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SCOTTISH MARINE TECHNOLOGY PARK ENVIRONMENTAL IMPACT ASSESSMENT REPORT ADDENDUM SCOPING DOCUMENT

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SCOTTISH MARINE TECHNOLOGY PARK
ENVIRONMENTAL IMPACT ASSESSMENT REPORT ADDENDUM
SCOPING DOCUMENT

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1 Introduction

This Environmental Impact Assessment Report Addendum (EIARA) scoping document has been prepared by Ramboll UK Ltd (Ramboll) on behalf of Malin SPV 2 Ltd (the 'applicant'), to establish the additional environmental assessment required to supplement the existing Environmental Impact Assessment Report (EIAR) prepared by Peter Brett Associates and Stantec in 2019[1] for the proposed development at Scottish Marine Technology Park (SMTP), West Dunbartonshire, Scotland, to support a new licence application to Marine Directorate Licensing Operations Team (MD-LOT).

The information provided within this ESA scoping document has been prepared in accordance with the statutory procedures set out in The Town and Country Planning (Environmental Impact Assessment (EIA)) (Scotland) Regulations 2017[2] and in The Marine Works (EIA) (Scotland) Regulations 2017[3] (collectively referred to as the 'EIA Regulations').

Previously, a marine licence (Ref: MS-00008746) was determined on 27 September 2020 which permitted the removal of the existing jetty and construction of a heavy lift quay. This previous marine licence application was supported by an EIA ('the submitted EIAR'); however the proposed development was previously screened out under the Marine Works (EIA) (Scotland) Regulations 2017, as no interaction with Mean High Water Springs (MHWS) was considered once the sheet-piled quay was in place. The Marine Works (EIA) (Scotland) Regulations 2017 were not engaged by the EIA but were considered to be of indirect relevance. MD-LOT approved this approach within their Screening Decision. The proposed development, including the heavy lift quay, was assessed voluntarily within EIA under The Town and Country Planning (EIA) (Scotland) Regulations 2017.

Since the time of obtaining this marine licence, the design of the proposed development has changed in such a way that warrants further consideration within an EIARA. The term 'revised proposed development' is therefore used hereafter to refer to the marine elements of the proposed scheme, as set out in more detail in Section 3. Owing to the size of the vessels that the proposed development is now confirmed and designed to facilitate, the proposed development is now considered to fall under Schedule 1(24) and Schedule 1 (8(2)) of the EIA Regulations respectively, and therefore EIA is a mandatory requirement. As EIA was previously undertaken ('the submitted EIAR'), an EIARA is deemed the most appropriate way to ensure that the potential environmental effects of the revised proposed development in its current form have been sufficiently and robustly addressed.

For the purposes of this EIARA scoping document, it is considered that the terrestrial elements of the scheme, and therefore the extant planning permissions from West Dunbartonshire Council (WDC) remain unchanged and valid (Ref: DC19/046 and DC23/211/PPP). This includes the planning consent for the site-wide remediation strategy (Ref: DC18/245).

The objectives of the revised proposed development remain as set out within the submitted EIAR, notably to replace the current jetty with a heavy lift quay and ship hoist (the submitted EIAR included a fixed jib crane and so any construction and operational differences are included within this EIARA scoping document), which would facilitate the wider redevelopment of the site as a hub for marine industries on the banks of the River Clyde.

In accordance with the Marine Works (EIA) (Scotland) Regulations 2017, this EIARA scoping document has been produced to:

[1] PBA/Stantec, 2019. Former Carless Oil Terminal, Old Kilpatrick. Proposed Marine Fabrication Complex. EIA Volume 1: Main Environmental Statement. March 2019.
[2] UK Government, 2017. The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017. [Online] Available at: https://www.legislation.gov.uk/ssi/2017/102/contents
[3] Scottish Government, 2017. The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017. [Online] Available at: https://www.legislation.gov.uk/ssi/2017/115/contents/made

- Provide information on the design changes that have been made to the proposed development since the submission of the EIAR; and
- Address whether these design changes have the potential to give rise to any new or materially different significant environmental effects, and if so, setting out the approach to undertake a supplemental assessment of these potential effects.

This EIARA scoping document comprises the following:

- Chapter 1 sets out the origins of this EIARA scoping requirement;
- Chapter 2 sets out the scope and methodology of the EIARA scoping process;
- Chapter 3 summarises the design changes that would form part of the subsequent marine licence application, supported by the EIARA;
- Chapter 4 addresses whether the design changes would give rise to any new or materially different environmental effects that have the potential to be significant and provides the methodology for any supplemental assessments considered to be required;
- Chapter 5 summarises the topics scoped out of further assessments within the EIARA; and
- Chapter 6 provides a summary of this EIARA scoping process.

This EIARA scoping document has been produced by Ramboll and a team of competent experts in accordance with Marine Works (EIA) (Scotland) Regulations 2017 and best practice guidelines including, the Institute of Environmental Management and Assessment (IEMA) Quality Mark scheme.

2 Scope and Methodology

As previously set out, the scope of this EIARA scoping document is to:

- address whether the design changes would give rise to any new or materially different environmental effects that have the potential to be significant;
- if so, set out the approach to undertake a supplemental assessment to address these potential effects; and
- provide an update to the conclusions of the submitted EIAR.

The potential for new effects to arise is considered in the context of the parameters assessed in the submitted EIAR.

The following steps have been undertaken.

Step 1 – Design changes (Chapter 3)

All design changes from the previous marine licence application were considered in the context of the submitted EIAR parameter plans and qualitative descriptions. Design changes that were considered to be outside of the parameters assessed in the submitted EIAR were also identified.

Step 2 - Consideration of additional environmental effects (Chapter 4)

A preliminary assessment of the significance of potential environmental effects that could arise as a result of the design changes identified in Step 1 in order to decide whether these warrant consideration in the EIARA. The likely significance of any effect has been preliminarily assessed in terms of the relationship between two factors:

i. The magnitude of the potential impact (including direct or indirect effects), including the consideration of duration and reversibility; and

ii. The importance of the receptor (the entity that is vulnerable to the effect), in terms of its value and sensitivity to the effect.

Step 3 – Proposed approach to supplemental assessment (Chapter 4 and Chapter 6)

For any potentially significant effects identified in Step 2, the proposed approach and methodology for supplemental assessment has been set out, to include:

- The assessment methodology and relevant industry-specific guidance that would be used to inform significance of effects;
- Survey requirements; and
- An early indication of the types of mitigation and enhancement measures that could be implemented, if required.

3 Proposed Development and Summary of Design Changes

3.1 Revised Proposed Development

For clarity a full summary of the revised proposed development is provided here, setting out the proposed construction phasing for the quay infrastructure and dredge requirements.

The revised proposed development will be constructed in three phases as follows:

Phase 1

- Demolition of existing concrete and steel jetty;
- Construction of finger jetty immediately upstream of the existing structure approximately 4.75 m in width to support the mobile ship hoist operations. The finger jetty is anticipated to comprise a pre-cast and *in situ* concrete deck supported on impact driven and rotary drilled steel piles;
- Creation of a ship hoist inlet basin, approximately 16.75 m in width, to facilitate ship hoist operations when required in the future;
- Construction of a heavy-lift quay with a berthing face of approximately 44 m anticipated to comprise a tied retaining wall structure. The main retaining wall will comprise a tubular steel piled retaining wall structure with impact driven steel piles. Rotary drilling would be implemented when obstructions were encountered. Fill will be placed behind the wall and compacted using rapid impact compaction;
- Creation of a working apron for landside operations adjacent to the heavy lift quay area, consisting of unbound crushed rock surfacing. This will allow surface to be topped up and regraded as necessary to accommodate settlement in the first few years of use. If desired, the crushed rock surfacing could be replaced by concrete paving once the majority of settlement has occurred;
- Installation of 4 to 6no. mooring bollard foundations on the riverbank upstream and downstream of the quay;
- Creation of a steel sheet-piled perimeter boundary to the quayside to support remediation of area within the boundary. Material to be excavated and replaced within an area of at least 2,700 m^2 (15 m x 180 m). Excavated material will be remediated on the wider Malin site. Replacement material will be either treated material from elsewhere on the site or will be imported fill;
- Sheet-piled wall along extent of waterfront and existing jetty to stabilise the area and to prevent contaminant migration from the site;
- Excavation dredge of seabed along the berthing face of Phase 1 infrastructure to ~-4 to -5 m Chart Datum (CD) using long-arm excavator from land, to facilitate underkeel clearance. This would return the site back to the dredge depth when previously operational and would not extend below the level of the existing revetment. The excavated material is anticipated to be reused within the wider SMTP site redevelopment (as consented under DC19/045) to assist in the raising of the ground level, if the material is deemed suitable following contamination testing.

The construction sequence for Phase 1 is anticipated to comprise the following:

1. Demolish existing jetty as required;
2. Install sheet pile retaining wall;
3. Install main wall (tubes and sheet infill) using marine plant;
4. Excavate soft material behind quay;
5. Fill with granular material to tie level and compact;
6. Install anchor wall and ties;
7. Fill to underside of running surface and compact;

8. Construct capping beam;
9. Place and compact crushed rock running surface; and
10. Excavation dredge from the jetty of area surrounding new quay.

Construction of Phase 1 is anticipated to require 12 months to complete.

Phase 2

- Construction of approximately 81 m extension to the heavy lift-quay downstream of the Phase 1 infrastructure. The quay extension is anticipated to consist of the same design as the Phase 1 quay and construction of a tubular steel piled retaining wall structure with impact driven steel piles. Rotary drilling would be implemented when obstructions were encountered. The line of the completed Phase 2 berthing face of the heavy lift quay will be parallel to that of the existing jetty but set up to 5m further forwards into the river.
- Excavation dredge along the berthing face of Phase 2 infrastructure to ~-4 to -5 mCD using long-arm excavator from land, to facilitate underkeel clearance. This would return the site back to the dredge depth when previously operational and would not extend below the level of the existing revetment. The excavated material is anticipated to be reused as part of the wider redevelopment of the SMTP site (as consented under DC19/045) to assist in the raising of the ground level, if the material is deemed suitable following contamination testing.

The construction sequence for Phase 2 is anticipated to comprise the following:

1. Install main wall (tubes and sheet infill) using marine plant;
2. Excavate soft material behind quay;
3. Fill with granular material to tie level and compact;
4. Install anchor wall and ties;
5. Fill to underside of running surface and compact;
6. Construct capping beam;
7. Place and compact crushed rock running surface; and
8. Excavation dredge of area surrounding new quay.

Construction of Phase 2 is not yet fully understood but is anticipated to require approximately 12 months to complete.

Phase 1 and Phase 2 are anticipated to be constructed sequentially, with works taking place as summarised above. Demolition works will take place during Phase 1.

Future Dredge Phase

- To facilitate the overarching objectives for the SMTP site, a pocket dredge of the riverbed surrounding the Phase 1 and Phase 2 infrastructure is anticipated to be required in the future. The dredge extents are subject to confirmation but at this stage the berth pocket is anticipated to be dredged to -8 mCD to align with the existing river bathymetry, which is considered to be a worst case depth. Sheet pile retaining wall features are required to stabilise the river frontage as part of the dredge activity. Indicative extents are shown in Figure 4, but are subject to detailed design.
- As previously outlined, the excavated material may be reused on site to assist in the raising of the ground level as part of the wider redevelopment of the SMTP site as consented, if the material is deemed suitable following contamination testing, and if the wider SMTP site has not been completed. Should the future dredge phase take place at a time that the wider SMTP works have been completed, the excavated material will be disposed of off-site.
- No maintenance dredging is anticipated at this stage.

The future dredge phase is anticipated to comprise dredging and stabilisation works along the river edge as indicated within the revised proposed development layout figure shown in Figure 2. Stabilisation is anticipated to require piling.

The timings of the future dredge phase are not yet confirmed, as it is dependent on the operational requirements of the new quay infrastructure, however it is anticipated that the future dredge phase will be undertaken in one of the following scenarios:

i. The future dredge occurs as part of Phase 2 construction, with any piling works to stabilise the riverbank taking place during Phase 2 works. Dredge arisings are assumed to be incorporated into the terrestrial site works for the wider SMTP site; or

ii. The future dredge occurs separately after Phase 2 completion, and it is assumed that dredge arisings will need to be disposed of appropriately off-site.

Where there is uncertainty relating to elements of the proposed development, worst-case assumptions will be made within the EIARA.

Consent for all phases of works is being sought at this time from MD-LOT, with a ground investigation (including an agreed sediment sampling plan) being undertaken for Phase 1 only. Once the option and requirement for future dredging is established, we would like to consult MD-LOT on the potential consenting mechanisms for the future dredging, noting the uncertainties around disposal. Potential approaches the consenting mechanism may include the inclusion of an appropriately worded condition to allow sediment sampling, appropriate testing and Best Practicable Environmental Option (BPEO) report to be undertaken post-determination.

Concept Design Development

The concept design to date has been developed from three initial conceptual design options which were refined further as applicant requirements for the proposed development evolved. At this stage of the concept design, three potential construction methods for the quay were identified including:

- Steel piled anchored retaining wall;
- Suspended deck over revetment; and
- Double walled steel piled.

There were two key assumptions used during the additional options development which were as follows:

- Quay level was set at +5.27 m Ordnance Datum (OD) (+7.40 mCD). This level matches the minimum floor levels for 'water compatible' buildings and +6.23 mOD otherwise); and
- The extent of seabed required to construct a steel piled anchored retaining wall exceeds the applicant's current ownership, but an application to purchase the additional Crown Estate seabed required has been submitted.

A limited Site Investigation (SI) was undertaken previously to inform the concept design and indicated that piles will need to be driven through stiff ground, and that the presence of some boulders with the glacial deposits was noted. Therefore, while piles will primarily be driven using an impact hammer, down hole drilling ('drive-drill-drive' method) may be required.

3.2 Summary of Design Changes

Change to Red Line Boundary

The redline boundary for the proposed development differs from that of the submitted EIAR to account for the design changes that are set out later in this section and is provided in Figure 1. For completeness, the red line boundary encompasses the boundary as provided within the submitted EIAR alongside any extension required to cover the footprint and working areas for the revised proposed development.

Figure 1: Site Boundary for the Revised Proposed Development

Changes to Design

- Length of quay and design vessels

The proposed development would replace the current life-expired jetty with a new quay approximately 146 m long, incorporating an inset basin to facilitate the operation of a 1000 tonne capacity ship hoist. This basin would effectively divide the quay into a 125 m long heavy lift quay, ship hoist basin and finger jetty. The new quay has been designed to accommodate vessels/barges of up to 137 m length overall (LOA), which was not confirmed as part of the submitted EIAR, shown in Figure 2.

- Demolition Plan

The submitted EIAR demolition encompassed the majority of the jetty except for the southern pier and the northern two piers as shown in Figure 3. Whereas the current demolition proposal, where the jetty tubular piles are to be cut off at bed level, encompasses the entirety of the jetty noting that the northern two piers may remain as part of the Phase 1, with demolition in Phase 2. The existing jetty would be all demolished and replaced as part of the phased construction of the quay. See Figure 3.

- Jetty Location

The submitted EIAR proposed jetty and heavy lift quay encompass the third and fourth cells of the existing jetty footprint in a north-south direction for the jetty, whereas the current proposal for a sheet piled anchored retaining wall jetty and heavy lift quay will encompass the fourth cell and include the construction of a finger pier for the heavy lift quay within the original jetty footprint of the existing southern pier.

- Inclusion of a Dredge Pocket

The submitted EIAR did not include the requirement for a dredge pocket as part of the proposed development. Due to the confirmed size of the design vessels and the required underkeel clearance, a total pocket dredge of a maximum of -8 mCD to align with the depth of the main navigable channel is now included within the proposed development. Smaller excavation dredges would be undertaken after the completion of Phase 1 and Phase 2 to remove sediment from the areas surrounding the quay infrastructure to approximately -4 to -5 mCD using a long-arm excavator from land. The dredge activity would be undertaken in phases as per the sequencing set out in Section 3.1, Figure 4 shows the proposed dredge plan.

Figure 2: Previous (left) and Revised (right) General Arrangement

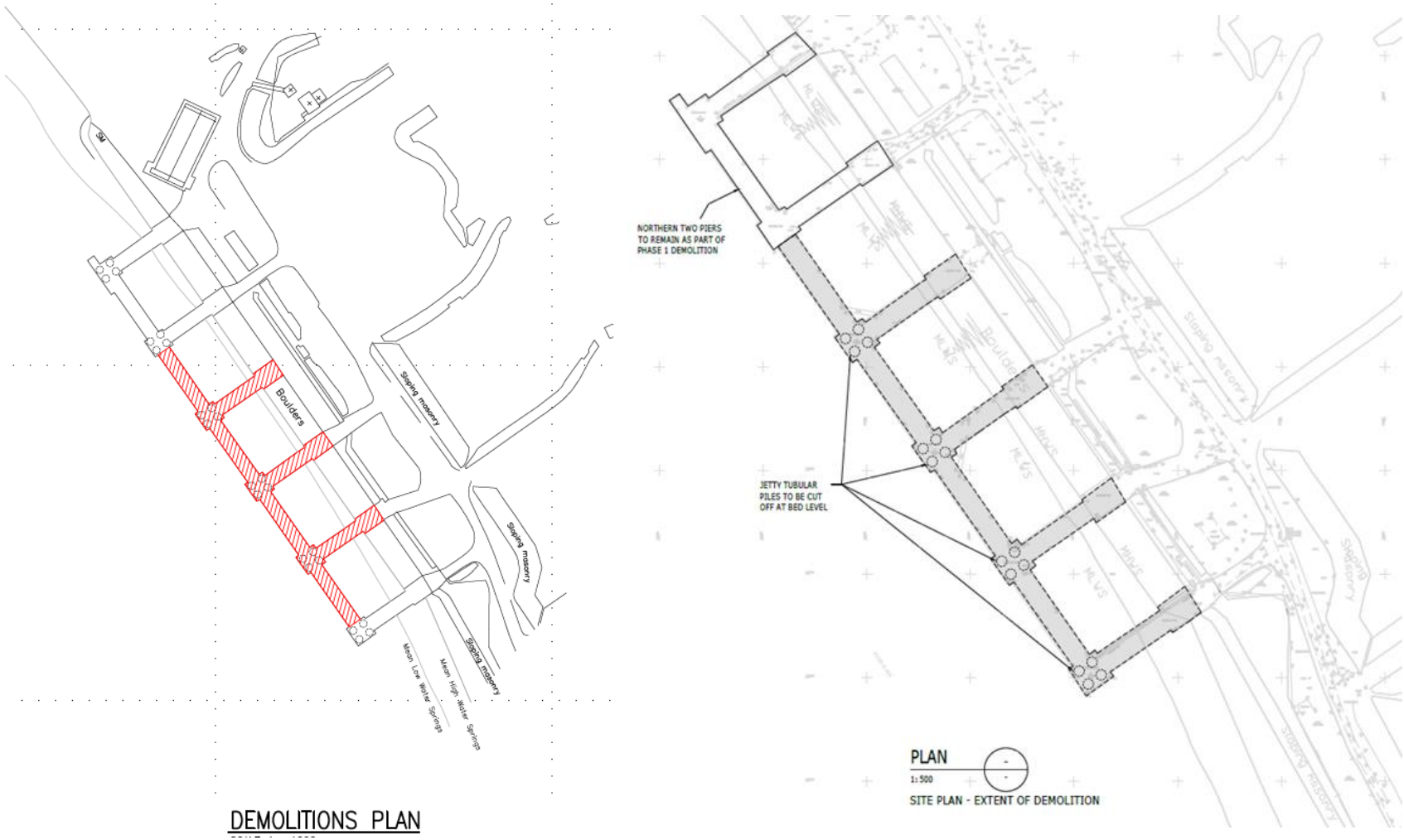


Figure 3: Previous (left) and Current (right) Demolition Plans. Note that the northern two piers could remain until Phase 2 demolition.

Figure 4: Proposed Dredge Extent

Summary

In summary, the following design changes outlined above are considered to be outside of the parameters assessed in the submitted EIAR, and therefore the potential for significant environmental effects associated with these design changes is considered in Chapter 4.

- The southern pier of the jetty is now to be demolished as part of the Phase 1 demolition works and replaced with a new finger pier;
- The repositioning of the Phase 1 new jetty section;
- A pocket dredge of the riverbed surrounding the Phase 1 and Phase 2 infrastructure to approximately -4 or -5 mCD and the future dredge pocket to -8 mCD were not assessed in the submitted EIAR; and
- The proposed development will be approximately 146 m long, which incorporates an inset basin to facilitate the operation of a 1000 tonne capacity ship hoist. This basin effectively divides the quay into a 125 m long heavy lift quay, ship hoist basin and finger jetty. The new quay has been designed to accommodate vessels/barges of up to 137 m LOA.
    - Vessels that would use the revised proposed development would be approximately 2,200 – 6,200 tonnes (deadweight)
    - Barges that would use the revised proposed development would be approximately 22,000 tonnes (deadweight)

The proposed development now requires an EIA in accordance with Schedule 1 (8(2)) of the Marine Works (EIA) (Scotland) Regulations 2017 as the new quay will be able to accommodate vessels of over 1,350 tonnes.

4 Potentially Significant Environmental Effects

The subsequent sections set out the baseline, relevant sensitive receptors, potential effects that could arise, and an indication of mitigation and enhancement measures that could be implemented for the revised proposed development. Where effects are 'scoped in' for assessment as part of the EIARA, the proposed approach and methodology for any potentially significant environmental effects is also provided.

4.1 Air Quality and Odour

The main air pollutants of concern would be dust and particulate matter with an aerodynamic diameter of less than 10 µm (PM_{10}), typically generated during demolition and construction activities and from industrial sources, and nitrogen dioxide (NO_2), PM_{10} and particulate matter with an aerodynamic diameter of less than 2.5 µm ($PM_{2.5}$), typically generated by road traffic and vessel operations.

Baseline

The immediate vicinity of the site is a mixture of industrial, commercial, residential, and recreational uses. The closest residential properties are located along Dumbarton Road approximately 250 m north of the site. Baseline air quality is likely to be primarily influenced by emissions from local road traffic, as well as vessel emissions operating along the River Clyde.

The site is not located within an Air Quality Management Area (AQMA); the nearest AQMA is located approximately 5.5 km south-east of the site in Renfrew. WDC undertake monitoring of NO_2 at a total of 39 automatic monitoring and diffusion tubes sites. Particulate matter (PM_{10} or $PM_{2.5}$) is only monitored at one location, there is no SO_2 monitoring undertaken by WDC (as concentrations are unlikely to breach National Air Quality Strategy Objectives).

Annual mean NO_2 concentrations have decreased over time at the monitoring locations closest to the site. The annual mean NO_2 concentrations were well below the national air quality objectives (NAQO) between 2018 and 2022. Annual mean NO_2 concentrations remained below pre-pandemic levels at monitoring sites in 2022.

WDC monitoring of PM_{10} and $PM_{2.5}$ approximately 2.9 km north-east of the site shows there were no exceedances of the PM_{10} or $PM_{2.5}$ NAQOs at monitoring sites in WDC between 2018 and 2022.

Sensitive Receptors

The closest human health receptors to the site include residential properties north-east of Dumbarton Road, located approximately 250 m from the site boundary.

The closest ecological receptors to the site include the Inner Clyde Special Protection Area (SPA), Ramsar and Site of Special Scientific Interest (SSSI), which are located adjacent to the north-west site boundary and on the south-west bank of the river Clyde.

Potential Impacts and Likely Effects

The additional potential impacts and likely effects that could arise are:

- Change in NO_2, PM_{10} and $PM_{2.5}$ concentrations at human health receptors due to road traffic emissions during construction associated with off-site disposal of dredge arisings;
- Change in NO_2, PM_{10} and $PM_{2.5}$ concentrations at human health and NO_X ecological receptors due to vessel emissions during dredging;
- Increase in odour from dredging activities; and
- Change in NO_2, PM_{10} and $PM_{2.5}$ concentrations at human health and NO_X ecological receptors due to vessel emissions during operation.

Table 1 presents a summary of the scoping process, identifying which likely environmental effects, with respect to air quality, will be assessed in the EIARA (i.e. considered potentially significant and therefore 'scoped in') and those which will not be assessed further (i.e., 'scoped out'), along with a justification for this decision.

Table 1: Scoping of Potential Environmental Effects Relating to Air Quality

Potential Effect	To be assessed in the EIARA (Yes/No)	Reason
Demolition and Construction Stage		
Increased NO_2, PM_{10} and $PM_{2.5}$ concentrations at human health receptors from road traffic emissions during construction associated with off-site disposal of dredge arisings	No	Annual average daily traffic movements during the peak demolition and construction phase are likely to be well below the EPUK/IAQM[4] indicative criteria for requiring an air quality assessment for road traffic emissions. Construction traffic impacts on human health receptors in the area would be temporary and are not considered to be significant.
Increase NO_2, PM_{10} and $PM_{2.5}$ concentrations from vessel emissions at human health receptors	No	Small number of vessel movements are expected during demolition and construction and there will be no relevant human exposure within 250 m of any areas of manoeuvring. Therefore, it is unlikely significant effects would arise.
Increase in odour from dredging	No	Odour emissions associated with dredging activities and reuse of dredged material onshore may give rise to annoyance, however relevant human exposure is considered unlikely due to the distance to sensitive receptors and therefore odour nuisance effects are considered to be negligible. Sensitive human health receptors are not located within 250 m of the proposed dredging and piling activities. Therefore, any effects are not considered to be significant.
Operational Stage		
Increase NO_2, PM_{10} and $PM_{2.5}$ concentrations from vessel emissions at human health receptors	No	Operational stage marine vessel activity is considered to be minimal and would increase as the landside development becomes fully operational. A small number of vessels are anticipated to use the jetty when operational. Current activity on the River Clyde from commercial vessels is low. In addition, any ships berthed at a UK port must switch to fuel with a sulphur content of 0.1% or less while loading,

[4] Moorcroft and Barrowcliffe, 2017. Land-Use Planning and Development Control: Planning for Air Quality. EPUK/IAQM, v1.2.

Potential Effect	To be assessed in the EIARA (Yes/No)	Reason
		unloading or hotelling. Relevant human exposure (at sensitive receptors) within 250 m of the berths and main areas of manoeuvring is unlikely due to the distance between the site and these receptors. Emissions from marine vessels are therefore unlikely to have a significant effect at sensitive receptor locations during operation.

The impacts of operational stage vehicle emissions on air quality at sensitive human and ecological receptors were assessed in the submitted EIAR and PPiP[5] and found to be not significant. These findings remain valid as annual average daily traffic (AADT) flows associated with operation of the proposed development are unlikely to exceed those assessed in the submitted EIAR and PPiP EIAR (an increase of over 500 AADT along several roads).

Preliminary Discussion of Mitigation and Enhancement

The demolition and construction stage would be undertaken in line with industry best practice with regards to the management of construction sites as set out within a Construction Environmental Management Plan (CEMP). An outline CEMP would be prepared to support the marine licence application, and an appropriately worded marine licence condition would secure the production of a final/detail CEMP (once a contractor is appointed) to be agreed with MD-LOT prior to works commencing.

[5] Stantec, October 2023, Scottish Marine Technology Park PPiP Masterplan Environmental Impact Assessment Report

4.2 Major Accidents and Disasters

The Marine Works (EIA) (Scotland) Regulations 2017, specifically Regulation 4(4) state that "The effects to be identified, described and assessed… include the expected effects deriving from the vulnerability of the development to risks, so far as relevant to the development, of major accidents and disasters" should be provided within the EIAR. There is no recognised guidance on the assessment of major accidents and disasters. However, the Institute of Environmental Management and Assessment (IEMA) provides guidance on the approach to major accidents and disasters assessments[6].

The vulnerability of the proposed development to relevant major accidents is considered within this section. Major accidents are events (accidental or deliberate) that threaten human health, welfare and/or the environment beyond reasonable management. These events can be caused by both natural and man-made hazards. Natural hazards are categorised as geophysical, hydrological, climatological, meteorological, and biological. In addition to the assessment of vulnerability, the potential for the proposed development to introduce a new risk source, or to increase the risk of surrounding infrastructure to a major accident is also considered.

All demolition, construction and operational activities will be subject to stringent controls and regulatory oversight under existing safety and environmental legislation. It should be noted that major accidents as assessed in this chapter are considered to be low likelihood, high consequence events.

Baseline

The site is not located within a geographical region that has historically been subject to natural disasters.

Due to past usage of the site, significant hydrocarbon contamination is known to be present in areas of the site. This creates a risk of mobilisation of free phase hydrocarbon contamination during the demolition and construction stage as a result of the creation of a pollutant pathway to the River Clyde. There is additional known risk of unexploded ordnance (UXO) within and around the site – previous reports[7] prepared to inform previous ground investigations at the site indicate a likely risk of UXO dating from the Second World War within the site and immediate surroundings.

There is not a Control of Major Accident and Hazard (COMAH) establishment on the site however, adjacent to the site is Dalmuir Bulk Warehouse[8] operated by Chivas Brother Ltd a COMAH regulated site which presents an additional risk as it stores 'Flammable liquids and gases' onsite.

Potential Impacts and Likely Effects

The following sensitive receptors have been identified:

- All living receptors and infrastructure located within the site and surrounding area during the demolition and construction stage; and
- All living receptors and infrastructure located within the site and surrounding area during the completed development stage.

Table 2 presents a summary of the scoping process, identifying which likely environmental effects, with respect to major accidents and disasters, will be assessed in the EIARA (i.e. considered potentially significant and therefore 'scoped in') and those which will not be assessed further (i.e., 'scoped out'), along with a justification for this decision.

[6] IEMA, 2020. Major Accidents and Disasters in EIA: A Primer, online. Available at: https://www.iema.net/content/major-accidents-and-disasters-in-eia-an-iema-primer-october-2020/#:~:text=Major%20accidents%20and%20disasters%20should%20be%20considered%20as,cannot%20be%20restored%20through%20minor%20clean-up%20and%20restoration.

[7] Zetica Ltd, 2013. SiteSafe Unexploded Ordnance Desk Study Report

[8] COMAH, 2015. Public Information, online. Available at: https://notifications.hse.gov.uk/COMAH2015/PublicInformation.aspx?piid=3349 [Accessed: 14/10/2024]

Table 2: Potential Environmental Effects Relating to Major Accidents and Disasters

Potential Effect	**To be Assessed in EIARA (Yes/No)**	**Reason**
Demolition and Construction Stage		
Water Contamination and Release of Contaminants	No	The site has protocols in place to address water contamination events and all users of the site adhere to these procedures. Prior to any works starting a Remediation Scheme should be in place to address Condition 2 of Planning permission DC18/245. The demolition and construction stage would also be implemented under an appropriately worded condition to secure the finalisation and implementation of a CEMP to manage any risks associated with the release of contaminants. Effects associated with dredging are addressed as part of the Marine Water and Sediment Quality section.
Operational Stage		
Severe Weather – Storms	No	The proposed development is considered to be resilient to storms through the implementation of design standards with an inclusion of climate change allowances that accommodate for greater storm events in the future. Strong winds associated with storm events will be factored into the design of the proposed development in respect of structural integrity and appropriateness of any above deck features.
Floods	No	The proposed development is required to be water compatible and therefore resilient to flooding through the implementation of design standards with an inclusion of climate change allowances that accommodate for greater flooding in the future.
Water Contamination and Release of Contaminants	No	Once operational, the site is considered to have been remediated under the Remediation Scheme as part of Condition 2 of Planning Permission DC18/245. Vessels using the site would operate under existing and well-established protocols to address water contamination events and all users of the site adhere to these procedures.
Marine Transport Accidents	No	Marine transport accidents are managed through the implementation of safety protocols as required by the Harbour Authority. Safety protocols are well-established and are considered effective to manage to transport accidents. Navigation risks during both the demolition and construction stage and the completed development stage will be addressed – see Navigation section. Terrestrial transport accidents associated with other road networks are not considered to affect the revised proposed development.

Potential Effect	To be Assessed in EIARA (Yes/No)	Reason
Fire Risks and Explosives	No	The site operates under all required Fire Safety and HSE requirements, and the adjacent COMAH Site (Dalmuir Bulk Warehouse[9] operated by Chivas Brother Limited which stores 'Flammable liquids and gases' onsite) is also considered to operate under these regulations to demonstrate compliance with the relevant UK laws and COMAH Regulations. Urban fires will be mitigated through appropriate design of any buildings in accordance with Building Regulations and relevant safety guidance, in addition to the established 999 emergency response procedures in place in Glasgow. These measures will remain in place for the proposed development and are considered to provide resilience to the threat of fire.

Approach and Methodology

No additional effects associated with major accidents and disasters have been identified. To address any effects associated with construction site management, an outline CEMP would be prepared to support the marine licence application, and an appropriately worded marine licence condition would secure the production of a final/detail CEMP (once a contractor is appointed) to be agreed with MD-LOT prior to works commencing.

[9] COMAH 2015 Public Information. Available at: https://notifications.hse.gov.uk/COMAH2015/PublicInformation.aspx?piid=3349 (Accessed 14th October 2024)

4.3 Marine Archaeology and Cultural Heritage

Baseline

Study Area

The general topic themes relevant to marine archaeology and cultural heritage are:

- Palaeogeography (for example, palaeochannels and other features that contain prehistoric sediment, and derived prehistoric artefacts such as handaxes) including their setting.
- Seabed/Riverbed features including:
    - Maritime / riverine sites (such as shipwrecks and associated material including cargo) including their setting;
    - Aviation sites (aircraft crash sites and associated debris) including their setting; and
    - Historic terrestrial debris found in a marine context.
- Extant and remains of demolished historic port infrastructure including wharves and jetties and other maritime and riverine structures such as navigational assets.
- The historic seascape character (HSC) in and around the marine archaeology and cultural heritage study area.

The archaeological themes above relate to the known and also the currently unknown marine archaeological resource.

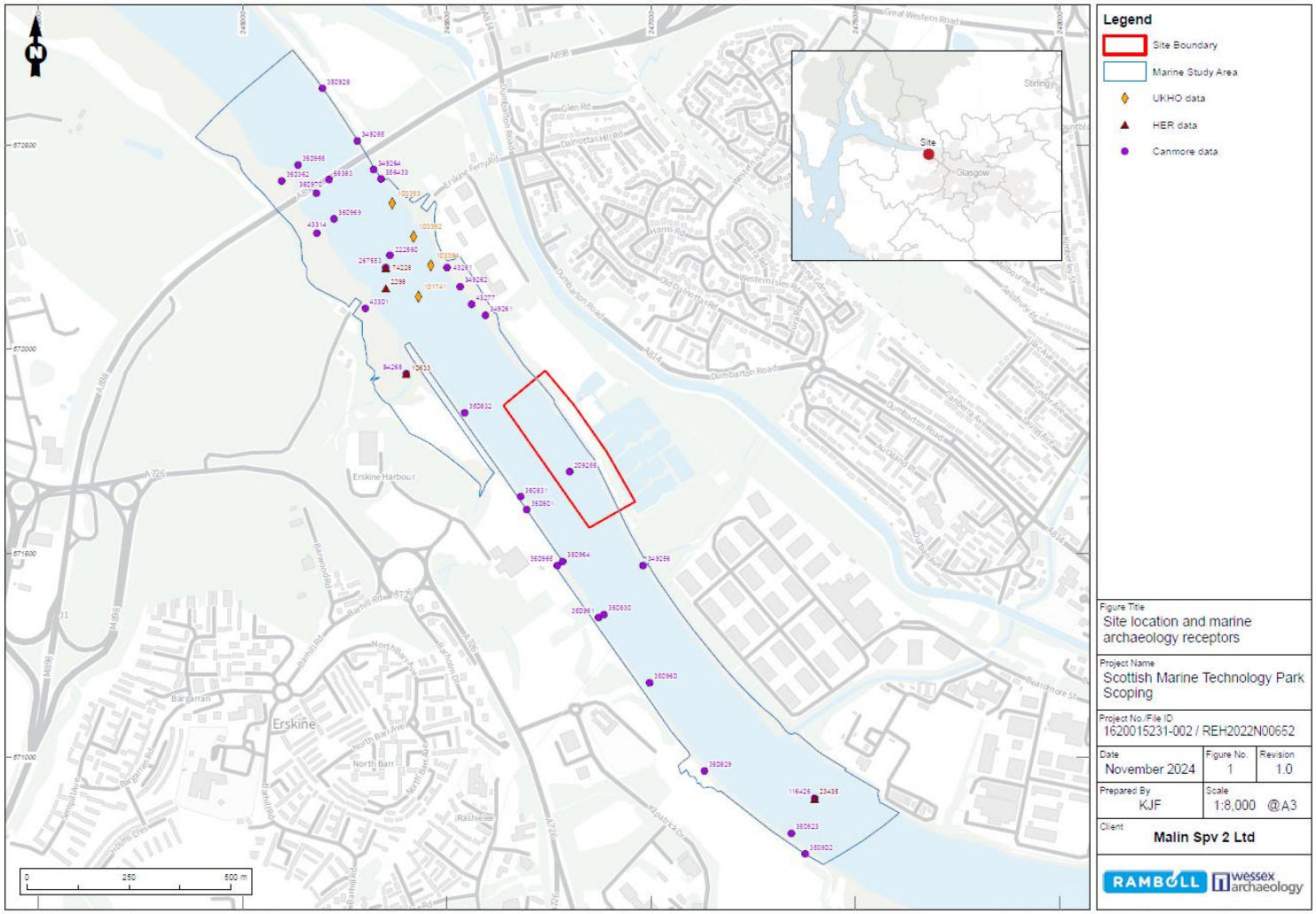
Data Sources

For the purposes of this section, the baseline of known heritage assets within the marine archaeology and cultural heritage study area has been obtained from:

- The United Kingdom Hydrographic Office (UKHO), which comprises data for charted wrecks and obstructions.
- Canmore, the National Record of the Historic Environment for Scotland, maintained by Historic Environment Scotland, which contains records for both designated and undesignated maritime heritage.
- The West Dunbartonshire Historic Environment Record (WDHER), maintained by West of Scotland Archaeological Service (WoSAS), which contains records for both designated and undesignated maritime heritage.
- The Old Kilpatrick to the Titan Crane sub-section of the Inner Firth of Clyde Assessment of Seascape Areas, within the Firth of Clyde Marine Spatial Plan, which sets out the current seascape assessment of the study area.
- British Geological Survey (BGS) GeoIndex Offshore, which contains geological bedrock and superficial deposits mapping covering the study area.
- Admiralty charts, maintained by the UKHO, which contains further information on the maritime seascape of the study area.

Known Marine Archaeological Baseline

The distribution of the known heritage receptors is illustrated in Figure 6.



Note: this figure depicts a red line for the revised proposed development footprint area only

Figure 5: Marine Archaeology Receptors

Protected Sites

Wrecks and other marine archaeology and cultural heritage receptors may be protected under the Protection of Military Remains Act 1986, the Ancient Monuments and Archaeological Areas Act 1979 or the Marine (Scotland) Act 2010, and some of these are marked on appropriate UKHO Admiralty Charts. Interference or damage to these wrecks is considered a criminal offence. If there were any aircraft material from crashed military aircraft identified within the marine archaeology and cultural heritage study area, it would automatically be legally protected under the Protection of Military Remains Act 1986.

There are currently no sites within the marine archaeology and cultural heritage study area that are subject to statutory protection (or designation) from these acts.

Palaeogeography

Sea levels within the Firth of Clyde have varied during the Quaternary period, with sea levels rising initially after the end of the last Pleistocene ice age and then gradually retreating during the Holocene as isostatic rebound allowed the land mass of western Scotland to rise. One of Scotland's earliest sites of human occupation has been recorded at Howburn in South Lanarkshire[10] and is thought to be evidence of later upper Palaeolithic people following the reindeer herds around what is now northern Britain. The Clyde valley would have been a major route of migration and seasonal movement from the North Sea basin via the Tweed into the west and north of Scotland, as evidenced by other early sites within Argyll, such as Kilmelfort Cave[11] and Rubha Port an t-Seilich in Islay[12].

Areas on the southern bank of the inner Clyde around Renfrew may have been submerged or part of an extensive bog for much of prehistory[13], creating a wide area of wetlands and riverine environments. These were ecologically rich landscapes which were attractive to early peoples during the Mesolithic, people known to have used early watercraft to travel coasts and rivers, for example using logboats, examples of which have been found within the area and discussed in the maritime archaeology section. The study area itself is likely to have been submerged for much of this early period, however there is evidence for sea levels to have been lower than present during later prehistory and Roman period, before slowly rising to present levels[14]. The presence of settlement activity within what is now the intertidal zone to the west of the proposed development is discussed in the intertidal archaeology section.

Maritime Archaeology

Four obstructions (UKHO 101741, 103392 – 10394) recorded within the UKHO dataset are present, outwith the revised proposed development, but within the wider study area to the north-west between the two ends of the former Eskine Ferry. These may relate to beacons or other river infrastructure, to remains of the landing jetties for the ferry or may be wreck remains. The Canmore dataset includes locations for some of the beacons, which are discussed below in the intertidal section, as well as one record in the vicinity of Erskine Ferry for the wreck of a 19th century smack

[10] Ballin, T B, Saville, A, Tipping, R, & Ward, T (2010) 'An Upper Palaeolithic Flint and Chert Assemblage from Howburn Farm, South Lanarkshire, Scotland: First Results'. *Oxford Journal of Archaeology* 29(4), 323-360.

[11] Saville, A, & Ballin, T B (2009) 'Upper Palaeolithic evidence from Kilmelfort Cave, Argyll: a re-evaluation of the lithic assemblage'. *Proceedings of the Society of Antiquaries of Scotland* 139, 9-45.

[12] Mithen, S, Wicks, K, Pirie, A, Riede, F, Lane, C, Banerjea, R, Cullen, V, Gittins, M, & Pankhurst, N (2015) 'A Lateglacial archaeological site in the far north-west of Europe at Rubha Port an t-Seilich, Isle of Islay, western Scotland: Ahrensburgian styled artefacts, absolute dating and geoarchaeology'. *Journal of Quaternary Science* 30(5): 396–416.

[13] Boyd, W E (1982) 'Archaeological implications of a new palaeoenvironmental model for part of the. Ayrshire coast', *Glasgow Archaeological Journal* 9, 15-17

[14] Tipping, R & Tisdall, E (2005) 'The landscape context of the Antonine Wall: a review of the literature' *Proceedings of the Society of Antiquaries of Scotland* 135: 443–469

(Canmore 267553), recorded to be the *Margeret* which sank after a collision with the steamer *Ailsa* in January 1879.

Antiquarian finds of logboats and similar dugout canoes have been made along the Clyde, demonstrating its importance as a transport route and as an area for exploitation of marine and riverine resources[15]. Two of these were recovered from the area of the Eskine ferry: the first on the north side of the river in 1854 (Canmore 43301) which proved to be a complex transomed example with large quantities of information on repair and construction; and the second in 1977 from the southern side of the Clyde close to Bottombow island (Canmore 84268) which had a unique-to-Scotland possible oarlock on one side. Neither of these have survived but both demonstrated a high degree of significance in understanding prehistoric vessel construction and use. A third was identified in 1903 during construction of the Dalmuir Sewage Purification Works c. 500 m to the south-east of the proposed development (Canmore 116426).

Aviation Archaeology

No records related to aviation receptors have been identified; however, the area was subjected to the Clydebank Blitz in March 1941 and the area had multiple primary targets for German bombers outside of these two specific raids. The airfields of Abbotsinch (now Glasgow Airport) and Renfrew were shared between the RAF and Fleet Air Arm during World War Two, largely as training and maintenance depots. There was a temporary airfield (Canmore 331316) located as part of the Beardmore Works to the east of the proposed development during World War One, where aircraft of various types were assembled and flown off to the testing airfield at what has become Glasgow Airport.

Intertidal archaeology

Prehistoric archaeology receptors in the study area are split between the logboat examples discussed above in the maritime section and settlement evidence which include the location of a crannog (Canmore 43277) and a souterrain (Canmore 43281) which were discovered in the early 19th century in the intertidal zone during the construction of the Napier and Wilson shipyard. These features were entirely removed by this construction but demonstrate the potential for prehistoric settlement along the edge of the Clyde. A Roman coin found during the excavation for piers for the Erskine Bridge (Canmore 43308) may have been brought in with the made ground material it was found within.

Records related to the Erskine ferry (Canmore 222560) between the two banks of the Clyde and its associated infrastructure are present outwith the proposed development to the north, with a quayside/slipway on the north bank (Canmore 350260), a jetty on the south bank (Canmore 43314) and cottages for the workers (Canmore 349263 and 197647).

The vast majority of receptors identified within the study area are the locations of former beacons along both sides of the Clyde, with three being present along MHWS within the footprint of the proposed development (south – north Canmore 349259, 349260 and 350926) and a further five outwith the proposed development boundary but within the study area (one south of the proposed development- Canmore 349256 and four north of it- Canmore 349261, 349262, 356433 and 359264). These are generally matched by beacons in similar positions on the south bank of the Clyde. These were all mapped from the 1st edition of the OS 25-inch map, and it is noted that no visible remains can currently be seen. Reworking of the north bank of the Clyde in the late 19th century saw the addition of a stone-faced embankment, which in turn was later at least partially removed by the development of the Mountblow naval fuel oil tank farm (Canmore 105838) and its concrete jetty for tankers which is within the intertidal zone. There may be some material related

[15] Mowat, R (1996) *The Logboats of Scotland*. Oxbow Monograph 68. Oxbow Books, Oxford.

to these features buried beneath the remains of the tank farm, and the jetty itself is part of the military heritage of the Clyde.

Marine Archaeological Potential

In addition to the known recorded sites located within the marine archaeology and cultural heritage study area, there is also the potential for the presence of the following archaeological remains:

- Palaeogeographic features dating from the later upper Palaeolithic onwards such as palaeochannels and other Quaternary geomorphology (and associated sedimentary records of palaeoenvironmental interest) of the River Clyde and their exploitation by animals and humans.
- Maritime craft dating from the Mesolithic to the modern period and associated ship related debris and artefacts. Post-medieval and modern wrecks, as they were generally made of more substantial material, are more likely to have been discovered following surveys undertaken by the UKHO and others, and thus recorded in the archaeological record. However, there is still potential for the discovery of previously unrecorded wreck sites, particularly of wooden wrecks, broken up wrecks or partially buried wrecks that are more difficult to detect through surveys undertaken by the UKHO.
- Twentieth century aircraft and associated debris, particularly in relation to the Second World War.
- Further remains of the infrastructure associated with the development of the Mountblow Royal Navy Oil Fuel Depot, built in 1918 and in use until 1982, as well as navigational, transit and bank infrastructure along the Clyde and material from the shipbuilding industry present either side of the proposed development (Napier & Miller yard to the west, Beardmore's to the east).

Potential Impacts and Likely Effects

The following sensitive receptors have been identified:

- Known and potential palaeogeographic features, prehistoric artefacts, ecofacts and palaeoenvironmental archives;
- Known and potential maritime sites and associated debris;
- Known and potential aviation sites and associated debris;
- Known and potential historic port and navigational infrastructure;
- Known and potential historic terrestrial debris; and
- The historic seascape character of the region.

All receptors have the potential to be damaged or destroyed if they interact with the dredging, demolition, and construction stages of the proposed development. All damage to archaeological sites or material is permanent and recovery is limited to stabilisation or re-burial, limiting further interactions.

Potential impacts can be both direct and indirect.

- Direct impacts can include direct damage to known and potential structures, features, deposits and artefacts, and the disturbance of relationships between these elements and the wider surroundings. The setting of known and named wreck sites may also be impacted and in turn this could potentially affect the significance of such receptors.
- The indirect interactions upon the known and potential marine archaeological receptors occur as a result of changes to hydrodynamic patterns and sediment transport regimes, where these changes have occurred as a consequence of activities and structures associated with the project activities. Scour has a negative or adverse impact on marine archaeological receptors whereby it can expose material which leads to increased rates of deterioration through biological, chemical, and physical processes. Alternatively, the redeposition of sediments following settling of sediment plumes can be beneficial to the preservation of marine archaeological receptors as greater sediment cover increases the

potential for anaerobic environment, which inhibits a range of biological, chemical, and physical degradation processes.

Error! Reference source not found. presents a summary of the scoping process, identifying which likely environmental effects, with respect to marine archaeology and cultural heritage, will be assessed in the EIARA (i.e. considered potentially significant and therefore 'scoped in') and those which will not be assessed further (i.e. 'scoped out'), along with a justification for this decision.

Table 3: Potential Environmental Effects Relating to Marine Archaeology

Potential Effect	To be assessed in the EIARA (Yes/No)	Reason
Demolition, Dredging and Construction Stage		
Physical disturbance to the seabed and sub-seabed during the demolition, dredging and construction stages of the proposed development	Yes	Potential to cause direct damage to known and potential palaeogeographic receptors and riverbed/seabed features (maritime, aviation and terrestrial debris) and historic navigational infrastructure receptors. For example, the removal of previously undisturbed seabed material outside of the current dredged channel of the River Clyde may remove in situ deposits related to the palaeolandscape of the River Clyde such as palaeochannels, or in situ artefacts and ecofacts related to these features. Similarly, the demolition and remediation of the waterfront, and the construction of quayside in its revised arrangement may disturb in situ wreck material including prehistoric and later vessels buried in Quaternary sediments preserved beneath the current deposits of artificial made ground.
Physical disturbance activities during dredging, causing indirect changes to hydrodynamic and sedimentary regimes leading to sediment reduction on the seabed	Yes	The excavation and dredge activities have the potential to cause indirect changes to hydrodynamic and sedimentary regimes which could expose receptors (palaeogeographic, maritime, aviation, terrestrial debris, and historic navigational infrastructure) to increased rates of deterioration through biological, chemical, and physical processes.
Physical disturbance activities during dredging, causing indirect changes to hydrodynamic and sedimentary regimes	Yes	The excavation and dredge activities have the potential to cause indirect changes to hydrodynamic and sedimentary regimes which could cause sediment to cover receptors (palaeogeographic, maritime, aviation, terrestrial debris and historic navigational

Potential Effect	To be assessed in the EIARA (Yes/No)	Reason
leading to sediment accumulation on the seabed		infrastructure) inhibiting a range of biological, chemical and physical processes. This is considered to be a beneficial effect.
Permanent change to the setting of a heritage receptor as a result of the demolition, dredging and construction stages	No	Potential heritage settings were addressed within the submitted EIAR. Significant residual were not identified and the revised proposed development is not considered to materially change this conclusion.
Operational Stage		
Permanent change to the setting of a heritage receptor as a result of the dredging, once the revised proposed development is complete and operational	No	Setting effects were assessed within the submitted EIAR and significant effects were not identified, the revised proposed development, notably dredging is not considered to materially change this conclusion.
Permanent change to the character of the historic seascape	No	Setting effects were assessed within the submitted EIAR and significant effects were not identified, the revised proposed development, notably dredging is not considered to materially change this conclusion.

Approach and Methodology

This section provides a summary of the proposed EIARA methodology specifically relevant to marine archaeology and cultural heritage for construction phase effects.

A full desk-based technical assessment based on the scoping study area will be compiled comprising:

- Details of the legislations and policies relevant to marine heritage.
- Further utilisation of relevant archives, including updated data searches for the data sources listed above, complimented as applicable by additional archives such as the Receiver of Wreck's database of droit reports of wreck and salvage, to better understand the known and potential marine archaeological resource in the marine archaeology and cultural heritage study area. The setting and significance of this resource will also be assessed.
- Completion of a Stage 1 geoarchaeological review of all geotechnical logs arising from planned GI works across the site and any applicable and available previous GI works at the site, with a focus on determining the archaeological potential of any preserved palaeogeographic features.
- Archaeologically assessed marine geophysical data of underwater cultural heritage assets in the development area, where available and applicable with a scope to be agreed with HES once data is available for audit.
- A walkover survey of the study area to inform the understanding of the existing intertidal heritage assets will be undertaken. The walkover survey will ground truth previously

recorded heritage receptors relevant to the marine archaeological assessment and identify any new receptors that may be of relevance to the assessment.

- An assessment of the HSC character types that are present within, and in the region of, the study area.
- Relevant mapping including Admiralty Charts, historic maps, and Ordnance Survey, together with documentary sources and grey literature held by Wessex Archaeology and those available through the Archaeological Data Service and other websites.

The technical assessment will be completed following the best practice professional guidance outlined in the CIfA's Standard and Guidance for Historic Environment Desk-Based Assessment[16]. The assessment will also be undertaken in a manner consistent with available guidance, listed below in chronological order:

- Managing Lithic Scatters: Archaeological Guidance for planning authorities and developers[17]
- Military Aircraft Crash Sites: Archaeological guidance on their significance and future management[18]
- The Code of Practice for Seabed Developers[19]
- Conservation Principles, Policies and Guidance for the Sustainable Management of the Historic Environment[20]
- Environmental Archaeology: A Guide to the Theory and Practice of Methods, from Sampling and Recovery to Post-excavation (second edition)[21]
- Characterising Scotland's Marine Archaeological Resource[22]
- Ships and Boats: Prehistory to Present - Designation Selection Guide[23]
- National Policy Statement for Ports[24]
- Marine Geophysics Data Acquisition, Processing and Interpretation Guidance Notes[25]
- Ports and the Historic Environment. NHPP 4A3 (Historic ports, dockyards, harbours and coastal resorts)[26]
- Dredging and Port Construction: Interaction with Features of Archaeological or Heritage Interest[27]
- Geoarchaeology: Using Earth Sciences to Understand the Archaeological Record[28]

[16] Chartered Institute for Archaeologists (2020) *Standard and Guidance for Historic Environment Desk-Based Assessment*. Published December 2014, updated in 2020. Available at https://www.archaeologists.net/sites/default/files/CIfAS%26GDBA_4.pdf [accessed October 2024]

[17] English Heritage (now Historic England) (2000) *Managing Lithic Scatters: Archaeological Guidance for planning authorities and developers*

[18] English Heritage (now Historic England) (2002) *Military Aircraft Crash Sites: Archaeological guidance on their significance and future management*. Available at https://historicengland.org.uk/images-books/publications/military-aircraft-crash-sites/milairсsites/ [Accessed October 2024]

[19] Joint Nautical Archaeology Policy Committee (2006) *The Code of Practice for Seabed Developers*. Available at http://www.jnapc.org.uk/Code%20of%20Practice%20No.2.pdf [accessed October 2024]

[20] English Heritage (now Historic England) (2008) C*onservation Principles, Policies and Guidance for the Sustainable Management of the Historic Environment*. Updated consultation draft 10/11/2017

[21] English Heritage (now Historic England) (2011) *Environmental Archaeology: A Guide to the Theory and Practice of Methods, from Sampling and Recovery to Post-excavation* (second edition)

[22] Wessex Archaeology (2012) *Characterising Scotland's Marine Archaeological Resource.* Edinburgh. Wessex Archaeology.

[23] English Heritage (now Historic England) (2012) *Ships and Boats: Prehistory to Present - Designation Selection Guide*.

[24] Department for Transport (2012) *National Policy Statement for Ports*. Available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/3931/national-policy-statement-ports.pdf [accessed October 2024]

[25] Plets, R., Dix, J. and Bates, R. (2013) *Marine geophysics data acquisition, processing and interpretation: Guidance notes*. London: English Heritage

[26] Fisher Associates (2014) *Ports and the Historic Environment. NHPP 4A3 (Historic ports, dockyards, harbours and coastal resorts).* Available at https://historicengland.org.uk/research/results/reports/7002/PortsandtheHistoricEnvironment [Accessed October 2024].

[27] PIANC (2014) *Dredging and Port Construction: Interaction with Features of Archaeological or Heritage Interest*. Guidance document No 124-2014

[28] English Heritage (now Historic England) (2015) *Geoarchaeology: Using Earth Sciences to Understand the Archaeological Record*. Available at https://historicengland.org.uk/images-books/publications/geoarchaeology-earth-sciences-to-understand-archaeological-record/heag067-geoarchaeology/ [Accessed October 2024]

- Managing Significance in Decision-Taking in the Historic Environment Historic Environment Good Practice Advice in Planning[29]
- The Assessment and Management of Marine Archaeology in Port and Harbour Development[30]
- Preserving Archaeological Remains Decision-taking for Sites under Development[31]
- Managing Change in the Historic Environment- Setting[32]
- Environmental Impact Assessment Handbook: Guidance for competent authorities, consultation bodies, and others involved in the Environmental Impact Assessment process in Scotland[33]
- Designation Policy and Selection Guidance, including Annexes[34]
- Deposit Modelling and Archaeology Guidance for Mapping Buried Deposits[35]
- Code of Conduct: Professional Ethics in Archaeology[36]
- Curating the Palaeolithic[37]

The results of the technical report will be used to prepare a robust chapter for the EIARA, presenting the information regarding the known and potential marine heritage receptors, with a discussion as to their archaeological value and sensitivity to impact.

Mitigation and Enhancement

Mitigation may be necessary to reduce, remove or offset the impacts on marine archaeological receptors and fall under three main categories: avoidance; reduction of impact; and remedying and offsetting.

Mitigation measures are project specific and tailored to the potential impacts of the proposed development on marine archaeological receptors, which will be reported in the EIARA. Measures could include:

- Implementation of an agreed marine archaeological Written Scheme of Investigation (WSI) that sets out the methods and standards for any proposed archaeological mitigation. The WSI would be agreed by the Regulator, with advice from the Archaeological Curator, prior to works commencing. The implementation of the measures within the WSI is the mitigation, rather than the document itself.
- for palaeogeographic features

[29] Historic England (2015) *Managing Significance in Decision-Taking in the Historic Environment Historic Environment Good Practice Advice in Planning: 2*. Available at https://historicengland.org.uk/images-books/publications/gpa2-managing-significance-in-decision-taking/gpa2/ [Accessed October 2024]

[30] Historic England (2016) *The Assessment and Management of Marine Archaeology in Port and Harbour Development*. Available at https://historicengland.org.uk/images-books/publications/assessment-management-marine-archaeology-port-and-harbour-development/6801-ports-and-harbours/ [Accessed October 2024]

[31] Historic England (2016) *Preserving Archaeological Remains Decision-taking for Sites under Development*. Available at https://historicengland.org.uk/images-books/publications/preserving-archaeological-remains/heag100a-preserving-archaeological-remains/ [Accessed October 2024]

[32] Historic Environment Scotland (2016) *Managing Change in the Historic Environment – Setting.* Available online at: https://app-hes-pubs-prod-neu-01.azurewebsites.net/api/file/3c15b3e9-b447-4b4e-801f-a67800be22c5 [Accessed October 2024]

[33] Historic Environment Scotland (HES) & Scottish Natural Heritage (SNH) (2018). *Environmental Impact Assessment Handbook: Guidance for competent authorities, consultation bodies, and others involved in the Environmental Impact Assessment process in Scotland.* Available online at https://www.historicenvironment.scot/archives-and-research/publications/publication/?publicationId=6ed33b65-9df1-4a2f-acbb-a8e800a592c0 [Accessed October 2024]

[34] Historic Environment Scotland (2019a, updated December 2020). *Designation Policy and Selection Guidance.* Available online at: https://www.historicenvironment.scot/archives-and-research/publications/publication/?publicationId=8d8bbaeb-ce5a-46c1-a558-aa2500ff7d3b [Accessed October 2024]

[35] Historic England (2020) *Deposit Modelling and Archaeology Guidance for Mapping Buried Deposits*. Available at https://historicengland.org.uk/images-books/publications/deposit-modelling-and-archaeology/heag272-deposit-modelling-and-archaeology/ [Accessed October 2024]

[36] Chartered Institute for Archaeologists (2021) *Code of Conduct: Professional Ethics in Archaeology*. Published December 2014, revised October 2021. Available at https://www.archaeologists.net/sites/default/files/Code%20of%20conduct.pdf [Accessed October 2024]

[37] Historic England (2023). Curating the Palaeolithic. Available online at: https://historicengland.org.uk/images-books/publications/curating-the-palaeolithic/ [Accessed October 2024]

- Recommendation of archaeological exclusion zones (AEZs);
- Recommendation for a watching brief to allow an archaeologist to be present during defined work stages to the archaeologist can record material as it is discovered/recovered using photographs, videos, drawings, and written descriptions, and can intervene if any unexpected discoveries are made; and
- A project-specific protocol for archaeological discoveries to support the reporting of unexpected archaeological material during the project.

4.4 Marine Ecology

Baseline

The following marine ecology receptors have been considered:

- Nature conservation protected habitats and species;
- Benthic habitats and species (including non-native species);
- Fish species; and
- Marine mammals.

Nature Conservation, Protected Habitats, and Species

The red line boundary for the revised proposed development is located within the Inner Clyde SPA and Ramsar site, both of which are designated for non-breeding Redshank *Tringa tetanus* and support extensive intertidal flats and saltmarsh.

The proposed development is also located immediately adjacent to the Inner Clyde SSSI, which is designated for saltmarsh habitat as well as a range of waterbird species. The SSSI provides the largest example in west central Scotland of grazed and ungrazed upper saltmarsh with relatively uninterrupted transitions to swamp and grassland vegetation. The saltmarsh habitat is listed as a nationally notifiable habitat within the SSSI citation[38,39,40].

The habitats of the Inner Clyde also support nationally important numbers of other non-breeding wader and wildfowl.

Benthic Habitats and Species (including non-native species)

The site lies within an estuarine section of the River Clyde which supports a wide variety of marine habitats including intertidal mudflats, saltmarsh, and dwarf eelgrass *Zostera noltii* beds.

A project specific marine ecology survey was undertaken in August 2024[41]. The survey involved a combination of Phase 1 intertidal habitat mapping and benthic sampling. The survey report is provided within Appendix 1. The foreshore within the survey area was predominately characterised by boulders, cobbles, gravel, and artificial hard structures (such as quay walls and berth structures). Horned wrack (*Fucus ceranoides*) was present along much of the lower and middle shore with patches of the saltmarsh plant sea aster (*Aster tripolium*) observed on the upper shore. Mobile epifaunal species observed included shore crabs and amphipods. The sediment within the samples analysed consisted of an infaunal assemblage characterised predominantly by oligochaetes as well as nematodes, polychaetes, and bivalves.

Non-native species including the New Zealand mud snail (*Potamopyrgus antipodarum),* the soft-shell clam *(Mya arenaria)* and the polychaete genus (*Marenzelleria)* were recorded as present within the majority of samples and are assumed to be present across the site.

The species recorded in the survey are considered characteristic of the brackish conditions present along this section of the River Clyde. The proposed development is directly adjacent to the Inner Clyde Estuary SPA, Ramsar and SSSI which support a range of habitats including intertidal flats and saltmarsh (see above). No other habitats or species which are protected or considered nationally rare were recorded in the survey.

Fish

[38] JNCC. (2008). Information Sheet on Ramsar Wetlands (RIS). Inner Clyde Estuary.
[39] Scottish Natural Heritage (2010a): Inner Clyde Site of Special Scientific Interest Citation.
[40] Scottish Natural Heritage (2010b): Inner Clyde Site of Special Scientific Interest Site Management Statement.
[41] ABPmer (2024), Scottish Marine Technology Park: Marine Ecology Survey Report, R4648, Version 2

The River Clyde supports a range of marine and estuarine fish species including flounder, sea bass, mullet, gobies, and three-spined sticklebacks[42]. Diadromous migratory species (fish that migrate between salt and freshwater) are also recorded in the River Clyde, including Atlantic salmon, sea trout, sea lamprey, river lamprey and European eel[43]. In general, the Scottish Environment Protection Agency (SEPA) do not routinely monitor migratory species within the inner and outer estuary. However, non-target species such as the occasional salmonid are recorded during trawl surveys. Further information of the status and behaviour of migratory species that have been recorded in the River Clyde are described further below.

Atlantic salmon is an anadromous species which migrates to freshwater to spawn, whilst spending most of its life in the marine environment. Spawning usually takes place in November or December. After one to four years in the river, dependent on growth rate, juvenile salmon (smolts) move down the river to the sea generally from April to June. Most salmon return the following summer after one winter spent feeding at sea (with the peak upstream movement of salmon in the River Clyde occurring in September).

The life cycle of the migratory sea trout is similar to that of salmon. However, in contrast to the salmon, the majority of sea trout survives spawning and return to their natal spawning river on numerous occasions during their lifetime with some sea trout remaining in the estuary year-round.

River lamprey and sea lamprey are both anadromous species, spawning in freshwater but completing part of their lifecycle in estuaries or at sea[44,45]. The sea lamprey adult growth phase is short and lasts around two years. In this time the species is parasitic, feeding on a variety of marine and anadromous fishes, including shad, herring, salmon, cod, haddock, and basking sharks. Unlike sea lamprey, the growth phase of river lamprey is primarily restricted to estuaries. After one to two years in estuaries, river lamprey stop feeding in the autumn and move upstream into medium to large rivers, usually migrating into fresh water from October to December.

European eel is a catadromous species which migrates to the marine environment (Sargasso Sea) to spawn. Juvenile European eels (elvers) migrate into estuaries and rivers during late winter and early spring.

Marine Mammals

The most commonly occurring marine mammals in the River Clyde are the grey seal, common (harbour) seal and harbour porpoise. Other species are only recorded more sporadically.

Both grey seal and common seal have haul out sites in the Firth of Clyde and are regularly recorded foraging in the River Clyde[46,47,48,49]. More recently, grey seal tracking data has demonstrated that they do not travel inland into the River Clyde[50], and therefore will not be in the vicinity of the

[42] Clyde River Foundation. 2009. The River Clyde Fishery Management Plan 2009-2015. Report CEF2009/09.
[43] O'Reilly, M., Nowacki, S., & Elliott, M. 2016. A Citizen Science approach to monitoring migratory lampreys under the Water Framework Directive, with some new accounts of Sea Lampreys (Petromyzon. Glasgow Naturalist, 26(Part 2), 102-105.
[44] Henderson, P.A. 2003. Background information on species of shad and lamprey. Bangor, CCW Marine Monitoring Report No: 7; 30pp.
[45] Maitland. P.S .2003. Ecology of the River, Brook and Sea Lamprey. Conserving Natura 2000 Rivers Ecology Series No. 5. English Nature, Peterborough.
[46] Duck, C.D. and Morris, C.D. 2016. Surveys of harbour and grey seals on the south-east (border to Aberlady Bay) and south-west (Sound of Jura to Solway Firth) coasts of Scotland, in Shetland, in the Moray Firth and in the Firth of Tay in August 2015. Scottish Natural Heritage Commissioned Report No. 929.
[47] Russell, D. J. F., Jones, E. L. and Morris, C. D. 2017. Updated Seal Usage Maps: The Estimated at-sea Distribution of Grey and Harbour Seals. Scottish Marine and Freshwater Science Vol 8 No 25.
[48] Clyde Porpoise CIC, 2017. Mobile Species of the Clyde.
[49] Applied Ecology Ltd, 2018. Seal sightings at Carless former Oil Refinery, Winter 2017/2018.
[50] Carter, M. I. D., Boehme, L., Duck, D.C., Grecian, W.J., Hastie, G.D., McConnell, B.J., Miller, D.L., Morris, C.D., Moss, S.E.W., Thompson, D., Thompson, P.M., and Russell, D.J.F. 2020 Habitat-based predictions of at-sea distribution for grey and harbour seals in the British Isles. Sea Mammal Research Unit, University of St Andrews, Report to BEIS, OESEA-16-76/OESEA-17-78.

proposed development. Furthermore, with respect to seal haul out sites, they are much further out in the River Clyde and not in the line of sight of the works[51].

Harbour porpoises are considered to be a commonly occurring species in the Firth of Clyde with several 'hotspot' areas known to occur[52]. Harbour porpoise are occasionally recorded foraging in the River Clyde.

Potential Impacts and Likely Effects

The following sensitive marine ecology receptors have been identified:

- Benthic habitats and species;
- Fish; and
- Marine mammals.

The above receptors include relevant protected habitats and species and interest features of nature conservation sites.

Error! Reference source not found. presents a summary of the scoping process, identifying which likely environmental effects, with respect to marine ecology, will be assessed in the EIARA (i.e. considered potentially significant and therefore 'scoped in') and those which will not be assessed further (i.e. 'scoped out'), along with a justification for this decision.

Table 4: Potential Environmental Effects Relating to Marine Ecology

Potential Effect	To be assessed in the EIARA (Yes/No)	Reason
Demolition and Construction Stage		
Direct loss and/or change in seabed habitats and species and changes in foraging habitat as a result of the introduction and removal of infrastructure and dredging	Yes	The revised proposed development has the potential to result in materially different effects on benthic habitats and species that use these habitats due to the introduction of new structures in the marine environment (i.e., the finger jetty, 'heavy lift' quay, extension of the quay and sheet pile stabilisation wall), the removal of existing structures (i.e., demolition of existing jetty). These changes have the potential to impact on fish species, through potential changes in prey resources and the quality of foraging, nursery, and spawning habitats. Dredging causes the direct physical removal of marine sediments from the dredge footprint, resulting in the modification of existing marine habitats. The fauna associated with the dredged material is damaged or killed. This could include the loss of protected habitat, namely saltmarsh that was recorded during the marine ecology survey.

[51] SCOS (2023). Scientific Advice on Matters Related to the Management of Seal Populations: 2022. Available at: https://www.smru.st-andrews.ac.uk/files/2023/09/SCOS-2022.pdf (Accessed October 2024).
[52] Brown, W. 2018. Fine scale distribution and habitat use of harbour porpoise *Phocoena phocoena* in the Firth of Clyde. An MSc thesis.

Potential Effect	To be assessed in the EIARA (Yes/No)	Reason
		In the context of the known foraging ranges of marine mammals (typically in the range of hundreds to thousands of km²), the changes brought about by the revised proposed development would be expected to have a negligible effect on the overall foraging resource available in the region. Furthermore, any marine mammals that are present in the vicinity of the revised proposed development are already subject to ongoing vessel movements and marine activities such as regular maintenance dredging of the main navigation channel. Existing navigational activities are considered in further detail in the Navigation. On this basis, this pathway is therefore scoped out.
Changes to benthic habitats and species as a result of sediment deposition during capital dredging	Yes	Dredging has the potential to result in localised physical disturbance and smothering of seabed habitat and species where the sediment settles out of suspension back onto the seabed. At this stage it is anticipated that no material would be disposed of at a marine disposal site. The capital dredge material will instead be screened, cleaned, and reused as fill material in deeper fill areas across the site. If this is not possible then options for disposal off-site would be considered. There will therefore be no physical disturbance or smothering of seabed habitats from any marine disposal activities.
Effects of changes in water and sediment quality on benthic habitats, fish and marine mammals and species as a result of the construction works and capital dredging activities	Yes	The effects of changes in water and sediment quality as a result of piling and demolition were assessed within the submitted EIAR and the conclusions are considered to remain the same. Changes in suspended sediment concentrations (and any resultant changes in dissolved oxygen and release of sediment bound contaminants) associated with bed disturbance during the capital dredging activities has the potential to adversely affect the receptors identified and their supporting habitat and prey. There is also the potential for accidental spillages and the risk of introduction of contaminants to occur throughout the construction phase and dredging activity although best practice pollution prevention guidelines will be followed. The demolition and construction stage would be

Potential Effect	To be assessed in the EIARA (Yes/No)	Reason
		implemented under an appropriately worded condition to secure the finalisation and implementation of a CEMP to manage any risks associated with the release of contaminants as a result of spillages. Marine mammals are not anticipated to be sensitive to the anticipated changes in water and sediment quality from the proposed development. Furthermore, best practice pollution prevention guidelines will be followed to minimise the risk of accidental spillages and the risk of introduction of contaminants throughout the construction phase and capital dredging activity. This potential pathway is therefore scoped out. Changes in water and sediment quality are discussed in further detail in the Marine Water and Sediment Quality section.
Underwater noise and vibration impacts on benthic species, fish and mammals as a result of the construction works and capital dredging activities	Yes	The submitted EIAR assessed underwater noise levels on the assumption that the piles would mostly be installed using vibratory methods with some need for impact driving to reach required depth. The construction methods for the revised proposed development are considered to be materially different from the submitted EIAR; the sheet piles would be installed by impact driving with rotary drilling. A revised assessment of the potential for elevated underwater noise levels during piling to cause disturbance, physiological damage and/or behavioural reactions to the receptors identified is considered to be required. The underwater noise levels associated with dredging are not considered to be greater than that of piling and therefore an assessment of this activity is not considered to be required.
Collision risk/visual disturbance on marine mammals	No	Any vessels or marine plant involved during construction will either be stationary or travelling at low speeds, making the risk of collision very low. Furthermore, through regular exposure to existing vessel movements, marine mammals using the River Clyde area routinely need to avoid collision and are also expected to be habituated to high levels of disturbance and light stimuli. This potential pathway is therefore scoped out.

Potential Effect	To be assessed in the EIARA (Yes/No)	Reason
Non-native species transfer and introduction as a result of construction works and capital dredging activities	No	Non-native species were assessed within the submitted EIAR have the potential to be transported into the local area in the ballast water and on the hulls of the vessels or surface of marine plant if they have operated in differing water bodies. Additionally, the introduction of hard structures as a result of the introduction of new infrastructure (i.e., the finger jetty, 'heavy lift' quay, extension of the quay and sheet pile stabilisation wall) provides available habitat for any introduced non-native species to colonise.
Air quality effects on marine habitats and species	No	Annual average daily traffic movements during the peak demolition and construction phase are likely to be well below the EPUK/IAQM[53] indicative criteria for requiring an air quality assessment for road traffic emissions. Construction traffic impacts on human health receptors in the area would be temporary and are not considered to be significant. Therefore no further assessment of this effect is required.
Effects due to lighting	No	The submitted EIAR recommended that daylight working be undertaken during the winter construction window to allow more than 12 hours per day without piling to allow movement of mobile species within the River Clyde. This mitigation measure also means that working with lighting would not be required and therefore this effect does not require further consideration.
Operational Stage		
Indirect changes to seabed habitats and species and foraging habitat as a result of changes to hydrodynamic and sedimentary processes	Yes	The presence of new infrastructure as a result of the construction works has been assessed within the submitted EIAR, however a change in bathymetry as a result of capital dredge has the potential to result in changes to hydrodynamic and sedimentary processes (e.g. water levels, flow rates, changes to tidal prism, accretion, and erosion patterns), which in turn have the potential to indirectly affect seabed habitats and species

[53] Moorcroft and Barrowcliffe, 2017. Land-Use Planning and Development Control: Planning for Air Quality. EPUK/IAQM, v1.2.

Potential Effect	To be assessed in the EIARA (Yes/No)	Reason
		(i.e. feeding, spawning and nursery areas). This effect was not included within the submitted EIAR. Changes in hydrodynamic and sedimentary processes are discussed in further detail in the Physical Processes section. It is recognised that these changes will start to take place during the construction stage of the revised proposed development but will not be fully realised until the revised proposed development has been completed and will therefore be assessed as part of the operational stage in the EIAR.
Underwater noise and vibration impacts on benthic species, fish and marine mammals as a result of vessel operations	No	The submitted EIAR scoped this effect out for further consideration and the revised proposed development is not considered to result in a materially different effect.
Non-native species transfer and introduction as a result of vessel operations	No	The submitted EIAR considered this effect during operation and concluded that, with best practice procedures in place, the overall effect would be negligible. The revised proposed development is not considered to give rise to materially different effects as the operational setting has not changed.
Changes to habitats and species due to shading as a direct result of the footprint of new structures	No	The submitted EIAR considered this effect during operation and concluded a negligible effect. In addition, the revised proposed development comprises a solid quay structure, therefore no functional habitat would exist beneath this once installed. The assessment of direct loss of habitat is covered within the construction stage.
Air quality effects on marine habitats and species	No	There may be increased air quality impacts in the area during operation from increased vessel movements. Changes in air quality during operation are discussed in further detail in the Air Quality and this effect has been scoped out for further assessment. Operational stage marine vessel activity is considered to be minimal and would increase as the landside development becomes fully operational. A small number of vessels are anticipated to use the jetty when operational. Emissions from marine vessels are therefore unlikely to have a significant effect at sensitive receptor locations during operation.

Potential Effect	To be assessed in the EIARA (Yes/No)	Reason
Collision risk/visual disturbance	No	The submitted EIAR scoped this effect out for further consideration and the revised proposed development is not considered to result in a materially different effect.

Approach and Methodology

The potential effects of the proposed development on each of the marine ecology receptors that have been scoped into the EIARA will be assessed by describing in turn: the baseline environmental conditions of each receiving environment; the 'impact pathways' by which the receptors could be affected; the significance of the impacts occurring; and the measures to mitigate for significant adverse impacts where these are predicted.

The impact assessment methodology that will be followed is designed to incorporate the key criteria and considerations without being overly prescriptive, and comprises the following key steps:

- Stage 1 – Identify receptors and changes;
- Stage 2 – Understand change and sensitivity;
- Stage 3 – Impact assessment;
- Stage 4 – Impact management (mitigation);
- Confidence assessment; and
- Cumulative impact and in-combination assessment.

It is recognised that there are important linkages between the marine ecology topic and other EIA topics. For example, the assessment of indirect impacts on marine ecology receptors will be informed by the outcomes of the physical processes and water and sediment quality assessments.

The marine ecology assessment will also provide supporting information to enable the competent authority to undertake an Appropriate Assessment (AA), assessing the effects of the proposed development on the interest features of European/Ramsar sites. Information to inform an Habitats Regulations Appraisal (HRA) will be provided as a technical appendix to the EIARA.

To facilitate the impact assessment process and ensure consistency in the terminology of significance, a standard assessment methodology will be applied. This methodology has been developed from a range of sources, including the Marine Works (EIA) (Scotland) Regulations 2017, the EIA Directive (2014/52/EU), statutory guidance, consultations and ABPmer's previous (extensive) EIA project experience. ABPmer has an Institute of Environmental Management and Assessment (IEMA) EIA Quality Mark, demonstrating their service excellence in leading the co-ordination of statutory EIAs in the UK. The EIAR will also follow the principles of relevant guidance, including the Chartered Institute of Ecology and Environmental Management (CIEEM) guidelines for ecological impact assessment in the UK and Ireland (which consolidate advice for terrestrial, freshwater, and coastal environments)[54] and IEMA guidelines[55].

Underwater Noise Assessment Methodology

Underwater noise modelling will be undertaken to assess the potential effects of underwater noise associated with the identified elements of the revised proposed development (i.e., piling). In

[54] CIEEM (2018). Guidelines for Ecological Impact Assessment in the UK and Ireland (Terrestrial, Freshwater, Coastal and Marine). Available at: https://www.cieem.net/data/files/ECIA%20Guidelines.pdf (Accessed October 2024).
[55] IEMA (2016). Environmental Impact Assessment Guide to: Delivering Quality Development.

accordance with good practice guidance[56], a simple logarithmic spreading model will be used to predict the propagation of sound pressure with range. The use of this model is an established approach in EIA that has been widely accepted by UK regulators for recent port and waterfront developments.

A range of well-established published thresholds will be used to assess the potential physiological and behavioural effects of underwater noise on key sensitive receptors in the study area[57,58,59,60]. There are no known published injury or behavioural thresholds for benthic invertebrates and no behavioural thresholds for marine mammals that have been accepted by the scientific community. A review of the observed responses of these receptors to underwater noise from published sources and case studies will be undertaken to determine the likelihood and significance of impacts. A review of the available published evidence of vibration (particle motion) effects on benthic invertebrates and fish will also be undertaken to support the assessment.

The potential significance of underwater noise effects on marine ecology receptors will then be assessed in the context of the physical nature of the site of the proposed development (i.e., the constrained nature of the River Clyde and potential screening effects of existing infrastructure). In addition, the spatiotemporal variability of underwater noise generated by the proposed development and the individual sensitivities and importance of receptors (e.g., level of protection, functional use, seasonality, and population dynamics) will be taken account of in the assessment.

Mitigation and Enhancement

The EIARA will identify any necessary additional mitigation and/or enhancement measures beyond those included within the submitted EIAR. These may include but are not limited to:

- An outline CEMP would be prepared to support the marine licence application, and an appropriately worded marine licence condition would secure the production of a final/detail CEMP (once a contractor is appointed) to be agreed with MD-LOT prior to works commencing;
- Minimising the direct physical footprint of the area, based on the design of the proposed development, to reduce the likely significant effects on marine ecological receptors;
- The use of impervious sheet piles during the sheet-pile stabilisation works will avoid potential contamination of the marine environment. Similarly, the use of bunding to contain potential pollutants (e.g., fuel stores) and the adoption of standard good practice construction techniques will minimise the risk of pollutants entering the River Clyde;
- Updates and adherence to the Marine Biosecurity Management Plan, secured through an appropriately wording marine licence condition; and
- Exploring opportunities for incorporating integrated green grey infrastructure[61] into the design of the proposed development (e.g. artificial pools, reef structures and/or vertical seagardens on the sheet piles).

[56] NPL. (2014). Good practice guides. Underwater noise measurement GPG133. 28 March 2014. Available online: https://www.npl.co.uk/gpgs/underwater-noise-measurement (Accessed October 2024).

[57] Popper A.N., Hawkins A.D., Fay R.R., Mann D.A., Bartol S., Carlson T.J., Coombs S., Ellison W.T., Gentry R.L., Halvorsen M.B., Løkkeborg S., Rogers P.H., Southall B.L., Zeddies D.G. and Tavolga W.N. (2014). Sound exposure guidelines for fishes and sea turtles: a technical report prepared by ANSI-Accredited Standards Committee S3/SC1 and registered with ANSI. ASA S3/SC1.4 TR-2014. Springer and ASA Press, Cham, Switzerland.

[58] Hawkins, A.D., Roberts, L. and Cheesman, S. (2014). Responses of free-living coastal pelagic fish to impulsive sounds. The Journal of the Acoustical Society of America, 135, pp.3101-3116.

[59] NOAA (2018). 2018 Revisions to: Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0): Underwater Thresholds for Onset of Permanent and Temporary Threshold Shifts. U.S. Dept. of Commer., NOAA. NOAA Technical Memorandum NMFS-OPR-59, 167p.

[60] Southall, B.L., Finneran, J.J., Reichmuth, C., Nachtigall, P.E., Ketten, D.R., Bowles, A.E., Ellison, W.T., Nowacek, D.P. and Tyack, P.L. (2019). Marine Mammal Noise Exposure Criteria: Updated Scientific Recommendations for Residual Hearing Effects. Aquatic Mammals, 45(2), p.125.

[61] Naylor, L. A. , Kippen, H., Coombes, M. A., Horton, B., MacArthur, M. and Jackson, N. (2017) Greening the Grey: A Framework for Integrated Green Grey Infrastructure (IGGI). Technical Report. University of Glasgow, Glasgow.

4.5 Marine Physical Processes

Baseline

The following marine physical process pathways have been considered as part of this EIARA scoping review:

- Suspended sediment concentration associated with dredge plumes;
- Local and regional hydrodynamics;
- Wave climate; and
- Local and regional sediment transport pathways.

General Setting

The Clyde Estuary is complex in its morphological shape, with the Firth of Clyde feeding several sea lochs (including Loch Striven, Loch Long and Loch Gare) before propagating eastwards towards Glasgow. The proposed development is located on the north bank of the River Clyde approximately 15 km north-west of Glasgow between Bowling and Clydebank. The site is located within the upper sections of the River Clyde, c. 60 km from the open sea.

Geomorphology

The geology of the Clyde basin consists of a mixture of geological features. The lower basin sediments are mainly glacial, overlying carboniferous limestone and extrusive igneous rock, while small pockets of Devonian sandstone are also present. Bed material within the River Clyde, including the proposed development site, is predominantly a mixture of silt and sand[62].

The UKHO Admiralty Chart No. 2007 ("River Clyde") indicates the main channel of the River Clyde is maintained at 7.5 metres Chart Datum (mCD) to facilitate safe navigation. The area immediately adjacent to the proposed development was previously maintained at 4.9 mCD, although this is unlikely to have continued after the Carless oil refinery ceased operations in 1992. There is a narrow band of intertidal habitat present on either side of the channel.

Hydrodynamics

The hydrodynamic conditions at the proposed development site are primarily influenced by tidal propagation up the Clyde Estuary. Tide level information from UKHO[63] is provided below in Table 5 for nearby secondary ports of Bowling and Rothesay Dock. The conversion from mCD to metres relative to Ordnance Datum Newlyn (mODN) is -2 m for Bowling and -2.2 m for Rothesay Dock.

Table 5: Tide levels at secondary ports located close to the proposed development

Tidal level	Bowling		Rothesay Dock	
	mCD	mODN	mCD	mODN
Highest Astronomic Tide (HAT)	4.6	2.6	5.1	2.9
Mean High Water Spring (MHWS)	4.0	2.0	4.5	2.3
Mean High Water Neap (MHWN)	3.1	1.1	3.7	1.5
Mean Sea Level (MSL)	-	-	2.7	0.5
Mean Low Water Neap (MLWN)	1.3	-0.7	1.6	-0.6
Mean Low Water Spring (MLWS)	0.4	-1.6	0.6	-1.6
Lowest Astronomic Tide (LAT)	-0.4	-2.4	-0.1	-2.3

[62] Natural Environmental Research Council. 1974. The Clyde Estuary and Firth: An Assessment of Present Knowledge Complied by Members of the Clyde Study Group. Publications Series C, No. 11.
[63] Admiralty Total Tide,

Table 5: Tide levels at secondary ports located close to the proposed development		
Mean spring range (m)	3.6	3.9
Mean neap range (m)	1.8	2.1

In general, the Clyde Estuary can be classed as mesotidal (2-4 m) in range and the resulting tidal currents in lower parts of the estuary entering the Firth of Clyde are relatively small (i.e., less than 0.2 m/s[64]). The locations of peak flows are likely to be concentrated within the deeper dredged channel within the upper sections of the estuary.

Waves

Given the location of the proposed development in the River Clyde, wave activity at the site is likely to only be a result of local wind-generation, with little or no swell expected to propagate upriver from the Firth of Clyde. The maximum effective fetch at the proposed development site is estimated to be less than 2 km from a north-westerly or south-easterly direction (i.e., parallel with the shape of the River Clyde). The width of the River Clyde adjacent to the proposed development is approximately 200 m and, therefore, cross river fetch (i.e., north-east to south-west) will result in minimal wave activity.

Sediment Dynamics

The low current speeds throughout the Clyde Estuary alongside negligible wave forcing in the upper estuary result in relatively low rates of sedimentation and sediment transport. The majority of bed material movement is likely to occur during peak current flows, and this is likely to be enhanced during spring tide periods. Sediment transport due to wave activity is suggested to be minimal, only occurring during adverse and/or wind-over-tide conditions.

Potential Impacts and Likely Effects

Error! Reference source not found. presents a summary of the scoping process, identifying which likely environmental effects, with respect to marine physical processes, will be assessed in the EIARA (i.e. considered potentially significant and therefore 'scoped in') and those which will not be assessed further (i.e. 'scoped out'), along with a justification for this decision.

Table 6: Potential Environmental Effects Relating to Marine Physical Processes

Potential Effect	To be assessed in the EIARA (Yes/No)	Reason
Demolition and Construction Stage		
Changes to suspended sediment concentrations	Yes	Temporary and highly localised increases in suspended sediment concentrations are expected to occur as a result of bed disturbance due to the proposed dredging operations. Changes to suspended sediment load within any dredge plume (and associated sedimentation) will be assessed within the EIARA. No material will be disposed of at a marine disposal site. The capital dredge material is anticipated to be screened, cleaned, and reused as fill

[64] ABPmer, Met Office and POL. 2008. Atlas of UK Marine Renewable Energy Resources: Atlas Pages. A Strategic Environmental Assessment Report, March 2008. Produced for BERR. Report and associated GIS layers available online at: http://www.renewables-atlas.info/.

Potential Effect	To be assessed in the EIARA (Yes/No)	Reason
		material in areas across the site. There will therefore be no changes in suspended sediment concentrations resulting from any disposal activities.
Operational Stage		
Changes to the wave climate	No	The complex morphological shape of the Firth of Clyde and the lower Clyde Estuary is likely to lead to dissipation of swell waves prior to entering the upper estuary containing the proposed development. Consequently, any wave activity at the site would be a result of local wind-generation and will be small in magnitude. Changes to the localised wave climate within the section of estuary as a result of the revised proposed development would be negligible.
Changes to the hydrodynamic regime	Yes	The marine elements of the revised proposed development (including pile arrangement and dredged berth pocket) have the potential to affect the local and regional hydrodynamic (flow) regime. This will be assessed within the EIARA.
Changes to sediment transport processes (including erosion and deposition)	Yes	As noted above, the revised proposed development has the potential to affect the local and regional hydrodynamic (flow) regime, which could have an associated effect on local and regional sediment transport pathways. This will be assessed within the EIARA.

Approach and Methodology

The potential effects of the revised proposed development on each of the marine physical process receptors that have been scoped into the EIARA will be assessed by describing in turn: the baseline environmental conditions of each receiving environment; the 'impact pathways' by which the receptors could be affected; the significance of the impacts occurring; and the measures to mitigate for significant adverse impacts where these are predicted.

The methods adopted for the assessment potential changes to physical processes will be slightly different to those adopted for other environmental topics. This is because whilst the proposed development has the potential to cause changes to hydrodynamic and sedimentary processes, these changes are not, in themselves, generally recognised as environmental features/receptors and, therefore, do not equate to 'impacts'. The impacts will instead be the consequence of these changes on other environmental features. For example, 'changes' in the transport and deposition of sediment may 'impact' on the structure and function of marine habitats and their associated species.

It should be noted, therefore, that it is intended that the assessment undertaken in relation to this topic, will apply a standard impact assessment methodology and will assess the potential 'exposure to change' resulting from the impact pathways that have been scoped into the assessment. The

consequent significance of effects resulting from physical processes changes on other environmental features/receptors can then be assessed in other topic-specific EIARA chapters, including (for example) water and sediment quality and marine ecology.

It is recognised that physical processes changes may potentially impact on physical environmental receptors, such as the local riverbanks, along with any existing berth and jetty infrastructure at the development site. For these physical receptors, therefore, an assessment of impact significance will be undertaken. In accordance with published guidance and an established approach that has been used in numerous previous EIA, the assessment will include an evaluation of the importance/value and sensitivity of relevant physical processes receptors.

Numerical modelling tools and conceptual analyses will be used to predict physical processes, hydrodynamic and sedimentary effects by comparing the baseline and future environmental conditions created by the proposed development. This will include predicting the changes to tidal water levels and currents, suspended sediment concentrations, and erosion and accretion patterns. The modelling tools will also allow for the fate of sediment plumes from marine construction to be simulated.

Changes in hydrodynamic and sedimentary processes will be considered in the context of climate change (specifically sea level rise) over the engineering design period of the proposed development by assessing the effects under projected future sea levels. Available geotechnical information will be analysed to optimise the construction and dredging methods and minimise changes in physical processes during construction and operation.

The modelling will be completed using the Danish Hydraulic Institute (DHI) software package MIKE21FM (Flexible Mesh), which has been developed specifically for oceanographic, coastal and estuarine applications. The selected modelling tools will be developed using the latest available bathymetric and topographic data, along with a verification stage using local measurements.

Following the development of the modelling tools to replicate the baseline conditions, the models will be updated to include a representation of the marine elements of the proposed development, namely the quay wall/pile structures and the proposed dredge footprint. Dredge material disposal is not proposed for the scheme and will not need assessment within the EIARA. The models will also be updated to include a representation of any other coastal and marine developments that may overlap or interact with the proposed development to allow the potential for cumulative effects to be assessed.

It is recognised that there are important linkages between the marine physical processes topic and other EIAR topics. For example, the assessment of changes to marine physical process pathways will be used to inform the impact assessments within the water and sediment quality, marine ecology, and navigation and marine operations topics.

Mitigation and Enhancement

These may include but are not limited to:

- Minimising the direct physical footprint of the area, based on the design of the proposed development, to reduce the likely significant effects on marine physical process pathways.

4.6 Marine Water and Sediment Quality

Baseline

Water Quality –Surface Water

The surface water body in which the site lies is designated under the Water Framework Directive (WFD) as Clyde Estuary – Inner. This is classified as a transitional water body, most recently (2022) being recorded with an overall status of 'moderate ecological potential' and 'Poor' physico-chemical quality[65]. It is classified as a heavily modified water body. The SEPA WFD classification records show that the water quality is affected by elevated concentrations of chromium. The waterbody is recorded as being moderately oxygenated and having 'poor' hydromorphological characteristics.

Downstream (west) of the Clyde Estuary - Inner lies the Clyde Estuary - Outer water body, which currently has an overall status of 'moderate ecological potential' and 'Poor' physico-chemical quality. The Clyde Estuary – Outer is also classified as a heavily modified water body. The waterbody is recorded as being highly oxygenated and having 'Moderate' hydromorphological

Water Quality –Groundwater

The superficial aquifer underlying the site (Clydebank Sand and Gravel water body) is classified as 'moderate to high' in relation to productivity and has an overall status of 'good'[66]. The bedrock aquifer underlying the site (Clydebank bedrock water body) is classified as 'moderate' in relation to productivity and has an overall status of 'good'. Groundwater levels have been found at depths ranging between around 1.5 m and 8 m below ground level (bgl) withing the made ground and alluvium, mean groundwater level is estimated to be 2 mAOD. It is considered that the alluvial aquifer is in hydraulic continuity with the River Clyde and will be subject to tidal variations.

Water Quality – Bathing Water

The nearest designated bathing water to the site is at Lunderston Bay, located approximately 26 km to the west of the site. It classified as having 'good' water quality[67], the water quality being classified in terms of Intestinal Enterococci and Escherichia coli.

Water Quality – Statutory Designations

The site lies within and opposite the Inner Clyde SSSI, SPA and Ramsar sites; designated primarily due to the site being the most northerly of Britain's west coast estuaries to be used by migrating birds, including internationally important wintering population of redshank[68].

Sediment Quality

During an environmental assessment[69] undertaken in 2002, sediment samples were collected from the northern and southern banks of the Clyde River, in the vicinity of the proposed development, and subjected to a range of chemical analysis. Concentrations of both TPH and mineral oil were identified throughout the northern and southern sites, although concentrations on the north bank of the river were consistently higher. However, it was reported that elevated concentrations recorded on the southern site could not be directly attributed to the Carless site and are likely to be indicative of chronic pollution in the River Clyde.

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[65] Scottish Environment Protection Agency: Water Classification Hub, Clyde Estuary - Inner (inc Cart), online. Available at: https://informatics.sepa.org.uk/WaterClassificationHub/ [Accessed 08/11/2024]

[66] Scottish Environment Protection Agency, Groundwater classifications. Available at: https://map.environment.gov.scot/sewebmap/?layers=groundwaterClassification [Accessed on 08/11/2024]

[67] Scottish Environment Protection Agency, Scotland Bathing Waters, Lunderston Bay. Available at: https://bathingwaters.sepa.scot/locations-and-results/results/?location=124599 [Accessed on 08/11/2024]

[68] MAGiC, 2024. MAGiC Interactive Mapping, online. https://magic.defra.gov.uk/magicmap.aspx [Accessed 12/11/2024]

[69] GeoDelft Enviromenta; Ltd (2002) Environmental Assessment of Potential pollution and Ecological System Effects Arising from the Former Carless Oil Site

Potential Impacts and Likely Effects

The following sensitive receptors have been identified:

- The surface waters both within the site boundary and in the vicinity (the River Clyde and wider Firth of Clyde – Inner water body).
- The superficial and bedrock groundwater body underlying the site.
- Construction and demolition workers on-site.
- Port operators or amenity site users downstream or in the immediate vicinity of the site.
- Future site users.
- Statutory designations.

Error! Reference source not found. presents a summary of the scoping process, identifying which likely environmental effects, with respect to marine waters and sediment quality, will be assessed in the EIARA (i.e. considered potentially significant and therefore 'scoped in') and those which will not be assessed further (i.e. 'scoped out'), along with a justification for this decision.

Table 7: Potential Environmental Effects Relating to Marine Waters and Sediment Quality

Potential Effect	To be assessed in the EIARA (Yes/No)	Reason
Demolition and Construction Stage		
Formation of pathways between contaminated sediments/ surface waters and the underlying moderate to high productivity aquifer.	No	The effect of piling on water quality was assessed within the submitted EIAR and the effects of the revised proposed development are not considered to be materially different.
Mobilisation of contaminated sediments during capital dredging potentially causing adverse effects on identified receptors (human health, ecological receptors, water quality)	Yes	The proposed dredging activity has the potential to disturb potentially contaminated sediment, which may result in the exposure of construction workers, ecological receptors and the local water environment to potentially contaminated sediments.
Mobilisation of contaminated sediments during capital dredging and construction works (including demolition/removal of some of the existing marine structures) potentially causing adverse effects on Human Health in the River Clyde (offsite)	No	Potential impacts on users of designated bathing waters are scoped out due to the distance from the site and likelihood of minimal impact.
Pollution of water environment through accidental spillage or leakages during construction works	No	Site operations and environmental protection will be implemented under an appropriately worded condition to secure the finalisation and implementation of a CEMP to manage any risks

Potential Effect	To be assessed in the EIARA (Yes/No)	Reason
		associated with the release of contaminants as a result of accidental spillage or leakages.
Operational Stage		
Mobilisation of materials and pollutants during rainfall events resulting in pollution being released into the River Clyde	No	The design of the revised proposed development will include appropriate management of surface water runoff (e.g. inclusion of oil/water interceptors) to prevent materials or pollutants washing from the site during rainfall events and entering the River Clyde. No further assessment is therefore required.
Release of contaminants from site during operations (for example through spillages or leakages) to surrounding waters	No	Operations on site will involve the handling of potentially hazardous materials as cargo, and during fuelling and mooring of marine vessels. Appropriate management procedures regarding refuelling and spill response will be in place to manage these risks and therefore no further assessment is required.
Discharges to water environment from operational activities such as removal of wastewater from shipping/ boats using the facility	No	The facility will operate under regulatory requirements in terms of discharge of waste and vessels using the facilities will be required to comply with the requirements of the IMO Ballast water management convention. These systems and requirements will be in place during the operation of the proposed scheme and therefore no further assessment is required.

Approach and Methodology

Relevant and applicable guidance such as, legislation, policies, and technical standards will be used to assess likely significant effects that could arise from the proposed development of the Scottish Marine Technology Park. The relevant legislation and guidance documents include the following:

- The Water Environment (Controlled Activities) (Scotland) Regulations 2011[70].
- Water Resources (Scotland) Act 2013[71].
- European Water Framework Directive ("the WFD")[72].
- Water Environment and Water Services (Scotland) Act 2003[73].

[70] Scottish Government (2011) The Water Environment (Controlled Activities) (Scotland) Regulations
[71] Scottish Government (2012) Water Resources (Scotland) Act
[72] EU Parliament and Council (2000) Directive 2000/60/EC of the EU Parliament And Council Establishing a Framework for Community Action in the Field of Water Policy.
[73] Scottish Government (2003) Water Environment and Water Services (Scotland)

- Guidance for Pollution Prevention (GPP) 5: Works and Maintenance in or Near Water[74].
- Pollution Prevention Guideline Note (PPG) 6: Work at Construction and Demolition Sites[75].

A water and sediment environment EIARA chapter will be prepared, detailing the baseline water and sediment environment at the site (focussed on sediment quality in the area of the site, WFD criteria and classifications). This will be supported by hydrodynamic modelling and marine ecological surveys as outlined in Marine Physical Processes and Marine Ecology respectively, as well as sediment sampling within the site to support a marine licence application for the required dredging.

The impact assessment documented within the EIARA chapter will use a source-pathway receptor approach to identify the likely significance of effects and develop criteria for site management and monitoring.

Where appropriate, technical appendices will be prepared to support the EIARA chapter. These will include, as a minimum, a WFD assessment to support the marine licence application and inform the EIARA, as well as results of any GI and sediment sampling. A sampling plan to support the marine licence application for the required dredging will be prepared and submitted to MD-LOT for approval, prior to commencement of any investigation works on site.

Potential impacts associated with sediments will be informed by Cefas (Centre for Environment, Fisheries, and Aquaculture Science) Action levels and associated guidance, as well as Scottish marine licensing guidance.

Study Area

The study area comprises the site and local surrounding area within the River Clyde which could potentially be impacted by any likely environmental effect identified Table 7.

Mitigation and Enhancement

Any necessary mitigation measures will be identified, dependant on the outcome of the water quality and sediment assessment and could include:

- Development of suitable methodologies (to mitigate the risk of creation of pollutant pathways) during demolition and construction works, informed by risk assessments;
- Dredge method controls such as silt curtains, in order to minimise the mobilisation and dispersion of sediments;
- Construction method recommendations; and
- An outline CEMP would be prepared to support the marine licence application, and an appropriately worded marine licence condition would secure the production of a final/detail CEMP (once a contractor is appointed) to be agreed with MD-LOT prior to works commencing.

[74] SEPA (2018). Works and maintenance in or near water: GPP 5 Version 1.2

[75] SEPA (2023). Guidance for Pollution Prevention Working at construction and demolition sites: GPP 6 Version 1.

4.7 Noise and Vibration

Baseline

A detailed daytime and night-time sound survey was undertaken in accordance with BS 7445-1[76] to support the submitted EIAR to establish the existing environmental sound climate around the site and nearby receptors. Typical daytime noise levels were considered to be range between 46 - 72 dB and night-time noise levels ranged from 39 – 60 dB. These baseline conditions are considered to remain unchanged for the revised proposed development.

No significant existing sources of ground-borne vibration have been identified around the site.

Potential Impacts and Likely Effects

The following sensitive receptors have been identified following an initial review of satellite imagery:

- Residential receptors to the north of the A814 Dumbarton Road;
- Residential receptors at and around Durban Avenue;
- CrossReach Erskine Waterfront Campus;
- Muthu Glasgow River Hotel and Spa; and
- Commercial uses around the site.

Table 8**Error! Reference source not found.** presents a summary of the scoping process, identifying which likely environmental effects, with respect to terrestrial noise and vibration, will be assessed in the EIARA (i.e. considered potentially significant and therefore 'scoped in') and those which will not be assessed further (i.e. 'scoped out'), along with a justification for this decision.

Table 8: Potential Environmental Effects Relating to Terrestrial Noise and Vibration

Potential Effect	To be assessed in the EIARA (Yes/No)	Reason
Demolition and Construction Stage		
Effects due to demolition and construction noise	Yes	The submitted EIAR assessed noise and vibration levels on the assumption that the piles would mostly be installed using vibratory methods with some need for impact driving to reach required depth. The construction methods for the revised proposed development are considered to be materially different from the submitted EIAR and therefore further assessment is required.
Effects due to demolition and construction vibration	No	The nearest human vibration sensitive receptors are expected to be over 100 m from the revised proposed development. Ground-borne demolition and construction vibration would not be expected to be

[76] British Standards Institution (2003); BS 7445:2003 Description and Measurement of Environment Noise – Part 1: Guide to Quantities and Procedures. London: BSI.

Potential Effect	To be assessed in the EIARA (Yes/No)	Reason
		significant at this distance and therefore no further assessment is required.
Effects due to changes in road traffic noise levels during construction	No	This effect was assessed as part of submitted EIAR and the design changes for the revised proposed development do not present a materially different change to the outcomes of this assessment.
Operational Stage		
Effects due to changes in road traffic noise levels during operation	No	This effect was assessed as part of submitted EIAR and the design changes for the revised proposed development do not present a materially different change to the outcomes of this assessment.
Effects due to noise from new fixed plant installations and site activity	No	This effect was assessed as part of submitted EIAR and the design changes for the revised proposed development do not present a materially different change to the outcomes of this assessment.
Effects due to operational vibration due to new site activity	No	No significant sources of operational vibration are expected.

Approach and Methodology

An updated noise and vibration assessment will be undertaken to ensure the potential effects of any changes in pile driving methodology on sensitive receptors are sufficiently captured within the EIARA. This update would use the existing baseline data from the submitted EIAR and would qualitatively assess the potential demolition and construction effects.

Study Area

The study area would include noise sensitive receptors up to 300 m from the site boundaries.

BS 5228:2009+A1:2014 states that any predictions of demolition and construction noise beyond 300 m should be treated with caution, due to meteorological effects.

Mitigation and Enhancement

The potential for significant effects due to construction noise will be reduced by application of Best Practicable Means to reduce levels of noise at nearby sensitive receptors. An outline CEMP would be prepared to support the marine licence application, and an appropriately worded marine licence condition would secure the production of a final/detail CEMP (once a contractor is appointed) to be agreed with MD-LOT prior to works commencing.

4.8 Navigation and Marine Operations

Baseline

The proposed development is located within Clydeport Operations Limited (COL) (owned by Peel Ports Group (PPG)) Statutory Harbour Authority (SHA) limits. COL in its capacity as the SHA has a set of powers, duties and responsibilities. This includes ensuring and maintaining safe port marine operations and the regulatory control of navigational activities along the tidal River Clyde covering all navigable areas into the Firth of Clyde including Loch Fyne.

The majority of COL's SHA area provides deep water channels relating to the local topography. The approach to Glasgow from Greenock is an area subject to some sediment accretion in the form of mudflats with saltmarsh boundaries. The main navigation channel is regularly dredged to maintain navigable depths.

The River Clyde from Greenock to Glasgow is comprised of shifting sandbanks and mudflats creating large areas of accretion which have an impact on the safety of surface navigation. This area is managed with one dredged channel running to Glasgow. Local shipping uses these deep channels with a negligible percentage manoeuvring outside of the managed channel. These vessels mostly consist of smaller vessels including port service and non-port service craft.

The Port Marine Safety Code (PMSC) requires that all organisations operate an effective Marine Safety Management System (MSMS) which is based on a set of comprehensive and regularly updated formal risk assessments for marine operations and related marine procedures. The MSMS for COL details how its statutory duties are met, through the effective implementation of plans, processes, and procedures.

The Competent Harbour Authority (CHA) for pilotage under the Pilotage Act 1987 for the sea area for the proposed development is also COL. COL has a set of Pilotage Directions in place that identify vessels that will require a Pilot and in addition under which circumstances. A Pilotage Exemption Certification (PEC) scheme is also in place for any bona fide ship's deck officers who demonstrate that they have the requisite skills, experience, and local knowledge to pilot their vessel. COL also has duties as the Local Lighthouse Authority (LLA) to the General Lighthouse Authority (GLA) for their area of jurisdiction by virtue of Section 193 of the Merchant Shipping Act 1995. This provides the responsibility for the maintenance of navigational marks and lights within the Authority's area. Approaches from seaward to the Firth of Clyde are managed by Northern Lighthouse Board as the GLA.

Potential Impacts and Likely Effects

The following sensitive receptors have been identified:

- Life (people);
- The environment;
- Port and shipping infrastructure (assets); and
- Port and port user operations (reputation).

Error! Reference source not found. presents a summary of the scoping process, identifying which likely effects, with respect to navigation and marine operations, will be assessed in the EIARA (i.e. considered potentially significant and therefore 'scoped in') and those which will not be assessed further (i.e. 'scoped out'), along with a justification for this decision. Where potential effects are identified, these will be assessed within a stand-alone Navigational Risk Assessment (NRA) which will cover the hazards and risks for navigation and marine operations, rather than a chapter of the EIAR.

Table 9: Potential Environmental Effects Relating to Navigation and Marine Operations

Potential Effect	To be assessed in the EIARA (Yes/No)	Reason
Demolition and Construction Stage		
Navigation and marine operation hazards relating to the risk receptors for the four required criteria; the consequence to: public safety; the environment; port and port user operations (business, reputation etc); and port and shipping infrastructure (damage) in line with the GtGP (DfT, 2018).	Yes	The degree of risk to the identified receptors is not fully known. An NRA will therefore be undertaken so that the impacts can be fully assessed with respect to risk.
Commercial vessel arrangements and restrictions to navigation with potential impact on socio-economic factors	No	These fall outside the scope of the PMSC and its guide to good practice. The principles of the NRA follow the FRA guidance as applied using the PMSC and GtGP. Commercial and socio-economic factors are not within the scope for FRA and should not be factored into the NRA. The NRA focuses purely on safety of navigation.
Land-side Health and Safety (H&S) risks	No	These risks are comprehensively covered through the Health and Safety Executive (HSE) which is separate to the scope of an NRA by jurisdiction and policy. The NRA should not conflate HSE and DfT/MCA/PMSC requirements and related legislation governing land-based H&S and marine safety management in relation to navigation of vessels.
Operational Stage		
Navigation and marine operation hazards sensitive to the risk receptors for the four required criteria; the consequence to: public safety; the environment; port and port user operations (business, reputation etc); and port and shipping infrastructure (damage). in line with the GtGP (DfT, 2018) during demolition and operation stage	Yes	The degree of risk to the identified receptors is not fully known. An NRA will therefore need to be undertaken so that the impacts can be fully assessed with respect to risk.
Commercial vessel arrangements and restrictions	No	These fall outside the scope of the Port Marine Safety Code and its guide to good practice.

Potential Effect	To be assessed in the EIARA (Yes/No)	Reason
to navigation with potential impact on socio-economic factors.		
Land-side H&S risks	No	These risks are comprehensively covered through the HSE which is separate to the scope of an NRA by jurisdiction and policy. The PMSC and GtGP define the requirements for marine and navigation risk assessment. Land based risk is kept separate due to legislative boundaries and jurisdiction limits.

Approach and Methodology

Assessment Guidance

To satisfy the need to assess impacts on Navigation and Marine Operations (both commercial and recreational), a NRA will be produced in compliance with the requirements of the PMSC (the 'Code') and the associated GtGP. The NRA will primarily need to satisfy the SHA, specifically COL (owned by PPG). The NRA will be conducted through a process that is used and recognised by PPG, which is also in line with the requirements and guidance of the PMSC and the GtGP. The NRA will assess navigational risk by utilising a matrix consisting of the four base receptors identified in the PMSC (DfT, 2016) and Chapter 4 of the GtGP (DfT, 2018) for formal risk assessment for port marine operations.

Within the context of Peel's SSP, the Code, and the GtGP, there are two elements which need to be satisfied from a navigation and marine operations risk perspective. These are the fundamental principles of 'ALARP' (which is defined as being 'as low as reasonably practicable' in the PMSC) and Tolerability:

- 'ALARP' is an industry-wide standard. Central to this standard is the term 'reasonably practicable'. To meet this standard, the NRA must balance risk against the effort, time and money required to control the risk; and
- 'Tolerability' seeks to define the point at which a risk has an unacceptable outcome (a function of likelihood and consequence) when measured against key criteria. Therefore, when determining whether the predicted level of risk is acceptable to PPG, as the SHA and duty holder under the requirements of the PMSC, will require a two-part test. That is, 'Is the risk tolerable to the organisation' and 'Is the risk mitigated to an 'ALARP' state', in line with the requirements as set by the SHA/duty holder.

NRA Methodology

The 5 stages in the NRA process are outlined below:

1. **Data gathering:** this stage will involve data gathering such as marine traffic data (automatic identification system (AIS) and Royal Yacht Association (RYA)), metocean and tidal data, and incident data from the Marine Accident Investigation Branch (MAIB), the Royal National Lifeboat Institution (RNLI) and PPG, if available.
2. **Hazard identification:** this stage will initially identify the potential marine hazard scenarios at a 'Pre-Hazard Identification meeting'. The scenarios identified will be confirmed with attendees at the Hazard Identification workshop with relevant stakeholders, where participants will also have the opportunity to raise any additional scenarios.

3. **Risk analysis:** this stage will consider the determination of frequency and consequence for each hazard scenario as well as the overall assessment of risk outcomes and determining their prioritisation.
4. **Assessment of existing measures:** this stage will consider the use of embedded controls, which either reduce the frequency or mitigate the severity (or both), and also the use of future controls, which are not currently in place or not fully in place but could be used to reduce or eliminate risk.
5. **Recommendations for future risk controls:** this stage will involve making final decisions in determining if the risk has been sufficiently mitigated. This needs to be made by the appropriate organisation, which in the case of this proposed development is PPG as the SHA.

Study Area

The recommended study area for the navigation and marine operations topic considers a boundary that best aligns with:

- Mean highwater springs (MHWS) on the north bank of the River Clyde adjacent to the revised proposed development (northern limit);
- MHWS on the south bank of the River Clyde (southern limit);
- 300 m downstream, to the West, of the revised proposed development (western limit); and
- 300 m upstream, to the east of the revised proposed development.

Due to the nature of navigation in a constrained estuarine system, this proposed study area will sufficiently capture the significant movements of vessels relative to the proposed development. As this proposed study area spans the navigable limits across both banks of the River Clyde, any vessels which utilise this section of the river, either for transit through or for manoeuvring will be included. As such, extending the proposed study area further west or east is considered unnecessary.

Assessment Scenarios

Assessment scenarios for the proposed development in the NRA will capture the risks captured above in Table 9 with respect to navigation and marine operations. The assessed scenarios for each risk will consider the 'most likely' and 'worst credible' scenarios for each hazard identified.

Risks and the impact of identified outcomes are assessed against the four required criteria; the consequence to: people (public safety); the environment; port and port user operations (business, reputation etc); and port and shipping infrastructure (damage), in line with the GtGP (DfT, 2018).

Hazard Scenarios are likely to consist of the following Hazard Categories:

- Allision/ Contact (with infrastructure);
- Collision;
- Stranding/ Grounding;
- Marine Pollution (including hazardous substance accidents);
- Accidents to Personnel;
- Payload Related Accident (dropped components); and
- Mooring Failure.

Additional risks to consider may be brought up during the Hazard Identification workshop and be considered if they are within scope of the proposed development's demolition and construction phase or the operational phase. These risk categories may include but not be limited to:

- Fire;
- Explosion;
- Flooding (vessel);
- Foundering; and

- Capsizing.

Preliminary Discussion of Mitigation and Enhancement Measures

The data gathering and stakeholder consultation meetings (including the Hazard Identification workshop) will identify existing risk control measures currently in place within the study area. Future risk control measures will be recommended if identified during the NRA process which could contribute to safer and more efficient operations for both phases of the proposed development.

Due to the nature of the revised proposed development, it is likely that the list of embedded controls will be minimal and, for those that are in place already, they will largely comprise of controls in place for the safe management of the port by PPG (e.g. Pilotage Directions).

5 Effects Scoped out of Further Assessment

Topics that have been scoped out of further assessment within the EIARA for the revised proposed development are set out in Table 10, These effects have been considered by relevant technical specialists as part of a revised scoping exercise. This table is not intended to supplement the scope of the submitted EIAR, rather to inform the decision making process for the required EIARA for the revised proposed development.

Table 10: Topics Scoped Out of Further Assessment within the EIARA

Topic	Sensitive Receptors	Effects Considered	Reason
Climate	• Construction workers for the proposed development; • Construction activities e.g. materials, programme, cost; • People in the immediate surroundings of the proposed development footprint; • The proposed development (e.g. integrity of landscape features and buildings/occupants of the development) during the operational stage; and • The global atmosphere due to emissions of greenhouse gases associated with the proposed development during construction and operation.	• Resilience of the revised proposed development to climate and climate change impacts (during construction and operation); • Additive effect that climate and climate change may have on impacts identified by other technical disciplines as a result of the proposed development; and • GHG emissions associated with demolition, construction and operation of the revised proposed development.	Climate was scoped out of the submitted EIAR on the basis that, the scale of the proposed development is limited and not considered to give rise to a significant effect on climate. The vulnerability of the revised proposed development to climate change is not considered to have changed. The additive effect that climate change may have on the revised proposed development is not considered to give rise to any significant effects. With regards to GHG emissions it is acknowledged that the construction stage will utilise energy intensive materials such as steel. Both stages would use fossil fuels for construction plant and operational energy requirements. These assumptions remain unchanged from the submitted EIAR and climate is therefore scoped out of further assessment for the revised proposed development.

Landscape and Visual	• Landscape Receptors
	  ○ Landscape Character Types; and
	  ○ Landscape Designations and Classifications.
	• Visual Receptors
	  ○ Recreational Routes, and lookouts:
	  ▪ NCN 7 Cycle Route/ Forth and Clyde Canal, 200m north-east of the Site;
	  ▪ Core Path 87, 1.5km north of the Site;
		• Effects on physical landscape of the site
		• Effects on landscape character beyond the site boundary
		• Effects on receptors at viewpoints
		• Effects on receptors within settlement and recreational/transport routes
			The submitted EIAR considered potential effects on landscape and amenity receptors, including assessment of building heights up to 30 m. The proposed ship hoist would not extend higher than this. The LVIA concluded that the construction and demolition stage would not result in significant effects on landscape character and visual amenity.
			
			During operation, the submitted EIAR concludes that potential significant effects could arise from the introduction of the fabrication shed. Visual screening would be provided for low-lying infrastructure by the proposed landscape planting. The visual effect of the fabrication shed is considered to give rise to the greatest effect and therefore, the revised proposed development is not considered to give rise to any additional

	▪ Erskine Bridge Core Path/ Core Paths 123, 124 & E1/2, 790m north-west of the Site; ▪ Riverside Walk and Cyle Path/ Core Path E1/1 & E1/5, 150m south-west of the Site; and ▪ Erskine Beach, 650m north-west of the Site. • Residential Receptors: o Old Kilpatrick, 220m north-east of the Site; o Erskine, 590m south-west of the Site; o Mountblow, 1km north-east of the Site; and o Parkhall, 1.6km north-east of the Site. • Transportation Routes: o A814/Dumbarton Road, 190m north-east of the Site; o A898/Erskine Bridge, 790m north-west of the Site; o A726, 500m south-west of the Site; o A82/Great Western Road, 1.1km north-east of the Site; and o Local Roads		effects relating to landscape and visual beyond those already assessed.
Population and Health	• Population and demography; • Health and wellbeing; • Healthcare; and • Public health and safety.	• Effects on health and wellbeing during construction • Increased pressure on local healthcare services during construction • Risks to public health and safety	Where potential changes to human health receptors could arise as a result of the revised proposed development, these are considered to have been addressed within the Marine Water and Sediment Quality and Navigation sections.

Socio-Economics	• Jobs - construction employment • Jobs - operational employment • Public access and recreational routes	• Effects on construction employment • Effects on operational employment • Effects on public access and recreational routes	The anticipated level of construction employment would not be expected to result in significant levels of construction labour displacement as the baseline review identified a reasonable supply of constriction labour in West Dunbartonshire and the Glasgow City Region. The proposed development would temporarily increase the demand for construction employment which would have a beneficial effect on the construction sector and the wider economy. The submitted EIAR assessed the potential socio-economic effects that could arise for the full proposed development, and the revised proposed development is not considered to materially change these conclusions.
Flood Risk	• The flood risk status of the site, taking account of the likelihood of flooding and the potential consequences to site infrastructure and occupants; and • The flood risk status of off-site areas and the hydrological regime of the water environment.	• Flood risk effects associated within construction and demolition • Changes to water levels during operation • Changes to wave conditions during operation • Long term changes to surface water run off	The submitted EIAR addressed Flood Risk, Hydrology and river channel morphology. The revised proposed development remains water compatible as quay infrastructure. Therefore the conclusions of this assessment are considered to remain accurate. In addition, the proposed dredge activity is considered to increase the river channel volume and therefore will not increase flood risk elsewhere or change the flood risk status off-site for receptors within the vicinity.
Materials and Waste	• Landfill void capacity; and • Materials markets	• Consumption of resources during construction and operation • Depletion of landfill void during construction and operation	The submitted EIAR addressed effects relating to the use of resources and waste generation during construction and operation and, with the exception of dredge arisings, the revised proposed development is not considered to introduce materially different effects. Capital dredge arisings are anticipated to be used on-site as fill material and therefore effects on landfill void would not be created. No inclusion for maintenance dredging has been incorporated at this time and therefore no additional operational waste would be generated.

6 Summary

Table 11 sets out the outcome of the assessment of potentially significant environmental effects that could arise as a result of the proposed development that should be considered further in the EIARA. The potential significance of any effect has been preliminarily assessed in terms of the relationship between two factors:

i. The magnitude of the potential impact (including direct or indirect effects), including the consideration of duration and reversibility; and

ii. The importance of the receptor (the entity that is vulnerable to the effect), in terms of its value and sensitivity to the effect.

Table 11: Summary of potentially significant effects Scoped into the EIARA for the revised proposed development

Potentially Significant Effects	Marine Archaeology		Water and Sediment Quality		Marine Ecology		Noise and Vibration		Marine Physical Processes		Navigation	
	Construction	Operation	Construction	Operation	Construction	Operation	Construction	Operation	Construction	Operation	Construction	Operation
Physical disturbance to the seabed causing loss and/or change in habitats	✓		✓		✓				✓			
Changes to hydrodynamic and sedimentary regimes due to dredging	✓		✓	✓	✓	✓			✓	✓		
Changes to water quality and suspended sediment concentrations (including contaminated sediments) due to dredging			✓		✓							
Noise generation due to impact piling (above ground and underwater)					✓		✓					
Navigation and marine operation hazards											✓	✓