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To	Drew Brentnall	Email	dbrentnall@burburyconsulting.com.au
From	Pierre Bouvais	Email	Pierre.Bouvais@o2marine.com.au
Subject	Onslow Recreational Jetty: Benthic Communities and Habitat Survey Report		

1. Introduction

The Shire of Ashburton (the Shire) propose to build a new Onslow Recreational Jetty (the Project) at Beadon Point, northwest of the main township of Onslow, Western Australia (WA). The regional location and an indicative Project Development Envelope (DE) is shown in Figure 1. The location has previously been used as a jetty site in the past, and remains of the Onslow Jetty are still present. The historical Onslow Jetty was used for ships importing building equipment and general merchandise and exporting wool, shell, and minerals through Onslow. It was originally built in 1925, rebuilt in 1934 following cyclone damage and then fell into disrepair when an alternative landing was constructed in Beadon Creek in 1972. Onslow Jetty was then destroyed in an Army explosives exercise in 1982.

The proposed jetty will be a pedestrian-accessible fixed jetty design, intended to provide access for deeper water fishing at low tide, with usage limited to walking and recreational fishing with no vehicle or vessel access (except for ad-hoc maintenance vehicles/vessels). It will be located adjacent to the remains of the historic Onslow Jetty, which will be able to be viewed from the proposed jetty.

The proposed design for the jetty features a "T" shaped end with two levels: the main deck at +8 m AHD and a lower platform at +2 m AHD, to be confirmed after detailed metocean analysis. The jetty, constructed with concrete decking and a lower landing with permeable grated decking, aims to provide consistent water access, with most areas having 0.5 m depth over 50% of the time. Construction involves driving piles into the sediment and using a mobile rig to build progressively seaward.

During the preliminary environmental impact assessment for the works, it was recommended to undertake further a benthic communities and habitats (BCH) field survey to provide updated BCH information within the local assessment unit (LAU). O2 Marine was contracted to conduct a BCH field survey to validate and update existing BCH mapping to support the environmental impact assessment process. This report provides a synopsis of field methods and data analysis used on BCH data collected on 5 June 2024.

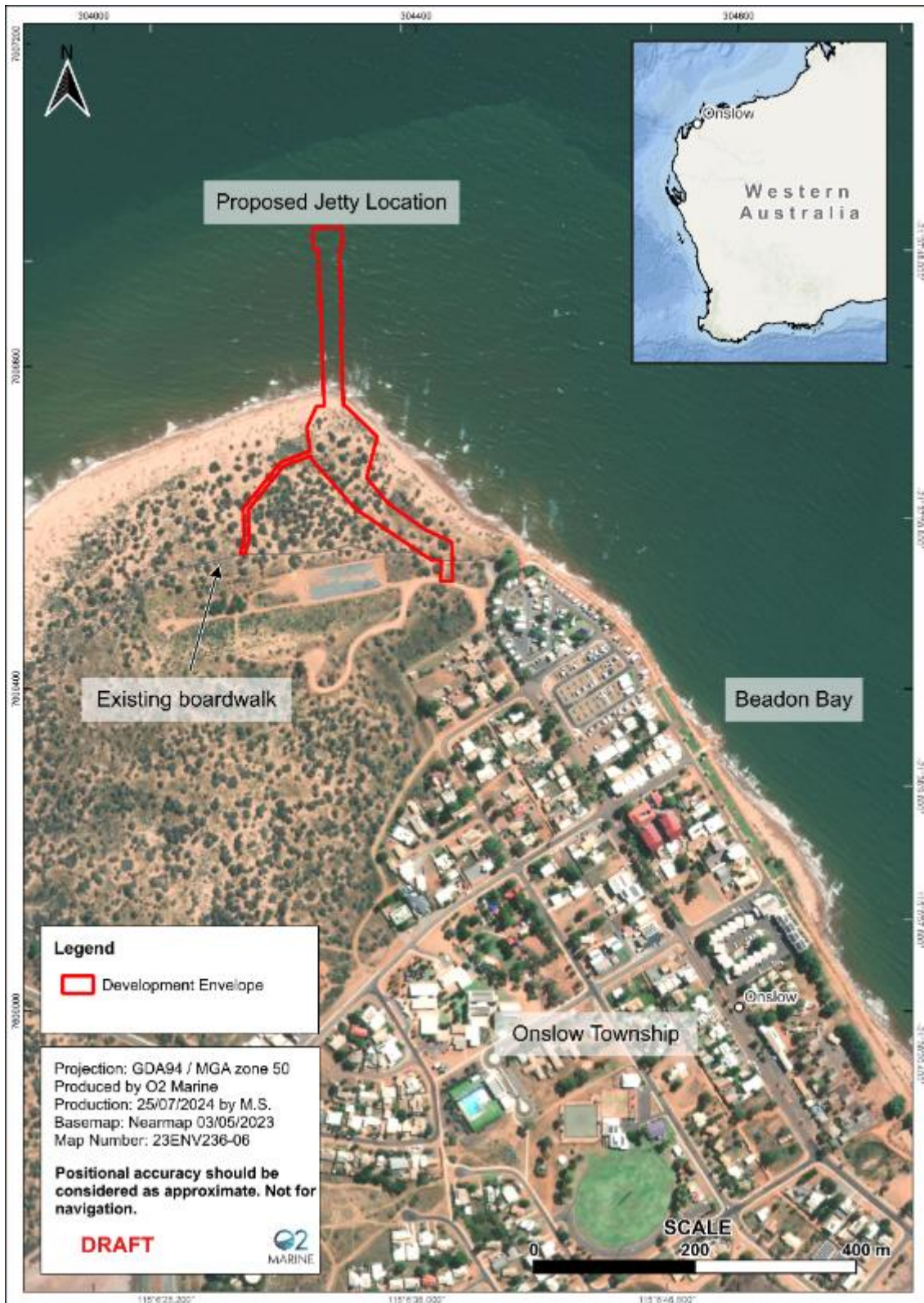


Figure 1: Project Location and indicative Development Envelope

2. Existing information

Detailed information on the BCH types within the immediate vicinity of the indicative Project areas is limited. Previous desktop assessments and habitat mapping conducted by O2 Marine (2021; 2022) and URS (2010) over the larger Onslow area revealed that the surrounding coastline predominantly comprises sandy beaches with sand bars and shoals at the mouths of tidal creeks. These beaches are often backed by coastal dunes, tidal flats, and limestone barriers, with pockets of mangroves lining the fringes of tidal creeks.

The intertidal zone is typically characterised by extensive limestone pavement and rocky platforms (~300 m wide) partially covered by mud, transitioning to a steep beach slope (URS 2010). The mid-littoral rocky platform is mainly populated by algal turf with minimal invertebrate fauna. In contrast, the lower littoral rock platform supports a moderately diverse sessile invertebrate fauna, particularly molluscs, along with patchy growths of leafy algae and sparse ephemeral seagrasses. Additionally, some shallow subtidal pools contain small, but numerous coral colonies (URS 2010).

3. Approach And Methods

The BCH survey involved four stages; pre-field/desktop tasks, in-field tasks, data processing and analysis, and reporting and these are described in more detail in Figure 2. Methods associated with the acquisition and preparation of the habitat mapping datasets are described in Sections 3.2 to 3.3.

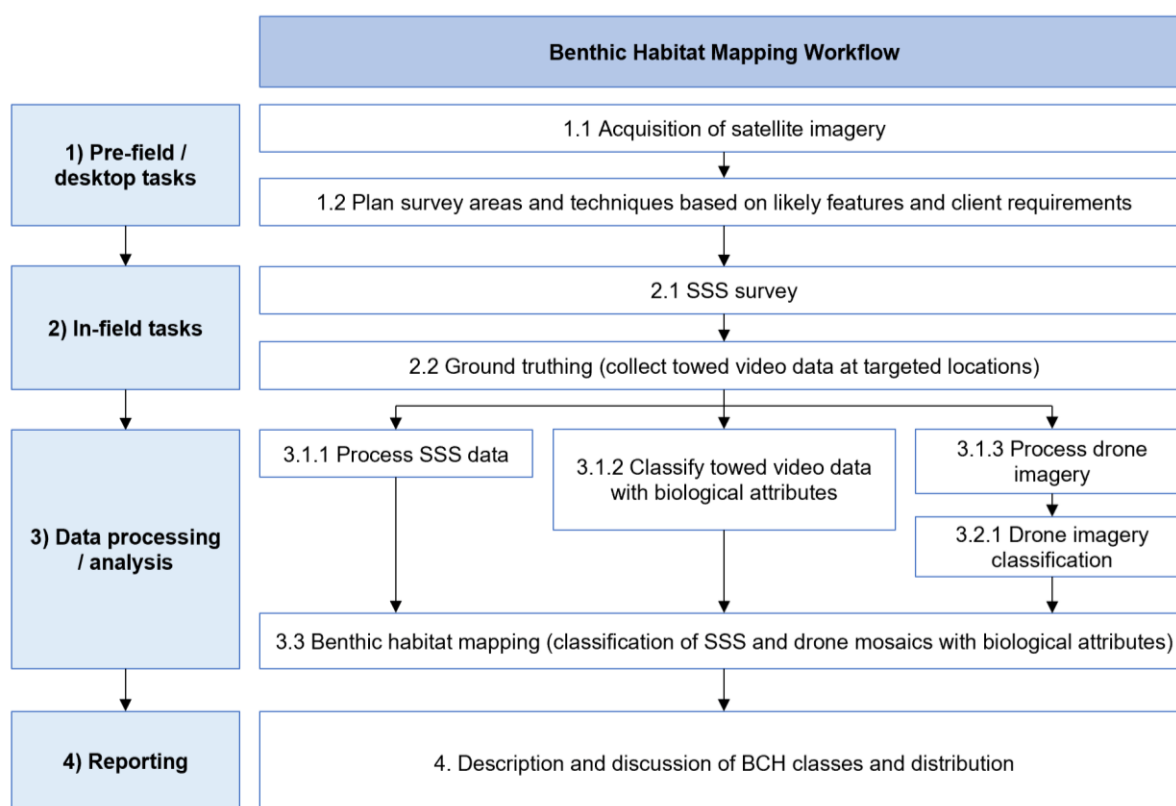


Figure 2: Breakdown of project stages and associated tasks

3.1. Survey design

The benthic habitat mapping for this report was initially informed by the desktop assessment and mapping work conducted for the larger Onslow area as part of the Ashburton Infrastructure Project (AIP) (O2 Marine, 2021). The BCH survey was separated into two mapping areas (Figure 3), based on the different survey techniques required to inform mapping in each:

Intertidal mapping area

- Drone imagery – to provide high-resolution imagery across the intertidal area which was used to identify substrate, morphology and biota.

Subtidal mapping area

- Sidescan sonar (SSS) – to provide a broad spatial coverage of sonar data which was used to infer substrate, morphology and biota.
- Towed video camera (TVC) transects – to validate sidescan sonar data and to allow identification of dominant BCH species and substrate type.

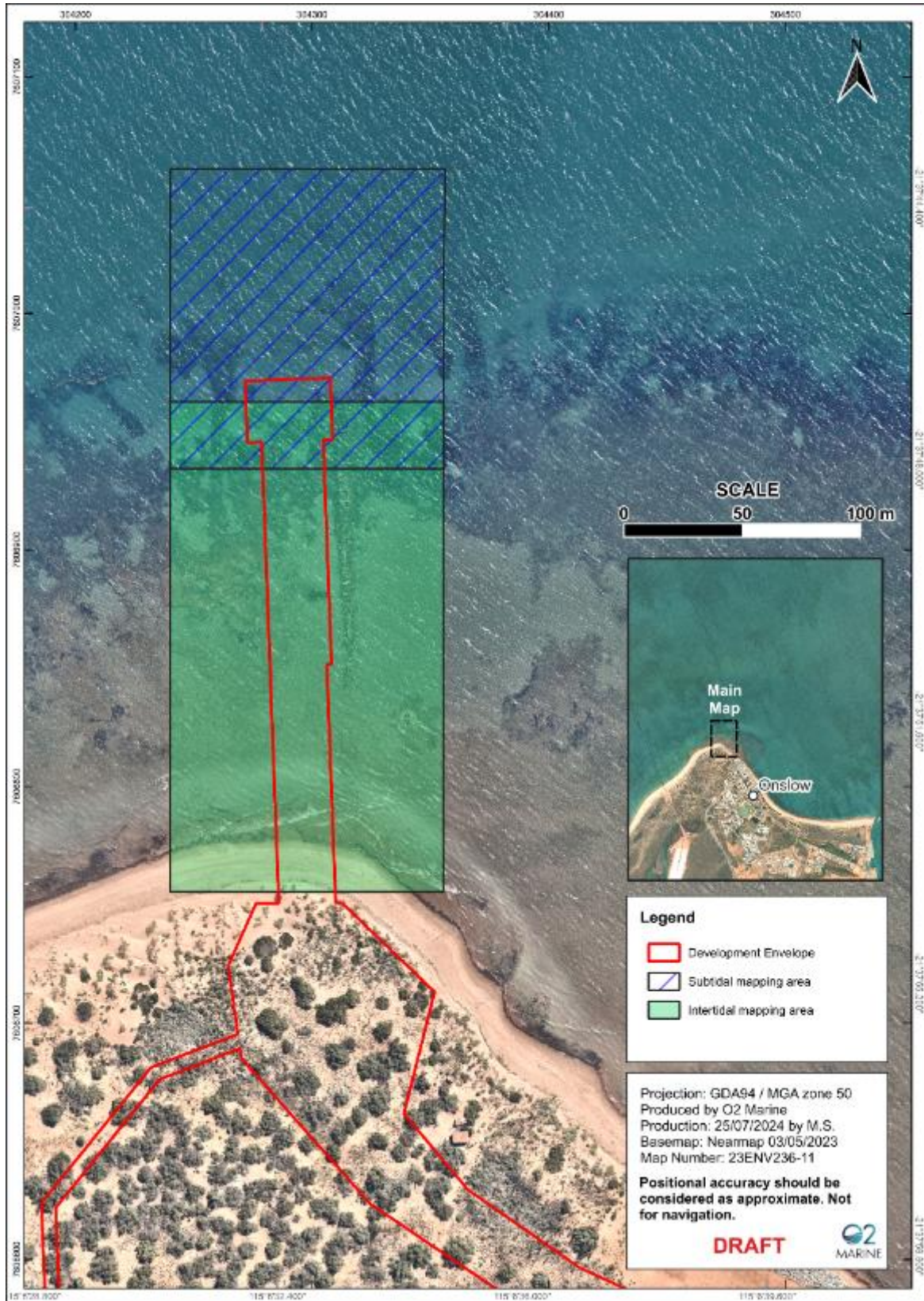


Figure 3: Location of Subtidal and Intertidal mapping areas used to focus field survey efforts

3.2. Acquisition of field data

3.2.1. Sidescan sonar

Equipment

O2 Marine used a portable dual channel 450 kHz towed SSS system (Tritech Starfish 452F) to collect sidescan data, that was operated through a topside control unit, using the acquisition software Scanline V2.1 (Figure 4). While immersed in the water column, the SSS unit emits and records acoustic waves (i.e. backscatter data) that are reflected by the seabed in a wide swath along the towed track. Geographic positioning of the SSS data was acquired using a non-differential GPS system (Hemisphere R120 integrated with OmniSTAR A20 receiver antenna).

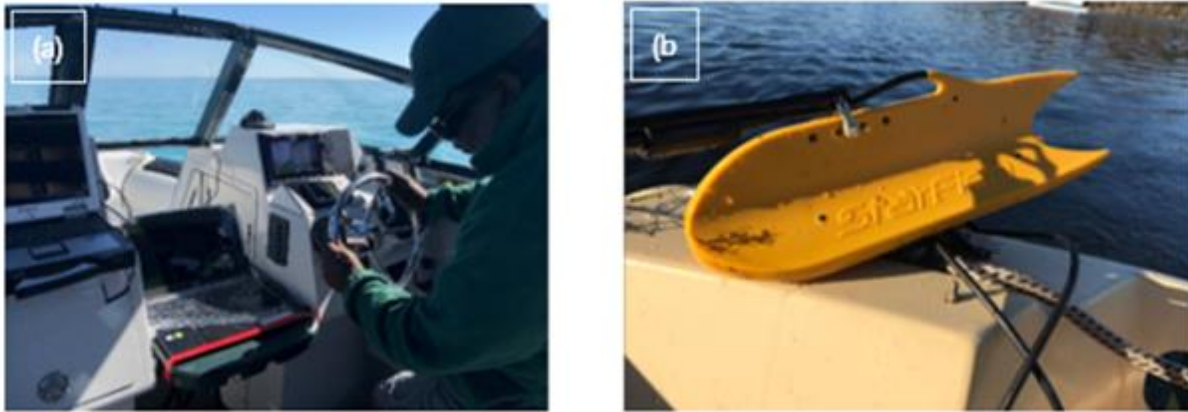


Figure 4: SSS equipment used in the field survey. a) Laptop operating Scanline V2.1 acquisition software, and b) Tritech Starfish 452F

Survey design

SSS surveys were carried out using a series of parallel transect lines (Figure 5). Transect spacing (approximately 30 m) was designed to achieve complete (100%) coverage. Transects were orientated parallel to the depth contours to minimise the need to adjust equipment once deployed, and to reduce the risk of seabed snags.

Survey effort

SSS survey data acquisition for the Offshore Survey was undertaken on 5 June 2024 (Figure 5, Table 1). A total of 5 transects were completed to capture textual information about the seabed and identify benthic features (Figure 5). The SSS transects were completed over 1 hour and covered a total distance of 0.8 km. 100 % SSS coverage of the survey area was achieved. The SSS was towed along the length of each survey transect at a speed of 2-3 knots. Sonar imagery was observed on topside controls to identify any benthic features of interest and for quality control of data. One transect (SSS_05) had to be cut short due to obstruction from the previous jetty structure and limited water depth.

Table 1: Daily survey effort for SSS

Survey Date	Survey Hours	SSS Transects	Total distance covered (km)
5 June 24	1	5	0.8

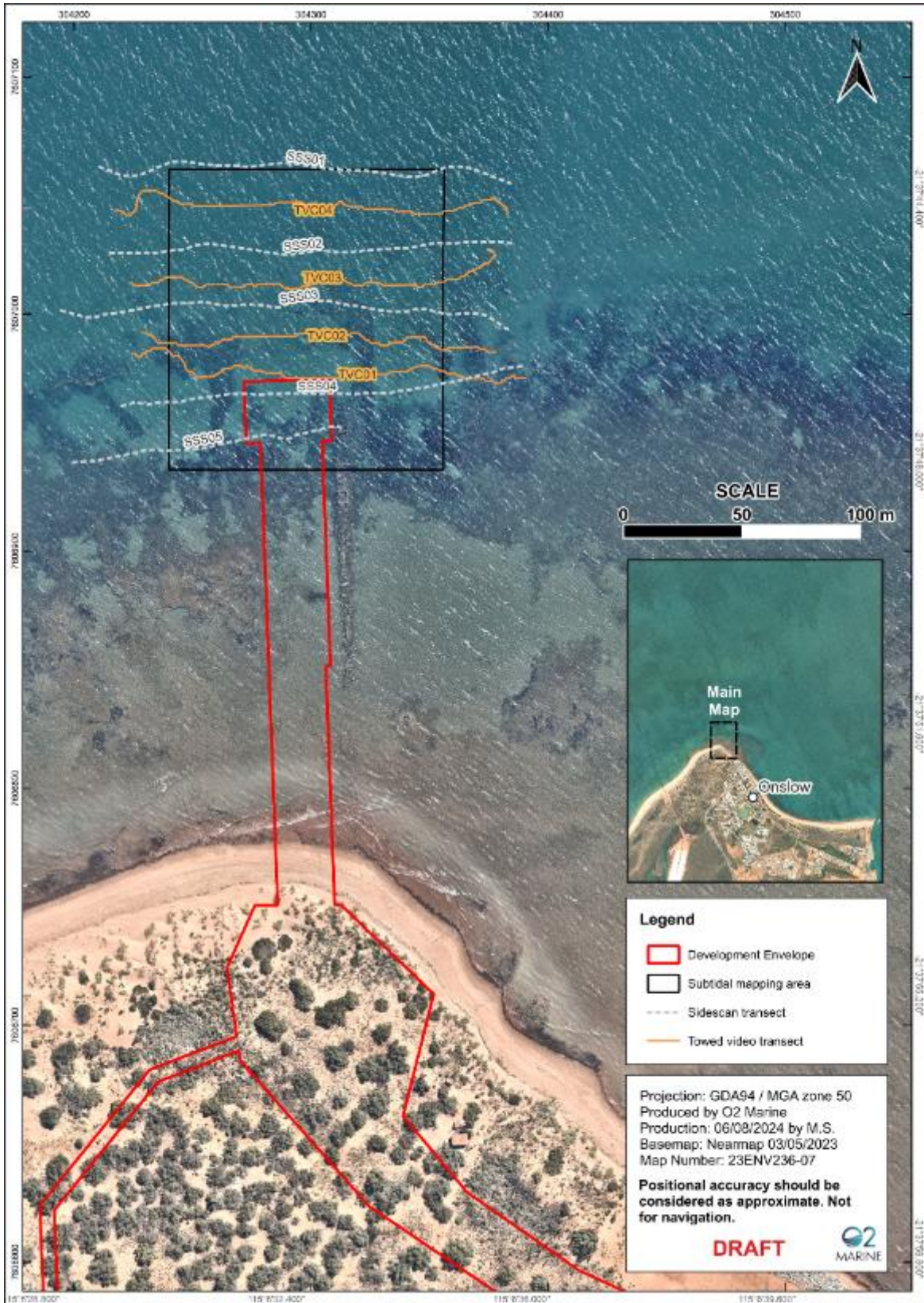


Figure 5: Sidescan sonar and towed video transect locations

3.2.2. Ground truthing

3.2.2.1. Towed Video Camera

Equipment

The primary TVC system used for the ground truth survey was a Spot X PRO SQUID 3 real-time subsea high definition (HD) video camera (Figure 6b). The TVC system was deployed from the vessel at each target location and operated by a scientist using the topside unit control box (Figure 6a). The topside unit provides live video feed for continuous quality control and allows adjustment of lights and camera settings.

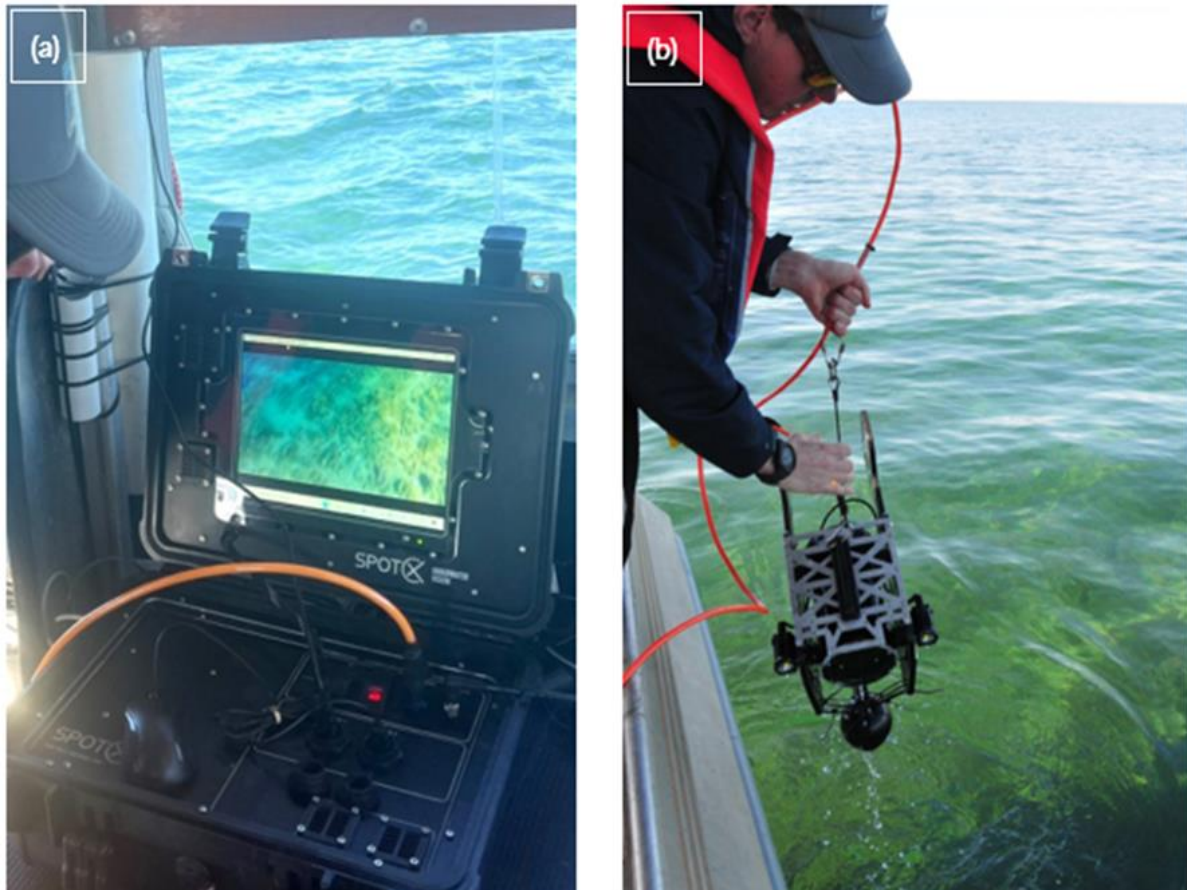


Figure 6: a) Spot X topside unit, and b) Spot X HD video camera and umbilical cable

Survey effort

The field survey was conducted on the 5 June 2024, onboard a locally operated 6.8 m charter vessel 'Karma' by three O2M marine scientists (Table 2).

Assessment of available satellite imagery prior to the field survey indicated the presence of a mixture of reef and exposed sediment within the survey area. Towed video transects were designed to cover the entire width of the mapping area in order to obtain continuous ground-truthing information across the sidescan data (Figure 5). Transects were orientated parallel to the anticipated depth contours to minimise the need to adjust equipment once deployed, and to reduce the risk of seabed collisions. Due to limited water depth during the field survey, the most landward transect had to be moved approximately 20m northwards.

During the survey, the camera was lowered to a depth of approximately 0.5 m above the seabed, with the operator recording between one to seven minutes of benthic video footage at four transects. Vessel speed ranged between 1-2 knots to allow for the recording of good-quality imagery.

The following information was recorded on field sheets at each targeted location:

- Date and time
- GPS coordinates
- Water depth (m)
- Dominant BCH type
- Comments to aid post-processing.

Table 2: Daily survey effort for TVC

Survey Date	Survey Hours	TVC Transects	Total distance covered (km)
5 June 24	1	4	0.7

3.2.2.2. Drone Imagery

A Mavic 3 Multispectral RTK (Real Time Kinematic) drone (Figure 7) was deployed to gather ground truthing data for the intertidal areas too shallow for vessel operation. The drone was deployed on a pre-defined flight path to collect high-resolution imagery of a range of habitat types, to provide comprehensive ground-truthing information for subsequent intertidal habitat mapping. Aerial photography was collected at low tide to ensure maximum exposure of intertidal habitats.



Figure 7: Mavic 3 Multispectral RTK Drone

3.3. Data processing and analysis

3.3.1. Side scan sonar processing

Following the field surveys, SSS data files were uploaded into processing software SonarWiz version 7.2. Processing involved determining the quality of data, bottom-tracking, navigational smoothing, and removing nadir, false artefacts, and noise generated in the data log files due to field conditions and interference. GPS offsets and cable lengths, which were recorded during the field survey, were applied to the transects to obtain the most accurate positioning of data. Empirical Gain Normalization (EGN) was applied to the dataset to optimise visualisation and correct for the decay in the backscatter level with distance from the receiver. The processed SSS mosaic of all transects was exported as 10 cm resolution Geotiffs, georeferenced to Geocentric Datum of Australia 1994 (GDA94) and presented in UTM coordinates (MGA, Zone 50). The SSS mosaic is shown in **Error! Reference source not found.**

3.3.2. Classification of towed video





Ground truthing videos were classified by analysing footage from each TVC transect. Recordings were visually analysed by a suitably qualified marine scientist in TransectMeasure and classified into habitat classes following the Collaborative and Automated Tools for Analysis of Marine Imagery (CATAMI) standard classification scheme for scoring marine biota and physical characteristics from underwater imagery, which defines benthic habitats based on the physical and biological characteristics, including:


- Relief
- substrate
- bedforms
- visual estimate of percent cover of benthic flora and fauna
- dominant taxa.

A quality assurance and control check was conducted by an experienced marine scientist specialising in BCH taxonomy and habitat classifications, including verification of percent cover estimates and species identification.

The TransectMeasure data output was synced with the GPS track log, as well as the corresponding auxiliary information (time, depth), to attribute the appropriate BCH category (Table 3) at each point location. GPS offsets and cable lengths, which were recorded during the field survey, were applied to the transects to obtain the most accurate positioning of data. Still images were also extracted from each transect at the point at which BCH type changed from one to the next

Table 3: Classifications used in the analysis of towed videos



BCH Class	Description	Example Image
Bare sediment	Bare sediment with no apparent structure. Minor ripple features, bioturbation, and shell fragments observed.	
Sediment with rock rubble and mixed assemblage	Scattered hard substrate (rock or infrastructure) on unconsolidated substrate (sediment). Mixed communities of macroalgae, hard corals, and/or suspension feeders, in varying densities.	
Low cover seagrass	Bare sediment with low (<10%) seagrass cover. Occasional mix of subdominant macroalgae. Seagrasses consistent with ephemeral species (i.e. genera: <i>Halophila</i> and <i>Halodule</i>).	
Low cover macroalgae	Low cover (<10%) macroalgae (erect fine branching) on bare sediments with shell fragments.	



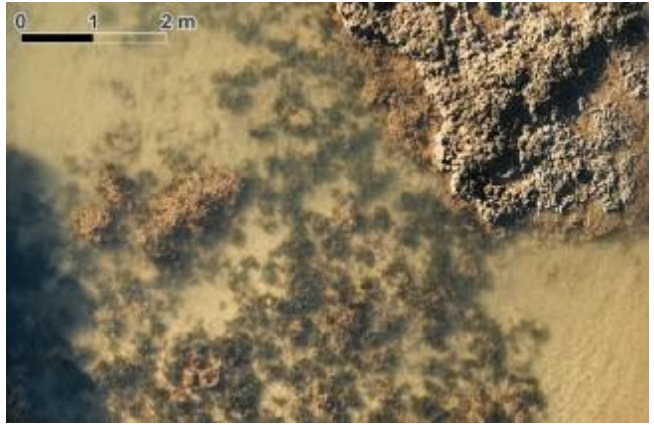
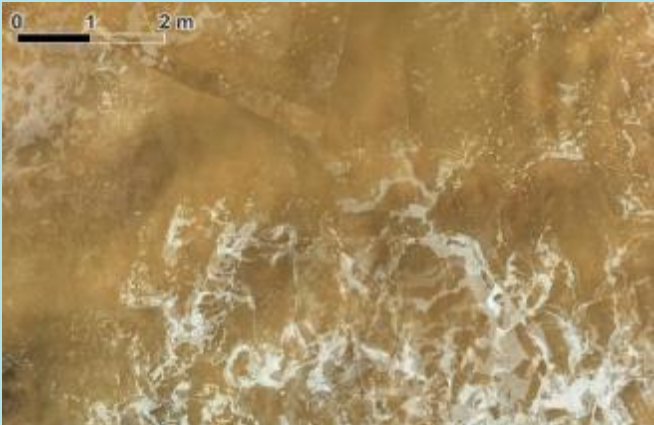
BCH Class	Description	Example Image
Reef with high cover mixed assemblage	High cover (> 50%) of mixed suspension feeder, hard coral, and / or macroalgae community on consolidated, hard substrate (rock or infrastructure) with varying rugosity (structural complexity).	

3.3.3. Classification of drone imagery

Drone photo imagery was stitched and georeferenced using Pix4DMapper. The subsequent georeferenced orthomosaic was then loaded into QGIS for analysis. Six transects were created, at 30 m spacing across the intertidal mapping area (**Error! Reference source not found.**). Points were generated along these transects at 2 m intervals. The drone imagery was classified at each of these points using the classifications in Table 4.

Table 4: Classifications used in the analysis of drone imagery

BCH Class	Description	Example Image
Sand	Bare, undifferentiated sediment with no visible biota. Ripple features of varied wavelengths frequently observed.	
Rock rubble	Rubble from pre-existing infrastructure. Sessile invertebrate assemblages frequently observed across higher relief of rubble.	

BCH Class	Description	Example Image
Reef	Low relief (< 1m) limestone reef with low biotic cover. The most seaward areas of reef are frequently covered in green turf algae.	
Sessile invertebrates	Assemblages of sessile invertebrates (<i>Saccostrea scyphophilla</i>). Typically hosted by higher relief areas of reef and rubble.	
Macroalgae	Erect coarse branching brown macroalgae. Mostly observed in submerged areas adjacent to exposed reef.	
Unidentified	Areas where benthic habitat is obscured by turbidity in the water column.	

3.3.4. Benthic habitat mapping

To undertake analysis and map BCH types across the survey area, spatial dataset layers (Table 5) were compiled in QGIS 3.38.

Table 5: Datasets used in mapping

Dataset	Description	Spatial Data Type	Resolution	Source
Sidescan sonar mosaic	Continuous mosaic in subtidal mapping area. Backscatter and textural characteristics to inform habitat identification.	Raster	5 cm	O2 Marine internal dataset
Classified towed video transects	Points with attributes including substrate, relief, dominant taxa, cover, subdominant taxa, overall classification. Transects distributed evenly across subtidal mapping area.	Vector (point)	N/A	O2 Marine internal dataset
Drone orthomosaic	Continuous high resolution imagery across the intertidal mapping area.	Raster	2 cm	O2 Marine internal dataset
Drone elevation grid	Provides information on reef relief.	Raster	2 cm	O2 Marine internal dataset
Drone slope grid	Provides information on reef relief.	Raster	2 cm	O2 Marine internal dataset
Classified drone imagery transects	Points classified every 2 m along 6 transects. Provides visual overview of distribution of habitat types to inform mapping.	Vector (point)	N/A	O2 Marine internal dataset
Nearmap satellite image	Image from 03/05/2023. Image chosen from all available dates due to the low turbidity allowing for the identification of benthic features.	Raster	15 cm	Nearmap (2023)

3.3.4.1. Intertidal mapping

Intertidal mapping was primarily informed by the analysis of the drone orthomosaic (Figure 8). A manual digitising approach was considered the best approach to mapping, as the high resolution (2 cm) imagery enabled reliable identification of BCH types. Classified image transects were used as a guide for mapping and to allow for the identification of common features and habitat distribution across the mapping area. Other data layers (including SSS, Nearmap satellite image) were assessed where benthic habitat type was obscured by turbidity in the water column in the drone orthomosaic.

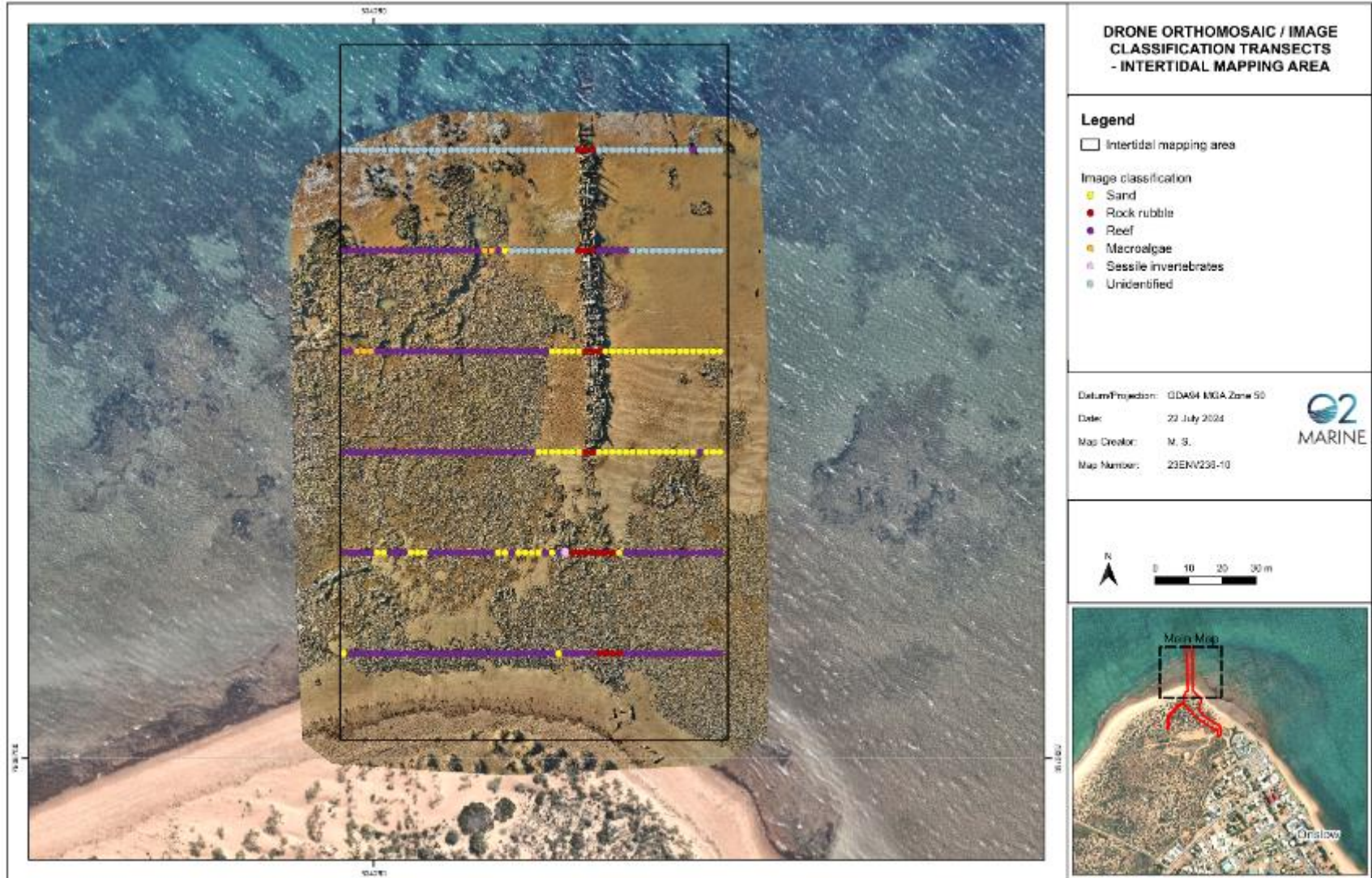


Figure 8: Drone orthomosaic overlaid with classified point transects

3.3.4.2. Subtidal mapping

Textural and backscatter attributes of the SSS data were assessed at the locations of the classified TVC transects (Figure 9). Due to the presence of remaining artefacts in the SSS data, a manual digitising approach was considered the most suitable and effective method to achieve accurate classification of the survey area. Polygons were manually digitised where distinct signatures in the SSS data could be associated with towed video classes. Where distinct SSS signatures were observed but could not be associated with individual towed video classes, broader mapping categories were generated to classify these areas. In areas where the SSS data was affected by noise from surface conditions that could not be removed in processing, a high-resolution satellite image (Nearmap) was used to identify the extent of the reef on the seabed.

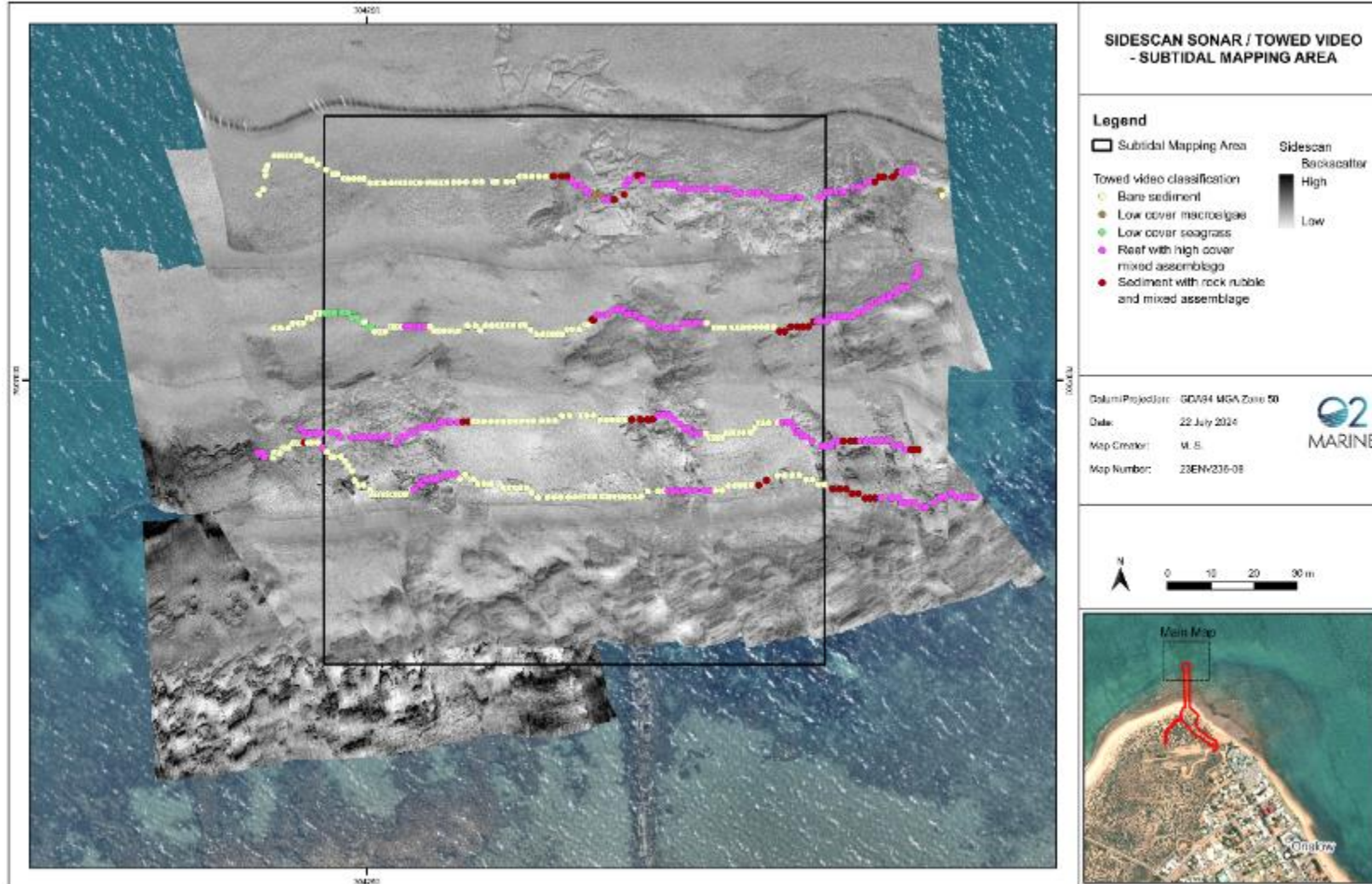


Figure 9: Sidescan sonar data overlaid with classified towed video transect

3.3.4.3. Mapping classifications

Nine classifications (Table 6) were used for the mapping of intertidal and subtidal areas surrounding the development envelope.

Table 6: Classifications used in BCH mapping

Mapping Classification	Description
Bare sediment	Bare, undifferentiated sediment with low biotic cover. Ripple features of varied wavelengths frequently observed.
Rock rubble	Rubble from pre-existing infrastructure. Sessile invertebrate assemblages frequently observed across higher relief areas of rubble.
Subtidal reef	Reef existing beyond the lowest astronomical tide (LAT) contour (as defined by Australian Hydrographic Chart). Reef typically hosts a mixed assemblage, characterised by a high cover (> 50%) of sponges, hard corals, and moderate-high cover of macroalgae. Scattered rocks are often present on the fringes of the main reef areas, hosting similarly composed mixed assemblages.
Intertidal reef	Reef existing above the lowest astronomical tide (LAT) contour. Reef is characterised by low relief (< 1m) and mostly low biotic cover, however, the most seaward areas of reef feature a high cover of green turf algae.
Macroalgal assemblage	Distinct assemblages of erect coarse branching brown macroalgae. These assemblages typically occur in submerged areas adjacent to exposed intertidal reef.
Sessile invertebrate assemblage	Assemblages of sessile invertebrates (<i>Saccostrea scyphophilla</i>). Typically hosted by higher relief areas of reef and rubble.
Coastal dunes	Sand / dunes present above the visible high tide mark (as defined by wrack line in drone imagery).
Low cover seagrass	Low cover (<10%) seagrass on undifferentiated sandy sediment. Characterised by ephemeral species ((i.e. genera: <i>Halophila</i> and <i>Halodule</i>). Occasional mix of subdominant macroalgae.
Terrestrial vegetation	Clumps of vegetation (<i>Spinifex</i>) existing on terrestrial sand.

4. Results and Discussion

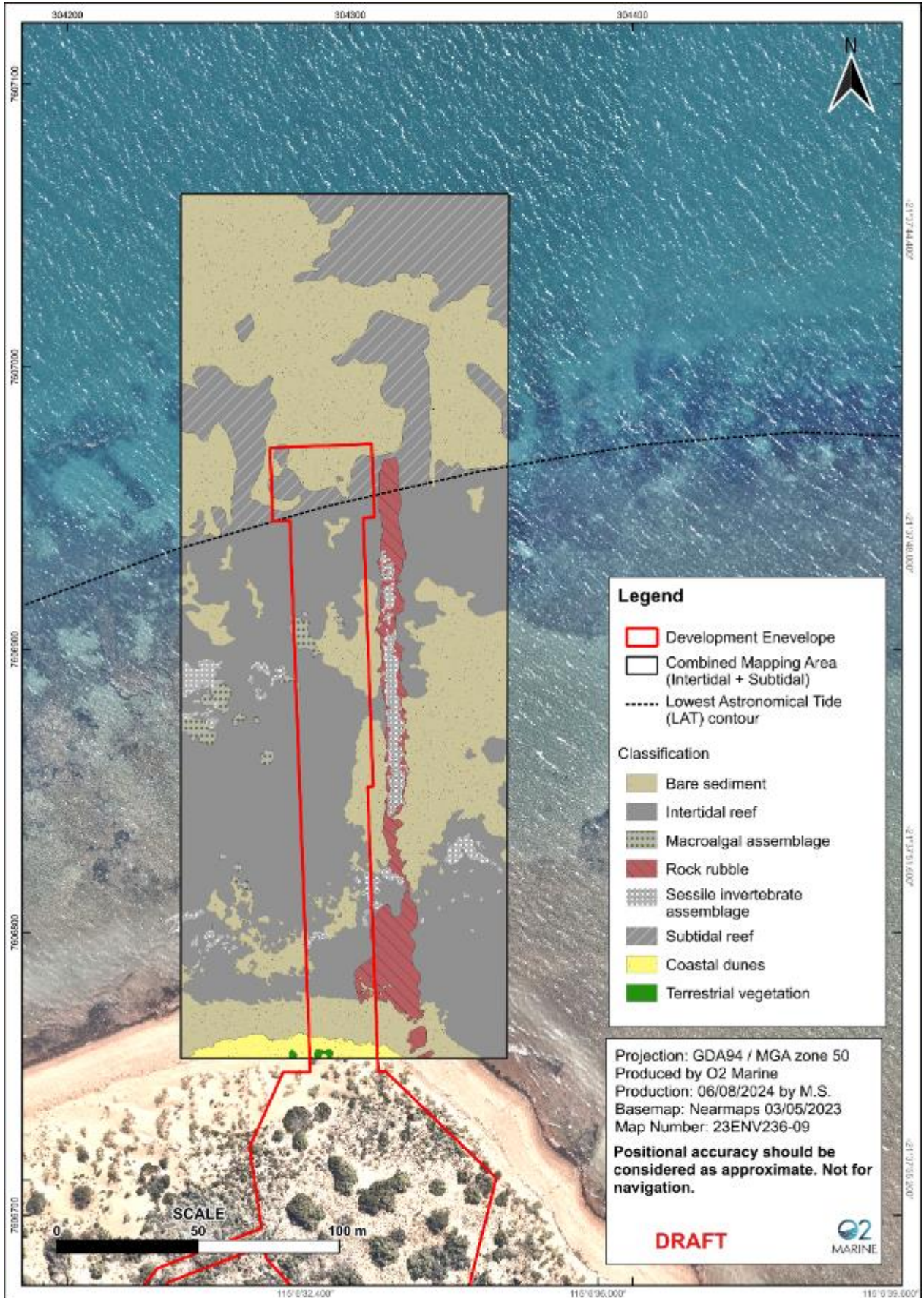
Ground-truthing surveys of the proposal area (Onslow Recreational Jetty) were completed in June 2024 by O2 Marine to update previous work and provide specific information for the proposal area.

The subtidal area around the indicative development envelope was found to be dominated by bare sediment (Table 7, Figure 10). A single isolated patch (0.005 ha) of very low density (<10%) seagrass (*Halophila sp.* and *Halodule sp.*) was identified approximately 50 m northwest of the development envelope. The subtidal BCH composition under the "T" shaped end of the proposed also comprised scattered rocks on the fringe of the main intertidal reef area, hosting moderate to high cover of mixed assemblages of suspension feeders, hard corals, and macroalgae (Table 7 and Figure 10).

The intertidal area was predominantly characterized by low-relief reef estimated to rise less than 1.0 m above the seafloor surface. This habitat appears to have relatively low ecological value due to low biotic cover. Other significant intertidal BCH types around the indicative development envelope include bare sediment, macroalgae assemblages, and assemblages of sessile suspension feeders (*Saccostrea scyphophilla*) found on higher relief areas of reef and rubble (Table 7, Figure 10). Except for oysters in the lower tidal zone, the intertidal area was largely devoid of encrusting or surface-dwelling marine flora and fauna due to the wide range of tidal inundation (~4.5 m) and associated impacts from exposure and desiccation.

Table 7: Mapping classifications by area and percentage of combined mapping area

Classification	Area (ha)	Area (%)
Bare sediment	1.40	39.7
Intertidal reef	1.36	38.5
Subtidal reef	0.49	13.9
Rock rubble	0.13	3.7
Sessile invertebrate assemblage	0.07	2.0
Coastal dune	0.04	1.1
Macroalgal assemblage	0.03	0.8
Low cover seagrass	0.005	0.1
Terrestrial vegetation	0.002	0.1
Total	3.53	100.0



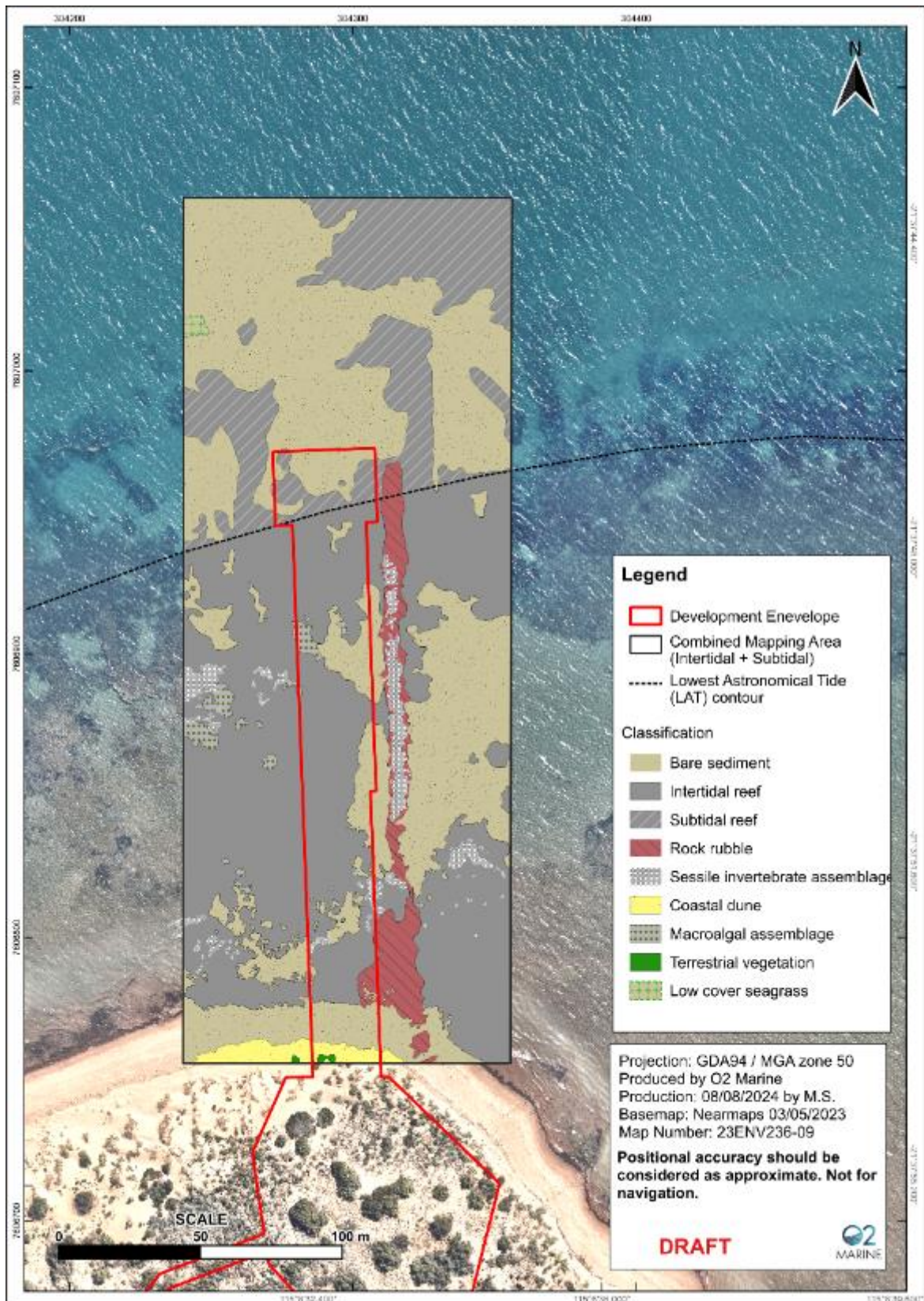


Figure 10: Onslow Public Jetty benthic habitat map

5. Conclusion

Benthic habitat mapping revealed that the Survey Area is mainly comprised by habitats which are characterised by a low level of biotic cover and diversity, including bare sediment (39.7%), and intertidal reef (38.5%). The proposed jetty footprint encompasses a small area (0.04 ha) of subtidal reef which supports a moderate to high cover of mixed assemblages of suspension feeders, hard corals, and macroalgae.

Due to the relatively low percentage cover of benthic communities and habitats (BCH) within the proposed area, no supplementary studies are deemed necessary to further inform the construction methodology, notably the piling methods (e.g, impact, drill or vibration piling). Overall, the BCH composition found in the Survey Area appears to be of limited ecological value, characterised by the sparsity of substrate types and low biotic cover and diversity. Consequently, independently of the piling methods selected it is unlikely to result in substantial ecological disruption.

6. References

- O2 Marine (2021) *Benthic Communities and Habitat Ashburton Infrastructure Project*, Prepared for Mineral Resources Limited, Report Number R200328, Revision 4, 20 October 2021
- O2 Marine (2022) *Supplementary Benthic Communities and Habitat Survey of Spoil Ground C – March 2022*, Technical Report number T210312, Revision 1, 7 April 2022
- URS (2010) *Wheatstone Project Draft EIS/ERMP Technical Appendices N12 Survey of Subtidal Habitats off Onslow, WA*