

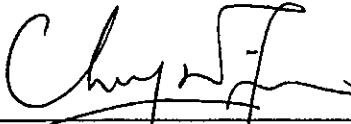
## Final Coral Monitoring Report

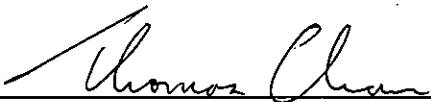
Contract No. : CV/2012/01

Project : Sediment Removal at Yim Tin Tsai (East)  
Fish Culture Zone

Client : Civil Engineering and Development  
Department (CEDD)

Main Contractor : Zhen Hua Engineering Company Limited

Certified By   
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Date: 7<sup>th</sup> July 2014

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Date: 7<sup>th</sup> July 2014

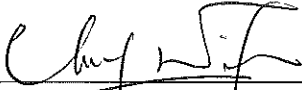
**Zhen Hua Engineering Company Limited**

**Contract No. CV/2012/01  
Sediment Removal at  
Yim Tin Tsai (East) Fish Culture Zone**

**Final Coral Monitoring Report**

June 2014

(Version 1.0)

Certified By   
(Environmental Team Leader)

REMARKS:

The information supplied and contained within this report is, to the best of our knowledge, correct at the time of printing.

CINOTECH accepts no responsibility for changes made to this report by third parties.

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## 1 INTRODUCTION

### Background

- 1.1 A priority list for removing sediments at the 26 Fish Culture Zones (FCZs) in Hong Kong (HK) had been prepared by the Agriculture, Fisheries and Conservation Department (AFCD), Civil Engineering and Development Department (CEDD) and AFCD consulted marine culturists' representatives on this list in May 2007. The representatives supported the government to carry out the sediment removal at the top five priority FCZs. Yim Yin Tsai (East) Fish Culture Zone was selected as one of them for improvement to the fish farming environment.
- 1.2 The works "Sediment Removal at Yim Tin Tsai (East) Fish Culture Zone" under Contract No. CV/2012/01 (hereinafter called the "Project") was awarded to Zhen Hua Engineering Company Limited (hereinafter called the "Contractor") by the Civil Engineering and Development Department (CEDD) of the Hong Kong Special Administrative Region (HKSAR).
- 1.3 Cinotech Consultants Ltd. (CINOTECH) was employed by the Contractor to serve as the Environmental Team (ET) to undertake the environmental monitoring services including the coral monitoring for the Project.

### Construction Programme

- 1.4 The site activities undertaken in the Project were:
  - Removal of seabed sediment;
  - Relocation of fish rafts;
  - Daily cleaning and weekly tidying;
  - Water Quality Monitoring; and
  - Bird and coral monitoring.

### Objective of the Report

- 1.5 This report presents the result of the coral monitoring programme which aims to record the physical (substrate types) and ecological (marine benthic organisms and corals) benthic components at two proposed impact sites (T2 and T3) at Yim Tin Tsai and one proposed control site (Site C) at Whitehead Peninsula, in order to identify any adverse impact on coral communities due to the Project.
- 1.6 The survey methodology is described in Section 2, the results and summary of the survey findings are presented in Sections 3, 4 and 5, respectively.

## 2 POST PROJECT CORAL MONITORING

- 2.1 On 8<sup>th</sup> June 2014, three subtidal sites (Sites T2, T3 and Site C), were surveyed to assess the substrate type and ecological attributes (species compositions). The locations of the three sites are shown in **Figure 1 and Figure 2**.

### Location of Coral Monitoring

- 2.2 The locations plan of the Coral monitoring stations is shown in **Figure 1**. The summary for Coral Monitoring Stations is shown in **Table 2.1**.

**Table 2.1 Summary of Coral Monitoring Stations**

Monitoring	Nature of Monitoring Station	Monitoring ID and Location
Post Project Coral Monitoring	Coral Monitoring Station	T2 – North of Shuen Wan Typhoon Shelter
		T3 - Southeast of Shuen Wan Typhoon Shelter
	Coral Control Station	Site C – Whitehead Peninsula

### Methodology

#### Dive Survey - Rapid Ecological Assessment

- 2.3 Assessment of substrate and ecological attributes using a semi-quantitative, Rapid Ecological Assessment (REA) method (DeVantier et al. 1998) was conducted at each site. The field data were collected by marine ecologists using SCUBA dive.
- 2.4 At each site, the REA survey was performed along a 100m transect parallel to the coastline. Substrate type along the transect was recorded at 1m intervals. The benthic cover, occurrence of both fishes and invertebrates and ecological attributes along the transect were recorded in a swathe of 2m wide, 1m either side of the transect. Locations of the transect are shown in **Figure 2**.
- 2.5 Locations of any corals and associated substrates size and health status (including percentage cover of bleaching, mortality and sedimentation) were recorded and feasibility of translocation were assessed.
- 2.6 The locations of the REA transects were recorded on site using handheld GPS unit (Garmin GPS). Pictures of representative taxa along the transects were taken during the surveys.
- 2.7 Assessment tables following the TM-EIAO guidance was completed in order to assess ecological value for each site. Two major types of information were recorded:
- (1) Cover of the major Benthic groups;
  - (2) Inventory of sessile benthic taxa.
- 2.8 These were performed according to Tier I and Tier II levels of information.

Tier I: Categorization of ecological (benthic cover) and environmental variables

To describe the benthic cover, six substrate and seven ecological attributes (**Table 2.2, column a**) were assigned. Each attribute was given a rank, from 0 to 6 (**Table 2.2, column b**) based on the overall cover along the survey area.

Tier II: Taxonomic inventories to define types of benthic communities

An inventory of benthic taxa was compiled during each dive. Taxa were identified either in situ or with the aid of photos to confirm identification afterward.

- **Hard corals** (Order Scleractinia) – to genus and species level where possible;
- **Soft corals** (Subclass Octocorallia) – to genus level where possible;
- **Other benthos** (such as sponges zoanthids, bryozoans, macroalgae, etc) – to genus level where possible or phylum with growth form.

Each taxon in the inventory was given a rank (0 to 5) on the basis of its abundance in the community at the site (**Table 2.2, column c**). These broad categories rank the taxa in terms of the relative abundance of individuals, rather than the contribution to benthic cover, at each site.

**Table 2.2 Categories of a) Benthic Attributes, b) Ordinal Ranks of Percentage Cover of Substrate, and c) Ordinal Ranks of Taxa Abundance**

a) Benthic attributes		b) Percentage Cover		c) Taxon abundance	
Substrate	Ecological	Rank	Percentage Cover	Rank	Abundance
Bedrock	Hard Corals	0	Not recorded	0	Absent
Boulders (diameter >50cm)	Dead Coral Skeleton	1	1-5%	1	Sparse
Dead Coral	Soft Corals	2	6-10%	2	Uncommon
Rubble (diameter < 50cm)	Sea anemone beds	3	11-30%	3	Common
Sand with gravel	Encrusting Algae	4	31-50%	4	Abundant
Mud & Silt	Coralline Algae	5	51-75%	5	Dominant
	Erect Macroalgae	6	76-100%		--

### 3 RESULTS OF POST PROJECT CORAL SURVEY

#### Dive Surveys – Rapid Ecological Assessment

- 3.1 The dive surveys at Yim Tin Tsai and Whitehead Peninsula were conducted on 8<sup>th</sup> June 2014 (Sunday).
- 3.2 The locations of the dive sites (Sites T2, T3 and Site C) for REA surveys are shown in **Figure 1 and 2**, and survey conditions in **Table 3.1**. Ecological and substrate attributes, and taxonomic Inventories along the REA transects at the three Sites are presented in **Table 3.2**. Records of coral colonies are presented in **Table 3.3**. Photos of representative taxa and corals along each transect are shown in **Appendices I and II**, respectively.
- 3.3 REA surveys were conducted at all sites. Hard substrates including bedrock, boulders and rubbles were mainly observed at shallow water (< 1.5m below Chart Datum). Sea bottom at any deeper water depth was mainly dominated by sand or mud. For coral communities, only hard corals were observed on hard substrates at shallow water, no soft coral was found; all these corals were absent from all the soft (sandy) sea beds.

#### Site T2

- 3.4 Site T2 is a natural, sheltered rocky shore. The rocky substrate was characterized by sand with gravels and rubbles, with patches of boulders (**Table 3.2**). The hard substrates were mainly covered by sediments. The common sessile taxa on the hard substrates were rock oysters and sea anemones, with patchy distribution of barnacles, mussels, tunicates, bryozoans, sponges, tube worms and hard corals (**Table 3.2; Appendix I**).
- 3.5 A total of 13 hard coral colonies of 1 species, *Oulastrea crispata* were observed (**Table 3.3; Appendix II**).
- 3.6 No octocoral (soft coral or gorgonian) was recorded at Site T2.

#### Site T3

- 3.7 Site T3 is a natural, sheltered rocky shore. The rocky substrate was characterized by sand with gravels and rubbles, with patches of boulders (**Table 3.2**). The hard substrates were mainly covered by sediments. The common sessile taxa on the hard substrates were rock oysters, sea anemones, mussels and tunicates, with patchy distribution of barnacles, bryozoans, sponges, tube worms and hard corals (**Table 3.2; Appendix I**).
- 3.8 A total of 12 hard coral colonies of 1 species, *Oulastrea crispata* were observed. (**Table 3.3; Appendix II**).
- 3.9 No octocoral (soft coral or gorgonian) was recorded at Site T3.

#### Site C

- 3.10 Site C is a natural, sheltered rocky shore. The rocky substrate was characterized by sand with gravels, rubbles and boulders, with patches of bedrock areas (**Table 3.2**). The hard substrates were mainly covered by sediments. The common sessile taxa on the hard substrates were rock oysters, sea anemones, barnacles, tunicates and mussels, with patchy distribution of hard



corals, bryozoans, sponges and tube worms (**Table 3.2; Appendix I**).

3.11 A total of 20 hard coral colonies of 1 species *Oulastrea crispata* were observed. (**Table 3.3; Appendix II**).

3.12 No octocoral (soft coral or gorgonian) was recorded at Site C.

**Table 3.1 Locations and Physical attributes of Sites for Dive Survey (T2, T3 and Site C)**

Sites	GPS Coordinates	Depth (m)	Visibility (m)	Substrate type	Weather	Tidal Condition	Sedimentation on Hard Substrate? (mm thickness)	
<b>08 June 2014</b>								
T2	Start	N 22°27.208' E 114°12.753'	1.0 – 1.5	1 – 1.5	Sand with gravel, rubbles and boulders	Calm; Sunny	Ebb	YES (2 – 4)
	End	N 22°27.161' E 114°12.727'						
T3	Start	N 22°27.079' E 114°12.661'	1.0 – 1.5	1 – 1.5	Rubbles, boulders and sand with gravel	Calm; Sunny	Ebb	YES (2 – 4)
	End	N 22°27.049' E 114°12.615'						
Site C	Start	N 22°26.184' E 114°14.229'	1.0 – 1.5	1 – 1.5	Rubbles, boulders and sand with gravel	Calm; Sunny	Ebb	YES (2 – 4)
	End	N 22°26.139' E 114°14.210'						

**Table 3.2 Post Project Coral Surveys - Ecological and Substrate Attributes, and Taxonomic Inventories along REA Transects at 3 Sites (T2, T3 and Site C)**

<b>Substrate attributes (0 – 6)</b>	<b>T2</b>	<b>T3</b>	<b>Site C</b>
Bedrock	0	0	1
Boulder (diameter > 50cm)	1	1	3
Dead Coral	0	0	1
Rubble (diameter < 50cm)	3	3	4
Sand with gravel	5	6	4
Mud & Silt	0	0	0
<b>Ecological attributes (0 – 6)</b>	<b>T2</b>	<b>T3</b>	<b>Site C</b>
Hard Corals	1	1	1
Dead Coral Skeleton	0	0	1
Soft Corals	0	0	0
Sea anemone beds	2	3	3
Encrusting Algae	1	1	1
Coralline Algae	0	0	0
Erect Macroalgae	0	0	0
Bare surface covered by sediments	5	5	4
<b>Taxonomic inventories (0 – 5)</b>	<b>T2</b>	<b>T3</b>	<b>Site C</b>
<b>Other sessile taxa</b>			
Sponges	1	1	1
Bryozoans	1	1	1
Tunicates	2	2	2
Hydroids	0	0	0
Rock Oysters	3	3	3
Mussel beds	1	2	2
Barnacles	1	1	2
Tube worms	1	1	1
	<b>T2</b>	<b>T3</b>	<b>Site C</b>
<b>*No. Hard Coral Colonies</b>	13	12	20
<b>*No. Soft Coral Colonies</b>	0	0	0

**Coral Community in the Study Area (Sites T2, T3 and Site C)**

- 3.13 At the impact monitoring Sites T2 and T3 in Yam Tin Tsai, a total of 25 hard coral colonies was found, the colony size, percentage area of sedimentation, bleaching and partial mortality are shown in **Table 3.3**. Size of the hard coral colonies was ranged from 6 to 120 cm<sup>2</sup>. All hard coral colonies were generally healthy; only six colonies showed low levels of sedimentation (5%), and most of the colonies were associated with rubbles and boulders (**Table 3.3**).
- 3.14 At the reference Site C in Wu Kwai Sha, a total of 20 hard coral colonies was found. Size of the hard coral colonies was ranged from 1 to 105 cm<sup>2</sup>. All hard coral colonies were generally healthy; fourteen colonies showed low levels of sedimentation (5-10%), and most of the colonies were associated with boulders (**Table 3.3**).
- 3.15 The species diversity of coral community in the Study Area was very low, colonies were small in size, with encrusting growth form, and patchily distributed. Only one hard coral species *Oulastrea crispata* (Faviidae) was observed in the Study Area (**Table 3.3**). This species can survive in turbid water, is characterized by its encrusting growth form and small size of only a few centimeters across, mainly occurs in turbid water, attaches to rock and boulders; and the abundance is generally not high within its distribution range (Veron 2000). This is a common species in Hong Kong waters (Chan et al. 2005).
- 3.16 No octocoral (soft coral or gorgonian) was observed in the Study Area.

3.17 No other sessile taxon of high conservation interest was recorded in the Study Area.

**Table 3.3. Size, Percentage Area of Sedimentation (SD), Bleaching (B) and Partial Mortality (PM), and Feasibility of Translocation of Hard Coral Colonies at each survey site in the Study Area**

Code	Site	No.	Family	Species	Location on 100m transect (m)	Size: Hard corals: L x W cm	%SD (mm thickness)	%B	%PM	Associated Substrate Type
1	T2	1	Faviidae	<i>Oulastrea crispata</i>	88.0	8 x 4	0	0	0	Rubble (< 50cm)
2	T2	2	Faviidae	<i>Oulastrea crispata</i>	88.0	5 x 3	0	0	0	Boulder (> 50cm)
3	T2	3	Faviidae	<i>Oulastrea crispata</i>	75.8	15 x 8	0	0	0	Boulder (> 50cm)
4	T2	4	Faviidae	<i>Oulastrea crispata</i>	75.4	8 x 4	5 (2)	0	0	Boulder (> 50cm)
5	T2	5	Faviidae	<i>Oulastrea crispata</i>	74.2	4 x 4	5 (2)	0	0	Boulder (> 50cm)
6	T2	6	Faviidae	<i>Oulastrea crispata</i>	73.0	15 x 4	0	0	0	Boulder (> 50cm)
7	T2	7	Faviidae	<i>Oulastrea crispata</i>	64.4	5 x 3	0	0	0	Boulder (> 50cm)
8	T2	8	Faviidae	<i>Oulastrea crispata</i>	64.2	8 x 4	0	0	0	Boulder (> 50cm)
9	T2	9	Faviidae	<i>Oulastrea crispata</i>	64.2	8 x 4	5(2)	0	0	Boulder (> 50cm)
10	T2	10	Faviidae	<i>Oulastrea crispata</i>	62.2	5 x 4	5 (2)	0	0	Boulder (> 50cm)
11	T2	11	Faviidae	<i>Oulastrea crispata</i>	58.4	3 x 3	0	0	0	Boulder (> 50cm)
12	T2	12	Faviidae	<i>Oulastrea crispata</i>	58.5	7 x 4	0	0	0	Rubble (< 50cm)
13	T2	13	Faviidae	<i>Oulastrea crispata</i>	57.0	5 x 3	0	0	0	Rubble (< 50cm)
14	T3	1	Faviidae	<i>Oulastrea crispata</i>	55.0	5 x 2	0	0	0	Boulder (> 50cm)
15	T3	2	Faviidae	<i>Oulastrea crispata</i>	44.5	10 x 8	0	0	0	Rubble (< 50cm)
16	T3	3	Faviidae	<i>Oulastrea crispata</i>	43.0	5 x 3	0	0	0	Boulder (> 50cm)
17	T3	4	Faviidae	<i>Oulastrea crispata</i>	41.8	5 x 3	0	0	0	Boulder (> 50cm)
18	T3	5	Faviidae	<i>Oulastrea crispata</i>	30.8	3 x 3	0	0	0	Boulder (> 50cm)
19	T3	6	Faviidae	<i>Oulastrea crispata</i>	27.2	4 x 4	0	0	0	Boulder (> 50cm)
20	T3	7	Faviidae	<i>Oulastrea crispata</i>	15.8	5 x 4	0	0	0	Boulder (> 50cm)
21	T3	8	Faviidae	<i>Oulastrea crispata</i>	14.8	8 x 3	5 (2)	0	0	Boulder (> 50cm)
22	T3	9	Faviidae	<i>Oulastrea crispata</i>	13.8	4 x 4	5 (2)	0	0	Boulder (> 50cm)
23	T3	10	Faviidae	<i>Oulastrea crispata</i>	12.0	5 x 4	0	0	0	Boulder (> 50cm)
24	T3	11	Faviidae	<i>Oulastrea crispata</i>	4.4	2 x 3	0	0	0	Rubble (< 50cm)
25	T3	12	Faviidae	<i>Oulastrea crispata</i>	4.0	4 x 4	0	0	0	Rubble (< 50cm)
26	Site C	1	Faviidae	<i>Oulastrea crispata</i>	88.8	8 x 4	0	0	0	Boulder (> 50cm)
27	Site C	2	Faviidae	<i>Oulastrea crispata</i>	84.7	2 x 2	5 (2)	0	0	Boulder (> 50cm)
28	Site C	3	Faviidae	<i>Oulastrea crispata</i>	83.2	3 x 3	5 (2)	0	0	Boulder (> 50cm)
29	Site C	4	Faviidae	<i>Oulastrea crispata</i>	83.2	1 x 1	5 (2)	0	0	Boulder (> 50cm)
30	Site C	5	Faviidae	<i>Oulastrea crispata</i>	83.2	6 x 4	0	0	0	Boulder (> 50cm)

31	Site C	6	Faviidae	<i>Oulastrea crispata</i>	83.2	5 x 4	0	0	0	Boulder (> 50cm)
32	Site C	7	Faviidae	<i>Oulastrea crispata</i>	82.6	2 x 2	0	0	0	Boulder (> 50cm)
33	Site C	8	Faviidae	<i>Oulastrea crispata</i>	82.6	2 x 2	0	0	0	Boulder (> 50cm)
34	Site C	9	Faviidae	<i>Oulastrea crispata</i>	82.0	4 x 3	5 (2)	0	0	Boulder (> 50cm)
35	Site C	10	Faviidae	<i>Oulastrea crispata</i>	80.5	5 x 4	5 (2)	0	0	Boulder (> 50cm)
36	Site C	11	Faviidae	<i>Oulastrea crispata</i>	75.0	5 x 2	5 (2)	0	0	Boulder (> 50cm)
37	Site C	12	Faviidae	<i>Oulastrea crispata</i>	74.2	5 x 4	10 (2)	0	0	Boulder (> 50cm)
38	Site C	13	Faviidae	<i>Oulastrea crispata</i>	68.2	3 x 3	0	0	0	Boulder (> 50cm)
39	Site C	14	Faviidae	<i>Oulastrea crispata</i>	67.0	3 x 3	10 (2)	0	0	Boulder (> 50cm)
40	Site C	15	Faviidae	<i>Oulastrea crispata</i>	65.2	3 x 4	5 (2)	0	0	Boulder (> 50cm)
41	Site C	16	Faviidae	<i>Oulastrea crispata</i>	64.6	6 x 2	10 (2)	0	0	Boulder (> 50cm)
42	Site C	17	Faviidae	<i>Oulastrea crispata</i>	62.0	5 x 4	5 (2)	0	0	Boulder (> 50cm)
43	Site C	18	Faviidae	<i>Oulastrea crispata</i>	60.4	4 x 3	5 (2)	0	0	Boulder (> 50cm)
44	Site C	19	Faviidae	<i>Oulastrea crispata</i>	58.3	6 x 4	5 (2)	0	0	Rubble (< 50cm)
45	Site C	20	Faviidae	<i>Oulastrea crispata</i>	51.3	15 x 7	5 (2)	0	0	Boulder (> 50cm)

### **Post Project Monitoring Survey**

- 3.18 The Post-project Monitoring Survey, representing the 14<sup>th</sup> coral monitoring survey, at Impact Sites T2, T3 and Reference Site C, was conducted on 08 June 2014.
- 3.19 The locations of the survey sites are shown in Figure 1, and survey conditions in **Table 3.1**. The code, species name, area, percentage of sedimentation level, bleaching and mortality of the tagged coral colonies at each site are summarized in **Tables 3.4a to c**. Photographs of the colonies, taken on 08 June 2014, are shown in **Appendix II**. The survey team had tried to take photographs of the corals from an angle and distance that best represented the colonies but difficulties sometimes occurred as a result of low water visibility during the surveys.

### **Summary of Coral Monitoring Survey on 8 June 2014**

#### **Site C (Reference site)**

- 3.20 Sedimentation cover on the coral colonies ranged from 0 to 10%, with thickness ~2mm. When compared with baseline data in August 2013, increased sedimentation cover was recorded on six colonies (C2, C4, C6, C7, C8 and C9) by 5 to 10%. No cover of bleaching or mortality was recorded (Table 3.4a).

#### **Site T2**

- 3.21 Sedimentation cover on the coral colonies ranged from 0 to 5%, with thickness ~2mm. When compared with baseline data in August 2013, increased sedimentation cover was recorded on 2 colonies (A3 and A8) by 5%. No cover of bleaching or mortality was recorded (Table 3.4b).

#### **Site T3**

- 3.22 Sedimentation cover ranged from 0 to 5%, with thickness ~2mm. When compared with baseline data in August 2013, increased sedimentation cover was recorded 1 colony (B9) by 5%. No cover of bleaching or mortality was recorded (Table 3.4c).
- 3.23 All coral tags from all sites were removed after the post-project monitoring survey (Appendix I).

**Table 3.4a. Site C (Reference site) – Percentage of Sedimentation, Bleaching and Mortality of the Tagged Coral Colonies in the Baseline Coral Monitoring Survey (10 Aug 2103), 12<sup>th</sup> (26 April 2014), 13<sup>th</sup> (17 May 2014) and 14<sup>th</sup> (08 Jun 2014), Monitoring Surveys. “▲” and “▼” indicate increased and decreased in percentage, respectively, when compared with the baseline data.**

Code	Coral Species	Size (length x width, cm)	Sedimentation, % (thickness, mm)				Bleaching, %				Mortality, %			
			Baseline (10Aug)	12 <sup>th</sup> (26Apr)	13 <sup>th</sup> (17May)	14 <sup>th</sup> (08Jun)	Baseline (10Aug)	12 <sup>th</sup> (26Apr)	13 <sup>th</sup> (17May)	14 <sup>th</sup> (08Jun)	Baseline (10Aug)	12 <sup>th</sup> (26Apr)	13 <sup>th</sup> (17May)	14 <sup>th</sup> (08Jun)
C1	<i>Oulastrea crispata</i>	5 x 2	5 (2)	5 (2)	5(2)	5 (2)	0	0	0	0	0	0	0	0
C2	<i>Oulastrea crispata</i>	5 x 4	0	10 (2) ▲	10 (2) ▲	10 (2) ▲	0	0	0	0	0	0	0	0
C3	<i>Oulastrea crispata</i>	3 x 3	0	0	0	0	0	0	0	0	0	0	0	0
C4	<i>Oulastrea crispata</i>	3 x 3	0	10 (2) ▲	10 (2) ▲	10 (2) ▲	0	0	0	0	0	0	0	0
C5	<i>Oulastrea crispata</i>	3 x 4	5 (2)	5 (2)	10(2) ▲	5 (2)	0	0	0	0	0	0	0	0
C6	<i>Oulastrea crispata</i>	6 x 2	0	10 (2) ▲	5 (2) ▲	10 (2) ▲	0	0	0	0	0	0	0	0
C7	<i>Oulastrea crispata</i>	5 x 4	0	5 (2) ▲	5 (2) ▲	5 (2) ▲	0	0	0	0	0	0	0	0
C8	<i>Oulastrea crispata</i>	4 x 3	0	5 (2) ▲	5 (2) ▲	5 (2) ▲	0	0	0	0	0	0	0	0
C9	<i>Oulastrea crispata</i>	6 x 4	0	10 (2) ▲	5 (2) ▲	5 (2) ▲	0	0	0	0	0	0	0	0
C10	<i>Oulastrea crispata</i>	15 x 7	5 (2)	10 (2) ▲	10 (2) ▲	5 (2)	0	0	0	0	0	0	0	0

**Table 3.4b. Site T2 - Percentage of Sedimentation, Bleaching and Mortality of the Tagged Coral Colonies in the Baseline Coral Monitoring Survey (10 Aug 2103), 12<sup>th</sup> (26 April 2014), 13<sup>th</sup> (17 May 2014) and 14<sup>th</sup> (08 Jun 2014), Monitoring Surveys. “▲” and “▼” indicate increased and decreased in percentage, respectively, when compared with the baseline data.**

Code	Coral Species	Size (length x width, cm)	Sedimentation, % (thickness, mm)				Bleaching, %				Mortality, %			
			Baseline (10Aug)	12 <sup>th</sup> (26Apr)	13 <sup>th</sup> (17May)	14 <sup>th</sup> (08Jun)	Baseline (10Aug)	12 <sup>th</sup> (26Apr)	13 <sup>th</sup> (17May)	14 <sup>th</sup> (08Jun)	Baseline (10Aug)	12 <sup>th</sup> (26Apr)	13 <sup>th</sup> (17May)	14 <sup>th</sup> (08Jun)
A1	<i>Oulastrea crispata</i>	15 x 8	0	0	0	0	0	0	0	0	0	0	0	
A2	<i>Oulastrea crispata</i>	8 x 4	5 (2)	5 (2)	5 (2)	5 (2)	0	0	0	0	0	0	0	
A3	<i>Oulastrea crispata</i>	4 x 4	0	0	5 (2) ▲	5 (2) ▲	0	0	0	0	0	0	0	
A4	<i>Oulastrea crispata</i>	15 x 4	0	0	0	0	0	0	0	0	0	0	0	
A5	<i>Oulastrea crispata</i>	5 x 3	0	0	0	0	0	0	0	0	0	0	0	
A6	<i>Oulastrea crispata</i>	8 x 4	0	0	0	0	0	0	0	0	0	0	0	
A7	<i>Oulastrea crispata</i>	8 x 4	5 (2)	5 (2)	5(2)	5(2)	0	0	0	0	0	0	0	
A8	<i>Oulastrea crispata</i>	5 x 4	0	5 (2) ▲	5 (2) ▲	5 (2) ▲	0	0	0	0	0	0	0	
A9	<i>Oulastrea crispata</i>	3 x 3	0	0	0	0	0	0	0	0	0	0	0	
A10	<i>Oulastrea crispata</i>	7 x 4	0	5 (2) ▲	0	0	0	0	0	0	0	0	0	



**Table 3.4c. Site T3 – Percentage of Sedimentation, Bleaching and Mortality of the Tagged Coral Colonies in the Baseline Coral Monitoring Survey (10 Aug 2103), 12<sup>th</sup> (26 April 2014), 13<sup>th</sup> (17 May 2014) and 14<sup>th</sup> (08 Jun 2014), Monitoring Surveys. “▲” and “▼” indicate increased and decreased in percentage, respectively, when compared with the baseline data.**

Code	Coral Species	Size (length x width, cm)	Sedimentation, % (thickness, mm)				Bleaching, %				Mortality, %			
			Baseline (10Aug)	12 <sup>th</sup> (26Apr)	13 <sup>th</sup> (17May)	14 <sup>th</sup> (08Jun)	Baseline (10Aug)	12 <sup>th</sup> (26Apr)	13 <sup>th</sup> (17May)	14 <sup>th</sup> (08Jun)	Baseline (10Aug)	12 <sup>th</sup> (26Apr)	13 <sup>th</sup> (17May)	14 <sup>th</sup> (08Jun)
B1	<i>Oulastrea crispata</i>	5 x 2	0	0	0	0	0	0	0	0	0	0	0	
B2	<i>Oulastrea crispata</i>	10 x 8	0	0	5 (2) ▲	0	0	0	0	0	0	0	0	
B3	<i>Oulastrea crispata</i>	5 x 3	0	0	5 (2) ▲	0	0	0	0	0	0	0	0	
B4	<i>Oulastrea crispata</i>	5 x 3	0	0	5 (2) ▲	0	0	0	0	0	0	0	0	
B5	<i>Oulastrea crispata</i>	3 x 3	0	0	0	0	0	0	0	0	0	0	0	
B6	<i>Oulastrea crispata</i>	4 x 4	0	0	0	0	0	0	0	0	0	0	0	
B7	<i>Oulastrea crispata</i>	5 x 4	0	0	0	0	0	0	0	0	0	0	0	
B8	<i>Oulastrea crispata</i>	8 x 3	5 (2)	5 (2)	5 (2)	5 (2)	0	0	0	0	0	0	0	
B9	<i>Oulastrea crispata</i>	4 x 4	0	5 (2) ▲	0	5 (2) ▲	0	0	0	0	0	0	0	
B10	<i>Oulastrea crispata</i>	5 x 4	0	0	0	0	0	0	0	0	0	0	0	

#### 4 SUMMARY OF POST PROJECT CORAL SURVEY

- 4.1 Dive surveys conducted at two impact monitoring sites (T2 and T3) and one reference site (Site C) showed that the abundance of hard corals were very low in the Study Area. Most hard substrates were covered by sediments and dominated by suspension feeding, sessile organisms such as rock oysters.
- 4.2 Hard coral colonies were observed at all dive sites, no octocoral (soft coral or gorgonian) was recorded. A total of 25 hard coral colonies was found at the Sites T2 and T3 in Yam Tin Tsai and 20 hard coral colonies at Site C in Whitehead Peninsula. All these coral colonies were generally in good and healthy condition, with low levels of sedimentation and showed no bleaching and partial mortality.
- 4.3 The percentage cover and the species diversity of coral community in the Study Area were very low, colonies were relatively small in size, with encrusting growth form, and patchily distributed. Only one hard coral species *Oulastrea crispata* (Faviidae) was observed in the Study Area (Table 3.3).
- 4.4 No other sessile taxon of high conservation interest was recorded in the Study Area.
- 4.5 All these findings were similar to the baseline coral survey conduct in August 2013, no potential adverse impact by the construction activity on the coral community was observed.

##### Post Project Monitoring Survey

- 4.6 In the monitoring survey conducted on 08 June 2014, at Impact Sites T2 and T3 and the reference Site C, the change in level of sedimentation on the tagged colonies was less than 15% when compared with the baseline data in Aug 2013. As the sedimentation occurred at all sites including the reference Site C, the small change in sedimentation was likely a natural fluctuation as a result of tidal current, wave, northeast monsoon, disturbance by waves during low tide period, etc. No significant increment in level of bleaching or partial mortality suggested that adverse effect, if any, was minor.
- 4.7 The data from this monitoring survey showed no significant increase in sedimentation, bleaching or mortality in both Sites T2 and T3 and the reference Site C. Hence, no adverse impact by the construction activity on the coral community was demonstrated.

## **5 ASSESSMENT OF HEALTH CONDITIONS OF CORALS IN THE ENTIRE MONITORING PROGRAMME**

- 5.1 Overall, a total of thirteen (13) coral impact monitoring surveys was conducted during the construction works since October 2013, and one (1) post-project monitoring survey was conducted after the construction work in June 2014. All tagged corals were in good condition and no adverse impact was observed during the construction phase.
- 5.2 In all the monitoring surveys conducted from October 2013 to June 2014, at Impact Sites T2 and T3 and the Reference Site C, the change in level of sedimentation on the tagged colonies was less than 15% when compared with the baseline data in August 2013. As the sedimentation occurred at all sites including the Reference Site C, the small change in sedimentation was likely a natural fluctuation as a result of tidal current, prevailing monsoons, disturbance by waves during low tide period, heavy rainfall and associated stream runoffs, etc. No significant increment in level of bleaching or partial mortality suggested that adverse effect, if any, was minor.
- 5.3 The data from all these monitoring surveys showed no significant increase in sedimentation, bleaching or mortality in both Sites T2 and T3 and the Reference Site C. Hence, no adverse impact by the construction activity on the coral community was observed.

## **6 ASSESSMENT ON THE EFFECTIVENESS OF THE MITIGATION MEASURES IMPLEMENTED**

- 6.1 According to the EIA Study Report, Environmental Permit and the Project Profile of the Project, the mitigation measures for water quality and ecological impact detailed in the documents were implemented during the construction phase. A summary of the mitigation measures is provided in **Appendix A**.
- 6.2 The result of coral monitoring programme shows no adverse impact by the construction activity on the coral community. Hence, the mitigation measures implemented were effective in reducing adverse impact on the coral colonies.

## 7 REFERENCES

- Chan ALK, Choi CLS, McCorry D, Chan KK, Lee MW, Put Jr. A (2005) Field Guide to Hard Corals of Hong Kong. Agriculture, Fisheries and Conservation Department, HKSAR.
- DeVantier L. M., De'Ath G., Done T. J., Turak E. (1998) Ecological Assessment of a complex natural system: A case study from the Great Barrier Reef, Ecological Applications 8, pp.480-496.
- Veron J. (2000) Corals of the world. AIMS. Townsville.

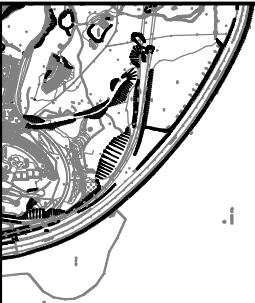
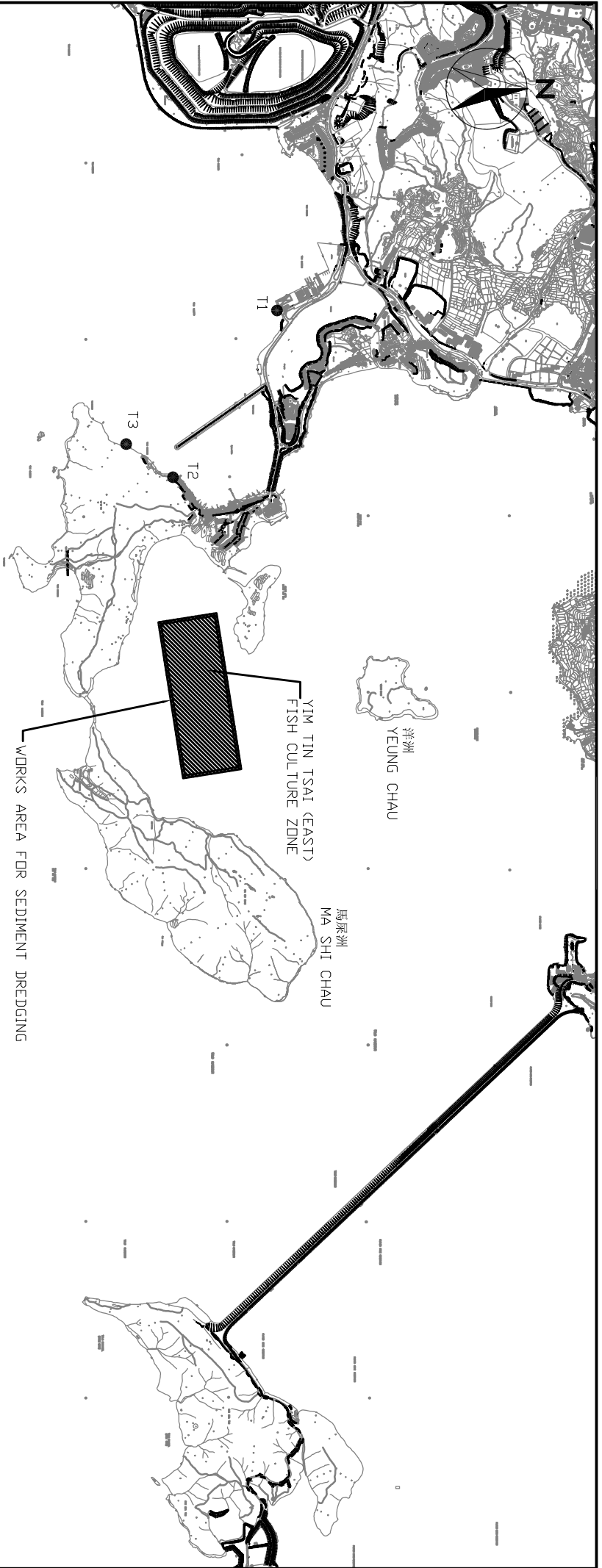
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**FIGURE**

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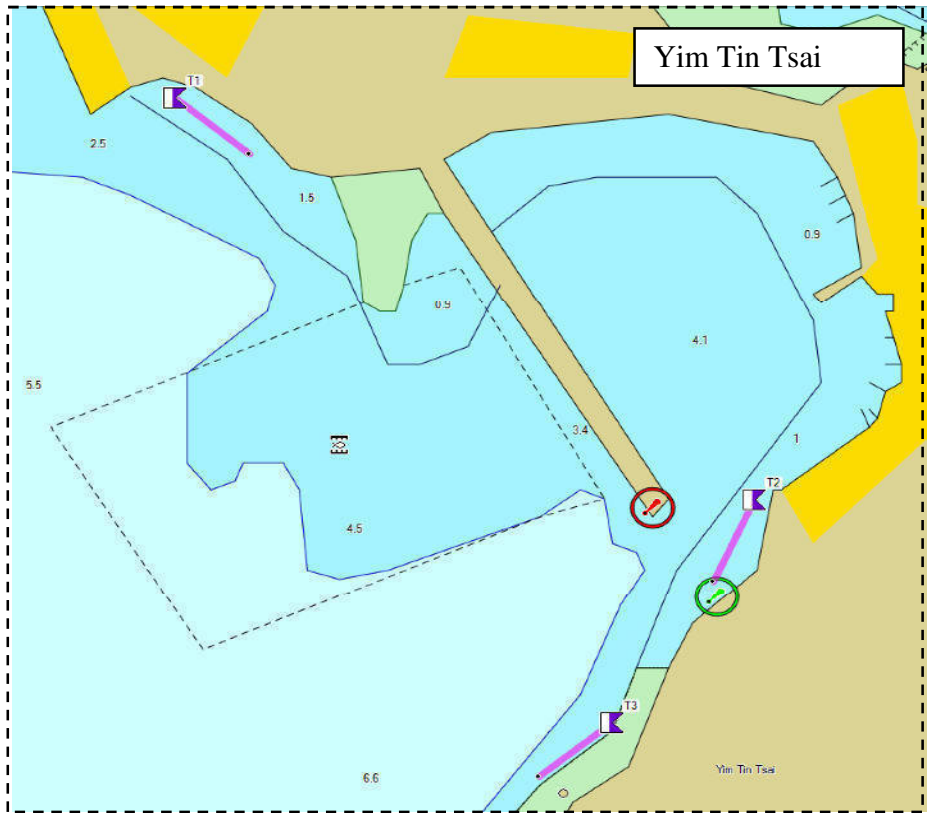
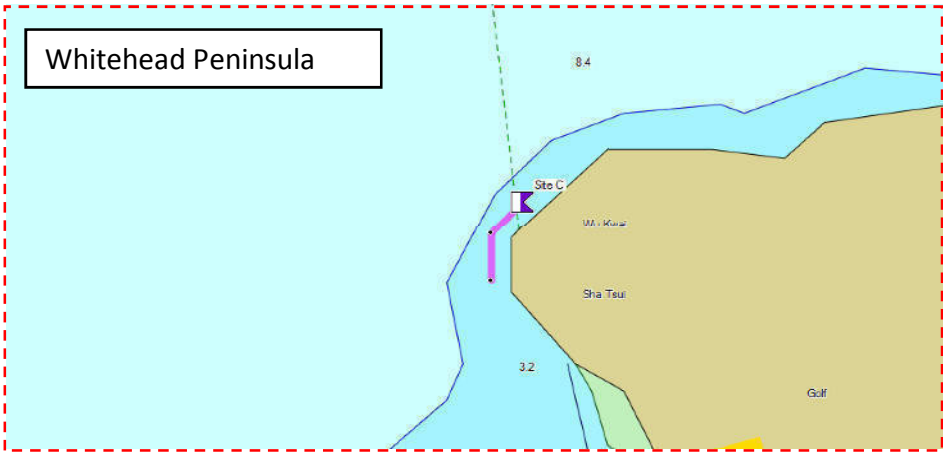
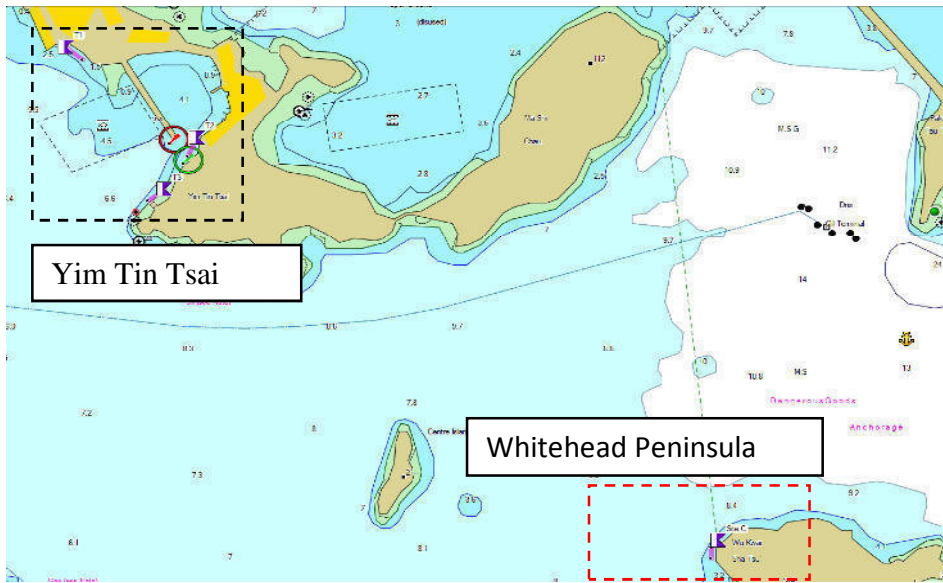
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LEGEND	
	FISH CULTURE ZONE
	IMPACT MONITORING STATION
	CONTROL STATION

SEDIMENT REMOVAL AT YIM TIN TSAI (EAST) FISH CULTURE ZONE  
LOCATION OF CORAL MONITORING STATIONS

SCALE	1:600	DATE	JUN 2013
CHECK	GL	DRAWN	JW
JDB No.	MA13027	FIGURE NO.	1
		REV	-



Legend:

-  Dive flags indicate starting points of 100m REA transects
-  Purple lines indicate the 100m transect direction
-   Entry / exit of the Typhoon Shelter

Title Contract No. CV/2012/01  
 Sediment Removal at Yim Tin Tsai (East) Fish Culture Zone  
 Baseline Coral Survey  
 Map showing Locations of Sites for Dive Survey at Yim Tin Tsai and Whitehead Peninsula

Scale	N.T.S	Propose No.	MA13027
Date	Aug-13	Figure	2





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**APPENDIX A  
ENVIRONMENTAL MITIGATION  
MEASURES IMPLEMENTED**

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**Appendix A – Environmental Mitigation Measures Implemented**

Project Stage / Location	Potential Environmental Impact	Mitigation Measure	Implementation Agent
Construction / Construction Site	Water quality impact	(1) Closed grab was used for dredging to minimize release of fines and contaminants. (2) The maximum production rates as indicated in the approved Project Profile were adopted for the proposed dredging activities. (3) Silt curtains were deployed around the dredging operation. (4) Good site practices were adopted during dredging and during transportation and disposal of dredged sediments. (5) Discharge of sewage effluent into drainage and water environment was not allowed. Appropriate numbers of portable chemical toilets were provided by a licensed contractor as necessary to serve the construction workers. (6) Collection and removal of floating refuse was performed at regular intervals on a daily basis at or near the dredging sites. (7) Water quality monitoring was undertaken before, during and after the dredging work.	Contractor
Construction / Construction Site	Ecological impact	(1) Mitigation measures to control water quality, i.e. constriction of dredging rate, use of closed grab for dredging and deployment of silt curtains, proposed in the water quality impact assessment was adopted. (2) Standard good site practice and management proposed in the water quality impact assessment, such as tight fitting seals to bottom openings of barges/dredgers, effective site drainage, and provision of chemical toilets were adopted. (3) Good site practices on noise control proposed in the noise impact assessment was adopted. (4) The health status of the nearby coral colonies were regularly monitored during the construction phase.	Contractor

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**APPENDIX I  
PHOTOS OF THE DIVE SURVEY SITES  
AT YIM TIN TSAI AND WHITEHEAD  
PENINSULA**

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Appendix I Photos of the Dive Survey Sites



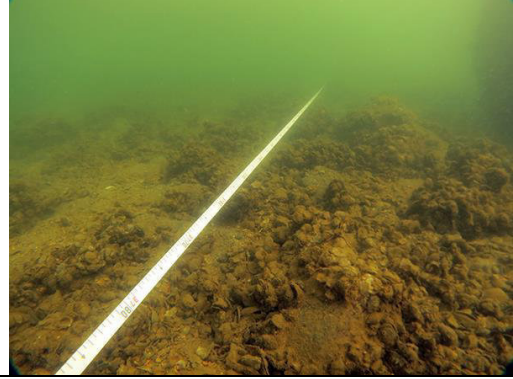
T2 – Natural Rocky Shore



T2 – Boulders, rubbles and sand



T3 – Natural Rocky Shore



T3 – Boulders, rubbles and sand



Site C – Natural Rocky Shore



Site C – Boulders, rubbles and sand



All sites – Sandy bottom at deeper water (> 1.5 – 2.0m depth)



All sites – Hard substrates were heavily covered by sediments



Appendix I Continued.



All sites – Sea anemones



All sites - Tunicates (*Styela plicata*)



All sites – Rock oysters (*Saccostrea cucullata*)



Common hard coral - *Oulastrea crispata*



All sites – Coral tags were removed after post-project monitoring



All sites – Coral tags were removed after post-project monitoring



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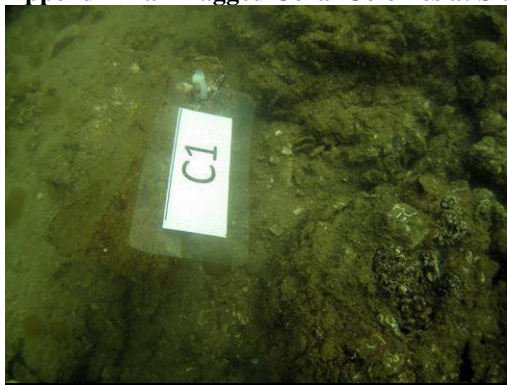
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**APPENDIX IIa**  
**TAGGED CORAL COLONIES AT SITE C**

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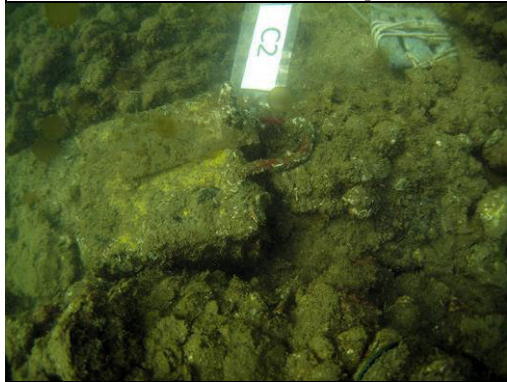
Appendix IIa Tagged Coral Colonies at Site C.



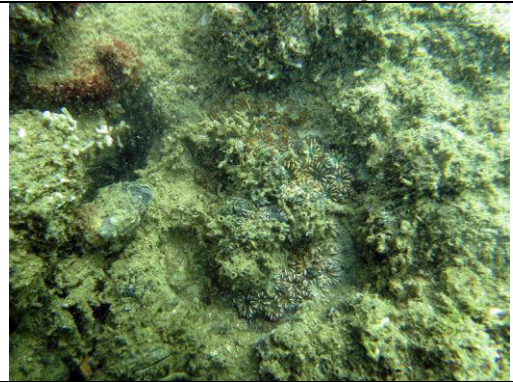
C01- *Oulastrea crispata*



C01- *Oulastrea crispata*



C02- *Oulastrea crispata*



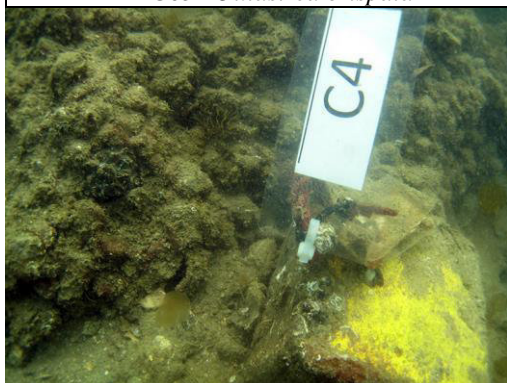
C02- *Oulastrea crispata*



C03- *Oulastrea crispata*



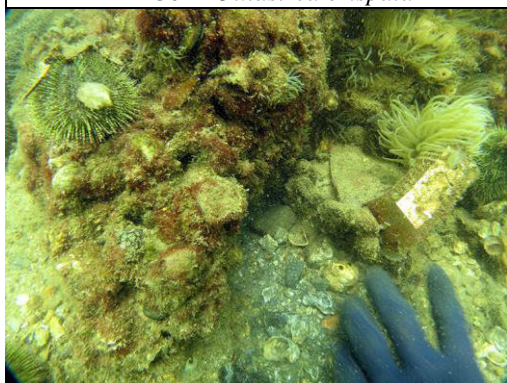
C03- *Oulastrea crispata*



C04- *Oulastrea crispata*



C04- *Oulastrea crispata*



C05- *Oulastrea crispata*



C05- *Oulastrea crispata*

Appendix IIa Continued.



C06- *Oulastrea crispata*



C06- *Oulastrea crispata*



C07- *Oulastrea crispata*



C07- *Oulastrea crispata*



C08- *Oulastrea crispata*



C08- *Oulastrea crispata*



C09- *Oulastrea crispata*



C09- *Oulastrea crispata*



C10- *Oulastrea crispata*



C10- *Oulastrea crispata*



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**APPENDIX IIb  
TAGGED CORAL COLONIES AT SITE  
T2**

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Appendix IIb Tagged Coral Colonies at Site T2.



A01- *Oulastrea crispata*



A01- *Oulastrea crispata*



A02- *Oulastrea crispata*



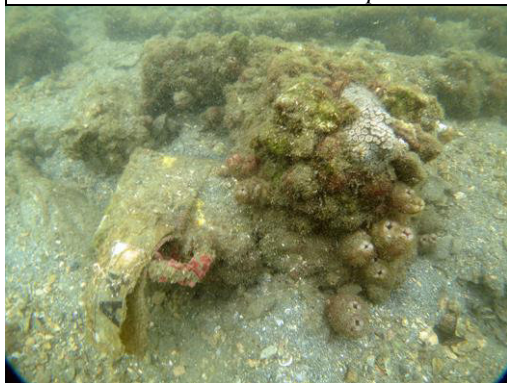
A02- *Oulastrea crispata*



A03- *Oulastrea crispata*



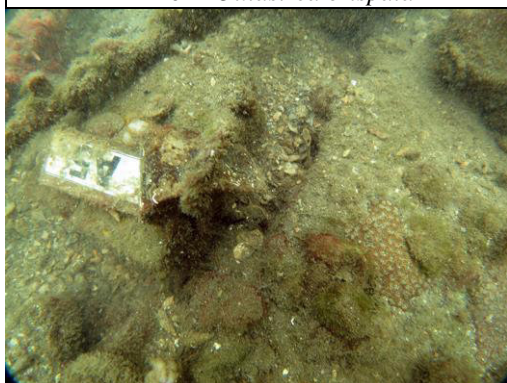
A03- *Oulastrea crispata*



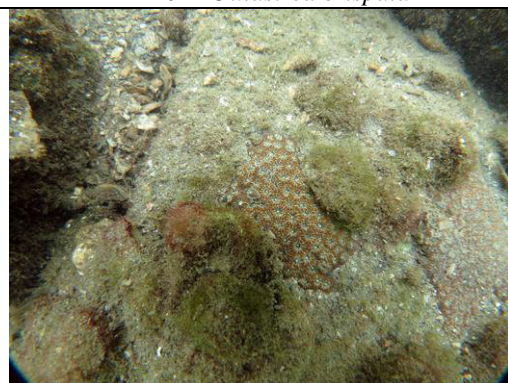
A04- *Oulastrea crispata*



A04- *Oulastrea crispata*



A05- *Oulastrea crispata*



A05- *Oulastrea crispata*

Appendix IIb Continued.



A06- *Oulastrea crispata*



A06- *Oulastrea crispata*



A07- *Oulastrea crispata*



A07- *Oulastrea crispata*



A08- *Oulastrea crispata*



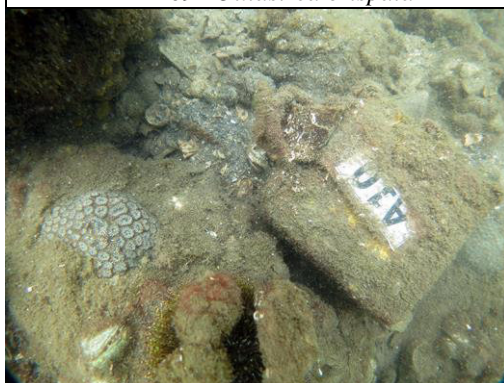
A08- *Oulastrea crispata*



A09- *Oulastrea crispata*



A09- *Oulastrea crispata*



A10- *Oulastrea crispata*



A10- *Oulastrea crispata*

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**APPENDIX IIc  
TAGGED CORAL COLONIES AT SITE  
T3**

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Appendix IIc Tagged Coral Colonies at Site T3.



B01– *Oulastrea crispata*



B01– *Oulastrea crispata*



B02– *Oulastrea crispata*



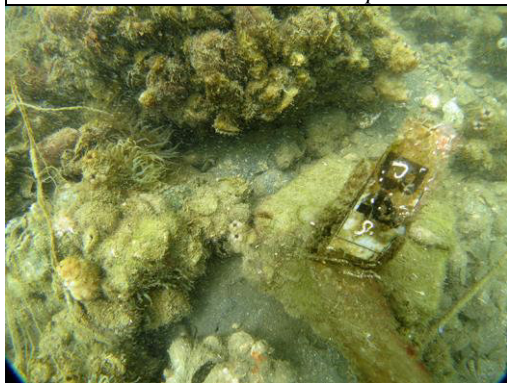
B02– *Oulastrea crispata*



B03– *Oulastrea crispata*



B03– *Oulastrea crispata*



B04– *Oulastrea crispata*



B04– *Oulastrea crispata*



B05– *Oulastrea crispata*



B05– *Oulastrea crispata*

Appendix IIc Continued.



B06– *Oulastrea crispata*



B06– *Oulastrea crispata*



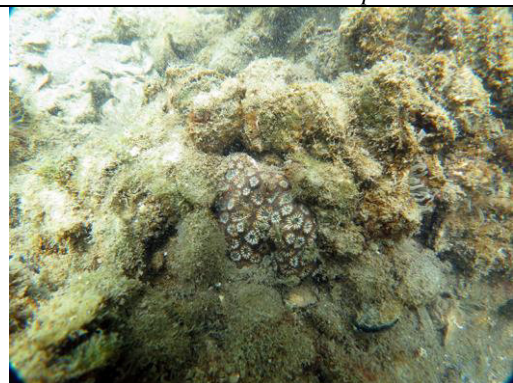
B07– *Oulastrea crispata*



B07– *Oulastrea crispata*



B08– *Oulastrea crispata*



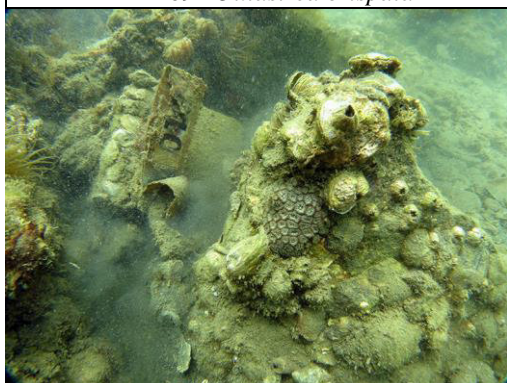
B08 *Oulastrea crispata*



B09– *Oulastrea crispata*



B09– *Oulastrea crispata*



B10– *Oulastrea crispata*



B10– *Oulastrea crispata*