Hampshire Water Transfer and Water Recycling Project

Environmental Statement – Appendix 9.5 Subtidal geophysical survey

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Contents

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1 Introduction

1.1 Overview

1.1.1 This technical report has been prepared in relation to the Hampshire Water Transfer and Water Recycling Project (hereafter referred to as the 'Proposed Development') and has been prepared to support the marine biodiversity assessment presented in Environmental Statement (ES) Chapter 9 Marine biodiversity, Volume I (Document reference 6.1, DCO Volume 6). Details of the Proposed Development are described in ES Chapter 3 Description of the Proposed Development, Volume I (Document reference 6.1, DCO Volume 6) and have informed the scope of this study.

1.1.2 Seastar Survey Ltd. (hereafter 'Seastar') were contracted by APEM Ltd. ('APEM') to contribute to a marine environmental survey project to be undertaken on behalf of Southern Water Services Limited (the Applicant). The aim of the survey project was to map the distribution and extent of broadscale subtidal benthic habitats present within the survey area, with the data used to support an ecological assessment and inform the consents and licensing requirements for the Proposed Development.

1.1.3 This report details baseline geophysical data and ground truthing for broadscale subtidal benthic habitats collected between 28 March 2022 and 27 April 2022 and is produced to inform the marine ecological assessment presented within ES Chapter 9 Marine biodiversity, Volume I (Document reference 6.1, DCO Volume 6). The survey scoping and methodology used for establishing the ecological baseline for broadscale subtidal benthic habitats are provided in section 2.1 and section 2.4 respectively of this report.

1.2 Objectives

1.2.1 The Environmental Impact Assessment (EIA) Scoping Report for the Proposed Development identified potential effects on subtidal benthic habitats with additional study being recommended.

1.2.2 To inform the assessment of likely significant effects on subtidal benthic habitats the objective was to map the distribution and extent of broadscale habitats present within the survey area. This involved:

1. Planning and conducting acquisition of acoustic data (single-beam echosounder (SBES) and sidescan sonar) across the required survey area.
2. Processing of acoustic data acquired and subsequent interpretation of seabed bathymetry, morphology and sediment types across the survey area.
3. Selection of locations for sediment sampling based on an initial assessment of the processed acoustic data, to cover the full range of potential habitat types present.
4. To undertake a sediment sampling survey using a 0.1m^2 Hamon grab, with sample acquired for particle size analysis (PSA) and macrofaunal analysis. Note that the PSA and macrofauna analysis are reported separately in ES Appendix 9.6 Subtidal grab sampling report, Volume II (Document reference 6.2, DCO Volume 6).

5. To use the results of the PSA to ground-truth the acoustic data and produce European University Information Systems (EUNIS) Level 3 broadscale habitat maps of the areas surveyed.

1.3 Subtidal benthic ecology

1.3.1 Subtidal habitats range from hard substrata such as rock and reefs to soft substrata including but not limited to sands, gravels, cobbles, pebbles, sandy muds and mixed sediment. The diversity of benthic communities colonising in the habitat is subject to environmental conditions to which they are exposed. Subtidal benthic habitats of the areas off the Proposed Development are mainly comprised of sands, gravels and sandy muds. Benthic species typically present in these areas include burrowing worms, crustaceans, bivalve molluscs and echinoderms. The shallower areas of sands are considered as important habitat for fish nursery and seabirds foraging grounds.

1.4 Legal context

1.4.1 Langstone Harbour is a designated Site of Special Scientific Interest (SSSI) under Section 28 of the Wildlife and Countryside Act 1981 (as amended). Langstone Harbour is also classified as a Special Protection Area (SPA) under Article 4.2 of the EU Directive (79/409/EEC), Ramsar site under the Convention on Wetlands of International Importance (Ramsar Convention) and forms part of the Solent Maritime Special Area of Conservation (SAC) designated under the Habitats Directive (92/43/EEC). Subtidal habitats are an integral part of these designations and are essential in supporting designated features.

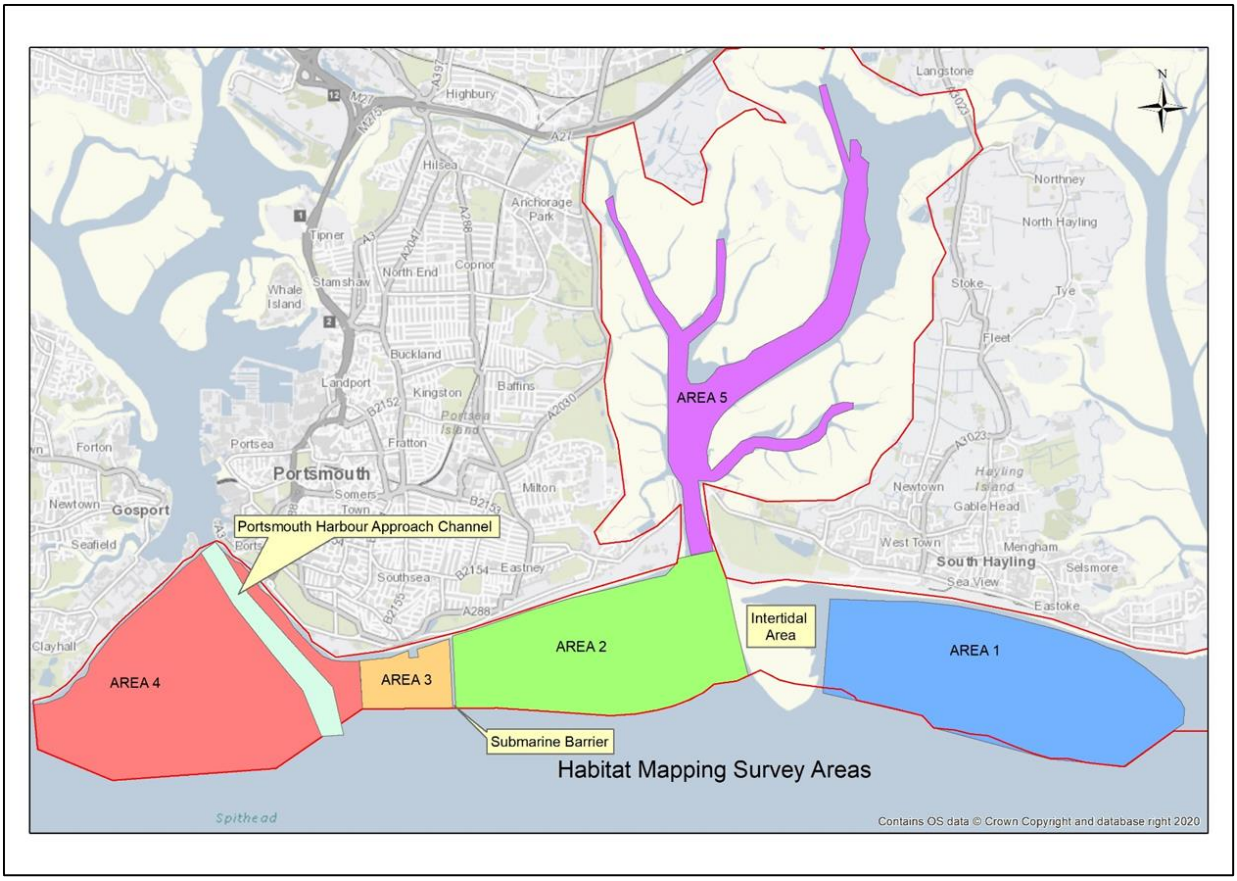
2 Methodology

2.1 Location

2.1.1 The extent of the survey area for subtidal habitats was selected to encompass subtidal areas of Langstone Harbour out into the Solent spanning the shallower nearshore areas (approximately 1-2km from shore) between Gilkicker Point (approximately 2.7km south-west of the Portsmouth Harbour entrance) in the west to the eastern end of Hayling Island in the east. In order to aid survey planning and operational management of data acquisition the survey area was split into five sections as is shown in Graphic 2-1. Data were collected from subtidal regions only. The Portsmouth Harbour approach channel was excluded from survey as it is subject to routine maintenance dredging.

Graphic 2-1 Broad indication of area surveyed as part of the 2022 Seafloor Characterisation Survey, showing the five distinct survey areas

(Area 1 in blue; Area 2 in green; Area 3 in orange; Area 4 in red; Area 5 in purple)



2.2 Plan

2.2.1 Prior to the start of the survey, detailed line plans were created for each survey area using Hypack survey management software.

2.2.2 Portsmouth and Langstone Harbour Masters were contacted prior to the start of the survey and supplied with copies of the survey plan. A local notice to mariners was issued by Portsmouth Harbour Master to cover work throughout the survey area. Regular communication was maintained between the survey vessel and both

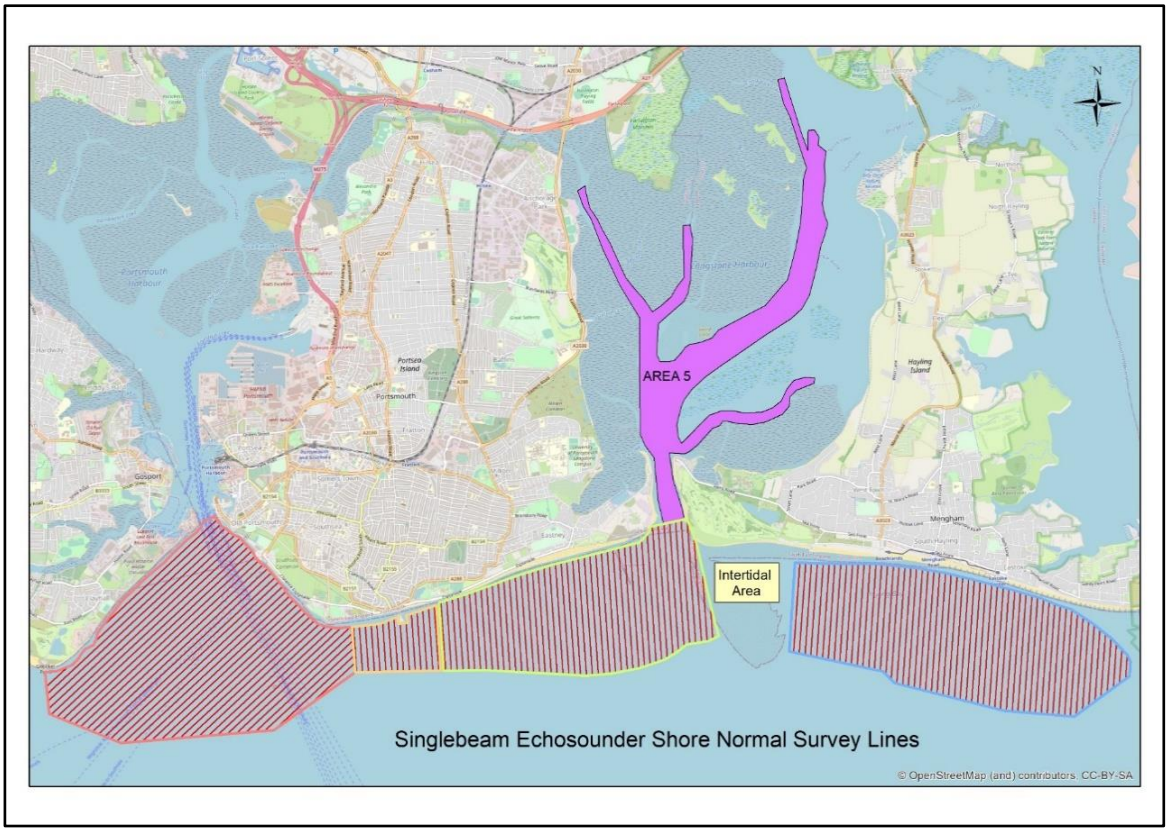
Harbour Masters, who were informed prior to any work being undertaken within the approaches to Portsmouth Harbour or inside Langstone Harbour.

2.2.3 For Area 1 to Area 4, the acoustic line plans consisted of shore-normal lines (a line conducted perpendicular to the shore) at a spacing of 75m for the acquisition of SBES data only and shore parallel lines (also at 75m spacing) for the combined acquisition of sidescan sonar and echosounder data. Collecting sidescan sonar data parallel to the main depth contours provides consistency in data acquisition by allowing the altitude of the sidescan tow-fish to be more easily maintained at a constant height above the seabed. Graphic 2-2 shows the planned shore-normal lines for SBES acquisition, and Graphic 2-3 shows the shore-planned lines for the acquisition of single beam echosounder and sidescan sonar data in Area 1 to Area 4.

2.2.4 In Area 5 (Langstone Harbour) all lines were planned at a spacing of 50m for the combined collection of SBES and sidescan sonar data. The line plan for the deeper main channels is shown in Graphic 2-3. The shallow water and narrow channels in the north and east of Langstone Harbour, along with the numerous boat moorings present, made it difficult to design a meaningful line plan for these area prior to surveying. Instead, a more dynamic approach was taken and data were planned to be collected by surveying within the marked channels and around moored vessels, with sufficient lines run to ensure good data coverage across all accessible subtidal areas.

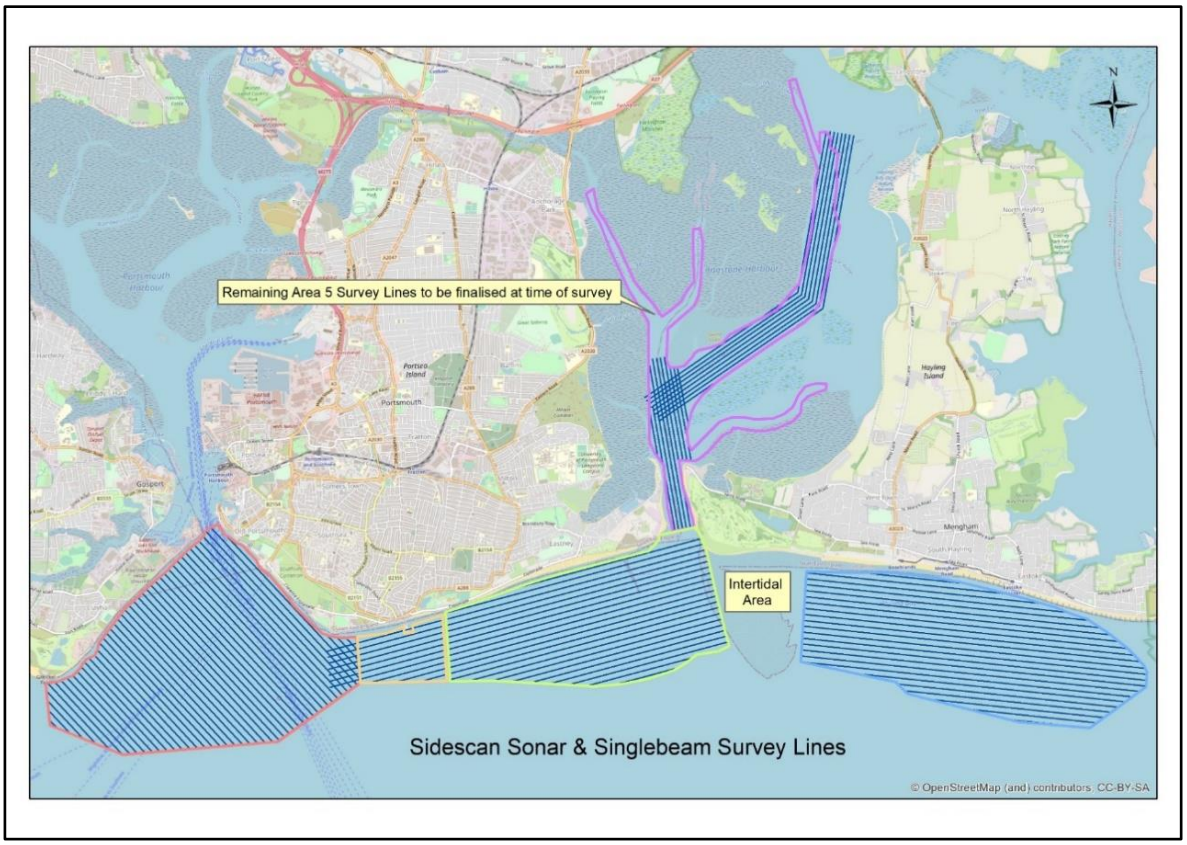
Graphic 2-2 Single-beam echosounder shore-normal line plans for the 2022 Seafloor Characterisation Survey in the five distinct survey areas*

(*The five survey areas are the coloured boundaries. The red stripes indicate survey lines at a spacing of 75m for the planned SBES survey acquisition path.)



Graphic 2-3 Sidescan sonar and single-beam echosounder line plans for the 2022 Seafloor Characterisation Survey in the five distinct survey areas*

(*The five survey areas are the coloured boundaries. The blue stripes indicate survey lines at a spacing of 50m for the combined collection of SBES and sidescan sonar data.)



2.3 Equipment

2.3.1 All acoustic survey work was conducted from Valkyrie VI, a Maritime and Coastguard Agency (MCA) category 2 coded 11m SouthCat catamaran, suitable for quickly transiting between survey areas and working in shallow waters. Valkyrie VI provided an ideal platform for collecting SBES and sidescan sonar data during the Proposed Development.

2.3.2 For the duration of the survey Valkyrie VI worked out of Gosport Marina, located on the western side of Portsmouth Harbour. Survey equipment was mobilised and tested on 28 and 29 March 2022. Following the successful completion of the survey all equipment was demobilised on 27 April 2022.

2.3.3 The following equipment was used for the SBES and sidescan sonar survey:

1. Leica GX1230 RTK GPS (Real-Time Kinematic Global Positioning System)
2. Hypack survey management software
3. Marimatech E-Sea Sound 206C singlebeam echosounder
4. Valeport Mini-CTD (Conductivity, Temperature and Depth)
5. TSS CMS25 (Compact Motion Sensor)
6. C-MAX CM2 (325 kilohertz (kHz)) sidescan sonar system

2.4 Methods

2.4.1 Survey navigation was achieved through the use of a Leica GX1230 RTK GPS. The GPS antenna was mounted inboard, adjacent to the echosounder transducer, and offsets between the transducer and antenna were measured and entered into Hypack during mobilisation. The GPS was used in full RTK mode; within the GPS, satellite derived positions (WGS84 latitude and longitude) were updated in real-time with pseudo-range corrections from Leica Smartnet, via a GSM receiver. Used in full RTK mode, GPS positions were accurate to ±0.03m in three dimensions. During the survey, positional data were recorded using Hypack survey management software and converted to OSGB36 National Grid co-ordinates in real time using the OSTN15 model within Hypack.

2.4.2 Navigation checks of the Leica GX1230 RTK GPS system were carried out against a known location in Gosport Marina at the start and end of each survey day.

2.4.3 Vertical control for the survey was achieved using a Marimatech E-Sea Sound 206 dual-frequency echosounder. The echosounder transducer was pole mounted on the port side of the vessel, approximately 0.5m below the water line. Throughout the survey high-frequency (200kHz) data were recorded digitally in Hypack.

2.4.4 Tide corrections were achieved in real-time via the vertical component of the RTK GPS positional data. The raw bathymetric soundings produced by the echosounder were reduced relative to Ordnance Datum Newlyn (ODN) using the Ordnance Survey OSGM15 model within Hypack. This enabled the tidal component to be removed from the raw soundings in real-time. Bathymetric soundings were then converted to Admiralty Chart Datum (ACD) during post-processing using the geoid-ellipsoid separation for Portsmouth.

2.4.5 A Valeport Mini-CTD was used to calculate the speed of sound through the water column on every survey day and, if multiple areas were visited on a single day, in each different area surveyed. The speed-of-sound profiles were applied to the raw bathymetric data during post-processing.

2.4.6 Potential errors associated with vessel movement (heave, pitch, and roll) were reduced using a TSS CMS25 motion reference unit (MRU). The MRU was mounted inboard and offsets to the echosounder transducer entered into Hypack during mobilisation. Corrections were applied in real-time through the echosounder and recorded in Hypack.

2.4.7 A C-MAX CM2 sidescan sonar was used at a frequency of 325kHz and at a range of 50m. The sidescan tow-fish was deployed on a short breast tow and maintained alongside the survey vessel at a depth of approximately 1m below the water surface. This method of deployment enabled shallow areas to be surveyed without risk of grounding the tow-fish and made the vessel more manoeuvrable. This was important when surveying the shallow waters of Langstone Harbour (Area 5), as well as the busy entrance to Portsmouth Harbour (Area 4), where data acquisition had to be stopped promptly to allow priority traffic (passenger ferries, naval vessels, etc.) to transit along the Harbour Approach Channel. The tow-fish was deployed from the port side of the vessel and offsets to the echosounder transducer and GPS antenna were measured and entered into Hypack.

2.5 Achieved survey

2.5.1 Survey operations took place between 30 March and 26 April 2022. During the survey there were a total of nine weather standby days, which equates to just less than 50% weather standby. All five areas were successfully surveyed with full line coverage achieved. On some days multiple areas were surveyed, depending on the conditions (wind direction and swell), in order to maximise efficiency with progressing the Proposed Development.

2.5.2 Area 1, located off the coast of Hayling Island, was surveyed between 30 March and 8 April 2022 and all 81 planned lines were completed. An additional 22 SBES-only infill lines were completed on 20 April 2022 in order to increase the resolution of depth soundings over a feature of interest identified during an initial assessment of the data. Some sidescan sonar and SBES lines were re-run on 25 April 2022 to ensure good data quality on all lines in the area.

2.5.3 Area 2, between the Langstone Harbour entrance and the submarine barrier, was surveyed between 2 and 13 April 2022 and all 70 planned lines were completed.

2.5.4 Area 3, located between the submarine barrier and Portsmouth Harbour entrance, was surveyed on 10 and 15 April 2022 and all 26 planned lines were completed. An additional line was run down the length of the submarine barrier for the acquisition of sidescan sonar and SBES data to ensure full data coverage with the sidescan sonar in this area.

2.5.5 Area 4, where Portsmouth Harbour approaches to Gilkicker Point, was surveyed between 10 and 16 April 2022, with line re-runs and infill carried out on 19 and 26 April 2022. All 82 planned lines were completed, and 9 additional lines were run along the Portsmouth Harbour Approach Channel on 26 April 2022, ensuring full sidescan sonar data coverage in this area. Area 4 was the busiest survey area with respect to other boat traffic as it included the main Portsmouth Harbour Approach Channel and the Small Boats Channel, which runs east to west across the survey area. A vigilant watch was maintained at all times and many lines were cut short, as a result of giving way to other, higher priority vessels (such as passenger ferries and naval vessels), and subsequently re-run. Additionally, some lines had to be re-run due to poor data quality caused by wash from other vessels as well as other commercial activity (e.g. a ship unloading rock armour to the south of the survey area resulted in high levels of turbulence within the water column, which impacted the quality of the SBES data).

2.5.6 Area 5, covering Langstone Harbour, was surveyed between 17 and 21 April 2022 and all 20 planned sidescan sonar and SBES lines were completed. An additional 27 ad hoc lines, including some SBES-only cross lines, were planned, and run across the area during the survey. This ensured good data coverage throughout the area, including within the narrower channels and around the moored boats present.

2.6 Acoustic data processing

2.6.1 During the survey period, the sidescan sonar data and SBES data underwent initial processing and charting. This allowed for a preliminary assessment of the range of potential habitat types present across the survey areas to be completed, and for the sediment sampling locations to be selected immediately following completion of the acoustic survey work. Sampling locations were selected to ensure each

different potential habitat type interpreted (based on acoustic return signals from the sidescan sonar) were ground-truthed across the range of depths recorded during the survey.

2.6.2 Following completion of the acoustic survey, all data from were reprocessed and checked for quality before being charted.

2.6.3 Raw SBES data were processed using the Single Beam Editor tool in Hypack. This included the removal of data spikes, multiple returns, and all other erroneous data points (e.g. seabed algal cover); applying speed of sound corrections; and checking the quality of the applied RTK tidal data and adjusting where necessary.

2.6.4 The edited SBES soundings were then reduced to ACD from ODN by applying the separation for Portsmouth (-2.73m). Soundings were reduced to ACD in order to allow for differentiation between intertidal and subtidal areas, thus aiding habitat mapping.

2.6.5 For charting purposes, a 1m horizontal sort of the edited SBES data was applied within Hypack (when applying a sort of the soundings the software selects the shallowest sounding within the sort-radius). A TIN (Triangulated Irregular Network) model was produced of the SBES soundings based on the 1m sort of the processed data in order to map bathymetry contours. The soundings used for all TIN models were processed, corrected for both speed of sound and tide, and reduced to ACD to form the final bathymetry dataset.

2.6.6 The raw sidescan sonar data were processed in Hypack using the sidescan mosaicking tool. Each line was checked for data quality and coverage, had a speed of sound correction and a time variable gain applied. Processed sidescan sonar data were analysed line-by-line to estimate the full range of sediment types and features present within the areas surveyed. Assessment of potential sediment types was based on the nature of the acoustic return, with dark returns suggesting harder substrate and lighter returns suggesting softer sediments. GeoTIFF mosaics of the sidescan sonar data for each survey area were completed with a resolution of 0.1m.

2.7 Habitat mapping

2.7.1 The principle of habitat mapping is to acquire data which enable areas to be discriminated based upon the consistency of their acoustic reflectivity, general water depth and morphology of bathymetric features. The different areas identified are then subsequently investigated by sampling or visual inspect in order to ground-truth what they comprise. Sampling was used to be able to ground-truth the areas. The ground-truthing of the acoustic data enables a substrate type or biotope to be assigned to areas of consistent sidescan sonar reflectivity or bathymetry. Data relating to sediment type, derived from PSA data provided by APEM, including EUNIS level 3 biotopes assigned to samples, were incorporated into the geographic information system (GIS). These data were then superimposed over the sidescan sonar and SBES data. Polygons were then created within the GIS around areas of consistent sidescan sonar reflectivity or bathymetric features and assigned labels based on the point sample data within those areas in order to create a habitat map.

3 Results

3.1 Bathymetry

3.1.1 A bathymetric TIN model of the entire survey area is shown in Graphic 3-1, while bathymetry TIN models for each of the five survey areas are shown from Graphic 3-2 to Graphic 3-5. The same consistent depth colour scale has been applied to each of the separate TIN models. The depths recorded across the area ranged from intertidal drying heights (shown in red) to depths greater than 20m below ACD (shown in blue). All TIN models have contour intervals at 1m spacing, with the 0m (chart datum) contour indicated by a black line where data acquisition beyond ACD was achieved.

3.1.2 Area 1 (south of Hayling Island) was found to be relatively flat and shallow, with maximum depths of approximately 3.5m recorded in the central offshore section of the area (Graphic 3-2). To the east and west of Area 1 intertidal sandbanks were identified that were likely formed by sediment transport out of the entrance channels to Langstone Harbour (in the west) and Chichester Harbour (in the east). A section of uneven seabed was identified towards the west of the area, with depths ranging between 2m and 3m below ACD.

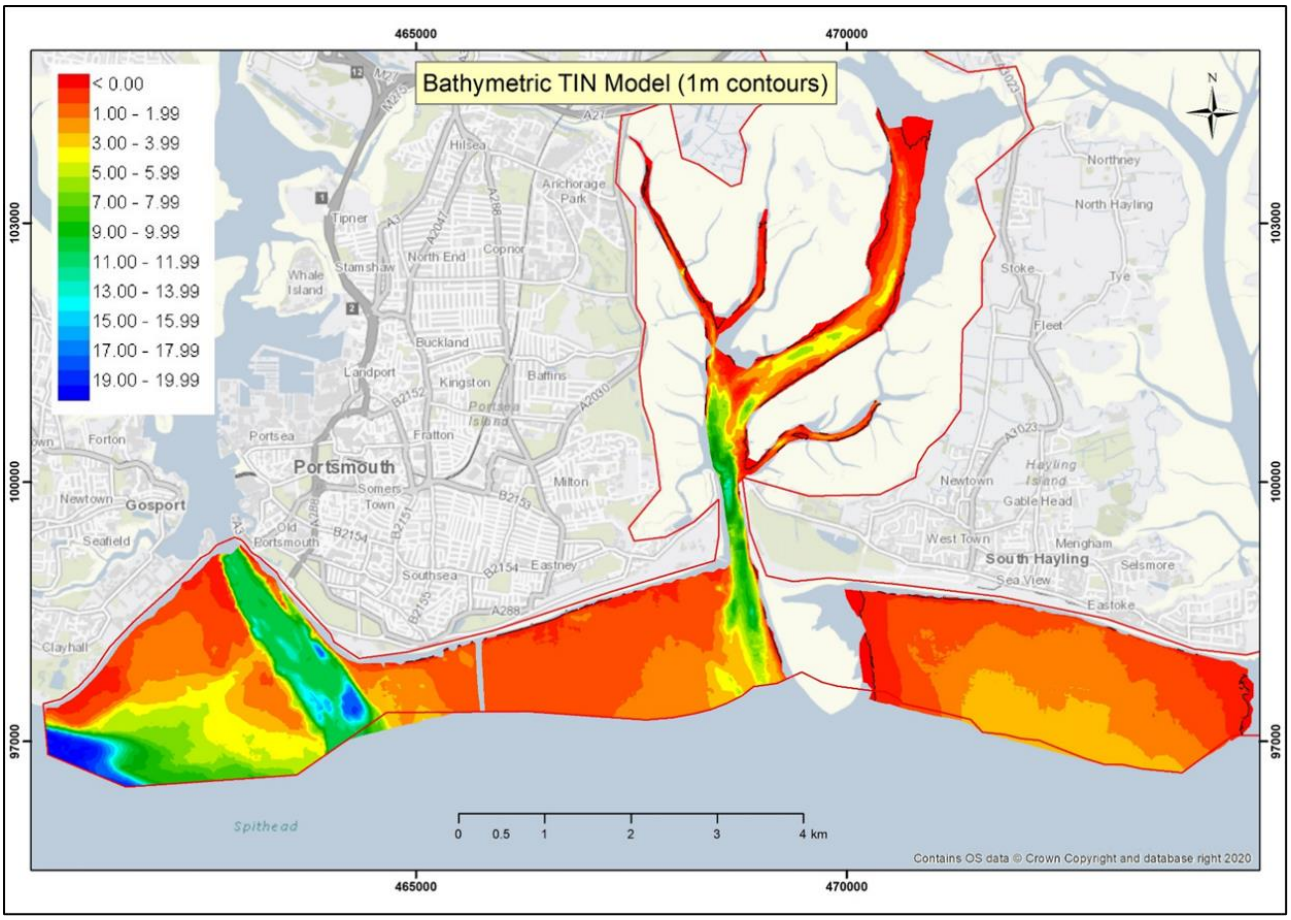
3.1.3 Area 2 (south of Eastney) and Area 3 (south of South Parade Pier) were very similar to Area 1, with depths ranging between 0 and 3m across most of the area (Graphic 3-3). However, in Area 2 the approach channel to Langstone Harbour is clearly visible with a maximum depth of 13.3m recorded in the middle of the channel. The channel is not routinely dredged and would have been created by the high tidal flows in and out of Langstone Harbour. It is approximately 200m wide at the entrance to the harbour and approximately 400m wide at its widest point. The sides of the channel were found to be reasonably steep (approximately 6.84 degrees) with depths increasing from approximately 3m to 9m below ACD over a horizontal distance of approximately 50m at the steepest point. In the westernmost section of Area 3, which marks the eastern edge of the Portsmouth Harbour approach channel, the depths were seen to increase slightly to approximately 5m below ACD.

3.1.4 With the exception of the Portsmouth Harbour approach channel, which is subject to routine maintenance dredging, the depths in Area 4 increase toward the south and west of the area, away from Portsmouth Harbour entrance (Graphic 3-4). The deepest section, located in the south-west of Area 4, with depths between 15m and 20m below ACD, forms part of the main navigational channel in the eastern Solent. Inshore of this deeper-water section the depths increase reasonably gradually toward the coast, with the inshore 1km of Area 4 being very similar to Area 1 to Area 3 in terms of the bathymetry.

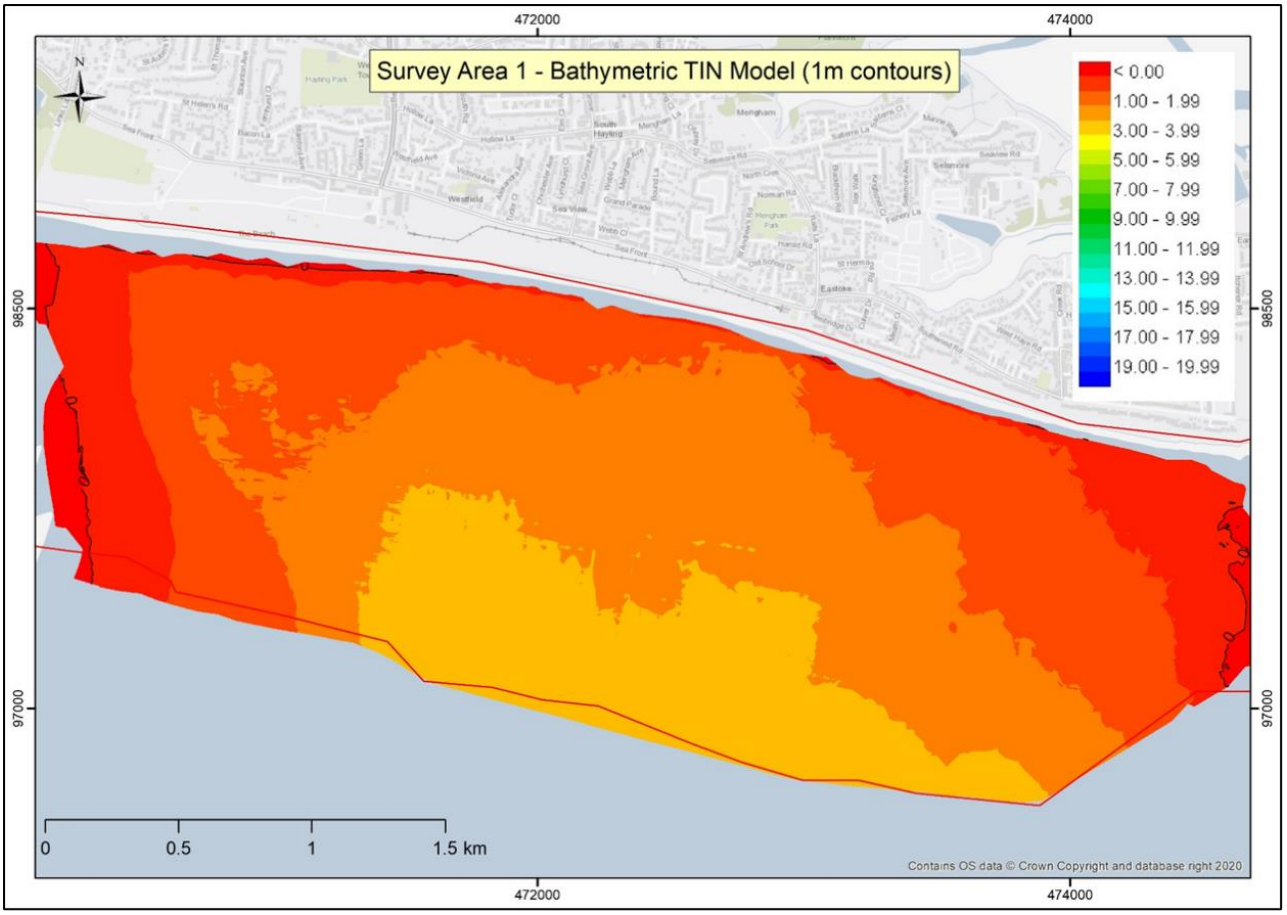
3.1.5 The bathymetry in Area 5, which covers Langstone Harbour and its entrance channel, is shown in Graphic 3-5. A deeper-water channel, which extends through the entrance and approximately 1km into the harbour was found to have average depths in the range of 5 to 10m below ACD, and a maximum depth of 13.5m. A wide navigable channel, with depths between 1m and 5m below ACD, was identified running north-east from the main entrance channel. The area where these two channels meet forms a central basin within the harbour. Outside of the

main channels, Langstone Harbour was found to be very shallow with large intertidal areas interspersed with smaller shallow channels.

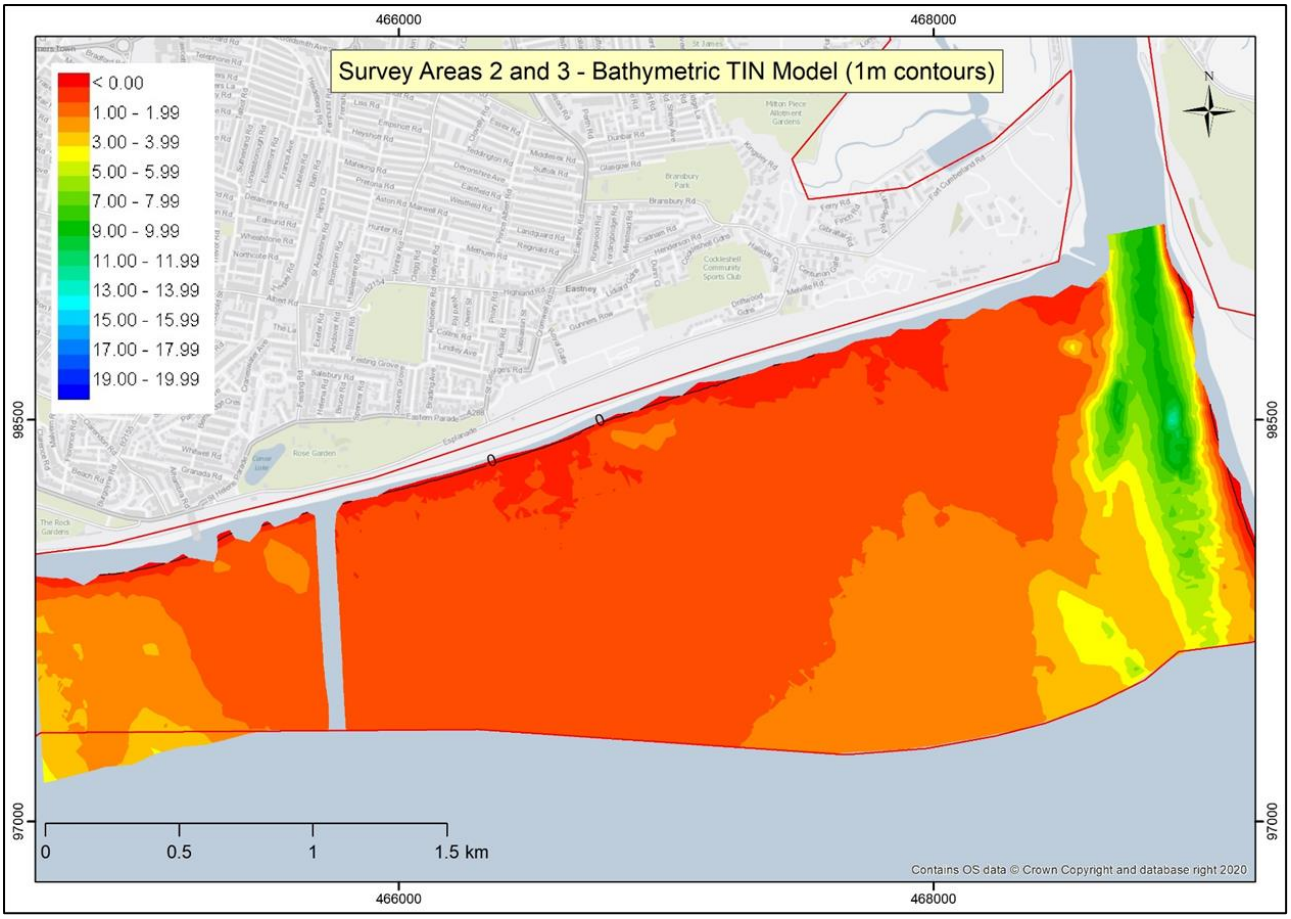
Graphic 3-1 Bathymetric Triangulated Irregular Network model of the area surveyed in 2022. Contours at 1m intervals.



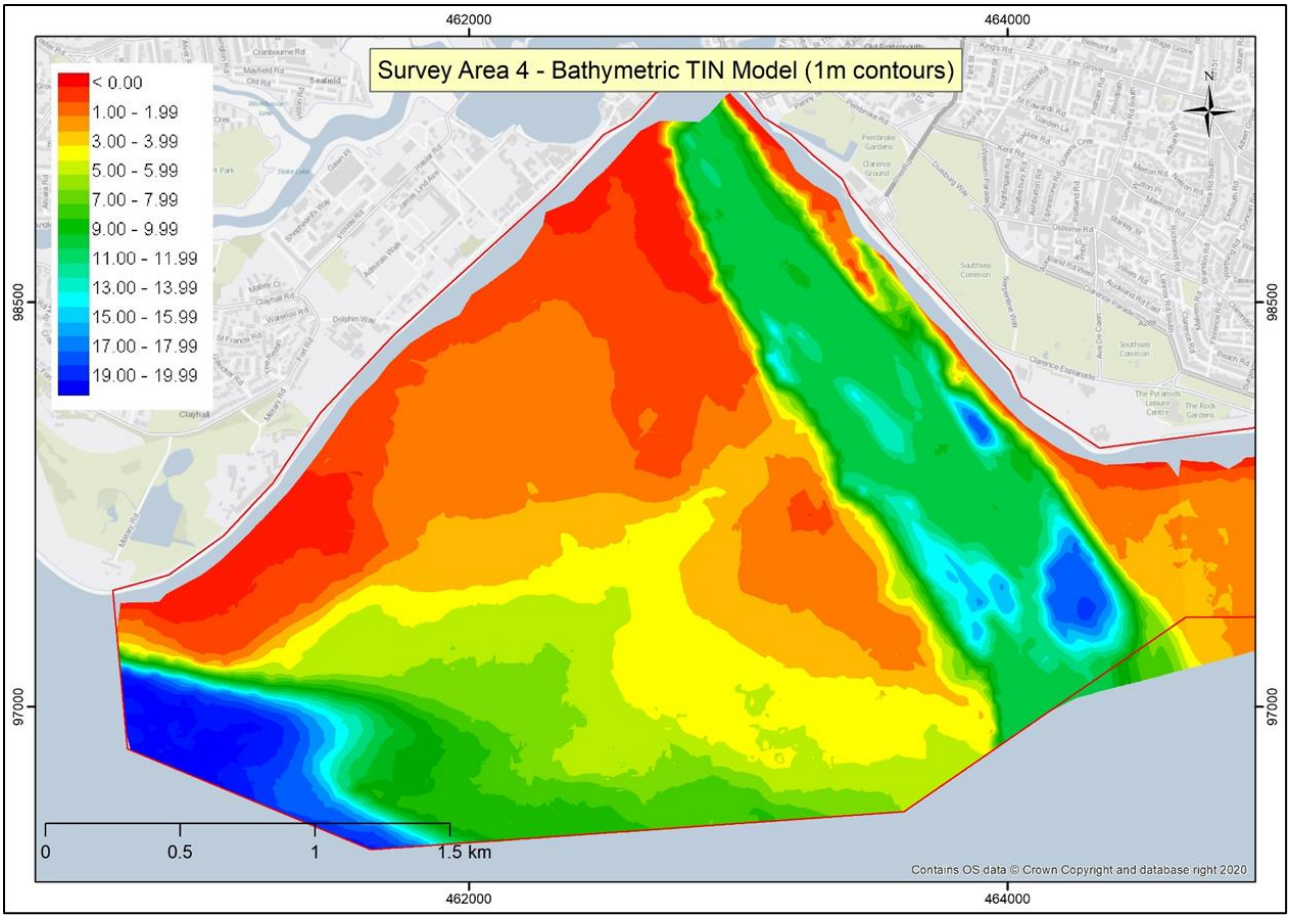
Graphic 3-2 Bathymetric Triangulated Irregular Network model of Area 1 (south of Hayling Island), surveyed in 2022. Contours at 1m intervals.



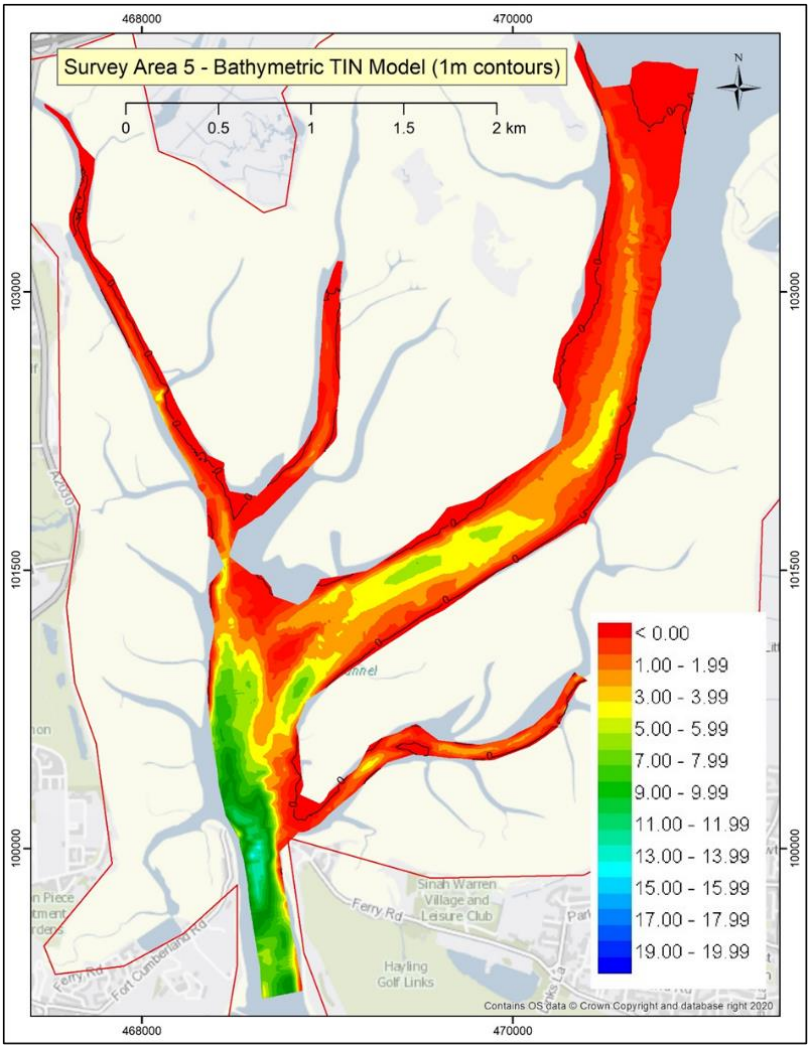
Graphic 3-3 Bathymetric Triangulated Irregular Network model of Area 2 (south of Eastney) and Area 3 (south of South Parade Pier), surveyed in 2022. Contours at 1m intervals.



Graphic 3-4 Bathymetric Triangulated Irregular Network model of Area 4 (Approaches to Portsmouth Harbour), surveyed in 2022. Contours at 1m intervals



Graphic 3-5 Bathymetric Triangulated Irregular Network model of Area 5 (Langstone Harbour), surveyed in 2022. Contours at 1m intervals.



3.2 Sidescan sonar

3.2.1 Following line-by-line analysis of the processed sidescan sonar data and assessment of the sidescan sonar mosaics, areas of distinct acoustic return, which could signify the location of different habitat types or seabed features, were identified. Examples of the types of return identified are provided in section 4.

3.2.2 The results from the sidescan sonar suggested that throughout Area 1, Area 2, Area 3 and Area 4 the majority of the sediment was fairly uniform and was likely to consist of mixed sediment comprising mud, sand, and fine gravel. Within Area 1 there were three main features of interest comprising: megaripples, which were located in the south-central area; coarse sediments forming a distinct bathymetric feature in the west of the area; and an area of indeterminate bedforms, possibly comprising sand and gravel, interspersed with small patches of megaripples, in the east (Graphic 3-6).

3.2.3 The main areas of megaripples were present as very distinct linear bands, running north to south, up to 600m long and approximately 45m wide. The distance between the megaripple peaks was found to be approximately 1.5m, and the shape of the ripples suggests that they would have been formed by an offshore current, with the steepest side of the ripples facing the direction of current flow. The coarse

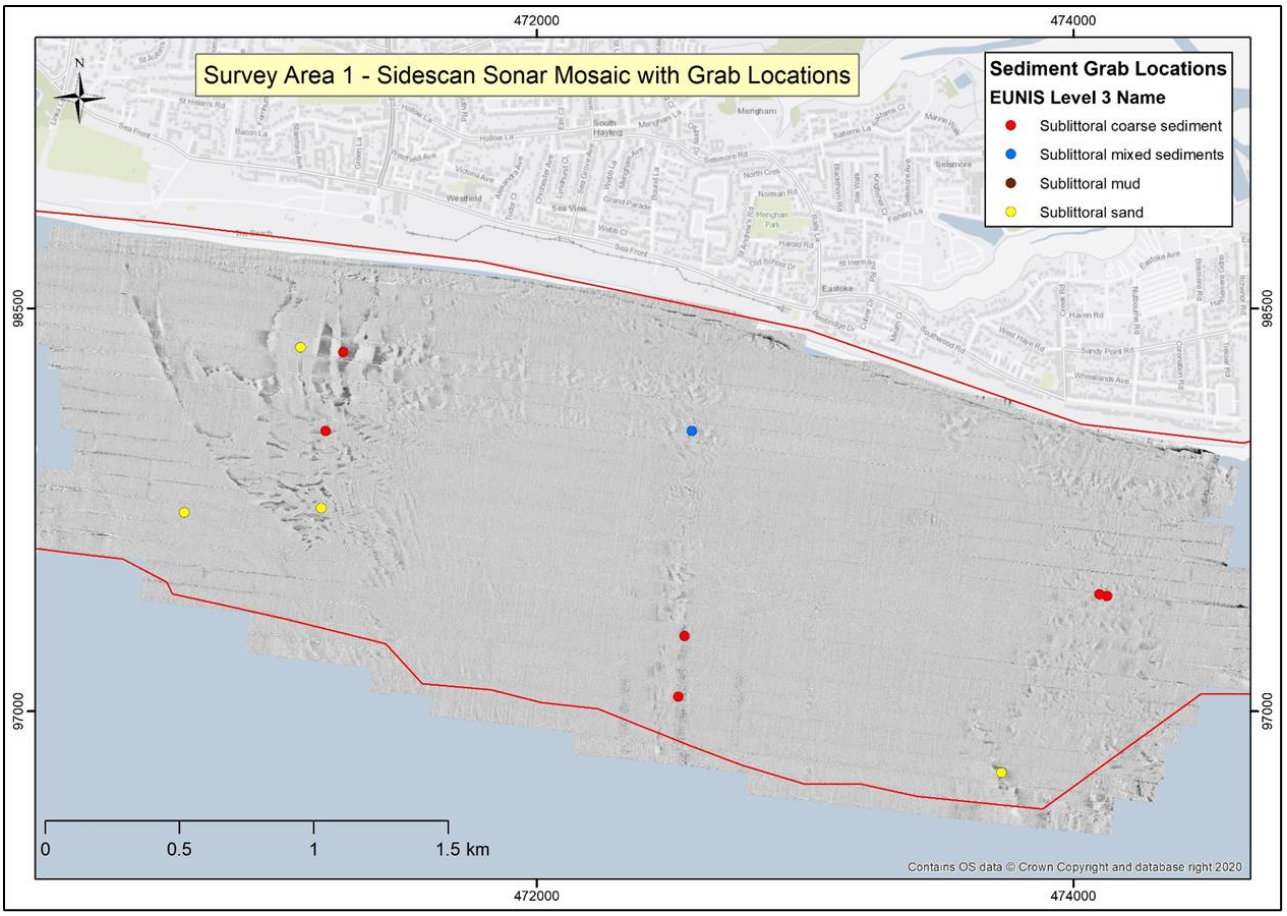
sediment beds in the west of Area 1, which were found to be approximately 0.5m higher than the surrounding sediment, returned a much darker image from the sidescan, suggesting that they comprised coarser material.

3.2.4 The sidescan mosaic of Area 2 and Area 3 is shown in Graphic 3-7. In the centre of Area 2, an area of sediment, likely comprising sand and gravel, was identified, with indeterminate bedforms present. Inshore and to the west of this area, a small area of sediment that was slightly deeper than the surrounding seabed was identified and comprised what appeared to be mixed sediment. In the west of Area 2, some small patches of harder return were identified, likely consisting of large cobbles with evidence of algae growth.

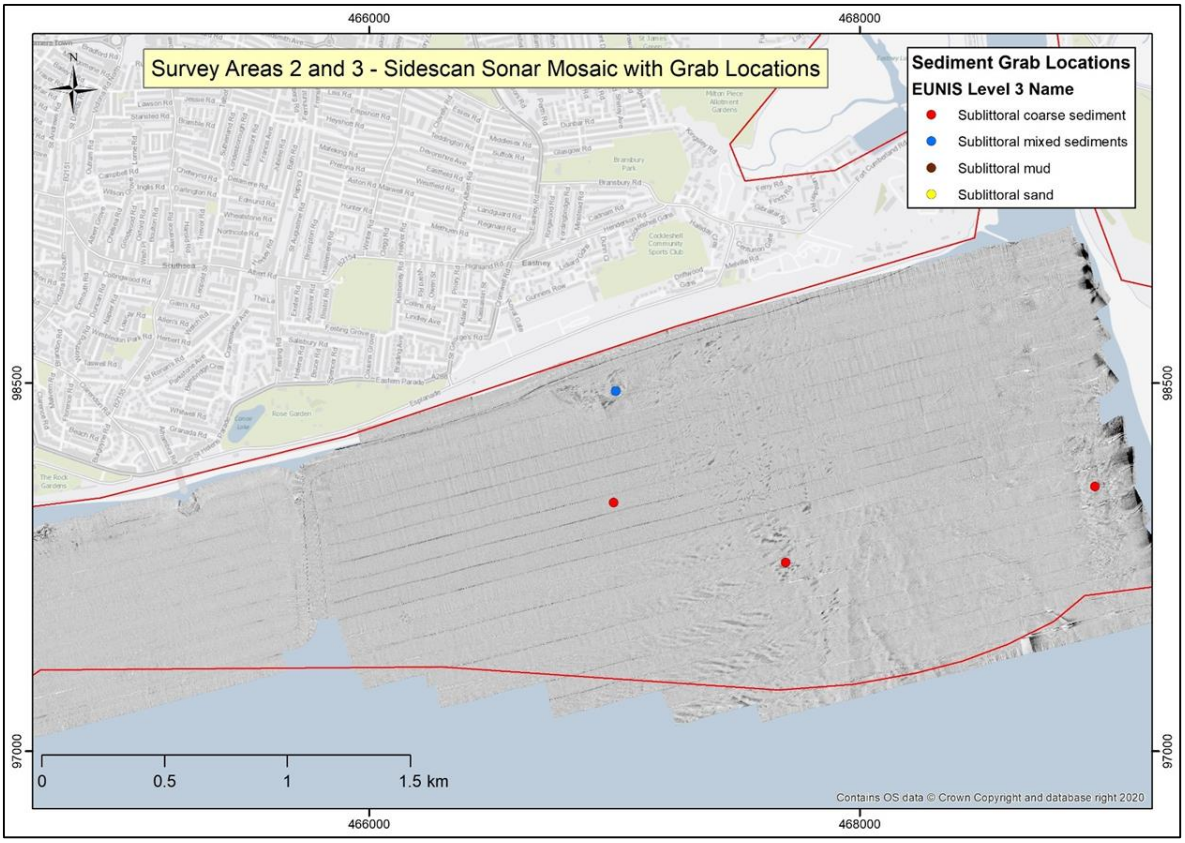
3.2.5 The data from Area 4 showed a series of bedform features and potential changes in sediment type across much of the area (Graphic 3-8). The south-west region of Area 4 covered an anchorage used by navy vessels and some commercial vessels waiting to enter Portsmouth Harbour, and large numbers of anchor scars were observed in the data in this area. Just inshore of the anchor scars were areas of indeterminate bedforms and megaripples composed of mixed coarse sediment.

3.2.6 The data from Area 5 suggest that much of the subtidal regions of Langstone Harbour comprise mud and fine sand, with discrete areas of coarser mixed material (Graphic 3-9). There were several areas of megaripples, likely caused by the high current flows in the main channels, as well as some areas with indeterminate bedforms.

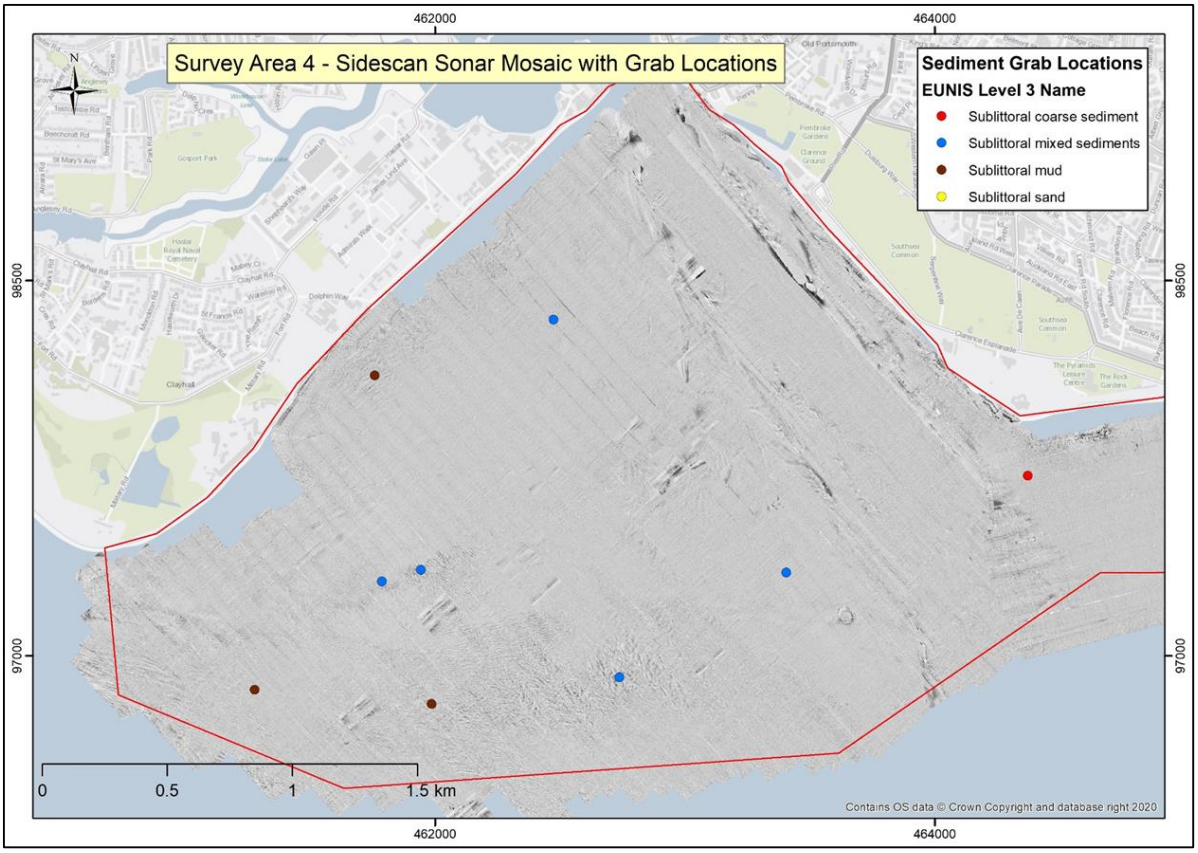
Graphic 3-6 Sidescan sonar mosaic of Area 1 surveyed during the 2022 Seafloor Characterisation Survey with grab locations



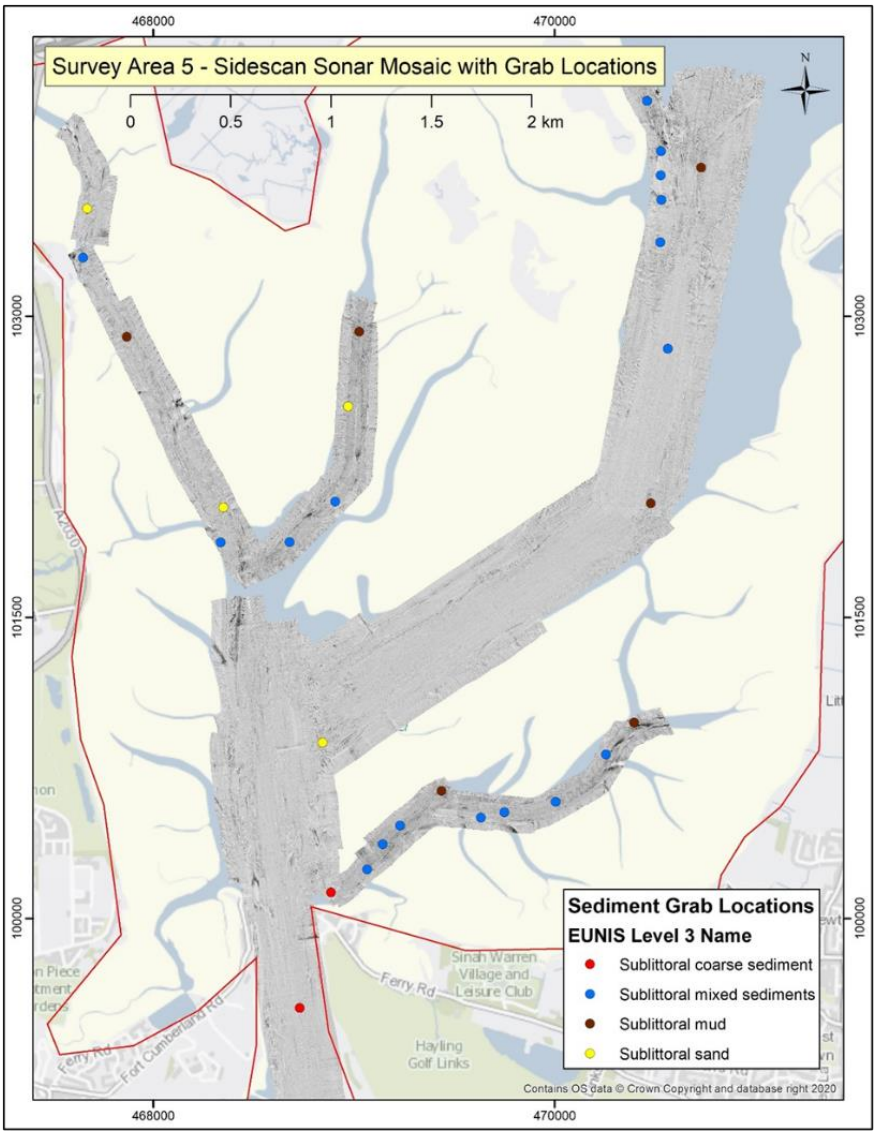
Graphic 3-7 Sidescan sonar mosaic of Area 2 and Area 3 surveyed during the 2022 Seafloor Characterisation Survey with grab locations



Graphic 3-8 Sidescan sonar mosaic of the Area 4 surveyed during the 2022 Seafloor Characterisation Survey with grab locations



Graphic 3-9 Sidescan sonar mosaic of Area 5 surveyed during the 2022 Seafloor Characterisation Survey with grab locations



3.3 Habitat distribution

3.3.1 The habitat maps created based on the acoustic data analysis and the PSA results are shown from Graphic 3-10 to Graphic 3-14. The areas of seabed that are not covered by habitat polygons are likely to consist of mixed sediments comprising mud, sand, and gravel, with no obvious bedform features (excluding the approach channel to Portsmouth Harbour).

3.3.2 The habitat types identified and delineated by polygons are a combination of the EUNIS level 3 classification and the bedform feature(s) present. The bedform features throughout the entire survey area were considered to be of significant importance when considering the range of habitats present and would likely require additional investigation if more detailed habitat mapping was undertaken.

3.3.3 The PSA results indicated that the sediment throughout the entire survey area was generally coarser in nature than the initial assessment of the sidescan sonar data had suggested.

3.3.4 Within Area 1, a total of three separate habitat types were identified, separate from the surrounding sediment. These comprised: sublittoral sediment with megaripples; sublittoral sand with coarse sediment beds; and sublittoral sand and gravel with indeterminate bedforms (Graphic 3-10).

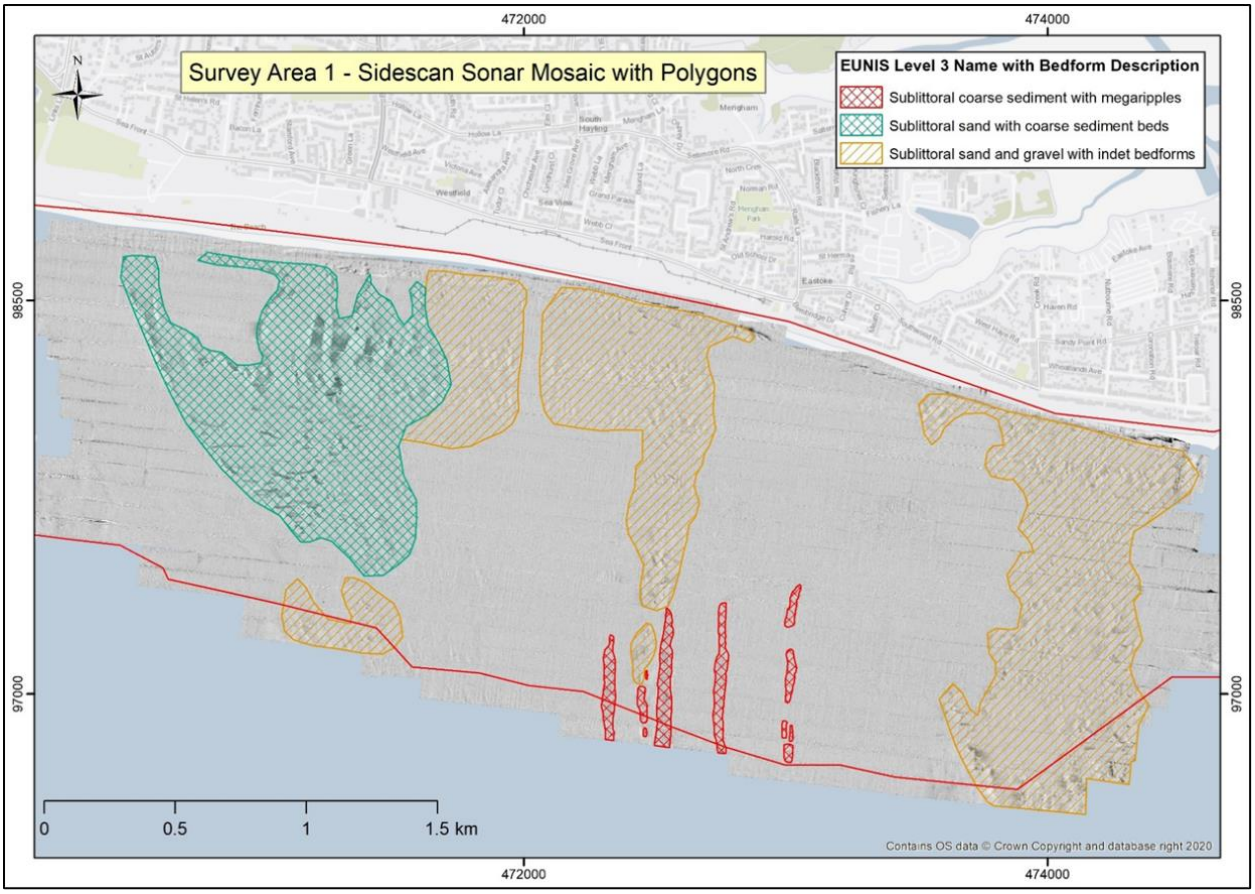
3.3.5 An area of sublittoral sand and gravel with indeterminate bedforms was also identified within Area 2, together with sublittoral mixed sediment, and an area of cobbles with algal coverage (Graphic 3-11).

3.3.6 Three separate habitat types were identified in Area 4: sublittoral mixed sediment with megaripples; sublittoral mixed sediment with indeterminate bedforms; and sublittoral mud (Graphic 3-12).

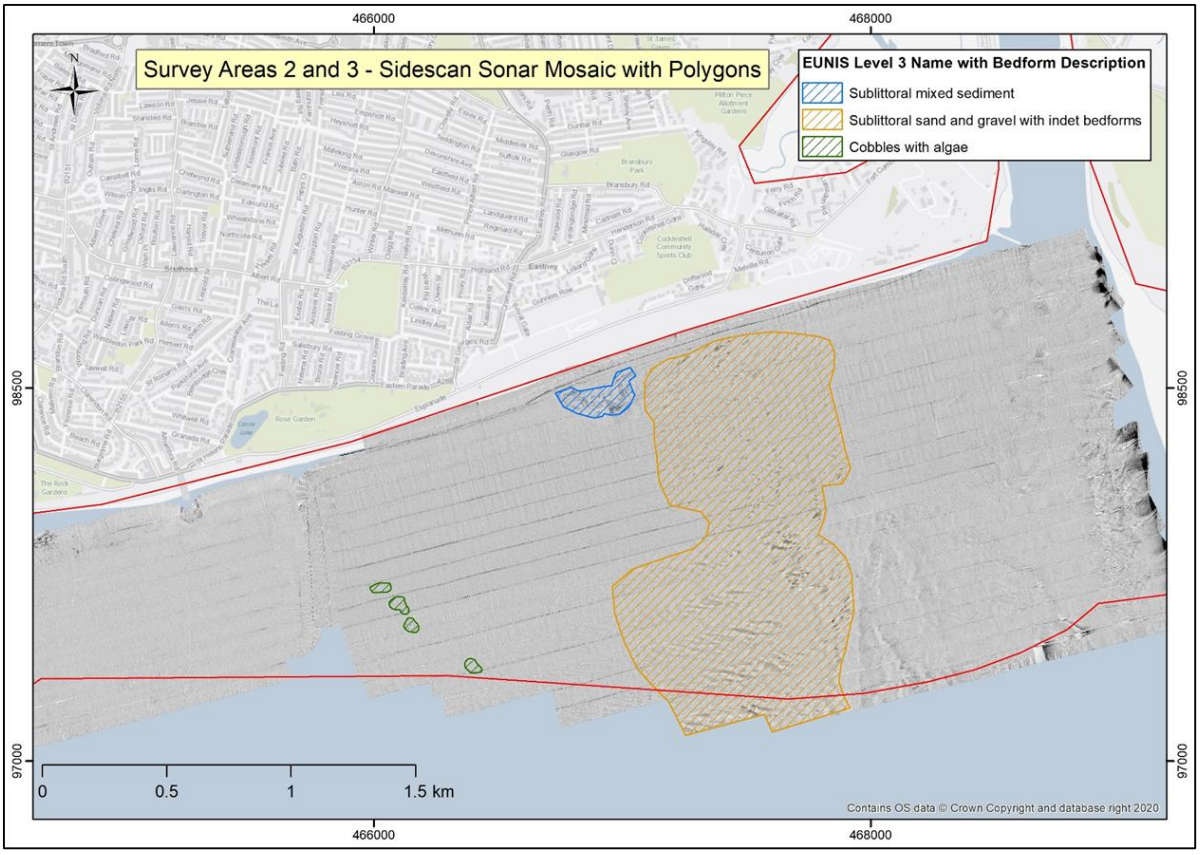
3.3.7 Langstone Harbour (Area 5) was the most diverse of the five areas surveyed, with a total of six habitat types identified. These comprised: sublittoral coarse sediment with megaripples; sublittoral mixed sediment; sublittoral mud; sublittoral sand; sublittoral sand with megaripples; and undefined sediment with megaripples (Graphic 3-13).

3.3.8 Excluding the non-polygon area likely consisting of mixed sediments, 11 separate habitat types, based on EUNIS level 3 classification and the presence of bedform features, were identified across the whole survey area (Graphic 3-14).

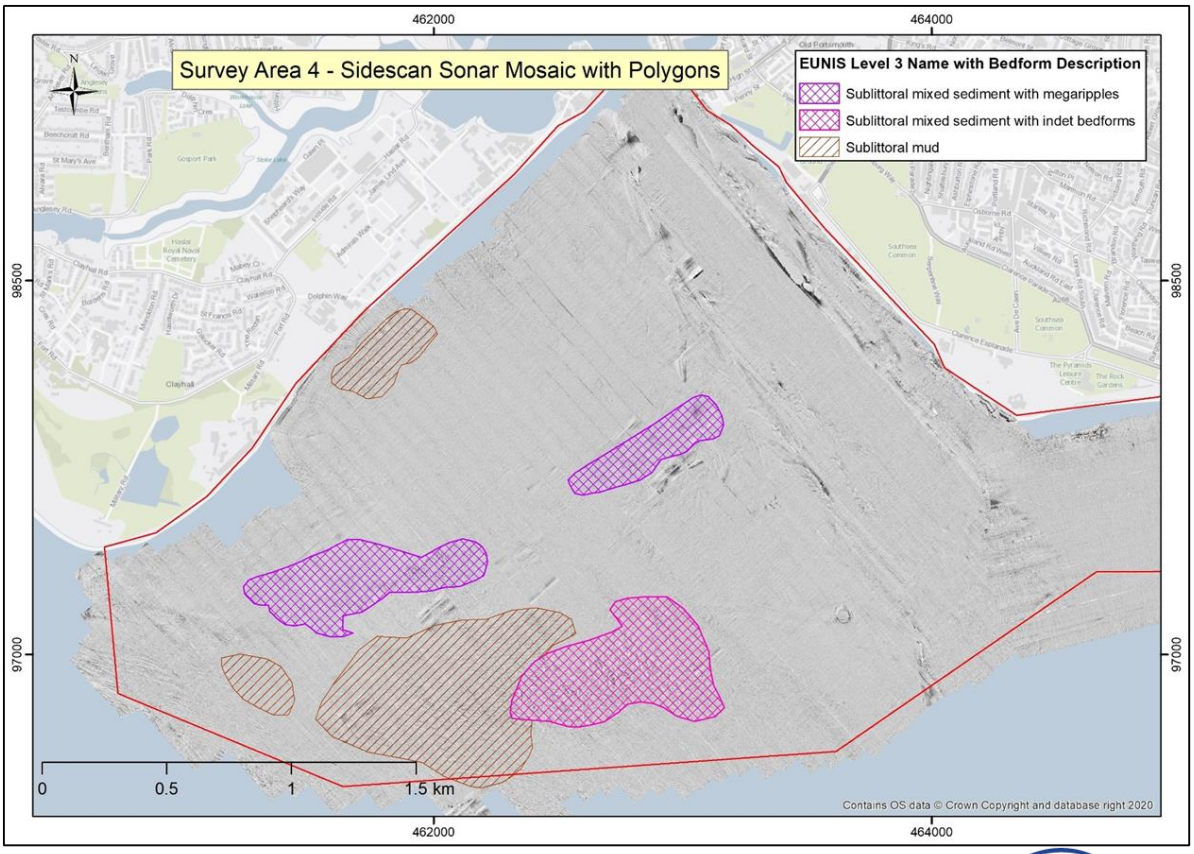
Graphic 3-10 Sidescan sonar mosaic of Area 1 surveyed during the 2022 Seafloor Characterisation Survey with EUNIS Level 3 polygons



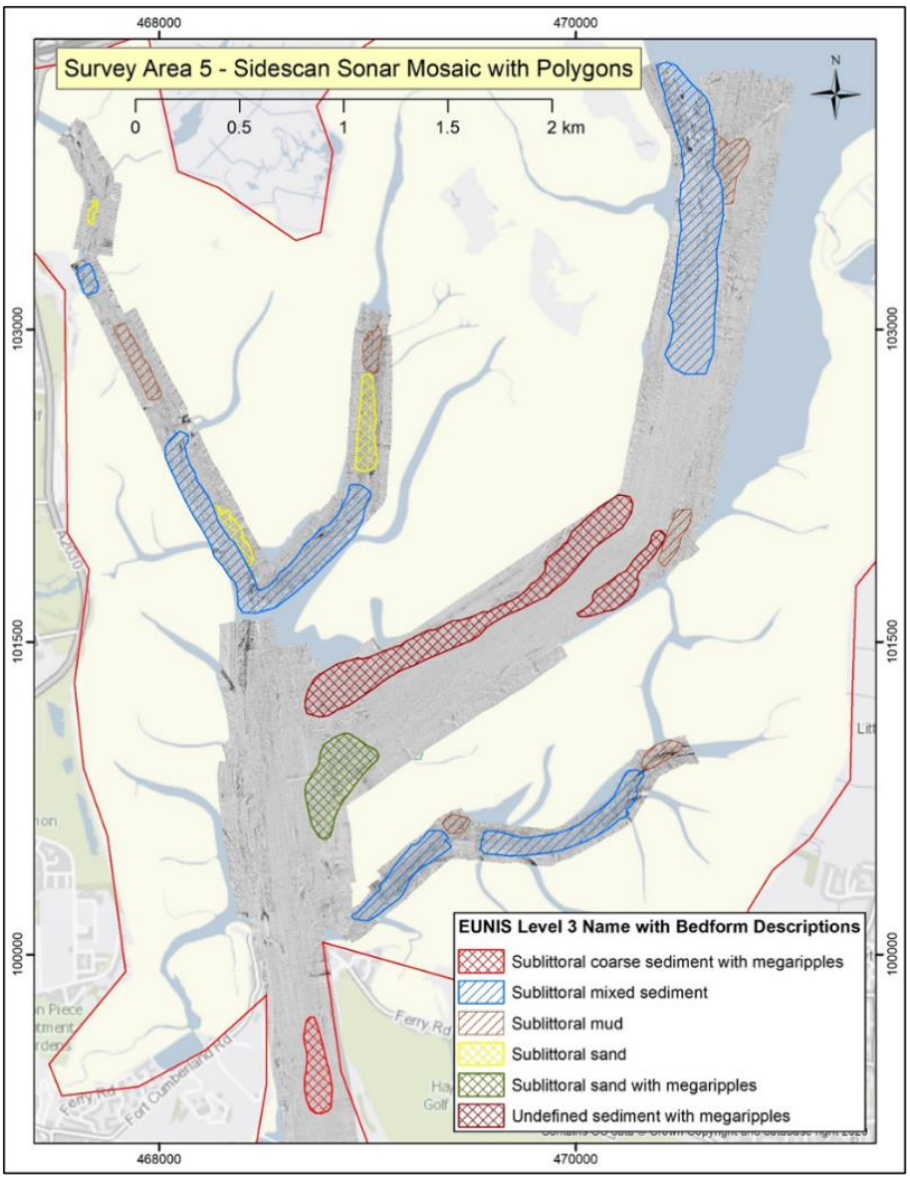
Graphic 3-11 Sidescan sonar mosaic of the Area 2 and Area 3 surveyed during the 2022 Seafloor Characterisation Survey with EUNIS Level 3 polygons



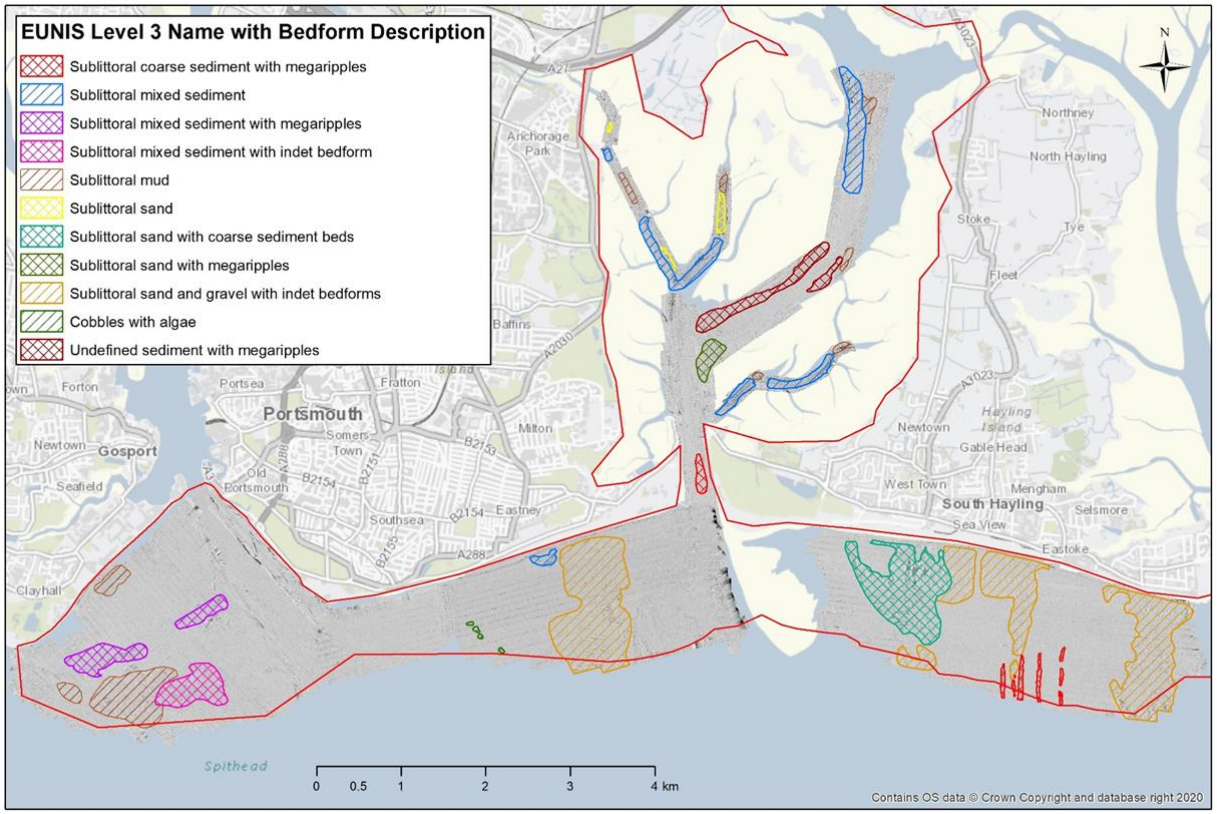
Graphic 3-12 Sidescan sonar mosaic of Area 4 surveyed during the 2022 Seafloor Characterisation Survey with EUNIS Level 3 polygons



Graphic 3-13 Sidescan sonar mosaic of Area 5 surveyed during the 2022 Seafloor Characterisation Survey with EUNIS Level 3 polygons



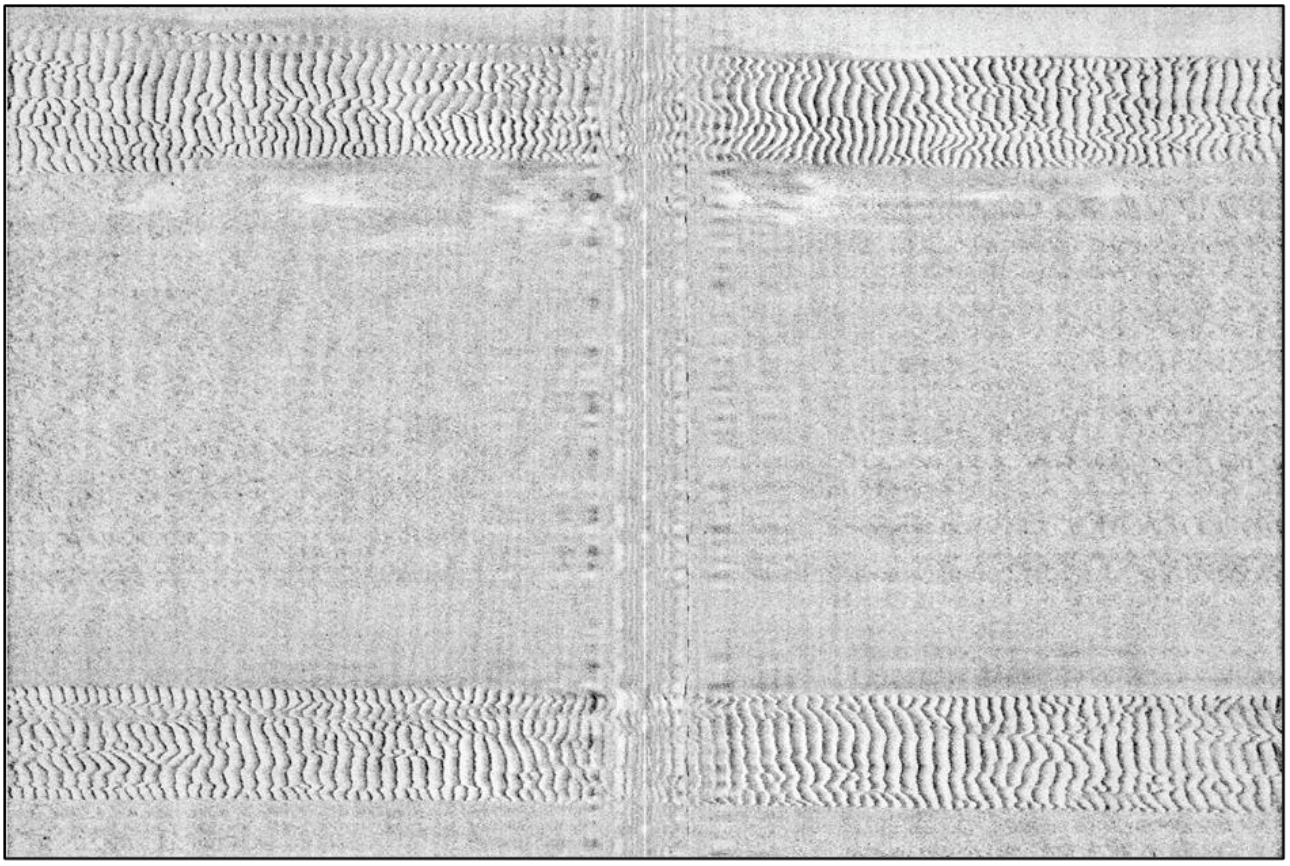
Graphic 3-14 Sidescan sonar mosaic of the area surveyed during the 2022 Seafloor Characterisation Survey with EUNIS Level 3 polygons



4 Sidescan sonar examples of substrate type and bedforms

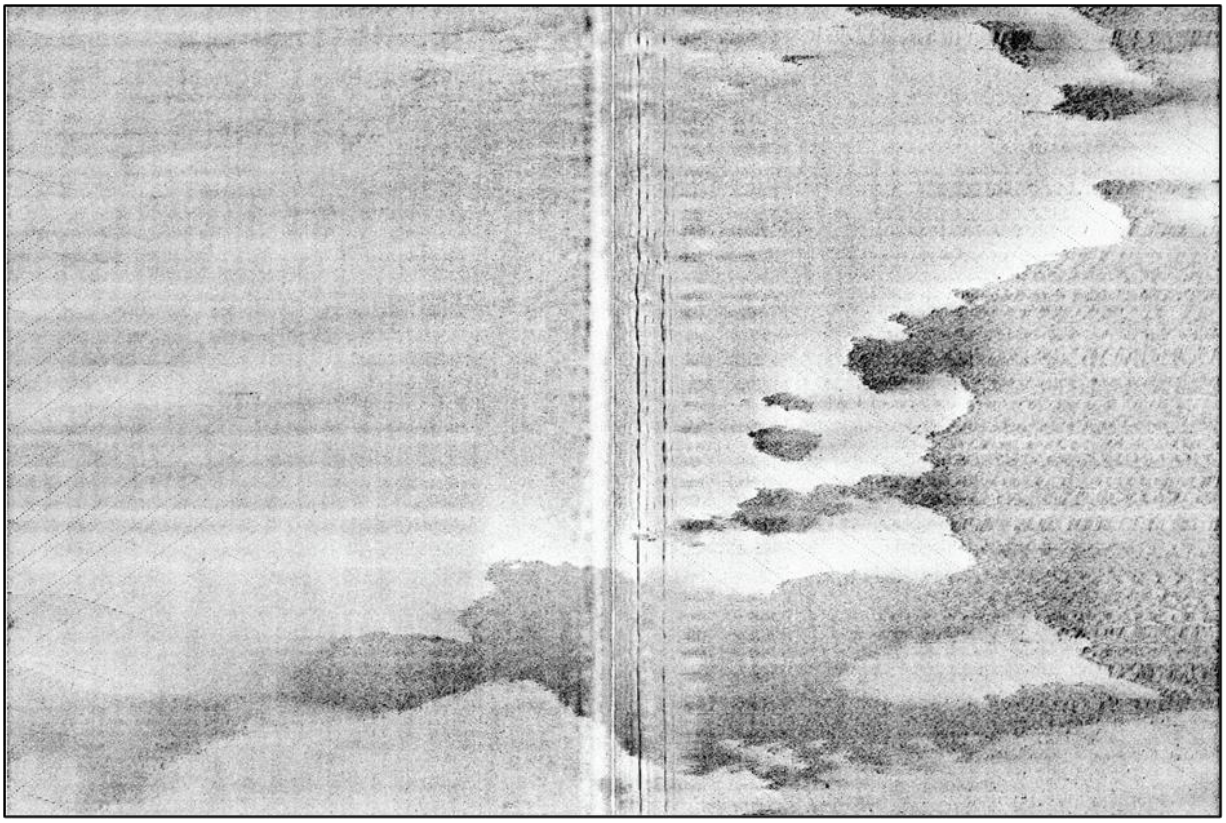
4.1.1 The following images show examples of different substrate types and bedforms identified from the sidescan sonar data during the processing and interpretation process.

Graphic 4-1 Area 1 line 5 – megaripples in the south of Area 1 in water depths of 3-4m

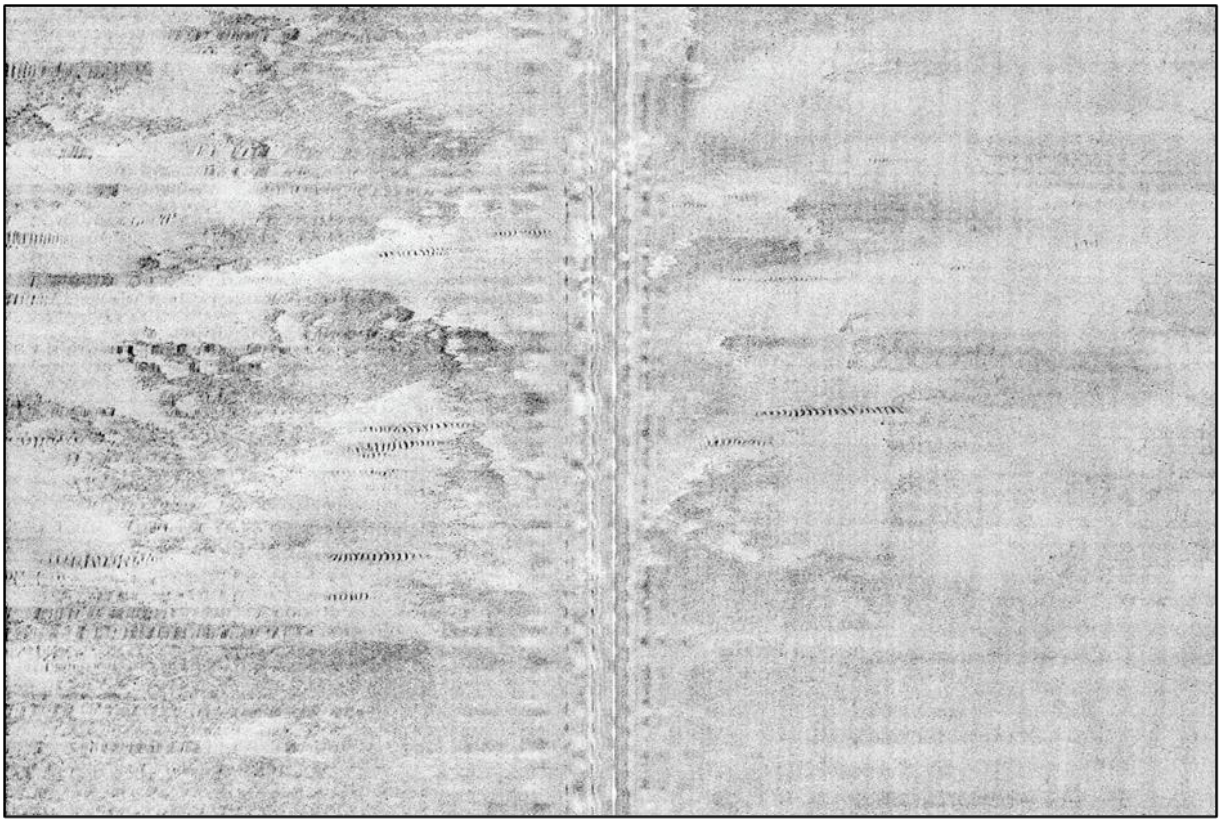


4.1.2 The megaripples were present as very distinct linear bands, running north to south, and measured up to 600m in length and approximately 45m width. The distance between the megaripple peaks was approximately 1.5m, and the shape of the ripples suggests they would have been formed by an offshore current.

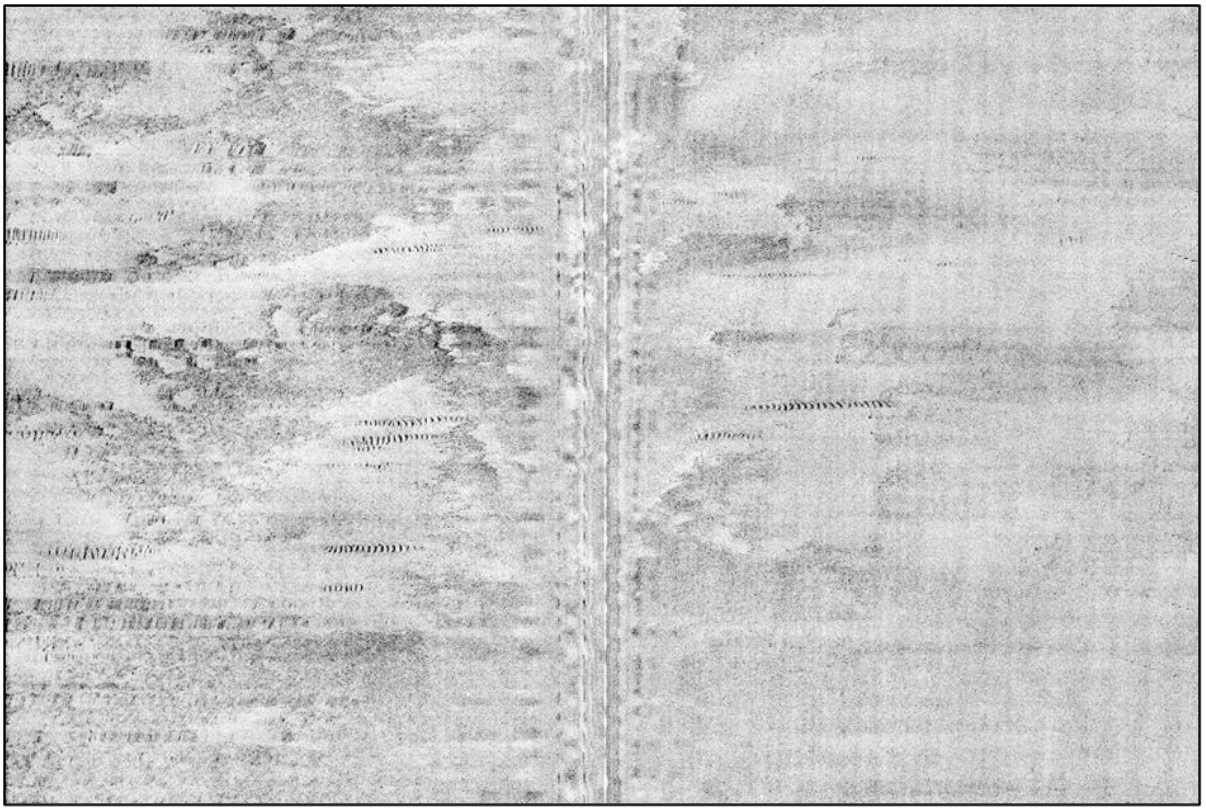
Graphic 4-2 Area 1 line 17 – coarse sediment beds located in the north-west of Area 1. The beds had a height of around 0.5m above the surrounding seabed



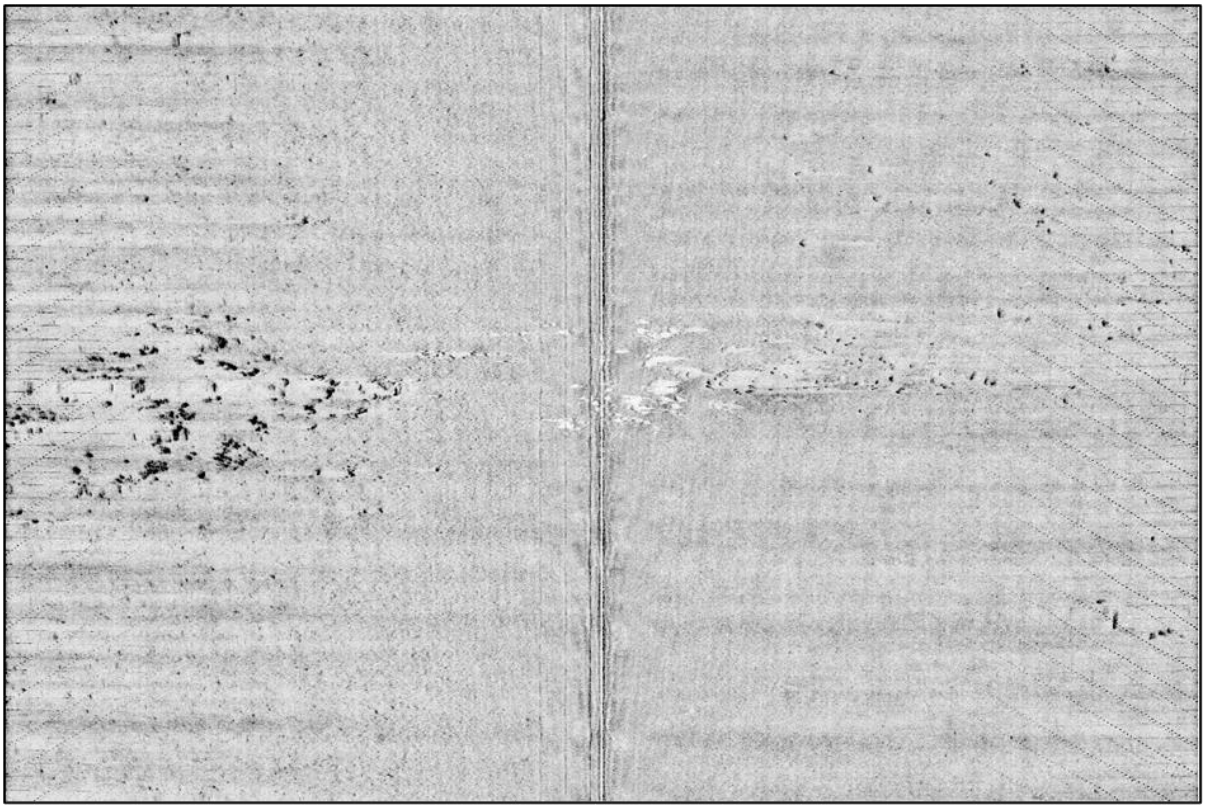
Graphic 4-3 Area 1 line 20 – sand and gravel with indeterminate bedforms and small areas of megaripples



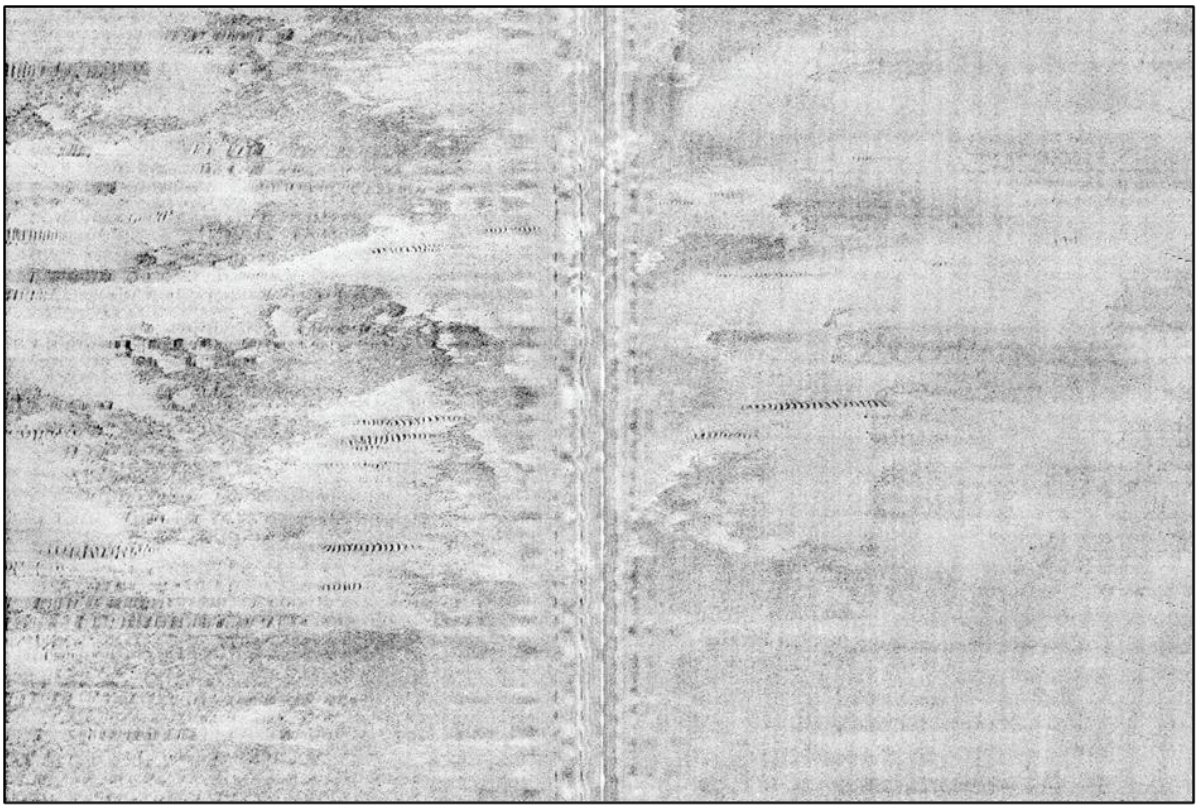
Graphic 4-4 Area 2 line 2 – a patch of coarse mixed sediment close to the beach in Area 2. The dark return on the right of the image is the steep slope of the intertidal beach section between groynes



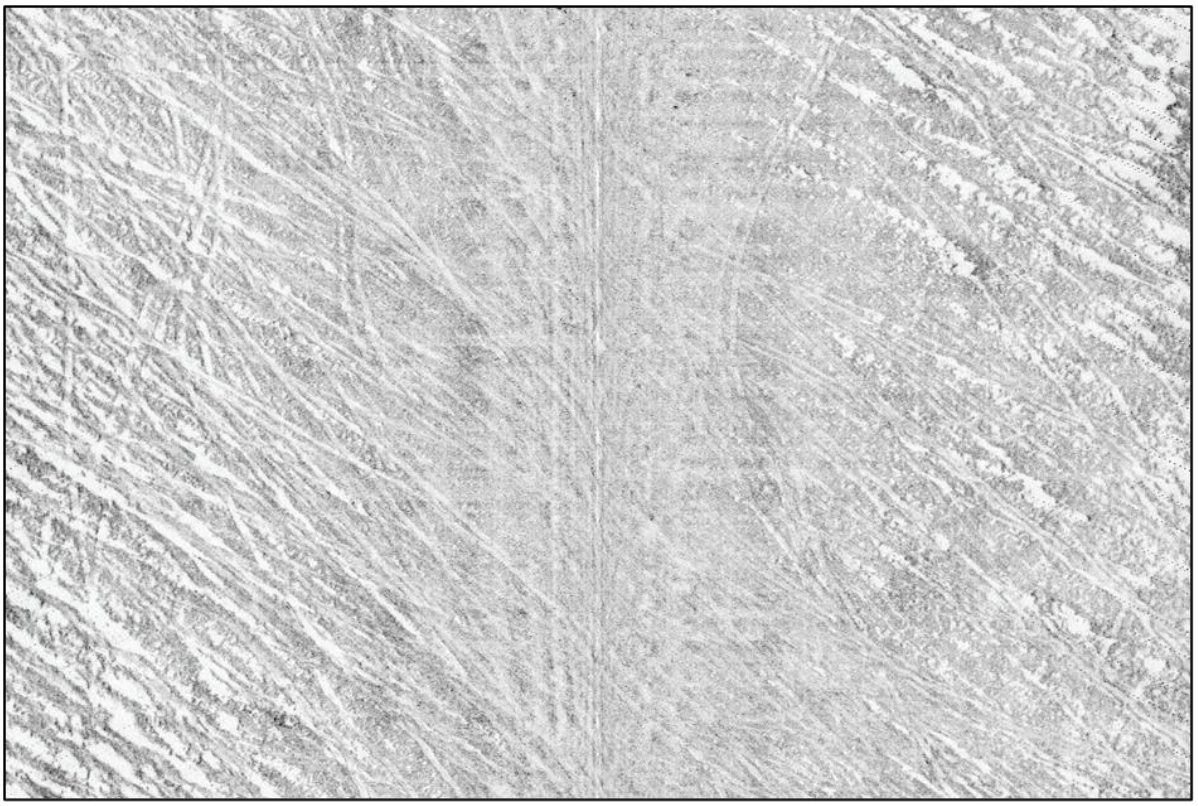
Graphic 4-5 Area 2 line 11 – potential areas of large cobbles with algae. The cobbles are indicated by the areas of darker return, while the lighter areas are acoustic shadow potentially caused by the presence of macroalgae



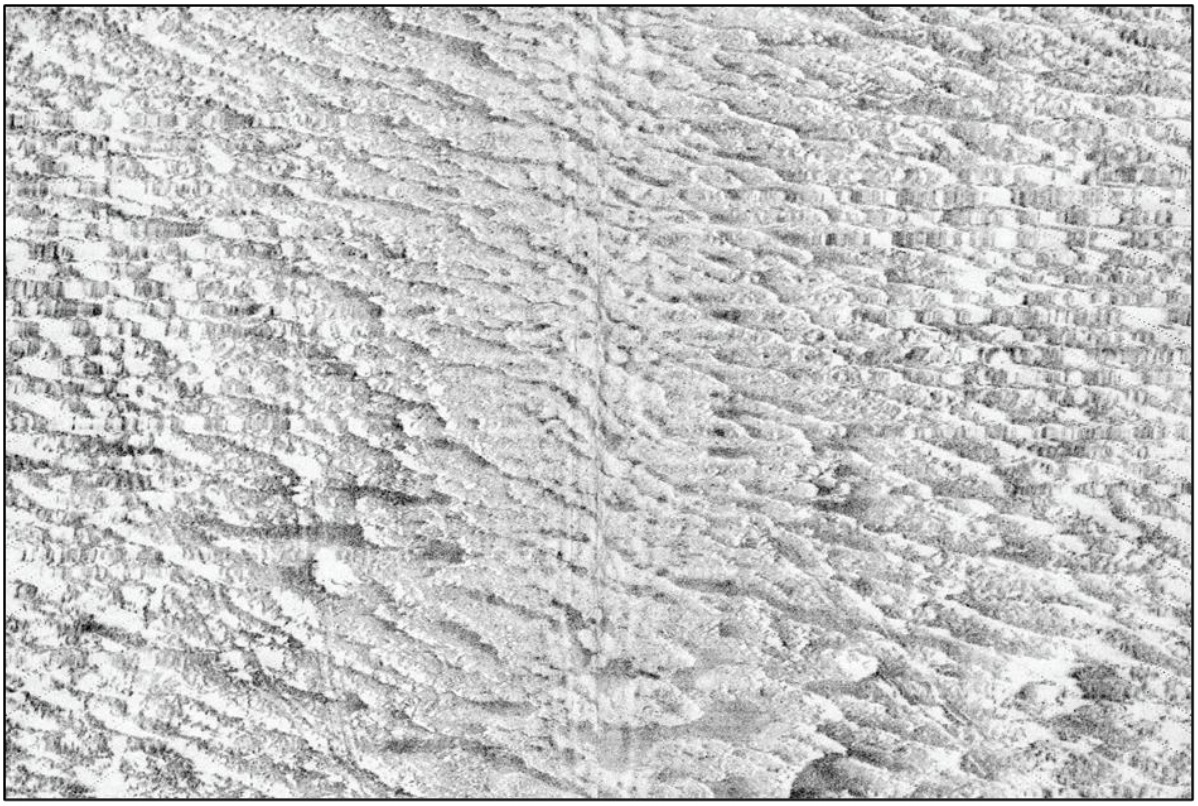
Graphic 4-6 Area 2 line 19 – patches of sand and gravel with indeterminate bedforms



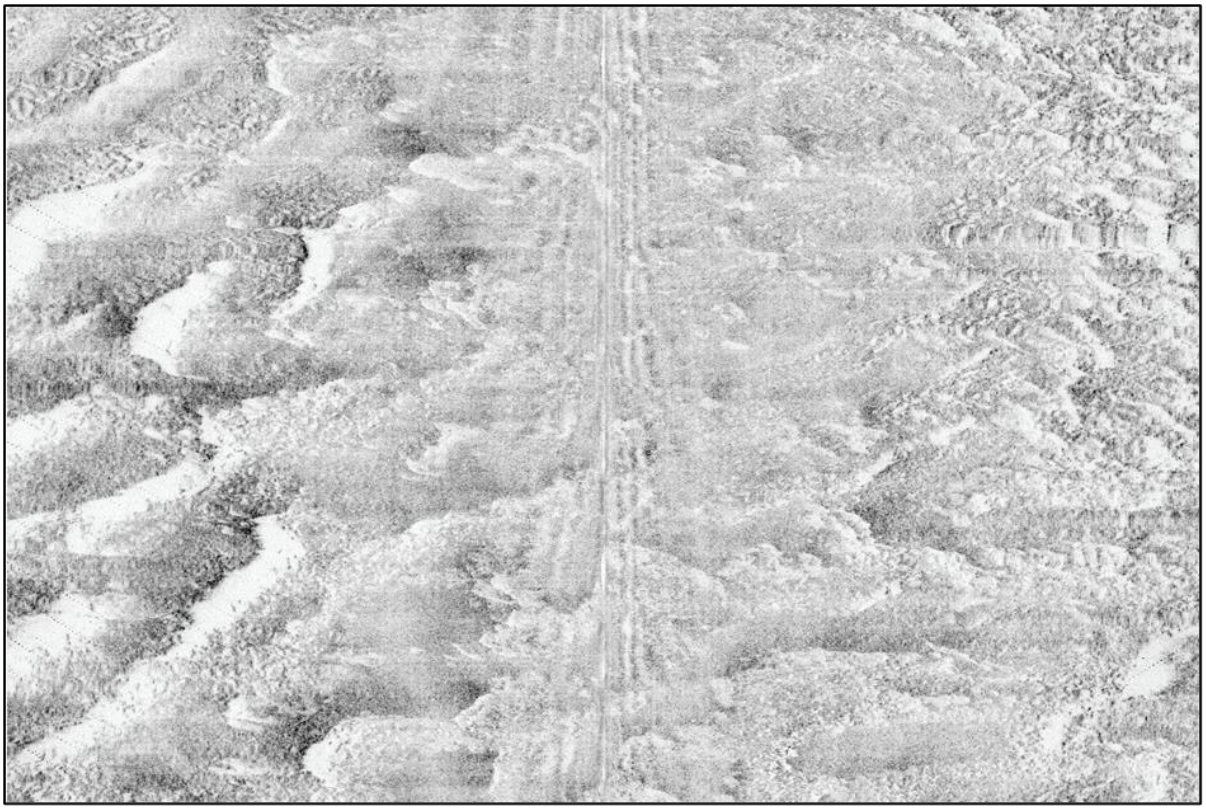
Graphic 4-7 Area 4 line 16 – vessel anchor scars seen in the south-west of Area 4 (water depth between 8 and 9m)



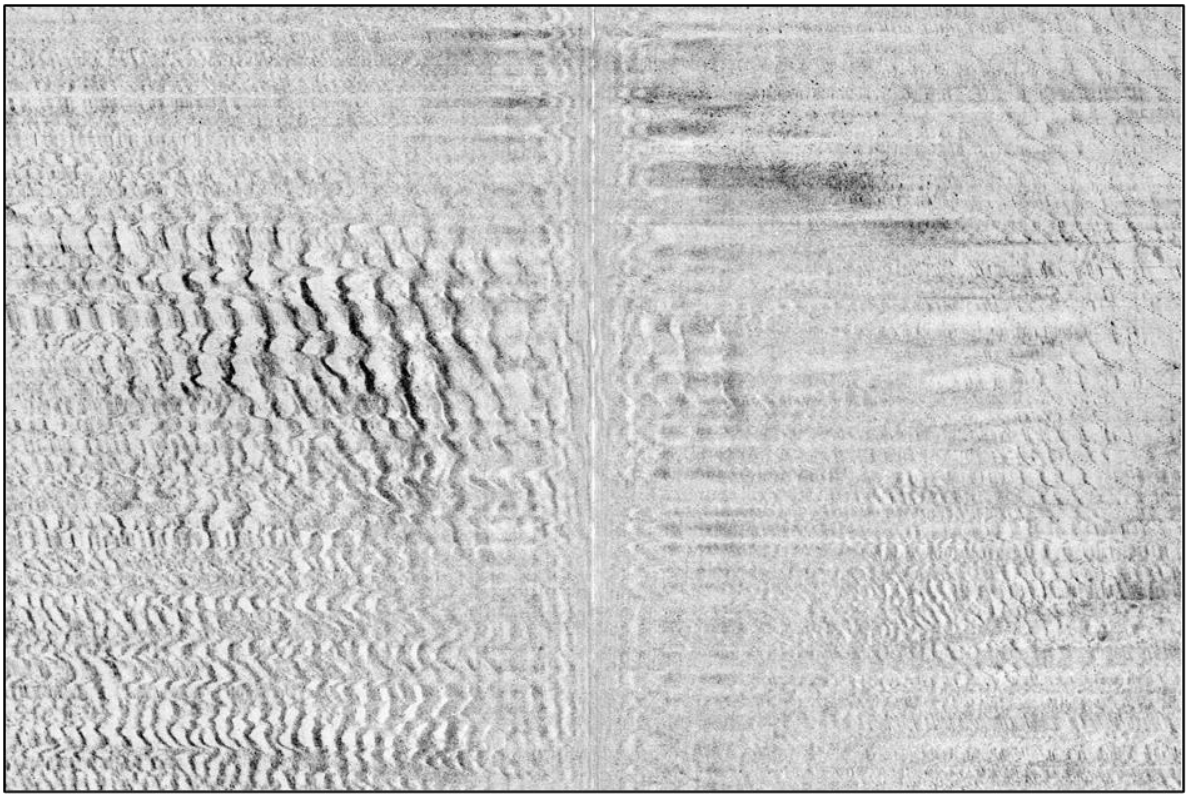
Graphic 4-8 Area 4 line 16 – sublittoral mud with rippled bedforms north of the area of vessel anchor scares (water depth ~7m)



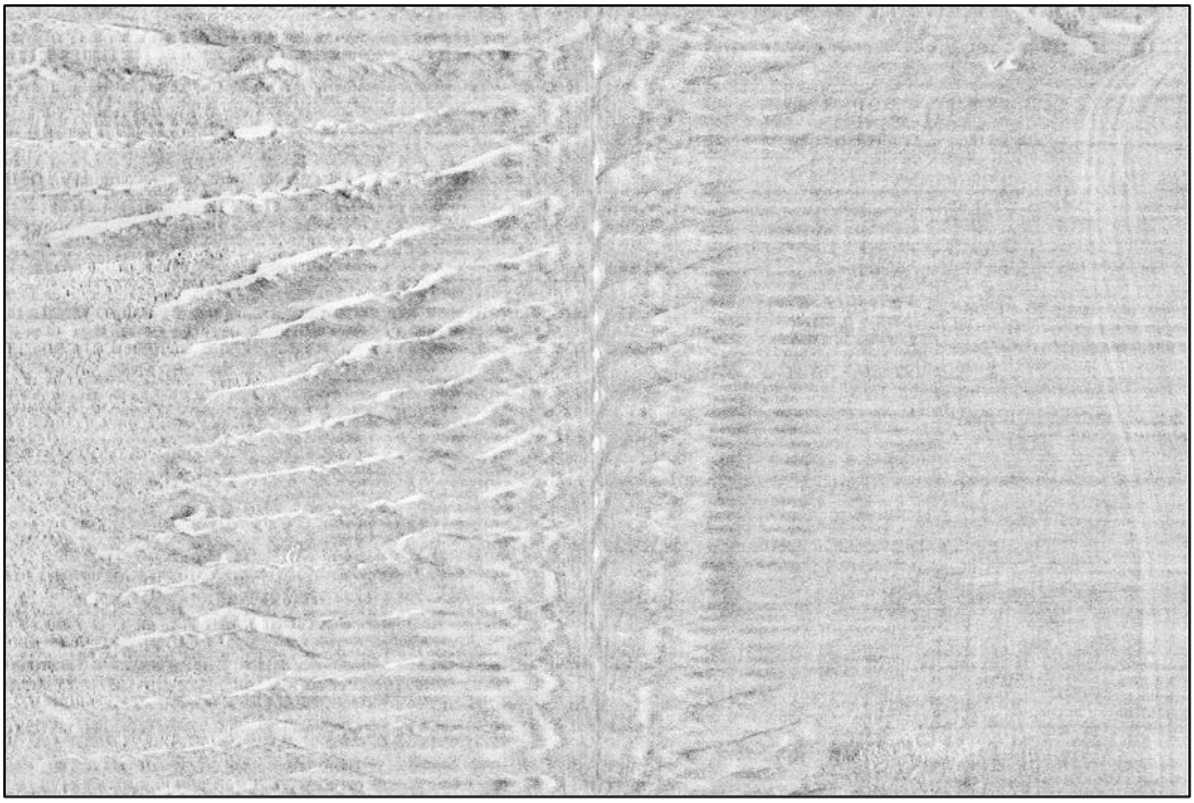
Graphic 4-9 Area 4 line 23 – mixed sediment with indeterminate bedform in the south of Area 4 (water depth ~5m)



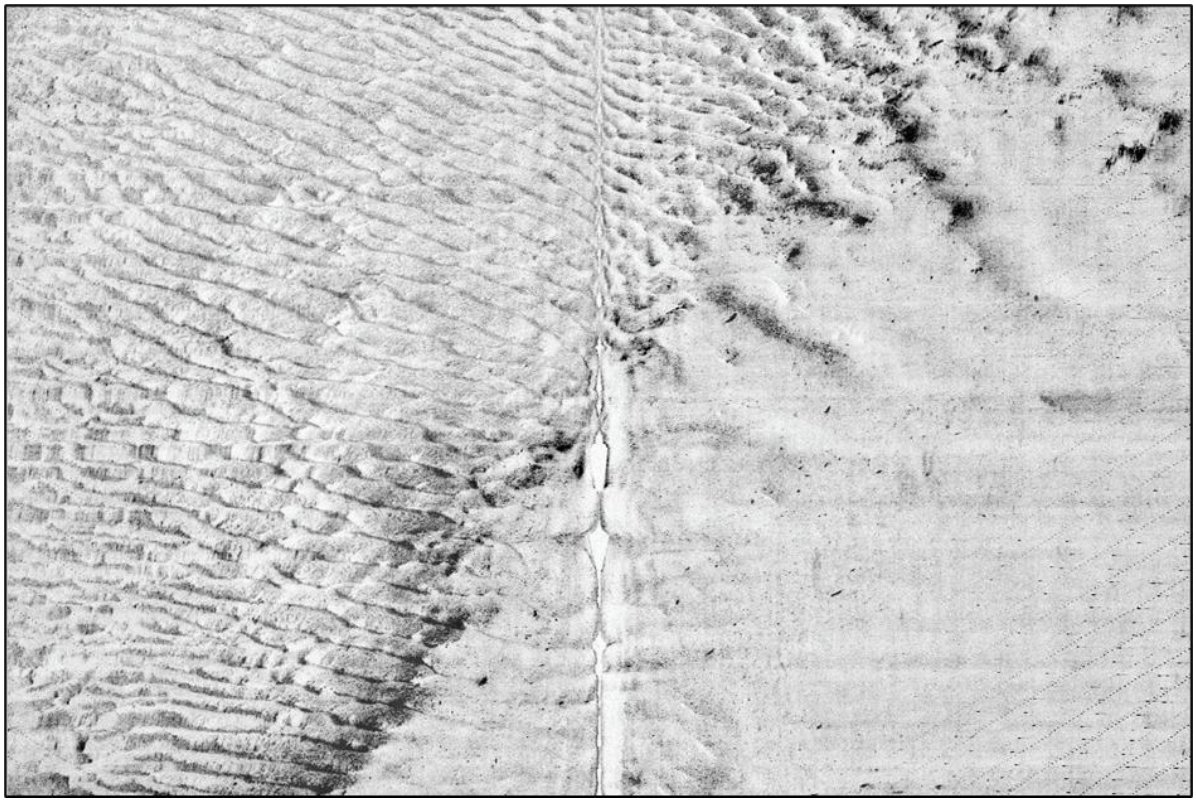
Graphic 4-10 Area 4 line 34 – an area of mixed sediment with megaripples in the west of Area 4 (water depth ~8m). The shape of the ripples suggests they were formed by a current flowing north-east, towards the entrance to Portsmouth Harbour



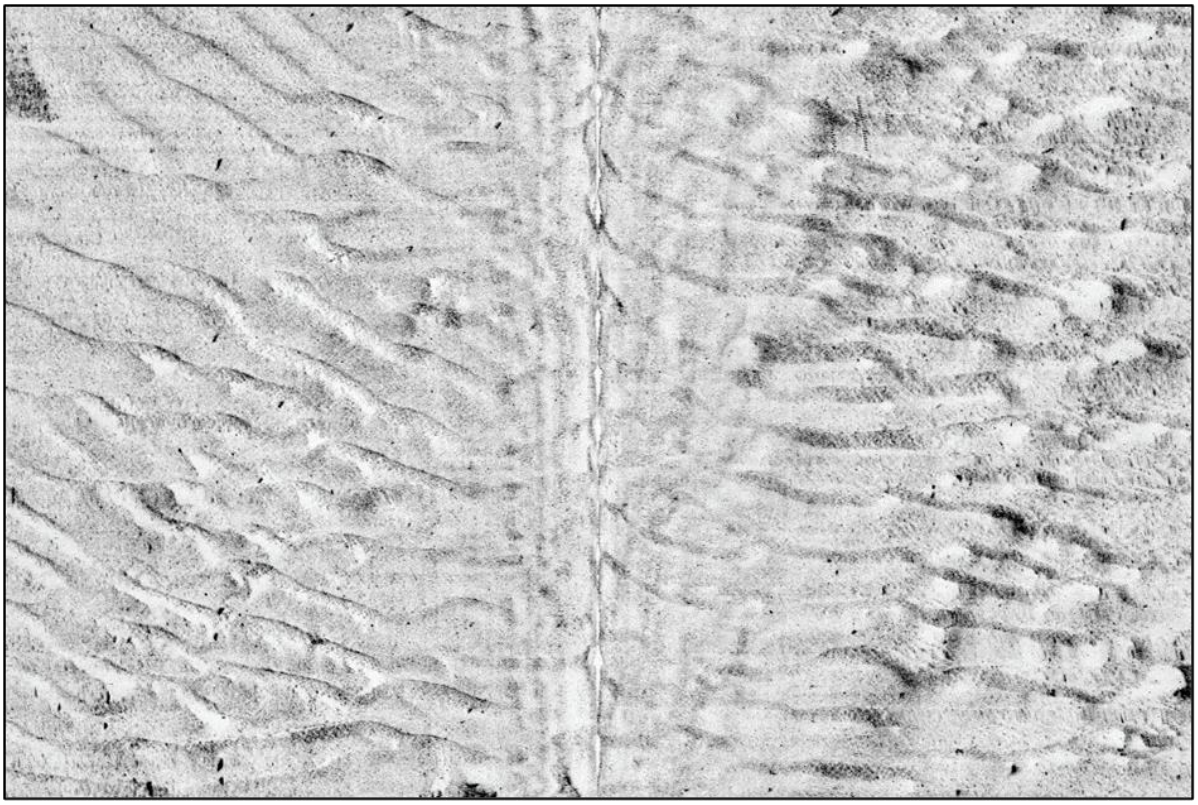
Graphic 4-11 Area 5 line 6 – coarse sediment with megaripples within Langstone Harbour entrance channel (water depth ~9m). The distance between the peaks is ~10m



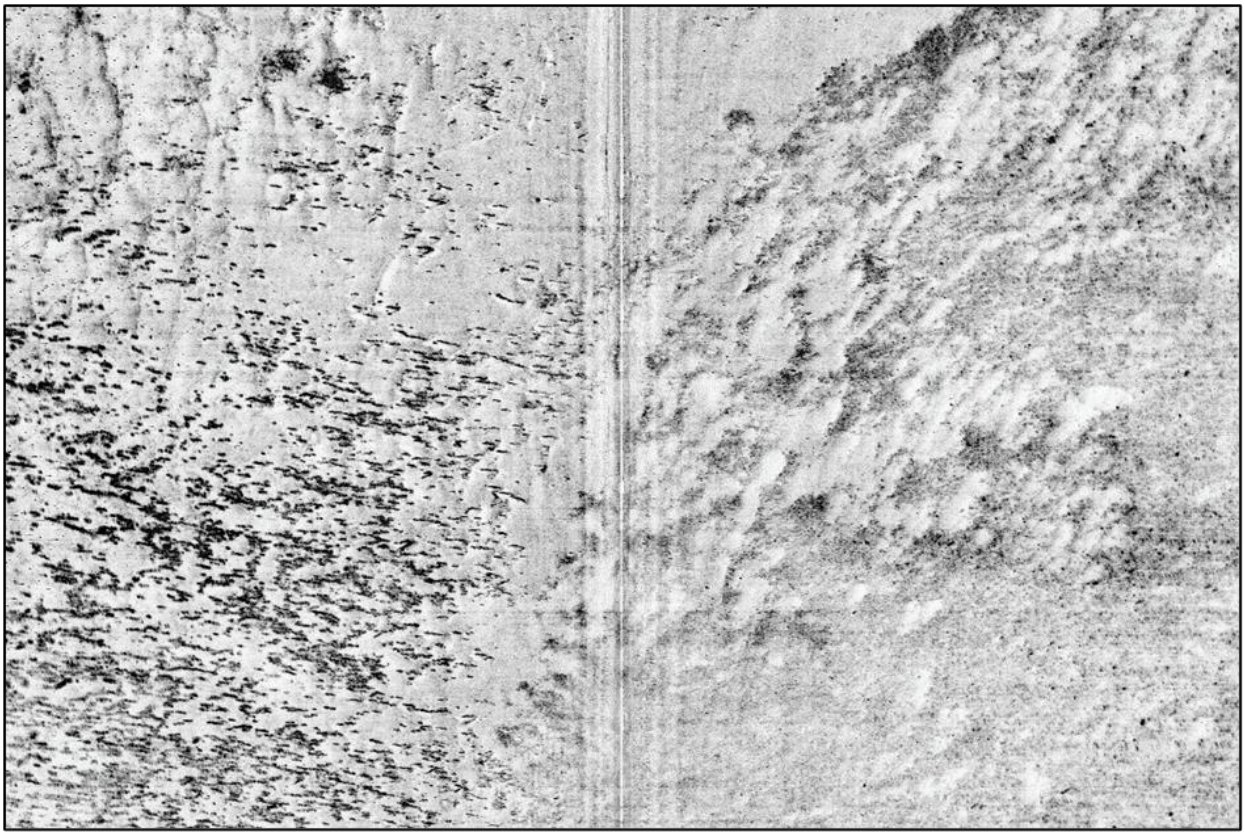
Graphic 4-12 Area 5 line 12 – sand with megaripples in the centre of Langstone Harbour



Graphic 4-13 Area 5 line 13 – megaripples composed of unknown sediment type (possibly sand) on the northern side of the central area within Langstone Harbour (water depth between 2 and 3m)



Graphic 4-14 Area 5 line 17 – mixed sediment in the north-east channel of Langstone Harbour

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