



Appendix 8

Nearshore marine ecology and benthic communities study

REPORT

Ichthys Gas Field Development
Project

Nearshore Marine Ecology and
Benthic Communities Study

Prepared for

INPEX Browse, Ltd.

Level 22, 100 St George's Terrace
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The logo for URS, consisting of the letters 'URS' in a bold, blue, sans-serif font.

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Executive Summary

A series of studies has been undertaken to describe and assess the current condition of marine benthic habitats in selected sites in Darwin Harbour including areas adjacent to the plant site at Blaydin Point, the pipeline shore crossing in Middle Arm, and at potential dredging locations in East Arm. These data were used to characterise the epibenthic biota and burrowing (infauna) communities present in these areas to provide biological input to the environmental impact statement (EIS) document and assist in the assessment of project impacts.

Overall, a moderate abundance of biota was found within the proposed disturbance areas where hard substrate was present, notably the rubble covered pavement located to the north of Blaydin Point. However, hard coral cover, abundance and diversity were lower than at the Channel Island, South Shell Island and Weed Reef sites. The soft bottom communities of sponges, soft corals and gorgonians, together with the associated motile invertebrates including holothurians and nudibranchs, were found to be similar in all areas. A number of similar communities have been recorded within Darwin Harbour during previous URS surveys.

The proposed areas of dredging in East Arm for the shipping channel, turning basin, materials offloading facility (MOF) and jetty, and the shore crossing area on the west coast of Wickham Point were found to have overall low biotic abundance and diversity. These seabed habitats were intertidal mudflats, rubble pavement or subtidal sandbanks. Lowest abundances of biota were found on areas of soft substrate, notably intertidal mudflats and subtidal sandbars, and in areas outside the zone of potential direct impact of the project, such as the surrounds of Elizabeth Island and the subtidal sandbar north of Channel Island.

The Channel Island site had the highest percentage cover and diversity of hard corals of all sites. The South Shell Island site and the Weed Reef site had similar cover and diversity, albeit with some differences in species composition. In contrast, hard coral cover was much lower and fewer species were recorded at each of the Blaydin Point sites.

The proposed pipeline route within the harbour, mostly comprising soft sediments, was found to have a very low abundance of epibenthic biota. This contrasts with the nearby DLNG pipeline which had a dense covering of soft biota together with numerous fish in areas where the pipeline was covered by rock armour or was suspended above the seabed.

Bathymetric data of the dredge spoil disposal area revealed a flat seabed with depths ranging from 20 m in the northern most extent to 15 m in the southern most. Side scan sonar records revealed a uniform, flat and generally featureless seafloor of low to moderate reflectivity interpreted as sand and/or silt. A remote drop camera survey supported these findings of a generally featureless seafloor with very sparse epibenthic fauna observed at 9 of the 21 sites surveyed, typically consisting of occasional bryozoans, sponges, and soft corals, with sparse bioturbation.

In conclusion, due to the low diversity and abundance of the benthic communities, the ecological significance of the proposed areas of disturbance has been found to be limited. More diverse and abundant benthic communities are present elsewhere within the harbour, e.g. Channel Island and Weed Reef, which lie outside the potential area of direct impact. The subtidal soft bottom communities were found to be relatively uniform in their composition and to be widely distributed through the harbour.

1.1 Background

INPEX Browse, Ltd. (INPEX) proposes to develop the natural gas and associated condensate contained in the Ichthys Field in the Browse Basin at the western edge of the Timor Sea about 200 km off Western Australia's Kimberley coast. The field is about 850 km west south west of Darwin in the Northern Territory.

The two reservoirs which make up the field are estimated to contain 12.8 tcf (trillion cubic feet) of sales gas and 527 MMbbl (million barrels) of condensate. INPEX will process the gas and condensate to produce liquefied natural gas (LNG), liquefied petroleum gas (LPG) and condensate for export to overseas markets.

For the Ichthys Gas Field Development Project (the Project), the company plans to install offshore facilities for the extraction of the natural gas and condensate at the Ichthys Field and a subsea gas pipeline from the field to onshore facilities at Blaydin Point in Darwin Harbour in the Northern Territory. A two train LNG plant, an LPG fractionation plant, a condensate stabilisation plant and a product loading jetty will be constructed at a site zoned for development on Blaydin Point. Around 85% of the condensate will be extracted and exported directly from the offshore facilities while the remaining 15% will be processed at and exported from Blaydin Point.

In May 2008 INPEX referred its proposal to develop the Ichthys Field to the Commonwealth's Department of the Environment, Water, Heritage and the Arts and the Northern Territory's Department of Natural Resources, Environment and the Arts. The Commonwealth and Northern Territory ministers responsible for environmental matters both determined that the Project should be formally assessed at the environmental impact statement (EIS) level to ensure that potential impacts associated with the Project are identified and appropriately addressed.

Assessment will be undertaken in accordance with the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth) (EPBC Act) and the *Environmental Assessment Act* (NT) (EA Act). It was agreed that INPEX should submit a single EIS document to the two responsible government departments for assessment.

URS Australia Pty Ltd was commissioned to carry out environmental work associated with INPEX's preparation of the EIS and this technical report, *Nearshore Marine Ecology and Benthic Communities Study*, was prepared in part fulfilment of that commission.

The objective of the marine benthic ecology study was to undertake inspections and assessment of marine benthic habitats in selected sites in Darwin Harbour including areas adjacent to the plant site at Blaydin Point, the pipeline shore crossing in Middle Arm, at potential dredging locations in East Arm and the dredge spoil disposal area in Shoal Bay. These data were used to characterise the epibenthic biota and burrowing (infauna) communities present in these areas to provide biological input to the environmental impact statement (EIS) document and assist in the assessment of project impacts. A survey of intertidal mangrove areas has been conducted separately to this study (see GHD 2008).

The location of the study area is shown in **Figure 1**.

Section 1

Introduction

1.2 Scope of Works

The scope of works comprised a literature and background information review, field and laboratory studies, and reporting.

1.2.1 Literature review

Prior to commencing the field investigation programme a review of existing literature, reports, habitat maps and other data pertaining to the Darwin Harbour marine environment was undertaken. This included government and industry reports and mapping, and studies previously undertaken by URS in Darwin harbour, to identify the major habitats present and guide the selection of sites for the survey programme. Results from a geophysical survey utilising side scan sonar and swathe bathymetry carried out by Fugro in March 2008 were also utilised to help determine locations of heritage sites and hard benthic substrate, particularly around Blaydin Point. Results from a further geophysical survey utilising side scan sonar and single beam echosounder by EGS Earth Sciences and Surveying (EGS) in February 2009 of the dredge spoil disposal area were also used to help determine the substrate type and subsequent habitats present.

1.2.2 Field surveys

The field survey program was designed to collect data required to characterise and record marine benthic habitats in both the nearshore and low intertidal areas together with known communities and other identified features within the survey area. The distribution of these benthic habitats was determined and the current condition of biological communities potentially at risk from the development was identified. Characterisation of biological communities present on existing infrastructure (the Darwin LNG pipeline) and heritage sensitive wrecks located within the harbour was also undertaken.

1.2.3 Reporting

The field survey data was summarised to provide a description of the marine benthic biological communities occurring in the vicinity of works associated with the proposed LNG project, and input to be used in assessing the impacts of the project on these communities.

2.1 Survey Design and Information Review

Indicative development locations provided by INPEX such as pipeline location, material offloading facility (MOF), shipping channel and proposed jetty alignment were used to determine the areas of potential impact. Surveys were then planned and conducted to identify significant benthic communities (e.g. coral and macroalgae) in the impact areas and compare them to known locations of significant communities. This was based on admiralty charts, aerial photographs, hydrographic surveys, previous benthic investigative reports and URS scientist's local knowledge of the area.

Historical wrecks such as WWII Catalina flying boats and naval wrecks within the area of influence of construction and operational activity were also examined and recorded. Results from the Fugro hydrographic survey were utilised to enable the precise locations of these wrecks to be identified.

2.2 Survey Methods

Field surveys were carried out between April 2008 and September 2009 principally by URS scientific personnel, with assistance from Tek Ventures Pty Ltd (Tek Ventures), a commercial diving company based in Darwin.

2.2.1 ROV survey

The first of the six surveys to be conducted was undertaken utilising a remote operated vehicle (ROV) at the end of April 2008, using a VideoRay Pro II ROV operated by Land and Marine Technology Systems, with cameras relaying images to monitors onboard the MV *Northern Exile*. This was to be the first of two main surveys, with the ROV focussing on areas such as known coral communities in the harbour, where a remote drop camera could possibly become entangled.

ROV dives were undertaken at 41 sites over two days, at locations including the potential pipeline route through Darwin Harbour from west Wickham Point to north of West Point, potential sea dumping grounds located outside of Darwin Harbour, and sites at West Point, Weed Reef and Middle Arm reef (**Figure 2**). Surveys were also carried out in East Arm including the coral communities of north Wickham Point, South Shell Island and Old Man Rock, along with identified bathymetric features of interest such as the sand bar to the west of Blaydin Point, together with north of Blaydin Point and the island upstream of Blaydin Point in Elizabeth River.

Observations were made at all sites, noting substrate and epibenthic biota communities present. Abundances and identification of epibenthic taxa were carried out by URS personnel in the field, with further identification taking place at URS offices in Perth, Western Australia.

Failure of the ROV drive system after the first of two dives rendered the manoeuvrable ROV usable only in drop camera mode and was then employed in the investigation of the remainder of flat, featureless sites to be visited, to reduce the possibility of entanglement. Operation of the ROV proved very difficult after the malfunction, but images gathered were of acceptable clarity with only a few dives being in lowered visibility and speeds deemed to be too fast to enable recognition of epibenthic biota.

2.2.2 Diving surveys

The first diving operation focussed on the sites of historical wrecks and objects detected by side scan sonar during the Fugro geophysical survey conducted in May 2008. The survey was conducted by Tek

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Methods

Ventures commercial diving services over three days, diving 16 locations and comprised still images and observations noted of objects identified, together with biota present. Areas visited were the potential module offloading facility at Blaydin Point, wrecks and features along the proposed jetty alignment in East Arm, a further number of wrecks located in East Arm, and features and wrecks to the north of Channel Island.

A second diving survey was carried out by URS scientific divers at the end of June 2008 comprising 21 dives to survey areas of seafloor relief (rock outcrops and platforms, etc.), previously known coral monitoring sites, and to complete the survey commenced by the ROV. Sites visited included areas surrounding Channel Island, proposed pipeline route, Weed Reef, South Shell Island and north Wickham Point, a pinnacle (Plater Rock) and shoal (Kurumba Shoal) to the north of Weed Reef, a wreck site in East Arm, together with the existing Bayu-Undan pipeline that is within Darwin Harbour. The pipeline was examined at areas where it was trenched, partially buried with rock armour and where it was suspended above the seabed, to investigate epibenthic biota.

A third diving survey was carried out in August 2008 by URS scientific divers to further investigate hard substrate located to the north-east of Blaydin Point, and to compare findings there to other areas in the harbour to ascertain the significance of biota surveyed. Six sites were visited (Channel Island, two sites at Blaydin Point, South Shell Island, Walker Shoal and Weed Reef) with four 10 m transects used at each site (five at Channel Island) with video and still records taken. The number of species of hard corals observed was recorded together with zonation, dominant species present and an estimate of coverage of live hard coral. Locations for all three diving surveys can be found in **Figure 3**.

2.2.3 Remote drop camera habitat surveys

Investigative techniques utilising remote drop camera for subtidal areas and intertidal surveys based on foot were used for determination of the remaining areas of benthos not previously investigated utilising the ROV (**Figure 4**). The vessel MV *Northern Exile* was used to access the majority of survey areas of interest. A small number of nearshore sites, unable to be accessed by vessel, were accessed from Blaydin Point on foot. Images were recorded and interpreted noting location, weather and current condition. The majority of images recorded proved of good quality allowing for predominant sessile faunal recognition, with a small number of images being of low quality due to rough seas and low visibility. Further identification was achieved by reviewing the video record.

2.2.4 Marine infauna survey

Samples were collected from three sites (G18 – G20) at the proposed jetty location off the east side of Wickham Point, nine sites (G21 – G29) at the pipeline shore crossing location on the west side of Wickham Point and 26 sites (G1 – G17 & G30 – G38) around the perimeter of Blaydin Point, to cover options for the location of the proposed module offloading facility (**Figure 5**).

Grab sampling was used for collection of samples for infauna determination as well as analysis of sediment quality. A Van Veen grab was employed with a ~0.15 m² gape (Plate 1). Infauna samples were processed by passing the sediment through decreasing sized sieves of 5 mm and 1 mm to remove animals from the substrate. Material retained on the sieves was fixed in 10% formalin for at least 24 hours, and then preserved in 20% ethyl alcohol for transport to Perth. Identification and recording of the majority of fauna was carried out in the field. Samples that were unable to be taxonomically determined in the field were transported to Perth for further identification. Characteristics

of the sediment were also determined and a photographic record was taken, together with notes on sampling conditions and other features.

2.2.5 Dredge spoil disposal area survey

Investigation of the dredge spoil disposal area was carried out in February 2009 by EGS with URS personnel present, utilising a side-scan sonar and single beam echosounder for bathymetry collection (see **Figure 6** for survey area). The survey consisted of 30 lines of 7-km length, at intervals of 100 m across the width of the spoil disposal area (total 210 km surveyed), with the objective to cover 100% of the seafloor within the survey area boundaries. Results were recorded and interpreted in the field (EGS 2009).

Further investigations to ground-truth results gathered from the bathymetric/side-scan-sonar survey and to characterise benthic fauna in the area were conducted on 28-29 September 2009 by Tek Ventures (Tek Ventures 2009). Twenty-one sites were surveyed utilising a remote drop camera; one site per square kilometre within and around the soil disposal area boundary (**Figure 6**). The survey was conducted on board the vessel *MV Equity*.

3.1 Summary of Results

A summary of the locations and observations from each of the surveys can be found in the following tables, attached at the end of this report –

- Data Table 1 – ROV site record, April 2008
- Data Table 2 – Diving survey sites conducted by Tek Ventures, May 2008
- Data Table 3 – Second diving survey sites, June 2008
- Data Table 4 – Third diving survey sites, August 2008
- Data Table 5 – Remote drop camera transects, June 2008
- Data Table 6 – Infauna sites, June 2008
- Data Table 7 – Infauna records

3.2 Low Intertidal and Subtidal Habitats

3.2.1 Blaydin Point

Mangroves fringe the majority of the shoreline of Blaydin Point, becoming less abundant towards the northern point, with a small area at the very north-eastern tip that is devoid of mangroves. In this area sloping rock platforms extend from the shore in northerly and easterly directions. This intertidal platform is an exposed pavement with veneers of coarse sand and silts, gravel, rubble and some larger rocks, with low biota cover present in the northern and western areas.

Mangrove mud characterised the majority of the rest of the mid to nearshore area surveyed. In general, a moderate bioturbation was evident (~20 burrows/m²), with fiddler crabs (*Uca* spp.), alpheid shrimp and mudskippers (*Periopthalmus* sp.) associated with many of the burrows (Plate 2 and 3).

In the deeper subtidal area (approximately 1,500 m from the shoreline), sites had low to moderate biota (remote drop camera sites RC24, RC27, RC28, RC31, RC34, RC35 and RC36, **Figure 4**). These included soft corals (mainly *Sarcophyton* and *Dendronephyta* species) where hard substrate was present (site RC36) together with zoanthids, laminar, digitate and barrel sponges, bryozoans, hydroids and ascidians, with moderate to high biota cover at sites RC37 and RC38. At deeper sites where hard pavement was not exposed (sites RC24, RC27, RC28, RC31 and RC34), biota typically comprised gorgonian fans, sea whips, sea pens and large sponges (Plates 3 – 7).

An area of subtidal hard pavement located approximately 2 km to the west of the northern tip of Blaydin Point (remote drop camera site RC37) was found to support a moderate to high abundance of biota predominantly consisting of algae with some soft coral and one identified hard coral (*Turbinaria*). Analysis of hydrographic data in the vicinity of camera site RC37 further revealed a 2 m high steep slope that, coupled with the findings of the remote drop camera, was concluded to be an area that required further study. The investigation that was prompted by these findings was carried out by URS scientific coral taxonomists in August 2008.

The methodology used for the survey involved one diver video recording four 10 m transects at each site, while the other diver conducted a census of hard corals, supported by still photographs. Across

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the five sites, 44 species of hard coral were identified. The area covered at each site was approximately 1000 m², with the inspection time at each site to conduct the survey being 45-60 minutes.

The first of two sites investigated during the coral survey at Blaydin Point (BLDN 01, **Figure 3**) found a platform dominated by green algae [approximately 0 m lowest astronomical tide (LAT)] with sponges, soft corals, gorgonians and limited live coral cover of 5%, with soft corals and sponges and live hard coral coverage of 10% on the slope (from 0 m LAT to -1.5 m LAT), consisting of mostly *Turbinaria peltata*, *Mycedium elephantotus* and several species of Faviids.

At the base of the slope (deeper than approximately 1.5 m below LAT), a soft bottom with a well developed community of sponges, soft corals and gorgonians occurred with numerous Synaptulid holothurians (sea cucumbers). Of the very few hard corals found in this zone, *Turbinaria* was the dominant genus.

A second dive on Blaydin Point (BLDN 07) revealed a less developed slope that was dominated by algae, soft corals and sponges, with less than 5% living hard coral cover and a poorly developed soft bottom community occurring at depths greater than approximately - 0.5 m LAT (Plates 8 and 9).

3.2.2 Wickham Point

Jetty area

Mangroves fringe the eastern edge of Wickham Point, with all surveyed sites (RC39 – RC41, **Figure 4**) resembling the nearshore sites of Blaydin Point, consisting of veneers of fine sand and silts, with low bioturbation (~10 burrows/m²) and low abundance of biota, typically consisting of sea whips and algal tufts.

Pipeline shore crossing

A sparse epibenthic biota and relatively featureless mangrove muds characterised the nearshore intertidal zone at the pipeline shore crossing (remote drop camera sites RC1 – RC12), with low to moderate bioturbation (~10-20 burrows/m²) within a light brown silt veneer overlying a grey fine sand and silt matrix. No epibenthic biota was observed at any of the twelve sites surveyed.

The eastern edge of the rock platform extending to the north of Wickham Point (sites DC10 and DC11, **Figure 3**) was found to support ~10-15% hard coral coverage, dominated by laminar *Turbinaria*, and *Goniopora* with lower numbers of *Mycedium* and faviids with small branching *Acropora*, together with soft corals (Dendronephyta), gorgonians and sea whips. This differed markedly from the northern edge of the platform (site ROV EA13, **Figure 2**), where the deeper areas consisted of coarse sand with wave formations and patches of rubble at shallower depths which were dominated by algae and hydroids (Plate 10).

3.2.3 East Arm

South Shell Island was found to have a well-developed hard coral community on the slope (approximately 0 to 1.5 m below LAT) with an estimated 15–20% cover of hard corals (site ROV EA2, **Figure 2**, and site DC12, **Figure 3**). Faviids were the dominant corals, although there were numerous *Turbinaria peltata* colonies. Sponges, soft corals and hydroids were numerous on the slope, and were dominant at the base of the slope (deeper than approx 1.5 m below LAT), along with gorgonians (sea

fans and sea whips) and crinoids (feather stars). Seafloor composition consisted of sand and gravel with shell fragments.

The top of Walker Shoal (6 m LAT) was found to be devoid of hard corals, with biotic coverage dominated by gorgonians and sponges.

Old Man Rock (site ROV EA12, **Figure 2**) comprised silt/sand-covered rock at shallow depths (0-0.5 m LAT) with <10% hard coral coverage, with Faviids (*Goniastrea*) dominant with *Goniopora* and few soft corals (gorgonians, Dendronephyta) also present. Many pelagic fish were also present including Acanthuridae (surgeon fish), and Chaetodontidae (butterfly fish). The surrounding substrate was composed of sandy/shelly seafloor with a high diversity of sponges (of laminar and branching forms) and increased numbers of soft corals. In contrast, the large sand bar south of Old Man Rock harboured very sparse biota and a low level of bioturbation. Strong ripples indicate that the sand bar is highly mobile, hence unsuitable for establishment of large epibenthic biota.

Surveys further upstream of the proposed development concentrated on the small island located in Elizabeth River (site ROV EA8, **Figure 2**). Nearshore areas consisted of uniform mangrove muds, with little bioturbation and shell fragments, becoming more gravelly and sandy with depth. Towards the deepest extent of the channel (~9 m LAT) moderate biota consisting of hydroids, gorgonians, and digitate and barrel sponges, was present in patches on a hard rocky substrate.

The steel barge, Kelat wreck and five Catalinas (World War II flying boats) were dived (sites TEK2, TEK3, TEK5, TEK6, TEK8, TEK10 and TEK13, **Figure 3**). All objects were observed to have a heavy growth consisting primarily of soft corals, sponges bryozoans, hydroids and ascidians, with a low abundance (where present) of solitary hard corals. Pelagic fish life was moderate to abundant at these sites, consisting of *Protonibea diacanthus* (Jewfish), *Platycephalus* sp. (flathead), *Synanceja verrucosa* (stonefish), Urolophidae (rays), as well as a small number of sharks. Other features investigated (sites TEK4, TEK9 and TEK12) were old mooring blocks, comprised of concrete filled sea containers or plain concrete blocks. These had sparse attached biota, and low abundance of fish.

3.2.4 Channel Island

Eight dives were carried out around Channel Island (sites DC1-DC8), including the lower intertidal and subtidal area extending eastwards from Channel Island. Along the northern edge of this area (Site DC6, **Figure 3**), the rocky substrate had sandy patches colonised by a wide range of sponges, hard and soft corals, with high coverage (~50%). At very low intertidal areas hard corals were predominantly faviids (*Goniastrea*, *Platygyra*) and also included *Symphyllia*, *Herpolitha* and soft corals. In subtidal areas, very large *Goniopora* were common together with scattered *Acropora*, *Turbinaria* and *Montipora*. Sponges, gorgonians, hydroids, soft corals and colonial anemones were also common (Plates 11 and 12).

The rock platform at Channel Island had the most developed hard coral community of all the sites surveyed within the harbour (site labelled CHI 01 and DC6, **Figure 3**). The upper crest and top of the platform (approx. 0 m LAT) was dominated by massive Faviids, showing clear signs of exposure to air during extreme low tide events. These corals may be up to 2 m in diameter, with a ring of living tissue, approximately 20–30 cm wide, around the circumference and dead coral in the middle. Hard coral cover on the top of the platform was estimated to be approximately 20% of the total area.

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The slope (approx. 0.5–1.5 m below LAT) was dominated by *Mycedium elephantotus* (Plate 8), with colonies up to 4 m across. Hard coral cover in this zone was estimated to be approximately 25–30%.

Below the slope (deeper than approx 1.5 m below LAT), a soft bottom community of sponges, soft corals and gorgonians (sea whips and sea fans) was present. Occasional hard corals were found in this zone, primarily *Goniopora* species. Hard coral cover in this zone was estimated to be approximately 5%.

Additional dives were carried out along the lower rocky edge of the intertidal platform, including deeper areas, extending from the northern tip of Channel Island (sites DC3, DC4, DC5, DC7 and DC8, **Figure 3**) and the south-western point (Site DC1). Hard coral cover varied from 10–25%, with Faviids predominant within a diverse community of mainly encrusting forms including *Lobophyllia*, *Goniopora*, *Alveopora* and *Mycedium*, with scattered *Acropora*, *Barabattoia* and *Oxypora*. Sponges were also common. The substrate in deeper areas was moderately bioturbated (~50 burrows/m²), silty sand with occasional sea whips and sponge gardens. Similar substrate was present at ~2 m LAT at the south-eastern point (Site DC2).

3.2.5 Ellengowan wreck

The *Ellengowan* wreck (site TEK1, **Figure 3**) located to the north of Channel Island was also found to have heavy growth on the structure, comprising mostly soft corals. The sandbar between this wreck and Channel Island (site DC9, **Figure 3**) was found to have a sand/silt composition with a low abundance of biota and bioturbation, including sparse sand dollars (Fibulariidae) and crinoids.

3.2.6 Weed Reef

Along the north-eastern and eastern edge of Weed Reef (sites ROV WR2, 3 and 4, **Figure 2**) the benthic assemblage on the pavement was dominated by nets of niphatid sponge and a diversity of hard corals, dominated by *Mycedium elephantotus*, *Goniastrea* sp. and Fungiids whilst also including *Porites*, *Barabattoia*, *Symphyllia* and *Turbinaria*. In deeper water (–1 m LAT), branching acroporids, large encrusting *Montipora*, *Echinophyllia*, *Pectinia paeonia*, *Hydnophora exesa*, *Euphyllia* and *Duncanopsammia* were found. Hard coral coverage was estimated to be approximately 15% (Plates 13 and 14). Gorgonians, sponges and corallimorpharians were also present.

The macroalgal community of the rubble covered pavement was sparse though diverse, and included browns (*Sargassum*, *Padina*), foliose reds (*Laurencia*), greens (*Caulerpa*, *Ulva*, *Udotea*) and calcareous greens (*Halimeda*). Over the broad areas of reef flat covered with a thin sand veneer, there was a very sparse, patchy coverage *Halophila* sp.

3.2.7 Plater Rock / Kurumba Shoal

Plater Rock is located some 1 km to the north of Weed Reef and is a steep-sided subtidal pinnacle (Site DC17, **Figure 3**). Surrounding the base of the rock was silty sand with sparse burrows (~1–2 m²), and sparse sponges. From the base to ~2 m LAT, rock walls were colonised by abundant sponges, gorgonians and the hard corals *Tubastrea* and *Arcohelia*. Gorgonians included *Junceella* (sea whip) and *Ctenocella* (red whip coral). Sponges also showed a wide range of morphologies, including fans, encrusting, barrel and branching forms. Bryozoans and crinoids were also present. Soft corals first appeared at ~3–4 m below LAT, and included *Sinularia*, nephyids and other branching colonies (Plates 15 and 16). At shallower depths (~2 m LAT) hard corals were dominant, mainly Faviids including *Favia*, *Favites*, *Moseleya*, *Echinopora*, *Acanthastrea echinata* and *Platygyra*. Many other

genera were present including *Turbinaria*, *Porites* (with some up to 3 m diameter), *Goniopora*, encrusting *Montipora* and *Mycedium*. Also present on the upper slopes were sponges, gorgonians, soft corals, *Sargassum* and other algae.

Kurumba Shoal, located 500 m to the north of Plater Rock (Site DC13, **Figure 3**), was found to have a sand and silt-covered pavement with low/moderate bioturbation (~10–20 burrows/m²), with dense biotic cover, dominated by laminar sponges, with occasional gorgonian, encrusting sponges and bryozoans (Plate 17).

3.2.8 West Point

Along the lower intertidal zone on the southern edge of the platform (sites ROV WP1 – 3, **Figure 2**), a sparse (<5%) but diverse hard coral community was present. Faviids were predominant, mainly *Goniastrea* and *Platygyra* species with *Favia*, *Favites*, *Barabattoia* and *Montastrea* species also represented. Colonies of *Porites* and *Montipora* species were common. In the subtidal zone, algae including brown (*Sargassum*, *Padina* and *Dictyota*) and calcareous green (*Halimeada*) were the dominant biotic cover. Hard corals were common and dominated by *Symphyllia* and *Goniastrea*. Other genera included *Porites*, *Goniopora*, *Leptastrea*, *Moseleya* sp., *Barabattoia*, *Platygyra*, *Euphyllia* and *Turbinaria*. Hard coral cover was higher in the deeper waters along the eastern edge of the platform, where *Acropora*, *Montipora* and *Turbinaria* species were dominant. Along the northern edge, hard coral cover was <5% and dominated by *Turbinaria*, with moderate cover of soft corals, hydroids and gorgonians and branching, laminar and barrel sponges also occurring.

3.2.9 Existing Bayu-Undan pipeline

The Bayu-Undan pipeline was found to harbour a high coverage of biota, with surrounding areas relatively void of epibenthic organisms. Rock armour covering the trenched and buried pipeline protruding from the seabed (site DC14, **Figure 3**) had <5% hard coral coverage, dominated by *Turbinaria*, with soft coral, gorgonians, algae and hydroids colonising the rocks and a moderate abundance of fish life most noticeable being Acanthuridae (surgeon fish) (Plates 18 and 19). The surrounding sand- and silt-covered seabed supported a low coverage of sparse sea whips and sea pens.

At certain areas of the pipeline, rock armour has been partially buried with mobilised sediments (site DC15). Coarse sand with shell fragments and low bioturbation surrounded exposed rock armour with <5% biota coverage and a thick silt veneer. No hard corals were found, with gorgonians, laminar fans, sea whips, crinoids, hydroids and algae the main biota present.

In sections where the pipeline was suspended between undulations in the seabed (site DC19), it supported abundant gorgonians and fans (~90%+ cover) with algae, laminar sponges, bryozoans and crinoids also present (Plate 20). By contrast, the exposed rock armour positioned where the pipeline passed into the trenched seabed, harboured low biotic abundance dominated by algae with a silt veneer.

3.2.10 Proposed pipeline

Surveys were undertaken at regular intervals at a total of 14 sites along the proposed pipeline route (sites ROV IDP1 – 12, **Figure 2**, and DC18 and DC20, **Figure 3**). Overall there was sparse biota at all

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sites (Plates 21 and 22) including occasional sea whips, hydroids, sea pens, sponges and ascidians with low bioturbation (~ 10 burrows/m²).

3.2.11 Dredge spoil disposal area

The side scan sonar and bathymetry survey (EGS 2009) provided extensive coverage of the dredge spoil disposal area (**Figure 6**). Bathymetric data revealed a flat seabed with depths ranging from 20 m in the northern-most extent to 15 m in the southern-most. Side scan sonar records revealed a uniform, flat and generally featureless seafloor of low to moderate reflectivity interpreted as silt/sand. The only feature observed was an approximately 3-km long scar running in an east-west direction across the survey area. The scar had no measurable depth and was characterised by moderate reflectivity associated with a disturbance of the seabed. This was attributed to anchor drag, or more likely, sampling or fishing equipment skimming along the seabed surface (EGS 2009).

Drop camera images from the Tek Ventures investigation supported findings from the bathymetric/ side-scan-sonar survey of a generally featureless seafloor. Sediments consisted of thick muds to the south of the 15-m isobath, and silty sands to the north. Very sparse epibenthic fauna was observed at nine of the 21 sites surveyed, typically consisting of occasional bryozoans, sponges, and soft corals, with sparse bioturbation (Plates 23–26). No scleractinian corals, seagrasses or macroalgae were observed at any of the survey sites (Tek Ventures 2009).

The seabed scar previously recorded by EGS in February 2009 was again observed by Tek Ventures in September 2009, although it was partially obscured and filled in—survey personnel agreed that the scar was consistent with anchor drag (Tek Ventures 2009).

3.3 Benthic Infauna

The sampling sites for infauna are shown in **Figure 5**: details of the infauna collected and identified are in Data Table 6. Diversity of major taxonomic groups ranged between six and 11 at each site i.e. per 0.15 m². The total number of individuals identified was 416 from 17 families. Amphipods were with the most abundant taxon (126 individuals, 30.3% of the total), with Polychaetes the second most abundant taxon (112 individuals, 26.9% of the total). Many Polychaete fragments were recovered from the samples, however only complete individuals were reported in the totals (Table 3-1).

Sites were grouped together in areas, to identify variations in infauna abundance and variations at both the nearshore and offshore zones in the same sampling area, together with variation in abundance and diversity between different areas. To allow comparison between areas surveyed, total abundances for each area were normalised by dividing the number of individuals collected by the number of sites visited / grab samples obtained.

Sites sampled at both Blaydin Point and at the shore crossing revealed similar average abundances of individuals (10 and 11 individuals per site respectively), with the jetty area (sites 18–20) revealing a slightly higher number of individuals (16).

At the pipeline shore crossing, increases in abundances were found with increasing distance from the shoreline (five, 11 and 16 individuals for near, mid and offshore areas respectively). The Blaydin Point area showed a similar but less marked increase with distance offshore (nine, 11 and 11 individuals for near, mid and offshore areas respectively).

Table 3-1 Benthic infauna diversity and abundance

Family / Taxa	Blaydin Point			Jetty	Pipeline Shore crossing			Overall Total	% of total abundance	Abundance rank
	Nearshore	Mid shore	Offshore		Nearshore	Mid shore	Offshore			
Ascidian	-	-	-	-	1	-	12	13	3.1	8
Anemone	-	-	-	-	-	1	-	1	0.2	14
Crustacean – amphipod	10	31	53	20	3	2	7	126	30.3	1
Crustacean – crab	5	11	1	1	-	-	1	19	4.6	6
Crustacean – decapod	4	3	4	-	1	3	2	17	4.1	7
Crustacean – stomatopod	-	1	3	3	-	1	1	9	2.2	6
Echinoderm – brittle star	2	5	8	-	5	1	1	22	5.3	5
Echinoderm – holothurian	-	1	-	1	-	1	-	3	0.7	11
Echinoderm – sand dollar	-	-	-	-	-	-	1	1	0.2	14
Fish	-	-	2	-	-	1	-	3	0.7	11
Hydroid	-	-	-	1	-	2	-	3	0.7	11
Isopod	-	1	-	-	-	-	-	1	0.2	14
Mollusc – bivalve	11	13	4	3	1	2	-	34	8.2	4
Mollusc – gastropod	3	4	4	1	-	-	1	13	3.1	8
Polychaete	34	17	32	10	4	7	8	112	26.9	2
Soft coral	-	3	-	7	-	13	15	38	9.1	3
Unidentified – site D6	1	-	-	-	-	-	-	1	0.2	14
Total fauna collected	70	90	111	47	15	34	49	416		

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Family / Taxa	Blaydin Point			Pipeline Shore crossing			Overall Total	% of total abundance	Abundance rank
	Nearshore	Mid shore	Offshore	Nearshore	Mid shore	Offshore			
Diversity	10	11	9	6	11	10			
Average diversity of each area	10			9					
Number of sites sampled	8	8	10	3	3	3			
Abundance (normalised)	9	11	11	5	11	16			
Average abundance of each area	10			11					

The areas proposed for dredging in East Arm for the shipping channel, jetty and module offloading facility, and the pipeline shore crossing on the west coast of Wickham Point, were found to have overall low biotic abundance and diversity. These seabed habitats were intertidal mudflats, rubble pavement or subtidal sandbanks. Lowest abundances of biota were found on areas of soft substrate, notably intertidal mudflats and subtidal sandbars, and in areas outside the zone of direct impact of the Project, such as the surrounds of Elizabeth Island and the subtidal sandbar north of Channel Island.

A moderate abundance of biota was found on the relatively sparse hard substrate present within the proposed disturbance areas, most notably the rubble covered pavement located to the north of Blaydin Point. However, hard coral cover, abundance and diversity were lower here than at the Channel Island, South Shell Island and Weed Reef sites. The soft bottom communities of sponges, soft corals and gorgonians, together with the associated motile invertebrates, including holothurians and nudibranchs, were found to be similar in all areas. A number of similar communities have been recorded within Darwin Harbour during previous surveys (Le Provost, Dames & Moore 1997; URS 2004).

The Channel Island site had the highest percentage cover (up to 100% in areas) and diversity (29 species) of hard corals of all sites. The South Shell Island site and the Weed Reef site had similar cover (15-20% and 15% respectively), and diversity (21 and 22 species respectively), albeit with some differences in species composition. In contrast there was much lower cover (5-10%) and only nine species of hard coral were recorded at each of the Blaydin Point sites, with six of these species also present at the other sites.

Wolstenholme, Dinesen and Alderslade (1997) found that the harbour is a highly dynamic environment, with restricted light availability, high turbidity and high rates of sedimentation, with a lack of suitable substrates on which coral larvae can settle.

The proposed pipeline route within the harbour was found to have a very low abundance of epibenthic biota. This contrasts with the nearby Bayu-Undan pipeline which had a dense covering of soft biota together with numerous fish in areas where the pipeline was covered by rock armour or suspended above the seabed.

Results from the dredge spoil disposal area surveys revealed a flat seabed with a uniform, flat and generally featureless seafloor consisting of a sand and/or silt substrate that had occasional very sparse epibenthic organisms present. This is consistent with survey results of Smit, Billyard and Ferns (2000) where sampling at sites within and around the dredge spoil disposal area found the seabed to be primarily comprised of carbonate sand. Sparse communities of benthic invertebrates were present, primarily bryozoans (which are often associated with coarse grained sediments), small crabs, shrimp and worms. Similar sediments and invertebrate communities are widespread across the Anson–Beagle Bioregion. Seagrasses were not recorded in this area, and are not likely to occur in waters of 15–20 m depth due to low light levels at the seabed (Smit, Billyard & Ferns 2000).

In conclusion, due to the low diversity and abundance of the benthic communities, the ecological significance of the proposed areas of disturbance has been found to be limited. More diverse and abundant benthic communities are present elsewhere within the harbour, e.g. Channel Island and Weed Reef, which lie outside the area of potential direct impact. The subtidal soft bottom communities were found to be relatively uniform in their composition and to be widely distributed through the harbour.

EGS—see EGS Earth Sciences and Surveying.

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The methodology adopted and sources of information used by URS are outlined in this report. URS has made no independent verification of this information beyond the agreed scope of works and URS assumes no responsibility for any inaccuracies or omissions. No indications were found during our investigations that information contained in this report as provided to URS was false.

This report was in prepared between September 2008 and February 2010, and is based on the survey data obtained and other information reviewed up to the time of preparation. URS disclaims responsibility for any changes that may have occurred after this time.

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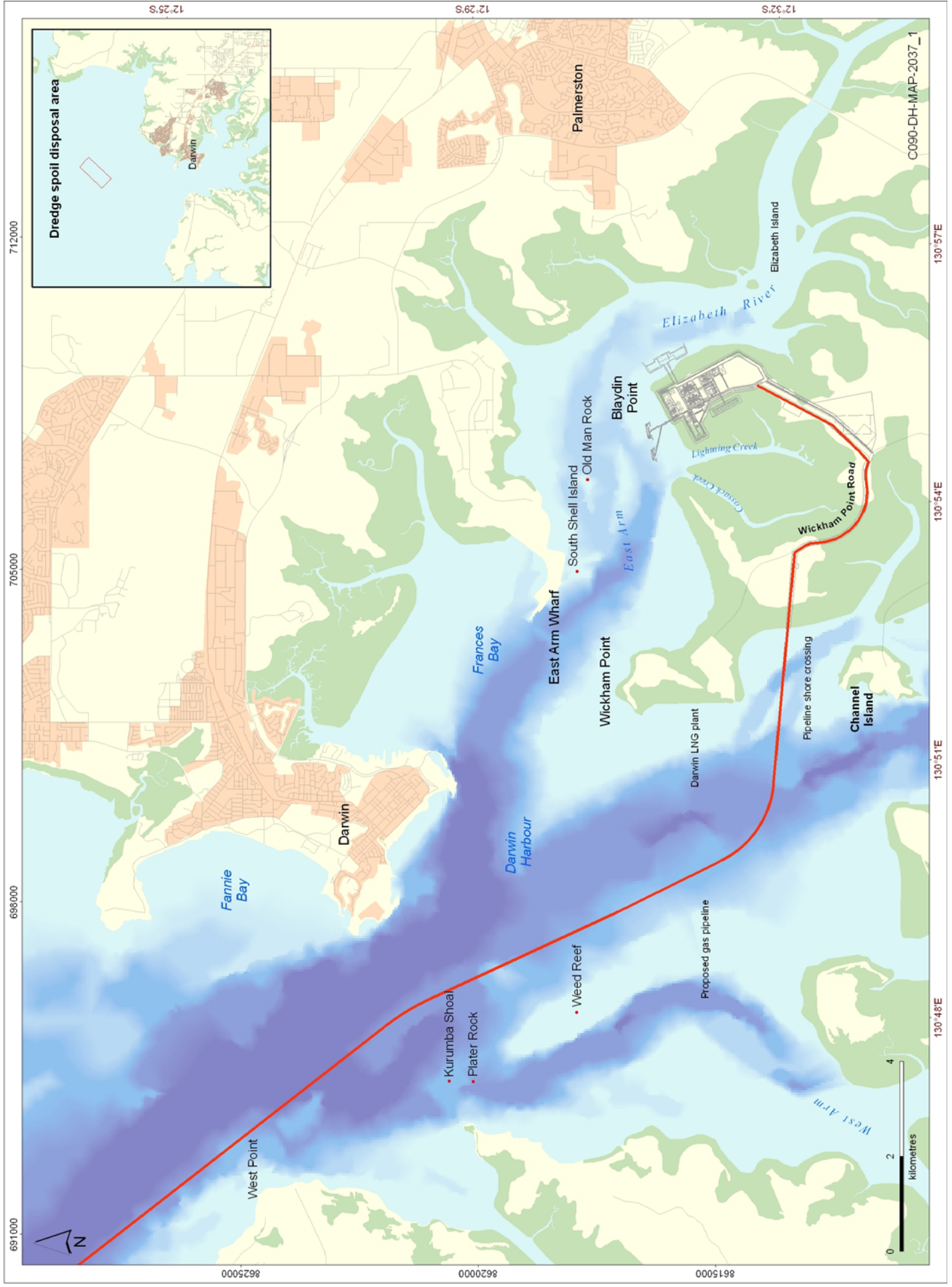


Figure 1: Location of study area

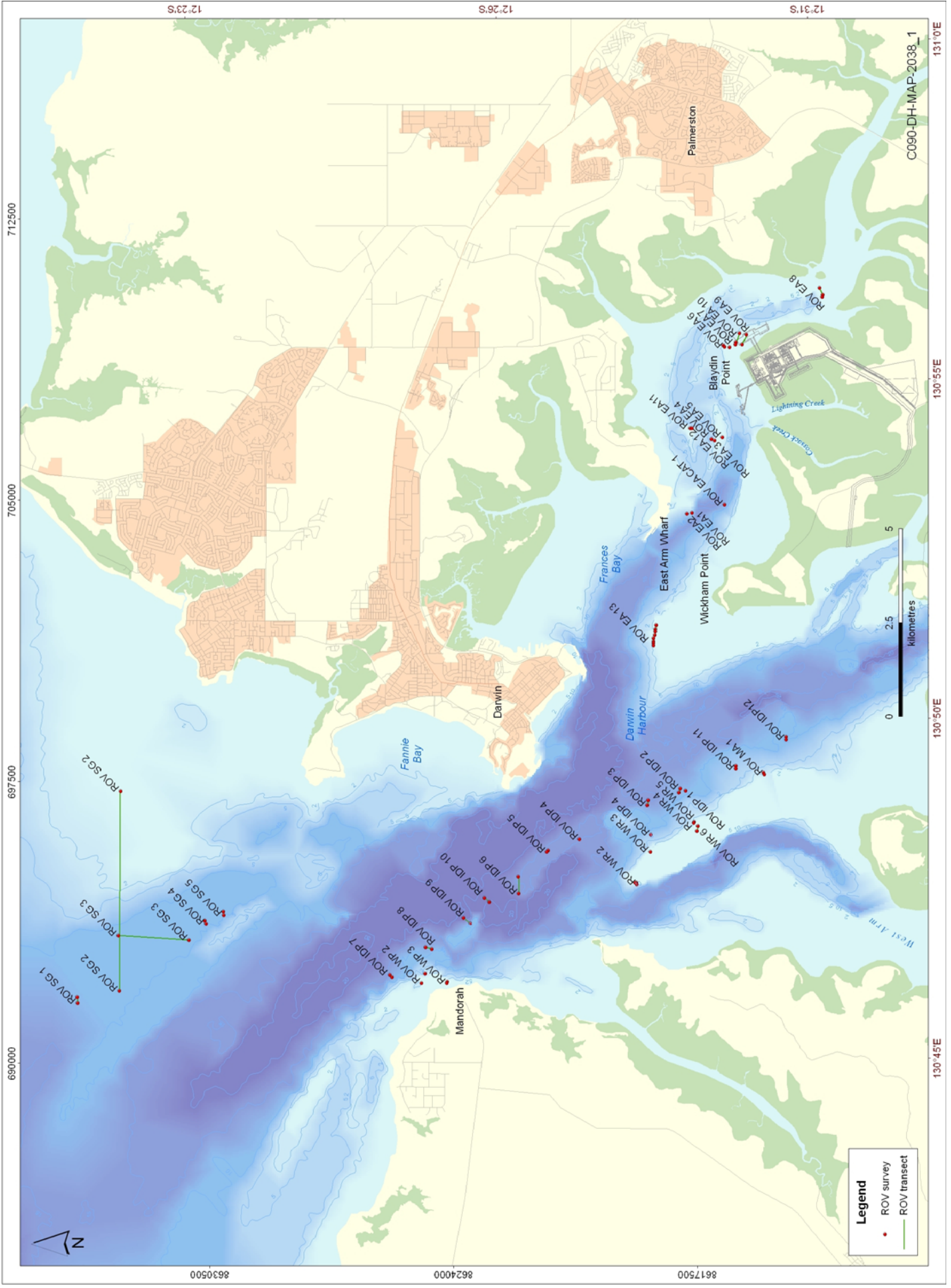


Figure 2: Sites visited during ROV survey, April 2008

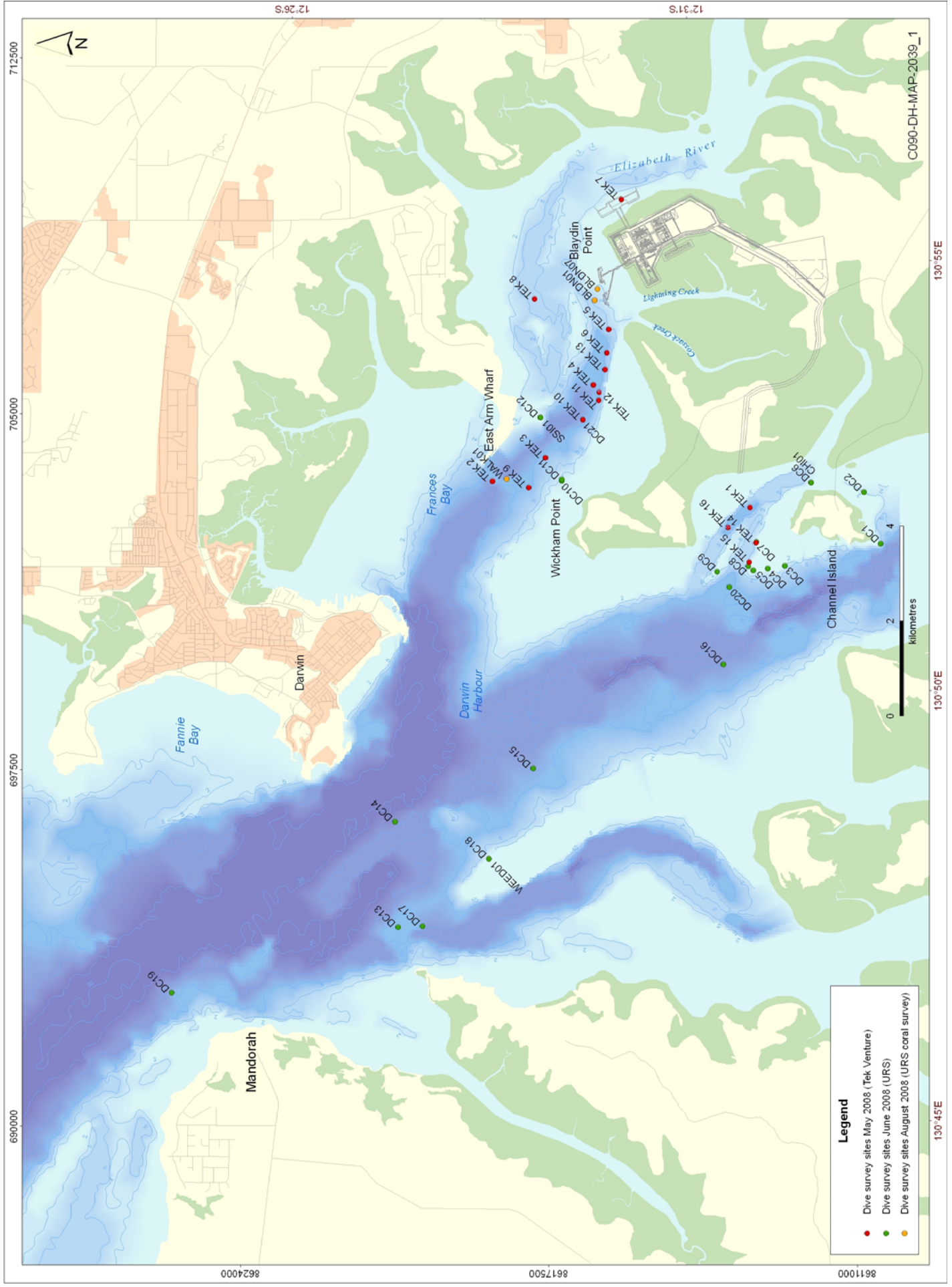


Figure 3: Diving survey sites, May, June and August 2008

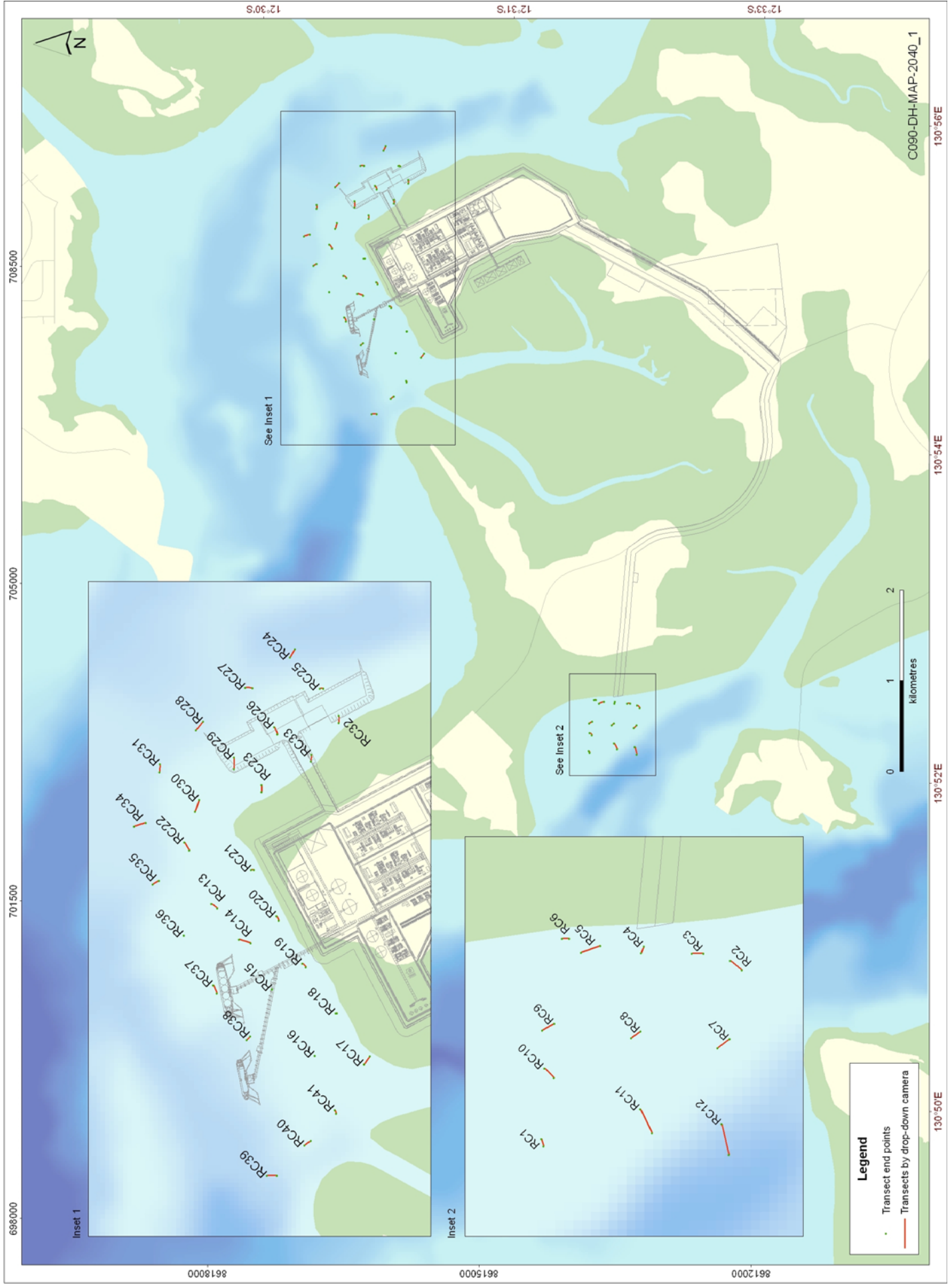


Figure 4: Epibenthic fauna transect sites, July 2008

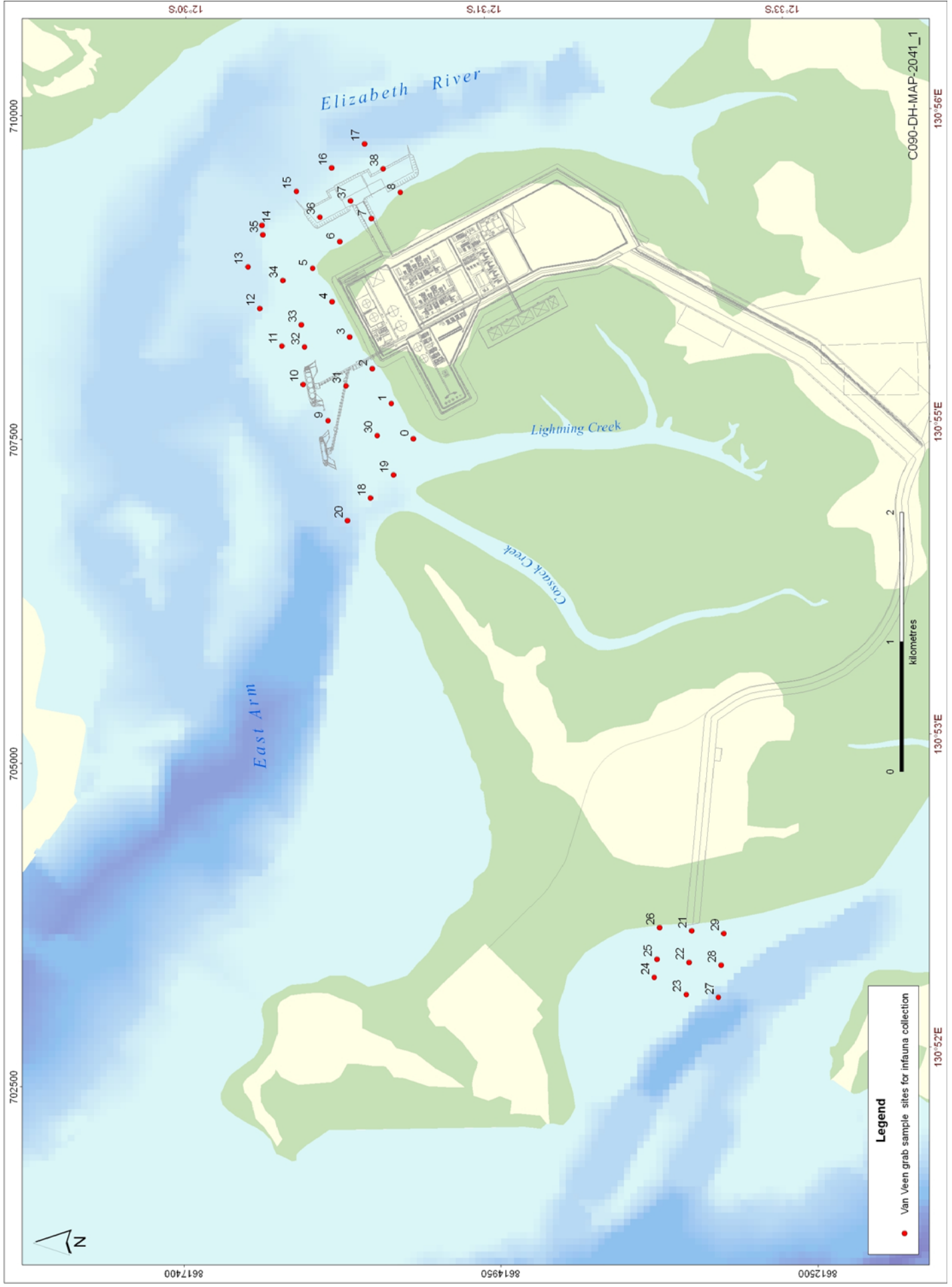


Figure 5: Grab sample sites for infauna collection, July 2008

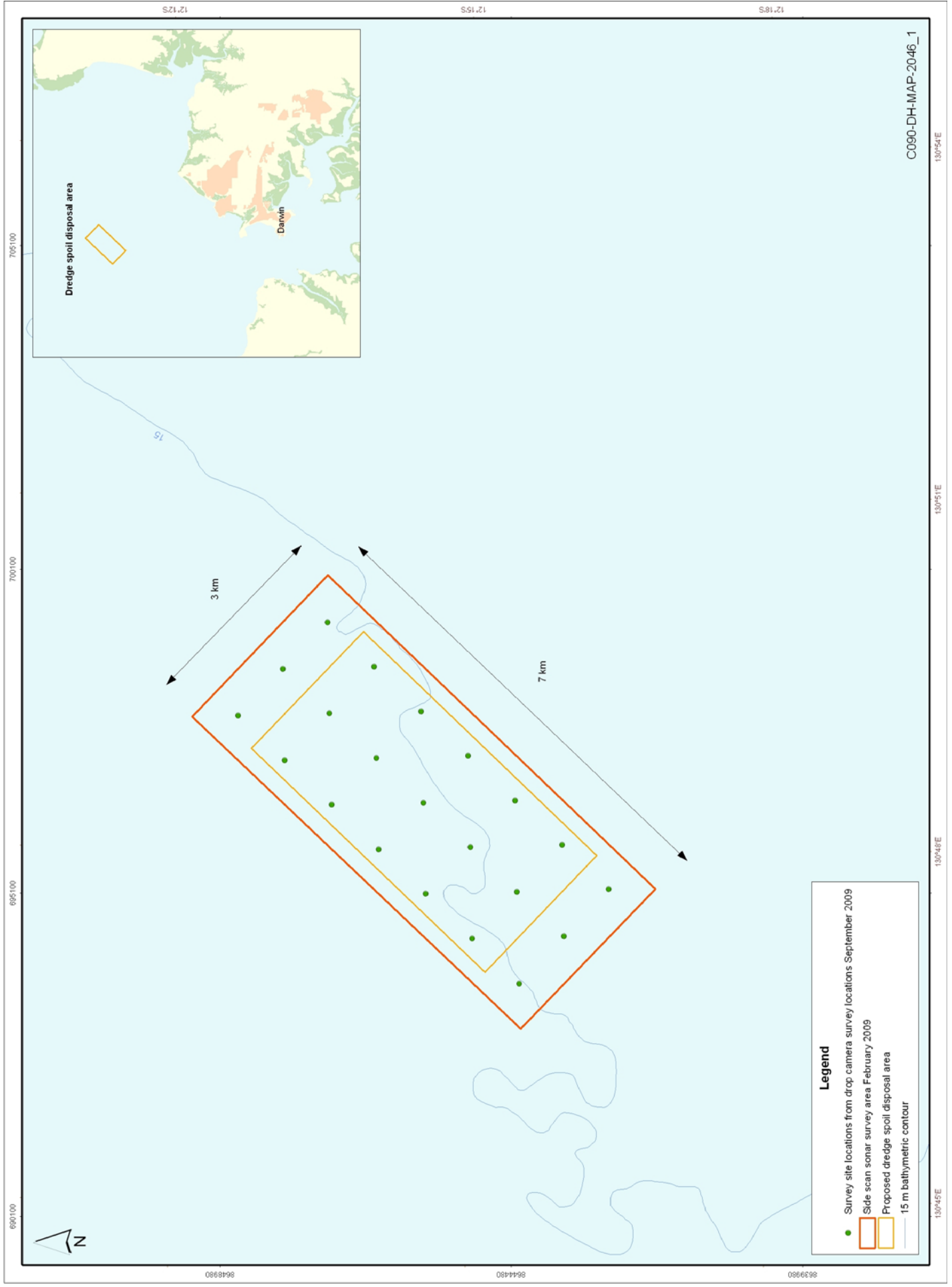


Figure 6: Potential dredge spoil disposal area survey location, February and September 2009



Plate 1 Van Veen Grab used for collecting sediment for infauna determination



Plate 2 An example of a large bioturbated hole, Blaydin Point



Plate 3 Jawfish (*Opistognathidae*) in burrow, Blaydin Point



Plate 4 Sparse biota cover (soft corals *Nephthea* sp. and algae, *Caulerpa* sp.) at Blaydin Point



Plate 5 Sparse biota cover (*Nephthea* sp. and digitate sponges) at Blaydin Point



Plate 6 Sea urchin (Echinoidea) at Blaydin Point



Plate 7 Gorgonian and digitated sponges at Blaydin Point



Plate 8 Synaptulid sea cucumbers on laminar sponge at Blaydin Point

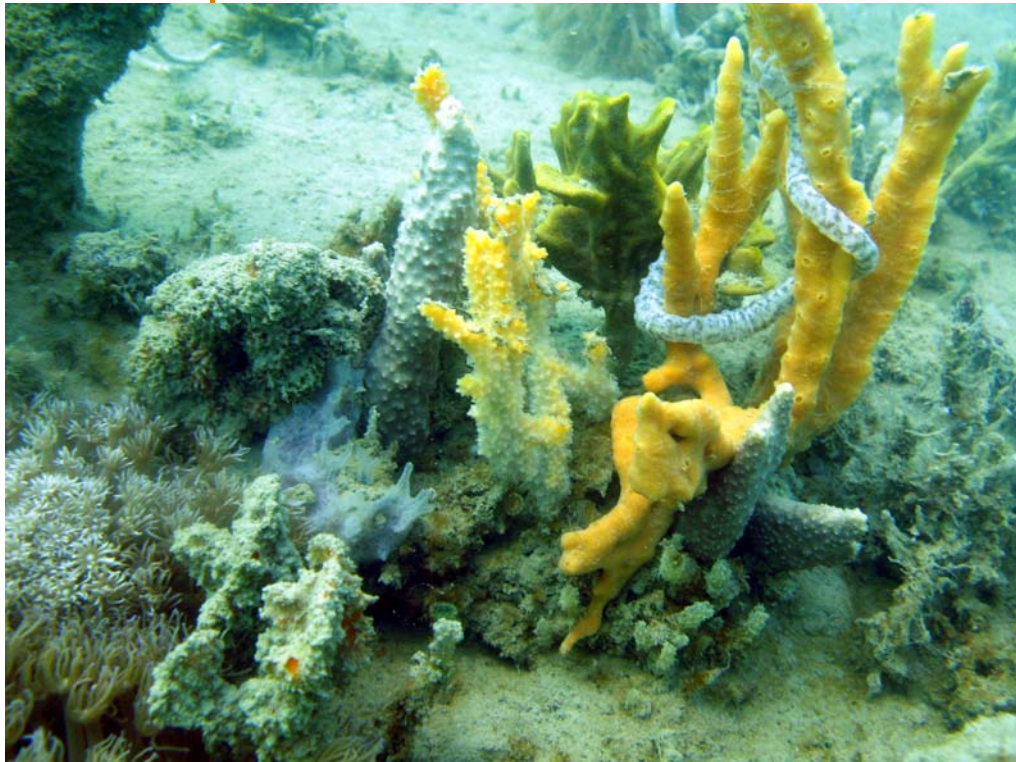


Plate 9 Example of moderate biota cover (digitate sponges, synaptulid sea cucumber and *Goniopora* sp.) at Blaydin Point



Plate 10 High biota abundance of hard and soft coral (*Mycedium* sp., *Turbinaria* sp. and *Goniopora* sp. with *Nephthea* sp.), Wickham Point

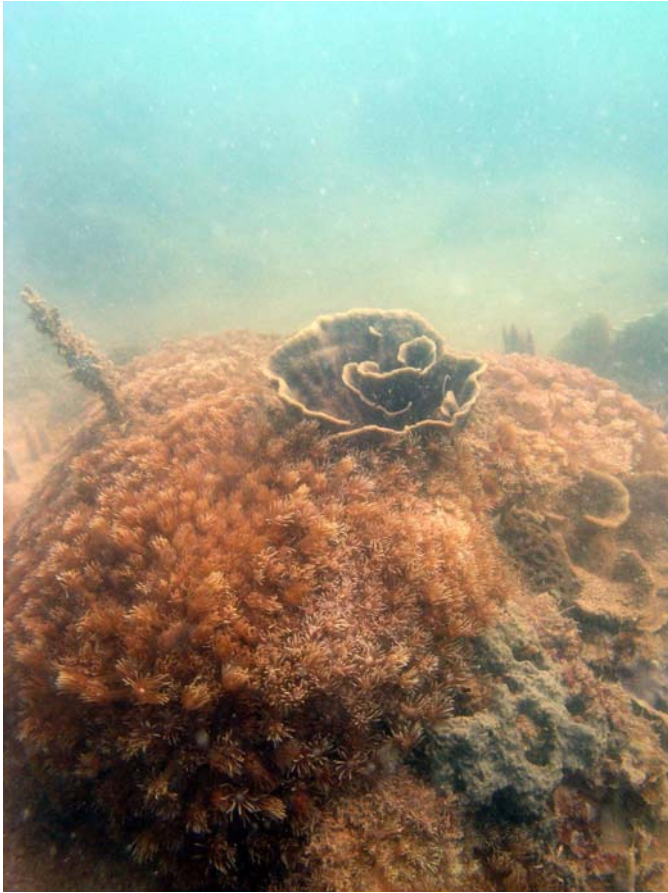


Plate 11 High abundance of biota (*Goniopora* sp., *Turbinaria* sp., colonial ascidian and sponges), Channel Island



Plate 12 Moderate biota cover (gorgonian and laminar sponge), Channel Island



Plate 13 Abundant hard coral cover (*Mycedium* sp.), Weed Reef

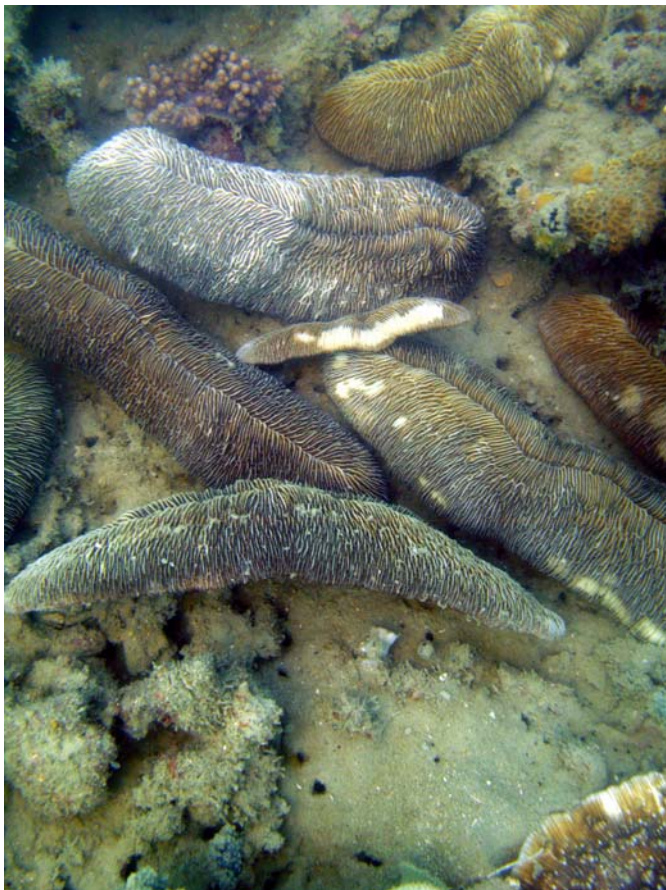


Plate 14 Slipper corals (*Polyphillia* sp.), Weed Reef

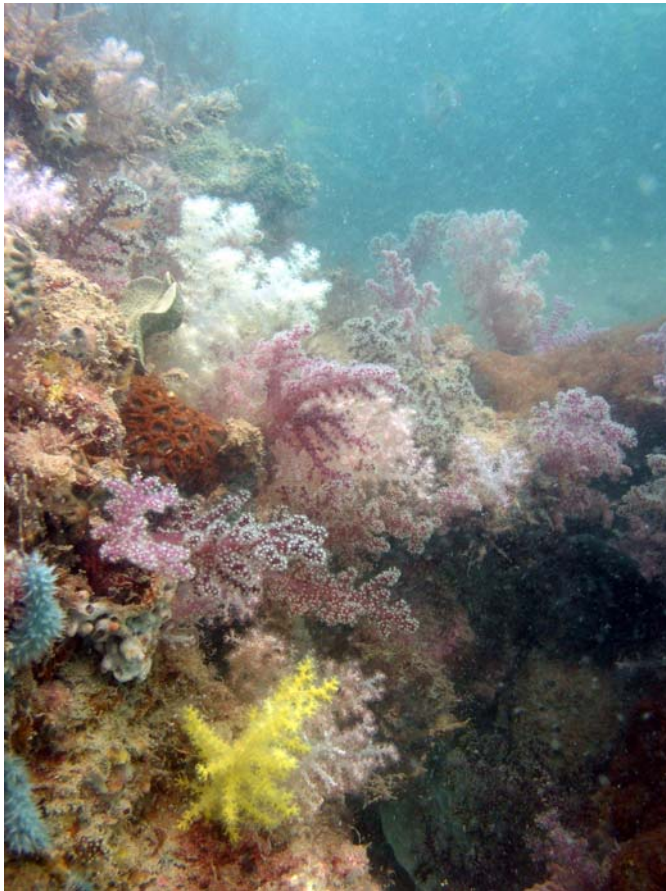


Plate 15 Soft coral community, Plater Rock

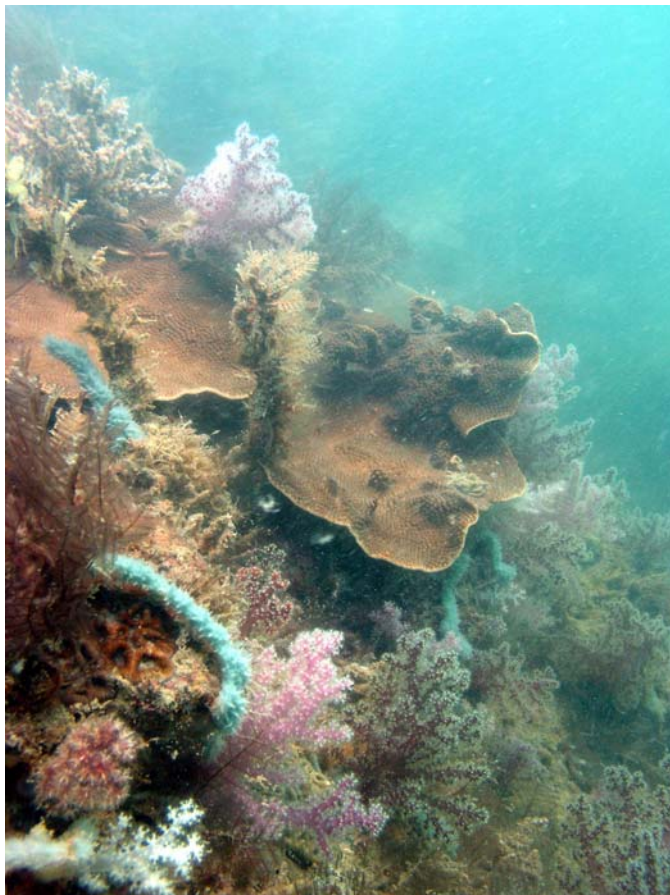


Plate 16 Soft and hard coral community, Plater Rock

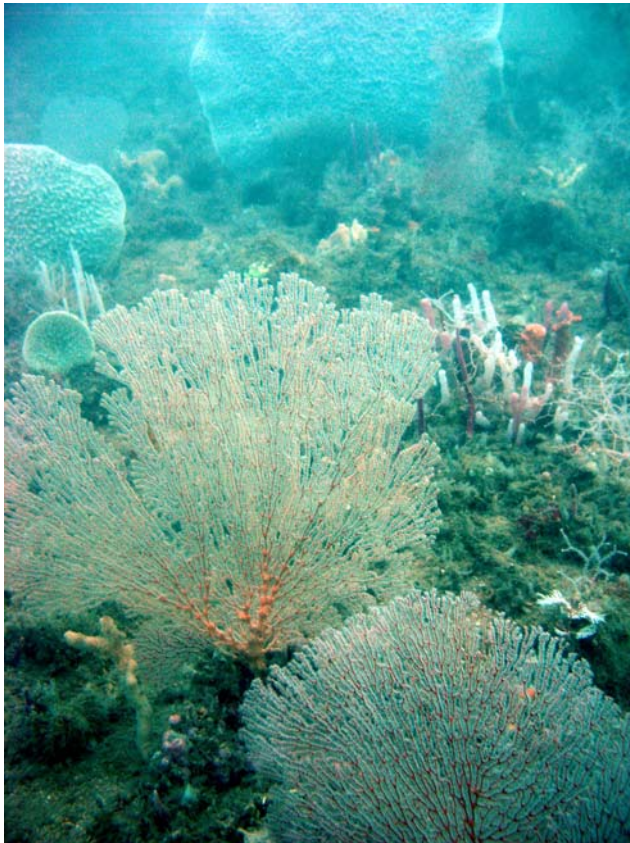


Plate 17 Moderate biota abundance (gorgonian fans and digitate and laminar sponge), Karumba Shoal



Plate 18 Rock armour covering ConocoPhillips trenched pipeline, with dense silt coverage with laminar and digitate sponges and hydroids



Plate 19 Rock armour covering ConocoPhillips pipeline showing moderate biota cover of gorgonians and sponges

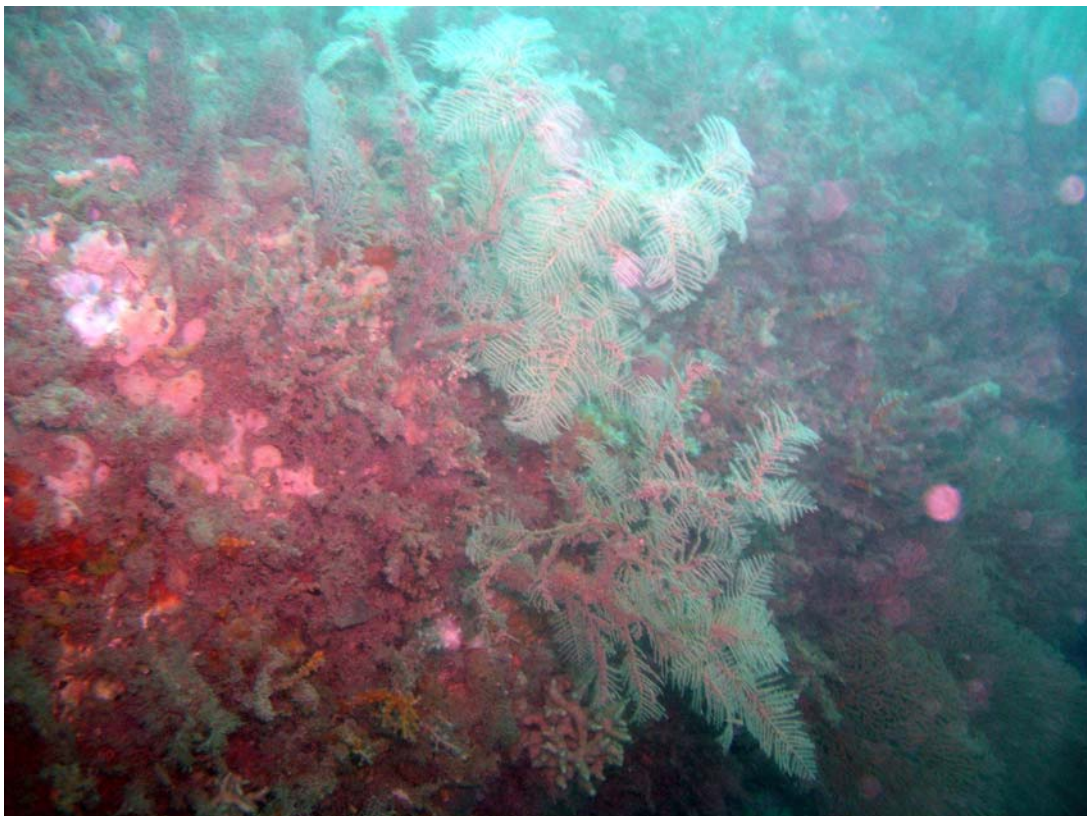


Plate 20 Suspended and exposed ConocoPhillips pipeline with abundant biota, predominately sponges and hydroids



Plate 21 Proposed pipeline route, silt and shell fragment substrate with very low abundance of biota present (gorgonian and crinoid)

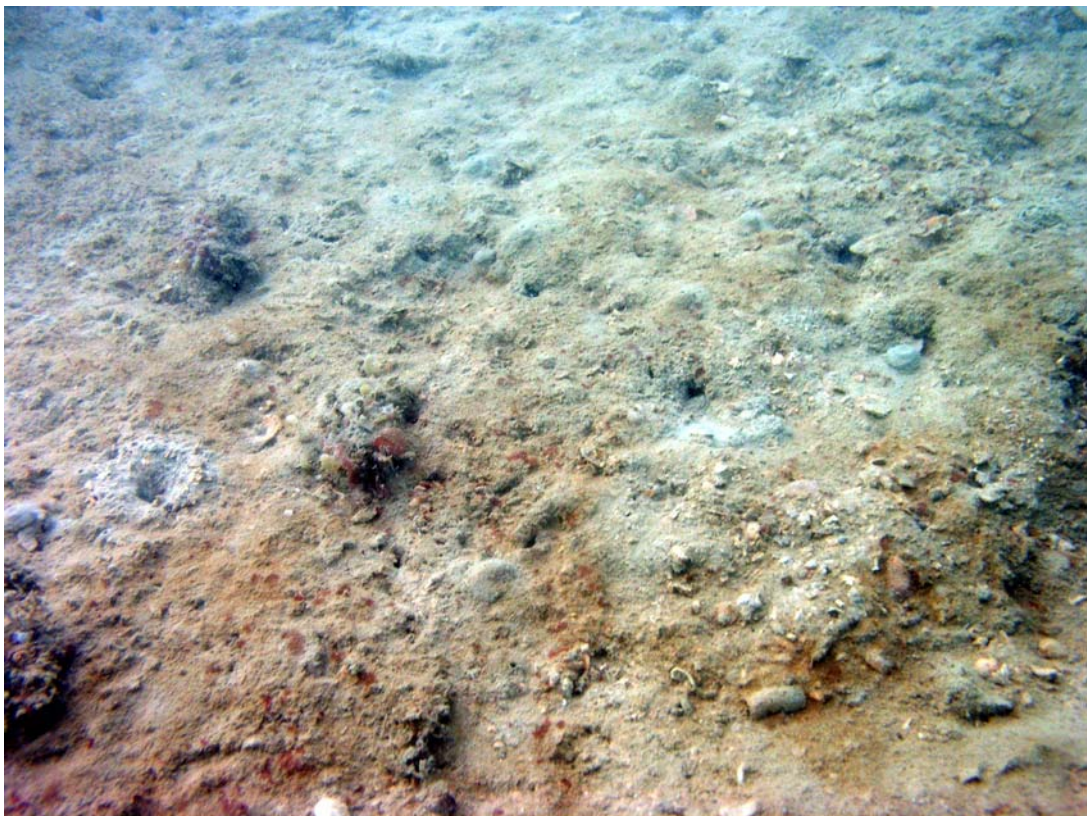


Plate 22 Proposed pipeline route, sand, silt and shell fragment substrate with low bioturbation

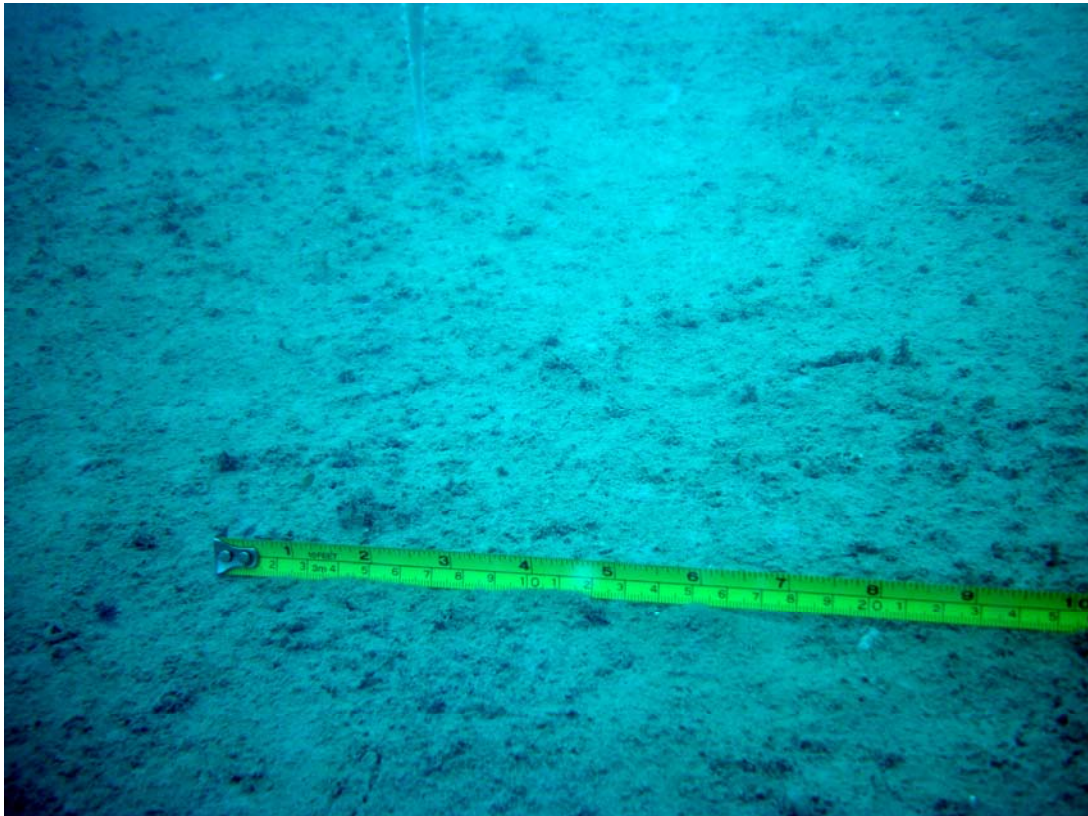


Plate 23 Dredge spoil disposal area; sand and silt substrate

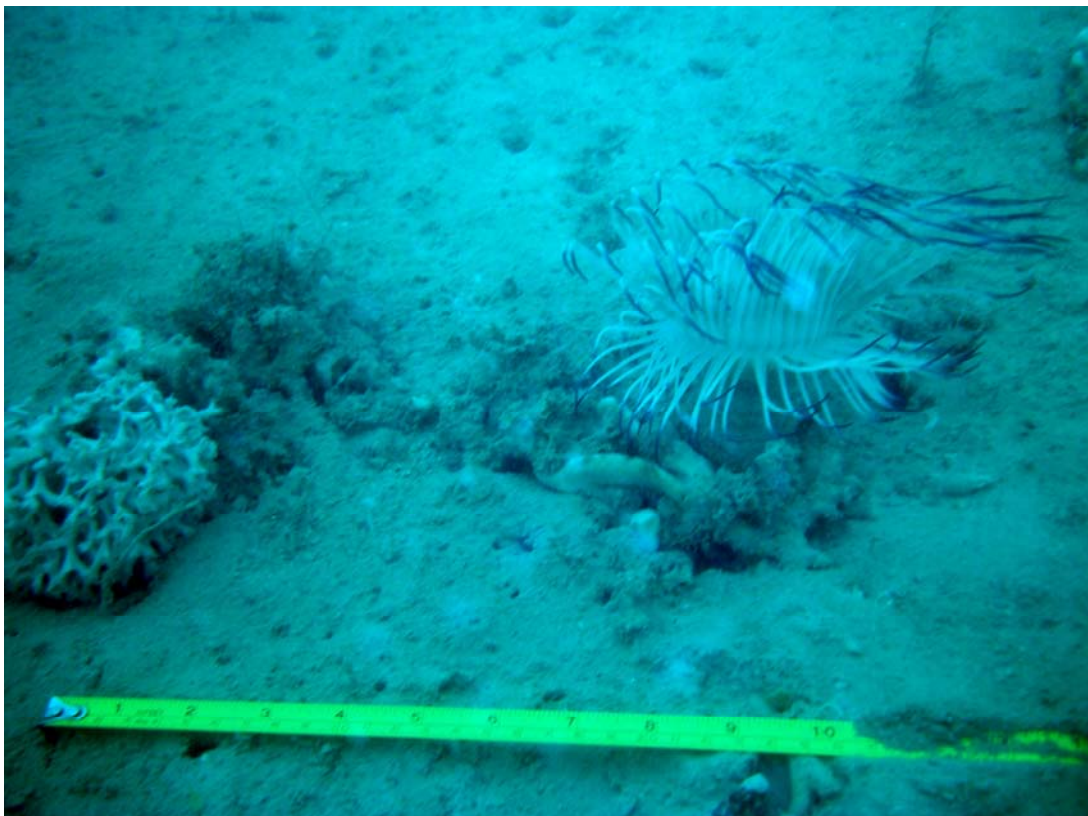


Plate 24 Dredge spoil disposal area; sand and silt substrate with bryozoan and anemone

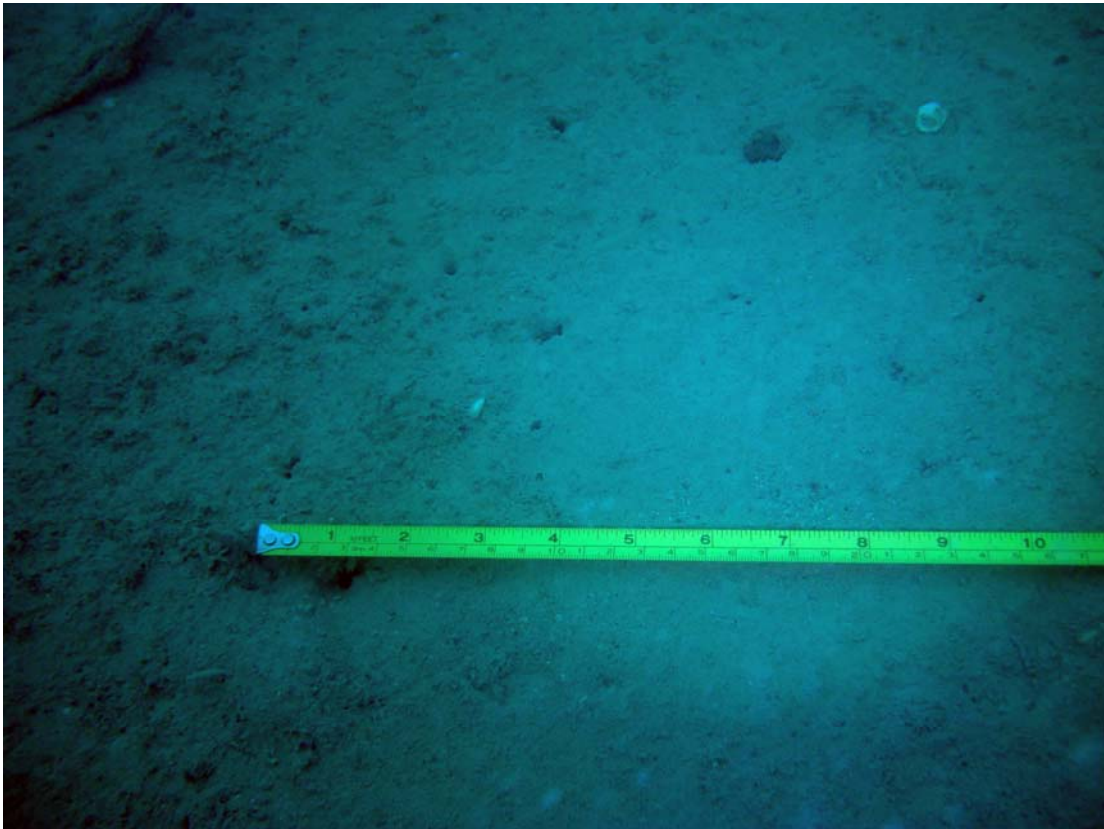


Plate 25 Dredge spoil disposal area; sand and silt substrate with fine shell fragments

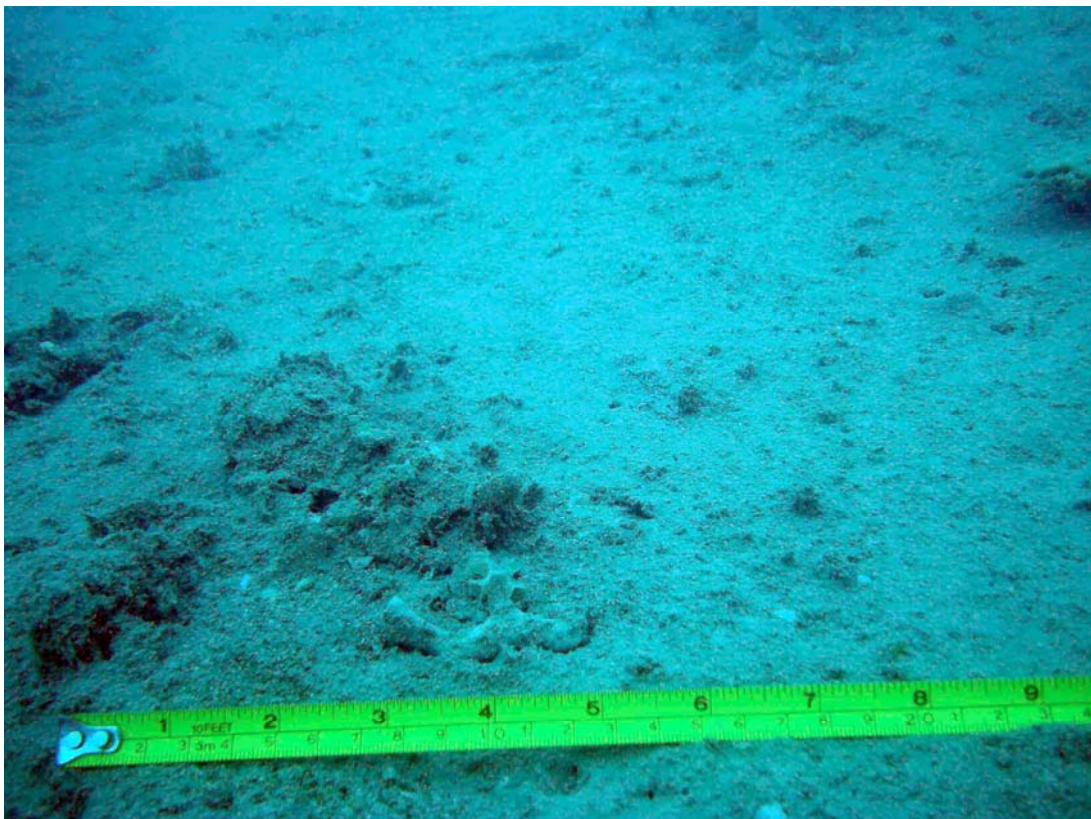


Plate 26 Dredge spoil disposal area; sand and silt substrate with detritus

**Data Table 1 : ROV Site Record
April 2008**

Site ID	Latitude	Longitude	Date taken	Time	Location	Comments	Depth	Observations
	12 29 178	130 50 243	29-Apr-08	7:10		ADCP Monitoring		W-10 knots E - Very slight chop, verifying that the ADCP is correctly positioned. Very difficult to follow surface markers to ADCP - decide to attach buoy for locating it at HT@1200.
ROV EA1	12 29 891	130 52 996	29-Apr-08	8:10		Opposite marker no. 18	22m	W-5 knots E - Soft sediment over rocky substrata, moderate density of sea whips, crinoids, sponges, <i>Nephthys</i> , hydroids and shell fragments. Some bioturbation and digitate sponges. Shelly and gravelly bottom. Occasional small solitary hard corals.
ROV EA2	12 29 817	130 52 982	29-Apr-08	9:05	Top of slope		15.4m	Sandy/silty seabed. Abundant broken coral, sand on top of shell/gravel. Digitated sponge, hermit crab in murex shell, very low density of benthic fauna.
ROV EA CAT 1			29-Apr-08	9:50		Catalina One	16m	W-5 knots E- Soft sediments, moderate bioturbation, dead shell fragments, few small solitary ascidians, hydroids, encrusting sponges. Catalina identified. Several small <i>Trevally</i> and one <i>batfish</i> . Two anchoring attempts, second attempt at wreck - no sighting.
ROV EA 3	12 30 210	130 54 064	29-Apr-08	10:45	Sand bank transit		9m	W-10 knots E - Sandy, few shell fragments, low bioturbation, occasional undulations in sand.
ROV EA 4	12 30 159	130 54 090	29-Apr-08	10:55	Top of sand bank			Broken up shell fragments, large ripples on sand, coarse material, no biota.
ROV EA 5	12 30 321	130 54 106	29-Apr-08	11:00	Side of sand bank (south)		7m	Coarse/medium sand, low shell fragments, no silt, no biota.
ROV EA 6	12 30 320 12 30 336	130 55 465 130 55 446	29-Apr-08 29-Apr-08	11:15 11:15	NE Blaydin Point shore NE Blaydin Point shore		7 - 8m	Fine silt on shell fragments, hydroids, low bioturbation. Soft coral and orange sponge, gravel present. Sparse epibenthic fauna, ascidian, sea star. End
ROV EA 7	12 30 416	130 55 445	29-Apr-08	11:27	NE Blaydin Point		4.5m	Further into shore, sand veneered pavement, colonial ascidians, hydroids, rubble, small sponges (black and orange), moderate algae coverage (10%), very small and sparse soft corals, thin veneer of silts over rubble.
ROV EA 8	12 31 710 12 31 756 12 31 749	130 56 317 130 56 223 130 56 185	29-Apr-08 29-Apr-08 29-Apr-08	11:50 11:50	North of island, futherest east of Blaydin Point At bottom of creek		6 - 13.5m 13.5m	5 knots Easterly, Dark brown veneer, small ripples, little bioturbation, some algal turf on crests of waves. Some shell fragments, slight 6m slope -> more shelly and more silt (9m), one sponge. 10m -> gravel (small) with silt. 13.5m -> solitary sponge, hydroids, sea fans, ascidians, sponge, cup sponge. More rubble/cobbles with biota attached, moderate cover in patches. Most biota described in 13.5m. Gorgonian fan, sponges, occasional sea whips - up to 50% coverage. End
ROV EA 9	12 30 656 12 30 598	130 55 619 130 55 486	29-Apr-08 29-Apr-08	12:35	MOF area		3.5 - 5m 5m	Soft seafloor, occasional cobble with sponge, hydroids, some shell, small colonial ascidian, low bioturbation, occasional gorgonian, increasing with depth to 5m. Also higher bioturbation at 5m. End
ROV EA 10	12 30 554	130 55 651	29-Apr-08	12:50	MOF area		6.2m	Sand/silt very fine. Sparse sponge, low bioturbation, sea whip and digitated sponge.
	12 30 507 12 30 501	130 55 511 130 55 475	29-Apr-08 29-Apr-08	13:04			6.8m 5.2m	Covered, low bioturbation, digitated sponges, low biota, sea pens (sparse), low bioturbation with fine silts. End
ROV EA 11	12 29 854	130 54 244	29-Apr-08	13:30	Old man rock-Northside		3.5-2m	Rock with silts, sand veneer, <10% hard coral - including faviids, occasional soft corals, few sponges, many surgeonfish, cod (one) and butterfly fish. 2m- encrusting faviids <10% coverage, occasional angelfish and surgeonfish.
ROV EA 12	12 29 884	130 54 240	29-Apr-08	13:55	Old man rock-Southside		3-6m	6m- gorgonians on rocks on sandy, shelly seafloor, with high diversity of sponges (mainly laminar and branching) and soft corals. Scribbled angelfish. 3m- rocks with sponges, hydroids, <i>Turbinaria</i> , soft corals, several scribbled angelfish, some <i>Goniopora</i> , faviids. 4.8m- predominantly sand and shell fragments, sponge garden, digitated sponges, sea whips and gorgonians.
ROV EA 13	12 29 385 12 29 371 12 29 369	130 51 338 130 51 277 130 51 242	29-Apr-08 29-Apr-08 29-Apr-08	14:40 14:45 14:47	North Point NW Wickham Point		1.5m	Coarse sand with small corals. <5% coral coverage, barrel sponge, <i>Dendronephthya</i> , dominated by <i>Goniopora</i> and occasional encrusting sponge.
	12 29 362	130 51 200	29-Apr-08				2.3m	Sand with large wave formation, coarse with shall fragments with fine silts, no biota. Algae and hydroids dominate rubble. School of surgeon fish. Some faviids, encrusting and digitated sponges, macroalgae present. Gorgonians and sparse patches of biota. Macroalgae, possibly <i>Caulerpa</i> sp.
	12 29 349 12 29 343 12 29 343	130 51 140 130 51 101 130 51 078	29-Apr-08 29-Apr-08 29-Apr-08		Edge of slope		3.5m 6m	Dominant high coverage of <i>Goniopora</i> , large faviids, 10% hard coral coverage, soft coral (<i>Dendronephthya</i>), small branching <i>Acropora</i> .
	12 29 344	130 51 038	29-Apr-08	15:00			6.5m	Sea whips, holothurians, gorgonians and sponge garden, laminar sponges. Shelf drops off past 7m. Sandy seabed with moderate bioturbation, 6m, flat and featureless. End

**Data Table 1 : ROV Site Record
April 2008**

Site ID	Latitude	Longitude	Date taken	Time	Location	Comments	Depth	Observations
ROV MA 1	12 30 957 12 30 959	130 49 178 130 49 159	29-Apr-08 29-Apr-08	15:26	East side of reef, south of Weed Reef		3.5m 2-3m	Silt/sand veneered pavement with rubble. Small soft coral colonies, cup and laminar sponges, corals present include <i>Turbinaria</i> , overall sponge dominated. <5% coral including faviids, sea whips, colonial ascidians. Solitary <i>Acropora</i> sp., dominated by gorgonians, sponges (10-20%), moderate bioturbation, <1% hard coral sparse small barrel sponges and two <i>Montipora</i> plates. End
ROV IDP 1	12 29 820	130 48 900	29-Apr-08	16:09	Proposed pipeline - No. 5		15.7m	Fine silt over small rubble terrain. No biota or bioturbation, one small sea whip and occasional ascidians.
ROV IDP 2	12 29 742 12 29 727	130 48 943 130 48 875	29-Apr-08 29-Apr-08	16:21	Proposed pipeline - No. 5	Transect - westerly	16.7m	Flat silty sandy bottom, occasional ascidian, sparse sponges, hydroids and bioturbation, solitary <i>Gorgonian</i> . End
ROV IDP 3	12 29 280 12 29 269	130 48 752 130 48 687	29-Apr-08 29-Apr-08	16:38	Proposed pipeline - No. 6	Transect - westerly	20m	Silt/sand matrix, featureless bottom. Very sparse biota, occasional sea whip, ascidian, sea star (echinoderms), crinoid on sea whip, occasional hydroid. End
ROV IDP 4	12 29 323 12 28 293	130 48 260 130 48 183	29-Apr-08 29-Apr-08	16:57	Proposed pipeline - No. 8	Transect - WNW direction	14m	Sand veneered pavement, tubular and digitated sponge (sparse) and gorgonians. Low bioturbation and hydroids. Spider crabs patchy throughout. Low density biota with a solitary ascidian. End
ROV IDP 5	12 27 834 12 27 820	130 48 013 130 47 992	29-Apr-08 29-Apr-08	17:12	Proposed pipeline - No. 9	Transect - westerly	17m	Sand veneered pavement with some shell fragments. Occasional digitated, laminar and branching sponges, gorgonians, patchy biota on exposed pavement, dominated by sponge and gorgonians, large patches of sand between. End
ROV IDP 6	12 27 412 12 27 422	130 47 620 130 47 382	29-Apr-08 29-Apr-08	17:29	Proposed pipeline - No. 10	Transect - westerly	19m	Silt veneer over pavement, some rubble with occasional hydroids, gorgonians, sponges, ascidians and very sparse biota. End
ROV SG 1	12 21 038 12 21 044	130 45 809 130 45 716	30-Apr-08 30-Apr-08	7:10	Spoil ground - far north	Transect - 1 knot	15.5m	W-10m E - Slight/moderate swell. Fine silts over moderate coarse grain, slight undulations, one crinoid, very low bioturbation and some shell fragments. Two stripey snapper sighted. Very sparse biota. End
ROV SG 2	12 21 643 12 21 642	130 45 900 130 48 838	30-Apr-08 30-Apr-08	7:28	Spoil ground - further south	Transect - 1 knot		Silt veneer over sand. Crinoid, hydroid, very sparse biota, low bioturbation. One crustacean (crab). End
ROV SG 3	12 21 627 12 22 655	130 46 721 130 46 658	30-Apr-08 30-Apr-08	7:51	Spoil ground - furthest north	(west) DLNG TAN01.2	15.4m	Fine silts over fine/medium sand. Sparse biota, one sea whip, solitary soft coral, hydroid. End
ROV SG 4	12 22 881 12 22 896	130 46 944 130 46 892	30-Apr-08 30-Apr-08	8:04	Spoil ground - middle site	Transect - westerly DLNG TAC01.2		Fine silts over fine/medium sands. Some algae growth. Two blue swimmer crabs sighted. Very sparse bioturbation and biota. Slight mounds and undulations. End
ROV SG 5	12 23 144 12 23 152	130 47 085 130 47 037	30-Apr-08 30-Apr-08	8:20	Spoil ground - south site	Transect - westerly DLNG TAS01.2		Fine silts over sand. One crinoid, small mounds and undulations. Very sparse biota and bioturbation. End
ROV IDP 7	12 25 563 12 25 597	130 46 166 130 46 136	30-Apr-08 30-Apr-08	8:50	Proposed pipeline - No. 14	Transect - SW direction	19m	Coarse rubble with fine silt veneer. Solitary soft coral, gorgonians, hydroids, small digitated sponges, patchy biota (20% coverage), sparse bioturbation. Vase sponge. Few shell fragments, two sea stars. End
ROV WP 1	12 26 075	130 46 193	30-Apr-08	9:18	West Point Reef	Spot Dive	6m	Moderate biota, soft corals, sea whips, <i>Turbinaria</i> , hydroids, cup sponges, gorgonians, digitated sponges, 5% cover. Patches of coarse sand with shell fragments. Planular sponges, <i>Turbinaria</i> , encrusting faviids. <10% hard coral cover. Pavement with coarse sand and rubble veneer, <i>Dendronephthya</i> . Crinoids, bryozoans and ascidians.
ROV WP 2	12 26 034	130 45 122	30-Apr-08	9:35	West Point Reef - North End	Spot Dive	5m	Coarse sand with shell fragments, sparse biota coverage. Sea whips, gorgonians, soft corals, some rubble, sponges (digitate) and <i>Goniopora</i> . Strong tides, low water, ROV drifted to rear of vessel in 180 degree heading for both sides, unable to investigate further in shore.
ROV WP 3	12 26 398 12 26 384	130 46 067 130 46 049	30-Apr-08 30-Apr-08	9:57	West Point Reef - South End	Short drift transect Replication of DLNG (DH04)	3m	Silts over sand and pavement, undulating bottom, occasional <i>Padina</i> sp., red algae, some rubble, <i>Goniopora</i>
								Silt brown veneer, digitated sponges, 10% biota coverage, <1-2% hard coral cover including faviids

**Data Table 1 : ROV Site Record
April 2008**

Site ID	Latitude	Longitude	Date taken	Time	Location	Comments	Depth	Observations
ROV IDP 8	12 26 072 12 26 171	130 46 577 130 46 550	30-Apr-08 30-Apr-08	10:16	Proposed pipeline - No. 13	Drift Transect	19m	W-15knots E - slight chop. Silt veneer over coarse sand and rubble. Sparse patchy biota. Hydroids, crinoids, undulating bottom with low-moderate bioturbation. Colonial ascidians, sea whips, gorgonian and laminar sponges End
ROV IDP 9	12 26 622 12 26 718	130 47 009 130 46 934	30-Apr-08 30-Apr-08	10:30	Proposed pipeline - No. 12		26m	Fine silt veneer over coarse sand and fine rubble. Flat, no undulations or mounds. Some shall fragments. Low bioturbation, very sparse biota. Occasional hydroid, possible sparse macroalgae presence (very fast transect 1.3 knots) End
ROV IDP 10	12 26 919 12 26 998	130 47 309 130 47 248	30-Apr-08 30-Apr-08	10:44	Proposed pipeline - No. 11		22m	Fine silt over coarse rubble, gorgonians, planular sponges, hydroids, overall sparse biota in patches, one sea whip. Occasional crinoid (very fast transect at 1 knot)
ROV WR 1	12 29 119	130 47 548	30-Apr-08	11:17	Weed Reef- NE corner	DLNG previous coral site		Sand and rubble on pavement, laminar sponges, soft coral, occasional <i>Turbinaria</i> (transect too quick and would repeat)
ROV WR 2	12 29 101 12 29 130	130 47 553 130 47 525	30-Apr-08 30-Apr-08	11:21	Weed Reef- NE corner	Repeat of WR1		Sand and some rubble on pavement with slope into deeper water. Large <i>Acropora</i> thickets, soft corals, barrel sponges, <i>Turbinaria</i> . Dense coral cover near top of reef, rapidly decreasing down slope (fast drift due to current). End
ROV WR 3	12 29 320	130 48 003	30-Apr-08	11:47	ENE Side of Weed Reed	From coral mon. site of DLNG (DH05)		Slipper coral, diverse coral (sparse coverage), sea whips, faviids, <i>Montipora</i> , <i>Goniopora</i> , holothurians, soft corals, sand patches with coarse gravel. Small <i>Turbinaria</i> , vase sponge, encrusting corals. Damsel fish
ROV WR 4	12 29 951	130 48 447	30-Apr-08	12:10	SE Corner of Weed Reef	previous site	6.8m	Fine silt veneer, sparse <i>Turbinaria</i> , very sparse biota, solitary sponge (digitated).
ROV WR 5	12 29 946	130 48 431	30-Apr-08	13:15		Transect - N direction		Fine silts over pavement. Soft corals and sponge (scattered), very low biota. (Both WR4 and 5 show little biota and decided to redeploy at different location, closer to main body of reef)
ROV WR 6	12 30 001 12 29 991	130 48 384 130 48 313	30-Apr-08 30-Apr-08	13:30		Transect - westerly	1.5m	Fine silts on rubble pavement with small hard coral colonies. Faviids, <i>Acropora</i> , <i>Turbinaria</i> , high diversity with moderate coverage. School of surgeon fish, faviid bommies and butterfly fish. End
ROV IDP 11	12 30 549 12 30 550	130 49 281 130 49 235	30-Apr-08 30-Apr-08	13:50	Proposed pipeline - No. 4		11m	Fine silts over sand with shell fragments. Sponge and gorgonians and sea whip gardens. 10% biota, moderate bioturbation.
ROV IDP12	12 31 273 12 31 272	130 49 706 130 49 666	30-Apr-08 30-Apr-08	14:06 14:20	Proposed pipeline - No. 3	Transect - westerly drift	15.7m	Silty bottom, high bioturbation, low biota. Occasional sea whip, sea pen, hydroid, crinoids and few shell fragments. End

Legend

EA: East Arm
MA: Middle Arm
CAT : Catalina
WRK : Wreck
WP : West Point
WR: Weed Reef
IDP: Ichthys darwin Pipeline
BDP: Bayu Darwin pipeline

Data Table 2 : Dive survey locations carried out by Tek Venture, May 2008

Site ID	Name	Comments
TEK1	ELLENGOWAN	Heritage Site wreck
TEK2	STEEL BARGE	Co-ordinates provided were very close to a steel World War II barge. Nothing found on Lat/Long provided.
TEK3	THE KELAT	World War II Heritage Site
TEK4	MOORING BLOCK	Mooring block for tug mooring buoy
TEK5	CATALINA 4	Cat 5 (PB4)- sunk during first raid in Darwin Harbour along with 2 others)
TEK6	CATALINA 3	Cat 4. Not Cat 3 (that is actually Site #8)
TEK7	WRECK B3	Rocky ledge near A24-1
TEK8	WRECK B2	Cat 3- A24-206
TEK9	WRECK B1	Near Wickham Point Buoy. Concrete mooring block.
TEK11	OBSTRUCTION 2	Nothing found. Muddy bottom.
TEK12	OBSTRUCTION 5	Old steel rectangular shaped structure with hole in top.
TEK14	Unident_ Wreck1	Resembled sink hole. Very find silt with huge amount of tree branches, small sticks and debris. Very little marine life. Puffer fish and sting ray. Rocks buried under silt.
TEK15	Unident_ Wreck2	Old oyster shell collection at random over coral reef.
TEK16	Unident_ Wreck3	Coral reef profiling from silty bottom

Note - All positions have been provided to NRETAS

**Data Table 3: Second diving survey sites
June 2008**

Site ID	Video/stills	Date	Name	Longitude	Latitude	Location description	Site Observations
DC1	Video (1)	15-Jun-08	Channel Island	130 51.700'	12 33.770'	Southwestern point of Southern side	10-25% coral coverage on low relief on rubble/sand pavement. No large bommies, all small recruits up to 50cm, no <i>Acropora</i> but good diversity. <i>Turbinaria</i> predominant. Algal coverage (50%) with hydroids and some sea whips. Sparse fish life. Remnants of previous attempts of a jetty (pipes/mooring blocks).
DC2	Video (1)	15-Jun-08	Channel Island	130 52.300'	12 33.571'	Eastern side of Channel Island, south of existing causeway.	Low/moderate bioturbation on fine silt substrate. Sparse sea pens, very sparse biota. Sounded area to south, no steep wall, just gradual slope of mud (interpreted by sounder signal on boat).
DC3	Video/stills (1)	15-Jun-08	Channel Island	130 51.435'	12 32.678'	Western side of Channel Island, northern point, southern extent of hard rocky substrate.	10-25% coral coverage, high diversity, large silt content and low rubble component (possibly less scouring). <i>Halomeada</i> - predominantly algae (50%). Barrel sponges, gorgonians and sparse presence of <i>Turbinaria</i> .
DC4	Video/stills (1)	15-Jun-08	Channel Island	130 51.404'	12 32.481'	Western side of Channel Island, northern point, mid-point of hard rocky substrate.	5-10% coral, increased rubble with silt, low bioturbation, soft corals prevalent (siphon aria?), sponges, predominantly coral. No sea whips or <i>Turbinaria</i> . Faviids and slipper corals present. Mostly encrusting corals. Location is in bay style.
DC5	Stills	15-Jun-08	Channel Island	130 51.375'	12 32.309'	Northern point of Channel Island	Sponge garden at depth (fans, sponges and sea whips). <i>Halomeada</i> meadows in shallows. Silt on rubble. 5-10% coral cover (diverse). <i>Goniopora</i> dominant. Mostly encrusting corals. Similar diversity and cover as 4.
DC6	Stills	15-Jun-08	Channel Island	130 52.409'	12 32.972'	Potential coral monitoring site	Most diversity and cover is no 3.
DC7	Stills	15-Jun-08	Channel Island	130 51.711'	12 32.346'	Northern point of Channel Island, Eastern side,	High diversity of coral cover (50%). Sandy substrate. <i>Goniopora</i> , encrusting faviids, <i>Platygyra</i> , ascidians, hydroids, sea whips, <i>Acropora</i> . Gentle sloping bottom, sparse algal cover, no silt. All camera shots, no video.
DC8	Stills	15-Jun-08	Channel Island	130 51.428'	12 32.260'	Northern point of Channel Island, Eastern side, further north	One soft coral. 1m visibility, no dead or bleached coral.
DC9	Video/stills (1)	15-Jun-08	Sandbar North of Channel Island	130 51.362'	12 31.905'	Western side	Sandy bottom, some green algae at bottom of slope. Anemone, 15% coral cover, sandy rubble on top of slope. Sea whips in patches.
DC10	Video (1)	15-Jun-08	Wickham Point	130 52.410'	12 30.115'	Eastern side of point, at potential coral monitoring site	Very similar to 7. Still sand with small silt component and algal growth. 10% coral cover - dominant <i>Goniopora</i> , with occasional soft corals.
DC11	Video/stills (1)	15-Jun-08	Wickham Point	130 52.420'	12 30.115'	Position east of previous	Silt and sand bottom, sand dollars, sparse crinoids. Low bioturbation.
DC12	Video (1)	15-Jun-08	South Shell Island	130 53.138'	12 29.869'	Potential coral monitoring site	10-15% coral growth cover, numerous sponges, <i>Mycedium</i> , faviids, dominated by laminar <i>Turbinaria</i> , hard pavement with coarse sand/low silt and some rubble. Sea whips, gorgonians and digitated soft corals.
DC13	Video/stills (2)	16-Jun-08	Karumba Shoal	130 47.200'	12 28.280'	Eastern side of harbour north of Weed Reef	Two large <i>Porites</i> similar to 10.
DC14	Video/stills (2)	16-Jun-08	CoP pipeline - Rock Armour	130 48.422'	12 28.239'	Mid-harbour location	50% coral cover, very diverse on pavement. Sea whips, fans, encrusting corals, coarse sand and no silt.
DC15	Video/stills (2)	16-Jun-08	CoP pipeline - rock and silt	130 49.056'	12 29.813'	Located west of <i>Maura Lova</i> .	2m visibility, silt and sand covered pavement with low moderate bioturbation, predominant laminar sponges, occasional sea whips and gorgonians, encrusting sponges, one encrusting coral.
DC16	Stills	16-Jun-08	Proposed Pipeline	130 50.280'	12 31.980'	West of Wickham Point	3-4m visibility, rock armour on bottom with coarse sand with sea whips. Transect moves to rocks with algae, hydrozoans, sea whips, <i>Turbinaria</i> colonies, <5% coral cover. Moderate fish life, barrel sponges, gorgonians and soft corals present.
DC17	Video/stills (2)	16-Jun-08	Plater Rock (Pinnacle)	130 47.210'	12 28.560'	Eastern side of harbour north of Weed Reef	Coarse shell sand with high silt component on surrounding area of pipeline. Occasional sea whips, crinoids, sparse bioturbation and similar abundance on trenced walls. On rocks- covered in thick silt layer. Exposed rocks with 300mm diameter. Gorgonians, laminar fans, sea whips, crinoids, no coral, hydroids, with algae covering. <5% biota.
DC18	Video/stills (2)	16-Jun-08	Weed Reef	130 48.000'	12 29.316'	Potential coral monitoring site	Pea gravel with silt. Low bioturbation, low biota. Occasional crinoids, anemone, sea whips and soft corals.
DC19	Video/stills (2)	16-Jun-08	CoP pipeline - Suspended	130 46.420'	12 25.700'	Suspended pipeline	Rocky outcrop covered in biota. Strong current. Sea whips, sponges, turbinaria, faviids. 50-100% coral cover in places, average 50%. Moderate fish life. Dominant species are <i>Turbinaria</i> , hydroids and <i>Mycedium</i> . Sand substrate on rocks, moderate abundance of soft corals and moderate sized <i>Turbinaria</i> vases.
DC20	Stills	17-Jun-08	Proposed Pipeline	130 51.180'	12 32.040'	West of Wickham Point	50-75% coral coverage, remnants of old coral transect site. Soft corals. Reef dominated by <i>Mycedium</i> , <i>Turbinaria</i> , <i>Goniopora</i> . Sea whips, fish life and slipper corals present. Sandy silty substrate.
DC21	Video/stills (3)	17-Jun-08	Catalina wreck PBY4	130 53.115'	12 30.355'	North Wickham Point	Pipeline, trenced one end and rocks on the other. Good fish life, abundant fans and gorgonians. Substrate and ledges and rocks with coarse sand, gravel and silt components. On pipe- algae dominant, sponges, gorgonians and laminar sponges, bryozoans and crinoids. Rocks - sparse biota, predominantly silt covered with some algae.

Data Table 4 : Third Diving Survey sites, August 2008

Site ID	Location	Depth	Latitude	Longitude
CHI 01	Channel Island	1.6	12° 32.972' S	130° 52.409' E
BLDN 01	Blaydin Point	3.5	12° 30.482' S	130° 54.506' E
BLDN 07	Blaydin Point	2.6	12° 30.508' S	130° 54.636' E
SSI 01	South Shell Island	3.4	12° 29.869' S	130° 53.138' E
WEED 01	Weed Reef	1.9	12° 29.316' S	130° 48.000' E

**Data Table 5 : Remote drop camera transects
June 2008**

Remote Camera Site	Date	Time	Area	Start		Finish		Site Observations
				Longitude	Latitude	Longitude	Latitude	
RC1	11-Jun-08		Pipeline shore crossing	130 52.169'	12 31.996'	130 52.177'	12 31.989'	Low moderate bioturbation, no fauna observed, low visibility, silt covered with very fine sand and silt matrix.
RC2	11-Jun-08		Pipeline shore crossing	130 52.450'	12 32.290'	130 52.451'	12 32.277'	Low moderate bioturbation, no fauna observed, low visibility, silt covered with very fine sand and silt matrix.
RC3	11-Jun-08		Pipeline shore crossing	130 52.469'	12 32.230'	130 52.465'	12 32.215'	Low moderate bioturbation, no fauna observed, low visibility, silt covered with very fine sand and silt matrix.
RC4	11-Jun-08		Pipeline shore crossing	130 52.474'	12 32.147'	130 52.471'	12 32.130'	Low moderate bioturbation, no fauna observed, low visibility, silt covered with very fine sand and silt matrix.
RC5	11-Jun-08		Pipeline shore crossing	130 52.483'	12 32.077'	130 52.463'	12 32.042'	Low moderate bioturbation, no fauna observed, low visibility, silt covered with very fine sand and silt matrix.
RC6	11-Jun-08		Pipeline shore crossing	130 52.495'	12 32.023'	130 52.495'	12 32.012'	Low moderate bioturbation, no fauna observed, low visibility, silt covered with very fine sand and silt matrix.
RC7	11-Jun-08		Pipeline shore crossing	130 52.339'	12 32.273'	130 52.327'	12 32.255'	Low moderate bioturbation, no fauna observed, low visibility, silt covered with very fine sand and silt matrix.
RC8	11-Jun-08		Pipeline shore crossing	130 52.350'	12 32.138'	130 52.337'	12 32.122'	Low moderate bioturbation, no fauna observed, low visibility, silt covered with very fine sand and silt matrix.
RC9	11-Jun-08		Pipeline shore crossing	130 52.362'	12 32.004'	130 52.350'	12 31.983'	Low moderate bioturbation, no fauna observed, low visibility, silt covered with very fine sand and silt matrix.
RC10	12-Jun-08		Pipeline shore crossing	130 52.285'	12 31.994'	130 52.270'	12 32.000'	Low moderate bioturbation, no fauna observed, low visibility, silt covered with very fine sand and silt matrix.
RC11	12-Jun-08		Pipeline shore crossing	130 52.226'	12 32.137'	130 52.197'	12 32.150'	Low moderate bioturbation, no fauna observed, low visibility, silt covered with very fine sand and silt matrix.
RC12	12-Jun-08		Pipeline shore crossing	130 52.203'	12 32.263'	130 52.161'	12 32.272'	Low moderate bioturbation, no fauna observed, low visibility, silt covered with very fine sand and silt matrix.
RC13	12-Jun-08		MOF	130 55.052'	12 30.516'	130 55.057'	12 30.494'	Moderate bioturbation, sand and silt veneer over pavement due to sparse soft corals and sea pens present (~2-5%), also occasional hydroid, digitated sponge and colonial ascidian.
RC14	12-Jun-08	9:10	MOF	130 54.944'	12 30.614'	130 54.953'	12 30.583'	Rubble with sand and silt veneer, overall low biota, few soft corals, one small faviid, sponges, ascidians, hydroids, algae and some low to moderate bioturbation.
RC15	12-Jun-08	9:40	MOF	130 54.794'	12 30.683'	130 54.798'	12 30.663'	Silt with low bioturbation, relatively featureless.
RC16	12-Jun-08	10:05	MOF	130 54.594'	12 30.813'	130 54.588'	12 30.816'	Silty substrate with relatively low bioturbation, some undulations.
RC17	12-Jun-08	10:45	MOF	130 54.574'	12 30.969'	130 54.586'	12 30.982'	Low visibility, soft silts and sediment with low/moderate bioturbation.
RC18	12-Jun-08	11:10	MOF	130 54.728'	12 30.874'	130 54.723'	12 30.888'	Soft mud/flats, low/moderate bioturbation with low visibility.
RC19	12-Jun-08	11:30	MOF	130 54.877'	12 30.779'	130 54.868'	12 30.788'	Soft mud/flats, low/moderate bioturbation with low visibility.
RC20	12-Jun-08	11:50	MOF	130 55.018'	12 30.692'	130 55.009'	12 30.700'	Rubble and silt, low biota and low bioturbation.
RC21	12-Jun-08	12:05	MOF	130 55.170'	12 30.613'	130 55.161'	12 30.623'	Rubble and silt with low bioturbation and low visibility.
RC22	12-Jun-08	12:30	MOF	130 55.246'	12 30.414'	130 55.226'	12 30.424'	Sea pens on scoured pavement with silts and fine sands, small/medium bioturbation.
RC23	12-Jun-08	13:05	MOF	130 55.427'	12 30.644'	130 55.405'	12 30.641'	Fine silts and moderate sand, low bioturbation. No grab - hard substrate.
RC24	13-Jun-08	8:25	MOF	130 55.831'	12 30.735'	130 55.851'	12 30.740'	Blaydin Point, moderate bioturbation with seaweeds, digitated sponges, gorgonian and 15% biota.
RC25	13-Jun-08	8:55	MOF	130 55.735'	12 30.822'	130 55.726'	12 30.832'	Low bioturbation on silt, sand with occasional sea whips, sponges and low biota.
RC26	13-Jun-08	9:35	MOF	130 55.612'	12 30.686'	130 55.588'	12 30.697'	Silt and sand with low bioturbation and very sparse biota.
RC27	13-Jun-08	9:50	MOF	130 55.729'	12 30.598'	130 55.727'	12 30.616'	Silt and sand over gravel substrate with sparse biota. Occasional bryozoan, sponge, sea whip, ascidian, hydroid. Low visibility.
RC28	13-Jun-08	10:30	MOF	130 55.626'	12 30.468'	130 55.593'	12 30.446'	20-25 knots with quite rough seas, low visibility, low to medium bioturbation and occasional sponge and biota.
RC29	13-Jun-08	10:55	MOF	130 55.517'	12 30.569'	130 55.475'	12 30.564'	Bad visibility, silt and sand with low/moderate bioturbation, very sparse biota and possible algal turf.
RC30	13-Jun-08	11:45	MOF	130 55.387'	12 30.451'	130 55.353'	12 30.441'	30 knots strong winds. Very bad visibility, gravel/rubble on bottom with sand veneer with very sparse biota - occasional soft coral and algal matting - very hard to ID from vessel with vessel rolling heavily.
RC31	13-Jun-08	12:00	MOF	130 55.493'	12 30.333'	130 55.468'	12 30.331'	Silt and sand substrate with low bioturbation and very sparse biota - sponge, hydroid and gorgonian. Heavy boat rolling.
RC32	13-Jun-08	13:32	MOF	130 55.645'	12 30.889'	130 55.622'	12 30.885'	Very rubby with some sediment and very low biota, mostly occasional algal turf. Low visibility. Too hard to grab.
RC33	13-Jun-08	13:45	MOF	130 55.529'	12 30.792'	130 55.507'	12 30.790'	Some rubble, no biota sighted, low bioturbation, very low visibility.
RC34	14-Jun-08	8:20	MOF	130 55.310'	12 30.292'	130 55.302'	12 30.269'	Sand/silt substrate with gravel with abundant sea pens (>25% coverage), occasional sea whip and hydroid. Low - moderate bioturbation
RC35	14-Jun-08	8:50	MOF	130 55.129'	12 30.339'	130 55.118'	12 30.312'	Sand/silt substrate with gravel over undulating pavement with abundant sea pens (>25% coverage), occasional sea whip and hydroid with low bioturbation
RC36	14-Jun-08	9:05	MOF	130 54.966'	12 30.412'	130 54.957'	12 30.410'	Sparse rubble with sand veneer pavement with low biota, with occasional sea pens, sea whips and sponges.
RC37	14-Jun-08	9:20	MOF	130 54.808'	12 30.502'	130 54.789'	12 30.510'	Moderate biota with algae, some soft coral (<i>Sarcophyton</i> sp.) and single <i>Turbinaria</i> and faviid (hard coral). High algal coverage with sand veneer over rubble pavement. Colonial ascidians, encrusting sponges, juvenile vase sponges, <i>Halimeda</i> sp. No grab, too shallow rubble pavement.
RC38	14-Jun-08	9:50	MOF	130 54.650'	12 30.610'	130 54.641'	12 30.606'	Sand and silt pavement with low/moderate bioturbation with occasional bryozoan and sea pen and some algae.
RC39	14-Jun-08	10:10	Proposed jetty	130 54.218'	12 30.674'	130 54.215'	12 30.703'	Sand and silt pavement with very low biota and low bioturbation.
RC40	14-Jun-08	10:25	Proposed jetty	130 54.319'	12 30.789'	130 54.322'	12 30.805'	Sand and silt pavement with low bioturbation and occasional sea whips.
RC41	14-Jun-08	10:40	Proposed jetty	130 54.427'	12 30.878'	130 54.413'	12 30.885'	Sand and silt, flat pavement with low bioturbation and one sea whip.

**Data Table 6 : Infauna sites
June 2008**

Site	Date	Time	Area	Longitude	Latitude	Duplicate/ TriPLICATE	Sediment samples taken	Location description
G1	11-Jun-08	9:05	Shore Crossing	130 54.724'	12 30.874'		Light grey silt, homogeneous, light brown veneer, full successful grab, slightly anoxic, Began on shore side - high tide 11:45.	Blaydin Point, NW area, nearshore
G2	11-Jun-08	9:18	Shore Crossing	130 54.872'	12 30.792'		Light grey silt, homogeneous, light brown veneer, full successful grab, slightly anoxic smell	Blaydin Point, NW area, nearshore
G3	11-Jun-08	9:32	Shore Crossing	130 55.006'	12 30.697'		Light grey silt, homogeneous, light brown veneer, full successful grab, slightly anoxic, sieved 1 bag and 1 vial (crab and worm present)	Blaydin Point, NW area, nearshore
G4	11-Jun-08	11:13	Shore Crossing	130 55.156'	12 30.622'		Light brown veneer over light grey silt homogeneous matrix, 1/2 full grab. Middle run of transects	Blaydin Point, N area, nearshore
G5	11-Jun-08	11:28	Shore Crossing	130 55.299'	12 30.539'		1/3 to 1/2 full grab similar to 4 but very fine sand.	Blaydin Point, N area, nearshore
G6	11-Jun-08	11:40	Shore Crossing	130 55.413'	12 30.652'		3/4 full grab similar to 5	Blaydin Point, N area, nearshore
G7	11-Jun-08	12:00	Shore Crossing	130 55.513'	12 30.784'		3/4 full grab similar to 5	Blaydin Point, NE area, nearshore
G8	11-Jun-08	13:45	Shore Crossing	130 55.625'	12 30.905'		3/4 full grab similar to 5	Blaydin Point, NE area, nearshore
G9	11-Jun-08	13:32	Shore Crossing	130 54.649'	12 30.608'		Offshore site, 1/3 full grab, thin light brown veneer over coarse grey gravel in a grey silt matrix, 15m off intertidal shelf.	Blaydin Point, NW area, offshore
G10	12-Jun-08	8:57	Blaydin Point - West Side	130 54.803'	12 30.504'		3/4 full grab, light grey silt with fine sand and shell fragments - no veneers	Blaydin Point, NW area, offshore
G11	12-Jun-08	9:25	Blaydin Point - West Side	130 54.966'	12 30.413'		1/4 full grab, gravel/shell fragments with grey silt and fine sand	Blaydin Point, NW area, offshore
G12	12-Jun-08	9:50	Blaydin Point - West Side	130 55.126'	12 30.318'	Duplicate	Mid point of 1 and 10; light brown silt veneer over dark brown/grey silt. No biota/smell/shell fragments, full grab	Blaydin Point, N area, offshore
G13	12-Jun-08	10:07	Blaydin Point - West Side	130 55.303'	12 30.268'	TriPLICATE	Full grab, light brown silt veneer over dark brown/grey silt. No smell/shell fragments, with bioturbation	Blaydin Point, N area, offshore
G14	12-Jun-08	10:55	Blaydin Point - West Side	130 55.480'	12 30.326'		Light brown silt veneer over light grey fine sand with shell fragments and gravel, 2/3 grab	Blaydin Point, N area, offshore
G15	12-Jun-08	11:15	Blaydin Point - West Side	130 55.626'	12 30.468'		2/3 grab, similar veneer but more silt (70%)	Blaydin Point, NE area, offshore
G16	12-Jun-08	11:33	Blaydin Point - West Side	130 55.727'	12 30.616'		1/4 grab, as for 15 but more shell fragments	Blaydin Point, NE area, offshore
G17	13-Jun-08	8:30	Blaydin Point - East Side	130 55.831'	12 30.753'		1/4 grab retained thin brown veneer over fine grey silt with coarse gravel, fine sand and bryozoan/sponge, some large rock fragments.	Blaydin Point, NE area, offshore
G18	13-Jun-08	9:05	Blaydin Point - East Side	130 54.320'	12 30.789'		1/2 grab retained, no veneer, grey silt with abundant gravel (coarse) shell fragments and small component of fine sand.	East Wickham Point, nearshore
G19	12-Jun-08	12:30	Blaydin Point - West Side	130 54.419'	12 30.884'	TriPLICATE	1/4 grab brown silt veneer over grey silt and fine/medium sand with gravel and shell fragments	East Wickham Point, nearshore
G20	13-Jun-08	9:40	Blaydin Point - East Side	130 54.223'	12 30.693'		1/2 grab retained, simialt to 18 but higher silt component	East Wickham Point, nearshore
G21	13-Jun-08	9:55	Blaydin Point - East Side	130 52.485'	12 32.149'		1/4 grab, larger gravel, brown/grey high silt component, ascidian/ polychaetes	West Wickham Point, nearshore
G22	13-Jun-08	10:39	Blaydin Point - East Side	130 52.350'	12 32.138'		1/2 grab brown/grey silt with coarse gravel and shell fragments, fine/medium sand	West Wickham Point, midshore
G23	13-Jun-08	10:58	Blaydin Point - East Side	130 52.213'	12 32.128'	TriPLICATE	1/2 grab, thin brown veneer over coarse gravel and grey with silt component. Included crab and sand dollar	West Wickham Point, offshore
G24	13-Jun-08	12:10	Blaydin Point - East Side	130 52.285'	12 31.994'		1/2 grab, coarse gravel and brown fine medium sane in a grey silt matrix	West Wickham Point, offshore
G25	13-Jun-08	13:25	Blaydin Point - East Side	130 52.362'	12 32.004'		1/4 grab as per 24.	West Wickham Point, midshore
G26	13-Jun-08	13:52	Blaydin Point - East Side	130 52.497'	12 32.014'		1/2 grab retained, brown veneer over grey silt and fine sand, shell fragments and organic material.	West Wickham Point, nearshore
G27	14-Jun-08	8:28	Blaydin Point - North and West	130 52.203'	12 32.263'	TriPLICATE	1/2 grab, light brown gravel/shell fragments in a fine silt/sand matrix, seapens and bryozoan	West Wickham Point, offshore
G28	14-Jun-08	8:55	Blaydin Point - North and West	130 52.339'	12 32.273'		1/2 grab, light brown silt veneer over grey silt/fine sand with sparse gravel, no shell fragments or biota	West Wickham Point, midshore
G29	14-Jun-08	9:12	Blaydin Point - North and West	130 52.475'	12 32.284'		1/4 grab, no veneer, coarse sans borken shell with small grey silt component	West Wickham Point, nearshore
G30	14-Jun-08		Blaydin Point - North and West	130 54.588'	12 30.816'		1/4 grab brown veneer over grey silt with gravel and shell fragments.	Blaydin Point, NW area, midshore
G31	14-Jun-08	9:50	Blaydin Point - West	130 54.798'	12 30.693'		1/2 grab light brown veneer over grey silt/sand homogeneous matrix, very little shell fragments of gravel, small light grey clay component.	Blaydin Point, NW area, midshore
G32	14-Jun-08	10:14	Blaydin Point - East Side	130 54.962'	12 30.508'		1/3 grab, thin light brown veneer over light grey silt with gravel.	Blaydin Point, NW area, midshore
G33	14-Jun-08	10:30	Blaydin Point - East Side	130 55.057'	12 30.494'		1/2 grab, coarse brown sand and small gravel - light brown veneer, silt grey component and shell fragments	Blaydin Point, N area, midshore
G34	14-Jun-08	10:45	Blaydin Point - East Side	130 55.246'	12 30.414'		1/2 grab, light brown silt veneer over grey silt/shell fragments, fine sand and small amount of clay	Blaydin Point, N area, midshore

**Data Table 6 : Infauna sites
June 2008**

Site	Date	Time	Area	Longitude	Latitude	Duplicate/ TriPLICATE	Sediment samples taken	Location description
G35	17-Jun-08	10:50	Blaydin Point	130 55.439'	12 30.330'		Intertidal zone - near to mangroves - not low enough tide to access site by person, chose site closer to shore, light brown veneer and dark grey silts. Low meoderate bioturbation over very hard pavement, rendering grab sample impossible.	Blaydin Point, N area, midshore
G36	17-Jun-08	11:30	Blaydin Point	130 55.517'	12 30.569'		Intertidal zone - as previous site. Shoreline, silt amd sand pockets within larger boulders and gravel, light brown veneer over grey sand silts. No grab would be possible due to substrate makeup. Descision mafe to undertake samples next day by road at low tide due to vessel unable to access site by water due to too deep a draft and numerous rocks with low visibility.	Blaydin Point, NE area, midshore
G37	18-Jun-08	12:05	Blaydin Point - Shore based sampling	130 55.588'	12 30.697'		Waters edge, 50m from mangroves edge, light brown veneer over sand and silt in pockets between cobbles, gravel on hard pavement, 4cm penetration.	Blaydin Point, NE area, midshore
G38	18-Jun-08	12:20	Blaydin Point - Shore based sampling	130 55.726'	12 30.832'		Waters edge, 50m from mangroves edge, light brown veneer over sand and silt in pockets between cobbles, gravel on hard pavement, 4cm penetration.	Blaydin Point, NE area, midshore

Data Table 7 : Infauna records

Benthic Infauna
Job No.: 42906726

Site: G1			
Date: 11/06/2008			
Species	Abundance (total)	Comments	
CA	1		
CC	1	Hermit	
MB	1		
P	3	3 spp	
PP	3		

Site: G4			
Date: 11/06/2008			
Species	Abundance (total)	Comments	
CA	1		
MG	1		
P	7	3 spp	
PP	4		

Site: G2			
Date: 11/06/2008			
Species	Abundance (total)	Comments	
CC	2	2 spp	
CD	1		
EBS	2		
MB	2	2 spp	
MG	1		
P	2		
PP	2		

Site: G5			
Date: 11/06/2008			
Species	Abundance (total)	Comments	
CA	1		
MB	3	3 spp	
P	5	3 spp	
PP	6		

Site: G3			
Date: 11/06/2008			
Species	Abundance (total)	Comments	
CA	2		
CC	1		
P	1		

Site: G6			
Date: 11/06/2008			
Species	Abundance (total)	Comments	
CA	1		
CD	2		
MB	1		
P	9	5 spp	
PP	11		
U2	1		

Fauna Key
A Ascidian
AN Anemone
CA Crustacean - Amphipod
CC Crustacean - Crab
CD Crustacean - Decapod
CS Crustacean - Stomatopod
EBS Echinoderm - Brittle Star
EH Echinoderm - Holothurian
ESD Echinoderm - Sand Dollar
F Fish
H Hydroid
I Isopod
MB Mollusc - Bivalve
MG Mollusc - Gastropod
P Polychaete
PP Polychaete - pieces only
S Soft Coral
U2 Unidentified organic material - Site D6

Data Table 7 : Infauna records

Benthic Infauna
Job No.: 42906726

Site: G7		
Date: 11/06/2008		
Species	Abundance (total)	Comments
CA	3	3 spp
P	4	2 spp

Site: G10		
Date: 12/06/2008		
Species	Abundance (total)	Comments
CA	1	
CD	1	
EBS	1	
F	1	
P	6	3 spp
PP	4	

Site: G8		
Date: 11/06/2008		
Species	Abundance (total)	Comments
CA	1	
CC	1	
CD	1	
MB	4	4 spp
MG	1	
P	3	2 spp
PP	5	

Site: G11		
Date: 12/06/2008		
Species	Abundance (total)	Comments
CA	15	3 spp
CS	3	
EBS	1	
MB	3	2 spp
P	6	3 spp
PP	7	

Site: G9		
Date: 11/06/2008		
Species	Abundance (total)	Comments
CA	6	2 spp
P	4	3 spp

Site: G12		
Date: 12/06/2008		
Species	Abundance (total)	Comments
CA	5	3 spp
CD	1	
EBS	1	2 legs only
MB	1	
P	7	4 spp
PP	3	

Fauna Key

- A Ascidian
- AN Anemone
- CA Crustacean - Amphipod
- CC Crustacean - Crab
- CD Crustacean - Decapod
- CS Crustacean - Stomatopod
- EBS Echinoderm - Brittle Star
- EH Echinoderm - Holothurian
- ESD Echinoderm - Sand Dollar
- F Fish
- H Hydroid
- I Isopod
- MB Mollusc - Bivalve
- MG Mollusc - Gastropod
- P Polychaete
- PP Polychaete - pieces only
- S Soft Coral
- U2 Unidentified organic material - Site D6

Data Table 7 : Infauna records

Benthic Infauna
Job No.: 42906726

Site: G13		
Date: 12/06/2008		
Species	Abundance (total)	Comments
CA	18	3 spp
CC	1	
CD	1	
EBS	2	
F	1	
MG	1	
P	3	2 spp
PP	3	

Site: G16		
Date: 12/06/2008		
Species	Abundance (total)	Comments
MG	1	
PP	5	

Site: G14		
Date: 12/06/2008		
Species	Abundance (total)	Comments
CA	2	2 spp
P	2	2 spp
PP	4	

Site: G17		
Date: 12/06/2008		
Species	Abundance (total)	Comments
CA	4	2 spp
EBS	2	
MG	1	Onchidium
P	1	

Site: G15		
Date: 12/06/2008		
Species	Abundance (total)	Comments
CA	1	
EBS	1	
MG	1	
P	2	2 spp
PP	2	

Site: G18		
Date: 13/06/2008		
Species	Abundance (total)	Comments
CA	7	2 spp
CC	1	Hermit
CS	1	
MB	1	
P	4	2 spp
PP	6	
S	1	

- Fauna Key**
- A Ascidian
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 - EH Echinoderm - Holothurian
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 - MG Mollusc - Gastropod
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 - PP Polychaete - pieces only
 - S Soft Coral
 - U2 Unidentified organic material - Site D6

Data Table 7 : Infauna records

Benthic Infauna
Job No.: 42906726

Site: G19		
Date: 12/06/2008		
Species	Abundance (total)	Comments
EH	1	
H	1	
MB	1	
MG	1	
P	2	2 spp
S	5	

Site: G22		
Date: 13/06/2008		
Species	Abundance (total)	Comments
CD	3	
CS	1	
F	1	
EH	1	
P	5	3 spp
S	13	pieces

Site: G20		
Date: 13/06/2008		
Species	Abundance (total)	Comments
CA	13	2 spp
CS	2	
MB	1	
P	4	3 spp
PP	1	
S	1	

Site: G23		
Date: 13/06/2008		
Species	Abundance (total)	Comments
A	10	
CA	3	2 spp
CC	1	
CD	1	
CS	1	
ESD	1	
MG	1	Onchidium
P	4	2 spp
PP	3	

Site: G21		
Date: 13/06/2008		
Species	Abundance (total)	Comments
A	1	
CA	3	3 spp
EBS	5	
P	2	2 spp
PP	1	

Site: G24		
Date: 13/06/2008		
Species	Abundance (total)	Comments
CA	4	2 spp
EBS	1	
P	3	3 spp
PP	5	
S	5	pieces

Fauna Key

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- CS Crustacean - Stomatopod
- EBS Echinoderm - Brittle Star
- EH Echinoderm - Holothurian
- ESD Echinoderm - Sand Dollar
- F Fish
- H Hydroid
- I Isopod
- MB Mollusc - Bivalve
- MG Mollusc - Gastropod
- P Polychaete
- PP Polychaete - pieces only
- S Soft Coral
- U2 Unidentified organic material - Site D6

Data Table 7 : Infauna records

Benthic Infauna
Job No.: 42906726

Site: G25		
Date: 13/06/2008		
Species	Abundance (total)	Comments
AN	1	
CA	1	
EBS	1	
H	2	
MB	2	2 spp
P	2	2 spp

Site: G28		
Date: 14/06/2008		
Species	Abundance (total)	Comments
CA	1	

Site: G26		
Date: 13/06/2008		
Species	Abundance (total)	Comments
CY	1	
MB	1	

Site: G29		
Date: 14/06/2008		
Species	Abundance (total)	Comments
P	2	2 spp
PP	2	

Site: G27		
Date: 14/06/2008		
Species	Abundance (total)	Comments
CD	1	
A	2	
EBS		pieces only
P	1	
S	10	pieces

Site: G30		
Date: 14/06/2008		
Species	Abundance (total)	Comments
CA	12	2 spp
PP	4	
S	3	pieces

Fauna Key

- A Ascidian
- AN Anemone
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- EBS Echinoderm - Brittle Star
- EH Echinoderm - Holothurian
- ESD Echinoderm - Sand Dollar
- F Fish
- H Hydroid
- I Isopod
- MB Mollusc - Bivalve
- MG Mollusc - Gastropod
- P Polychaete
- PP Polychaete - pieces only
- S Soft Coral
- U2 Unidentified organic material - Site D6

Data Table 7 : Infauna records

Benthic Infauna
Job No.: 42906726

Site: G31		
Date: 14/06/2008		
Species	Abundance (total)	Comments
CA	3	
CC	1	
CP	1	
EH	1	
P	2	2 spp
PP	2	

Site: G32		
Date: 14/06/2008		
Species	Abundance (total)	Comments
CA	1	
CC	3	2 spp
MB	4	3 spp
PP	2	
I	1	

Site: G33		
Date: 14/06/2008		
Species	Abundance (total)	Comments
CA	8	
CS	1	
EBS	2	
P	5	3 spp
PP	3	

Site: G34		
Date: 14/06/2008		
Species	Abundance (total)	Comments
CA	2	2 spp
CP	2	
P	5	3 spp
PP	1	

Site: G35		
Date: 17/06/2008		
Species	Abundance (total)	Comments
CA	1	
CP	1	
P	1	
PP	1	

Site: G36		
Date: 17/06/2008		
Species	Abundance (total)	Comments
CC	1	Hermit
EBS	2	
MB	2	2 spp
MG	4	3 spp

Site: G37		
Date: 18/06/2008		
Species	Abundance (total)	Comments
CC	6	3 Hermit
MB	1	
P	4	3 spp

Site: G38		
Date: 18/06/2008		
Species	Abundance (total)	Comments
CA	5	2 spp
EBS	1	2 legs only
MB	6	3 spp
P	1	

Fauna Key
A Ascidian
AN Anemone
CA Crustacean - Amphipod
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CD Crustacean - Decapod
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F Fish
H Hydroid
I Isopod
MB Mollusc - Bivalve
MG Mollusc - Gastropod
P Polychaete
PP Polychaete - pieces only
S Soft Coral
U2 Unidentified organic material - Site D6