FISHGUARD REPLACEMENT LINKSPAN

ENVIRONMENTAL STATEMENT

VOLUME II Technical Appendices

794-NI-POR-08886R
F01
Fishguard
Replacement Linkspan
May 2025

ENVIRONMENTAL STATEMENT VOLUME II TECHNICAL APPENDICES

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APPENDIX 2.A
CEMP

APPENDIX 2.A - OUTLINE CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN (OCEMP)

Fishguard Linkspan Replacement







Outline Construction Environmental Management Plan (oCEMP)

Fishguard Linkspan Replacement

V01
May 2025

Natural Resources Wales (NRW) Pollution Prevention Hotline Number 0300 065 3000

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1 INTRODUCTION

1.1 Purpose of this Document

This document is an Outline Construction and Environmental Management Plan (OCEMP) and contains all the appropriate environmental mitigation and management techniques to help ensure no significant impacts are caused to the environment during the construction phase of the Proposed Development. It is a **'live'** document and may be updated as the project progresses. This OCEMP sets out the minimum requirements which will be adhered to during the construction phase of the Proposed Development.

1.2 The Proposed Development

Stena Line operate a ferry terminal in Fishguard, Wales. Vehicles embark/disembark the ferries via a temporary linkspan structure which is nearing the end of its useful life. To safeguard the port and provide a safe, long-term solution, Stena wish to replace the existing temporary arrangement with a floating linkspan pontoon.

The application site is located within Goodwick/Fishguard, Pembrokeshire (central grid reference 195171.227: 238812.970). The site is a parcel of land spanning an area of approximately 36 hectares of the harbour, to include the existing linkspan, hinterland and within the bay foreshore. The port was created in the 1910s by reclaiming land at the base of the headland.

The Proposed Development location is illustrated in Figure 1.1**Error! Reference source not found.**.



Figure 1.1: Site Location

1.3 Key Components of the Proposed Development

The project involves several key activities aimed at enhancing the infrastructure and operational capabilities of the harbour. These include the following:

- Demolition of
  - Disused RNLI slipway structure
  - Buffer Dolphin
  - Suspended deck structure
  - 3 No. small disused kiosks
- Removal of
  - Linkspan bridge, equipment and cabin
  - Jack up barge
- Dredging with disposal at sea
- Reclamation
- Scour protection to the berth and dredged slope to the rear of the berth.
- Piled Reinforced Concrete Bankseat
- Tubular Steel Guide Pile
- Floating pontoon linkspan installation
- Terminal reconfiguration
- Temporary Works

The schematic diagram shown in Figure 1.2 below identifies the main components of the Proposed Development which will constitute the replacement linkspan.

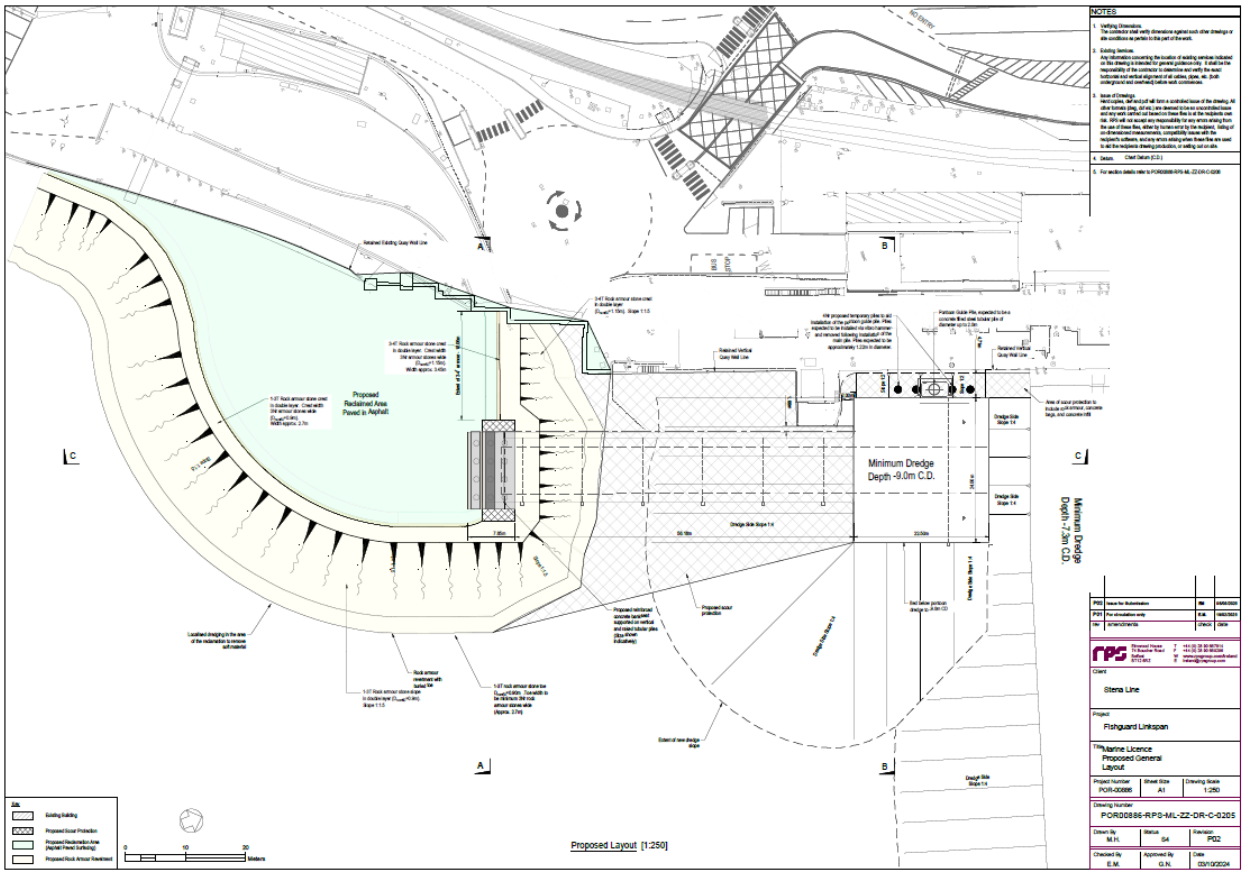


Figure 1.2: Layout showing proposed reclamation works and linkspan and dredging at berth overlaid on existing arrangement.

2 DEFINING THE OCEMP

2.1 Purpose of the OCEMP

An OCEMP is a key tool for delivering environmental management during the construction phase. It sets out the mechanisms by which the various construction activities would be managed to comply with the relevant environmental legislation and best practice to minimise the impacts and effects on human receptors and environmental receptors.

It provides the framework for recording environmental risks and also defines the measures required to mitigate and monitor construction effects, including the mitigation measures set out in the associated supporting environmental documents and assessments. It also outlines provisions for auditing and reporting and sets out action to be taken to resolve any corrective actions arising during the course of construction. The purpose of the OCEMP is to:

1. **record environmental risks and identify how they would be managed during the construction period;**
2. **provide a means of identifying environmental commitments, objectives and targets;**
3. **provide a means of monitoring and reporting performance against the objectives and targets;**
4. **provide a framework to ensure that all parties are aware of their responsibilities;**
5. **establish a checklist of control procedures which can then be integrated into an overall environmental management protocol;**
6. **describe how construction activities would be undertaken and managed in accordance with the obligations of environmental legislation and policy, and the requirements of environmental regulatory authorities;**
7. **provide detailed environmental mitigation measures for reducing the potential for environmental impacts during pre-construction and construction;**
8. **highlights that some activities may require consents or licences;**
9. **act as a link and main document reference for environmental issues between the design, and construction stages; and,**
10. **ensure the mitigation requirements of the associated environmental assessments (contained in supporting environmental documents for the planning application) are met.**

The Appointed Contractor is required to develop and implement a CEMP to help ensure that construction activities are planned and managed in accordance with the environmental requirements. The contractor will use this OCEMP as the template for their own individual CEMP.

2.2 Scope of the OCEMP

The scope of the OCEMP covers all environmental effects related to the construction of the Proposed Development. The term 'construction' in the OCEMP includes all site preparation, earthworks, waste removal and related engineering and construction activities as authorised by the local authority and associated permissions. The OCEMP will document the Contractor's plans to ensure compliance with their legal and contractual obligations as well as implement best practice in construction environmental management. The OCEMP will be applicable to all works associated with the Proposed Development including those carried out by sub-contractors.

2.3 Status of the OCEMP

The status of the OCEMP is as follows:

1. This document comprises the OCEMP and has been prepared during the preliminary design and in parallel with submission of full planning application stage of the Proposed Development.
2. The OCEMP (and adopted version before onsite works i.e. CEMP) is a 'live' document that can be reviewed on a regular basis and updated where necessary to include the further requirements from the local authority.
3. The CEMP would identify any further mitigation methods and control measures to be agreed with key stakeholders, including NRW and District Council and would be in place before construction begins.
4. During construction, the CEMP may be revised to take into account any modifications to the design, changes in external factors (for example, regulations or standards), any unforeseen circumstances, and any failings in environmental performance arising from routine inspections.
5. The provisions of the OCEMP would be incorporated into the contracts for construction of the Proposed Development. It would be a mandatory requirement for both the Principal Contractor and all subcontractors to comply with the OCEMP to ensure that best practice is implemented during construction and to safeguard the environment.
6. The requirements of the OCEMP do not remove or overwrite the legal duties, responsibilities or obligations of the Principal Contractor (and subcontractors) and other parties in accordance with the contract documents and legislation.
7. The CEMP is the mechanism for ensuring that the Proposed Development adopts relevant best practice management techniques for sustainable construction.

2.4 Structure of the OCEMP

The following appendices are included in the OCEMP:

- **Appendix A: Proposed Site Plan, Sections and Elevations**
- **Appendix B: Environmental Inspection Schedule**
- **Appendix C : Complaints Form**
- **Appendix D: Incident Report Form**
- **Appendix E: Site Waste Management Plan**
- **Appendix F: Construction Method Statement**
- **Appendix G: Pollution Prevention Plan**
- **Appendix H: Emergency Response & Environmental Plan**

3 ROLES AND RESPONSIBILITIES

3.1 Introduction

The Project Manager/Construction Manager would have overall responsibility for the construction of the Proposed Development. A full-time Environmental Manager would be responsible for developing the OCEMP and implementing the CEMP (and its various potential iterations as it is a **'live'** document) during construction.

Other members of the project team would be assigned specific roles to assist the Project Manager in the implementation of the OCEMP and individual specialists would be appointed to provide expert advice. The key environmental roles and responsibilities are in the sections that follow.

The assigned environmental roles and responsibilities for the relevant project personnel are detailed in this section.

For a project like this development the environmental officer role maybe combined with the site manager role due to the size of the project and development area. All roles are still listed for completeness.

3.2 Construction Director

The Construction Director will have an overall responsibility for the organisation and execution of all related environmental activities as appropriate, in accordance with regulatory and project environmental requirements. The principal duties and responsibilities of this position will include:

1. Overall responsibility for the Proposed Development and implementation of the CEMP;
2. Allocating resources to ensure the implementation of the CEMP;
3. Participates in the management review of the CEMP for suitability, adequateness and effectiveness; and,
4. Sets the focus of environmental policy, objectives and targets for the Contractor.

3.3 Construction Manager/Site Manager

The Construction Manager/Site Manager is directly responsible to the Construction Director for the successful execution of the project. The principal duties and responsibilities of this position will include:

1. To report to the Construction Director on the on-going performance of the CEMP;
2. To discharge his/her responsibilities as outlined in the CEMP; and,
3. To support and augment the Environmental Officer through the provision of adequate resources and facilities in the implementation of the CEMP.

3.4 Environmental Officers

The Environmental Officer will be responsible for, but not limited to, the following activities:

1. Ensuring that the requirements of the CEMP are developed and environmental system elements (including procedures, method statements and work instructions) are implemented and adhered to with respect to environmental requirements;
2. Reviewing the environmental responsibilities of other managed Contractors in scoping their work and during contract execution;
3. To ensure that advice, guidance and instruction on all CEMP matters are provided to all their managers, employees, construction contractors and visitors on site;
4. Report to the Construction Manager on the environmental performance of Line Management, Supervisory Staff, Employees and Contractors;
5. Advise site management (including, but not limited to, the site Construction/Commissioning Manager) on environmental matters;

6. maintaining environmental records;
7. providing guidance for the site team in dealing with environmental matters, including legal and statutory requirements affecting the works;
8. reviewing environmental management content of method statements;
9. reporting environmental performance to the Site Manager;
10. liaison with statutory and non-statutory bodies and third parties with an environmental interest in the Proposed Development;
11. Monitoring and completing the waste register and ensuring the correct waste management procedures are implemented (An example Site Waste Management Plan (SWMP) is set out in Appendix E);
12. Implementing and maintaining environmental controls on site. (Refer to Appendix B Environmental Inspection Schedule and details of what is included in method statements are set out in Appendix F).
13. Attending to any spills or environmental incidents that may occur on site. (Refer to Appendix G Pollution Prevention Plan, Appendix H Emergency Response & Environmental Plan);
14. Undertake site environmental monitoring and walk overs (Refer to Appendix B Environmental Inspection Schedule);
15. Ensuring correct procedures are followed in the event of environmental incidents (Refer to Appendix D Incident Report Form and Appendix H Emergency Response & Environmental Plan).

3.5 Site Supervisors

Site Supervisors are required to:

1. Promote a Health & Safety culture on site, to read, understand and implement the CEMP;
2. Know the broad requirements of the relevant law in environmental matters and take whatever action is necessary to achieve compliance;
3. Ensure that environmental matters are taken into account when considering Contractors' construction methods and materials at all stages;
4. Be aware of any potential environmental risks relating to the site, plant or materials to be used on the premises and bring these to the notice of the appropriate management;
5. Ensure plant suggested is environmentally suited to the task in hand;
6. Co-ordinate environmental planning of all construction activities to comply with environmental authorities' requirements and with minimum risk to the environment. Give Contractors precise instructions as to their responsibility to ensure correct working methods where risk of environmental damage exists;
7. Where appropriate, ensure Contractors method statements include correct waste disposal methods;
8. Be aware of any potential environmental risks relating to the Contractors and bring these to the notice of the appropriate management; and,
9. Ensure materials/waste register is completed as appropriate.

3.6 Site Personnel

All Contractors, and other site personnel, on the project will adhere to the following principal duties and responsibilities:

1. To support and promote the Health & Safety culture on site.
2. To co-operate fully with the General Contractor and the Environmental Officer in the implementation and development of the CEMP at the site;
3. To conduct all their activities in a manner consistent with regulatory and best environmental practice;
4. To participate fully in the environmental training program and provide management with any necessary feedback to ensure effective environmental management at the site; and,
5. Adhere fully to the requirements of the site environmental rules.

3.7 Team Structure & Distribution List

All personnel working on the project will be responsible for the environmental control of their own work and will perform their duties in accordance with the requirements of the CEMP (as updated) and in compliance with the controls referenced therein.

A distribution list for the CEMP should be developed when all contact names and companies are known. The purpose of the distribution list is to establish communication channels that will enable more effective control of environmental-related issues. The distribution list should identify individuals and organizations that have received or will receive a copy of the construction stage CEMP for implementation.

Individuals of importance could include the developer, the environmental consultant, lead contractors, subcontractors, and any appointed environmental managers (or other identifiable titles for the persons in charge of implementing the contents of the construction stage CEMP).

The distribution list will be established prior to commencement of construction by the appointed contractor. Prior to commencement of construction, all roles and responsibilities should be confirmed in the CEMP as updated. Table 3-1 shows a template for project roles and responsibilities and can act as a template for the distribution list for the CEMP.

Table 3-1: Role, Company, Named Contact & Contact Details

ROLE	COMPANY	NAMED CONTACT	CONTACT DETAILS
Construction Director	Write name of company here	Write name of person here	Write phone number here
Construction Manager	Write name of company here	Write name of person here	Write phone number here
Environmental Officer	Write name of company here	Write name of person here	Write phone number here
Site Supervisors	Write name of company here	Write name of person here	Write phone number here
Site Personnel	Write name of company here	Write name of person here	Write phone number here
Health & Safety Representative (May be combined with Construction Manager role)	Write name of company here	Write name of person here	Write phone number here
Other specialists as required (e.g. geotechnical , drainage/civil engineer)	Write name of company here	Write name of person here	Write phone number here
Other specialists as required (e.g. geotechnical , drainage/civil engineer)	Write name of company here	Write name of person here	Write phone number here
Other specialists as required (e.g. geotechnical , drainage/civil engineer)	Write name of company here	Write name of person here	Write phone number here
Other specialists as required (e.g. geotechnical , drainage/civil engineer)	Write name of company here	Write name of person here	Write phone number here
Other specialists as required (e.g. geotechnical , drainage/civil engineer)	Write name of company here	Write name of person here	Write phone number here
NRW Pollution Prevention Hotline	**NRW's Pollution Prevention Hotline Number** **0300 065 3000** **Any spillages / pollution incidents should be reported to the NRW water pollution hotline within 30 minutes of the incident occurring unless it is not safe to do so**		

The Principal Contractor as appointed has ultimate responsibility for the successful environmental performance of the Proposed Development through appointment and management of subcontractors and environmental specialists, as required, as detailed in Table 3-1. Specifically, this includes:

1. **Principal Contractor & all sub-contractors** will need to comply with all relevant environmental legislation when carrying out work on the site;
2. **Definition** of environmental standards and requirements for the contractors throughout the contract stages;
3. **Acting as a point of contact** for consultation and feedback with landowners/occupiers, statutory and non-statutory consultees, other interested parties and the public;

4. **Auditing** of the performance of sub-contractors;
5. **Environmental monitoring and reporting (in conjunction with Environmental Officer)** - Environmental issues relevant to the project will be discussed during weekly Site Progress Meetings attended by the Site Manager and Environment Manager. Environmental performance will also be discussed at regular HSEQ meetings. This will include dissemination and discussion of the findings of audits, environmental reports and other inspections where appropriate. Other responsibilities are as follows:
6. **Health and Safety** - The site will be managed by a full time project management team who will be responsible for the Health and Safety of all personnel on site.
7. **Site Rules** - All personnel must comply with the rules and regulations laid down in the appropriate site rules.
8. **Induction and signing in and out** - All visitors to the site will be required to sign in and out and all personnel working on the site will be subject to an induction by the Principal Contractor.
9. **Training** - All construction staff, including sub-contractors, would receive structured training on the requirements of the CEMP and the associated environmental control plans, as developed. They would also be required to attend a site induction which would include the key environmental issues identified for the Proposed Development. The briefing would emphasise the methods and working practices which must be employed to protect the environment, including emergency procedures for reporting and dealing with environmental incidents. Records of training and those attended will also be retained.

4 COMMUNICATIONS

Effective communication is essential to ensure the appropriate employment of environmental standards and relaying of information, reports/assessments, and data. It shall be the responsibility of the Principal Contractor(s) to ensure that effective communication, in relation to this document, is carried out. The following points are some of the key forms of communication required:

1. Statutory and Non-Statutory Bodies - During the construction works, communication may be required with external parties such as, statutory authorities, interest groups and the public/business owners. Communication may take the form of scheduled meetings, site visits and written correspondence. As the project progresses, there may be a requirement by the client, his representatives, and the Contractor to clarify potential issues with relevant statutory bodies.
2. Detailed in Table 4-1 is a list of statutory bodies with an environmental remit within Wales and the local authority area who may require consultation – during the construction phase of the project. Also provided is a link to their internet sites from which useful information and contact details of these organisations can be obtained. This list will be reviewed by the Contractor, added to or amended if required.
3. Public/businesses - The Principal Contractor's Project Manager shall ensure that the public/businesses are kept informed of operations that may have an effect upon them. This may involve letter drops and meetings to keep local commercial premises owners up to date with progress with the Proposed Development and any new operations that are to be carried out. The Site Manager will provide details of contacts within the project team for the public/businesses to contact should any issues arise.
4. Consents, Licences and Permits - The provisions for controlling, pumping and discharging water will be agreed with the Natural Resources Wales (NRW). The Contractor will ensure that any licences required are in place.
5. Changes in legislation or guidance - Legislative changes or proposed improvements to manage processes on site that have a bearing on the commitments given in the supporting environmental documents or other consultations will be communicated by the Site Manager to the Client and;
6. Meetings & Records - Environmental issues relevant to the project will be discussed during weekly Site Progress Meetings attended by the Principal Contractor's Project Manager and Environment Manager. Environmental performance will also be discussed at regular HSEQ meetings. This will include dissemination and discussion of the findings of audits, environmental reports and other inspections where appropriate.

Table 4-1: List of Statutory Bodies with an Environmental Remit within Wales

Organisation	Web link
Natural Resources Wales	https://naturalresources.wales/?lang=en
National Infrastructure Planning	https://infrastructure.planninginspectorate.gov.uk/projects/wales/
Natural Resources Wales – Flooding	https://naturalresources.wales/flooding/?lang=en
Natural Resources Wales - Fisheries	https://naturalresources.wales/guidance-and-advice/business-sectors/fisheries/?lang=en
Dŵr Cymru Welsh Water	https://www.dwrcymru.com/en
Senedd Cymru - Communities and regeneration	https://www.gov.wales/communities-regeneration
Pembrokeshire County Council	https://www.pembrokeshire.gov.uk/

5 CONSTRUCTION TIMEFRAME

5.1 Introduction

This section describes the methods to be employed for the construction of the proposed development.

5.2 Health and Safety Requirements / Considerations

The Contractor will ensure that adequate welfare facilities are available within the red line boundary, where works have a duration more than 1 day or when multiple 1 day work durations occur at any location: Facilities will include as a minimum:

- Sanitary conveniences
- Washing facilities (including hot and cold running water)
- Provision of drinking water
- Changing rooms and lockers
- Facilities for rest.

Where the duration of works is less than 1 day, facilities can be shared with another work site provided that those facilities are located less than 10 minutes from the work site. Local amenities shall not be permitted to be used for planned facilities.

5.3 Construction Programme

The construction programme is expected to be 9 months in total, with a 3 month shutdown window for the demolition works, dredging in the vicinity of the existing jack up barge, linkspan installation and the completion of the terminal reconfiguration works.

It is anticipated that port operations will continue during the initial construction works, however the port will close with ferry operations suspended during the 3 month shutdown period.

5.3.1 Construction Sequence – During Ferry Operations

The construction sequence during ferry operations are detailed below:

1. Demolition of RNLI slipway
2. Dredging in the wider harbour and outside the area of the jack up barge
3. Reclamation and revetment construction and paving works
4. Road furniture and fencing
5. Bankseat piling and concrete works
6. Pavement construction and tie in to existing
7. Guide Pile installation (including installation and removal of temporary piles)

5.3.2 Construction Sequence – While Ferry is suspended

The construction sequence during while ferry operations are suspended are detailed below:

1. Demolition of Buffer Dolphin
2. Demolition of Suspended Slab
3. Installation of Linkspan
4. Remove hydraulic Linkspan and Jackup Barge
5. Dredge beneath of Jackup Barge
6. Drainage and connection to the existing network

7. Completion of the pavement works to reclaimed area and rock armour
8. Scour protection

5.4 Construction Hours

The Port currently operates 24 hours per day, 7 days a week. Due to the 3 month shutdown to the ferry service, it is expected that work during the construction stage will be 24hrs/day 7 days per week.

5.5 General Site Set Up

The following will be considered during site mobilisation:

5.5.1 Site Construction Compound

An area will be required for the establishment of the Contractor's site compound. The site compound will be used for the Contractor's site office accommodation, welfare facilities and temporary storage of construction materials. Two potential areas have been identified. Area 1 is sited along the eastern edge of the Terminal area. The area is currently in use as a carpark for staff and passengers. It is envisaged that this area could be used throughout works for site cabins and parking. Area 2 comprises a large area of gravel on the north end of the Port which is currently in use for overflow parking for trailers and machinery could be utilised.

It is not expected that the use of either or both of these areas would adversely affect the operation of the terminal.

The construction site should operate within a secure hoarded compound site in line with Construction Design and Management Regulations 2015 and will be controlled by the Principal Contractor. All access will be monitored and recorded. All construction support activities will be controlled within the site construction compound including office facilities, toilets, canteen etc. Materials and waste handling and storage will be within the confines of the site. The work area will be protected from the public at all times. CCTV may be installed and compliant Health & Safety information signs will be installed. The external façade of the solid hoarding panels will have a mix of Health & Safety warning signs. The site compound will be positioned away from any exclusion zones and located in a safe and convenient area.

All construction plant and materials shall be stored within the curtilage of the site.

5.5.1.1 Plant and Equipment

Plant and machinery would be used for the construction activities involved in the development of this site. The choice of plant and machinery will be made by the Principal Contractor, this is likely to include at least the following:

- 360º tracked excavator
- Dumper
- Concrete crusher
- Ready-mix concrete lorries
- Concrete splitters and concrete saws
- Cutters, drills and small tools
- Hydraulic excavators
- Skip lorries
- Tracked bulldozers
- Road rollers
- Pneumatic drills / hammers (hand held and on back of excavators)
- Cement mixers

- Generators
- Pumping equipment
- ‘Cherry Pickers’ / Mobile Platforms
- Cranes

5.5.1.2 Deliveries

Delivery of equipment and materials will be carefully controlled and managed at the site. Access and egress to the proposed area will be managed by the Principal Contractor. Delivery times will be planned in advance.

There will be occasions whereby materials are needed to be delivered to site, a banksman will be in place to ensure safe access is provided. The times of deliveries will be limited to arrive on site during off peak periods of time.

There will be periods of time during the construction programme whereby larger equipment is needed to construct the building including cranes required for installation of the steel frame and cladding for the building.

5.6 Construction Access and Traffic Management Requirements

5.6.1 Vehicular Access & Egress

With the exception of ferry operations, other port activities will continue to operate throughout the works. This includes any small craft which regularly use the Port.

Access to the site will be via Station Hill roundabout which can be accessed at Quay Road from Goodwick in the West or via the Parrog/A40 from Fishguard town in the East. Construction related traffic will use the Stena Ferry Terminal entrance via Station Hill which is accessed from the main centre of Fishguard. Construction traffic is most likely to arrive from Fishguard town direction, as it is the main commuter road from inland cities and towns within Wales.

Suitable traffic management and other systems will be put in place as required to minimise disruption to existing activities within the Stena Line port during the construction period.

The town itself should not be majorly affected by construction traffic; however, shipping and fishing vessels may be interrupted during the construction works.

A suitable vehicle turning area within the site will be provided to enable all vehicle movements onto or from the public road to be carried out in forward gear. It is assumed typical construction traffic will comprise of tipper lorries, articulated low loaders and plant delivery. It is not anticipated that any specialist vehicles will be required to serve the Site.

A speed limit will be implemented on Site to reduce the health and safety risk due to the movement of construction traffic. It is proposed that temporary signage be located in the vicinity of the site access during the construction period to warn drivers of the site entrance, as shown in Figure 5.1 below.



Figure 5.1: Temporary Signage at Site Access



Figure 5.2: Temporary Signage to be Located at Site Access

The logistic management team would organise and plan prescribed delivery times to ensure that busy roads do not become congested with frequent material deliveries.

5.6.2 Anticipated Types of Construction Vehicles

Typical construction deliveries would comprise, ready mix lorries, articulated low loaders, plant delivery and rigid vehicles. It is not anticipated to require any specialist vehicles to serve the Site. However, if an abnormal load is required prior notice would be agreed with the police, highway and other relevant authorities. Following this, appropriate routing requirements would be agreed.

5.7 Services

Note that in relation to working near services such as electricity, gas, water etc, liaison will take place with the service provider.

All utility services discovered adjacent to the site will be treated as "live" until proven otherwise and the co-ordination of switchovers and temporary disruptions for new constructions will be undertaken in accordance with the standard procedures of the relevant statutory authorities.

5.8 Lighting

Depending on when construction works occur there could be a need in the winter months for some mobile lighting columns to illuminate works area/compounds.

Throughout the construction phase, adherence to high standards of Health and Safety for all construction workers, site visitors and members of the public will be of paramount importance. All construction activities will take place in the context of the relevant Wales Health and Safety legislation.

As such, it is important that the construction site is secured adequately to ensure that uncontrolled access e.g. by children or vandals, is restricted as much as possible. As well as the potential health and safety risk from uncontrolled access, it is recognised that one of the biggest causes of pollution events from construction sites is due to the activities of vandals.

6 ENVIRONMENTAL PERFORMANCE MANAGEMENT

6.1 Environmental Risk Register

The Environmental Manager/Officer should prepare and maintain an Environmental Risk Register having regard for legal requirements, project environmental commitments the potential for aspects of works to cause significant environmental impact.

The Environmental Manager should record responsibilities assigned for actions required for mitigation and control of the environmental risks in the Environmental Risk Register.

The Environmental Risk Register will be subject to regular review by the Environmental Manager together with the Site Manager.

6.2 Consents

Copies of legal consents, permits and licences obtained will be held in the site environmental file by the Environmental Manager.

6.3 Method Statements and Risk Assessments

Specific environmental risks will be assessed during preparation of method statements. Actions and environmental constraints associated with specific construction operations will be included in method statements, field control sheets and activity plans where appropriate. Generic environmental requirements will be included in all method statements. Details of what should be included in method statements are set out in **Appendix F**.

6.4 Inspections

Routine inspections to check that pollution control measures are in place will be undertaken by the Environmental Manager, who will produce weekly inspection reports. Daily inspections will be made by the supervisors during each shift and any environmental problems or risks that are identified will be actioned as soon as is reasonably practicable. Any issues arising from the daily inspections will be notified to the Environmental Manager. **Appendix B** of this OCEMP details an example environmental inspection schedule.

6.5 CEMP Review Programme

The CEMP is a **'live'** document that will be updated by the Contractor and reviewed by the Environmental Manager on a monthly basis as a minimum. The CEMP will also be reviewed following any environmental incidents which require the works methods to be updated or changed.

6.6 Notices of Non-Conformance

In instances where the requirements of the CEMP are not upheld a non-conformance and corrective action notice/procedure will be produced. The notice/procedure will be generated during the inspections conducted by the Supervisors, the Site Manager, Environmental Manager or any external third-party audits.

The Site Manager will be responsible for ensuring a corrective action plan is established and implemented to address the identified shortcoming. An incident report form is set out in **Appendix D**.

6.7 Complaints Handling

The response to any complaints will be managed by the Site Manager, who will inform the Environmental Manager of any environmental complaints. A Complaints Register will be maintained to detail the name and contact details of the complainant, date and time of the complaint, nature of complaint, action taken to resolve issues, and date of complaint handover.

The Environmental Manager will ensure that all environmental complaints and concerns will be responded to in 24 hours. An example complaints form is contained with **Appendix C** of this OCEMP.

6.8 Key Performance Indicators and Objectives

The Contractor should set environmental objectives in order to continuously improve environmental performance on the site. The Contractor will set objectives based on each significant environmental impact and they will be reviewed, and revised if necessary, on a monthly basis. Procedures, monitoring requirements and key performance indicators will be measured against achievable targets.

7 POLLUTION PREVENTION

7.1 Guidance for Pollution Prevention

Guidance for Pollution Prevention (GPPs) provide environmental good practice guidance for the whole UK, and environmental regulatory guidance directly to Northern Ireland, Scotland and Wales. Guidance for Pollution Prevention (GPP) documents are based on relevant legislation and reflect current good practice. Following this guidance will help you manage the environmental responsibilities to prevent pollution and comply with the law.

If you cause pollution or allow it to occur, you may be committing a criminal offence. Following these guidelines will help you reduce the likelihood of an incident. If an incident does occur contact NRW's Incident Hotline on **0300 065 3000**. The Guidance for Pollution Prevention series (GPPs) have been developed in relation to a variety of activities by the Environment Agency (EA), the Scottish Environmental Agency (SEPA) and the Northern Ireland Environment Agency (NIEA).

GPPS are downloadable in full from this link: http://www.netregs.org.uk/environmental-topics/pollution-prevention-guidelines-ppgs-and-replacement-series/guidance-for-pollution-prevention-gpps-full-list/

7.1.1 GPP01 Understanding your Environmental Responsibilities – Good Environmental Practices

For Northern Ireland, Scotland and Wales, this document provides guidance on environmental legislation. The basis of any good environmental performance is compliance with environmental regulations. You must be aware of your environmental responsibilities and make sure that you operate in a completely legal way.

The site and activities will only cause a risk to the environment or people if it has all three parts of the pollutant linkage present i.e. a source, a pathway and a receptor. Measures should be put in place to prevent or minimise or mitigate the effects of any risks and thereby break the pollutant linkages between these three.

It offers advice on drainage from site. Drains are common pathways for dirty water to enter the environment and cause pollution so it should be known where drains are situated and where they lead to reduce the risk of pollution. All premises should have a drainage plan to guide any activities. This guidance covers on-site water treatment facilities such as septic tanks, package treatment plants or oil separators. It also mentions Sustainable Drainage Systems (SuDS) which can be used to treat lightly contaminated water.

Safe storage of fuels, oils, chemicals and other materials can be achieved by planning storage areas, using suitable containers, containing leaks and spills and overseeing deliveries. GPP 01 also contains information on waste handling, storage and minimisation as poorly managed wastes, including both direct and indirect waste, can pollute the environment. In this context everyone has a duty of care to ensure waste is produced, stored, transported and disposed of without harming the environment. Hazardous or special waste must be dealt with differently to non-hazardous waste. It also covers how to correctly dispose of your waste and measures that must be taken.

Dealing with pollution incidents starts with preparation, planning and training which is discussed in this guidance. It recommends the implementation of plans, analysing risks such as flood and fire risks and having spill kits and pollution control equipment at the ready to ensure that everybody knows what to do in the case of an emergency. Following the guidance in this GPP can help reduce or eliminate the negative impacts that may arise.

A way of ensuring awareness of impacts is to develop a suitable Environmental Management System (EMS). An environmental management system (EMS) is similar to other management systems, such as those that manage quality or safety. It assesses business' strengths and weaknesses and helps identify and manage environmental risks/opportunities. This guidance covers the different types of EMS.

7.1.2 GPP02 Guidance for Pollution Prevention Above Ground Oil Storage Tanks

This Guidance for Pollution Prevention is written for anyone who:

- Intends to install or replace above ground oil storage tanks

- Has existing oil storage tanks on their site to help look after their oil safely.

Following this guidance will help look after above ground oil storage tanks safely and minimise the risk of causing pollution.

Oil is one of the most common pollutants in the UK therefore it is important to have adequate insurance cover which should include:

- environmental clean-up for accidental oil loss, or deliberate oil loss through vandalism
- a high enough liability limit to cover you if neighbouring land, premises and/or boreholes are affected
- the costs of cleaning up oil on your own property.

Insurers may not settle a claim if the oil tank and associated pipework which leaked did not comply with the applicable oil storage regulations. In Wales, oil storage regulations primarily concern above-ground storage of oil and aim to prevent pollution and ensure safety. These regulations apply to any container holding over 200 litres of oil, including various types like diesel, petrol, vegetable oil, and waste oil, used for both agricultural and business purposes. The key requirement is the use of secondary containment, like a bund, to prevent leaks from escaping into the environment.

Oil tanks connected to fixed combustion appliances, like central heating boilers and cookers, need to comply with the building regulations that apply in the UK which are discussed in section 4.2 of this GPP. When deciding where to put the tank, environmental high-risk locations should be avoided and areas at risk from flooding. It is important to check which type of oil storage is best suited, recommendations for which are included within the guidance.

There are manufacturing and quality standards for different types of tanks and your tank manufacturer, supplier or installer should advise you on the minimum design and manufacturing standards under the appropriate accredited quality assurance scheme. It should comply with BS EN ISO 9001. More details on compliance is covered in section 6 of this GPP as well as the types of oil storage tanks. These include single skinned tanks, double skinned tanks and integrally bunded tanks.

It may be a legal requirement to have secondary containment or bunds, which must hold at least 110% of the volume of oil the tank is designed to contain. Further guidance on secondary storage can be found in section 6.3 and 6.4 of this GPP.

Tanks should be installed by a competent person who is registered with a professional scheme for the type of tank you’re having installed. Further advice on tank installation, appropriate base or supports, placement, and tanks within buildings is found within section 7 of this GPP.

Ancillary equipment is covered in section 8 and discusses how to measure tank contents, including information on sight gauges and oil deliveries. Valves, filters, sight gauges, vent pipes, or other tank ancillary equipment, not including the fill pipe, draw-of pipe or pumps for oil with a flashpoint less that 32^{o}C, must be within the secondary containment system, so any discharges of oil are retained. In terms of pipework, it is suggested that underground pipework is avoided where possible. All above ground pipework must be protected against corrosion, positioned or protected to minimise the chances of damage by impact or collision and supported so it is secure and can’t come loose. Further information on pipework including the vent pipe, fill point, supply pipe, taps and valves, and overfill prevention devices are outlined in section 9 of this guidance.

It is essential to ensure safe deliveries to the tank. Tanks should be labelled with the capacity and type of oil they contain. The area around your tank where deliveries are made and, if applicable, oil is dispensed should have an impermeable surface and be isolated from surface water drainage systems. More information is outlined in section 10 of this GPP.

It is important to monitor the legal compliance of existing tanks with Building regulations or OSR, Scotland, England or Wales.

Section 12 covers tank maintenance including aspects such as removing rainwater and recording oil usage and relevant regulations across the UK. It also covers how to correctly disconnect and dispose of old tanks. As well as tanks mobile bowsers can be used to store oil. Mobile bowsers are oil storage containers that can dispense oil and are designed to be moved, either being towed or lifted onto another vehicle, but which can’t move under their own power. Requirements for these are available within this guidance.

Oil storage areas should be secured to prevent theft and vandalism. Permanent taps or valves through which oil can be discharged to open areas should be locked when not in use. Display a notice telling users to keep valves, nozzles and trigger guns locked when they’re not in use. Pumps should also be protected from

unauthorised use. If the Oil Storage Regulations apply, you must ensure you protect the containers and the secondary containment system.

In the event of an oil spill, take immediate action to stop the oil getting into any drains or watercourses or soaking into the ground, as per Figure 7.1. Keep a spill kit with commercial sorbent products, sand or earth close to oil storage areas to deal with spills. Make sure all personnel know how to use it safely. If oil soaks into the ground, a professional company should remove the soil soaked in oil, so it doesn't cause long term pollution.

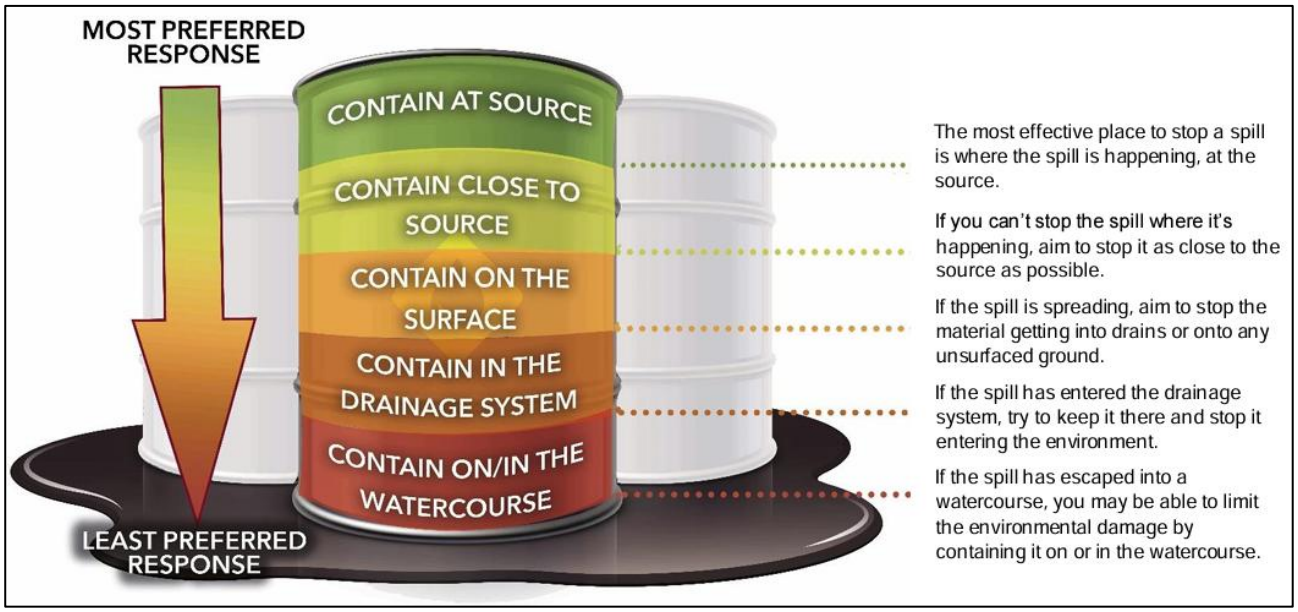


Figure 7.1: Pollution Control Hierarchy

7.1.3 GPP 03 Guidance for Pollution Prevention Use and Design of Oil Separators in Surface Water Drainage Systems

Oil separators (also known as oil interceptors) are fitted to surface water drainage systems to prevent pollution from oils and to prevent disruption to sewage treatment works. They are designed to separate the oil from the water, and to collect the oil for removal. They can be installed at the point where potentially contaminated water leaves a site, and protect water courses, groundwater, land, Sustainable Drainage Systems (SuDS) or the sewer system. They are often used to contain leaks from vehicles and plant, and where oils are handled and accidental spills are possible.

They are used anywhere there is a risk of oil entering surface waters or sewers from rainfall runoff, petrol station forecourts or vehicle refuelling sites, or any other site where there is a risk of oil contamination.

SuDS can be used to manage runoff from site and can reduce the overall impact on the environment. On High-risk sites they can provide further treatment below an oil separator. SuDS should be considered on all sites. The guidance covers other techniques for low risk and high risk sites as well as what to do in terms of discharges from sites.

In many cases sites change ownership and there is often little information available on the size, type, condition or even existence of separators. New owners or tenants of a site, should establish Baseline Asset information to confirm that any separator/s present on site are fit for purpose and adequately sized and type for the current activities.

Existing sites may move site boundaries, change or move processes on site. Sites should be re-assessed for separator requirement when any significant changes are undertaken to ensure adequate protection is provided.

The UK has adopted a two-part European Standard (BS EN 858-1:2002 and BS EN 858- 2:2003) for the design, use, selection, installation, operation and maintenance of prefabricated oil separators. It must be ensured that these standards are adhered to with when fitting an oil separator. There are Class 1 and Class 2 separators which are explained in section 4.1 of this GPP. Information on full retention separators and bypass separators is also found within this guidance and when they are likely to be used.

Separators must have automatic warning devices or alarm systems to provide visual and audible warning (if necessary to a remotely located supervisory point) when the level of oil reaches 90 per cent of the oil storage volume under static liquid level conditions. This automatic warning device tells the operator that the separator is in need of immediate emptying for it to continue to work effectively. More details are found in section 4.5.2 of this GPP.

All separators that comply with the European Standard will have been given a nominal size (NS) based on a standard test procedure. The formulae to calculate the nominal size of both a bypass separator and a full retention separator can be found within this guidance as well as the formulae to calculate both the oil storage capacity and silt storage capacity. The minimum working capacity (which excludes any provision for silt deposition) of a separator should be 1,000 litres; though for forecourts, it is likely that risk assessment will indicate the need for a larger separator. For bypass separators, the minimum capacity is defined as the working capacity of the oil separating chamber only.

Information on installation and labelling is found in section 6 of this GPP. It provides a criteria of what information labels should contain.

To prevent pollution and minimise your costs, you need to manage your separator effectively. Every six months, or in accordance with manufacturer's instructions, experienced personnel should:

- Physically inspect the integrity of the separator and all mechanical parts
- Assess the depth of accumulated oil and silt
- Service all electrical equipment such as alarms and separator management systems
- Check the condition of any coalescing device and replace it if necessary
- Clean the sampling shaft if required.

It covers waste management with reference to the Duty or Care for waste legislation. This section reinstates points from GPP 01 such as dealing with hazardous waste.

7.1.4 GPP05 Guidance for Pollution Prevention Works and Maintenance In Or Near Water

This guidance is for anyone carrying out works or activities in or near the water environment. Such activities have the potential to cause pollution, transfer non-native species and can impact on the bed and banks of a watercourse.

Potential environmental risks when working in or near water include:

- Silt
- Cement and concrete
- Chemicals and solvents
- Bridge cleaning debris
- Herbicides
- Invasive Non-Native Species
- Waste materials

Even if the works that are carrying out are required because of an emergency, this Guidance for Pollution Prevention should be followed as closely as possible.

Good soil use and management is crucial to preventing silt pollution which is a major cause of environmental incidents. It can harm water quality, damage and kill aquatic life by smothering and suffocation and can cause flooding by blocking culverts and channels.

Activities that cause silt pollution include:

- Run-off from exposed ground/stockpiles
- Plant washing, roads and river crossings
- Dredging

- De-watering/ pumping excavations

Where run off water is contaminated with silt or other pollutants such as oil this water must not be pumped or allowed to flow (directly or indirectly) into the water environment without treatment. Discharges to the water environment may require formal approval from the environmental regulator – see section 1 of this GPP. The choice of method for the treatment and disposal of contaminated water will depend on:

- the volume of water
- the area of land available for storage, treatment or discharge
- the amount and type of silt
- the presence of other substances in the water
- the conditions of any consent or authorisation.

Contaminated water treatment and disposal options include:

- Sustainable Drainage Systems

  The most effective SuDS use a series of drainage components to imitate natural drainage rather than traditional end-of-pipe drainage solutions.

- Settlement lagoons/tanks

  To be effective a settlement lagoon or tank should retain contaminated water long enough for silt to settle out. The length of time will depend on the type of silt

- Filtration

  If you do not have the space for lagoons and the water is contaminated with coarse silt only (not fine clay silts), you may be able to use tanks filled with filter material.

- Pump to grassland

  This method of disposal is only suitable for water contaminated with silt only and you must have permission from your environmental regulator and landowner.

- Discharge to sewer

  Discharges to foul sewer will require the permission of the local water and sewerage provider.

- Tanker off site

  If no other disposal routes are available, then contaminated water can be collected by tanker for authorised disposal off-site.

Concrete, cement and grouts are very alkaline and corrosive and can cause serious pollution to water. Concrete, cement and grout mixing and washing areas must therefore meet certain requirements which can be found in this guideline. Wash waters from concrete and cement works should never be discharged into the water environment as this could have serious impact on the water quality and ecology.

Section 4 covers guidance on **oil and chemicals** such as biodegradable oils and trade materials, including the relevant regulations that are to be followed.

Guidance on bridge maintenance and structures over water discusses pollutant containment during maintenance and advised methods of paint removal, surface cleaning and painting.

Information on **pesticides** including the required equipment and methods of spraying is found in section 6. If it is decided to use a pesticide in or near water, approval is needed from an environmental regulator before use, however it should always be considered alternative ways of controlling pests and weeds in or near water.

This guidance covers **invasive non-native species** (INNS) and how to eliminate the risk of transferring water and soil potentially containing plant or animal diseases, or invasive non-native species, to or from the development site.

Legal waste storage and disposal are essential for effective pollution prevention. Advice on waste management can be found in section 8 of this guidance. This reinstates what is outlined in other GPPs concerning Duty of Care and storage and disposal of hazardous waste.

7.1.5 GPP06 Guidance for Pollution Prevention Working at Construction and Demolition Sites

This guidance is for anyone carrying out works or activities on construction or demolition sites. Any building or development works are considered to be construction sites. Such activities have the potential to cause pollution and harm to the environment.

On construction and demolition sites there are forms of pollution that are classed as a statutory nuisance, noise being the largest cause of complaint. Activities that can cause nuisance should be regularly monitored and it should be checked that measures put in place to reduce or eliminate nuisance are working. This guidance covers how to minimise nuisance in terms of operating vehicles and machinery and the importance of informing neighbours.

Section 2 managing water on construction sites discusses ways in which to minimise 'dirty' water such as: reducing the area of stripped soil, stop water entering working areas, keep nearby roads clean, and protecting watercourses. Water can be treated through on site treatment methods or alternative treatment methods such as Sustainable Drainage Systems, settlement lagoons or tanks, filtration and the use of oil separators. Water can also be recycled through various methods including rainwater harvesting, wheel washing systems and recycling concrete wash down water.

Where run off water is contaminated with silt or other pollutants, such as oil, this water must not be pumped or allowed to flow (directly or indirectly) into the water environment without treatment. There it must be established what the most appropriate method of water disposal is from site. This is covered in section 2.6 of this GPP and the various methods discussed are as follows:

- pumping to grassland,
- discharging to sewers and
- collection by a tanker for disposal off-site.

Protecting soils is essential for many environmental, social and economic functions. This guidance offers information on how to protect soils and prepare a soil resource plan. Before starting work on a contract, a soil survey should be carried out. It outlines how the criteria to create good stockpiles and how to deal with contaminated land. If unexpected contamination is discovered on site, stop works and seek advice from an environmental regulator or the local district council. At times it may be necessary to import or export soil from sites, under these circumstances refer to this guidance for the measures that should be followed including information on surplus soil for use off-site, topsoil from outside the site and using soils from brownfield or industrial sites.

Other areas such as archaeology, unexplored ordnance, invasive non-native species and pesticides must be considered when working on construction and demolition sites. In terms of the environmental and fire protection, this GPP discusses safe delivery access, maintenance, and security requirements before deciding where to put any permanent or temporary oil storage facilities. Fuel stores should be in dedicated areas specifically designed and constructed to be safe and secure. When using and handling oil and fuel on site, dispensing and refuelling must be taken into account alongside the regular inspection and maintenance of all storage facilities. On construction and demolition sites it is important to be aware of asbestos in terms of waste management, to prevent any adverse health effects. Further details on waste management and recycling of construction materials are found in section 5 of this GPP.

Cement, concrete, and grouts are highly alkaline and corrosive and can cause serious pollution to the ground and watercourses therefore advise on working with these materials on site and near water courses is provided. All chemicals and hazardous substances should be stored away from watercourses, drains and areas where there is risk of damage from impact or collision.

Pollution incident response plans should be produced to identify the possible pollution incidents and outline the actions necessary to minimise pollution any caused. This is a site-specific document. All environmental incidents should be immediately reported to the relevant environmental regulator.

7.1.6 GPP08 Guidance for Pollution Prevention Safe Storage and Disposal of Used Oils

This guidance is for anyone who stores and disposes of used oils. The guidance applies to activities ranging from a single engine oil change to those of large industrial users.

Disposing of domestic used oil from households refers to engine oil and used cooking oils and fats. Used oils such as engine or gearbox oil from vehicles of machine maintenance should be taken to specific oil banks to be recycling. Used cooking oils and fats should be allowed to cool before separating them for collection and should not be poured down the sink. They can be recovered in local authority food waste collections or disposed of in the general household waste through being soaked into normal household rubbish or putting them into rigid plastic containers.

Used mineral oil from commercial and industrial sources will be classified as hazardous/special waste. It must be managed in accordance with the relevant regulations which impose legal requirements for its movement, recovery and disposal. Used oil is a useful substance that can be recycled and reused or recovered and used as a fuel to save resources; it should be treated as such. Cooking oils from commercial users can be collected by specialist contractors and recovered by manufacturers of biofuels.

Sites such as garages can generate large quantities of used oil. This oil must be collected by a registered waste carrier. Electrical transformers may use specialist oil. When spent, used transformer oil is always a hazardous/special waste.

In terms of storing waste oil and associated pipework in all cases care must be taken to avoid spillage when transferring waste oil to storage facilities. Any spills should be dealt with using absorbent materials. The environmental regulators recommend that waste oil tanks should be installed and pipework above ground whenever possible. This enables regular maintenance checks to be carried out more easily, allowing leaks to be identified earlier. This document offers guidance on above ground storage, on site storage of waste oils, underground tanks and pipes and the disposal of waste from bunded areas.

Regardless of whether they are covered by specific on-site waste oil storage legislation, all oil storage facilities must be sited on an impervious base within an oil-tight secondary containment system such as a bund. Where oil is stored within a bunded area, rainwater and oil residues can build up. This build-up reduces the storage capacity of the bund and you should remove it regularly by bailing from the sump or using a manually operated pump. This residue is likely to be contaminated with oil and, as such, may be hazardous/special waste.

The storage of used oils below ground poses a potential threat to groundwater. All new tanks must be double skinned with a suitable leak detection device. If you do not have a continuous leak detection system you must test:

- Pipework before use
- Pipework with mechanical joints every 5 years
- All other pipe work at least every ten years.

7.1.7 GPP20 Guidance for Pollution Prevention Dewatering Underground Ducts and Chambers

This guidance is for utilities and contractors who often need to remove a build-up of water from underground ducts and chambers. The volume of water is usually below 5m^3, but can be contaminated with:

- Silt
- Oil
- Various chemicals

If the water is not dealt with correctly there is a risk of pollution to surface waters and groundwater. Discharge should directly to a watercourse unless this has been agreed with your environmental regulator. If the water or silt is contaminated it could be classed as hazardous/special waste. Technical Guidance Waste Management 3 (WM3) can be used to help classify the resulting waste and to determine whether it is hazardous/special waste. Advice from an environmental regulator should be attained if in doubt about the classification of the materials.

There are alternative options that don't involve a discharge to ground or water including design through pumping to a foul sewer or by removal to a waste or treatment facility. If possible, design and construct ducts and chambers that prevent the ingress of water. If water is likely to enter the structure sloped can be used on the base of the chamber and include a sump where water can collect.

Alternatively, any accumulated water should be pumped to a foul sewer if possible. This will ensure that any contamination is treated before it is discharged. If there is no access to a foul sewer, and a sample of the water has either:

- Silt in suspension
- An unusual colour
- An unusual odour

Water should be removed by pumping to suitable containers or to a tanker. This must then be taken to a licensed waste disposal site and transported by a suitably licenced waste carrier.

If contamination is suspected where there is no odour or colour present, for example from metals or organics, samples should be analysed by a lab.

You must comply with the requirements of the Duty of Care Regulations. There is a legal responsibility to produce, store, transport and dispose of controlled waste without harming the environment.

If no foul sewer is available it can be discharged to land or water. Before discharging water from a duct or chamber it is your responsibility to make a thorough check of the quality of the water. If the water is clean accumulated water without silt and if it is possible to remove light contamination, then pumps can go directly to surface waters or to a surface water drain. If possible, water should be pumped across a grassy strip to remove any silt.

7.1.8 GPP21 Guidance for Pollution Prevention Pollution Incident Response Planning

These guidelines set out best practice for producing an incident response plan to deal with an environmental incident on your site. Following such a plan will help you to prevent or reduce environmental damage if such an incident occurs. The guidelines set out:

- why you need a plan
- what information you should include
- who should be involved in its production
- what the plan should look like by providing a template

It is important to minimise the risk of pollution to protect the environment and human health. If pollution is caused, one can be liable to enforcement action by the local Environmental Regulator.

This guidance is for:

- site operators of industrial and commercial premises to help them produce an incident response plan.
- other organisations, authorities and individuals whose site or operations pose a potential risk to the environment and who should have an incident response plan.
- the Fire and Rescue Service and others who may be involved in the production of, and/or have an interest in such plans, for example the Health and Safety Executive, Maritime and Coastguard Agency, Government Decontamination Service, public health officials and insurers/underwriters.

The guidelines are aimed at sites which are not already required, as a condition of a permit, to prepare pollution incident response plans. If you operate a site that is required to have a pollution incident response plan, then one should speak to their environmental regulator about the specific requirements for site. Contact details are listed at the end of these guidelines.

The Pollution Incident Response Plan could be designed to deal with environmental incidents on site, or it could be part of a more comprehensive incident response plan for the site, for example Control of Major Accident Hazards (COMAH) on-site and off-site plans.

The planning cycle consists of 5 stages:

- Assess the risks on site

  Identify all potential risks to the environment from the materials, processes and activities on your site. Refer to GPP1, GPP18 and GPP28.

- Gather information and prepare your plan

  This includes a cover page, external and internal contacts list, site chemical products and waste inventory, pollution prevention equipment inventory, site plan and drainage plan.

- Activate your plan and seek responses

  Once plans have been developed, develop supporting emergency procedures to check the plan works if there's an incident. Make sure all relevant staff and contractors are aware of these procedures and the plan.

- Test plans and train your staff

  Once the plan has been completed test it regularly by carrying out exercises. At some sites, for example COMAH sites, it is a legal requirement.

- Review plans and update it

  The plan must remain effective and up to date, so record any lessons learnt from exercises or actual incidents. Use these recommendations, or comments from staff and contractors, to improve any developed plans.

Once any relevant comments have been considered, distribute copies of the completed plan to the relevant organisations.

7.1.9 Guidance Note For The Control Of Pollution (Oil Storage) (Wales) Regulations 2016

The purpose of this guidance is to provide essential background information regarding The Water Resources (Control of Pollution) (Oil Storage) (Wales) Regulations 2016 (the Regulations) and to outline recommended 'best practice' measures that extend beyond the minimum requirements set forth by the legislation. This guidance clearly differentiates between the mandatory regulatory requirements and the additional recommendations by employing the terms 'must' for obligations and 'should' for suggested practices.

These regulations are crucial for mitigating the environmental risks associated with oil storage, which can lead to severe ecological damage. In recent years, numerous pollution incidents have underscored the need for stringent controls, with a significant portion attributed to oil-related spills resulting from inadequate storage systems, equipment failures, vandalism, and human oversight.

The regulations encompass a wide range of oils, including mineral oils such as petrol, diesel, and kerosene; heating and lubricating oils; vegetable and plant oils; oil-based solvents; waste oils; and bio-fuels, while explicitly excluding bitumen due to its solidifying nature upon spillage.

Additionally, the provisions of the **Waste (England and Wales) Regulations 2011** govern the management of waste oil, while the **Hazardous Waste (Wales) Regulations 2005** apply to the transport of oil classified as hazardous.

Reference will also be made to relevant legislation to ensure comprehensive understanding and compliance. The key points are summarized below for clarity:

Every year in Wales there are between 130 and 300 recorded water pollution incidents caused by oil. Investigations commissioned by the Oil Care Campaign in 2005 indicated that the number of incidents recorded by environmental regulators may only represent a small proportion, with as few as 28% of serious incidents being reported.

SCOPE OF THE REGULATIONS

Types of Oils:

(1) The Regulations apply to a comprehensive range of oils, which includes petrol, diesel, kerosene, lubricating oils (both mineral and synthetic), waste oil, and vegetable and plant oils. It is important to note that uncut bitumen is specifically excluded from these regulations, as this material solidifies in the vicinity of any spillage, thereby reducing the risk of liquid pollution. Furthermore, the storage of Agricultural Fuel Oil is now governed by these Regulations, with Regulation 11 explicitly removing oil storage from the purview of the Control of Pollution (Silage, Slurry and Agricultural Fuel Oil) (Wales) Regulations 2010. Additionally, the relevant provisions of the Environmental Permitting Regulations 2010 will also apply to the handling and storage of waste oil, ensuring a comprehensive regulatory framework for oil management.

Oil Storage Facilities:

(1) The Regulations are applicable to any type of container used for oil storage that is situated above ground, regardless of whether it is located inside or outside a building. This encompasses a variety of storage options, including fixed tanks, intermediate bulk containers, drums (such as oil drums or similar containers), and mobile bowsers. For portable containers with a storage capacity of less than 200 litres, it is mandated that these containers possess sufficient strength and structural integrity to ensure that they are unlikely to burst or leak during ordinary use. In contrast, containers with a storage capacity of 200 litres or greater are subject to additional prescriptive requirements that must be adhered to, ensuring enhanced safety and environmental protection.

(2) The scope of the Regulations covers a wide array of premises, including but not limited to industrial businesses (such as small manufacturing operations in food processing, textiles, paper and publishing, engineering, ceramics, metals, and chemicals), commercial establishments (including shops, offices, theatres, hotels, restaurants, pubs, building and construction sites, motor garages, and transport depots), as well as institutions (both residential and non-residential) in the public and private sectors, including schools, hospitals, churches, village halls, prisons, libraries, public sector buildings, nursing homes, and multi-residential dwellings. Farms are also included, covering the storage of any oil used for agricultural and commercial purposes. For oil intended exclusively for heating or cooking in a farmhouse or other residential premises on a farm, and stored separately from other oil, the provisions relating to domestic properties will apply.

Exemptions:

(3) The Regulations provide for specific exemptions to the prescriptive requirements. Notably, the storage of oil on premises used wholly or mainly as a single private dwelling is exempt if the oil storage container was in use prior to the coming into force of the Regulations. However, it is crucial to note that any replacement tanks must comply with the requirements set forth in the Regulations. Additionally, oil stored in any container that is situated wholly underground (i.e., below the level of the adjacent ground, unless located within a building underground) is also exempt. Furthermore, premises used for the refining of oil and those engaged in the onward distribution of oil (such as oil distribution depots) are exempt from these Regulations, although they are subject to oversight by NRW, which retains the authority to issue notices requiring improvements if the activities on the site are deemed to pose a significant risk to the water environment.

Time-frame for Application of the Regulations:

(5) The Regulations will be implemented in a phased approach, occurring in three distinct stages following their introduction in the Assembly. New tanks installed after the Regulations come into force must comply immediately. Existing tanks that are identified as being at significant risk (i.e., those located within 10 metres of any surface water or wetland, or within 50 metres of a borehole or well) will be required to comply within two years from the date the Regulations come into force. Remaining existing tanks will have a compliance deadline of four years. It is strongly advised that oil storage containers be positioned in locations that minimize the risk of leaking oil entering groundwater, inland waters, or coastal waters, including rivers, lakes, reservoirs, and smaller watercourses. In cases where compliance poses challenges, it is recommended to seek guidance from NRW.

Standards For Oil Storage Containers:

(6) The Regulations establish mandatory standards for both new and existing above-ground oil storage facilities, primarily impacting the industrial, commercial, and institutional sectors, as well as new domestic installations. Key provisions include:

- *Structural Integrity: All tanks, drums, or other containers must be constructed to withstand the weight and pressure of the oil without leaking or bursting. Containers must meet the performance standards specified in the Regulations at all times.*
- *Secondary Containment Systems: A secondary containment system, such as a bund or drip tray, must be provided to capture any oil that may leak from the container or its ancillary pipework and equipment. The secondary containment system must have a capacity sufficient to contain at least 110% of the maximum contents of the oil container. In cases where multiple containers are stored, the bund should be capable of holding at least 110% of the largest tank's capacity or at least 25% of the total storage capacity, whichever is greater. For drums, the tray or bund size should be at least 25% of the total storage capacity.*
- *Regular Inspections and Maintenance: Regular inspections of the primary and secondary containment systems are essential to identify and address any leaks or signs of damage. It is recommended that a competent person conduct a detailed annual inspection.*
- *Positioning and Protection: Containers must be positioned to avoid damage from impact (e.g., from vehicular traffic) wherever practicable. If this is not possible, physical barriers should be employed to provide protection.*
- *Leak Detection: Above-ground pipework must be properly supported to prevent damage, while below-ground pipework must be protected from physical damage and corrosion, with adequate leak detection facilities in place.*
- *Valves and Ancillary Equipment: Any valve, filter, sight gauge, vent pipe, or other ancillary equipment must be situated within the secondary containment system when not in use. Additionally, all above-ground pipework must be adequately supported and positioned to avoid damage.*

- *Emergency Preparedness: Facilities must be equipped with appropriate emergency response materials, such as oil sorbent materials, to address accidental spills. A contingency plan should be in place to outline procedures for spill response, and immediate notification to NRW's emergency hotline is required in the event of a spill.*

In summary, the Regulations provide a comprehensive framework for the safe storage and handling of oil, ensuring that environmental risks are minimized and that best practices are adhered to across various sectors. Compliance with these standards is essential for protecting the water environment and maintaining public safety.

Typical arrangements for fixed oil storage tanks as per 'best practice guidance' are shown in Figure 7.2. and Figure 7.3 (Diagrams courtesy of OFTEC).

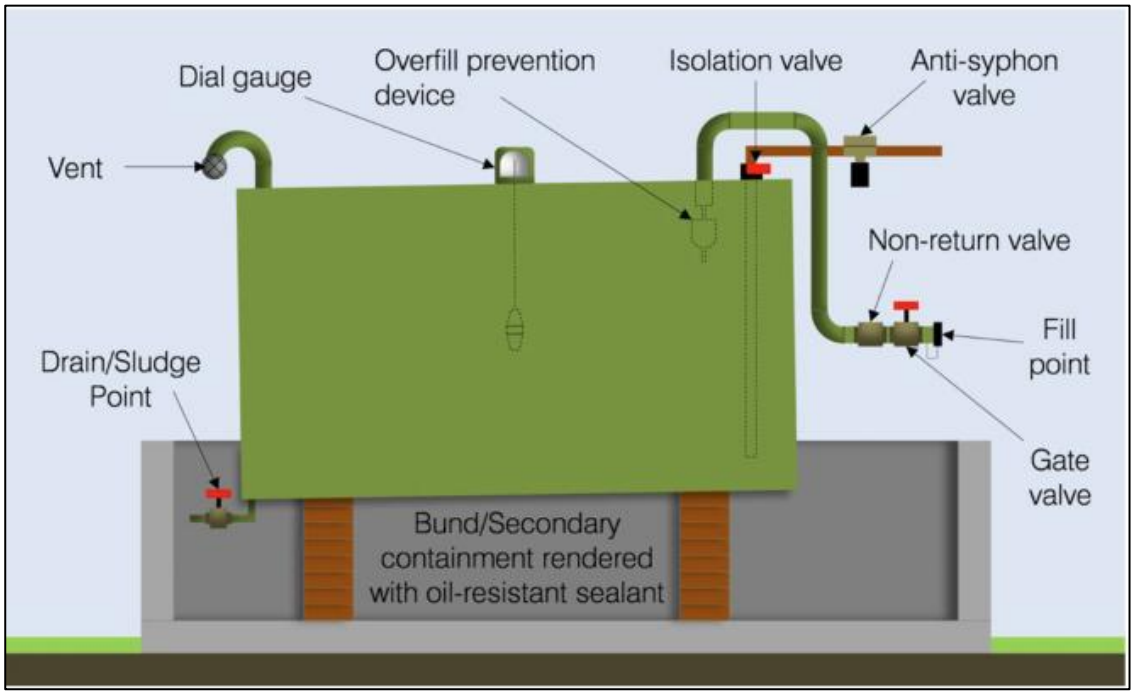


Figure 7.2: Built Bunded Oil Tank

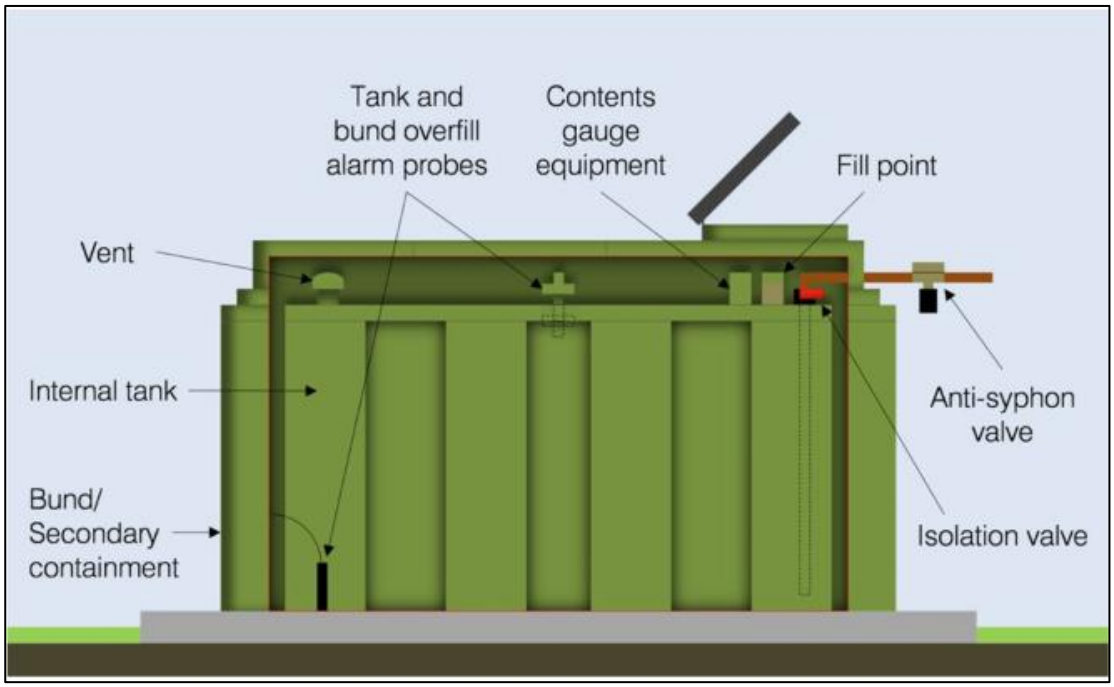


Figure 7.3: Integrally Bunded Tank System

7.1.10 Technical Guidance C648: Control of Water Pollution from Linear Construction Projects, (CIRIA, 2006);

This guidance addresses the control of water pollution throughout the whole project cycle, from the design of a scheme to construction and commissioning. It also highlights issues encountered on upgrades and on-line replacement, and sets out generic good practice and procedures for controlling water pollution from construction sites in the UK.

The guide includes regional legislative and regulatory variations and anyone intending to adopt the practices and procedures should ensure the work complies with these relevant regional variations. It is intended to supplement any contractual requirements, consultation with regulators, or company procedures rather than replace them.

Linear construction projects, such as roads, railways, pipelines, cables and water courses, could all have negative impacts on the environment. This document looks at the issues of controlling and managing water pollution. Covers the characteristics of linear projects, water environment, water pollution and the law, planning and design, stakeholder consultation, development consent, site investigations and monitoring, programming and seasonal influences, contracts, construction, site planning, licenses and consents, emergency and contingency planning, site set-up, adjacent land and water use, runoff and sediment control, water treatment methods and disposal, works in or near water, excavations and dewatering, concrete and grouting activities, contaminated land and ecology.

7.1.11 Technical Guidance C532: Control of Water Pollution from Construction Sites: Guidance for Consultants and Contractors (CIRIA, 2001).

This publication provides advice on environmental good practice for the control of water pollution arising from construction activities. It focuses on the potential sources of water pollution from within construction sites and the effective methods of preventing its occurrence. The guide provides information on benefits and obligations, managing water pollution, legislative frameworks, construction contracts, and water management techniques.

There are three main functions, as a user-friendly guide, a reference book and a training aid. It is aimed at project promoters, site managers, foremen and supervisors, site engineers, project managers and contract supervisors/resident engineers.

This document provides practical help for consultants and contractors on how to plan and manage construction projects to control water pollution. It has seven main chapters; benefits and obligations; water pollution from construction; legislative framework; construction contracts; managing water pollution from construction; water management techniques; summary and recommendations.

7.2 General Pollution Control and Contingency Plan

7.2.1 Spillage Management

Training will be given in the actions to take in the event of a spillage of potential contaminants. Emergency procedures to be implemented in the event of a spillage or leakage of any polluting material such as fuel, oil, or silt-laden drainage, will be in place on-site and incorporated into the oCEMP. Provision for containment and clean-up of the material will be made. The procedure will follow the recommendations contained within GPP21 ‘Pollution Incident Response Planning.’ Any oil or similar material will be cleaned away immediately using an absorbent material (sand, absorbent pads or other purpose made products) to prevent it entering any watercourse. Spill kits will be provided and training on their use given to all site personnel. No refuelling of plant will be permitted in close proximity (10m) to any watercourse, storm drain or on steep sloping ground.

Due to the nature of the project, it is not possible to connect welfare facilities to existing public sewers. Welfare facilities will comprise on site self-contained chemical toilets and washing facilities. The facilities will be taken offsite to a suitable treatment facility for cleaning. Any waste material will be treated and disposed of offsite at a suitable treatment facility.

7.2.2 Oil Storage and Refuelling

Oil storage and refuelling areas will not be located close to any local watercourses or any drainage ditch which feeds into a watercourse.

The following measures must be implemented.

1. **Dedicate specific areas for oil storage and refuelling, separated a minimum of 10m from any adjacent waterbodies or surface water drains and comply with legislation, including providing bunds sized to contain 110% of fuel storage capacity.**
2. **The contractor will use fill point drip trays, bunded pallets and secondary containment units.**
3. **The site will be enclosed and secured, and fuel storage areas will be secondarily secured.**
4. **All fuel, oil and chemical deliveries will be supervised by a responsible person who will be trained to deal with any spillage to prevent a pollution problem occurring.**
5. **Storage of COSHH items is not permitted and only brought to site as required, fuel is provided by client from an existing bunded static supply, where small portable machines are to be fuelled up a drip tray is used.**
6. **Please refer to Section 8 of this OCEMP for further details on the storage of materials and exclusion zones.**

7.2.3 Emergency Procedures

Appendix G of this OCEMP contains an example Emergency Response & Environmental Plan. The Environmental Emergency Plan would set out the procedures to be followed and measures to be implemented in the event of a pollution incident. These incidents may be the result of:

1. **delivery and use of materials.**
2. **spillages of oils or chemicals.**
3. **discharge of silty water or other pollutants to watercourses.**
4. **flooding event; and,**
5. **fire (emissions to air) and failure to contain firewater runoff.**

Emergency procedures are developed to support the response plan. The procedures define the circumstances when the plan should be activated and include:

1. **The names and contact details of staff trained in incident response,**
2. **Clearly defined roles and responsibilities,**
3. **The types and location of emergency response equipment available,**
4. **The location of the emergency assembly point, and,**
5. **Procedures for recovering spilled product.**

Responsible staff will be trained in emergency procedures to form an Emergency Team, so that these procedures can be implemented swiftly and effectively. Periodic testing of emergency procedures will be undertaken by the Site Manager.

The Environmental Manager will observe the test and to report on results. Any corrective actions are taken forward for review and approval.

Should an emergency incident occur, the Environmental Manager will be notified immediately. The emergency response will be co-ordinated by the Site Manager.

Protective measures, mitigation, clean up and remediation actions will be identified from the evaluation and shall be put into place, having regard for the sensitivities of the environment.

A record of the emergency incident will be kept to show the nature of the corrective action undertaken. (See **Appendix C** for an example template).

Appendix G of this OCEMP contains an example Emergency Response & Environmental Plan. All relevant staff would be trained in how and when to contact the emergency services, NRW and other organisations identified in the Environmental Emergency Plan.

7.2.3.1 Site Health, Safety and Welfare

The proposed works will be undertaken in compliance with The Construction (Design and Management) Regulations 2015 which places key responsibilities on members of the Project team and Contractor (s). The selected contractor will be required to submit a construction phase plan (CPP) when tendering for the project. This will include outline method statements and risk assessments on key activities which will require mitigation. The CPP will also reflect any specific recommendations contained within the Construction Environmental Management Plan and how these can be addressed on site.

Specific construction related risks to this project are working at height, working over water and working with suspended loads. Each activity will be planned in advance and only suitably qualified and experienced personnel used. In addition to staff, visitors to the site must be given a full induction and have the correct PPE required for any specific tasks.

No work on site shall take place unless the task has been risk assessed by competent individuals and a suitable method statement and risk assessment produced. Relevant mandatory Regulations and Approved Codes of Practice that the Contractor must follow are;

- **The Work at Height Regulations 2005**
- **Construction (Design and Management) Regulations Wales 2015**
- **LOLER Approved Code of Practice and Guidance**
- **Health and Safety in Construction 'HSG150'**
- **Workplace health, safety and Welfare 'INDG244'**
- **Health and Safety at Work Act 1974**

In the event of an accident the nearest Hospital is the Withybush Hospital. The contractor will be expected to have a site emergency plan in place and have a sufficient number of first aiders on site to administer first aid. The accident shall be recorded in the site accident register and be notified to the HSE if required. Site welfare facilities shall in provided in accordance with schedule 2 of the CDM Regulations 2015.

Approved Incident Control Procedures will raise awareness of all personnel on site. Safety, health and environmental induction training courses to highlight site dangers and key potential environmental pollution issues will be completed by all project personnel prior to them beginning works on site.

7.2.4 Concrete Pouring

Concrete, cement and grouts are very alkaline and corrosive and can cause serious pollution to water. The following measures shall be followed on-site during construction and pouring of concrete:

1. Ensure that concrete pour are contained within the working area and do not enter any watercourses or surface water drains.
2. When mixing grout on site, construct a suitable barrier around mixing areas, supply lines and around working areas to prevent its escape.
3. Trucks, hoppers, mixers and concrete pumps that have contained concrete must be washed out in a contained area, see 'management of concrete wash out areas' below.
4. All concrete pours will be carried out under supervision,
5. Pours will be properly prepared to avoid run off (shuttering, mud matts, membranes used) and waste.
6. **Pouring of concrete should not take place when heavy rain is imminent.**

Wash down water arising from the washing of equipment that has come into contact with concrete will be collected in an impervious container.

7.2.5 Stockpiles

The following measures are proposed in relation to stockpiling of materials:

1. Locate stockpiles out of the wind or provide wind breaks to minimise dust generation
2. Keep stockpiles to minimum practicable height and use gentle slopes
3. Minimise the storage time of materials on site
4. Store materials away from the site boundary
5. Minimise the height of fall of all materials
6. Avoid spillage, and clean any spill up as soon as possible
7. Good soil handling and storage methods including protection of stockpiles with geotextiles.

All construction plant and materials shall be stored within the curtilage of the site.

8 CONSTRUCTION METHOD STATEMENT (CMS)

8.1 CMS – Works in and Close to Water

Water pollution will be prevented during the construction phase of the Proposed Development by following good working practices. Specific controls that will be in place during construction are outlined in Table 8-1 below.

Table 8-1: Water Pollution Prevention Controls

TASK	RESPONSIBILITY
General:	
All water bodies that occur in areas proposed for site compounds and storage facilities will be fenced off to a minimum distance of 10m. Appropriate sediment control measures in line with guidance provided in Guidance for Pollution Prevention and/or updated GPP's and CIRIA guidelines will be installed to ensure silt laden or contaminated surface runoff from the compound does not discharge directly to a water body	**Construction Manager/ Environmental Advisor/ Foreman**
Toolbox talks and water quality awareness training will be given to all site personnel and subcontractors	**Construction Manager / Environmental Advisor**
Drip trays must be placed under all mobile plant & equipment.	**Foreman**
Oils and diesels must be stored on drip trays (incl. when in vans).	**Foreman**
Locate plant & equipment as far away as possible from drains.	**Foreman**
Do not refuel near drains. Refuel at a designated area on impermeable surface and do not leave the activity unsupervised	**All Staff**
Check the plant, equipment & vehicles for leaks on a regular basis, and at least twice daily if working in or near waterways.	**All Staff**
Stand small plant that is leaking in drip trays.	**All Staff**
If plant & equipment is leaking report to your supervisor.	**All Staff**
Arrange for leaking plant to be taken out of service and maintained.	**Construction Manager**
A permit to pump, permit to dig and permit to refuel system will be used to ensure the appropriately trained personnel undertake these tasks to ensure these activities do not impact on water quality.	**Construction Manager / Environmental Adviser**

Check for underground services before starting to excavate.	**Construction Manager**
Never pump silt laden water into a watercourse.	**All Staff**
Do not disturb water in excavations to prevent stirring up silt.	**All Staff**
Use the lowest corner of the excavation as a pump sump.	**All Staff**
Position the pump off the bottom of the excavation.	**All Staff**
Remove light contamination with absorbent pads from your spill kit.	**All Staff**
Store water heavily contaminated with oil in containers & tanker off-site.	**Construction Manager / Environmental Advisor/ Foreman**
When disposing of silt laden water from pumping out excavations/ dewatering: Pump via a settlement tank/ lagoon (with sufficient retention time to settle any silt). Obtain permission from the landowner and then pump onto grasslands / fields. Monitor pump to prevent scouring and generation of suspended solids. Obtain permission from NRW Water Industry Act consent and discharge to surface watercourse/ surface water drain. Note: It is recommended the Environmental Advisor is contacted for advice first.	**Construction Manager / Environmental Advisor/ Foreman**
For very small quantities of water in excavations – pump onto grassland with the landowners' permission provided there is no potential from preferential flow paths and overland flow to the aquatic environment.	**All Staff**
Never pump silt laden water into the watercourse.	**All Staff**
Watercourse banks will be left intact where possible to prevent soils from entering the watercourse.	**All Staff**
Silt fences or other suitable measures will be installed where the working area encroaches within 10m of a watercourse (except for dedicated water course crossing points) and the local topography indicates there is potential for run-off to directly enter the watercourse. Silt fences will be monitored to ensure working effectively.	**All Staff**
Keep all materials, plant & equipment over 10m away from the watercourse.	**All Staff**
Excess material stockpiles will be managed to prevent siltation of water bodies through run-off and overland flow during rainfall events.	**All Staff**

Where the soil stockpiles represent a particular risk of runoff an interception ditch (cut-off) or silt fencing will be deployed to contain and direct run-off to a treatment area will be provided.	All Staff
Do not re-fuel within 10m of a watercourse or 50m of a borehole without the prior agreement of the NRW.	**All Staff**
Prevent vehicles & plant from entering the watercourse.	**Foreman**
Where possible, place a boom across the watercourse directly downstream of where you are working.	**Foreman**
The volume of water entering the construction site shall be reduced to decrease the volume of silt laden water that could be generated.	**Foreman**
Keep a spill kit handy.	**All Staff.**
Allocate a designated wash-out area at least 10m from the water body.	**Environmental Manager/ Foreman**
Only wash-out concrete in the designated, contained wash-out area.	**All Staff**
Forward a copy of the Consent to the Project Manager/Quality Manager.	**Environmental Advisor/ Client (if applicable)**
Inform the Agent/Team Leader of the consent conditions and any required controls.	**Environmental Advisor**
Follow the additional controls as required.	**Construction Manager/ Foreman**

8.1.1 GPP 5 Guidance for Pollution Prevention Works and Maintenance In Or Near Water Mitigation

With the Proposed Development being located adjacent to the Irish Sea, mitigation measures set out in GPP 5 must be adhered to, as to ensure pollution of waterways is prevented. A number of these measures are listed below, for the full list please refer to GGP Guidance for Pollution Prevention Works and Maintenance In Or Near Water, as detailed Section 7.1.4[1].

8.1.1.1 Sediment

Suspended sediment, including all soils, sands and rubble is the single main pollutant to the aquatic environment generated at construction sites and largely arises from the erosion of exposed soils and sediments by surface water runoff. Appropriate erosion and sediment controls during construction to prevent sediment pollution will be implemented.

[1] https://www.netregs.org.uk/environmental-topics/guidance-for-pollution-prevention-gpp-documents/gpp-5-works-and-maintenance-in-or-near-water/

Suspended sediment will occur during construction works of the Proposed Development. The following mitigation measures should be considered:

- Minimising the amount of time stripped ground are exposed;
- Divert clean water away from the area of construction work in order to minimise the volume of contaminated water;
- Vehicle access routes will be selected and managed to minimize sediment mobilisation and transfer;
- Brushing or scraping roads to reduce dust and mud deposits, appropriately disposing of material collected.

8.1.1.2 Dredging and Disposal

All initial dredging undertaken as part of these works will be capital dredging. The Client is also applying for a licence to subsequently maintenance dredge the harbour over the next 5 years under a separate application. As part of the marine licence to dredge and/or dispose of dredge material the following mitigation measures have been recommended:

- 20 minute soft start to piling activity;
- Adoption of Joint Nature Conservation Committee (JNCC) guidelines for minimising the risk of injury to marine mammals from piling noise via 30 minute pre piling visual watch for absence of marine mammals with a mitigation zone (minimum 500m) by qualified Marine Management Organisation;
- Artificial nest sites and refuges for black guillemot within Fishguard Harbour;
- Installation of five long life bat boxes and five bird nest boxes;
- Pre-demolition checks for otter resting places in the harbourside working area;
- Protection of habitats adjoining the temporary working areas including coastal heath adjoining the western boundary of the northern temporary compound and broadleaved woodland and the woodland edge trees;
- Protection of the adjoining environment from the movement of surface water from construction and compound areas into the surrounding environment;
- Sensitive construction lighting in the northern temporary compound to avoid light spill onto coastal heath beyond the western boundary;
- Avoidance of the need for any additional temporary lighting where the southern temporary compound adjoins broadleaved woodland;
- Protection of adjoining priority habitats during the decommissioning of temporary construction compounds;
- Temporary flood protection (if required);
- Adherence to weather warnings advance notifications;
- Programme of archaeological recording to record remaining structural elements of the lifeboat station;
- Protocol for Archaeological Discoveries to be agreed with RCAHMW prior to construction;
- Safety zones/cardinal marker buoys and rolling advisory clearance distances to be implemented;
- Vessel traffic monitoring for project related vessels; and
- Advance warning to mariners issued by Harbour Master to keep clear of the area/prohibited area;

8.1.1.3 Concrete, Cement and Grout

Concrete, cement and grouts are very alkaline and corrosive and can cause serious pollution to water. Concrete, cement and grout mixing and washing areas should:

- Be sited on an impermeable designated area;
- Have settlement and re-circulation systems for water reuse, to minimise the risk of pollution and reduce water usage;

- Where concrete is to be placed under water or in tidal conditions, specific fast-setting mix is required to limit segregation and washout of fine material / cement. This will normally be achieved by having either a higher than-normal fines content, a higher cement content or the use of chemical admixtures;
- The use of concrete in close proximity to water bodies requires a great deal of care. Fresh concrete and cement are very alkaline and corrosive and can cause serious pollution in water bodies. It is essential to ensure that the use of wet concrete and cement in or close to any water body is carefully controlled so as to minimise the risk of any material entering the water, particularly from the washing of equipment;
- Have a contained area for washing out and cleaning of concrete batching plant or ready mix lorries.

8.1.2 GPP 02 Above Ground Oil Storage

In Wales, the term "oil" encompasses various substances including petrol, diesel, kerosene, lubricating oil (both mineral and synthetic), waste oil, and vegetable or plant oil. The mitigation measures set out in GPP 02 must be adhered to (Section 7.1.2), as to ensure pollution of waterways is prevented. A number of these measures are listed below, for the full list please refer to GGP Above Ground Oil Storage[2].

It is recommended that oil is not stored in high-risk locations; these include:

- Within 50 metres of a spring, well or borehole;
- Within 10 metres of a watercourse;
- Places where spilt oil could enter open drains, loose fitting manhole covers or soak into the ground where it could pollute groundwater;
- Places where a spill could run over hard ground to enter a watercourse or soak into the ground where it could pollute groundwater;
- Places where tank vent pipe outlets can’t be seen from the filling point;
- Above roof level, as spilt oil can run unseen into guttering connected to surface water systems; and
- Source protection zones (spzs) where groundwater is particularly vulnerable.

The area around your tank where deliveries are made and, if applicable, oil is dispensed should have an impermeable surface and be isolated from surface water drainage systems. This will help stop oil and/or contaminated water getting into the soil and groundwater. If any oil is spilt during an oil delivery, you should make sure that it can’t run into a surface water drainage system.

8.2 Drainage Network

A preliminary storm water drainage design has been completed for the new area. It is proposed to use ACO channels and connect to the existing storm water drainage network. The closest outfall will be encompassed by the new reclamation works, and so the drainage will connect to this and the outfall will be extended out. There is no increase in storm water runoff to the Port because of the development. An application will be made to the SuDs Approving Body (SAB) at Pembrokeshire council as part of the planning application.

[2] https://www.netregs.org.uk/environmental-topics/guidance-for-pollution-prevention-gpp-documents/gpp-2-above-ground-oil-storage/

9 ENVIRONMENTAL MITIGATION MEASURES

Supporting environmental mitigation measures have been undertaken to assess the likely impacts that the Proposed Development may have on the environment. Those supporting mitigation measures are aimed to reduce the magnitude of effect of those likely impacts. Section 9.1 details mitigation measures proposed for the Development.

An environmental inspection schedule is set out in **Appendix B**. An incident report form is set out in **Appendix C**. A site waste management plan (SWMP) is set out in **Appendix D**. An Emergency Response & Environmental Plan is located in **Appendix G** of this document. Details of what should be included in method statements are set out in **Appendix E**.

9.1 The Water Environment

The location of the proposed development lies within the Irish Sea and St. George's Channel, and specifically within the Cardigan Bay South coastal water body (GB621009580000) in the Western Wales River Basin District (WWRBD). Within the development area there are no direct surface freshwater inputs from rivers or streams, as shown in Figure 9.1. There are two rivers which ultimately flow into the Cardigan Bay South water body to the south of this development, namely Goodwick Brook and Gwaun River (via Gwaun Estuary).

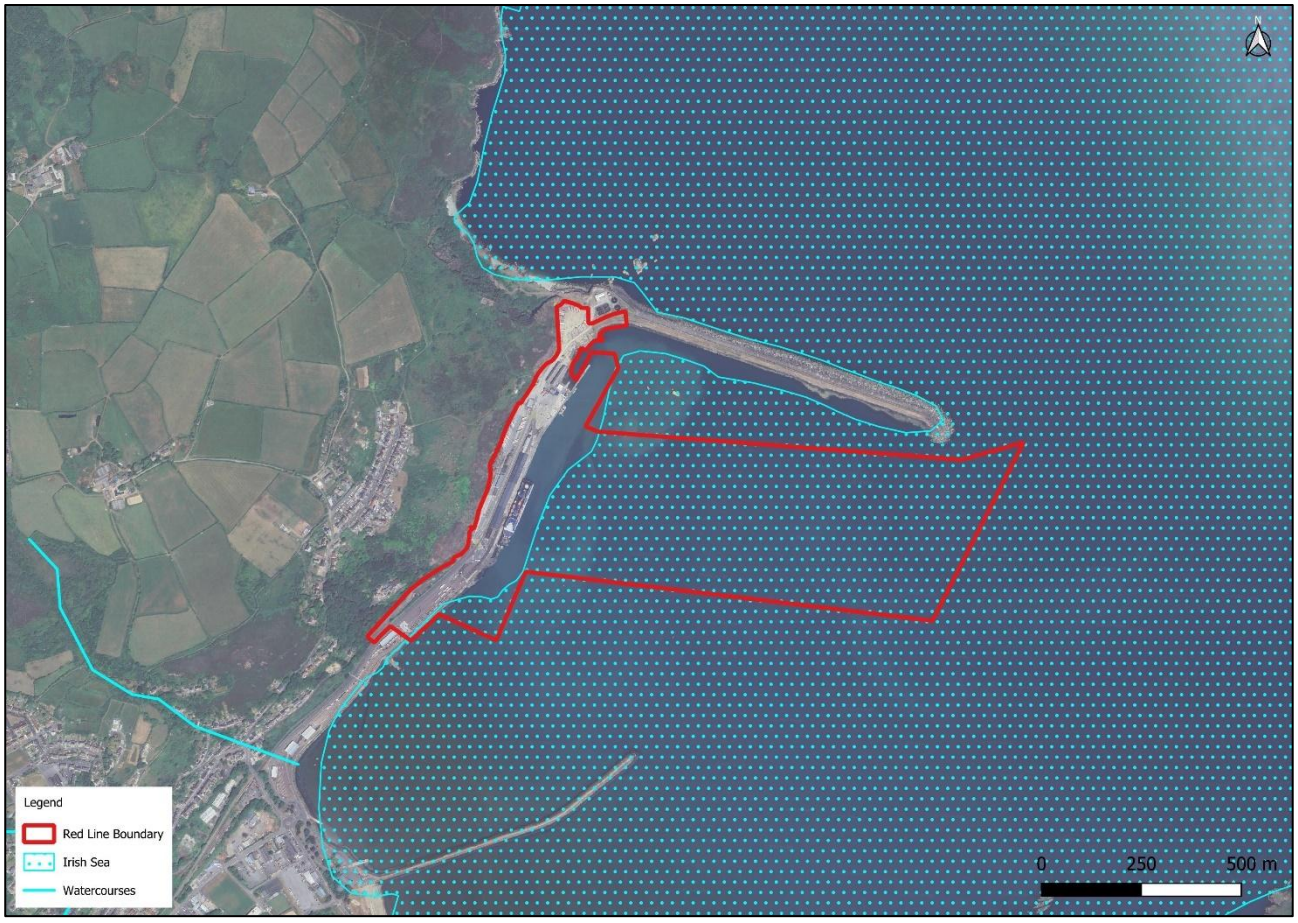


Figure 9.1: Water Environment

9.1.1 Exclusion Zone & Materials

Pollution prevention measures detailed below will be incorporated during the construction phase to prevent any possibility of sediments and other pollutants entering any nearby watercourses or surface drainage systems. The following measures must be implemented;

1. **Dedicate specific areas for oil storage and refuelling, separated a minimum of 10m from any adjacent waterbodies and comply with legislation, including providing bunds sized to contain 110% of fuel storage capacity.**
2. **The contractor will use fill point drip trays, bunded pallets and secondary containment units.**
3. **The site will be enclosed and secured and fuel storage areas will be secondarily secured.**
4. **All fuel, oil and chemical deliveries will be supervised by a responsible person who will be trained to deal with any spillage to prevent a pollution problem occurring.**
5. **Storage of COSHH items is not permitted and only brought to site as required, fuel is provided by client from an existing bunded static supply, where small portable machines are to be fuelled up a drip tray is used.**

Oil storage and refuelling will be separated at preferably 10m but absolute minimum of 5m, from adjacent waterbodies and comply with legislation, including providing bunds sized to contain 110% of fuel storage capacity. These buffer zones are illustrated in Figure 9.2.



Figure 9.2: Nearby Watercourse and Buffer Zone

9.1.2 General Construction Works

The risk of water quality impacts associated with works machinery, infrastructure and on-land operations (for example leakages/spillages of fuels, oils, other chemicals and wastewater) will be controlled through good site management and the adherence to codes and practices which limit the risk to within acceptable levels. In circumstances where mitigation measures are employed during construction operations, the potential magnitude of the impact on receiving water environment will be reduced to negligible thus reducing the significance of environmental effect will be reduced to minor on a temporary basis.

Appendix G details GPP 1 in full and refer back to Section 8 for a summary of mitigation measures.

9.1.3 Specific Construction Mitigation

The implementation of best practice measures in terms of pollution control and prevention will be based on the GPPSs produced by Natural Resources Wales (NRW) summarised in detail in Section 7 and 8. These GPPs will ensure there will not be a significant effect on water quality or the achievement of the environmental objectives for the Cardigan Bay South Coastal Water body within which the works are proposed.

9.2 Ecology

9.2.1 Ecological Protected Areas

The proposed development is included within two ecologically protected areas which includes West Wales Marine / Gorllewin Cymru Forol Special Area of Conservation (SAC) / Marine Protected Area (MPA) / Site of Community Importance (SCI), and hydrologically connected to Creigiau Abergwaun (Fishguard Cliffs) Site of Special Scientific Interest (SSSI).. An illustration of the ecological protected areas in proximity to the proposed development is demonstrated in Figure 9.3.

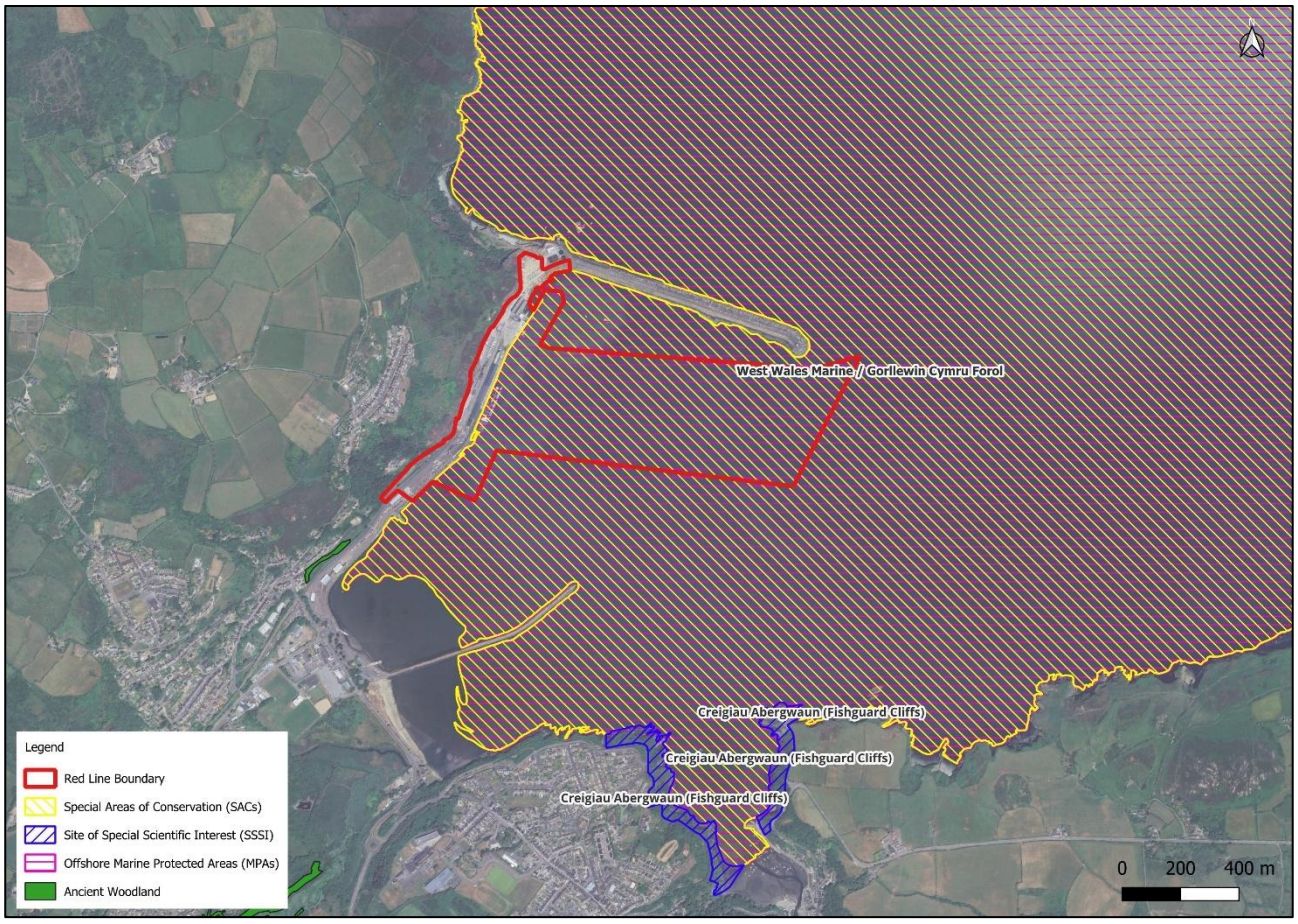


Figure 9.3: Ecological Protected Areas in Close Proximity to Proposed Development

9.2.1.1 West Wales Marine / Gorllewin Cymru Forol MPA/SAC/SCI

Situated between the Llŷn peninsula in the north, and the Pembrokeshire coast in the south-west, and extending into Cardigan Bay, the West Wales Marine SAC is designated for the protection of harbour porpoise *Phocoena phocoena*, supporting an estimated 5.4% of the UK Celtic and Irish Seas Management Unit (MU) population. This SAC spans an area over three times the size of Snowdonia National Park at 7,376 km^2. This SAC overlaps a number of other SACs including parts of the Pembrokeshire Marine SAC and the Pen Llŷn a'r Sarnau SAC, and encompasses the entire Cardigan Bay SAC.

The conservation objectives for the site are to maintain site integrity by ensuring:

- Harbour porpoise are a viable component of the site;
- There is no significant disturbance of the species; and
- The condition of supporting habitats and processes, and the availability of prey is maintained.

The Conservation Objectives and Advice on Operations document summarises ongoing activities occurring within or close to the site, with an assessment as to whether they pose a risk to harbour porpoise. This information is useful when assessing an activity, plan or project which may affect the protected features and the Joint Nature Conservation Committee (JNCC) has provided this to aid the cumulative assessment of impacts of human activities within the site. While every attempt has been made to ensure this information is accurate and kept up-to-date, the list is not to be considered exhaustive or definitive. The list does not, for example, include activities occurring off-site which may also be capable of affecting the protected features.

9.2.1.2 Creigiau Abergwaun (Fishguard Cliffs) SSSI

The cliffs at Abergwaun offer the best opportunity to examine the Ordovician Fishguard Volcanic 'Series' (Llanvirn Series) in association with dateable sedimentary rocks. Interbedded with the volcanic tuffs, ashes and rarer lavas, including the pillow lavas of Lampit Cliffs, are several shale horizons yielding the Llanvirn zonal index *Didymograptus bifidus*. This occurrence places a definite Upper Llanvirn age on the very substantial volcanic outpourings which affected 'Pembrokeshire' in Lower Ordovician times.

The operations listed below may damage the features of interest of Creigiau Abergwaun (Fishguard Cliffs) SSSI. Before any of these operations are undertaken you must consult CCW, and may require our consent. **The list of operations is not a prohibited list**. It is usually possible to carry out some of these operations in certain ways, or at specific times of year, or on certain parts of the SSSI, without damaging the features of interest.

The relevant operations can include:

- **Ref No. 7** - Dumping, spreading or discharging of any materials;
- **Ref No. 19** - Erection of sea defences or coast protection works; and
- **Ref No. 21** - Construction, removal or destruction of roads, tracks, walls, fences, hardstands, banks, ditches or other earthworks.

This SSSI is of national importance not only because it shows lateral variation in erupted materials when compared with exposures of volcanic rocks on Strumble Peninsula, but particularly because interbedded sedimentary rocks have yielded fossilised graptolites which help determine the age of the rock sequence (c. 465 million years old) by comparison with known evolutionary changes within these sea creatures.

The following is a description of how Natural Resources Wales would like to see the future development of Creigiau Abergwaun SSSI:

"*Our aims for this site will be focused on ensuring that the exposures of volcanic and sedimentary rock remain visible, accessible and in suitable condition (i.e. not too deeply weathered) for study. In seeking to achieve these aims we should ensure that Creigiau Abergwaun SSSI continues to provides a suitable location for the study of this nationally important sequence of Ordovician rocks and associated fossils, and contributes to the network of sites that has been established for the study of Ordovician rocks in the UK*."

There are a number of different factors that could damage or reduce the scientific value of the special feature of the SSSI if they are not properly managed. The following are the ones we regard as most important:

- **Oil Spills**

  Spills of crude or fuel oil from shipping could leave persistent tarry residues on geological interest in the splash zone, particularly if the spill coincided with spring tides and a large swell. Tar balls and spots in varying states of weathering are sometimes present on this shoreline, and it would be a natural collection point if winds were blowing from a northerly direction.

  Oil spill contingency plans should ensure that they include appropriate measures (such as emplacement of booms if weather conditions permit, and offshore use of dispersants) to safeguard intertidal and splash zone exposures. In the event of heavy oiling of splash zone exposures, carefully directed cleaning operations might be appropriate to prevent the formation of 'tar pavements' and to restore accessibility to the SSSI, but great care would be required not to damage the less robust components of the geological interest.

9.2.1 Specific Construction Mitigation

9.2.1.1 Marine Ecology

There are a range of mitigation measures associated with the construction phase of the Proposed Development:

- Piling will include a combination of a 20-minute soft start, as detailed in Chapter 13: Underwater Acoustics, with a 12 dB reduction in source level. This will lower the auditory injury exceedance range to less than 630m for the VHF group and less than 340m for the remaining hearing groups (HF, PCW, and fish) for a 60-minute impact piling duration. Additional soft start time will not lessen the effects as the noise from the soft start itself will drive the exceedance ranges. Although soft starts are more appropriate mitigation for marine mammals compared to fish, the 20-minute soft start may also act as a deterrent for fish receptors.
- Adoption of Joint Nature Conservation Committee (JNCC) (2010) guidelines for minimising the risk of injury to marine mammals from piling noise. As per Chapter 13: Underwater Acoustics, this will involve a 30-minute pre-piling visual watch for absence of marine mammals with a mitigation zone by a qualified MMOb. While the MMOb mitigation zone would be a minimum of 500m, the calmer waters resulting from the breakwaters would enable the detection of marine mammals to ranges over 630m. The end of the northern breakwater, approximately 1,100m away from the linkspan, could be used as a visual que to aid in determining this range.
- Development of and adherence to a Vessel Management Plan (VMP) and Navigation Safety Plan (NSP).
- Development of, and adherence to a Construction Method Statement (CMS) along with a Code of Construction Practice (CoCP).
- Development of and adherence to an EMP, which will include a MPCP, Marine Mammal Mitigation Plan (MMMP), and an INNS Management Plan.
- All relevant Health and Safety Executive (HSE) procedures will be followed.

9.2.1.2 Terrestrial Ecology

Environmental best practice will such as pollution prevention, dust minimisation, precautionary working methods to prevent the potential for injury and/mortality to protected and/notable species, sensitive management, and materials.

9.2.1.2.1 Bird Mitigation Measures

Pre-construction site clearance works and to the quay wall will take place outside the bird breeding season which extends between 1st March and 31st August inclusive to ensure breeding birds are protected from harm. If pre construction site clearance is deemed necessary within the bird breeding season an Ecological Clerk of Works will undertake a survey to check for breeding birds immediately prior to works, and confirm that breeding birds will be protected from harm during works.

9.2.1.2.2 Specific Measures

Specific measures will be employed where the working areas adjoin sensitive habitat

- Pre-demolition checks would be made of the operations building prior to the start of its removal
- Pre-demolition checks for otter resting places in the harbourside working area
- Protection of habitats adjoining the temporary working areas including coastal heath adjoining the western boundary of the northern temporary compound and broadleaved woodland and the woodland edge trees
- Protection of the adjoining environment from the movement of surface water from construction and compound areas into the surrounding environment
- Sensitive construction lighting in the northern temporary compound to avoid light spill onto coastal heath beyond the western boundary

- Avoidance of the need for any additional temporary lighting where the southern temporary compound adjoins broadleaved woodland
- Protection of adjoining priority habitats during the decommissioning of temporary construction compounds

The effects of underwater noise on wildlife would be reduced through the adoption of the Soft – Start Procedures for all piling in line with JNCC guidance. Designed to reduce effects on marine mammals this method would ensure any otters active in the harbour would move away from the working area at the outset of periods of piling. In addition, standard noise mitigations would be applied including the use of Noise Reduced equipment, and ensuring that plant is not left idling when not in active use.

9.2.1.2.3 Additional Mitigation Measures

Consideration has been given to further or 'additional mitigation' over and above the embedded mitigation that may be required and has the potential to mitigate any significant adverse effects identified following the assessment of the Proposed Development inclusive of its embedded mitigation.

Specific measures would be provided for black guillemot prior to the start of construction.

In the 2010s several projects in Northern Ireland were undertaken to provide artificial nest boxes for black guillemots (Leonard, 2015; Greenwood, 2015). More recently nestboxes have been used in Holyhead harbour where the second confirmed use of a nesting box in Wales was recorded in 2023.

A minimum of five purpose built nest boxes would be installed on the remnant vertical block harbour walls on the north-western edge of the harbour and/or on walls in the small quay adjoining the RNLI building. Both locations are sheltered by the northern breakwater. Next boxes will be installed towards the top of vertical quay walls.

Each next box would be purpose built following the designs successfully used in Northern Ireland (Leonard, 2015). Box specifications will include a landing area, entrance size small enough to prevent access by larger birds that could prey on the eggs and an internal 'wooden stop' to prevent eggs rolling out or being displaced easily by non-parental birds. The length of the internal nesting space would be 40cm with a narrow entrance (9cm x12cm). Robust wooden construction materials would be used to give significant protection from adverse weather. Each box will be strongly weighted and securely fixed to minimise the risk of loss during very high tides.

Integrated nest boxes built into concrete will be adopted as alternative where practical which is a design that was successful in Bangor pier, Northern Ireland (Greenwood 2010).

The additional mitigation would provide artificial nest sites and refuges for black guillemot within Fishguard Harbour using a design that has been successful in other locations in the past.

9.3 Geology, Soils and Contaminated Land

9.3.1 Baseline Geology

The site is indicated by Geological mapping data to be underlain by Goodwick Volcanic Formation - Rhyolite. This igneous bedrock formed between 465.5 and 460.5 million years ago during the Ordovician period. The lower portion of the site is Penyraber Mudstone Formation – Mudstone, which is sedimentary bedrock formed between 458.4 and 449 million years ago during the Ordovician period as show in Figure 9.4.



Figure 9.4: Bedrock Geology Obtained Via BGS Geology Utility (The Development Site Is Circled In Red)

9.3.2 Disposal of Waste Arising

The fractured rock resulting from the process can be utilised in compliance with recommended practices for repurposing concrete waste. It is essential to adhere to producers' guidelines, ensuring that the lime concrete component does not surpass 10% of the total mass of the fractured rock.

It is envisaged that any waste soil material from rock excavation works will be disposed off-site to an appropriately licensed landfill. If any waste pile arisings are to be temporarily stored on site prior to transport and disposal off site, the waste soils will be stored upon a HDPE liner surrounded by a clay bund. The material will be covered with a plastic liner to minimise precipitation infiltration.

All waste generated on site will be dealt with in accordance with the appropriate current legislation; The Waste (England and Wales) Regulations 2011 and The Hazardous Waste (Wales) (Amendment) Regulations 2019.

Waste classification will be undertaken in accordance with the WM3 Technical Guidance (Guidance on the Classification and Assessment of Waste, Natural Resources Wales, 1st Edition v1.2.GB), October 2021).

Waste characterisation (Waste Acceptance Criteria) testing will be carried out as per BS 12457/2.

A full record of waste transfer consignment notes will be kept on site of all material that is removed off-site for disposal to a licensed landfill. A copy of the consignment notes will be included within the Verification Report.

Under Article 4 of The Contaminated Land (Wales) Regulations 2006 all those responsible for producing or handling wastes have legal requirements placed upon them for the safe keeping, transport and subsequent recovery or disposal. Consequently, at the basic minimum, the Contractor shall ensure that all waste leaving site must have a Waste Transfer Note.

The Waste Transfer Note as a minimum shall include detail on:

- **Type of Waste and its 6 digit European Waste Code;**
- **What sort of container it is in;**
- **Time, date, and place the waste was transferred to;**
- **The names and addresses of both persons involved in the transfer;**
- **Details of which category of authorised person each one is (i.e. producer, waste license holder, registered waste carrier);**
- **Certificate number of registered waste carrier;**

- **Waste management license number of waste facility;**
- **The name and addresses of any broker involved in the transfer; and**
- **Signatures of both parties.**

All Waste Transfer Notes shall be kept for a minimum of three years.

All construction works will be carried out in accordance with NetRegs Guidance for Pollution Prevention (GPP) documents (NetRegs, 2021) to ensure safeguarding of the water environment.

9.3.1 Specific Construction Mitigation

The construction activities should be conducted in a safe environmentally conscious manner and in line with all health and safety guidelines. The following practical steps will be followed:

- Fuel storage tanks, paints and oils will be stored in clearly labelled and bunded areas.
- Refuelling of all plant and machinery will only take place in designated areas away from surface waters and drains. Spill kits will be placed within the designated re-fuelling areas to contain any accidental spillages of fuel.
- An emergency plan to deal with accidental spillages will be drafted prior to construction and implemented to prevent contamination of groundwater and surface water.

9.4 Noise

9.4.1 Control of Noise at Source

There are many general measures that will be used to reduce noise levels at source. Such as:

- The avoidance of unnecessary revving of engines and switching off equipment when not required;
- Keeping internal haul routes well maintained and avoiding steep gradients;
- The use of rubber linings in, for example, chutes and dumpers reduce impact noise;
- The minimisation of drop heights; and
- Starting up plant and vehicles sequentially rather than all together.

The use of conventional audible reversing alarms can be a noise nuisance issue on some sites, the reversing alarms used on the proposed site will be of a type which, whilst ensuring that they give proper warning, has a minimum noise impact on persons outside the proposed site. Where practicable, alternative reversing alarm systems will be employed to reduce the impact of noise outside of construction sites.

Prior to the construction phase, the contractor shall review the specification for all plant and equipment to be employed on-site to ensure that the quietest plant/equipment available is to be used. Modifications to plant and equipment to improve sound reduction will be implemented if required, but any alterations shall be conducted in consultation with the plant manufacturer.

For steady state continuous noise, it may be possible to reduce noise by fitting a more effective silencer system or by an acoustic canopy to replace the normal engine cover, if the item of plant is in a stationary position. On-site generators supplying electricity for electric motors will be suitably enclosed and appropriately located.

Noise caused by resonance of body panels and cover plates will be reduced by stiffening with additional ribs or by increasing the damping effect with a surface coating of special resonance damping material. Rattling noises will be controlled by tightening loose parts and fixing resilient materials between surfaces in contact.

As far as reasonably practicable, sources of significant noise will be enclosed. The effectiveness of partial noise enclosures and of screens can be reduced if they are used incorrectly.

Care shall be taken to site equipment away from noise sensitive areas. Where possible, loading and unloading will also be carried out away from such areas. Machines shall not be left running unnecessarily. Plant from which the noise generated is known to be particularly directional should, wherever practicable, be orientated so that the noise is directed away from noise sensitive areas.

Materials shall be lowered whenever practicable and shall not be dropped. The surfaces on to which the materials are being moved will be covered by resilient material.

In order to minimise the likelihood of complaints, Pembrokeshire County Council and affected residents will be kept informed of the works to be carried out and of any proposals for work outside normal hours.

9.4.2 Construction Noise General Mitigations

In order to ensure that there is no unacceptable noise impact at the nearest noise sensitive receptors during the construction phase, construction phase noise levels should not exceed the appropriate daytime noise threshold limit specified in BS5228:2009+A1:2014 (i.e. 65dB daytime). It is assumed that there will be no evening or night-time construction phase activities. British Standard *BS5228:2009+A1:2014 – Noise and vibration control on construction and open sites* outlines a range of measures that can be used to reduce the impact of construction phase noise on the nearest noise sensitive receptors. These measures will be applied by the contractor where appropriate during the construction phase of the proposed development.

Examples of some of the best practice measures included in BS5228 are listed below:

- ensuring that mechanical plant and equipment used for the purpose of the works are fitted with effective exhaust silencers and are maintained in good working order;
- careful selection of quiet plant and machinery to undertake the required work where available;
- all major compressors will be 'sound reduced' models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use;
- any ancillary pneumatic percussive tools will be fitted with mufflers or silencers of the type recommended by the manufacturers;
- machines in intermittent use will be shut down in the intervening periods between work;
- ancillary plant such as generators, compressors and pumps will be placed behind existing physical barriers, and the direction of noise emissions from plant including exhausts or engines will be placed away from sensitive locations, in order to cause minimum noise disturbance. Where possible, in potentially sensitive areas, acoustic barriers of enclosures will be utilised around noisy plant and equipment.
- Handling of all materials will take place in a manner which minimises noise emissions;
- Audible warning systems will be switched to the minimum setting required by the Health & Safety Executive.
- In order to minimise the likelihood of complaints, Pembrokeshire Council and potentially affected residents will be kept informed of the works to be carried out and of any proposals for work outside normal hours.

In order to minimise the likelihood of complaints, Pembrokeshire County Council and affected residents must be kept informed of the works to be carried out and of any proposals for work outside normal hours. A complaints procedure must be operated by the Contractor throughout the construction phase. Best practice will therefore be implemented in order to minimise noise and vibration and comply with the contents and recommendations of the BS 5228 "Code of Practice for Noise Control on Construction and Open sites".

9.4.3 Specific Construction Mitigation

Although recognised that the choice of dredgers is likely to be determined by the engineering requirements and the suitability of available equipment, dredging activities should be planned where possible to reduce the overall source noise level during the works – e.g. limiting night-time works directly adjacent to noise-sensitive properties etc.

Any dredger used for the works will be expected to be fitted with effective engine exhaust silencers, and there will be a requirement placed on the chosen dredger operator to ensure that all engine silencers are effective and reducing engine exhaust noise levels to the lowest reasonably practicable level.

Screening shall be provided nearest to those properties most likely to experience high noise levels from dredging, particularly during more sensitive night-time periods.

9.5 Air Quality

9.5.1 Construction Phase

During the construction phase there will be associated air quality and dust impacts that are typical of building developments. In order to avoid significant impacts from dust emissions during the construction phase, a series of mitigation measures are detailed. These are presented below (these mitigation measures form a Dust Management Plan (DMP).

This plan contains mitigation measures and industry standard good practice measures for reducing dust and emissions from vehicles. This is In line with Institute of Air Quality Management (IAQM) Guidance on the Assessment of Dust from Demolition and Construction Sites. This plan will be used to ensure that mitigation measures are appropriate and being applied rigorously and to provide early warning of increased dust emissions to inform the cessation or modification of activities prior to impacts occurring. General good practice guidance measures that will be implemented onsite to control dust and vehicle emissions are outlined.

9.5.2 Types of Particles

Dust is the generic term used to describe particulate matter in the size range 1-75 µm in diameter. Particles greater than 75 µm in diameter are termed grit rather than dust. Dusts can contain a wide range of particles of different sizes. The normal fate of suspended (i.e. airborne) dust is deposition. The rate of deposition depends largely on the size of the particle and its density; together these influence the aerodynamic and gravitational effects that determine the distance it travels and how long it stays suspended in the air before it settles out onto a surface. In addition, some particles may agglomerate to become fewer, larger particles; whilst others react chemically.

The effects of dust are linked to particle size and two main categories are usually considered:

- PM_{10} particles, those up to 10 µm in diameter, remain suspended in the air for long periods and are small enough to be breathed in and so can potentially impact on health; and,
- Dust, generally considered to be particles larger than 10 µm which fall out of the air quite quickly and can soil surfaces (e.g. a car, window sill, laundry, general amenity).

The IAQM Guidance on the assessment of dust from demolition and construction sets out 250 m as the distance from the site boundary and 50 m from the site traffic route(s) up to 250 m of the entrance, within which there could potentially be nuisance dust (amenity) and PM_{10} effects on human receptors. For sensitive ecological receptors, the corresponding distances are 50 m in both cases.

9.5.3 Potential Impact of Suspended Particulates on Amenity

In terms of disamenity effects, residential dwellings are considered highly sensitive. In some instances, industrial and commercial premises may be considered highly sensitive receptors if they are particularly vulnerable to soiling effects. Dust arising from construction works can reduce amenity in the local community due to visible dust plumes and dust soiling. The generally coarser dust that leads to these effects may, therefore, be referred to as ‘disamenity dust’. The most noticeable air quality impact likely to arise during construction works activities is dust accumulation resulting from deposition, which can lead to disamenity due to the soiling of surfaces.

The UK Government Planning Portal does not define disamenity, but its literal meaning would be “impaired amenity” and from its definition of amenity could be considered to be a negative element or elements that detract from the overall character or enjoyment of an area. The Oxford English Dictionary defines disamenity as “the unpleasant quality or character of something”. For example, in relation to the impacts of landfill projects, DEFRA has described “disamenity” as nuisance caused by an activity such as noise, odour, litter, vermin, visual intrusion and associated perceived discomfort.

9.5.3.1 Limits for nuisance dust

In contrast to suspended particulate matter (PM), there are no UK or European statutory standards that define the point when deposited dust causes annoyance or disamenity. This is largely due to the difficultly in accurately determining human response to dust accumulation and soiling. There are a number of "custom and practice" thresholds in use. These however are based on rather old studies, incorporate large corrections and assumptions, are sometimes equipment-specific, and lack validation in current conditions. More recent guidance for the minerals industry for example, recommends that site-specific thresholds should be agreed between the site operator and the local planning authority, appropriate for both the site and its surroundings, taking into account baseline values.

Similarly, no firm guidance is available on significance criteria for frequency of disamenity dust episodes. Previous guidance suggested that a community may be prepared to tolerate an incident once a month, but not repeated incidents at frequencies of once or twice a week. There is, however, no contemporary evidence base to support this assumption.

9.5.4 IAQM Guidance

The documents referenced in this DMP are as follows:

- **Institute of Air Quality Management (IAQM) Guidance on Air Quality Monitoring in the Vicinity of Demolition and Construction Sites;**
- **Institute of Air Quality Management (IAQM) Guidance on the Assessment of Dust from Demolition and Construction.**

The type of activities that could cause fugitive dust emissions are: earthworks; handling and disposal of spoil; wind-blown particulate material from stockpiles; handling of loose construction materials; and movement of vehicles, both on and off site. The level and distribution of construction dust emissions will vary according to factors such as the type of dust, duration and location of dust-generating activity, weather conditions and the effectiveness of suppression methods.

The main effect of any dust emissions, if not mitigated, could be annoyance due to soiling of surfaces, particularly windows, cars and laundry. However, it is normally possible, by implementation of proper control, to ensure that dust deposition does not give rise to significant adverse effects, although short-term events may occur (for example, due to technical failure or exceptional weather conditions). The following mitigation measures and recommended best guidance will ensure the risk of dust impacts are controlled during the construction activities proposed as part of the development.

9.5.5 Specific Mitigation Measures

The 2024 IAQM dust guidance list mitigation measures for low, medium and high dust risks.

Table 9-1 and Table 9-2 detailing specific mitigation for Demolition, Earthworks, Construction and Trackout.

Key to tables:

- **H** Highly recommended
- **D** Desirable
- **N** Not required

Table 9-1: Mitigation for all Sites: Communications

Mitigation measure	Low Risk	Medium Risk	High Risk
Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the site manager.		**H**	
Develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions, approved by the Local Authority. The level of detail will		**H**	

Mitigation measure	Low Risk	Medium Risk	High Risk
depend on the risk, and should include as a minimum the highly recommended measures in this document. The desirable measures should be included as appropriate for the site.			
Site Management			
Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken.		**H**	
Make the complaints log available to the local authority when asked.		**H**	
Monitoring – No Dust Monitoring Proposed			
Preparing and Maintaining the Site			
Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible.		**H**	
Erect solid screens or barriers along boundaries nearest sensitive receptors, or the site boundary that are at least as high as any stockpiles on site.		**H**	
Avoid site runoff of water or mud.		**H**	
Keep site fencing, barriers and scaffolding clean using wet methods.		**H**	
Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site.		**H**	
Cover, seed or fence stockpiles to prevent wind whipping.		**H**	
Operating Vehicle/Machinery and Sustainable Travel			
Ensure all vehicles switch off engines when stationary - no idling vehicles.		**H**	
Avoid the use of diesel- or petrol-powered generators and use mains electricity or battery powered equipment where practicable.		**H**	
Operations			
Only use cutting, grinding, or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g., suitable local exhaust ventilation systems.		**H**	
Ensure an adequate water supply on the site for effective dust/particulate matter suppression/ mitigation, using non-potable water where possible and appropriate.		**H**	
Use enclosed chutes and conveyors and covered skips.		**H**	
Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.		**H**	

Mitigation measure	Low Risk	Medium Risk	High Risk
Ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.		H	
Waste Management			
Avoid bonfires and burning of waste materials.		H	

Table 9-2: Measures Specific to Demolition, Earthworks, Construction and Trackout

Mitigation Measure	Low Risk	Medium Risk	High Risk
Demolition			
Ensure effective water suppression is used during demolition operations. Hand held sprays are more effective than hoses attached to equipment as the water can be directed to where it is needed. In addition high volume water suppression systems, manually controlled, can produce fine water droplets that effectively bring the dust particles to the ground.		H	
Avoid explosive blasting, using appropriate manual or mechanical alternatives.		H	
Bag and remove any biological debris or damp down such material before demolition.		H	
Earthworks			
Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable.		D	
Construction			
Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place.		H	
Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery.		D	
For smaller supplies of fine power materials ensure bags are sealed after use and stored appropriately to prevent dust.		D	
Trackout			
Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.	D		

The IAQM dust guidance states that with the recommended dust mitigation measures in place residual effect will normally be *"not significant",* and recommends the mitigation is secured by for example planning conditions, a legal obligation, or by legislation.

9.5.5.1 Complaints Procedure

All complaints received in relation to air quality and dust are during construction phases of the Proposed Development will be referred to the appointed contractor. Contact details of the appointed contractor foreman will be visible and accessible to nearest surrounding receptors. All complaints regarding dust emissions will be recorded and reported to the Site Manager, who will investigate the circumstances and ensure that the necessary corrective measures are taken.

Annex A

Visual Inspection Template

Note: This form is designed for general use and may not be exhaustive. Modifications and additions may be necessary to suit individual projects and to address specific environmental issues and associated mitigation measures.

Project :			Site Location :	
Construction Phase :				
Inspection Date :			Time :	
Inspected by :			Weather :	

Inspection Items	Yes	No*	N/A	REMARKS (i.e. specify location, good practices, problem observed, possible cause of nonconformity and/or proposed corrective/preventative actions)
Air Pollution and Dust Control	✓	✘		
1.1. Are stockpiles of dusty materials (size with more than 20 bags cement) covered appropriately?				
1.2. Notable dusty activities taking place?				
1.3. Are all vehicles carrying dusty loads covered over prior to leaving the site?				
1.4. Specifically, are demolition work areas watered? (e.g. trimming activities by using breaker, internal demolitions or cutting of materials being undertaken)				
1.5. Are dusty roads notable outside site footprint?				
1.6. Are dusts controlled during any onsite fabrication or cutting of materials?				
1.7. Are plant and equipment well maintained? (any black smoke observed, please indicate the plant/equipment and location)				
1.8. Is dark smoke controlled from any plant?				
1.9. Are there enclosures around the main dust-generating activities?				
1.10. Hoarding/screening provided along boundaries and properly maintained (any damage / opening observed, please indicate the location).				
1.11. Are speed control measures applied? (e.g. speed limit sign)				
1.12. Has site inspection on peripheries of the site been undertaken – any visible dust noted on cars, windows, window sills?*				

1.13. Are any skips on site covered?				
1.14. Are chutes enclosed and in use? Any visible dust from chute?				
1.15. Is site fencing, barriers and scaffolding clean?				
1.16. Others (please specify)				

Any "No" recorded represents the potential breach of mitigation advice and an improvement is potentially needed and details of nonconformity (NC) shall be recorded in the **Remarks column.*

***Sketch of Site visit if required**

Site Operative Signature		Date	
Reviewed by Project Manager (if not undertaken by Project Manager)		Date	

PLEASE KEEP ON FILE

10 ENVIRONMENTAL RISK ASSESSMENTS

An example environmental inspection schedule is set out in **Appendix B**. An example incident report form is set out in **Appendix C**.

11 EMERGENCY RESPONSE & ENVIRONMENTAL PLAN

An emergency response & environmental plan is located in **Appendix G** of this document.

12 SITE WASTE MANAGEMENT PLAN

An example site waste management plan (SWMP) is located in **Appendix D** of this document.

13 FINAL COMMENT

The Contractor is required to develop and implement this Outline Construction Environmental Management Plan (OCEMP) to help ensure that construction activities are planned and managed in accordance with the environmental requirements identified within and the relevant guidance and legislation.

This is VERSION 01 of the OCEMP.

Future updates to the CEMP will be sequential and be saved as such (i.e. VERSION 02, 03 etc.) and shall be adopted on site in full.

APPENDICES

Appendix A

Proposed Development Plans

Appendix B

Environmental Inspection Schedule

Environmental Inspection Schedule		**Site:**	
Inspected by:		**Date:**	
	Assessment Ratings *0 – Not in place = Non Compliance* *1 – In place but not full Compliance = Non Compliance* *2 – Full Compliance* ***Actions raised from this audit must be closed out within the agreed time scale with Pembrokeshire County Council.***	*0/1/2*	
1.0	***Emergency preparedness and incidents response***	*0/1/2*	*Comment*
1.1	*Is environmental response equipment held on-site?*		
1.2	*Where is it located?*		
1.3	*Is it all in working order?*		
1.4	*Can site staff operate the equipment?*		
2.0	***Environmental Incidents***	*0/1/2*	*Comment*
2.1	*Have any incidents been reported?*		
2.2	*Have all such incidents been investigated?*		
2.3	*Have they all been documented?*		
2.4	*Have all relevant parties been made aware of any incident?*		
2.5	*Has the Incident Report Form* **(Appendix E)** *been completed ?*		
3.0	***Hazardous Materials Storage***	*0/1/2*	*Comment*
3.1	*Are hazardous materials kept in secure areas?*		
3.2	*Are stores of fuels or oils bunded?*		
3.3	*Has any damage occurred to Mobile Bowsers or tanks?*		
3.4	*Are containers/drums labelled with content and capacity?*		
3.5	*Are drip trays empty of water ?*		
3.6	*Are hoses inside bunds/cabinets ?*		
3.7	*Are spill kits fully stocked and have all staff been trained to use equipment ?*		
3.8	*Has an individual been appointed for the safe handling of fuels ?*		

4.0	***Waste minimisation***	*0/1/2*	*Comment*
4.1	*Are all waste containers covered and labelled?*		
4.2	*Is waste segregated correctly ? Do skips need to be emptied ?*		
4.3	*Have waste skips been located on-site?*		
4.4	*Are different waste types segregated for recycling?*		
4.5	*Are staff and contractors encouraged to recycle? Is relevant signage in place*		
4.6	*Has litter been removed from site and the external boundary*		
4.7	*Is all appropriate duty of care documentation in place i.e. waste licence, Carrier's licence all kept on file ?*		
4.8	*Does the external appearance of the site present a positive image of the industry?*		
4.9	*Does the site appear well organised, clean and tidy?*		
4.10	*Does the appearance of all facilities, stored materials, vehicles and plant make a positive impression?*		
5.0	***Water Discharges & Pollution Control***	*0/1/2*	*Comment*
5.1	*Are there any de-watering activities conducted on-site?*		
5.2	*Any visible signs of spillage on site (fuel, oil, lubricants etc)? Including from machinery and plant.*		

5.3	*PPG/GPP guidance being followed as stipulated in CEMP/CEMP ?* ***1.Annotated Sketch if appropriate of any spillage and clean up detailed***

6.0	***Site Boundary & Access***	*0/1/2*	*Comment*
6.1	*Site boundary fencing in place ?* *No visible signs of breaches*		
6.2	*Site signage and information boards in place ?*		
6.3	*Appropriate sign in followed and appropriate health and safety followed ? Hi-vis, boots, hard hat worn for site visit. Appropriate PPE and H&S recommendations for this site in particular.*		
7.0	***Land contamination***		
7.1	*Has any unforeseen historical land contamination been discovered on-site?* *IF yes, please detail.* ***Annotated Sketch if Appropriate***		

7.2	*Has this been managed?* ***Please detail***
8.0	Site Photographs – labelled, detailed and saved on file
8.1	**SITE PHOTOS TO BE TAKEN DURING CONSTRUCTION PHASE (From first commencement of works). These will include; boundary photographs, internal roadways, fuel storage areas, pollution control in place (inc. spill kits), spills, waste storage areas, recycling signs, machinery.**
8.2	*Have site photos been taken of any specific environmental incidents ? If yes please details:*
8.3	*Have site photos been stored on file, labelled and dated ? Please ensure this is completed*

Corrective Action Plan relating to this environmental inspection schedule:						
		Site :	**Actionee**	**Target date (if not immediate)**	**Close out by Actionee**	**Issue dealt with ? Y/N**
	Count	Proposed Corrective Action				
	1					
	2					
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10					
Managers use only		**Follow up Action from Incidents?**		**Closed out by Manger**		
Acknowledged		Signed:		Signed:		

PLEASE KEEP ON FILE with other completed environmental inspections

Appendix B1

Complaints Form

	Complaints Form
	Make the complaints log available to the local authority when asked
1	Have any complaints been received? If so please detail
2	The name and contact details of the complainant:
3	Date and time of the complaint:
4	Nature of complaint:
5	Action taken to resolve issues:
6	Date of complaint handover:
7	Name of person addressing the complaint: Company: Signature:

Appendix C

Incident Report Form

INCIDENT DATE	INCIDENT TIME	REPORT DATE	REPORT TIME

INCIDENT OWNERSHIP		
DIVISION	SUB-DIVISION	UNIT OR DEPT

DESCRIPTION OF WHAT HAPPENED

EXACT INCIDENT LOCATION			
On or Off Site		**Location**	**Sub-Area**

PERSON INVOLVED

CATEGORY OF PERSON [✓]											
Employee	[ ]	Contractor	[ ]	Visitor	[ ]	Environmental	[ ]	Mem of. Public	[ ]		

NATURE OF INVOLVEMENT [✓]					
Witness	[ ]	First Person on Scene	[ ]	Other	[ ]

PERSON'S NAME					
Name:	Mr/Mrs/Miss/Ms	First Name:		Last Name:	

OTHER INFORMATION

Site Manager in attendance (if applicable)						
Reported in Duty Log/Site Book?	Yes	[ ]	No	[ ]	N/A	[ ]

TYPE OF INCIDENT [✓]					
Breach of Limits/Licence Cond.	[ ]	Oil & Chemical Storage	[ ]	Spillage/Spillage Response	[ ]
Waste Storage & Disposal	[ ]	Serious Public/Other Complaint	[ ]	Water Abstraction/Disposal	[ ]
Third Parties and Supply Chain	[ ]	Smoke, Fumes & Odours	[ ]	Natural Envnment & Wildlife	[ ]
Light Pollution	[ ]	Noise Nuisance	[ ]	Other	[ ]
If "Other" please describe:					

Is this a reportable incident?	Yes	[ ]	No	[ ]	Unknown	[ ]
If "Yes" which agency						

What are the actual or foreseeable potential consequences known at this time? [✓]					
Prosecution	[ ]	Enforcement Notice (Imp/Proht)	[ ]	Civil Claim	[ ]
Clean-up/Restoration	[ ]	Breach of Licence Requirements	[ ]	Adverse Publicity/Reaction	[ ]
Adverse Customer Reaction	[ ]	Contamination of Water	[ ]	Habitat or Species	[ ]
Health Effects	[ ]				

Please provide any other relevant information

What immediate actions have been taken?

INCIDENT REPORTED BY		
Name	Telephone No.	Date

Appendix D

Site Waste Management Plan (SWMP)

In the course of the Project, it is estimated that the following quantities of C & D Wastes/material surpluses will arise:

C & D Waste Material	**Quantity** (tonnes)
Clay and Stones	To be completed for Final CEMP
Concrete	To be completed for Final CEMP
Masonry	To be completed for Final CEMP
Wood	To be completed for Final CEMP
Packaging	To be completed for Final CEMP
Hazardous Materials	To be completed for Final CEMP
Other Waste Materials	To be completed for Final CEMP
TOTAL Arising's	To be completed for Final CEMP

Proposals for Minimisation, Reuse and Recycling of C & D Waste

a. C & D Waste will arise on the Project mainly from excavation and unavoidable construction waste/material surpluses/damaged materials.

b. The Contractors Purchasing Manager etc. shall ensure that materials are ordered so that the quantity delivered, the timing of the delivery and the storage is not conducive to the creation of unnecessary waste.

c. Excavated soils will be carefully stored in segregated piles on the site for subsequent re-use/removed from site for direct beneficial use elsewhere.

d. Concrete waste will be recycled where possible or source segregated/collected in receptacles with mixed C & D Waste materials, for subsequent separation and recovery at a remote facility.

e. Masonry and wood will be source segregated/collected in receptacles with mixed C & D Waste materials, for subsequent separation and recovery at a remote facility.

f. Packaging will be source segregated for recycling or return to suppliers.

g. Hazardous wastes will be identified, removed and kept separate from other C & D Waste materials in order to avoid further contamination.

h. Other C & D Waste materials will be collected in receptacles with mixed C & D Waste materials, for subsequent separation and disposal at a remote facility.

Excavation soils and C & D Waste-derived aggregates are considered suitable for certain on-site construction applications. It is proposed that the following quantities, corresponding to all C & D Waste arising's from the project, will be used within the works and beyond the site confines:

Standard form that will be completed by the contractor on-site: Proposals for Beneficial Use/Management of C & D Material Surpluses/Deficits and Waste Arisings on and off the Project

C & D Waste Type **Proposed Use**	**Clay and Stones** (t)	**Concrete** (t)	**Masonry** (t)	**TOTALS**
Earthworks	To be completed for Final CEMP			
General Fill/Hardcore				
Pipe Bedding				
Selected Trench Backfill				
Fill to Structures				
Beneath Paths Structure				
Beneath Road Structure				
Other Site Use A				
Other Site Use B				
Off-Site Use				
TOTAL				

It is anticipated that waste materials will have to be moved off site. It is the intention to engage specialist waste service Contractors (as required), who will possess the requisite authorisations, for the collection and movement of waste off-site, and to bring the material to a facility which currently holds a Waste Licence/Waste Permit. Accordingly, it will be necessary to arrange the following waste authorisations specifically for the Project:

Specific Waste Authorisations Necessary for the Scheme

Authorisation Type	Specific Need for Project (Yes/No?)	
Waste Licence	Yes	No
Waste Permit	Yes	No
Waste Collection Permit	Yes	No
Movement of Hazardous Waste Form	Yes	No

Assignment of Responsibilities

a. **The Principal Contractor shall be designated as the Responsible Person and have overall responsibility for the implementation of the on-site Waste Management Plan.**

b. **The Responsible Person will be assigned the authority to instruct all site personnel to comply with the specific provisions of the Plan.**

c. **At the operational level, a site manager/foreman from the main contractor and appropriate personnel from each sub-contractor on the site shall be assigned the direct responsibility to ensure that the discrete operations stated in the Waste Management Plan are performed on an on-going basis.**

Training

a. **Copies of the Waste Management Plan will be made available to all personnel on site (as required).**

b. **All site personnel and sub-contractors will be instructed about the objectives of the Waste Management Plan and informed of the responsibilities which fall upon them as a consequence of its provisions.**

Site Waste Management Check List	
Planning and Preparation	
	Have you set aside time to prepare your SWMP?
	Have you considered the construction methods and materials that you can use to reduce the amount of waste your project produces?
	Have you thought about ordering materials that have less or reusable/returnable packaging?
	Have you recorded all of your waste reduction decisions in your plan?
Allocation responsibility	
	Has someone with authority been assigned overall responsibility for the SWMP?
	Have you included a declaration from the client and principal contractor in your SWMP?
Identifying your waste	
	Have you assessed the waste produced at each stage of the project- the types, how much and when, including the processes involved?
	Have you identified which workers will produce waste?
Managing your waste	
	Has an area of the site been set aside for storing new materials and waste, including separate containers for different types of waste? You must store new materials separately from waste, and make sure storage areas are secure against vandalism.
	Have you set targets for the different types of waste likely to be produced by the project? Include targets for the amounts of each waste type to be reused, recycled and disposed of.
	Have measures been put in place to deal with expected and unexpected hazardous waste?
	Have you considered whether you can reuse materials either on-site or off-site?
	Have you considered on-site and off-site processing and reuse of materials?
Disposing of your waste	
	Have you considered how you will dispose of liquid wastes such as wash-down water and lubricants?
	Have you got agreement from your water and sewerage operator for trade effluent discharge?
	Are you complying with your duty of care, including waste transfer notes or consignment notes for all movements of waste from your site and checking the details of those removing the waste?
	Has someone been made responsible for checking that loads of waste leaving your site are accurately described, and waste transfer notes and consignment notes completed correctly?
	Have you checked that every waste carrier you use is registered with your environmental regulator?
	Have you checked that all sites receiving your waste have the appropriate permits, licences or registered exemptions?
	Have you identified your nearest waste sites? Use our Waste Directory (http://ww.netregs.org.uk/library_of_topics/waste/waste/_site_directories.aspx).
	Have you considered how to reduce disposal costs by reusing or recycling waste materials with a commercial value?

Site Waste Management Check List	
Organising materials and waste	
	Have you assessed the quantities of materials you need to order to reduce over-ordering and site waste?
	Can you return unused materials to the supplier, sell them or use them on another job?
	Have you considered using recycled materials?
	Can you return unwanted packaging to the supplier for reuse or recycling?
	Will you separate different types of waste to enable you to get best value from good waste management practices?
	Have you labelled containers and skips clearly to avoid confusion? Colour coding you containers could help.
	Are your storage areas secure and weatherproof to prevent wind and rain damaging your materials?
	Have you covered or nettled any loose materials to prevent them being spread and possibly causing pollution?
	Is everyone who will handle waste aware of the SWMP requirements?
Communicating and training	
	Have you planned site inductions and toolbox talks for all site staff?
	Are contractors and subcontractors trained and aware of their responsibilities?
	Have contractors and subcontractors understood and agreed the SWMP?
	Are SWMP requirements built into contracts?
	Are you carrying out spot checks and monitoring your staff regularly to make sure they are following procedures?
Measuring and monitoring your waste	
	Are you updating your plan every time waste is removed from your site?
	Are you checking the SWMP regularly and making sure targets are being reached?
	Are the agreed waste management procedures being checked and monitored regularly?
	Are you producing regular reports on waste quantities, treatment/disposal routes and costs?
	When construction is underway, are you making notes of problem and recording them for your next plan?

Appendix E

Construction Method Statement

The Principal Contractor is aware of Environmental Legislation and will ensure the following measures are taken:

1. The handling, use and storage of hazardous materials will be undertaken in line with the Pollution Prevention Guidelines.
2. All site operatives will receive a Site Induction which includes Health & Safety, Waste & Environmental details (Pollution Prevention Requirements) and Quality Management Procedures.
3. Regular Environmental Toolbox talks will be delivered on site - at least one per week.
4. ***A named person*** will be nominated as the responsible person for pollution prevention on site.
5. ***The Principal Contractor*** will have spill kits on site and all concerned will be briefed during site inductions on the contents and their use.
6. A spill kit will be on hand during fuel deliveries
7. ***The Principal Contractor*** will manage any waste arising on site and ensure it is kept to a minimum
8. ***The Principal Contractor*** will keep in touch with weather forecasts throughout the project and take appropriate action.
9. Daily site inspections will be carried out to check for pollution incidents and/or potential problems.
10. Times for deliveries will be controlled to avoid major disruption to neighbouring traffic.
11. The site manager/site foreman will be on hand to supervise deliveries.
12. Any drums, containers and/or tanks whether used for deliveries to site or on site will be inspected and verified as fit for purpose before accepted to site or used on site.
13. Appropriate fuel transfer techniques will be employed such as fuel transfer pumps, drip trays and spill kits.
14. ***The Principal Contractor*** will Inspect and maintain on a regular basis all temporary and permanent drainage systems and water courses.

Appendix F

Pollution Prevention Plan

GPP 1: Understanding Your Environmental Responsibilities – Good Environmental Practices

Guidance for Pollution Prevention

Understanding your environmental responsibilities – good environmental practices: GPP 1

Version 1.2 June 2021

This guidance has been produced by Natural Resources Wales (NRW), the Northern Ireland Environment Agency (NIEA), the Scottish Environment Protection Agency (SEPA) and the Oil Care Campaign. For Northern Ireland, Scotland and Wales, this document provides guidance on environmental legislation. These guidelines are not endorsed by the Environment Agency as regulatory guidance in England.

For guidance on environmental regulations in England go to www.gov.uk.
To find the relevant regulations visit www.legislation.gov.uk.

Guidance for Pollution Prevention (GPP) documents are based on relevant legislation and reflect current good practice. Following this guidance will help you manage the environmental responsibilities to prevent pollution and comply with the law.

If you cause pollution or allow it to occur, you will be committing a criminal offence. Following these guidelines will help you reduce the likelihood of a pollution incident. If one does occur contact the environmental regulator immediately on the relevant incident hotline number: In Northern Ireland and Scotland call **0800 80 70 60**, in Wales call **0300 065 3000**.

SECTION 1

1.1 Legal compliance

The basis of any good environmental performance is compliance with environmental regulations. You must be aware of your environmental responsibilities and make sure that you operate in a completely legal way.

Non-compliance brings the risk of enforcement action, possible fines and real damage to your reputation as a business.

1.2 Save money

Good environmental performance includes reducing waste, minimising energy and water use and taking steps to reduce other environmental impacts that your business might have. This creates a leaner and more efficient business with lower costs.

1.3 Manage risk

Businesses which manage the risks to their success are often better prepared to deal efficiently with problems when they happen. Managing risks gives you peace of mind and maximises your chances of running a successful business.

1.4 Enhance your reputation

Legal compliance and implementing good practice will improve your reputation with customers and your neighbours. Your environmental credentials can help you win contracts; an increasingly relevant part of the tendering process for many sectors.

1.5 Why we need to protect our environment

Pollution occurs when substances released to water, land or to air have a harmful effect on our environment. It can affect our drinking water supplies, people's health, business activities, wildlife and habitats, and our enjoyment and use of the environment. You might not see it, but you can pollute it.

Pollution can happen accidentally or deliberately, and can come from a single place (point source) or from lots of different, possibly unknown and unconnected sources (diffuse sources).

Many different substances can cause pollution – common examples include:

- fuels and oils
- chemicals
- sewage
- farm manure
- slurry
- detergents
- milk
- fire-fighting run-off.

You should understand your premises and how your activities could affect the environment and cause pollution. Think about what pollution linkages you have.

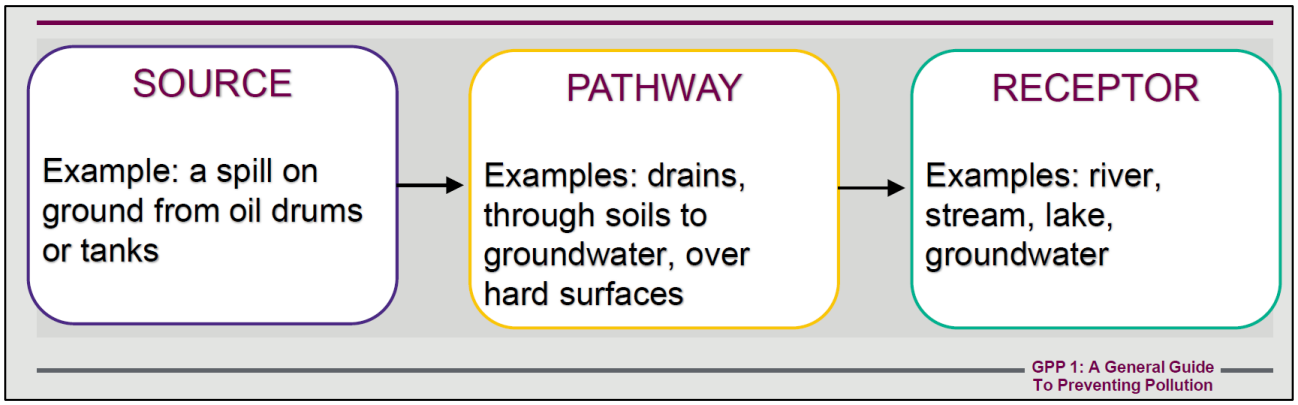


Figure F1 Source, Pathway, Receptor

Your site and activities will only cause harm to the environment or people if you have all of these present: a source, a pathway and a receptor.

You should put in place measures to break the links or weaken the links between potential sources, the pathways and the final receptor.

By doing this, you can identify how to prevent or reduce the likelihood of pollution and reduce the impact of any problems which may occur.

SECTION 2

2.1 Where does “dirty water” come from?

Where does “dirty water” come from?

Almost all premises produce dirty water which could cause pollution if it enters rivers, streams, ditches or groundwater.

Dirty water comes from:

- Kitchens
- Bathrooms
- Toilet and laundry facilities
- Vehicle washing
- Rainwater run-off from dirty areas of your premises
- Rainwater run-off: spills from storage and delivery areas
- Liquid wastes or trade effluents from your business activities.

Many premises also store liquid materials such as chemicals, fuels and oils, milk or fertilisers which can spill, leak or release their contents if there is a fire or flood.

To protect your environment from spills, leaks and other accidents it is very important that you make sure that you know where your drains are, and where they go.

2.2 Drains - why are they important?

Drains are common pathways for dirty water to enter the environment and cause pollution. This can happen through wrong connections, spills and leaks, fires and poor or inadequate maintenance.

Your site can have two types of drain: surface water drains, and drains that connect to the sewer.

You must not allow dirty water to enter surface water drains

To reduce the risk of pollution, you should know where your drains are, where they go and correct any problems you may find, such as wrongly-connected pipes.

If you make changes to your premises, such as building an extension or changing activities, you should understand your drainage systems so you can manage these changes safely, cost-effectively and without causing pollution.

If you want to discharge anything other than clean rainwater runoff from your site onto land, or into a watercourse you must contact your environmental regulator (NIEA, SEPA or NRW) and get permission. You will probably have to treat any dirty runoff before you can discharge it. Contact details are at the end of this document. If you want to put dirty water into a sewer, you must contact your water and sewerage provider.

2.3 Where do your drains go?

All premises should have a drainage plan.

This will show where **surface water drains** are located and where they discharge to any nearby ditches, streams, rivers or other watercourses. This includes storm drains.

It will also show where **drains that connect to the sewer** are located. These can be sewers that remove dirty water only, or combined sewers, which take dirty water and runoff from some surface water drains to the sewage treatment plant.

This information should be available when you need it:

- when you plan activities on your site,
- when you to carry out inspection and maintenance of your drains
- when contractors or visitors need this information.

You can get help to work out where your drains are, and where they go, from:

- your sewerage provider
- your landlord
- a drainage consultant.

Produce a clear plan of your site, with all the drains identified, and include the direction of the drain, where it leaves your premises and where it goes. Include any nearby watercourses in your plan.

Colour code manhole covers and drains, **red for drains that lead to the sewer** and **blue for drains that lead to surface water.** This can prevent accidental contamination of the surface water drain.

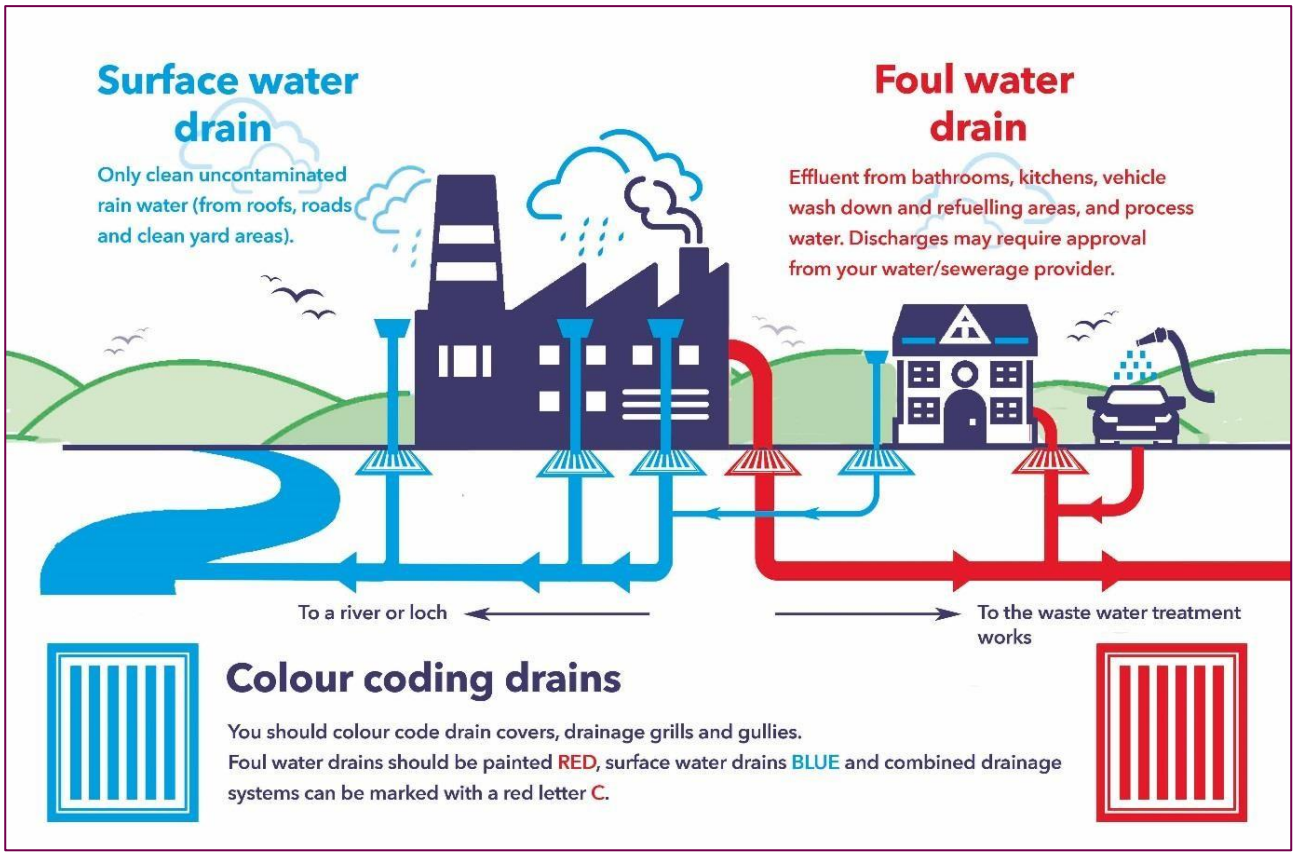


Figure F2: Surface Water and Foul Water Drainage

2.4 On site treatment facilities

You might have treatment facilities on your site, such as septic tanks, package treatment plants or oil separators.

Make sure that these are maintained properly as they can be a source of pollution if they are not working correctly.

Manufacturers will provide information on how to maintain these facilities, you should make sure you have this information available so you can correct any problems, or if you need to change your site layout.

2.5 SuDS

You might also use Sustainable Drainage Systems (SuDS) to treat lightly contaminated water that runs off your site. Speak to your environmental regulator before installing SuDS. It is important to make sure the system is properly maintained.

SuDS can treat runoff where there is a possibility that runoff will collect light contamination, for example from car parks, and will trap and help break down these pollutants. SuDs will also reduce the risk of downstream flooding, and can add green space to built-up areas.

SuDS require a certain amount of land, and are not possible on every site. If you are designing new premises then consider SuDS from the outset. In Scotland all new developments (but not single dwellings) must include SuDS for the treatment and attenuation of surface water runoff.

If you wash or clean vehicles on site then make sure runoff from this activity does not go into surface water drains. Make sure that you have permission from your sewerage provider if you want to discharge this runoff to the foul sewer.

2.6 More information on drainage

- All GPPs can be found at: https://www.netregs.org.uk/environmental-topics/pollutionprevention-guidelines-ppgs-and-replacement-series/guidance-for-pollutionprevention-gpps-full-list/
- Connect right website - http://www.connectright.org.uk/
- GPP 13 Vehicle washing and cleaning.
- GPP 3 Use and design of oil separators in surface water drainage systems
- GPP 4 Treatment and disposal of wastewater where there is no connection to the public foul sewer
- GPP 5: Works and maintenance in or near water.
- NetRegs SuDS https://www.netregs.org.uk/environmentaltopics/water/sustainable-drainage-systems-suds/

SECTION 3

You might store a number of different materials at your premises. Even materials that you think of as safe can cause serious damage to the environment.

Think of all the materials that arrive on your premises, including those delivered, collected, stored and handled by staff, and also by visitors or contractors.

Oils and chemicals are obvious sources of potential environmental harm, but other materials such as food and drink products and detergents can cause significant pollution. For example a spill of milk can cause more harm to a watercourse than the same volume of sewage.

Remember, you have already paid for these materials, and if you lose a quantity of them you are losing money. You will then also have clean-up costs. You also want to avoid any health and safety problems which could affect people on your premises or people nearby.

3.1 Plan your storage areas

Make sure that you understand the risks associated with any materials you store on site. Suppliers will provide product information and highlight materials with particular risks associated with their storage or handling.

You must pay the same attention to the storage of waste, waste management companies can advise you about containers and storage areas.

Use your **drainage plan** to identify the safest places to store materials. Consider when and how you use these materials, and use this to plan your storage areas.

You should avoid storing materials:

- Near to open drains
- On bare ground; always use impermeable surfaces
- Anywhere near to watercourses, soakaways or other sensitive areas
- Anywhere there is a risk of flooding

Choose areas that are:

- Under cover – to prevent rainwater carrying pollutants away
- Bunded to prevent spills spreading
- In a safe place away from vehicles, to prevent collisions.

Leaks and spills can soak into unmade ground where there is a risk of pollution to groundwater. This can affect drinking water, and the clean-up can be a lengthy and expensive task.



Figure F3: Safe Storage, Bunded and Under Cover

3.2 Use suitable containers

Use containers that are suitable for the materials stored. Label them clearly and store them in a dedicated area.

Make sure your containers are in good condition by doing regular inspections. Any cracks or leaks can be dealt with before causing an incident.

Some materials must have specific storage, for example all kinds of oils and fuels.

Certain materials must be kept away from other materials to prevent reactions or fire.

Keep your storage areas secure, to prevent accidental damage, theft or vandalism.

You are responsible for clean-up costs even if the damage is caused by vandalism.

3.3 Contain leaks and spills

You can’t completely avoid spills and leaks, so put in place measures to reduce their likelihood and severity. You should be able to catch minor spills, leaks or overflows from your containers or stores, and be able to clean them up easily and safely.

Consider installing and maintaining secondary containment, such as a bund wall, or using bunded pallets. It's good practice for your secondary containment to be able to hold more than your tank or container is able to hold, commonly called 110% containment. In some cases this is a legal requirement, such as when storing oils. Secondary containment gives you time to either correct or minimise the problem and to get help.



Figure F4: Bunded Storage Drums and Containers

You should inspect and maintain your secondary containment so it's still effective, such as sealing any cracks or holes, making sure any walls or floors are rendered impermeable, and safely removing any rainwater from the secondary containment. If you store fuels or other liquids in underground storage tanks (USTs) you must take care when installing these tanks, or when decommissioning or removing them. If not carried out properly, these activities can result in serious pollution of soil, groundwater and nearby water courses.

You and others on your premises should know where to find your spill kits, understand how to use them properly and understand how to store and use materials safely. Label your spill kits and check their contents regularly.

If you have a spill or any pollution incident, report immediately on **0800 807060** **(24 hours, 7 days a week)** – your environmental regulator can advise you on what to do, and can help to inform any other agencies that might be required.

3.4 Deliveries

Delivery and handling of materials can be risky, and delivery areas should be managed to prevent incidents.

Have procedures in place for safe deliveries, and make sure all your suppliers understand them. Supervise deliveries to make sure that procedures are followed.

Keep spill kits or appropriate clean-up equipment close to where deliveries are made, and make sure staff and suppliers understand how to use them.

Minimise the handling and movement of materials around your site by planning where deliveries take place. This reduces the risk of spills, and also saves time and money.

3.5 More information on storage of materials

- All GPPs can be found at: https://www.netregs.org.uk/environmental-topics/pollutionprevention-guidelines-ppgs-and-replacement-series/guidance-for-pollutionprevention-gpps-full-list/
- GPP 2 Above ground oil storage tanks.
- GPP 8 Safe storage and disposal of used oils
- GPP 13 Vehicle washing and cleaning
- GPP 21 Pollution Incident Response Planning
- GPP 22 Dealing with spills
- GPP 26 Safe storage - drums and intermediate bulk containers

Section 4

4.1 Minimising your waste (Appendix F details a SWMP)

Wastes which are most hazardous to the environment or human health, such as solvents, asbestos and oils must be managed differently from other wastes. You have a legal duty to understand what types of waste you produce and how you need to manage them.

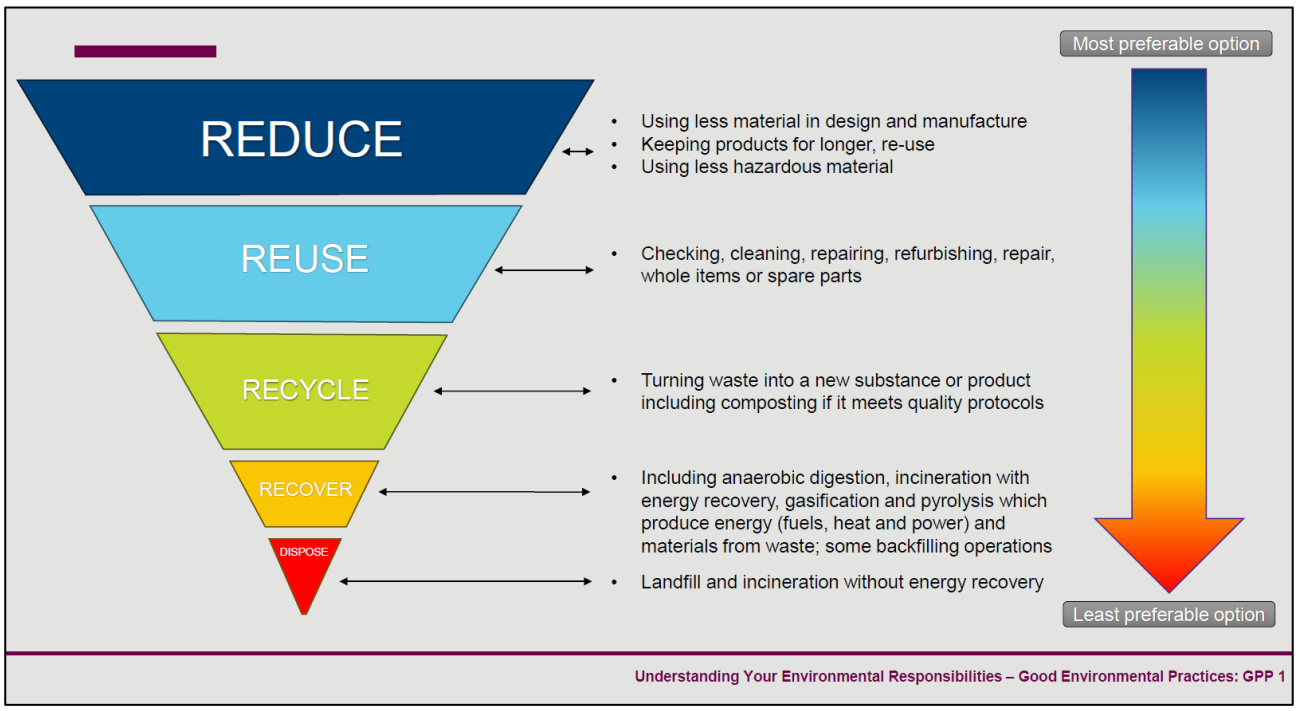


Figure F5: The Waste Hierarchy

Reduce - There are a number of ways to reduce the amount of waste you produce. This ranges from simple measures such as purchasing goods with less packaging or buying in bulk, not in individual packs, to entirely redesigning your products and processes to eliminate waste.

Reuse - Identify goods or materials that can be reused, perhaps with minimal cleaning and preparation. Design for re-use, e.g. your packaging.

Recycle - Items that can't be re-used can often have the materials they are composed of recycled. Items made of a single material are easier, however you may be able to find a cheap way of removing recyclable parts from more complex items.

Recover - Rather than dispose of materials to landfill, it is sometimes possible to recover some value from them, even if this is just heat from burning them. Energy from waste plants convert the waste into heat and power.

Dispose - The least desirable destination for waste. A last resort if all other options have been tried and have not been feasible.

4.2 Storage and handling

Store waste in secure containers. If they contain liquids, make sure they don't leak. Where appropriate keep waste in containers with lids. This will prevent the wind blowing waste around your site, and will keep the waste dry. Rain water could pick up pollutants from the waste and this contaminated water would need to be

managed as a waste too. Also, for example, wet cardboard weighs more than dry, and if soaked you could end up paying extra to have this material removed from your site.

4.3 Segregate your wastes

In Wales all businesses must segregate dry recyclable materials. Paper, cardboard, glass, metals and plastic must be segregated to allow for high quality recycling.

Clearly label the containers for different materials, and make your staff aware so the right materials go into the right containers.

Identify all the waste materials you produce, then identify those that can be reused or recycled.

4.4 Hazardous/special waste

Some types of waste, called 'hazardous wastes', or, in Scotland, 'special wastes', are very harmful to human health or to the environment. You must store, handle and dispose of these differently to non-hazardous wastes.

You must not mix different types of hazardous/special wastes together. Also, if you mix hazardous wastes with non-hazardous wastes then you must consider it all as hazardous/special waste.

Consider the security of your premises too - any waste dumped on your property becomes your responsibility to remove, and it will cost you money.

4.5 Waste Disposal

You must only use a registered waste carrier to take your waste away. Check your environmental regulators website to find a list of all registered waste carriers.

Ask where they will take your waste, and check that waste site is authorised to accept your type of waste. Not all waste management sites can accept all types of waste.

You can transport your own business waste to a site for recovery or disposal, but you will need to register with your environmental regulator.

If waste is removed from your site you must complete a Waste Transfer Note, and keep your copy for 2 years. If the waste removed from your site is hazardous/special waste then you must complete a Consignment Note and keep your copy for at least 3 years.

SECTION 5

5.1 Preparation

Dealing with incidents mean significant disruption to your activities. The better prepared you are the less downtime you will experience. Preparing and incident response plan can save time and effort and will reduce the cost of dealing with an incident.

Remember, you are responsible for any contractors working on your behalf, so you must make sure you give them clear work instructions and supervise them appropriately

5.2 Planning and training

The best way for you to cope when problems and emergencies arise is to plan. Well managed premises are less likely to have problems in the first place.

You should create and implement an **incident response plan**. You may even have a legal responsibility to make a plan. It should include procedures to deal with problems and emergencies and importantly include a copy of your drainage plan.

5.3 Implement plans

Make sure everyone on your premises understands what to do in case of an emergency. Include advice to visitors and contractors. Keep a copy of your plan offsite, so you can always access it. Regularly train staff, and review your plans on a regular basis to make sure they are fit for purpose. Make sure the plan is updated if there are changes to you premises, or you change the materials or processes you carry out.

5.4 Flooding

You can check whether you are at risk from flooding on the flood maps available from your environmental regulator. You will also be able to sign up for free flood warnings direct to your phone.

5.5 Fire

Contact your local Fire and Rescue Service and ask them to visit and give you advice of fire safety and fire prevention. They can help you draw up a fire response plan for your premises.

5.6 Spill kits and pollution control equipment

Keep spill kits close to areas where there is a risk of spills, for example near to oil storage areas. Make sure these are maintained and restocked after any incident.

Train staff in when and how to use them.

Have pollution control equipment that is appropriate to your site, your activities, and the risks they pose.

5.7 If you have an incident

If you have a pollution incident:

Use the pollution hotline 0300 065 3000 (24 hours a day, 7 days a week)

Your environmental regulator can offer advice on what to do and can inform any other agencies that may be required.

5.8 More information on dealing with pollution incidents

All GPPs can be found at: https://www.netregs.org.uk/environmental-topics/pollutionprevention-guidelines-ppgs-and-replacement-series/guidance-for-pollutionprevention-gpps-full-list/

GPP 21 Pollution Incident Response Plans GPP 22 Dealing with spills

Flood maps and guidance

Natural Resources Wales: Flood Maps https://naturalresources.wales/flooding/check-your-flood-risk-on-a-map-flood-risk-assessment-wales-map/?lang=en

Fire and Rescue contact information

Mid and West Wales Fire and Rescue Service: Business safety advice

https://www.mawwfire.gov.uk/eng/your-safety/business-fire-safety/fire-law-and-guidance-for-business/

Appendix G

Emergency Response & Environmental Plan

The contractor will be responsible for the preparation and implementation of the spillage response procedure. The key issues to consider for the spillage response procedure include:

1. **If the main contractor already has a standard spill response procedure in operation then this should be amended to reflect the local conditions on site;**

2. **It will be important to ensure that the Environmental Manager is notified of all incidents where there has been a breach in agreed environmental management procedures;**

3. **As a general rule the following principles should apply In the event of an environmental emergency:**

    a. **If SAFE, stop the source of the spill and raise the alarm to alert people working in the vicinity of any potential dangers. Inform Engineer immediately**

    b. **IF SAFE (USE PPE), contain the spill using the absorbent spill material provided. Do not spread or flush away the spill. Cover or bund off any vulnerable areas where appropriate.**

    c. **If possible, clean up as much as possible using the absorbent spills materials. Do not hose the spillage down or use any detergents.**

    d. **Contain any used absorbent material so that future contamination is limited.**

    e. **Notify the Construction Project Manager and environmental officer so that used absorbent material can be disposed of using a specialist contractor.**

4. The Construction Manager, in conjunction with the contractor's environmental manager, will develop and test, through exercises, the Emergency Spillage Procedure to ensure that appropriate measures to prevent and mitigate damage due to accidents and spillages are in place.

5. Testing of the Emergency Spillage Procedure shall be recorded on the relevant environmental control form.

6. Inform all personnel about the spill response procedure through toolbox talks and/or induction training. Consider the need for refresher training on long-term construction projects.

7. Use reminder posters, identifying the key essential elements of the spill response procedure, located in appropriate areas such as fuel storage areas, mess cabins, security points or on the back of toilet doors.

8. Example control containment measures for different pollutants are given here:

Control/Containment Measure	Pollutants				
Spill on ground	**Concrete / cement**	**Paints**	**Oils**	**Silt**	**Detergents**
Sand	✓	✓	✓	×	✓
Straw bales	×	×	✓	✓	×
Absorbent granules	×	×	✓	×	×
Geotextile fence	✓	×	×	✓	×
Drip trays	×	✓	✓	×	×
Pads/rolls	×	×	✓	×	×
Drain seal	✓	✓	✓	✓	✓
Earth bunds	✓	✓	✓	✓	✓
Spill in water					
Straw bales	×	×	✓	✓	×
Pads/rolls	×	×	✓	×	×
Booms	×	×	✓	×	×
Stop further spill contain and inform appropriate personnel immediately	✓	✓	✓	✓	✓

In the event of a significant spill contact

NRW'S Incident Hotline (0300 065 3000)

It will be important to incorporate the names and telephone numbers of others you need to inform (includes alerting people out of hours) and who should contact them within the spillage response plan.

Further issues to be considered when the main contractor is preparing an emergency spill response plan include:

- Details of a professional 24 hour call-out clean-up service e.g.: Spill Response Wales. Tel: 01550 721301
- Ensure sufficient types and quantities of spill response equipment are available on site. Keep spill kits where spills may occur, e.g. at refuelling points or on plant working near a watercourse.
- Material safety data sheets and COSHH assessments will assist in identifying appropriate spill measures for dealing with hazardous materials.
- Dispose of used spill response material appropriately, e.g. oily granules or pads should be bagged up and placed in the designated waste skip.

IMPORTANT TELEPHONE NUMBERS

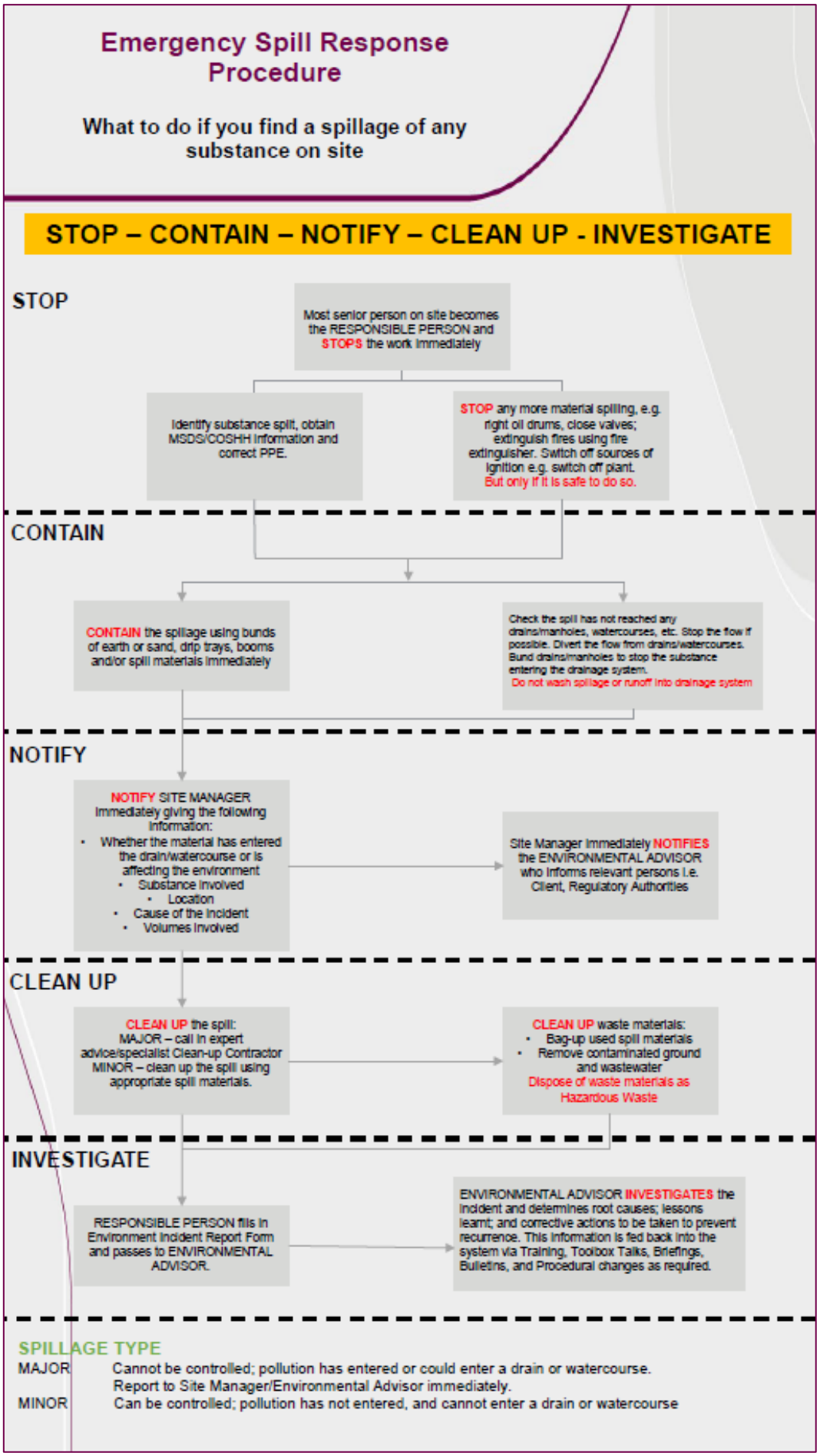
Emergency Contact Details	
Emergency Services	**999**
Nearest Hospital Withybush General Hospital Fishguard Road, Haverfordwest SA61 2PZ	
NRW Environmental Incident Hotline	**0300 065 3000** (Free 24 hr Emergency Hotline)

Contractor Contacts: (Out of Hours)	
Construction Director	TBC
Construction Manager/Site Manager	TBC
Environmental Manager	TBC

Incident response plan KEY POINTS (From: GPP 21: Pollution Incident Response Plans)

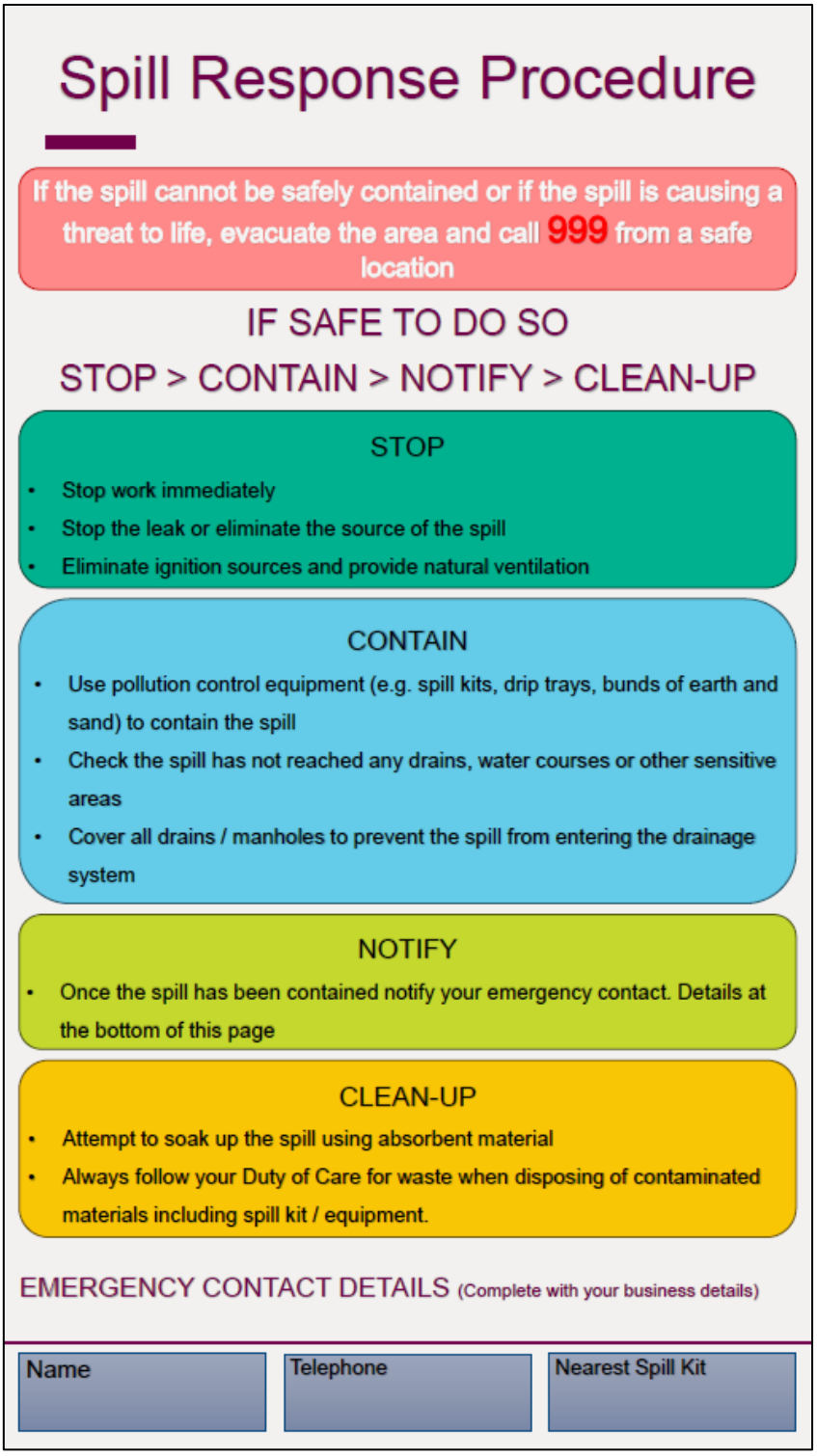
Pollution Incident Response Plan Checklist

Procedure	Included?
Clearly define **when you will activate the plan**. This will depend on the nature of your site and the type of the incident.	
Ensure all relevant staff know how and when to **contact other emergency** responders: emergency services, environmental regulator, local authority, sewage undertaker and others identified in your plan.	
Agree **contact procedures**, if possible, with nearby properties, downstream or downgradient abstractors (from surface water and groundwater), agricultural land or environmentally sensitive sites that could be affected by an incident on your site.	
Put in place **staff evacuation procedures** – your local authority emergency planning department will help you with these.	
Identify any special methods you need to deal with **substances** posing particular health or environmental risk.	
Develop a **firefighting strategy** with your local fire and rescue service; if a controlled burn is an agreed option, state this clearly. The same applies to the use of foam (see **reference 1: Controlled Burn** for further advice).	
Train your staff in **the use of spill kits**, drain blockers and other pollution control equipment and the operation of pollution control devices.	
Identify procedures for recovering spilled product and the safe handling and **legal disposal of any waste** associated with the incident.	
Have staff available who are trained to deal with **media enquiries**.	


Emergency Spill Response Procedure
What to do if you find a spillage of any substance on site
STOP – CONTAIN – NOTIFY – CLEAN UP - INVESTIGATE
STOP
Most senior person on site becomes the RESPONSIBLE PERSON and STOPS the work immediately
Identify substance spilt, obtain MSDS/COSHH information and correct PPE.
STOP any more material spilling, e.g. right oil drums, close valves; extinguish fires using fire extinguisher. Switch off sources of ignition e.g. switch off plant. But only if it is safe to do so.
CONTAIN
CONTAIN the spillage using bunds of earth or sand, drip trays, booms and/or spill materials immediately
Check the spill has not reached any drains/manholes, watercourses, etc. Stop the flow if possible. Divert the flow from drains/watercourses. Bund drains/manholes to stop the substance entering the drainage system. Do not wash spillage or runoff into drainage system
NOTIFY
NOTIFY SITE MANAGER Immediately giving the following information:
Whether the material has entered the drain/watercourse or is affecting the environment
Substance involved
Location
Cause of the incident
Volumes involved
Site Manager Immediately NOTIFIES the ENVIRONMENTAL ADVISOR who informs relevant persons i.e. Client, Regulatory Authorities
CLEAN UP
CLEAN UP the spill:
MAJOR – call in expert advice/specialist Clean-up Contractor
MINOR – clean up the spill using appropriate spill materials.
CLEAN UP waste materials:
Bag-up used spill materials
Remove contaminated ground and wastewater
Dispose of waste materials as Hazardous Waste
INVESTIGATE
RESPONSIBLE PERSON fills in Environment Incident Report Form and passes to ENVIRONMENTAL ADVISOR.
ENVIRONMENTAL ADVISOR INVESTIGATES the incident and determines root causes; lessons learnt; and corrective actions to be taken to prevent recurrence. This information is fed back into the system via Training, Toolbox Talks, Briefings, Bulletins, and Procedural changes as required.
SPILLAGE TYPE
MAJOR Cannot be controlled; pollution has entered or could enter a drain or watercourse. Report to Site Manager/Environmental Advisor immediately.
MINOR Can be controlled; pollution has not entered, and cannot enter a drain or watercourse

From: Guidance for Pollution Prevention Dealing with spills: GPP 22 October 2018 (Version 1)

PRINT OUT AND DISPLAY SIGN (To be located throughout site)



Spill Response Procedure

If the spill cannot be safely contained or if the spill is causing a threat to life, evacuate the area and call 999 from a safe location

IF SAFE TO DO SO

STOP > CONTAIN > NOTIFY > CLEAN-UP

STOP

- Stop work immediately
- Stop the leak or eliminate the source of the spill
- Eliminate ignition sources and provide natural ventilation

CONTAIN

- Use pollution control equipment (e.g. spill kits, drip trays, bunds of earth and sand) to contain the spill
- Check the spill has not reached any drains, water courses or other sensitive areas
- Cover all drains / manholes to prevent the spill from entering the drainage system

NOTIFY

- Once the spill has been contained notify your emergency contact. Details at the bottom of this page

CLEAN-UP

- Attempt to soak up the spill using absorbent material
- Always follow your Duty of Care for waste when disposing of contaminated materials including spill kit / equipment.

EMERGENCY CONTACT DETAILS (Complete with your business details)

Name	Telephone	Nearest Spill Kit

NRW Incident Hotline

0300 065 3000

4.A

APPENDIX 4.A
Cumulative Effects

Cumulative Longlist of Projects (100km radius)

Project Name	Application Reference	Description	Status	Location	Co-ordinates	EIA	Distance from Proposed Development	Tier
	NP/24/0164/OBS	Shellfish Farm expansion	Decision made (outcome unknown) 03/04/2024	Car-Y-Mor Ocean Farm, St Brides Bay, Pembrokeshire	E – 172504 N – 223350	N / A	26km	2
	NP/22/0133/OBS	Jetty berth maintenance	Decision made (outcome unknown) 11/07/2023	South Hook LNG Terminal Company Ltd, South Hook LNG Terminal, Dale Road, Herbrandston, Milford Haven, SA73 3SU	E – 186855 N – 204372	N / A	38km	2
Arklow Bank Wind Park 2	APB 319864	Proposed offshore wind energy development	Live Case – decision pending	Located off the coasts of Co. Wicklow and Co. Wexford	E - 337935 N - 176613	EIA Report submitted	Approx 110km	2
White Cross Offshore Windfarm	North Devon Council – App no. 77576	Full planning permission for the construction and installation of onshore electrical infrastructure required to export electricity from the White Cross Offshore Wind Farm to the national distribution network; including installation of 132kV underground electricity transmission cable(s) from landfall at Saunton Sands Car park to a new substation at East Yelland. Construction of temporary facilities required during construction to include haul road, vehicular access, compounds, associated works areas and a permanent substation access road . Construction of a new substation	Live Case – decision pending	Located 52km off the North Devon coast	E – 178550 N - 132417	EIA Report submitted	Approx 100km	2

		under the Rochdale Envelope Approach with additional information regarding architectural form and silhouette, design code, scale and layout, landscaping, lighting, and appearance and materials.						
Llyr 1 and 2	Llŷr Floating Wind has applied to Welsh Ministers under Section 36 of the Electricity Act 1989 for consent to build and operate Llŷr 1	Floating Offshore Wind Farm 10 wind turbines generators per project, 10 floating platforms, mooring infrastructure & 2 x export cables to landfall at Freshwater West)	Live application - Ongoing	Located in the Celtic Sea, within Welsh Waters, offshore from the Pembrokeshire coastline. At its closest point, the boundary of the proposed area for lease for the Projects is approximately 38 km from the Lundy Island shore and 31 km from the Welsh coastline	E – 174973 N - 156365	EIA Report submitted	Approx 90km	2
Erebus	DNS/3251528 – S36 Application under Electricity Act deemed planning application	Floating Offshore Wind Farm (7 wind turbine generators of 43.5km with 49km offshore cable **https://www.bluegemwind.com/planning**	Consenting complete -	Located approximately 35 km off the South West coast of Pembrokeshire and landfall at West Angle Bay, Pembrokeshire.	E - 158975 N - 181356	Approval 06/03/2023 Construction commenced January 2025	Approx. 80km	2
ORE Operation and Maintenance facility	Maritime Area Consent Applications - MAC20230005	Reclamation of approximately 20 hectares for assembly/storage, relocation of small boat harbour, capital dredging, quay walls, road access and rock armour boundary.	Live application	Rosslare Europort	E - 313739 N - 113375		Approx 95km	2

Greenlink Interconnector	Approvals in Ireland and Wales for Convertor Stations, Onshore cable route and marine cables	Interconnector cable between existing electricity grids in Ireland and Wales	Construction complete & project commissioned	Freshwater West beach, Pembrokeshire, Wales and Baginbun Beach, Wexford Ireland		EIA reporting complete	Approx 20km (Wales) & 50km (Ireland)	2

5.A

APPENDIX 5.A
EIA Screening and Scoping Opinion

Ein cyf/Our ref: SC2402

Natural Resources Wales, Marine Licensing Team, Welsh Government Offices, Cathays Park, King Edward VII Avenue, Cardiff, CF10 3NQ

Ebost/Email: maria.alvarez@cyfoethnaturiolcymru.gov.uk
Ffôn/Phone: 03000653477

Stena Line Ports Ltd

31 January 2025

Dear Michelle Price,

SCREENING AND SCOPING OPINION UNDER THE MARINE WORKS (ENVIRONMENTAL IMPACT ASSESSMENT) REGULATIONS 2007 (as amended)

FISHGUARD REPLACEMENT LINKSPAN

I am writing further to your request for a screening and scoping opinion, dated 29 November 2024, made in accordance with The Marine Works (Environmental Impact Assessment) Regulations 2007 (as amended) ("The Regulations").

The purpose of the Environmental Impact Assessment (EIA) screening procedure is to determine whether the Proposed Development require an Environmental Impact Assessment and submission of an Environmental Statement (ES). The purpose of the scoping procedure is to determine what information should be provided in the ES.

In reaching our Screening Opinion we have considered the Proposed Development against Schedule A1 and A2 of the above regulations. In reaching our scoping opinion we have had regard to the information provided in the "FISHGUARD LINKSPAN REPLACEMENT EIA Scoping Report" (*SC2402 - 794-NI-POR-00886 Fishguard EIA_Scoping_Report V.01 28.11.24*), dated 28 November 2024, and considered the requirements of Schedule 3 of the Marine Works Regulations. We have also consulted with the bodies that we consider have an interest in the project by reason of their environmental responsibilities, or local or regional competences, as required by the above regulations, and had regard to their comments.

Screening Opinion

It is our opinion that the works fall within the categories of project listed within Schedule A2, paragraphs 63 and 69 of the above regulations:

> ***63**. Construction of harbours and port installations including fishing harbours*
>
> ***69**. Coastal work to combat erosion and maritime works capable of altering the coast through the construction of, for example, dykes, moles, jetties and other sea defence works, excluding the maintenance and reconstruction of such works.*

Therefore, the project must be considered in terms of its size, nature and location having regard to the relevant criteria listed in Schedule 1 of the above regulations.

We have carefully considered the views of the consultation bodies alongside the criteria as set out in Schedule 1 of the regulations, and have determined, based on the information provided; that the project has the potential to have a significant effect on the environment and therefore a statutory Environmental Impact Assessment is required.

We have come to this conclusion on the basis of the likely significant impacts of the project, specifically with regard to the magnitude of the project which involves substantial construction, dredging and land reclamation and its location within the West Wales Marine Special Area of Conservation.

Scoping Opinion

This letter sets out the additional information that we consider necessary to be included and/or assessed in the ES for this project.

Please note our scoping opinion is based on the information available to us at this time. The information provided is not a definitive list of the ES / EIA requirements and further information may be required following an application for this project, to ensure a full assessment is carried out.

This Screening and Scoping Opinion will be provided to all those bodies that were consulted and will be publicised on our website and on our Public Register.

The Marine Works (Environmental Impact Assessment) Regulations 2007 (as amended)

Scoping Opinion (SC2402)

Summary of the proposal

Stena Line wish to replace their existing temporary arrangement in Fishguard Bay of a linkspan and jack up barge and provide a replacement floating pontoon to allow safe berthing of the ferry at Fishguard in the long term. The berth is also infrequently used by cruise vessels and historic steamboats.

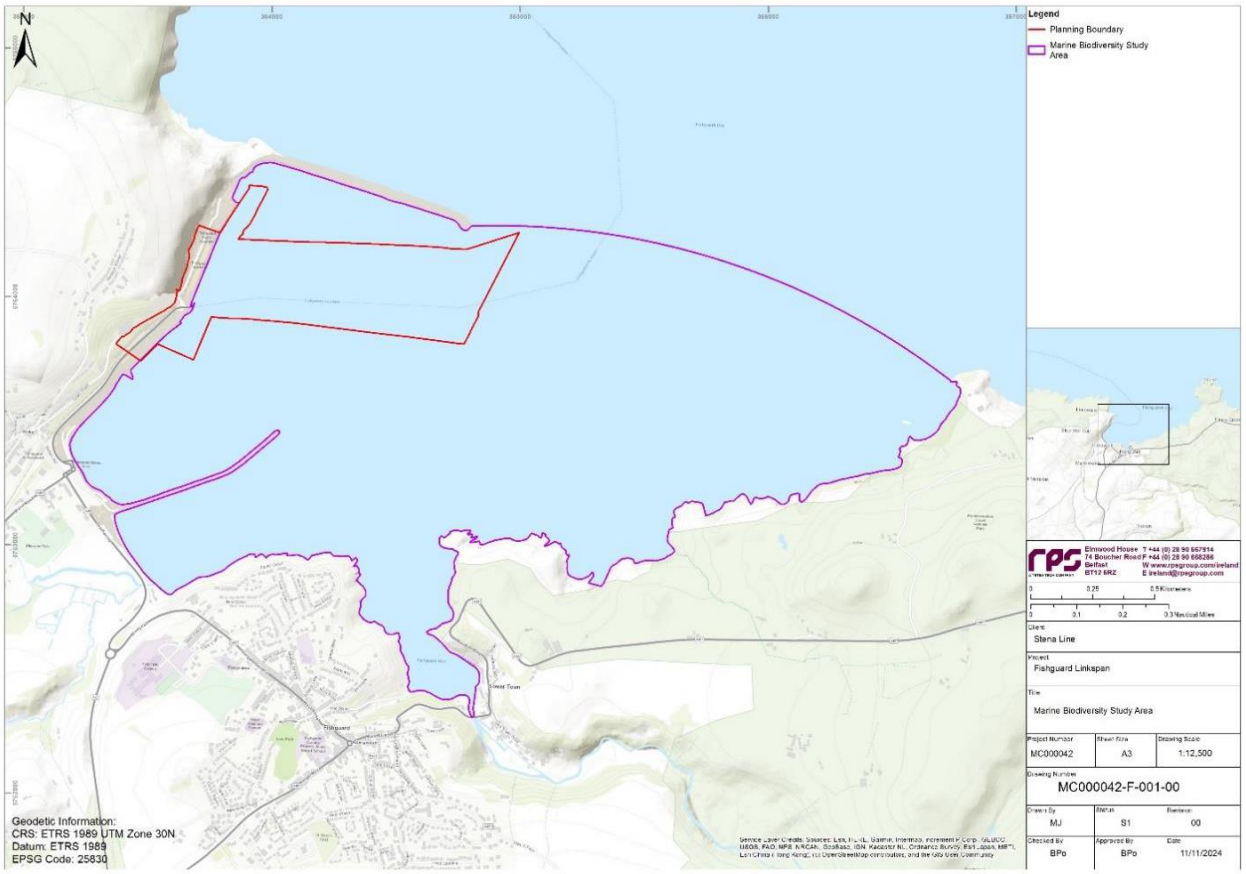
The Proposal requires land reclamation and rock armour revetment construction to enable access and utilisation of the pontoon for the ferry traffic. Landside works will be required to adjust traffic and pedestrian routes to service the new floating pontoon. Dredging works will include maintenance dredging of the berth; capital dredge of the navigation channel and beneath the pontoon, and soft material removal to allow construction of the reclaimed area.

The project involves several key activities aimed at enhancing the infrastructure and operational capabilities of the harbour and are summarised below:

1. The construction of a new reclamation area retained using a rock armour revetment and with an asphalt surface. To facilitate the construction of this reclaimed land, dredging of soft material behind the new berth will be necessary.
2. Dredging to a depth of -9mCD beneath the pontoon to ensure sufficient depth for operations.
3. Maintenance dredging of the harbour to maintain depths of -7.3mCD and -5.5mCD.
4. The construction of a reinforced concrete bank seat structure to support the pontoon at the edge of the reclamation which is expected to be a piled bank seat, likely using rotary installed steel tubular piles filled with concrete.
5. The installation of the pontoon and its supporting guide pile, with the pile being rotary bored and partially filled with concrete. The installation of the guide pile will require two steel piles (of approximately 1.22m in diameter) to be installed temporarily.
6. The removal of the existing temporary jack-up barge, which will be floated away without the need for demolition.
7. The demolition of one of the existing ‘buffer dolphin’ tower structures and the operations room, along with the removal of the steel access bridge and the demolition of the existing suspended concrete deck structure. The existing disused RNLI jetty will also be demolished to enable the reclamation works. The area beneath the existing RNLI slipway will be enveloped into the reclamation.
8. On the landside, changes will be made to road markings, car parking, and the movement of passenger access and footways. No works are planned for the railway station or rail line.

Location

The application site is located within Goodwick/Fishguard, in Fishguard Bay, Pembrokeshire. See figure below (Figure 4-1 of the Scoping Report):



The site is a parcel of land spanning an area of approximately 36 hectares of the harbour, to include the existing linkspan, hinterland and within the bay foreshore. The site lies within West Wales Marine Special Area of Conservation (SAC).

Consultation Responses Received

In considering the Scoping Report, the NRW Permitting Service (NRW PS) consulted with various consultation bodies. The consultation bodies that responded are listed in **bold** below:

- **The Crown Estate**
- **NRW Advisory (NRW A)**
- **Ministry of Defence (MoD)**
- **Maritime and Coastguard Agency (MCA)**
- **Trinity House (TH)**
- **Royal Yachting Association (RYA)**
- Local Biodiversity Officer (Pembrokeshire)
- Local Planning Authority (Pembrokeshire County Council)

- Local Planning Authority (Pembrokeshire Coast National Park Authority)
- Local Harbour Authority (ABP)
- Local Port Authority (Fishguard)
- Local Port Authority (Stenaline)
- Welsh Fishermen's Association (WFA)
- National Federation of Fishermen's Organisations (NFFO)
- Royal Society for the Protection of Birds (RSPB)
- **Welsh Government Marine and Fisheries Division/WG Marine Enforcement Officers**
- **Cadw**
- **Welsh Archaeological Trusts (Heneb)**
- **Royal Commission on the Ancient and Historical Monuments of Wales (RCAHMW)**
- **Environmental Public Health Service Wales**
- Chamber of Shipping
- **NERL Safeguarding**

0. General comments

0.1. Marine and coastal guidance produced by NRW that may provide useful information to help with your project is available here: https://naturalresources.wales/guidance-and-advice/business-sectors/marine/?lang=en

0.2. The ES submitted should demonstrate consideration of the points raised in this scoping opinion. It is recommended that a table is provided in the ES summarising the scoping opinion comments and how they are addressed in the ES.

0.3. The EIA must be undertaken by a competent person and the ES must include a competent expert statement.

0.4. Where possible, other environmental assessments should be coordinated with the EIA process. However, it is important to note that the Habitats Regulations Assessment (HRA) and Water Framework Directive assessment (WFD), and any other assessment, are separate processes to the EIA.

0.5. Throughout the ES robust evidence should be presented so that the potential environmental impacts can be properly understood and evaluated; and appropriate measures identified to avoid, reduce or where necessary compensate for those impacts.

0.6. The ES must include:

- A Non-Technical Summary (NTS);
- A chart or map identifying where the activity will be carried out;
- A description of the likely significant effects of the project, whether direct, indirect, secondary, cumulative, transboundary, short-term, medium-term, long-term, permanent, temporary, positive and negative;
- A description of the methods used to make the assessment of the significant

effects and difficulties encountered in compiling the information and uncertainties involved;
- A description of measures to avoid, prevent, reduce or offset identified significant adverse effects and proposed monitoring arrangements; &
- A description of the expected significant adverse effects of the project on the environment resulting from the vulnerability of the project to risks of major accidents or disasters.

0.7. The ES must consider any potential transboundary impacts where appropriate.

0.8. Early engagement with relevant stakeholders is encouraged. You are able to obtain further advice from NRW Advisory (NRW A) through the NRW Discretionary Advice Service, please see here: https://naturalresources.wales/guidance-and-advice/business-sectors/planning-and-development/advice-for-developers/our-service-to-developers/

0.9. All applications for dredge and/or disposal activities must be supported by the results of the sediment sampling and analysis and a biosecurity risk assessment. This information should be submitted using the forms on our website: https://naturalresources.wales/permits-and-permissions/marine-licensing/applying-for-a-marine-licence/?lang=en

0.10. No consideration has been given to the relevant Shoreline Management Plan. Since you are carrying out works that will affect (change or maintain) the current shoreline position, you will need to identify within your application the relevant Shoreline Management Plan and policy unit for the area of planned work. This information can be found on our website Shoreline Management Plans where you can identify the relevant Plan and Policy Unit (West of Wales and policy unit 4.2 for Fishguard Harbour). Further information for the area of planned work is here https://www.grwparfordirolgorllewincymru.cymru/page/smp2/main-document

0.11. You must ensure that the ES show clear consideration of compliance with the UK Marine Policy Statement and the Welsh National Marine Plan. You can use the Welsh National Marine Plan signposting document available on our website (Natural Resources Wales / Marine licence application forms) to assess how the project complies with its policies within the Plan. The published Welsh National Marine Plan can be found here: https://gov.wales/welsh-national-marine-plan-document and guidance on the implementation can also be found here: https://gov.wales/welsh-national-marine-plan-implementation-guidance

0.12. Please note that The Crown Estate has indicated that it is affected by the Proposed Development and landowner's consent is required. Please contact the Managing Agent for the area: Ellie Hitchings of Cooke and Arkwright on 02920 346345, Ellie.Hitchings@coark.com regarding landowner's consent for the proposed activity.

0.13. NRW PS generally agree with the topics that the report has scoped into the EIA. NRW PS have provided specific comment below. Where no comment has been provided the assessment should be carried out as detailed within the Scoping Report.

1. Non-technical Summary

1.1. The ES must include a non-technical summary, which concisely and clearly describes the project (the site, design, size, etc.); its likely significant effects on the environment; a description of the features/measures to mitigate the project likely significant adverse effects; and a description of the possible alternatives.

2. Project Description

2.1. As included in the Scoping Report, an introductory section would need to be included in the ES setting the background and need for the project, the location, and a description of the methods to be used in the project.

2.2. Limited detail surrounding some aspect of the project description and methodology have been presented within the Scoping Report, this therefore has limited advice that can be given at this stage regarding these aspect of works and assessments. Therefore, we would strongly encourage you to engage with all relevant consultees as you carry out your assessment.

Dredge/disposal Activities

2.3. NRW PS consider that there is a lack of information on the details of the capital dredging campaign. NRW PS require that specifics on the capital dredging such as the amount of sediment (dredge volume), footprint and type of material (particle size distribution analysis) will be required in the ES.

2.4. NRW PS expect that seabed sediment samples and core samples will be taken in areas of proposed capital dredge, excavation for the rock armour revetment and piling. NRW PS remind you that the samples should be analysed by an accredited UK laboratory and the sediment characterised in relation to particle size distribution, type, and contaminants (CEFAS Action 1 and 2).

2.5. NRW PS require that the ES includes further detail on:

- The exact dredge methodology, location and duration.
- Details on whether the material dredged will be used as infill for the land reclamation. Chapter 17 of the Scoping Report indicates that “onsite reuse of dredged material will be prioritised”, however, no details are given.
- The ES should make clear any existing dredge maintenance regimes which are in place and identify if ongoing maintenance requirements would be predicted following the proposal.
- NRW PS will require further details on the disposal of the dredging arisings, including sediment characterisation and disposal site suitability.

Land Reclamation

2.6. NRW PS require further details on the land reclamation methodology and the construction of the rock armour revetment. Further information on the proposed approach is needed including clarity on how the sediment will be retained (if any) within the land reclamation area prior to construction of the rock armour revetment. As an example, there are no details on the possible need of a

temporary cofferdam; the amount of material required for land reclamation; the area to be reclaimed resulting on permanent loss of seabed habitat, etc.

2.7. NRW A are concerned that permanent removal of soft sediment dredged through capital dredge activities may not be enough to fill the area designated for land reclamation. It is not possible to understand whether more material will be required without more information on the estimated volume to be dredged.

Rock Armour Revetment Toe

2.8. Details on the methodology and type of material to be used for the buried toe of the rock revetment will be required.

3. Policy and legislation

3.1. The ES should include a policy and legislation section relevant for the project, to include local, national and international obligations. These include but are not limited to:

- The Marine and Coastal Access Act (2009)
- The Marine Works (Environmental Impact Assessment) Regulations 2007
- The Wellbeing of Future Generations (Wales) Act 2015
- The Environment (Wales) Act 2016
- The Conservation of Habitats and Species Regulations 2017
- Wildlife and Countryside Act 1981 (as amended)
- The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017
- The UK Marine Policy Statement 2011
- The Welsh National Marine Plan

3.2. Marine licence determinations must be made in accordance with the UK Marine Policy Statement and the Welsh National Marine Plan. The ES must show full consideration of the Plan policies. Please see point 0.11.

3.3. The consenting processes, associated requirements and authorities for the totality of the project should be identified.

4. Population & Human Health - Chapter 3

4.1. NRW PS agree that population and human health is scoped into the assessment.

4.2. Public Health Wales (PHW) would expect the project to comply in full with best practice techniques. PHW indicates that if good management and maintenance of the works in compliance with current sector guidance is followed, there should not be any adverse impacts to human health, during or after construction.

4.3. NRW consider the assessment should be carried out as detailed within the Scoping Report.

5. Biodiversity Marine – Chapter 4 of Scoping Report

Benthic subtidal and intertidal ecology (Scoping Report section 4.1.1)

5.1. NRW PS draw to your attention, as identified by NRW A, that there are records of blue mussel beds within the planning boundary of the development. These beds are listed as 'Habitat of Principal Importance to Wales' under Section 7 of the Environment (Wales) Act (2016), and must be appropriately considered in the ES.

5.2. NRW A note that no subtidal surveys are proposed. NRW A have a low confidence in the existing subtidal data identified within the Scoping Report. NRW A indicate that the DDV survey undertaken in 2015, which classified much of the study area as *Arenicola marina* in infralittoral fine sand or muddy sand' (SS.SSA.IMuSa.AreISa), has relatively low confidence due to the age of the data and the lack of associated direct ground-truthing. NRW A also note that there are discrepancies between the habitats maps shown in Figures 4.2 (EUSeaMap) and 6.7 (BGS) of the Scoping Report. NRW A request that a survey programme is conducted to gain an accurate understanding of the benthic habitats present within the Proposed Development and its zone of influence.

5.3. NRW PS consider that the baseline subtidal environment must be suitably assessed and see this to be necessary to fully understand the potential impacts on benthic habitats and identify possible mitigation measures. NRW PS would strongly recommend you engage with NRW A to ensure that baseline data relied upon or collected is suitable.

5.4. NRW PS recommend engagement with NRW A to understand the extent and sampling effort required to adequately assess the Proposed Developments direct and indirect impacts. NRW A advise that sediment samples are analysed for PSA, macrofauna and contaminants. NRW PS remind you that this has to be undertaken by an accredited UK laboratory in line with the guidelines of the NMBAQC scheme.

5.5. NRW PS disagree that accidental pollution should be scoped out of the ES (Table 4.4). NRW PS consider that the details of the proposed post-consent plans are unknown at this stage. Therefore, as mitigation measures are not yet known, accidental pollution should be scoped into the assessment.

Fish and shellfish ecology (Scoping Report section 4.1.2)

5.6. NRW PS agrees with the sites included and potential impacts scoped into the assessment for fish and shellfish ecology (Table 4.5). NRW A welcomes the inclusion of nearby designated sites (Cardigan Bay SAC, Afon Teifi SAC, Cleddau Rivers SAC, Pembrokeshire Marine SAC and Carmarthen Bay and Estuaries SAC) in view of the migratory species features.

5.7. NRW PS agrees with NRW A that the relevant section 7 species listed within the Environment (Wales) Act 2016 should also be scoped into the assessment.

5.8. NRW PS agrees that underwater noise from piling during construction is scoped into the EIA and agrees with the preliminary mitigation measures proposed.

NRW A advises that these standard mitigation measures are likely to be sufficient; however, stresses that measures designed to reduce noise impact for mammals are not always appropriate on fish species. NRW PS would encourage you to engage with NRW A as you carry out your assessment and consider appropriate mitigation measures.

Marine mammals (Scoping Report section 4.1.3)

5.9. The activity is located within the West Wales Marine SAC and Celtic and Irish Seas Marine Mammal Management Unit (MMMU) for harbour porpoise. NRW A consider that the Marine Mammal Management Unit are the appropriate spatial scale that should be used when assessing impact. NRW A therefore will expect that North Anglesey Marine SAC is included in the assessment as animals from the SAC population could be found in the area and potentially be impacted. This is particularly relevant for impact pathways that result in injury or mortality. NRW PS will expect that the assessment is carried out in line with NRW's position statement[1].

5.10. Regarding grey seals, NRW A indicates that the OSPAR Region III should be used as the assessment's spatial area rather than Seal Management Units (SMU's). However, no change will be required as this will also result in the inclusion of all three Welsh sites for grey seal.

5.11. NRW A also requests that common dolphin is included in the assessment of marine mammals.

6. Biodiversity – Terrestrial and Birds - Chapter 5 of Scoping Report

6.1. No specific comments were received from consultees regarding the Terrestrial Biodiversity.

6.2. NRW PS agree with the scoping out of the ES of non-marine designated nature conservation sites or terrestrial habitats including those listed under Section 7 of the Environment (Wales) Act 2016.

6.3. NRW PS welcome that surveys for otter, black guillemot and bat roosts will be conducted to inform the need to include these species in the ES.

6.4. NRW A wish to remind the applicant that The Wildlife and Countryside Act (1981) protects all birds and their eggs. NRW PS would expect that the applicant provides further information on how they will ensure no bird nests or eggs are damaged during construction. NRW A suggest the applicant considers the possibility of creating habitat for black guillemots as described in Leonard *et al.* (2015)[2].

7. Coastal Processes - Chapter 6 of Scoping Report

[1] NRW (2023) Position on Assessing Behavioural Disturbance of Harbour Porpoise (Phocoena phocoena) from underwater noise and NRW's Position on Assessing the effects of hearing injury from underwater noise for environmental assessments

[2] Leonard, K., Greenwood, J.G. & Wolsey, S. (2015) Nest Boxes for Black Guillemots. Northern Ireland Seabird Report 2014, 40-41

7.1. NRW PS welcome the proposal to carry out numerical modelling to inform your assessment. NRW PS would expect consideration to be given to advice provided by NRW A in relation to modelling proposed.

Numerical modelling:

7.2. NRW PS agree with NRW A requirements for physical numerical modelling (2D and 3D) of real time series data sets from fixed point current velocities and direction (normally through a fixed point seabed mounted ADCP) as well as accurate water depth measurements, wave data (available from wave buoys or AWACs), and accurate high resolution bathymetry for the study area. If the model will be used for sediment transport estimates, then seabed sediment characteristics (size, distribution, type etc) will also be required.

7.3. NRW PS understand that that numerical modelling for Fishguard Harbour was conducted in support of the earlier Fishguard Linkspan licence in 2018 (CRML1806) and requests it is incorporated to inform the baseline. However, NRW A requires clarity on the data used to calibrate and validate the earlier numerical model (hydrodynamic survey data (waves, currents and water levels) and bathymetric studies carried out).

7.4. NRW A welcomes the intention to conduct further numerical modelling to quantify the potential changes to the waves, currents and sediment transport regime caused by the dredging activities and the construction and operation of the rock armour revetment and land reclamation proposed, including the fixed pontoon.

7.5. NRW PS agree with NRW A that the numerical modelling calibration and validation results and the scenario test outputs should be included as a separate technical annex to the coastal processes ES chapter so that the model calibration and validation outputs and the model scenarios proposed to assess the physical processes impacts can be reviewed.

Modelling of SSC plumes:

7.6. NRW PS agree with NRW A that proposed modelling should also assess the duration, as well as the dispersion and settlement of SSC plumes generated during the construction phase and its impacts (e.g. on benthic ecology, water quality, etc).

Scour Protection

7.7. NRW PS agree with NRW A that the possible formation of secondary scour pits around toe of the rock armour needs to be assessed when considering the placement of scour toe protection in front of the rock armour revetment.

Coastal Erosion

7.8. NRW PS agree with NRW A that consideration needs to be given to the potential for increased erosion at the end of the revetment and the potential for seabed lowering in front of the revetment caused by partial wave reflection.

8. Water Resources & WFD - Chapter 7 of Scoping Report

8.1. As identified in the Scoping Report, Water Resources should be included in the ES and a WFD compliance assessment should be undertaken in support of the application.

8.2. NRW PS agree that the potential impacts on the water and benthic environment arising from the resuspension of sediment-bound contaminants through dredging during the construction and operation phases is scoped into the EIA.

9. Flood Risk - Chapter 8 of Scoping Report

9.1. NRW PS have received no comments in relation to Flood Risk and agree an assessment of impacts should be carried out as set out in the Scoping Report.

10. Noise & Vibration - Chapter 9 of Scoping Report

10.1. NRW PS have received no direct comments in relation to Chapter 9 Noise and Vibration of the Scoping Report, and agree that construction noise and vibration should be scoped into the EIA.

10.2. However, please note that no information has been provided within the Scoping Report regarding how material will be transported to site. There is an indication on Table 3.4 that there will be no road transport increase. If the materials to site will be transported by sea, then an increase in vessel traffic is expected and should be appropriately considered.

11. Underwear Acoustics - Chapter 10 of Scoping Report

11.1. NRW PS agree that underwater noise from piling during construction is scoped into the EIA with the preliminary mitigation measures proposed.

11.2. The assessment should be based on the 'noisiest' dredging and piling method proposed to ensure the worst-case scenario is assessed.

11.3. Please note advise included in point 5.11. NRW A indicate that standard mitigation measures are likely to be sufficient; however, stresses that measures designed to reduce noise impact for mammals are not always appropriate on fish species.

11.4. NRW A also advise that assessments for fish focus on fish as a stationary receptor (this is contrary to the proposal within section 10.4 of the Scoping Report) as this will represent the worst case scenario. NRW PS would encourage you to engage with NRW A as you carry out this assessment and consider appropriate mitigation.

12. Air Quality & Climate - Chapter 11 of Scoping Report

12.1. No specific comments regarding Air quality and Climate have been received. However, please note Public Health Wales comments in section 4.2 in relation to using best practice techniques.

12.2. NRW PS consider that the ES should include an assessment of the impacts as set out in the Scoping Report.

13. Archaeology, Architectural & Cultural Heritage - Chapter 12 of Scoping Report

13.1. NRW PS agree that archaeology and cultural heritage is scoped into the assessment.

13.2. NRW PS agree with the proposal to produce a Historic Environment Desk Based Assessment as well as preparing a Written Scheme of Investigation. NRW PS would strongly encourage that you engage with RCAHMW, HENEB and Cadw for guidance on these documents.

13.3. NRW PS agree that there is potential for the Proposed Development to impact designated and undesignated historic environment. NRW PS welcome the proposal to produce and implement a Protocol for Archaeological discoveries to cover any dredging works.

13.4. Due to the nature of the material, the RCAHMW request that the intertidal historic environment (from mean high water spring mark) is assessed as part of the marine historic environment rather than the terrestrial historic environment. NRW PS would advise that you engage with RCAHMW, HENEB and Cadw as you carry out your assessment.

13.5. Cadw have indicated they are in agreement with the approach for assessing the historic environment. This includes the production of a Historic Environment Desk-based Assessment (as per the Chartered Institute for Archaeologist), and recommends a search area of 3km for designated historic assets (see Annex) and 1km for non-designated historic assets. The impact should be assessed in accordance with the Welsh Government guidance given in the document “The Setting of Historic Assets in Wales”. Cadw expects a stage 1 assessment to be carried out for all of the designated historic assets listed in the Annex, which will determine the need, if necessary, for stages 2 to 4 to be carried out for specific historic assets.

13.6. Cadw also indicates that section 12.2.2 of the Scoping Report identifies the legislation and guidance relevant to the historic environment, however, Cadw notes that The Historic Environment (Wales) Act 2023 was enacted on the 4 November 2024 and therefore The Ancient Monuments and Archaeological Areas Act 1979 and The Historic Environment (Wales) Act 2016 should be removed from this list of relevant legislation.

14. Soils, Geology and Geohydrology - Chapter 13 of Scoping Report

14.1. NRW PS have received no comments in relation to Soils, Geology and Geohydrology and agrees it should be scoped into the EIA. NRW PS consider that the ES should include an assessment of the impacts as set out in the Scoping Report.

15. Land Use and Material Assets - Chapter 14 of Scoping Report

15.1. NRW PS have received no comments in relation to Land Use and Material Assets and agrees it should be scoped into the EIA. NRW PS consider that the ES should include an assessment of the impacts as set out in the Scoping Report.

16. Transport - Chapter 15 of Scoping Report

16.1. NRW PS have received no specific comments in relation to Transport and agrees it should be scoped into the EIA. NRW PS consider that the ES should include an assessment of the impacts as set out in the Scoping Report.

16.2. NRW PS stress that it is not clear how materials will be transported to site and this should be made clear as part of the EIA, and impact on traffic and transport assessed if necessary.

17. Seascape, Landscape & Visual - Chapter 16 of Scoping Report

17.1. NRW PS have received no specific comments in relation to Seascape, Landscape & Visual and agrees it should be scoped into the EIA. NRW PS consider that the ES should include an assessment of the impacts as set out in the Scoping Report.

18. Waste - Chapter 17 of Scoping Report

18.1. NRW PS have received no specific comments in relation to Waste and agrees construction and operation should be included in the EIA. NRW PS consider that the ES should include an assessment of the impacts as set out in the Scoping Report.

18.2. Please note that adequate disposal of dredging arising will be required. NRW A note their guidance in relation to undertaking sediment management activities sustainably Natural Resources Wales / Managing sediment: marine coastal and estuarine

18.3. Please note that if you require to dispose of sediment at sea, you will require to identify a suitable disposal site within the application. The location of the disposal sites and their status (open, closed or disused) can be found in the Wales Marine Planning Portal.

19. Risk of Major Accidents & Disasters - Chapter 18 of Scoping Report

19.1. NRW PS have received no specific comments in relation to the Risk Major Accidents & Disasters and agrees it should be included in the EIA for construction and operation.

20. Conclusion - Chapter 19 of Scoping Report

20.1. NRW PS have received no specific comments in relation to the Conclusions of the Scoping Report

21. Shipping and Navigation

21.1. No reference is made in the Scoping Report to Shipping and Navigation. NRW PS consider that Shipping and Navigation should be scoped in the EIA. NRW PS understand that there will be a Navigation Safety Plan and Vessel Management Plan which we agree should be used as mitigation measures.

21.2. The MCA considers that the impact on recreational sea users should be included in the EIA. NRW PS therefore request recreational activity is included in the EIA.

21.3. Little information has been provided within the Scoping Report regarding how material will be transported to site.. There is an indication on Table 3.4 that

there will be no road transport increase. The MCA would like to understand if materials will be transported on site by sea, as the impact of increased vessel activity should be assessed as part of the EIA.

22. Cumulative impacts and in-combination effects

22.1. NRW PS have received no specific comments in relation to the cumulative and in combination assessment approach.

22.2. NRW PS understand that the following data sources may provide useful information on other projects for the assessment of cumulative effects:

- The Nationally Significant Infrastructure Projects register: https://infrastructure.planninginspectorate.gov.uk/projects/register-of-applications/
- The Developments of National Significance Register: http://gov.wales/docs/desh/publications/180312-dns-register-en.pdf
- Planning Policy e.g. Local Development Plans, Transport Plans (National and Local) and National Policy Statements.
- An up to date list of marine licensable developments can be found at the following link: http://lle.gov.wales/catalogue/item/MarineLicences

Yours sincerely



Dr. Maria Alvarez
Lead Specialist Officer
Marine Licensing Team
Natural Resources Wales

Approved by:



Dr. Emmer Litt
Marine Licensing Team Leader
Natural Resources Wales

Cc: All Consultation Bodies

Annex

Scheduled Monuments
PE030 Garn Wen Burial Chambers
PE031 Carn Wnda Burial Chamber
PE033 Pen-Rhiw Burial Chamber
PE096 Castle Point Old Fort
PE258 Incised Cross at Cemetery Cross Roads
PE485 Inscribed Stone 130m E of Penwaun
PE518 Parc Hen Standing Stone

Registered Parks and Gardens
PGW(Dy)22(PEM) Plas Glyn-y-Mel
PGW(Dy)63(PEM) Fishguard Bay Hotel
PGW(Dy)64(PEM) Manorowen

Registered Historic Landscape:
HLW (D) 11 Pen Gaer: Garn Fawr and Stumble Head

Listed Buildings:
12247 Training Ship Skirmisher II
12248 Fishguard Bridge II
12249 ,2,Bridge Street,Lower Town,Fishguard,DYFED,SA65 9LX II
12250 ,6,Bridge Street,Lower Town,Fishguard,DYFED,SA65 9LX II
12251 ,10,Bridge Street,Lower Town,Fishguard,DYFED,SA65 9LX II
12252 ,1,Glyn-y-Mel Road,Lower Town,Fishguard,DYFED,SA65 9LY II
12254 Glyn-y-Mel Cottage (Cwm Cwsgi) II
12256 Plas Glyn-y-Mel, including quadrant wall & gatepier to W service court II*
12257 ,20,Glyn-y-Mel Road,Lower Town,Fishguard,DYFED,SA65 9LY II
12258 Cleals II
12261 ,7,Hamilton Street,Fishguard,Fishguard,DYFED,SA65 9HL II
12262 ,11,Hamilton Street including area railings,Fishguard,Fishguard,DYFED,SA65 9HL II
12265 Sycamore Lodge II
12266 Premises occupied by The Dragon House II
12267 Ffynnon Clun farmhouse & adjoining outbuilding II
12269 ,5,High Street,Fishguard,Fishguard,DYFED,SA65 9AN II
12270 ,11,High Street,Fishguard,Fishguard,DYFED,SA65 9AN II
12271 Cartref Hotel II
12272 ,21,High Street,Fishguard,Fishguard,DYFED,SA65 9AW II
12273 Hermon Baptist Church including forecourt walls and steps II*
12274 Mileplate in forecourt wall of Hermon Chapel II
12275 Cottage occupied by St John's Fishguard Nursing Division II
12276 Bank House II
12278 Mount Pleasant II

12279 ,43,High Street,Fishguard,Fishguard,DYFED,SA65 9AW II
12280 Nevern House II
12281 ,61,High Street, including forecourt railing,Fishguard,Fishguard,DYFED,SA65 9AW II
12283 ,12,High Street,Fishguard,Fishguard,DYFED,SA65 9AR II
12284 ,14,High Street,Fishguard,Fishguard,DYFED,SA65 9AR II
12287 Llys Mair II
12288 ,1,Hill Terrace,Fishguard,Fishguard,DYFED,SA65 9LU II
12289 ,2,Hill Terrace,Fishguard,Fishguard,DYFED,SA65 9LU II
12290 ,4,Hill Terrace,Fishguard,,DYFED,SA65 9LU II
12291 ,1,Hottipass Street,Fishguard,Fishguard,DYFED,SA65 9LJ II
12292 Bodlondeb II
12294 Kensington House II
12295 ,17,Kensington Street,Fishguard,Fishguard,DYFED,SA65 9LH II
12296 ,12,Kensington Street,Fishguard,Fishguard,DYFED,SA65 9LB II
12297 ,16/18,Kensington St,Fishguard,,DYFED,SA65 9LB II
12298 Maesgwynne II
12299 Parish Church of St Mary II
12300 Inscribed stone in St Mary's Churchyard II
12301 Railings to churchyard of Church of St Mary II
12302 ,1,Main Street,Fishguard,Fishguard,DYFED,SA65 9HG II
12303 ,3,Main Street,Fishguard,Fishguard,DYFED,SA65 9HG II
12304 ,5,Main Street,Fishguard,Fishguard,DYFED,SA65 9HG II
12306 Sally Port II
12307 Manor House Hotel II
12308 Elim Lodge II
12309 Ty Rhos II
12310 Sail Cottage II
12311 ,16,Main Street,Fishguard,Fishguard,DYFED,SA65 9HJ II
12312 ,22,Main Street,Fishguard,Fishguard,DYFED,SA65 9HJ II
12313 The Globe Inn II
12314 Black Fox Bar II
12315 Swansea House (Ty Abertawe) II
12316 The Town Hall II
12317 The Farmer's Arms II
12318 Nos 15 and 16,,Market Square,Fishguard,Fishguard,DYFED,SA65 9HA II
12319 Nos 17 and 18,,Market Square,Fishguard,Fishguard,DYFED,SA65 9HA II
12320 ,20,Market Square, including Boots the Chemists.,Fishguard,Fishguard,DYFED,SA65 9HA II
12321 The Royal Oak II
12323 Berachah Cottage II
12324 ,1,Newport Road,Lower Town,Fishguard,DYFED,SA65 9NA II
12325 ,15,Newport Road,Lower Town,Fishguard,DYFED,SA65 9NA II
12328 The Dinas Arms II
12329 Bodmor II
12330 West wall and railings to garden at Bodmor II
12331 Fishguard Fort II

12332 Former store building II
12333 Tabernacle Independent Chapel II
12334 Walter Brearley House II
12335 ,2,Park Street,Fishguard,Fishguard,DYFED,SA65 9HN II
12336 ,4,Park Street,Fishguard,Fishguard,DYFED,SA65 9HN II
12337 Greenwood House II
12338 Park House II
12339 Bridge Cottages II
12341 Church of St Peter II
12345 Fishguard Bay Hotel II
12347 ,19,Quay Street,Lower Town,Fishguard,DYFED,SA65 9NB II
12348 ,21,Quay Street, incl decorative cobbled forecourt.,Lower Town,Fishguard,DYFED,SA65 9NB II
12349 ,33,Quay Street,Lower Town,Fishguard,DYFED,SA65 9NB II
12350 ,37,Quay Street,Lower Town,Fishguard,DYFED,SA65 9NB II
12352 The Quay, including slipway, bollard and flights of steps. II
12353 Dyffryn House II
12354 ,1,The Slade, including front garden walls & gates,Fishguard,Fishguard,DYFED,SA65 9PE II
12356 The Monthly Tutor's Cottage II
12357 Rosslyn II
12360 Hill House II
12361 Tower House II
12362 Talarfor II
12363 Court House, front railings and gatepiers to right II
12364 Ardwyn and railings to front II
12365 Capel Pentour, including forecourt railings and gates II
12366 Prospect House II
12367 ,29,Wallis Street,Fishguard,Fishguard,DYFED,SA6 59HP II
12369 ,5,West Street,Fishguard,Fishguard,DYFED,SA65 9AE II
12370 The Old Post Office II
12373 Victoria Wine II
12374 ,39,West Street,Fishguard,,DYFED,SA 65 9AD II
12379 Seaways Bookshop II
12380 ,14,West Street,Fishguard,Fishguard,DYFED,SA65 9AE II
12381 Pen-rhiw II
12980 Church of St Gwyndaf II*
12981 Three walled enlosures at SE.Angle of churchyard of Church of St. Gwyndaf II
12982 Cartref II
12987 Pontiago Moor II
13029 Manorowen II
13048 Telephone Call-box adjoining No 2 II
13072 ,32,Main Street, including area railings.,Fishguard,Fishguard,DYFED,SA65 9HJ II
13073 Vincent House II
13084 Goodwick Institute II
14951 Former Farmhouse at Castell Farmyard II

15199 Walled Garden at Manorowen II
15200 Gazebo in walled garden at Manorowen II
15201 Home Farm Buildings, Manorwen north range. II
15202 Home Farm Buildings, Manorwen East range II
15203 Home Farm Buildings Manorwen South Range II
15204 Home Farm Buildings II
15205 St Marys Church II
15206 Tre-Llewelyn II
15881 ,23,Glyn-y-Mel Road,Lower Town,Fishguard,DYFED,SA65 9LY II
22760 Berachah Presbyterian Church II
26026 ,52,High Street,Fishguard,Fishguard,,SA65 9AR II
26028 ,3,Hottipass Street,Fishguard,Fishguard,,SA65 9LJ II
26029 ,35,Quay Street,Lower Town,Fishguard,,SA65 9NB II
26030 Emscote II
26031 Solway House II
26032 ,4,Bridge Street,Lower Town,Fishguard,,SA65 9LX II
26033 The Ship Inn II
26034 ,9,Newport Road,Lower Town,Fishguard,,SA65 9NA II
26035 Justin Cottage II
26036 Well Cottage/Bwthyn Ffynnon II
26037 ,12,Bridge Street,Lower Town,Fishguard,,SA65 9LX II
26038 ,2,The Slade, including front garden walls & gates,Fishguard,Fishguard,,SA65 9PE II
26039 ,5,Newport Road,Lower Town,Fishguard,,SA65 9NA II
26040 Bryn Haulwen II
26041 Moonstone II
26042 ,8,Hill Terrace,Fishguard,Fishguard,,SA65 9LU II
26043 ,30a,Main Street,Fishguard,Fishguard,,SA65 9HJ II
26044 The Fishguard Arms II
26045 ,26,Main Street,Fishguard,Fishguard,,SA65 9HJ II
26046 ,18,Main Street,Fishguard,Fishguard,,SA65 9HJ II
26047 ,20,Main Street,Fishguard,Fishguard,,SA65 9HJ II
26048 ,16,High Street,Fishguard,Fishguard,,SA65 9AR II
26049 Llys-Teg II
26050 ,47,High Street,Fishguard,Fishguard,,SA65 9AW II
26051 Old Pump House II
26052 ,79,High Street,Fishguard,Fishguard,,SA65 9AW II
26053 ,21a,High Street,Fishguard,Fishguard,,SA65 9AW II
26054 ,11a,High Street,Fishguard,Fishguard,,SA65 9AN II
26055 ,13,High Street,Fishguard,Fishguard,,SA65 9AN II
26056 ,7,High Street,Fishguard,Fishguard,,SA65 9AN II
26057 ,9,High Street,Fishguard,Fishguard,,SA65 9AN II
26058 ,7,Newport Road,Lower Town,Fishguard,,SA65 9NA II
26059 ,9,Hamilton Street,Fishguard,Fishguard,,SA65 9HL II
26060 ,13,Hamilton Street including area railings,Fishguard,Fishguard,,SA65 9HL II
26062 ,25,Quay Street,Lower Town,Fishguard,,SA65 9NB II
26063 ,22,Glyn-y-Mel Road,Lower Town,Fishguard,,SA65 9LY II

26064	,3,Hamilton Street,Fishguard,Fishguard,,SA65 9HL	II
26065	,5,Hamilton Street,Fishguard,Fishguard,,SA65 9HL	II
26066	Penrhyn	II
26067	Lime Kilns	II
26068	Lifeboat Memorial	II
26069	,5,Hill Terrace,Fishguard,Fishguard,,SA65 9LU	II
26070	Range of outbuildings at Maesgwynne	II
26071	Cartshed at Maesgwynne	II
26072	,16,West Street,Fishguard,Fishguard,,SA65 9AE	II
26073	Ty Twt	II
26074	,37,West Street,Fishguard,Fishguard,,SA65 9AD	II
26075	,41,West Street,Fishguard,Fishguard,,SA65 9AD	II
26076	Halifax Building Society	II
26077	,73,High Street, including forecourt railings.,Fishguard,Fishguard,,SA65 9AW	II
26078	Bennett's Navy Tavern	II
26079	New Villa	II
26081	,7,Main Street including area railings,Fishguard,Fishguard,,SA65 9HG	II
26791	The Drim	II
26792	Outbuilding at The Drim	II

5.B

APPENDIX 5.B
Crown Estate

Our Ref: EKH/HLT/33704/324 44 07
Your Ref:

21 May 2025

To whom it may concern

THE CROWN ESTATE
SEABED AT FISHGUARD HARBOUR, PEMBROKESHIRE
LEASE NO: 00025034

As managing agent of behalf of The Crown Estate Commissioners I confirm that The Crown Estate Commissioners support the Harbour Revision Order Application submitted by Stena Line Ltd, concerning the application site at Goodwick/Fishguard, Pembrokeshire (central grid reference 195171.227: 238812.970), to replace the existing temporary arrangement with a floating linkspan pontoon.

Yours faithfully

PP

AS MANAGING AGENT ON BEHALF OF THE CROWN ESTATE COMISSIONERS
ELLIE HITCHINGS LLM MRICS
SENIOR SURVEYOR
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6.A

APPENDIX 6.A WNMP Signposting Document

WNMP Policy No.	WNMP Policy		Does the project have the potential to impact the Policy?	How Does the Proposed Project Comply with the Policy?
GEN_01	Planning policy	There is a presumption in favour of the sustainable development of the plan area in order to contribute to Wales' well-being goals.	Yes	The Proposed Development will ensure the continuation of the Fishguard to Rosslare ferry route supporting a prosperous and resilient Wales in terms of the wellbeing goals.
GEN_02	Planning policy	Relevant public authorities should take a proportionate, risk-based approach to application of relevant marine planning policies in decision making.	Yes	The Proposed Development demonstrates compliance with the Marine Plan Policies and is accompanlied by a proportionate EIA.
ECON_01	Sustainable economic growth	Proposals for economically sustainable activities are encouraged, particularly where they contribute to: • the sustainable management of natural resources thereby supporting ecosystem resilience; • a more resilient economy; • employment opportunities particularly for coastal communities; • protecting and creating employment at all skill levels; • maintaining communities with a high-density of Welsh speakers; and/or • tackling poverty by supporting deprived coastal communities.	Yes	The Proposed Development will contribute to the resilience of the economy via enhanced replacement linkspan, the continuation of the ferry route and protection of the employment that it brings for Fishguard.
ECON_02	Coexistence	Proposals should demonstrate how they have considered opportunities for coexistence with other compatible sectors in order to optimise the value and use of the marine area and marine natural resources.	Yes	The Proposed Development is compatable with the Harbour as a linkspan serving a ferry and adjacent transport network.
SOC_01	Access to the marine environment	Proposals that maintain or enhance access to the marine environment are encouraged.	Yes	The Proposed Development ensures that people are able to avail of the ferry service. There is no impact on any recreation as the harbour is owned and managed by Stena Line.
SOC_02	Well-being of coastal communities	Proposals that contribute to the well-being of coastal communities are encouraged.	Yes	The Proposed Development has the potential to positively affect the socio-economic future of Fishguard and Goodwick.
SOC_03	Marine pollution incidents	Proposals should demonstrate how they minimise their risk of causing or contributing to marine pollution incidents.	Yes	An EIA accompanies the Proposed Development which has assessed the impacts and outlined mitigation measures were necessary.
SOC_04	Welsh language and culture	Proposals that contribute to the promotion and facilitation of the use of the Welsh language and culture are encouraged.	Yes	The Proposed Development will facilitate and promote the use of Welsh language in the Harbour were possible.
SOC_05	Historic assets	Proposals should demonstrate how potential impacts on historic assets and their settings have been taken into consideration and should, in order of preference: a) avoid adverse impacts on historic assets and their settings; and/or b) minimise impacts where they cannot be avoided; and/or c) mitigate impacts where they cannot be minimised. If significant adverse impacts cannot be avoided, minimised or mitigated, proposals must present a clear and convincing case for proceeding. Opportunities to enhance historic assets are encouraged.	Yes	The EIA which accompanies the Proposed Development submission includes an assessment of impacts on archaeology and cultural heritage assets and their setting and demonstrates no impact.
SOC_06	Designated landscapes	Proposals should demonstrate how potential impacts on the purposes and special qualities for which National Parks or Areas of Outstanding Natural Beauty have been designated have been taken into consideration and should, in order of preference: a) avoid adverse impacts on designated landscapes; and/or b) minimise impacts where they cannot be avoided; and/or c) mitigate impacts where they cannot be minimised. If significant adverse impacts cannot be avoided, minimised or mitigated, proposals must present a clear and convincing case for proceeding. Opportunities to enhance designated landscapes are encouraged.	Yes	The EIA which accompanies the Proposed Development submission includes an assessment of the landscapes and visual impacts upon the surrounding area and photomontage have been prepared which demonstrates no unacceptable adverse visual impact.
SOC_07	Seascapes	Proposals should demonstrate how potential impacts on seascapes have been taken into consideration and should, in order of preference: a) avoid adverse impacts on seascapes; and/or b) minimise impacts where they cannot be avoided; and/or c) mitigate impacts where they cannot be minimised. If significant adverse impacts cannot be avoided, minimised or mitigated, proposals must present a clear and convincing case for proceeding. Opportunities to enhance seascapes are encouraged.	Yes	The EIA which accompanies the Proposed Development submission includes an assessment of the impacts on the seascape and photomontage have been prepared which demonstrates no unacceptable adverse visual impact.

SOC_08	Resilience to coastal change and flooding	Proposals should demonstrate how they are resilient to coastal change and flooding over their lifetime.	Yes	The EIA which accompanies the Proposed Development submission includes an assessment of the impacts on coastal processes, flood risk and climate change and includes measures to address any risk and increase resilience. The location of the Proposed Development is essential for operational reasons and it cannot be located elsewhere. Rock revetment is proposed within the Proposed Development.
SOC_09	Effects on coastal change and flooding	Proposals should demonstrate how they: avoid significant adverse impacts upon coastal processes; and minimise the risk of coastal change and flooding; Proposals that align with the relevant Shoreline Management Plan(s) and its policies are encouraged.	Yes	The EIA which accompanies the Proposed Development submission includes an assessment of the impacts on coastal processes, flood risk and climate change and includes measures to address any risk and increase resilience. The location of the Proposed Development is essential for operational reasons and it cannot be located elsewhere. Rock revetment is proposed within the Proposed Development.
SOC_10	Minimising climate change	Proposals should demonstrate how they, in order of preference: a) avoid the emission of greenhouse gases; and/or b) minimise them where they cannot be avoided; and/or c) mitigate them where they cannot be minimised. Where significant emission of greenhouse gases cannot be avoided, minimised or mitigated, proposals for regulated activities must present a clear and convincing case for proceeding.	Yes	The EIA which accompanies the Proposed Development submission includes an assessment of the impacts of climate change in terms of greenhouse gases and climate vulnerability and includes essential and embedded mitigation and no residual impacts from climate.
SOC_11	Resilience to climate change	Proposals should demonstrate that they have considered the impacts of climate change and have incorporated appropriate adaptation measures, taking into account Climate Change Risk Assessments for Wales. Proposals that contribute to climate change adaptation and/or mitigation are encouraged.	Yes	The EIA which accompanies the Proposed Development submission includes an assessment of the impacts of climate change in terms of greenhouse gases and climate vulnerability and includes essential and embedded mitigation and no residual impacts from climate.
ENV_01	Resilient marine ecosystems	Proposals should demonstrate how potential impacts on marine ecosystems have been taken into consideration and should, in order of preference: a) avoid adverse impacts; and/or b) minimise impacts where they cannot be avoided; and/or c) mitigate impacts where they cannot be minimised. If significant adverse impacts cannot be avoided, minimised or mitigated, proposals must present a clear and convincing case for proceeding. Proposals that contribute to the protection, restoration and/or enhancement of marine ecosystems are encouraged.	Yes	The EIA which accompanies the Proposed Development submission includes an assessment of the impacts on marine ecology and protected marine areas and includes mitigation and embedded mitigation measures.
ENV_02	Marine Protected Areas	Proposals should demonstrate how they: avoid adverse impacts on individual Marine Protected Areas (MPAs) and the coherence of the network as a whole; have regard to the measures to manage MPAs; and avoid adverse impacts on designated sites that are not part of the MPA network.	Yes	The EIA which accompanies the Proposed Development submission includes an assessment of the impacts on marine ecology and protected marine areas and includes mitigation and embedded mitigation measures.
ENV_03	Invasive non-native species	Proposals should demonstrate how they avoid or minimise the risk of introducing and spreading invasive non-native species. Where appropriate, proposals should include biosecurity measures to reduce the risk of introducing and spreading of invasive non-native species.	Yes	An Invasive non-native management plan/biosecurity risk assessment accompanies this submission and includes mitigation measures.
ENV_04	Marine litter	Proposals should demonstrate how they: avoid the deliberate introduction of litter into the marine plan area; and minimise the risk of accidental release of litter.	Yes	The EIA which accompanies the Proposed Development includes an outline Construction and Environmental Management Plan which will be updated throughout the construction process.
ENV_05	Underwater noise	Proposals should demonstrate that they have considered man-made noise impacts on the marine environment and, in order of preference: a) avoid adverse impacts; and/or b) minimise impacts where they cannot be avoided; and/or c) mitigate impacts where they cannot be minimised. If significant adverse impacts cannot be avoided, minimised or mitigated, proposals must present a clear and convincing case for proceeding.	Yes	The EIA which accompanies the Proposed Development includes an assessment of noise and including underwater noise on fish species and other species and includes essential and embedded mitigation for the construction phase.
ENV_06	Air and water quality	Proposals should demonstrate that they have considered their potential air and water quality impacts and should, in order of preference: a) avoid adverse impacts; and/or b) minimise adverse impacts where they cannot be avoided; and/or c) mitigate adverse impacts where they cannot be minimised. If significant adverse impacts cannot be avoided, minimised or mitigated, proposals must present a clear and convincing case for proceeding.	Yes	The EIA which accompanies the Proposed Development includes an assessment of the affects on air quality, water quality and an assessment under the water framework directive.

ENV_07	Fish species and habitats	Proposals potentially affecting important feeding, breeding (including spawning & nursery) and migration areas or habitats for key fish and shellfish species of commercial or ecological importance should demonstrate how they, in order of preference: a) avoid adverse impacts on those areas; and/or b) minimise adverse impacts where they cannot be avoided; and/or c) mitigate adverse impacts where they cannot be minimised; If significant adverse impacts cannot be avoided, minimised or mitigated, proposals must present a clear and convincing case for proceeding.	Yes	The EIA which accompanies the Proposed Development includes an assessment of underwater noise including on fish species and other species and includes essential and embedded mitigation for the construction phase.
GOV_01	Cumulative effects	Proposals should demonstrate that they have assessed potential cumulative effects and should, in order of preference: a) avoid adverse effects; and/or b) minimise effects where they cannot be avoided; and/or c) mitigate effects where they cannot be minimised. If significant adverse effects cannot be avoided, minimised or mitigated, proposals must present a clear and convincing case for proceeding. Proposals that contribute to positive cumulative effects are encouraged.	Yes	The EIA which accompanies this Proposed Development includes a Cumulative assessment within each chapter topic and any mitigation if relevant.
GOV_02	Cross-border and plan compatibility	Relevant public authorities, in making their decisions, should have regard to: any applicable policy in a relevant marine plan; any applicable policy in relevant terrestrial development plans or related documents; the Natural Resources Policy; any relevant local well-being plan(s) (including the local well-being assessment); and evidence in any relevant Area Statement(s) produced by Natural Resources Wales (NRW).	Yes	The EIA which accompanies this Proposed Development outlines the relevant legislation and policies including the west of wales shoreline management plan which seeks to maintain Fishguard as a viable commercial centre; the Pembrokeshire Local Development Plan which supports development at Fishguard Port and demonstrates compatibility.
SCI_01	Using sound science responsibly	Relevant public authorities should make decisions using sound evidence and a risk-based, proportionate approach. Where appropriate they should apply the precautionary principle and consider opportunities to apply adaptive management.	Yes	The EIA which accompanies this Proposed Development is proportionate to the project, and has followed a systematic and evidence based approach to evaluate the potential effects on receptors.
AGG_01a	Aggregates (supporting)	Proposals for new aggregate extraction will be supported, within any tonnage limits, where they contribute to the objectives of this plan. Proposals should comply with the relevant general policies and sector safeguarding policies of this plan and any other relevant considerations.	No	N/A
AGG_01b	Aggregates (supporting)	Relevant public authorities and the sector are encouraged, in liaison with other interested parties, to collaborate to understand opportunities: for the sustainable use of wider marine aggregate natural resources; to define and, once in place, further develop and refine Strategic Resource Areas for aggregates in order to support the sustainable development of the aggregate sector through marine planning.	No	N/A
AQU_01a	Aquaculture (supporting)	Proposals for new aquaculture developments will be supported where they contribute to the objectives of this plan. Proposals should comply with the relevant general policies and sector safeguarding policies of this plan and any other relevant considerations.	No	N/A
AQU_01b	Aquaculture (supporting)	Relevant public authorities and the sector are encouraged, in liaison with other interested parties, to collaborate to understand opportunities for the sustainable use of aquaculture resources including the identification of: natural resources that provide aquaculture potential opportunities to define and, once in place, further develop and refine Strategic Resource Areas for aquaculture in order to support the sustainable development of the aquaculture sector through marine planning.	No	N/A
D&D_01	Dredging and disposal (supporting)	Proposals that maintain navigable channels and long term access to open at-sea disposal sites for appropriate material will be supported where they contribute to the objectives of this plan. Proposals should comply with the relevant general policies and sector safeguarding policies of this plan and any other relevant considerations.	Yes	The Proposed Development includes essential dredging within the Fishguard Harbour to maintain navigational channels which is vital to the Port development and construction of the replacement linkspan. The Proposed Development will use a licensed disposal site to deposit sediment which has been analysed as acceptable.

ELC_01a	Low carbon energy (supporting) wind	Proposals for offshore wind energy generation will be supported where they contribute to the objectives of this plan. Proposals should comply with the relevant general policies and sector safeguarding policies of this plan and any other relevant considerations. Proposals for wind >350MW will be considered by UK Government in accordance with relevant national policy. In determining an NSIP for a wind proposal, the decision maker will have regard to this plan. Any determination in relation to energy developments of any scale will be taken in accordance with this plan alongside any other relevant considerations.	No	N/A
ELC_01b	Low carbon energy (supporting) wind	In order to understand future opportunities for offshore wind development, including floating technologies, this plan supports strategic planning for the sector. Relevant public authorities and the sector are encouraged, in liaison with other interested parties, to collaborate to understand opportunities for the sustainable use of wind energy resources including identification of: • natural resources that provide potential opportunity for future use; • evidence to de-risk consenting for the sector; and • opportunities to define and, once in place, further develop and refine Strategic Resource Areas for offshore wind energy resource safeguarding; in order to support the sustainable development of the sector through marine planning. Relevant public authorities should make appropriate evidence available to support planning and decision making in order to support the sustainable development of the sector through marine planning, where it is appropriate to do so.	No	N/A
ELC_02a	Low carbon energy (supporting) wave	Proposals for wave energy generation will be supported where they contribute to the objectives of this plan. Proposals should comply with the relevant general policies and sector safeguarding policies of this plan and any other relevant considerations.	No	N/A
ELC_02b	Low carbon energy (supporting) wave	In order to understand future opportunities for wave energy development, relevant public authorities and the sector are encouraged, in liaison with other interested parties, to collaborate to understand opportunities for the sustainable use of wave energy resources including identification of: • natural resources that provide potential opportunity for future use; • evidence to de-risk consenting for the sector; and • opportunities to define and, once in place, further develop and refine Strategic Resource Areas for wave energy resource safeguarding;in order to support the sustainable development of the sector through marine planning. Relevant public authorities should make appropriate evidence available to support planning and decision making in order to support the sustainable development of the sector through marine planning, where it is appropriate to do so.	No	N/A
ELC_03a	Low carbon energy (supporting) tidal stream	Proposals for tidal stream energy generation will be supported where they contribute to the objectives of this plan. Proposals should comply with the relevant general policies and sector safeguarding policies of this plan and any other relevant considerations.	No	N/A
ELC_03b	Low carbon energy (supporting) tidal stream	In order to understand future opportunities for tidal stream energy development, relevant public authorities and the sector are encouraged, in liaison with other interested parties, to collaborate to understand opportunities for the sustainable use of tidal stream energy resources including identification of: • natural resources that provide potential opportunity for future use; • evidence to de-risk consenting for the sector; and • opportunities to define and, once in place, further develop and refine Strategic Resource Areas for tidal stream energy resource safeguarding; in order to support the sustainable development of the sector through marine planning.Relevant public authorities should make appropriate evidence available to support planning and decision making in order to support the sustainable development of the sector through marine planning, where it is appropriate to do so.	No	N/A

ELC_04	Low carbon energy (supporting) tidal range	In order to understand future opportunities for tidal range development, strategic planning for the sector is encouraged. Relevant public authorities and the sector are encouraged, in liaison with other interested parties, to collaborate to: • collect evidence to support understanding of environmental constraints and opportunities for the sustainable use of the tidal range resource; • support understanding of the optimal siting of tidal lagoon developments across Wales as part of a wider, UK perspective; and • identify opportunities to define and, once in place, further develop and refine Strategic Resource Areas for tidal lagoon safeguarding purposes. Relevant public authorities should make appropriate evidence available to support planning and decision making in order to support the sustainable development of the sector through marine planning, where it is appropriate to do so.	No	N/A
O&G_01a	Oil and gas (supporting)	Proposals that maximise the economic recovery of oil and gas sustainably will be supported where they comply with the objectives of this plan, and fully meet the environmental safeguards contained within the statutory processes of awarding production licences and subsequent activity-specific approvals. Proposals should comply with the relevant general policies and sector safeguarding policies of this plan and any other relevant considerations.	No	N/A
O&G_01b	Oil and gas (supporting)	Welsh Government policy is to avoid the continued extraction of fossil fuels in intertidal areas and estuaries and coastal inlet waters that fall within the Welsh onshore licence area. Applications for new petroleum licenses in these areas should not be supported, unless required for mine safety or scientific purposes. Proposals for the development and extraction of oil and gas in these areas with land based elements must provide robust and credible evidence to demonstrate how they conform to the Planning Policy Wales Energy Hierarchy for Planning, including how they make a necessary contribution towards decarbonising the energy system.	No	N/A
O&G_02	Oil and gas (supporting)	Proposals that support the long-term development of carbon capture and storage technology will be supported where they contribute to the objectives of this plan. Proposals should comply with the relevant general policies and sector safeguarding policies of this plan and any other relevant considerations.	No	N/A
FIS_01a	Fisheries (supporting)	Proposals that support and enhance sustainable fishing activities will be supported where they contribute to the objectives of this plan. Proposals should comply with the relevant general policies and sector safeguarding policies of this plan and any other relevant considerations.	No	N/A
FIS_01b	Fisheries (supporting)	Relevant public authorities and the sector are encouraged, in liaison with other interested parties, to collaborate to understand opportunities to develop a strategic evidence base to improve understanding of opportunities for the sustainable development of fisheries in order to support the sustainable development of the fisheries sector through marine planning.	No	N/A
P&S_01a	Ports and shipping (supporting)	Proposals for ports, harbours and shipping activities will be supported where they contribute to the objectives of this plan. Proposals should comply with the relevant general policies and sector safeguarding policies of this plan and any other relevant considerations.	Yes	The Proposed Development includes the replacement of an existing linkspan pontoon to safeguard the continuation of the Stena Line Fishguard to Rosslare ferry route.
P&S_01b	Ports and shipping (supporting)	Relevant public authorities and the sector are encouraged, in liaison with other interested parties, to collaborate to understand opportunities to support the sustainable development of the ports and shipping sector through marine planning.	Yes	The EIA processes has included engagement with Natrual Resource Wales and Planning and Environment Decisions Wales to support the sustainable development at Fishguard Port.
P&S_02	Ports and shipping (supporting)	Proposals that provide for the maintenance, repair, development and diversification of port and harbour facilities will be supported where they contribute to the objectives of this plan. Proposals should comply with the relevant general policies and sector safeguarding policies of this plan and any other relevant considerations.	Yes	The Proposed Development includes the replacement of an existing linkspan pontoon to safeguard the continuation of the Stena Line Fishguard to Rosslare ferry route.

CAB_01	Subsea cabling (supporting)	Proposals that facilitate the growth of digital communications networks and/or the optimal distribution of electricity will be supported where they contribute to the objectives of this plan. Proposals should comply with the relevant general policies and sector safeguarding policies of this plan and any other relevant considerations.	No	N/A
T&R_01a	Tourism and recreation (supporting)	Proposals that demonstrate a positive contribution to tourism and recreation opportunities and policy objectives (for the sector) around the Welsh coast will be supported where they contribute to the objectives of this plan. Proposals should comply with the relevant general policies and sector safeguarding policies of this plan and any other relevant considerations.	Yes	The Proposed Development ensures the long term future of the Fishguard to Rosslare ferry route linking Wales and Ireland.
T&R_01b	Tourism and recreation (supporting)	Relevant public authorities and the sector are encouraged, in liaison with other interested parties, to collaborate to understand opportunities for sustainable tourism and recreation around the Welsh coast, including: a) developing a strategic evidence base to improve understanding of current and potential tourism and recreation activities, including eco-tourism and other low impact activities; and b) opportunities to define areas of future opportunity for tourism and recreation; in order to support the sustainable development of the tourism and recreation sector through marine planning.	Yes	Through the EIA Scoping report consultations with recreational bodies had no objections to the Proposed Development due to limited activities witin Fishguard Harbour.
SAF_01	Safeguarding existing activity	a: Proposals likely to have significant adverse impacts upon an established activity covered by a formal application or authorisation must demonstrate how they will address compatibility issues with that activity. Proposals unable to demonstrate adequate compatibility must present a clear and convincing case for the proposal to progress under exceptional circumstances. b: Proposals likely to have significant adverse impacts upon an established activity not subject to a formal authorisation must demonstrate how they will address compatibility issues with that activity. Proposals unable to demonstrate adequate compatibility must present a clear and convincing case for proceeding. Under SAF 01 a and b, compatibility should be demonstrated through, in order of preference: a. Avoiding significant adverse impacts on those activities, and/or b. Minimising significant adverse impacts where these cannot be avoided; and/or c. Mitigating significant adverse impacts where they cannot be minimised.	Yes	There are no other planning dredging campaigns within Fishguard Harbour and Stena is the sole operator. The EIA which accompanies this Proposed Development includes an assessment of the affects on coastal processes within the Fishguard Harbour and calibration of the model of the disposal site area. The Proposed dredging materials have been analysed and demonstrate compatibility with the licensed disposal site.
SAF_02	Safeguarding strategic resources	Proposals which may have significant adverse impacts upon the prospects of any sector covered by this plan to engage in sustainable future strategic resource use (of resources identified by an SRA) must demonstrate how they will address compatibility issues with that potential resource use. Proposals unable to demonstrate adequate compatibility must present a clear and convincing case for proceeding. Compatibility should be demonstrated through, in order of preference: a. Avoiding significant adverse impacts on this potential strategic resource use, and/or b. Minimising significant adverse impacts where these cannot be avoided; and/or c. Mitigating significant adverse impacts where they cannot be minimised.	NO	N/K
DEF_01	Defence (safeguarding)	Proposals that: • potentially affect Ministry of Defence (MOD) Danger Areas, Exercise Areas or strategic defence interests; and/or • potentially interfere with communication, surveillance and navigation facilities necessary for defence and national security; should only be authorised with the agreement of MOD.	No	N/K

8.A

APPENDIX 8.A
Subtidal Benthic Survey Report

FISHGUARD SUBTIDAL BENTHIC ECOLOGY SURVEY REPORT

Fishguard Linkspan Replacement
794-NI-POR-00886R
May 2025
RevD01

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Acronyms

Term	Definition
AL	Action Level
CSQG	Canadian Sediment Quality Guidelines
DBT	Dibutyltin
DDV	Drop Down Video
EIA	Environmental Impact Assessment
ERL	Effect Range Low
ERM	Effect Range Median
ES	Environmental Statement
IDA	Industrial Denatured Alcohol
JNCC	Joint Nature Conservation Committee
LOD	Limit of Detection
MDS	Multi-dimensional Scaling
MLT	Marine Licensing Authority
NMBAQC	North-east Atlantic Marine Biological Analytical Quality Control
NRW	Natural Resources Wales
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyls
PEL	Probable Effect Level
PSD	Particle Size Distribution
SIMPER	Similarity Percentages
SIMPROF	Similarity Profile
TBT	Tributyltin
TEL	Threshold Effect Level
THC	Total Hydrocarbon Content
TOM	Total Organic Matter

Units

Unit	Definition
mm	Millimetres
µm	Micrometres
mg	Milligram
mg/kg	Milligrams per kilogram
µg/kg	Micrograms per kilogram

1.0 Introduction

This subtidal benthic ecology survey report has been prepared by TetraTech RPS Energy on behalf of Stena Line UK Ltd to support the Environmental Impact Assessment (EIA) of the potential impacts of the Fishguard Linkspan Replacement (hereafter referred to as "the Proposed Development") on marine biodiversity.

The EIA, to which this report is an appendix, was produced in order to support an application to replace the existing temporary arrangement of a linkspan and jack up barge in Fishguard harbour, Pembrokeshire with a new pontoon to allow berthing of the ferry in the long term.

To inform the consenting of these works, Natural Resources Wales Marine Licensing Team (NRW MLT) requested that the baseline subtidal benthic environment of the Proposed Development site must be suitably assessed via a grab survey, to enable a full understanding of the impact of the Proposed Development on the benthic community.

1.1 Proposed Development Background

The application site is located within Goodwick/Fishguard, Pembrokeshire. The site is a parcel of land spanning an area of approximately 36 hectares of the harbour, to include the existing linkspan, hinterland and within the bay foreshore. The site lies within the northern fringes of Goodwick, which is a coastal town immediately west of its twin town of Fishguard, within Fishguard Bay. The current Stena Line operation includes a twice daily ferry service to Rosslare, covering public ferry passengers and accompanied and unaccompanied freight. The berth is also infrequently used by cruise vessels and historic steamboats.

Stena Line wish to replace their existing temporary arrangement of a linkspan and jack up barge with a new pontoon to allow berthing of the ferry at Fishguard in the long term.

Stena Line own a floating pontoon, that is currently in service at Mostyn, north Wales, which they propose to relocate to Fishguard harbour. Civils works will be required to enable access and utilisation of the pontoon for the ferry traffic, to include land reclamation and rock armour revetment construction. Landside works will be required to adjust traffic and pedestrian routes to service the new floating pontoon. Dredging works are also proposed, these cover maintenance dredging of the berth, capital dredge of the navigation channel and beneath the pontoon to allow sufficient depth, and soft material removal to allow construction of the reclaimed area.

1.2 Purpose of this report

The primary purpose of this report is to present the results of the site-specific subtidal benthic ecology validation survey undertaken in March 2025. This report provides analysis of grab samples collected for:

- Particle Size Distribution (PSD);
- Sediment contaminants (including metals, Polychlorinated Biphenyls (PCBs), Polycyclic Aromatic Hydrocarbons (PAHs) and organotins); and
- Macrofauna.

The data presented in this report characterises the benthic subtidal environment within the immediate vicinity of the Proposed Developments footprint and more generally within Fishguard Harbour in order to validate the results of the desktop baseline characterisation presented in the Environmental Statement (ES) Chapter 7: Marine Biodiversity.

2.0 Study Area

The subtidal benthic validation survey was undertaken within the planning boundary of the Proposed Development (Figure 2.1). Sampling within this area allows for a detailed understanding of the subtidal benthic communities present within the direct area of impact.

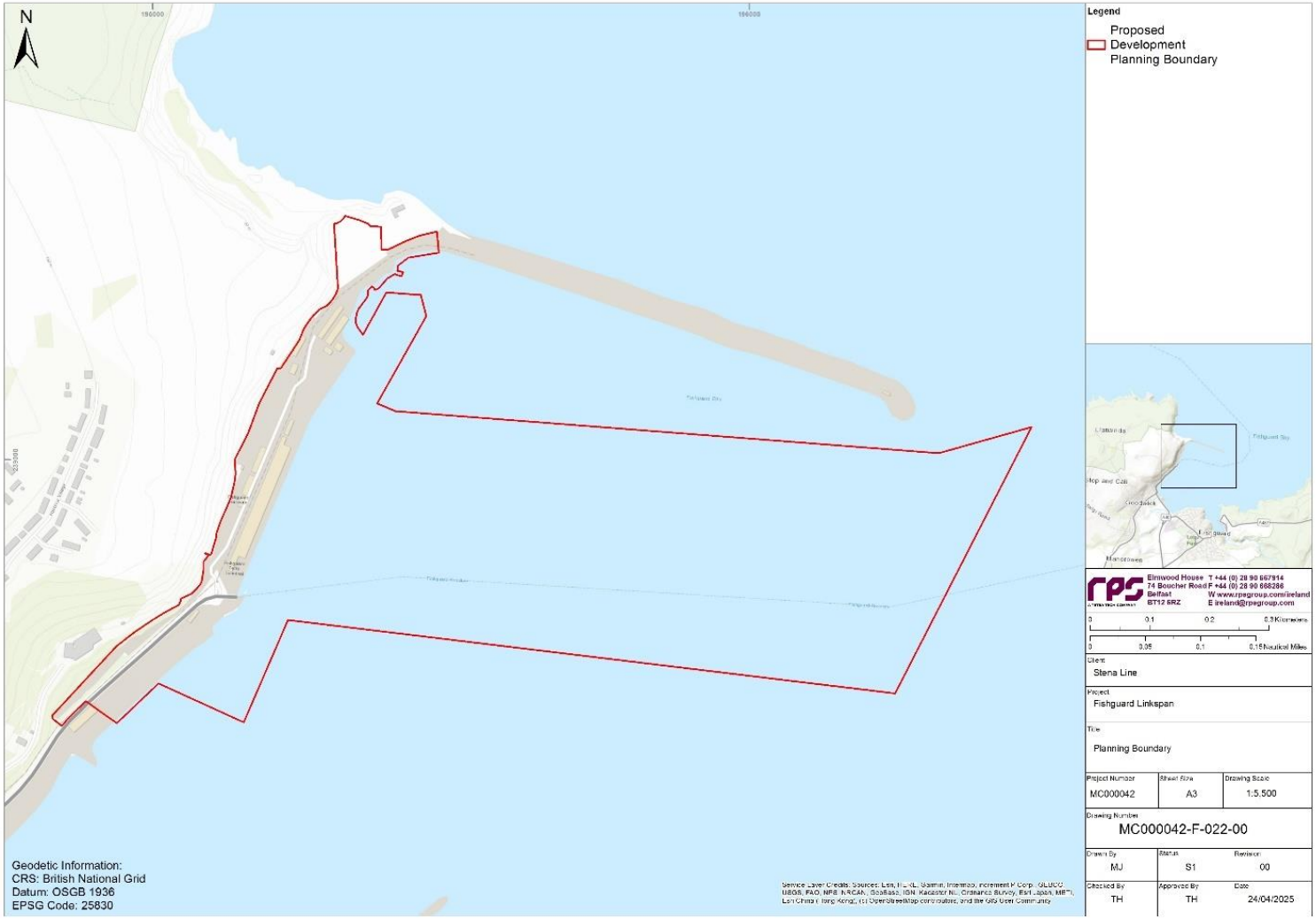


Figure 2.1: Planning Boundary

3.0 Environmental Baseline

The existing baseline data for Fishguard Harbour, as presented in ES Chapter 7: Marine Biodiversity and characterised by desktop data and data from previous surveys in the area, identifies a variety of habitats and species including juvenile blue mussels, although not bed forming (NRW, 2025) (not classified as a 'Habitat of Principal Importance to Wales' under Section 6 of the Environment (Wales) Act 2016).

A 2015 drop down video (DDV) survey undertaken in Fishguard Harbour for another project characterised most of the Fishguard Harbour as the '*Arenicola marina* in infralittoral fine sand or muddy sand' (SS.SSA.IMuSa.AreISa) biotope (Aquatic Environments (2015) cited in RPS (2018)) (Figure 3.1). The 'Filamentous green seaweeds on low salinity infralittoral mixed sediment or rock' (SS.SMp.KSwSS.FilG) (Aquatic Environments (2015) cited in RPS (2018)) was also identified (Figure 3.1).

A survey undertaken for similar works in 2017 identified the '*Saccharina latissima* and *Laminaria digitata* on sheltered sublittoral fringe rock' (IR.LIR.K.Slat.Ldig; Joint Nature Conservation Committee (JNCC) 2022 Classification) biotope as well as the '*Saccharina latissima* and filamentous red algae on infralittoral sand' (SS.SMp.KSwSS.SlatR.Sa; JNCC 2022 Classification) (ABPmer, 2018) (Figure 3.2). The grab samples taken for this survey identified a number of key species groups including:

- polychaetes (*Aphelochaeta marioni, Chaetozone gibber, Mediomastus fragilis*, and *Euclymene oerstedii*);
- bivalves (*Abra alba, Varicorbula gibba, Kurtiella. bidentata, Nucula hanleyi,* and *Thyasira flexuosa*); and
- brittlestars (*Amphiura filiformis* and Ophiuroidea) (ABPmer, 2018) (Figure 3.2).

Additionally grab sample data provided by NRW included grab sampling from two sites within the study area in 2022 (one of which was within the Planning Boundary). The PSD results of the grab samples within the Planning Boundary classified the substrate as mud, while the PSD results of the samples within the wider Fishguard Harbour classified the substrate as sand.

Based on the desktop data, the ES Chapter 7: Marine Biodiversity concluded that, for the purposes of undertaking an assessment of potential impacts of the Proposed Development, the Fishguard Harbour benthic subtidal community is characterised by the 'Circalittoral muddy sand' (SS.SSa.CMuSa; JNCC 2022 Classification) biotope, which is not representative of any 'Habitat of Principal Importance to Wales' under Section 6 of the Environment (Wales) Act 2016.

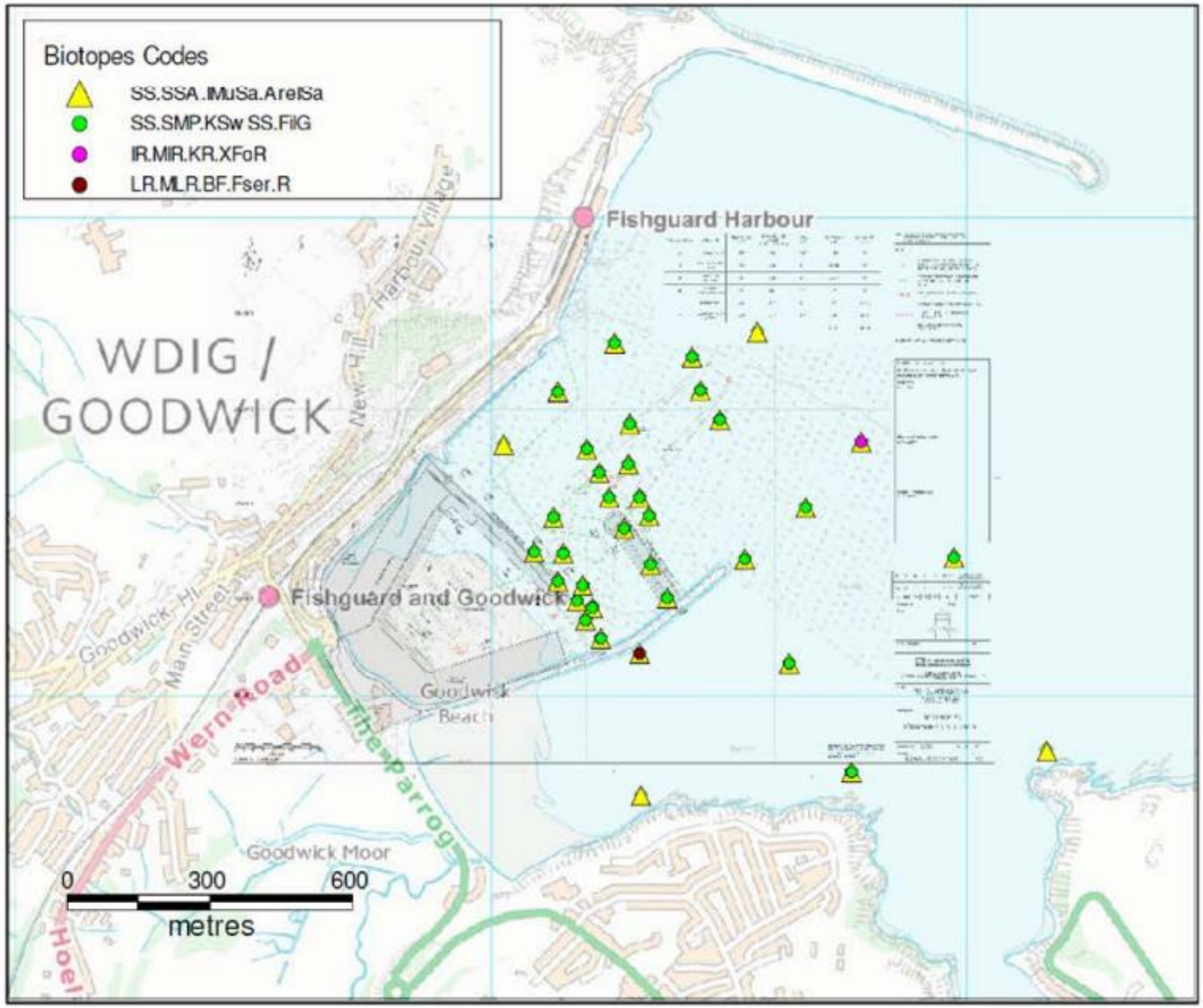


Figure 3.1: Subtidal Biotopes Recorded in a DDV Survey of Fishguard Harbour (Aquatic Environments (2015) cited in RPS (2018))



Figure 3.2: Grab Sample Locations and the Results of Site-specific Surveys Conducted in 2017 for Similar Works at the Stena Line Fishguard Terminal (ABPmer, 2018)

4.0 Methodology

4.1 Survey

The subtidal benthic validation survey was undertaken between 11 March and 14 March 2025. The sampling strategy was designed to adequately sample subtidal benthic ecology study area to provide data for baseline characterisation The survey design was discussed and agreed with NRW MLT. The subtidal benthic validation survey was undertaken by Geoforce Technical Services Limited, with specialist environmental support from Thompson Environmental Consultants, onboard the vessel *Willendeavour.*

4.2 Sample Collection

The subtidal benthic ecology survey comprised five sampling stations within the subtidal benthic validation study area (Figure 4.1). Two grab samples were collected, using a 0.1 m^2 Double Van Veen grab, at each sampling stations resulting in 10 grab samples in total. One sample from each station was retained for macrofaunal analysis and one for PSD and chemical analysis.

At each sample station, sampling details were logged, and an initial visual sediment assessment was performed, accompanied by photographic documentation. Biological samples were sieved over a 0.5 mm mesh and preserved in neutral, buffered formalin solution within 24 hours of collection.

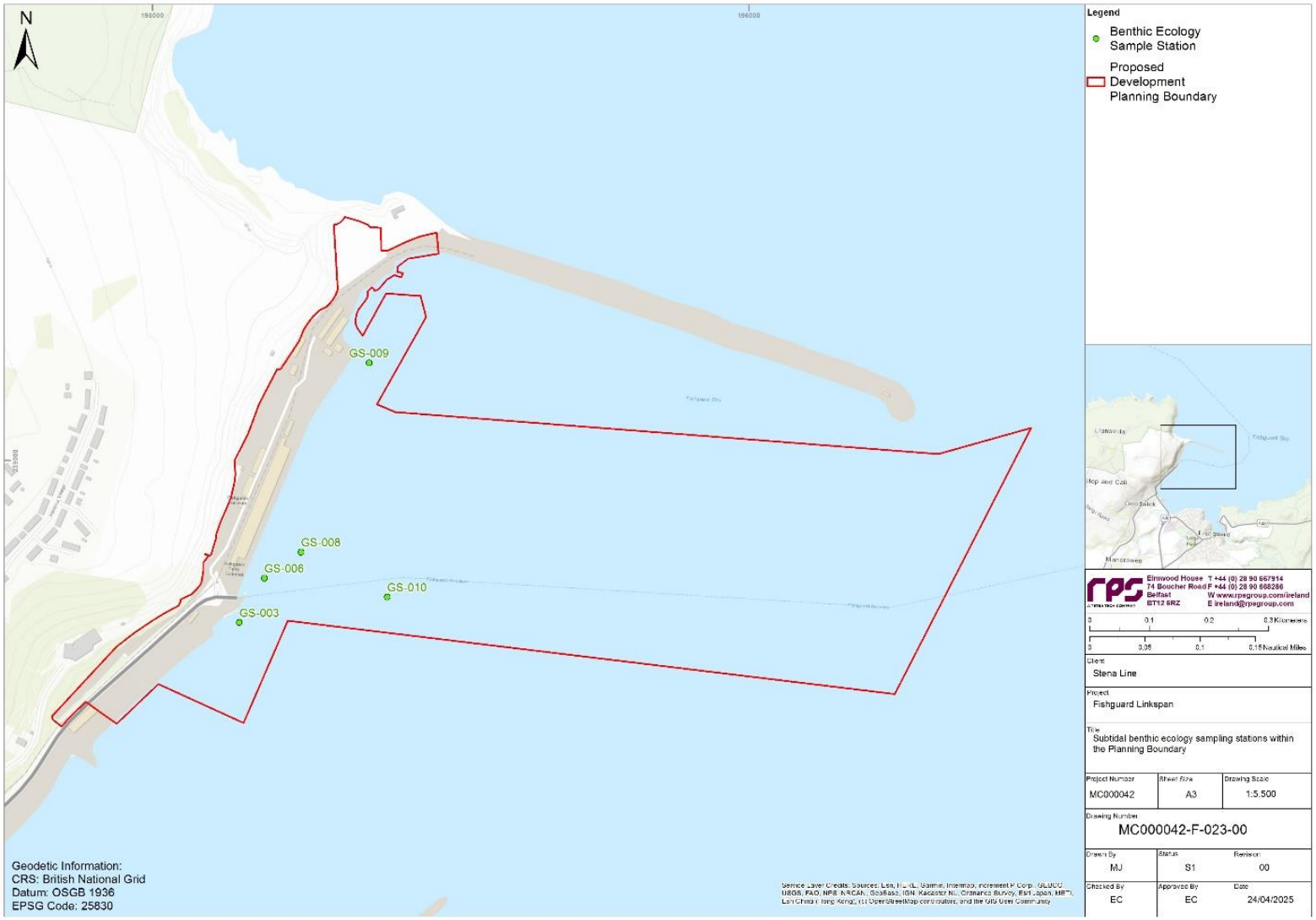


Figure 4.1: Subtidal Benthic Ecology Sampling Stations Within the Planning Boundary.

4.3 Sample Analysis

4.3.1 Sediment Characterisation Analysis

PSD tests were performed by In Situ Site Investigation Limited on one of the samples collected at each station. This was carried out by wet and dry sieving, followed by laser diffraction analysis.

4.3.2 Sediment Chemistry Analysis

Chemical testing was carried out on the recovered grab samples. The chemical analysis follows the requirements of a sampling plan provided to Stena Line by NRW, to support the Marine Licence application for dredging and subsequent disposal of material. The following determinants were tested by Socotec UK Limited:

- Total Organic Matter (TOM) by loss on ignition;
- Metals Suite (Arsenic, Cadmium, Chromium, Mercury, Nickel, Lead and Zinc);
- Chromium VI;
- Organotins (dibutyltin (DBT) and tributyltin (TBT));
- PAHs (DTI 2-6 Ring Aromatics + EPA 16);
- Total Hydrocarbon Content (THC);
- PCBs (25 Congeners including ICES 7);
- Brominated Flame Retardants (including BDE209); and
- Organochlorine Pesticides.

4.3.3 Benthic Infaunal Analysis

All infaunal analyses were conducted at Thomson's laboratory, following their standard operating procedure, in line with the NMBAQC (North-east Atlantic Marine Biological Analytical Quality Control) processing requirement protocol (Worsfold and Hall, 2010).

After storage in fixative, the formalin was drained from the samples using a 63 µm sieve. Any animals collected on this sieve were gently washed over a 0.5 mm mesh sieve and extracted immediately, avoiding damage from further sieving. The samples were then washed over a clean stack of sieves (4, 2, 1, and 0.5 mm), dividing the sediment into uniform fractions, allowing for more accurate faunal extraction.

For all size fractions, lighter animals were removed by repeatedly agitating the sediment with water and decanting off the liquid onto the corresponding sieve. This floated material was transferred to clean, labelled pots and preserved with 70% industrial denatured alcohol (IDA).

When large amounts of 2 mm and 4 mm sediment was present, these fractions were examined by eye in white gridded trays. Any individuals that were not removed by floating were extracted using forceps. Tubes, shells with boring holes, or any other structures that may have contained cryptic fauna were scraped from rocks, crushed, or examined under the microscope. Examples of encrusting fauna were also extracted for further examination. For the 1 and 0.5 mm fractions, the lightest sediment, which contained animals such as molluscs, was taken for extraction of fauna under a stereomicroscope. This fraction is referred to as a "blast fraction". A subsample of the remaining sediment was taken and checked under a stereomicroscope. If any fauna were present in this subsample more sediment was taken and added to the blast fraction, a further subsample of the remaining sediment was then taken to be checked. This process was then repeated until no fauna were found during the check of the sub sample.

All material and sediment extracted during sieving were sorted under a stereomicroscope. The fauna was extracted by a series of circular searches of the sediment. All countable animals and examples of colonial taxa were extracted and sorted into high level groups for identification.

Extracted fauna were passed to an experienced analyst for identification to the most accurate taxonomic level practicable, usually species. Higher taxonomic levels were used if specimens were too damaged or small to identify further, or where the taxonomy was unresolved (in line with the NMBAQC taxonomic discrimination protocol). Countable individuals were enumerated, with the exceptions of nematodes, barnacles, ascidians, ostracods, copepods and protozoans which were recorded as present ('P'). All non-countable taxa, such as colonial fauna, plants, and algae, were recorded as present ('P').

Calibrated scales were used for biomass analysis. For each sample, all specimens for each taxon were gently blotted and weighed on a tared balance. When the reading was stable, the weight was recorded to 0.1 mg. Following weighing, care was taken to ensure that all specimens were transferred from the weighing boat back to a labelled vial for storage of the samples.

4.4 Data Analysis

4.4.1 Sediment Characterisation Analysis

The PSD data were categorised using the Folk classification which groups particles into mud, sand and gravel (mud 2 mm) and the relative proportion of each used to ascribe the sediment to one of 15 classes (e.g. slightly gravelly sand, muddy sand etc.) (Folk, 1954; Long, 2006). These classifications were then used to describe the data in the analysis. Proportions of mud, sand and gravel, as well as the Folk and Ward sorting coefficient, were also used to describe the sediment data. The Folk and Ward sorting coefficient describes the extent of deviation from lognormality of the particle size distribution (i.e. the variation in particle size with a sample).

4.4.2 Sediment Chemistry Analysis

The results of the sediment chemistry analysis were compared to the Cefas Action Levels (ALs) (Cefas, 1994). Cefas Action Level 1 (AL1) and Action Level 2 (AL2) are thresholds which give an indication of how suitable the sediments are for disposal at sea. Contaminant levels which are below AL1 are of no concern and are unlikely to influence the marine licensing decision while those above AL2 are considered unsuitable for disposal at sea. Those between AL1 and AL2 would require further consideration before a licensing decision can be made.

Sediment chemistry data were also compared to the Canadian Sediment Quality Guidelines (CSQG; CCME, 2001). These thresholds give an indication on the degree of contamination and the likely impact on marine ecology. For each contaminant, the guidelines provide Canadian Threshold Effect Level (TEL), which is the minimal effect range at which adverse effects rarely occur and a Canadian Probable effect level (PEL), which is the probable effect range within which adverse effects frequently occur. For PAHs the best estimates of the potential toxicity of in marine sediments are Effect Range Low (ERL) and Effect Range Median (ERM) concentrations for total low molecular weight, total high molecular weight and total PAHs (Neff, 2004).

4.4.3 Macrofaunal Analysis

4.4.3.1 Univariate

From the untransformed benthic macrofaunal data, a summary of the number of individuals and number of taxa recorded was calculated. Analysis was also undertaken to identify the percentage composition of the major taxonomic groups within each sample station, and the percentage contribution of each taxonomic group to the total number of taxa and to the total number of individuals.

4.4.3.2 Multivariate

The benthic infaunal grab data was analysed using the PRIMER v6 software (Clarke and Gorley, 2006). The benthic infaunal datasets was square root transformed to down-weight the species with the highest abundances for multivariate community analysis. Additionally colonial/encrusting taxa within the grab samples, which were recorded only as present were removed from the dataset.

To determine the relative similarities between stations, the benthic infaunal community structure were investigated using CLUSTER analysis (hierarchical agglomerative clustering). This used the Bray Curtis similarity coefficient to assess the similarity of sites based on the faunal components. The procedure produces a dendrogram indicating the relationships between sites based on the similarity matrix and uses a Similarity Profile (SIMPROF) test (at a 5% significance level) to test whether the differences between the clusters are significant.

Similarity Percentages (SIMPER) analyses were subsequently undertaken on the infauna dataset to identify which species best explained the similarity within groups and the dissimilarity between groups identified in the CLUSTER analysis. The similarity matrix was also used to produce a Multi-dimensional Scaling (MDS) ordination plot to show, on a two or three-dimensional representation, the relatedness of the communities (at each site) to one another. Full methods for the application of both the hierarchical clustering and the MDS analysis are given in Clarke and Warwick (2001).

4.4.3.3 Biotope Allocation

The results of the CLUSTER analyses and associated SIMPER outputs were reviewed alongside the raw, untransformed data to assign biotopes (Connor *et al*., 2004). Using the clusters identified, several sites within a cluster and, where appropriate several clusters, were assigned to a single biotope, where possible, based on relatedness and presence/absence of key indicator species for a particular biotope.

4.4.3.4 Biomass

The biomass data was compiled to take a mean across the samples within each faunal group identified in the multivariate community analysis for the main marine faunal groups (crustaceans, molluscs etc.).

5.0 Site-Specific Subtidal Survey Baseline Characterisation

5.1 Physical Sediment Characterisation

The subtidal benthic sediments across the Planning Boundary were classified into sediment types according to the Folk classification and are presented in Figure 5.1.

Sediments within the Planning Boundary ranged from muddy sand to sandy mud, with the majority of samples (five) being classed as muddy sand, with sandy mud only be identified at one sample station (GS-003).

All samples contained a very small proportion of gravel, less than 0.5% of the proportion of each sample. Sample station GS-003, in the south of the Planning Boundary, was dominated by sand (85.2%) with smaller proportions of fine sediments (silt and clay, 14.6%) and gravel (0.25%). This high proportion of sand compared to fine sediment led to a folk sediment classification of muddy sand for sample station GS-003. The sediments at all other sample stations (GS-006, GS-008, GS-009 and GS-010) had lower proportions of sand, between 20.7% and 46.4%, and higher proportions of fine sediment, between 53.1% and 79.2%. At sample stations GS-006, GS-008, GS-009 and GS-010 the proportion of gravel was very small and ranged from 0.1% to 0.4%. The higher proportion of fine sediment compared to sand has led to a folk sediment classification of sandy mud for sample stations GS-006, GS-008, GS-009 and GS-010. The full PSD dataset is presented in Appendix 0.

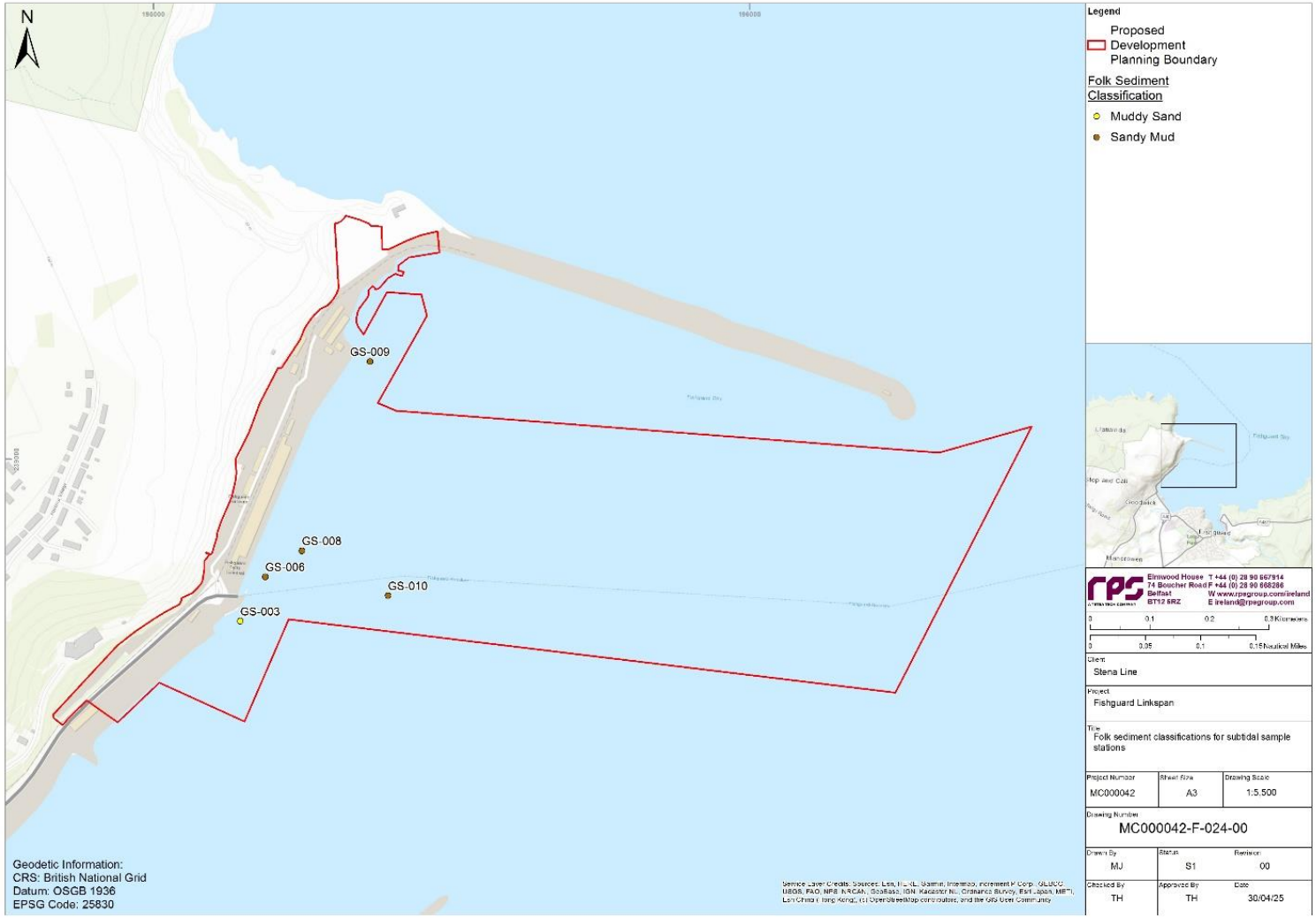


Figure 5.1: Folk sediment classifications at each benthic grab sample station in the Planning Boundary.

5.2 Sediment Contamination

5.2.1 Metals

Heavy metals are readily adsorbed by sediments which can lead to metals accumulating to concentrations far higher than the surrounding environment. These sediments can become re-suspended through bioturbation or through physical processes/disturbances. Metals will tend to accumulate in these fine-grained sediments and can become bioavailable to marine organisms through ingestion. The uptake of heavy metals by marine organisms can lead to bioaccumulation through trophic levels leading to apex organisms accumulating metals to adverse and toxic levels. This could result in significant adverse effects including mortality, impaired reproduction, reduced growth, alterations in metabolism as a result of oxidative stress and disruption to the food chain.

Table 5.1 presents the levels of metals that were recorded in the sediment samples collected from the five stations within the Planning Boundary. The results show that the levels of contaminants were very low throughout the Planning Boundary and, with one exception, were below the relevant Cefas ALs and Canadian thresholds.

Only one sample station exceeded any of the sediment chemistry thresholds, sample station GS-010 exceeded the Cefas AL1 for nickel however was well below Cefas AL2. The sediment from sample station GS-010 also exceeded the Canadian TEL for Arsenic but was well below the Canadian PEL.

Table 5.1: Concentrations of metals recorded in sediments within the Planning Boundary.

Description (metals)	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Detection Limit	0.14	0.03	1	0.7	0.6	0.01	0.4	3.5
Threshold: Cefas AL1	20	0.4	40	40	50	0.3	20	130
Threshold: Cefas AL2	100	5	400	400	500	3	200	800
Threshold: Canadian TEL	7.24	0.7	52.3	18.7	30.2	0.13	N/A	124
Threshold: Canadian PEL	41.6	4.2	160	108	112	0.7	N/A	271
Station Number								
GS - 003	6.1	0.06	11.9	7.1	9.3	0.02	9.3	41.6
GS – 006	9.7	0.08	18	15	17.2	0.03	17.2	60.6
GS – 008	8.3	0.09	18.5	11.7	18.3	0.03	18.3	68.9
GS – 009	7.7	0.08	15.4	9.7	13.6	0.03	13.6	51.4
GS - 010	12.7	0.14	27.3	15.4	29.9	0.08	29.9	96

5.2.2 Organotins

Organotin compounds are based on tin with hydrocarbon substitutes, these include the historically used biocides DBT and TBT. Primarily used as antifungal and anti-fouling agents to improve the efficiency, performance and longevity of marine structures and vessels. Concerns over toxicity of these compounds to biological organisms led to the International Maritime Organisation introducing a worldwide ban. Adverse biological effects are comparable to hydrogen cyanide, whereby the compound halts cellular respiration within the mitochondria leading to cell and organism death. Legacy trace TBT and DBT can still be present within sediments in harbours and low energy environments.

Concentrations of organotins across the Planning Boundary were all below 0.005 mg/kg at all stations and therefore unlikely to result in adverse impacts on the biological community. The full organotins data is presented in A.2.

5.2.3 Polychlorinated Biphenyls

PCBs are toxic to fish and other aquatic organisms. Reproductive and developmental problems have been observed in fish at low PCB concentrations, with the early life stages being most susceptible. There is growing evidence linking PCBs and similar compounds with reproductive and immuno-toxic effects in wildlife, including effects on seals and other marine mammals. Due to their persistence and lipophilic nature, PCBs have the potential to bioaccumulate, particularly in lipid rich tissue such as fish liver. Bioaccumulation of PCBs is recorded in fish, birds and marine mammals with known sublethal toxicological effects. Accumulation of PCBs in sediments poses a potential hazard to sediment-dwelling organisms.

Table 5.2 presents the levels of the ICES7 PCBs that were recorded in the sediment samples collected from the five stations within the Planning Boundary. The results show that levels of the individual ICES-7 PCBs were typically recorded below the limit of detection (LOD) (0.00008 mg/kg) across the Planning Boundary. The total ICES-7 PCB concentrations were also below the relevant Cefas AL1 and AL2 at each sample station.

The concentration of total PCBs presented in Table 5.2, are also well below its respective ALs and ranged from 0.00073 mg/kg (GS-009) to 0.00241 mg/kg (GS-008). All concentrations were at least one order of magnitude less than AL1 and two orders of magnitude less than AL2. No total PCB concentration has been provided for GS-003 as all of the PCB concentrations were below the LOD.

The full PCB data is presented in Appendix A.2.

Table 5.2: Total concentrations ICES-7 PCBs in sediments within the Planning Boundary.

	PCB 28	PCB 52	PCB 101	PCB 118	PCB 138	PCB 153	PCB 180	Total ICES-7 PCBs	Total PCBs
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Detection Limit	0.00008	0.00008	0.00008	0.00008	0.00008	0.00008	0.00008	0.00008	0.00008
Threshold: Cefas AL1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.02	0.02
Threshold: Cefas AL2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.2	0.2
Station Number									
GS - 003	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00010	<0.00008	N/A	N/A
GS – 006	0.00017	0.00009	0.00008	0.00009	<0.00008	<0.00010	<0.00008	N/A	0.00089
GS – 008	0.00022	0.00011	0.00009	0.00016	0.00021	0.00023	0.00022	0.00124	0.00241
GS – 009	<0.00008	<0.00008	0.00009	<0.00008	0.00009	<0.00010	0.00023	N/A	0.00073
GS - 010	0.00059	0.00032	0.00020	0.00039	0.00055	0.00054	0.00040	0.00299	0.00614

5.2.4 Polycyclic Aromatic Hydrocarbons

PAHs enter the environment through a number of sources, these include road run-off, sewage, atmospheric circulation and from historical industrial discharge. Once in the environment, PAHs exert a strong affinity for organic carbon and as such organic sediment in rivers can act as a substantial sink. Due to the high affinity for organic carbon, once ingested by fauna the PAHs cause oxidative stress and lead to adverse effects in the organism. Most species have a limited ability to metabolise PAHs and as a result can bioaccumulate to toxic levels.

Table 5.3 presents the concentrations of PAHs, which have relevant thresholds, that were recorded in the sediment samples collected from the five stations within the Planning Boundary. The full PAH data is presented in Appendix A.2.

Concentrations of individual PAHs ranged from 1 µg/kg (acenaphthylene at GS-003) to 93.4 µg/kg (fluoranthene at GS-010) across the Planning Boundary. The CSQG TEL was exceeded for five different PAHs across three sample stations (acenaphthene, acenaphthylene, dibenzo[ah]anthracene, fluorene and naphthalene), however all samples were found to below the CSQG PEL. The ERL was exceeded for three different PAHs (acenaphthene, acenaphthylene and fluorene) at two sample stations (GS-006 and GS-010) however all samples were below the ERM threshold.

Table 5.3: Concentrations of PAHs (µg/kg) in sediments within the Planning Boundary.

	Acenaphthene	Acenaphthylene	Anthracene	Benzo[a]anthracene	Benzo[a]pyrene	Chrysene	Dibenzo[ah]anthracene	Fluoranthene	Fluorene	Naphthalene	Phenanthrene	Pyrene
Units	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
Detection Limit	1	1	1	1	1	1	1	1	1	1	1	1
Threshold: CSQG TEL	6.71	5.87	46.9	74.8	88.8	108	6.22	113	21.2	34.6	86.7	153
Threshold: CSQG PEL	88.9	128	245	693	763	846	135	1494	144	391	544	1,398
Threshold: ERL	16	44	85.3	261	430	384	63.4	600	19	160	240	665
Threshold: ERM	500	640	110	1600	1600	2800	260	5100	540	2100	1500	2600
Station Number												
GS - 003	1.72	1	2.01	3.57	4.05	6.4	1.44	9.74	3.1	6.26	9.25	8.14
GS – 006	7.5	2.93	10.2	28	27.8	52	6.69	50.2	11	18.5	36.5	39.4
GS – 008	4.02	2.49	9.31	23.1	24.4	36.2	6.32	46.4	9.5	18.8	36.8	35.2
GS – 009	3.65	1.87	5.77	13.4	14.4	22.8	3.44	32.4	7.96	13.6	28.2	24.3
GS - 010	9.17	6.18	13.6	43.5	47.7	66.7	9.55	93.4	21.7	44.1	75.5	69.8

5.2.5 Total Organic Matter by Loss on Ignition

Analysis of TOM by the loss on ignition process indicated that in the Planning Boundary organic matter ranged from 2.1% at GS-003 to 10% at GS-010. The mean TOM for the Survey Area was 5%. The full sediment chemistry dataset is presented in Appendix A.2.

5.2.6 Chromium VI

Chromium VI or hexavalent chromium is a toxic form of the chromium which is used for commercial and industrial processes and can be present in solution or as a solid (UK Health Security Agency, 2022).

For all sample stations within the Planning Boundary level of Chromium VI were below the LOD (0.1 mg/kg dry weight) and therefore judged to not be hazardous. The full sediment chemistry dataset is presented in Appendix A.2.

5.2.7 Total Hydrocarbon Content

The THC is used to describe the amount of measured hydrocarbon impurities present which may have been released as a result of activities such as oil and gas exploration, infrastructure maintenance and decommissioning.

THC levels within the Planning Boundary are derived from 22 different hydrocarbons and concentrations ranged from 6.98 mg/kg (GS-006) to 32.5 mg/kg (GS-010). The full sediment chemistry dataset is presented in Appendix A.2.

5.2.8 Brominated Flame Retardants

Brominated flame retardants are organobromine compounds that have an inhibitory effect on combustion chemistry and tend to reduce the flammability of products containing them. They are also however a highly persistent, bioaccumulative group of chemicals which can lead to adverse effect in fauna (NIH, 2025).

All brominated flame retardants were below the LOD (0.0001 mg/kg dry weight) with the exception of decabromodiphenyl ether which was found at concentrations between 0.027 mg/kg (GS-009) and 0.0134 mg/kg (GS-003). Decabromodiphenyl ether is thought to be of low toxicity following acute exposure therefore no threshold has been established (UK Health Security Agency, 2024). The full sediment chemistry dataset is presented in Appendix A.2.

5.2.9 Organochlorine Pesticides

Organochlorine pesticides are synthetic pesticides used globally, however that are lipophilic, and which means they accumulate in fatty tissues, remaining in the body for years (Ozen *et al*., 2014).

All sample stations were found to have concentrations of organochlorine pesticides below the LOD 0.0001 mg/kg dry weight. The full sediment chemistry dataset is presented in Appendix A.2.

5.3 Infaunal Analysis

5.3.1.1 Summary Statistics

A total of 82 taxa were recorded in the five sample stations within the Planning Boundary. Of these 15 were taxa whose abundance could not be enumerated, and therefore were only recorded as present. These taxa were removed from the infaunal numerical and statistical analysis. A total of 1,339 individuals representing 67 enumerated taxa were recorded within the Planning Boundary. Of these, juveniles accounted for 50 individuals from two taxa (Mollusca and Polychaeta) representing 3.7% of the total number of individuals and 2.4% of the total number of taxa.

Of the 67 taxa enumerated from the Planning Boundary, two were observed at all stations (*Thyasira flexuosa* and juvenile *Mytilidae*). A total of 24 taxa (29%) were recorded as single individuals. A total of 19 taxa (23%) were represented by <10 individuals. It is generally accepted that ecological communities which are frequently subjected to local disturbance or contamination events will be dominated by a limited number of tolerant taxa, which will be

represented in high individual abundances (Clarke and Warwick, 2001). The relatively low numbers of single and low abundance species recorded in this survey could suggest a reasonably diverse community.

The most abundant taxa were recorded at all sample stations with the exception of sample station GS-008. The five of the most abundant taxa were all recorded at sample stations GS-003, GS-006, GS-010.

The dataset from the subtidal survey can be divided in to five major taxonomic groups: Annelida, Crustacea, Mollusca, Echinodermata and 'Other'. The 'Other' group comprised of:

- Seven taxa of Cnidaria (Actiniaria and *Edwardsia claparedii*); and
- One taxa of Nemertea (Nemertea).

The absolute and proportional contributions of these five taxonomic groups to the overall community structure is summarised in Table 5.4.

Table 5.4: Contribution of gross taxonomic groups recorded in the infaunal grab samples for the Planning Boundary.

Group	Individual Abundance	Proportional Contribution	Taxa Abundance	Proportional Contribution
Annelida	359	26.81%	25	37.31%
Crustacea	63	4.71%	9	13.43%
Mollusca	807	60.26%	25	37.31%
Echinodermata	99	7.39%	5	7.46%
Other	11	0.01%	3	4.47%

Table 5.5: Biomass contribution of gross taxonomic groups recorded in the infaunal grab samples for the Planning Boundary.

Group	Taxa Biomass	Proportional Contribution
Annelida	12.43	23.65%
Crustacea	0.02	0.04%
Mollusca	21.48	40.85%
Echinodermata	18.01	34.25%
Other	0.64	1.21%

In the Planning Boundary the faunal communities were generally dominated by Mollusca (n=807) and Annelida (n=359) which contributed 60.26% and 26.81% of the total number of individuals respectively. The number of taxa were also dominated by Annelida and Mollusca, both contributing 37.31% of the total number of taxa. Mollusca made up the highest proportion of individuals at all sample stations with the exception of GS-008 where Annelida represented the highest proportion of individuals.

The most abundant species overall was the mollusc *A. alba* (n=225) and individuals of this species were recorded at all stations, with the exception of station GS-008, however the majority of individuals recorded was at station GS-009 (n=128). The species with the second highest abundance was *K. bidentata* (n=206), which also occurred at all sample stations with the exception of GS-008, with the highest abundance recorded at GS-003 (n=130). Other species recorded in high abundances included *Nucula nitidosa, Melinna palmata* and *Pholoe baltica*.

The biomass data also reflected the dominance of Mollusca with Echinodermata having the second highest biomass (Table 5.5). At sample stations GS-008 and GS-010 however the highest biomass group was Annelida, at GS-008 this can be attributed to Notomastus and at GS-010 it can be attributed largely to *Nephtys incisa*..

The full infaunal abundance and biomass dataset is presented in Appendix A.4.

5.3.1.2 Multivariate Community Analysis

The results of the CLUSTER analyses, SIMPROF tests and SIMPER analyses were used, together with the raw untransformed infaunal data, to assign infaunal biotopes to each sample station. The results of the hierarchical CLUSTER analysis of the square root transformed infaunal dataset, together with the SIMPROF test, identified one Faunal group and one individual sample, GS-008, which was identified in section 5.1 as having a different sediment type (muddy sand rather than sandy mud) (Figure 5.2). Faunal group a (GS-003, GS-006, GS-009 and GS-010) showed a range of similarities between the group members from 40% between GS-0101 and the rest of group, up to ~50% between GS-003 and GS-009. The red dotted lines between the sample stations in Faunal group a (Figure 5.2) however indicates that the sub-structure has no statistical support and therefore would be unwise to interpret. These stations have all been identified as similar in section 5.1 which showed they had the same sediment type, sandy mud.

The 2D MDS plot presented in Figure 5.3 and the low stress value indicates that this is a good representation of the data. The 3D MDS plot has not been presented as the 2D MDS plot presents a clearer representation of the data.

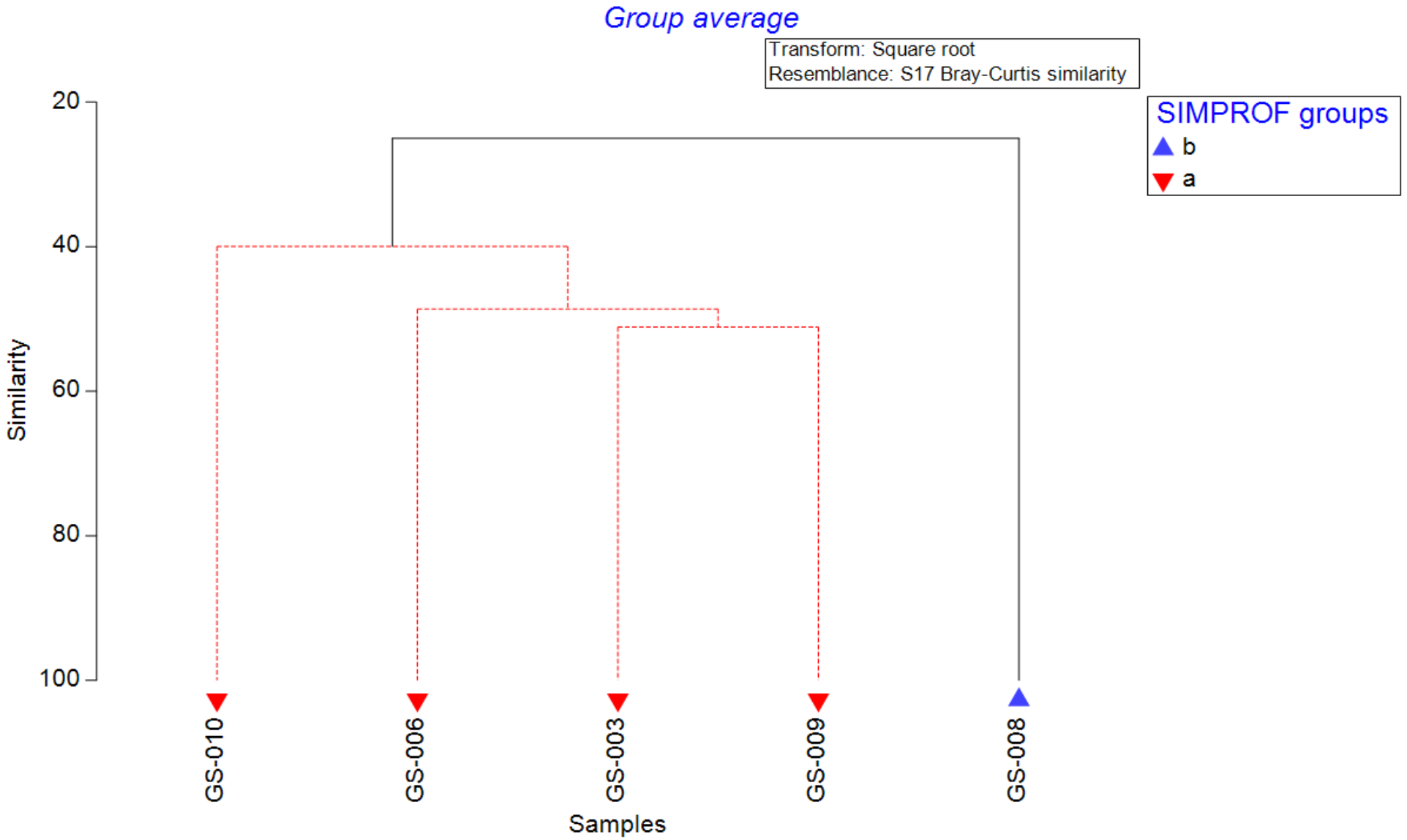


Figure 5.2: Dendrogram of Infaunal Communities in the Planning Boundary from Benthic Grab Samples.

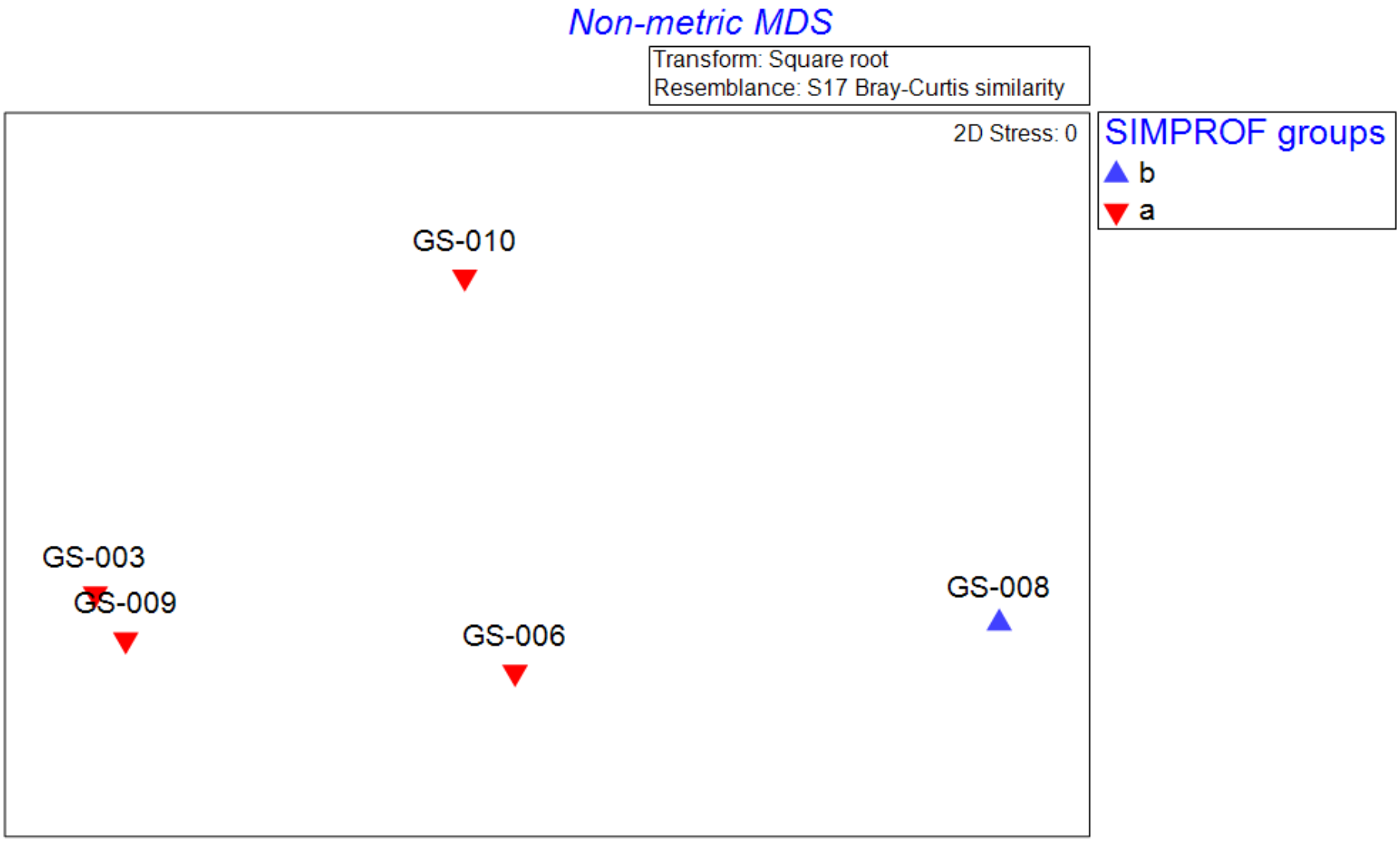


Figure 5.3: 2D MDS Plot of Infaunal Communities in the Planning Boundary from Grab Samples.

The muddy sand and sandy mud sediments associated with Faunal group A (GS-003, GS-006, GS-009 and GS-010) and the infaunal community dominated by *A. abra*, *K. bidentata*, *M. palmata* and *Thyasira flexuosa* aligns with the '*Kurtiella bidentata* and *Abra* spp. in infralittoral sandy mud' (SS.SMu.ISaMu.KurAbr; JNCC 2022 Classification) biotope. The sediments at these stations aligns with the sandy mud usually associated with this biotope additionally a number of the key species align such as *K. bidentata* and *A. abra.* This habitat is typically found in sheltered areas such as marine inlets and the harbour which forms the Planning Boundary.

At the outlying sample station GS-008, the key species in the abundance dataset for this sample station were *M. palmata, Notomastus sp., Nephtys* and *A. alba*. Due to the limited number of species recorded at this station as well as the sandy mud sediment classification and its location within a sheltered harbour it has been characterised as 'Infralittoral sandy mud' (SS.SMu.ISaMu; JNCC 2022 Classification) based on the similarity in sediment and the species which have been identified.

The biotopes as well as the characterising fauna and sediment have been presented in Table 5.6 and Figure 5.4.

Table 5.6: SIMPROF groups and biotope classifications for the Planning Boundary.

SIMPROF group	Station	EUNIS Folk Classification	Characterising Infauna	Biotope
A	GS-003	Muddy sand	*Abra alba, Kurtiella bidentata, Melinna palmata, Mytilidae, Nucula nitidosa, Pholoe baltica, Thyasira flexuosa, Varicorbula gibba, and Thysanocardia procera*	SS.SMu.ISaMu.KurAbr
	GS-006	Sandy mud		
	GS-009	Sandy mud		
	GS-010	Sandy mud		
B	GS-008	Sandy mud	*Melinna palmata, Notomastus, Abra sp.*, and *Nephtys*	SS.SMu.ISaMu

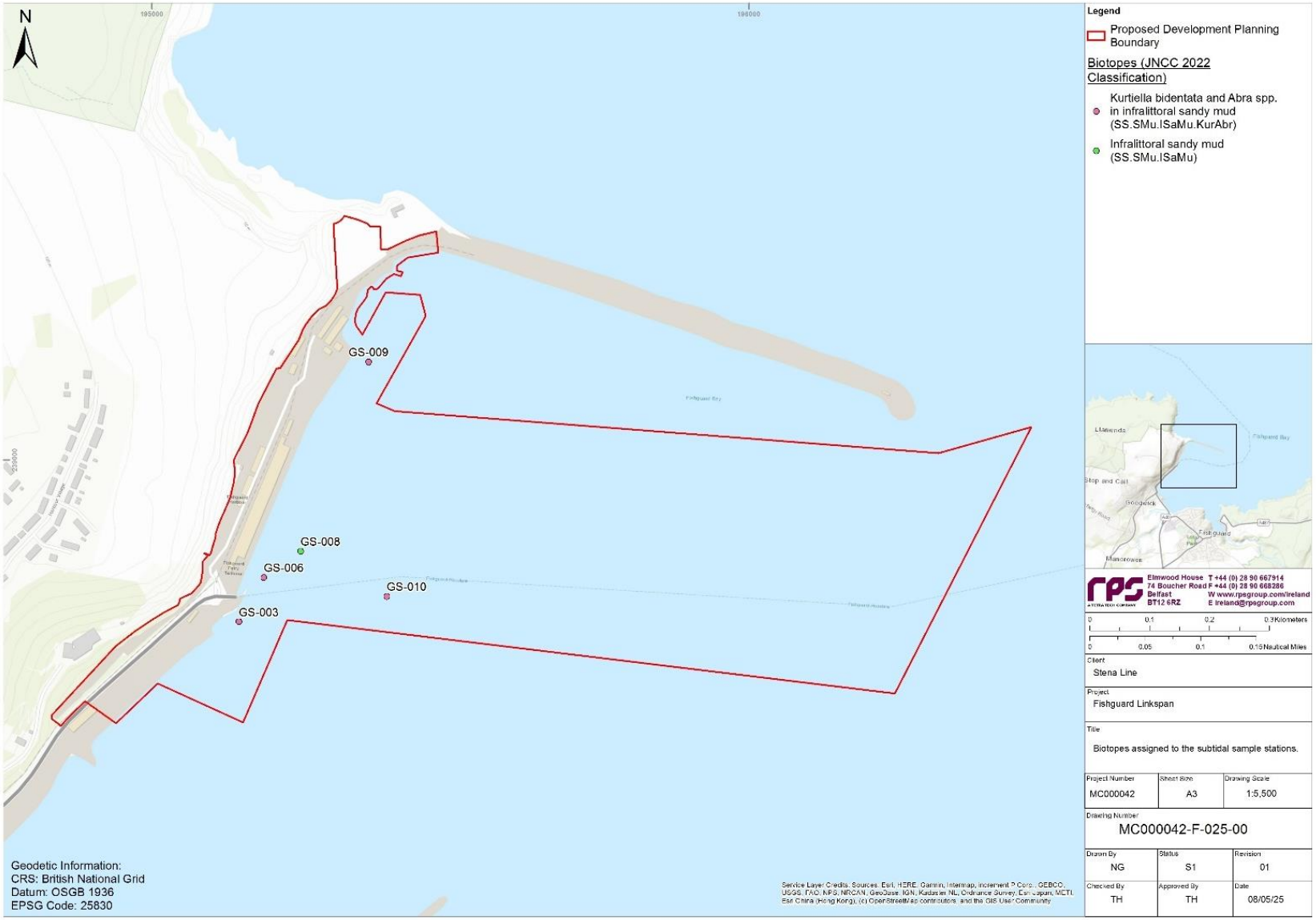


Figure 5.4: Biotopes assigned to each sample station.

5.3.1.3 Comparison with Existing Baseline

As summarised in section 1.0, there have been a number of previous subtidal surveys within Fishguard Harbour over the past decade. These surveys have identified a number of different biotopes, largely characterised by either sand and muddy sand or infralittoral/sublittoral rock.

No rock based habitat was identified in this subtidal survey. The sediments were however identified to predominantly sandy mud which is in line with previous survey results. The biotopes identified during this survey align with the biotope chosen to characterise the Fishguard Harbour generally SS.SSa.CMuSa in ES Chapter 7: Marine Biodiversity. The results of the benthic subtidal survey has been characterised the majority of stations to a more specific biotope which is based on the predominant biological community. The SS.SMu.ISaMu.KurAbr biotope was not identified by any previous survey conducted in the Fishguard Harbour subtidal survey area however it exhibits a number of similarities with the species identified in the previous surveys including bivalves such as *A. alba*, *K. bidentata* and *T. flexuosa*.

Overall the communities identified within this survey align with the physical and biological characterisation undertaken previously and summarised in the environmental baseline in Chapter 7: Marine Biodiversity.

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Appendix A

A.1 Seabed Sediments Analysis

A.1.1 Sediment Classification and TOC

Stations Number	Folk Classification	Sediment Fractions			Total Organic Carbon (%M/M)
		Gravel	Sand	Fines	
GS-003	Muddy sand	0.2%	85.2%	14.6%	1.46
GS-006	Sandy mud	0.2%	38.8%	61.0%	0.66
GS-008	Sandy mud	0.4%	46.4%	53.1%	0.75
GS-009	Sandy mud	0.3%	26.5%	73.2%	0.56
GS-010	Sandy mud	0.1%	20.7%	79.2%	1.66

A.1.2 Full PSD Results – Phi Intervals (Part 1)

Stations Number	45mm	31.5mm	22.4mm	16mm	11.2mm	8mm	5.6mm	4mm	2.8mm	2mm	1.4mm	1mm	707µm	500µm
GS-003	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.05	0.05	0.07	0.10	0.00	0.00
GS-006	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.02	0.05	0.05	0.07	0.07	0.57	1.49
GS-008	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.07	0.15	0.18	0.24	0.26	0.00	0.00
GS-009	0.00	0.00	0.00	0.00	0.00	0.24	0.00	0.00	0.03	0.03	0.03	0.03	0.00	0.00
GS-010	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.03	0.03	0.03	0.03	0.03	0.00	0.00

A.1.3 Full PSD Results – Phi Intervals (Part 2)

Stations Number	353.6µm	250µm	176.8µm	125µm	88.39µm	63µm	44.2µm	31.3µm	22.1µm	15.6µm	11µm	7.8µm	5.5µm	3.9µm
GS-003	1.99	10.85	21.94	25.58	17.69	7.02	1.90	1.56	2.06	1.81	1.47	1.45	1.47	1.25
GS-006	2.64	5.00	7.77	8.72	7.12	5.37	5.25	6.06	6.58	6.67	6.87	7.14	6.92	5.86
GS-008	0.43	6.46	12.75	13.34	8.61	4.33	3.33	4.08	4.65	4.81	5.23	6.02	6.53	6.16
GS-009	0.02	2.38	5.53	6.77	6.18	5.59	6.00	6.86	7.45	7.81	8.39	8.93	8.64	7.24
GS-010	0.29	1.73	3.38	4.57	5.14	5.51	6.10	6.70	6.90	6.84	7.26	8.30	9.12	8.81

A.1.4 Full PSD Results – Phi Intervals (Part 3)

Stations Number	2.75µm	1.95µm	1.38µm	0.98µm	0.69µm	0.49µm	0.34µm	0.24µm	0.17µm	0.12µm	0.09µm	0.06µm	0.04µm	<0.04µm
GS-003	0.87	0.49	0.24	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GS-006	4.19	2.46	1.24	0.86	0.79	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GS-008	4.86	3.10	1.63	1.12	1.19	0.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GS-009	5.13	3.00	1.50	1.04	0.99	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GS-010	7.27	4.87	2.61	1.76	1.92	0.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

A.2 Sediments Chemistry Analysis

A.2.1 Total Organic Matter, Chromium IV and Organotins

Stations Number	TOM (%)	Chromium IV (mg/kg)	Organotins	
			DBT (mg/kg)	TBT (mg/kg)
GS-003	2.1	<0.1	<0.001	<0.001
GS-006	4.5	<0.1	<0.005	<0.005
GS-008	4.6	<0.1	<0.005	<0.005
GS-009	3.7	<0.1	<0.005	<0.005
GS-010	10.0	<0.1	<0.005	<0.005

A.2.2 PAHs

Stations Number	ACENAPTH (µg/Kg)	ACENAPHY (µg/Kg)	ANTHRACN (µg/Kg)	BAA (µg/Kg)	BAP (µg/Kg)	BBF (µg/Kg)	BENZGHIP (µg/Kg)	BKF (µg/Kg)	CHRYSENE (µg/Kg)	DBENZAH (µg/Kg)	FLUORANT (µg/Kg)	FLUORENE (µg/Kg)	INDPYR (µg/Kg)	NAPTH (µg/Kg)	PHENANT (µg/Kg)	PYRENE (µg/Kg)
GS-003	1.72	<1	2.01	3.57	4.05	6.13	4.85	5.41	6.40	1.44	9.74	3.10	5.03	6.26	9.25	8.14
GS-006	7.50	2.93	10.2	28.0	27.8	35.5	26.5	25.6	52.0	6.69	50.2	11.0	30.0	18.5	36.5	39.4
GS-008	4.02	2.49	9.31	23.1	24.4	34.8	24.6	25.1	36.2	6.32	46.4	9.50	27.8	18.8	36.8	35.2
GS-009	3.65	1.87	5.77	13.4	14.4	20.8	15.7	14.4	22.8	3.44	32.4	7.96	16.2	13.6	28.2	24.3
GS-010	9.17	6.18	13.6	43.5	47.7	64.5	46.9	44.9	66.7	9.55	93.4	21.7	51.0	44.1	75.5	69.8

A.2.3 PCBs (Part 1)

Stations Number	PCB 101 (mg/Kg)	PCB 105 (mg/Kg)	PCB 110 (mg/Kg)	PCB 118 (mg/Kg)	PCB 128 (mg/Kg)	PCB 138 (mg/Kg)	PCB 141 (mg/Kg)	PCB 149 (mg/Kg)	PCB 151 (mg/Kg)	PCB 153 (mg/Kg)
GS-003	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00010
GS-006	0.00008	<0.00008	0.00009	0.00009	<0.00008	<0.00008	<0.00008	0.00009	<0.00008	<0.00010
GS-008	0.00009	0.00010	0.00014	0.00016	<0.00008	0.00021	<0.00008	0.00014	<0.00008	0.00023
GS-009	0.00009	<0.00008	<0.00008	<0.00008	<0.00008	0.00009	<0.00008	0.00015	<0.00008	<0.00010
GS-010	0.00020	0.00015	0.00030	0.00039	0.00011	0.00055	0.00015	0.00033	0.00013	0.00054

A.2.4 PCBs (Part 2)

Stations Number	PCB 156 (mg/Kg)	PCB 158 (mg/Kg)	PCB 170 (mg/Kg)	PCB 18 (mg/Kg)	PCB 180 (mg/Kg)	PCB 183 (mg/Kg)	PCB 187 (mg/Kg)	PCB 194 (mg/Kg)	PCB 28 (mg/Kg)	PCB 31 (mg/Kg)
GS-003	<0.00010	<0.00010	<0.00008	<0.00008	<0.00008	<0.00010	<0.00008	<0.00008	<0.00008	<0.00008
GS-006	<0.00010	<0.00010	<0.00008	<0.00008	<0.00008	<0.00010	<0.00008	<0.00008	0.00017	0.00014
GS-008	<0.00010	<0.00010	0.00009	0.00012	0.00022	<0.00010	0.00009	<0.00008	0.00022	0.00018
GS-009	<0.00010	<0.00010	<0.00008	<0.00008	0.00023	<0.00010	0.00017	<0.00008	<0.00008	<0.00008
GS-010	<0.00010	<0.00010	0.00013	0.00026	0.00040	<0.00010	0.00021	0.00009	0.00059	0.00041

A.2.5 PCBs (Part 3)

Stations Number	PCB 44 (mg/Kg)	PCB 47 (mg/Kg)	PCB 49 (mg/Kg)	PCB 52 (mg/Kg)	PCB 66 (mg/Kg)
GS-003	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
GS-006	<0.00008	<0.00008	0.00008	0.00009	0.00014
GS-008	<0.00008	<0.00008	0.00010	0.00011	0.00021
GS-009	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
GS-010	0.00017	<0.00008	0.00020	0.00032	0.00051

A.2.6 Organochlorine Pesticides

Stations Number	AHCH (mg/Kg)	BHCH (mg/Kg)	GHCH (mg/Kg)	DIELDRIN (mg/Kg)	HCB (mg/Kg)	PPTDE (mg/Kg)	PPDDE (mg/Kg)	PPDDT (mg/Kg)
GS-003	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
GS-006	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
GS-008	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001

Stations Number	AHCH (mg/Kg)	BHCH (mg/Kg)	GHCH (mg/Kg)	DIELDRIN (mg/Kg)	HCB (mg/Kg)	PPTDE (mg/Kg)	PPDDE (mg/Kg)	PPDDT (mg/Kg)
GS-009	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001
GS-010	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0002	<0.0001	<0.0001

A.2.7 Brominated Flame Retardants (Part 1)

Stations Number	BDE17 (mg/Kg)	BDE28 (mg/Kg)	BDE47 (mg/Kg)	BDE66 (mg/Kg)	BDE85 (mg/Kg)	BDE99 (mg/Kg)
GS-003	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
GS-006	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
GS-008	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
GS-009	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
GS-010	<0.00005	<0.00005	0.00006	<0.00005	<0.00005	<0.00005

A.2.8 Brominated Flame Retardants (Part 2)

Stations Number	BDE100 (mg/Kg)	BDE138 (mg/Kg)	BDE153 (mg/Kg)	BDE154 (mg/Kg)	BDE183 (mg/Kg)	BDE209 (mg/Kg)
GS-003	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.0134
GS-006	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.0050
GS-008	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.0041
GS-009	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.0027
GS-010	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.0071

A.3 Multivariate Analysis Results

SIMPER

Similarity Percentages - species contributions

One-Way Analysis

Data worksheet

Name: SQRT

Data type: Abundance

Sample selection: All

Variable selection: All

Parameters

Resemblance: S17 Bray-Curtis similarity

Cut off for low contributions: 70.00%

Factor Groups

Sample	Sprof gr.
GC-003	b
GC-006	b
GC-009	b
GC-010	b
GC-008	a

Group b

Average similarity: 44.71

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%	
Abra alba	6.81	5.84	2.62	13.07	13.07	
Kurtiella bidentata		6.30	5.25	1.77	11.74	24.81
Melinna palmata		4.31	4.80	3.70	10.74	35.56
Mytilidae	3.23	3.74	4.37	8.36	43.91	
Nucula nitidosa		5.42	3.66	1.48	8.19	52.10
Pholoe baltica	4.23	2.86	1.20	6.39	58.49	
Thyasira flexuosa		2.49	2.52	5.78	5.65	64.14
Varicorbula gibba		3.26	2.36	0.91	5.27	69.41
Thysanocardia procera		1.60	1.72	5.62	3.85	73.25

Group a

Less than 2 samples in group

Groups b & a

Average dissimilarity = 75.00

	Group b	Group a

Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%	
Kurtiella bidentata		6.30	0.00	7.00	1.56	9.34	9.34
Abra alba	6.81	0.00	6.88	2.35	9.17	18.51	
Nucula nitidosa		5.42	0.00	5.28	1.60	7.04	25.55
Amphiura filiformis		3.11	0.00	3.17	0.92	4.22	29.77
Varicorbula gibba		3.26	0.00	3.07	1.50	4.09	33.86
Pholoe baltica	4.23	1.00	2.96	1.03	3.95	37.81	
Nephtys incisa	2.03	0.00	2.65	0.94	3.53	41.34	
Notomastus	0.43	2.65	2.50	1.84	3.33	44.67	
Mytilidae	3.23	1.00	2.47	2.28	3.30	47.97	
Eudorella truncatula		1.83	0.00	1.94	0.98	2.59	50.55
BIVALVIA	1.95	0.00	1.80	0.85	2.40	52.96	
Abra nitida	1.27	0.00	1.69	0.82	2.26	55.21	
Thysanocardia procera		1.60	0.00	1.68	5.73	2.24	57.46
Orbiniidae	1.37	0.00	1.57	1.37	2.09	59.54	
Melinna palmata		4.31	5.57	1.48	0.93	1.98	61.52
Thyasira flexuosa		2.49	1.00	1.46	2.21	1.95	63.47
Nephtys	1.73	1.41	1.39	1.59	1.85	65.32	
Abra	0.43	1.41	1.29	1.63	1.72	67.04	
Euclymene oerstedii agg.		1.19	1.00	1.23	1.23	1.64	68.67
Pholoe inornata		1.19	0.00	1.18	0.64	1.57	70.24

A.4 Macrofauna Data

A.4.1 Infaunal Abundance Data (P=Present)

Taxon name	VC-003	VC-006	VC-008	VC-009	VC-010
ANIMALIA	-	p	-	p	-
PORIFERA	-	-	-	P	-
ACTINIARIA	-	1	-	-	1
Edwardsia claparedii	-	4	1	1	-
NEMERTEA	-	1	1	-	1
NEMATODA	P	-	-	-	-
Thysanocardia procera	4	4	-	2	1

Tubificoides benedii	-	-	-	1	2
POLYCHAETA	P	P	P	P	P
Pholoe baltica	49	4	1	48	1
Pholoe inornata	1	14	-	-	-
Harmothoe	-	1	-	-	-
Malmgrenia	2	-	-	-	2
Glycera alba	-	1	-	-	-
Eulalia ornata	-	1	-	-	-
Phyllodoce mucosa	-	-	1	-	-
Nephtys	6	1	2	12	-
Nephtys caeca	1	-	-	-	-
Nephtys hombergii	-	-	-	3	-
Nephtys incisa	-	4	-	4	17
Lumbrineris aniara agg.	3	3	-	-	-
Notocirrus scoticus	-	1	-	-	-
Notomastus	-	3	7	-	-
Euclymene oerstedii agg.	14	1	1	-	P
Orbiniidae	-	2	-	7	2
Scalibregma inflatum	-	6	-	-	-
Chaetozone zetlandica	-	1	-	1	-
Melinna palmata	9	31	31	27	12
Spirobranchus lamarcki	-	1	-	-	-
Sabellaria spinulosa	-	1	-	-	-
Magelona	-	-	-	-	2
Magelona alleni	1	1	-	-	1
MYODOCOPIDA	P	P	P	P	-
PODOCOPIDA	-	-	-	-	P
Bodotria pulchella	-	-	-	1	-
Diastylis laevis	-	-	-	4	-

Eudorella truncatula	-	2	-	24	1
Pseudocuma (Pseudocuma) longicorne	4	-	-	1	-
Leucothoe incisa	-	-	-	1	-
Perioculodes longimanus	-	-	-	1	-
Ampelisca tenuicornis	-	3	-	1	-
Harpinia	4	1	-	3	-
Pariambus typicus	4	-	-	8	-
GASTROPODA	-	-	-	-	1
Turritellinella tricarinata	1	-	-	-	-
Melanella polita	-	-	-	1	-
Mangelia costata	-	1	-	-	-
Parthenina indistincta	1	-	-	-	-
Turbonilla acuta	-	-	-	3	-
BIVALVIA	23	9	-	-	-
Pharus legumen	-	1	1	2	-
Parvicardium	1	-	-	-	-
Abra	-	3	2	-	-
Abra alba	45	46	-	128	6
Abra nitida	-	6	-	-	7
Tellinidae	-	-	-	1	-
Fabulina fabula	1	-	-	-	-
Kurtiella bidentata	130	16	-	6	54
Lasaea adansoni	1	-	-	-	-
Lucinoma borealis	5	-	-	-	-
Thyasira flexuosa	12	8	1	5	2
Varicorbula gibba	24	16	-	17	-
Mytilidae	9	20	1	6	9
Nucula nitidosa	60	8	-	94	2
Spisula subtruncata	5	-	-	1	-

Chamelea striatula	2	-	-	1	-
Timoclea ovata	-	-	-	1	-
THRACIOIDEA	1	-	-	-	-
Bugula neritina	P	-	-	-	P
Cradoscrupocellaria ellisi	-	P	-	-	-
Phaeostachys spinifera	-	-	-	P	-
Scruparia	-	-	-	P	-
Watersipora subatra	P	-	-	-	-
Crisia	-	-	-	P	P
Crisidia cornuta	-	P	-	P	-
Leptosynapta	3	P	1	-	2
Paraleptopentacta elongata	-	1	-	-	-
Acrocnida brachiata	3	-	-	-	-
Amphiura filiformis	81	1	P	-	6
Ophiura	-	-	-	1	-
RHODOPHYTA	-	-	-	P	-
Araceae	P	-	P	-	-

A.4.2 Infaunal Biomass Data (mg)

Taxon name	VC-003	VC-006	VC-008	VC-009	VC-010
ANIMALIA	-	-	-	-	-
PORIFERA	-	-	-	-	-
ACTINIARIA	-	-	-	-	-
Edwardsia claparedii	-	0.4793	0.0841	0.0137	-
NEMERTEA	-	0.0026	0.0587	-	0.0002
NEMATODA	-	-	-	-	-
Thysanocardia procera	0.4775	0.0293	-	0.0666	0.0341

Tubificoides benedii	-	-	-	0.0008	0.0021
POLYCHAETA	0.4353	0.0938	0.3867	0.0783	0.0017
Pholoe baltica	0.0787	0.0037	0.0004	0.0097	0.0001
Pholoe inornata	0.0013	0.0044	-	-	-
Harmothoe	-	0.0024	-	-	-
Malmgrenia	0.0352	-	-	-	0.0179
Glycera alba	-	0.0013	-	-	-
Eulalia ornata	-	0.0002	-	-	-
Phyllodoce mucosa	-	-	0.0008	-	-
Nephtys	0.0776	0.0145	0.3062	0.1595	-
Nephtys caeca	3.1809	-	-	-	-
Nephtys hombergii	-	-	-	0.9603	-
Nephtys incisa	-	0.6413	-	0.5085	2.5719
Lumbrineris aniara agg.	0.0376	0.0014	-	-	-
Notocirrus scoticus	-	0.0025	-	-	-
Notomastus	-	0.1323	1.0053	-	-
Euclymene oerstedii agg.	0.0061	0.0001	0.0069	-	0.0019
Orbiniidae	-	0.001	-	0.0025	0.001
Scalibregma inflatum	-	0.0307	-	-	-
Chaetozone zetlandica	-	0.001	-	0.0004	-
Melinna palmata	0.1585	0.2247	0.2164	0.1703	0.2377
Spirobranchus lamarcki	-	0.0004	-	-	-
Sabellaria spinulosa	-	0.0007	-	-	-
Magelona	-	-	-	-	0.0001
Magelona alleni	0.0087	0.0009	-	-	0.0019
MYODOCOPIDA	-	-	-	-	-
PODOCOPIDA	-	-	-	-	0.0001
Bodotria pulchella	-	-	-	0.0001	-
Diastylis laevis	-	-	-	0.001	-

Eudorella truncatula	-	0.0007	-	0.0099	0.0003
Pseudocuma (Pseudocuma) longicorne	0.0009	-	-	0.0001	-
Leucothoe incisa	-	-	-	0.0001	-
Perioculodes longimanus	-	-	-	0.0001	-
Ampelisca tenuicornis	-	0.0007	-	0.0021	-
Harpinia	0.0019	0.0002	-	0.0004	-
Pariambus typicus	0.0007	-	-	0.0015	-
GASTROPODA	-	-	-	-	0.0014
Turritellinella tricarinata	0.1693	-	-	-	-
Melanella polita	-	-	-	0.0015	-
Mangelia costata	-	0.0107	-	-	-
Parthenina indistincta	0.0022	-	-	-	-
Turbonilla acuta	-	-	-	0.0029	-
BIVALVIA	0.0295	0.0047	-	-	-
Pharus legumen	-	0.1759	0.1714	4.4385	-
Parvicardium	0.008	-	-	-	-
Abra	-	0.0026	0.0075	-	-
Abra alba	0.7702	2.7341	-	3.9231	1.1088
Abra nitida	-	0.234	-	-	1.2743
Tellinidae	-	-	-	0.0001	-
Fabulina fabula	0.0568	-	-	-	-
Kurtiella bidentata	0.3037	0.0637	-	0.0129	0.2426
Lasaea adansoni	0.0001	-	-	-	-
Lucinoma borealis	0.0151	-	-	-	-
Thyasira flexuosa	0.1576	0.065	0.0143	0.025	0.0154
Varicorbula gibba	0.235	0.0278	-	0.0207	-
Mytilidae	0.0051	0.0097	0.0001	0.0048	0.0037
Nucula nitidosa	1.9833	0.2289	-	2.514	0.0034
Spisula subtruncata	0.0924	-	-	0.2943	-

Chamelea striatula	0.0049	-	-	0.0046	-
Timoclea ovata	-	-	-	0.0016	-
THRACIOIDEA	0.0042	-	-	-	-
Bugula neritina	-	-	-	-	-
Cradoscrupocellaria ellisi	-	-	-	-	-
Phaeostachys spinifera	-	-	-	-	-
Scruparia	-	-	-	-	-
Watersipora subatra	-	-	-	-	-
Crisia	-	-	-	-	-
Crisidia cornuta	-	-	-	-	-
Leptosynapta	2.5865	1.364	0.1165	-	1.0252
Paraleptopentacta elongata	-	0.059	-	-	-
Acrocnida brachiata	0.7417	-	-	-	-
Amphiura filiformis	10.6013	0.0087	0.0012	-	1.5027
Ophiura	-	-	-	0.0013	-
RHODOPHYTA	-	-	-	-	-
Araceae	-	-	-	-	-

8.B

APPENDIX 8.B
INNSMP Biosecurity Risk Assessment

Stena Fishguard

Invasive Non-Native Species Management Plan

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Glossary

Term	Meaning
Biofouling	The accumulation of aquatic organisms on surfaces.
Invasive Non-Native Species	Any non-native animal or plant that can spread causing damage to the environment, the economy and/or human health.
Non-Native Species	The equivalent of 'alien species' (as used by the Convention on Biological Diversity (CBD)) and 'non-indigenous species' (as used by the OSPAR Commission and the UK Marine Strategy); it refers to a species intentionally or unintentionally introduced outside its native range by human actions.

Acronyms and Initialisations

Acronym/ Initialisation	Description
CBD	Convention on Biological Diversity
Defra	Department for Environment, Food & Rural Affairs
EU	European Union
GB	Great Britan
IMO	International Maritime Organisation
INNS	Invasive Non-Native Species
INNSMP	Invasive Non-Native Species Management Plan
JUB	Jack Up Barge
MARPOL	International Convention for the Prevention of Pollution from Ships
MHPA	Milford Haven Port Authority
MHWS	Mean High-Water Springs
NBN	National Biodiversity Network
NRW	Natural Resources Wales
NNS	Non-Native Species
NNSS	Non-native Species Secretariat
RNLI	Royal National Lifeboat Institution
SPR	Source Pathway Receptor
TBC	To Be Confirmed
TTRPSE	Tetra Tech RPS Energy
TSHD	Trailer Suction Hopper Dredger
WWBIC	West Wales Biodiversity Information Centre

Units

Unit	Description
km	Kilometre (distance)
m	Metre (distance)
m/s	Metre per second
m^2	Square meter

Unit	Description
m^3	Cubic metre
mCD	Metre (Chart Datum)
mm	Millimetre
t	Tonne

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A.1 Existing General Arrangement Plan of Fishguard linkspan and Proposed Development Plan

1.0 Introduction

1.1 Background

This Invasive Non-Native Species Management Plan (INNSMP) has been prepared by Tetra Tech RPS Energy (TTRPSE) on behalf of Stena Line with regard to replacing the existing temporary linkspan and jack up barge (JUB) at the Fishguard ferry terminal in Wales (hereafter referred to as the 'Proposed Development').

1.2 Purpose and scope

This document provides an outline INNSMP, which will be further developed post-application in advance of the construction phase of the Proposed Development.

The purpose of the INNSMP is to set out the approach to Invasive Non-Native Species (INNS) management and mitigation in respect of the Proposed Development. This INNSMP will provide an outline of the measures proposed to be implemented to facilitate biosecurity control and to minimise potential impacts on the local and wider environment.

The scope of this INNSMP includes all activities undertaken during the construction phase within Fishguard Harbour. Figure 1.1 illustrates the location of the Proposed Development, which will take place within the Planning Boundary, positioned seaward of the Mean High-Water Springs (MHWS).

The INNSMP will ensure all procedures pertaining to marine works (including construction of subsea structures) and vessel operations follow best practice guidance, reducing the risk of the possible spread or introduction of INNS into the waters of the Proposed Development.

The method employed follows the principles of the 'Great Britain (GB) INNS Strategy' (Department for Environment, Food & Rural Affairs (Defra) and The Welsh Government, 2023). The INNS Strategy follows a hierarchical approach which emphasises prevention of INNS introduction, followed by early detection and rapid response, and finally long-term management and control. The key outcomes of the GB INNS Strategy are that by 2030 it will have achieved:

- **Prevention**: reduce establishments of INNS by at least 50% compared to 2000 levels.
- **Surveillance**: early detection and monitoring: significantly improve our detection and monitoring capability, including increasing inspections and investigations.
- **Management**: eradicate, control or contain INNS, prioritised by greatest impact and the likelihood of success.
- **Prioritisation and risk analysis**: set out an agreed approach to the prioritisation of species based on risk and likelihood of success to ensure our efforts are focused on where they can achieve the greatest benefit.
- **Evidence**: commission the research priorities outlined in the Evidence Strategic Plan, to ensure that the strategy is based on the best available evidence and identify gaps and priority areas for further development.
- **Awareness raising**: increase awareness of INNS issues and promote appropriate changes in behaviour or attitudes throughout all relevant sectors and among the general public.
- **Coordination**: improve coordination of actions within governments, government-associated bodies, and key actors outside government.

This INNSMP will be finalised prior to construction and will remain a 'live' document throughout construction as outlined within Section 7.0 (Evaluation and Review).

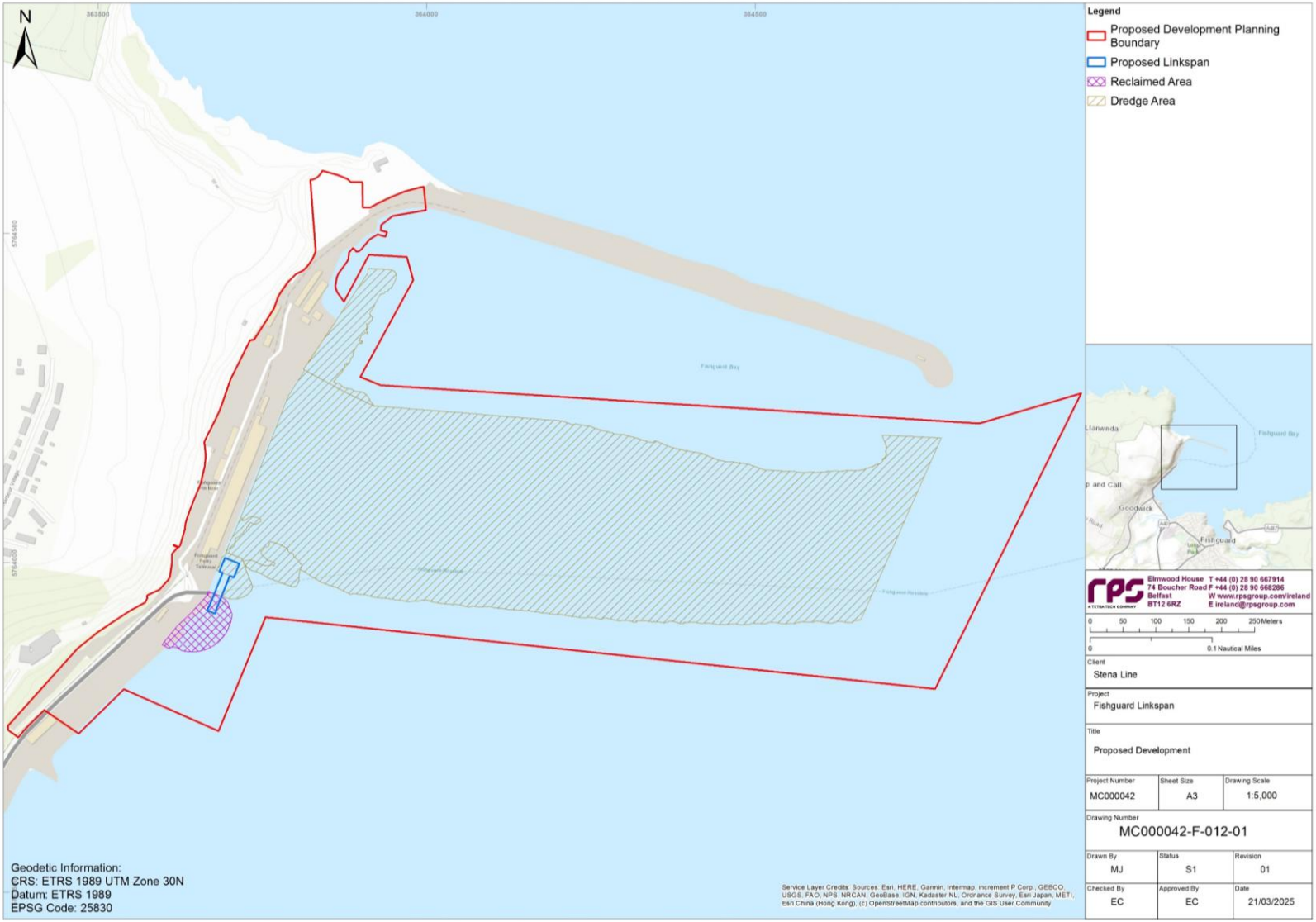


Figure 1.1: The location of the Proposed Development and associated construction activities.

1.3 Legislative context and guidance

1.3.1 Policy

1.3.1.1 International

Convention on Biological Diversity (CBD)

This convention arose from the United Nations Conference on Environment and Development held in Rio in 1992. Within the framework of the convention, there are 15 Guiding Principles for the prevention and mitigation of impacts of alien species (i.e. non-native species (NNS)) that threaten ecosystems, habitats or species. Article 8(h) states that each Contracting Party shall prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species (CBD, 2024). These principles therefore provide an international framework for governments and other organisations to develop effective strategies to prevent the introduction, control and eradicate INNS.

Acknowledging the growing threat from INNS, the CBD has provided a major driver for international action. One of its guiding principles calls for national strategies on INNS. In response to this, devolved governments across the UK have produced the 'GB INNS Strategy' (Defra and The Welsh Government, 2023) as described in Section 1.2. This Strategy provides the framework to support the coordination of policy and action across GB and aligns these efforts with national and international biosecurity and environmental strategies.

The International Convention for the Prevention of Pollution from Ships (MARPOL)

MARPOL was adopted on 2 November 1973 following a conference at the London headquarters of the International Maritime Organisation (IMO), the United Nations agency responsible for the safety of shipping and the prevention of marine pollution. The convention currently includes six technical Annexes, which cover both accidental pollution and that from routine operations.

MARPOL also recognises the growing threat from alien species' (i.e. NNS) and their transfer across the oceans. The convention has been a major driver of developing guidelines to address the problem of alien species (IMO, 1998).

International Convention for the Control and Management of Ships' Ballast Water and Sediments

The Ballast Water Management Convention, adopted in 2004, aims to prevent the spread of harmful aquatic organisms from one region to another, by establishing standards and procedures for the management and control of ships' ballast water and sediments. Generally, the provisions of the convention aim to prevent, minimise and ultimately eliminate the transfer of harmful aquatic organisms and pathogens through the control and management of ships' ballast water and sediments. A number of guidelines have been developed to facilitate the implementation of the Convention (IMO, 2019).

1.3.1.2 National

Regulation (EU) No 1143/2014 on the prevention and management of the introduction and spread of invasive alien species

Regulation 1143/2014 was retained in domestic law under the European Union (Withdrawal) Act 2018. It was amended through several statutory instruments to ensure operability following the UK's exit from the European Union (EU) but applies to GB only (EU, 2014).

This Regulation sets out rules to prevent, minimise and mitigate the adverse impact on biodiversity of the introduction and spread within the EU, both intentional and unintentional, of invasive alien species.

The Animal Welfare and Invasive Non-native Species (Amendment etc.) (EU Exit) Regulations 2020

In Wales EU Regulation 1143/2014 was amended through the Animal Welfare and Invasive Non-native Species (Amendment etc.) (EU Exit) Regulations 2020. It contains provisions relating to offences, penalties, enforcement, licensing and permitting to meet the requirements of the Regulation (Welsh Government, 2020).

The Wildlife and Countryside Act 1981

Section 14(4A) of the Wildlife and Countryside Act 1981, as inserted by section 23 of the Infrastructure Act 2015, enables species control agreements and orders to be made by environmental authorities to ensure that landowners take action on invasive non-native species, or permit others to enter the land and carry out those operations, to prevent their establishment and spread. In 2017, the Welsh Government published the Code of Practice for Species Control Provisions in Wales (Welsh Government, 2017), which sets out how species control agreements and orders should be applied in Wales.

1.3.2 Guidance

Marine Biosecurity Planning – Guidance for producing site and operation-based plans for preventing the introduction and spread of non-native species in England and Wales (Cook *et al.*, 2014)

The Scottish guidance by Payne *et al.* (2014) on producing biosecurity plans was written as a report to the Firth of Clyde Forum and Scottish Natural Heritage as part of the Marine Pathways Project. This guidance was then adapted for England and Wales and updated in response to feedback (Cook *et al.,* 2014).

This document outlines guidance for marine users on the development of biosecurity plans for controlling the introduction and spread of marine species outside their natural range by human action (i.e. NNS). It defines an INNS as a NNS which threatens native biological diversity, human health or economic activity. For the purposes of this INNSMP, all NNS will be treated as having the potential to become invasive and will therefore be referred to as INNS.

Both guidance documents (Payne *et al.,* 2014; Cook *et al.,* 2014) outline a 6-step process for preparing a marine biosecurity plan:

1. Understanding your site
2. Understanding how INNS can be introduced to your site
3. Identifying activities which risk introducing INNS
4. Listing your biosecurity measures
5. Biosecurity surveillance, monitoring and reporting
6. Contingency planning.

2.0 Methodology

The Payne *et al.* (2014) and Cook *et al.* (2014) guidance documents were adapted for the methodology of this INNSMP. To conduct an accurate risk assessment of the Proposed Development, and derive a suitable INNSMP, a stepwise approach was taken, as outlined in Figure 2.1, with the methodology for each step described in detail below.

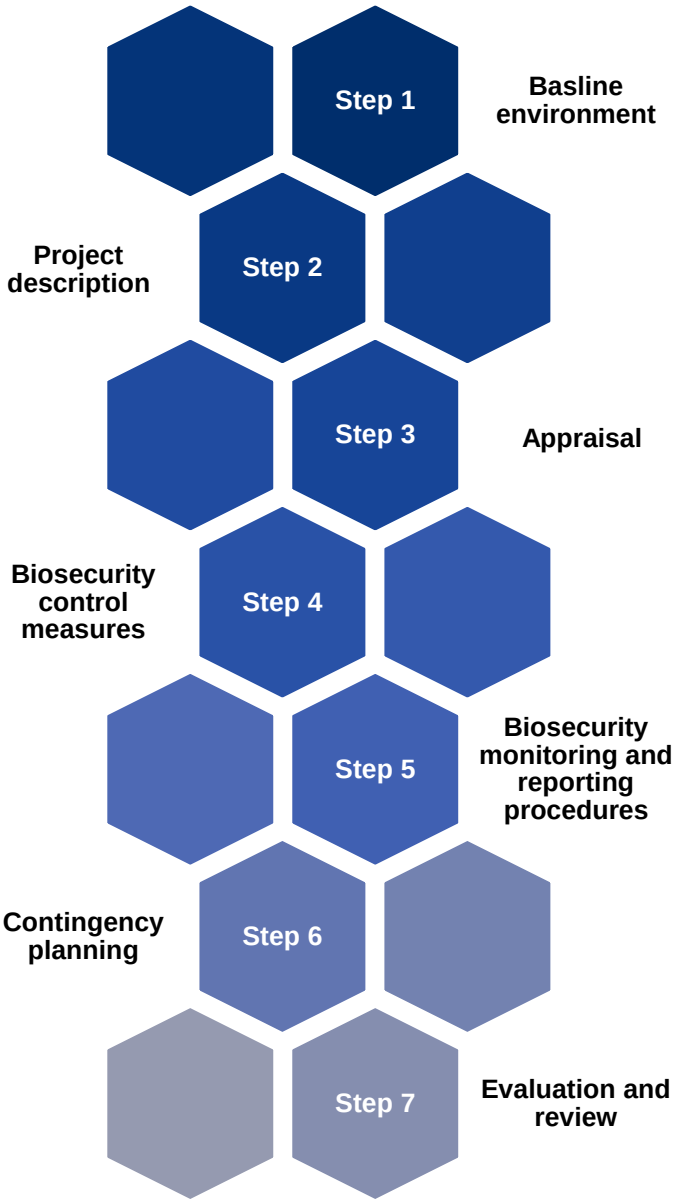


Figure 2.1: Seven steps used to produce the INNSMP for the Proposed Development.

2.1 Step 1: Baseline environment

A detailed description of the site was produced to define variables that can affect the colonisation and spread of INNS. These variables include the environmental conditions of the site, such as salinity, depth and the availability of hard substrate (Zaiko, 2007), details of any man-made structures, and records of INNS already present within the site.

The salinity of the site will determine the suitability of the site for INNS, as the majority of marine flora and fauna are unable to tolerate freshwater due to osmoregulatory effects (Evans, 1980). An increased volume of freshwater flowing into a site will likely result in less hospitable conditions, decreasing the risk of INNS on site; conversely, a fully marine site tends to represent a greater risk of INNS introduction to communities of native species (Tang *et al*., 2022).

The depth profile of a site can influence the ability of a species to colonise a site. Species live within an ecological range of tolerances, therefore, should a site be too deep for a species to live there, it won't establish. Equally, within shallow environments, periods of tidal inundation and air exposure may decrease the likeliness of a species to establish.

The establishment of a sessile INNS can also be influenced by the presence of a suitable hard substrate for colonisation (Zaiko, 2007). Should a site only have gravel or sand present, then the likeliness of a sessile INNS being able to establish is reduced. Therefore, the presence of artificial structures increases the risk of INNS establishment.

Marine INNS records for Fishguard were sought from West Wales Biodiversity Information Centre (WWBIC) and obtained on 23 January 2025. Other data on marine INNS were obtained from publicly available online resources.

If INNS have been found on-site, then an INNSMP should focus on reducing the risk of introducing new INNS and consider how to prevent the spread of existing INNS to other sites. Throughout the whole process, the precautionary principle has been followed, as the absence of INNS records does not mean INNS are not present at the site and, owing to the nature of the Proposed Development, there is risk of INNS being introduced or spread to other areas.

The baseline environment for the Proposed Development is presented in Section 3.0.

2.2 Step 2: Project description

The project description, detailed in Section 4.0, outlines the scope of the Proposed Development and the construction activities to be undertaken. This information is derived from Chapter 2 of the Proposed Development Environmental Statement.

2.3 Step 3: Appraisal

To determine if site activities pose a risk of introducing or spreading INNS, the Source Pathway Receptor (SPR) model was used:

- **Source:** where there are known INNS in the region, details on their life-history and GB NNS risk assessment (where available) are used to indicate the level of risk they pose (Non-native Species Secretariat (NNSS), 2025).
- **Pathway:** the activities are assessed for whether they represent a route by which INNS could be introduced or spread, taking into account embedded mitigation (see Section 4.2).
- **Receptor:** the receptor is the region into which INNS could be introduced, which is assessed for whether it represents a suitable habitat for INNS colonisation. The receptor could either be the sites of the Proposed Development (see Figure 1.1), which are assessed in Step 1 (Baseline environment), or a new region that INNS could be spread to, as a result of the Proposed Development.

Following the precautionary principle, it is assumed that there is always a source of INNS that could be introduced or spread. Therefore, if there is also a pathway and suitable habitat (receptor) for their establishment, then the activity poses a risk of introducing or spreading INNS.

Site activities which pose a risk of introducing INNS were then taken forward to the Management Plan (Section 6.0), which is described below.

2.4 Management plan

The Management Plan itself is composed of Steps 4, 5 and 6 (Figure 2.1). The Proposed Development Management Plan is presented in Section 6.0.

2.4.1 Step 4: Biosecurity control measures

Biosecurity measures were set for each site activity which was considered a significant risk in the Appraisal. These measures were designed to be effective, clear, realistic and easy to communicate to others. As part of this Section, the responsible party for each biosecurity control measure was also defined.

2.4.2 Step 5: Biosecurity monitoring and reporting procedures

Procedures were then produced for the monitoring for INNS to allow early detection, including the procedures to be followed in the event of discovering and positively identifying an INNS on site. The procedures in place for the Proposed Development are described in Section 6.2**.**

2.4.3 Step 6: Contingency plan

A contingency plan was then produced for use in the event of the failure of the 'prevention' and 'early detection' methods to effectively manage INNS introduction (Section 6.3). This provides a step-by-step approach to action. If required to be implemented, this contingency plan will review the identified significant activities to identify potential biosecurity control failures and recommend actions for effective management.

2.5 Step 7: Evaluation and review

A clear recording system and review cycle was produced to enable this INNSMP to be refined and updated as required, in line with relevant regulations and legislation. This is presented in Section 7.0.

3.0 Baseline Environment

This section provides information on the baseline environment at the location of the Proposed Development and factors that could influence the establishment of INNS throughout construction.

3.1 Site location and existing infrastructure

The Proposed Development is located in the coastal town of Fishguard in Pembrokeshire, Wales (Figure 1.1). Together with the nearby town of Goodwick, Fishguard forms a connected coastal community that surrounds Fishguard Bay on Pembrokeshire's northern coast.

The site encompasses approximately 36 hectares of land within the harbour area, including the existing linkspan, hinterland, and sections of the bay's foreshore. The port was originally constructed in the 1910s through land reclamation at the base of the headland. It is important to note that the scope of this INNSMP only pertains to areas seaward of MHWS.

Positioned on Fishguard harbour, the Planning Boundary is bordered by steep cliff faces and Fishguard Train Station to the west, the North Breakwater, and the Royal National Lifeboat Institution (RNLI) Lifeboat Station to the north. The site opens onto Fishguard Bay, which is part of the larger Cardigan Bay. Fishguard Bay provides natural protection from severe weather conditions and is a crucial hub for maritime connections between Wales and Ireland. The bay supports various marine activities, including ferry services operated by Stena Line, which connect Fishguard to Rosslare in the Republic of Ireland. Additionally, the bay's sheltered waters are ideal for anchorage and navigation, making it a vital component of the region's maritime infrastructure.

Currently, the port accommodates Stena Line's operations, which include a twice-daily ferry service to Rosslare. This service caters to both public ferry passengers and freight, including accompanied and unaccompanied vehicles.

3.2 Environmental conditions affecting biosecurity

Fishguard Bay (see Figure 1.1) primarily experiences south-westerly waves driven by prevailing Atlantic swells along the Pembrokeshire coast. Localised storms from the south, north, and east occasionally influence the wave climate. South-westerly winds dominate the region, consistent with the broader weather patterns the western coastline of Wales. The bay is oriented northward, bordered by Dinas Head to the east and Crincoed Point to the west.

Water depths within the Harbour slope from the coastline to a depth of *c.* 5-10 m to the east of the North Breakwater, descending to depths of *c.* 15-20 m at the Harbour entrance (RPS, 2025). The bay also features localised sediment deposition and sandbanks.

Tidal currents in Fishguard Harbour are shaped by its coastal location and harbour geometry. These currents are relatively uniform across the harbour, creating a consistent marine environment. Prior modelling was undertaken by RPS to evaluate coastal processes at Fishguard Harbour in 2018 as part of a previous application to replace the Fishguard Linkspan (RPS, 2018). This modelling demonstrated that tidal currents within the harbour are extremely weak, with peak speeds of less than 0.05 m/s. The tidal flow is generally in a south/south-westerly direction for most of the tidal cycle. The tidal range at Fishguard Harbour varies from approximately *c.* 4 m at spring tides to 1.4 m at neap tides (White Consultants, 2013). In the bay, tidal currents are influenced by broader Irish Sea movements, with weaker currents in sheltered areas compared to exposed regions.

The average annual significant wave height in the bay is 0.96 m, with a mean peak wave period of 6.85 seconds (Copernicus, 2024). Wind speeds average 6.56 m/s, increasing during winter with average speeds ranging between 8.81 and 9.52 m/s (Danish Hydraulic Institute, 2024). Sediment transport is minimal due to weak currents and a benign wave climate, though ship movements occasionally mobilise fine sediment.

Salinity levels are regulated by the mixing of freshwater from the River Gwaun, which opens out into lower Fishguard Bay, with saline water from the Irish Sea, maintaining a stable salinity gradient. The only other minor freshwater inputs come from local streams and runoff, which contribute to the mixing process.

Fishguard Harbour's seabed is heterogeneous. The subtidal zone consists of slightly gravelly sand to muddy sand habitats, hosting polychaetes, bivalves, brittlestars, and crustaceans. The sublittoral fringe is characterised by large boulders and hard substrates, supporting flora such as sugar kelp (*Saccharina latissima*), oarweed (*Laminaria digitata*), dead man's rope (*Chorda filum*), and sea lettuce (*Ulva lactuca*), alongside fauna like the light bulb sea squirt (*Clavelina lepadiformis*). The lower shore features oarweed, red seaweeds (e.g., Irish moss), and sea lettuce, with large boulders and cobbles providing habitat for broad-clawed porcelain crabs, barnacles, star ascidians, sea squirts, polychaete worms, and sponges on boulders and concrete pillars. The mid to lower shore has knotted wrack dominating boulders, transitioning to spiralled wrack in the mid shore, with fauna such as barnacles, limpets, top shells, and periwinkles. The upper shore is characterised by channelled wrack, barnacles, green algae, and lichens above this zone.

A 2011 survey at Goodwick Beach recorded 16 distinct biotopes in rocky areas and two in the sandy bay, with typical rocky shore species and under boulder communities, as well as characteristic sandy bay species like polychaetes, bivalves, sand burrowing brittlestars, brown shrimp, and sand slugs (Aquatic Environments (2011) cited in RPS (2018)). The seabed consists of various biotopes classified by the European Nature Information System, including circalittoral sandy mud (A5.35), infralittoral sandy mud (A5.33), moderate-energy infralittoral rock (A3.2), and infralittoral rock and other hard substrata (A3) (EMODnet, 2025). These sediment types support diverse benthic communities and play a key role in influencing species distribution.

3.3 Man-made structures

The Proposed Development involves the construction of new infrastructure to enhance the existing facilities at Fishguard Harbour. This includes the installation of a new linkspan and associated works to support ferry operations. Detailed design specifications for the development are provided in the project description section (Section 4.0).

The General Arrangements showing the existing man-made structures and the Proposed Development for Fishguard Harbour are included in Appendix A.1. In summary, man-made structures known to be in the vicinity of the Proposed Development include:

- **Temporary Jack-Up Barge:** currently used for ferry operations, to be replaced by the new linkspan pontoon.
- **Linkspan Gantry Structures:** one of these buffer dolphin and linkspan tower structures will be demolished as part of the project.
- **Operations Room (Linkspan Kiosk):** to be demolished along with the buffer dolphin.
- **Steel Access Bridge:** to be removed as part of the demolition works.
- **Suspended Concrete Deck Structure:** to be demolished; it is not a piled structure, with columns placed directly on the seabed.
- **RNLI slipway:** to be demolished to enable reclamation works, the area beneath this slipway will be enveloped into the reclamation.

3.4 INNS records

The data returned from WWBIC for marine INNS present around Fishguard Bay, as well as INNS records found from publicly online available resources (National Biodiversity Network (NBN) Atlas, 2025) can be found in Table 3.1. This INNSMP plan exclusively considers marine INNS records.

The only marine INNS recorded by WWBIC in proximity to the Proposed Development is the modest barnacle (*Austrominius modestus*). Two records from 2017 have been documented within the Fishguard Bay area and within 2 km of the Proposed Development. One record was found at Goodwick Breakwater and the other at Goodwick Beach, both located south of the Proposed Development.

INNS records from publicly online available resources (NBN Atlas, 2025) include wireweed (*Sargassum muticum*), broad-clawed porcelain crab (*Porcellana platycheles*), and a small barnacle (*Hesperibalanus fallax*). Although these

species are listed as being potentially present, due to the records coming from publicly online available resources and each of the records being over 5 years old they have not been considered further.

However, as stated in Section 2.1, the absence of INNS records does not mean INNS are not present at the site. Therefore, the INNSMP assumes that there are potential sources of INNS that could be introduced or spread to other areas, and considers the potential for these as part of the Appraisal and Management Plan in Sections 5.0 and 6.0, respectively.

Table 3.1: Marine INNS data for species potentially present in the vicinity of the Proposed Development (* = from publicly online available resources and >5 years old).

Invasive Non-native Species		
Common name	**Scientific name**	**Record source**
Modest barnacle (or Darwin's barnacle)	*Austrominius modestus*	WWBIC, 2025
Wireweed*	*Sargassum muticum*	NBN Atlas, 2025
Broad-clawed porcelain crab*	*Porcellana platycheles*	NBN Atlas, 2025
Small barnacle*	*Hesperibalanus fallax*	NBN Atlas, 2025

3.4.1 Species record – Modest barnacle (or Darwin's barnacle)

A. modestus, commonly known as the modest barnacle (or Darwin's barnacle by the NNSS), is a small sessile barnacle, five to ten mm in diameter, characterised by four shell plates and a low, conical body shape with a diamond-shaped opening. It can dominate hard surfaces and outcompete native species, particularly in estuarine and sheltered marine habitats (Avant, 2007). This species attaches to various substrates, including rocks, stones, hard-shelled animals, and artificial structures. Given its ability to tolerate a wide range of temperatures and salinities, the modest barnacle can quickly spread and could become a nuisance as a fouling organism and compete for space with native species, having entirely displaced native barnacle species in some areas (NNSS, 2025).

The modest barnacle is already ubiquitous across the coasts of Wales (NBN Atlas, 2025), though it is not considered a Species of Special Concern (NNSS, 2025). Although non-native in Scotland, England and Wales, the species was introduced in 1946 from its native region of Australasia (Avant, 2007) and therefore it is not considered to present a substantial risk as an INNS in the area of the Proposed Development, being part of the baseline of the wider region.

4.0 Project Description

This section provides an overview of the Proposed Development, including project characteristics and activities relevant to the management of INNS, as well as embedded mitigation to reduce the risk of the introduction or spread of INNS. An overview of the design specifications for the Proposed Development is shown in Table 4.1.

Table 4.1: Design specifications for the Proposed Development.

Site Activities	Design specifications
Dredging Works	• **Phased Dredging:** removal of soft and hard material in phases over a 12-week period (the length of phases are to be confirmed (TBC)). • **Capital Dredging Depth:** between -9.0 m Chart Datum (CD) and -5.5 mCD across the dredge area. • **Dredging Techniques:** combination of Trailer Suction Hopper Dredger (TSHD) and Backhoe Dredger. • **Disposal:** surplus seabed material transported to an approved offshore licensed disposal site at Milford Haven (LU169), southeast Wales. • **24/7 Operations:** dredging and disposal of capital dredge arising will involve 24/7 working during phased work periods.
Reclamation and Infilling Works	• **Infill Material:** crushed rock from terrestrial origin (source TBC). • **Infill Material Delivery:** by road or by split hopper barge vessel. • **Placement and Levelling:** using excavators and JUB. • **Revetment Construction:** rock armour revetment to retain the reclaimed land.
Bankseat Construction	• **Bankseat:** expected to be a piled bank seat, with steel tubular piles filled with concrete. • **Piling Techniques:** combination of vibro, impact driving and rotary boring. • **Temporary Works:** constructed within the reclamation area to facilitate the installation of the reinforced concrete bankseat. • **Materials:** terrestrial origin, to be delivered by road.
Guide Pile Installation	• **Temporary Piling Gate:** four steel piles used to facilitate the installation of guide pile (to support piling rig). • **Piling Techniques:** vibro and rotary boring. • **Temporary Works Removal:** upon completion of the guide pile installation.
Demolition/Removal Works	• **Disused RNLI slipway, Linkspan Gantry and JUB, Buffer Dolphin and Suspended Deck:** demolition/removal to accommodate the installation of the new linkspan pontoon. • **Demolition Techniques:** combination of wire saws, underwater drilling, coring, expansive compounds, and excavators with rock breakers. • **Demolition Arisings:** temporarily deposited on the seabed within the dredging footprint and recovered during the dredging campaign. To be disposed of at an appropriate offsite (onshore) disposal facility. • **JUB:** to be floated away (location TBC).
Scour Protection Installation	• **Scour Protection on Quay Wall:** discrete rock/grout filled bags or gabion mattresses placed on the seabed along sections of the existing quay wall and rock filled gabion mattresses along the dredged pocket and dredged slope behind the linkspan pontoon.
Linkspan Installation	• **Linkspan pontoon:** a floating linkspan pontoon from a dry dock in Mostyn, North Wales, to be transported to site via barge after having undergone cleaning.

Stena Line plans to replace the temporary linkspan and JUB with a new permanent linkspan pontoon at Fishguard Harbour. This involves floating away the existing JUB and undertaking civil works, including reclamation and infilling works, bankseat construction, guide pile installation, demolition/removal works, scour protection installation and linkspan installation.

Dredging will be conducted for maintenance of the berth, capital dredging of the navigation channel, and soft material removal for the reclaimed area. Dredging depths will range from -9 mCD beneath the pontoon to -7.3 mCD to -6.8 mCD in the berth and channel, and -5.5 mCD to the north of the harbour.

A new reclamation area with an asphalt surface will be constructed, retained by a rock armour revetment. A reinforced concrete bank seat will support the linkspan pontoon, using rotary-installed steel tubular piles filled with concrete. The materials for this construction will be of terrestrial origin and delivered by road. The guide pile installation will require four temporary steel piles (piling gate).

Landside changes will include road markings, car parking, and pedestrian access adjustments. The linkspan pontoon will be equipped with electricity, drainage, and ducting for communications.

The Proposed Development and associated dredging activities are shown in Figure 1.1, with further details in the following section.

4.1.1 Site activities

Table 4.2 outlines the proposed site activities for the Proposed Development, as detailed in Chapter 2 of the Proposed Development Environmental Statement.

Table 4.2: Site activities associated with the construction of the Proposed Development.

Site Activity	Description
Dredging works	• **Phased Dredging:** Removal of soft and hard material using TSHD and Backhoe Dredger. Surplus seabed material will be transported to an approved offshore disposal site at Milford Haven (LU169), southeast Wales. • **Capital Dredging:** To a depth of -9.0 mCD beneath the footprint of the linkspan pontoon and between -7.3 mCD and -6.8 mCD in the berth and channel and -5.5 mCD to the north of the harbour, within the footprint dredge area and reclamation area (Figure 1.1).
Demolition/Removal works	• **Removal of Temporary JUB:** The existing temporary JUB will be floated away without demolition. • **Demolition of Marine Structures:** Demolition of the disused RNLI slipway, the linkspan gantry structure including buffer dolphin, the linkspan ramp, and the suspended concrete deck. The area of the RNLI slipway is within the area of reclamation.
Construction and installation	• **Reclamation Area Construction:** Creation of a new area of land in front of the existing quay wall, featuring an asphalt surface. Infill material will be delivered by road and end tipped off the side of the sea wall or by split hopper barge vessel and dumped within the reclamation area. Crushed rock will be levelled and shaped within the reclamation footprint using excavators and JUBs. • **Rock Armour Revetment:** Construction of a rock armour revetment to retain the reclaimed land via excavators on JUBs. • **Piled Bankseat:** Construction of both a temporary structure to facilitate the installation of the reinforced concrete bankseat and the reinforced concrete bankseat itself to support the linkspan pontoon, using rotary-installed steel tubular piles filled with concrete. • **Temporary Piling Gate:** Installation of guide piles for the linkspan using a temporary piling gate. Vibro/impact driving and rotary boring techniques will be employed. Four temporary steel piles, approximately 1.22m in diameter, will be installed. • **Scour Protection:** Discrete scour protection will be installed along sections of the existing quay wall where issues are regularly experienced with ship bow thrusters creating scour holes in front of the quay wall. Scour protection will also be provided to the southern face of the dredged pocket and to the northern face of the dredged slope behind the linkspan pontoon.

Site Activity	Description
	• **Linkspan Pontoon:** It will towed to site via barge which would support the roadway (60 m long). It would be towed by a tug, with possibly a second small harbour tug required for final positioning and lifted into position using floating plant and crawler cranes. The installation will include the supporting guide pile.
Terminal Reconfiguration	• **Traffic and Pedestrian Adjustments:** Changes to the movement of vehicles, passenger access and footways to integrate the new reclaimed area to the existing road network to connect the linkspan to the internal terminal road network. No works are planned for the railway station or rail line. • **Utility Provisions:** The linkspan pontoon will be equipped with electricity, drainage, and ducting for communications and future provisions. • **Security:** International Ship and Port Security Fencing and vehicle barriers will be provided around the boundary of the proposed reclamation area at the waterside.

4.2 Embedded mitigation

This section outlines the embedded mitigation measures for the Proposed Development, to ensure vessels comply with the relevant guidelines and regulations for biofouling and ballast, which will reduce the risk of INNS being introduced via these routes. The following measures will apply throughout construction:

- All vessels to be used for construction activities must follow the 'Guidelines for the control and management of ships' biofouling to minimise the transfer of invasive aquatic species'[1] (IMO, 2023), including;
  - Installing a type-approved Anti-Fouling System;
  - Implementing a ship-specific Biofouling Management Plan;
  - Maintaining a Biofouling Record Book; and
  - Conducting regular inspections and maintaining Contingency Action Plans.
- Where applicable, vessels should comply with the 'International Convention for the Control and Management of Ships' Ballast Water and Sediments'[2] (IMO, 2019);
- Vessels should follow the Marine INNS Biosecurity Risk Assessment and Management Plan Guidance (Natural Resources Wales (NRW), 2025); and
- Vessels will be required to have an up-to-date inspection history complying with MARPOL Regulations.

[1] For more information, see: Biofouling (imo.org)

[2] For more information, see: Ballast Water Management (imo.org)

5.0 Appraisal

5.1 Significant site activities summary

Based on the site activities which will be undertaken as part of the Proposed Development (outlined in Section 4.0), all activities are listed and appraised for whether they represent a risk for INNS in Table 5.1, broken down by project phase. As per the methodology outlined in Section 2.0, this appraisal uses the SPR model to determine if these activities represent a potential likely pathway for the introduction or spread of INNS. The assessment of significant site activities will be updated based on the final project design as explained in the assessment methodology (Section 2.0).

Site activities which pose a likely risk of introducing or spreading INNS were considered significant and taken forward to Section 6.0 to set biosecurity control measures to reduce that risk.

Table 5.1: Site activities which have a significant risk of introducing or spreading INNS.

Phase	Site activity/factor affecting risk of INNS	Likely pathway for INNS introduction/spread?	Justification
Pre-construction and baseline	• Presence of existing man-made structures that may have INNS present	**Yes**	The existing man-made structures in Fishguard Harbour, such as RNLI slipway, access bridge, retaining walls, and temporary JUB (see Section 3.3 and Appendix A.1), provide hard substrates and baseline conditions that can facilitate the colonisation and spread of potential INNS during construction. These structures enhance habitat complexity, act as vectors for introduction via vessel traffic, and create opportunities for INNS to establish, making them a significant pathway for their spread in the harbour.
	• Environmental conditions affecting biosecurity	**No**	The limited freshwater input into Fishguard Harbour may increase the risk of INNS establishing in the Proposed Development. The nearest source of significant freshwater input into Fishguard Harbour originates from the River Gwaun. Freshwater flow makes conditions less suitable for INNS, reducing the risk of introduction, in contrast fully marine sites increase the risk of INNS affecting native species (Tang *et al.*, 2022). The limited freshwater input at the site means high salinity levels, creating favourable conditions for the establishment and spread of INNS. As this is considered part of the baseline conditions, this factor is not discussed further in the Management Plan in Section 6.0. Strong ocean currents may also lead to a higher frequency of INNS dispersal (Salimi *et al.,* 2021). However, there are extremely weak tidal currents in the harbour, so there is no enhanced potential for spread.
	Demolition/removal works – Disposal of demolished material	**No**	During the removal and transportation of demolition arisings from the current marine structures, including the linkspan gantry structure with buffer dolphin, the current linkspan ramp, suspended concrete deck, and the disused RNLI slipway, there is no potential risk of spreading INNS. This is due to the arisings being transported to an approved offsite disposal facility on land.
	Demolition/removal works – Removal of temporary JUB	**Yes**	The temporary JUB will be towed away from the site by tugboats upon completion of the works. Risk for the spread of INNS is created due to the JUB being transported via barge and having to travel through multiple water bodies to be removed (specific location

Phase	Site activity/factor affecting risk of INNS	Likely pathway for INNS introduction/spread?	Justification
			TBC). This movement through various water bodies increases the likelihood of INNS introduction and spread, as the JUB can carry organisms from one location to another.
	Dredging works – Dredging operations on site (see locations in Figure 1.1)	**No**	The use of dredgers and support vessels at Fishguard Harbour poses a potential risk for the introduction or spread of INNS. Vessel movements can overcome natural dispersal barriers, leading to altered patterns and rates of spread (Johnston *et al*., 2017). While the source of these vessels is yet TBC, the contractor states they could come from anywhere in the UK, which increases the risk of INNS spread. However, embedded mitigation measures (Section 4.2), including anti-fouling coatings, inspection history, and ballast water management, will significantly reduce this risk. Consequently, these activities are not considered a significant pathway for introducing INNS.
	Dredging works – Disposal of surplus seabed material	**No**	The surplus seabed material will be disposed of at Milford Haven (LU169), southeast Wales, a licensed disposal site. There is a potential risk of spreading INNS if they were to be present in the sediment. However, no infaunal INNS have been recorded, and the only identified INNS is the modest barnacle, which does not inhabit soft sediment, making its presence in the material unlikely. Therefore, the risk of spread of INNS is considered to be low. The material will be transported via barge to the disposal site. However, vessels will adhere to the embedded mitigation measures outlined in Section 4.2, therefore, these vessel activities are not considered a significant pathway for introducing INNS.
Construction	**Construction and installation** • Construction and installation works – Land reclamation and infilling works – Rock armour revetment – Piled bankseat – Guide pile installation – Scour protection	**No**	The construction works for the land reclamation and infilling works, rock armour revetment, piled bankseat, guide pile installation and scour protection are not considered a likely pathway for the introduction or spread of INNS. The materials for all construction works are expected to be of terrestrial origin, with quarried stone being used for the land reclamation, infilling works, and rock armour revetment and delivered by road or split hopper barge vessel. The official source locations are yet TBC. The source and method of delivery for construction works by road eliminate any

Phase	Site activity/factor affecting risk of INNS	Likely pathway for INNS introduction/spread?	Justification
			pathway for the spread of INNS. For materials that may be delivered by split hopper barge vessels, the same mitigation measures as those used for dredging work vessels will be applied, including anti-fouling coatings, inspection history, and ballast water management. Therefore, this method of delivery is also not considered a significant pathway for the introduction of INNS.
	Construction and installation – Use of underwater equipment and machinery	**Yes**	The use of underwater equipment and machinery for construction of these works could represent a pathway for the introduction or spread of INNS. Biofouling on industrial equipment is a known issue, where biofouling can occur on equipment surfaces, as sessile species preferentially settle on hard man-made surfaces (Payne *et al*., 2014). Biofouled equipment can act as vectors for the introduction or spread of INNS, acting as pathways for their spread.
	Construction and installation – Installation of new hard structures	**Yes**	The installation of new hard structures such as the linkspan pontoon represents a risk factor for the introduction of INNS, it is also the case for all new man-made structures including the rock armour revetment, piled bankseat, guide piles and scour protection. These new artificial structures increase the risk of INNS as sessile species preferentially settle on man-made surfaces (Payne *et al.,* 2014). Like existing structures, the new ones will enhance habitat complexity, and provide opportunities for INNS to establish, thereby becoming potentially significant pathways for their spread in the harbour.
	Construction and installation – Linkspan pontoon transported via barge	**Yes**	The linkspan pontoon will be towed to Fishguard harbour via barge, with tugboats assisting in its positioning. This process represents a potential pathway for the spread of INNS through the translocation of organisms (Johnston *et al.,* 2017), either attached to the linkspan pontoon or on the vessels. The tugs/barges required for manoeuvring the linkspan could originate from anywhere in the UK. The origin of the vessels required for transportation is yet TBC, but vessels will adhere to the embedded mitigation measures outlined in Section 4.2, therefore, these vessel activities are not considered a significant pathway for introducing INNS. However, there is a

Phase	Site activity/factor affecting risk of INNS	Likely pathway for INNS introduction/spread?	Justification
			potential pathway for the spread of INNS if attached to the linkspan pontoon.
Post construction	**Terminal reconfiguration** – Traffic and Pedestrian Adjustments – Utility Provisions – Security	**No**	Given that these proposed changes do not involve any marine works, there is no pathway for the spread of marine INNS. The adjustments to traffic and pedestrian movement, utility provisions, and security measures are all land-based and do not interact with the marine environment. Therefore, these changes would not facilitate the introduction or spread of marine INNS.

6.0 Management plan

This section provides the biosecurity control measures for the site activities concluded to present a likely pathway for introducing INNS, to reduce the risk.

6.1 Biosecurity control measures

6.1.1 Pre-construction and baseline phase

6.1.1.1 Presence of existing man-made structures that may have INNS present

Risk

The presence of existing hard structures, including the quay wall and linkspan within the Proposed Development at Fishguard Bay, increases the potential for the spread of INNS. Although the modest barnacle is the only INNS recorded as present by WWBIC in the vicinity of Fishguard Harbour, this may be due to a lack of comprehensive monitoring. When construction begins, there will be a significant and prolonged increase in marine traffic in the vicinity of the Proposed Development, which could facilitate the spread of INNS if they are present.

Control

Prior to construction, the existing structures in the immediate vicinity of the Proposed Development should be checked for INNS. In the case of suspected INNS identification, these should be removed and disposed of as outlined in Section 6.3. This will reduce the risk of INNS spreading from the Proposed Development.

6.1.1.2 Removal of temporary JUB

Risk

The removal of the temporary JUB by tugboats poses a significant risk for the spread of INNS due to its transportation via barge, with the possibility of INNS being present on the JUB and therefore being spread through its translocation. This process can facilitate the transfer of biofouling organisms from the JUB to new environments, increasing the potential for INNS establishment and spread. Biofouling occurs when sessile species, such as barnacles and mussels, attach themselves to hard surfaces like the JUB. When the JUB is transported, these organisms can be dislodged and introduced to new areas, where they may thrive and outcompete native species. This risk is compounded by the fact that the JUB will be in contact with multiple water bodies during its transportation, creating numerous opportunities for INNS to spread.

Control

To mitigate the risk of INNS spread during the removal of the temporary JUB, the "Check, Clean, and Dry" approach will be applied as a biosecurity control measure. This will ensure that the JUB is thoroughly cleaned, effectively preventing the transfer of INNS. These cleaning measures, along with adherence to best practices and environmental guidelines for vessels outlined in Section 4.2, ensure comprehensive protection against the spread of INNS. Therefore, the temporary JUB will be inspected and cleaned in line with vessel requirements before its removal from Fishguard Harbour.

6.1.2 Construction phase

6.1.2.1 Use of underwater equipment and machinery

Risk

The use of underwater equipment and machinery for the construction poses a risk for the introduction and spread of INNS. Biofouling, where sessile species settle on hard surfaces, is common on hard man-made structures including industrial equipment (Payne *et al.,* 2014). Biofouling can occur on various equipment and machinery surfaces. This process turns these surfaces into vectors for INNS, facilitating their movement to new environments.

Control

The Check, Clean, Dry approach will be implemented for all equipment and machinery before transport to ensure they are free from INNS (GB NNSS, 2025). Regular anti-fouling practices should be implemented and meticulously documented in an up-to-date logbook to maintain clean immersed surfaces. NRW guidance also states that equipment, machinery and PPE should be washed with freshwater and/or thoroughly airdried before moving between locations to ensure that no water or material is trapped that could transfer marine INNS (NRW, 2025). These measures will help ensure that the development proceeds with minimal risk to the local ecosystem.

6.1.2.2 Installation of new hard structures

Risk

New surfaces in the marine environment are typically the first colonisation sites for INNS due to their ability to settle and rapidly proliferate. The newly available hard surfaces associated with the Proposed Development, including the rock armour revetment, piled bankseat, guide pile, scour protection and berthing structures, may be susceptible to colonisation by INNS in the first few weeks or months after installation. The modest barnacle is the only INNS recorded within 2 km of the site and is already widespread. Although there are no current records of other INNS in the vicinity of the Proposed Development, if INNS were to be present, these structures would provide a pathway for their rapid colonisation and spread.

Control

All materials used for the Proposed Development should be of terrestrial origin (i.e., not sourced from another marine environment) to prevent the introduction or spread of INNS from other marine environments. Although specific sources are yet to be confirmed, materials for the rock armour revetment, piled bankseat, guide pile and scour protection are to be of terrestrial origin, thereby limiting the pathway for INNS introduction to the site. If materials are used from another marine environment, this INNSMP should be updated with additional control measures. The Check, Clean, and Dry method should be implemented as a minimum standard (GB NNSS, 2025). This aligns with biosecurity measures outlined in Stena Line's biosecurity plan for similar operations in Holyhead (Stena Line Ports, 2023), which emphasises the importance of thorough inspections and maintenance to prevent the spread of marine INNS.

6.1.2.3 Linkspan pontoon transported via barge

Risk

The transportation and installation of the new linkspan pontoon at Fishguard Harbour presents a significant risk for the introduction and spread of INNS. Man-made structures, such as the linkspan pontoon, increase the risk of INNS as sessile species preferentially settle on hard surfaces (Payne *et al.,* 2014). The linkspan pontoon will be towed to Fishguard Harbour via barge, with tugboats assisting in its positioning. This transportation process represents a potential pathway for the spread of INNS through the translocation of organisms on the linkspan pontoon (Johnston *et al.,* 2017). The risk is particularly pronounced during the barge transport, as the pontoon may come into contact with various marine environments, facilitating the transfer of INNS.

Control

To mitigate the risk of INNS introduction and spread during the transportation and installation of the new linkspan pontoon for the Proposed Development, biosecurity control measures will be implemented. The linkspan pontoon will undergo thorough cleaning before transportation, and the Check, Clean, Dry approach will be applied to ensure it is free from INNS. The pontoon will originate from Mostyn, North Wales, where it will be taken directly from a dry dock after maintenance work, ensuring it is clean and free from INNS.

6.2 Biosecurity monitoring and reporting procedures

The monitoring and reporting procedures outline who is responsible for carrying out checks for INNS, where these checks are to be carried out and when (see Table 6.1). Note that these positions are indicative, and roles and responsibilities will be confirmed upon contract award. All staff and other site users should be encouraged to report any unusual sightings to the biosecurity officer.

Table 6.1: Roles, responsibilities, and instructions for staff, contractors, and site users.

Who	What	Where	When
Project Operations & Environment Manager - developers and contractors	• Ensure surplus seabed material is properly disposed of at Milford Haven (LU169), southeast Wales and that no material is released into the water as per the relevant Port/Harbours 'Waste Management Plan'. • Awareness of INNS, including identification guidance on the key risk species. If uncertainty arises, follow the contingency plan.	At Port	Beginning of works
Project Operations & Environment Manager or appropriate contractor	• Oversee installation of linkspan pontoon and associated civil works, checking for INNS or unknown organisms. • Periodic checks should be carried out to ensure no growth/settlement of INNS, when possible. • Be aware of any slow-moving or inactive craft and take steps to assess risk. • Ensure a Check, Clean and Dry message is sent to any new developers or contractors.	At Port	Beginning of works
Developers and contractors	• Ensure that all materials used in the construction for the project are of terrestrial origin and have not been previously submerged in marine water. • Conduct regular 'toolbox' talks to educate and encourage all personnel on the importance of INNS prevention and monitoring. These sessions should cover best practices, identification of INNS, and reporting procedures to ensure everyone is aware and vigilant.	N/A	Throughout works
Project Operations & Environment Manager - developers and contractors	• Through collaboration with the Regulators (including relevant stakeholders), develop measures appropriate to the Proposed Development deployment specific to the site, nature, and duration of activities on a case-by-case basis.	N/A	Beginning of works

6.3 Contingency planning

In the event of the failure of the 'prevention' and 'early detection' methods to effectively manage INNS introduction, a contingency plan is in place. This provides a step-by-step approach to action in the event of suspected INNS detection and should be accessible to all staff (see Table 6.2).

Table 6.2: Contingency plan in the event of failure of prevention of INNS introduction.

Action	Responsibility
Stage One – Suspected arrival of high-alert species	
Take photographs of the sample and collect the sample in a plastic bag.	Designated biosecurity officer, site manager, Contractor Environmental Manager or Client Environmental Manager (depending on the phase of the project), or any member of staff at the site of INNS discovery.
Check the organism against the identification sheet (see ID sheets » NNSS (nonnativespecies.org)) Report to Recording » NNSS (nonnativespecies.org)	Designated biosecurity officer, site manager, Contractor Environmental Manager or Client Environmental Manager (depending on the phase of the project), or any member of staff at the site of INNS discovery.
Stage Two – Presence of high-alert species confirmed	
Initiate immediate containment measures, including restricted vessel movements.	Designated biosecurity officer, site manager, Contractor Environmental Manager or Client Environmental Manager (depending on the phase of the project).
Carry out a wider survey of vessels and structures.	Designated biosecurity officer, and qualified ecologist.
Stage Three – Eradication/employ long-term control measures	
Seek advice from the GB NNSS on appropriate measures and actions for long-term control.	Designated biosecurity officer and Contractor Environmental Manager or Client Environmental Manager (depending on the phase of the project).

7.0 Evaluation and review

7.1 Location of biosecurity logbook

A biosecurity logbook will be kept (in electronic form) for the Proposed Development and will be made available for inspection and review as and when required.

7.2 Plan review date

This plan will be updated prior to construction to include the final project design and include an updated risk assessment based on that final design. This will include all measures to manage INNS during the construction phase.

The plan will be updated as required during construction if activities or procedures change, to ensure the plan is appropriate for the development and the risks and activities associated with it. The plan will also be updated as necessary should any changes in the environment or risk of INNS (e.g. records of INNS being present on site) come to light.

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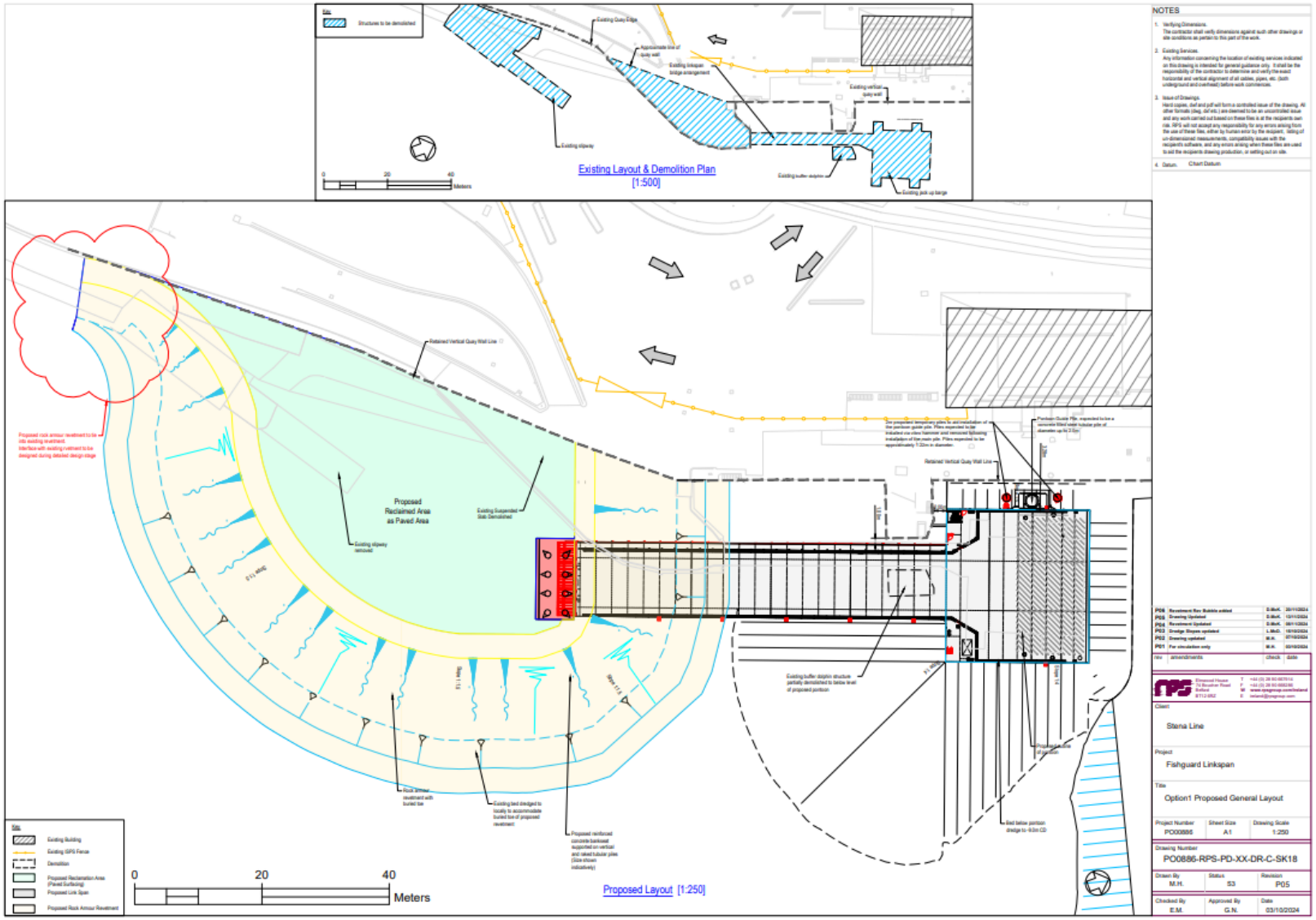
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A.1 Existing General Arrangement Plan of Fishguard linkspan and Proposed Development Plan



9.A

APPENDIX 9.A
Preliminary Ecological Assessment Report

PRELIMINARY ECOLOGICAL APPRAISAL REPORT

Replacement Linkspan, Fishguard Harbour

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1	Ecological Baseline	Tim Oliver		Tim Oliver	03/03/25

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Appendix A Relevant Legislation

1 INTRODUCTION

1.1 Purpose and Scope of this Report

1.1.1 RPS has undertaken a Preliminary Ecological Appraisal (PEA) of the terrestrial ecology features within the Proposed Development area in Fishguard Harbour.

1.1.2 The preliminary ecological appraisal comprises a desk study, habitat survey, and a preliminary protected species assessment (CIEEM, 2017) and the results are presented in this Preliminary Ecological Appraisal Report (PEAR).

1.1.3 The PEA aims to:

- undertake a desk study to review designated sites and records of protected species and other species that could present a constraint on development;
- review aerial imagery to assess the site in relation to its context in the wider landscape;
- describe the habitats and features present on site; and
- assess the site's potential to support legally protected species, species of conservation concern and species of principal importance.

1.1.4 The report describes the baseline information on habitat and protected species scoping and forms an appendix to the terrestrial ecology and ornithology chapter of the Environmental Statement (ES).

1.1.5 The assessment of the effects on relevant sensitive ecological receptors is presented in the ES chapter taking into account incorporated mitigation.

1.2 Study Area Location and Context

1.2.1 The application site comprising the Fishguard Ferry Terminal and associated infrastructure, Fishguard Harbour railway station and railway line, the quay, internal roads and areas of hardstanding as well as part of the harbour.

1.2.2 The landside terrestrial areas of the application site and are generally between 65 and 90m wide. This area of the site is bounded by a rock face to the west and by the quayside to the east.

1.2.3 The rock face was created in 1901 when the original coastal cliff was blasted to create the development platform on which the railway station and ferry terminal are sited. The steeply sloping cliff has been colonised by low growing scrub (primarily gorse) with dense scrub and young trees establishing towards its base.

1.2.4 The south-eastern section of the application site includes an area of broadleaved woodland, on a steeply sloping ground with some sections of exposed rockface, directly below the Fishguard Bay Hotel located beyond the site boundary.

1.2.5 The majority of the section of quayside within the application site is a near vertical engineered block and concrete wall. A walkway is inset with the structure of the harbour wall, which was historically used for the movement of livestock being transported by boat.

1.2.6 A small quay lies to the north of the ferry terminal with the bounding walls constructed from stone and mortar.

1.2.7 The margins of the wider harbour are rock armour stone revetments. These are constructed from relatively large stones which create a gradient of approximately 45^{o} down to the open water. The revetments extend into the application site at the boundaries of the harbour including the North and East Breakwaters which enclose the harbour.

1.2.8 The southern part of the harbour, outside the application site, is intertidal below the revetement with sand/mud exposed at low tide. A public car park and commercial facilities lie immediately to the south of the harbour and there is frequent recreational activity, including dog walkers, on the foreshore and along the East Breakwater.

1.2.9 The Afon Gwaun flows into Fishguard Bay to the south-east of the East Breakwater where there is a larger area of intertidal sand/mud habitat extending up to the base of coastal cliffs.

1.3 Legislation, Policy and Guidance

1.3.1 Relevant legislation, policy guidance and both Local and National Biodiversity Action Plans (BAPs) are referred to throughout this report where appropriate.

1.3.2 The relevant articles of legislation are:

- Planning Policy Wales 12:
- Technical Advice 5: Nature Conservation and Planning;
- The Conservation of Habitats and Species Regulations 2017;
- The Environment (Wales) Act 2016;
- The Wildlife and Countryside Act 1981 (as amended);
- The Protection of Badgers Act 1992;
- Well-being of Future Generations (Wales) Act 2015;
- Natural Environment and Rural Communities Act 2006;
- The Countryside and Rights of Way Act 2000; and
- The Action Plan for Pollinators in Wales.

1.3.3 A summary of legislation relevant to protected or other species identified as potential constraints in this report is provided in Appendix A.

2 METHODS

2.1 Desk Study

2.1.1 Ecological records were requested from West Wales Biodiversity Information Centre. The following data were requested:

- Records for protected species or other species of conservation interest recorded within the last ten years and within 2 km of the site.
- Bat records within the last ten years and within 5 km of the site.
- Non-statutory sites of nature conservation interest within 2km of the site e.g. Sites of Importance for Nature Conservation (SINCs) and Local Wildlife Sites (LWSs).

2.1.2 Wetland Bird Survey Data (WeBS) was obtained from the British Trust for Ornithology.

2.1.3 Information on International statutory sites of nature conservation interest within 10km of the site e.g. Special Protection Areas (SPAs) and Special Area of Conservation (SACs) and statutory sites of nature conservation interest within 2km of the site e.g. Sites of Special Scientific Interest (SSSIs), Local Nature Reserves (LNRs) and National Nature Reserves (NNRs) were obtained from the 'MAGIC' website (https://www.magic.defra.gov.uk), the Natural Resources Wales website (https://naturalresources.wales/evidence-and-data/maps/) and the Joint Nature Conservation Committee website (http://jncc.defra.gov.uk).

2.2 Habitat Survey

2.2.1 The habitat survey was carried out on 15th January 2025 by Tim Oliver. The survey broadly followed the standard methodology (JNCC, 2016), and as described in the Guidelines for Preliminary Ecological Assessment (CIEEM, 2017).

2.2.2 During the survey visits, an assessment was made of each of the habitats within the survey area. Habitats were classified according to their composition and structure. The extent of habitats was defined using a combination of aerial photography and mapping during the walkover survey. The structure and composition of habitats with restricted access were assessed from the margins.

2.2.3 The buildings within application site boundary were assessed externally from the record there structure and features and inform a preliminary assessment of their potential to support roosting bats.

2.2.4 The application site and immediate surroundings was assessed for its suitability to support legally protected species and/or priority species, namely otter, bats, wintering birds, breeding birds, badger and reptile species, and badger *Meles meles*.

2.2.5 The extent, structure of features and their context was reviewed to assess the potential value of the application site for these species / species groups.

2.3 Limitations

2.3.1 Habitat survey undertaken in winter outside the optimal period. Many species would not have been evident at the time of the survey.

2.3.2 The quay wall was viewed from a distance and from the southern end adjacent to the former RNLI jetty

2.3.3 Observations were made on bird activity around the quay periodic scanning over a number of hours to assess species presence and activity as a snapshot. The harbour was viewed at different tide levels with exposed sand and mud present outside the application site towards the end of the survey. The BTO data collected over 5 years provides information on the assemblage of species

that would be expected to be present in winter 2024/2025. The most recent BTO data was collected in 2023 and is considered to give a good indication of how frequently species occur and the variation in numbers. This data coupled with a scoping assessment in winter 2025 provide a realistic baseline for the assessment of impacts.

2.3.4 The nature of the rock armour and quay wall prevented systematic searches or signs of otter within the survey area. Only a small extent of rock armour falls within the application site and the quay wall lacks features that would provide otter with cover. Although the scope of the survey was restricted by the nature of the ground, the inspections with the aid of binoculars were able to effectively assess the suitability of the features within the application site.

2.3.5 No information available on feeding, loafing, roosting activity of black guillemot within the harbour.

Survey Data

2.3.6 It should be noted that whilst every effort has been made to provide a comprehensive description of the site, no investigation can ensure the complete characterisation and prediction of the natural environment.

2.3.7 The protected/notable species assessment provides a preliminary view of the likelihood of these species occurring on the site, based on the suitability of the habitat, known distribution of the species in the local area provided in response to our enquiries and any direct evidence on the site. It should not be taken as providing a full and definitive survey of any protected/notable species group.

Accurate Lifespan of Ecological Data

2.3.8 The majority of ecological data remain valid for only short periods due to the inherently transient nature of the subject. The survey results contained in this report are considered accurate for two years, assuming no significant considerable changes to the site conditions.

3 RESULTS

3.1 Designated Sites

Statutory Designated Sites

3.1.1 Fishguard Harbour lies within West Wales Marine Special Area of Conservation (SAC) an international designated over 730,000ha in extent incorporating marine habitats between the Llyn Peninsula and the west coast of the Gower Peninsula. The SAC is designated for the protection of harbour porpoise *Phocoena Phocoena*.

3.1.2 There are no biological Sites of Special Scientific Interest (SSSIs) located within 2km of the application site. A Geological SSSI, Fishguard Cliffs, lies 1.1km south-east of the Proposed Development on the opposite side of the harbour.

3.1.3 St. David's SAC is located 4.6km west of the proposed development designated for vegetated sea cliffs, European dry heaths, and the plant species, floating water-plantain. Strumble Head – Llechdafad Cliffs SSSI is the only component of the SAC located within 10km of the Proposed Development which extending for approximately 12km along a west facing section of the Pembrokeshire coastline.

3.1.4 Two further SACs of international importance are located within 10km of the application site: Cleddau Rivers SAC 3.9km to the south at the closest point and North Pembrokeshire Woodlands SAC 5.5km to the south east at the closest point. Both the SACs comprise multiple component SSSIs, the closest being the Western Cleddau River SSSI and the Garn Wood, Kilkiffeth Wood & Dan-Deri_Cwm Felin Ban SSSI.

3.1.5 Other biological SSSIs within 5km of the application site are Cwm Dewi SSSI located 3.87km to the east, and Esgyrn Bottom SSSI located 4.5km to the south-east.

Non-statutory Sites

3.1.6 There are no non-statutory county value nature conservation sites are not Sites of Interest to Nature Conservation (SINC) designated in Pembrokeshire. Part of Goodwick Moor is a Wildlife Trust Reserve lies 820m south of the application site.

Ancient Woodland

3.1.7 There are two blocks of ancient semi-natural woodland within 2km of the application site, both located to the south, one area associated with Goodwick Brook, 980m south of the application site and the second being the eastern part of a large woodland complex; Tre Llewelyn Wood.

3.1.8 Two areas of restored ancient woodland are also located within 2km, the closest being 1.2km to the south.

3.1.9 A further area of woodland on steeply sloping ground adjoining the access road into the harbour is classified as an Ancient Woodland Site of Unknown Category. This area is c150m south of the boundary of the application site.

B-Lines

3.1.10 The whole of the 2km search area, (excluding intertidal and marine habitats) are classified as part of the regional 'B-Line' network. This is a national initiative led by Buglife for pollinators and wider biodiversity. The objective of the B-Line network is to define locations where the restoration, enhancement and creation of wildflower-rich habitat for pollinators will have greatest value and facilitate projects within the network that will create stepping stones or contribute to corridors.

3.2 Species Records

3.2.1 A number of species of conservation importance or otherwise notable have been recorded within the 2 km search radius of the site in the past. A summary of these records are listed in Table 3.1. Species of local importance recorded within the site or wider docks are also included on the table. Records of seabirds have been omitted.

Table 3-1: Selected Species Records from within 2 km of the Site

Scientific name	Common name	Status*	Nearest distance from site (m)	Number of records
Bats				
Common pipistrelle	*Pipistrellus pipistrellus*	WCA5, S7, UKBAP	20m	11
Soprano pipistrelle	*Pipistrellus pygmaeus*	WCA5, S7, UKBAP	20m	12
Greater horseshoe bat	*Rhinolophus ferrumequinum*	WCA5, S7, UKBAP	1.9km	1
Whiskered bat	*Myotis mystacinus*	WCA5, S7, UKBAP	1.5km	1
Natterers bat	*Myotis nattereri*	WCA5, S7, UKBAP	2.1km	2
Brown long eared bat	*Plecotus auritus*	WCA5, S7, UKBAP	874m	7
Noctule	*Nyctalus noctula*	WCA5, S7, UKBAP	200m	4
Myotis species	*Myotis sp.*	WCA5, S7, UKBAP	1.5km	2
Other Mammals				
Otter	*Lutra lutra*	WCA5, S7, UKBAP	Within	4
Badger	*Meles meles*	PBA	1.2m	3
Polecat	*Mustela putorius*	S7, UKBAP	1.8km	1
Western European hedgehog	*Erinaceus europaeus*	S7, UKBAP	900m	5
Harvest mouse	*Micromys minutus*	S7, UKBAP	1.4km	1
Water vole	*Arvicola terrestris*	WCA5, S7, UKBAP	Over 700m	1
Reptiles				
Grass Snake	*Natrix natrix*	WCA5, S7, UKBAP	1.5km	1
Slow worm	*Anguis fragilis*	WCA5, S7, UKBAP	542m	3
Adder	*Vipera vipera*	WCA5, S7, UKBAP	325m	2
Common Lizard	*Zootoca vivipara*	WCA5, S7, UKBAP	250m	7
Amphibians				
Common Toad	*Bufo bufo*	S7, UKBAP	970m	2

*Abbreviations used: WCA1: Wildlife and Countryside Act Schedule; WCA1.1: Wildlife and Countryside Act Schedule 1, part 1; WCA5: Wildlife and Countryside Act Schedule 5; WCA8: Wildlife and Countryside Act Schedule 5; S7: Environment (Wales) Act 2016, Section 7 species; WBR (RSPB): RSPB – Wales' Red Bird List; WBAm (RSPB): RSPB – Wales' Amber Bird List; UKBR(RSPB): RSPB – UK Red Bird List; UKBAm (RSPB): RSPB – UK Amber Bird List; UKBAP: UK Biodiversity Action Plan, listed species; The Vascular Plant Red Data List (UK), listed species.

Birds

Wintering

3.2.1 A total of 41 bird species were recorded in Fishguard Harbour during the WeBS counts completed between 2018 / 2019 and 2022 / 2023. This comprised 12 red list species, 15 amber list species and 14 green list species from the Birds of Conservation Concern Wales (BoCCW) 4 (Johnstone *et al*, 2022).

3.2.2 Of the 41 species in the WeBS data most were recorded with monthly average counts and peak monthly counts of between zero and 5 over the five-year period. The BoCCW Red and amber list species recorded in the WeBS data are listed in Table 3-2.

Table 3-2. BoCCW Red and Amber List Species in the WeBS Monthly Counts September to March for 2018 / 2019 to 2022/ 2023.

Species	Scientific name	BoCCW Status	Average monthly count range	Peak monthly count range
Bar-tailed godwit	*Limosa lapponica*	Red	0	0 to 1
Black-headed gull	*Chroicocephalus ridibundus*	Red	13 to 15	24 to 400
Curlew	*Numenius arquata*	Red	0 to 6	1 to 13
Dunlin	*Calidris alpina*	Red	0 to 12	0 to 50
Grey Plover	*Pluvialis squatarola*	Red	0	0 to 1
Herring gull	*Larus argentatus*	Red	38 to70	71 to 170
Kittiwake	*Rissa tridactyla*	Red	0 to 1	0 to 4
Lesser black-backed gull	*Larus fuscus*	Red	1 to 23	2 to 50
Long-tailed duck	*Clangula hyemalis*	Red	0	0 to 1
Purple sandpiper	*Calidris maritima*	Red	0 to 1	0 to 5
Redshank	*Tringa totanus*	Red	0 to 2	1 to 5
Ringed plover	*Charadrius hiaticula*	Red	0 to 1	0 to 5
Black-tailed godwit	*Limosa limosa*	Amber	0	0 to 1
Common gull	*Larus canus*	Amber	0 to 4	0 to 5
Common sandpiper	*Actitis hypoleucos*	Amber	0	0 to 1
Common scoter	*Melanitta nigra*	Amber	0 to 1	0 to 2
Great black-backed gull	*Larus marinus*	Amber	0 to 2	1 to 5
Grey heron	*Ardea cinerea*	Amber	0 to 2	0 to 6
Mediterranean gull	*Larus melanocephalus*	Amber	0 to 1	0 to 2
Oystercatcher	*Haematopus ostralegus*	Amber	17 to 25	24 to 55
Red-throated diver	*Gavia stellata*	Amber	0 to 1	0 to 3
Sandwich tern	*Sterna sandivicensis*	Amber	0 to 5	0 to 23
Shag	*Gulosus aristotelis*	Amber	0 to 5	0 to 24
Snipe	*Gallinago gallinago*	Amber	0 to 1	0 to 3
Turnstone	*Arenaria interpres*	Amber	**8 to 13**	12 to 19
Wigeon	*Anas penelope*	Amber	0 to 1	0 to 3
Yellow legged gull	*Larus michahellis*	Amber	0	0 to 1

Breeding and Other Records

3.2.3 The following BoCCW red and amber list species have been recorded within 2km of the site within the last ten years during the breeding season (March to August inclusive):

- Red list species – meadow pipit *Anthus pratensis*, swift *Apus apus,* dunlin, ringed plover (priority species), black-headed gull (priority species), whitethroat *Curruca communis*, merlin *Falco columbarius* (priority species), peregrine *Falco peregrinus* (LBAP). Kestrel *Falco tinnunculus* (priority species and LBAP), herring gull, common gull, bar-tailed godwit, linnet *Linaria cannabina* (priority species), spotted flycatcher *Muscicapa striata*, curlew (LBAP), marsh tit *Poecile palustris* (priority species), woodcock *Scolopax rusticola*, starling *Sturnus vulgaris* (priority species), redshank and ring ouzel *Turdus torquatus.*
- Amber list species – skylark *Alauda arvensis*, razorbill *Alca torda* (LBAP), grey heron, turnstone, black guillemot *Cepphus grylle*, dartford warbler, fulmar *Fulmarus glacialis*, shag, oystercatcher, mediterranean gull, great black-backed gull, yellow-legged gull, gannet *Morus bassanus* (LBAP), grey wagtail *Motacilla cinerea*, whimbrel *Numenius phaeopus*, house sparrow Passer domesticus (priority species), dunnock *Prunella modularis* (priority species),

manx shearwater *Puffinus puffinus* (LBAP), chough *Pyrrhocorax pyrrhocorax* (priority species, LBAP), bullfinch *Pyrrhula pyrrhula* (priority species, LBAP), sandwich tern, mistle thrush *Turdus viscivorus* and common guillemot *Aria aalge* (LBAP)

3.2.4 The following BoCCW red and amber list species, priority species and species protected under Schedule 1 of the Wildlife and Countryside Act 1981 (WCA1) have been recorded within 2km of the site within the last ten years either outside of the breeding season or on unspecified dates.

- Red list species – purple sandpiper, greenfinch *Chloris chloris*, long-tailed duck, cuckoo *Cuculus canorus* (priority species), yellowhammer *Emberiza citrinella* (priority species), puffin *Fratercula arctica* (LBAP), Leach's petrel *Hydrobates leucorhous*, lesser black-backed gull, grasshopper warbler *Locustella naevia* (priority species), red-breasted merganser *Mergus serrator*, willow warbler *Phylloscopus trochilus*, grey plover, goldcrest *Regulus regulus*, arctic tern *Sterna paradisaea*,
- Amber list species – common sandpiper, teal *Anas crecca* (LBAP), goldeneye *Bucephala clangula,* knot *Calidris canutus*, ruff *Calidris pugnax*, hooded crow, snipe, black throated diver *Gavia immer*, red-throated diver, little gull *Hydrocoleus minutus*, glaucus gull *Larus hyperboreus*, black-tailed godwit, jack-snipe *Limnocryptes minimus*, wigeon, common scoter, wheatear *Oenanthe oenanthe*, black redstart *Phoenicurus ochruros*, snow bunting *Plectrophenax nivalis*, Firecrest *Regulus ingnicapilla*, eider *Somateria mollissima*, common tern *Sterna hirundo*,
- Priority species – reed bunting *Emberiza schoeniclus*,
- WCA1 species - barn owl *Tyto alba*

Invertebrates

3.2.5 The desk study provided records of a wide assemblage of invertebrate species records from the surrounding area. A small number of priority species have been recorded from the coastal grassland above cliffs to the west of the harbour: small pearl bordered fritillary, wall, and lackey. The black oil beetle has also been recorded at Goodwick Moor. Assemblages of moth species recorded from locations in the vicinity of Cwmbrandy Farm, south of Goodwick Moor.

Invasive plants

3.2.6 Japanese knotweed has been recorded in two locations to the south of Fishguard Harbour and in three other locations in the wider area to the east and west of Fishguard, generally close to roads.

3.2.7 There are also records of Montbretia (and unspecified invasive flowering plants) from a few locations within the wider area. None are from locations within the application site with the closest being recorded at the top of coastal cliffs to the north-west.

3.2.8 Himalayan balsam has been recorded on the banks of Afon Guam to the south-east and Goodwick Brook which flows into the harbour from the south.

3.3 Habitats

Hardstanding and Bare Ground

3.3.1 The landside part of the application site primarily comprises extensive areas of developed land with vegetation limited to very small areas of self-sown butterfly bush (invasive non-native plant species) and an area of broadleaved woodland on the south-western boundary.

3.3.2 The areas of sealed hardstanding and unsealed bare ground located between buildings and infrastructure are largely devoid of vegetation. Moss and ruderals are colonising the surface of unsealed, less frequently used section of long stay car park.

Broadleaved Woodland

3.3.3 An area of broadleaved woodland occurs on steeply sloping ground beyond the south-western boundary located between the long stay car park (within the application site) and the grounds of the Fishguard Bay Hotel.

3.3.4 The edge of the northern end of the woodland overlaps the boundary of the application site. This section of woodland has an open structured comprising scattered multi-stemmed sycamore and ash trees. The largest tree trunk diameters had a diameter at breast height (DBH) of up to 40cm, with most less than 20cm. Colonising tree saplings up to 3m tall were present with pedunculate oak and beech represented as well as sycamore.

3.3.5 The non-native butterfly bush was also present on the edge of the woodland in a few locations.

3.3.6 Ivy forms an almost continuous dense ground cover and madder was locally abundant. The woodland soil appears to be shallow, overlying bedrock. Stone and chippings form the base of the slope with sparse colonisation of common ruderal species.

Non-native shrubs

3.3.7 A narrow linear area of butterfly bush grows between the railway line and long stay car park and is one of the of the few areas of vegetation within the developed land.

Individual Trees

3.3.8 Two young ash trees grow at either end of this linear habitat. The older tree is 10m tall with the trunk splitting into three less than 1m above the ground. The canopy only comprises narrow branches. The younger ash tree is c8m high and has a DBH of 10cm.

Coastal Grassland

3.3.9 A strip of low diversity coastal grassland is present on the southern side of the North Breakwater. Red fescue is the dominant species with occasional creeping bent and rarely cock's-foot. The grassland had a dense thatch of dead grass in the base indicating limited management. Coastal wildflower species included kidney vetch which was locally frequent, with occasional sea thrift, and buck's-thorn plantain.

3.3.10 The western end of this habitat, adjacent to the water treatment works is included within application site boundary.

Bare Ground / Ephemeral Vegetation

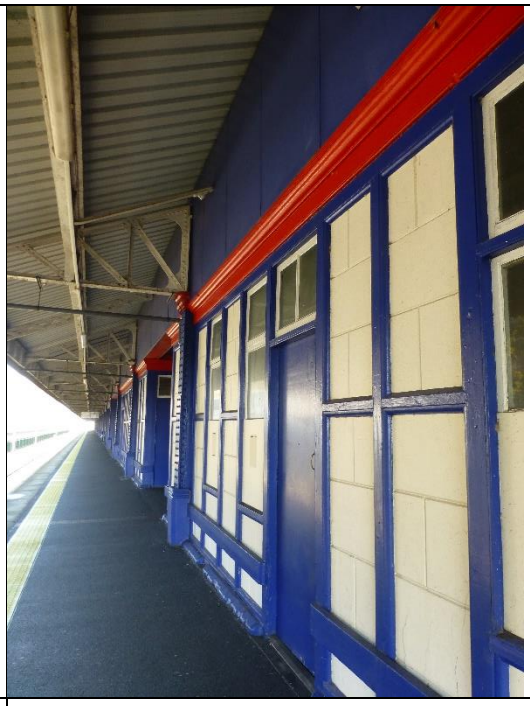
3.3.11 Localised area of recolonising hardstanding lie at the base of the western boundary rock face. Patches of recolonising vegetation are growing amongst mosses where soil has collected between stones. Red fescue, wild carrot and mayweed were all noted amongst more ubiquitous ruderals.

3.4 Buildings

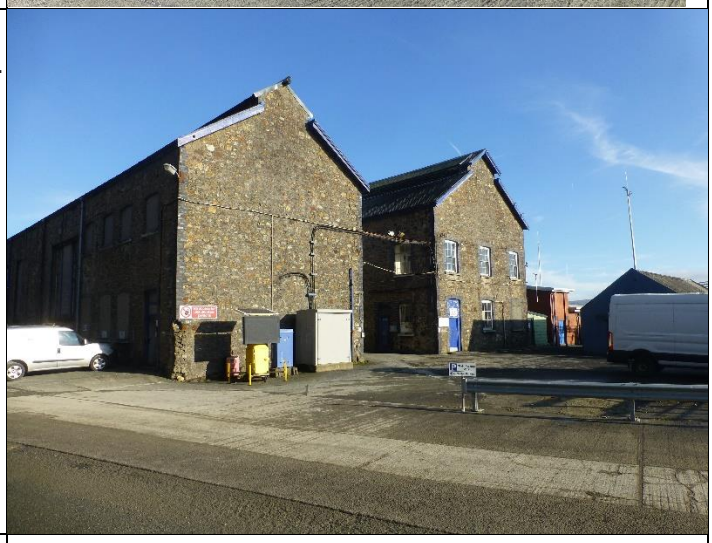
3.4.1 A number of buildings lie within the application site, which encompasses a much larger part of the harbour then the construction areas and temporary compound. These are described and pictured in Table 3-3.

Table 3-3: Building Descriptions

Ref.	Building	Photograph
B1	Fishguard Harbour Railway Station Pitched corrugated metal canopy over sections of building and the platform	
B1a	Brick built single storey building with flat roof	Part of Fishguard Harbour Railway Station
B1b	Open working yard covered by the pitched corrugated metal canopy	Part of Fishguard Harbour Railway Station
B1c	Building with boarded walls with open space between the roof and the canopy	Part of Fishguard Harbour Railway Station

B1d	Blockwork and wooden boarded building extending to height of the pitched canopy	
B1e	Main railway station with suspended ceiling and façade primarily glass windows and doors	Part of Fishguard Harbour Railway Station
B1f	2 (No.) single storey boarded units with felt covered flat roofs	
B1g	Two storey boarded building section extending to the height of the pitched canopy	Part of Fishguard Harbour Railway Station
B2	Port Office 2-3 storey building constructed from blocks and fully rendered. Pitched tiled roof with bargeboards/soffits around the roof,	
B2a	Small single storey extension at the northern end of main building with the same constructed and fully rendered walls.	

B3	Stena Line Office Building Two storey modern block office building with tiled pitched roof and bargeboard gables. The walls are unrendered.	
B4a and b	Two storey modern building with corrugated metal sheeting walls and roof	
B5	Single storey timber constructed building. The roof is flat and surfaced with roofing felt	
B6	Security office Single storey brick building with flat roof covered with roofing felt.	

B7	Modern single storey stone block flat roofed industrial building with no windows. The flat roof comprises roofing felt and has a fascia board around each side of the building	
B8	Single storey brick irregularly shaped building. Flat roof with raised square brick section in the middle. The facades have many windows and a few of the panes were broken.	
B9 and B10	Warehouse buildings Two and half storey industrial buildings. The steep pitched roof has a raised central section with wooden boards on the sides. Some of the sections are in a poor state of repair. The building has many large ground floor windows, some which have been blocked up. Internally the warehouse building is open to the roof.	
B11	Single storey industrial building with high pitched roof made from corrugated sheeting. The walls are a combination of painted brick and boarding.	

B12	Modern RNLI building Brick construction with shallow pitched roofs constructed from corrugated metal sheeting. Brick facades with uPVC window frames	
B13	Single storey wooden 'shiplap' boarded building. Façade is white washed with no cavities between the boards. This building section has a flat felt covered roof	

3.5 Adjacent Habitats

Broadleaved Woodland

3.5.1 The western section of the woodland comprised very steep wooded slope with areas of exposed rock above a 10-20m wide area of low-lying wetter ground. A low retaining wall defines the boundary between the woodland and the car park.

3.5.2 Several larger sycamore and ash trees grow on the low -lying ground where the soil is deeper. Most are multi-stemmed but the largest trunks have a DBH of 50-60cm and showed signs of decay and cavity features.

3.5.3 Ivy was the dominant ground flora species throughout with localised patches of low growing bramble.

3.5.4 Several non-native shrub species are present including cherry laurel, Himalayan honeysuckle and a cotoneaster species,

3.5.5 Water flow was noted down a channel in a narrow exposed section of rock face in January. No channel was visible at the base of the cliff on the woodland edge and the flow is very likely to be seasonal. A remnant stone wall with a dense cover of ivy is located within the woodland, close to the water flow and appears to part of an old industrial structure. The non-native herbaceous plant, winter heliotrope, has colonised in this part of the woodland and forms a few large single species patches, where it is spreading and outcompeting native species.

Coastal Cliffs/Coastal Heath

3.5.6 The majority of the western boundary of the application site adjoins the rock face that was created in 1901 when the harbour was created. Dense scrub with scattered trees occurs on many of the lower slopes of the rockface. This habitat is dominated by grey willow forming dense thickets. Ivy is the dominant ground flora species with occasional pendulous sedge noted in the areas that were visible.

3.5.7 The northern section of rock face is steep at the base and much more sparsely vegetated.

3.5.8 The upper sections of the rockface support coastal heath with low growing gorse the most abundant species. The total cover of vegetation across the rockface is over 80% with the areas of exposed rock limited in extent.

3.5.9 The north-western end of the rockface has a shallower slope and coastal heath vegetation, dominated by gorse extents to close to base of the slope.

3.6 Invasive Species

3.6.1 No species listed under Schedule 9 of the Wildlife and Countryside were recorded within the application site during the survey, but a linear strip of the non-native butterfly bush has established alongside the railway line in one location.

3.7 Fauna

Otter

3.7.1 No field signs of otter were recorded during the walkover survey in January. No scat or feedings were seen during the inspections of rock armour stone revetement with the aid of binoculars.

3.7.2 The walkover inspection covered the areas of rock armour revetment within the application site, a rocky harbour edge slope below the existing suspended concrete deck used by vehicles to drive on and off the ferry, and the harbour edge below the derelict former RNLI slipway.

Badger

3.7.3 No signs of badger activity were recorded during the walkover survey including within 30m of the site boundary to the south-west. Fox scat and rabbit droppings were observed on the linear strip of coastal grassland on the North Breakwater. A mammal hole could have been used by either species.

Birds

3.7.4 Small numbers of cormorant, herring gull and black headed gull, generally as singletons or groups of two, were noted in the open water of the harbour during the survey. A little grebe was also noted in the harbour with two guillemots observed in the adjoining part of Fishguard Bay.

3.7.5 Groups of herring gull (20) and black headed gull (32) were recorded over the water at the quayside alongside the recently docked ferry, with the girds dispersing within an hour.

3.7.6 Negligible gull activity was noted at quayside during other periods during the daytime walkover survey. A group of 15 herring gull were also noted roosting on the large rock located close to the coastline, to the north of the North Breakwater.

3.7.7 A heron was observed at the base of the quayside to the south of the ferry terminal.

3.7.8 A small number of wader species were observed during the walkover assessment. A curlew and three oystercatcher flew over the harbour from coast beyond the site to the north and a single oystercatcher was observed flying in the opposite direction. Nine turnstone were roosting on rocks set back from the rock armour revetment at the eastern end of the North Breakwater.

4 EVALUATION

4.1 Designated Sites

4.1.1 With the exception of the West Wales Marine Special Area of Conservation (SAC) there are no statutory designated nature conservation sites within 2km of the application site boundary. The closest SSSIs are wooded valleys over 3.5km to the south of Fishguard Harbour. There are no potential impact pathways associated with the Proposed Development and the features for which the SSSIs are designated.

4.2 Habitats

4.2.1 The woodland edge overlapping the south-western application site boundary is part of a much larger off-site priority habitat listed under Section 7 Habitat of Principal Importance.

4.2.2 The woodland has a high percentage of sycamore and indicative of long established secondary woodland. It is likely to have developed following the blasting of the rock face and establishment of the harbour (120 years old). The absence of any very old trees and dominance of ivy are also consistent with this.

4.2.3 The coastal heath located beyond the north-western site boundary is also a priority habitat. The vegetation in the section of habitat directly adjoining the site boundary had only scattered heather plants and did not support an assemblage of other species indicative of higher value examples of this habitat type.

4.2.4 There are very few areas of vegetated habitats within the application site. The red fescue grassland and young ash trees are features of biodiversity value in the context of a site that is predominantly built development and hardstanding. The butterfly bush is a source of nectar but being a non-native species which readily colonises into semi-natural habitat its presence is considered to be a negative factor with evidence of colonisation on the edge of the broadleaved woodland.

4.3 Species and Species Assemblages

Otter

4.3.1 Otter are known to be resident in locality. There are two records of otter sightings in the harbour, with individuals seen from the end of East Breakwater, where there is open public access. There are further otter records from Goodwick Brook and two small tributaries of the brook.

4.3.2 The river environment will be important for otters which need freshwater to clean their fur of salt and unconfirmed reports of an otter holt close to the mouth of the Afon Gwaun.

4.3.3 The open water harbour forms part of the extensive foraging territory for the local otter population and is classified as potentially having local importance for otter.

Bats

Roosts

4.3.4 There are records of 7 species of bat from within 2km of the application site. The closest records are from the Fishguard Hotel were soprano pipistrelle, common pipistrelle and brown long eared bat occur. The hotel buildings would be expected to have a number of features with the potential to support roosting bats. Whiskered bat, an undefined Myotis species and noctule have also been

recorded within the search area. Greater horseshoe bat over 1km square to the south of the site likely to be associated with wetlands around Goodwick Moor.

4.3.5 The buildings within the application site of varying structure associated with the ferry terminal, railway station, and quayside. Based on the initial ground inspections and the structure and context of the buildings, the majority of the buildings have been classified as having moderate roost potential, following a precautionary approach. The two warehouse buildings could have higher value features and as a precaution are classified as having high roost potential.

4.3.6 The single storey flat roofed operations building adjacent to the ferry terminal, which lies within enclosed by hardstanding and built development, is in very good condition and lacks any cavity features which could be used by roosting bats. It has been classified as having negligible roost potential.

4.3.7 The young, multi-stemmed ash trees have narrow diameter trunks and lack features that could be used by roosting bats.

4.3.8 A number of the trees on the edge of the broadleaved woodland adjoining the south-western site boundary had confirmed cavity features. The status of cavities in these (whether they are able to support groups of bats and higher status roosts) would require further survey. The open ivy cover on the trees provided very limited cover and had negligible value as potential roost features.

Activity

4.3.9 Many of the bat species that have been recorded in the past with 2km have the potential to commute through and forage along the western boundary of the application site. Common pipistrelle, soprano pipistrelle and brown long eared bat would all be expected to utilise the woodland and vegetated rock face which have direct connectivity to adjacent Fishguard Bay Hotel.

4.3.10 On nights when the wind direction is from the south-west, the east-facing rockface will create still, sheltered conditions that could be favoured by bats.

4.3.11 In comparison, bat foraging and commuting activity around the ferry terminal and railway station would be expected to be limited, which are subject to artificial lighting is not expected to be high but foraging of pipistrelle bats on elevated numbers insects around lights is possible.

4.3.12 The site provides sub-optimal conditions for horseshoe bats, but vegetated rockface and coastal heath could provide a flight corridor for these rarer species which generally avoid areas that are subject to artificial lighting.

4.3.13 The application site is classified as having the potential to have importance in up to a local context for bat populations.

Other Mammal Species

4.2 There is a record of harvest mouse from the Goodwick Moor area and a record of water vole in the 1km square that includes Goodwick Brook and Goodwick Moor. Hedgehog and polecat have also been recorded within 2km of the application site. There are several records of badgers to west of the centre of Fishguard, close to Goodwick Moor.

4.3.1 None of these species are likely to be active within the application site which is classified as having negligible value for each.

Breeding Birds

4.3.2 The application site has the potential to support a small assemblage of breeding birds. A previous breeding bird survey (BBS) was carried out at the ferry terminal and railway station between May and July 2017 as part of a previous replacement of the linkspan infrastructure at the ferry terminal. A very small number of species were recorded. Five pairs of feral pigeon *Columba livia domestica*

nesting under the quay wall within or adjacent to the linkspan. Four house martin *Delichon urbicum* nests were recorded in an open section of the railway station building.

4.3.3 Other bird species that could nest in buildings and built structures within the application site include house sparrow and starling; both BoCCW red list, as well as green list species including pied wagtail and robin.

4.3.4 Within the harbour, black guillemot is classified as a former breeding species with chicks confirming successful breeding over several years.

4.3.5 The assemblage of breeding species within the application site, would have site importance on the basis of black guillemot being a non-breeding species.

Wintering Birds

4.3.6 During the walkover survey the bird activity close to the quay comprised flocks of herring gull and black headed gull. Small numbers of cormorant were feeding in the open water section of the application site with further small flocks of gulls. A flock of 16 turnstone were roosting on the northern breakwater and oystercatcher and curlew were recorded in small numbers, flying between the harbour and the coast. A heron was disturbed from the edge of the harbour beneath the suspended concrete deck structure.

4.3.7 Towards sunset, a large flock of gulls was present on the expanse of intertidal mud/sand beyond the east breakwater at low tide. In comparison, a number of people were walking dogs on the low tide sand/mud within the harbour and no flocks of birds were observed in this location.

Reptiles

4.3.8 There are three records of common lizard associated with the coastal grassland above cliffs with a record of adder in connected habitat further to the west. Common lizard has also been recorded at Goodwick Moor. Records of slow-worm are from the edge of residential areas of Fishguard.

4.3.9 The built development that form the majority of the application site have no value for any reptile species. The coastal grassland adjoining the water treatment works provide some cover. The habitat is isolated from other potential reptile habitat significantly reducing the likelihood of any reptiles being present.

4.3.10 Other potential reptile habitat adjoins the western boundary of the application site. The scrubby vegetated at the base of the east facing rock face also provides cover and shelter and would have the potential to support slow-worm should there be any cavities in the ground. Continuous solid bedrock without cavities would make the area unsuitable.

4.3.11 The gorse dominated coastal heath adjoining the north-western boundary has the potential support common lizard and potentially adder and slow worm.

Invertebrates

4.3.12 A few priority invertebrate species recorded from the coastal grassland above cliffs to the west of the harbour: small pearl bordered fritillary, wall, and lackey. The black oil beetle has been recorded at Goodwick Moor and many moth species recorded from locations in the vicinity of Cwmbrandy Farm, south of Goodwick Moor.

5 CONCLUSION AND RECOMMENDATIONS

5.1.1 The majority of application site comprises built development, hardstanding and stone surfaced made ground. Vegetated within the site are limited to the edge of an area of broadleaved woodland to the south-west, the edge of species-poor coastal grassland to the north-east and a linear strip of butterfly bush with two young semi-mature ash trees.

5.1.2 Priority habitats adjoin the boundary of the site to the south-west (lowland broadleaved woodland) and north-west (coastal heath). Consistent with planning policy, the development should seek to protect the higher value habitats that adjoin the application site from any indirect impacts.

5.1.3 Selected features within application site and adjoining habitats are considered to have value for legally protected and priority faunal species. The open water habitat in the harbour has value as a foraging habitat for otter and some wintering/passage bird species. In locations away from public access and the operational quayside the rock armour revetment around the margin of the wider harbour has the potential to provide places of shelter for otter. Buildings within the application site could support roosting bats and/or nesting birds.

5.1.4 The intertidal sand and mud in the wider area is a foraging resource used by a number of bird species, but the WeBS data, covering a five year recording period, indicate that each species (with the exception of herring gull and black-headed gull) would be expected to occur in relatively small numbers.

5.1.5 There are many buildings within the harbour. Under a precautionary approach, following the external inspections of the structure of each building, the two large old warehouse buildings in the northern part of the site have been provisionally classified as having high roost potential, and the railway station and other harbour office buildings have been classified as having moderate roost potential. The operations room at the southern end of the ferry terminal infrastructure had negligible bat roost potential. Changes or works to any of buildings, other than the operations room, would require further surveys to confirm the presence / absence of bat roosts.

5.1.6 Potential indirect effects on trees in the off-site woodland should be avoided including light spill onto the woodland edge and activities generating high levels of noise close to the woodland.

5.1.7 In addition, the scrub habitat along the base of the rockface and coastal heath should not be subject to any additional artificial lighting / light spill to retain its potential value as a bat flight line and potential foraging habitat.

5.1.8 Any works to buildings that have the potential to be used by nesting birds would ideally be carried out outside the bird breeding season. Alternatively where a suitably experienced ecologist has inspected buildings for nests sites and has been able to confirm absence, potential nest features could be dismantled removed within 48 hours of the inspection.

5.1.9 Development proposals should seek to avoid adverse effects wherever possible and include measures that will benefit target species and species groups that could be adversely affected by development. The mitigation, compensation and biodiversity enhancement should ensure that the development achieves an overall gain for biodiversity to fully offset the value of habitats that will be lost or damaged in line with Planning Policy Wales 12 and the Environment (Wales) Act 2016.

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Figures

Figure 1: Site Habitat and Building Plan

Appendix A

Relevant Legislation

Nesting Birds

All birds, their nests and eggs are afforded protection under the Wildlife and Countryside Act 1981, as updated by the Countryside and Rights of Way Act 2000. It is an offence to:

- intentionally kill, injure or take any wild bird;
- intentionally take, damage or destroy the nest of any wild bird while it is in use or being built; and
- intentionally take or destroy the egg of any wild bird.

Schedule 1 birds cannot be intentionally or recklessly disturbed when nesting and there are increased penalties for doing so. Licences can be issued to visit the nests of such birds for conservation, scientific or photographic purposes but not to allow disturbance during a development even in circumstances where that development is fully authorised by consents such as a valid planning permission.

Otter

Otter and their habitats are fully protected under the Wildlife and Countryside Act 1981 (as amended). Under this legislation it is an offence to:

- capture, kill or injure a Otter;
- damage, destroy or obstruct access to a breeding site or resting place (i.e. burrow);
- disturb a Otter whilst in a place of shelter;

Offences can result from intentional or reckless actions. Penalties include fines of up to £5000 and / or imprisonment for up to six months, per offence.

Otters have additional protection, being listed as a European Protected Species (EPS) under Conservation of Habitats and Species Regulations 2017. This makes it an offence to deliberately or recklessly:

- capture, injure or kill an Otter;
- damage or destroy a breeding site or resting place of an otter (note that this does not need to be deliberate or reckless to constitute an offence);
- harass an Otter or group of Otters;
- disturb an Otter in a holt or any other structure or place it uses for shelter or protection;
- disturb an Otter while it is rearing or otherwise caring for its young;
- obstruct access to a holt or other structure or place Otters use for shelter or protection or to otherwise deny the animal use of that place;
- disturb an Otter in a manner that is, or in circumstances which are, likely to significantly affect the local distribution or abundance of the species;
- disturb an Otter in a manner that is, or in circumstances which are, likely to impair its ability to survive, breed or reproduce, or rear or otherwise care for its young.

The otter is also listed as Species of Principal Importance under Section 7 of the Environment (Wales) Act 2016.

Bats

All British bat species are fully protected under Schedule 5 of the Wildlife and Countryside Act 1981, as updated by the Countryside and Rights of Way Act 2000. All British bats are also included on Schedule 2 of

The Conservation of Habitats and Species Regulations 2017 as European Protected Species. It is an offence to:

- intentionally or recklessly kill, injure or capture bats;
- deliberately or recklessly disturb bats (whether in a roost or not); and
- damage, destroy or obstruct access to bat roosts

A roost is defined as 'any structure or place which [a bat] uses for shelter or protection'. As bats tend to reuse the same roosts, legal opinion is that a roost is protected whether or not bats are present at the time of survey.

A licence will therefore be required by those who carry out any operation that would otherwise result in offences being committed.

The following bat species are listed as Species of Principal Importance within the Environment (Wales) Act 2016: Barbastelle, Bechstein's, Noctule, Soprano Pipistrelle, Common Pipistrelle, Brown Long-eared, Greater Horseshoe, and Lesser Horseshoe.

Reptiles

All common UK reptile species (Adder *Vipera berus*, Grass Snake *Natrix helvetica*, Common Lizard *Zootoca vivipara* and Slow Worm *Anguis fragilis*) are protected through part of Section 9(1 and 5) of the Wildlife & Countryside Act 1981 (as amended). This prohibits:

- intentional or reckless injuring or killing;
- selling, offering or exposing for sale, or having in possession or transporting for the purpose of sale, any live or dead wild animal or any part of, or anything derived from, such an animal; or
- publishing or causing to be published any advertisement likely to be understood as conveying buying or selling, or intending to buy or sell, any of those things.

These species are listed as Species of Principal Importance under Section 7 of the Environment (Wales) Act 2016.

Appendix B

10.A

APPENDIX 10.A
Coastal Processes Modelling

FISHGUARD LINKSPAN REPLACEMENT

Environmental Statement
Volume 2 Technical Appendices

Chapter 10 Coastal Processes

794-NI-POR-00886R
May 2025

10 COASTAL PROCESSES

The Time Series Comparator tool provided within MIKE was used to undertake statistical analysis of modelled and measured datasets for both tidal and wave parameters.

The MIKE tool provides several performance measures and statistics including the Index of Agreement which is also known as d_2 or "*model skill*". Model performance may be assessed using two main types of metrics: those related to absolute values such as the mean absolute error (MAE) or the root-mean-square error (RMSE) and those which are normalised such as the model skill (d_2) or the Coefficient of determination (R^2).

The MIKE analysis provides three normalised parameters directly:

- Coefficient of determination R^2 being the square of the Pearson's product-moment correlation coefficient. It ranges from 0 to 1 with larger values indicating a better fit.
- Coefficient of efficiency or Nash-Sutcliffe coefficient E (Nash and Sutcliffe, 1970)[1]. It ranges from minus infinity to 1 with larger values indicating a better fit.
- Index of agreement d_2 (Willmott et al., 1985)[2]. It ranges from 0 to 1 with large values indicating a better fit.

Having developed a value relating to goodness-of-fit between measured and modelled data it is necessary to determine if the model is fit for the purpose of assessment. Classification is a useful tool in this respect. The simplest form of classification, shown in Table 10-1 may be applied to those metrics whose values range from zero to unity.

Table 10-1 Coefficient of Determination Interpretation.

Coefficient of Determination (R^2)	Interpretation
0	The model does not predict the outcome
Between 0 and 1	The model partially predicts the outcome
1	The model perfectly predicts the outcome

On the other end of the scale more complex classifications have been developed, such as that proposed by Ladson for the application of the coefficient of efficiency in stream flow modelling (Ladson, 2008)[3]. This is a dual system in which a reduced level of fit is accepted as satisfactory for the validation phase compared with that from the calibration phase parameters, Table 10-2.

Table 10-2 Coefficient of Efficiency Interpretation.

Classification	Coefficient of Efficiency Calibration	Coefficient of Efficiency Validation	
Excellent	E ≥ 0.93	E ≥ 0.93	
Good	0.8 ≤ E < 0.93	0.8 ≤ E < 0.93	
Satisfactory	0.7 ≤ E < 0.8	0.6 ≤ E < 0.8	
Passable	0.6 ≤ E < 0.7	0.3 ≤ E < 0.6	
Poor	E < 0.6	E < 0.3	

[1] Nash, J.E., Sutcliffe, J., (1970), River flow forecasting through conceptual models, Part I A discussion of principles, J. Hydrol., 10, 282-290.

[2] Willmott, C.J., Ackleson, S.G., Davis, R.E., Feddema, J.J, Klink, K.M., Legates, D.R., O'Donnell, J., Rowe, C.M., (1985), Statistics for the evaluation and comparison of models, J. Geophys. Res., 90, 8995-9005.

[3] Ladson, A. R. (2008) Hydrology: an Australian Introduction. Oxford University Press.

For the purposes of this study the classification proposed by Sutherland is applied to the model output (Sutherland *et al* 2004)[4]. This classification is applied to metrics based around the normalising the Mean Absolute Error (MAE), where an allowance is made for the potential inaccuracy of the monitoring equipment, to derive an Average Relative Mean Absolute Error (ARMAE), as shown in Table 10-3. Model results from the study were analysed without accounting for potential device errors in the first instance (i.e., RMAE); therefore, the classification was applied on a conservative basis with a value of <0.7 providing a satisfactory level of model accuracy.

For each of the model parameters the MIKE timeseries comparator was used to derive statistics and performance measures.

Table 10-3 Average Relative Mean Absolute Error (ARMAE) Interpretation.

Classification	Range of ARMAE
Excellent	< 0.2
Good	0.2 – 0.4
Reasonable	0.4 – 0.7
Poor	0.7 – 1.0
Bad	> 1.0

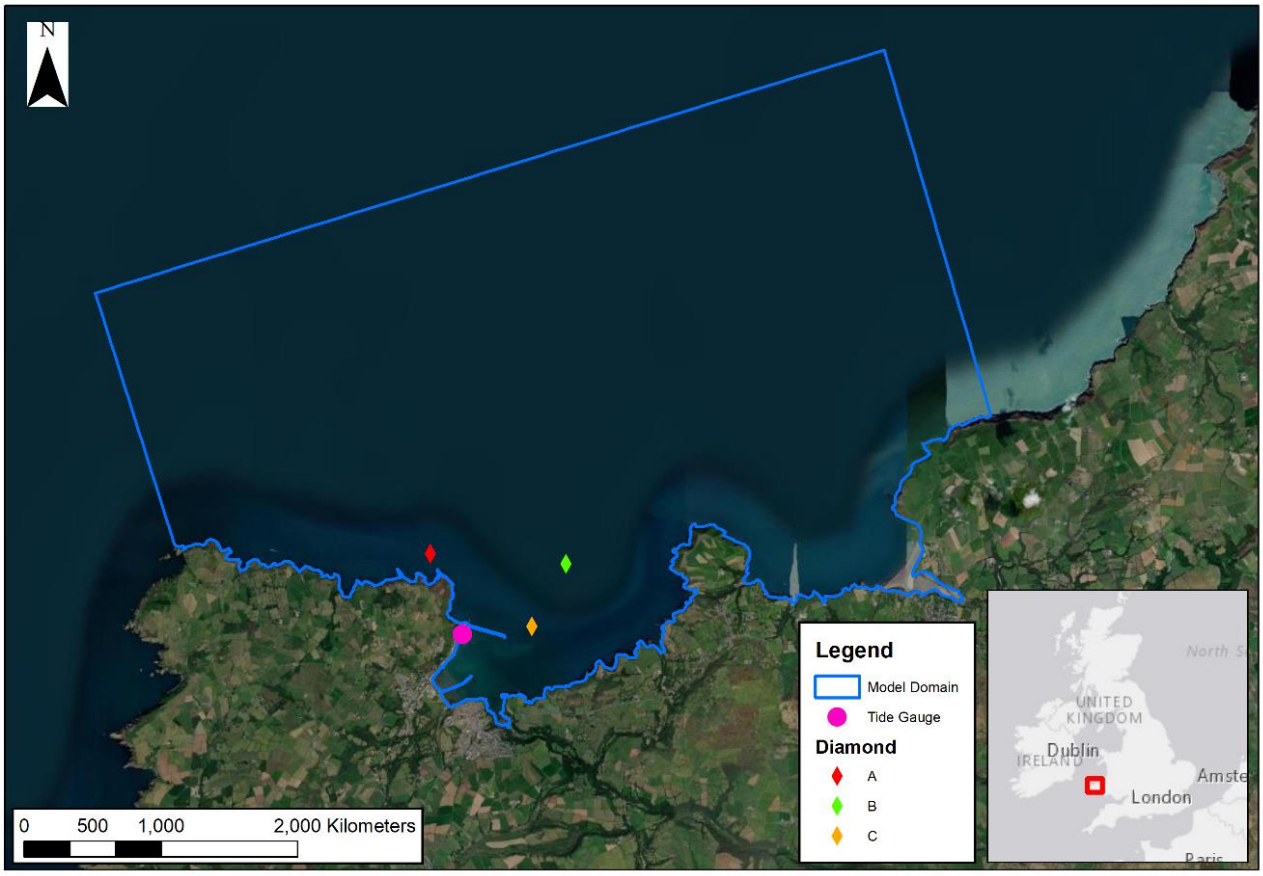


Figure 10.1 Location of calibration sources used for coastal processes

[4] J. Sutherland, D.J.R. Walstra, T.J. Chesher, L.C. van Rijn, H.N. Southgate. (2004), Evaluation of coastal area modelling systems at an estuary mouth. Coastal Engineering 51, 119– 142.

10.1 Validation of Hydrodynamics

10.1.1 Surface Elevation

The hydrodynamic model was verified using data tide gauge data available for Fishguard Harbour, recorded by the National Oceanography Centre and available from the British Oceanographic Data Centre, the location of which is presented in Figure 10.1. The model correlated well through both the spring and neap tidal phases. For the purposes of the validation exercise, hydrodynamic wave simulations were run and compared between 01/05/2021-16/06/2021, simulating *c.* 6 weeks of summer tides.

Table 10-4 Validation statistics for Surface Elevation.

Metric	Statistic			Performance Measure			
Parameter	**Average Absolute Value Observed AAV**	**Mean Absolute Error MAE**	**Root Mean Square Error RMSE**	**Coeff of Determination R^2**	**Coeff of Efficiency E**	**Index of Agreement d_2**	**Relative Mean Absolute Error* ARMAE**
Fishguard							
Surface Elevation	0.87	0.09	0.11	0.99	0.99	0.99	0.10

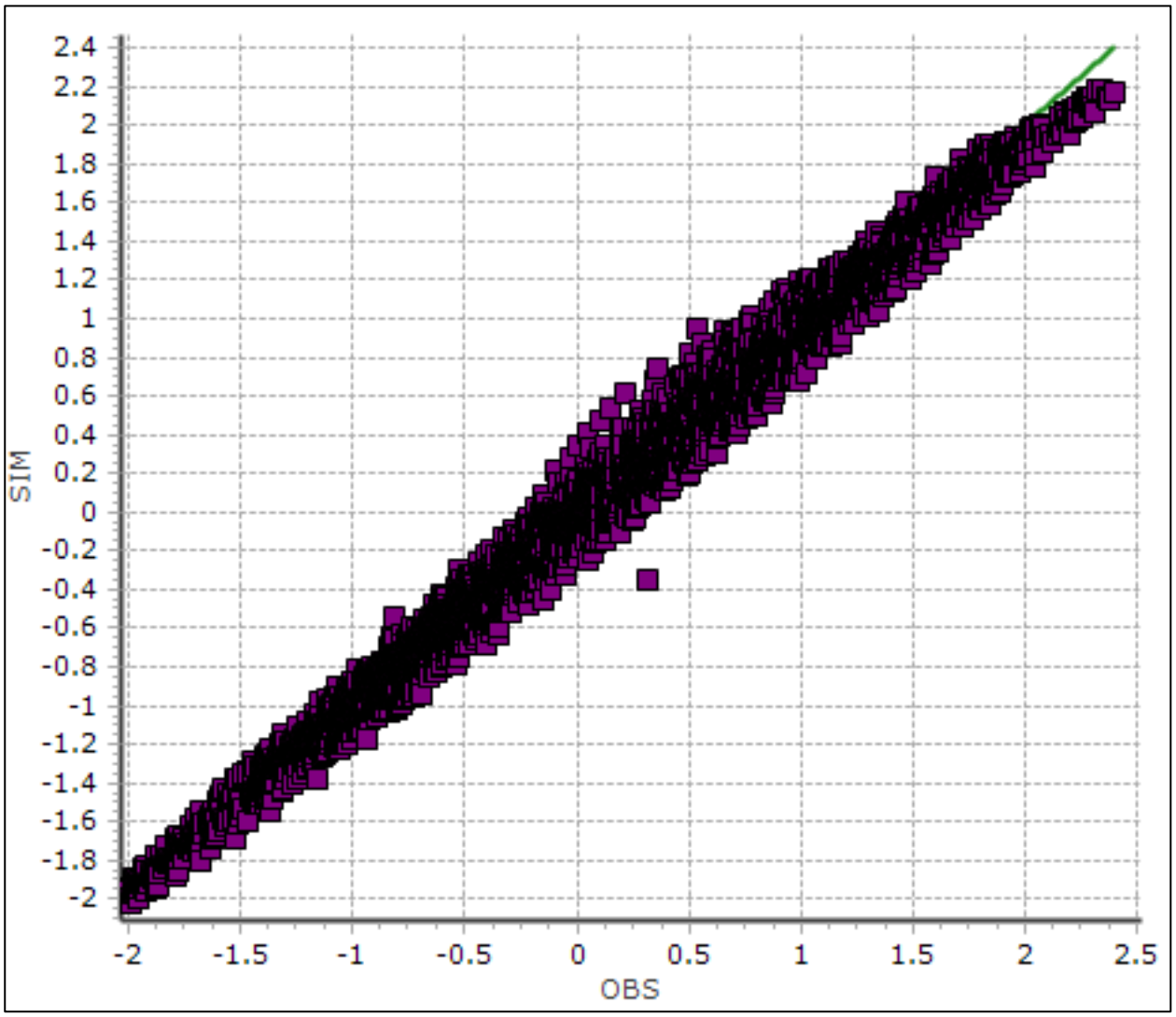


Figure 10.2 Statistical comparison of surface elevation between the modelled and observed between 01/05/2021-16/06/2021.

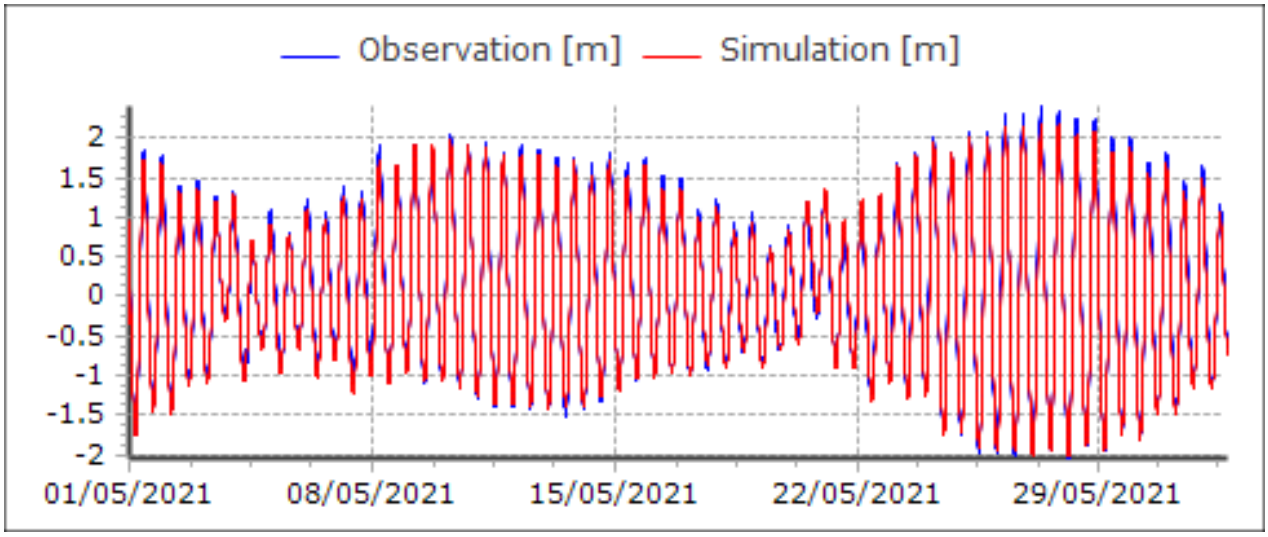


Figure 10.3 Surface elevation comparison 01/05/2021-16/06/2021.

10.1.2 Current Speeds & Direction

In order to calibrate tidal current speeds and directions within the model domain, the simulated results were compared with speed and direction data calculated for a number of tidal diamonds included within the Fishguard Bay Admiralty chart, the locations of which are presented in Figure 10.1, the results of which are displayed in Figure 10.4 - Figure 10.6 below. As can be seen the model correlated well over spring tides within the summer months of 2021, particularly at Tidal Diamond C, located closest to the Proposed Development and located in a high resolution area of the numerical model.

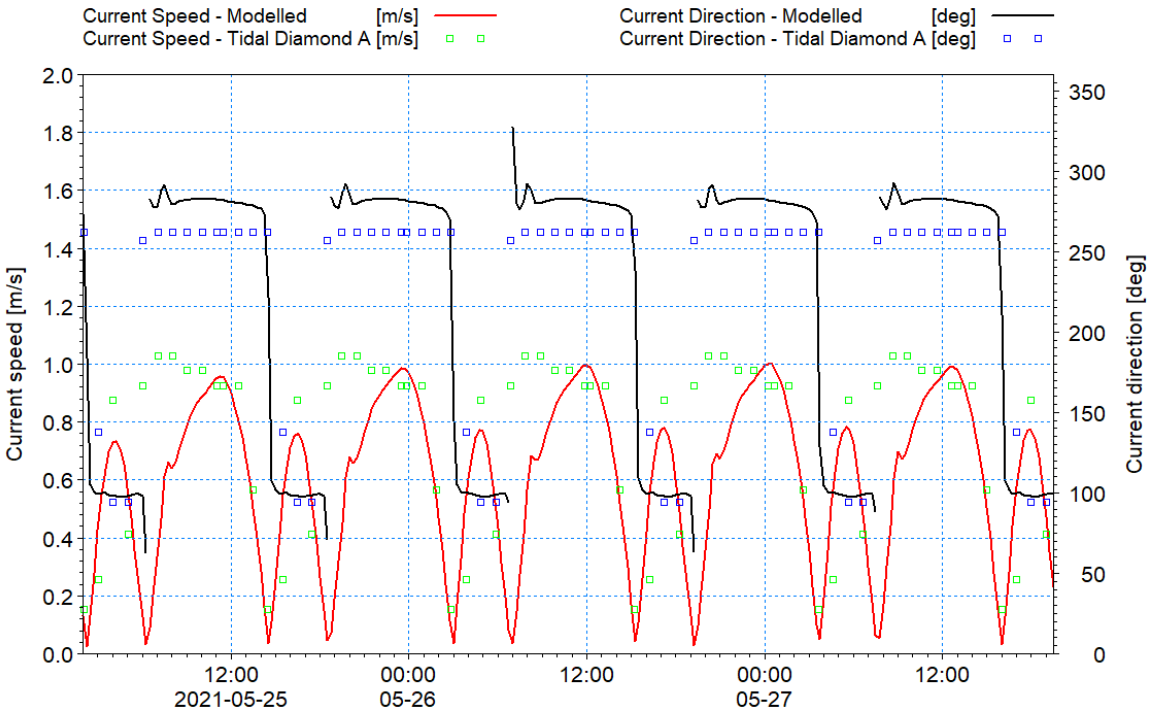


Figure 10.4 Modelled spring tidal currents and directions comparison with Tidal Diamond A between 25/05/2021-29/05/2021

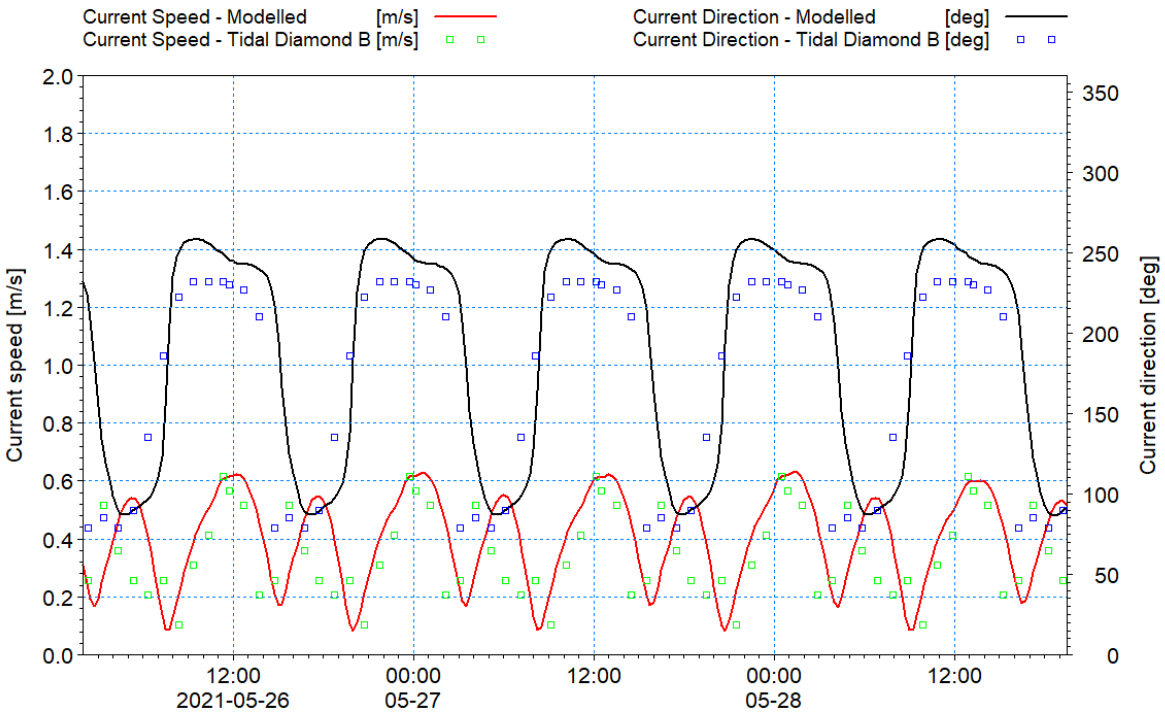


Figure 10.5 Modelled spring tidal currents and directions comparison with Tidal Diamond B between 25/05/2021-29/05/2021

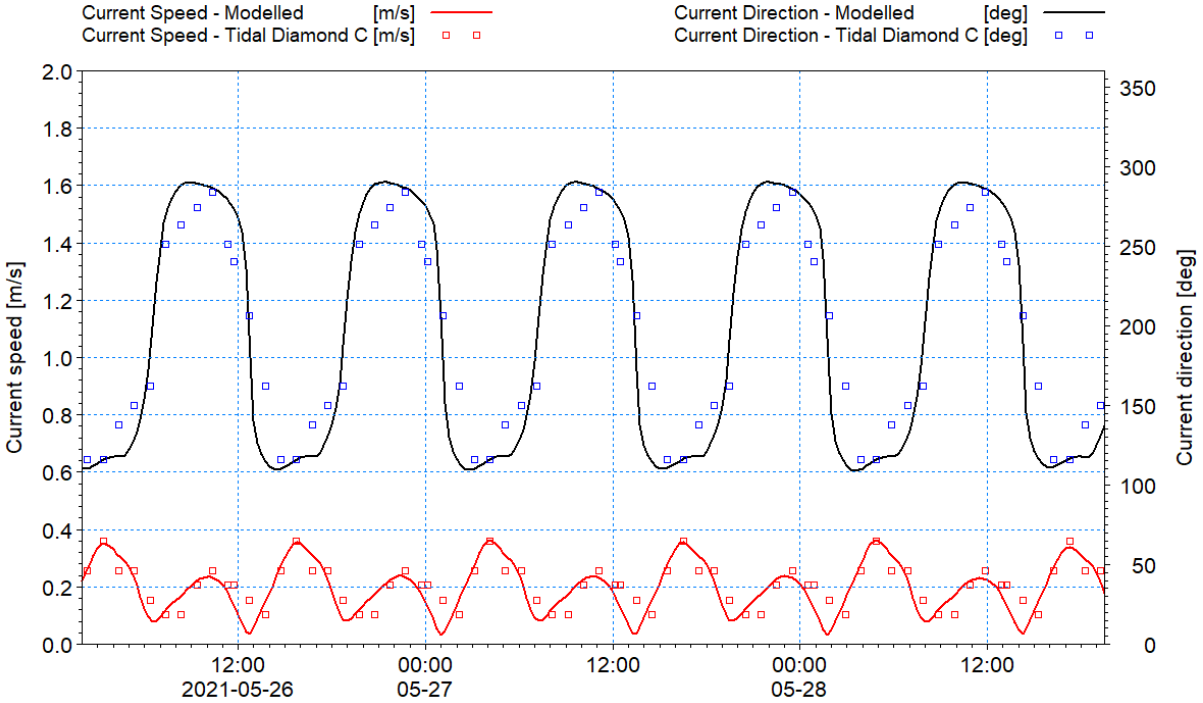


Figure 10.6 Modelled spring tidal currents and directions comparison with Tidal Diamond C between 25/05/2021-29/05/2021

11.A

APPENDIX 11.A Water Framework Directive Assessment

FISHGUARD LINKSPAN REPLACEMENT

Environmental Statement

Appendix 11.A: Water Framework Directive Compliance Assessment

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May 2025

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Glossary

Term	Meaning
Catchments	An area that serves a watercourse with rainwater. Every part of land where the rainfall drains to a single watercourse is in the same catchment.
Chemical Status	Chemical status is assessed from compliance with environmental standards for chemicals that are priority substances and/or priority hazardous substances.
Diffuse sources	Non-point sources primarily associated with run-off and other discharges related to different land uses such as agriculture and forestry, from septic tanks associated with rural dwellings and from the land spreading of industrial, municipal and agricultural wastes.
Ecology	The study of the relationships among organisms and between those organisms and their non-living environment.
Ecological Potential	Ecological potential in artificial and heavily modified water bodies is determined by an assessment of whether measures are properly in place to mitigate the impacts of any modification on the ecology of the water body
Ecological Status	An expression of the structure and functioning of aquatic ecosystems associated with surface waters. Such waters are classified as being of good ecological status when they meet the requirements of the Water Framework Directive
Ecosystem	A community of interdependent organisms together with the environment they inhabit and with which they interact; community and environment being distinct from adjacent communities and environments
Environmental Objective	Objective setting considered waters that require protection from deterioration as well as waters that require restoration and the timescales needed for recovery.
Ecological Quality Ratio (EQR)	Measure of the deviation of biological elements from undisturbed or reference conditions
Field drainage	Limiting the effect of flooding by maintaining surface water and land drainage systems.
Good Ecological Potential	This is in recognition of the fact that the water body will not achieve the ecological status of an unmodified natural water body without compromising the specified use for that water body
Good Status	A collective term used to refer to the status achieved by a surface water body when both its ecological status and its chemical status are at least good or, for groundwater, when both its quantitative status and chemical status are at least good.
Ground Conditions	An assessment of the history and chemical and physical characteristics of the soil conditions at a site.
Groundwater	All water which is below the surface of the ground in the saturated zone and in direct contact with the ground or subsoil.
Heavily modified water bodies	A body of surface water which, as a result of physical alterations by human activity, is substantially changed in character, as designated in accordance with the provisions of Annex II of the WFD
Hydrology	The study of the movement, distribution, and quality of water.
Hydromorphology	A study of the quantity and dynamics of water flow within a water body that has variations in its width, depth, structure and substrate of bed and riparian zone.
Invasive Non-Native Species	Non-native plants or animals that successfully establish themselves in aquatic and fringing habitats and damage natural flora and fauna.

Term	Meaning
Main rivers	The term used to describe a water course in respect of which the Natural Resources Wales has permissive powers in relation to its management.
Minor watercourses	The term used to describe a water course owned and operated by a local Drainage Board, a Lead Local Flood Authority or a private land owner.
Mitigation Measures	Measures to avoid, prevent, minimise, reduce or, as fully as possible, offset or compensate for any significant adverse effects on the environment, as a result of implementing a plan or programme.
Morphology	Term used to describe channel form and its process of change in shape and direction over time
One-out, all-out	The Water Framework Directive uses the "one-out, all-out" principle in assessing water bodies (i.e., the worst status of the elements used in the assessment determines the final status of the water body).
Programme of Measures	Those actions, defined in detail, which are required to achieve the environmental objectives of the Directive within a river basin district.
Protected Area	Water protected by European legislation including drinking waters, shellfish waters, bathing waters, urban wastewater nutrient sensitive areas or sites designated as Special areas of Conservation or Special Protected Areas
Protected Area Register	A register of protected areas
Quality Element	Biological, hydromorphological, physico-chemical and chemical elements that contribute to the WFD status classification
River Basin District	Administrative area for coordinated water management, composed of multiple river basins (or catchments)
River Basin Management Plan	The purpose of a river basin management plan is to provide a framework for protecting and enhancing the benefits provided by the water environment.
Special Area of Conservation (SAC)	A site designation specified in the Habitats Directive (Council Directive 92/43/EEC). Each site is designated for one or more of the habitats and species listed in the Directive. The Directive requires a management plan to be prepared and implemented for each SAC to ensure the favourable conservation status of the habitats or species for which it was designated. In combination with Special Protection Areas (SPAs), these sites contribute to the Natura 2000 Sites network.
Surface Water	Inland waters on the land surface (such as reservoirs, lakes, rivers, transitional waters, coastal waters) within a river basin.
Water body	A coherent sub-unit in the river basin (district) to which the environmental objectives of the directive must apply. Hence, the main purpose of identifying “water bodies” is to enable the status to be accurately described and compared to environmental objectives
Water Framework Directive (WFD)	Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy. The WFD promotes water management through river basin planning. It covers inland surface waters, estuarine waters, coastal waters and groundwater.
2017 WFD Regulations	The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017. National legislation transposing WFD into law in England and Wales.
Water Quality	The physical, chemical and biological characteristics of water.

Acronyms

Acronym	Description
BOD	Biochemical Oxygen Demand
CEMP	Construction Environmental Management Plan
DCO	Development Consent Order
DIN	Dissolved Inorganic Nitrogen
DO	Dissolved Oxygen
DrWPA	Drinking Water Protected Area
EQR	Ecological quality ratio
EQS	Environmental Quality Standard
HDD	Horizontal Directional Drilling
HMWB	Heavily Modified Water Body
HVAC	High Voltage Alternating Current
INNS	Invasive Non-Native Species
LPA	Local Planning Authority
LSO	Less Stringent Objective
MHWS	Mean High Water Springs
MLWS	Mean Low Water Springs
NRW	Natural Resources Wales
RBMP	River Basin Management Plan
SAC	Special Area of Conservation
SDF	Standard Data Form
SPA	Special Protection Area
SPZ	Source Protection Zone
SWMI	Significant Water Management Issues
uPBT	ubiquitous, persistent, bioaccumulative and toxic
UWWTD	Urban Waste Water Treatment Directive
WFD	Water Framework Directive
ZoI	Zone of Influence

.

1 Water Framework Directive surface water assessment technical report

1.1 Introduction

1.1.1 Background

1.1.1.1 This Water Framework Directive (WFD) surface water technical report provides an assessment of the WFD compliance for the Fishguard Linkspan Replacement Project, referred to hereafter as the Proposed Development. Specifically, this report considers the potential impact of the onshore elements of the Fishguard Linkspan Replacement Project during the construction and operational phases.

1.1.1.2 The technical report draws upon information contained within the following documents:

- Volume 2, Chapter 1: Physical processes of the Environmental Statement
- Volume 3, Chapter 1: Geology, hydrogeology and ground conditions of the Environmental Statement
- Volume 3, Chapter 2: Hydrology and flood risk of the Environmental Statement
- Volume 3, Chapter 3: Onshore ecology of the Environmental Statement
- Volume 7, Annex 3.6: Aquatic invertebrate survey technical report of the Environmental Statement
- Volume 7, Annex 3.15: Fish and eel survey technical report of the Environmental Statement.

1.1.2 Purpose of this report

1.1.2.1 This technical report comprises a WFD compliance assessment to demonstrate how any impact on WFD receptors caused by the different activities that will take place within the Proposed Development Area fits with the objectives of any affected WFD surface water within the WFD study area as defined in section 1.3.

1.1.2.2 The compliance assessment for the Proposed Development also provides the opportunity to inform the detailed design of the project to avoid, minimise, mitigate, or compensate for the risks to WFD surface water receptors where the risk assessment determined that the activities have the potential to:

- Cause a surface water body to deteriorate from one WFD status class to another or cause significant localised impacts that could contribute to this happening
- Prevent or undermine action to get surface water and groundwater bodies to good status (e.g. compromise the programme of measures put in place to achieve the ultimate water body objective).

1.1.3 WFD assessment scope

1.1.3.1 In order to achieve the aims outlined within paragraph 1.1.2.2, a staged approach has been adopted in undertaking the WFD compliance assessment in accordance with NRW's Guidance Note (GN078) Complying with the WFD Regulations 2017.

1.1.3.2 A WFD scoping assessment of the Proposed Development has been undertaken to review each project component in terms of the potential impact to the water environment. The scoping assessment summarises potential impact to the water environment for each component of each WFD quality element. This WFD scoping defines the scope of the detailed assessment and identifies potential issues. This has formed the basis for the consultation undertaken with Natural Resources Wales (NRW), as the competent authority, on the key issues for WFD compliance (see section 1.5).

1.2 Legislative and policy context

1.2.1 Introduction

1.2.1.1 Whilst it is recognised that the WFD compliance is an assessment in its own right and a requirement under legislation, the relevant national policy with regard to water quality, water resources and the Water Framework Directive compliance is included in this section to demonstrate the need for this technical report in support of the Marine Licence application.

1.2.2 Legislation

1.2.2.1 The WFD (Council Directive 2000/60/EC establishing a framework for community action in the field of water policy) was adopted by the European Commission in December 2000. The WFD is transposed into law in England and Wales by The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (hereafter referred to as 'the 2017 WFD Regulations'). The WFD is retained EU legislation and is still applicable in England and Wales as set out in sections 2 and 3 of the European Union (Withdrawal) Act 2018 and the Floods and Water (Amendment etc.) (EU Exit) Regulations 2019. The 2017 WFD regulations require Secretary of State (SoS), Welsh Ministers, the Environment Agency and NRW to exercise their 'relevant functions' so as to secure compliance with the WFD (Regulation 3). Under the regulations the SoS, the Welsh Ministers, NRW, and each public body have a specific duty to have regard to the relevant River Basin Management Plan (RBMP), and any supplementary plans made under it, in exercising their functions. 'Having regard to' river basin management plans includes taking account of and considering the environmental objectives and summary of measures contained within the plan when exercising any functions and the effects of those functions on the objectives and measures within the plan (Planning Inspectorate, 2018).

1.2.2.2 NRW will consider the implications of the Proposed Development, firstly in relation to the specific duty to have regard to the RMBP and supplementary plans, and secondly, in more general terms in relation to the UK's ability to comply with the WFD.

1.3 Study area

1.3.1.1 For the purposes of this WFD Assessment, water bodies that are within, intersect or which are hydrologically connected to the Proposed Development have been identified and considered as relevant water bodies for the different stages of the WFD compliance assessment (i.e. the WFD assessment study area).

1.3.1.2 The seabed and coastal areas that may be influenced by changes to physical processes due to the Proposed Development are defined in Chapter 9 Coastal Processes of the Environmental Statement, as one Spring Tidal Excursion. A Spring

Tidal Excursion is the distance suspended sediment is transported prior to being carried back on the returning tide. On this basis the coastal and transitional water bodies that have the potential to be directly and indirectly impacted by the Proposed Development are Cardigan Bay South coastal water body, the Gwaun Estuary and Nyfer Estuary transitional waterbodies.

1.3.1.3 The surface water bodies that occur within the Proposed Development Area are illustrated in Figure 1.1:WFD surface water bodies within the ZoI of the Proposed Development Area**Error! Reference source not found.**. These water bodies fall within the Zone of Influence (ZoI) of the Proposed Development for the purposes of the WFD assessment. The impact of the different project components on these water bodies is considered in this WFD compliance assessment.

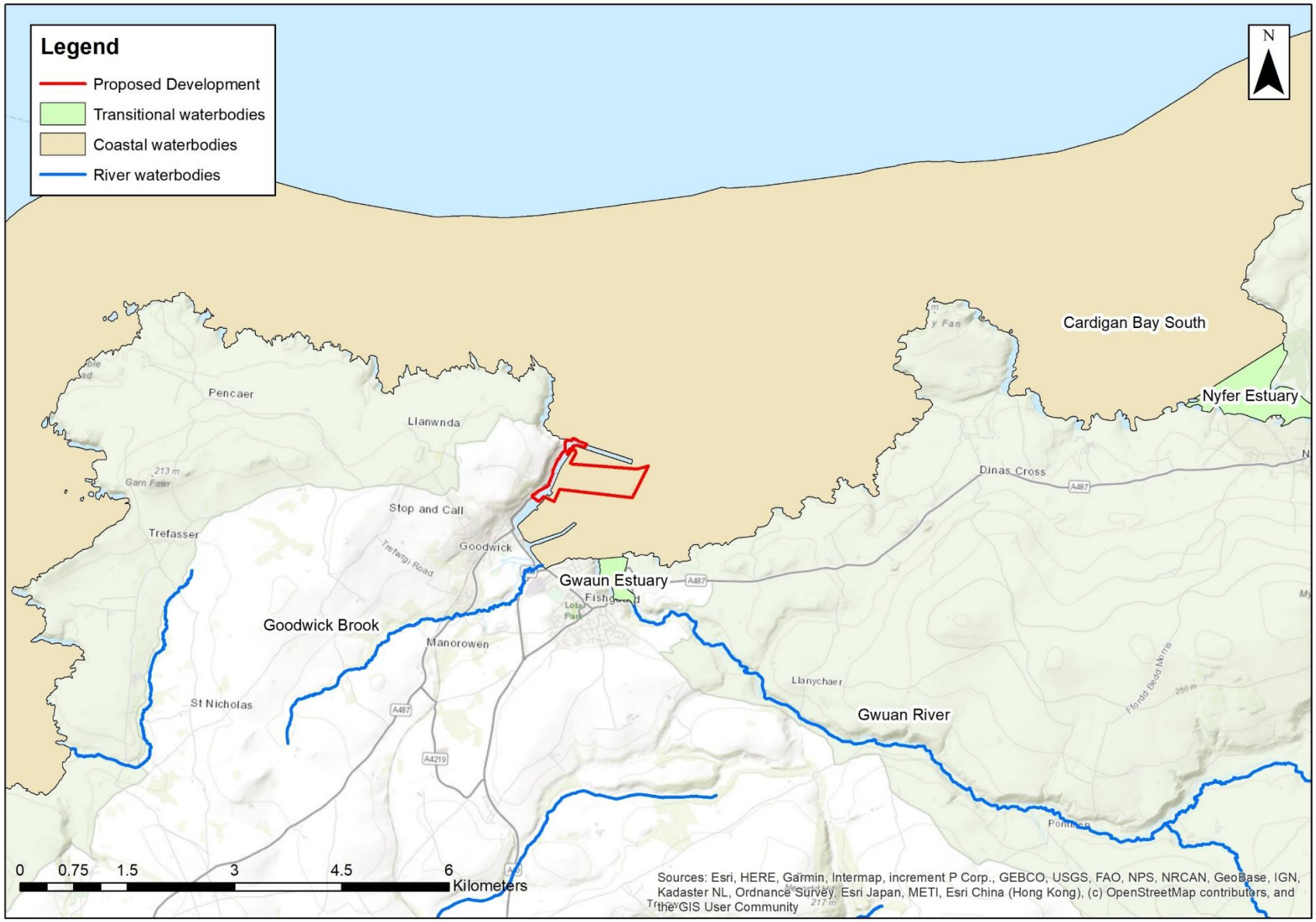


Figure 1.1: WFD surface water bodies within the ZoI of the Proposed Development Area

1.4 Project overview

1.4.1.1 The components of the Proposed Development that have the potential to impact on the WFD objectives are outlined below. More detail on the nature of these activities is provided in Volume 1, Chapter 2: Project Description of the Environmental Statement.

- **Reclamation**: This area will be formed with imported crushed rock fill material protected by a rock armour revetment. The footprint of the entire reclaimed area including the rock armour revetment is approximately 5500m^2. Excavators shaping the reclamation area will be located on the reclamation area whilst excavators placing the rock armour may be located on jack up barges immediately adjacent to the reclamation area. The rock armour revetment will have a toe detail which will tie into the scour protection proposed to the dredged slope behind the berth.
- **Demolition/Removal of Structures**: Two phases of demolition will be required. The structures to be demolished or removed in two phases are when berth is operational and the berth is closed.
- **Dredging**: All initial dredging undertaken as part of these works will be capital dredging. The harbour will be dredged to depths ranging between -7.3mCD and -6.8mCD in the berth and channel and -5.5mCD to the north of the harbour. It is anticipated that the dredging will be a 24/7 operation over a 12 week period which may be broken into phases. Maintenance dredging will be carried out over next 5 years.
- **Bankseat**: A reinforced concrete bankseat structure will be constructed at the northern edge of the reclamation to support the linkspan pontoon. This structure is expected to be a piled bank seat, with steel tubular piles filled with concrete. The piles will be raked or vertical piles installed using vibro, impact driving and rotary boring techniques. These piles are proposed to be steel tubes approximately 0.914m in diameter
- **Guide Pile**: The guide pile to restrain the floating linkspan will be a steel tube, approximately 2m in diameter, filled with reinforced concrete. The installation of the guide pile will require four temporary steel piles to be installed adjacent to it to support the piling rig. The four temporary support piles will be removed once the guide pile has been installed.
- **Scour Protection**: Discrete scour protection will be installed along sections of the existing quay wall where issues are regularly experienced with ship bow thrusters creating scour holes in front of the quay wall.
- **Terminal Reconfiguration**: On the landside, changes will be made to the movement of vehicles passenger access and footways to integrate the new reclaimed area to the existing road network to connect the linkspan to the internal terminal road network. Drainage provision including drainage channels, gulleys, pipework, manholes, interceptor (where required) and an extension of the existing outfall through the reclamation area will be established. Ducting will be installed to connect power and communication cables to the linkspan pontoon.
- **Linkspan Installation**:

  The proposed linkspan will be transported to the site via floating plant. The linkspan will be floated or lifted into position using floating plant and crawler cranes working from the land.

1.5 Consultation

1.5.1.1 A summary of the key issues raised during consultation activities undertaken to date specific to the WFD assessment is presented in Table 1.1 with an explanation of how these issues have been considered in the production of this technical report.

Table 1.1: Summary of key consultation topics raised during consultation activities undertaken for the Proposed Development Project relevant to WFD Assessment.

Date	Consultee and type of response	Issues raised	Response to issue raised and/or were considered in this technical report
Jan 2025	Natural Resource Wales - Scoping Opinion	Where possible, other environmental assessments should be coordinated with the EIA process. However, it is important to note that the Habitats Regulations Assessment (HRA) and Water Framework Directive assessment (WFD), and any other assessment, are separate processes to the EIA.	WFD Assessment submitted.
Jan 2025	Natural Resource Wales - Scoping Opinion	All applications for dredge and/or disposal activities must be supported by the results of the sediment sampling and analysis and a biosecurity risk assessment. This information should be submitted using the forms on our website: https://naturalresource.wales/permits-and -permissions/marine-licencing/applying-for-a-marine-licence/lang=en	Suspended sediment impact and upon water body objectives and sediment sampling results has been assessed within this technical report.

1.6 Methodology

1.6.1 Introduction

1.6.1.1 The 2017 WFD Regulations require that the competent authority, and all public authorities, in undertaking their statutory functions must prevent the deterioration in the status of all water bodies and enhance and restore all bodies of water where they are currently not achieving their environmental objectives. This means that new development should not adversely impact upon on the ability of a water body to achieve its environmental objectives.

1.6.1.2 The 2017 WFD Regulations provide for the implementation of the WFD through the designation of all surface waters (rivers, lakes, transitional (estuarine) and coastal waters) and groundwaters as water bodies and the establishment of targets to achieve their environmental objectives.

1.6.1.3 The WFD applies to WFD water bodies. The consideration of the proposals under the WFD will therefore, apply to all surface water bodies that have the potential to be impacted by the Proposed Development.

1.6.2 Water body classification

1.6.2.1 The WFD specifies the quality elements that are used to assess the ecological and chemical status of a water body. Quality elements are generally biological (e.g. fish, invertebrates, macrophytes) or chemical (e.g. heavy metals, pesticides, nutrients). Classifications indicate where the quality of the environment is good, where it may need improvement, and what may need to be improved. They can also be used, over

the years, to plan improvements, show trends and to monitor the effectiveness of the programme of measures identified.

1.6.2.2 Chemical status is assessed from compliance with environmental standards for chemicals that are priority substances and/or priority hazardous substances for surface water and groundwater bodies. These are known as 'Annex X' substances listed in the 2017 WFD Regulations. Chemical status is recorded as 'good' or 'fail'. The chemical status of groundwater also considers electrical conductivity. Chemical status for a water body is determined by the worst scoring chemical (one-out-all-out approach).

1.6.2.3 Ecological status classifications can be composed of up to four different assessments and apply to surface water bodies only:

1. An assessment of status indicated by a biological quality element such as fish, invertebrates, or algae. The presence of Invasive Non-Native Species (INNS) is also assessed as a separate test
2. An assessment of compliance with environmental standards for supporting physio-chemical conditions, such as dissolved oxygen, phosphorus, or ammonia
3. An assessment of compliance with environmental standards for concentrations of specific pollutants, such as zinc, cypermethrin or arsenic (these are known as 'Annex VIII' substances)
4. In determining high status only, a series of tests is included to make sure that hydromorphology is largely undisturbed.

1.6.2.4 Ecological status is recorded as high, good, moderate, poor or bad. 'High' represents 'largely undisturbed conditions'. Other classes show increasing deviation from undisturbed or reference conditions. This deviation must be expressed as an Ecological Quality Ratio (EQR) which ranges from zero for bad status to one for high status. As with chemical status, ecological status is determined by the worst scoring component (one-out-all-out approach).

1.6.2.5 Biological status is a sub-set of ecological status where the results of the biological quality elements are assessed (and so ignore physio-chemical and Annex VIII substances and hydromorphology). The one-out-all-out rule is applied again here to give a biological status classification.

1.6.2.6 Quantitative status measures the degree to which a body of groundwater is affected by direct and indirect abstractions (i.e. the available groundwater resource must not be exceeded by the long-term annual average rate of abstraction). Groundwater abstraction must also not cause failure of 'Good' ecological status in water dependent surface waters. This also applies to surface water bodies.

1.6.2.7 Overall status is a composite measure that looks at ecological status, chemical status and quantitative status dependent on the water body type. So, in assessing overall status for surface waters all four assessment types under ecological status (biology, physio-chemical, Annex VIII substances and hydromorphology) as well as incorporating the results of the chemical status assessment (priority substances and priority hazardous substances) contribute to the classification of the water body status. The one-out-all-out rule is applied again here, so a surface water body must be of good or better ecological status, good chemical status and good quantitative status assessment to be given a good overall status.

1.6.3 Water body objectives

1.6.3.1 The completion of a WFD compliance assessment is a staged process where data on the WFD assessment study area and project proposals are assessed with respect to the requirements of the WFD to ascertain if the proposals have the potential to have a detrimental impact on the achievement of the environmental objectives for water bodies connected to the proposal. If the assessment concludes, after taking account of the mitigation proposed, that the proposal may either reduce the quality of any of the contributing elements of the status of the water bodies or prevent the quality elements from achieving the standards required in the RBMP, then this represents a failure to achieve the WFD objectives and the proposal should not go ahead unless justification for the new modification is demonstrated under Article 4.7 of the Directive. The four objectives of the WFD compliance assessment are:

1. Objective 1: To prevent deterioration of any contributing quality element to the status of the water body
2. Objective 2: To prevent the introduction of impediment to the attainment of Good WFD status for the water body
3. Objective 3: To ensure the attainment of the WFD objectives for the water body are not compromised
4. Objective 4: To ensure the achievement of WFD objectives in other water bodies within the same catchment are not permanently excluded or compromised.

1.6.4 WFD compliance assessment

1.6.4.1 The WFD surface water and groundwater assessment draws upon a number of other disciplines in determining the potential impact to the environmental objectives of the water bodies that have the potential to be impacted. These include Volume 1, Chapter 17: Soils, Geology, and Hydrogeology, Volume 1, Chapter 12: Flood risk and Volume 1, Chapter 9 Terrestrial Ecology of the Environmental Statement and supporting technical reports for these chapters .

1.6.4.2 To achieve the aims outlined within section 1.1.2, a staged approach has been undertaken in completing the WFD compliance assessment in accordance with the NRW Guidance Note (GN078) Complying with the WFD Regulations 2017.

1.6.4.3 The WFD compliance assessment is typically undertaken in three stages:

1. Screening – excludes any activities that do not need to go through the scoping or impact assessment stages
2. Scoping – identifies the receptors that are potentially at risk from your activity and need impact assessment
3. Impact assessment – considers the potential impacts of your activity, identifies ways to avoid or minimise impacts, and shows if your activity may cause deterioration or jeopardise the water body achieving good status.

1.6.4.4 A flow chart, taken from the Planning Inspectorate Advice Note 18: Water Framework Directive for assessing activities and projects for compliance with the WFD has been included below in Figure 1.2. This provides an overview of the recommended process to address the WFD during the pre-application process.

1.7 WFD Screening

1.7.1.1 A Stage 1 screening assessment for compliance with the WFD Regulations 2017 was undertaken based on the NRW guidance document (GN078). The completed screening based on the GN078 template is included in Appendix A. The proposed development screens in for WFD assessment given the potential for direct effects on the Cardigan Bay South. The proposed development was screen out for potential impacts on the environmental objectives of the Gwuan Estuary (GB521006110500), and Nyfer estuary (GB511006115200).

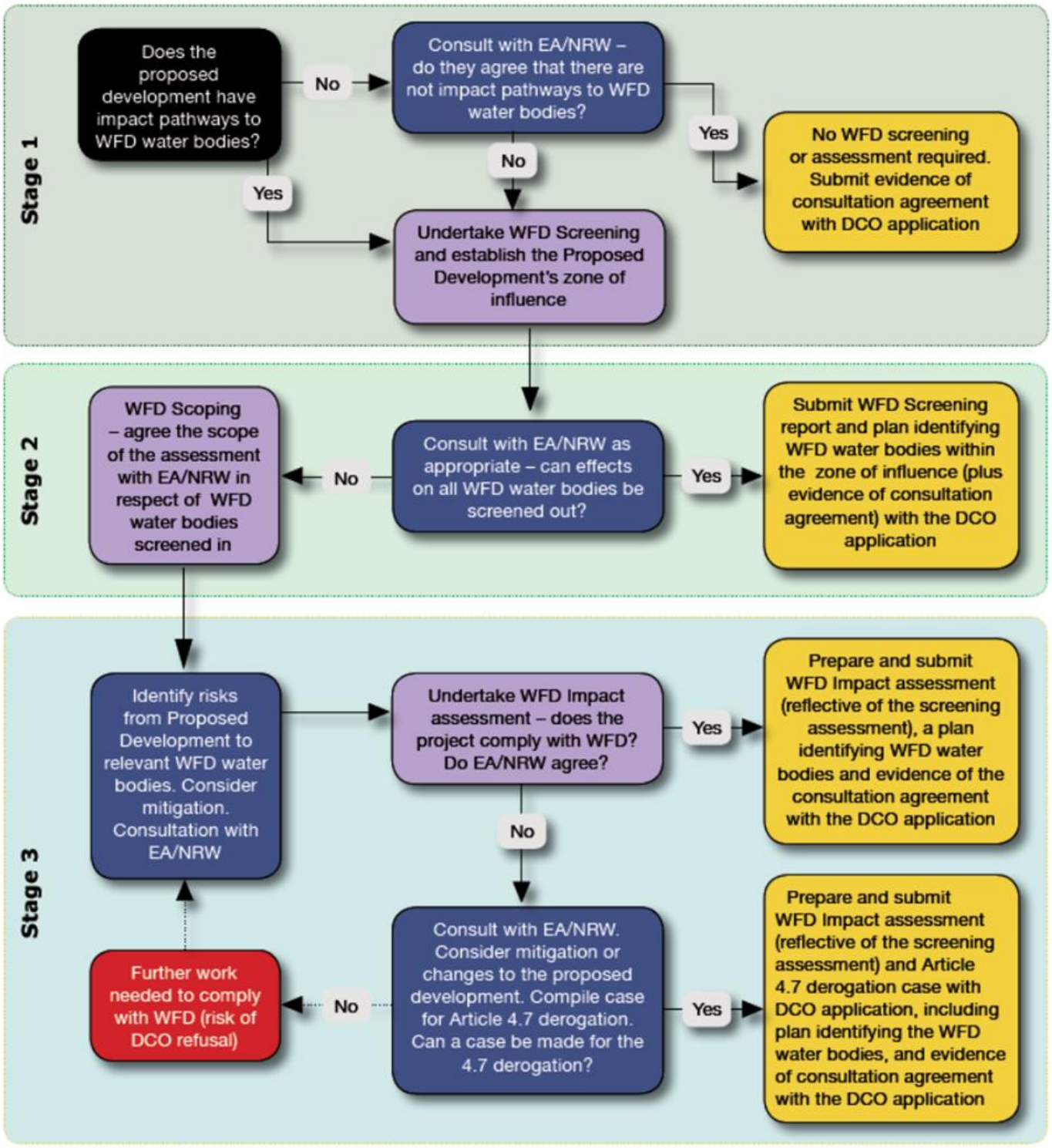


Figure 1.2: Flow chart illustrating the WFD compliance assessment process

1.8 Baseline environment

1.8.1 Desktop study

1.8.1.1 Information on WFD Status of the water bodies within the WFD assessment study area was collected through a detailed desktop review of existing studies and datasets. These are summarised at Table 1.2 below.

Table 1.2: Summary of key desktop sources.

Title	Source	Year	Author
WFD Cycle 3 water bodies	WebGIS mapping tool for the 3rd cycle RBMP classification for the ecological and chemical status of WFD water bodies in Wales Water Watch Wales - https://waterwatchwales.naturalresourceswales.gov.uk/en/	2021	NRW
2021 C3 Classification WWW	Database of the classification of individual elements of ecological and chemical status for all water bodies in Wales Water Watch Wales - https://cyfoethnaturiolcymru.sharefile.eu/share/view/sc8f1ea840a594d32a5ac24f3aa3c2350	2021	NRW
RBMP Measures and Objectives	Database of the environmental objectives and measures for all water bodies in Wales Water Watch Wales - https://cyfoethnaturiolcymru.sharefile.eu/share/view/sc0c2a20ae9c2429394326eb75e0eda5d	2022	NRW
Heavily Modified Uses and Mitigation Measures	Database of heavily modified water bodies in Wales, and mitigation measures that need to be implemented to achieve good ecological potential Water Watch Wales - https://cyfoethnaturiolcymru.sharefile.eu/share/view/sdde43d782ae54702ad52b189cadcd827	2022	NRW
Reasons for not achieving good status Cycle 3	Database outlining the pressures that are resulting in a water body from not achieving good status (ecological, chemical and quantitative) Water Watch Wales https://cyfoethnaturiolcymru.sharefile.eu/share/view/s11466c27806c4fccb29ba4c6900cc3a1	2022	NRW
Western Wales River Basin Management Plan 2021-2027 - Summary	Summary of the 3rd Cycle River Basin Management Plan for the Western Wales River Basin District (RBD) https://cdn.cyfoethnaturiol.cymru/media/695227/western-wales-rbmp-2021_2027-summary.pdf	2022	NRW
River Basin Management Plan Overview Annex Wales December 2022	Detail on how the RBMPs within Wales have been prepared providing supporting information to the Summary RBMP for Western Wales and Dee RBDs https://cdn.cyfoethnaturiol.cymru/media/695980/wales-rbmp-overview-annex-2021-2027.pdf	2022	NRW

Title	Source	Year	Author
River basin management plans 2021-2027: protected area register	Register of protected areas in the Dee and Western Wales river basin districts for information on: • Drinking water protected areas • Shellfish waters • Bathing (recreational) waters • European sites • Nutrient sensitive areas. https://naturalresources.wales/evidence-and-data/research-and-reports/water-reports/river-basin-management-plans/river-basin-management-plans-2021-2027-protected-area-register/?lang=en	2022	NRW
Abermawr Bathing Water Profile Newport North Bathing Water Profile	Bathing Water Profiles - Information on the status of bathing waters in Wales https://environment.data.gov.uk/wales/bathing-waters/profiles/profile.html?site=ukl1403-38540 https://environment.data.gov.uk/wales/bathing-waters/profiles/profile.html?_search=abergele&site=ukl1403-38600	2024	NRW
Standard Data Form (Including Conservation Objectives) for West Wales Marine / Gorllewin Cymru Forol Special Area of Conservation (SAC)	This document provides the main elements of the management plan for the site(s) named. It sets out what needs to be achieved on the site(s), the results of monitoring and advice on the action required https://jncc.gov.uk/jncc-assets/SAC-N2K/UK0030397.pdf	2019	Joint Nature Conservation Committee (JNCC)

1.8.2 WFD water body status classification

Surface water bodies

1.8.2.1 The WFD Classification of the surface water bodies within the WFD assessment study area is outlined in Table 1.3 for surface water bodies. During the first RBMP cycle (2009-2015) the classification was updated annually. However, it is now updated once every three years for surface waters. The most up to date classification is the 2021 classification. The contributing elements to ecological and chemical status are detailed and the driving element for the status classification highlighted. A summary of the key issues is outlined below for each water body.

Cardigan Bay South Coastal Water Body

1.8.2.2 *Biological quality elements* – the key driver for the overall water body status is invertebrates and morphology. Invertebrates are classified as good status and morphology is not high status. Macroalgae is classified as high. Its biological status is good.

1.8.2.3 *Physico-chemical supporting elements* – The available elements are dissolved inorganic nitrogen (DIN) which is moderate and is a status driver of the water body. Dissolved oxygen (DO) is classified as high. The physico-chemical supporting elements are classified as high.

1.8.2.4 *Hydromorphology* – Cardigan Bay South is classified as not high hydromorphological status. There is no information available on what the key pressures are affecting this status. Its morphology status is not high. This water body is not heavily modified.

1.8.2.5 *Chemical status* – Specific pollutants and priority hazardous substances are not assessed in the Cardigan Bay South coastal water body however the water body has been assigned as high chemical status.

1.8.2.6 Overall water body status - Good

Gwaun Estuary Transitional Water Body

1.8.2.7 *Biological quality elements* – the biological quality elements for this water body are indicative of high ecological status. Invertebrate status in unavailable, Macroalgae is classified as high and phytoplankton status is not available. Its biological status is high

1.8.2.8 *Physico-chemical supporting elements* – The available elements are dissolved inorganic nitrogen (DIN) which is moderate and is a status driver of the water body. Dissolved oxygen (DO) is unavailable.

1.8.2.9 *Hydromorphology* – the Gwuan Estuary is considered to be not high status and there is no information available on what the key pressures are for this. Its morphology status is not high. This water body is not heavily modified.

1.8.2.10 *Chemical status* – Specific pollutants and priority hazardous substances are not assessed, but the water body has been assigned as High chemical status.

1.8.2.11 Overall water body status – Moderate.

Nyfer Estuary Transitional Water Body

1.8.2.12 *Biological quality elements* – the biological quality elements for this water body are indicative of moderate ecological status with invertebrates (moderate) and fish (moderate), mercury (moderate) and dissolved organic nitrogen the driving element for this status classification.

1.8.2.13 *Physico-chemical supporting elements* – The available elements status; is DO which is classified as high and DIN is classified as moderate of which the status driver for the water body. The physico-chemical supporting element status is currently moderate with an objective of good status to be achieved in 2027.

1.8.2.14 *Hydromorphology* – the hydromorphogical status for the Nyfer Estuary is classified as high and morphology is high status. This water body is not heavily modified.

1.8.2.15 *Chemical status* – Priority and priority hazardous substances have been assessed. Thes contribute to the overall chemical status of moderate for the Nyfer Estuary. It has been identified that Mercury (moderate status) and DIN (moderate status) are the driving elements for this water body chemical status classification. The specific pollutants , priority and priority hazardous substances include; Arsenic, Cadmium, Copper, Iron, Nickel, Zinc, Lead, and Trichloromethane all of which are classified as high status and Mercury PHS, another status driver is moderate.

1.8.2.16 Overall water body status - Moderate

Table 1.3: Surface water body classification within the WFD Assessment Study Area

Management catchment	Water body name and ID	Water body type	Heavily modified water body	Ecological Status/Potential						Chemical Status			Overall water body status	Driving element
				Hydrological regime	Morphology	Specific pollutants	Physio-chemical quality elements	Biological quality elements	Overall ecological status	Priority substances	Priority hazardous substances	Overall chemical status		
Cleddau and Pembrokeshire Coastal Rivers TraC	Cardigan Bay South, GB621009580000	River	No	Not Available	Not High	Not Assessed	DO – High DIN – Not Assessed Hydromorphology – Not High	Macroalgae – High	Good	Not Assessed	Not Assessed	High	Good	Invertebrates, Morphology
Cleddau and Pembrokeshire Coastal Rivers TraC	Gwaun Estuary, GB521006110500	Transitional	No	Not High	Not High	Not Assessed	DO – Not Assessed DIN – Moderate Hydromorphology – Not High	Macroalgae – High	Moderate	Not Assessed	Not Assessed	High	Moderate	DIN
Cleddau and Pembrokeshire Coastal Rivers TraC	Nyfer Estuary GB511006115200	Transitional	No	High	High	High	DO – High DIN – Moderate Hydromorphology – High	Macroalgae - Good Invertebrates – Moderate Fish – Moderate Phytoplankton - High	Moderate	Trichloromethane - High All other priority substances - High	Mercury - Moderate All other priority hazardous substances - High	Moderate	Moderate	Mercury, Fish, Invertebrates, DIN

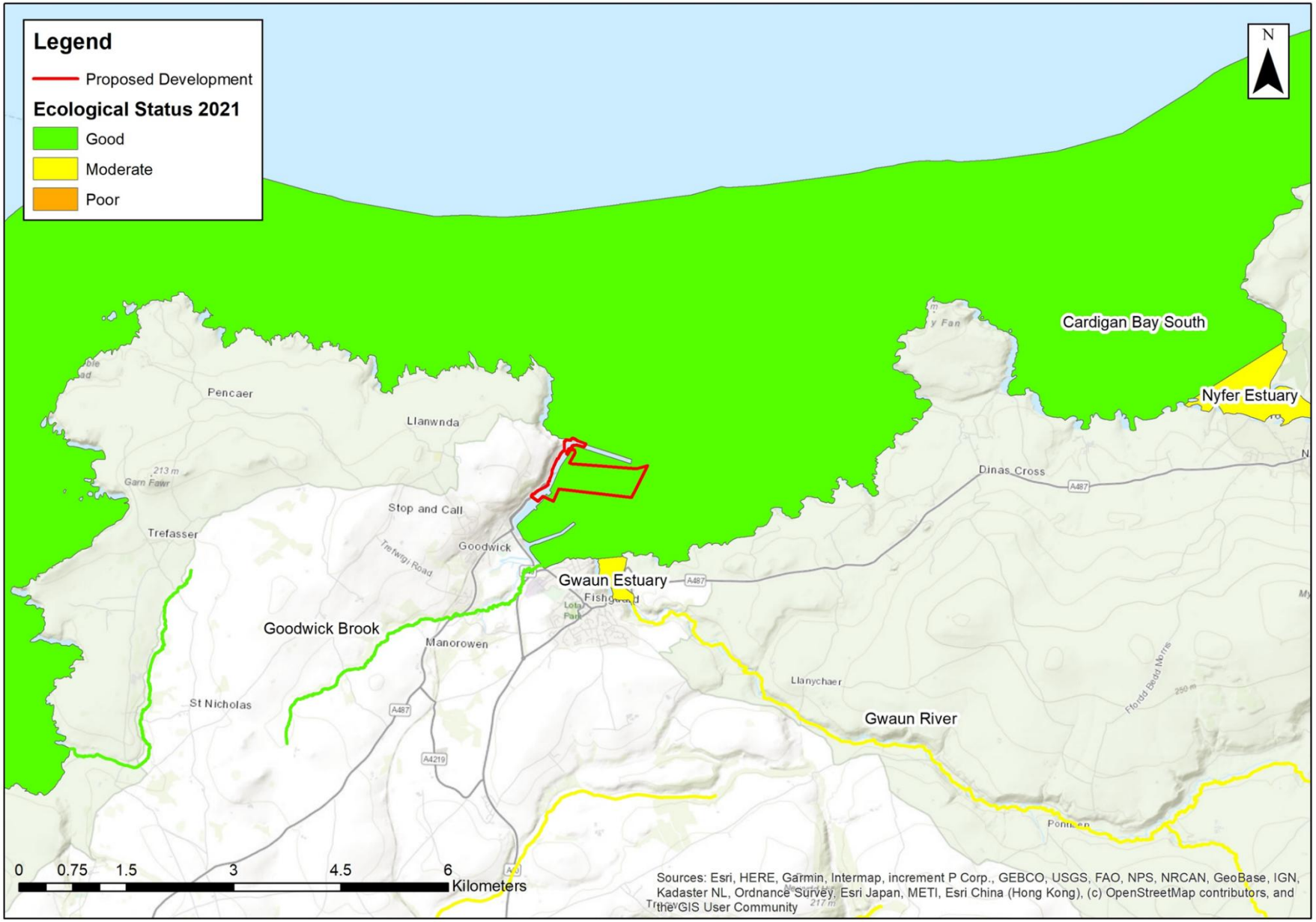


Figure 1.3: WFD Status Classification 2021

1.8.3 River Basin Management Plan objectives

1.8.3.1 As required under the WFD Regulations, NRW and other relevant public bodies aim to implement measures to achieve good overall status/potential for surface and groundwaters by 2027. Alternatives to that objective are allowable which may result in two additional options:

1.8.3.2 An objective of less than good by 2027 (less stringent objective (LSO)) due to technical infeasibility (no known technical solution is available) or disproportionate cost (unfavourable balance of costs and benefits)

1.8.3.3 An extended deadline of good status/potential beyond 2027 for reasons of natural conditions (ecological recovery) or technical infeasibility for a small number of chemicals.

1.8.3.4 The environmental objectives for the water bodies within the WFD assessment study area of the Proposed Development Area are outlined in Table 1.4.

Table 1.4: Water body objectives from Western Wales RBMP

Water body name	Type	Overall water body status	Objective	Derogation type	Reason
Cardigan Bay South, GB621009580000	Coastal	Good	Good by 2027	N/A	N/A
Gwaun Estuary, GB521006110500	River	Moderate	Good by 2027	N/A	N/A
Nyfer Estuary, GB511006115200	River	Moderate	Good by 2033	Extended	Natural Conditions

1.8.3.5 As outlined from Table 1.4, there is one water body that have been assigned an extended derogation until 2033 to achieve good status/potential. This water body is the Nyfer Estuary Transitional water body. The Cardigan Bay South coastal water body is achieving good status/potential already and the Gwaun Estuary is expected to meet its objective of good ecological status potential by 2027. It is important to demonstrate that the Proposed Development does not increase the risk of deterioration in any of the contributing elements to overall status in these water bodies.

1.8.3.6 In the case of the Nyfer Estuary, the driving element for the status classification is mercury and phytoplankton. The annex to the Western Wales RBMP (NRW, 2022a) identifies the reasons and justification for the alternative objectives set for water bodies. In the case of the Nyfer Estuary, which is failing chemical status due to mercury, the extended deadline of 2033 for the achievement of good ecological potential has been set as mercury is a chemical which is ubiquitous, persistent, bioaccumulative and toxic (uPBTs). The chemical fact sheets for mercury, included in Appendix C of the Planning Overview Annex (Wales) (NRW, 2022b) show that mercury has been phased out of use and further measures would not be practicable. The deadline of 2033 has been set by expert judgement due to the natural recovery times for mercury in this water body. However, because of its persistence in the environment it is likely that there will not be widespread compliance with the relevant EQS in the next river basin management planning periods.

1.8.3.7 The stage 1 screening assessment (Appendix A) has screened out the potential for any impact on the environmental objectives of the Gwuan Estuary (GB521006110500), and Nyfer Estuary (GB511006115200) transitional water bodies.

1.8.4 Heavily Modified Water Bodies

1.8.4.1 Under Article 4(3) of the WFD, NRW can designate surface water bodies as 'Heavily Modified Water Bodies'. A Heavily Modified Water Body (HMWB) means a body of surface water which, as a result of physical alterations by human activity, is substantially changed in character, as designated in accordance with the provisions of Annex II of the WFD. If the specified use of such a water body (e.g. flood defence, water abstraction, land drainage) or the 'wider environment' would be significantly affected by the restoration measures required to achieve good ecological status, and if no other better, technically feasible, then the environmental objective would be 'Good Ecological Potential'. This is in recognition of the fact that the water body will not achieve the ecological status of an unmodified natural water body without compromising the specified use for that water body.

1.8.4.2 As outlined in Table 1.3, no water bodies within the WFD assessment study area of the Proposed Development Area have been identified as HMWBs. The objective for these water bodies is therefore, based on the 'Ecological Status' rather than ecological potential. Ecological potential in artificial and heavily modified water bodies is determined by an assessment of whether measures are properly in place to mitigate the impacts of any modification on the ecology of the water body. In WFD classification, this is referred to as the mitigation measures assessment. If all mitigation measures are in place, the water body would be classified as being at good potential. If one or more identified mitigation measures are absent the water body would be classified at moderate potential. In both cases, if appropriate biological or chemical classifications are assessed to be at less than good then the potential of the water body is classified by the worst scoring element according to the usual one-out-all-out procedure.

1.8.4.3 The Western Wales RBMP recognises that without a programme of measures to address significant water management issues (due to unmitigated physical modifications) deterioration in the ecological condition of some rivers by 2030 is likely unless further action is taken to mitigate the impacts of and control the development of modifications. The importance of measures to address physical modifications and morphological pressures is therefore critical. Whilst there is significant uncertainty about future trends for physical modifications, recent assessments indicate the effects of climate change and population growth will result in greater demands from flood protection, land drainage and the spread of urban areas. It will be important to demonstrate that the Proposed Development will not introduce further significant hydromorphological pressures that could compromise the attainment of the environmental objectives of the connected water bodies.

1.8.5 Register of Protected Areas

1.8.5.1 A number of waters in the Proposed Development area are protected under other existing EU legislation which applied directly or indirectly to the UK before December 2020 and have been retained in UK law as a form of domestic legislation known as 'retained EU legislation'. These water dependent protected areas require special protection due to their sensitivity to pollution or their particular economic, social or environmental importance. All of the areas requiring special protection have been

identified by NRW, and area mapped and listed in a register of protected areas (required under Article 5 of the WFD). The register of protected areas includes:

- Drinking Water Protected Areas
- Economically Significant Waters (Shellfish Waters)
- Recreational Waters (Bathing Waters)
- Nutrient Sensitive Areas
- Special Protection Areas (SPAs)
- Special Areas of Conservation (SACs)

1.8.5.2 Protected areas for the WFD are the areas of land and bodies of water that have specific uses which require special protection. These include waters used for drinking water, bathing (recreational waters), commercial shellfish harvesting (economically significant), nutrient sensitive (both in terms of the Urban Wastewater Treatment Directive and the Nitrates Directive) and those that sustain the most precious wildlife species and habitats (European sites otherwise known as National Sites Network (SACs and SPAs) in Wales). These areas have legally binding objectives in place that protect those uses from potentially harmful activities and new developments. Table 1.5 provides a list of protected areas connected to the water bodies within the Proposed Development Area. Figure 1.4illustrates the Protected Areas within the vicinity of the Proposed Development.

Recreational waters (Bathing waters)

There are a number of bathing waters in proximity to the Proposed Development in Cardigan Bay South. As identified in the scoping tables for each water body the majority of these bathing waters are located more than 2km from the Proposed Development Area which are Abermawr and Newport North bathing waters. Newport North bathing water is located close to boundary of Cardigan Bay South coastal water body and the Nyfer Estuary transitional water body. Abermawr bathing waters is located 7.6km SW, and Newport North is located 9km NE of the Proposed Development.

Drinking Water Protected Areas

1.8.5.3 There are no drinking water protected areas in the vicinity of the Proposed Development.

Economically significant waters (Shellfish waters)

1.8.5.4 There are no shellfish water protected areas in the vicinity of the Proposed Development.

Table 1.5: Protected areas connected to the water bodies within the Proposed Development Area

Water body name and ID	Protected area type					
	Drinking waters	Recreational waters (Bathing waters)	Economically significant waters (Shellfish waters)	Nutrient Sensitive Areas	SACs	SPAs
Cardigan Bay South, GB621009580000	×	✓	×	×	✓	×
Gwaun Estuary, GB521006110500	×	×	×	×	✓	×
Nyfer Estuary, GB511006115200	×	✓	×	×	✓	×

Nutrient Sensitive Areas

1.8.5.5 A nutrient sensitive area in the context of urban wastewater treatment is a water body identified as affected by eutrophication or having a surface water abstraction affected by elevated nitrate concentrations from wastewater treatment works. There are no such water bodies with the WFD assessment study area of the Proposed Development Area.

1.8.5.6 Nitrate Vulnerable Areas in Wales previously included on the Protected Area Register have been removed for the final RBMP. The implementing legislation, the Nitrate Pollution Prevention (Wales) Regulations (2013), has been replaced by the Water Resources (Control of Agricultural Pollution) (Wales) Regulations 2021 which have been introduced to reduce losses of pollutants from agriculture to the environment by setting rules for certain farming practices.

European Sites (SACs/SPAs)

1.8.5.7 The provisions of the 2017 WFD Regulations only relate to water dependent habitats and species. The objective is to protect and, where necessary, improve the water environment to work towards achieving the conservation objectives for the water dependent features of these sites.

1.8.5.8 SACs associated with the water bodies that have the potential to be affected by the Proposed Development area include the West Wales Marine / Gorllewin Cymru Forol SAC and Dee Estuary (Wales) SAC which both overlap with the Proposed Development boundary (Figure 1.4). A review of the SAC conservation objectives have established that the qualifying feature, the Harbour Porpoise is water dependent. The SAC is considered to be one of the best areas in the UK for Harbour Porpoise (JNCC, 2019).

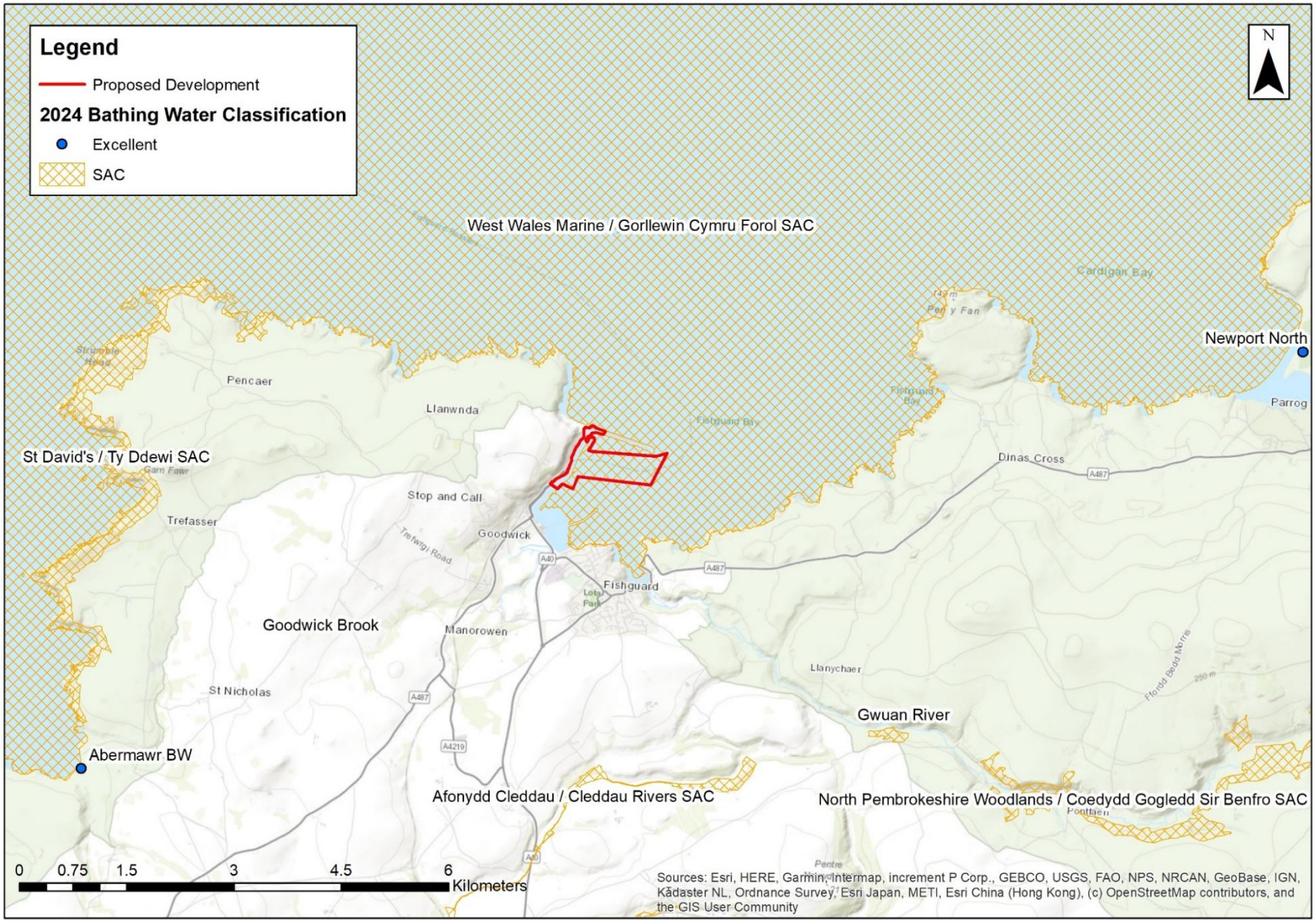


Figure 1.4: WFD Protected Areas

1.8.6 INNS

1.8.6.1 Some non-native animals and plants are invasive and can have significant social, economic and environmental impacts. Where they lead to greater erosion some plants, such as Himalayan balsam, *Impatiens glandulifera*, can increase flood risk. Others like American signal crayfish, *Pacifastacus leniusculus*, can decrease river bank stability and most have negative impacts on ecology and leisure activities such as angling and water sports. There are also significant costs in controlling and safely disposing of invasive species such as Japanese knotweed, *Fallopia japonica*, on development sites and managing species such as zebra mussels, which can block pipes, water intakes and other structures.

1.8.6.2 Many INNS spread rapidly and once they are established, control is often prohibitively expensive or technically infeasible and ultimately unsuccessful. A review of the risk assessment undertaken by NRW during the characterisation of water bodies in the Western Wales RBMP has establish the risk to the environmental objectives of the relevant water bodies from INNS. A summary of the INNS that are presenting a risk or probable risk of the water bodies failing to achieve their environmental objectives is provided in Table 1.6. The Cardigan Bay coastal water body is the only water body that is at risk from INNS. The INNS that have been recorded within the Proposed Development area are: Bonnemaisons hookweed and Small hookweed.

Table 1.6: INNS presenting a risk to the achievement of water body environmental objectives

Water body name and ID	INNS causing water body to be at risk								
	Bonnemaisons hook weed, *Bonnemaisons hamifera*	Mud Shrimp *Monocorophium sextonae*	Orange Stripped anemone Diadumene lineata	American hard shelled clam *Mercenaria mercenaria*	Small Barnacle Hesperibalanus fallaz	Darwin's Barnacle Autrominius modestus	Wireweed *Sargassum muticum*	Oyster thief *Colpomenia peregrina*	Harpoon weed Asparagopsis armata
Cardigan Bay South, GB621009580000	✓	✓	✓	✓	✓	✓	✓	✓	✓
Gwaun Estuary, GB521006110500	×	×	×	×	×	×	×	×	×
Nyfer Estuary, GB511006115200	×	×	×	×	×	×	×	×	×

1.9 Scoping assessment

1.9.1.1 It is necessary to identify links between the proposed activity and every quality element that could be affected.

1.9.1.2 For all activities, the scoping phase involves considering each WFD quality element to identify all those where a possible causal link exists. That is, where water body status or objectives could be affected at water body level by the proposed activities.

1.9.1.3 The potential impacts for each activity is provided below which has informed the selection of the activities which will be scoped into the assessment.

1.9.1.4 The scoping assessment for the coastal water body (Cardigan Bay South) follows NRW Guidance GN078, Complying with the WFD Regulations 2017: scoping (NRW, 2024). The scoping template contained in this guidance has been used for the Cardigan Bay South coastal water body and is included in Appendix B. Table 1.7 provides a summary of the outcome of the scoping assessment and concludes that water quality, hydromorphology, protected areas and INNS in this coastal water bodies required further detailed assessment.

Table 1.7: Summary of scoping exercise undertaken in accordance with the Environment Agency Guidance, WFD Assessment: Estuarine and Coastal Waters in the WFD assessment study area

Receptor	Water Body	Potential risk to receptor?	Note the risk issue(s) for impact assessment
Hydromorphology	Cardigan Bay South	No	The Cardigan Bay South is not designated as a HMWB. The hydromorphological status of this water body is not high which is a contributing element of overall Ecological Status which is currently good. The proposed development within the water body may cause localised sediment plumes to form due to the displacement of sediment and the costal process could be impacted by the new structures and land reclamation impacting on the supporting hydromorphological conditions.
Biology: habitats	Cardigan Bay South	Yes	Lower sensitivity and higher sensitivity habitats are located either within or close to the boundary of the proposed development. These include Mussel beds, Polychaete reefs and Subtidal kelp beds (higher sensitivity habitats) and subtidal reefs soft sediments and rocky coasts (lower sensitivity habitats).
Biology: fish	Cardigan Bay South	No	Fish migration in the marine or freshwater environment will not be at risk from the Proposed Development
Water quality	Cardigan Bay South	Yes	A broad range of potential pollutants, such as hydrocarbons i.e. fuels can accumulate in surfaces waters, during the construction and operation phases. These chemicals may be included on the Environmental Quality Standards Directive (EQSD) list. This can arise from accidental spillages and in collisions between marine plant during construction. Water quality may also be affected by suspended sediment from dredging activities. There is a localised area of contamination where zinc concentrations exceed the Action level 2 for this contaminant of concern.
Protected areas	Cardigan Bay South	Yes	The development is located within the West Wales Marine/Gorllewin Cymru Forol SAC. There are also 8 other European Sites where Likely Significant Effects could not be ruled out and a detailed appropriate assessment was undertaken to establish if there was a risk to the conservation objectives of these sites.
Invasive non-native species	Cardigan Bay South	Yes	Construction and operational phases may cause the spread of INNS, which could adversely affect the status of native, protected or notable habitats and species and present a risk in the achievement of the Environmental Objectives of the water bodies affected.

1.10 Detailed assessment

1.10.1 Introduction

1.10.1.1 Based on the outcomes of the scoping assessment, this detailed assessment establishes whether the activities associated with Proposed Development will:

- Cause deterioration in water body status
- Impinge upon protected areas designated under the European Directives listed in Article 5 of the WFD and outlined in section 1.8.5 of this annex
- Prevent the achievement of WFD status objectives.

1.10.1.2 This is the stage of the assessment where evidence is provided to demonstrate that the proposed works are compliant. Specifically, for each quality element it must be shown that the activities scoped into the assessment will not cause a deterioration in status of any of the contributing quality elements nor prevent the achievement of WFD status objectives. Where appropriate it is also the stage where design mitigation, aimed at reducing the effect of an activity, is discussed.

1.10.1.3 The assessment looks at each individual water body traversed by Proposed Development in the context of its status, the main contributing elements to the status classification, the objective of the water body and scoped in activities.

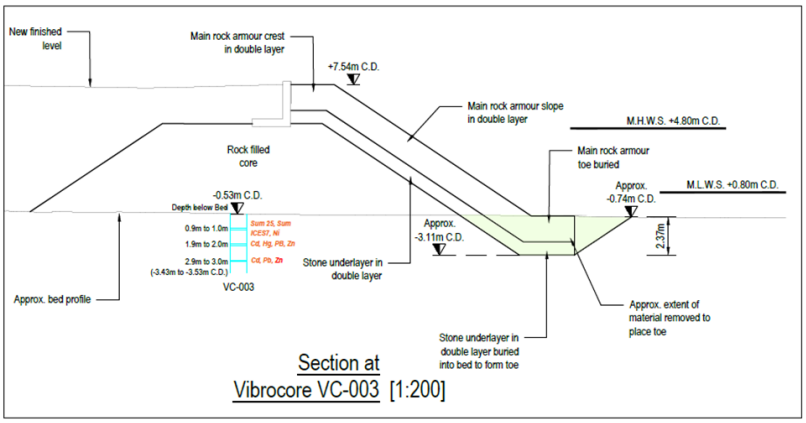
1.10.2 Measures adopted as part of the Proposed Development

1.10.2.1 For the purposes of the WFD Assessment process, the term 'measures adopted as part of the project' is used to include the following measures (adapted from IEMA, 2016):

- Measures included as part of the project design. These include modifications to the location or design of the Proposed Development which are integrated into the application for consent. These measures are secured through the consent itself through the description of the development and the parameters secured in the DCO and/or marine licences (referred to as primary mitigation in IEMA, 2016)
- Measures required to meet legislative requirements, or actions that are generally standard practice used to manage commonly occurring environmental effects and are secured through the DCO requirements and/or the conditions of the marine licences (referred to as tertiary mitigation in IEMA, 2016).

1.10.2.2 A number of measures (primary and tertiary) have been adopted as part of the Proposed Development to reduce the potential for impacts on the environmental objectives of the water bodies that could potentially be affected by the Proposed Development. These are outlined in Table 1.8. As there is a commitment to implementing these measures, they are considered inherently part of the design of the Proposed Development and have therefore been considered in the assessment presented in sections 1.10.3 and 1.10.4 below (i.e. the determination of potential impact on a water body's objective, including protected area objectives, assumes implementation of these measures).

Table 1.8: Measures adopted as part of the Proposed Development.

Measures adopted as part of the Proposed Development	Justification
Primary measures: Measures included as part of the project design	
Capital dredging activities in Areas E-H and the reclamation area will be subject to the following measures: • Loading will be carried out by a backhoe dredger or trailing suction hopper dredger (TSHD). • No over-spilling from the vessel will be permitted while the dredging activity is being carried out. • The TSHD pumps will be switched off while the drag head is being lifted and returned to the bottom as the dredger turns between successive lines of dredging to minimise the risk of fish entrainment. • A documented Accident Prevention Procedure will be put in place prior to commencement. • A documented Emergency Response Procedure will be put in place prior to commencement. • A full record of loading and dumping tracks and record of the material being dumped will be maintained for each trip.	To minimise sediment dispersal within the Cardigan Bay South coastal water body and to adjacent water bodies.
The key mitigation for the localised area of contaminated sediment during dredging activities is to avoid the disturbance of the layer of contamination found at 3 metre depth (-3.43m to -3.53m C.D). The design has been developed to ensure that these contaminated sediments at 3 metre depth will not be disturbed when the land reclamation activities are being undertaken. The section below demonstrates that the design and the approximate extent of material to be removed will avoid this contamination at depth.  	To prevent the mobilisation of contaminated sediment in the Cardigan Bay South Coastal water body
All dredge spoil will be deposited at licensed sea disposal site near Milford Haven (LU169)	To minimise impacts on water bodies to ensure such material is deposited responsibly
The construction compounds, welfare facilities and office accommodation will be located away from water courses. All potential locations for temporary construction compounds will avoid direct impact on water courses by providing adequate drainage and effluent storage.	To avoid the direct damage of these features and reduce potential for pollution.
Operational drainage network provisions will include an interceptor where required in the reconfiguration of the ferry terminal. The oil interceptors on the surface water drainage network will be selected and sized based on the pollution prevention guideline: “Use and design of oil separators in surface water drainage systems: GPP3 and BS EN 858 which is the European Standard for the design, performance, testing, marking and quality control of separators within the EU. All separators must comply with this standard. In accordance with GPP3 a class 1 bypass separator will be required for general road and car parking areas of the site whilst a class 1 full retention separator will be required for the HGV parking and loading areas.	To prevent potential interactions of runoff and the water environment

Measures adopted as part of the Proposed Development	Justification
Tertiary measures: Measures required to meet legislative requirements, or adopted standard industry practice	
An Outline Construction and Environmental Management Plan (oCEMP) will be deployed for the duration of the Proposed Development The purpose of the oCEMP is to set out a written set of standards and measures that will be implemented during the construction process to ensure a consistent and effective approach to managing potential impacts in order to safeguard the water environment. The measures include strategies, control measures and monitoring procedures for managing the potential environmental impacts and limiting disturbance from construction and maintenance activities as far as reasonably practicable. The detailed oCEMP will include regulatory guidance and industry best practice guidance including: • A detailed Construction Surface Water Drainage Management Plan. It will set out the methods for managing surface water runoff and groundwater, to protect the local environment and sensitive receptors and include measures to prevent surface water flooding during construction • Management and auditing procedures, including toolbox talks to personnel, shall be put in place to ensure that any works which have the potential to impact on the aquatic environment are being conducted in accordance with required, licences, certificates and planning permissions; • Fuel, oil and chemical storage must be sited on an impervious base with a bund and secured. The base and bund walls must be impermeable to the material stored and of adequate capacity. GPP 2 shall be implemented to ensure safe storage of oils and chemicals. • The safe operation of refuelling activities shall be in accordance with GPP 8 Safe storage and disposal of used oils (Netregs, 2017) • With regard to potential oil spills during construction, an emergency spill kit and oil spill containment equipment will be located at strategic locations adjacent to the works; • The Port Authority have in place an Oil Spill Contingency Plan which is adhered to by all staff including those employed to carry out works on behalf of the Port Authority. This plan is provided to assist the Harbour Master, or in his absence the Deputy Harbour Master in dealing with an accidental discharge of oil and/or HNS (Hazardous Noxious Substances). Its primary purpose is to set in motion the necessary actions to stop or minimise the discharge and to mitigate its effects. Effective planning will ensure that the necessary actions are taken in structured, logical and timely manner. • An Invasive Species Management Plan will be included in the oCEMP to ensure that working plant are subject to stringent biosecurity measures to prevent the introduction and/or spread of INNS.	In accordance with the Guidance for Pollution Prevention as set by Netregs. To reduce the risk of surface water pollution To ensure that all site personnel is aware of the risks to water environment and to ensure that mitigation measures are implemented to protect the water environment. To prevent the introduction and/or spread of INNS
Guidance will be followed to address the impact of suspended sediment: • Technical Guidance C648: Control of Water Pollution from Linear Construction Projects, (CIRIA, 2006); • Technical Guidance C532: Control of Water Pollution from Construction Sites: Guidance for Consultants and Contractors (CIRIA, 2001); and • GPP 6: Working on construction and demolition sites.	To minimise the risk of suspended sediment.
A protocol for regular communication between the appointed contractor, the engineer's representatives, statutory agencies, such as Natural Resources Wales and Fishguard & Goodwick Town Council, and other third parties shall be established	To ensure effective communication between all stakeholders for the duration of the Proposed Development.

1.10.3 Deterioration in water body status

1.10.3.1 As part of the project design process, a number of designed-in measures have been proposed to reduce the potential impacts for the water environment. As there is a commitment to implementing these measures, they are considered inherently part of the design of Proposed Development and have therefore, been considered in the assessment presented in this detailed WFD compliance assessment. These measures are considered standard industry practice for this type of development. The construction measures set out below are contained within the oCEMP.

1.10.3.2 The Western River Basin Management Plan (NRW, 2022a) states that the 2021 water body classification is the baseline from which deterioration is not permitted and therefore, this is the status classification that must not deteriorate when considering the impact of Proposed Development on the 'no deterioration of water body status objective'.

1.10.3.3 The detailed assessment demonstrates that taking into consideration the mitigation measures committed to the Proposed Development. This will ensure that there will be no deterioration in the individual elements of ecological and chemical status and therefore, no deterioration in the overall WFD status classification outlined in Section 1.6.2 of this annex.

1.10.3.4 Table 1.9 provide the justification for this assessment based on the different quality elements, the potential impacts scoped into the WFD assessment and mitigation measures for the Proposed Development.

Table 1.9: Summary of mitigation measures to ensure the surface water body status does not deteriorate

Impact	Biological elements				Hydro-morphological supporting elements		Physico-chemical supporting elements	Chemical	
	Fish	Invertebrates	Macrophytes	Macrophytes and Phytobentos combined	Hydrological Regime	Morphology		Priority hazardous substances	Priority Substances
Increase in suspended sediments due to dredging activities and its impact on the supporting hydromorphological conditions of water bodies during construction, operations and maintenance of the Proposed Development Area	Dredging activities has the potential to increase suspended sediment load to adjacent transitional water bodies with the associated impacts that this can have on the biological quality elements.. Measures will be set in place to minimise the potential for pollution from sediment deposition in the water body and from works vehicles, including measures to prevent transfer of invasive plant or animal species between watercourses. All construction work will be undertaken in accordance with good environmental practice based on legal responsibilities and guidance in accordance with the general overarching guidance on good environmental management in accordance with Netregs Guidelines for Pollution Prevention. The oCEMP and management plans will ensure that the Proposed Development will not result in a deterioration in the status of biological supporting elements using 2021 as the baseline status.				The use of the TSHD for dredging activities will ensure that there will be no deterioration in hydromorphological supporting elements of the overall ecological status of the Cardigan Bay South coastal water body and the adjacent Gwuan and Nyfer Estuaries. This method directly removes dredged sediment by suction which prevent sediment from dispersing to wider distance within the water column. Material will be deposited in the licensed Milford Haven (LU169) licensed disposal site. Coastal processes modelling as outlined in EIA Chapter 9 Coastal Processes demonstrates that the potential impact of suspended sediment will be confined to the Proposed Development boundary area and will not be transported outside this area.		Water clarity due to temporary increases in suspended sediments will be localised and will not extend far beyond the immediate works area as demonstrated in Chapter 9 of the ES, Coastal Processes.	As with the physico-chemical elements sediment bound contaminants could carry priority or priority hazardous substances into the aquatic environment. The measures outlined to address the potential impact to the biology will ensure that the quality elements for chemical status will not be put at risk of deterioration in their individual status'. The adjacent Nyfer Estuary contains numerous priority and priority hazardous substances. The works are not taking place within this water body. No such substances have been identified in the Cardigan Bay South Coastal waterbody or the Gwuan Estuary as outlined in Section 1.8.2.	
The impact on the coastal processes and therefore the supporting hydromorphological	Coastal processes modelling outlined in Chapter 9 provides an assessment of the impact of the Proposed Development on coastal processes and includes sediment plume and deposition modelling undertaken for dredging during the construction phase of the proposed development. The modelling and studies for coastal processes have shown the proposed development will have no significant impact on coastal processes						There will be no significant change in the coastal processes that could impact on the	Sediment transport and deposition will be localised and the mitigation to ensure the localised area of contaminated sediment will not be disturbed	

Impact	Biological elements				Hydro-morphological supporting elements		Physico-chemical supporting elements	Chemical	
	Fish	Invertebrates	Macrophytes	Macrophytes and Phytobentos combined	Hydrological Regime	Morphology		Priority hazardous substances	Priority Substances
conditions of the Cardigan Bay South coastal water body.	away from the immediate area around the site. In Areas A, B, C, E and H and the reclamation area where increased suspended sediment concentration will arise from dredging activities, there will be a negligible effect on the suspended solids concentrations where increased in suspended solids are very localised within the harbour area and do not extend into the wider coastal water body. The coastal processes chapter concluded that the effects on coastal process will not be significant. There will be limited change to the tidal current regime (current speed generally limited to +/- < 1cm/s) within Fishguard. Therefore there will no effect upon tidal regime during the operation of the Proposed Development.						supporting physico-chemical conditions such as temperature or dissolved oxygen levels.	should ensure that the chemical status of the Cardigan Bay Sout water body should not be adversely affected.	
Disturbance of contaminated sediment from a localises areas within the land reclamation area.	Suspended sediment levels can hold potentially hazardous contaminants such as heavy metals which in higher concentrations can be toxic to the biological elements. As outlined in Chapter 10 of the ES the sediment analysis results identified a pocket of heavy metal contamination (zinc) at a 3 metre depth at one of the vibrocore,(VC003) which is within the area of land reclamation. As outlined in **Table 1.8** the design has been developed to ensure that these contaminated sediments at 3 metre depth will not be disturbed when the land reclamation activities are being undertaken and therefore should not have a significant impact on the biological elements of the ecological status of the Cardigan Bay South coastal water body.				n/a		n/a	As per biological elements	
The impact of pollution caused by accidental spills/contaminant release during construction and operation of the	During construction works, there is potential for accidental spillages of oils, fuels and chemicals from plant and equipment adjacent to water bodies. There is potential for such substances to contribute to surface runoff and impact upon biological supporting elements of water bodies.				During construction works, there is potential for accidental spillages of oils, fuels and chemicals from plant and equipment adjacent to water bodies. There is potential for such substances to contribute		Mitigation measures outlined in Table 1.8 will ensure concrete and cement pollution will not cause deterioration of physico-chemical supporting elements	Oils and petroleum spills in particular from construction machinery used during the preparation of the Proposed Development could impact on the chemical status of the Cardigan Bay South coastal waterbody.	

Impact	Biological elements				Hydro-morphological supporting elements		Physico-chemical supporting elements	Chemical	
	Fish	Invertebrates	Macrophytes	Macrophytes and Phytobentos combined	Hydrological Regime	Morphology		Priority hazardous substances	Priority Substances
Proposed Development					to surface runoff and may enter the marine environment.		of overall ecological status.	Pollution prevention measures to address the risk from accidental spills and measures for mitigating spills should they occur are included in the oCEMP and supporting management plans.	
The impact of cement and concrete pollution during construction and operation of the Proposed Development.	The impacts in relation to concrete for the Proposed Development are associated with demolition of existing concrete structures such as the buffer dolphin tower structure and the disused RNLI jetty. The construction of concrete bank seat structure and concrete piling works and infilling/reclamation works can contribute to cement and concrete pollution. Demolition works and construction works can generate high volumes of high alkaline dust and fresh cement and concrete can contribute to contaminant runoff in the absence of mitigation, which may be transported into the water column and pose detriment to biological supporting elements of water bodies. Therefore, it is essential that the use of wet concrete and cement in or close to any water body is carefully controlled so as to minimise the risk of any material entering water courses. All demolition waste will be disposed of at offsite licensed area. Mitigation measures outlined in Table 1.8 will ensure concrete and cement pollution will not cause deterioration of biological supporting elements of overall ecological status.				The impacts in relation to concrete for the Proposed Development are associated with demolition of existing concrete structures such as the buffer dolphin tower structure and the disused RNLI jetty. The construction of concrete bank seat structure and concrete piling works and infilling/reclamation works can contribute to cement and concrete pollution. Demolition works and construction works can generate high volumes of high alkaline dust and fresh cement and concrete can contribute to contaminant runoff in the absence of mitigation, which may be transported into the water column and pose detriment to biological supporting elements of water bodies. Therefore, it is essential that the use of wet concrete and cement in or close to any		Mitigation measures outlined in Table 1.8 will ensure concrete and cement pollution will not cause deterioration of physico-chemical supporting elements of overall ecological status	Concrete and cement pollution could carry priority or priority hazardous substances into the aquatic environment. The measures outlined to address the potential impacts will ensure quality elements for chemical status will not be put at risk of deterioration. Where the works are planned within Cardigan Bay South coastal water body no such substances have been identified	

Impact	Biological elements				Hydro-morphological supporting elements		Physico-chemical supporting elements	Chemical	
	Fish	Invertebrates	Macrophytes	Macrophytes and Phytobentos combined	Hydrological Regime	Morphology		Priority hazardous substances	Priority Substances
					water body is carefully controlled so as to minimise the risk of any material entering water courses. All demolition waste will be disposed of at offsite licensed area. Mitigation measures outlined in Table 1.8 will ensure concrete and cement pollution will not cause deterioration of biological supporting elements of overall ecological status.				
The impact of the introduction and/or the spread of INNS during construction and operation of the Proposed Development.	All plant working within or near to water courses will be subject to stringent mitigation measures as set in the oCEMP to prevent the establishment or spread of INNS with water bodies.				All plant working within or near to water courses will be subject to stringent mitigation measures as set in the oCEMP to prevent the establishment or spread of INNS with water bodies.		Mitigation measures outlined in Table 1.8 will ensure INNS will not affect physico-chemical supporting element of overall ecological status	There will be no impact from INNS on chemical status therefore no such mitigation measures are proposed.	

1.10.4 Protected area objectives

1.10.4.1 A number of protected areas, listed on the register are located within the WFD assessment study area of the Proposed Development. These protected areas have their own monitoring and assessment requirements to determine their condition. They are often assessed for additional pollutants or requirements relevant to their designation. For example, faecal coliform levels are assessed within shellfish and bathing waters. Therefore, it is important that the standards required for these protected areas are also met. If they are not met, a water body which would otherwise meet the requirements of the WFD, may have the status reduced to 'less than good' as it is not meeting the protected area objectives. The water bodies within the Proposed Development area that contain protected areas listed in the register of protected areas are detailed in Table 1.5.

1.10.4.2 As outlined in section 1.8.5 and Table 1.5 the protected areas linked to the water bodies within the WFD assessment study area for the Proposed Development include bathing waters and European sites in the Cardigan Bay South coastal water body.

Recreational Waters (Bathing Waters)

1.10.4.3 Both Bathing water designations are located outside 2km of the Proposed Development. Abermawr bathing waters are located 7.6km SW, and Newport North, is located 9km NE of the Proposed Development.

1.10.4.4 Pathogens are unlikely to be a source of contamination as the works will be confined to the Proposed Development boundary. Coastal processes modelling will confirmed that suspended sediment will not be transported to these bathing water areas.

Economically Significant Waters (Shellfish Waters)

1.10.4.5 There will be no impact upon shellfish waters from the Proposed Development.

Nutrient Sensitive Areas

1.10.4.6 There are no water bodies within the WFD assessment study area of the Proposed Development that have been designated as nutrient sensitive in the context of urban wastewater treatment.

1.10.4.7 Nitrate Vulnerable Areas (NVAs) in Wales previously included on the Protected Area Register have been removed for the final RBMP.

European Sites (SACs/SPAs)

1.10.4.8 The provisions of the WFD Regulations 2017 only relate to water dependent habitats and species. The objective is to protect and, where necessary, improve the water environment to work towards achieving the conservation objectives for the water dependent features of these sites.

1.10.4.9 West Wales Marine / Gorllewin Cymru Forol SAC incorporates all of the Cardigan Bay South coastal water body. The Standard Data Form (SDF) (JNCC, 2019) for this SAC notes that there is medium risk of toxic organic chemicals which represents a potential threat. Potential impacts from the Proposed Development on surface waters have been assessed. The mitigation measures proposed will not compromise the achievement of the conservation objectives of this European Site.

1.10.4.10 On this basis the Proposed Development will not compromise the protected area objectives for the water bodies impacted and therefore will not cause any deterioration in status or compromise the achievement of the objectives for the water bodies in question.

1.10.5 Achievement of the WFD objectives

1.10.5.1 During the River Basin Management cycle characterisation of the water bodies to establish the key pressures and associated pathways that are resulting in a status classification of less than good status were determined. A programme of measures is then put in place to assist in the achievement of the WFD objectives. The key objective of the WFD was to achieve good ecological status or potential by 2015, however extended timelines can apply where there are justifiable reasons (e.g. due to issues with disproportionate cost, affordability, technical difficulties). In these instances, the objective of the achievement of good status may be the end of the second river basin management cycle in 2021, or the third river basin management cycle in 2027. Where good status is unlikely to be achieved then less stringent objectives can apply to a water body.

1.10.5.2 Table 1.10 outlines the objectives for each water body within the WFD study area of the Proposed Development area and the key quality elements driving the status. The Significant Water Management Issues (SWMI), where known, resulting in a status of less than good are summarised and the measures that are recommended in the RBMP to achieve the WFD objectives are identified. The final column of Table 1.10 assesses the potential impact on the achievement of the WFD objectives and concludes for all water bodies that Proposed Development will not prevent the achievement of the WFD objectives.

Table 1.10: Significant Water Management Issues (SWMI), Source, Programme of measures and assessment of impact of the project on the WFD objectives

Water Body Name	Cardigan Bay South (GB621009580000)
Type	Coastal
Overall Status	Good
Driving Element	Invertebrates Morphology
Significant Water Management Issue	No issue identified by NRW
Source/Activity	N/A
RBMP Measures	N/A
Good by 2027	Good by 2027
Derogation Type	N/A
Reason	N/A
Impact of Project on WFD Objectives	Considering the design mitigation and the pollution prevention measures as outlined in Table 1.9, the construction and operation of the Proposed Development will not introduce and new significant water management issues that could cause a risk of deterioration in the good status currently assigned to this water body and will therefore not compromised the environmental objective for the Cardigan Bay South coastal water body.

1.10.6 Assessment summary and conclusion

1.10.6.1 A WFD assessment has been undertaken for the key elements of the Proposed Development. The assessment is based on guidance developed by NRW and is undertaken in a staged approach to ensure that those components of the project and the associated activities are assessed in the context of the quality elements that contribute to overall WFD status.

1.10.6.2 The key focus of the assessment was to ensure that the Proposed Development does not result in a deterioration in the current WFD status of the water bodies within the WFD study area, based on the 2021 baseline as reported in the Western Wales RBMP 2021-2027, and also to ensure that the project does not compromise the achievement of the WFD objectives for the protection of the overall status of the Cardigan Bay South coastal water body. The assessment also considers the protected areas linked to the water bodies in question and ensures that the protected area objectives are also unaffected.

1.10.6.3 The scoping stage of the WFD compliance assessment concluded that there were a number of components and activities associated with Proposed Development that represent a risk to the WFD status and objectives and therefore were scoped into the assessment. The relevant quality elements contributing to the overall status were considered and how each potential impact could affect these.

1.10.6.4 The overall conclusion of the WFD compliance assessment is that there will be no risk of deterioration in status or the prevention of the achievement of the objectives for the Cardigan Bay South coastal water body nor will the protected area objectives be compromised.

1.11 References

Environment Agency (2017) WFD Assessment of estuarine (transitional) and coastal waters, 'Clearing the waters for All'. https://www.gov.uk/guidance/water-framework-directive-assessment-estuarine-and-coastal-waters.

IEMA (2016) Environmental Impact Assessment. Guide to Delivering Quality Development. Available: https://www.iema.net/download-document/7014. Accessed: October 2022.

JNCC (2019) Natura 200 – Standard Data Form, West Wales Marine / Gorllewin Cymru Forol SAC. Joint Nature Conservation Committee.

Netregs.,(2017a) GPP 4: Treatment and disposal where there is no connection to the public foul sewer

Netregs.,(2017b) GPP 8: Safe storage and disposal of used oils

Netregs.,(2018a) GPP 2: Above ground oil storage

Netregs., (2018b) GPP 5: Works and maintenance in or near water

Netregs., (2018c) GPP 20: Dewatering of underground ducts and chambers

Netregs., (2018d) GPP 22: Dealing with spills

Netregs., (2019).GPP 26: Safe storage of drums and intermediate bulk containers (IBCs)

Netregs., (2021a) GPP 1: Understanding your environmental responsibilities – good environmental practises

Netregs., (2021b) GPP 21: Pollution incident response planning

Netregs., (2023) GPP 6: Working on construction and demolition sites

Northwest and North Wales Coastal Group (2015) Shoreline Management Plan

NRW (2024) NRW Guidance on WFD compliance assessments (GN078).

NRW (2022a) Western Wales Western Wales River Basin Management Plan 2021 – 2027 – Summary. https://cdn.cyfoethnaturiol.cymru/media/695227/western-wales-rbmp-2021_2027-summary.pdf.

NRW (2022b) River Basin Management Plan Overview Annex, Wales December 2022. https://cdn.cyfoethnaturiol.cymru/media/695980/wales-rbmp-overview-annex-2021-2027.pdf.

Planning Inspectorate (2017) Advice Note Eighteen: The Water Framework Directive. https://infrastructure.planninginspectorate.gov.uk/legislation-and-advice/advice-notes/advice-note-18/.

Appendix A – WFD Stage 1 Screening

Appendix B – WFD Stage 2 Scoping

WFD Compliance Assessment of Fishguard Linkspan Project

Stage 1 step 1: proposal details.

Project reference number	*N/A*
Proposal	*This area will be developed to allow long term berthing of the Fishguard to Rosslare Ferry Service. Some of the activities, include capital and maintenance dredging, land reclamation and rock armour revetment construction. These works are to improve the infrastructure and operational capabilities of the harbour.*
List all permissions that may be required where known	*Marine Licence under section 66 of the Marine and Coastal Access Act 2009* *Permission is to be sought for sediment disposal at Milford Haven I licenced disposal site*
Location (include map where appropriate)	*British National Grid: -52.0115917, -4.979375*
Estimated extent of footprint/impact of the works	*Overall planning boundary area – 36 hectares (ha)*
Supporting documents	*See Environmental Statement for project purpose and background, site map, scaled plan, site photographs and working method statement. Pre-application correspondence is included in the ES including details of scoping opinion for water resources.*
Environmental Statement	*An ES has been prepared, Relevant chapters:* *Chapter 2: Project Description* *Chapter 8: Marine Biodiversity* *Chapter 9: Coastal Processes* *Chapter 10: Water Resources and WFD*
List ongoing maintenance requirements. All structures will require maintenance	*During the operational stage, maintenance of the newly developed infrastructure will be required, including the provision of cathodic protection of steel piles against corrosion. Fishguard Port has a comprehensive maintenance programme in place for all its assets, supported by documented procedures, to ensure the upkeep and efficient operation of the port.* *Maintenance dredging will be required to maintain sufficient depths for berthing.*
Timing of works	*9 months for construction. No constraints on timing due to outcome of the impacts assessments contained in the ES when the measures to be included in the Project are considered.*
Name of the person completing the assessment	*Mark Magee (BA (Mod), MSc, CSci, CEnv, CWEM)* *Technical Director RPS Water Environment*
Date of assessment	*May 2025*

Stage 1, step 2 : Collate baseline information on all water bodies at risk from the proposal.

Date of classification information: *Cycle 3 2024 interim classification*

Water body ID	Water body name	Water body type	HMWB	Overall water body status	Morphology status*	Relevance to the proposal
GB621009580000	*Cardigan Bay South*	*Coastal*	*No*	*Good*	*Not High*	*Proposed Development is taking place within this waterbody. Contamination has been identified at depth in sediments where Proposed Development is situated.*
GB521006110500	*Gwuan Estuary within the catchment of the Nant Morlais Tributary to the Gwendraeth Fach - headwaters to tidal limit*	*Transitional*	*No*	*Moderate*	*Not High*	*Potential for Suspended sediment concentrations (SSC) to interact with this waterbody due to hydrological link with Cardigan Bay South Coastal Waterbody e.g. hydrologically linked – potential risk*
GB511006115200	*Nyfer Estuary course*	*Transitional*	*No*	*Moderate*	*High*	*Potential for Suspended sediment concentrations (SSC) to interact with this waterbody due to hydrological link with Cardigan Bay South Coastal Waterbody e.g. within proposal footprint*

*where there is no information, or a null value then assume it is at good status for morphology (or hydromorphology for TraC water bodies) or, if the water body is designated HMWB the morphological status is **not applicable (please be aware that these water bodies are still sensitive to physical modifications).**

The potential for the proposal to affect the following water bodies was also initially considered, but can be ruled out without further consideration:

- Gwuan Estuary (GB521006110500) hydrologically linked but not at risk due to the localised nature of the impact from the development in the context of coastal processes, suspended solids concentrations and sediment deposition.
- Nyfer Estuary (GB511006115200) hydrologically linked, but not at risk due to the localised nature of the impact from the development in the context of coastal processes, suspended solids concentrations and sediment deposition.

Stage 1, Step 3: Risk Screening - complete a risk screening table for each water body listed above that has **potential risk of impact from the proposal**

Water body name: *Cardigan Bay South Coastal Waterbody* Water body ID: *GB621009580000*			
Question number	**Risk screening questions**	**Name of activity**	**Screening decision – delete as appropriate**
Q1.1	**Is the proposal in a water body at high status or high status for morphology** or hydromorphology?	The waterbody is not at high status for morphology nor at high status for hydromorphology.	**No** – go to Q1.2
Q1.2	**Is the proposed activity listed a low risk activity?** Complete new row for each activity	*Dredging activities including maintenance dredging*	**No –** complete Stage 2 scoping assessment for each water body
		Building of new infrastructure with the waterbody, including reclamation, linkspan, Bankseat, tubular steel guide pile, reclamation	**No** – complete Stage 2 scoping assessment for each water body
		Demolition of existing concrete structures	No – complete Stage 2 scoping assessment for each water body
Q1.3	Are there any potential cumulative/in combination impacts?	**Yes/No**	**Yes** – complete Stage 2 scoping assessment for each water body

Water body name: *Gwuan Estuary* Water body ID: *GB521006110500*			
Question number	**Risk screening questions**	**Name of activity**	**Screening decision – delete as appropriate**
Q1.1	**Is the proposal in a water body at high status or high status for morphology** or hydromorphology?	The waterbody is not at high status for morphology nor at high status for hydromorphology. The Proposed Development is taking place with the adjacent Cardigan Bay South Coastal waterbody. **Therefore, this waterbody can be screened out.**	**No** – go to Q1.2
Q1.2	**Is the proposed activity listed a low risk activity?** Complete new row for each activity	*No activities taking place within the water body and coastal process demonstrates that the is no potential for elevated suspended solids concentrations, contaminants or costal process to be impacted in this water body.*	**No –** no further WFD assessment needed
Q1.3	Are there any potential cumulative/in combination impacts?	**As above**	**No** – no further WFD assessment needed

Water body name: *Nyfer Estuary* Water body ID: *GB110059032310*			
Question number	**Risk screening questions**	**Name of activity**	**Screening decision – delete as appropriate**
Q1.1	**Is the proposal in a water body at high status or high status for morphology** or hydromorphology?	The waterbody is high status for morphology and at high status for hydromorphology. The Proposed Development is taking place with the adjacent Cardigan Bay South Coastal waterbody. **Therefore, this waterbody can be screened out.**	**No** – go to Q1.2
Q1.2	**Is the proposed activity listed a low risk activity?** Complete new row for each activity	*No activities taking place within the water body and coastal process demonstrates that the is no potential for elevated suspended solids concentrations, contaminants or costal process to be impacted in this water body.*	**No –** no further WFD assessment needed
Q1.3	Are there any potential cumulative/in combination impacts?	**As above**	**No** – no further WFD assessment needed

WFD Compliance Assessment of Fishguard Linkspan Project

Stage 2: Scoping Assessment

Stage 2, step 1 – Relate activity to receptors

Scoping table for:
Transitional and Coastal water bodies

Invasive Non-Native Species
Refer to the Check Clean Dry campaign to help prevent the spread of invasive plants and animals in British waters.

Does your proposal have the potential to introduce or spread INNS?

Yes - Complete impact assessment.

The negative effects of invasive non- native species has been risk assessed as part of the Western Wales River Basin Management Plan. The latest assessment was completed in 2022 and determined that Invasive Non-Native Species (INNS) were probably not placing the Cardigan Bay South coastal water body at risk of failing to achieve its Environmental Objectives.

However, The introduction of new INNS to the Cardigan Bay South water body during the construction and operation of the proposed development cannot be ruled out. A INNS management plan has been prepared and is included in Chapter 8 Marine Biodiversity.

WFD Protected Areas

You must ensure that your proposal will not prevent any Protected Area/s from achieving their objectives. Include WFD protected areas in your assessment if your activity is within the zone of influence.

West Wales Marine / Gorllewin Cymru Forol SAC – The Proposed Development is located within the boundary of this SAC. Stage 1: Screening for Likely Significant Effects was undertaken to ascertain whether or not the Proposed Development is likely to have a significant effect on any European site. The potential for LSE could not be excluded at the screening stage for seven European sites, without further evaluation, or the application of mitigation measures intended to reduce effects of the Proposed

Development on the European sites concerned. A Habitat Regulations assessment has been prepared for the proposed development and cannot rule out the potential for significant effects on the conservation objectives of these SACs at screening stage and therefore a Stage 2 Appropriate Assessment was undertaken.

Abermawr and Newport North Bathing Waters – These bathing waters are located in the wider Cardigan Bay South Coastal Waterbody (7.6 km SW and 9km NE of the Proposed Development). The potential for the Proposed Development to impact upon this area is not anticipated. Coastal Processes modelling has demonstrated that sediment plumes and subsequent deposition from dredging activities will be very localised, hence to significant effect will arise on these bathing waters. Dredging activities will avoid areas where contaminants are known to be present in sediments, therefore there will be no significant effects upon any bathing water designation

Other Protected and Priority habitats and species.

Higher Sensitivity Habitat within Cardigan Bay South

- Mussel beds
- Subtidal Kelp beds
- Polychaete Reef

Lower Sensitivity Habitat within Cardigan Bay South

- Subtidal Rocky Reef
- Intertidal soft sediment
- Rocky shore

Suspended sediment plumes may interact with these sensitive habitats. This cannot be discounted and has be assessed further in the Environmental Statement Chapter 10 Water Resources and WFD accompanying this assessment. Sediment samples has identified contamination with marine sediments in Fishguard Bay. Dredging activities will avoid areas where contaminants are known to be present in sediments, therefore there will be no significant effects upon protected species or habitats.

Summary of step 1 scoping

Q2.1 Is there a risk that a component of the proposal may cause deterioration of any element that makes up water body status?

The activities that are mostly likely to cause a deterioration are suspended sediment concentrations and potential contaminated sediment from dredging activities and the release of oils, fuels and chemicals during construction that could impact on the supporting physico-chemical conditions and the chemical status of the water body. There is also the potential for physical structures to alter the coastal processes and therefore the hydromorphological supporting conditions of the Cardigan Bay South Coastal Waterbody.

Stage 2, step 2: Summary of scoping decision of the project 'alone'

Q2.2 Is there a risk that a component of the proposal may prevent the water body or Protected Area from achieving its objectives in the future?

The proposed development including dredging and infrastructure including linkspan and land reclamation have been scoped in for detailed assessment as they could have as impact on the water dependent protected area objectives for the Cardigan Bay South coastal water body. This water body is currently achieving good status and the objective is to protect this status and prevent deterioration.

Stage 1: Screening for Likely Significant Effects was undertaken to ascertain whether or not the Proposed Development is likely to have a significant effect on any European site. The potential for LSE could not be excluded at the screening stage for seven European sites, without further evaluation, or the application of mitigation measures intended to reduce effects of the Proposed Development on the European sites concerned.

Stage 2, step 3: Assessing potential in combination and/or cumulative impacts

Q2.3 Can the risk of deterioration or prevention of achieving water body objectives from in combination and or cumulative effects be ruled out?

Yes. There will be no cumulative effects with any other project. This is outlined within the Environmental Statement Chapter 10 Water Resources and WFD. The closest project from the Proposed development is a shellfish farm expansion in the Ramsey Sound located in a different coastal waterbody; Pembrokeshire South Coastal waterbody approximately 28.8 km SE from Fishguard

Bay. There will be no risk of deterioration or prevention of the waterbody achieving its WFD objectives from in combination and or cumulative effects.

Stage 2, Step 4: Overall scoping summary

Summarise if there a potential risk that your proposal may cause deterioration or prevent a water body from meeting its objectives either alone or in combination.

Scoping Assessment Completed by	Conor Sweeney	**Date**	20/05/2025
Scoping Assessment Reviewed by	Mark Magee	**Date**	22/05/2025
Document Reference	Final	**Version**	F01

Consultation with NRW and any other regulatory/advisory organisation

Officer name and job title	Organisation	Date	Advice received
Dr Maria Alverez ***Lead Specialist Officer*** ***Marine Licensing Team***	Natural Resource Wales	**31 January 2025**	Where possible, other environmental assessments should be coordinated with the EIA process. However, it is important to note that the Habitats Regulations Assessment (HRA) and Water Framework Directive assessment (WFD), and any other assessment, are separate processes to the EIA.

Officer name and job title	Organisation	Date	Advice received
Dr Maria Alverez ***Lead Specialist Officer*** ***Marine Licensing Team***	Natural Resource Wales	**31 January 2025**	All applications for dredge and/or disposal activities must be supported by the results of the sediment sampling and analysis and a biosecurity risk assessment. This information should be submitted using the forms on our website: https://naturalresource.wales/permits-and -permissions/marine-licencing/applying-for-a-marine-licence/lang=en

Supporting information and documents

Title of supporting documents / assessments / modelling	Date & Version number
VOLUME IV Habitat Regulations Assessment	April 2025 D02
Environmental Statement Chapter 8 Marine Biodiversity	May 2025 D02
Environmental Statement Chapter 9 Coastal Processes	May 2025 D02
Environmental Statement Chapter 10 Water Resources and WFD	May 2025 D02

Scoping table for Transitional and Coastal water bodies

Scoping table for Transitional and Coastal water bodies Water body name: Cardigan Bay South Coastal Waterbody Water body ID: *GB621009580000*			
Elements	**Applicable**	**Potential Impact** (include direct and indirect potential impacts)	**Avoidance measures included in the proposal**
Transitional and Coastal water bodies	Choose one of the following: **Direct** – risk of direct impact **Indirect** – risk of indirect impact **N/A – no impact pathway** **N/A – other** – include additional text to explain	Further detail on potential impacts. Where N/A is included then provide detail to explain.	Briefly describe any measure included within the proposal at this point that will ensure the potential effects are avoided. Where impacts can be avoided through measures already included in the scheme then add **Scoped Out**. Or where further assessment is required add **Scoped In**
Hydromorphology – hydromorphology constitutes both 'hydrology' and 'geomorphology' and describes the physical characteristics and processes of a water body. ***Could the proposal lead to changes in:***			
• morphological conditions, for example depth variation, the seabed and intertidal zone structure • tidal patterns, for example, dominant currents • freshwater flow • wave exposure	Direct	Potential direct impacts upon hydromorphological supporting conditions include increased suspended sediment concentration from dredging activities and impacts on sediment deposition, changes to the physical process in the Cardigan Bay South Coastal Water Body due to the new structures and land reclamation.	**Scoped in** Further Assessment required
Is the proposal in a HMWB?	No		

Scoping table for Transitional and Coastal water bodies Water body name: Cardigan Bay South Coastal Waterbody Water body ID: *GB621009580000*			
Elements	**Applicable**	**Potential Impact** (include direct and indirect potential impacts)	**Avoidance measures included in the proposal**
Water quality An activity can modify the flow of water, introduce artificial materials or remove sediment and/or vegetation. These can all affect the water quality – particularly physico-chemical aspects of water quality - such as levels of dissolved oxygen, nutrients and ammonia. Include water quality in the detailed assessment if the activity could affect:			
• water clarity (turbidity or suspended particulate matter concentration) • thermal conditions (including shading) • oxygen levels – dissolved oxygen conditions • nutrients - dissolved inorganic nitrogen • microbial patterns • salinity/conductivity • is in a water body with a phytoplankton or opportunistic macroalgae status of moderate, poor or bad • is in a water body with a history of harmful algae (where there is an existing designation for the area, information should be available; however, local water quality officers will be able to help).	Direct	Increased suspended sediment concentrations from dredging could impact on water clarity. Changes in oxygen levels could be introduced if anoxic sediment is disturbed. There is no history of harmful algae from bathing waters in this waterbody	**Scoped In** Further Assessment required Dredging of sediments will be avoided where contamination level is over Cefas level 1.
Chemicals - A detailed assessment will also be required if the activity uses or releases chemicals, for example, through sediment disturbance or building works. This is necessary when either the:			

Scoping table for Transitional and Coastal water bodies Water body name: Cardigan Bay South Coastal Waterbody Water body ID: *GB621009580000*			
Elements	**Applicable**	**Potential Impact** (include direct and indirect potential impacts)	**Avoidance measures included in the proposal**
• chemicals are on the Environmental Quality Standards Directive (EQSD) list • activity disturbs sediment with contaminants (for estuarine and coastal above Cefas Action Level 1). • or, if the activity releases chemicals on the EQSD list and has a mixing zone, like a discharge pipeline or outfall, follow the Environment Agency's surface water pollution risk assessment guidance. This is part of the Environmental Permitting Regulations guidance.	Direct	Sediment sampling has determined there is small areas of contamination present within marine sediments. These pollutants are included on the EQSD list. Any disturbance of contaminated sediments may cause a risk to the waterbody.	**Scoped In** Further Assessment required. It is proposed not to disturb areas where contamination (over Cefas level 1) is present therefore effects will be avoided. Sediments determined to have contamination level below Cefas Action level 1 are to be disposed of at Millford Haven Three (LU169) licensed disposal site.
Biology Identify if the activity or project could impact on the abundance or composition of the biological elements listed below: Biological elements for transitional (T) and coastal (C) waters under the directive are: • Benthic invertebrates (T, C) • Fish (T) • Phytoplankton (T, C) • Macroalgae (T, C) • Angiosperms (T, C) ***Could the proposal lead to:***			
• changes to the composition and abundance of aquatic flora • changes to the composition and abundance of benthic invertebrate fauna	Direct and Indirect	• Temporary habitat loss and/or disturbance • Long term habitat loss and/or disturbance • Increased SSCs and associated deposition	**Scoped in** Further Assessment required.

Scoping table for Transitional and Coastal water bodies Water body name: Cardigan Bay South Coastal Waterbody Water body ID: *GB621009580000*			
Elements	**Applicable**	**Potential Impact** (include direct and indirect potential impacts)	**Avoidance measures included in the proposal**
		• Increased SSCs and associated deposition • Changes in water quality (including the release of sediment bound contaminants) • Significant hydromorphological changes due to introduction of new structures and land reclamation could have an impact on the biological elements that are sensitive to hydromorphological changes	
For TraC water bodies - scope in if the footprint (where footprint can be direct or a plume i.e. chemical or thermal; for dredging multiply the area by 1.5x) of your activity is:			
• 0.5km^2 or larger • 1% or more of the water body's area • Within 500m of any higher sensitivity habitat (see table below) • 1% or more of any lower sensitivity habitat (see table below)	Direct	The total area of the activity is 0.58 km^2. As dredging is involved the total area of the activity is 0.87km^2. The area of the activity is not more than 1% of the Cardigan Bay South coastal water body's area. The Proposed Development is within 500m higher sensitivity habitats such as mussel beds and the subtidal kelp beds in Fishguard Bay.	**Scoped In** Further Assessment required

Scoping table for Transitional and Coastal water bodies Water body name: Cardigan Bay South Coastal Waterbody Water body ID: *GB621009580000*			
Elements	**Applicable**	**Potential Impact** (include direct and indirect potential impacts)	**Avoidance measures included in the proposal**
		The underlying lower sensitivity habitat is subtidal rocky reef and rocky shore. The activity is not 1% or more of any lower sensitivity habitat	
Fish fauna (Transitional water bodies only): could the proposal lead to:			
□ changes to the composition, abundance and age structure of fish fauna □ an impact on normal fish behaviour like movement, migration or spawning (for example creating a physical barrier, noise, chemical change or a change in depth or flow) □ entrainment or impingement of fish □ refuge/predation areas Or: is the proposal in an estuary and could affect fish in the estuary; is outside the estuary but could delay or prevent fish entering it; or, could affect fish migrating through the estuary	N/A – no impact pathway	The Proposed Development is taking place within the Cardigan Bay South Coastal Waterbody and not within any transitional waterbody. The Coastal processes chapter has established that there is no potential for direct impact on any of the adjacent transitional or coastal water bodies	**Scoped Out**

Info for TraC water bodies

Extract from EA Clearing the water for All

Higher and lower sensitivity habitats for TraC water bodies

Higher sensitivity habitats [2]	**Lower sensitivity habitats** [3]
chalk reef	cobbles, gravel and shingle
clam, cockle and oyster beds	intertidal soft sediments like sand and mud
intertidal seagrass	rocky shore
maerl	subtidal boulder fields
mussel beds, including blue and horse mussel	subtidal rocky reef
polychaete reef	subtidal soft sediments like sand and mud
saltmarsh	

Higher sensitivity habitats [2]	Lower sensitivity habitats [3]
subtidal kelp beds	
subtidal seagrass	

[2] *Higher sensitivity habitats have a low resistance to, and recovery rate, from human pressures.*
[3] *Lower sensitivity habitats have a medium to high resistance to, and recovery rate from, human pressures.*

13.A

APPENDIX 13.A Baseline Noise Monitoring

APPENDIX A

Baseline Noise Monitoring

Figure A1: Noise Monitoring Locations



Noise Monitoring Location 1

Location

NML 1 was located at 76 Harbour Village, SA640DZ. Noise monitoring was undertaken at NML1 on 21/01/25 – 03/02/25. The outdoor noise monitoring equipment was positioned high on the cliff overlooking the port. In addition to the noise monitoring equipment a weather station was also deployed at this location to monitor meteorological conditions throughout the noise measurement period.

Subjective Notes

Shipping noise and noise from the port could be heard very faintly. Winds were starting to pick up ahead of the storm, so wind noise and wind induced vegetation noise was dominant.

Noise Equipment

Details of the monitoring equipment used at NML1 are described in Table A1 below, with photographs being shown in Table A2.

Table A1: SoundExpert 821 Noise Instrument Records (NML1)

SoundExpert 821				
Equipment	Model / Type	Serial Number	Calibration Certificate Number	Last Calibration Date
Sound Level Meter	SoundExpert 821	40138	2023015443	16/11/2023
Preamplifier	PRM821	001152	2023015443	16/11/2023
Microphone	PCB 377B02	352209	2023015443	16/11/2023

The location of NML1 can be found in Volume II Figure 12.2 Noise Monitoring Locations, and Figure A1 above. The calibration certificate for equipment used at NML1 is shown below in Figure A2.

Table A2: Photographs of Sound Expert 40138 Sound Level Meter at NML 1 from Northern, Southern, Easterly and Westerly Directions (21/01/25 – 03/02/25)

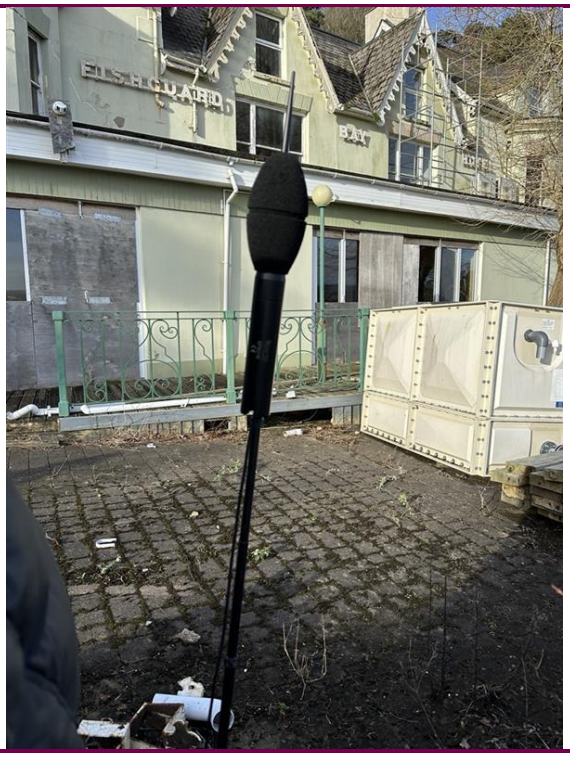
North	East
	
South	**West**
	

Figure A2: SoundExpert 821 40138 Calibration Certificate NML1

Calibration Certificate

Certificate Number 2023015443
Customer:
Irwin Carr Consulting
7 Osborne Promenade
Warrenpoint
County Down, BT34 3NQ, United Kingdom

Model Number	SoundExpert 821		***Procedure Number***	D0001.8466	
Serial Number	40138		***Technician***	Jacob Cannon	
Test Results	**Pass**		***Calibration Date***	16 Nov 2023	
Initial Condition	As Manufactured		***Calibration Due***		
			Temperature	23.8 °C	± 0.25 °C
Description	SoundExpert 821 Class 1 Sound Level Meter Firmware Revision: 1.002R02		***Humidity***	51.7 %RH	± 2.0 %RH
			Static Pressure	86.2 kPa	± 0.13 kPa

Evaluation Method ***Tested with:*** ***Data reported in dB re 20 µPa.***

Larson Davis CAL200. S/N 9079
TMS 9917C. S/N 219
Larson Davis PRM821. S/N 001152
PCB 377B02. S/N 352209

Compliance Standards Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8467:

IEC 60651:2001 Type 1	ANSI S1.4-2014 Class 1
IEC 60804:2000 Type 1	ANSI S1.4 (R2006) Type 1
IEC 61260:2014 Class 1	ANSI S1.11-2014 Class 1
IEC 61672:2013 Class 1	ANSI S1.43 (R2007) Type 1

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017.
Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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Correction data from Larson Davis SoundExpert 721/821 Manual, I821.01 Rev A

For 1/4" microphones, the Larson Davis ADP024 1/4" to 1/2" adaptor is used with the calibrators and the Larson Davis ADP043 1/4" to 1/2" adaptor is used with the preamplifier.

LARSON DAVIS – A PCB DIVISION
1681 West 820 North
Provo, UT 84601, United States
716-684-0001

ACCREDITED CERT #3622.01

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2023-11-16T13:27:43 **Page 1 of 3** D0001.8468 Rev C

Certificate Number 2023015443

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

Periodic tests were performed in accordance with procedures from IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part3.

No Pattern approval for IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1 available.

The sound level meter submitted for testing successfully completed the periodic tests of IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part 3, for the environmental conditions under which the tests were performed. However, no general statement or conclusion can be made about conformance of the sound level meter to the full specifications of IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1 because (a) evidence was not publicly available, from an independent testing organization responsible for pattern approvals, to demonstrate that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1 or correction data for acoustical test of frequency weighting were not provided in the Instruction Manual and (b) because the periodic tests of IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part 3 cover only a limited subset of the specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1.

Standards Used

Description	Cal Date	Cal Due	Cal Standard
Hart Scientific 2626-S Humidity/Temperature Sensor	2023-02-20	2024-08-20	006946
Larson Davis CAL200 Acoustic Calibrator	2023-07-17	2024-07-17	007027
Larson Davis Model 831	2023-02-22	2024-02-22	007182
PCB 377A13 1/2 inch Prepolarized Pressure Microphone	2023-03-06	2024-03-06	007185
SRS DS360 Ultra Low Distortion Generator	2023-03-30	2024-03-30	007635
TMS 9917C-LD Microphone Comparison Calibrator	2023-03-14	2024-03-14	007649
Larson Davis 1/2" Preamplifier for Model 831 Type 1	2023-09-28	2024-09-28	PCB0004783

Acoustic Calibration

Measured according to IEC 61672-3:2013 10 and ANSI S1.4-2014 Part 3: 10

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
1000 Hz	114.01	113.80	114.20	0.14	Pass

Loaded Circuit Sensitivity

Measurement	Test Result [dB re 1 V / Pa]	Lower Limit [dB re 1 V / Pa]	Upper Limit [dB re 1 V / Pa]	Expanded Uncertainty [dB]	Result
1000 Hz	-26.01	-27.50	-24.50	0.14	Pass

-- End of measurement results--

Acoustic Signal Tests, C-weighting

Measured according to IEC 61672-3:2013 12 and ANSI S1.4-2014 Part 3: 12 using a comparison coupler with Unit Under Test (UUT) and reference SLM using slow time-weighted sound level for compliance to IEC 61672-1:2013 5.5; ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Expected [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
125	-0.20	-0.20	-1.20	0.80	0.40	Pass
1000	0.20	0.00	-0.70	0.70	0.40	Pass
8000	-3.20	-3.00	-5.50	-1.50	0.50	Pass

-- End of measurement results--

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Certificate Number 2023015443

Self-generated Noise

Measured according to IEC 61672-3:2013 11.1 and ANSI S1.4-2014 Part 3: 11.1

Measurement	Test Result [dB]
A-weighted	29.38

-- End of measurement results--

-- End of Report--

Signatory: Jacob Cannon

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Noise Monitoring Location 2

Location

NML 2 was located at Fishguard Bay Hotel, Quay Road, Goodwick. Noise monitoring was undertaken at NML2 on 21/01/25 – 03/02/25. The outdoor noise monitoring equipment was located close to the port. HGVs pass this position on the access road, which is directly below this position.

Subjective Notes

HGV reversing alarms were audible during the survey. There is a ramp which makes an abrupt noise when driven over. Upon setup the Stena Line boat was parked up with its engine running so that could be heard whirring away in the distance. A train line runs along the access road to the port. A train pass was seen during the attended period, audible from this position.

Noise Equipment

Details of the monitoring equipment used at NML2 are described below in Table A3, with photographs being shown in Table A4.

Table A3: SoundExpert 821 Noise Instrument Records (NML2)

SoundExpert 821				
Equipment	**Model / Type**	**Serial Number**	**Calibration Certificate Number**	**Last Calibration Date**
Sound Level Meter	SoundExpert 821	40398	2024013665	18/09/2024
Preamplifier	PRM821	001806	2024013665	18/09/2024
Microphone	PCB 377B02	359302	2024013665	18/09/2024

The location of NML2 can be found in Volume II Figure 12.2 Noise Monitoring Locations, and Figure A1 above. The calibration certificate for equipment used at NML2 is shown below in Figure A3.

Table A4: Photographs of Sound Expert 40398 Sound Level Meter at NML2 from Northern, Southern, Easterly and Westerly Directions (21/01/25 – 03/02/25)

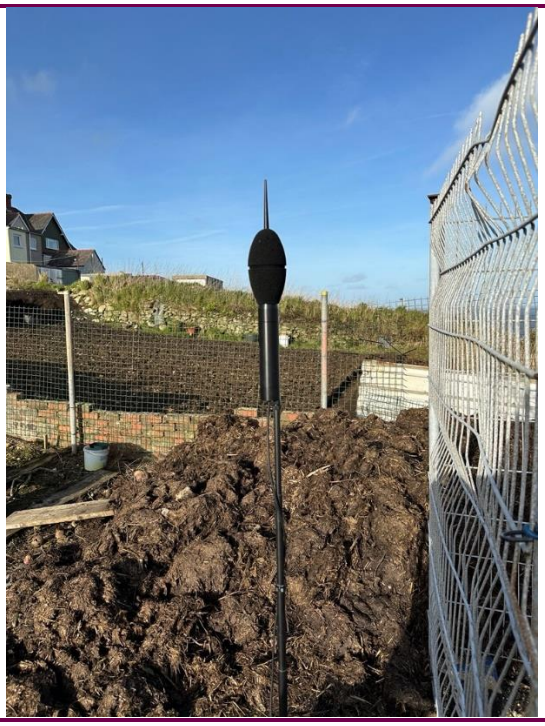
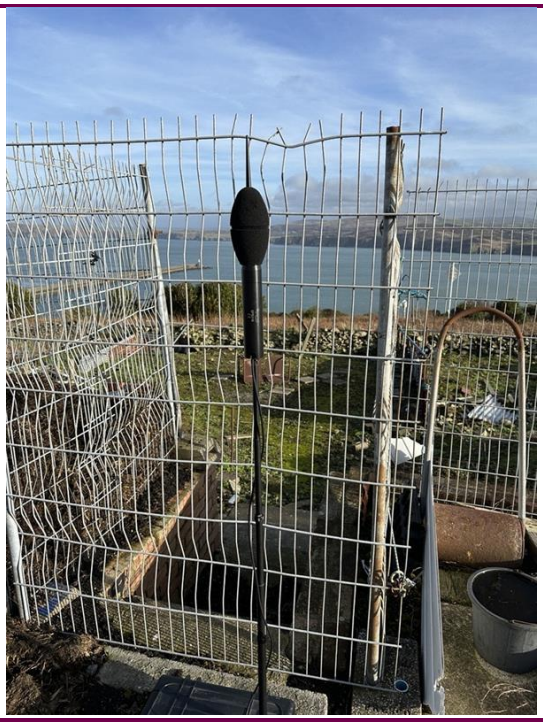
North	East
	
South	**West**
	

Figure A3: Sound Expert 821 40398 Calibration Certificate NML2

Calibration Certificate

Certificate Number 2024013665
Customer:
Irwin Carr Consulting
121 Ormeau Road
Belfast, BT7 1SH United Kingdom

Model Number	SoundExpert 821	***Procedure Number***	D0001.8466
Serial Number	40398	***Technician***	Jacob Cannon
Test Results	**Pass**	***Calibration Date***	2024-09-18
Initial Condition	As Manufactured	***Calibration Due***	
Description	SoundExpert 821 Class 1 Sound Level Meter Firmware Revision: 1.300R17	***Temperature***	23.47 °C ± 0.25 °C
		Humidity	53.2 %RH ± 2.0 %RH
		Static Pressure	86.02 kPa ± 0.13 kPa

Evaluation Method ***Tested with:*** ***Data reported in dB re 20 µPa.***

TMS 9917C, S/N 219
Larson Davis CAL200, S/N 9079
Larson Davis PRM821, S/N 001806
PCB 377B02, S/N 359302

Compliance Standards Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8467:

IEC 60651:2001 Type 1	ANSI S1.4-2014 Class 1
IEC 60804:2000 Type 1	ANSI S1.4 (R2006) Type 1
IEC 61260:2014 Class 1	ANSI S1.11-2014 Class 1
IEC 61672:2013 Class 1	ANSI S1.43 (R2007) Type 1

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). The results documented in this certificate relate only to the item(s) calibrated or tested. It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017.
Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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Correction data from Larson Davis SoundExpert 721/821 Manual, I821.01 Rev B

For 1/4" microphones, the Larson Davis ADP024 1/4" to 1/2" adaptor is used with the calibrators and the Larson Davis ADP043 1/4" to 1/2" adaptor is used with the preamplifier.

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Certificate Number 2024013665

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

Periodic tests were performed in accordance with procedures from IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part3.

No Pattern approval for IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1 available.

The sound level meter submitted for testing successfully completed the periodic tests of IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part 3, for the environmental conditions under which the tests were performed. However, no general statement or conclusion can be made about conformance of the sound level meter to the full specifications of IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1 because (a) evidence was not publicly available, from an independent testing organization responsible for pattern approvals, to demonstrate that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1 or correction data for acoustical test of frequency weighting were not provided in the Instruction Manual and (b) because the periodic tests of IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part 3 cover only a limited subset of the specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1.

Standards Used

Description	Cal Date	Cal Due	Cal Standard
Hart Scientific 2626-S Humidity/Temperature Sensor	2024-05-07	2025-11-07	006943
Larson Davis CAL200 Acoustic Calibrator	2024-07-18	2025-07-18	007027
PCB 377A13 1/2 inch Prepolarized Pressure Microphone	2024-02-12	2025-02-12	007080
Larson Davis Model 831	2024-02-15	2025-02-15	007182
SRS DS360 Ultra Low Distortion Generator	2024-03-26	2025-03-26	007635
TMS 9917C-LD Microphone Comparison Calibrator	2024-03-14	2025-03-14	007649
Larson Davis 1/2" Preamplifier for Model 831 Type 1	2023-09-28	2024-09-28	PCB0004783

Acoustic Calibration

Measured according to IEC 61672-3:2013 10 and ANSI S1.4-2014 Part 3: 10

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
1000 Hz	114.01	113.80	114.20	0.14	Pass

Loaded Circuit Sensitivity

Measurement	Test Result [dB re 1 V / Pa]	Lower Limit [dB re 1 V / Pa]	Upper Limit [dB re 1 V / Pa]	Expanded Uncertainty [dB]	Result
1000 Hz	-25.47	-27.50	-24.50	0.14	Pass

-- End of measurement results--

Acoustic Signal Tests, C-weighting

Measured according to IEC 61672-3:2013 12 and ANSI S1.4-2014 Part 3: 12 using a comparison coupler with Unit Under Test (UUT) and reference SLM using slow time-weighted sound level for compliance to IEC 61672-1:2013 5.5; ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Expected [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
125	-0.17	-0.20	-1.20	0.80	0.60	Pass
1000	0.26	0.00	-0.70	0.70	0.60	Pass
8000	-2.91	-3.00	-5.50	-1.50	0.81	Pass

-- End of measurement results--

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Certificate Number 2024013665

Self-generated Noise

Measured according to IEC 61672-3:2013 11.1 and ANSI S1.4-2014 Part 3: 11.1

Measurement	Test Result [dB]
A-weighted	24.58

-- End of measurement results--

-- End of Report--

Signatory: Jacob Cannon

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Noise Monitoring Location 3

Location

NML 3 was located at 30 Heol Dewi, SA659DY. Noise monitoring was undertaken at NML3 on 03/02/25-11/02/25. The outdoor monitoring equipment was located on the balcony of the residential property at 30 Heol Dewi.

Subjective Notes

Upon setup, conditions were quiet at this position, shielded from wind during the attended period. Stena Line ship could be seen and just about heard in the very distance idling. Mostly birdsong heard at this position and very occasional traffic on local roads.

Noise Equipment

Details of the monitoring equipment used at NML3 are provided below in Table A5, with photographs being shown in Table A6.

Table A5: SoundExpert 821 Noise Instrument Records (NML3)

SoundExpert 821				
Equipment	Model / Type	Serial Number	Calibration Certificate Number	Last Calibration Date
Sound Level Meter	SoundExpert 821	40397	2024013661	18/09/2024
Preamplifier	PRM821	001805	2024013661	18/09/2024
Microphone	PCB 377B02	359301	2024013661	18/09/2024

The location of NML3 can be found in Volume II Figure 12.2 Noise Monitoring Locations and Figure A1 above. The calibration certificate for equipment used at NML3 is shown below in Figure A4.

Table A6: Photographs of Sound Expert 40397 Sound Level Meter at NML3 from Northern, Southern, Easterly and Westerly Directions (03/02/25- 11/02/25)

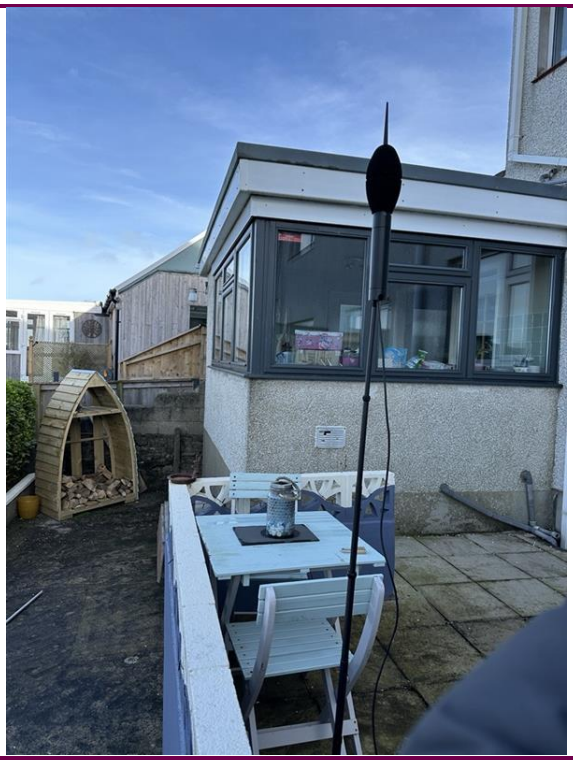
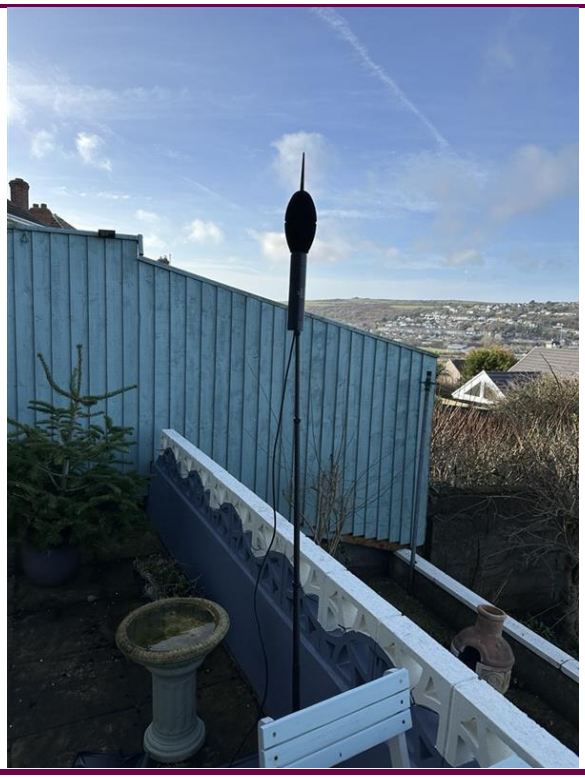
North	East
	
South	**West**
	

Figure A4: Sound Expert 821 40397 Calibration Certificate NML3

Calibration Certificate

Certificate Number 2024013661
Customer:
Irwin Carr Consulting
121 Ormeau Road
Belfast, BT7 1SH United Kingdom

Model Number	SoundExpert 821		***Procedure Number***	D0001.8466	
Serial Number	40397		***Technician***	Jacob Cannon	
Test Results	**Pass**		***Calibration Date***	2024-09-18	
Initial Condition	As Manufactured		***Calibration Due***		
Description	SoundExpert 821 Class 1 Sound Level Meter Firmware Revision: 1.300R17		***Temperature***	23.49 °C	± 0.25 °C
			Humidity	53.7 %RH	± 2.0 %RH
			Static Pressure	86.03 kPa	± 0.13 kPa

Evaluation Method ***Tested with:*** ***Data reported in dB re 20 µPa.***

Larson Davis CAL200, S/N 9079
TMS 9917C, S/N 219
Larson Davis PRM821, S/N 001805
PCB 377B02, S/N 359301

Compliance Standards Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8467:

IEC 60651:2001 Type 1	ANSI S1.4-2014 Class 1
IEC 60804:2000 Type 1	ANSI S1.4 (R2006) Type 1
IEC 61260:2014 Class 1	ANSI S1.11-2014 Class 1
IEC 61672:2013 Class 1	ANSI S1.43 (R2007) Type 1

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). The results documented in this certificate relate only to the item(s) calibrated or tested. It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017.
Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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Correction data from Larson Davis SoundExpert 721/821 Manual, I821.01 Rev B

For 1/4" microphones, the Larson Davis ADP024 1/4" to 1/2" adaptor is used with the calibrators and the Larson Davis ADP043 1/4" to 1/2" adaptor is used with the preamplifier.

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Certificate Number 2024013661

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

Periodic tests were performed in accordance with procedures from IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part3.

No Pattern approval for IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1 available.

The sound level meter submitted for testing successfully completed the periodic tests of IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part 3, for the environmental conditions under which the tests were performed. However, no general statement or conclusion can be made about conformance of the sound level meter to the full specifications of IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1 because (a) evidence was not publicly available, from an independent testing organization responsible for pattern approvals, to demonstrate that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1 or correction data for acoustical test of frequency weighting were not provided in the Instruction Manual and (b) because the periodic tests of IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part 3 cover only a limited subset of the specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1.

Standards Used

Description	Cal Date	Cal Due	Cal Standard
Hart Scientific 2626-S Humidity/Temperature Sensor	2024-05-07	2025-11-07	006943
Larson Davis CAL200 Acoustic Calibrator	2024-07-18	2025-07-18	007027
PCB 377A13 1/2 inch Prepolarized Pressure Microphone	2024-02-12	2025-02-12	007080
Larson Davis Model 831	2024-02-15	2025-02-15	007182
SRS DS360 Ultra Low Distortion Generator	2024-03-26	2025-03-26	007635
TMS 9917C-LD Microphone Comparison Calibrator	2024-03-14	2025-03-14	007649
Larson Davis 1/2" Preamplifier for Model 831 Type 1	2023-09-28	2024-09-28	PCB0004783

Acoustic Calibration

Measured according to IEC 61672-3:2013 10 and ANSI S1.4-2014 Part 3: 10

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
1000 Hz	114.00	113.80	114.20	0.14	Pass

Loaded Circuit Sensitivity

Measurement	Test Result [dB re 1 V / Pa]	Lower Limit [dB re 1 V / Pa]	Upper Limit [dB re 1 V / Pa]	Expanded Uncertainty [dB]	Result
1000 Hz	-25.74	-27.50	-24.50	0.14	Pass

-- End of measurement results--

Acoustic Signal Tests, C-weighting

Measured according to IEC 61672-3:2013 12 and ANSI S1.4-2014 Part 3: 12 using a comparison coupler with Unit Under Test (UUT) and reference SLM using slow time-weighted sound level for compliance to IEC 61672-1:2013 5.5; ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Expected [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
125	-0.21	-0.20	-1.20	0.80	0.60	Pass
1000	0.23	0.00	-0.70	0.70	0.60	Pass
8000	-2.54	-3.00	-5.50	-1.50	0.81	Pass

-- End of measurement results--

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Certificate Number 2024013661

Self-generated Noise

Measured according to IEC 61672-3:2013 11.1 and ANSI S1.4-2014 Part 3: 11.1

Measurement	Test Result [dB]
A-weighted	24.11

-- End of measurement results--

-- End of Report--

Signatory: Jacob Cannon

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13.B

APPENDIX 13.B
Noise Monitoring Results and Analysis

APPENDIX B

Noise Monitoring Results and Analysis

NOISE MONITORING LOCATION 1

Results

Results of the noise survey conducted at NML1 are shown below in Figure B1 and B2.

Figure B1: Noise Monitoring Location 1 Complete Noise Monitoring Data (21/01/2025 – 03/02/2025)

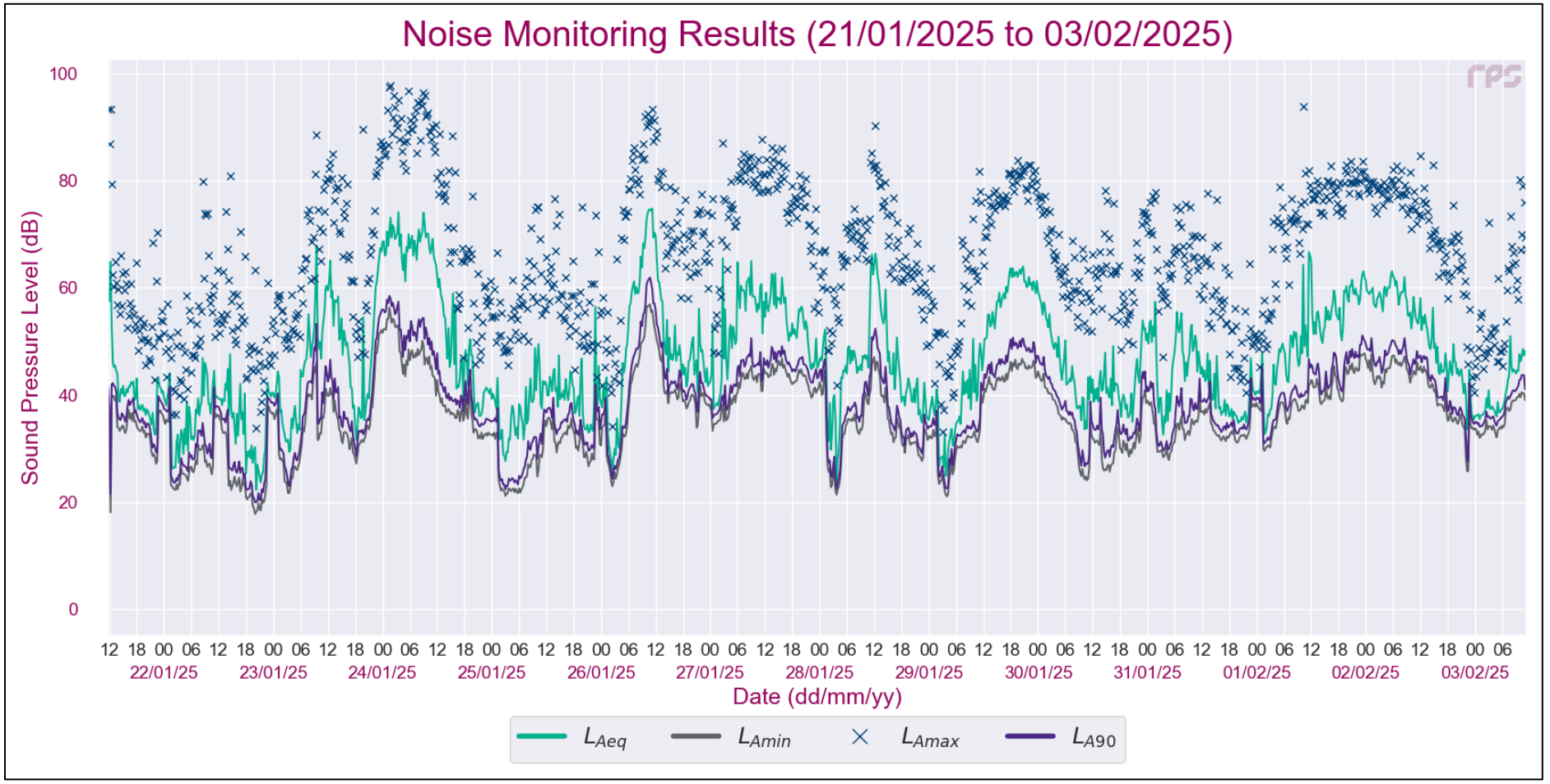
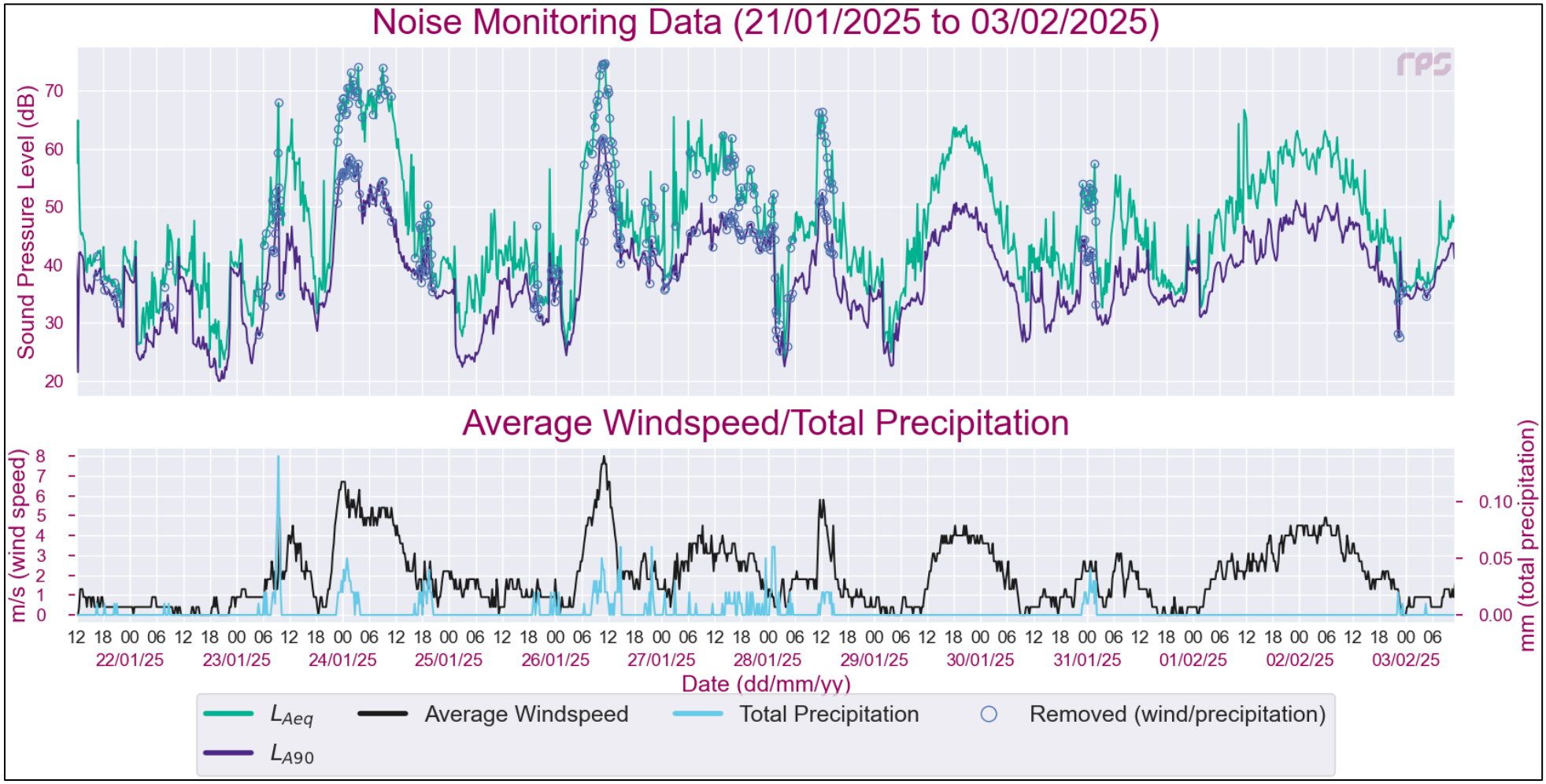


Figure B2: Noise Monitoring Location 1 Noise and Weather Data (21/01/2025 – 03/02/2025)



Analysis

Analysis of the noise data collected at NML1 is shown below in Figure B3 and B4.

Figure B3: Daytime Histogram Showing $L_{Aeq\ 1hr}$ and $L_{A90\ 1hr}$ at Noise Monitoring Location 1 (21/01/2025 – 03/02/2025)

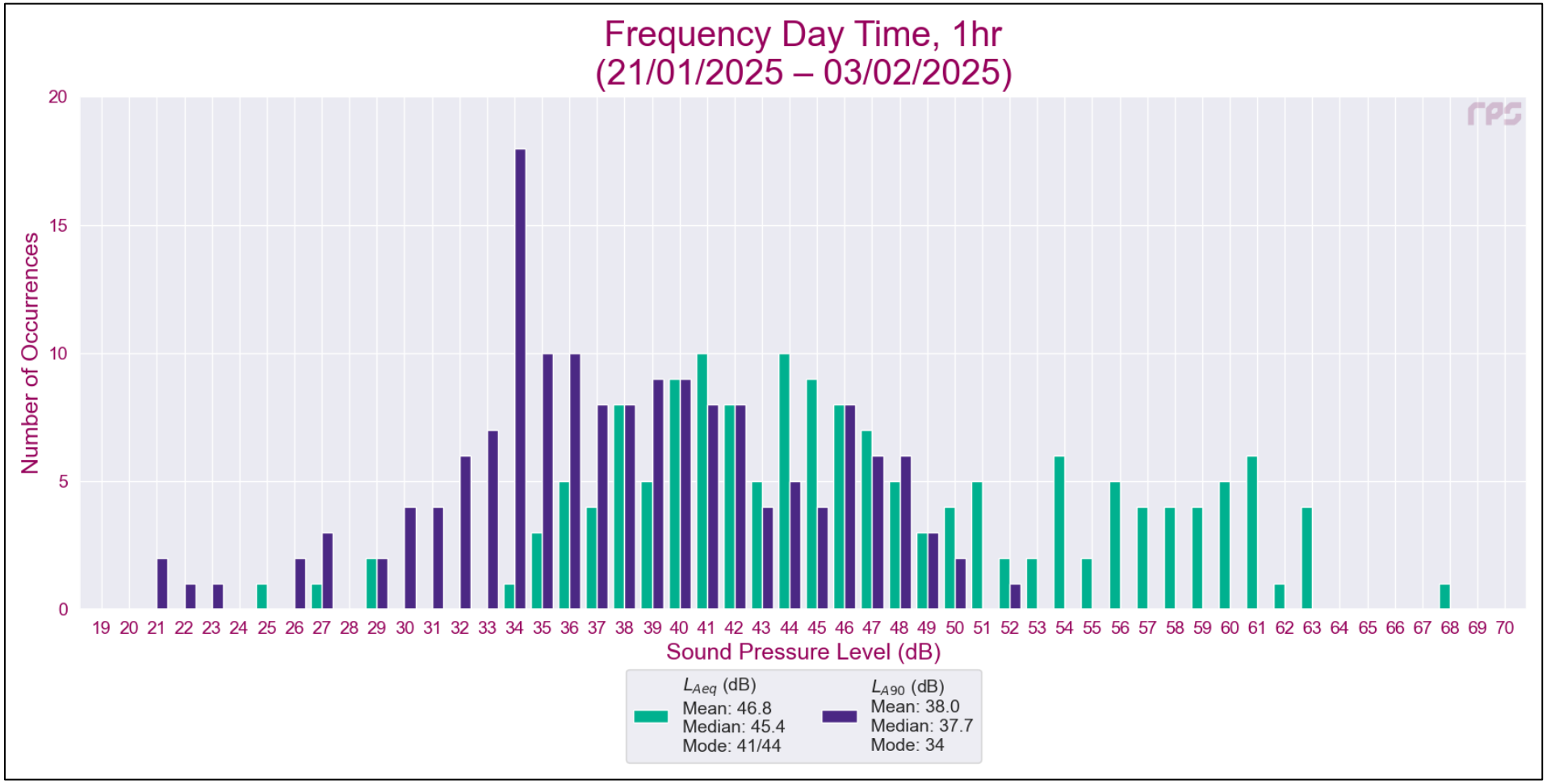
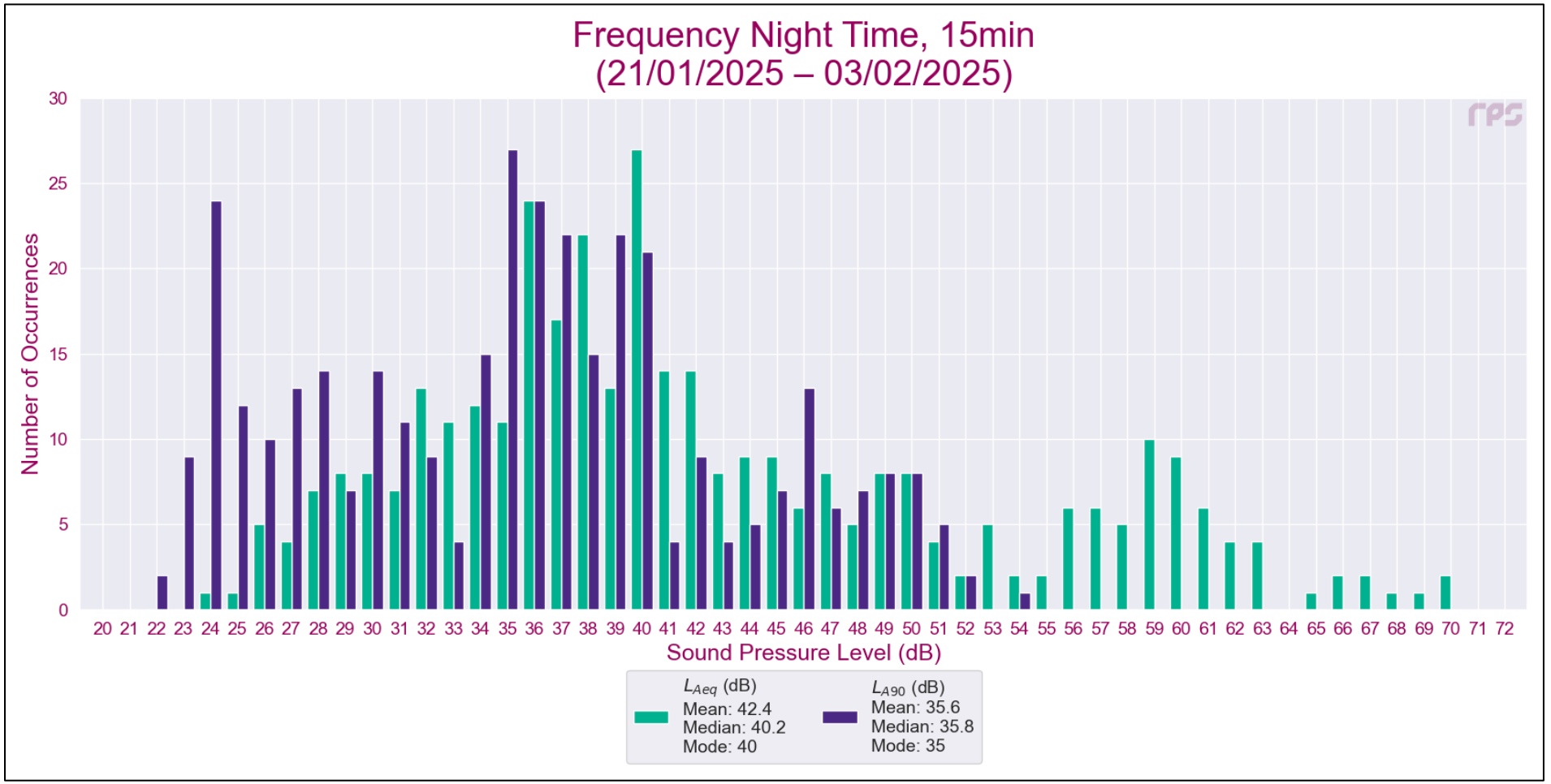


Figure B4: Night-time Histogram Showing $L_{Aeq\ 15min}$ and $L_{A90\ 15min}$ at Noise Monitoring Location 1 (21/01/2025 – 03/02/2025)



NOISE MONITORING LOCATION 2

Results

Results of the noise survey conducted at NML2 are shown below in Figure B5 and B6.

Figure B5: Noise Monitoring Location 2 Complete Noise Data (21/01/2025 – 03/02/2025)

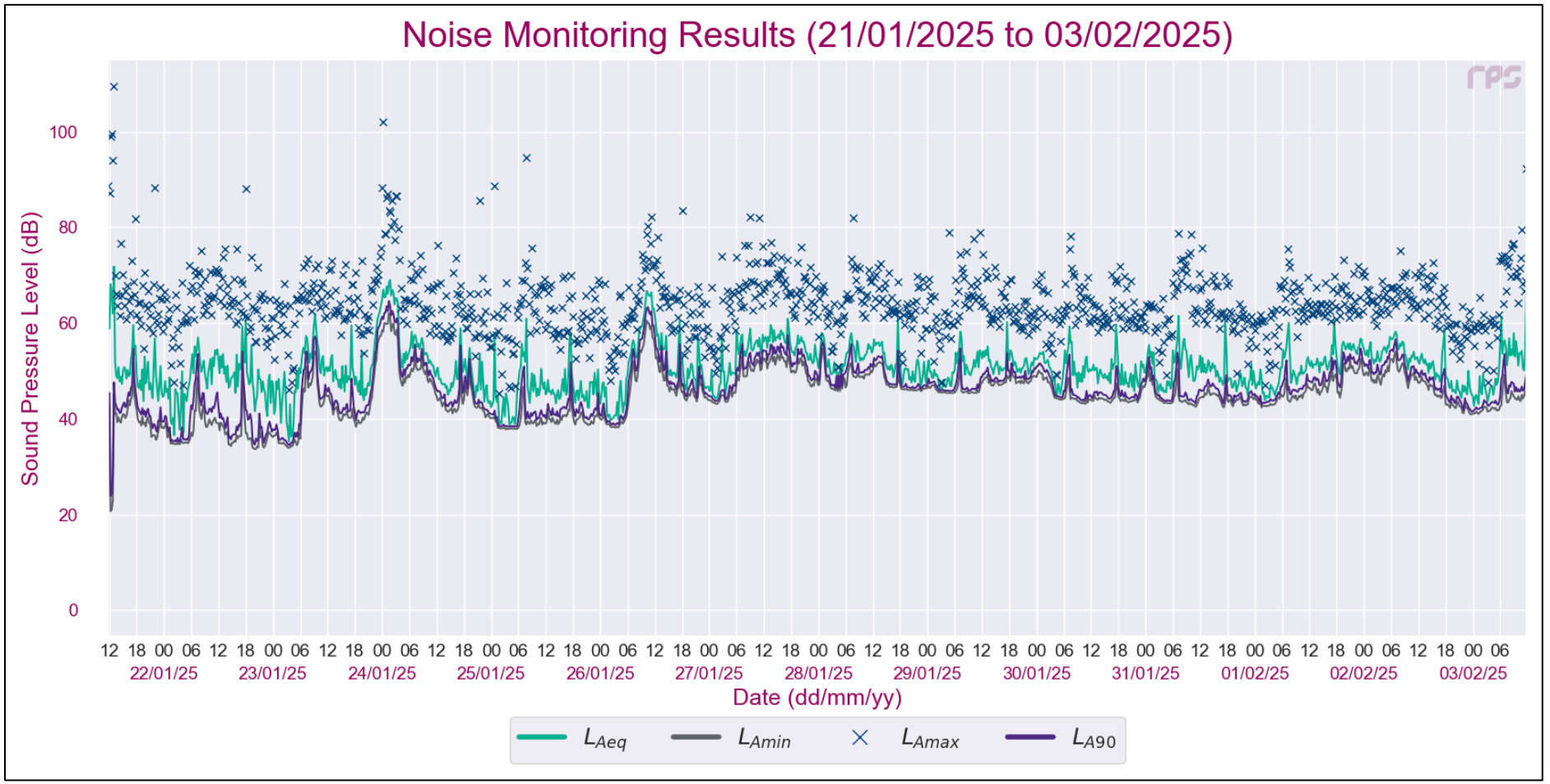
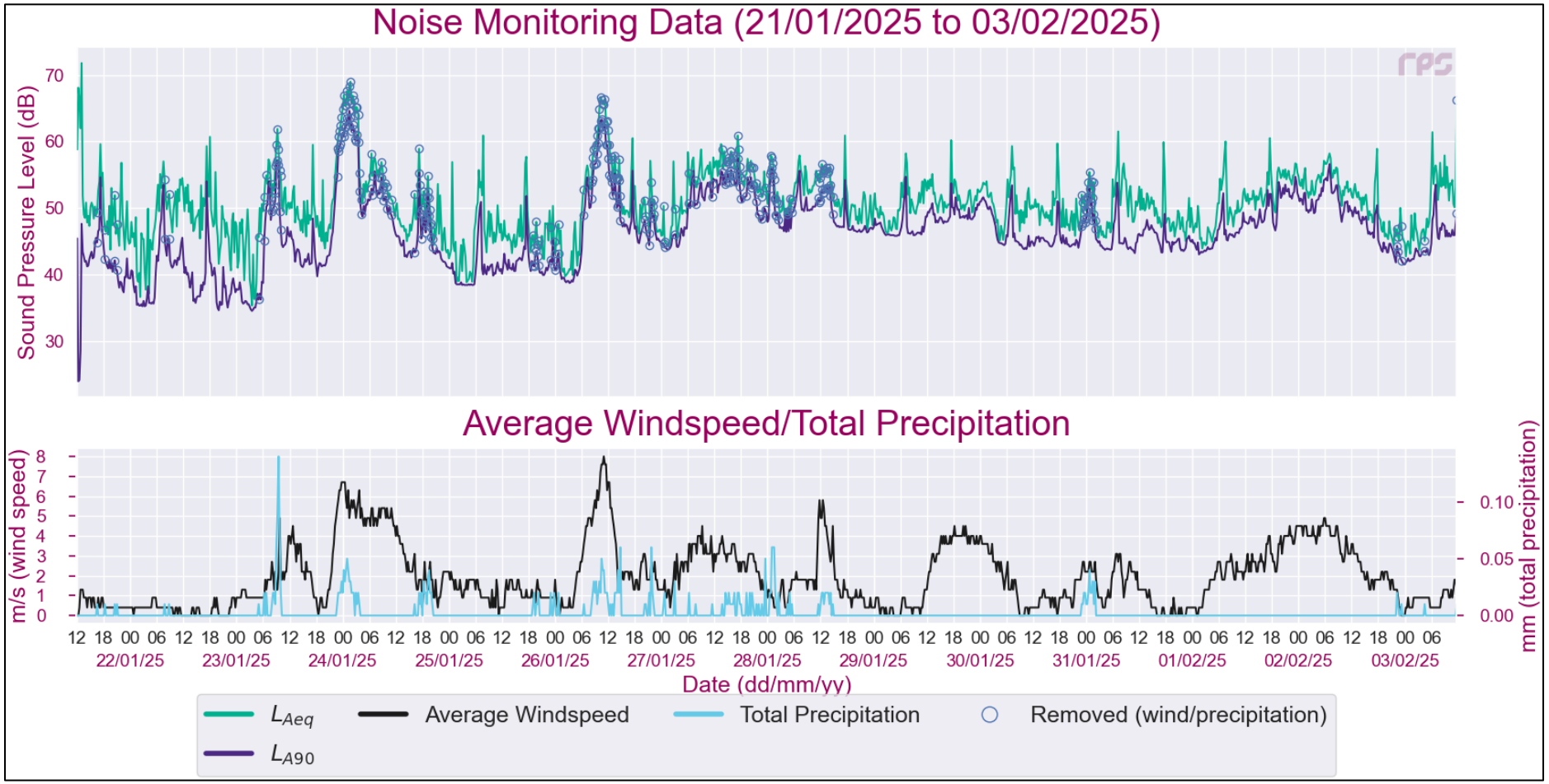


Figure B6: Noise Monitoring Location 2 Noise and Weather (21/01/2025 – 03/02/2025)



Analysis

Analysis of the noise data collected at NML2 is shown below in Figure B7 and B8.

Figure B7: **Daytime Histogram Showing $L_{Aeq\ 1hr}$ and $L_{A90\ 1hr}$ at Noise Monitoring Location 2 (21/01/2025 – 03/02/2025)**

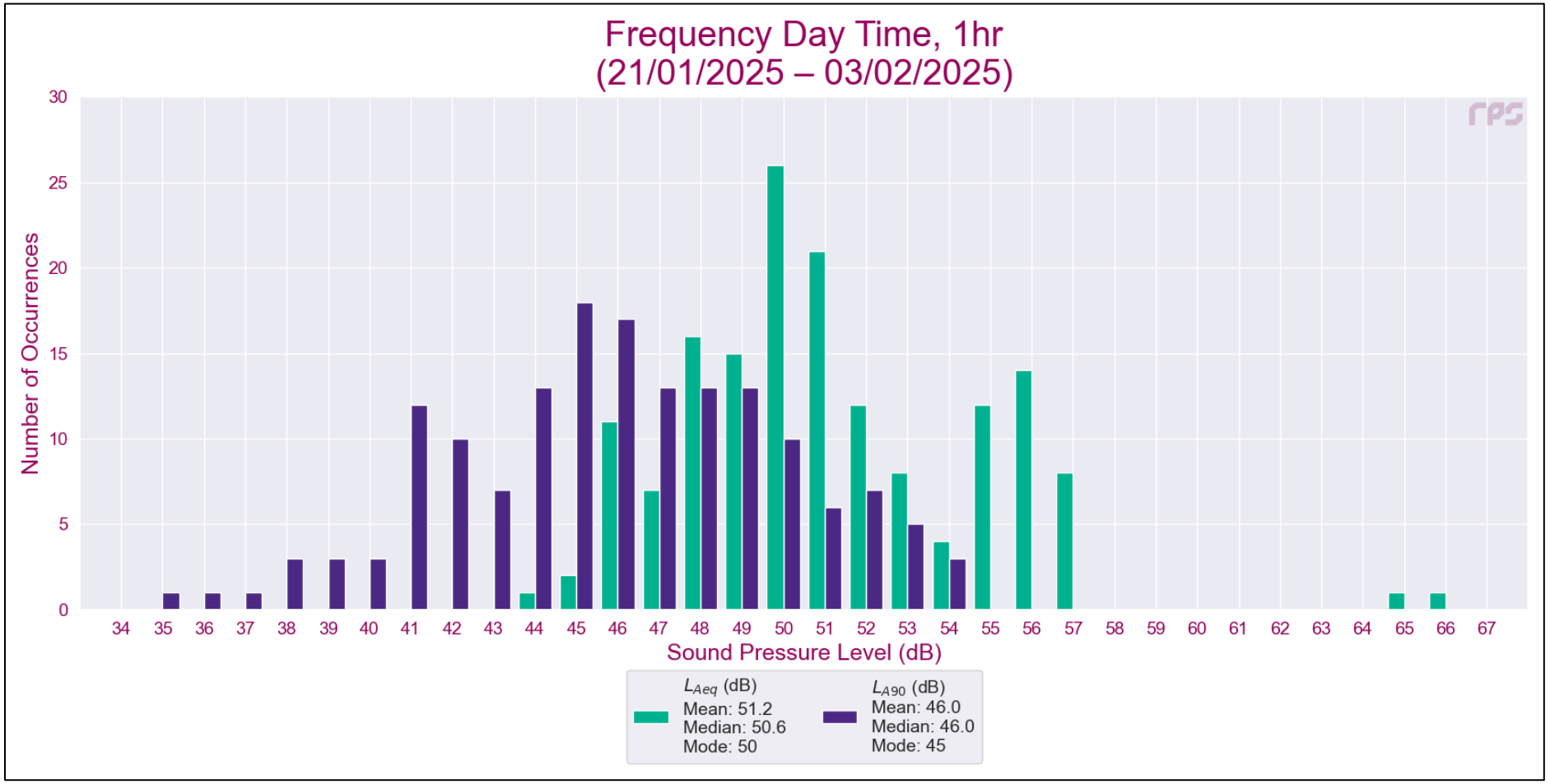
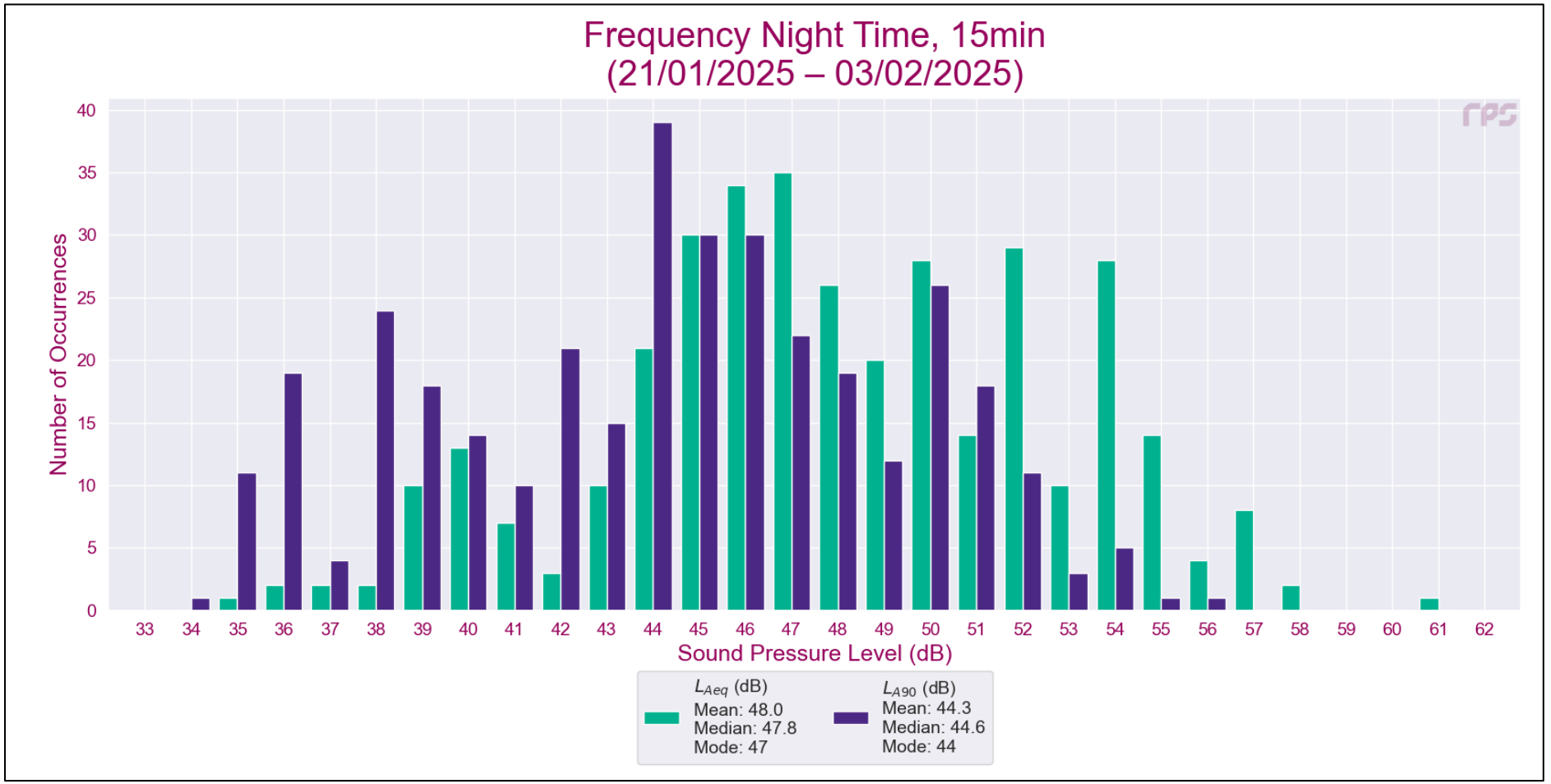


Figure B8: Night-time Histogram Showing $L_{Aeq\ 15min}$ and $L_{A90\ 15min}$ at Noise Monitoring Location 2 (21/01/2025 – 03/02/2025)



NOISE MONITORING LOCATION 3

Results

Results of the noise survey conducted at NML3 are shown below in Figure B9 and B10.

Figure B9: Noise Monitoring Location 3 Complete Noise Data (03/02/2025 – 11/02/2025)

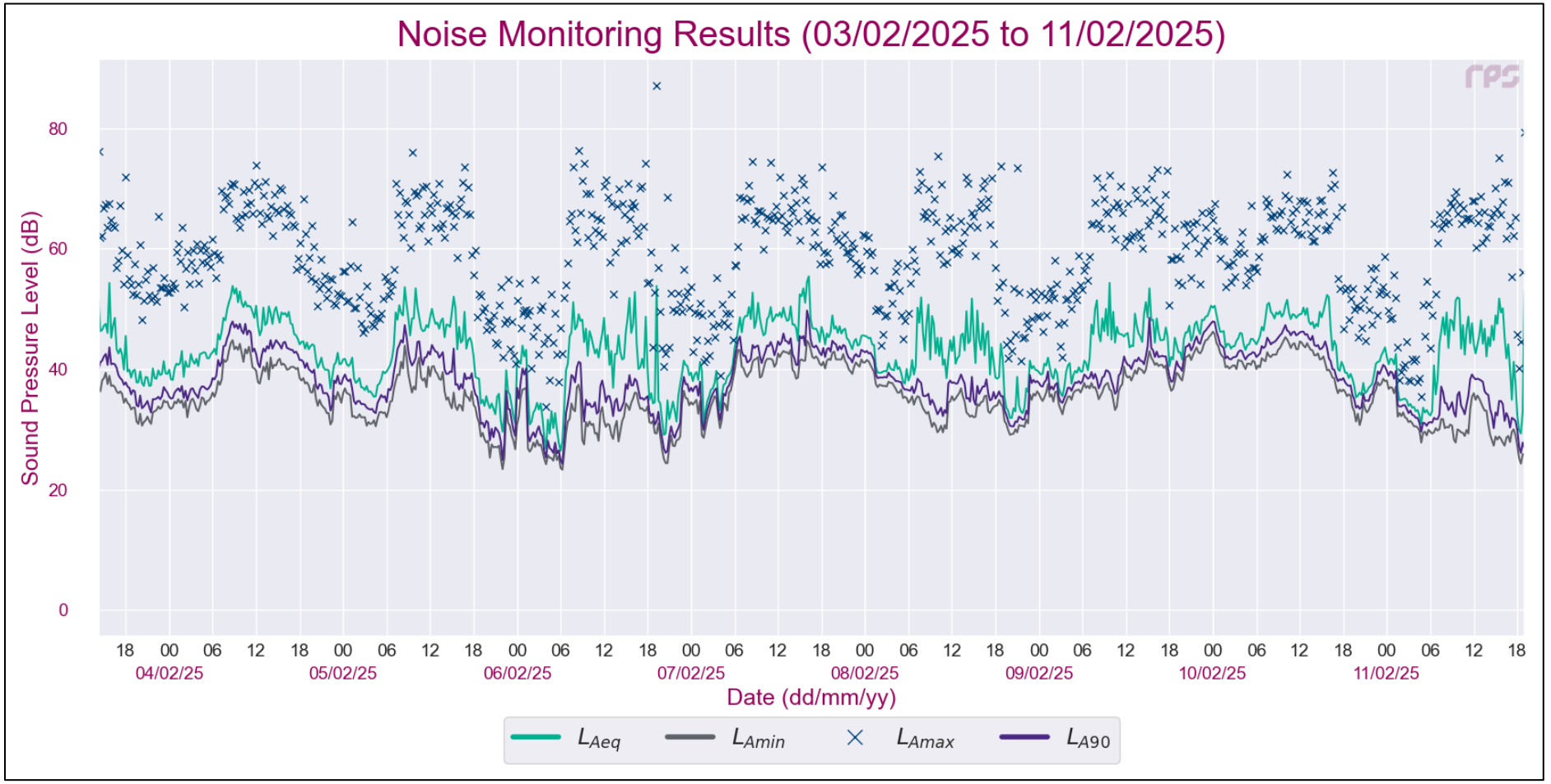
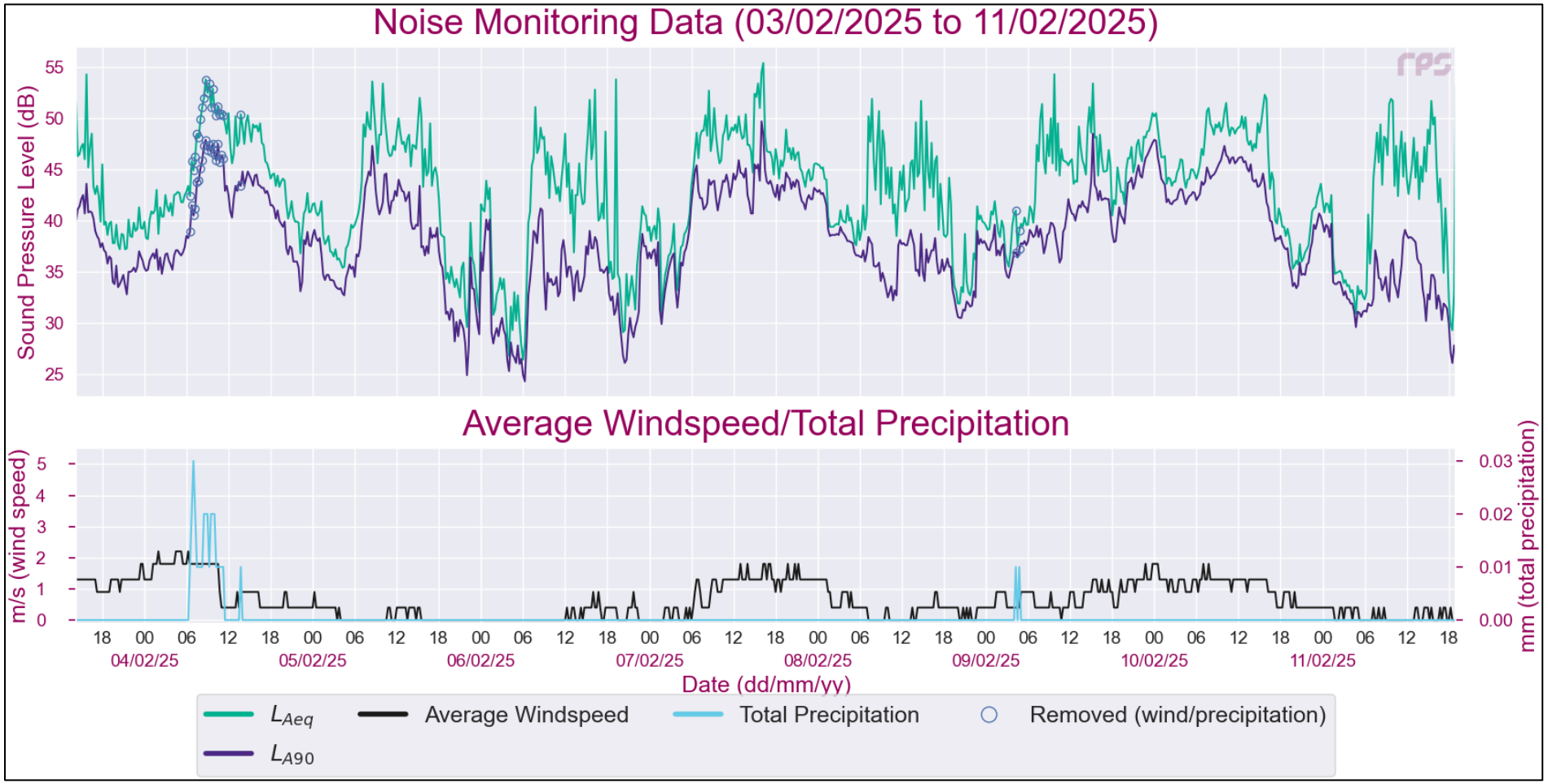


Figure B10: Noise Monitoring Location 3 Noise and Weather Data (03/02/2025 – 11/02/2025)



Analysis

Analysis of the noise data collected at NML3 is shown below in Figure B11 and B12.

Figure B11: Daytime Histogram Showing $L_{Aeq\ 1hr}$ and $L_{A90\ 1hr}$ at Noise Monitoring Location 3 (03/02/2025 – 11/02/2025)

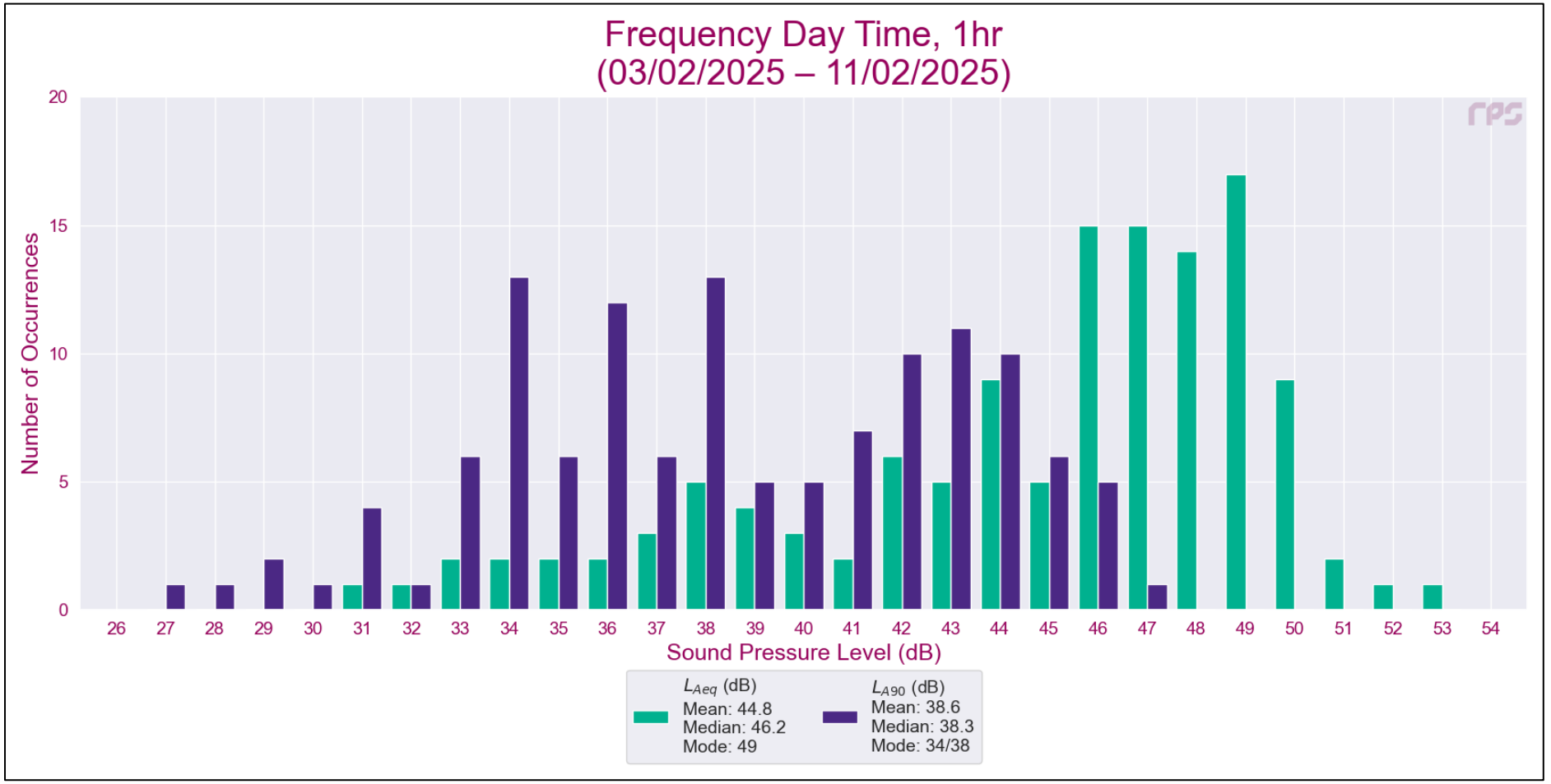
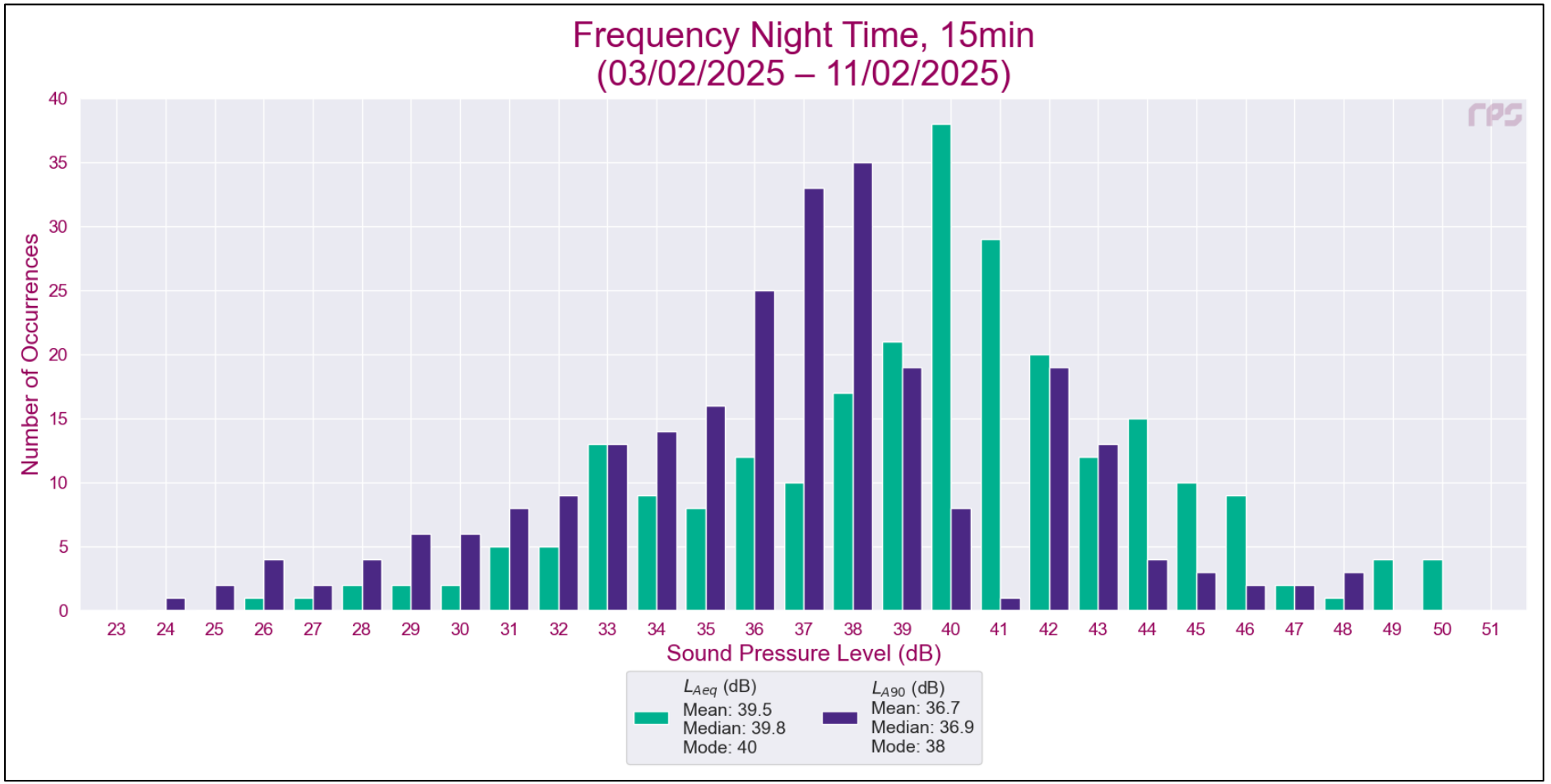


Figure B12: Night-time Histogram Showing $L_{Aeq\ 15min}$ and $L_{A90\ 15min}$ at Noise Monitoring Location 3 (03/02/2025 – 11/02/2025)



SUMMARY OF BACKGROUND NOISE LEVELS

The typical background noise levels in accordance with BS 4142 for the daytime and night-time periods are summarised below in Table B1 below

Table B1: Typical (Mode) L_{A90} and L_{Aeq} Noise Levels at Noise Monitoring Location 1, 2 & 3

Noise Monitoring Location	L_{A90} Analysis		L_{Aeq} Analysis	
	Daytime (dB)	Night-time (dB)	Daytime (dB)	Night-time (dB)
1	34	35	41/44	40
2	45	44	50	47
3	34/38	38	49	40

13.C

APPENDIX 13.C Construction Noise Assessment

Appendix C

Construction Noise Assessment

Summary of Construction Methodologies

The project involves several key activities aimed at enhancing the infrastructure and operational capabilities of the harbour. These include the following:

- Demolition of
    - Disused RNLI slipway structure
    - Buffer Dolphin
    - Suspended deck structure
    - 3 No. small disused kiosks
- Removal of
    - Linkspan bridge, equipment and cabin
    - Jack up barge
- Dredging with disposal at sea
- Reclamation
- Scour protection to the berth and dredged slope to the rear of the berth.
- Piled Reinforced Concrete Bankseat
- Tubular Steel Guide Pile
- Floating pontoon linkspan installation
- Terminal reconfiguration
- Temporary Works

Ferry Operational

Demolition of RNLI Slipway

It will be necessary to demolish or dismantle a number of structures to enable the construction of the civil engineering works and the installation of the Linkspan Pontoon. These are presented in **Figure C.1**, below. Note the car ramp structure is to be demolished and removed in advance of the rest of the works.

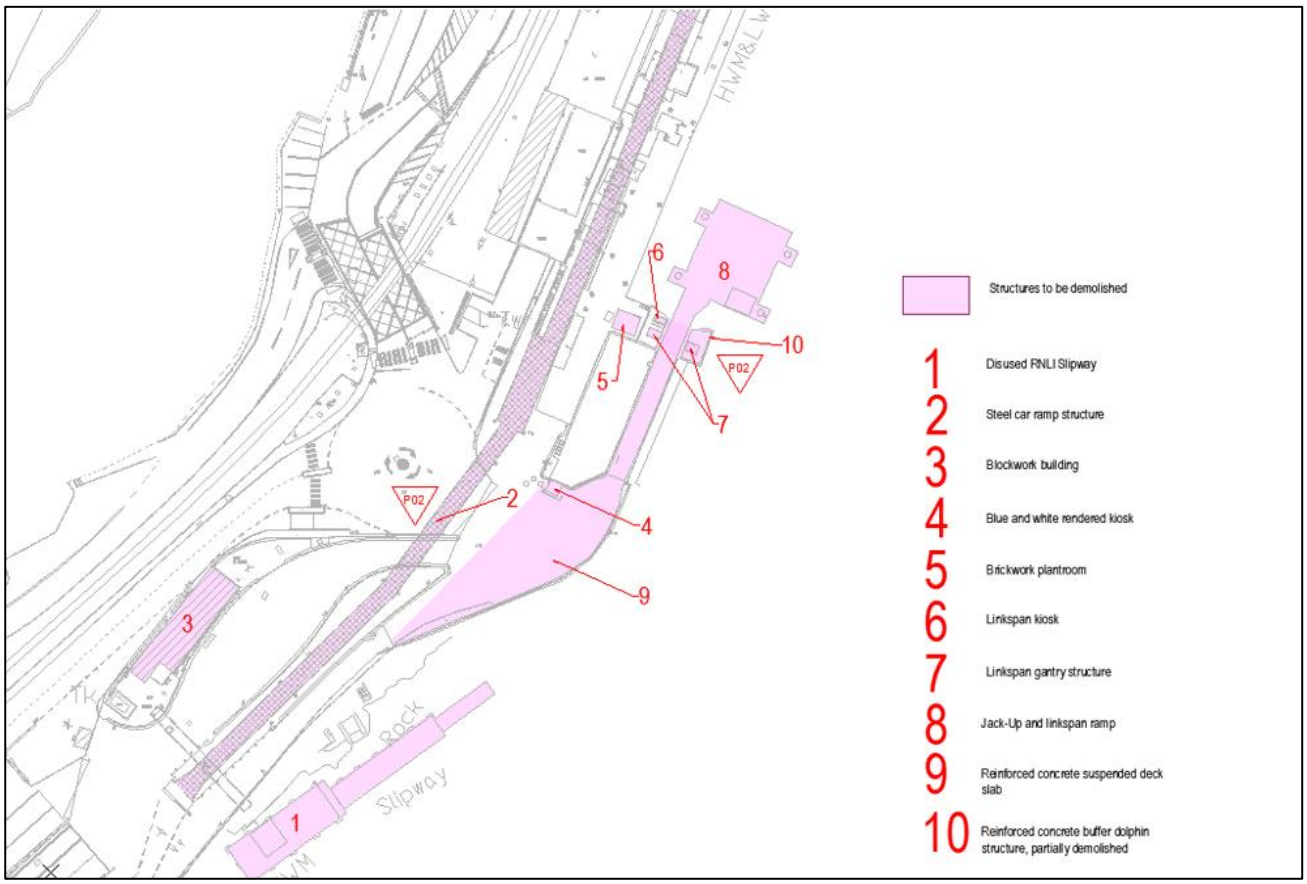


Figure C.1: Extents of Demolition/Removal from site

Two phases of demolition will be required. The structures to be demolished or removed whilst the ferry remains operational are as follows:

The existing disused RNLI slipway, presented in Figure C.2 below will be removed using land-based excavators equipped with rock breakers and hydraulic grabs. The area of the RNLI slipway is within the area of reclamation. The shoreline in this area around the slipway consists of concrete or block retaining walls, rock rubble revetment or exposed bedrock. Approximate volume of material to be removed is 350m^3





Figure C.2: Disused RNLI Slipway Structure

Dredging in the wider harbour and outside the area of the jack up barge

Dredging of the wider harbour and area outside of the jack up barge is expected to be carried out whilst the ferry remains operational. These areas include the Reclamation Area (to remove soft material to allow construction), Areas E and Area H. these areas are shown below in Figure C.3 and Figure C.4.

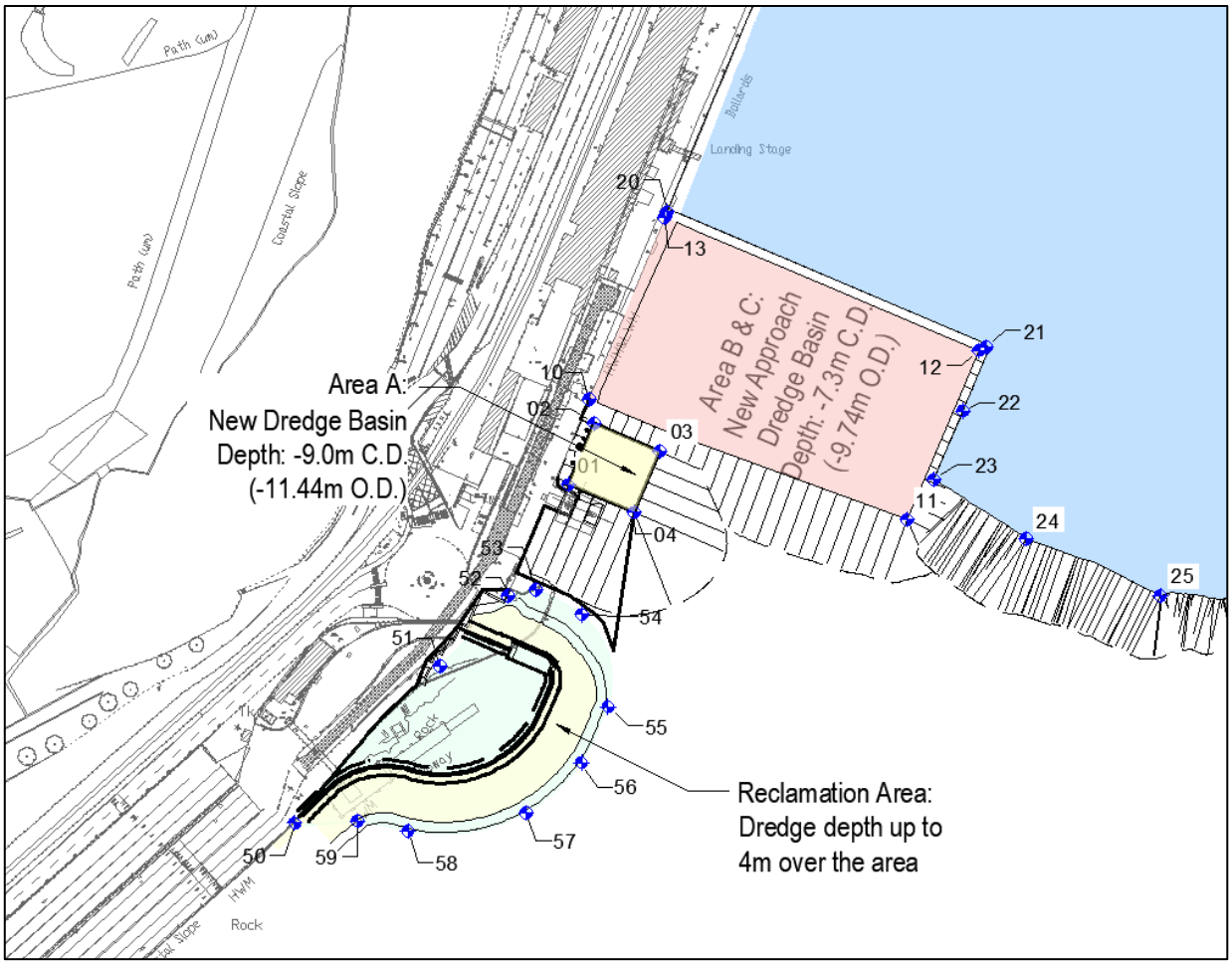


Figure C.3: Dredge Areas A, B and C and the Reclamation Area

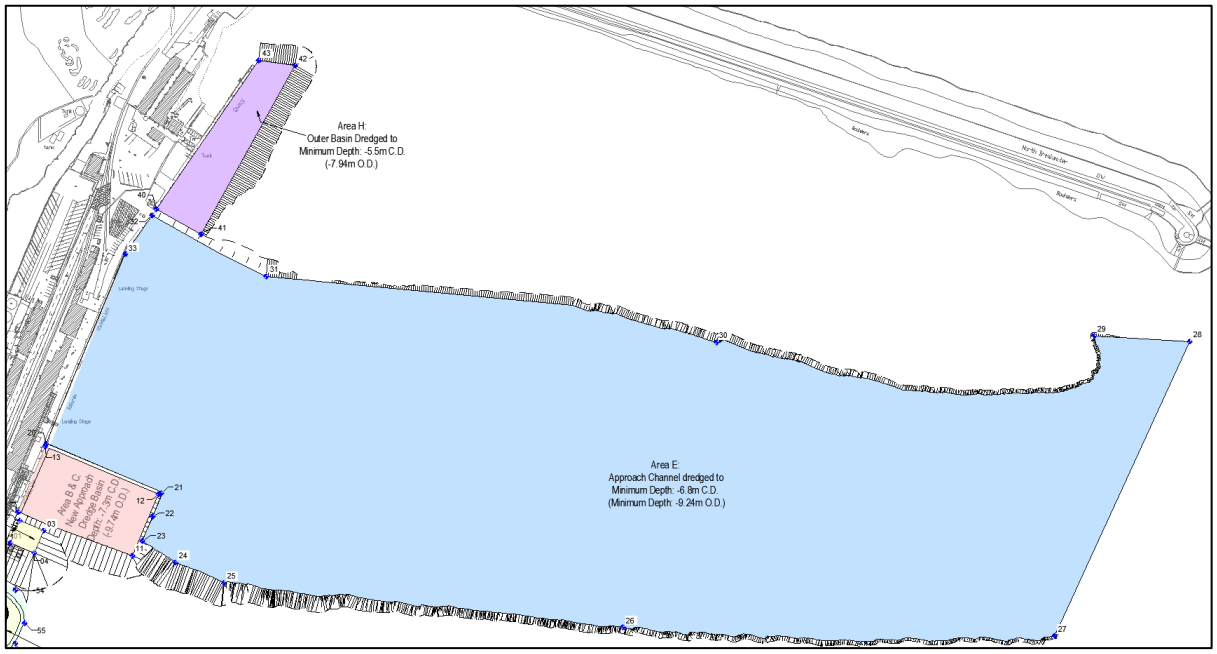


Figure C.4: Dredge Areas E and H

Reclamation and revetment construction and paving works

Construction of the new reclamation area will be undertaken against the shoreline in the vicinity of the old RNLI slipway. The extent of the reclamation is shown in Figure C.5 below.

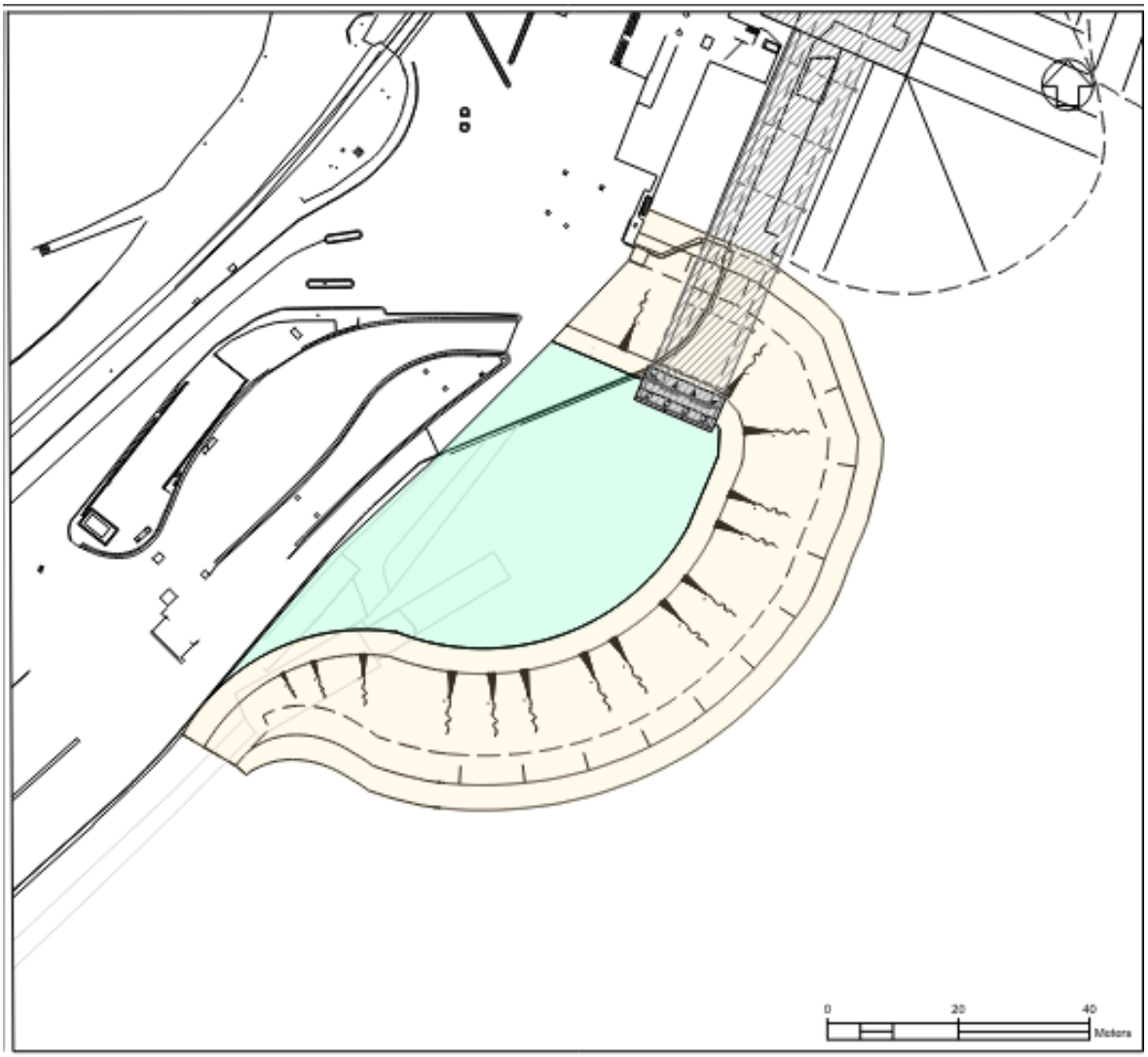


Figure C.5: Area of Land Reclamation in the area of the dis-used RNLI Slipway

This area will be formed with imported crushed rock fill material protected by a rock armour revetment. Crushed rock will be in the 0-500mm size range. Rock armour will range in size from 0.5 tonnes up to 6 tonnes. The footprint of the entire reclaimed area including the rock armour revetment is approximately 5500m^2. The volume of primary rock armour (1-6t) required has been estimated at 5600m^3.

The crushed rock and rock armour to form the revetment will either be delivered by road and end tipped off the side of the sea wall or by split hopper barge vessel and dumped within the reclamation area. The crushed rock will be levelled and shaped within the reclamation footprint using plant such as excavators and jack up barges. Excavators shaping the reclamation area will be located on the reclamation area whilst excavators placing the rock armour may be located on jack up barges immediately adjacent to the reclamation area.

The rock armour revetment will have a toe detail which will tie into the scour protection proposed to the dredged slope behind the berth.

This area will be surfaced with an asphalt road surface (surfaced area approximately 1800sqm) which will connect to the existing road and pedestrian footpath network within the terminal. There is currently a storm

water outfall at the location of the proposed revetment. The storm sewer will be extended through the reclaimed area with a new headwall being constructed in the revetment.

Bankseat piling and concrete works

A reinforced concrete bankseat structure will be constructed at the northern edge of the reclamation to support the linkspan pontoon. This structure is expected to be a piled bank seat, with steel tubular piles filled with concrete. The piles will be raked or vertical piles installed using vibro, impact driving and rotary boring techniques. These piles are proposed to be steel tubes approximately 0.914m in diameter. Figure C.6 below outlines the bankseat plan and section details showing the pile arrangement.

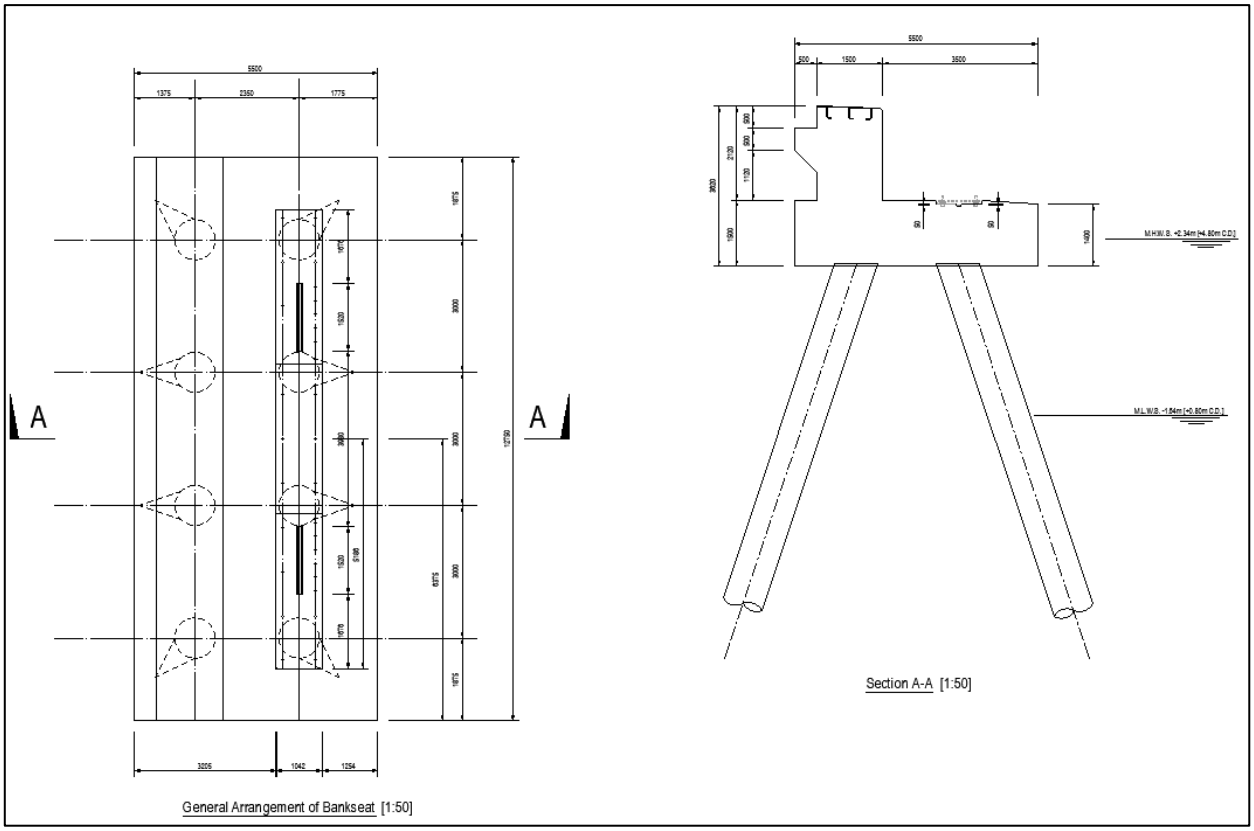


Figure C.6: Preliminary Bankseat Arrangement

Pavement construction and tie in to existing

Drainage, service ducts to be installed where allowable within the partially complete reclamation area. Surfacing and transition slabs to be installed where reclamation meets the existing surfacing and structure where allowable.

Guide Pile installation (including installation and removal of temporary piles)

The guide pile to restrain the floating linkspan will be a steel tube, approximately 2m in diameter, filled with reinforced concrete. This single guide pile will be socketed into bedrock beneath the bed material using a combination of vibro and rotary boring techniques. The installation of the guide pile will require four temporary steel piles to be installed adjacent to it to support the piling rig. These temporary support piles will each be approximately 1.22m in diameter and will be installed via vibro and/or impact driving techniques. The four temporary support piles will be removed once the guide pile has been installed.

Ferry Operational

Table C.1 below details the proposed construction plant during the ferry operational phase and the associated sound pressure levels of the equipment, as well as the cumulative noise level of all plant within each construction activity.

Table C.1: Construction Plant Ferry Operational

Activity	Item	BS5228 ref	Number	SPL at 10m	Cumulative Level
Demolition of RNLI Slipway	Tracked Excavator	C.2.14	1	79	79.0
	90t Long reach excavator	C.4.56	1	83	83.0
	Dump truck	C.2.31	2	87	90.0
	Rock Breaker	D.2.4	1	91	91.0
				TOTAL:	**94.0**
Dredging in the wider harbour and outside the area of the jack up barge	Backhoe Dredger	C.7.2	1	82	82.0
				TOTAL:	**82.0**
Reclamation and revetment construction and paving works	Dump truck	C.2.31	3	87	91.8
	Tracked excavator	C.2.3	2	78	81.0
	Dozer	C.2.12	1	81	81.0
	Compaction Roller	C.2.37	2	70	73.0
	Long Reach Excavator	C.4.56	1	83	83.0
				TOTAL:	**93.0**
Road furniture and fencing	Dumper	C.2.30	1	79	79
	Excavator	C.2.14	1	79	79
				TOTAL:	**82.0**
Bankseat piling and concrete works	120t Rotary Bored Piling Rig / Leader Rig	C.3.14	1	83	83.0
	Vibratory piling rig (Temporary Piles)	C.3.8	1	88	88.0

Activity	Item	BS5228 ref	Number	SPL at 10m	Cumulative Level
	Crawler Crane	C.3.21	1	79	79.0
	Dumper	C.2.30	2	79	82.0
	Excavator	C.2.14	1	79	79.0
				TOTAL:	**90.6**
Pavement construction and tie in to existing	Dump truck	C.2.31	3	87	91.8
	Tracked excavator	C.2.3	2	78	81.0
	Compaction Roller	C.2.37	2	70	73.0
				TOTAL:	**92.2**
Guide Pile installation (including installation and removal of temporary piles)	Tubular steel piling (Guide Pile)	C.3.3	1	88	88
	200T Crawler Crane	C.3.21	1	79	79
	Vibratory / Impact Hammer CX110	C.3.2	1	87	87
	120t Rotary Bored Piling Rig / Leader Rig	C.3.14	1	83	83
	Vibratory piling rig (Temporary Piles)	C.3.8	1	88	88
				TOTAL:	**93.1**

Ferry Not Operational

Table C.2 below details the proposed construction plant during the ferry not operational phase and the associated sound pressure levels of the equipment, as well as the cumulative noise level of all plant within each construction activity.

Table C.2: Construction Plant Ferry Not Operational

Activity	Item	BS5228 ref	Number	SPL at 10m	Cumulative Level
Remove hydraulic linkspan and Jack Up Barge	Tracked Excavator	C.2.14	1	79	79.0
	90t Long reach excavator	C.4.56	1	83	83.0
	Dump truck	C.2.31	1	87	87.0
	200T Crawler Crane	C.3.21	1	79	79.0
				TOTAL:	**89.3**
Dredge beneath the Jack Up Barge	Backhoe Dredger	C.7.2	1	82	82.0
	Rock Breaker	D.2.4	1	91	91.0
				TOTAL:	**91.5**
Demolition of buffer dolphin	Dump truck	C.2.31	2	87	90.0
	Tracked excavator	C.2.3	1	78	78.0
	Rock Breaker	D.2.4	1	91	91.0
	Underwater drilling / coring	N/A	N/A	0	0.0
	Wire saw	N/A	N/A	0	0.0
	Long Reach Excavator	C.4.56	1	83	83.0
				TOTAL:	**94.0**
Demolition of suspended deck and supports	Dump truck	C.2.31	2	87	90.0
	Tracked excavator	C.2.3	1	78	78.0
	90t Long reach excavator	C.4.56	1	83	83.0
				TOTAL:	**91.0**
Installation of new Linkspan	Crawler Crane	C.3.21	1	79	79.0
	Crane Barge	CNP 061	1	76	76.0
				TOTAL:	**80.8**
Drainage, connection to the existing network	Tracked excavator	C.2.3	1	78	78.0
				TOTAL:	**78.0**
Completion of pavement works to reclaimed area rock armour to north face of reclamation	Dump truck	C.2.31	3	87	91.8
	Tracked excavator	C.2.3	2	78	81.0

Activity	Item	BS5228 ref	Number	SPL at 10m	Cumulative Level
				TOTAL:	**92.1**
Scour protection throughout the berth and to the dredged slope	Backhoe Dredger	C.3.3	1	88	88
	90t Long reach excavator	C.4.56	1	83	83
				TOTAL:	**89.2**

Construction Plant Ferry Not Operational

Remove hydraulic linkspan and Jack Up Barge

Jack up barge to be floated away. Linkspan bridge and gantry structures to be deconstructed and taken off site and disposed of on land.

Dredge beneath the Jack Up Barge

Dredging of Area A is to take place during the period when the ferry is not operational.

There has been no dredging undertaken in the harbour for at least the last ten years. All initial dredging undertaken as part of these works will be capital dredging. The Client is also applying for a licenced to subsequently maintenance dredge the harbour over the next 5 years under a separate application.

The proposed areas to be dredged have been named A-H and are presented in Figures 2-9 & 2-10. The harbour will be dredged to depths ranging between -7.3mCD and -6.8mCD in the berth and channel and -5.5mCD to the north of the harbour.

It is anticipated that the dredging will be a 24/7 operation over a 12 week period which may be broken into phases. The dredge material is expected to be silty sands and gravels. The dredge material is thought to be unsuitable for reclamation fill due to the potential settlement issues from the fine silt material present and the time and space required to dry out material.

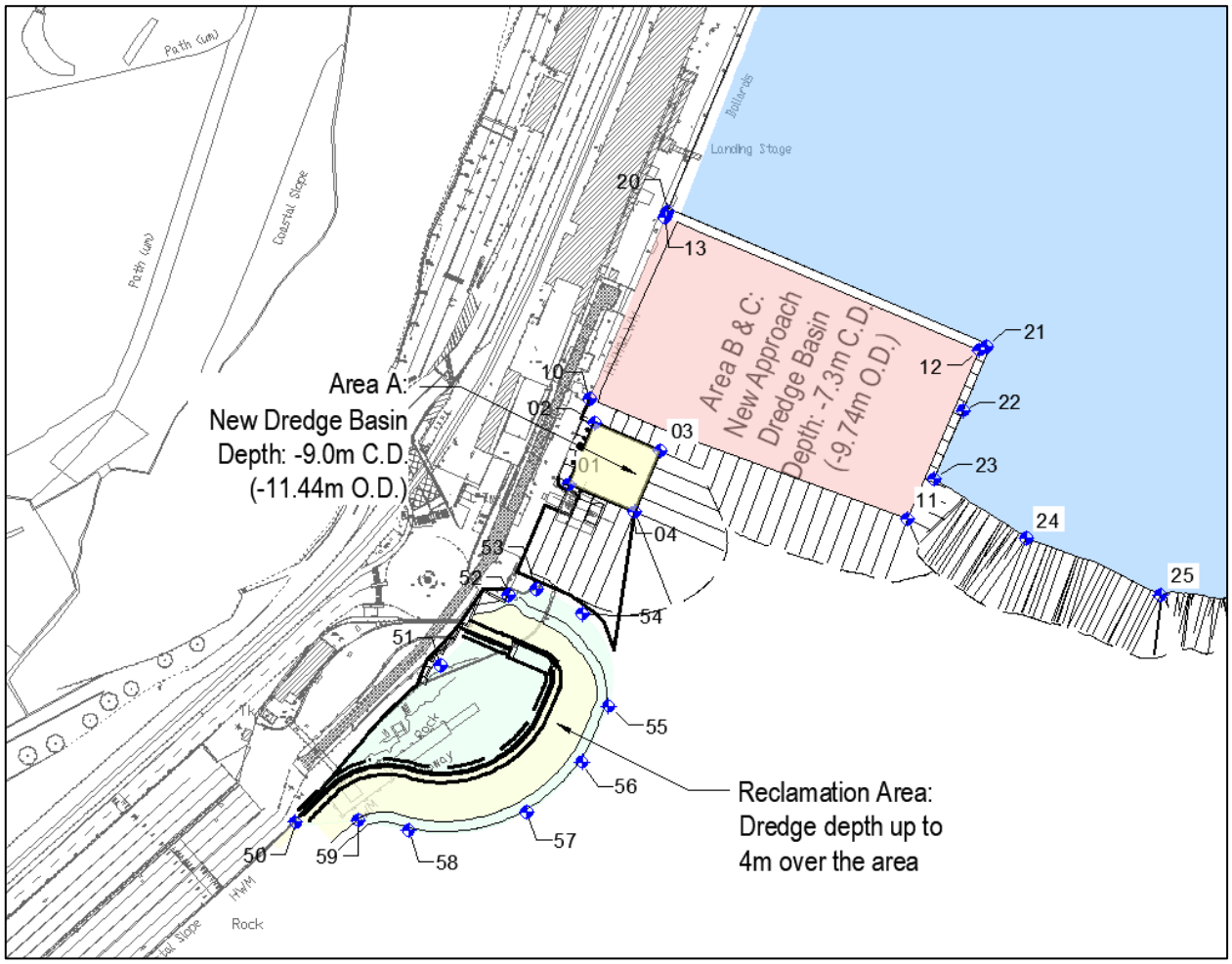


Figure C.7: Dredge Areas A, B and C and the Reclamation Area

In total 78,000m^3 of capital dredging is expected. The bed material in and around the area of the new linkspan will be dredged using a backhoe excavator mounted on a pontoon. The dredging in the approach channel and

the north section of the berth will be undertaken using a Trailer Suction Hopper Dredger (TSHD). Approximate dredge volumes & dredge methods for each area are summarised in Figure C.7.

Demolition of buffer dolphin and Demolition of suspended deck and supports

1. Construction Phase with closed berth
   The existing jack-up barge will be floated away and the steel linkspan bridge and gantry removed. The following structures will be demolished;
   - 3 No. small masonry kiosk buildings adjacent to the structures
   - Existing linkspan bridge and steel linkspan towers
   - Suspended reinforced concrete deck structure (See Figure C.8). This suspended deck is not a piled structure; the columns are placed directly on to bedrock exposed on the shoreline.
   - Concrete 'buffer dolphin' structure. (See Figure C.9)
   - Jack up barge will be floated away
   - Approximate total volume of material 2200m^3





Figure C.8: Suspended Reinforced Concrete Deck Structure



Figure C.9: South Buffer Dolphin and Linkspan Tower and Bridge

Demolition of suspended deck and supports

The suspended slab and buffer dolphin structures are all reinforced concrete marine structures. The demolition arisings from these structures may be temporarily placed on the seabed in the immediate vicinity of the respective structure before being removed prior to the construction of the reclaimed area.

All demolition arisings shall be disposed of to an appropriate offsite disposal facility.

Installation of new Linkspan

The proposed linkspan will be transported to the site via floating plant. The linkspan will be floated or lifted into position using floating plant and crawler cranes working from the land.

Drainage, connection to the existing network

Completion of the drainage works, including installation and commissioning of an interceptor and new / extended outfall are planned for this stage of the works.

Completion of pavement works to reclaimed area rock armour to north face of reclamation

Following demolition of the existing suspended deck the remaining filling works can be completed for the reclamation area. This includes completion of the rock armour revetment, new pavement installation and completion of tie in works to the existing pavement.

Scour protection throughout the berth and to the dredged slope

Discrete scour protection will be installed along sections of the existing quay wall where issues are regularly experienced with ship bow thrusters creating scour holes in front of the quay wall. This discrete scour protection will involve either rock /grout filled bags or gabion mattresses placed on the seabed.

Scour protection will also be provided to the southern face of the dredged pocket and to the northern face of the dredged slope behind the linkspan pontoon. This scour protection will be formed by laying rock filled gabion mattresses or rock armour on the seabed. If mattresses are installed, they will be laid to the top of the slope where they will extend beneath the rock armour revetment. If rock armour is installed it will tie into the rock armour of the adjacent revetment. The gabion mattresses/additional rock armour will also address the issue of secondary scour pits forming in front of the rock armour revetment.

Construction Noise Receptors

Figure C.10: Noise Sensitive Receptors

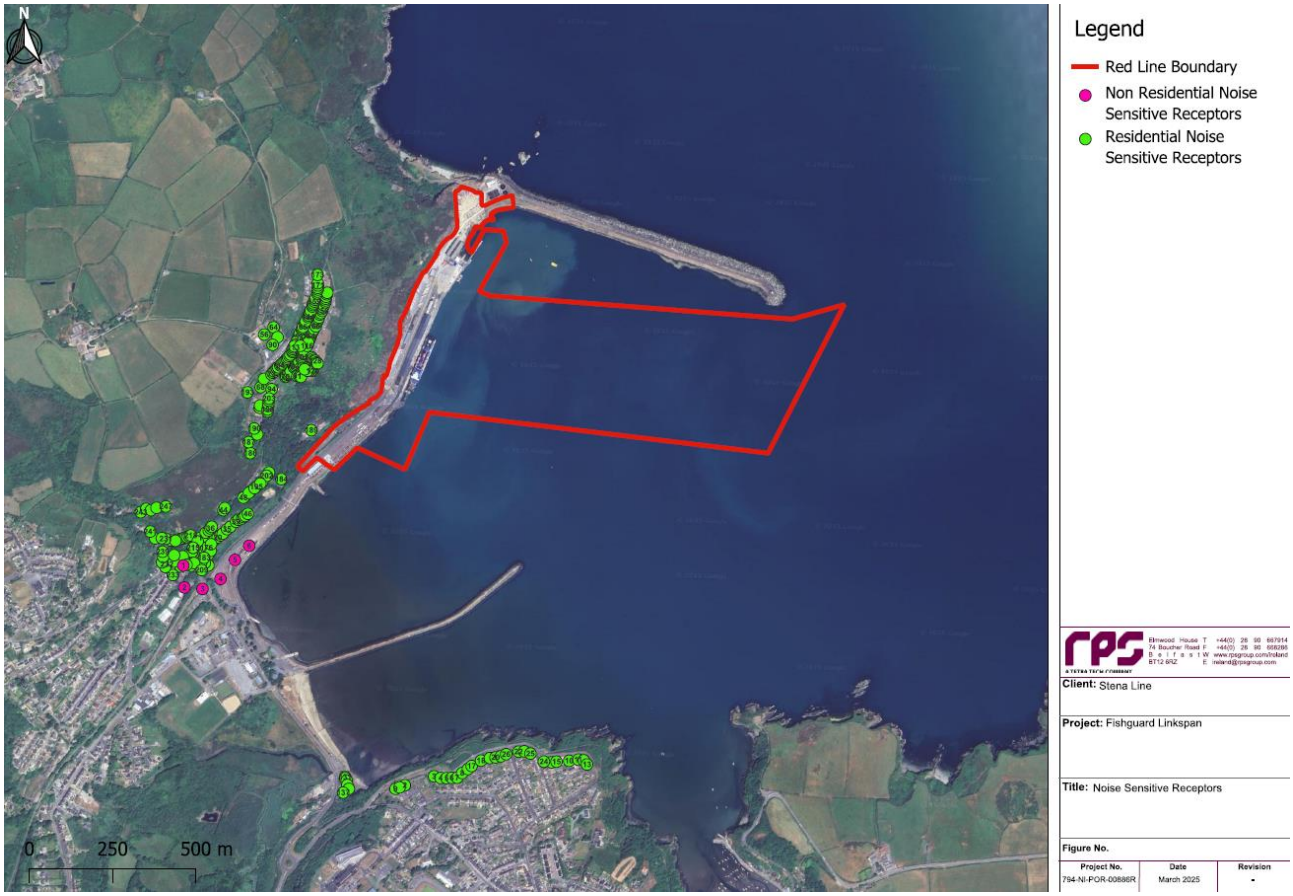


Table C.3: Noise Sensitive Receptor Distance to Site Boundary.

Receptor ID	Eastings	Northings	Distance (m)
1	194538	238355	362
2	195152	237612	948
3	195240	237639	925
4	195260	237634	932
5	195278	237634	935
6	195293	237635	936
7	195310	237635	938
8	195325	237649	927
9	195124	237601	959
10	195646	237686	988
11	195674	237689	982
12	195690	237687	982
13	195700	237675	993
14	195593	237681	983
15	195608	237683	988
16	195342	237661	919
17	195353	237670	912
18	195381	237686	903
19	195408	237694	903
20	195425	237696	906
21	195441	237699	908
22	195494	237713	913
23	195511	237714	919
24	195570	237683	971
25	195530	237707	933
26	195457	237705	907
27	194555	238348	352
28	194577	238348	335
29	194582	238351	330
30	194590	238356	320
31	194598	238362	310
32	194605	238367	302
33	194554	238371	340
34	194563	238377	329
35	194618	238381	283
36	194568	238383	321
37	194628	238388	271
38	194572	238388	315
39	194645	238403	248
40	194652	238409	239
41	194663	238413	228
42	194668	238417	221
43	194673	238421	216
44	194607	238438	259
45	194611	238444	252
46	194681	238427	206
47	194672	238480	181
48	194667	238475	188
49	194864	238945	246
50	194829	238948	275
51	194831	238954	278
52	194868	238955	247
53	194834	238958	279
54	194870	238960	247
55	194835	238963	280
56	194730	238965	347
57	194872	238965	248
58	194837	238967	280
59	194874	238971	249
60	194876	238976	249
61	194843	238979	280

Receptor ID	Eastings	Northings	Distance (m)
62	194879	238981	249
63	194845	238983	281
64	194758	238987	347
65	194846	238988	281
66	194885	238990	247
67	194770	238957	316
68	194719	238807	242
69	194729	238832	252
70	194793	238838	209
71	194796	238840	209
72	194800	238844	209
73	194752	238845	244
74	194802	238847	210
75	194806	238850	210
76	194756	238850	245
77	194761	238854	243
78	194809	238855	211
79	194765	238859	244
80	194768	238863	245
81	194819	238866	214
82	194772	238867	245
83	194822	238869	215
84	194778	238872	245
85	194825	238873	216
86	194781	238875	245
87	194784	238878	245
88	194829	238877	217
89	194828	238944	272
90	194755	238934	307
91	194829	238840	187
92	194835	238839	183
93	194840	238838	179
94	194752	238801	214
95	194832	238881	218
96	194841	238883	214
97	194835	238884	219
98	194790	238884	246
99	194794	238888	247
100	194798	238892	248
101	194841	238893	222
102	194801	238896	249
103	194843	238897	224
104	194805	238901	250
105	194845	238902	227
106	194809	238905	251
107	194848	238907	230
108	194849	238910	232
109	194814	238913	254
110	194850	238916	236
111	194814	238917	257
112	194816	238921	260
113	194818	238926	262
114	194861	238935	244
115	194822	238934	266
116	194859	238931	244
117	194820	238930	264
118	194862	238941	246
119	194838	238931	255
120	194875	238855	172
121	194871	238856	175
122	194866	238857	178
123	194860	238856	181
124	194851	238861	190

Receptor ID	Eastings	Northings	Distance (m)
125	194873	238896	207
126	194876	238892	202
127	194880	238888	196
128	194883	238886	193
129	194887	238881	187
130	194890	238878	182
131	194973	237637	923
132	194973	237634	926
133	194978	237626	934
134	194980	237613	947
135	194984	237601	959
136	195137	237606	954
137	194967	237590	969
138	194852	239000	281
139	194888	239000	248
140	194854	239005	281
141	194890	239006	247
142	194892	239011	245
143	194894	239016	243
144	194862	239017	276
145	194863	239022	275
146	194897	239025	241
147	194866	239027	273
148	194900	239029	238
149	194867	239032	272
150	194904	239036	236
151	194869	239037	270
152	194903	239042	238
153	194906	239047	236
154	194874	239049	267
155	194909	239052	234
156	194876	239054	267
157	194878	239058	266
158	194913	239062	232
159	194880	239064	265
160	194914	239068	234
161	194882	239069	264
162	194915	239073	234
163	194884	239075	264
164	194916	239079	235
165	194889	239088	263
166	194918	239086	235
167	194890	239094	264
168	194919	239090	236
169	194890	239100	266
170	194891	239105	268
171	194891	239112	270
172	194891	239119	274
173	194890	239144	285
174	194542	238292	399
175	194544	238326	375
176	194556	238325	366
177	194561	238304	377
178	194562	238272	399
179	194569	238316	363
180	194570	238336	349
181	194551	238279	402
182	194541	238282	407
183	194549	238295	392
184	194781	238531	62
185	194744	238551	89
186	194688	238609	148
187	194683	238642	164

Receptor ID	Eastings	Northings	Distance (m)
188	194709	238665	154
189	194871	238678	43
190	194700	238683	172
191	194716	238745	202
192	194717	238752	206
193	194679	238791	261
194	194689	238494	160
195	194706	238508	139
196	194723	238522	117
197	194740	238734	177
198	194740	238740	181
199	194742	238751	187
200	194742	238757	191
201	194743	238767	197
202	194737	238541	98
203	194744	238773	201
204	194684	238490	167
205	194701	238504	145
206	194718	238518	124
207	194454	238346	437
208	194448	238347	442
209	194471	238350	421
210	194481	238352	411
211	194486	238353	406
212	194492	238356	400
213	194498	238357	394
214	194504	238360	387
215	194509	238362	382
216	194434	238352	452
217	194463	238346	430
218	194506	238308	416
219	194508	238277	434
220	194513	238313	407
221	194517	238279	426
222	194521	238328	392
223	194516	238325	397
224	194530	238344	375
225	194516	238325	397
226	194485	238299	438
227	194510	238271	437
228	194519	238279	425
229	194542	238258	423
230	194478	238269	462
231	194496	238274	445
232	194455	238243	496
233	194437	238276	490
234	194432	238267	499
235	194458	238283	469
236	194423	238281	499
237	194426	238298	486
238	194459	238303	456
239	194424	238313	480
240	194402	238353	480
241	194387	238374	485
242	194422	238354	462
243	194359	238432	492
244	194375	238442	473
245	194389	238438	461
246	194406	238445	443
247	194434	238449	415

Table C.4: Non Sensitive Receptors Distance to Site Boundary

Receptor ID	Eastings	Northings	Distance to Boundary (m)
1	194487	238272	454
2	194490	238206	497
3	194544	238202	464
4	194598	238231	408
5	194642	238289	336
6	194685	238331	276

Ferry Operational Predictions

Table C.5: Demolition of RNLI Slipway Predictions

ID	Distance (m)	Attenuation at 10m	Prediction
1	738	37.4	56.7
2	1154	41.2	52.8
3	1130	41.1	53.0
4	1137	41.1	52.9
5	1139	41.1	52.9
6	1140	41.1	52.9
7	1142	41.2	52.9
8	1130	41.1	53.0
9	1165	41.3	52.7
10	1187	41.5	52.6
11	1196	41.6	52.5
12	1205	41.6	52.4
13	1220	41.7	52.3
14	1171	41.4	52.7
15	1174	41.4	52.7
16	1121	41.0	53.1
17	1114	40.9	53.1
18	1104	40.9	53.2
19	1102	40.8	53.2
20	1104	40.9	53.2
21	1105	40.9	53.2
22	1107	40.9	53.2
23	1111	40.9	53.1
24	1160	41.3	52.8
25	1124	41.0	53.0
26	1103	40.9	53.2
27	728	37.2	56.8
28	710	37.0	57.0
29	704	37.0	57.1
30	695	36.8	57.2
31	685	36.7	57.3
32	676	36.6	57.4
33	716	37.1	56.9
34	705	37.0	57.1
35	657	36.4	57.7
36	697	36.9	57.2
37	645	36.2	57.9
38	691	36.8	57.3

ID	Distance (m)	Attenuation at 10m	Prediction
39	623	35.9	**58.2**
40	614	35.8	**58.3**
41	602	35.6	**58.5**
42	596	35.5	**58.6**
43	590	35.4	**58.6**
44	635	36.1	**58.0**
45	628	36.0	**58.1**
46	580	35.3	**58.8**
47	557	34.9	**59.1**
48	564	35.0	**59.0**
49	333	30.4	**63.6**
50	365	31.3	**62.8**
51	366	31.3	**62.8**
52	334	30.5	**63.6**
53	365	31.3	**62.8**
54	334	30.5	**63.6**
55	367	31.3	**62.8**
56	463	33.3	**60.7**
57	335	30.5	**63.5**
58	367	31.3	**62.7**
59	336	30.5	**63.5**
60	337	30.5	**63.5**
61	368	31.3	**62.7**
62	337	30.6	**63.5**
63	368	31.3	**62.7**
64	446	33.0	**61.1**
65	369	31.3	**62.7**
66	337	30.6	**63.5**
67	423	32.5	**61.5**
68	433	32.7	**61.3**
69	426	32.6	**61.5**
70	363	31.2	**62.8**
71	362	31.2	**62.9**
72	358	31.1	**63.0**
73	406	32.2	**61.9**
74	357	31.0	**63.0**
75	354	31.0	**63.1**
76	403	32.1	**61.9**
77	399	32.0	**62.0**

ID	Distance (m)	Attenuation at 10m	Prediction
78	351	30.9	**63.1**
79	396	32.0	**62.1**
80	394	31.9	**62.1**
81	345	30.8	**63.3**
82	391	31.8	**62.2**
83	343	30.7	**63.3**
84	386	31.7	**62.3**
85	341	30.7	**63.4**
86	384	31.7	**62.4**
87	382	31.6	**62.4**
88	339	30.6	**63.4**
89	365	31.2	**62.8**
90	428	32.6	**61.4**
91	329	30.3	**63.7**
92	323	30.2	**63.9**
93	318	30.0	**64.0**
94	399	32.0	**62.0**
95	337	30.6	**63.5**
96	330	30.4	**63.7**
97	336	30.5	**63.5**
98	378	31.5	**62.5**
99	376	31.5	**62.6**
100	373	31.4	**62.6**
101	333	30.5	**63.6**
102	371	31.4	**62.7**
103	333	30.5	**63.6**
104	369	31.3	**62.7**
105	333	30.4	**63.6**
106	368	31.3	**62.7**
107	332	30.4	**63.6**
108	332	30.4	**63.6**
109	365	31.3	**62.8**
110	334	30.5	**63.6**
111	367	31.3	**62.7**
112	367	31.3	**62.7**
113	367	31.3	**62.7**
114	331	30.4	**63.7**
115	366	31.3	**62.8**
116	332	30.4	**63.6**

ID	Distance (m)	Attenuation at 10m	Prediction
117	367	31.3	62.8
118	333	30.4	63.6
119	350	30.9	63.2
120	288	29.2	64.9
121	293	29.3	64.7
122	298	29.5	64.6
123	303	29.6	64.4
124	313	29.9	64.1
125	305	29.7	64.4
126	301	29.6	64.5
127	295	29.4	64.6
128	292	29.3	64.7
129	286	29.1	64.9
130	282	29.0	65.0
131	1144	41.2	52.9
132	1147	41.2	52.9
133	1153	41.2	52.8
134	1166	41.3	52.7
135	1177	41.4	52.6
136	1160	41.3	52.8
137	1191	41.5	52.5
138	370	31.4	62.7
139	341	30.7	63.4
140	371	31.4	62.7
141	343	30.7	63.3
142	344	30.7	63.3
143	346	30.8	63.3
144	373	31.4	62.6
145	374	31.5	62.6
146	350	30.9	63.2
147	375	31.5	62.6
148	350	30.9	63.2
149	377	31.5	62.5
150	352	30.9	63.1
151	378	31.6	62.5
152	356	31.0	63.0
153	358	31.1	63.0
154	383	31.7	62.4
155	359	31.1	62.9

ID	Distance (m)	Attenuation at 10m	Prediction
156	385	31.7	62.3
157	386	31.7	62.3
158	363	31.2	62.8
159	388	31.8	62.3
160	367	31.3	62.7
161	390	31.8	62.2
162	370	31.4	62.7
163	393	31.9	62.2
164	374	31.5	62.6
165	399	32.0	62.0
166	378	31.6	62.5
167	403	32.1	62.0
168	381	31.6	62.4
169	407	32.2	61.9
170	411	32.3	61.8
171	416	32.4	61.7
172	421	32.5	61.6
173	441	32.9	61.2
174	772	37.8	56.3
175	750	37.5	56.6
176	741	37.4	56.7
177	750	37.5	56.6
178	769	37.7	56.3
179	736	37.3	56.7
180	723	37.2	56.9
181	773	37.8	56.3
182	779	37.8	56.2
183	764	37.7	56.4
184	438	32.8	61.2
185	460	33.3	60.8
186	488	33.8	60.3
187	483	33.7	60.4
188	453	33.1	60.9
189	293	29.3	64.7
190	458	33.2	60.8
191	434	32.8	61.3
192	433	32.7	61.3
193	471	33.5	60.6
194	536	34.6	59.5

ID	Distance (m)	Attenuation at 10m	Prediction
195	514	34.2	**59.8**
196	492	33.8	**60.2**
197	411	32.3	**61.8**
198	411	32.3	**61.8**
199	408	32.2	**61.8**
200	408	32.2	**61.8**
201	407	32.2	**61.9**
202	471	33.5	**60.6**
203	406	32.2	**61.9**
204	543	34.7	**59.4**
205	521	34.3	**59.7**
206	499	34.0	**60.1**
207	814	38.2	**55.8**
208	818	38.3	**55.8**
209	797	38.0	**56.0**
210	787	37.9	**56.1**
211	783	37.9	**56.2**
212	776	37.8	**56.3**
213	770	37.7	**56.3**
214	764	37.7	**56.4**
215	758	37.6	**56.5**
216	828	38.4	**55.7**
217	806	38.1	**55.9**
218	791	38.0	**56.1**
219	808	38.2	**55.9**
220	782	37.9	**56.2**
221	800	38.1	**56.0**
222	767	37.7	**56.4**
223	773	37.8	**56.3**
224	751	37.5	**56.5**
225	773	37.8	**56.3**
226	813	38.2	**55.8**
227	810	38.2	**55.9**
228	798	38.0	**56.0**
229	793	38.0	**56.1**
230	837	38.5	**55.6**
231	819	38.3	**55.8**
232	870	38.8	**55.3**
233	866	38.7	**55.3**

ID	Distance (m)	Attenuation at 10m	Prediction
234	875	38.8	**55.2**
235	844	38.5	**55.5**
236	875	38.8	**55.2**
237	863	38.7	**55.3**
238	833	38.4	**55.6**
239	856	38.7	**55.4**
240	855	38.6	**55.4**
241	859	38.7	**55.4**
242	837	38.5	**55.6**
243	859	38.7	**55.4**
244	840	38.5	**55.6**
245	829	38.4	**55.7**
246	811	38.2	**55.9**
247	783	37.9	**56.2**

Table C.6: Dredging in the Wider Harbour and outside the area of the Jack Up Barge Predictions

ID	Distance (m) to Area A	Attenuation at 10m (Area A)	Prediction (Area A)	Distance (m) to Area B&C	Attenuation at 10m (Area B&C)	Prediction (Area B&E)	Distance (m) to Area E	Attenuation at 10m (Area E)	Prediction (Area E)	Distance (m) to Area H	Attenuation at 10m (Area H)	Prediction (Area H)
1	746	37.4	**44.6**	789	37.9	**44.1**	848	38.6	**43.4**	1065	40.5	**41.5**
2	1148	41.2	**40.8**	1184	41.5	**40.5**	1171	41.4	**40.6**	1479	43.4	**38.6**
3	1122	41.0	**41.0**	1152	41.2	**40.8**	1129	41.1	**40.9**	1444	43.2	**38.8**
4	1129	41.1	**40.9**	1156	41.3	**40.7**	1131	41.1	**40.9**	1448	43.2	**38.8**
5	1130	41.1	**40.9**	1157	41.3	**40.7**	1129	41.1	**40.9**	1448	43.2	**38.8**
6	1131	41.1	**40.9**	1156	41.3	**40.7**	1126	41.0	**41.0**	1446	43.2	**38.8**
7	1132	41.1	**40.9**	1156	41.3	**40.7**	1124	41.0	**41.0**	1445	43.2	**38.8**
8	1120	41.0	**41.0**	1143	41.2	**40.8**	1109	40.9	**41.1**	1431	43.1	**38.9**
9	1159	41.3	**40.7**	1198	41.6	**40.4**	1187	41.5	**40.5**	1494	43.5	**38.5**
10	1169	41.4	**40.6**	1167	41.3	**40.7**	1038	40.3	**41.7**	1428	43.1	**38.9**
11	1176	41.4	**40.6**	1172	41.4	**40.6**	1033	40.3	**41.7**	1431	43.1	**38.9**
12	1185	41.5	**40.5**	1180	41.4	**40.6**	1033	40.3	**41.7**	1437	43.1	**38.9**
13	1200	41.6	**40.4**	1195	41.5	**40.5**	1045	40.4	**41.6**	1451	43.2	**38.8**
14	1153	41.2	**40.8**	1155	41.3	**40.7**	1048	40.4	**41.6**	1422	43.1	**38.9**
15	1157	41.3	**40.7**	1157	41.3	**40.7**	1044	40.4	**41.6**	1423	43.1	**38.9**
16	1110	40.9	**41.1**	1131	41.1	**40.9**	1095	40.8	**41.2**	1419	43.0	**39.0**
17	1103	40.9	**41.1**	1123	41.0	**41.0**	1086	40.7	**41.3**	1410	43.0	**39.0**
18	1092	40.8	**41.2**	1110	40.9	**41.1**	1067	40.6	**41.4**	1394	42.9	**39.1**
19	1090	40.7	**41.3**	1105	40.9	**41.1**	1056	40.5	**41.5**	1388	42.8	**39.2**
20	1091	40.8	**41.2**	1105	40.9	**41.1**	1052	40.4	**41.6**	1387	42.8	**39.2**
21	1092	40.8	**41.2**	1104	40.9	**41.1**	1048	40.4	**41.6**	1385	42.8	**39.2**
22	1092	40.8	**41.2**	1100	40.8	**41.2**	1030	40.3	**41.7**	1376	42.8	**39.2**
23	1096	40.8	**41.2**	1103	40.8	**41.2**	1027	40.2	**41.8**	1377	42.8	**39.2**
24	1143	41.2	**40.8**	1147	41.2	**40.8**	1048	40.4	**41.6**	1416	43.0	**39.0**

ID	Distance (m) to Area A	Attenuation at 10m (Area A)	Prediction (Area A)	Distance (m) to Area B&C	Attenuation at 10m (Area B&C)	Prediction (Area B&E)	Distance (m) to Area E	Attenuation at 10m (Area E)	Prediction (Area E)	Distance (m) to Area H	Attenuation at 10m (Area H)	Prediction (Area H)
25	1108	40.9	**41.1**	1113	40.9	**41.1**	1031	40.3	**41.7**	1386	42.8	**39.2**
26	1089	40.7	**41.3**	1101	40.8	**41.2**	1040	40.3	**41.7**	1380	42.8	**39.2**
27	735	37.3	**44.7**	779	37.8	**44.2**	840	38.5	**43.5**	1058	40.5	**41.5**
28	717	37.1	**44.9**	762	37.6	**44.4**	822	38.3	**43.7**	1043	40.4	**41.6**
29	712	37.0	**45.0**	756	37.6	**44.4**	817	38.2	**43.8**	1037	40.3	**41.7**
30	702	36.9	**45.1**	747	37.5	**44.5**	808	38.1	**43.9**	1028	40.2	**41.8**
31	692	36.8	**45.2**	737	37.4	**44.6**	798	38.0	**44.0**	1018	40.2	**41.8**
32	683	36.7	**45.3**	728	37.2	**44.8**	789	37.9	**44.1**	1010	40.1	**41.9**
33	724	37.2	**44.8**	766	37.7	**44.3**	826	38.3	**43.7**	1043	40.4	**41.6**
34	713	37.1	**44.9**	755	37.6	**44.4**	815	38.2	**43.8**	1032	40.3	**41.7**
35	665	36.5	**45.5**	710	37.0	**45.0**	770	37.7	**44.3**	991	39.9	**42.1**
36	705	37.0	**45.0**	748	37.5	**44.5**	807	38.1	**43.9**	1024	40.2	**41.8**
37	653	36.3	**45.7**	698	36.9	**45.1**	758	37.6	**44.4**	979	39.8	**42.2**
38	699	36.9	**45.1**	742	37.4	**44.6**	801	38.1	**43.9**	1018	40.2	**41.8**
39	630	36.0	**46.0**	675	36.6	**45.4**	736	37.3	**44.7**	956	39.6	**42.4**
40	621	35.9	**46.1**	666	36.5	**45.5**	726	37.2	**44.8**	947	39.5	**42.5**
41	609	35.7	**46.3**	654	36.3	**45.7**	715	37.1	**44.9**	937	39.4	**42.6**
42	603	35.6	**46.4**	648	36.2	**45.8**	709	37.0	**45.0**	930	39.4	**42.6**
43	597	35.5	**46.5**	642	36.2	**45.8**	703	36.9	**45.1**	925	39.3	**42.7**
44	643	36.2	**45.8**	684	36.7	**45.3**	743	37.4	**44.6**	958	39.6	**42.4**
45	636	36.1	**45.9**	677	36.6	**45.4**	735	37.3	**44.7**	950	39.6	**42.4**
46	587	35.4	**46.6**	632	36.0	**46.0**	693	36.8	**45.2**	915	39.2	**42.8**
47	565	35.0	**47.0**	606	35.7	**46.3**	665	36.5	**45.5**	882	38.9	**43.1**
48	572	35.2	**46.8**	613	35.8	**46.2**	672	36.5	**45.5**	889	39.0	**43.0**
49	322	30.2	**51.8**	324	30.2	**51.8**	335	30.5	**51.5**	458	33.2	**48.8**
50	355	31.0	**51.0**	358	31.1	**50.9**	369	31.3	**50.7**	489	33.8	**48.2**

ID	Distance (m) to Area A	Attenuation at 10m (Area A)	Prediction (Area A)	Distance (m) to Area B&C	Attenuation at 10m (Area B&C)	Prediction (Area B&E)	Distance (m) to Area E	Attenuation at 10m (Area E)	Prediction (Area E)	Distance (m) to Area H	Attenuation at 10m (Area H)	Prediction (Area H)
51	356	31.0	51.0	358	31.1	50.9	369	31.3	50.7	486	33.7	48.3
52	322	30.2	51.8	324	30.2	51.8	333	30.4	51.6	451	33.1	48.9
53	355	31.0	51.0	357	31.0	51.0	367	31.3	50.7	482	33.7	48.3
54	322	30.2	51.8	324	30.2	51.8	331	30.4	51.6	447	33.0	49.0
55	356	31.0	51.0	357	31.1	50.9	366	31.3	50.7	479	33.6	48.4
56	453	33.1	48.9	457	33.2	48.8	470	33.4	48.6	580	35.3	46.7
57	323	30.2	51.8	325	30.2	51.8	331	30.4	51.6	443	32.9	49.1
58	356	31.0	51.0	358	31.1	50.9	366	31.3	50.7	476	33.6	48.4
59	323	30.2	51.8	325	30.2	51.8	330	30.4	51.6	440	32.9	49.1
60	323	30.2	51.8	324	30.2	51.8	329	30.3	51.7	436	32.8	49.2
61	355	31.0	51.0	357	31.0	51.0	362	31.2	50.8	467	33.4	48.6
62	324	30.2	51.8	324	30.2	51.8	327	30.3	51.7	431	32.7	49.3
63	355	31.0	51.0	357	31.0	51.0	362	31.2	50.8	464	33.3	48.7
64	436	32.8	49.2	438	32.8	49.2	447	33.0	49.0	548	34.8	47.2
65	356	31.0	51.0	357	31.1	50.9	361	31.2	50.8	462	33.3	48.7
66	323	30.2	51.8	322	30.2	51.8	325	30.2	51.8	424	32.5	49.5
67	413	32.3	49.7	417	32.4	49.6	429	32.7	49.3	543	34.7	47.3
68	435	32.8	49.2	449	33.0	49.0	483	33.7	48.3	647	36.2	45.8
69	426	32.6	49.4	438	32.8	49.2	469	33.4	48.6	627	35.9	46.1
70	362	31.2	50.8	374	31.4	50.6	405	32.1	49.9	567	35.1	46.9
71	360	31.1	50.9	371	31.4	50.6	402	32.1	49.9	564	35.0	47.0
72	356	31.0	51.0	367	31.3	50.7	397	32.0	50.0	558	34.9	47.1
73	404	32.1	49.9	416	32.4	49.6	445	33.0	49.0	600	35.6	46.4
74	354	31.0	51.0	365	31.3	50.7	395	31.9	50.1	555	34.9	47.1
75	351	30.9	51.1	362	31.2	50.8	391	31.8	50.2	550	34.8	47.2
76	401	32.1	49.9	412	32.3	49.7	441	32.9	49.1	595	35.5	46.5

ID	Distance (m) to Area A	Attenuation at 10m (Area A)	Prediction (Area A)	Distance (m) to Area B&C	Attenuation at 10m (Area B&C)	Prediction (Area B&E)	Distance (m) to Area E	Attenuation at 10m (Area E)	Prediction (Area E)	Distance (m) to Area H	Attenuation at 10m (Area H)	Prediction (Area H)
77	396	32.0	50.0	407	32.2	49.8	435	32.8	49.2	589	35.4	46.6
78	348	30.8	51.2	358	31.1	50.9	387	31.8	50.2	545	34.7	47.3
79	393	31.9	50.1	403	32.1	49.9	431	32.7	49.3	583	35.3	46.7
80	390	31.8	50.2	400	32.0	50.0	427	32.6	49.4	578	35.2	46.8
81	340	30.6	51.4	350	30.9	51.1	376	31.5	50.5	531	34.5	47.5
82	387	31.8	50.2	397	32.0	50.0	424	32.5	49.5	573	35.2	46.8
83	338	30.6	51.4	347	30.8	51.2	373	31.4	50.6	527	34.4	47.6
84	382	31.6	50.4	391	31.8	50.2	417	32.4	49.6	565	35.0	47.0
85	336	30.5	51.5	345	30.7	51.3	370	31.4	50.6	522	34.4	47.6
86	379	31.6	50.4	389	31.8	50.2	414	32.3	49.7	561	35.0	47.0
87	377	31.5	50.5	386	31.7	50.3	410	32.3	49.7	557	34.9	47.1
88	333	30.4	51.6	341	30.7	51.3	366	31.3	50.7	518	34.3	47.7
89	355	31.0	51.0	358	31.1	50.9	370	31.4	50.6	492	33.8	48.2
90	419	32.4	49.6	425	32.6	49.4	441	32.9	49.1	564	35.0	47.0
91	327	30.3	51.7	338	30.6	51.4	369	31.3	50.7	535	34.6	47.4
92	320	30.1	51.9	332	30.4	51.6	363	31.2	50.8	530	34.5	47.5
93	315	30.0	52.0	327	30.3	51.7	358	31.1	50.9	526	34.4	47.6
94	402	32.1	49.9	416	32.4	49.6	452	33.1	48.9	621	35.9	46.1
95	330	30.4	51.6	338	30.6	51.4	362	31.2	50.8	512	34.2	47.8
96	322	30.2	51.8	330	30.4	51.6	353	31.0	51.0	503	34.0	48.0
97	329	30.3	51.7	337	30.5	51.5	360	31.1	50.9	509	34.1	47.9
98	372	31.4	50.6	380	31.6	50.4	404	32.1	49.9	549	34.8	47.2
99	369	31.3	50.7	377	31.5	50.5	400	32.0	50.0	544	34.7	47.3
100	366	31.3	50.7	374	31.5	50.5	396	32.0	50.0	539	34.6	47.4
101	325	30.2	51.8	332	30.4	51.6	353	31.0	51.0	499	34.0	48.0
102	364	31.2	50.8	371	31.4	50.6	393	31.9	50.1	534	34.6	47.4

ID	Distance (m) to Area A	Attenuation at 10m (Area A)	Prediction (Area A)	Distance (m) to Area B&C	Attenuation at 10m (Area B&C)	Prediction (Area B&E)	Distance (m) to Area E	Attenuation at 10m (Area E)	Prediction (Area E)	Distance (m) to Area H	Attenuation at 10m (Area H)	Prediction (Area H)
103	324	30.2	51.8	331	30.4	51.6	352	30.9	51.1	496	33.9	48.1
104	361	31.2	50.8	368	31.3	50.7	389	31.8	50.2	528	34.5	47.5
105	324	30.2	51.8	330	30.4	51.6	350	30.9	51.1	492	33.8	48.2
106	359	31.1	50.9	366	31.3	50.7	386	31.7	50.3	524	34.4	47.6
107	323	30.2	51.8	328	30.3	51.7	347	30.8	51.2	488	33.8	48.2
108	322	30.2	51.8	328	30.3	51.7	346	30.8	51.2	485	33.7	48.3
109	356	31.0	51.0	362	31.2	50.8	381	31.6	50.4	516	34.2	47.8
110	324	30.2	51.8	329	30.3	51.7	346	30.8	51.2	482	33.7	48.3
111	358	31.1	50.9	363	31.2	50.8	381	31.6	50.4	515	34.2	47.8
112	358	31.1	50.9	363	31.2	50.8	380	31.6	50.4	511	34.2	47.8
113	357	31.1	50.9	362	31.2	50.8	378	31.6	50.4	508	34.1	47.9
114	320	30.1	51.9	323	30.2	51.8	336	30.5	51.5	464	33.3	48.7
115	356	31.0	51.0	360	31.1	50.9	375	31.5	50.5	501	34.0	48.0
116	321	30.1	51.9	324	30.2	51.8	338	30.6	51.4	468	33.4	48.6
117	357	31.0	51.0	361	31.2	50.8	376	31.5	50.5	504	34.1	47.9
118	322	30.2	51.8	324	30.2	51.8	336	30.5	51.5	461	33.3	48.7
119	340	30.6	51.4	344	30.7	51.3	359	31.1	50.9	487	33.7	48.3
120	283	29.0	53.0	293	29.3	52.7	321	30.1	51.9	487	33.7	48.3
121	287	29.2	52.8	297	29.5	52.5	325	30.2	51.8	490	33.8	48.2
122	292	29.3	52.7	302	29.6	52.4	330	30.4	51.6	494	33.9	48.1
123	298	29.5	52.5	308	29.8	52.2	336	30.5	51.5	499	34.0	48.0
124	308	29.8	52.2	317	30.0	52.0	345	30.7	51.3	505	34.1	47.9
125	296	29.4	52.6	302	29.6	52.4	322	30.1	51.9	469	33.4	48.6
126	291	29.3	52.7	297	29.5	52.5	318	30.1	51.9	468	33.4	48.6
127	286	29.1	52.9	293	29.3	52.7	314	30.0	52.0	467	33.4	48.6
128	283	29.0	53.0	289	29.2	52.8	311	29.9	52.1	465	33.3	48.7

ID	Distance (m) to Area A	Attenuation at 10m (Area A)	Prediction (Area A)	Distance (m) to Area B&C	Attenuation at 10m (Area B&C)	Prediction (Area B&E)	Distance (m) to Area E	Attenuation at 10m (Area E)	Prediction (Area E)	Distance (m) to Area H	Attenuation at 10m (Area H)	Prediction (Area H)
129	277	28.9	53.1	284	29.1	52.9	308	29.8	52.2	464	33.3	48.7
130	274	28.7	53.3	281	29.0	53.0	305	29.7	52.3	463	33.3	48.7
131	1141	41.1	40.9	1191	41.5	40.5	1192	41.5	40.5	1489	43.5	38.5
132	1144	41.2	40.8	1194	41.5	40.5	1195	41.5	40.5	1492	43.5	38.5
133	1150	41.2	40.8	1201	41.6	40.4	1201	41.6	40.4	1498	43.5	38.5
134	1163	41.3	40.7	1212	41.7	40.3	1212	41.7	40.3	1510	43.6	38.4
135	1174	41.4	40.6	1223	41.7	40.3	1222	41.7	40.3	1520	43.6	38.4
136	1154	41.2	40.8	1192	41.5	40.5	1180	41.4	40.6	1488	43.5	38.5
137	1188	41.5	40.5	1238	41.9	40.1	1238	41.9	40.1	1535	43.7	38.3
138	356	31.0	51.0	356	31.0	51.0	359	31.1	50.9	452	33.1	48.9
139	326	30.3	51.7	324	30.2	51.8	325	30.2	51.8	418	32.4	49.6
140	357	31.1	50.9	356	31.0	51.0	358	31.1	50.9	449	33.1	48.9
141	327	30.3	51.7	324	30.2	51.8	325	30.2	51.8	414	32.3	49.7
142	328	30.3	51.7	324	30.2	51.8	325	30.2	51.8	411	32.3	49.7
143	330	30.4	51.6	325	30.2	51.8	325	30.2	51.8	408	32.2	49.8
144	357	31.1	50.9	355	31.0	51.0	356	31.0	51.0	440	32.9	49.1
145	359	31.1	50.9	355	31.0	51.0	356	31.0	51.0	437	32.8	49.2
146	332	30.4	51.6	326	30.3	51.7	326	30.3	51.7	403	32.1	49.9
147	360	31.1	50.9	355	31.0	51.0	356	31.0	51.0	434	32.7	49.3
148	332	30.4	51.6	324	30.2	51.8	324	30.2	51.8	399	32.0	50.0
149	361	31.2	50.8	356	31.0	51.0	356	31.0	51.0	431	32.7	49.3
150	334	30.5	51.5	324	30.2	51.8	323	30.2	51.8	394	31.9	50.1
151	362	31.2	50.8	356	31.0	51.0	356	31.0	51.0	428	32.6	49.4
152	338	30.6	51.4	328	30.3	51.7	326	30.3	51.7	394	31.9	50.1
153	339	30.6	51.4	327	30.3	51.7	325	30.2	51.8	391	31.8	50.2
154	365	31.2	50.8	357	31.0	51.0	356	31.0	51.0	422	32.5	49.5

ID	Distance (m) to Area A	Attenuation at 10m (Area A)	Prediction (Area A)	Distance (m) to Area B&C	Attenuation at 10m (Area B&C)	Prediction (Area B&E)	Distance (m) to Area E	Attenuation at 10m (Area E)	Prediction (Area E)	Distance (m) to Area H	Attenuation at 10m (Area H)	Prediction (Area H)
155	340	30.6	51.4	327	30.3	51.7	324	30.2	51.8	387	31.7	50.3
156	367	31.3	50.7	357	31.1	50.9	356	31.0	51.0	420	32.5	49.5
157	368	31.3	50.7	358	31.1	50.9	356	31.0	51.0	417	32.4	49.6
158	343	30.7	51.3	328	30.3	51.7	324	30.2	51.8	381	31.6	50.4
159	370	31.4	50.6	358	31.1	50.9	356	31.0	51.0	414	32.3	49.7
160	347	30.8	51.2	331	30.4	51.6	326	30.3	51.7	380	31.6	50.4
161	372	31.4	50.6	359	31.1	50.9	356	31.0	51.0	411	32.3	49.7
162	350	30.9	51.1	333	30.5	51.5	327	30.3	51.7	379	31.6	50.4
163	374	31.4	50.6	360	31.1	50.9	356	31.0	51.0	409	32.2	49.8
164	353	31.0	51.0	336	30.5	51.5	328	30.3	51.7	377	31.5	50.5
165	379	31.6	50.4	363	31.2	50.8	356	31.0	51.0	403	32.1	49.9
166	357	31.0	51.0	338	30.6	51.4	329	30.3	51.7	374	31.5	50.5
167	382	31.6	50.4	365	31.3	50.7	358	31.1	50.9	402	32.1	49.9
168	359	31.1	50.9	340	30.6	51.4	329	30.4	51.6	373	31.4	50.6
169	386	31.7	50.3	368	31.3	50.7	359	31.1	50.9	401	32.1	49.9
170	390	31.8	50.2	371	31.4	50.6	361	31.2	50.8	401	32.1	49.9
171	394	31.9	50.1	375	31.5	50.5	363	31.2	50.8	401	32.1	49.9
172	399	32.0	50.0	379	31.6	50.4	366	31.3	50.7	401	32.1	49.9
173	418	32.4	49.6	396	31.9	50.1	376	31.5	50.5	404	32.1	49.9
174	779	37.8	**44.2**	825	38.3	**43.7**	886	39.0	**43.0**	1108	40.9	**41.1**
175	757	37.6	**44.4**	802	38.1	**43.9**	862	38.7	**43.3**	1082	40.7	**41.3**
176	748	37.5	**44.5**	793	38.0	**44.0**	854	38.6	**43.4**	1074	40.6	**41.4**
177	757	37.6	**44.4**	803	38.1	**43.9**	865	38.7	**43.3**	1086	40.7	**41.3**
178	776	37.8	**44.2**	823	38.3	**43.7**	886	38.9	**43.1**	1109	40.9	**41.1**
179	743	37.4	**44.6**	789	37.9	**44.1**	850	38.6	**43.4**	1072	40.6	**41.4**
180	730	37.3	**44.7**	775	37.8	**44.2**	836	38.4	**43.6**	1057	40.5	**41.5**

ID	Distance (m) to Area A	Attenuation at 10m (Area A)	Prediction (Area A)	Distance (m) to Area B&C	Attenuation at 10m (Area B&C)	Prediction (Area B&E)	Distance (m) to Area E	Attenuation at 10m (Area E)	Prediction (Area E)	Distance (m) to Area H	Attenuation at 10m (Area H)	Prediction (Area H)
181	780	37.8	**44.2**	827	38.3	**43.7**	889	39.0	**43.0**	1111	40.9	**41.1**
182	786	37.9	**44.1**	832	38.4	**43.6**	894	39.0	**43.0**	1116	41.0	**41.0**
183	771	37.7	**44.3**	818	38.3	**43.7**	879	38.9	**43.1**	1101	40.8	**41.2**
184	446	33.0	49.0	489	33.8	48.2	549	34.8	47.2	770	37.7	**44.3**
185	469	33.4	48.6	507	34.1	47.9	565	35.0	47.0	781	37.9	**44.1**
186	498	33.9	48.1	528	34.4	47.6	580	35.3	46.7	783	37.9	**44.1**
187	493	33.9	48.1	519	34.3	47.7	569	35.1	46.9	766	37.7	**44.3**
188	463	33.3	48.7	487	33.8	48.2	536	34.6	47.4	732	37.3	**44.7**
189	302	29.6	52.4	333	30.4	51.6	388	31.8	50.2	601	35.6	46.4
190	468	33.4	48.6	490	33.8	48.2	537	34.6	47.4	728	37.2	**44.8**
191	441	32.9	49.1	459	33.2	48.8	500	34.0	48.0	680	36.7	45.3
192	440	32.9	49.1	457	33.2	48.8	498	33.9	48.1	676	36.6	45.4
193	474	33.5	48.5	489	33.8	48.2	525	34.4	47.6	689	36.8	45.2
194	544	34.7	47.3	585	35.3	46.7	643	36.2	45.8	860	38.7	**43.3**
195	522	34.4	47.6	562	35.0	47.0	621	35.9	46.1	838	38.5	**43.5**
196	500	34.0	48.0	540	34.7	47.3	599	35.5	46.5	816	38.2	**43.8**
197	419	32.5	49.5	438	32.8	49.2	481	33.6	48.4	666	36.5	45.5
198	418	32.4	49.6	436	32.8	49.2	479	33.6	48.4	663	36.4	45.6
199	415	32.4	49.6	432	32.7	49.3	474	33.5	48.5	655	36.3	45.7
200	414	32.3	49.7	431	32.7	49.3	472	33.5	48.5	652	36.3	45.7
201	412	32.3	49.7	429	32.6	49.4	468	33.4	48.6	646	36.2	45.8
202	479	33.6	48.4	518	34.3	47.7	577	35.2	46.8	793	38.0	**44.0**
203	411	32.3	49.7	427	32.6	49.4	466	33.4	48.6	642	36.1	45.9
204	551	34.8	47.2	591	35.4	46.6	650	36.3	45.7	867	38.8	**43.2**
205	529	34.5	47.5	569	35.1	46.9	628	36.0	46.0	845	38.5	**43.5**
206	507	34.1	47.9	547	34.8	47.2	606	35.6	46.4	823	38.3	**43.7**

ID	Distance (m) to Area A	Attenuation at 10m (Area A)	Prediction (Area A)	Distance (m) to Area B&C	Attenuation at 10m (Area B&C)	Prediction (Area B&E)	Distance (m) to Area E	Attenuation at 10m (Area E)	Prediction (Area E)	Distance (m) to Area H	Attenuation at 10m (Area H)	Prediction (Area H)
207	822	38.3	**43.7**	862	38.7	**43.3**	920	39.3	**42.7**	1132	41.1	**40.9**
208	826	38.3	**43.7**	866	38.8	**43.2**	924	39.3	**42.7**	1136	41.1	**40.9**
209	805	38.1	**43.9**	846	38.5	**43.5**	904	39.1	**42.9**	1117	41.0	**41.0**
210	795	38.0	**44.0**	836	38.4	**43.6**	895	39.0	**43.0**	1108	40.9	**41.1**
211	791	38.0	**44.0**	832	38.4	**43.6**	890	39.0	**43.0**	1104	40.9	**41.1**
212	784	37.9	**44.1**	825	38.3	**43.7**	884	38.9	**43.1**	1097	40.8	**41.2**
213	778	37.8	**44.2**	820	38.3	**43.7**	878	38.9	**43.1**	1092	40.8	**41.2**
214	772	37.7	**44.3**	813	38.2	**43.8**	872	38.8	**43.2**	1086	40.7	**41.3**
215	766	37.7	**44.3**	808	38.1	**43.9**	866	38.8	**43.2**	1081	40.7	**41.3**
216	836	38.4	**43.6**	875	38.8	**43.2**	933	39.4	**42.6**	1143	41.2	**40.8**
217	814	38.2	**43.8**	855	38.6	**43.4**	913	39.2	**42.8**	1126	41.0	**41.0**
218	798	38.0	**44.0**	843	38.5	**43.5**	903	39.1	**42.9**	1121	41.0	**41.0**
219	815	38.2	**43.8**	861	38.7	**43.3**	922	39.3	**42.7**	1142	41.2	**40.8**
220	790	38.0	**44.0**	834	38.4	**43.6**	894	39.0	**43.0**	1113	40.9	**41.1**
221	807	38.1	**43.9**	853	38.6	**43.4**	914	39.2	**42.8**	1135	41.1	**40.9**
222	775	37.8	**44.2**	818	38.3	**43.7**	878	38.9	**43.1**	1096	40.8	**41.2**
223	781	37.8	**44.2**	824	38.3	**43.7**	884	38.9	**43.1**	1102	40.8	**41.2**
224	758	37.6	**44.4**	802	38.1	**43.9**	861	38.7	**43.3**	1079	40.7	**41.3**
225	781	37.8	**44.2**	824	38.3	**43.7**	884	38.9	**43.1**	1102	40.8	**41.2**
226	821	38.3	**43.7**	865	38.7	**43.3**	925	39.3	**42.7**	1142	41.2	**40.8**
227	817	38.2	**43.8**	863	38.7	**43.3**	924	39.3	**42.7**	1145	41.2	**40.8**
228	805	38.1	**43.9**	851	38.6	**43.4**	912	39.2	**42.8**	1133	41.1	**40.9**
229	800	38.1	**43.9**	848	38.6	**43.4**	910	39.2	**42.8**	1133	41.1	**40.9**
230	844	38.5	**43.5**	889	39.0	**43.0**	949	39.5	**42.5**	1168	41.4	**40.6**
231	826	38.3	**43.7**	872	38.8	**43.2**	933	39.4	**42.6**	1152	41.2	**40.8**
232	877	38.9	**43.1**	923	39.3	**42.7**	984	39.9	**42.1**	1203	41.6	**40.4**

ID	Distance (m) to Area A	Attenuation at 10m (Area A)	Prediction (Area A)	Distance (m) to Area B&C	Attenuation at 10m (Area B&C)	Prediction (Area B&E)	Distance (m) to Area E	Attenuation at 10m (Area E)	Prediction (Area E)	Distance (m) to Area H	Attenuation at 10m (Area H)	Prediction (Area H)
233	873	38.8	**43.2**	917	39.2	**42.8**	976	39.8	**42.2**	1193	41.5	**40.5**
234	882	38.9	**43.1**	926	39.3	**42.7**	985	39.9	**42.1**	1202	41.6	**40.4**
235	852	38.6	**43.4**	896	39.0	**43.0**	955	39.6	**42.4**	1172	41.4	**40.6**
236	883	38.9	**43.1**	925	39.3	**42.7**	984	39.9	**42.1**	1199	41.6	**40.4**
237	871	38.8	**43.2**	913	39.2	**42.8**	971	39.7	**42.3**	1185	41.5	**40.5**
238	840	38.5	**43.5**	883	38.9	**43.1**	942	39.5	**42.5**	1158	41.3	**40.7**
239	864	38.7	**43.3**	905	39.1	**42.9**	963	39.7	**42.3**	1176	41.4	**40.6**
240	863	38.7	**43.3**	902	39.1	**42.9**	958	39.6	**42.4**	1167	41.3	**40.7**
241	867	38.8	**43.2**	904	39.1	**42.9**	959	39.6	**42.4**	1165	41.3	**40.7**
242	845	38.5	**43.5**	884	38.9	**43.1**	941	39.5	**42.5**	1151	41.2	**40.8**
243	869	38.8	**43.2**	901	39.1	**42.9**	954	39.6	**42.4**	1152	41.2	**40.8**
244	850	38.6	**43.4**	882	38.9	**43.1**	935	39.4	**42.6**	1133	41.1	**40.9**
245	838	38.5	**43.5**	871	38.8	**43.2**	924	39.3	**42.7**	1124	41.0	**41.0**
246	820	38.3	**43.7**	853	38.6	**43.4**	906	39.1	**42.9**	1106	40.9	**41.1**
247	792	38.0	**44.0**	826	38.3	**43.7**	880	38.9	**43.1**	1081	40.7	**41.3**

Table C.7: Reclamation and Revetment Construction, and Paving Works Predictions

ID	Distance (m)	Attenuation at 10m	Prediction
1	628	36.0	**57.0**
2	1069	40.6	**52.4**
3	1049	40.4	**52.5**
4	1056	40.5	**52.5**
5	1059	40.5	**52.5**
6	1060	40.5	**52.4**
7	1063	40.5	**52.4**
8	1052	40.4	**52.5**
9	1079	40.7	**52.3**
10	1121	41.0	**52.0**
11	1131	41.1	**51.9**
12	1140	41.1	**51.8**
13	1156	41.3	**51.7**
14	1102	40.8	**52.1**
15	1107	40.9	**52.1**
16	1043	40.4	**52.6**
17	1037	40.3	**52.6**
18	1028	40.2	**52.7**
19	1027	40.2	**52.7**
20	1030	40.3	**52.7**
21	1031	40.3	**52.7**
22	1035	40.3	**52.7**
23	1040	40.3	**52.6**
24	1091	40.8	**52.2**
25	1054	40.5	**52.5**
26	1030	40.3	**52.7**
27	617	35.8	**57.1**
28	599	35.5	**57.4**
29	594	35.5	**57.5**
30	584	35.3	**57.6**
31	574	35.2	**57.8**
32	565	35.0	**57.9**
33	606	35.7	**57.3**
34	595	35.5	**57.5**
35	547	34.8	**58.2**
36	587	35.4	**57.6**
37	535	34.6	**58.4**
38	582	35.3	**57.7**

ID	Distance (m)	Attenuation at 10m	Prediction
39	512	34.2	**58.8**
40	503	34.0	**58.9**
41	491	33.8	**59.1**
42	485	33.7	**59.2**
43	479	33.6	**59.3**
44	526	34.4	**58.5**
45	519	34.3	**58.6**
46	469	33.4	**59.5**
47	449	33.0	**59.9**
48	456	33.2	**59.8**
49	321	30.1	**62.8**
50	349	30.8	**62.1**
51	351	30.9	**62.1**
52	325	30.2	**62.7**
53	352	30.9	**62.0**
54	326	30.3	**62.7**
55	354	31.0	**62.0**
56	434	32.8	**60.2**
57	328	30.3	**62.6**
58	356	31.0	**61.9**
59	330	30.4	**62.6**
60	332	30.4	**62.5**
61	359	31.1	**61.8**
62	333	30.5	**62.5**
63	361	31.1	**61.8**
64	427	32.6	**60.3**
65	362	31.2	**61.8**
66	335	30.5	**62.5**
67	398	32.0	**61.0**
68	367	31.3	**61.7**
69	366	31.3	**61.7**
70	311	29.8	**63.1**
71	310	29.8	**63.1**
72	308	29.8	**63.2**
73	351	30.9	**62.0**
74	307	29.8	**63.2**
75	306	29.7	**63.3**
76	350	30.9	**62.1**
77	347	30.8	**62.2**

ID	Distance (m)	Attenuation at 10m	Prediction
78	305	29.7	63.3
79	346	30.8	62.2
80	345	30.8	62.2
81	303	29.6	63.3
82	344	30.7	62.2
83	303	29.6	63.3
84	341	30.7	62.3
85	303	29.6	63.3
86	340	30.6	62.3
87	339	30.6	62.4
88	302	29.6	63.4
89	347	30.8	62.1
90	395	31.9	61.0
91	281	29.0	64.0
92	275	28.8	64.2
93	270	28.6	64.3
94	334	30.5	62.5
95	302	29.6	63.4
96	296	29.4	63.5
97	302	29.6	63.4
98	337	30.6	62.4
99	336	30.5	62.4
100	336	30.5	62.4
101	303	29.6	63.3
102	335	30.5	62.4
103	304	29.7	63.3
104	335	30.5	62.5
105	306	29.7	63.3
106	335	30.5	62.4
107	307	29.7	63.2
108	308	29.8	63.2
109	336	30.5	62.4
110	312	29.9	63.1
111	339	30.6	62.4
112	341	30.6	62.3
113	342	30.7	62.3
114	316	30.0	63.0
115	344	30.7	62.2
116	315	30.0	63.0

ID	Distance (m)	Attenuation at 10m	Prediction
117	343	30.7	62.2
118	319	30.1	62.9
119	330	30.4	62.6
120	252	28.0	64.9
121	256	28.2	64.8
122	260	28.3	64.6
123	264	28.4	64.5
124	274	28.8	64.2
125	281	29.0	64.0
126	276	28.8	64.1
127	270	28.6	64.3
128	267	28.5	64.4
129	261	28.3	64.6
130	256	28.2	64.8
131	1053	40.4	52.5
132	1056	40.5	52.5
133	1063	40.5	52.4
134	1075	40.6	52.3
135	1087	40.7	52.2
136	1075	40.6	52.3
137	1100	40.8	52.1
138	366	31.3	61.7
139	340	30.6	62.3
140	368	31.3	61.6
141	342	30.7	62.3
142	344	30.7	62.2
143	346	30.8	62.2
144	371	31.4	61.6
145	373	31.4	61.5
146	351	30.9	62.1
147	375	31.5	61.5
148	351	30.9	62.0
149	377	31.5	61.4
150	354	31.0	62.0
151	379	31.6	61.4
152	359	31.1	61.9
153	361	31.1	61.8
154	384	31.7	61.3
155	363	31.2	61.8

ID	Distance (m)	Attenuation at 10m	Prediction
156	386	31.7	61.2
157	388	31.8	61.2
158	368	31.3	61.6
159	391	31.8	61.1
160	372	31.4	61.5
161	393	31.9	61.1
162	376	31.5	61.5
163	396	32.0	61.0
164	380	31.6	61.4
165	403	32.1	60.8
166	384	31.7	61.3
167	407	32.2	60.8
168	387	31.8	61.2
169	412	32.3	60.7
170	416	32.4	60.6
171	421	32.5	60.5
172	427	32.6	60.3
173	448	33.0	59.9
174	661	36.4	56.6
175	639	36.1	56.8
176	630	36.0	57.0
177	638	36.1	56.9
178	657	36.4	56.6
179	625	35.9	57.0
180	612	35.7	57.2
181	662	36.4	56.5
182	668	36.5	56.5
183	653	36.3	56.7
184	329	30.3	62.6
185	353	31.0	62.0
186	389	31.8	61.2
187	388	31.8	61.2
188	360	31.1	61.8
189	197	25.9	67.1
190	368	31.3	61.6
191	356	31.0	61.9
192	356	31.0	61.9
193	401	32.1	60.9
194	427	32.6	60.3

ID	Distance (m)	Attenuation at 10m	Prediction
195	406	32.2	**60.8**
196	384	31.7	**61.3**
197	330	30.4	**62.6**
198	331	30.4	**62.6**
199	331	30.4	**62.6**
200	332	30.4	**62.5**
201	333	30.5	**62.5**
202	364	31.2	**61.7**
203	334	30.5	**62.5**
204	434	32.7	**60.2**
205	412	32.3	**60.6**
206	391	31.8	**61.1**
207	708	37.0	**56.0**
208	726	37.2	**55.7**
209	682	36.7	**56.3**
210	641	36.1	**56.8**
211	657	36.3	**56.6**
212	687	36.7	**56.2**
213	689	36.8	**56.2**
214	663	36.4	**56.5**
215	663	36.4	**56.5**
216	672	36.5	**56.4**
217	699	36.9	**56.1**
218	649	36.2	**56.7**
219	697	36.9	**56.1**
220	680	36.7	**56.3**
221	654	36.3	**56.6**
222	661	36.4	**56.6**
223	667	36.5	**56.5**
224	673	36.6	**56.4**
225	703	36.9	**56.0**
226	678	36.6	**56.3**
227	688	36.7	**56.2**
228	697	36.9	**56.1**
229	705	37.0	**56.0**
230	709	37.0	**55.9**
231	719	37.1	**55.8**
232	756	37.6	**55.4**
233	759	37.6	**55.3**

ID	Distance (m)	Attenuation at 10m	Prediction
234	764	37.7	**55.3**
235	734	37.3	**55.6**
236	765	37.7	**55.3**
237	753	37.5	**55.4**
238	722	37.2	**55.8**
239	747	37.5	**55.5**
240	747	37.5	**55.5**
241	751	37.5	**55.4**
242	729	37.3	**55.7**
243	755	37.6	**55.4**
244	736	37.3	**55.6**
245	724	37.2	**55.8**
246	706	37.0	**56.0**
247	679	36.6	**56.3**

Table C.8: Road furniture and Fencing Predictions

ID	Distance (m)	Attenuation at 10m	Prediction
1	362	31.2	**50.8**
2	948	39.5	**42.5**
3	925	39.3	**42.7**
4	932	39.4	**42.6**
5	935	39.4	**42.6**
6	936	39.4	**42.6**
7	938	39.4	**42.6**
8	927	39.3	**42.7**
9	959	39.6	**42.4**
10	988	39.9	**42.1**
11	982	39.8	**42.2**
12	982	39.8	**42.2**
13	993	39.9	**42.1**
14	983	39.9	**42.2**
15	988	39.9	**42.1**
16	919	39.3	**42.7**
17	912	39.2	**42.8**
18	903	39.1	**42.9**
19	903	39.1	**42.9**
20	906	39.1	**42.9**
21	908	39.2	**42.8**

ID	Distance (m)	Attenuation at 10m	Prediction
22	913	39.2	**42.8**
23	919	39.3	**42.7**
24	971	39.7	**42.3**
25	933	39.4	**42.6**
26	907	39.2	**42.9**
27	352	30.9	**51.1**
28	335	30.5	**51.5**
29	330	30.4	**51.6**
30	320	30.1	**51.9**
31	310	29.8	**52.2**
32	302	29.6	**52.4**
33	340	30.6	**51.4**
34	329	30.3	**51.7**
35	283	29.0	**53.0**
36	321	30.1	**51.9**
37	271	28.7	**53.4**
38	315	30.0	**52.0**
39	248	27.9	**54.1**
40	239	27.6	**54.5**
41	228	27.1	**54.9**
42	221	26.9	**55.1**
43	216	26.7	**55.3**
44	259	28.3	**53.7**
45	252	28.0	**54.0**
46	206	26.3	**55.7**
47	181	25.2	**56.8**
48	188	25.5	**56.5**
49	246	27.8	**54.2**
50	275	28.8	**53.2**
51	278	28.9	**53.1**
52	247	27.8	**54.2**
53	279	28.9	**53.1**
54	247	27.9	**54.2**
55	280	28.9	**53.1**
56	347	30.8	**51.2**
57	248	27.9	**54.1**
58	280	28.9	**53.1**
59	249	27.9	**54.1**
60	249	27.9	**54.1**

ID	Distance (m)	Attenuation at 10m	Prediction
61	280	29.0	53.1
62	249	27.9	54.1
63	281	29.0	53.1
64	347	30.8	51.2
65	281	29.0	53.0
66	247	27.9	54.2
67	316	30.0	52.0
68	242	27.7	54.3
69	252	28.0	54.0
70	209	26.4	55.6
71	209	26.4	55.6
72	209	26.4	55.6
73	244	27.8	54.3
74	210	26.4	55.6
75	210	26.4	55.6
76	245	27.8	54.2
77	243	27.7	54.3
78	211	26.5	55.5
79	244	27.8	54.3
80	245	27.8	54.2
81	214	26.6	55.4
82	245	27.8	54.2
83	215	26.6	55.4
84	245	27.8	54.2
85	216	26.7	55.3
86	245	27.8	54.2
87	245	27.8	54.2
88	217	26.7	55.3
89	272	28.7	53.3
90	307	29.7	52.3
91	187	25.5	56.6
92	183	25.2	56.8
93	179	25.1	56.9
94	214	26.6	55.4
95	218	26.8	55.2
96	214	26.6	55.4
97	219	26.8	55.2
98	246	27.8	54.2
99	247	27.9	54.2

ID	Distance (m)	Attenuation at 10m	Prediction
100	248	27.9	54.1
101	222	26.9	55.1
102	249	27.9	54.1
103	224	27.0	55.0
104	250	28.0	54.1
105	227	27.1	54.9
106	251	28.0	54.0
107	230	27.2	54.8
108	232	27.3	54.7
109	254	28.1	53.9
110	236	27.5	54.5
111	257	28.2	53.8
112	260	28.3	53.7
113	262	28.4	53.6
114	244	27.8	54.3
115	266	28.5	53.5
116	244	27.7	54.3
117	264	28.4	53.6
118	246	27.8	54.2
119	255	28.1	53.9
120	172	24.7	57.3
121	175	24.8	57.2
122	178	25.0	57.0
123	181	25.2	56.9
124	190	25.6	56.4
125	207	26.3	55.7
126	202	26.1	55.9
127	196	25.9	56.2
128	193	25.7	56.3
129	187	25.4	56.6
130	182	25.2	56.8
131	923	39.3	42.7
132	926	39.3	42.7
133	934	39.4	42.6
134	947	39.5	42.5
135	959	39.6	42.4
136	954	39.6	42.4
137	969	39.7	42.3
138	281	29.0	53.0

ID	Distance (m)	Attenuation at 10m	Prediction
139	248	27.9	54.1
140	281	29.0	53.0
141	247	27.8	54.2
142	245	27.8	54.2
143	243	27.7	54.3
144	276	28.8	53.2
145	275	28.8	53.2
146	241	27.7	54.4
147	273	28.7	53.3
148	238	27.5	54.5
149	272	28.7	53.3
150	236	27.5	54.6
151	270	28.6	53.4
152	238	27.5	54.5
153	236	27.5	54.6
154	267	28.5	53.5
155	234	27.4	54.6
156	267	28.5	53.5
157	266	28.5	53.5
158	232	27.3	54.7
159	265	28.5	53.6
160	234	27.4	54.6
161	264	28.4	53.6
162	234	27.4	54.6
163	264	28.4	53.6
164	235	27.4	54.6
165	263	28.4	53.6
166	235	27.4	54.6
167	264	28.4	53.6
168	236	27.5	54.6
169	266	28.5	53.5
170	268	28.6	53.4
171	270	28.6	53.4
172	274	28.7	53.3
173	285	29.1	52.9
174	399	32.0	50.0
175	375	31.5	50.5
176	366	31.3	50.7
177	377	31.5	50.5

ID	Distance (m)	Attenuation at 10m	Prediction
178	399	32.0	50.0
179	363	31.2	50.8
180	349	30.9	51.2
181	402	32.1	49.9
182	407	32.2	49.8
183	392	31.9	50.2
184	62	15.8	66.2
185	89	19.0	63.0
186	148	23.4	58.6
187	164	24.3	57.7
188	154	23.7	58.3
189	43	12.6	69.4
190	172	24.7	57.3
191	202	26.1	55.9
192	206	26.3	55.7
193	261	28.3	53.7
194	160	24.1	57.9
195	139	22.8	59.2
196	117	21.4	60.6
197	177	25.0	57.0
198	181	25.2	56.8
199	187	25.5	56.6
200	191	25.6	56.4
201	197	25.9	56.1
202	98	19.9	62.2
203	201	26.1	56.0
204	167	24.4	57.6
205	145	23.2	58.8
206	124	21.9	60.1
207	437	32.8	49.2
208	442	32.9	49.1
209	421	32.5	49.5
210	411	32.3	49.7
211	406	32.2	49.8
212	400	32.0	50.0
213	394	31.9	50.1
214	387	31.8	50.2
215	382	31.6	50.4
216	452	33.1	48.9

ID	Distance (m)	Attenuation at 10m	Prediction
217	430	32.7	49.3
218	416	32.4	49.6
219	434	32.8	49.3
220	407	32.2	49.8
221	426	32.6	49.4
222	392	31.9	50.2
223	397	32.0	50.0
224	375	31.5	50.5
225	397	32.0	50.0
226	438	32.8	49.2
227	437	32.8	49.2
228	425	32.6	49.5
229	423	32.5	49.5
230	462	33.3	48.7
231	445	33.0	49.0
232	496	33.9	48.1
233	490	33.8	48.2
234	499	34.0	48.1
235	469	33.4	48.6
236	499	34.0	48.1
237	486	33.7	48.3
238	456	33.2	48.8
239	480	33.6	48.4
240	480	33.6	48.4
241	485	33.7	48.3
242	462	33.3	48.7
243	492	33.8	48.2
244	473	33.5	48.5
245	461	33.3	48.7
246	443	32.9	49.1
247	415	32.4	49.7

Table C.9: Bankseat piling and Concrete Works Predictions

ID	Distance (m)	Attenuation at 10m	Prediction
1	769	37.7	52.9
2	1198	41.6	49.0
3	1174	41.4	49.2
4	1180	41.4	49.2

ID	Distance (m)	Attenuation at 10m	Prediction
5	1182	41.5	49.1
6	1183	41.5	49.1
7	1184	41.5	49.1
8	1173	41.4	49.2
9	1209	41.6	49.0
10	1225	41.8	48.8
11	1233	41.8	48.8
12	1242	41.9	48.7
13	1258	42.0	48.6
14	1209	41.7	48.9
15	1213	41.7	48.9
16	1163	41.3	49.3
17	1156	41.3	49.3
18	1145	41.2	49.4
19	1143	41.2	49.4
20	1145	41.2	49.4
21	1146	41.2	49.4
22	1147	41.2	49.4
23	1151	41.2	49.4
24	1199	41.6	49.0
25	1163	41.3	49.3
26	1144	41.2	49.4
27	760	37.6	53.0
28	742	37.4	53.2
29	737	37.3	53.3
30	727	37.2	53.4
31	717	37.1	53.5
32	709	37.0	53.6
33	747	37.5	53.1
34	736	37.3	53.3
35	690	36.8	53.8
36	728	37.2	53.4
37	678	36.6	54.0
38	722	37.2	53.4
39	655	36.3	54.3
40	646	36.2	54.4
41	635	36.0	54.6
42	628	36.0	54.6
43	622	35.9	54.7

ID	Distance (m)	Attenuation at 10m	Prediction
44	665	36.5	54.1
45	658	36.4	54.2
46	612	35.7	54.9
47	587	35.4	55.2
48	594	35.5	55.1
49	324	30.2	60.4
50	357	31.1	59.5
51	358	31.1	59.5
52	325	30.2	60.4
53	357	31.0	59.6
54	325	30.2	60.4
55	358	31.1	59.5
56	456	33.2	57.4
57	326	30.3	60.3
58	358	31.1	59.5
59	326	30.3	60.3
60	326	30.3	60.3
61	358	31.1	59.5
62	326	30.3	60.3
63	358	31.1	59.5
64	438	32.8	57.8
65	358	31.1	59.5
66	326	30.3	60.3
67	415	32.4	58.2
68	440	32.9	57.7
69	430	32.7	57.9
70	366	31.3	59.3
71	364	31.2	59.4
72	360	31.1	59.5
73	408	32.2	58.4
74	358	31.1	59.5
75	355	31.0	59.6
76	405	32.1	58.5
77	400	32.0	58.6
78	352	30.9	59.7
79	397	32.0	58.6
80	394	31.9	58.7
81	344	30.7	59.9
82	391	31.8	58.8

ID	Distance (m)	Attenuation at 10m	Prediction
83	342	30.7	59.9
84	386	31.7	58.9
85	339	30.6	60.0
86	383	31.7	58.9
87	380	31.6	59.0
88	337	30.5	60.1
89	357	31.1	59.5
90	422	32.5	58.1
91	331	30.4	60.2
92	325	30.2	60.4
93	320	30.1	60.5
94	407	32.2	58.4
95	334	30.5	60.1
96	326	30.3	60.3
97	332	30.4	60.2
98	375	31.5	59.1
99	373	31.4	59.2
100	370	31.4	59.2
101	328	30.3	60.3
102	367	31.3	59.3
103	327	30.3	60.3
104	365	31.2	59.4
105	327	30.3	60.3
106	363	31.2	59.4
107	326	30.3	60.3
108	325	30.2	60.4
109	359	31.1	59.5
110	327	30.3	60.3
111	361	31.1	59.5
112	360	31.1	59.5
113	360	31.1	59.5
114	322	30.2	60.4
115	359	31.1	59.5
116	324	30.2	60.4
117	359	31.1	59.5
118	324	30.2	60.4
119	343	30.7	59.9
120	287	29.1	61.5
121	291	29.3	61.3

ID	Distance (m)	Attenuation at 10m	Prediction
122	296	29.4	61.2
123	302	29.6	61.0
124	312	29.9	60.7
125	299	29.5	61.1
126	294	29.4	61.2
127	289	29.2	61.4
128	286	29.1	61.5
129	281	29.0	61.6
130	277	28.8	61.8
131	1188	41.5	49.1
132	1191	41.5	49.1
133	1197	41.6	49.0
134	1210	41.7	48.9
135	1221	41.7	48.9
136	1204	41.6	49.0
137	1235	41.8	48.8
138	359	31.1	59.5
139	329	30.3	60.3
140	360	31.1	59.5
141	330	30.4	60.2
142	331	30.4	60.2
143	333	30.4	60.2
144	360	31.1	59.5
145	362	31.2	59.4
146	336	30.5	60.1
147	363	31.2	59.4
148	336	30.5	60.1
149	364	31.2	59.4
150	337	30.6	60.0
151	365	31.2	59.4
152	342	30.7	59.9
153	343	30.7	59.9
154	368	31.3	59.3
155	344	30.7	59.9
156	370	31.4	59.2
157	372	31.4	59.2
158	347	30.8	59.8
159	373	31.4	59.2
160	351	30.9	59.7

ID	Distance (m)	Attenuation at 10m	Prediction
161	375	31.5	59.1
162	354	31.0	59.6
163	378	31.5	59.1
164	358	31.1	59.5
165	383	31.7	58.9
166	361	31.2	59.4
167	386	31.7	58.9
168	364	31.2	59.4
169	391	31.8	58.8
170	394	31.9	58.7
171	399	32.0	58.6
172	404	32.1	58.5
173	423	32.5	58.1
174	805	38.1	52.5
175	782	37.9	52.7
176	773	37.8	52.8
177	783	37.9	52.7
178	803	38.1	52.5
179	769	37.7	52.9
180	756	37.6	53.0
181	807	38.1	52.5
182	812	38.2	52.4
183	798	38.0	52.6
184	469	33.4	57.2
185	489	33.8	56.8
186	512	34.2	56.4
187	504	34.1	56.5
188	472	33.5	57.1
189	316	30.0	60.6
190	476	33.5	57.1
191	447	33.0	57.6
192	445	33.0	57.6
193	479	33.6	57.0
194	566	35.1	55.5
195	544	34.7	55.9
196	522	34.3	56.3
197	425	32.6	58.0
198	424	32.6	58.0
199	421	32.5	58.1

ID	Distance (m)	Attenuation at 10m	Prediction
200	420	32.5	58.1
201	418	32.4	58.2
202	500	34.0	56.6
203	416	32.4	58.2
204	572	35.2	55.4
205	551	34.8	55.8
206	529	34.5	56.1
207	843	38.5	52.1
208	848	38.6	52.0
209	827	38.4	52.2
210	818	38.3	52.3
211	813	38.2	52.4
212	806	38.1	52.5
213	801	38.1	52.5
214	794	38.0	52.6
215	789	37.9	52.7
216	857	38.7	51.9
217	836	38.4	52.2
218	823	38.3	52.3
219	841	38.5	52.1
220	814	38.2	52.4
221	833	38.4	52.2
222	799	38.1	52.5
223	805	38.1	52.5
224	782	37.9	52.7
225	805	38.1	52.5
226	845	38.5	52.1
227	843	38.5	52.1
228	831	38.4	52.2
229	827	38.4	52.2
230	869	38.8	51.8
231	852	38.6	52.0
232	903	39.1	51.5
233	898	39.1	51.5
234	906	39.1	51.5
235	876	38.9	51.7
236	906	39.1	51.5
237	894	39.0	51.6
238	864	38.7	51.9

ID	Distance (m)	Attenuation at 10m	Prediction
239	886	39.0	**51.6**
240	884	38.9	**51.7**
241	886	39.0	**51.6**
242	866	38.8	**51.8**
243	885	38.9	**51.7**
244	865	38.7	**51.9**
245	854	38.6	**52.0**
246	836	38.4	**52.2**
247	809	38.2	**52.4**

Ferry Not Operational Predictions

Table C.10: Remove Hydraulic Linkspan and Jack Up Barge

ID	Linkspan Distance (m)	Linkspan Attenuation at 10m	Linkspan Predictions	Jack Up Barge Distance (m)	Jack Up Barge attenuation at 10m	Jack up Barge Predictions
1	719	37.1	52.2	765	37.7	51.7
2	1132	41.1	48.3	1184	41.5	47.9
3	1108	40.9	48.4	1158	41.3	48.1
4	1115	40.9	48.4	1165	41.3	48.0
5	1117	41.0	48.4	1166	41.3	48.0
6	1118	41.0	48.4	1167	41.3	48.0
7	1120	41.0	48.4	1168	41.3	48.0
8	1109	40.9	48.4	1156	41.3	48.1
9	1143	41.2	48.2	1195	41.6	47.8
10	1168	41.4	48.0	1204	41.6	47.7
11	1177	41.4	47.9	1212	41.7	47.7
12	1186	41.5	47.9	1220	41.7	47.6
13	1202	41.6	47.7	1236	41.8	47.5
14	1151	41.2	48.1	1189	41.5	47.8
15	1155	41.3	48.1	1192	41.5	47.8
16	1100	40.8	48.5	1146	41.2	48.2
17	1093	40.8	48.6	1139	41.1	48.2
18	1082	40.7	48.7	1128	41.0	48.3
19	1081	40.7	48.7	1125	41.0	48.3
20	1083	40.7	48.6	1127	41.0	48.3
21	1084	40.7	48.6	1127	41.0	48.3
22	1086	40.7	48.6	1127	41.0	48.3
23	1091	40.8	48.6	1131	41.1	48.3
24	1140	41.1	48.2	1179	41.4	47.9
25	1104	40.9	48.5	1143	41.2	48.2
26	1083	40.7	48.7	1125	41.0	48.3
27	709	37.0	52.3	755	37.6	51.8
28	690	36.8	52.6	737	37.3	52.0
29	685	36.7	52.6	732	37.3	52.1
30	676	36.6	52.7	722	37.2	52.2
31	666	36.5	52.9	712	37.1	52.3
32	657	36.3	53.0	703	36.9	52.4
33	697	36.9	52.5	743	37.4	51.9
34	686	36.7	52.6	732	37.3	52.1
35	638	36.1	53.2	685	36.7	52.6
36	679	36.6	52.7	724	37.2	52.2
37	626	35.9	53.4	673	36.6	52.8
38	673	36.6	52.8	718	37.1	52.2

ID	Linkspan Distance (m)	Linkspan Attenuation at 10m	Linkspan Predictions	Jack Up Barge Distance (m)	Jack Up Barge attenuation at 10m	Jack up Barge Predictions
39	604	35.6	53.7	650	36.3	53.1
40	594	35.5	53.9	641	36.1	53.2
41	583	35.3	54.0	629	36.0	53.4
42	576	35.2	54.1	623	35.9	53.5
43	571	35.1	54.2	617	35.8	53.5
44	617	35.8	53.5	661	36.4	52.9
45	610	35.7	53.6	654	36.3	53.0
46	561	35.0	54.4	607	35.7	53.7
47	539	34.6	54.7	583	35.3	54.0
48	546	34.7	54.6	590	35.4	53.9
49	326	30.3	59.1	329	30.3	59.0
50	359	31.1	58.3	361	31.2	58.2
51	359	31.1	58.2	362	31.2	58.2
52	326	30.3	59.1	329	30.4	59.0
53	358	31.1	58.3	361	31.2	58.2
54	326	30.3	59.1	329	30.4	59.0
55	359	31.1	58.2	362	31.2	58.2
56	457	33.2	56.1	460	33.3	56.1
57	327	30.3	59.0	330	30.4	59.0
58	360	31.1	58.2	363	31.2	58.1
59	328	30.3	59.0	330	30.4	59.0
60	328	30.3	59.0	331	30.4	59.0
61	359	31.1	58.2	362	31.2	58.2
62	328	30.3	59.0	331	30.4	59.0
63	360	31.1	58.2	362	31.2	58.2
64	439	32.9	56.5	442	32.9	56.4
65	360	31.1	58.2	363	31.2	58.1
66	328	30.3	59.0	330	30.4	59.0
67	417	32.4	56.9	420	32.5	56.9
68	425	32.6	56.8	442	32.9	56.4
69	420	32.5	56.9	433	32.7	56.6
70	358	31.1	58.3	369	31.3	58.0
71	357	31.0	58.3	367	31.3	58.0
72	353	31.0	58.4	363	31.2	58.1
73	400	32.0	57.3	411	32.3	57.1
74	352	30.9	58.4	361	31.2	58.2
75	349	30.9	58.5	358	31.1	58.3
76	398	32.0	57.4	408	32.2	57.1
77	394	31.9	57.4	403	32.1	57.2

ID	Linkspan Distance (m)	Linkspan Attenuation at 10m	Linkspan Predictions	Jack Up Barge Distance (m)	Jack Up Barge attenuation at 10m	Jack up Barge Predictions
78	347	30.8	**58.5**	355	31.0	**58.3**
79	392	31.9	**57.5**	400	32.0	**57.3**
80	389	31.8	**57.5**	397	32.0	**57.4**
81	342	30.7	**58.7**	347	30.8	**58.5**
82	387	31.8	**57.6**	394	31.9	**57.4**
83	340	30.6	**58.7**	345	30.8	**58.6**
84	383	31.7	**57.7**	389	31.8	**57.5**
85	339	30.6	**58.7**	343	30.7	**58.6**
86	381	31.6	**57.7**	386	31.7	**57.6**
87	379	31.6	**57.8**	384	31.7	**57.7**
88	336	30.5	**58.8**	340	30.6	**58.7**
89	358	31.1	**58.3**	361	31.2	**58.2**
90	423	32.5	**56.8**	426	32.6	**56.8**
91	324	30.2	**59.1**	334	30.5	**58.9**
92	318	30.1	**59.3**	328	30.3	**59.0**
93	313	29.9	**59.4**	323	30.2	**59.2**
94	392	31.9	**57.5**	409	32.2	**57.1**
95	334	30.5	**58.9**	337	30.6	**58.8**
96	326	30.3	**59.1**	329	30.4	**59.0**
97	332	30.4	**58.9**	336	30.5	**58.8**
98	375	31.5	**57.9**	379	31.6	**57.8**
99	373	31.4	**57.9**	376	31.5	**57.8**
100	370	31.4	**58.0**	373	31.4	**57.9**
101	328	30.3	**59.0**	332	30.4	**58.9**
102	368	31.3	**58.0**	371	31.4	**58.0**
103	328	30.3	**59.0**	331	30.4	**58.9**
104	365	31.2	**58.1**	368	31.3	**58.0**
105	327	30.3	**59.0**	331	30.4	**59.0**
106	363	31.2	**58.1**	366	31.3	**58.1**
107	326	30.3	**59.1**	330	30.4	**59.0**
108	326	30.3	**59.1**	329	30.4	**59.0**
109	360	31.1	**58.2**	363	31.2	**58.1**
110	328	30.3	**59.0**	331	30.4	**59.0**
111	361	31.2	**58.2**	365	31.2	**58.1**
112	361	31.2	**58.2**	364	31.2	**58.1**
113	361	31.2	**58.2**	364	31.2	**58.1**
114	324	30.2	**59.1**	327	30.3	**59.1**
115	360	31.1	**58.2**	363	31.2	**58.2**
116	325	30.2	**59.1**	328	30.3	**59.0**

ID	Linkspan Distance (m)	Linkspan Attenuation at 10m	Linkspan Predictions	Jack Up Barge Distance (m)	Jack Up Barge attenuation at 10m	Jack up Barge Predictions
117	360	31.1	58.2	363	31.2	58.1
118	326	30.3	59.1	329	30.3	59.0
119	344	30.7	58.6	347	30.8	58.5
120	286	29.1	60.2	290	29.2	60.1
121	290	29.2	60.1	295	29.4	60.0
122	295	29.4	59.9	300	29.5	59.8
123	300	29.5	59.8	305	29.7	59.7
124	310	29.8	59.5	315	30.0	59.4
125	299	29.5	59.8	303	29.6	59.7
126	295	29.4	60.0	298	29.5	59.9
127	290	29.2	60.1	293	29.3	60.0
128	286	29.1	60.2	290	29.2	60.1
129	281	29.0	60.4	284	29.1	60.3
130	277	28.9	60.5	281	29.0	60.4
131	1121	41.0	48.3	1175	41.4	47.9
132	1124	41.0	48.3	1178	41.4	47.9
133	1131	41.1	48.3	1185	41.5	47.9
134	1143	41.2	48.2	1197	41.6	47.8
135	1155	41.2	48.1	1208	41.6	47.7
136	1138	41.1	48.2	1191	41.5	47.8
137	1168	41.4	48.0	1222	41.7	47.6
138	361	31.1	58.2	364	31.2	58.1
139	331	30.4	58.9	333	30.5	58.9
140	362	31.2	58.2	364	31.2	58.1
141	332	30.4	58.9	334	30.5	58.9
142	333	30.5	58.9	336	30.5	58.8
143	335	30.5	58.8	337	30.6	58.8
144	362	31.2	58.2	365	31.2	58.1
145	364	31.2	58.1	366	31.3	58.1
146	338	30.6	58.8	340	30.6	58.7
147	365	31.2	58.1	367	31.3	58.1
148	338	30.6	58.8	340	30.6	58.7
149	366	31.3	58.1	368	31.3	58.0
150	340	30.6	58.7	341	30.7	58.7
151	367	31.3	58.0	369	31.3	58.0
152	344	30.7	58.6	346	30.8	58.6
153	345	30.8	58.6	347	30.8	58.5
154	371	31.4	58.0	373	31.4	57.9
155	347	30.8	58.5	348	30.8	58.5

ID	Linkspan Distance (m)	Linkspan Attenuation at 10m	Linkspan Predictions	Jack Up Barge Distance (m)	Jack Up Barge attenuation at 10m	Jack up Barge Predictions
156	373	31.4	57.9	375	31.5	57.9
157	374	31.5	57.9	376	31.5	57.8
158	350	30.9	58.5	351	30.9	58.4
159	376	31.5	57.8	377	31.5	57.8
160	354	31.0	58.4	355	31.0	58.3
161	378	31.5	57.8	379	31.6	57.8
162	357	31.1	58.3	358	31.1	58.3
163	380	31.6	57.7	382	31.6	57.7
164	360	31.1	58.2	361	31.2	58.2
165	386	31.7	57.6	387	31.8	57.6
166	364	31.2	58.1	365	31.3	58.1
167	389	31.8	57.5	390	31.8	57.5
168	367	31.3	58.1	368	31.3	58.0
169	393	31.9	57.4	394	31.9	57.4
170	397	32.0	57.4	398	32.0	57.3
171	402	32.1	57.3	403	32.1	57.2
172	407	32.2	57.1	408	32.2	57.1
173	426	32.6	56.7	427	32.6	56.7
174	752	37.5	51.8	800	38.1	51.3
175	730	37.3	52.1	777	37.8	51.5
176	721	37.2	52.2	768	37.7	51.6
177	730	37.3	52.1	778	37.8	51.5
178	749	37.5	51.9	797	38.0	51.3
179	716	37.1	52.2	764	37.7	51.7
180	704	36.9	52.4	750	37.5	51.8
181	753	37.5	51.8	801	38.1	51.3
182	759	37.6	51.7	807	38.1	51.2
183	745	37.4	51.9	792	38.0	51.4
184	420	32.5	56.9	465	33.3	56.0
185	442	32.9	56.4	485	33.7	55.6
186	473	33.5	55.8	510	34.1	55.2
187	469	33.4	55.9	503	34.0	55.3
188	439	32.9	56.5	472	33.5	55.9
189	278	28.9	60.5	314	29.9	59.4
190	445	33.0	56.4	476	33.5	55.8
191	424	32.5	56.8	449	33.0	56.3
192	423	32.5	56.8	447	33.0	56.3
193	463	33.3	56.0	482	33.7	55.7
194	518	34.3	55.1	562	35.0	54.4

ID	Linkspan Distance (m)	Linkspan Attenuation at 10m	Linkspan Predictions	Jack Up Barge Distance (m)	Jack Up Barge attenuation at 10m	Jack up Barge Predictions
195	496	33.9	55.4	540	34.6	54.7
196	474	33.5	55.8	518	34.3	55.1
197	400	32.0	57.3	427	32.6	56.7
198	400	32.0	57.3	426	32.6	56.8
199	398	32.0	57.3	422	32.5	56.8
200	398	32.0	57.3	422	32.5	56.8
201	398	32.0	57.4	420	32.5	56.9
202	453	33.1	56.2	496	33.9	55.4
203	397	32.0	57.4	418	32.4	56.9
204	524	34.4	54.9	568	35.1	54.3
205	503	34.0	55.3	546	34.8	54.6
206	481	33.6	55.7	525	34.4	54.9
207	795	38.0	51.3	839	38.5	50.9
208	800	38.1	51.3	844	38.5	50.8
209	779	37.8	51.5	823	38.3	51.0
210	769	37.7	51.6	813	38.2	51.1
211	764	37.7	51.7	809	38.2	51.2
212	758	37.6	51.8	802	38.1	51.3
213	752	37.5	51.8	796	38.0	51.3
214	745	37.4	51.9	790	38.0	51.4
215	740	37.4	52.0	785	37.9	51.5
216	810	38.2	51.2	853	38.6	50.7
217	788	37.9	51.4	832	38.4	50.9
218	772	37.8	51.6	818	38.3	51.1
219	789	37.9	51.4	836	38.4	50.9
220	763	37.7	51.7	810	38.2	51.2
221	780	37.8	51.5	828	38.4	51.0
222	748	37.5	51.9	794	38.0	51.3
223	754	37.5	51.8	800	38.1	51.3
224	732	37.3	52.1	778	37.8	51.5
225	754	37.5	51.8	800	38.1	51.3
226	794	38.0	51.3	840	38.5	50.9
227	790	38.0	51.4	838	38.5	50.9
228	778	37.8	51.5	826	38.3	51.0
229	773	37.8	51.6	821	38.3	51.1
230	817	38.2	51.1	864	38.7	50.6
231	800	38.1	51.3	847	38.6	50.8
232	851	38.6	50.7	898	39.1	50.3
233	847	38.6	50.8	893	39.0	50.3

ID	Linkspan Distance (m)	Linkspan Attenuation at 10m	Linkspan Predictions	Jack Up Barge Distance (m)	Jack Up Barge attenuation at 10m	Jack up Barge Predictions
234	856	38.6	50.7	902	39.1	50.2
235	825	38.3	51.0	871	38.8	50.5
236	856	38.7	50.7	901	39.1	50.2
237	844	38.5	50.8	889	39.0	50.4
238	814	38.2	51.1	859	38.7	50.7
239	838	38.5	50.9	882	38.9	50.4
240	837	38.5	50.9	880	38.9	50.5
241	841	38.5	50.8	883	38.9	50.4
242	819	38.3	51.1	862	38.7	50.6
243	843	38.5	50.8	882	38.9	50.4
244	824	38.3	51.0	863	38.7	50.6
245	812	38.2	51.1	852	38.6	50.7
246	794	38.0	51.3	834	38.4	50.9
247	767	37.7	51.6	807	38.1	51.2

Table C.11: Dredge Beneath the Jack Up Barge Predictions

ID	Distance (m)	Attenuation at 10m	Prediction
1	765	37.7	53.8
2	1184	41.5	50.0
3	1158	41.3	50.2
4	1165	41.3	50.2
5	1166	41.3	50.2
6	1167	41.3	50.2
7	1168	41.3	50.2
8	1156	41.3	50.3
9	1195	41.6	50.0
10	1204	41.6	49.9
11	1212	41.7	49.8
12	1220	41.7	49.8
13	1236	41.8	49.7
14	1189	41.5	50.0
15	1192	41.5	50.0
16	1146	41.2	50.3
17	1139	41.1	50.4
18	1128	41.0	50.5
19	1125	41.0	50.5
20	1127	41.0	50.5
21	1127	41.0	50.5

22	1127	41.0	**50.5**
23	1131	41.1	**50.4**
24	1179	41.4	**50.1**
25	1143	41.2	**50.4**
26	1125	41.0	**50.5**
27	755	37.6	**54.0**
28	737	37.3	**54.2**
29	732	37.3	**54.2**
30	722	37.2	**54.3**
31	712	37.1	**54.5**
32	703	36.9	**54.6**
33	743	37.4	**54.1**
34	732	37.3	**54.2**
35	685	36.7	**54.8**
36	724	37.2	**54.3**
37	673	36.6	**55.0**
38	718	37.1	**54.4**
39	650	36.3	**55.3**
40	641	36.1	**55.4**
41	629	36.0	**55.5**
42	623	35.9	**55.6**
43	617	35.8	**55.7**
44	661	36.4	**55.1**
45	654	36.3	**55.2**
46	607	35.7	**55.8**
47	583	35.3	**56.2**
48	590	35.4	**56.1**
49	329	30.3	**61.2**
50	361	31.2	**60.4**
51	362	31.2	**60.3**
52	329	30.4	**61.2**
53	361	31.2	**60.4**
54	329	30.4	**61.2**
55	362	31.2	**60.3**
56	460	33.3	**58.3**
57	330	30.4	**61.1**
58	363	31.2	**60.3**
59	330	30.4	**61.1**
60	331	30.4	**61.1**
61	362	31.2	**60.3**
62	331	30.4	**61.1**

63	362	31.2	**60.3**
64	442	32.9	**58.6**
65	363	31.2	**60.3**
66	330	30.4	**61.1**
67	420	32.5	**59.1**
68	442	32.9	**58.6**
69	433	32.7	**58.8**
70	369	31.3	**60.2**
71	367	31.3	**60.2**
72	363	31.2	**60.3**
73	411	32.3	**59.2**
74	361	31.2	**60.4**
75	358	31.1	**60.4**
76	408	32.2	**59.3**
77	403	32.1	**59.4**
78	355	31.0	**60.5**
79	400	32.0	**59.5**
80	397	32.0	**59.5**
81	347	30.8	**60.7**
82	394	31.9	**59.6**
83	345	30.8	**60.8**
84	389	31.8	**59.7**
85	343	30.7	**60.8**
86	386	31.7	**59.8**
87	384	31.7	**59.8**
88	340	30.6	**60.9**
89	361	31.2	**60.4**
90	426	32.6	**58.9**
91	334	30.5	**61.0**
92	328	30.3	**61.2**
93	323	30.2	**61.3**
94	409	32.2	**59.3**
95	337	30.6	**61.0**
96	329	30.4	**61.2**
97	336	30.5	**61.0**
98	379	31.6	**59.9**
99	376	31.5	**60.0**
100	373	31.4	**60.1**
101	332	30.4	**61.1**
102	371	31.4	**60.1**
103	331	30.4	**61.1**

104	368	31.3	**60.2**
105	331	30.4	**61.1**
106	366	31.3	**60.2**
107	330	30.4	**61.2**
108	329	30.4	**61.2**
109	363	31.2	**60.3**
110	331	30.4	**61.1**
111	365	31.2	**60.3**
112	364	31.2	**60.3**
113	364	31.2	**60.3**
114	327	30.3	**61.2**
115	363	31.2	**60.3**
116	328	30.3	**61.2**
117	363	31.2	**60.3**
118	329	30.3	**61.2**
119	347	30.8	**60.7**
120	290	29.2	**62.3**
121	295	29.4	**62.1**
122	300	29.5	**62.0**
123	305	29.7	**61.8**
124	315	30.0	**61.6**
125	303	29.6	**61.9**
126	298	29.5	**62.0**
127	293	29.3	**62.2**
128	290	29.2	**62.3**
129	284	29.1	**62.4**
130	281	29.0	**62.6**
131	1175	41.4	**50.1**
132	1178	41.4	**50.1**
133	1185	41.5	**50.0**
134	1197	41.6	**50.0**
135	1208	41.6	**49.9**
136	1191	41.5	**50.0**
137	1222	41.7	**49.8**
138	364	31.2	**60.3**
139	333	30.5	**61.1**
140	364	31.2	**60.3**
141	334	30.5	**61.0**
142	336	30.5	**61.0**
143	337	30.6	**61.0**
144	365	31.2	**60.3**

145	366	31.3	**60.2**
146	340	30.6	**60.9**
147	367	31.3	**60.2**
148	340	30.6	**60.9**
149	368	31.3	**60.2**
150	341	30.7	**60.9**
151	369	31.3	**60.2**
152	346	30.8	**60.7**
153	347	30.8	**60.7**
154	373	31.4	**60.1**
155	348	30.8	**60.7**
156	375	31.5	**60.0**
157	376	31.5	**60.0**
158	351	30.9	**60.6**
159	377	31.5	**60.0**
160	355	31.0	**60.5**
161	379	31.6	**59.9**
162	358	31.1	**60.4**
163	382	31.6	**59.9**
164	361	31.2	**60.4**
165	387	31.8	**59.8**
166	365	31.3	**60.3**
167	390	31.8	**59.7**
168	368	31.3	**60.2**
169	394	31.9	**59.6**
170	398	32.0	**59.5**
171	403	32.1	**59.4**
172	408	32.2	**59.3**
173	427	32.6	**58.9**
174	800	38.1	**53.5**
175	777	37.8	**53.7**
176	768	37.7	**53.8**
177	778	37.8	**53.7**
178	797	38.0	**53.5**
179	764	37.7	**53.9**
180	750	37.5	**54.0**
181	801	38.1	**53.4**
182	807	38.1	**53.4**
183	792	38.0	**53.5**
184	465	33.3	**58.2**
185	485	33.7	**57.8**

186	510	34.1	**57.4**
187	503	34.0	**57.5**
188	472	33.5	**58.0**
189	314	29.9	**61.6**
190	476	33.5	**58.0**
191	449	33.0	**58.5**
192	447	33.0	**58.5**
193	482	33.7	**57.9**
194	562	35.0	**56.5**
195	540	34.6	**56.9**
196	518	34.3	**57.2**
197	427	32.6	**58.9**
198	426	32.6	**58.9**
199	422	32.5	**59.0**
200	422	32.5	**59.0**
201	420	32.5	**59.1**
202	496	33.9	**57.6**
203	418	32.4	**59.1**
204	568	35.1	**56.4**
205	546	34.8	**56.8**
206	525	34.4	**57.1**
207	839	38.5	**53.0**
208	844	38.5	**53.0**
209	823	38.3	**53.2**
210	813	38.2	**53.3**
211	809	38.2	**53.4**
212	802	38.1	**53.4**
213	796	38.0	**53.5**
214	790	38.0	**53.6**
215	785	37.9	**53.6**
216	853	38.6	**52.9**
217	832	38.4	**53.1**
218	818	38.3	**53.3**
219	836	38.4	**53.1**
220	810	38.2	**53.4**
221	828	38.4	**53.2**
222	794	38.0	**53.5**
223	800	38.1	**53.5**
224	778	37.8	**53.7**
225	800	38.1	**53.5**
226	840	38.5	**53.0**

227	838	38.5	**53.1**
228	826	38.3	**53.2**
229	821	38.3	**53.2**
230	864	38.7	**52.8**
231	847	38.6	**53.0**
232	898	39.1	**52.5**
233	893	39.0	**52.5**
234	902	39.1	**52.4**
235	871	38.8	**52.7**
236	901	39.1	**52.4**
237	889	39.0	**52.5**
238	859	38.7	**52.8**
239	882	38.9	**52.6**
240	880	38.9	**52.6**
241	883	38.9	**52.6**
242	862	38.7	**52.8**
243	882	38.9	**52.6**
244	863	38.7	**52.8**
245	852	38.6	**52.9**
246	834	38.4	**53.1**
247	807	38.1	**53.4**

Table C.12: Demolition of Buffer Dolphin Predictions

ID	Distance (m)	Attenuation at 10m	Prediction
1	762	37.6	**56.4**
2	1175	41.4	**52.6**
3	1150	41.2	**52.8**
4	1157	41.3	**52.8**
5	1159	41.3	**52.7**
6	1159	41.3	**52.7**
7	1161	41.3	**52.7**
8	1149	41.2	**52.8**
9	1186	41.5	**52.5**
10	1201	41.6	**52.4**
11	1209	41.6	**52.4**
12	1217	41.7	**52.3**
13	1233	41.8	**52.2**
14	1185	41.5	**52.5**
15	1188	41.5	**52.5**
16	1139	41.1	**52.9**

17	1132	41.1	52.9
18	1121	41.0	53.0
19	1119	41.0	53.0
20	1121	41.0	53.0
21	1122	41.0	53.0
22	1122	41.0	53.0
23	1126	41.0	53.0
24	1175	41.4	52.6
25	1139	41.1	52.9
26	1119	41.0	53.0
27	752	37.5	56.5
28	734	37.3	56.7
29	728	37.2	56.8
30	719	37.1	56.9
31	709	37.0	57.0
32	700	36.9	57.1
33	740	37.4	56.6
34	728	37.2	56.8
35	681	36.7	57.4
36	721	37.2	56.9
37	669	36.5	57.5
38	715	37.1	56.9
39	647	36.2	57.8
40	637	36.1	57.9
41	626	35.9	58.1
42	619	35.8	58.2
43	614	35.8	58.3
44	658	36.4	57.7
45	651	36.3	57.7
46	604	35.6	58.4
47	580	35.3	58.7
48	587	35.4	58.6
49	337	30.5	63.5
50	369	31.4	62.7
51	370	31.4	62.7
52	338	30.6	63.4
53	369	31.3	62.7
54	338	30.6	63.4
55	371	31.4	62.6
56	468	33.4	60.6
57	339	30.6	63.4

58	371	31.4	**62.6**
59	340	30.6	**63.4**
60	341	30.6	**63.4**
61	372	31.4	**62.6**
62	341	30.7	**63.4**
63	372	31.4	**62.6**
64	450	33.1	**60.9**
65	373	31.4	**62.6**
66	341	30.7	**63.4**
67	427	32.6	**61.4**
68	445	33.0	**61.1**
69	437	32.8	**61.2**
70	374	31.4	**62.6**
71	372	31.4	**62.6**
72	368	31.3	**62.7**
73	416	32.4	**61.6**
74	366	31.3	**62.7**
75	363	31.2	**62.8**
76	413	32.3	**61.7**
77	408	32.2	**61.8**
78	360	31.1	**62.9**
79	405	32.2	**61.9**
80	403	32.1	**61.9**
81	353	31.0	**63.1**
82	400	32.0	**62.0**
83	351	30.9	**63.1**
84	395	31.9	**62.1**
85	349	30.9	**63.2**
86	392	31.9	**62.1**
87	390	31.8	**62.2**
88	346	30.8	**63.2**
89	369	31.3	**62.7**
90	433	32.7	**61.3**
91	339	30.6	**63.4**
92	333	30.4	**63.6**
93	327	30.3	**63.7**
94	412	32.3	**61.7**
95	344	30.7	**63.3**
96	336	30.5	**63.5**
97	343	30.7	**63.3**
98	385	31.7	**62.3**

99	383	31.7	62.4
100	380	31.6	62.4
101	339	30.6	63.4
102	378	31.5	62.5
103	338	30.6	63.4
104	375	31.5	62.5
105	338	30.6	63.4
106	374	31.4	62.6
107	337	30.6	63.5
108	337	30.5	63.5
109	370	31.4	62.6
110	338	30.6	63.4
111	372	31.4	62.6
112	372	31.4	62.6
113	372	31.4	62.6
114	335	30.5	63.5
115	370	31.4	62.7
116	336	30.5	63.5
117	371	31.4	62.6
118	337	30.5	63.5
119	355	31.0	63.0
120	296	29.4	64.6
121	300	29.6	64.5
122	305	29.7	64.3
123	311	29.9	64.2
124	321	30.1	63.9
125	310	29.8	64.2
126	305	29.7	64.3
127	300	29.6	64.5
128	297	29.4	64.6
129	291	29.3	64.7
130	288	29.2	64.8
131	1167	41.3	52.7
132	1170	41.4	52.7
133	1176	41.4	52.6
134	1189	41.5	52.5
135	1200	41.6	52.4
136	1182	41.4	52.6
137	1214	41.7	52.3
138	374	31.5	62.6
139	345	30.8	63.3

140	375	31.5	**62.5**
141	347	30.8	**63.2**
142	348	30.8	**63.2**
143	350	30.9	**63.1**
144	376	31.5	**62.5**
145	378	31.6	**62.5**
146	353	31.0	**63.1**
147	379	31.6	**62.4**
148	353	31.0	**63.1**
149	381	31.6	**62.4**
150	355	31.0	**63.0**
151	382	31.6	**62.4**
152	360	31.1	**62.9**
153	361	31.2	**62.9**
154	386	31.7	**62.3**
155	363	31.2	**62.8**
156	388	31.8	**62.2**
157	390	31.8	**62.2**
158	367	31.3	**62.7**
159	392	31.9	**62.2**
160	371	31.4	**62.6**
161	394	31.9	**62.1**
162	374	31.5	**62.6**
163	396	32.0	**62.1**
164	378	31.5	**62.5**
165	403	32.1	**61.9**
166	382	31.6	**62.4**
167	406	32.2	**61.9**
168	384	31.7	**62.3**
169	410	32.3	**61.8**
170	414	32.3	**61.7**
171	419	32.4	**61.6**
172	424	32.6	**61.5**
173	444	33.0	**61.1**
174	796	38.0	**56.0**
175	774	37.8	**56.3**
176	765	37.7	**56.4**
177	774	37.8	**56.2**
178	793	38.0	**56.0**
179	760	37.6	**56.4**
180	747	37.5	**56.6**

181	797	38.0	**56.0**
182	803	38.1	**55.9**
183	789	37.9	**56.1**
184	462	33.3	**60.7**
185	483	33.7	**60.4**
186	509	34.1	**59.9**
187	503	34.0	**60.0**
188	471	33.5	**60.6**
189	313	29.9	**64.1**
190	476	33.5	**60.5**
191	450	33.1	**61.0**
192	448	33.0	**61.0**
193	484	33.7	**60.3**
194	559	34.9	**59.1**
195	537	34.6	**59.4**
196	515	34.2	**59.8**
197	427	32.6	**61.4**
198	427	32.6	**61.4**
199	423	32.5	**61.5**
200	423	32.5	**61.5**
201	421	32.5	**61.5**
202	494	33.9	**60.2**
203	420	32.5	**61.6**
204	566	35.1	**59.0**
205	544	34.7	**59.3**
206	522	34.4	**59.7**
207	837	38.5	**55.6**
208	841	38.5	**55.5**
209	820	38.3	**55.7**
210	811	38.2	**55.8**
211	806	38.1	**55.9**
212	799	38.1	**56.0**
213	794	38.0	**56.0**
214	787	37.9	**56.1**
215	782	37.9	**56.2**
216	851	38.6	**55.4**
217	829	38.4	**55.6**
218	815	38.2	**55.8**
219	832	38.4	**55.6**
220	806	38.1	**55.9**
221	824	38.3	**55.7**

222	791	38.0	**56.1**
223	797	38.0	**56.0**
224	774	37.8	**56.2**
225	797	38.0	**56.0**
226	837	38.5	**55.6**
227	834	38.4	**55.6**
228	822	38.3	**55.7**
229	818	38.3	**55.8**
230	861	38.7	**55.3**
231	843	38.5	**55.5**
232	894	39.0	**55.0**
233	890	39.0	**55.0**
234	898	39.1	**55.0**
235	868	38.8	**55.2**
236	898	39.1	**55.0**
237	886	39.0	**55.1**
238	856	38.7	**55.4**
239	879	38.9	**55.1**
240	878	38.9	**55.2**
241	881	38.9	**55.1**
242	860	38.7	**55.3**
243	881	38.9	**55.1**
244	862	38.7	**55.3**
245	850	38.6	**55.4**
246	832	38.4	**55.6**
247	805	38.1	**55.9**

Table C.13: Demolition of Suspended Deck and Supports Predictions

ID	Distance (m)	Attenuation at 10m	Prediction
1	683	36.7	**54.3**
2	1123	41.0	**50.0**
3	1103	40.9	**50.2**
4	1110	40.9	**50.1**
5	1113	40.9	**50.1**
6	1115	40.9	**50.1**
7	1117	41.0	**50.1**
8	1107	40.9	**50.1**
9	1133	41.1	**49.9**
10	1176	41.4	**49.6**
11	1185	41.5	**49.5**

ID	Distance (m)	Attenuation at 10m	Prediction
12	1194	41.5	49.5
13	1210	41.7	49.4
14	1158	41.3	49.7
15	1162	41.3	49.7
16	1098	40.8	50.2
17	1092	40.8	50.3
18	1083	40.7	50.3
19	1083	40.7	50.3
20	1085	40.7	50.3
21	1087	40.7	50.3
22	1092	40.8	50.3
23	1097	40.8	50.2
24	1147	41.2	49.8
25	1110	40.9	50.1
26	1086	40.7	50.3
27	673	36.6	54.5
28	655	36.3	54.7
29	649	36.2	54.8
30	640	36.1	54.9
31	630	36.0	55.0
32	621	35.9	55.2
33	661	36.4	54.6
34	650	36.3	54.8
35	603	35.6	55.4
36	642	36.2	54.9
37	591	35.4	55.6
38	636	36.1	54.9
39	568	35.1	55.9
40	559	34.9	56.1
41	547	34.8	56.3
42	541	34.7	56.4
43	535	34.6	56.5
44	581	35.3	55.7
45	574	35.2	55.8
46	525	34.4	56.6
47	503	34.0	57.0
48	510	34.1	56.9
49	320	30.1	60.9
50	349	30.9	60.2

ID	Distance (m)	Attenuation at 10m	Prediction
51	351	30.9	**60.1**
52	324	30.2	**60.8**
53	352	30.9	**60.1**
54	326	30.3	**60.8**
55	354	31.0	**60.0**
56	441	32.9	**58.1**
57	328	30.3	**60.7**
58	356	31.0	**60.0**
59	331	30.4	**60.6**
60	332	30.4	**60.6**
61	359	31.1	**59.9**
62	334	30.5	**60.5**
63	360	31.1	**59.9**
64	429	32.7	**58.4**
65	362	31.2	**59.8**
66	337	30.5	**60.5**
67	403	32.1	**58.9**
68	393	31.9	**59.1**
69	389	31.8	**59.2**
70	329	30.3	**60.7**
71	327	30.3	**60.7**
72	325	30.2	**60.8**
73	371	31.4	**59.6**
74	324	30.2	**60.8**
75	321	30.1	**60.9**
76	369	31.3	**59.7**
77	365	31.2	**59.8**
78	320	30.1	**60.9**
79	363	31.2	**59.8**
80	361	31.2	**59.9**
81	315	30.0	**61.1**
82	359	31.1	**59.9**
83	314	29.9	**61.1**
84	355	31.0	**60.0**
85	313	29.9	**61.1**
86	354	31.0	**60.0**
87	352	30.9	**60.1**
88	311	29.9	**61.2**
89	348	30.8	**60.2**

ID	Distance (m)	Attenuation at 10m	Prediction
90	403	32.1	**58.9**
91	296	29.4	**61.6**
92	290	29.2	**61.8**
93	285	29.1	**61.9**
94	360	31.1	**59.9**
95	310	29.8	**61.2**
96	303	29.6	**61.4**
97	309	29.8	**61.2**
98	349	30.9	**60.2**
99	347	30.8	**60.2**
100	346	30.8	**60.3**
101	308	29.8	**61.2**
102	344	30.7	**60.3**
103	309	29.8	**61.2**
104	343	30.7	**60.3**
105	310	29.8	**61.2**
106	342	30.7	**60.3**
107	310	29.8	**61.2**
108	311	29.9	**61.2**
109	341	30.7	**60.4**
110	314	29.9	**61.1**
111	344	30.7	**60.3**
112	345	30.8	**60.3**
113	346	30.8	**60.2**
114	316	30.0	**61.0**
115	346	30.8	**60.2**
116	315	30.0	**61.0**
117	346	30.8	**60.2**
118	319	30.1	**60.9**
119	332	30.4	**60.6**
120	260	28.3	**62.7**
121	264	28.4	**62.6**
122	269	28.6	**62.4**
123	274	28.7	**62.3**
124	284	29.1	**62.0**
125	283	29.1	**62.0**
126	278	28.9	**62.1**
127	273	28.7	**62.3**
128	269	28.6	**62.4**

ID	Distance (m)	Attenuation at 10m	Prediction
129	263	28.4	62.6
130	259	28.3	62.8
131	1105	40.9	50.2
132	1108	40.9	50.1
133	1115	40.9	50.1
134	1128	41.0	50.0
135	1139	41.1	49.9
136	1128	41.0	50.0
137	1152	41.2	49.8
138	367	31.3	59.7
139	343	30.7	60.3
140	369	31.3	59.7
141	345	30.8	60.3
142	347	30.8	60.2
143	350	30.9	60.1
144	373	31.4	59.6
145	375	31.5	59.5
146	354	31.0	60.0
147	377	31.5	59.5
148	355	31.0	60.0
149	380	31.6	59.4
150	357	31.1	60.0
151	382	31.6	59.4
152	363	31.2	59.8
153	364	31.2	59.8
154	387	31.8	59.3
155	367	31.3	59.7
156	390	31.8	59.2
157	392	31.9	59.2
158	371	31.4	59.6
159	394	31.9	59.1
160	376	31.5	59.5
161	397	32.0	59.0
162	379	31.6	59.4
163	400	32.0	59.0
164	384	31.7	59.3
165	407	32.2	58.8
166	388	31.8	59.2
167	411	32.3	58.7

ID	Distance (m)	Attenuation at 10m	Prediction
168	391	31.8	59.2
169	416	32.4	58.6
170	420	32.5	58.6
171	425	32.6	58.5
172	431	32.7	58.3
173	452	33.1	57.9
174	717	37.1	53.9
175	695	36.8	54.2
176	686	36.7	54.3
177	695	36.8	54.2
178	714	37.1	53.9
179	681	36.7	54.4
180	668	36.5	54.5
181	718	37.1	53.9
182	724	37.2	53.8
183	709	37.0	54.0
184	383	31.7	59.3
185	406	32.2	58.9
186	436	32.8	58.2
187	433	32.7	58.3
188	403	32.1	58.9
189	241	27.6	63.4
190	409	32.2	58.8
191	390	31.8	59.2
192	389	31.8	59.2
193	430	32.7	58.4
194	481	33.6	57.4
195	459	33.2	57.8
196	438	32.8	58.2
197	366	31.3	59.8
198	366	31.3	59.8
199	364	31.2	59.8
200	364	31.2	59.8
201	364	31.2	59.8
202	417	32.4	58.6
203	364	31.2	59.8
204	488	33.8	57.3
205	466	33.4	57.6
206	444	33.0	58.1

ID	Distance (m)	Attenuation at 10m	Prediction
207	759	37.6	53.4
208	764	37.7	53.4
209	742	37.4	53.6
210	733	37.3	53.7
211	728	37.2	53.8
212	721	37.2	53.9
213	716	37.1	53.9
214	709	37.0	54.0
215	704	36.9	54.1
216	773	37.8	53.3
217	751	37.5	53.5
218	736	37.3	53.7
219	753	37.5	53.5
220	727	37.2	53.8
221	745	37.4	53.6
222	712	37.1	54.0
223	718	37.1	53.9
224	696	36.9	54.2
225	718	37.1	53.9
226	758	37.6	53.4
227	755	37.6	53.5
228	743	37.4	53.6
229	738	37.4	53.7
230	782	37.9	53.2
231	764	37.7	53.4
232	815	38.2	52.8
233	811	38.2	52.8
234	820	38.3	52.7
235	789	37.9	53.1
236	820	38.3	52.7
237	808	38.1	52.9
238	778	37.8	53.2
239	801	38.1	52.9
240	801	38.1	53.0
241	804	38.1	52.9
242	783	37.9	53.2
243	806	38.1	52.9
244	787	37.9	53.1
245	775	37.8	53.2

ID	Distance (m)	Attenuation at 10m	Prediction
246	757	37.6	53.4
247	730	37.3	53.8

Table C.14: Installation of New Linkspan Predictions

ID	Distance (m)	Attenuation at 10m	Prediction
1	719	37.1	**43.6**
2	1132	41.1	**39.7**
3	1108	40.9	**39.9**
4	1115	40.9	**39.8**
5	1117	41.0	**39.8**
6	1118	41.0	**39.8**
7	1120	41.0	**39.8**
8	1109	40.9	**39.9**
9	1143	41.2	**39.6**
10	1168	41.4	**39.4**
11	1177	41.4	**39.3**
12	1186	41.5	**39.3**
13	1202	41.6	**39.2**
14	1151	41.2	**39.5**
15	1155	41.3	**39.5**
16	1100	40.8	**39.9**
17	1093	40.8	**40.0**
18	1082	40.7	**40.1**
19	1081	40.7	**40.1**
20	1083	40.7	**40.1**
21	1084	40.7	**40.1**
22	1086	40.7	**40.0**
23	1091	40.8	**40.0**
24	1140	41.1	**39.6**
25	1104	40.9	**39.9**
26	1083	40.7	**40.1**
27	709	37.0	**43.8**
28	690	36.8	**44.0**
29	685	36.7	**44.0**
30	676	36.6	**44.2**
31	666	36.5	**44.3**
32	657	36.3	**44.4**
33	697	36.9	**43.9**
34	686	36.7	**44.0**

35	638	36.1	**44.7**
36	679	36.6	**44.1**
37	626	35.9	**44.8**
38	673	36.6	**44.2**
39	604	35.6	**45.1**
40	594	35.5	**45.3**
41	583	35.3	**45.5**
42	576	35.2	**45.6**
43	571	35.1	**45.6**
44	617	35.8	**45.0**
45	610	35.7	**45.1**
46	561	35.0	**45.8**
47	539	34.6	**46.1**
48	546	34.7	**46.0**
49	326	30.3	**50.5**
50	359	31.1	**49.7**
51	359	31.1	**49.7**
52	326	30.3	**50.5**
53	358	31.1	**49.7**
54	326	30.3	**50.5**
55	359	31.1	**49.7**
56	457	33.2	**47.6**
57	327	30.3	**50.5**
58	360	31.1	**49.6**
59	328	30.3	**50.5**
60	328	30.3	**50.5**
61	359	31.1	**49.7**
62	328	30.3	**50.4**
63	360	31.1	**49.7**
64	439	32.9	**47.9**
65	360	31.1	**49.6**
66	328	30.3	**50.5**
67	417	32.4	**48.4**
68	425	32.6	**48.2**
69	420	32.5	**48.3**
70	358	31.1	**49.7**
71	357	31.0	**49.7**
72	353	31.0	**49.8**
73	400	32.0	**48.7**
74	352	30.9	**49.8**
75	349	30.9	**49.9**

76	398	32.0	**48.8**
77	394	31.9	**48.9**
78	347	30.8	**49.9**
79	392	31.9	**48.9**
80	389	31.8	**49.0**
81	342	30.7	**50.1**
82	387	31.8	**49.0**
83	340	30.6	**50.1**
84	383	31.7	**49.1**
85	339	30.6	**50.2**
86	381	31.6	**49.1**
87	379	31.6	**49.2**
88	336	30.5	**50.2**
89	358	31.1	**49.7**
90	423	32.5	**48.2**
91	324	30.2	**50.5**
92	318	30.1	**50.7**
93	313	29.9	**50.8**
94	392	31.9	**48.9**
95	334	30.5	**50.3**
96	326	30.3	**50.5**
97	332	30.4	**50.3**
98	375	31.5	**49.3**
99	373	31.4	**49.3**
100	370	31.4	**49.4**
101	328	30.3	**50.4**
102	368	31.3	**49.5**
103	328	30.3	**50.4**
104	365	31.2	**49.5**
105	327	30.3	**50.5**
106	363	31.2	**49.6**
107	326	30.3	**50.5**
108	326	30.3	**50.5**
109	360	31.1	**49.6**
110	328	30.3	**50.5**
111	361	31.2	**49.6**
112	361	31.2	**49.6**
113	361	31.2	**49.6**
114	324	30.2	**50.6**
115	360	31.1	**49.6**
116	325	30.2	**50.5**

117	360	31.1	**49.6**
118	326	30.3	**50.5**
119	344	30.7	**50.0**
120	286	29.1	**51.7**
121	290	29.2	**51.5**
122	295	29.4	**51.4**
123	300	29.5	**51.2**
124	310	29.8	**50.9**
125	299	29.5	**51.2**
126	295	29.4	**51.4**
127	290	29.2	**51.5**
128	286	29.1	**51.6**
129	281	29.0	**51.8**
130	277	28.9	**51.9**
131	1121	41.0	**39.8**
132	1124	41.0	**39.7**
133	1131	41.1	**39.7**
134	1143	41.2	**39.6**
135	1155	41.2	**39.5**
136	1138	41.1	**39.6**
137	1168	41.4	**39.4**
138	361	31.1	**49.6**
139	331	30.4	**50.4**
140	362	31.2	**49.6**
141	332	30.4	**50.3**
142	333	30.5	**50.3**
143	335	30.5	**50.3**
144	362	31.2	**49.6**
145	364	31.2	**49.5**
146	338	30.6	**50.2**
147	365	31.2	**49.5**
148	338	30.6	**50.2**
149	366	31.3	**49.5**
150	340	30.6	**50.1**
151	367	31.3	**49.5**
152	344	30.7	**50.0**
153	345	30.8	**50.0**
154	371	31.4	**49.4**
155	347	30.8	**50.0**
156	373	31.4	**49.3**
157	374	31.5	**49.3**

158	350	30.9	**49.9**
159	376	31.5	**49.3**
160	354	31.0	**49.8**
161	378	31.5	**49.2**
162	357	31.1	**49.7**
163	380	31.6	**49.2**
164	360	31.1	**49.6**
165	386	31.7	**49.0**
166	364	31.2	**49.5**
167	389	31.8	**49.0**
168	367	31.3	**49.5**
169	393	31.9	**48.9**
170	397	32.0	**48.8**
171	402	32.1	**48.7**
172	407	32.2	**48.6**
173	426	32.6	**48.2**
174	752	37.5	**43.2**
175	730	37.3	**43.5**
176	721	37.2	**43.6**
177	730	37.3	**43.5**
178	749	37.5	**43.3**
179	716	37.1	**43.7**
180	704	36.9	**43.8**
181	753	37.5	**43.2**
182	759	37.6	**43.2**
183	745	37.4	**43.3**
184	420	32.5	**48.3**
185	442	32.9	**47.8**
186	473	33.5	**47.3**
187	469	33.4	**47.3**
188	439	32.9	**47.9**
189	278	28.9	**51.9**
190	445	33.0	**47.8**
191	424	32.5	**48.2**
192	423	32.5	**48.2**
193	463	33.3	**47.5**
194	518	34.3	**46.5**
195	496	33.9	**46.9**
196	474	33.5	**47.2**
197	400	32.0	**48.7**
198	400	32.0	**48.7**

199	398	32.0	**48.8**
200	398	32.0	**48.8**
201	398	32.0	**48.8**
202	453	33.1	**47.6**
203	397	32.0	**48.8**
204	524	34.4	**46.4**
205	503	34.0	**46.7**
206	481	33.6	**47.1**
207	795	38.0	**42.8**
208	800	38.1	**42.7**
209	779	37.8	**42.9**
210	769	37.7	**43.0**
211	764	37.7	**43.1**
212	758	37.6	**43.2**
213	752	37.5	**43.2**
214	745	37.4	**43.3**
215	740	37.4	**43.4**
216	810	38.2	**42.6**
217	788	37.9	**42.8**
218	772	37.8	**43.0**
219	789	37.9	**42.8**
220	763	37.7	**43.1**
221	780	37.8	**42.9**
222	748	37.5	**43.3**
223	754	37.5	**43.2**
224	732	37.3	**43.5**
225	754	37.5	**43.2**
226	794	38.0	**42.8**
227	790	38.0	**42.8**
228	778	37.8	**42.9**
229	773	37.8	**43.0**
230	817	38.2	**42.5**
231	800	38.1	**42.7**
232	851	38.6	**42.2**
233	847	38.6	**42.2**
234	856	38.6	**42.1**
235	825	38.3	**42.4**
236	856	38.7	**42.1**
237	844	38.5	**42.2**
238	814	38.2	**42.6**
239	838	38.5	**42.3**

240	837	38.5	**42.3**
241	841	38.5	**42.3**
242	819	38.3	**42.5**
243	843	38.5	**42.2**
244	824	38.3	**42.4**
245	812	38.2	**42.6**
246	794	38.0	**42.8**
247	767	37.7	**43.1**

Table C.15: Drainage and Connection to the Existing Network Predictions

ID	Distance (m)	Attenuation at 10m	Prediction
1	626.2	35.9	**42.1**
2	1084.1	40.7	**37.3**
3	1067.6	40.6	**37.4**
4	1075.9	40.6	**37.4**
5	1079.5	40.7	**37.3**
6	1081.5	40.7	**37.3**
7	1084.7	40.7	**37.3**
8	1074.6	40.6	**37.4**
9	1093.2	40.8	**37.2**
10	1159.7	41.3	**36.7**
11	1170.4	41.4	**36.6**
12	1180.5	41.4	**36.6**
13	1196.4	41.6	**36.4**
14	1138.3	41.1	**36.9**
15	1143.5	41.2	**36.8**
16	1067.0	40.6	**37.4**
17	1061.1	40.5	**37.5**
18	1053.5	40.5	**37.5**
19	1054.3	40.5	**37.5**
20	1057.8	40.5	**37.5**
21	1060.5	40.5	**37.5**
22	1067.1	40.6	**37.4**
23	1073.1	40.6	**37.4**
24	1126.0	41.0	**37.0**
25	1087.0	40.7	**37.3**
26	1060.1	40.5	**37.5**
27	616.6	35.8	**42.2**
28	598.8	35.5	**42.5**
29	593.4	35.5	**42.5**

ID	Distance (m)	Attenuation at 10m	Prediction
30	584.0	35.3	**42.7**
31	574.0	35.2	**42.8**
32	565.2	35.0	**43.0**
33	604.2	35.6	**42.4**
34	593.1	35.5	**42.5**
35	546.6	34.8	**43.2**
36	585.4	35.3	**42.7**
37	534.6	34.6	**43.4**
38	579.4	35.3	**42.7**
39	511.7	34.2	**43.8**
40	502.5	34.0	**44.0**
41	491.3	33.8	**44.2**
42	484.6	33.7	**44.3**
43	479.1	33.6	**44.4**
44	522.9	34.4	**43.6**
45	515.8	34.2	**43.8**
46	469.1	33.4	**44.6**
47	444.9	33.0	**45.0**
48	451.9	33.1	**44.9**
49	292.2	29.3	**48.7**
50	317.5	30.0	**48.0**
51	320.2	30.1	**47.9**
52	297.7	29.5	**48.5**
53	321.3	30.1	**47.9**
54	300.2	29.5	**48.5**
55	324.4	30.2	**47.8**
56	402.6	32.1	**45.9**
57	303.6	29.6	**48.4**
58	326.9	30.3	**47.7**
59	306.6	29.7	**48.3**
60	309.3	29.8	**48.2**
61	332.2	30.4	**47.6**
62	312.3	29.9	**48.1**
63	334.1	30.5	**47.5**
64	395.3	31.9	**46.1**
65	336.6	30.5	**47.5**
66	316.6	30.0	**48.0**
67	366.5	31.3	**46.7**
68	340.8	30.7	**47.3**

ID	Distance (m)	Attenuation at 10m	Prediction
69	338.8	30.6	47.4
70	281.4	29.0	49.0
71	280.3	29.0	49.0
72	278.3	28.9	49.1
73	322.5	30.2	47.8
74	277.6	28.9	49.1
75	275.6	28.8	49.2
76	320.8	30.1	47.9
77	317.8	30.0	48.0
78	275.0	28.8	49.2
79	316.6	30.0	48.0
80	315.3	30.0	48.0
81	272.5	28.7	49.3
82	313.8	29.9	48.1
83	271.8	28.7	49.3
84	310.8	29.8	48.2
85	271.5	28.7	49.3
86	309.8	29.8	48.2
87	308.2	29.8	48.2
88	270.5	28.6	49.4
89	315.7	30.0	48.0
90	363.9	31.2	46.8
91	250.6	28.0	50.0
92	244.9	27.8	50.2
93	240.0	27.6	50.4
94	307.4	29.8	48.2
95	270.4	28.6	49.4
96	264.6	28.5	49.5
97	270.2	28.6	49.4
98	306.3	29.7	48.3
99	305.5	29.7	48.3
100	304.6	29.7	48.3
101	270.9	28.7	49.3
102	304.0	29.7	48.3
103	272.1	28.7	49.3
104	303.6	29.6	48.4
105	273.6	28.7	49.3
106	303.7	29.6	48.4
107	275.2	28.8	49.2

ID	Distance (m)	Attenuation at 10m	Prediction
108	276.5	28.8	49.2
109	303.9	29.7	48.3
110	280.2	28.9	49.1
111	306.8	29.7	48.3
112	308.6	29.8	48.2
113	310.2	29.8	48.2
114	286.2	29.1	48.9
115	312.1	29.9	48.1
116	284.8	29.1	48.9
117	311.2	29.9	48.1
118	290.0	29.2	48.8
119	299.0	29.5	48.5
120	220.4	26.9	51.1
121	224.3	27.0	51.0
122	228.9	27.2	50.8
123	233.0	27.3	50.7
124	243.1	27.7	50.3
125	249.9	28.0	50.0
126	244.5	27.8	50.2
127	238.8	27.6	50.4
128	235.3	27.4	50.6
129	229.0	27.2	50.8
130	224.7	27.0	51.0
131	1061.3	40.5	**37.5**
132	1064.4	40.5	**37.5**
133	1071.5	40.6	**37.4**
134	1084.1	40.7	**37.3**
135	1095.6	40.8	**37.2**
136	1089.5	40.7	**37.3**
137	1108.4	40.9	**37.1**
138	343.2	30.7	47.3
139	324.5	30.2	47.8
140	346.0	30.8	47.2
141	328.1	30.3	47.7
142	331.6	30.4	47.6
143	335.3	30.5	47.5
144	352.5	30.9	47.1
145	356.0	31.0	47.0
146	341.9	30.7	47.3

ID	Distance (m)	Attenuation at 10m	Prediction
147	359.0	31.1	46.9
148	344.3	30.7	47.3
149	362.5	31.2	46.8
150	348.9	30.9	47.1
151	365.4	31.3	46.7
152	354.7	31.0	47.0
153	358.1	31.1	46.9
154	373.7	31.5	46.5
155	361.9	31.2	46.8
156	377.3	31.5	46.5
157	380.3	31.6	46.4
158	369.1	31.3	46.7
159	384.3	31.7	46.3
160	374.3	31.5	46.5
161	388.3	31.8	46.2
162	378.8	31.6	46.4
163	392.4	31.9	46.1
164	384.0	31.7	46.3
165	402.7	32.1	45.9
166	390.0	31.8	46.2
167	407.5	32.2	45.8
168	393.8	31.9	46.1
169	413.0	32.3	45.7
170	417.8	32.4	45.6
171	424.1	32.5	45.5
172	430.6	32.7	45.3
173	454.1	33.1	**44.9**
174	661.8	36.4	**41.6**
175	638.7	36.1	**41.9**
176	629.9	36.0	**42.0**
177	639.7	36.1	**41.9**
178	659.9	36.4	**41.6**
179	625.6	35.9	**42.1**
180	612.3	35.7	**42.3**
181	663.4	36.4	**41.6**
182	668.9	36.5	**41.5**
183	654.4	36.3	**41.7**
184	326.2	30.3	47.7
185	347.0	30.8	47.2

ID	Distance (m)	Attenuation at 10m	Prediction
186	376.3	31.5	46.5
187	373.0	31.4	46.6
188	343.2	30.7	47.3
189	181.3	25.2	52.8
190	349.8	30.9	47.1
191	333.1	30.5	47.5
192	332.8	30.4	47.6
193	375.9	31.5	46.5
194	423.4	32.5	45.5
195	401.3	32.1	45.9
196	379.4	31.6	46.4
197	308.5	29.8	48.2
198	308.8	29.8	48.2
199	307.8	29.8	48.2
200	308.5	29.8	48.2
201	308.9	29.8	48.2
202	358.0	31.1	46.9
203	308.9	29.8	48.2
204	430.1	32.7	45.3
205	408.2	32.2	45.8
206	386.3	31.7	46.3
207	701.1	36.9	**41.1**
208	705.6	37.0	**41.0**
209	684.6	36.7	**41.3**
210	675.1	36.6	**41.4**
211	670.3	36.5	**41.5**
212	663.7	36.4	**41.6**
213	658.1	36.4	**41.6**
214	651.4	36.3	**41.7**
215	646.2	36.2	**41.8**
216	715.0	37.1	**40.9**
217	693.5	36.8	**41.2**
218	679.8	36.6	**41.4**
219	697.8	36.9	**41.1**
220	671.2	36.5	**41.5**
221	689.6	36.8	**41.2**
222	655.8	36.3	**41.7**
223	661.6	36.4	**41.6**
224	639.1	36.1	**41.9**

ID	Distance (m)	Attenuation at 10m	Prediction
225	661.6	36.4	**41.6**
226	702.0	36.9	**41.1**
227	699.7	36.9	**41.1**
228	687.7	36.7	**41.3**
229	684.1	36.7	**41.3**
230	725.8	37.2	**40.8**
231	708.7	37.0	**41.0**
232	759.7	37.6	**40.4**
233	754.4	37.6	**40.4**
234	763.1	37.7	**40.3**
235	733.0	37.3	**40.7**
236	763.1	37.7	**40.3**
237	750.7	37.5	**40.5**
238	720.8	37.2	**40.8**
239	743.8	37.4	**40.6**
240	742.2	37.4	**40.6**
241	745.5	37.4	**40.6**
242	724.3	37.2	**40.8**
243	746.5	37.5	**40.5**
244	727.5	37.2	**40.8**
245	715.9	37.1	**40.9**
246	697.9	36.9	**41.1**
247	670.4	36.5	**41.5**

Table C.16: Completion of Pavement Works to Reclaimed Area Rock Armour Predictions

ID	Distance (m)	Attenuation at 10m	Prediction
1	628	36.0	**56.2**
2	1069	40.6	**51.5**
3	1049	40.4	**51.7**
4	1056	40.5	**51.6**
5	1059	40.5	**51.6**
6	1060	40.5	**51.6**
7	1063	40.5	**51.6**
8	1052	40.4	**51.7**
9	1079	40.7	**51.5**
10	1121	41.0	**51.1**
11	1131	41.1	**51.1**
12	1140	41.1	**51.0**
13	1156	41.3	**50.9**

ID	Distance (m)	Attenuation at 10m	Prediction
14	1102	40.8	51.3
15	1107	40.9	51.2
16	1043	40.4	51.8
17	1037	40.3	51.8
18	1028	40.2	51.9
19	1027	40.2	51.9
20	1030	40.3	51.9
21	1031	40.3	51.9
22	1035	40.3	51.8
23	1040	40.3	51.8
24	1091	40.8	51.4
25	1054	40.5	51.7
26	1030	40.3	51.9
27	617	35.8	56.3
28	599	35.5	56.6
29	594	35.5	56.7
30	584	35.3	56.8
31	574	35.2	56.9
32	565	35.0	57.1
33	606	35.7	56.5
34	595	35.5	56.6
35	547	34.8	57.4
36	587	35.4	56.7
37	535	34.6	57.6
38	582	35.3	56.8
39	512	34.2	57.9
40	503	34.0	58.1
41	491	33.8	58.3
42	485	33.7	58.4
43	479	33.6	58.5
44	526	34.4	57.7
45	519	34.3	57.8
46	469	33.4	58.7
47	449	33.0	59.1
48	456	33.2	59.0
49	321	30.1	62.0
50	349	30.8	61.3
51	351	30.9	61.2
52	325	30.2	61.9

ID	Distance (m)	Attenuation at 10m	Prediction
53	352	30.9	**61.2**
54	326	30.3	**61.9**
55	354	31.0	**61.1**
56	434	32.8	**59.4**
57	328	30.3	**61.8**
58	356	31.0	**61.1**
59	330	30.4	**61.7**
60	332	30.4	**61.7**
61	359	31.1	**61.0**
62	333	30.5	**61.7**
63	361	31.1	**61.0**
64	427	32.6	**59.5**
65	362	31.2	**60.9**
66	335	30.5	**61.6**
67	398	32.0	**60.1**
68	367	31.3	**60.8**
69	366	31.3	**60.8**
70	311	29.8	**62.3**
71	310	29.8	**62.3**
72	308	29.8	**62.4**
73	351	30.9	**61.2**
74	307	29.8	**62.4**
75	306	29.7	**62.4**
76	350	30.9	**61.2**
77	347	30.8	**61.3**
78	305	29.7	**62.4**
79	346	30.8	**61.3**
80	345	30.8	**61.4**
81	303	29.6	**62.5**
82	344	30.7	**61.4**
83	303	29.6	**62.5**
84	341	30.7	**61.5**
85	303	29.6	**62.5**
86	340	30.6	**61.5**
87	339	30.6	**61.5**
88	302	29.6	**62.5**
89	347	30.8	**61.3**
90	395	31.9	**60.2**
91	281	29.0	**63.2**

ID	Distance (m)	Attenuation at 10m	Prediction
92	275	28.8	**63.3**
93	270	28.6	**63.5**
94	334	30.5	**61.7**
95	302	29.6	**62.5**
96	296	29.4	**62.7**
97	302	29.6	**62.5**
98	337	30.6	**61.6**
99	336	30.5	**61.6**
100	336	30.5	**61.6**
101	303	29.6	**62.5**
102	335	30.5	**61.6**
103	304	29.7	**62.5**
104	335	30.5	**61.6**
105	306	29.7	**62.4**
106	335	30.5	**61.6**
107	307	29.7	**62.4**
108	308	29.8	**62.3**
109	336	30.5	**61.6**
110	312	29.9	**62.2**
111	339	30.6	**61.5**
112	341	30.6	**61.5**
113	342	30.7	**61.4**
114	316	30.0	**62.1**
115	344	30.7	**61.4**
116	315	30.0	**62.2**
117	343	30.7	**61.4**
118	319	30.1	**62.0**
119	330	30.4	**61.7**
120	252	28.0	**64.1**
121	256	28.2	**64.0**
122	260	28.3	**63.8**
123	264	28.4	**63.7**
124	274	28.8	**63.4**
125	281	29.0	**63.1**
126	276	28.8	**63.3**
127	270	28.6	**63.5**
128	267	28.5	**63.6**
129	261	28.3	**63.8**
130	256	28.2	**63.9**

ID	Distance (m)	Attenuation at 10m	Prediction
131	1053	40.4	51.7
132	1056	40.5	51.6
133	1063	40.5	51.6
134	1075	40.6	51.5
135	1087	40.7	51.4
136	1075	40.6	51.5
137	1100	40.8	51.3
138	366	31.3	60.8
139	340	30.6	61.5
140	368	31.3	60.8
141	342	30.7	61.4
142	344	30.7	61.4
143	346	30.8	61.3
144	371	31.4	60.7
145	373	31.4	60.7
146	351	30.9	61.2
147	375	31.5	60.6
148	351	30.9	61.2
149	377	31.5	60.6
150	354	31.0	61.1
151	379	31.6	60.6
152	359	31.1	61.0
153	361	31.1	61.0
154	384	31.7	60.4
155	363	31.2	60.9
156	386	31.7	60.4
157	388	31.8	60.3
158	368	31.3	60.8
159	391	31.8	60.3
160	372	31.4	60.7
161	393	31.9	60.2
162	376	31.5	60.6
163	396	32.0	60.2
164	380	31.6	60.5
165	403	32.1	60.0
166	384	31.7	60.4
167	407	32.2	59.9
168	387	31.8	60.4
169	412	32.3	59.8

ID	Distance (m)	Attenuation at 10m	Prediction
170	416	32.4	59.7
171	421	32.5	59.6
172	427	32.6	59.5
173	448	33.0	59.1
174	661	36.4	55.7
175	639	36.1	56.0
176	630	36.0	56.1
177	638	36.1	56.0
178	657	36.4	55.8
179	625	35.9	56.2
180	612	35.7	56.4
181	662	36.4	55.7
182	668	36.5	55.6
183	653	36.3	55.8
184	329	30.3	61.8
185	353	31.0	61.2
186	389	31.8	60.3
187	388	31.8	60.3
188	360	31.1	61.0
189	197	25.9	66.2
190	368	31.3	60.8
191	356	31.0	61.1
192	356	31.0	61.1
193	401	32.1	60.1
194	427	32.6	59.5
195	406	32.2	60.0
196	384	31.7	60.4
197	330	30.4	61.7
198	331	30.4	61.7
199	331	30.4	61.7
200	332	30.4	61.7
201	333	30.5	61.7
202	364	31.2	60.9
203	334	30.5	61.7
204	434	32.7	59.4
205	412	32.3	59.8
206	391	31.8	60.3
207	708	37.0	55.1
208	726	37.2	54.9

ID	Distance (m)	Attenuation at 10m	Prediction
209	682	36.7	55.4
210	641	36.1	56.0
211	657	36.3	55.8
212	687	36.7	55.4
213	689	36.8	55.4
214	663	36.4	55.7
215	663	36.4	55.7
216	672	36.5	55.6
217	699	36.9	55.2
218	649	36.2	55.9
219	697	36.9	55.3
220	680	36.7	55.5
221	654	36.3	55.8
222	661	36.4	55.7
223	667	36.5	55.6
224	673	36.6	55.6
225	703	36.9	55.2
226	678	36.6	55.5
227	688	36.7	55.4
228	697	36.9	55.3
229	705	37.0	55.2
230	709	37.0	55.1
231	719	37.1	55.0
232	756	37.6	54.6
233	759	37.6	54.5
234	764	37.7	54.5
235	734	37.3	54.8
236	765	37.7	54.5
237	753	37.5	54.6
238	722	37.2	54.9
239	747	37.5	54.7
240	747	37.5	54.7
241	751	37.5	54.6
242	729	37.3	54.9
243	755	37.6	54.6
244	736	37.3	54.8
245	724	37.2	54.9
246	706	37.0	55.1
247	679	36.6	55.5

Table C.17: Scour Protection Throughout the Berth and to the Dredged Slope Predictions

ID	Distance (m)	Attenuation at 10m	Prediction
1	748.6	37.5	51.7
2	1144.4	41.2	48.0
3	1119.2	41.0	48.2
4	1125.6	41.0	48.2
5	1127.5	41.0	48.2
6	1128.0	41.0	48.1
7	1129.5	41.1	48.1
8	1117.7	41.0	48.2
9	1156.0	41.3	47.9
10	1170.0	41.4	47.8
11	1178.1	41.4	47.8
12	1186.9	41.5	47.7
13	1202.5	41.6	47.6
14	1153.8	41.2	48.0
15	1157.5	41.3	47.9
16	1108.0	40.9	48.3
17	1100.9	40.8	48.4
18	1089.9	40.7	48.4
19	1087.8	40.7	48.5
20	1089.5	40.7	48.4
21	1090.4	40.8	48.4
22	1091.1	40.8	48.4
23	1095.3	40.8	48.4
24	1143.6	41.2	48.0
25	1107.6	40.9	48.3
26	1088.2	40.7	48.5
27	738.5	37.4	51.8
28	720.1	37.1	52.0
29	714.8	37.1	52.1
30	705.3	37.0	52.2
31	695.3	36.8	52.3
32	686.5	36.7	52.5
33	726.8	37.2	52.0
34	715.6	37.1	52.1
35	668.0	36.5	52.7
36	708.0	37.0	52.2
37	656.0	36.3	52.9
38	702.1	36.9	52.3

ID	Distance (m)	Attenuation at 10m	Prediction
39	633.2	36.0	53.2
40	624.0	35.9	53.3
41	612.6	35.7	53.4
42	606.0	35.6	53.5
43	600.4	35.6	53.6
44	646.3	36.2	53.0
45	639.2	36.1	53.1
46	590.4	35.4	53.8
47	568.4	35.1	54.1
48	575.3	35.2	54.0
49	343.5	30.7	58.5
50	376.2	31.5	57.7
51	376.9	31.5	57.7
52	344.6	30.7	58.4
53	376.1	31.5	57.7
54	344.8	30.8	58.4
55	377.3	31.5	57.7
56	474.1	33.5	55.7
57	345.9	30.8	58.4
58	377.9	31.5	57.6
59	346.6	30.8	58.4
60	347.1	30.8	58.4
61	378.1	31.6	57.6
62	347.5	30.8	58.4
63	378.4	31.6	57.6
64	457.1	33.2	56.0
65	379.2	31.6	57.6
66	347.6	30.8	58.4
67	434.1	32.8	56.4
68	444.4	33.0	56.2
69	437.4	32.8	56.4
70	374.7	31.5	57.7
71	372.9	31.4	57.8
72	369.5	31.4	57.8
73	417.1	32.4	56.8
74	368.0	31.3	57.9
75	364.9	31.2	57.9
76	414.1	32.3	56.9
77	410.0	32.3	56.9

ID	Distance (m)	Attenuation at 10m	Prediction
78	362.6	31.2	58.0
79	407.3	32.2	57.0
80	404.8	32.1	57.0
81	356.0	31.0	58.2
82	402.2	32.1	57.1
83	354.1	31.0	58.2
84	397.3	32.0	57.2
85	352.4	30.9	58.3
86	395.3	31.9	57.3
87	392.8	31.9	57.3
88	350.0	30.9	58.3
89	376.0	31.5	57.7
90	438.9	32.8	56.3
91	340.2	30.6	58.6
92	334.1	30.5	58.7
93	329.0	30.3	58.8
94	411.0	32.3	56.9
95	348.0	30.8	58.4
96	340.3	30.6	58.6
97	346.7	30.8	58.4
98	388.7	31.8	57.4
99	386.4	31.7	57.5
100	384.0	31.7	57.5
101	343.8	30.7	58.5
102	382.0	31.6	57.6
103	343.6	30.7	58.5
104	379.9	31.6	57.6
105	343.4	30.7	58.5
106	378.4	31.6	57.6
107	343.0	30.7	58.5
108	343.0	30.7	58.5
109	375.9	31.5	57.7
110	344.8	30.8	58.4
111	377.8	31.5	57.6
112	378.0	31.6	57.6
113	378.1	31.6	57.6
114	341.5	30.7	58.5
115	377.0	31.5	57.7
116	342.4	30.7	58.5

ID	Distance (m)	Attenuation at 10m	Prediction
117	377.6	31.5	57.7
118	343.4	30.7	58.5
119	361.3	31.2	58.0
120	299.0	29.5	59.7
121	303.5	29.6	59.6
122	308.5	29.8	59.4
123	313.9	29.9	59.3
124	323.9	30.2	59.0
125	315.8	30.0	59.2
126	311.1	29.9	59.3
127	305.8	29.7	59.5
128	302.3	29.6	59.6
129	296.7	29.4	59.7
130	292.7	29.3	59.9
131	1137.6	41.1	48.1
132	1140.6	41.1	48.1
133	1147.2	41.2	48.0
134	1159.5	41.3	47.9
135	1170.5	41.4	47.8
136	1151.2	41.2	48.0
137	1184.7	41.5	47.7
138	380.5	31.6	57.6
139	351.3	30.9	58.3
140	381.4	31.6	57.6
141	352.6	30.9	58.2
142	354.1	31.0	58.2
143	355.8	31.0	58.2
144	382.5	31.7	57.5
145	384.2	31.7	57.5
146	359.1	31.1	58.1
147	385.3	31.7	57.5
148	359.3	31.1	58.1
149	387.0	31.8	57.4
150	361.0	31.1	58.0
151	388.1	31.8	57.4
152	365.8	31.3	57.9
153	367.0	31.3	57.9
154	392.0	31.9	57.3
155	368.4	31.3	57.9

ID	Distance (m)	Attenuation at 10m	Prediction
156	394.1	31.9	57.3
157	395.5	31.9	57.3
158	372.1	31.4	57.8
159	397.4	32.0	57.2
160	376.1	31.5	57.7
161	399.7	32.0	57.2
162	379.3	31.6	57.6
163	402.1	32.1	57.1
164	382.8	31.7	57.5
165	407.9	32.2	57.0
166	386.7	31.7	57.4
167	411.3	32.3	56.9
168	389.3	31.8	57.4
169	415.6	32.4	56.8
170	419.4	32.5	56.7
171	424.2	32.6	56.6
172	429.6	32.7	56.5
173	449.1	33.0	56.1
174	782.1	37.9	51.3
175	760.2	37.6	51.6
176	751.0	37.5	51.7
177	759.9	37.6	51.6
178	778.9	37.8	51.4
179	746.0	37.5	51.7
180	733.4	37.3	51.9
181	783.0	37.9	51.3
182	789.0	37.9	51.3
183	774.7	37.8	51.4
184	449.0	33.0	56.1
185	471.2	33.5	55.7
186	500.0	34.0	55.2
187	495.3	33.9	55.3
188	464.5	33.3	55.9
189	304.3	29.7	59.5
190	469.7	33.4	55.8
191	446.4	33.0	56.2
192	445.1	33.0	56.2
193	482.9	33.7	55.5
194	546.9	34.8	54.4

ID	Distance (m)	Attenuation at 10m	Prediction
195	525.0	34.4	54.8
196	503.2	34.0	55.2
197	423.2	32.5	56.7
198	422.7	32.5	56.7
199	420.1	32.5	56.7
200	419.9	32.5	56.7
201	418.7	32.4	56.8
202	482.1	33.7	55.5
203	417.7	32.4	56.8
204	553.6	34.9	54.3
205	531.8	34.5	54.7
206	510.0	34.2	55.0
207	824.5	38.3	50.9
208	829.2	38.4	50.8
209	807.9	38.1	51.0
210	798.3	38.0	51.2
211	793.5	38.0	51.2
212	786.8	37.9	51.3
213	781.2	37.9	51.3
214	774.5	37.8	51.4
215	769.2	37.7	51.5
216	838.7	38.5	50.7
217	816.8	38.2	51.0
218	801.6	38.1	51.1
219	818.5	38.3	50.9
220	793.0	38.0	51.2
221	810.2	38.2	51.0
222	777.8	37.8	51.4
223	783.6	37.9	51.3
224	761.4	37.6	51.6
225	783.6	37.9	51.3
226	823.9	38.3	50.9
227	820.2	38.3	50.9
228	808.2	38.2	51.0
229	803.2	38.1	51.1
230	847.0	38.6	50.6
231	829.6	38.4	50.8
232	880.7	38.9	50.3
233	876.6	38.9	50.3

ID	Distance (m)	Attenuation at 10m	Prediction
234	885.2	38.9	50.3
235	855.0	38.6	50.6
236	885.6	38.9	50.2
237	873.6	38.8	50.4
238	843.3	38.5	50.7
239	867.0	38.8	50.4
240	866.2	38.8	50.4
241	869.7	38.8	50.4
242	848.1	38.6	50.6
243	870.9	38.8	50.4
244	851.9	38.6	50.6
245	840.4	38.5	50.7
246	822.3	38.3	50.9
247	794.9	38.0	51.2

14.A

APPENDIX 14.A
Underwater Acoustics

Appendix A – Acoustic Concepts and Terminology

Sound travels through water as vibrations of the fluid particles in a series of pressure waves. The waves comprise a series of alternating compressions (positive pressure variations) and rarefactions (negative pressure fluctuations). Because sound consists of variations in pressure, the unit for measuring sound is usually referenced to a unit of pressure, the Pascal (Pa). The unit usually used to describe sound is the decibel (dB) and, in the case of underwater sound, the reference unit is taken as 1 µPa, one micro-pascal, whereas airborne sound is usually referenced to a pressure of 20 µPa. To convert from a sound pressure level referenced to 20 µPa to one referenced to 1 µPa, a factor of 20 log (20/1) i.e. 26 dB has to be added to the former quantity. Thus, a sound pressure of 60 dB re 20 µPa is the same as 86 dB re 1 µPa, although care also needs to be taken when converting from in air sound to in water sound levels due to the different sound speeds and densities of the two mediums resulting in a conversion factor of approximately 62 dB for comparing intensities (watt/m²), see Table **1**-1 , below.

Table **1**-1: Comparing sound quantities between air and water.

	Constant intensity		Constant pressure	
Properties	**Air**	**Water**	**Air**	**Water**
Soundspeed (C) [m/s]	340	1500	340	1500
Density (ρ) [kg/m³]	1.293	1026	1.293	1026
Acoustic impedance (Z=C·ρ) [kg/(m²·s) or (Pa·s)/m³]	440	1539000	440	1539000
Sound intensity (I=p²/Z) [Watt/m²]	1	1	22.7469	0.0065
Sound pressure (p=(I*Z)^{½}) [Pa]	21	1241	100	100
Particle velocity (I/p) [m/s]	0.04769	0.00081	0.22747	0.00006
dB re 1 µPa²	146.4	**181.9**	160.0	**160.0**
dB re 20 µPa²	**120.4**	155.9	**134.0**	134.0
Difference dB re 1 µPa² & dB re 20 µPa²	**61.5**		**26.0**	

All underwater sound pressure levels in this report are described in dB re 1 µPa². In water, the sound source strength is defined by its sound pressure level in dB re 1 µPa², referenced back to a representative distance of 1m from an assumed (infinitesimally small) point source. This allows calculation of sound levels in the far-field. For large, distributed sources, the actual sound pressure level in the near-field will be lower than predicted.

There are several descriptors used to characterise a sound wave. The difference between the lowest pressure deviation (rarefaction) and the highest pressure deviation (compression) from ambient is the peak to peak (or pk-pk) sound pressure ($L_{P\text{-}P}$ for the level in dB), Note that $L_{P\text{-}P}$ can be hard to measure consistently, as the maximal duration between the lowest and highest pressure deviation is not standardised. The difference between the highest deviation (either positive or negative) and the ambient pressure is called the peak pressure (L_P for the level in dB). Lastly, the average sound pressure is used as a description of the average amplitude of the variations in pressure over a specific time window (SPL for the level in dB). SPL is equal to the L_{eq} when the time window for the SPL is equal to the time window for the total duration of an event. The cumulative sound energy from pressure is the integrated squared pressure over a given period (SEL for the level in dB). These descriptions are shown graphically in Figure 2.1 and reflect the units as given in ISO 18405:2017, “Underwater Acoustics – Terminology”.

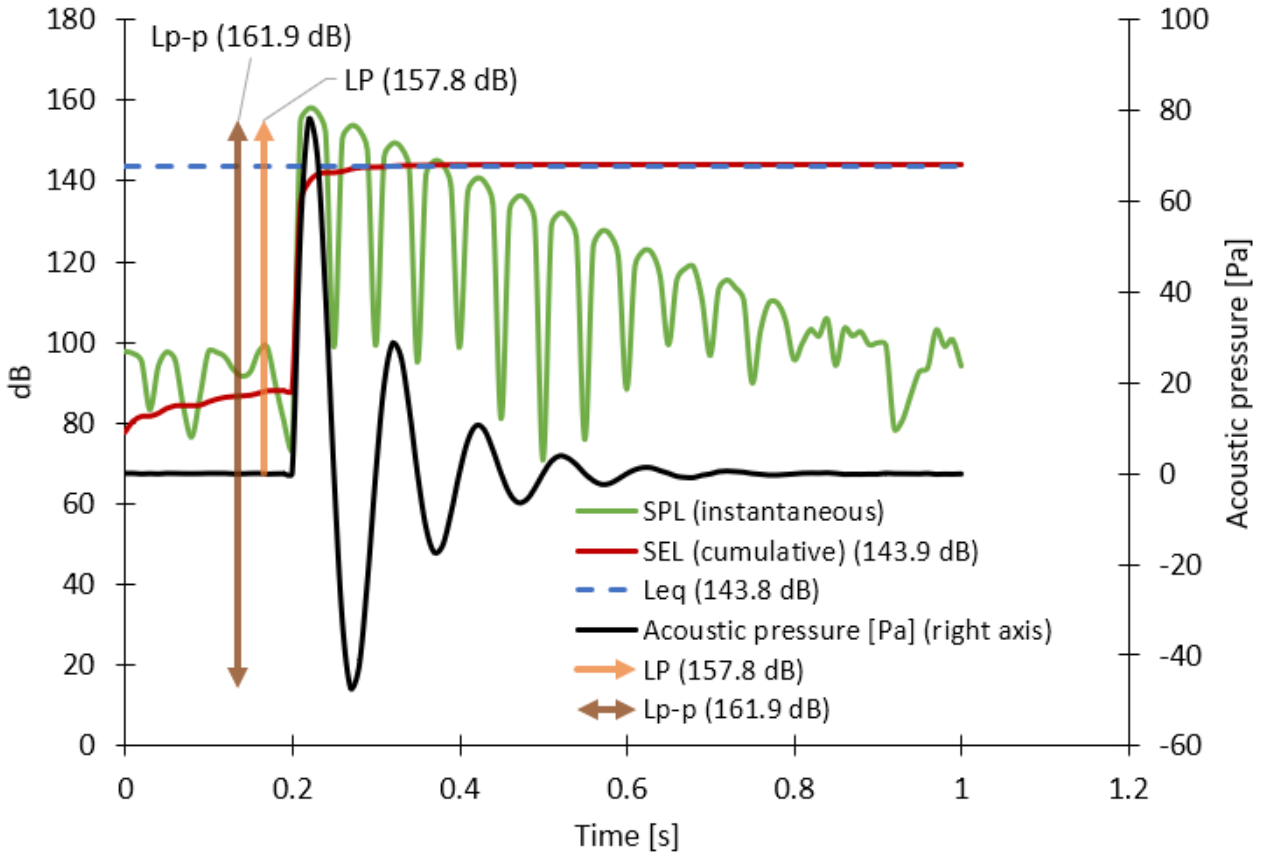


Figure 1.1: Graphical representation of acoustic wave descriptors.

The sound pressure level (SPL[1]) is defined as follows (ISO 18405:2017, 3.2.1.1):

$$SPL = 10 \cdot Log_{10}\left(\frac{\overline{p^2}}{1 \cdot 10^{-12} Pa}\right) \quad (1)$$

Here $\overline{p^2}$ is the arithmetic mean of the squared pressure values. Note that L_P is simply the instantaneous SPL (ISO 18405:2017, 3.2.2.1).

The peak sound pressure level, L_P, is the instantaneous decibel level of the maximal deviation from ambient pressure and is defined in (ISO 18405:2017, 3.2.2.1) and can be calculated as:

$$L_P = 10 \cdot Log_{10}\left(\frac{max(p^2)}{1 \cdot 10^{-12} Pa}\right)$$

Another useful measure of sound used in underwater acoustics is the Exposure Level, or SEL. This descriptor is used as a measure of the total sound energy of a single event or a number of events (e.g. over the course of a day). This allows the total acoustic energy contained in events lasting a different amount of time to be compared on a like for like basis. Historically, use was primarily made of SPL and L_P metrics for assessing the potential effects of sound on marine life. However, the SEL is increasingly being used as it allows exposure duration and the effect of exposure to multiple events over e.g. a 24-hour period to be taken into account. The SEL is defined as follows (ISO 18405:2017, 3.2.1.5):

$$SEL = 10 \cdot Log_{10}\left(\frac{\int_{t_1}^{t_2} p(t)^2 dt}{1 \cdot 10^{-12} Pa}\right) \quad (2)$$

To convert from SEL to SPL the following relation can be used:

[1] Equivalent to the commonly seen “RMS-level”.

$$SEL = \mathrm{SPL} + 10 \cdot Log_{10}(t_2 - t_1) \quad (3)$$

Converting from a single event to multiple events for SEL:

$$SEL_{n\ events} = SEL_{single\ event} + 10 \cdot Log_{10}(n) \quad (4)$$

The frequency, or pitch, of the sound is the rate at which these oscillations occur and is measured in cycles per second, or Hertz (Hz). When sound is measured in a way which approximates to how a human would perceive it using an A-weighting filter on a sound level meter, the resulting level is described in values of dB(A). However, the hearing faculties of marine mammals and fish are not the same as humans, with marine mammals hearing over a wider range of frequencies, fish over a typically smaller range of frequencies and both with different sensitivities. It is therefore important to understand how an animal's hearing varies over the entire frequency range to assess the effects of sound on marine life. Consequently, use can be made of frequency weighting scales to determine the level of the sound in comparison with the auditory response of the animal concerned. A comparison between the typical hearing response curves for fish, humans and marine mammals is shown in Figure 1.3Figure. Note that hearing thresholds are sometimes shown as audiograms with sound level on the y axis rather than sensitivity, resulting in the graph shape being the inverse of the graph shown. It is also worth noting that some fish are sensitive to particle velocity rather than pressure, although paucity of data relating to particle velocity levels for anthropogenic sound sources means that it is often not possible to quantify this effect. Marine reptiles (mostly sea turtles) have relatively poor hearing underwater, lacking a good acoustic coupling mechanism from the sea water to the inner ear.

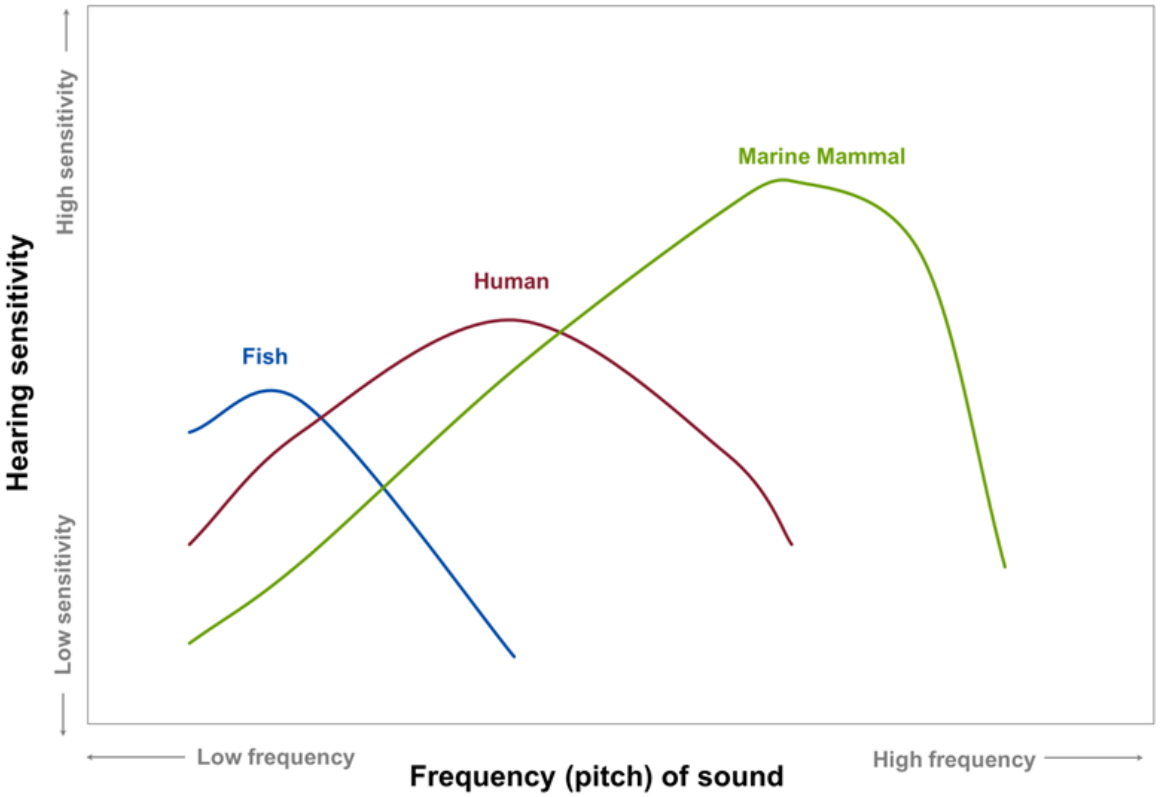


Figure1.3: Comparison between hearing thresholds of different marine animals and humans.

Impulsiveness

The impulsiveness of a source can be estimated from the kurtosis of the weighted signal (as suggested by Matin et al. in "Techniques for distinguishing between impulsive and non-impulsive sound in the context of regulating sound exposure for marine mammals", Journal of the Acoustical Society of America, 2020)

The consequence of this is that the same equipment can be both impulsive and non-impulsive, depending o marine mammal presence and the local environment.

Below is an example of a hull mounted echo sounder at 15 m depth and at 250 m depth.

In shallow water the ping rate can be high as reflections from the sediment return quickly, but the single pulse duration is usually shorter as less energy in the signal is required due to the short range the pulse must travel. This leads to high repetition rate (decreases kurtosis) and shorter pulses (increases kurtosis). Figure 1.4 shows an example where this leads to a non-impulsive source, to be compared to the thresholds for non-impulsive noise.

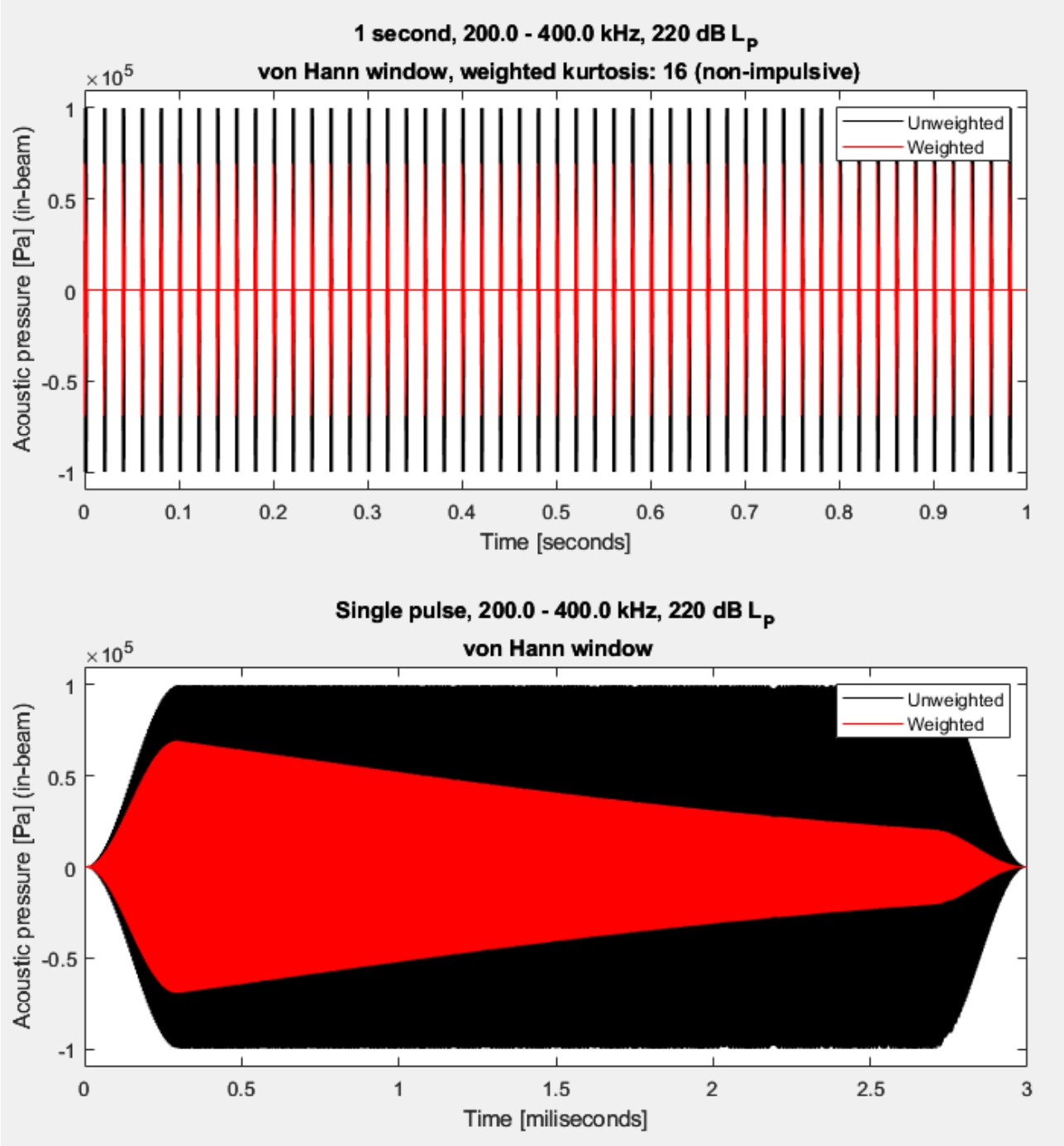


Figure1.4. Example of a multibeam echosounder at 15 m depth (achieving 50 ping/sec) with a 3 ms ping duration. VHF-weighted kurtosis of 16 – non-impulsive.

In deeper water, the ping rate will usually be slower as echoes take longer to return to the sediment and the pulses will be longer to increase the energy in the pulses and make their echoes easier to detect. This leads to low repetition rate (increases kurtosis) and longer pulses (decreases kurtosis). Figure 1.5 shows an example where this combination resulted in an impulsive source, to be compared to the thresholds for impulsive noise.

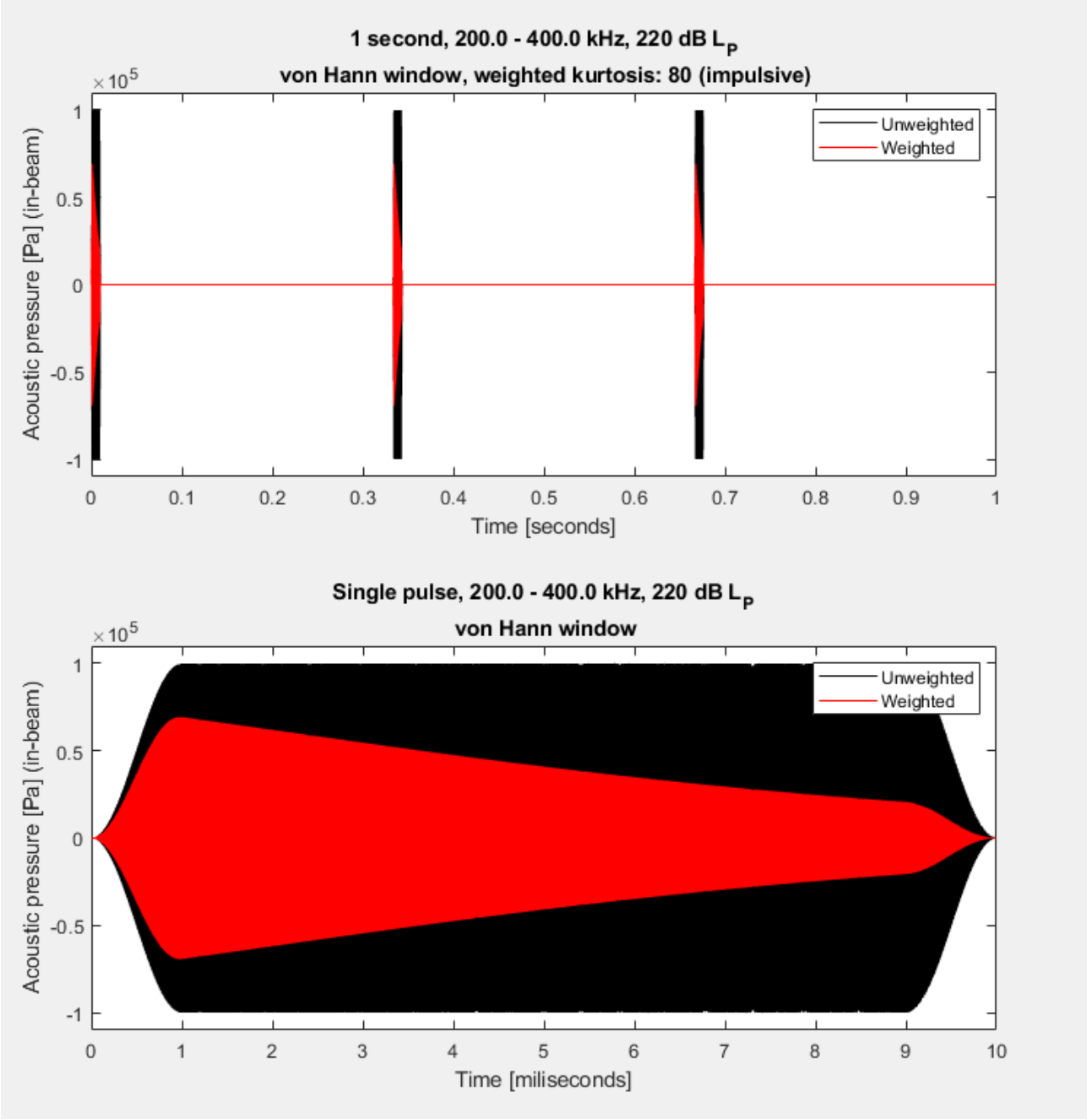


Figure1.5. Example of a multibeam echosounder at 250 m depth (achieving 3 ping/sec) with a 10 ms ping duration. VHF-weighted kurtosis of 80 – impulsive.

With range, due to multiple reflections and scattering, the kurtosis will decrease with increased range, for shallow water this decrease will be quicker than for deeper water, compare Figure 1.4 &Figure 1.5, where a kurtosis <40 is reached at c. 200 m in 20 m depth, but at over 1000 m at 200 m depth.

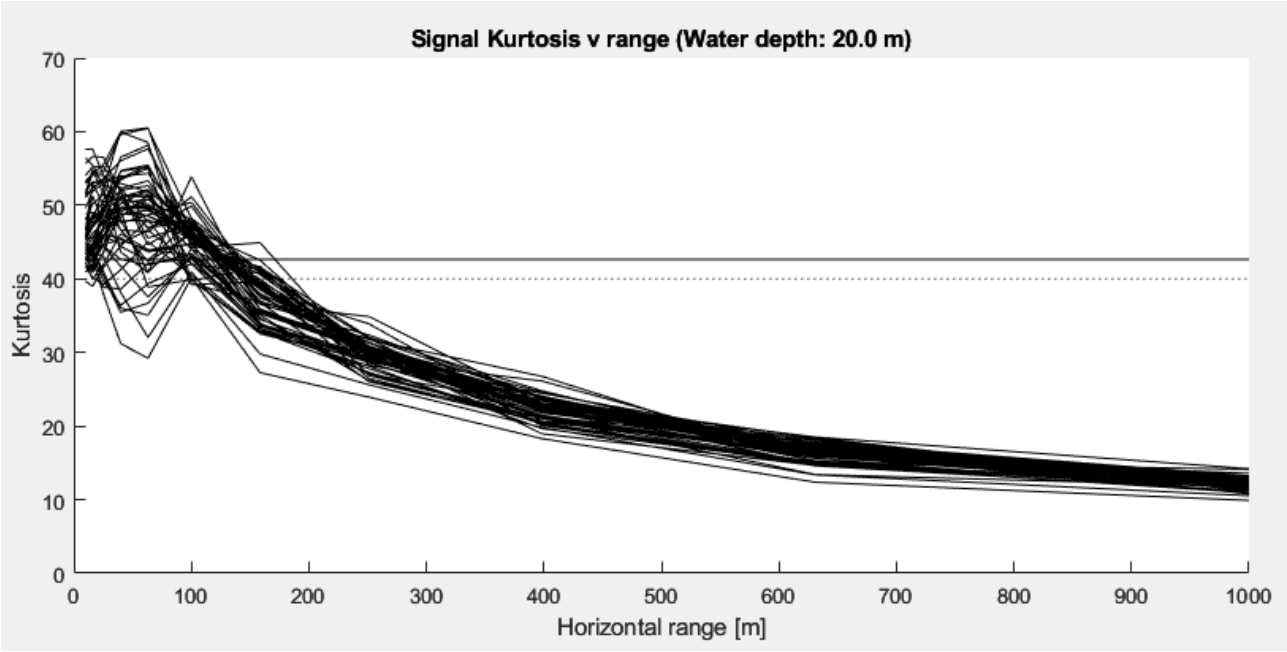


Figure 1.6. Example of USBL signal kurtosis decreasing with range at 20 m depth. Multiple lines are various combinations of source and receiver depths.

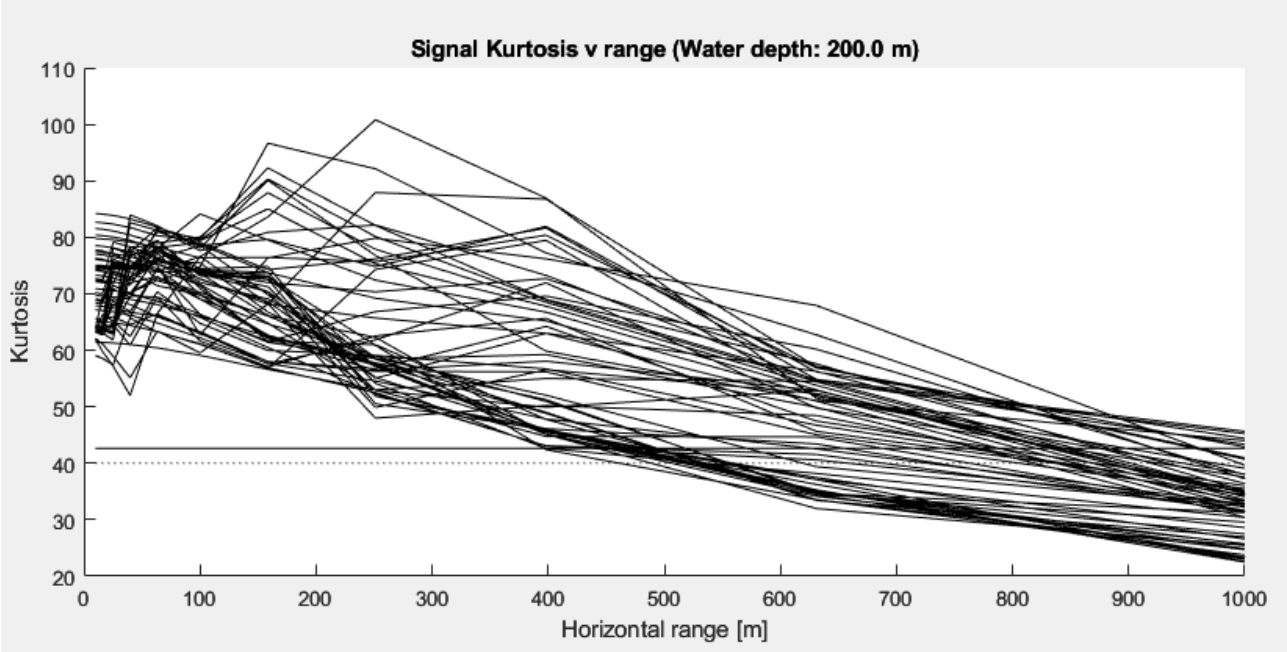


Figure1.7. Example of USBL signal kurtosis decreasing with range at 200 m depth. Multiple lines are various combinations of source and receiver depths.

Review of Sound Propagation Concepts

Increasing the distance from the sound source usually results in the level of sound getting lower, due primarily to the spreading of the sound energy with distance, analogous to the way in which the ripples in a pond spread after a stone has been thrown in.

The way that the sound spreads will depend upon several factors such as water column depth, pressure, temperature gradients, salinity, as well as water surface and seabed conditions. Thus, even for a given locality, there are temporal variations to the way that sound will propagate. However, in simple terms, the sound energy may spread out in a spherical pattern (close to the source, with no boundaries) or a cylindrical pattern (much further from the source, bounded by the surface and the sediment), although other factors mean that decay in sound energy may be somewhere between these two simplistic cases.

In acoustically shallow waters[2] in particular, the propagation mechanism is coloured by multiple interactions with the seabed and the water surface (Lurton, 2002; Etter, 2013; Urick, 1983; Brekhovskikh and Lysanov 2003, Kinsler et al., 1999). Whereas in deeper waters, the sound will propagate further without encountering the surface or bottom of the sea, in shallower waters the sound is reflected many times by the surface and sediment.

At the sea surface, the majority of sound is reflected back into the water due to the difference in acoustic impedance (i.e. sound speed and density) between air and water. However, scattering of sound at the surface of the sea is an important factor with respect to the propagation of sound from a source. In an ideal case (i.e. for a perfectly smooth sea surface), the majority of sound wave energy will be reflected back into the sea. However, for rough waters, much of the sound energy is scattered (Eckart, 1953; Fortuin, 1970; Marsh, Schulkin, and Kneale, 1961; Urick and Hoover, 1956). Scattering can also occur due to bubbles near the surface such as those generated by wind or fish or due to suspended solids in the water such as particulates and marine life. Scattering is more pronounced for higher frequencies than for low frequencies and is dependent on the sea state (i.e. wave height). However, the various factors affecting this mechanism are complex. Generally, the scattering effect at a particular frequency depends on the physical size of the roughness in relation to the wavelength of the frequency of interest.

As surface scattering results in differences in reflected sound, its effect will be more important at longer ranges from the source sound and in acoustically shallow water (i.e. where there are multiple reflections between the source and receiver). The degree of scattering will depend upon the water surface smoothness/wind speed, water depth, frequency of the sound, temperature gradient, grazing angle and range from source. Depending upon variations in the aforementioned factors, significant scattering could occur at sea state 3 or more for higher frequencies (e.g. 15 kHz or more). It should be noted that variations in propagation due to scattering will vary temporally (primarily due to different sea-states/wind speeds at different times) and that more sheltered areas (which are more likely to experience calmer waters) could experience surface scattering to a lesser extent, and less frequently, than less sheltered areas which are likely to encounter rougher waters. However, over shorter ranges (e.g. within 10-20 times the water depth) the sound will experience fewer reflections and so the effect of scattering should not be significant. Consequently, over the likely distances over which injury will occur, this effect is unlikely to significantly affect the injury ranges presented in this report, and not including this effect will overestimate the impact.

When sound waves encounter the seabed, the amount of sound reflected will depend on the geoacoustic properties of the seabed (e.g. grain size, porosity, density, sound speed, absorption coefficient and roughness) as well as the grazing angle (Figure 1.7[3]) and frequency of the sound (Cole, 1965; Hamilton, 1970; Mackenzie, 1960; McKinney and Anderson, 1964; Etter, 2013; Lurton, 2002; Urick, 1983). Thus, seabeds comprising primarily of mud or other acoustically soft sediment will reflect less sound than acoustically harder seabeds such as rock or sand. This effect also depends on the profile of the seabed (e.g. the depth of the sediment layers and how the geoacoustic properties vary with depth below the sea floor).

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[2] Acoustically, shallow water conditions exist whenever the propagation is characterised by multiple reflections with both the sea surface and seabed (Etter, 2013). Consequently, the depth at which water can be classified as acoustically deep or shallow depends upon numerous factors including the sound speed gradient, water depth, sediment type, frequency of the sound and distance between the source and receiver.

[3] The density of “rays” indicate difference in effective propagation angle from the source, with acoustically harder sediments (gravel) having better reflection at steeper angles leading to more “rays” being effectively propagated (no significant bottom attenuation) in the waveguide. Beam shape indicated in left chart, with the black line showing the same received level.

The sediment interaction is less pronounced at higher frequencies (a few kHz and above) where interaction is primarily with the top few cm of the sediment (related to the wavelength). A scattering effect (similar to that which occurs at the surface) also occurs at the seabed (Essen, 1994; Greaves and Stephen, 2003; McKinney and Anderson, 1964; Kuo, 1992), particularly on rough substrates (e.g. pebbles and larger).

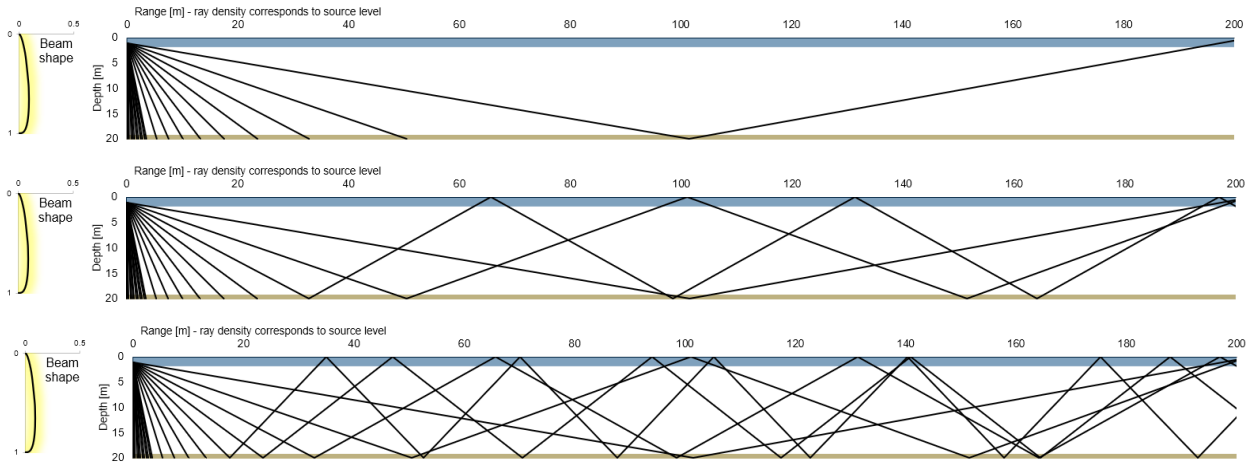


Figure1.8: Schematic of the effect of sediment on sources with narrow beams. Sediments range from fine silt (top panel), sand (middle panel), and gravel (lower panel).

These sediment effects mean that the directivity of equipment such as sub-bottom profilers have a profound effect on the effective source level – the apparent source level to a far-away receiver.

A parametric SBP such as the “Innomar Medium” or “Standard” sub-bottom profiler use two higher frequencies (“primary frequencies”) to generate an interference pattern at lower frequencies (“secondary frequencies”). This means that the secondary beam can be made extraordinarily narrow, e.g. 5 degrees at -10 dB (Figure 1.8), versus c. 50 degrees for a chirper/pinger type, leading to a much smaller sound impact – even when a parametric sub-bottom profiler has higher sound output within the main beam. We account for these differences in beam pattern by including the sediment reflection loss at high incidence angles to reduce the effective source level accordingly.

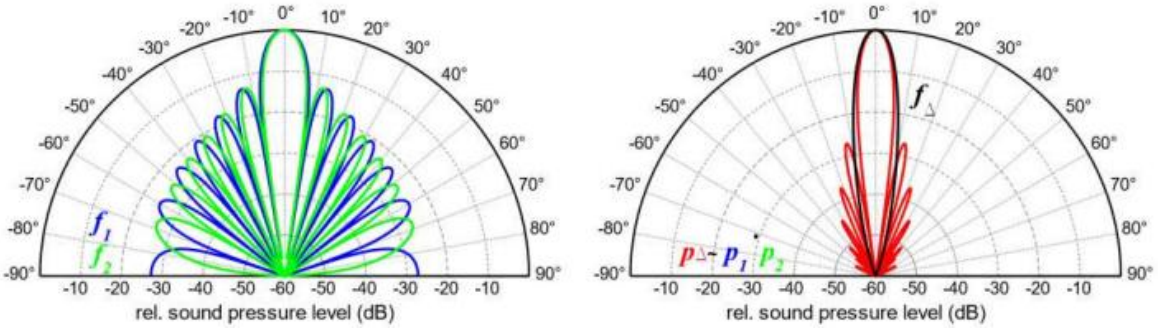


Figure 1.9. Example of a beam pattern on an Innomar SES 2000. Primary frequencies left (f1 & f2), the interference pattern between the primary frequencies means that the beam pattern for the secondary frequency (right plot) is very narrow (Source: Innomar technical note TN-01).

Another phenomenon is the waveguide effect which means that shallow water columns do not allow the propagation of low frequency sound (Urick, 1983; Etter, 2013). The cut-off frequency of the lowest mode in a channel can be calculated based on the water depth and knowledge of the sediment geoacoustic properties. Any sound below this frequency will not propagate far due to energy losses through multiple reflections. The cut-off frequency as a function of water depth is shown in Figure 1.9 for a range of seabed types. Thus, for a

water depth of 10m (i.e. shallow waters typical of coastal areas and estuaries) the cut-off frequency would be approximately 70Hz for sand, 115Hz for silt, 155Hz for clay and 10Hz for bedrock.

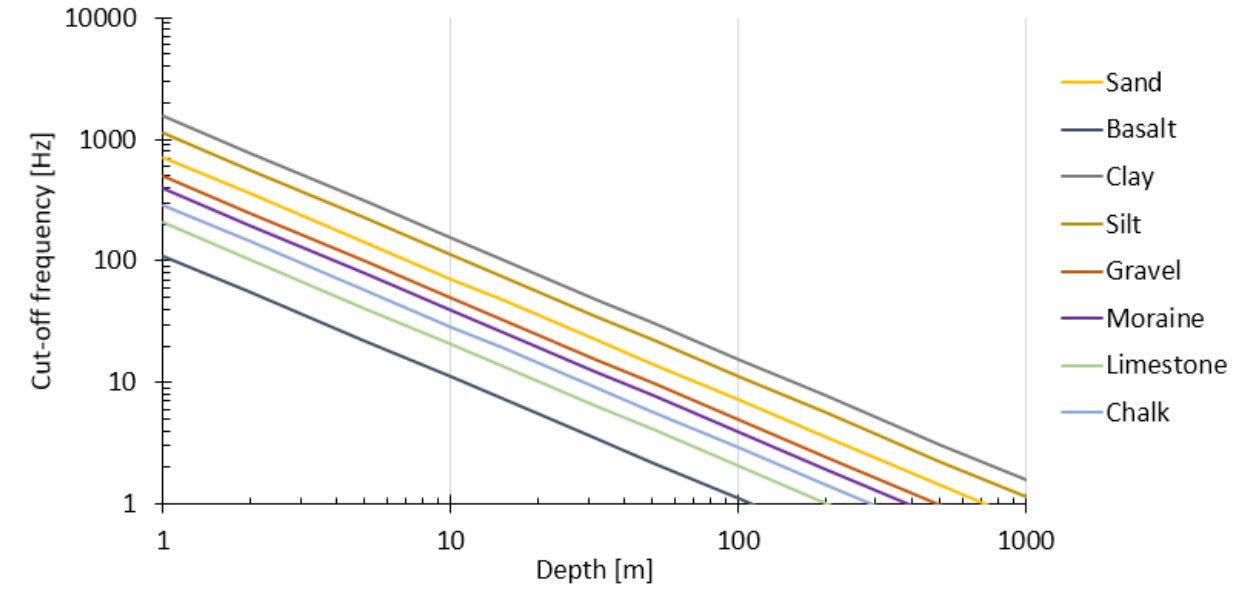


Figure1.10: Lower cut-off frequency as a function of depth for a range of seabed types.

Changes in the water temperature and the hydrostatic pressure with depth mean that the speed of sound varies throughout the water column. This can lead to significant variations in sound propagation and can also lead to sound channels, particularly for high-frequency sound. Sound can propagate in a duct-like manner within these channels, effectively focussing the sound, and conversely, they can also lead to shadow zones. The frequency at which this occurs depends on the characteristics of the sound channel but, for example, a 25m thick layer would not act as a duct for frequencies below 1.5 kHz. The temperature gradient can vary throughout the year and thus there will be potential variation in sound propagation depending on the season.

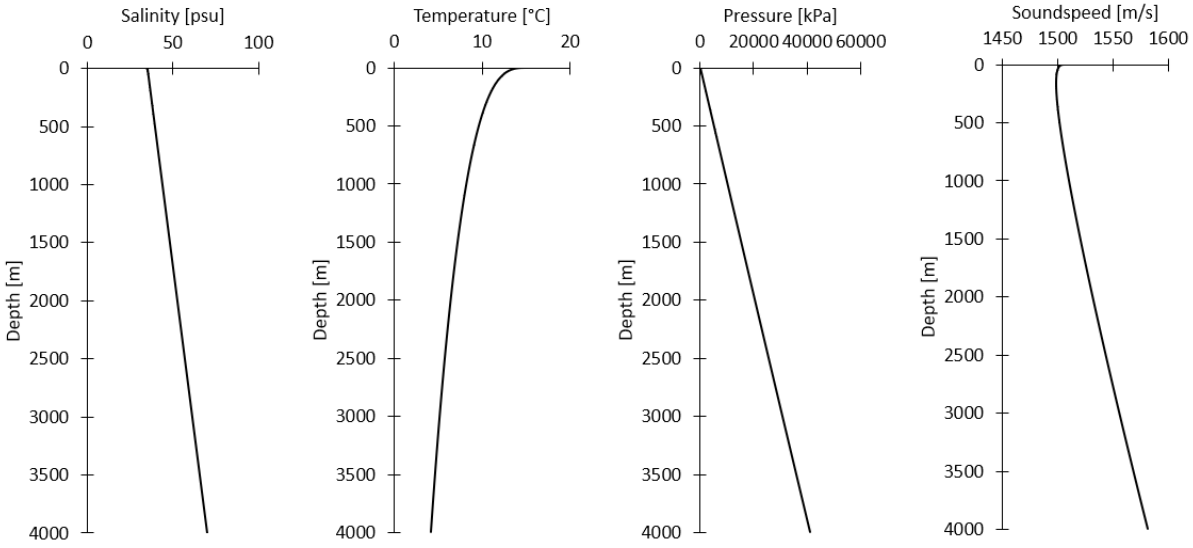


Figure1.11: Soundspeed profile as a function of salinity, temperature and pressure.

Wind can make a significant difference to the soundspeed in the uppermost layers as the introductions of bubbles decreases the soundspeed and refracts (bends) the sound towards the surface, where the increased roughness and bubbles from the wind will cause increased transmission loss.

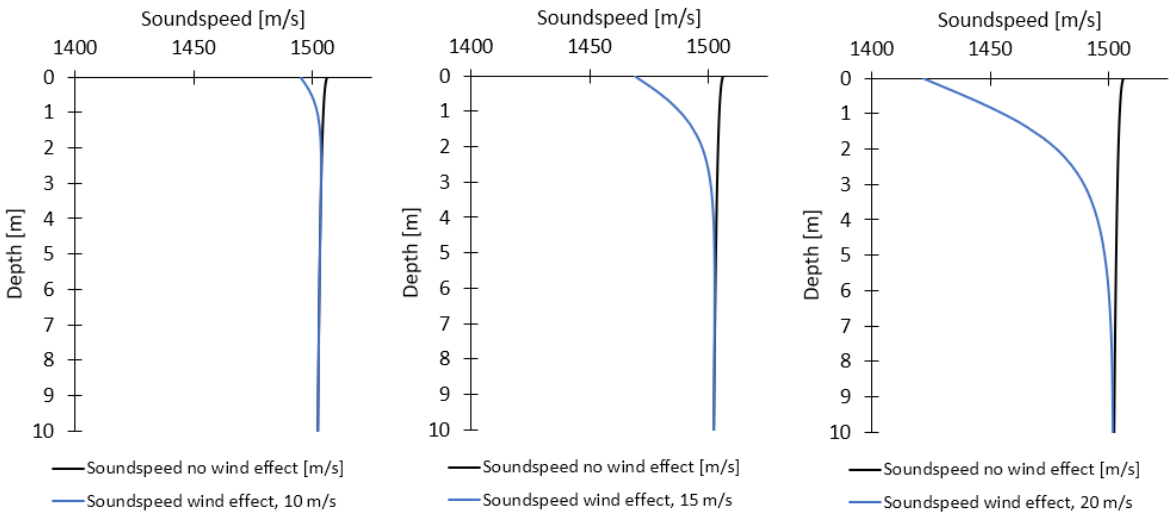


Figure1.12: Effect of wind (at 10 m height) on upper portion of soundspeed profile.

Sound energy can also be absorbed due to interactions at the molecular level converting the acoustic energy into heat. This is another frequency dependent effect with higher frequencies experiencing much higher losses than lower frequencies. This is shown in Figure 1.13 where the variation of the absorption (sometimes called volume attenuation) is shown for various salinities and temperatures. As the effect is proportional to the wavelength, colder water, with slower soundspeed/period and being slightly more viscous, will have more absorption. Higher salinity slightly decreases absorption at low frequencies (mostly due to increase in soundspeed and wavelength/period), but much higher absorption at higher frequencies where interaction with pressure sensitive molecules of magnesium sulphite and boric acid increase the conversion acoustic energy to heat.

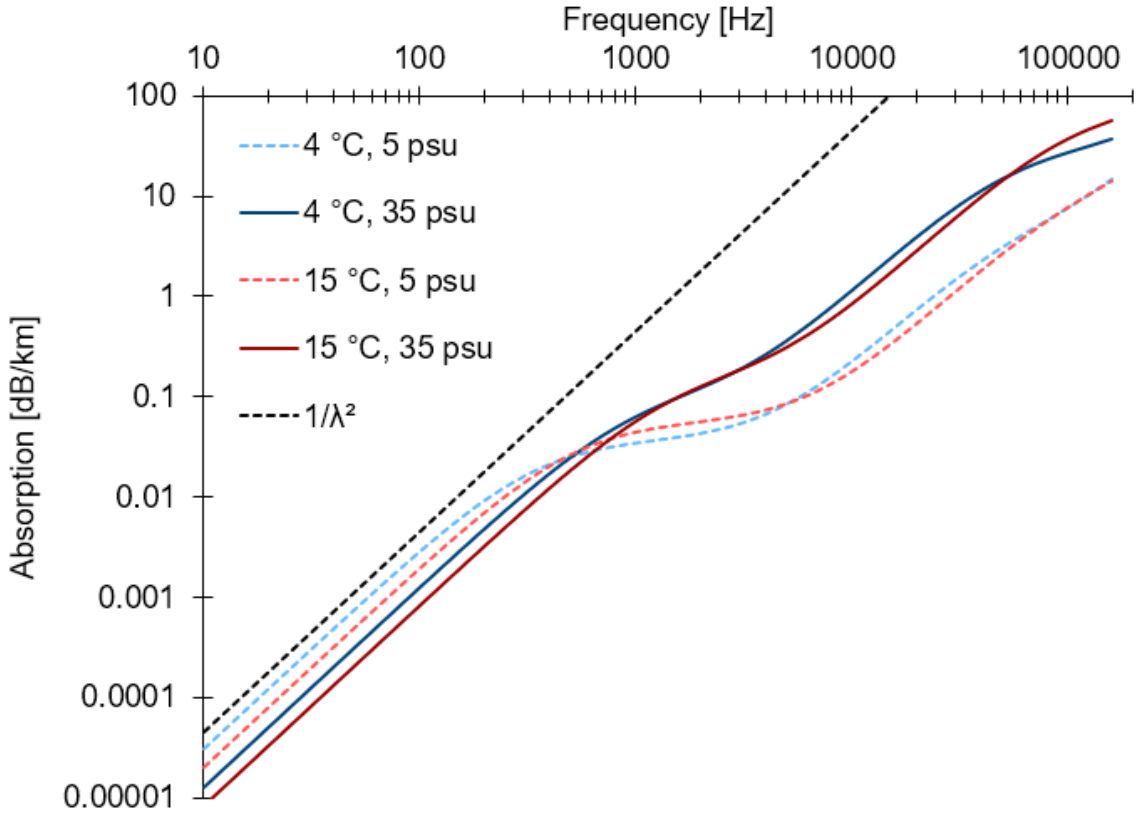


Figure1.13: Absorption loss coefficient (dB/km) for various salinities and temperature.

14.B

APPENDIX 14.B
Taranis

Appendix B – Taranis impact piling model

RPS has developed a hybrid model for prediction of source levels from impact piling – “Taranis”. The model is part numerical and part empirical, taking the best of both worlds in that it is fast like an empirical model, but also able to predict source levels from sites where no data exists, like a numerical model. The model has been validated against a large dataset of measured data from installation of piles from 0.5 - 9 m diameter in both nearshore and offshore settings for varying sediment conditions and hammer sizes and types. By outputting both per-blow band levels & time-series impulses it is an excellent tool for prediction of impact piling source levels. Additionally, because the model has a large validation dataset it reports the statistical uncertainty for the generated output, to give the user a full understanding of the confidence they can have in any given set-up.

The model was compared and calibrated against a range of real-world recordings that were back-calculated, using a combination of simple spreading relations, Rogers model (Rogers, 1981) and dBSea[1] propagation modelling software, accounting for the specific environment of the recording location. This means that the model has greater validity when used within the range of conditions of the measurements, and within those bounds we further know the statistical uncertainty of the model. Outside those bounds the model is essentially extrapolating, but care has been taken to ensure the model is “stable” and results outside the bounds change in a predictable manner.

Below is a graphical representation of the model coverage.

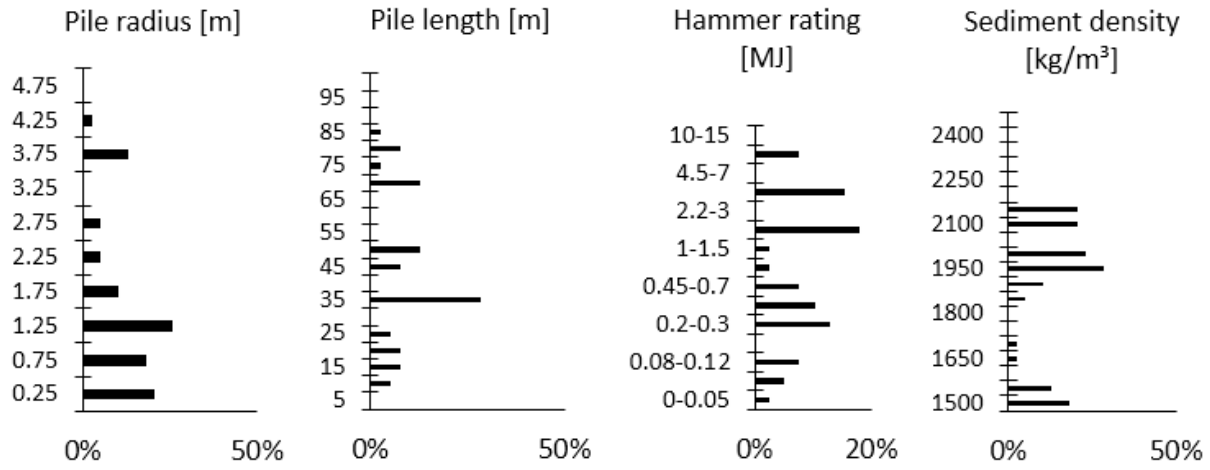


Figure **Error! No text of specified style in document.**-1. Overview of equipment and environmental parameters covered in the validation.

These cover a multidimensional space, and even if within all parameter limits, that particular combination of parameters might not have been tested, but given that the model has shown no “run-away” predictions we are confident that such combinations will still give representative results.

Table **Error! No text of specified style in document.**-1. Overview of the Taranis model’s inputs.

Model part	Parameter [unit] (default value)
Sediment	Density [kg/m³] as list (2100) Soundspeed [m/s] as list (2000)

[1] www.dBSea.co.uk

Model part	Parameter [unit] (default value)
	Grain size (diameter) [m] as list (0.35)
Water	Depth at piling site [m] Salinity [psu] (35) Temperature [degrees C] (15)
Hammer	Minimal blow energy [kJ] Maximal planned blow energy [kJ] Maximal rated blow energy [kJ]
Pile	Length [m] Radius [m] Penetration at desired installation depth [m] Density [kg/m³] (8050) Young's modulus [Pa] (2e11) Soundspeed [m/s] (5900) Wall thickness [m] (radius/50) Raking angle [degrees] (0.0)

Generally (>50 % of cases) the model predicts band levels within 6 dB of recorded levels with broad band levels being within 4 dB and peak levels within 7.5 dB (Figure **Error! No text of specified style in document.**-2, p. 3). There seems to be a bias in the band-wise errors showing a tendency for Taranis to underpredict levels at higher frequencies. This tendency is driven by a single validation case where Taranis' predictions for higher frequencies were >20 dB below the recorded. This case is included in the data, but remind the reader that something was likely different about this case making it a non-representative case. It is likely that the piling was done with the piles somewhat restricted and not free to move as assumed by the model (piles are assumed to be fixed at one end only).

The approach for model validation was to collate available data for recordings of impact piling where information on the hammer, the pile dimensions, the sediment and the water conditions where available. Recorded levels were back-calculated to an "equivalent monopoint source[2]". The back-calculation was mostly done using "Roger's model" (Rogers, 1981) when bathymetry was flat, dBSeaPE for longer ranges in range-dependent scenarios, and spherical spreading if the range to the source from the receiver was shorter than the depth. Roger's model and dBSea take into account the additional loss at low frequencies often not accounted for in simpler transmission loss calculations.

The main metrics used for accuracy estimation are:

- Band-wise error: The per decidecade band error for single blow SEL in dB
- Broadband error: The broadband error for single blow SEL in dB
- Peak error: The error in predicted L_P in dB

[2] Non-exiting quantity used to compare source levels at 1 meter from a point. In reality pile act like line or moving sources that have a "mach cone" (supersonic pressure front).

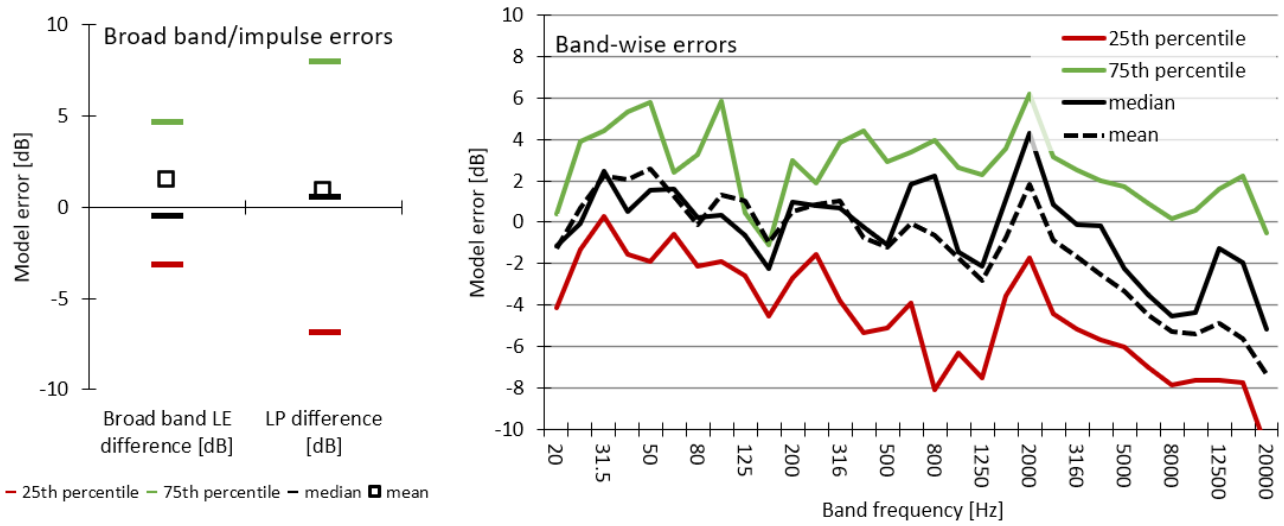


Figure **Error! No text of specified style in document.**-2. An overview of the broadband, peak and band-wise performance of the Taranis model.

Comparisons against other models (here a FE model) are favourable to this model for the 3 cases we have data for, where the FE model used in the case report has 50 % of is predictions within 14.6 dB, Taranis is within 3.3 dB. This serves only as an example that in at least this case the simpler approach from Taranis was not inferior to an FE model that's being used commercially by other actors.

14.C

APPENDIX 14.C
Weston Propagation Model Validation

Appendix C – Weston Propagation Model Validation

The Weston 1971-1976 sound propagation model was first published in 1971 as “Intensity-Range Relations in Oceanographic Acoustics” by D. E. Weston in the Journal of Sound and Vibration, with an update in 1976 as “Propagation in Water With Uniform Sound Velocity but Variable-Depth Lossy Bottom” by D.E. Weston in the Journal of Sound and Vibration.

The model presents a pragmatic approach to sound propagation modelling by splitting propagation into four distinct regions dependent on the given range, water depth and wavelength, and has be made range-dependent for both depth, soundspeed and sediment properties.

This appendix presents a few testcases with known solutions compared to this implementation of the Weston propagation model.

Comparison to normal modes, ray-tracing and parabolic equation models

Source:

Sertlek H. Ö. & Ainslie M. A (2003), “Propagation loss model comparisons on selected scenarios from the Weston memorial workshop”. 1st International Conference and Exhibition on Underwater Acoustics.

Case 1

Depth 100 m, max range 40 km.

This is a simple semi-deep waveguide which might be considered representative for parts of the continental shelf.

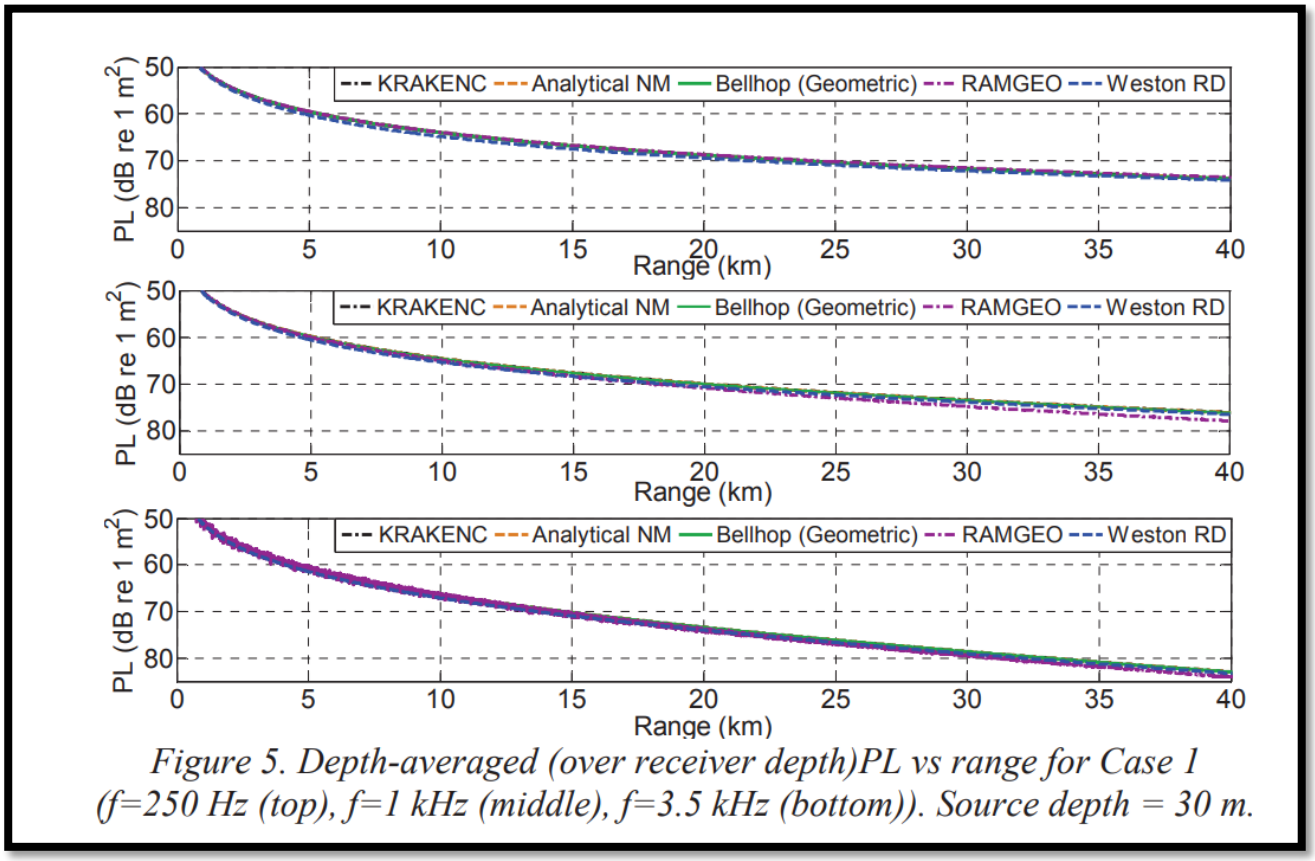


Figure 5. Depth-averaged (over receiver depth)PL vs range for Case 1 (f=250 Hz (top), f=1 kHz (middle), f=3.5 kHz (bottom)). Source depth = 30 m.

Case 2

Depth 100 m to 5 km then sloping up to 30 m at 7 km. Remaining at 30 m depth to 40 km range.

The step up at 5 km range tests the models' ability to calculate the effect of slowly changing depths in an upslope environment. Note that for 250 Hz (top panel in figure below) the Weston model underestimates the loss after c. 20 km, leading to a higher received level. The ray-tracer (Bellhop) shows the same result. This is expected as the Weston model relies on approximations made from ray-theory to specify the transitions between propagation regions.

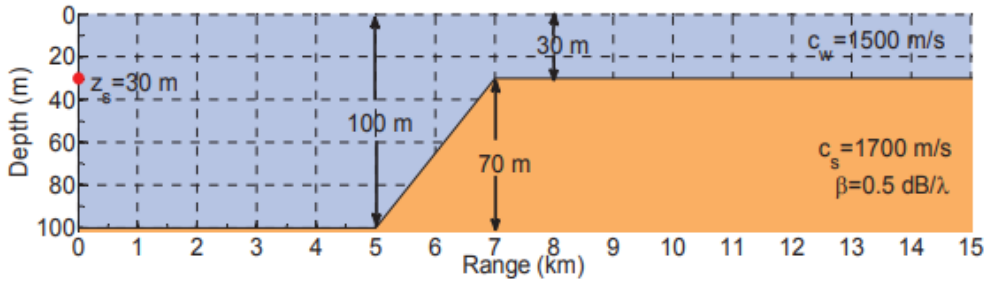


Figure 6. The bathymetry of Case 4

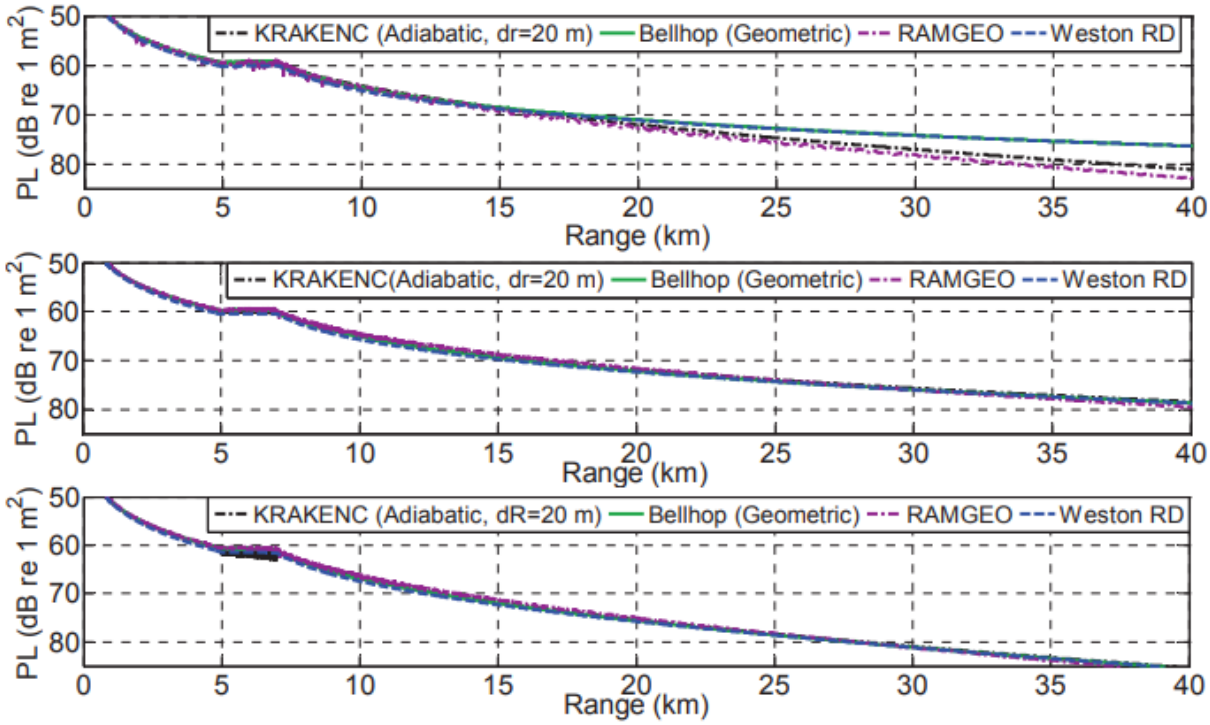


Figure 7. Depth-averaged (over receiver depth)PL vs range for Case 4 (f=250 Hz (top), f=1 kHz (middle), f=3.5 kHz (bottom)). Source depth = 30 m.

Case 3

Depth 100 m to 5 km, then sloping up to 30 m at 7 km. Remaining at 30 m depth to 7 km, then sloping down to 100 m depth at 10 km.

The “bump” scenario represents a shallow bank between two deeper sections. It tests the models’ ability to transition between different regions of propagation. There is excellent agreement between the Weston model and the numerical models.

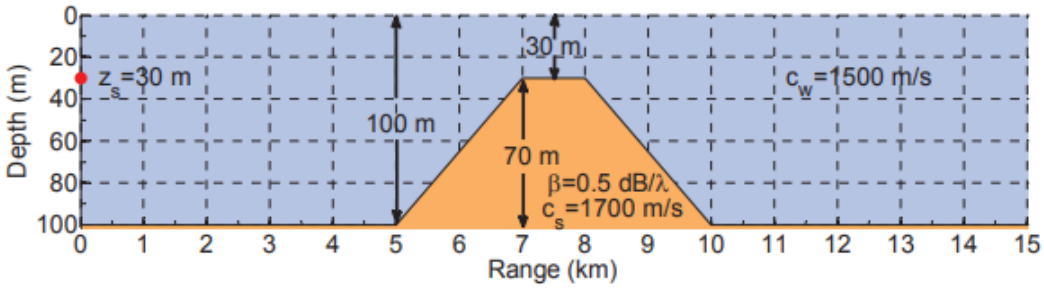


Figure 8. The bathymetry of Case 9

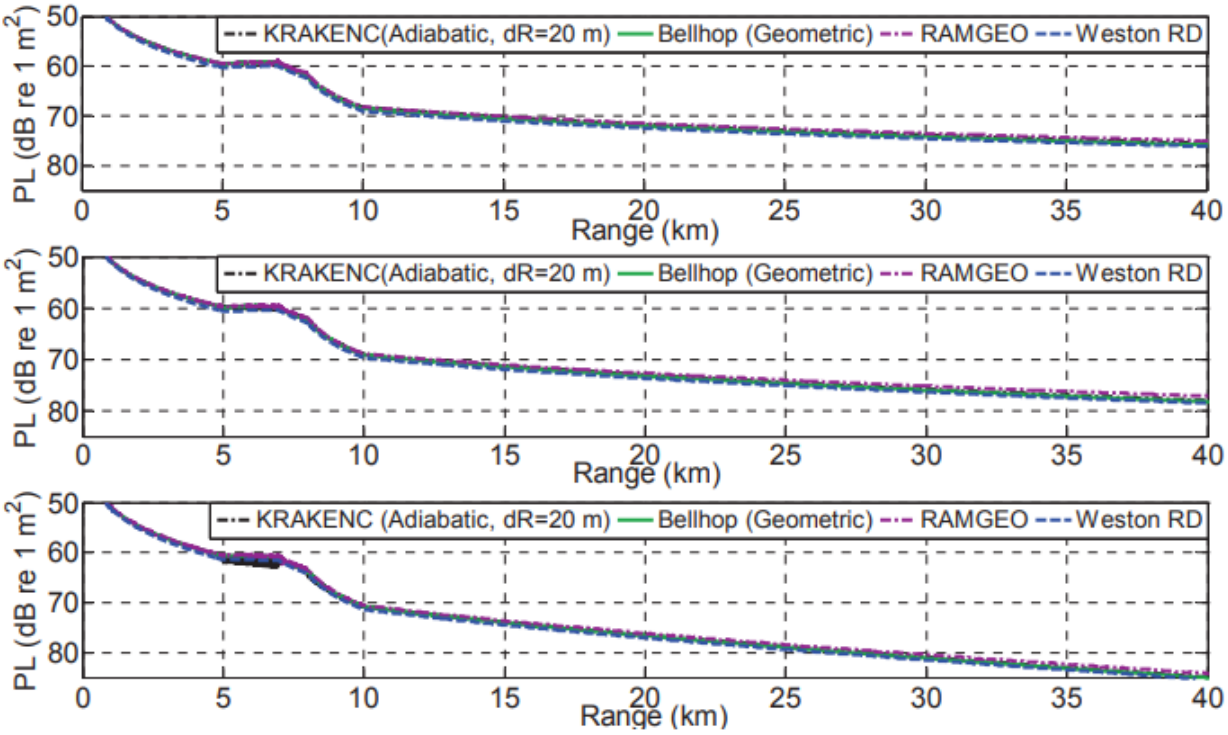


Figure 9. Depth-averaged (over receiver depth) PL vs range for Case9 (f=250 Hz (top), f=1 kHz (middle), f=3.5 kHz (bottom)). Source depth = 30 m.

Broadband comparison with various commercial models

Source:

Bas Binnerts, Christ de Jong, Ilkka Karasalo, Martin Östberg, Thomas Folegot, Dominique Clorennec, Michael A. Ainslie, Graham Warner, Lian Wang (2109), "Model Benchmarking Results For Ship Noise In Shallow Water", JOMOPANS.

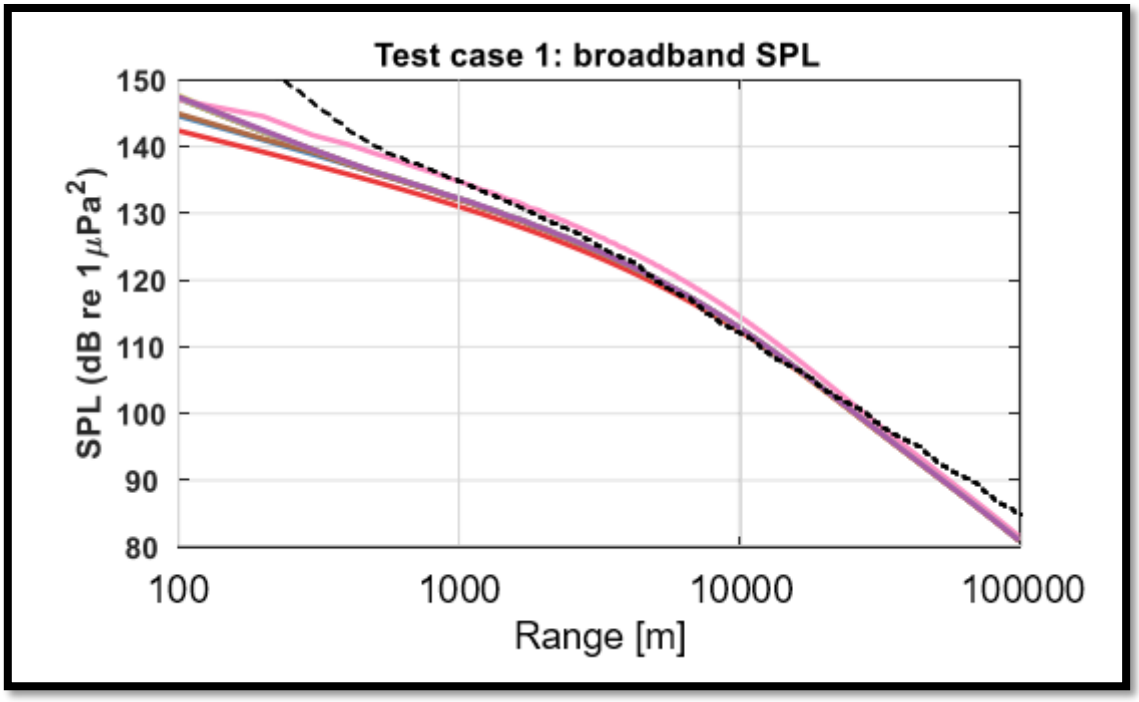
Two cases are investigated, both with a vessel source model used as the source and from 10 Hz to 20 kHz.

Case 1

50 m depth to 100 km range.

Broadband levels versus range

The Weston model matches the general losses well at ranges over c. 500 m.

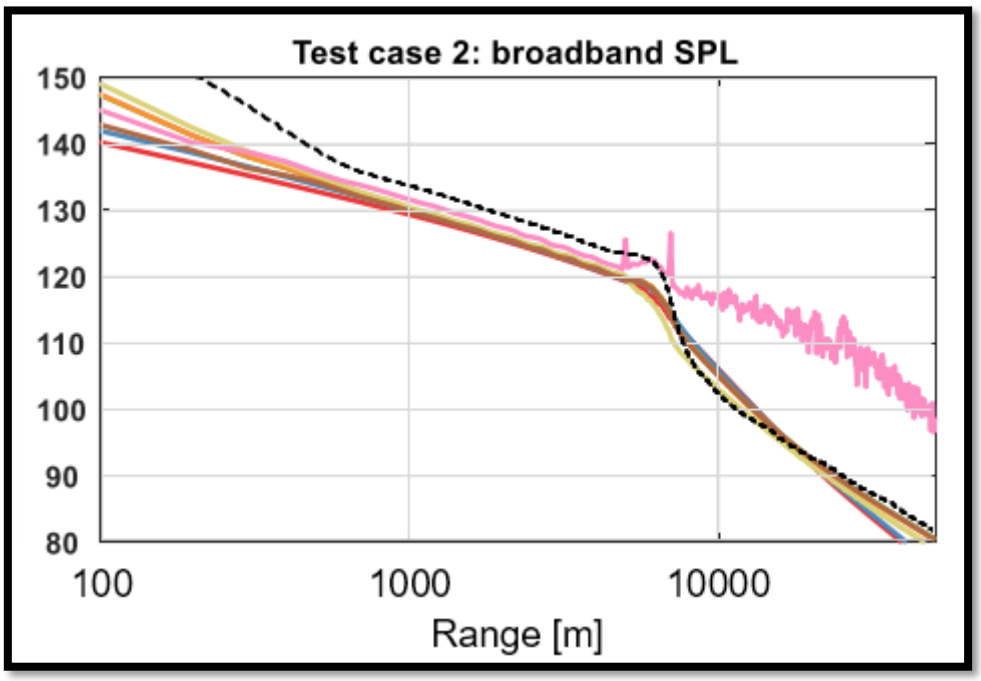


Case 2

100 m depth to 5 km, then upslope to 30 m depth at 7 km. Remaining at 30 m depth to 50 km range.

Broadband levels versus range

The Weston model matches the general losses well at ranges over c. 500 m.



15.A

APPENDIX 15.A Detailed Dust Assessment

Appendix 15.A

Detailed Dust Assessment

Introduction

The main air quality impacts that may arise during demolition and construction activities are:

1. **dust deposition, resulting in the soiling of surfaces;**
2. **visible dust plumes, which are evidence of dust emissions;**
3. **elevated PM_{10} concentrations, as a result of dust generating activities on site; and**
4. **an increase in concentrations of airborne particles and nitrogen dioxide due to exhaust emissions from diesel powered vehicles and equipment used on site (non-road mobile machinery) and vehicles accessing the site[1].**

The most common impacts are dust soiling and increased ambient PM_{10} concentrations due to dust arising from activities on the site. Dust soiling will arise from the deposition of dust in all size fractions. The ambient dust relevant to health outcomes will be that measured as PM_{10}, although most of this will be in the coarse ($PM_{2.5-10}$) fraction, rather than the $PM_{2.5}$ fraction. Research undertaken in the USA suggests that 85% to 90% by weight of the fugitive dust emissions of PM_{10} from construction sites are $PM_{2.5-10}$ and 10% to 15% are in the $PM_{2.5}$ fraction.

There are other potential impacts, such as the release of heavy metals, asbestos fibres or other pollutants during the demolition of certain buildings, such as former chemical works, or the removal of contaminated soils. The release of certain fungal spores during the demolition of old buildings can also give rise to specific concerns if immune-compromised people are likely to be exposed, for example close to an oncology unit of a hospital. These issues need to be considered on a site by site basis, and are not covered by this Guidance.

Experience of assessing the exhaust emissions from on-site plant (also known as non-road mobile machinery or NRMM) and site traffic suggests that they are unlikely to make a significant impact on local air quality, and in the vast majority of cases they will not need to be quantitatively assessed. For site plant and on-site traffic, consideration should be given to the number of plant/vehicles and their operating hours and locations to assess whether a significant effect is likely to occur. For site traffic on the public highway, if it cannot be scoped out (for example by using the EPUK's criteria), then it should be assessed using the same methodology and significance criteria as operational traffic impacts. The impacts of exhaust emissions from on-site plant and site traffic are not considered further in this Guidance.

Receptors

Human Receptor

A 'human receptor', refers to any location where a person or property may experience the adverse effects of airborne dust or dust soiling, or exposure to PM over a time period relevant to the air quality objectives, as defined in the Government's technical guidance for Local Air Quality Management. In terms of annoyance effects, this will most commonly relate to dwellings, but may also refer to other premises such as buildings housing cultural heritage collections (e.g. museums and galleries), vehicle showrooms, food manufacturers, electronics manufacturers, amenity areas and horticultural operations (e.g. salad or soft-fruit production). Care should be taken to ensure that the assessment takes into account whether exposure will arise in practice (e.g. computer chip manufacture is sensitive to dust and so premises are likely to have extensive dust filtering equipment and exposure may therefore not be increased).

Ecological Receptor

An 'ecological receptor' refers to any sensitive habitat affected by dust soiling. This includes the direct impacts on vegetation or aquatic ecosystems of dust deposition, and the indirect impacts on fauna (e.g. on foraging habitats). For locations with a statutory designation, e.g. Special Areas of Conservation (SACs) and Areas of Special Scientific Interest (ASSIs), consideration should be given as to whether the particular site is sensitive to dust and this will depend on why it has been designated. Some non-statutory sites (i.e. local wildlife sites) and/or locations with very specific sensitivities may also be considered if appropriate. The inclusion or exclusion of sites should be justified in the assessment.

Dust from construction sites deposited on vegetation may create ecological stress within the local plant community. During long dry periods dust can coat plant foliage adversely affecting photosynthesis and other biological functions. Rainfall removes the deposited dust from foliage and can rapidly leach chemicals into the

soil. Plant communities near short-term works are likely to recover within a year of the dust soiling stress ceasing. However, large scale construction sites may give rise to dust deposition over an extended period of time and adversely affect vascular plants. For example cement dust deposited on leaves can increase the surface alkalinity, which in turn can hydrolyse lipid and wax components, penetrate the cuticle, and denature proteins, finally causing the leaf to wilt.

Limestone dust coating of lichen has been shown to damage its photosynthetic apparatus. These types of damage over a long period have the potential to change plant community structure and function. Noticeable effects include the increase in ruderal and pioneer plant communities.

Risk of Dust Emissions

The risk of dust emissions from a demolition/construction site causing loss of amenity and/or health or ecological impacts is related to:

1. **the activities being undertaken (demolition, number of vehicles and plant etc.);**
2. **the duration of these activities;**
3. **the size of the site;**
4. **the meteorological conditions (wind speed, direction and rainfall);**
5. **the proximity of receptors to the activities;**
6. **the adequacy of the mitigation measures applied to reduce or eliminate dust; and**
7. **the sensitivity of the receptors to dust.**

The quantity of dust emitted from construction operations will be related to the area of land being worked, and the level of construction activity (nature, magnitude and duration). Emissions from construction vehicles passing over unpaved ground can be particularly important. These will be related to the silt content of the soil (defined by the US Environmental Protection Agency as particles smaller than 75 micrometres [µm] in diameter), as well as the speed and weight of the vehicle, the soil moisture content, the distance covered and the frequency of vehicle movements.

Weather

Although not specifically required as part of the IAQM dust assessment method, analysis of the local climatic conditions was also undertaken to provide additional context to the risk assessment and assist in the determination of the sensitivity of the area.

The wind direction, wind speed and rainfall, at the time when a construction activity is taking place, will also influence whether there is likely to be a dust impact. Due to the variability of the weather, it is impossible to predict what the weather conditions will be when specific construction activities are being undertaken.

Local wind speed and direction influences the dispersion of dust. This will depend on the frequency that the receptor is downwind and the distance of the receptors from the construction activities. Higher wind speeds will result in the highest potential release of dust from a site. Buildings, structures and trees can also influence dispersion.

Adverse impacts can occur in any direction from a site. They are, however, more likely to occur downwind of the prevailing wind direction and/or close to the site. It should be noted that the ‘prevailing’ wind direction is usually the most frequent direction over a long period such as a year; whereas construction activity may occur over a period of weeks or months during which the most frequent wind direction might be quite different. The most frequent wind direction may also not be the direction from which the wind speeds are highest. The use of the prevailing wind direction in the assessment of risk is most useful, therefore, for construction projects of long duration.

Dust impacts are more likely to occur during drier periods, as rainfall acts as a natural dust suppressant.

Seasonal

Impacts during the summer and winter months are generally different, and if it can be guaranteed that the construction will take place during a particular season (with this enforced through a planning condition, for

example), consideration could be given to using seasonal wind and rainfall data. This type of guarantee is not usual because the start of construction depends on many factors.

Topography & Natural Barriers

Local conditions also need to be accounted for. Topography and natural barriers (e.g. woodland) will reduce airborne concentrations due to impaction. In addition, if the locality has a history of dust generating activities, such as quarrying, a given level of additional dust may be more acceptable, i.e. more readily tolerated, than in a suburban residential area. Alternatively, impacts may be less acceptable, where nearby residents have become sensitised to dust, have a history of complaining and may therefore be more likely to complain about a new dust source. Similarly, in rural areas agricultural activities may generate dust and this should be taken into account in the assessment of risk.

Assessment Procedure (Risk/Magnitude/Impact highlighted as appropriate to this Proposed Development)

This guidance provides a framework for the assessment of risk. Every site is different and therefore this guidance cannot be too prescriptive and professional judgement is required. Any judgements must be fully auditable in the dust assessment report, with the source(s) defined and choice of dust risk category justified for each activity (see below). Where justification cannot be given, a precautionary approach must be taken and the highest level of mitigation recommended.

Activities on construction sites have been divided into four types to reflect their different potential impacts. These are:

A. **Demolition;**

B. **Earthworks;**

C. **Construction; and**

D. **Trackout.**

The potential for dust emissions is assessed for each activity that is likely to take place. Obviously, if an activity is not taking place, e.g. demolition, then it does not need to be assessed.

The assessment methodology considers three separate dust impacts:

1. annoyance due to dust soiling;
2. the risk of health effects due to an increase in exposure to PM_{10}; and
3. harm to ecological receptors with account being taken of the sensitivity of the area that may experience these effects.

The assessment is used to define appropriate mitigation measures to ensure that there will be no significant effect.

The assessment steps are summarised below and in **Figure A**.

STEP 1 is to screen the requirement for a more detailed assessment.

No further assessment is required if there are no receptors within a certain distance of the works.

STEP 2 is to assess the risk of dust impacts. This is done separately for each of the four activities (demolition; earthworks; construction; and trackout) and takes account of:

1. the scale and nature of the works, which determines the potential dust emission magnitude (STEP 2A); and
2. the sensitivity of the area (STEP 2B).

These factors are combined in STEP 2C to give the risk of dust impacts.

Risks are described in terms of there being a low, medium or high risk of dust impacts for each of the four separate potential activities. Where there are low, medium or high risks of an impact, then site-specific mitigation will be required, proportionate to the level of risk. Based on the threshold criteria and professional judgement one or more of the groups of activities may be assigned a 'negligible' risk. Such cases could arise, for example, because the scale is very small and there are no receptors near to the activity.

STEP 3 is to determine the site-specific mitigation for each of the four potential activities in STEP 2. This will be based on the risk of dust impacts identified in STEP 2. Where a local authority has issued guidance on measures to be adopted at demolition/construction sites, these should also be taken into account.

STEP 4 is to examine the residual effects and to determine whether or not these are significant.

STEP 5 is to prepare the dust assessment report.

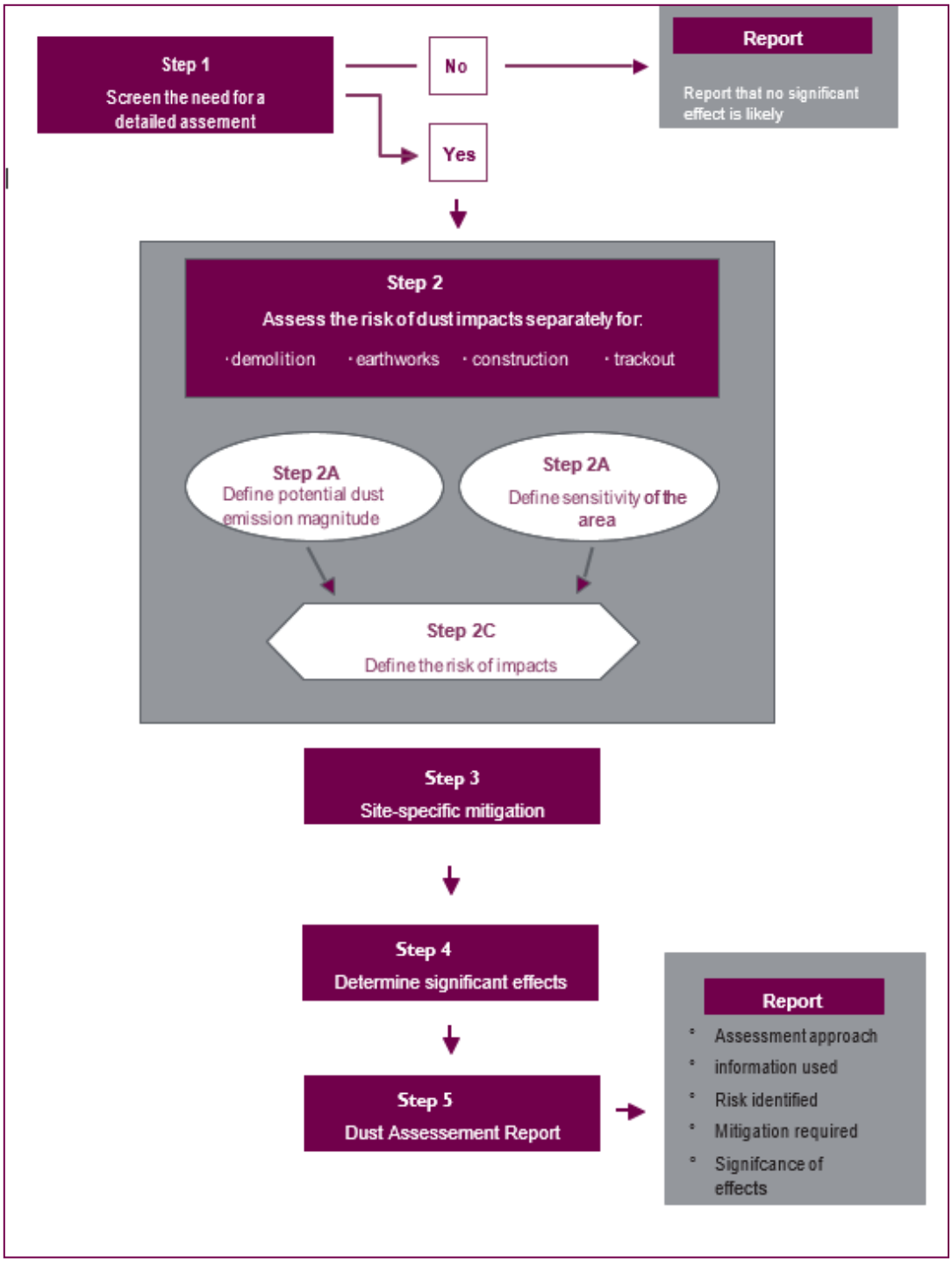


Figure A: Steps to Perform a Dust Assessment

STEP 1: SCREEN THE NEED FOR A DETAILED ASSESSMENT

This step is deliberately chosen to be conservative, and will require assessments for most schemes. The distances cited here, and in subsequent sections, take account of the exponential decline in both airborne concentrations and the rate of deposition with distance, as well as practical experience of members of the Working Group.

Where the need for a more detailed assessment is screened out, it can be concluded that the level of risk is "negligible", and any effects will be not be significant.

Box 1: Screening Criteria

An assessment will normally be required where there is:

- a 'human receptor' within:
  - 250 m of the boundary of the site; or
  - 50 m of the route(s) used by construction vehicles on the public highway, up to 250 m from the site entrance(s).
- an 'ecological receptor' within:
  - 50 m of the boundary of the site; or
  - 50 m of the route(s) used by construction vehicles on the public highway, up to 250 m from the site entrance(s).

STEP 2: ASSESS THE RISK OF DUST IMPACTS

The risk of dust arising in sufficient quantities to cause annoyance and/or health and/or ecological impacts should be determined using four risk categories: negligible, low, medium and high risk. A site is allocated to a risk category based on two factors:

1. the scale and nature of the works, which determines the potential dust emission magnitude as small, medium or large (**STEP 2A**); and

2. the sensitivity of the area to dust impacts (**STEP 2B**), which is defined as low, medium or high sensitivity.

These two factors are combined in **STEP 2C** to determine the risk of dust impacts with no mitigation applied. The risk category assigned to the site can be different for each of the four potential activities (demolition, earthworks, construction and trackout). More than one of these activities may occur on a site at any one time.

Where appropriate, the site can be divided into 'zones' for the dust risk assessment. This may result in different mitigation levels being applied to each zone. This could be where different parts of a large site are different distances from the nearest receptors, or where development activities move away from a receptor through time on a large scheme.

However, on complex sites where activities are not easily segregated the mitigation appropriate for the highest risk category should be applied. The aim is to ensure that it is clear what mitigation is supposed to be implemented on a site and to make auditing this simpler.

Every site is different in terms of timing (seasonality), building type (construction materials), duration and scale (area, volume and height), and therefore professional judgement must be applied by a technically competent assessor (see **Box 2**) when allocating activities into one of the three potential dust emission magnitude categories. Justification of the category used must be stated in the report. Where there is doubt, the higher risk category should be applied (e.g. if the site is assessed as low/ medium then mitigation appropriate to a medium site should be applied).

Box 2: Technical Competency of Assessor

The following risk assessment procedure requires 'professional judgement'. Those who are responsible for making this judgement must be able to demonstrate technical competency in the assessment of dust impacts. It is difficult to define precisely who has sufficient experience and expertise to make reasonable judgements, but, a person with full Membership of IAQM *and* experience of assessing dust impacts for a minimum of 10 diverse projects, including some complex multi-phase projects and similar projects to that being assessed, is likely to be technically competent.

IAQM is the only professional body specifically for air quality practitioners in the UK, although there are a number of more general environmental professional bodies, whose members may be competent.

STEP 2A: Define the Potential Dust Emission Magnitude

The dust emission magnitude is based on the scale of the anticipated works and should be classified as Small, Medium, or Large.

The following are examples of how the potential dust emission magnitude for different activities can be defined. Note that, in each case, not all the criteria need to be met, and that other criteria may be used if justified in the assessment:

Demolition: Example definitions for demolition are:

Large: Total building volume >75,000 m^3, potentially dusty construction material (e.g. concrete), on-site crushing and screening, demolition activities >12 m above ground level;

Medium: Total building volume 12,000 m^3 – 75,000 m^3, potentially dusty construction material, demolition activities 6-12 m above ground level; and

Small: Total building volume <12,000 m^3, construction material with low potential for dust release (e.g. metal cladding or timber), demolition activities <6 m above ground, demolition during wetter months.

The proposed development dust emission magnitude for Demolition is **Low**

Earthworks: Earthworks will primarily involve excavating material, haulage, tipping and stockpiling. This may also involve levelling the site and landscaping. Example definitions for earthworks are:

Large: Total site area >110,000 m^2, potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size), >10 heavy earth moving vehicles active at any one time, formation of bunds >6 m in height;

Medium: Total site area 18,000 m^2 – 110,000 m^2, moderately dusty soil type (e.g. silt), 5-10 heavy earth moving vehicles active at any one time, formation of bunds 3m - 6m in height; and

Small: Total site area <18,000 m^2, soil type with large grain size (e.g. sand), <5 heavy earth moving vehicles active at any one time, formation of bunds <3 m in height.

The proposed development dust emission magnitude for Earthworks is **Medium**

Box 3: Crushing and Screening

Mobile crushing equipment can be a significant source of dust associated with the demolition phase. This equipment is regulated by District Councils or Unitary Authorities in England and Wales, SEPA in Scotland and District Councils in Northern Ireland, under the Environmental Permitting Regulations 2010 in England and Wales, and equivalent legislation in Scotland and Northern Ireland.

Equipment should be designed and operated in accordance with the most recent version of Process Guidance Note 3/16 for Mobile Crushing and Screening (note this is under review).

Professional judgement will be required to determine how the use of crushing and screening equipment will affect the dust emission magnitude. For example, it may be appropriate to increase the dust emission magnitude by one or more classes

Box 4: Concrete Batching Plant

Concrete batching equipment is regulated by District Councils or Unitary Authorities in England and Wales, SEPA in Scotland and District Councils in Northern Ireland under the Environmental Permitting Regulations 2010 and equivalent legislation in Scotland and Northern Ireland.

Such equipment should be operated in accordance with the latest version of Process Guidance Note 3/1 on Guidance for Blending, Packing, Loading, Unloading and Use of Bulk Cement.

Professional judgement will be required to determine how the use of concrete batching equipment will affect the dust emission magnitude. For example, it may be appropriate to increase the dust emission magnitude by one or more classes.

Construction: The key issues when determining the potential dust emission magnitude during the construction phase include the size of the building(s)/infrastructure, method of construction, construction materials, and duration of build. Example definitions for construction are:

Large: Total building volume >75,000 m^3, on site concrete batching, sandblasting;

Medium: Total building volume 12,000 m^3 – 75,000 m^3, potentially dusty construction material (e.g. concrete), on site concrete batching; and

Small: Total building volume <12,000 m^3, construction material with low potential for dust release (e.g. metal cladding or timber).

The proposed development dust emission magnitude for Construction is **Medium**

Trackout: Factors which determine the dust emission magnitude are vehicle size, vehicle speed, vehicle numbers, geology and duration. As with all other potential sources, professional judgement must be applied when classifying trackout into one of the dust emission magnitude categories. Example definitions for trackout are:

Large: >50 HDV (>3.5t) outward movements in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length >100 m;

Medium: 20-50 HDV (>3.5t) outward movements in any one day, moderately dusty surface material (e.g. high clay content), unpaved road length 50 m – 100 m; and

Small: <20 HDV (>3.5t) outward movements in any one day, surface material with low potential for dust release, unpaved road length <50 m.

The proposed development dust emission magnitude for Trackout is **Small**

These numbers are for vehicles that leave the site after moving over unpaved ground, where they will accumulate mud and dirt that can be tracked out onto the public highway.

STEP 2B: Define the Sensitivity of the Area

The sensitivity of the area takes account of a number of factors:

1. the specific sensitivities of receptors in the area;
2. the proximity and number of those receptors;
3. in the case of PM_{10}, the local background concentration; and
4. site-specific factors, such as whether there are natural shelters, such as trees, to reduce the risk of wind-blown dust.

The type of receptors at different distances from the site boundary or, if known, from the dust generating activities, should be included. Consideration also should be given to the number of 'human receptors'. Exact counting of the number of 'human receptors', is not required. Instead it is recommended that judgement is used to determine the approximate number of receptors (a residential unit is one receptor) within each distance band. For receptors which are not dwellings professional judgement should be used to determine the number of human receptors for use in the tables, for example a school is likely to be treated as being in the >100 receptor category.

The likely routes the construction traffic will use should also be included to enable the presence of trackout receptors to be included in the assessment. As general guidance, without site-specific mitigation, trackout may occur along the public highway up to 500 m from large sites (as defined in STEP 2A), 200 m from medium sites and 50 m from small sites, as measured from the site exit.

A number of attempts have been made to categorise receptors into high, medium and low sensitivity categories; however, there is no unified sensitivity classification scheme that covers the quite different potential effects on property, human health and ecological receptors.

A series of boxes provide guidance on the sensitivity of different types of receptor to dust soiling (**Box 6**), health effects (**Box 7**) and ecological effects (**Box 8**).

In all cases the specific circumstances should be taken into account and may mean that on occasion the examples given will be subject to exceptions. For instance, the first occupants moving into residential dwellings on a large phased housing development, may reasonably be expected to be less sensitive to dust soiling effects (albeit for a limited time) than other residential receptors. **Box 9** contains additional factors that may need to be taken into account.

Box 6: Sensitivities of People to Dust Soiling Effects

For the sensitivity of people and their property to soiling, the IAQM recommends that the air quality practitioner uses professional judgement to identify where on the spectrum between high and low sensitivity a receptor lies, taking into account the following general principles:

High sensitivity receptor – surrounding land where:

- users can reasonably expect enjoyment of a high level of amenity; or
- the appearance, aesthetics or value of their property would be diminished by soiling; and
- the people or property would reasonably be expected to be present continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land.
- indicative examples include dwellings, museums and other culturally important collections, medium and long term car parks[b] and car showrooms.

Medium sensitivity receptor

- users would expect[a] to enjoy a reasonable level of amenity, but would not reasonably expect[a] to enjoy the same level of amenity as in their home; or
- the appearance, aesthetics or value of their property could be diminished by soiling; or
- the people or property wouldn't reasonably be expected[a] to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land.
- indicative examples include parks and places of work.

Low sensitivity receptor

- the enjoyment of amenity would not reasonably be expected[a]; or
- property would not reasonably be expected[a] to be diminished in appearance, aesthetics or value by soiling; or
- there is transient exposure, where the people or property would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land.
- indicative examples include playing fields, farmland (unless commercially-sensitive horticultural), footpaths, short term car parks[b] and roads.

[a] People's expectations will vary depending on the existing dust deposition in the area.
[b] Car parks can have a range of sensitivities depending on the duration and frequency that people would be expected to park their cars there, and the level of amenity they could reasonably expect whilst doing so. Car parks associated with work place or residential parking might have a high level of sensitivity compared to car parks used less frequently and for shorter durations, such as those associated with shopping. Cases should be examined on their own merits.

Box 7: Sensitivities of People to the Health Effects of PM_{10}

For the sensitivity of people to the health effects of PM_{10}, the IAQM recommends that the air quality practitioner assumes that there are three sensitivities based on whether or not the receptor is likely to be exposed to elevated concentrations over a 24-hour period, consistent with the Defra's advice for local air quality management (Defra. 2022, LAQM Technical Guidance LAQM.TG (22).

High sensitivity receptor

- locations where members of the public are exposed over a time period relevant to the air quality objective for PM_{10} (in the case of the 24-hour objectives, [a] relevant location would be one where individuals may be exposed for eight hours or more in a day).[a]
- Indicative examples include residential properties. Hospitals, schools and residential care homes should also be considered as having equal sensitivity to residential areas for the purposes of this assessment.

Medium sensitivity receptor

- locations where the people exposed are workers , and exposure is over a time period relevant to the air quality objective for PM_{10} (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day).
- Indicative examples include office and shop workers, but will generally not include workers occupationally exposed to PM_{10}, as protection is covered by Health and Safety at Work legislation.

Low sensitivity receptor

- locations where human exposure is transient.
- indicative examples include public footpaths, playing fields, parks and shopping streets.

[a]This follows Defra guidance as set out in LAQM.TG(22).

[b] Notwithstanding the fact that the air quality objectives and limit values do not apply to people in the workplace, such people can be affected to exposure of PM_{10}. However, they are considered to be less sensitive than the general public as a whole because those most sensitive to the effects of air pollution, such as young children are not normally workers. For this reason workers have been included in the medium sensitivity category.

[c] There are no standards that apply to short-term exposure,

e.g. one or two hours, but there is still a risk of health impacts, albeit less certain.

Box 8: Sensitivities of Receptors to Ecological Effects

Dust deposition due to demolition, earthworks, construction and trackout has the potential to affect sensitive habitats and plant communities.

Dust can have two types of effect on vegetation: physical and chemical. Direct physical effects include reduced photosynthesis, respiration and transpiration through smothering. Chemical changes to soils or watercourses may lead to a loss of plants or animals for example via changes in acidity. Indirect effects can include increased susceptibility to stresses such as pathogens and air pollution. These changes are likely to occur only as a result of long-term demolition and construction works adjacent to a sensitive habitat. Often impacts will be reversible once the works are completed, and dust emissions cease.

The advice of an ecologist should be sought to determine the need for an assessment of dust impacts on sensitive habitats and plants[a]. Professional judgement is required to identify where on the spectrum between high and low sensitivity a receptor lies, taking into account the likely effect and the value of the ecological asset. A habitat may be highly valuable but not sensitive, alternatively it may be less valuable but more sensitive to dust deposition. Consequently, specialist ecological advice should also be sought to determine the sensitivity of the ecological receptors to dust impacts. In general most receptors will either be of high sensitivity or low sensitivity i.e. either sensitive or not to dust deposition. The following provides an example of possible sensitivities:

High sensitivity receptor

- locations with an international or national designation and the designated features may be affected by dust soiling; or
- locations where there is a community of a particularly dust sensitive species such as vascular species included in the Red Data List For Great Britain[b].
- indicative examples include a Special Area of Conservation (SAC) designated for acid heathlands or a local site designated for lichens adjacent to the demolition of a large site containing concrete (alkali) buildings.

Medium sensitivity receptor

- locations where there is a particularly important plant species, where its dust sensitivity is uncertain or unknown; or
- locations with a national designation where the features may be affected by dust deposition.
- indicative example is a Area of Special Scientific Interest (ASSI) with dust sensitive features.

Low sensitivity receptor

- locations with a local designation where the features may be affected by dust deposition.
- indicative example is a local Nature Reserve with dust sensitive features.

[a] Habitat Regulation Assessment of the site may be required as part of the planning process, if the site lies close to an internationally designated site i.e. Special Conservation Areas (SACs), Special Protection Areas (SPAs) designated under the Habitats Directive (92/43/EEC) and RAMSAR sites.

Table B, **Table C**, and **Table D** show how the sensitivity of the area may be determined for dust soiling, human health and ecosystem impacts respectively. These tables take account of a number of factors which may influence the sensitivity of the area. When using these tables, it should be noted that distances are to the dust source and so a different area may be affected by trackout than by on-site works. The highest level of sensitivity from each table should be recorded. It is not necessary to work through the whole of each table once it is clear that the highest level of sensitivity has been determined.

While these tables are necessarily prescriptive, professional judgement may be used to determine alternative sensitivity categories, and the factors set out in **Box 9** may be useful to consider. Any judgements made should be fully documented.

Box 9: Additional Factors to Consider when Determining the Sensitivity of the Area

- any history of dust generating activities in the area;
- the likelihood of concurrent dust generating activity on nearby sites;
- any pre-existing screening between the source and the receptors;
- any conclusions drawn from analysing local meteorological data which accurately represent the area; and if relevant the season during which the works will take place;
- any conclusions drawn from local topography;
- duration of the potential impact, as a receptor may become more sensitive over time; and
- any known specific receptor sensitivities which go beyond the classifications given in this document.

Receptor Sensitivity	Number of Receptors	Distance from the Source (m)[c]			
		<20	<50	<100	<350
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	**Medium**	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

[a] The sensitivity of the area should be derived for each of the four activities: demolition, construction, earthworks and trackout. See **STEP 2B**, **Box 6** and **Box 9**.

[b] Estimate the total number of receptors within the stated distance. Only the highest level of area sensitivity from the table needs to be considered. For example, if there are 7 high sensitivity receptors <20 m of the source and 95 high sensitivity receptors between 20 and 50 m, then the total of number of receptors <50 m is 102. The sensitivity of the area in this case would be high.

[c] For trackout, the distances should be measured from the side of the roads used by construction traffic. Without site- specific mitigation, trackout may occur from roads up to 500 m from large sites, 200 m from medium sites and 50 m from small sites, as measured from the site exit. The impact declines with distance from the site, and it is only necessary to consider trackout impacts up to 50 m from the edge of the road.

Table B: Sensitivity of the Area to Human Health Impacts [a] [b]							
Receptor Sensitivity	Annual Mean PM10 concentration[c]	Number of Receptors[d]	Distance from the Source (m)[e]				
			<20	<50	<100	<200	<350
High	>32 µg/m^3 (>18 µg/m^3 in Scotland)	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28-32 µg/m^3 (16-18 µg/m^3 in Scotland)	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	24-28 µg/m^3 (14-16 µg/m^3 in Scotland)	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<24 µg/m^3 (<14 µg/m^3 in Scotland)	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	**Low**	Low	Low	Low	Low
Medium	>32 µg/m^3 (>18 µg/m^3 in Scotland)	>10	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	28-32 µg/m^3 (16-18 µg/m^3 in Scotland)	>10	Medium	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	24-28 µg/m^3 (14-16 µg/m^3 in Scotland)	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	<24 µg/m^3 (<14 µg/m^3 in Scotland)	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Low	-	≥1	Low	Low	Low	Low	Low

[a] *The sensitivity of the area should be derived for each of the four activities: demolition, construction, earthworks and trackout. See* ***STEP 2B***, ***Box 7*** *and* ***Box 9****.*

[b] *Estimate the total within the stated distance (e.g. the total within 350 m and not the number between 200 and 350 m), noting that only the highest level of area sensitivity from the table needs to be considered. For example, if there are 7 high sensitivity receptors <20 m of the source and 95 high sensitivity receptors between 20 and 50 m, then the total of number of receptors <50 m is 102. If the annual mean PM10 concentration is 29 µg/m^3, the sensitivity of the area would be high.*

[c] *Most straightforwardly taken from the national background maps but should also take account of local sources. The values are based on 32 µg/m^3 being the annual mean concentration at which an exceedance of the 24-hour objective is likely in England, Wales and Northern Ireland. In Scotland there is an annual mean objective of 18µg/m^3.*

[d] In the case of high sensitivity receptors with high occupancy (such as schools or hospitals) approximate the number of people likely to be present. In the case of residential dwellings, just include the number of properties.

[e] For trackout, the distances should be measured from the side of the roads used by construction traffic. Without site- specific mitigation, trackout may occur from roads up to 500 m from large sites, 200 m from medium sites and 50 m from small sites, as measured from the site exit. The impact declines with distance from the site, and it is only necessary to consider trackout impacts up to 50 m from the edge of the road.

Table C: Sensitivity of the Area to Ecological Impacts [a b]

Receptor Sensitivity	Distance from the Source (m)[c]	
	<20	<50
High	High	Medium
Medium	Medium	Low
Low	Low	Low

Table D: Example of the Outcome of Defining the Sensitivity of the Area

Potential Impact	Sensitivity of the Surrounding Area			
	Earthworks	Construction	Trackout	Demolition
Dust Soiling	Medium	Medium	Medium	Medium
Human Health	Low	Low	Low	Low
Ecological	Negligible	Negligible	Negligible	Negligible

Notes:

[a] *The sensitivity of the area should be derived for each of the four activities: demolition, construction, earthworks and trackout and for each designated site. See **STEP 2B**, **Box 8** and **Box 9**.*

[b] *Only the highest level of area sensitivity from the table needs to be considered.*

[c] *For trackout, the distances should be measured from the side of the roads used by construction traffic. Without site- specific mitigation, trackout may occur from roads up to 500 m from large sites, 200 m from medium sites and 50 m from small sites, as measured from the site exit. The impact declines with distance from the site.*

STEP 2C Define the Risk of Impacts

The dust emission magnitude determined at **STEP 2A** should be combined with the sensitivity of the area determined at **STEP 2B** to determine the risk of impacts with no mitigation applied. The matrices in **Table E**, **Table F**, **Table G** and **Table H** provide a method of assigning the level of risk for each activity. This should be used to determining the level of mitigation that must be applied. Mitigation is discussed in **STEP 3**. For those cases where the risk category is 'negligible', no mitigation measures beyond those required by legislation will be required.

Table E: Risk of Dust Impacts- Demolition

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	**Medium Risk**
Medium	High Risk	Medium Risk	**Low Risk**
Low	Medium Risk	**Low Risk**	Negligible

Table F: Risk of Dust Impacts- Earthworks

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	**Medium Risk**	Low Risk
Medium	Medium Risk	**Medium Risk**	Low Risk
Low	Low Risk	Low Risk	Negligible

Table G: Risk of Dust Impacts- Construction

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	**Medium Risk**	Low Risk
Medium	Medium Risk	**Medium Risk**	Low Risk
Low	Low Risk	Low Risk	Negligible

Table H: Risk of Dust Impacts- Trackout

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	**Low Risk**
Medium	Medium Risk	Low Risk	**Negligible**
Low	Low Risk	Low Risk	Negligible

People and Property

Ecology

15.B

APPENDIX 15.B
Air Quality Impacts on Designated Nature Conservation Sites

Appendix 15.B

Air Quality Impacts on Designated Nature Conservation Sites

Introduction

Purpose:

- To assist members in the assessment of the air quality impacts of development on designated nature conservation sites.
- May be useful for ecologists who use the results of air quality assessments to evaluate the effects of air pollution on habitats and species, by increasing understanding of information provided by air quality specialists.
- Focuses on air quality assessments in support of Habitats Regulations Assessment (HRA), but is also useful for assessing air quality impacts on national or local designated nature conservation sites.

Sites covered by this guidance:

- It is applicable to the assessment of European, national and local designated sites when required. This includes Special Areas of Conservation (SACs), Special Protection Areas (SPAs) (known as European sites), and Ramsar sites which are covered by the Habitats Regulation. It also applies to Sites of Special Scientific Interest (SSSIs), Areas of Special Scientific Interest (ASSIs), National Nature Reserves (NNRs), local nature reserves (LNRs), local wildlife sites (LWSs) and areas of ancient woodland (AW).

Habitats Regulations

The European Commission (EC) provides guidance on managing internationally designated nature conservation sites. The requirement to produce and HRA is driven in England and Wales by the Conservation of Habitats and Species Regulations 2017 (as amended), which states that 'A competent authority, before deciding to undertake, or give any consent, permission or other authorisation for, a plan or project which

- Is likely to have a significant effect on a European site or a European offshore marine site (either alone or in combination with other plans or projects); and
- Is not directly connected with or necessary for the management of that site, must make an appropriate assessment of the implications for that site in view of that site's conservation objectives.

Similar requirements apply in Scotland and Northern Ireland.

Receptors

Ecological Receptor

An 'ecological receptor' refers to any sensitive habitat affected by dust soiling. This includes the direct impacts on vegetation or aquatic ecosystems of dust deposition, and the indirect impacts on fauna (e.g. on foraging habitats). For locations with a statutory designation, e.g. Special Areas of Conservation (SACs) and Areas of Special Scientific Interest (ASSIs), consideration should be given as to whether the particular site is sensitive to dust and this will depend on why it has been designated. Some non-statutory sites (i.e. local wildlife sites) and/or locations with very specific sensitivities may also be considered if appropriate. The inclusion or exclusion of sites should be justified in the assessment.

Dust from construction sites deposited on vegetation may create ecological stress within the local plant community. During long dry periods dust can coat plant foliage adversely affecting photosynthesis and other biological functions. Rainfall removes the deposited dust from foliage and can rapidly leach chemicals into the soil. Plant communities near short-term works are likely to recover within a year of the dust soiling stress ceasing. However, large scale construction sites may give rise to dust deposition over an extended period of time and adversely affect vascular plants. For example cement dust deposited on leaves can increase the surface alkalinity, which in turn can hydrolyse lipid and wax components, penetrate the cuticle, and denature proteins, finally causing the leaf to wilt.

Limestone dust coating of lichen has been shown to damage its photosynthetic apparatus. These types of damage over a long period have the potential to change plant community structure and function. Noticeable effects include the increase in ruderal and pioneer plant communities.

Box 1: Key Issues for the Air Quality Assessment

1. Impacts vs. effects
   - The air quality practitioner calculates the air quality impacts.
   - The ecologist identifies the ecological effects.
2. IAQM document scope
   - This document is concerned with determining whether there will be a 'likely significant effect' on a habitat, and where this cannot be screened out, providing the ecologist with detailed information on the air quality impacts.
   - It is the job of the ecologist to determine whether in reality there will be a 'significant effect', or, for European sites, an 'adverse effect on the integrity of the site'
3. Consultation
   - Always consult the regulator on the:
     -assessment approach
     -pollutants to be included
     -designated sites to be considered; and
     -the list of projects and plans to be included in the in-combination or cumulative impact assessment.
4. Collaboration
   - Work closely with the project ecologist throughout the air quality assessment.
   - If there is no project ecologist, as is the case for many environmental permit applications, it may be necessary in some circumstances to recommend to the client that on is appointed.

5. Professional judgement
   - There are too many different types of plans and projects and regulatory regimes in the UK to be prescriptive on how to undertake air quality assessments.
   - Professional judgement of an experienced air quality practitioner is essential.
   - Demonstration of experience of undertaking similar assessments should be provided in the assessment report or other appropriate document.

6. Proportionate
   - The scope and detail of assessment should be proportionate to the risk.

7. Precautionary principle
   - The assessment should be precautionary, but not so precautionary as to produce results that are unrealistic.

8. Guidance changes with time
   - Always check for the most recent guidance from the relevant regulator.

Other Guidance

For impacts associated with dust soiling e.g. from construction projects and mineral sites are not within the scope of this guide. IAQM offers alternative guidance specific to these associated impacts. There is existing guidance on planning and air quality

It is often necessary to incorporate a wider ecological impact assessment (EcIA) into the assessment of impacts. Guidance for the implementation of the EcIA has been produced by CIEEM.

Background

After much research, the broad effects of air pollution on habitats are now substantially understood. Despite recent reductions in sulphur dioxide (SO_2) emissions in the UK, there remains a legacy effect in various habitats from the accumulated deposition since the Industrial Revolution. Effects of other pollutants are also apparent at many designated sites, especially from nitrogen (N) deposition. This problem is likely to persist for some time on a national and international scale.

- IAQM uses the term 'impact' where discussing changes in concentration or deposition and the term 'effect' when discussing ecological changes.

- There are two categories of pollutants that are typically the subject of AQAs for designated sites. These are pollutants that have an effect on vegetation/habitats in a gaseous form and those which have an impact through deposition.
- Some other pollutants, for example, heavy metals and hydrogen chloride, are emitted by industrial processes and these pollutants may also need to be assessed. It is recommended that, prior to the assessment of industrial emissions, the scope of any assessment is discussed with the regulator
- Another gaseous pollutant that has important effects on vegetation is ozone. This is a secondary pollutant, formed in the atmosphere from emissions of nitrogen oxides (NOx) and volatile/semi-volatile organic compounds. Its production through photochemical reactions occurs at a considerable distance from the release point and is not amenable to the assessment methods set out in this document. Consequently, no guidance on its assessment is provided

Table 15.B.A below shows the critical levels for various significant gaseous pollutants, below which significant harmful effects are not thought to occur. These have been adopted the European Union and United Nations Economic Commission for Europe (UNECE) and are used as regulatory standards.

Table 15.B.A: Critical Levels

Pollutant	Averaging Period	Critical Level
Oxides of nitrogen (NO_x)	24 hours	75/200 µg/m^3 *
	Annual	30 µg/m^3
Sulphur dioxide (SO_2)	Annual	10 µg/m^3 (for lichens and bryophytes)
	Annual	20 µg/m^3
Ammonia (NH_3)	Annual	1 µg/m^3 (for lichens and bryophytes
	Annual	3 µg/m^3
Hydrogen fluoride (HF)	24 hours	5 µg/m^3
	Weekly	0.5 µg/m^3

** The critical level is generally considered to be 75 µg/m^3 ; but this only applies where there are high concentrations of SO_2 and ozone, which is not generally the current situation in the UK. See paragraph D.4.11 in Appendix D. 19.*

- For the deposition of air pollutants critical loads, given as a range, for different habitats have been provided by UNECE (see the APIS20). APIS provides critical loads for nitrogen deposition (leading to eutrophication) and acid deposition (leading to acidification)
- Critical loads for nitrogen deposition are in units of kilogrammes of nitrogen per hectare per year (kg N/ha/year) and vary with habitat sensitivity.
- Nitrogen and sulphur deposition both contribute to acid deposition, as do some other compounds such as hydrogen chloride. APIS provides a Critical Load Function that defines the contributions from sulphur and nitrogen deposition that will not cause harmful effects. Critical loads for acidification are in units of kilograms of H+ ion equivalents per hectare per year (keq/ha/year).

Assessment Outline

The main purpose of this document is to lay out a procedure to be followed by air quality specialists when evaluating the impacts of airborne pollution at designated sites. The procedure assumes that the assessment will be collaborative between air quality and ecology specialists, representing the ideal combination of expertise. Ecologists however are not always engaged on all projects for which air quality impact assessments are set out.

Table 15.B.B below provides an overview of the different stages involved in the assessment.

Table 15.B.B: Outline of assessment stages

Stage	Who	What	Planning/permitting output (all sites)	HRA Output	Guidance in this document/elsewhere
Scoping	Air Quality specialist and ecology	Initial evaluation of potential receptors, consultation with competent authority/stakeholders	Study area, relevant receptors, pollutants	n/a	Chapter 4 and 5
Quantification and Screening					
Simple Assessment	Air quality specialist	Calculate/estimate PC and compare with screening thresholds (1%, 1000 AADT)	Identify if insignificant OR if further assessment required (e.g. detailed modelling	Screening Identification of likely significant effects (project alone & in-combination)	Chapter 5
	Ecologist		Assessment of significance of effects (inter & intra project		
Detailed Assessment	Air quality specialist	Calculate PC & PEC and compare against critical levels/loads at relevant receptors	Identification of impacts (project alone & cumulative impacts)	Identification of adverse effects on integrity (project alone & incombination)	
	Ecologist		Assessment of significance of the project alone and cumulative effect (i.e. inter and intra project effects)		
Mitigation and Monitoring	Air quality specialist and ecologist	The application of measures to address air quality impacts and associated ecological effects following a mitigation hierarchy, and the use of monitoring		Apply mitigation hierarchy. Identify imperative reasons of overriding public interest (IROPI)	IAQM position statement sets out the basic hierarchical principles for identifying mitigation measures[31]

- Both the ecology and the air quality specialists should consult with each other and the relevant decision-makers and/or stakeholders prior to commencing their assessments. In those cases where effects (alone and in-combination) cannot be definitively described as insignificant on the basis of the air quality assessment alone (see Section 5), the ecologist will review the information provided by the air quality specialist and consider the likely significance of the effects.

Box 2 Initial Evaluation (Scoping)

Considerations

- Pollutants: Are there any that may cause adverse effects on vegetation or habitats?
- Study area: Has the relevant regulator specified any screening distances from air pollution sources?
- Has the ecologist identified any other designated sites that might be affected by the change in emissions?

Actions

Identify designated sites.

- Scope out any sites with habitats/species not sensitive to air pollution.
- Provide mapping showing the sites to be assessed.

Box 3 Key elements of the air quality assessment (Quantification and Screening)

Considerations

- Agreement between the air quality and ecology specialists on appropriate critical loads.
- Agreement on the locations where estimates of pollutant concentrations and deposition rates are required.
- Agreement with the regulator on the 'in-combination' effects that need to be accounted for.
- Are the estimated impacts sufficiently small that their effects could be described as insignificant?

Outputs

- A list of sites and/or pollutants that have been screened out and require no further assessment;
- A list of sites and/or pollutants that require further assessment to determine whether, or not, there may be a likely significant effect at the relevant site(s);
- The grid references or areas of the modelled impacts;
- The basis for emissions calculations, and whether it takes into account the operational characteristics e.g. batch processes do not operate continuously;
- A list of the emission sources considered in the incombination assessment and why they were included or excluded;
- Existing concentrations and deposition rates (except in some cases for permitting);
- The change due to the project, or the 'future baseline with project', and 'future baseline without project' concentrations and deposition rates;
- The change in the case of European sites should be quantified for the project without taking into account mitigation;
- A description of the assumptions used in the assessment e.g. hours of operation, assessment year, location of ecological habitats of concern, and future year conditions. The degree of conservatism and whether there are known uncertainties in the input data. A summary of the habitat categories selected, the critical levels and loads applied and existing concentrations and rates of deposition at each site;
- Tabulated results for the project or plan alone and, incombination with other projects and plans showing for all pollutants the totals and changes in concentrations and deposition rates at the key locations of interest, and contributions as a percentage of the air quality criteria (critical levels and loads);
- If they are likely to be useful in the interpretation (notably, when assessing impacts of point sources) concentration contours (isopleths) overlaid in a clear manner over an Ordnance Survey (or equivalent) base map

* Mitigation is generally considered to be any additional measure to reduce or remove emissions, or diminish their impacts, above and beyond those that would be expected to be present as part of a

The assessment of air quality impacts

There is a range of existing statutory and non-statutory guidance and supporting tools provided by *inter alia* the Environment Agency (EA), Natural Resources Wales (NRW), Scottish Environmental Protection Agency (SEPA), Highways England, Defra, Natural England and the Air Pollution Information Service (APIS) on how to estimate the impact of a project or plan on ambient concentrations and pollutant deposition.

- Most of the existing published guidance predates the Wealden Judgement and CJEU rulings described in Chapter 3. The exception is guidance for road traffic produced by Natural England in 2018 to address specifically the issues raised in the Wealden judgement. The approaches to air quality assessment differ according to whether the project or plan comprises transport sources, industrial sources33 or agricultural sources.

The stages of air quality assessment can be summarised as:

1. Scoping
2. Quantification; and
3. Screening

In-combination impacts

- The Habitats Regulations place a duty on competent authorities to assess the effect of new projects and plans both alone and in-combination with other projects and plans, i.e. the effects of the plan or project being assessed must also be considered together with the effects of other relevant projects and plans. This is because a series of individually modest impacts may, in-combination, produce a significant effect on a habitat/species.
- Similarly developments requiring an Environmental Impact Assessment (EIA) under the EIA regulations, require the consideration of cumulative effects of the development and other relevant developments.
- Projects and plans that may have been approved but are, as yet, incomplete, subject of an outstanding appeal or ongoing review, should all be considered.
- It should, however, be noted that where the impacts are due to road traffic emissions, the cumulative impact may not be explicitly identified. It is normal in an air quality assessment to include traffic growth estimates using the Department of Transport's TEMPRO36 growth factors or from a strategic transport model that explicitly includes traffic from other projects and/or plans.
- The impacts from different pollutants also need to be considered, such as the impact on deposition of nitrogen derived from NO_x and NH_3 . For example, the NH_3 contribution from agricultural activities may need to be considered together with NO_x and NH_3 emissions from road transport.
- Defining an 'isolated source' is not possible and where there is doubt, it should be assumed that there may be an in-combination effect.
- Further advice on in-combination assessments is provided in the European Commission's 2018 guidance.

Stage 1 – Scoping

- For individual planning applications for conventional residential or mixed-use development where European sites are a consideration, the assessor should first investigate whether the air quality issues have already been fully explored for the Local Plan HRA.
- For projects requiring assessment, the air quality specialist, assisted by the ecologist, should identify the designated sites likely to be affected by the source of emissions to air that require assessment, taking into account distance criteria in the relevant guidance documents, where these exist, relevant to the scale and type of development being assessed. These criteria are described below.
- The Design Manual for Roads and Bridges (DMRB)41 describes the approach for the assessment of the impact of emissions from schemes on the strategic road network. A quantitative air quality assessment is required if European Sites are within 200 m of affected roads. Natural England advises

that if there are no qualifying features sensitive to air pollution within 200 m of a road, then no further assessment is required.

- The Defra/Environment Agency's Air emissions risk assessment for your environmental permit (which applies to industrial emission sources) currently identifies distances of 2 km for local and nationally important sites and areas of ancient woodland, and 5, 10 or 15 km depending on the emission source for European Sites. Different distances apply for agricultural emissions.

Stage 2 – Quantification

Approach and Methods

- Once all the required information on the project/plan and the projects/plans for the in-combination assessment, has been gathered, concentrations and deposition rates will be calculated.
- The change in pollutant concentrations due to an industrial or agricultural source is often determined simply by modelling the dispersion of the emissions. This is known as the process contribution (PC). The in-combination impacts would then be assessed by adding the PCs from the other relevant projects and plans.
- The PCs may be calculated by a variety of methods, depending on the circumstances and scale of the project but detailed dispersion modelling is used in most cases.
- To determine the concentration/deposition rates, the PC is added to the baseline concentration/deposition rates. All relevant emission sources should be included in the baseline e.g. traffic emissions. These may be taken from measurement data or other appropriate sources such as Defra or APIS background maps. The concentration/deposition rate is known as the predicted environmental concentration (PEC).
- Measurements of pollutant concentrations are made by local authorities and Defra. The choice of data source will often depend on the location of the study area, i.e. whether urban or rural, which dictates the amount of monitoring data available. Site-specific monitoring (e.g. using diffusion tubes) is sometimes undertaken to determine baseline concentrations, to obtain the most up to date information or where appropriate baseline data are not available.
- For projects/plans that generate road traffic, the dispersion modelling will estimate the PEC "without the project/plan" (i.e. the future baseline) and PEC concentrations "with the project/plan".
- When modelling dispersion of emissions, several points should be assessed within each designated site, both along the site boundary and within the site itself to identify maximum impact at the site as well as the range experienced across the area. Consideration should also be given to the distribution of habitat features of interest within the site and receptor points and grids should be carefully selected. Meteorological data should also be used in dispersion modelling.
- For road transport sources, individual receptors along a transect, or along a series of transects at suitable intervals, perpendicular to the road up to 200 m are generally used.
- The changes in deposition rates (i.e. PC) resulting from the project or plan for the pollutants of interest are typically derived from the product of the atmospheric concentration and the deposition velocity55 (taking into account the units). The best available estimate of the deposition velocity available should be used for this calculation. The deposition velocity depends on the vegetation type (this can be general, for example, forest or heathland) at the location of interest. This information on vegetation type can be informed by the ecologist.

The most used deposition velocity values, taken from AQTAG guidance, are show below in Table 15.B.C.

Table 15.B.C: Deposition Velocities (after AQTAG)

Pollutant	Habitat	Deposition velocity (m/s)
NO_2	Grassland	0.0015
	Forest	0.003
SO_2	Grassland	0.012
	Forest	0.024

Pollutant	Habitat	Deposition velocity (m/s)
NH_3	Grassland	0.020
	Forest	0.030
HCl	Grassland	0.025
	Forest	0.060

Future concentrations and deposition rates

- Natural England guidance signposts the APIS website which provides information on deposition trends drawn from the results of national modelling over a number of years. The trend data for these 3-year averages are provided for maximum and minimum deposition (nutrient nitrogen and acid). The APIS website also provides background concentrations data, but the higher spatial resolution background data available from Defra for certain pollutants should be used when possible.
- The air quality specialist may choose to assume no change in future baseline concentrations or deposition rates, where there is no evidence to indicate that they may decrease in value. This concerns projects/plans which are expected to be completed in a short period of time. For long lead-in periods, it may be appropriate to reduce future baseline concentrations/ deposition rate to allow for anticipated improvements in national emissions.
- There is clear evidence that UK NOx emissions, including those from road traffic, are declining but what is not certain is the exact rate of reduction of NOx emissions and therefore it is important that a conservative estimate is used for the modelling.
- In the UK, the Government has published a Clean Air Strategy, which sets out the mechanisms by which the target of a 73% reduction in NO_x emissions will take place by 2030 (relative to a 2005 baseline). This will ensure compliance with the National Ceilings Emission Directive. The strategy also includes a target for the reduction of deposition of reactive forms of nitrogen in England's protected priority sensitive habitats.
- There is more uncertainty regarding ammonia emissions, but the government is legally committed, under the 2016 National Emissions Ceiling Directive to reduce these emissions, along with SO_2 and NO_x emissions. The UK has a good track record on meeting its international emission reduction obligations. Any assumption should be clearly explained, with justification given.
- Whichever approach is adopted, it is advisable to gain agreement in advance from the regulator and explain to the ecologist the basis of assessment.

Stage 3 – Screening

- A database of site-specific critical loads for nitrogen and acid deposition rates is available on the APIS website60. Unless the lowest value for a high-level screening assessment is adopted, the selection of critical loads requires knowledge of the habitat type, site interest features, and specialist knowledge, such as whether the environment is nitrogen or phosphorous limited, or whether grassland is acidic or calcareous. It also requires knowledge as to the relative reliability of the critical load in question as some are supported by firmer evidence than others. This is identified on the APIS website.
- APIS does not cover all habitat types. In these cases, for an assessment to be undertaken advice from a suitably qualified ecologist is required.
- For each site, and for each habitat within each site, the air quality specialist should calculate the PC as a percentage of the relevant critical level/load both alone and in-combination with other plans and projects. The calculated maximum PC is then used to determine whether the impacts will have an insignificant effect or, controversially, may be large enough to warrant further evaluation by an ecologist.
- In the case of Environment Agency permitting, an increment of 1% (or less) of the relevant long term critical level or critical load alone is considered inconsequential. The 1% threshold has become widely used throughout the air quality assessment profession to define a reasonable quantum of long term pollution which is not likely to be discernible from fluctuations in background/measurements.
- The 1% threshold is used in the context of an in-combination assessment. Crucially, it is not a threshold of harm and exceeding this threshold does not, of itself, imply damage to a habitat.

- For all types of project/plan, if the air quality specialist identifies that the impact is sufficiently large (alone and/or in-combination) that it cannot be screened out and therefore it could have a potential significant effect, the information should be passed to the ecologist to further assess the likelihood of a significant effect of the project or plan on the habitat, and, if so, whether for European Sites it is possible to ascertain that there will be no adverse effect on the integrity of the site and for other types of designated sites, no likelihood of damage.
- If it is concluded that adverse effects on site integrity cannot be ruled out, an assessment of the impact of mitigation measures and advice on emission control measures should be provided by an air quality specialist.

Industrial point sources

- The Environment Agency's risk assessment guidance advises that to screen out the need for further assessment for Ramsar, European and national designated sites, a PC for any substance emitted from an industrial source must meet both of the following criteria:
  - the short-term PC is less than 10% of the short-term environmental standard; and
  - the long-term PC is less than 1% of the long-term environmental standard.
- IAQM believe that the 1% and 10% screening criteria should not be used rigidly and, not to a numerical precision greater than the expression of the criteria themselves.
- Less stringent criteria are used for local wildlife sites and ancient woodlands. If either the short-term or long-term PC is less than 100% of the critical level or load, they do not require further assessment to support a permit application.
- In ecological impact assessments of projects and plans, it is, however, normal practice to treat such sites in the same manner as SSSIs and European Sites, although the determination of the significance of an effect may be different. It is difficult to understand how the Environment Agency's approach can provide adequate protection.
- A change of more than 1% does not necessarily indicate that a significant effect (or adverse effect on integrity) will occur; it simply means that the change in concentration or deposition rate cannot in itself be described as numerically inconsequential or imperceptible and therefore requires further consideration.

Predicted Environmental Concentration (PEC)

- The PEC (which applies to both annual mean concentrations and deposition rates) should be calculated with the project or plan alone and in-combination with other projects and plans to identify whether the critical levels or critical loads will be exceeded. This information should be passed on to the ecologist if the PC exceeds 1% of the critical level/load either alone or in-combination.
- As stated by the Environmental Agency risk assessment guidance, if the PEC is less than 70% of the long-term criterion it can be deemed insignificant, regardless of the PC.

Traffic impacts

- There is evidence that ammonia emissions from road vehicles may contribute more than half the local traffic related increment to nitrogen deposition.
- The DMRB methodology only requires the assessment of NO_x emissions and nitrogen deposition. It does not consider NH_3 or its contribution to nitrogen deposition. As road transport is a source of ammonia, albeit a small source compared to agriculture at a national level, consideration should be given to including it and its contribution to local nitrogen deposition.

Local Plans

- It has been increasingly common practice for air quality assessments to be undertaken to support the development of Local Plans for local planning authorities where sensitive internationally important wildlife sites may be affected. This is to enable an HRA to be completed for that Local Plan. Due to the nature of Local Plans, this means that all growth expected across a given district over a long period is assessed collectively.

- The scale of physical separation between a Local Plan area and European site will clearly be an important factor in making the decision, given that there is a limit to the accuracy of transport modelling at considerable distances (i.e. tens of kilometres) from source, as well as the fact that very small changes in air quality (such as are likely to occur at these distances) are unlikely to be detectable in air quality calculations, or in monitoring data.
- It is no longer advised for individual local authorities to reply purely on a change in flows of less than 1000 AADT as a reason to dismiss traffic-related air quality impacts in-combination with other local plans, unless there is reason to believe that flows on the road in question would likely be dominated by journeys arising from that district.
- Air quality calculations should also make reasonable assumptions about expected changes in the baseline NO2 concentrations over the plan period; given the 15 to 20 year or so timescale of most Local Plans. Making a suitable allowance for improvements in baseline air quality can, given the long timescale of most Local Plans, mean that overall air quality at the end of the plan period is very likely to be better than air quality at the start, even allowing for the effects of Local Plan growth on traffic flows.
- Assessing the results of both the 'alone' and 'in-combination' assessments, it is possible to identify the relative contribution of the Local Plan being assessed. This is necessary if the ecologist concludes that there is an adverse effect on the integrity of the designated site to enable the appropriate scale of mitigation measures that may be needed (such as transport management plans, rerouting of heavy duty vehicles,).
- The preceding discussion is concerned with Local Plans, but the same principle would apply to the traffic impacts of Minerals & Waste Plans where those plans are expected to result in any net increase in vehicle movements within 200 m of sensitive designated sites.

General Principles

There are a number of principles that should be applied when undertaking assessments of the air quality impacts on designated sites, which are set out below.

1. Suitably qualified, experienced and competent assessors should be responsible for the assessment.
2. A precautionary approach is required.
3. The assessment should be appropriate to the risk.
4. The assessment should be undertaken with an ecologist.
5. Always consult with the regulator.

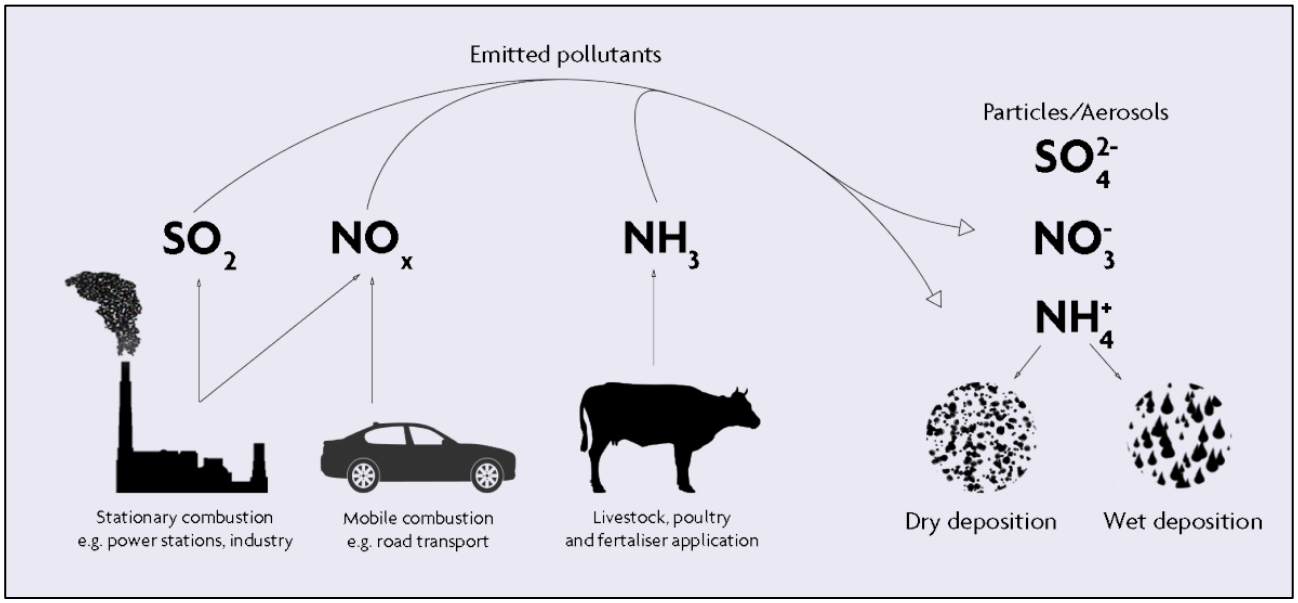


Figure 15.B.A:Schematic of the sources of air pollution

Table 15.B.D: Typical relationship between Ecological Impac Assessment (EcIA) and Air Quality Assessment (AQA)

EcIA Stage[71]	Interactions with this guidance
Scoping: Determining the matters to be addressed in the EcIA. Scoping is an ongoing process – the scope of the EcIA may be modified following further ecological survey/ research and during impact assessment.	The initial stages of the air quality assessment process will determine whether air quality impacts on designated sites require consideration. See Chapters 3 and 4.
Establishing the baseline: Collecting information and describing the ecological conditions in the absence of the proposed project, to inform the assessment of impacts.	The ecologist and air quality specialist will often jointly identify designated sites that are relevant to the plan or project and describe these. See Chapters 3 and 4. It should be noted that ecologists are not instructed on all projects that require an AQA, for example, many applications for environmental permits.
Important ecological features: Identifying important ecological features that may be affected, with reference to a geographical context in which they are considered important.	
Impact assessment: An assessment of whether important ecological features will be subject to impacts and characterisation of these impacts and their effects. Assessment of residual ecological impacts of the project remaining after mitigation and the significance of their effects, including cumulative effects.	The assessment of air quality impacts on designated sites is an iterative process, with consideration of potential impacts starting early in the process set out in this guidance. Initial consideration of impacts starts during the air quality scoping (see Chapter 4) with the assessment becoming more detailed in the latter stages (see Chapter 4).
Avoidance, mitigation, compensation and enhancement: Incorporating measures to avoid, reduce and compensate ecological impacts, and the provision of ecological enhancements. Monitoring impacts of the development and evaluation of the success of proposed mitigation, compensation and enhancement measures.	An IAQM Position Statement[72] sets out the basic hierarchical principles for identifying mitigation measures.
Consequences for decision making: Consideration of the legal and policy framework throughout the EcIA process and assessment of how the proposed development has responded to this.	This will be assessed iteratively throughout the process of assessing air quality impacts on designated sites.

[71] Modified from page iv of: CIEEM (2016) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal, 2nd edition. Chartered Institute of Ecology and Environmental Management, Winchester.

[72] iaqm.co.uk/text/position_statements/mitigation_of_development.pdf.

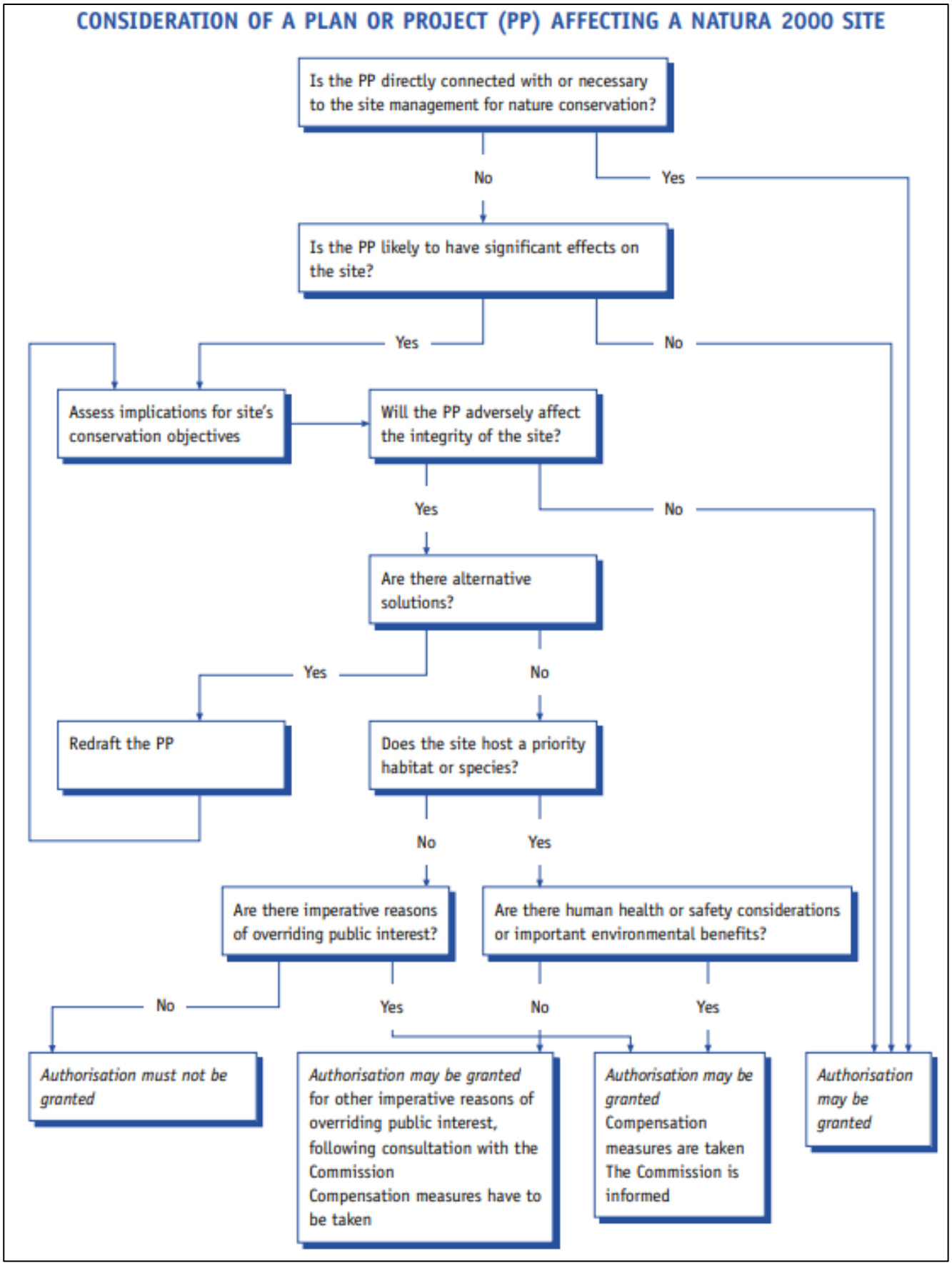


Figure 15.B.B: Flowchart reproduced from Annex III of European Commissions guidance on managing Natura 2000 sites.

Sensitivities of Receptors to Ecological Effects

Dust deposition due to demolition, earthworks, construction and trackout has the potential to affect sensitive habitats and plant communities.

Dust can have two types of effect on vegetation: physical and chemical. Direct physical effects include reduced photosynthesis, respiration and transpiration through smothering. Chemical changes to soils or watercourses may lead to a loss of plants or animals for example via changes in acidity. Indirect effects can include increased susceptibility to stresses such as pathogens and air pollution. These changes are likely to occur only as a result of long-term demolition and construction works adjacent to a sensitive habitat. Often impacts will be reversible once the works are completed, and dust emissions cease.

The advice of an ecologist should be sought to determine the need for an assessment of dust impacts on sensitive habitats and plants[1] Professional judgement is required to identify where on the spectrum between high and low sensitivity a receptor lies, taking into account the likely effect and the value of the ecological asset. A habitat may be highly valuable but not sensitive, alternatively it may be less valuable but more sensitive to dust deposition. Consequently, specialist ecological advice should also be sought to determine the sensitivity of the ecological receptors to dust impacts. In general most receptors will either be of high sensitivity or low sensitivity i.e. either sensitive or not to dust deposition. The following provides an example of possible sensitivities:

High sensitivity receptor

- locations with an international or national designation and the designated features may be affected by dust soiling; or
- locations where there is a community of a particularly dust sensitive species such as vascular species included in the Red Data List For Great Britain[2].
- indicative examples include a Special Area of Conservation (SAC) designated for acid heathlands or a local site designated for lichens adjacent to the demolition of a large site containing concrete (alkali) buildings.

Medium sensitivity receptor

- locations where there is a particularly important plant species, where its dust sensitivity is uncertain or unknown; or
- locations with a national designation where the features may be affected by dust deposition.
- indicative example is a Area of Special Scientific Interest (ASSI) with dust sensitive features.

Low sensitivity receptor

- locations with a local designation where the features may be affected by dust deposition.
- indicative example is a local Nature Reserve with dust sensitive features.

The Proposed Development is located within the West Wales Marine / Gorllewin Cymru Forol Special Areas of Conservation (SACs). Designated site that should be considered for assessment are those which the designated features are sensitive to air pollutants, either directly or indirectly, and which could be adversely affected by the effect of local air quality on vegetation with the following nature conservation sites: SACs (SCIs or SACs), SPAs, pSPAs, ASSIs and Ramsar sites.

[1] Habitat Regulation Assessment of the site may be required as part of the planning process, if the site lies close to an internationally designated site i.e. Special Conservation Areas (SACs), Special Protection Areas (SPAs) designated under the Habitats Directive (92/43/EEC) and RAMSAR sites.

[2] Cheffing C. M. & Farrell L. (Editors) (2005), The Vascular Plant. Red Data List for Great Britain, Joint Nature Conservation Committee.

Table 15.B.E shows how the sensitivity of the area may be determined for ecosystem impacts. These tables take account of a number of factors which may influence the sensitivity of the area. When using these tables, it should be noted that distances are to the dust source and so a different area may be affected by trackout than by on-site works. The highest level of sensitivity from each table should be recorded. It is not necessary to work through the whole of each table once it is clear that the highest level of sensitivity has been determined.

In relation to the proposed development, the nearest sensitive receptor is High sensitivity receptor West Wales Marine / Gorllewin Cymru Forol Special Areas of Conservation. The IAQM assessment determines that anything within 20m is deemed as **High Risk**.

Table 15.B.E: Sensitivity of the Area to Ecological Impacts [a]

Receptor Sensitivity	Distance from the Source (m)[c]	
	<20	<50
High	High	Medium
Medium	Medium	Low
Low	Low	Low

STEP 2C Define the Risk of Impacts

The dust emission magnitude determined at **STEP 2A** should be combined with the sensitivity of the area determined at **STEP 2B** to determine the risk of impacts with no mitigation applied. The matrices in **Table 15.B.F**, **Table 15.B.G**, **Table 15.B.H** and **Table 15.B.I** provide a method of assigning the level of risk for each activity. This should be used to determining the level of mitigation that must be applied. Mitigation is discussed in **STEP 3**. For those cases where the risk category is 'negligible', no mitigation measures beyond those required by legislation will be required.

Table 15.B.F: Risk of Dust Impacts- Demolition

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	**Medium Risk**
Medium	High Risk	Medium Risk	**Low Risk**
Low	Medium Risk	**Low Risk**	Negligible

Table 15.B.G: Risk of Dust Impacts- Earthworks

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	**Medium Risk**	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Table 15.B.H: Risk of Dust Impacts- Construction

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	**Medium Risk**	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Table 15.B.I: Risk of Dust Impacts- Trackout

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	**Low Risk**
Medium	Medium Risk	Low Risk	Negligible
Low	Low Risk	Low Risk	Negligible

16.A

APPENDIX 16.A Heritage Desk Based Assessment

FISHGUARD LINKSPAN, PEMBROKESHIRE, SOUTH WALES

Cultural Heritage Desk-Based Assessment

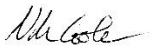
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Approval for issue

Nick Cooke		27 February 2025

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EXECUTIVE SUMMARY

Land at the Port of Fishguard (including areas of the harbour floor), Pembrokeshire, South Wales has been reviewed for its heritage and archaeological potential.

The Proposed Development comprises the demolition of the existing linkspan, barge and vehicle boarding platform, as well as the mid-20th century former lifeboat slipway. These features are to be replaced by a new vehicle boarding platform formed of reclaimed land, and a new linkspan and barge. This is to be supported by a programme of dredging within the study site boundary.

The Fishguard Bay Hotel Registered Park and Garden and Goodwick Conservation Area extend into the southern part of the study site. Potential development impacts have been assessed and it is considered the development proposals will not impact upon the significance of either asset.

There are no other designated heritage assets (World Heritage Sites, Registered Landscape of Outstanding Historic Interest, Scheduled Monuments, Listed Buildings, Registered Park and Gardens, Registered Battlefields, Protected Wreck sites, or Conservation Areas) within the study site. The study site does not lie within an area of designated archaeological priority.

There are multiple designated heritage assets present within the 2km study area, consisting of one Registered Landscape of Outstanding Historic Interest, three Grade II* Listed Buildings, six Scheduled Monuments, two Registered Historic Park & Gardens, three Conservation Areas, and multiple Grade II Listed Buildings. Based on the results of the site walkover, and professional judgement, it is considered that the majority of the designated heritage within the study area will not be impacted by the Proposed Development.

In regard to Castle Point Old Fort Scheduled Monument and Grade II Listed Building, Bridge Cottage Grade II Listed Building, and the Lower Town Conservation Area, the assessment has identified that the Proposed Development will result in minor positive impact upon the significance of these assets.

Based on the available evidence, there is considered to be a negligible potential for terrestrial archaeological deposits within the study site for all periods apart from the Post Medieval and Modern periods. There is judged to be moderate potential for the presence of maritime remains within the study site, alongside the known remains of the former lifeboat station and slipway.

Due to the presence of the remains of the former lifeboat station within the study site, which is likely to be demolished, it is recommended that a programme of archaeological recording is undertaken prior to its demolition. It is also recommended that a Protocol for Archaeological Discoveries (PAD) is agreed with the RCAHMW prior to any intrusive construction or dredging works within the site.

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1 INTRODUCTION AND SCOPE OF STUDY

1.1 This cultural heritage desk-based assessment has been prepared by Chris Clarke of RPS on behalf of Stena Line, who is the applicant of the Proposed Development.

1.2 The subject of this assessment comprises a parcel of land at the Port of Fishguard (including areas of the harbour floor), Pembrokeshire, South Wales upon which it is proposed to remove the existing ferry linkspan and replace it with a new linkspan (hereafter, 'the study site). The study site comprises an area of the harbour quayside on the western side of the harbour, as well an extensive area of the harbour floor. The area amounts to some 56ha in extent. The site is centred at NGR SM 9538 3917 (see Figs. 1-2).

1.3 This assessment will utilise a 1km study area for undesignated assets and a 2km study area for designated assets, as agreed with Mike Ings of Heneb, archaeological advisor to the local authority and with Neil Maylan at Cadw. Each study area is taken as a radius from the boundary of the study site.

1.4 There are multiple designated heritage assets present within the 2km study area, consisting of one Registered Landscape of Outstanding Historic Interest, three Grade II* Listed Buildings, six Scheduled Monuments, two Registered Historic Park & Gardens, three Conservation Areas, and multiple Grade II Listed Buildings. Based on the results of the site walkover, and professional judgement, it is considered that the majority of the designated heritage within the study area will not be impacted by the Proposed Development and have been scoped out of detailed assessment.

1.5 In terms of other designated historic assets, no World Heritage Sites, Historic Battlefields, and Protected Wreck Sites lie within the study site or the study area. The study site does not lie within an area of designated archaeological priority.

1.6 Stena Line have commissioned RPS to establish the heritage potential of the study site, and to provide guidance on ways to accommodate any heritage constraints identified.

1.7 In accordance with relevant policy and guidance on heritage and planning, and in accordance with the 'Standard and Guidance for Historic Environment Desk-Based Assessments' (Chartered Institute for Archaeologists October 2020), this assessment draws together the available archaeological, topographic and land-use information in order to clarify the heritage potential of the Development Site.

1.8 This desk-based assessment comprises an examination of evidence deriving from multiple sources, including the Heneb Historic Environment Record, the Royal Commission on the Ancient and Historical Monuments of Wales database, and Pembrokeshire Archives. The report also includes the results of a map regression exercise, and site walkover undertaken on 16th January 2025. It also utilises a Zone of Theoretical Visibility (ZTV) for the project in order to determine which historic assets may have intervisibility with the proposed linkspan (Figure 2b)

1.9 A Written Scheme of Investigation setting out the methodology for production of the Cultural Heritage Desk-Based Assessment was submitted in December 2024 and approved by Mike Ings at Heneb (RPS 2024) and by Dr Julian Whitewright of the Royal Commission on the Ancient and Historical Monuments of Wales (RCAHMW).

1.10 The Assessment thus enables relevant parties to assess the heritage potential of various parts of the study site and to consider the need for design, civil engineering, and archaeological solutions to the archaeological potential identified.

2 PLANNING BACKGROUND AND DEVELOPMENT PLAN FRAMEWORK

National Legislation and Policy

2.1 Legislative frameworks provide protection to the historic environment while planning policy guidance provides advice concerning how the historic environment should be addressed within the planning process.

2.2 Statutory protection for archaeology is principally enshrined in the *Ancient Monuments and Archaeological Areas Act* (1979) amended by the *National Heritage Acts* (1983 and 2002). Nationally important archaeological sites are listed in a Schedule of Monuments and are accorded statutory protection.

2.3 The *Hedgerow Regulations* 1997 set out criteria for the identification of 'Important Hedgerows'; these include several historic environment criteria. Consent from the local planning authority is usually required for the removal of an 'Important Hedgerow'.

The Historic Environment (Wales) Act 2023

2.4 The *Historic Environment (Wales) Act* became law after receiving Royal Assent in June 2023, and came into effect in November 2023. It gives more effective protection to listed buildings and scheduled monuments, improves the sustainable management of the historic environment, and introduces greater transparency and accountability regarding decisions affecting the historic environment.

2.5 This Act replaces the two pieces of UK legislation, the *Ancient Monument and Archaeological Areas Act 1979* and the *Planning (Listed Buildings and Conservation Areas) Act 1990*, which previously provided the framework for the protection and management for the Welsh historic environment. The document sets out provisions for the designation of scheduled monuments and listed buildings, from the Secretary of State to Welsh Ministers. The key provisions of the Act can be summarised as the following:

- amendments to the procedure for determining scheduled monument consent;
- provision for Welsh Ministers to enter into a Heritage Partnership Agreement with the owner of a scheduled monument, or any associated land, within Wales;
- provision for Welsh Ministers to compile and maintain a register of historic parks and gardens of special historic interest; and
- provision for Welsh Ministers and/or local authorities to enter into a Heritage Partnership Agreement with the owner of a listed building, or part of such a building, situated in Wales.

2.6 The Act included a provision for historic parks and gardens to be placed on a statutory register and this came into force on 1st February 2022. The statutory register does not include historic landscapes, which are instead identified on the non-statutory *Register of Landscapes of Outstanding Historic Interest in Wales* (published as Part 2.1, by Cadw, in 1998), and on the non-statutory *Register of Landscapes of Special Historic Interest in Wales* (published as Part 2.2, by Cadw, in 2001).

2.7 The Act also contains new stand-alone provisions for the compilation of a list of historic place names in Wales; for the compilation of an historic environment record for each local authority area in Wales; and for the establishment of an Advisory Panel for the Welsh Historic Environment.

Planning Policy Wales (Edition 12, February 2024)

2.8 The principal national planning policy is *Planning Policy Wales* (Edition 12, Welsh Government, February 2024, PPW12). This establishes Welsh Government objectives with regard to the protection of the historic environment and explains that responsibility for caring for the historic environment lies with all those that have an interest in the planning system. It sets out the land use planning policies of the Welsh Government. It is supplemented by a series of Technical Advice Notes (TANs). Procedural advice is given in circulars and policy clarification letters.

2.9 Chapter 6 of PPW12, entitled 'Distinctive and Natural Places', has a section entitled 'The Historic Environment' (section 6.1 – pp. 129-135) which provides policy for planning authorities, property owners, developers and others on the conservation and investigation of heritage assets. Overall, the objectives of Section 6.1 (6.1.6) in relation to the historic environment can be summarised as seeking to:

- protect the Outstanding Universal Value of the World Heritage Sites;
- conserve archaeological remains, both for their own sake and for their role in education, leisure and the economy;
- safeguard the character of historic buildings and manage change so that their special architectural and historic interest is preserved;
- preserve or enhance the character or appearance of conservation areas, whilst the same time helping them remain vibrant and prosperous;
- preserve the special interest of sites on the register of historic parks and gardens; and
- protect areas on the register of historic landscapes in Wales.

2.10 Section 6.1 of PPW12 (6.1.1) describes the historic environment as comprising all the surviving physical elements of previous human activity and illustrates how past generations have shaped the world around us. The historic environment is made up of individual historic features, archaeological sites, historic buildings and historic parks, gardens, townscapes and landscapes, collectively known as historic assets.

2.11 Paragraphs 6.1.7 and 6.1.8 of PPW12 state the following: "It is important that the planning system looks to protect, conserve and enhance the significance of historic assets. This will include consideration of the setting of an historic asset which might extend beyond its curtilage. Any change that impacts on an historic asset or its setting should be managed in a sensitive and sustainable way. It is the responsibility of all those with an interest in the planning system, including planning authorities, applicants, developers and communities, to appropriately care for the historic environment in their area. The protection, conservation and enhancement of historic assets is most effective when it is considered at the earliest stage of plan preparation or when designing proposals new proposals".

2.12 Welsh planning legislation and policy guidance outlines that the conservation of archaeological remains and their settings is a material consideration in the determination of a planning application, whether those remains are scheduled or not (PPW12 Para. 6.1.23). In order to take account of archaeological considerations and deal with them from the beginning of the development control process, Local Planning Authorities in Wales need to be fully informed about the nature and importance of archaeological remains, and their setting, and the likely impact of any proposed development upon them.

2.13 Paragraphs 6.1.26 of PPW12 states that where archaeological remains are known to exist or there is a potential for them to survive, an application should be accompanied by sufficient information, through desk-based assessment and/or field evaluation, to allow a full understanding of the impact of the proposal on the significance of the remains. The needs of archaeology and development

may be reconciled, and potential conflict very much reduced, through early discussion and assessment.

2.14 Paragraph 6.1.27 of PPW12 states that if the planning authority is minded to approve an application and where archaeological remains are affected by proposals that alter or destroy them, the planning authority must be satisfied that the developer has secured appropriate and satisfactory provision for their recording and investigation, followed by the analysis and publication of the results and the deposition of the resulting archive in an approved repository. On occasions, unforeseen archaeological remains may still be discovered during the course of a development. A written scheme of investigation should consider how to react to such circumstances, or it can be covered through an appropriate condition for a watching brief.

2.15 PPW is additionally supported by guidance published by Cadw. This includes Heritage Impact Assessment in Wales (2017), and Setting of Historic Assets in Wales (2017).

2.16 In considering any planning application for development, the planning authority will be mindful of the framework set by government policy, in this instance the NPPF, by current Development Plan Policy and by other material considerations.

2.17 The aspirations and vision of the Welsh Government regarding the historic environment are additionally expressed in the following documents.

- *People, Places, Future: The Wales Spatial Plan* (Welsh Assembly Government, 2008).
- *Conservation Principles for the Sustainable Management of the Historic Environment in Wales* (Welsh Assembly Government, 2011).
- *Historic Environment Strategy for Wales* (Welsh Government, 2013).

National Guidance

Technical Advice Note (TAN) 24: The Historic Environment (2017)

2.18 TAN 24 is one of a suite of documents designed to aid the application of PPW12. TAN 24 was adopted in May 2017, and supersedes pre-existing Welsh Office Circulars concerning the historic environment.

2.19 TAN 24 provides specific guidance on how the planning system considers each aspect of the historic environment during development plan preparation and decision-making on planning and Listed Building (LBC) applications. It also sets out that it is for an applicant to provide the LPA with sufficient information to allow the assessment of their proposal in respect of historic assets, irrespective of their designation, which may take the form of a heritage impact statement.

2.20 Regarding archaeological remains, *TAN24* provides the following guidance:

'Archaeological remains are a fragile and non-renewable resource. In many cases they are highly fragile and vulnerable to damage and destruction. Produced by human activity over thousands of years, they are the only evidence of our prehistoric past and complement historic records from the last 2,000 years. Archaeological remains include evidence buried below the ground and the surviving fabric of historic buildings and structures. Their significance, as evidence of the past development of our civilisation and as part of Wales' identity, is not necessarily related to their size, visibility or popularity.' (Paragraph 4.1)

'The conservation of archaeological remains is a material consideration in determining a planning application. When considering development proposals that affect scheduled monuments or other nationally significant important archaeological remains, there should be a presumption in favour of their physical preservation in situ, i.e., a presumption against proposals which would involve significant alteration or cause damage, or which would have a significant adverse impact causing

harm within the setting of the remains (see Annex A). In cases involving less significant archaeological remains, local planning authorities will need to weigh the relative importance of the archaeological remains and their settings, including the need for the proposed development.' (Paragraph 4.2)

2.21 With regards to Listed Buildings, it states:

'Listed buildings are nationally important assets which represent a unique source of information about the past and make a valuable contribution to the quality and character of Welsh landscapes and townscapes. Buildings are listed when they are considered to be of special architectural or historic interest.' (Paragraph 5.1)

2.22 Annex A of TAN24 as referenced above deals with the legal issues applied to scheduled monuments.

'Where development might reveal, disturb or destroy archaeological remains, including palaeoenvironmental evidence, it is important that opportunities to record archaeological evidence are taken and that archaeological remains are not needlessly destroyed. The ability to record such evidence should not be a factor in deciding whether controlled removal should be permitted.' (Paragraph 4.3)

'The needs of archaeology and development may be reconciled and potential conflicts between development proposals and the preservation of significant archaeological remains can often be avoided through pre-application discussion. This should be between the applicant, the local planning authority, their archaeological advisors and, in cases where scheduled monuments may be affected, Cadw. In the case of those local authorities that do not have in-house archaeological advisors, they could draw upon the expertise and advice of the curatorial sections of the Welsh Archaeological Trusts.' (Paragraph 4.4)

'Where there is a possibility that archaeological remains may be present, applicants are encouraged to make an enquiry with the body responsible for the relevant historic environment record and seek advice from the local planning authority's advisor at an early stage in considering their development proposal. This will help determine if the proposal might impact on known archaeological remains. Certain major developments require pre-application consultation with the local planning authority and, where specialist advice is required, the Welsh Ministers through Cadw.' (Paragraph 4.5)

'Where archaeological remains are known to exist, or considered likely to exist, and a study has not been undertaken by the applicant, the local planning authority should ask an applicant to undertake a desk-based archaeological assessment and, where appropriate, an archaeological evaluation. These should be done by a competent expert to the appropriate standard. The reposts of these investigations will form part of the planning application. Applicants should show how they have modified their development proposals to minimise any negative impact on the identified archaeological remains, and how they intend to mitigate any remaining negative impacts.' (Paragraph 4.7)

'The need for a desk-based assessment, and field evaluation where appropriate, should be discussed with the local planning authority prior to submission of an application, and where required the results of these studies should be submitted as part of the planning application. Failure to provide sufficient archaeological information of the appropriate standard may be a valid reason for the local planning authority to refuse planning permission.' (Paragraph 4.8)

'When considering planning applications that affect known or potential archaeological remains, the local planning authority should consult with their archaeological advisor, about the impact, including the potential scale and harm, of the development on archaeological remains, and/or the adequacy

of the mitigation of what has been proposed. Where a planning application directly affects a scheduled monument and its setting then the local planning authority is required to consult the Welsh Ministers through Cadw.' (Paragraph 4.9)

'The case for the preservation of archaeological remains that are not considered to meet the criteria for national importance (See Annex A2), must be assessed on the individual merits of each case. The local planning authority must take into account relevant policies and material considerations, and will need to weigh the significance of the remains against the benefits of, and need for the proposed development. In cases where there are issues of more than local importance, applications may be called in for determination by the Welsh Ministers.' (Paragraph 4.10)

2.23 Annex A2 of TAN24 as referenced above identifies the criteria used for assessing the national importance of an ancient monument, but these criteria are not regarded as definitive.

'Having considered all policies and other material considerations and the need for the proposed development, the local planning authority may decide that the significance of the archaeological remains is not sufficient to justify their physical preservation. In these cases, the local planning authority must satisfy itself that the necessary and proportionate arrangements for the excavation and recording of these archaeological remains are secured, and the results of this archaeological work are properly analysed and published, and that arrangements are made for the deposition of the resulting archive to the appropriate standards. This can be achieved by the local planning authority issuing a brief setting out the scope of the archaeological work that is required, which should be prepared in conjunction with their archaeological advisor.' (Paragraph 4.12).

Technical Advice Note (TAN) 12: Design (2016)

2.24 TAN 12 provides advice on the good design of new development. Alongside promoting sustainability, it sets out that the context of a development should be appraised, including the historic environment, to inform design.

2.25 Section 5.6 Historic Environment highlights that design should have regard to the desirability of preserving or enhancing the character and appearance of areas of special character, such as conservation areas. It also highlights that specialists are needed to accurately assess areas of architectural or historic character.

Conservation Principles for the Sustainable Management of the Historic Environment in Wales (Conservation Principles) (2011)

2.26 Conservation Principles provides the basis upon which Cadw discharges certain statutory duties on behalf of the Welsh Ministers. It is also for use by others (including owners, developers and other public bodies) to assess the potential impacts of development proposals on the significance of historic assets, and assist in the decision-making process where the historic environment is affected by the planning process.

2.27 The document echoes PPW in the emphasis it places upon the importance of understanding significance as a means to properly assess the effects of change to heritage assets. The guidance describes a range of heritage values which enable the significance of assets to be established systematically, with the four main component values being:

2.28 **Evidential value**: which derives from those elements of an historic asset that can provide evidence about past human activity, including its physical remains or historic fabric. These may be visible and relatively easy access, or may be buried below ground, under water or be hidden by later fabric. These remains provide the primary evidence for when and how an historic asset was made or built, what it was used for and how it has changed over time.

2.29 **Historical value**: derives from the ways an historic asset might illustrate a particular aspect of past life or be associated with a notable family, person, event or movement. These illustrative or

associative values of an historic asset may be less tangible than its evidential value but will often connect past people, events and aspects of life with the present. As the functions of an historic asset are likely to have changed over time, the full range of changing historical values might not become clear until all the evidential values have been gathered together.

2.30 **Aesthetic value**: which derives from the ways in which people draw sensory and intellectual stimulation from a place. Aesthetic values can be the result of the conscious design of a place, including artistic endeavour, or they can be the seemingly fortuitous outcome of the way in which a place has evolved and been used over time, or a combination of both.

2.31 **Communal value**: which derives from the meanings of a place for the people who relate to it, or for whom it figures in their collective experience or memory. Communal values are closely bound up with historical (particularly associative) and aesthetic values, but tend to have additional and specific aspects. Commemorative and symbolic values reflect the meanings of a place for those who draw part of their identity from it, or have emotional links to it. Social value is associated with places that people perceive as a source of identity, distinctiveness, social interaction and coherence. Spiritual value attached to places can emanate from the beliefs and teachings of an organised religion or reflect past or present-day perceptions of the spirit of a place.

Best Practice Guidance Overview

2.32 Cadw publishes a wide range of Best Practice Guidance documents (BPGs). This guidance relates to the care and understanding of historic buildings, scheduled monuments and other archaeological remains; understanding the significance of, and managing, conservation areas; managing local lists, historic parks and gardens, wider historic landscapes, and World Heritage Sites; the role of the planning system in the management of the historic environment; and technical guidance for conservation.

2.33 This Best Practice Guidance is intended to complement the Historic Environment (Wales) Act 2016 and recent planning policy and advice. In particular, it is designed to provide information on good conservation practice to assist LPAs, planning and other consultants, owners, applicants, and other interested parties when implementing Welsh policy. BPGs of particular relevance are discussed below:

Heritage Impact Assessment in Wales (May 2017)

2.34 Guidance on Heritage Impact Assessment in Wales has been published by Cadw (2017a) on behalf of the Welsh Government. This document advises that a heritage assessment should '*take into account sufficient information to enable both the significance of the asset and the impact of change to be understood. It should be proportionate both to the significance of the historic asset and to the degree of change proposed*' (Page 5).

2.35 This document sets out the general principles to consider when planning changes to historic assets and applying for listed building, conservation area, and scheduled monument consent. In particular, it emphasises the purpose and value of undertaking Heritage Impact Assessments in order to help identify the most appropriate way to accommodate change within the historic environment. The guidance echoes PPW12 by stressing that understanding the significance of historic assets is key to making decisions regarding the historic environment.

Setting of Historic Assets in Wales (May 2017)

2.36 This guidance document focuses on the management of change within the setting of heritage assets. It explains what setting is, how it contributes to the significance of a historic asset, and why it is important, in order to aid practitioners with the implementation of Welsh national policies and guidance relating to the historic environment.

2.37 In the Conservation Principles document (Cadw, 2011), setting was defined as: '*The surroundings in which an historic asset is experienced, its local context, embracing present and past relationships to the adjacent landscape*'.

2.38 This definition has been updated thus in TAN24: '*The setting of a historic asset includes the surroundings in which it is understood, experienced and appreciated, embracing present and past relationships to the surrounding landscape. Its extent is not fixed and may change as the asset and its surroundings evolve. Setting is not a historic asset, though land within a setting may contain other historic assets*' (Welsh Government, 2017, Annex D).

2.39 The definition is repeated in recent guidance regarding the issue of the settings of historic assets in Wales (Cadw, 2017b), which makes the following points:

- Setting usually extends beyond the property boundary of an individual historic asset.
- Intangible factors such as function, sensory perceptions or historical, artistic, literary and scenic associations can be important in understanding settings, as well as physical elements within the surroundings of the asset.
- When development is proposed there is a need to assess the historic assets that may be affected and understand how their settings contribute to the significance of these assets.

2.40 The 2017 document goes on to outline a four-stage approach to decision-taking, as follows:

1. Identify which historic assets and their settings could be affected by a proposed development;
2. Define and analyse the setting of each historic asset and assess whether, how and to what degree the setting contributes to the significance of the asset;
3. Evaluate the effects of the proposed development, whether beneficial or harmful, on that significance; and
4. Consider options to mitigate or improve potential impacts on that significance.

2.41 Although assessments of changes within the settings of historic assets can involve non-visual issues such as noise, odour and vibration, it is more usually the visual aspects of a development that form the major part of the assessment.

2.42 The existence of direct lines of sight between the historic asset and the proposed development is an important factor in judging the visual impact of the development. However, it is possible for changes within the setting to occur even when such a relationship does not exist. For example, views towards a listed building from a frequently visited location, such as a park or a public footpath, may be affected by the presence of a larger development, even if the development is not directly visible from the building itself.

2.43 An assessment of visual impacts on the historic assets and their settings needs to consider a wide variety of factors including the location of the asset within the physical landscape, its relationship with contemporary and non-contemporary features within that landscape and the location, size and character of the proposed development in relation to these factors.

2.44 The assessment then needs to balance the impact of these various considerations based on informed professional judgment. Assessment of visual impacts can be undertaken in accordance with the procedures expressed in the *Guidelines for Landscape and Visual Impact Assessment* (3rd Edition, Landscape Institute, 2013). If there is the potential for changes within the setting of historic assets due to noise or other impacts than these would be considered using appropriate procedures.

2.45 There should also be consideration of the sensitivity to change of the setting of a historic asset. This requires examination of the current setting with regard to identifying elements that contribute to the significance of the asset, elements that make a neutral contribution to the significance of the asset and elements that make a negative contribution to (i.e. detract from) the significance of the asset.

2.46 The guidance states that the introduction of offsetting or compensatory proposals, such as public access or interpretation panels, will not reduce the impact of the development within the setting of the historic asset, and thus should not be accepted as mitigation. However, these may be considered when the decision-making body weighs up the benefits of the scheme.

Local Planning Policy

2.47 On the 28th February 2013, Pembrokeshire County Council adopted the Local Development Plan (LDP) for Pembrokeshire (excluding the area of the Pembrokeshire Coast National Park).

2.48 The following policies within the Pembrokeshire County Council Local Development Plan relate to the historic environment:

GN.38 Protection and Enhancement of the Historic Environment

Development that affects sites and landscapes of architectural and/or historical merit or archaeological importance, or their setting, will only be permitted where it can be demonstrated that it would protect or enhance their character and integrity.

2.49 In line with relevant planning policy and guidance, this desk-based assessment seeks to clarify the site's archaeological potential and the likely significance of that potential and the need or otherwise for additional mitigation measures.

3 GEOLOGY AND TOPOGRAPHY

Geology

3.1 The solid geology within the terrestrial areas of the study site consists of Goodwick Volcanic Formation – Rhyolite, in addition to a narrow corridor of Penyraber Mudstone Formation following the shoreline in the southern part of the study site. No superficial deposits are recorded (BGS 2024). The majority of the area currently used to house the ferry terminal is modern made ground, created from cutting back the cliffs to the west,

Topography

3.2 The greater part of the study area is occupied by Fishguard Harbour itself. With the exception of gentle rising ground associated with the cove at the southwest end of the harbour, the southern and western shore of the harbour are defined by low cliffs. The western shore of the harbour is also defined by reclaimed ground associated with the harbour facilitates. The settlements at Harbour Village to the west and Penyraber to the south, define the character of much of the terrestrial areas within the study area. The seascape is characterised by the relatively shallow waters of Fishguard Harbour which shelve gently towards Goodwick to the south.

4 ARCHAEOLOGICAL AND HISTORICAL BACKGROUND WITH ASSESSMENT OF SIGNIFICANCE

Timescales used in this report

Prehistoric

Palaeolithic	900,000	-	12,000 BC
Mesolithic	12,000	-	4,000 BC
Neolithic	4,000	-	1,800 BC
Bronze Age	1,800	-	600 BC
Iron Age	600	-	AD 43

Historic

Roman	AD 43	-	410
Saxon/Early Medieval	AD 410	-	1066
Medieval	AD 1066	-	1485
Post Medieval	AD 1486	-	1799
Modern	AD 1800	-	Present

Introduction

4.1 This chapter reviews the available heritage evidence for the Development Site and the archaeological/historical background of the general area, and, in accordance with PPW, considers the potential for any undiscovered archaeological evidence on the Development Site.

4.2 A study area for this desk based assessment was agreed with the Mike Ings of Heneb, who advise the Local Planning Authority on heritage matters and with Dr Julian Whitewright of the RCAHMW who has a national remit for maritime heritage. What follows comprises a review of known designated heritage assets within a 2km radius of the study site and non-designated heritage assets within a 1km radius of the study site (Figs. 2a-2e), also referred to as the study area, held on the Heneb Historic Environment Record (HER) and the National Monument Record (NMR) data, together with a historic map regression exercise charting the development of the study area from nineteenth century onwards until the present day.

4.3 The Fishguard Bay Hotel Registered Historic Park & Garden and Goodwick Conservation Area partially extend into the southern part of the study site.

4.4 There are no other designated heritage assets (World Heritage Sites, Registered Landscapes, Scheduled Monuments, Listed Buildings, Registered Battlefields, or Protected Wreck sites) within the study site. The study site does not lie within an area of designated archaeological priority.

4.5 There are multiple designated heritage assets present within the 2km study area, consisting of one Registered Landscape of Outstanding Historic Interest, three Grade II* Listed Buildings, six Scheduled Monuments, two Registered Historic Park & Gardens, three Conservation Areas, and multiple Grade II Listed Buildings. It is considered that the majority of these designated heritage assets within the study area will not be impacted by the Proposed Development and have been scoped out of detailed assessment.

4.6 A review of the HER data indicates that there are a moderate number of records present within the study area which primarily relate to the Post-Medieval and Modern industrial development of the area and are of limited direct relevance to previous activity within the study site itself. Those records associated with the Prehistoric are primarily related to the presence of funerary monuments located on the higher ground to the west of the study site, while there are several Post-Medieval and Modern records located within, or in close proximity of, the study site which relate to historic maritime activity. The remains of several wrecks are recorded within the harbour itself.

4.7 The map regression exercise and a review of documentary evidence and secondary sources demonstrates that prior to the 20th century the study site occupied an area of rocky coastline and an extensive part of the natural harbour seascape. By 1908 extensive land reclamation had been undertake to covert the rock shoreline into a quayside which was altered overtime to accept larger vessels, while the harbour itself was protected by an artificial breakwater by this time.

4.8 Chapter 5 subsequently considers the conditions within the Development Site and whether the Proposed Development will impact the theoretical archaeological potential identified below.

Previous Archaeological Work

4.9 A review of the events data (Fig. 2c) indicates that the scale of modern archaeological investigation which has taken place within the study area is very limited. The only intrusive archaeological fieldwork recorded within the study area relates to a watching brief undertaken at Picola Calabria c400m to the west of the study site where little of archaeological interest was recorded (57025). Within the study site a desk-based assessment was undertaken in 2003 for a linear water disposal scheme (25243, while in the wider study area several walkover surveys have been undertaken to inform assessments of the general character of the heritage resource present (48168, 49678, 52509).

Prehistoric

4.10 The earliest human activity recorded within the study area relates to the presence of several Neolithic Chambered Tombs. A group or three, potentially four, Chambered Tombs are located on high ground c350m to the west of the study site, all of which fall within a single Scheduled area (Scheduled Monument PE030). The group are located along the eastern side of Garn Wen rock outcrop, with the three confirmed tombs all in possession of large capstones measuring between 3m-4m in length by 2m-3m wide. All of the capstones are supported by a mix of upright or recumbent stones. The site visit confirmed that there is no intervisibility between these tombs and the site, and they were scoped out of further detailed assessment.

4.11 Another Scheduled Neolithic Chambered Tomb is located c900m to the west of the study site, with the burial chamber capped by a trapezoidal shaped stone supported by three upright sidestones measuring approximately 4.3m long, 2.7m wide and 1.25m high (Scheduled Monument PE033). The site visit confirmed that there is no intervisibility between the tomb and the site, and it was scoped out of further detailed assessment.

4.12 Multiple Bronze Age burial mounds, in the form of barrows, are recorded in the western part of the study area. A possible barrow is located close to the three Scheduled Chambered Tombs discussed above, c400m to the east of the study site (2510) and associated with a possible adjacent Prehistoric hut circle (2511).

4.13 Other possible Bronze Age barrows are located c800m to the northwest of the study area (12109), c800m to the southwest of the study site (7622), and c1km to the west of the study site (5000).

4.14 A number of Bronze Age cairns are recorded on the HER located on the headland between 800m and 1km to the north of the study site forming a cairn field, although it is possible that some may actually represent later clearance cairns (32095; 32098 and 32104).

4.15 The Pen Gaer, Garn Fawr and Stumble Head Registered Landscape of Special Historic Interest lies to the north west of the Site, on the high ground. It was registered because it is a topographically and visually distinctive landscape containing significant well-preserved prehistoric funerary monuments, including Neolithic chambered tombs, standing stones, prehistoric fields and defended enclosures, including the Garn Fawr hillfort. It extends as far east as harbour village atop the cliffs above the site to the west.

4.16 The HER also records a number of possible standing stones within the western part of the study area attributing them to the Bronze Age period as well. These are located c300m to the northwest of the study site (32126), c850m to the west of the study site (5482), c1km to the west of the study site (2068), and two separate stones c700m to the southwest of the study site (4597; and 7960).

4.17 A suspected Iron Age promontory fort is located in a cliff top location c850m to the south east of the study site, on the site of the later 18th century coastal defence fort known as Castle Point Old Fort. Evidence for the presence of the promontory fort is limited to that of place name evidence and the suggestion that the rock cut ditch across the neck of the promontory forming part of the Post-Medieval defences was enlarged during that period from a pre-existing Prehistoric defensive ditch (Scheduled Monument PE096).

4.18 A review of the available HER data indicates that during the Neolithic and Bronze Age the upland areas within the western half of the study area are likely to have been part of a funerary landscape, represented by the presence of chambered tombs, cairns and barrows sited in prominent locations. Due to the study site itself consisting of either principally reclaimed land or maritime in character, it is considered that the potential within the study site for Prehistoric activity is considered to be negligible.

Roman

4.19 The HER does not contain any records within the 1km study area associated with the Roman period. Overall, there is considered to be a negligible potential for such contemporary activity to be present within the study site.

Early Medieval & Medieval

4.20 An Early Medieval Penannular broach was found on Goodwick beach by a metal detector in 1995, c800m to the south of the study site (11446).

4.21 The area in the vicinity of the modern Fishguard Harbour, was named ‘Pwllgwdig’ as early as 1074 when it was the scene of a battle between warring Welsh Princes, the site of which has been tentatively identified as Goodwick Moor. During the later medieval period, the area formed part of the medieval Cantref Pebidiog, or ‘Dewisland’, which was held directly by the Bishops of St David’s, having represented the core of the bishopric from 1082 when it was granted (or confirmed) by Rhys ap Tewdwr, king of pre-Anglo-Norman Conquest Dyfed, to Bishop Sulien. Pwll-hir Common, over which part of the town is built, may have medieval origins but has no recorded early history (46062).

4.22 The HER provides the potential location of the Medieval settlement of Trefhaylyn as being located c500m to the west of the study site (12309).

4.23 There is a record of Medieval common land c800m to the north of the study site (14032), and c900m to the west of the study site (14036).

4.24 A possible Medieval holy well is associated with springs c900m to the southwest of the study site (2526), while a small C-shape fish trap thought to be Medieval in date is located on the shoreline c850m to the south of the study site (103601).

4.25 Information relating to the Early Medieval and Medieval occupation of the landscape in the vicinity of the study site is limited, but it is anticipated that, at best, such a peripheral area is only likely to have supported a small coastal community. Due to the study site itself consisting of either principally reclaimed land or maritime in character, it is considered that the potential within the study site for Early Medieval and Medieval activity is considered to be negligible.

Post Medieval & Modern (including map regression exercise)

4.26 During the Post-Medieval period, the study site is likely to have comprised rocky shoreline, as well as being principally maritime in character.

4.27 The 18th century saw the construction of an artillery fortification for defence of the harbour, located a rocky promontory c800m to the south of the study site. It was built to defend the entrance to the old harbour following an attack in the late 18th century by the American privateer Black Prince, and it fired its guns in order to drive off the attempted French invasion of 1797. The surviving elements of the fortification consist of perimeter defences and entrance, a battery, and a magazine (Plates 1 and 2). To the north and north-west the defences consist of a rock-cut ditch with a vertical inner face, partly rock cut and partly formed by a wall, but the latter not projecting above ground level to allow a full field of fire for the guns on the battery. The fortifications are both Scheduled and Grade II Listed (PE096 and 5015). The artillery fort also contains later 20th century military features (32156). Due to the designated asset's prominent coastal position overlooking Fishguard Harbour it shares direct intervisibility with the study site and associated harbour facilities, albeit at a distance.

4.28 Other designated assets of this date within the study area include numerous Listed Buildings, the majority of which are linked to the historic settlements at Fishguard and Goodwick. Both Goodwick and Fishguard had their origins in the medieval period, but expanded significantly in the post medieval period. Fishguard in particular contains a number of Listed Buildings, however the site visit has demonstrated that many buildings in both Fishguard and have no intervisibility with, or historical associations with the site, and can be scoped out of any further assessment. Those taken forward to further assessment are described in section 5.

4.29 There are also three Conservation areas within the 2km study area - the Goodwick Conservation Area, the Fishguard Conservation Area and the Lower Town Conservation Area. The Goodwick Conservation Area partially extends within the redline boundary for the proposed development, and there is intervisibility between the Lower Town Conservation Area and the Site. There is, however, no intervisibility or historical associations between the Fishguard Conservation Area and the site. The Goodwick and Lower Town Conservation Areas will be discussed further in section 5 below.

4.30 Two Registered Parks and Gardens lie within the 2km study area. One, at Plas Glyn-y-Mel (PGW(Dy)22(PEM)), to the south east of Lower Town, Fishguard, was designed as the picturesque garden setting for a mansion, which is itself Grade II Listed. Both the mansion and gardens were built between 1799 and 1805 by Richard Fenton a historian and archaeologist, Cadw have identified significant views from the park and garden to the south. The site visit has established that there is no intervisibility with, or historical associations with the linkspan site, and it can be scoped out of any further assessment. The second, the Registered Park and Garden associated with the Fishguard Bay Hotel (PGW(Dy)63(PEM)). This partially overlaps with the redline boundary for the linkspan project, and Cadw have identified key views from the hotel

(which is Grade II Listed) towards the south east and east, towards the current linkspan. This park and garden are considered further in section 5 below.

4.31 Harbour Village, which lies on the cliff above the ferry port was built in to house workers at the port. It can be seen as partially complete on the 1938 Ordnance Survey map (Figure 9) and substantially complete on the 1953 Ordnance Survey Map (Figure 10).

4.32 The earliest maps of the area do not depict the study site in great detail. Bowen's New and accurate map of South Wales printed in 1729 (Fig 3) shows the site as occupying the western part of Goodwick Bay. The first realistic depiction of the site is the Ordnance Survey Surveyors Drawing of 1814 (Fig 4). This shows the study site occupying the rocky western shoreline of the bay between Goodie Pier and Maenmwd Point and extending eastwards into the bay itself. There is less detail on the 1845 Llanwnda Tithe Map (Fig 5), although does indicate that majority of the terrestrial element of the site comprised an exposed headland (Plot 1295) recorded under land type as Cnwc, while in the southern part of the terrestrial study site two patches of waste ground are recorded (Plots 1289 and 1290), and plantation (Plot 1294). Located between Plots 1290 and 1294 appear to be marked a building adjacent to what is thought to be Goodwick Pier.

4.33 In 1870, the Admiralty Sailing Directions describe the anchorage at Fishguard as being of great importance to the coasting trade, affording good shelter for small vessels from all winds except those between north and east, and it is extensively frequented during the summer months by small vessels requiring shelter, or waiting for the turn of the tide (518465).

4.34 The 1st Edition Ordnance Survey map of 1888 (Fig. 6) is more detailed and generally supports the depiction of the terrestrial part of the study site forming the western rocky shoreline to what is now recorded as Fishguard Bay. The detail provided shows a number of terrestrial features of interest named along the coastline which consist mainly of natural inlets and rock outcrops. Artificial features depicted within the study comprise a lifeboat station (30840; 32129,) adjacent to a small area of beach named Wig Wen along the northern study site coastline, and the Goodwick Quay (30848) and associated building in the southern part of the study site as shown on the 1845 mapping (Fig. 5).

4.35 By 1908 (Fig. 7), it is clear that the terrestrial layout of the study site has altered significantly due to the construction of Fishguard Harbour Station, with building work having commenced in 1902. The profile of the rocky shoreline has been substantially re-engineered to level off the shoreline close to the water level of the harbour and the reclamation of nearly 1km of shoreline for the construction of an artificial quay (32133). The harbour facilities constructed comprise numerous rail lines (27970), a landing stage, rail sheds, railway station (27973), engine sheds, marshalling yard (32138), customs house (27972), slipway (32132), and possible warehouses in addition to other smaller ancillary buildings (30849, 32135). The lifeboat station and building adjacent to the former Goodwick Quay appear to be retained. The study site also encompasses part of a new c500m long breakwater (30842) extending from the headland out into the bay. A lighthouse is marked at the furthest extent of the breakwater.

4.36 World War 1 saw additional war time related activities take place at Fishguard Harbour. A maritime factory was established at the northern end of the harbour facilities which converted steamships into hospital ships (109300) alongside a flying boat base (32131), as well as a further noted military building (32122). In 1917 a seaplane taking off from the bay became entangled in power cables, and veered into a cliff above the port. It caught fire, and two bombs aboard exploded. The pilot, Lieutenant Eldon Bush was recovered alive, badly burnt, and died in his quarters at the Fishguard Bay Hotel.

4.37 An archival document providing detailed plan and elevation drawings of the new lifeboat station (Fig. 8), indicate that the original lifeboat station located within the northern part of the study site appears to have been replaced when a new lifeboat station and slipway was built in 1930 on the quay wall within the southern part of the study site. A review of the 1938 Ordnance Survey map

(Fig. 9) indicates that the layout of the study site remains generally unaltered to that depicted in 1908 (Fig. 7), although the position of the new lifeboat station is yet to be shown.

4.38 By 1953 (Fig. 10) the harbour facilities have been upgraded to incorporate several new large rectangular buildings centrally within the harbour facilities built up against the artificial cliff face, further reclamation and quay construction immediately to the north of these buildings. The relocation of the lifeboat station is now shown, with the former northern lifeboat station having been demolished and the new lifeboat station and slipway depicted in the southern part of the study site. The breakwater has been extended by a further c300m and new lighthouse constructed on its tip (129376). The layout of the study site remains unaltered in 1964 (Fig. 11).

4.39 By 1977 (Fig. 12) further modernisation has taken place. The existing complex of buildings centrally within the terrestrial part of the site have been demolished followed by the construction of a new quayside reception building and ancillary buildings, associated with modification of the harbour rail infrastructure. The 19th century building located adjacent to the former Goodwick Quay has also been demolished. Facilities to handle the loading/unloading of roll on roll-off ferries has also been constructed. With the exception of the construction of a sewage plant in the northern part of the study site on the landward side of the breakwater and removal of the majority of rail tracks, the layout of the study site has altered little up to the present (Figs. 13-15).

4.40 Within the wider study area there are a significant number of records listed on the HER which in the main relate to Post-Medieval and Modern structures deriving from the analysis of 19th and 20th century historic mapping. These records refer to the presence of rural features such as farmsteads and quarries, in additional to structures associated with the settlement of Goodwick and are not immediately relevant to the development of the study site itself.

Intertidal and Marine Assets

4.41 In addition to the terrestrial archaeology identified above there are a number of records in regional and National databases relating to archaeological remains both within the tidal zones and in marine contexts.

4.42 The HER, curated by Heneb, and the National Monuments Record for Wales (NMRW), held by the RCAHMW, both contain records for archaeological findspots within the intertidal zone, whilst the NMRW also contains evidence for remains within marine contexts. A Study Area of 5km was agreed for the study of marine assets (see Figs 2g and 2h). Much of the locational data relating to historic ship wrecks is limited, as historic reports of ship wrecks rarely contain accurate locational information, and wrecks can often only be assigned general co-ordinates. As a result, whilst the records may show only a small number of assets in a particular area, the inaccuracy of the locational data means that there is always a potential that an area contains a poorly located asset.

4.43 The NMRW records one hundred and thirteen possible shipwreck locations within a 5km study area (Figs. 2f & 2g; Appendix 2), as well as a smaller number of other maritime assets, such as the former seaplane station at Fishguard (NPRN 407792), Fishguard Quay (NPRN 34309) which are also recorded in the HER data.

4.44 Four of the NMRW records either lie within, or immediately adjacent to the study site and are considered of immediate relevance. Two historical reports of ships being wrecked are associated with the original Goodwick Quay formerly located in the terrestrial southern part of the study site and was subsequently absorbed into the area reclaimed in the early 20th century. The Agnes was an iron-hulled bucket dredger built in 1883 and recorded as being driven ashore at Wyncliff Point during a gale in 1901 (NPRN 272407). The Constitution was a wooden sailing vessel reported as being driven ashore near Goodwick Quay in 1825 (NPRN 273344). The Crystal was a wooden ketch built in 1863 and recorded as being lost in 1905 following the construction of the new harbour facilities, when driven onto the rocks close by the quay wall during a gale (NPRN 272671).

4.45 An unnamed wreck is shown in 29ft of water marked on an historic chart within the study area (NPRN 507266). The RCAHMW notes the location of the record as centrally positioned within the overall study site, although the location of the record was not provided on the data issued by the same body.

4.46 The remains of several wrecks have been located within the intertidal zone at Goodwick Beach c500m to the south of the study site (NPRN 416723 and NPRN 704003), in addition to multiple wrecks recorded in the vicinity of the beach based on documentary evidence (NPRN 272983, NPRN 240748, NPRN 525536, NPRN 272807, NPRN 273143, NPRN 272804,NPRN 518261, NPRN 240271, and NPRN 240284).

4.47 The remaining shipwrecks are recorded within the 5km study area are either located based on the converted documented latitude and longitude coordinate of the ships foundering scattered along the wider shoreline of Fishguard Bay (with a notable concentration within the bay at Lower Town c1km to the southeast of the study site) or recorded centrally within Fishguard Bay where the documentary sources have mentioned the bay in general. Due to the general nature of their recording, it is possible that additional wrecks could lie within, or in the immediate vicinity of the study site, other than those noted in the previous paragraphs.

4.48 Evidence for other archaeological features within the intertidal zone other than those of shipwrecks (see paragraph 4.42) are focussed at Goodwick Beach. The RCAHMW records two Post-Medieval fish traps in proximity to the study site, one of which is located c400m to the southwest of the study site (NPRN 407699) and the other c750m to the south of the study site (NPRN 401338). A third features consisting of a possible fish trap or wall (NPRN 409081), is located between the aforementioned fish traps.

4.49 The potential for the study site to contain terrestrial features of significance dating to the Post-Medieval or Modern periods is considered to be negligible. The initial construction of the harbour is considered to have removed any features of intertest pre-dating the 20th century, while multiple phases of development of the harbour facilities are also considered to have removed many features of interest as supported by the observations of the walkover visit undertaken in January 2025. The earliest surviving features in the area of the proposed linkspan appear to be the mid-20th century replacement lifeboat slipway and the located in the southern part of the study site. In terms of archaeological potential within the maritime area of the study site there are several historic records of wrecks occurring within, or within close proximity to, the study site. On this basis there is considered to be a moderate potential for shipwreck remains to survive within the sediments that form the current harbour seabed.

Historic Landscape Characterisation

4.50 Based on the data provided by Heneb, terrestrial elements of the study site are recorded within the historic landscape area associated with the settlement of Goodwick (Fig. 2e).

Assessment of Significance

4.51 Existing national policy guidance for archaeology enshrines the concept of the ‘significance’ of heritage assets. Significance as defined in the PPW12 centres on the value of an archaeological or historic asset for its ‘heritage interest’ to this or future generations.

4.52 There are multiple Listed Buildings, Registered Historic Park and Gardens, and Scheduled Monuments, in addition to the single Registered Landscape of Outstanding Historic, present within the 2km designated asset study area, due to their designation such assets can be considered of national significance.

4.53 The three Conservation Areas recorded within the 2km designated asset study area can be considered of regional significance.

4.54 As identified by desk based work, archaeological potential by period and the likely significance of any archaeological remains which may be present is summarised in table form below:

Period:	Identified Archaeological Potential	Identified Archaeological Significance
Prehistoric	Negligible	Low (Local)
Roman	Negligible	Low (Local)
Early Medieval & Medieval	Negligible	Low (Local)
Post Medieval & Modern	Terrestrial – mid-20th lifeboat slipway; Maritime - Moderate	Terrestrial - Low (Local); Maritime – Medium (Regional)

5 SITE CONDITIONS, THE PROPOSED DEVELOPMENT & REVIEW OF POTENTIAL DEVELOPMENT IMPACTS ON ARCHAEOLOGICAL ASSETS

Site Conditions

5.1 A walkover visit of the site was undertaken on 8th January 2025, along with visits undertaken to surrounding historic assets to determine potential impacts on them as a result of the development. The weather was slightly overcast, but visibility was good.

5.2 The site comprises a busy commercial ferry port, with roads, railway lines, a railway station, warehousing, engineering buildings, customs offices and terminal buildings, a lifeboat station and a number of other ancillary buildings and structures. The site of the proposed linkspan is occupied by the current linkspan (Plate 9), by an elevated roadway, and by the remains of the slipway and elevated platform constructed in the 1930s (Plates 10 and 11).

5.3 No new assets were identified in the walkover survey. The assets visited were generally in good condition, and were clearly visible. The only exception to this was the fish trap recorded in Goodwick Bay to the south of the site, which was obscured by the murkiness of the water in Goodwick Bay. It was not possible to access all of the assets within the study area, as some lie on private land. Where this was the case nearby publicly accessible land and the ZTV for the site was used in order to determine intervisibility with the site.

5.4 The construction of the Fishguard Harbour facilities is considered to have truncated all earlier deposits within its terrestrial footprint, removing the potential for deposits predating the 20th century to be present.

5.5 The creation of the made ground upon which the ferry port sits is likely to have had some impact upon seabed deposits on the edge of Goodwick Harbour, and may have impacted any archaeological remains in that area. Subsequent activities associated with the use of the ferry port may also have caused degradation of seabed deposits and archaeological potential.

Proposed Development

5.6 The Proposed Development comprises the demolition of the existing linkspan, barge and vehicle boarding platform, as well as the mid-20th century former lifeboat slipway. These features are to be replaced by a new vehicle boarding platform formed of reclaimed land, and a new linkspan and barge. This is to be supported by a programme of dredging within the study site boundary.

Review of Potential Development Impacts on Designated Heritage Assets

5.7 In order to accurately assess the potential impacts to the setting of the heritage assets adjacent to the site, a staged approach, as recommended within ‘The Setting of Heritage Assets in Wales’ (Cadw 2017) has been adopted.

5.8 To facilitate Stage 1 of the assessment, identification of heritage assets that could be affected by the proposals, the following table has been prepared. The table also identifies the justification for scoping in/out of the asset for further assessment. Scoping decisions have been informed by a site visit.

Cadw Ref	Name/Grade	Scoped In/Out	Justification
HLW(D) 11	Pen Gaer - Historic Landscape	Out	No intervisibility with the proposed development, nor does it make a positive contribution to its setting.
PGW(Dy)22(PEM)	Plas Glyn-y-Mel - Registered Historic Park & Garden	Out	No intervisibility with the study site. Proposals would lie outside the setting of the asset.
PGW(Dy)63(PEM)	Fishguard Bay Hotel - Registered Historic Park & Garden	In	The asset partially lies within the study site.
	Fishguard – Conservation Area	Out	Proposals would lie outside the setting of the asset.
	Goodwick – Conservation Area	In	The asset partially lies within the study site.
	Lower Town – Conservation Area	In	There are long views from the old harbour and breakwater toward the site
PE030	Garn Wen Burial Chamber – Scheduled Monument	Out	No intervisibility with the study site due to intervening urban environment.
PE031	Can Wnds Burial Chamber – Scheduled Monument	Out	No intervisibility with the study site.
PE033	Pen-Rhiw Burial Chamber – Scheduled Monument	Out	No intervisibility with the study site.
PE096	Castle Point Old Fort – Scheduled Monument	In	There will be extended views from the asset across the harbour of the proposals and study site.
PE258	Incised Cross at Cemetery Cross Roads – Scheduled Monument	Out	No intervisibility with the study site.
PE518	Parc Hen Standing Stone – Scheduled Monument	Out	No intervisibility with the study site.
12247	Training Ship Skirmisher - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12247	Training Ship Skirmisher - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12248	Fishguard Bridge - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12249	,2,Bridge Street, Lower Town,Fishguard,DYFED,SA65 9LX - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.

12250	,6,Bridge Street, Lower Town,Fishguard,DYFED,SA65 9LX - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12251	,10,Bridge Street, Lower Town,Fishguard,DYFED,SA65 9LX- Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12252	,1,Glyn-y-Mel Road, Lower Town,Fishguard,DYFED,SA65 9LY - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12254	Glyn-y-Mel Cottage (Cwm Cwsgi) - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12256	Plas Glyn-y-Mel, including quadrant wall & gate pier to W service court - Grade II* Listed Building	Out	No intervisibility with the study site. Proposals would lie outside the setting of the asset.
12257	,20,Glyn-y-Mel Road, Lower Town,Fishguard,DYFED,SA65 9LY - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12258	Cleals- Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12261	,7,Hamilton Street,Fishguard,Fishguard,DYFED ,SA65 9HL - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12262	,11,Hamilton Street including area railings,Fishguard,Fishguard,DYFE D,SA65 9HL - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12265	Sycamore Lodge - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12266	Premises occupied by The Dragon House - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12267	Ffynnon Clun farmhouse & adjoining outbuilding - Grade II Listed Building	Out	No intervisibility with the study site. Proposals would lie outside the setting of the asset.
12269	,5,High Street,Fishguard,Fishguard,DYFED	Out	Located in urban setting with no intervisibility with the

	,SA65 9AN - Grade II Listed Building		Development Site. Proposals would lie outside the setting of the asset.
12270	,11,High Street,Fishguard,Fishguard,DYFED ,SA65 9AN - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12271	Cartref Hotel - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12272	,21,High Street,Fishguard,Fishguard,DYFED ,SA65 9AW - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12273	Hermon Baptist Church including forecourt walls and steps - Grade II* Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12274	Mileplate in forecourt wall of Hermon Chapel - Grade II Listed	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12275	Cottage occupied by St John's Fishguard Nursing Division - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12276	Bank House - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12278	Mount Pleasant - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12279	,43,High Street,Fishguard,Fishguard,DYFED ,SA65 9AW - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12280	Nevern House - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12281	,61,High Street, including forecourt railing,Fishguard,Fishguard,DYFED ,SA65 9AW - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12283	,12,High Street,Fishguard,Fishguard,DYFED	Out	Located in urban setting with no intervisibility with the

	,SA65 9AR - Grade II Listed Building		Development Site. Proposals would lie outside the setting of the asset.
12284	,14,High Street,Fishguard,Fishguard,DYFED ,SA65 9AR - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12287	Llys Mair - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12288	,1,Hill Terrace,Fishguard,Fishguard,DYF ED,SA65 9LU - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12289	,2,Hill Terrace,Fishguard,Fishguard,DYF ED,SA65 9LU - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12290	,4,Hill Terrace,Fishguard,,DYFED,SA65 9LU - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12291	,1,Hottipass Street,Fishguard,Fishguard,DYFED ,SA65 9LJ - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12292	Bodlondeb - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12294	Kensington House - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12295	,17,Kensington Street,Fishguard,Fishguard,DYFED ,SA65 9LH - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12296	,12,Kensington Street,Fishguard,Fishguard,DYFED ,SA65 9LB - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12297	,16/18,Kensington St,Fishguard,,DYFED,SA65 9LB - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12298	Maesgwynne - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the

			proposals. Proposals would lie outside the setting of the asset.
12299	Parish Church of St Mary - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12300	Inscribed stone in St Mary's Churchyard - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12301	Railings to churchyard of Church of St Mary - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12302	,1,Main Street,Fishguard,Fishguard,DYFED ,SA65 9HG - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12303	,3,Main Street,Fishguard,Fishguard,DYFED ,SA65 9HG - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12304	,5,Main Street,Fishguard,Fishguard,DYFED ,SA65 9HG - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12306	Sally Port - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12307	Manor House Hotel - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12308	Elim Lodge - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12309	Ty Rhos - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12310	Sail Cottage - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12311	,16,Main Street,Fishguard,Fishguard,DYFED	Out	Located in urban setting with no intervisibility with the

	,SA65 9HJ - Grade II Listed Building		Development Site. Proposals would lie outside the setting of the asset.
12312	,22,Main Street,Fishguard,Fishguard,DYFED ,SA65 9HJ - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12313	The Globe Inn - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12314	Black Fox Bar - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12315	Swansea House (Ty Abertawe) - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the proposals. Proposals would lie outside the setting of the asset.
12316	The Town Hall - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12317	The Farmer's Arms - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12318	Nos 15 and 16,,Market Square,Fishguard,Fishguard,DYFE D,SA65 9HA - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12319	Nos 17 and 18,,Market Square,Fishguard,Fishguard,DYFE D,SA65 9HA - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12320	,20,Market Square, including Boots the Chemists.,Fishguard,Fishguard,DY FED,SA65 9HA- Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12321	The Royal Oak - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12323	Berachah Cottage - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the proposals. Proposals would lie outside the setting of the asset.

12324	,1,Newport Road, Lower Town,Fishguard,DYFED,SA65 9NA- Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12325	,15,Newport Road, Lower Town,Fishguard,DYFED,SA65 9NA- Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12328	The Dinas Arms- Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12329	Bodmor - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12330	West wall and railings to garden at Bodmor - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12331	Fishguard Fort - Grade II Listed Building	In	There will be extended views from the asset across the harbour of the proposals and study site.
12332	Former store building - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12333	Tabernacle Independent Chapel - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12334	Walter Brearley House - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12335	,2,Park Street,Fishguard,Fishguard,DYFED ,SA65 9HN - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12336	,4,Park Street,Fishguard,Fishguard,DYFED ,SA65 9HN - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12337	Greenwood House - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.

12338	Park House - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12339	Bridge Cottages - Grade II Listed Building	In	There are oblique views of the proposed linkspan form the cottage
12341	Church of St Peter - Grade II Listed Building	Out	Located in principally urban setting with limited intervisibility with the proposals. Relatively minor infrastructure works that would not result in notable changes occurring within the wider setting of the asset.
12345	Fishguard Bay Hotel - Grade II Listed Building	In	The asset lies immediately adjacent to the study site.
12347	,19,Quay Street, Lower Town,Fishguard,DYFED,SA65 9NB - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12348	,21,Quay Street, incl decorative cobbled forecourt, Lower Town,Fishguard,DYFED,SA65 9NB - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12349	,33,Quay Street, Lower Town,Fishguard,DYFED,SA65 9NB - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12350	,37,Quay Street, Lower Town,Fishguard,DYFED,SA65 9NB- Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12352	The Quay, including slipway, bollard and flights of steps. - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12353	Dyffryn House - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the proposals. Proposals would lie outside the setting of the asset.
12354	,1,The Slade, including front garden walls & gates,Fishguard,Fishguard,DYFED ,SA65 9PE - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12356	The Monthly Tutor's Cottage - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12357	Rosslyn - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the

			proposals. Proposals would lie outside the setting of the asset.
12360	Hill House - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12361	Tower House - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12362	Talarfor- Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12363	Court House, front railings and gate piers to right - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12364	Ardwyn and railings to front - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12365	Capel Pentour, including forecourt railings and gates - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12366	Prospect House - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12367	,29,Wallis Street,Fishguard,Fishguard,DYFED ,SA6 59HP - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12369	,5,West Street,Fishguard,Fishguard,DYFED ,SA65 9AE - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12370	The Old Post Office - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12373	Victoria Wine - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.

12374	,39,West Street, Fishguard ,DYFED,SA 65 9AD - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12379	Seaways Bookshop- Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12380	,14,West Street,Fishguard,Fishguard,DYFED ,SA65 9AE - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
12381	Pen-rhiw - Grade II Listed Building	Out	No intervisibility with the study site. Proposals would lie outside the setting of the asset.
12980	Church of St Gwyndaf - Grade II* Listed Building	Out	No intervisibility with the study site. Proposals would lie outside the setting of the asset.
12981	Three walled enclosures at SE Angle of churchyard of Church of St. Gwyndaf - Grade II Listed Building	Out	No intervisibility with the study site. Proposals would lie outside the setting of the asset.
12982	Cartref - Grade II Listed Building	Out	No intervisibility with the study site. Proposals would lie outside the setting of the asset.
13048	Telephone Callbox adjoining No 2- Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
13072	,32,Main Street, including area railings.,Fishguard,Fishguard,DYF ED,SA65 9HJ - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
13073	Vincent House - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
13084	Goodwick Institute - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the proposals. Proposals would lie outside the setting of the asset.
14951	Former Farmhouse at Castell Farmyard - Grade II Listed Building	Out	No intervisibility with the study site. Proposals would lie outside the setting of the asset.
15881	,23,Glyn-y-Mel Road, Lower Town,Fishguard,DYFED,SA65 9LY - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.

22760	Berachah Presbyterian Church - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the proposals. Proposals would lie outside the setting of the asset.
26026	,52,High Street,Fishguard,Fishguard,,SA65 9AR - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
26028	,3,Hottipass Street,Fishguard,Fishguard,,SA65 9LJ - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
26029	,35,Quay Street, Lower Town,Fishguard,,SA65 9NB - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
26030	Emscote - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
26031	Solway House - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
26032	4, Bridge Street, Lower Town, Fishguard, SA65 9LX - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
26033	The Ship Inn - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
26034	,9,Newport Road, Lower Town,Fishguard,,SA65 9NA - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
26035	Justin Cottage- Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
26036	Well Cottage/Bwthyn Ffynnon - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
26037	,12,Bridge Street, Lower Town,Fishguard,,SA65 9LX - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.

26038	,2,The Slade, including front garden walls & gates,Fishguard,Fishguard,,SA65 9PE - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
26039	,5,Newport Road, Lower Town,Fishguard,,SA65 9NA - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
26040	Bryn Haulwen - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
26041	Moonstone - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
26042	,8,Hill Terrace,Fishguard,Fishguard,,SA65 9LU - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
26043	,30a,Main Street,Fishguard,Fishguard,,SA65 9HJ - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
26044	The Fishguard Arms - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
26045	,26,Main Street,Fishguard,Fishguard,,SA65 9HJ - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
26046	,18,Main Street,Fishguard,Fishguard,,SA65 9HJ - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
26047	,20,Main Street,Fishguard,Fishguard,,SA65 9HJ - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
26048	,16,High Street,Fishguard,Fishguard,,SA65 9AR - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
26049	Llys-Teg - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.

26050	,47,High Street,Fishguard,Fishguard,,SA65 9AW - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
26051	Old Pump House - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
26052	,79,High Street,Fishguard,Fishguard,,SA65 9AW - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
26053	,21a,High Street,Fishguard,Fishguard,,SA65 9AW - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
26054	,11a,High Street,Fishguard,Fishguard,,SA65 9AN - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
26055	,13,High Street,Fishguard,Fishguard,,SA65 9AN - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
26056	,7,High Street,Fishguard,Fishguard,,SA65 9AN - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
26057	,9,High Street,Fishguard,Fishguard,,SA65 9AN - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
26058	,7,Newport Road, Lower Town,Fishguard,,SA65 9NA - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
26059	,9,Hamilton Street,Fishguard,Fishguard,,SA65 9HL - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
26060	,13,Hamilton Street including area railings,Fishguard,Fishguard,,SA65 9HL - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
26062	,25,Quay Street, Lower Town,Fishguard,,SA65 9NB - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.

26063	,22,Glyn-y-Mel Road, Lower Town,Fishguard,,SA65 9LY - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
26064	,3,Hamilton Street,Fishguard,Fishguard,,SA65 9HL - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
26065	,5,Hamilton Street,Fishguard,Fishguard,,SA65 9HL - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
26066	Penrhyn - Grade II Listed Building	Out	No intervisibility with the study site, nor does the site contribute to its significance
26067	Lime Kilns - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
26068	Lifeboat Memorial - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the proposals. Proposals would lie outside the setting of the asset.
26069	,5,Hill Terrace,Fishguard,Fishguard,,SA65 9LU - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
26070	Range of outbuildings at Maesgwynne - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the proposals. Proposals would lie outside the setting of the asset.
26071	Cart shed at Maesgwynne - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the proposals. Proposals would lie outside the setting of the asset.
26072	,16,West Street,Fishguard,Fishguard,,SA65 9AE - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
26073	Ty Twt - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
26074	,37,West Street,Fishguard,Fishguard,,SA65 9AD - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.

26075	,41,West Street,Fishguard,Fishguard,,SA65 9AD - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
26076	Halifax Building Society- Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
26077	,73,High Street, including forecourt railings.,Fishguard,Fishguard,,SA65 9AW - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
26078	Bennett's Navy Tavern - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
26079	New Villa- Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
26081	,7,Main Street including area railings,Fishguard,Fishguard,,SA65 9HG - Grade II Listed Building	Out	Located in urban setting with no intervisibility with the Development Site. Proposals would lie outside the setting of the asset.
26791	The Drim - Grade II Listed Building	Out	No intervisibility with the study site. Proposals would lie outside the setting of the asset.
26792	Outbuilding at The Drim - Grade II Listed Building	Out	No intervisibility with the study site. Proposals would lie outside the setting of the asset.

5.9 For those designated assets scoped in for further assessment, the following section of the assessment addresses Stage 2: Assessing Setting and Contribution to Significance. To assist in the assessment there are instances where several designated assets have been assessed as a group due to their similar character and geographic location.

Fishguard Bay Hotel (12345) and Registered Park and Garden (PGW(Dy)63(PEM))

5.10 The Fishguard Bay Hotel first started life as a sizeable late 19th century house known as Windcliffe. It was enlarged in 1887 – 8, providing it with 4 sitting rooms and 16 bedrooms before being sold to the Fishguard & Rosslare Railways & Harbour Co in 1896 to become the Hotel Wyncliffe. It was later acquired by the Great Western Railway, and was used as a railway hotel until 1951. It is currently undergoing a significant refurbishment (Plate 7). The hotel is approached from the south west, and the main façade faces to the south east across Goodwick Bay. There are views from the hotel to the north east toward the ferry terminal and the site, but these are somewhat restricted by the large number of mature trees in the surrounding park and garden. Views in this direction already incorporate the modern ferry terminal, and do not contribute positively to the significance of the hotel, although they do afford glimpsed views of the railway and railway station that the hotel was once associated with (Plate 8). Its main heritage values lie in its evidential value in the building's fabric and form and as an example of a former gentleman's

residence and railway hotel, the historical values it has through its links to the hotel and the link to Jenkinson & White of London who drew up the designs for the extension of 1910 It also has some aesthetic appeal as a grand late Victorian and early Edwardian railway hotel. It has limited communal value. Its primary setting comprises the hotel, the south western approach and the registered park and garden, along with distant views to the east across Goodwick Bay. Whilst the site, and the ferry terminal which now sits there, is obliquely visible from the hotel, these views are significantly obscured by vegetation, and although there are historic links between the port and the hotel, these views do not contribute positively to the significance off the hotel, unlike the views across Goodwick Bay which can be obtained from the long façade.

5.11 The Registered Park and Garden was laid out early in the 20th century, when the building first became used as a hotel, and is largely terraced and heavily wooded, with paths and small watercourses forming focal features, whilst the lower areas of the park include an ornamental garden and a tennis court. Cadw have identified key views from the park to the east and north east, including views across the bay and ferry port. These views are significantly limited by tall trees. the views of the ferry port include predominantly modern infrastructure and buildings, and whilst they do form part of the setting of the park and garden they contribute nothing positive to its significance.

5.12 In the light of these assessments, it is considered that the construction works proposed, which will be seen in the context of an already busy modern port environment, will not impact upon the significance either of the Fishguard Bay Hotel or the associated Registered Park and Garden.

Castle Point Old Fort (Scheduled Monument PE096 and Listed Building 12331)

5.13 Castle Point Old Fort was built in 1781 in response to an attack on Fishguard undertaken by an American privateer, the Black Prince, in 1779. The fort comprised a fan shaped battery, initially holding eight 9-pound cannon, defended by a rock cut ditch, with a tall stone defensive wall on the landward side and a magazine building/guardhouse. It was barely adequately equipped, and in particular given little ammunition, although with the increased threat from Napoleon, a small group of invalid artillerymen were sent to train volunteers in the use of the guns. the guns were only fired once, with blanks being fired at the French invasion fleet of 1797 – the garrison deciding not to use their three rounds of ammunition.

5.14 The main heritage attributes of the fort lie in its evidential value, as a unique late 18th century coastal defence battery, still in relatively good state of preservation, in its historical value, particularly with regards to its role in the failed French invasion of 1797, and to a degree in its aesthetic value, which derives from its prominent location on a headland in the bay. Its setting includes wide ranging views across Goodwick Bay, including towards the ferry port and location of the proposed new linkspan (see Plates 1 and 2). These views make a positive contribution to the significance of the monument because they clearly demonstrate the purpose of the fort and the value of its location. These views include the entire length of the current ferry port. The proposed works are relatively small scale, and within the context and backdrop of the wider operations of the ferry port are unlikely to be a significant negative impact. Once the construction is completed and the linkspan is operational, it will be less visually intrusive than the current infrastructure.

Bridge Cottages, 3 The Parrog Goodwick (12339),

5.15 Bridge Cottages is a small, whitewashed rubble stone cottage, thought likely to date to the late 18th or early 19th century, but not apparent on themed 19th century tithe map. The Cadw listing description describes it as being included for listing as a traditional smaller house with offset facade, grouted roof and rear outshut, picturesquely placed overlooking beach towards Goodwick (Plate 4). Its main heritage value lies in its evidential value, as a well preserved smaller rubble built house in a coastal setting and its aesthetic appeal as a small typical whitewashed Welsh cottage. It has limited historical or communal value. Its setting largely comprises the immediate cluster of buildings within which it is sited – a small group of houses at the south eastern end of Goodwick beach close to Goodwick Bridge - the beach itself and views across Goodwick Moor. The main

façade of the building faces to the north west, but adjacent buildings mean that there are only oblique and obstructed views towards the proposed linkspan site, whilst the wider views of the bay, moor and beach provide a slight positive contribution to the setting of the house, those in the direction of the proposed linkspan contribute nothing positive. These views already include distant views of the ferry port, and the construction works will not be a noticeable impact within that context, whilst the new linkspan will be slightly less intrusive than the current infrastructure.

Goodwick Conservation Area

5.16 The Goodwick Conservation area covers the historic core of Goodwick and extends as far north as the Fishguard Bay Hotel and gardens, bringing it slightly within the redline boundary for the site. It was designated in 1975 and a recent Conservation area appraisal (https://www.pembrokeshire.gov.uk/objview.asp?object_id=2954&language=) identified a number of key special characteristics for the conservation area, relating to the landform, diverse and unusual building form and type, architecturally distinct landmark buildings, a coherent central Victorian core, and the historic relationship with the sea, initially through fishing and latterly through the ferry port. This relationship with the ferry port and associated railway terminus is identified as a key driver to the town's development and success. The Conservation Area Appraisal identifies a number of key views, including views from the town across Goodwick Bay and views of the town from the moor to the south east, but does not positively identify views towards the ferry port, which are limited from the conservation area by the topography and heavily wooded slopes.

5.17 There is clearly an historic relationship between Goodwick and the ferry port, and therefore the port does form part of its setting. However, the continued upgrading of port facilities does not threaten this association, and there is unlikely to be any noticeable change within the Conservation Area either during the construction or operation of the linkspan.

Lower Town Conservation Area

5.18 The Lower Town Conservation area covers the historic old harbour and lower town of Fishguard. The recent Conservation area appraisal undertaken in 2016 (https://www.pembrokeshire.gov.uk/objview.asp?object_id=2956&language=) identified a number of key special characteristics for the conservation area, relating to the unique landform, diverse and unusual 18th and 19th century buildings, architecturally distinct landmark buildings, Victorian buildings and terraces, industrial buildings, Listed Buildings, narrow streets, sheltered harbour and river mouth, the marsh to the south of the bridge and the long historic relationship with the sea.

5.19 The Conservation Area Appraisal identifies a number of key views, but none in the direction of Goodwick Bay and the ferry terminal. Despite this, however, there is a fine view from the southern end of the Old Harbour looking north (Plate 3) which captures the harbour, breakwater and harbourside terraces which incorporates the ferry terminal in the background. However, the ferry port is only visible in long view, and the proposed construction works on the new linkspan will not impact upon the significance of the conservation area, whilst the operational phase of linkspan is likely to represent a very slight visual improvement.

Review of Potential Development Impacts on Non-Designated Heritage Assets

5.20 Based on the available evidence, there is considered to be a negligible potential for terrestrial archaeological deposits within the study site for all periods apart from Post Medieval and Modern periods. There is judged to be moderate potential for the presence of maritime remains within the study site, alongside the known remains of the former lifeboat station and slipway.

5.21 Due to the presence of the remains of the former lifeboat station within the study site, which is likely to be demolished, it is recommended that a programme of archaeological recording is

undertaken prior to its demolition. It is also recommended that a Protocol for Archaeological Discoveries (PAD) is agreed with the RCAHMW prior to any intrusive construction or dredging works within the site.

6 CONCLUSION

6.1 Land at the Port of Fishguard (including areas of the harbour floor), Pembrokeshire, South Wales has been reviewed for its heritage and archaeological potential.

6.2 In accordance with central and local government planning policy and guidance, a desk based assessment has been undertaken to clarify the heritage and archaeological potential of the study area.

6.3 The Proposed Development comprises the demolition of the existing linkspan, barge and vehicle boarding platform, as well as the mid-20th century former lifeboat slipway. These features are to be replaced by a new vehicle boarding platform formed of reclaimed land, and a new linkspan and barge. This is to be supported by a programme of dredging within the study site boundary.

6.4 The Fishguard Bay Hotel Registered Park and Garden and Goodwick Conservation Area extend into the southern part of the study site. Potential development impacts have been assessed and it is considered the development proposals will not impact upon the significance of either asset.

6.5 There are no other designated heritage assets (World Heritage Sites, Registered Landscape of Outstanding Historic Interest, Scheduled Monuments, Listed Buildings, Registered Park and Gardens, Registered Battlefields, Protected Wreck sites, or Conservation Areas) within the study site. The study site does not lie within an area of designated archaeological priority.

6.6 There are multiple designated heritage assets present within the 2km study area, consisting of one Registered Landscape of Outstanding Historic Interest, three Grade II* Listed Buildings, six Scheduled Monuments, two Registered Historic Park & Gardens, three Conservation Areas, and multiple Grade II Listed Buildings. Based on the results of the site walkover, and professional judgement, it is considered that the majority of the designated heritage within the study area will not be impacted by the Proposed Development.

6.7 In regard to Castle Point Old Fort Scheduled Monument and Grade II Listed Building, Bridge Cottage Grade II Listed Building, and the Lower Town Conservation Area, the assessment has identified that the Proposed Development will result in minor positive impact upon the significance of these assets.

6.8 Based on the available evidence, there is considered to be a negligible potential for terrestrial archaeological deposits within the study site for all periods apart from the Post Medieval and Modern periods. There is judged to be moderate potential for the presence of maritime remains within the study site, alongside the known remains of the former lifeboat station and slipway.

6.9 Due to the presence of the remains of the former lifeboat station within the study site, which is likely to be demolished, it is recommended that a programme of archaeological recording is undertaken prior to its demolition. It is also recommended that a Protocol for Archaeological Discoveries (PAD) is agreed with the RCAHMW prior to any intrusive construction or dredging works within the site.

Sources Consulted

General

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Internet

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British History Online – http://www.british-history.ac.uk/

Domesday Online – http://www.domesdaybook.co.uk/

Archwilio - https://archwilio.org.uk/

Portable Antiquities Scheme – www.finds.org.uk

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Cartographic

1729 Bowen's New and accurate map of South Wales

1814 Ordnance Survey Drawing

1845 Llanwnda Tithe Map

1888 Ordnance Survey Map

1908 Ordnance Survey Map

1930 Plan and Elevation Drawings of the New Lifeboat Station

1938 Ordnance Survey Map

1953 Ordnance Survey Map

1964 Ordnance Survey Map

1974-77 Ordnance Survey Map

2000 Ordnance Survey Map

2009 Google Earth Image

2023 Google Earth Image

FIGURES

PLATES

APPENDICES

Appendix 1

Gazetteer of Historic Environment Data (Heneb) & National Monuments Record Data

HER Records

prn	site name	period
105325	Sopwith Baby Seaplane N1033	Modern
30841	East Breakwater	POST MEDIEVAL
30842	North Breakwater	Modern
32144	Goodwick Beach	POST MEDIEVAL
17557	Goodwick Bridge	POST MEDIEVAL
42842	Crincoed	POST MEDIEVAL
32102	The Warren	Modern
32099	The Warren	Modern
32103	The Warren	Modern
32095	The Warren	Bronze Age
32135	Fishguard Harbour	Modern
2501	Carreg Samson;garn Wen;harbour Village	Neolithic
2502	Garn Wen	Neolithic
2503	Garn Wen	Neolithic
48330	Garn Wen	Neolithic
2499	Pen-rhiw;parc Y Cromlech	Neolithic
4599	Pencwm Cromlech	Neolithic
2908	Garn Wen	Neolithic
17524		POST MEDIEVAL
20274		POST MEDIEVAL
20276		POST MEDIEVAL
59722	Berachah Presbyterian Church	POST MEDIEVAL
17525	Ebenezer Chapel	POST MEDIEVAL
18157	Goedwig Baptist Chapel	POST MEDIEVAL
17528	St Peters	POST MEDIEVAL
42843	Crincoed	POST MEDIEVAL
32096	The Warren	Bronze Age
32104	The Warren	Bronze Age
32098	The Warren	Bronze Age
32143	Goodwick Beach	POST MEDIEVAL
32156	Castle Point	POST MEDIEVAL
42844	Crincoed	POST MEDIEVAL
20282	Quay Road Nos.1-4; Rocket Cottage	POST MEDIEVAL
14032	Pwll Hir	Medieval; POST MEDIEVAL
14036	Waun Ffynon Clyn	Medieval; POST MEDIEVAL
20280	Berachah	POST MEDIEVAL
53895	Cw Cottage	POST MEDIEVAL
53894	Trehelyn Fach	POST MEDIEVAL
103000	Wymcliffe	POST MEDIEVAL
27972		POST MEDIEVAL
32101	Crincoed	Modern
32162	Goodwick	POST MEDIEVAL

32163	Goodwick Bridge	Modern
110385	14 New Hill	Modern
42820	Crincoed Farm	POST MEDIEVAL
20284	Beach House; Quay Road	POST MEDIEVAL
20133	Bridge Cottages No.3;the Parrog	POST MEDIEVAL
20278	Main Street; Swansea House	POST MEDIEVAL
20281	Quay Road; Pen-y-graig	POST MEDIEVAL
20285	Station Hill; Rosslyn	POST MEDIEVAL
20279	The Laurels; Laurels Cotttage	POST MEDIEVAL
20134	Windyhall Cottage; The Parrog	POST MEDIEVAL
32100	The Warren	POST MEDIEVAL; Prehistoric?
27971		POST MEDIEVAL
42840	Crincoed	POST MEDIEVAL
42841	Crincoed	POST MEDIEVAL
109300	Gwr Marine	Modern
20292	Pen-rhiw	POST MEDIEVAL
118376	Carcoed	POST MEDIEVAL
118377	Pen-rhiw	POST MEDIEVAL
21743	Pen-rhiw;pen-y-rhiw	POST MEDIEVAL
53890		POST MEDIEVAL
11445	Goodwick Beach	Early Medieval
2550	Pen Cw	Prehistoric
128566	Fishguard	UNKNOWN
32127	Fishguard Harbour	POST MEDIEVAL
103601	Goodwick Beach	Medieval
32131	Rnas Fishguard; Raf Fishguard	Modern
5015	Fishguard Fort;castle Point	POST MEDIEVAL
54282		POST MEDIEVAL;UNKNOWN
103003	Pen-cwm	POST MEDIEVAL
103002	Wymcliffe	POST MEDIEVAL
30843	Goodwick	POST MEDIEVAL
59203	Goodwick Institute	POST MEDIEVAL
30849	Fishguard Harbour	Modern
32140	Goodwick	POST MEDIEVAL
2526	Ffynnon Wnda	Medieval
20283	Fishguard Bay Hotel	Modern; POST MEDIEVAL
59797	Penrhyn	POST MEDIEVAL
58630	Rosslyn	POST MEDIEVAL
58613	Swansea House (ty Abertawe)	POST MEDIEVAL
2511	Garn Wen	Prehistoric
46062	Goodwick	NOT APPLICABLE
32129	Fishguard Harbour	POST MEDIEVAL
30840	Goodwick	POST MEDIEVAL

129376	North Breakwater Lighthouse	MODERN
30892	Goodwick Beach	POST MEDIEVAL
18142	Pwll Hir	POST MEDIEVAL
32138	Fishguard Harbour	Modern
59798	Lifeboat Memorial	POST MEDIEVAL
32122	Pwll Hir	POST MEDIEVAL
109327		Modern
32123	Pwll Hir;pen-cw	Modern
32146	Goodwick Moor	Not Applicable
42831	Crincoed Farm	POST MEDIEVAL
32157	Castle Point	Iron Age
17523		POST MEDIEVAL
30845		POST MEDIEVAL
30844	Goodwick	POST MEDIEVAL
32133	Fishguard Harbour	Modern
30848	Goodwick Quay	Modern; POST MEDIEVAL
17551	Warren the	POST MEDIEVAL
27970	Tre-heilyn-fach	POST MEDIEVAL
32145	Goodwick Moor	Modern
27973	Fishguard Harbour Station	Modern
17526	Goodwick Station	POST MEDIEVAL
32120	Pwll Hir; Fishguard Harbour	POST MEDIEVAL
32121	Pwll Hir	Modern; POST MEDIEVAL
32141	Goodwick	POST MEDIEVAL
2510	Garn Wen	Bronze Age
12109	Parc Y Garn	Bronze Age
5000	Parc Y Garn;carn Ellen	
Round Barrow	Religious, Ritual and Funerary	
20272	Goodwick County Primary	POST MEDIEVAL
32097	The Warren	Bronze Age; Modern
30847	Goodwick	Modern; POST MEDIEVAL
42835	Crincoed	Modern
12309	Trefhaylyn	Medieval
53891		POST MEDIEVAL
32124	Pwll Hir	POST MEDIEVAL
32139	Goodwick Beach	POST MEDIEVAL
32132	Rnas Fishguard; Raf Fishguard	POST MEDIEVAL
2068	Carn Wen	Bronze Age
4597	Parc Carreg	
Religious, Ritual and Funerary	Near Intact	
53893		NOT KNOWN
110396		Modern

103001	Wymcliffe	POST MEDIEVAL
42815	Ciliau Ganol Farm	POST MEDIEVAL
42816	Ciliau Ganol Farm	POST MEDIEVAL
32134	Fishguard Harbour	Modern
7958	Park Caer Coed	Unknown
117019	Goodwick	MODERN
42834	Carn Coed	POST MEDIEVAL
42836	Crincoed	Modern
42830	Ciliau Moor	POST MEDIEVAL
42827	Crincoed Farm	POST MEDIEVAL
22121	Goodwick Institute	POST MEDIEVAL
120222	Pen-feidr	POST MEDIEVAL
118377	Pen-rhiw	POST MEDIEVAL
118376	Carcoed	POST MEDIEVAL

HER Events

prn	name	site type
130643	Berachah Chapel, New Hill, Goodwick	Photographic Record
129019	Penrhiw, Llanwnda, Goodwick, Pembrokeshire	Photographic Record
49679	Pencaer Community	Field Survey
52509	Pen Anglas	Field Survey
57025	Rear of Picola Calabria	Watching Brief
49678	Pen Anglas	Field Survey
48168	Fishguard Harbour Marina Development	Field Survey
28243	Fishguard/Goodwick Proposed Water Disposal Scheme	Desk Based Assessment

NMR Data

NPRN	NMRW_Name	NMRW_Period
11101	Ebeneser Welsh Independent Chapel; Ebenezer Chapel Vestry; Stop and Call, Goodwick Hill, Goodwick	Multiperiod
11102	Bethany English Congregational Chapel, Goodwick Hill, Goodwick	Post Medieval
11106	Goedwig Welsh Baptist Church; Goodwick, Main Street, Goodwick	Post Medieval
11107	Berachah Chapel (Welsh Calvinistic Methodist), New Hill, Goodwick	19th Century
21619	Beach House	Post Medieval
21630	Berachan Cottage, New Hill	Post Medieval
21655	Bridge Cottages, 3; 3 Beach Cottages	Post Medieval
21934	Fishguard Bay Hotel, Goodwick	Post Medieval
22233	The Laurels, New Hill	Post Medieval
22235	Laurel Cottage, New Hill	Post Medieval
30111	Quay Road 4;Rocket Cottage	Post Medieval
30112	Quay Road 1,2 and 3	Post Medieval
30046	Penrhiw Farmhouse	Post Medieval
30057	Pen-y-Graig	Post Medieval
30168	Rosslyn	Post Medieval
30279	Swansea House, Main Street	Post Medieval
30428	Windyhall Cottage	Post Medieval
32074	Goodwick Institute	Post Medieval
97124	Bethesda English Baptist Church, Main Street, Goodwick	Post Medieval
270781	Weapons Pit, Goodwick	Post Medieval
270784	Weapons Pit, Fishguard	Post Medieval
270785	Weapons Pit, Fishguard	Post Medieval
272407	Agnes	Modern
272671	Cristal (Or Crystal)	Modern
273344	Constitution	Post Medieval
276025	Castle Point Old Fort; Fishguard Fort	Post Medieval
305183	Pen-Rhiw, Burial Chamber; Parc-y-Cromlech, Chambered Tomb	Neolithic
305184	Carreg Samson, Carn Wen, Chambered Tomb I; Garn Wen Burial Chambers	Neolithic
309043	Park-y-Llan, Sheep shelter on South-East of	Post Medieval
309558	Fishguard Harbour: North Breakwater Lighthouse	Modern
400046	Cw-Cottage, Clearance Feature of	Post Medieval
401807	Goodwick	Post Medieval
402126	Fishguard Bay Hotel Garden, Goodwick	20th Century

410488	Harbour Village; Garden Village, Fishguard	20th Century
413716	Crincoed, Cultivation Ridges	Post Medieval
415206	Pwll Hir, Earthworks	Post Medieval
421021	St Peter's Church, Goodwick	20th Century
515919	Sopwith Baby Seaplane N1033	Modern
525065	Lifeboat Station, Goodwick Sands	Post Medieval
525066	Lime Kiln and Coal Yard, Goodwick Sands	Post Medieval
525067	Coastguard Station, Goodwick Sands	Post Medieval
525068	Lifeboat Station, Goodwick Harbour	Post Medieval

Appendix 2

Gazetteer of RCAHMW Maritime Data

NPRN	Name	Site_Type	Period
272983	Xanthus	WRECK	Post Medieval
273142	Albion	WRECK	Post Medieval
525062	Landing Place, Aber Bach	LANDING POINT	Post Medieval
270791	Coast Artillery Battery, Dinas Cross	COAST ARTILLERY BATTERY	Post Medieval
272888	Union	WRECK	Post Medieval
272622	William Rhodes Moorhouse	WRECK	20th Century
525070	Landing Place, Porth Sychan	LANDING POINT	Post Medieval
507265	Fishguard Bay Maritime Named Location	SEASCAPE	Multiperiod
272863	Kitty	WRECK	Post Medieval
272585	George	WRECK	Post Medieval
272817	Kitty	WRECK	Post Medieval
273392	Friendship	WRECK	Post Medieval
272870	Royal George	WRECK	Post Medieval
240748	John and Betsy	WRECK	Post Medieval
272808	Catharine	WRECK	Post Medieval
272174	Trevor	WRECK	Post Medieval
272886	Sir Peregrine	WRECK	Post Medieval
273350	Fox	WRECK	Post Medieval
272889	Unnamed Wreck	WRECK	Post Medieval
273077	Laura	WRECK	Post Medieval
525517	Navigation Channel, off Strumble Head	SEASCAPE	Multiperiod
409081	Fishguard Harbour Submerged Walls	FISH TRAP; WALL	Post Medieval; Medieval
272762	Polly	WRECK	Post Medieval
34308	Fishguard Harbour	HARBOUR	Modern; 20th Century
272599	Charlotte	WRECK	Post Medieval
525536	Commerce	WRECK	Post Medieval
272718	Charlotte	WRECK	Post Medieval
273543	Penguin	WRECK	Post Medieval
525175	Betsey of Holyhead	WRECK	Post Medieval
272807	Swan	WRECK	Post Medieval
273191	Moyallon (UKHO 93302)	WRECK	20th Century
272764	Reliance	WRECK	Post Medieval
516184	Ebenezer	WRECK	Post Medieval
273145	Flora	WRECK	Modern
273012	Ann	WRECK	Post Medieval
272626	Horatio	WRECK	Post Medieval
273143	Mary	WRECK	Post Medieval
272804	Friend's Good Will	WRECK	Post Medieval
272741	Margaret and Mary	WRECK	Post Medieval
273380	Neptune	WRECK	Post Medieval

272931	Two Sisters	WRECK	Post Medieval
272504	Amity	WRECK	Post Medieval
273379	Mary	WRECK	Post Medieval
273374	Sophia	WRECK	Post Medieval
273063	Agricola	WRECK	Post Medieval
515094	Lizzie Edith	WRECK	Post Medieval
518261	Valiant	WRECK	Post Medieval
524884	Sapphire	WRECK	Post Medieval
240271	Princess Royal	WRECK	Post Medieval
704007	Fishguard Outer Quay	QUAY	Post Medieval; 18th Century
240284	Echo	WRECK	Modern
272678	Lizzie Edith	WRECK	Post Medieval
273160	William Wilmott	WRECK	20th Century
273040	Robert	WRECK	Post Medieval
507266	Unnamed Wreck	WRECK	Post Medieval
519263	Valiant	WRECK	Post Medieval
525225	Erin	WRECK	Post Medieval
273343	Anacreon	WRECK	Post Medieval
273236	Gramsbergen (UKHO 93956)	WRECK	20th Century
272803	Keturah	WRECK	Post Medieval
515472	Avro Anson I L9148	AIRCRAFT	Post Medieval
273054	Evviva	WRECK	19th Century
273162	Hermina	WRECK	20th Century
409506	Pen Castell; Dinas Island	PROMONTORY FORT	Iron Age
240286	Dinorwic	WRECK	Modern
240268	Elinor and Mary	WRECK	Post Medieval
507240	Unnamed Wreck	WRECK	Post Medieval
515093	Goodwick Sands Maritime Named Location	SEASCAPE	Multiperiod
525060	Landing Place, Pwllgaelod	LANDING POINT	Post Medieval
507138	Anne	WRECK	Post Medieval
272436	Ann and Mary	WRECK	Post Medieval
525685	Cleared Channel Approach to Slade Mill, Fishguard	SEASCAPE	Post Medieval
273065	Margaretta	WRECK	Post Medieval
273071	John and Ann	WRECK	Post Medieval
273075	Albert	WRECK	Post Medieval
272711	Nancy	WRECK	Post Medieval
272984	Llaethliw	WRECK	Post Medieval
273022	Mary Jane	WRECK	Post Medieval
407699	Goodwick Fish Trap 1	FISH TRAP	Post Medieval
416723	Goodwick Wreck 1	WRECK	Post Medieval
240272	Lady Kenmare	WRECK	Post Medieval
272712	Eleanor	WRECK	Post Medieval

273092	Fawn	WRECK	Post Medieval
240266	John and Grace	WRECK	Post Medieval
518465	Fishguard (Or Goodic) Road	ANCHORAGE	Post Medieval
272872	Castle Malgyn	WRECK	Post Medieval
272787	Mary	WRECK	Post Medieval
272884	Providence	WRECK	Post Medieval
272806	Trial	WRECK	Post Medieval
272821	Eliza	WRECK	Post Medieval
515870	John	WRECK	Post Medieval
273131	Rosezillia	WRECK	Modern
800601	Goodwick Wreck 3	WRECK	Post Medieval
272851	New Hope	WRECK	Post Medieval
273068	Espiegle	WRECK	Post Medieval
525682	Anchorage, Fishguard Lower Town	ANCHORAGE	Post Medieval
240270	Independence	WRECK	Post Medieval
240285	Cautiose	WRECK	Modern
525681	Landing Place, Goodwick Sands	LANDING POINT	Post Medieval
401338	Goodwick Fish Trap 2	FISH TRAP	Post Medieval
34309	Fishguard Quay	QUAY	Post Medieval
507144	Margaret May	WRECK	Post Medieval
272887	Catherine	WRECK	Post Medieval
272765	I. W. A.	WRECK	Post Medieval
273140	Flora	WRECK	Post Medieval
272968	Osnabruck	WRECK	Post Medieval
272703	Vine	WRECK	Post Medieval
272745	Margaret	WRECK	Post Medieval
525061	Old Quarries, Craig Hesg-Cwm	QUARRY; QUAY	Post Medieval
272747	Queen of Trumps	WRECK	Post Medieval
272974	George and Mary	WRECK	Post Medieval
273117	Princess Louise	WRECK	Modern
544253	Mary	WRECK	Post Medieval
273536	Mary	WRECK	Post Medieval
704003	Goodwick Wreck 2	WRECK	Post Medieval
273008	Rapid	WRECK	Post Medieval
240755	Keel Pin Find, Carreg Wastad	WRECK	Post Medieval
272895	Hopewell	WRECK	Post Medieval
273534	Sally	WRECK	Post Medieval
272656	Dolly	WRECK	Post Medieval
272915	Abeona	WRECK	Post Medieval
272805	Rosa	WRECK	Post Medieval
544241	Martha	WRECK	Post Medieval
273070	Progress	WRECK	Post Medieval
515095	Warrenpoint	WRECK	Post Medieval
273391	Industry	WRECK	Post Medieval
800307	UKHO 10046 (GRAMSBERGEN)	WRECK	20th Century; Modern

525516	Strumble Bank	SEASCAPE	Multiperiod
525680	Cow and Calf, Fishguard Bay	SEASCAPE	Multiperiod
273525	Seaflower	WRECK	Post Medieval
240269	Laura	WRECK	Post Medieval
544387	Britannia	WRECK	Post Medieval
407792	Fishguard Seaplane Base	FLYING BOAT STATION; AIRFIELD	20th Century; Modern
240283	Emlyn	WRECK	Modern
272967	Ann and Mary	WRECK	Post Medieval
272462	Swansea Trader	WRECK	Post Medieval

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