6 Marine Works

6.1 Project details

The marine works for the project consists of a new rock armour breakwater and a capital dredge, see Figure 30.

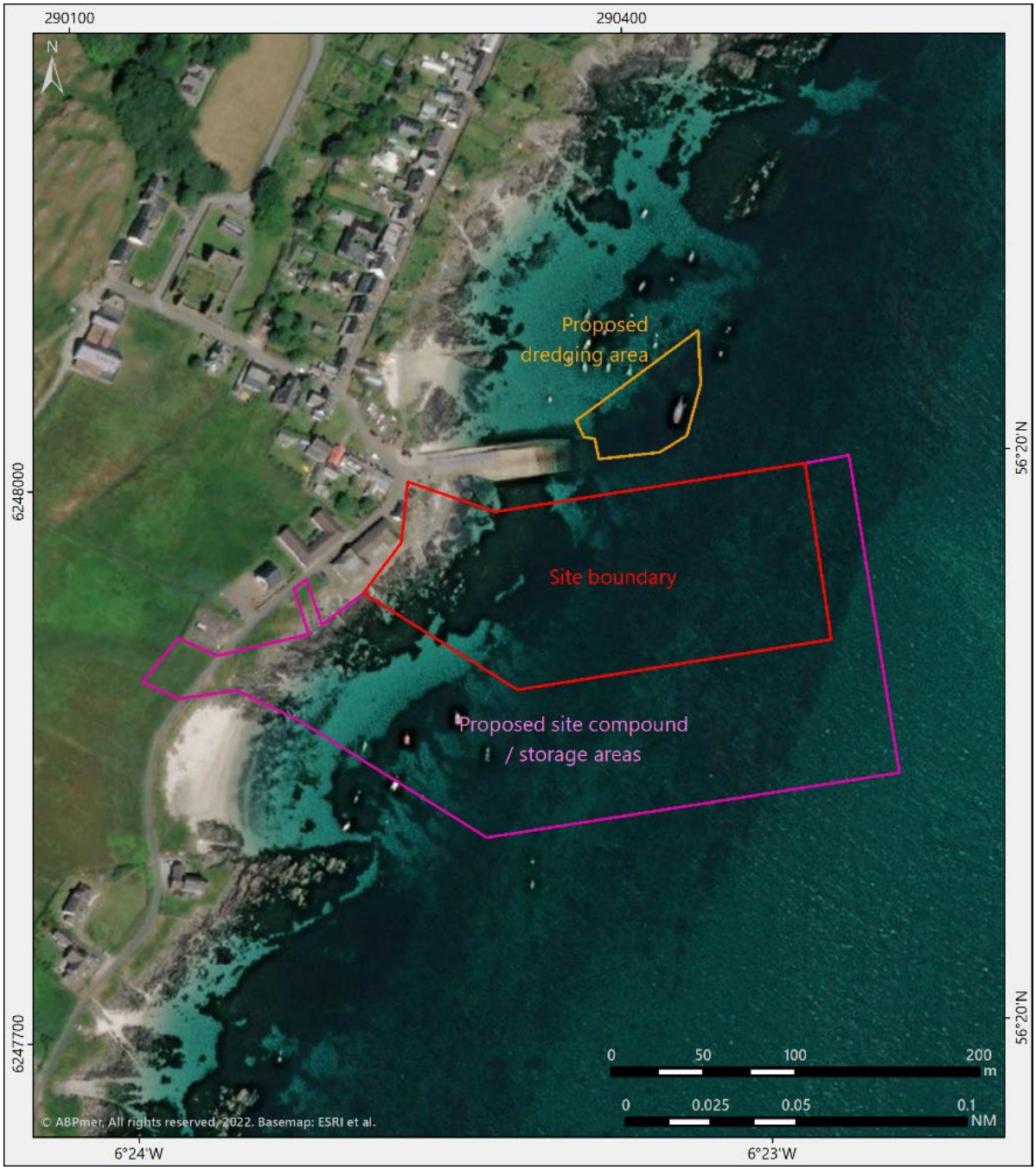

Figure 30. Iona Breakwater and dredge area

The following sections provide a description of each component of the works, as relevant to marine safety and navigation.

The Breakwater: the breakwater will be comprised a rock armour structure with a proposed 2:1 slope on outer face (non-slipway side) and 1:1.5 on the inner face (slipway side). The crest length will be *circa* 185 m and a crest level of 7.1 m above chart datum. The breakwater will be located approximately 70 m south of the existing slipway in Iona. The function of the breakwater is primarily to provide defence from waves propagating from a southerly direction, the structure will not provide protection from the waves propagating from northerly or easterly directions. The breakwater will result in an overall reduction of wave heights at the structure. The overall footprint of the breakwater is approximately 7,000 m^2. The rock armour breakwater will be constructed of clean quarried rock. The estimated volume of rock armour required for the proposed breakwater is 43,000 m^3.

The capital dredge: in order to accommodate the new navigation channel requirements, some dredging works will be required. The approximate dredge area is 2,017 m^2 manoeuvring depth for the ferry to safely access and egress the berth. The approximate dredge volume is 1,225 m^3. It is proposed that this is carried out by a backhoe dredge with the material deposited at Portnahaven disposal site, as shown on Figure 2.

6.2 Construction phase

During construction, site welfare facilities and site compound is expected to be established on a barge. This is where all works will be undertaken from, however there will likely be a small compound on shore which could be established at the car park adjacent to the pier (occupying maximum 2 spaces). The materials are expected to be transported to site by barge and installed from a barge fully equipped with crane and grab. Transport by road will be minimal. The duration of the works is expected to be 52 weeks.

The dredging plant will be mobilised to dredge one pocket at the site. One vessel is envisaged for this activity, and it would be expected to undertake multiple movements from the dredge site to the disposal site. As part of the dredging along the ferry route, the dredging operations will either be overnight or arranged with CFL to eliminate (as far as possible) any impact to the ferry service.

The sea level formation for rock armour installation will be undertaken by a diving team who will be accommodated on a barge. Rock armour for breakwaters delivered to site by barge and installation on the south faces of the breakwater will occur by crane grab off the barge (there is no anticipation of rock storage as it will be installed upon delivery to site). If a barge with a capacity of around 2,700 t were used for delivering rock armour to site, it would be expected to involve in the region 40-50 movements. This will be unloaded from the south face. The number of vessels may change in accordance with the successful contractor's proposals. The proposed breakwater at Iona is approximately 40 m from both ferries / tourism / fishing slipways, therefore rock armour activities will not encroach on the movement of ferries or other vessels.

Following this a security gate will be installed and all work will be tested and commissioned. Then the contractor will be demobilised.

6.3 Operational phase

The breakwater will be incorporated into Argyll and Bute Council's marine facility portfolio and be monitored as part of the Council's engineering and Port Marine Safety Code assurance programme. This includes monitoring and maintenance of breakwater and lighting, lifesaving equipment and AtoN. The ferry service will continue to operate (in its current form) with updated passage plan information and procedures. The approach area will be subject to period bathymetric survey to monitor the depth of water as part of Argyll and Bute Council's survey programme.

7 Hazard Workshop

In order to provide an NRA of navigational risk during the construction and operational phases of the proposed breakwater, a hazard workshop with maritime community stakeholders was undertaken. The hazard identification workshop was held on 09 September 2021 over Microsoft Teams. During the workshop, a presentation was given of the available baseline data and exercises were carried out to identify potential hazards associated with the proposed scheme.

The aim of the workshop was to identify navigational safety concerns relative to the study's scope. In addition, attendees at the workshop provided anecdotal information regarding marine use of the study area, which enhanced the level of detail collected through the navigation baseline activities. The output from the workshop was documented and shared with attendees. A total of 16 hazard scenarios were identified for the construction phase and 4 hazard scenarios for the operational phase.

7.1 Attendance

Stakeholder attendees at the hazard workshops are shown in Table 7. This list was drawn from known port users, maritime stakeholders, project officers and those that were identified through local consultation. This list is not exhaustive but is representative of those with interests in the area. Other invitees included individual local fisherman, the Scottish Canoe Association, the Royal Yachting Association (RYA) and the RNLI, who were unable to attend.

Table 7. Hazard Workshop Attendees

Attendee	Organisation
Scott Reid	Argyll and Bute Council
Elsa Simoes	Argyll and Bute Council
Jamie Salmon	Argyll and Bute Council
James Hamilton	RPS
Helen Croxson	MCA
Sam Chudley	MCA
Peter Douglas	NLB
David McHardie	Caledonian Maritime Assets Ltd
Alastair Mackie	Fionnphort Fishing Vessel Owner
Mark Jardine	Iona Tour Boat
Sophie Butler	ABPmer
Monty Smedley	ABPmer

8 Navigational Risk Assessment

This NRA has been carried out to determine the navigational risks for vessels, associated with the proposed development and operation of the Iona Breakwater. To assess navigational risk, the specifics of the scheme have been considered in relation to the potential impacts during the construction and operational phases of the development.

- **Construction:** construction of the breakwater and capital dredging.
- **Operation:** changes to vessel movement patterns, port and facility maintenance.

The process for carrying out an NRA follows the process identified in the PMSC's Guide to Good Practice (DfT, 2018). The process also includes the relevant process for the size and scale of the marine works within the methodology from the MCA (2021b); Methodology for Assessing the Marine Navigational Safety and Emergency Response Risks of Offshore Renewable Energy Installations (OREI).

1. Identification of hazard definitions;
2. Listing of potential hazard scenarios (i.e. descriptions of hazard and outcome);
3. Identification of causes that may lead to one of the described hazard scenarios (i.e. an accident or incident outcome);
4. Consideration of existing (embedded) mitigation measures, which either control or address the outcome of an accident or incident; and
5. Additional (future) risk controls, which are not currently in place, but could be used to further reduce or eliminate risk.

The following sections identify the outcomes from the above steps, as carried out within this NRA.

8.1 Hazard definitions

The first step in the NRA process is the consideration of potential hazards resulting from the proposed scheme. Table 8 provides hazard category definitions, taken from the MCA; 'Methodology for Assessing the Marine Navigational Safety and Emergency Response Risks of OREI', (MCA, 2021b).

Six hazard categories have been scoped out of this NRA. These are shown in Table 9 along with the reason. The rationale considers the construction methodology as well as the operational requirements for the proposed development, and the potential outcomes, in terms of navigational hazards.

Table 8. Hazard category definitions

Category	Description
Accidents to personnel	Accidents to personnel are defined as those accidents which cause harm to any person on board the vessel e.g. crew, passengers, stevedores; which do not arise as a result of one of the other accident categories. Essentially, it refers to accidents to individuals, though this does not preclude multiple human casualties as a result of the same hazard, and typically includes harm caused by the movement of the vessel when underway, slips, trips, falls, electrocution and confined space accidents, food poisoning incidents, etc.
Accidents to the General Public	Accidents to personnel are defined as those accidents which lead to injury, death or loss of property amongst the population ashore resulting from one of the other ship accident categories.
Allision	Defined as a violent contact between a vessel and a fixed structure.
Capsizing	The overturning of a vessel after attaining negative stability.
Capsizing	The overturning of a vessel after attaining negative stability.
Collision	Collision is defined as a vessel striking, or being struck by, another vessel, regardless of whether either vessel is under way, anchored or moored; but excludes hitting underwater wrecks.
Contact	Contact is defined as a vessel striking, or being struck by, an external object that is not another vessel or the sea bottom. Sometimes referred to as impact.
Explosion	An explosion is defined as an uncontrolled release of energy, which causes a pressure discontinuity or blast wave.
Fire	Fire is defined as the uncontrolled process of combustion, characterised by heat or smoke or flame or any combination of these.
Flooding	Flooding is defined as sea water, or water ballast, entering a space, from which it should be excluded, in such a quantity that there is a possibility of loss of stability leading to capsizing or sinking of the vessel.
Foundering	To sink below the surface of the water.
Grounding	Grounding is defined as the ship coming to rest on, or riding across, underwater features or objects, but where the vessel can be freed from the obstruction by lightning and/or assistance from another vessel (e.g. tug) or by floating off on the next tide.
Hazardous substances accidents	Hazardous substance accidents are defined as any substance which - if generated as a result of a fire, accidental release, human error, failure of process equipment, loss of containment, or overheating of electrical equipment - can cause impairment of the health and/or functioning of people or damage to the vessel. These materials may be toxic or flammable gases, vapours, liquids, dusts or solid substances.
Loss of hull integrity	Loss of hull integrity is defined as the consequence of certain initiating events that result in damage to the external hull, or to internal structure and sub-division, such that any compartment or space within the hull is opened to the sea or to any other compartment or space (where it is not designed to be).
Machinery related accidents	Machinery related accidents are defined as any failure of equipment, plant and associated systems which prevents, or could prevent if circumstances dictate, the ship from manoeuvring or being propelled or controlling its stability.

Category	Description
Payload related accidents	Payload related accidents include loss of stability due to cargo shifting and damage to the vessel's structure resulting from the method employed for loading or discharging the cargo. This category does not include incidents which can be categorised as Hazardous substance, Fires, Explosions, Loss of hull integrity, Flooding accidents etc.
Stranding	Stranding is defined as being a greater hazard than grounding and is defined as the ship becoming fixed on an underwater feature or object such that the vessel cannot readily be moved by lightening, floating off, or with assistance from other vessels (e.g. tugs).

Table 9. Hazard categories scoped out

Scoped Out Hazard Category	Rationale
Accidents to the general public	The site will not be open to the general public shoreside during the works. Water access is considered by its hazard category.
Capsizing	The risk of capsize to project craft has been considered as part of Payload related accidents.
Contact	Contact has been considered as part of allision.
Foundering	Foundering is not considered a likely hazard scenario in its own right and has been considered as part of grounding.
Loss of hull integrity	The construction phase does not have the potential to cause a vessel to lose hull integrity. This may occur from allision, collisions or grounding, which are considered separately.
Stranding	Stranding is not considered a likely hazard scenario in its own right and has been considered as a potential consequence of grounding.

8.2 Hazard scenarios

From the hazard categories scoped into the NRA, the study team at ABPmer has identified the following specific hazard scenarios which relate to either the scheme construction (Table 10) or the operational (Table 11) phases. In total, 19 hazard scenarios are identified in the NRA, 16 in the construction phase and 4 in the operational phase.

Table 10. Construction phase hazard scenarios

Assessment Number	Hazard Category	Hazard Scenario Title
1	Accidents to personnel	Man overboard during dredge/construction works
2	Accidents to personnel	Diving operations associated with the marine works
3	Allision	Dredge/construction plant with marine works during construction phase
4	Allision	Recreational or fishing vessel allision with marine works
5	Allision	Ferry or tour boat allision with marine works
6	Collision	Dredge/construction plant collision with recreational/fishing vessel
7	Collision	Dredge/construction plant collision with ferry/tour boat
8	Collision	Tug and tow collision with recreational/fishing vessel
9	Collision	Tug and tow collision with ferry/tour boat
10	Fire/Explosion	Dredge/construction plant on-board fire
11	Flooding	Dredger flooding whilst engaged in operations
12	Grounding	Dredger grounding whilst engaged in operations
13	Hazardous substance accidents	Accidental spill during marine works
14	Machinery related accidents	Heavy lift failure or failure of lifting gear
15	Payload related accidents	Incorrect payload distribution/loading affects vessel stability
16	Other	Small non-powered craft displaced by marine works

Table 11. Operational phase hazard scenarios

Assessment Number	Hazard Category	Hazard Scenario Title
1	Allision	Ferry or tour boat with the breakwater
2	Allision	Recreational or fishing vessel allision with the breakwater
3	Grounding	Any vessel
4	Other	Small non-powered craft displaced by breakwater

The hazard scenarios identified in Table 10 and Table 11 have been considered according to their 'Most Likely' and 'Worst Credible' outcomes. This provides the option to consider very serious outcomes, which could credibly occur, along with outcomes that are less serious, but could occur on a more frequent basis. The full working and outcome description of each scenario, presented as a full NRA, is provided in table format in Appendix B.

8.2.1 Hazard scenario causes

Each hazard scenario was considered to determine its possible cause(s). Table 12 and Table 13 give a frequency (count) of the causes identified during the assessment process for the construction and operational phases of the project.

Table 12. Cause frequency for the construction phase

Cause	Frequency
Human error/fatigue - Vessel Personnel	13
Vessel breakdown or malfunction	12
Adverse weather conditions	10
Restricted visibility	10
Inadequate procedures in place onboard vessel	10
Inadequate training/competence - Personnel	7
Human error/fatigue - Construction personnel	7
Reduction in safe navigable space	6
Unplanned interaction with recreational/fishing craft	6
Communication failure - Personnel	6
Failure to follow passage plan	6
Incorrect assessment of tidal flow	5
Inadequate bridge resource management	5
Communication failure - Operational/procedural	5
Failure to comply with safe systems of work	5
Notice to Mariners failure to observe	5
Manoeuvre misjudged	4
Inadequate marine procedures - Project	4
AIS failure	4
Limited area for manoeuvring	3
Excessive vessel speed	3
Human error/fatigue - Marine personnel	3
Towing equipment failure	3
Inadequate maintenance/inspection	3
Unplanned interaction with ferry/tour boat	3
Failure of Aid to Navigation (out of position/unlit)	2
Loss of watertight integrity	2
Interaction with passing vessel	2
Navigation equipment failure	2
Scheduling conflicts	2
Increased vessel use	1
Human error	1
Competence	1
Fire/Explosion	1
Vessel has unreported defect	1
Vessel Ramps or Hatches not secure	1
Port Equipment (including craft) mechanical breakdown/system malfunction	1
Equipment failure (bridge)	1

The most frequently identified causes for the construction phase are 'Human error/fatigue – Vessel Personnel' with a frequency of 13, 'Vessel breakdown or malfunction' with a frequency of 12, 'Inadequate procedures in place onboard vessel', 'Adverse weather conditions' and 'Restricted visibility' with a frequency of 10. Since there is dredging and a breakwater constructed in an area which has vessels passing through it, numerous hazards have causes which are attributed to these vessels. There will be periods were non-construction vessel movements affect the construction, such as dredging along the ferry route. Due to the location of the site, it is particularly exposed to weather fronts from certain directions. This means there will be periods where wind direction and wave height may affect the construction.

Table 13. Cause frequency for the operational phase

Cause	Frequency
Reduction in safe navigable space	4
Limited area for manoeuvring	4
Human error/fatigue - Vessel Personnel	3
Adverse weather conditions	3
Restricted visibility	3
Unplanned interaction with recreational/fishing craft	3
Incorrect assessment of tidal flow	3
Manoeuvre misjudged	3
Increased vessel use	3
Vessel breakdown or malfunction	2
Inadequate procedures in place onboard vessel	2
Inadequate training/competence - Personnel	2
Inadequate bridge resource management	2
Excessive vessel speed	2
Failure of Aid to Navigation (out of position/unlit)	2
Human error	2
Competence	2
Human error/fatigue - Construction personnel	1
Communication failure - Personnel	1
Failure to follow passage plan	1
Failure to observe standing notices	1
Incapacitated master (drinks/drugs)	1
Inadequate surveying	1

The most commonly identified causes both have a frequency of four. They are: 'Limited area for manoeuvring' and 'Reduction in safe navigable space'. These causes are closely followed in frequency by 'Human error/fatigue - Vessel Personnel', 'Unplanned interaction with recreational/fishing craft', 'Adverse weather conditions', 'Restricted visibility', 'Increased vessel use', 'Incorrect assessment of tidal flow', 'Manoeuvre misjudged' which each have a frequency of 3. The most frequently identified causes for the operational phase are similar to those identified for the construction phase, with the addition of the site causing a reduction of safe navigable space. The next stage of the process considers these causes in the context of existing controls, which might be applicable to prevent the hazard scenario from occurring.

8.3 Existing (embedded) risk controls

Each hazard scenario has been considered in light of embedded risk controls. It should be noted that embedded risk controls, in the context of marine safety, relate to processes, practices and available safety resources that are currently implemented and items identified as part of the project scheme. For example, these might include international regulations (such as the International Regulations for Preventing Collisions at Sea (COLREGS) (IMO, 1972)), or provision of emergency services (such as ambulances). In addition, any controls planned as part of the scheme have been considered as embedded within the scheme design.

Table 14 and Table 15 present the embedded risk controls with a frequency count of the number of assessments to which they apply for the construction and operational phases respectively. Following construction of the Marine Works certain controls (which are already implemented) will be updated to include for new operating instructions. These include controls such as the 'Marine Safety Management System' and 'Passage Planning' for the ferry.

Table 14 Embedded risk controls for the construction phase

Controls	Frequency
Marine Safety Management System	16
Vessel's emergency response procedures	8
Contractor risk assessment method statement (RAMS)	8
Emergency services equipment - shore side	7
Standing Orders/SOPs	4
Oil spill contingency plans	3
Communications equipment	3
Safe systems of work (H&S)	3
Passage planning	2
Tier 2 contractor	2
Availability of latest hydrographic information	1
Visual observation (clear line of sight)	1
Weather forecasting	1
Vessel maintenance	1
Vessel inspection/survey	1

Table 15 Embedded risk controls for the operation phase

Controls	Frequency
Marine Safety Management System	4
Oil spill contingency plans	3
Tier 2 contractor	3
Vessel's emergency response procedures	2
Emergency services equipment - shore side	2
Passage planning	2
Weather forecasting	2
Aids to navigation, Provision and maintenance of	2
Communications equipment	1
Dredging programme	1

The assessment of risk is based upon the descriptions of the 'Most Likely' and 'Worst Credible' to determine the outcome in respect of effect to people, property, the environment and port business. This approach follows the best practice guidance from the PMSC 'Guide to Good Practice' (DfT, 2018). In making the assessment, the outcome from each scenario using the receptors of 'people, property, environment and port' has been evaluated to give a baseline risk with **no mitigation** measures in place.

8.3.1 Risk evaluation: embedded

After determining which controls are applicable to each hazard scenario, an embedded risk score has been calculated by determining the reduction in likelihood and consequence for each risk control should it be implemented; these reductions were then applied to the frequency and consequence of the scenario to give the overall risk score. Table 16 and
Table 17 show the hazard scenarios ranked by current risk after embedded risk controls have been considered.

Table 16. Ranked hazard scenarios for the construction phase

Hazard Category	Hazard Scenario	Baseline Risk	Current Risk
Allision	Ferry or tour boat allision with marine works	Hig	Sig
Flooding	Dredger flooding whilst engaged in operations	Hig	Sig
Allision	Dredge/construction plant impact with marine works during construction phase	Sig	Sig
Allision	Recreational or fishing vessel allision with marine works	Sig	Sig
Collision	Dredge/construction plant collision with recreational/fishing vessel	Sig	Sig
Collision	Tug and tow collision with recreational/fishing vessel	Sig	Sig
Collision	Tug and tow collision with ferry/tour boat	Sig	Sig
Hazardous substance accidents	Accidental spill during marine works	Sig	Sig
Machinery related accidents	Heavy lift failure, or failure of lifting gear	Sig	Sig
Payload related accidents	Incorrect payload distribution/ loading affects vessel stability	Sig	Mod
Fire/Explosion	Dredge/construction plant on-board fire	Sig	Mod
Other	Small non-powered craft displaced by marine works	Sig	Mod
Accidents to personnel	Man overboard during dredge/construction works	Mod	Low
Accidents to personnel	Diving operations associated with the marine works	Mod	Low
Collision	Dredge/construction plant collision with ferry/tour boat	Low	Low
Grounding	Dredger grounding whilst engaged in operations	Low	Low

Table 17. Ranked hazard scenarios for the operational phase

Allision	Ferry or tour boat with the breakwater		
Allision	Recreational or fishing vessel allision with the breakwater.		
Other	Small non-powered craft, displaced by breakwater		
Grounding	Any vessel		

The risk scores associated with each of the 20 hazard scenarios has been set on a scale of no risk to Very High Risk. The classification of each score is given in Table 18.

8.4 Tolerability

In determining whether the predicted level of risk is tolerable and acceptable, the following questions are considered:

- Is the risk below any unacceptable limit that has been established?
- If so, has it also been reduced to as low as reasonably practicable (ALARP)?

The risk is tolerable and acceptable if the answer to both these questions is 'Yes'. A&BC, as the marine asset owner and operator consider that any final risk outcome in the High or Very High band, is intolerable. Following which, all hazard scenarios have risk reduced to a point concluded to be ALARP. Table 18 identifies the score outcome used in this NRA.

Table 18. Classification of hazard scenario outcome

Classification	Outcome
Very High Risk	VH
High Risk	Hig
Significant Risk	Sig
Moderate Risk	
Low Risk	Low
Negligible Risk	Neg
No Risk	Non

8.5 Additional (future) risk controls

Additional controls have been identified to ensure that risk levels are reduced to a level which is considered to be ALARP (see Section 1.4.3 for a description of ALARP). These additional controls are safety recommendations which were then assigned a likelihood and consequence reduction to allow the calculation of a Future risk score. The identified measures, if fully adopted, should be incorporated into Argyll and Bute Council's operational plans for establishing and running the proposed breakwater.

Table 19 details the additional controls which were identified as recommendations for potential mitigation for the breakwater construction phase along with the frequency in which they were applied to the hazard scenarios.

Table 20 details the additional controls which were identified as recommendations for potential mitigation for the breakwater operational phase along with the frequency in which they were applied to the hazard scenarios.

Table 19. Additional controls for the construction phase

Control	Frequency
Marine liaison officer	15
AIS/Radar coverage	7
Notices to mariners	7
Weather forecasting	4
Aids to navigation, Provision and maintenance of	4
Communications - Stakeholder	4
Availability of pollution response equipment	4
Promulgation of information	4
Operational weather limits	4
Safety boat	3
Passage planning	2
Operational planning	1
Loading/unloading plan	1

Table 20. Additional controls for the operational phase

Control	Frequency
Review of available powers	4
Update ALRS and Sailing Directions	3
Passage planning	2
Shore side facility maintenance programme	2
Hydrographic surveying program	1
Promulgation of information	1

8.6 Risk evaluation future

Following the application of the additional (future) risk controls, the outcome of each hazard scenario in respect of the assessed future risk has been determined. The future risk outcome takes into account the likelihood reduction and consequence reduction from each proposed risk control. Table 21 and Table 22 present the future risk level for the hazard scenarios after the additional controls have been applied.

Table 21. Ranked hazard scenarios for the construction phase

Hazard Category	Hazard Scenario	Baseline Risk	Current Risk	Future Risk
Flooding	Dredger flooding whilst engaged in operations	Hig	Sig	Sig
Collision	Tug and tow collision with ferry/tour boat	Sig	Sig	Sig
Allision	Ferry or tour boat allision with marine works	Hig	Sig	Mod
Allision	Dredge/construction plant impact with marine works during construction phase	Sig	Sig	Mod
Allision	Recreational or fishing vessel allision with marine works	Sig	Sig	Mod
Collision	Dredge/construction plant collision with recreational/fishing vessel	Sig	Sig	Mod
Collision	Tug and tow collision with recreational/fishing vessel	Sig	Sig	Mod
Hazardous substance accidents	Accidental spill during marine works	Sig	Sig	Mod
Machinery related accidents	Heavy lift failure, or failure of lifting gear	Sig	Sig	Mod
Payload related accidents	Incorrect payload distribution/loading affects vessel stability	Sig	Mod	Mod
Fire/Explosion	Dredge/construction plant on-board fire	Sig	Mod	Mod
Other	Small non-powered craft displaced by marine works	Sig	Mod	Mod
Accidents to personnel	Man overboard during dredge/construction works	Mod	Low	Low
Accidents to personnel	Diving operations associated with the marine works	Mod	Low	Low
Collision	Dredge/construction plant collision with ferry/tour boat	Low	Low	Low
Grounding	Dredger grounding whilst engaged in operations	Low	Low	Low

Table 22. Ranked hazard scenarios for the operational phase

Hazard Category	Hazard Scenario	Baseline Risk	Current Risk	Future Risk
Allision	Ferry or tour boat with the breakwater	Hig	Hig	Mod
Other	Small non-powered craft, displaced by breakwater	Sig	Mod	Mod
Allision	Recreational or fishing vessel allision with the breakwater.	Sig	Mod	Low
Grounding	Any vessel	Sig	Mod	Low

9 NRA Discussion

This section expands upon the assessments and comments on future risk controls, as part of the existing harbour operation. Section 9.1 provides a commentary on construction hazard scenarios; Section 9.1.1 addresses the operational phase of the scheme.

9.1 Construction hazard scenarios

The NRAs for the construction stage of the project which have an assessed outcome of significant risk (or above) when currently available controls are applied have been taken forward into this section for further consideration. These hazard scenarios are listed in Table 23.

Table 23. Construction NRAs with significant or higher current risk

Hazard Category	Hazard Scenario	Current Risk	Future Risk
Flooding	Dredger flooding whilst engaged in operations	Sig	Sig
Collision	Tug and tow collision with ferry/tour boat	Sig	Sig
Allision	Ferry or tour boat allision with marine works	Sig	Mod
Allision	Dredge/construction plant impact with marine works during construction phase	Sig	Mod
Allision	Recreational or fishing vessel allision with marine works	Sig	Mod
Collision	Dredge/construction plant collision with recreational/fishing vessel	Sig	Mod
Collision	Tug and tow collision with recreational/fishing vessel	Sig	Mod
Hazardous substance accidents	Accidental spill during marine works	Sig	Mod
Machinery related accidents	Heavy lift failure, or failure of lifting gear	Sig	Mod

9.1.1 Flooding – Dredger flooding whilst engaged in operations

During the construction phase dredge and marine works, there is an increased risk of dredge vessels having an ingress of water during dredge operations through a weld failure, sea value defect or dredge cargo loading error with the vessel close inshore, in complex tidal conditions. The outcome would have a small negative magnitude as the potential impact will be localised to the extent of the marine construction area and will be present for the construction phase only. The hazard scenario has the potential to occur throughout the construction phase and would have a high impact on safety with limited ability to adapt to the situation, hence the sensitivity is high. Therefore, the dredger flooding has an overall assessment of minor adverse.

The following mitigation measure would need to be introduced by Argyll and Bute Council to reduce the risk to a level that could be considered ALARP:

- Marine liaison officer – to coordinate emergency response with shore side resources.

Following the implementation of this measure neither the sensitivity nor the magnitude of this assessment will change and therefore it will still be considered minor adverse.

9.1.2 Collision – Tug and tow collision with ferry/tour boat

A tug and tow collision with a ferry/tour boat carries a risk when the ferry/tour boat is travelling to and from the current slipway or pier. Collision risk is increased during periods of high vessel traffic, and when adverse weather may negatively affect vessel manoeuvrability. The collision has the potential to result in damage which may lead to a pollution event (e.g. fuel spill).

This assessment has a medium level of sensitivity as vessels have some ability to adapt to the situation through application of their engines, anchors or adjust moorings. In addition, it is likely the tug and tows will be moving at slow speed to transport material short distances between the barge and the marine works. The potential effect from a collision will be localised to the immediate extent of the marine construction area. The impact has potential to occur throughout the construction phase when these vessels are manoeuvring thus it has a magnitude of large negative. Therefore, the collision risk has an overall assessment of moderate adverse.

The following mitigation measures would need to be introduced by Argyll and Bute Council to reduce the risk to a level that could be considered ALARP:

- AIS coverage – all dredge/construction vessels, including barges to carry AIS (A or B).
- Notices to mariners – issued on the Council website containing details about construction activities.
- Marine liaison officer – to provide safety information to vessels navigating in the area and to local authorities.
- Safety lighting – Appropriate illumination of the marine works to be provided, without affecting mariners' night vision (BSI, Road Lighting, BS:5489-1 2020).

Following the implementation of these measures, specifically the issuing of notices to mariners and AIS coverage, the impact reduces to medium as incidents and accidents are less likely. Therefore, the scenario is assessed as moderate to minor adverse.

9.1.3 Allision – Ferry or tour boat allision with marine works

Ferry and tour boats transiting in proximity to the marine works have the potential to make heavy contact (allision) with the works. Allision risk will be increased during times of adverse weather when wind activity and wave action has the potential to adversely affect vessel manoeuvring and in periods of reduced visibility where it will be difficult to see breakwater. The risk will also be increased in periods of high vessel movements as this will decrease the available space for manoeuvring. Any contact has the potential to result in some damage which may lead to a pollution event (e.g. fuel or oil spill) and due to passengers being often onboard the vessel there is a risk of multiple injuries and associated negative publicity.

This potential effect would have a medium level of sensitivity as vessels have some ability to adapt to the situation through the application of their engines to manoeuvre or use of anchors to avoid/ reduce the impact of an allision. These vessels will also have SOPs in place which would provide a process to

follow for crew and passengers if a marine incident occurs, this could potentially reduce the severity of an incident. The potential effect from an allision will be localised to the immediate extent of the marine construction area. The impact has the potential to occur throughout the construction phase and therefore has a medium negative magnitude. Therefore, the overall outcome is moderate to minor adverse.

The following mitigation measures would need to be introduced by Argyll and Bute Council to reduce the risk to a level that could be considered ALARP:

- Notices to mariners – issued on the Council website containing details about construction activities.
- Aids to navigation, Provision and maintenance of – illumination of marine works at night.
- Marine liaison officer – central point of contact to coordinate activities.
- Availability of pollution response equipment – contractor to have tier 1 pollution equipment
- Promulgation of information – information on activities shared with local communities.
- Safety lighting – Appropriate illumination of the marine works to be provided, without affecting mariners' night vision (BSI, Road Lighting, BS:5489-1, 2020).

Following the implementation of these measures, specifically the appointment of a marine liaison officer, notices to mariners and the illumination of marine works at night, the magnitude is reduced to small negative as likelihood of an allision is reduced. Therefore, the scenario is assessed as minor adverse.

9.1.4 Allision – Dredge/construction plant impact with marine works during construction phase

Dredge/construction plant used during the marine works has the potential to make heavy contact (allision) with the works. These vessels include jack-up platforms, barges, tugs and tows, dredging plant and workboat support craft. It should be noted that construction activities carried out from platforms held in place by spud support legs are not subject to allision when the platform is elevated. However, when being manoeuvred into position there is a risk of contact between the vessel and structures within the marine construction area. Allision risk increases during times of adverse weather when wind activity and wave action has the potential to adversely affect vessel manoeuvring. Any contact has the potential to result in some damage which may lead to a pollution event (e.g. fuel or oil spill).

This potential effect would have a high level of sensitivity as the vessels have some ability to adapt to the situation through the application of their engines, anchors or adjusting moorings. In addition, it is likely that dredge and construction vessels would be moving at a slow speed whilst working making any allision a controlled outcome if avoidance action is taken. The potential effect from an allision will be localised to the immediate extent of the marine construction area. The impact has the potential to occur throughout the construction phase whilst vessels are manoeuvring leading to a magnitude of medium thus this scenario has an overall outcome of major to moderate adverse.

The following mitigation measures would need to be introduced by Argyll and Bute Council to reduce the risk to a level that could be considered ALARP:

- AIS coverage – all construction craft to carry AIS to reduce the severity of the hazard if it were to occur.
- Aids to navigation, Provision and maintenance of – illumination of marine works at night.
- Marine liaison officer – central point of contact to coordinate activities.
- Weather forecasting – monitored by construction personnel with weather limits for activities identified.

- Operational weather limits – Maximum wind/wave limits for construction activities.
- Safety lighting – Appropriate illumination of the marine works to be provided, without affecting mariners' night vision (BSI, Road Lighting, BS:5489-1, 2020).

Following the implementation of these measures, specifically the appointment of a marine liaison officer, operational weather limits and the illumination of marine works at night, the sensitivity is reduced to low. Therefore, the scenario is assessed as minor adverse.

9.1.5 Allision – Recreational or fishing vessel allision with marine works

Recreational and fishing vessels transiting proximate to the marine works have the potential make heavy contact (allision) with the works during construction. Allision risk will be increased during times of adverse weather when wind activity and wave action has the potential to adversely affect vessel manoeuvring and in periods of reduced visibility where it will be difficult to see breakwater. The risk will also be increased in periods of high vessel movements as this will decrease the available space for manoeuvring. Any contact has the potential to result in some damage which may lead to a pollution event (e.g. fuel or oil spill).

This potential effect would have a high level of sensitivity as the vessels have some ability to adapt to the situation through the application of their engines to manoeuvre or use of anchors to avoid/ reduce the impact of an allision. The potential effect from an allision will be localised to the immediate extent of the marine construction area. The impact has the potential to occur throughout the construction phase, with accidents occurring often, leading to a medium negative magnitude. Therefore, the overall outcome is major to moderate adverse.

The following mitigation measures would need to be introduced by Argyll and Bute Council to reduce the risk to a level that could be considered ALARP:

- Notices to mariners – issued on the Council website containing details about construction activities.
- Aids to navigation, Provision and maintenance of – illumination of marine works at night.
- Marine liaison officer – central point of contact to coordinate activities.
- Availability of pollution response equipment – contractor to have tier 1 pollution equipment.
- Promulgation of information – information on activities shared with local communities.
- Communications – Stakeholder – stakeholders should be informed of the need to move buoyed areas during construction and advised of other suitable locations.
- Safety lighting – Appropriate illumination of the marine works to be provided, without affecting mariners' night vision (BSI, Road Lighting, BS:5489-1, 2020).

Following the implementation of these measures, specifically the appointment of a marine liaison officer, notices to mariners and the illumination of marine works at night, the magnitude is reduced to small negative. Therefore, the scenario is assessed as minor adverse.

9.1.6 Collision – Dredge/construction plant collision with recreational/fishing vessel

Dredge/construction plant used during the marine works have the potential to collide with recreational and fishing vessels transiting past the works or accessing moorings at Iona. The dredge and construction vessels include jack-up platforms, barges, dredging plant and workboat support craft. Tugs and tows are considered under a separate assessment see Section 9.1.7. Collision risk will be increased during times of adverse weather when wind activity and wave action has the potential to adversely affect

vessel manoeuvring or when there is high vessel activity in the area. Any collision has the potential to result in damage which may lead to a pollution event (e.g. fuel or oil spill).

This potential effect would have a high level of sensitivity as the is a high level of safety impact for shipping and navigation receptors, despite vessels also have some ability to adapt to the situation through the application of their engines, anchors or adjusting moorings. It is likely that dredge and construction vessels would be moving at a slow speed whilst working making any potential collision more avoidable and have a smaller impact. The potential effect from a collision will be localised to the immediate extent of the marine construction area. The impact has the potential to occur throughout the construction phase whilst vessels are manoeuvring leading to an assessed magnitude of medium. Therefore, the assessment of significance is moderate to minor adverse.

The following mitigation measures would need to be introduced by Argyll and Bute Council to reduce the risk to a level that could be considered ALARP:

- AIS coverage – all dredge/construction vessels, including barges to carry AIS (A or B).
- Notices to mariners – issued on the Council website containing details about construction activities.
- Promulgation of information – information on activities shared with local communities.
- Safety boat – available and manned during construction activities.
- Marine liaison officer – to provide safety information to vessels navigating in the area and to local authorities.
- Communications – Stakeholder – stakeholders should be informed of the need to move buoyed areas during construction and advised of other suitable locations.
- Safety lighting – Appropriate illumination of the marine works to be provided, without affecting mariners' night vision (BSI, Road Lighting, BS:5489-1, 2020).

Following the implementation of these measures, specifically the appointment of a marine liaison officer, the publicising of the notices to mariners and AIS coverage, then the magnitude is reduced to small. Therefore, the scenario is assessed as minor adverse.

9.1.7 Collision – Tug and tow collision with recreational/fishing vessel

A tug and tow moving material to the construction side or departing for sea may come into contact and collide with a recreational or fishing vessel. Collision risk is increased during periods of high vessel traffic, and when adverse weather may adversely affect either vessels ability to manoeuvre. The collision has the potential to result in damage which may lead to a pollution event (e.g. fuel spill).

The potential effect would have high level of sensitivity as there is a high level of safety impact and the vessels will also have some ability to adapt to the situation through application of their engines, anchors or adjust moorings. It is likely the tug and tow vessels will be moving at slow speed to transport material short distances between the barge and the marine works. The potential effect from the collision will be localised to the immediate extent of the marine construction area. The magnitude of effect is considered to be medium due to the frequency of tug and tow movements during the works. Hence the overall significance is moderate adverse.

The following mitigation measure would need to be introduced by Argyll and Bute Council to reduce the risk to a level that could be considered ALARP:

- AIS coverage – all dredge/construction vessels, including barges to carry AIS (A or B).
- Communications – Stakeholder – stakeholders should be informed of the need to move buoyed areas during construction and advised of other suitable locations.

- Safety lighting – Appropriate illumination of the marine works to be provided, without affecting mariners' night vision (BSI, Road Lighting, BS:5489-1, 2020).

Following the implementation of this measure the risk would be reduced but remains within the classification of moderate adverse. This is reflective of the fact that once a tug and tow has left the immediate vicinity of the works, vessels will navigate in the usual way, following international rules such as COLREGS. The ability of the project scheme to implement additional controls is limited past the requirement to use AIS for identification.

9.1.8 Hazardous substance accidents – Accidental spill during marine works

During the marine works there is an increased risk of accidental spillage of oil, fuel and chemical pollutants from the dredge plant, construction vessel activity and marine construction works. This may result in a reduction in water quality. The prevailing weather conditions during any marine pollution event will dictate the path and extent of surface water sheens.

The impact has the potential to occur infrequently throughout the period; and the volume of a spill is likely to be small scale due to the volume which could be spilled at any one time through construction activity. It should be noted that Argyll and Bute Council have oil spill contingency plans in place, which include a Tier 2 response contractor. These factors lead to an assessment of the magnitude of a spill as small and a sensitivity as high. Therefore, the overall assessment being minor adverse.

The following mitigation measures would need to be introduced by Argyll and Bute Council to reduce the risk to a level that can be considered ALARP:

- Availability of pollution response equipment – contractor to have tier 1 pollution equipment.
- Marine liaison officer – coordinating activities for the construction.
- Safety lighting – Appropriate illumination of the marine works to be provided, without affecting mariners' night vision (BSI, Road Lighting, BS:5489-1, 2020).

Following the implementation of these measures, specifically the availability of pollution response equipment, the future risk is assessed to remain as minor adverse.

9.1.9 Machinery related accidents – Heavy lift failure, or failure of lifting gear

During the marine works there is a risk of lifting gear failure whilst a load is slung or a heavy load is transferred between vessels, a vessel and the marine works or rock is placed along the breakwater. The nature of the loads during the construction phase of the marine works means that should a failure occur and the load be dropped onto a vessel, it would lead to major damage for the vessel and possible fatalities. The prevailing weather conditions will be the main factor leading to this impact occurring; especially high wind conditions affecting cranes, and large swell causing movement of vessels.

The potential effect would have a high level of impact for vessels and crew, with limited ability to adapt to a quickly developing incident. The sensitive is therefore assessed as high. The potential effect would be localised to the extent of the incident within the study area and will be present for the construction phase only. The impact has the potential to occur infrequently throughout the period of the construction, which leads to 'small negative magnitude and an overall outcome of minor adverse.

The following mitigation measures would need to be introduced by Argyll and Bute Council to reduce the risk to a level that can be considered ALARP:

- Weather forecasting – monitoring of weather conditions.

- Operational weather limits – maximum wind/wave limits for construction activities.
- Marine liaison officer – coordinating activities for the construction.
- Safety lighting – Appropriate illumination of the marine works to be provided, without affecting mariners' night vision (BSI, Road Lighting, BS:5489-1, 2020).

Following the implementation of these measures, specifically the implementation of operational weather limits, the future risk is assessed to remain as minor adverse.

9.2 Operation hazard scenarios

The NRAs for the operational stage of the project which have an assessed outcome of significant risk (or above) when currently available controls are applied have been taken forward into this section for further consideration. These hazard scenarios are listed in Table 24.

Table 24. Operation NRAs with significant or higher current risk

Hazard Category	Hazard Scenario	Current Risk	Future Risk
Allision	Ferry or tour boat with the breakwater	Hig	Mod

9.2.1 Allision – Ferry or tour boat with the breakwater

Any allision has the potential to cause damage to a vessel which may lead to a pollution event and cause injuries to personnel. This risk will diminish with time as crew become familiar with the new breakwater locations and the effects of wind and tidal flow at this location. The passage of the ferry would be altered by the proposed marine works as the presence of the breakwaters would require the ferry and tour boats to transit around the new structure, thereby altering the approach/departure route compared to that used presently.

This potential effect would have a medium level of sensitivity due safety impacts for the vessel from an allision. It is likely that any allision would be at low speed given that vessels are arriving or departing the port on the approach to the berth; meaning that there is time to react to an allision situation by use of the vessel's engines, rudder and bow thruster (if fitted). In addition, the potential impact is localised to the area of the marine facilities but can occur throughout the operational phase leading to a magnitude of medium and an overall ranking of moderate to minor adverse.

The following mitigation measures would need to be introduced by Argyll and Bute Council to reduce the risk to a level that can be considered ALARP:

- Passage planning – update to CalMac passage plan.
- Update the Admiralty List of Radio Signals (ALRS) volume 6, and Sailing Directions – updates to include new structures.
- Review of available powers – Argyll and Bute Council should review their powers in relation to operating the port facility at Iona to determine whether further powers are required to ensure navigational safety.
- Shore side facility maintenance programme – schedule of maintenance including AtoN.

Following the implementation of these measures, specifically the review of available powers and the updates to the marine safety management system the overall ranking will be reduced to minor adverse.

10 Mitigation Measures Summary

The following sections consolidates the list of additional (future) risk controls identified in Sections 9.1 and 9.2. The context of the description is drawn from the assessments in Appendix B.

- Marine liaison officer – the marine liaison officer provides a point of contact for the marine works, will provide safety information to vessels navigating in the area and coordinate with local authorities during emergency situations. This is just to provide a central point of contact.
- AIS coverage – all dredge/construction vessels, including barges to carry AIS (A or B).
- Notices to mariners – issued by Argyll and Bute Council containing details about the construction works. These should be issued prior to any works (or any related activities such as diving or towage movements).
- Availability of pollution response equipment – pollution response equipment should be available and carried by the contractors for use at Iona. The equipment should be appropriate for the type and scale of pollution that may occur.
- Weather forecasting – a weather forecasting service should be regularly monitored to indicate any periods of upcoming adverse weather conditions. Appropriate actions should then be taken to mitigate any potential situations that may arise. These actions should be documented in the safety management system with the specific weather conditions which necessitates the actions.
- Operational weather limits – including maximum wave and wind limits for construction activities should be detailed in the contractors 'Risk Assessment Method Statement'.
- Promulgation of information – information on the project and upcoming operations with associated vessel movements should be provided to local stakeholders. This should include details of the marine works and breakwater being given to the Scottish Canoe Association to distribute to their members. A website page (potentially on the Council's website) for the project, providing information and a method to contact the project would allow any vessels in the area to obtain information.
- Aids to navigation, Provision and maintenance of – aids to navigation should be provided after consultation and approval of the NLB. Marine works to be illuminated at night. The aids to navigation must be maintained to provide the availability of the aids to navigation required by the NLB with any out of service periods reported via the LATON system.
- Safety boat – the safety boat should be appropriate for the wind and wave conditions in the area. It should be available on site and manned during construction operations in order to provide quick assistance if any incident was to occur.
- Passage planning – CFL should update their passage plan, both during the works and on completion of the works to recognise the altered route.
- Operational planning – capital dredging should be scheduled, as far as possible, to avoid disruption to ferry operations.
- Review of available powers – Argyll and Bute Council should review their powers in relation to operating the port facility at Iona to determine whether further powers are required to ensure navigational safety
- Update ALRS and Sailing Directions – updates to include new structures after completion of the marine works.
- Shore side facility maintenance programme – to schedule the maintenance of the site, including the AtoN.
- Communications – Stakeholder – stakeholders should be informed of the need to move buoyed areas during construction and advised of other suitable locations.

- Safety – Lighting - it is important that any marine works at night or at times of reduced visibility are sufficiently illuminated in accordance with the Health and Safety Executive (HSE) Approved Code of Practice (ACOP) 'Safety in Docks' (HSE, 2014). The guidance on illumination levels is drawn from the 'Safety and Health in Ports' code of practice published by the International Labour Organization, this states that: *"On access routes for people, plant and vehicles and in lorry parks and similar areas, the minimum level of illumination should not be less than 10 lux. In operational areas where people and vehicles or plant work together, the minimum level of illumination should not be less than 50 lux"*. (ILO 2016). This level of illumination must be balanced alongside the requires from the British Standard Institute (BSI) publication 'Design of Road Lighting' BS:5489-1, 2020.

A further three additional mitigation measures were listed in risk assessments that were not brought forward as having a 'Significant' or higher current risk but should be considered as part of the overall scheme mitigation as they contribute to lowering risk overall, and form part of the 'ALARP' conclusion.

- Hydrographic surveying program – data to be provided to UKHO for use in navigational charts.
- Loading/unloading plan – during the construction phase, a loading/unloading plan should be created detailing the location and order in which equipment will be loaded/unloaded on the construction barge. This should take vessel stability and crane location into account to prevent list or loll.
- Operation planning – the dredging should be scheduled to deconflict with the ferry schedule.

11 Summary

In total, this NRA has identified 20 hazard scenarios which have been assessed. A total of 16 hazard scenarios were identified for the construction phase and 4 hazard scenarios for the operational phase. Consultation has been conducted with stakeholders to draw out local user opinion. To inform the consultees, information defining the baseline navigational environment has been used, including a traffic assessment from one year of AIS data collected between 01 November 2021 to 31 October 2022.

The initial assessment identified 10 assessments with a current risk score outcome of significant or higher. Following the NRA process, 17 mitigation measures were identified, split between the Construction and Operational phases of the proposed development. After implementation of appropriate mitigation, marine risk to navigational receptors was reduced to a level of 'as low as reasonably practicable' as required by the Port Marine Safety Code (DfT, 2016) through the adoption of future mitigation controls.

12 References

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13 Abbreviations/Acronyms

A&BC	Argyll and Bute Council
A&B	Argyll and Bute
AtoN	Aids to Navigation
ACOP	Approved Code of Practice
AIS	Automatic Identification System
ALARP	As Low As Reasonably Practicable
ALRS	Admiralty List of Radio Signals
BS	British Standard
BSI	British Standard Institute
CFL	CalMac Ferries Ltd
CMAL	Caledonian Maritime Assets Limited
COLREGS	International Regulations for Preventing Collisions at Sea
DfT	Department for Transport
FSA	Formal Safety Assessment
GLA	General Lighthouse Authority
GT	Gross Tonnage
H&S	Health & Safety
HM	Her Majesty's
Hig	High Risk
HSE	Health and Safety Executive
HW	High Water
ID	Identity
ILO	International Labour Organization
IMO	International Maritime Organization
LATON	Local Aids to Navigation
LOA	Length Overall
Low	Low Risk
lux	Unit of Illuminance
M+F	Merchant + Fishing
MAIB	Marine Accident Investigation Branch
MCA	Maritime and Coastguard Agency
MGN	Marine Guidance Note
MoB	Man Overboard
Mod	Moderate Risk
MSMS	Marine Safety Management Systems
MV	Motor Vessel
Neg	Negligible Risk
NLB	Northern Lighthouse Board
Non	No Risk
NRA	Navigational Risk Assessment
OREI	Offshore Renewable Energy Installation
PMSC	Port Marine Safety Code
RAMS	Risk Assessment Method Statement
RHIBs	Rigid Hull Inflatable Boats
RNLI	Royal National Lifeboat Institution
RPS	RPS Group
RYA	Royal Yachting Association

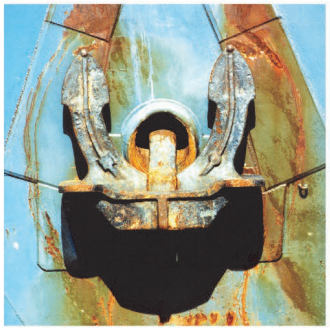
SHA	Statutory Harbour Authority
Sig	Significant Risk
SMS	Safety Management System
SOLAS	Safety of Life at Sea
SOP	Standard Operating Procedure
UK	United Kingdom
UKHO	UK Hydrographic Office
UNCLOS	United Nations Convention on the Law of the Sea
VH	Very High Risk

Cardinal points/directions are used unless otherwise stated.

SI units are used unless otherwise stated.

Appendices




Innovative Thinking - Sustainable Solutions

ABP mer

A Wave Model Output

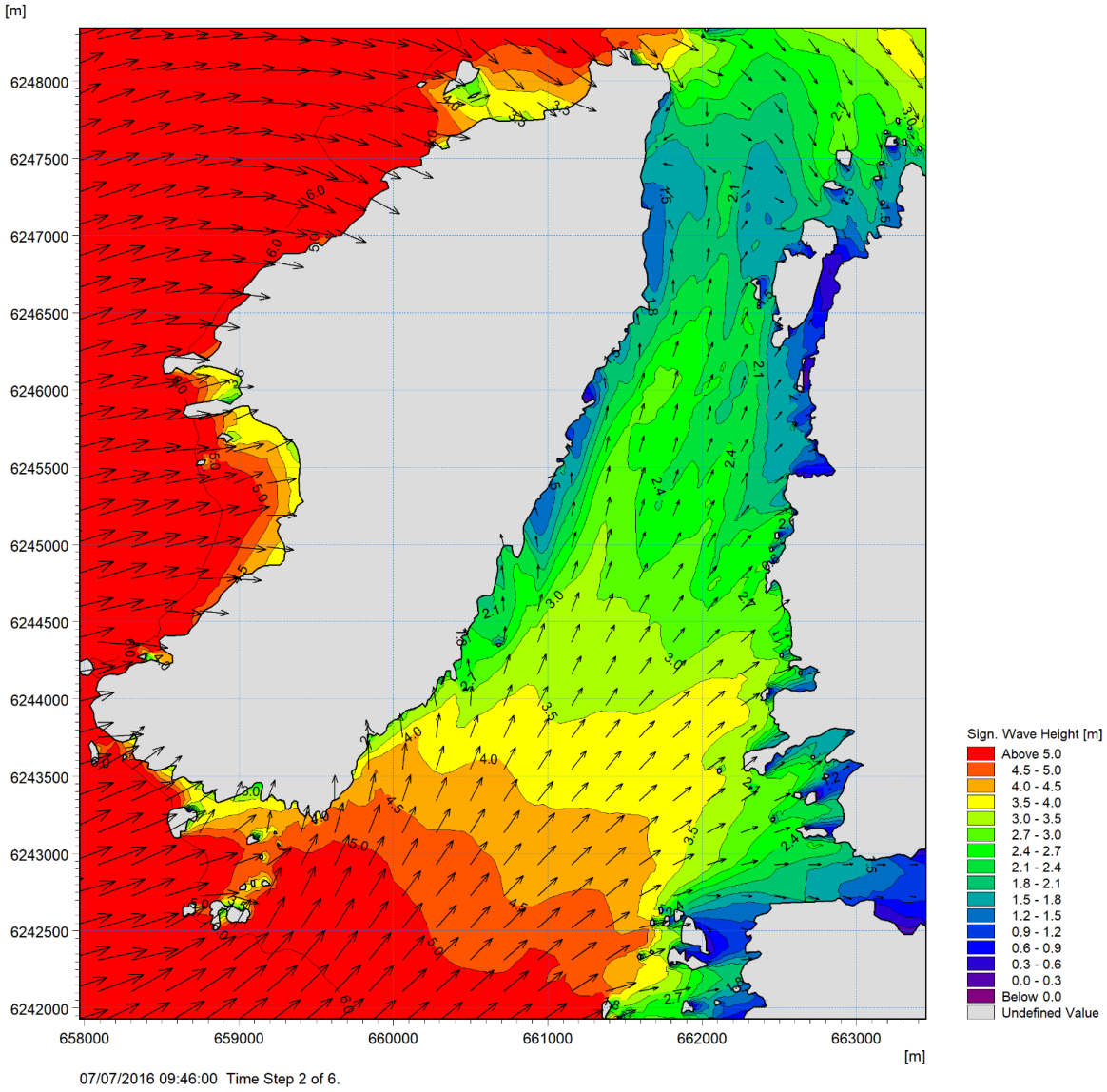


Figure A1. **Significant wave height and mean wave direction – 1 in 1 year return period storm from 240° at HW**

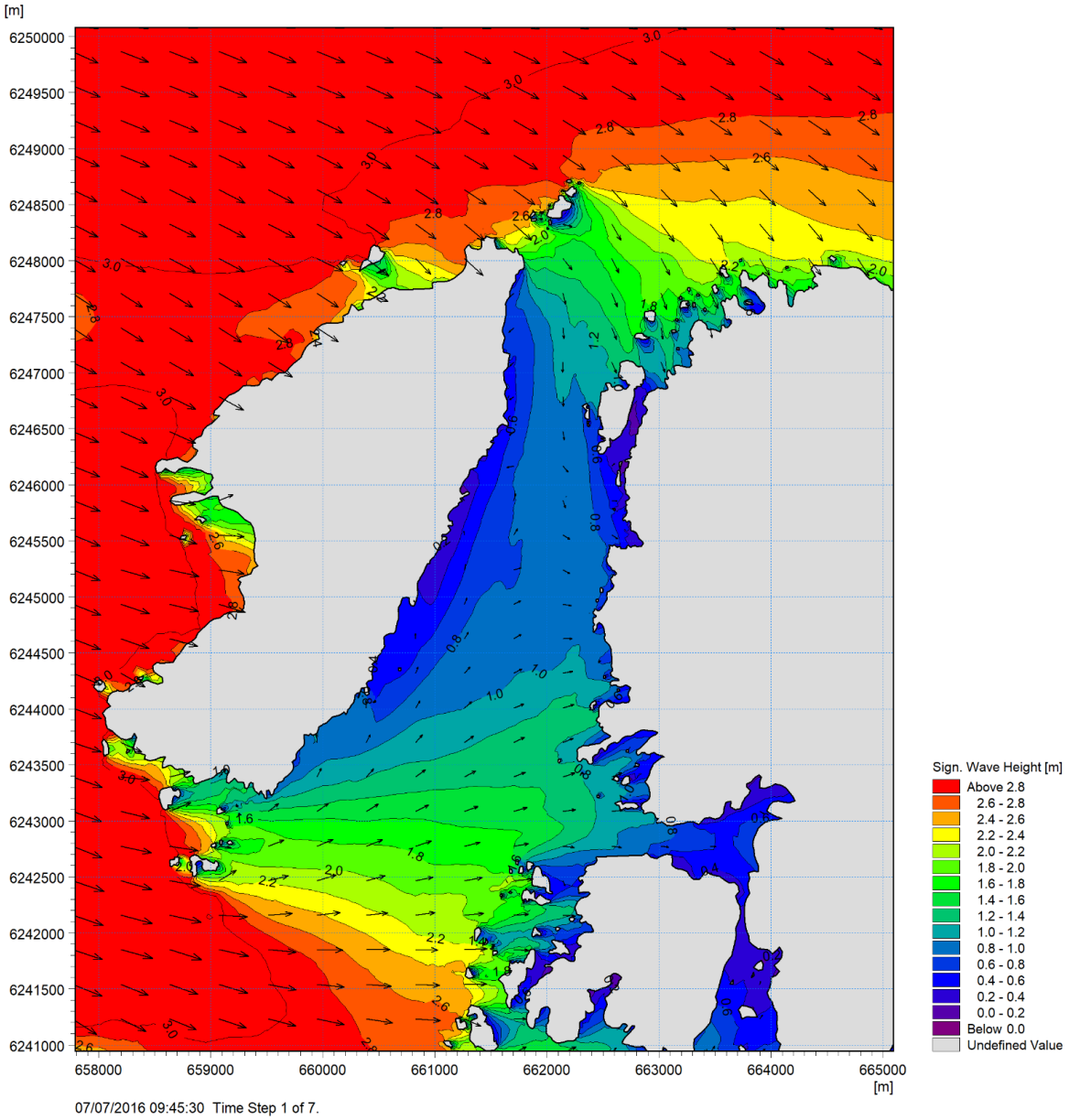


Figure A2. **Significant wave height and mean wave direction – 1 in 1 year return period storm from 315° at HW**

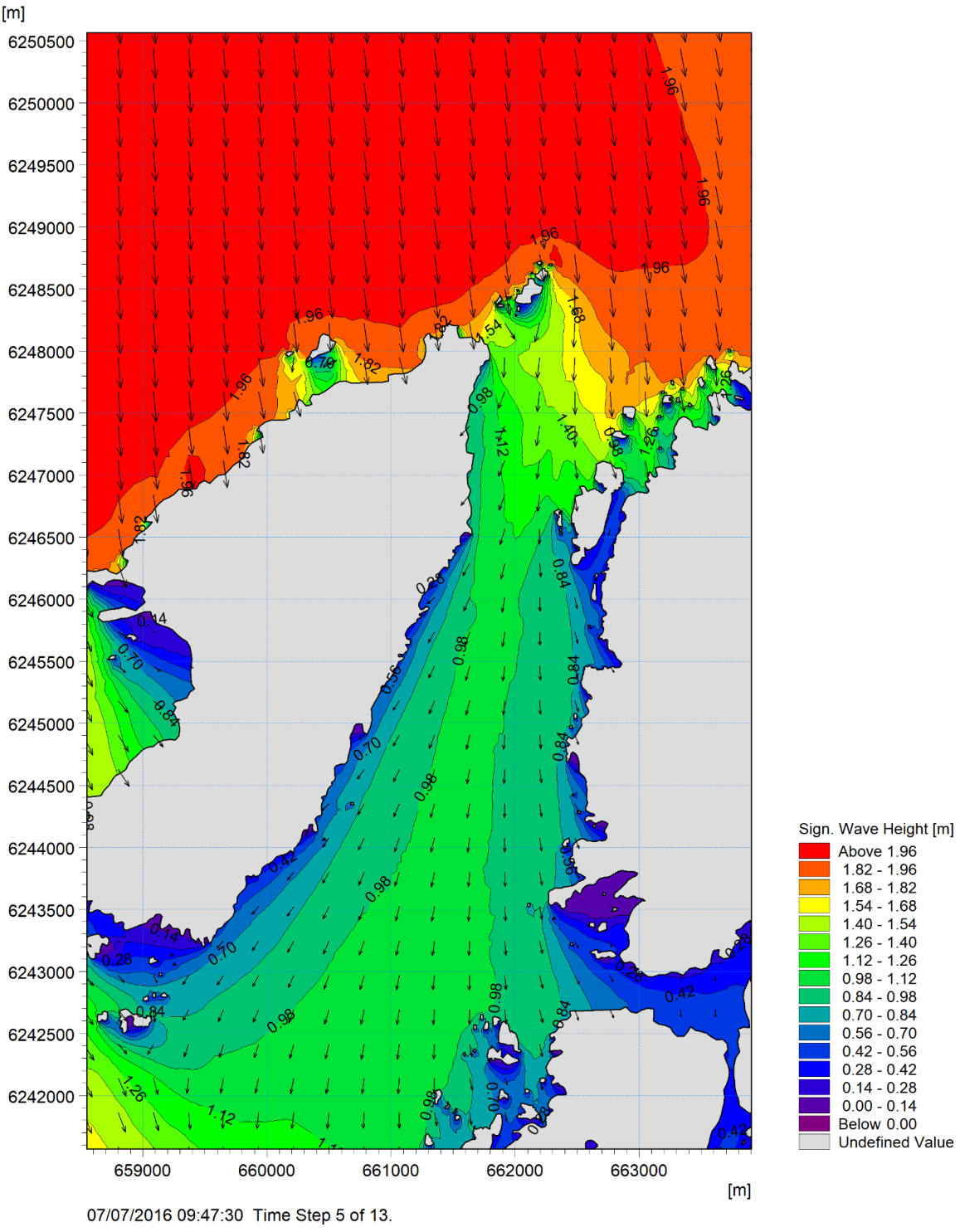


Figure A3. Significant wave height and mean wave direction – 1 in 1 year return period storm from 000º at HW

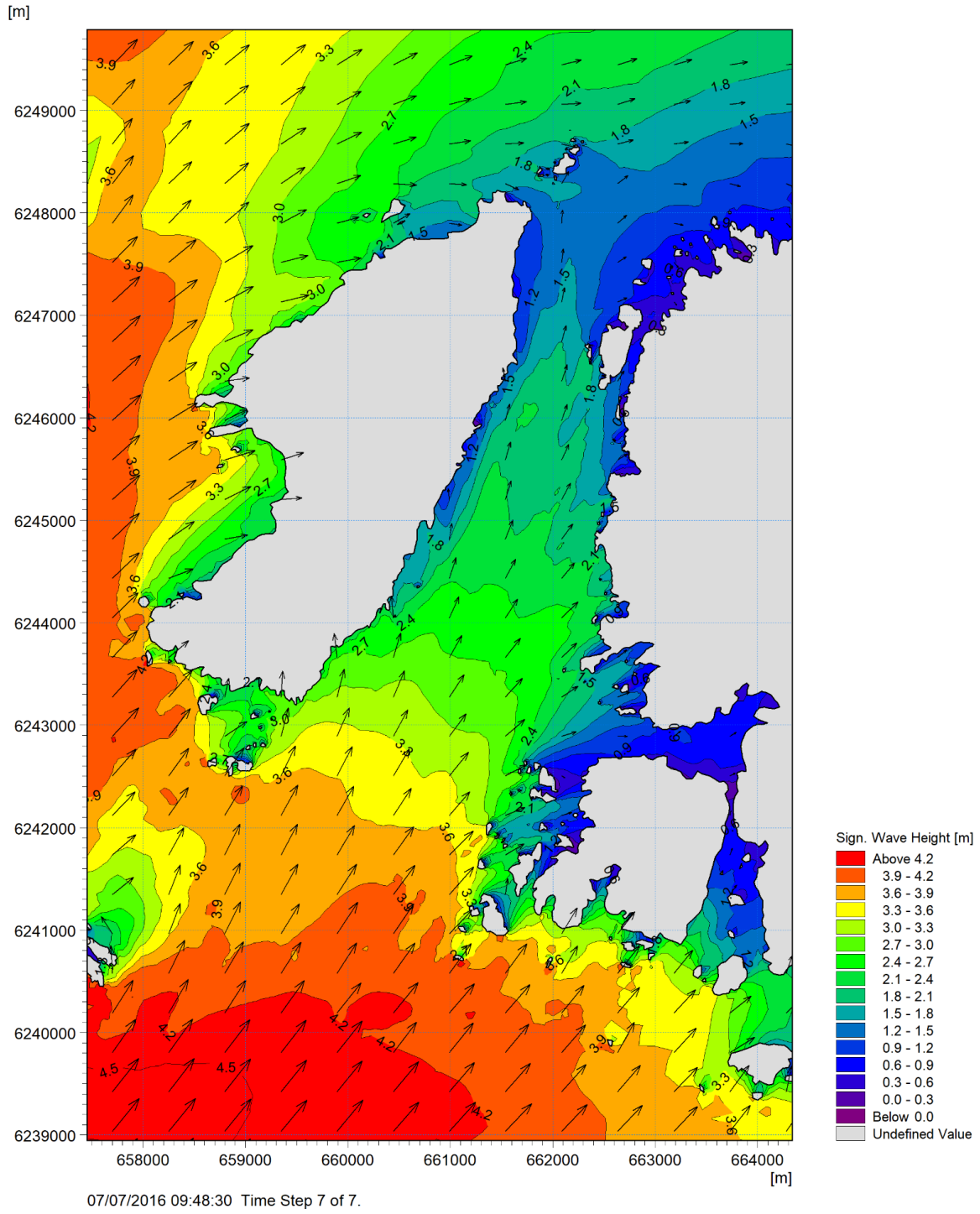


Figure A4. **Significant wave height and mean wave direction – 1 in 1 year return period storm from 210° at HW**

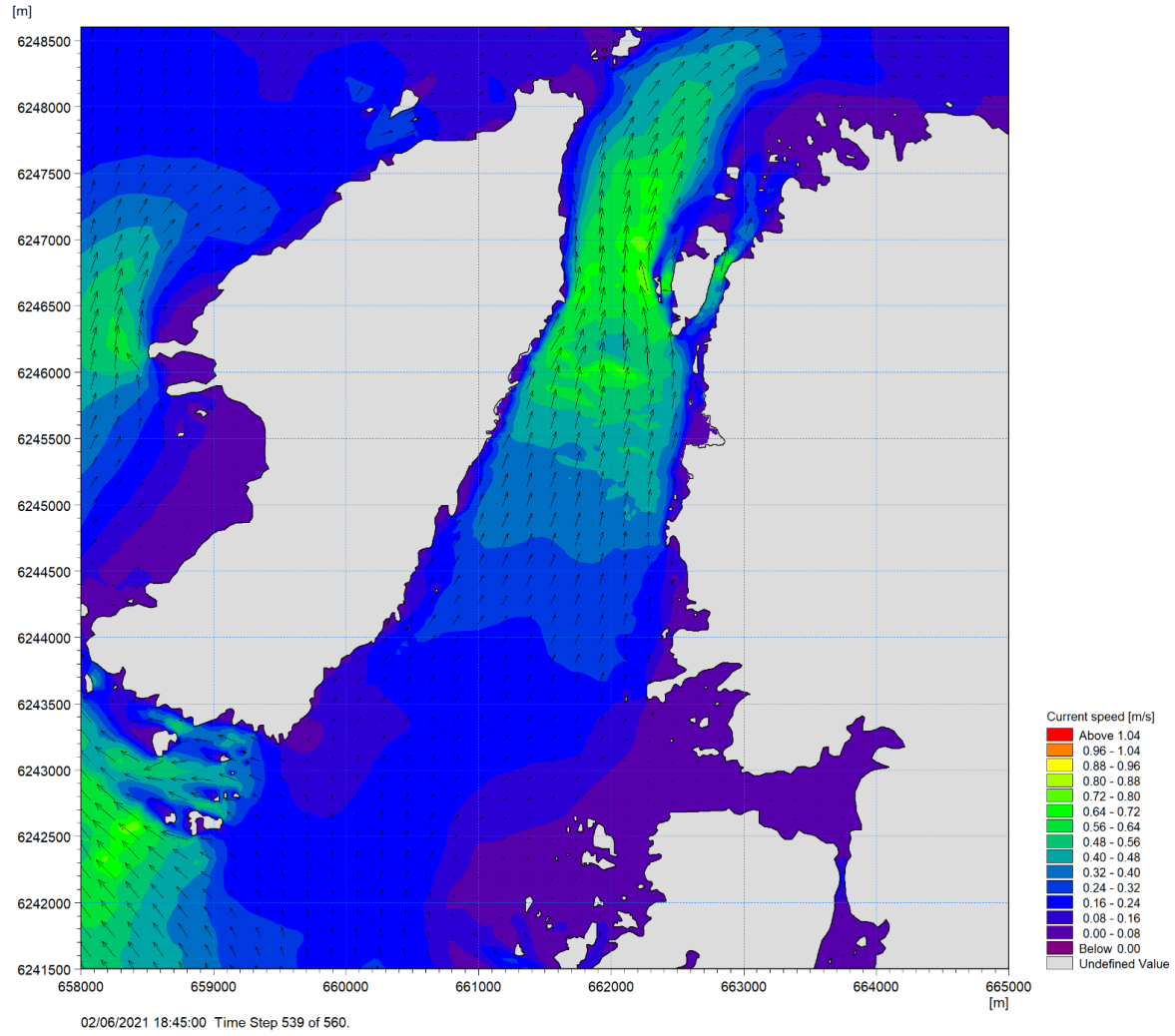


Figure A5. Typical neap tidal flood (north going) current flow through the Sound of Iona

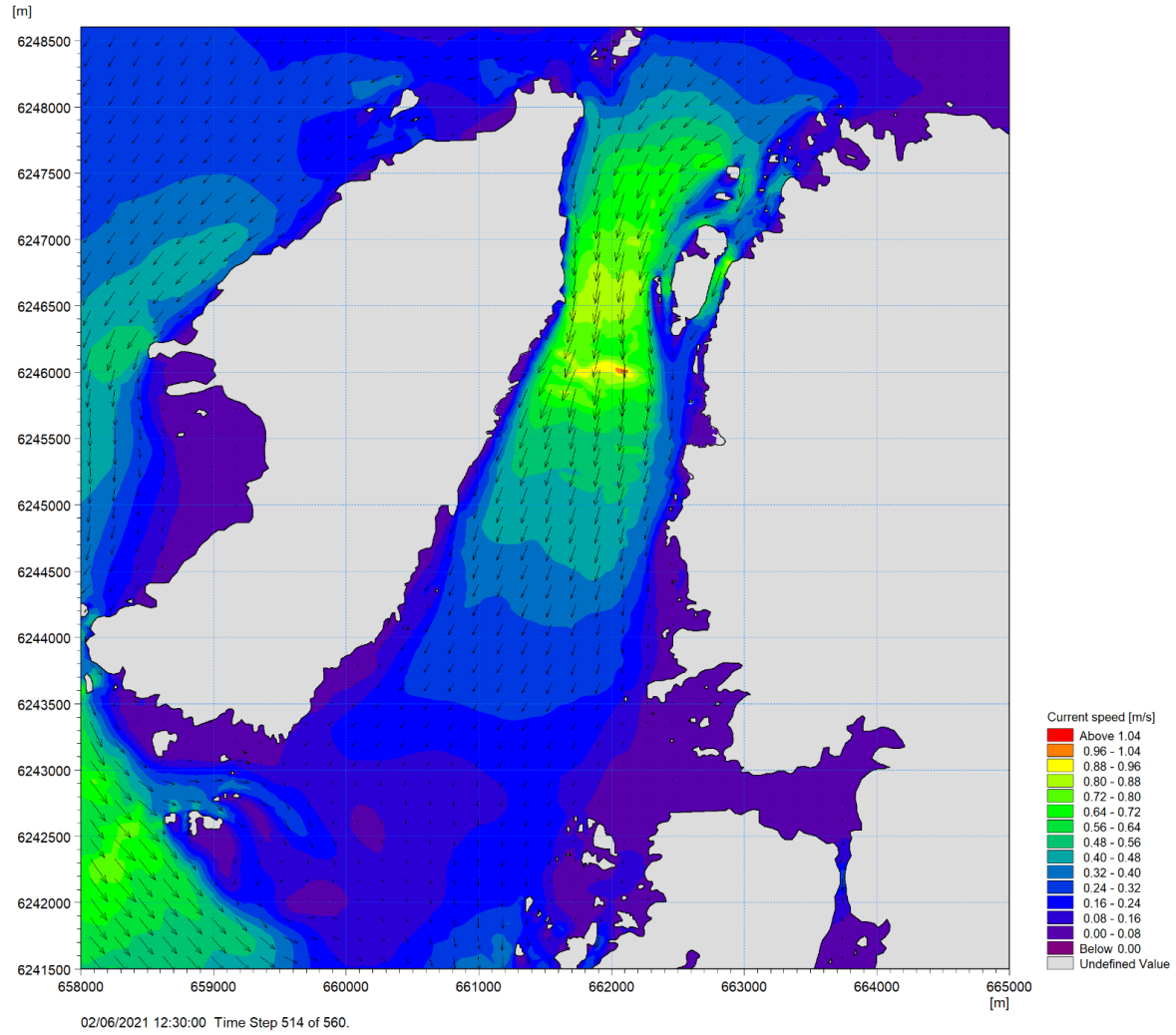


Figure A6. Typical neap tidal ebb (south going) flow through the Sound of Iona

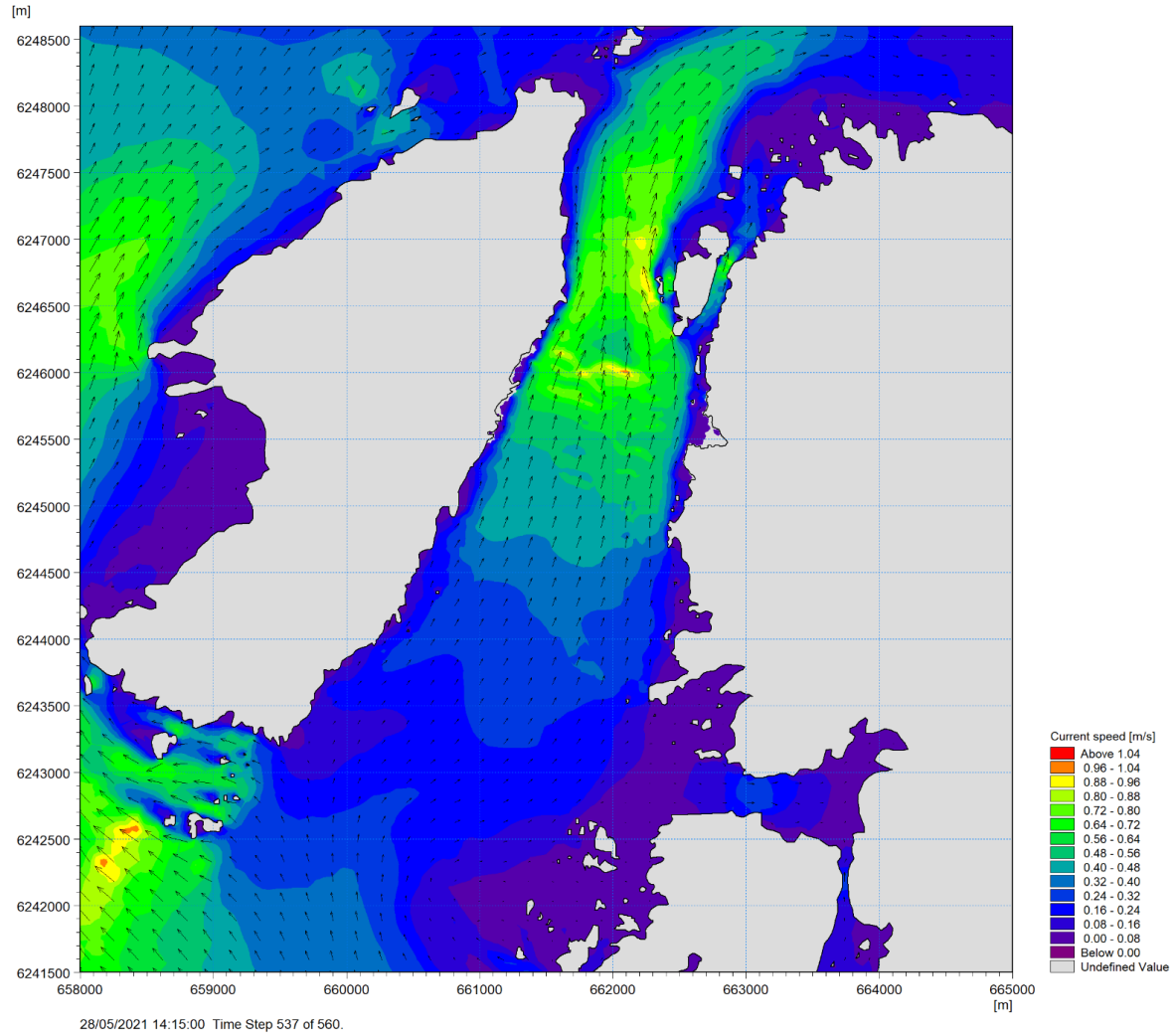


Figure A7. Typical spring tidal flood (north going) flow through the Sound of Iona

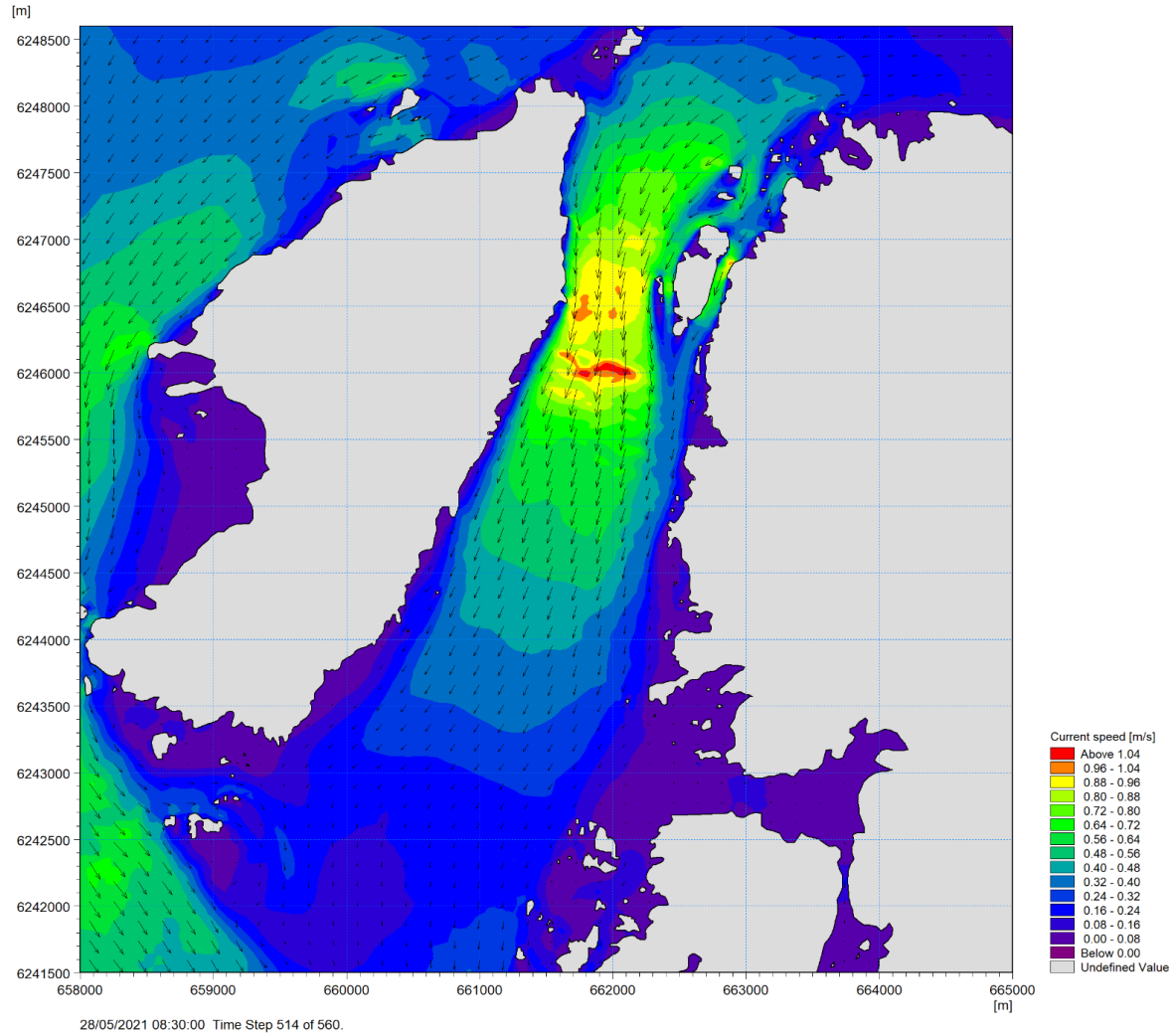


Figure A8. Typical spring tide ebb (south going) flow through the Sound of Iona

B Marine Risk Assessments

B.1 Construction phase

Assessment Number	Hazard Category	Hazard Scenario Title	Worst Credible Scenario	Years between worst occurrence	Consequence				Most Likely Scenario	Years between likely occurrence	Consequence				Inherent Risk	Inherent Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port				
1	Accidents to personnel	Man overboard during dredge/construction works	Man overboard (MoB) during the dredge/construction works, MoB hits head on the vessel leading to drowning. No pollution, minor delay to construction works.	25	3	0	0	3	MoB recovered to shore and treated for cold water immersion. No pollution, minor delay to construction works.	5	1	0	0	1	4.43	Mod	1	Human error/fatigue - Vessel Personnel
																	3	Human error/fatigue - Construction personnel
																	7	Inadequate procedures in place onboard vessel
																	25	Communication failure - Personnel
																	26	Adverse weather conditions
																	37	Failure to comply with safe systems of work
																	59	Inadequate marine procedures - Project
																	76	Inadequate training/competence - Personnel

Control ID	Embedded Controls				Current Risk	Current Risk	Control ID	Further Applicable Controls				Final Risk	Final Risk
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction		
26	Communications equipment	To request shore assistance	5%	0%	3.98	Low	9	Safety lighting	Appropriate illumination of the marine works to be provided, without affecting mariners' night vision (BSI, Road Lighting, BS:5489-1, 2020)	5%	0%	2.70	Low
44	Safe systems of work (H&S)	Specific to each of the construction activities	15%	0%			28	AIS/Radar coverage	All construction craft to carry AIS	0%	5%		
62	Emergency services equipment - shore side	Ambulance services	0%	10%			116	Weather forecasting	Monitored by construction personnel with weather limits for activities identified	10%	0%		
70	Marine Safety Management System	Argyll and Bute Council has a MSMS to cover the requirements of the PMSC	5%	0%			117	Operational weather limits	Maximum wind/wave limits for construction activities	15%	0%		
116	Weather forecasting	Monitored to indicate periods of adverse weather conditions	5%	0%			135	Safety boat	Available on site and appropriate for the wind and wave conditions in the area	0%	20%		
130	Vessel's emergency response procedures	Actions to be taken in a MoB emergency	5%	0%			136	Marine liaison officer	Central point of contact to coordinate activities	10%	5%		
140	Contractor risk assessment method statement (RAMS)	to be approved by the client before construction begins	15%	0%									

Assessment Number	Hazard Category	Hazard Scenario Title	Worst Credible Scenario	Years between worst occurrence	Consequence				Most Likely Scenario	Years between likely occurrence	Consequence				Inherent Risk	Inherent Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port				
2	Accidents to personnel	Diving operations associated with the marine works	Dredge/construction vessel unaware of divers in the water. Diver caught in propellers or umbilical severed, loss of life, operations cease, national adverse publicity.	50	3	1	0	4	Dredge/Construction vessel approaches diving area and does not see 'A' flag. Vessel is warned of underwater operations and alters course. Divers taken out of water, disruption to activities.	5	0	0	0	1	4.99	Mod	1	Human error/fatigue - Vessel Personnel
																	3	Human error/fatigue - Construction personnel
																	6	Inadequate bridge resource management
																	23	Communication failure - Operational/procedural
																	28	Restricted visibility
																	37	Failure to comply with safe systems of work
																	59	Inadequate marine procedures - Project
																	87	Notice to Mariners failure to observe

Control ID	Embedded Controls				Current Risk	Current Risk	Control ID	Further Applicable Controls				Final Risk	Final Risk
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction		
26	Communications equipment	To warn vessels of ongoing diving operations	10%	0%	3.94	Low	9	Safety lighting	Appropriate illumination of the marine works to be provided, without affecting mariners' night vision (BSI, Road Lighting, BS:5489-1, 2020)	5%	0%	3.33	Low
44	Safe systems of work (H&S)	Required for permit/permission to work process	15%	0%			28	AIS/Radar coverage	All construction craft to carry AIS	10%	0%		
70	Marine Safety Management System	Argyll and Bute Council has a MSMS to cover the requirements of the PMSC	5%	0%			41	Notices to mariners	Issued on the Council website prior to diving operations	10%	0%		
97	Visual observation (clear line of sight)	Identification of 'A' flag	10%	0%			135	Safety boat	Available and manned during diving operations	20%	5%		
140	Contractor risk assessment method statement (RAMS)	to be approved by the client before construction begins	15%	0%			136	Marine liaison officer	Central point of contact to coordinate activities	10%	0%		

Assessment Number	Hazard Category	Hazard Scenario Title	Worst Credible Scenario	Years between worst occurrence	Consequence				Most Likely Scenario	Years between likely occurrence	Consequence				Inherent Risk	Inherent Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port				
3	Allision	Dredge/construction plant impact with marine works during construction phase	Dredge/construction vessel slow speed impact with structures during the marine works dredge/construction phase, leading to minor damage to vessel, serious injury to crew, minor pollution (Tier 1). Delay to marine works.	25	2	4	2	2	Slow speed impact results in no damage to vessel hull, minor injury to crew, no pollution. Minor delay to marine works.	1	0	0	0	1	5.00	Sig	3	Human error/fatigue - Construction personnel
																	11	Vessel breakdown or malfunction
																	16	Unplanned interaction with recreational/fishing craft
																	20	Towing equipment failure
																	26	Adverse weather conditions
																	28	Restricted visibility
																	61	Incorrect assessment of tidal flow
																	110	Reduction in safe navigable space
																	112	Unplanned interaction with ferry/tour boat
																	113	Manoeuvre misjudged

Control ID	Embedded Controls				Current Risk	Current Risk	Control ID	Further Applicable Controls				Final Risk	Final Risk
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction		
21	Oil spill contingency plans	Covers all A&B Council facilities	0%	5%	5.00	Sig	9	Safety lighting	Appropriate illumination of the marine works to be provided, without affecting mariners' night vision (BSI, Road Lighting, BS:5489-1, 2020)	5%	0%	4.41	Mod
24	Tier 2 contractor	Provides personnel and equipment during oil spill response	0%	10%			28	AIS/Radar coverage	All construction craft to carry AIS	10%	0%		
70	Marine Safety Management System	Argyll and Bute Council has a MSMS to cover the requirements of the PMSC	5%	0%			57	Aids to navigation, Provision and maintenance of	Illumination of marine works at night	10%	0%		
130	Vessel's emergency response procedures	Actions to be taken in a contact/allision emergency	0%	5%			116	Weather forecasting	Monitored by construction personnel with weather limits for activities identified	10%	0%		
140	Contractor risk assessment method statement (RAMS)	Details the methods used to complete the construction	10%	0%			117	Operational weather limits	Maximum wind/wave limits for construction activities	10%	0%		

Assessment Number	Hazard Category	Hazard Scenario Title	Worst Credible Scenario	Years between worst occurrence	Consequence				Most Likely Scenario	Years between likely occurrence	Consequence				Inherent Risk	Inherent Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port				
4	Allision	Recreational or fishing vessel allision with marine works	Recreational or fishing vessel transiting past the marine works allides with temporary or part build structures. Impact causes vessel to be holed leading to flooding and the vessel sinking, multiple fatalities, delay to the construction programme, national adverse publicity, limited pollution (Tier 1).	25	4	3	2	4	Slow speed impact causes vessel damage, leading to minor injury to crew, no delay to construction programme, no pollution.	1	1	1	0	1	5.95	Sig	1	Human error/fatigue - Vessel Personnel
																	11	Vessel breakdown or malfunction
																	16	Unplanned interaction with recreational/fishing craft
																	26	Adverse weather conditions
																	28	Restricted visibility
																	34	Limited area for manoeuvring
																	36	Failure of Aid to Navigation (out of position/unlit)
																	61	Incorrect assessment of tidal flow
																	87	Notice to Mariners failure to observe
																	105	Navigation equipment failure
																	110	Reduction in safe navigable space
																	112	Unplanned interaction with ferry/tour boat
																	113	Manoeuvre misjudged

Control ID	Embedded Controls				Current Risk	Current Risk	Control ID	Further Applicable Controls				Final Risk	Final Risk
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction		
70	Marine Safety Management System	Argyll and Bute Council has a MSMS to cover the requirements of the PMSC	5%	0%	5.91	Sig	4	Communications - Stakeholder	Covering the moving of buoyed areas	5%	0%	4.86	Mod
							9	Safety lighting	Appropriate illumination of the marine works to be provided, without affecting mariners' night vision (BSI, Road Lighting, BS:5489-1, 2020)	5%	0%		
							36	Availability of pollution response equipment	Contractor to have tier 1 pollution equipment	0%	5%		
							41	Notices to mariners	Issued on the Council website containing details about construction activities	10%	0%		
							48	Promulgation of information	Information on activities shared with local communities	10%	0%		
							57	Aids to navigation, Provision and maintenance of	Illumination of marine works at night	10%	0%		
							136	Marine liaison officer	Central point of contact to coordinate activities	5%	5%		

Assessment Number	Hazard Category	Hazard Scenario Title	Worst Credible Scenario	Years between worst occurrence	Consequence				Most Likely Scenario	Years between likely occurrence	Consequence				Inherent Risk	Inherent Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port				
5	Allision	Ferry or tour boat allision with marine works	Ferry or Tour Boat transiting past the marine works allides with temporary or part build structures. Impact causes vessel to be holed leading to flooding, multiple fatalities, operations cease during investigation and recovery, pollution (Tier 2), international adverse publicity.	50	4	3	3	4	Slow speed impact causes minor vessel damage, leading to minor injury to crew/passengers, no delay to construction programme, no pollution, adverse publicity from passengers.	10	1	1	0	2	7.05	Hig	1	Human error/fatigue - Vessel Personnel
																	6	Inadequate bridge resource management
																	11	Vessel breakdown or malfunction
																	16	Unplanned interaction with recreational/fishing craft
																	26	Adverse weather conditions
																	28	Restricted visibility
																	36	Failure of Aid to Navigation (out of position/unlit)
																	61	Incorrect assessment of tidal flow
																	72	Failure to follow passage plan
																	103	Excessive vessel speed
																	110	Reduction in safe navigable space
																	111	Scheduling conflicts
																	113	Manoeuvre misjudged

Control ID	Embedded Controls				Current Risk	Current Risk	Control ID	Further Applicable Controls				Final Risk	Final Risk
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction		
21	Oil spill contingency plans		0%	5%	5.69	Sig	9	Safety lighting	Appropriate illumination of the marine works to be provided, without affecting mariners' night vision (BSI, Road Lighting, BS:5489-1, 2020)	5%	0%	4.63	Mod
26	Communications equipment		0%	5%			10	Passage planning	CFL ferry to update passage planning based on the works	5%	0%		
70	Marine Safety Management System	Argyll and Bute Council has a MSMS to cover the requirements of the PMSC	5%	0%			36	Availability of pollution response equipment	Contractor to have tier 1 pollution equipment	0%	10%		
95	Standing Orders/SOPs		5%	0%			41	Notices to mariners	Issued on the Council website containing details about construction activities	5%	0%		
130	Vessel's emergency response procedures		0%	5%			57	Aids to navigation, Provision and maintenance of	Illumination of marine works at night	10%	0%		
							136	Marine liaison officer	Central point of contact to coordinate activities and provide safety information	0%	5%		

Assessment Number	Hazard Category	Hazard Scenario Title	Worst Credible Scenario	Years between worst occurrence	Consequence				Most Likely Scenario	Years between likely occurrence	Consequence				Inherent Risk	Inherent Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port				
6	Collision	Dredge/construction plant collision with recreational/fishing vessel	Collision of a recreational/fishing craft with a dredge/construction vessel. Vessels do not identify each other and do not take avoiding action. Recreational/fishing vessel holed and sinks, multiple fatalities, small scale pollution (Tier 1), construction activities cease until investigation and recovery of vessel complete.	25	4	4	2	4	Vessels take avoiding action resulting in minor collision. Recreational/fishing vessel receives minor damage, no damage to dredge/construction plant, minor injuries, no pollution. No delay to construction activities.	10	1	1	0	0	5.31	Sig	1	Human error/fatigue - Vessel Personnel
																	3	Human error/fatigue - Construction personnel
																	6	Inadequate bridge resource management
																	7	Inadequate procedures in place onboard vessel
																	11	Vessel breakdown or malfunction
																	16	Unplanned interaction with recreational/fishing craft
																	25	Communication failure - Personnel
																	26	Adverse weather conditions
																	28	Restricted visibility
																	72	Failure to follow passage plan
																	76	Inadequate training/competence - Personnel
																	82	AIS failure
																	87	Notice to Mariners failure to observe
																	103	Excessive vessel speed
																	105	Navigation equipment failure
																	110	Reduction in safe navigable space

Control ID	Embedded Controls				Current Risk	Current Risk	Control ID	Further Applicable Controls				Final Risk	Final Risk
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction		
62	Emergency services equipment - shore side	Ambulance services	0%	5%	5.31	Sig	4	Communications - Stakeholder	Covering the moving of buoyed areas	5%	0%	4.02	Mod
70	Marine Safety Management System	Argyll and Bute Council has a MSMS to cover the requirements of the PMSC	5%	0%			9	Safety lighting	Appropriate illumination of the marine works to be provided, without affecting mariners' night vision (BSI, Road Lighting, BS:5489-1, 2020)	5%	0%		
130	Vessel's emergency response procedures	Actions to be taken following a collision	0%	5%			28	AIS/Radar coverage	All dredge/construction vessels, including barges to carry AIS	10%	0%		
140	Contractor risk assessment method statement (RAMS)	Details the risks and mitigations for specific construction activities	10%	0%			41	Notices to mariners	Issued on the Council website containing details about construction activities	10%	0%		
							48	Promulgation of information	Information on activities shared with local communities	10%	0%		
							135	Safety boat	Available and manned during construction activities	0%	10%		
							136	Marine liaison officer	Central point of contact to coordinate activities and provide safety information	10%	5%		

Assessment Number	Hazard Category	Hazard Scenario Title	Worst Credible Scenario	Years between worst occurrence	Consequence				Most Likely Scenario	Years between likely occurrence	Consequence				Inherent Risk	Inherent Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port				
7	Collision	Dredge/construction plant collision with ferry/tour boat	Collision of a ferry/tour boat with a dredge/construction vessel when manoeuvring. Damage to both vessels requires survey and repair, minor injuries from impact, no pollution, delays to construction activities.	25	1	3	0	2	Minor collision at slow speed during manoeuvring results in minor damage to vessels. No injuries, no pollution, no delay to activities.	5	0	1	0	0	3.97	Low	1	Human error/fatigue - Vessel Personnel
																	3	Human error/fatigue - Construction personnel
																	6	Inadequate bridge resource management
																	7	Inadequate procedures in place onboard vessel
																	11	Vessel breakdown or malfunction
																	23	Communication failure - Operational/procedural
																	26	Adverse weather conditions
																	28	Restricted visibility
																	34	Limited area for manoeuvring
																	61	Incorrect assessment of tidal flow
																	68	Interaction with passing vessel
																	72	Failure to follow passage plan
																	82	AIS failure
																	87	Notice to Mariners failure to observe
																	103	Excessive vessel speed
																	107	Equipment failure (bridge)
																	110	Reduction in safe navigable space
																	111	Scheduling conflicts
																	113	Manoeuvre misjudged

Control ID	Embedded Controls				Current Risk	Current Risk	Control ID	Further Applicable Controls				Final Risk	Final Risk
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction		
62	Emergency services equipment - shore side	Ambulance services	5%	0%	3.82	Low	1	Operational planning	Dredging scheduled to avoid ferry timings	5%	0%	3.23	Low
70	Marine Safety Management System	Argyll and Bute Council has a MSMS to cover the requirements of the PMSC	5%	0%			9	Safety lighting	Appropriate illumination of the marine works to be provided, without affecting mariners' night vision (BSI, Road Lighting, BS:5489-1, 2020)	5%	0%		
130	Vessel's emergency response procedures	Actions to be taken after a collision	0%	5%			10	Passage planning	CFL ferry to update passage planning based on the works	5%	0%		
140	Contractor risk assessment method statement (RAMS)	Details the risks and mitigations for specific construction activities	10%	0%			28	AIS/Radar coverage	All dredge/construction vessels, including barges to carry AIS (A or B).	10%	0%		
							41	Notices to mariners	Issued on the Council website containing details about construction activities	10%	0%		
							48	Promulgation of information	Information on activities shared with local communities	10%	0%		
							136	Marine liaison officer	To provide safety information to vessels navigating in the area and to local authorities	10%	5%		

Assessment Number	Hazard Category	Hazard Scenario Title	Worst Credible Scenario	Years between worst occurrence	Consequence				Most Likely Scenario	Years between likely occurrence	Consequence				Inherent Risk	Inherent Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port				
8	Collision	Tug and tow collision with recreational/fishing vessel	Tug and tow (transporting material by barge) on transit in the Sound of Iona collision with recreational/fishing vessel. Recreational/fishing vessel holed and sinks in deep water. Multiple fatalities, pollution (Tier 2). Disruption to marine works meaning temporary suspension of operations.	50	4	4	3	4	Vessels make contact whilst taking avoiding action, glancing blow resulting in minor damage to both vessels. Vessels proceed to nearest suitable berth to assess damage. Minor injury to crew, no pollution, minor disruption to operations.	10	1	1	0	1	5.89	Sig	1	Human error/fatigue - Vessel Personnel
																	7	Inadequate procedures in place onboard vessel
																	11	Vessel breakdown or malfunction
																	20	Towing equipment failure
																	23	Communication failure - Operational/procedural
																	26	Adverse weather conditions
																	28	Restricted visibility
																	72	Failure to follow passage plan
																	76	Inadequate training/competence - Personnel
																	82	AIS failure

Control ID	Embedded Controls				Current Risk	Current Risk	Control ID	Further Applicable Controls				Final Risk	Final Risk
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction		
10	Passage planning	Required by the SOLAS convention	10%	0%	5.16	Sig	4	Communications - Stakeholder	Covering the moving of buoyed areas	5%	0%	4.83	Mod
62	Emergency services equipment - shore side	Ambulance services	0%	5%			9	Safety lighting	Appropriate illumination of the marine works to be provided, without affecting mariners' night vision (BSI, Road Lighting, BS:5489-1, 2020)	5%	0%		
70	Marine Safety Management System	Argyll and Bute Council has a MSMS to cover the requirements of the PMSC	5%	0%			28	AIS/Radar coverage	All dredge/construction vessels, including barges to carry AIS (A or B).	10%	0%		
130	Vessel's emergency response procedures	Actions to be taken after a collision	0%	5%									

Assessment Number	Hazard Category	Hazard Scenario Title	Worst Credible Scenario	Years between worst occurrence	Consequence				Most Likely Scenario	Years between likely occurrence	Consequence				Inherent Risk	Inherent Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port				
9	Collision	Tug and tow collision with ferry/tour boat	Tug and tow (transporting material by barge) on transit in the Sound of Iona collision with ferry/tour boat. Ferry/tour boat (carrying passengers) holed and sinks in deep water. Loss of life, pollution (Tier 2). Disruption to marine works meaning temporary suspension of operations, and international adverse publicity.	50	4	4	3	4	Collision occurs in deep water within Sound of Iona. Vessels make contact whilst taking avoiding action, glancing blow resulting in minor damage to both vessels. Vessels proceed to nearest suitable berth to assess damage. Minor injury to crew/passengers, no pollution, no disruption to operations.	10	1	1	0	2	5.87	Sig	1	Human error/fatigue - Vessel Personnel
																	6	Inadequate bridge resource management
																	7	Inadequate procedures in place onboard vessel
																	11	Vessel breakdown or malfunction
																	16	Unplanned interaction with recreational/fishing craft
																	20	Towing equipment failure
																	23	Communication failure - Operational/procedural
																	25	Communication failure - Personnel
																	26	Adverse weather conditions
																	28	Restricted visibility
																	68	Interaction with passing vessel
																	72	Failure to follow passage plan
																	76	Inadequate training/competence - Personnel
																	82	AIS failure
																	112	Unplanned interaction with ferry/tour boat

Control ID	Embedded Controls				Current Risk	Current Risk	Control ID	Further Applicable Controls				Final Risk	Final Risk
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction		
10	Passage planning	Required by the SOLAS convention	10%	0%	5.78	Sig	9	Safety lighting	Appropriate illumination of the marine works to be provided, without affecting mariners' night vision (BSI, Road Lighting, BS:5489-1, 2020)	5%	0%	5.18	Sig
70	Marine Safety Management System	Argyll and Bute Council has a MSMS to cover the requirements of the PMSC	5%	0%			28	AIS/Radar coverage	All dredge/construction vessels, including barges to carry AIS (A or B).	20%	0%		
							41	Notices to mariners	Issued on the Council website containing details about construction activities	10%	0%		
							136	Marine liaison officer	To provide safety information to vessels navigating in the area and to local authorities	5%	0%		

Assessment Number	Hazard Category	Hazard Scenario Title	Worst Credible Scenario	Years between worst occurrence	Consequence				Most Likely Scenario	Years between likely occurrence	Consequence				Inherent Risk	Inherent Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port				
10	Fire/Explosion	Dredge/construction plant on-board fire	Fire on-board the dredge/construction vessel. Fire makes the vessel inoperative, multiple fatalities, minor pollution (Tier 1) from fire fighting products and run off, vessel laid up or removed from service. Disruption to the marine works.	50	4	4	2	3	Fire is contained by ship's crew, resulting in localised damage to vessel on-board equipment. Minor injury, no pollution, vessel operational capability unaffected. Minor disruption to the marine works.	10	1	1	0	0	5.32	Sig	3	Human error/fatigue - Construction personnel
																	7	Inadequate procedures in place onboard vessel
																	8	Fire/Explosion
																	11	Vessel breakdown or malfunction

Control ID	Embedded Controls				Current Risk	Current Risk	Control ID	Further Applicable Controls				Final Risk	Final Risk
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction		
62	Emergency services equipment - shore side	Fire and ambulance services	0%	10%	4.72	Mod	9	Safety lighting	Appropriate illumination of the marine works to be provided, without affecting mariners' night vision (BSI, Road Lighting, BS:5489-1, 2020)	5%	0%	4.42	Mod
70	Marine Safety Management System	Argyll and Bute Council has a MSMS to cover the requirements of the PMSC	5%	0%			136	Marine liaison officer	To coordinate emergency response with shore side resources	0%	5%		
95	Standing Orders/SOPs	Vessel's procedures for undertaking operations	10%	0%									
130	Vessel's emergency response procedures	Actions to be taken for a fire	0%	10%									
140	Contractor risk assessment method statement (RAMS)	Details the risks and mitigations for specific construction activities	5%	0%									

Assessment Number	Hazard Category	Hazard Scenario Title	Worst Credible Scenario	Years between worst occurrence	Consequence				Most Likely Scenario	Years between likely occurrence	Consequence				Inherent Risk	Inherent Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port				
11	Flooding	Dredger flooding whilst engaged in operations	Ingress of water due to weld failure, sea valve failure, hatches/ramps not secure, affects vessel stability leading to vessel sinking. Loss of life, pollution (Tier 2), navigation hazard disrupting operations, major adverse publicity.	50	4	4	3	4	Ingress of water controlled before vessel stability affected. Operations delayed until investigation/repairs completed.	10	0	2	0	2	6.28	Hig	1	Human error/fatigue - Vessel Personnel
																	7	Inadequate procedures in place onboard vessel
																	9	Loss of watertight integrity
																	11	Vessel breakdown or malfunction
																	25	Communication failure - Personnel
																	57	Vessel Ramps or Hatches not secure
																	75	Inadequate maintenance/inspection

Control ID	Embedded Controls				Current Risk	Current Risk	Control ID	Further Applicable Controls				Final Risk	Final Risk
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction		
70	Marine Safety Management System	Argyll and Bute Council has a MSMS to cover the requirements of the PMSC	5%	0%	5.66	Sig	136	Marine liaison officer	To coordinate emergency response with shore side resources	0%	5%	5.44	Sig
95	Standing Orders/SOPs	Standard vessel operating procedures	5%	5%									
118	Vessel maintenance	Maintenance schedule part of the vessel SMS	15%	10%									
119	Vessel inspection/survey	Port and flag state inspections and survey by classification society	15%	10%									

Assessment Number	Hazard Category	Hazard Scenario Title	Worst Credible Scenario	Years between worst occurrence	Consequence				Most Likely Scenario	Years between likely occurrence	Consequence				Inherent Risk	Inherent Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port				
12	Grounding	Dredger grounding whilst engaged in operations	Dredger grounds whilst dredging. Drag head and pipe damaged, hull holed causing ingress of water, pollution (Tier 2), disruption to marine works and adverse publicity.	25	0	2	0	3	Dredger grounds, minor damage to drag head and pipe, plus damage to vessel hull from contact with the seabed. Vessel requires hull survey causing delay to marine works.	5	0	1	0	1	3.89	Low	1	Human error/fatigue - Vessel Personnel
																	7	Inadequate procedures in place onboard vessel
																	9	Loss of watertight integrity
																	11	Vessel breakdown or malfunction
																	14	Vessel has unreported defect
																	25	Communication failure - Personnel
																	61	Incorrect assessment of tidal flow

Control ID	Embedded Controls				Current Risk	Current Risk	Control ID	Further Applicable Controls				Final Risk	Final Risk
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction		
31	Availability of latest hydrographic information	Survey provided in advance of the dredge	10%	0%	3.89	Low	9	Safety lighting	Appropriate illumination of the marine works to be provided, without affecting mariners' night vision (BSI, Road Lighting, BS:5489-1, 2020)	5%	0%	3.70	Low
70	Marine Safety Management System	Argyll and Bute Council has a MSMS to cover the requirements of the PMSC	5%	0%			116	Weather forecasting	Monitoring of weather conditions	5%	0%		
95	Standing Orders/SOPs	Vessels procedures for carrying out operations	5%	0%			117	Operational weather limits	Maximum wind/wave limits for construction activities	10%	0%		
130	Vessel's emergency response procedures	Actions taken following a grounding	0%	5%			136	Marine liaison officer	Coordinating activities for the construction	5%	0%		

Assessment Number	Hazard Category	Hazard Scenario Title	Worst Credible Scenario	Years between worst occurrence	Consequence				Most Likely Scenario	Years between likely occurrence	Consequence				Inherent Risk	Inherent Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port				
13	Hazardous substance accidents	Accidental spill during marine works	Pollution from marine incident or accidental spill during construction phase leading to Tier 2 response. For example split hose or pipe on construction craft. No effect to other nearby vessels.	5	0	0	3	3	Pollution from accidental spill during construction phase leading to Tier 1 response. For example, from refuelling machinery on marine plant such as generators, compressors or cranes. Contractors pollution response equipment deployed. No effect to other nearby vessels.	1	0	0	2	1	5.35	Sig	1	Human error/fatigue - Vessel Personnel
																	5	Human error/fatigue - Marine personnel
																	7	Inadequate procedures in place onboard vessel
																	11	Vessel breakdown or malfunction
																	25	Communication failure - Personnel
																	37	Failure to comply with safe systems of work
																	59	Inadequate marine procedures - Project
																	75	Inadequate maintenance/inspection
																	76	Inadequate training/competence - Personnel

Control ID	Embedded Controls				Current Risk	Current Risk	Control ID	Further Applicable Controls				Final Risk	Final Risk
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction		
21	Oil spill contingency plans	Covers all A&B Council facilities	0%	5%	5.35	Sig	9	Safety lighting	Appropriate illumination of the marine works to be provided, without affecting mariners' night vision (BSI, Road Lighting, BS:5489-1, 2020)	5%	0%	4.70	Mod
24	Tier 2 contractor	Provides personnel and equipment during oil spill response	0%	10%			36	Availability of pollution response equipment	Contractor to have tier 1 pollution equipment	0%	15%		
70	Marine Safety Management System	Argyll and Bute Council has a MSMS to cover the requirements of the PMSC	5%	0%			136	Marine liaison officer	Coordinating activities for the construction	0%	5%		

Assessment Number	Hazard Category	Hazard Scenario Title	Worst Credible Scenario	Years between worst occurrence	Consequence				Most Likely Scenario	Years between likely occurrence	Consequence				Inherent Risk	Inherent Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port				
14	Machinery related accidents	Heavy lift failure, or failure of lifting gear	Failure during unloading of barge with load slung. Load released and lands on vessel deck causing major damage to either vessel or failure during transfer of heavy cargo from vessel to construction site. Single fatality, minor pollution (Tier 1), operations cease pending recovery and investigation.	25	3	3	2	4	Failure of lifting equipment causes automatic shutoff. Delay to operations while repairs are made.	1	0	0	0	1	5.88	Sig	1	Human error/fatigue - Vessel Personnel
																	5	Human error/fatigue - Marine personnel
																	7	Inadequate procedures in place onboard vessel
																	11	Vessel breakdown or malfunction
																	23	Communication failure - Operational/procedural
																	37	Failure to comply with safe systems of work
																	69	Port Equipment (inc. craft) mechanical breakdown/system malfunction
																	75	Inadequate maintenance/inspection

Control ID	Embedded Controls				Current Risk	Current Risk	Control ID	Further Applicable Controls				Final Risk	Final Risk
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction		
62	Emergency services equipment - shore side	Ambulance services	0%	5%	5.19	Sig	9	Safety lighting	Appropriate illumination of the marine works to be provided, without affecting mariners' night vision (BSI, Road Lighting, BS:5489-1, 2020)	5%	0%	4.88	Mod
70	Marine Safety Management System	Argyll and Bute Council has a MSMS to cover the requirements of the PMSC	5%	0%			116	Weather forecasting	Monitoring of weather conditions	5%	0%		
140	Contractor risk assessment method statement (RAMS)	Details the risks and mitigations for specific construction activities	10%	0%			117	Operational weather limits	Maximum wind/wave limits for construction activities	10%	0%		
							136	Marine liaison officer	Coordinating activities for the construction	5%	0%		

Assessment Number	Hazard Category	Hazard Scenario Title	Worst Credible Scenario	Years between worst occurrence	Consequence				Most Likely Scenario	Years between likely occurrence	Consequence				Inherent Risk	Inherent Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port				
15	Payload related accidents	Incorrect payload distribution/loading affects vessel stability	Rock barge is loaded/unloaded incorrectly, causing instability and capsize of vessel. Loss of vessel, loss of life if barge manned, pollution (Tier 1), navigation hazard created by the sunk vessel, delays to marine construction programme.	25	3	3	2	3	Barge takes on list during unloading. Operations cease and barge unloaded causing delays.	1	0	0	0	1	5.49	Sig	1	Human error/fatigue - Vessel Personnel
																	5	Human error/fatigue - Marine personnel
																	26	Adverse weather conditions
																	37	Failure to comply with safe systems of work
																	59	Inadequate marine procedures - Project
																	76	Inadequate training/competence - Personnel

Control ID	Embedded Controls				Current Risk	Current Risk	Control ID	Further Applicable Controls				Final Risk	Final Risk
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction		
44	Safe systems of work (H&S)		10%	10%	4.72	Mod	9	Safety lighting	Appropriate illumination of the marine works to be provided, without affecting mariners' night vision (BSI, Road Lighting, BS:5489-1, 2020)	5%	0%	4.41	Mod
62	Emergency services equipment - shore side		0%	10%			121	Loading/unloading plan	Detailing the order to load/unload and position of cargo to maintain stability	15%	0%		
70	Marine Safety Management System	Argyll and Bute Council has a MSMS to cover the requirements of the PMSC	5%	0%			136	Marine liaison officer	Coordinating activities for the construction	5%	0%		
140	Contractor risk assessment method statement (RAMS)	Details the risks and mitigations for specific construction activities	10%	0%									

Assessment Number	Hazard Category	Hazard Scenario Title	Worst Credible Scenario	Years between worst occurrence	Consequence				Most Likely Scenario	Years between likely occurrence	Consequence				Inherent Risk	Inherent Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port				
16	Other	Small non-powered craft, displaced by marine works	Displacement of small non-powered craft (e.g. kayaks, Paddleboards) which may be transiting past the word into deeper water due to the presence of marine works, loss of line-of-sight for smaller craft with larger craft in the area such as tour boats or the ferry leaving or entering the slipway area. Worst case scenario is the non-powered craft is operated solo. Non-powered craft capsizes, occupant is separated from the craft, vessel sinks or is lost, loss of life, no pollution. Adverse publicity.	25	4	1	0	4	Displacement of small non-powered craft (e.g. kayaks, Paddleboards) which may be transiting past the word into deeper water due to the presence of marine works, loss of line-of-sight for smaller craft with larger craft in the area such as tour boats or the ferry leaving or entering the slipway area. One or more members of the non-powered craft group capsize, occupants remain with their craft and are rescued by the emergency services or nearby commercial craft. Minor injury (hypothermia), local publicity. No pollution or property damage.	5	1	0	0	1	5.11	Sig	16	Unplanned interaction with recreational/fishing craft
																	3	Human error/fatigue - Construction personnel
																	26	Adverse weather conditions
																	28	Restricted visibility
																	28	Restricted visibility
																	33	Increased vessel use
																	34	Limited area for manoeuvring
																	72	Failure to follow passage plan
																	76	Inadequate training/competence - Personnel
																	80	Human error
																	86	Competence
																	87	Notice to Mariners failure to observe
																	110	Reduction in safe navigable space

Control ID	Embedded Controls				Current Risk	Current Risk	Control ID	Further Applicable Controls				Final Risk	Final Risk
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction		
70	Marine Safety Management System	Review the A&B Council MSMS to cover new operations at Iona	0%	5%	4.73	Mod	9	Safety lighting	Appropriate illumination of the marine works to be provided, without affecting mariners' night vision (BSI, Road Lighting, BS:5489-1, 2020)	5%	0%	4.19	Mod
							41	Notices to mariners	Issued on the Council website containing details about construction activities	10%	0%		
							48	Promulgation of information	Information on activities shared with local communities and the Scottish Canoe Association	10%	0%		
							57	Aids to navigation, Provision and maintenance of	Illumination of marine works at night	10%	0%		
							136	Marine liaison officer	Central point of contact to coordinate activities	5%	5%		

B.2 Operation phase

Assessment Number	Hazard Category	Hazard Scenario Title	Worst Credible Scenario	Years between worst occurrence	Consequence				Most Likely Scenario	Years between likely occurrence	Consequence				Inherent Risk	Inherent Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port				
1	Allision	Ferry or tour boat with the breakwater	Ferry or tour boat makes heavy contact with the breakwater on approach. Hull punctured leading to extensive flooding and vessel sinking. Multiple fatalities, pollution (Tier 2), national adverse publicity. Operations cease until wreck can be recovered.	50	4	4	3	4	Ferry or tour boat makes contact with breakwater on approach at slow speed causing minor damage to vessel hull. Minor injuries to passengers and crew, no pollution, vessel out of service until survey and repairs made.	10	1	3	0	1	7.13	Hig	1	Human error/fatigue - Vessel Personnel
																	6	Inadequate bridge resource management
																	7	Inadequate procedures in place onboard vessel
																	11	Vessel breakdown or malfunction
																	16	Unplanned interaction with recreational/fishing craft
																	26	Adverse weather conditions
																	28	Restricted visibility
																	34	Limited area for manoeuvring
																	36	Failure of Aid to Navigation (out of position/unlit)
																	61	Incorrect assessment of tidal flow
																	72	Failure to follow passage plan
																	76	Inadequate training/competence - Personnel
																	103	Excessive vessel speed
																	110	Reduction in safe navigable space
																	113	Manoeuvre misjudged

Control ID	Embedded Controls				Current Risk	Current Risk	Control ID	Further Applicable Controls				Final Risk	Final Risk
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction		
10	Passage planning	Including all relevant information on the area	5%	0%	6.25	Hig	10	Passage planning	Update to CalMac passage plan	10%	0%	###	Sig
21	Oil spill contingency plans	Covers all A&B Council facilities	0%	5%			14	Update ALRS and Sailing Directions	Updates to include new structures	10%	0%		
24	Tier 2 contractor	Provides personnel and equipment during oil spill response	0%	10%			112	Review of available powers	To determine whether further powers are required to ensure navigational safety	10%	10%		
26	Communications equipment	Ability to request shoreside assistance	5%	5%			122	Shore side facility maintenance programme	Schedule of maintenance including AtoN	10%	0%		

Assessment Number	Hazard Category	Hazard Scenario Title	Worst Credible Scenario	Years between worst occurrence	Consequence				Most Likely Scenario	Years between likely occurrence	Consequence				Inherent Risk	Inherent Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port				
2	Allision	Recreational or fishing vessel allision with the breakwater.	Recreational or fishing vessel makes heavy impact with the breakwater. Impact causes vessel to be holed leading to serious injury to crew, and significant damage to the vessel. Limited pollution (Tier 1), vessel stranded on breakwater resulting in delays to operations until vessel recovered.	50	2	2	2	3	Recreational or fishing vessel makes contact with the breakwater at slow speed causing vessel damage, leading to minor injury to crew, no pollution.	5	1	1	0	1	5.44	Sig	1	Human error/fatigue - Vessel Personnel
																	11	Vessel breakdown or malfunction
																	16	Unplanned interaction with recreational/fishing craft
																	26	Adverse weather conditions
																	28	Restricted visibility
																	31	Failure to observe standing notices
																	33	Increased vessel use
																	34	Limited area for manoeuvring
																	36	Failure of Aid to Navigation (out of position/unlit)
																	55	Incapacitated master (drinks/drugs)
																	61	Incorrect assessment of tidal flow
																	76	Inadequate training/competence - Personnel
																	103	Excessive vessel speed
																	110	Reduction in safe navigable space
																	113	Manoeuvre misjudged

Control ID	Embedded Controls				Current Risk	Current Risk	Control ID	Further Applicable Controls				Final Risk	Final Risk
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction		
21	Oil spill contingency plans	Covers all A&B Council facilities	0%	5%	4.27	Mod	14	Update ALRS and Sailing Directions	Updates to include new structures	10%	0%	###	Low
24	Tier 2 contractor	Provides personnel and equipment during oil spill response	0%	10%			112	Review of available powers	To determine whether further powers are required to ensure navigational safety	10%	10%		
57	Aids to navigation, Provision and maintenance of	AtoN have been proposed for the breakwater, to be confirmed by NLB	15%	0%			122	Shore side facility maintenance programme	Schedule of maintenance including AtoN	10%	0%		
62	Emergency services equipment - shore side	Ambulance service	0%	10%									
70	Marine Safety Management System	Review the A&B Council MSMS to cover new operations at Iona	0%	5%									
116	Weather forecasting	Advance warning gained from available internet resources and metocean forecasts	5%	0%									

Assessment Number	Hazard Category	Hazard Scenario Title	Worst Credible Scenario	Years between worst occurrence	Consequence				Most Likely Scenario	Years between likely occurrence	Consequence				Inherent Risk	Inherent Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port				
3	Grounding	Any vessel	Vessel grounds on materials dropped during the construction of the breakwater. Rock penetrates the hull resulting in flooding, vessel requires survey and repair, potential for minor pollution (Tier 1).	25	0	2	2	3	Breakwater construction, dredge works and changes to localised flow patterns lead to depth changes post-construction (scour, deposit, accidental material left from construction works). Grounding of a vessel on accumulated sediment, delay to operations as vessels requires checks for damage.	5	0	1	0	1	5.20	Sig	1	Human error/fatigue - Vessel Personnel
																	3	Human error/fatigue - Construction personnel
																	6	Inadequate bridge resource management
																	7	Inadequate procedures in place onboard vessel
																	25	Communication failure - Personnel
																	26	Adverse weather conditions
																	33	Increased vessel use
																	34	Limited area for manoeuvring
																	61	Incorrect assessment of tidal flow
																	80	Human error
																	86	Competence
																	104	Inadequate surveying
																	110	Reduction in safe navigable space
																	113	Manoeuvre misjudged

Control ID	Embedded Controls				Current Risk	Current Risk	Control ID	Further Applicable Controls				Final Risk	Final Risk
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction		
10	Passage planning	Including all relevant information on the area and contingency planning for ferry/tour boats	10%	0%	4.20	Mod	10	Passage planning	Update to CalMac passage plan	5%	0%	###	Low
11	Dredging programme	To be influenced by hydrographic survey	10%	5%			17	Hydrographic surveying program	Data to be provided to the UKHO for use in navigational charts	10%	0%		
21	Oil spill contingency plans	Covers all A&B Council facilities	0%	5%			112	Review of available powers	To determine whether further powers are required to ensure navigational safety	10%	10%		
24	Tier 2 contractor	Provides personnel and equipment during oil spill response	0%	10%									
70	Marine Safety Management System	Review the A&B Council MSMS to cover new operations at Iona	0%	5%									
130	Vessel's emergency response procedures	Actions to be taken during a grounding emergency	0%	10%									

Assessment Number	Hazard Category	Hazard Scenario Title	Worst Credible Scenario	Years between worst occurrence	Consequence				Most Likely Scenario	Years between likely occurrence	Consequence				Inherent Risk	Inherent Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port				
4	Other	Small non-powered craft, displaced by breakwater	Displacement of small non-powered craft (e.g. kayaks, Paddleboards) into deeper water due to Breakwater presence, loss of line-of-sight for non-powered craft with larger craft moving in the area due to the Breakwater size. Capsize of non-powered craft, loss of life, no pollution. Adverse publicity.	25	4	1	0	4	Displacement of small non-powered craft (e.g. kayaks, Paddleboards) into deeper water due to Breakwater presence, loss of line-of-sight for non-powered craft with larger craft moving in the area due to the Breakwater size. Capsize of non-powered craft, minor injury (hypothermia), rescued by emergency services or local craft. No pollution, adverse publicity.	5	1	0	0	1	4.77	Mod	16	Unplanned interaction with recreational/fishing craft
																	28	Restricted visibility
																	33	Increased vessel use
																	34	Limited area for manoeuvring
																	80	Human error
																	86	Competence
																	110	Reduction in safe navigable space

Control ID	Embedded Controls				Current Risk	Current Risk	Control ID	Further Applicable Controls				Final Risk	Final Risk
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction		
70	Marine Safety Management System	Review the A&B Council MSMS to cover new operations at Iona	0%	5%	4.73	Mod	14	Update ALRS and Sailing Directions	Updates to include new structures	10%	0%	###	Mod
							48	Promulgation of information	Information on breakwater and lighting shared with local communities and the Scottish Canoe Association	10%	0%		
							112	Review of available powers	To determine whether further powers are required to ensure navigational safety	10%	10%		

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APPENDIX 7.1

Terrestrial Biodiversity Survey Results

7 TERRESTRIAL BIODIVERSITY SURVEY RESULTS

7.1 Introduction

7.1.1 Purpose and Scope of the Report

This report details the results of ecology surveys undertaken for the Proposed Development. The surveys were designed to assess the baseline conditions within the site boundary and surrounding area including habitats and protected species of conservation concern. The findings of these surveys will be used to inform the Proposed Development Ecological Impact Assessment.

7.1.2 Report Objectives

The main objectives of these surveys were to identify any areas:

- Which support notable or legally protected habitats;
- To identify the use of the proposed development area and zone of influence by protected species; and
- Which support significant numbers of qualifying species of nearby designated sites that may have connectivity to the habitats within the site.

7.2 Relevant Legislation

A summary of the legislation relevant to habitats and protected species, or those which may pose a potential constraint to the scheme as identified in this report, are provided in Appendix A and include:

- The Wildlife and Countryside Act 1981 (as amended);
- The Protection of Badgers Act 1992;
- Nature Conservation (Scotland) Act 2004 (as amended);
- The Wildlife and Natural Environment (Scotland) Act 2011;
- The UK Biodiversity Action Plan (UKBAP) 1994;
- Environmental Impact Assessment Directive 85/337/EEC (the EIA Directive);
- Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019);
- The Conservation (Natural Habitats &c.) Amendment (Scotland) Regulations 2012, relating to reserved matters in Scotland; and
- Scottish Planning Policy (2020).

7.3 Methodology

7.3.1 Desk Study

A desk study was undertaken to gather information on the potential value of the site and wider area for protected species (excluding avian interests which are dealt with in Chapter 9) and habitats through the following:

- A request was made to Argyll Biological Record Centre (ABReC) for records from the last 10 years relating to:
  - All other notable and protected species - 2km buffer;
  - Non-statutory sites (e.g, Scottish Wildlife Nature Reserves, Local Nature Conservation Sites (LNCS) - 2km buffer;
- NatureScot (NS) SiteLink website was consulted to identify the presence of any Sites designated for terrestrial biological features within 5km (e.g., Special Areas of Conservation (SAC), Sites of Special Scientific Interest (SSSI) and Local Nature Reserves (LNR);
- Scotland's environment web[1];
- JNCC website[2];
- Argyll and Bute Council open data website[3]; and
- Aerial imagery which was studied prior to the survey to inform any areas of high sensitivity which might require additional survey effort during the site visit.

7.3.2 Ecology

7.3.2.1 Preliminary Ecological Appraisal

A Preliminary Ecological Appraisal (PEA) Report was undertaken in accordance with CIEEM (2017). This comprised a desk study, Phase 1 Habitat survey and a preliminary protected species assessment within 100m of the footprint of the site as defined at the time of survey (Figure 7-2). The following species were screened out of the assessment due to the Proposed Development falling outside of the known distribution and/or the absence of suitable habitat: badger (*meles meles*), water vole (*Arvicola amphibious*), red squirrel (*Sciurus vulgaris*), pine marten (*Martes martes*), wildcat (*Felis sylvestris*) and great crested newt (*Triturus cristatus*).

[1] Map | Scotland's environment web

[2] https://jncc.gov.uk/our-work/list-of-spas/

[3] https://data-argyll-bute.opendata.arcgis.com/datasets/open-data-local-nature-conservation-site

Phase 1 Habitat Survey

An extended Phase 1 Habitat survey was carried out 7 July 2021. All habitats were mapped using the methodology described in the Joint Nature Conservation Committee's (JNCC) Handbook (JNCC, 2016). The survey also aimed to identify the presence of Invasive Non-Native Species (INNS) subject to legal control. The results of the Phase 1 Habitat survey can be found in Figure 7-3.

Botanical nomenclature in this report follows that of Stace (2010).

During the Phase 1 Habitat survey, habitats on site were assessed for their suitability to support legally protected or notable species that would be affected by, or need to be considered for, the scheme.

Any incidental sightings of individual species or field signs such as footprints, latrines or feeding remains discovered during the survey were noted as Target Notes (TNs) and are referenced as such (e.g., TNxx) throughout this report, with a detailed Target Note Record presented in Appendix B, which also includes all GPS locations.

Bats

As part of the PEA, an assessment was made of the suitability of the habitats present to support roosting, foraging and commuting bats within the survey area. The assessment criteria as per the Bat Conservation Trust (Collins, 2016) are detailed in Table 7.1.1.

Table 7.1.1: Bat Habitat Assessment Criteria

Suitability	Description of Roosting Habitats	Foraging and Commuting Habitats
Negligible	Negligible habitat features on site not likely to be used by roosting bats.	Negligible habitat features on site not likely to be used by commuting or foraging bats.
Low	A structure with one or more potential roost sites that could be used by individual bats opportunistically. However, these potential roost sites do not provide enough space, shelter, protection, appropriate conditions and/or suitable surrounding habitat to be used on a regular basis or by larger numbers of bats (i.e. unlikely to be suitable for maternity or hibernation). A tree of sufficient size and age to contain potential roost features but with none seen from the ground or features seen with only very limited roosting potential.	Habitat that could be used by small numbers of commuting bats such as gappy hedgerow or un-vegetated stream, but isolated, i.e. not very well connected to the surrounding landscape by other habitat. Suitable, but isolated habitat that could be used by small numbers of foraging bats such as a lone tree (not in a parkland situation) or a patch of scrub.
Moderate	A structure or tree with one or more potential roost sites that could be used by bats due to its size, shelter, protection, conditions and surrounding habitat but unlikely to support a roost of high conservation status (with respect to roost type only – the assessments in this table are made irrespective of species conservation status, which is established after presence is confirmed).	Continuous habitat connected to the wider landscape that could be used by bats for commuting such as lines of trees and scrub or linked back gardens. Habitat that is connected to the wider landscape that could be used by bats for foraging such as trees, scrub, grassland or water.
High	A structure or tree with one or more potential roost sites that are obviously suitable for use by larger numbers of bats on a more regular basis and potentially for longer periods of time due to their size, shelter, protection, condition and surrounding habitat.	Continuous, high-quality habitat that is well connected to the wider landscape that is likely to be used regularly by commuting bats such as river valleys, streams, hedgerows, lines of trees and woodland edge. Site close to, and connected to, known roosts.

Otters

All coastline, waterbodies, watercourses and minor ditches within the PEA survey area were assessed for their potential to support otters (where access permitted and where it was safe to do so).

Reptiles

Areas of suitable reptile habitat were identified within the assessment area as part of the PEA. Reptiles require dry habitats with areas of refugia and basking such as rock piles, crags, scree, and drystone walls. Any features such as these were assessed for their potential to support reptile species (e.g., common lizard (*Zootoca vivipara*)).

7.3.2.2 Otter Survey

A dedicated otter survey was undertaken of the site footprint (as proposed at the time of survey) and a 200m buffer (Figure 7-2) concurrently with the PEA survey. All signs of otter were recorded. Otter field

signs are described in Bang & Dahlstrøm (2001) and include resting sites (e.g., holts and couches), spraints, prints and feeding remains. Descriptions of these and other field evidence terms are summarised below:

- Shelters / Holts: these are underground features where otters live. They can be tunnels within banksides, underneath root plates or boulder piles, and even man-made structures such as disused drains. Holts are used by otters to rest up during the day and are the usual site of natal or breeding places. Otters may use holts permanently or temporarily.
- Couches: these are above ground resting sites. They may be partially sheltered, or fully exposed. Couches may be regularly used, especially in reed beds and on in-stream islands. They have been known to be used as natal and breeding sites. Couches can be very difficult to identify, sometimes consisting of no more than an area of flattened grass or earth and are best identified by the presence of other field signs (e.g., spraints). Where rocks or rock armour are used as couches, these can be almost impossible to identify without observing the otter in-situ.
- Prints: otters have characteristic footprints that can be found in soft ground and muddy areas.
- Spraints: otter faeces can be used to mark territories, often on in-stream boulders. They can be present within or outside the entrances of holts and couches. Spraints have a characteristic smell and often contain fish remains.
- Feeding signs: the remains of prey items may be found at preferred feeding stations. Remains of fish, crabs or skinned amphibians can indicate the presence of otters.
- Paths: these are terrestrial routes that otters take when moving between resting-up sites and watercourses, or at high flow conditions when they will travel along bank sides in preference to swimming.
- Slides and play areas: slides are typically worn areas on steep slopes where otters slide on their bellies, often found between holts/couches and watercourses. Play areas are used by juvenile otters in play and are often evident by trampled vegetation and the presence of slides. These are often positioned in sheltered areas adjacent to the natal holt.

Any of these field signs are diagnostic of the presence of otters although spraints are the most reliably identifiable evidence. Where resting sites are discovered, then an indication of their importance is recorded. This is done by evaluating spraint freshness, prints and paths or niche availability and quality of the feature.

7.4 Results

7.4.1 Desk Study

7.4.1.1 Ecology

ABReC responded on 31 August 2021 stating that they could not produce full data reports at this time and granted permission for their data to be downloaded from NBN Atlas[4] in relation to this project. The website was accessed, and data collated on 1st September 2021, detailing protected and notable species (non-avian) within 2 km of the Proposed Development within the last 10 years (Table 7.1.2).

Table 7.1.2: ABReC Records of Protected and Notable Species Within 2km From the Last 10 Years

Common Name	Taxon Name	European Protected Species (Following EU Exit)	Wildlife and Countryside Act 1981 (as amended)	Argyll and Bute Local Biodiversity Action Plan
Mammal				
Eurasian otter	*Lutra lutra*	EPS (Habitats Directive)		Yes
West European hedgehog				
Reptile				
Common lizard	*Zootoca vivipara*		Schedule 5 (Section 9(5))	

Within 5km of the Proposed Development eight non-statutory designated sites relating to terrestrial ecology were identified, (Table 7.1.3 and Figure 7.1). No SAC's designated for otters were identified within 20km:

Table 7.1.3: Statutory and Non-Statutory Sites Designated for Terrestrial Biodiversity (Excluding Avian Interests).

Site	Designation	Distance from site	Features of interest
South East Iona	LNCS	1.4	No Information available
A Mhachair, Iona	LNCS	1.5	No Information available
Port Baul-Mhoir, Iona	LNCS	3.3	No Information available
Port an Fhir-Bheige, Iona	LNCS	2.8	No Information available
Kintra	LNCS	1.9	No Information available
Slugan Dubh	LNCS	2.3	No Information available
Fidden	LNCS	2.2	No Information available
Erraid Sound	LNCS	3.2	No Information available

No information was available on the NatureScot SiteLink website or from the local authority on the nature of the designations listed in the table above. Only the first four of these were located on Iona, with the remaining sites located on Mull.

No areas of ancient woodland were identified on Iona.

[4] https://scotland.nbnatlas.org/

7.4.2 Survey Results

7.4.2.1 Ecology

7.4.2.1.1 Phase 1 Habitat

A list of the habitats present within the site and survey boundary along with the total area they occupy is shown in Table 7.1.4. Individual habitat types are described in more detail below, with the dominant species listed.

The main habitat found within the site boundary comprised open sea. The habitats identified within the survey can be found in Figure 7.3. All habitats below the Mean High Water Springs (MHWS) line have been excluded from the calculations and are dealt with in Chapter 8 (Marine Biodiversity).

Table 7.1.4: Phase 1 Habitat Types

Phase 1 Habitat Type	Survey Area (ha)*	Area in Site Boundary and Temporary Work Area (ha)
Neutral grassland - semi-improved - B2.2	0.29	0.06
Improved grassland - B4	0.12	0.01
Swamp - F1	0.03	-
Intertidal – mud/sand – H1.1	0.06	-
Boulders/rocks above high tide mark – H4	0.16	0.06
Strandline vegetation – H5	0.05	-
Coastal grassland – H8.4	0.14	0.06
Cultivated/disturbed land – amenity grassland – J1.2	0.18	-
Buildings J3.6	0.22	-
Defunct hedge – species poor - J2.2.2	N/A	-
Fence – J2.4	N/A	-
Wall – J2.5	N/A	-
Other habitat - J5 (pier, hardstanding)	0.25	0.03
Road/track	0.20	0.02
Total	**1.70**	**0.24**

* Survey Area includes those habitats mapped during the Phase 1 Habitat survey as well as a small section of the temporary working area which was mapped from aerial photography.

$ All habitats below the Mean High Water Springs (MHWS) line have been mapped as 'sea'

Semi-improved Neutral Grassland (B2.2)

The majority of the habitat within the survey area comprises semi-improved neutral grassland dominated by Yorkshire fog (*Holcus lanatus*) (TN 4). The area comprises a very species rich community including abundant creeping buttercup (*Ranunculus repens*), hogweed (*Heracleum sphondylium*) and white clover (*Trifolium repens*). Other species include crested dog's tail (*Cynosurus cristatus*), broad-leaved dock (*Rumex obtusifolius*) and common eyebright (*Euphrasia nemorosa*) with occasional yellow rattle (*Rhinanthus minor*), red clover (*Trifolium pratense*) and ragged robin (*Lychnis flos-cuculi).* Patches of soft rush (*Juncus effusus*) and yellow iris (*Iris pseudacorus*) present. Common spotted-

orchid (*Dactylorhiza fuchsia*) and Northern marsh-orchid (*Dactylorhiza purpurella*) were rare. There were no signs of grazing with ground cover reaching up to 1m tall.

The semi-improved neutral grassland in the surrounding survey area has the same typical species composition though is slightly more improved due to more intensive management (e.g., mowing).

Improved Grassland (B4)

Small pockets of improved grassland surrounded the buildings at Baile Mor village, which were dominated by perennial rye-grass (*Lolium perenne*), with abundant daisy (*Bellis perennis*), crested dog's tail and common nettle (*Urtica dioica*) and frequent white clover and field horsetail (*Equisetum arvense*).

Swamp (F1)

An area of swamp was found at the south-western corner of the main field which surrounded a drainage ditch (TN 5). It was dominated by common reed (*Phragmites australis*), with frequent yellow iris and occasional meadowsweet (*Filipendula ulmaria*). Access through the reed was too difficult therefore the survey was done from out with the habitat. The area appeared unmanaged.

Intertidal – Sand (H1.1)

An area of bare sand was present along the intertidal zone which was exposed only during low tide (TN7).

Boulders/Rock Above High Tide Mark (H4)

There is an area of boulders and rocks above the high tide mark (TN 8), that runs along the length of the survey area from north to south adjacent to the sea. These have occasional thrift (*Armeria maritima*) growing on them, as well as lichen species *Xanthoria parietina* and *Ramalina spp*.

Strandline Vegetation (H5)

A thin strip of strandline vegetation was found along the boundary of the survey area at the northern end. This was dominated by curly dock (*Rumex crispus*) with frequent sea plantain (*Plantago maritima*) and occasional thrift and silverweed (*Potentilla anserina*). The substrate was rock and shingle.

Coastal Grassland (H8.4)

Within the survey area there was a strip of coastal grassland adjacent to the coast (TN 1). The grassland is dominated by red fescue (*Festuca rubra*) with: abundant white clover, field horsetail and

silverweed; and frequent meadow buttercup, yellow iris and creeping thistle (*Cirsium arvense*). Thrift and lady's bedstraw (*Galium verum*) were occasional with meadowsweet and sea plantain rarely found. A thin strip of common reed surrounded a ditch at the south-western edge of this area (TN 3) and a small patch of dense bramble (*Rubus fruticosus*) was located at TN 2. The grassland which is at the side of the road appeared unmanaged.

Amenity Grassland (J1.2)

Small pockets of mown lawns were found around some of the buildings and houses at Baile Mor village. Some were inaccessible such as gardens, but those that were accessible included vegetation such as daisy, ribwort plantain (*Plantago lanceolata*), red clover and common dandelion (*Taraxacum officinale*).

Buildings (J3.6)

Several buildings were located within the survey boundary which form part of Baile Mor village ranging from small modern buildings to larger older buildings.

Ditch (J2.6)

A drainage ditch was found at NM 28470, 23930, close to TN5. This went through the area of swamp and across the road and out to sea. Most of it was inaccessible, however from the area that was accessible outside the survey boundary, common reed was found to be dominant, with abundant marsh marigold (*Caltha palustris*) and meadow buttercup (*Ranunculus acris*) and frequent yellow iris.

Hedge (J2.2.2)

A defunct species poor hedge surrounded one of the gardens in the village which was mostly composed of introduced species and dominated by Buddleia (*Buddleja spp.*).

Other Habitat (J5)

Other habitat within the survey area included the pier at Baile Mor and the road that goes through the village, as well as a small car park adjacent to the fire station.

Invasive Non-Native Species

A mink, an INNS, was observed at NM 28779, 24287 on the 16th June 2021 during another survey at the site. No other signs of INNS were observed during this survey.

7.4.2.1.2 Protected/Notable Species

During the survey, no signs of protected species were recorded. The habitats as described above have been assessed for their potential to support protected species.

Otter

The coastal habitats present offer good commuting potential for otters, though there is limited connectivity within the survey area to inland freshwater foraging habitats. Due to the high levels of disturbance associated with the presence of a ferry terminal and the local village it is unlikely that the habitats in the survey area are used as refugia by otters.

During the otter survey undertaken on 16th June 2021, no field signs of otter were recorded.

Bats

The Proposed Development offers negligible foraging or commuting habitat for bats due its marine situation. The terrestrial habitats in the survey buffer to the west offer low foraging and commuting habitat for bat species, due to the exposed nature and lack of woodland and watercourses. The semi-improved neutral grassland (TN4), coastal grassland (TN1), swamp habitat (TN5) and gardens offer foraging potential however the foraging opportunities in the wider area are also relatively limited with generally poor connectivity.

During the PEA survey undertaken on 16th of June 2021, two trees were found within the survey area, neither of which had potential bat roost features. The buildings in Baile Mòr village within the survey buffer could offer moderate potential for roosting bat species utilising the area.

Therefore, the site has been assessed as having negligible potential for foraging, commuting and roosting bat species, with the terrestrial habitats to the west offering moderate potential for roosting bats and low potential for foraging and commuting.

Reptiles

The site offers no suitable habitat for reptiles. The survey buffer to the west has been assessed as having the potential to support common lizard (*Zootoca vivipara*) and slow worms (*Anguis fragilis*). This is due to the presence of the field of semi-improved neutral grassland at TN 4 and the area of coastal grassland at TN1. The desk study only identified the presence of common lizards on Iona.

7.5 References

- Bang, P & Dahlstrøm, P (2001). Animal Tracks and Signs. Oxford University Press, Oxford.
- CIEEM (2017) Guidelines for Preliminary Ecological Appraisal: 2nd Edition. Chartered Institute of Ecology and Environmental Management, Winchester.

- Collins, J. (ed.) (2016) Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edn). The Bat Conservation Trust, London.
- Joint Nature Conservation Committee (2010) Phase 1 Habitat Survey: A technique for environmental audit.
- Stace C. A (2016), New Flora of the British Isles, 3rd Edition, Cambridge University Press.

Appendix A Legislation

European Protected Species

European Protected Species are defined under the European Commission (EC) Habitats and Species Directive 92/43/EEC and include species such as otter, and all species of bat. The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) translates this European legislation into UK law. This was updated to the Conservation of Habitats and Species (Amendment) (EU Exit) regulations 2019 following the UK's exit from the European Union.

This legislation makes it an offence to deliberately or recklessly kill, injure or disturb European Protected Species. Their places of shelter are fully protected, and it is an offence to damage, destroy or obstruct access to or otherwise deny the animal use of a breeding site or resting site, whether deliberately or not. It is also an offence to disturb in a manner that is, or in circumstances which are likely to significantly affect the local distribution or abundance of the species, disturb in a manner or circumstances which are likely to impair its ability to survive, breed or reproduce, or rear or otherwise care for its young. Any activity which is likely to affect such a species requires prior consultation with the relevant statutory nature conservation organisation. In Scotland, this means that NatureScot should be consulted.

A licence from NatureScot is required in cases of potential disturbance of European Protected Species or damage or destruction of a resting site as a result of work activities. Under Regulation 44 2(e) of the Conservation (Natural Habitats etc.) Regulations 1994 licences may be granted for:

- preserving public health or public safety or other imperative reasons of overriding public interest including those of a social or economic nature and beneficial consequences of primary importance for the environment.

Importantly, under Section 3 of Regulation 44, in order for a licence application to be successful, two tests must be satisfied, namely:

- there is no satisfactory alternative (including retaining the status quo); and
- the action authorised will not be detrimental to the maintenance of the population of the species concerned at a favourable conservation status in its natural range.

The Wildlife and Countryside Act 1981 (as amended)

The Wildlife and Countryside Act 1981 provides protection to a range of species and habitats. The Nature Conservation (Scotland) Act 2004 and Wildlife and Natural Environment (Scotland) Act 2011 amend the Wildlife and Countryside Act in Scotland.

Section 9 of the Act provides protection to certain animal species. Enhanced protection is provided for species listed in Schedule 5, which includes water voles and red squirrels. It is an offence to intentionally or recklessly kill, injure or take animals listed in Schedule 5, with the exception of water voles, which are protected in respect of Section 9(4) only, meaning that water vole habitat is protected, although the animals themselves are not. It is also an offence to recklessly damage, destroy or obstruct

access to any place used for shelter or breeding by species listed under Schedule 5. Any works which may potentially cause disturbance to such a species requires prior consultation with NatureScot.

The Wildlife and Countryside Act 1981 (as amended) also protects against the spread of invasive non-native plant and animal species (INNS). Specifically, in relation to plants, it is an offence under this legislation to plant or otherwise cause a plant to grow in the wild at a place outwith its native range and includes species such as Japanese knotweed (*Fallopia japonica*), giant hogweed (*Heracleum mantegazzianum*) and rhododendron (*Rhododendron ponticum* and hybrids).

In addition to the above, all wild birds, their nests and their eggs are protected under the Wildlife and Countryside Act 1981 (as amended). This legislation makes it an offence to intentionally or recklessly:

- kill, injure or take any wild bird (excluding certain specified game and other licence-controlled species);
- take, damage, destroy or otherwise interfere with the nest of any wild bird while it is in use or being built;
- obstruct or prevent any wild bird from using its nest; or
- take or destroy the egg of any wild bird.

In addition, there are some rare breeding species, such as golden eagle, barn owl or kingfisher, which are listed on Schedule 1 of the Wildlife and Countryside Act 1981 (as amended), which receive extra protection, making it an offence to intentionally or recklessly:

- disturb any species listed under Schedule 1 of the Act whilst at the nest site, or while building a nest;
- disturb the dependent young of any species listed under Schedule 1;
- disturb any species listed under Schedule 1 which leks while it is doing so;
- harass any wild bird included in Schedule 1A; or
- take, damage, destroy or otherwise interfere with any nest habitually used by any wild bird included in Schedule A1, even when that nest is not in use.

Appendix B Target Notes

Target Note Reference	Easting	Northing	Note
1	128519	723906	Area of coastal grassland - H8.4
2	128521	723922	Small patch of bramble - dense
3	128501	723903	Thin strip of common reed surrounding drain
4	128499	723981	Area of semi-improved neutral grassland
5	128490	723936	Area of swamp dominated by common reed
6	128654	724003	Built-up area including the Iona Pier and road
7	128615	724103	Thin strip of strandline vegetation
8	128611	724084	Boulders / rocks above high tide mark
9	128595	724052	Sandy bay with rocky outcrops.
10	128578	724026	Area of grassland (B2.2) that is used for storing boats and other fishing equipment.
11	128575	723945	Area of hardstanding outside a closed cafe.
12	128493	723913	Other - J5 - hardstanding

APPENDIX 7.2

Otter Species Protection Plan

7 OTTER SPECIES PROTECTION PLAN

7.1 Introduction

This Otter Protection Plan (OPP) has been prepared to manage and protect otter (*Lutra lutra*) during the construction phase of the Iona Breakwater Project. Figure 7-1 shows the site location and the survey areas used in the assessment of the Proposed Development.

The scope of the survey was informed by the suitable habitats found within the Site and surrounding area.

7.1.1 Designated Sites

During the Screening process, all links to Special Areas of Conservation (SACs) designated for otter were screened out, as such there are no risks associated with connections to SACs.

7.2 Otter Survey Results

7.2.1 Field Survey

The coastal habitats present offer good commuting and potential for otters, though there is limited connectivity within the survey area to inland freshwater foraging habitats. Due to the high levels of disturbance associated with the presence of a ferry terminal and the local village it is unlikely that the habitats in the survey area are used as refugia by otters.

During the otter survey undertaken on 16th June 2021, no field signs of otter were recorded. Survey methods are described in detail Technical Appendix 7.1.

7.2.2 Desk Study

Historic biological records from Argyll and Bute Records Centre pertaining to otter were confirmed within 2km from the Project area within the last ten years.

7.3 Species Protection Protocol

The measures outlined in this report have been developed to mitigate against the potential effects on otters.

7.3.1 Pre-Construction Surveys

In advance of construction works commencing, a walkover of the Site Boundary and Temporary Working Area plus a minimum of 200m buffer should be undertaken to identify any change in the baseline conditions presented in Appendix 7.1.

7.3.2 Construction Specific Protection

The following guidelines should be complied with throughout the construction phase of breakwater to ensure impacts to otters and their habitats are limited:

- An Ecological Clerk of Works (ECoW) should be present on site to oversee enabling works and construction including dredging works; and contribute to all relevant construction method. They should be a suitably experienced individual, whose role would ensure works are carried out in accordance with the Construction Environmental Management Plan (CEMP) produced for the development, ensuring compliance with international and national legislation and planning conditions. Once works are underway, the ECoW would work full time on site providing ecological and pollution control advice and supervision for all relevant mitigation measures;
- No work should be carried out within 30m of any otter shelter or 200m of any breeding holt, except under license from NatureScot. Should a licence be required for any works, the ECoW will be responsible for ensuring compliance with any licensing conditions;
- No works resulting in large scale noise or vibration such as pile driving or blasting should be undertaken within 100m of any otter shelter, unless under license from NatureScot;
- Ensure all rubbish and materials will be collected and removed from site on a regular basis to prevent trapping or injury of any wildlife;
- Any excavations, including trenches and trial pits more than 0.5 m deep will be covered in the evening to prevent animals falling in. Where pits and trenches cannot be closed or filled on a nightly basis, ensure that a plank is placed into the excavation so an animal can use this as a means of escape if necessary;
- Any open pipes, whether installed or being stored, should be closed to prevent any animals entering and becoming trapped;
- In the unlikely event of discovering any evidence suggesting otter presence within the footprint of the works, work must stop immediately and the ECoW should be contacted for advice on how to proceed;
- Night working should be avoided wherever possible. Where this is not possible, lighting should be focussed on the works area(s) and directed away from water and areas of potential otter foraging. Lighting should be kept to an absolute minimum within 100m from any identified otter shelter;
- Toolbox talks on otters should be given to all construction staff on site and an emergency procedure protocol given to contractors in the event of encountering an otter or discovering a new shelter; and
- If otters or new shelters are recorded during construction, all of the following emergency procedure must be adhered to:

- All works, in the vicinity of the otter are to stop immediately and the ECoW contacted;
- The ECoW will review the situation and install the relevant exclusion zone and timings;
- Should micrositing of works outwith exclusion zones applied to new shelters not be possible, an application to NatureScot will be required;
- Consultation with NatureScot will be undertaken, if required;
- Mitigation measures additional to those already in place may be required;
- Incident, outcomes and recommendations will be recorded; and
- Works will only recommence following advice from the ECoW.

In the unlikely event of an otter being injured or killed, or shelters damaged, the ECoW will be contacted immediately. They will attend the site and make a written and photographic record. This will record the time, location, personnel involved, and the details of the incident. This information will be supplied within 24 hours to NatureScot and the developer.

7.4 Post Construction Monitoring

Rock armour will be used in the construction of the breakwaters. In time, these blocks will be colonised by marine life to offer suitable foraging habitat for otter. The defect period of this is anticipated to be 104 weeks, during which time monitoring of the breakwater will occur and any movement recorded and reported. After this, the breakwater will be inspected as part of the ongoing seabed bathymetric surveys regime. Systematic surveying of the UK's coastal waters is administered by the Maritime and Coastal Agency (MCA) under the Civil Hydrology Programme[5].

[5] The Civil Hydrography Programme - https://www.gov.uk/guidance/the-civil-hydrography-programme

FIGURES

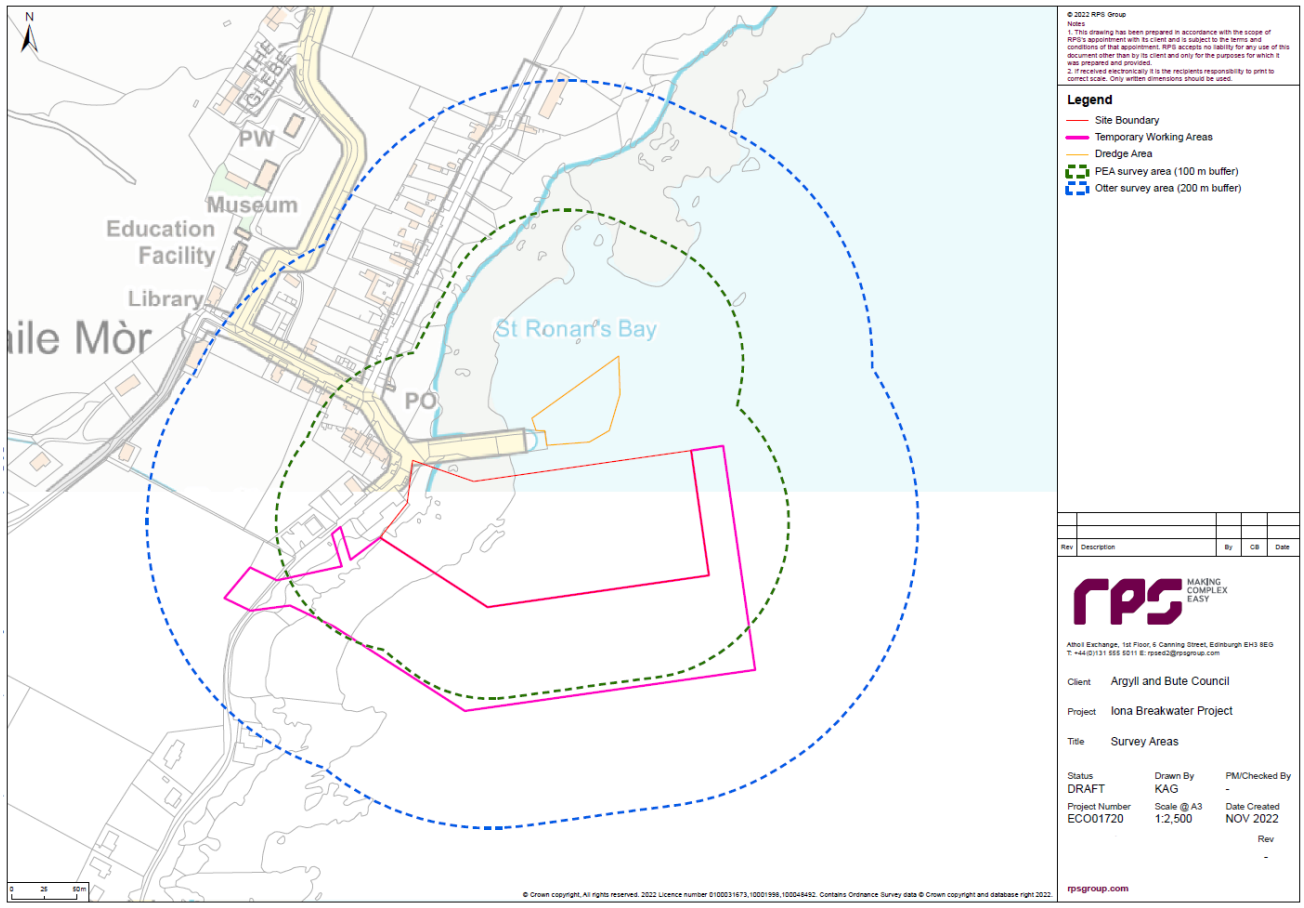

Figure 7-1: Survey Areas

APPENDIX 8.1

Seabed Sediment Analysis

Seabed Sediment Analysis

Metals		Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc	dibutyltin (DBT)	tributyltin (TBT)
Units		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg DW	mg/kg DW
Detection Limit		0.5	0.04	0.5	0.5	0.5	0.01	0.5	2	0.001	0.001
Cefas AL1 (mg/kg)		20	0.4	40	40	50	0.3	20	130	0.1	0.1
Cefas AL2(mg/kg)		100	5	400	400	500	3	200	800	1	1
Canadian TEL(mg/kg)		7.2	0.7	52.3	18.7	30.2	0.13	15.9	124		
Canadian PEL(mg/kg)		41.6	4.2	160	108	112	0.7		271		
Sample ID	Sample Location										
MAR00820.007	BHI1 ES101 0.00-0.15m	1.3	0.14	4.5	4.4	2.7	0.06	4.6	4.7	<0.005	<0.005
MAR00820.008	BHI1 ES102 0.20-0.70m	1.2	0.2	5.2	4.5	4.4	0.04	5.2	11.8	<0.005	0.007
MAR00820.009	BHI2 ES101 0.00-0.15m	1.2	0.14	4.9	5.2	2.9	0.02	5.3	9.4	<0.005	<0.005
MAR00820.010	BHI2 ES102 0.15-0.45m	2	0.18	8.9	13.1	3.5	0.02	13.4	18.4	<0.005	<0.005
MAR00820.011	BHI3 ES101 0.00-0.15m	1.3	0.14	7.6	6.2	2.6	0.02	6.3	10.4	<0.005	<0.005
MAR00820.012	BHI3 ES102 0.15-0.40m	0.9	0.15	7.9	4.9	3.1	0.03	6.1	12.8	<0.005	<0.005
MAR00820.013	BHI3 ES103 0.40-0.65m	1.1	0.17	7.4	5	4.2	0.03	5.8	11.2	<0.005	0.008

Polyaromatic Hydrocarbons		Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(ghi)perylene	Benzo(K)fluoranthene	Chrysene	Diben(ah)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3	Naphthalene	Phenanthrene	Pyrene	Total Hydrocarb
Units		ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	mg/kg	ug/kg
Detection Limit		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	100
Cefas AL1 (µg/kg)		100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Canadian TEL (µg/kg)		6.71	5.87	46.9	74.8	88.8				108	6.22	113	21.2		34.6	86.7	153000	
Sample No.	Sample location																	
MAR00820.007	BHI1 ES101 0.00-0.15m	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	2660
MAR00820.008	BHI1 ES102 0.20-0.70m	<1	<1	<1	1.03	1.47	1.92	1.7	<1	1.44	<1	1.17	<1	1.46	<1	1.53	2.37	5720
MAR00820.009	BHI2 ES101 0.00-0.15m	<1	<1	1.52	1.5	<1	1.15	1.25	<1	1.83	<1	2.02	<1	<1	<1	1.37	2.6	3090
MAR00820.010	BHI2 ES102 0.15-0.45m	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1.16	1510
MAR00820.011	BHI3 ES101 0.00-0.15m	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	2750
MAR00820.012	BHI3 ES102 0.15-0.40m	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1690
MAR00820.013	BHI3 ES103 0.40-0.65m	<1	<1	<1	<1	<1	1.21	<1	<1	<1	<1	1.16	<1	<1	<1	1.59	1.89	3040

PCB congener		PCB28	PCB52	PCB101	PCB118	PCB138	PCB153	PCB180	Sum of ICES7	alpha Hexachlorcyclohexan	beta Hexachlorcyclohexan	gamma Hexachlorcyclohexan	Dieldrin	Hexachlorobenzene	p,p Dichorodiphenyldichl	p,p Dichorodiphenyltrichl	p,p Dichorodiphenyldichl
Units		ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
Detection Limit		0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.56	0.1	0.1	0.1	0.1	0.1	0.1	0.1	
Cefas AL1 (mg/kg)									100				5				
Cefas AL2(mg/kg)									None								
Canadian TEL(mg/kg)									21.5								
Canadian PEL(mg/kg)									189								
MAR00820.007	BHI1 ES101 0.00-0.15m	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	0.56	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MAR00820.008	BHI1 ES102 0.20-0.70m	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	0.56	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MAR00820.009	BHI2 ES101 0.00-0.15m	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	0.56	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MAR00820.010	BHI2 ES102 0.15-0.45m	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	0.56	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MAR00820.011	BHI3 ES101 0.00-0.15m	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	0.56	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MAR00820.012	BHI3 ES102 0.15-0.40m	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	0.56	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MAR00820.013	BHI3 ES103 0.40-0.65m	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	0.56	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1