior to mitigation the magnitude of impact of sediment discharge and dispersion from dredging works will be low within the immediate dredge area, and negligible out with this area, thus maintaining the supporting habitats for grey seal.

Drainage designs to ensure that there are no untreated surface water discharges directly to surrounding coastal waters and the use of a silt booms during land reclamation works will mitigate against pollution spills which could affect the qualifying interests of the SAC and their prey sources. In terms of water pollution from the quay and attendant vessels, adherence to strict Pollution Prevention controls will aim to prevent the release of pollutants to the water environment. With these measures in place, the supporting habitats for grey seal will be maintained.

Given the above, it is considered that there would be no adverse effect on the integrity of Faray and Holm of Faray SAC.

9 APPROPRIATE ASSESSMENT: SANDAY SPECIAL AREA OF CONSERVATION (SAC)

During the design team meeting with NatureScot on 19th December 2024 it was agreed that only the construction related phase of the project was to be assessed and therefore no assessments in relation to operational phase are included within this section.

Sanday is a large, low-lying island situated in the north-east of the Orkney archipelago. The island has a complex coastline characterised by extensive sandy beaches, sheltered inlets and exposed rocky headlands and comprises 10976.97 hectares (ha). The coastal waters of Sanday hold the largest colony of harbour seals at any relatively discrete site in Scotland. Around 1,450 adults haul out on the intertidal reefs to pup, moult and rest. This represents around 17% of the Orkney, 5% of the UK and 2% of the EU populations of the species. During the 1998 breeding survey over 550 pups were observed at the site, accounting for 34% of newborn pups in Orkney. Large breeding colonies are important in maintaining overall population size and are significant as sources of emigration to smaller or newly established groups. The current status of harbour seals at Sanday is unfavourable declining, with a significant decline in numbers since the designation. Based on counts from 1997-2019, there has been a decline of 95% at Sanday SAC, indicating it is one of the local areas hit hardest by the harbour seal declines observed in northern and eastern areas of Scotland. In the last count in 2019, the SAC represented 77 individuals (around 5% of the North Coast and Orkney SMU). This is reflected across the whole of Orkney, where populations have declined by ~90%. The Sanday conservation management advice suggests that research is indicating that off-site factors such as predation, competition for prey, prey quality and availability, and toxin exposure from harmful algae are the most likely potential causes of the decline. For harbour seal at Sanday SAC, the reasons for the unfavourable condition appear to lie out with the SAC.

The SAC is located 30km north east from Hatston (or 33km via sea).

9.1 Assessment of Potential Impacts on Conservation Objectives

The conservation objectives are to avoid deterioration of the habitats of qualifying species (harbour seal) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained, and the site makes an appropriate contribution to achieving favourable conservation status for the qualifying interest.

To ensure for the qualifying species that the following are maintained in the long term:

- Population of the species as a viable component of the site;
- Distribution of the species within site;
- Distribution and extent of habitats supporting the species;
- Structure, function and supporting processes of habitats supporting the species; and
- No significant disturbance of the species

The designated site boundary is approx. 33km from the proposed development as the seal swims. It is not anticipated that there will be any disturbance to harbour seals or their habitats within the designated site themselves. Harbour seals main pupping times in Orkney are between June and July with moulting until mid-September. The typical foraging ranges of harbour seals are in the range of 50km, between haul outs and feeding areas, with harbour seals from Sanday SAC noted to forage from 20km to over 100km from the SAC (however the majority of these will be at the shorter end of the range). Telemetry

studies also do not indicate strong connectivity between the seal tagged at Sanday SAC and the area of the Proposed Development. Therefore, although the development site is not considered widely used by harbour seal from the SAC, it is possible individuals could be present within waters surrounding the development site.

Seals present in the marine environment associated with the Proposed Development, which form part of the SAC population could potentially feed and forage within the bay of Kirkwall. They could be at risk of temporary disturbance from underwater noise associated with the blasting, piling and dredging operations. In addition, seals are also at risk from collision with vessels and a reduction in water quality.

Blasting, dredging, drilling and vibro-piling works will be undertaken during the construction phase. These works are timed to occur during April to October, utilising suitable weather windows during this time. The piling works will be vibro-piling, which is less intrusive than hammer piling. There is proposed dredging works within the footprint of the Proposed Development. The estimated dredge volume is small (approximately 6,700m^3 of sediment). Dredging will be undertaken by a long reach from land. The sediment dredged will be used as infill material reused in the reclamation.. Dredging works will be completed within 20 days for phase 2 and 3 and 35 blasts will occur in total over a 6 month period.

9.1.1 Permanent Threshold Shift (PTS) or Temporary Threshold Shift (TTS)

Construction activities within the marine environment (blasting, dredging, vibro-piling and drilling) will result in underwater noise which can cause injuries and result in a Permanent Threshold Shift (PTS) or Temporary Threshold Shift (TTS) in hearing. Prolonged exposure to underwater noise below the PTS and TTS thresholds can reduce individual fitness as it interferes with individuals' ability to communicate with others, feed and navigate in an effect known as masking. In extreme cases, exposure to high levels of underwater noise can result in death.

Underwater noise modelling (See Seal Risk Assessment in Appendix D) for each construction activity shows blasting activities have short PTS ranges for harbour seals of 77.1m for 1 blast, with TTS ranges up to 354.4m from unweighted SEL levels, with SPL peak from one blast equating to maximum PTS range of 285.2 and TTS range of 425.3m, with an average PTS range of 192.6m and TTS range of 330.4m, which is considered more realistic. Auditory injury may occur to harbour seals within the vicinity of blasting. The charges (holes) for each blast are estimated by the contractor at 27 kg TNT, therefore the worst-case for blasting is based on the accumulation of 10 x 27kg. However, due to the 5-10 second delay between charges, increasing the number of blasts does not increase an animal's exposure and therefore it's risk of auditory injury remains the same should it fail to vacate the area during 1 or more blasts. As the blasting has no slow build-up of noise or soft-start and leaves no time for seals to vacate the area, mitigation will be put in place (as detailed in Section 11) to ensure seals are clear of the area prior to blasting. This would reduce the likelihood of auditory impacts occurring to seals as a result of blasting.

Vibration piling activities also have low acoustic impact upon harbour seals with short risk ranges of PTS and TTS of <50m for 1 hour. The UW noise modelling assumed that there would be active piling maximally 1 hour every 24 hours, when in reality this is the maximum and may likely be reduced. Mitigation via pre-works checks (within a 1.1km mitigation zone) and slow ramp up of vibration piling would ensure seals were clear of works areas ahead of works commencing. Also, it is essential to note, that in other UW noise modelling for similar projects, the potential for instantaneous PTS/TTS has been found to occur as a result of vibration piling, thus, the mitigation measures put in place to ensure seals are clear of the area prior to vibration piling would caveat for this.

The noise from dredging, has short risk ranges for PTS for harbour seal of <50m for 8 hours dredging. There is no acute risk of noise related injury related to the dredging, and seals have time to swim away.

TTS risk ranges present the highest risk of temporary injury to seals ranging from 195.4m (average range) to 287.5m (maximum range) for 8 hours dredging, however, this is only for animals staying close to the activity for extended periods (prolonged exposure). In addition, the figures quoted are conservative (based on cutter suction dredger), whilst in reality dredging activities will be land-based using a long reach excavator during the daylight hours over a 7-10 day period (per phase). It is acknowledged that despite this, seals could still be displaced or actively avoid the area for the duration of the dredging works (disturbance). Therefore, mitigation (as detailed in Section 11) will be implemented to ensure seals are clear of the area prior to dredging and slow ram up of machinery will be implemented.

Although drilling was screened out in the UW noise modelling, as it was not considered loud enough to be meaningfully assessed in an environment with many vessels and general human activity, drilling through hard sediment can be significantly noisy, and given that the drilling will be part of the wider blasting activity and will occur just in advance of the blasting, the noise from drilling will not be dominated by the acoustic impact of the blasting. The modelling suggests that as the modest broadband level for drilling is 156 dB SPL and the typical background noise for Hatston is 107.2 dB SPL, drilling would equate to meaning an increase of <50 dB from baseline, therefore there is no auditory risk to seals from drilling. Although mitigation to be implemented for other methods of works would likely ensure seals were clear of the works area ahead of drilling commencing.

Based on the distance of PTS and TTS ranges it is considered unlikely that harbour seal individuals from the Sanday SAC would be exposed to auditory related impacts associated with noise when within the SAC. However, as stated above, individuals from the SAC may be present within the water surrounding the Proposed Development.

For all of the noise sources, it is considered that the main effects will most likely be temporary displacement of individuals from the waters surrounding the site. It is not considered that the habitat is important for breeding, mating or resting and that there are sufficient alternative foraging areas for them to utilise.

Given the above, it is considered that there would be no adverse effect on the integrity of Sanday SAC.

9.1.2 General Disturbance

General disturbance to seals may occur as a result of the construction works (blasting, dredging, drilling and vibro-piling). The most likely disturbance to seals as a result of the noise related activities include both physiological (increased stress and cortisol levels, rapid heartbeat, increased breathing rate, cold water shock (if on land)) and behavioural disturbance (increased vigilance, crash diving, flipper splashing and vocalisation). Seals are considered to be more easily disturbed when on land. However, due to the distance of the Sanday SAC to the Proposed Development, it is not considered that seals would be disturbed or exhibit behaviours such as tombstoning and stampeding, as the noise levels associated with the works would not extend this far. Therefore, even with works occurring during the main pupping times (between June and July) and moulting (until mid-September) for harbour seal in Orkney this is not considered to result in impacts due to the distance of the SAC and the works area. In addition, it would be less likely that harbour seal would forage great distances from pupping grounds, further reducing likelihood of impacts to seals from the Sanday SAC. However, it is expected that harbour seals would be likely to exhibit a behavioural change as a result of the noise, when in water, predominantly fleeing away from the noise source, with vocalisations and splashing occurring. In addition, physiological stress is likely to also occur. This could impact seals energy and fitness levels through disturbing foraging or causing avoidance of feeding areas for periods of time.

Given the mitigation which will be employed (as detailed in Section 11) and the temporary nature of the works producing underwater noise, and any disturbance which may occur will not fall under the JNCC (2008) definition of significant disturbance. Therefore, it is considered that the SMP will be sufficient to prevent short term negative effects associated with underwater noise related activities during construction to harbour seals.

Quantitative data analysis was undertaken (Appendix D of the Supplementary Environmental Information Report (July 2025): Seal Risk Assessment – Appendix D of this HRA) to try and obtain an indicative numerical value for the number of individual seals that could be subject to general disturbance when at sea, as a result of development activities. The underwater noise modelling used the level B-Harassment criteria to model potential impacts to behaviour for impulsive and non-impulsive sounds. The maximum range is considered to be the worst-case scenario, with the average range considered more realistic. Absolute seal densities from Carter et al 2025 data 'at sea' within these buffers (ranges) were used to determine the maximum number of grey seals that have the potential to be disturbed from non-impulsive (dredging) and impulsive noise (one blasting event) when using the disturbance criteria.

The duration of dredging is expected to take 20 days total (10 days in Phase 2 and 10 days in Phase 3) within a 6 month timeframe, and dredging activities will be land-based using a long reach excavator during the daylight hours therefore the number of seals with potential to be disturbed is likely to be lower than predicted.

It is predicted that non-impulsive sounds (dredging) would result in a maximum range of 5.6km, with and average range of 2.3km. Absolute seal densities from Carter et al 2025 data 'at sea' within these buffers (ranges) were used to determine that a maximum of 42 harbour seals have the potential to be disturbed from non-impulsive noise (dredging) when using the disturbance criteria (worst-case scenario), with actual numbers more likely to reflect those in the average range; 9 harbour seals. The duration of dredging is expected to take 20 days total (10 days in Phase 2 and 10 days in Phase 3) within a 6 month timeframe, and dredging activities will be land-based using a long reach excavator during the daylight hours therefore the number of harbour seals with potential to be disturbed is likely to be lower than predicted.

Impulsive sounds (blasting) were predicted to result in mild disturbance at a maximum range of 6.1km and average range of 1.9km, with strong disturbance predicted at a maximum range of 1.6km and average range of 707m. Absolute seal densities from Carter et al 2025 data 'at sea' within these buffers (ranges) were used to determine that a maximum of 48 harbour seals have the potential to be disturbed from impulsive noise (one blasting event) when using the mild disturbance criteria (worst-case scenario), with actual numbers more likely to reflect those in the average range; 9 harbour seals (due to TTS and PTS ranges being <500m for all activities). In addition, maximum ranges for strong disturbance would only result in 6 harbour seals being impacted. During the 6 months period of works only 35 blasts are to occur, therefore the number of seals with potential to be disturbed is likely to be lower than predicted.

Based on the distance of predicted level B-Harassment maximum ranges, harbour seals are not considered to be directly impacted whilst within the SAC boundary, from auditory related impacts and behavioural impacts associated with noise. However, some behaviour changes may occur (vigilance or avoidance) up to 6.1km (maximum range) (although more realistically 2.3km (average range)) from the development. Although disturbance could occur out to these ranges, it is unlikely that individual seals from the SAC would be spending all of their time in the development area (or maximum range area), if it is returning to SAC up to 50km away and the works to be undertaken are temporary in nature, as such disturbance is likely to be limited.

Blasting, dredging, drilling and vibro-piling works will be undertaken during April to October (6 months). The duration of dredging is expected to take 20 days total (10 days in Phase 2 and 10 days in Phase 3) within this timeframe, and dredging activities will be land-based using a long reach excavator during the

daylight hours. During the 6 months period of works only 35 blasts are to occur and vibro piling is to occur maximally 1 hour every 24 hours over the 6 months (although in reality, this would likely be reduced). The duration of each of the construction method over the 6 month period is considered fairly low and therefore, it is expected that these works will likely have low impacts on the number of seals being disturbed.

Given the mitigation (as detailed in Section 11) which will be employed and the temporary nature of the works producing underwater noise, and any disturbance which may occur will not fall under the JNCC (2008) definition of significant disturbance. Therefore, it is considered that the Seal Mitigation Plan (SMP) will be sufficient to prevent short term negative effects associated with underwater noise related activities during construction to harbour seals.

Given the above, it is considered that there would be no adverse effect on the integrity of Sanday SAC.

9.1.3 Vessel Movements

Impacts associated with disturbance from increased vessel movements will be temporary during construction, with the increase being relatively small, and it is considered that seals utilising waters around the site will be somewhat habituated to vessel activity associated with the existing Hatston pier and those in the wider Bay of Kirkwall.

The construction phase of the development will only require a small number of vessels that will be of consistent size, speed and operating procedure. This can result in seal collision risk associated with the Hatston development activities. The likelihood of vessel collisions is therefore dependent upon vessel speed, animal behaviour and vessel manoeuvrability[6]. Vessels travelling at slower speeds in general can allow time for seals and vessel operators to react to avoid collisions.

However, the Hatston pier is within a highly trafficked area for vessels, with designated vessel routes being in place and as the development is an extension for the existing pier, it is considered that seals utilising the waters within this area would likely avoid or be accustomed to the regular movements of vessels and thus the likelihood of vessel strike may be lower. Vessel movements associated with construction activities will be fairly self-contained only moving approx. 10m, within the development footprint per day, with no need to extend into existing navigational channels, further reducing the likelihood of vessel impacts on seals.

At Hatston, most of the material (rock etc) required for the development will be transported via the road network. There will only be a small volume of vessel movements, as it is anticipated that the majority of materials will be brought by land from sites within Orkney Mainland. Rock armour import will consist of two shipments at start and halfway through contract, therefore 8 vessel movements in total. These vessel movements will be following existing shipping routes, with no new/novel routes being utilised. Sheet piles and any other material that cannot be sourced on the mainland will be imported through the existing Orkney Northlink freight services, so there will be no increase to current vessel movement baseline levels to deliver these. As described in section 3.3.7, the existing baseline for vessel movements into and out of Hatston annually is 1026. An increase in 8 vessel movements during the construction phase represents an increase of 0.7%.

Dredging will not require any vessel movements, with a long reach excavator being used from land. Vessels involved with blasting, piling and drilling will include a small barge, small workboat / crew transfer boats and workboat barge with crane, with all vessels only moving approx. 10m, within the development

[6] SEER U.S. Offshore Wind Synthesis pf Environmental Effects Research: Presence of Vessels: Effects of Vessel Collision on Marine Life (2022): https://tethys.pnnl.gov/sites/default/files/summaries/SEER-Educational-Research-Brief-Effects-of-Vessel-Collision-on-Marine-Life.pdf

footprint per day, with no need to extend into existing navigational channels. Vessel operations are therefore self-contained to and from shore base further reducing the likelihood of vessel impacts on seals.

The Hatston pier is within a highly trafficked area for vessels, with designated vessel routes being in place and as the development is an extension for the existing pier, it is considered that seals utilising the waters within this area would likely avoid or be accustomed to the regular movements of vessels and thus the likelihood of vessel strike may be lower. Vessel movements associated with construction activities will be fairly self-contained only moving approx. 10m, within the development footprint per day, with no need to extend into existing navigational channels, further reducing the likelihood of vessel impacts on seals. By using these existing routes, and adhering to accepted speed limits, and the implementation of a vessel management plan none of these potential disturbance effects will result in significant disturbance to grey seals. If there is some displacement from areas of high activity, it is considered that there is sufficient alternative habitat for foraging and commuting and so there is unlikely to be an effect on the conservation status of populations of Sanday SAC.

Given the above, it is considered that there would be no adverse effect on the integrity of Sanday SAC.

9.1.4 Pollution and Sedimentation

As outlined in section 4.5.3, in Volume 1 of the EIAR, the marine deposits within the dredge area comprise of loose to medium dense sands and gravels occasionally with cobbles interspersed with layers of sandy gravelly clay. Dredged material will be used as fill within the reclaimed areas.

Given the relatively coarse nature of the dredge budget, small proposed dredge volume, and the weak tidal currents within the vicinity of the proposed dredge pockets, it is considered that any plumes generated as a result of the dredging works and their reuse in the reclamation will be very localised and short term in duration. Overall, it is considered that prior to mitigation the magnitude of impact of sediment discharge and dispersion from dredging works will be low within the immediate dredge area, and negligible out with this area, thus maintaining the supporting habitats for harbour seal.

Drainage designs to ensure that there are no untreated surface water discharges directly to surrounding coastal waters and the use of a silt booms during land reclamation works will mitigate against pollution spills which could affect the qualifying interests of the SAC and their prey sources. In terms of water pollution from the quay and attendant vessels, adherence to strict Pollution Prevention controls will aim to prevent the release of pollutants to the water environment. With these measures in place, the supporting habitats for harbour seal will be maintained.

Given the above, it is considered that there would be no adverse effect on the integrity of Sanday SAC.

10 IN COMBINATION EFFECTS

It is a requirement of Appropriate Assessment that the cumulative or in-combination effects of the proposed development together with other plans or projects are assessed. Cumulativeimpacts can be defined as a project/plan/programme likely to have a significant effect thereon, either individually or in combination with other plans or projects. In- combination effects associated with the construction phase only were considered. It was agreed in- combination operational impacts would be considered as a separate assessment, as the project details developed [7].

In order to adequately assess in-combination effects, a thorough search of both the MD-LOT marine licensing portal and the Orkney Islands Council planning applications portal. By default, all aquaculture sites within North Orkney SPA are included, regardless of time since the application was decided. In addition, aquaculture sites elsewhere in Orkney that could cause impacts to the qualifying features of Sanday SAC are also included. Given that harbour seals can travel up to 50km from haul out and pupping sites, a 50km radius was used for determining projects to screen for in-combination assessment. The MD-LOT portal does not have a map search feature to enable a quick search for marine licence applications within this distance, so best judgement based on site names and project descriptions was made.

For other development sites, a search of both planning portals for developments since 2022 was undertaken and a determination made whether to screen them in or out for assessment. Projects were screened out if there was no information on project specifics such as impacts or adverse effects on SPA/SAC qualifying features or if projects were deemed to have been completed (ie marine licence expiry).

Table 10.1 below details the sites taken forward for in-combination effects and provides information and predicted impacts on designated sites.

In isolation, with mitigation, the Proposed Development will not have an adverse impact on the integrity of the designated sites assessed. From a review of the other projects assessed as part of this process, no significant impacts are predicted. Therefore, it is considered highly unlikely that the Proposed Development would contribute cumulatively to adverse effects on the integrity of these designated sites.

[7] Agreed during design team meeting with NatureScot 19th December 2024.

Table 10.1: Summary table of in-combination effects

Project (Distance to Proposed Development)	Local Authority and Ref No.	Applicant	Status / Decision	Project Details	Discussion and Conclusion
Scapa Deep Water Quay	Orkney Islands Council 23/256/NATEIA Supplementary Environmental Information submitted	Orkney Islands Council Harbour Authority	Awaiting Decision	Construct a deep water quay including 597 metre, 2.7 hectare quayside and quay extension, excavate landform and reclaim land to create an 18 hectare laydown including rock armour revetments, construct an access road, vehicle parking, water tanks and associated infrastructure	It has been predicted that there will be no adverse effect on site integrity with regards to Scapa Flow SPA, North Orkney SPA and Sanday SAC. **As such, there will be no in-combination effects.**
Meil Bay Fish Farm	Orkney Islands Council 24/294/MAR	Cooke Aquaculture	Awaiting Decision	Create salmon farming site comprising of 16 x 100 metre circumference circular cages, with pole mounted top nets, underwater lighting, and 300 tonne capacity automated feed barge (replacement of existing equipment)	There is no information given on the numbers of birds that could be impacted from this development, however, NatureScot concluded that there would not be an adverse effect on the integrity of North Orkney SPA and its qualifying features. Therefore, there would be no cumulative effects in combination with the Proposed Development. **As such, there will be no in-combination effects.**
Kirk Noust Fish Farm	Orkney Islands Council 24/204/MARPN	Cooke Aquaculture	Consented	Install pole mounted top nets to replace hamster wheel nets	NatureScot concluded that the proposal is likely to have a significant effect on the great black-backed gull of Calf of Eday SPA and Copinsay SPA, the arctic skua and kittiwakes of Rousay SPA and on gannets of a selection of SPAs. However, if the proposal is carried out strictly in accordance with the following mitigation, our conclusion is that the proposal will not adversely affect the integrity of the site.

Project (Distance to Proposed Development)	Local Authority and Ref No.	Applicant	Status / Decision	Project Details	Discussion and Conclusion
					With regards to North Orkney SPA, NatureScot concluded that it is unlikely that the proposal will have a significant effect on any qualifying interests either directly or indirectly. An appropriate assessment is therefore not required. With regards to Sanday SAC, NatureScot concluded that it is unlikely that the proposal will have a significant effect on any qualifying interests either directly or indirectly. An appropriate assessment is therefore not required. The Proposed Hatston Logistics base will not have an impact on breeding Gannet SPAs nor Calf of Eday, Copinsay and Rousay SPAs. Given NatureScot's comments on North Orkney SPA and Sanday SAC there will also be no in-combination effects with regards to North Orkney SPA or Sanday SAC. **As such, there will be no in-combination effects.**
Bay of Vady, Rousay Sound Fish Farm	Orkney Islands Council 24/308/MARPN		Consented	Install pole mounted top nets to replace hamster wheel nets and amend mesh size	NatureScot concluded no adverse impact on SPA with breeding Gannet as a qualifying feature due to adoption of ceiling mesh dimensions of 100mm or less. Concluded unlikely that the proposal will have a significant effect on any qualifying features of North Orkney SPA either directly or indirectly. Concluded that with specific mitigation, there would not be an adverse effect on the integrity of Calf of Eday SPA and Copinsay SPAwith regards to Great Black-backed Gull.

Project (Distance to Proposed Development)	Local Authority and Ref No.	Applicant	Status / Decision	Project Details	Discussion and Conclusion
					The Proposed Hatston Logistics base will not have an impact on breeding Gannet SPAs nor Calf of Eday and Copinsay SPAs. Given NatureScot's comments on North Orkney SPA, there will be no in-combination effects with regards to North Orkney SPA. **As such, there will be no in-combination effects.**
Puldrite Fish Farm	Orkney Islands Council 23/182/MARPN	Scottish Sea Farms	Unknown	Replace 10 x 80metre circumference cages with 7 x 100 metre circumference cages	NatureScot consider that given it is a replacement of cages of smaller size, it is unlikely that the proposal will have a significant effect on any qualifying interests either directly or indirectly. An appropriate assessment is therefore not required. **As such, there will be no in-combination effects.**
Veantrow Bay, Shapinsay Orkney Fish Farm	Orkney Islands Council 24/423/MARMAJ	Scottish Sea Farms	Awaiting Decision	Create salmon farming site comprising of 12 x 140 metre circumference circular cages in a 100 metre mooring grid, with pole mounted top nets, underwater lighting, and 250 tonne capacity automated feed barge (replacement of existing equipment)	NatureScot request further information with regards to disturbance and displacement and habitat loss to qualifying features of North Orkney SPA. This information is not currently available. **Without information and data, it is not possible to a undertake an assessment of in-combination effects.**
Noust Geo Fish Farm	Orkney Islands Council 14/202/MAR	Scottish Sea Farms	Consented	Install 12 x 100m circumference cages with feed barge (to replace existing fish farm cages at Noust Geo (Backaland) and at Kirk Taing)	NatureScot concluded it was unlikely that the proposals will have a significant effect on the seal qualifying interests Sanday SACs, either directly or indirectly. An appropriate assessment is therefore not required. Given NatureScot's comments on Sanday SAC, tThere will be no in-combination effects with regards to Sanday SAC.

Project (Distance to Proposed Development)	Local Authority and Ref No.	Applicant	Status / Decision	Project Details	Discussion and Conclusion
					As such, there will be no in-combination effects
Bay of Holland Fish Farm, Stronsay	Orkney Islands Council	Cooke Aquaculture	Consented	Create salmon farming site comprising of 16 x 100 metre circumference circular cages arranged in a 2 x (2 x 4) formation with a 70 metre grid, with a 300 tonne capacity semi-automated feed barge	Already constructed so now forms part of baseline conditions. NatureScot concluded it is unlikely that the proposal will have a significant effect on any qualifying interests of Sanday SAC or Fray and Holm of Faray SAC either directly or indirectly. An appropriate assessment is therefore not required. Given NatureScot's comments on Sanday SAC and Faray and Holm of Faray SAC, there will be no in-combination effects with regards to Sanday SAC. **As such, there will be no in-combination effects**
Wyre Fish Farm, Gairsay Sound	Orkney Islands Council 23/183/MARPN	Scottish Sea Farms	Unknown	Replace 12 x 100metre circumference cages with 9 x 120 metre cages, install pole-supported top nets and reposition a feed barge	NatureScot concluded no adverse effect on Sanday SAC. The proposed Predator Exclusion Plan includes the appropriate measures to prevent and reduce any risk of entanglement to seals as a result of predation. Measures include appropriate mesh size and strength for the site, and also sufficient tensioning with the use of net weights. Suitable monitoring of the site has been proposed to ensure equipment is maintained and seal interactions are monitored and reported. Given NatureScot's comments on Sanday SAC, and the lack of information relevant to assess against the Proposed Develpoment, tThere will be no in-combination effects with regards to Sanday SAC.

Project (Distance to Proposed Development)	Local Authority and Ref No.	Applicant	Status / Decision	Project Details	Discussion and Conclusion
					As such, there will be no in-combination effects
Quanterness Fish Farm	Orkney Islands Council 24/216/MAR	Cooke Aquaculture	Awaiting Decision	Create salmon farming site comprising of 14 x 120 metre circumference circular cages, with pole mounted top nets, underwater lighting, and 200 tonne capacity feed barge (replacement of existing equipment	No HRA available on planning portal at time of search (June 2025). NatureScot advice was for further information with regards to impacts to North Orkney SPA qualifying features to determine any adverse effect. NatureScot concluded no adverse effect on the integrity of Sanday SAC. **Given NatureScot's comments and the lack of available information and data with regards to qualifying features of the North Orkney SPA, it is not possible to a undertake an assessment of in-combination effects**
Quanterness (Land Near) St Ola, Orkney	Orkney Islands Council 20/037/TPPMAJ	Orkney's Community Wind Farm	Currently awaiting decision – called in by Scottish Government	Erect 6 wind turbines (maximum height 149.9m, maximum wind capacity 50MW), erect a meteorological mast (maximum height 90m) and a substation, create an access and construct access tracks, and associated infrastructure.	The ornithology assessment highlights that no SPA species were present within the site boundary, and that the area is unsuitable for nesting Red-throated Diver. No impacts on designated sites are concluded. **As such, there will be no in-combination effects**
Faray Wind Farm	Orkney Islands Council 21/240/TPPMAJ	Orkney's Community Wind Farm	Awaiting Decision	Erect 6 wind turbines (maximum height 149.9 metres, maximum wind farm capacity 50MW), erect a meteorological mast (maximum height 90 metres) and a substation, construct access tracks, crane hardstandings, underground cabling, transformers, and a slipway and jetty, create a borrow pit, and associated infrastructure	No impacts on qualifying features of North Orkney SPA. Mitigation measures are required to avoid impacts to qualifying features of Faray and Holm of Faray SAC and Sanday SAC, including timing of construction works, construction method statements, and JNCC protocols for offshore piling activities. If there is strict adherence to mitigation measures, no

Project (Distance to Proposed Development)	Local Authority and Ref No.	Applicant	Status / Decision	Project Details	Discussion and Conclusion
					adverse effect on Faray and Holm of Faray SAC and Sanday SAC. Given NatureScot's comments with regards to North Orkney SPA, there would be no in-combination effects on North Orkney SPA There is no information relevant to assess against the Proposed Development with regards to seals. However, given NatureScot's comments on no adverse impacts on site integrity for Sanday SAC and Faray and Holm of Faray SAC, and given that the Proposed Development at Hatston will not result in adverse impacts on site integirty **there will be no in-combination effects**
Stymilders/Heddle Hill (Land Near), Firth, Orkney	Orkney Islands Council 19/113/NATEIA	Scottish and Southern Energy Networks (SSEN)	Consented subject to conditions.	Erect a 220/132kV substation comprising platform area, electrical infrastructure and buildings, associated plant, ancillary infrastructure, drainage, landscaping, access road and temporary construction compound areas	Agreed by NatureScot that there is no connectivity between this development and Orkney Mainland Moors SPA. The Proposed Hatston Logistics Base Development would not result in adverse effects on the integrity of the Orkney Mainland Moors SPA. **As such, there would be no in-combination effects**
Kirkwall Pier	Orkney Islands Council 20/240/SCR		At screening stage	Extend a pier to provide additional quay infrastructure, reclaim land to create a mixed-use development, and reconfigure and expand marina	Currently at screening stage so no assessment information available.

11 MITIGATION

The following mitigation will be employed to avoid and minimise any impacts occurring both during the construction and operational phases of the proposed development:

- Production of a Vessel Management Plan for both the Construction and Operational phases which will detail vessel routes, speeds etc to minimise, and where possible, avoid any disturbance impacts;
- Adherence to measures set out in the Construction Environmental Management Document (CEMD);
- Deployment of an ornithologist and marine mammal observer to monitor for the presence of qualifying species of the North Orkney SPA, Orkney Mainland Moors SPA (Red-throated Diver) and cetaceans and pinnipeds (in particular harbour seal) in the vicinity of the Proposed Development during piling, blasting and dredging works;
- A soft-start approach to piling works to prevent disturbance;
- Undertake a pre-works search within a pre-determined mitigation zone for seals of 1km for blasting and 1.1km for dredging and piling (see bullet points below for details).
- Production and adherence to detailed Seal Mitigation Plan (SMP) which includes:
    - A standard marine mammal observer (MMO) protocol as per JNCC guidance to be implemented during operations in optimal sea states less than 4 and during times of optimal visibility.
    - The Seal Observation Protocol (SOP) will be implemented so that the blasting, vibration piling and dredging works do not cause injury or unnecessary disturbance to seals.
    - A suitably qualified MMO, competent in the identification of seals at sea, will be present during the blasting, vibration piling and dredging. The MMO will undertake observation for seals within the mitigation zone before and during the blasting, vibration piling and dredging and will be dedicated to that one task for the duration of any watch. The MMO will advise the contractors and crews on the implementation of the procedures set out in the agreed protocol, to ensure compliance with those procedures.
    - A formal chain of communication from the MMO to the contractor, who will start/stop piling, dredging or halt blasting will be established.
    - The mitigation zone (pre-agreed radius) around the blasting, dredging or piling site prior to any works, is the area where a MMO keeps watch for seals (and delays the start of activity should any seals be detected). The MMO should be located on the most appropriate viewing platform to ensure effective coverage of the mitigation zone. The radius of the mitigation zone should be 1km for blasting and 1.1km dredging and piling to cover the PTS and TTS ranges of these activities. The greatest PTS and TTS ranges for seals equate to 285.2m for blasting and 425.3m for dredging. However, based on JNCC guidance, the mitigation zone for blasting is defined as the full extent within which auditory injury (PTS) could occur or a 1km radius, whichever is larger. Therefore, a 1km mitigation zone for blasting should be implemented (as greatest PTS value is 285.2m). As the MMO should take into consideration all marine mammals when undertaking the pre-works search within the mitigation zone, the radius of the mitigation zone for dredging and vibration piling should be 1.1km to account for the greatest average TTS range of marine mammals.
    - Should the mitigation zone need to be changed during the works this must be agree with statutory bodies before being implemented.
    - Blasting, piling and dredging will not commence during poor visibility (such as fog) or potentially during periods when the sea state is not conducive to visual mitigation (above

sea state 3 is considered not conducive[8]) as there is a greater risk of failing to detect the presence of seals. An elevated platform for the MMO to monitor from would be beneficial when the sea state is 3 or above, the blasting, piling and dredging works could also be scheduled on a day where the sea is expected to be calm.

- At least 30 minutes before any type of piling/ dredging and 1 hour before detonation works, a visual watch, should be carried out in the mitigation zone. The pre-works search should continue until the MMO advises that the mitigation zone is clear of seals, and the detonation/ piling/ dredging works can start.
- Explosive detonations, vibratory piling or dredging should not be undertaken within 20 minutes of a seal being detected within the mitigation zone.
- If a seal is observed, or acoustically detected, within the mitigation zone, it should be monitored and tracked until it moves out of range. The MMO should notify the relevant chain of command of the detection and advise that the operation should be delayed. If the seal is not detected again within 20 minutes, it can be assumed that it has left the area and the works may commence.
- If an MMO is uncertain whether seals are present within the mitigation zone, they should advise that the activity should be delayed as a precaution until they are certain that no animals are present.
- A soft-start will be employed for dredging/ piling, with the gradual ramping up of works (where possible)[9]. The soft-start duration will be a period of not less than 20 minutes. This will allow for any seals to move away from the noise source.
- If a seal enters the mitigation zone during the soft-start then, whenever possible, the dredging/piling operation will cease until the seal exits the mitigation zone and there is no further detection for 20 minutes.
- The MMO or Ecological Clerk of Works (ECoW) should periodically check the silt boom to ensure that no seals have been enclosed or interacted with the boom during works.

- Production and adherence to a detailed Pollution Prevention Plan;
- A silt boom to contain fine sediments will be used whilst reclamation work activities are undertaken.

[8] Detection of marine mammals decreases as sea state increases. According to the JNCC guidance ideally sea states of 2 or less are required for optimal visual detection.
[9] Soft-start procedures are only relevant for equipment which have this capability, and which have the potential to cause instantaneous PTS, otherwise this procedure extends the time of unnecessary emitted noise into the environment.

APPENDICES

A NAVIGATIONAL RISK ASSESSMENT

MARICO MARINE GLOBAL MARITIME EXPERTISE

ORKNEY ISLANDS COUNCIL

HATSTON PIER DEVELOPMENT NRA



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EXECUTIVE SUMMARY

This Navigation Risk Assessment report has been prepared by Marine and Risk Consultants Limited for Orkney Islands Council to support the proposed re-development of Hatston Pier, Kirkwall, within the Orkney Islands Statutory Harbour Authority Area.

This Navigation Risk Assessment references the Orkney Islands Council Safety Management System, which aims to enhance safety within the Harbour Authority area by ensuring that all marine navigation hazards are identified, control measures are in place, and levels of risks are acceptable.

In order to support the consenting process for this large project, a full Navigation Risk Assessment considering the effects of both the construction and operation phases of the new jetty has been undertaken, and the results of the assessment will be used to update Orkney Island Council's Port Marine Safety Code assessment in due course.

The assessment was undertaken following the collation of detailed input data including information about the project methodology, current vessel traffic densities, historic incident rates in the project area and, importantly, comprehensive stakeholder input.

It was established that both existing and anticipated future traffic levels will be relatively low, and that conflicts between different harbour users are also likely to be low. Historic incident rates are low and indicated that the likelihood of hazards occurring in the future would also be low.

Nevertheless, 50 potential hazards were identified during the project construction phase, and 38 during operation. All of these have been assessed in accordance with the International Maritime Organization Formal Safety Assessment methodology for risk assessments.

No hazards were assessed to be in the High Risk or Significant Risk band for either the construction or operation phase of the project.

For the construction phase, six of the 50 hazards were assessed to be within the ALARP band, with risk scores between 4.3 and 4.56. This is in the lower band of the ALARP region; however, efforts should nonetheless be made to reduce this risk further, based on the cost-effectiveness of implementing additional risk control measures.

For the operation phase, five of the 38 hazards were assessed to be within the ALARP band.

This assessment has concluded that there is little significant new navigational risk associated with either the construction or operation of the proposed Hatston Pier redevelopment.

The project site is located in an area of relatively low present day traffic density (albeit with significant seasonal variations), and which is already subject to numerous effective risk control measures (VTS, Pilotage, Towage, etc). As a result of both of these factors, incident frequency is also low.

There will be an inevitable increase in navigation risk through the introduction of a new structure, generating an increased volume of traffic. However, the increase in risk is low, on top of an already low baseline.

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ABBREVIATIONS

Abbreviation	Detail
AIS	Automatic Identification System
AToNs	Aids to Navigation
COLREGs	Convention on International Regulations for Preventing Collisions at Sea
CPA	Closest Point of Approach
CMR	Construction Monitoring Report
DML	Deemed Marine Licence
DWR	Deep-Water Route
KWh	Kilowatt-hour
IMO	International Maritime Organization
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
LOA	Length Over-All
m	Metre
MAIB	Marine Accident Investigation Branch
Marico Marine	Marine and Risk Consultants Ltd
MCA	Maritime and Coastguard Agency
MGN	Marine Guidance Note
MMO	Marine Management Organisation
nm	Nautical Mile
NRA	Navigation Risk Assessment
NtM	Notice to Mariners
OIC	Orkney Islands Council
OICHA	Orkney Islands Council Harbour Authority
RCM	Risk Control Measures
SHA	Statutory Harbour Authority
SMS	Safety Management System
SOLAS	Safety Of Life At Sea
TSS	Traffic Separation Scheme
VHF	Very High Frequency
VMS	Vessel Monitoring System
VTS	Vessel Traffic Study

1 INTRODUCTION

This Navigation Risk Assessment (NRA) report has been prepared by Marine and Risk Consultants Limited (Marico Marine) for Orkney Islands Council (OIC) to support the proposed re-development of Hatston Pier, Kirkwall, within the Orkney Islands Statutory Harbour Authority (SHA) Area.

This NRA references the OIC Safety Management System (SMS), which aims to enhance safety within the Harbour Authority area by ensuring that all marine navigation hazards are identified, control measures are in place, and levels of risks are acceptable. In particular, reference is made to the NRA undertaken on behalf of OIC by Marico Marine for the Kirkwall SHA area (Report 15UK1073_NRA_Kirkwall_OIC_Issue01, 30 December 2015).

1.1 BACKGROUND AND SCOPE

The Port Marine Safety Code (PMSC)[1] establishes a national standard for every aspect of port marine safety and aims to enhance safety for those who use or work within ports, their ships, passengers and the environment. The PMSC applies to all harbour authorities in the UK that have statutory powers and duties.

The PMSC promotes the principle that all harbour authorities shall base their policies and procedures relating to marine operations on a formal identification of hazards and assessment of risk to marine operations. They shall maintain an SMS based on a formal navigational risk assessment, and any subsequent supporting risk assessments deemed necessary as the SMS develops and evolves over time as a result of changing trade and harbour usage.

The development of the proposed new facility is clearly a change in trade and usage warranting a review of the existing NRA. However, in order to support the consenting process for this large project, a full NRA considering the effects of both the construction and operation phases of the new jetty has been undertaken, and the results of the assessment will be used to update OIC's PMSC assessment in due course.

It should be noted that this assessment **only** considers the impact of the project on navigational safety, through assessing risks to vessels navigating in the project area. Other impacts of the project (for example on the land and marine environments) are being assessed separately as part of the consenting process.

This new NRA complies with the PMSC and its associated Guide to Good Practice[2], and was conducted in accordance with the International Maritime Organization (IMO) Formal Safety Assessment (FSA) methodology for risk assessments. It comprises the following four stages:

- Stage 1: Data Gathering and Vessel Traffic Analysis;

[1] Port Marine Safety Code, Department for Transport, November 2016

[2] A Guide to Good Practice on Port Marine Operations, Prepared in Conjunction with the Port Marine Safety Code, DfT, February 2018

- Stage 2: Hazard Identification;
- Stage 3: Risk Assessment; and
- Stage 4: Identification of Risk Control Measures.

The Kirkwall SHA area (from the 2015 NRA) is shown in **Figure 1**.

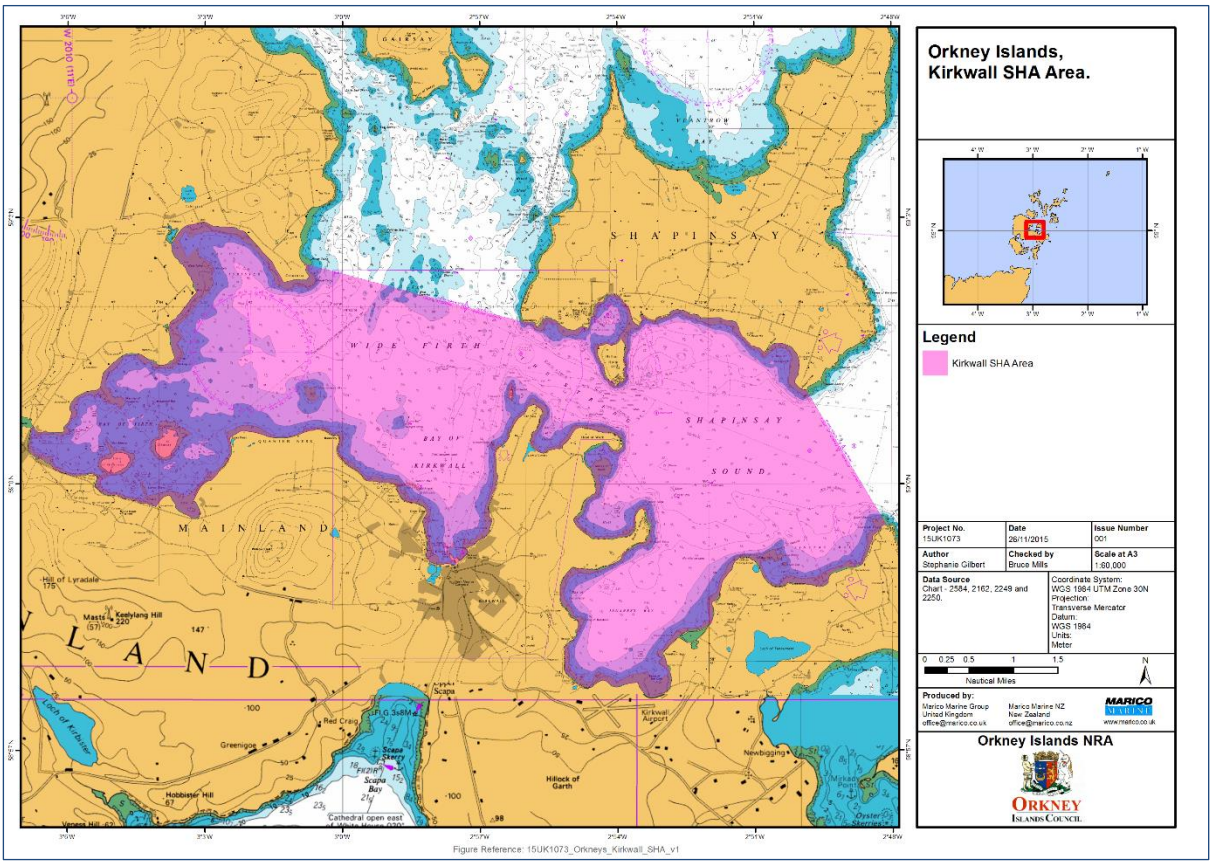


Figure 1: Kirkwall SHA Area.

1.2 PROJECT DESCRIPTION

OICHA, the Orkney Islands Harbour Authority, has published the "Orkney Harbours Masterplan Phase 1"[3]. This plan has identified "*a structured framework for the physical development and transformation of Orkney's harbours over a 20-year period*". The Orkney Harbours Masterplan Phase 1 comprises proposals at six harbour locations, one of which is Hatston Pier situated near Kirkwall.

The following project description is taken from the Masterplan:

"Hatston Pier and Terminal is Orkney's primary commercial terminal and link south to Aberdeen and north to Shetland.

[3] OIC Master Plan March 2020 https://www.orkneyharbours.com/masterplan

This multi-purpose infrastructure has been hugely successful in accommodating a range of operational activities including the largest cruise ships, renewable energy, ferries, oil and gas and cargo/livestock.

The plan for Hatston is focussed on reducing conflicts between users and operational activity and enabling growth across a range of economic sectors. Seasonal lack of availability of berths due to cruise with a resultant year-round constraint on other vessel use would be resolved and the plan also considers how freight and traffic can be handled more efficiently and effectively.

Core proposals comprise a significant extension to the existing pier and expansion of landside area through reclamation to futureproof availability of sufficient land for harbour operations.

The existing outer quay would be extended by 300m (with water depth of -10m CD) and there would be a 125m inner berth. There will be substantially more quayside available both for the existing pier and the extension.

Circa 7.5 hectares of additional land would be made available for harbour-related operations through reclamation. There will also be an ex-pipe fuel supply and fuel storage facility in close proximity to the pier.

This new infrastructure will be able to accommodate a range of activities across several sectors.

As noted earlier, the design of new infrastructure here will be futureproofed so as to accommodate future provision and storage of alternative (less polluting/carbon-free) fuels and provision of shore power to smaller vessels where viable".

An artists impression and proposed layout of the project are given in **Figure 1** and **Figure 2** below.



Figure 2: Artist's Impression of Proposed Pier and Landside Infrastructure.

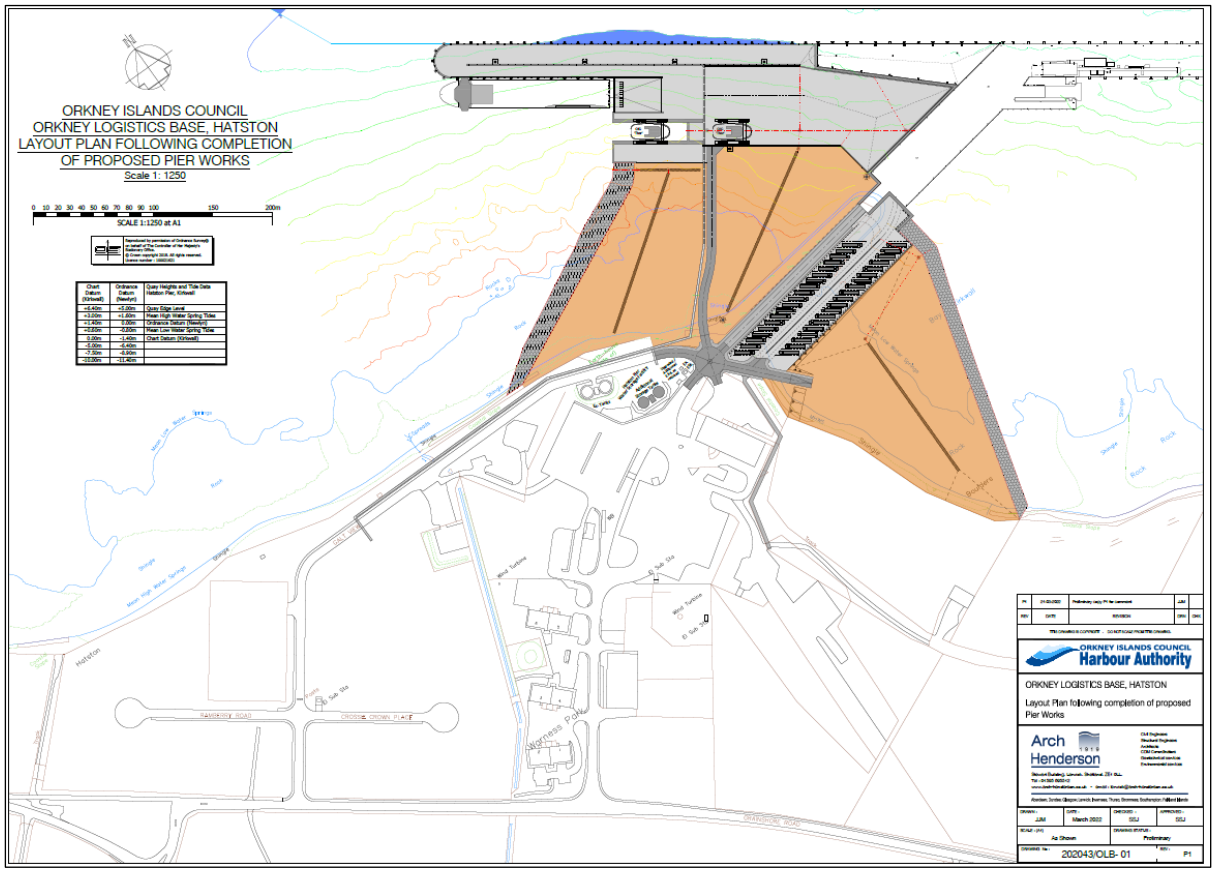


Figure 3: Hatston Pier Site Layout.

2 DATA GATHERING

In order to inform the new NRA, the following sources of data were referenced to inform the NRA process:

- A review of the design and location of the enlarged jetty, along with assessment of the volume and type of additional marine vessel traffic that is anticipated to use the facility;
- A review of existing vessel traffic in the immediate vicinity of the study area. (Using the most recent data available, noting that, although regularly reviewed, the PMSC NRA is now 8 years old);
- Review of available navigational incident data for the project area; and
- Consultation with marine stakeholders to verify traffic analysis, and incident data.

2.1 PROJECT ASSESSMENT

While the overall detailed project design is still in the early stages, the exemplar design is now well established for Orkney Logistics Base (Hatston) and the anticipated timetable[4] for works will be:

- Phase 1 is likely to be tendered late in 2023 or early 2024 with the Phase 1 project on site in 2024, assuming planning and marine licence can be obtained. Phase 1 shall be operational by 2025 with the aim of supporting the existing operations at Hatston, particularly the lifeline freight and passenger ferry services; and
- Phase 2 and Phase 3 are not likely to be undertaken until 2027. Phase 2 and Phase 3 are to be solid sheet pile wall structures with substantial areas (7 hectares) of land to be reclaimed across the three phases.

2.2 PROJECT RELATED VESSEL TRAFFIC

2.2.1 Construction Phase

Until tenders are issued for construction works, the type and volume of vessel traffic associated with the construction of the new facility is unknown. However, it would be reasonable to assume that much of the construction activity will be from landward.

Whilst OIC cannot predict the working methods of the Contractor, nor any future planning issues / restrictions with designated quarry sources, they would anticipate all fill material except for rock armour to come from Orkney-based resources via land.

The only other construction vessels imports would be one or two cargo vessels delivering steel piles and approximately 4 to 5 cargo rock carrying vessels delivering imported rock armour stone from mainland UK or more likely Norway or another Scandinavian neighbour.

[4] Source: OIC Marine Department, email communication.

2.2.2 Operational Phase

Traffic volumes during operations will be very dependent on the ultimate commercial users of the new facility, and the success of the project in attracting such users to the facility. However, the economic predictions for the new quay have been made on the following assessment of likely marine traffic (**Figure 4**), once operational, and these numbers have been used during the assessment of navigational risk during the operational phase of the new facility.

Hatston Pier – vessel calls and movements

The proposed enhancements at Hatston Pier are intended to attract more activity to the harbour, excluding cruise.

With the new extension and additional land available it is envisaged that additional oil supply vessels would call at Hatston and that there would be additional oil and gas activity onshore also. The Outline Business Case assumes that there could be around 80 oil supply vessel calls annually by 2035 and thereafter in the Base Case. These would be PSVs (3,104 GT) and SSVs (1343 GT), similar to what operates in ports such as Aberdeen.

In terms of offshore wind it is envisaged that Hatston will be the main centre for Operations & Maintenance activity from 2028 onwards. It is estimated that there would be an SOV calling fortnightly at Hatston.

There will be an opportunity for a boat repair facility to be developed at Hatston. There would then be boats calling at Hatston to use this repair facility. Whilst no market analysis has been undertaken a broad assumption could be stated that up to 80 vessels use this facility per year. Assume that this builds up over time and is constant from 2032 onwards.

With a new deep water berth it is envisaged that larger freight vessels could call at Hatston- with a forecast of 20 additional calls per annum in the Base Case.

In terms of pilotage and towage there is likely to be no additional requirement at Hatston.

There may be an opportunity to develop an aquaculture processing facility adjacent to Hatston Pier with some form of infrastructure that would enable well boats to bring live or dead fish which would be pumped by pipe into the processing facility. Thus there would be well boats travelling between fish farm sites around the North Isles and Hatston Pier – up to 150 calls per annum. As yet there are no plans for such a facility and further discussion with the aquaculture companies are required to ascertain if this could be a real project.

Type of vessel	Vessel calls	Vessel movements
Cruise	No change	No change
Oil & gas supply	+60	+120
Offshore wind	+24	+48
Freight / Cargo	*+20*	*+40*
Boat repair	+80	+160
Aquaculture	+150	+300
Total additional calls & movements	*334*	*668*

FUTURE VESSEL CALLS AND MOVEMENTS

Figure 4: Vessel Movement Information (Source OICHA).

Total numbers of traffic movements generated are relatively small in relation to existing traffic density, and this has been taken into consideration during the operational phase NRA.

2.3 VESSEL TRAFFIC ANALYSIS

A full understanding of vessel traffic in the project area is an important and integral part of the NRA and therefore the following tools / techniques have been used to analyse the vessel traffic, including the traffic profile (i.e. numbers and types), traffic density and traffic routes:

- Traffic Plots;
- Traffic Density Analysis; and
- Gate Analysis.

2.3.1 Vessel Categories

Kirkwall Bay is used by a wide variety of commercial and recreational vessels, and it comprises a number of distinct areas, each with different geographic and operational characteristics. The following vessel type categories (**Table 1**) were identified during the 2015 NRA and have been retained for consistency. For the purposes of this assessment, a new category (I) of Construction Vessels has been added to the 2015 list.

Table 1: Vessel Categories.

Ref	Vessel Type Category	Including
A	Cruise Ship	All cruise ships.
B	Inshore Fishing Vessel	Trawler, Creel / Potter.
C	Inter-Island Ferry	Inter-Island Ferry.
D	Large Commercial Vessel	General Cargo, Product Tanker, Large Offshore Support Vessel Inc. ETV, Offshore Fishing Vessel (not fishing in the harbour area). (Military; Cable Layer; Buoy Laying).
E	Mainland Ferry	NorthLink Ferries (freight and passenger)
F	Recreational Vessel	Sailing Yacht, Motor Yacht, Sailing Dinghy, Rigid Hull Inflatable Boat (RHIB), Personal Watercraft (PWC) including kayaks and rowing boats.
G	Small Commercial Vessel	Fish Farm Service Vessel, General Workboat, Harbour Launch, Offshore Renewables Vessel, Diving Support Boat, Pilot Boat, Agent Launch, Small Passenger Vessel (≤12 passengers), Cruise Ship Tender, Law Enforcement Vessel.
H	Towage Vessel	Towage Tug, Escort Tug.
I	Construction vessels	Barges, jack ups, dredgers, aggregate delivery vessels and associated workboats.

2.3.2 Study Area

The 2015 NRA considered the SHA area shown in **Figure 1**. However, for this project the area shown in **Figure 5** has been considered to capture the full navigational activity in the vicinity of, and approach to Hatston Pier.

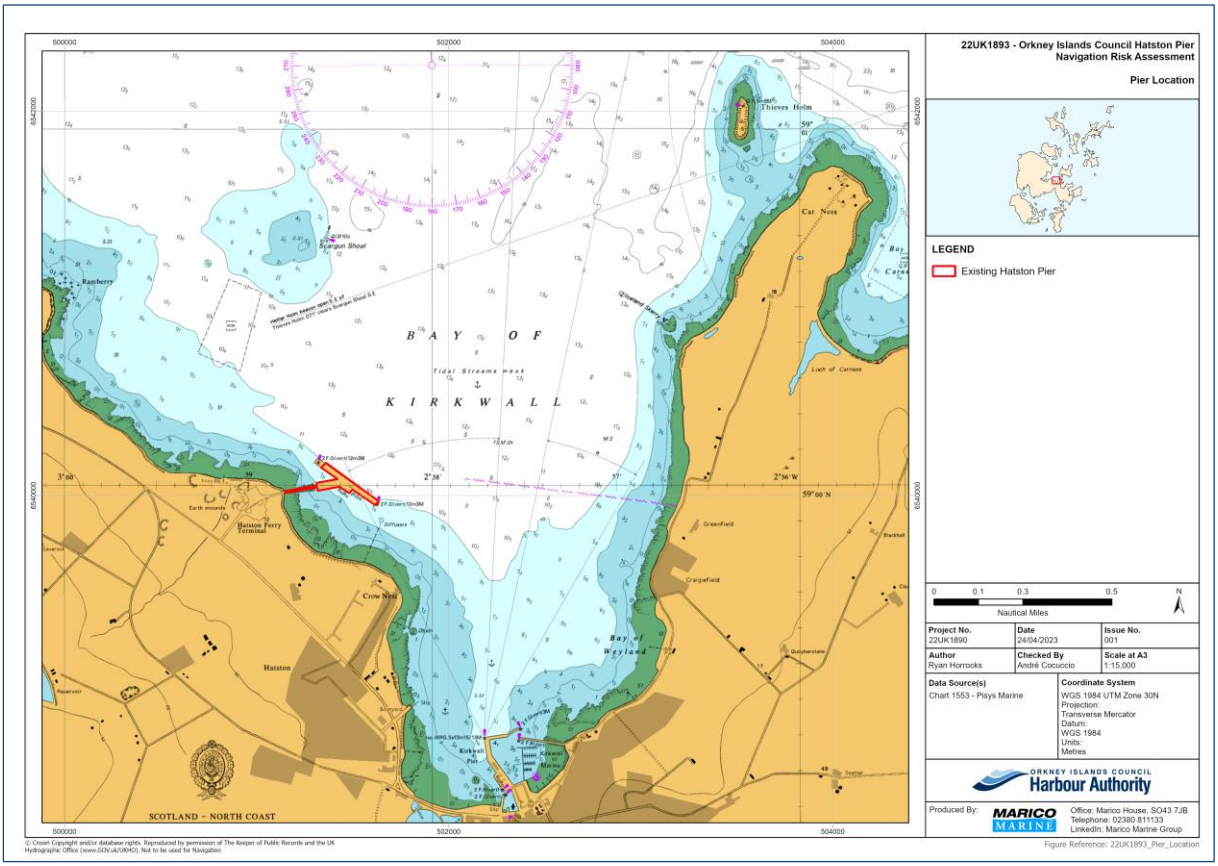


Figure 5: Hatston Pier Location.

2.3.3 Data Sources

The principal input to the analysis was Automatic Identification System (AIS) data. The following section outlines the data type, extent and duration of the dataset. Incidents data from the Marine Accident Investigation Branch (MAIB), Royal National Lifeboat Institution (RNLI) and Orkney Island Council (OIC) were used within the analysis.

2.3.3.1 Automatic Identification System Data

In 2000, the IMO adopted a new requirement as part of a revised Chapter V of Safety of Life at Sea (SOLAS) for ships to be fitted with an AIS receiver. The system aims to improve a mariner's awareness of other vessels by augmenting radar, visual and sound as collision avoidance tools. AIS broadcasts key information about a vessel (such as its identity, position, type, speed, and course) at regular intervals through Very High Frequency (VHF) radio waves.

AIS exists in two forms: Class A and Class B. The former is fitted in all vessels required to carry AIS under SOLAS; the latter is on a voluntary basis by non-SOLAS vessels such as recreational craft and commercial fishing vessels less than 15m in length.

Regulation 19 of SOLAS Chapter V sets out the navigational equipment to be carried on board ships according to ship type, and AIS is required on:

- All ships greater than or equal to 300 gross tonnage and engaged on international voyages;
- Cargo ships greater than or equal to 500 gross tonnage not engaged on international voyages; and
- All passenger ships irrespective of size.

An AIS vessel traffic dataset was sourced from our commercial provider for both a summer and winter two-week period, the extents of which are between:

- Winter – 01/01/2022 – 31/01/2022; and
- Summer – 01/07/2022 – 31/07/2022.

The dataset is composed of terrestrial AIS vessel positions. The dataset was of sufficient duration to identify any seasonality and to provide a reliable sample of vessel traffic in the area. The extent of the dataset was large enough to include the study area and the local vicinity. Please note that some types of vessels are not required by legislation to carry AIS transponders and are therefore under-represented in the AIS data set.

Cruise ship movements are slightly under-represented due to ongoing effects of the Covid pandemic, but this has been taken into account during the assessment. Full months of AIS data have been used, as during consultation it became apparent that some classes of vessels are on three-week rotations. The AIS dataset covers the entire geographic limits of the study area and includes all vessels carrying “Class A” or “Class B” AIS transponders.

An estimate of the percentage of vessels in each category that carry transponders was made during 2015 and is provided in **Table 2**. It is likely that percentages may have increased slightly since that time for those vessels with less than 100% estimates.

Table 2: Estimated Percentage of Vessels with Class A or Class B AIS Transponders.

Ref	Vessel Type Category	Percentage
A	Cruise Ship	100%
B	Inshore Fishing Vessel	75%
C	Inter-Island Ferry	100%
D	Large Commercial Vessel	100%
E	Mainland Ferry	100%
F	Recreational Vessel	10%
G	Small Commercial Vessel	80%

Ref	Vessel Type Category	Percentage
H	Towage Vessel	100%

2.3.4 Vessel Traffic Overview

All vessel track data that represents the number of vessel tracks within the following report sections has been extracted from the parallel gate as shown in **Section 2.3.4.8**.

The tracks of all vessels within the vicinity of Hatston Pier for both winter and summer periods are shown in **Figure 6**.

Vessel track density within a square kilometre grid is shown within **Figure 7** for both summer and winter periods. The highest density recorded within the winter period within the data extent was 167 tracks (approximately 5 tracks per day) and was located within the approach area to Kirkwall marina. The highest density recorded within the summer period within the data extent was 391 tracks (approximately 13 tracks per day) and was also located within the entrance to Kirkwall marina. For both summer and winter periods, vessel traffic density in the direct vicinity of Hatston Pier is low, however a traffic route can be seen more clearly within the summer dataset, with the highest density across both summer and winter periods being 61 tracks or approximately 2 tracks per day.

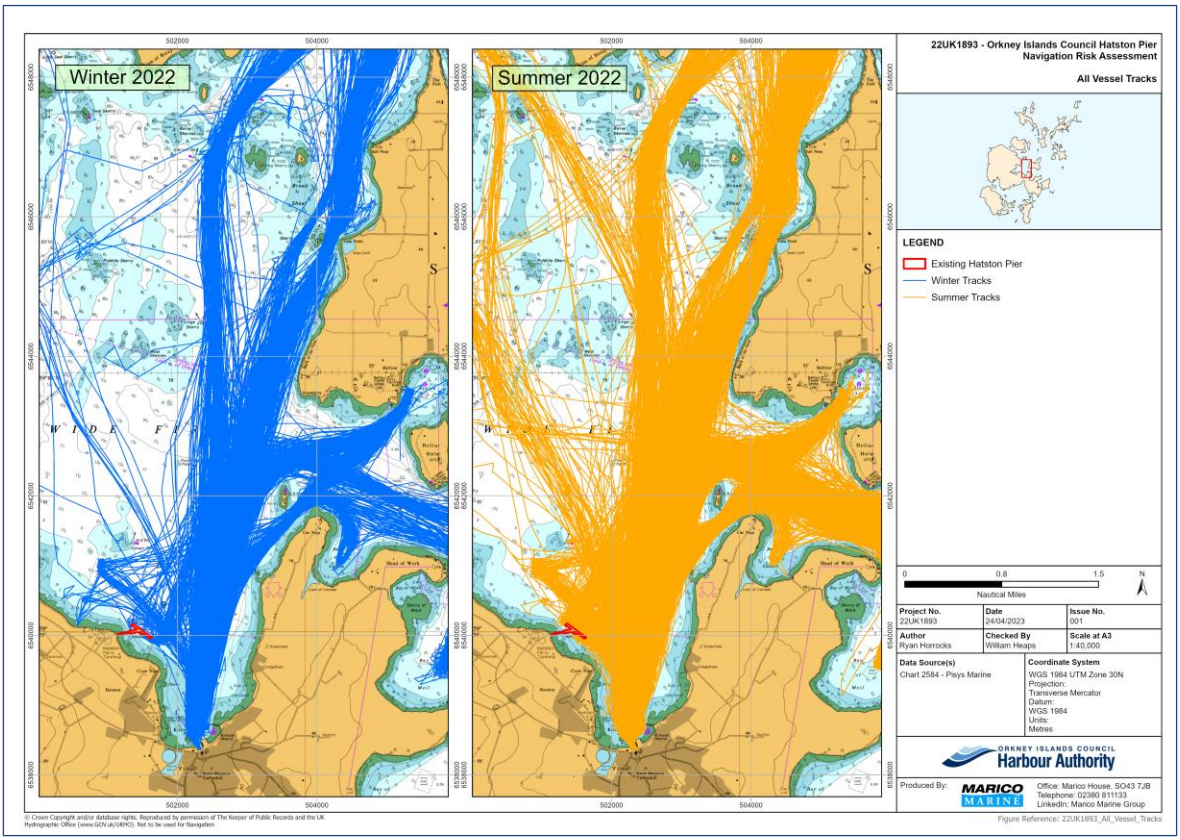


Figure 6: All Vessel Tracks.

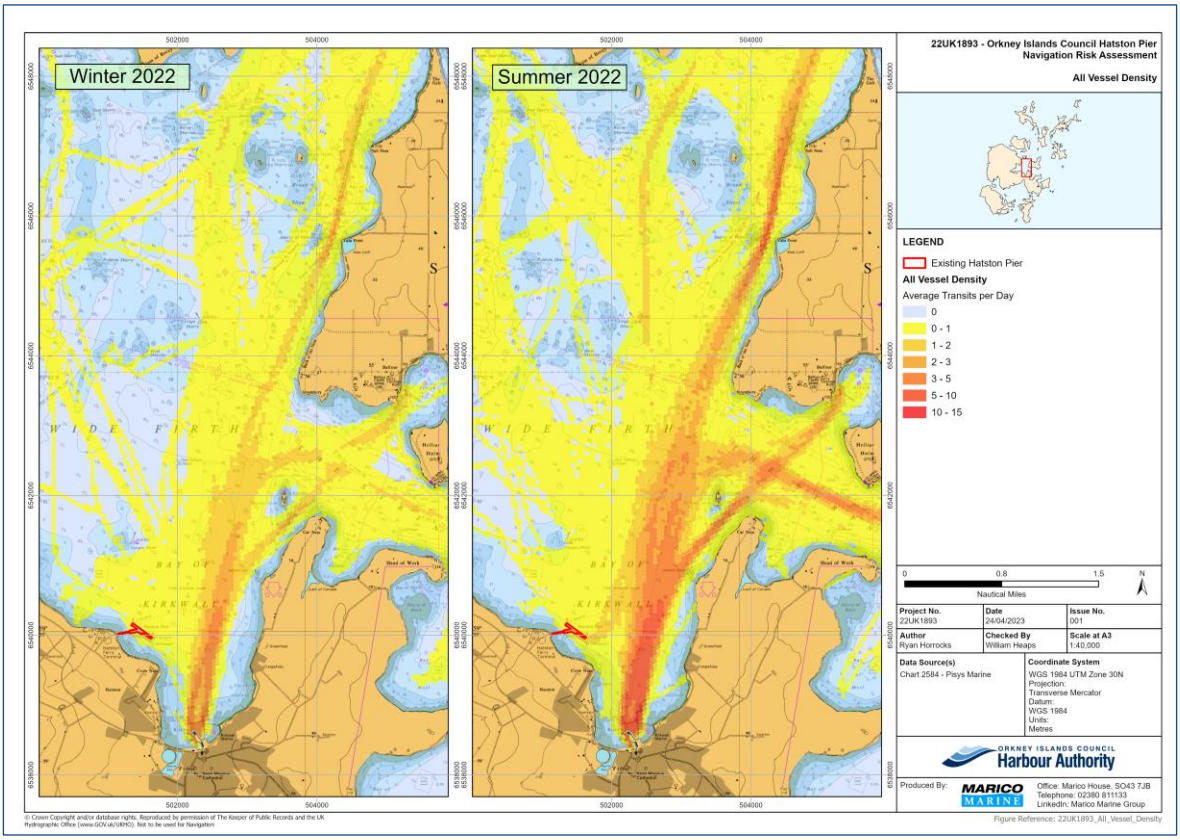


Figure 7: All Vessel Density.

2.3.4.1 Cruise Ships (A)

Cruise Ship vessel tracks are illustrated in **Figure 8**. This vessel type can be seen transiting primarily through 'The String'. Cruise Ship vessels are seen to primarily dock at Hatston Pier, with some vessels mooring outside of the Kirkwall marina. A total of 68 Cruise Ship tracks were recorded in the summer period, and no Cruise Ship tracks were recorded in the winter data.

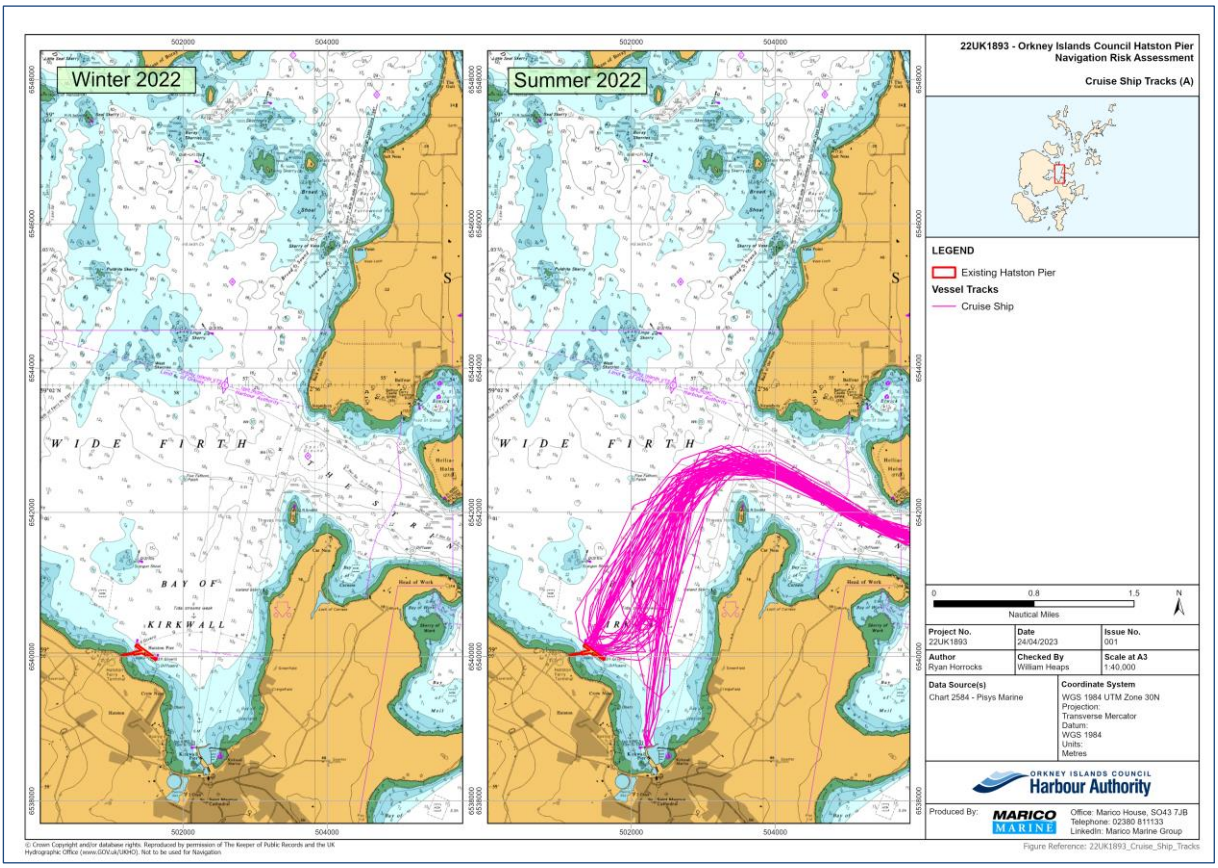


Figure 8: Cruise Ship Tracks.

2.3.4.2 Inshore Fishing Vessels (B)

Most fishing vessels are not required to carry AIS under SOLAS Chapter V but vessels longer than 15 metres in length are required to carry AIS under EU regulations. Inshore Fishing vessel tracks are shown in

Figure ***9***. No tracks were recorded within the map extent for the winter period and 16 tracks in the summer period. Only 2 tracks were recorded transiting to Hatston Pier across the summer period.

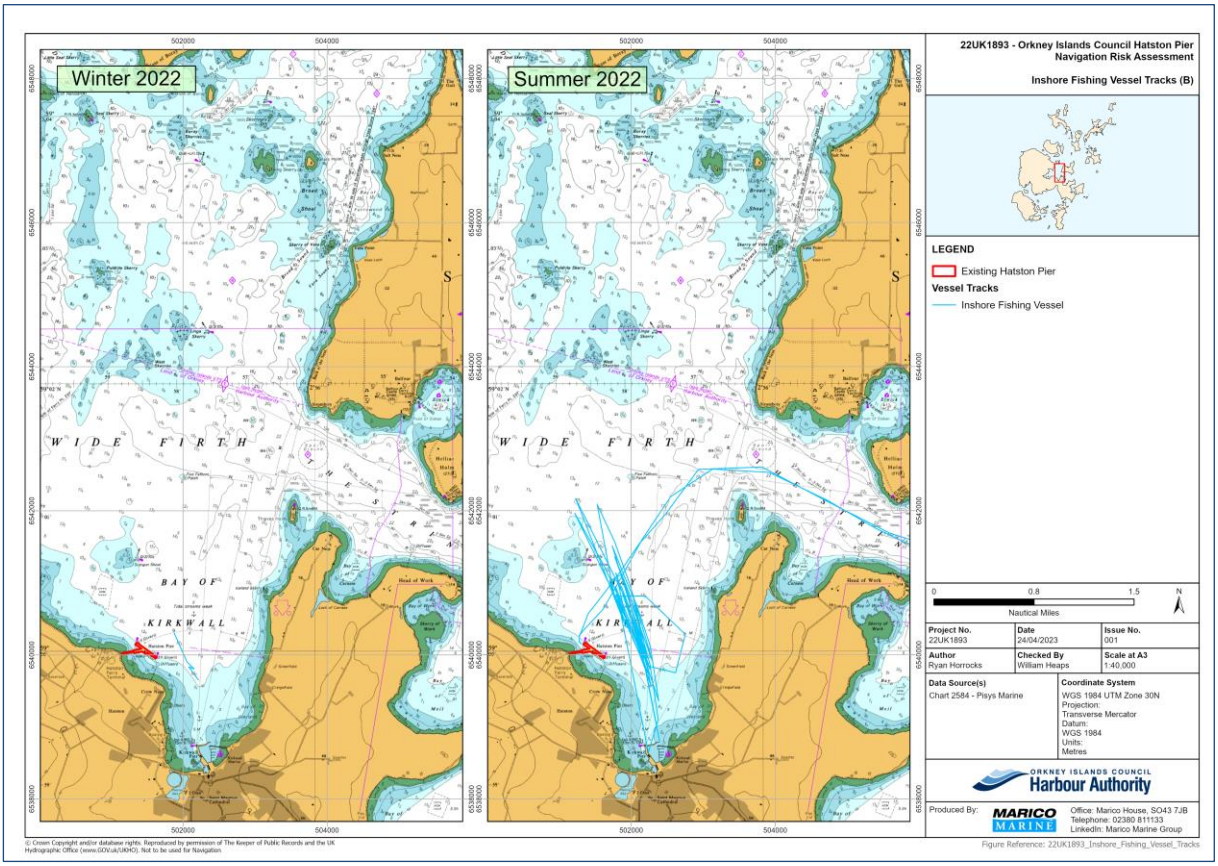


Figure 9: Inshore Fishing Vessel Tracks.

2.3.4.3 Inter-Island Ferries (C)

Inter-Island Ferry vessel tracks are shown in **Figure 10**. Inter-Island ferries are a primary form of Transport between islands within Orkney. The recorded tracks are seen to transit predominantly within the Kirkwall area, with only 2 tracks observed within the vicinity of Hatston Pier across both data sets. The Inter-Island Ferries were the most abundant vessels within the study, 609 tracks were recorded during the winter period and 973 recorded in the summer period.

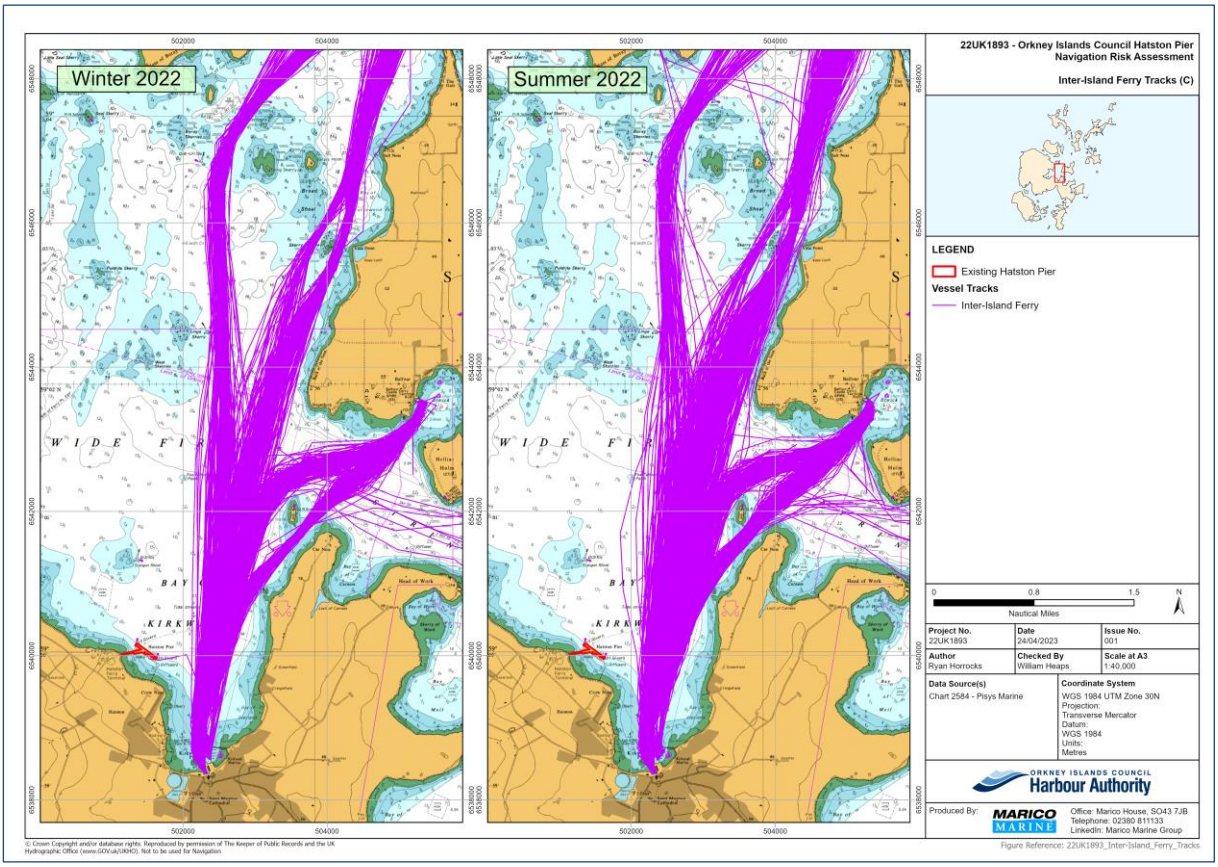


Figure 10: Inter-Island Ferry Tracks.

2.3.4.4 Large Commercial Vessels (D)

Large Commercial Vessels tracks are shown in **Figure 11**. These vessels include General Cargo, Product Tankers and Large Offshore Support Vessels. These vessels are seen to transit within and around the Hatston Pier location, with 221 recorded tracks in winter and 381 recorded tracks in summer.

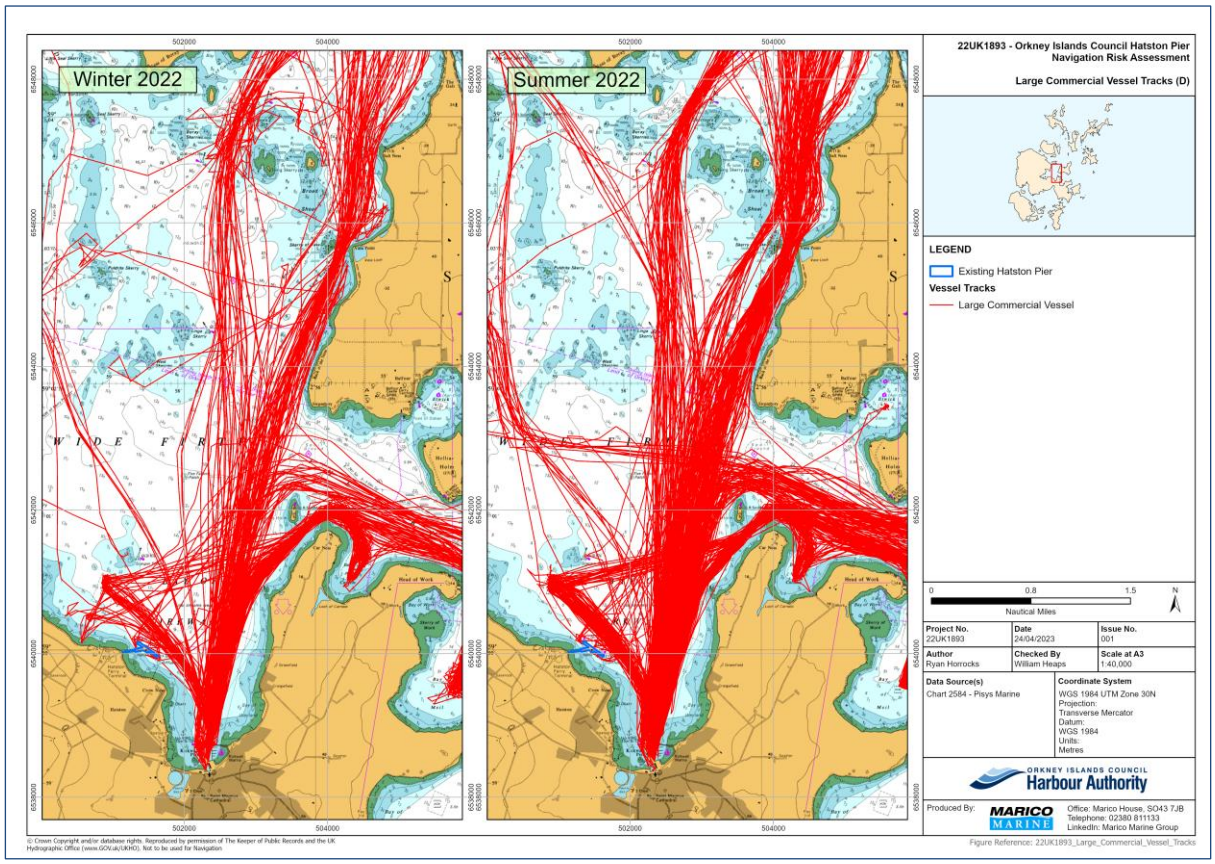


Figure 11: Large Commercial Vessel Tracks.

Mainland Ferries are seen to only call at Hatston Pier within the study area shown in **Figure 12**. 59 vessels tracks were recorded in the winter period, equalling approximately 2 tracks per day. Within the summer period there were 101 Mainland Ferry tracks recorded, equalling approximately 3 vessel tracks per day.

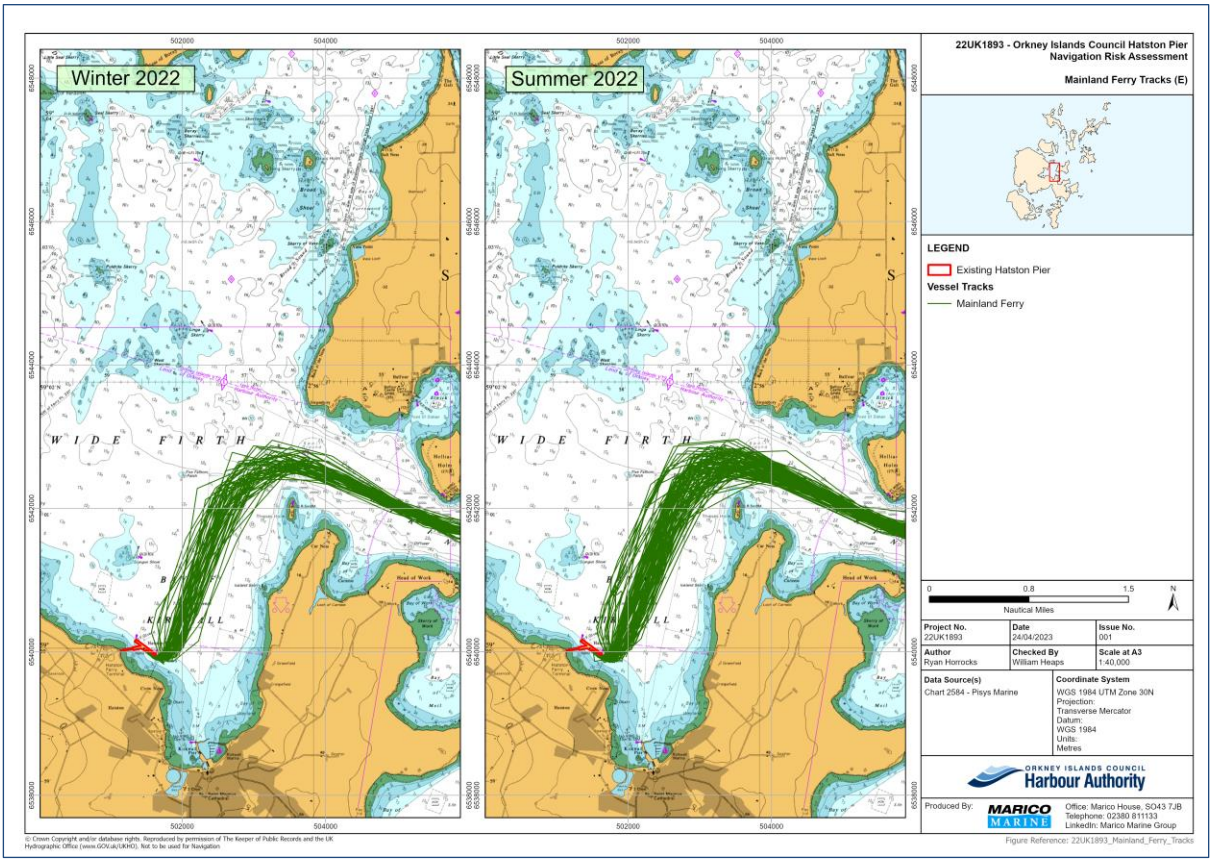


Figure 12: Mainland Ferry Tracks.

2.3.4.5 Recreational Vessels (F)

Recreational Vessel tracks can be seen in **Figure 13**. These vessels include Sailing Yachts, Motor Yachts, Sailing Dinghies, Rigid Hull Inflatable Boats and Personal Watercraft. These vessels show seasonal disparity between summer and winter periods. During the winter data set no recreational vessels tracks were recorded through the Gate, with all movements observed to be close into the Kirkwall marina area. The number of vessel tracks recorded in the summer period rises to 242 recorded tracks.

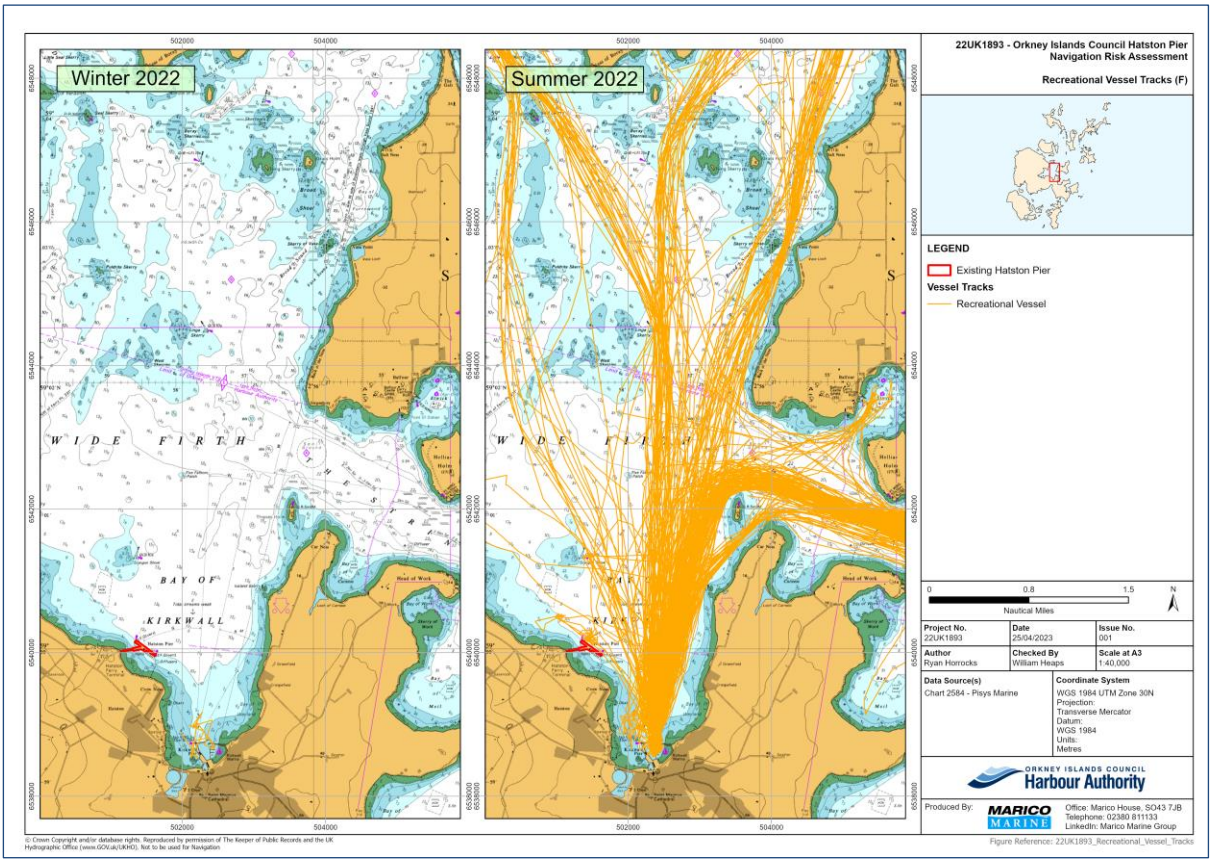


Figure 13: Recreational Vessel Tracks.

2.3.4.6 Small Commercial Vessels (G)

Small Commercial Vessels are classified as Fish Farm Service Vessels, General Workboats, Harbour Launches, Offshore Renewables Vessels, Diving Support Boats, Pilot Boats, Agent Launches, Small Passenger Vessels (≤12 passengers), Cruise Ship Tenders and Law Enforcement Vessels. **Figure 14** shows these Small Commercial Vessels tracks. There were 42 recorded vessel tracks in the winter period and 251 recorded tracks in the summer period.

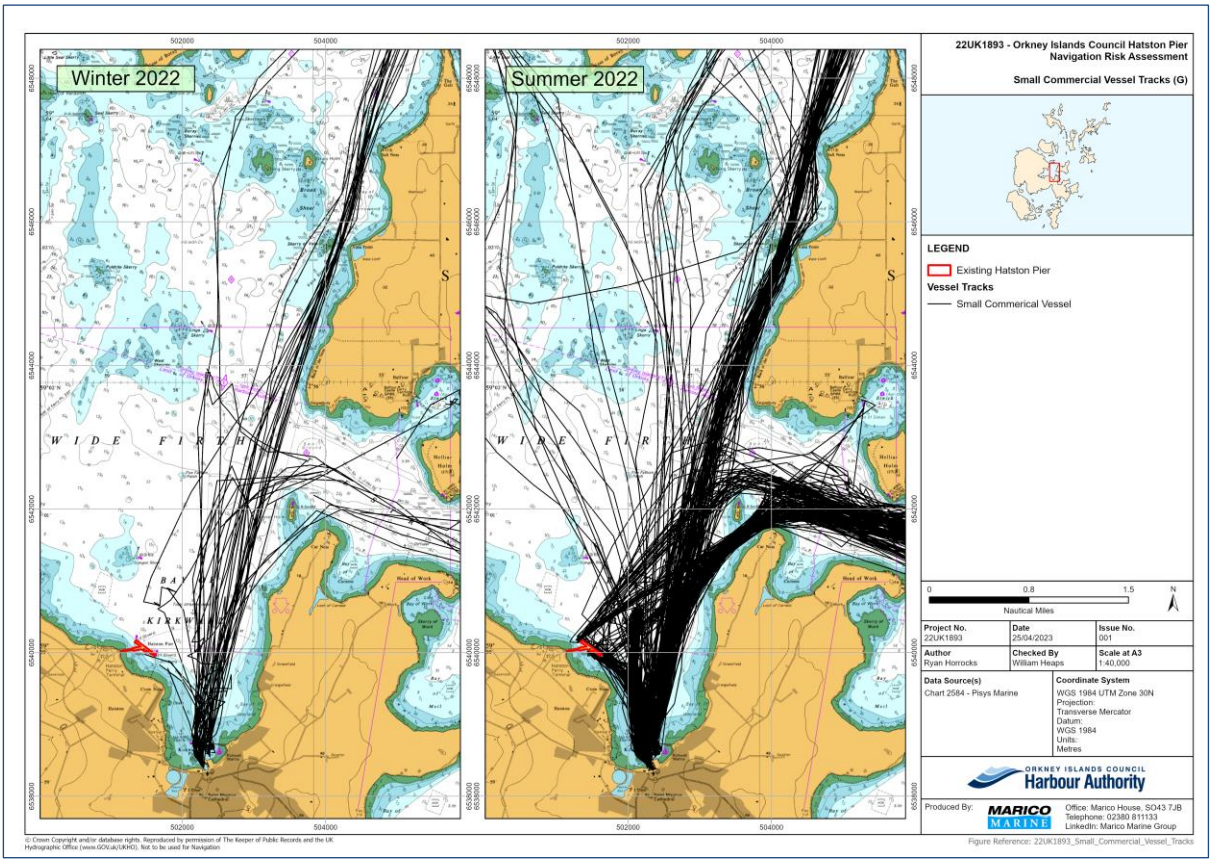


Figure 14: Small Commercial Vessel Tracks.

2.3.4.7 Towage Vessels (H)

Towage Vessels tracks are shown in **Figure 15**. A total of 67 transits were recorded in the winter period and 72 transits recorded in the summer. In both periods, these vessels are observed within the vicinity of Hatston pier.

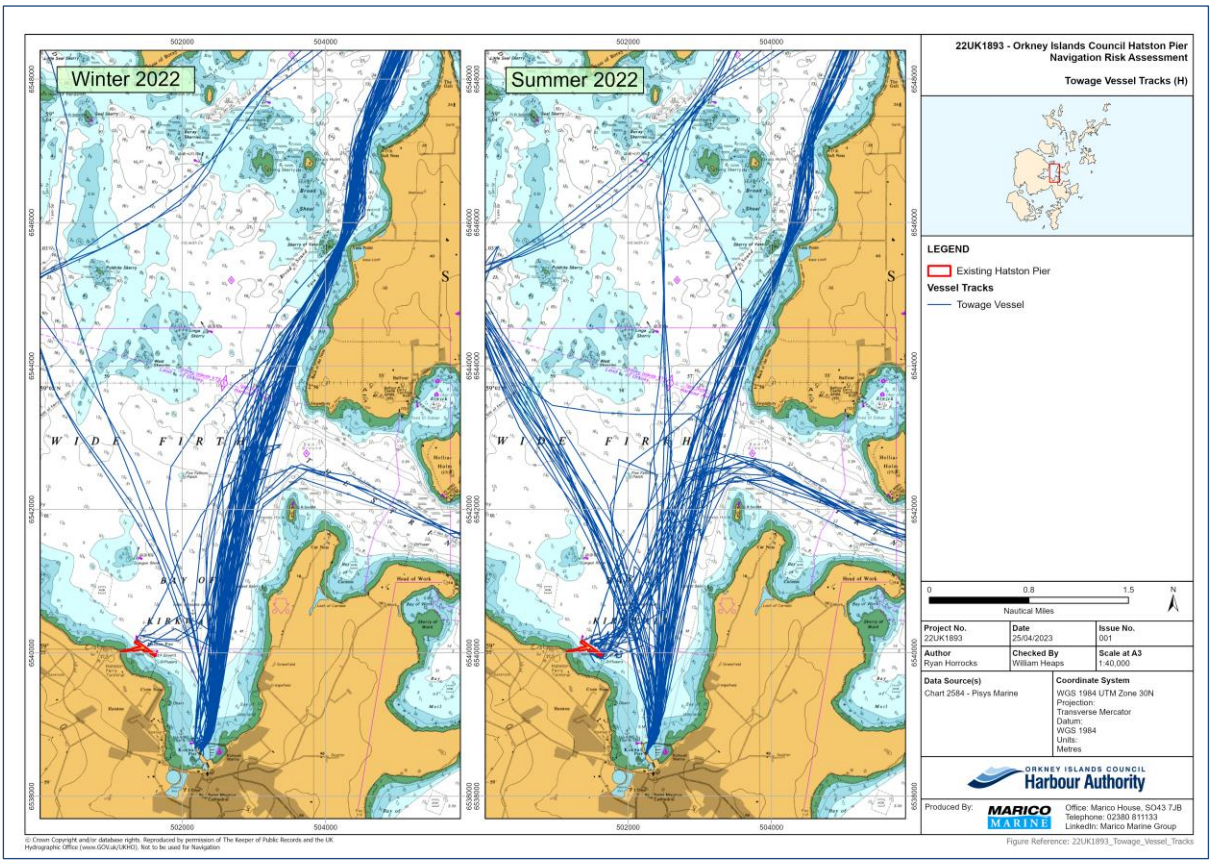


Figure 15: Towage Vessel Tracks.

2.3.4.8 Gate Analysis

Gate analysis has been undertaken within the Bay of Kirkwall area to examine the frequency and direction of vessel traffic through a linear channel or "Gate". Two transects have been created in the vicinity of the Hatston Pier, one parallel across the main vessel route and one perpendicular to the pier. Columns have been generated depending upon the frequency and direction of intersecting vessel tracks. The parallel gate was the transect used within the data analysis work above.

Figure 16 illustrates the location of both gates and the frequency and distribution of recorded vessels passing through them. The figure shows the eastern side of the parallel transect being primarily used for vessels travelling both North and South. The smaller transect demonstrates a primarily eastern direction of travel for vessels passing close to Hatston pier.

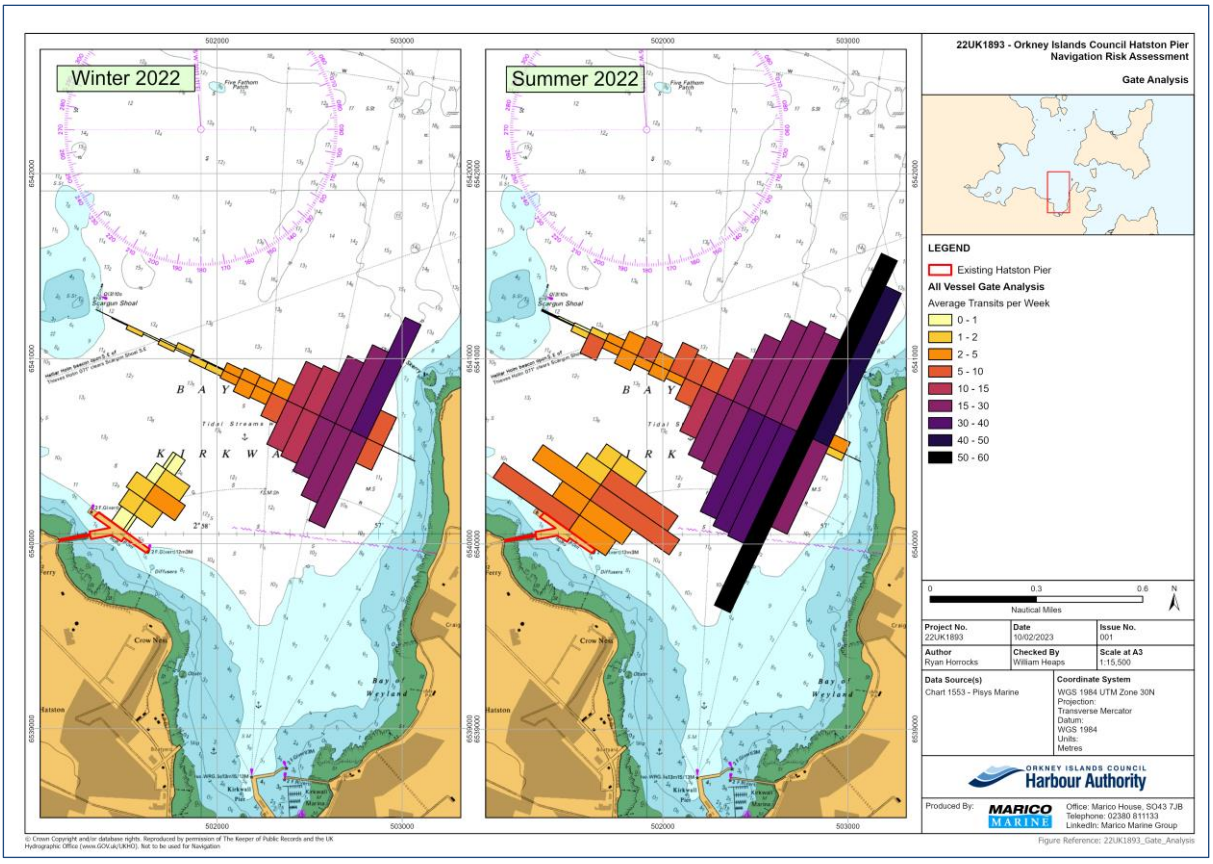


Figure 16: Gate Analysis.

2.3.4.9 Data Analysis

The figures below represent the recorded tracks through the parallel gate for both summer and winter data periods.

Figure 17 represents the total number of movements through the parallel gate for both summer and winter periods. Vessel tracks approaching Hatston Pier show variance in summer and winter periods. In total, 998 transits were recorded through the gate in the winter period and 2,104 transits in the summer. The most common vessel type for both data periods was the Category C Vessels (inter-island ferries) which had a total of 609 (approximately 61% of all transits) in the winter and 973 (approximately 46% of all transits) in the summer.

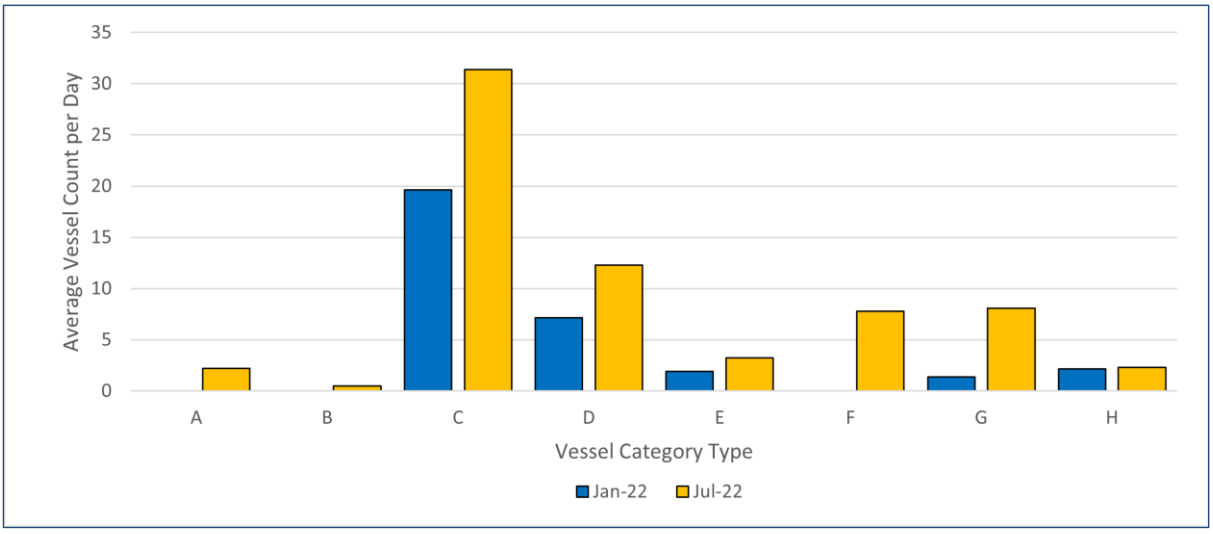


Figure 17: Vessel Type - Average Vessel Type per Day.

Figure 18 and **Figure 19** show the daily recorded number of vessel tracks through the parallel gate. The 04-Jan and 29-Jan are shown to have no vessel transits in **Figure 18**, this is due to extreme weather conditions stopping all vessel movements in the area.

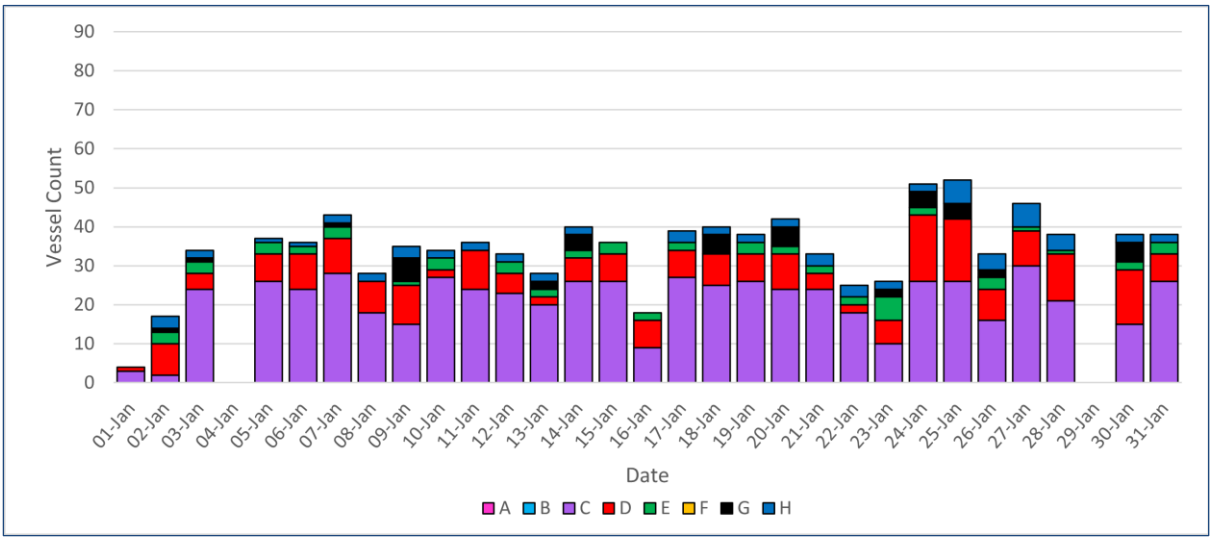


Figure 18: Frequency of Vessel Transits per Day – Jan 22.

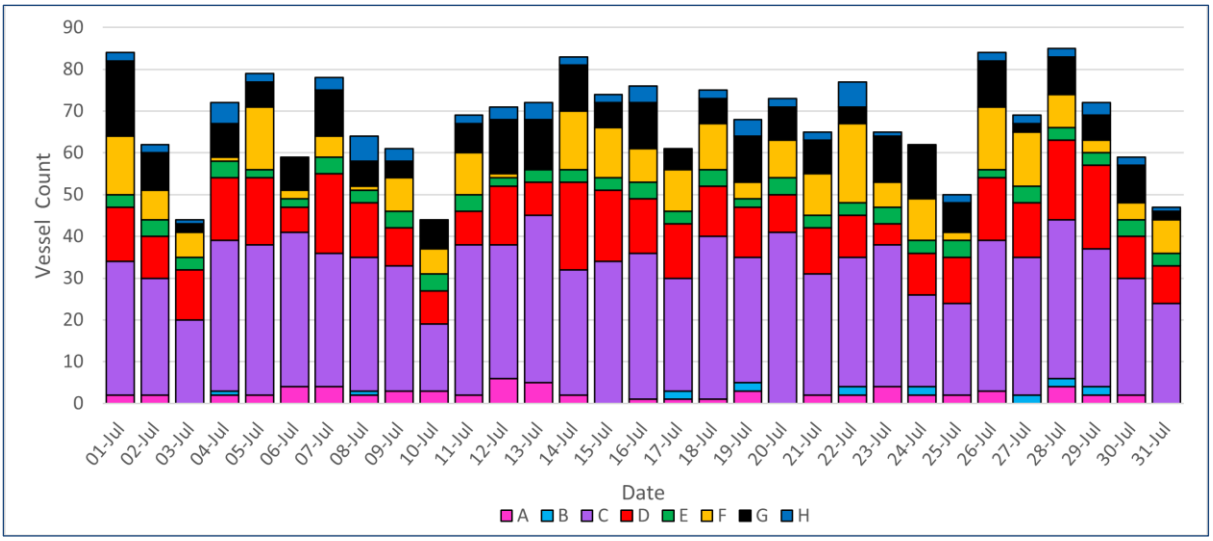


Figure 19: Frequency of Vessel Transits per Day – Jul 22.

2.3.5 Commentary

Overall, traffic density in the project area is low, and most traffic is bound for the Pier itself, rather than "passing by".

There is a very strong seasonal variation in traffic density, with traffic to both the pier and Kirkwall being much denser during the summer months. In particular, cruise vessels visit almost exclusively during the summer.

Use by some classes of vessel, notably recreation, inshore fishing vessels and inter-island ferries is effectively negligible during the winter and summer seasons. While it is noted that some of these vessels are unlikely to carry AIS and be represented in the preceding track plots, this usage pattern was confirmed by the stakeholders consulted.

2.4 INCIDENT ANALYSIS

Information relating to accidents / incidents that have occurred in the past have been used as an input to the hazard identification and risk assessment process. In particular, the incident record helps inform the likely frequency of identified hazards occurring and gives an insight into the most likely and worst credible outcomes in the study area.

Figure 20 shows the location of both the RNLI and MAIB incidents data within the map extent for Hatston Pier and Bay of Kirkwall area. A total of 48 incidents were recorded for RNLI across the 12-year dataset, of which the most common callout was "Stranding or Grounding", with 11 callouts. Within the direct vicinity of the Hatston Pier location, no callouts were recorded, the most common location of incidents being around the Kirkwall marina, with 11 recorded. Within the MAIB dataset, a total of 63 incidents were recorded across the 25-year dataset, the most common of which being "Accident to Person" which was recorded 15 times. Only one incident (Fire/Explosion, 2015) was recorded in the vicinity of Hatston Pier in the MAIB dataset.

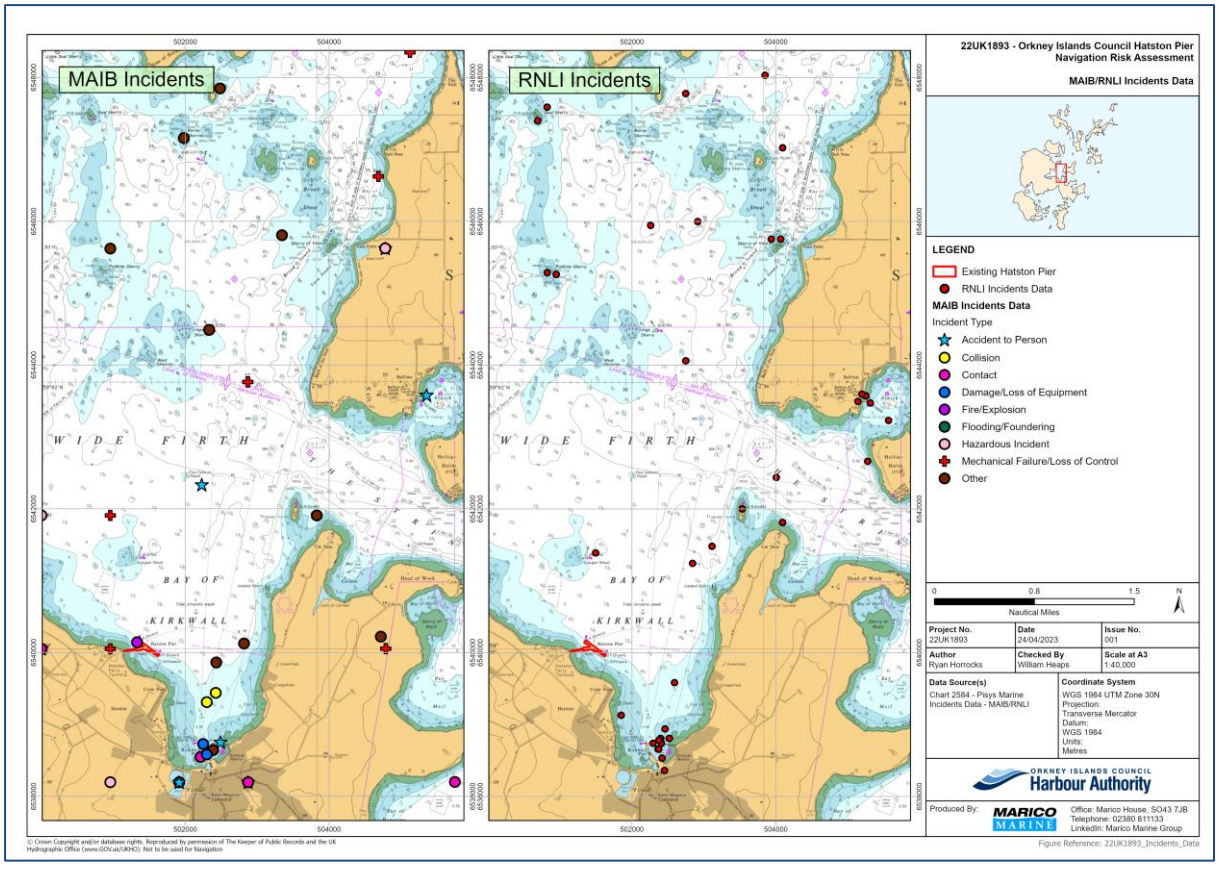


Figure 20: MAIB and RNLI Incidents Data.

2.4.1 MAIB Incidents

The following incidents have been recorded within the study area by the MAIB between January 1997 and March 2022 as shown in **Figure 20**. **Figure 21** depicts the number of each incident type in the study area and shows 'Accident to Person' as the most frequent incident, with 15 recorded.

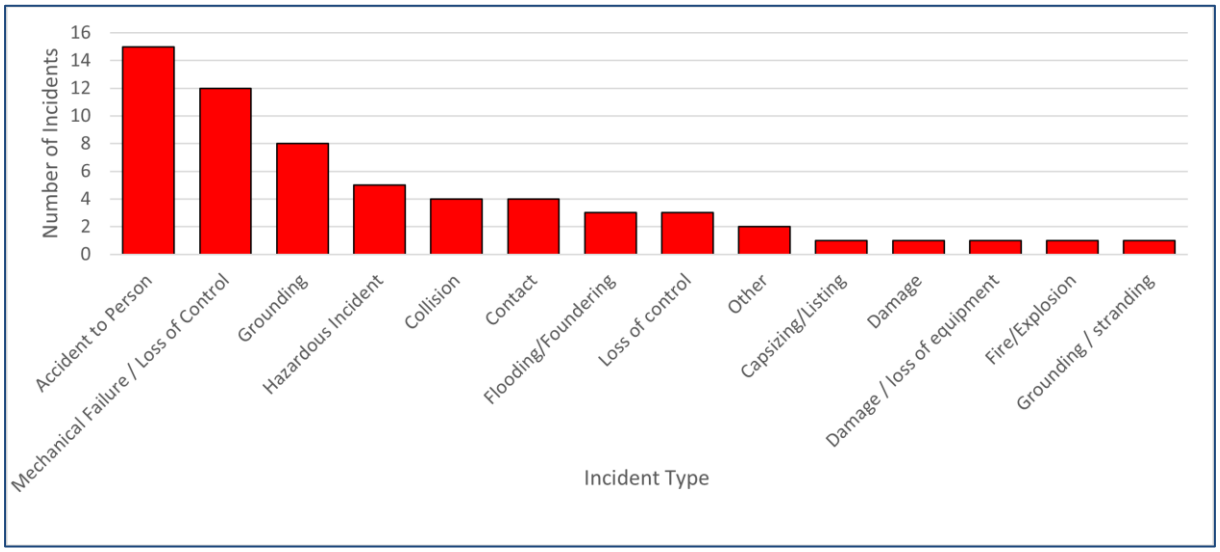


Figure 21: MAIB Incidents by Type for the Bay of Kirkwall Area.

2.4.2 RNLI Incidents

The incidents seen in **Figure 20** have been recorded within the study area by the RNLI between 2008 and 2020. 2011 shows the greatest number of incidents, with 7 recorded, as seen in **Figure 22**.

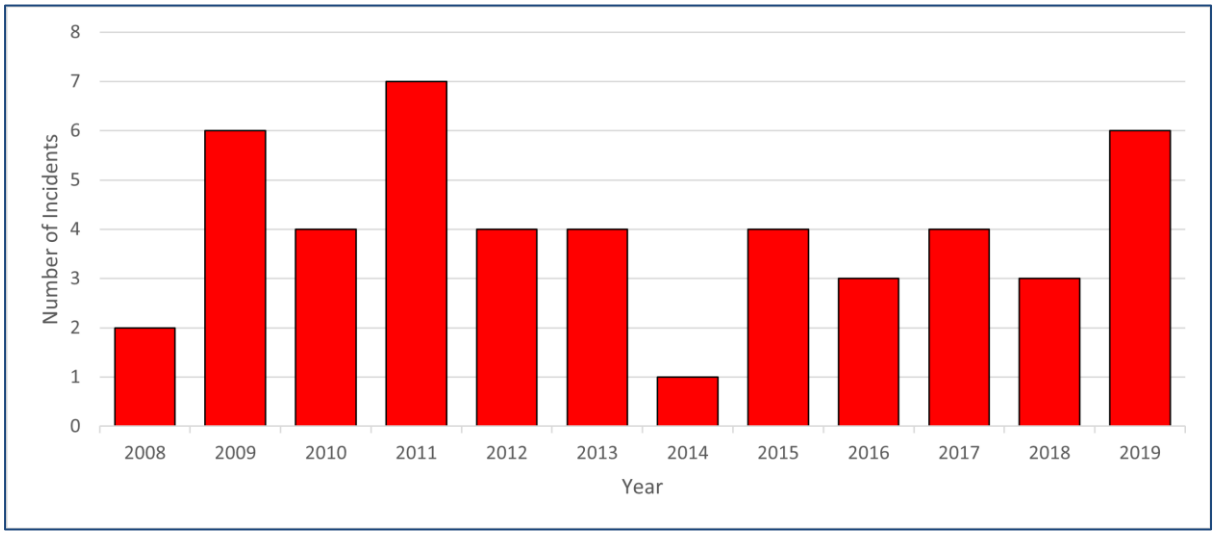


Figure 22: RNLI incidents by Year for the Bay of Kirkwall Area.

2.4.3 OIC Incidents

The following incidents have been recorded within the study area by the OIC between January 2007 and February 2023. The number of each incident type within the study area is depicted in **Figure 23.** This total number of incidents recorded by OIC is 68, with Contacts and Pollution being the most common incidents at 20 reports each since 2007. **Figure 24** shows the frequency of incidents by year, with 2011 demonstrating the peak annual incidents with 13 recorded.

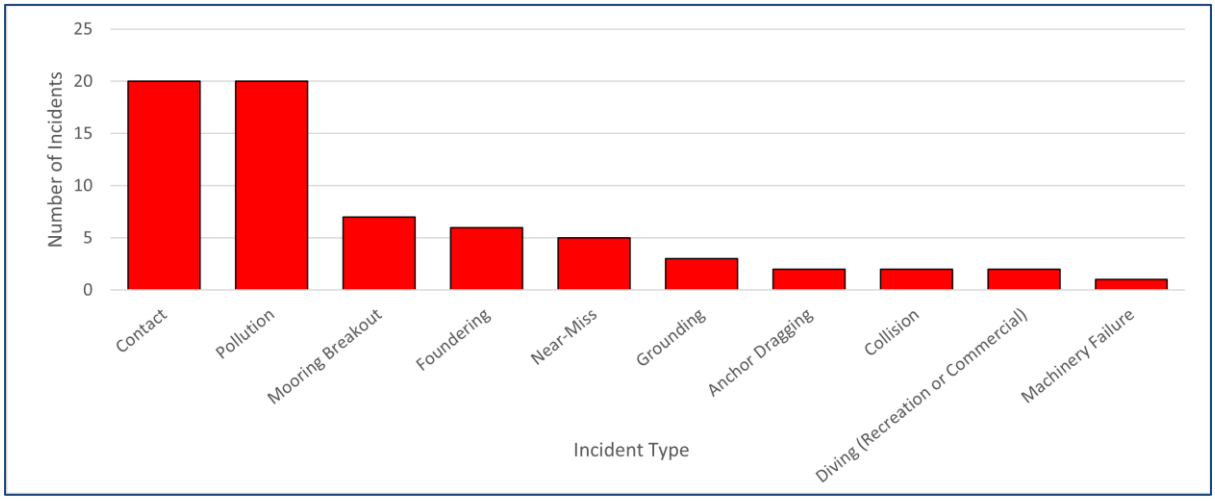


Figure 23: OIC Incidents by Type for the Bay of Kirkwall Area.

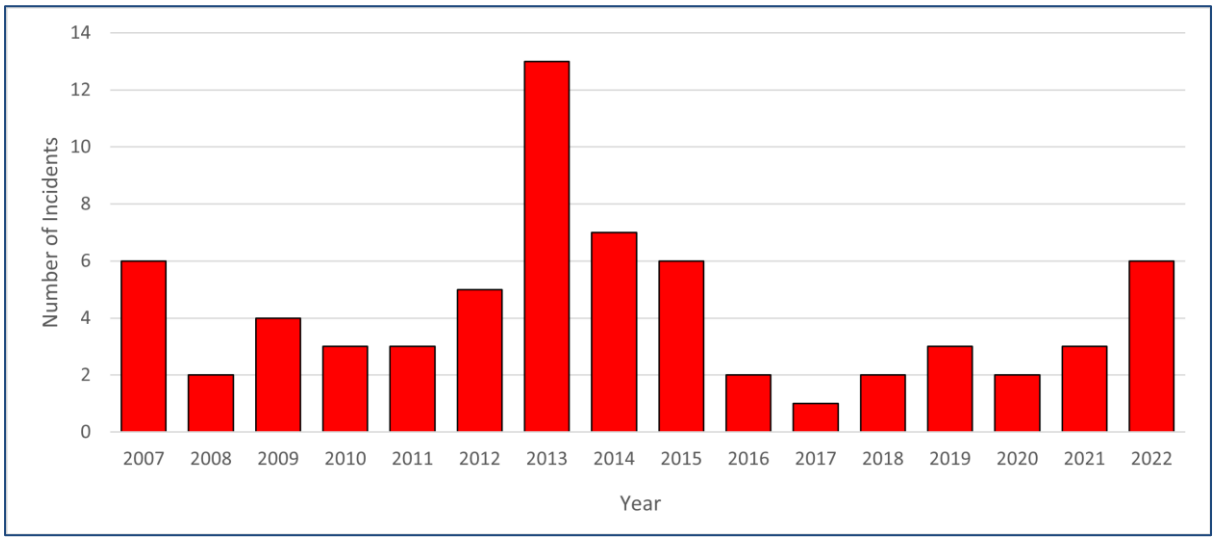


Figure 24: OIC Incidents by Year for the Bay of Kirkwall Area.

2.4.4 Commentary

The available incident data from three separate sources, and covering a period in excess of 10 years, suggests that the number of incidents at Hatston Pier is low. Most of the incidents recorded are spread across the study area, with very few in the vicinity of the project area. The data records a high number of non-navigational incidents such as pollution, which are not relevant to this study.

2.5 STAKEHOLDER CONSULTATION

In order to inform this assessment a number of comprehensive consultation meetings were held with OIC Marine Services personnel and other local stakeholders. Full minutes of the meetings (which were held in OIC's offices at Scapa and Kirkwall) are shown in **Annex A** The primary aim was to collect data and other information to enhance the NRA, and ensure, as far as possible, that all relevant issues are taken into account during the assessment.

These meetings were facilitated by Marico Marine personnel and followed the agenda shown in **Annex B**.

The following stakeholders were approached (**Table 3**).

Table 3: List of Stakeholders Consulted.

Stakeholder Group	Meeting time	Consultees	Role / Representing
OIC	14:00 7 November 2022	David Sawkins Peter Bentley Alastair MacDonald	DHM OICHA Pilot VTS
Commercial	09:30 8 November 2022	Stuart Pottinger Abbie Sinclair Dougie Leask John Skuse Daniel Wise Alan Scott Ollie Cameron	Orkney Ferries Orkney Ferries Leask Marine EMEC Orbital (renewables) SERCO NorthLink Ferries OIC Kirkwall AHM / Pier Master
Leisure	12:30 8 November 2022	Mike Cooper Ian Hutchison David Flett	Orkney Marinas / RNLI / Cruising Assoc / Ocean Cruising Club Orkney Sailing Club Orkney Rowing club – comments received post meeting
Aquaculture	14:30 8 November 2022	Steve Kolthammer Maddy Walker Robert Petersen Naomi Dempsey	Scottish Seafarms Scottish Seafarms Cooke Aquaculture Cooke Aquaculture
Fishing	By email	Hannah Fennel	Orkney Fisheries Association

2.5.1 Consultation Outcome

As indicated in **Table 3** above, there was a good response to the request for stakeholder input into this NRA.

The expert assessors undertaking this NRA, have attempted to consider likely impacts on all users when assessing the navigational risk, and therefore the views of those users are vital to ensure no concerns or observations are missed.

The consultation meetings were wide ranging, and provided confidence that data obtained (vessel types, traffic density, incident history, etc.) was representative and accurate for the purposes of informing the risk assessment.

Key outcomes of the consultation (aside from confirmation of input data) were:

- Grounding was considered a potential hazard, especially inside the new quay face, both during construction and operation. Potential mitigations included buoys, dredging (costly as rock substrate) or fender piles to prevent access to shallow areas;
- It was considered that there would be insufficient water inside the pier extension without dredging (including dredging a pocket for tugs to use);
- The location of the fish farm and Scargun shoal were noted as existing hazards in the approach, although it was later confirmed that the fish farm was relocating out of the project area;
- Although risks to leisure vessels were considered low, a potential additional mitigation was proposed by the Rowing club: inform VTS when leaving and returning to shore (reporting numbers of vessels / people and safe return);
- The current quay space for small vessels inside the existing pier was noted and considered to be very useful for smaller work boats and barges. It was noted that these berths would be lost on the East side of the existing causeway, and current users would therefore be displaced to Kirkwall Pier (if sufficient space could be found), resulting in increased traffic / risk in Kirkwall as a result of the development (cumulative impact); and
- The suggested mitigation was provision of equivalent quay space to the eastern edge of the new fill area (south of proposed boat lift) by replacing rock revetment with sheet piling and suitable dredging.

3 HAZARD IDENTIFICATION

IMO Guidelines define a hazard as *"something with the potential to cause harm, loss or injury"*, the realisation of which results in an accident. The likelihood that the hazard will be realised can be combined with an estimate of the consequence, and this combination is termed "risk". Risk is therefore a measure of the likelihood and the consequence of a particular hazard.

It is important that the hazard identification process follows a structured and systematic process that is thorough and comprehensive. It must identify common hazards as well as hazards that may never have occurred in the project area in the past but are nonetheless possible and credible.

3.1 HAZARD IDENTIFICATION

Hazards relating to navigation within Kirkwall Bay were identified using a variety of methods, including reference to the previous NRA, stakeholder consultation meetings / workshops, review of incident records, and traffic analysis. The Data Gathering (Stage 1) was the principal input to the Hazard Identification (Stage 2).

3.1.1 Hazard Categories

Kirkwall Bay is used by a wide variety of commercial and recreational operators and this results in a high number of potential hazards. In order to focus the overall NRA and provide a structured hazard identification process, the following hazard categories identified during the original SHA assessment were used, but with two additional specific additional hazards during the construction phase (**Table 4**). Categorising hazards in this way also helps in the determination of risk control measures pertinent to the geographic location of each hazard.

Note that Health and Safety (H&S) hazards are not included within the scope of this NRA, for example slips/trips/falls.

Table 4: Hazard Categories.

Ref	Hazard Category	Comments
A	Anchor Dragging	When a vessel unintentionally moves from its anchored position because the anchor has failed to hold. This may be due to a combination of strong winds, large waves, adverse anchoring (seabed) conditions, mechanical failure, or poor seamanship / anchoring technique.
B	Collision	When two or more vessels impact each other whilst manoeuvring.
C	Contact	When one or more vessels makes physical contact with a fixed object such as a pier / jetty or a mooring buoy. This hazard is sometimes referred to as "allision" when contact is made with a fixed structure, or a "striking" when contact is made with a floating structure (e.g. navigation buoy or anchored ship).
D	Diving	Diving incident involving Recreational or Commercial diving.

Ref	Hazard Category	Comments
E	Girting	Sometimes referred to as "Girding". This is when a towline under tension exerts a heeling moment which results in excessive heel that could cause the tug to capsize.
F	Grounding	When a vessel unintentionally makes contact with the seabed.
G	Mooring Incident / Breakout	When a vessel ranges (moves excessively) whilst alongside the berth or when one or more mooring lines fail resulting in the vessel unintentionally breaking away from its moored position. This may be due to a combination of strong winds, large waves, adverse mooring arrangements (bollards) or poor seamanship / mooring technique.

3.2 NAVIGATION HAZARDS – CONSTRUCTION PHASE

The Hazard Identification process identified a total of 50 hazards for the study area during the construction phase of the project, as shown in **Table 5**. The full Hazard Logs with additional information are shown in **Annex D.**

Table 5: Construction Phase Navigation Hazards.

Hazard ID	Category	Hazard Title	Hazard Detail
1	Anchor Dragging	Anchor Dragging - Construction Vessel	A Construction Vessel unintentionally moves from its anchored position because the anchor has failed to hold.
2	Anchor Dragging	Anchor Dragging - Cruise Ship / Mainland Ferry / Large Commercial Vessel / Inter-Island Ferry	A Cruise Ship / Mainland Ferry / Large Commercial Vessel / Inter-Island Ferry unintentionally moves from its anchored position because the anchor has failed to hold.
3	Anchor Dragging	Anchor dragging - Inshore Fishing Vessel / Recreational Vessel / Small Commercial Vessel / Towage Vessel	An Inshore Fishing Vessel / Recreational Vessel / Small Commercial Vessel / Towage Vessel unintentionally moves from its anchored position because the anchor has failed to hold.
4	Collision	Construction Vessel - Construction Vessel	A Construction Vessel collides with another Construction Vessel

Hazard ID	Category	Hazard Title	Hazard Detail
5	Collision	Construction Vessel - Cruise Ship / Mainland Ferry	A Construction Vessel collides with a Cruise Ship / Mainland Ferry.
6	Collision	Construction Vessel - Inshore Fishing Vessel	A Construction Vessel collides with a Fishing Vessel.
7	Collision	Construction Vessel - Inter-Island Ferry	A Construction Vessel collides with an Inter-Island Ferry.
8	Collision	Construction Vessel - Large Commercial Vessel	A Construction Vessel collides with a Large Commercial Vessel.
9	Collision	Construction Vessel - Recreational Vessel	A Construction Vessel collides with a Recreational Vessel.
10	Collision	Construction Vessel - Small Commercial Vessel	A Construction Vessel collides with a Small Commercial Vessel.
11	Collision	Construction Vessel - Towage Vessel	A Construction Vessel collides with a ship towage Vessel
12	Collision	Cruise Ship / Mainland Ferry - Cruise Ship / Mainland Ferry	A Cruise Ship / Mainland Ferry collides with another Cruise Ship / Mainland Ferry.
13	Collision	Cruise Ship / Mainland Ferry - Inshore Fishing Vessel	A Cruise Ship / Mainland Ferry collides with an Inshore Fishing Vessel.
14	Collision	Cruise Ship / Mainland Ferry - Inter-Island Ferry	A Cruise Ship / Mainland Ferry collides with an Inter-Island Ferry.
15	Collision	Cruise Ship / Mainland Ferry - Large Commercial Vessel	A Cruise Ship / Mainland Ferry collides with a Large Commercial Vessel.
16	Collision	Cruise Ship / Mainland Ferry - Recreational Vessel	A Cruise Ship / Mainland Ferry collides with a Recreational Vessel.
17	Collision	Cruise Ship / Mainland Ferry - Small Commercial Vessel	A Cruise Ship / Mainland Ferry collides with a Small Commercial Vessel.
18	Collision	Cruise Ship / Mainland Ferry - Towage Vessel	A Cruise Ship / Mainland Ferry collides with a Towage Vessel.

Hazard ID	Category	Hazard Title	Hazard Detail
19	Collision	Inshore Fishing Vessel - Inshore Fishing Vessel	An Inshore Fishing Vessel collides with another Inshore Fishing Vessel.
20	Collision	Inshore Fishing Vessel - Inter-Island Ferry	An Inshore Fishing Vessel collides with an Inter-Island ferry.
21	Collision	Inshore Fishing Vessel - Large Commercial Vessel	An Inshore Fishing Vessel collides with a Large Commercial Vessel.
22	Collision	Inshore Fishing Vessel - Recreational Vessel	An Inshore Fishing Vessel collides with a Recreational Vessel.
23	Collision	Inshore Fishing Vessel - Small Commercial Vessel	An Inshore Fishing Vessel collides with a Small Commercial Vessel.
24	Collision	Inshore Fishing Vessel - Towage Vessel	An Inshore Fishing Vessel collides with a Towage Vessel.
25	Collision	Inter-Island Ferry - Inter-Island Ferry	An Inter-Island Ferry collides with another Inter-Island Ferry.
26	Collision	Inter-Island Ferry - Large Commercial Vessel	An Inter-Island Ferry collides with a Large Commercial Vessel.
27	Collision	Inter-Island Ferry - Recreational Vessel	An Inter-Island Ferry collides with a Recreational Vessel.
28	Collision	Inter-Island Ferry - Small Commercial Vessel	An Inter-Island Ferry collides with a Small Commercial Vessel.
29	Collision	Inter-Island Ferry - Towage Vessel	An Inter-Island Ferry collides with a Towage Vessel.
30	Collision	Large Commercial Vessel - Large Commercial Vessel	A Large Commercial Vessel collides with another Large Commercial Vessel.
31	Collision	Large Commercial Vessel - Recreational Vessel	A Large Commercial Vessel collides with a Recreational Vessel.
32	Collision	Large Commercial Vessel - Small Commercial Vessel	A Large Commercial Vessel collides with a Small Commercial Vessel.

Hazard ID	Category	Hazard Title	Hazard Detail
33	Collision	Large Commercial Vessel - Towage Vessel	A Large Commercial Vessel collides with a Towage Vessel.
34	Collision	Recreational Vessel - Recreational Vessel	A Recreational Vessel collides with another Recreational Vessel.
35	Collision	Recreational Vessel - Small Commercial Vessel	A Recreational Vessel collides with a Small Commercial Vessel.
36	Collision	Recreational Vessel - Towage Vessel	A Recreational Vessel collides with a Towage Vessel.
37	Collision	Small Commercial Vessel - Small Commercial Vessel	A Small Commercial Vessel collides with another Small Commercial Vessel.
38	Collision	Small Commercial Vessel - Towage Vessel	A Small Commercial Vessel collides with a Towage Vessel.
39	Collision	Towage Vessel - Towage Vessel	A Towage Vessel collides with another Towage Vessel.
40	Contact	Contact - Construction Vessel	A Construction Vessel contacts a fixed object including the works.
41	Contact	Contact - Cruise Ship / Mainland Ferry / Large Commercial Vessel / Inter-Island Ferry	A Cruise Ship / Mainland Ferry / Large Commercial Vessel / Inter-Island Ferry contacts a fixed object.
42	Contact	Contact - Inshore Fishing Vessel / Recreational Vessel / Small Commercial Vessel / Towage Vessel	An Inshore Fishing Vessel / Recreational Vessel / Small Commercial Vessel / Towage Vessel contacts a fixed object.
43	Diving	Diving Incident (including construction works)	A diving incident involving a Recreational and / or Commercial Vessel.
44	Girting	Girting Incident (including during construction)	A towline under tension exerts a heeling moment which results in excessive heel that causes the tug to capsize.
45	Grounding	Grounding - Construction Vessel	A Construction Vessel runs aground.
46	Grounding	Grounding - Cruise Ship / Mainland Ferry / Large	A Cruise Ship / Mainland Ferry / Large Commercial

Hazard ID	Category	Hazard Title	Hazard Detail
		Commercial Vessel / Inter-Island Ferry	Vessel / Inter-Island Ferry runs aground.
47	Grounding	Grounding - Inshore Fishing Vessel / Recreational Vessel / Small Commercial Vessel / Towage Vessel	An Inshore Fishing Vessel / Recreational Vessel / Small Commercial Vessel / Towage Vessel runs aground.
48	Mooring Incident / Breakout	Mooring Breakout - Construction Vessel	A Construction Vessel breaks away from her moorings.
49	Mooring Incident / Breakout	Mooring Breakout - Cruise Ship / Mainland Ferry / Large Commercial Vessel / Inter-Island Ferry.	A Cruise Ship / Mainland Ferry / Large Commercial Vessel / Inter-Island Ferry breaks away from her moorings.
50	Mooring Incident / Breakout	Mooring Breakout - Inshore Fishing Vessel / Recreational Vessel / Small Commercial Vessel / Towage Vessel	An Inshore Fishing Vessel / Recreational Vessel / Small Commercial Vessel / Towage Vessel breaks away from her moorings.

3.3 NAVIGATION HAZARDS – OPERATIONAL PHASE

The Hazard Identification process identified a total of 38 hazards for the study area during the operational phase of the project, as shown in **Table 6**. The full Hazard Logs with additional information are shown in **Annex E.**

Table 6: Operational Phase Navigation Hazards.

Hazard ID	Category	Hazard Title	Hazard Detail
1	Anchor Dragging	Anchor Dragging - Cruise Ship / Mainland Ferry / Large Commercial Vessel / Inter-Island Ferry	A Cruise Ship / Mainland Ferry / Large Commercial Vessel / Inter-Island Ferry unintentionally moves from its anchored position because the anchor has failed to hold.
2	Anchor Dragging	Anchor dragging - Inshore Fishing Vessel / Recreational Vessel / Small Commercial Vessel / Towage Vessel	An Inshore Fishing Vessel / Recreational Vessel / Small Commercial Vessel / Towage Vessel unintentionally moves from its anchored position

Hazard ID	Category	Hazard Title	Hazard Detail
			because the anchor has failed to hold.
3	Collision	Cruise Ship / Mainland Ferry - Cruise Ship / Mainland Ferry	A Cruise Ship / Mainland Ferry collides with another Cruise Ship / Mainland Ferry.
4	Collision	Cruise Ship / Mainland Ferry - Inshore Fishing Vessel	A Cruise Ship / Mainland Ferry collides with an Inshore Fishing Vessel.
5	Collision	Cruise Ship / Mainland Ferry - Inter-Island Ferry	A Cruise Ship / Mainland Ferry collides with an Inter-Island Ferry.
6	Collision	Cruise Ship / Mainland Ferry - Large Commercial Vessel	A Cruise Ship / Mainland Ferry collides with a Large Commercial Vessel.
7	Collision	Cruise Ship / Mainland Ferry - Recreational Vessel	A Cruise Ship / Mainland Ferry collides with a Recreational Vessel.
8	Collision	Cruise Ship / Mainland Ferry - Small Commercial Vessel	A Cruise Ship / Mainland Ferry collides with a Small Commercial Vessel.
9	Collision	Cruise Ship / Mainland Ferry - Towage Vessel	A Cruise Ship / Mainland Ferry collides with a Towage Vessel.
10	Collision	Inshore Fishing Vessel - Inshore Fishing Vessel	An Inshore Fishing Vessel collides with another Inshore Fishing Vessel.
11	Collision	Inshore Fishing Vessel - Inter-Island Ferry	An Inshore Fishing Vessel collides with an Inter-Island ferry.
12	Collision	Inshore Fishing Vessel - Large Commercial Vessel	An Inshore Fishing Vessel collides with a Large Commercial Vessel.
13	Collision	Inshore Fishing Vessel - Recreational Vessel	An Inshore Fishing Vessel collides with a Recreational Vessel.
14	Collision	Inshore Fishing Vessel - Small Commercial Vessel	An Inshore Fishing Vessel collides with a Small Commercial Vessel.
15	Collision	Inshore Fishing Vessel - Towage Vessel	An Inshore Fishing Vessel collides with a Towage Vessel.

Hazard ID	Category	Hazard Title	Hazard Detail
16	Collision	Inter-Island Ferry - Inter-Island Ferry	An Inter-Island Ferry collides with another Inter-Island Ferry.
17	Collision	Inter-Island Ferry - Large Commercial Vessel	An Inter-Island Ferry collides with a Large Commercial Vessel.
18	Collision	Inter-Island Ferry - Recreational Vessel	An Inter-Island Ferry collides with a Recreational Vessel.
19	Collision	Inter-Island Ferry - Small Commercial Vessel	An Inter-Island Ferry collides with a Small Commercial Vessel.
20	Collision	Inter-Island Ferry - Towage Vessel	An Inter-Island Ferry collides with a Towage Vessel.
21	Collision	Large Commercial Vessel - Large Commercial Vessel	A Large Commercial Vessel collides with another Large Commercial Vessel.
22	Collision	Large Commercial Vessel - Recreational Vessel	A Large Commercial Vessel collides with a Recreational Vessel.
23	Collision	Large Commercial Vessel - Small Commercial Vessel	A Large Commercial Vessel collides with a Small Commercial Vessel.
24	Collision	Large Commercial Vessel -Towage Vessel	A Large Commercial Vessel collides with a Towage Vessel.
25	Collision	Recreational Vessel - Recreational Vessel	A Recreational Vessel collides with another Recreational Vessel.
26	Collision	Recreational Vessel - Small Commercial Vessel	A Recreational Vessel collides with a Small Commercial Vessel.
27	Collision	Recreational Vessel - Towage Vessel	A Recreational Vessel collides with a Towage Vessel.
28	Collision	Small Commercial Vessel - Small Commercial Vessel	A Small Commercial Vessel collides with another Small Commercial Vessel.
29	Collision	Small Commercial Vessel - Towage Vessel	A Small Commercial Vessel collides with a Towage Vessel.

Hazard ID	Category	Hazard Title	Hazard Detail
30	Collision	Towage Vessel - Towage Vessel	A Towage Vessel collides with another Towage Vessel.
31	Contact	Contact - Cruise Ship / Mainland Ferry / Large Commercial Vessel / Inter-Island Ferry	A Cruise Ship / Mainland Ferry / Large Commercial Vessel / Inter-Island Ferry contacts a fixed object.
32	Contact	Contact - Inshore Fishing Vessel / Recreational Vessel / Small Commercial Vessel / Towage Vessel	An Inshore Fishing Vessel / Recreational Vessel / Small Commercial Vessel / Towage Vessel contacts a fixed object.
33	Diving	Diving Incident	A diving incident involving a Recreational and / or Commercial Vessel.
34	Girting	Girting Incident	A towline under tension exerts a heeling moment which results in excessive heel that causes the tug to capsize.
35	Grounding	Grounding - Cruise Ship / Mainland Ferry / Large Commercial Vessel / Inter-Island Ferry	A Cruise Ship / Mainland Ferry / Large Commercial Vessel / Inter-Island Ferry runs aground.
36	Grounding	Grounding - Inshore Fishing Vessel / Recreational Vessel / Small Commercial Vessel / Towage Vessel	An Inshore Fishing Vessel / Recreational Vessel / Small Commercial Vessel / Towage Vessel runs aground.
37	Mooring Incident / Breakout	Mooring Breakout - Cruise Ship / Mainland Ferry / Large Commercial Vessel / Inter-Island Ferry.	A Cruise Ship / Mainland Ferry / Large Commercial Vessel / Inter-Island Ferry breaks away from her moorings.
38	Mooring Incident / Breakout	Mooring Breakout - Inshore Fishing Vessel / Recreational Vessel / Small Commercial Vessel / Towage Vessel	An Inshore Fishing Vessel / Recreational Vessel / Small Commercial Vessel / Towage Vessel breaks away from her moorings.

4 RISK ASSESSMENT

This risk assessment complies with the PMSC and its associated Guide to Good Practice and was conducted in accordance with the IMO FSA methodology for risk assessments. A detailed description of the methodology is provided in **Annex C** Overview of the Risk Assessment Methodology.

A standard 5x5 risk matrix was used (see **Figure 25**) and each hazard was assessed twice. Firstly, to determine the risk associated with the "*most likely*" outcome of the hazard, and secondly, to determine the risk associated with the "*worst credible*" outcome for each hazard. The results are then combined to give a total Risk Score for each Hazard.

This approach provides a realistic and thorough assessment of risk, which reflects reality, in that relatively few incidents result in the "worst credible" outcome.

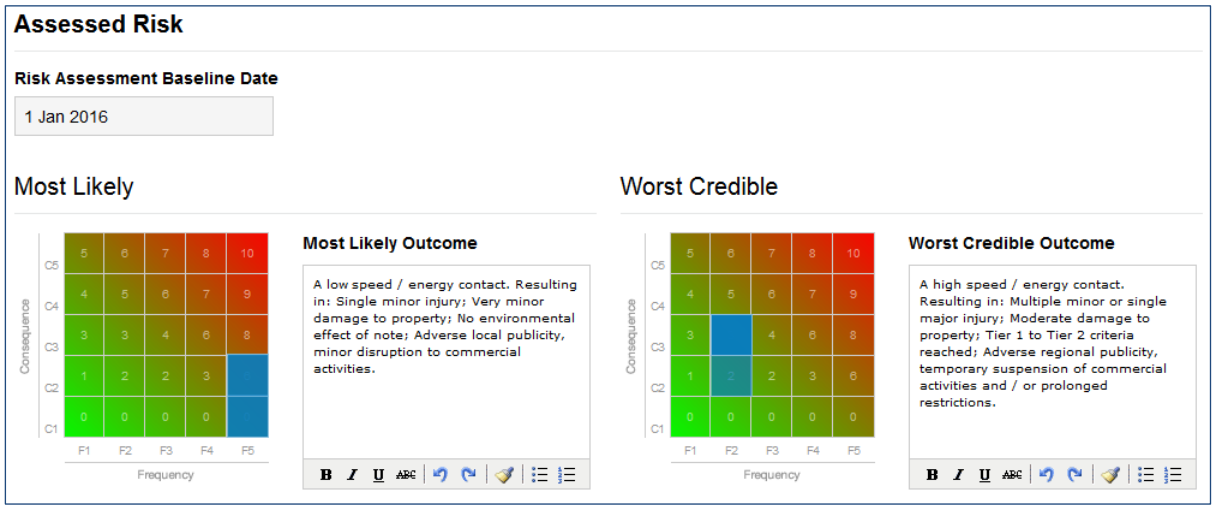


Figure 25: Example Risk Matrix.

4.1.1 Assessment of Frequency and Consequence

For both the construction and operational phases of the proposed new facility, an assessment of frequency was made for a notional "*most likely*" and "*worst credible*" likelihood of occurrence, for each hazard. These were combined with assessments of typical consequences to people, property, environment and business. The frequency and consequence bands used for this NRA are shown in **Annex C.**

The frequency and consequence assessments were largely based on the data / information collected during Stage 1 of this NRA.

This data / information was supplemented by expert judgement and specialist knowledge provided by the assessment team, who have considerable experience in undertaking NRAs of this type in ports / harbours all around the world, including the Orkney harbours.

4.1.2 Risk Scores

The frequency and consequence scores are combined to give two separate risk scores that represent the "*most likely*" and the "*worst credible*" risk for each hazard. These two scores are further combined to give a final risk score for each hazard, between 0 (negligible) and 10 (high). The risk scores are sorted into a Ranked Hazard List that shows the highest risk hazards prioritised at the top and the lowest at the bottom (see **Section 4.2**).

Risks are deemed to be negligible, low, As Low as Reasonably Practicable (ALARP), significant or high, as per **Table 7**. ALARP represents that risk band where the level of risk is neither acceptable nor unacceptable. It is the risk band for which further investment of resources for risk reduction may not be justifiable – i.e. risks which fall within the ALARP band have to be reduced unless there is a disproportionate cost to the benefits obtained.

A navigation hazard with a risk score that is "significant" or "high" is termed "unacceptable" and as such additional risk control measures should be implemented. This may range from stopping the activities which bring about such high-risk hazards or by measures which seek to reduce the likelihood and / or consequence of the hazard occurrence.

Table 7: Risk Scoring.

Risk Score	Risk Definition	Action Taken
0 - 1.99	Negligible	The risk is acceptable and at level where operational safety is unaffected.
2 - 3.99	Low	The risk is acceptable and at level where operational safety is assumed.
4 - 6.99	ALARP	The risk is neither acceptable nor unacceptable. Risks in the ALARP band are to be managed to a level which is "As Low As Reasonably Practicable", based on the cost-effectiveness of implementing additional risk control measures. These risks and associated risk control measures shall be regularly reviewed as part of the Safety Management System.
7 - 8.99	Significant	The risk is unacceptable and additional risk control measures shall be identified and implemented as soon as possible (or the activity / operation temporarily suspended). These risks and associated risk control measures shall be regularly reviewed as part of the Safety Management System.
9 - 10	High	The risk is unacceptable and additional risk control measures shall be identified and implemented immediately (or the activity / operation permanently suspended). These risks and associated risk control measures shall be regularly reviewed as part of the Safety Management System.

4.2 RISK ASSESSMENT RESULTS

4.2.1 Construction Phase

Table 8 shows a summary of the Ranked Hazard List for the construction phase of the new quay. More details on each hazard are provided in **Annex D**, which also contains the associated risk scores in terms of the "*most likely*" and the "*worst credible*" consequences to people, property, environment and business.

Table 8: Summary of the Ranked Hazard List – Construction Phase.

Rank	Hazard Ref.	Accident Category	Hazard Title	Risk Overall
1	5	Collision	Construction Vessel - Cruise Ship / Mainland Ferry	**4.56**
2	7	Collision	Construction Vessel - Inter-Island Ferry	**4.45**
3	45	Grounding	Grounding - Construction Vessel	**4.41**
4	41	Contact	Contact - Cruise Ship / Mainland Ferry / Large Commercial Vessel / Inter-Island Ferry	**4.31**
5	49	Mooring Incident / Breakout	Mooring Breakout - Cruise Ship / Mainland Ferry / Large Commercial Vessel / Inter-Island Ferry.	**4.19**
6	28	Collision	Inter-Island Ferry - Small Commercial Vessel	**4.03**
7	14	Collision	Cruise Ship / Mainland Ferry - Inter-Island Ferry	**3.90**
8	15	Collision	Cruise Ship / Mainland Ferry - Large Commercial Vessel	**3.90**
9	50	Mooring Incident / Breakout	Mooring Breakout - Inshore Fishing Vessel / Recreational Vessel / Small Commercial Vessel / Towage Vessel	**3.82**
10	23	Collision	Inshore Fishing Vessel - Small Commercial Vessel	**3.80**
11	17	Collision	Cruise Ship / Mainland Ferry - Small Commercial Vessel	**3.70**
12	13	Collision	Cruise Ship / Mainland Ferry - Inshore Fishing Vessel	**3.69**
13	6	Collision	Construction Vessel - Inshore Fishing Vessel	**3.64**

Rank	Hazard Ref.	Accident Category	Hazard Title	Risk Overall
14	10	Collision	Construction Vessel - Small Commercial Vessel	**3.64**
15	25	Collision	Inter-Island Ferry - Inter-Island Ferry	**3.55**
16	47	Grounding	Grounding - Inshore Fishing Vessel / Recreational Vessel / Small Commercial Vessel / Towage Vessel	**3.52**
17	12	Collision	Cruise Ship / Mainland Ferry - Cruise Ship / Mainland Ferry	**3.50**
18	37	Collision	Small Commercial Vessel - Small Commercial Vessel	**3.40**
19	46	Grounding	Grounding - Cruise Ship / Mainland Ferry / Large Commercial Vessel / Inter-Island Ferry	**3.40**
20	29	Collision	Inter-Island Ferry - Towage Vessel	**3.27**
21	16	Collision	Cruise Ship / Mainland Ferry - Recreational Vessel	**3.25**
22	32	Collision	Large Commercial Vessel - Small Commercial Vessel	**3.18**
23	30	Collision	Large Commercial Vessel - Large Commercial Vessel	**3.00**
24	26	Collision	Inter-Island Ferry - Large Commercial Vessel	**2.95**
25	38	Collision	Small Commercial Vessel - Towage Vessel	**2.81**
26	9	Collision	Construction Vessel - Recreational Vessel	**2.76**
27	21	Collision	Inshore Fishing Vessel - Large Commercial Vessel	**2.71**
28	27	Collision	Inter-Island Ferry - Recreational Vessel	**2.71**
29	35	Collision	Recreational Vessel - Small Commercial Vessel	**2.71**
30	36	Collision	Recreational Vessel - Towage Vessel	**2.71**
31	40	Contact	Contact - Construction Vessel	**2.68**

Rank	Hazard Ref.	Accident Category	Hazard Title	Risk Overall
32	31	Collision	Large Commercial Vessel - Recreational Vessel	**2.65**
33	24	Collision	Inshore Fishing Vessel - Towage Vessel	**2.61**
34	48	Mooring Incident / Breakout	Mooring Breakout - Construction Vessel	**2.41**
35	1	Anchor Dragging	Anchor Dragging - Construction Vessel	**2.34**
36	2	Anchor Dragging	Anchor Dragging - Cruise Ship / Mainland Ferry / Large Commercial Vessel / Inter-Island Ferry	**2.34**
37	19	Collision	Inshore Fishing Vessel - Inshore Fishing Vessel	**2.28**
38	4	Collision	Construction Vessel - Construction Vessel	**2.26**
39	8	Collision	Construction Vessel - Large Commercial Vessel	**2.26**
40	18	Collision	Cruise Ship / Mainland Ferry - Towage Vessel	**2.24**
41	44	Girting	Girting Incident (including during construction)	**2.24**
42	33	Collision	Large Commercial Vessel - Towage Vessel	**2.15**
43	20	Collision	Inshore Fishing Vessel - Inter-Island Ferry	**2.07**
44	43	Diving	Diving Incident (including construction works)	**2.00**
45	22	Collision	Inshore Fishing Vessel - Recreational Vessel	**1.85**
46	11	Collision	Construction Vessel - Towage Vessel	**1.80**
47	34	Collision	Recreational Vessel - Recreational Vessel	**1.69**
48	42	Contact	Contact - Inshore Fishing Vessel / Recreational Vessel / Small Commercial Vessel / Towage Vessel	**1.69**

Rank	Hazard Ref.	Accident Category	Hazard Title	Risk Overall
49	3	Anchor Dragging	Anchor dragging - Inshore Fishing Vessel / Recreational Vessel / Small Commercial Vessel / Towage Vessel	**1.54**
50	39	Collision	Towage Vessel - Towage Vessel	**1.26**

4.2.2 Operational Phase

Table 9 shows a summary of the Ranked Hazard List for the operational phase of the new quay. More details on each hazard are provided in **Annex E** which also contains the associated risk scores in terms of the "*most likely*" and the "*worst credible*" consequences to people, property, environment and business.

Table 9: Summary of the Ranked Hazard List – Operational Phase.

Rank	Hazard Ref.	Accident Category	Hazard Title	Risk Overall
1	35	Grounding	Grounding - Cruise Ship / Mainland Ferry / Large Commercial Vessel / Inter-Island Ferry	**4.40**
2	31	Contact	Contact - Cruise Ship / Mainland Ferry / Large Commercial Vessel / Inter-Island Ferry	**4.31**
3	37	Mooring Incident / Breakout	Mooring Breakout - Cruise Ship / Mainland Ferry / Large Commercial Vessel / Inter-Island Ferry.	**4.19**
4	8	Collision	Cruise Ship / Mainland Ferry - Small Commercial Vessel	**4.03**
5	19	Collision	Inter-Island Ferry - Small Commercial Vessel	**4.03**
6	5	Collision	Cruise Ship / Mainland Ferry - Inter-Island Ferry	**3.90**
7	6	Collision	Cruise Ship / Mainland Ferry - Large Commercial Vessel	**3.90**

Rank	Hazard Ref.	Accident Category	Hazard Title	Risk Overall
8	38	Mooring Incident / Breakout	Mooring Breakout - Inshore Fishing Vessel / Recreational Vessel / Small Commercial Vessel / Towage Vessel	**3.82**
9	14	Collision	Inshore Fishing Vessel - Small Commercial Vessel	**3.80**
10	28	Collision	Small Commercial Vessel - Small Commercial Vessel	**3.80**
11	4	Collision	Cruise Ship / Mainland Ferry - Inshore Fishing Vessel	**3.69**
12	16	Collision	Inter-Island Ferry - Inter-Island Ferry	**3.55**
13	36	Grounding	Grounding - Inshore Fishing Vessel / Recreational Vessel / Small Commercial Vessel / Towage Vessel	**3.52**
14	3	Collision	Cruise Ship / Mainland Ferry - Cruise Ship / Mainland Ferry	**3.50**
15	23	Collision	Large Commercial Vessel - Small Commercial Vessel	**3.40**
16	29	Collision	Small Commercial Vessel - Towage Vessel	**3.40**
17	20	Collision	Inter-Island Ferry - Towage Vessel	**3.27**
18	7	Collision	Cruise Ship / Mainland Ferry - Recreational Vessel	**3.25**
19	21	Collision	Large Commercial Vessel - Large Commercial Vessel	**3.00**
20	17	Collision	Inter-Island Ferry - Large Commercial Vessel	**2.95**
21	12	Collision	Inshore Fishing Vessel - Large Commercial Vessel	**2.71**
22	18	Collision	Inter-Island Ferry - Recreational Vessel	**2.71**
23	26	Collision	Recreational Vessel - Small Commercial Vessel	**2.71**
24	27	Collision	Recreational Vessel - Towage Vessel	**2.71**
25	22	Collision	Large Commercial Vessel - Recreational Vessel	**2.65**

Rank	Hazard Ref.	Accident Category	Hazard Title	Risk Overall
26	15	Collision	Inshore Fishing Vessel - Towage Vessel	**2.61**
27	10	Collision	Inshore Fishing Vessel - Inshore Fishing Vessel	**2.28**
28	9	Collision	Cruise Ship / Mainland Ferry - Towage Vessel	**2.24**
29	24	Collision	Large Commercial Vessel - Towage Vessel	**2.15**
30	11	Collision	Inshore Fishing Vessel - Inter-Island Ferry	**2.07**
31	1	Anchor Dragging	Anchor Dragging - Cruise Ship / Mainland Ferry / Large Commercial Vessel / Inter-Island Ferry	**1.96**
32	34	Girting	Girting Incident	**1.88**
33	13	Collision	Inshore Fishing Vessel - Recreational Vessel	**1.85**
34	25	Collision	Recreational Vessel - Recreational Vessel	**1.69**
35	32	Contact	Contact - Inshore Fishing Vessel / Recreational Vessel / Small Commercial Vessel / Towage Vessel	**1.69**
36	33	Diving	Diving Incident	**1.63**
37	2	Anchor Dragging	Anchor dragging - Inshore Fishing Vessel / Recreational Vessel / Small Commercial Vessel / Towage Vessel	**1.54**
38	30	Collision	Towage Vessel - Towage Vessel	**1.26**

5 RISK CONTROL MEASURES

There are a number of over-arching merchant shipping regulations that apply in all ports / harbours in the UK, and the most applicable include (but not limited to):

- International Convention for the Safety of Life at Sea (SOLAS), 1974 (and amendments);
- The International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (or STCW), 1978 (and amendments);
- The International Regulations for Preventing Collisions at Sea (COLREGs); and
- The Merchant Shipping (Oil Pollution Preparedness, Response Co-operation Convention) Regulations 1998, Statutory Instrument 1998 No. 1056.

5.1 EXISTING RISK CONTROL MEASURES

The current NRA maintained by OIC for Kirkwall references the following active risk controls:

- Aids to Navigation;
- Charts and Publications;
- Emergency Plans;
- Fendering;
- Hydrographic Policy and Survey Programme;
- International / National Regulations;
- Local Traffic Control;
- Permit System;
- Pier Manning;
- Pilotage Service;
- Pollution Control Equipment;
- Prior notification procedure;
- SAR and Emergency Services;
- Ship Towage;
- Towage Guidelines; and
- VTS.

5.2 ADDITIONAL RISK CONTROL MEASURES

Navigation hazards that may be scored as high or significant risk are termed “intolerable”, and as such additional risk control measures should be implemented. This may range from stopping the activities which

bring about such high-risk hazards or by measures which seek to reduce the likelihood and / or consequence of hazard occurrence.

All the navigation hazards identified and scored for this NRA fell into the negligible, low or ALARP categories of risk, so the current navigation activities are deemed to be largely acceptable.

This does not however mean that mitigation for the ALARP hazards must not be considered. There is a rationale underlying any risk assessments that no matter how low the risk, there remains, no matter how small, a possibility that accidents or incidents may still occur. There are also underlying principles of the PMSC which encourage port authorities and operators to operate as safely as possible and implement a coherent and clear SMS.

The relationship between the NRA and the OIC SMS is shown in **Figure 26**: Relationship between the NRA and the Safety Management System.

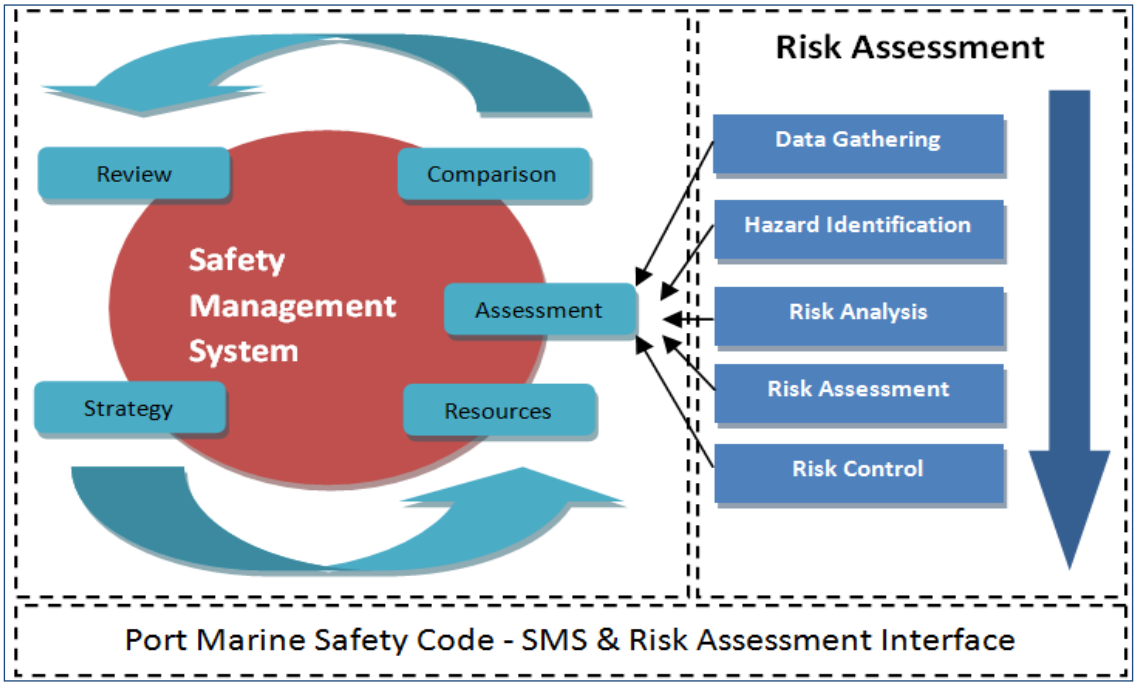


Figure 26: Relationship between the NRA and the Safety Management System.

5.2.1 High Risks and Significant Risks

No hazards were assessed to be in the High Risk or Significant Risk band for either the construction or operation phase of the project.

5.2.2 ALARP Risks

5.2.2.1 Construction Phase

Six of the 50 hazards were assessed to be within the ALARP band, with risk scores between 4.3 and 4.56. This is in the lower band of the ALARP region; however efforts should nonetheless be made to reduce this risk further, based on the cost-effectiveness of implementing additional risk control measures. These hazards and their associated control measures should be regularly reviewed as part of the OIC and Project Safety Management System. They are:

- Collision: Construction Vessel - Cruise Ship / Mainland Ferry;
- Collision: Construction Vessel - Inter-Island Ferry;
- Grounding: Grounding - Construction Vessel;
- Contact: Contact - Cruise Ship / Mainland Ferry / Large Commercial Vessel / Inter-Island Ferry;
- Mooring Incident / Breakout: Mooring Breakout - Cruise Ship / Mainland Ferry / Large Commercial Vessel / Inter-Island Ferry; and
- Collision: Inter-Island Ferry - Small Commercial Vessel.

However, it is noted that four of the hazards involve passenger vessels, and while assessed as unlikely to happen in the project vicinity, the relatively high-risk scores are attributable to the severity of outcome in the remote event the hazard is realised (particularly injuries to people).

The three highest scored hazards are directly related to the construction activity, and it is recommended that in addition to the ongoing traffic monitoring and direction provided by the OIC VTS, a navigation management plan is developed and implemented to manage all vessels involved in the construction project.

5.2.2.2 Operation Phase

Five of the 38 hazards were assessed to be within the ALARP band, with risk scores between 4.03 and 4.40. This is towards the lower end of the ALARP region; however, efforts should nonetheless be made to reduce this risk further, based on the cost-effectiveness of implementing additional risk control measures. These hazards and their associated control measures should be regularly reviewed as part of the OIC Safety Management System. They are:

- Grounding: Grounding - Cruise Ship / Mainland Ferry / Large Commercial Vessel / Inter-Island Ferry;
- Contact: Contact - Cruise Ship / Mainland Ferry / Large Commercial Vessel / Inter-Island Ferry;
- Mooring Incident / Breakout: Mooring Breakout - Cruise Ship / Mainland Ferry / Large Commercial Vessel / Inter-Island Ferry;
- Collision: Cruise Ship / Mainland Ferry - Small Commercial Vessel; and

- Collision: Inter-Island Ferry - Small Commercial Vessel.

All of these hazards pre-exist the proposed development, and while increased levels of shipping in the area following the commissioning of the pier extension may slightly increase the likelihood (frequency) of these hazards being realised, it is considered that existing risk controls remain effective and appropriate.

5.2.3 Negligible and Low Risks

All of the remaining hazards that were identified for both phases fell within the "negligible" or "low risk" regions, therefore no additional risk controls are formally required.

However, the following mitigations, many of which were suggested by consultees are offered for consideration and implementation during the development:

- The project design should ensure sufficient water depth on the inshore face of the new jetty for both commercial vessels and tugs assisting them;
- Impact protection piles / buoys inshore side of construction and operational area should be considered to further reduce the likelihood of groundings;
- Notice to Mariners (NTMs);
- Deconflicting construction traffic movements with others (e.g. Cruise / ferries etc). This would be a normal VTS function, but should be considered during project planning; and
- Seasonal working to avoid the peak summer traffic should be included in project planning.

The following mitigations do not specifically appear in the current list of control measures in the OIC NRA for Kirkwall Bay, but it is assumed that they will be in place during and after construction:

- Lighting / marking of structures and construction plant to the satisfaction of Local Lighthouse Authority / General Lighthouse Authority; and
- Issue of regular Notices to Mariners to inform all users of construction activity, and temporary restrictions or hazards.

6 CONCLUSIONS

This assessment has concluded that there is little significant new navigational risk associated with either the construction or operation of the proposed Hatston Pier redevelopment.

The project site is located in an area of relatively low present day traffic density (albeit with significant seasonal variations), and which is already subject to numerous effective risk control measures (VTS, Pilotage, Towage, etc). As a result of both of these factors, incident frequency is also low.

There will be an inevitable increase in navigation risk through the introduction of a new structure, generating an increased volume of traffic. However, the increase in risk is low, on top of an already low baseline.

7 RECOMMENDATIONS

While this assessment has found that navigation risk will be low, or in a small number of scenarios, within the ALARP band both during the construction and operational phases, the following recommendations are made:

- The project design should consider additional dredging or other mitigations to prevent vessels grounding inshore of the extended pier (during both construction and operation phases);
- The project design should consider amendments to provide sheltered small vessel moorings inshore of the new pier extension, to replace mooring lost on the current eastern side of the causeway;
- Existing control measures should be kept in place (VTS, Pilotage, Towage) during both construction and operation phases;
- Good communications should be maintained with stakeholders throughout (NTMs, website, meetings etc). There will be a need for close liaison between the OICHA and the contractors during the construction phase and between OICHA and the berth operator during the operational phase.;
- A Navigation Management Plan for the construction phase should be designed and implemented to reduce the chance of ship-to-ship collisions between craft involved in the construction phase;
- Other mitigations, to further reduce low or ALARP risks (see section 5.2.3), should be considered;
- All of the risks should be kept under review as the project is developed, and once the facility is operational, OICs PMSC NRA should be updated and kept under review to reflect the new operations.

Annex A Stakeholder Meeting Minutes

Minutes – Hatston Pier Redevelopment – 22UK1893

Client:	OICHA	
Project:	22UK1893	**OICHA Stakeholders**
Attendees:	William Heaps (WH)	Marico Marine
	David Foster	Marico Marine
	David Sawkins	DHM OICHA
	Peter Bentley	Pilot
	Alastair MacDonald	VTS
Venue:	Orkney	
Date of Meeting:	14:00 7 November 2022	

Item	Action item / Notes for the record	Action
1	**Introductions**	
	All present introduced themselves, and indicated that they were already broadly aware of the project proposals.	
2	**Overview**	
	WH / DS gave a brief project overview using drawings / plans supplied by OICHA. Attendees were reminded that more detail was available in the published Master Plan.	
3	**NRA Process**	
	A very brief overview was given of the NRA process as all present were familiar with the concept of undertaking NRA's as part of a development consent application.	
4	**Existing and Future Shipping and Navigation Activity**	
	See commercial users summary – the OICHA stakeholders were in close agreement with the numbers and types of vessels currently using the pier. However, the seasonality / variability of some traffic types was stressed, and this should be analysed using AIS / VTS data. It was noted that all ferries made use of PEC's but less regular callers would often be Piloted in to Hatston Pier (especially those requiring towage). It was noted that vessel berths were allocated by the Kirkwall Pier Master in conjunction with VTS via a basic manual (whiteboard) system. Future traffic – no significant changes were expected with regard to existing users, but it was noted that the new facility should attract additional users. However, it was not considered that the number of extra vessel movements would be great compared with now, nor that vessel types or sizes would change significantly.	
5	**Existing and Potential Hazards**	
	Existing hazards identified were: Collison –mitigated through VTS reporting requirements but collision hazard currently most significant with leisure / fishing vessels "crossing" approach to pier. Few incidents, but hazard will remain after development. Contact – Pilot highlighted potential for heavy contact with pier during berthing manoeuvres especially during strong northerly winds. New pier not expected to increase risk, and indeed sheet pile construction may lead to reduced risk if effective at reducing swell on inner face.	Marico note future control

	Also noted that fender design should allow for lateral forces during berthing as existing design liable to damage if vessel moves fore and aft alongside. Grounding – considered most likely hazard, especially for vessels using shoreside quay faces. Would be unchanged for existing ferry berth, but it was considered that there would be insufficient water inside pier extension without dredging (including dredging a pocket for tugs to use). Simulation was identified as a mitigation in advance of design finalisation. The location of the fish farm and Scargun Shoal were identified as a potential hazard on approach.	Marico note future control
6	**Incidents History**	
	See incident history. It was suspected that contacts are under reported, but no significant damage has occurred. Fog was noted as a potential incident cause, but is rare in Orkney. There was little even anecdotal experience of leisure / small vessels impeding commercial users of the pier.	
7	**Next Steps (AOB)**	
	It was noted that most commercial users / ferries etc are AIS equipped, and can "see each other" / are visible to VTS.	

Minutes – Hatston Pier Redevelopment – 22UK1893

Client:	OICHA	
Project:	22UK1893	**Commercial Stakeholders**
Attendees:	William Heaps (WH)	Marico Marine
	David Foster	Marico Marine
	Stuart Pottinger	Orkney Ferries
	Abbie Sinclair	Orkney Ferries
	Dougie Leask	Leask Marine
	John Skuse	EMEC
	Daniel Wise	Orbital (renewables)
	Alan Scott (from 10:10)	SERCO NorthLink Ferries
	Ollie Cameron	OIC Kirkwall AHM / Pier Master
Venue:	Kiln Corner, Kirkwall	
Date of Meeting:	09:30 8 November 2022	

Item	Action item / Notes for the record	Action
1	**Introductions**	
	All present introduced themselves, and indicated that they were already broadly aware of the project proposals, and that all present would be directly affected as current / future pier users. Alan Scott (SERCO NorthLink) was slightly delayed and joined at 10:10 with a brief recap being given. All attendees were given the opportunity to view the model of the planned development in the adjacent exhibition space.	
2	**Overview**	
	WH gave a brief project overview using drawings / plans supplied by OICHA. Attendees were reminded that more detail was available in the published Master Plan and from the exhibition facility.	
3	**NRA Process**	
	A very brief overview was given of the NRA process as all present were familiar with the concept of undertaking NRA's as part of a development consent application.	
4	**Existing and Future Shipping and Navigation Activity**	
	Mainland Ferries: One passenger ferry to Aberdeen or Shetland every night (slightly reduced during winter (GMT) period). Vessels currently 20 years old and bespoke to route, but currently no firm plans for replacement ferries, or changes to service. Expect to continue "business as usual" during and after development. Freight Ferry: variable service on demand – usually 2-3 per week, but can be more e.g. during "cattle season". Not unknown to have two freight and one passenger movement in a 24hr period, but unusual. No expected changes to this pattern, but proposed new RoRo ramp would add flexibility (freight vessel could remain alongside working at same time as passenger, with additional ramp).	

	Cruise: Significant user but seasonal (March to October). This year 157 calls to pier, and expected to be more in future. Pier development an obvious benefit when very large or more than one vessel stemmed on same day. General cargo. Varied and unpredictable. Some seasonal (salt deliveries / fertiliser). Also includes towed barges, offshore support vessels (layby) and other general cargoes. Result is steady usage overall (few / week) and not expected to change greatly in future (aside from new business in offshore support). Others: include regular crew change / storing visits by ETV (up tando 2 /month), renewable device maintenance vessels, including larger work boats (multicats) restricted by draft at Kirkwall, large aquaculture support vessels. None of the above existing uses were expected to significantly change following the pier development, though some would benefit from the extra quay / laydown space. Additionally, the current quay space for small vessels inside the existing pier was noted, and considered to be very useful for smaller work boats and barges. It was noted that these berths would be lost on the East side of the existing causeway, and current users would therefore be displaced to Kirkwall Pier (if sufficient space could be found), resulting in increased traffic / risk in Kirkwall as a result of the development. Suggested mitigation was provision of equivalent quay space to the eastern edge of the new fill area (south of proposed boat lift) by replacing rock revetment with sheet piling and suitable dredging. Stakeholders did not identify any future increases in traffic level (despite the development being promoted to attract additional business).	Marico to suggest
5	**Existing and Potential Hazards**	
	Existing hazards identified were: Collison – all present felt that this hazard is currently effectively mitigated through VTS reporting requirements, and enlarged pier would have minimal effect. Contact – several stakeholders mentioned potential for heavy contact with pier during berthing manoeuvres especially during strong northerly winds. New pier not expected to increase risk, and indeed sheet pile construction may lead to reduced risk if effective at reducing swell on inner face. Also noted that fender design should allow for lateral forces during berthing as existing design liable to damage if vessel moves fore and aft alongside. Grounding – considered most likely hazard, especially for vessels using shoreside quay faces. Would be unchanged for existing ferry berth, but it was considered that there would be insufficient water inside pier extension without dredging (including dredging a pocket for tugs to use). Entanglement with fishing gear in inshore area was noted as a current hazard in the vicinity of the pier. No effective controls measures suggested beyond current methods.	Marico note future control Marico note future control
6	**Incidents History**	
	Stakeholders indicated that they thought incidents were routinely reported to OICHA (note – not supported by OICHA records). There was little anecdotal reporting of incidents in the area, except for a few fishing gear foulings, one work boat fouled by steel cable picked up from seabed while alongside, and a small number (2) of shore side incidents.	
7	**Next Steps (AOB)**	
	Stakeholders were keen to emphasise that they would all need to work as normal during construction of the facility. It was considered that construction would be challenging during the cruise season if all other activities were to be accommodated as well. There was a feeling from the majority present (including OICHA staff) that while they were aware of the planned development, they had not been sufficiently consulted to date.	

	There being no further comments, the meeting was concluded with a visit to the models and exhibition room.	

Minutes – Hatston Pier Redevelopment – 22UK1893

Client:	OICHA	
Project:	22UK1893	**Aquaculture Stakeholders**
Attendees:	William Heaps (WH)	Marico Marine
	David Foster	Marico Marine
	Steve Kolthammer	Scottish Seafarms
	Maddy Walker	Scottish Seafarms
	Robert Petersen	Cooke Aquaculture
	Naomi Dempsey	Cooke Aquaculture
Venue:	Kiln Corner, Kirkwall	
Date of Meeting:	14:30 8 November 2022	

Item	Action item / Notes for the record	Action
1	**Introductions**	
	All present introduced themselves and indicated that they were already broadly aware of the project proposals. All attendees were given the opportunity to view the model of the planned development in the adjacent exhibition space.	
2	**Overview**	
	WH gave a brief project overview using drawings / plans supplied by OICHA. Attendees were reminded that more detail was available in the published Master Plan and from the exhibition facility.	
3	**NRA Process**	
	A very brief overview was given of the NRA process and then function of the NRA as part of a development consent application.	
4	**Existing and Future Shipping and Navigation Activity**	
	There is an existing fish farm located to the northwest of Hatston Pier, which is between the shore and Scargun Shoal. The fish farm had been identified as a potential hazard to navigation by other stakeholders; however it was stated that it was likely the infrastructure would be relocated further northwest in the fairly near future, thus deconflicting with any navigation in the vicinity of Hatston Pier. The marine licence applications for the proposed re-location are at an advanced stage, and public consultation has been ongoing since February 2022. As it is likely the fish farm infrastructure will be removed by the time the Hatston Pier development takes place, the main navigation activity will be limited to passing service vessels (transiting from Kirkwall to the relocated farm at Quanterness Skerry – 1/day), and other farms currently serviced from Kirkwall. Additionally, some of the larger service boats (well boats etc.) will continue to use Hatston Pier as they currently do (few per year). It was noted that there was a commercial opportunity to develop a feed warehouse at Hatston (relocate from Kirkwall?) which would potentially generate more vessel movements from the new pier, but status unknown at present.	

	A further future commercial opportunity was use of the new laydown areas to construct fish cages, which would also generate occasional vessel / workboat movements from the pier to deliver them to sites around Orkney.	
5	**Existing and Potential Hazards**	
	Existing hazards identified were: Collision – aquaculture and other fishing vessels crossing the tracks of vessels bound for Hatston Pier. Considered to be low risk at present due to VTS controls, and seamanship. Level of risk not expected to change significantly due to proposed development. Contact – Vessels using Hatston Pier would be subject to the same risk of contact damage, but this may be slightly reduced by the increased shelter provided by the solid pier construction (Reduced wave effects on inner berths). Grounding – See commercial notes. Grounding, especially in adverse weather would be a risk when using inner berths. Fouling fishing gear – considered an ever-present hazard close inshore in all Orkney waters. Future hazards considered similar.	
6	**Incidents History**	
	No incident history beyond OICHA records	
7	**Next Steps (AOB)**	
	No other comments. Stakeholders were thanked for their positive and useful engagement. Additional detail regarding the fish farm re-location was provided post-meeting.	

Minutes – Hatston Pier Redevelopment – 22UK1893

Client:	OICHA	
Project:	22UK1893	**Leisure Stakeholders**
Attendees:	William Heaps (WH)	Marico Marine
	David Foster	Marico Marine
	Mike Cooper	Orkney Marinas / RNLI / Cruising Assoc / Ocean Cruising Club
	Ian Hutchison	Orkney Sailing Club
Apologies:	David Flett	Orkney Rowing club – comments received
Venue:	Kiln Corner, Kirkwall	
Date of Meeting:	12:30 8 November 2022	

Item	Action item / Notes for the record	Action
1	**Introductions**	
	All present introduced themselves and indicated that they were already broadly aware of the project proposals. All attendees were given the opportunity to view the model of the planned development in the adjacent exhibition space.	
2	**Overview**	
	WH gave a brief project overview using drawings / plans supplied by OICHA. Attendees were reminded that more detail was available in the published Master Plan and from the exhibition facility.	
3	**NRA Process**	
	A very brief overview was given of the NRA process and then function of the NRA as part of a development consent application.	
4	**Existing and Future Shipping and Navigation Activity**	
	Attendees described leisure activity in Kirkwall Bay and in the vicinity of the proposed development: Dinghy racing is mainly confined to the bay from May to October (approx.). Mainly organised racing for dinghies / catamarans one or two evenings a week and Sunday afternoons. Numbers are normally less than 20 per event. Occasional longer races further into bay are well planned and promulgated. Very little dinghy (or kayak / SUP / other leisure) activity in the vicinity of Hatston Pier. Club activity is concentrated from the Hatston Slipway (also used very occasionally by sea cadets, commercial kayaks companies etc.) Yacht cruising / racing takes place from Kirkwall marina with about 80 local berths and a maximum capacity for 30 to 40 visitors. Total visitors this year is about 400, which is a significant increase on recent years, and likely to be sustained. Once again, little activity in vicinity of Hatston pier, with racing in Wide Firth, and cruisers heading away from Kirkwall. From the RNLI perspective, it was stated that there were few “shouts” (17 this year) but incidents tended to be serious – however most are not in the Kirkwall / Hatston vicinity. Rowing – operate from Hatston slipway. Not a large number of vessels. Early morning / evenings weekends. Typically two boats for an hour.	

5	**Existing and Potential Hazards**	
	Existing hazards identified were: Collison – all stakeholder recognised the potential for collision with commercial traffic, but did not consider the current risk to be high due to experienced users (leisure and commercial) and relatively low traffic densities. It was not considered that the proposed Hatston development would have any significant impact on current or future leisure activities. No other hazards were considered to be directly relevant to current leisure activities in the project area. A potential additional mitigation was proposed by the Rowing club: inform VTS when leaving and returning to shore (reporting numbers of vessels / people and safe return).	
6	**Incidents History**	
	Very few leisure incidents known in the study area. Lifeboat has responded to yachts (breakdowns, groundings) but almost always further afield. Fishing gear fouling mentioned as a potential for incidents (hazard).	
7	**Next Steps (AOB)**	
	No other comments. Stakeholders were thanked for their positive and useful engagement. Additional feedback was received from the rowing club on the following day.	

Annex B Sample Stakeholder Meeting Agenda

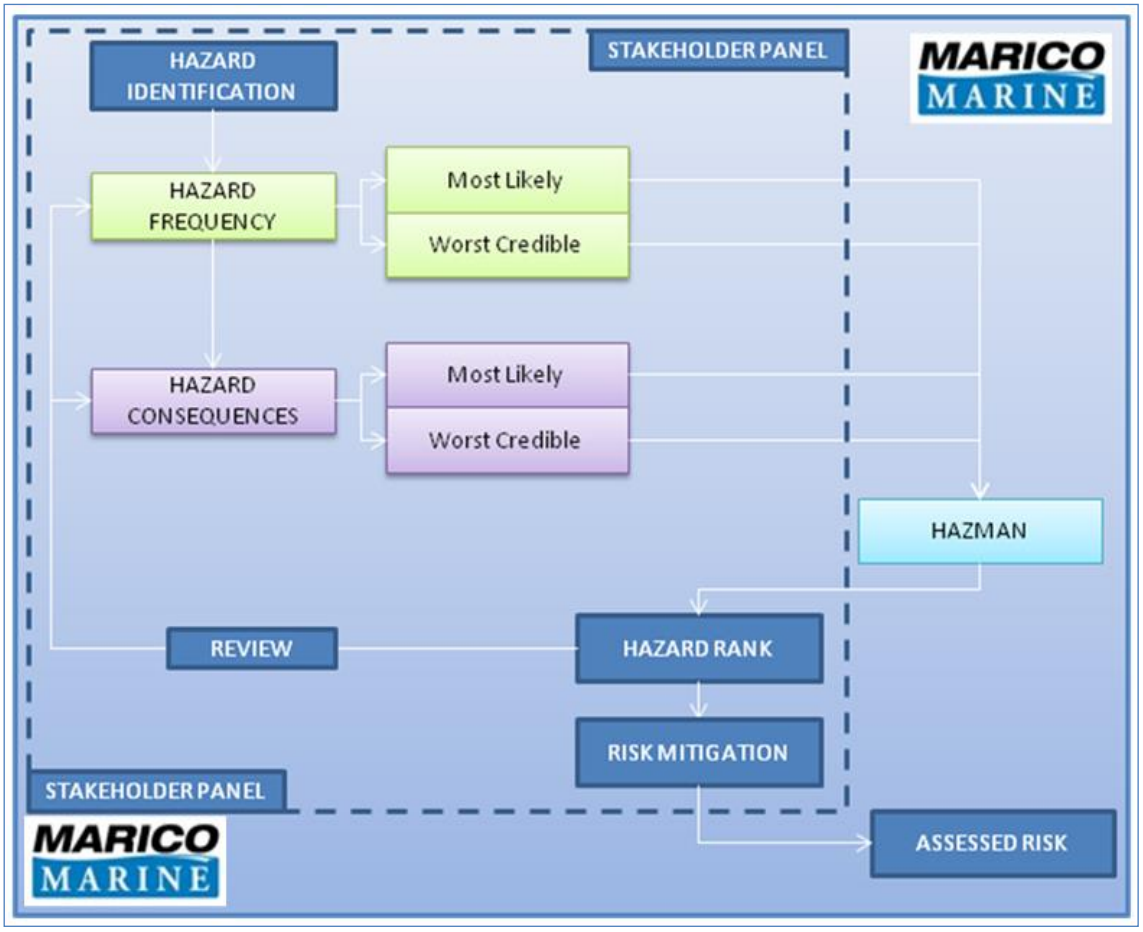
Stakeholder Meeting Agenda

1. Introductions & Purpose of Workshop
2. Project Overview
3. The NRA / Formal Safety Assessment process
4. Existing Shipping and Navigation Activity
5. Existing & Potential Navigation Hazards
6. Incident History
7. Next Steps

Annex C NRA Methodology

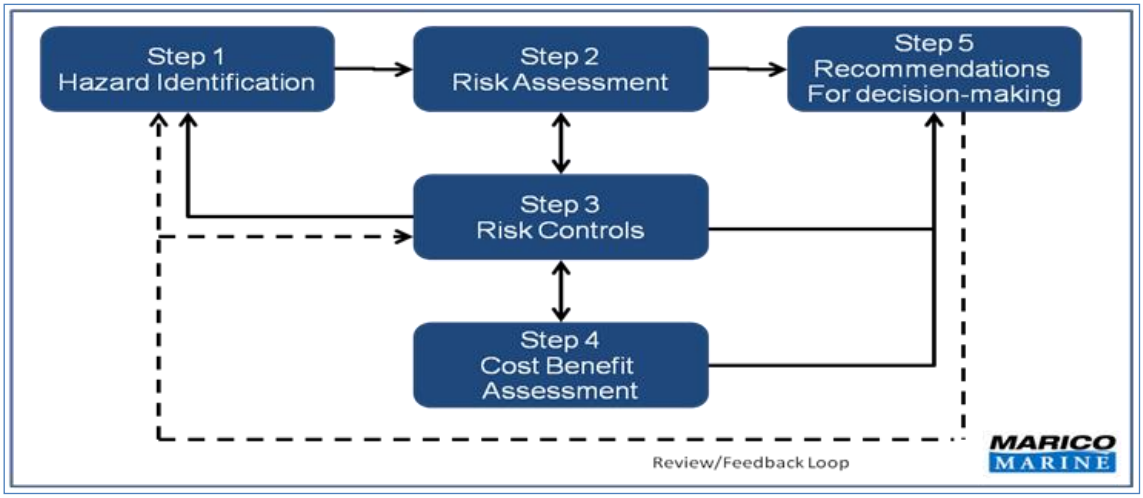
RISK ASSESSMENT METHODOLOGY

The Navigation risk assessment methodology was based on the Formal Safety Assessment methodology as adopted by IMO. It also follows the guidance set out within the Port Marine Safety Code. Marico Marine uses a form of risk assessment that has been specifically adapted for navigational use. It is unique to Marico and is fundamentally based on concepts of "Most Likely" and "Worst Credible", which reflect the range of outcomes arising from a shipping accident. This approach matches marine incident data that is customarily available. It is relevant that incident data often shows a high frequency of "Most Likely" events, separated from a much lower frequency of "Worst Credible" events.



Marico hazard identification and risk assessment process.

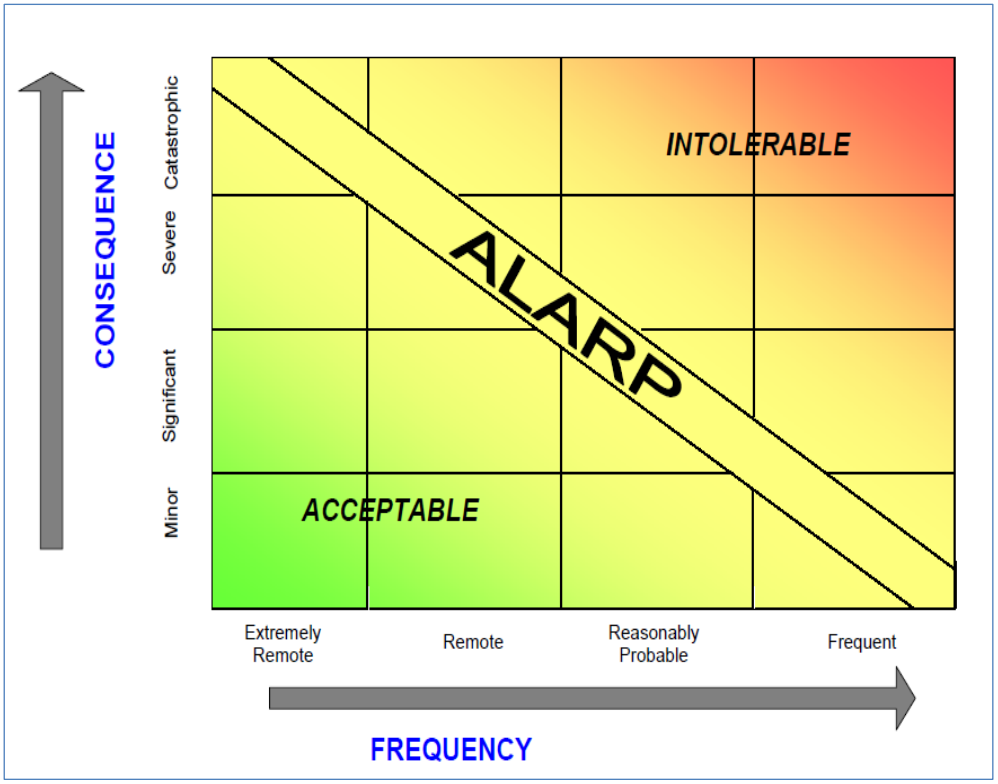
The NRA for the project was carried out using the Marico Marine "HAZMAN II" program to provide ranked hazard reports. The data handled within "HAZMAN II" can subsequently form the basis for an on-going navigational Safety Management System (SMS).



Formal Safety Assessment Risk Assessment Process.

IMO Guidelines define a hazard as "*something with the potential to cause harm, loss or injury*", the realisation of which results in an accident. The potential for a hazard to be realised can be combined with an estimate or known consequence of outcome. This combination is termed "risk". Risk is therefore a measure of the frequency and consequence of a particular hazard. One way to compare risk levels is to use a matrix approach as illustrated below. At the lowest end of the scale, frequency is extremely remote and consequence insignificant such that a risk can be said to be negligible. At the high end, where hazards are defined as frequent and the consequence catastrophic, then risk is termed intolerable. Between the two lies an area known "As Low As Reasonably Practicable" (ALARP).

The IMO guidelines allow the selection of definitions of frequency and consequence to be made by the organisation carrying out the risk assessment. This is important, as it allows risk to be applied in a qualitative and comparative way. To identify high risk levels in a purely mathematically quantitative way would require a large volume of casualty data, which is rarely available in the maritime context. ALARP can be accepted as being "Tolerable", if the further reduction of the risk is impracticable, or if the cost of such reduction would obviously be highly disproportionate to the improvement. It can also be considered "Tolerable", if the cost of reducing the risk is greater than any improvement gained.



Frequency / Consequence Chart.

The NRA used accident categories to organise hazards for assessment. The hazard categories identified as relevant to this study are likely to be:

- Anchor dragging;
- Collision;
- Contact;
- Diving incident;
- Girting;
- Grounding; and
- Mooring incident / breakout.

Each hazard was reviewed with respect to cause and effect. Frequencies were then derived for notional "Most Likely" and "Worst Credible" hazard events in each case, using the frequency bands defined below.

Frequency Criteria.

Scale	Description	Definition
F5	Frequent	An event that could be expected to occur more than once per year.
F4	Likely	An event that could be expected to occur between 1 to 10 years.
F3	Possible	An event that could be expected to occur between 10 to 100 years.
F2	Unlikely	An event that could be expected to occur between 100 to 1000 years.
F1	Remote	An event that could be expected to occur less than once in 1000 years.

Assessment of Consequence

Using the assessed notional frequency for the "*most likely*" and "*worst credible*" scenarios for each hazard, an assessment was made for the consequences to people, property, environment and business, using the categories and criteria below.

Consequence Categories and Criteria.

Cat.	People	Property	Environment	Business
C1	Negligible			
	Very minor injury (e.g. bruising).	Very minor damage to property.	No effect of note. Tier 1 may be declared but criteria not necessarily met.	Very short-term disruption to services (1-2hrs) with ensuing loss of revenue.
		Costs <£10k	Costs <£10k	Costs <£10k
C2	Minor			
	Single minor injury.	Minor damage to property.	Tier 1 – Tier 2 criteria reached. Small operational (oil) spill with little effect on environmental amenity.	Adverse local publicity. Short-term loss of revenue including minor disruption to commercial activities (<1 day).
		Costs £10k –£100k	Costs £10K–£100k	Costs £10k – £100k
C3	Moderate			
	Multiple minor or single major injury.	Moderate damage to property.	Tier 2 spill criteria reached but capable of being limited to immediate area within area.	Adverse regional publicity. Temporary suspension of commercial activities and/or prolonged restrictions (1≥7 days).
		Costs£ 100k - £1M	Costs £100k -£1M	Costs £100k - £1M
C4	Major			
	Multiple major injuries or single fatality.	Major damage to property.	Tier 3 criteria reached with pollution requiring national support. Chemical spillage or small gas release.	Adverse national publicity. Medium-term suspension of operations or prolonged restrictions, major disruption to commercial activities.
		Costs £1M -10M	Costs £1M - £10M	Costs £1M -£10M
C5	Catastrophic			
	Multiple fatalities	Catastrophic damage to property.	Tier 3 oil spill criteria reached. International support required. Widespread shoreline contamination. Serious chemical or gas release. Significant threat to environmental amenity.	Adverse international publicity. Long-term suspension of operations, prolonged restrictions, and/or termination of commercial activities.
		Costs>£10M	Costs >£10M	Costs >£10M

Note that the Oil Pollution Preparedness, Response Co-operation Convention[5] defines the following response levels for oil spills in the United Kingdom:

- Tier 1 Local (within the capability of the operator on site): A Tier 1 response is the lowest response level and requires resources to be available locally. Depending on the characteristics of the oil this may or may not include the use of dispersants. By definition these resources must be at or near the incident site. It is expected that these resources will be deployed as quickly as operational circumstances allow.
- Tier 2 Regional (beyond the in-house capability of the operator): For larger pollution incidents, local resources may be insufficient to deliver a proper response. In these cases it may be that resources from a regional centre will be required. A key component of UK offshore Tier 2 response is that operators are expected to have this capability mobilised and applied within 2 to 6 hours of an oil pollution incident.
- Tier 3 National (requiring national resources): For very large pollution incidents, resources supplied from national and international sources may be required. A key component of UK offshore Tier 3 response is that operators are expected to have this capability mobilised and applied within 6 to 18 hours of an oil pollution incident.

Using the assessed notional frequency for the "Most Likely" and "Worst Credible" scenarios for each hazard, the probable consequences associated with each were assessed in terms of damage to:

- People - Personal injury, fatality etc.;
- Property – including third party;
- Environment - Oil pollution etc.; and
- Business - Reputation, financial loss, public relations etc.

The magnitude of each is then assessed using the consequence categories as shown in the table below. These have been set such that the consequences in respect of property, environment and business have similar monetary equivalent outcomes.

[5] The Merchant Shipping (Oil Pollution Preparedness, Response Co-operation Convention) Regulations 1998, Statutory Instrument 1998 No. 1056

Project Risk Matrix.

Consequences	Cat 5	5.1	5.9	7.0	8.3	10.0
	Cat 4	4.1	4.9	5.9	7.4	9.4
	Cat 3	2.9	3.5	4.4	5.9	8.3
	Cat 2	1.5	1.8	2.4	3.5	5.9
	Cat 1	0	0	0	0	0
	Frequency (years)	**<1,000**	**100-1,000**	**10-100**	**1-10**	**>1**

Navigation hazards are identified by the project team, and scored for "frequency" and "consequence" and in terms of a "Most Likely" and "Worst Credible" outcome, with results documented in a "Hazard Log".

Risk bands.

Matrix Outcome	Risk Definition	Action Taken
0 & 1	Negligible Risk	A level where operational safety is unaffected.
2 & 3	Low risk	A level where operational safety is assumed.
4 ,5 and 6	As Low As Reasonably Practicable (ALARP)	A level defined by study at which risk control in place is reviewed. It should be kept under review in the ensuing SMS.
7 & 8	Significant Risk	A level where existing risk control is automatically reviewed and suggestions made where additional risk control could be applied if appropriate. Significant risk can occur in the average case or in individual categories. New risk controls identified should be introduced in a timescale of two years.
9 & 10	High Risk	A level requiring immediate mitigation.

Risk is then calculated for each consequence category (e.g. people, property, environment and business) based on the scores in the hazard log, using a risk matrix. Risk scores are calculated for each hazard under the "Most Likely" and "Worst Credible" scenarios for each of the consequence criteria. This generates eight individual risk scores per hazard. These risk scores are documented in the "Ranked Hazard Lists". The risk scores are then analysed further to obtain four indices for each hazard as follows:

- The average risk score of the categories in the 'most likely' set;
- The average risk score of the categories in the 'worst credible' set;
- The maximum risk score of the categories in the 'most likely' set; and
- The maximum risk score of the categories in the 'worst credible' set.

These scores were then combined to produce a single numeric value representing each of the four indices. The hazard list was then sorted in order of the aggregate of the four indices to produce a 'Ranked Hazard

List' with the highest risk hazards prioritised at the top. The ranked hazard list documents the individual category risk scores in more detail.

All risk scores, whether individual per consequence category, or overall for a hazard are scored on a scale of 0 (low risk) to 10 (high risk). Where the resultant risk levels cannot be considered in the low / negligible risk range, possible risk mitigation measures are identified for implementation.

Annex D Ranked Risk Register (Construction)

Rank	Hazard Ref.	Accident Category	Hazard Title	Hazard Detail	Consequence Descriptions		Risk By Consequence Category								Risk Overall
							ML				WC				
					Most Likely (ML)	Worst Credible (WC)	Environment	People	Property	Stakeholders	Environment	People	Property	Stakeholders	
1	5	Collision	Construction Vessel - Cruise Ship / Mainland Ferry	A Construction Vessel collides with a Cruise Ship / Mainland Ferry.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Very minor injury; Very minor damage to property; No environmental effect of note; Adverse regional publicity, temporary suspension of commercial activities and / or prolonged restrictions.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple fatalities; Catastrophic damage to property; Tier 2 spill criteria reached but capable of being limited to immediate area; Adverse international publicity, long-term suspension of operations, prolonged restrictions and / or termination of commercial activities.	0	4	2	4	3	6	6	5	**4.56**
2	7	Collision	Construction Vessel - Inter-Island Ferry	An Construction Vessel collides with a Inter-Island Ferry.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Single minor injury; Very minor damage to property; No environmental effect of note; Adverse local publicity, minor disruption to commercial activities.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple fatalities; Major damage to property; Tier 1 to Tier 2 criteria reached; Adverse international publicity, long-term suspension of operations, prolonged restrictions and / or termination of commercial activities.	0	4	2	4	2	6	5	6	**4.45**
3	45	Grounding	Grounding - Construction Vessel	A Construction Vessel runs aground.	Low speed / energy grounding, vessel able to refloat without assistance. Resulting in: Single minor injury; Very minor damage to property; No environmental effect of note; Adverse local publicity, minor disruption to commercial activities.	High speed / energy grounding, vessel unable to refloat without assistance. Resulting in: Multiple major injuries or single fatality; Major damage to property; Tier 2 spill criteria reached but capable of being limited to immediate area; Adverse national publicity, medium-term suspension of operations or prolonged restrictions.	0	0	6	0	2	4	6	4	**4.41**
4	41	Contact	Contact - Cruise Ship / Mainland Ferry / Large Commercial Vessel / Inter-Island Ferry	A Cruise Ship / Mainland Ferry / Large Commercial Vessel / Inter-Island Ferry contacts a fixed object.	A low speed / energy contact. Resulting in: Single minor injury; Very minor damage to property; No environmental effect of note; Adverse local publicity, minor disruption to commercial activities.	A high speed / energy contact. Resulting in: Multiple minor or single major injury; Moderate damage to property; Tier 1 to Tier 2 criteria reached; Adverse regional publicity, temporary suspension of commercial activities and/or prolonged restrictions.	0	6	0	6	2	4	4	4	**4.31**

Rank	Hazard Ref.	Accident Category	Hazard Title	Hazard Detail	Consequence Descriptions		Risk By Consequence Category								Risk Overall
							ML				WC				
					Most Likely (ML)	Worst Credible (WC)	Environment	People	Property	Stakeholders	Environment	People	Property	Stakeholders	
5	49	Mooring Incident / Breakout	Mooring Breakout - Cruise Ship / Mainland Ferry / Large Commercial Vessel / Inter-Island Ferry.	A Cruise Ship / Mainland Ferry / Large Commercial Vessel / Inter-Island Ferry breaks away from her moorings.	Mooring lines in propeller/bow thruster, damage to gangway, lines parted. Resulting in: Single minor injury; Very minor damage to property; No environmental effect of note; Very short-term disruption to services.	Grounding or Contact. Resulting in: Multiple major injuries or single fatality; Major damage to property; Tier 2 spill criteria reached but capable of being limited to immediate area; Adverse national publicity, medium-term suspension of operations or prolonged restrictions.	0	6	0	0	3	5	5	5	**4.19**
6	28	Collision	Inter-Island Ferry - Small Commercial Vessel	An Inter-Island Ferry collides with a Small Commercial Vessel.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Single minor injury; Very minor damage to property; No environmental effect of note; Adverse regional publicity, temporary suspension of commercial activities and/or prolonged restrictions.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple fatalities; Moderate damage to property; Tier 1 to Tier 2 criteria reached; Adverse national publicity, medium-term suspension of operations or prolonged restrictions.	0	2	0	4	2	6	3	5	**4.03**
7	14	Collision	Cruise Ship / Mainland Ferry - Inter-Island Ferry	A Cruise Ship / Mainland Ferry collides with an Inter-Island Ferry.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Very minor injury; Very minor damage to property; No environmental effect of note; Adverse regional publicity, temporary suspension of commercial activities and / or prolonged restrictions.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple fatalities; Catastrophic damage to property; Tier 2 spill criteria reached but capable of being limited to immediate area; Adverse international publicity, long-term suspension of operations, prolonged restrictions and / or termination of commercial activities.	0	0	0	3	3	6	6	6	**3.9**
8	15	Collision	Cruise Ship / Mainland Ferry - Large Commercial Vessel	A Cruise Ship / Mainland Ferry collides with a Large Commercial Vessel.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Very minor injury; Very minor damage to property; No environmental effect of note; Adverse regional publicity, temporary suspension of commercial activities and / or prolonged restrictions.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple fatalities; Catastrophic damage to property; Tier 2 spill criteria reached but capable of being limited to immediate area; Adverse international publicity, long-term suspension of operations, prolonged restrictions and / or termination of commercial activities.	0	0	0	3	3	6	6	6	**3.9**

Rank	Hazard Ref.	Accident Category	Hazard Title	Hazard Detail	Consequence Descriptions		Risk By Consequence Category								Risk Overall
							ML				WC				
					Most Likely (ML)	Worst Credible (WC)	Environment	People	Property	Stakeholders	Environment	People	Property	Stakeholders	
9	50	Mooring Incident / Breakout	Mooring Breakout - Inshore Fishing Vessel / Recreational Vessel / Small Commercial Vessel / Towage Vessel	An Inshore Fishing Vessel / Recreational Vessel / Small Commercial Vessel / Towage Vessel breaks away from her moorings.	Mooring lines in propeller/bow thruster, damage to gangway, lines parted. Resulting in: Single minor injury; Very minor damage to property; No environmental effect of note; Very short-term disruption to services.	Grounding or Contact. Resulting in: Multiple minor or single major injury; Moderate damage to property; Tier 1 to Tier 2 criteria reached; Adverse local publicity, minor disruption to commercial activities.	0	6	0	0	2	4	4	2	**3.82**
10	23	Collision	Inshore Fishing Vessel - Small Commercial Vessel	An Inshore Fishing Vessel collides with a Small Commercial Vessel.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Single minor injury; Very minor damage to property; No environmental effect of note; Adverse local publicity, minor disruption to commercial activities.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple fatalities; Moderate damage to property; Tier 1 to Tier 2 criteria reached; Adverse national publicity, medium-term suspension of operations or prolonged restrictions.	0	3	0	3	2	6	3	5	**3.8**
11	17	Collision	Cruise Ship / Mainland Ferry - Small Commercial Vessel	A Cruise Ship / Mainland Ferry collides with a Small Commercial Vessel.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Single minor injury; Very minor damage to property; No environmental effect of note; Adverse regional publicity, temporary suspension of commercial activities and / or prolonged restrictions.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple fatalities; Moderate damage to property; Tier 1 to Tier 2 criteria reached; Adverse national publicity, medium-term suspension of operations or prolonged restrictions.	0	2	0	3	2	6	3	5	**3.7**
12	13	Collision	Cruise Ship / Mainland Ferry - Inshore Fishing Vessel	A Cruise Ship / Mainland Ferry collides with an Inshore Fishing Vessel.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Single minor injury; Very minor damage to property; No environmental effect of note.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple major injuries or single fatality; Moderate damage to property; Tier 1 to Tier 2 criteria reached; Adverse national publicity, medium-term suspension of operations or prolonged restrictions.	0	2	0	4	2	5	3	5	**3.69**
13	6	Collision	Construction Vessel - Inshore Fishing Vessel	An Construction Vessel collides with a Fishing Vessel.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Very minor injury; Very minor damage to property; No environmental effect of note; Very short-term disruption to services.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple major injuries or single fatality; Moderate damage to property; No environmental effect of note; Adverse local publicity, minor disruption to commercial activities.	0	4	2	2	0	5	3	3	**3.64**

Rank	Hazard Ref.	Accident Category	Hazard Title	Hazard Detail	Consequence Descriptions		Risk By Consequence Category								Risk Overall
							ML				WC				
					Most Likely (ML)	Worst Credible (WC)	Environment	People	Property	Stakeholders	Environment	People	Property	Stakeholders	
14	10	Collision	Construction Vessel - Small Commercial Vessel	A Construction Vessel collides with a Small Commercial Vessel.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Single minor injury; Very minor damage to property; No environmental effect of note; Adverse local publicity, minor disruption to commercial activities.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple fatalities; Moderate damage to property; Tier 1 to Tier 2 criteria reached; Adverse national publicity, medium-term suspension of operations or prolonged restrictions.	0	4	2	2	0	5	3	3	**3.64**
15	25	Collision	Inter-Island Ferry - Inter-Island Ferry	An Inter-Island Ferry collides with another Inter-Island Ferry.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Single minor injury; Very minor damage to property; No environmental effect of note; Adverse local publicity, minor disruption to commercial activities.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple fatalities; Major damage to property; Tier 1 to Tier 2 criteria reached; Adverse international publicity, long-term suspension of operations, prolonged restrictions and / or termination of commercial activities.	0	2	0	2	2	6	5	6	**3.55**
16	47	Grounding	Grounding - Inshore Fishing Vessel / Recreational Vessel / Small Commercial Vessel / Towage Vessel	An Inshore Fishing Vessel / Recreational Vessel / Small Commercial Vessel / Towage Vessel runs aground.	Low speed / energy grounding, vessel able to refloat without assistance. Resulting in: Single minor injury; Very minor damage to property; No environmental effect of note; Very short-term disruption to services.	High speed / energy grounding, vessel unable to refloat without assistance. Resulting in: Multiple major injuries or single fatality; Moderate damage to property; Tier 1 to Tier 2 criteria reached; Adverse local publicity, minor disruption to commercial activities.	0	3	0	0	2	6	4	2	**3.52**
17	12	Collision	Cruise Ship / Mainland Ferry - Cruise Ship / Mainland Ferry	A Cruise Ship / Mainland Ferry collides with another Cruise Ship / Mainland Ferry.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Very minor injury; Very minor damage to property; No environmental effect of note; Adverse regional publicity, temporary suspension of commercial activities and / or prolonged restrictions.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple fatalities; Catastrophic damage to property; Tier 2 spill criteria reached but capable of being limited to immediate area; Adverse international publicity, long-term suspension of operations, prolonged restrictions and / or termination of commercial activities.	0	0	0	3	3	5	5	5	**3.5**

Rank	Hazard Ref.	Accident Category	Hazard Title	Hazard Detail	Consequence Descriptions		Risk By Consequence Category								Risk Overall
							ML				WC				
					Most Likely (ML)	Worst Credible (WC)	Environment	People	Property	Stakeholders	Environment	People	Property	Stakeholders	
18	37	Collision	Small Commercial Vessel - Small Commercial Vessel	A Small Commercial Vessel collides with another Small Commercial Vessel.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Single minor injury; Very minor damage to property; No environmental effect of note; Adverse local publicity, minor disruption to commercial activities.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple fatalities; Moderate damage to property; Tier 1 to Tier 2 criteria reached; Adverse national publicity, medium-term suspension of operations or prolonged restrictions.	0	2	0	2	2	6	3	5	**3.4**
19	46	Grounding	Grounding - Cruise Ship / Mainland Ferry / Large Commercial Vessel / Inter-Island Ferry	A Cruise Ship / Mainland Ferry / Large Commercial Vessel / Inter-Island Ferry runs aground.	Low speed / energy grounding, vessel able to refloat without assistance. Resulting in: Single minor injury; Very minor damage to property; No environmental effect of note; Adverse local publicity, minor disruption to commercial activities.	High speed / energy grounding, vessel unable to refloat without assistance. Resulting in: Multiple major injuries or single fatality; Major damage to property; Tier 2 spill criteria reached but capable of being limited to immediate area; Adverse national publicity, medium-term suspension of operations or prolonged restrictions.	0	2	2	2	3	5	5	5	**3.4**
20	29	Collision	Inter-Island Ferry - Towage Vessel	An Inter-Island Ferry collides with a Towage Vessel.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Single minor injury; Very minor damage to property; No environmental effect of note; Adverse local publicity, minor disruption to commercial activities.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple fatalities; Major damage to property; Tier 1 to Tier 2 criteria reached; Adverse national publicity, medium-term suspension of operations or prolonged restrictions.	0	2	0	2	2	6	5	5	**3.27**
21	16	Collision	Cruise Ship / Mainland Ferry - Recreational Vessel	A Cruise Ship / Mainland Ferry collides with a Recreational Vessel.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Single minor injury; Very minor damage to property; No environmental effect of note; Adverse regional publicity, temporary suspension of commercial activities and / or prolonged restrictions.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple major injuries or single fatality; Moderate damage to property; No environmental effect of note; Adverse national publicity, medium-term suspension of operations or prolonged restrictions.	0	2	0	3	0	5	3	5	**3.25**
22	32	Collision	Large Commercial Vessel - Small Commercial Vessel	A Large Commercial Vessel collides with a Small Commercial Vessel.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Single minor injury; Very minor damage to property; No environmental effect of note; Adverse local publicity, minor disruption to commercial activities.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple fatalities; Moderate damage to property; Tier 1 to Tier 2 criteria reached; Adverse national publicity, medium-term suspension of operations or prolonged restrictions.	0	2	0	2	2	6	3	5	**3.18**

Rank	Hazard Ref.	Accident Category	Hazard Title	Hazard Detail	Consequence Descriptions		Risk By Consequence Category								Risk Overall
							ML				WC				
					Most Likely (ML)	Worst Credible (WC)	Environment	People	Property	Stakeholders	Environment	People	Property	Stakeholders	
23	30	Collision	Large Commercial Vessel - Large Commercial Vessel	A Large Commercial Vessel collides with another Large Commercial Vessel.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Very minor injury; Very minor damage to property; No environmental effect of note; Adverse local publicity, minor disruption to commercial activities.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple major injuries or single fatality; Major damage to property; Tier 3 criteria reached; Adverse national publicity, medium-term suspension of operations or prolonged restrictions.	0	0	0	2	5	5	5	5	**3**
24	26	Collision	Inter-Island Ferry - Large Commercial Vessel	An Inter-Island Ferry collides with a Large Commercial Vessel.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Single minor injury; Very minor damage to property; No environmental effect of note; Adverse local publicity, minor disruption to commercial activities.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple fatalities; Major damage to property; Tier 1 to Tier 2 criteria reached; Adverse international publicity, long-term suspension of operations, prolonged restrictions and / or termination of commercial activities.	0	2	0	2	1	5	4	5	**2.95**
25	38	Collision	Small Commercial Vessel - Towage Vessel	A Small Commercial Vessel collides with a Towage Vessel.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Single minor injury; Very minor damage to property; No environmental effect of note; Adverse local publicity, minor disruption to commercial activities.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple fatalities; Moderate damage to property; Tier 1 to Tier 2 criteria reached; Adverse national publicity, medium-term suspension of operations or prolonged restrictions.	0	2	0	2	1	5	3	4	**2.81**
26	9	Collision	Construction Vessel - Recreational Vessel	A Construction Vessel collides with a Recreational Vessel.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Very minor injury; Very minor damage to property; No environmental effect of note; Very short-term disruption to services.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple minor or single major injury; Minor damage to property; No environmental effect of note; Adverse local publicity, minor disruption to commercial activities.	0	2	0	2	0	5	2	3	**2.76**
27	21	Collision	Inshore Fishing Vessel - Large Commercial Vessel	An Inshore Fishing Vessel collides with a Large Commercial Vessel.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Single minor injury; Very minor damage to property; No environmental effect of note; Very short-term disruption to services.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple major injuries or single fatality; Moderate damage to property; No environmental effect of note; Adverse regional publicity, temporary suspension of commercial activities and/or prolonged restrictions.	0	2	0	0	0	5	3	3	**2.71**

Rank	Hazard Ref.	Accident Category	Hazard Title	Hazard Detail	Consequence Descriptions		Risk By Consequence Category								Risk Overall
							ML				WC				
					Most Likely (ML)	Worst Credible (WC)	Environment	People	Property	Stakeholders	Environment	People	Property	Stakeholders	
28	27	Collision	Inter-Island Ferry - Recreational Vessel	An Inter-Island Ferry collides with a Recreational Vessel.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Single minor injury; Very minor damage to property; No environmental effect of note; Very short-term disruption to services.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple major injuries or single fatality; Moderate damage to property; No environmental effect of note; Adverse regional publicity, temporary suspension of commercial activities and/or prolonged restrictions.	0	2	0	0	0	5	3	3	**2.71**
29	35	Collision	Recreational Vessel - Small Commercial Vessel	A Recreational Vessel collides with a Small Commercial Vessel.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Very minor injury; Very minor damage to property; No environmental effect of note; Adverse local publicity, minor disruption to commercial activities.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple major injuries or single fatality; Moderate damage to property; No environmental effect of note; Adverse regional publicity, temporary suspension of commercial activities and/or prolonged restrictions.	0	0	0	2	0	5	3	3	**2.71**
30	36	Collision	Recreational Vessel - Towage Vessel	A Recreational Vessel collides with a Towage Vessel.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Very minor injury; Very minor damage to property; No environmental effect of note; Adverse local publicity, minor disruption to commercial activities.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple major injuries or single fatality; Moderate damage to property; No environmental effect of note; Adverse regional publicity, temporary suspension of commercial activities and/or prolonged restrictions.	0	0	0	2	0	5	3	3	**2.71**
31	40	Contact	Contact - Construction Vessel	A Construction Vessel contacts a fixed object including the works.	A low speed / energy contact. Resulting in: Single minor injury; Very minor damage to property; No environmental effect of note; Adverse local publicity, minor disruption to commercial activities.	A high speed / energy contact. Resulting in: Multiple minor or single major injury; Moderate damage to property; Tier 1 to Tier 2 criteria reached; Adverse regional publicity, temporary suspension of commercial activities and/or prolonged restrictions.	0	0	0	0	4	6	4	4	**2.68**
32	31	Collision	Large Commercial Vessel - Recreational Vessel	A Large Commercial Vessel collides with a Recreational Vessel.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Single minor injury; Very minor damage to property; No environmental effect of note; Adverse local publicity, minor disruption to commercial activities.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple major injuries or single fatality; Moderate damage to property; No environmental effect of note; Adverse regional publicity, temporary suspension of commercial activities and/or prolonged restrictions.	0	2	0	2	0	5	3	3	**2.65**

Rank	Hazard Ref.	Accident Category	Hazard Title	Hazard Detail	Consequence Descriptions		Risk By Consequence Category								Risk Overall
							ML				WC				
					Most Likely (ML)	Worst Credible (WC)	Environment	People	Property	Stakeholders	Environment	People	Property	Stakeholders	
33	24	Collision	Inshore Fishing Vessel - Towage Vessel	An Inshore Fishing Vessel collides with a Towage Vessel.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Single minor injury; Very minor damage to property; No environmental effect of note; Very short-term disruption to services.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple major injuries or single fatality; Moderate damage to property; No environmental effect of note; Adverse local publicity, minor disruption to commercial activities.	0	2	0	0	0	5	3	2	**2.61**
34	48	Mooring Incident / Breakout	Mooring Breakout - Construction Vessel	A Construction Vessel breaks away from her moorings.	Mooring lines in propeller/bow thruster, damage to gangway, lines parted. Resulting in: Single minor injury; Very minor damage to property; No environmental effect of note; Very short-term disruption to services.	Grounding or Contact. Resulting in: Multiple major injuries or single fatality; Major damage to property; Tier 2 spill criteria reached but capable of being limited to immediate area; Adverse national publicity, medium-term suspension of operations or prolonged restrictions.	0	0	0	0	0	6	4	4	**2.41**
35	1	Anchor Dragging	Anchor Dragging - Construction Vessel	A Construction Vessel unintentionally moves from its anchored position because the anchor has failed to hold.	Anchor dragging detected and remedial action taken. Resulting in: Very minor injury; Very minor damage to property; No environmental effect of note; Very short-term disruption to services.	Contact or grounding. Resulting in: Multiple major injuries or single fatality; Major damage to property; Tier 2 spill criteria reached but capable of being limited to immediate area; Adverse national publicity, medium-term suspension of operations or prolonged restrictions.	0	0	0	0	3	5	5	5	**2.34**
36	2	Anchor Dragging	Anchor Dragging - Cruise Ship / Mainland Ferry / Large Commercial Vessel / Inter-Island Ferry	A Cruise Ship / Mainland Ferry / Large Commercial Vessel / Inter-Island Ferry unintentionally moves from its anchored position because the anchor has failed to hold.	Anchor dragging detected and remedial action taken. Resulting in: Very minor injury; Very minor damage to property; No environmental effect of note; Very short-term disruption to services.	Contact or grounding. Resulting in: Multiple major injuries or single fatality; Major damage to property; Tier 2 spill criteria reached but capable of being limited to immediate area; Adverse national publicity, medium-term suspension of operations or prolonged restrictions.	0	0	0	0	3	5	5	5	**2.34**
37	19	Collision	Inshore Fishing Vessel - Inshore Fishing Vessel	An Inshore Fishing Vessel collides with another Inshore Fishing Vessel.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Very minor injury; Very minor damage to property; No environmental effect of note; Very short-term disruption to services.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple major injuries or single fatality; Moderate damage to property; No environmental effect of note; Adverse local publicity, minor disruption to commercial activities.	0	0	0	0	0	6	4	2	**2.28**

Rank	Hazard Ref.	Accident Category	Hazard Title	Hazard Detail	Consequence Descriptions		Risk By Consequence Category								Risk Overall
							ML				WC				
					Most Likely (ML)	Worst Credible (WC)	Environment	People	Property	Stakeholders	Environment	People	Property	Stakeholders	
38	4	Collision	Construction Vessel - Construction Vessel	A Construction Vessel collides with another Construction Vessel	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Very minor injury; Very minor damage to property; No environmental effect of note; Adverse regional publicity, temporary suspension of commercial activities and / or prolonged restrictions.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple fatalities; Catastrophic damage to property; Tier 2 spill criteria reached but capable of being limited to immediate area; Adverse international publicity, long-term suspension of operations, prolonged restrictions and / or termination of commercial activities.	0	0	0	0	3	5	5	3	**2.26**
39	8	Collision	Construction Vessel - Large Commercial Vessel	A Construction Vessel collides with a Large Commercial Vessel.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Very minor injury; Very minor damage to property; No environmental effect of note; Adverse local publicity, minor disruption to commercial activities.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple major injuries or single fatality; Major damage to property; Tier 3 criteria reached; Adverse national publicity, medium-term suspension of operations or prolonged restrictions.	0	0	0	0	3	5	5	3	**2.26**
40	18	Collision	Cruise Ship / Mainland Ferry - Towage Vessel	A Cruise Ship / Mainland Ferry collides with a Towage Vessel.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Very minor injury; Very minor damage to property; No environmental effect of note; Very short-term disruption to services.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple major injuries or single fatality; Major damage to property; Tier 1 to Tier 2 criteria reached; Adverse national publicity, medium-term suspension of operations or prolonged restrictions.	0	0	0	0	2	5	5	5	**2.24**
41	44	Girting	Girting Incident (including during construction)	A towline under tension exerts a heeling moment which results in excessive heel that causes the tug to capsize.	Tug recovers. Resulting in: Very minor injury; Very minor damage to property; No environmental effect of note; Very short-term disruption to services.	Tug is capsized. Resulting in: Multiple major injuries or single fatality; Major damage to property; Tier 1 to Tier 2 criteria reached; Adverse national publicity, medium-term suspension of operations or prolonged restrictions.	0	0	0	0	2	5	5	5	**2.24**

Rank	Hazard Ref.	Accident Category	Hazard Title	Hazard Detail	Consequence Descriptions		Risk By Consequence Category								Risk Overall
							ML				WC				
					Most Likely (ML)	Worst Credible (WC)	Environment	People	Property	Stakeholders	Environment	People	Property	Stakeholders	
42	33	Collision	Large Commercial Vessel -Towage Vessel	A Large Commercial Vessel collides with a Towage Vessel.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Very minor injury; Very minor damage to property; No environmental effect of note; Very short-term disruption to services.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple major injuries or single fatality; Major damage to property; Tier 1 to Tier 2 criteria reached; Adverse regional publicity, temporary suspension of commercial activities and/or prolonged restrictions.	0	0	0	0	2	5	5	3	**2.15**
43	20	Collision	Inshore Fishing Vessel - Inter-Island Ferry	An Inshore Fishing Vessel collides with an Inter-Island ferry.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Very minor injury; Very minor damage to property; No environmental effect of note; Very short-term disruption to services.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple major injuries or single fatality; Moderate damage to property; Tier 1 to Tier 2 criteria reached; Adverse regional publicity, temporary suspension of commercial activities and/or prolonged restrictions.	0	0	0	0	2	5	3	3	**2.07**
44	43	Diving	Diving Incident (including construction works)	A diving incident involving a Recreational and / or Commercial Vessel.	Resulting in: Very minor injury; Very minor damage to property; No environmental effect of note; Very short-term disruption to services.	Resulting in: Multiple major injuries or single fatality; Very minor damage to property; No environmental effect of note; Adverse local publicity, minor disruption to commercial activities.	0	0	0	0	0	6	0	2	**2**
45	22	Collision	Inshore Fishing Vessel - Recreational Vessel	An Inshore Fishing Vessel collides with a Recreational Vessel.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Very minor injury; Very minor damage to property; No environmental effect of note; Very short-term disruption to services.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple major injuries or single fatality; Moderate damage to property; No environmental effect of note; Adverse local publicity, minor disruption to commercial activities.	0	0	0	0	0	5	3	2	**1.85**
46	11	Collision	Construction Vessel - Towage Vessel	A Construction Vessel collides with a ship towage Vessel			0	0	0	0	1	4	4	3	**1.8**
47	34	Collision	Recreational Vessel - Recreational Vessel	A Recreational Vessel collides with another Recreational Vessel.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Very minor injury; Very minor damage to property; No environmental effect of note; Very short-term disruption to services.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple minor or single major injury; Minor damage to property; No environmental effect of note; Adverse local publicity, minor disruption to commercial activities.	0	0	0	0	0	4	2	2	**1.69**

Rank	Hazard Ref.	Accident Category	Hazard Title	Hazard Detail	Consequence Descriptions		Risk By Consequence Category								Risk Overall
							ML				WC				
					Most Likely (ML)	Worst Credible (WC)	Environment	People	Property	Stakeholders	Environment	People	Property	Stakeholders	
48	42	Contact	Contact - Inshore Fishing Vessel / Recreational Vessel / Small Commercial Vessel / Towage Vessel	An Inshore Fishing Vessel / Recreational Vessel / Small Commercial Vessel / Towage Vessel contacts a fixed object.	A low speed / energy contact. Resulting in: Very minor injury; Very minor damage to property; No environmental effect of note; Very short-term disruption to services.	A high speed / energy contact. Resulting in: Multiple minor or single major injury; Minor damage to property; No environmental effect of note; Adverse local publicity, minor disruption to commercial activities.	0	0	0	0	0	4	2	2	**1.69**
49	3	Anchor Dragging	Anchor dragging - Inshore Fishing Vessel / Recreational Vessel / Small Commercial Vessel / Towage Vessel	An Inshore Fishing Vessel / Recreational Vessel / Small Commercial Vessel / Towage Vessel unintentionally moves from its anchored position because the anchor has failed to hold.	Anchor dragging detected and remedial action taken. Resulting in: Very minor injury; Very minor damage to property; No environmental effect of note; Very short-term disruption to services.	Contact or grounding. Resulting in: Multiple minor or single major injury; Moderate damage to property; Tier 1 to Tier 2 criteria reached; Adverse local publicity, minor disruption to commercial activities.	0	0	0	0	2	3	3	2	**1.54**
50	39	Collision	Towage Vessel - Towage Vessel	A Towage Vessel collides with another Towage Vessel.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Very minor injury; Very minor damage to property; No environmental effect of note; Very short-term disruption to services.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple minor or single major injury; Moderate damage to property; Tier 1 to Tier 2 criteria reached; Adverse local publicity, minor disruption to commercial activities.	0	0	0	0	1	3	3	1	**1.26**

Annex E Ranked Risk Register (Operation)

Rank	Hazard Ref.	Accident Category	Hazard Title	Hazard Detail	Consequence Descriptions		Risk By Consequence Category								Risk Overall
							ML				WC				
					Most Likely (ML)	Worst Credible (WC)	Environment	People	Property	Stakeholders	Environment	People	Property	Stakeholders	
1	35	Grounding	Grounding - Cruise Ship / Mainland Ferry / Large Commercial Vessel / Inter-Island Ferry	A Cruise Ship / Mainland Ferry / Large Commercial Vessel / Inter-Island Ferry runs aground.	Low speed / energy grounding, vessel able to refloat without assistance. Resulting in: Single minor injury; Very minor damage to property; No environmental effect of note; Adverse local publicity, minor disruption to commercial activities.	High speed / energy grounding, vessel unable to refloat without assistance. Resulting in: Multiple major injuries or single fatality; Major damage to property; Tier 2 spill criteria reached but capable of being limited to immediate area; Adverse national publicity, medium-term suspension of operations or prolonged restrictions.	0	3	3	3	4	6	6	6	**4.4**
2	31	Contact	Contact - Cruise Ship / Mainland Ferry / Large Commercial Vessel / Inter-Island Ferry	A Cruise Ship / Mainland Ferry / Large Commercial Vessel / Inter-Island Ferry contacts a fixed object.	A low speed / energy contact. Resulting in: Single minor injury; Very minor damage to property; No environmental effect of note; Adverse local publicity, minor disruption to commercial activities.	A high speed / energy contact. Resulting in: Multiple minor or single major injury; Moderate damage to property; Tier 1 to Tier 2 criteria reached; Adverse regional publicity, temporary suspension of commercial activities and/or prolonged restrictions.	0	6	0	6	2	4	4	4	**4.31**
3	37	Mooring Incident / Breakout	Mooring Breakout - Cruise Ship / Mainland Ferry / Large Commercial Vessel / Inter-Island Ferry.	A Cruise Ship / Mainland Ferry / Large Commercial Vessel / Inter-Island Ferry breaks away from her moorings.	Mooring lines in propeller/bow thruster, damage to gangway, lines parted. Resulting in: Single minor injury; Very minor damage to property; No environmental effect of note; Very short-term disruption to services.	Grounding or Contact. Resulting in: Multiple major injuries or single fatality; Major damage to property; Tier 2 spill criteria reached but capable of being limited to immediate area; Adverse national publicity, medium-term suspension of operations or prolonged restrictions.	0	6	0	0	3	5	5	5	**4.19**
4	8	Collision	Cruise Ship / Mainland Ferry - Small Commercial Vessel	A Cruise Ship / Mainland Ferry collides with a Small Commercial Vessel.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Single minor injury; Very minor damage to property; No environmental effect of note; Adverse regional publicity, temporary suspension of commercial activities and / or prolonged restrictions.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple fatalities; Moderate damage to property; Tier 1 to Tier 2 criteria reached; Adverse national publicity, medium-term suspension of operations or prolonged restrictions.	0	2	0	4	2	6	3	5	**4.03**

Rank	Hazard Ref.	Accident Category	Hazard Title	Hazard Detail	Consequence Descriptions		Risk By Consequence Category								Risk Overall
							ML				WC				
					Most Likely (ML)	Worst Credible (WC)	Environment	People	Property	Stakeholders	Environment	People	Property	Stakeholders	
5	19	Collision	Inter-Island Ferry - Small Commercial Vessel	An Inter-Island Ferry collides with a Small Commercial Vessel.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Single minor injury; Very minor damage to property; No environmental effect of note; Adverse regional publicity, temporary suspension of commercial activities and/or prolonged restrictions.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple fatalities; Moderate damage to property; Tier 1 to Tier 2 criteria reached; Adverse national publicity, medium-term suspension of operations or prolonged restrictions.	0	2	0	4	2	6	3	5	**4.03**
6	5	Collision	Cruise Ship / Mainland Ferry - Inter-Island Ferry	A Cruise Ship / Mainland Ferry collides with an Inter-Island Ferry.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Very minor injury; Very minor damage to property; No environmental effect of note; Adverse regional publicity, temporary suspension of commercial activities and / or prolonged restrictions.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple fatalities; Catastrophic damage to property; Tier 2 spill criteria reached but capable of being limited to immediate area; Adverse international publicity, long-term suspension of operations, prolonged restrictions and / or termination of commercial activities.	0	0	0	3	3	6	6	6	**3.9**
7	6	Collision	Cruise Ship / Mainland Ferry - Large Commercial Vessel	A Cruise Ship / Mainland Ferry collides with a Large Commercial Vessel.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Very minor injury; Very minor damage to property; No environmental effect of note; Adverse regional publicity, temporary suspension of commercial activities and / or prolonged restrictions.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple fatalities; Catastrophic damage to property; Tier 2 spill criteria reached but capable of being limited to immediate area; Adverse international publicity, long-term suspension of operations, prolonged restrictions and / or termination of commercial activities.	0	0	0	3	3	6	6	6	**3.9**
8	38	Mooring Incident / Breakout	Mooring Breakout - Inshore Fishing Vessel / Recreational Vessel / Small Commercial Vessel / Towage Vessel	An Inshore Fishing Vessel / Recreational Vessel / Small Commercial Vessel / Towage Vessel breaks away from her moorings.	Mooring lines in propeller/bow thruster, damage to gangway, lines parted. Resulting in: Single minor injury; Very minor damage to property; No environmental effect of note; Very short-term disruption to services.	Grounding or Contact. Resulting in: Multiple minor or single major injury; Moderate damage to property; Tier 1 to Tier 2 criteria reached; Adverse local publicity, minor disruption to commercial activities.	0	6	0	0	2	4	4	2	**3.82**

Rank	Hazard Ref.	Accident Category	Hazard Title	Hazard Detail	Consequence Descriptions		Risk By Consequence Category								Risk Overall
							ML				WC				
					Most Likely (ML)	Worst Credible (WC)	Environment	People	Property	Stakeholders	Environment	People	Property	Stakeholders	
9	14	Collision	Inshore Fishing Vessel - Small Commercial Vessel	An Inshore Fishing Vessel collides with a Small Commercial Vessel.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Single minor injury; Very minor damage to property; No environmental effect of note; Adverse local publicity, minor disruption to commercial activities.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple fatalities; Moderate damage to property; Tier 1 to Tier 2 criteria reached; Adverse national publicity, medium-term suspension of operations or prolonged restrictions.	0	3	0	3	2	6	3	5	**3.8**
10	28	Collision	Small Commercial Vessel - Small Commercial Vessel	A Small Commercial Vessel collides with another Small Commercial Vessel.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Single minor injury; Very minor damage to property; No environmental effect of note; Adverse local publicity, minor disruption to commercial activities.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple fatalities; Moderate damage to property; Tier 1 to Tier 2 criteria reached; Adverse national publicity, medium-term suspension of operations or prolonged restrictions.	0	3	0	3	2	6	3	5	**3.8**
11	4	Collision	Cruise Ship / Mainland Ferry - Inshore Fishing Vessel	A Cruise Ship / Mainland Ferry collides with an Inshore Fishing Vessel.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Single minor injury; Very minor damage to property; No environmental effect of note.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple major injuries or single fatality; Moderate damage to property; Tier 1 to Tier 2 criteria reached; Adverse national publicity, medium-term suspension of operations or prolonged restrictions.	0	2	0	4	2	5	3	5	**3.69**
12	16	Collision	Inter-Island Ferry - Inter-Island Ferry	An Inter-Island Ferry collides with another Inter-Island Ferry.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Single minor injury; Very minor damage to property; No environmental effect of note; Adverse local publicity, minor disruption to commercial activities.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple fatalities; Major damage to property; Tier 1 to Tier 2 criteria reached; Adverse international publicity, long-term suspension of operations, prolonged restrictions and / or termination of commercial activities.	0	2	0	2	2	6	5	6	**3.55**
13	36	Grounding	Grounding - Inshore Fishing Vessel / Recreational Vessel / Small Commercial Vessel / Towage Vessel	An Inshore Fishing Vessel / Recreational Vessel / Small Commercial Vessel / Towage Vessel runs aground.	Low speed / energy grounding, vessel able to refloat without assistance. Resulting in: Single minor injury; Very minor damage to property; No environmental effect of note; Very short-term disruption to services.	High speed / energy grounding, vessel unable to refloat without assistance. Resulting in: Multiple major injuries or single fatality; Moderate damage to property; Tier 1 to Tier 2 criteria reached; Adverse local publicity, minor disruption to commercial activities.	0	3	0	0	2	6	4	2	**3.52**

Rank	Hazard Ref.	Accident Category	Hazard Title	Hazard Detail	Consequence Descriptions		Risk By Consequence Category								Risk Overall
							ML				WC				
					Most Likely (ML)	Worst Credible (WC)	Environment	People	Property	Stakeholders	Environment	People	Property	Stakeholders	
14	3	Collision	Cruise Ship / Mainland Ferry - Cruise Ship / Mainland Ferry	A Cruise Ship / Mainland Ferry collides with another Cruise Ship / Mainland Ferry.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Very minor injury; Very minor damage to property; No environmental effect of note; Adverse regional publicity, temporary suspension of commercial activities and / or prolonged restrictions.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple fatalities; Catastrophic damage to property; Tier 2 spill criteria reached but capable of being limited to immediate area; Adverse international publicity, long-term suspension of operations, prolonged restrictions and / or termination of commercial activities.	0	0	0	3	3	5	5	5	**3.5**
15	23	Collision	Large Commercial Vessel - Small Commercial Vessel	A Large Commercial Vessel collides with a Small Commercial Vessel.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Single minor injury; Very minor damage to property; No environmental effect of note; Adverse local publicity, minor disruption to commercial activities.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple fatalities; Moderate damage to property; Tier 1 to Tier 2 criteria reached; Adverse national publicity, medium-term suspension of operations or prolonged restrictions.	0	2	0	2	2	6	3	5	**3.4**
16	29	Collision	Small Commercial Vessel - Towage Vessel	A Small Commercial Vessel collides with a Towage Vessel.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Single minor injury; Very minor damage to property; No environmental effect of note; Adverse local publicity, minor disruption to commercial activities.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple fatalities; Moderate damage to property; Tier 1 to Tier 2 criteria reached; Adverse national publicity, medium-term suspension of operations or prolonged restrictions.	0	2	0	2	2	6	3	5	**3.4**
17	20	Collision	Inter-Island Ferry - Towage Vessel	An Inter-Island Ferry collides with a Towage Vessel.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Single minor injury; Very minor damage to property; No environmental effect of note; Adverse local publicity, minor disruption to commercial activities.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple fatalities; Major damage to property; Tier 1 to Tier 2 criteria reached; Adverse national publicity, medium-term suspension of operations or prolonged restrictions.	0	2	0	2	2	6	5	5	**3.27**
18	7	Collision	Cruise Ship / Mainland Ferry - Recreational Vessel	A Cruise Ship / Mainland Ferry collides with a Recreational Vessel.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Single minor injury; Very minor damage to property; No environmental effect of note; Adverse regional publicity, temporary suspension of commercial activities and / or prolonged restrictions.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple major injuries or single fatality; Moderate damage to property; No environmental effect of note; Adverse national publicity, medium-term suspension of operations or prolonged restrictions.	0	2	0	3	0	5	3	5	**3.25**

Rank	Hazard Ref.	Accident Category	Hazard Title	Hazard Detail	Consequence Descriptions		Risk By Consequence Category								Risk Overall
							ML				WC				
					Most Likely (ML)	Worst Credible (WC)	Environment	People	Property	Stakeholders	Environment	People	Property	Stakeholders	
19	21	Collision	Large Commercial Vessel - Large Commercial Vessel	A Large Commercial Vessel collides with another Large Commercial Vessel.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Very minor injury; Very minor damage to property; No environmental effect of note; Adverse local publicity, minor disruption to commercial activities.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple major injuries or single fatality; Major damage to property; Tier 3 criteria reached; Adverse national publicity, medium-term suspension of operations or prolonged restrictions.	0	0	0	2	5	5	5	5	**3**
20	17	Collision	Inter-Island Ferry - Large Commercial Vessel	An Inter-Island Ferry collides with a Large Commercial Vessel.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Single minor injury; Very minor damage to property; No environmental effect of note; Adverse local publicity, minor disruption to commercial activities.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple fatalities; Major damage to property; Tier 1 to Tier 2 criteria reached; Adverse international publicity, long-term suspension of operations, prolonged restrictions and / or termination of commercial activities.	0	2	0	2	1	5	4	5	**2.95**
21	12	Collision	Inshore Fishing Vessel - Large Commercial Vessel	An Inshore Fishing Vessel collides with a Large Commercial Vessel.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Single minor injury; Very minor damage to property; No environmental effect of note; Very short-term disruption to services.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple major injuries or single fatality; Moderate damage to property; No environmental effect of note; Adverse regional publicity, temporary suspension of commercial activities and/or prolonged restrictions.	0	2	0	0	0	5	3	3	**2.71**
22	18	Collision	Inter-Island Ferry - Recreational Vessel	An Inter-Island Ferry collides with a Recreational Vessel.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Single minor injury; Very minor damage to property; No environmental effect of note; Very short-term disruption to services.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple major injuries or single fatality; Moderate damage to property; No environmental effect of note; Adverse regional publicity, temporary suspension of commercial activities and/or prolonged restrictions.	0	2	0	0	0	5	3	3	**2.71**

Rank	Hazard Ref.	Accident Category	Hazard Title	Hazard Detail	Consequence Descriptions		Risk By Consequence Category								Risk Overall
							ML				WC				
					Most Likely (ML)	Worst Credible (WC)	Environment	People	Property	Stakeholders	Environment	People	Property	Stakeholders	
23	26	Collision	Recreational Vessel - Small Commercial Vessel	A Recreational Vessel collides with a Small Commercial Vessel.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Very minor injury; Very minor damage to property; No environmental effect of note; Adverse local publicity, minor disruption to commercial activities.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple major injuries or single fatality; Moderate damage to property; No environmental effect of note; Adverse regional publicity, temporary suspension of commercial activities and/or prolonged restrictions.	0	0	0	2	0	5	3	3	**2.71**
24	27	Collision	Recreational Vessel - Towage Vessel	A Recreational Vessel collides with a Towage Vessel.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Very minor injury; Very minor damage to property; No environmental effect of note; Adverse local publicity, minor disruption to commercial activities.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple major injuries or single fatality; Moderate damage to property; No environmental effect of note; Adverse regional publicity, temporary suspension of commercial activities and/or prolonged restrictions.	0	0	0	2	0	5	3	3	**2.71**
25	22	Collision	Large Commercial Vessel - Recreational Vessel	A Large Commercial Vessel collides with a Recreational Vessel.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Single minor injury; Very minor damage to property; No environmental effect of note; Adverse local publicity, minor disruption to commercial activities.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple major injuries or single fatality; Moderate damage to property; No environmental effect of note; Adverse regional publicity, temporary suspension of commercial activities and/or prolonged restrictions.	0	2	0	2	0	5	3	3	**2.65**
26	15	Collision	Inshore Fishing Vessel - Towage Vessel	An Inshore Fishing Vessel collides with a Towage Vessel.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Single minor injury; Very minor damage to property; No environmental effect of note; Very short-term disruption to services.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple major injuries or single fatality; Moderate damage to property; No environmental effect of note; Adverse local publicity, minor disruption to commercial activities.	0	2	0	0	0	5	3	2	**2.61**
27	10	Collision	Inshore Fishing Vessel - Inshore Fishing Vessel	An Inshore Fishing Vessel collides with another Inshore Fishing Vessel.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Very minor injury; Very minor damage to property; No environmental effect of note; Very short-term disruption to services.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple major injuries or single fatality; Moderate damage to property; No environmental effect of note; Adverse local publicity, minor disruption to commercial activities.	0	0	0	0	0	6	4	2	**2.28**

Rank	Hazard Ref.	Accident Category	Hazard Title	Hazard Detail	Consequence Descriptions		Risk By Consequence Category								Risk Overall
							ML				WC				
					Most Likely (ML)	Worst Credible (WC)	Environment	People	Property	Stakeholders	Environment	People	Property	Stakeholders	
28	9	Collision	Cruise Ship / Mainland Ferry - Towage Vessel	A Cruise Ship / Mainland Ferry collides with a Towage Vessel.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Very minor injury; Very minor damage to property; No environmental effect of note; Very short-term disruption to services.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple major injuries or single fatality; Major damage to property; Tier 1 to Tier 2 criteria reached; Adverse national publicity, medium-term suspension of operations or prolonged restrictions.	0	0	0	0	2	5	5	5	**2.24**
29	24	Collision	Large Commercial Vessel -Towage Vessel	A Large Commercial Vessel collides with a Towage Vessel.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Very minor injury; Very minor damage to property; No environmental effect of note; Very short-term disruption to services.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple major injuries or single fatality; Major damage to property; Tier 1 to Tier 2 criteria reached; Adverse regional publicity, temporary suspension of commercial activities and/or prolonged restrictions.	0	0	0	0	2	5	5	3	**2.15**
30	11	Collision	Inshore Fishing Vessel - Inter-Island Ferry	An Inshore Fishing Vessel collides with an Inter-Island ferry.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Very minor injury; Very minor damage to property; No environmental effect of note; Very short-term disruption to services.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple major injuries or single fatality; Moderate damage to property; Tier 1 to Tier 2 criteria reached; Adverse regional publicity, temporary suspension of commercial activities and/or prolonged restrictions.	0	0	0	0	2	5	3	3	**2.07**
31	1	Anchor Dragging	Anchor Dragging - Cruise Ship / Mainland Ferry / Large Commercial Vessel / Inter-Island Ferry	A Cruise Ship / Mainland Ferry / Large Commercial Vessel / Inter-Island Ferry unintentionally moves from its anchored position because the anchor has failed to hold.	Anchor dragging detected and remedial action taken. Resulting in: Very minor injury; Very minor damage to property; No environmental effect of note; Very short-term disruption to services.	Contact or grounding. Resulting in: Multiple major injuries or single fatality; Major damage to property; Tier 2 spill criteria reached but capable of being limited to immediate area; Adverse national publicity, medium-term suspension of operations or prolonged restrictions.	0	0	0	0	3	4	4	4	**1.96**
32	34	Girting	Girting Incident	A towline under tension exerts a heeling moment which results in excessive heel that causes the tug to capsize.	Tug recovers. Resulting in: Very minor injury; Very minor damage to property; No environmental effect of note; Very short-term disruption to services.	Tug is capsized. Resulting in: Multiple major injuries or single fatality; Major damage to property; Tier 1 to Tier 2 criteria reached; Adverse national publicity, medium-term suspension of operations or prolonged restrictions.	0	0	0	0	1	4	4	4	**1.88**

Rank	Hazard Ref.	Accident Category	Hazard Title	Hazard Detail	Consequence Descriptions		Risk By Consequence Category								Risk Overall
							ML				WC				
					Most Likely (ML)	Worst Credible (WC)	Environment	People	Property	Stakeholders	Environment	People	Property	Stakeholders	
33	13	Collision	Inshore Fishing Vessel - Recreational Vessel	An Inshore Fishing Vessel collides with a Recreational Vessel.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Very minor injury; Very minor damage to property; No environmental effect of note; Very short-term disruption to services.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple major injuries or single fatality; Moderate damage to property; No environmental effect of note; Adverse local publicity, minor disruption to commercial activities.	0	0	0	0	0	5	3	2	**1.85**
34	25	Collision	Recreational Vessel - Recreational Vessel	A Recreational Vessel collides with another Recreational Vessel.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Very minor injury; Very minor damage to property; No environmental effect of note; Very short-term disruption to services.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple minor or single major injury; Minor damage to property; No environmental effect of note; Adverse local publicity, minor disruption to commercial activities.	0	0	0	0	0	4	2	2	**1.69**
35	32	Contact	Contact - Inshore Fishing Vessel / Recreational Vessel / Small Commercial Vessel / Towage Vessel	An Inshore Fishing Vessel / Recreational Vessel / Small Commercial Vessel / Towage Vessel contacts a fixed object.	A low speed / energy contact. Resulting in: Very minor injury; Very minor damage to property; No environmental effect of note; Very short-term disruption to services.	A high speed / energy contact. Resulting in: Multiple minor or single major injury; Minor damage to property; No environmental effect of note; Adverse local publicity, minor disruption to commercial activities.	0	0	0	0	0	4	2	2	**1.69**
36	33	Diving	Diving Incident	A diving incident involving a Recreational and / or Commercial Vessel.	Resulting in: Very minor injury; Very minor damage to property; No environmental effect of note; Very short-term disruption to services.	Resulting in: Multiple major injuries or single fatality; Very minor damage to property; No environmental effect of note; Adverse local publicity, minor disruption to commercial activities.	0	0	0	0	0	5	0	2	**1.63**
37	2	Anchor Dragging	Anchor dragging - Inshore Fishing Vessel / Recreational Vessel / Small Commercial Vessel / Towage Vessel	An Inshore Fishing Vessel / Recreational Vessel / Small Commercial Vessel / Towage Vessel unintentionally moves from its anchored position because the anchor has failed to hold.	Anchor dragging detected and remedial action taken. Resulting in: Very minor injury; Very minor damage to property; No environmental effect of note; Very short-term disruption to services.	Contact or grounding. Resulting in: Multiple minor or single major injury; Moderate damage to property; Tier 1 to Tier 2 criteria reached; Adverse local publicity, minor disruption to commercial activities.	0	0	0	0	2	3	3	2	**1.54**

Rank	Hazard Ref.	Accident Category	Hazard Title	Hazard Detail	Consequence Descriptions		Risk By Consequence Category								Risk Overall
							ML				WC				
					Most Likely (ML)	Worst Credible (WC)	Environment	People	Property	Stakeholders	Environment	People	Property	Stakeholders	
38	30	Collision	Towage Vessel - Towage Vessel	A Towage Vessel collides with another Towage Vessel.	One or both vessels take avoiding action resulting in a slow speed / energy collision. Resulting in: Very minor injury; Very minor damage to property; No environmental effect of note; Very short-term disruption to services.	Neither vessel takes avoiding action resulting in a high speed / energy collision. Resulting in: Multiple minor or single major injury; Moderate damage to property; Tier 1 to Tier 2 criteria reached; Adverse local publicity, minor disruption to commercial activities.	0	0	0	0	1	3	3	1	**1.26**

B ORNITHOLOGY TECHNICAL REPORT

Hatston Pier
Ornithological Technical Report



March 2025

CONTROL SHEET

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1 INTRODUCTION

1.1 Terms of Reference

EnviroCentre was commissioned by Orkney Islands Council Harbour Authority (OICHA) to undertake Wintering Bird Surveys to inform an environmental Impact Assessment for the development of Hatston Pier.

There is potential for these projects to impact bird species during the construction period and effect bird species over the longer-term once the projects are operational, especially the qualifying species of the North Orkney Special Protection Areas (SPA).

1.2 Scope of Report

The aim of the surveys was to establish the ornithological baseline in terms of species present, with additional studies of bird behaviour and activity around the proposed site of Hatston Pier. These surveys would provide evidence of protected and notable species (the qualifying species of the North Orkney SPA) and inform assessments with regards to any potential impacts from the proposed development. The main objectives were as follows:

- Identify and map the presence of all bird species present on and adjacent to the sites;
- Provide counts of those species present within and adjacent to the proposed areas of development;
- Compile locations and behavioural traits of qualifying species of the SPA which were present in the survey area;

1.3 Site Location and Proposed Development

The proposed development is located on the eastern shore of the Orkney mainland, approximately 1.9km west of Kirkwall. It is located on the Hatston coastline within the Bay of Kirkwall,1.7km northwest of the Peerie Sea and 1.8km west of the Bay of Weyland.

The proposal for Hatston comprises a 300m extension to the existing pier and the creation of 7.5 hectares of quayside laydown area through reclamation; there will be a ship lift, additional link span and fuel facility incorporated in the development.

The proposed development is located on the eastern shore of the Orkney mainland, approximately 1.9km west of Kirkwall. It is located on the Hatston coastline within the Bay of Kirkwall,1.7km northwest of the Peerie Sea and 1.8km west of the Bay of Weyland.

It is proposed that the main quay berth depth at the site should be a minimum of minus 10m to Chart Datum (CD).

In summary, the proposed development contains the following components during each Phase:

- Phase 1: Reclamation, armour and drainage works
    - Stage 1 - Existing armour stone uplifted and stored for reuse as outer slope protection.

    - Stage 2 - Section of sheet pile retaining wall will be installed at intersection with existing suspended deck using vibro piling hammer.
    - Stage 3 and 4 – Full reclamation of the 29,600m^2 with sheet pile.
- Phase 2 and 3: Reclamation and Quay Works
    - Stage 5 - Forming works access approach parallel to existing causeway.
    - Stage 6 - Forming reclamation access to commence steel sheet piling using vibro piling hammer adjacent to existing suspended deck pier.
    - Stage 7 - Sheet piling at commencement of new 300m quay will involve pre-treatment of seabed ahead of vibro piling sheet piles to final depth soon after last blast.
    - Stage 8 - A pontoon platform barge (spud leg) will be used to support drilling equipment including an Atlas Copco 9H5 rig with further barge and crane used for lifting and progressing piling operation including vibro hammer of sheet piles into blasted trench.
        - Drilling is likely to be undertaken using an Atlas Copco 9H5 tracked drill rig using a rotary percussive DTH hammer with a Symmetrix N131 casing system or equivalent.
        - Hole size will generally be 110mm dia. and drilling patterns will be reviewed following trial pile installation to ensure the required depth is being achieved.
        - Explosive charge of around 15 to 20Kg will be required per hole at 1m centres along complete pile line. The hole firing sequence will be designed so that each hole is fired individually to minimise the MIC (Maximum Instantaneous Charge) and hence reduce vibration.

1.4 Ornithology Conservation Legislation & Policy

1.4.1 General Nature Conservation Legislation & Policy

European and national legislation and policy relevant to the proposed development in terms of nature conservation are listed below. Cognisance has been taken of these instruments in the preparation of this report.

- The Conservation of Natural Habitats and of Wild Flora and Fauna EC Directive (92/43);
- The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended);
- The Conservation of Wild Birds and their Habitats EC Directive (2009/147/EC);
- The Wildlife and Countryside Act 1981 (as amended) (WCA);
- The Nature Conservation (Scotland) Act 2004;
- The Wildlife and Natural Environment (Scotland) Act 2011 (WANE);
- The British Standard for Biodiversity BS 42020:2013;
- Scottish Planning Policy (2014) sections 193 to 218;
- Scottish Biodiversity Strategy: Scotland's Biodiversity – It's In Our Hands (2004) and 2020 Challenge For Scotland's Biodiversity (2013);
- UK Biodiversity Action Plan (UK BAP); and
- The Scottish Biodiversity List (SBL).

1.4.2 Legislation & Policy Relating to Birds

Several bird species are protected under international and national legislation, and several instruments of national legislation protect all areas of nationally significant, natural heritage. The relevant legislation is described below:

The Wild Birds Directive, or European Directive 2009/147/EC (the codified version of EEC Directive 79/409/EEC as amended) and the Habitats Directive (EEC Directive 92/43/EEC), state that all wild bird populations within the UK are protected under European legislation. Through these Directives, which highlight key species within specifically detailed annexes, came the establishment of a Europe-wide network of designated conservation areas known as Natura 2000 (comprised of Special Protection Areas (SPA) from the Birds Directive and Special Areas of Conservation (SAC) from the Habitats Directive). It should be noted that any changes to European Directives following the UK withdrawal from the European Union do not apply in the UK from 1 January 2021.

The Wildlife and Countryside Act 1981 (as amended) is the primary legislation that protects wild birds within the UK. Through a series of Schedules, this Act makes it an offence to intentionally kill, injure or take any wild bird or take, damage or destroy their nests or eggs. It is also an offence to intentionally or recklessly disturb the nest building, nests that contain eggs or young, or to disturb or take the dependent young of birds on the Schedule 1 list, which are offered the highest level of protection.

The Nature Conservation (Scotland) Act 2004 imposes a wide-ranging duty to conserve biodiversity and protect the nation's natural heritage. Implementation is linked to a national biodiversity strategy that is endorsed by the Scottish Government.

On a local level or for particular species, Scottish Planning Policy (Scottish Government 2014) states that areas should be safeguarded, and the character of the habitat enhanced, species diversity, rarity and extent must be established, and the species requirements must be fully factored into the planning and design of the development.

1.5 Report Usage

The information and recommendations contained within this report have been prepared in the specific context stated above and should not be utilised in any other context without prior written permission from EnviroCentre Limited.

If this report is to be submitted for regulatory approval more than 12 months following the report date, it is recommended that it is referred to EnviroCentre Limited for review to ensure that any relevant changes in data, best practice, guidance or legislation in the intervening period are integrated into an updated version of the report.

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2 METHODS

2.1 Desk Study

A desk study of published data was undertaken to inform the bird surveys from 2020-2022. The results of the desk study were used to identify if the development could potentially impact upon any notable or protected species; to inform the field survey; and to provide information to guide actions and priorities for any ecological mitigation and enhancement.

The main data source for the desk study was:

- NatureScot Sitelink website[1] for statutory designated sites within a 5-kilometre radius (*e.g.* Special Protection Areas (SPA), Special Areas of Conservation (SAC), Sites Special of Scientific Interest (SSSI) and Ramsar Sites.

2.2 Bird Conservation Criteria

The criteria used to define the current conservation status of UK bird populations are BAPs at national and local levels, and the Red, Amber and Green lists of Birds of Conservation Concern (BoCC)[2].

Both the UKBAP and the network of Local BAPs were initialised in response to the 1992 Convention of Biological Diversity[3] signed in Rio de Janeiro (also referred to as the Rio Convention). Implemented through the Biodiversity Steering Group, the BAPs identified both the habitat types and species that were of conservation concern. Plans were then drawn up to aid protection and conservation of these priority habitats and species.

Taking account of the Scottish Biodiversity Strategy, the conservation status of the species recorded during the bird survey were evaluated by their inclusion on the UKBAP and by using the RSPB / BTO Conservation Status Criteria from the lists of BoCC, which is a simple 'traffic light' method to gauge conservation importance for those species which are not afforded protection under international or national legislation. The criteria used to evaluate this conservation concern are listed below:

Red-listed criteria

- Globally threatened;
- Historical population decline in UK during 1800 – 1995;
- Rapid (≥ 50%) decline in UK breeding population over last 25 years; and
- Rapid (≥ 50%) contraction of UK breeding range over last 25 years.

Amber-listed criteria

- Moderate (25-49%) decline in UK breeding population over last 25 years;
- Moderate (25-49%) contraction of UK breeding range over last 25 years;

[1] NatureScot SiteLink website. Available at https://sitelink.nature.scot/map (Accessed 2013, 2015, 2016, 2017 & 2022)
[2] Stanbury, A.J., Eaton, M.A., Aebischer, N.J., Balmer, D., Brown, A.F., Douse, A., Lindley, P., McCulloch, N., Noble, D.G. & Win, I. 2021. The status of our bird populations: the fifth Birds of Conservation Concern in the United Kingdom, Channel Islands and Isle of Man and second IUCN Red List assessment of extinction risk for Great Britain. *British Birds*, **114**, 723-747. Or online at https://www.bto.org/our-science/publications/birds-conservation-concern/status-our-bird-populations-fifth-birds (Accessed November 2022)
[3] Rio Convention: http://www.cbd.int/ (Accessed October 2021)

- Moderate (25-49%) decline in UK non-breeding population over last 25 years;
- European Red List of Birds Species (ERLOB) that have been categorised as Critically Endangered, Endangered or Vulnerable;
- Five year mean of 1-300 breeding pairs in UK;
- ≥50% of UK breeding population in 10 or fewer sites, but not rare breeders;
- ≥50% of UK non-breeding population in 10 or fewer sites;
- ≥20% of European breeding population in UK; and
- ≥20% of NW European (wildfowl), East Atlantic Flyway (waders) or European (others) non-breeding population in UK.

Green-listed criteria

No identified threat to the population's status.

In addition to the UKBAP and the BoCC criteria, the Scottish Biodiversity List (SBL) was also used in the evaluation process. The SBL is a list of animals, plants and habitats that Scottish Ministers consider to be of principal importance for biodiversity conservation in Scotland. It is based on the aims of the Scottish Biodiversity Strategy and the UKBAP and refers to the international importance of conserving certain species.

2.3 Field Surveys

2.3.1 Low Tide Counts

Low tide counts were undertaken in line with the national Wetland Bird Survey (WeBS) programme. WeBS Core Counts are made using so-called 'look-see' methodology, whereby the observer, familiar with the species involved, surveys the whole of a predefined area. Counts are made at all wetland habitats, including sections of open coast as is the case at Hatston. Numbers of waterbird species, including divers, grebes, cormorants, herons, swans, geese, ducks, waders and kingfisher were counted. Counts of gulls and terns were optional.

For the Hatston site, counts were made once per month throughout the year, ideally eight days after the predetermined 'priority dates' defined in the WeBS guidance to cover the optimal low-tide period to ensure all foraging waders will be included in the counts. This included potential intertidal areas to be lost during the proposed construction of the Hatston site.

Any terrestrial species present (Rock Pipit, Pied Wagtail, corvids, etc) within the survey area should also be recorded to ensure all bird activity is included within the data.

2.3.2 Vantage Point Surveys

Vantage Point (VP) surveys were undertaken to record the bird activity around the Hatston Pier site where the most construction activity will occur, and where the highest number of SPA bird species are most likely to be observed;

The VP surveys were conducted for Hatston pier, with the site split up into north and south in the centre of the proposed works area which offers an excellent panorama of the vicinity and water of the Bay of Kirkwall to both the north and south.

The VP surveys provided a spread over the full daylight period available (from official local sunrise to sunset times) and also through a range of tide heights and sea states.

From the VP, the visible sea area within a 180º arc is divided into 10 sectors. This area is scanned for target species over a (maximum) 2-hour period, with all bird activity recorded.

Appendix A details the Vantage Point locations used.

2.4 HiDef Survey Data from Winter 2021/22 and 2022/23

NatureScot has provided Orkney Island Council with data collected during inshore wintering waterbird surveys in the North Orkney SPA undertaken by HiDef aerial surveying limited under contract to NatureScot in partnership with Marine Scotland and Orkney Islands Council.

It is noted that the data provided is to be used solely for the purposes of informing impact assessments for the Hatston Pier development. It is also acknowledged that the report (from which the data extracts have been provided) has not yet been through NatureScot's quality assurance process. As such information and data provided may be subject to change.

2.5 Bird/Boat Interactions

During vantage point watches, observations of bird behaviour from boat/vessel movements were undertaken.

2.6 Survey Conditions

Tables 2.1 and 2.2 below detail the survey timings and conditions for the low tide counts and vantage point surveys.

Table 2.1: Survey Timings and Conditions during Low Tide Counts Surveys 2020-2022

DATE	SURVEY TIME	LOW TIDE TIME	WIND DIRECTION*	WIND SPEED (/12)**	PRECIPITATION (/3)***	SURVEYOR###
27/10/2020	14:30 – 15:20	13:47	SSE	3	0	AU
20/11/2020	09:25 – 09:55	07:36	SE	5	0	AU
20/12/2020	09:35 – 10:05	07:58	S	6	0	AU
26/01/2021	15:55 – 16:30	15:02	E	1-2	0	AU
26/02/2021	15:35 – 16:15	15:59	S	1-2	0	AU
21/03/2021	09:25 – 09:55	09:12	WNW	3	0	AU
23/04/2021	14:20 – 14:55	14:27	N-E	2	0	AU
17/05/2021	08:25 – 08:55	08:28	SW-SE	2-3	0	AU
26/06/2021	18:05 – 18:35	18:32	NW	2-3	0	AU
16/07/2021	08:20 – 09:15	08:39	S	3	0	AU
24/08/2021	18:20 – 18:50	18:27	NW	3	0	AU
22/10/2021	17:50 - 18:10	18:11	W	2	0	AU
25/11/2021	09:25 – 09:55	07:09	NW	4-5	0	AU
17/12/2021	15:15 – 15:45	15:22	S - W	0 -3	0	AU
26/01/2022	10:00 – 10:30	10:06	SW	5-6	0	AU
19/02/2022	16:40 – 17:10	18:15	SW	3-2	0	AU
14/03/2022	15:05 – 15:35	14:27	S	3-4	0	AU
23/04/2022	10:30 – 10:55	10:17	N	3	0	AU

21/05/2022	08:55 – 09:20	09:17	SW-W	3-4	0	AU
26/06/2022	15:35 – 16:10	15:43	SE	5-6	0	AU
28/07/2022	17:30 – 18:00	17:26	SE	4-5	0	AU
27/08/2022	16:35 – 17:10	17:38	S-NE	2-3	0	AU

Table 2.2: Survey Timings and Conditions for Vantage Point Surveys during Winter 2022/23

Date	Count	Times	Wind	Force	Sea State	Cloud (out of 8)	Precipitation	Tide	Surveyor
25/10/2022	S pier	12:55-14:27	S	2-3	1-2	4 - 6	none	falling	AU
25/10/2022	N pier	14:36-16:04	S	3	1-2	6	none	falling	AU
29/10/2022	S pier	09:59-11:25	S	1- 2	1-2	2	none	rising	AU
29/10/2022	N pier	11:37-13:24	S	2	1-2	1	none	rising	AU
08/11/2022	S pier	12:40-13:55	S	4-5	3	5 - 7	none	falling	AU
08/11/2022	N pier	10:27-12:25	SSE - S	3-4	2-4	3 - 5	none	falling	AU
24/11/2022	S pier	08:50-11:30	SSW - S	5 -3	2-4	2	none	falling	AU
24/11/2022	N pier	11:45-14:05	S	4-5	2-3	1 - 4	none	falling	AU
05/12/2022	S pier	11:15-12:25	N	3-4	3-4	7 - 6	none	falling	AU
05/12/2022	N pier	08:40-10:50	W - N	2-4	1-4	7	none	falling	AU
16/12/2022	S pier	10:20–11:45	W	1	1-2	3	none	rising	AU
16/12/2022	N pier	12:05–14:10	S	1	1	3	none	rising	AU

12/01/2023	S pier	13:25-14:55	SE	3-4	1-3	6-7	none	rising	AU
12/01/2023	N pier	10:50-13:05	SE	1-3	2-3	8	none	falling	AU
20/01/2023	S pier	15:30-16:20	W-SW	1-3	2-1	2	none	Low	AU
20/01/2023	N pier	13:55-15:25	SW	1-2	1	3	none	rising	AU
06/02/2023	S pier	14:45–15:45	SW	4	2-3	1	none	falling	AU
06/02/2023	N pier	15:50-17:15	SW	5-6	3-4	1	none	falling	AU
18/02/2023	S pier	11:55-13:00	W	2-3	2	3	none	falling	AU
18/02/2023	N pier	09:10-11:50	W	2-3	2	3	none	falling	AU
02/03/2023	S pier	17:15-17:55	E	2	2	2	none	rising	AU
02/03/2023	N pier	15:20-17:10	ENE	2-3	2-3	3	none	rising	AU
08/03/2023	S pier	10:00-1205	N	2-3	2-3	2	none	high	AU
08/03/2023	N pier	12:20-13:45	N	2-3	2-3	3	none	falling	AU
29/04/2023	S pier	16:05–17:10	N	2-3	2-3	4	none	rising	AU
29/04/2023	N pier	17:15-18:20	N	2	2	5	none	rising	AU
21/05/2023	S pier	14:35-16:50	SE	1-2	1-2 to 2	5	Slight shower	falling	AU
21/05/2023	N pier	12:55-14:25	S-SE	1-2	1-2	6	none	rising	AU
31/05/2023	S pier	10:35-11:40	W	4	2-3	8	none	falling	AU

31/05/2023	N pier	08:40-10:25	W	4	3-4	6	none	falling	AU
12/06/2023	S pier	09:15-10:20	NE	1-2	1	1	none	falling	AU
12/06/2023	N pier	10:25-11:20	NE	1-2	1	2	none	falling	AU
24/06/2023	S pier	20:20-21:10	NE	2	1	2	none	low	AU
24/06/2023	N pier	19:30-20:20	S	1-2	1	6	none	falling	AU
07/07/2023	S pier	20:50-21:30	S	2-3	2-3	7	none	rising	AU
07/07/2023	N pier	21:30-22:10	S	3-4	2	7	none	rising	AU
29/07/2023	S pier	20:10-20:45	SE	3-2	2-3	6	none	rising	AU
29/07/2023	N pier	19:05-20:05	SE	1-2	1-2	4	none	high	AU
10/08/2023	S pier	10:35-12:05	S	3	2-3	4	none	rising	AU
10/08/2023	N pier	12:10-13:35	S	3-4	2-3	3-1	none	rising	AU
26/08/2023	S pier	15:05-16:20	NE	3	2-3	8	none	rising	AU
26/08/2023	N pier	13:15-15:00	NE	2-3	3	8-7	Light rain shower	rising	AU
09/09/2023	S pier	09:10-10:05	W-S	2-3	1-2	4-7	none	falling	AU
09/09/2023	N pier	10:10-11:15	S	3	2-3	7-5	none	falling	AU
23/09/2023	S pier	16:50-17:45	W	2-3	2-3	2	none	rising	AU
23/09/2023	N pier	15:15-16:45	NW	1-2	1-2	3	none	high	AU

05/10/2023	S pier	11:20-12:15	SW	3-2	2-3	7	none	rising	AU
05/10/2023	N pier	09:55-11:10	SW	3	2-3	8	none	rising	AU
05/11/2023	S pier	08:25-09:40	S	0-1	0-1	6	none	falling	AU
05/11/2023	N pier	09:55-11:15	S-W	0-1	0-2	6	none	low	AU
17/11/2023	S pier	14:15-15:30	ENE-E	2	2	2	none	high	AU
17/11/2023	N pier	12:35-14:05	ENE	2	2	2	none	falling	AU
02/12/2023	S pier	09:50-12:00	SW	1	0-1	2	none	rising	AU
02/12/2023	N pier	12:10-13:50	SW	1	0-1	2	none	Rising/high	AU
23/12/2023	S pier	08:40-10:15	W	2	1-2	8	none	falling	AU
23/12/2023	N pier	10:20-11:35	S-SE	2	1-2	8	none	falling	AU
05/01/2024	S pier	15:30-16:15	S	3-4	2-3	8	Light rain	falling	AU
05/01/2024	N pier	13:45-15:25	SSW	2-3	1-2	8	none	falling	AU
23/01/2024	S pier	10:50-12:10	S	4-6	3-4	8	Rain at end	High/falling	AU
23/01/2024	N pier	08:35-10:45	SSW	3-4	2-4	8	none	rising	AU
05/02/2024	S pier	14:00-15:25	S	2	1-2	8	none	rising	AU
05/02/2024	N pier	15:30-16:50	S-SSE	2-1	1-2	8	none	rising	AU
25/02/2024	S pier	16:55-17:45	N	2-3	1-3	6	none	low	AU

25/02/2024	N pier	13:45-16:45	N-NW	2-4	1-3	4-6	none	falling	AU
14/03/2024	S pier	14:50-16:05	W-N	2-3	2-3	7	none	falling	AU
14/03/2024	N pier	16:15-18:10	N	2-3	2-3	7	none	falling	AU
20/03/2024	S pier	17:55-18:35	S	2-3	1-2	1	none	rising	AU
20/03/2024	N pier	16:45-17:50	SW-S	1-3	1-2	3	none	rising	AU
27/05/2024	S pier	15:30 – 16:30	SW	2-3	1-2	2	None	Rising	MS
27/05/2024	N pier	16:40-18:00	SW	3	1-2	1	None	Rising	MS
28/05/2024	S pier	08:00-09:10	S	3	1-2	3	None	High	MS
28/05/2024	N pier	09:20-10:35	S	3-2	1-2	3	none	falling	MS
17/06/2024	S pier	19:30-20:10	N	3	3	7	none	High	AU
17/06/2024	N pier	17:55-19:25	NW	3	3	7	none	rising	AU
21/06/2024	S pier	16:35–17:20	S	3	2	5	none	low	AU
21/06/2024	N pier	15:30-16:25	S	3	2	7	none	Falling	AU
12/07/2024	S pier	1155-12:55	N	2-3	2	8	none	Rising	AU
12/07/2024	N pier	13:00-14:15	N	2-3	2	8	none	Rising	AU
22/07/2024	S pier	14:50-15:40	SE	3	2-3	7	none	falling	AU
22/07/2024	N pier	13:35-14:45	SE	2-3	2	6	none	falling	AU

03/08/2024	S pier	17:45-18:30	SW	2	1	6	none	Rising	AU
03/08/2024	N pier	18:40-19:40	SW	1-2	1	6	none	Rising	AU
20/08/2024	S pier	18:40-19:30	S	3-2	2-1	5	none	Rising	AU
20/08/2024	N pier	17:15-18:25	S	2-3-4	3	6	none	low	AU
23/08/2024	S pier	07:10-08:00	SW	1-2	1	7	none	low	AU
23/08/2024	N pier	08:15-09:25	SW-W	2	1	7	none	rising	AU
04/09/2024	S pier	17:30-18:20	NE	2-3	2-3	7-6	none	Low	AU
04/09/2024	N pier	16:05-17:25	NE	3	2-3	8	none	falling	AU
13/09/2024	S pier	07:55-09:10	W	3	3	6	none	falling	AU
13/09/2024	N pier	09:20-11:50	W	3-4	3-4	6	none	falling	AU
17/09/2024	S pier	15:50-16:50	SE	1	1	7	None	Falling	AU
17/09/2024	N pier	14:25-15:45	SE	1	1	7	none	falling	AU

3 RESULTS

3.1 Desk Study

The desk study found three SPAs within 5km of Hatston. These are detailed below.

3.1.1 North Orkney SPA

The North Orkney Special Protection Area (SPA) lies to the north of Mainland in the Orkney Islands, extending from Deerness in the east to Eynhallow in the west. The site includes Wide Firth and several large sheltered bays, such as Deer Sound, Inganess Bay and Bay of Firth. North Orkney SPA also encompasses Shapinsay Sound and tidal channels among the islands of Gairsay, Rousay, Egilsay and Wyre, including Rousay Sound and Eynhallow Sound. Water depths are generally less than 20m. Sediments are primarily mixtures of mud, sand and gravel but become coarser in areas where tidal currents are stronger and there are extensive maerl beds in the sounds around Rousay. The varied marine habitats support a rich and varied invertebrate fauna, including polychaete worms, crustaceans and bivalve molluscs, many of which are important prey species for marine birds. These rich sheltered waters support large numbers of waterfowl, particularly in the winter months when frequent storms affect the surrounding North Sea and eastern Atlantic.

The North Orkney Special Protection Area (SPA) qualifies under Article 4.1 by regularly supporting a non-breeding population of European importance of the following Annex 1 species: Great Northern Diver (*Gavia immer*) (a mean peak annual non-breeding population of 308 birds (12.3% of the Great Britain population) for the years 2006/07 to 2008/09) and Slavonian Grebe (*Podiceps auritus*) (a mean peak annual non-breeding population of 120 birds (10.9% of the Great Britain population) for the years 2007/08-2008/9). The site also qualifies under Article 4.1 by regularly supporting a population of European importance of the following Annex 1 species during the breeding season: Red-throated Diver (*Gavia stellata*) (up to 47 pairs (3.7% of the Great Britain population) for the year of 2006). The site further qualifies under Article 4.2 by regularly supporting a population of European importance of the following migratory species: Velvet Scoter (*Melanitta fusca*) (a mean peak annual non-breeding population of 147 birds (5.9% of the Great Britain population) for the years of 2006/07 to 2008/09).

3.1.2 Orkney Mainland Moors SPA

Orkney Mainland Moors SPA comprises four areas of moorland on Mainland; at its closest point, it lies within 5km of Hatston Pier. The predominant habitats include extensive areas of blanket bog, heaths and mires, with these upland areas supporting 5.9% of the UK's breeding and 2% of the UK's overwintering Hen Harrier (*Circus cyaneus*) population, 2% of the UK's breeding Short-eared Owl (*Asio flammeus*) population. In both cases one of very few sites to support such dense and significant numbers. The area also supports 2% of the UK's breeding Red-throated Diver (Gavia stellata) population. This site's boundaries also correspond to Keelylang Hill and Swartaback Burn Site of Special Scientific Interest (SSSI) which is designated for breeding Hen Harrier.

3.1.3 Scapa Flow SPA

The Scapa Flow SPA comprises a total area of 371km^2 located within Scapa Flow -an enclosed sea area, sheltered by Mainland Orkney to the north, Hoy, South Walls and Flotta to the west and south, and Burray and South Ronaldsay to the east. The Flow is linked to the Pentland Firth in the south through the Sound of Hoxa, and to the Atlantic Ocean in the west through Hoy Sound. The site also

includes nearshore waters to the east of Orkney, extending from South Ronaldsay to Deerness, and including the sheltered shallow waters of Holm Sound, between Burray and East Mainland. Prior to construction of the Churchill Barriers in World War II, there were openings between Scapa Flow and Holm Sound to the North Sea.

The Scapa Flow Special Protection Area (SPA) qualifies under Article 4.1 by regularly supporting a non-breeding population of European importance of the following Annex 1 species: Great Northern Diver (a mean peak annual non-breeding population of 505 birds (20.2% of the GB population) for the years 1998/99-2006/7), Black-throated Diver (*Gavia arctica*) (a mean peak annual non-breeding population of 57 birds (9.5% of the GB population) for the years 1998/99-2006/7) and Slavonian Grebe (a mean peak annual non-breeding population of 135 birds (12.3% of the GB population) for the years 1998/99-2006/7). The site also qualifies under Article 4.1 by regularly supporting a population of European importance of the following Annex 1 species during the breeding season: Red-throated Diver (up to 76 pairs (6.1% of the GB population) in 2006). The site further qualifies under Article 4.2 by regularly supporting populations of European importance of the following migratory species: Common Eider (*Somateria mollissima*) (a mean peak annual non-breeding population of 1997 birds (3.6% of the GB population) for the years of 1998/99 to 2006/07), Long-tailed Duck (*Clangula hyemalis*) (a mean peak annual non-breeding population of 1,395 birds (12.7% of the GB population) for the years of 1998/99 to 2006/07), Red-breasted Merganser (*Mergus serrator*) (a mean peak annual non-breeding population of 539 birds (6.4% of the GB population) for the years of 1998/99 to 2006/07), and European Shag (*Phalacrocorax aristotelis*) (a mean peak annual non-breeding population of 2927 birds (1.5% of the biogeographic population) for the years of 1998/99 to 2006/07).

3.2 Field Surveys

From all the surveys undertaken, a total of 47 species have been recorded from Hatston Pier. listed in alphabetical order below in Table 3.1. The table provides the legal protection status and conservation status of each species recorded during the survey. All 47 species constituted birds resident on Orkney throughout the year or those which regularly breed or overwinter on Orkney.

Table 3.1: Legal Protection and Conservation Status of Species Recorded

Species Name	Scientific Name	Legal Protection		Conservation Status				
		Annex 1	Schedule 1	UK BAP	SBL	Red	Amber	Green
Arctic Tern	*Sterna paradisaea*	X			X		X	
Black Guillemot	*Cepphus grylle*						X	
Black-headed Gull	*Chroicocephalus ridibundus*				X		X	
Black-throated Diver	*Gavia arctica*	X	X	X	X		X	
Common Gull	*Larus canus*						X	

Common Tern	*Sterna hirundo*	X			X		X	
Cormorant	*Phalacrocorax carbo*							X
Curlew	*Numenius arquata*			X	X	X		
Eider	*Somateria mollissima*						X	
Fulmar	*Fulmarus glacialis*						X	
Gannet	*Morus bassanus*						X	
Golden Plover	*Pluvialis apricaria*	X			X			X
Great Black-backed Gull	*Larus marinus*						X	
Great Northern Diver	*Gavia immer*	X	X		X		X	
Great Skua	*Stercolarius skua*						X	
Grey Heron	*Ardea cinerea*							X
Guillemot	*Uria aalge*						X	
Herring Gull	*Larus argentatus*			X	X	X		
Hooded Crow	*Corvus cornix*				X			X
Iceland Gull	*Larus glaucoides*						X	
Jackdaw	*Corvus monedula*							X
Lapwing	*Vanellus*			X	X	X		
Little Auk	*Alle*							X
Little Gull	*Hydrocoloeus minutus*							X
Long-tailed Duck	*Clangula hyemalis*		X			X		
Kittiwake	*Rissa tridactyla*					X		
Mallard	*Anas platyrhynchos*						X	
Mute Swan	*Cygnus olor*							X
Oystercatcher	*Haematopus ostralegus*						X	
Razorbill	*Alca torda*						X	
Red-breasted Merganser	*Mergus serrator*						X	
Redshank	*Tringa totanus*						X	
Red-throated Diver	*Gavia stellata*	X	X		X		X	

Ringed Plover	*Charadrius hiaticula*					X		
Rock Dove / Feral Pigeon	*Columba livia*							X
Rock Pipit	*Anthus petrosus*							X
Rook	*Corvus frugilegus*						X	
Sand Martin	*Riparia*							X
Shag	*Phalacrocorax aristotelis*					X		
Short-eared Owl	*Asio flammeus*	X			X		X	
Slavonian Grebe	*Podiceps auritus*	X	X		X	X		
Snipe	*Gallinago gallinago*						X	
Starling	*Sturnus vulgaris*			X	X	X		
Turnstone	*Arenaria interpres*						X	
Velvet Scoter	*Melanitta fusca*					X		
Whooper Swan	*Cygnus*	X	X		X		X	
Wigeon	*Anas penelope*						X	

3.2.1 Low Tide Count Surveys

The Low Tide Counts showed a diverse number of species being present through the two-year survey period, including some large accumulations of wader and gull species which roost to the south of Hatston pier, on the rocky foreshore.

Notable counts of roosting Curlew included 169 on 27th October 2020,275 on 20th December 2020, 169 on 25th November 2021 and 156 on 26th January 2022

A large flock of 226 Golden Plover was recorded on 27th October 2020, but such numbers were not subsequently recorded during the remainder of the survey period.

Large roosts of gulls were recorded, with post-breeding numbers highest, where numbers of Herring Gulls and Greater Black-backed Gulls were recorded in their hundreds.

Accumulations of duck, auks and other marine species remained low at all sites. Slavonian Grebe was recorded using the inshore waters to the west of Hatston Pier on 26th January 2021.

Maps detailing bird species and numbers for each survey visit can be found in Appendix B.

3.2.2 Vantage Point Surveys (including HiDef Data for winter 2021/22 & 2022/23)

3.2.2.1 North Orkney SPA Qualifying Species

Velvet Scoter

During the Vantage Point Surveys at Hatston, a peak count of 38 birds was recorded on 14th March 2024, which represents 25% of the non-breeding population in North Orkney SPA.

This species was exclusively recorded off the north pier, in the mouth of the Bay of Kirkwall. The sectors where birds were most frequently encountered were Sectors 8, 9 and 10 which are between 500m-1km form the Proposed Development. Small numbers were occasionally recorded in Sectors 5 and 6. No Velvet Scoter were recorded in inshore waters.

No Velvet Scoter were recorded within the Bay of Kirkwall during the HiDef surveys over winter 2021/22. During the 2022/23 surveys, ten birds were recorded in December 2022 and 19 birds in January 2023. These birds were located at the mouth of the Bay of Kirkwall, similar to the findings of the project surveys.

Table 3.2: Average and Peak Monthly Counts of Velvet Scoter at Hatston

	Month							
	October	November	December	January	February	March	April	May
Average monthly count	5.5	18.75	22	30.75	13.25	17.75	13	0
Peak monthly count	21 (29/10/22)	34 (17/11/22)	35 (02/12/22)	37 (20/01/24)	20 (05/02/24)	38 (14/03/24)	13 (29/04/23)	-

As can be seen from Table 3.2, the core period for Velvet Scoter was November to March, where average numbers and peak counts relatively constant (with the exception of a larger peak in January). Low numbers occur in October before building up and then a reduction in number in April. No Velvet Scoter were present between May and September.

Appendix C details the densities of Velvet Scoter, in the form of heat maps, across the survey area.

Appendix D charts the daily and monthly counts of Velvet Scoter.

Appendix E details the records of Velvet Scoter from HiDef surveys.

Great Northern Diver

During the Vantage Point Surveys at Hatston, A peak count of 31 birds were recorded on 16th December 2022 and 5th January 2024, which represents 10% of the non-breeding population in North Orkney SPA.

From the North Pier vantage point, Great Northern Diver was recorded during all months between October and May, peaking with 31 on 16th December 2022. The majority of birds were recorded in the mouth of the Bay of Kirkwall. However, a peak count of 9 was also recorded close to the fish cages.

From the southern pier vantage point, small numbers were recorded, with a peak of 8 birds on 16th December 2022. Birds were predominately recorded out towards Iceland Skerry.

Great Northern Diver was also recorded in all months (except March 2023) during the HiDef surveys over winters 2021/22 and 2022/23., with a peak count of 18 birds in January 2022 and 20 birds in February 2023. As with winter 2022/23, the majority of birds were recorded at the mouth of the Bay of Kirkwall.

Table 3.3: Average and Monthly Peak counts for Great Northern Diver at Hatston

	Month							
	October	November	December	January	February	March	April	May
Average monthly count	6.5	12.25	20.75	16.25	13.25	11.75	11	3.5
Peak monthly count	9 (29/10/22, 05/10/23)	17 (17/11/23)	31 (16/12/22)	31 (05/01/24)	21 (05/02/24)	15 (20/03/24)	11 (29/04/23)	7 (21/05/23)

As can be seen from Table 3.3, the core period for Great Northern Diver was November to April, where average numbers and peak counts relatively constant (with the exception of a larger peaks in December and January). Low numbers occur in October before building up and then a reduction in number in May. No Great Northern Diver were present between June and September. During the surveys undertaken in 2017/18, it was found that numbers of Great Northern Diver within the SPA increased during November and December suggesting that birds were continuing to arrive from their breeding grounds in this period.

Appendix C details the densities of Great Northern Diver, in the form of heat maps, across the survey area.

Appendix D charts the daily and monthly counts for Great Northern Diver.

Appendix E details the records of Great Northern Diver from HiDef surveys.

Table 3.4 below details the peak counts of Great Northern Diver during the flightless moult period (February to mid-April).

Table 3.4: Average and Peak counts of Great Northern Diver during Flightless Moult Period

Month	No. of Count Days	Average Count <2km	Peak Count <2km
February 2023	2	9	12
March 2023	2	9	12
2023 seasonal figures	4	9	12
February 2024	2	17.5	21

March 2024	2	14.5	15
2024 seasonal figures	4	16	21

Slavonian Grebe

During the Vantage Point Surveys at Hatston, a peak count of 10 birds was recorded on 5th November 2023, which represents 6% of the non-breeding population of the North Orkney SPA. All birds were exclusively recorded from sectors 3, 4, 7 and 8 to the west of the Proposed Development.

Table 3.5: Average and Peak monthly counts for Slavonian Grebe at Hatston

	Month							
	October	November	December	January	February	March	April	May
Average monthly count	1.25	5.25	3.75	4.5	1.5	5.25	0	0
Peak monthly count	5 (25/10/22)	10 (05/11/22)	7 (16/12/22)	8 (05/01/24)	3 (25/02/24)	9 (20/03/24)	-	-

As can be seen from Table 3.5, the core period for Slavonian Grebe was November to March, where average numbers and peak counts relatively constant. Low numbers occur in October before building up and then a reduction from March. No Slavonian Grebe were present between April and September. During the surveys undertaken in 2017/18, it was found that numbers of Slavonian grebe within the SPA increased from November through to January and remained steady in February and March which correlates with the Project survey findings.

Appendix C details the densities of Slavonian Grebe, in the form of heat maps, across the survey area.

Appendix D charts the daily and monthly counts for Slavonian Grebe.

Appendix E details the records of Slavonian Grebe from HiDef surveys.

Red-throated Diver Breeding

For most of the year Red-throated Divers were present in very low numbers within 2 km of the existing pier, generally from nought to three birds.

However, there was a distinct peak in the autumn, from mid-August to mid-November with up to 19 birds on 23rd Sept 2023. Some of these autumn birds were seen to be juveniles, twice an adult and juvenile together (26th Aug and 5th Oct 2023), and on 23rd Sept 2023 a group of six included at least one adult in wing moult. It is likely that birds from the local Orkney breeding population were mainly involved early in the autumn, although the highest numbers in late September and early October could also have included birds from further afield (e.g. Shetland).

During the early breeding season of 2023 there were very few sightings and, of the four birds recorded up to early June, two were seen to be immatures.

Overall, about 15% of birds were within 500m of the existing pier, 38% at 500m–1km, and 47% at 1–2km.

In the 2024 breeding season, numbers were much lower than in 2023, perhaps an indication of a poor breeding year. Peaks of two birds in June and three in July were recorded. Only two birds were recorded over three survey dates in August. In September, a peak of six birds were recorded on 4th September, falling to two birds over the last two survey dates in September (13th and 17th).

Appendix D charts the daily and monthly counts for Red-throated Diver.

3.2.2.2 Other notable species

Red-throated Diver (non-breeding)

Small numbers were recorded in early winter 2022, with 8 birds from the north pier on 29th October 2021 and 7 on 8th November 2022. Records were scattered across the Bay of Kirkwall.

Appendix C details the densities of Red-throated Diver, in the form of heat maps, across the survey area.

Appendix D charts the daily and monthly counts for Red-throated Diver.

Black- throated Diver

Two Black-throated Divers were recorded within sector 2 from the south pier vantage point on 24th November 2022 and a single bird from sector 8 off the north pier vantage point on 16th December 2022. No Black-throated Divers were recorded during the 2023/24 surveys.

No Black-throated Diver were recorded within the Bay of Kirkwall during the HiDef surveys over winter 2021/22.

Appendix C details the densities of Black-throated Diver, in the form of heat maps, across the survey area.

Table 3.6 below details the peak counts of Black-throated Diver during the flightless moult period (mid-September to end December).

Table 3.6: Average and Peak counts of Black-throated Diver during Flightless Moult Period

Month	No. of Count Days	Average Count <2km	Peak Count <2km
October 2022	2	0	0
November 2022	2	1	2
December 2022	2	0.5	2
2022 Seasonal figures	6	0.5	2
September/October 2023	2	0	0

November 2023	2	1	1
December 2023	2	0.5	1
2024 seasonal figures	6	0.5	1

Long-tailed Duck

Good numbers of Long-tailed Duck were recorded each month, particularly from the north pier vantage point where large flocks were seen in the vicinity of the fish cages and beyond. A total of 313 birds were recorded here on 24th November, 432 on 16th December 2022 and 393 on 20th January 2023. The largest peak count during all surveys was 543 present on 20th March 2024.

Smaller numbers were seen from the southern pier vantage point, with a peak of 147 on 17th November 2023. Flocks were widely dispersed within the inner bay; however, the main area was between Hatston pier and Iceland Skerry.

During the Hidef surveys in 2021/22 and 2022/23, a peak of 471 birds was recorded in January 2023.

Appendix C details the densities of Long-tailed Duck, in the form of heat maps, across the survey area.

Table 3.7 below details the peak counts of Long-tailed Duck during the pre-migration build up (March-mid-May).

Table 3.7: Average and Peak counts of Long-tailed Duck during Pre-migration build up

Month	No. of Count Days	Average Count <2km	Peak Count <2km
March 2023	2	340	424
April 2023	1	338	338
2023 seasonal figures	3	339	424
March 2024	2	340	543

Eider

Large numbers of Eider were recorded from the north pier vantage point on 24th November 2022 (1149 birds), 16th December 2022 (1570 birds) and 20th January 2023 (1502 birds), 25th February 2024 (1751 birds) and 14th March 2024 (1217 birds). The vast majority of these birds were recorded within sectors 3, 4 and 5, associated with the fish cages present in this area.

Small numbers were recorded from the south pier vantage point, typically up to 20 birds. The exception was on the 24th of November when 139 birds were present, predominately off Crow Ness.

During the Hidef surveys in 2021/22, smaller numbers were present, with a peak of 44 birds in January 2022. During surveys in 2022/23, the peak count was significantly higher, with 1155 birds in February 2023, again associated with the fish cages.

Appendix C details the densities of Eider, in the form of heat maps, across the survey area.

Table 3.8 below details the peak counts of Eider during the flightless moult period (July to mid-September).

Table 3.8 Average and Peak counts of Eider during Flightless Moult Period

Month	No. of Count Days	Average Count <2km	Peak Count <2km
July 2023	2	597	739
August 2023	2	456	649
September 2023	1	394	394
2023 seasonal figures	5	500	739
July 2024	2	29	46
August 2024	3	584	790
September 2024	2	626	906
2024 seasonal figures	7	437	906

Red-breasted Merganser

Small numbers were recorded every month of the vantage point surveys, with a peak count of 24 from the south pier vantage point on 12th January 2023. These birds were located just north of Bay of Weyland, predominately close to shore. During the 2023/24 surveys, the peak count was 33 on 5th February 2024.

During the Hidef surveys in 2021/22, small numbers were also present, with a peak of 41 birds in January 2022 and 39 birds in January 2023

Appendix C details the densities of Red-breasted Merganser, in the form of heat maps, across the survey area.

Shag

Small numbers were recorded from the south pier vantage point, with a peak of 34 birds on 12th January 2023. The majority of records were from sectors 6 and 7 towards Iceland Skerry and north of the Bay of Weyland.

Similar numbers were recorded form the north pier vantage point, with a peak of 50 birds on 29th October 2022. Records were spread out across the Bay of Kirkwall, although birds were regularly recorded around the fish cages in sectors 4 and 8. During the 2023/24 surveys a peak count of 147 birds was recorded on 5th October 2023.

The HiDef survey during the 2021/22 winter period produced similar numbers of birds, with a peak of 24 in November 2021. In 2022/23, the peak count was 38 birds in November 2022.

Appendix C details the densities of Shag, in the form of heat maps, across the survey area.

3.3 Bird/Boat Interactions

A total of 67 vessel movements and interactions were recorded, with the majority of vessel movements eliciting no discernible change in bird behaviour.

Examples of changes in behaviour were swimming away or diving a distance away from vessels. In the most extreme cases, vessel movements elicited a flight response, sometimes with birds alighting back at their original position but also some birds flying over 1km or more away. These instances are as follows:

- 25th October 2022- A tugboat (moving slowly) causing 12 Long-tailed Ducks to fly up before returning to their original position.
- 24th November 2022- The Shapinsay ferry moving quite fast causing a Great Northern Diver to take off and fly out of the Bay of Kirkwall.
- 24th November 2022 – A sailing yacht moving quite fast causing a Red-throated Diver to fly 1.5km away.
- 5th December 2022 – A workboat, moving slowly caused a single Long tailed Duck to take flight. However, the rest of the flock remained unmoved.
- 20th January 2023 – The Earl Thorfinn ferry, moving quite fast, caused a flock of 6 Long-tailed Duck to take flight. The birds were likely to have been directly in the path of the ferry.
- 20th January 2023 – A workboat and larger workboat, moving at various speeds, caused a dense flock of ~100 Long-tailed Duck to take flight in all directions. Most alighted back on the water 1km west or 1km south-east of their original position.

Appendix F details the findings of the bird /boat interactions

4 SYNOPSIS

The surveys undertaken between October 2020 and March 2023, April to September 2023 and October 2023 to September 2024 has provided a baseline for any potential impacts to be assessed.

The Low Tide Count surveys identified a regular winter roost site for Curlew and occasionally used by wintering Golden Plover as well as a roost site for large numbers of gulls (predominately Herring Gull and Great Black-backed Gull). This area is situated just south-east of Hatston Pier and will be lost as a result of the development. However, suitable habitat exists along that coastline towards Crow Ness, and it is anticipated that these birds will move further south to utilise these areas during and post-construction.

The Vantage Point Surveys, along with the HiDef surveys from 2021/22 and 2022/23 has identified numbers and favoured area used by bird species, particularly those species which are qualifying features of the North Orkney SPA. These are detailed below:

- Velvet Scoter – A peak of 38 birds which represents 25% of the non-breeding population in North Orkney SPA. All records were of birds in the mouth of the Bay of Kirkwall, between 1km and 2km from Hatston pier.
- Great Northern Diver – A peak of 31 birds which represents 10% of the non-breeding population in North Orkney SPA. The majority of birds were recorded between 1km and 2km+ from Hatston pier.
- Slavonian Grebe – A peak of 10 birds which represents 6% of the non-breeding population of the North Orkney SPA. Records were almost exclusively of birds in the mouth of the Bay of Kirkwall, between 1km and 2km from Hatston pier, although one bird was recorded in the inshore waters around Hatston pier during a Low Tide Count survey.
- Red-throated Diver (breeding) – low numbers during the main breeding period (peak of 5 birds). Numbers increased during mid-August to mid-November, with a peak of 19 birds (including juveniles) in late September 2023. Numbers in 2024 were much lower than in 2023, with a peak of 6 birds in September 2024.

Observations made of bird and boat interactions indicate that an evasive response elicited in birds (with the most extreme example being taking flight to distance over 1.5km) most often occurred with interactions with work boats, tugboats or recreational vessels such as yachts. The observations also indicate that ferries, using established vessel routes and agreed speeds, seldom caused a flight response in birds, and in particular qualifying species of the SPA.

APPENDICES

A VANTAGE POINT SURVEY LOCATIONS

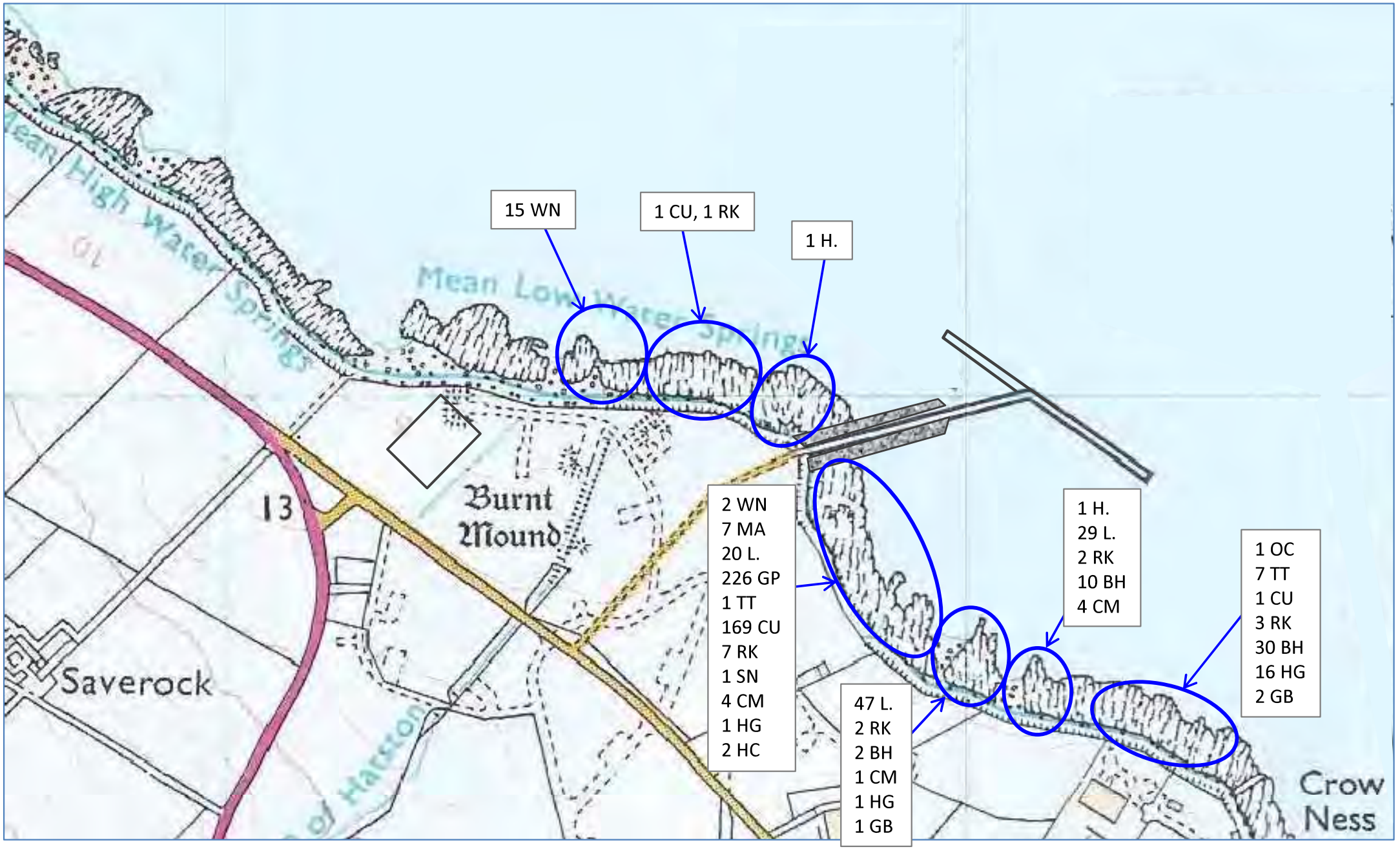
Hatston 2022/23 - suggested VPs and count sectors

sight line to outer edges of VP areas

water within 2km out of view from VPs



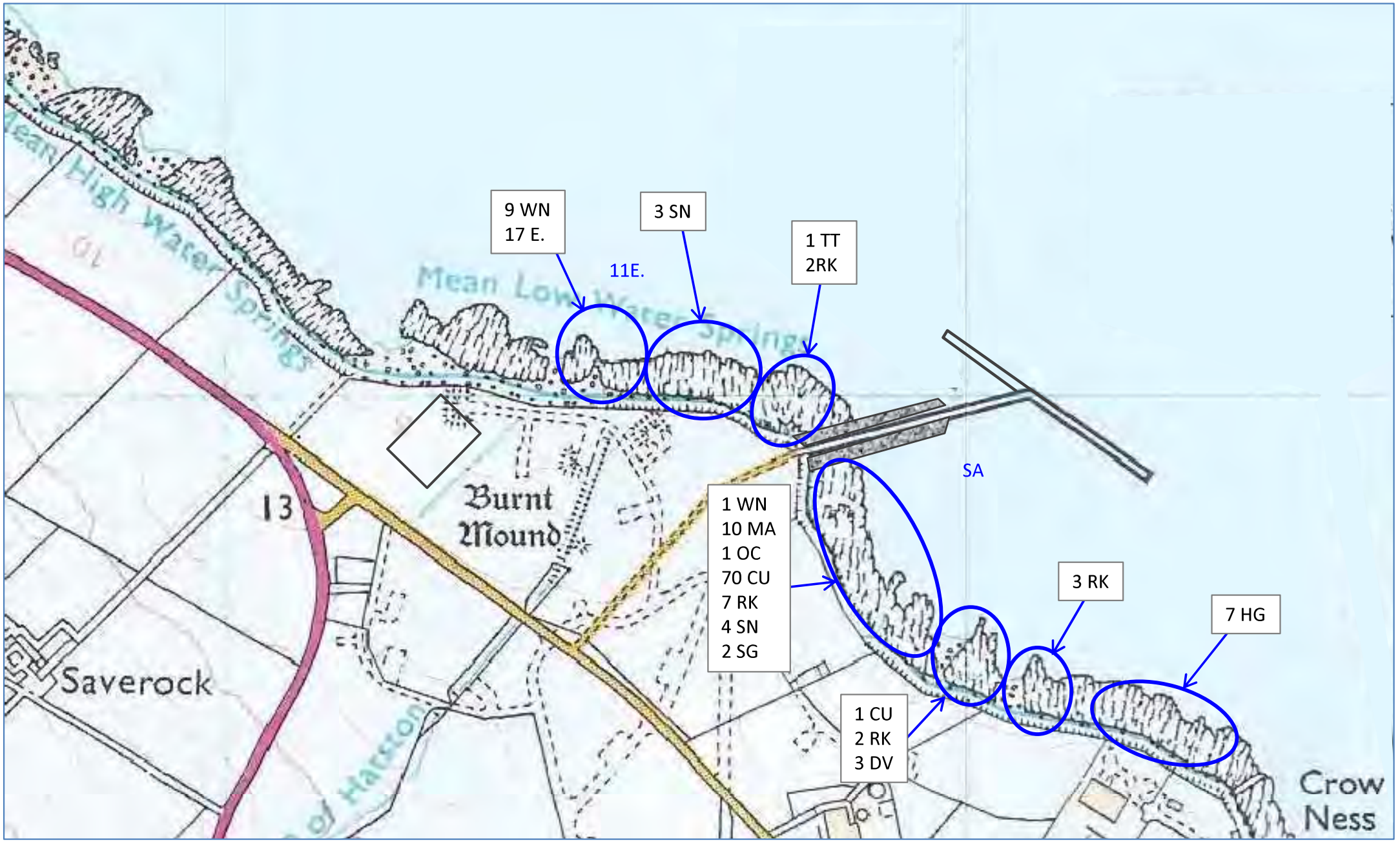
B LOW TIDE COUNT DATA



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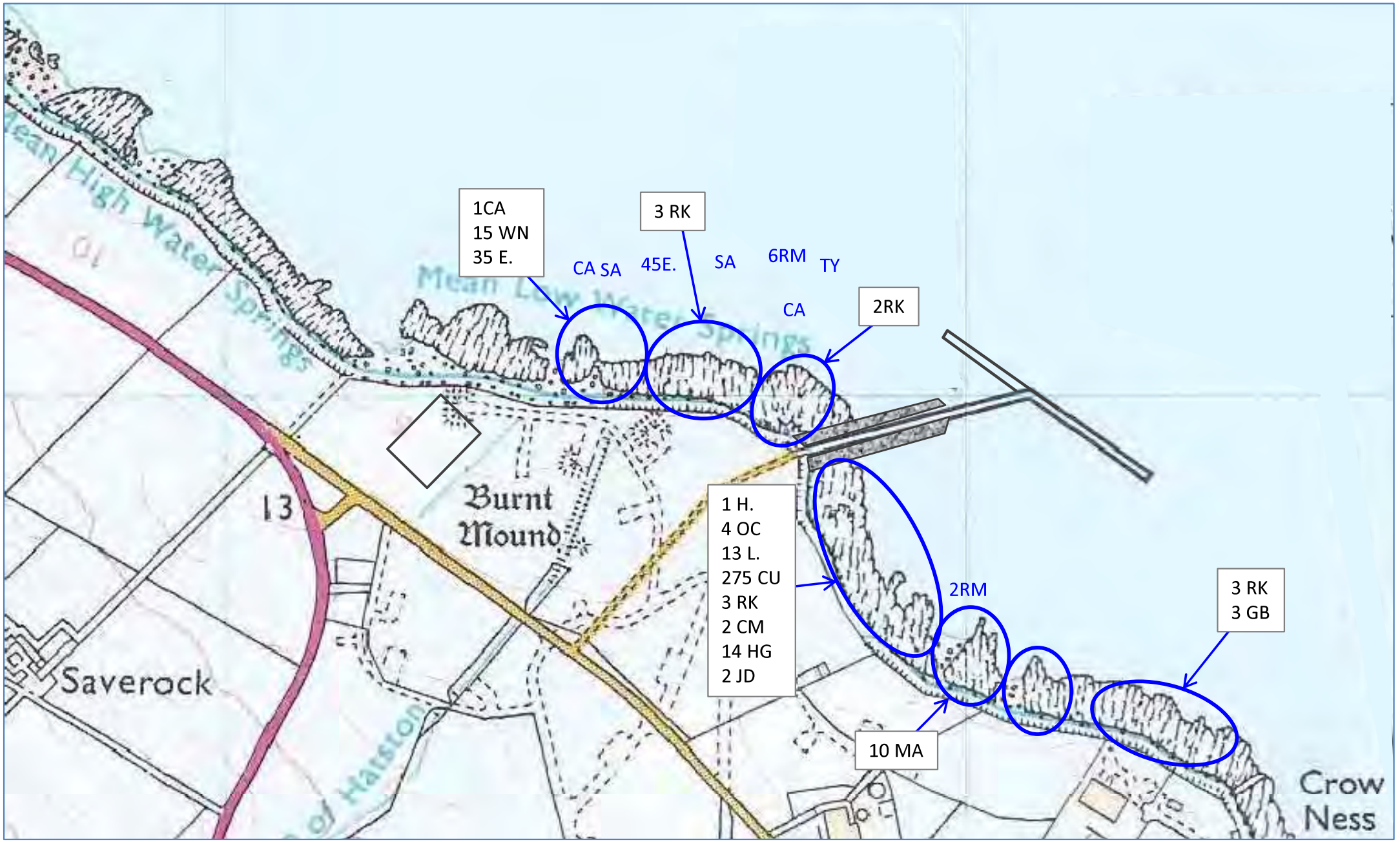
Hatston Pier
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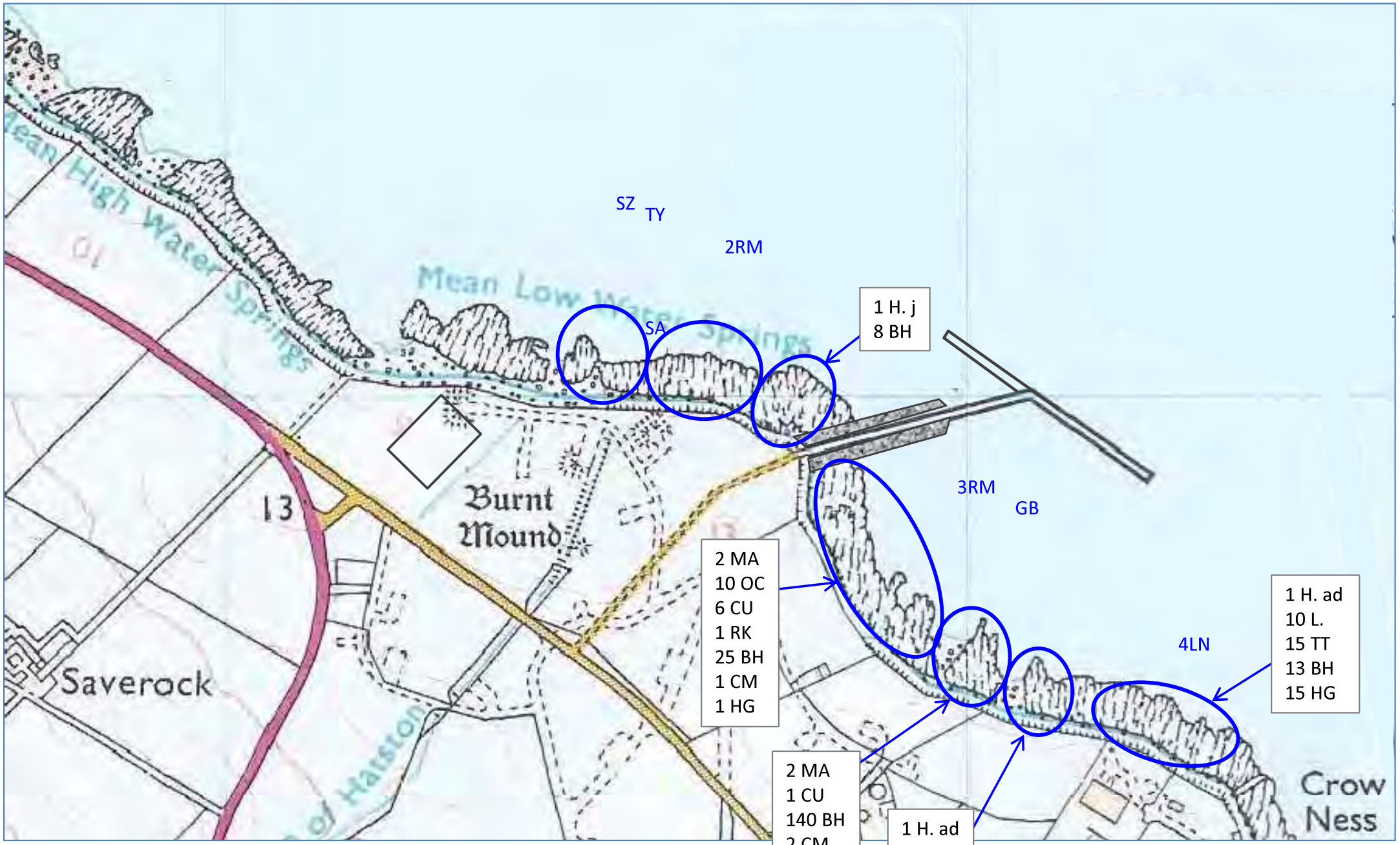
Hatston Pier
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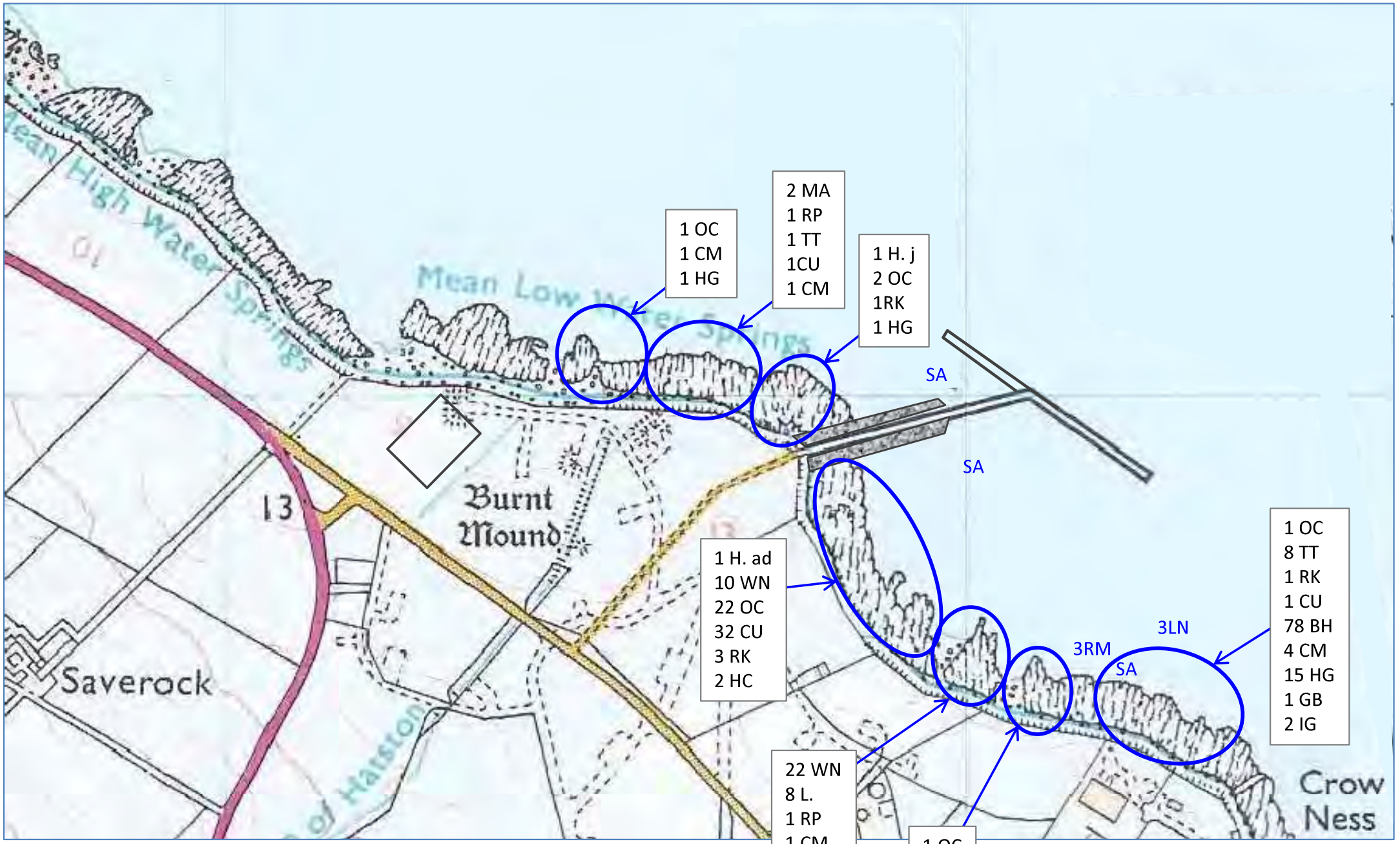
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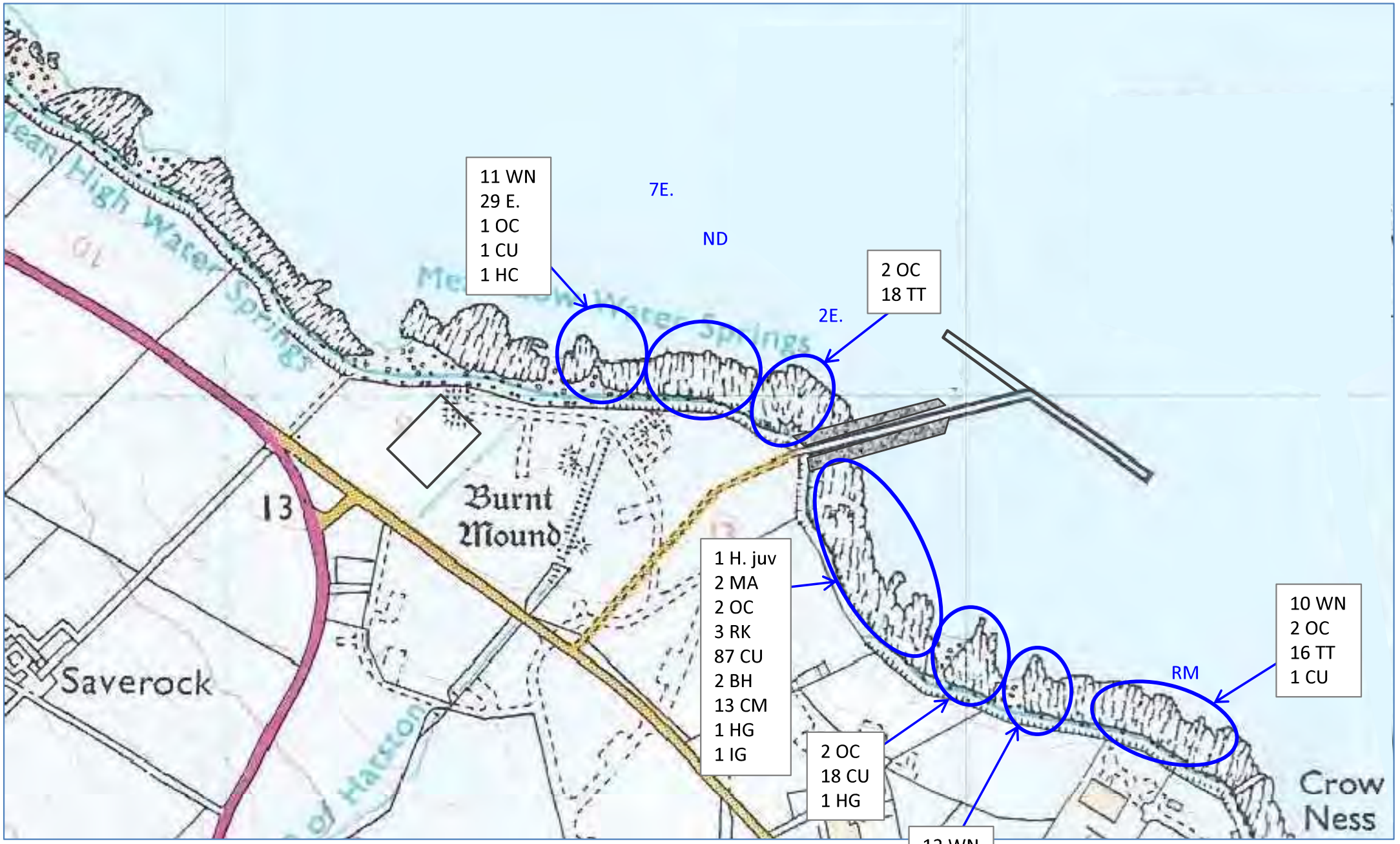
Hatston Pier
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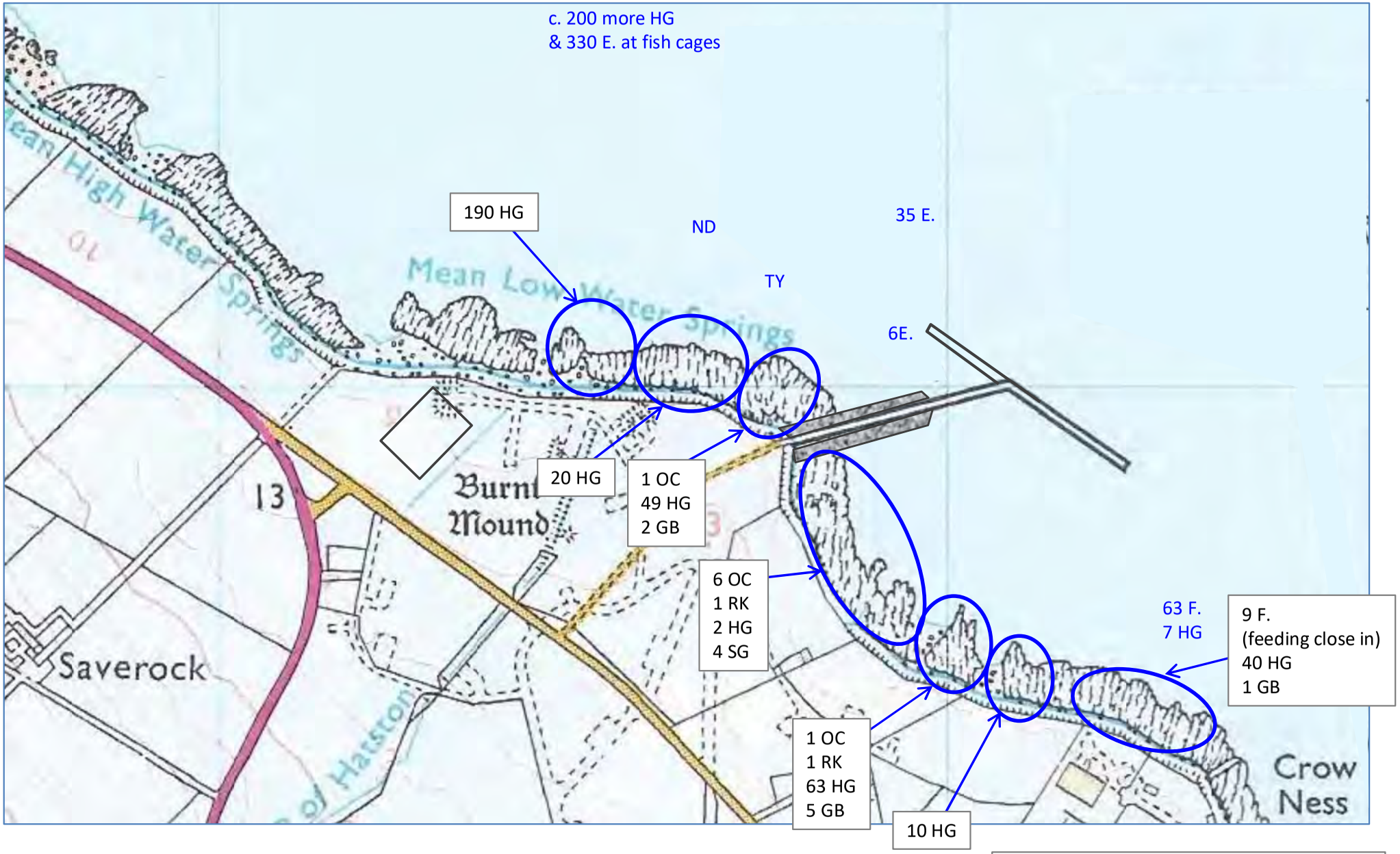
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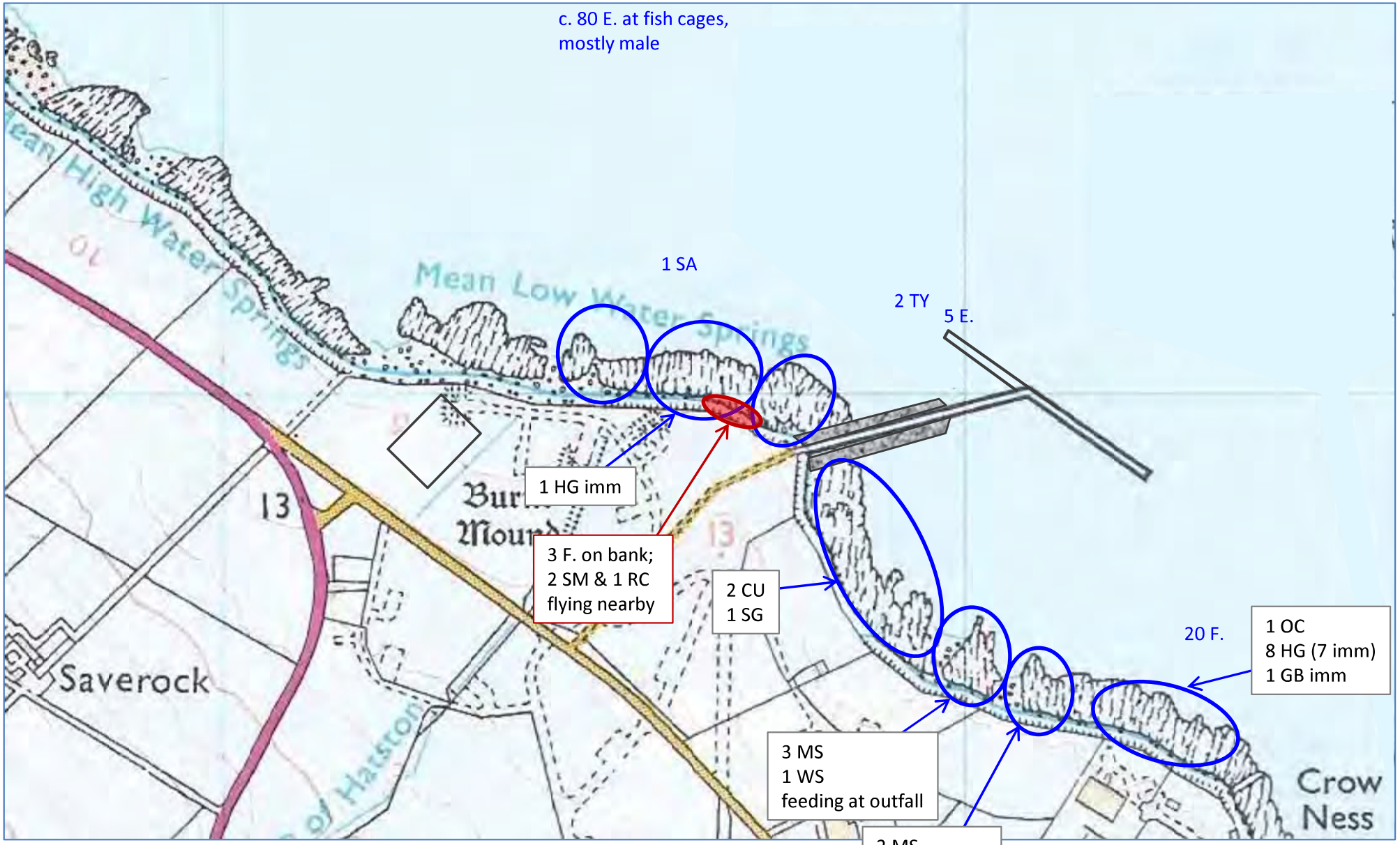
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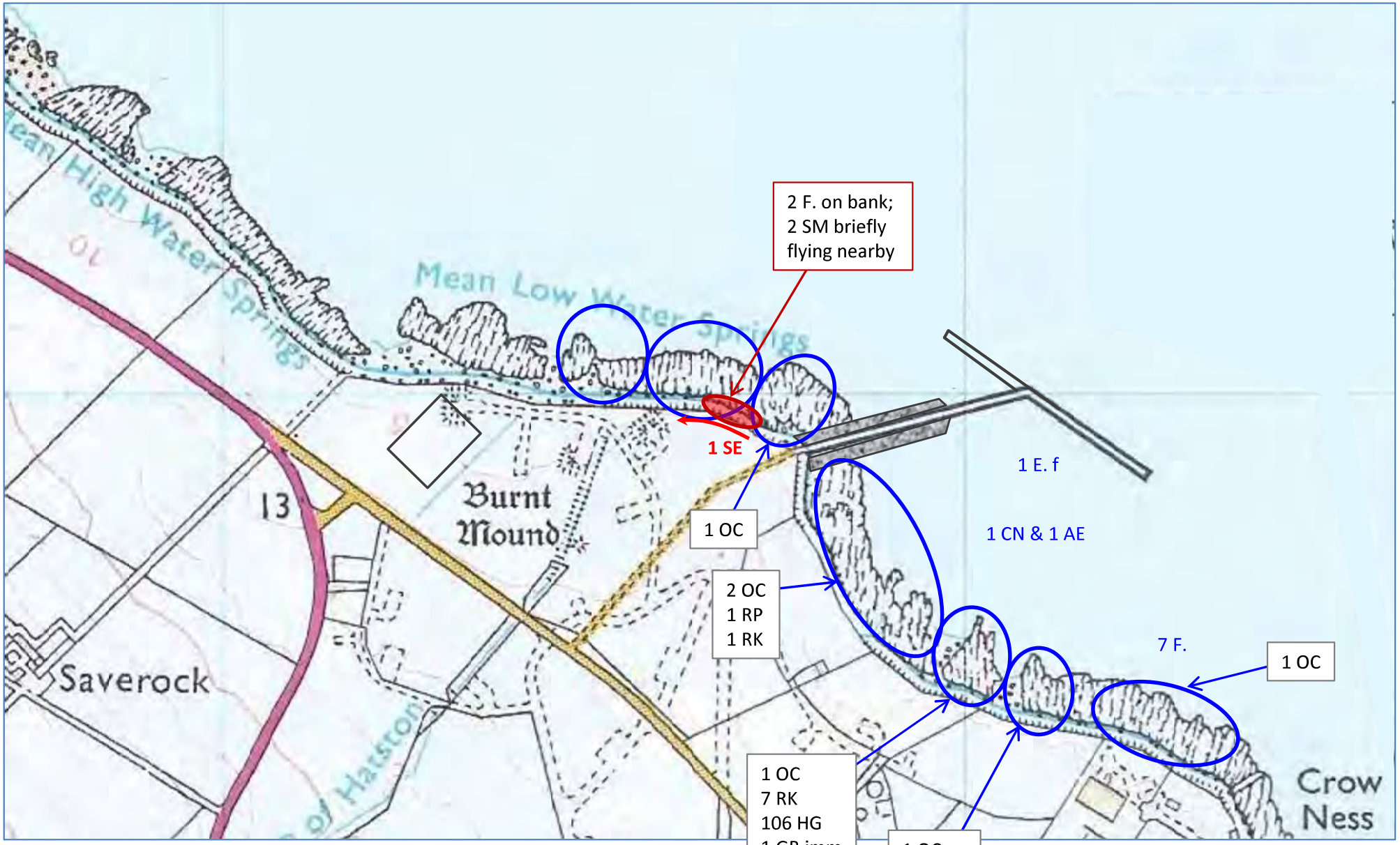
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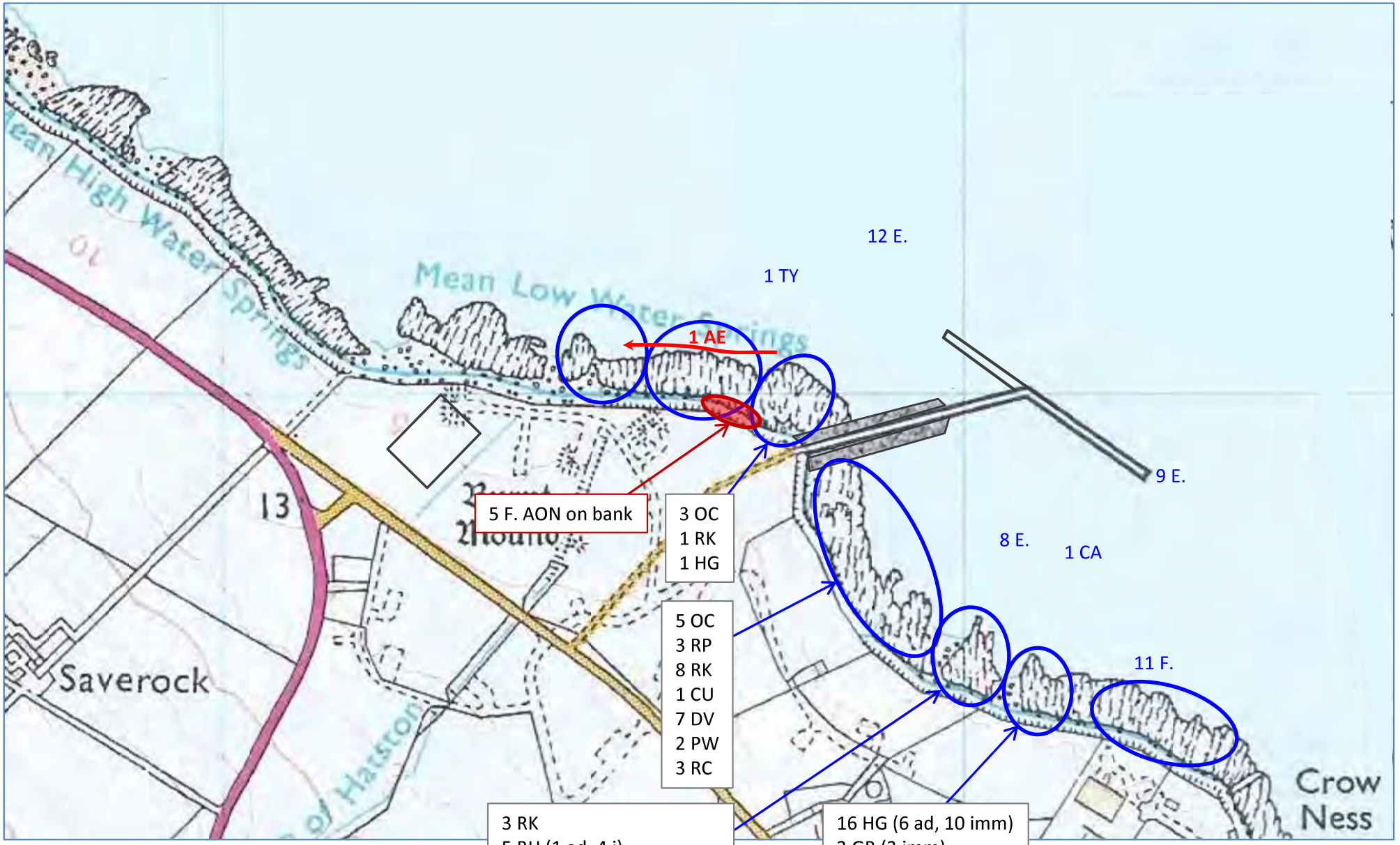
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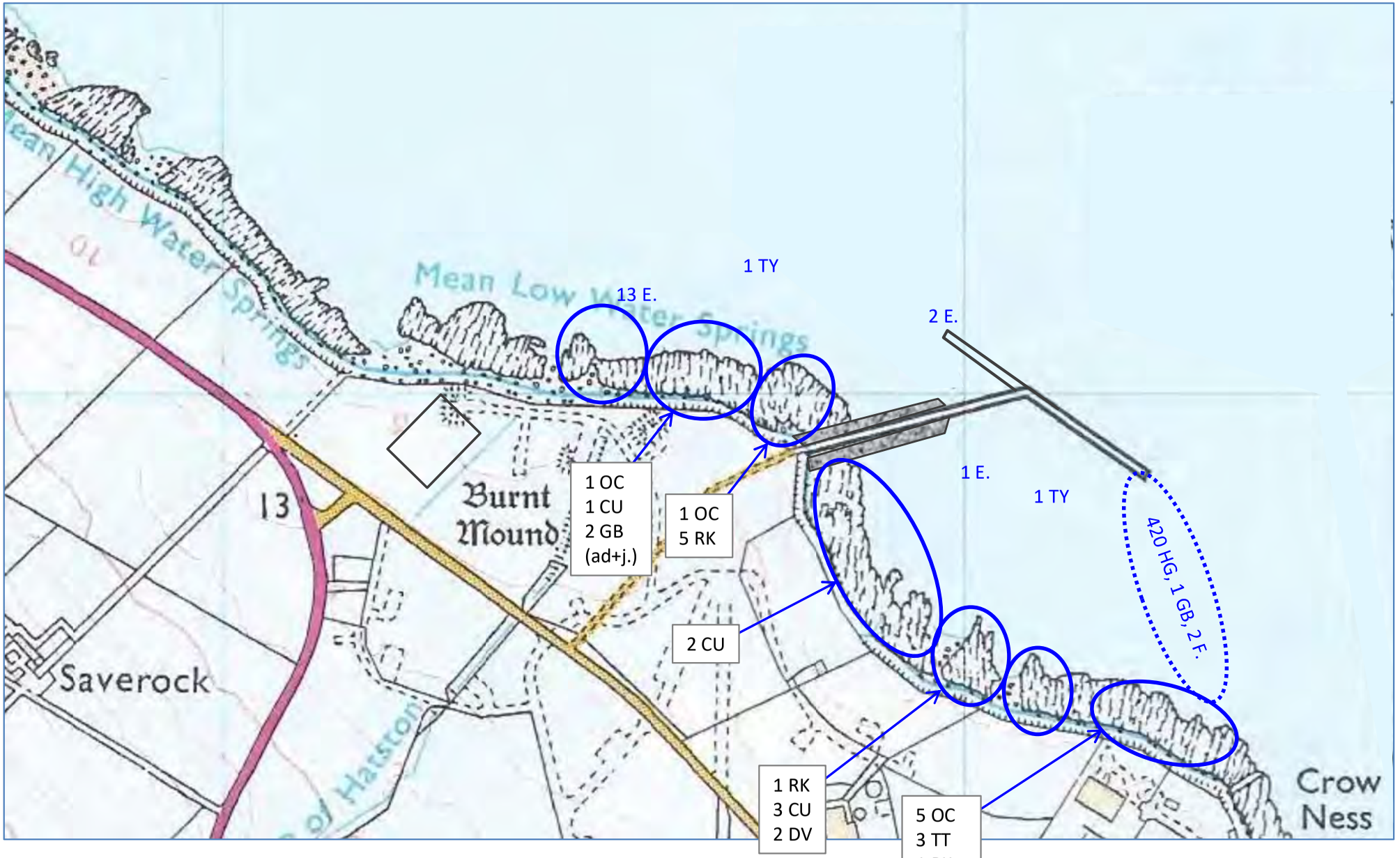
Hatston Pier
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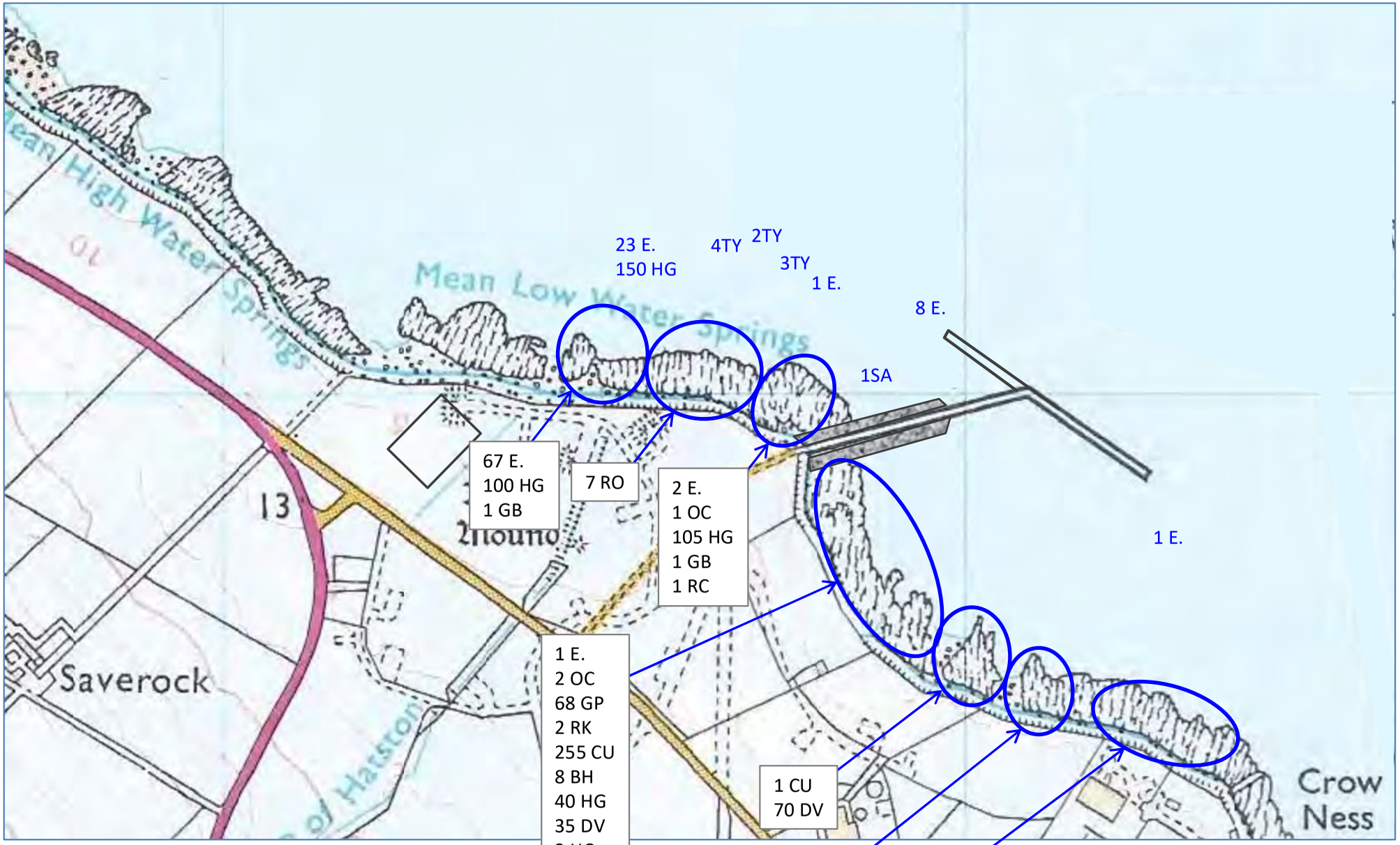
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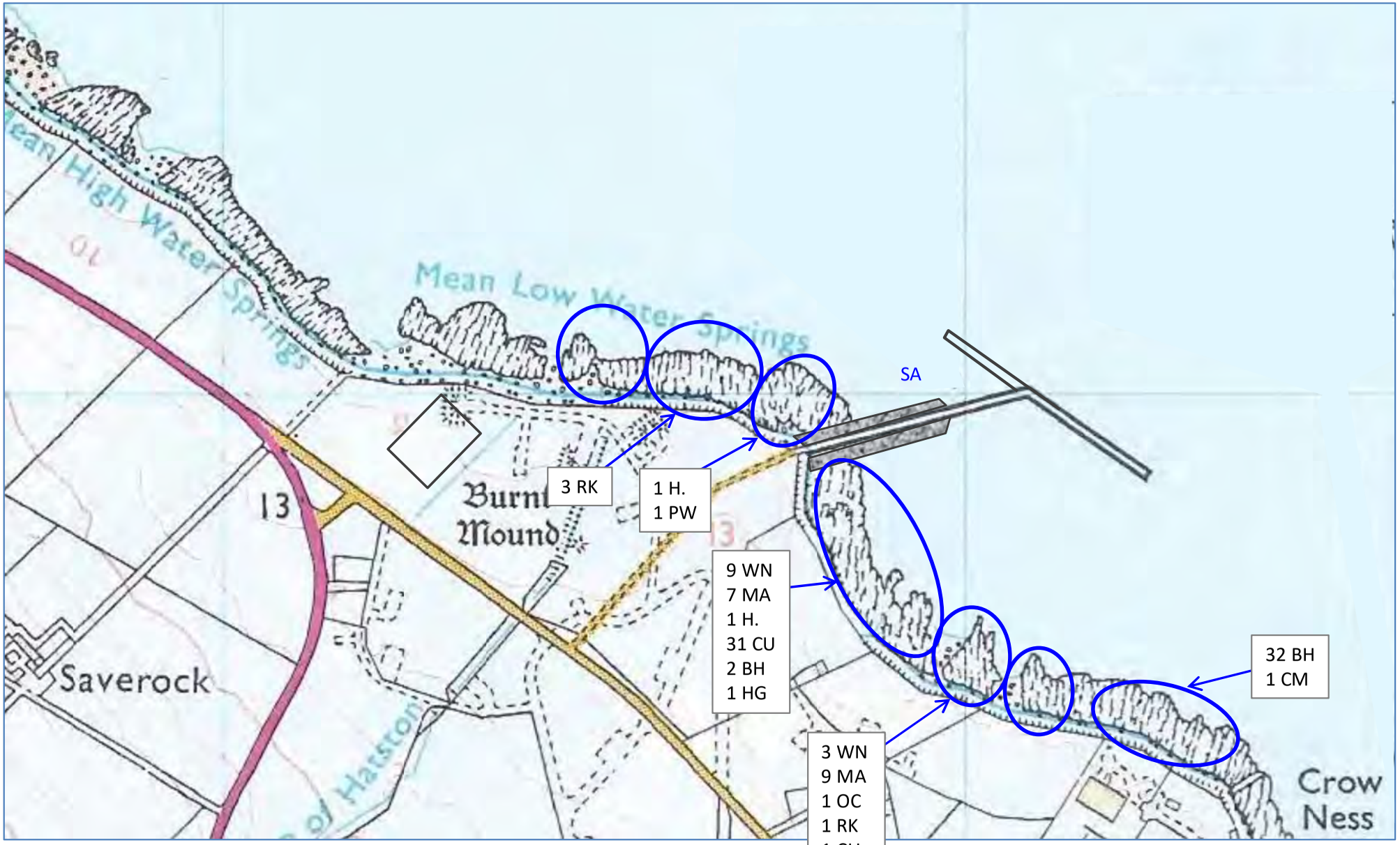
Hatston Pier
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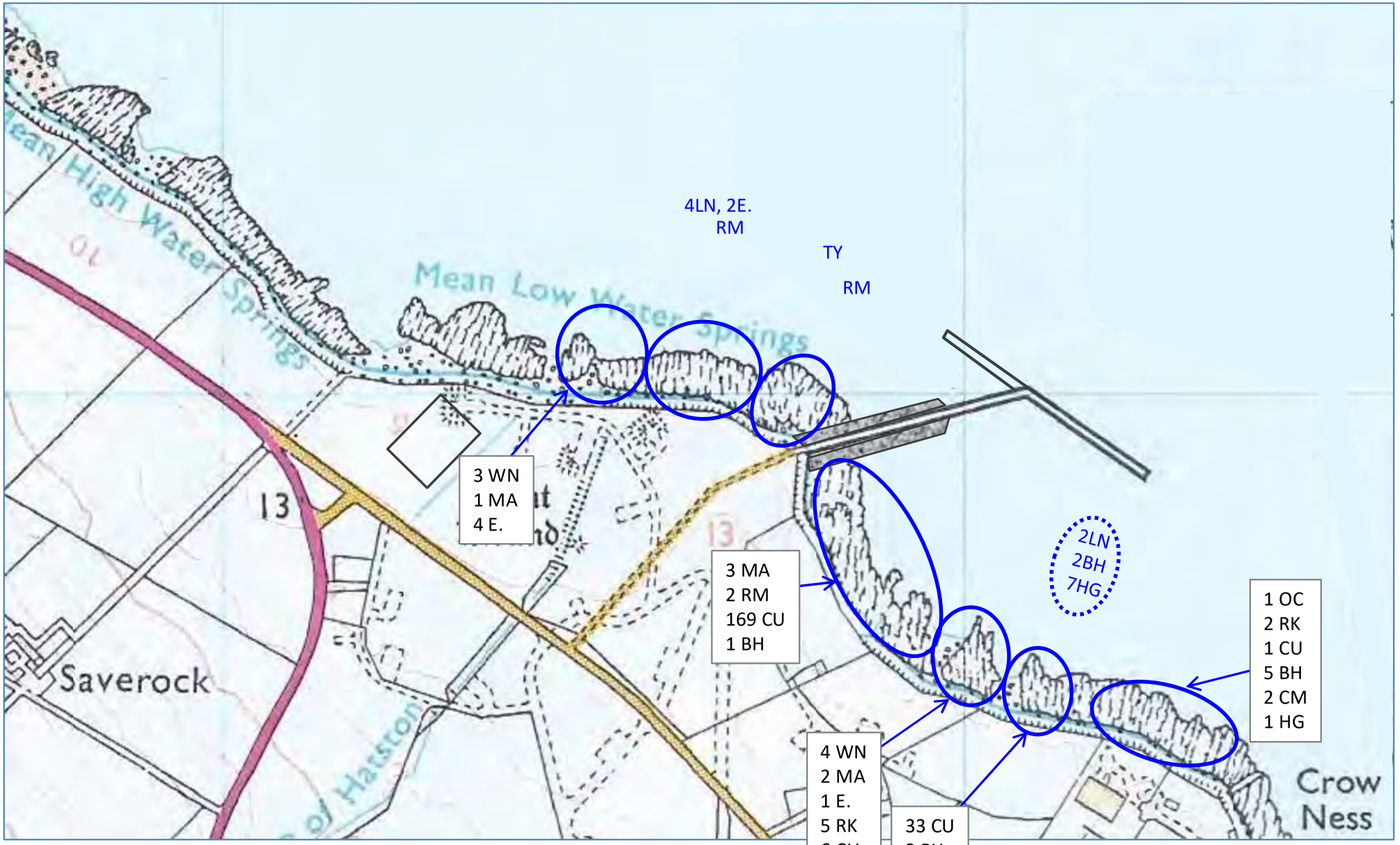
Hatston Pier
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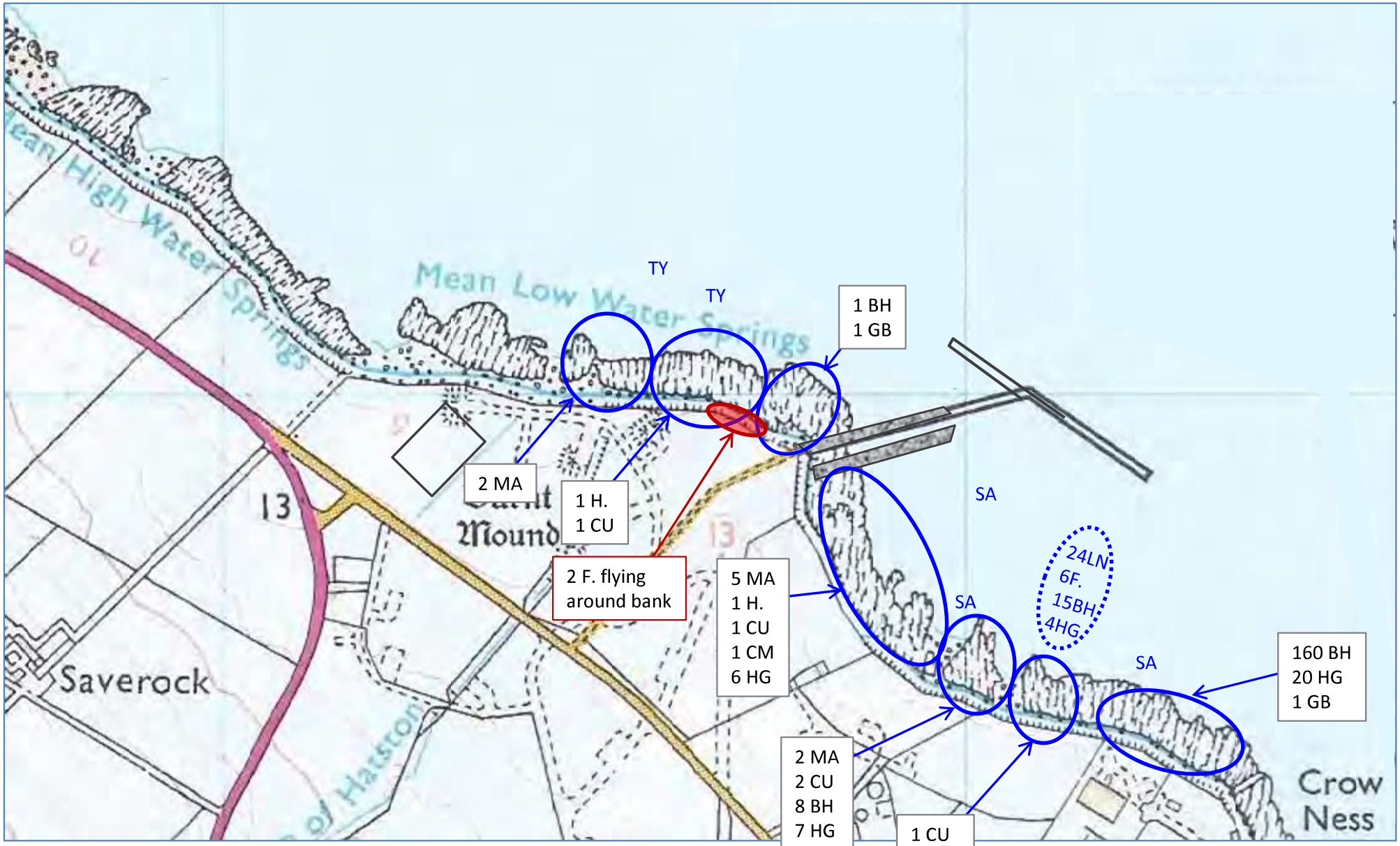
Hatston Pier
22nd Oct 2021 (17:50 – 18:10)
at dusk



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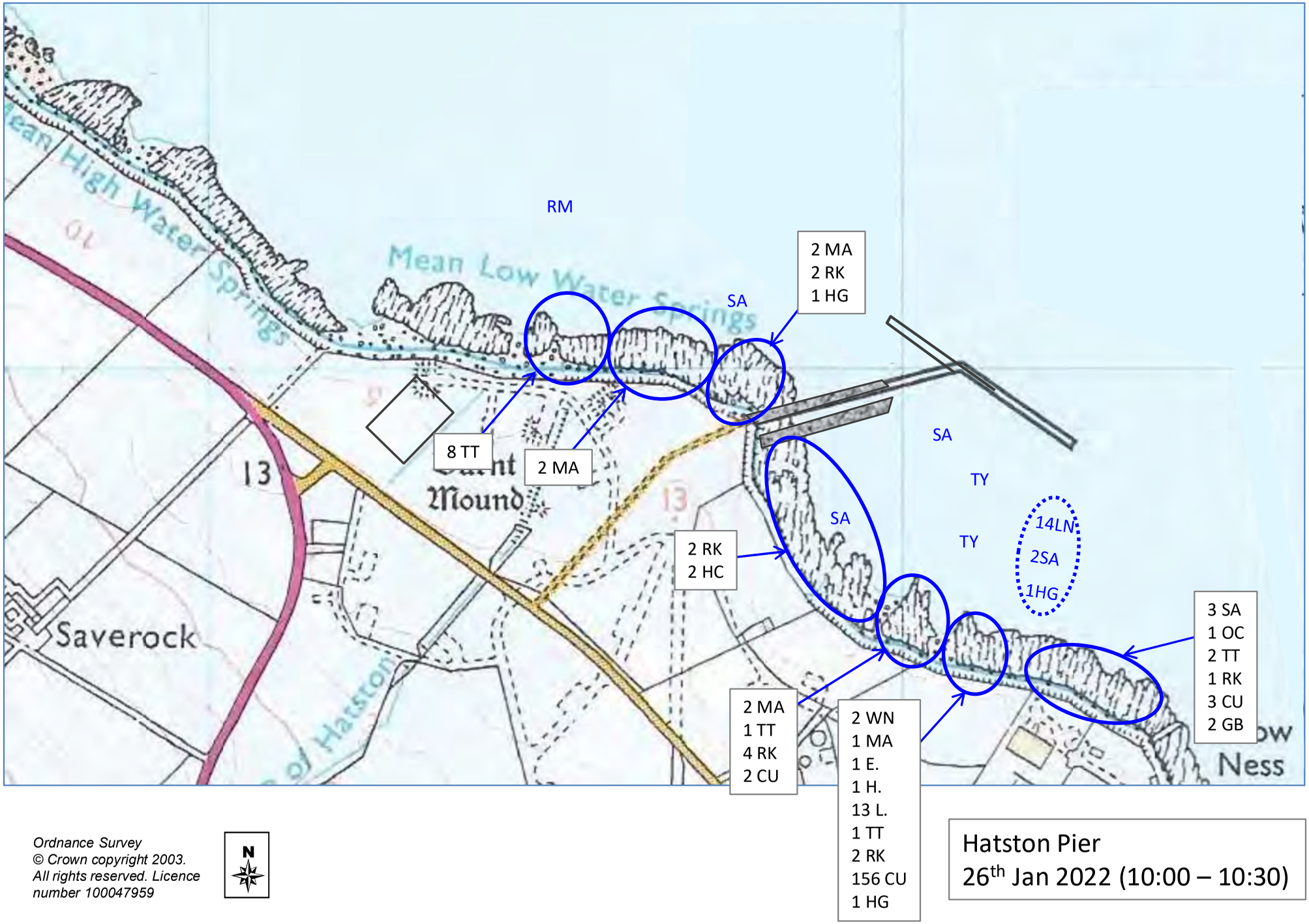
Hatston Pier
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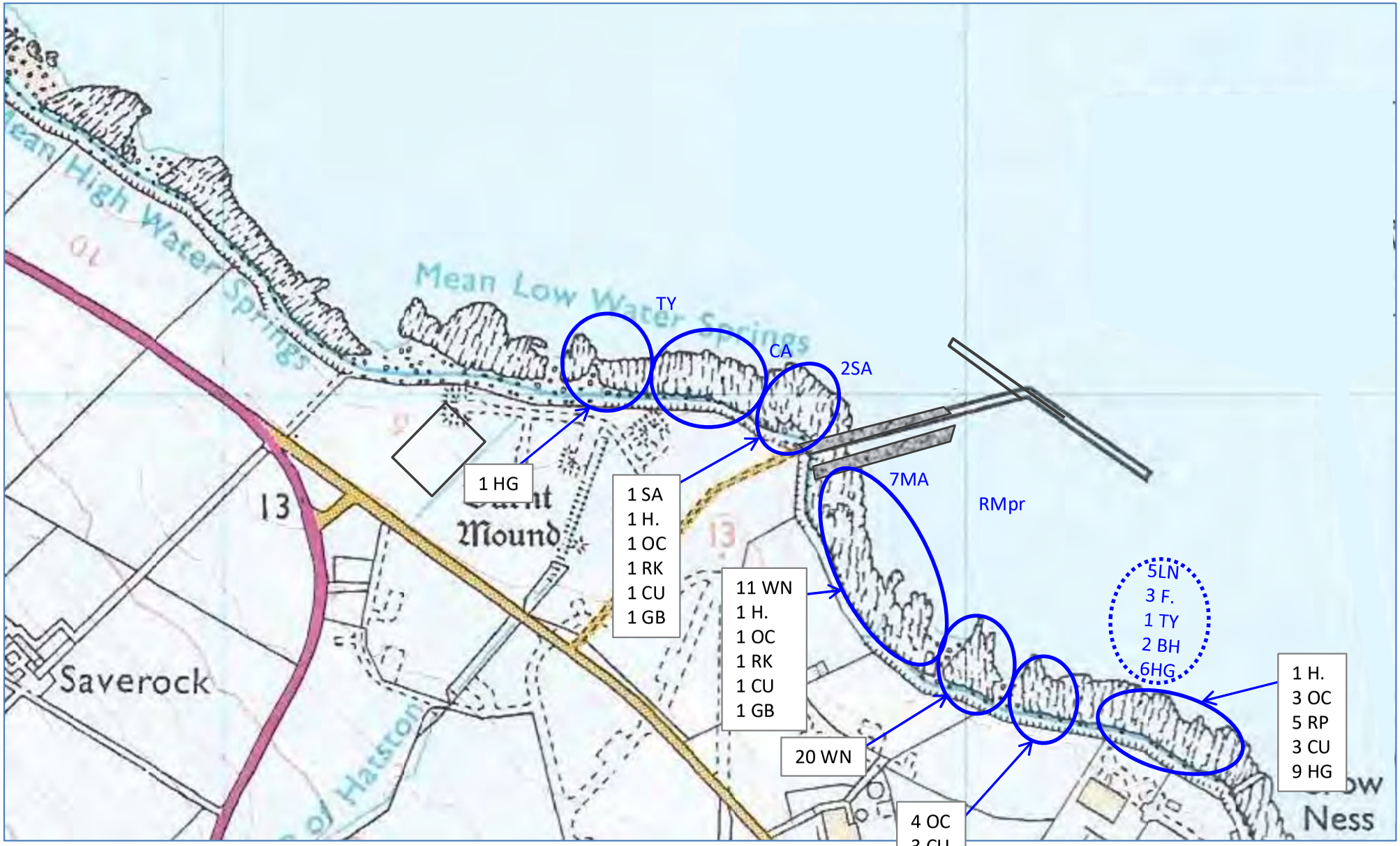
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Hatston Pier
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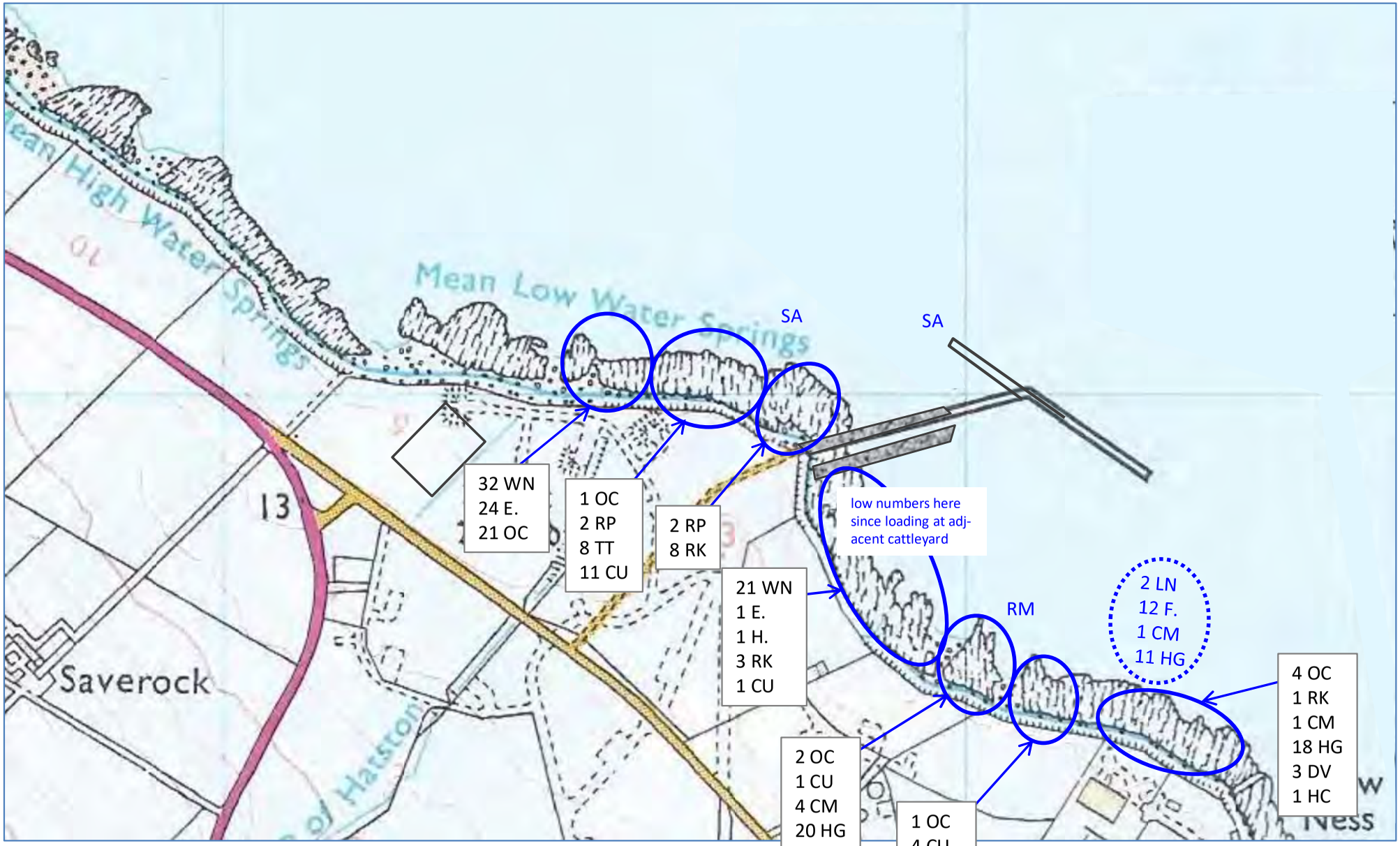
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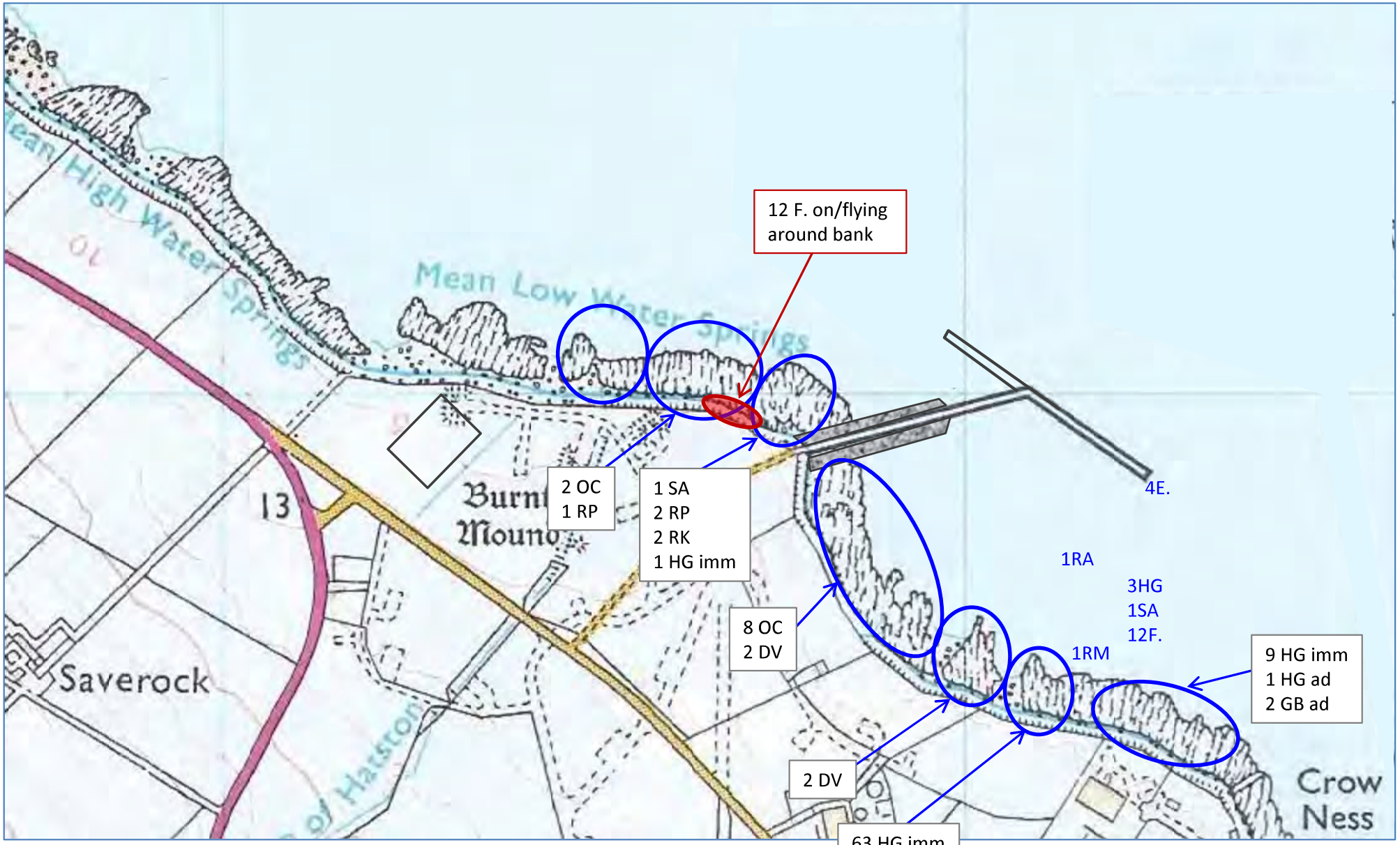
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Hatston Pier
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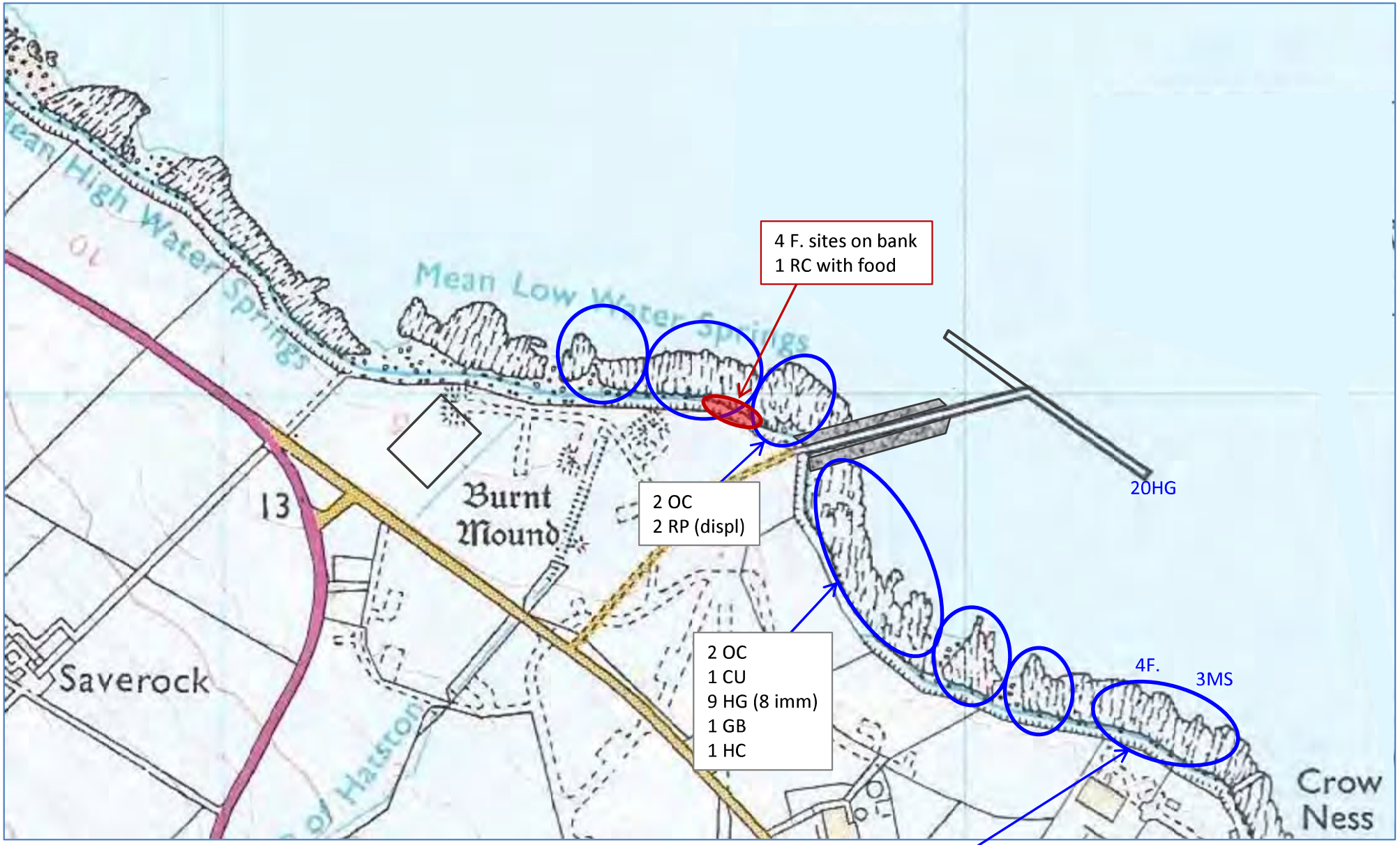
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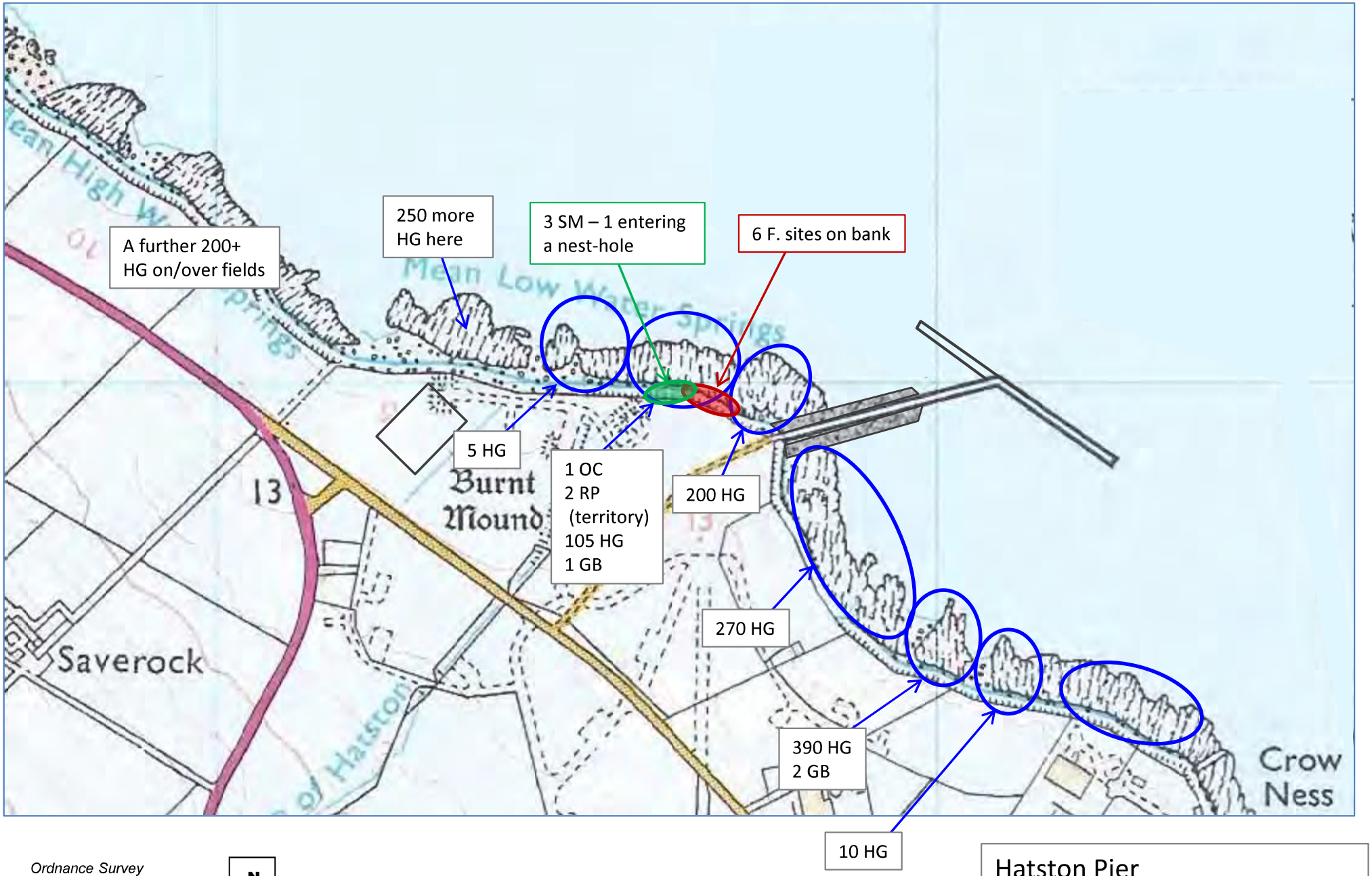
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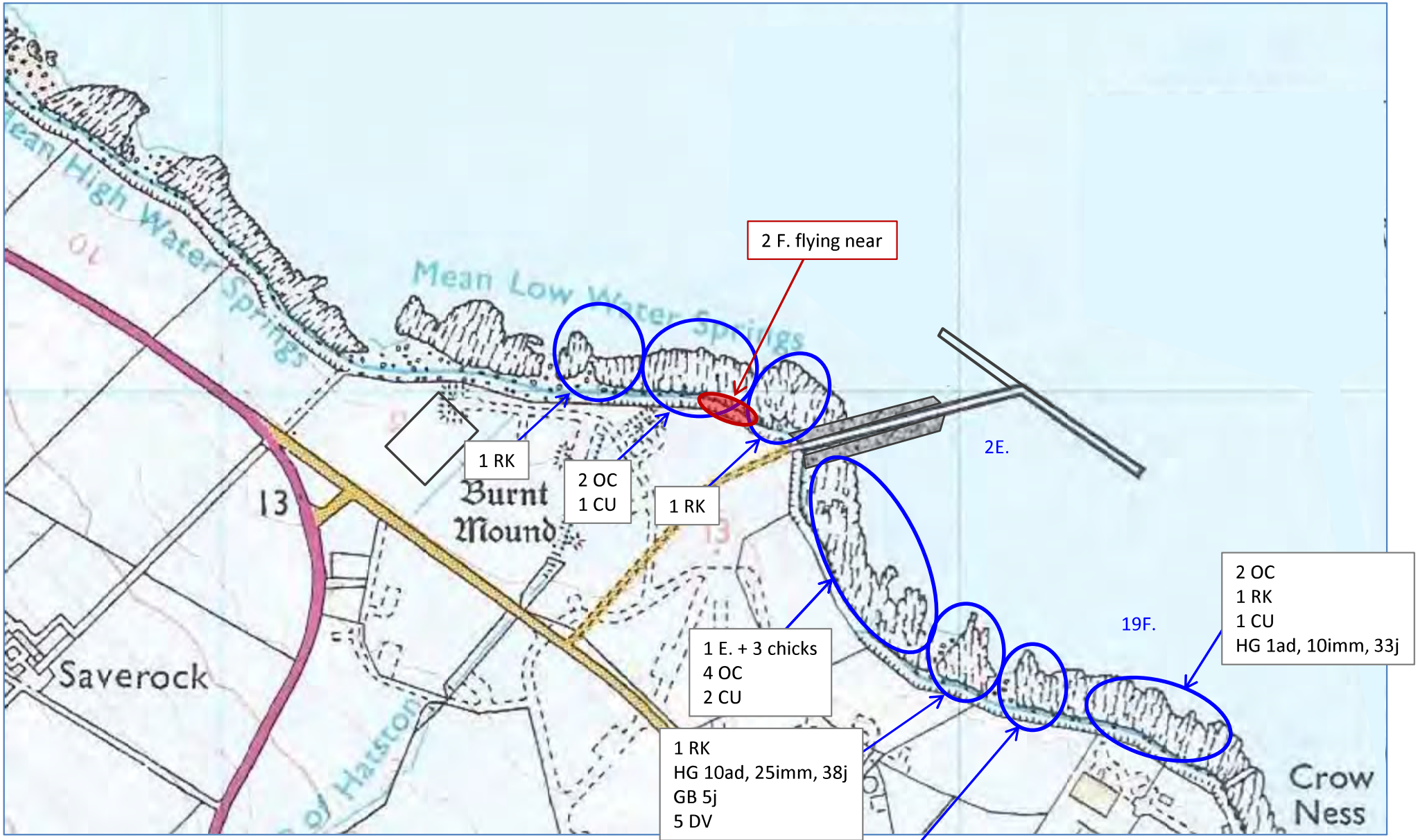
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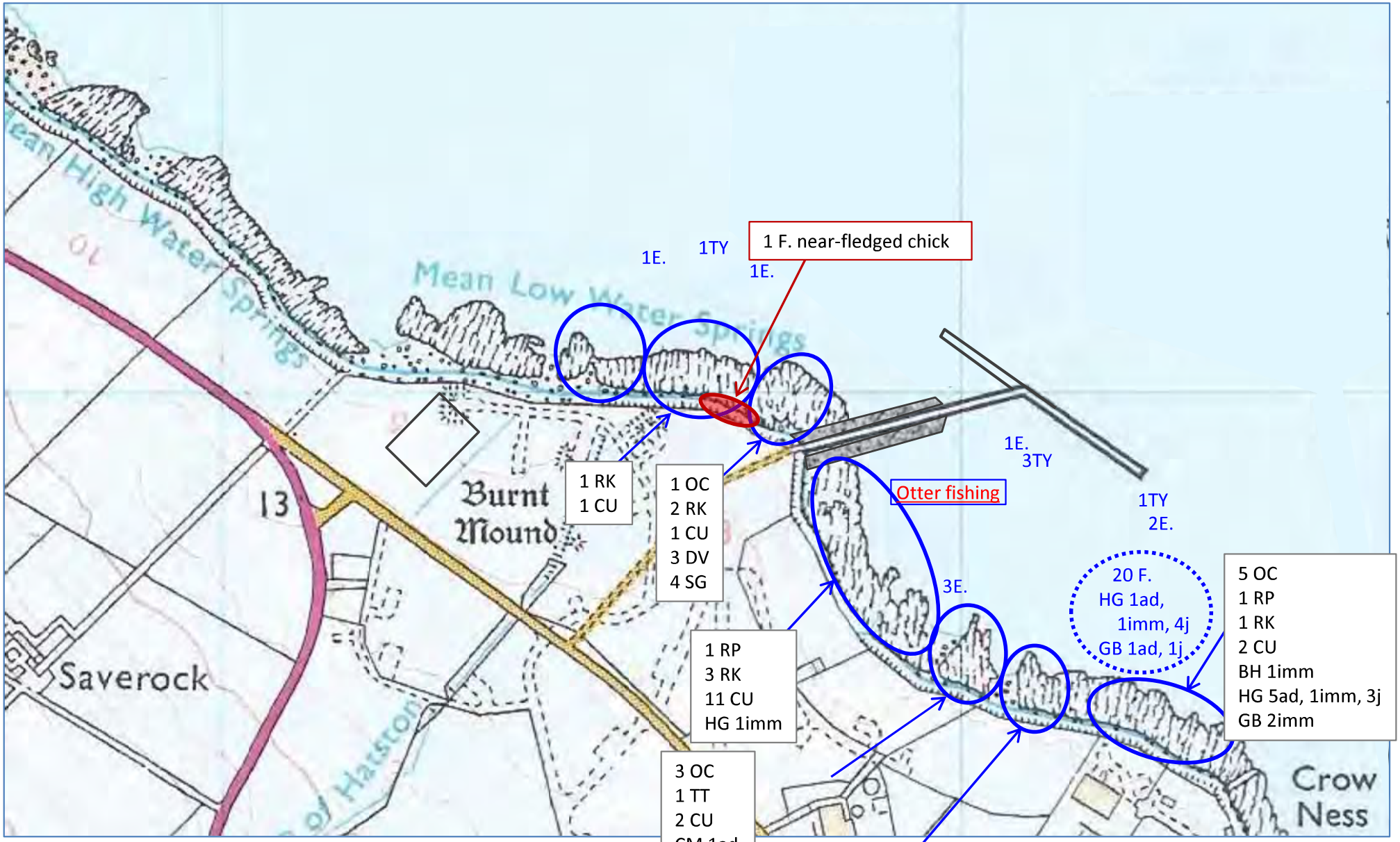
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Hatston Pier
26th June 2022 (15:35-16:10)



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Hatston Pier
28th July 2022 (17:30-18:00)

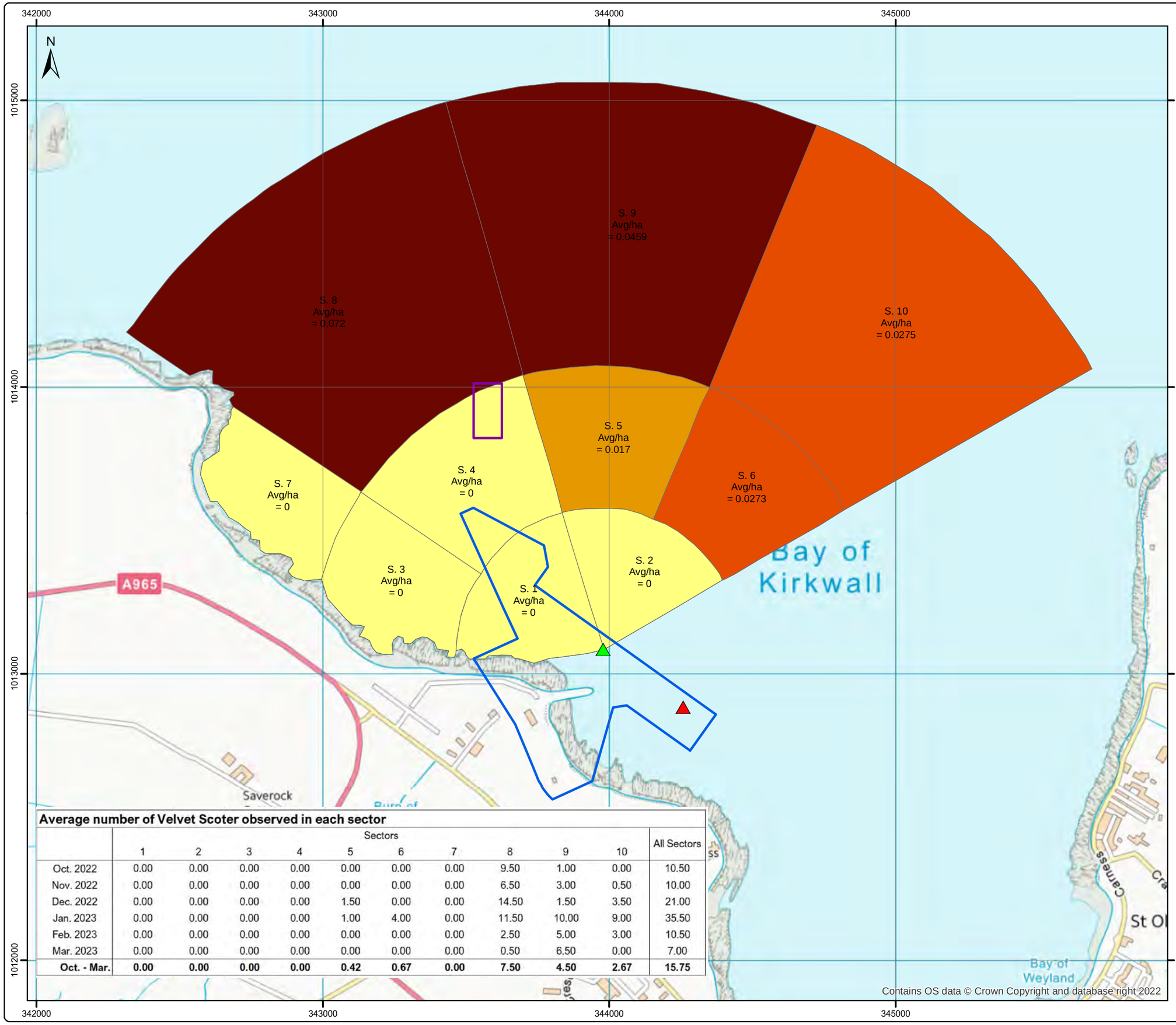


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Hatston Pier
27th August 2022 (16:35 – 17:10)

C HEAT MAPS FOR SELECTED SPECIES



Average number of Velvet Scoter observed in each sector

	Sectors										All Sectors
	1	2	3	4	5	6	7	8	9	10	
Oct. 2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.50	1.00	0.00	10.50
Nov. 2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.50	3.00	0.50	10.00
Dec. 2022	0.00	0.00	0.00	0.00	1.50	0.00	0.00	14.50	1.50	3.50	21.00
Jan. 2023	0.00	0.00	0.00	0.00	1.00	4.00	0.00	11.50	10.00	9.00	35.50
Feb. 2023	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.50	5.00	3.00	10.50
Mar. 2023	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	6.50	0.00	7.00
Oct. - Mar.	**0.00**	**0.00**	**0.00**	**0.00**	**0.42**	**0.67**	**0.00**	**7.50**	**4.50**	**2.67**	**15.75**

Legend

- Northern Vantage Point (HY 44257 12883)
- Southern Vantage Point (HY 43978 13084)
- Proposed Site Extent
- Survey Sectors
- Fish Cage

Average Bird Count Density per ha

- < 0.005
- 0.005 - 0.015
- 0.015 - 0.025
- 0.025 - 0.035
- 0.035 - 0.045
- >0.045

Do not scale this map

Client
Orkney Islands Council Harbour Authority

Project
Orkney Haston Pier

Title
Velvet Scoter Observations
Northern Sectors - Oct 2022 to March 2023

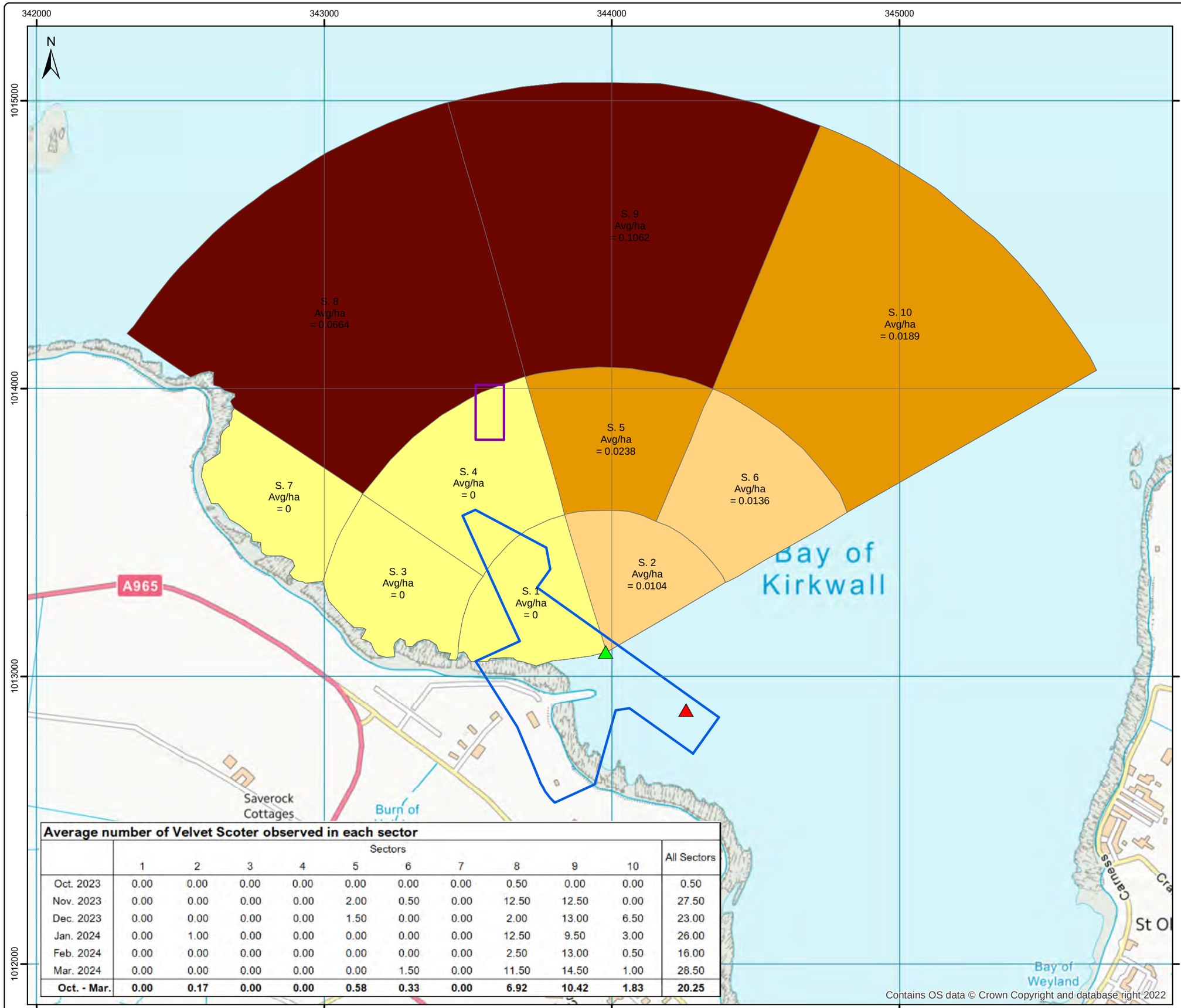
Status
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Drawing No.	Revision	Date
674795-GIS100	-	21 March 2023
Drawn	**Checked**	**Approved**
JAS	MS	xx

Scale
1:12,500 @A3
0 62.5 125 250 375 Metres

Rev	Date	Amendment	Initials
-	-	-	-

envirocentre
8 Eagle Street, Craighall Business Park, Glasgow, G4 9XA.
T: 0141 341 5040 E: info@envirocentre.co.uk
W: www.envirocentre.co.uk



Average number of Velvet Scoter observed in each sector

	Sectors										All Sectors
	1	2	3	4	5	6	7	8	9	10	
Oct. 2023	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.50
Nov. 2023	0.00	0.00	0.00	0.00	2.00	0.50	0.00	12.50	12.50	0.00	27.50
Dec. 2023	0.00	0.00	0.00	0.00	1.50	0.00	0.00	2.00	13.00	6.50	23.00
Jan. 2024	0.00	1.00	0.00	0.00	0.00	0.00	0.00	12.50	9.50	3.00	26.00
Feb. 2024	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.50	13.00	0.50	16.00
Mar. 2024	0.00	0.00	0.00	0.00	0.00	1.50	0.00	11.50	14.50	1.00	28.50
Oct. - Mar.	**0.00**	**0.17**	**0.00**	**0.00**	**0.58**	**0.33**	**0.00**	**6.92**	**10.42**	**1.83**	**20.25**

Legend

- Northern Vantage Point (HY 44257 12883)
- Southern Vantage Point (HY 43978 13084)
- Fish Cage
- Proposed Site Extent

Average Bird Count Density per ha

- < 0.005
- 0.005 - 0.015
- 0.015 - 0.025
- 0.025 - 0.035
- 0.035 - 0.045
- >0.045
- Survey Sectors

Do not scale this map

Client
Orkney Islands Council Harbour Authority

Project
Orkney Haston Pier

Title
Velvet Scoter Observations
Northern Sectors - Oct 2023 to March 2024

Status
FINAL

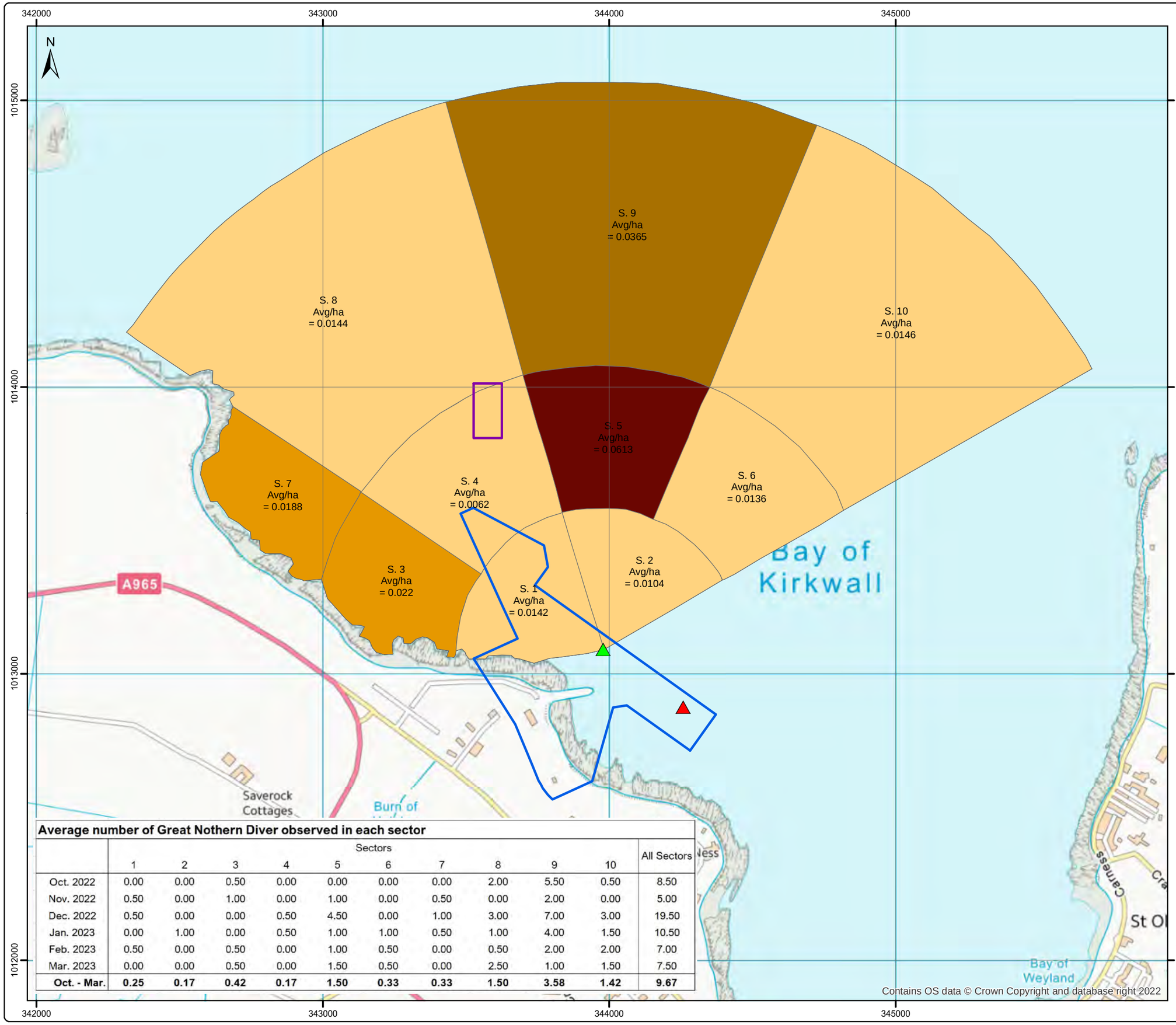
Drawing No.	Revision	Date
674795-GIS177	-	29 April 2024
Drawn	**Checked**	**Approved**
JAS	MS	MS

Scale
1:12,500 @A3
0 62.5 125 250 375 Metres

Rev	Date	Amendment	Initials
-	-	-	-

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Average number of Great Nothern Diver observed in each sector

	Sectors										All Sectors
	1	2	3	4	5	6	7	8	9	10	
Oct. 2022	0.00	0.00	0.50	0.00	0.00	0.00	0.00	2.00	5.50	0.50	8.50
Nov. 2022	0.50	0.00	1.00	0.00	1.00	0.00	0.50	0.00	2.00	0.00	5.00
Dec. 2022	0.50	0.00	0.00	0.50	4.50	0.00	1.00	3.00	7.00	3.00	19.50
Jan. 2023	0.00	1.00	0.00	0.50	1.00	1.00	0.50	1.00	4.00	1.50	10.50
Feb. 2023	0.50	0.00	0.50	0.00	1.00	0.50	0.00	0.50	2.00	2.00	7.00
Mar. 2023	0.00	0.00	0.50	0.00	1.50	0.50	0.00	2.50	1.00	1.50	7.50
Oct. - Mar.	**0.25**	**0.17**	**0.42**	**0.17**	**1.50**	**0.33**	**0.33**	**1.50**	**3.58**	**1.42**	**9.67**

Legend

- Northern Vantage Point (HY 44257 12883)
- Southern Vantage Point (HY 43978 13084)
- Proposed Site Extent
- Survey Sectors
- Fish Cage

Average Bird Count Density per ha

- < 0.005
- 0.005 - 0.015
- 0.015 - 0.025
- 0.025 - 0.035
- 0.035 - 0.045
- >0.045

Do not scale this map

Client
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Project
Orkney Haston Pier

Title
Great Northern Diver Observations
Northern Sectors - Oct 2022 to March 2023

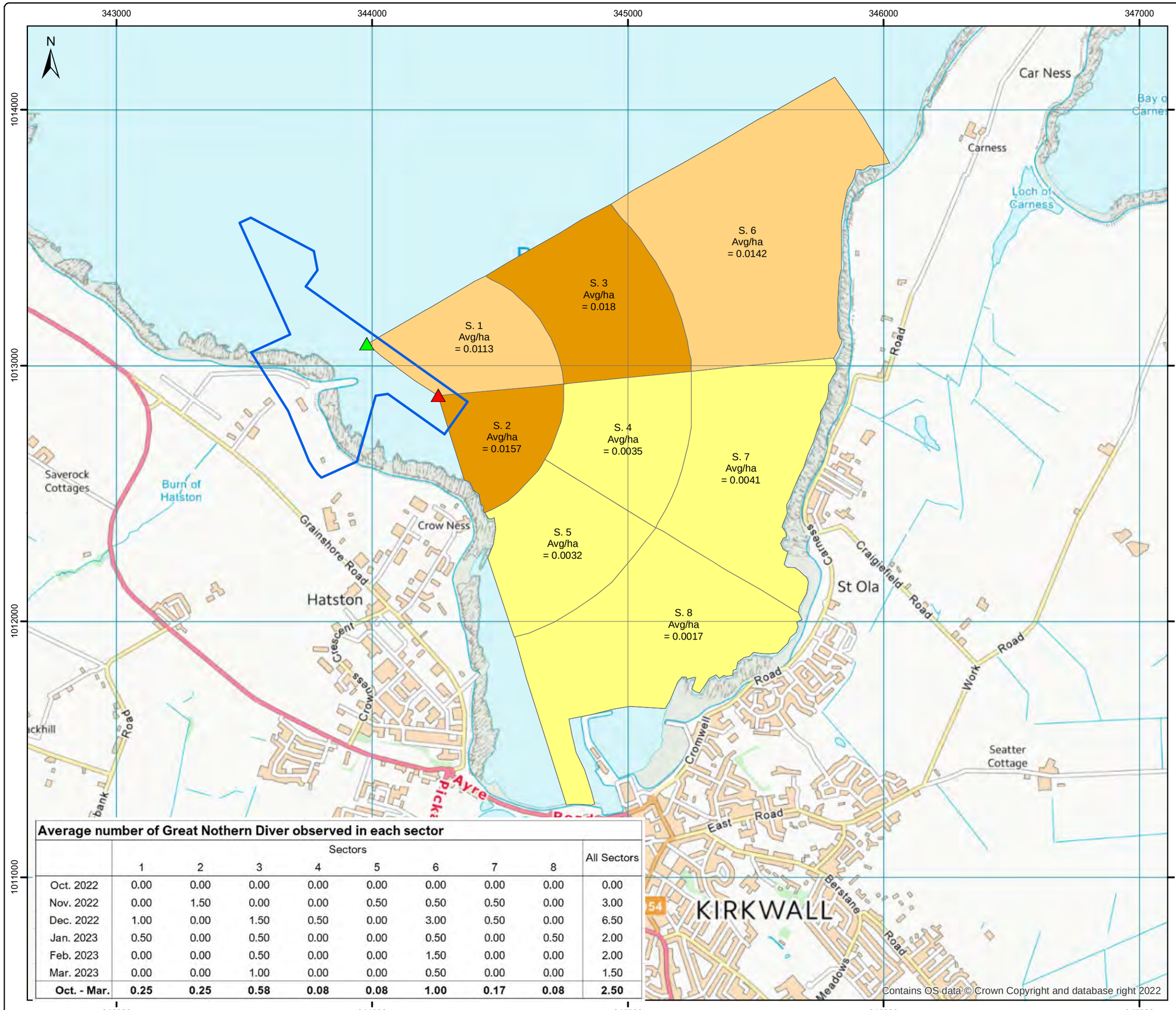
Status
DRAFT

Drawing No.	Revision	Date
674795-GIS088	-	21 March 2023
Drawn	**Checked**	**Approved**
JAS	MS	xx

Scale
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0 62.5 125 250 375 Metres

Rev	Date	Amendment	Initials
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Legend

- Northern Vantage Point (HY 44257 12883)
- Southern Vantage Point (HY 43978 13084)
- Proposed Site Extent
- Survey Sectors

Average Bird Count Density per ha

- < 0.005
- 0.005 - 0.015
- 0.015 - 0.025
- 0.025 - 0.035
- 0.035 - 0.045
- >0.045

Average number of Great Nothern Diver observed in each sector

	Sectors								All Sectors
	1	2	3	4	5	6	7	8	
Oct. 2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nov. 2022	0.00	1.50	0.00	0.00	0.50	0.50	0.50	0.00	3.00
Dec. 2022	1.00	0.00	1.50	0.50	0.00	3.00	0.50	0.00	6.50
Jan. 2023	0.50	0.00	0.50	0.00	0.00	0.50	0.00	0.50	2.00
Feb. 2023	0.00	0.00	0.50	0.00	0.00	1.50	0.00	0.00	2.00
Mar. 2023	0.00	0.00	1.00	0.00	0.00	0.50	0.00	0.00	1.50
Oct. - Mar.	**0.25**	**0.25**	**0.58**	**0.08**	**0.08**	**1.00**	**0.17**	**0.08**	**2.50**

Do not scale this map

Client
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Project
Orkney Haston Pier

Title
Great Northern Diver Observations
Southern Sectors - Oct 2022 to March 2023

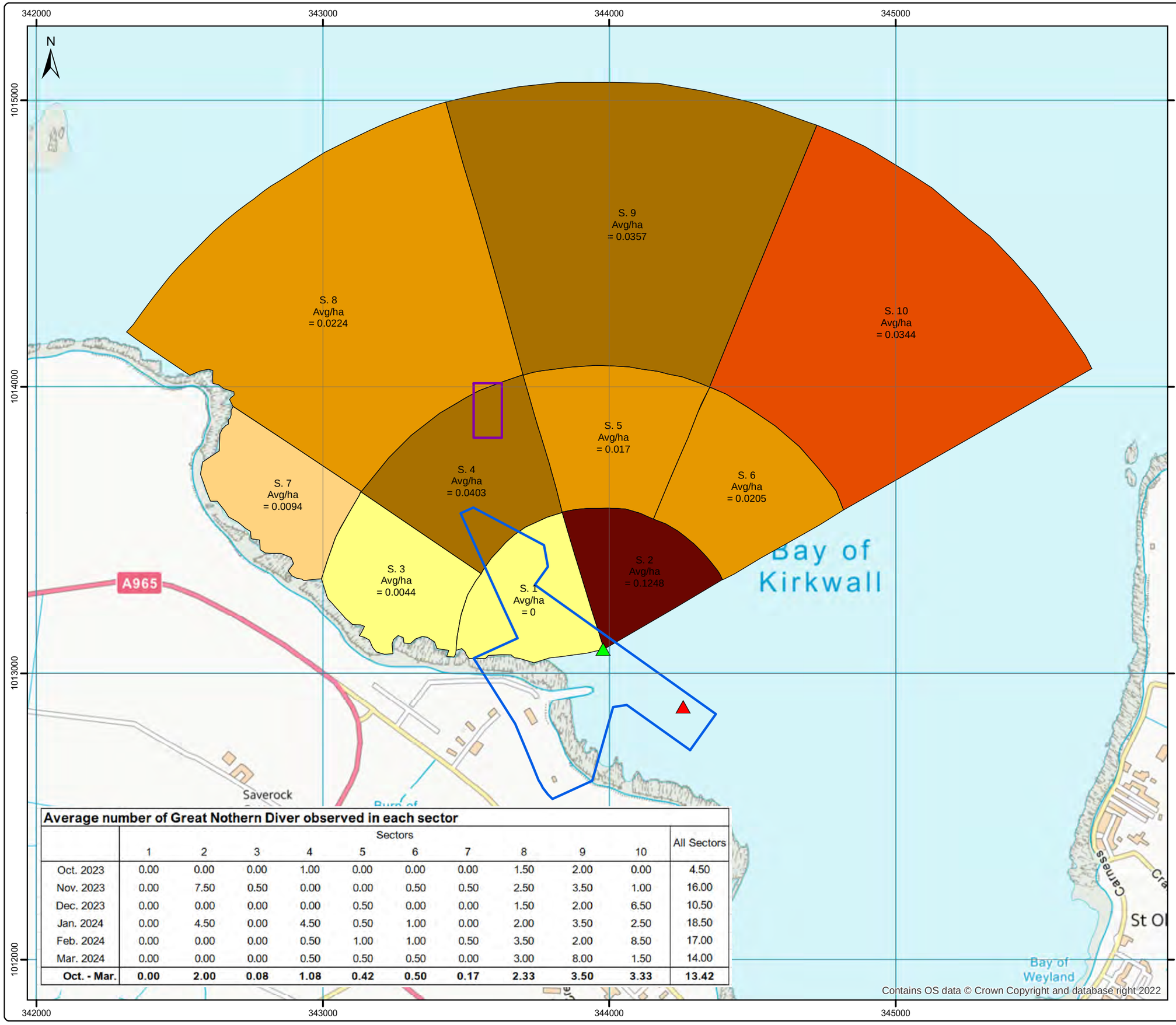
Status
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Drawing No.	Revision	Date
674795-GIS089	-	21 March 2023
Drawn	**Checked**	**Approved**
JAS	MS	xx

Scale
1:14,000 @A3
0 70 140 280 420 Metres

Rev	Date	Amendment	Initials
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Average number of Great Nothern Diver observed in each sector

	Sectors										All Sectors
	1	2	3	4	5	6	7	8	9	10	
Oct. 2023	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.50	2.00	0.00	4.50
Nov. 2023	0.00	7.50	0.50	0.00	0.00	0.50	0.50	2.50	3.50	1.00	16.00
Dec. 2023	0.00	0.00	0.00	0.00	0.50	0.00	0.00	1.50	2.00	6.50	10.50
Jan. 2024	0.00	4.50	0.00	4.50	0.50	1.00	0.00	2.00	3.50	2.50	18.50
Feb. 2024	0.00	0.00	0.00	0.50	1.00	1.00	0.50	3.50	2.00	8.50	17.00
Mar. 2024	0.00	0.00	0.00	0.50	0.50	0.50	0.00	3.00	8.00	1.50	14.00
Oct. - Mar.	**0.00**	**2.00**	**0.08**	**1.08**	**0.42**	**0.50**	**0.17**	**2.33**	**3.50**	**3.33**	**13.42**

Legend

- Northern Vantage Point (HY 44257 12883)
- Southern Vantage Point (HY 43978 13084)
- Proposed Site Extent
- Fish Cage
- Survey Sectors

Average Bird Count Density per ha

- < 0.005
- 0.005 - 0.015
- 0.015 - 0.025
- 0.025 - 0.035
- 0.035 - 0.045
- > 0.045

Do not scale this map

Client
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Project
Orkney Haston Pier

Title
Great Northern Diver Observations
Northern Sectors - Oct 2023 to March 2024

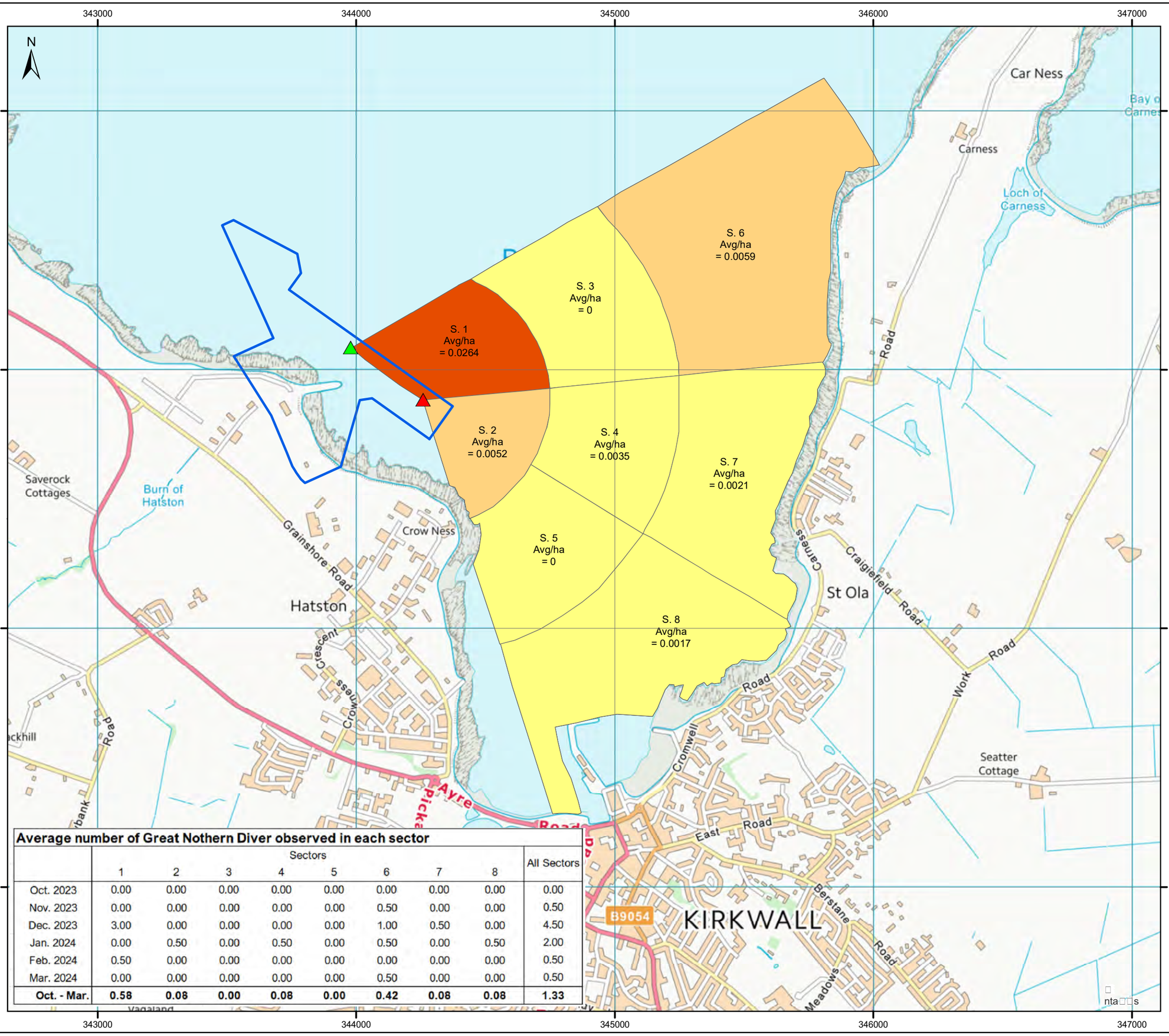
Status
FINAL

Drawing No.	Revision	Date
674795-GIS166	-	29 April 2024
Drawn	**Checked**	**Approved**
JAS	MS	MS

Scale
1:12,500 @A3
0 62.5 125 250 375 Metres

Rev	Date	Amendment	Initials
-	-	-	-

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Average number of Great Nothern Diver observed in each sector

	Sectors								All Sectors
	1	2	3	4	5	6	7	8	
Oct. 2023	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nov. 2023	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.50
Dec. 2023	3.00	0.00	0.00	0.00	0.00	1.00	0.50	0.00	4.50
Jan. 2024	0.00	0.50	0.00	0.50	0.00	0.50	0.00	0.50	2.00
Feb. 2024	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50
Mar. 2024	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.50
Oct. - Mar.	**0.58**	**0.08**	**0.00**	**0.08**	**0.00**	**0.42**	**0.08**	**0.08**	**1.33**

Legend

- Northern Vantage Point (HY 44257 12883)
- Southern Vantage Point (HY 43978 13084)
- Proposed Site Extent
- Survey Sectors

Average Bird Count Density per ha

- < 0.005
- 0.005 - 0.015
- 0.015 - 0.025
- 0.025 - 0.035
- 0.035 - 0.045
- > 0.045

Do not scale this map

Client
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Project
Orkney Haston Pier

Title
Great Northern Diver Observations
Southern Sectors - Oct 2023 to March 2024

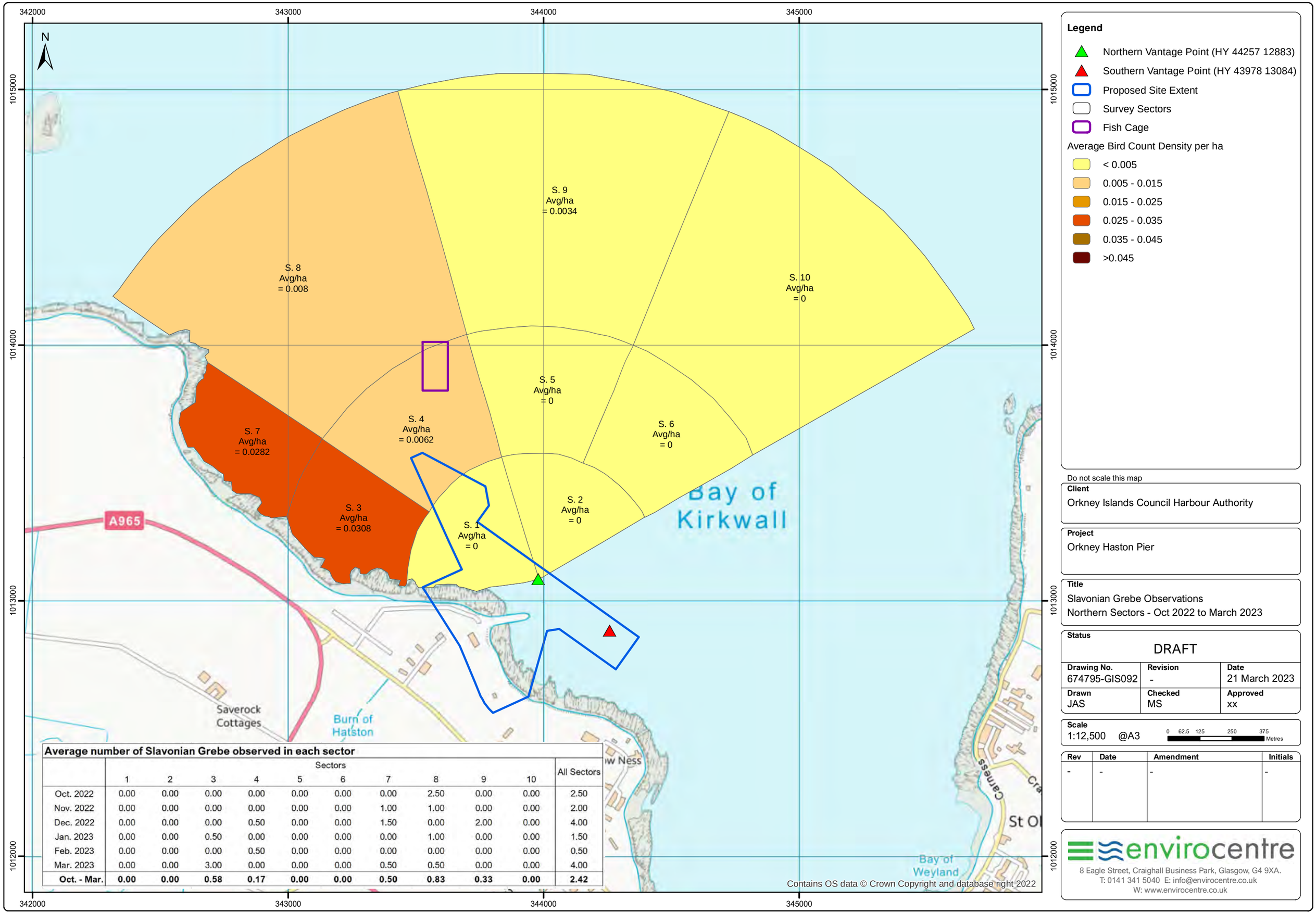
Status
FINAL

Drawing No.	Revision	Date
674795-GIS167	-	29 April 2024
Drawn	**Checked**	**Approved**
JAS	MS	MS

Scale
1:14,000 @A3
0 70 140 280 420 Metres

Rev	Date	Amendment	Initials
-	-	-	-

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Average number of Slavonian Grebe observed in each sector

	Sectors										All Sectors
	1	2	3	4	5	6	7	8	9	10	
Oct. 2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.50	0.00	0.00	2.50
Nov. 2022	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	0.00	0.00	2.00
Dec. 2022	0.00	0.00	0.00	0.50	0.00	0.00	1.50	0.00	2.00	0.00	4.00
Jan. 2023	0.00	0.00	0.50	0.00	0.00	0.00	0.00	1.00	0.00	0.00	1.50
Feb. 2023	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.50
Mar. 2023	0.00	0.00	3.00	0.00	0.00	0.00	0.50	0.50	0.00	0.00	4.00
Oct. - Mar.	**0.00**	**0.00**	**0.58**	**0.17**	**0.00**	**0.00**	**0.50**	**0.83**	**0.33**	**0.00**	**2.42**

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Legend

- Northern Vantage Point (HY 44257 12883)
- Southern Vantage Point (HY 43978 13084)
- Proposed Site Extent
- Survey Sectors
- Fish Cage

Average Bird Count Density per ha

- < 0.005
- 0.005 - 0.015
- 0.015 - 0.025
- 0.025 - 0.035
- 0.035 - 0.045
- >0.045

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Project
Orkney Haston Pier

Title
Slavonian Grebe Observations
Northern Sectors - Oct 2022 to March 2023

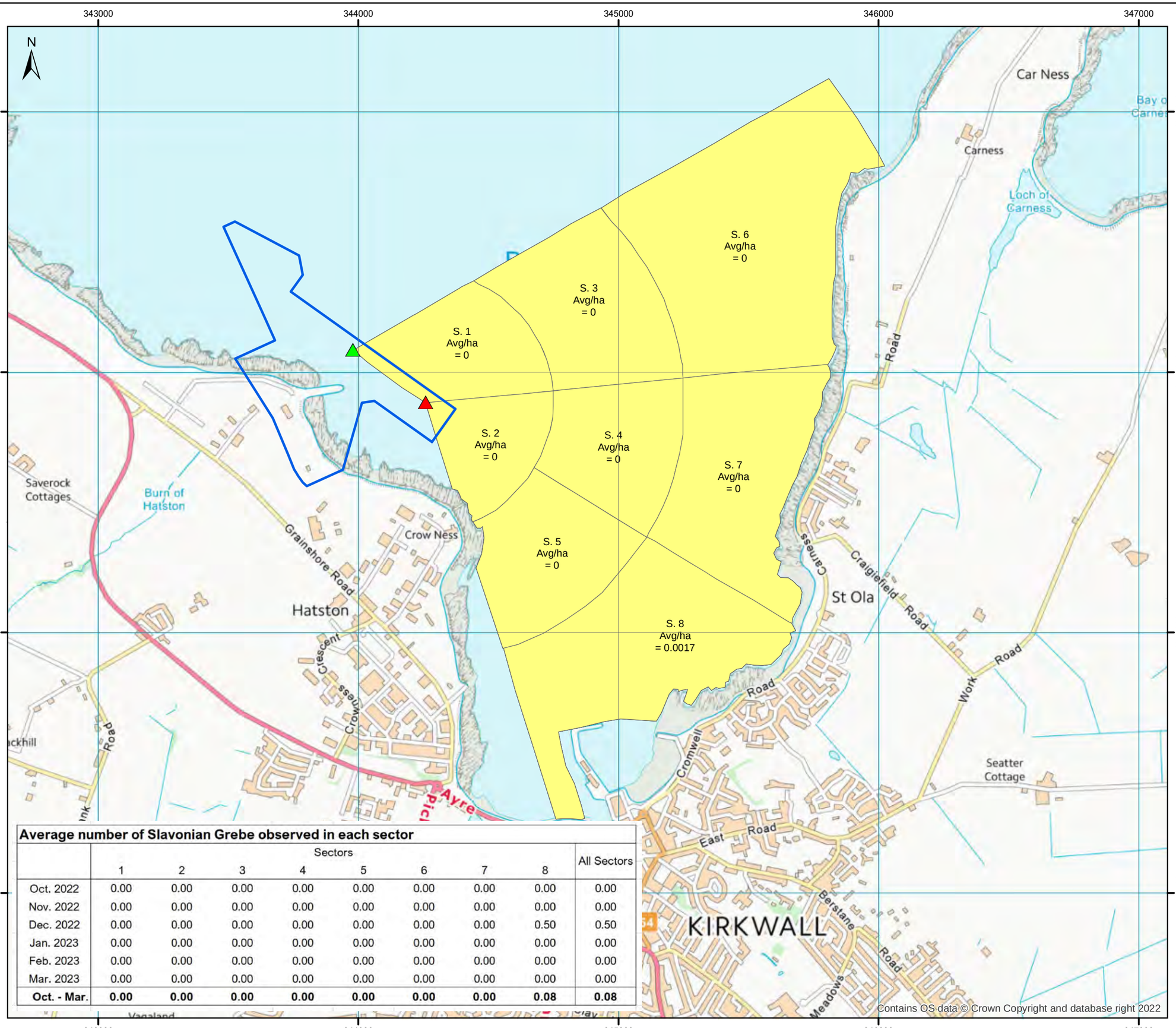
Status
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Drawing No.	Revision	Date
674795-GIS092	-	21 March 2023
Drawn	**Checked**	**Approved**
JAS	MS	xx

Scale
1:12,500 @A3
0 62.5 125 250 375 Metres

Rev	Date	Amendment	Initials
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Average number of Slavonian Grebe observed in each sector

	Sectors								All Sectors
	1	2	3	4	5	6	7	8	
Oct. 2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nov. 2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dec. 2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.50
Jan. 2023	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Feb. 2023	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mar. 2023	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Oct. - Mar.	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.08**	**0.08**

Legend

- Northern Vantage Point (HY 44257 12883)
- Southern Vantage Point (HY 43978 13084)
- Proposed Site Extent
- Survey Sectors

Average Bird Count Density per ha

- < 0.005
- 0.005 - 0.015
- 0.015 - 0.025
- 0.025 - 0.035
- 0.035 - 0.045
- >0.045

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Project
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Title
Slavonian Grebe Observations
Southern Sectors - Oct 2022 to March 2023

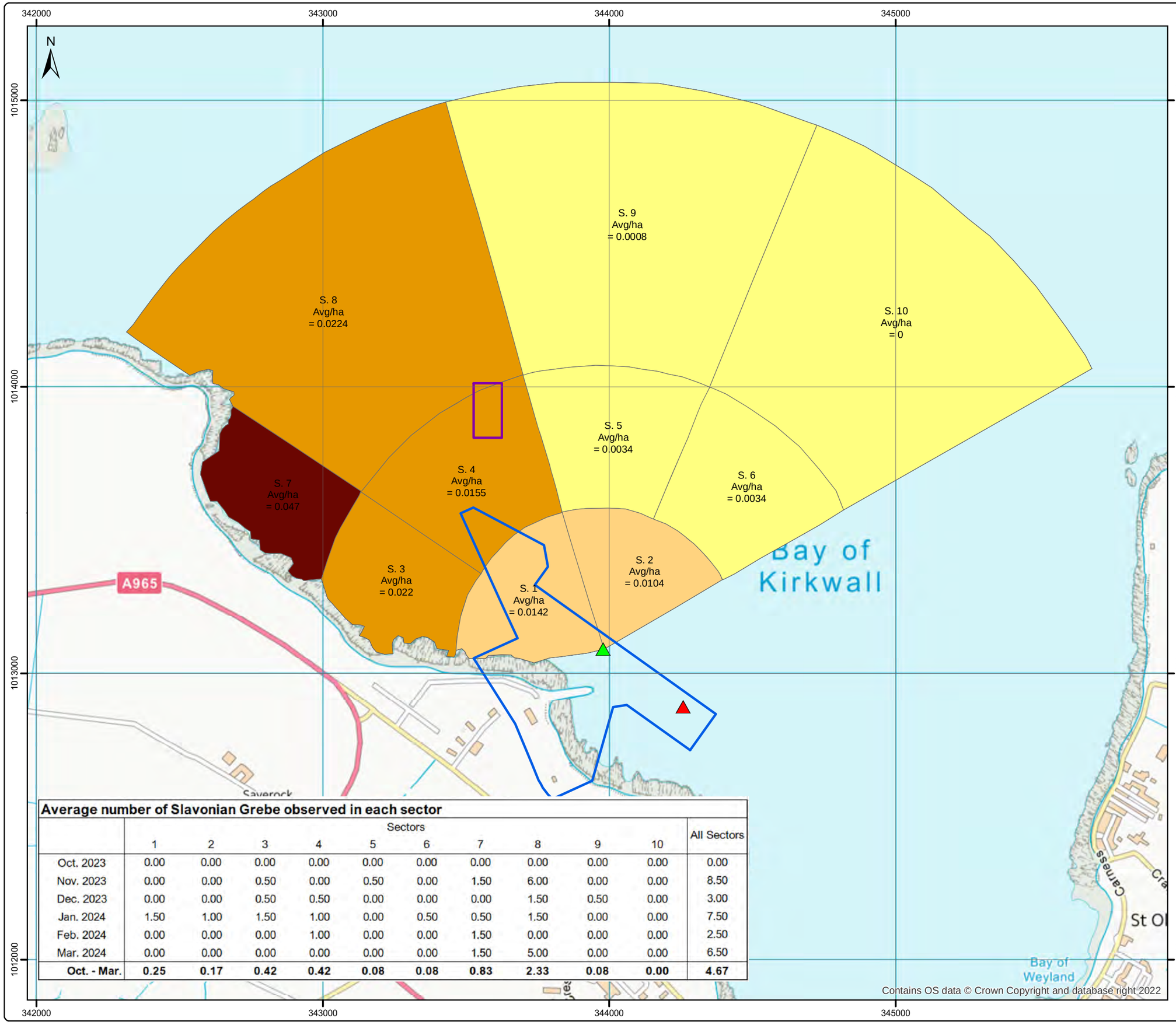
Status
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Drawing No.	Revision	Date
674795-GIS093	-	21 March 2023
Drawn	**Checked**	**Approved**
JAS	MS	xx

Scale
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Average number of Slavonian Grebe observed in each sector

	Sectors										All Sectors
	1	2	3	4	5	6	7	8	9	10	
Oct. 2023	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nov. 2023	0.00	0.00	0.50	0.00	0.50	0.00	1.50	6.00	0.00	0.00	8.50
Dec. 2023	0.00	0.00	0.50	0.50	0.00	0.00	0.00	1.50	0.50	0.00	3.00
Jan. 2024	1.50	1.00	1.50	1.00	0.00	0.50	0.50	1.50	0.00	0.00	7.50
Feb. 2024	0.00	0.00	0.00	1.00	0.00	0.00	1.50	0.00	0.00	0.00	2.50
Mar. 2024	0.00	0.00	0.00	0.00	0.00	0.00	1.50	5.00	0.00	0.00	6.50
Oct. - Mar.	**0.25**	**0.17**	**0.42**	**0.42**	**0.08**	**0.08**	**0.83**	**2.33**	**0.08**	**0.00**	**4.67**

Legend

- Northern Vantage Point (HY 44257 12883)
- Southern Vantage Point (HY 43978 13084)
- Fish Cage
- Proposed Site Extent

Average Bird Count Density per ha

- < 0.005
- 0.005 - 0.015
- 0.015 - 0.025
- 0.025 - 0.035
- 0.035 - 0.045
- >0.045
- Survey Sectors

Do not scale this map

Client
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Project
Orkney Haston Pier

Title
Slavonian Grebe Observations
Northern Sectors - Oct 2023 to March 2024

Status
FINAL

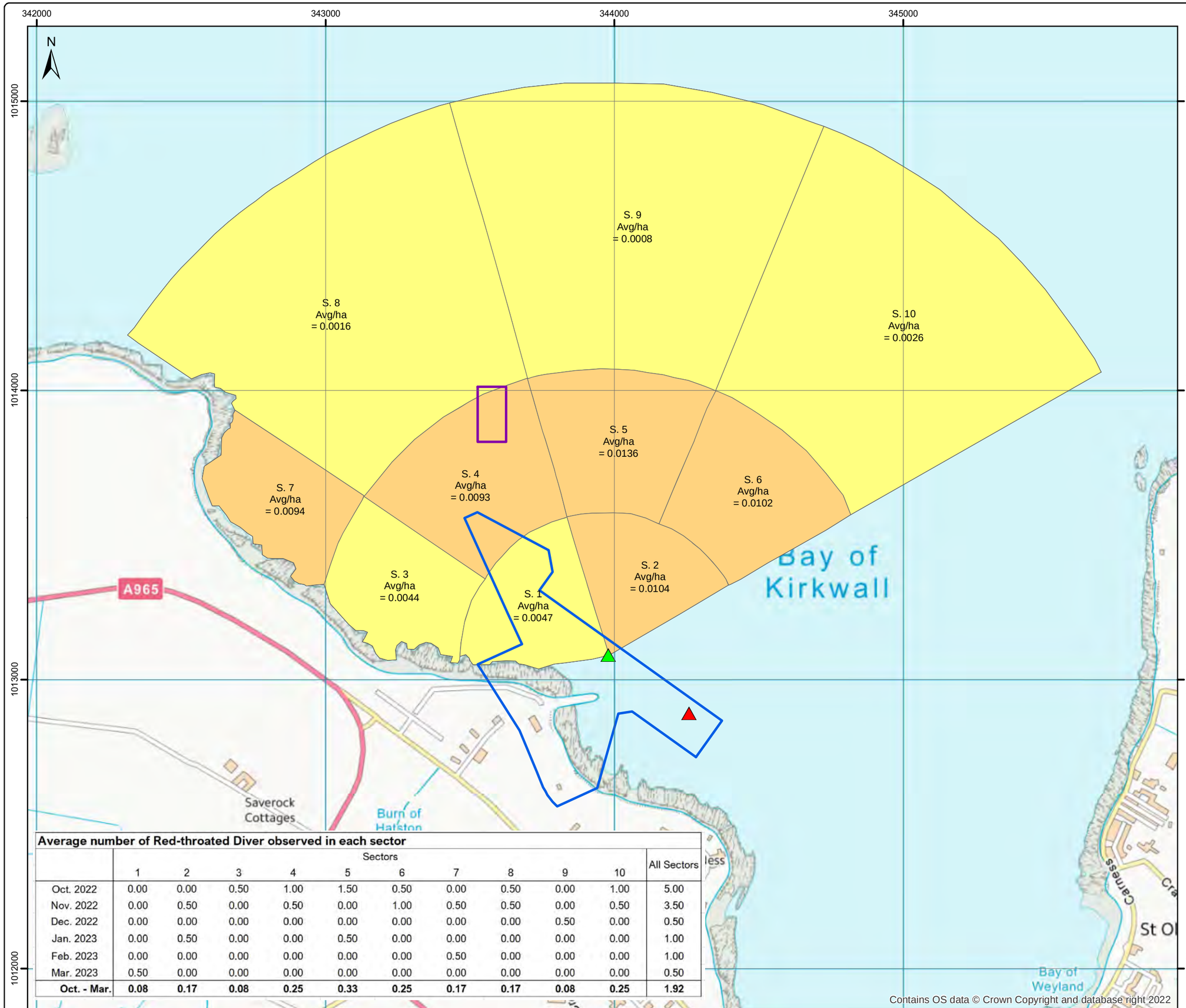
Drawing No.	Revision	Date
674795-GIS170	-	29 April 2024
Drawn	**Checked**	**Approved**
JAS	MS	MS

Scale
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Average number of Red-throated Diver observed in each sector

	Sectors										All Sectors
	1	2	3	4	5	6	7	8	9	10	
Oct. 2022	0.00	0.00	0.50	1.00	1.50	0.50	0.00	0.50	0.00	1.00	5.00
Nov. 2022	0.00	0.50	0.00	0.50	0.00	1.00	0.50	0.50	0.00	0.50	3.50
Dec. 2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.50
Jan. 2023	0.00	0.50	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	1.00
Feb. 2023	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	1.00
Mar. 2023	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50
Oct. - Mar.	**0.08**	**0.17**	**0.08**	**0.25**	**0.33**	**0.25**	**0.17**	**0.17**	**0.08**	**0.25**	**1.92**

Legend

- Northern Vantage Point (HY 44257 12883)
- Southern Vantage Point (HY 43978 13084)
- Proposed Site Extent
- Survey Sectors
- Fish Cage

Average Bird Count Density per ha

- < 0.005
- 0.005 - 0.015
- 0.015 - 0.025
- 0.025 - 0.035
- 0.035 - 0.045
- >0.045

Do not scale this map

Client
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Project
Orkney Haston Pier

Title
Red-throated Diver Observations
Northern Sectors - Oct 2022 to March 2023

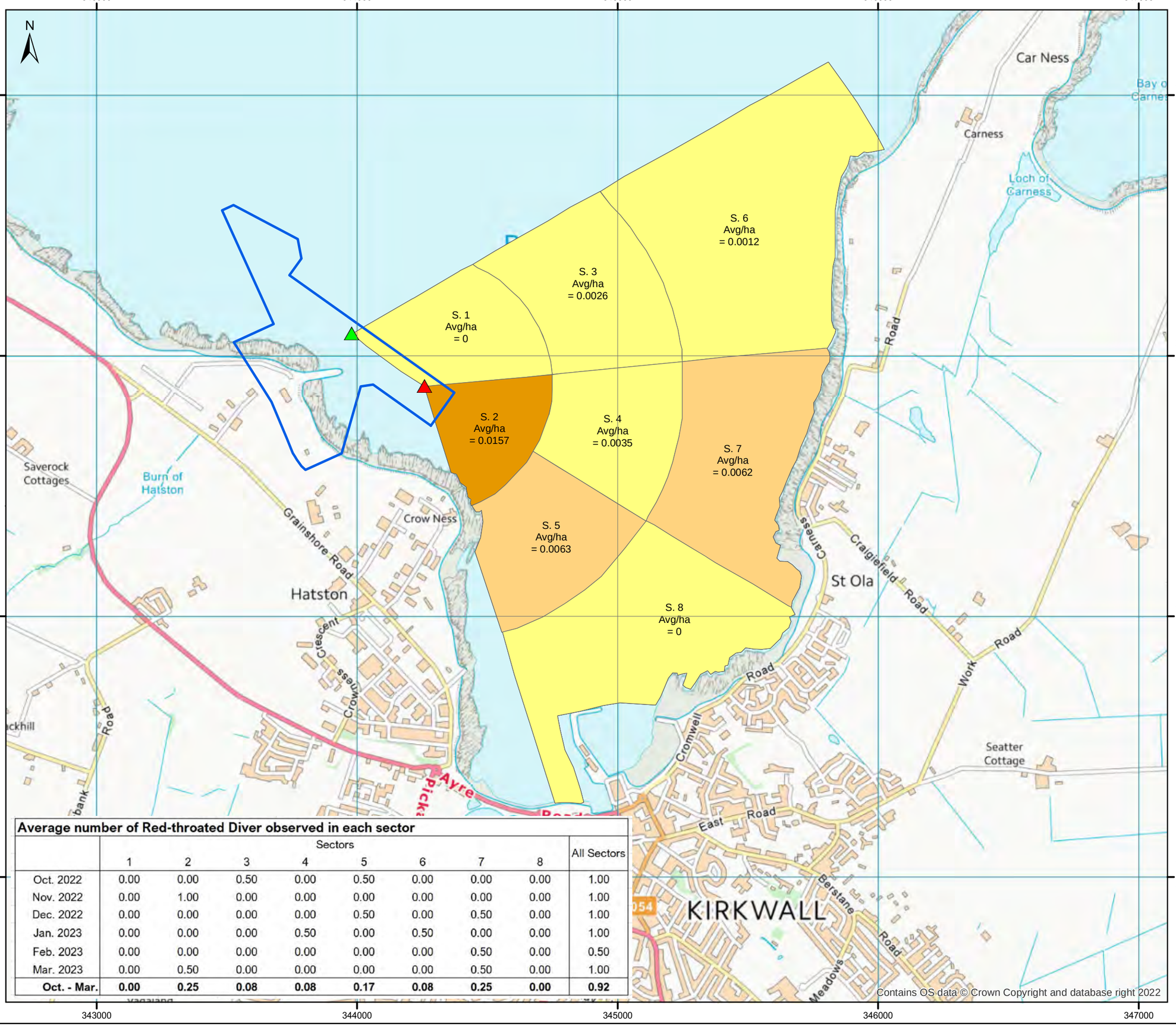
Status
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Drawing No.	Revision	Date
674795-GIS094	-	21 March 2023
Drawn	**Checked**	**Approved**
JAS	MS	xx

Scale
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Rev	Date	Amendment	Initials
-	-	-	-

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Average number of Red-throated Diver observed in each sector

	Sectors								All Sectors
	1	2	3	4	5	6	7	8	
Oct. 2022	0.00	0.00	0.50	0.00	0.50	0.00	0.00	0.00	1.00
Nov. 2022	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
Dec. 2022	0.00	0.00	0.00	0.00	0.50	0.00	0.50	0.00	1.00
Jan. 2023	0.00	0.00	0.00	0.50	0.00	0.50	0.00	0.00	1.00
Feb. 2023	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.50
Mar. 2023	0.00	0.50	0.00	0.00	0.00	0.00	0.50	0.00	1.00
Oct. - Mar.	**0.00**	**0.25**	**0.08**	**0.08**	**0.17**	**0.08**	**0.25**	**0.00**	**0.92**

Legend

- Northern Vantage Point (HY 44257 12883)
- Southern Vantage Point (HY 43978 13084)
- Proposed Site Extent
- Survey Sectors

Average Bird Count Density per ha

- < 0.005
- 0.005 - 0.015
- 0.015 - 0.025
- 0.025 - 0.035
- 0.035 - 0.045
- >0.045

Do not scale this map

Client
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Project
Orkney Haston Pier

Title
Red-throated Diver Observations
Southern Sectors - Oct 2022 to March 2023

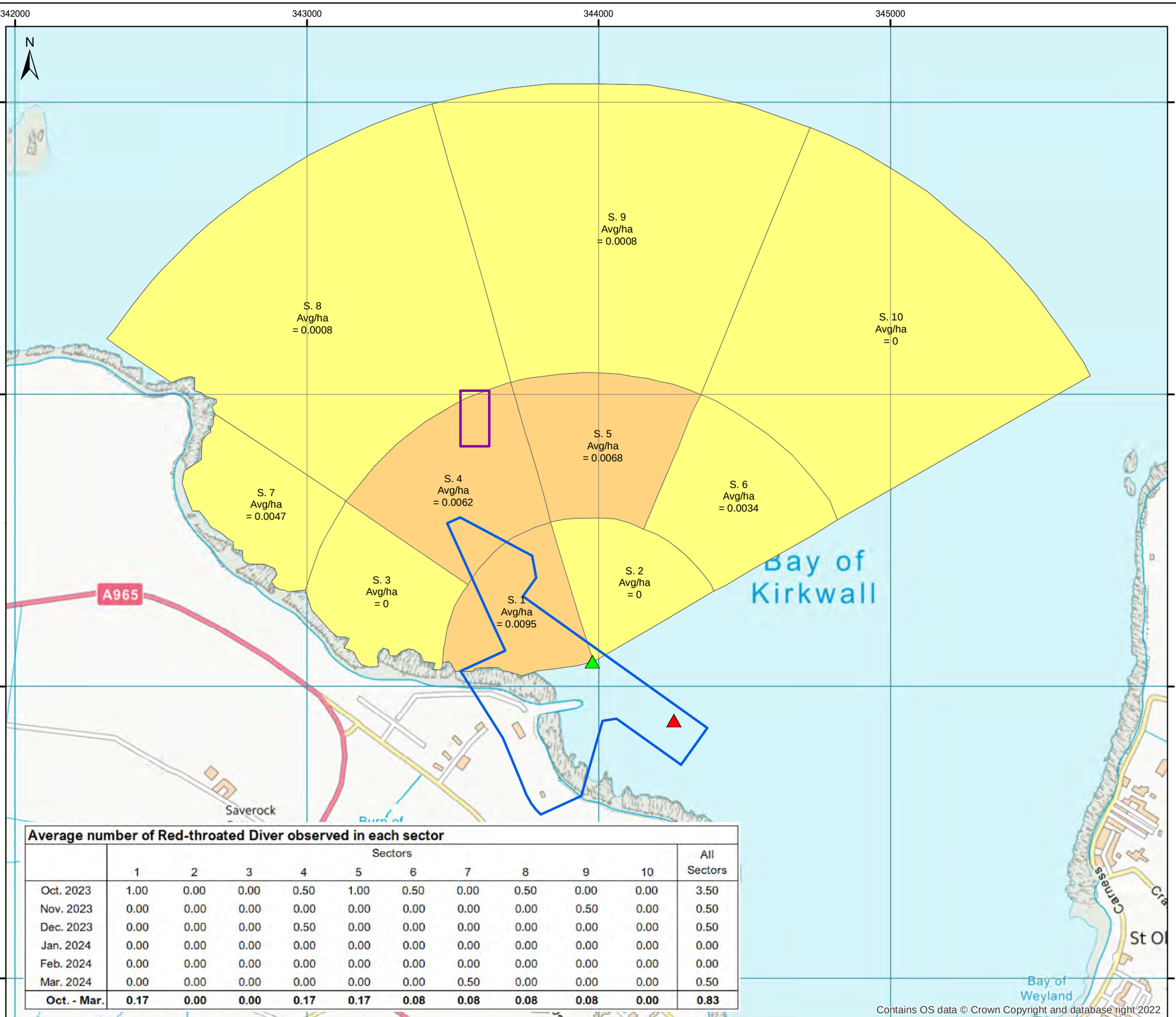
Status
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Drawing No.	Revision	Date
674795-GIS095	-	21 March 2023
Drawn	**Checked**	**Approved**
JAS	MS	xx

Scale
1:14,000 @A3
0 70 140 280 420 Metres

Rev	Date	Amendment	Initials
-	-	-	-

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Average number of Red-throated Diver observed in each sector

	Sectors										All Sectors
	1	2	3	4	5	6	7	8	9	10	
Oct. 2023	1.00	0.00	0.00	0.50	1.00	0.50	0.00	0.50	0.00	0.00	3.50
Nov. 2023	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.50
Dec. 2023	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.50
Jan. 2024	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Feb. 2024	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mar. 2024	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.50
Oct. - Mar.	**0.17**	**0.00**	**0.00**	**0.17**	**0.17**	**0.08**	**0.08**	**0.08**	**0.08**	**0.00**	**0.83**

Legend

- Northern Vantage Point (HY 44257 12883)
- Southern Vantage Point (HY 43978 13084)
- Proposed Site Extent
- Fish Cage
- Survey Sectors

Average Bird Count Density per ha

- < 0.005
- 0.005 - 0.015
- 0.015 - 0.025
- 0.025 - 0.035
- 0.035 - 0.045
- >0.045

Do not scale this map

Client
Orkney Islands Council Harbour Authority

Project
Orkney Haston Pier

Title
Red-throated Diver Observations
Northern Sectors - Oct 2023 to March 2024

Status
FINAL

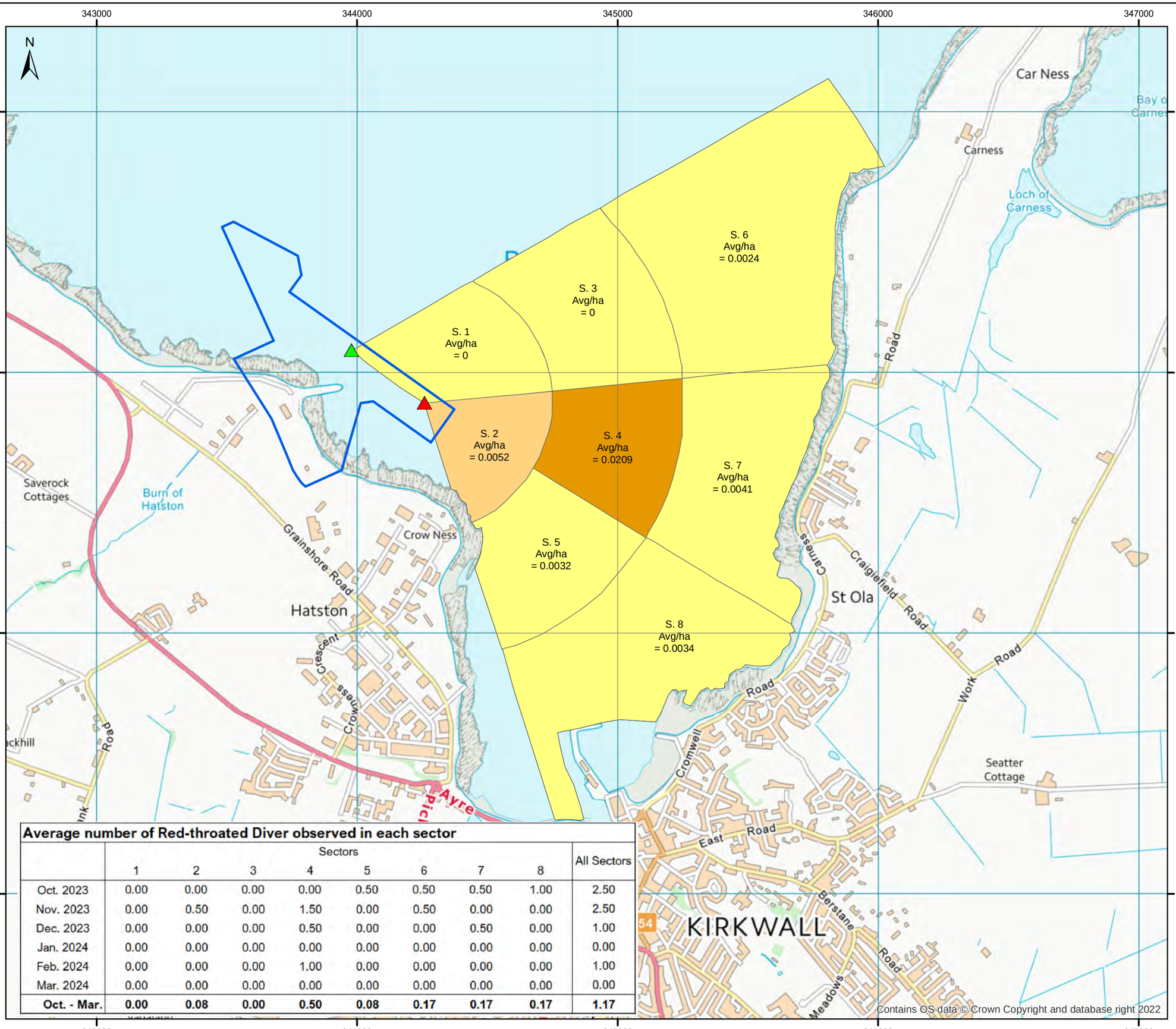
Drawing No.	Revision	Date
674795-GIS171	-	29 April 2024
Drawn	**Checked**	**Approved**
JAS	MS	MS

Scale
1:12,500 @A3
0 62.5 125 250 375 Metres

Rev	Date	Amendment	Initials
-	-	-	-

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Average number of Red-throated Diver observed in each sector

	Sectors								All Sectors
	1	2	3	4	5	6	7	8	
Oct. 2023	0.00	0.00	0.00	0.00	0.50	0.50	0.50	1.00	2.50
Nov. 2023	0.00	0.50	0.00	1.50	0.00	0.50	0.00	0.00	2.50
Dec. 2023	0.00	0.00	0.00	0.50	0.00	0.00	0.50	0.00	1.00
Jan. 2024	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Feb. 2024	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	1.00
Mar. 2024	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Oct. - Mar.	**0.00**	**0.08**	**0.00**	**0.50**	**0.08**	**0.17**	**0.17**	**0.17**	**1.17**

Legend

- Northern Vantage Point (HY 44257 12883)
- Southern Vantage Point (HY 43978 13084)
- Proposed Site Extent
- Survey Sectors

Average Bird Count Density per ha

- < 0.005
- 0.005 - 0.015
- 0.015 - 0.025
- 0.025 - 0.035
- 0.035 - 0.045
- >0.045

Do not scale this map

Client
Orkney Islands Council Harbour Authority

Project
Orkney Haston Pier

Title
Red-throated Diver Observations
Southern Sectors - Oct 2023 to March 2024

Status
FINAL

Drawing No.	Revision	Date
674795-GIS172	-	29 April 2024
Drawn	**Checked**	**Approved**
JAS	MS	MS

Scale
1:14,000 @A3
0 70 140 280 420 Metres

Rev	Date	Amendment	Initials
-	-	-	-

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342000 343000 344000 345000 346000

1015000 1014000 1013000 1012000

N

S. 9
Avg/ha
= 0.0051

S. 8
Avg/ha
= 0.0036

S. 10
Avg/ha
= 0

S. 5
Avg/ha
= 0.0051

S. 4
Avg/ha
= 0

S. 6
Avg/ha
= 0

S. 7
Avg/ha
= 0.0141

S. 6
Avg/ha
= 0

S. 3
Avg/ha
= 0.0066

S. 2
Avg/ha
= 0

S. 1
Avg/ha
= 0

S. 3
Avg/ha
= 0

S. 1
Avg/ha
= 0

S. 2
Avg/ha
= 0.0079

S. 4
Avg/ha
= 0

S. 7
Avg/ha
= 0.0031

S. A
Avg/ha
= 0

S. B
Avg/ha
= 0

S. 5
Avg/ha
= 0

S. 8
Avg/ha
= 0

S. C
Avg/ha
= 0

Thieves Holm

Carness

A965

nterness
ttages

Saverock
Cottages

Burn of
Hatston

Crow Ness

Grainshore Road

Hatston

Blackhill

Road

Sunnybank

Crescent

Ayre

Pickaquoy

Road

Cromwell

East

Road

Craigiefield

Road

Work

Road

St Ola

Seatter
Cottage

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342000 343000 344000 345000 346000

Legend

- Northern Vantage Point (HY 44257 12883)
- Southern Vantage Point (HY 43978 13084)
- Fish Cage
- Proposed Site Extent
- Survey Sectors

Average Bird Count Density per ha

- < 0.005
- 0.005 - 0.015
- 0.015 - 0.025
- 0.025 - 0.035
- 0.035 - 0.045
- >0.045

Note: Refer to Red-throated Diver at Haston document by Firth Ecology, May 2024 for bird counts per sector

Do not scale this map

Client
Orkney Islands Council Harbour Authority

Project
Orkney Haston Pier

Title
Red-throated Diver Observations
April to mid August

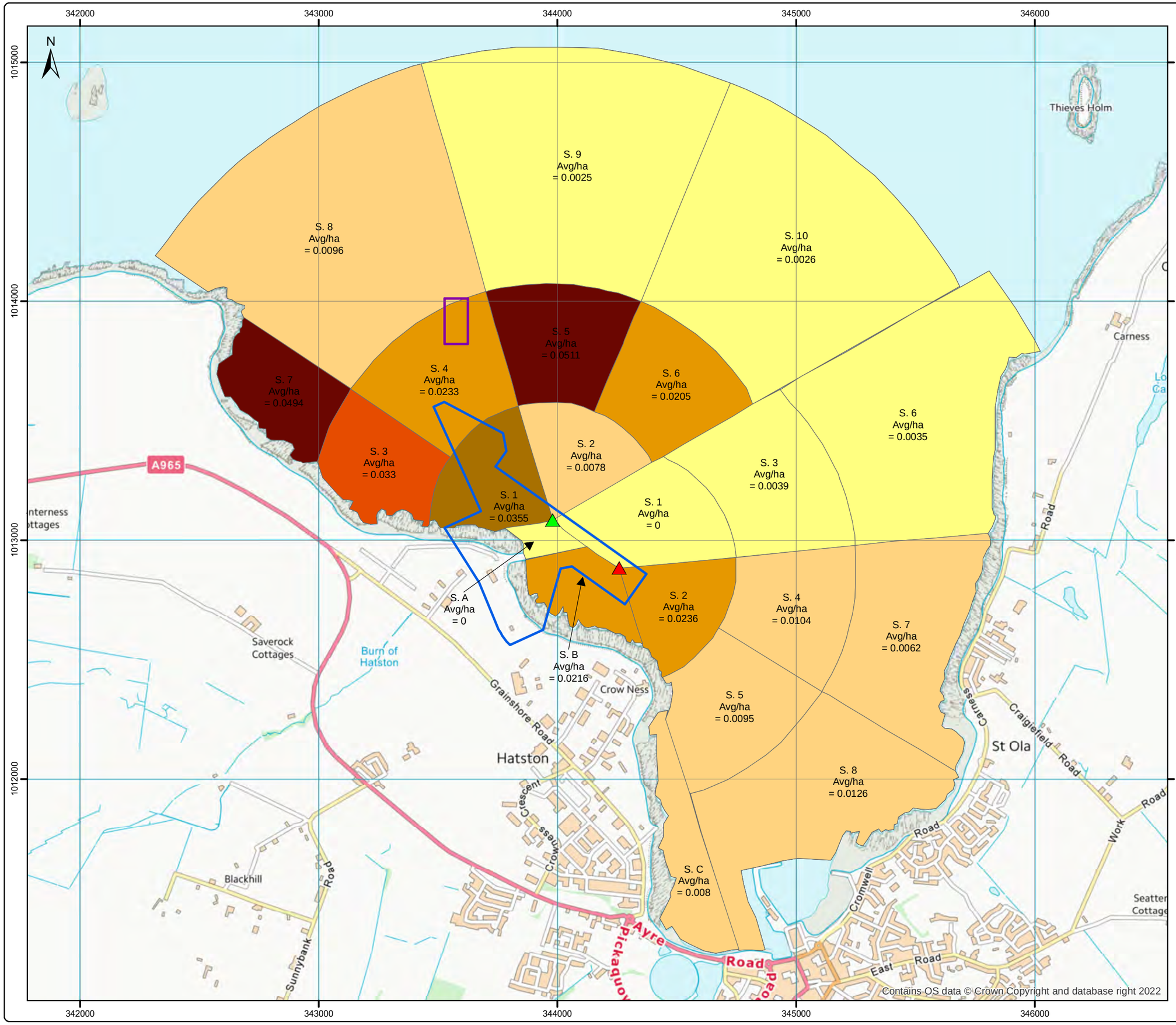
Status
FINAL

Drawing No.	Revision	Date
674795-GIS184	-	08 May 2024
Drawn	**Checked**	**Approved**
JAS	MS	MS

Scale
1:15,000 @A3
0 75 150 300 450 Metres

Rev	Date	Amendment	Initials
-	-	-	-

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Legend

- Northern Vantage Point (HY 44257 12883)
- Southern Vantage Point (HY 43978 13084)
- Fish Cage
- Proposed Site Extent

Average Bird Count Density per ha

- < 0.005
- 0.005 - 0.015
- 0.015 - 0.025
- 0.025 - 0.035
- 0.035 - 0.045
- >0.045
- Survey Sectors

Note: Refer to Red-throated Diver at Haston document by Firth Ecology, May 2024 for bird counts per sector

Do not scale this map

Client
Orkney Islands Council Harbour Authority

Project
Orkney Haston Pier

Title
Red-throated Diver Observations
Mid August - mid November

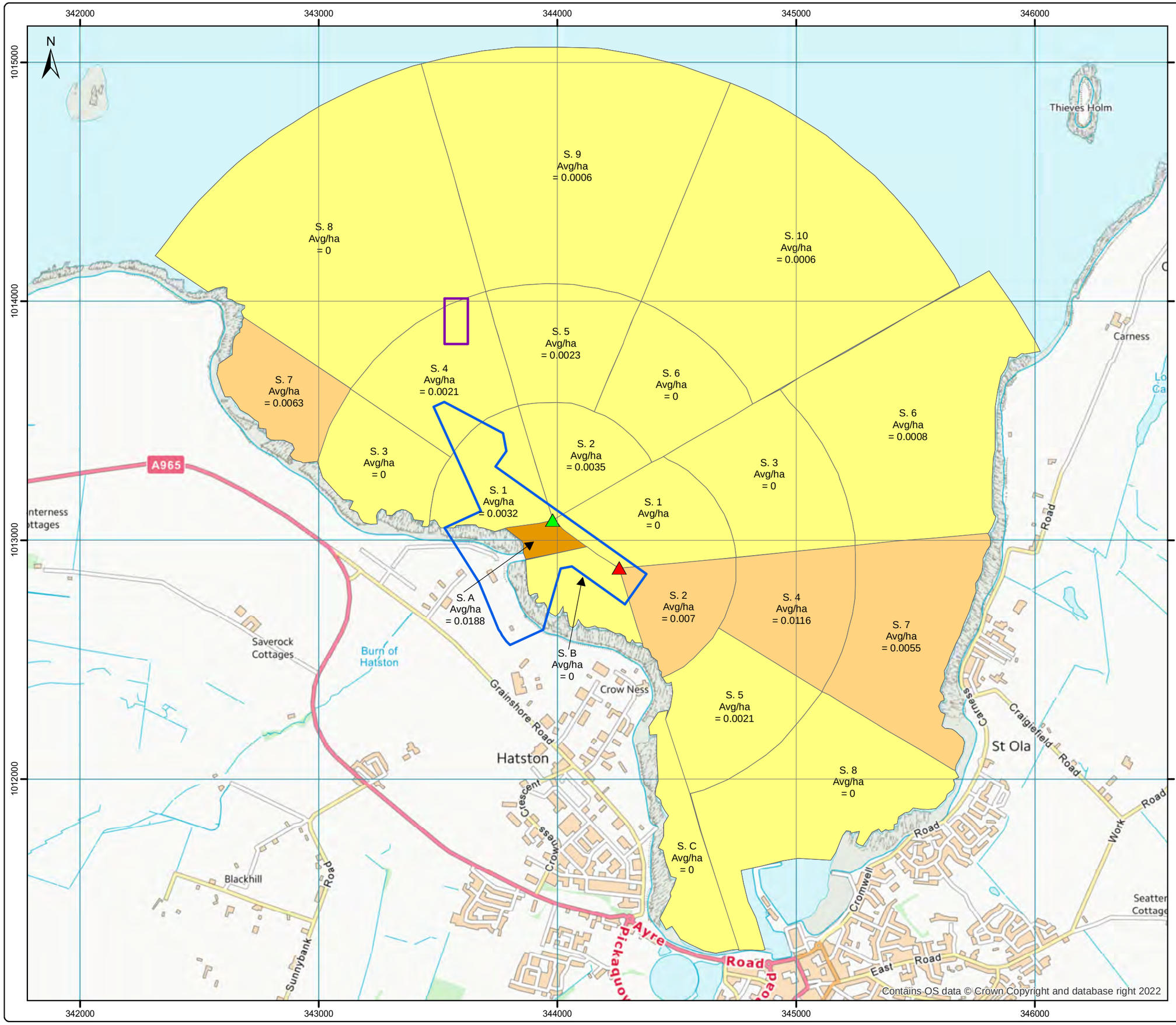
Status
FINAL

Drawing No.	Revision	Date
674795-GIS185	-	08 May 2024
Drawn	**Checked**	**Approved**
JAS	MS	MS

Scale
1:15,000 @A3
0 75 150 300 450 Metres

Rev	Date	Amendment	Initials
-	-	-	-

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Legend

- Northern Vantage Point (HY 44257 12883)
- Southern Vantage Point (HY 43978 13084)
- Fish Cage
- Proposed Site Extent

Average Bird Count Density per ha

- < 0.005
- 0.005 - 0.015
- 0.015 - 0.025
- 0.025 - 0.035
- 0.035 - 0.045
- >0.045
- Survey Sectors

Note: Refer to Red-throated Diver at Haston document by Firth Ecology, May 2024 for bird counts per sector

Do not scale this map

Client
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Project
Orkney Haston Pier

Title
Red-throated Diver Observations
Mid November to March

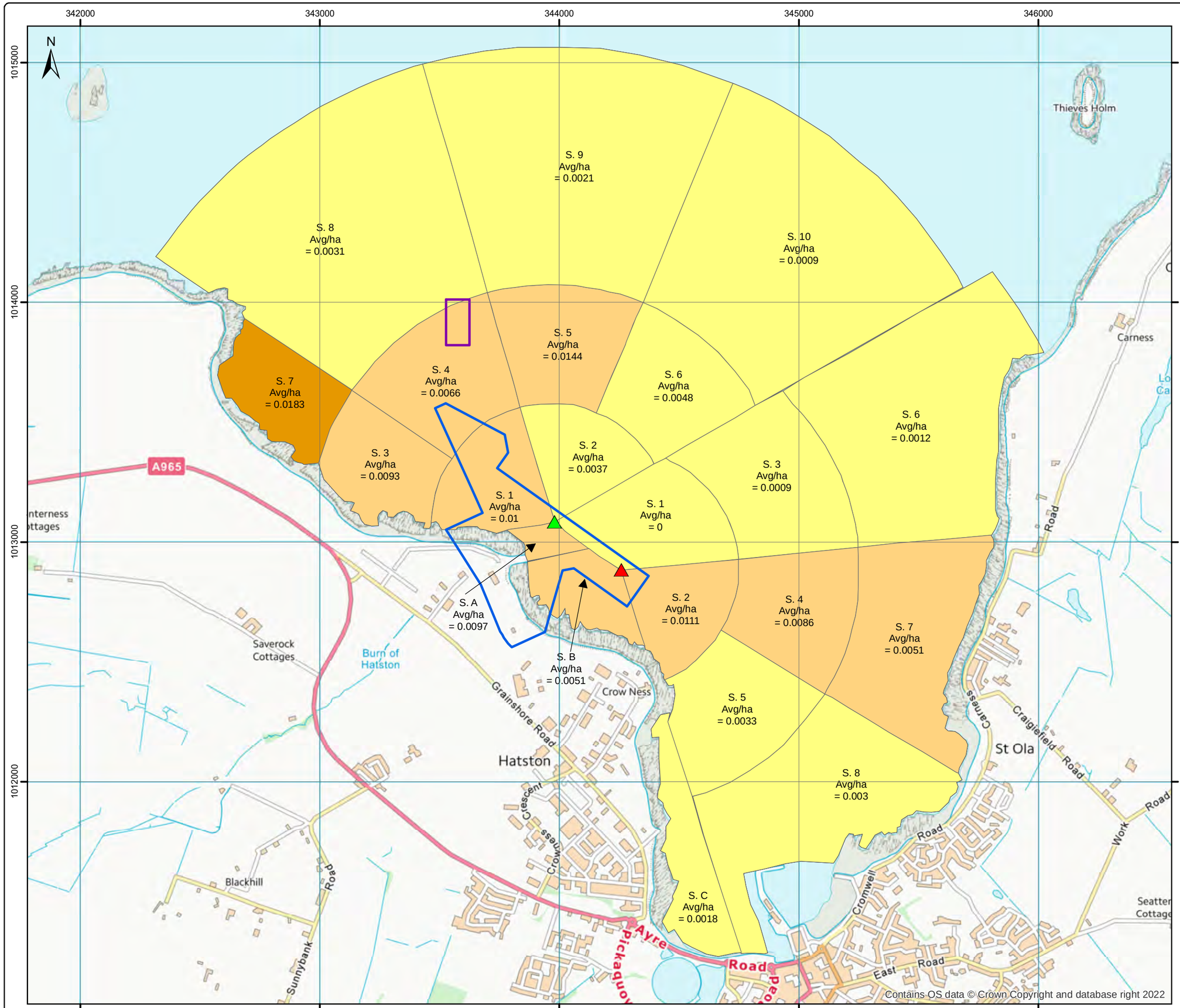
Status
FINAL

Drawing No.	Revision	Date
674795-GIS186	-	08 May 2024
Drawn	**Checked**	**Approved**
JAS	MS	MS

Scale
1:15,000 @A3
0 75 150 300 450 Metres

Rev	Date	Amendment	Initials
-	-	-	-

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Legend

- Northern Vantage Point (HY 44257 12883)
- Southern Vantage Point (HY 43978 13084)
- Fish Cage
- Proposed Site Extent

Average Bird Count Density per ha

- < 0.005
- 0.005 - 0.015
- 0.015 - 0.025
- 0.025 - 0.035
- 0.035 - 0.045
- >0.045
- Survey Sectors

Note: Refer to Red-throated Diver at Haston document by Firth Ecology, May 2024 for bird counts per sector

Do not scale this map

Client
Orkney Islands Council Harbour Authority

Project
Orkney Haston Pier

Title
Red-throated Diver Observations
All Data - October 2022 to March 2024

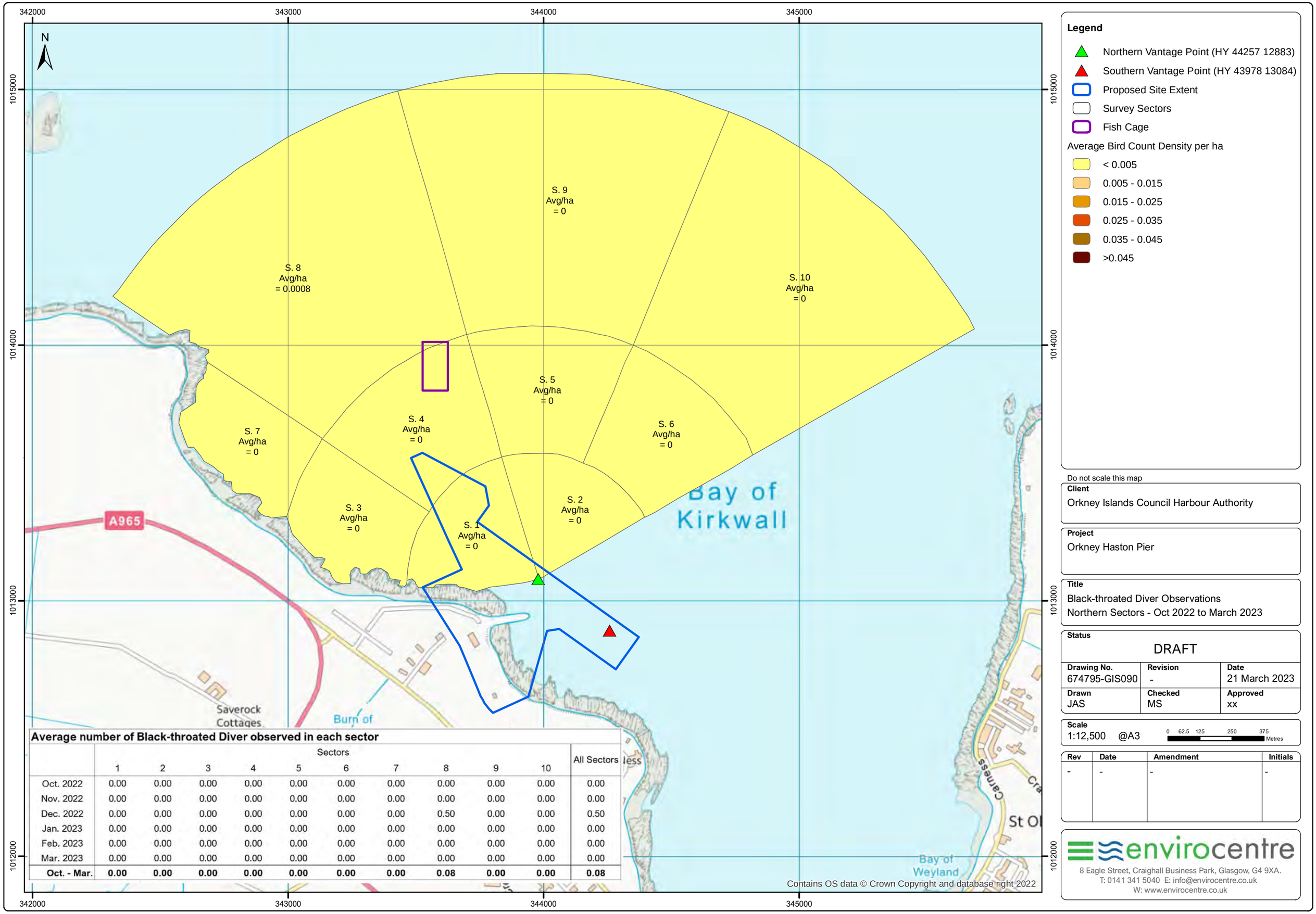
Status
FINAL

Drawing No.	Revision	Date
674795-GIS187	-	08 May 2024
Drawn	**Checked**	**Approved**
JAS	MS	MS

Scale
1:15,000 @A3
0 75 150 300 450 Metres

Rev	Date	Amendment	Initials
-	-	-	-

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Average number of Black-throated Diver observed in each sector

	Sectors										All Sectors
	1	2	3	4	5	6	7	8	9	10	
Oct. 2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nov. 2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dec. 2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.50
Jan. 2023	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Feb. 2023	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mar. 2023	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Oct. - Mar.	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.08**	**0.00**	**0.00**	**0.08**

Legend

- Northern Vantage Point (HY 44257 12883)
- Southern Vantage Point (HY 43978 13084)
- Proposed Site Extent
- Survey Sectors
- Fish Cage

Average Bird Count Density per ha

- < 0.005
- 0.005 - 0.015
- 0.015 - 0.025
- 0.025 - 0.035
- 0.035 - 0.045
- >0.045

Do not scale this map

Client
Orkney Islands Council Harbour Authority

Project
Orkney Haston Pier

Title
Black-throated Diver Observations
Northern Sectors - Oct 2022 to March 2023

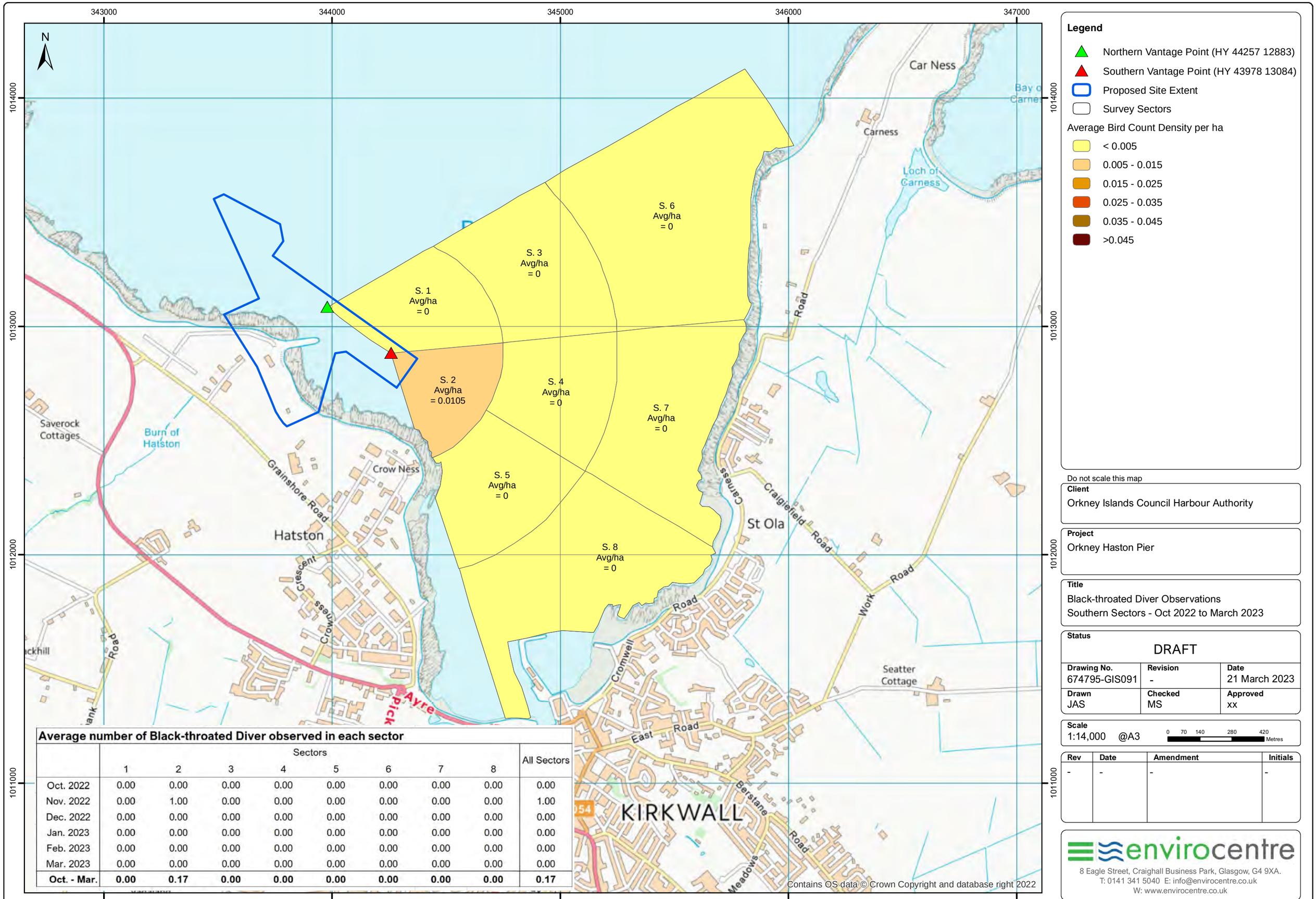
Status
DRAFT

Drawing No.	Revision	Date
674795-GIS090	-	21 March 2023
Drawn	**Checked**	**Approved**
JAS	MS	xx

Scale
1:12,500 @A3
0 62.5 125 250 375 Metres

Rev	Date	Amendment	Initials
-	-	-	-

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Average number of Black-throated Diver observed in each sector

	Sectors								All Sectors
	1	2	3	4	5	6	7	8	
Oct. 2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nov. 2022	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
Dec. 2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Jan. 2023	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Feb. 2023	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mar. 2023	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Oct. - Mar.	**0.00**	**0.17**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.17**

Legend

- Northern Vantage Point (HY 44257 12883)
- Southern Vantage Point (HY 43978 13084)
- Proposed Site Extent
- Survey Sectors

Average Bird Count Density per ha

- < 0.005
- 0.005 - 0.015
- 0.015 - 0.025
- 0.025 - 0.035
- 0.035 - 0.045
- >0.045

Do not scale this map

Client
Orkney Islands Council Harbour Authority

Project
Orkney Haston Pier

Title
Black-throated Diver Observations
Southern Sectors - Oct 2022 to March 2023

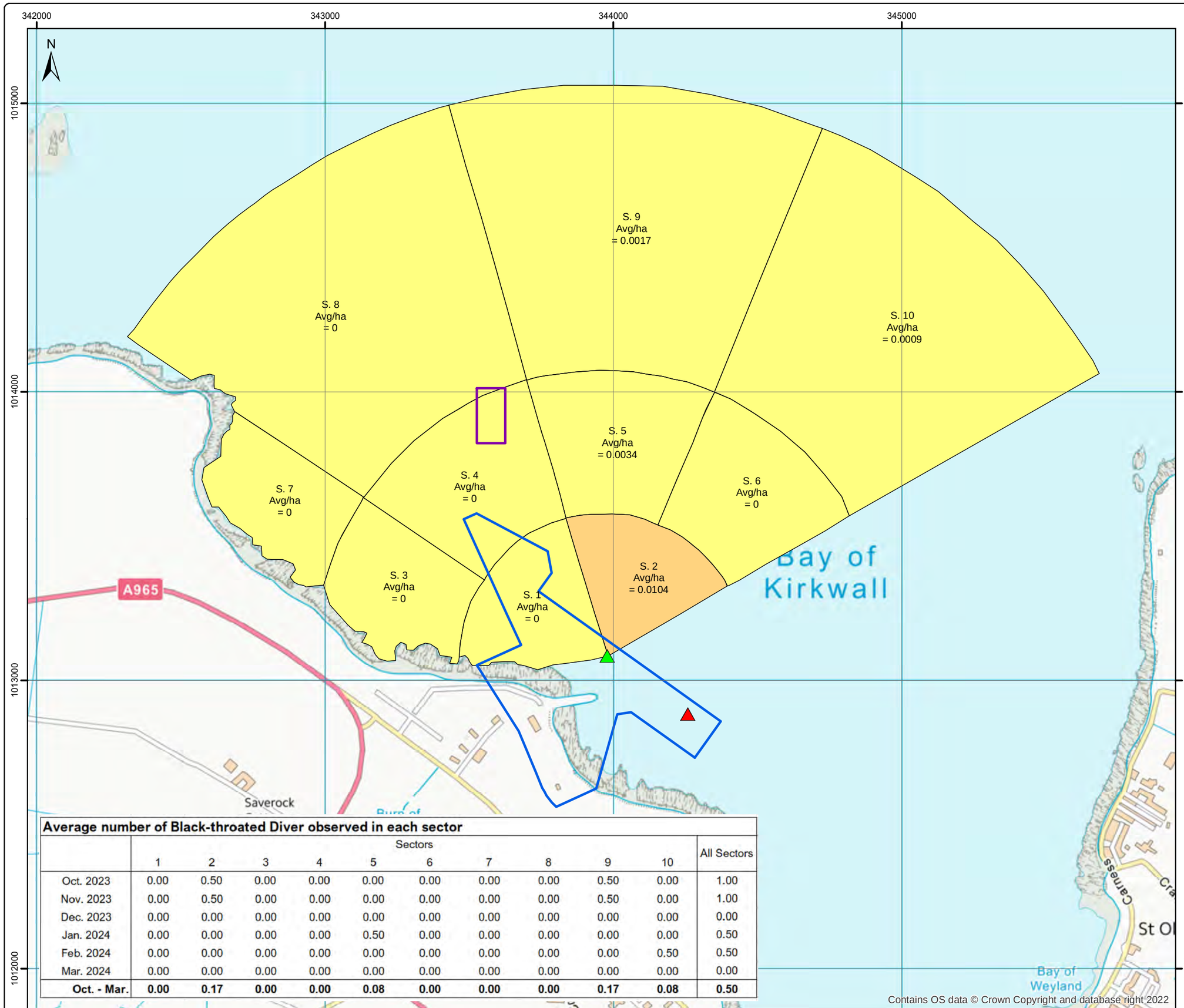
Status
DRAFT

Drawing No.	Revision	Date
674795-GIS091	-	21 March 2023
Drawn	**Checked**	**Approved**
JAS	MS	xx

Scale
1:14,000 @A3
0 70 140 280 420 Metres

Rev	Date	Amendment	Initials
-	-	-	-

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Average number of Black-throated Diver observed in each sector

	Sectors										All Sectors
	1	2	3	4	5	6	7	8	9	10	
Oct. 2023	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	1.00
Nov. 2023	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	1.00
Dec. 2023	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Jan. 2024	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.50
Feb. 2024	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.50
Mar. 2024	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Oct. - Mar.	**0.00**	**0.17**	**0.00**	**0.00**	**0.08**	**0.00**	**0.00**	**0.00**	**0.17**	**0.08**	**0.50**

Legend

- Northern Vantage Point (HY 44257 12883)
- Southern Vantage Point (HY 43978 13084)
- Proposed Site Extent
- Fish Cage
- Survey Sectors

Average Bird Count Density per ha

- < 0.005
- 0.005 - 0.015
- 0.015 - 0.025
- 0.025 - 0.035
- 0.035 - 0.045
- > 0.045

Do not scale this map

Client
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Project
Orkney Haston Pier

Title
Black-throated Diver Observations
Northern Sectors - Oct 2023 to March 2024

Status
FINAL

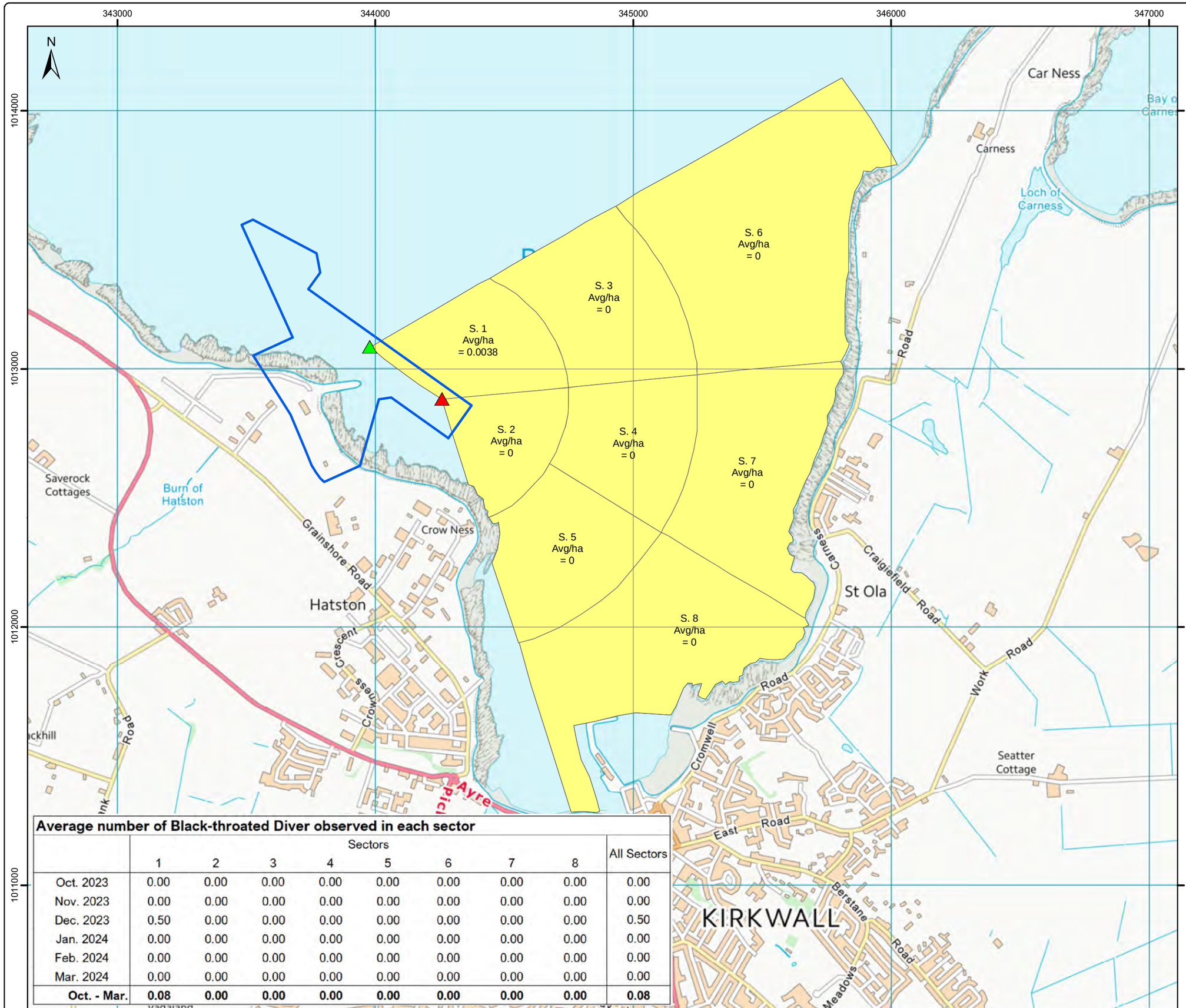
Drawing No.	Revision	Date
674795-GIS168	-	29 April 2024
Drawn	**Checked**	**Approved**
JAS	MS	MS

Scale
1:12,500 @A3
0 62.5 125 250 375 Metres

Rev	Date	Amendment	Initials
-	-	-	-

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Average number of Black-throated Diver observed in each sector

	Sectors								All Sectors
	1	2	3	4	5	6	7	8	
Oct. 2023	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nov. 2023	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dec. 2023	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50
Jan. 2024	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Feb. 2024	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mar. 2024	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Oct. - Mar.	**0.08**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.08**

Legend

- Northern Vantage Point (HY 44257 12883)
- Southern Vantage Point (HY 43978 13084)
- Proposed Site Extent
- Survey Sectors

Average Bird Count Density per ha

- < 0.005
- 0.005 - 0.015
- 0.015 - 0.025
- 0.025 - 0.035
- 0.035 - 0.045
- >0.045

Do not scale this map

Client
Orkney Islands Council Harbour Authority

Project
Orkney Haston Pier

Title
Black-throated Diver Observations
Southern Sectors - Oct 2023 to March 2024

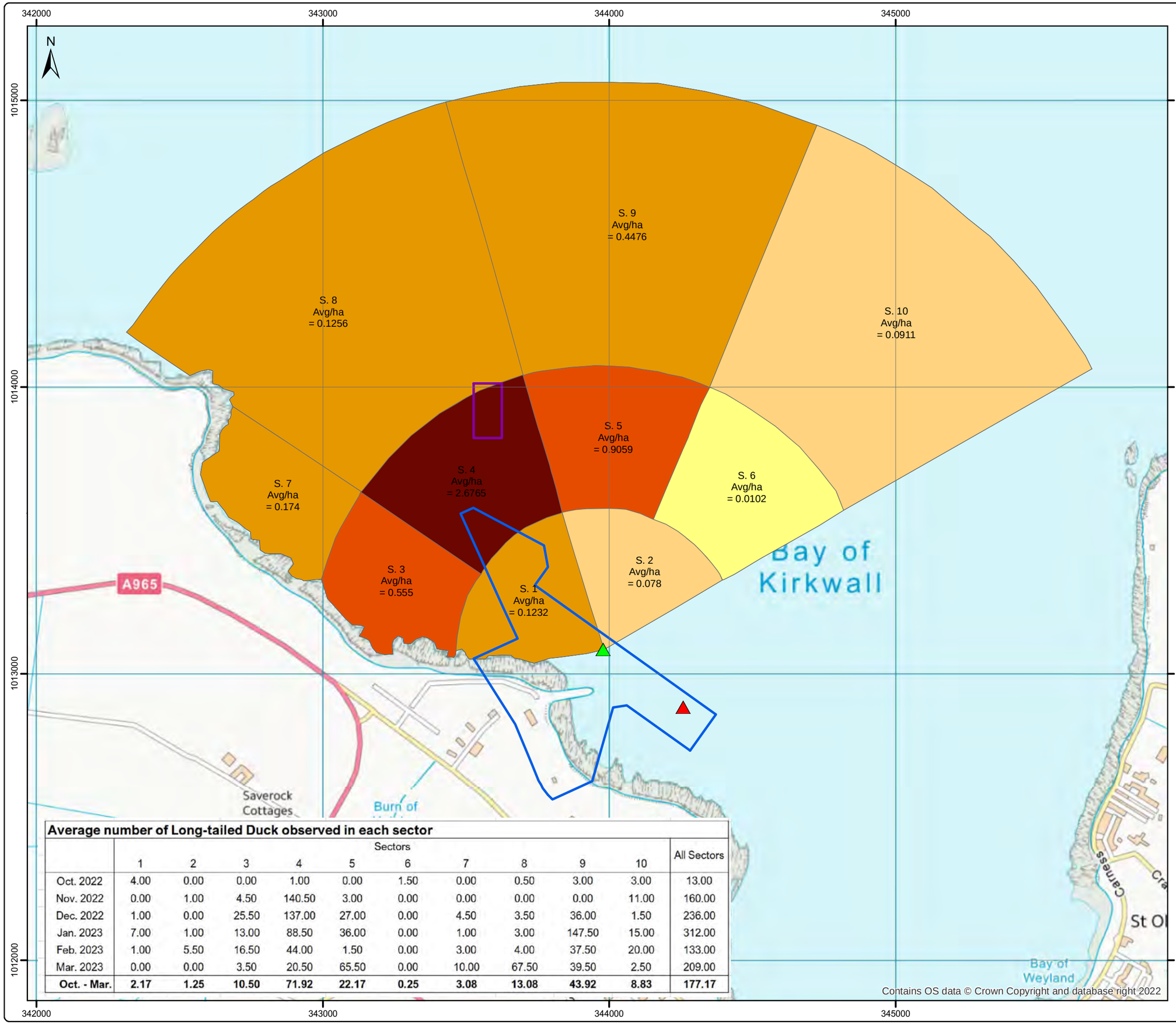
Status
FINAL

Drawing No.	Revision	Date
674795-GIS169	-	29 April 2024
Drawn	**Checked**	**Approved**
JAS	MS	MS

Scale
1:14,000 @A3
0 70 140 280 420 Metres

Rev	Date	Amendment	Initials
-	-	-	-

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Average number of Long-tailed Duck observed in each sector

	Sectors										All Sectors
	1	2	3	4	5	6	7	8	9	10	
Oct. 2022	4.00	0.00	0.00	1.00	0.00	1.50	0.00	0.50	3.00	3.00	13.00
Nov. 2022	0.00	1.00	4.50	140.50	3.00	0.00	0.00	0.00	0.00	11.00	160.00
Dec. 2022	1.00	0.00	25.50	137.00	27.00	0.00	4.50	3.50	36.00	1.50	236.00
Jan. 2023	7.00	1.00	13.00	88.50	36.00	0.00	1.00	3.00	147.50	15.00	312.00
Feb. 2023	1.00	5.50	16.50	44.00	1.50	0.00	3.00	4.00	37.50	20.00	133.00
Mar. 2023	0.00	0.00	3.50	20.50	65.50	0.00	10.00	67.50	39.50	2.50	209.00
Oct. - Mar.	**2.17**	**1.25**	**10.50**	**71.92**	**22.17**	**0.25**	**3.08**	**13.08**	**43.92**	**8.83**	**177.17**

Legend

- Northern Vantage Point (HY 44257 12883)
- Southern Vantage Point (HY 43978 13084)
- Proposed Site Extent
- Survey Sectors
- Fish Cage

Average Bird Count Density per ha

- <0.05
- 0.05 - 0.1
- 0.1 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- >1.5

Do not scale this map

Client
Orkney Islands Council Harbour Authority

Project
Orkney Haston Pier

Title
Long-Tailed Duck Observations
Northern Sectors - Oct 2022 to March 2023

Status
DRAFT

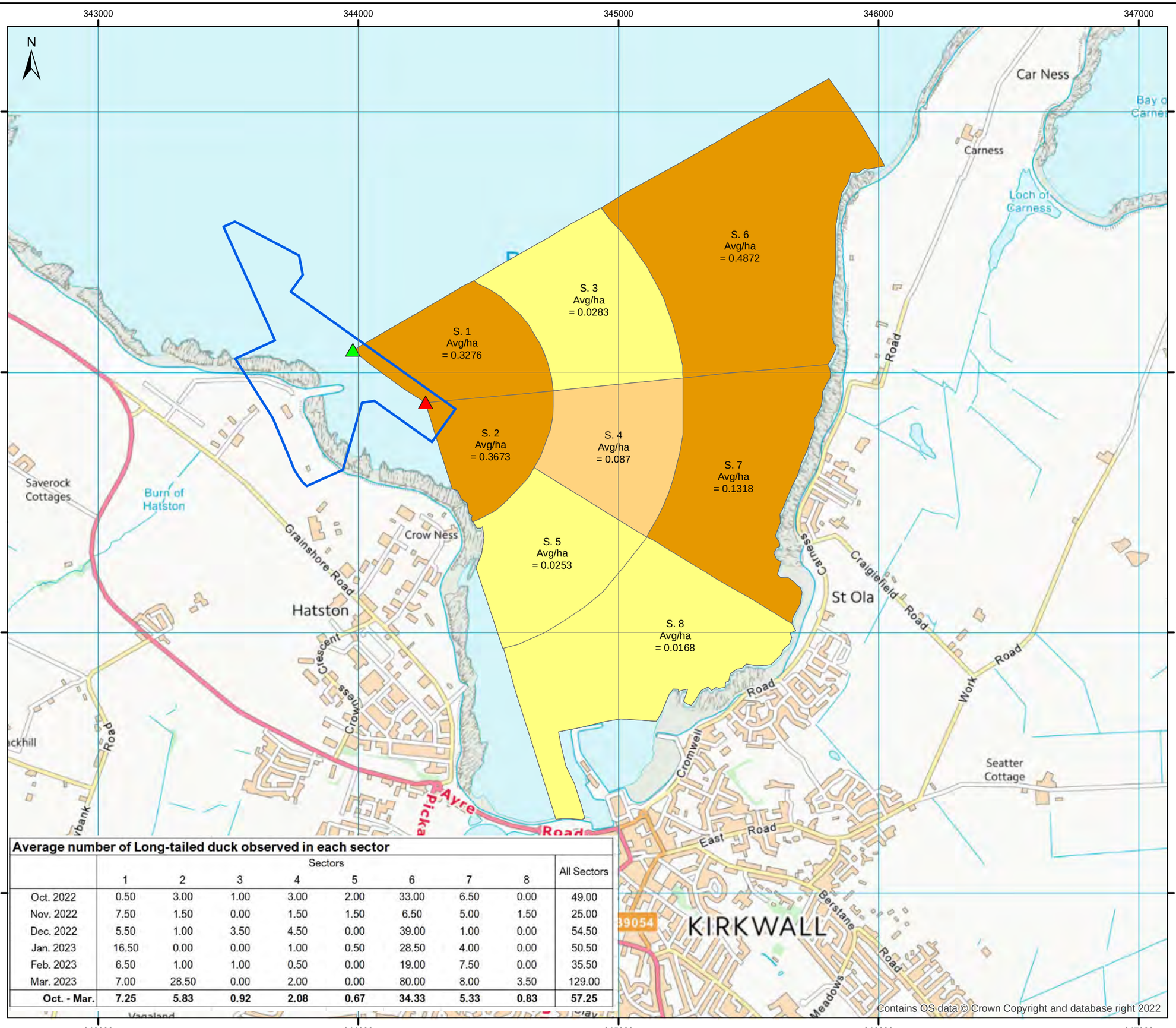
Drawing No.	Revision	Date
674795-GIS096	-	21 March 2023
Drawn	**Checked**	**Approved**
JAS	MS	xx

Scale
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0 62.5 125 250 375 Metres

Rev	Date	Amendment	Initials
-	-	-	-

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Average number of Long-tailed duck observed in each sector

	Sectors								All Sectors
	1	2	3	4	5	6	7	8	
Oct. 2022	0.50	3.00	1.00	3.00	2.00	33.00	6.50	0.00	49.00
Nov. 2022	7.50	1.50	0.00	1.50	1.50	6.50	5.00	1.50	25.00
Dec. 2022	5.50	1.00	3.50	4.50	0.00	39.00	1.00	0.00	54.50
Jan. 2023	16.50	0.00	0.00	1.00	0.50	28.50	4.00	0.00	50.50
Feb. 2023	6.50	1.00	1.00	0.50	0.00	19.00	7.50	0.00	35.50
Mar. 2023	7.00	28.50	0.00	2.00	0.00	80.00	8.00	3.50	129.00
Oct. - Mar.	**7.25**	**5.83**	**0.92**	**2.08**	**0.67**	**34.33**	**5.33**	**0.83**	**57.25**

Legend

- Northern Vantage Point (HY 44257 12883)
- Southern Vantage Point (HY 43978 13084)
- Proposed Site Extent
- Survey Sectors

Average Bird Count Density per ha

- <0.05
- 0.05 - 0.1
- 0.1 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- >1.5

Do not scale this map

Client
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Project
Orkney Haston Pier

Title
Long-tailed Duck Observations
Southern Sectors - Oct 2022 to March 2023

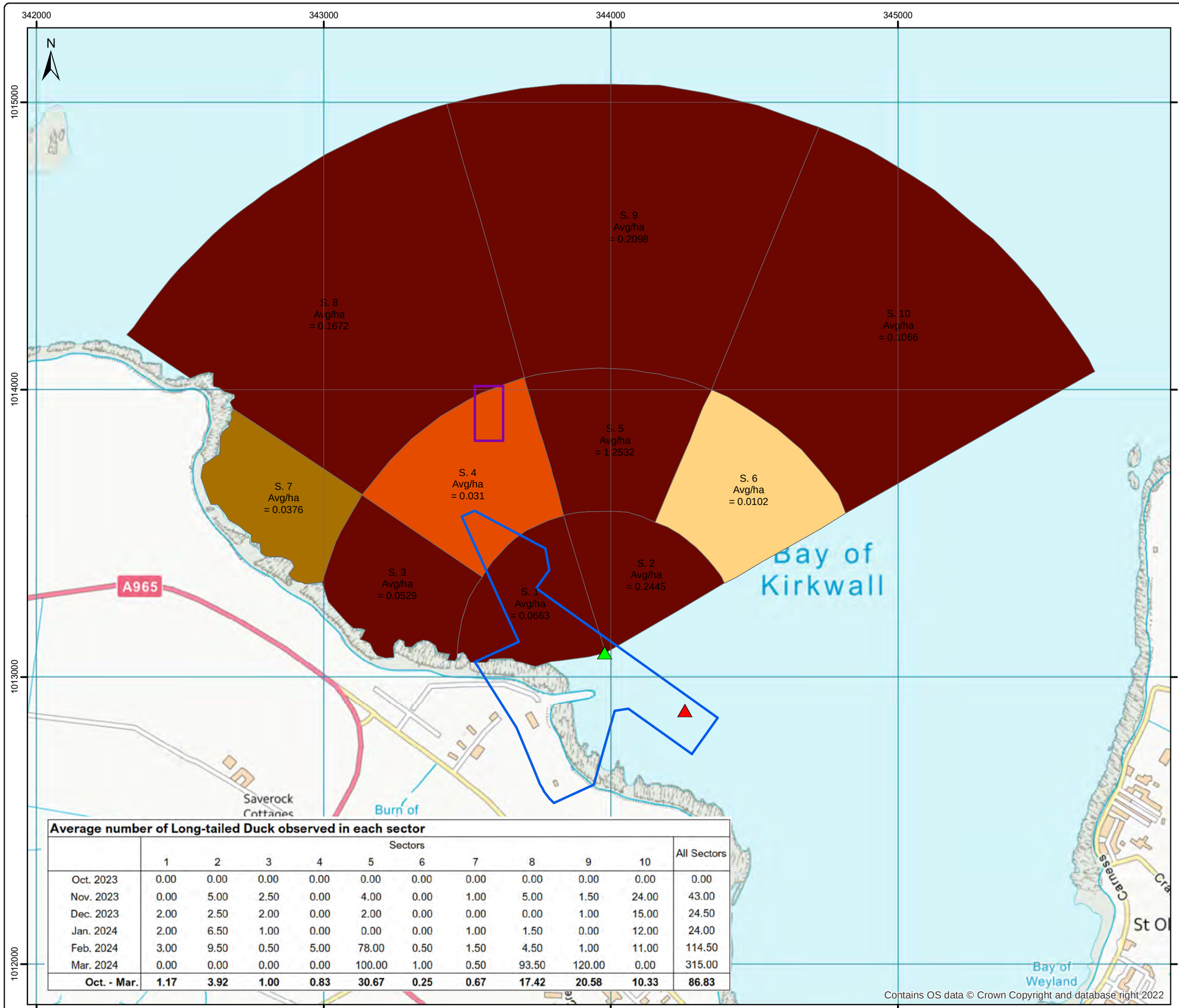
Status
DRAFT

Drawing No.	Revision	Date
674795-GIS097	-	21 March 2023
Drawn	**Checked**	**Approved**
JAS	MS	xx

Scale
1:14,000 @A3
0 70 140 280 420 Metres

Rev	Date	Amendment	Initials
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Average number of Long-tailed Duck observed in each sector

	Sectors										All Sectors
	1	2	3	4	5	6	7	8	9	10	
Oct. 2023	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nov. 2023	0.00	5.00	2.50	0.00	4.00	0.00	1.00	5.00	1.50	24.00	43.00
Dec. 2023	2.00	2.50	2.00	0.00	2.00	0.00	0.00	0.00	1.00	15.00	24.50
Jan. 2024	2.00	6.50	1.00	0.00	0.00	0.00	1.00	1.50	0.00	12.00	24.00
Feb. 2024	3.00	9.50	0.50	5.00	78.00	0.50	1.50	4.50	1.00	11.00	114.50
Mar. 2024	0.00	0.00	0.00	0.00	100.00	1.00	0.50	93.50	120.00	0.00	315.00
Oct. - Mar.	**1.17**	**3.92**	**1.00**	**0.83**	**30.67**	**0.25**	**0.67**	**17.42**	**20.58**	**10.33**	**86.83**

Legend

- Northern Vantage Point (HY 44257 12883)
- Southern Vantage Point (HY 43978 13084)
- Fish Cage
- Proposed Site Extent

Average Bird Count Density per ha

- <0.05
- 0.05 - 0.1
- 0.1 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- >1.5
- Survey Sectors

Do not scale this map

Client
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Project
Orkney Haston Pier

Title
Long-Tailed Duck Observations
Northern Sectors - Oct 2023 to March 2024

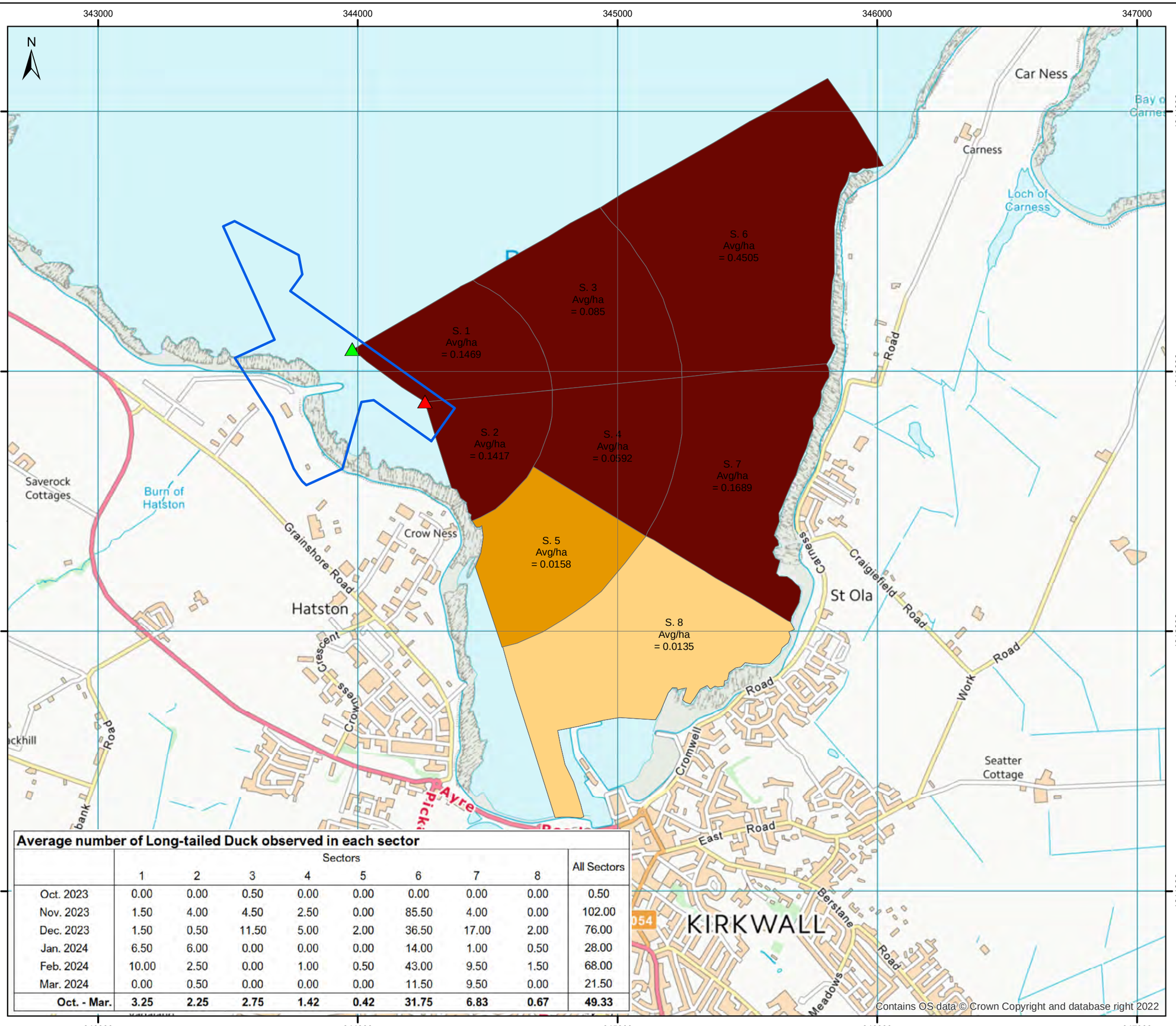
Status
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Drawing No.	Revision	Date
674795-GIS173	-	29 April 2024
Drawn	**Checked**	**Approved**
JAS	MS	MS

Scale
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Rev	Date	Amendment	Initials
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Average number of Long-tailed Duck observed in each sector

	Sectors								All Sectors
	1	2	3	4	5	6	7	8	
Oct. 2023	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.50
Nov. 2023	1.50	4.00	4.50	2.50	0.00	85.50	4.00	0.00	102.00
Dec. 2023	1.50	0.50	11.50	5.00	2.00	36.50	17.00	2.00	76.00
Jan. 2024	6.50	6.00	0.00	0.00	0.00	14.00	1.00	0.50	28.00
Feb. 2024	10.00	2.50	0.00	1.00	0.50	43.00	9.50	1.50	68.00
Mar. 2024	0.00	0.50	0.00	0.00	0.00	11.50	9.50	0.00	21.50
Oct. - Mar.	**3.25**	**2.25**	**2.75**	**1.42**	**0.42**	**31.75**	**6.83**	**0.67**	**49.33**

Legend

- Northern Vantage Point (HY 44257 12883)
- Southern Vantage Point (HY 43978 13084)
- Proposed Site Extent
- Survey Sectors

Average Bird Count Density per ha

- <0.05
- 0.05 - 0.1
- 0.1 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- >1.5

Do not scale this map

Client
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Project
Orkney Haston Pier

Title
Long-tailed Duck Observations
Southern Sectors - Oct 2023 to March 2024

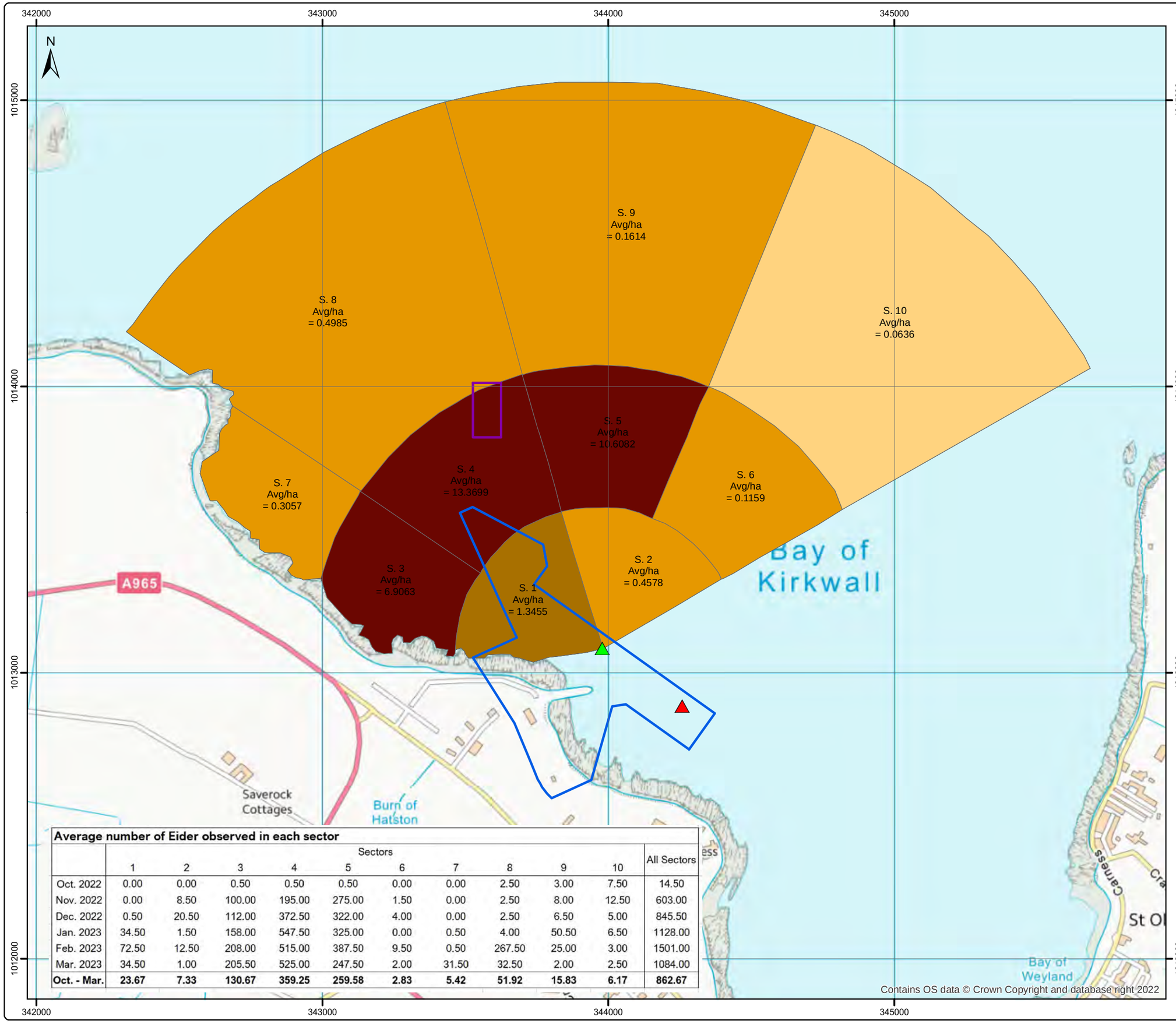
Status
FINAL

Drawing No.	Revision	Date
674795-GIS174	-	29 April 2024
Drawn	**Checked**	**Approved**
JAS	MS	MS

Scale
1:14,000 @A3
0 70 140 280 420 Metres

Rev	Date	Amendment	Initials
-	-	-	-

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Average number of Eider observed in each sector

	Sectors										All Sectors
	1	2	3	4	5	6	7	8	9	10	
Oct. 2022	0.00	0.00	0.50	0.50	0.50	0.00	0.00	2.50	3.00	7.50	14.50
Nov. 2022	0.00	8.50	100.00	195.00	275.00	1.50	0.00	2.50	8.00	12.50	603.00
Dec. 2022	0.50	20.50	112.00	372.50	322.00	4.00	0.00	2.50	6.50	5.00	845.50
Jan. 2023	34.50	1.50	158.00	547.50	325.00	0.00	0.50	4.00	50.50	6.50	1128.00
Feb. 2023	72.50	12.50	208.00	515.00	387.50	9.50	0.50	267.50	25.00	3.00	1501.00
Mar. 2023	34.50	1.00	205.50	525.00	247.50	2.00	31.50	32.50	2.00	2.50	1084.00
Oct. - Mar.	**23.67**	**7.33**	**130.67**	**359.25**	**259.58**	**2.83**	**5.42**	**51.92**	**15.83**	**6.17**	**862.67**

Legend

- Northern Vantage Point (HY 44257 12883)
- Southern Vantage Point (HY 43978 13084)
- Proposed Site Extent
- Survey Sectors
- Fish Cage

Average Bird Count Density per ha

- <0.05
- 0.05 - 0.1
- 0.1 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- >1.5

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Client
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Project
Orkney Haston Pier

Title
Eider Observations
Northern Sectors - Oct 2022 to March 2023

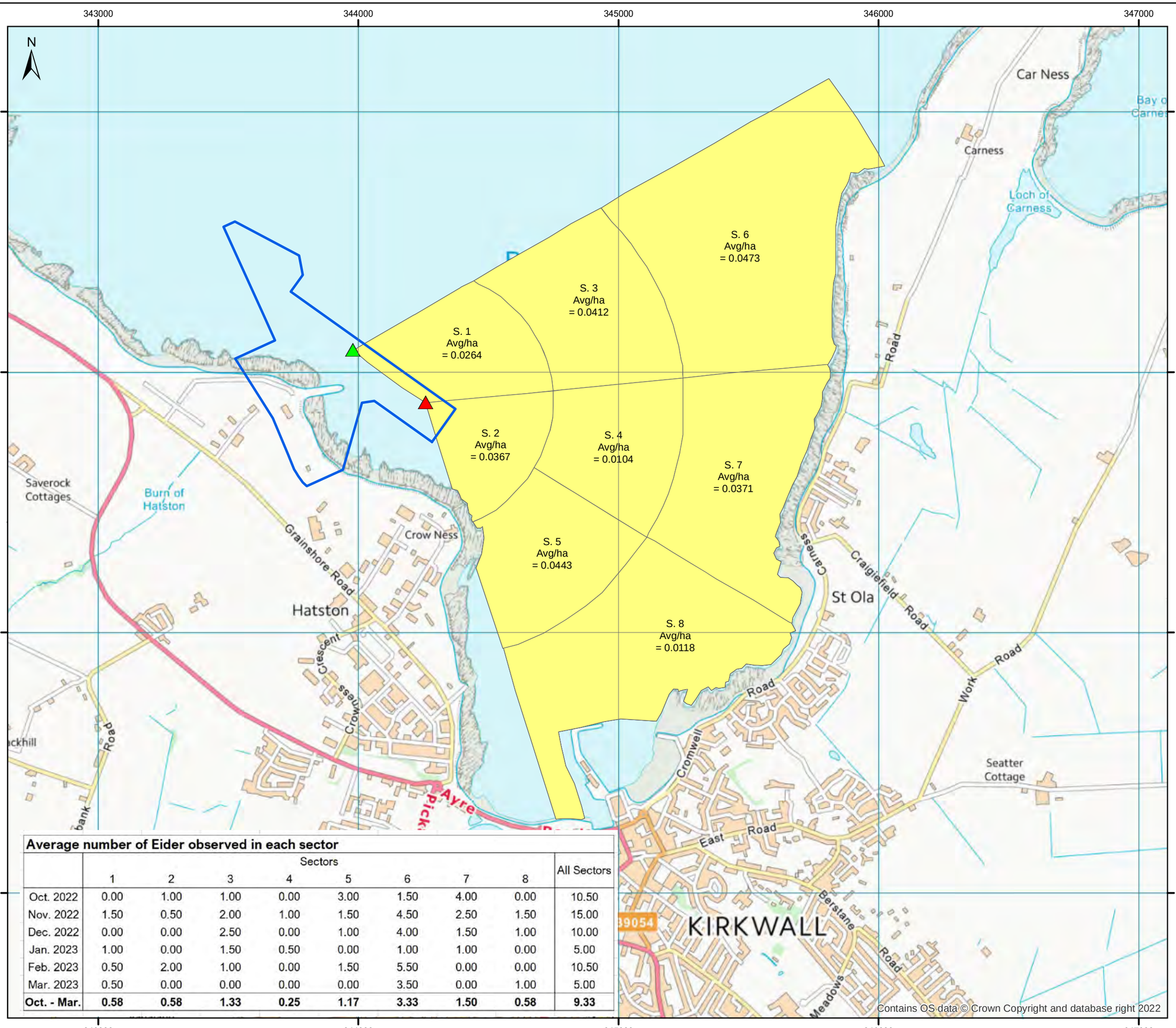
Status
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Drawing No.	Revision	Date
674795-GIS098	-	21 March 2023
Drawn	**Checked**	**Approved**
JAS	MS	xx

Scale
1:12,500 @A3
0 62.5 125 250 375 Metres

Rev	Date	Amendment	Initials
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Average number of Eider observed in each sector

	Sectors								All Sectors
	1	2	3	4	5	6	7	8	
Oct. 2022	0.00	1.00	1.00	0.00	3.00	1.50	4.00	0.00	10.50
Nov. 2022	1.50	0.50	2.00	1.00	1.50	4.50	2.50	1.50	15.00
Dec. 2022	0.00	0.00	2.50	0.00	1.00	4.00	1.50	1.00	10.00
Jan. 2023	1.00	0.00	1.50	0.50	0.00	1.00	1.00	0.00	5.00
Feb. 2023	0.50	2.00	1.00	0.00	1.50	5.50	0.00	0.00	10.50
Mar. 2023	0.50	0.00	0.00	0.00	0.00	3.50	0.00	1.00	5.00
Oct. - Mar.	**0.58**	**0.58**	**1.33**	**0.25**	**1.17**	**3.33**	**1.50**	**0.58**	**9.33**

Legend

- Northern Vantage Point (HY 44257 12883)
- Southern Vantage Point (HY 43978 13084)
- Proposed Site Extent
- Survey Sectors

Average Bird Count Density per ha

- < 0.05
- 0.05 - 0.1
- 0.1 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- >1.5

Do not scale this map

Client
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Project
Orkney Haston Pier

Title
Eider Observations
Southern Sectors - Oct 2022 to March 2023

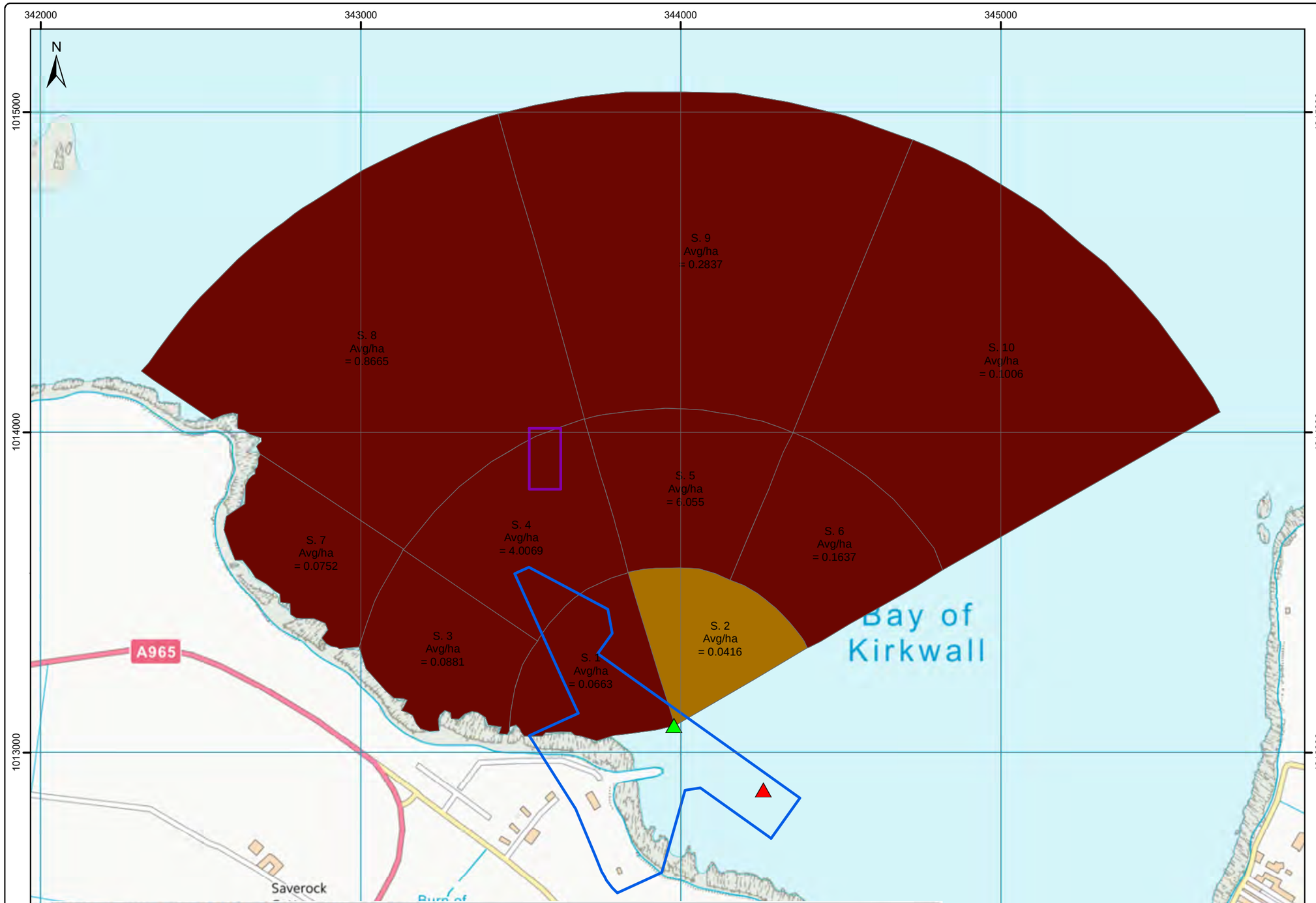
Status
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Drawing No.	Revision	Date
674795-GIS099	-	21 March 2023
Drawn	**Checked**	**Approved**
JAS	MS	xx

Scale
1:14,000 @A3
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Average number of Eider observed in each sector

	Sectors										All Sectors
	1	2	3	4	5	6	7	8	9	10	
Oct. 2023	0.50	0.00	0.00	8.00	1.00	1.50	3.00	8.50	4.50	3.50	30.50
Nov. 2023	0.00	0.00	2.50	3.50	25.00	0.00	1.50	15.50	6.00	4.50	58.50
Dec. 2023	0.50	0.50	0.00	8.50	18.50	0.50	0.50	1.50	6.50	4.50	41.50
Jan. 2024	3.50	2.50	1.50	2.50	2.50	0.00	1.00	5.50	11.00	4.00	34.00
Feb. 2024	2.50	1.00	0.50	392.50	442.00	0.00	0.00	94.00	16.50	9.50	958.50
Mar. 2024	0.00	0.00	5.50	231.00	400.00	22.00	2.00	416.50	122.50	32.50	1232.00
Oct. - Mar.	**1.17**	**0.67**	**1.67**	**107.67**	**148.17**	**4.00**	**1.33**	**90.25**	**27.83**	**9.75**	**392.50**

Legend

- Northern Vantage Point (HY 44257 12883)
- Southern Vantage Point (HY 43978 13084)
- Fish Cage
- Proposed Site Extent

Average Bird Count Density per ha

- <0.05
- 0.05 - 0.1
- 0.1 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- >1.5
- Survey Sectors

Do not scale this map

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Project
Orkney Haston Pier

Title
Eider Observations
Northern Sectors - Oct 2023 to March 2024

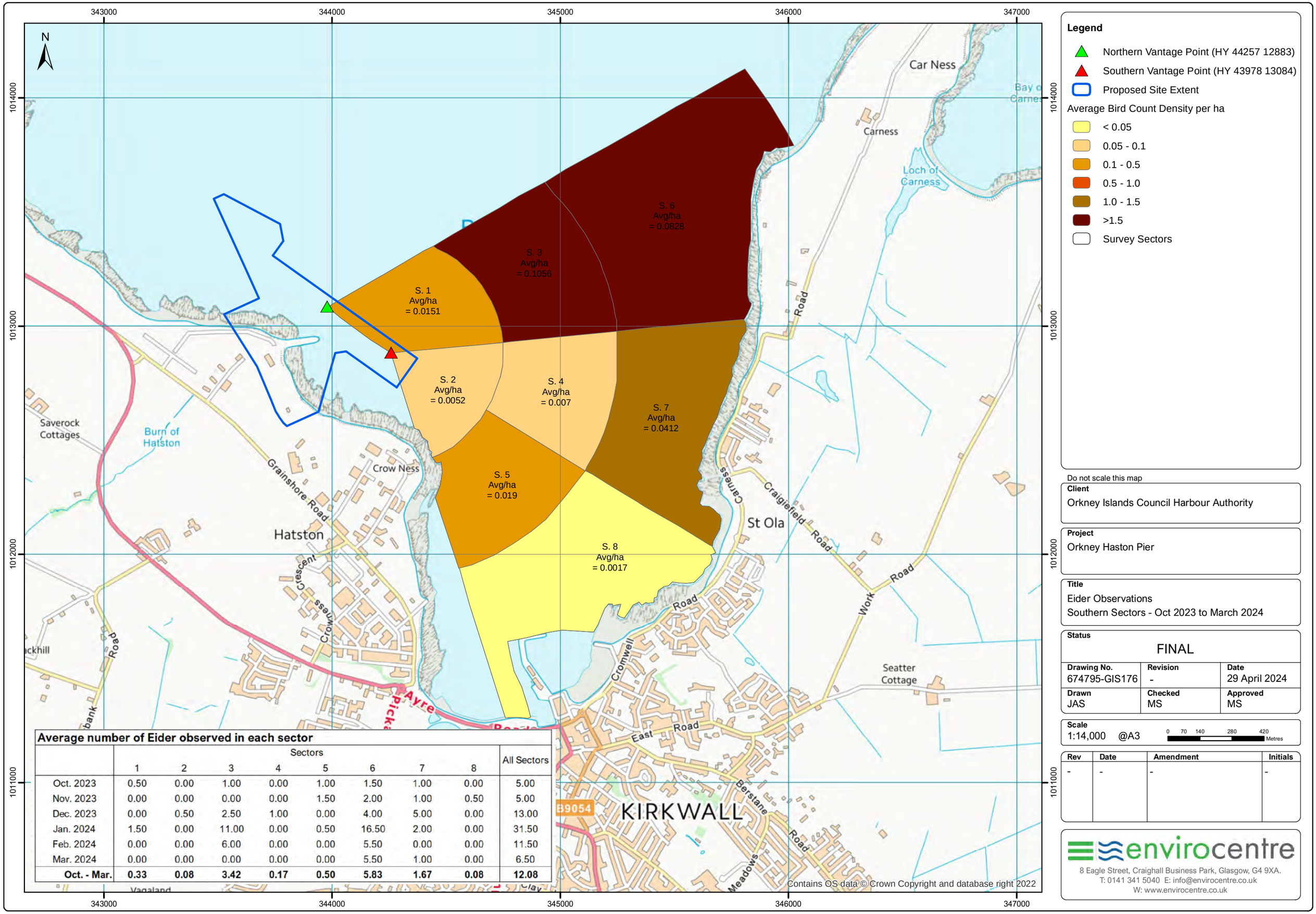
Status
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Drawing No.	Revision	Date
674795-GIS175	-	29 April 2024
Drawn	**Checked**	**Approved**
JAS	MS	MS

Scale
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0 62.5 125 250 375 Metres

Rev	Date	Amendment	Initials
-	-	-	-

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Average number of Eider observed in each sector

	Sectors								All Sectors
	1	2	3	4	5	6	7	8	
Oct. 2023	0.50	0.00	1.00	0.00	1.00	1.50	1.00	0.00	5.00
Nov. 2023	0.00	0.00	0.00	0.00	1.50	2.00	1.00	0.50	5.00
Dec. 2023	0.00	0.50	2.50	1.00	0.00	4.00	5.00	0.00	13.00
Jan. 2024	1.50	0.00	11.00	0.00	0.50	16.50	2.00	0.00	31.50
Feb. 2024	0.00	0.00	6.00	0.00	0.00	5.50	0.00	0.00	11.50
Mar. 2024	0.00	0.00	0.00	0.00	0.00	5.50	1.00	0.00	6.50
Oct. - Mar.	**0.33**	**0.08**	**3.42**	**0.17**	**0.50**	**5.83**	**1.67**	**0.08**	**12.08**

Legend

- Northern Vantage Point (HY 44257 12883)
- Southern Vantage Point (HY 43978 13084)
- Proposed Site Extent

Average Bird Count Density per ha

- < 0.05
- 0.05 - 0.1
- 0.1 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- >1.5
- Survey Sectors

Do not scale this map

Client
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Project
Orkney Haston Pier

Title
Eider Observations
Southern Sectors - Oct 2023 to March 2024

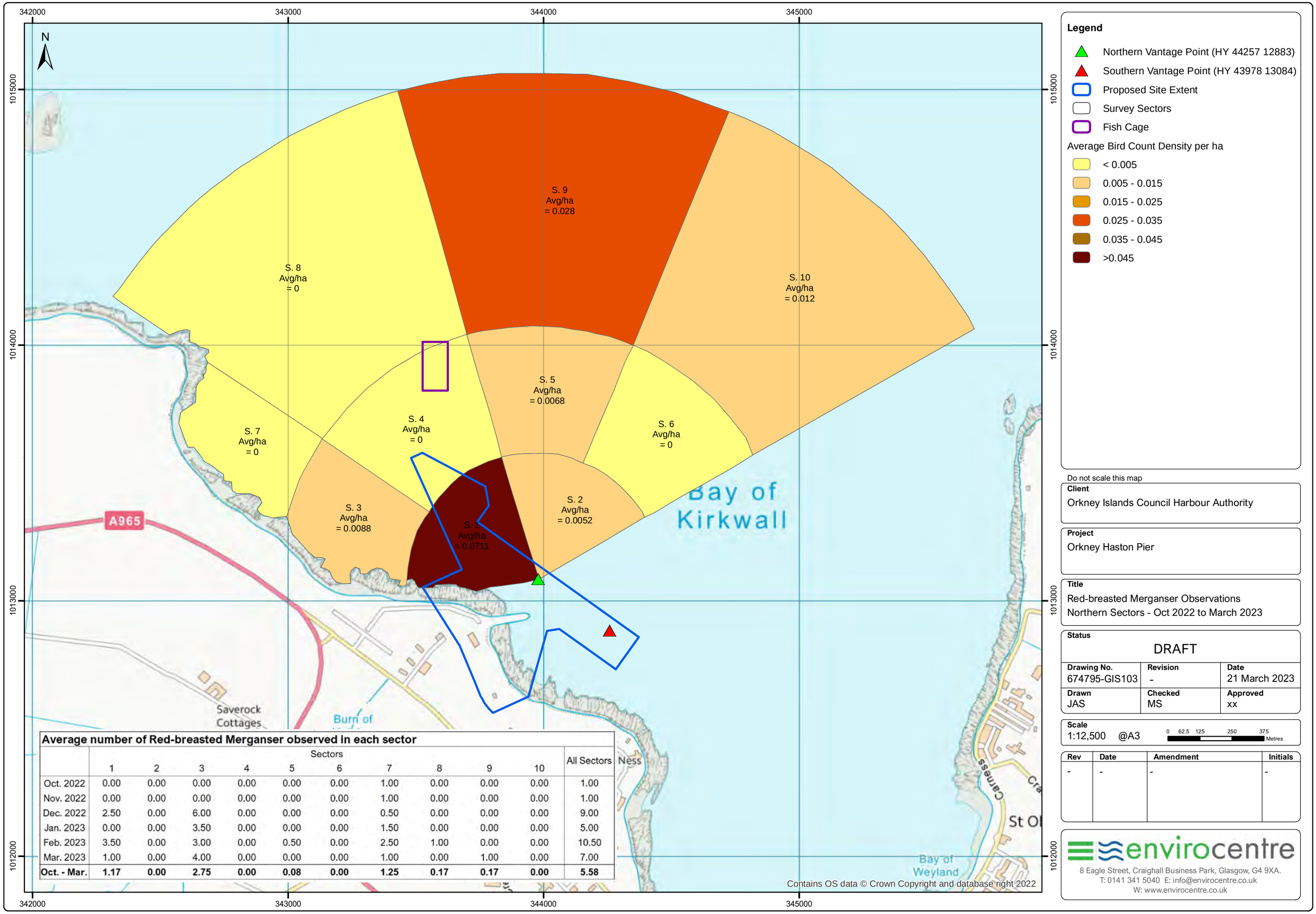
Status
FINAL

Drawing No.	Revision	Date
674795-GIS176	-	29 April 2024
Drawn	**Checked**	**Approved**
JAS	MS	MS

Scale
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0 70 140 280 420 Metres

Rev	Date	Amendment	Initials
-	-	-	-

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Average number of Red-breasted Merganser observed in each sector

	Sectors										All Sectors
	1	2	3	4	5	6	7	8	9	10	
Oct. 2022	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00
Nov. 2022	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00
Dec. 2022	2.50	0.00	6.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	9.00
Jan. 2023	0.00	0.00	3.50	0.00	0.00	0.00	1.50	0.00	0.00	0.00	5.00
Feb. 2023	3.50	0.00	3.00	0.00	0.50	0.00	2.50	1.00	0.00	0.00	10.50
Mar. 2023	1.00	0.00	4.00	0.00	0.00	0.00	1.00	0.00	1.00	0.00	7.00
Oct. - Mar.	**1.17**	**0.00**	**2.75**	**0.00**	**0.08**	**0.00**	**1.25**	**0.17**	**0.17**	**0.00**	**5.58**

Legend

- Northern Vantage Point (HY 44257 12883)
- Southern Vantage Point (HY 43978 13084)
- Proposed Site Extent
- Survey Sectors
- Fish Cage

Average Bird Count Density per ha

- < 0.005
- 0.005 - 0.015
- 0.015 - 0.025
- 0.025 - 0.035
- 0.035 - 0.045
- >0.045

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Client
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Project
Orkney Haston Pier

Title
Red-breasted Merganser Observations
Northern Sectors - Oct 2022 to March 2023

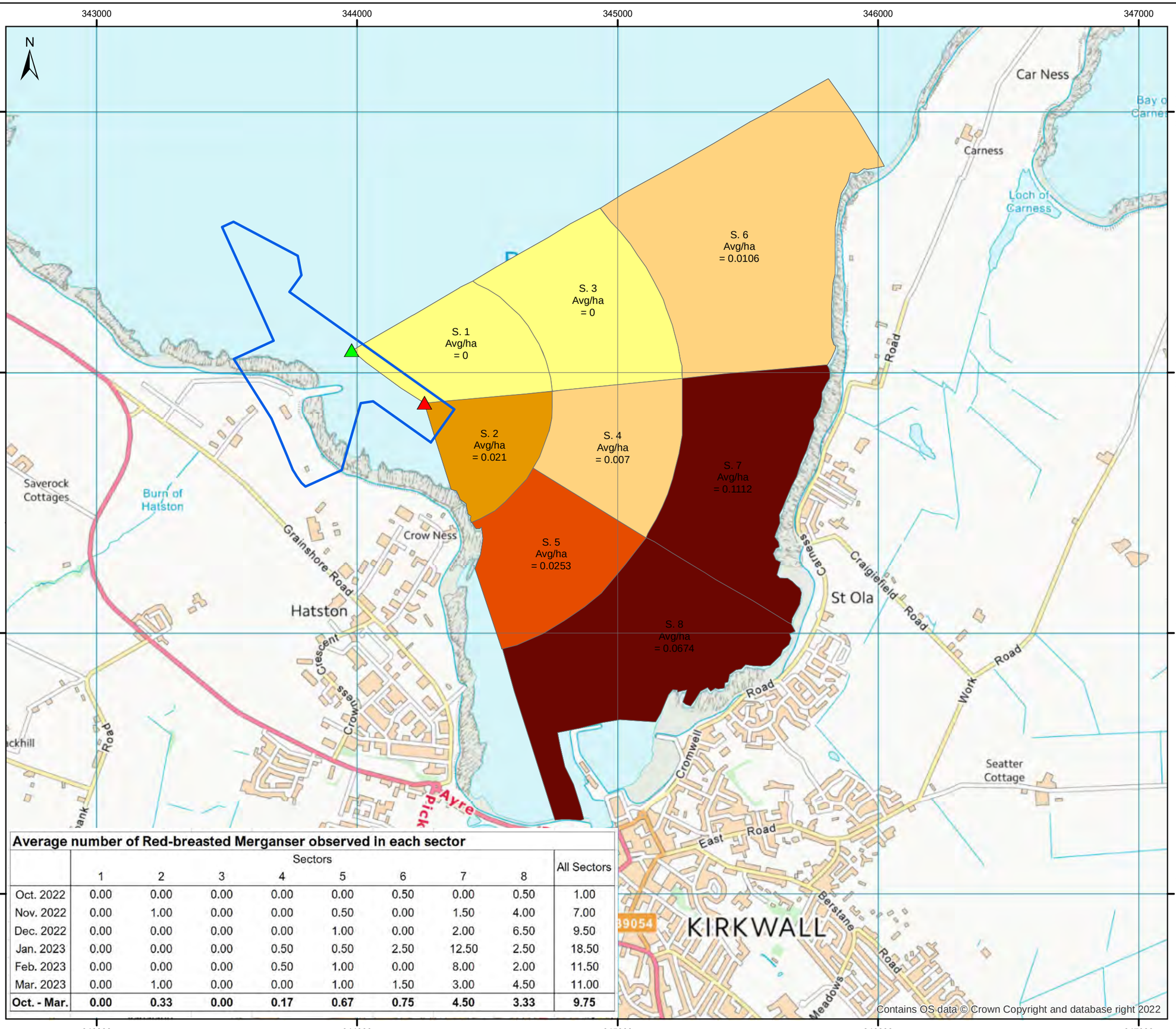
Status
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Drawing No.	Revision	Date
674795-GIS103	-	21 March 2023
Drawn	**Checked**	**Approved**
JAS	MS	xx

Scale
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Rev	Date	Amendment	Initials
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Legend

- Northern Vantage Point (HY 44257 12883)
- Southern Vantage Point (HY 43978 13084)
- Proposed Site Extent
- Survey Sectors

Average Bird Count Density per ha

- < 0.005
- 0.005 - 0.015
- 0.015 - 0.025
- 0.025 - 0.035
- 0.035 - 0.045
- >0.045

Average number of Red-breasted Merganser observed in each sector

	Sectors								All Sectors
	1	2	3	4	5	6	7	8	
Oct. 2022	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.50	1.00
Nov. 2022	0.00	1.00	0.00	0.00	0.50	0.00	1.50	4.00	7.00
Dec. 2022	0.00	0.00	0.00	0.00	1.00	0.00	2.00	6.50	9.50
Jan. 2023	0.00	0.00	0.00	0.50	0.50	2.50	12.50	2.50	18.50
Feb. 2023	0.00	0.00	0.00	0.50	1.00	0.00	8.00	2.00	11.50
Mar. 2023	0.00	1.00	0.00	0.00	1.00	1.50	3.00	4.50	11.00
Oct. - Mar.	**0.00**	**0.33**	**0.00**	**0.17**	**0.67**	**0.75**	**4.50**	**3.33**	**9.75**

Do not scale this map

Client
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Project
Orkney Haston Pier

Title
Red-breasted Merganser Observations
Southern Sectors - Oct 2022 to March 2023

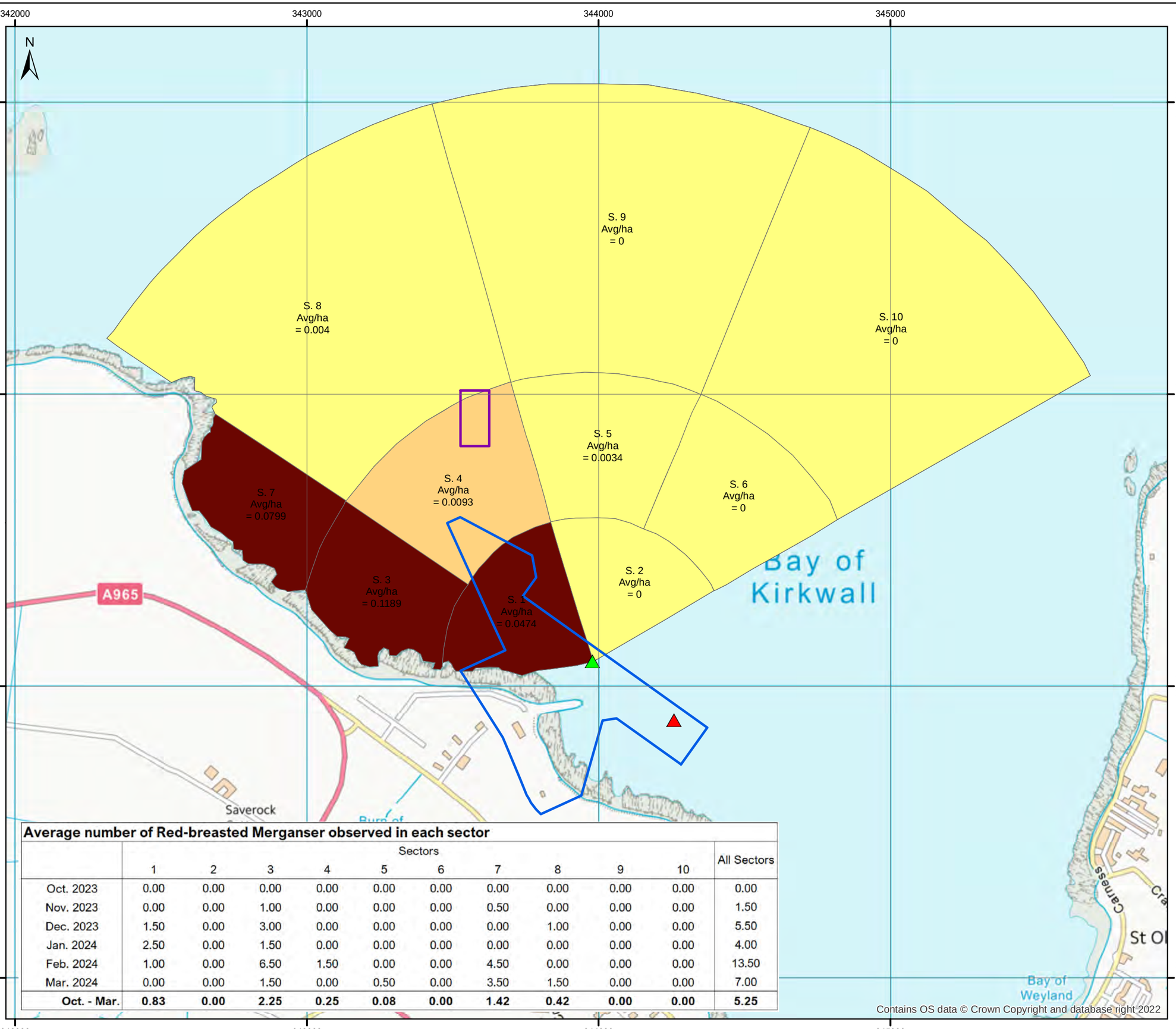
Status
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Drawing No.	Revision	Date
674795-GIS104	-	21 March 2023
Drawn	**Checked**	**Approved**
JAS	MS	xx

Scale
1:14,000 @A3
0 70 140 280 420 Metres

Rev	Date	Amendment	Initials
-	-	-	-

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Average number of Red-breasted Merganser observed in each sector

	Sectors										All Sectors
	1	2	3	4	5	6	7	8	9	10	
Oct. 2023	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nov. 2023	0.00	0.00	1.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	1.50
Dec. 2023	1.50	0.00	3.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	5.50
Jan. 2024	2.50	0.00	1.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.00
Feb. 2024	1.00	0.00	6.50	1.50	0.00	0.00	4.50	0.00	0.00	0.00	13.50
Mar. 2024	0.00	0.00	1.50	0.00	0.50	0.00	3.50	1.50	0.00	0.00	7.00
Oct. - Mar.	**0.83**	**0.00**	**2.25**	**0.25**	**0.08**	**0.00**	**1.42**	**0.42**	**0.00**	**0.00**	**5.25**

Legend

- Northern Vantage Point (HY 44257 12883)
- Southern Vantage Point (HY 43978 13084)
- Fish Cage
- Proposed Site Extent

Average Bird Count Density per ha

- < 0.005
- 0.005 - 0.015
- 0.015 - 0.025
- 0.025 - 0.035
- 0.035 - 0.045
- >0.045
- Survey Sectors

Do not scale this map

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Project
Orkney Haston Pier

Title
Red-breasted Merganser Observations
Northern Sectors - Oct 2023 to March 2024

Status
FINAL

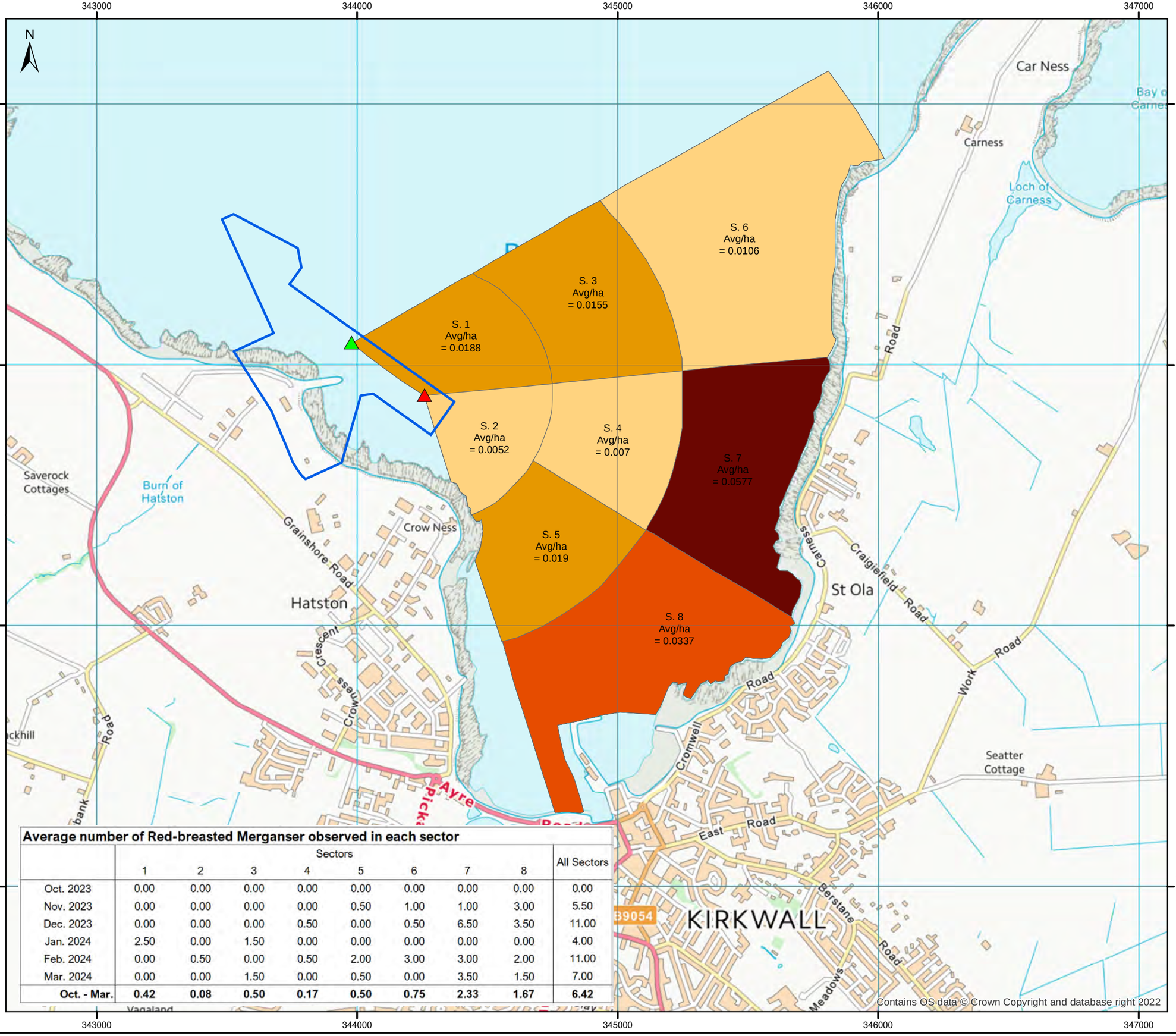
Drawing No.	Revision	Date
674795-GIS180	-	30 April 2024
Drawn	**Checked**	**Approved**
JAS	MS	MS

Scale
1:12,500 @A3
0 62.5 125 250 375 Metres

Rev	Date	Amendment	Initials
-	-	-	-

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Average number of Red-breasted Merganser observed in each sector

	Sectors								All Sectors
	1	2	3	4	5	6	7	8	
Oct. 2023	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nov. 2023	0.00	0.00	0.00	0.00	0.50	1.00	1.00	3.00	5.50
Dec. 2023	0.00	0.00	0.00	0.50	0.00	0.50	6.50	3.50	11.00
Jan. 2024	2.50	0.00	1.50	0.00	0.00	0.00	0.00	0.00	4.00
Feb. 2024	0.00	0.50	0.00	0.50	2.00	3.00	3.00	2.00	11.00
Mar. 2024	0.00	0.00	1.50	0.00	0.50	0.00	3.50	1.50	7.00
Oct. - Mar.	**0.42**	**0.08**	**0.50**	**0.17**	**0.50**	**0.75**	**2.33**	**1.67**	**6.42**

Legend

- Northern Vantage Point (HY 44257 12883)
- Southern Vantage Point (HY 43978 13084)
- Proposed Site Extent
- Survey Sectors

Average Bird Count Density per ha

- < 0.005
- 0.005 - 0.015
- 0.015 - 0.025
- 0.025 - 0.035
- 0.035 - 0.045
- >0.045

Do not scale this map

Client
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Project
Orkney Haston Pier

Title
Red-breasted Merganser Observations
Southern Sectors - Oct 2023 to March 2024

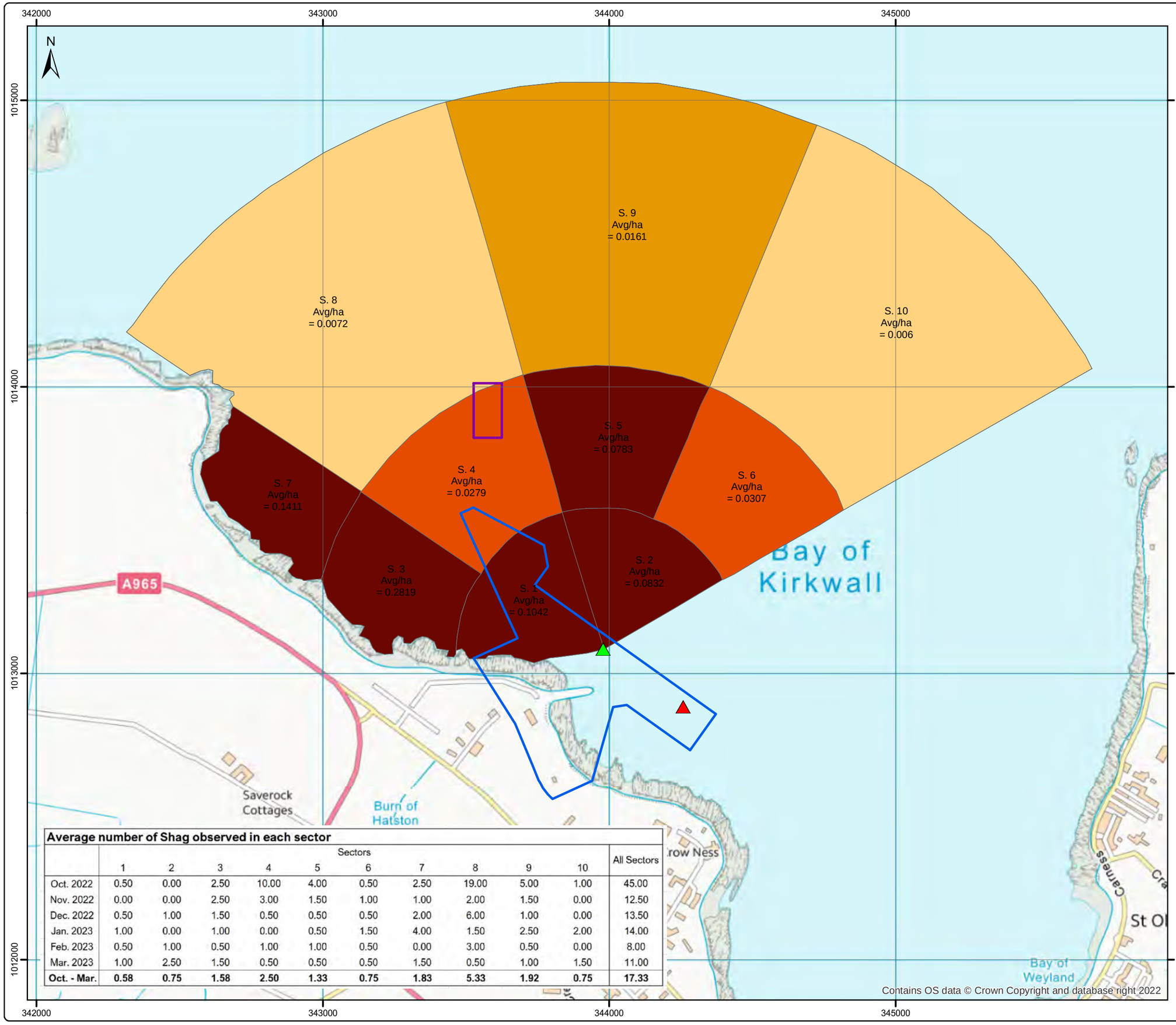
Status
FINAL

Drawing No.	Revision	Date
674795-GIS181	-	30 April 2024
Drawn	**Checked**	**Approved**
JAS	MS	MS

Scale
1:14,000 @A3
0 70 140 280 420 Metres

Rev	Date	Amendment	Initials
-	-	-	-

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Average number of Shag observed in each sector

	Sectors										All Sectors
	1	2	3	4	5	6	7	8	9	10	
Oct. 2022	0.50	0.00	2.50	10.00	4.00	0.50	2.50	19.00	5.00	1.00	45.00
Nov. 2022	0.00	0.00	2.50	3.00	1.50	1.00	1.00	2.00	1.50	0.00	12.50
Dec. 2022	0.50	1.00	1.50	0.50	0.50	0.50	2.00	6.00	1.00	0.00	13.50
Jan. 2023	1.00	0.00	1.00	0.00	0.50	1.50	4.00	1.50	2.50	2.00	14.00
Feb. 2023	0.50	1.00	0.50	1.00	1.00	0.50	0.00	3.00	0.50	0.00	8.00
Mar. 2023	1.00	2.50	1.50	0.50	0.50	0.50	1.50	0.50	1.00	1.50	11.00
Oct. - Mar.	**0.58**	**0.75**	**1.58**	**2.50**	**1.33**	**0.75**	**1.83**	**5.33**	**1.92**	**0.75**	**17.33**

Legend

- Northern Vantage Point (HY 44257 12883)
- Southern Vantage Point (HY 43978 13084)
- Proposed Site Extent
- Survey Sectors
- Fish Cage

Average Bird Count Density per ha

- < 0.005
- 0.005 - 0.015
- 0.015 - 0.025
- 0.025 - 0.035
- 0.035 - 0.045
- >0.045

Do not scale this map

Client
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Project
Orkney Haston Pier

Title
Shag Observations
Northern Sectors - Oct 2022 to March 2023

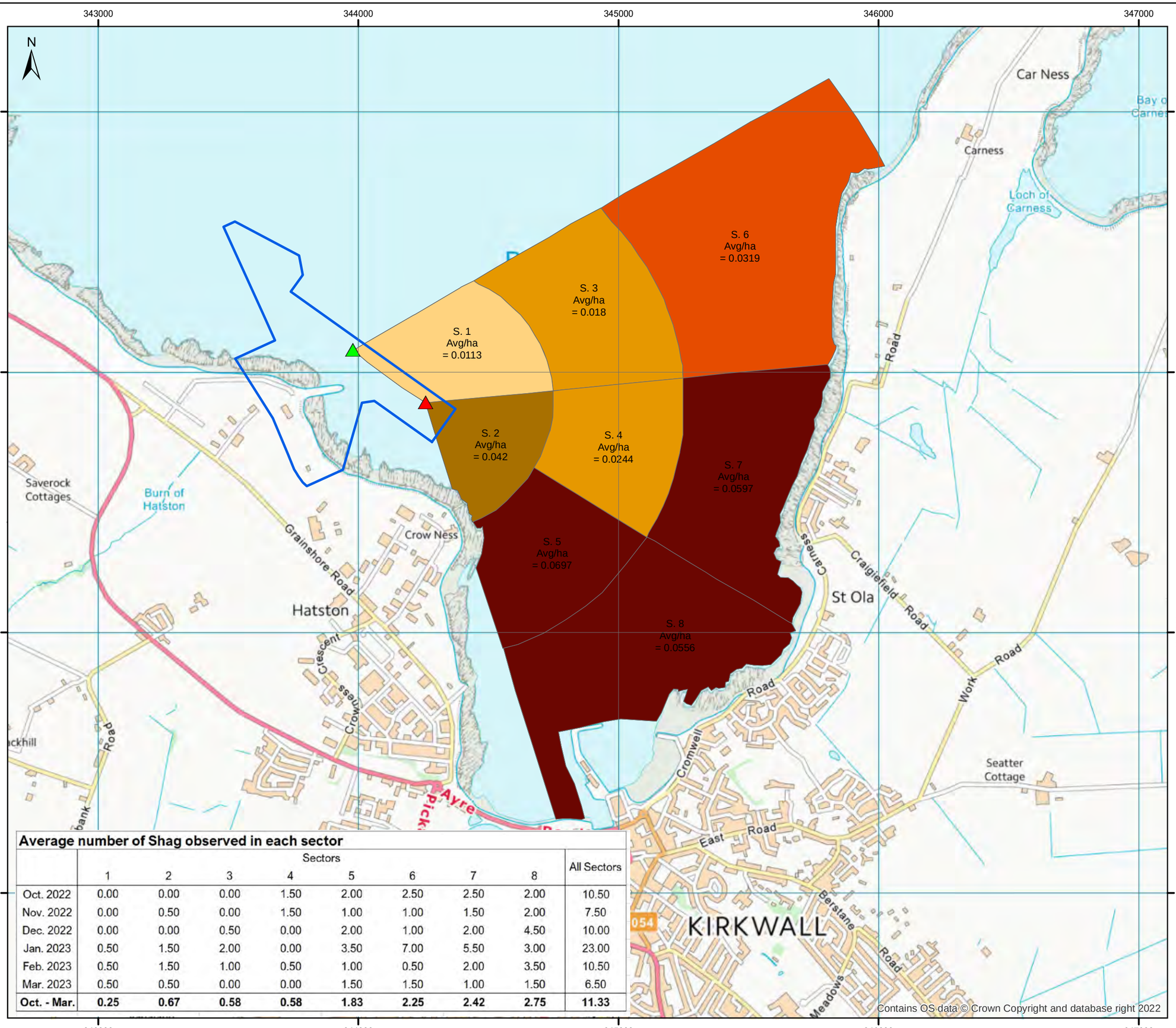
Status
DRAFT

Drawing No.	Revision	Date
674795-GIS101	-	21 March 2023
Drawn	**Checked**	**Approved**
JAS	MS	xx

Scale
1:12,500 @A3
0 62.5 125 250 375 Metres

Rev	Date	Amendment	Initials
-	-	-	-

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Average number of Shag observed in each sector

	Sectors								All Sectors
	1	2	3	4	5	6	7	8	
Oct. 2022	0.00	0.00	0.00	1.50	2.00	2.50	2.50	2.00	10.50
Nov. 2022	0.00	0.50	0.00	1.50	1.00	1.00	1.50	2.00	7.50
Dec. 2022	0.00	0.00	0.50	0.00	2.00	1.00	2.00	4.50	10.00
Jan. 2023	0.50	1.50	2.00	0.00	3.50	7.00	5.50	3.00	23.00
Feb. 2023	0.50	1.50	1.00	0.50	1.00	0.50	2.00	3.50	10.50
Mar. 2023	0.50	0.50	0.00	0.00	1.50	1.50	1.00	1.50	6.50
Oct. - Mar.	**0.25**	**0.67**	**0.58**	**0.58**	**1.83**	**2.25**	**2.42**	**2.75**	**11.33**

Legend

- Northern Vantage Point (HY 44257 12883)
- Southern Vantage Point (HY 43978 13084)
- Proposed Site Extent
- Survey Sectors

Average Bird Count Density per ha

- < 0.005
- 0.005 - 0.015
- 0.015 - 0.025
- 0.025 - 0.035
- 0.035 - 0.045
- >0.045

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Project
Orkney Haston Pier

Title
Shag Observations
Southern Sectors - Oct 2022 to March 2023

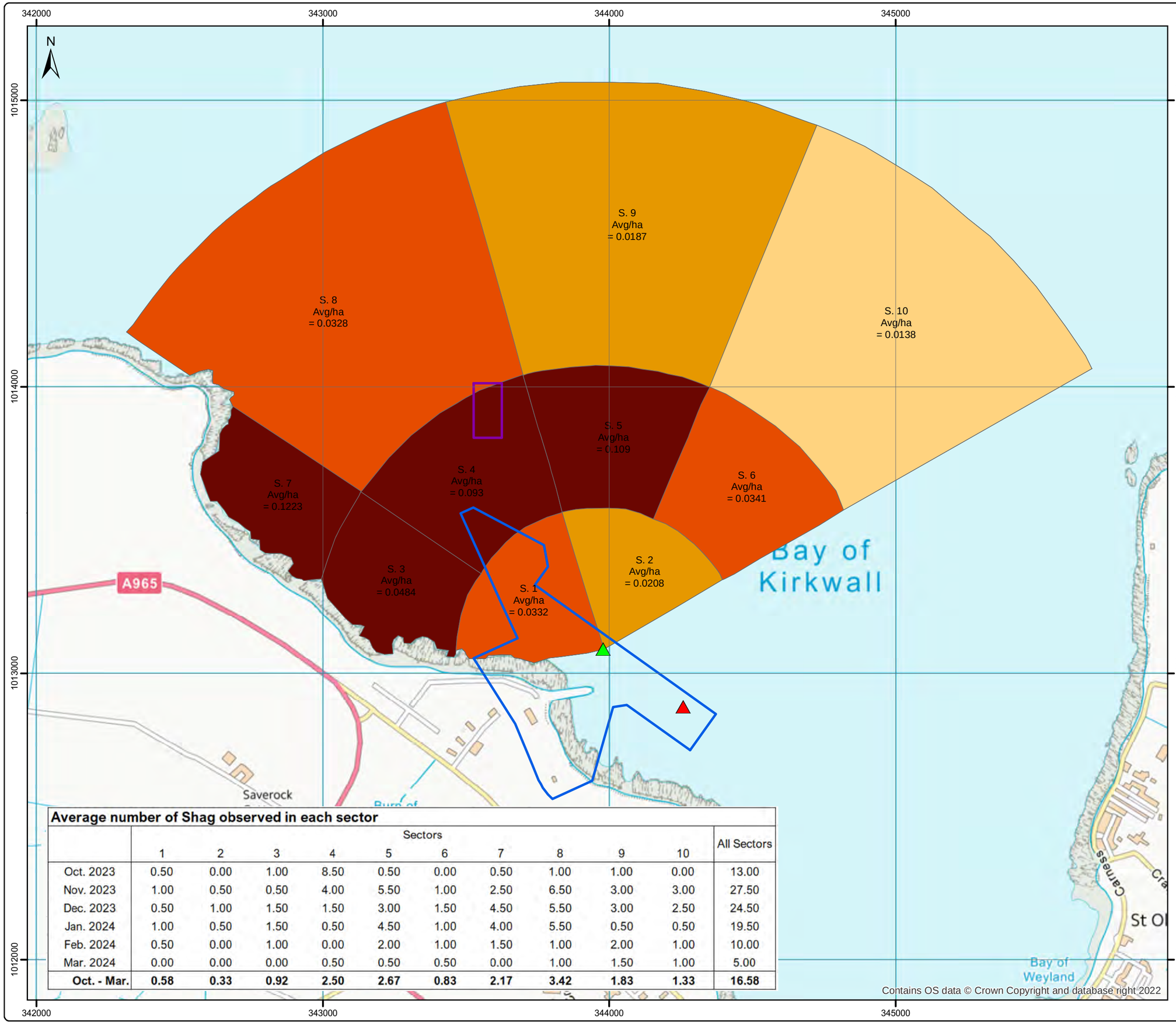
Status
DRAFT

Drawing No.	Revision	Date
674795-GIS102	-	21 March 2023
Drawn	**Checked**	**Approved**
JAS	MS	xx

Scale
1:14,000 @A3
0 70 140 280 420 Metres

Rev	Date	Amendment	Initials
-	-	-	-

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Average number of Shag observed in each sector

	Sectors										All Sectors
	1	2	3	4	5	6	7	8	9	10	
Oct. 2023	0.50	0.00	1.00	8.50	0.50	0.00	0.50	1.00	1.00	0.00	13.00
Nov. 2023	1.00	0.50	0.50	4.00	5.50	1.00	2.50	6.50	3.00	3.00	27.50
Dec. 2023	0.50	1.00	1.50	1.50	3.00	1.50	4.50	5.50	3.00	2.50	24.50
Jan. 2024	1.00	0.50	1.50	0.50	4.50	1.00	4.00	5.50	0.50	0.50	19.50
Feb. 2024	0.50	0.00	1.00	0.00	2.00	1.00	1.50	1.00	2.00	1.00	10.00
Mar. 2024	0.00	0.00	0.00	0.50	0.50	0.50	0.00	1.00	1.50	1.00	5.00
Oct. - Mar.	**0.58**	**0.33**	**0.92**	**2.50**	**2.67**	**0.83**	**2.17**	**3.42**	**1.83**	**1.33**	**16.58**

Legend

- Northern Vantage Point (HY 44257 12883)
- Southern Vantage Point (HY 43978 13084)
- Fish Cage
- Survey Sectors
- Proposed Site Extent

Average Bird Count Density per ha

- < 0.005
- 0.005 - 0.015
- 0.015 - 0.025
- 0.025 - 0.035
- 0.035 - 0.045
- >0.045

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Project
Orkney Haston Pier

Title
Shag Observations
Northern Sectors - Oct 2023 to March 2024

Status
FINAL

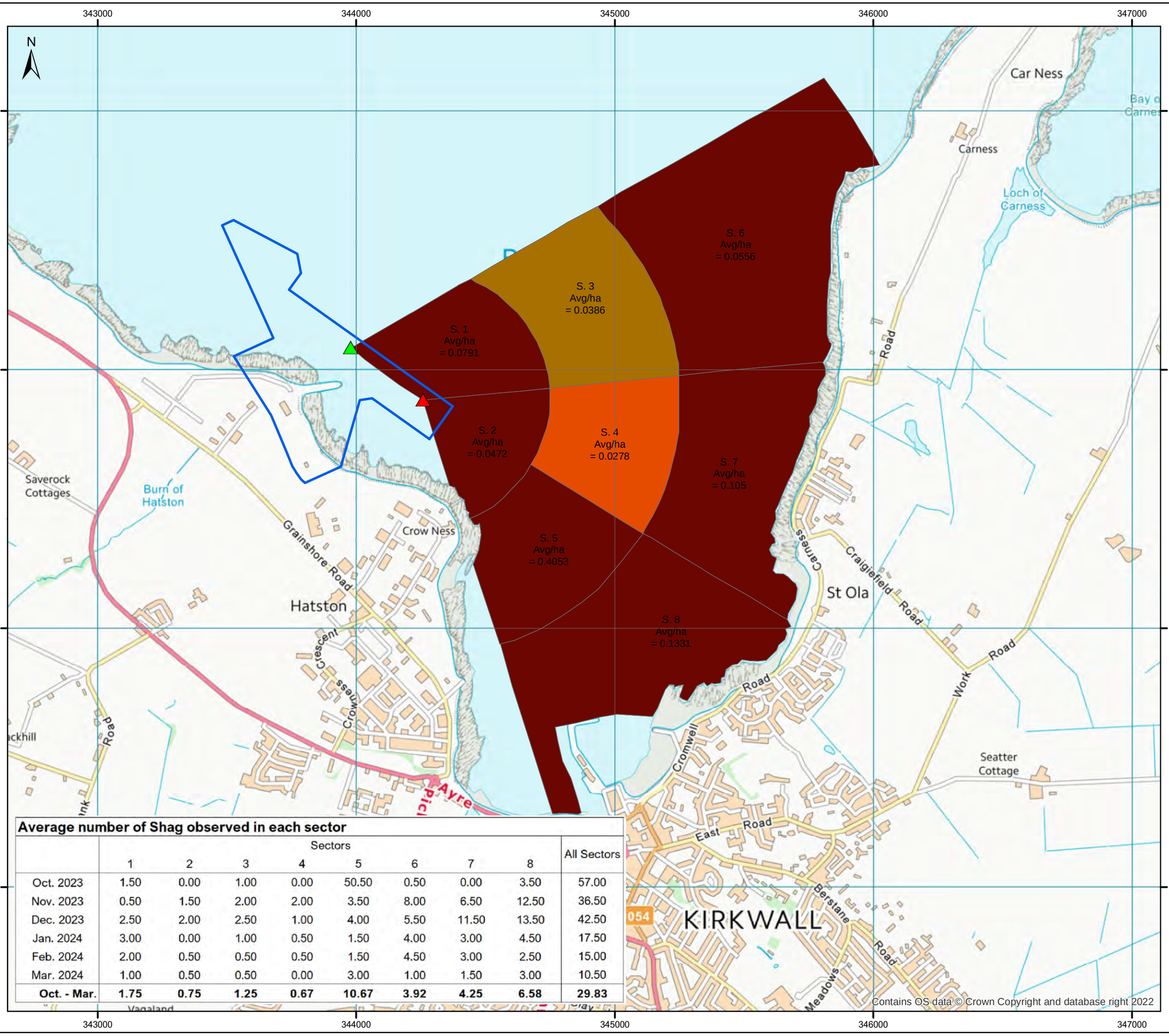
Drawing No.	Revision	Date
674795-GIS178	-	29 April 2024
Drawn	**Checked**	**Approved**
JAS	MS	MS

Scale
1:12,500 @A3
0 62.5 125 250 375 Metres

Rev	Date	Amendment	Initials
-	-	-	-

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Average number of Shag observed in each sector

	Sectors								All Sectors
	1	2	3	4	5	6	7	8	
Oct. 2023	1.50	0.00	1.00	0.00	50.50	0.50	0.00	3.50	57.00
Nov. 2023	0.50	1.50	2.00	2.00	3.50	8.00	6.50	12.50	36.50
Dec. 2023	2.50	2.00	2.50	1.00	4.00	5.50	11.50	13.50	42.50
Jan. 2024	3.00	0.00	1.00	0.50	1.50	4.00	3.00	4.50	17.50
Feb. 2024	2.00	0.50	0.50	0.50	1.50	4.50	3.00	2.50	15.00
Mar. 2024	1.00	0.50	0.50	0.00	3.00	1.00	1.50	3.00	10.50
Oct. - Mar.	**1.75**	**0.75**	**1.25**	**0.67**	**10.67**	**3.92**	**4.25**	**6.58**	**29.83**

Legend

- Northern Vantage Point (HY 44257 12883)
- Southern Vantage Point (HY 43978 13084)
- Proposed Site Extent

Average Bird Count Density per ha

- < 0.005
- 0.005 - 0.015
- 0.015 - 0.025
- 0.025 - 0.035
- 0.035 - 0.045
- >0.045
- Survey Sectors

Do not scale this map

Client
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Project
Orkney Haston Pier

Title
Shag Observations
Southern Sectors - Oct 2023 to March 2024

Status
FINAL

Drawing No.	Revision	Date
674795-GIS179	-	30 April 2024
Drawn	**Checked**	**Approved**
JAS	MS	MS

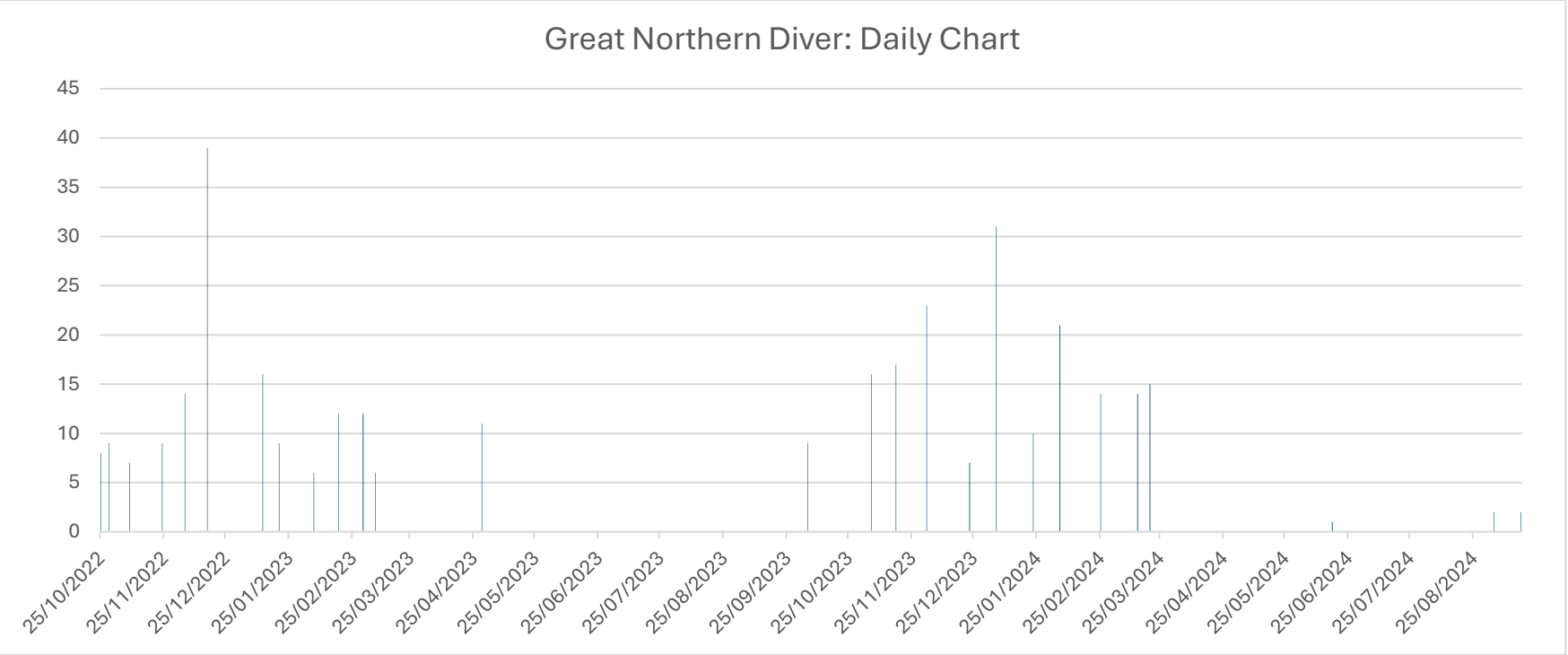
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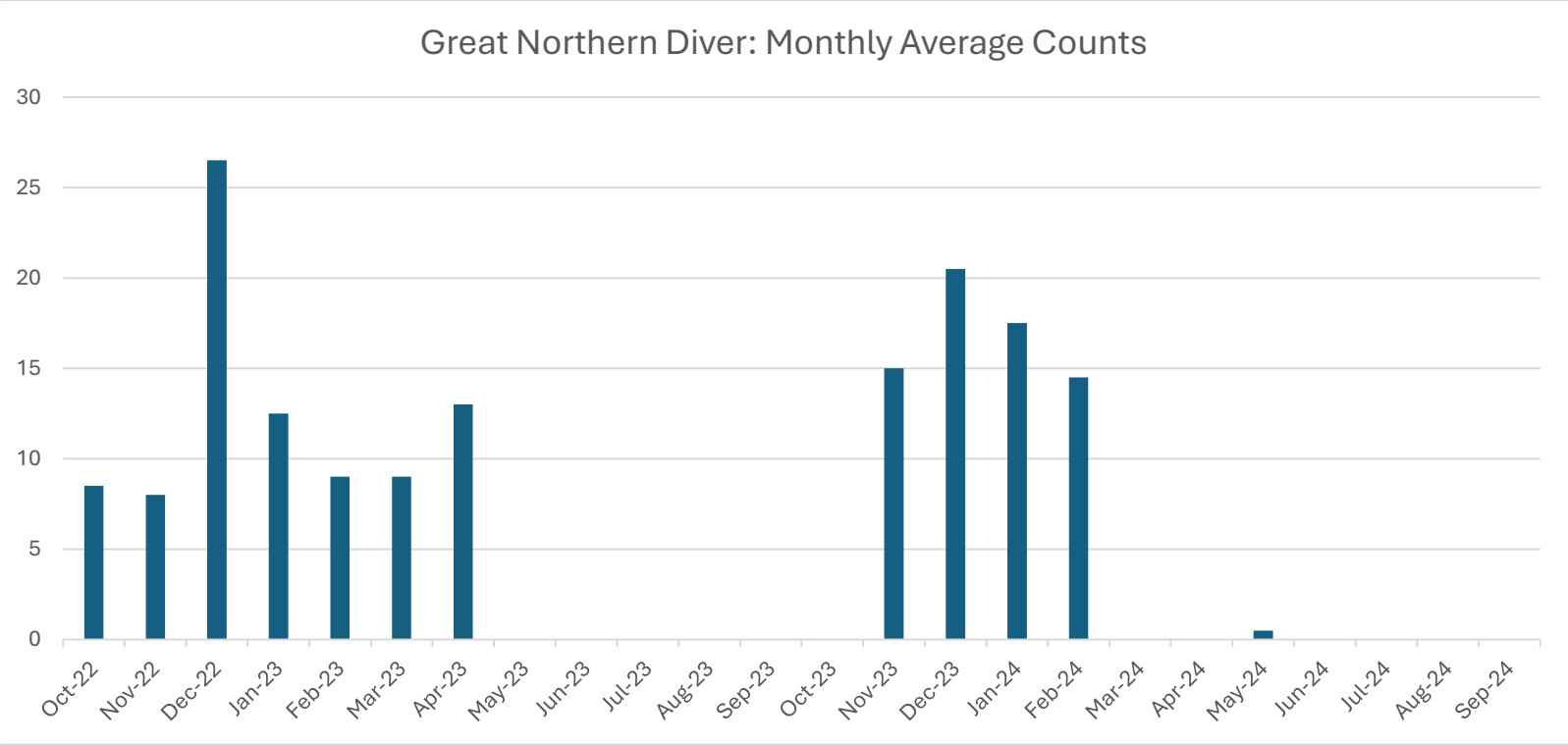
Rev	Date	Amendment	Initials
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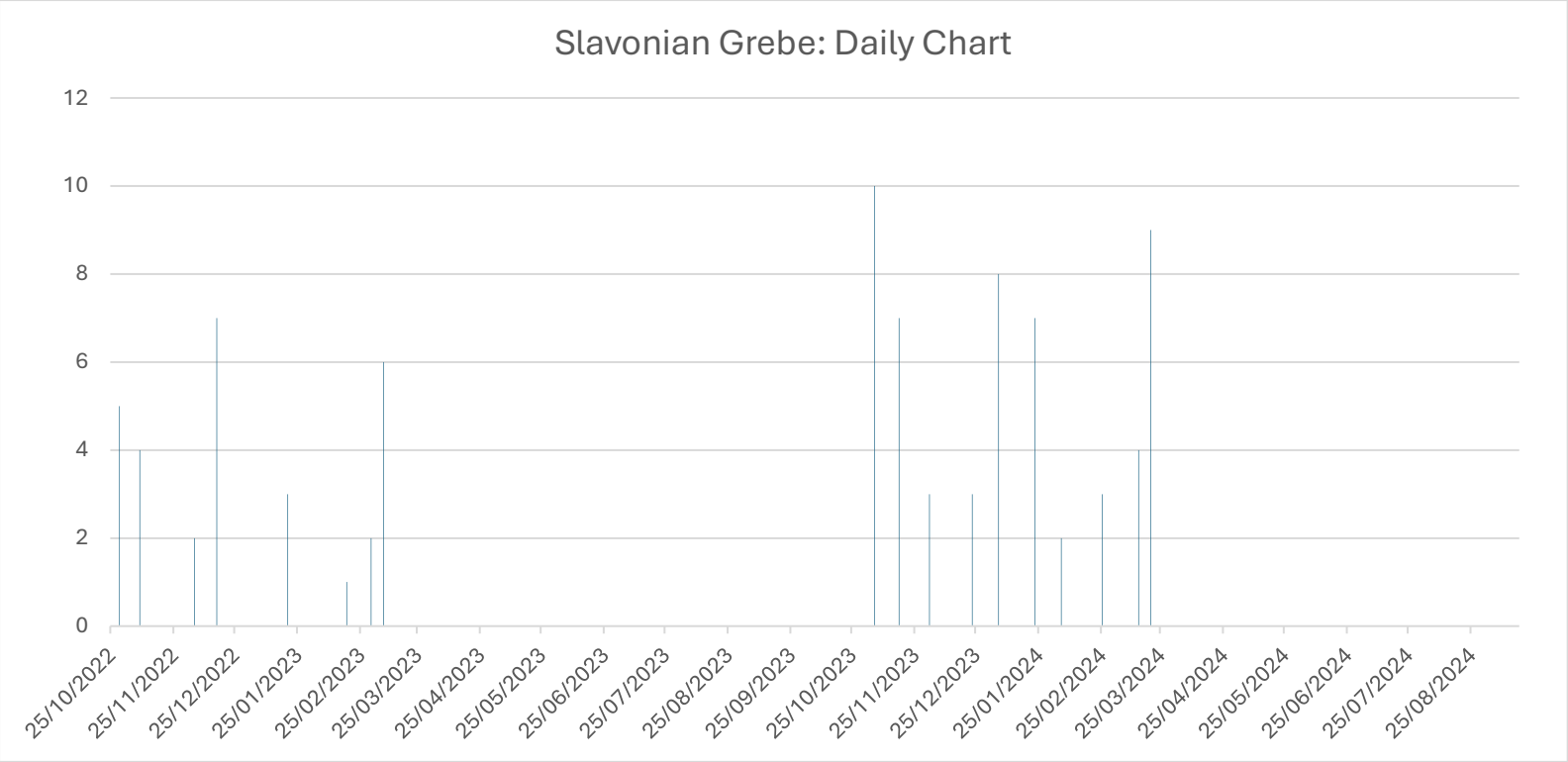
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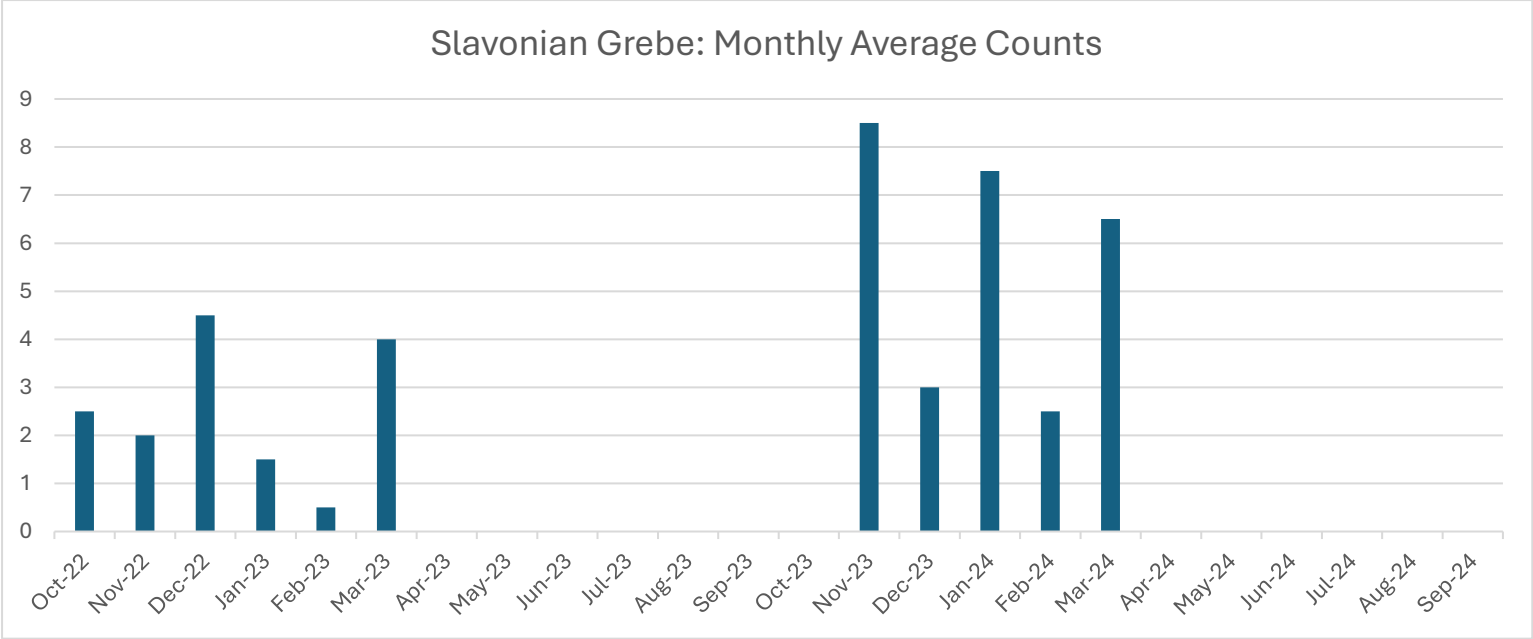
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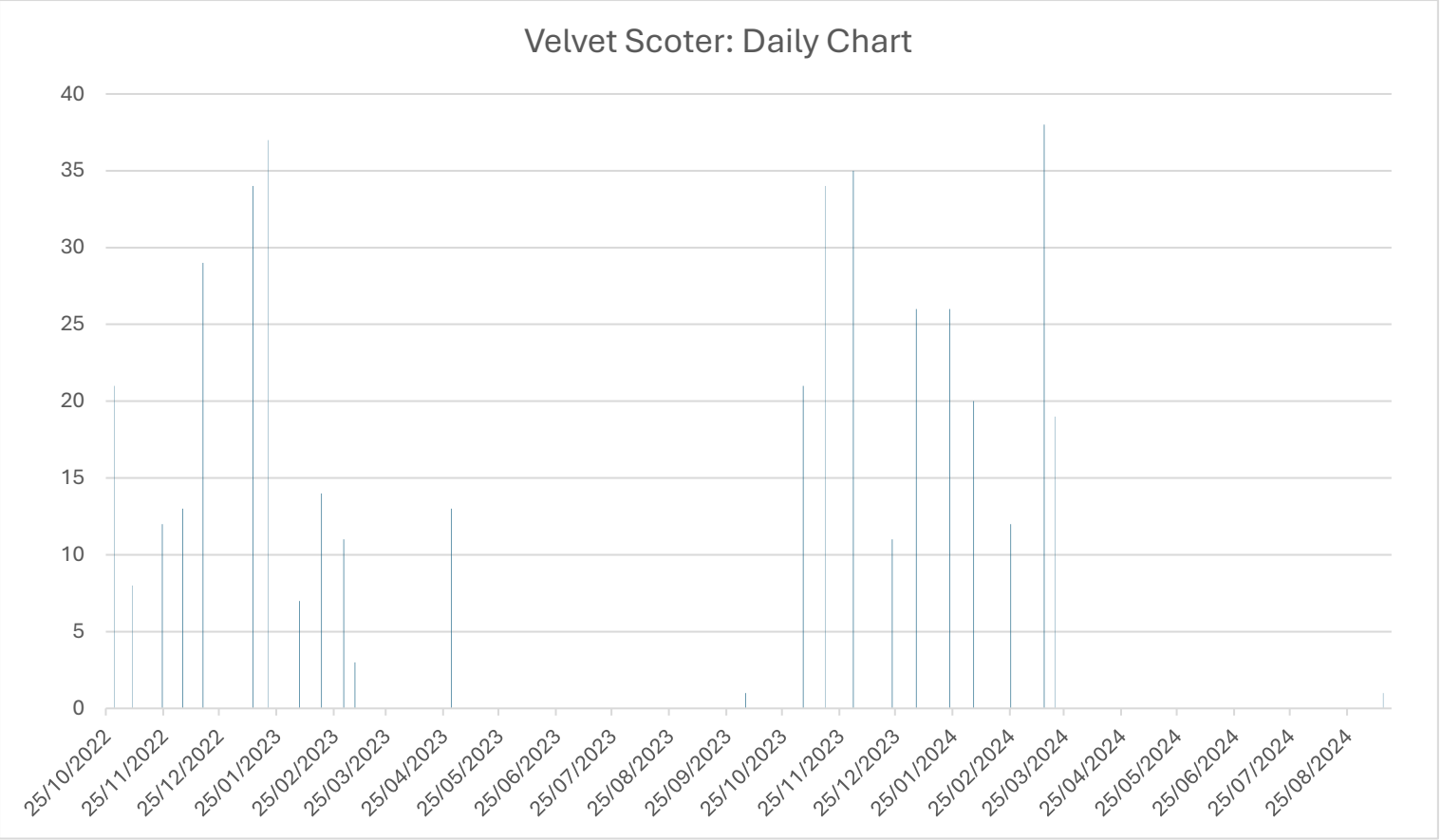
D DAILY AND MONTHLY BAR CHARTS (SPA SPECIES)

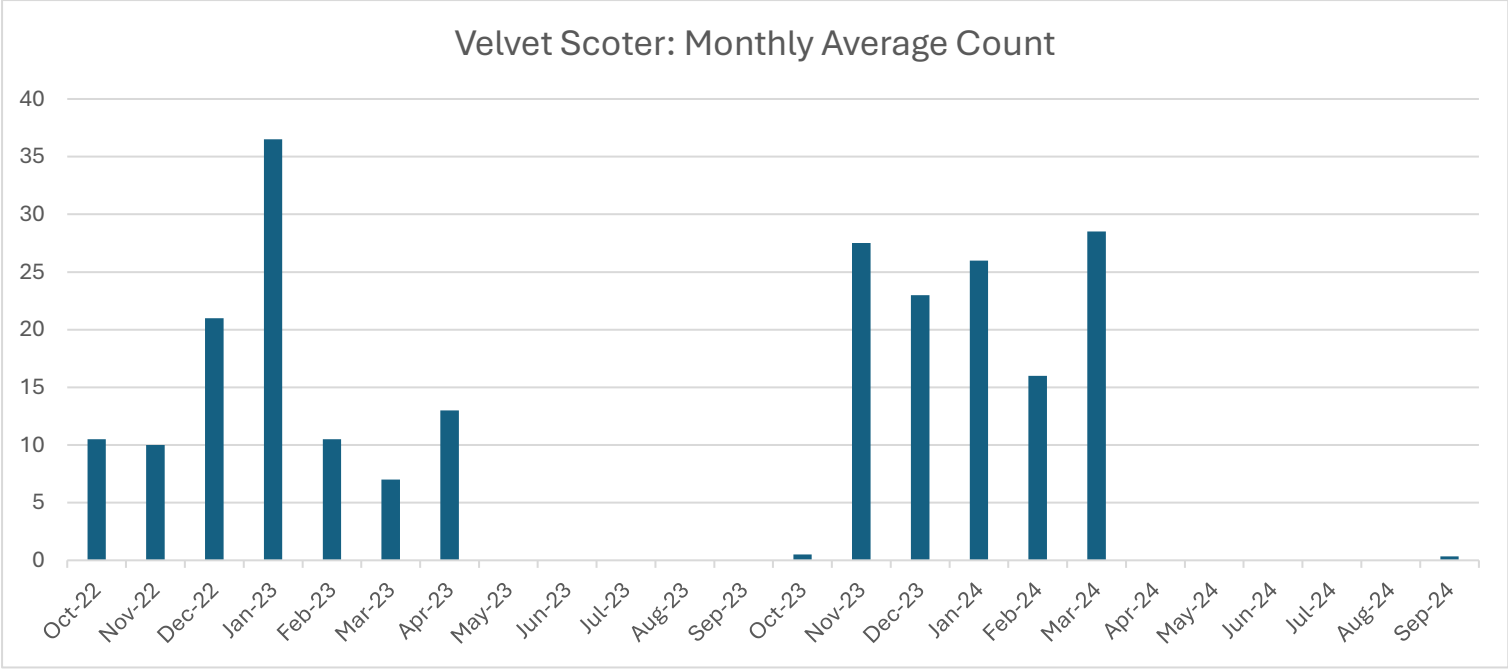

Great Northern Diver: Daily Chart
45
40
35
30
25
20
15
10
5
0
25/10/2022
25/11/2022
25/12/2022
25/01/2023
25/02/2023
25/03/2023
25/04/2023
25/05/2023
25/06/2023
25/07/2023
25/08/2023
25/09/2023
25/10/2023
25/11/2023
25/12/2023
25/01/2024
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25/07/2024
25/08/2024

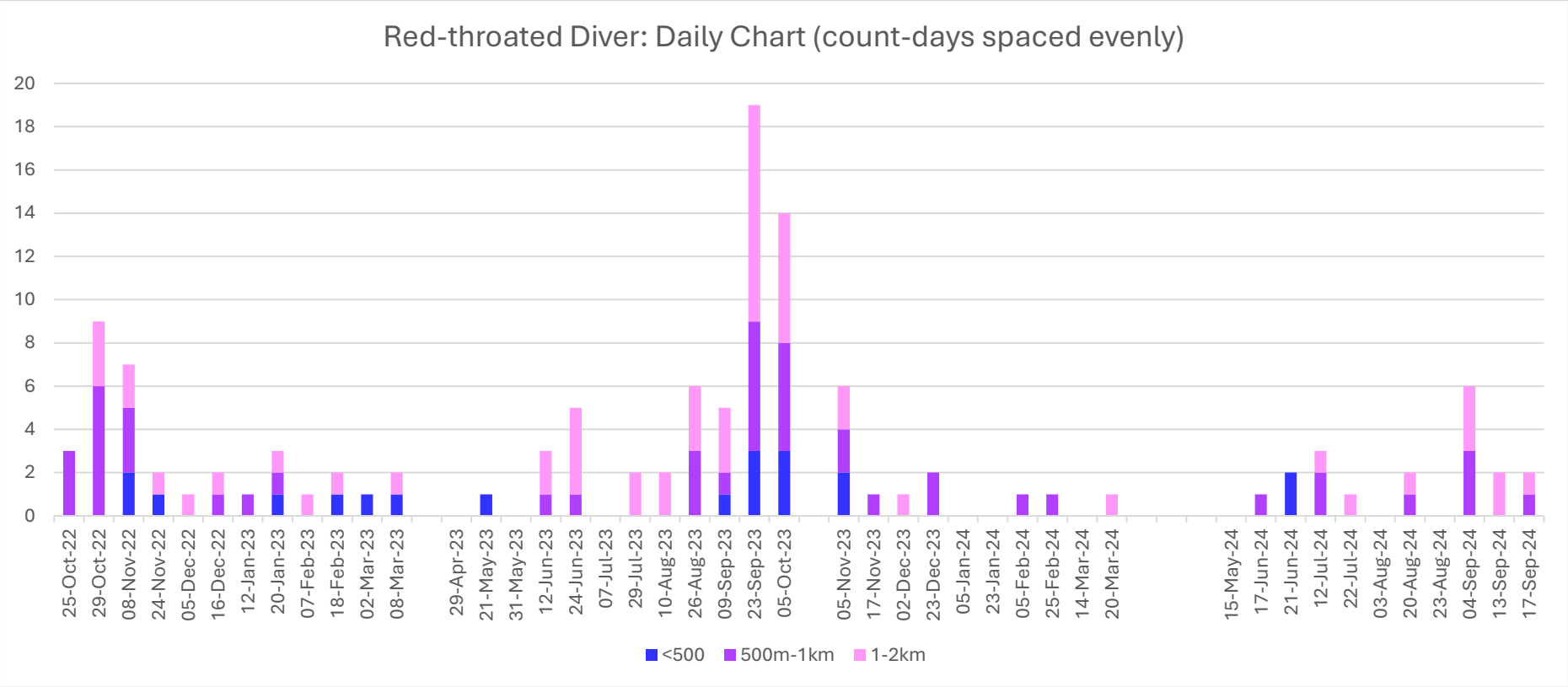

Great Northern Diver: Monthly Average Counts
30
25
20
15
10
5
0
Oct-22
Nov-22
Dec-22
Jan-23
Feb-23
Mar-23
Apr-23
May-23
Jun-23
Jul-23
Aug-23
Sep-23
Oct-23
Nov-23
Dec-23
Jan-24
Feb-24
Mar-24
Apr-24
May-24
Jun-24
Jul-24
Aug-24
Sep-24

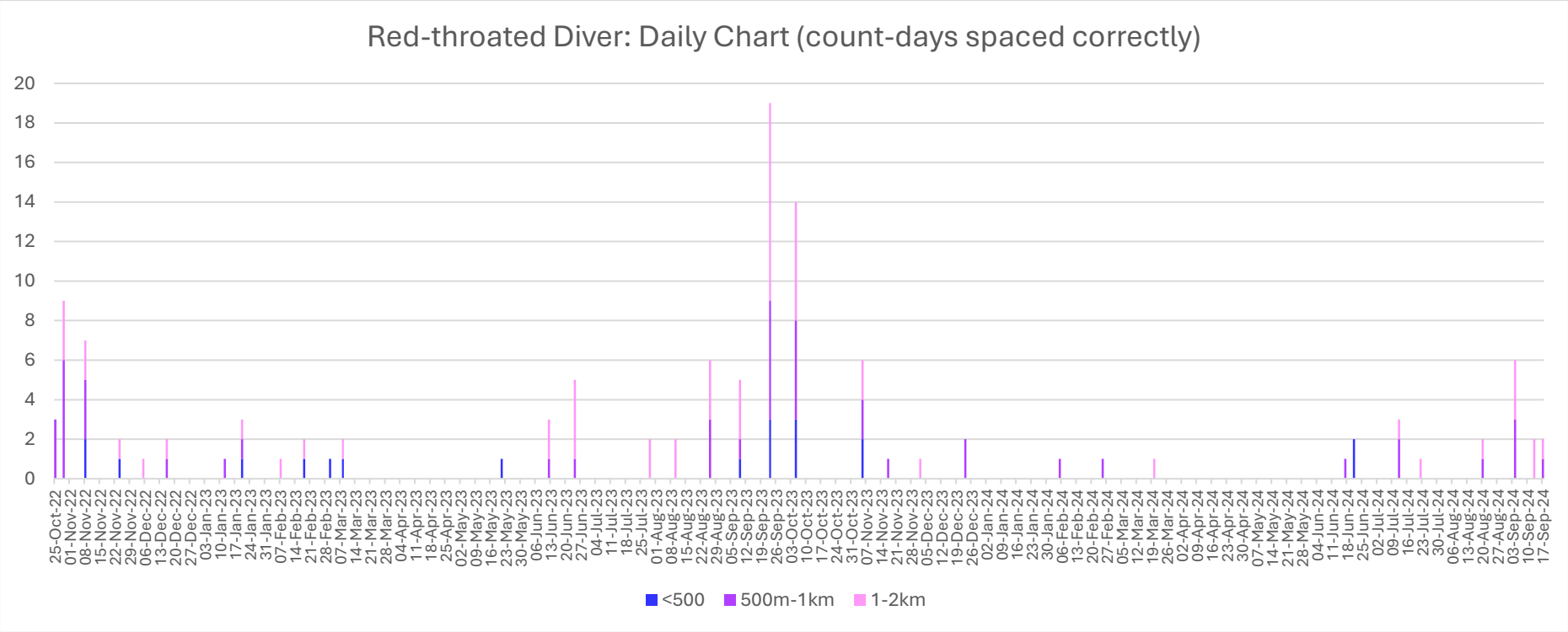

Slavonian Grebe: Daily Chart
12
10
8
6
4
2
0
25/10/2022
25/11/2022
25/12/2022
25/01/2023
25/02/2023
25/03/2023
25/04/2023
25/05/2023
25/06/2023
25/07/2023
25/08/2023
25/09/2023
25/10/2023
25/11/2023
25/12/2023
25/01/2024
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25/07/2024
25/08/2024

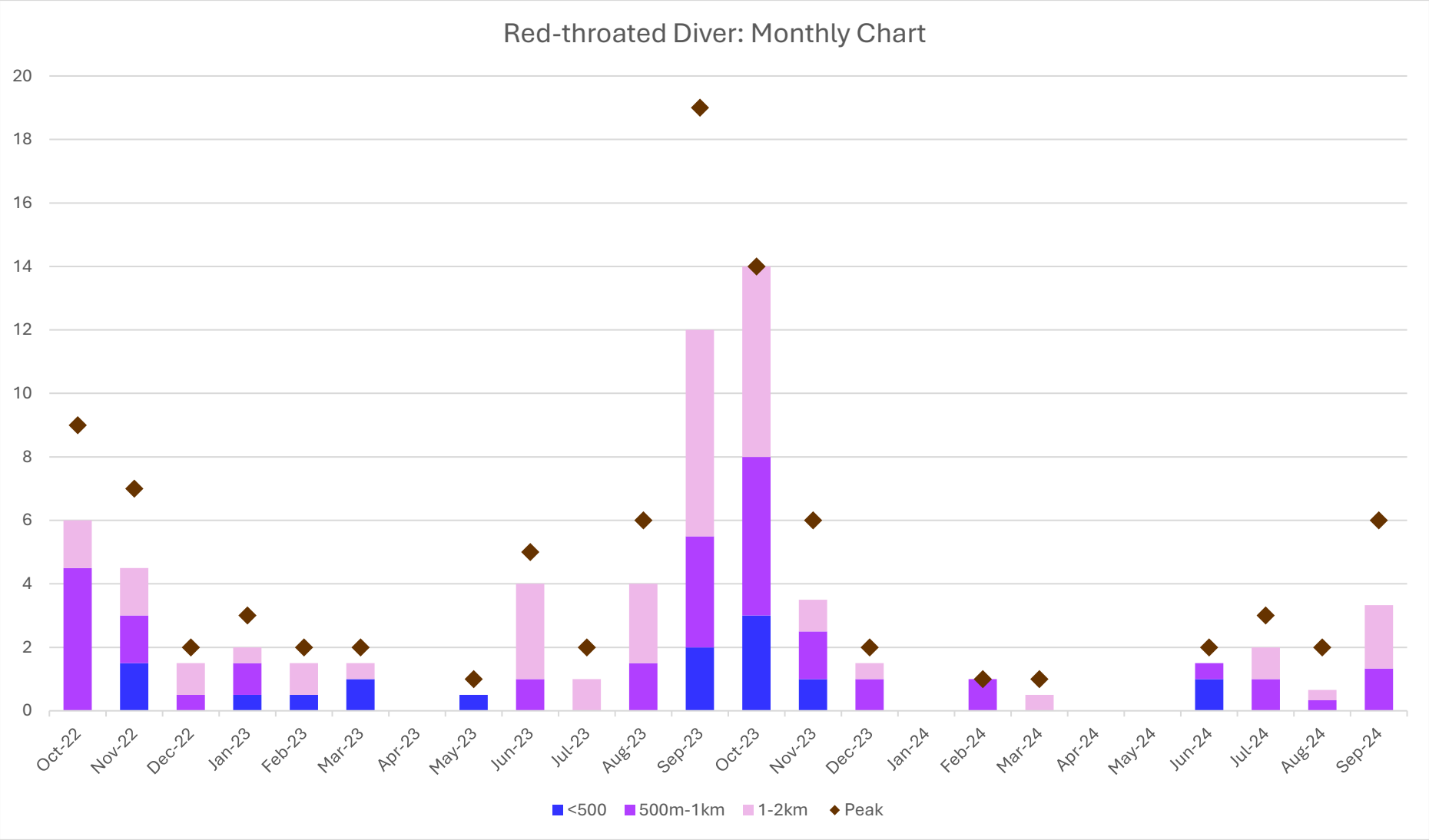

Slavonian Grebe: Monthly Average Counts
9
8
7
6
5
4
3
2
1
0
Oct-22
Nov-22
Dec-22
Jan-23
Feb-23
Mar-23
Apr-23
May-23
Jun-23
Jul-23
Aug-23
Sep-23
Oct-23
Nov-23
Dec-23
Jan-24
Feb-24
Mar-24
Apr-24
May-24
Jun-24
Jul-24
Aug-24
Sep-24


Velvet Scoter: Daily Chart
40
35
30
25
20
15
10
5
0
25/10/2022
25/11/2022
25/12/2022
25/01/2023
25/02/2023
25/03/2023
25/04/2023
25/05/2023
25/06/2023
25/07/2023
25/08/2023
25/09/2023
25/10/2023
25/11/2023
25/12/2023
25/01/2024
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25/07/2024
25/08/2024

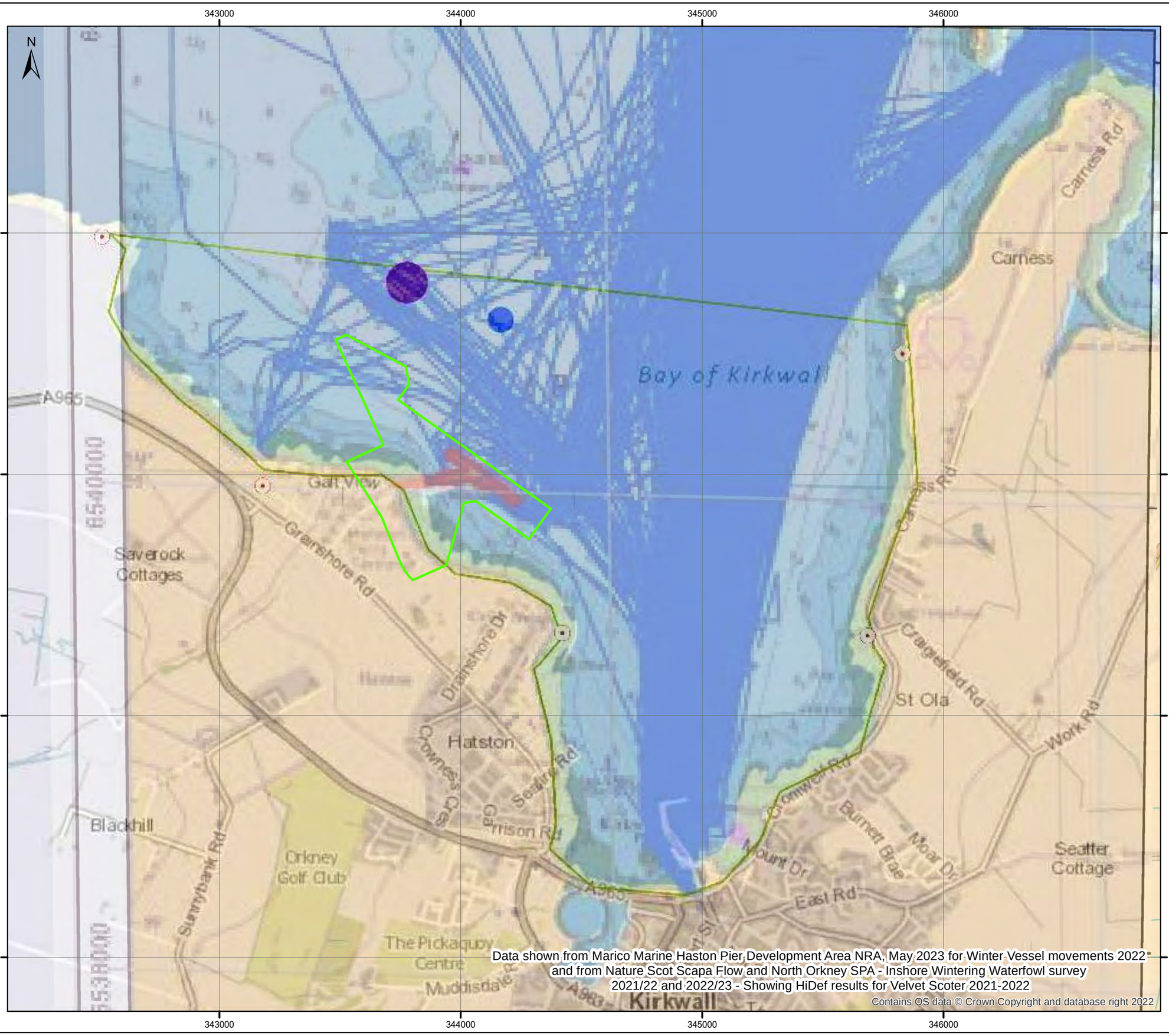

Velvet Scoter: Monthly Average Count
40
35
30
25
20
15
10
5
0
Oct-22
Nov-22
Dec-22
Jan-23
Feb-23
Mar-23
Apr-23
May-23
Jun-23
Jul-23
Aug-23
Sep-23
Oct-23
Nov-23
Dec-23
Jan-24
Feb-24
Mar-24
Apr-24
May-24
Jun-24
Jul-24
Aug-24
Sep-24


Red-throated Diver: Daily Chart (count-days spaced evenly)
20
18
16
14
12
10
8
6
4
2
0
25-Oct-22
29-Oct-22
08-Nov-22
24-Nov-22
05-Dec-22
16-Dec-22
12-Jan-23
20-Jan-23
07-Feb-23
18-Feb-23
02-Mar-23
08-Mar-23
29-Apr-23
21-May-23
31-May-23
12-Jun-23
24-Jun-23
07-Jul-23
29-Jul-23
10-Aug-23
26-Aug-23
09-Sep-23
23-Sep-23
05-Oct-23
05-Nov-23
17-Nov-23
02-Dec-23
23-Dec-23
05-Jan-24
23-Jan-24
05-Feb-24
25-Feb-24
14-Mar-24
20-Mar-24
15-May-24
17-Jun-24
21-Jun-24
12-Jul-24
22-Jul-24
03-Aug-24
20-Aug-24
23-Aug-24
04-Sep-24
13-Sep-24
17-Sep-24
<500
500m-1km
1-2km


Red-throated Diver: Daily Chart (count-days spaced correctly)
20
18
16
14
12
10
8
6
4
2
0
25-Oct-22
01-Nov-22
08-Nov-22
15-Nov-22
22-Nov-22
29-Nov-22
06-Dec-22
13-Dec-22
20-Dec-22
27-Dec-22
03-Jan-23
10-Jan-23
17-Jan-23
24-Jan-23
31-Jan-23
07-Feb-23
14-Feb-23
21-Feb-23
28-Feb-23
07-Mar-23
14-Mar-23
21-Mar-23
28-Mar-23
04-Apr-23
11-Apr-23
18-Apr-23
25-Apr-23
02-May-23
09-May-23
16-May-23
23-May-23
30-May-23
06-Jun-23
13-Jun-23
20-Jun-23
27-Jun-23
04-Jul-23
11-Jul-23
18-Jul-23
25-Jul-23
01-Aug-23
08-Aug-23
15-Aug-23
22-Aug-23
29-Aug-23
05-Sep-23
12-Sep-23
19-Sep-23
26-Sep-23
03-Oct-23
10-Oct-23
17-Oct-23
24-Oct-23
31-Oct-23
07-Nov-23
14-Nov-23
21-Nov-23
28-Nov-23
05-Dec-23
12-Dec-23
19-Dec-23
26-Dec-23
02-Jan-24
09-Jan-24
16-Jan-24
23-Jan-24
30-Jan-24
06-Feb-24
13-Feb-24
20-Feb-24
27-Feb-24
05-Mar-24
12-Mar-24
19-Mar-24
26-Mar-24
02-Apr-24
09-Apr-24
16-Apr-24
23-Apr-24
30-Apr-24
07-May-24
14-May-24
21-May-24
28-May-24
04-Jun-24
11-Jun-24
18-Jun-24
25-Jun-24
02-Jul-24
09-Jul-24
16-Jul-24
23-Jul-24
30-Jul-24
06-Aug-24
13-Aug-24
20-Aug-24
27-Aug-24
03-Sep-24
10-Sep-24
17-Sep-24
<500
500m-1km
1-2km


Red-throated Diver: Monthly Chart
20
18
16
14
12
10
8
6
4
2
0
Oct-22
Nov-22
Dec-22
Jan-23
Feb-23
Mar-23
Apr-23
May-23
Jun-23
Jul-23
Aug-23
Sep-23
Oct-23
Nov-23
Dec-23
Jan-24
Feb-24
Mar-24
Apr-24
May-24
Jun-24
Jul-24
Aug-24
Sep-24
<500
500m-1km
1-2km
Peak

E HIDEF SURVEY DATA MAPS (SPA SPECIES)



Legend

Proposed Site Extent

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Client
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Project
Orkney Haston Pier

Title
Winter 2022 Vessel Movements and observations of Velvet Scoter 2021-2022

Status
DRAFT FOR COMMENT

Drawing No.	Revision	Date
674795-GIS206	-	17 Jan 2025
Drawn	**Checked**	**Approved**
JAS	MS	MS

Scale
1:15,000 @A3
0 75 150 300 450 Metres

Rev	Date	Amendment	Initials
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1014000 1013000 1012000 1011000

N

Bay of Kirkwall

Carness

Carness Rd

A965

B9040

Galt View

Grainshore Rd

Saverock Cottages

Drainshore Dr

Hatston

Crowness Cswy

Seafire Rd

Garrison Rd

Craigfield Rd

St Ola

Work Rd

Cromwell Rd

Burnett Brae

Moar Dr

Mount Dr

East Rd

Seatter Cottage

Blackhill

Sunnybank Rd

Orkney Golf Club

The Pickaquoy Centre

Muddisdale Rd

Kirkwall

Data shown from Marico Marine Haston Pier Development Area NRA, May 2023 for Winter Vessel movements 2022 and from Nature Scot Scapa Flow and North Orkney SPA - Inshore Wintering Waterfowl survey 2021/22 and 2022/23 - Showing HiDef results for Great-Northern Diver 2021-2022

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Legend

Proposed Site Extent

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Client
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Project
Orkney Haston Pier

Title
Winter 2022 Vessel Movements and observations of Great-Northern Diver 2021-2022

Status
DRAFT FOR COMMENT

Drawing No.	Revision	Date
674795-GIS204	-	17 Jan 2025
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N

Bay of Kirkwall

Carness

Carness Rd

A965

B9040

Graemeshall

Gait View

Grainshore Rd

Saverock Cottages

Drainshore Dr

Crowness Cres

Hatston

Seatter Rd

Grimison Rd

Blackhill

Sunnybank Rd

Orkney Golf Club

The Pickaquoy Centre

Muddisdale

A963

Kirkwall

Craigfield Rd

St Ola

Work Rd

Cromwell Rd

Mount Dr

Burnet Brae

Moar Dr

East Rd

Seatter Cottage

Data shown from Marico Marine Haston Pier Development Area NRA, May 2023 for Winter Vessel movements 2022 and from Nature Scot Scapa Flow and North Orkney SPA - Inshore Wintering Waterfowl survey 2021/22 and 2022/23 - Showing HiDef results for Great-Northern Diver 2022-2023

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Project
Orkney Haston Pier

Title
Winter 2022 Vessel Movements and observations of Great-Northern Diver 2022-2023

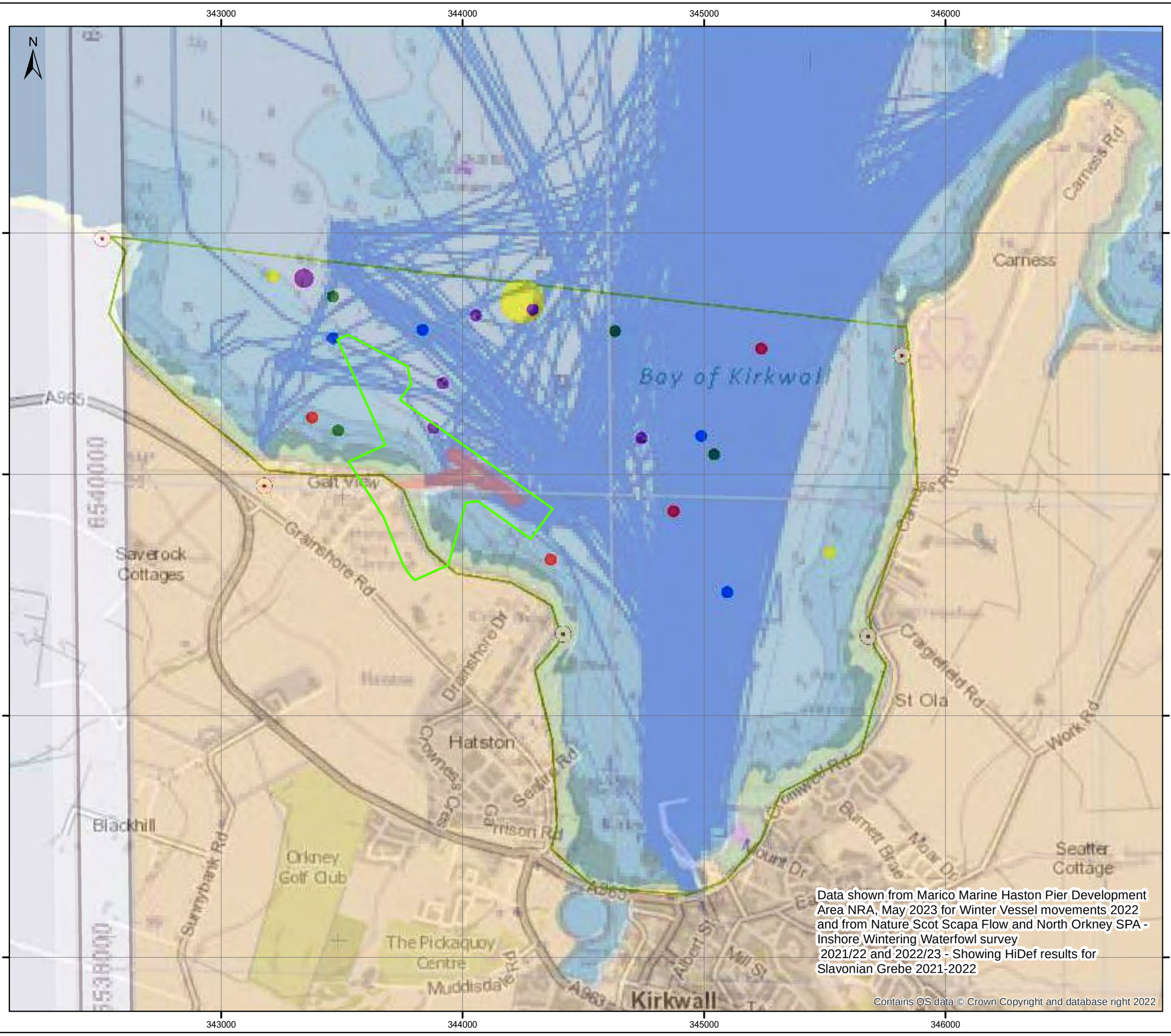
Status
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Drawing No.	Revision	Date
674795-GIS207	-	17 Jan 2025
Drawn	**Checked**	**Approved**
JAS	MS	MS

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Client
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Project
Orkney Haston Pier

Title
Winter 2022 Vessel Movements and observations of Slavonian Grebe 2021-2022

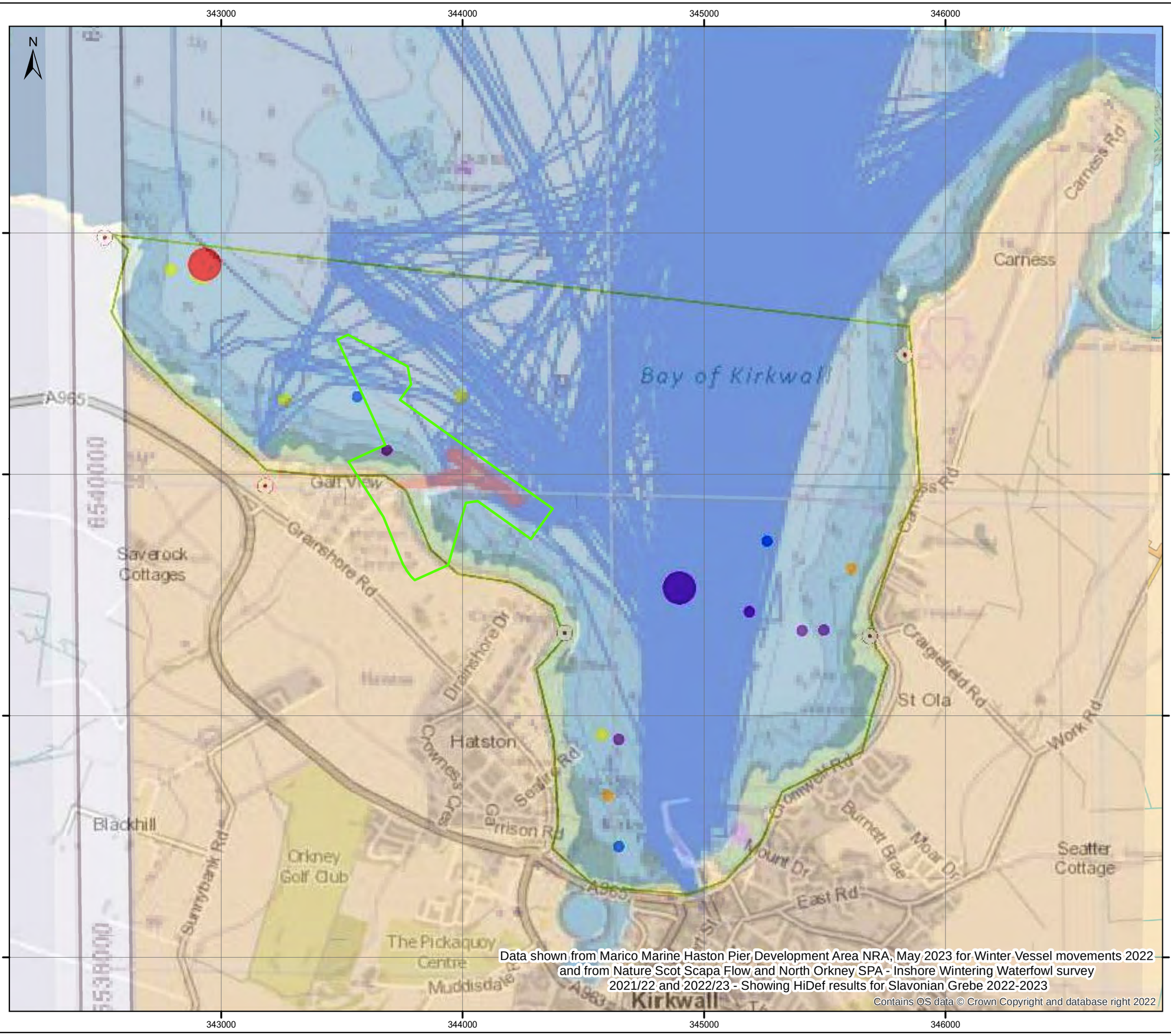
Status
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Drawing No.	Revision	Date
674795-GIS205	-	17 Jan 2025
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Proposed Site Extent

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Client
Orkney Islands Council Harbour Authority

Project
Orkney Haston Pier

Title
Winter 2022 Vessel Movements and observations of Slavonian Grebe 2022-2023

Status
DRAFT FOR COMMENT

Drawing No.	Revision	Date
674795-GIS208	-	17 Jan 2025
Drawn	**Checked**	**Approved**
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F BIRD/BOAT INTERACTIONS

Boat ref no.	Species ref no.	Date	Time start	Time end	Boat type	Boat direction	Speed	Species	Number	Distance	Reaction/Evasion	Comment
A	1	25-Oct-22	16:23	16:31	tug		slow	GU	1	<100m	none	
A	2	25-Oct-22	16:23	16:31	tug		slow	LN	12	100-200m	flying up	flew c.250m (with display calls); on alighting then swam slowly back towards their original position
A	3	25-Oct-22	16:23	16:31	tug		slow	E.	1	c.100m	slow swim away	
B	4	29-Oct-22	c.10:00	1-2 mins	creel boat		slow	RH	1	c.200m	diving, but not moving away	this bird was already actively foraging and diving, so no obvious change in behaviour
C	4	29-Oct-22	c.10:01	1-2 mins	Earl T		quite fast	RH	1	100-200m	diving, but not moving away	this bird was already actively foraging and diving, so no obvious change in behaviour
D	5	29-Oct-22	13:35	13:40	creel boat		slow	LN	16	100-150m	none	
D	6	29-Oct-22	13:35	13:40	creel boat		slow	E.	2	100-150m	none	

Boat ref no.	Species ref no.	Date	Time start	Time end	Boat type	Boat direction	Speed	Species	Number	Distance	Reaction/Evasion	Comment
D	7	29-Oct-22	13:35	13:40	creel boat		slow	TY	1	100-150m	none	
E	5	29-Oct-22	13:43	13:49	Shapinsay		quite fast	LN	16	c.300m	none	
E	6	29-Oct-22	13:43	13:49	Shapinsay		quite fast	E.	2	c.300m	none	
E	7	29-Oct-22	13:43	13:49	Shapinsay		quite fast	TY	1	c.300m	none	
		08-Nov-22	watch from 14:15 to 14:45 - MV Shapinsay out but only a very thin scattering of LN visible in bay - no interactions noted									
F	8	24-Nov-22	09:20	not timed	Shapinsay		quite fast	ND	1	400-500m	flying out of bay	picked up already in flight, but thought to be shortly after take-off
F	9	24-Nov-22	09:20	not timed	Shapinsay		quite fast	ND	1	c.500m	none	
G	10	24-Nov-22	10:20	not timed	Earl T		quite fast	ND	2	c.300m	slow swim away & dive	with 2 BV - already foraging
G	10	24-Nov-22	10:20	not timed	Earl T		quite fast	BV	2	c.300m	slow swim away & dive	with 2 ND - already foraging
H	11	24-Nov-22	10:52	not timed	Earl S		quite fast	RH	1	c.400m	none	bird preening
I	12	24-Nov-22	11:55	not timed	yacht (sailing)		quite fast	RH	1	c.400m	flying away approx 1.5km	seen alert, then flying away west and down beyond fish cages

Boat ref no.	Species ref no.	Date	Time start	Time end	Boat type	Boat direction	Speed	Species	Number	Distance	Reaction/Evasion	Comment
J	13	24-Nov-22	13:45	not timed	workboat		slow	E.	tens	<25m	paddling/short flights	boat heading straight through a dense flock, which moved a few tens of metres to either side, but no further
K	14	05-Dec-22	13:17	13:27	charter boat		quite fast	ND	1	500m	probably no change	bird was already swimming steadily in this direction when the boat appeared, and continued to do so
K	15	05-Dec-22	13:17	13:27	charter boat		quite fast	ND	1	c.200m	none apparent	in a group with 7 LN and 1 SA; boat passed south at 13:26
K	15	05-Dec-22	13:17	13:27	charter boat		quite fast	LN	7	c.200m	none apparent	in a group with 1 ND and 1 SA; boat passed south at 13:26
K	15	05-Dec-22	13:17	13:27	charter boat		quite fast	SA	1	c.200m	none apparent	in a group with 1 ND and 7 LN; boat

Boat ref no.	Species ref no.	Date	Time start	Time end	Boat type	Boat direction	Speed	Species	Number	Distance	Reaction/Evasion	Comment
												passed south at 13:26
L	15	05-Dec-22	13:24	13:27	workboat		slow	ND	1	100-150m	dived	in a group with 7 LN and 1 SA; boat passed north at 13:27; diver not refound straight away, but an actively foraging ND several minutes later a few hundred metres to N was probably this bird
L	15	05-Dec-22	13:24	13:27	workboat		slow	LN	7	100-150m	1 flew off, the rest appeared unmoved	in a group with 1 ND and 7 LN; boat passed north at 13:27
L	15	05-Dec-22	13:24	13:27	workboat		slow	SA	1	100-150m	none apparent	in a group with 1 ND and 7 LN; boat passed north at 13:27

Boat ref no.	Species ref no.	Date	Time start	Time end	Boat type	Boat direction	Speed	Species	Number	Distance	Reaction/Evasion	Comment
M	16	05-Dec-22	13:40	13:51	Shapinsay		quite fast	RH	2	c.350m	none apparent; foraging throughout	these two divers had first been seen foraging at c.13:15 (16 i), before any of the vessel movements K, L and M. They were not refound until 13:48 (16 ii) and 13:51 (16 iii), still foraging; whilst they may have reacted unseen to the first two smaller boats, they were clearly able to avoid them without major stress

Boat ref no.	Species ref no.	Date	Time start	Time end	Boat type	Boat direction	Speed	Species	Number	Distance	Reaction/Evasion	Comment
N	17	16-Dec-22	14:25	14:37	creel boat		q fast on approach, but much slower past Hatston pier	RH	1	c.400m	diving in advance of boat, which was heading directly towards it; it probably stayed under longer than it would otherwise have done, but no real change of behaviour	diver resurfaced 3 minutes later behind the boat by several hundred metres; had already been foraging and spending little time on the surface, and continued to do so, with several more sightings as it came back into the same area again after moving west
O	17	16-Dec-22	15:21	-	Earl Sigurd		quite fast	RH	1	c.350m	swimming away & diving as ferry at closest point; up again soon after, similar to its apparently normal foraging pattern, so probably not a change in behaviour	presumed same bird still foraging actively with only brief appearances on the surface; resurfacing a couple of hundred metres later &

Boat ref no.	Species ref no.	Date	Time start	Time end	Boat type	Boat direction	Speed	Species	Number	Distance	Reaction/Evasion	Comment
												diving again in line with its apparently normal foraging pattern
O	18	16-Dec-22	15:21	-	Earl Sigurd		quite fast	ND	1	c.750m	none apparent	bird already foraging actively and steadily moving out of the bay as the ferry came in
P	18	16-Dec-22	15:08	15:11	large work boat		quite fast	ND	1	c.600m	swam slightly alert as boat past but otherwise no change of behaviour	bird foraging actively and steadily moving out of the bay before boat passed
Q	19	20-Jan-23	10:11	-	Earl Thorfinn	In	quite fast	E.	25	<50m	alert, then swimming, then flying away further than 1 km	initially likely to have been directly in the path of the ferry
Q	20	20-Jan-23	10:11	-	Earl Thorfinn	In	quite fast	LN	6	<50m	flying away	initially likely to have been directly in the path of the

Boat ref no.	Species ref no.	Date	Time start	Time end	Boat type	Boat direction	Speed	Species	Number	Distance	Reaction/Evasion	Comment
												ferry; not followed
Q	21	20-Jan-23	10:14	-	Earl Thorfinn	In	quite fast	ND	2	150-200m	none apparent	both birds stayed on the surface as the ferry passed
R	22	20-Jan-23	10:44	-	Shapinsay	In	quite fast	RH	1	c.600m	none apparent	bird foraging actively and, in doing so, diving before boat drew level, and not refound
R	23	20-Jan-23	10:46	-	Shapinsay	In	quite fast	ND	1	350-400m	none apparent	bird foraging actively
S	23	20-Jan-23	10:53	-	Earl Thorfinn	Out	quite fast	ND	1	125-150m	none apparent	bird foraging actively; at surface unmoved as boat passed
S	24	20-Jan-23	10:53	-	Earl Thorfinn	Out	quite fast	ND	1	c.100m	none apparent	bird foraging actively; in wing moult
S	25	20-Jan-23	10:56	-	Earl Thorfinn	Out	quite fast	ND	1	<100m	none apparent	bird foraging actively; underwater as boat passed

Boat ref no.	Species ref no.	Date	Time start	Time end	Boat type	Boat direction	Speed	Species	Number	Distance	Reaction/Evasion	Comment
T	24	20-Jan-23	11:38	-	Shapinsay	Out	quite fast	ND	1	125-150m	none apparent	bird loafing unmoved between bouts of foraging
U	24	20-Jan-23	11:59	-	Varagen	In	quite fast	ND	1	c.150m	none apparent	bird foraging; underwater as boat passed then up close by
U	26	20-Jan-23	11:59	-	Varagen	In	quite fast	ND	1	<100m	none apparent	bird foraging; underwater as boat passed then up close by
V, W	27	20-Jan-23	13:28	-	Workboat plus large workboat	In & away N	quite slow & quite fast	LN	c.100	? 100-200m	flying up	Dense flock in direct track of both boats; flying up in all directions, most alighting at less than a kilometre to the west or at c.1km to southeast
V, W, X	28	20-Jan-23	c.13:30	-	2 workboats plus large workboat	2 in & 1 away N	quite slow & quite fast	VS	3	300-400m	swimming slowly away and back again as boats passed on both sides	essentially unmoved after boats had gone, but ceased foraging for a

Boat ref no.	Species ref no.	Date	Time start	Time end	Boat type	Boat direction	Speed	Species	Number	Distance	Reaction/Evasion	Comment
												few minutes
W, X	29	20-Jan-23	c.13:30	-	2 workboats	2 in	quite slow	VS	5	>500m when bird flew; closest at c.350m or more	1 male flying up and away W (but had not appeared alert beforehand); 4 birds swimming slowly away then back again as boats passed by	4 out 5 essentially unmoved after boats had gone, but ceased foraging for a few minutes
W, X	30	20-Jan-23	c.13:35	-	2 workboats	2 in	quite slow	VS	6	c.600m	none apparent	birds on surface as boats passed, but not alert or swimming away
W, X	31	20-Jan-23	c.13:35	-	2 workboats	2 in	quite slow	ND	1	c.500m	none apparent	on surface as boats passed, but not alert or swimming away

Boat ref no.	Species ref no.	Date	Time start	Time end	Boat type	Boat direction	Speed	Species	Number	Distance	Reaction/Evasion	Comment
Y	32	20-Jan-23	c.15:00	-	small creel boat	In	slow	SZ	1	250-300m	swimming alertly, then diving & swimming out of the way	as the boat curved round, the grebe changed direction so as to still be heading away from it; total alarmed swim/dive movement probably little more than 200-300m; little or no reaction from many Eiders nearby
Z	33	25-Feb-23	10:45	-	Shapinsay	in	quite fast	ND	1	c.200m	none apparent	bird loafing & preening; fully winged
AA	33	25-Feb-23	10:55	-	rib	out	not very fast, but splashy into wind	ND	1	200-250m	Diving	dived once; previously loafing and continued to do so after rib past, drifting S on wind
AB	33	25-Feb-23	11:33	-	Shapinsay	Out	quite fast	ND	1	c.300 and c.100m	Alert as boat approached and swimming to side	Alert at c.300m and swimming sideways;

Boat ref no.	Species ref no.	Date	Time start	Time end	Boat type	Boat direction	Speed	Species	Number	Distance	Reaction/Evasion	Comment
												swimming slowly at c.100m as boat passed
AC	34	25-Feb-23	11:45	-	work boat	E from cages	quite fast	VS	1	v approx 150-200m	swimming	Later these three each seen foraging, so at most a brief pause as the boat passed
AC	35	25-Feb-23	11:45	-	work boat	E from cages	quite fast	ND	1	v approx c.200m	swimming	
AC	36	25-Feb-23	11:45	-	work boat	E from cages	quite fast	ND	1	v approx c.250m	swimming	
AD	37	25-Feb-23	11:50	-	Earl Thorfinn	in	quite fast	VS	2	v approx c.500m	swim away to c.200-250m from path of boat, then back again	mostly swimming/loafing throughout - moving to the side well in advance of the ferry, then back again; only a couple of dives, so no real interruption to foraging
AE	38	04-Mar-23	09:40	10:05	small creel boat	in from Gairsay Sound	quite slow	VS	1	150-200m	flying, for less than 1 km	more or less directly at bird; VS found swimming (?alertly) as boat approached

Boat ref no.	Species ref no.	Date	Time start	Time end	Boat type	Boat direction	Speed	Species	Number	Distance	Reaction/Evasion	Comment
												then flying off at 09:50, landing much closer to pier where it dived (?foraging) at least once
AF	39	04-Mar-23	10:00		work boat	out from W of pier	quite slow	VS	2	not seen	probably flying up (but actual interaction not seen); alighted c. 1km away	These two scoters picked up flying past no. 38, which took off after them and all three alighted further out
AF	38 & 39	04-Mar-23	10:05		work boat	out to Gairsay Sound	quite slow	VS	3	250-300m	swimming so as to be about equidistant between boats AF and AG as they passed in opposite directions	Mostly swimming to E as AF passed first, then slowly back to SW from 10:10-10:23, during which time some foraging. By 10:23 the three were quite spread apart and two seemed to be sleeping.
AG	38 & 39	04-Mar-23	10:05		fish cage 'pump' boat	in from Gairsay Sound	slow	VS	3	250-300m		

Boat ref no.	Species ref no.	Date	Time start	Time end	Boat type	Boat direction	Speed	Species	Number	Distance	Reaction/Evasion	Comment
AH	38 & 39	04-Mar-23	10:15	10:30	large creel boat	out	quite slow	VS	3	c.800m	inconclusive - birds already swimming and continued to do so	Scoters picked up again after boat gone at 10:43, now loafing in a tight group again, back to the E. Very soon splitting into 1 (continued loafing nearby) and 2 birds again swimming SW and commencing foraging at 10:58
AI	40	04-Mar-23	11:45	12:06	Earl Sigurd	in	quite fast	LN	tens	v approx 500m	swimming to the side, well in advance of boat, at c.11:50	
AI	41	04-Mar-23	11:45	12:06	Earl Sigurd	in	quite fast	LN	tens	v approx 200m or less	flying up much closer to boat, which was more directly at them	v estimated distance of disturbance; looping around widely in flight for a few minutes - not sure where they went

Boat ref no.	Species ref no.	Date	Time start	Time end	Boat type	Boat direction	Speed	Species	Number	Distance	Reaction/Evasion	Comment
AI	42	04-Mar-23	11:45	12:06	Earl Sigurd	in	quite fast	E.	5	v approx 200m or less	flying up with LN no. 41	heading away W
AI	43	04-Mar-23	11:45	12:06	Earl Sigurd	in	quite fast	ND	1	c.700m & c.450m	Sitting up and semi-alert as ferry approached at c.700m, otherwise unmoved as ferry passed at c.450m	

C SPA QUALIFYING SPECIES MORTALITY MATRIX MODELS

Red-throated Diver Mortality Matrix Model

	Mortality Level (% of all birds on site)																
Displacement Level (% of all birds on site)		1%	2%	3%	4%	5%	10%	15%	20%	30%	40%	50%	60%	70%	80%	90%	100%
	0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	10%	0.0125	0.025	0.0375	0.05	0.0625	0.125	0.1875	0.25	0.375	0.5	0.625	0.75	0.875	1	1.125	1.25
	20%	0.025	0.05	0.075	0.1	0.125	0.25	0.375	0.5	0.75	1	1.25	1.5	1.75	2	2.25	2.5
	30%	0.0375	0.075	0.1125	0.15	0.1875	0.375	0.5625	0.75	1.125	1.5	1.875	2.25	2.625	3	3.375	3.75
	40%	0.05	0.1	0.15	0.2	0.25	0.5	0.75	1	1.5	2	2.5	3	3.5	4	4.5	5
	50%	0.0625	0.125	0.1875	0.25	0.3125	0.625	0.9375	1.25	1.875	2.5	3.125	3.75	4.375	5	5.625	6.25
	60%	0.075	0.15	0.225	0.3	0.375	0.75	1.125	1.5	2.25	3	3.75	4.5	5.25	6	6.75	7.5
	70%	0.0875	0.175	0.2625	0.35	0.4375	0.875	1.3125	1.75	2.625	3.5	4.375	5.25	6.125	7	7.875	8.75
	80%	0.1	0.2	0.3	0.4	0.5	1	1.5	2	3	4	5	6	7	8	9	10
	90%	0.1125	0.225	0.3375	0.45	0.5625	1.125	1.6875	2.25	3.375	4.5	5.625	6.75	7.875	9	10.125	11.25
	100%	0.125	0.25	0.375	0.5	0.625	1.25	1.875	2.5	3.75	5	6.25	7.5	8.75	10	11.25	12.5

Slavonian Grebe Mortality Matrix Model

	Mortality Level (% of all birds on site)																
Displacement Level (% of all birds on site)		1%	2%	3%	4%	5%	10%	15%	20%	30%	40%	50%	60%	70%	80%	90%	100%
	0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	10%	0.0095	0.019	0.0285	0.038	0.0475	0.095	0.1425	0.19	0.285	0.38	0.475	0.57	0.665	0.76	0.855	0.95
	20%	0.019	0.038	0.057	0.076	0.095	0.19	0.285	0.38	0.57	0.76	0.95	1.14	1.33	1.52	1.71	1.9
	30%	0.0285	0.057	0.0855	0.114	0.1425	0.285	0.4275	0.57	0.855	1.14	1.425	1.71	1.995	2.28	2.565	2.85
	40%	0.038	0.076	0.114	0.152	0.19	0.38	0.57	0.76	1.64	1.52	1.9	2.28	2.66	3.04	3.42	3.8
	50%	0.0475	0.095	0.1425	0.19	0.2375	0.475	0.7125	0.95	1.425	1.9	2.375	2.85	3.325	3.8	4.275	4.75
	60%	0.057	0.114	0.171	0.228	0.285	0.57	0.855	1.14	1.71	2.28	2.85	3.42	3.99	4.56	5.13	5.7
	70%	0.0665	0.133	0.1995	0.266	0.3325	0.665	0.9975	1.33	1.995	2.66	3.325	3.99	4.655	5.32	5.985	6.65
	80%	0.076	0.152	0.228	0.304	0.38	0.76	1.14	1.52	2.28	3.04	3.8	4.56	5.32	6.08	6.84	7.6
	90%	0.0855	0.171	0.2565	0.342	0.4275	0.855	1.2825	1.71	2.565	3.42	4.275	5.13	5.985	6.84	7.695	8.55
	100%	0.095	0.19	0.285	0.38	0.475	0.95	1.425	1.9	2.85	3.8	4.75	5.7	6.65	7.6	8.55	9.5

Velvet Scoter Mortality Matrix Model

	Mortality Level (% of all birds on site)																
Displacement Level (% of all birds on site)		1%	2%	3%	4%	5%	10%	15%	20%	30%	40%	50%	60%	70%	80%	90%	100%
	0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	10%	0.0365	0.073	0.1095	0.146	0.1825	0.365	0.5475	0.73	1.095	1.45	1.825	2.19	2.555	2.92	3.285	3.65
	20%	0.073	0.146	0.219	0.292	0.365	0.73	1.095	1.46	2.19	2.92	3.65	4.38	5.11	5.84	6.57	7.3
	30%	0.1095	0.219	0.3285	0.438	0.5475	1.095	1.6425	2.19	3.285	4.38	5.475	6.57	7.665	8.76	9.855	10.85
	40%	0.146	0.292	0.438	0.684	0.73	1.46	2.19	2.92	4.38	5.84	7.3	8.76	10.22	11.68	13.14	14.6
	50%	0.1825	0.365	0.5475	0.73	0.9125	1.825	2.7375	3.65	5.475	7.3	9.125	10.95	12.775	14.6	16.425	18.25
	60%	0.219	0.438	0.657	0.876	1.095	2.19	3.285	4.38	6.57	8.76	10.95	13.14	15.33	17.52	19.71	21.9
	70%	0.2555	0.511	0.7665	1.022	1.2775	2.555	3.8325	5.11	7.665	10.22	12.775	15.33	17.885	20.44	22.995	25.5
	80%	0.292	0.584	0.876	1.168	1.46	2.92	4.38	5.84	8.76	11.68	14.6	17.52	20.44	23.36	26.28	29.2
	90%	0.3285	0.657	0.9855	1.314	1.6425	3.285	4.9275	6.57	9.855	13.14	16.425	19.71	22.995	26.28	29.565	32.85
	100%	0.365	0.73	1.095	1.46	1.825	3.65	5.475	7.3	10.95	14.6	18.25	21.9	25.55	29.2	32.85	36.5

Great Northern Diver Mortality Matrix Model

	Mortality Level (% of all birds on site)																
Displacement Level (% of all birds on site)		1%	2%	3%	4%	5%	10%	15%	20%	30%	40%	50%	60%	70%	80%	90%	100%
	0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	10%	0.031	0.062	0.093	0.124	0.155	0.31	0.465	0.62	0.93	1.24	1.55	1.86	2.17	2.48	2.79	3.1
	20%	0.062	0.124	0.186	0.248	0.31	0.62	0.93	1.24	1.86	2.48	3.1	3.72	4.34	4.96	5.58	6.2
	30%	0.093	0.186	0.279	0.372	0.465	0.93	1.395	1.86	2.79	3.72	4.65	5.58	6.51	7.44	8.37	9.3
	40%	0.124	0.248	0.372	0.496	0.62	1.24	1.86	2.48	3.72	4.96	6.2	7.44	8.68	9.92	11.16	12.4
	50%	0.155	0.31	0.465	0.62	0.775	1.65	2.325	3.1	4.65	6.3	7.75	9.3	10.85	12.4	13.95	15.5
	60%	0.186	0.372	0.558	0.744	0.93	1.86	2.79	3.72	5.58	7.44	9.3	11.16	13.02	14.88	16.74	18.6
	70%	0.217	0.434	0.651	0.868	1.085	2.17	3.255	4.34	6.51	8.68	10.85	13.02	15.19	17.36	19.53	21.7
	80%	0.248	0.496	0.744	0.992	1.24	2.48	3.72	4.96	7.44	9.92	12.4	14.88	17.36	19.84	22.32	24.8
	90%	0.279	0.558	0.837	1.116	1.395	2.79	4.185	5.58	8.37	11.16	13.95	16.74	19.53	22.32	25.11	27.9
	100%	0.31	0.62	0.93	1.24	1.55	3.1	4.65	6.2	9.3	12.4	15.5	18.6	21.7	24.8	27.9	31

D SEAL RISK ASSESSMENT

Orkney Logistics Base (Hatston)
Seal Risk Assessment



August 2025

CONTROL SHEET

Client:	Orkney Island Council Harbour Authority
Project Title:	Orkney Logistics Base (Hatston)
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EXECUTIVE SUMMARY

EnviroCentre Limited was commissioned by Orkney Islands Council Harbour Authority to undertake a Seal Risk Assessment to inform an Environmental Impact Assessment and Habitats Regulations Appraisal in relation to construction phase of the development at Hatston for a pier extension and quayside laydown area.

Both harbour seal and grey seal are priority marine features and Annex II species and can be seen all around Scotland, predominantly on many of the offshore islands and along much of the west mainland coast.

Two Special Areas of Conservation (SAC) and three Sites of Special Scientific Interest (SSSI) designated for harbour and grey seals and 57 haul out sites are considered within influence of the development site. However, due to distance the Hatston development is not considered to directly impact these designated sites or seal haul out sites.

There is a clear decline in harbour seal populations based on reviews of data over the years. The causes for the decline are not yet been defined, however factors such as prey quality and availability, exposure to toxins/ harmful algae and competition for resources from grey seal, whose population size are considered to be at carrying capacity in Orkney waters, are currently considered to be the most likely critical drivers. However, coastal developments and/or increase in vessel movements can't be ruled out as also contributing to declines directly or indirectly.

Underwater noise modelling identified that vibration piling activities will have low acoustic impact upon seals with permanent threshold shift (PTS) and Temporary threshold shift (TTS) of <50m for 1 hour. Blasting also has short PTS ranges for seals of 77.1m for 1 blast, with TTS presenting the highest risk of temporary injury to seals ranging up to 354.4m. Dredging has short risk ranges of PTS for seals (<50m) for 8 hours dredging, with TTS risk ranges up to 287.5m (figures quoted are conservative based on being modelled using cutter suction dredger, whilst in reality dredging activities will be land-based). However, this is only for animals staying close to the activity for extended periods (prolonged exposure), As piling, blasting and dredging works will only take place during daylight hours and mitigation will be implemented to ensure seals are clear of the disturbance buffers ahead of these works activities commencing, there is not considered to be an acute risk of noise related injury.

General disturbance to seals in water may occur as a result of works. It is expected that seals would be likely to exhibit a behavioural change due to the noise, when in water (fleeing from noise source/ vocalisations/ splashing), with physiological stress likely to also occur. This could impact seals energy and fitness levels through disturbing foraging or causing avoidance of feeding areas for periods of time. The underwater noise modelling used the level B-Harassment criteria to model potential impacts to behaviour for impulsive (blasting) and non-impulsive (dredging) sounds, which predicted a maximum range of 6.1km and 5.6km respectively. Quantitative data identified a maximum of 48 harbour seals and 380 grey seals at sea could be disturbed from noise related activities. These numbers and ranges are considered a 'worst case' scenario and the actual numbers would likely be lower and thus potential for disturbance is considered to be limited.

If protocols, controls and mitigation outlined in section 5 are implemented during dredging, piling and blasting works and based on the distance of the designated sites and seal haul out sites from the works area, it is considered unlikely that the local seal populations will be negatively impacted from these works and vessel movements during the construction phase.

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1 INTRODUCTION

1.1 Terms of Reference

EnviroCentre Limited was commissioned by Orkney Islands Council Harbour Authority to undertake a Seal Risk Assessment (SRA) to inform an Environmental Impact Assessment (EIA) and Habitat Regulations Appraisal (HRA) in relation to the construction phase of Hatston of a pier extension and quayside laydown area. Please see Appendix A: Proposed Site Location and Layout.

The SRA is required to identify known populations and records of seals and assess potential risks of causing injury and disturbance as a result of proposed construction activities.

1.2 Project Overview

It is proposed to extend the existing outer quay by 300m (with minimum water depth of -10m Chart Datum (CD)) which would also form a 125m inner berth. This would create substantially more quayside which would be available for both current and future operations. In addition to the above, circa 7.5 hectares (Ha) of additional land extending from the current shoreline outwards would be made available for harbour-related operations through reclamation. The design includes a ship lift, additional link span and fuel facility.

The development is designed to be built in three phases as noted below. These phases should not be considered consecutively but allow for a degree of flexibility which can be adapted to suit the requirements, budget and programme of OICHA.

In summary, the proposed construction phases of the development contain the following components:

- **Phase 1**
  - Reclaim the area by depositing appropriate material to form a platform on the south-eastern side of the current pier causeway and thereby create 3Ha of hard-core surfaced marshalling / storage area along with an HGV trailer park for the ferry service which will be covered by a reinforced concrete slab;
  - A sheet pile wall is to be installed to allow a retained interface with the current suspended deck; and
  - Place rock armour along the northern and eastern edges of the infill area.
- **Phase 2**
  - Extend the current quay to the west by circa 300m with a 25m return and an inner berth to facilitate the proposed linkspan berth and fixed ramp. The extension will comprise a steel sheet pile wall and will initially interface with the alignment of the existing suspended deck on the north-west inner face before forming the new quay extension;
  - Reinforced concrete slabs will form the new main deck areas;
  - Reclaim the shoreline by depositing appropriate material to form a platform on the southwestern side of the current pier causeway to create an additional 3.71Ha to be used as a multi-use laydown/work area surfaced with hard-core, as well as establish a separate access road to the new quay extension;
  - Place rock armour along the western edge of the infill area; and
  - Small scale dredging of the approaches to the quay to -10m CD following completion of the quay works

- **Phase 3**
    - Reclaim the shoreline to the south-west of Phase 2 to form a platform on the southwestern side of the current pier causeway to be used as a multi-use laydown/work area as well as create a ship lift;
    - The ship lift will extend from the linkspan fixed ramp installed in Phase 2 and will comprise piles and reinforced concrete pads designed for the boatlift wheel-loads;
    - The rest of the area will be infilled to provide extra yard / storage;
    - Place uplifted and re-used rock armour along the western edge of the infill area; and
    - Small scale dredging in the area around the ship lift to -6m CD.

1.3 Alternative Consideration

The project was identified as part of the Orkney Harbours Masterplan. At the start of the Masterplan development, optioneering was undertaken through stakeholder discussions / workshops, OICHA internal discussions with staff, market assessments in conjunction with desk-based research. A Strategic Environmental Assessment was used to inform a draft Orkney Harbours Masterplan Phase 1 with details of the process including alternatives considered, reasons for discounting or taking forward options and potential environmental impacts as reported in the Strategic Environmental Assessment – Environmental Report.

1.3.1 Do Nothing

Hatston is proposed to provide space for a core base for offshore wind operations and maintenance activities, oil and gas supply, freight and ferries, boat repair, aquaculture and logistics, with the potential to be a hub for servicing renewable (e.g. tidal and wave) devices in the future. The Hatston project will also future proof the site to accommodate future provision and storage of alternative (less polluting/carbon-free) fuels and provision of shore power to smaller vessels where viable. Doing nothing will not allow the long-term future of Orkney, in particular looking at facilities that ensure the decarbonisation of the industry.

1.3.2 Relocation

The draft Orkney Harbours Masterplan Phase 1 and accompanying SEA Environmental Report were consulted on in summer 2019. The consultation comprised public meetings and ‘drop-in’ sessions with copies of the documents available to the public both online and as a hard copy. Comments from the consultation process were then fed into the Masterplan prior to finalisation and adoption in August 2020. The SEA – Post Adoption Statement[1] provides information on how the SEA and consultee’s views have been taken into account within the finalised Masterplan.

Given that the planned development at Hatston has gone through the above process it was not considered necessary to look further at geographical alternatives to the Hatston development.

[1] Orkney Harbours Masterplan Phase 1 Strategic Environmental Assessment – Post Adoption Statement, *Intertek Report No P2214_RN5054_Rev1, dated 16 June 2020*

1.4 Report Usage

The information and recommendations contained within this report have been prepared in the specific context stated above and should not be utilised in any other context without prior written permission from EnviroCentre Limited.

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2 METHODS

2.1 Baseline

In order to anticipate the potential ecological sensitivities in relation to seals at the site, a desk study was conducted. The following sources were checked:

- Marine Directorate National Marine Plan interactive (NMPi) for:
  - Seal haul out sites;
  - Distribution of Priority Marine Features (PMFs)
- Sea Watch Foundation (SWF) website for recent sightings of marine mammals from the Orkney region[2];
- Scottish Marine Animal Stranding Scheme (SMASS) for records of strandings between 2001 and 2024[3];
- MS Updated Seal Usage Maps: The Estimated at-sea Distribution of Grey and Harbour Seals[4], which includes data obtained from the Sea Mammal Research Unit at St Andrews University[5];
- NatureScot Aerial surveys of seals in Scotland during the harbour moult season 2016-2019[6];
- Natural Environment Research Council Scientific Advice on Matters Related to the Management of Seal Populations: 2021[7];
- Marine Scotland Regional Differences in the Abundance Trends Amongst Harbour Seal Populations[8];
- Special Committee on seals (SCOS) reports 2015 to 2022[9];
- Fine-scale harbour seal at-sea usage mapping around Orkney and the North coast of Scotland[10];
- Data of Orkney seal haul out counts 2016-2019 provided by SMRU[11];
- Carter et al (2025) Harbour seal and grey seals: distribution maps for Scotland[12]
- Sanday Special Area of Conservation (SAC) Conservation and Management Advice (2024)[13];
- JNCC Sanday SAC[14];

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[2] Sea Watch Foundation Recent Sightings Orkney available at: https://www.seawatchfoundation.org.uk/recentsightings/ (Accessed 12/12/2023)

[3] Species reported within a 10km (sea route) from 2001-2024 to Scottish Marine Animal Stranding Scheme (SMASS) available at: https://strandings.org/map/ (Accessed 17/03/2025)

[4] Updated Seal Usage Maps: The Estimated at-sea Distribution of Grey and Harbour Seals, Scottish Marine and Freshwater Science, Vol 8 No 25, available at: https://data.marine.gov.scot/sites/default/files//SMFS%200825.pdf (Accessed 07/06/2024)

[5] St Andrews Sea Mammal Research Unit, available at: http://www.smru.st-andrews.ac.uk/ (Accessed 07/06/2024)

[6] NatureScot Aerial Surveys of Seals in Scotland during the Harbour Seal Moult, 2016-2019, available at: https://www.nature.scot/doc/naturescot-research-report-1256-aerial-surveys-seals-scotland-during-harbour-seal-moult-2016-2019 (Accessed 07/06/2024)

[7] Scientific Advice on Matters Related to the Management of Seal Populations: 2021, Natural Environment Research Council Special Committee on Seals. Available at: http://www.smru.st-andrews.ac.uk/files/2022/08/SCOS-2021.pdf (Accessed 07/06/2024)

[8] Marine Scotland topic Sheet Number 33 (V2), Regional Differences in the Abundance Trends Amongst Harbour Seal Populations, available at: https://www.gov.scot/binaries/content/documents/govscot/publications/factsheet/2019/11/marine-scotland-topic-sheets-marine-mammals/documents/regional-differences-in-the-abundance-trends-amongst-harbour-seal-populations-updated-march-2017/regional-differences-in-the-abundance-trends-amongst-harbour-seal-populations-updated-march-2017/govscot%3Adocument/harbour-seal-populations.pdf (Accessed 27/05/2024)

[9] SCOS Reports | SMRU

[10] Fine-scale harbour seal at-sea usage mapping around Orkney and the North coast of Scotland | Marine Scotland Data Publications (Accessed 26/02/2025)

[11] Excel file detailing the latest SMRU seal data counts (2016-2019) for Orkney provided by John Baxter on 03/03/2025

[12] Carter, M. I. D, Bivins, M., Duck, C. D., Hastie, G. D., Morris, C. D., Moss, S. E. W., Thompson, D., Thompson, P. M., Vincent, C., Russell, D. J. F. (2025) Updated habitat-based distribution maps for harbour and grey seals in Scotland. Report to Scottish Government by Sea Mammal Research Unit, University of St Andrews. Available at: https://www.gov.scot/publications/updated-habitat-based-sea-distribution-maps-harbour-grey-seals-scotland/pages/6/

[13] Sanday - Conservation and Management Advice - Final Version (Accessed 26/02/2025)

[14] Sanday - Special Areas of Conservation (Accessed 26/02/2025)

- Faray and Holm of Faray SAC Conservation and management Advice (2024)[15]
- JNCC Faray and Holm of Faray SAC[16];
- NatureScot Eynhallow Site of Special Scientific Interest (SSSI) Citation[17]
- Muckle and Little Green SSSI Site Management Statement[18];
- NatureScot Muckle and Little Green SSSI Citation[19];
- East Sanday Coast SSSI Site Management Statement[20];
- East Sanday Coast SSSI Citation[21].

2.2 Underwater Noise Modelling

Underwater noise modelling was commissioned as part of this assessment assess noise levels generated by common construction methods.

Please refer to Irwin Carr Consulting report: 'Hatston Pier, UW Noise Modelling', Appendix B which details the methods and findings of the underwater noise modelling.

2.3 Disclaimer

It should be noted that the baseline is limited by the reliability of third party information and the geographical availability of biological and/or ecological records and data. The absence of species from biological records cannot be taken to represent actual absence. Species distribution patterns should be interpreted with caution as they may reflect survey/reporting effort rather than actual distribution.

[15] Faray and Holm of Faray - Conservation and Managment Advice - Final (Accessed 26/02/2025)
[16] Faray and Holm of Faray - Special Areas of Conservation (Accessed 26/02/2025)
[17] https://www.nature.scot/sites/default/files/site-special-scientific-interest/618/sssi-citation.pdf (Accessed 26/02/2025)
[18] https://www.nature.scot/sites/default/files/site-special-scientific-interest/1205/site-management-statement.pdf (Accessed 26/02/2025)
[19] https://www.nature.scot/sites/default/files/site-special-scientific-interest/1205/sssi-citation.pdf (Accessed 26/02/2025)
[20] https://www.nature.scot/sites/default/files/site-special-scientific-interest/1678/site-management-statement.pdf (Accessed 26/02/2025)
[21] https://www.nature.scot/sites/default/files/site-special-scientific-interest/1678/sssi-citation.pdf (Accessed 26/02/2025)

3 BASELINE

3.1 Desk Study

Both harbour seal (*Phoca vitulina*) and grey seal (*Halichoerus grypus*) are PMFs and can be seen all around Scotland, predominantly on many of the offshore islands and along much of the west mainland coast.

3.1.1 Designated Sites SAC and SSSI

Two SAC and three SSSI sites designated for harbour and grey seals are considered within influence of the development site and include:

- Sanday SAC (Harbour seal)
- Faray and Holm of Faray SAC (Grey seal)
- Eynhallow SSSI (Harbour seal)
- Muckle and Little Green Holm SSSI (Grey seal)
- East Sanday Coast SSSI (Harbour seal)

Sanday SAC

Sanday SAC is located 33km (via sea) north east of the Hatston development site. The Sanday SAC has been designated to protect harbour seal, as well as intertidal mudflats and sandflats, reefs and subtidal sandbanks. The SAC comprises 10976.97 hectares (ha). Harbour seal feature as 'Unfavourable declining' in condition within the SAC. Based on counts from 1997-2019, there has been a decline of 95% at Sanday SAC, indicating it is one of the local areas hit hardest by the harbour seal declines observed in northern and eastern areas of Scotland. In the last count in 2019, the SAC represented 77 individuals (around 5% of the North Coast and Orkney SMU). Harbour seals from Sanday SAC are noted to forage 20-30km to over 100km from the SAC (however the majority of these will be at the shorter end of the range). The Sanday conservation management advice suggests that research is indicating that off-site factors such as predation, competition for prey, prey quality and availability, and toxin exposure from harmful algae are the most likely potential causes of the decline. For harbour seal at Sanday SAC, the reasons for the unfavourable condition appear to lie out with the SAC.

Faray and Holm of Faray SAC

Faray and Holm of Faray SAC is located 23.5km (via sea) north of the Hatston development site and comprises 781.33 ha. The Faray and Holm of Faray SAC is designated for grey seal, which currently feature as 'Unfavourable declining' in condition within the SAC. The unfavourable condition of grey seal at the SAC corresponds to a 43% decline in pup production in 2019 since the late 1990s with the SAC now accounting for 10% of the SMU production. The decrease in pup production does not reflect the trend of the North Coast and Orkney SMU with both grey seal population and pup production remaining stable. SMU pup production is stable (decline appearing to be due to changes in movement of pup activities to other locations within the SMA), accessibility of the site for pupping has not changed and disturbance is minimal during the breeding season, meaning no direct conservation measures can be taken at a site level to address the causes of the unfavourable condition of grey seal. Therefore, the focus of the Conservation Objectives for grey seal are ensuring that the conditions on site are suitable to support a recovery.

Eynhallow SSSI

Eynhallow SSSI is located 17km (via sea) north west of the Hatston development site and comprises 97.22 ha. The Eynhallow SSSI is designated for harbour seal, which are considered 'Unfavourable declining' condition within the SSSI. The site is one of the two most important breeding and haul out sites for Harbour Seals in Orkney, and supports on average more than 10% of Orkney's total Harbour Seal population. The most recent count for the Eynhallow SSSI in 2019 was 76 individuals.

Muckle and Little Green Holm SSSI

Muckle and Little Green Holm SSSI is located 15.5km (via sea) north of the Hatston development site and comprises 52.26 ha. The Muckle and Little Green Holm SSSI is designated for grey seal which are considered to be of a 'favourable, maintained' condition. The site regularly supports about 2% of the pups born in the UK and is one of the largest sites for breeding grey seals in Orkney and is therefore considered a nationally important colony for breeding grey seals. The pup survey for 2010 estimates that 900 pups were born on the Muckle and Little Green Holms SSSI.

East Sanday Coast SSSI

East Sanday Coast SSSI is located 33km (via sea) north east of the Hatston development site and comprises 1607.56 ha. The East Sanday Coast SSSI lies within the Sanday SAC and is designated for harbour seal, as well as intertidal marine habitats and birds. Harbour seal currently features as 'Favourable, maintained' in condition within the SSSI. The SSSI site supports the largest colony in Orkney. The most recent count for the East Sanday Coast SSSI in 2019 was 78 individuals.

3.1.2 Haul Out Sites

Section 117 of the Marine (Scotland) Act 2010 provided addition protection to seals. The Protection of Seals (Designation of Haul-out Sites) (Scotland) Act 2014 designates a total of 194 individual seal haul-out sites around Scotland, at which it will be an offence to harass seals. Seal haul-outs are locations on land where seals come ashore to rest, moult or breed.

A number of designated seal haul out sites are associated with Orkney, 57 have been identified as potentially relevant to the Hatston development, due to being in commuting distances to both seal species and are detailed in Appendix C. Those haul out sites considered to be at most risk from disturbance through underwater noise or during vessel movement associated with the development, due to proximity are detailed in Table 3-1 overleaf..

It should be highlighted that the 'Breeding Colony' column in Table 3-1 below (and in Appendix C) is based on the breeding sites on the NMPi, because they are discrete areas that are primarily used for breeding. No information is provided for harbour seals on the NMPi, because they do not go to specific places to breed, they simply breed at their 'home' haul out sites and as such remain relatively dispersed during the breeding season. Therefore, all harbour seal haul sites are considered potential places where pups are born.

Note that all designated seal haul outs provide protection for both species of seal year round regardless of whether it was identified as a breeding colony.

Table 3-1: Seal Haul Out Sites

Seal Haul Out Name	Distance* and Orientation	Species	No. seals (based on August counts)		NMPi Breeding Colony (Grey seals)
			Harbour seal	Grey seal	
Damsay and Holm of Grimbister	4km west	Harbour and Grey seal	63	28	No
Helliar Holm North and Elwick	5km north	Harbour seal	21	13	No
Taing Skerry and Grass Holm	7km north	Harbour and grey seal	6	87	No
Gairsay	8km north	Grey seal	0	0	Yes
Holm of Rendall	8km north	Harbour and Grey seal	28	6	No
Sweyn Holm	10km north	Harbour and Grey seal	4	0	No
Deer Sound	14km south east	Harbour and Grey seal	39	79	No
South East Egilsay	14km north	Harbour and Grey seal	2	19	No
Little Green Holm	15km north east	Grey seal	8	20	Yes
Muckle Green Holm	16km north east	Grey seal	0	5	Yes
Holm of Scockness	18km north	Harbour seal	20	22	No
Costa and Burgar	19km north west	Harbour and Grey seal	20	3	No
Eynhallow and Westside	19km north west	Harbour and Grey seal	77	88	No
Egilsay North	20km north	Harbour and Grey seal	4	61	No
Greenli Ness	21km north east	Grey seal	0	309	No
Seal Skerry (Eday)	21km north east	Harbour and Grey seal	0	612	No

*Direct route via sea

3.1.3 Grey Seal

Orkney is a stronghold for breeding grey seals and is part of the North Coast and Orkney Seal Management Unit (SMU). It is estimated that the Orkney colonies produced nearly a third of UK pups in 2019. The overall trend is for an increased numbers in the UK population but there was a slight reduction in the Orkney population estimate between 2016 and 2019. The latest estimate of the UK grey seal population is 129,100 with the Orkney and North Coast SMU being home to approx. 7% of that (based on most recent population estimates for grey seal from 2019-2021 for the North Coast and Orkney SMU of 8599).

From research undertaken and presented in SCOS 2021, it is considered that grey seal within the Orkney region are estimated to be close to carrying capacity when undertaking modelling. In addition, population estimates for seal management areas in Scotland suggest that due to sustained growth in the numbers of pups born over the last 30 years, this has resulted in all UK populations either

increasing or (apparently) stabilising at the maximum levels ever recorded, which is being assumed to be at or close to their carrying capacities.

In general, grey seals are loyal to a pupping sites and frequent those places for a few months during the breeding season when the females give birth and wean their pups before mating again. During that period they do not move very far from the breeding sites. However, after the breeding season grey seals are much more mobile and disperse over very large areas and can travel large distances, frequently over 100km, to exploit various haul out sites and forage and prefer offshore feeding areas as well as exposed coasts and islands to come ashore, with the outer fringes of Orkney being classed as suitable. The waters surrounding the site offer habitat for various gadoids and flat fish which are grey seal prey species. From research undertaken by St Andrews Sea Mammal Research Unit on seal diets[22], in Orkney sandeels were the greatest prey resources, with gadoids (haddock, cod, whiting) being the second biggest contributor.

A total of 57 haul outs sites, including 20 breeding for grey seals (see Appendix CTable 3-1), are present within 100km of the Hatston development, with 14 in the vicinity of the development activities. The nearest seal haul out site from the development site is located 4km west (Damsay and Holm of Grimbister) and the nearest breeding colony is located 8km north (Gairsay). Two SSSIs (Faray and Holm of Faray SSSI located 23km north and Muckle and Little Green Holm SSSI located 17km north) and a SAC (Faray and Holm of Faray SAC located 23km north) designated for grey seals are present within 100km of the site.

Seal haul out data counts for grey seal also show the important association with Orkney, as detailed in Figure 3-1[12].

[22] http://www.smru.st-andrews.ac.uk/documents/scotgov/CSD3-3_Grey_Seal_Diet_Composition_and_Prey_Consumption.pdf (Accessed 07/06/2024)

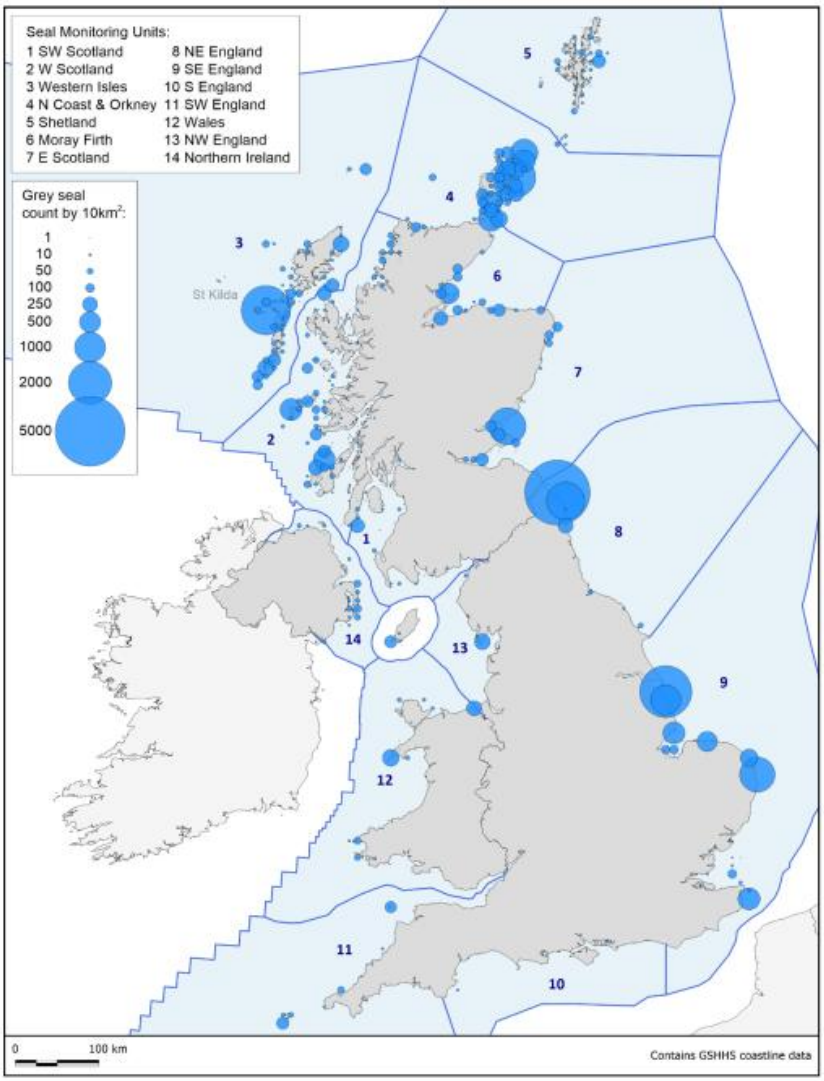


Figure 3-1: August distribution of grey seals around the British Isles by 10km squares based on the most recent available haul out count data collected up until 2021. Map obtained from SCOS 2022.

Records of 285 out of 355 tagged grey seals within UK waters (1988-2018) show a broad-scale distribution, with tagged grey seals utilising both coastal and offshore habitat, with Orkney being a key high-use area, as detailed in Figure 3-2. Grey seal distribution estimates show the mean number of grey seals estimated to be present in each 5 km by 5 km grid cell at any one time, with that around the development site estimated to be >50 individuals per 5km^2 as detailed in Figure 3-3.

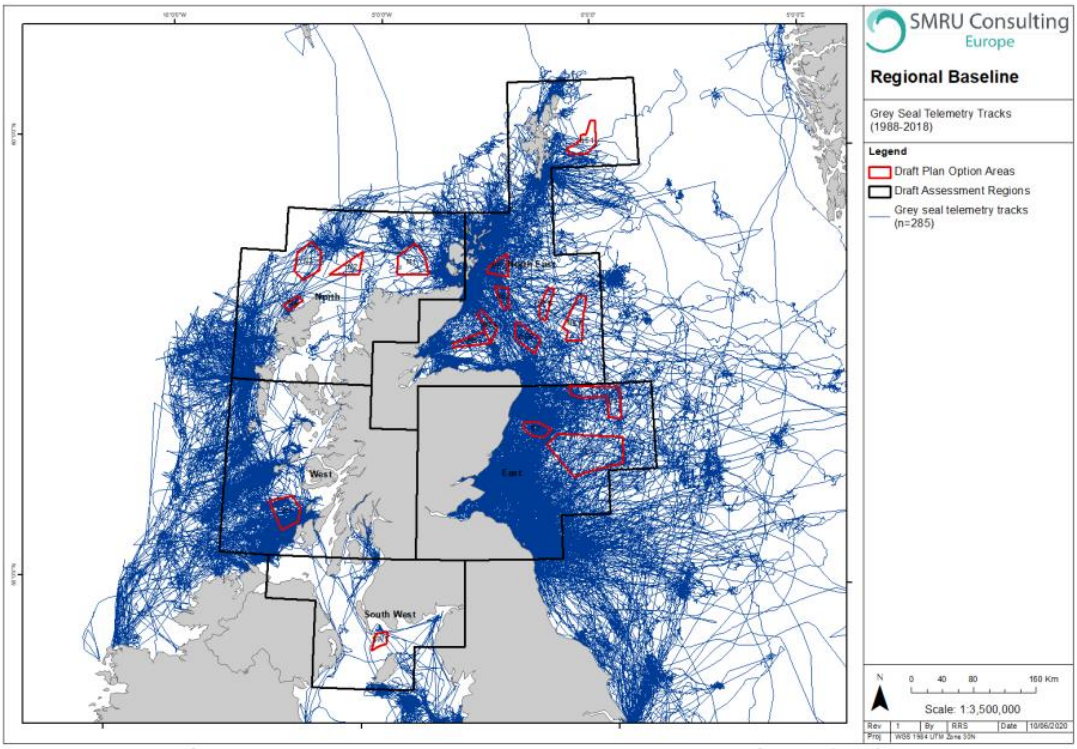


Figure 3-2: Telemetry tracked grey seals (1988-2018)

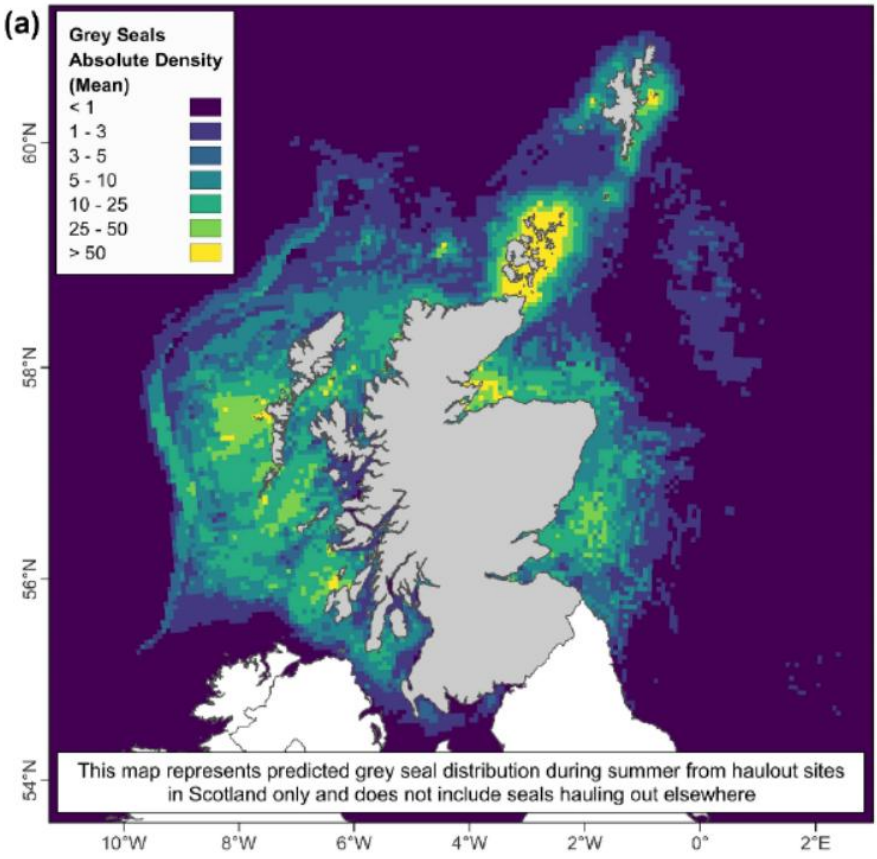


Figure 3-3: Map showing grey seal distribution estimates. The mean number of grey seals estimated to be present in each 5 km by 5 km grid cell at any one time. Image taken from Carter et al (2025).

OW state that grey seals can be observed annually and SMASS have recorded 23 grey seal strandings within 8km of the site between 1995-2021. No records of grey seal were returned from SWF, HWDT or OMMRI.

The development site is not within a designated site for grey seal and due to activities associated with the existing pier and adjacent industrial area, it is not considered that the habitat is suitable for use as a breeding or moulting haul out site. However, grey seals may use the coastal waters within and adjacent to the site for commuting between haul outs (including breeding colonies) and/or foraging.

3.1.4 Harbour Seal

The latest estimate of the UK harbour seal population is 36,600 with the Orkney and North Coast SMU being home to approx. 4% of that (most recent population estimates for harbour seal from 2019-2021 for the North Coast and Orkney SMU of 1405). Whilst the overall trend for harbour seals within the UK is increasing, there has been a dramatic change in distribution. Counts within the Orkney and North Coast SMU have gone from 8,522 in 1997 to 1296 in 2019 (an 85% decline) for counts between 2016 and 2019 (see Figure 3-4 below). Orkney and Shetland were once proportionally the most important regions in Scotland for harbour seals in 1990s, whereas these regions only contribute to one sixth of the Scottish total. Within Scotland there is a general pattern of population increases in the west and losses along the east and north coasts.

The causes of decline for harbour seals in the east and north coasts have not been confirmed yet. Various causes have been speculated, some have been discounted but there is no evidence to support any one of these or indeed a combination of possible causes. SMRU have been working on resolving this problem for the last 15 years and are still no nearer to having a definitive answer[23]. A range of factors such as prey quality and availability, exposure to toxins/ harmful algae and competition for resources from grey seal, whose population size are considered to be at carrying capacity in Orkney waters, are currently considered to be the most likely critical drivers[24]. Although no evidence for coastal developments or vessel movement have been identified, these can't be ruled out as also contributing to declines directly or indirectly to harbour seal decline.

As stated above (Section 3.1.3) as grey seals are considered to be at carrying capacity and although there were limited harbour seal population estimates available before grey seal populations reached/ approached carrying capacity, it has been postulated that if grey seal populations are considered a major driver of harbour seal dynamics it may be that density related effects were already in place before monitoring began in Scotland.

[23] Email correspondence from John Baxter on 03/03/2025.
[24] Marine Scotland topic Sheet Number 33 (V2), Regional Differences in the Abundance Trends Amongst Harbour Seal Populations, available at: https://www.gov.scot/binaries/content/documents/govscot/publications/factsheet/2019/11/marine-scotland-topic-sheets-marine-mammals/documents/regional-differences-in-the-abundance-trends-amongst-harbour-seal-populations-updated-march-2017/regional-differences-in-the-abundance-trends-amongst-harbour-seal-populations-updated-march-2017/govscot%3Adocument/harbour-seal-populations.pdf (Accessed 27/05/2024)

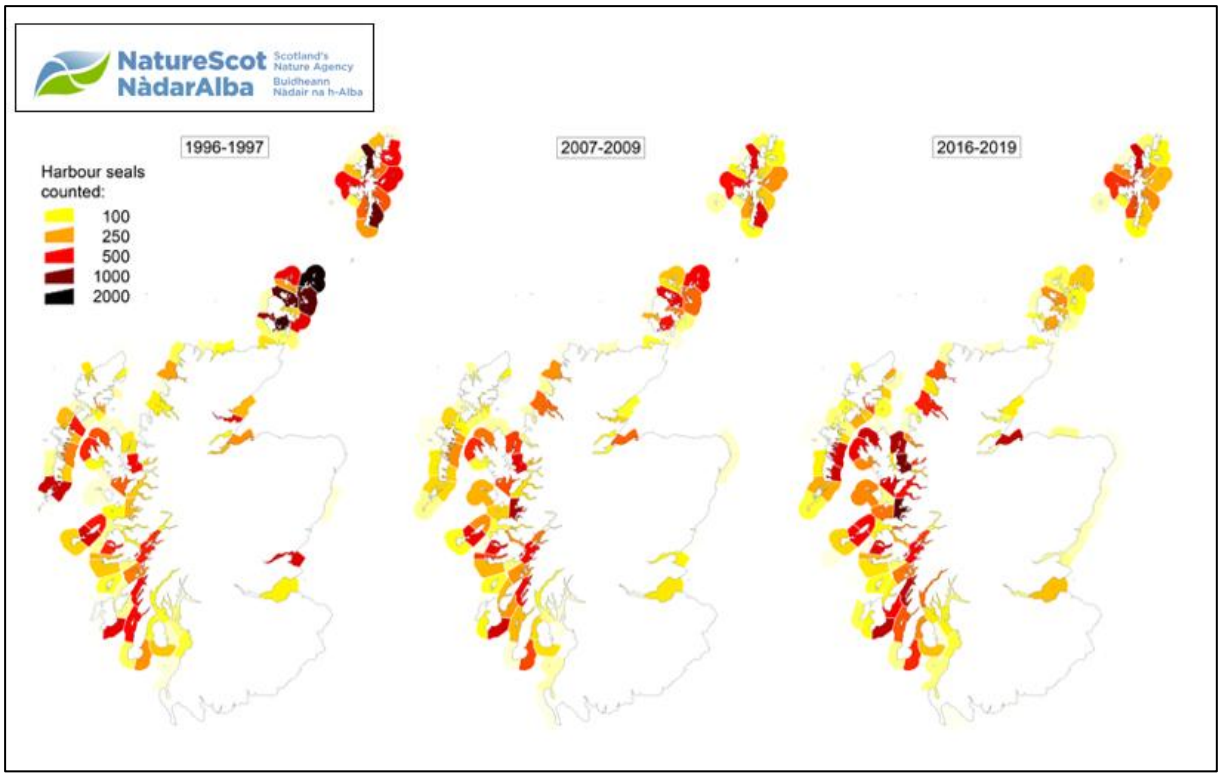


Figure 3-4: Maps showing the number of harbour seals counted during August over three time periods (1996-1997; 2007-2009 and 2016-2019) are detailed in NatureScot Research Report 1256

Harbour seals routinely travel 40-50km from their haul-out sites to forage and prefer more sheltered waters. In general, harbour seals are fairly loyal to a haul out site throughout the year and generally do not forage further than 50km from that site (although there are always exceptions to the rule). The waters within and surrounding the site are known to host fish and other suitable prey items for harbour seals. A total of 34 designated haul out sites for harbour seals (see Appendix C) are present within 50km of the Hatston development site. The nearest haul out site is 4km west (Damsay and Holm of Grimbister). Two SSSI (Eyenhallow SSSI; 17km north west and East Sanday Coast SSSI; 33km north east) and one SAC (Sanday SAC; 33km north east) with harbour seal being a designated feature are located within 50km of the site.

Records of 420 out of 461 tagged harbour seals within UK waters (2001-2018) show a primarily coastal distribution, with concentrations of tagged seals in Hebrides, the Moray Firth, Orkney and Shetland, as detailed in Figure 3-5. However, telemetry data from 54 tagged harbour seals between 2003-2015 showed a lack of strong connectivity between sites they were tagged at (four from Sanday in 2003 and 12 from Eynhallow 2003-2015) and the SDWQ development site, as detailed in Figure 3-6.

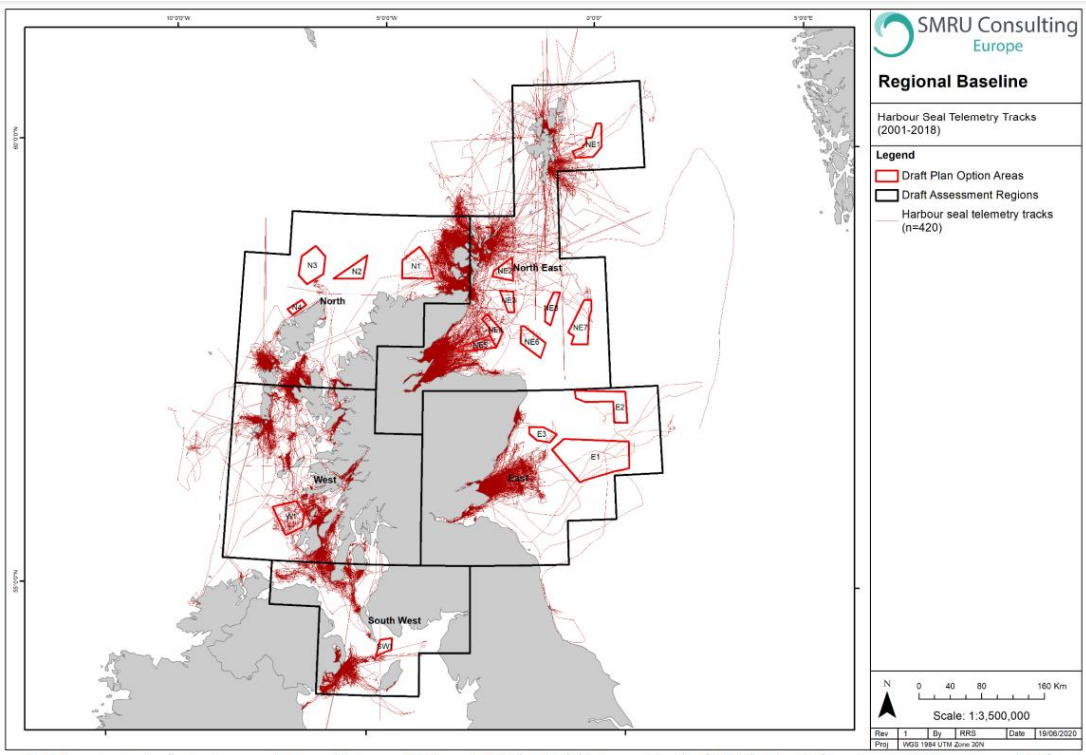


Figure 3-5: Telemetry tracked harbour seals (2001-2018)

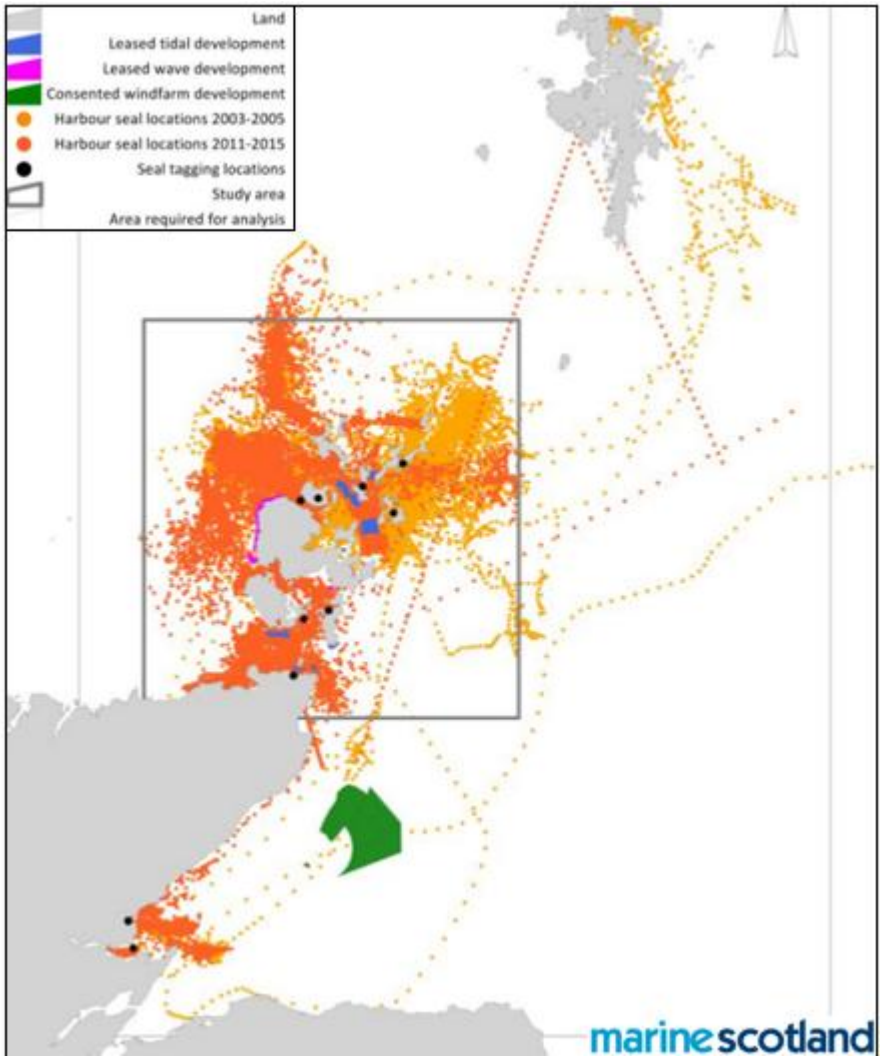


Figure 3-6: Map obtained from Marine Scotland and shows the tracks of 54 harbour seals included in the analysis (orange circles), their tagging locations (black circles).

Harbour seal distribution estimates show the mean number of harbour seals estimated to be present in each 5 km by 5 km grid cell at any one time, with that around the development site estimated to be 10-25 individuals per $5km^2$ as detailed in Figure 3-7.

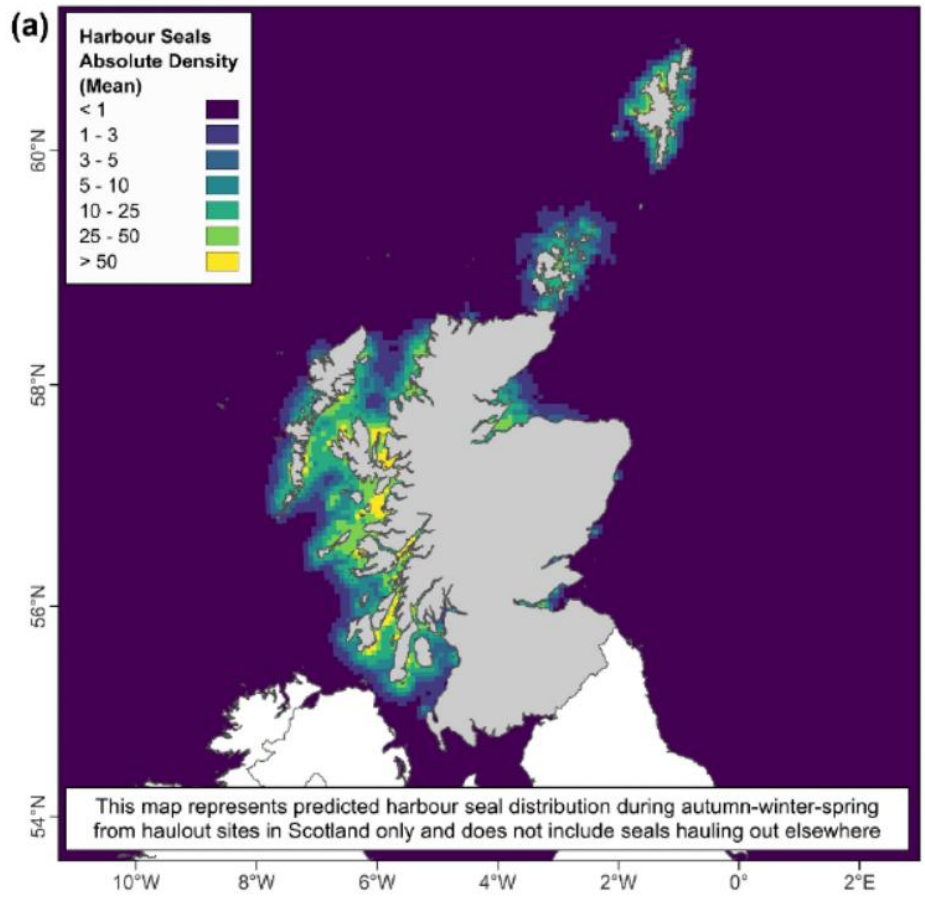


Figure 3-7: Map showing harbour seal distribution estimates. The mean number of harbour seals estimated to be present in each 5 km by 5 km grid cell at any one time. Image taken from Carter et al (2025).

Seal haul out data counts for harbour seal also show the important association with Orkney, as detailed in Figure 3-7.

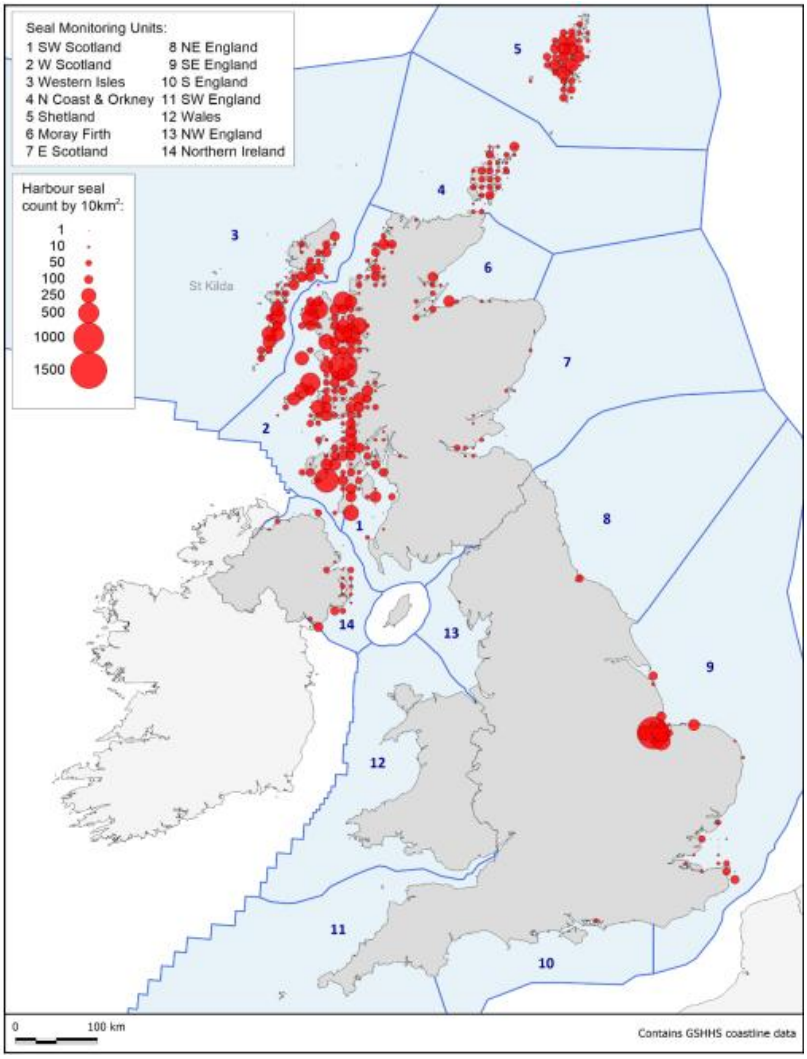


Figure 3-8: August distribution of harbour seals around the British Isles by 10km squares based on the most recent available haul out count data collected up until 2021. Map obtained from SCOS 2022.

SMASS have recorded 76 harbour seal strandings within 8km of the site between 1994-2022. No records of harbour seal were returned from SWF, HWDT, OW or OMMRI.

The site and adjacent coastline is not considered suitable for use as a haul out site by harbour seals due to the relatively high level of disturbance associated with the existing pier and adjacent industrial units. However, harbour seals may use the coastal waters within and adjacent to the site for commuting between haul outs and/or foraging, and two haul out sites are within 4 and 5km of the development site, therefore, there is a risk of disturbance to a small number from in water development works and vessel movements.

4 SEAL RISK ASSESSMENT

4.1 Activities Affecting Seals

4.1.1 Underwater Noise Producing Activities

The way in which noise affects marine mammals is dependent on several factors, including the type of noise generated, the noise level, the species of marine mammal and the distance between the animal and the source of the noise. The National Oceanic and Atmospheric Administration (NOAA) describes how different groups of marine mammals hear and are affected by sounds, which can be found in the *'Guidance for Assesing the Effects of Anthropogenic Sound on Marine Mammal Hearing'*[25]. The effects can be described as either a Permanent Threshold Shift (PTS), where an animal experiences irreversible damage to their hearing which can in turn affect their ability to forage and reproduce and in extreme circumstances result in death; or a Temporary Threshold Shift (TTS) which an animal can recover from but may experience 'masking' which reduces its ability to communicate with other animals and locate prey, resulting in fatigue[26].

While exemplar tender designs have been completed, until the preferred contractor is identified, and procurement complete, the exact detail of the construction methodologies cannot be confirmed at this stage in the development process. Therefore, the data to inform the noise models has been interpolated from equipment used on similar projects. The four construction methods below are considered the most significant:

Construction Methodology

Blasting
Blasting works will be undertaken during the period of April – October and only undertaken in daylight hours during suitable weather windows. There is a small possibility that blasting works could occur beyond October if the construction programme slips.

Blasting is planned prior to pile installation. Blasting will be undertaken maximum once per day during the works, likely to be at the end of the working day.

A barge will initially be set up adjacent to the existing pier and once the required depth of drill hole has been established in this area drilling will begin at the farthest away point from the pier and will continue in a direction towards the pier with holes being loaded utilising conservative charge weights of explosives. The shotfirer will design each blast to give optimum results taking into account the specific character of each section of work. Present assessment of rock quality indicates that explosive charge of around 27Kg will be required per hole. Approx. 9 holes will be drilled along proposed sheet pile wall clutch line (approx. 10m length) will be produced per day and then charged with blast completed during daylight hours. Upon completion of the drilling and charging the barge will be moved out of position and following audible warning procedures and approval from the port authority, the blast will be fired with each hole firing on a separate delay with the farthest hole from the pier firing first to allow the broken rock and blast energy to channel in the direction away from the existing pier. The hole firing sequence will be designed so that each hole is fired individually to minimise the MIC (Maximum Instantaneous Charge) and hence reduce vibration. Note that once detonated then it will appear as one blast due to only millisecond delay between each of the 9 No. holes. After the blast is complete

[25] NOAA guidance available at: http://www.nmfs.noaa.gov/pr/acoustics/guidelines.htm last accessed 05/03/2025
[26] JNCC UK Marine Noise Registry: Information Document available at: http://jncc.defra.gov.uk/pdf/MNR__Draft_InfoDoc_V1_20160808.pdf last accessed 05/03/2025

then the 10m of pile will be placed and a vibro hammer will be used for approx. 20 minutes to vibro place the sheet piles through the treated ground to final toe level position before the end of the day shift. Allowing for shift changes, weather delays and break downs then it is estimated that 500m of sheet piling will be installed over a period of 6 months between early April and October. Approximately 35 blasts in total will be required to install the 500m of piling.

Blasts will be monitored by using permanent recording three-directional vibration measuring instruments (vibrographs) at suitable agreed onshore locations. These will be monitored as blasting continuous to ensure vibration levels will be kept within the norms laid out in the internationally recognised British Standards 7385:1993, “Evaluation and Measurement for Vibration in Buildings, Part 2: Guide to damage levels from ground borne vibrations”.

Drilling
Drilling will take place for each blast as all explosives will be placed in holes prior to detonation, with approximately 9 holes drilled per day during 8am to 4pm.

Drilling is likely to be undertaken using an Atlas Copco 9H5 tracked drill rig using a rotary percussive DTH hammer with a Symmetrix N131 casing system or equivalent. Hole size will generally be 110mm dia. and drilling patterns will be reviewed following trial pile installation to ensure the required depth is being achieved. There will be a written Blast Proposal for each blast which will show patterns and drill depths of the holes to be drilled.

Vibration Piling
Vibration piling works will be undertaken during the period of April – October, and only undertaken during suitable weather windows. There is a small possibility that piling works could occur beyond October if the construction programme slips.

Sheet piles are to be used for the pier extension, which will be vibrated into the trench created by the blasting operation. Sheet piles will be vibro piled to the required depth, with no impact hammers being utilised.

It is assumed that Piling will be carried out between the hours of 08:00 and 19:00 Monday to Friday, and Saturday 08:00 – 19:00 and Sunday 09:00 – 13:00, with approximately 1hr of vibration piling occurring per day, to insert piles into treated ground.

Dredging
Once all Phase 2 quay works are complete and seabed survey post treatment undertaken a small amount of dredging is required to the west along the line of the quay extension to provide a deeper approach channel to the quay berth area including bulking factor and create future boat lift area. Dredging will also be required at the end of Phase 3 in the area around the boat lift.

Dredging will be undertaken by a long reach from land during daylight hours, dredging a total of approximately 6,700m^3 (10,300m^2 area) of sediment. The deepest likely dredge depth is between 1m and 2m and land based long reach excavation technique would be used to remove dredge spoil directly ashore into the new reclamations works. The sediment dredged will be used as infill material, therefore no offshore dredge disposal will be required. It is not currently known when dredging works will be undertaken but will take 7-10 days to complete for each phase of the development (<20 days dredging for phase 2 and 3).

4.1.2 General Disturbance

The Marine Scotland 'Guidance for Scottish Inshore Waters: The Protection of Marine European Protected Species from Injury and Disturbance[27] defines what disturbance means to marine mammals as: 'Changes in behaviour which may not appear detrimental in the short-term, but may have significant long-term consequences. Additionally the effects may be minor in isolation, but may become more significant in accumulation'. This is also considered applicable to seals. Therefore those disturbances which may be identified that are applicable to seals includes the following behaviour:

- Changes in (direction or speed of) swimming or diving behaviour;
- Certain surface behaviours such as increased alertness (head lifting); and
- Moving out of a previously occupied area.

The following negative effects are linked to disturbance:

- Displacement from important feeding areas;
- Disruption of feeding;
- Disruption of social behaviours such as communication, pupping, breeding, nursing, resting and feeding;
- Increased risk of injury or mortality;
- Increased vulnerability of an individual or population to predators or physical stress; and
- Changes to regular migration pathways to avoid human interaction.

Behavioural Impact Range
As part of the underwater noise modelling an assessment of potential **disturbance** via a sound source on seals was undertaken, sound sources were categorised as either impulsive or non-impulsive:

- Impulsive, or pulsed sound is brief, broadband and will consist of a high peak pressure with rapid rise and decay, such as seismic airguns.
- Non-impulsive, can be broadband, narrowband or tonal, typically do not have high peak pressure and rise time, and can be continuous, such as shipping and drilling.

Level B harassment encompasses activities that may disturb marine mammals or populations in their natural environment without causing physical injury, potentially disrupting critical behaviours like migration, nursing, breeding, feeding, or seeking shelter.

The hearing groups from the Southall 2019[28] and the NMFS 2018 guidance were specified by collating available information on marine mammal hearing and generalising their hearing sensitivity into representative groups. This grouping represents a significant research effort and are reviewed by the leading experts (academic, industrial and conservation) on the topic. Because of the large amount of work this represents and the widespread acceptance of the method, the thresholds and the methodology associated, have become de-facto standards for assessing noise impact on marine mammals and represents best available knowledge and practise.

Along with weighting curves, similar in function to the human dB(C) curves, a set of thresholds for hearing impact and injury is associated with the framework and allows for conversion of threshold exceedance into ranges with risk of impact.

[27] https://www.gov.scot/binaries/content/documents/govscot/publications/advice-and-guidance/2020/07/marine-european-protected-species-protection-from-injury-and-disturbance/documents/marine-european-protected-species-guidance-july-2020/marine-european-protected-species-guidance-july-2020/govscot%3Adocument/EPS%2Bguidance%2BJuly%2B2020.pdf
[28] Southall *et* al. (2019) Marine Mammal Noise Exposure Criteria: Updated Scientific Recommendations for Residual Hearing Effects, Aquatic Mammals 2019, 45(2), 125-232, DOI 10.1578/AM.45.2.2019.125 Available at: https://www.aquaticmammalsjournal.org/wp-content/uploads/2019/03/45_2_southall.pdf

For the current assessment, the loudest impulsive sound source to model possible disturbance was blasting, and the loudest non-impulsive sound source was dredging. The predicted level B-Harassment was modelled for these, with maximum range and average range of disturbance being provided for both non-impulsive and impulsive and being separated further to mild and strong disturbance for impulsive.

For impulsive/ pulsed sound, Level B Harassment, behavioural disruption, used a 160 dB re 1 µPa (rms) 6 threshold[29].

For non-impulsive/ continuous sound (ongoing noise sources), such as drilling, dredging, vibratory pile driving, vessel operations, and other continuous sounds, applying the Level B harassment threshold of 120 dB re 1µPa SPLrms established by the National Marine Fisheries Service (NMFS) [30].

Individuals Impacted (Quantitative Data) - Disturbance

In order to try and obtain an indicative numerical value for the number of individual seals that could be impacted when at sea, as a result of the noise related activities, a similar approach was undertaken to that adopted for the Marine Scotland European Protected Species (EPS) licensing applications.

To calculate the number of individuals, likely to be present within the behavioural impact ranges the following process was used:

Step 1 – Obtaining at sea area of maximum buffer distances for disturbance

The Underwater Noise Modelling in Section 7.1 shows received levels on moving animals at levels >120 dB from dredging activities, however does not provide the distances that this model predicted for disturbance ranges. Therefore, values for the maximum distance over which disturbance for seals is predicted for the relevant noise producing activity (dredging) is required. It was considered that a 5km disturbance range suggested by NatureScot would provide a worst-case scenario range, with the understanding that this is likely an overestimation for disturbance, for all noise producing elements.

A buffer of this distance is applied to the application site boundary and only the area (km^2) 'at sea' is taken.

Step 2: Obtain Seal density

Density values of seals present within the 'at sea' disturbance buffer distance were obtained using data from Carter et al 2025)[31] which provides density data in 5km x 5km ($25km^2$) for at sea usage. As values are provided by 25km2, to calculate the number of individuals per km2, the Carter et al absolute estimates were divided by 25 to obtain the estimated number of individuals impacted per km^2.

Where the calculated number of individuals is not an exact number, the figure has been rounded up as it would not be possible to cause disturbance to a fraction of an individual.

4.1.3 Designated Sites

Two SAC and three SSSI sites designated for harbour and grey seals are considered within influence of the development site and therefore an assessment in relation to the auditory and behavioural

[29] Based on 1980's research on the observed reactions of baleen whale to seismic airgun arrays
[30] NMFS Summary of Marine Mammal Acoustic Thresholds
[31] Carter et al., 2025

impacts as a result of the works associated with the development are to be undertaken. The designated sites to be assessed include:

- Sanday SAC (Harbour seal), located 33km (via sea) from the development
- Faray and Holm of Faray SAC (Grey seal), located 23.5km (via sea) from the development
- Eynhallow SSSI (Harbour seal), located 17km (via sea) from the development
- Muckle and Little Green Holm SSSI (Grey seal), located 15.5km (via sea) from the development
- East Sanday Coast SSSI (Harbour seal), located 33km (via sea) from the development

Seal Haul Out Sites
Two seal haul out sites are located within 5km of the development comprising of Damsay and Holm of Grimbister 4km west (harbour and grey seal) and Helliar Holm North and Elwick 5km north (harbour seal). Therefore, an assessment in relation to the auditory and behavioural impacts as a result of the works associated with the development are to be undertaken in relation to these two sites also.

4.2 Increased Vessel Movement

Current Vessel Movement

From information contained in the Navigational Risk Assessment (NRA) (see Technical Appendix 2.2) Existing vessel movements to and from Kirkwall/Hatston show a strong seasonality being demonstrated. Vessel movements are 998 in winter and 2,104 in summer, a total of 3102 vessel movements through the approaches to Hatston and Kirkwall piers over a calendar year.

During Construction

During construction works, there will only be a small volume of vessel movements.

It is anticipated that the majority of materials will be brought by land from sites within Orkney Mainland. Rock armour import will consist of two shipments at start and halfway through contract, therefore 8 vessel movements in total. These vessel movements will be following existing shipping routes, with no new/novel routes being utilised. Sheet piles and any other material that cannot be sourced on the mainland will be imported through the existing Orkney Northlink freight services, so there will be no increase to current vessel movement baseline levels to deliver these.

Dredging will not require any vessel movements as previously described, dredge material will be pumped on to land to be reclaimed. Vessels involved with blasting, piling and drilling will include the following. A small modular drill barge will be imported into Orkney by Northlink Ferries, transferred by road to site reclamation, put together and launched with small workboat / crew transfer boat used to position at start of pile line installation. A separate workboat barge with crane would be used to transfer material, piles, explosives from shore to pile line each day. Vessel operations are therefore self-contained to and from shore base with no vessel transiting through existing navigational channel.

4.3 Cumulative Impacts

Cumulative impacts associated with the construction phase only were considered. It was agreed cumulative operational impacts would be considered as a separate assessment, as the project details developed. The projects listed in Table 4-1 below were considered for cumulative effects to seals

Table 4-1: Projects to consider for In-Combination Effects on Seals

Project (Distance to Proposed Development)	Local Authority and Ref No.	Applicant	Status / Decision	Project Details	Discussion and Conclusion
Scapa Deep Water Quay	Orkney Islands Council 23/256/NATEIA Supplementary Environmental Information re-submitted	Orkney Islands Council Harbour Authority	Awaiting Decision	Construct a deep water quay including 597 metre, 2.7 hectare quayside and quay extension, excavate landform and reclaim land to create an 18 hectare laydown including rock armour revetments, construct an access road, vehicle parking, water tanks and associated infrastructure	With the low numbers of potentially disturbed Sanday SAC features from the SDWQ development it is predicted that there will be no adverse effect on site integrity with regards to Sanday SAC. **As such, there will be no in-combination effects.**
Meil Bay Fish Farm	Orkney Islands Council 24/294/MAR	Cooke Aquaculture	Awaiting Decision	Create salmon farming site comprising of 16 x 100 metre circumference circular cages, with pole mounted top nets, underwater lighting, and 300 tonne capacity automated feed barge (replacement of existing equipment)	No concerns in regards to seals raised by NatureScot. **As such, there will be no in-combination effects.**
Kirk Noust Fish Farm	Orkney Islands Council 24/204/MARPN	Cooke Aquaculture	Consented	Install pole mounted top nets to replace hamster wheel nets	With regards to Sanday SAC, NatureScot concluded that it is unlikely that the proposal will have a significant effect on any qualifying interests either directly or indirectly. An appropriate assessment is therefore not required. There will also be no in-combination effects with regards to North Orkney SPA or Sanday SAC. **As such, there will be no in-combination effects.**
Bay of Vady, Rousay Sound Fish Farm	Orkney Islands Council 24/308/MARPN		Consented	Install pole mounted top nets to replace hamster wheel nets and amend mesh size	Consented in November 2024, no concerns in regard to seals raised by NatureScot. No cumulative effects on seals predicted from Hatston with respect to Bay of Vady. **As such, there will be no in-combination effects.**

Project (Distance to Proposed Development)	Local Authority and Ref No.	Applicant	Status / Decision	Project Details	Discussion and Conclusion
Puldrite Fish Farm	Orkney Islands Council 23/182/MARPN	Scottish Sea Farms	Unknown	Replace 10 x 80metre circumference cages with 7 x 100 metre circumference cages	NatureScot consider that given it is a replacement of cages of smaller size, it is unlikely that the proposal will have a significant effect on any qualifying interests either directly or indirectly. An appropriate assessment is therefore not required. **As such, there will be no in-combination effects.**
Veantrow Bay, Shapinsay Orkney Fish Farm	Orkney Islands Council 24/423/MARMAJ	Scottish Sea Farms	Awaiting Decision	Create salmon farming site comprising of 12 x 140 metre circumference circular cages in a 100 metre mooring grid, with pole mounted top nets, underwater lighting, and 250 tonne capacity automated feed barge (replacement of existing equipment)	NatureScot request further information with regards to disturbance and displacement and habitat loss to qualifying features of North Orkney SPA. This information is not currently available. For Hatston, a small number of vessels and associated movements will occur within the development footprint. This will not give rise to any cumulative effects to seals. **As such, there could be in-combination effects**
Noust Geo Fish Farm	Orkney Islands Council 14/202/MAR	Scottish Sea Farms	Consented	Install 12 x 100m circumference cages with feed barge (to replace existing fish farm cages at Noust Geo (Backaland) and at Kirk Taing)	NatureScot concluded it was unlikely that the proposals will have a significant effect on the seal qualifying interests Sanday SACs, either directly or indirectly. An appropriate assessment is therefore not required. **As such, there will be no in-combination effects**
Bay of Holland Fish Farm, Stronsay	Orkney Islands Council	Cooke Aquaculture	Consented	Create salmon farming site comprising of 16 x 100 metre circumference circular cages arranged in a 2 x (2 x 4) formation with a 70 metre grid, with a 300 tonne capacity semi-automated feed barge	Already constructed so now forms part of baseline conditions. NatureScot concluded it is unlikely that the proposal will have a significant effect on any qualifying interests of Sanday SAC or Fray and Holm of Faray SAC either directly or

Project (Distance to Proposed Development)	Local Authority and Ref No.	Applicant	Status / Decision	Project Details	Discussion and Conclusion
					indirectly. An appropriate assessment is therefore not required. **As such, there will be no in-combination effects**
Wyre Fish Farm, Gairsay Sound	Orkney Islands Council 23/183/MARPN	Scottish Sea Farms	Unknown	Replace 12 x 100metre circumference cages with 9 x 120 metre cages, install pole-supported top nets and reposition a feed barge	NatureScot concluded no adverse effect on Sanday SAC. The proposed Predator Exclusion Plan includes the appropriate measures to prevent and reduce any risk of entanglement to seals as a result of predation. Measures include appropriate mesh size and strength for the site, and also sufficient tensioning with the use of net weights. Suitable monitoring of the site has been proposed to ensure equipment is maintained and seal interactions are monitored and reported. **As such, there will be no in-combination effects**
Quanterness Fish Farm	Orkney Islands Council 24/216/MAR	Cooke Aquaculture	Awaiting Decision	Create salmon farming site comprising of 14 x 120 metre circumference circular cages, with pole mounted top nets, underwater lighting, and 200 tonne capacity feed barge (replacement of existing equipment	No HRA available on planning portal at time of search (June 2025). NatureScot advice was for further information with regards to impacts to North Orkney SPA qualifying features to determine any adverse effect. NatureScot concluded no adverse effect on the integrity of Sanday SAC. **Given NatureScot's comments and the lack of available information and data with regards to qualifying features of the North Orkney SPA, it is not possible to a undertake an assessment of in-combination effects**

Project (Distance to Proposed Development)	Local Authority and Ref No.	Applicant	Status / Decision	Project Details	Discussion and Conclusion
Quanterness (Land Near) St Ola, Orkney	Orkney Islands Council 20/037/TPPMAJ	Orkney's Community Wind Farm	Currently awaiting decision – called in by Scottish Government	Erect 6 wind turbines (maximum height 149.9m, maximum wind capacity 50MW), erect a meteorological mast (maximum height 90m) and a substation, create an access and construct access tracks, and associated infrastructure.	No impacts on designated sites for seals are concluded. **As such, there could be in-combination effects**
Faray Wind Farm	Orkney Islands Council 21/240/TPPMAJ	Orkney's Community Wind Farm	Awaiting Decision	Erect 6 wind turbines (maximum height 149.9 metres, maximum wind farm capacity 50MW), erect a meteorological mast (maximum height 90 metres) and a substation, construct access tracks, crane hardstandings, underground cabling, transformers, and a slipway and jetty, create a borrow pit, and associated infrastructure	No impacts on qualifying features of North Orkney SPA. Mitigation measures are required to avoid impacts to qualifying features of Faray and Holm of Faray SAC and Sanday SAC, including timing of construction works, construction method statements, and JNCC protocols for offshore piling activities. If there is strict adherence to mitigation measures, no adverse effect on Faray and Holm of Faray SAC and Sanday SAC. Given NatureScot's comments with regards to North Orkney SPA, there would be no in-combination effects on North Orkney SPA There is no information relevant to assess against the Proposed Development with regards to seals. However, given NatureScot's comments on no adverse impacts on site integrity for Sanday SAC and Faray and Holm of Faray SAC, and given that the Proposed Development at Hatston will not result in adverse impacts on site integirty **there will be no in-combination effects**
Stymilders/Heddle Hill (Land	Orkney Islands Council 19/113/NATEIA	Scottish and Southern Energy	Consented subject to conditions.	Erect a 220/132kV substation comprising platform area, electrical infrastructure and buildings,	Agreed by NatureScot that there is no connectivity between this development and Orkney Mainland Moors SPA.

Project (Distance to Proposed Development)	Local Authority and Ref No.	Applicant	Status / Decision	Project Details	Discussion and Conclusion
Near), Firth, Orkney		Networks (SSEN)		associated plant, ancillary infrastructure, drainage, landscaping, access road and temporary construction compound areas	The Proposed Hatston Logistics Base Development would not result in adverse effects on the integrity of the Orkney Mainland Moors SPA. **As such, there would be no in-combination effects**
Kirkwall Pier	Orkney Islands Council 20/240/SCR		At screening stage	Extend a pier to provide additional quay infrastructure, reclaim land to create a mixed-use development, and reconfigure and expand marina	Currently at screening stage so no assessment information available.

4.4 Effects of Construction Activities on Seals

Seals rely on their hearing for foraging, navigation, communication and locating threats. The impact of noise to a population level is difficult to determine, however the expected impact on an individual animal's hearing ability and potential damage that could be caused by noisy activities during construction is assessed by modelling representative scenarios, taking into account environmental variables and the animal's hearing capabilities.

Harbour seals are known to have the highest sensitivity to acoustic exposure of all tested pinniped species. Grey seals are also known to have a high sensitivity to acoustic exposure, however there is no published threshold audio data for grey seals, therefore it is assumed audio data for harbour seals to be the closest approximation for grey seals.

Both harbour and grey seals are vulnerable to increases in acoustic levels when underwater, from dredging, drilling, blasting and piling. Harbour seals exhibit avoidance behaviour (haul out) when in close proximity to noise above background levels from vessel movement. Grey seals may exhibit avoidance behaviour by hauling out or creating distance from the underwater noise source.

Four noise sources were considered for this assessment and include:

Drilling

Drilling was screened out in the UW noise modelling, as it was not considered loud enough to be meaningfully assessed in an environment with many vessels and general human activity. However, drilling through hard sediment can be significantly noisy, given that the drilling will be part of the wider blasting activity and will occur just in advance of the blasting, the noise from drilling will not be dominated by the acoustic impact of the blasting. Drilling will be undertaken for 9 holes per day between 8am and 4pm during which, there would be a noise increase in the water environment over a 6 month period. Both PTS and TTS risk ranges are <50m (maximum and average range) over 8 hour period. However, the modelling suggests that as the modest broadband level for drilling is 156 dB SPL and the typical background noise for Hatston is 107.2 dB SPL, drilling would therefore equate to an increase of <50 dB from baseline, and as such, it is considered that this noise source is unlikely to lead to PTS or TTS in seals. However, as drilling will be undertaken for 9 holes per day over 6 month period, and noise levels will be produced which are above ambient background noise, drilling may still have impacts on seals in relation to general disturbance (behavioural changes). Although mitigation to be implemented for other methods of works would likely ensure seals were clear of the works area ahead of works commencing.

The underwater noise modelling provide a comparison of drilling noise with the other noise producing works and vessel noise which is depicted in Figure 4-1 overleaf.

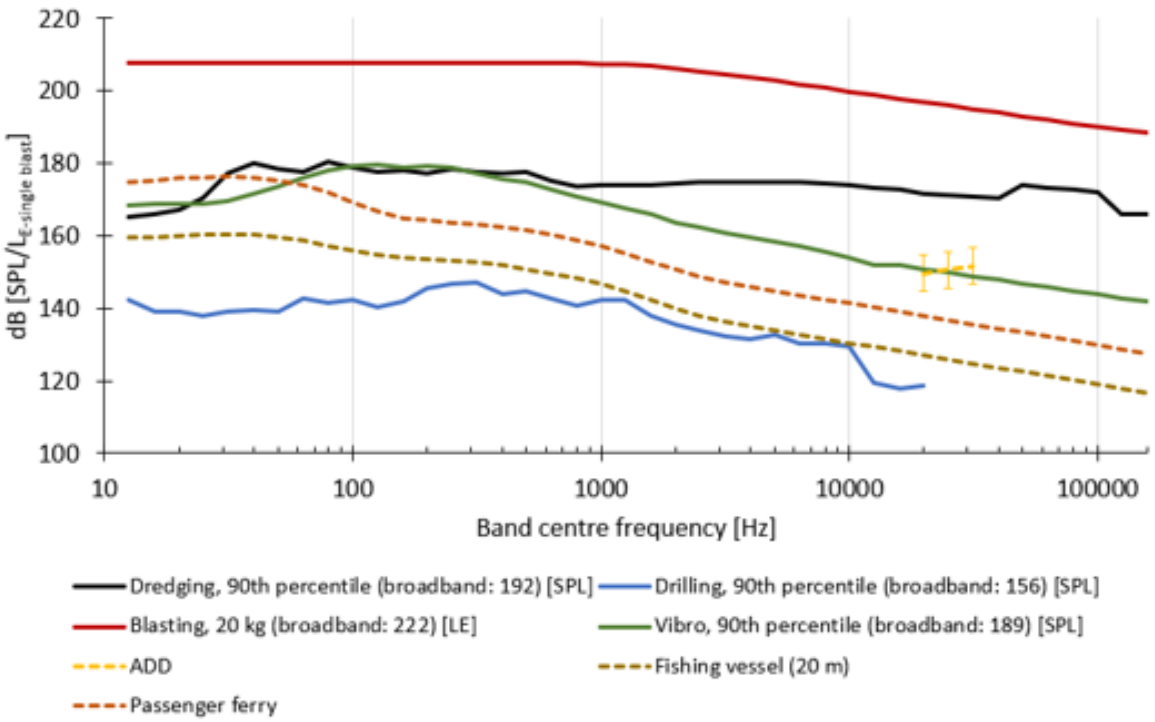


Figure 4-1: Underwater noise modelling figure showing the three sound sources considered in the report, alongside a fishing boat and a small ferry for context.

Blasting

Blasting activities have short PTS ranges for both harbour and grey seals ranging from 77.1m (maximum range) to 55.5 (average range) for 1 blast, with TTS up to 354.4m (maximum range), from unweighted Sound Exposure Level (SEL). Peak pressure (Sound Pressure Level (SPL)) (a seal would suffer the effect acutely/instantly and from just one exposure) for blasting equates to PTS of 285.2m (maximum range) to 192.6m (average range) and TTS of up to 425.3m (maximum range). This means that where seals are in the vicinity of blasting, auditory injury may occur. In addition, the charges for each hole are estimated by the contractor at 27Kg TNT, with up to 9 holes per blast (per day) and a total of 35 blasts occurring over a 6-month period. Therefore, the worst-case for blasting per day is based on the accumulation of 9 x 27Kg, thus equivalent to 1 blast of 243kg when modelling peak pressure levels. However, due to the millisecond delay between charges, increasing the number of blasts does not increase an animal's exposure and therefore it's risk of auditory injury remains the same should it fail to vacate the area during 1 or more blasts. As the blasting has no slow build-up of noise or soft-start and leaves no time for seals to vacate the area, mitigation will be put in place to ensure seals are clear of the area prior to blasting. This would reduce the likelihood of auditory impacts occurring to seals.

Vibration Piling

Vibration piling activities has low acoustic impact upon seals with short risk ranges of PTS and TTS <50m for 1 hour. As such, there is no acute risk of noise related injury related to the vibration piling, and animals have time to swim away. The UW noise modelling assumed that there would be active piling maximally 1 hour every 24hrs, when in reality this is the maximum and may likely be reduced. However, it is acknowledged that despite this, seals could still be displaced or actively avoid the area for the duration of the dredging works (disturbance). Therefore, mitigation via pre-works checks and slow ramp up of vibration piling would ensure seals were clear of works areas ahead of works commencing. Also, it is essential to note, that in other UW noise modelling for similar projects, the potential for instantaneous PTS/TTS has been found to occur as a result of vibration piling, thus, the

mitigation measures put in place to ensure seals are clear of the area prior to vibration piling would caveat for this.

Dredging
The noise from dredging, has short risk ranges for PTS for harbour and grey seal of <50m for 8 hours dredging. There is no acute risk of noise related injury related to the dredging, and seals have time to swim away. TTS risk ranges present the highest risk of temporary injury to seals with worst case ranging from 195.4m (average range) to 287.5m (maximum range) for 8 hours dredging, however, this is only for animals staying close to the activity for extended periods (prolonged exposure). The mean (expected case) TTS risk ranges are lower, ranging from 62.5m (maximum range) and <50m (average range). In addition, the figures quoted are conservative (based on cutter suction dredger), whilst in reality dredging activities will be land-based using a long reach excavator during the daylight hours over a 7-10 day period (per phase). Therefore, the above distances are considered to be very conservative. However, it is acknowledged that despite this, seals could still be displaced or actively avoid the area for the duration of the dredging works (disturbance). However, mitigation will be implemented to ensure seals are clear of the area prior to dredging and slow ram up of machinery will be implemented.

4.4.1 General Disturbance

Disturbance to seals may occur as a result of the works occurring (drilling, dredging, blasting and vibration piling). The most likely disturbance to seals as a result of the noise related activities include both physiological (increased stress and cortisol levels, rapid heartbeat, increased breathing rate, coldwater shock (if on land)) and behavioural disturbance (increased vigilance, crash diving, flipper splashing, vocalisation or avoidance)[32].

The NMFS predicts that seals (and other marine mammals) are likely to be behaviourally harassed when exposed to underwater noise levels of 120dB during continuous sources such as vibratory piling or drilling, and 160dB for non-explosive, impulsive sources, such as impact pile driving, whilst for underwater explosive sources where multiple detonations occur within a 24 hour period, the behavioural threshold is -5dB from TTS onset.

The underwater noise modelling used the level B-Harassment criteria to model potential impacts to behaviour for impulsive and non-impulsive sounds. It is predicted that non-impulsive sounds (dredging) would result in a maximum range (worst case) of 5.6km, with and average range of 2.3km. Impulsive sounds (blasting) were predicted to result in mild disturbance at a maximum range of 6.1km and average range of 1.9km, with strong disturbance predicted at a maximum range of 1.6km and average range of 707m. The maximum range is considered to be the worst-case scenario, with the average range considered more realistic.

Overall, it is expected that both seal species would be likely to exhibit a behavioural change as a result of the noise, when in water, predominantly fleeing away from the noise source, with vocalisations and splashing occurring. In addition, physiological stress is likely to also occur. This could impact seals energy and fitness levels through disturbing foraging or causing avoidance of feeding areas for periods of time.

Individuals Impacted (Quantitative Data) - Disturbance
Based on an adaptation of the EPS licensing methods, calculations aimed to quantify the number of individuals to be disturbed by the development for noise related activities are detailed below.

[32] https://britishcanoeingawarding.org.uk/wp-content/files/Seal_Disturbance_Factsheet.pdf

Step 1

The maximum buffer and average buffer distances for the impulsive and non-impulsive disturbance ranges equates to the following number of 5km x 5km grids 'at sea' of the Carter et al 2025 data, for both harbour and grey seal.

Non-impulsive

- Maximum range – 58.97 km^2
- Average range – 12.11 km^2

Impulsive

- Mild disturbance
  - Maximum range – 75.44 km^2
  - Average range – 9.67 km^2
- Strong disturbance
  - Maximum range – 8.08 km^2
  - Average range – 2.78 km^2

Step 2

The absolute density estimates of each of the grid squares within the disturbance buffer area 'at sea' were summed, then the value was divided by the number of grids within the site plus the disturbance buffer area averaged and then divided by 25 to obtain the estimated number of individuals impacted per km^2. The results for grey and harbour seal are provided as follows:

Harbour seal
Non-impulsive

- Maximum range: Density estimate of 8 grid squares equates to 142 per 25 km^2. 142/ 8 (grid squares)/ 25 (km^2) = 0.71 per km^2.
- Average range: Density estimate of 4 grid squares equates to 74 per 25 km^2. 74/ 8 (grid squares)/ 25 (km^2) = 0.74 per km^2.

Impulsive
Mild disturbance

- Maximum range: Density estimate of 10 grid squares equates to 142 per 25 km^2. 159/ 10 (grid squares)/ 25 (km^2) = 0.64 per km^2.
- Average range: Density estimate of 4 grid squares equates to 74 per 25 km^2. 74/ 4 (grid squares)/ 25 (km^2) = 0.74 per km^2.

Strong disturbance

- Maximum range: Density estimate of 4 grid squares equates to 74 per 25 km^2. 74/ 4 (grid squares)/ 25 (km^2) = 0.74 per km^2.
- Average range: Density estimate of 2 grid squares equates to 36 per 25 km^2. 36/ 2 (grid squares)/ 25 (km^2) = 0.72 per km^2.

Grey seal
Non-impulsive

- Maximum range: Density estimate of 8 grid squares equates to 1012 per 25 km^2. 1012/ 8 (grid squares)/ 25 (km^2) = 5.06 per km^2.
- Average range: Density estimate of 4 grid squares equates to 456 per 25 km^2. 456/ 4 (grid squares)/ 25 (km^2) = 4.56 per km^2.

Impulsive
Mild disturbance

- Maximum range: Density estimate of 10 grid squares equates to 1258 per 25 km^2. 1258/ 10 (grid squares)/ 25 (km^2) = 5.03 per km^2.
- Average range: Density estimate of 4 grid squares equates to 456 per 25 km^2. 456/ 4 (grid squares)/ 25 (km^2) = 4.56 per km^2.

Strong disturbance

- Maximum range: Density estimate of 4 grid squares equates to 456 per 25 km^2. 456/ 4 (grid squares)/ 25 (km^2) = 4.56 per km^2.
- Average range: Density estimate of 2 grid squares equates to 275 per 25 km^2. 275/ 2 (grid squares)/ 25 (km^2) = 5.5 per km^2.

Step 3

The estimated number of individuals per km^2 is then calculated as:

Harbour seal
Non-impulsive

- Maximum range: 0.71 per km^2 X 58.97 km^2 buffer area = 41.87 (42 individuals)
- Average range: 0.74 per km^2 X 12.11 km^2 buffer area = 8.96 (9 individuals)

Impulsive
Mild disturbance

- Maximum range: 0.64 per km^2 X 75.44 km^2 buffer area = 47.98 (48 individuals)
- Average range: 0.74 per km^2 X 9.67 km^2 buffer area = 7.16 (8 individuals)

Strong disturbance

- Maximum range 0.74 per km^2 X 8.08 km^2 buffer area = 5.98 (6 individuals)
- Average range: 0.72 per km^2 X 2.78 km^2 buffer area = 2.00 (2 individuals)

Grey seal
Non-impulsive

- Maximum range: 5.06 per km^2 X 58.97 km^2 buffer area = 298.39 (299 individuals)
- Average range: 4.56 per km^2 X 12.11 km^2 buffer area = 55.22 (56 individuals)

Impulsive
Mild disturbance

- Maximum range: 5.03 per km^2 X 75.44 km^2 buffer area = 379.61 (380 individuals)
- Average range: 4.56 per km^2 X 9.67 km^2 buffer area = 44.1 (45 individuals)

Strong disturbance

- Maximum range: 4.56 per km^2 X 8.08 km^2 buffer area = 36.85 (37 individuals)
- Average range: 5.5 per km^2 X 2.78 km^2 buffer area = 15.29 (16 individuals)

Conclusion

The quantitative data shows that a maximum of 48 harbour seals and 380 grey seals could be disturbed from noise related activities. These numbers are considered a ‘worst case’ scenario due to the maximum ranges being used. Therefore, the actual numbers would likely reflect those in the average range; 9 harbour seals and 56 grey seals (due to TTS and PTS ranges being <500m for all activities). In addition, the maximum range for strong disturbance would only result in 6 harbour seal and 37 grey seals being impacted. Thus, potential for disturbance is considered to be limited.

4.4.2 Designated Sites

Harbour Seal from SACs and SSSIs

- Sanday SAC (Harbour seal), located 33km (via sea) from the development
- Eynhallow SSSI (Harbour seal), located 17km (via sea) from the development
- East Sanday Coast SSSI (Harbour seal), located 33km (via sea) from the development

Based on the distance of PTS, TTS and predicted level B-Harassment maximum ranges, harbour seals are not considered to be directly impacted whilst within the SAC and SSSI boundaries, from auditory related impacts and behavioural impacts associated with noise. However, the typical foraging ranges of harbour seals are in the range of 50km and with Sanday SAC, Eynhallow SSSI and East Sanday Coast SSSI within this 50km buffer harbour seal are at risk of being in the same vicinity of the impacts of the development. Although telemetry studies do not show strong a strong connectivity between designated areas and the area for construction activities (see Figure 3-6 above), likely due to the highly active nature of the site currently. Even where a seal from the SAC/SSSI was present in the vicinity of the development (commuting/ foraging) it would likely not be exposed to injury (due to the mitigation measure to be implemented in Section 5). However, some behaviour changes may occur (vigilance or avoidance) up to 6.1km (maximum range) based on impulsive noise activities (blasting) (although more realistically 1.9km (average range) for blasting and 2.3km (average range) for dredging) from the development. Although disturbance could occur out to these ranges, it is unlikely that individual seals from the SAC/SSSI would be spending all of their time in the development area (or maximum range area), if it is returning to SAC/SSSI up to 50km away and the works to be undertaken are temporary in nature, as such disturbance is likely to be limited.

Grey Seal from SACs and SSSIs

- Faray and Holm of Faray SAC (Grey seal), located 23.5km (via sea) from the development
- Muckle and Little Green Holm SSSI (Grey seal), located 15.5km (via sea) from the development

Although grey seals can and do forage considerable distances, the Conservation Objectives for grey seal SACs (and SSSIs) are related to the protection of the breeding colony only. During this sensitive time, grey seals (especially females) do not tend to travel beyond 20km from these sites. Therefore, NatureScot advise screening in grey seal SACs and SSSIs for assessment only where a project site/impact radius is within 20km of the SAC or SSSI. Based on the distance of PTS, TTS and predicted level B-Harassment maximum ranges it is considered unlikely that grey seal individuals from the Fary and Holm of Faray SAC or Muckle and Little Green Holm SSSI would be exposed to auditory related impacts and behavioural impacts associated with noise when within the SAC/SSSI. However, individuals from the SAC/SSSI may be in the waters near the development. However, where a seal from the SAC/SSSI was present in the vicinity of the development (commuting/ foraging) it would likely not be exposed to injury (due to the mitigation measure to be implemented in Section 5).

The level B-Harassment maximum ranges are predicted at 5.6km (at the greatest range), which would result in the site/impact radius falling within 20km of the SAC/SSSI. Therefore, some behaviour changes may occur (vigilance or avoidance) up to 6.1km (maximum range) based on impulsive noise activities (blasting) (although more realistically 1.9km (average range) for blasting and 2.3km (average range) for dredging) from the development. Although disturbance could occur out to these ranges, it is unlikely that individual seals from the SAC/SSSI would be spending all of their time in the development area (or maximum range area), if it is returning to SAC/SSSI up to 23.5km away and the works to be undertaken are temporary in nature, as such disturbance is likely to be limited.

Designated seal haul outs

Seals at the two seal haul outs within 5km of the development (Damsay and Holm of Grimbister 4km west (harbour and grey seal) and Helliar Holm North and Elwick 5km north (harbour seal)) would not be considered to be impacted auditorily when within the haul outs, due to the short risk TTS and PTS ranges.

Seals are considered to be more easily disturbed when on land. Although the maximum range of disturbance from predicted level B-Harassment is 6.1km for impulsive noise and 5.6 for non-impulsive noise, the largest average range of disturbance is 2.3km, which is considered to be more realistic. Therefore, due to the distance of the nearest seal haul out to the development site being 4km and noise sources at that distance being unlikely to transfer from the underwater environment to the terrestrial environment, it is not considered that seals would be disturbed or exhibit behaviours such as tombstoning and stampeding, from the noise levels associated with the works.

4.4.3 Vessel Movements

Increased vessel movement has the potential to increase collisions with seals.

The construction phase of the development will only require a small number of vessels that will be of consistent size, speed and operating procedure. This can result in seal collision risk associated with the Hatston development activities.

Presence of vessels can induce a vigilance/alert response in seals, considered to be attributed to similar behavioural responses to predator detection, foraging, observation of conspecifics, kleptoparasitism avoidance, and social cohesion maintenance[33]. Not only does this result in physical disturbance but also other costs (rest, locomotion, not foraging, not mating etc.) to seals.

However, research undertaken by the Sea Mammal Research Unit involving a telemetry-based study of the swimming behaviour of seals was carried out in the Moray Firth to compare seal and vessel movements with the purpose of identifying potential areas with high spatial overlap. The observations of movements of individual seals and vessels did not show any apparent responses, with seals not appearing to react to close passing vessels (not moving towards nor away from them)[34].

As well as disturbance, mortality of seals can occur from vessel strikes. Using data of stranded harbour seals in the Salish Sea from 2002–2019, Olson et al identified 27 cases of fatal propeller strikes, with weaned pups being the most frequently affected (64% of cases)[35].

The likelihood of vessel collisions is therefore dependent upon vessel speed, animal behaviour and vessel manoeuvrability[36]. Vessels travelling at slower speeds in general can allow time for seals and vessel operators to react to avoid collisions.

However, the Hatston pier is within a highly trafficked area for vessels, with designated vessel routes being in place and as the development is an extension for the existing pier, it is considered that seals utilising the waters within this area would likely avoid or be accustomed to the regular movements of vessels and thus the likelihood of vessel strike may be lower. Vessel movements associated with construction activities will be fairly self-contained only moving approx. 10m, within the development

[33] https://www.seawatchfoundation.org.uk/wp-content/uploads/2012/08/Kate-Lewis-thesis.pdf
[34] https://data.marine.gov.scot/sites/default/files/SMFS%20Vol%207%20No%2024.pdf
[35] J.K. Olson; D.M. Lambourn; J.L. Huggins; S. Raverty; A.A. Scott; J.K. Gaydos (2021) Trends in Propeller Strike-Induced Mortality in Harbor Seals (Phoca vitulina) of the Salish Sea. Journal of Wildlife Diseases. Vulme 57. Issue 3. Pages 689-693
[36] SEER U.S. Offshore Wind Synthesis pf Environmental Effects Research: Presence of Vessels: Effects of Vessel Collision on Marine Life (2022): https://tethys.pnnl.gov/sites/default/files/summaries/SEER-Educational-Research-Brief-Effects-of-Vessel-Collision-on-Marine-Life.pdf

footprint per day, with no need to extend into existing navigational channels, further reducing the likelihood of vessel impacts on seals.

In addition, the movement of vessels will not be within 500m of the two seal haul out sites located 4km west and 5km north of the development and therefore these haul out sites will be unaffected by the additional vessel movements during construction.

Although vessel trike is considered highly unlikely during the construction phase, a vessel management plan should be implemented.

4.5 Conclusion

There is a clear decline in harbour seal populations based on reviews of population data over the years. However, although the cause for the decline has not yet been identified, coastal developments or vessel movements are not considered to be linked.

Some of the activities associated with the Hatson development (blasting, dredging, vibration piling and vessel strike) have the potential to cause disturbance, injury or in extreme circumstances, death to individual seals. For the most part the activities associated with the proposed development will result in temporary avoidance of a small area of habitat available to individuals. It is considered that with mitigation described in the following Seal Mitigation Plan (SMP) the risk of death and injury this will be greatly decreased. It is not possible to rule out some level of disturbance to individuals which might be present within the area.

Overall, the increase in the number of vessels travelling through to Hatston, during construction would increase the risk of collision with seals, potentially resulting in death or injury to individuals.

It is considered unlikely that disturbance of seals using haul outs and designated sites (SAC/SSSIs) would occur due to the distance from the works, however it is possible that seals form the haul outs and designated sites may be present within the waters around the development and thus could be disturbed during in water works. However, the works are temporary in nature and mitigation will be implemented to avoid or reduce negative effects on the favourable conservation of the local seal population

5 SEAL MITIGATION PLAN

The seal mitigation will comprise a standard Marine Mammal Observer (MMO) protocol as per JNCC guidance to be implemented during operations in optimal sea states less than 4 and during times of optimal visibility.

5.1 Seal Observation Protocol

The Seal Observation Protocol (SOP) will be implemented so that the blasting, vibration piling and dredging works do not cause injury or unnecessary disturbance to seals. This section has been designed with reference to current JNCC guidance 'Statutory nature conservation agency protocol for minimising the risk of injury to marine mammals from piling noise' (August 2010) [37] and 'Statutory nature conservation agency protocol for minimising the risk of injury to marine mammals from explosives' (January 2025) [38] [39].

5.1.1 Marine Mammal Observer

Suitably qualified MMO (may be more than one), competent in the identification of seals at sea, will be present during the blasting, vibration piling and dredging. The MMO will undertake observation for seals within the mitigation zone before and during the blasting, vibration piling and dredging and will be dedicated to that one task for the duration of any watch. The MMO will advise the contractors and crews on the implementation of the procedures set out in the agreed protocol, to ensure compliance with those procedures.

The JNCC guidance provides the following definitions of an MMO:

MMO: Individual responsible for conducting visual watches for seals. It may be requested that observers are trained, dedicated and/or experienced.

Trained MMO: Has been on a JNCC recognised course.

Dedicated MMO: Trained observer whose role on board a vessel is to conduct visual watches for seals.

Experienced MMO: Trained observer with three years of field experience observing for seals, and practical experience of implementing the JNCC guidelines.

The MMO will be, positioned appropriately to cover the full mitigation zone and will be trained. The identity and credentials of the MMO will be agreed with Marine Directorate.

5.1.2 MMO Equipment

The MMO will be equipped with binoculars (10X42 or similar) and/or a spotting scope (20-60 zoom or equivalent), a copy of the agreed protocol and the Marine Mammal Recording Form (MMRF), which is

[37] https://data.jncc.gov.uk/data/31662b6a-19ed-4918-9fab-8fbcff752046/JNCC-CNCB-Piling-protocol-August2010-Web.pdf
[38] https://data.jncc.gov.uk/data/24cc180d-4030-49dd-8977-a04ebe0d7aca/jncc-guidelines-marine-mammals-and-explosive-use.pdf
[39] It should be noted that these protocols do not document measures to mitigate disturbance effects but have been developed to reduce to negligible levels of risk of injury or death to marine mammals in close proximity to piling operations or explosives.

a Microsoft Excel spreadsheet containing embedded worksheets named Cover Page, Operations, Effort and Sightings. A Microsoft Word document named Deck forms is also available, and the MMO may prefer to use this when observing before transferring the details to the Excel spreadsheets. Although these forms were developed for seismic surveys, they can be used for piling, dredging and blasting operations, although many columns will not be applicable. The ability to determine the range of seals is a key skill for MMOs, therefore a hand-held rangefinder will be used to verify the range.

All MMO forms, including a guide to completing the forms; and instructions on how to make a rangefinder are available on the JNCC website: https://data.jncc.gov.uk/data/31662b6a-19ed-4918-9fab-8fbcff752046/Marine-mammal-recordingforms-guide-piling-rev05.pdf and https://hub.jncc.gov.uk/assets/24cc180d-4030-49dd-8977-a04ebe0d7aca

5.1.3 Communication

The contractor will be responsible for the communication channels between those providing the mitigation service and the crews working on the piling, blasting and dredging. A formal chain of communication from the MMO to the contractor, who will start/stop piling, dredging or halt blasting will be established. In order to confirm the chain of communication and command the MMO will attend any relevant pre-mobilisation meetings.

5.1.4 Mitigation Zone

Following appointment of contractor / Ecological Clerk of Works (ECoW), logistical information will be available/ updated to provide more detailed mitigation zones for the MMO. This may change throughout the construction period due to ground levels changing and depending on the area of works which need to be viewed. Should the mitigation zone need to be changed during the works this must be agree with statutory bodies before being implemented.

The JNCC guidance defines the mitigation zone as a pre-agreed radius around the blasting, dredging or piling site prior to any works. This is the area where a MMO keeps watch for seals (and delays the start of activity should any seals be detected). The extent of this zone represents the area in which a seal could be exposed to sound/ disturbance that could cause injury and will be determined by factors such as the number of blasts, the water depth, the nature of the activities (for example whether drilling will also take place) and the effect of the substrate on noise transmission. The MMO should be located on the most appropriate viewing platform to ensure effective coverage of the mitigation zone.

The greatest PTS and TTS ranges for seals equate to 285.2m for blasting and 425.3m for dredging. However, based on JNCC guidance, the mitigation zone for blasting is defined as the full extent within which auditory injury (PTS) could occur or a 1km radius, whichever is larger. Therefore, a 1km mitigation zone for blasting should be implemented (as greatest PTS value is 285.2m). As the MMO should take into consideration all marine mammals when undertaking the pre-works search within the mitigation zone, the radius of the mitigation zone for dredging and vibration piling should be 1.1km to account for the greatest average TTS range of marine mammals.

5.1.5 Blasting, Vibration Piling and Dredging Protocol

Following appointment of contractor / Ecological Clerk of Works (ECoW), logistical information will be available/ updated to provide more detail regarding blasting, vibration piling and dredging protocols.

The standard JNCC protocol is outlined below:

1. Blasting, piling and dredging will not commence during poor visibility (such as fog) or during periods when the sea state is not conducive to visual mitigation (above sea state 3 is considered not conducive[40]) as there is a greater risk of failing to detect the presence of seals. An elevated platform for the MMO to monitor from would be beneficial when the sea state is 3 or above, the blasting, piling and dredging works could also be scheduled on a day where the sea is expected to be calm.

2. The MMO(s) should be situated in a location that provides the best viewing platform and is likely to be closest to the explosive/ piling/ dredging activities. For example, an elevated area of the coast or a vessels bridge that allows 360 degree cover (depending upon the size of the mitigation zone more than one MMO viewing platform (and therefore more than one vessel) may be required to ensure that the entire mitigation zone can be observed).

3. At least 30 minutes before any type of piling/ dredging and 1 hour before detonation works, a visual watch, should be carried out in the mitigation zone. The pre-works search should continue until the MMO advises that the mitigation zone is clear of seals, and the detonation/ piling/ dredging works can start.

4. The MMO will scan the waters using binoculars or a spotting scope and by making visual observations. Sightings of seals will be appropriately recorded in terms of date, time, position, weather conditions, sea state, species, number, adult/juvenile, behavior, range etc. on the JNCC standard forms. Communication between the MMO and the contractor and the start/end times of the activities will also be recorded on the forms.

5. Explosive detonations, vibratory piling or dredging should not be undertaken within 20 minutes of a seal being detected within the mitigation zone.

6. If a seal is observed, or acoustically detected, within the mitigation zone, it should be monitored and tracked until it moves out of range. The MMO should notify the relevant chain of command of the detection and advise that the operation should be delayed. If the seal is not detected again within 20 minutes, it can be assumed that it has left the area and the works may commence.

7. If an MMO is uncertain whether seals are present within the mitigation zone, they should advise that the activity should be delayed as a precaution until they are certain that no animals are present.

8. A soft-start will be employed for dredging/ piling, with the gradual ramping up of works (where possible)[41]. The soft-start duration will be a period of not less than 20 minutes. This will allow for any seals to move away from the noise source.

9. If a seal enters the mitigation zone during the soft-start then, whenever possible, the dredging/ piling operation will cease until the seal exits the mitigation zone and there is no further detection for 20 minutes.

10.The MMO or ECoW should periodically check the silt boom to ensure that no seals have been enclosed or interacted with the boom during works.

[40] Detection of marine mammals decreases as sea state increases. According to the JNCC guidance ideally sea states of 2 or less are required for optimal visual detection.
[41] Soft-start procedures are only relevant for equipment which have this capability, and which have the potential to cause instantaneous PTS, otherwise this procedure extends the time of unnecessary emitted noise into the environment.

5.1.6 Reporting

As per the JNCC guidance, reports detailing the blasting, piling and dredging activity and seal mitigation (the MMO reports) will be sent to Marine Directorate at the conclusion of these activities. Reports will include:

- Completed MMRFs;
- Date and location of the blasting/ piling/ dredging activities;
- A record of all occasions when blasting/ piling/ dredging occurred, including details of the duration of the pre-piling/ pre-dredging/ pre-blasting search and soft-start procedures, and any occasions when blasting/ piling/ dredging activity was delayed or stopped due to presence of seals;
- Details of watches made for seals, including details of any sightings, and details of the blasting/ piling/ dredging activity during the watches;
- Details of any problems encountered during the blasting/ piling/ dredging activities including instances of non-compliance with the agreed blasting/ piling/ dredging protocols; and
- Any recommendations for amendment of the protocols.

5.2 Vessel Movement Mitigation Protocol

The Harbour Authority implement speed restrictions on vessels within Orkney waters. Implementation of a Vessel Management Plan including agreed routes, speed limits and incorporation of the Scottish Marine Wildlife Watching Code[42] should be in place ahead of construction works commencing (inclusive of dredging)[43].

Training courses such as those provided by the WiSe scheme[44] could be offered to vessel operators.

5.3 Additional Good Practice Recommendations

If any dead seal is anecdotally observed during construction, it should be reported to the Scottish Marine Animal Stranding Scheme (SMASS) (www.strandings.org) and live seals in distress will be reported to British Divers Marine Live Rescue (www.bdmlr.org.uk). All dead or distressed seals should also be reported to the local NatureScot office.

The MMO should keep a record of all seal sightings, whether in the mitigation zone or not, to be issued to NatureScot. An understanding of the location of species is essential to appropriately assess the impacts of a proposed development and plan and target effective mitigation, therefore this data could be used to inform future projects. Biodiversity data are extremely important as, aside from use in planning and decision making, they are key to delivering state of environment reporting, education, modelling trends in species and habitat distribution, and research and policy making.

[42] https://www.nature.scot/doc/scottish-marine-wildlife-watching-code-smwwc

[43] Identified in a project team meeting that 4 knots isn't a safe/practical speed for dredging vessels and isn't considered necessary as vessels will be using established shipping routes to reach the licensed sea deposit site.

[44] Information available at: https://www.wisescheme.org/ (accessed 02/06/2023)

APPENDICES

A PROPOSED SITE LOCATION AND LAYOUT

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+6.40m	+5.00m	Quay Edge Level
+3.00m	+1.60m	Mean High Water Spring Tides
+1.40m	0.00m	Ordnance Datum (Newlyn)
+0.60m	-0.80m	Mean Low Water Spring Tides
0.00m	-1.40m	Chart Datum (Kirkwall)
-5.00m	-6.40m	
-7.50m	-8.90m	
-10.00m	-11.40m	

-11m CD
-10m CD
-9m CD
-8m CD
-7m CD
-6m CD
-5m CD
-4m CD
-3m CD
-2m CD
-1m CD

Note:
U-Shaped Sheet Piling wall with concrete surafce created around end of existing suspended quay, to to allow access from HGV Trailer area on new reclamation area directly to existing quay

Quay Access to HGV Trailers
+6.4m CD
Fall
Ex. Roadway to Quay
Footpath along Road to Armco Barrier for HGV Trailers
HGV Trailer Parking To/From Ferry
Armco Barrier to HGV Trailers
+8.0m CD
Future Access to Works Phase 2 & 3 Quay Works
Ex. Tanks
Hatston Pier Water Storage Facility
Ex. ESS
Earth-house (site of)
Proposed Coastal Cycleway / Footpath
Hardcore Surfaced Marshalling / Lairage / Storage Area 20,600m2 / 2.06Ha / 5.09 Acres
Mean Low Water Springs
Rock Armour Revetment
New Surface Water Outfall from Reclamation Area
Surface Water Drain (French Drain) between existing area and new reclamation
MH

Orkney Cheese Outfall Pipe Diffuser Location
(Position taken from Admiralty Chart)
Approx 771m
Approx 350m
Outfall Pipe

Rocks
Shingle
Rock
Coastal Slope
Boulders
Track
WB
Turbine
Sub Sta

ORKNEY ISLANDS COUNCIL
ORKNEY LOGISTICS BASE, HATSTON
PHASE 1 WORKS
SOUTH SIDE RECLAMATION

Scale 1: 1000

10 0 10 20 30 40 50 60 70 80 90 100m
SCALE 1:1000 at A1

N

REV	DATE	REVISION	DRN	CHK
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Orkney Logistics Base, Hatston, Orkney

Consenting Process
Phase 1 Works: South Side Reclamation

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+0.60m	-0.80m	Mean Low Water Spring Tides
0.00m	-1.40m	Chart Datum (Kirkwall)
-5.00m	-6.40m	
-7.50m	-8.90m	
-10.00m	-11.40m	

Overall Length of Extended Berth = 321.061m
27No Fender Panels at 11.200m crs
14No Ladders at 22.400m crs
14No 80T Bollards at 22.400m crs
Area Dredged to -10.0m CD
Inner Berth Length = 150.719m
29.174
27.963m
9.12m
400mm thk R.C Concrete Deck Slab (Deck Loading - 10Tonne/m2)
Incoming Fuel Delivery System
Security Fence to Fuel Berth
Service Trench with removable concrete covers
Fixed Ramp
Ramp Length 40m
Slope 1 in 10
New Surface Water Outfall
75.787m
400mm thk R.C Concrete Deck Slab (Deck Loading - 10Tonne/m2)
Total Concrete Deck Area = 21,630m2 / 2.16 Ha / 5.34 Acres
Drainage Channel
Note:
Curved end of existing pier removed, with overhang cope from new pier closing gap at deck level
New Surface Water Outfall through sheet pile wall from Reclamation Area
Hardcore Surfaced Storage Area 13,300m2 1.33Ha / 3.29 Acres
Road to Quays
Rock Armour Revetment
French Drain
Ex. Roadway to Quay
Rock Armour Revetment to marry into existing foreshore at corner
+8.5m CD
Earth House site left un-disturbed. All services routed in road verge on landward side.
Hatston Pier Water Storage Facility
Additional Storage Tanks
Upgraded / Additional E.S.S. as required
Ex. ESS
Ex. Tanks
Proposed Site for Fuel Tank Farm
Wind Turbine
El Sub Sta
Phase 1 Works: South Side Reclamation
-11m CD
-10m CD
-9m CD
-8m CD
-7m CD
-6m CD
-5m CD
-4m CD
-3m CD
-2m CD
Rocks
Rock
Shingle
Coastal Slope
Earth-house (site of)
Spreads
GALT VIEW
WB
Track
Boulders
Bay of Kirkwall
Mean Low Water Spring

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ORKNEY LOGISTICS BASE, HATSTON
PHASE 2 WORKS
PIER EXTENSION & NORTH SIDE RECLAMATION

Scale 1: 1000

10 0 10 20 30 40 50 60 70 80 90 100m
SCALE 1:1000 at A1

REV	DATE	REVISION	DRN	CHK
A	02:05:2023	Pier Approach Dredging Removed	JJM	
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0.00m	-1.40m	Chart Datum (Kirkwall)
-5.00m	-6.40m	
-7.50m	-8.90m	
-10.00m	-11.40m	

-5.0m CD Contour
(Boundary taken from Admiralty Chart)

-10.0m CD Contour
(Boundary taken from Admiralty Chart)

Hellier Holm beacon open S.E. of Thieves Holm 071° clears Scargun Shoal SE

Outline of existing Fish Farm
Boundary taken from Admiralty Chart

(Fish Farm to be Re-located under separate applications)

-10.0m CD Contour
(Boundary taken from Admiralty Chart)

-10.0m CD Contour
(Boundary taken from Admiralty Chart)

Bay of Kirkwall

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PHASE 2 WORKS
DREDGING LAYOUT

Scale 1: 2000

20 0 20 40 60 80 100 120 140 160 180 200m
SCALE 1:2000 at A1

Works Phase 2: Dredging	Quantities
Pier Berth	
Dredged Area (assumed no blasting required)	1,307m2
Dredged Quantity (available for pier works infill)	650m3

100m
Proposed Extension to Hatston Pier
Existing Hatston Pier
-10.0m CD Contour
(Boundary taken Hydrographic Survey)
30°

-10m CD
-9m CD
-8m CD
-7m CD
-6m CD
-5m CD
-4m CD
-3m CD
-2m CD
-1m CD

Contours taken from recent Hydrographic survey

Mean Low Water Springs
Mean High Water Springs
Rock
Shingle
Shingle and Boulders
Boulders
Sand
Wind Turbine
Sub Sta
CAL 1 VIEW
Boy Kirkwall
Existing Hatston Pier

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Consenting Process
Phase 2 Works: Dredging Layout

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0.00m	-1.40m	Chart Datum (Kirkwall)
-5.00m	-6.40m	
-7.50m	-8.90m	
-10.00m	-11.40m	

Phase 2 Works: Dredging

Phase 2 Works:
Pier Extension &
North Side
Reclamation

Phase 1 Works:
South Side
Reclamation

Travel Lift Dock:
Based on Planet Marina (Italy)
820Tonne Lift, with dock sizes based on recommendations for lift size.
Dock Width: 15.0m
Dock Length: min 56.5m

15.0m
18.9m
62.672m
20.0m
OIC 'Thor'
OIC 'Thor'

New Surface Water Outfall from Reclamation Area

MH
MH
French Drain

Hardcore Surfaced Storage / Development Area
14,000m2 1.4Ha / 3.46 Acres

Fall
Fall
Fall
French Drain

Rock Armour Revetment

Earth House site left un-disturbed. All services routed in road verge on landward side.

Hatston Pier Water Storage Facility
Ex. Tanks
Ex. ESS

Proposed Site for Fuel Tank Farm

-11m CD
-10m CD
-9m CD
-8m CD
-7m CD
-6m CD
-5m CD
-4m CD
-3m CD
-2m CD

Rock
Shingle
Coastal Slope
Spreads
GALT VIEW
Wind Turbine
WB
El Sub Sta
Track
Boulders
Kirkwall Bay
Mhan Low Water Line

N

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ORKNEY LOGISTICS BASE, HATSTON
PHASE 3 WORKS
SHIP LIFT & ADDITIONAL NORTH SIDE RECLAMATION

Scale 1: 1000

10 0 10 20 30 40 50 60 70 80 90 100m
SCALE 1:1000 at A1

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Phase 3 Works: Ship Lift & Reclamation

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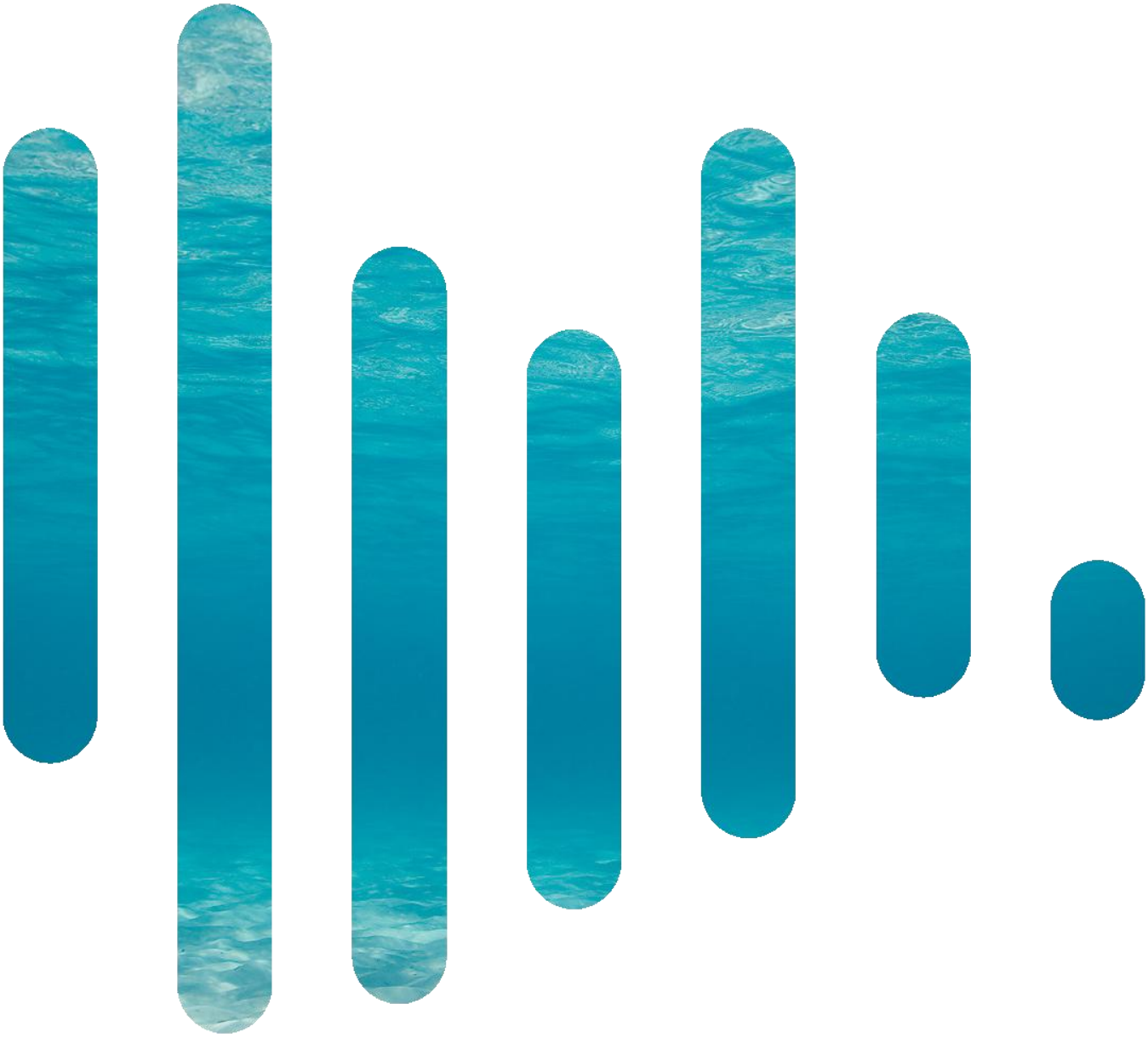
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B UNDERWATER NOISE MODELLING REPORT

IRWIN CARR
CONSULTING



Hatston Pier, UW Noise Modelling

Kirkwall, Orkney

RP001 Rv3 2022248 (Hatston Pier, UW Modelling)

21 August 2025

PROJECT: HATSTON PIER, UW NOISE MODELLING

PREPARED FOR: ENVIROCENTRE

8 EAGLE STREET,

CRAIGHALL BUSINESS PARK,

GLASGOW, G4 9XA

SCOTLAND

ATTENTION: EMMA CORMACK

REPORT NO.: RP001 2022248 (Hatston Pier, UW Modelling)

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Document Control

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Glossary

Term	Meaning
Duct	Conditions that facilitate the focusing of sound by one or more mechanisms: sound speed gradient, surface and/ or bottom reflection.
Hearing group	Refers to the Southall 2019 hearing groups (Southall, et al., 2019).
Mean case	The expected case, both median and mean values will inform this.
Noise	Sound that causes, or is assumed to cause, annoyance or disadvantage. No automatic significance of impact is associated with this term.
Peak Pressure	The highest pressure associated with a sound wave.
Permanent Threshold Shift (PTS)	The total or partial loss of hearing, that is permanent and irreversible, resulting from damage to sensory hair cells during acoustic events.
Safe Starting Range	Range at which a given threshold was not exceeded for a moving receiver.
Signature, Impulse	When in relation to sound, this refers to the time pressure signal associated with that sound, normally as a time-series of pressures relative to ambient pressure, in pascals.
Source Level	Apparent monopoint source level as viewed from the acoustic far field.
SOFAR Channel	Sound Fixing and Ranging Channel. The phenomenon where sound is refracted towards a certain depth, thus minimising spreading loss.
Solver	Mathematical algorithm for calculating sound transmission losses in water.
Sound Exposure Level (SEL)	A constant sound level that has the same amount of energy in one second as the original noise.
Temporary Threshold Shift (TTS)	Temporary reduction in hearing sensitivity due to exposure to noise over time.
Vibro	Vibration pile driving
Worst Case	Used as “reasonable worst case”. E.g., the use of MHWS instead of historical maximum for max water level. Or 90th percentile as representative of worst case.
3rd octave, decidecade	Refers to the subdivision of octaves (doublings of frequency) and decidecades (10x frequency). Using the appropriate base frequency, the two are identical for practical purposes.
β, Log multiplier	Symbol used to denote the factor multiplied by the base ten Log in equations like: “$TL = \beta \times Log_{10}(range)$”

Acronyms

Term	Meaning
ADD	Acoustic Deterrent Device
DP	Dynamic Positioning
HF	High Frequency
EIA	Environmental Impact Assessment
GEBCO	General Bathymetric Chart of the Oceans
JNCC	Joint Nature Conservation Committee
LF	Low Frequency
MF	Mid Frequency
MSL	Mean Sea Level
NMFS	National Marine Fisheries Service
OCA	Other Marine Carnivores in Air
OCW	Other Marine Carnivores in Water
OW	Otariid Pinnipeds
PL	Propagation Loss
PTS	Permanent Threshold Shift
PCW	Phocid Carnivores in Water
RL	Received Level
RMS	Root Mean Square
SAC	Special Area of Conservation
SEL	Sound Exposure Level
SL	Source Level
SPL	Sound Pressure Level
SSP	Sound Speed Profile
TL	Transmission Loss
TTS	Temporary Threshold Shift
VHF	Very High Frequency

Units

Unit	Description
µPa	Micro Pascal
dB	Decibel
Hrs	Hours
Hz	Hertz
kHz	Kilohertz
kJ	Kilojoule
km	Kilometre
km^2	Kilometre Squared
m	Metre
ms	Millisecond
m/s	Metres per second
Pa	Pascal
Psu	Practical Salinity Unit, equivalent to parts per thousand as g/kg, mass of salts per mass of water.
s	Second

EXECUTIVE SUMMARY

BRIEF DESCRIPTION OF WORK

In relation to the expansion of Hatston pier, dredging, piling, drilling and blasting will be carried out. The noise from these activities can adversely affect local fauna either through direct injury of sensory systems or indirect harm from noise pollution drowning out communication and foraging sounds. The noise emissions from the various sources are modelled in this report and used to estimate impacts from construction noise and what mitigation can/needs to be employed to keep impacts below levels of significant harm to the local wildlife. Source sources are modelled from a combination of empirical models (based on recorded data) and numerical models (calculated source levels from inputs).

CONCLUSION & RESULTS SUMMARY

Blasting

Noise from blasting has the potential to cause PTS to LF, VHF and PW hearing groups, however this does not exceed the 500m range when assessing against weighted hearing groups. We note that this assessment has used the upper bound of amount of explosive used and energy transfer to the water, so it is very unlikely that the real risks are as high as presented here. As the blasting has no slow build-up of noise or soft-start and leaves no time for the animals to vacate the area, it is important that mitigation be put in place to facilitate the clearing of marine mammals in the area prior to blasting. Having a qualified Marine Mammal Observer (MMO) observe the area for a 60-minute duration prior to commencing blasting is a common procedure.

Dredging

Exposure to 8 hours of dredging at the 90th percentile has a risk range of 137.5m for LF hearing group, well below the significant range of 500m. There is potential temporary hearing damage caused to LF, PW, P- and P* hearing groups, however the relatively low (compared to limits) source level of the dredging means that there is not acute risk from noise and animals have time to swim away. It should be noted that when modelling the mean noise levels, a more realistic scenario, there is no risk of PTS to any hearing group assessed and that all TTS risk falls within the standard 500m mitigation zone.

Vibro piling and Drilling

Even prolonged exposure to vibro piling and drilling at close range (<100 m) carries little to no auditory risk for the animals assessed.

Behavioural impacts

Impacts to behaviour were modelled for the two loudest sources for both impulsive (blasting) and non-impulsive (dredging) sound sources as this was taken as the worst-case scenario for all works to be carried out during pier expansion. Behaviour thresholds were based on Level B harassment criteria as discussed later within this report.

The maximum range of disturbance for non-impulsive sound is 5,571.2m, with an average range of 2,317. However, as the background noise levels associated with nearby sites (~130dB), exceed the Level B-Harassment criterion of 120dB, the significance of these criteria in the current assessment is unclear. In an environment where background noise levels exceed the specified impact threshold, local wildlife may have become accustomed to continuous higher noise levels. As a more realistic scenario, the mean sound level for the dredger was also modelled, at this level we see a maximum disturbance range of 2,304.1m and an average range of 1,023.2m.

For impulsive sound, the maximum range for strong disturbance is 1,612.1m, with an average range of 707.3m. For mild disturbance, the maximum range is 6,058.8m, with an average range of 1,929.8m, however this is modelled as a worst-case scenario for both amount of explosive used and energy transfer into water, as such the actual disturbance range would likely be far less.

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1. INTRODUCTION

This report presents the results of a desktop modelling study undertaken by Irwin Carr Consulting to consider the potential impacts of underwater noise on the marine environment during the proposed expansion of Hatston pier, Scotland.

Within the planned activities, different noise sources have been identified, these include dredging, piling, blasting and drilling. These sources are both continuous and impulsive and are modelled using a combination of empirical models (based on recorded levels) and numerical models (calculated source levels from inputs).

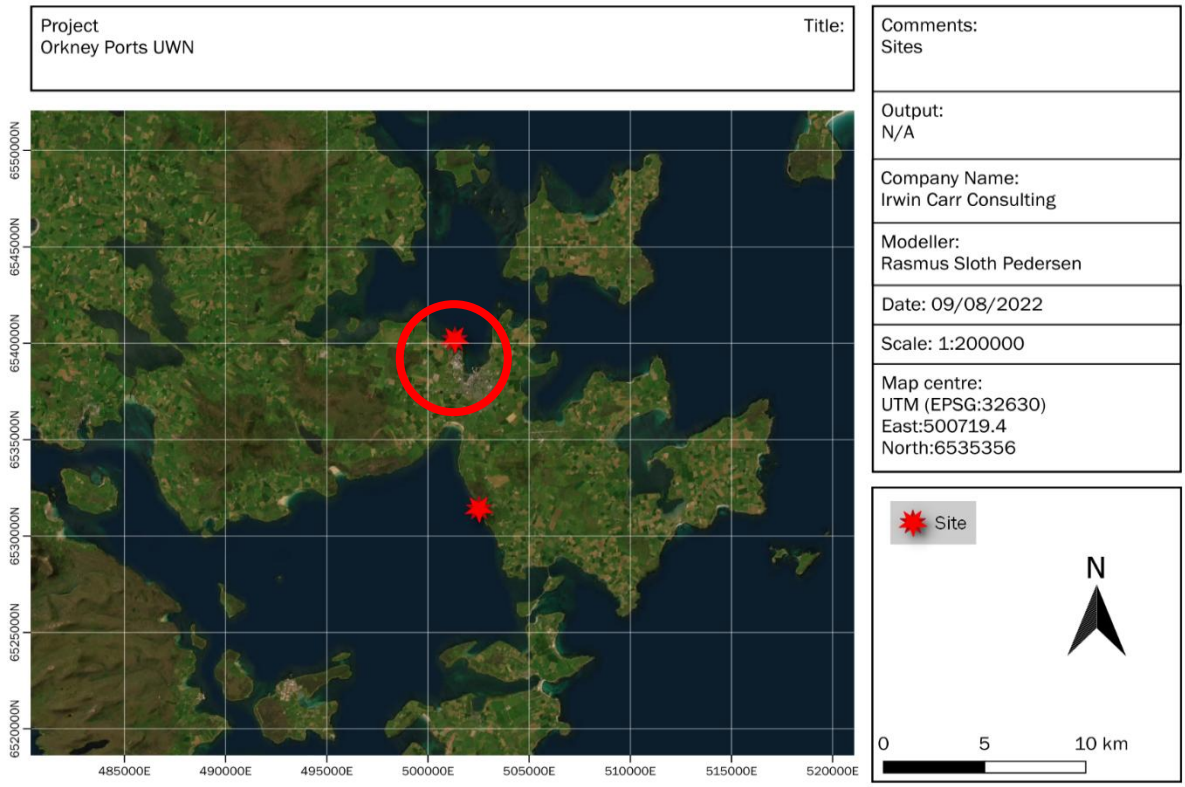
Noise is readily transmitted underwater and sound emissions during the proposed expansion have the potential to adversely affect local fauna, either through direct injury of sensory systems or indirect harm from noise pollution disrupting communicational and foraging sounds. This report provides an overview of the potential impacts from underwater noise on the surrounding environment.

The purpose of this report is to model the noise emissions from the identified noise sources to estimate the impact from the proposed development. The assessment will predict the range for onset of physiological and behavioural impacts on different marine mammals when exposed to the anthropogenic noise during project development. The results of the assessment will be used to inform if mitigation is required during works to reduce any potential injury to local wildlife.

2. PROJECT DESCRIPTION

Hatston Pier is located in Orkney, Scotland, Latitude: 59.002115, Longitude: -2.970403. The site is sheltered from oceanic swell, with little current and with no major outflows from rivers, meaning that conditions important for sound propagation are quite stable. The sediment is generally a soft upper layer of mud/ silt and gravel overlaid a layer or weathered sedimentary rock, before a stronger layer of sedimentary rock (silt-/mud-/sand-/limestone). Water depths in the area range from 5-15m.

Figure 1. Location of Hatston pier (in red circle) on Main Island of the Orkney Islands. Scapa site (in Scapa flow, south of Kirkwall shown for completeness as both surveys undertaken as part of consultancy works).



Underwater noise emissions are expected to occur during project work to expand Hatston Pier. The scope of work proposed and used during noise modelling is as follows:

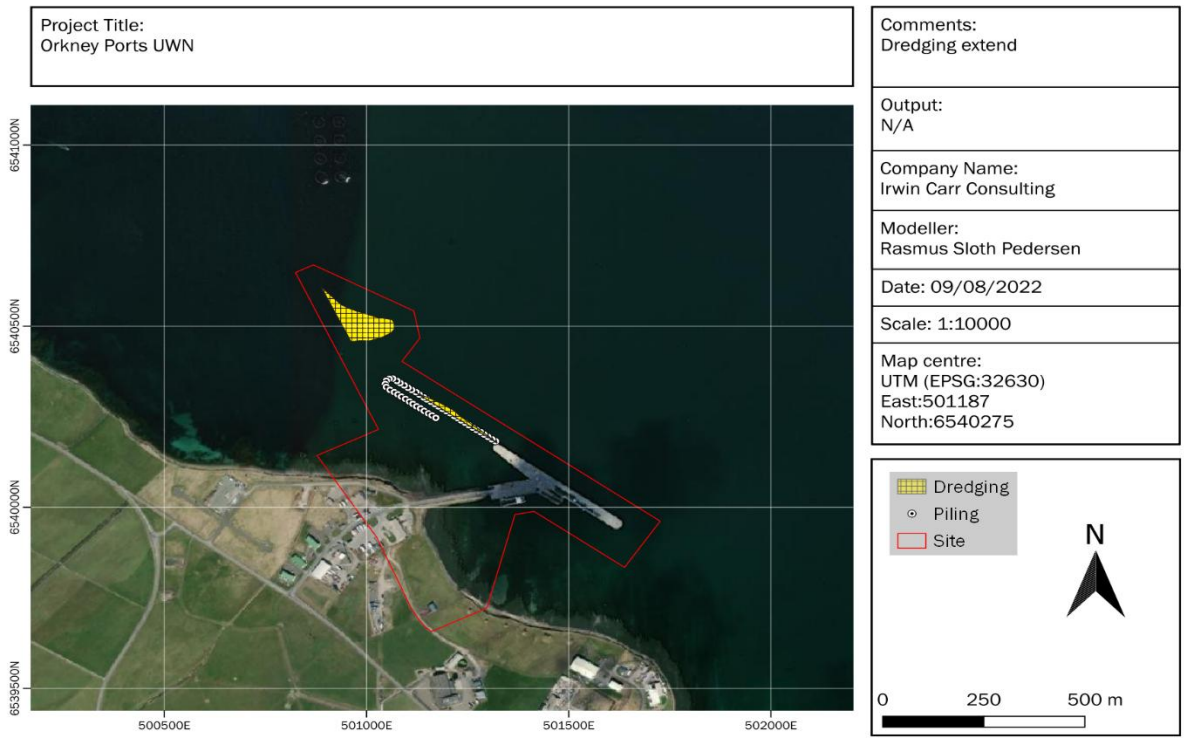
- **Drilling** 10 holes of 100mm diameter will be drilled per day and will take place between the hours of 8am and 4pm.

- **Blasting** a maximum of 9 blasts will occur at the end of the day, with the charges placed after drilling activities have finished, blasts will occur during daylight hours. Approximately 35 days of blasting will take place in total over a 6-month period (9 blasts per day). No blasting will occur within 20m of the existing structure.

- **Dredging** is modelled as taking place for a maximum of 8 hours per 24-hour period, with all works completed by a dredge plant located on the shore, and all material will be brought ashore.

- **Vibration piling** 1 hour of vibration piling will take place per day, with piles inserted into pre-treated ground, approximately 1.4m pile clutch centre.

Figure 2. Overview of assumed piling/blasting locations and approximate areas to be dredged.



3. Underwater Acoustics Basics

Underwater acoustics modelling is the application of physical models to characterise the behaviour of sound in environments under the surface of the sea and in the top layers of the seabed. As some familiarity with in-air acoustics is assumed the focus here is on key differences between in-air acoustics and underwater acoustics, making waterborne propagation more efficient than airborne propagation.

This chapter only gives reader a quick overview, please see APPENDIX B – Underwater Acoustics Basics *for more detail.*

3.1 SOUND SPEED

Water is much harder to compress than air, and a sound speed of 1500 m/s is often used as a standard sound speed in water[1] much as 340 m/s is in air. The sound speed changes with depth, "sound speed profile", this is quite important in sound propagation, as refraction (changes in propagation angle) will occur when sound moves between layers of water with varying sound speed. These effects can lead to profoundly inhomogeneous sound fields and SOFAR channels.

The same relationships are valid in the sediment, though sediments commonly have sound speeds higher than water. Sound speeds from 1700 m/s (fine sand/silt) to 2500 m/s (gravel) are common for non-solid sediments, with solid sediments (rocks) having much higher sound speeds 2800 m/s (Calcarenite) to 6000 m/s (some granite).

3.2 SPREADING LOSS

Most of the propagation loss (loss in dB from source to receiver, "PL") that occurs initially is governed by "spreading loss". It is the simple "thinning out" of acoustic energy as it spreads away from the source, usually in all directions – spherically. This means a reduction in received level of 6 dB per doubling of distance. At longer ranges the medium is no longer unbounded. We reach ranges where the sound has interacted with the surface (near perfect acoustic reflector) or the seabed (lossy acoustic reflector). Here we expect spreading loss to be ~3 dB per doubling of distance.

3.3 ABSORPTION

Besides the "thinning out" of the sound energy as described above, the sound is also dissipated into heat by the way the pressure changes interact with water, molecules and particles in its path. This absorption is salinity dependant. Frequencies under 1 kHz experiences almost no absorption, while high frequencies, over 10 kHz, can be attenuated by over 10 dB / km. Small bubbles, wind or wave induced, will further attenuate especially the high frequencies.

3.4 SEDIMENT

Depending on the incident angle of the sound, the frequency and the acoustic properties of the sediment, sound can either mostly penetrate the sediment or mostly be reflected by it. In shallow areas with soft sediment (acoustically similar to water), it is typical to find that close to the source, at high incidence angles and at low frequencies (<250 Hz) the sound will penetrate the sediment and dissipate there, leading to very high transmission losses for these frequencies.

3.5 SOUND LEVEL UNITS

All references to sound pressure levels (SPL), peak pressure levels and sound exposure levels refer to a logarithmic ratio between a reported/measured pressure or exposure and a reference pressure or exposure. As an example, a level of 220 L_p (decibel zero-to-peak) is equal to a peak

[1] Varies from 1450 m/s at 0° to 1550 m/s at 30° at salinity of 35 psu.

pressure of 100000 Pascals (Pa) over ambient pressure, while 120 L_p is equal to 1 Pa over ambient pressure.

To avoid dealing with these large numbers as pascals (as a linear scale), they are converted to a decibel ratio (Table 1 for definitions). Besides compressing large numbers to a smaller scale this also corresponds better to how animals are thought to perceive sound, namely as relative steps. This means that an increase from 1 to 2 Pa *sounds like* the same increase as from 100 to 200 Pa, even though the first step was only 1 Pa, while the second was 100 Pa. This is better reflected in a logarithmic scale based on ratios, where both steps are equal, here 3 dB.

However, while dBs are practical, they can be hard to compare between studies, due to vague definitions, and so we have adopted the standards set by ISO 18405-2017 (Table 1 below).

Table 1: Definitions.

Unit	Definition	Comments
SPL (dB_{RMS}) ISO 18405- 2017: 3.2.1.1	$SPL = 10 \cdot Log_{10}\left(\frac{\frac{1}{t_2 - t_1} \cdot \int_{t_1}^{t_2} p(t)^2 dt}{1 \cdot 10^{-12} Pa}\right)$	Functionally equivalent to deprecated $20 \cdot Log_{10}\left(\frac{RMS}{1 \cdot 10^{-6} Pa}\right)$
L_p ($dB_{z\text{-}p}$) ISO 18405- 2017: 3.2.2.1	$L_p = 20 \cdot Log_{10}\left(\frac{Pa_{max}}{1 \cdot 10^{-6} Pa}\right)$	This assumes that Pa_{max} is equal or greater than $\sqrt{Pa_{min}{}^2}$
$L_{p\text{-}p}$ ($dB_{p\text{-}p}$)	$L_{p-p} = 20 \cdot Log_{10}\left(\frac{Pa_{max} - Pa_{min}}{1 \cdot 10^{-6} Pa}\right)$	Often[2] equivalent to $L_P + 6.02\ dB$
L_E (dB_{SEL}) ISO 18405- 2017: 3.2.1.5	$L_E = 10 \cdot Log_{10}\left(\frac{\int_{t_1}^{t_2} p(t)^2 dt}{1 \cdot 10^{-12} Pa}\right)$	For continuous sound this is equivalent to $SPL + 10 \cdot Log_{10}(t_2 - t_1)$ "t" is seconds

Unless otherwise stated SPL has an averaging period of 1 second, and L_E for the duration of the specified event, sometimes indicated as $L_{E\text{-}\text{"time"}}$ or $L_{E\text{-single blow}}$.

If the averaging period for SPL is equal to the total even duration, then SPL is equal to "Leq" the "equivalent constant level".

When source levels are presented, the same units are used, and it is implicit that all source levels are given as if recorded 1 m from an omnidirectional mono-point source, unless otherwise specified.

[2] If maximum pulse rarefaction is below ambient pressure and compression and rarefaction phases are of equal size.

4. Underwater Sound Propagation

Basic principles of underwater sound propagation are described here; project specific parameters used during sound propagation modelling are also presented. The model used is the underwater sound propagation software tool dBSea, developed by Irwin Carr and Marshall Day Acoustics.

Several factors influence sound propagation in the marine environment, including bathymetry, seabed sediment, temperature, salinity, sound speed profile, sea surface roughness, and volume attenuation. Available data used for these parameters at the Hatston site are described in the following sections.

4.1. Bathymetry

The composition and shape of the seafloor strongly influences how sound waves propagate through the water column, the seafloor can act as a barrier to sound waves, either reflecting or scattering them. Bathymetry impacts the propagation of sound by influencing the direction, speed and intensity of the sound wave.

Bathymetry data for the sites were collected from three sources:

- The proponent, detailed data near the site, 4m resolution
- EMODNET (European Marine Observation and Data Network), long range data, 90m resolution
- ADMIRALTY Marine Data Portal

These were corrected to MSL and combined, using mosaic method, to give the best possible total cover of the area.

The MHWS (Mean High Water Spring) level is used as deeper water decreases sound transmission loss.

4.2 Sediment Properties

Sediment properties can play a crucial role in propagation of sound waves, influenced by several factors, including composition, density, grain size and porosity. Sediment thickness also changes sound propagation, with sound being absorbed more effectively by thicker sediment layers, in comparison to thinner layers that reflect and refract sound waver stronger. Sediment properties are often obtained through site specific surveys or literature and past research.

Given the project is a construction project, access to sediment cores for sediment characterisation was made available by “Causeway Geotech”. These allow for good coverage in areas close to the Hatston Pier, for general sediment types located further away from the site, we have used data made available through British Geological Survey (British Geological Survey, 2022).

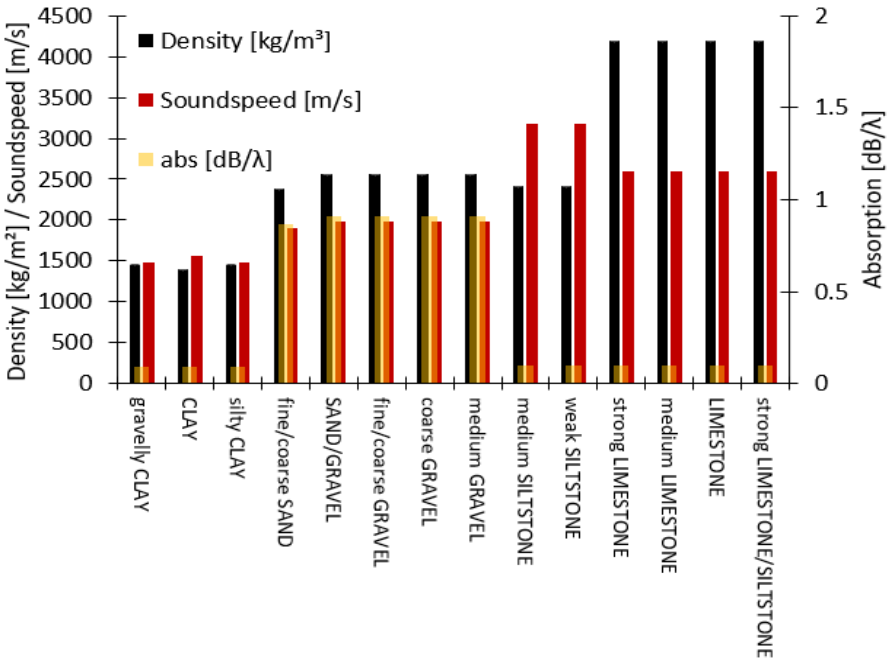
For boreholes, we mapped the descriptions in the sediment core reports in relation to their Udden-Wentworth or Folk sediment descriptions where these matched the nomenclature well. For other sediment types, e.g. sandstone/mudstone/limestone we have used given values for nominal “sandstone” (Jensen, Kuperman, Porter, & Schmidt, 2011; Boyce, 1981). The cores also contain classifications such as “weak sandstone” this was interpreted as loose, sandy sandstone, and we characterised this with density and sound speed between that of sandstone and sand. This interpolation assumed that the scale “very weak-, weak-, medium weak-, sandstone” corresponds to linear interpolation between sand and sandstone (see Table 2 below). We have not changed the properties for categories indicating harder than usual sediments, such as “medium strong”, “very strong”.

Table 2. Example of interpolation scheme for Sand-sandstone.

Material	Interpolation value	Density [kg/m³]
Sand	0	1931
Very weak sandstone	0.25	2111
Weak sandstone	0.5	2291
Medium weak sandstone	0.75	2470
Sandstone	1	2650

Where we had no direct properties (density, sound speed, absorption) for the sediment we have used a modelling approach to estimate them, following (Ainslie, 2010).

Figure 3. Sediment types. Note that absorption is read on the right vertical axis.



4.3 Water Properties

4.3.1 Salinity

Generally, the site has no major outflows of fresh water, so salinity is expected to be near 35 psu (confirmed by (Marine Scotland, 2022)).

4.3.2 Temperature

The temperature was measured using the SoundTraps (hydrophone) inbuilt thermometer.

Mean water temperature at Hatston site: 9.1 °C

The water columns are assumed to be well-mixed, due to the lack of nearby freshwater outflows, windy location, evaporation and generally shallow depths (<30 m).

4.3.3 Sound speed profile

Based on the water properties of the site, as stated above, we assume the sound speed to be constant at all depths, with no significant deviations from the expected values.

The sound speed calculation is based on a widely used model for sound speed in water (Leroy, Robinson, & Goldsmith, 2008), with input of temperature, depth and salinity.

Sound speed in water is calculated as 1486 m/s.

4.3.4 Sea surface roughness

Roughness of the sea surface can cause the scattering of sound waves, changing how sound would propagate through the water and resulting in a reduced range of underwater sound propagation and increased attenuation. As a precautionary approach, modelling assumes that a calm sea state, as such the model is likely to overestimate sound propagation.

5. Ambient Noise

During site visits to collect noise recordings, the weather was very calm (< sea state 1) with no detectable current.

Ambient noise at Hatston was in the expected range for inshore waters.

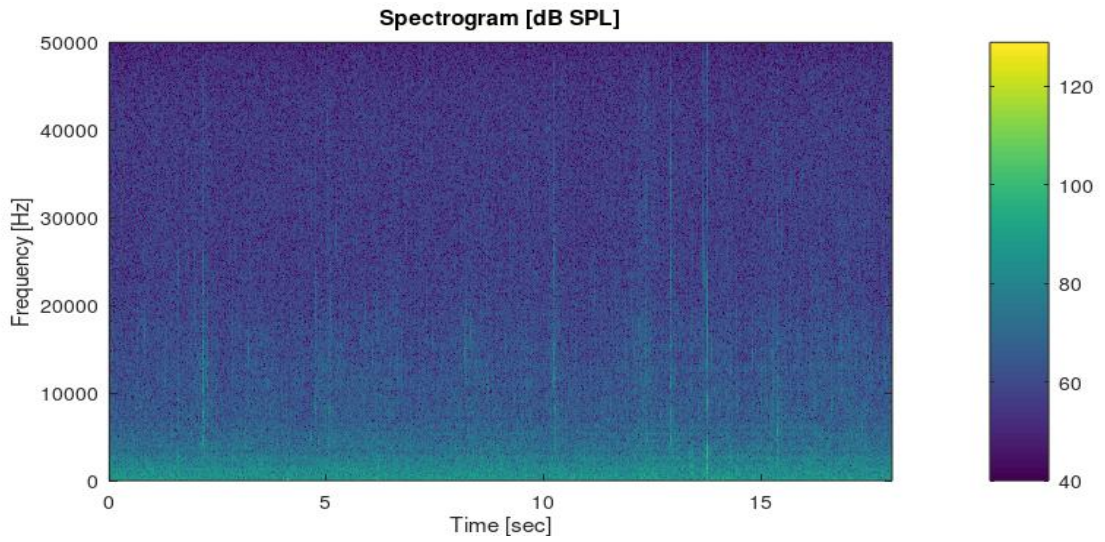
Note that ambient noise here excludes noise from nearby vessel passes, it is meant as the ambient noise with no identifiable noise sources.

Table 3. Typical background noise levels at Hatston.

Site	SPL [dB]
Hatston	107.2

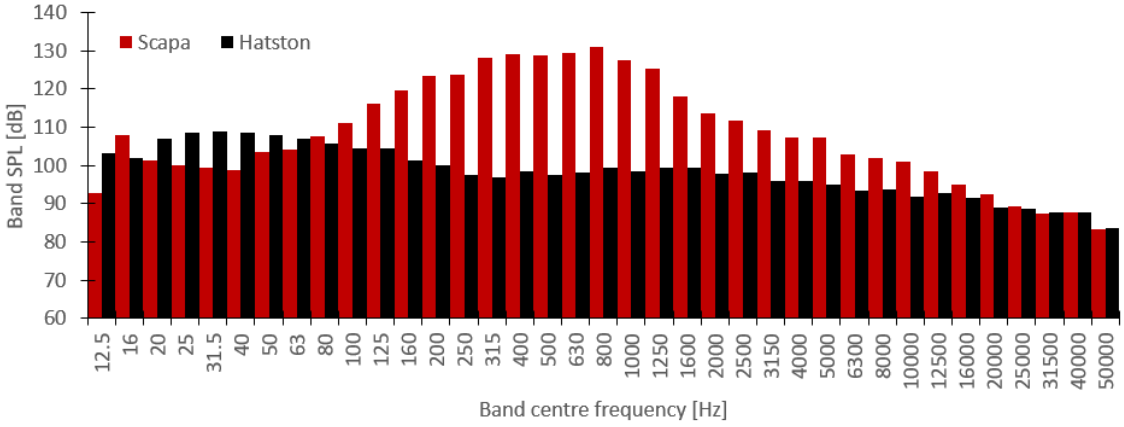
There were multiple other vessels in the bay, but all far away (> 1km). The most likely source was the small oil platform stationed a few km to the south. This could have some active machinery causing the noise, indicated by the tonal components (seen as horizontal bands in spectrogram (Figure 4).

Figure 4. Spectrogram of ambient noise at Hatston.



It should be noted that, Scapa Deep Water Quay site (assessed at the same time as Hatston site), was unexpectedly noisy with ~130 dB SPL for all measurements (unaffected by range to our vessel).

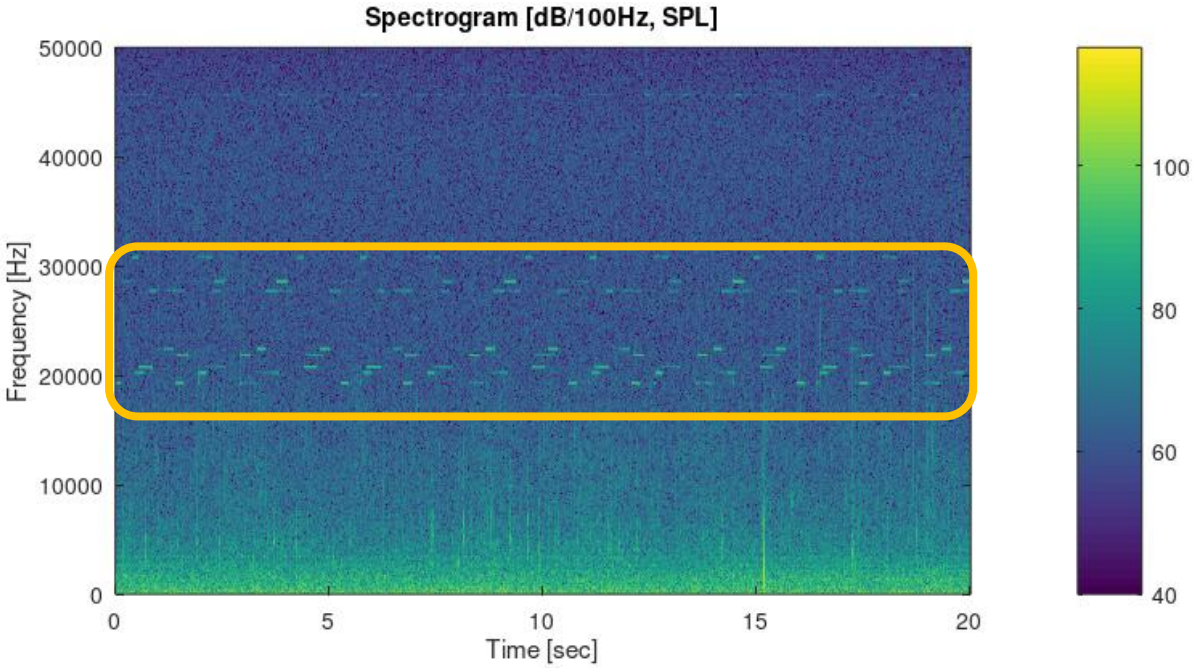
Figure 5. Typical band levels of ambient noise at Hatston (107.2 dB SPL) and Scapa (129.9 dB SPL).



5.1 Nearby Fish Farm

We note that a nearby fish farm (~500 m NW of the Hatston transects) uses what is presumably ADDs (Acoustic Deterrent Devices / Seal scarers). We present these here to keep in mind as part of the soundscape for a later acoustic impact assessment. A rough estimate for the source level for the ADDs is 100-120 dB SPL per Hz at 20-22 kHz and 28-30 kHz.

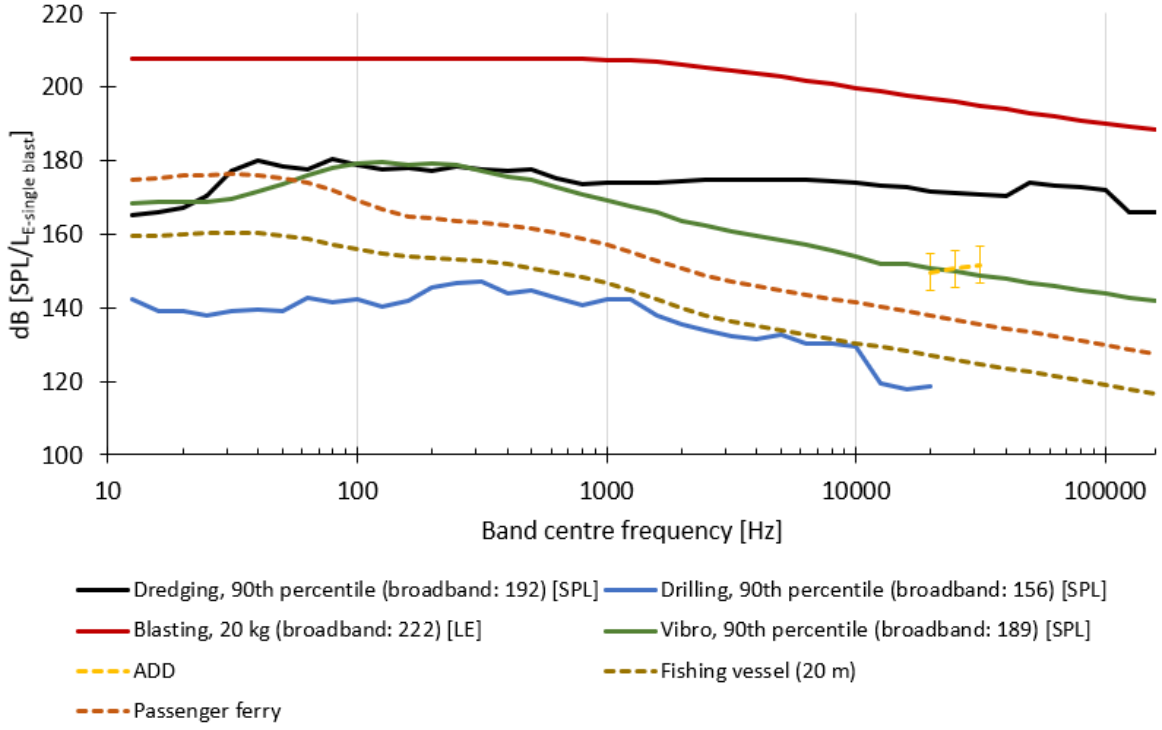
Figure 6. Spectrogram showing what is presumably one or more ADDs (Acoustic Deterrent Devices / Seal scarers) at the fish farm northwest of Hatston in Figure 2, p. 9. ADD pulsed are ~66-70 dB SPL/Hz, which at 500 m range might mean 100-120 dB/Hz at the source.



6 SOUND SOURCE MODELLING

We have considered four noise sources for this assessment, for the purposes of a complete assessment we have included all sources, however it should be noted that drilling is not loud enough to meaningfully assess in an environment with many vessels and general human activity (compare with vessel noise in Figure 7, below).

Figure 7. The four sound sources considered in this report. The ADD from the fish farm (yellow), a fishing boat and a small ferry has been added for context.



6.1 Blasting

Due to the hard underlying sediment at Hatston blasting is planned prior to pile installation. Charges used during blasting is estimated by the contractor at 27kg TNT equivalent, with 9 holes per day, charged at the same time, thus equivalent to 1 blast of 243kg when modelling peak pressure levels. Blasting will take place for a total of 35 days over a 6-month period, blasting will occur during daylight hours, after drilling. Charges will be placed into predrilled holes, as such, intensity of shockwaves will be reduced, with unconfined shock wave intensity being 10-15% higher than the intensity of in-hole shock waves (Kaushik et al., 2024).

From previous experience about 5-10% of the acoustic energy from the blast makes it into the water column. We have assumed 10% here as a conservative measure. We have used the models from (Soloway & Dahl, 2014) to generate an idealised impulse for the blasting. These impulses will not match recordings, but the intention is to match the true peak pressure level (LP) and the true impulse energy (as LE).

Figure 8. Assumed timeseries for 27 kg TNT equivalent detonation at 1 metre, 10% acoustic energy. This is an idealised impulse and will not correspond directly to a measured impulse.

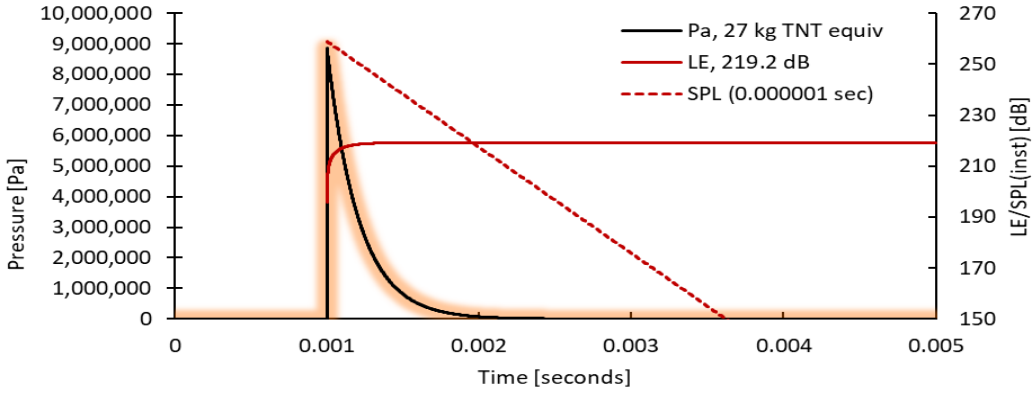


Figure 9: Assumed timeseries for 243 kg TNT equivalent detonation at 1 metre, 10% acoustic energy. This is an idealised impulse and will not correspond directly to a measured impulse.

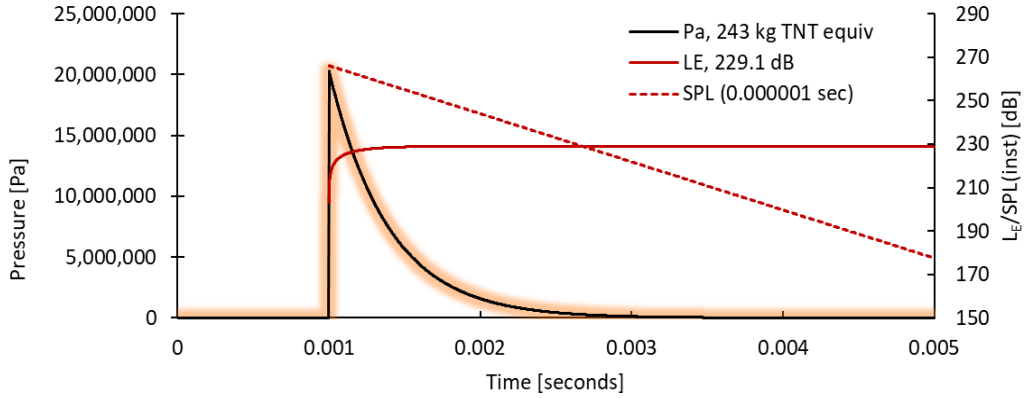


Table 4. Assumed in-water equivalent source levels for blasting, based on a charge of 27kg and combined 243Kg detonation.

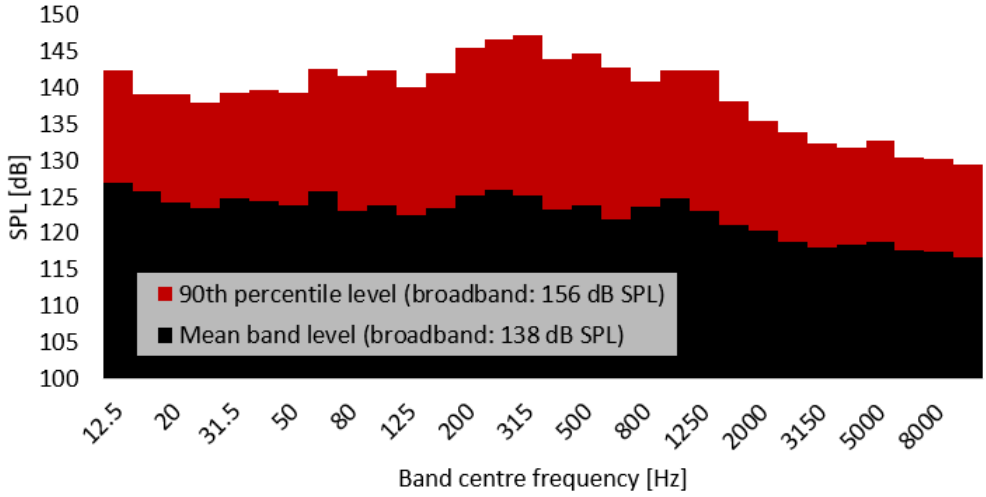
	Source level [dB] 27kg	Source level [dB] 243kg
L_P	259	266.1
$L_{E\text{-single blast}}$	219.12	229.1

6.2 Drillling

Drilling will take place between the hours of 8am and 4pm, with 10 holes drilled per day, prior to blasting. While drilling through hard sediment can be significantly noisy, given that the drilling will be part of the wider blasting activity and will occur in advance of the blasting, the noise from drilling will be dominated by the acoustic impact of the blasting.

A summary of 13 different recorded drilling episodes shows noise levels to vary considerably between sites and equipment, and there is no clear connection between drill size, power or sediment type to the emitted noise level. Drilling has a broadband level of 156 dB SPL at 90th percentile, which will mean that its impact to the marine environment is minimal. However, for the purposes of a complete assessment, this source has been included in impact range calculations.

Figure 10. Example of drilling noise band levels. Data from various drills, diameter 0.1-1.2 m and various rock types.

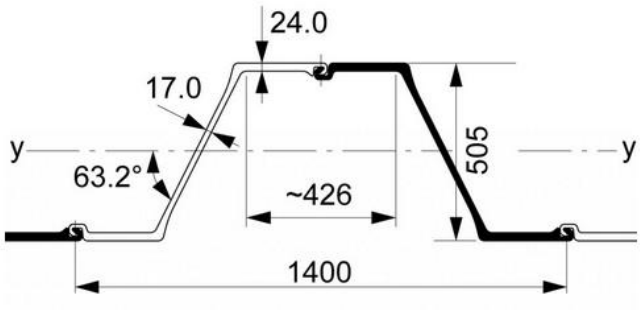


6.3 VIBRATION PILING MODEL

Details in APPENDIX C – Source Models

The piles used for the pier extension are sheet piles (Arcelor Mittal AZ52-700[3]). These will be vibrated into the trench created by the blasting operation.

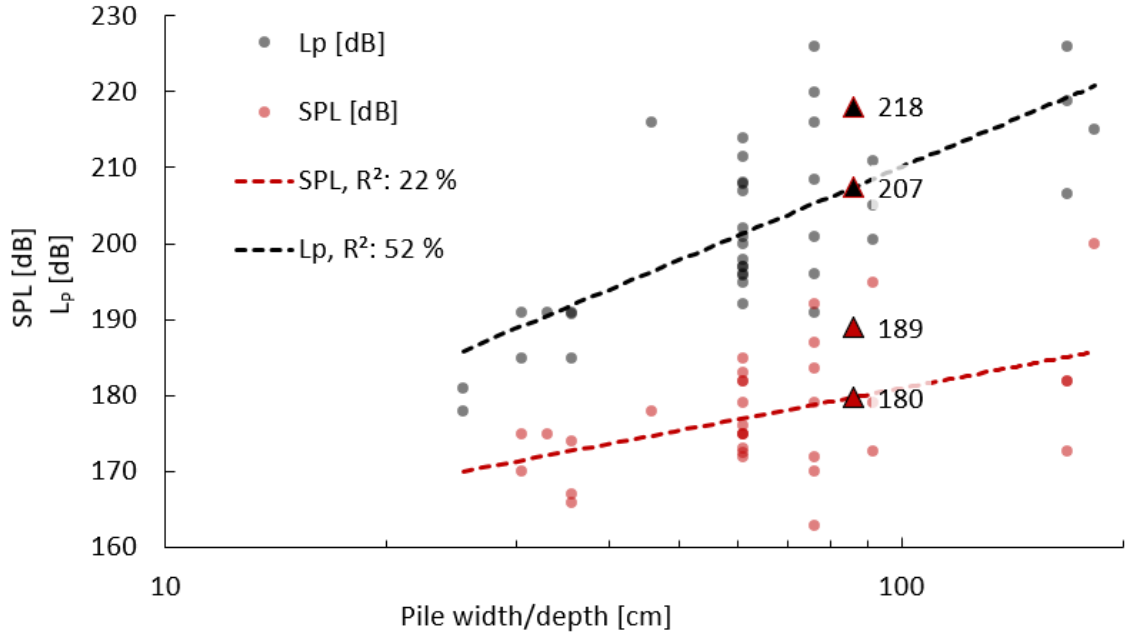
Figure 11. Schematic of the sheet piles profile.



[3] https://sheetpiling.arcelormittal.com/products/az-52-700/

The diagonal of a single sheet (86 cm) is used a basis for an empirical model based on 50 recorded levels as from CalTrans (CalTrans, 2015).

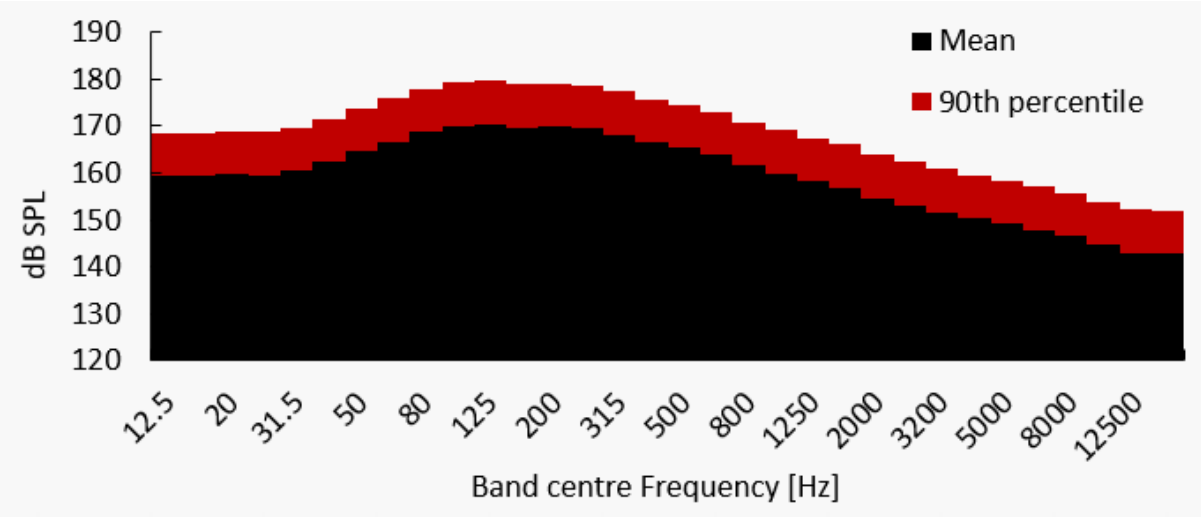
Figure 12. Basis of vibro piling broad band source level as a function of pile size (86 cm diagonal).



Given the low confidence we have in this approach (low R^2 values) we use the 90th percentile level as the broadband source level. LP is estimated to be 218 dB and SPL 189 dB. The frequency content is assumed to be identical to that of the impact piling.

Vibration piling will take place for a maximum of 1 hour per 24-hour period, this duration has been used during noise modelling.

Figure 13. Band levels for vibro-piling.



6.4 DREDGING

Dredging is done to chart Datum -10 metres, meaning this will likely be done with a cutter suction dredger (Max reach 15 m). A cutter power of 540 kW is assumed, equivalent to the Boskalis "Seine" cutter suction dredger. During modelling, it is assumed that dredging will occur 8 hours a day.

Figure 14. Approximate extent of dredging campaign (yellow hatched area).

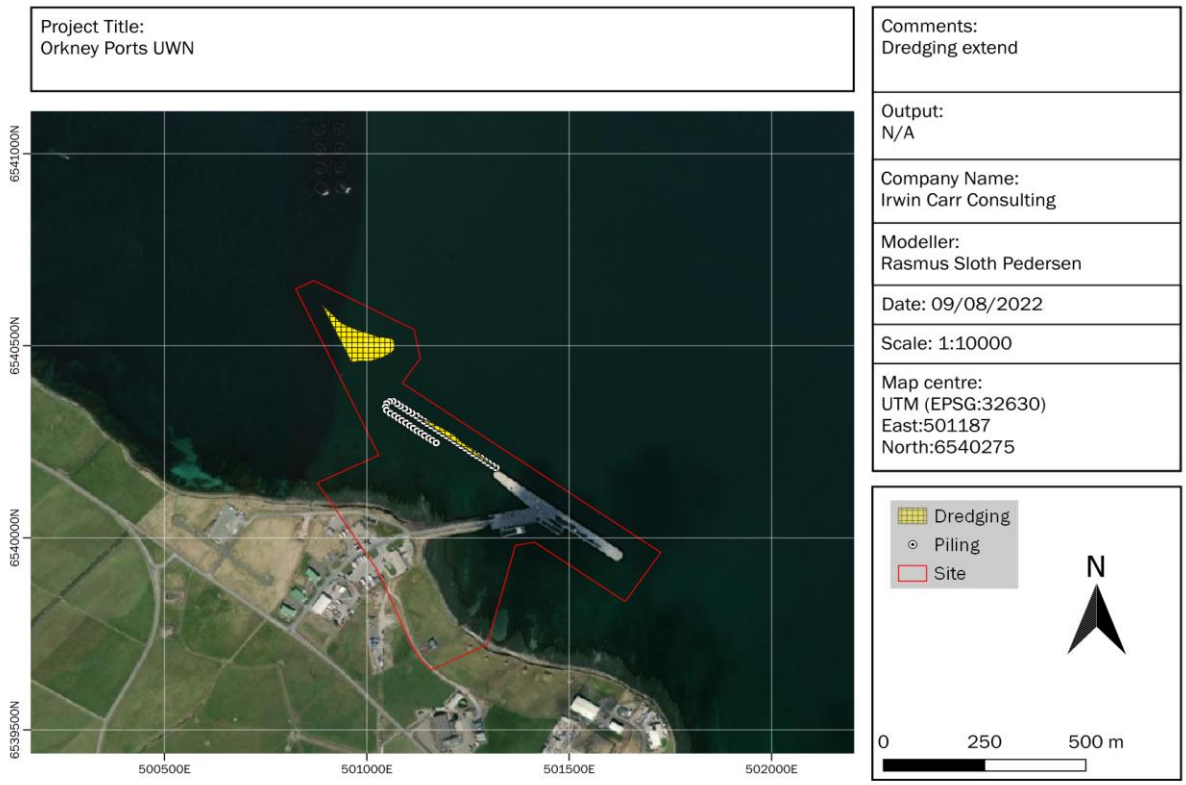
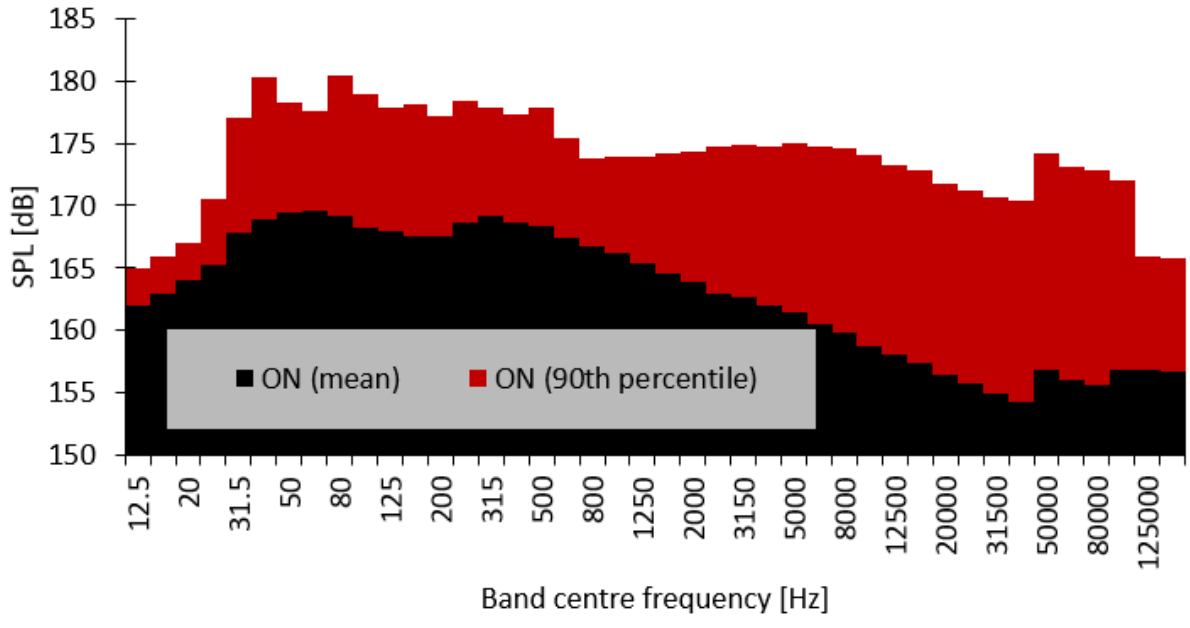


Figure 15. Band levels as modelled for a 540-kW cutter suction dredger with coarse sediment. "ON" refers to active dredging.



3. TRANSMISSION LOSS MODELLING

Transmission loss modelling is done using dBSea underwater noise modelling software.

This software is partially developed by us and can model frequencies from 10 Hz to 168 kHz, normally as 3rd octave bands, but any logarithmic band-spacing can be used. All solvers are range dependent (meaning all conditions can change with range not just depth).

Further details of this modelling software package can be found in APPENDIX A - dBSea.

The sound sources from section 6, Sound Source Modelling, was used sources for the model, both as band levels when modelling energy transmission losses (L_E, SPL) and as timeseries/impulse for modelling peak pressure (L_P).

Before this assessment, measurements of the actual transmission loss for the site were measured along two transects. The modelling has been calibrated to match the measurements of these recordings (details in APPENDIX D – Model Calibration).

The measurements show a broadband transmission loss consistent with ~22 × Log_{10}(range) at Hatston. However, these are frequency specific, and these losses are not consistent across all frequencies. We have matched the frequency-wise transmission losses to the extent that they are less than 20 × Log_{10}(range) as we find it unlikely that a transmission loss, even for higher frequencies, of > 20 × Log_{10}(range) is sufficiently representative for the site as a whole.

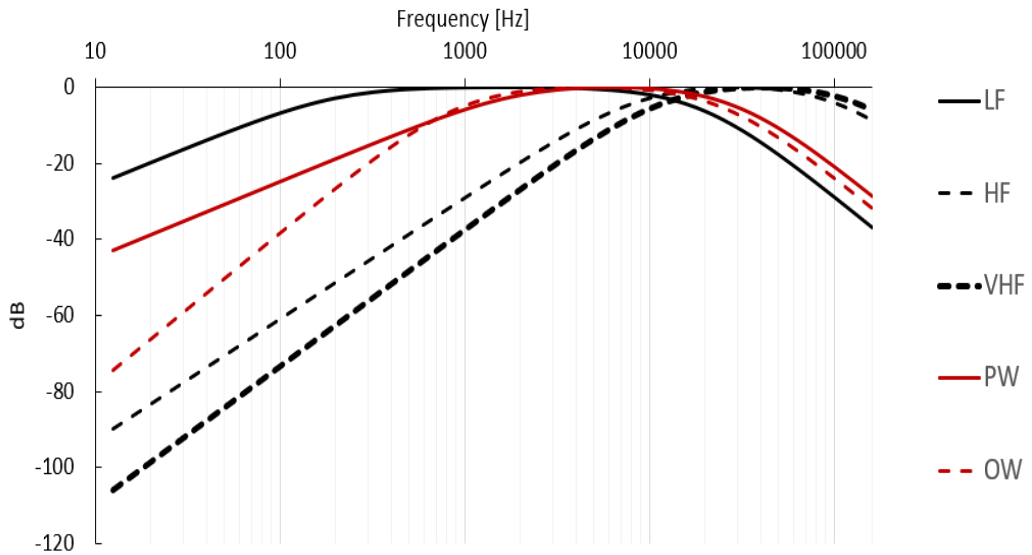
4. ASSESSMENT CRITERIA

See 3.5, p. 10 for definitions.

A. WEIGHTING OF NOISE LEVELS

When not reporting L_p or L_{p-p} levels, the noise levels are often weighted according to a generalised hearing sensitivity profile for up to ten different hearing groups. This is done to better reflect the actual impact on the species in question, much like dB(C) level unit for humans.

Figure 16. Weightings for various hearing groups. For L_E levels, the weightings are applied to the noise level to give the weighted noise level (like dB(A) or dB(C)-weighted noise for humans).



8.3 Marine Mammal Weightings

For the marine/aquatic mammals present we will adhere to the thresholds described in "Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing" (National Marine Fisheries Service, 2018), which determines impact from an assessment of area wherein the noise will induce either "Temporary Threshold Shift" (TTS) or "Permanent Threshold Shift" (PTS)[4] as judged by the weighted SEL level (L_{E-24}) over a typical 24-hour period or by L_P levels, for the different hearing groups.

Please note that the Southall 2019 thresholds and weightings are identical to the NMFS 2018 criteria, only the nomenclature has changed (Southall, et al., 2019; National Marine Fisheries Service, 2018).

Where relevant we might use the thresholds for behavioural disruption as set by NOAA fisheries[5]. These are split into impulsive and non-impulsive sound (Table 6).

To assess potential injury, a sound source is categorised as either impulsive or non-impulsive:

- Impulsive, or pulsed sound is brief, broadband and will consist of a high peak pressure with rapid rise and decay, such as seismic airguns.

- Non-impulsive, can be broadband, narrowband or tonal, typically do not have high peak pressure and rise time, and can be continuous, such as shipping and drilling.

Impulsive/ Pulsed sound

Level A Harassment, potential injury, is set at 180 dB re 1 µPa (rms) for cetaceans and 190 dB re 1 µPa (rms) for pinnipeds.

Level B Harassment, behavioural disruption, used a 160 dB re 1 µPa (rms) [6] threshold, which was based on 1980's research on the observed reactions of baleen whale to seismic airgun arrays.

Non-impulsive/ Continuous Sound

Non-pulsed (continuous) noise requires different assessment criteria. For ongoing noise sources such as drilling, dredging, vibratory pile driving, vessel operations, and other continuous sounds, we recommend applying the Level B harassment threshold of 120 dB re 1µPa SPLrms[7] established by NMFS (1995; 2005). Level B harassment encompasses activities that may disturb marine mammals or populations in their natural environment without causing physical injury, potentially disrupting critical behaviours like migration, nursing, breeding, feeding, or seeking shelter.

The hearing groups from the Southall 2019 and the NMFS 2018 guidance were specified by collating available information on marine mammal hearing and generalising their hearing sensitivity into representative groups. This grouping represents a significant research effort and are reviewed by the leading experts (academic, industrial and conservation) on the topic. Because of the large amount of work this represents and the widespread acceptance of the method, the thresholds and the methodology associated, have become de-facto standards for assessing noise impact on marine mammals and represents best available knowledge and practise.

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[4] TTS/PTS. A temporary/permanent change in hearing sensitivity caused by acoustic stimuli.

[5] Available from: https://archive.fisheries.noaa.gov/wcr/protected_species/marine_mammals/threshold_guidance.html

[6] Assumed to be SPL of 90 % of energy in one impulse or SPL of total duration (L_{EQ}).

[7] Here taken as meaning "SPL"

Along with weighting curves, similar in function to the human dB(C) curves, a set of thresholds for hearing impact and injury is associated with the framework and allows for conversion of threshold exceedance into ranges with risk of impact. E.g. we might see that the PW group (true seals) has a risk of PTS at ranges shorter than 50 metres, and a risk of TTS at ranges shorter than 200 metres.

All marine mammal species are covered by the hearing groups and a full list of species in the different groups can be found in the "Marine Mammal Noise Exposure Criteria: Updated Scientific Recommendations for Residual Hearing Effects" (Southall, et al., 2019), but in general the groups cover the following species:

Table 5. Summary of Southall 2019 thresholds and groups with species examples. For full species list see source (National Marine Fisheries Service, 2018; Southall, et al., 2019)

Hearing group	Species examples	Non-impulsive TTS/PTS threshold [$L_{E\text{-}24\ hours}$]	Impulsive TTS/PTS threshold [$L_{E\text{-}24\ hours}$]	Impulsive TTS/PTS threshold [L_p]
PW	Harbour seal, Grey seal	181/201	170/185	212/218
OW	Otters	199/219	188/203	226/232
LF	Minke whale, Humpback whale	179/199	168/183	213/219
HF	Sperm whale, Common dolphin, Bottlenose dolphin, Killer whale, Risso's dolphin, Pilot whales	178/198	170/185	224/230
VHF	Porpoises	153/173	140/155	196/202

It's important to note that the assessment is thus based on the received level of receptors with the above-described auditory sensitivity and not based on the sensitivity of the individual species.

Table 6: Level B harassment thresholds and assessment criteria

Effect	Non-Impulsive Threshold	Impulsive Threshold (Non- Piling)	Impulsive Threshold (Piling)
Mild disturbance (all marine mammals)	-	140 dB re 1µPa (rms)	-
Strong disturbance (all marine mammals)	120 dB re 1µPa (rms)	160 dB re 1µPa (rms)	-
Disturbance (all marine mammals)	-	-	Based on SEL 5 dB contours
Disturbance (harbour porpoise only)	-	-	143 dB re 1 µPa2s SEL-ss contour

6.4 FISHES ETC.

Impacts of noise on fishes is less well established than for marine mammals, but a review from 2014 (Popper, et al., 2014) provides guidelines on exposure limits for fish and turtles. The report does not directly use the PTS nomenclature (as above for mammals) as many fish have the capacity to repair structural damage to their ear, and even structural damage then cannot be said to be "permanent".

We use "PTS" here to cover the categories "Mortality and potential mortal injury" and "Recoverable injury".

Note that we use the impulsive limits from piling for all impulsive sources as the information for explosions is rather less well documented (and limits are significantly higher).

TTS is directly used in the report, and we use it in the same way here.

Table 7. Overview of Impact piling thresholds from (Popper, et al., 2014). We use these for all impulsive noise, even though explosions have separate thresholds.

Hearing group	Species examples	Impulsive TTS/PTS threshold [$L_{E\text{-}24\ hours}$]	Impulsive TTS/PTS threshold [L_p]
P* (Fish with no swim bladder)	Sharks, Rays	186/216	TTS not specified/213
P- (Fish with swim-bladder, but not involved in hearing)	Salmon, Trout, Cod, Herring	186/203	TTS not specified/207
P+ (swim-bladder used in hearing)	Carp, Catfish	186/203	TTS not specified/207

5. THRESHOLD INTERPRETATION

6.4.1 THRESHOLD TYPES

The three threshold types refer to different ways that sound can affect the hearing of an animal and are important to keep in mind when evaluating the results of this report:

Non-impulsive, $L_{E\text{-}24\ hours}$

The threshold, over which an effect (TTS/PTS) occurs, taking into account ***continuous***[8] sound received by the animal over a typical 24-hour period as sound exposure, L_E.

When presented as a zone on a map, this refers to the area, within which, an animal would suffer the effect, if it stayed there for 24 hours (or the full duration of the activity or as otherwise specified). We thus identify areas given by this limit as areas of TTS-**risk** or PTS-**risk** respectively, i.e., an animal within the area has a risk of suffering from either TTS or PTS within the zone. Alternatively, this can be thought of as the total sound-dose limit over 24 hours.

Weightings are applied for non-impulsive L_E (for mammals only[9]).

[8] Please see (National Marine Fisheries Service, 2018) for definitions of "non-impulsive" and "impulsive". For quick reference, if a sound is shorter than 1 second and is clearly intermittent in nature, it is impulsive – otherwise, it's continuous.

[9] When assessing for fish groups levels are not weighted.

Impulsive, $L_{E\text{-}24\ hours}$

The threshold, over which an effect (TTS/PTS) occurs, considering ***impulsive*** sound received by the animal over a typical 24-hour period as sound exposure, L_E.

When presented as a zone on a map, this refers to the area, within which, an animal would suffer the effect, if it stayed there for 24 hours (or the full duration of the activity or as otherwise specified). We thus identify areas given by this limit as areas of TTS-**risk** or PTS-**risk** respectively, i.e., an animal within the area has a risk of suffering from either TTS or PTS within this zone.

Alternatively, this can be thought of as the total sound-dose limit over 24 hours.

Impulsive $L_{E\ single\ impulse}$ / $L_{E\ \#\ impulses}$

It is sometimes useful to assess the impact of a single/a number of impulse(s). When we do this, we will refer to it as "LE single impulse / LE # impulses". Like for the Lp, when single-impulse LE is presented as an impact zone, this refers to the area, within which, an animal would suffer the effect acutely/instantly.

Weightings are applied for Impulsive L_E (for mammals only).

Impulsive, L_p

The threshold over which an effect (TTS/PTS) occurs, considering ***impulsive*** sound received by the animal at any instant as maximal peak pressure. When presented as a zone on a map, this refers to the area, within which, an animal would suffer the effect acutely/instantly and from just one exposure.

Weightings are ***not*** applied for Impulsive L_P.

6.4.2 MASKING

Levels that are not over threshold can still cause significant impact, if that noise makes foraging, navigation or communication harder due to masking or where biologically relevant sounds are "drowned out" by the anthropogenic noise. Continuous noise is more likely than impulsive noise to cause this form of impact.

6.4.3 DISPERSAL

Many animals can recognise sounds and might be dispersed from an area at noise levels well below TTS limits. Quantifying a level of dispersal from desk-spaced studies is very challenging and not done here.

6. RESULTS

Non-impulsive sound

Injury Range

With regards to non-impulsive noise during construction works the noise levels for both vibration piling and drilling are insufficient to cause any permanent injury to the marine mammals and fish in the project area (Table 8). When modelling the 90th percentile for dredger noise, the risk of PTS in LF marine mammals was found to potentially occur at a maximum distance of 137.5m, however this assumes that the animal is stationary within the area for the entirety of the 8 hours of dredging and does not account for the receiver moving out of the area. In a real-life scenario, there would be no acute risk of noise related injury related to the dredging, and animals have time to swim away.

It is assumed that the 90th percentile source level used during dredger modelling will far exceed the noise produced during construction. As such we also present the mean noise level, which would result in no PTS risk for any hearing groups assessed and a maximum TTS risk range of 395m for LF hearing group.

Hearing impairment range

Drilling noise was insufficient to cause any temporary hearing damage and vibration piling was only found to have the potential to cause temporary damage to the LF marine mammal group at a maximum range of 463.1m (Table 9). Dredging, modelled at the 90th percentile, was found to have the potential to cause temporary damage to the LF, PW, P- and P* hearing groups, however all but the LF group would fall in the 500m mitigation range, as such potential injury would be mitigated through use of proper MMO and PAM techniques - if required.

When modelling the mean source level for the dredger, over the 8-hour duration, there is potential TTS risk for the hearing groups LF, PW, P- and P*, however no range is beyond a standard 500m mitigation area.

No sound source has a PTS or TTS risk range of over 500m for fish hearing groups; it should be noted that this means there will not be an overlap with the fish farm to the north of the pier.

Behavioural impact range

The level B harassment criteria has been used to model potential impacts to behaviour, for non-impulsive noise this follows the following criteria:

Strong disturbance (all marine mammals) 120 dB re 1µPa (rms)

For the current assessment, we have used the loudest non-impulsive sound source to model possible disturbance, this being dredging at the 90th percentile. During these works, the maximum range of disturbance is 5,571.2m, with an average range of 2,317.6m (Table 13). When modelled at the mean source level, dredging has a maximum disturbance range of 2,304.1m.

During collation of underwater noise measurements, recordings were also taken from nearby sites, notably Scapa Deep Water Quay, which had a background noise level of 130dB. As background noise levels associated with nearby sites, exceed the Level B-Harassment criterion of 120dB, the significance of these criteria in the current assessment is unclear. In an environment where background noise levels exceed the specified impact threshold, local wildlife may have become accustomed to continuous higher noise levels.

Table 8: Summary of the predicted PTS impact ranges for non-impulsive sound sources, Southall et al., 2019.

Southall et al. (2019)	LF		HF		VHF		PW		OW		P-		P*	
Weighted SEL	Maximum Range (m)	Average Range (m)	Maximum Range (m)	Average Range (m)	Maximum Range (m)	Average Range (m)	Maximum Range (m)	Average Range (m)	Maximum Range (m)	Average Range (m)	Maximum Range (m)	Average Range (m)	Maximum Range (m)	Average Range (m)
Dredging (8 hours) 90th Percentile	137.5	107.2	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Dredging (8 hours) Mean	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Vibration Piling (1 hour)	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Drilling (8 hour)	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50

Table 9: Summary of the predicted TTS impact ranges for non-impulsive sound sources, Southall et al., 2019.

Southall et al. (2019)	LF		HF		VHF		PW		OW		P-		P*	
Weighted SEL	Maximum Range (m)	Average Range (m)	Maximum Range (m)	Average Range (m)	Maximum Range (m)	Average Range (m)	Maximum Range (m)	Average Range (m)	Maximum Range (m)	Average Range (m)	Maximum Range (m)	Average Range (m)	Maximum Range (m)	Average Range (m)
Dredging (8 hours) 90th Percentile	1,709.4	1,302.1	<50	<50	<50	<50	287.5	195.4	<50	<50	437.5	250	437.5	250
Dredging (8 hours) Mean	395	263.5	<50	<50	<50	<50	62.5	<50	<50	<50	87.5	55	87.5	55
Vibration Piling (1 hour)	463.1	390.1	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Drilling (8 hour)	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50

Impulsive sound

Injury Range

With regards to impulsive noise during construction works, the noise levels produced during blasting have the potential to cause PTS in LF, VHF and PW hearing groups, when assessing against weighted hearing groups (Table 10). However, this noise is insufficient to cause injury outside of the standard 500m mitigation zone, with potential injury to marine life being mitigated through proper use of MMO and PAM.

Impact ranges when assessing unweighted SPL peak exceed the standard 500m mitigation range for MMO, with PTS risk to VHF hearing group reaching a maximum 1,025m and average 755.7m, all other hearing groups fall within the 500m range (Table 11). It should be noted that given the sheltered condition of the bay, extending the monitoring range to the average ~750m should be possible.

Hearing impairment range

All hearing groups have TTS risk during blasting, however this is a precautionary scenario, as this assumes no smoothing of the pulse over distance, with long-range smoothing of the pulse peak likely to occur. This would reduce the potential harm caused by the 'impulsive' nature of the detonation (Martin et al., 2020) (Table 11).

Although impact ranges are large, the duration of noise must be considered, with detonations being a single noise event, as opposed to the longer duration and multiple pulse nature of impact piling, upon which the criteria are formed.

Behavioural impact range

The level B harassment criteria has been used to model potential impacts to behaviour, for impulsive noise that is not piling this follows the following criteria:

Mild disturbance (all marine mammals) 140 dB re 1µPa (rms)

Strong disturbance (all marine mammals) 160 dB re 1µPa (rms)

For the current assessment, we have used the loudest impulsive sound source to model possible disturbance, this being blasting, the maximum range for strong disturbance is 1,612.1m, with an average range of 707.3m. For mild disturbance, the maximum range is 6,058.8m, with an average range of 1,929.8m (Table 13).

Pre-Blasting Monitoring Protocol

Trained Marine Mammal Observers (MMO) and Passive Acoustic Monitoring (PAM) operators shall conduct comprehensive surveys of the monitoring area during daylight hours and appropriate sea conditions before any blasting operations commence.

Surveys should:

- Begin monitoring one hour before scheduled blasting operations
- Cover the designated risk zone (recommended radius: 750-1,000m)
- Continue surveillance until a full hour passes without any mammal detections

When marine mammals are observed within the mitigation zone, operators must continuously monitor and track their movements until the animals have definitively exited the area. Following a precautionary approach, if the MMO cannot confirm with certainty that all animals have cleared the mitigation zone, blasting operations must be postponed until clearance is verified.

Table 10: Blasting, 9 blasts at 27kg charge. Summary of predicted PTS and TTS impact range for impulsive sound, weighted SEL, Southall et al., 2019.

Southall et al. (2019) Weighted SEL	LF		HF		VHF		PW		OW		P-		P*	
	Maximum Range (m)	Average Range (m)	Maximum Range (m)	Average Range (m)	Maximum Range (m)	Average Range (m)	Maximum Range (m)	Average Range (m)	Maximum Range (m)	Average Range (m)	Maximum Range (m)	Average Range (m)	Maximum Range (m)	Average Range (m)
PTS	304.1	197.1	<50	<50	472.1	230.7	77.1	55.5	<50	<50	<50	<50	<50	<50
TTS	2,416.4	1,083.1	156.2	93.5	1,591.6	606.9	354.4	211.5	62.1	<50	102.2	70.6	102.2	70.6

Table 11: Blasting, 243kg charge. Summary of predicted PTS and TTS impact range for impulsive sound, unweighted SPL peak, Southall et al., 2019 (marine mammal groups only).

Southall et al. (2019) Unweighted SPLpeak	LF		HF		VHF		PW		OW	
	Maximum Range (m)	Average Range (m)	Maximum Range (m)	Average Range (m)	Maximum Range (m)	Average Range (m)	Maximum Range (m)	Average Range (m)	Maximum Range (m)	Average Range (m)
PTS	245	173.3	104.5	56.1	1,025	755.7	285.2	192.6	56.3	<50
TTS	415.1	309.3	145.3	83.8	1,745.6	1,070.9	425.3	330.4	115.2	83.3

Table 12: Summary of predicted PTS impact range for impulsive sound, Popper at al., 2014 (fish groups only).

P-		P*	
Maximum Range (m)	Average Range (m)	Maximum Range (m)	Average Range (m)
76.4	54.7	<50	<50

Table 13: Summary of predicted Level B-Harassment for loudest non-impulsive and impulsive sound sources.

Sound source	Non impulsive		Impulsive (non-piling)			
	Disturbance (120dB)		Mild disturbance (140dB)		Strong disturbance (160 dB)	
	Maximum range (m)	Average range (m)	Maximum range (m)	Average range (m)	Maximum range (m)	Average range (m)
Dredging 90th	5,571.2	2,317.6				
Dredging Mean	2,304.1	1,023.4				
Blasting			6,058.8	1,929.8	1,612.1	707.3

7. SUMMARY AND CONCLUSIONS

The level of underwater noise produced from the expansion to Hatston Pier has been estimated using the underwater noise modelling software dBSea. The results from the noise modelling were analysed against relevant criteria to assess the impact of noise generated during construction on marine mammals and fish (Southall et al., 2019; NOAA, 2005).

The loudest levels of noise and greatest impact ranges were predicted from the impulsive sound source taking place during construction, this being blasting. For marine mammals the maximum range predicted for PTS occurred in the LF (304.1m) and VHF (472.1m) hearing groups, with a maximum TTS range of 2,416.4m across all hearing groups.

Noise sources other than impulsive blasting were also assessed, this included dredging, vibration piling and drilling. Non-impulsive sound sources were not found to have any significant risk of PTS to marine mammal or fish hearing groups, except for the LF group. However, this had a maximum range of 137.5m at 90th percentile of noise modelling and assume a stationary receiver, which is an unrealistic scenario.

Use of standard mitigation procedures (e.g. MMO, PAM and AHD) should be sufficient to ensure no marine mammals are present during blasting; therefore, preventing PTS to any marine mammals. During blasting, small soft-start charges are also sometimes used prior to the main detonation to deter fish away from the area, which may act as an additional mitigation measure for fish.

8. BIBLIOGRAPHY

Ainslie, M. A. (2010). *Principles of Sonar Performance Modelling.* Heidelberg: Springer. doi:10.1007/978-3-540-87662-5

Audoly, V. M. (2020). Accounting for sea floor properties in the assessment of underwater noise radiated from ships in shallow water. *Proceedings of Meetings on Acoustics* .

Boyce, R. E. (1981). *LABORATORY-DETERMINED SOUND VELOCITY, POROSITY, WET-BULK DENSITY, ACOUSTIC IMPEDANCE, ACOUSTIC ANISOTROPY, AND REFLECTION COEFFICIENTS FOR CRETACEOUS-JURASSIC TURBIDITE SEQUENCES AT DEEP SEA DRILLING PROJECT SITES 370 AND 416 OFF THE COAST OF MOROCCO.* La Jolla: Scripps institution of Oceanography.

British Geological Survey. (2022, June 30). *Geology of Britain Viewer*. Retrieved from British Geological Survey: https://mapapps2.bgs.ac.uk/geoindex/home.html

CalTrans. (2015). *Technical Guidance for the Assessment of Hydroacoustic Effects of Pile Driving on Fish, CALTRANS.* Sacramento: California Department of Transportation.

European Marine Observation and Data Network. (2019, May 01). *Bathymetry portal*. Retrieved from EMODnet: http://portal.emodnet-bathymetry.eu/

Jensen, F. B., Kuperman, W. A., Porter, M. B., & Schmidt, H. (2011). *Computational Ocean Acoustics, Second Edition.* Springer. doi:10.1007/978-1-4419-8678-8

Leroy, C. C., Robinson, S. P., & Goldsmith, M. J. (2008). A new equation for the accurate calculation of sound speed in all oceans. *The Journal of the Acoustical Society of America*, 2774-2782.

Marine Scotland. (2022, 12 12). *Salinity*. Retrieved from Marine Scotland: https://marine.gov.scot/sma/assessment/salinity

National Marine Fisheries Service. (2018). *Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0).* Silver Spring: U.S. Department of Commerce.

Popper, A. N., Hawkins, A. D., Fay, R. R., Mann, D. A., Bartol, S., Carlson, T. J., . . . Travolga, W. (2014). Sound Exposure Guidelines for Fishes and Sea Turtles: A Technical Report prepared by ANSI-Accredited Standards Committee S3/SC1 and registered with ANSI. *Springer Briefs in Oceanography, S3*.

Soloway, A. G., & Dahl, P. H. (2014). Peak sound pressure and sound exposure level from underwater explosions in shallow water. *Journal of the Acoustical Society of America*, 218-223.

Southall, B. L., Finneran, J. J., Reichmuth, C., E.Nachtigall, P., Ketten, D. R., Bowles, A. E., . . . Tyack, P. L. (2019). Marine Mammal Noise Exposure Criteria:Updated Scientific Recommendations for Residual Hearing Effects. *Aquatic Mammals*, 125-232. doi:10.1578/AM.45.2.2019.125

APPENDIX A - DBSEA

A summary of dBSea's models in standard scenarios can be found in the document (online): http://www.dbsea.co.uk/media/30782/dBSea-Benchmark-Testing.pdf.

All solvers in dBSea are based on Jensen et al. 2011 (Jensen, Kuperman, Porter, & Schmidt, 2011)

dBSea has four primary models of calculation:

- **Range dependent Parabolic Equation model - dBSeaPE**
  dBSeaPE uses a split-step, wide angle parabolic equation method. It uses either Greene's approximation or several Padé terms (as set by user) to get very wide propagation with low phase error.

  dBSeaPE is best suited to deeper scenarios (>50 m) or where sediment interaction is not dominant relative to sound speed profile. The model is very efficient for low frequencies and only suffers a small efficiency penalty for higher frequencies.

  dBSeaPE will generally be used for deeper/long range scenarios in the frequency interval 10-1000 Hz.
- **Range dependent Normal Modes model - dBSeaModes**
  dBSeaModes is especially suited to shallower and sediment dependent scenarios and will typically be used where water is shallower than 50 m and depth changes are a large proportion of the total depth, or where sediment effects are thought to play a significant role. dBSeaModes incurs a significant efficiency-penalty at high frequencies and will normally be used in the frequency range 10-1000 Hz.
- **Ray tracing**
  dBSea uses a Gaussian raytracing method, dBSeaRay, to calculate transmission losses for higher frequencies (scenario dependent, but normally from 500 Hz). dBSeaRay compares favourably with the opensource BELLHOP model, in that it is accurate to lower frequencies and agrees well with PE and NM models.
- **Full waveform propagation**
  dBSeaRay also supports full waveform propagation in the frequency range 10 Hz to 168 kHz (limited by the waveform sample rate). Used in this way dBSeaRay considers all scenario range dependence (as models above) as well as the arrival time, phase information and transmission loss of all significant paths to any number of receivers in the scenario (the results grid).

General notes:

- dBSea is an "Nx2D" solver, meaning it models transmission losses in "N" number of vertical radial slices from the source (
-
- Figure , p. 32). There is no backwards propagation towards the source, and no sideways reflection/refraction (We're testing dBSea with full 3D solvers currently).

- dBSea models the sediment propagation only for compressional waves, not for shear waves. This generally means that the transmission loss will be slightly underestimated as no energy is transferred into shear waves and means that dBSeaRay does not propagate into the sediment but relies on a complex reflection coefficient (calculated from the sediment layers) to calculate the reflection/refraction properties of the sediment. Given that dBSeaRay is generally only used for higher frequencies, this has very little practical effect, as higher frequencies will only interact weakly with deeper layers of the sediment.

- The individual sources in a scenario are modelled radially (radial coordinates) from the source at several depths. In post-processing levels are transferred to a cartesian "results grid". This results grid stores levels from all sources so that the cumulative level at any point in the scenario can be investigated immediately.

- Levels can be, and are often post-processed to apply a conservative margin and smooth results (Figure , p. 32). Radial smoothing (triangular kernel of variable width) is carried out to mitigate modelling artefacts arising from low environment sampling density or chance occurrences. Levels are often made to decrease monotonically from the source to make general trends more visible and decrease the risk of misinterpreting impact ranges.

- When refereeing to a level at a certain range, this usually refers to the greatest level at any depth at that range (unless specifically mentioned otherwise).

Figure 17. Post-processing to eliminate artefacts and ease interpretation. Levels are radially smoothed by default and are made to be monotonically decreasing with increasing range from the source.

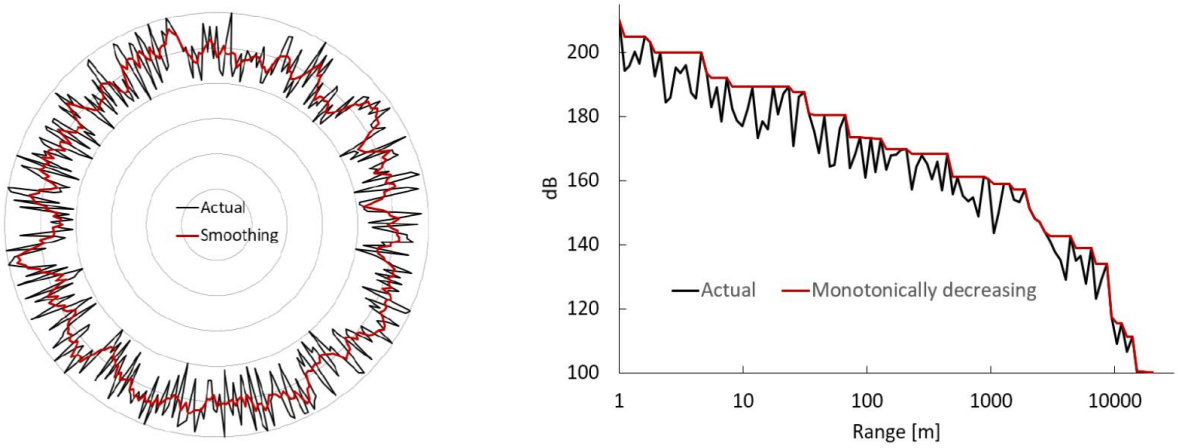


Figure 18. Low resolution schematic of the dBSea modelling space. Source transmission loss is modelled radially from the sources at several depths. Results are extracted from a "square" 3D grid that hold cumulative levels from all sources in the scenario.

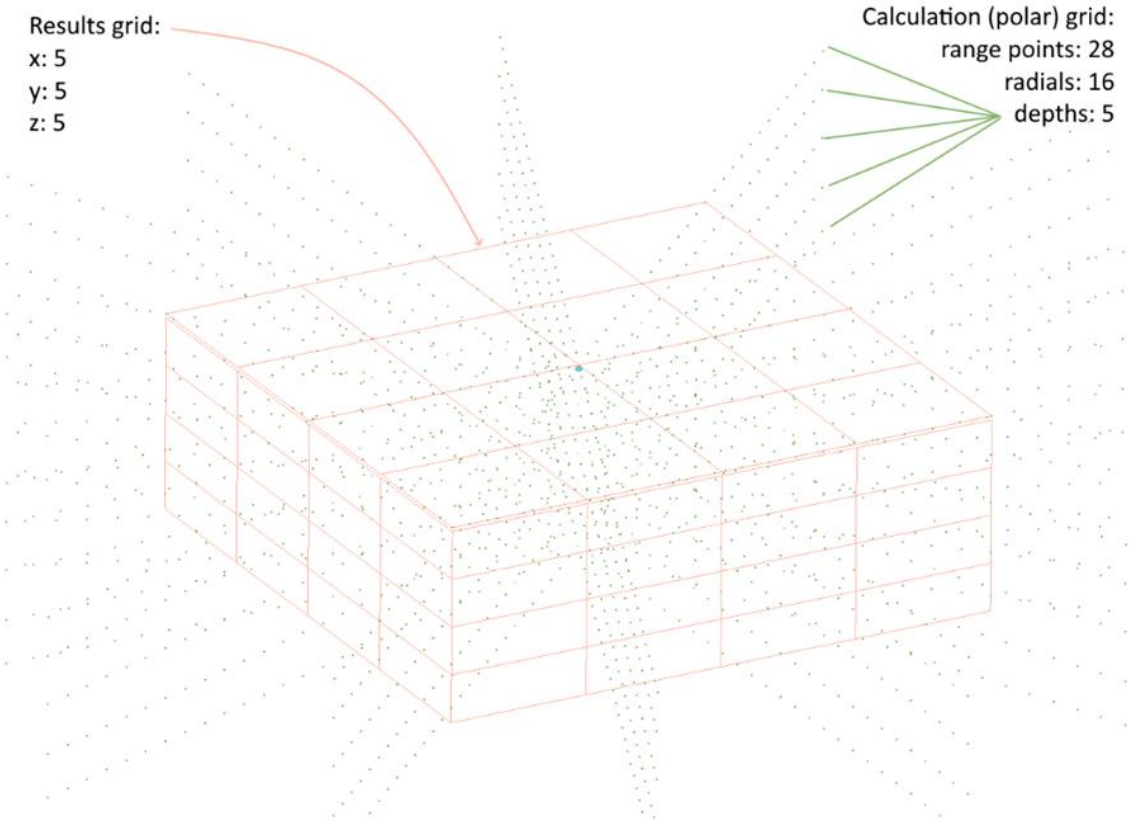
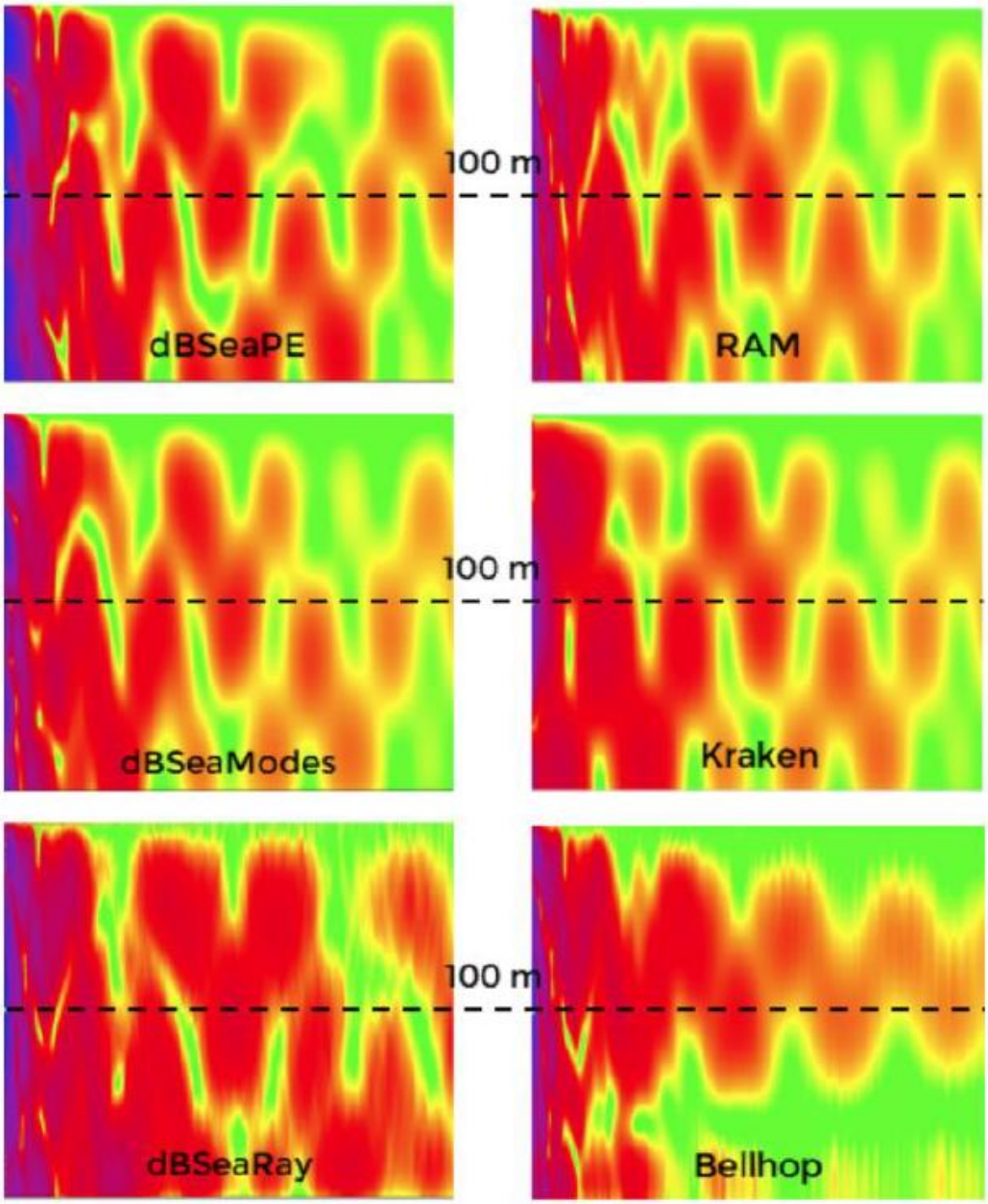


Figure 19. the “Pekeris” standard problem, a low frequency problem. Note that due to sediment effects, neither dBSeaRay nor Bellhop should be relied upon for low frequency problems and are only include for completeness.



APPENDIX B – UNDERWATER ACOUSTICS BASICS

Sound Speed

Water is much harder to compress than air, and a sound speed of 1500 m/s is often used as a standard sound speed in water[10] much as 340 m/s is in air. Sound speed is given by the following equation:

$$c = \frac{Z}{\rho}$$

$$Soundspeed\ [m/s] = \frac{Acoustic\ impedance\ \left[\frac{kg}{m^2 \cdot s}\right]}{Specific\ density\ [kg/m^3]}$$

Because changes to pressure, salinity and temperature occur with changes in depth, the specific density and acoustic impedance of water changes with depth, and thus the sound speed changes as well.

The sound speed profile is quite important in sound propagation, as refraction (changes in propagation angle) will occur when sound moves between layers of water with varying sound speed. This change is quantified in "Snell's Law" and results in sound being "bent" towards the depth of minimal sound speed. These effects can lead to profoundly inhomogeneous sound fields and SOFAR channels.

The same relationships are valid in the sediment, though sediments commonly have sound speeds higher than water. Sound speeds from 1700 m/s (fine sand/silt) to 2500 m/s (gravel) are common for non-solid sediments, with solid sediments (rocks) having much higher sound speeds 2800 m/s (Calcarenite) to 6000 m/s (some granite).

Spreading loss

Most of the propagation loss (loss in dB from source to receiver, "PL") that occurs initially is governed by "spreading loss". It is the simple "thinning out" of acoustic energy as it spreads away from the source, usually in all directions – spherically.

For a sound source in an unbound medium the initial PL will be dominated by spherical PL:

$$Received\ level = Source\ level_{at\ reference\ range} - 20 \cdot \log_{10}\left(\frac{range}{reference\ range}\right)$$

This means a reduction in received level of 6 dB per doubling of distance and explains the rapid reduction in received levels often seen close to the source, e.g.: with a reference range of 1 m, at 16 metres range, there has been 4 doublings of distance, and thus 24 dB loss (4×6 dB).

At longer ranges the medium is no longer unbounded. We reach ranges where the sound has interacted with the surface (near perfect acoustic reflector) or the seabed (lossy acoustic reflector). Also, at greater ranges a doubling of distance is no longer trivial as the PL from spherical spreading loss from 500 m to 1000 m is also just 6 dB.

Sound Channels and Wave guides

In bounded mediums where the sound energy is confined to cylindrical spreading, the PL (ignoring absorption) is often well-characterised by:

$$Received\ level = Source\ level_{at\ reference\ range} - 10 \cdot \log_{10}\left(\frac{range}{reference\ range}\right)$$

This means a reduction of received level of 3 dB per doubling of distance. Depending on the sediment this kind of "waveguide" can sustain efficient transmission of sound over long ranges, provided the sediment is acoustically hard and there is low absorption (such as is the case for low frequencies or in low salinity).

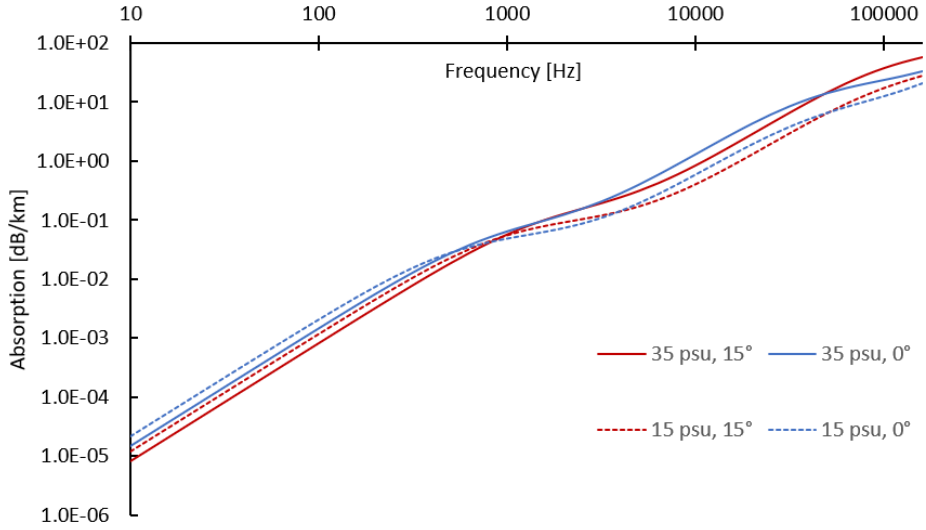
[10] Varies from 1450 m/s at 0° to 1550 m/s at 30° at salinity of 35 psu.

In absence of a bounding from the surface or the seabed, a sound speed profile with a clear low-speed region, surrounded by higher sound speeds can act a sound channel, by focusing the sound on a single depth (with lower sound speed), limiting the PL from spherical to cylindrical (a SOFAR channel is formed).

Absorption

Besides the "thinning out" of the sound energy as described above, the sound is also dissipated into heat the pressure changes interact with water, molecules and particles in its path. This absorption is mostly governed by the concentration of boric acid and magnesium sulphate and is very dependent on the frequency, with lower frequencies, <1 kHz, experiencing almost no absorption, while high frequencies, > 10 kHz, can be attenuated by over 10 dB / km.

Figure 20. Absorption comparison at salinities of 35 psu & 15 psu and temperatures of 0° and 15°. Both scales are logarithmic. Note how increased salinity increases high-frequency absorption (solid v dashed lines), while a decrease in temperature increases absorption at lower frequencies (red v blue lines).



Small bubbles, wind or wave induced, will further attenuate especially the high frequencies, but as modelling is often done to estimate a worst-reasonable case, or for weather sensitive activities, fair weather with little wind and waves are assumed, thus ignoring this attenuation effect.

Sediment

Depending on the incident angle of the sound, the frequency and the acoustic properties of the sediment, sound can either mostly penetrate the sediment or mostly be reflected by it.

In shallow areas with soft sediment (acoustically like water), it is typical to find that close to the source, at high incidence angles and at low frequencies (<250 Hz) the sound will penetrate the sediment and dissipate there, leading to very high transmission losses for these frequencies. This effect coupled with the high absorption at high frequencies often leads to the soundscape being dominated by frequencies from a few hundred hertz to a few thousand hertz. In deeper water, or with an upward refracting sound speed profile, low frequencies will tend to dominate the soundscape away from sound sources, as there is no efficient mechanism for attenuating them.

A "cut-off[11]" frequency, below which, there will be high sediment-associated attenuation can be approximated by:

[11] The cut-off is not an immediate loss of energy in frequencies under this frequency, but rather something like a high pass, 1st-order, Butterworth filter (Audoly, 2020).

$$f_{cut-off} = \frac{c_{water}}{4 \cdot D \cdot \sqrt{1 - \left(\frac{c_{water}}{c_{sediment}}\right)^2}}$$

With "C_{water}" and "$C_{sediment}$" being the sound speed in the water and the sediment respectively, and "D" the local depth (Jensen, Kuperman, Porter, & Schmidt, 2011).

In water with lower salinity and less absorption, the soundscape will tend to have a relatively higher content of high frequencies as these are absorbed much less efficiently when the salinity is lower.

Sound transmission Across Interfaces

Sound waves are reflected and refracted (Snell's law) as they travel through interfaces. Also, depending on acoustic impedance and interface angles only a proportion of the incident acoustic energy is transmitted through that interface (the rest is reflected).

In the following: W: Watt; Pa: Pascal; s: second; m: metre; N: Newton; J: Joule; θ: angle; v: sound speed; Z: acoustic impedance; p: pressure from ambient.

Snell's law:

$$\frac{\sin\theta_{in}}{\sin\theta_{out}} = \frac{v_{in}}{v_{out}}$$

- rearranged to give transmission angle from incidence angle and sound speeds:

$$\sin^{-1}\left(\frac{\sin\theta_{in}}{\frac{v_{in}}{v_{out}}}\right) = \theta_{out}$$

Transmission fraction of sound pressure for plane waves (part of the Fresnel equations):

$$\frac{p_{out}}{p_{in}} = \frac{2 \cdot Z_{out} \cdot \cos\theta_{in}}{Z_{out} \cdot \cos\theta_{in} + Z_{in} \cdot \cos\theta_{out}}$$

Reflection fraction of sound pressure for plane waves (part of the Fresnel equations):

$$\frac{p_{out}}{p_{in}} = \frac{Z_{out} \cdot \cos\theta_{in} - Z_{in} \cdot \cos\theta_{out}}{Z_{out} \cdot \cos\theta_{in} + Z_{in} \cdot \cos\theta_{out}}$$

It follows from these relations that for transmission from an acoustically relatively slow medium like water to an acoustically faster medium here exists an incident angle above which there is total reflection, and thus no transmission of acoustic energy through the interface (real interfaces are rugged and lumpy, and perfect reflection is not realistic).

For the water/sediment interface presented here (sediment is sand with a sound speed of 2000 m/s) this occurs at 0.84 radians (~48.5 degrees) from normal incidence.

The fraction of pressure transmission from water (sound speed 1500 m/s) to sediment (2000 m/s) is around 146 % at normal incidence and drops as the incidence angle increases away from normal, much faster for water-to-sediment than for sediment-to-water.

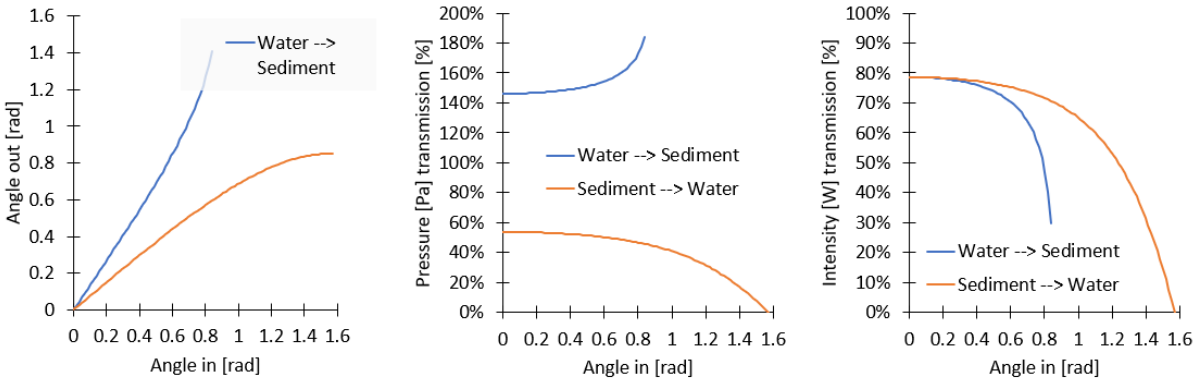
While it may seem counter-intuitive that pressure can increase after transmission over an interface, remember that the energy in the sound is a function of pressure *and* acoustic impedance:

$$I = \frac{p^2}{Z}$$

$$With\ units: [W] = \frac{[Pa]^2}{\left[\frac{Pa \cdot s}{m^3}\right]} = \frac{\frac{N^2}{m^4}}{\frac{N}{\frac{m^2}{m^3} \cdot s}} = \frac{N^2 \cdot m^3}{m^4 \cdot \frac{N}{m^2} \cdot s} = \frac{N}{m \cdot m^{-2} \cdot s} = \frac{J \cdot m}{m^{-1} \cdot s} = \frac{J}{s} = W$$

Thus, if the transmitted intensity fraction is 80 % then the reflected intensity is 20 %; there is energy conservation.

Figure 21. Transmission angles [radians] and fractions as function of incident angle between water and sediment (sand). Note that total reflection from water to sediment occurs around incident angle of 0.84 [rad] (48.5 degrees), meaning there is no transmission of sound at greater incidence angles.



Simplified Propagation Loss Model

Taking all the above into account we can construct a simplified model, that will give a good indication of the expected propagation loss (PL) in scenarios of constant depth:

$$PL = \begin{Bmatrix} r < D \ : & -20 \cdot \log_{10}\left(\frac{r}{r_0}\right) \\ r > D \ : & -20 \cdot \log_{10}\left(\frac{D}{r_0}\right) - 10 \cdot \log_{10}\left(\frac{D}{r_0}\right) \end{Bmatrix} - \alpha(f) \cdot r - l(f) \cdot r$$

Where:

- "r" is horizontal range from source.
- "D" depth at source.
- "r_0" the reference range of the source (often 1 m).
- "f" the frequency,
- "l" the frequency specific leakage loss to the sediment.
- "α" the frequency specific absorption.

Sound Level Units

All references to sound pressure levels, peak pressure levels and sound exposure levels refer to a logarithmic ratio between a reported/measured pressure or exposure and a reference pressure or exposure. As an example, a level of 220 L_p (decibel zero-to-peak) is equal to a peak pressure of 100000 Pascals (Pa) over ambient pressure, while 120 L_p is equal to 1 Pa over ambient pressure.

To avoid dealing with these large numbers as pascals (as a linear scale), they are converted to a decibel ratio (Table 1 for definitions). Besides compressing large numbers to a smaller scale this also corresponds better to how animals are thought to perceive sound, namely as relative steps. This means that an increase from 1 to 2 Pa *sounds like* the same increase as from 100 to 200 Pa, even though the first step was only 1 Pa, while the second was 100 Pa. This is better reflected in a logarithmic scale based on ratios, where both steps are equal, here 3 dB.

However, while dBs are practical, they can be hard to compare between studies, due to vague definitions, and so we have adopted the standards set by ISO 18405-2017.

For ease of reference please see following overview for unit definition.

Table 14: Definitions.

Unit	Definition	Comments
SPL (dB_{RMS}) ISO 18405- 2017: 3.2.1.1	$SPL = 10 \cdot Log_{10}\left(\frac{\frac{1}{t_2 - t_1} \cdot \int_{t_1}^{t_2} p(t)^2 dt}{1 \cdot 10^{-12} Pa}\right)$	Functionally equivalent to deprecated $20 \cdot Log_{10}\left(\frac{RMS}{1 \cdot 10^{-6} Pa}\right)$
L_p ($dB_{z\text{-}p}$) ISO 18405- 2017: 3.2.2.1	$L_p = 20 \cdot Log_{10}\left(\frac{Pa_{max}}{1 \cdot 10^{-6} Pa}\right)$	This assumes that Pa_{max} is equal or greater than $\sqrt{Pa_{min}{}^2}$
$L_{p\text{-}p}$ ($dB_{p\text{-}p}$)	$L_{p-p} = 20 \cdot Log_{10}\left(\frac{Pa_{max} - Pa_{min}}{1 \cdot 10^{-6} Pa}\right)$	Often[12] equivalent to $L_P + 6.02\ dB$
L_E (dB_{SEL}) ISO 18405- 2017: 3.2.1.5	$L_E = 10 \cdot Log_{10}\left(\frac{\int_{t_1}^{t_2} p(t)^2 dt}{1 \cdot 10^{-12} Pa}\right)$	For continuous sound this is equivalent to $SPL + 10 \cdot Log_{10}(t_2 - t_1)$ "t" is seconds

Unless otherwise stated SPL has an averaging period of 1 second, and L_E for the duration of the specified event, sometimes indicated as $L_{E\text{-}"time"}$ or $L_{E\text{-}single\ blow}$.

If the averaging period for SPL is equal to the total even duration, then SPL is equal to "Leq" the "equivalent constant level".

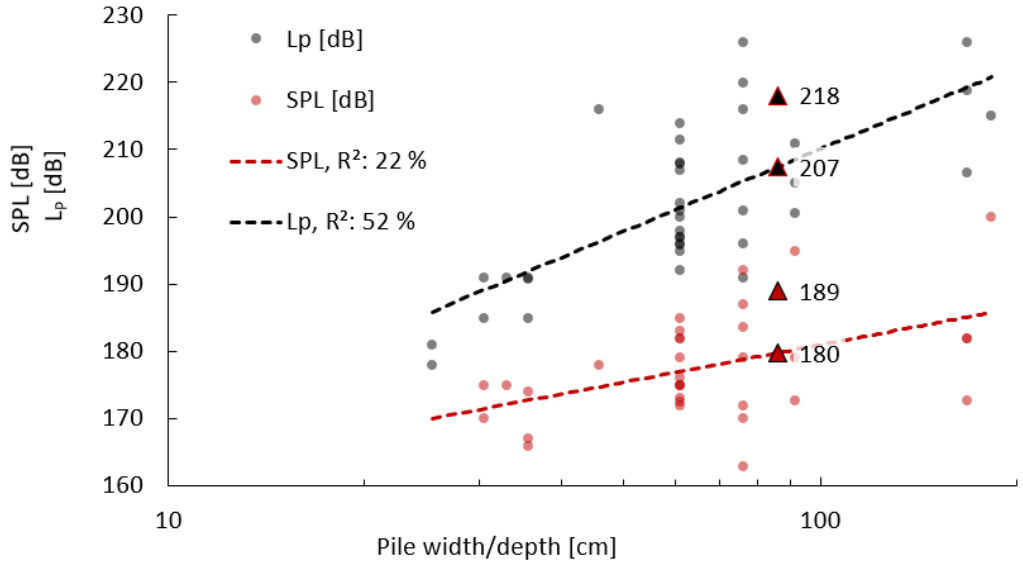
When source levels are presented, the same units are used, and it is implicit that all source levels are given as if recorded 1 m from an omnidirectional mono-point source, unless otherwise specified.

[12] If maximum pulse rarefaction is below ambient pressure and compression and rarefaction phases are of equal size.

APPENDIX C – SOURCE MODELS

We only have a few recordings (50) from vibration piling and have no dedicated source model for this type of piling. Instead, we rely on published recorded levels as from CalTrans (CalTrans, 2015).

Figure 22. Basis of vibro piling broad band source level as a function of pile size.



Given the low confidence we have in this approach (low R^2 values) we use the 90th percentile level as the broadband source level. L_P is estimated to be 218 dB and SPL 189 dB. The frequency content is assumed to be identical to that of the impact piling.

Table 15. Decidecade band levels of sources.

Band centre frequency [Hz]	Dredging, Mean (broadband: 182) [SPL]	Dredging, 90th percentile (broadband: 192) [SPL]	Drilling, Mean (broadband: 138) [SPL]	Drilling, 90th percentile (broadband: 156) [SPL]	Blasting, 27 kg (broadband: 230) [LE]	Vibro, Mean (broadband: 180) [SPL]	Vibro, 90th percentile (broadband: 189) [SPL]
12.5	162	165	127	142	210	159	169
16	163	166	126	139	210	159	169
20	164	167	124	139	210	160	169
25	165	170	123	138	210	160	169
31.5	168	177	125	139	210	160	170
40	169	180	124	140	210	162	171
50	169	178	124	139	210	165	174
63	170	178	126	143	210	167	176
80	169	180	123	142	210	169	178
100	168	179	124	142	210	170	179
125	168	178	123	140	210	170	180
160	168	178	123	142	210	170	179
200	168	177	125	146	210	170	179
250	169	178	126	147	210	169	179
315	169	178	125	147	210	168	177
400	169	177	123	144	210	167	176
500	168	178	124	145	210	165	175
630	167	175	122	143	210	164	173

800	167	174	124	141	210	162	171
1000	166	174	125	142	210	160	169
1250	165	174	123	142	209	158	167
1600	165	174	121	138	209	157	166
2000	164	174	120	135	208	155	164
2500	163	175	119	134	208	153	162
3150	163	175	118	132	207	152	161
4000	162	175	118	132	206	150	160
5000	162	175	119	133	205	149	158
6300	161	175	118	130	204	148	157
8000	160	175	117	130	203	147	156
10000	159	174	117	129	202	145	154
12500	158	173	110	120	201	143	152
16000	157	173	109	118	200	143	152
20000	156	172	109	119	199	142	151
25000	156	171			198	141	150
31500	155	171			197	140	149
40000	154	170			196	139	148
50000	157	174			195	138	147
63000	156	173			194	137	146
80000	156	173			193	136	145
100000	157	172			192	135	144
125000	157	166			191	134	143
160000	157	166			190	133	142

APPENDIX D – MODEL CALIBRATION

Recorded Transmission losses

Broadband transmission losses for exposure levels (L_E) show good consistency between measurements and a transmission loss consistent with -22.2 × Log_{10}(range), suggesting a highly absorbent sediment with little ability to reflect sound back into the water column and form a waveguide as well as high scattering from a rough seabed.

Transmission loss for LP was close to spherical spreading loss which is consistent with a poorly reflecting bottom resulting in little overlap in arrival times for the source impulse.

There was a clear pattern in the transmission losses versus frequency, with higher frequencies experiencing much higher losses, likely due to interaction with a rough sediment resulting in a lot of scattering.

Figure 23. Broadband transmission losses at Hatston. L_P losses follow a near spherical loss pattern while L_E shows a tendency to follow a waveguide with some absorption losses. Thick lines are best fit of logarithmic loss, while thin lines are for loss accounting for the depth at the source. Error bars are expected 95 % of measurements.

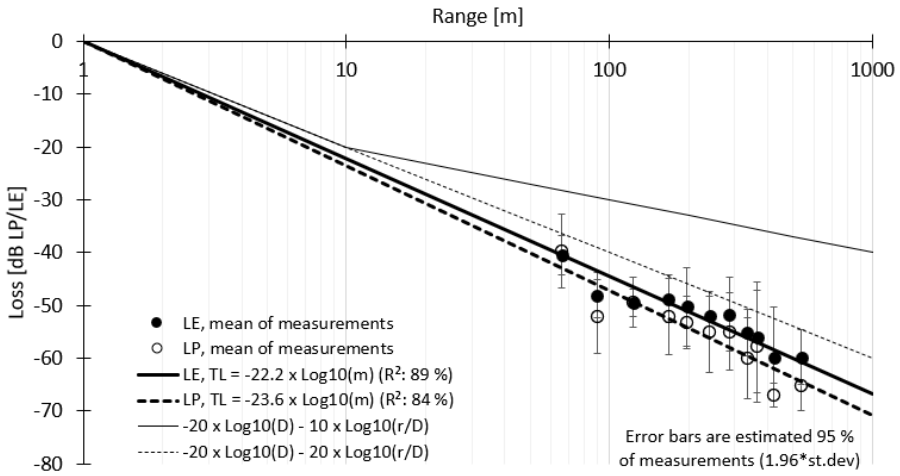
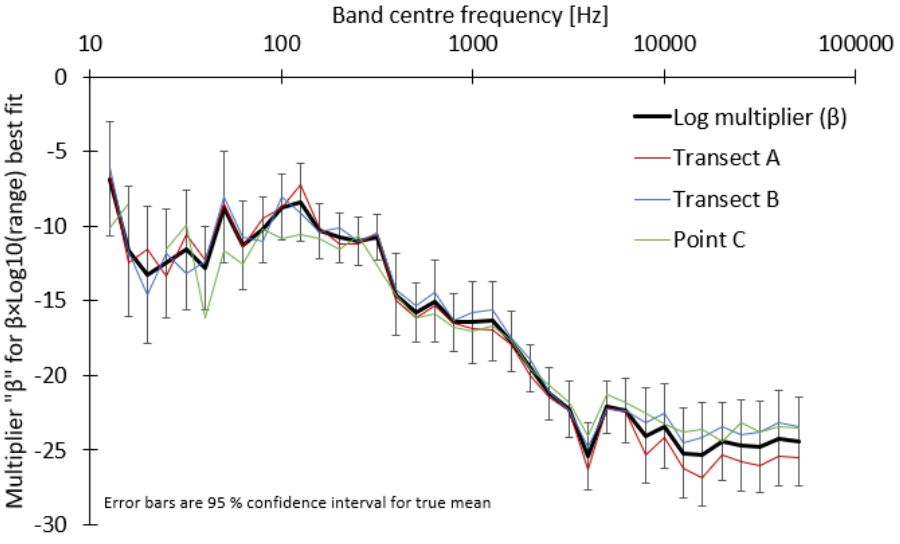


Figure 24. Transmission losses per band shown as the best fit multiplier "β" for a simple logarithmic transmission loss. Error bars are 95 % confidence interval for the true mean. While Transects A & B have some difference, this was not significant at a 10 % level in a t-test.



C SEAL HAUL OUT SITES

Seal Haul Out Name	Distance* and Orientation	Species	No. seals (based on August counts)		NMPi Breeding Colony (Grey seals)
			Harbour seal	Grey seal	
Damsay and Holm of Grimbister	4km west	Harbour and Grey seal	63	28	No
Helliar Holm North and Elwick	5km north	Harbour seal	21	13	No
Taing Skerry and Grass Holm	7km north	Harbour and grey seal	6	87	No
Gairsay	8km north	Grey seal	0	0	Yes
Holm of Rendall	8km north	Harbour and Grey seal	28	6	No
Sweyn Holm	10km north	Harbour and Grey seal	4	0	No
Deer Sound	14km south east	Harbour and Grey seal	39	79	No
South East Egilsay	14km north	Harbour and Grey seal	2	19	No
Little Green Holm	15km north east	Grey seal	8	20	Yes
Muckle Green Holm	16km north east	Grey seal	0	5	Yes
Holm of Scockness	18km north	Harbour seal	20	22	No
Costa and Burgar	19km north west	Harbour and Grey seal	20	3	No
Eynhallow and Westside	19km north west	Harbour and Grey seal	77	88	No
Egilsay North	20km north	Harbour and Grey seal	4	61	No
Greenli Ness	21km north east	Grey seal	0	309	No
Seal Skerry (Eday)	21km north east	Harbour and Grey seal	0	612	No
Rusk Holm	23km north east	Grey seal	0	0	Yes
Auskerry	23km north east	Grey seal	0	77	Yes
Bay of Holland East and Tor Ness	23km north east	Harbour and grey seal	11	607	No
Copinsay	25km south east	Grey seal	0	311	No
Linga Holm	25km north east	Grey seal	1	347	Yes
Bay of Houseby	27km north east	Harbour and Grey seal	6	213	No

Seal Haul Out Name	Distance* and Orientation	Species	No. seals (based on August counts)		NMPi Breeding Colony (Grey seals)
			Harbour seal	Grey seal	
Little Linga	28km north east	Grey seal	3	27	Yes
Sty Taing	28km north east	Grey seal	0	0	Yes
South Westray	28km north east	Grey seal	0	0	Yes
Skerry of Wastbist	29km north	Harbour and Grey seal	52	47	No
Holms of Spurness	29km north east	Grey seal	0	100	Yes
Holm of Huip	30km north east	Grey seal	0	214	Yes
Odness	33km north east	Harbour and Grey seal	25	95	No
Calf of Eday	35km north east	Grey seal	0	55	Yes
North end Mill Bay	36km north east	Harbour and Grey seal	10	44	No
Spo Ness to Ness of Brough	37km north	Harbour and Grey seal	6	3	No
Holm of Papa Westray and North Wick	40km north	Harbour and Grey seal	22	206	No
South Ronaldsay East	43km south	Grey seal	0	0	Yes
North West Water Sound	44km south	Harbour seal	63	32	No
Narr Ness	47km north	Harbour and Grey seal	14	0	No
Calf of Flotta	49km south	Grey seal	1	13	Yes
North Flotta	50km south	Grey seal	0	228	Yes
Pentland Skerries	51km south	Grey seal	0	343	No
Barrel of Butter	52km south	Harbour seal	18	11	No
Flotta Oil Terminal	52km south	Harbour seal	9	0	No
Ve Ness	52km south west	Harbour and Grey seal	0	8	No
South Ronaldsay West	53km south	Grey seal	0	0	Yes
Switha	54km south west	Harbour and Grey seal	19	27	No
Cava	54km south west	Harbour seal	17	20	No
North and East Fara	54km south west	Harbour and Grey seal	8	179	No
Swona	55km south	Grey seal	0	238	Yes
Holm of Houton	56km south west	Harbour and Grey seal	21	24	No

Seal Haul Out Name	Distance* and Orientation	Species	No. seals (based on August counts)		NMPi Breeding Colony (Grey seals)
			Harbour seal	Grey seal	
South North Ronaldsay	56km north east	Harbour and Grey seal	121	202	No
North east Hoy	58km south west	Grey seal	0	3	Yes
Stroma	59km south	Harbour and Grey seal	0	570	No
Duncansby Head	59km south	Grey seal	0	0	Yes
Seal Skerry (North Ronaldsay)	61km north east	Grey seal	0	612	No
Gills Bay	62km south	Harbour and Grey seal	41	29	No
Selwick	64km south west	Harbour and grey seal	17	117	No
Bay of Ireland	65km west	Harbour seal	44	23	No
Dunbeath-Wick	83km south	Grey seal	0	0	Yes

E AIRBORNE NOISE REPORT

Orkney Logistics Base (Hatston)
Technical Appendix 9.2, Noise Impact Assessment

June 2023

CONTROL SHEET

Client: Orkney Islands Council Harbour Authority
Project Title: Orkney Logistics Base (Hatston)
Report Title: Technical Appendix 9.2, Noise Impact Assessment
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EXECUTIVE SUMMARY

A construction and operational noise assessment has been carried out for the proposed development at Hatston.

Construction Noise

Worst case combined construction stages based on the proposed construction schedule have been modelled using CadnaA software. Details of construction activities have been provided by Arch Henderson.

The outcome of the assessment is that Neutral impacts are predicted during the day-time period for all construction phases. There are no significant adverse impacts in EIA terms.

The change in road traffic noise levels along routes which HGVs carrying infill material to / from the local quarries which will supply the site has been predicted. The maximum change in noise level as a result of construction HGVs is predicted to be less than 1dB along the routes. The maximum significance of effects as a result of the construction traffic is Slight, which is not significant in EIA terms.

Operational Noise

The operational noise assessment considers the increase in potentially significant noise generating activities post development completion.

During the day and night-time periods noise levels are predicted to increase by up to 1dB at surrounding residential receptors as a result of the increased operational activities at Hatston. The maximum significance of the changes in noise levels is Neutral / Slight, which is not significant in EIA terms.

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1 INTRODUCTION

1.1 Terms of Reference

EnviroCentre Ltd has been appointed by Orkney Islands Council Harbour Authority (OICHA) to undertake a Noise Impact Assessment (NIA) for the proposed expansion of the existing Hatston Ferry Terminal to create a Logistics Base.

This report presents the results of the noise assessment for the proposed development. The noise assessment considers the airborne construction and operational noise impacts at existing sensitive receptors surrounding the site. The effects of construction noise on marine life is considered as part of the Underwater Noise Assessment presented in Technical Appendix 5.6, and Chapter 5, Biodiversity of the EIAR.

1.2 Site Description

Hatston Pier and Harbour is located on the coast to the northwest of Kirkwall. The proposed development site boundary and surrounds are shown in Drawing No. 674795-GIS083, Appendix A.

There are a number of existing noise sensitive receptors in the surrounding area with full or partial line of sight to the site. Saverock Farm is located circa 1km to the south-west, a small hamlet at Hatston Park is located circa 950m to the south-east. Housing at Grainbank on the outskirts of Kirkwall is located circa 1.3km to the south east. Directly across the water to the east is housing on Carness Road on the northern outskirts of Kirkwall.

1.3 Existing Use

Hatston Pier and Harbour is Orkney's primary commercial terminal and link south to Aberdeen and north to Shetland. It is also Scotland's longest deep-water commercial berth with a total of 884 metres of quay side available for multi-purpose use. This infrastructure accommodates a range of operational activities including large cruise ships, renewable energy, ferries, oil and gas and cargo/ livestock.

The site also comprises an area of land used for short/long term parking, freight, marshalling area and storage. There are a number of commercial / industrial buildings situated adjacent to the access road. A causeway edged with rock armour extends out towards a 'T'-shaped pier formed from piles topped by a concrete slab. On the eastern arm of the pier is the passenger reception facility and associated infrastructure.

1.4 Proposed Development

The proposed development comprises an extension to the existing pier facilities which will increase quay length. An area of land will be reclaimed to create a new laydown and storage area adjacent to the quay. The pier extension, laydown area and associated infrastructure has been designed to be future proofed so as to accommodate a range of potential future uses.

It is intended that the site will be used to enable offshore wind activities such as maintenance and operations, complementing activities at the future proposed Scapa Deep Water Quay. The new

laydown area is likely to be used for storage of renewable energy devices, such as wind turbine components.

The development includes provision of a new boat lift capable of handling vessels of up to 800 tonnes. A small scale boatyard with undercover facilities for storage and maintenance of boats including smaller leisure, fishing and aquaculture may be developed at a future unspecified date. There are no developed plans for undercover storage and maintenance facilities at the time of writing.

The site could potentially be used for the storage of alternative fuels. There are no developed plans for alternative fuel storage at the time of writing.

1.5 Potential Impacts

Noise from the proposed development has the potential to impact surrounding existing residential receptors during the construction and operational phases.

1.5.1 Construction Phase

Significant noise generating construction activities associated with the construction of the pier extension and laydown area, including piling and dredging have the potential to impact existing residents in the surrounding area.

Noise from HGV movements associated with import of infill material has the potential to impact existing noise sensitive receptors located along the routes to and from the site from Heddle and Cursiter quarries.

1.5.2 Operational Phase

The operational phase will see an extension of existing activities at Hatston. The following activities have been identified as having the potential to increase noise levels in the surrounding area;

- Increased ship berthing and mooring, including use of onboard ship generators;
- Ship loading / unloading activities;
- Movement of materials, including renewables components between ships and laydown area;
- HGV movements associated with increased activities;
- Boat lifting and transport between pier and storage areas.

1.6 Report Usage

The information and recommendations contained within this report have been prepared in the specific context stated above and should not be utilised in any other context without prior written permission from EnviroCentre Limited.

If this report is to be submitted for regulatory approval more than 12 months following the report date, it is recommended that it is referred to EnviroCentre Limited for review to ensure that any relevant changes in data, best practice, guidance or legislation in the intervening period are integrated into an updated version of the report.

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2 NOISE POLICY AND GUIDANCE

This section outlines policy and guidance relevant to this NIA.

2.1.1 National Planning Framework 4

The purpose of the National Planning Framework 4[1] is to set out national planning policies which reflect Scottish Ministers priorities for the operation of the planning system and the development and use of land.

Noise is highlighted as a key aspect of a development which should be considered. Methods of attenuating noise levels are encouraged.

2.1.2 PAN 1/2011 Planning and Noise

Advice on the role of the planning system in helping to prevent and limit the adverse effects of noise is provided in Planning Advice Note (PAN) 1/2011 – Planning and Noise[2]. PAN 1/2011 promotes the principles of good acoustic design and a sensitive approach to the location of both noise sensitive and noise generating developments. PAN 1/2011 promotes the avoidance of significant adverse noise impacts from new development while supporting sustainable economic growth. The input of environmental health officers and professional acousticians from an early stage is recommended to avoid unreasonable effects on quality of life. PAN 1/2011 promotes the application of reasonable criteria to assess noise impact but does not suggest specific target levels, allowing for consideration of contextual and non-acoustic factors.

The associated *Technical Advice Note (TAN) 'Assessment of Noise*'[3] provides guidance on NIA methods. The recommended assessment method includes an initial identification of noise sensitive receptors and their sensitivity, a quantitative assessment, a qualitative assessment, a determination on the level of significance and recommendations for the decision process.

2.1.3 Assessment of Noise: Technical Advice Note

Assessment of Noise: Technical Advice Note[3] (TAN) is supplementary guidance to PAN 1/2011 published by the Scottish Government. TAN recommends a five stage process to the assessment of noise, as detailed below

Stage 1: Initial Process

The development is categorised according to whether it has the potential to generate noise *i.e.* a Noise Generating Development (NGD) or be affected by the existing noise *i.e.* a Noise Sensitive Development (NSD). All Noise Sensitive Receptors (NSRs) that have the potential to be impacted by the proposed development are identified and prioritised according to their level of sensitivity. Residential NSRs are noted to be of high sensitivity.

Stage 2: Quantitative Assessment

[1] The Scottish Government (2023), *National Planning Framework 4.*
[2] The Scottish Government (2011), *PAN 1/2011 Planning and Noise*.
[3] The Scottish Government (2011), *TAN 1/2011 Technical Advice Note*.

The quantitative assessment method depends on the type of development proposed *i.e.* Noise Sensitive Development (NSD) or Noise Generating Development (NGD). Typically the assessment will compare absolute levels (predicted or measured) with an agreed target. The magnitude of the impact is then defined by assessing the amount the predicted noise level exceeds the agreed assessment target criteria for either day or night time periods. The agreed target and magnitude of impact scales used in this assessment are presented in Section 3.

Stage 3: Qualitative Assessment

The qualitative assessment allows the magnitude of the impact established in Stage 2 to be adjusted accordingly to account for additional factors not addressed in the quantitative assessment.

Stage 4: Level of Significance

The level of significance of the noise impact at the NSR is obtained through the relationship of the receptor's sensitivity to noise and the magnitude of the noise impact. The prescribed level of significance is used to determine whether or not noise is a key decision making issue for the NSR in question.

Stage 5: The Decision Process.

Stages 2 to 4 are repeated for all identified NSRs and a Summary Table of Significance is completed which provides an overview of the level of significance of the noise impact on all NSRs. The recommendation from the environmental health officer to the planning officer should be informed by the distribution of levels of significance.

2.1.4 Calculation of Road Traffic Noise

CRTN[4] is the standard UK procedure which defines measurement and calculation methods for assessing road traffic noise.

The standard contains a shortened measurement procedure by which daytime $L_{A10,18h}$ noise level can be calculated from the arithmetic average of three consecutive hourly $L_{A10,1h}$ measurements.

2.1.5 World Health Organization Guidelines for Community Noise

In *Guidelines for Community Noise*[5], 55 dB $L_{Aeq,16h}$ is indicated as a criterion threshold below which few people are seriously annoyed for an outdoor living area, during daytime and evening hours. A lower guideline value of 50 dB $L_{Aeq,16h}$ is provided as a criterion below which few people are annoyed. In addition, the guidance identifies that negative sleep impacts are avoided at 30 dB $L_{Aeq,8h}$ for continuous noise sources. It is stated that "for a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45 dB L_{Amax} more than 10 – 15 times per night".

It should be noted that these limits are typically understood to relate to the onset of adverse impact. This is clarified in TAN: *"The WHO guideline levels have been set at the threshold of detectable effects in the population. There is no evidence that anything other than a small minority of the population exposed at the WHO guideline noise levels finds them to be particularly onerous in the context of their daily lives."*

[4] The Department for Transport (1988), *The Calculation of Road Traffic Noise*.
[5] World Health Organization (1999), *Guidelines for Community Noise*.

2.1.6 BS5228-1:2009+A1:2014; Code of Practice for Noise and Vibration Control on Construction and Open Sites.

Methods for calculating noise and vibration produced by construction and open sites are provided in BS5228-1:2009+A1:2014[6]. Annexes C and D of Part 1 provide generic source data for different types of noise source, as well as methods for calculating noise from stationary and mobile plant. Specific advice on noise from sources such as piling is provided.

2.1.7 BS 4142:2014+A1:2019, Methods for rating and assessing industrial and commercial sound

BS 4142:2014+A1:2019[7] provides methods for rating and assessing sound of an industrial and/or commercial nature, which includes:

a) Sound from industrial and manufacturing processes;
b) Sound from fixed installations which comprise mechanical and electrical plant and equipment;
c) Sound from loading and unloading of goods and materials at industrial and/or commercial premises; and
d) Sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from premises or processes, such as that from forklift trucks, or that from train or ship movements in or around an industrial and/or commercial site.

The methods described use outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident.

The measured specific sound source is corrected for acoustic features (if present) of intermittency, impulsivity and tonality to give the rated noise level. The assessment considers the impact of the specific sound by subtracting the measured background sound level from the rating level, and considering the following;

a) Typically, the greater this difference, the greater the magnitude of impact.
b) A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context.
c) A difference of around +5dB(A) is likely to be an indication of an adverse impact, depending on the context.
d) The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact, or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

[6] British Standards Institution (2014), *BS 5228-1:2009+A1:2014 – Code of Practice for Noise and Vibration Control on Construction and Open Sites – Part 1: Noise.*
[7] British Standards Institution (2019), *BS 4142:2014+A1:2019 – Methods for Rating and Assessing Industrial and Commercial Sound*.

3 CONSULTATION, METHODOLOGY AND TARGET CRITERIA

3.1 Consultation

A summary of the relevant responses to the Scoping Report submitted by EnviroCentre, is shown below and overleaf in Table 3-1.

Table 3-1: Summary of Consultation Responses

Organisation	Consultation Response	How and where addressed
Orkney Islands Council (OIC)	The EIA should define the source of infill material and if this is not known at the time of submission, should outline the potential options ensuring assessment of the potential impacts associated with the worst case scenario through providing information of likely HGV movements associated with that option and appropriate mitigation, including a Framework CEMP/Dust Mitigation Strategy. With appropriate mitigation of the worst case scenario outlined in the introductory sections of the EIA, noise and air quality during the construction phase of the proposed development can be scoped out of the EIA.	The source of infill material and associated worst case assumptions adopted in this NIA are described in Section 5.3.4.
	It is agreed that operational noise can be scoped out of the assessment for the reasons set out in the Scoping Report.	Assessment of operational noise has been included in the EIA to address Marine Directorate requirements.
Marine Directorate	The Scottish Ministers advise that airborne noise is scoped in for both construction and operation phases and a construction noise impact assessment must be included in the EIA Report. If construction methodologies have not been confirmed then the worst case scenario must be assessed.	Assessment of construction and operational airborne noise have been included in the EIA report. Both assessments assume worst case scenarios.

3.2 Methodology

The noise assessment was undertaken to establish the impact of construction and operational activities on noise sensitive receptors surrounding the Site. The assessment involved the following stages;

- Consultation with OIC Environmental Health Department to agree assessment methodology and noise criteria;
- Measurement of existing baseline noise environment at a sample of 3 areas representative of the most exposed noise sensitive receptors surrounding the proposed development; the monitoring locations are shown in Drawing No. 674795-GIS081 Appendix A;

- Measurement of existing baseline road traffic noise at two locations along routes to / from Heddle and Cursiter Quarries. The monitoring locations are shown in Drawing No. 674795-GIS082, Appendix A.
- Review of construction activities, locations and noise data;
- Calculation and assessment of construction noise at the most exposed sensitive receptors, following guidance provided in BS5228-1:2009+A1:2-014; Code of Practice for Noise and Vibration on Construction and Open Sites. 3D computer noise modelling using CadnaA software has been used in the calculation of construction noise at sensitive receptors.
- Review of existing and proposed operational activities, locations and noise data;
- Prediction of operational noise using CadnaA software at location of most exposed sensitive receptors; and
- PAN 1/2011 assessment of operational noise, using principles defined in BS4142:2014.

3.3 Construction Noise Assessment Methodology and Target Criteria

3.3.1 BS5228-1:2009+A1: 2014 – Methodology (ABC Method)

The assessment of construction noise is carried out in accordance with guidance provided in BS 5228-1:2009+A1:2014[6] 'Code of Practice for Noise and Vibration Control on Construction and Open Sites – Part 1 Noise'. The standard describes methods for evaluating the potential significant effects of construction noise, one of which is the 'ABC' method which is based on exceedance of fixed noise limits. The ABC method, as detailed within Annex E.3.2 of BS 5228-1:2009+A1:2014 has been used within this noise assessment, as it considers the pre-existing industrial noise climate at the receptors.

The ABC method considers that a potential significant effect occurs when the total noise level at a dwelling, including construction activity, exceeds the appropriate category values shown in

Table 3-2. The table is used as follows;

- The ambient noise is determined and rounded to the nearest 5dB;
- The rounded ambient noise level is then compared with the total noise level, including construction. A significant effect at a noise sensitive receptor is considered to occur when the total noise, including construction activity exceeds the appropriate category values, shown in
-

- Table 3-2.
- The ABC method of BS5228-1:2009+A1:2014 does not provide specific guidance on determining the magnitude and significance of noise impacts above the threshold values shown in
-

- Table 3-2. In order to determine the level of significance, guidance provided in the Technical Advice Note (TAN) 1/2011 has been used. The significance criteria adopted within this noise assessment are shown in Table 3-3.

Table 3-2: Threshold of Significant Effect at Dwellings

Period	Threshold Value, in decibels (dB)		
	Category A	Category B	Category C
Night-time (23:00 to 07:00)	45	50	55
Evenings weekday (19:00-23:00), Saturdays (13:00-23:00) and Sundays (07:00-23:00)	55	60	65
Daytime weekday (07:00-19:00) and Saturdays (07:00-13:00)	65	70	75
Note 1: A significant effect has been deemed to occur if the total L_{Aeq} noise level, including construction, exceeds the threshold level for the Category appropriate to the ambient noise level. Note 2: If the ambient noise level exceeds the Category C threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a potential significant effect is indicated if the total L_{Aeq}, T noise level for the period increases by more than 3 dB due to site noise. Note 3: Applied to residential receptors only.			
Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values. Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as category A values. Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than category A values.			

Table 3-3: Significance Criteria for the Assessment of Construction Noise

Significance	Level Above Threshold Value dB(A)	Definition
Neutral	< 0	No effect, not significant, noise need not be considered as a determining factor in the decision making process.
Slight adverse	≤ 0 to < 3	These effects may be raised but are unlikely to be of importance in the decision making process.
Moderate adverse	≤ 3 to < 5	These effects, if adverse, while important, are not likely to be key decision making issues.
Large adverse	≤ 5.0 to < 10	The effects are likely to be important considerations but where mitigation may be effectively employed such that resultant adverse effects are likely to have a moderate or slight significance.
Very large adverse	≥ 10	These effects represent key factors in the decision making process. They are generally, but not exclusively, associated with impacts where mitigation is not practical or would be ineffective.

3.3.2 PAN 1/2011 Methodology and Target Criteria - Change in Road Traffic Noise

The change in road traffic noise as a result of development generated road traffic during the construction phase (specifically HGVs associated with infill activities) is assessed in accordance with methodology provided in PAN 1/2011, and associated TAN 2011.

The magnitude of impact is defined by assessing the change in road traffic as a result of development generated traffic during the day and night-time periods at existing noise sensitive receptors. The classification of the magnitude of impacts used in this assessment is shown in Table 3-4.

Table 3-4: Classification of Magnitude of Noise Impacts; Construction Road Traffic Noise

Change in Noise Level, x $L_{Aeq,T}$ dB	Magnitude of Impact
x ≥ 5	Major adverse
3 ≤ x < 5	Moderate adverse
1 ≤ x < 3	Minor adverse
0 < x < 1	Negligible adverse
x = 0	No change

3.4 Operational Noise Assessment Target Criteria

Proposed activities from the operations within the site are assessed following guidance provided in PAN 1/2011 (as the associated document TAN 1/2011 'Technical Assessment of Noise'), using principles defined in BS4142:2014.

The noise criteria to be applied to operational industrial noise is summarised in Table 3-5. The table is used as follows;

- Calculate the difference between the rated operational noise level ($L_{Ar,T}$) and the background noise ($L_{A90,T}$) at each noise sensitive receptor, following principles defined in BS4142:2014. This difference in levels is used to define the Sensitivity of Receptor, as shown in Table 3-5.
- Calculate the total noise at each noise sensitive receptor, including operational activity ($L_{Aeq,T}$). The difference between the total noise including operational activity, and that before development at each sensitive receptor is used to define the Magnitude of Impact, as shown in Table 3-5.
- The Significance of Impact is then defined, as shown in Table 3-5.

Table 3-5: Significance of Effects; Operational Industrial Noise

Magnitude of Impact (After – Before) L_{AeqT} dB	Sensitivity of Receptor based on likelihood of complaint X = (Rating ($L_{Ar,Tr}$) – Background ($L_{A90,T}$)) dB		
	Low (x < 5)	Medium (5 ≤ x < 10)	High (x ≥ 10)
Major (≥ 5)	Slight / Moderate	Moderate / Large	Large / Very Large
Moderate (3 to 4.9)	Slight	Moderate	Moderate / Large
Minor (1 to 2.9)	Neutral / Slight	Slight	Slight / Moderate
Negligible (0.1 to 0.9)	Neutral / Slight	Neutral / Slight	Slight
No Change (0)	Neutral	Neutral	Neutral

4 BASELINE MONITORING

4.1 Baseline Background Noise

A background noise survey was carried out in the area surrounding the proposed development site during day and night-time periods between 28th and 30th November 2022. The purpose of the survey was to establish day and night-time background noise levels at areas representative of the most exposed properties surrounding the development site. The noise monitoring locations and methodology were agreed with OIC Environmental Health department through consultation.

Measurements were conducted using a Norsonic Nor140 (serial number 1403301) calibrated using a Nor-1251 calibrator (serial number 30796), and Norsonic Nor 145 (serial number 14529959) and calibrated using a Nor-1255 calibrator (serial number 125526127) before and after measurements, with a maximum drift of 0.2 dB noted. Calibration certificates are available on request. Measurements were conducted 1.3 m above ground using a fast time weighting.

4.1.1 Background Noise Monitoring Locations

The noise monitoring locations are described in Table 4-1, and shown in Drawing No. 674795-GIS081, Appendix A.

Table 4-1: Noise Monitoring Locations

ID	Grid Reference	Location
01	342756 1012636	On the grounds of Saverock farmhouse. The monitoring position was located adjacent to the access road which runs north east from Saverock farmhouse in order to represent the closest property on this track to Hatston Pier.
02	343425 1012133	At the end of the farm track accessed via Hatston Park. The monitoring position was located to the north east of the barn with direct line of sight to Hatston Pier.
03	345718 1012302	Located approximately 15 metres west of Carness Road with a direct view across the Bay of Weyland to Hatston Pier.

4.1.2 Meteorological Conditions and Observations

The weather conditions and observations noted during the monitoring period of 28/11/22 – 30/11/22 are summarised in Table 4-2 and Table 4-3.

Table 4-2: Baseline Noise Monitoring Weather Conditions

Date	Monitoring Period	Meteorological Conditions
28/11/22	Daytime – Afternoon	Mostly clear skies, 1 – 2 oktas. Negligible wind. Temperature 3 – 4°C.
28/11 to 29/11/22	Night-time	Clear skies, 0 – 1 oktas. Negligible wind. Temperature 1 – 2°C.
29/11/22	Daytime – Afternoon	Mostly clear skies, 1 – 2 oktas. Some light breezes from the south. Temperature 1 – 2°C.
29/11 to 30/11/22	Night-time	Clear skies, 0 – 1 oktas. Negligible wind. Temperature 0 – 2°C.

Date	Monitoring Period	Meteorological Conditions
30/11/22	Daytime - Afternoon	Some scattered clouds, 2 – 3 oktas. Wind from west around 3 – 4 m/s, some gusts of 5 m/s and above. Temperature 5 - 7°C.

Table 4-3: Baseline Monitoring Observations

NML ID	Date	Period	Start Time	Observations
1	29/11/2022	Day	17:25	Road traffic noise is dominant at this location, with the background noted to be comprised mostly of distant traffic noise to the south east (Kirkwall). Some faint industrial noise was also heard from the Hatston Retail and Business Park, with greater contributions from this noted on the second day of measurement. Some occasional clattering and banging was also heard from towards Hatston Pier.
	30/11/2022		12:33	
	28/11/2022	Night	23:26	Road traffic noise was dominant when present, however passing vehicles were infrequent during night time hours. The background noise at this location comprised of a mix of low level intermittent traffic and industrial noise /low level hum from the east. On the second night of measurement there was noted to be increased activity at Hatston Pier, with metallic bangs and clattering noted on several occasions to be clearly audible against the quiet background.
	29/11/2022		00:17	
2	30/11/2022	Day	12:07	Both daytime measurements were captured on the same afternoon owing to practical monitoring constraints. The noise environment was noted to be similar to Position 1, with comparable context and distance to key sources of noise. Road traffic on the A965 dominated levels when present. Traffic was noted to be regular and it was rare for individual vehicles to not be audible. The background was comprised of a mix of constant distant traffic to the south east (Kirkwall) and a mix of industrial sources to the east from various industrial sources within Hatston Retail and Business Park. During the first hour a large earth moving vehicle seen moving back and forth on the western boundary of the retail and was clearly audible throughout. Other noted sources from the park were intermittent reverse alarms and a low frequency generator hum with an accompanying rattling sound which would be active for up to 20 minutes at a time.
	30/11/2022		13:28	
	28/11/2022	Night	00:04	As with the daytime measurements, the noise environment was noted to be similar to Position 1. Noise from passing cars on the A965 was dominant when present. The background comprised of a mix of low level distant traffic and night time operations at Hatston Retail and Business Park to the east. On the second night there was noted to be increased activity at Hatston
	29/11/2022		23:41	

NML ID	Date	Period	Start Time	Observations
				Pier, including some metallic banging and low frequency hum.
3	29/11/2022	Day	15:31	Road traffic on Carness Road was dominant when present. The background was noted to be comprised of a mix of distant road traffic from Kirkwall and low frequency hum from various vessels at Hatston Pier and possibly industrial sources across the bay. The increase in wind speeds on the second day of measurement introduced some low level waves and interactions with the water but this did not raise levels.
	30/11/2022		13:52	
	28/11/2022	Night	00:45	Road traffic on Carness Road was dominant when present, with two or three passing vehicles during each measurement. An unidentified source of mid frequency broadband noise directly south of the measurement position was clearly audible on both nights. The background was otherwise noted to be comprised of low frequency hum/rumble from across the water, assumed to be idling vessels, and some distant traffic noise.
	29/11/2022		23:01	

4.1.3 Background Noise Data

A summary of the day and night-time results can be found in Table 4-4 and

As noted in Table 4-3, daytime levels at Position 2 were captured on the same day rather than on consecutive days as was the case for Positions 1 and 3. However, the measured levels at Position 2 are considered representative of the area. It was noted during the survey that the context and levels at Position 2 are particularly similar to Position 1, an observation which is supported by the measured results.

All six daytime LA90,1hr measurements undertaken at the three measurement positions are within 2.4 dB of each other, indicating that that the baseline noise environment in the area is generally consistent and that the surveys have captured the levels in the area accurately

.

Table 4-5.

Table 4-4: Daytime Background Sound Measured Results

ID	Date	Start time	Duration, T (hrs:mins)	$L_{Aeq,T}$ (dB)	$L_{A90,T}$ (dB)
1	29/11/2022	17:25	01:00	49.4	41.7
	30/11/2022	12:33	01:00	48.2	42.2
2	30/11/2022	12:07	01:00	48.5	44.1
	30/11/2022	13:28	01:00	45.8	42.2
3	29/11/2022	15:31	01:00	52.5	42.5
	30/11/2022	13:52	01:00	51.9	41.9

As noted in Table 4-3, daytime levels at Position 2 were captured on the same day rather than on consecutive days as was the case for Positions 1 and 3. However, the measured levels at Position 2 are considered representative of the area. It was noted during the survey that the context and levels at Position 2 are particularly similar to Position 1, an observation which is supported by the measured results.

All six daytime $L_{A90,1hr}$ measurements undertaken at the three measurement positions are within 2.4 dB of each other, indicating that that the baseline noise environment in the area is generally consistent and that the surveys have captured the levels in the area accurately

.

Table 4-5: Night-time Background Sound Measured Results

ID	Date	Start time	Duration, T (hrs:mins)	$L_{Aeq,T}$ (dB)	$L_{A90,T}$ (dB)
1	28/11/2022	23:26	00:30	36.5	23.3
	29/11/2022	00:17	00:30	37.8	26.6
2	28/11/2022	00:04	00:30	32.2	25.8
	29/11/2022	23:41	00:30	35.2	28.5
3	28/11/2022	00:45	00:30	34.6	32.6
	29/11/2022	23:01	00:30	42.6	33.0

4.2 Baseline Road Traffic Noise

Noise from Heddle Road and the A965 was measured at two positions for three consecutive one hour intervals in accordance with the shortened measurement procedure detailed in CRTN. The positions are along routes which HGVs will travel with infill material from Heddle and Cursiter Quarries to the development site.

4.2.1 Road Traffic Noise Monitoring Locations

The baseline CRTN measurement positions are described in Table 4-6 and shown in Drawing No. 674795-GIS082, Appendix A.

Table 4-6: Baseline CRTN Noise Monitoring Location

ID	Grid Reference	Location
CRTN 1	335822 1013392	Adjacent to Heddle Road in the front garden of a residential property
CRTN 2	338891 1012493	Adjacent to A965, on drive of Ingashowe House

The road traffic noise measurement on Heddle Road was conducted using a Norsonic Nor 145 (serial number 14529959) and calibrated using a Nor-1255 calibrator (serial number 125526127) before and after measurements, with a maximum drift of 0.1 dB noted. The measurement on the A965 was conducted using a Norsonic Nor118 sound level meter (serial number 131675), calibrated using a Nor-1251 calibrator (serial number 30796) before and after measurements, with a drift of 0.1 noted. Calibration certificates are available on request. Measurements were conducted at approximately 1.3 m above ground using a fast time weighting

The weather conditions and observations noted during the monitoring are summarised in Table 4-2.

4.2.2 Results

A summary of the hourly results can be found in **Error! Reference source not found.**.

Table 4-7: CRTN Hourly Measured Results

ID	Start time	Duration (hh:mm)	$L_{Aeq,1h}$ (dB)	$L_{A10,1h}$ (dB)
CRTN 1	29/11/2022 10:09	01:00	58.6	51.9
	29/11/2022 11:09	01:00	59.6	54.6
	29/11/2022 12:09	01:00	58.3	48.5
CRTN 2	29/11/2022 10:18	01:00	67.7	72.3
	29/11/2022 11:19	01:00	68.3	73.0
	29/11/2022 12:20	01:00	68.2	72.7

It is noted that the hourly L_{A10} results are lower than the hourly L_{Aeq} results for Position CRTN 1, captured on Heddle Road. This is a result of the traffic composition at this location. There were very few vehicles, with those passing observed to be predominantly HGVs associated with the quarry. The pass by events themselves were short in duration but high in level, resulting in an increase to the average sound level over the period while having minimal impact on the statistical parameter L_{A10} which shows the level which was exceeded for 10% of the measurement duration.

5 NOISE MODELLING

5.1 Noise Sensitive Receptors

A sample of five residential noise sensitive receptors have been chosen as being representative of those most exposed to noise from construction and operational activities at the proposed development. These are described in Table 5-1, and shown in Drawing No. 674795-GIS083 Appendix A.

Table 5-1: Noise Sensitive Receptor Locations; Construction and Operational Noise

NSR ID	Location	Grid Reference
NSR 1	Saverock Farm	342746 1012647
NSR 2	Hatston Park	343254 1012117
NSR 3	Grainbank	343640 1011602
NSR 4	Boray Drive Housing Estate	345799 1011976
NSR 5	Carness Road	345708 1012386

During consultation with the EHO at OIC, it was requested that background noise monitoring at NSR 2 be conducted at a location representative of the farm to the south of the housing estate at Hatston Park. This was carried out as indicated by Monitoring Location No. 2 in Drawing No. 674795-GIS081, Appendix A. It was noted on site, however, that the residential properties at the farm do not have line of sight to Hatston Pier, as there are intervening farm buildings. Noise modelling has determined that the most exposed property is at the northern corner of Hatston Park, which has greater line of sight to Hatston Pier. For this reason, NSR 2 is a property at Hatston Park as this is more exposed than the farmhouse.

Receptors have been modelled at 1.5m height at one-story properties, and 4m height at two-storey.

5.2 Change in Road Traffic Noise Level Noise Sensitive Receptors

The sections of road considered within the change in road traffic noise assessment as a result of the construction phase are described in Table 5-2 and shown in Drawing No. 674795-GIS084, Appendix A. The sections have been chosen to represent the routes that the HGVs from Heddle and Cursiter Quarries will take. The HGV routes from both quarries are shown in Drawing No. 202043/FS-04 titled *Hatston Pier, Kirkwall, Feasibility Study, Existing Commercial Quarries Location Plan* by Arch Henderson, Appendix A. It should be noted that these locations represent assessment locations rather than individual NSRs along each road. As the assessment carried out relates to a change in road traffic noise level, any propagation corrections would cancel out in calculating the change in level, and so are not included in the calculations.

Table 5-2: Change in Road Traffic Noise Level NSRs

ID	Assessed Road Section
CiR-1	Heddle Road
CiR-2	A965 between Heddle Road and Old Finstown Road
CiR-3	Old Finstown Road
CiR-4	A965 east of Old Finstown Road

5.3 Construction Noise Model Input Parameters

5.3.1 Construction Schedule and Modelled Scenarios

Details of the proposed construction schedule at the Site have been supplied by Arch Henderson. A summary of the proposed construction schedule is shown in Table 5-3.

Table 5-3: East Quay, Proposed Construction Schedule

Phase	Stage	Description
1	1	Formation of reclamation bund. Existing armour stone uplifted and used as outer slope protection to Stage 2.
	2	Continuation of reclamation bund, with section of sheet pile retaining wall installed using vibro hammer.
	3 & 4	Drainage and infill behind reclamation bund progressed to create reclaimed area.
2	5	Forming works access approach parallel to existing causeway.
	6	Forming reclamation access to commence steel sheet piling using vibro hammer adjacent existing suspended deck pier.
	7	Sheet piling at commencement of new 300m quay. Rotary drill located on spud leg barge to pre-treat sea bed. Crane on further barge used for lifting and progressing piling using vibro piling methods.
	8	Pre-treatment of hard strata and then vibro piling to form quay wall. Infill and install of tie rods. Install of main concrete cope and deck works.
	9	Dredging north of quay extension along outer berth using long reach excavator to -10 CD. Dredge arising used for remaining infill/reclamation works
3	10	Dredging south of quay extension at western end at the berth around the boat lift using long reach excavator to --6m CD.

At this stage exact construction timings for the Phases in Table 5-3 are not know, however, it is understood that Phase 1 reclamation, armour and drainage works are programmed to be carried out circa 6 months ahead of Phase 2 and 3 works commencing.

As can be seen in Table 5-3, in many cases more than one type of construction activity will occur during the same months. Noise modelling scenarios have been set up to account for the cumulative impact of the concurrent activities. The scenarios have been set up to model the worst-case potential combination of construction activities for the construction phases. A summary of the combined construction activities and relevant assessment periods for each of the modelled scenarios is shown in Table 5-4. A full breakdown of the individual items of plant and activities for each set of construction activities and scenarios are shown in Appendix C. It should be noted that while the modelling has predicted all operations within a scenario to be concurrent, this is a conservative assumption and some activities will in fact be contiguous.

Table 5-4: Modelled Scenarios; Construction Noise

Modelled Scenario	Phases	Modelled Combination of Construction Stages (Worst Case)	Relevant Assessment Periods
1	1 & 2	HGV deliveries and tipping	Day, Weekend
		Rock armour revetment	
		Drainage, infill and compaction	

Modelled Scenario	Phases	Modelled Combination of Construction Stages (Worst Case)	Relevant Assessment Periods
		Pile sea bed pre-treatment	
		Install sheet pile wall	
		Dredging from land using long reach excavator	
2	3	HGV deliveries and tipping	Day, Weekend
		Rock armour revetment	
		Drainage, infill and compaction	
		Install sheet pile wall	
		Pile sea bed pre-treatment	
		Tie rod / anchor walls	
		Surfacing	
		Dredging from land using long reach excavator	

5.3.2 Evening and Night-time Construction Noise

With reference to the assessment periods included in Table 5-4, there are no works scheduled to be carried out over a 24-hour period. All activities are expected to have finished by 7 pm on a daily basis.

5.3.3 Weekend Construction Noise

The proposed construction schedule includes working during daytime hours during the week days and the weekends. The implication of this is that works associated with higher noise levels are likely to be carried out during weekend hours (Saturday 07:00 – 19:00 and Sunday 09:00 – 13:00), which are subject to more stringent noise limits than during the weekdays (refer to

Table 3-2).

5.3.4 Infill and Associated HGV movements

Import of the fill material will be carried out over a circa 10 month period using up to 6 to 7 trucks per hour. The material will come from the existing Cursiter and Heddle quarries 7.5km to 9km away from the site. The HGV routes between both quarries and Hatston Pier are shown in Drawing No. 202043/FS-04 titled *Hatston Pier, Kirkwall, Feasibility Study, Existing Commercial Quarries Location Plan* by Arch Henderson, Appendix A. The split of materials coming from each quarry is anticipated to be circa 50 / 50.

Arch Henderson have confirmed that up to 6 to 7 HGVs are expected per hour during the infill stages. HGV movements have been modelled using a worst case of 8 HGVs per hour, with a 50% split of HGVs travelling from Heddle and Cursiter Quarries respectively. The infill material will be supplemented by dredge arisings during Phases 2 & 3.

5.3.5 Sea Bed Pre-Treatment and Piling

Piling will be carried out between the hours of 08:00 and 19:00 M to F, and Saturday 08:00 – 19:00 and Sunday 09:00 – 13:00.

Steel sheets will be installed at specified locations using vibro hammering technique, which typically generates less noise than impact hammering techniques. The installation of sheet piling for construction of the new 300m quay will involve pre-treatment of the seabed. Drilling will be undertaken using a rotary percussive DTH hammer with a Symmetrix N131 casing or equivalent. Hole size will generally be 110mm diameter. Drilling patterns will be reviewed following trial pile installation to ensure the required depth is being achieved. Underwater blasting will be carried out in the drilled spaces to prepare the seabed for sheet piling. The impact of blasting on underwater noise is assessed in Chapter 5, Biodiversity of the EIAR.

Water to airborne sound transmission from underwater blasting for piling preparation will not be significant. The prediction of underwater to airborne sound transmission from blasting is beyond the scope of BS5228 which simply provides good practice guidelines in relation to controlling vibration emissions from surface coal and mineral extraction sites.

The audible component of blasting is caused by air overpressure. As stated within BS 5228, due to uncertainties with meteorological conditions it is not possible to predict the location of the maximum air overpressure. Additionally, pressure variations in the atmosphere due to windy conditions can mask the blast-generated air overpressure levels. For these reasons, it is not accepted practice to set specific limits for air overpressure.

In order to control air overpressure the most practical approach is to take measures to minimize its generation at source using best practices. BS5228-2:2009+A1:2014 provides good practice guidelines in relation to controlling vibration emissions from surface coal and mineral extraction sites. The good practice guidance includes the following;

- Restriction of blasting as far as practicable to regular daytime periods, not on Sundays and away from public holidays;
- Good community relations; where relevant, informing nearby noise/vibration sensitive receptors ahead of periods of blasting;
- The choice of appropriate drilling rigs; and
- Designing blasts to maximize efficiency and reduce the transmission of noise/vibration.

Normal production blasting has also not been found to damage property, and that even the most cosmetic of plaster cracking is extremely unlikely.

Taking the above into account, airborne noise associated with blasting has not been considered further in this NIA.

5.3.6 Dredging

Following the completion of the quay works during Phase 2, two short dredging campaigns will be carried out to provide deeper approach channels to the quay berthing areas. The dredging will be carried out from the land and quay platform using long reach excavator.

The first of these will be carried out during Phase 2 along the outer berth of the quay extension over roughly one week. The second will be carried out during Phase 3 at the berth around the boat lift over two weeks. The total dredge volume will be approximately 6,700m^3. These activities shall be conducted during the typical working hours of the site and have been included in modelling Scenarios 1 and 2 respectively, as outlined in Table 5-4.

5.3.7 Construction Noise Model Data

3D computer noise modelling of the various stages of construction activity at the site has been carried out using CadnaA software. Details on worst case construction activities, operating times, and associated items of noise generating plant for each stage of construction used within the noise models have been supplied by Arch Henderson.

Calculations were carried out using noise data and guidance provided in BS5228-1:2009+A1:2014, to derive predicted noise levels at noise sensitive receptors. Where data was not available within BS5228 it has been sourced from the Environmental Protection Department of Hong Kong's Technical Memorandum on Noise from Construction Work[8]. Noise data for impact wrenches was taken from published online sources[9].

Full details of the items of modelled construction plant, noise data (including data source), operating times, durations and source heights for each of the considered scenarios is shown in Appendix C.

5.3.8 Construction Noise Model Assumptions

A number of assumptions have been established during the CadnaA modelling exercise, as detailed below:

- The ground model uses Lidar 1m resolution terrain height data for the existing Hatston site and the surrounding area.
- The heights of buildings have been estimated from photographs;
- Predicted levels are calculated in the free-field environment;

[8] Environmental Protection Department of Hong Kong; *Technical Memorandum on Noise from Construction Work other than Percussive Piling,* 1989.
[9] Markesino et al, *Study of Noise Transmission from an Electric Impact Wrench*, Noise-Con 2004, Baltimore

- Ground absorption has been set to 1 for areas of soft ground. Areas of hard ground and water have been set to 0.1 for reflective surfaces;
- Weekend daytime noise levels generated by construction activities have been assumed to be the same as those generated during weekday hours representing a worst case scenario;
- The noise model assumes locations of plant based on descriptions of construction activities provided by Arch Henderson;
- Worst case scenario combinations of construction activities likely to occur in any one day during the considered assessment periods have been assumed;
- Spud-leg barges on which piling equipment is intended to be located have been assumed to have a height of 1m above sea level. The height of equipment located on the barges (eg piling rigs) has been assumed as relative to the height of the barge.
- The following sources have been modelled as line sources within CadnaA;
    - Heavy goods vehicles (HGVs) and dump trucks;
    - Moving construction plant;
- All remaining sources (not outlined above) have been modelled within CadnaA as point sources.

5.3.9 ABC Category Thresholds

The appropriate ABC category thresholds above which there is considered to be a noise impact from construction noise have been calculated following guidance provided in BS5228-1:2009+A1:2014 (refer to Section 3.3.1). Details of the calculations are shown in Appendix B.

5.3.10 Change in Road Traffic during Construction Phase

For each NSR the aspects of road traffic noise subject to change has been calculated. A full 3D propagation model has not been conducted, as the only aspects of interest are those that change due to development generated traffic. Those aspects subject to change in accordance with CRTN are the total number of vehicles in an 18-hour period, Q, the velocity, v, and the percentage of HGVs, p. The formulas associated with these variables are provided below:

$$Basic\ L_{A10,18h} = 29.1 + 10\log_{10} Q$$

$$Correction = 33\log_{10}\left(V + 40 + \frac{500}{V}\right) + 10\log_{10}\left(1 + \frac{5p}{V}\right) - 68.8$$

The $L_{Aeq,16h}$ is determined from the $L_{A10,18h}$ by subtracting 2 dB, in line with recommendations in BS 8233, resulting in the following formula:

$$L_{Aeq,16h} = Basic\ L_{A10,18h} + Correction - 2\ dB$$

Baseline traffic data for Old Finstown Road and the A965 between Heddle Road and Old Finstown Road was taken from the Finstown Traffic Management Study conducted by Systra in April 2022[10]. Baseline traffic count data was not available for Heddle Road and the A865 east of Old Finstown Road. Traffic count data collected by EnviroCentre as part of the baseline CRTN measurements described in Section 4.2 has been used for these sections.

HGV movements have been modelled using a worst case of eight HGVs per hour, with a fifty percent split of HGVs travelling from Heddle and Cursiter Quarries respectively. Four HGVs per hour are assumed to travel along the routes from each Quarry. The HGV routes from both quarries are shown

[10] Systra, *Finstown Traffic Management Study*. Report Ref: GB01T21F18 dated 29/04/2022.

in Drawing No. 202043/FS-04 titled *Hatston Pier, Kirkwall, Feasibility Study, Existing Commercial Quarries Location Plan* by Arch Henderson, Appendix A. This assessment does not consider the potential limitations of vehicle movements imposed by the respective quarry management plans in order to assess a worst case scenario.

- Do-Minimum. Contains baseline traffic data without construction HGV movements.
- Do-Something. Contains baseline traffic with construction HGV movements.

The traffic data for the NSR locations relevant for the change in road traffic noise level are shown in Table 5-5.

Table 5-5: Baseline Road Traffic Noise Data and Predicted Levels

ID	Baseline			With Development		
	18 Hour AAWT	P (%)	v (km/h)	18 Hour AAWT	P (%)	v (km/h)
CiR-1	390	45.3	82.1	394	49.0	48.3
CiR-2	4046	1.0	86.4	4050	1.1	48.3
CiR-3	988	0.7	96.5	992	1.1	96.5
CiR-4	5355	4.3	96.5	5363	4.3	96.5

5.3.11 Operational Noise Model Input Parameters

5.3.12 Increased Vessel Movements

During the operational phase, there will be an increase in vessel movements and associated harbour activity over that of the existing baseline which was established in 2016. Current baseline vessel movements comprise circa 2292 total movements per year, which comprise predominantly ferries (42%), cruise ships (11%), pilot boats (31%) and cargo vessels (8%). There are also a smaller percentage of oil supply (2%), renewables (3%), tugs (2%) and other vessels (2%).

The proposed development shall increase the number of oil supply vessels by circa 120 movements per year initially, rising to 400 per year (circa 1 extra vessel per week, rising to 3 to 4). It is estimated that there would be 4 additional HGV movements associated with each extra supply vessel, which equates to circa 2 extra HGVs arriving/departing per week, rising to 6 to 8.

The use of Hatston as a base for operations and maintenance activities associated with offshore wind farm development is anticipated to commence from 2028 onwards. There shall be an increase of circa 24 vessel movements initially, rising to 48 by 2032. There is not anticipated to be a significant increase in HGV movements associated with operations and maintenance of offshore wind farms, with the majority of supplies arriving to / from the harbour via vessels.

There shall also be an increase in other types of vessel, such as boat repair, renewables and cargo, the numbers of which will increase based on demand, with exact numbers not known at this stage. The number of associated HGVs will depend on the type of vessel, however, it is anticipated that most materials will arrive to / from the port via vessels so significant increases are unlikely.

5.3.13 Proposed Operational Activities

During the operational stage, there is the potential for noise from ships berthing, loading / unloading activities, and transfer to / from materials to the laydown area to impact upon existing residents. In

summary, the potentially significant noise generating operational activities as a result of the proposed quay extension and laydown are anticipated to comprise of;

- Ship berthing (including on-board generators) and cargo loading / unloading activities;
- Use of boat lift and movement of boats within site for storage or maintenance;
- Laydown and storage of renewables components such as those for off shore wind farms. This is typically carried out using Self Propelled Modular Transporters (SMPTs);
- Movement of cargo to / from laydown area; and
- HGV loading / unloading and movements.

To account for the new berthing areas, two additional ship generators running over a 24 hour period have been modelled. As a worst case it has been the boat lift has been modelled as operating during both the day and night-time hours.

It is understood that it is proposed to use the laydown area predominantly for the storage of wind turbine components. These structures shall be loaded / unloaded directly from the ship using pairs of SPMTs. It is assumed that two pairs of SPMTs shall be driven onto the ship to load / unload each component, with approximately one movement within a daytime period. The noise model has assumed a worst case one movement per hour during the day.

Two additional 16 ton Fork Lift Trucks are likely to be present on the quay to service the vessels and move materials. Circa two additional HGV movements in and out of the extended quay and laydown area are likely to occur per 24 hour period. The noise model has assumed a worst case two movements per hour during the day and night-time period.

5.3.14 Operational Noise Data

3D computer noise modelling of operational activity at the proposed development has been carried out using CadnaA software.

Calculations were carried out using plant manufacturer's noise data, and published data in BS5228:2009+A1:2014, to derive predicted noise levels at noise sensitive receptors. Full details of the items of modelled operational plant, noise data (including data source), operating times, durations and source heights for the modelled operations are shown in Appendix D.

5.3.15 Operational Noise Model Assumptions

A number of assumptions have been established during the CadnaA modelling exercise, as detailed below.

- The ground model uses Lidar 1m resolution terrain height data for the existing Hatston site and the surrounding area.
- The heights of buildings have been estimated from photographs;
- Predicted levels are calculated in the free-field environment;
- Ground absorption has been set to 1 for areas of soft ground. Areas of hard ground and water have been set to 0.1 for reflective surfaces;
- Vehicle movements and mobile plant have been modelled as line sources within CadnaA;
- The ship generators and boat lift have been modelled as point sources.

6 CONSTRUCTION NOISE MODEL RESULTS AND ASSESSMENT

6.1 Construction Noise Assessment

The noise model results for each modelled scenario of construction activity, along with the BS5228 assessment at each of the considered noise sensitive receptors are summarised in Table 6-1 to Table 6-5.

Table 6-1: Noise Model Results and BS5228 Assessment; Noise Sensitive Receptor No. 1

NSR 01	Weekday Daytime			Weekend Daytime			Evening			Night-time		
Scenario	Threshold Level dB(A)	Predicted Level dB(A)	Significance	Threshold Level dB(A)	Predicted Level dB(A)	Significance	Threshold Level dB(A)	Predicted Level dB(A)	Significance	Threshold Level dB(A)	Predicted Level dB(A)	Significance
1	65	51	Neutral	55	50	Neutral	N/A	N/A	N/A	N/A	N/A	N/A
2	65	50	Neutral	55	49	Neutral	N/A	N/A	N/A	N/A	N/A	N/A

Table 6-2: Noise Model Results and BS5228 Assessment; Noise Sensitive Receptor No. 2

NSR 02	Weekday Daytime			Weekend Daytime			Evening			Night-time		
Scenario	Threshold Level dB(A)	Predicted Level dB(A)	Significance	Threshold Level dB(A)	Predicted Level dB(A)	Significance	Threshold Level dB(A)	Predicted Level dB(A)	Significance	Threshold Level dB(A)	Predicted Level dB(A)	Significance
1	65	49	Neutral	55	48	Neutral	N/A	N/A	N/A	N/A	N/A	N/A
2	65	49	Neutral	55	48	Neutral	N/A	N/A	N/A	N/A	N/A	N/A

Table 6-3: Noise Model Results and BS5228 Assessment; Noise Sensitive Receptor No. 3

NSR 03	Weekday Daytime			Weekend Daytime			Evening			Night-time		
Scenario	Threshold Level dB(A)	Predicted Level dB(A)	Significance	Threshold Level dB(A)	Predicted Level dB(A)	Significance	Threshold Level dB(A)	Predicted Level dB(A)	Significance	Threshold Level dB(A)	Predicted Level dB(A)	Significance
1	65	48	Neutral	55	47	Neutral	N/A	N/A	N/A	N/A	N/A	N/A
2	65	48	Neutral	55	46	Neutral	N/A	N/A	N/A	N/A	N/A	N/A

Table 6-4: Noise Model Results and BS5228 Assessment; Noise Sensitive Receptor No. 4

NSR 04	Weekday Daytime			Weekend Daytime			Evening			Night-time		
Scenario	Threshold Level dB(A)	Predicted Level dB(A)	Significance	Threshold Level dB(A)	Predicted Level dB(A)	Significance	Threshold Level dB(A)	Predicted Level dB(A)	Significance	Threshold Level dB(A)	Predicted Level dB(A)	Significance
1	65	52	Neutral	55	50	Neutral	N/A	N/A	N/A	N/A	N/A	N/A
2	65	52	Neutral	55	50	Neutral	N/A	N/A	N/A	N/A	N/A	N/A

Table 6-5: Noise Model Results and BS5228 Assessment; Noise Sensitive Receptor No. 5

NSR 05	Weekday Daytime			Weekend Daytime			Evening			Night-time		
Scenario	Threshold Level dB(A)	Predicted Level dB(A)	Significance	Threshold Level dB(A)	Predicted Level dB(A)	Significance	Threshold Level dB(A)	Predicted Level dB(A)	Significance	Threshold Level dB(A)	Predicted Level dB(A)	Significance
1	65	52	Neutral	55	50	Neutral	N/A	N/A	N/A	N/A	N/A	N/A
2	65	52	Neutral	55	49	Neutral	N/A	N/A	N/A	N/A	N/A	N/A

The greatest weekday and weekend noise levels are predicted during Phases 1 & 2 of construction. The outcome of the BS5228 assessment is that Neutral impacts are predicted at the surrounding residential receptors as a result of all construction phases during the day-time period. There are no adverse effects in EIA terms.

6.2 Construction Road Traffic Noise Levels

Table 6-6 presents a comparison of the current baseline and future road traffic noise levels at a reference distance of 10m from the road edge on the routes along which HGVs carrying infill from Heddle and Cursiter Quarries will travel. The road sections are shown in Drawing No. 674795-GIS084, Appendix A.

Table 6-6: Comparison of Baseline and Construction Road Traffic Noise Levels.

ID	Existing Noise Level (dB $L_{Aeq,16h}$)	Future Noise Level (dB $L_{Aeq,16h}$)	Difference (dB $L_{Aeq,16h}$)	Magnitude of Impact	Significance of Impact
CiR-1	57.6	57.9	0.3	Negligible	Slight
CiR-2	60.6	60.6	0	No Change	Neutral
CiR-3	59.4	59.5	0.1	Negligible	Slight
CiR-4	67.5	67.5	0	No Change	Neutral

The increase in road traffic noise levels as a result of increased construction HGV movements is predicted to be less than 1dB at CiR-1 (Heddle Road) and CiR 3 (Old Finstown Road). No change in level is predicted at CiR-2 (A965 between Heddle Road and Old Finstown Road) and CiR-4 (A965 east of Old Finstown Road). The maximum level of significance of the change in road is Slight. There are no significance adverse effects in EIA terms.

7 OPERATIONAL NOISE MODEL RESULTS AND ASSESSMENT

7.1 BS4142:2014 Acoustic Feature Correction

CadnaA software has been used to model the specific sound level from operational activities at the location of the most exposed sensitive receptors. To calculate the rated sound level, the assessment considers the character of the sound being assessed at the receptor location. If present, corrections for impulsivity, intermittency and/or tonality are added to the specific sound level to calculate the rated sound level.

A sound source may exhibit acoustic characters at source, however, the prominence of these features may be masked at the location of the noise sensitive receptors by the residual (background) sound at these locations. The amount by which the residual sound masks these features varies as the residual sound changes in level and possible character. Similarly, the sources acoustic character may also vary with time.

In the case of ships loading / unloading, the movement of cargo and wind turbine components has the potential to create sound which is impulsive in nature. The modelled specific sound from these activities is predicted to be below, or close to the measured background noise at the most exposed sensitive receptors, which is an indication that the sound is predicted to be mostly inaudible. Despite this, due to the high transient peak levels that the movement of cargo and wind turbine components may create it is considered likely that some sound from these activities may be just perceptible at the most exposed sensitive receptors. For this reason, a correction of 3dB(A), for impulsivity that is just perceptible, has been applied to the specific noise levels all receptor locations.

7.2 East Quay Operational Activities

The noise model results and TAN 2011 assessments for the day and night-time periods for operational activities are shown in Table 7-1 and Table 7-2.

Table 7-1: Noise Model Results and TAN 1/2011 Assessment; Daytime

Noise Sensitive Receptor ID	1	2	3	4	5
Modelled Specific Level $L_{S, (1\ hour)}$ **dB**	32.5	29.3	27.3	0.0	20.9
Acoustic Feature Correction dB(A)	3	3	3	3	3
Rated Noise $L_{Ar, (1\ hour)}$ **dB**	35.5	32.3	30.3	3.0	23.9
Background Noise $L_{A90, (1\ hour)}$ **dB**	41.7	42.2	42.2	41.9	41.9
Rated - Background Noise dB(A)	-6.2	-9.9	-11.9	-38.9	-18
Sensitivity of Receptor	Low	Low	Low	Low	Low
Existing Level $L_{Aeq, (1\ hour)}$ **dB**	48.2	45.8	45.8	51.9	51.9
Specific Level + Existing Level $L_{Aeq, (1\ hour)}$ **dB**	48.3	45.9	45.9	51.9	51.9

Noise Sensitive Receptor ID	1	2	3	4	5
Change in level	0.1	0.1	0.1	0.0	0.0
Magnitude of Impact (After – Before)	Negligible	Negligible	Negligible	No change	No change
Significance of Effects	Neutral / Slight	Neutral / Slight	Neutral / Slight	Neutral	Neutral

Table 7-2: Noise Model Results and TAN 1/2011 Assessment; Night-time

Noise Sensitive Receptor ID	1	2	3	4	5
Modelled Specific Level $L_{S, (1\ hour)}$ dB	29.9	26.3	24.3	0.0	16.5
Acoustic Feature Correction dB(A)	3	3	3	3	3
Rated Noise $L_{Ar, (1\ hour)}$ dB	32.9	29.3	27.3	3	19.5
Background Noise $L_{A90, (1\ hour)}$ dB	23.3	25.8	25.8	32.6	32.6
Rated - Background Noise dB(A)	9.6	3.5	1.5	-29.6	-13.1
Sensitivity of Receptor	Medium	Low	Low	Low	Low
Existing Level $L_{Aeq, (1\ hour)}$ dB	36.5	32.2	32.2	34.6	34.6
Specific Level + Existing Level $L_{Aeq, (1\ hour)}$ dB	37.4	33.2	32.9	34.6	34.7
Change in level	0.9	1.0	0.7	0.0	0.1
Magnitude of Impact (After – Before)	Negligible	Minor	Negligible	No change	Negligible
Significance of Effects	Neutral / Slight	Neutral / Slight	Neutral / Slight	Neutral	Neutral / Slight

The results show that the daytime noise from proposed operations is predicted to result in an increase in noise levels at sensitive receptors of up to 0.1dB(A) at NSR 1 to 3 (Saverock Farm, Hatston Park & Grainbank). The significance of the increases in noise levels is Neutral / Slight.

At night the noise from proposed operations is predicted to result in an increase in noise levels at sensitive receptors of between 0.1dB(A) at NSR 5 (Carness Road) and 1.0dB(A) at NSR 2 (Hatston Park). The significance of the increases in noise levels is Neutral / Slight. The noise levels are predicted to be unchanged at NSR 4 (Boray Drive Housing Estate).

In terms of human perception of sound, an increase of 3dB(A) is considered to be barely perceptible, therefore the maximum predicted increase of 1 dB(A) at night is considered likely to be mostly imperceptible.

At NSR 4 there is predicted to be no specific sound associated with operations at the East Quay of the development.

There are no significant adverse impacts in EIA terms during the day or night time periods.

8 CONCLUSIONS

A construction and operational noise assessment has been carried out for the proposed development at Hatston.

8.1 Construction Noise

Worst case combined construction stages based on the proposed construction schedule have been modelled using CadnaA software. Details of construction activities have been provided by Arch Henderson.

The outcome of the assessment is that Neutral impacts are predicted during the day-time period for all construction phases. There are no significant adverse impacts in EIA terms.

The change in road traffic noise levels along routes which HGVs carrying infill material to / from the local quarries which will supply the site has been predicted. The maximum change in noise level as a result of construction HGVs is predicted to be less than 1dB along the routes. The maximum significance of effects as a result of the construction traffic is Slight, which is not significant in EIA terms.

8.2 Operational Noise

The operational noise assessment considers the increase in potentially significant noise generating activities post development completion.

During the day and night-time periods noise levels are predicted to increase by up to 1dB at surrounding residential receptors as a result of the increased operational activities at Hatston. The maximum significance of the changes in noise levels is Neutral / Slight, which is not significant in EIA terms.

NOISE DEFINITIONS

The following definitions relating to noise are used in this report:-

Ambient Sound Level: As defined in BS4142:2014; equivalent continuous A-weighted sound pressure level of the totally encompassing sound in a given situation at a given time, at the assessment location. The ambient sound level includes the contribution from the residual sound level and the specific sound level. Measured with $L_{Aeq,T}$.

Background Sound Level: The background sound level represents baseline conditions, filtering out intermittent noises, and can be thought of as a baseline over which a continuous noise would be heard. Defined in BS 4142 as the A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of any given time interval, T, $L_{A90,T}$.

Free-field: Sound can propagate from a source to a receiver through a direct path as well as reflected paths. The free-field represents a scenario where there are no contributions from reflections. In environmental assessments this largely refers to the scenario where the contribution from reflections is negligible.

Façade Effect: When sound is reflected back towards its source, off a surface, such a wall, the reflected and incident sound waves sum. One metre from the façade of a building this typically results in an increase in level, compared to that of the free-field, by approximately 3 dB, referred to as the façade effect.

$L_{Aeq,T}$: Equivalent continuous A-weighted sound pressure level. This is the single number that represents the average sound energy over a given time period, T. It is the sound level of a notionally steady sound that has the same energy as a sound that fluctuates over the specified measurement period.

$L_{A10,T}$: The noise level exceeded for 10% of the measurement period, T.

$L_{A10,18h}$: The average noise level exceeded for 10% of the time in each of the eighteen one hour periods between 06:00 to 24:00 hours. This takes into account the fluctuation in traffic volumes over time to provide a single figure for assessment purposes and is typically used in road traffic assessments.

$L_{A90,T}$: The noise level exceeded for 90% of the measurement period.

L_{Amax}: The maximum A-weighted sound pressure level over the specified period.

Octave: A range of frequencies whose upper frequency limit is twice that of its lower frequency limit.

Octave Band: Sound pressure level is often measured in octave bands, the centre frequencies of the bands are defined by ISO – 31.5Hz, 63Hz, 125Hz, 250Hz, 500Hz, 1kHz, 2kHz, 4kHz, 8kHz, 16kHz to divide the audio spectrum into 10 equal parts. The sound pressure level of sound that has been passed through an octave band pass filter is termed the octave band sound pressure level. Additionally, sound is often represented by one-third octave bands, which divides each octave band into three.

Rating Level: The specific sound level with the addition of any character correction penalties.

Residual Sound Level: The continuous A-weighted sound pressure level at a given location in the absence of the specific sound level. This, unlike the background sound level, includes the contribution from fluctuating sounds.

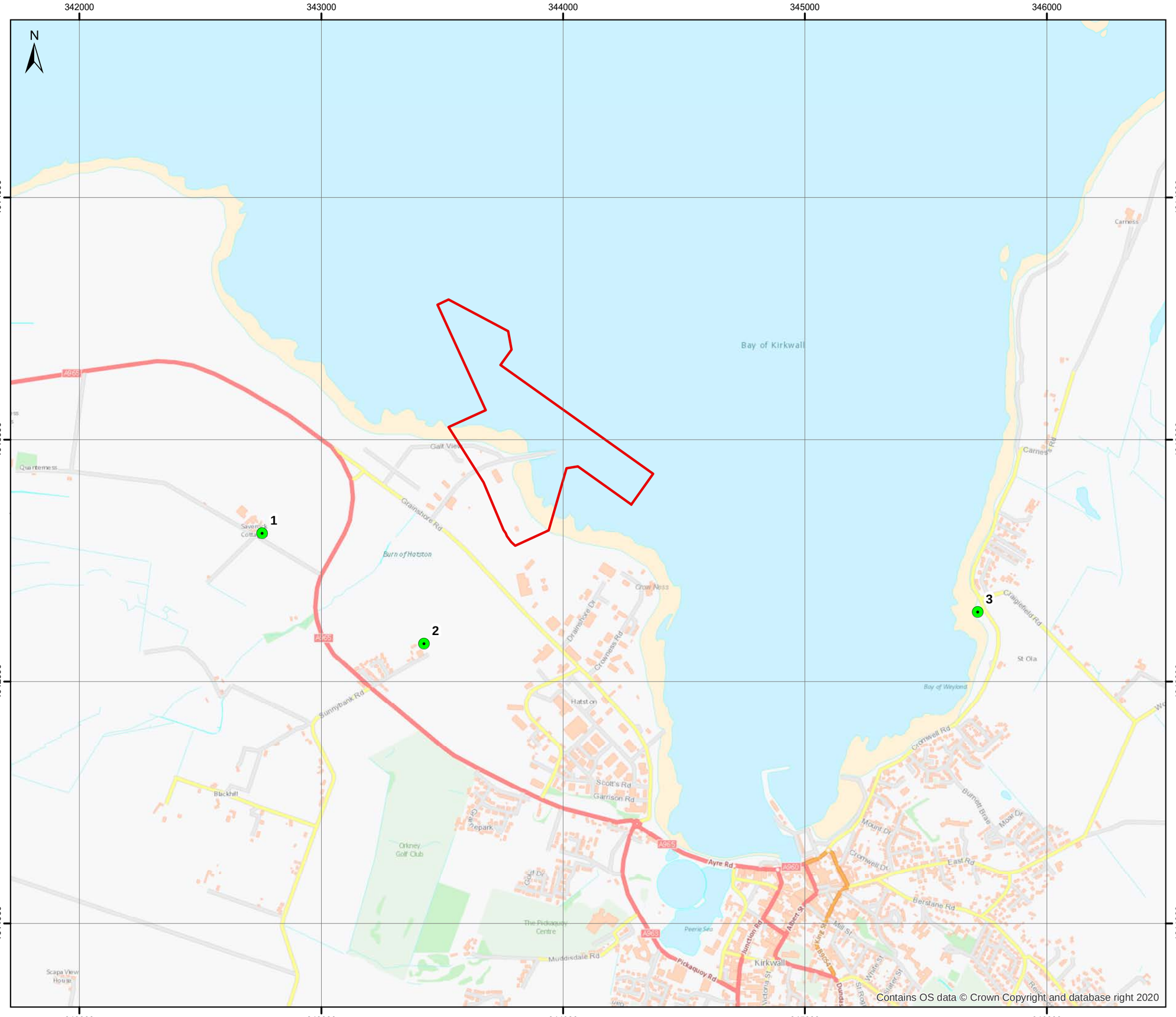
Specific Sound Level: The continuous A-weighted sound pressure level at a given location of the isolated industrial noise source.

Tonal Penalty: A penalty applied to a specific sound source to account for inherent tonality of a source as perceived at the position of the noise sensitive receptor. Tonal penalty can be derived subjectively (2 dB for a tone which is just perceptible at the receptor, 4 dB where it is clearly perceptible, and 6 dB where it is highly perceptible). The tonal penalty can be derived objectively through two procedures. The first is to assess the one-third octave band spectrum, where if certain criteria are met a 6 dB penalty is applicable. If a tone is not identified using the one-third octave band spectrum the penalty should be derived using the reference method, a more in depth narrow-band method based on a psychoacoustic model for tonal audibility.

Weighting: Human hearing is most sensitive to frequencies between about 500Hz and 6kHz and less sensitive to frequencies above and below these. In order to measure noise levels representative of human hearing a filter is applied termed a Frequency Weighting which is a prescribed frequency filter provided in a sound level meter. An A-weighted sound pressure level in decibels (denoted as dB(A)) is designed to reflect the sharpness of the human ear, which does not respond equally to all frequencies

APPENDICES

A DRAWINGS



Legend

- Hatston Site Boundary
- Noise Monitoring Locations

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Project
Hatston Pier

Title
Background Noise Monitoring Locations

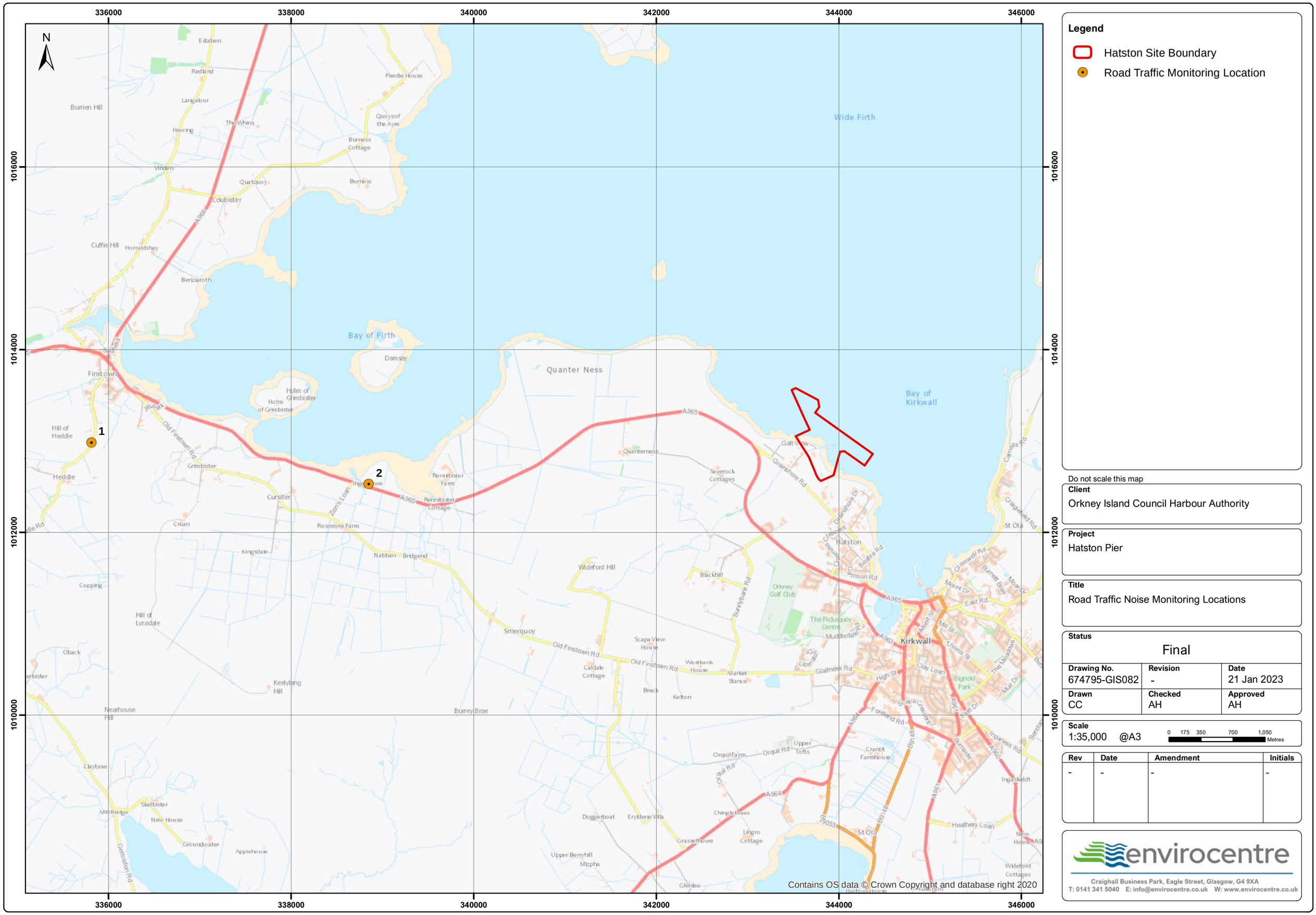
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Legend

- Hatston Site Boundary
- Road Traffic Monitoring Location

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Project
Hatston Pier

Title
Road Traffic Noise Monitoring Locations

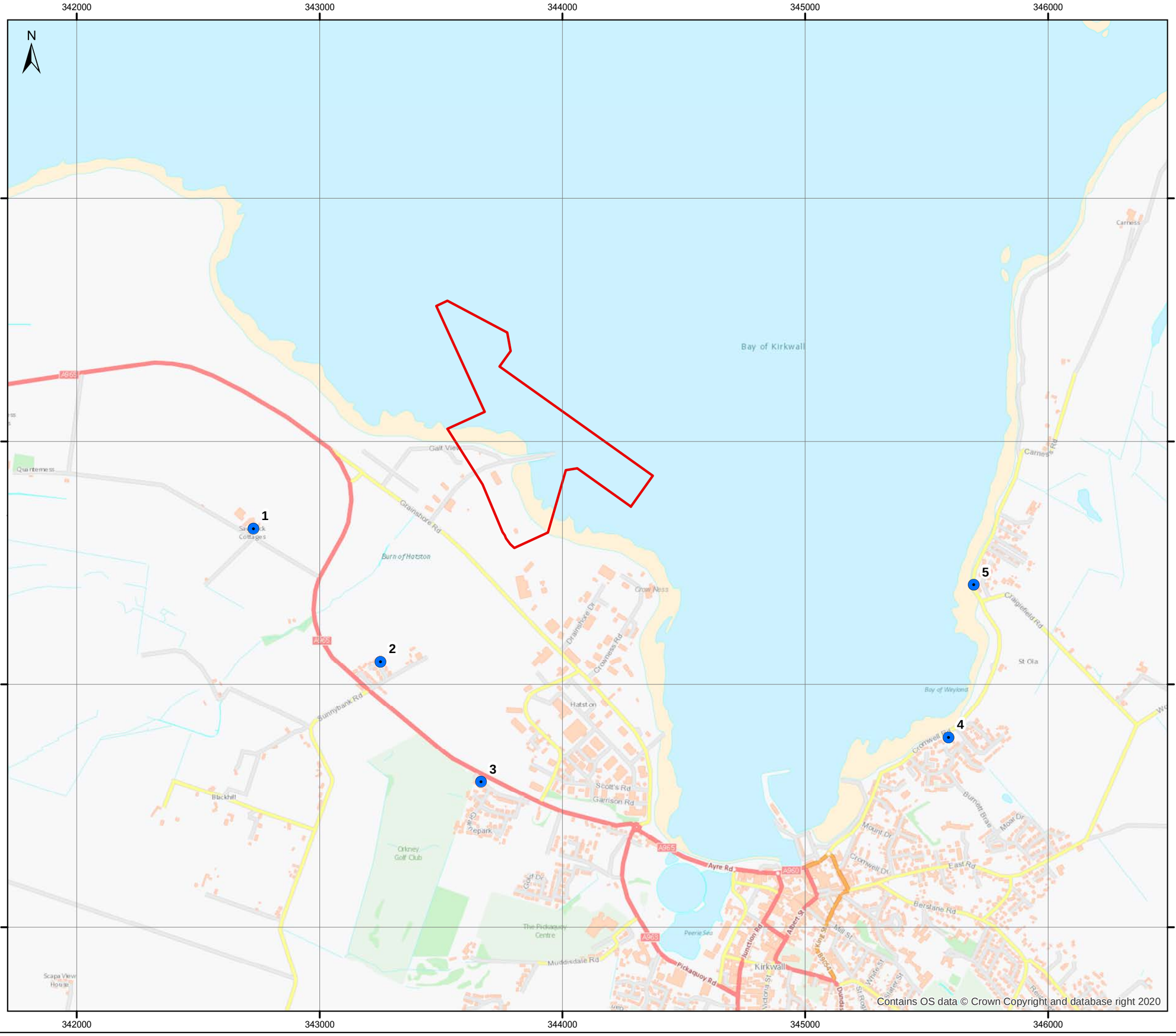
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Legend

- Hatston Site Boundary
- Noise Sensitive Receptors

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Project
Hatston Pier

Title
Noise Sensitive Receptors

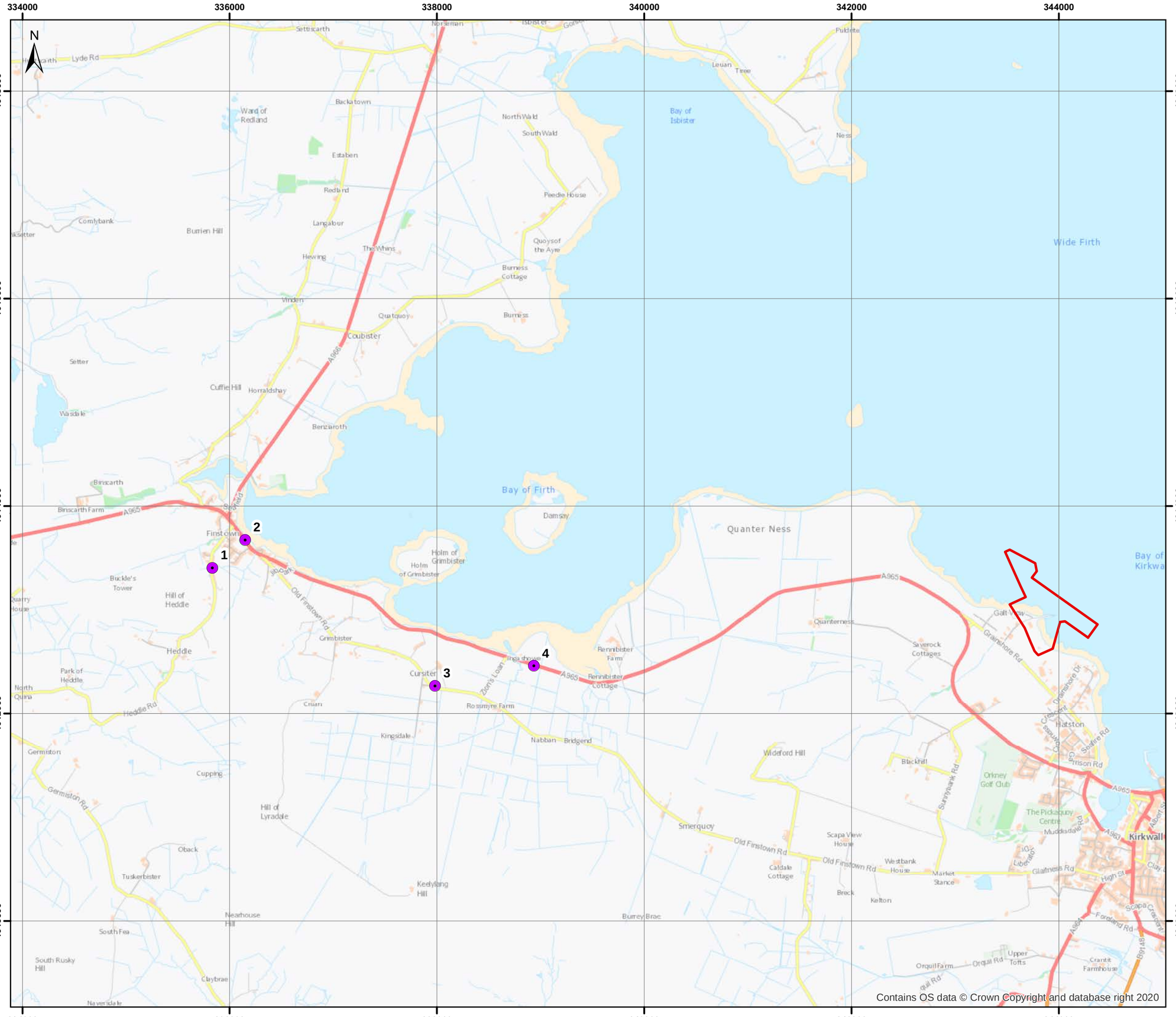
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Legend

- Hatston Site Boundary
- CiRTN Assessment Road Sections

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Project
Hatston Pier

Title
Change in Road Traffic Noise, Construction Phase
Road Section Assessment Locations

Status
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B ABC CATEGORY THRESHOLDS

The appropriate ABC category thresholds for each of the noise sensitive receptors has been calculated following guidance provided in Annex E of the standard (refer to Section 3.3.1 for assessment criteria).

Calculations for each of the noise sensitive receptors, based on measured day and night-time ambient noise levels in the absence of construction noise is shown in Table B-1 to Table B-3. Evening and Weekend ambient noise levels have been assumed to be the average of daytime and night-time measured noise levels.

Table B-1: ABC Category Thresholds, NSR 01

NSR 01	Lowest Measured Daytime dB(A)	Lowest Measured Night-time dB(A)	Evening dB(A)	Weekend dB(A)
Ambient Levels	48.2	36.5	45.5	45.5
Ambient Levels Rounded	50	35	45	45
BS5228 ABC Category	**A**	**A**	**A**	**A**
Threshold Value	65	45	55	55

Table B-2: ABC Category Thresholds, NSRs 02 & 03

NSR 02	Lowest Measured Daytime dB(A)	Lowest Measured Night-time dB(A)	Evening dB(A)	Weekend dB(A)
Ambient Levels	45.8	32.2	42.9	42.9
Ambient Levels Rounded	45	30	45	45
BS5228 ABC Category	**A**	**A**	**A**	**A**
Threshold Value	65	45	55	55

Table B-3: ABC Category Thresholds, NSRs 04 & 05

NSR 03	Lowest Measured Daytime dB(A)	Lowest Measured Night-time dB(A)	Evening dB(A)	Weekend dB(A)
Ambient Levels	51.9	34.6	49	49
Ambient Levels Rounded	50	35	50	50
BS5228 ABC Category	**A**	**A**	**A**	**A**
Threshold Value	65	45	55	55

C CONSTRUCTION NOISE MODEL DATA

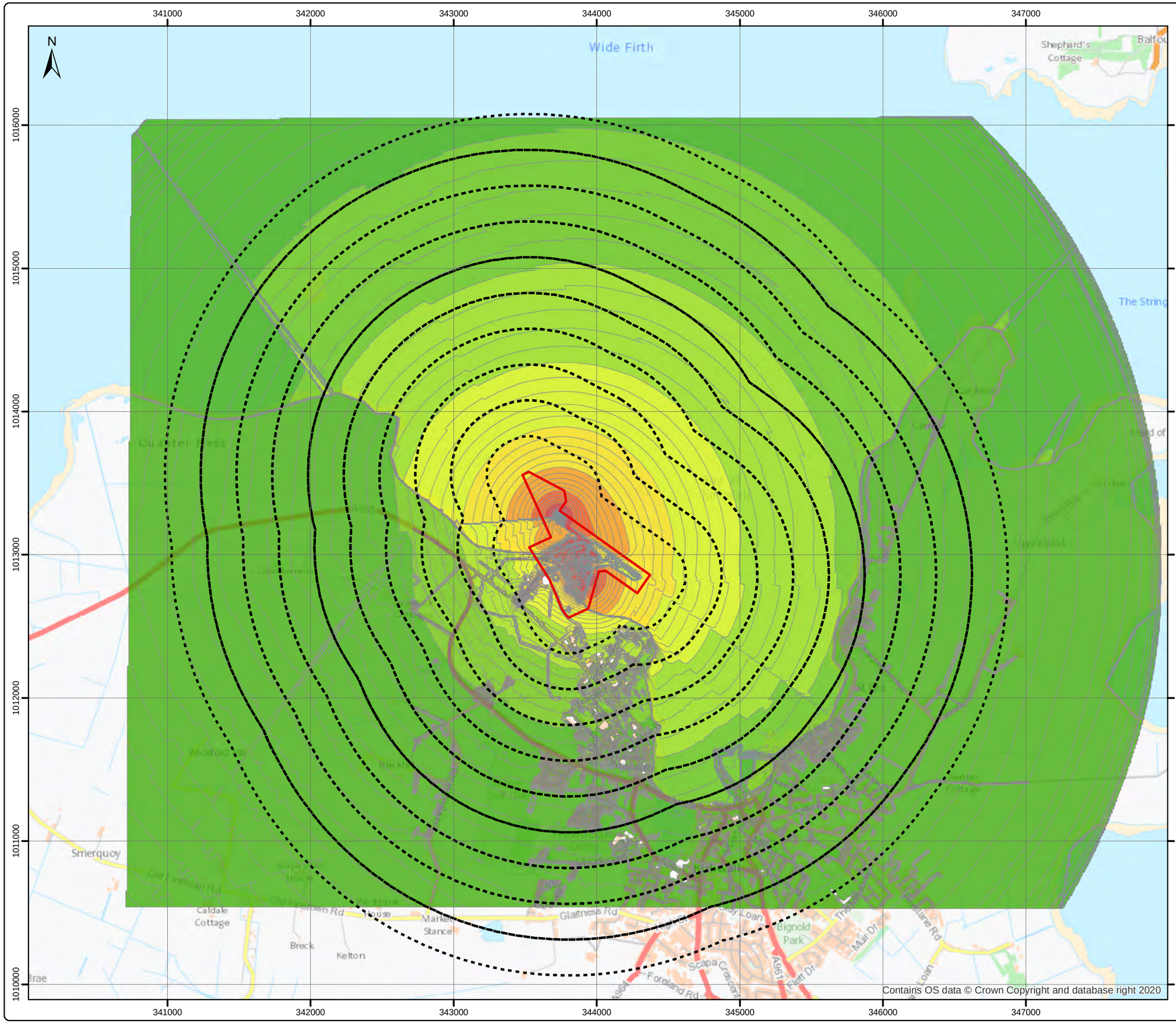
Construction Activities	Individual Plant / Activities	No. of Units	Lp at 10m dB(A)	Data Source	Source Height (m)	Operating Times	% On-time of Operating Hours	Operating Periods			
								D	W	E	N
HGV Deliveries	HGV delivery full	7 p/h	80	BS5228 C.6 Ref 21	0.5	07:00 – 19:00	7 p/h	x	x		
	HGV delivery empty	7 p/h	83	BS5228 C.6 Ref 22	0.5		7 p/h	x	x		
	Dump truck tipping fill	7 p/h	80	BS5228 C.1 Ref 11	0.5		7 p/h	x	x		
Drainage, Infill and Compaction	D6 Dozers - 18T	2	81	BS5228 C.2 Ref 12	1	07:00 – 19:00	80	X	X		
	Dump truck movements	2	90	BS5228 C.9 Ref 21	0.5		80	X	X		
	Dump truck tipping fill	2	80	BS5228 C.1 Ref 11	0.5		25	X	X		
	50T Excavators	2	79	BS 5228 C.2 Ref 14	1		80	X	X		
	16T Twin Drum Rollers	2	73	BS 5228 C.2 Ref 38	0.5		80	X	X		
	26T High Energy Impact Compaction Roller	1	80	BS5228 C.5 Ref 19	0.5		80	X	X		
	9T Rapid Impact Compaction (compactor rammer)	1	91	BS5228 D.3 Ref 121	0.5		80	X	X		
	Diesel water pump	1	91	BS5228 D.11 Ref 1	0.5		80	X	X		
	D6 Dozers - 18T	2	81	BS5228 C.2 Ref 12	1		80	X	X		
Surfacing	Asphalt spreader	1	82	BS5228 D.8 Ref 22	0.5	07:00 – 19:00	80	X	X		
	Batching Plant	1	78	BS5228 D.6 Ref 10	1		100	X	X		
	Truck mixer	1	81	BS5228 D.5 Ref 15	1		80	X	X		
	Lorry mounted Concrete pump	1	81	BS5228 D.5 Ref 16	1		80	X	X		
Rock Armour Revetment	50T Excavators	2	79	BS5228 C.2 Ref 14	1	07:00 – 19:00	80	x	x		
	Dump truck movements	2	90	BS5228 C.9 Ref 21	0.5		80				
	Dump truck tipping	2	80	BS5228 C.1 Ref. 11	1		25	x	x		
Install Sheet Pile Wall	100t crawler crane	1	67	BS5228 C.3 Ref 28	1	07:00 – 19:00	80	x	x		
	Large capacity vibrating hammer	1	88	BS5228 D.4 Ref 43	0.5		80	x	x		
	Vibrating hammer generator	1	74	BS5228 C.4 Ref 84	0.5		80	x	x		
Tie Rod, Anchor Walls	Impact wrenches	4	70	Markesino et al. Study of noise transmission from impact wrench.	1	07:00 – 19:00	80	X	80		
	Hammer	4	79	BS5228 D.7 Ref 80	0.5		20	X	20		
Rotary Percussive Drilling (Sea bed Prep for Piling)	Small boat to transfer personnel between the barge and shore	1	82	CNP 221	1	07:00 – 19:00	5	x	x		
	Hopper barge	1	76	CNP 061	1		100	x	x		

Construction Activities	Individual Plant / Activities	No. of Units	Lp at 10m dB(A)	Data Source	Source Height (m)	Operating Times	% On-time of Operating Hours	Operating Periods			
								D	W	E	N
	Tracked mobile drilling rig (23t / 110mm dia)	1	87	BS5228 C.9 Ref 3	0.5		80	X	X		
Dredging	Long reach excavator	1	78	BS5228 C.7 Ref 1	1	07:00 – 19:00	80	X	X		

D OPERATIONAL NOISE MODEL DATA

Description of Operations	Individual Plant / Activities	No. of Units	Lw	Data Source	Source Height (m)	Operating Periods	% On-time of Operating Hours	Mins per 16 Hour Daytime	Mins per 8 Hour Night-time	Assumptions
Proposed Operations	Boat Lift (tracked crane)	1	99	BS5228 C4 Ref. 50	10	24 hours	5	48	24	Assume may operate both day and night-time as worst case scenario.
	SPMT	2 pairs	111 per pair	EnviroCentre database	0.5		80	768	0	4 x SPMTs per renewables component typically move to yard and then back once in a 10 hour period, going at 2km/h. They go onto the ship to unload the components, then are jacked down in the yard. As worst case assume 1 movement per hour max and 2km/h.
	16 ton Fork Lift Trucks	2	107	EnviroCentre database	0.5		80	768	384	Assume 10 movements per hour during the day and night-time. 15km/h.
	HGV delivery or pick up	2 per hour max	108	BS5228, Table C6, Ref 21	0.5		2 per hour max	N/A	N/A	Assume 2 movements per hour during the day and night-time. 20km/h.
	Ship generator noise	2	100	EnviroCentre database	1.5		100	960	480	2 additional generators over existing operations.

F BIRD HEAT MAPS AND NOISE CONTOUR MAPS



Legend

- Hatston Site Boundary
- 250m Distance Lines

LAeq,1hr dB

- < 35
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65
- > 65

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Project
Hatston Pier

Title
Construction Noise Contours
0.5m Height. Construction Phases 1 & 2

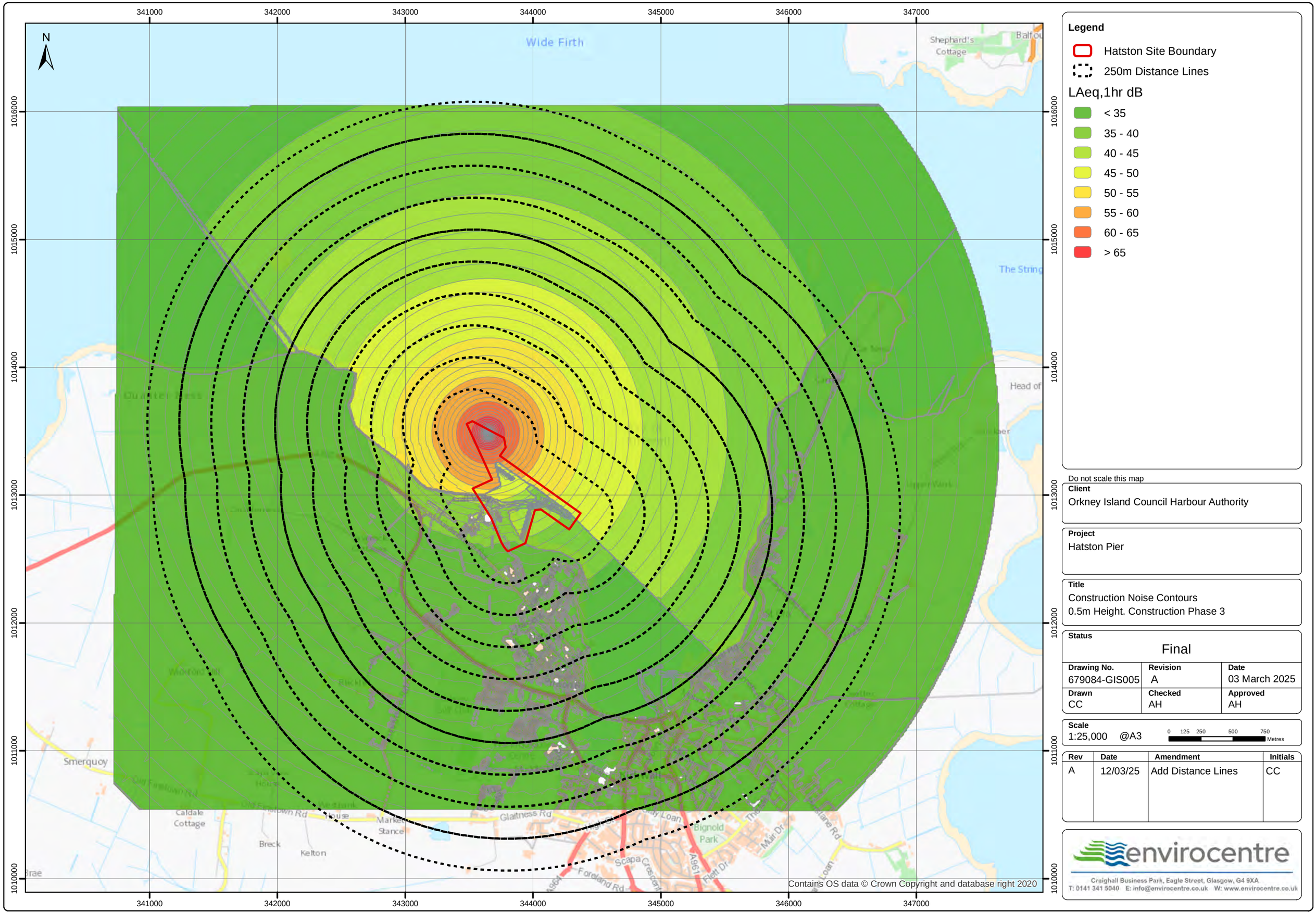
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A	12/03/25	Add Distance Lines	CC

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Legend

- Hatston Site Boundary
- 250m Distance Lines

LAeq,1hr dB

- < 35
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65
- > 65

Do not scale this map

Client
Orkney Island Council Harbour Authority

Project
Hatston Pier

Title
Construction Noise Contours
0.5m Height. Construction Phase 3

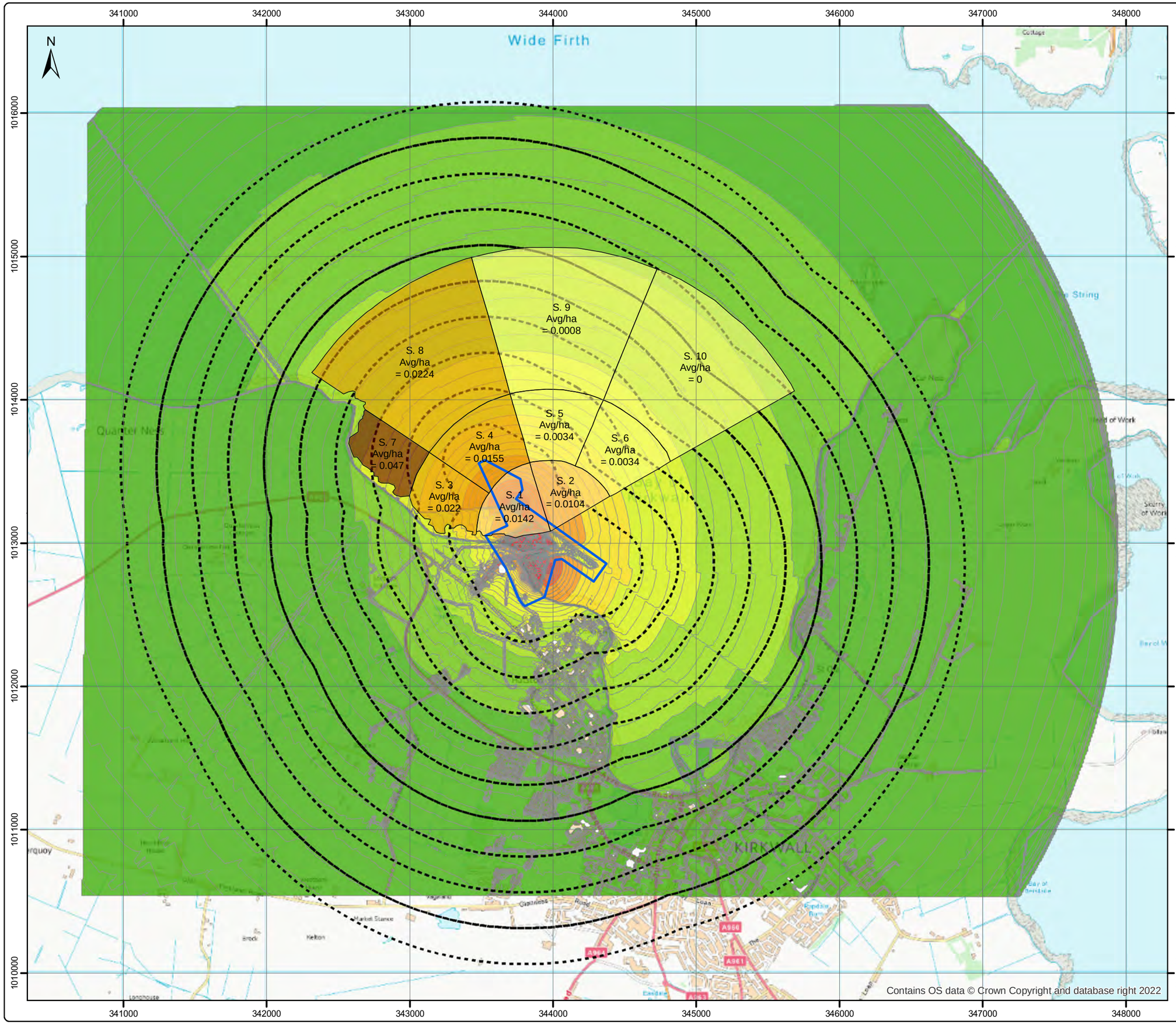
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Drawn	**Checked**	**Approved**
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A	12/03/25	Add Distance Lines	CC

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Legend

Proposed Site Extent

Noise Data

LAeq,1hr dB

- < 35
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65
- > 65
- 250m Distance Lines

Bird Data

Survey Sectors

Average Bird Count Density per ha

- < 0.005
- 0.005 - 0.015
- 0.015 - 0.025
- 0.025 - 0.035
- 0.035 - 0.045
- >0.045

Do not scale this map

Client
Orkney Islands Council Harbour Authority

Project
Orkney Haston Pier

Title
Slavonian Grebe Observations
Northern Sectors - Oct 2023 to March 2024 and Noise Contours
(0.5m bund Phase 1 and 2 Construction)

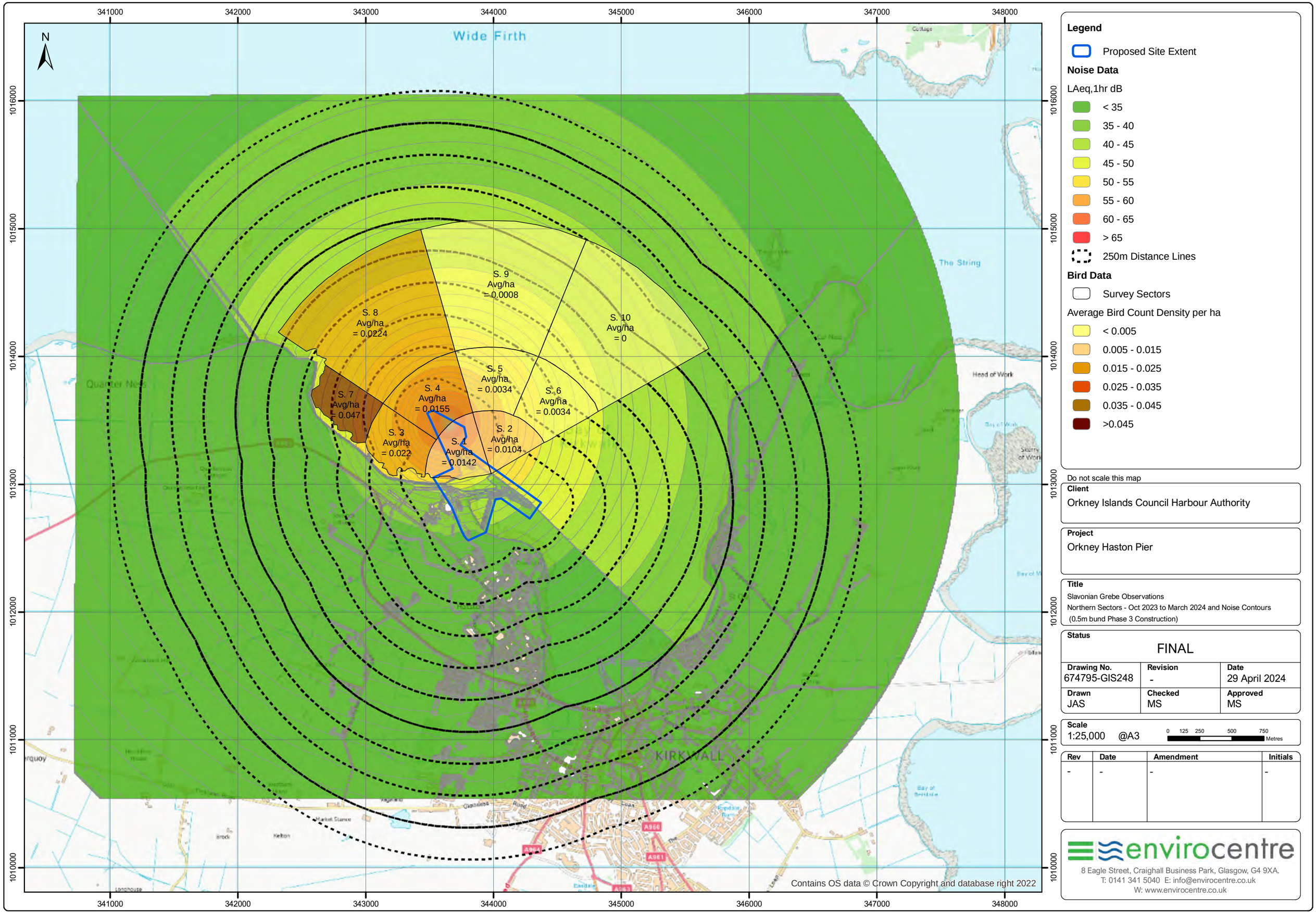
Status
FINAL

Drawing No.	Revision	Date
674795-GIS245	-	29 April 2024
Drawn	**Checked**	**Approved**
JAS	MS	MS

Scale
1:25,000 @A3
0 125 250 500 750 Metres

Rev	Date	Amendment	Initials
-	-	-	-

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Legend

Proposed Site Extent

Noise Data

LAeq,1hr dB

- < 35
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65
- > 65
- 250m Distance Lines

Bird Data

Survey Sectors

Average Bird Count Density per ha

- < 0.005
- 0.005 - 0.015
- 0.015 - 0.025
- 0.025 - 0.035
- 0.035 - 0.045
- >0.045

Do not scale this map

Client
Orkney Islands Council Harbour Authority

Project
Orkney Haston Pier

Title
Slavonian Grebe Observations
Northern Sectors - Oct 2023 to March 2024 and Noise Contours
(0.5m bund Phase 3 Construction)

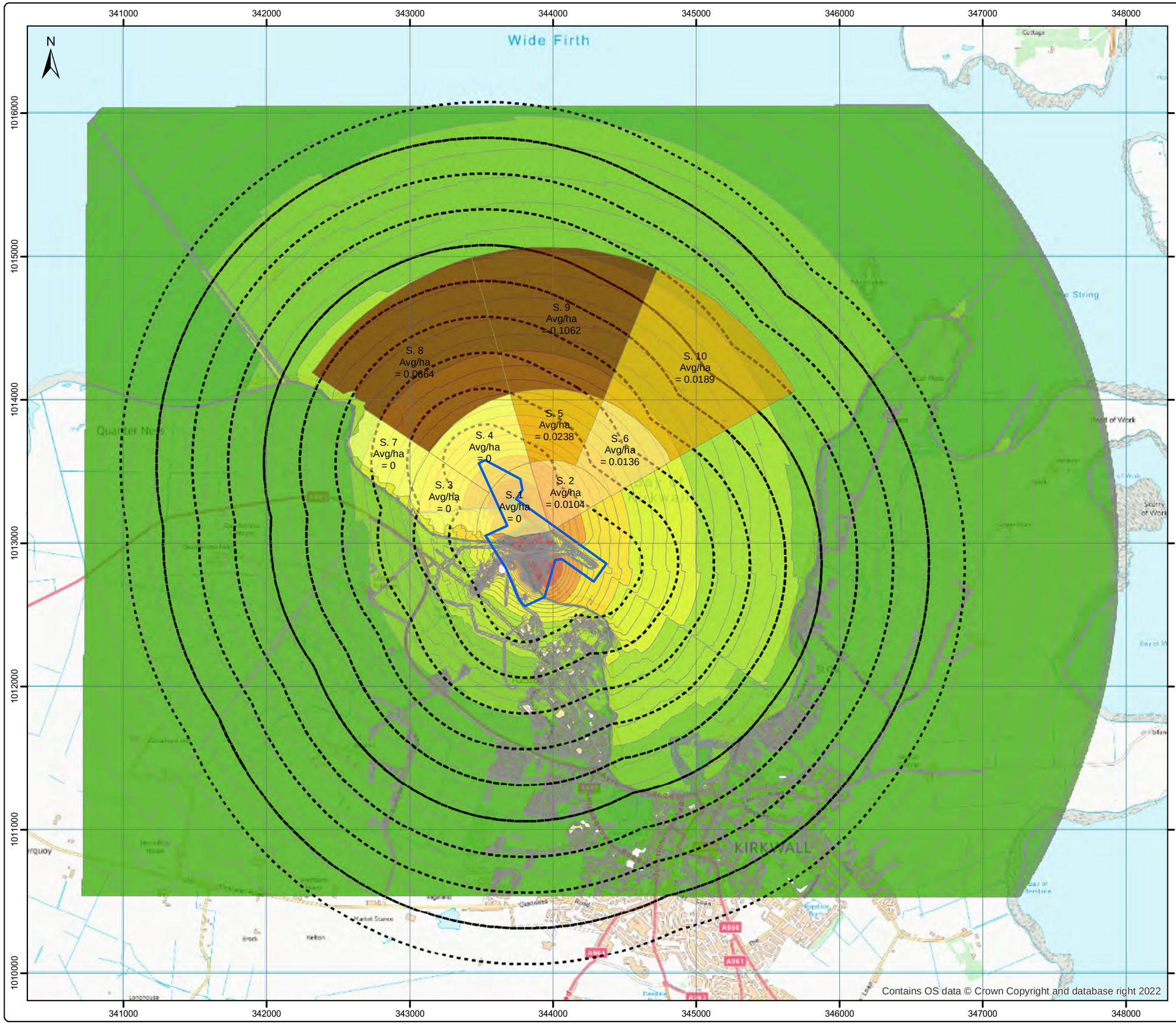
Status
FINAL

Drawing No.	Revision	Date
674795-GIS248	-	29 April 2024
Drawn	**Checked**	**Approved**
JAS	MS	MS

Scale
1:25,000 @A3
0 125 250 500 750 Metres

Rev	Date	Amendment	Initials
-	-	-	-

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Legend

Proposed Site Extent

Noise Data

LAeq,1hr dB

- < 35
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65
- > 65
- 250m Distance Lines

Bird Data

Survey Sectors

Average Bird Count Density per ha

- < 0.005
- 0.005 - 0.015
- 0.015 - 0.025
- 0.025 - 0.035
- 0.035 - 0.045
- >0.045

Do not scale this map

Client
Orkney Islands Council Harbour Authority

Project
Orkney Haston Pier

Title
Velvet Scoter Observations
Northern Sectors - Oct 2023 to March 2024 and Noise Contours
(0.5m bund Phase 1 and 2 Construction)

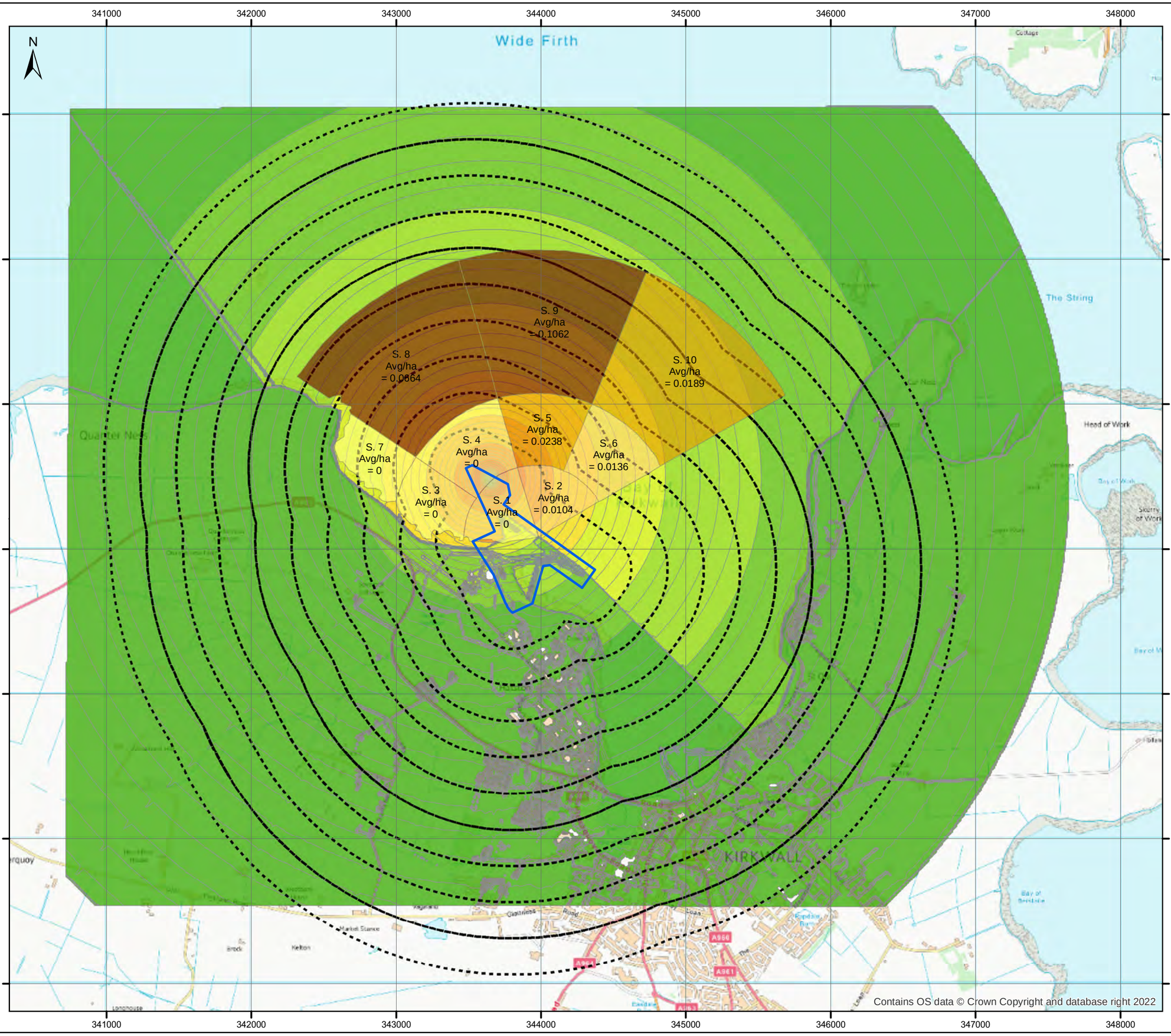
Status
FINAL

Drawing No.	Revision	Date
674795-GIS246	-	25 April 2025
Drawn	**Checked**	**Approved**
JAS	MS	MS

Scale
1:25,000 @A3
0 125 250 500 750 Metres

Rev	Date	Amendment	Initials
-	-	-	-

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Legend

Proposed Site Extent

Noise Data

LAeq,1hr dB

- < 35
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65
- > 65
- 250m Distance Lines

Bird Data

Survey Sectors

Average Bird Count Density per ha

- < 0.005
- 0.005 - 0.015
- 0.015 - 0.025
- 0.025 - 0.035
- 0.035 - 0.045
- >0.045

Do not scale this map

Client
Orkney Islands Council Harbour Authority

Project
Orkney Haston Pier

Title
Velvet Scoter Observations
Northern Sectors - Oct 2023 to March 2024 and Noise Contours
(0.5m bund Phase3 Construction)

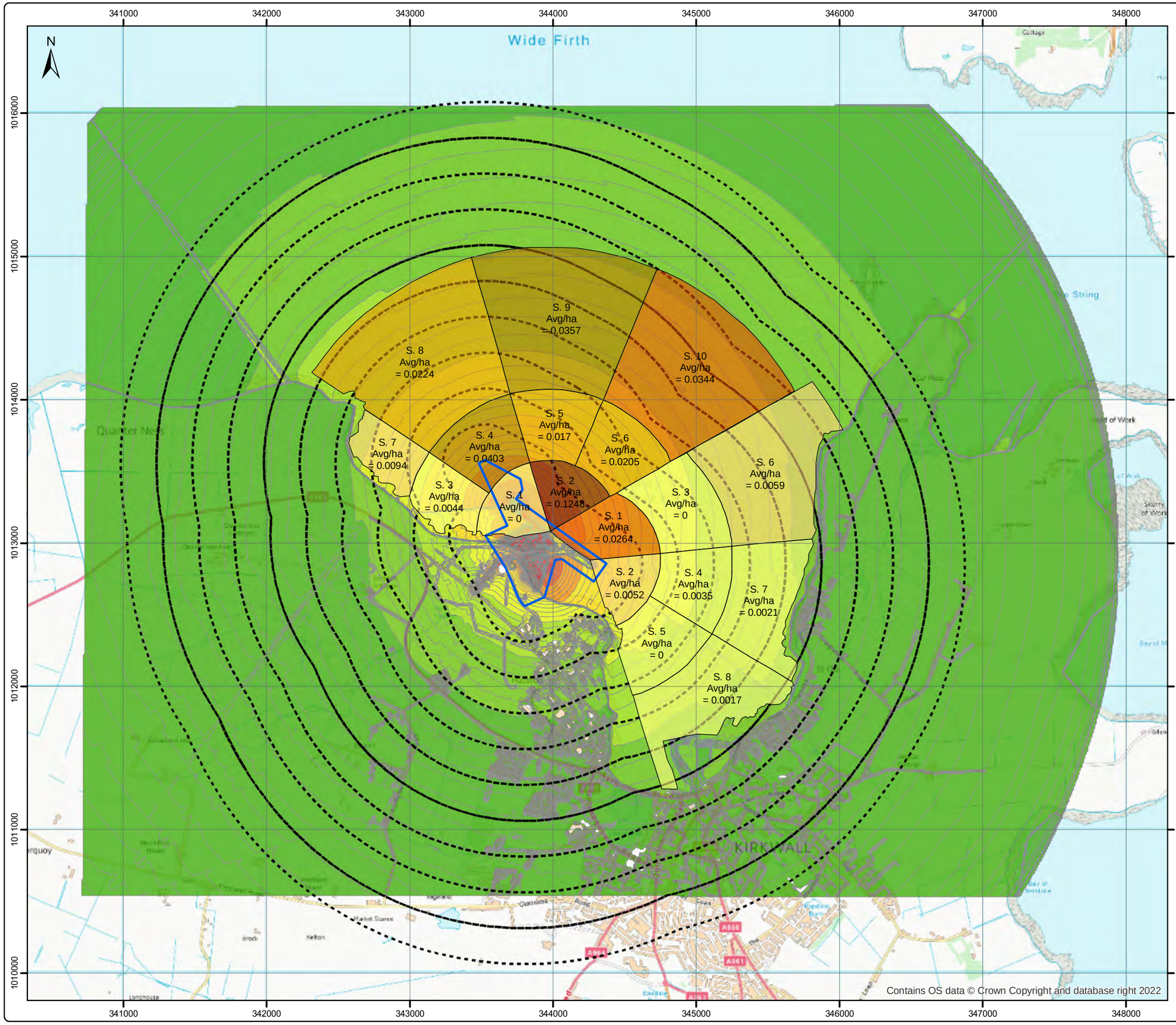
Status
FINAL

Drawing No.	Revision	Date
674795-GIS249	-	25 April 2025
Drawn	**Checked**	**Approved**
JAS	MS	MS

Scale
1:25,000 @A3
0 125 250 500 750 Metres

Rev	Date	Amendment	Initials
-	-	-	-

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Legend

Proposed Site Extent

Noise Data

LAeq,1hr dB

- < 35
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65
- > 65
- 250m Distance Lines

Bird Data

Survey Sectors

Average Bird Count Density per ha

- < 0.005
- 0.005 - 0.015
- 0.015 - 0.025
- 0.025 - 0.035
- 0.035 - 0.045
- >0.045

Do not scale this map

Client
Orkney Islands Council Harbour Authority

Project
Orkney Haston Pier

Title
Great-Northern Diver Observations
- Oct 2023 to March 2024 and Noise Contours
(0.5m bund Phase 1 and 2 Construction)

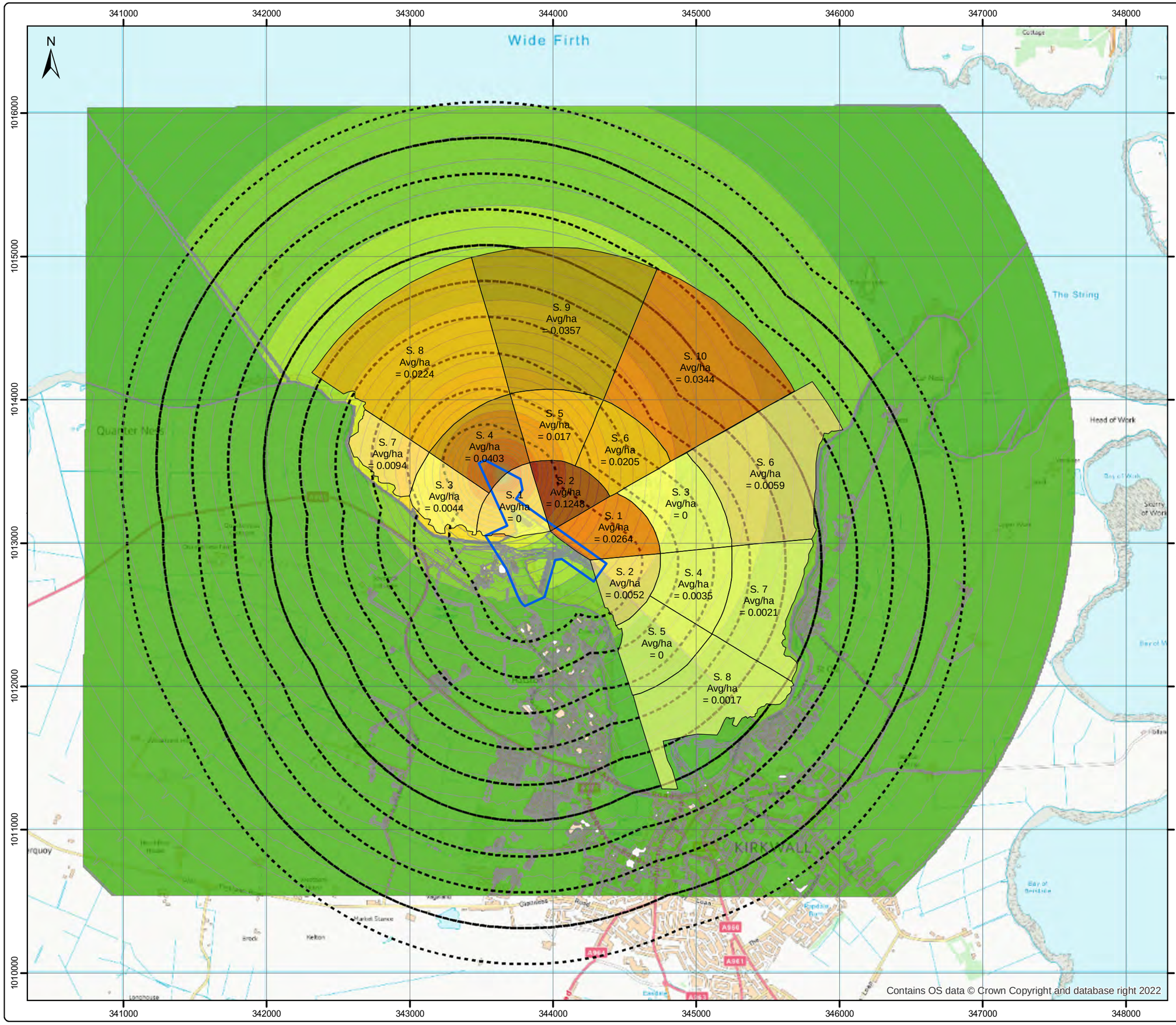
Status
FINAL

Drawing No.	Revision	Date
674795-GIS247	-	25 April 2025
Drawn	**Checked**	**Approved**
JAS	MS	MS

Scale
1:25,000 @A3
0 125 250 500 750 Metres

Rev	Date	Amendment	Initials
-	-	-	-

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Legend

Proposed Site Extent

Noise Data

LAeq,1hr dB

- < 35
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65
- > 65
- 250m Distance Lines

Bird Data

Survey Sectors

Average Bird Count Density per ha

- < 0.005
- 0.005 - 0.015
- 0.015 - 0.025
- 0.025 - 0.035
- 0.035 - 0.045
- >0.045

Do not scale this map

Client
Orkney Islands Council Harbour Authority

Project
Orkney Haston Pier

Title
Great-Northern Diver Observations
- Oct 2023 to March 2024 and Noise Contours
(0.5m bund Phase 3 Construction)

Status
FINAL

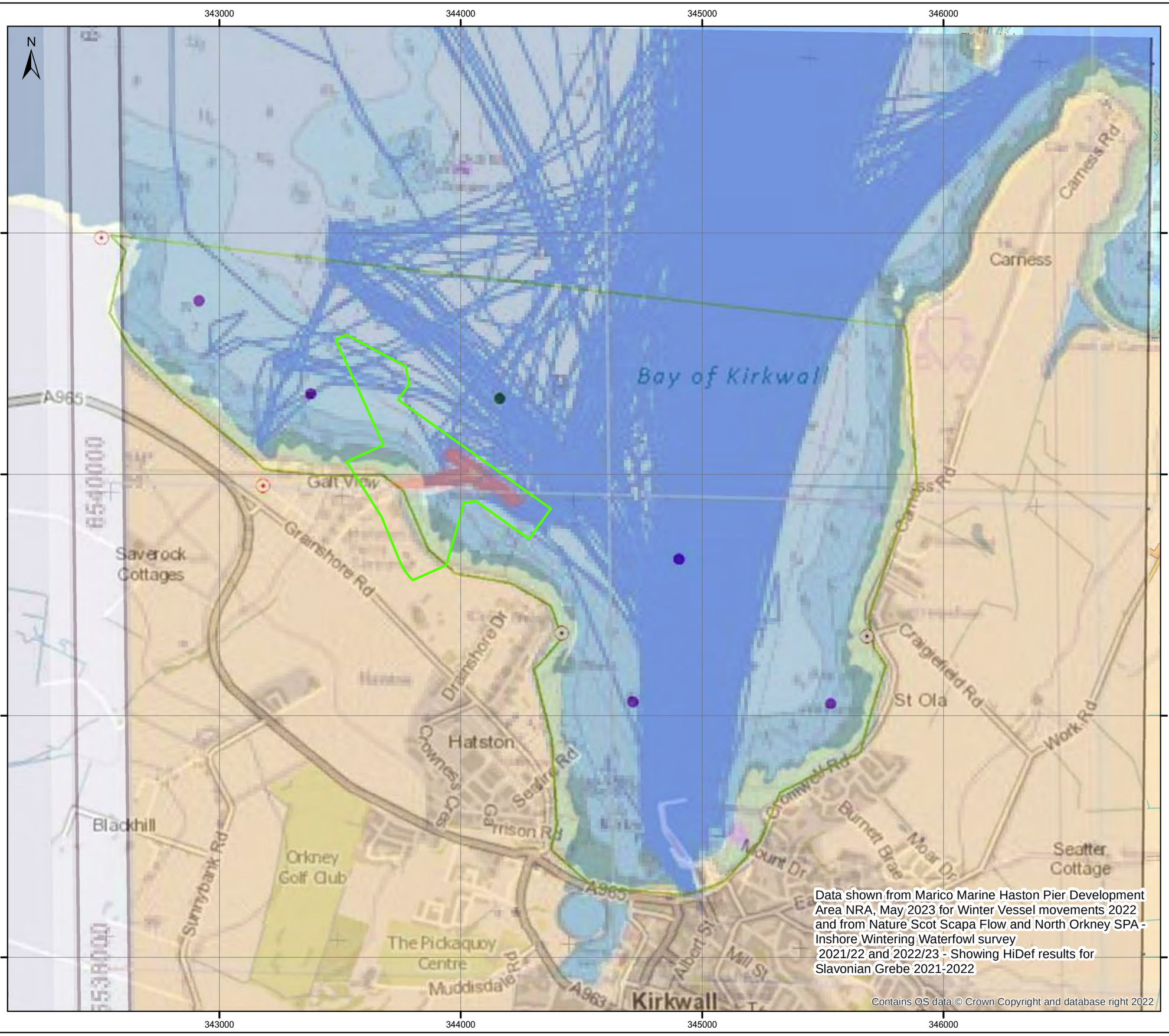
Drawing No.	Revision	Date
674795-GIS250	-	25 April 2025
Drawn	**Checked**	**Approved**
JAS	MS	MS

Scale
1:25,000 @A3
0 125 250 500 750 Metres

Rev	Date	Amendment	Initials
-	-	-	-

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G VESSEL MOVEMENT ROUTES AND HIDEF SURVEYS COMBINED



Legend

Proposed Site Extent

Legend taken from NatureScot report for HiDef results*. Shore based observations between 2021-2022.

Number of records

1

Survey Month

November

January

Do not scale this map

Client
Orkney Islands Council Harbour Authority

Project
Orkney Haston Pier

Title
Winter 2022 Vessel Movements and observations of Slavonian Grebe 2021-2022

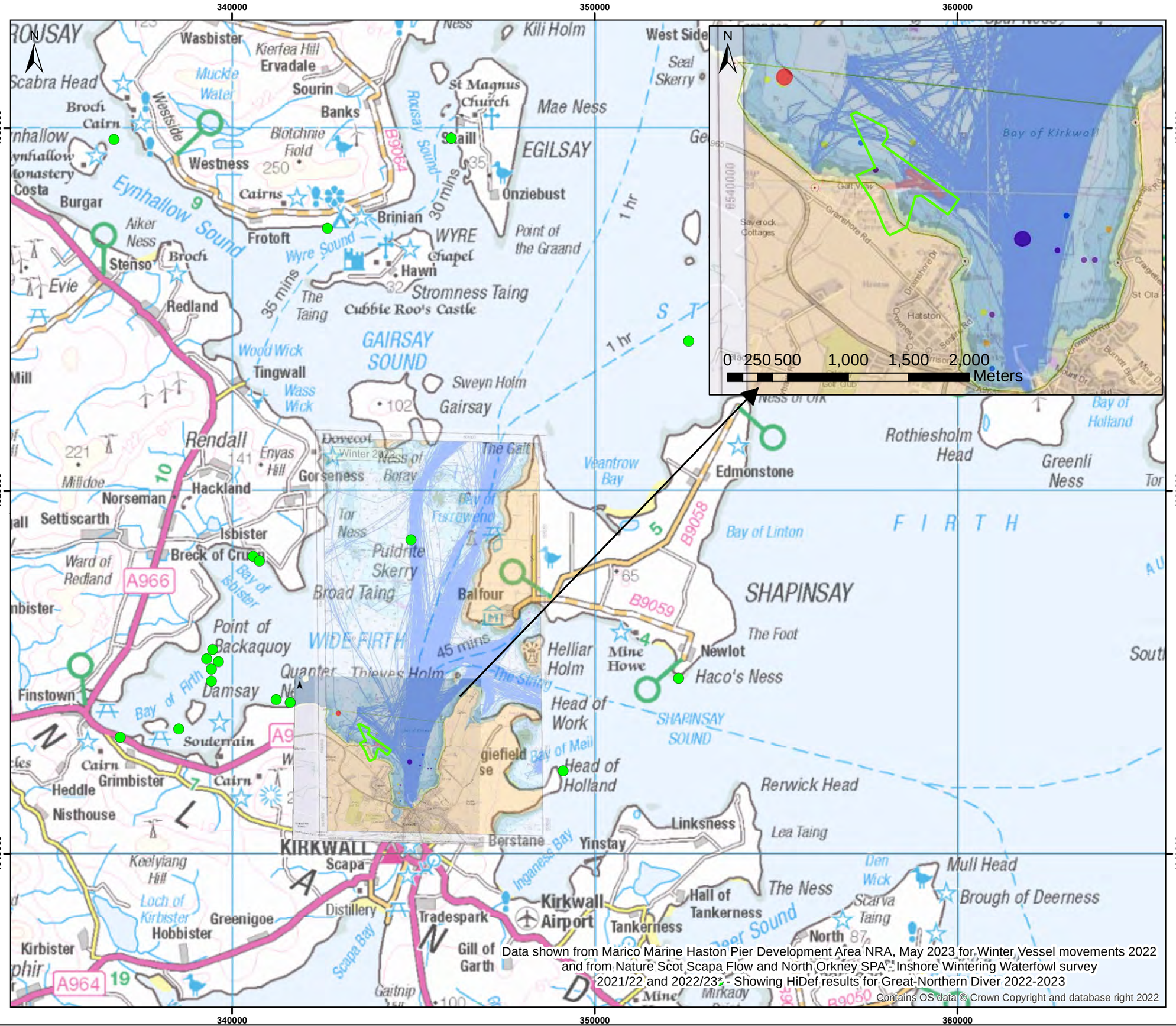
Status
FINAL

Drawing No.	Revision	Date
674795-GIS205	A	17 Jan 2025
Drawn	**Checked**	**Approved**
JAS	MS	MS

Scale
1:15,000 @A3
0 75 150 300 450 Metres

Rev	Date	Amendment	Initials
A	25/04/25	Update to legend	JAS

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Legend

- Proposed Site Extent
- Bird sightings from aerial observations (Feb 2022 and Jan 2023)

Legend taken from NatureScot report for HiDef results*.Shore based observations between 2022-2023.

Number of records	Survey month
1	December
2	January S01
3	January S02
	February
	March

Do not scale this map

Client
Orkney Islands Council Harbour Authority

Project
Orkney Haston Pier

Title
Winter 2022 Vessel Movements and observations of Savonian Grebe 2022-2023

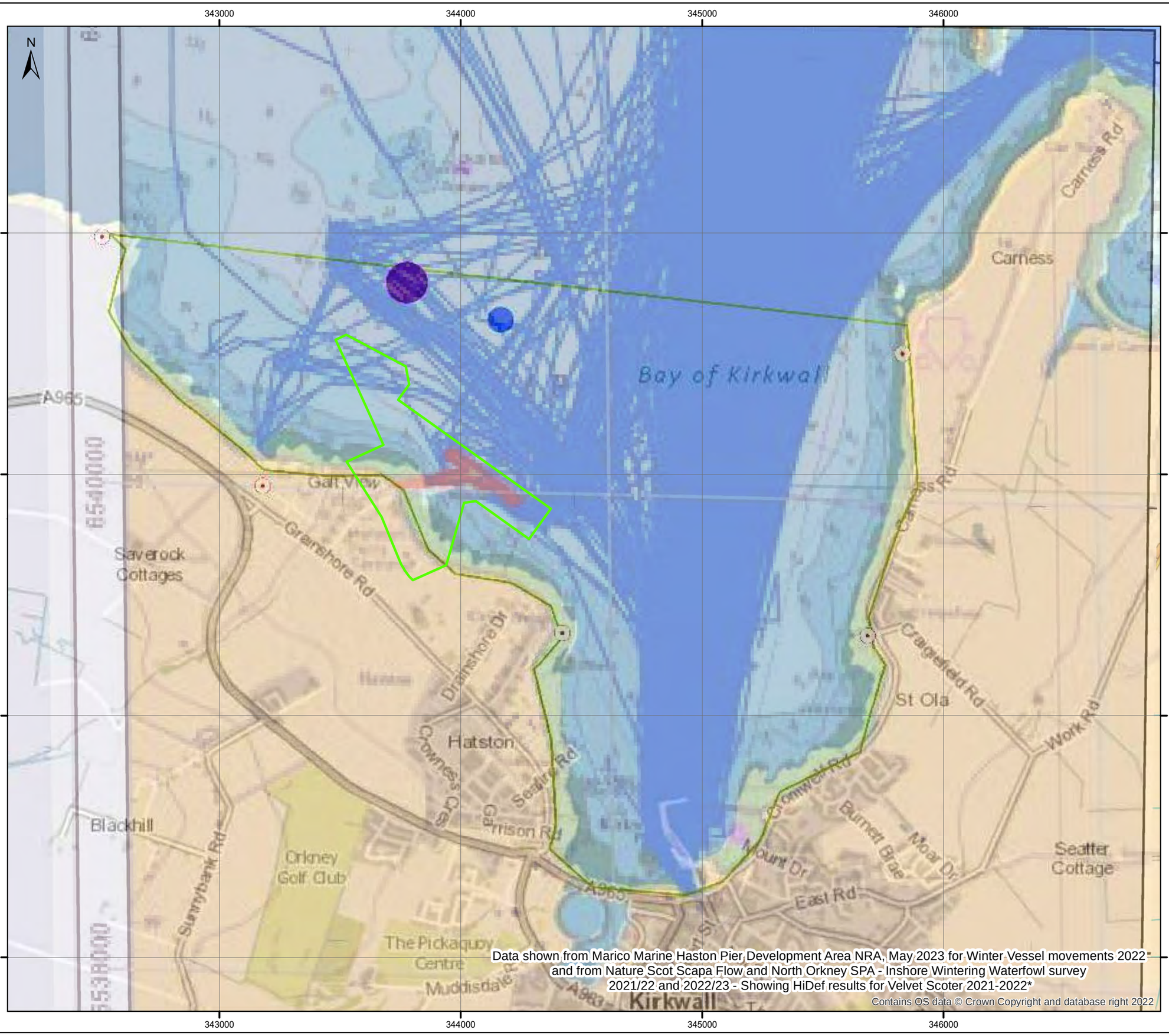
Status
FINAL

Drawing No.	Revision	Date
674795-GIS221	-	25 April 2025
Drawn	**Checked**	**Approved**
JAS	MS	MS

Scale
1:100,000 @A3
0 500 1,000 2,000 3,000 Metres

Rev	Date	Amendment	Initials
-	-	-	-

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Data shown from Marico Marine Haston Pier Development Area NRA, May 2023 for Winter Vessel movements 2022 and from Nature Scot Scapa Flow and North Orkney SPA - Inshore Wintering Waterfowl survey 2021/22 and 2022/23 - Showing HiDef results for Velvet Scoter 2021-2022*

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Legend

Proposed Site Extent

Legend taken from NatureScot report for HiDef results*. Shore based observations between 2021-2022.

Number of records	Survey month
1	December
2 - 5	January 501
6 - 10	
11 - 15	
16 - 20	

Do not scale this map

Client
Orkney Islands Council Harbour Authority

Project
Orkney Haston Pier

Title
Winter 2022 Vessel Movements and observations of Velvet Scoter 2021-2022

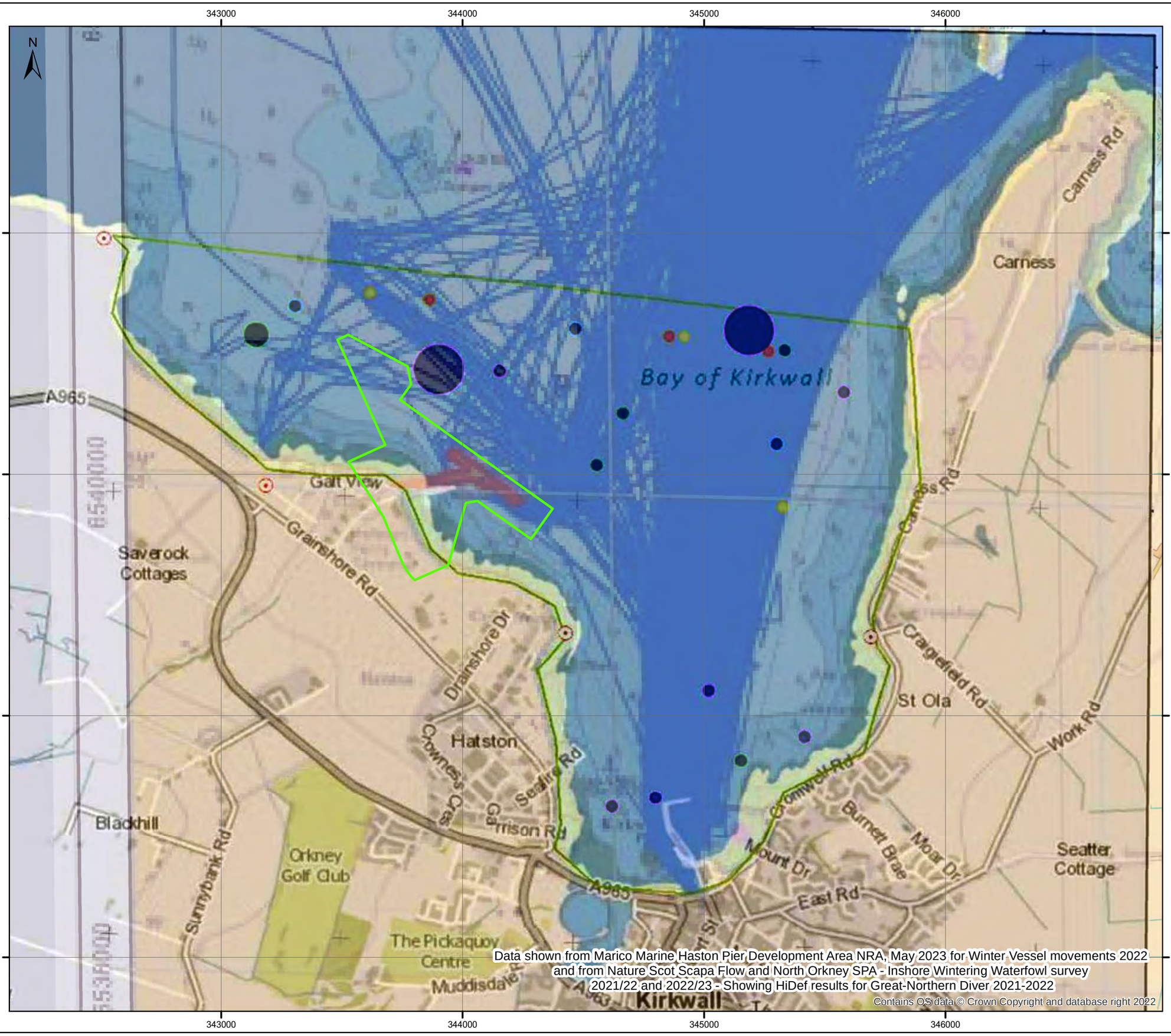
Status
FINAL

Drawing No.	Revision	Date
674795-GIS206	A	17 Jan 2025
Drawn	**Checked**	**Approved**
JAS	MS	MS

Scale
1:15,000 @A3
0 75 150 300 450 Metres

Rev	Date	Amendment	Initials
A	25/04/25	Update to legend	JAS

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Legend

Proposed Site Extent

Legend taken from NatureScot report for HiDef results*.
Shore based observations between 2021-2022.

Number of records

1
2
3
4

Survey Month

November
December
January
February
March

Do not scale this map

Client
Orkney Islands Council Harbour Authority

Project
Orkney Haston Pier

Title
Winter 2022 Vessel Movements and observations of Great-Northern Diver 2021-2022

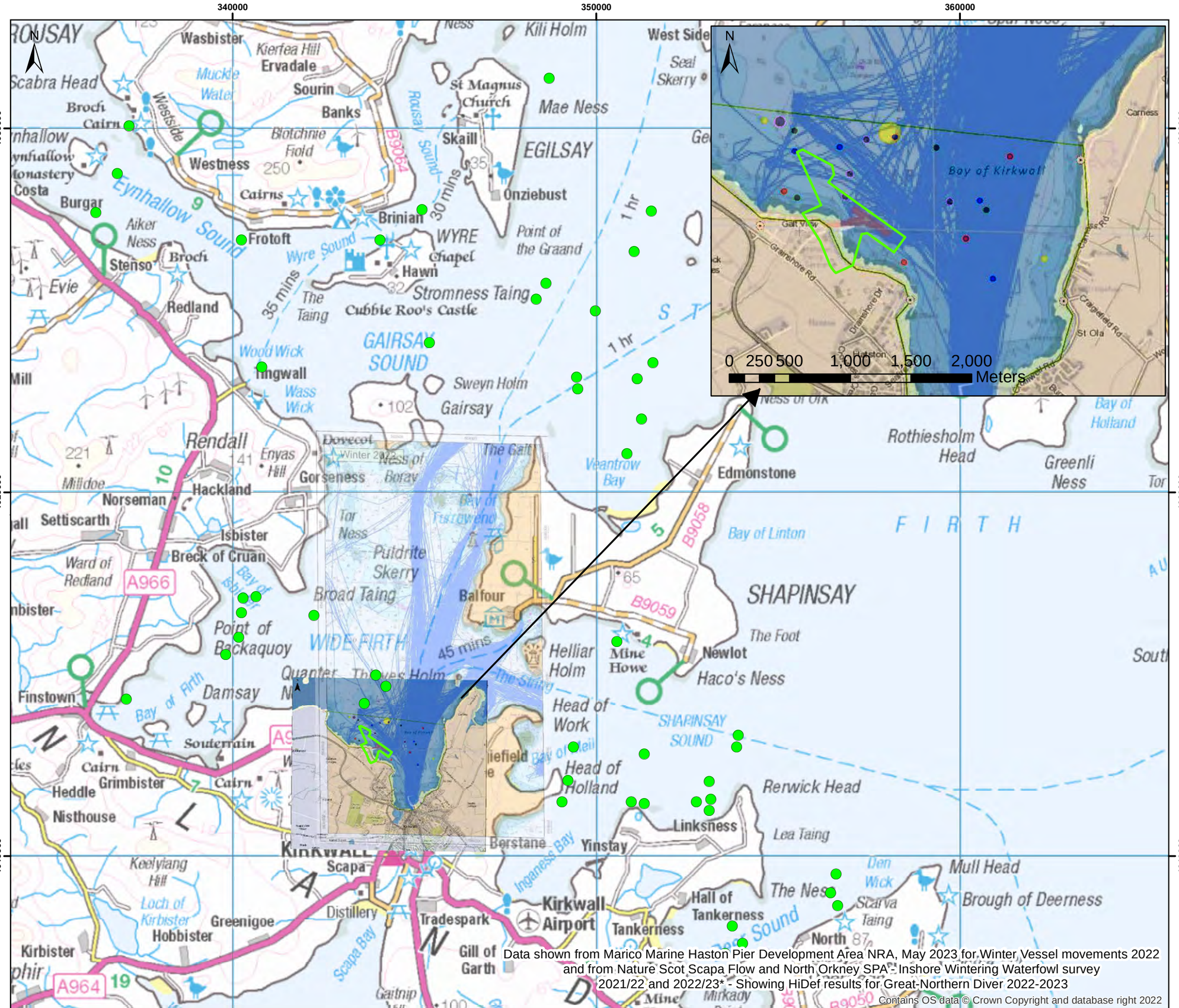
Status
FINAL

Drawing No.	Revision	Date
674795-GIS204	A	17 Jan 2025
Drawn	**Checked**	**Approved**
JAS	MS	MS

Scale
1:15,000 @A3
0 75 150 300 450 Metres

Rev	Date	Amendment	Initials
A	25/04/25	Update to legend	JAS

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Legend

- Proposed Site Extent
- Bird sightings from aerial observations (Feb 2022 and Jan 2023)

Legend taken from NatureScot report for HiDef results*.Shore based observations between 2022-2023.

Number of records

1

18

Survey month

- November
- December
- January S01
- January S02
- February

Data shown from Marico Marine Haston Pier Development Area NRA, May 2023 for Winter Vessel movements 2022 and from Nature Scot Scapa Flow and North Orkney SPA - Inshore Wintering Waterfowl survey 2021/22 and 2022/23* - Showing HiDef results for Great-Northern Diver 2022-2023

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Do not scale this map

Client
Orkney Islands Council Harbour Authority

Project
Orkney Haston Pier

Title
Winter 2022 Vessel Movements and observations of Great-Northern Diver 2022-2023

Status
DRAFT FOR COMMENT

Drawing No.	Revision	Date
674795-GIS216	-	17 Jan 2025
Drawn	**Checked**	**Approved**
JAS	MS	MS

Scale
1:100,000 @A3
0 500 1,000 2,000 3,000 Metres

Rev	Date	Amendment	Initials
-	-	-	-

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