MARINE NATURAL VALUES ASSESSMENT FOR PROPOSED BOATHOUSE AND JETTY - FLOWERPOT

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AQUATIC ENVIRONMENT ANALYSTS

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Executive Summary

A private boathouse and jetty development have been proposed at 4101 Channel Highway Flowerpot. As part of Kingborough Council and Crown Land Services' planning requirements, an assessment of marine values is required. Aquenal was engaged by ERA Planning and Environment to design and implement a suitable marine values assessment survey to satisfy government requirements. The survey was designed in accordance with the Tasmanian Government's *Guidelines for Natural Values Surveys - Estuarine and Marine Development Proposals*. The proposal includes a boatshed overlying the intertidal zone, along with a 30 m long jetty and a 15 m long slipway extending into the subtidal zone.

The marine natural values assessment comprised two main components – (1) a desktop survey and risk assessment; and (2) a field survey. The risk assessment was based on species identified in the Tasmanian Natural Values Atlas (NVA). Based on this assessment, listed species with the potential to occur in the development area included humpback whales (*Megaptera novaengliae*), southern right whales (*Eubalaena australis)*, spotted handfish (*Brachionichthys hirsutus*), Tasmanian live-bearing seastar (*Parvulastra vivipara*), Gunn's screw shell (*Gazameda gunnii*) and Australian grayling (*Prototroctes maraena*).

The outputs from the NVA search and risk assessment were also used to inform the field survey design. The field survey included:

(i) Bathymetry survey in the vicinity of the proposed development;

(ii) Underwater video transects along the footprint of the proposed development;

(iii) Survey for the Tasmanian live-bearing seastar *Parvulastra vivipara* in the vicinity of the proposed development;

(iv) Survey for Gunn's Screw Shell (*Gazameda gunnii*)

No threatened species were detected in the field survey of intertidal and subtidal habitats in the vicinity of the proposed development.

For those species identified in the NVA search, the risk of the proposed development was considered negligible. Potential impacts are expected to be localised and restricted to a short time period associated with construction activities and can be mitigated using appropriate methodologies and controls. The most likely impacts relate to acoustic disturbance and to a lesser extent, seabed disturbance. A range of mitigation options to minimise acoustic disturbance are recommended. Provided these mitigation measures are undertaken, the proposed development is expected to have minimal impacts on marine environmental values in the study area.

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A private boathouse and jetty development have been proposed at 4101 Channel Highway, Flowerpot. As part of Kingborough Council and Crown Land Services' planning requirements, an assessment of marine values is required. Aquenal was engaged by ERA Planning and Environment to design and implement a suitable marine vales assessment survey to satisfy government requirements. The survey was designed in accordance with the Tasmanian Government's *Guidelines for Natural Values Surveys - Estuarine and Marine Development Proposals* (NCH 2019). DPIPWE's Policy and Conservation Advice Branch (PCAB) were consulted regarding the field survey design.

The proposal includes a boatshed overlying the intertidal zone, along with a 30 m long jetty and a 15 m long slipway extending into the subtidal zone. The location of the development is shown in Figure 1 (refer to Appendix 1 for detailed architectural drawings).

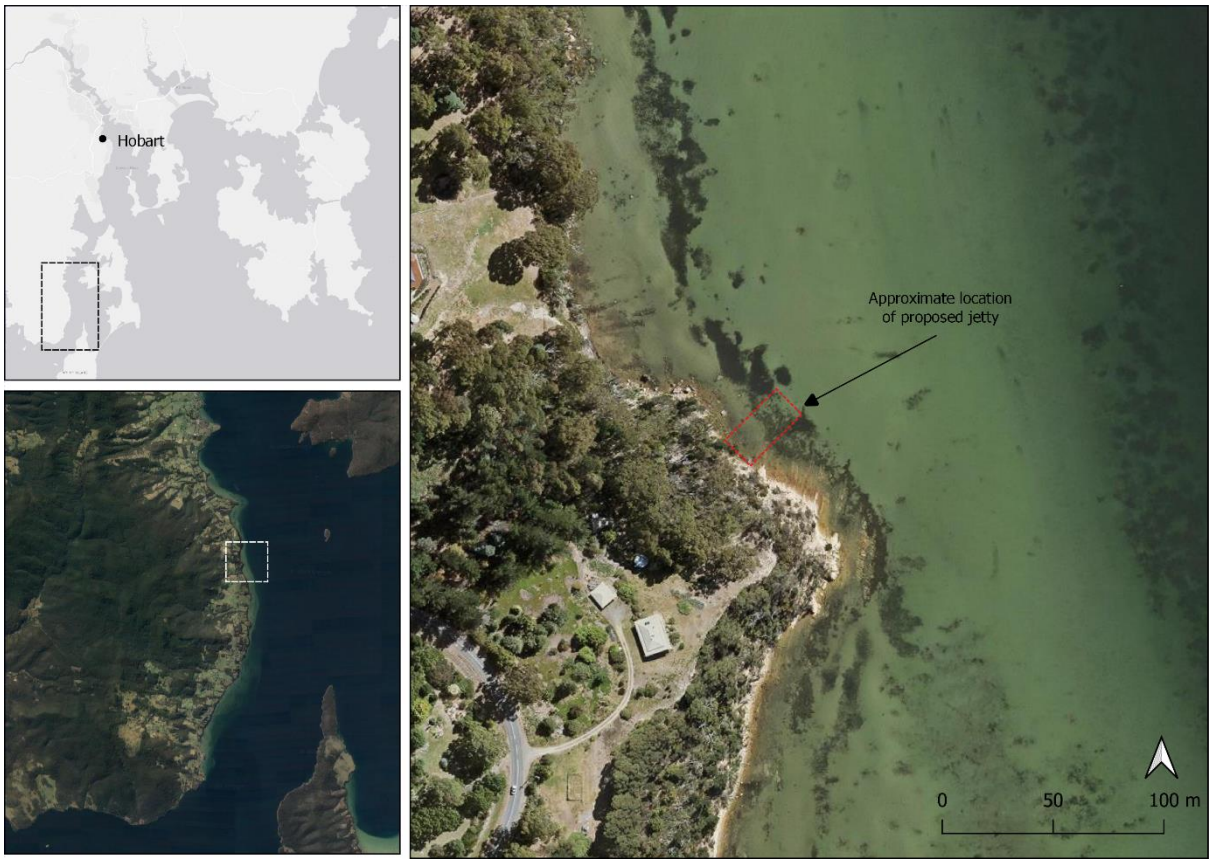

Figure 1 Diagram showing location of proposed development (refer to Appendix 1 for detailed architectural drawings). Aerial imagery sourced from the LIST[1].

[1] https://www.thelist.tas.gov.au/

The marine natural values assessment comprised two main components – (1) a desktop survey and risk assessment; and (2) a field survey. The field survey included:

(i) Bathymetry survey in the vicinity of the proposed development;

(ii) Underwater video transects along the footprint of the proposed development;

(iii) Survey for the Tasmanian live-bearing seastar *Parvulastra vivipara* in the vicinity of the proposed development;

(iv) Survey for Gunn's Screw Shell (*Gazameda gunnii*)

Targeted searches for spotted handfish (*Brachionichthys hirsutus*) were not specifically included in the survey design due to the very low likelihood of them occurring in the survey area. Detailed sediment surveys were not included in the survey design since construction activities in the marine area will be limited to pylon installation which should cause minimal disturbance to sediments.

This report provides a summary of desktop and field studies.

2. Methods

2.1 Desktop survey

In accordance with the *Guidelines for Natural Values Surveys - Estuarine and Marine Development Proposals* (NCH 2019), a report using buffers of 500 m and 5000 m around the proposed jetty was generated using the online tool for the Tasmanian Natural Values Atlas (NVA). For each species listed on the NVA report, a qualitative risk assessment was undertaken as to the likelihood of the species occurring in the local area and being impacted by the proposed development. The risk assessment used a consequence x likelihood matrix (adapted from Fletcher 2014). The outcome of the NVA search and risk assessment was also used to inform species-specific searches undertaken as part of the field assessment.

Background information on marine habitats in the vicinity of the development was also investigated using the IMAS Seamap project[2] and aerial imagery in the vicinity of the site.

2.2 Field survey

For the purpose of the assessment, the development footprint of the boathouse and jetty was 16 x 42 m (Figure 2; see architectural drawings, Appendix 1). A buffer adjacent to the footprint was incorporated for the natural values assessment and field survey (Figure 2). The overall dimensions of the survey area including the buffer was 30 x 110 m (Figure 2).

[2] http://seamap.imas.utas.edu.au/

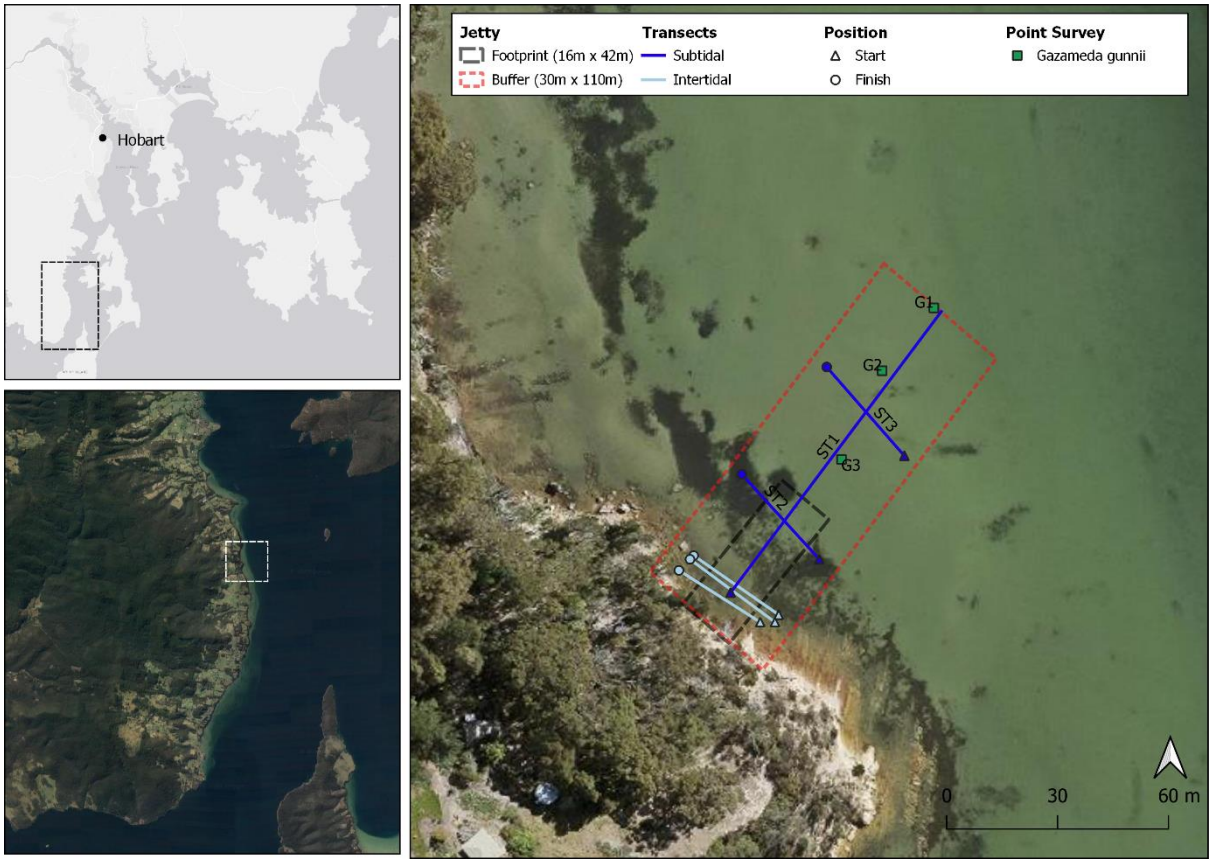

Figure 2 Survey area and location of transects and sample sites. Survey coordinates are included in Appendix 2.

2.2.1 Bathymetry survey

Bathymetric surveys were undertaken in the vicinity of the jetty development from Aquenal's purpose-built survey vessel. Depth soundings were recorded to the nearest 0.1 m, with GPS positions recorded, accurate to +/- 2 m.

2.2.2 Underwater video survey

Underwater video transects were performed in accordance with the following protocols:

- Transects were filmed using a hand-held digital HD video camera (Sony CX110) in an underwater housing (Amphibico Dive Buddy, EVO HD Elite 2).
- Filming was conducted slowly to ensure clear images were recorded.
- Transect cables were marked at 5 m intervals, with the diver slowly panning away from the transect every 10 m to capture footage of adjacent habitat.
- Video footage was prepared in high resolution format to be provided to the client.

During filming, the diver collected representative footage of species and habitats present. Video footage collected was subsequently assessed in the laboratory, and notes were compiled on the following variables:

- Sediment colour and texture (e.g. fine or coarse material)
- Habitat type
- Algal cover
- The variety and density of animals living on and in the seabed

Three transects were filmed in the subtidal zone (Figure 2), including one perpendicular to the shore along the approximate jetty route (T1, 100 m long) and two transects parallel to the shore (T2 and T3, 30 m long).

2.2.3 Parvulastra vivipara survey

For the Tasmanian live-bearing seastar survey, habitat in the vicinity of the proposed development was examined using transects and targeted searches (Figure 2). Transects (30 m) laid parallel to the shore were conducted at three tide levels (low, mid and high). Along each transect, a 0.5 x 0.5 m quadrat was searched every 5 m.

P. vivipara has been shown to prefer habitat including rocks and stones approximately 20-30 cm in diameter in the intertidal zone (Prestedge 1998). Based on this information, targeted searches of rocks and stones of this size range in the mid-high intertidal zone were conducted in the survey area. For both quadrat and targeted searches, boulders and loose stones were carefully overturned and the undersides examined for the presence of *P. vivipara*. The intertidal survey was conducted at a tide level between 0.3 and 0.6 m (relative to Lowest Astronomical Tide - LAT).

2.2.4 Gunn's screw shell (Gazameda gunnii) survey

At each site, a survey was conducted for *Gazameda gunnii* via the collection of sediments from three locations in the vicinity of the proposed development areas using a Van-Veen grab (Figure 2). Sediments were passed through a 2 mm sieve on the vessel and inspected for live specimens, and/or empty shells of *G. gunnii*.

3. Results

3.1 Desktop Assessment

3.1.1 NVA search

A report using buffers of 500 m and 5000 m around the proposed jetty was generated using the online tool for the Tasmanian Natural Values Atlas (NVA). There were no threatened marine species records within 500 m of the proposed jetty. Marine species observed within the 5000 m buffer include the humpback whale and the southern right whale (Table 1; Figure 3). A single observation of spotted handfish has been recorded in the D'Entrecasteaux Channel approximately 5800 m to the south of the proposed development and the zone associated with this observation in the Tasmanian NVA was within the 5000 m buffer (Figure 3). A population of live-bearing seastar is included in the NVA at Woodbridge just outside the 5000 m buffer (see also DPIPWE 2012). Whilst there are nearby records in the NVA, the sediment substrates in the vicinity of the proposed jetty have the potential to support Gunn's screw shell (*Gazameda gunnii*) which is listed as vulnerable under state legislation (Table 1).

The potential range boundary of the Australian grayling and the spotted handfish was within 500 m of the proposed jetty (Table 2), but this area does not include the core or known range of these two species.

Table 1 Threatened fauna within 500 m and 5000 m of the proposed jetty based on verified observations in the NVA. See Figure 2 for locations. TSPA = Tasmanian Threatened Species Protection Act 1995; EPBCA = Commonwealth Environment Protection and Biodiversity Conservation Act 1999. TSPA abbreviations: e = endangered; v =- vulnerable. EPBCA abbreviations: EN = endangered, VU = vulnerable, CR = critically endangered. The full NVA threatened species assessment is included as supplementary material to this report.

Buffer	**Species**	**Common Name**	**TSPA**	**EPBCA**	**Observation Count**	**Last Recorded**
500 m	No observations					
5000 m	*Megaptera novaengliae*	Humpback whale	e	VU	6	09 Jun 2008
5000 m	*Eubalaena australis*	Southern right whale	e	EN	3	19 Jul 2005
5000 m[#]	*Brachionichthys hirsutus*	Spotted handfish	e	CR	1	03 Sep 2013
5100 m*	*Parvulastra vivapara*	Live bearing seastar	v	VU	510	2001
Other	*Gazameda gunnii*	Gunn's screw shell	v	NA	NA	NA

* This observation was just outside the 5000 m buffer but included in assessments.

[#] This observation was just outside the 5000 m buffer but included in assessments, but a buffer zone associated with this observation in the NVA overlapped with the 5000 m buffer used in this analysis (see Figure 3).

Table 2 Threatened fauna within 500 m and 5000 m of the proposed jetty based on Range Boundaries in the NVA. TSPA = Tasmanian Threatened Species Protection Act 1995; EPBCA = Commonwealth Environment Protection and Biodiversity Conservation Act 1999. TSPA abbreviations: e = endangered; v =- vulnerable. EPBCA abbreviations: EN = endangered, VU = vulnerable, CR = critically endangered. The full NVA threatened species assessment is included as supplementary material to this report.

Buffer	Species	Common Name	TSPA	EPBCA
500 m	*Prototroctes maraena*	Australian grayling	v	Vu
500 m	*Brachionichthys hirsutus*	Spotted handfish	e	CR
5000 m	*Prototroctes maraena*	Australian grayling	v	Vu
5000 m	*Brachionichthys hirsutus*	Spotted handfish	e	CR

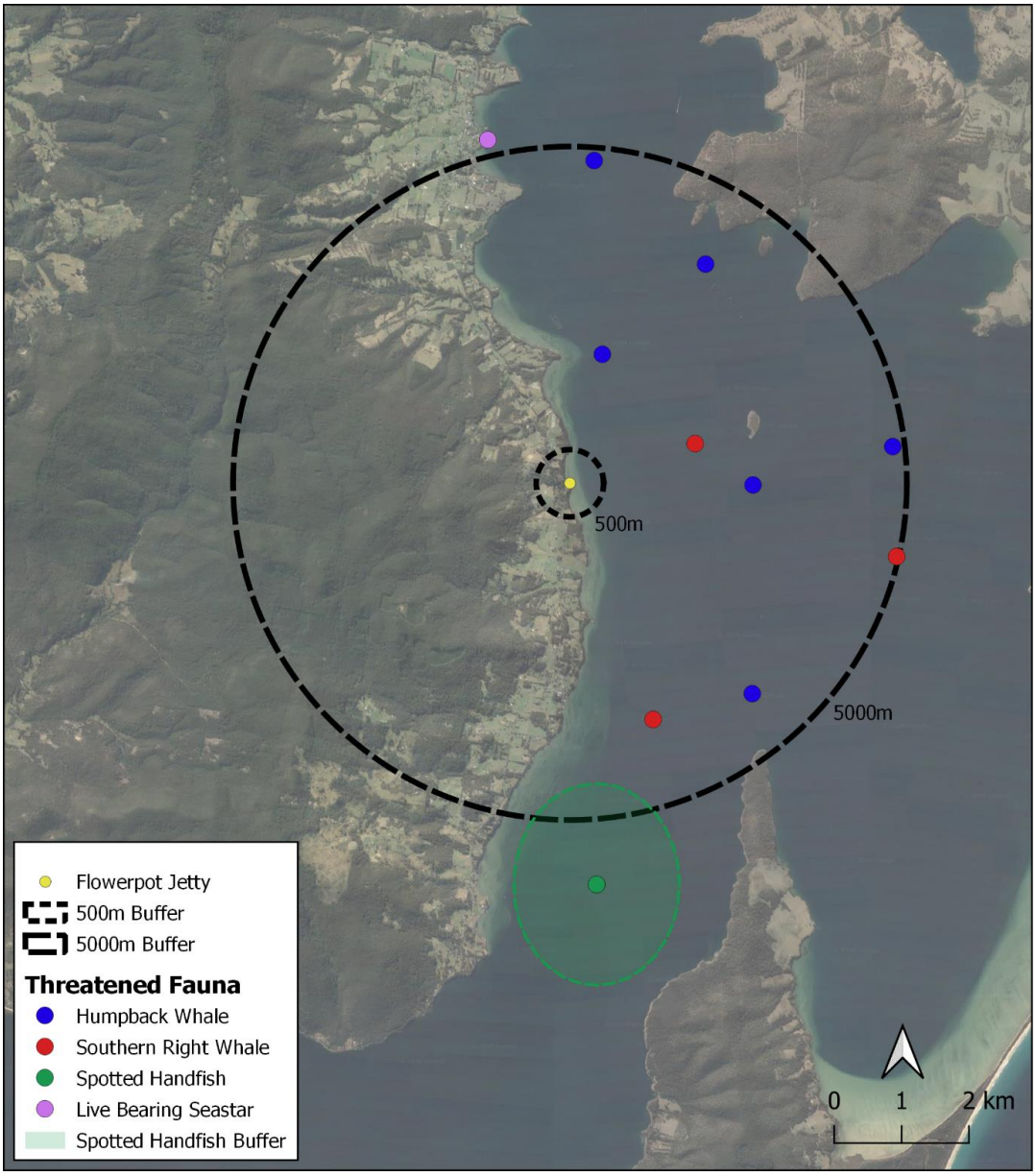

Figure 3 Location of observations of threatened marine species in the Tasmanian Natural Values Atlas within (a) 500 m of the jetty and (b) 5000 m of the jetty. The Tasmanian NVA includes a buffer around observations of spotted handfish. A population of live bearing seastar was just outside the 5000 m buffer but was included in the desktop assessment.

3.1.2 Other species of conservation significance

In addition to listed threatened species, there were a number of species protected through Commonwealth legislation that were considered as part of the assessment. The Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) not only lists threatened species, but also migratory species that are protected in international agreements (JAMBA, CAMBA and the Bonn Convention). As a signatory to these agreements, Australia has responsibilities to protect migratory species, and any project that may potentially impact upon them must undergo an environmental assessment. Listed migratory species that could occasionally occur in the waters surrounding the development include the humpback whale (*Megaptera novaeangliae*) and the killer whale (*Orcinus orca*). The EPBCA also lists other marine species for long-term conservation and, in the absence of a permit, it is illegal to kill, injure or take any of the listed marine species. Listed marine species that occur, or may potentially occur, in the vicinity of the proposed development site include seals (e.g. Australian fur seal (*Arctocephalus pusillus*) and other cetaceans (e.g. dolphins). Under the EPBC Act, all marine mammals are protected in Australian waters and it is an offence to injure, take, trade, keep, move, harass, chase, herd, tag, mark or brand marine mammals in Australian waters without a permit. These species are included as listed marine species under the EPBC Act.

The little penguin *Eudyptula minor* is not listed in threatened species legislation but is considered to be of high conservation significance in Tasmania. This species breeds in colonies around the southern Tasmanian coastline (Stahel and Gales 1987). There are no records of this species breeding in the development area, however little penguins are common in the Dentrecasteaux Channel and it is likely they feed in the area adjacent to the development site.

3.1.3 Risk Assessment

Humpback whale, southern right whale, other marine mammals and little penguin

The humpback whale and southern right whale are known to enter the D'Entrecasteaux Channel (Figure 3; Table 1). Other species of conservation significance such as Australian fur seals (*Arctocephalus pusillus*), dolphins and little penguins (*Eudyptula minor*) may also occur in the vicinity of the proposed jetty. There are two potential threats to these animals: (1) collision with the jetty; and (2) acoustic interference during construction of the jetty. The jetty is limited to the shallows and does not extend into deeper waters (maximum depth approximately 0.9 m relative to MSL) that would be favoured by passing mammals or penguins. As such, the chance of collision with the jetty is remote. Construction activities may result in acoustic disturbance in the water column. Noise emanating from the drilling or pile-driving of pylons used in jetty construction may disturb passing marine mammals. The level of this threat can be minimised by limiting these components of jetty construction to a short amount of time and employing appropriate mitigation controls during construction activities (e.g. soft start procedures; see section 4.1 below). Overall, the risk to marine mammals was assessed as negligible (Table 3).

Spotted handfish

The stronghold for known populations of spotted handfish is in the Derwent Estuary approximately 40 km to the north of the proposed jetty. A single observation of spotted handfish has been recorded in the D'Entrecasteaux Channel approximately 5.8 km to the south of the proposed jetty and the zone associated with this observation in the Tasmanian NVA was within the 5000 m buffer (Figure 3; Table 1). There are two potential threats to spotted handfish arising from the proposed jetty: (1) habitat loss from the jetty structure and (2) reduction in water quality during construction. The pylons associated with the jetty would result in the loss of an extremely small amount of potential habitat for the spotted handfish and the likelihood of impacts is remote. The construction of the jetty could result in sediment plumes carried into the waters of the D'Entrecasteaux Channel but the likelihood of these plumes reaching the distant (5.8 km) known population of spotted handfish is remote and likely to be short lived. Overall, the risk to spotted handfish populations was assessed as negligible (Table 3).

Live bearing seastar and Gunn's screw shell

There was a population of live-bearing seastar observed 5.1 km to the north of the proposed jetty at Woodbridge in 2001 and Gunn's screw shell is known to be present in the D'Entrecasteaux Channel (Figure 1; Table 1). There are two potential threats to live-bearing seastar and Gunn's screw shell arising from the

proposed jetty: (1) habitat loss from the jetty structure and (2) reduction in water quality during construction. The pylons associated with the jetty would result in the loss of a vanishingly small amount of potential habitat for the live-bearing seastar and Gunn's screw shell and therefore the likelihood of impacts is negligible. The construction of the jetty could result in sediment plumes carried into the waters of the D'Entrecasteaux Channel but the likelihood of these plumes reaching the known population of live-bearing seastar is remote and the effect is likely to be short lived. The risk to both species was assessed as negligible (Table 3).

Australian Grayling

The Australian Grayling *Prototroctes maraena* species is a migratory diadromous species with juveniles occurring in marine waters[3]. This species was not included in the risk assessment due to the extremely low likelihood of them being affected by the development.

Table 3 Qualitative risk assessment matrix for threatened marine species identified from the Tasmanian Natural Values Atlas and literature review. The framework and definitions for assessment is included in Appendix 3.

Species	Threat/Impact	Risk Analysis			
		Likelihood	Consequence	Risk Score	Risk Level
Humpback whale Southern right whale Other marine mammals (e.g. Australian fur seal)	Collision or entanglement	1	2	2	Negligible
	Noise/Acoustic disturbance	2	1	2	Negligible
Spotted handfish	Changes in water quality	1	2	2	Negligible
	Benthic habitat disturbance	1	2	2	Negligible
Live bearing seastar	Changes in water quality	1	2	2	Negligible
	Benthic habitat disturbance	1	2	2	Negligible
Gunn's screw shell	Changes in water quality	1	2	2	Negligible
	Benthic habitat disturbance	1	2	2	Negligible
Little Penguin	Collision or entanglement	1	1	1	Negligible
	Noise/Acoustic disturbance	2	1	2	Negligible

[3] https://www.threatenedspecieslink.tas.gov.au/Pages/Australian-Grayling.aspx

3.2 Field surveys

3.2.1 Bathymetry and subtidal habitat surveys

The seabed in the survey area was shallow gently sloping, with depths of only 1.2 m (relative to MSL) measured 100 m from shore (Figure 4). Adjacent to the shoreline a narrow band of sandstone reef was evident. This reef was predominately in the intertidal zone with only very small areas of subtidal reef present. A band of patchy sparse seagrass extended to approximately 40 m from the shoreline (Figure 5). Epiphytic filamentous algae was common amongst the seagrass and formed dense patches in some areas (Figure 6). Extending further seaward the seafloor was shallow and dominated by unvegetated coarse soft sediments (Figure 5, Figure 6). The habitat map was broadly consistent with broad scale habitat mapping undertaken by IMAS (see Appendix 4). Differences between the two habitat maps reflect the finer scale assessment undertaken in the current survey.

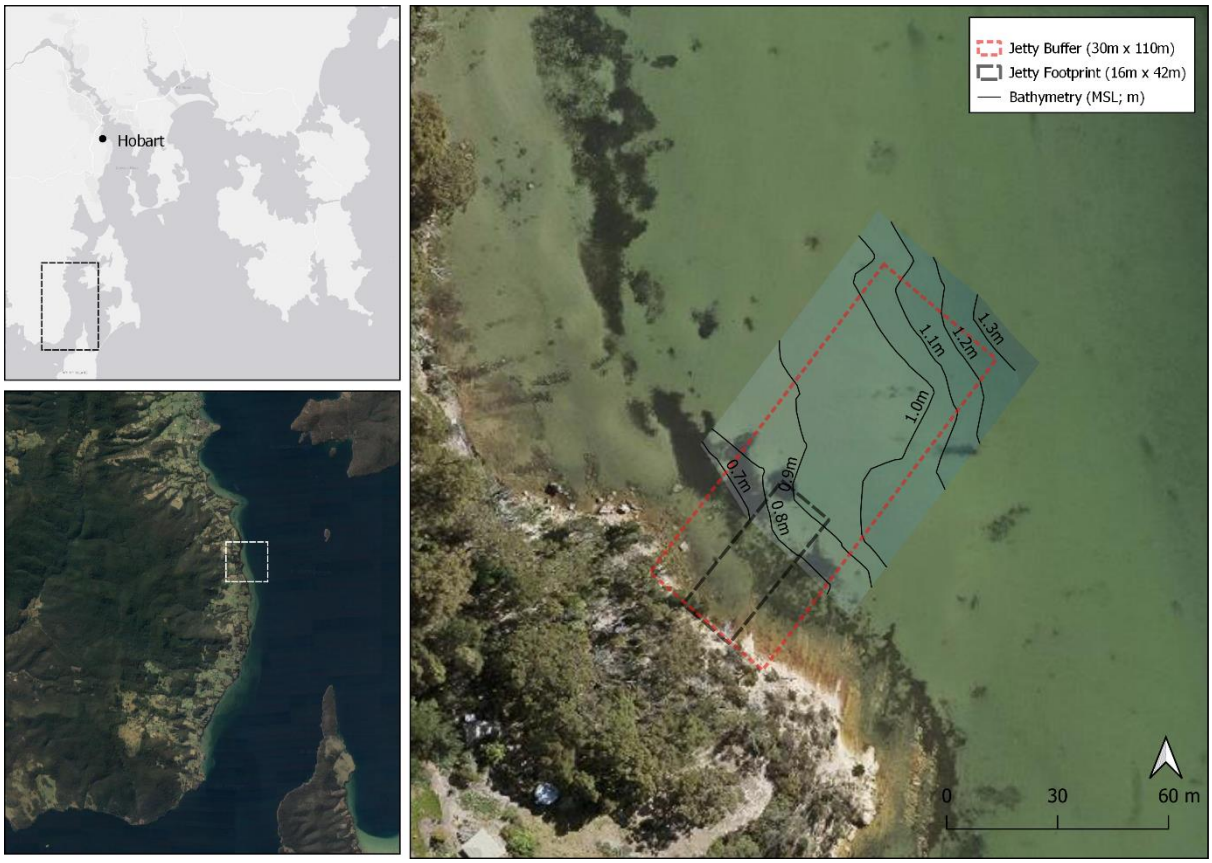

Figure 4 Bathymetric map in the vicinity of the of proposed development. Depth contours are relative to Mean Sea Level (MSL)

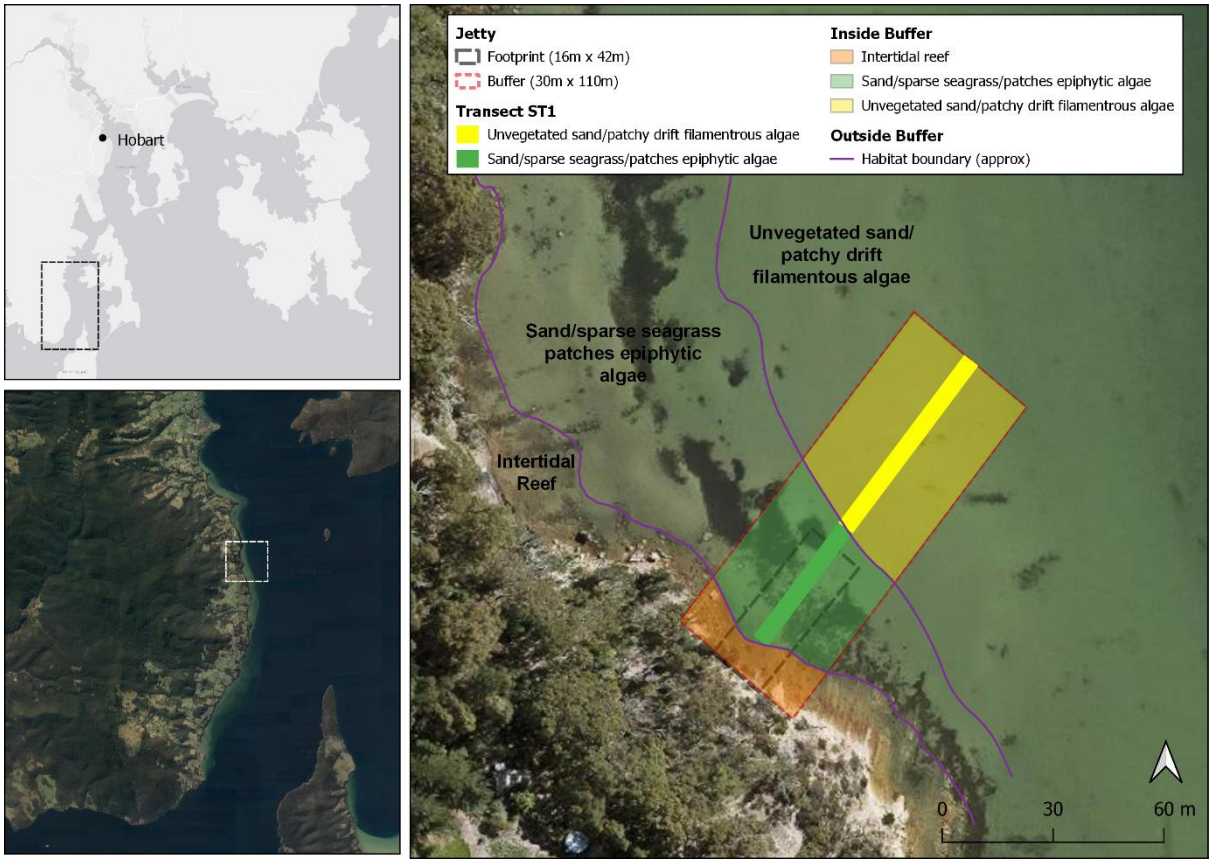

Figure 5 Marine habitats in the vicinity of the of proposed development. Habitats identified in field during the underwater visual survey along Transect ST1 (bold colours) were extended to the buffer area (semitransparent colours) and surrounding habitat (purple lines).

A summary of the video transect observations and representative habitat imagery is included below (Table 4, Figure 6). Note that consistent with the IMAS habitat map, sediment was coarse and rapidly settled following disturbance by the diver during filming of subtidal transects.

No threatened species were observed during the current survey and there was no evidence of handfish or handfish habitat (e.g. vertical spawning substrate such as stalked ascidians *Sycozoa* sp.) in the survey area.

Table 4 Summary of video transect observations. Visibility was approximately 3 m and consistent across the surveys transects.

Transect	Category	Underwater observations
ST1 (100 m)	*Sediment colour and texture*	Light grey coarse sand with burrows and mounds
	Habitat and algal cover	0-3 m: Unvegetated sand, occasional small rock 3-10 m: Sand sparse seagrass and occasional small rock 10-37 m: Sand with sparse seagrass and epiphytic filamentous brown algae. Some patches of dense epiphytic algae 37-100 m: Unvegetated sand with occasional patch of drift filamentous algae
	Animals	*Neoodax balteatus* (little weed whiting), Gobiidae sp. (gobies),
ST2 (30 m)	*Sediment colour and texture*	Light grey coarse sand with burrows and mounds
	Habitat and algal cover	0-8 m: Sand with sparse seagrass and epiphytic filamentous brown algae 8-13 m: Unvegetated sand with occasional patch of drift filamentous algae 13-30 m: Sand with sparse seagrass and epiphytic filamentous brown algae.
	Animals	Nil
ST3 (30 m)	*Sediment colour and texture*	Light grey coarse sand with burrows and mounds
	Habitat and algal cover	0-30 m: Unvegetated sand with occasional patch of drift filamentous algae
	Animals	*Rhombosolea tapirina* (greenback flounder)

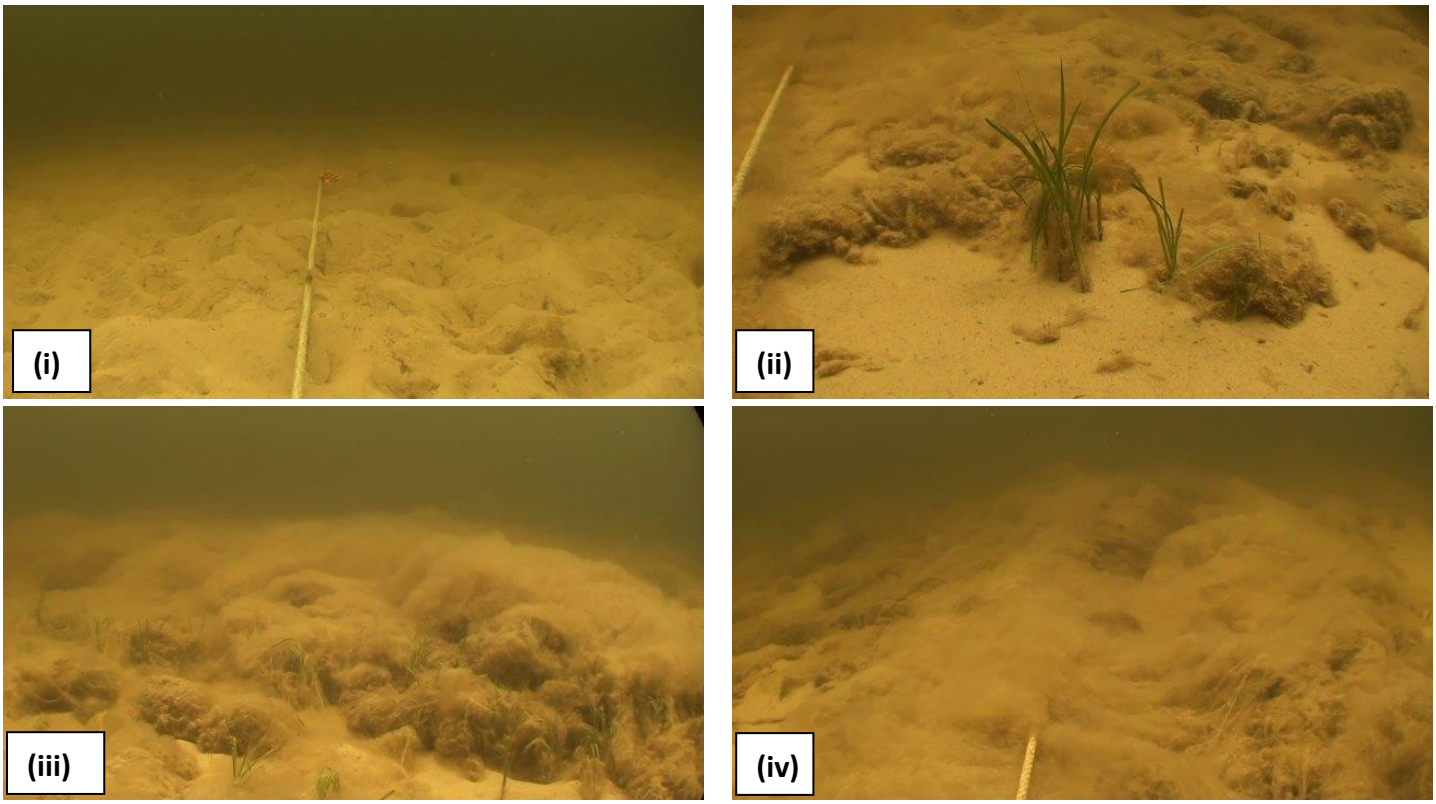

Figure 6 Representative habitat imagery from video transect surveys including (i) unvegetated sand with burrows and mounds; (ii) sparse seagrass; (iii, iv) sparse seagrass with dense patches of epiphytic filamentous algae.

3.2.2 Intertidal surveys

The intertidal zone consisted of a narrow band of rocky shore 5-10 m wide (Figure 7). Intertidal habitat was dominated by a rocky sandstone substratum with overlying stones and rocks. A thin veneer of sand was also evident in patches. No *Parvulastra vivipara* or other threatened species were observed during the intertidal survey.

A range of taxa were observed in the intertidal surveys, mainly comprised of molluscs and crustaceans (Table 5). Oysters (*Crassostrea gigas*) were dominant in the low intertidal zone. Extending up the shore there was only minor variation in species composition relative to tidal height, likely reflecting the gently sloping profile of the shoreline. Transect images for low, medium and high tide are shown in Figure 7. Raw data, quadrat photos and images of representative taxa are provided in Appendix 5 and Appendix 6.

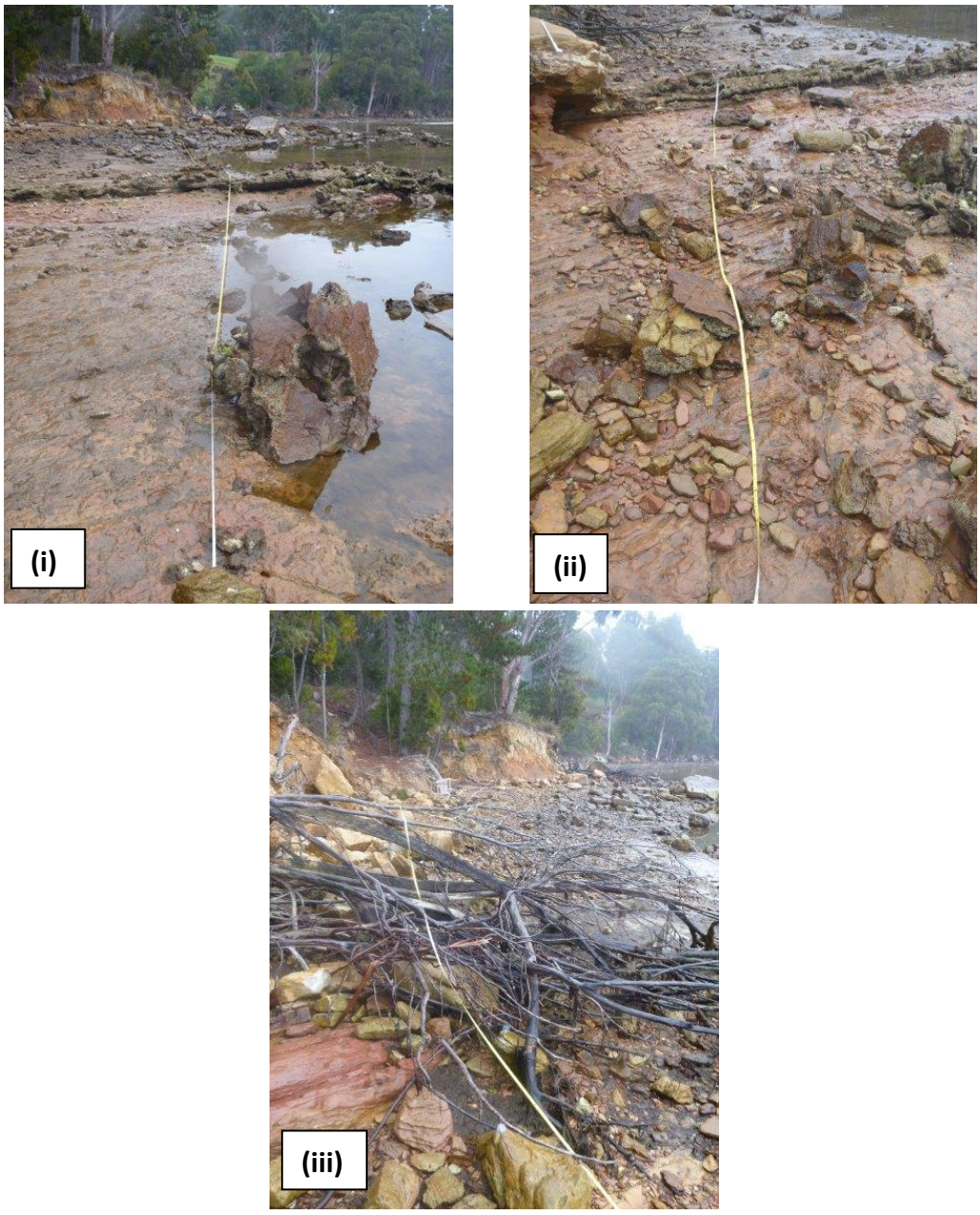

Figure 7 Survey transects including (i) low, (ii) mid and (iii) high tide

Table 5 Summary of taxa observed during the survey

Habitat	Fauna	Flora
Subtidal	*Neoodax balteatus* (little weed whiting) *Rhombosolea tapirina* (greenback flounder) Gobiidae sp.	Seagrass – *Zostera tasmanica* Filamentous epiphytic brown algae
Intertidal	Crustaceans: *Petrolisthes elongatus*, Paragrapsus quadridentatus, Cyclograpsus granulosus* Mollusc – bivalves: *Crassostrea gigas*, Mytilus galloprovincialis* Mollusc – gastropods: *Austrocochlea constricta, A. concamerata*, *Columinella lineolata, Cabestaner spengleri, Lepsiella vinosa, Bembicium* sp. Mollusc – chiton: *Spharochiton pelliserpentis* Mollusc – sea slug: *Onchidella patelloides* Mollusc – false limpet: *Siphonaria diemensis* Barnacle: *Elminius modestus* Polychaetes: *Galeolaria caespitosa*, Nereid sp. Flatworm: Unidentified Seastars: *Asterias amurensis*, Patiriella regularis*, Parvulastra exigua*	*Hormosira banksia, Ulva* sp., *Codium fragile*,* filamentous brown algae

*Introduced or cryptogenic species

3.3.3 Gunn's screw shell *Gazameda gunnii survey*

No *Gazameda gunnii* specimens were detected in the Van-veen grab samples collected in the vicinity of the proposed development.

4. Discussion and recommendations

For those species identified in the NVA search, the risk of the proposed development was considered negligible and no threatened species were detected during thorough field surveys of intertidal and subtidal habitats. Overall, the proposed development is expected to have minimal impacts on marine and coastal natural values in the area. Potential impacts are likely to be localised and restricted to a short time period associated with construction activities and can be mitigated using appropriate methodologies and controls. The most likely impacts relate to acoustic disturbance and to a lesser extent, seabed disturbance. Impacts and recommended mitigation options are described below:

4.1 Potential impacts and mitigation – acoustic disturbance

Marine mammals and little penguins have the potential to occur in the development area. These animals are potentially sensitive to acoustic disturbance during construction activities, since noise emissions can interfere with natural sounds in the marine and coastal environment, potentially impacting social and reproductive behaviour. It is therefore important that contractors are aware of the potential for these species to occur in the area. They must also be aware of appropriate evasive actions to implement if they encounter any of these species during the project to ensure that no wildlife is affected. Prior to and during any heavy marine activities that create significant acoustic disturbance (such as pylon installation) the following conditions should be applied:

- Each day the immediate area should be scanned for the presence of cetaceans, pinnipeds, turtles, and/or penguins.
- Construction activities must not occur, or must cease, if any listed cetacean and pinniped/turtle/penguin species are known to be present within 500 m of construction activities.
- A 'soft start' technique should also be used at the beginning of each pile installation day to allow any cetaceans, pinniped, turtle, and/or penguin that may be in the immediate area to avoid the area before impact piling reaches full capacity. Employing a 'soft start' technique would also benefit other mobile animals (e.g. birds, fish, sharks) which have the ability to move away. PCAB recommends that, consistent with EPBC Act Policy Statement 2.1 – Interaction between offshore seismic exploration and whales, it be specifically noted that a slow start should ramp up to full capacity over a 30 minute period[4].
- It is also recommended that the Wildlife Management Branch within DPIPWE is consulted immediately prior to construction activities, to determine whether there has been any recent marine mammal sightings in the proposed work area (24hr Whale Hotline on 0427 WHALES (0427 942 537)).

[4] https://www.environment.gov.au/system/files/resources/8d928995-0694-414e-a082-0ea1fff62fc8/files/seismic-whales.pdf

- Occurrences of cetaceans, pinnipeds, turtles, and/or penguins must be reported to DPIPWE within 90 days. Reference data should include species name, location-GPS (grid reference GDA94), observer name, date, number of individuals and area occupied.

4.2 Potential impacts and mitigation – seabed disturbance

Sediment disturbance is likely to be short term in nature and highly localised. The field survey identified coarse sediments in the area that are likely to settle out rapidly. The site is subject to tide and wave action so any sediment plume should also disperse within a short timeframe. Despite the limited potential impacts, wherever practical, disturbance to seabed sediment should be minimised during construction activities. For example, propeller scour of the seabed from tending vessel(s) should be avoided where practicable. If pylons are installed via a barge, manoeuvring the construction barge during periods of higher tides would also minimise sediment disturbance.

In summary, provided the recommended mitigation measures are undertaken, the proposed development is expected to have minimal impacts on marine environmental values in the study area.

5. References

Natural and Cultural Heritage Division (2019) Guidelines for Natural Values Surveys - Estuarine and Marine Development Proposals. Department of Primary Industries, Parks, Water and Environment

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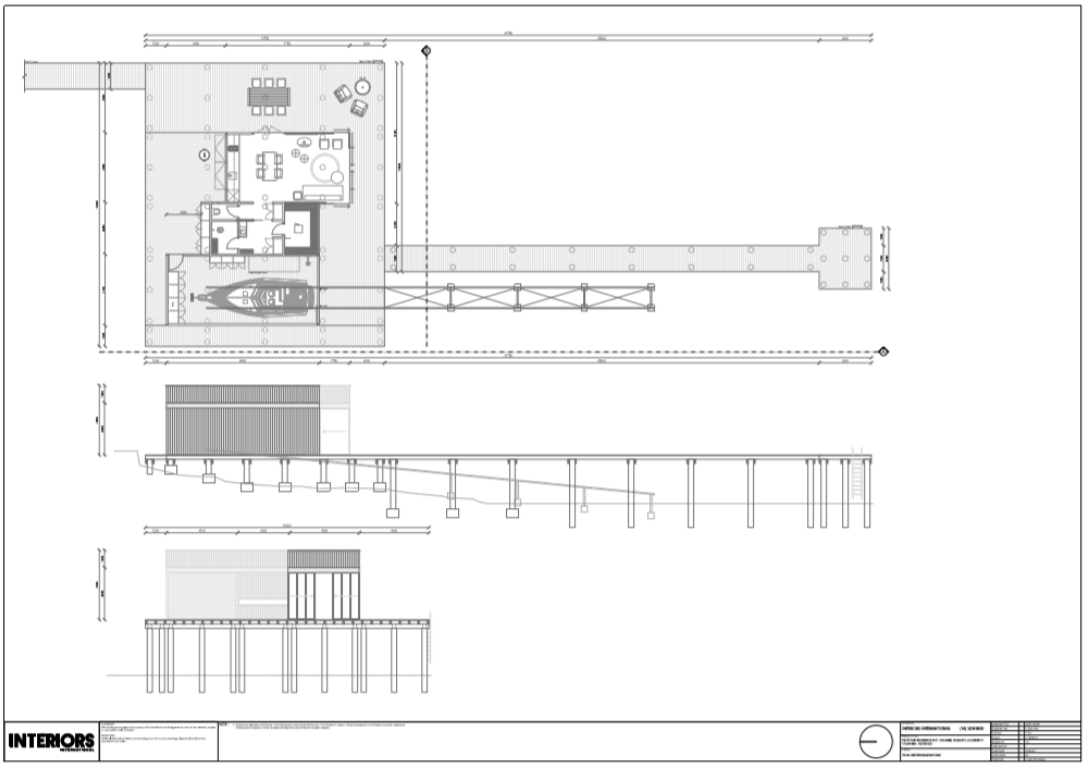
Prestedge, G.K. (1998) The distribution and biology of *Patiriella vivipara* (Echinodermata: Asteroidea: Asterinidae) a seastar endemic to southeast Tasmania. Records of the Australian Museum 50: 161–170.

Stahel, C. and Gales, R. (1987) Little penguin: fairy penguins in Australia. New South Wales University Press, Kensington

Appendix 1 Architectural Drawings of Proposed development at 4101 Channel Highway, Flowerpot



Appendix 2 Geographical coordinates (WGS 84, Zone 55) for survey locations

Site Label	Easting	Northing	Description
IT1_0	520904	5216351	Intertidal Transect 1 (0m) - Start Point
IT1_30	520881	5216367	Intertidal Transect 1 (30m) - End Point
IT2_0	520903	5216349	Intertidal Transect 2 (0m) - Start Point
IT2_30	520880	5216366	Intertidal Transect 2 (30m) - End Point
IT3_0	520899	5216349	Intertidal Transect 3 (0m) - Start Point
IT3_30	520877	5216363	Intertidal Transect 3 (30m) - End Point
ST1_0	520891	5216357	Subtidal Transect 1 (0m) - Start Point
ST1_100	520948	5216433	Subtidal Transect 1 (100m) - End Point
ST2_0	520915	5216366	Subtidal Transect 2 (0m) - Start Point
ST2_30	520894	5216389	Subtidal Transect 2 (30m) - End Point
ST3_0	520938	5216394	Subtidal Transect 3 (0m) - Start Point
ST3_30	520917	5216418	Subtidal Transect 3 (30m) - End Point
G1	520946	5216434	Targeted search for *Gazameda gunnii*
G2	520932	5216417	Targeted search for *Gazameda gunnii*
G3	520921	5216393	Targeted search for *Gazameda gunnii*

Appendix 3 Risk Assessment Framework.

Table A1: Consequence x likelihood risk matrix (adapted from Fletcher 2014). The numbers in the cells indicate the risk score values and the colours/shades represent the levels of risk as described in Table 2. Generic descriptions of each of the consequence and likelihood levels for threatened species and communities are presented in Table 3.

			Consequence			
			Minor	Moderate	Major	Extreme
			(1)	(2)	(3)	(4)
Likelihood	Remote	(1)	1	2	3	4
	Unlikely	(2)	2	4	6	8
	Possible	(3)	3	6	9	12
	Likely	(4)	4	8	12	16

Table A2: Levels of risk and their associated likely management and reporting requirements (adapted from Fletcher 2014)

Risk Score	Risk Level	Possible Management Response
1-2	Negligible (0)	Acceptable with no management actions or regular monitoring
3-4	Low (1)	Acceptable with no direct management actions and monitoring at specified intervals
6-8	Moderate (2)	Acceptable with specific, direct management and regular monitoring
9-16	High (3)	Unacceptable unless additional management actions are undertaken

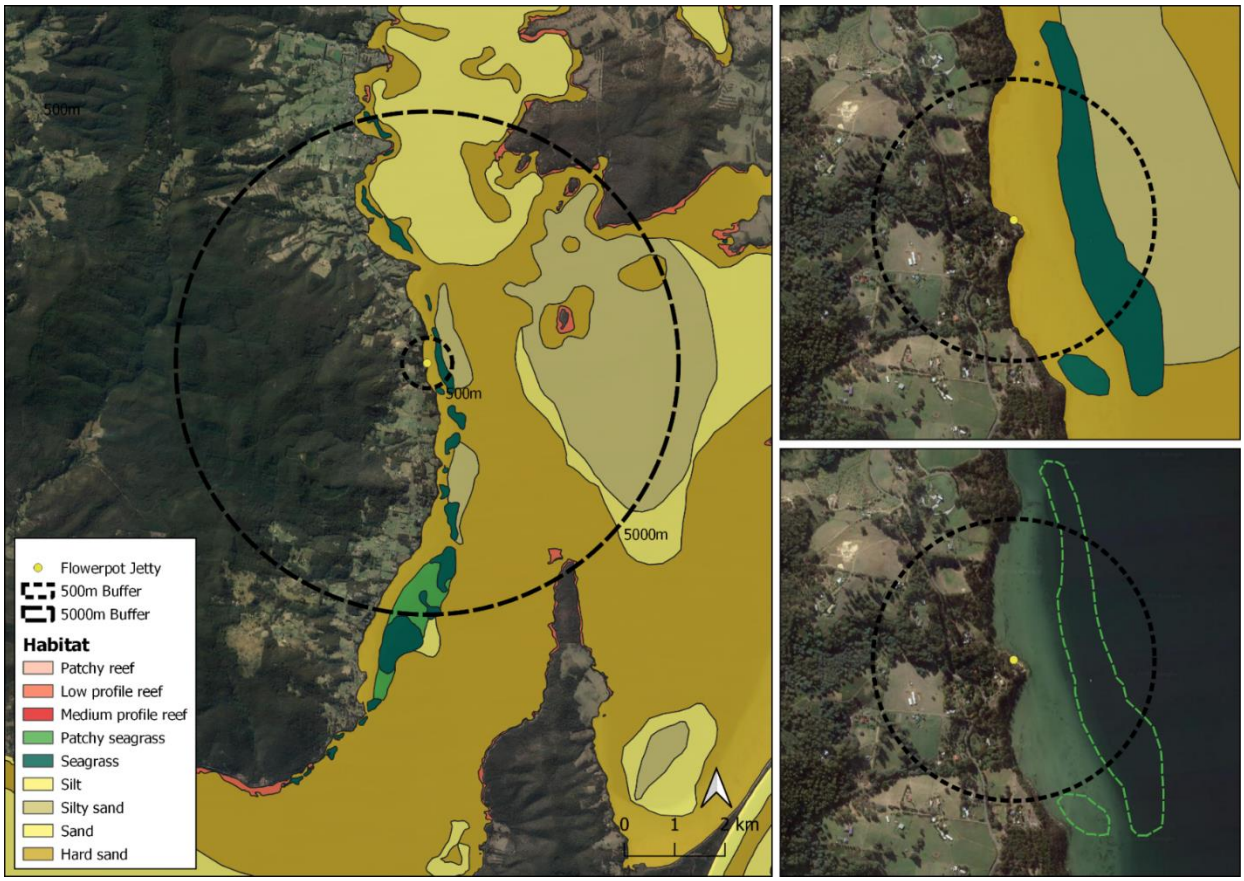
Table A3: Description of likelihood ratings using a four-level system (adapted from Fletcher et al. 2014)

Likelihood	**Description**
Remote	The consequence is not heard of in these circumstances but still plausible within the time frame (indicative probability 1-2%)
Unlikely	The consequence is not expected to occur in the time frame but some evidence that it could occur under special circumstances (indicative probability (3-9%)
Possible	Evidence to suggest this consequence may occur in some circumstances within the time frame (indicative probability 10-39%)
Likely	A particular circumstance is expected to occur in the time frame (indicative probability 40-100%)

Table A4: Description of consequence ratings for protected species and ecosystem structure (adapted from Fletcher 2014 and de Jong and Tanner 2004).

Consequence	Threatened Species	Threatened Communities
Minor	Few individuals directly impacted in most years. Possibly detectable, but minimal impact on populations.	Measurable but minor changes to ecosystem structure but no measurable change to function
Moderate	Impact at the maximum acceptable level.	Maximum acceptable level of change in ecosystem structure with no material change in function
Major	Recovery may be affected and serious and long-term impacts occurring.	Ecosystem function no altered with some function or major components now missing/ and or new species are prevalent
Extreme	Population declines generated with widespread and irreversible effects.	Extreme change to structure and function. Complete species shift in prevalence in system

Appendix 4 SEAMAP Tasmania benthic habitats within (a) 5000 m and (b) 500 m of the proposed jetty. The mapped location of seagrass within 500 m is shown



Appendix 5 Intertidal Quadrats

IT1 – Low tide

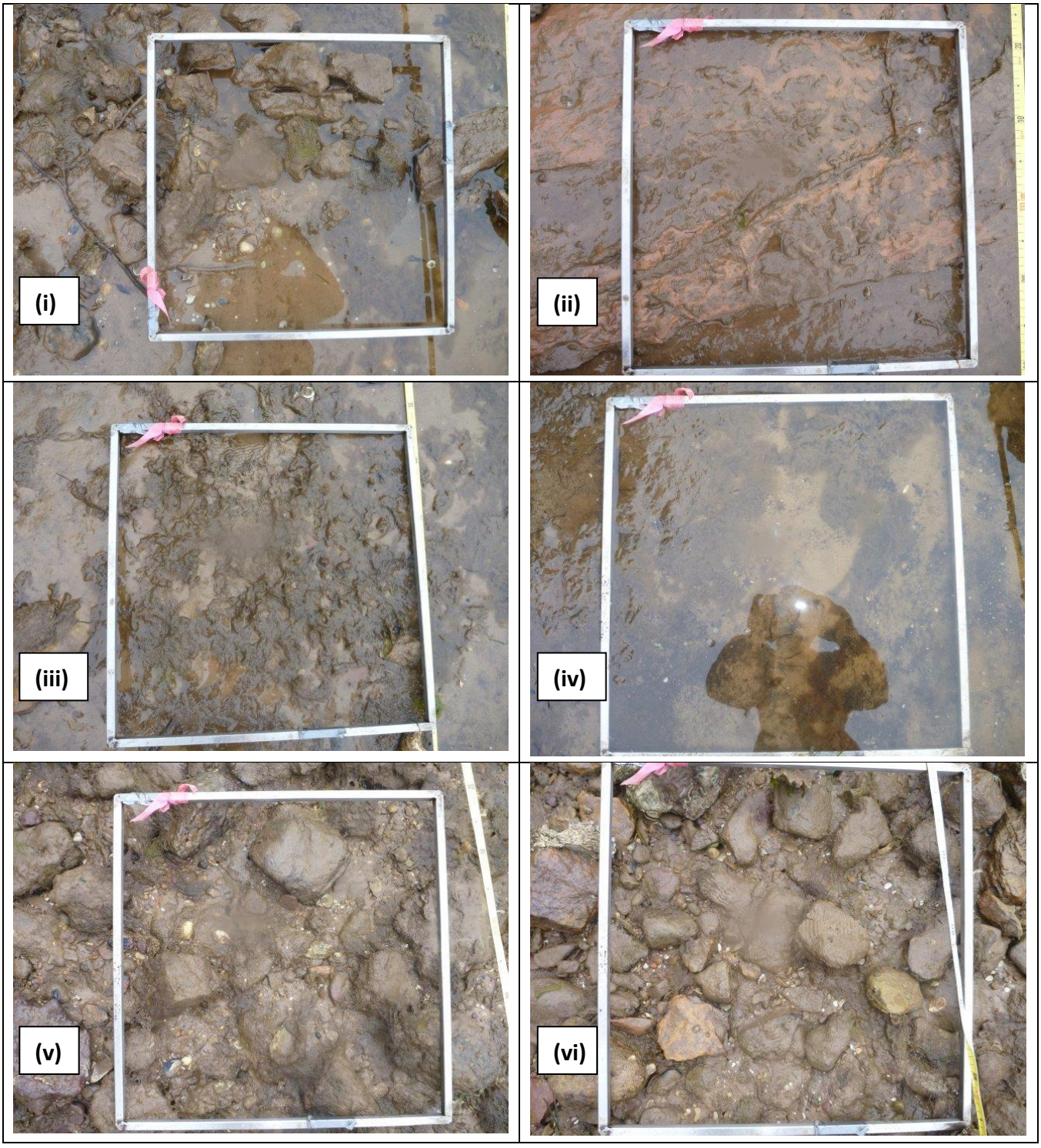


Plate (i) 5 m; (ii) 10 m; (iii) 15 m; (iv) 20 m; (v) 25 m; (vi) 30 m.

IT2 – Mid tide

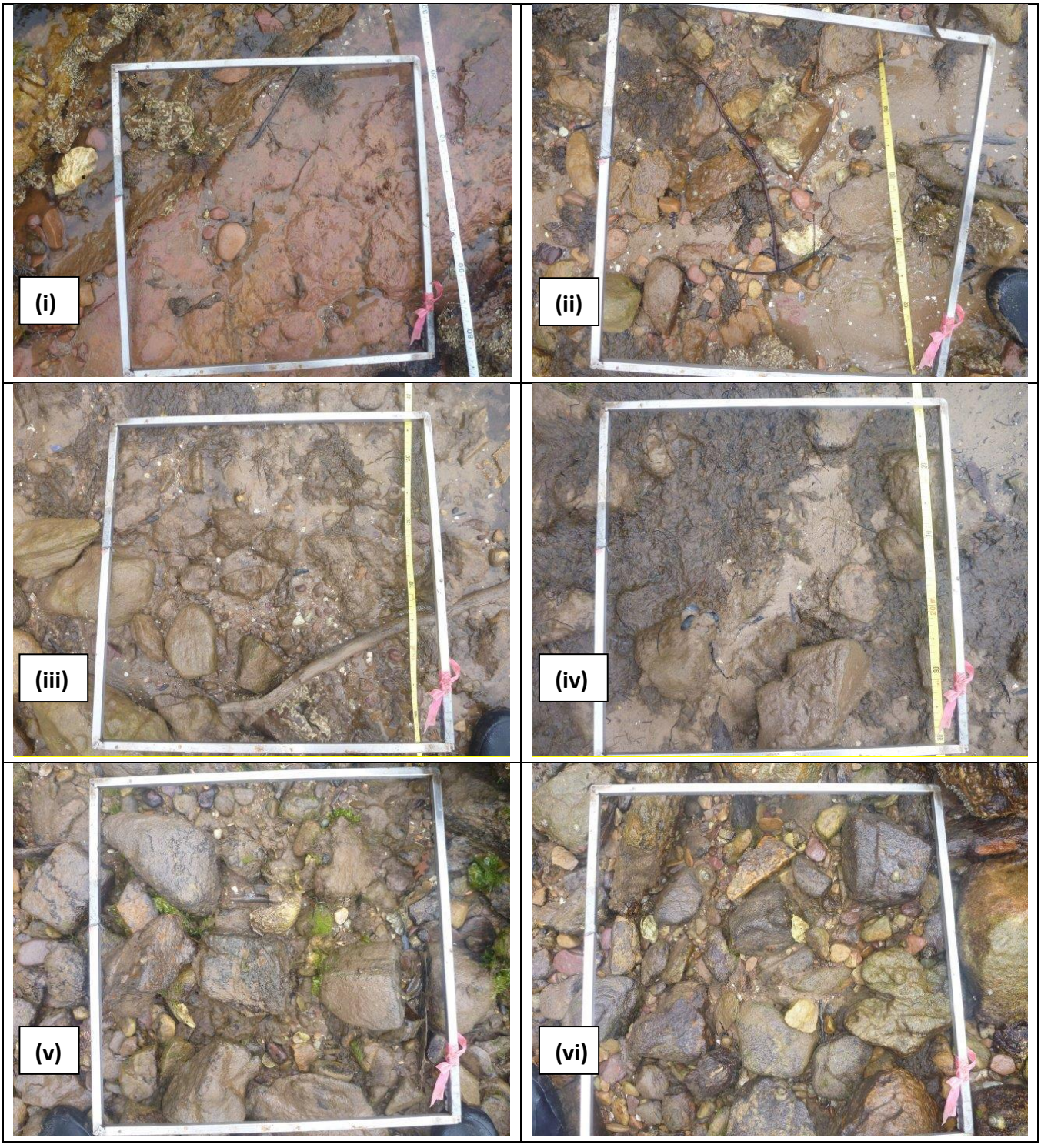


Plate (i) 5 m; (ii) 10 m; (iii) 15 m; (iv) 20 m; (v) 25 m; (vi) 30 m.

IT3 – High Tide

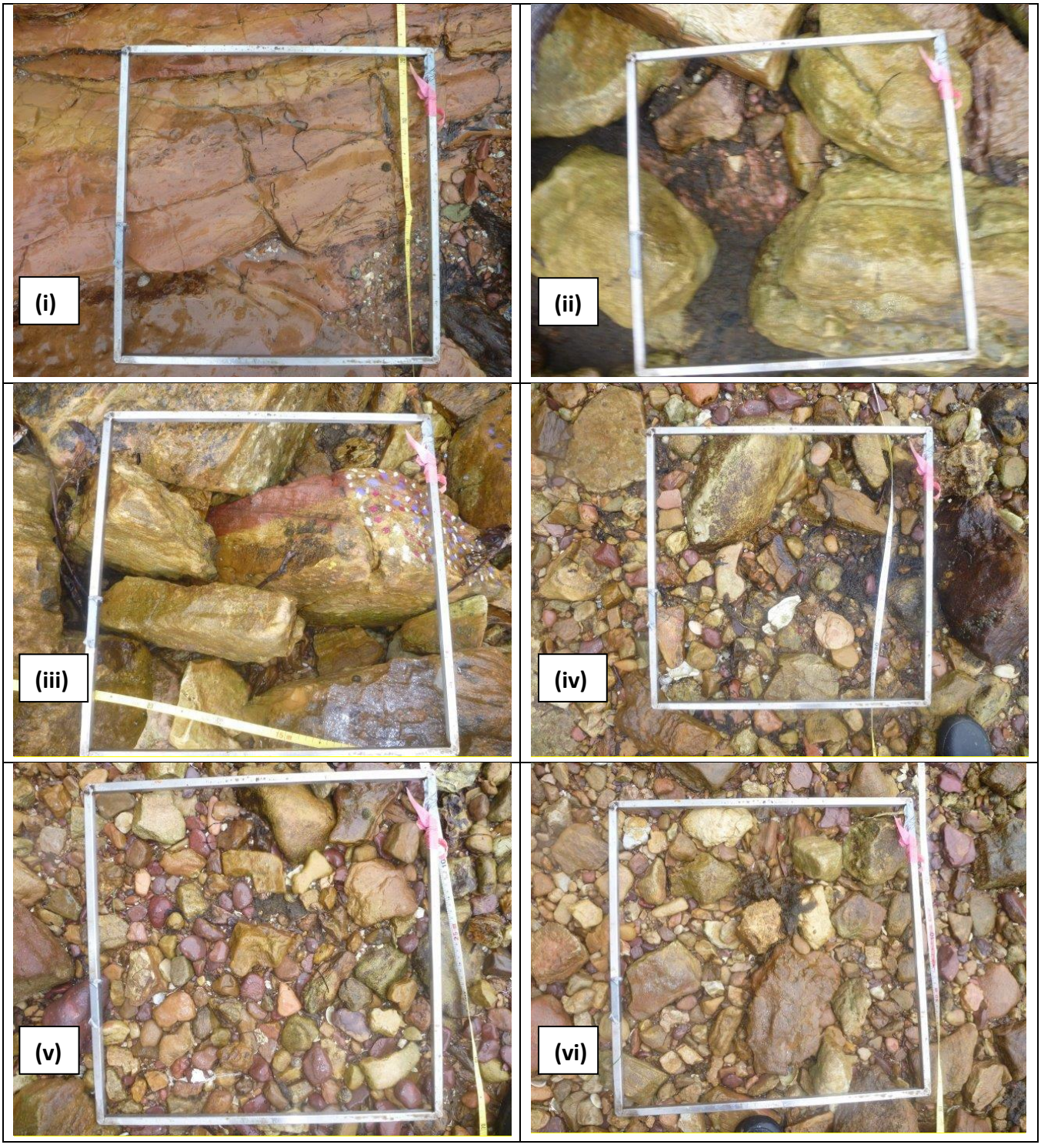


Plate (i) 5 m; (ii) 10 m; (iii) 15 m; (iv) 20 m; (v) 25 m; (vi) 30 m.

Appendix 6 Intertidal Flora and Fauna – representative images

Plate (i) Gastropods *Austrocochlea constricta*, *A. concamerata* and crab *Cyclograpsus granulosus* (ii) gastropod *Lepsiella vinosa*; (iii) gastropod *Bembicium* sp. (iv) gastropod *Columinella lineolata*; (v) seastar *Parvulastra exigua*; (vi) seastar *Patiriella regularis*.

Appendix 6 (continued) Intertidal Flora and Fauna – representative images

Plate (i) Crab *Petrolisthes elongatus* (ii); crab *Paragrapsus quadridentatus*; (iii) limpet *Siphonaria diemensis* (iv); bivalve *Crassostrea gigas* (v) chiton *Spharochiton pelliserpentis*; (vi) algae *Hormosira banksii* and *Crassostrea gigas* in lower intertidal zone