ENVIRONMENT
& HEALTH

Falmouth Docks Development: Appropriate Assessment Addendum – Fal and Helford SAC

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1 Introduction

This Habitats Regulations Assessment (HRA) Appropriate Assessment (AA) Addendum has been prepared by Ramboll UK Ltd (Ramboll) in response to comments received from Natural England on the HRA report[1] submitted as part of the marine licence application for the proposed redevelopment at Falmouth Docks (MLA/2025/00157).

This AA Addendum provides further information on the potential effects to the Fal and Helford Special Area of Conservation (SAC), as requested by Natural England (NE) and the Marine Management Organisation (MMO) as part of ongoing consultation. It is not intended as a standalone document and should be read alongside the HRA report.

1.1 Objective

This AA Addendum addresses the following specific points raised by Natural England regarding detailed advice (Ref: 519879, 08 September 2025) on the HRA for impacts to support a conclusion of no Adverse Effect on Integrity (AEoI) on the Fal and Helford SAC:

- Habitat and pressure mapping;
- Chronic suspended sediment concentration (SSC) impacts on benthic habitats;
- Sediment deposition depth and duration;
- Sediment deposition impacts on sensitive habitats (contamination);
- Mitigation for secondary dredge impacts; and

[1] Ramboll, 2025. Falmouth Docks Development, Habitats Regulations Assessment Report, 15743-RAM-FD-SW-RP-EV-00017

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- Coastal processes and sediment modelling limitations.

It contains outputs from the following additional modelling undertaken by HR Wallingford:

- Sediment deposition - increased resolution modelling undertaken in the area to the north of the Eastern Breakwater as well as an updated mitigation approach (refined dredge timings) to further minimise sediment deposition (**Appendix A**);
- TBT dispersion modelling (with mitigation in place) (**Appendix C**).

2 Supplementary Information for Appropriate Assessment

2.1 Habitat Mapping

The application includes a significant amount of both habitat and project related 'pressure' mapping, with information presented across Chapter 9 of the ES, the HRA, a number of detailed technical sediment modelling appendices as well as a specific maerl technical note as requested by NE. The level of detail supporting the assessments, including the HRA, is therefore to be found in several places within the application. The following brings together relevant information, to assist NE's AA, and to address the specific comments.

Habitat mapping used both publicly available information and the results of two project specific surveys to characterise the benthic ecological baseline for the project. Survey scopes were determined in consultation with Natural England and the classification of maerl habitats undertaken according to specific guidance from NE SMEs. To ensure no destructive sampling of maerl the surveys deployed drop down video data for the collection of images in areas with this species and grab samples were taken only in areas outside maerl habitat.

To provide a detailed understanding of the baseline conditions, the extensive survey effort and habitat characterisation was also undertaken alongside consideration of bathymetry within the survey area (Figure 1), and historic dredge activity at the site (Figure 2).

Pressure mapping involved detailed modelling of sediment transport and deposition processes undertaken by industry experts HR Wallingford.

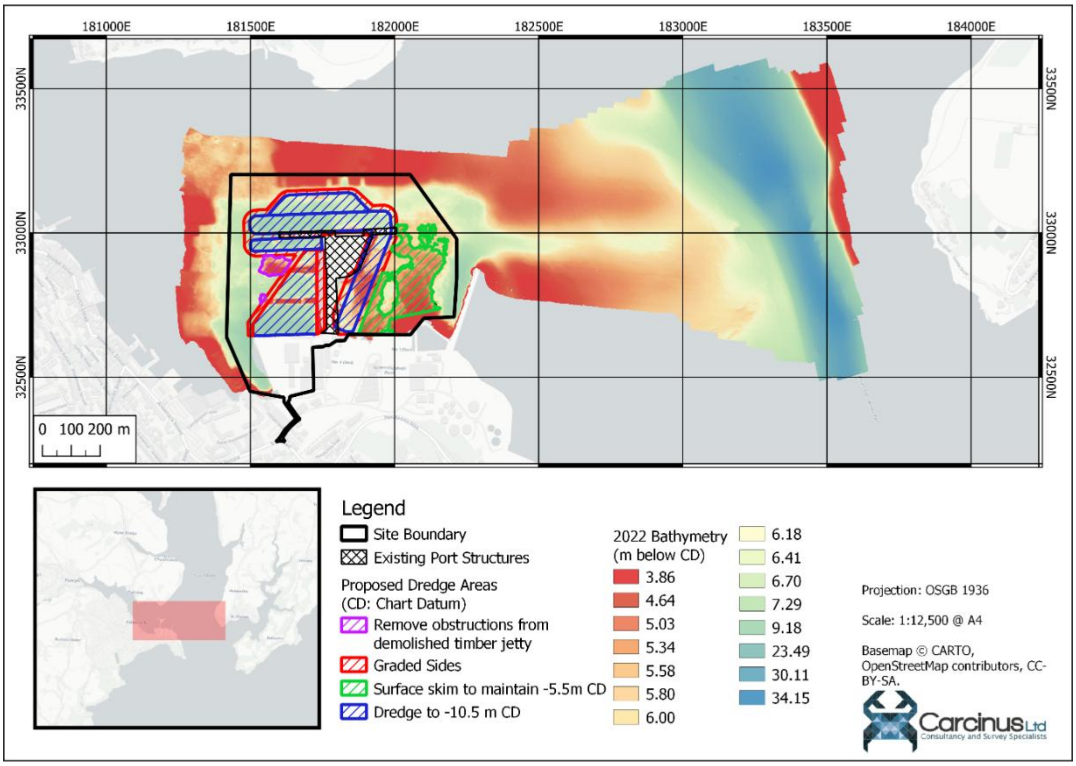

Figure 1 - Bathymetric data from waters surrounding the proposed development location, based on 2022 survey data (Carcinus Ltd, 2025)

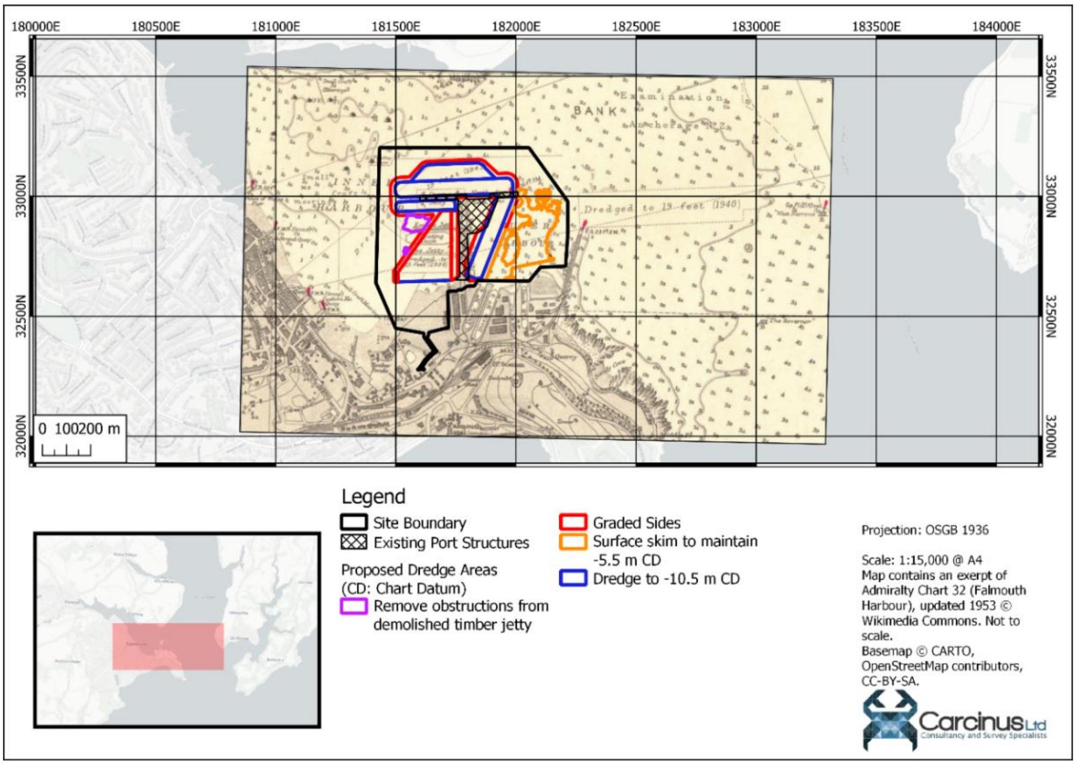

Figure 2 - Historic Dredge records (Admiralty Chart 32 excerpt), updated 1953 with proposed dredge pockets overlaid (Carcinus Ltd, 2025)

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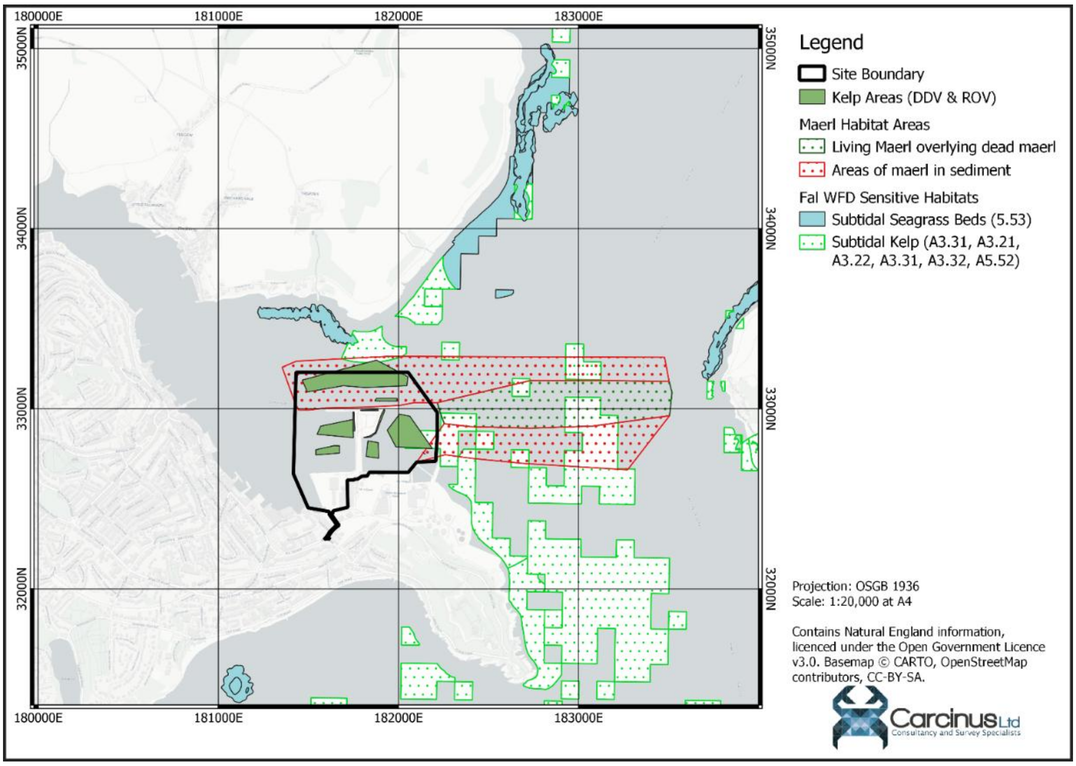


Figure 3 - Relevant sensitive habitats within the vicinity of the proposed development. WFD habitats extracted from Natural England's Marine Habitats and Species Open Data (Carcinus Ltd, 2024)

Broadscale habitat mapping, from NE online information, determined that, in addition to maerl beds, the area around the project also included Annex 1 habitats, designated by the SAC, particularly seagrass beds and kelp habitats (Figure 3).

A detailed categorisation of habitats, within and around the red line boundary, was undertaken based on survey data to plot the observed biotopes, sediment type, percentage of dead and live maerl, and maerl structure (2D or 3D) in and around the site boundary. These characteristics were mapped, as shown in the example below for biotopes, sediment type and the presence and structure of live and dead maerl in the survey area (Figures 4 – 6).

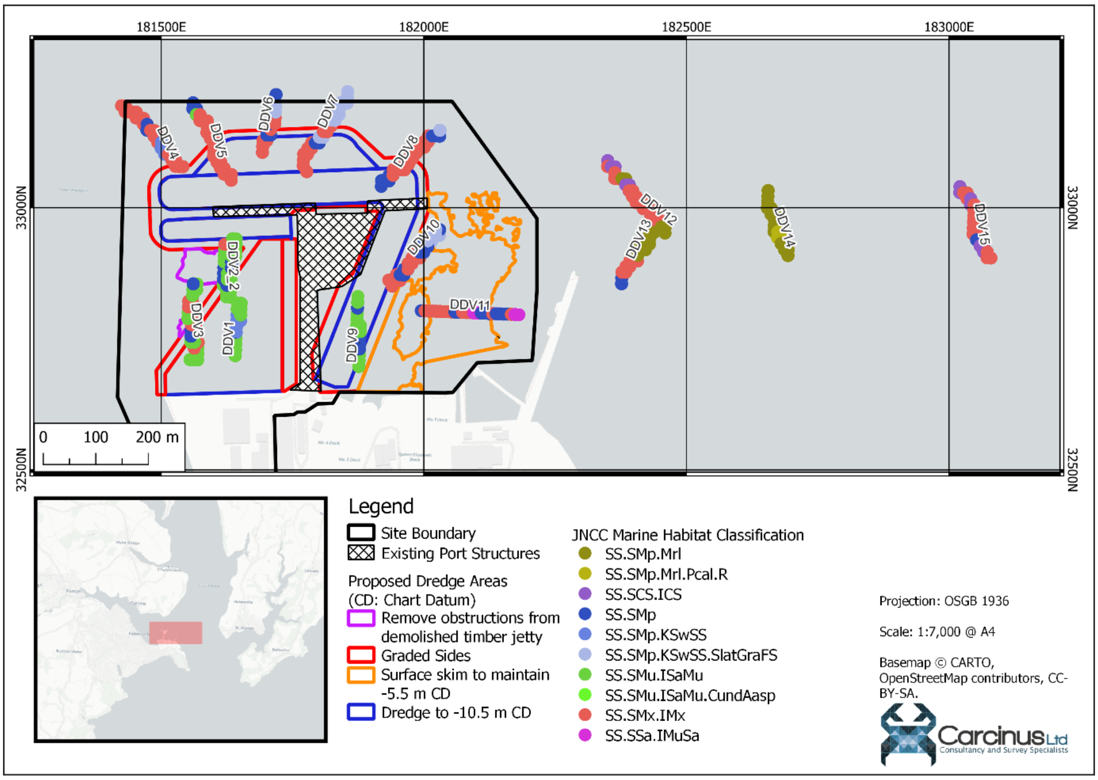


Figure 4 - Habitat biotopes along DDV transects surveyed within the study area (Carcinus Ltd, 2024)

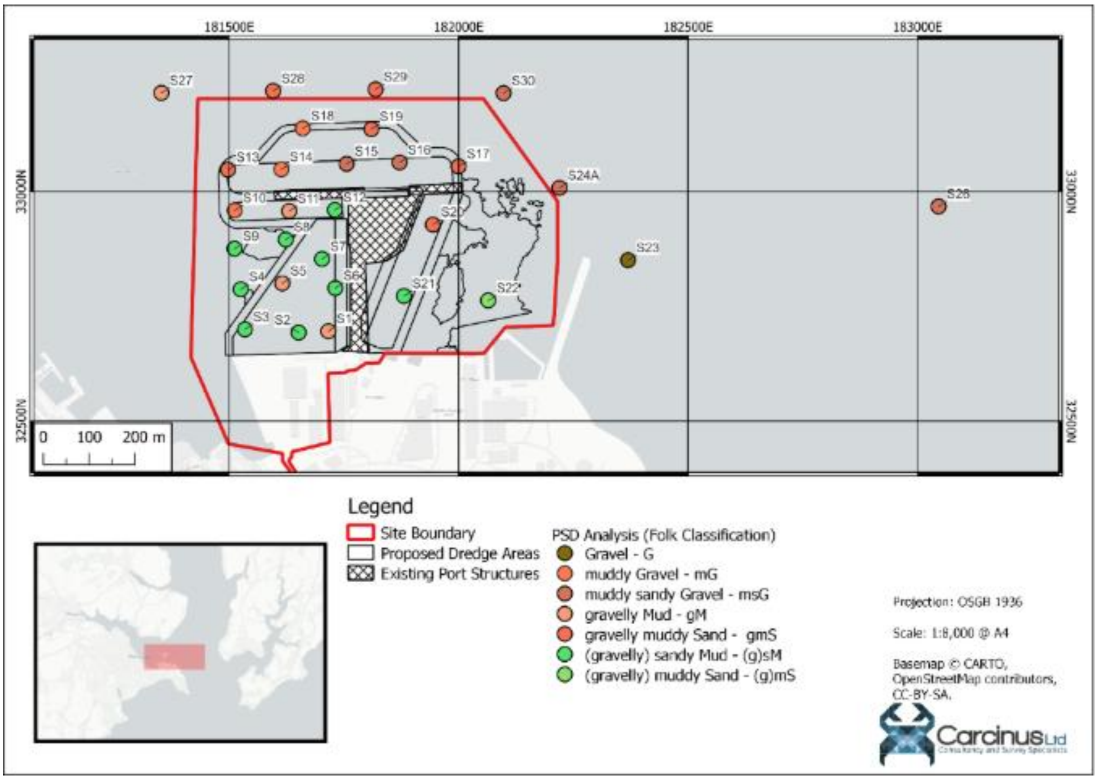


Figure 5 – Sediment type at grab stations within the study area

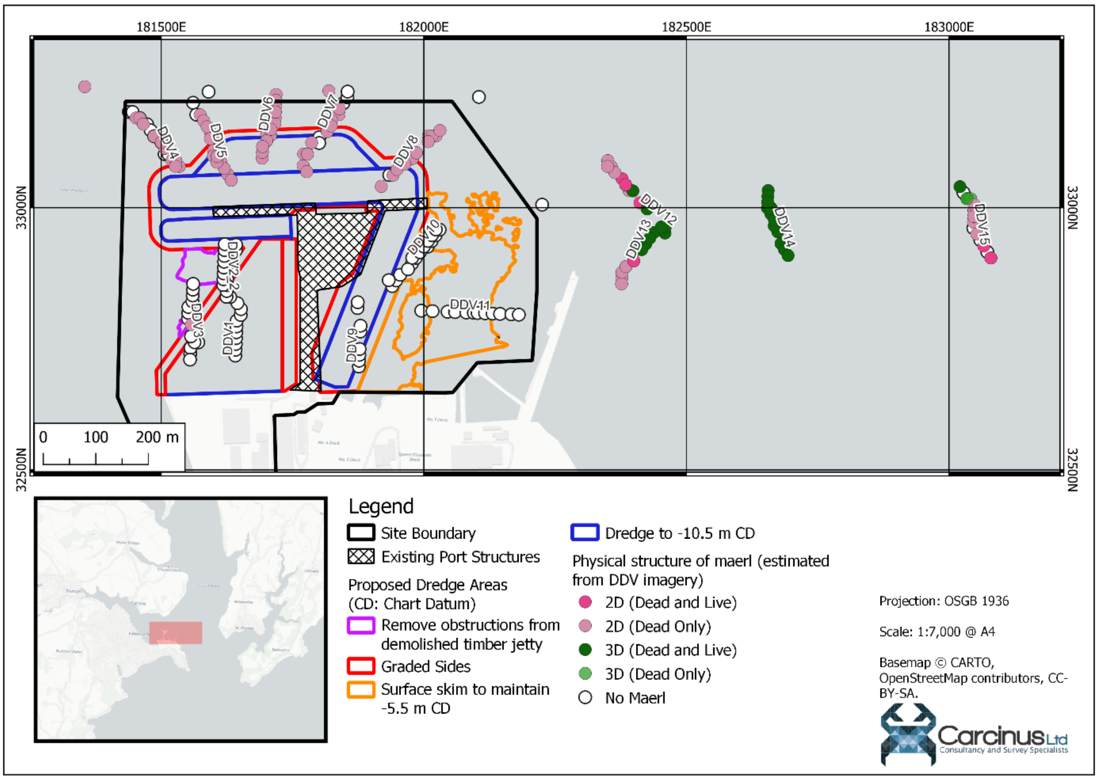


Figure 6 - Estimated 3D/2D structure of identified areas of maerl within the vicinity of the site (Carcinus Ltd, 2024)

Maerl habitat was classified according to NE guidance and consultation feedback, to show the distribution of maerl habitat as shown in Appendix 3 of the HRA Report. NE advised adopting the quoted descriptions of maerl habitat type provided in the Fal and Helford SAC's Conservation Advice Package[1]. From the description of maerl beds, as a sub-feature of *Large Shallow Inlets and Bays* and the *Sandbanks which are slightly covered by sea water all the time* qualifying features, the text descriptions shown below were extracted:

- pristine live maerl beds with up to 100% live maerl coverage;
- extensive areas of dead maerl with little to no live maerl;
- extensive areas of dead and crushed maerl;
- living maerl overlying dead maerl; and
- areas of maerl in sediment.

The survey data identified habitat types thought to be consistent with two of the descriptions above: living maerl overlying dead maerl and areas of maerl in sediment. These two habitat types are mapped and overlaid with the red line boundary (Figure 7). As there are no criteria for these descriptions there was not an opportunity to present a greater resolution within these two maerl habitat and thus some of the discrimination relies on the mapping shown in Figures 4-6 above.

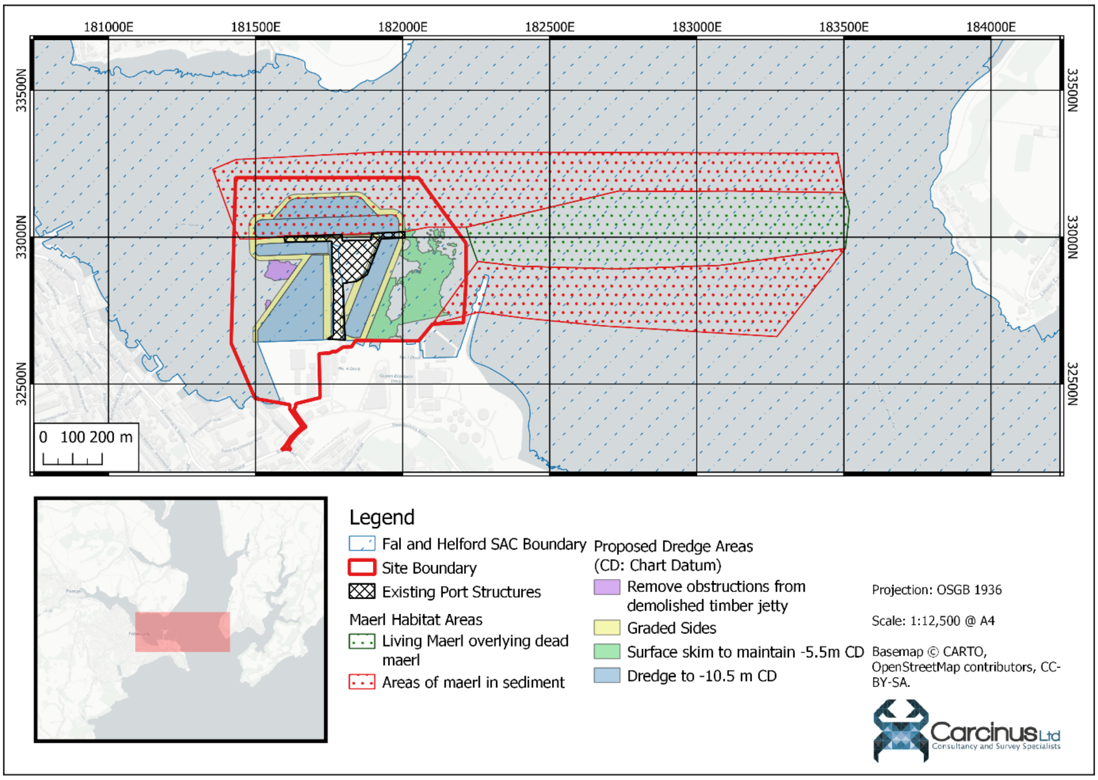


Figure 7 – Proposed Dredge Areas in Relation to Areas of Maerl Habitat, Categorised as Living Maerl overlying Dead Maerl or Areas of Maerl in Sediment

2.2 'Chronic' Suspended Sediment Concentration Impacts on Benthic Habitats

As set out within Section 6.2 (6.2.41) of the HRA report, mitigation (Modelling Scenario 3 in Technical Appendix 6.3) will be implemented during all dredge activity to minimise suspended sediment dispersion and deposition extent. Backhoe dredge methods using a 10 m^3 or smaller lidded bucket in all areas, and to restrict the dredge window according to tidal movements, specifically restricting dredge activities to the period from 1.75 hours before low water to 1.75 hours before high water i.e. on the late ebb, early flood tide.

Dredging operations are scheduled to take approximately 20 weeks at the Western Wharf, 18 weeks at the Northern Wharf (including Queen's Wharf extension) and 20 weeks at the FLOW Deck. The modelled dredge movements, and associated increases in SSC, assumed no breaks between the dredging campaign periods set out here, which is considered a precautionary approach.

The modelling results for increases in SSC were mapped showing the maximum increase in suspended sediment concentrations resulting from proposed dredging operations in each of the three areas (Figure 8). With the exception of the dredge campaign in the north area, increases in SSC are largely contained within the docks.

Despite the fact that there would therefore be a daily spike in SSC during that time, the maximum increases in SSC at all modelled receptor locations are not higher than periodic storm events and average SSC values are within the ambient range. The restriction of dredging to certain tidal states significantly minimises the spatial extent of this plume, and SSC peak values are expected to be within natural variation. Sediment plumes are limited to within 300 m of the dredged area and are, on average, largely confined to the area within the site boundary. Where the plume extends beyond the site boundary the concentration modelled is very low (Figure 8, Dredging in North Area panel).

However, these contour plots can be misleading as they appear to represent an actual plume, when in reality the figure shows the maximum values that can occur across the whole dredge programme, not what occurs every time dredging takes place or what occurs all of the time.

In addition, maximum values generally occur only occasionally and represent the worst-case scenario for the assessment. The mean SSC values, shown in Figure 9 below, are considered to be more representative of the general increase in SSC from dredging for most of the time across the whole campaign. However, both maximum and mean SSC plots, mapped together with the site boundary and the sensitive maerl habitat show that the ZOI for SSC would be largely restricted to the site boundary.

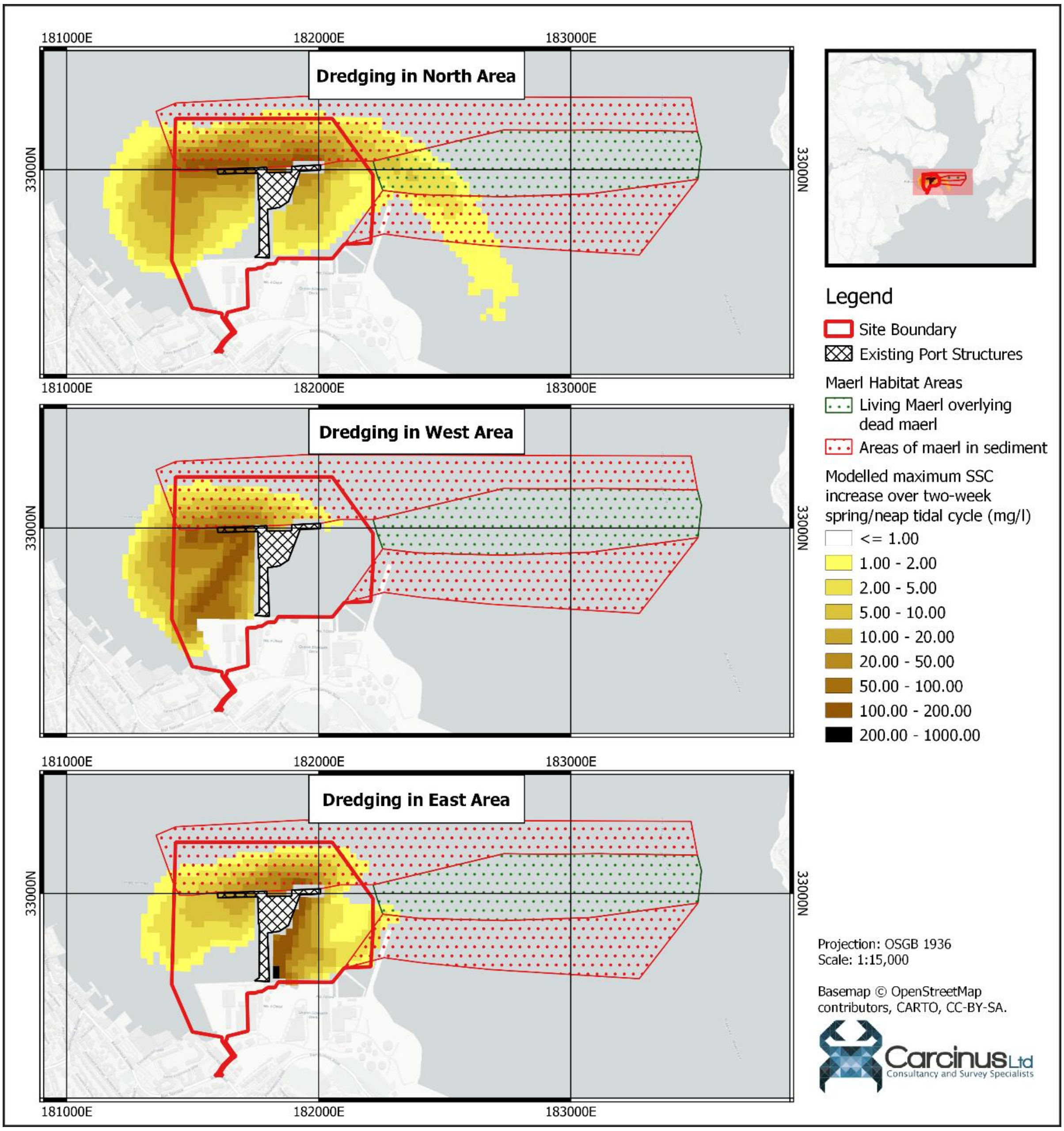


Figure 8 - Maximum increase in suspended sediment concentrations resulting from proposed dredging operations in each of the three areas

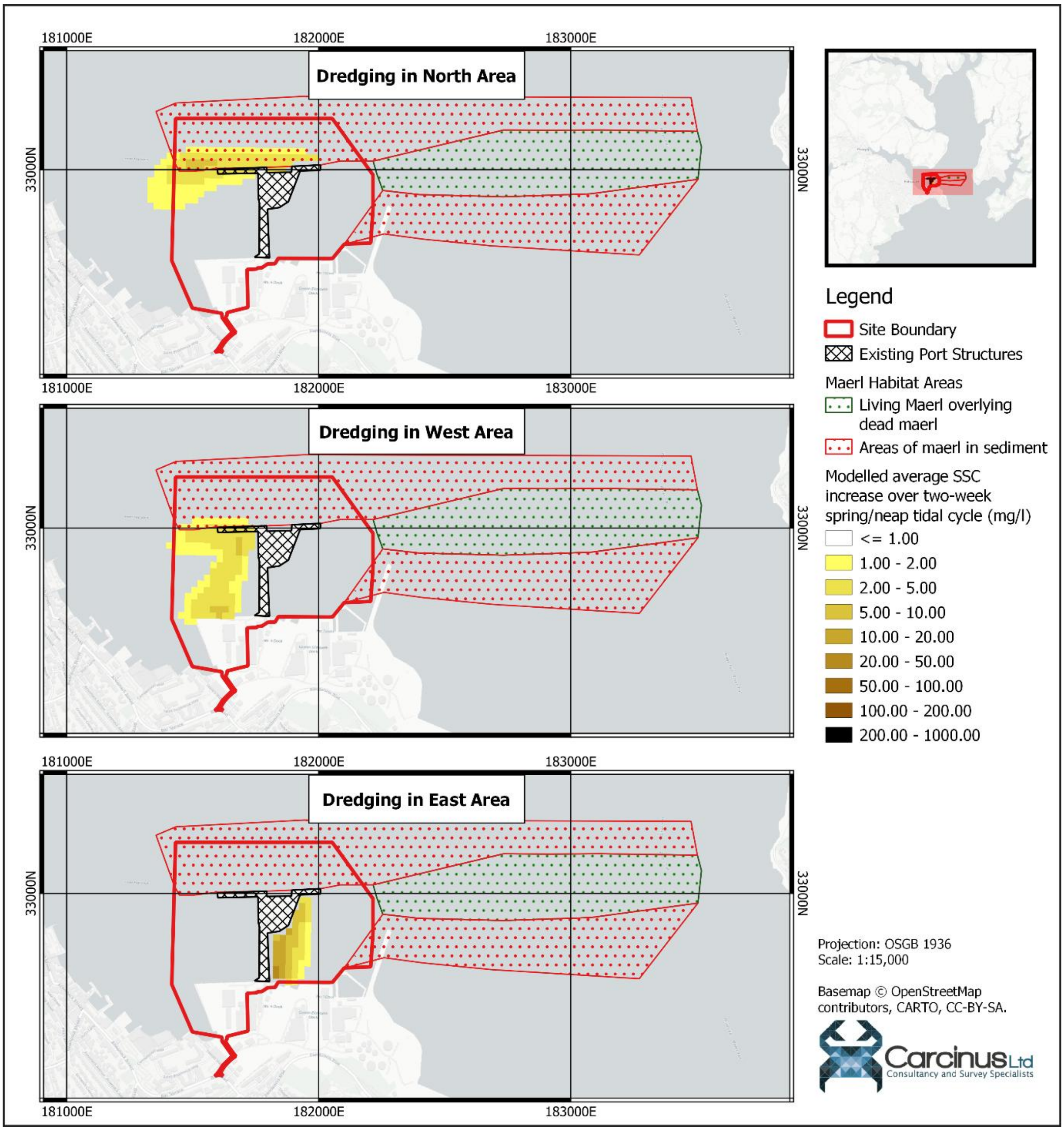


Figure 9 - Mean increase in suspended sediment concentrations resulting from proposed dredging operations in each of the three areas (Maerl Technical Note)

In addition to the SSC contour mapping shown above, SSC timeseries values were determined for each of dredge areas (north, west and east) at each of the nine habitat receptor sites (locations as shown in Figure 10), to show the significant variability in SSC values over a 15-day time simulation. Habitats considered to be more sensitive include seagrass beds, kelp and maerl and the reasons for the selection of the sites are provide below.

- Sites 1, 2 and 8: located within the western, northern and eastern berth pockets;
- Sites 3 and 4: located in positions where maerl habitat had been identified, including in a region of live maerl cover;

- Site 5: located in proximity to seagrass and kelp habitats to the north, off Flushing Headland (see Figure 3);
- Site 6: located at the position of maerl south-east of the Eastern Breakwater, based on historical data;
- Site 7: located near the southern extent of the modelled sediment dispersion, albeit without the adopted mitigation measures; and
- Site 9: north-west of the site boundary, outside the predicted ZOI.

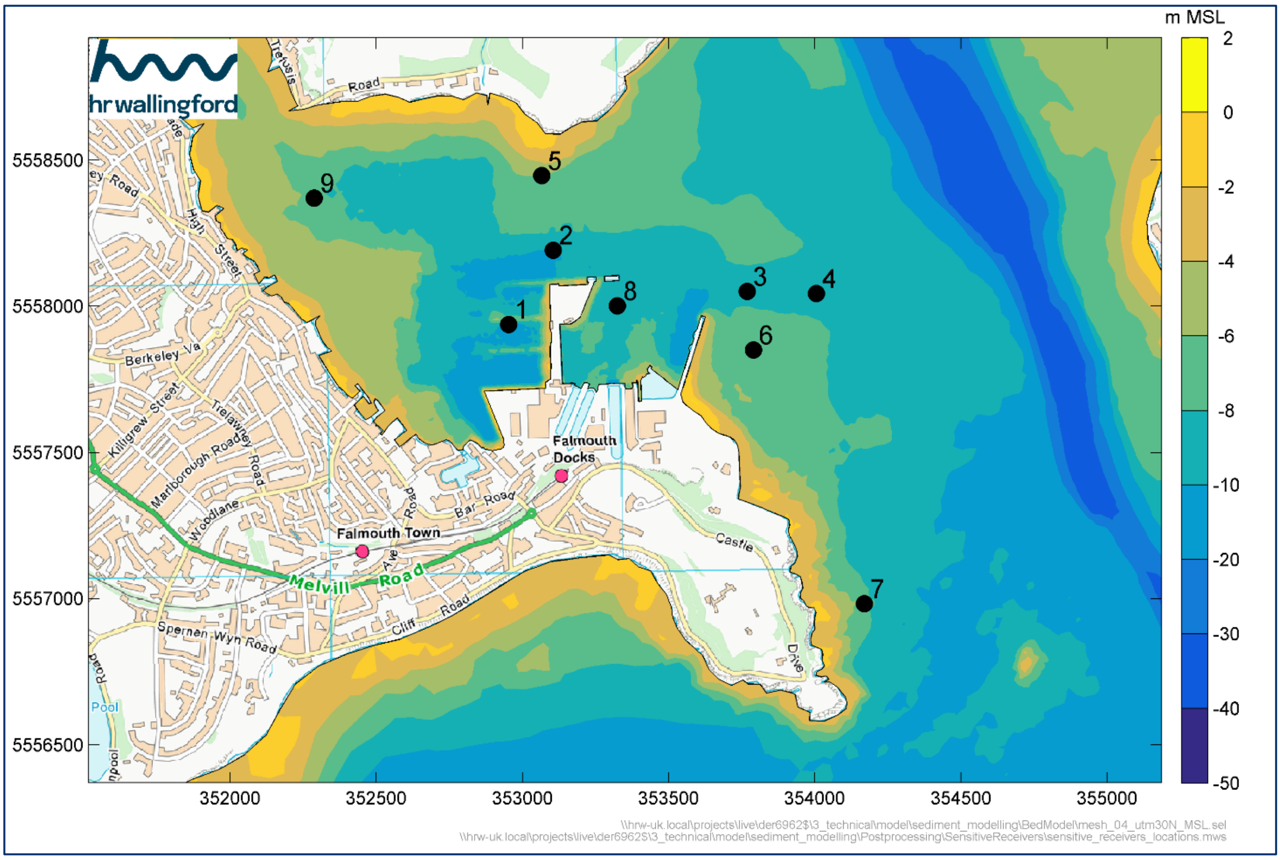


Figure 10 - Ecological Receptor Locations for detailed review of SSC and deposition from dredge campaign

Three time-series figures, one for each of the dredge areas were provided in Technical Appendix 6.3, which was submitted with the application, but they were not specifically presented in the HRA report. As an example, the time-series for SSC from dredging in the northern area (the worst-case area) is shown in Figure 11.

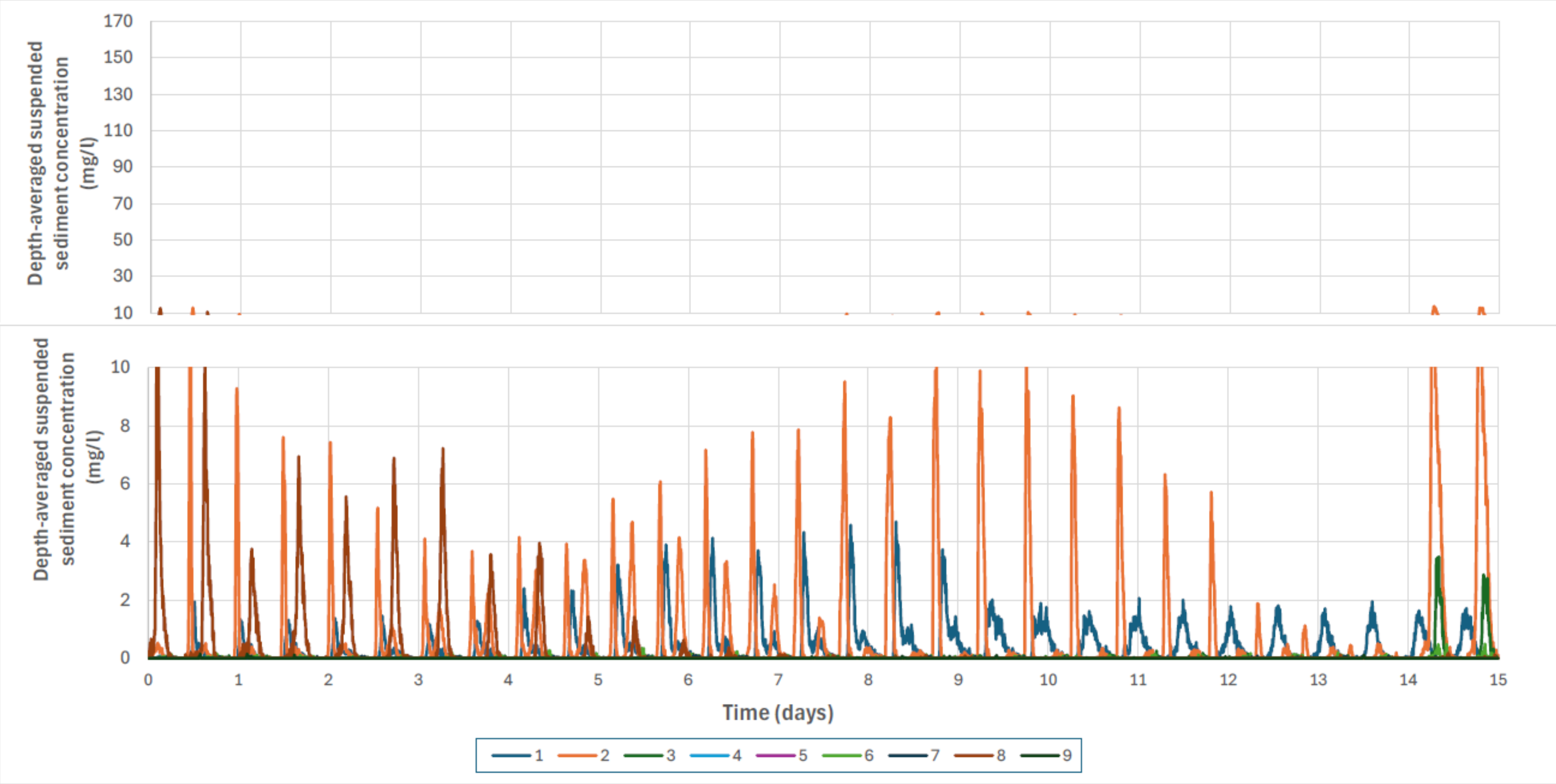


Figure 11 – Time series of predicted increase in suspended sediment concentration, for all nine receptor sites. Dredging in the north of the site

However, teasing out the information for individual locations from this plot is difficult. Therefore, to supplement the HRA timeseries plots for SSC levels, additional plots have now been produced, one for each of the nine receptor sites, to supplement the assessment of SSC effects on the SAC.

The plots for the following locations: Site 2 (immediately to the north of the northern berth pocket), Site 3 (within areas of live maerl) and Site 5 (adjacent to areas of seagrass and kelp habitats) are provided below in Figure 12 to Figure 14. The maerl beds at receptor Site 3 are considered to be the habitat of primary importance with respect to SSC. Timeseries plots for all nine receptor locations are available but not presented in order to focus on the habitats of concern in relation to the designated habitats of the SAC.

Note that in the original timeseries, right at the end of the timeseries (after 14.5 days of dredging) the model erroneously switched to being all tide, showing artificial high peaks at the end of the plot in Figure 11. The location specific plots in Figure 12 to Figure 14 have therefore been stopped at 14.2 days.

Site 2, immediately to the north of the northern berth pocket but within the site boundary has SSC values up to just over 10 mg/l (Figure 12) but only during part of the tidal cycle and the plots show the peaks are short-lived, rapidly returning to baseline.

Site 3, within the area of maerl that was mapped as 'live maerl over dead maerl' also has a very low increase in SSC across the whole tidal cycle, indicative of the effectiveness of the tidal restriction mitigation measure (Figure 13).

At Site 5 the maximum SSC was <0.1 mg/l, including from dredging in the north area (Figure 14), and thus the seagrass beds at Flushing were beyond the ZOI for SSC and no further assessment of this habitat is required.

The timeseries plots demonstrate that temporary spikes in SSC will occur as the dredger moves around the site, but these spikes are temporary in duration and extremely limited in spatial extent. They also demonstrate that effects would be constrained to locations within the site red line boundary, as has been assessed, beyond which SSC levels will reduce to background levels within 24 hours and with tidal movements. The data for the individual sites shows periods in which there are dredge activities occurring that result in no increase in SSC at the receptor, as a result of the tidal state. Therefore, it is concluded that increases in SSC would not occur every day, even if dredging is being undertaken. This variability in SSC therefore supports the use of mean SSC modelled values, as the maximum values are occasional. This indicates that increased SSC is periodic, rather than chronic.

The information above supports the impact assessment for increased SSC in the HRA Report, that the effect of SSC would be temporary, non-continuous and of short-duration due to the natural downtime between the tides, during which dredging would stop and suspended sediment would decrease back to background levels. Thus, overall, with the implementation of mitigation in the form of choice of plant and dredging non-continuously according to the tidal restrictions, it is considered that increased SSC during the proposed development's demolition and construction stage would be neither of the spatial nor temporal scale to lead to adverse effects on the integrity of the SAC. Therefore, there would be **no adverse effect on site integrity**.

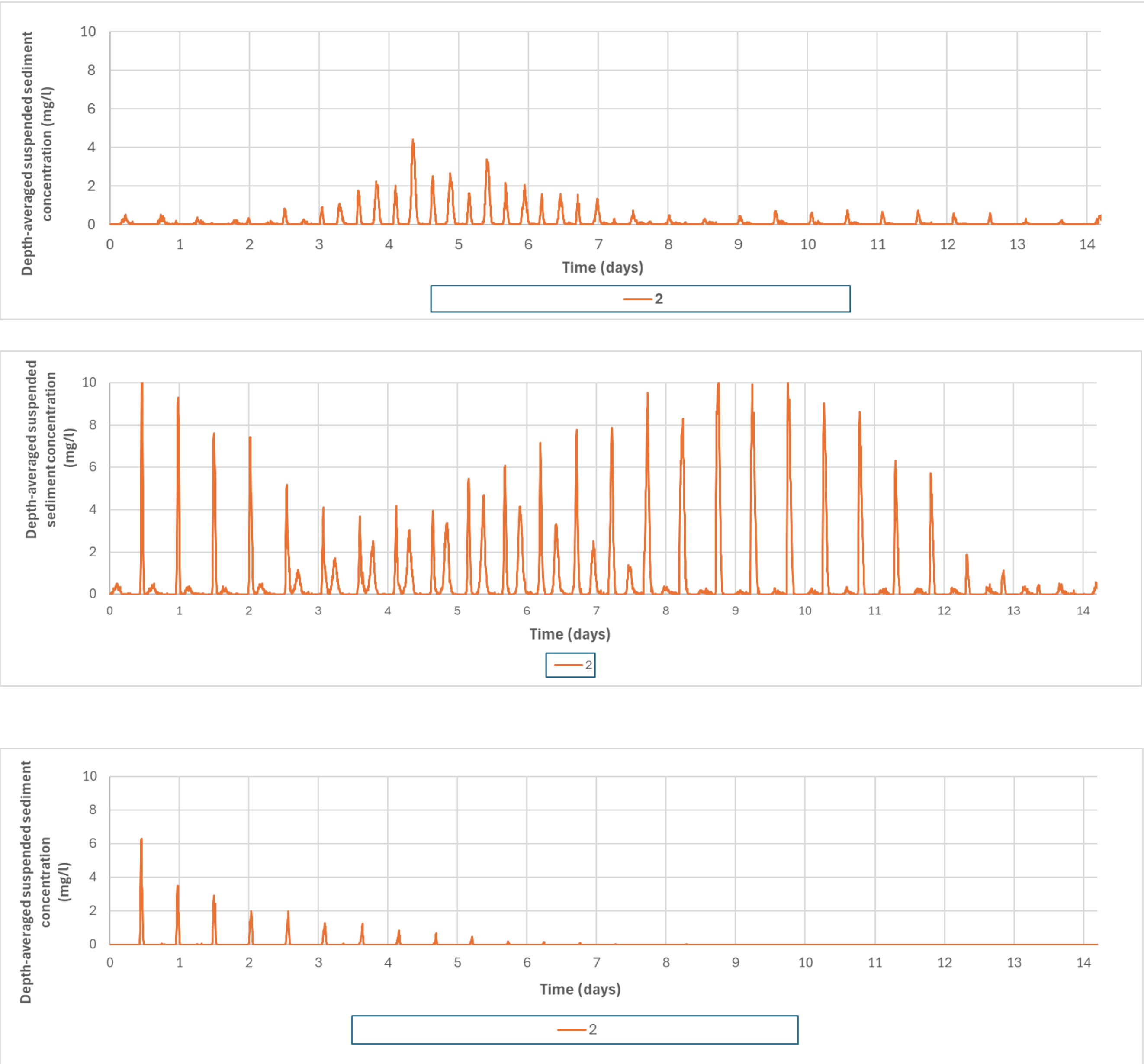
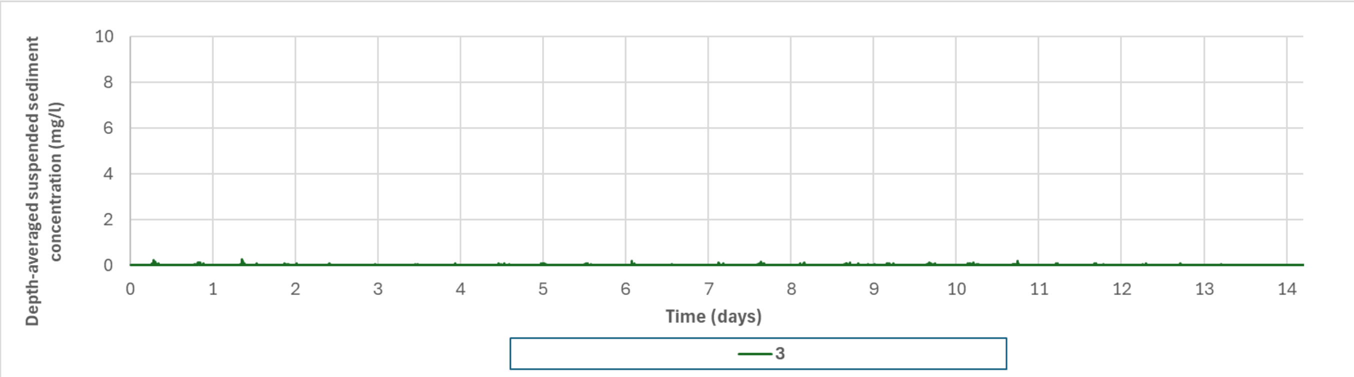
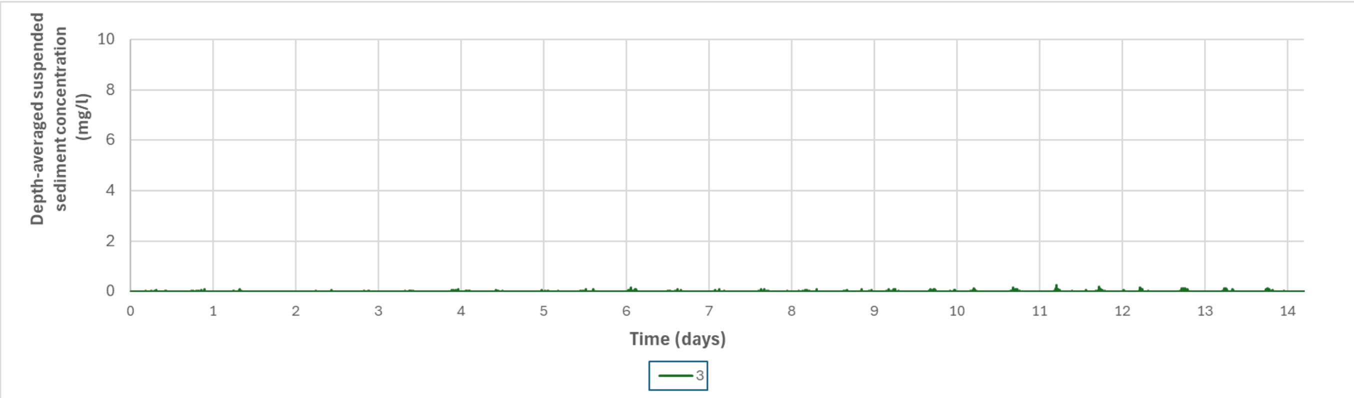


Figure 12 - Location 2 showing SSC time-series for dredging in west (top), north (middle) and east (bottom) over a 2-week spring-neaps tidal cycle





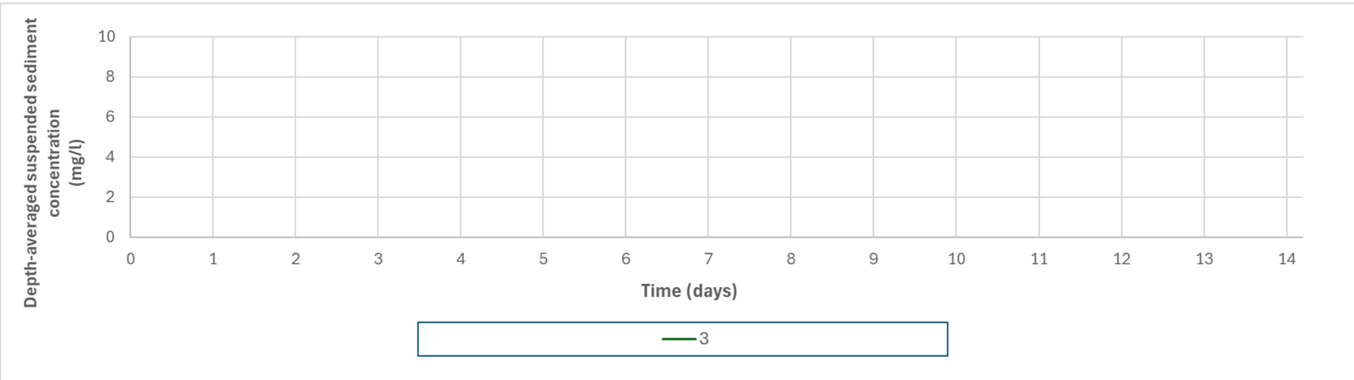


Figure 13 - Location 3 showing SSC time-series for dredging in west (top), north (middle) and east (bottom) over a 2-week spring-neaps tidal cycle

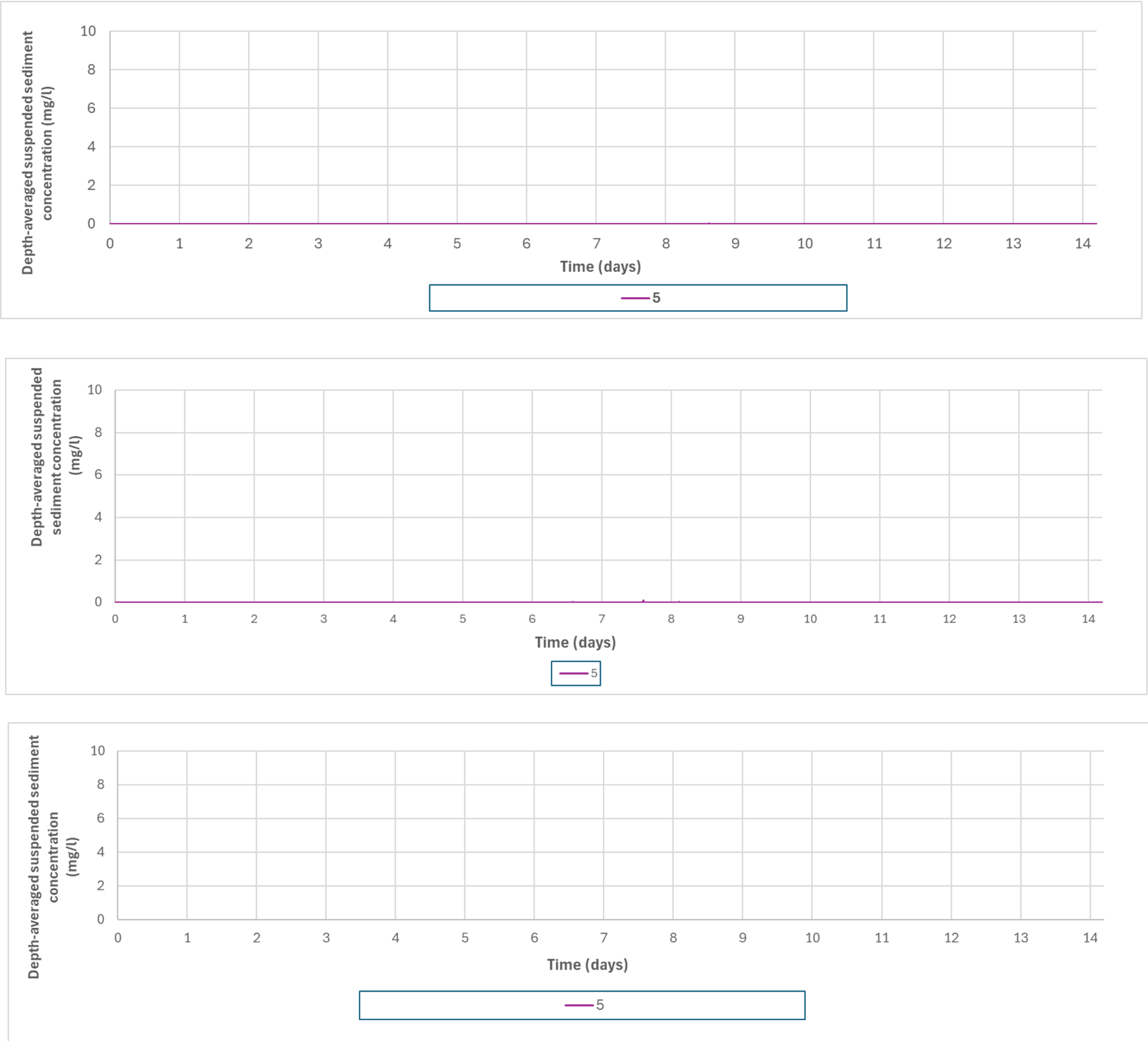


Figure 14 – Location 5 showing SSC time-series for dredging in west (top), north (middle) and east (bottom) over a 2-week spring-neaps tidal cycle

2.3 Sediment Deposition Depth and Duration

2.3.1 Sediment deposition – Original mitigation scenario (late ebb tide/early flood tide dredging)

Figure 15 shows deposition modelling following dredge activities (restricting dredging to the period from 1.75 hours before low water to 1.75 hours before high water). When overlaid as contour plots on maerl habitat mapping it demonstrates that the area of deposition is largely constrained to the red line boundary, with a very limited spatial ZOI. In relation to habitat sensitivities the key areas of impact are around the Eastern Breakwater where the area of deposition is shown to extend to areas mapped as live maerl over dead maerl. The maerl in this area is however, comprised of a low percentage of live maerl (<10%) and has a 2-D structure with small sparse thalli.

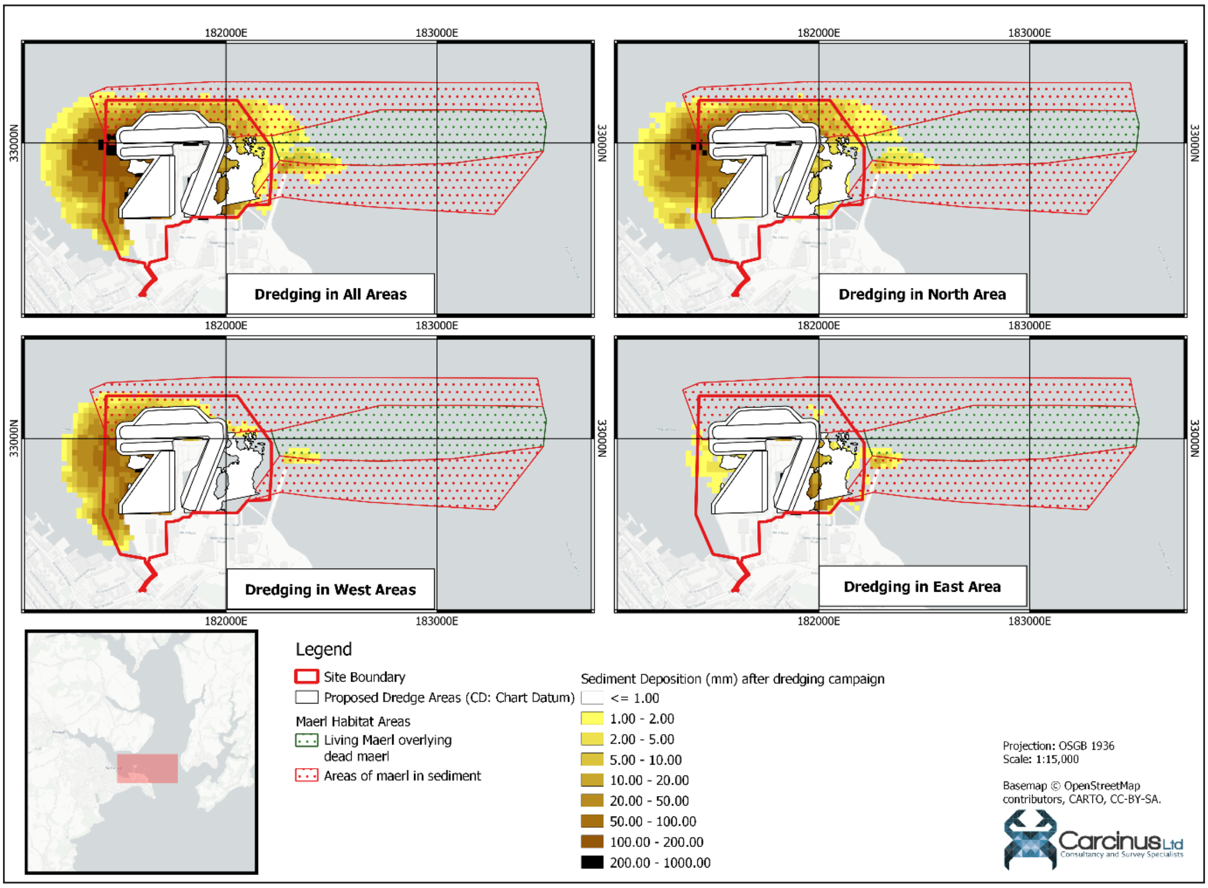


Figure 15 - Sediment deposition (mm) overlain on maerl habitat classification at the end of the entire dredging campaign as a result of proposed dredging operations (Carcinus Ltd, 2025)

Figure 16 shows a 'zoomed in' version of Figure 15, illustrating the total deposition within the areas mapped as live maerl over dead maerl to the north of the Eastern Breakwater.

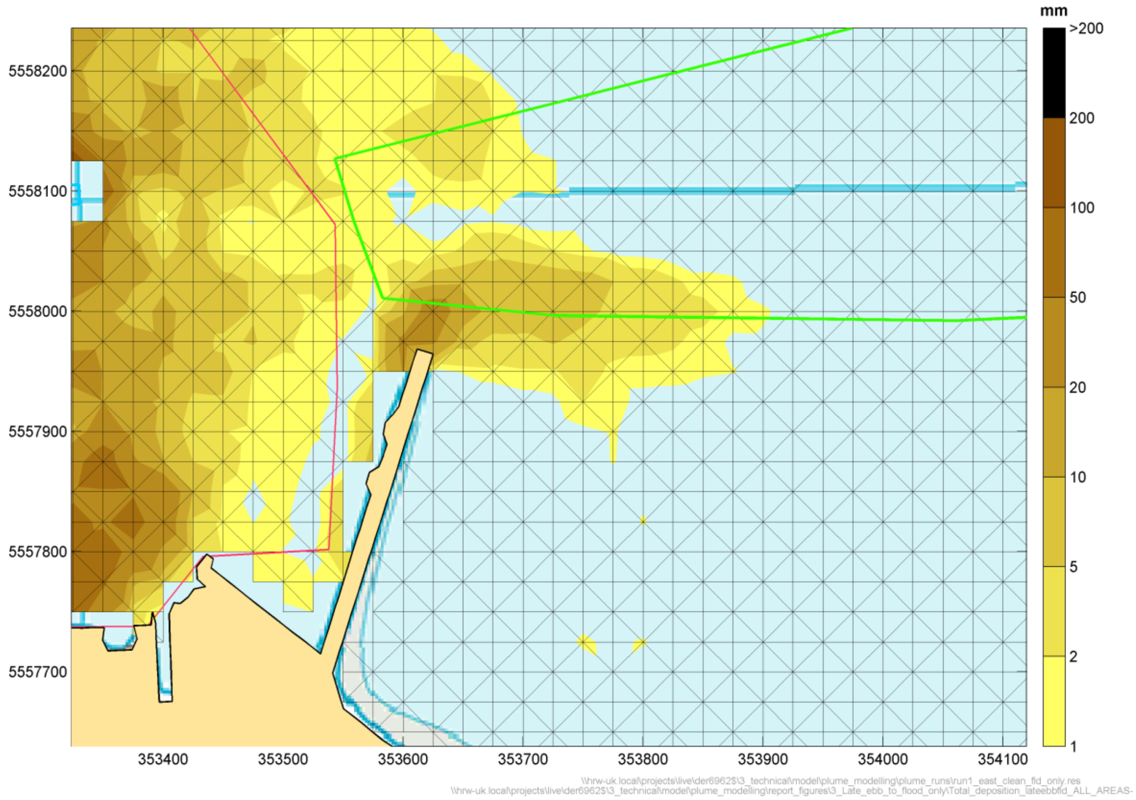


Figure 16 – Sediment deposition (mm) within the areas mapped as live maerl over dead maerl at the end of the entire (estimated 52 week) dredging campaign – original mitigation scenario

In order to further reduce sediment deposition in the areas mapped as live marl over dead maerl, HR Wallingford have undertaken some further modelling which investigates the effectiveness of additional refinement of the dredge timings. The updated HR Wallingford modelling has also used a higher resolution grid than originally presented to provide higher resolution in this area and reduce data interpolation issues. The subsequent section summarises this additional mitigation (refinement of the dredge timings) and modelling, with full details in **Appendix A**.

2.3.2 Sediment deposition – additional mitigation (amended late ebb tide/early flood tide dredging)

The further modelling undertaken by HR Wallingford included the following changes:

- **More detailed modelling:** An output grid of 8 m rather than 25 m used in the original modelling – this provides an improved level of detail in the area of live maerl over dead mearl;
- **Additional mitigation – amended timing of dredging in the East:** Dredging to start an hour later in the north area of the East dredge pocket under certain tidal conditions (for tides with a high water level above 1.6 m MSL which is 4.6 m CD) – this was identified as the additional refinement to dredging that would be most effective at reducing total deposition in the area mapped as live mearl over dead mearl.

The output of the updated modelling is shown in Figure 17. For reference the deposition contour bandings have also been revised to give greater resolution and to reflect the evidence provided in subsequent sections of this note.

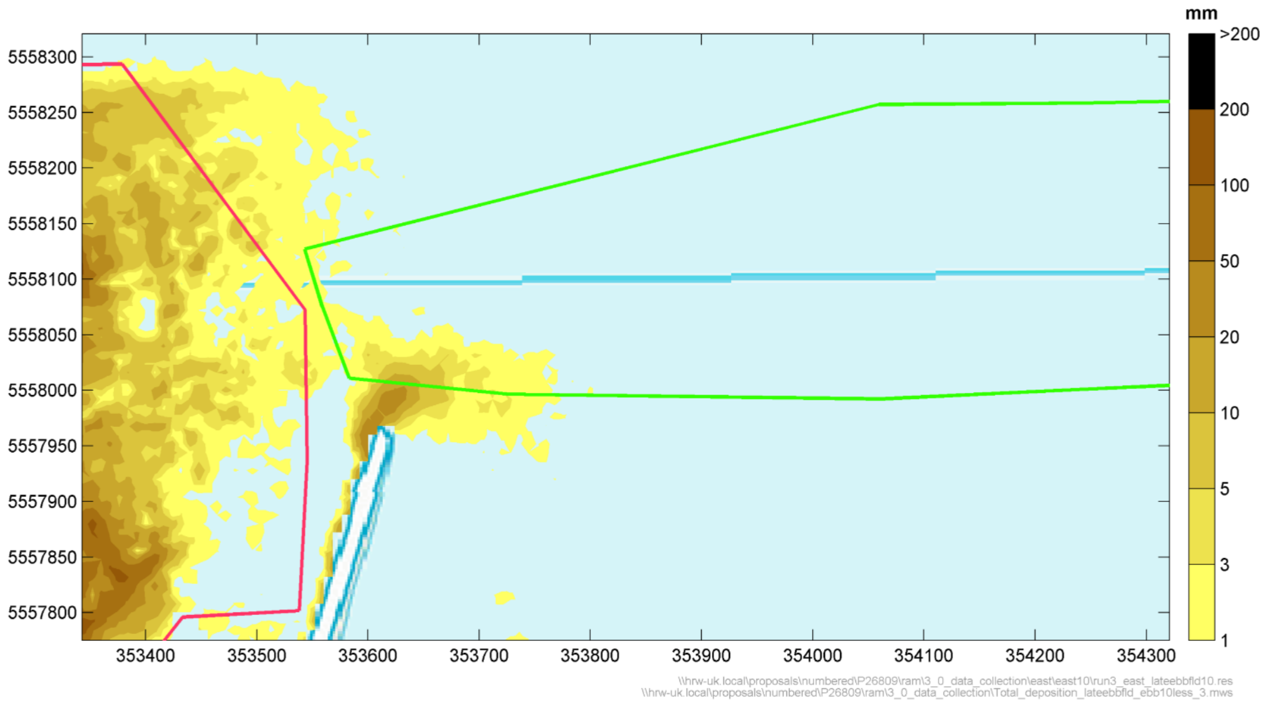


Figure 17 - Sediment deposition (mm) overlain on maerl habitat classification at the end of the entire dredging campaign – higher resolution model of live maerl area, with additional mitigation (refined dredging in the East)

Tabulated total depths of deposition have been provided as two sets of points (Table 2-1), the locations of which are shown in Figure 18:

- Locations DDV1-10 are from DDV survey transect 13 and points S23 and S24 are grab survey stations.
- N1-N6 are further to the west, and although are not coincident with survey data, are provided to give point deposition data in an area of higher total deposition within the area mapped as live maerl over dead maerl.

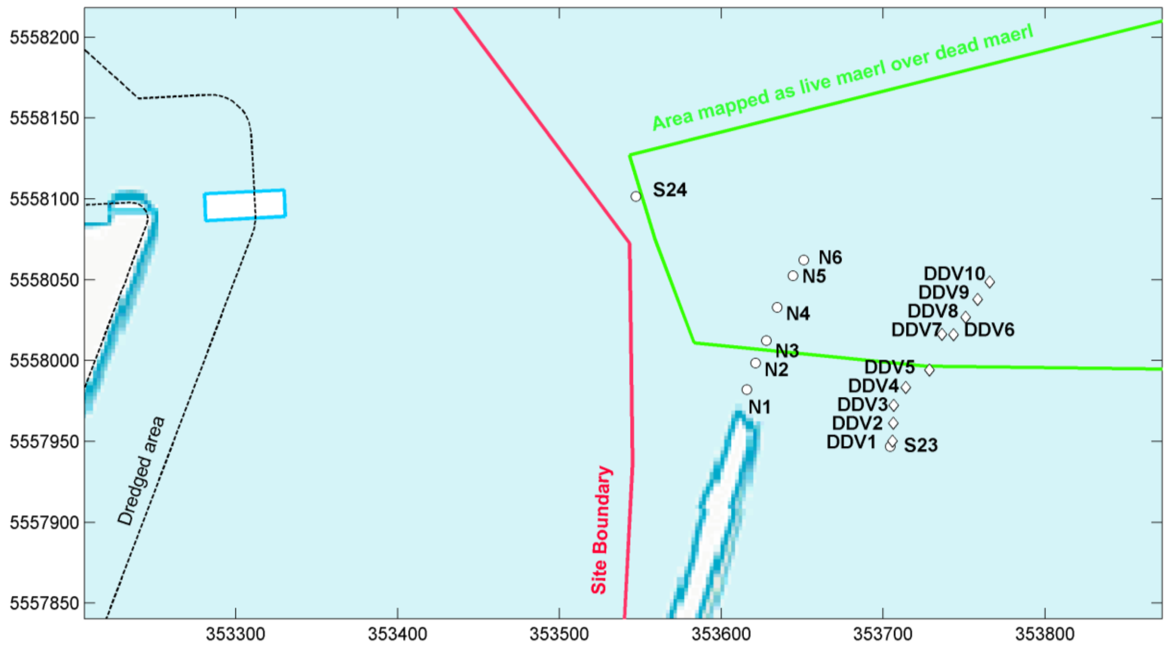


Figure 18 – Locations for tabulated data (DDV locations are for DDV13 2023 survey locations)

Table 2-1: Total deposition over complete dredge period for point locations, comparing original modelling to further modelling

Point Green Text – point data within area of live mearl over dead mearl	**Total deposition over complete dredge period/mm**	
	Original modelling - original mitigation scenario (late ebb tide/early flood tide dredging)	**Further modelling – finer grid and additional mitigation scenario (amended late ebb tide/early flood tide dredging in East)**
DDV1	1.79	0.64
DDV2	2.86	1.07
DDV3	4.10	1.7
DDV4	5.52	2.72
DDV5	6.74	2.83
DDV6	7.16	2.05
DDV7	6.90	1.62
DDV8	6.37	1.16
DDV9	3.75	0.9
DDV10	1.13	0.13
S23	1.62	0.91
S24	2.09	1.35

Point Green Text – point data within area of live mearl over dead mearl	Total deposition over complete dredge period/mm	
	Original modelling - original mitigation scenario (late ebb tide/early flood tide dredging)	**Further modelling – finer grid and additional mitigation scenario (amended late ebb tide/early flood tide dredging in East)**
N1	24.20	27.91
N2	26.31	22.03
N3	18.18	12.37
N4	5.67	2.21
N5	1.91	0.56
N6	1.61	0.59

The further modelling results show that the majority of the area mapped as live over dead maerl would not have any deposition at the end of the dredging campaign. Some deposition may occur close to the north of the eastern breakwater, but will be mostly limited to less than 3 mm. Location N3 is the only point within the area mapped as live maerl over dead maerl that is more than 3 mm, with a maximum sediment deposition of 12.37 mm predicted. Table 2-2 provides the areas of predicted fine sediment deposition within the area mapped as live maerl over dead mearl for each contour.

Table 2-2: Area of predicted fine sediment deposition within mapped area of live maerl over dead maerl - amended late ebb tide – early flood tide dredging

Deposition depth (mm)	Area (ha)
1 - 3	0.71
3 - 5	0.15
5 – 10	0.10
> 10	0.03

Note that the modelling assumes no resuspension of the deposited sediment during storm waves, which is unlikely to be the case in this location. Modelling of the background fine sediment deposition indicated the annual climate of offshore waves entering Falmouth Harbour resulted in forces sufficient to erode fine sediment deposited in the area immediately east of the eastern breakwater. Therefore, the actual total deposition remaining at the end of the dredge campaign will be even less than predicted. HR Wallingford have also considered time series plots, with predicted rates of sediment deposition per tide being very low, at no more than 0.2 mm/tide within the live maerl area.

Figures 19a-c show the location of dead and live maerl identified as part of the project-specific surveys. **Appendix B** provides a full set of DDV stills for DDV13 and DDV17. Although the data doesn't specifically overlap the area of sediment deposition in the mapped maerl habitat boundary (e.g. at point N3), the data shows a clear gradient of increase in live maerl presence from west to east and then from south to north. For example, all of DDV17 has no live maerl, with DDV17_6 the closest survey point to N3, with no live maerl identified. DDV17_12 is further to the east, still with no live maerl identifed. DDV13_4 changes from 50% dead maerl/0% live maerl to 50% dead maerl/ 10% live maerl (2D only) at DDV13_6, to 20% dead maerl / 30% live maerl (3D) at DDV13_7 further to the north. Based on the data presented it is estimated that the maerl present in the vicinity of N3 would comprise 0-10% of live maerl with a 2-D structure.

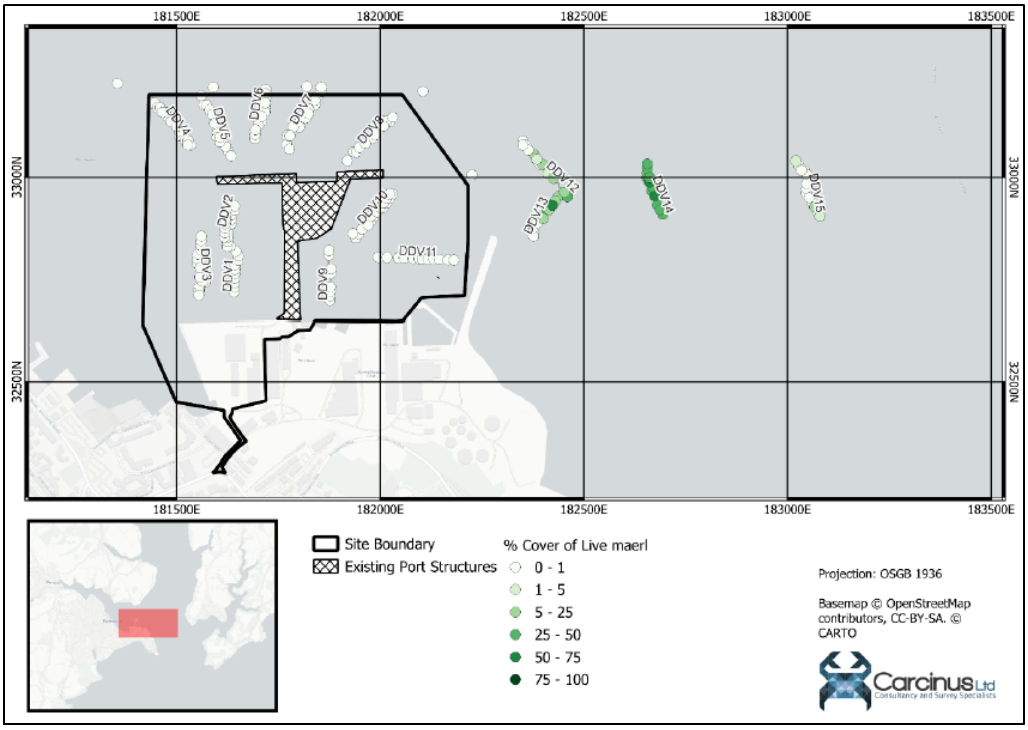


Figure 19a – 2023 surveys results showing estimated percentage coverage of live maerl

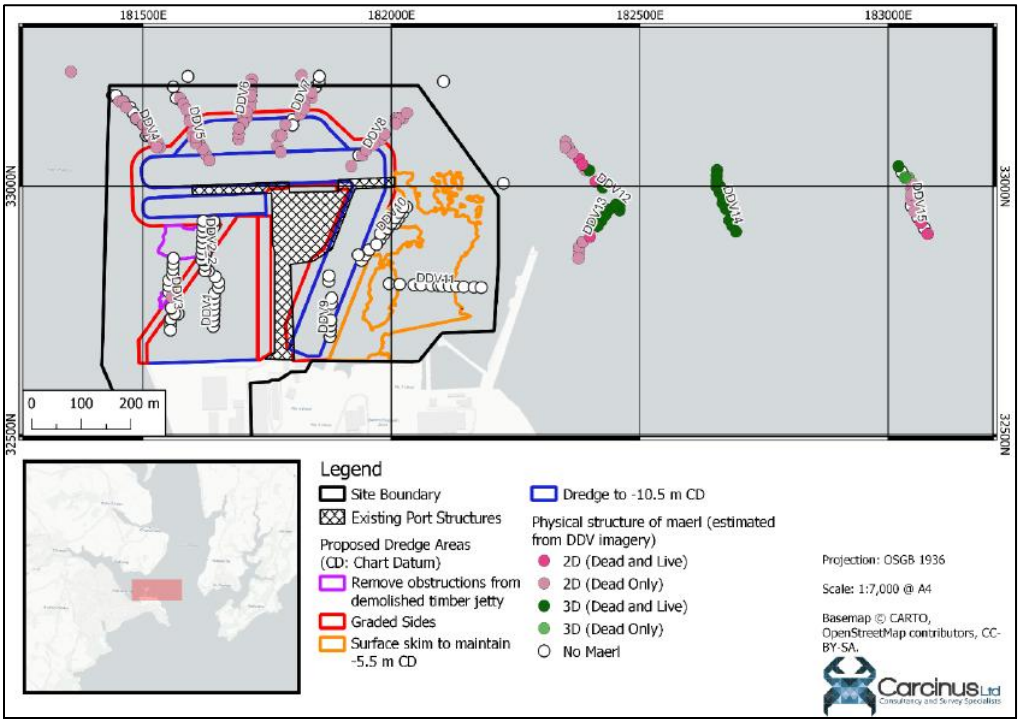


Figure 19b– 2023 surveys results showing locations of dead and live mearl (2D/3D)

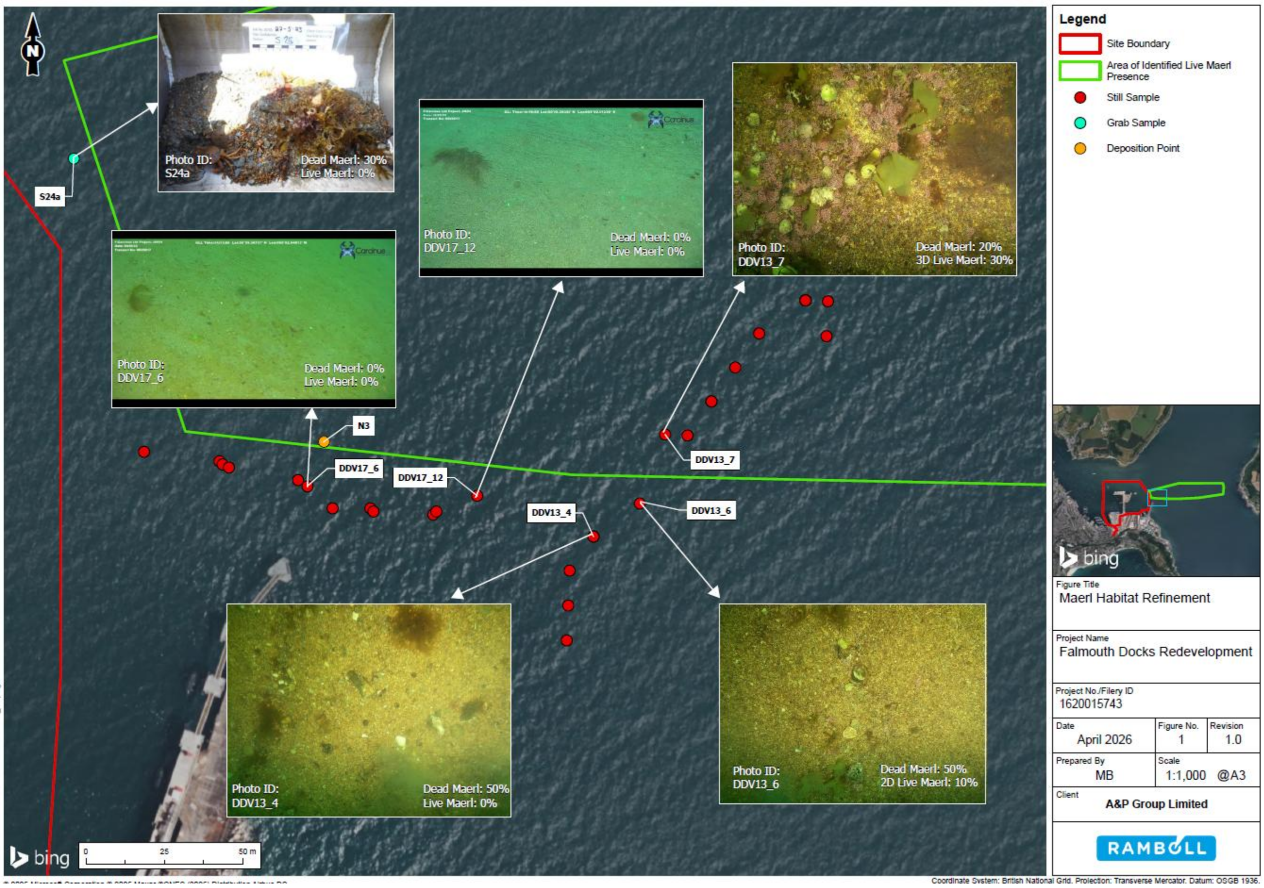


Figure 19c – Location of DDV17 and DDV13 stills, with selected images

2.3.3 Consideration of Thresholds for Maerl Mortality

There are no thresholds cited in literature for levels of sediment deposition at which maerl may be significantly affected or where mortality will occur in real life environmental conditions. The MarESA threshold for light deposition is 5 cm which is clearly not a useful benchmark for maerl habitats.

MarESA also refers to 100% maerl death from a sedimentation depth of 2 cm (Wilson et al., 2004) and reference made to this value as a potential threshold. However, this study was a laboratory experiment, where maerl rodoliths taken from Strangford Lough were placed in an experimental tank and subject to burial to different depths by three different sediment types. The sediment types were maerl gravel, sand (clean sand 0.3-1.0 mm in diameter, which is medium to coarse sand) and muddy sand that had been collected from below the redox layer and was black in colour and smelling of hydrogen sulphide.

The maerl buried under 2 cm of the anoxic high H_2S concentration mud in a small tank was, unsurprisingly, significantly impacted and reported to be dead (on the basis of thalli colour and photochemistry potential measurements) after two weeks of burial. Even thalli placed on the surface of the black muddy sand died within two weeks, which is clearly indicative of the high sensitivity of maerl to H_2S. Thus, the effect to maerl, including any mortality, of burial alone was not established by this experiment and a 2 cm threshold cannot be considered applicable.

In the same study (Wilson et al., 2004), where maerl was buried beneath 4 cm and 8 cm of clean sand the photosynthetic potential of the maerl was reduced in comparison to the no-burial control but all thalli remained alive after 4 weeks despite burial at these significant depths. This does indicate that maerl can tolerate experimental burial under significant depths of medium to coarse sand, presumably due to the sufficient levels of oxygenation of the pore water in this sediment type. This study also identified that burial depths up to 8 cm of medium to coarse sand would not result in maerl mortality.

However, the burial depth effects identified in this study are not considered useful in assessing the potential effect of sediment deposition in field conditions, particularly in the context of the proposed development, where deposition comprises short term pulses of extremely low levels of sediment deposition per pulse, over the medium term (52 weeks), with periods between pulses when almost no deposition occurs. These intervals between pulses will allow for some redistribution of sediments from natural water movements, particularly from wave driven currents that can reach the seabed in shallow waters.

In the Bay of Brest maerl habitats are known to be present in areas reported to receive net sediment deposition of 3 mm per year, though the density of maerl was lower than other stations where deposition was lower. The sediment type in the area with the highest deposition was dominated by mud (53%) and this station also experienced higher fluctuations of salinity, nutrient concentrations and carbonate system parameters (Qui-Minet et al. 2018).

This study showed that maerl (including *Phymatolithon calcaerum*) responded differently across the Bay of Brest sites. The site impacted by river runoff experienced large pulses of nitrate and silicate concentrations, fluctuations in salinity, and high-fine sediment deposition, and had the lowest living maerl biomass. The authors suggest that nutrient enrichment interacts with sedimentation and salinity, and maerl decline is linked to the combination of these effects. However, the study does show that maerl can grow in areas that receive pulses of fine sediment from riverine input, which will have occurred year in year out, and thus in the presence of a very long term stressor. Thus, the live maerl observed in areas of the Bay of Brest, where there is estimated to be 3 mm of sediment deposition every year, and knowing that the maerl beds in this region have been studied for a considerable period of time, indicates some resilience to continuous and regular sediment deposition from a nearby river, over many years. In comparison, the Falmouth Dock dredging programme with the tidal mitigation in place, results in a predicted total depth of deposition which is of a very low level (<3 mm) over most of the area where some live maerl is present, resulting from a one-off event.

In a more recent study in the Bay of Brest, Ehrhold et al. (2021) looked at the maerl fossil record and also found that maerl beds can grow under moderate sediment input. Evidence from fossil records showed that during a period of environmental change and increased anthropogenic activity this led to increased sedimentation rates that exceeded the maerl beds' tolerance, causing the beds to disappear. The maerl beds later recovered under a cooler, drier climate period when sediment input was reduced, highlighting that maerl beds have the potential to recover if environmental conditions improve and sedimentation decreases.

However, an overall review of the evidence indicates there are no clear quantitative thresholds or benchmarks for very short pulses of very low levels of sediment deposition over the medium term, in this case 52 weeks. However, evidence presented above indicates that maerl does survive in areas of regular low-level deposition, and that in certain areas, are not likely to result in mortality despite the stressor occurring over considerable time periods. For example, in the Bay of Brest, maerl is present in areas where there is an annual deposition depth of 3 mm.

2.3.4 Sediment Deposition in relation to maerl habitats in the Fal Estuary

When considering the updated modelling with the additional mitigation, refining the dredging in the East, the majority of sediment deposition within the area mapped to contain some live maerl is a total of 1 to 3 mm (0.71 ha) for the entire dredging campaign, which is estimated to take 52 weeks should there be no time intervals between dredge pockets. At these depths there is not considered to be any mortality of maerl, particularly when considering the evidence provided above.

There is predicted to be a total of 0.28 ha with over 3 mm deposition (3-5 mm deposition 0.15 ha; 5-10 mm deposition 0.10 ha; >10 mm 0.03 ha). As already described, there is a significant range of maerl condition and structure across the mapped area. Where the highest levels of sediment deposition are predicted, the coverage of live maerl is low, at less than 10% of the habitat with a 2D structure comprising single small thalli distributed across the seabed. The levels of deposition that are predicted, which are the absolute worst case scenario, would not change the structure or nature of the maerl in this region and it is considered highly unlikely there would be any perceptible change if surveyed at the end of the dredge programme.

In addition, the project specific full-port bathymetry survey, undertaken in 2024, shows that the water depth within the area where the maximum deposition would occur ranges between 4 to 6 m. At such shallow depths water movement from storm and weather driven wave action will reach the seabed. As presented in **Volume 1; Chapter 6: Coastal Processes and Technical Annex 6.2** time-series of near-surface turbidity data provided by Falmouth Harbour Commissioners (FHC), indicated that storm events (shown by clear short-lived peaks in turbidity) occur in the project area on a monthly or bi-monthly basis. These storms and other weather driven waves would be a driving force creating periodic water movement at the seabed that will redistribute deposited sediment. This is considered particularly likely as the sediment deposited in the area of interest would consist of fines (<63 μm), in a fine layer that is very unlikely to become compacted over short timescales, and so would be readily mobilised.

The modelling of sediment deposition does not take into account that there will be redistribution of sediment over the 52-week dredging period, particularly in-between the pulses when the increased SSC and subsequent deposition is either nil or so negligible as to be undetectable in the field. The importance of water movements are known to be an important determining factor for the distribution and nature of maerl habitats. For example, in Galway Bay Joshi et al. (2017a) showed that storm-driven waves rather than tidal currents influence maerl bed dynamics and sediment transport. Therefore, considering sediment deposited at point N3 comprises very small pulses of sediment deposition, interspersed with regular storm and wave events, deposited fines will be remobilised and readily redistributed and therefore, would not be likely to accumulate to the 12.37 mm depth determined from the simple summation of the individual deposition pulses from a 52-week period comprising short low level pulses of sediment.

In conclusion, with the mitigation in place (summary below), considering the very small extent of sediment deposition in a very restricted extent, in an area where only a very low percentage coverage of maerl is present in a 2D structure, the deposition predicted to result from the proposed development together with the natural remobilisation of fines during regular storm events would, on the balance of probability, be neither of the spatial scale nor depth to lead to habitat loss or detectable maerl mortality, change in spatial extent or distribution of the live maerl over dead maerl habitat mapped. Accordingly, **no adverse effects on site integrity** of the Fal and Helford SAC are predicted.

Summary of mitigation commitments:

- Use of backhoe dredger with lidded bucket
- Dredging will be limited to occur during the flood tide, to be undertaken from 1.75 hours before low water to 1.75 hours before high water
- Additional dredge refinement - dredging to start an hour later in the north area of the East dredge pocket under certain tidal conditions (for tides with a high water level above 1.6 m MSL which is 4.6 m CD)

2.4 Sediment Deposition Impacts on Sensitive Habitats (contaminants)

HRW has undertaken additional modelling of TBT dispersion, with the inclusion of the mitigated scenario (restricting dredging to the period from 1.75 hours before low water to 1.75 hours before high water) to confirm the predictions set out in the ES and HRA Report. The modelling outputs are included within **Appendix C** and summarised in this section.

To simulate the release of TBT into the dissolved phase a representation of the dredging was required to cover both the temporal and spatial variability in the tidal currents in the area. The simulations were undertaken over a 15-day spring-neap period to take account of all the tide ranges and associated variability in currents over which the dredging could occur and show both the maximum and mean footprint of the plume.

The assessment of changes in water quality resulting from release of contaminants was undertaken using a similar steady-state approach to that undertaken for the all-tide dredging case (ES Technical Annex 6.3 HR Wallingford, 2025). For the purpose of the analysis the partitioning of the contaminants was assumed to occur at the point of dredging. This assumption would be expected to give the highest dissolved contamination levels.

The predicted time-averaged dissolved concentrations for TBT are presented for the three areas of proposed dredging in Figures 20, 21 and 22. Where the EQS are exceeded, this is indicated in the results by presenting the exceeded iso-contour of contaminant concentration - either the Maximum Allowed Concentration (MAC) or Annual Average (AA) threshold.

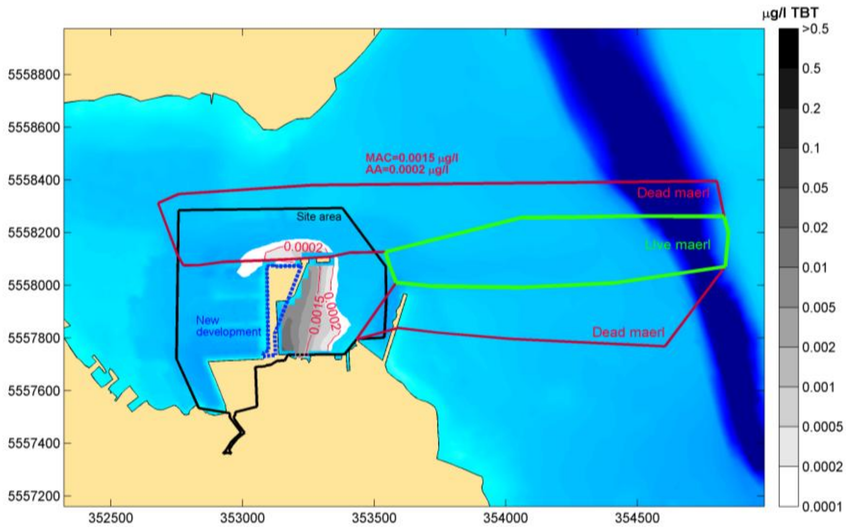


Figure 20 - Predicted time-averaged concentration of Tributyltin (TBT) over 15 days of dredging in the east of the site (Western Wharf)

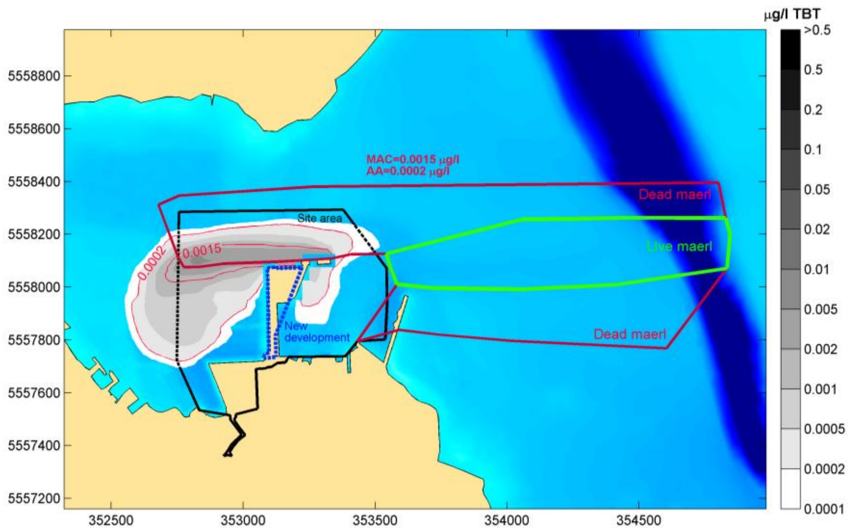


Figure 21 - Predicted time-averaged concentration of Tributyltin (TBT) over 15 days of dredging in the north of the site

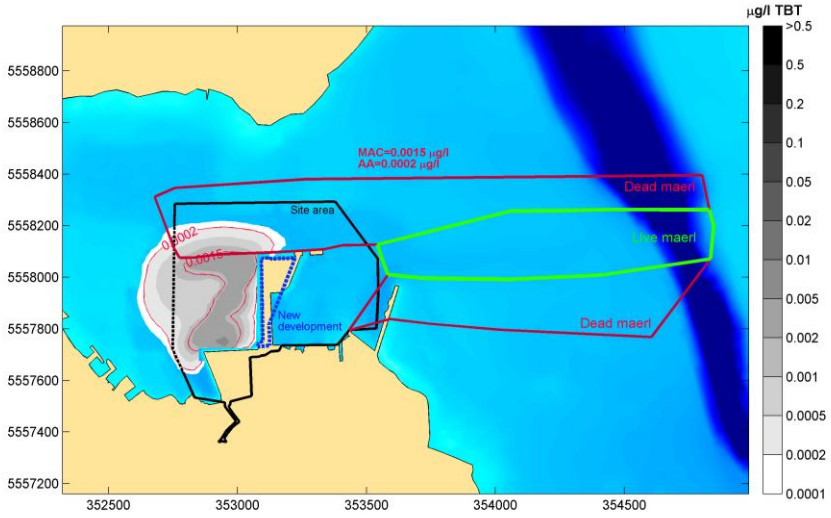


Figure 22 - Predicted time-averaged concentration of Tributyltin (TBT) over 15 days of dredging in the west of the site (FLOW Basin)

The results above show the approach of dredging only during the late ebb and early flood tide results in a substantially reduced footprint of the area where TBT concentrations exceed the EQS measures. There are no exceedances of the EQS levels outside the site boundary to the east, in the area mapped as live maerl overlying dead maerl.

Thus, the proposed mitigation also constrains the ZOI in relation to contamination of TBT in the water column to be largely contained within the red line boundary. Cefas have reviewed the ES and the Technical Appendices and were satisfied with the approach taken and conclusions of no significant impacts to benthic features.

Considering the limited deposition of sediments on the maerl sub-feature of the Fal and Helford SAC and the contamination levels identified, given the spatial extent and intensity of deposition, and that the predicted deposition is in a small area of habitat largely comprising dead maerl thalli that do not contribute to the longevity of the feature within the SAC, nor comprise maerl beds that support high biodiversity, there is expected to be **no adverse effect on site integrity.**

2.5 Mitigation for Secondary Dredge Impacts

Silt curtains were considered as part of early discussions of potential mitigation solutions for the proposed development. The mitigation, as presented within the ES and HRA Report, of the 10 m^3 lidded bucket and restricting dredging to the period from 1.75 hours before low water to 1.75 hours before high water i.e. on the late ebb, early flood tide, was shown to be sufficient to address the potentially significant effects associated with SSC and deposition effects and to support a conclusion of **no adverse effect on site integrity**, as supported by the data presented in this AA Addendum, therefore no further mitigation is presented. It was also established that the use of silt curtains would not be a viable mitigation method in the site environment.

2.6 Coastal Processes and Sediment Modelling Limitations

Data used to inform the coastal processes assessment is set out in ES Chapter 6: Coastal Processes. It is acknowledged that the data was collected between June 1984 – June 1985, with additional data collected in June to August 2024. This later data only included one event with a significant wave height of greater than 1 m so was not added to the validation dataset but was used to provide a verification of the model.

The calibration and validation exercise was undertaken in two stages:

1) Comparison of measured waves at the offshore 45 m buoy and the Met Office NWS hindcast model at the same location and derivation of adjustment factors for the hindcast model; and
2) Comparison of measured waves and SWAN prediction at the two buoys for selected winter peaks.

Based on this comparison exercise, an adjustment for the hindcast model was derived.

The verification exercise measured waves from data collected in 2024 and was used to calibrate with SWAN model outputs for the highest observed peak. A comparison between the highest measures waves and SWAN result are shown in Table 2-3, with full detail presented in Technical Appendix 6.1: Wave Modelling.

Table 2-3: Comparison of model and measurement for the time of the highest quoted measured waves

	Hs (m)	Tp (s)	Wave direction (°N)
Highest measured wave (08/07/2024, 19:40)	1.3	7.1	249
SWAN run for this time	1.1	5.9	144

In their consultation response, Cefas advised that the modelling conducted for the proposed development is suitable. Cefas acknowledged that no new field data were collected for the establishment of the coastal processes baseline (Chapter 6, Section 6.4.1). Wave and tidal hydrodynamics field data were collected in 1984-1985 but also were characterised on the basis of the Met Office wave hindcast from 1980-near present (2024) (Chapter 6, 6.5.26) and wind data from measurements 1973-2023 (Chapter 6, Section 6.8.6) with the field data used to validate and calibrate the model.

The wave modelling and associated return periods presented in ES Chapter 6 was focussed on wave conditions common enough to have a potential effect on the sediment regime. It should be noted that the use of the 'morphological' wave integrates the whole wave climate including more extreme cases, which is considered to represent the worst-case scenario.

The conclusion drawn in the consultation response is that the method applied is standard scientific modelling assessment of magnitudes of change to physical system processes and states and is appropriate. The modelled data is therefore considered to be accurate of the conditions at the site, and no new monitoring was requested to support the conclusions drawn. No further work is required in this regard.

The dredge scenario modelled, using a single large dredge, is considered as a reasonable worst case with the largest likely dredger and largest rate of sediment release from the dredger. The use of two smaller dredgers would have a lower production rate for each and a lower rate of sediment release into the water column and would be much more likely to dredge different areas at the same time to maximise efficiency. It was considered that any other combination of smaller dredgers would be likely to have less effect than the scenario modelled on suspended sediment concentrations and a very similar effect on total deposition depth albeit depositing at a slower rate. The modelling also includes dredging throughout the area to be dredged so does reflect sensitivity to location of dredger.

To account for re-dredge activity, by integration of the total volume of dredged sediment which deposits within the area to be dredged, the model calculated a small increase (approximately 2-3%) of the total dredged volume and therefore would not significantly alter the predicted effects of the works as modelled.

In terms of sediment budget and consideration of potential impact pathways relating to estuarine dynamics, HR Wallingford has undertaken modelling including wave, sediment transport, sediment plume and tidal flow modelling. This considers both the construction and operational stages of the proposed development, taking into account new bed levels post-dredge and the structure of the proposed development. Chapter 6 of the ES summarises the modelling undertaken and the magnitude of change, and is supported by Technical Annexes 6.1-6.4. It reports on the predicted change as a result of the proposed development on: water levels, current speed and magnitude, wave height and period, suspended sediment concentration, sediment deposition and erosion, and sedimentation within operational areas requiring maintenance dredging. The outputs of Chapter 6 enabled a number of impact pathways to be scoped out of consideration in terms of ecological receptors due to a negligible to low magnitude of change. This included scoping out of the ES operational stage effects on ecological receptors relating to tidal levels, currents and wave height. In the HRA, consideration of these operational stage effects are addressed in the screening tables (see Table 5-7 of the HRA).

Appendix A – HRW Technical Note – Additional Modelling (Dredging Refinement)

Falmouth Docks Redevelopment

Dredge timing sensitivity testing

1 Introduction

Falmouth Docks & Engineering Company is planning to upgrade the port infrastructure at Falmouth. The proposed development includes dredging and piling, and is supported by a comprehensive EIA submitted to secure planning permission and a marine licence.

Within the EIA modelling programme the dispersion of fine sediment released into the water column during the dredging operation was investigated. The initial case studied represented dredging throughout the tidal cycle with a 10 m^3, lidded backhoe. During the EIA process an iterative approach to the mitigation of impacts from the dredging on areas of maerl located to the east of the project site was developed with the 10 m^3 lidded backhoe. This resulted in a mitigation that restricted dredging operations to the late ebb and early flood tide period. This change significantly reduced the footprint of the sediment plume over the maerl areas.

This technical note investigates the sensitivity of further refinement of the timing of the dredging with particular reference to the total depth of fine sediment deposition from the released fine sediment within the areas mapped as ‘live maerl over dead maerl’ found to the east of the port area, in the vicinity of the Eastern Breakwater.

Full details of the previous dredging scenarios modelled, modelling methodology, hydrodynamic inputs, fine sediment release rates and sediment properties are provided in Technical Appendix 6.3 to the ES (HR Wallingford, 2025a).

2 Scenario modelled

2.1 Dredging scenario

To simulate the release of fine sediment a representation of the dredging was required to cover both the temporal and spatial variability in the tidal currents in the area.

The simulations were over a 15-day spring-neap period to take account of all the tide ranges and associated variability in currents over which the dredging could occur and show both the maximum and mean footprint of the fine sediment plume.

To take account of the spatial variability of the fine sediment plume as the dredger worked in different locations, the point of sediment release was moved throughout the eastern, northern and western parts of the site. The paths of the dredger were chosen to characterise the plume from the whole area within which the dredging would occur. The dredging paths represented in the simulations are shown in Figure 2.1. For each area, the start and end points of the dredge path are shown.

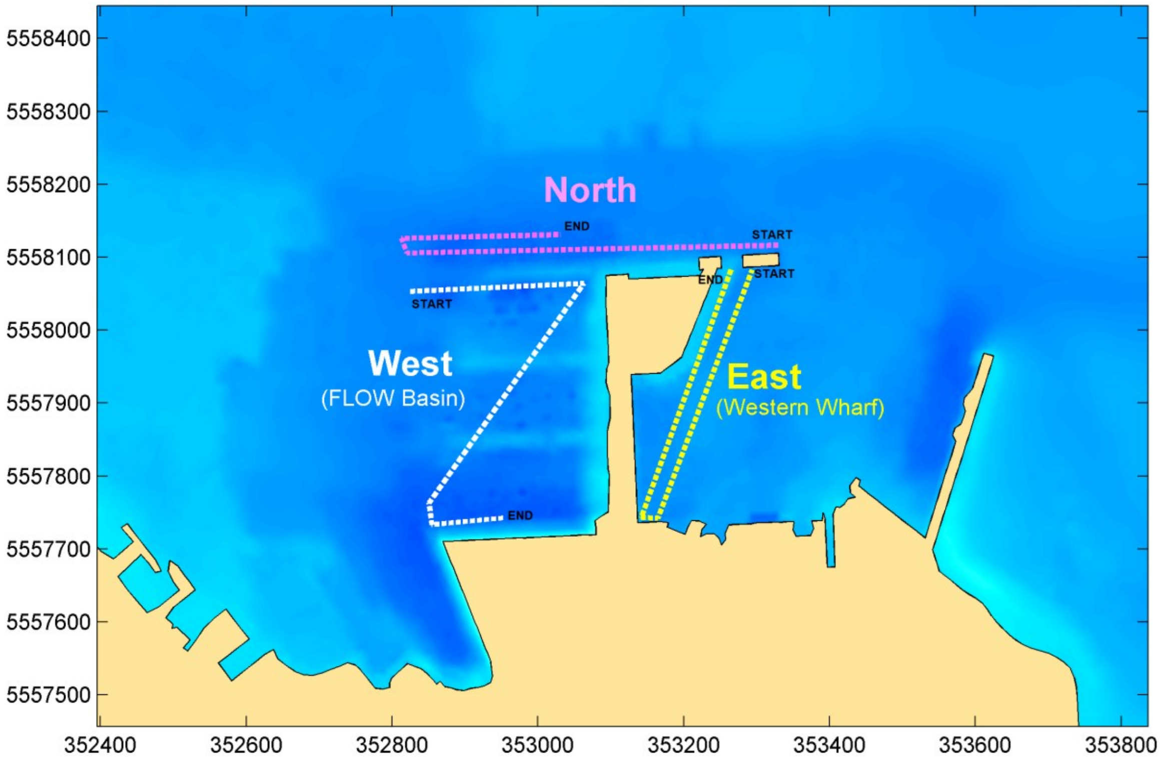


Figure 2.1: Dredging paths used in plume dispersion modelling

Following review of the all-tide and flood tide only simulations a timing of the periods of dredging was developed by starting 1.75 hours earlier than the flood tide case. This meant that more of the fine sediment released at the end of the period of dredging deposited before it approached the area mapped as live maerl over dead mearl. Dredging on the late ebb also means the released sediment did not have enough time to reach the maerl before the tide turned and the flood flow moved the sediment westwards, away from the maerl. The relationship between the tide and the period of simulated dredging is shown by Figure 2.2. A total of 155¾ hours of dredging was simulated.

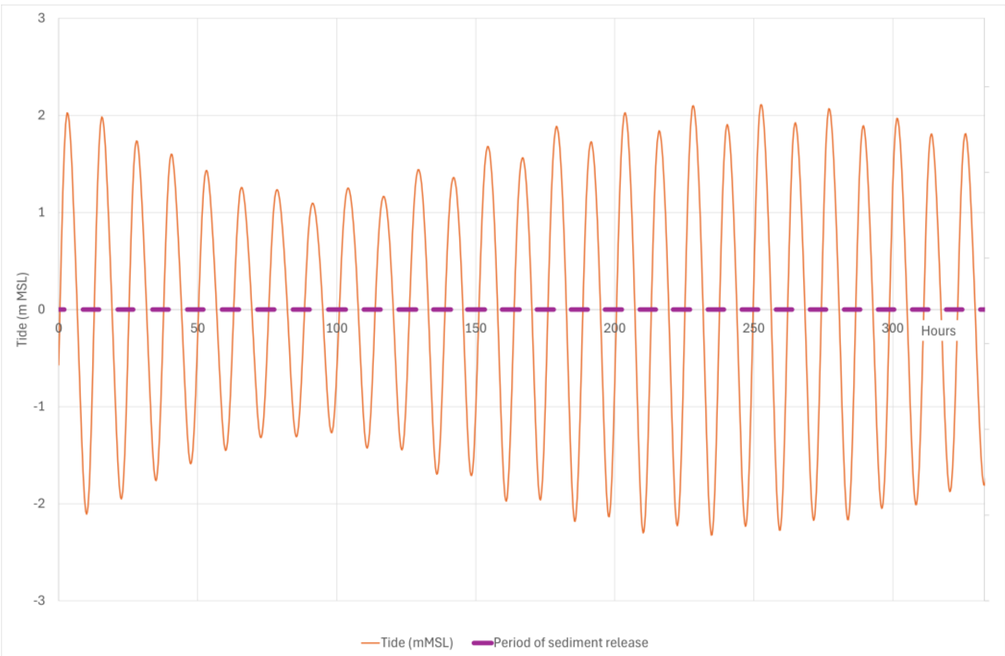


Figure 2.2: Late ebb – early flood tide dredging timing as simulated

2.2 Model assumptions

2.2.1 Calculation of total depth of deposition

The results of the scenarios are presented below by calculating the total deposition for the whole dredging project. This was done by a simple scaling up of the results of the 15 day simulations by an estimate of the time taken to complete the dredge in the east, north and west areas. Noting the whole dredge will take more than 50 weeks and the very low thresholds for impact on live maerl under consideration, there are a number of assumptions in this approach which should be noted.

- The bathymetry used in the simulations is the baseline, undredged case. This is a precautionary assumption as currents are likely to reduce in dredged areas resulting in more local deposition of the released fine sediment. This factor will reduce the footprint of the released sediment plume and the area and depth of fine sediment deposition.
- The dredge operation can continue at a unform rate without weather, maintenance or other downtime.
- An average fine sediment release rate is used in each of the three areas of dredging, negating spatial variability in the fine sediment content of the dredged material
- No resuspension of the deposited fine sediment during storm waves is included. This is a reasonable assumption in areas of live maerl forming a deep, reef like matrix but is potentially over precautionary in areas of non-continuous, live maerl over dead maerl as seen closer to the port area. Modelling of the background fine sediment deposition indicated the annual climate of offshore waves entering Falmouth Harbour resulted in forces sufficient to erode fine sediment deposited in the area immediately east of the eastern breakwater (HR Wallingford, 2025b).

2.2.2 Output grid

The SEDPLUME-RW model is a Lagrangian model which tracks the movement of fine sediment represented by particles which move in 3D as it is carried by the tidal currents. The particles can move anywhere within the flow model domain and are tracked at locations within the input flow model mesh. This allows sediment plumes that are below the resolution of the flow model to be simulated.

To provide graphical outputs, the mass of fine sediment represented by the particles is calculated within an output square grid, defined by the user. The size of the grid will have some influence on the representation of sharp gradients in the sediment plume results. In the studies presented in HR Wallingford (2025a) a 25 m mesh was used. The model results (average excess suspended sediment concentration and average deposition depth) are output at a set of points located at the centres of the square grid. Due to the level of detail required for the assessment in the areas of live maerl the output grid was reduced to 8 m.

3 Scenario results

Results are presented below as;

- Spatial plots of total deposition from the whole dredging program
- Tabulated total depths of deposition at two sets of points, one coincident with a drop down video (DDV) survey transect, identifying some coverage of live maerl towards the northern end of the transect and a second one further west to include the full extent inferred as potentially having some live maerl present. The point locations are shown in Figure 3.1, which also indicates the inferred area mapped as live maerl over dead maerl.
- Tabulated maximum rate of deposition (mm/tide) at the set of points shown by Figure 3.1.
- Time history of deposition at a selection of the points shown by Figure 3.1.

- Tabulated areas with predicted deposition depth in range 1-3 mm, 3-5 mm, 5-10 mm and greater than 10 mm, within mapped area of live maerl over dead maerl.

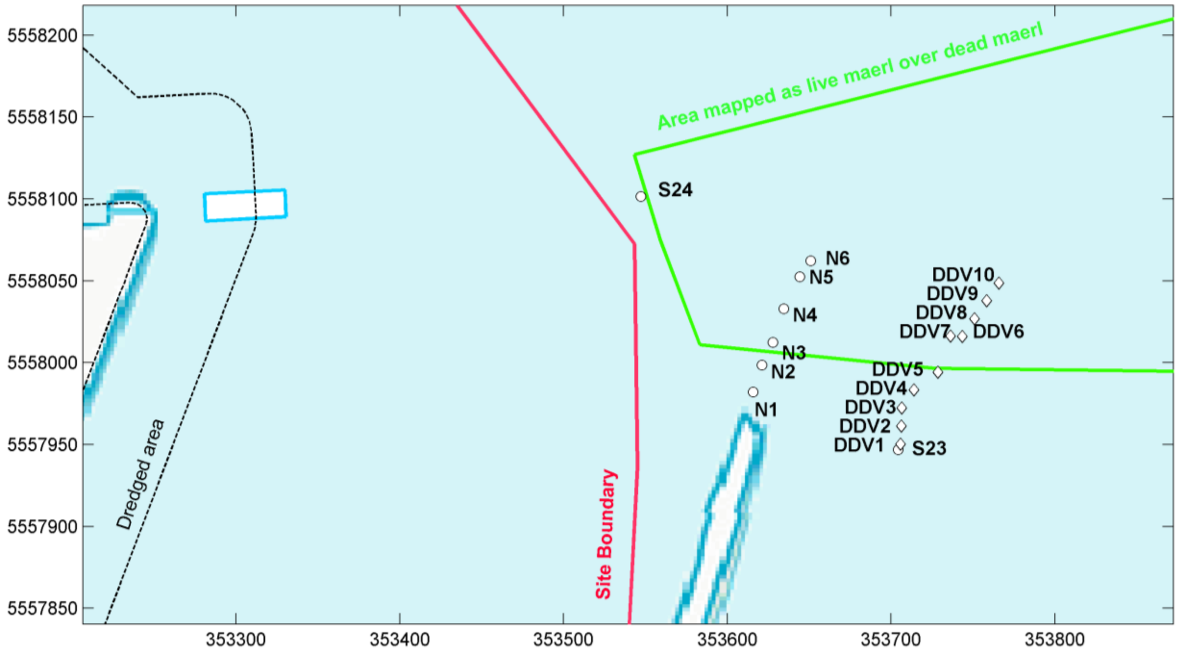


Figure 3.1: Locations for tabulated data

3.1 Original mitigation approach – Late ebb tide / early flood tide dredging

The original approach to mitigating the impacts of the dredging was by only dredging during this late ebb and early flood tides. This case was presented in the Environmental Statement. This case was re-run using the finer (8m) output grid for the results.

The results for total depth of deposition is shown in Figure 3.2. To provide detail in the lower end of predicted deposition depths, the 1, 3 and 5 mm deposition contours are included.

Table 3.2 summarises the predicted depths of deposition by integrating the area of deposition in a range of depth bands.

Table 3.2: Area of predicted deposition within mapped area of live maerl over dead maerl – late ebb tide / early flood tide dredging

Deposition depth (mm)	Area (ha)
1 – 3	0.64
3 – 5	0.20
5 – 10	0.10
> 10	0.03

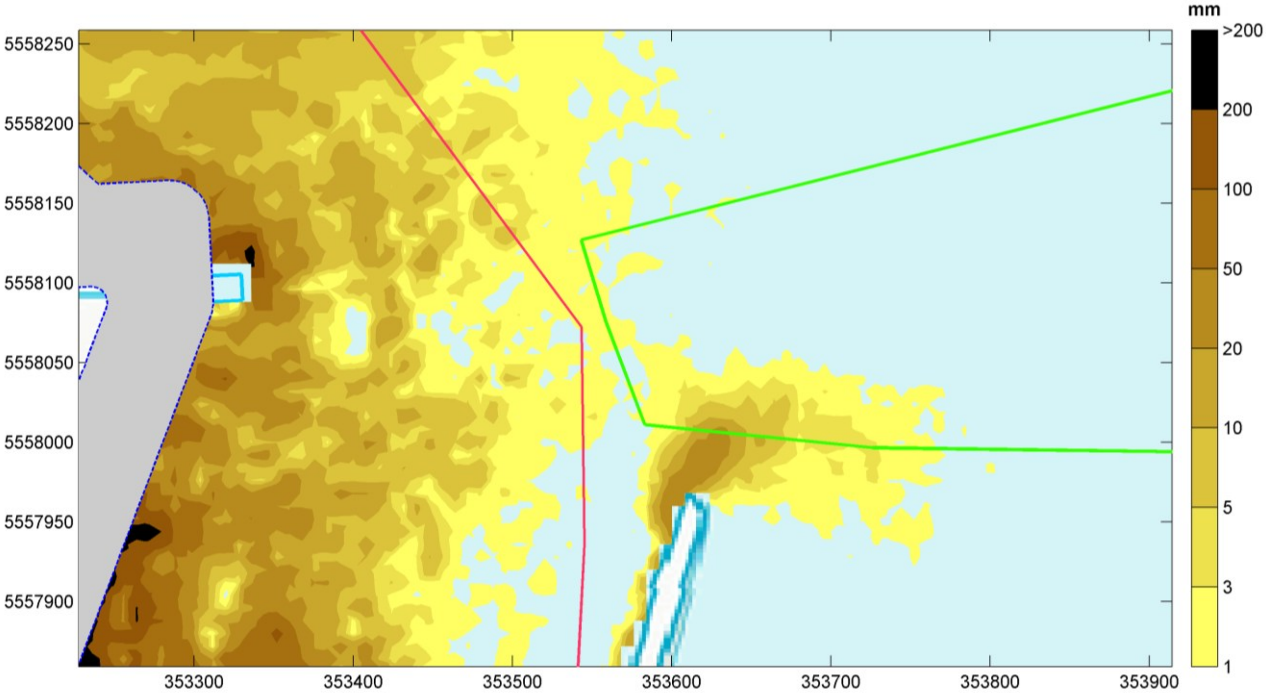


Figure 3.2: Predicted fine sediment deposition resulting from dredging as a whole, late ebb tide / early flood tide dredging

The extracted data for the selected points are provided below. All values are limited at 2 decimal places hence values of 0.00 mm result from any prediction less than 0.005 mm.

Table 3.2: Deposition over complete dredge at DDV locations – late ebb tide / early flood tide dredging

Point	Dredging in West total (mm)	Dredging in North total (mm)	Dredging in East total (mm)	TOTAL (mm)
1	0.30	0.10	0.74	1.14
2	0.19	0.19	0.43	0.82
3	0.40	0.43	0.86	1.70
4	0.64	0.66	0.72	2.02
5	0.89	1.35	0.91	3.15
6	0.46	0.67	0.44	1.57
7	0.46	0.80	0.30	1.57
8	0.58	0.32	0.11	1.02
9	0.43	0.18	0.15	0.76
10	0.00	0.10	0.23	0.33

Table 3.3: Deposition over complete dredge at N and S locations – late ebb tide / early flood tide dredging

Point	Dredging in West total (mm)	Dredging in North total (mm)	Dredging in East total (mm)	TOTAL (mm)
N1	1.59	11.21	17.40	30.20
N2	2.12	7.69	13.12	22.93
N3	2.13	4.44	8.12	14.69
N4	0.32	0.58	1.55	2.44
N5	0.00	0.07	1.12	1.20
N6	0.00	0.14	0.45	0.59

S23	0.13	0.21	0.43	0.76
S24	0.00	1.13	0.09	1.22

Table 3.41: Maximum rate of fine sediment deposition over a single tide at DDV locations – late ebb tide / early flood tide dredging

Point	Dredging in West (mm/tide)	Dredging in North (mm/tide)	Dredging in East (mm/tide)
1	0.01	0.02	0.02
2	0.01	0.02	0.02
3	0.01	0.04	0.02
4	0.01	0.08	0.02
5	0.02	0.13	0.02
6	0.02	0.19	0.01
7	0.02	0.19	0.01
8	0.01	0.20	0.01
9	0.01	0.13	0.01
10	0.00	0.05	0.00

Table 3.5: Maximum rate of fine sediment deposition over a single tide at N and S locations – late ebb tide / early flood tide dredging

Point	Dredging in West (mm/tide)	Dredging in North (mm/tide)	Dredging in East (mm/tide)
N1	0.04	0.11	0.30
N2	0.05	0.12	0.28
N3	0.04	0.08	0.19
N4	0.01	0.05	0.04
N5	0.00	0.04	0.01
N6	0.00	0.04	0.01
S23	0.01	0.02	0.02
S24	0.00	0.04	0.00

Assessment of the above values indicated that the predicted maximum rate of fine sediment deposition per tide were all too low (no more than 0.2 mm/tide within the live maerl area) to have an impact on live maerl. Therefore the further assessments were limited to investigating total deposition.

The extracted points in each of the two sections with the highest total deposition within the mapped live maerl over dead maerl area depth were DDV5 with 3.15 mm and N3 with 14.69 mm. At N3 it was notable that more than half of the predicted deposition (<8 mm) was associated with dredging in the East area (Table 3.3). Looking at the time history of deposition at this site during the simulated dredging in the East area (Figure 3.3) compared to the tide, it was observed that the largest period of deposition occurred during the early stage of the dredge for particular combination of tide range and location of the dredger at its closest point to the live maerl area.

The maximum depth of deposition predicted anywhere within the mapped area of live maerl over dead mearl is 23.0 mm, at a point very close to the southern limit of the area as shown by the green line on Figure 3.2.

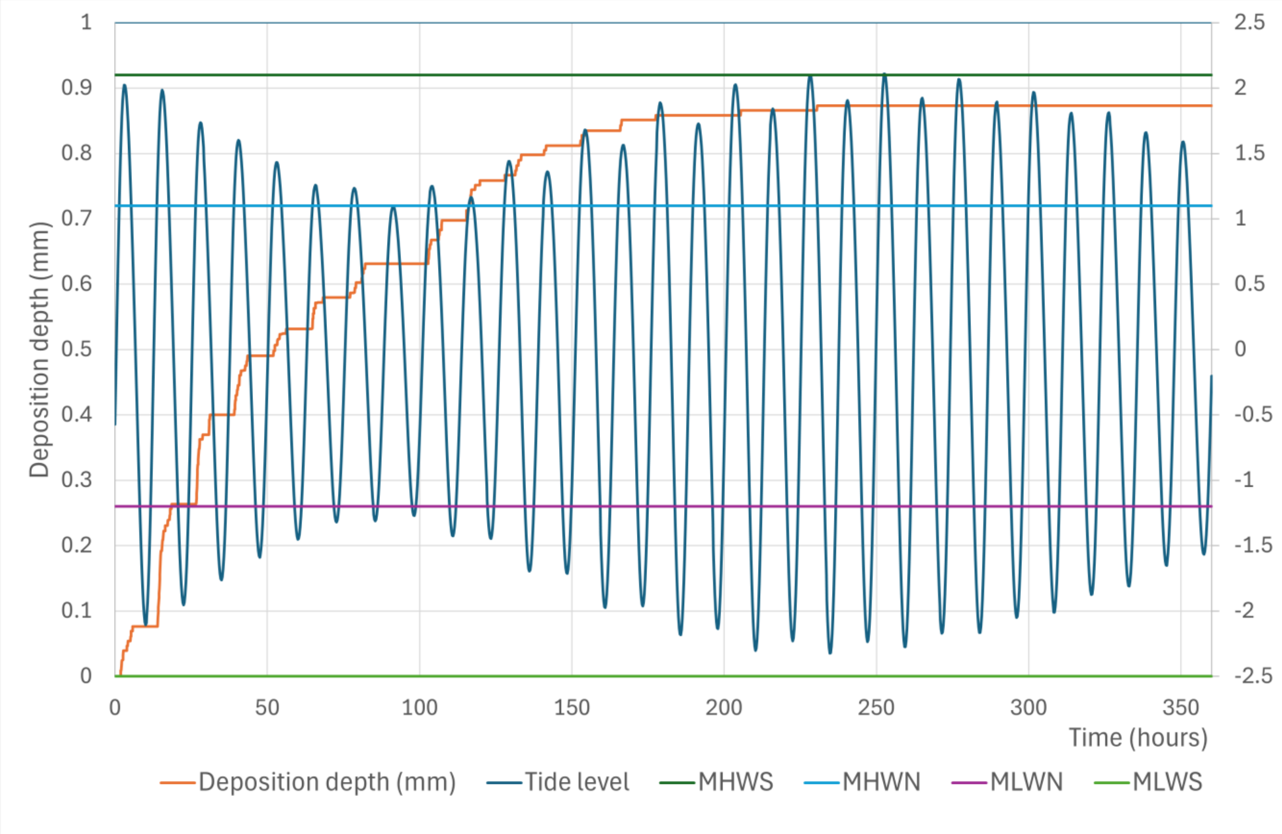


Figure 3.3: Time history of tide level and fine sediment deposition depth at point N3 for dredging in the East area – late ebb tide / early flood tide dredging

3.2 Updated mitigation approach – amended late ebb tide / early flood tide case

Based on Figure 3.3 an investigation of the reason for the higher deposition rates was made at the beginning of the simulation. It appears that at the start of dredging in the East area during spring tides the released fine sediment circulates in the flood tide eddy between Queens Quay and the Eastern Breakwater. This circulation meets the incoming flood tide close to the end of the Eastern Breakwater and deposition occurs in this area of flow confluence. The flood tide flow pattern is illustrated by Figure 3.4.

To reduce this pathway of fine sediment supply, a sensitivity test was undertaken with the dredging starting an hour later in the East area but only for the first 10 tides of the simulation. This test was aimed to reduce total deposition in the area mapped as live maerl over dead maerl without significantly extending the total duration of the dredging. In this scenario the total period of dredging was 145 ¾ hours meaning that the full dredge of the East area would take 6% longer to complete.

In practical terms a tide level based approach to the period of modified commencement of dredging would be implemented. For example, undertaking this approach in the northern end of dredging in the East area for tides with a high water levels above 1.6 m MSL which is 4.6 m CD.

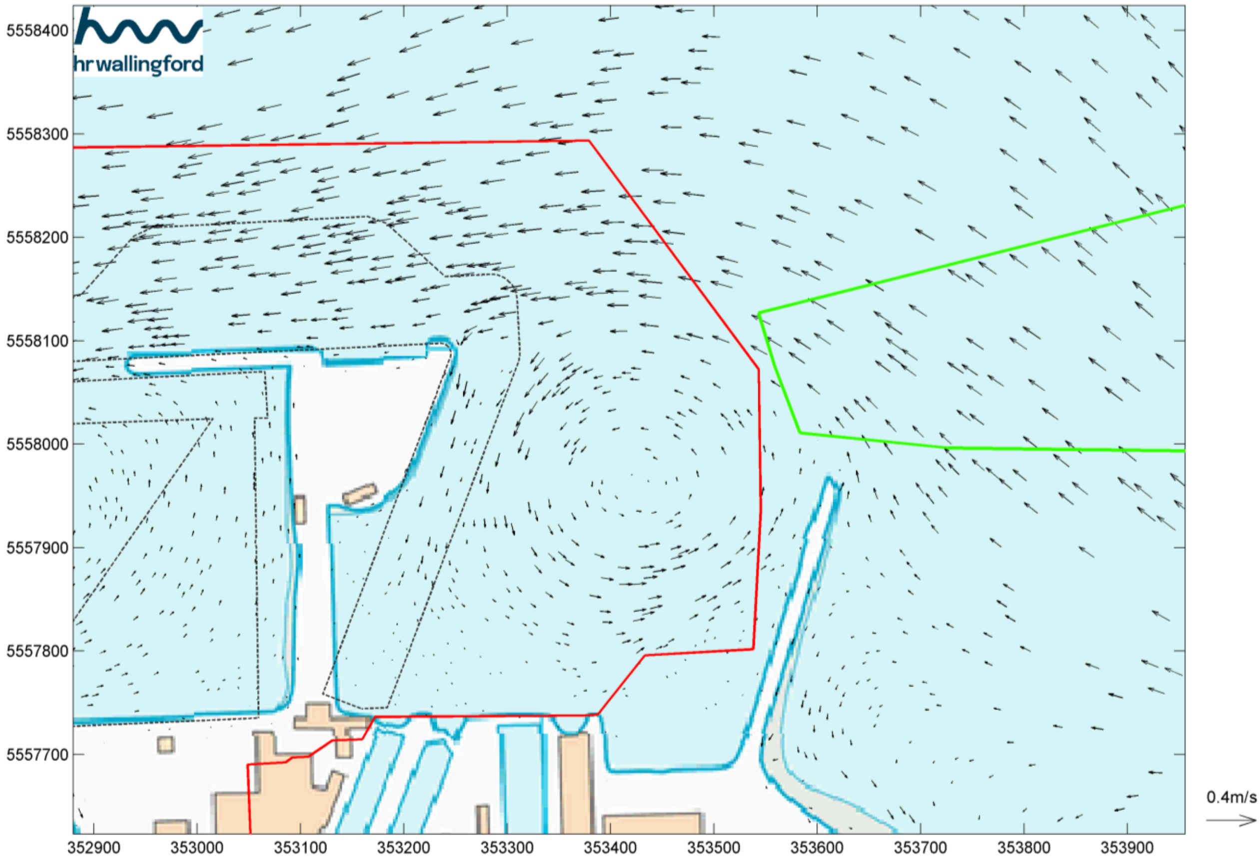


Figure 3.4: Flood tide current pattern

The results for total depth of deposition is shown in Figure 3.5 and the areas of defined bands of fine sediment deposition depth are shown in Table 3.6. The results show a reduction in the area of deposition 3-5 mm with a small increase in the area with a depth of deposition in the range 1-3 mm. The other areas with depths of deposition greater than 5 mm are unchanged.

Table 3.6: Area of predicted fine sediment deposition within mapped area of live maerl over dead maerl - amended late ebb tide – early flood tide dredging

Deposition depth (mm)	**Area (ha)**
1 – 3	0.71
3 – 5	0.15
5 – 10	0.10
> 10	0.03

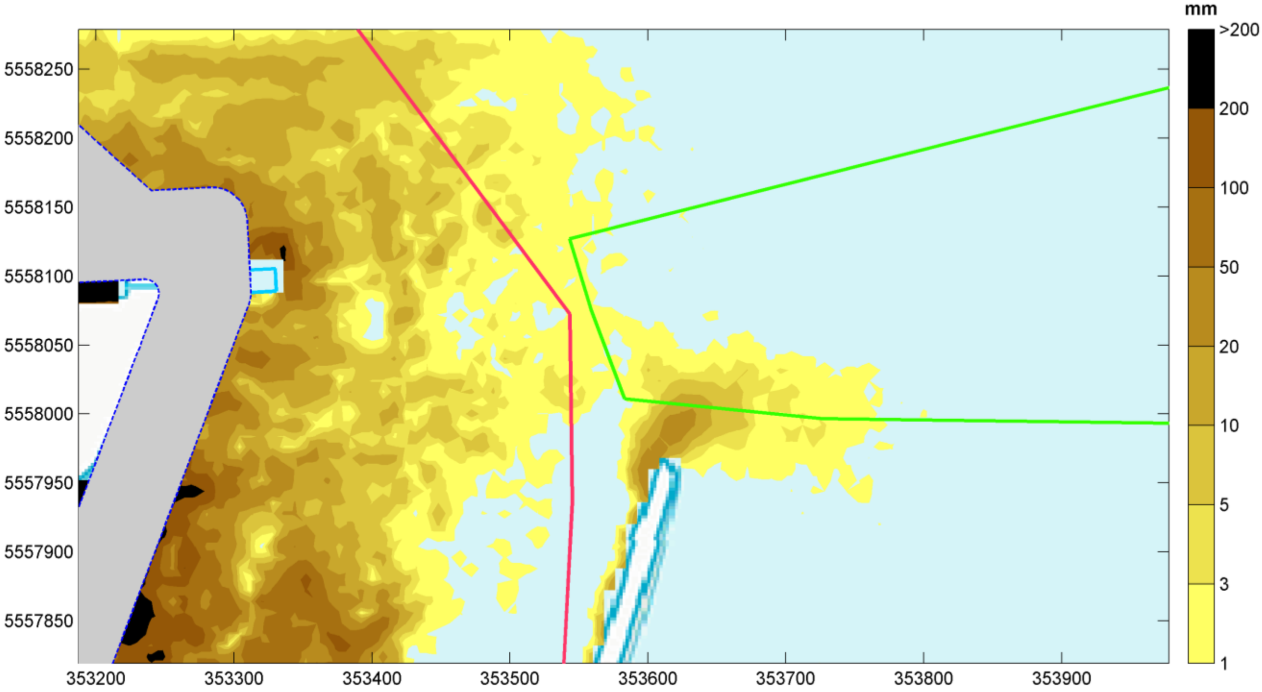


Figure 3.5: Predicted fine sediment deposition resulting from dredging as a whole, amended late ebb tide – early flood tide dredging

The extracted data for the selected points are provided below. A reduction in predicted depth of deposition is seen. All of the points on the DDV transect are now less than 3 mm and three points (1, 9 and 10) are less than 1 mm. On the other section At the other section of extracted data, a general reduction in deposition depth is also seen, The extracted data point within the live maerl over dead maerl with the highest depth of deposition, N3, is reduced by slightly over 2 mm to 12.37 mm.

The maximum depth of deposition predicted anywhere within the mapped area of live maerl over dead mearl is reduced from 23.0 mm to 16.8 mm.

Table 3.7: Predicted deposition of fine sediment over complete dredge at DDV locations – amended late ebb tide – early flood tide dredging

Point	Dredging in West total (mm)	Dredging in North total (mm)	Dredging in East total (mm)	TOTAL (mm)
1	0.30	0.10	0.24	0.64
2	0.19	0.19	0.68	1.07
3	0.40	0.43	0.86	1.70
4	0.64	0.66	1.41	2.72
5	0.89	1.35	0.59	2.83
6	0.46	0.67	0.92	2.05
7	0.46	0.80	0.36	1.62
8	0.58	0.32	0.26	1.16
9	0.43	0.18	0.28	0.90
10	0.00	0.10	0.03	0.13

Table 3.8: Deposition over complete dredge at N and S locations – amended late ebb tide – early flood tide dredging

Point	Dredging in West total (mm)	Dredging in North total (mm)	Dredging in East total (mm)	TOTAL (mm)
N1	1.59	11.21	15.10	27.91
N2	2.12	7.69	12.22	22.03
N3	2.13	4.44	5.80	12.37
N4	0.32	0.58	1.32	2.21
N5	0.00	0.07	0.49	0.56
N6	0.00	0.14	0.45	0.59
S23	0.13	0.21	0.58	0.91
S24	0.00	1.13	0.22	1.35

4 References

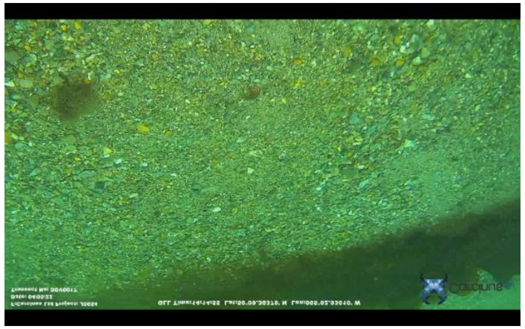
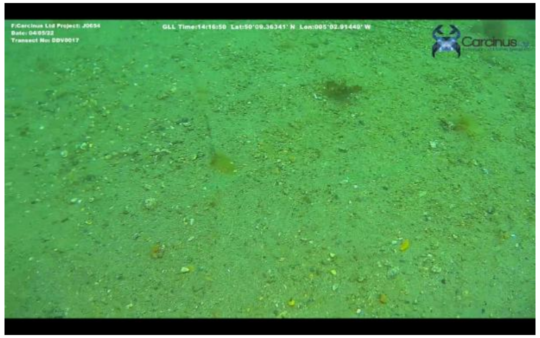
HR Wallingford (2025a). Falmouth Docks Redevelopment. Sediment and contaminant plume modelling. Report DER6962-RT003-R02-00, ES Volume 2 Technical Appendix 6.3.

HR Wallingford (2025b). Falmouth Docks Redevelopment. Sediment Transport modelling. Report DER6962-RT004-R02-00, ES Volume 2 Technical Appendix 6.2.

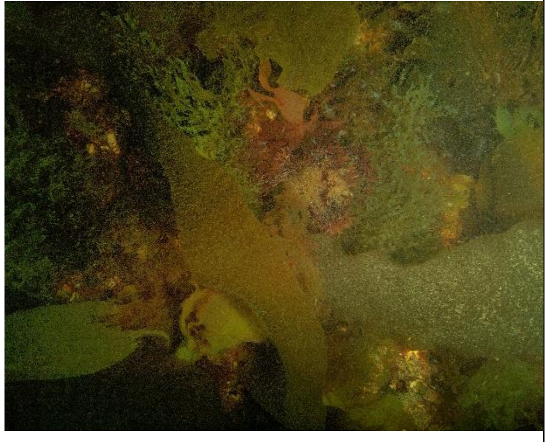
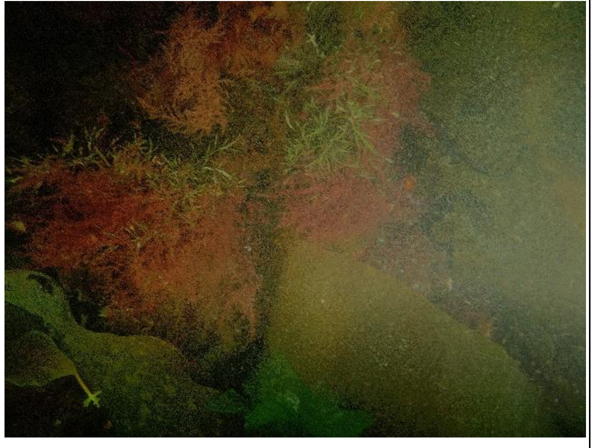
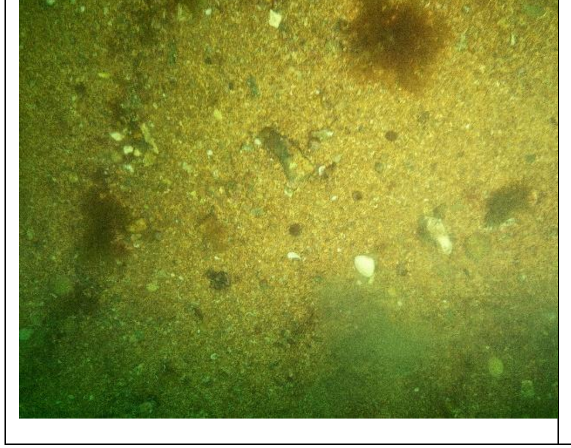
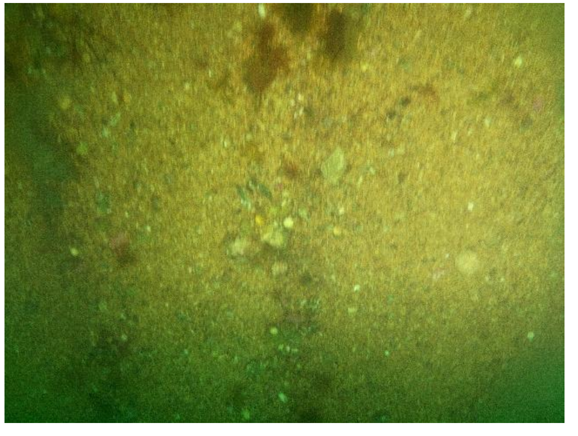
Appendix B – DDV17 (2022 Survey) and DDV13 (2023 Survey) Stills

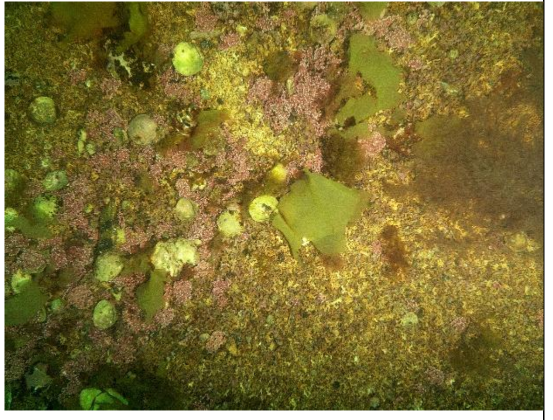
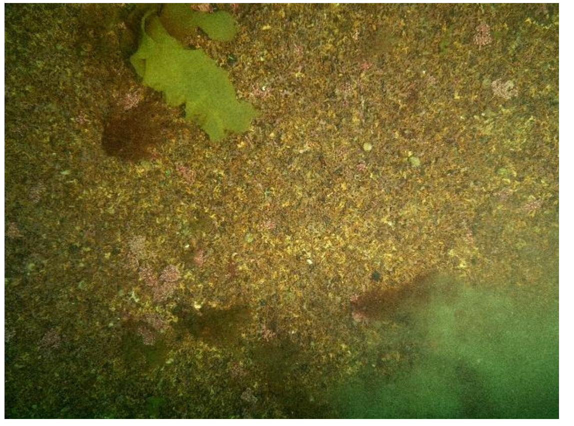
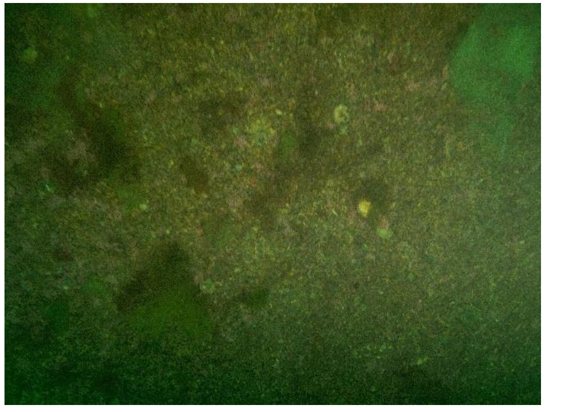
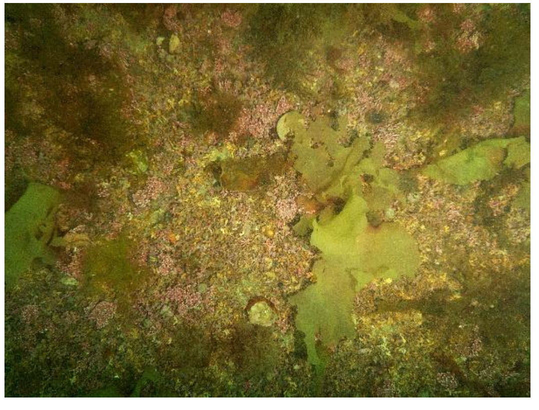
2022 Survey DDV17 west to east

DDV17_1	DDV17_2	DDV17_3
		
DDV17_4	DDV17_5	DDV17_6
		

DDV17_7	DDV17_8	DDV17_9
		
DDV17_10	DDV17_11	DDV17_12
		

2023 Survey – DDV13 south to north

DDV13_1 15% dead, 0% live, 2D 	DDV13_2 5% dead, 0% live, 2D 	DDV13_3 40% dead, 0% live, 2D 
DDV13_4 50% dead, 0% live, 2D 	DDV13_5 30% dead, 0% live, 2D 	DDV13_6 50% dead, 10% live, 2D 

DDV13_7 20% dead, 30% live, 3D 	DDV13_8 45% dead, 25% live, 3D 	DDV13_9 30% dead, 30% live, 3D 
DDV13_10 20% dead, 60% live, 3D 	DDV13_11 40% dead, 25% live, 3D 	DDV13_12 25% dead, 20% live, 3D 

Appendix C – HRW Technical Note – Additional Modelling (TBT)

Falmouth Docks Redevelopment

TBT dispersion assessment

1 Introduction

Falmouth Docks & Engineering Company is planning to upgrade the port infrastructure at Falmouth. The proposed development includes dredging and piling, and is supported by a comprehensive EIA submitted to secure planning permission and a marine licence.

Within the EIA modelling programme the dispersion of contaminants released into the dissolved phase was investigated. The case studied was precautionary by representing dredging throughout the tide with a 10 m^3, lidded backhoe. During the EIA process an approach to the mitigation of impacts from the dredging on areas of maerl located to the east of the project site was developed with the 10 m^3, lidded backhoe only operating during the late ebb and early flood tide period. This change significantly reduced the footprint of the sediment plume over the maerl areas.

This technical note shows the implications of the late ebb, early flood tide dredging on the release of Tributyltin (TBT), a priority hazardous substance, into the dissolved phase with consequences for water and sediment quality.

Full details of the dredging scenario modelled, modelling methodology, hydrodynamic inputs, assessment of contaminant levels in the sediments, sediment release rates and sediment properties are provided in technical appendix 6.3 to the ES (HR Wallingford, 2025). The technical appendix also includes the model results for TBT release for dredging throughout the tidal cycle.

2 Scenario modelled

2.1 Dredging scenario

To simulate the release of TBT into the dissolved phase a representation of the dredging was required to cover both the temporal and spatial variability in the tidal currents in the area.

The simulations were over a 15-day spring-neap period to take account of all the tide ranges and associated variability in currents over which the dredging could occur and show both the maximum and mean footprint of the plume.

To take account of the spatial variability of the plume as the dredger worked in different locations the point of sediment release was moved throughout the eastern, northern and western parts of the site. The paths of the dredger were chosen to characterise the plume from the whole area within which the dredging would occur. The dredging paths represented in the simulations are shown in Figure 2.1.

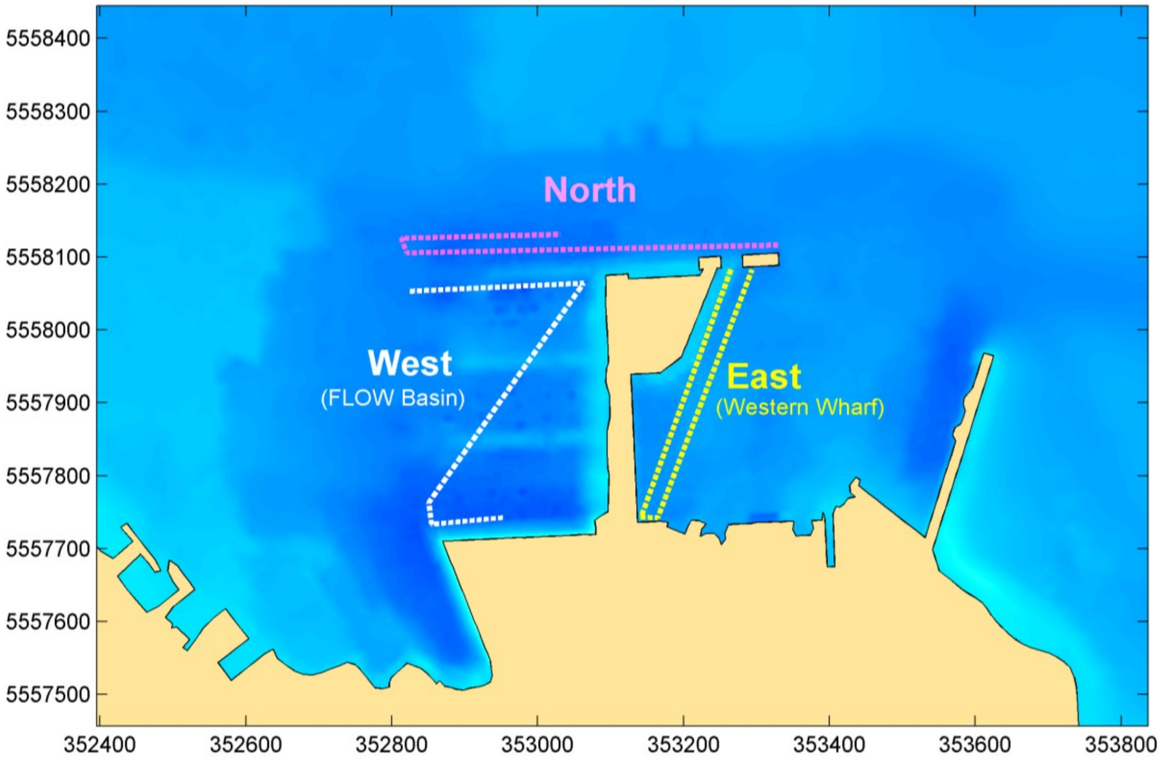


Figure 2.1: Dredging paths used in plume dispersion modelling

2.2 TBT release scenario

The assessment of changes in water quality resulting from release of contaminants was undertaken using a similar steady-state approach to that undertaken for the all-tide dredging case (HR Wallingford, 2025). The amount of contaminant released into the water column is a function both of the concentration of contaminant on the disturbed sediment and the amount of contaminant that passes from the sediment into the dissolved phase. The distribution of the contaminants between the dissolved phase and that adsorbed onto the sediment is controlled by the partition coefficient. These coefficients vary from site to site and for differing levels of background parameters such as ambient suspended solids, salinity, etc. The partition coefficient used for the study is the same as that used in the EIA (HR Wallingford, 2025).

For the purpose of the analysis the partitioning of the contaminants was assumed to occur at the point of dredging. This assumption would be expected to give the highest dissolved contamination levels.

The implications of the modelled results should be considered by comparison against specific pollutant, priority substance and hazardous priority substance environmental quality standards (EQS) (Environment Agency, 2022a, 2022b). For TBT, the applicable EQS values are a Maximum Allowed Concentration (MAC) of 0.0015 µg/l and an Annual Average (AA) of 0.0002 µg/l.

3 Scenario results

In this section the predicted time-averaged dissolved concentrations for TBT are presented for the three areas of proposed dredging – east (Figure 3.1), north (Figure 3.2) and west (Figure 3.3) of the site. Where the EQS are exceeded, this is indicated in the results by presenting the exceeded iso-contour of contaminant concentration – either the Maximum Allowed Concentration (MAC) or Annual Average (AA) threshold.

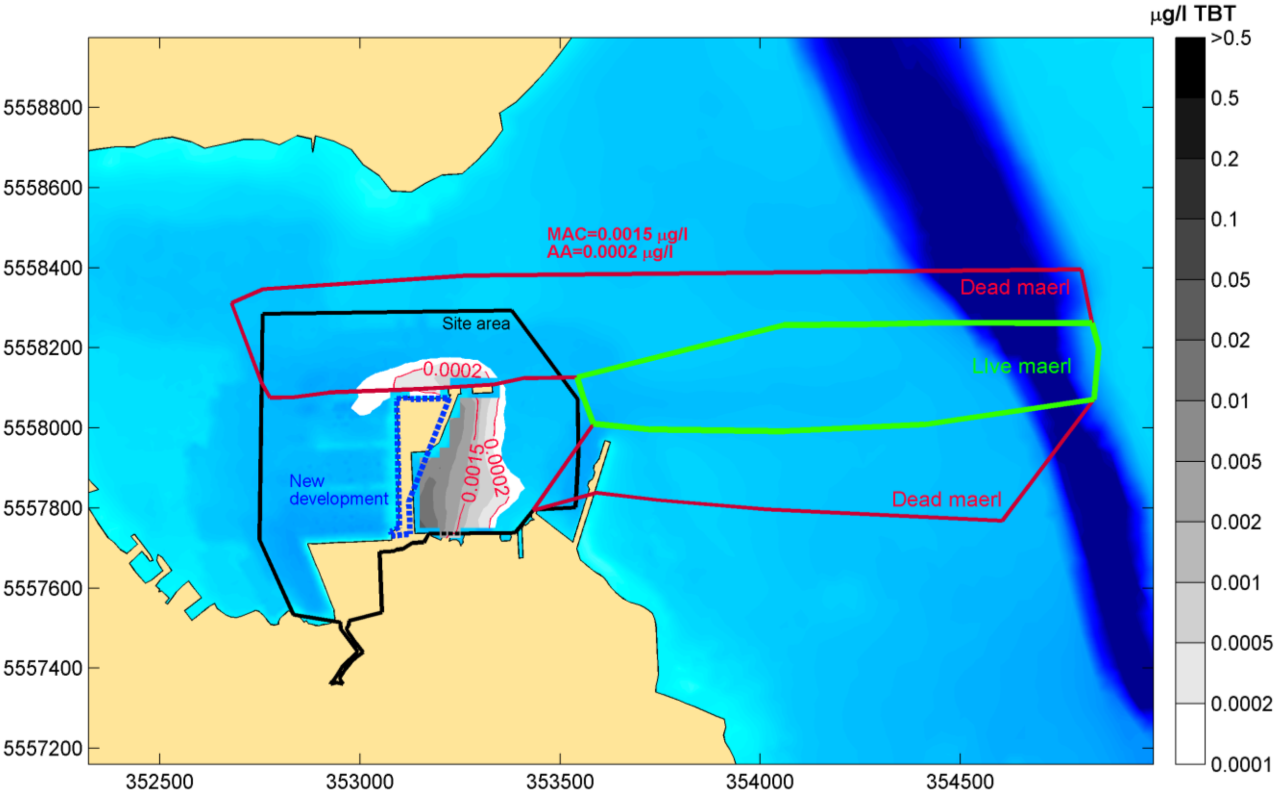


Figure 3.1: Predicted time-averaged concentration of Tributyltin (TBT) over 15 days of dredging in the east of the site (Western Wharf)

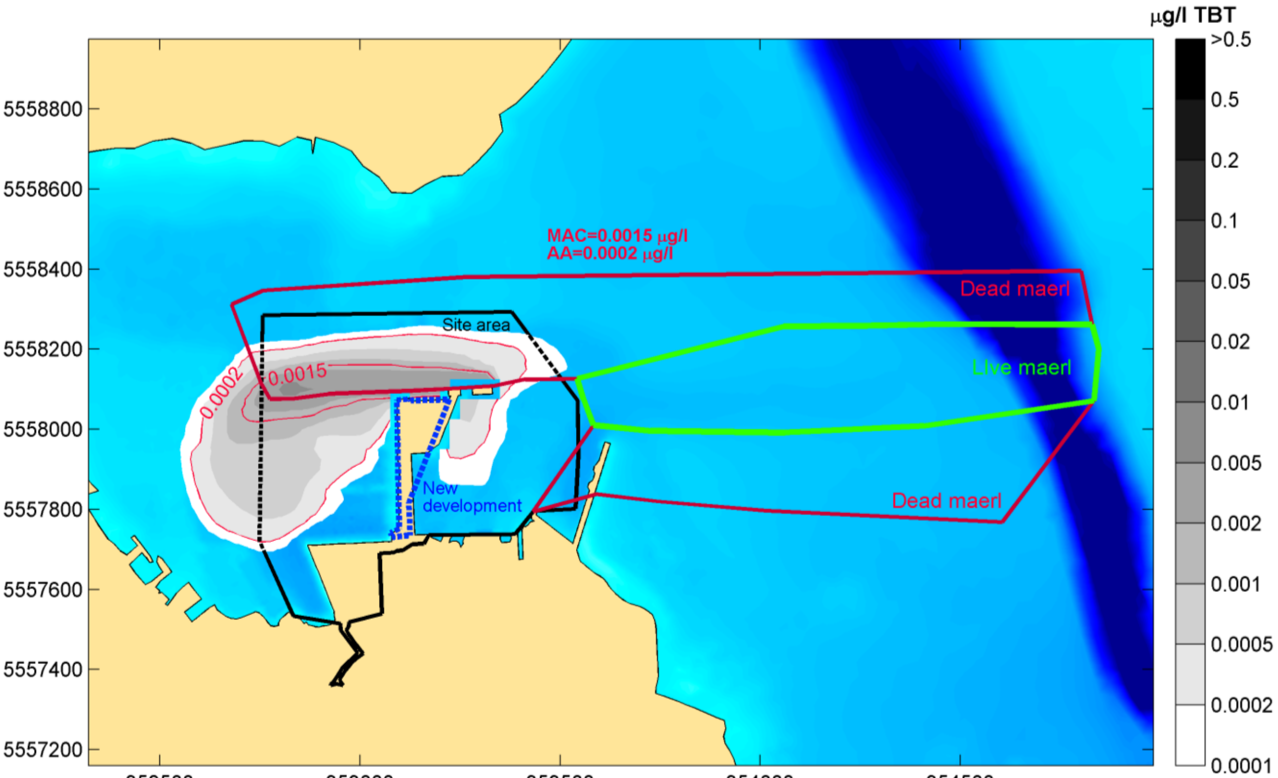


Figure 3.2: Predicted time-averaged concentration of Tributyltin (TBT) over 15 days of dredging in the north of the site

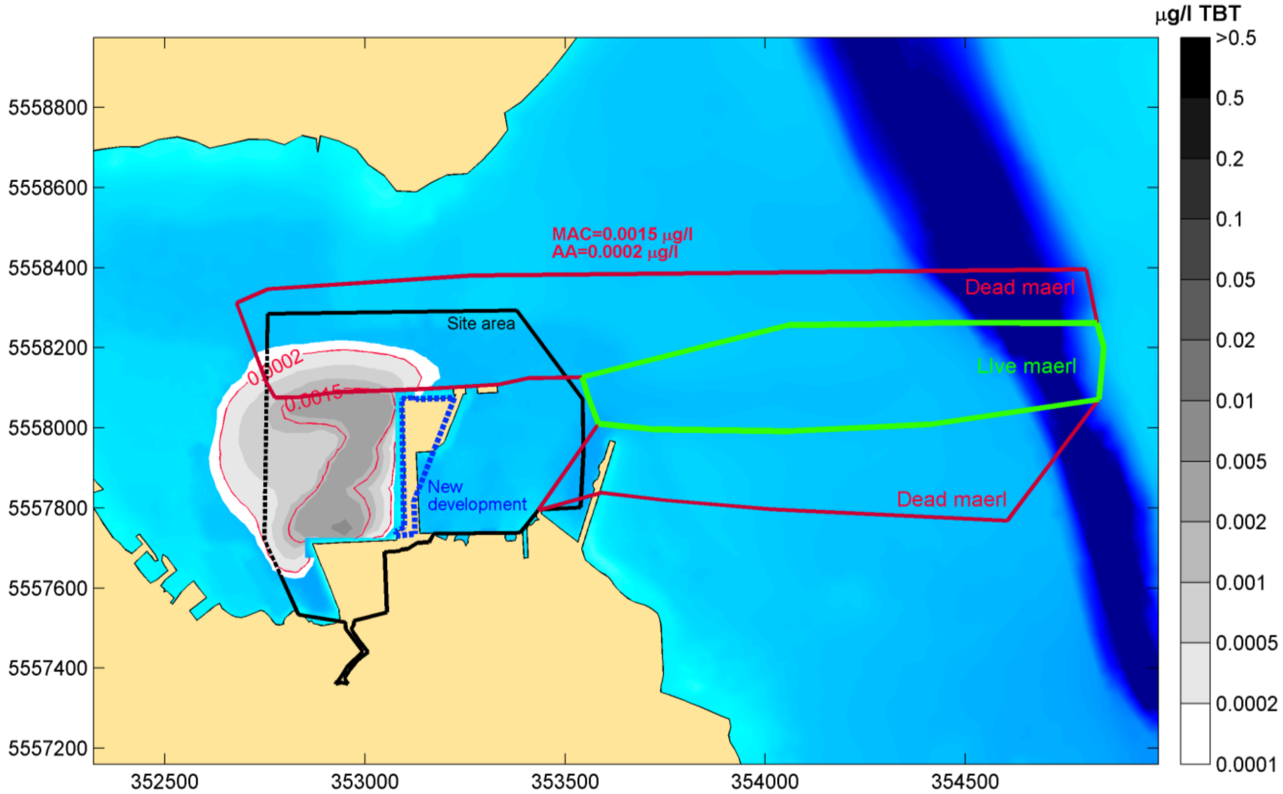


Figure 3.3: Predicted time-averaged concentration of Tributyltin (TBT) over 15 days of dredging in the west of the site (FLOW Basin)

4 Conclusions

The results above show the approach of dredging only during the late ebb and early flood tide results in a substantially reduced footprint of the area where TBT concentrations exceed the EQS measures. The reduced area of effect is particularly towards the east of the site where live maerl is present.

Table 4.1 summarises the results of the contaminant modelling by noting whether the contaminant in a given zone is predicted to exceed the Annual Average (AA) or Maximum Acceptable Concentration (MAC) inside or outside of the site area.

Table 4.1: Summary of contaminant results

Dredging zone	AA exceeded within the site area?	MAC exceeded within the site area?	AA exceeded outside the site area?	MAC exceeded outside the site area?
East (Western Wharf)	Yes	Yes	No	No
North	Yes	Yes	Yes (to the west)	Yes (to the west)
West (FLOW Basin)	Yes	Yes	Yes (to the west)	No

Both EQS are exceeded within the site area for all three dredging areas. For dredging in in the east area (Western Wharf) neither EQS are exceeded outside of the site area. For dredging in the north area both EQS are exceeded outside of the site area with these areas of exceedance being to the west of the site area with an extent that is very similar to the all- tide dredging case shown in HR Wallingford (2025). For dredging in the west area only the AA is exceeded outside of the site area to the west of the site. This area of exceedance of the AA is again very similar to that predicted for all tide dredging.

Neither of the EQS are exceeded in the area of live maerl for any of the dredging areas simulated.

5 Reference

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