

Agreement No. CE 18/2002 (EP)
Construction of Helipads at Peng Chau and Lamma Island



Final Coral Survey

**Report for
Ecological Assessment and Tagged Coral Survey
at Yung Shue Wan and Shum Wan, Lamma Island**

August 2008



miniprojects co. Ltd.

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1 INTRODUCTION

1.1 Project Background

- 1.1.1 Cinotech Consultants Limited has been appointed to formulate a Coral Survey Team to conduct the Marine Ecology Survey for Construction of Helipads at Yung Shue Wan, Lamma Island, Agreement No. CE 18/2002 (EP).
- 1.1.2 miniprojects Company Limited (miniprojects co. Ltd.) have been commissioned by Cinotech Consultants Limited to undertake, 1) Ecological Assessment, and 2) Tagged Coral Monitoring at both the Impact Monitoring Site (IMS) at Yung Shue Wan and Control Monitoring Site (CMS) at Shum Wan, Lamma Island.
- 1.1.3 An Initial Coral Survey has been conducted in July 2007 before the commencement of the construction to record the abundance, diversity and health status of the corals in the IMS and CMS using Rapid Ecological Assessment (REA). At each site, 10 coral colonies were marked and regularly monitored during the construction phase to minimize the potential adverse impact to the coral community.
- 1.1.4 Upon completion of all the construction work, a Final Coral Survey at the IMS and CMS was conducted to assess the health condition of the coral community, and evaluate if there is any adverse impact on the standing corals.
- 1.1.5 This report presents the findings of the Final Coral Survey, including
- Ecological assessment of the coral community at the IMS and CMS
 - Tagged coral monitoring at the IMS and CMS
 - Evaluation of any adverse impact caused by the construction

2 METHODOLOGY

The coral survey was divided into 2 parts:

- Ecological assessment of the coral community at the IMS and CMS
- Tagged coral monitoring at the IMS and CMS

2.1 Ecological Assessment of the Coral Community at the IMS and CMS in August 2008

Rapid Ecological Assessment (REA)

- 2.1.1 Assessment of coral community using the semi-quantitative REA method was conducted at the Impact Monitoring Site (IMS) and Control Monitoring Site (CMS) (Fig. 2.1) using the sample method as the Initial Coral Survey in July 2007.
- 2.1.2 Rapid Ecological Assessment methods have been adopted in many regions to examine baseline information on coral reefs, such as the Great Barrier Reef (DeVantier et al. 1998). The methods can be applied to a wide range of coral reef and community types and were also used in a coral community study in Hong Kong with some modification (OCL 2003).
- 2.1.3 For each site selected for REA study, three 50 m-long transect tape (T1 to T3) was laid (Fig. 2.1a and b). Each transect was positioned within a single ecological zone/habitat at an approximately constant depth range. Survey was performed along the transect tape. On each transect, a belt area of 100 m² (2 m wide × 50 m long) was surveyed.
- 2.1.4 Two types of information were recorded:
- a. cover of the major benthic groups;
 - b. inventory of sessile benthic taxa.

These were performed according to Tier I and Tier II levels of information.

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

To describe the benthic cover, six ecological and seven substratum attributes (Table 2.1a) were assigned. Each attribute was given a rank, from 0 to 6 (Table 2.1b) based on the overall cover along the survey area.

- 2.1.6 Tier II: Taxonomic inventories to define types of benthic communities.

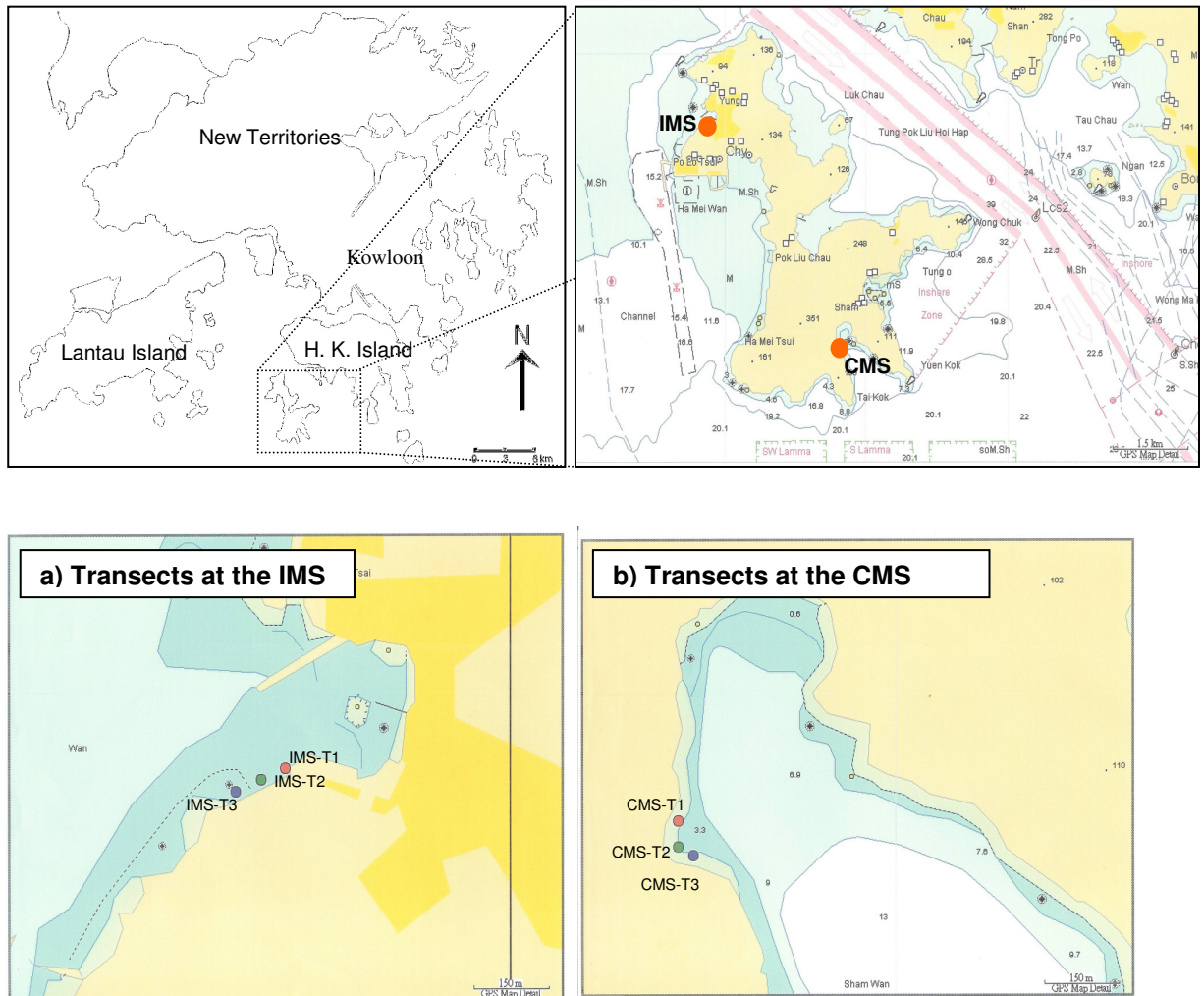
An inventory of benthic taxa was compiled during each swim. Taxa were identified either *in situ* or with the aid of photographs to confirm identification afterward.

- a. Hard corals (Order Scleractinia) – to genus and species level whenever possible.
 - b. Soft corals (Subclass Octocorallia) – genus level
 - c. Other benthos (such as sponges zoanthids, bryozoans, macroalgae etc) – high taxonomic level (usually phylum plus growth form)
- 2.1.7 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 2.1c). These broad categories rank taxa in terms of the relative abundance of individuals, rather than the contribution to benthic cover, at each site.
- 2.1.8 Along each transect, each coral colony was recorded for its taxonomic identity, colony size, health status in terms of percentage covers of sediment, bleaching and partial mortality.
- 2.1.9 The ecological attributes, taxonomic inventory and health status of coral colonies were compared against baseline data collected in the Initial Coral Survey.

Table 2.1 Categories of a) benthic attributes, b) ordinal ranks of percentage cover and c) ordinal ranks of taxon abundance.

a) Attributes		b) Cover		c) Taxon Abundance	
Ecological	Substratum	Rank	Percentage	Rank	Abundance
Hard coral	Bedrock	0	Not recorded	0	Absent
Dead standing coral	Boulders (diam. >50cm)	1	1-5%	1	Rare
Soft coral	Rubble (diam. <50cm)	2	6-10%	2	uncommon
Encrusting algae	Sand & Shell debris	3	11-30%	3	Common
Coralline algae	Mud & Silt	4	31-50%	4	Abundant
Macro-algae		5	51-75%	5	Dominant
Sea anemone		6	76-100%		

Fig. 2.1 Map Showing the Locations of the Impact Monitoring Site (IMS) and Control Monitoring Site (CMS). The Positions of the Transects (Only Starting Points are Shown) for Ecological Assessment at the IMS (a) and CMS (b).



2.2 Tagged Coral Monitoring at the IMS and CMS in August 2008

- 2.2.1 At both IMS and CMS, the 10 hard coral colonies, tagged for impact monitoring over the course construction phase, were monitored after the completion of the construction works.
- 2.2.2 Dive surveys were conducted to record the health status (degree of sedimentation, bleaching and mortality) of the tagged corals, in terms of percentage covers of sediment, bleaching and mortality, respectively.
- 2.2.3 The condition of each tagged coral colony was recorded by taking photographs that best represents the entire colony. General physical parameters were recorded for each survey site, including visibility, weather, tidal conditions and water current.

2.3 Coral Monitoring Frequency

2.3.1 Monitoring on the tagged corals for degree of sedimentation, bleaching and mortality shall be conducted at the frequencies indicated below during works affecting the seabed.

- During the first two weeks of works affecting seabed: twice a week.
- If no exceedance detected for the first 2 weeks of monitoring: once a week for the following 2 weeks.
- If no exceedance detected for the first 4 weeks of monitoring: once every two weeks for the 2nd and 3rd months (i.e. October and November 2007, respectively).
- If no exceedance in the 3rd month of monitoring, coral monitoring shall be conducted once per month (i.e. since December 2007) until completion of the construction works.

2.4 Actions on Exceedance of Action and Limit Levels

2.4.1 Where the coral survey indicates the health conditions of the corals exceed the action and limit levels, the Engineer may direct more frequent monitoring to be carried out until exceedance stops. The action and limit level of coral monitoring is shown in Table 2.2.

2.4.2 The Contractor shall take all necessary steps to ensure that the actions of the Contractor are not contributing to the deterioration. These steps shall include, but not be limited to the following:

- Checking of water quality monitoring data;
- Checking of all marine plant and equipment; maintenance or replacement of any marine plant or equipment contributing to the deterioration;
- Checking and maintenance of silt curtains;
- Review of all working methods; and
- Reduced construction rate.

2.4.3 Upon action level being exceeded and after agreement from the Environmental Specialist and AFCD has been obtained regarding the most appropriate method for reducing the adverse impacts during works affecting the seabed, this mitigated method should then be enacted on the next working day.

2.4.4 Upon limit level being exceeded, the Contractor shall suspend all works affecting the seabed until an effective solution is identified. Once the solution has been identified and agreed with the Environmental Specialist and AFCD, construction works affecting seabed may recommence.

2.4.5 The Engineer and AFCD shall be kept informed of all steps taken; and written reports and proposals for action shall be passed to the Engineer and AFCD by the Contractor whenever the coral survey shows any adverse impact upon the corals.

2.4.6 After the Contractor have implemented the agreed mitigating measures, if the coral surveys indicate the coral condition is unacceptable, additional mitigation

measures should be recommended by the Contractor after consulting the Environmental Specialist for the approval of the Engineer and AFCD to rectify the situation. The Engineer can temporarily suspend the site activities until the problem is under control and an acceptable coral condition is restored.

2.4.7 In case the Contractor fails to implement the agreed mitigation measures, the Engineer can direct the Contractor to slow down or suspend his work until the Engineer and AFCD is convinced that the mitigation measures have restored the corals to an acceptable condition.

2.4.8 The Environmental Specialist shall assess the effectiveness and efficiency of the proposed mitigation measures and/or remedial actions for construction activities affecting the seabed. The performance of the Environmental Monitoring and Audit Programme shall be reviewed and audited by the Environmental Specialist on a quarterly basis. The findings of this review shall be included in the quarterly EM&A summary reports, together with any recommendations to improve the performance of the Environmental Monitoring and Audit Programme.

Table 2.2. Action and Limit Level for Coral Monitoring.

Parameter	Action Level Definition	Limit Level Definition
Sedimentation	If during Impact Monitoring a 15% increase in the percentage cover of sediment on hard corals occurs at more than 20% of the tagged coral at any one Impact Monitoring Site that is not recorded at the Control Site, then the Action Level is exceeded.	If during the Impact Monitoring a 25% increase in the percentage cover of sediment occurs at more than 20% of the tagged coral at any one Impact Monitoring Site that is not recorded at the Control Site, then the Limit Level is exceeded.
Bleaching	If during Impact Monitoring a 15% increase in the percentage cover of bleaching (bleached coral surface) on hard corals occurs at more than 20% of the tagged coral at any one Impact Monitoring Site that is not recorded at the Control Site, then the Action Level is exceeded.	If during the Impact Monitoring a 25% increase in the percentage cover of bleaching (bleached coral surface) occurs at more than 20% of the tagged coral at any one Impact Monitoring Site that is not recorded at the Control Site, then the Limit Level is exceeded.
Mortality	If during Impact Monitoring a 15% increase in the percentage cover of mortality on hard corals occurs at more than 20% of the tagged coral at any one Impact Monitoring Site that is not recorded at the Control Site, then the Action Level is exceeded.	If during the Impact Monitoring a 25% increase in the percentage cover of mortality occurs at more than 20% of the tagged coral at any one Impact Monitoring Site that is not recorded at the Control Site, then the Limit Level is exceeded.

3 RESULTS

3.1 Ecological Assessment of the Coral Community at the IMS and CMS in August 2008

3.1.1 The coral surveys at the IMS and CMS were conducted on 30th and 31st August 2008.

3.1.2 At each survey site, three transects (T1 to T3) were deployed for the REA survey. The location of the transects and the survey condition are shown in Fig. 2.1 and Table 3.1. Records of ecological and substratum attributes, as well as the taxonomic inventories are presented in Table 3.2

Table 3.1 Location and Condition of Ecological Assessment at the IMS and CMS.

Site	Transact Replicate	GPS Coordinates	Depth (m)	Sedimentation on Rocks Surface (mm)	Visibility (m)	Weather	Tide	Current (knot)
IMS (Yung Shue Wan)	T1	Start	N 22°13'29.1 E 114°06'32.3	2.8-4.2	1-2	<1.0	northwest wind, sunny	ebb
		End	N 22°13'28.5 E 114°06'30.3					
	T2	Start	N 22°13'28.4 E 114°06'30.6	2.8-4.5	1-2			
		End	N 22°13'27.7 E 114°06'28.9					
	T3	Start	N 22°13'27.7 E 114°06'28.8	3.1-4.5	1-2			
		End	N 22°13'27.6 E 114°06'27.0					
CMS (Shum Wan)	T1	Start	N 22°11'15.0 E 114°08'04.0	2.7-4.0	1-2	2.0-3.0	Northwest wind, sunny	ebb
		End	N 22°11'13.4 E 114°08'04.0					
	T2	Start	N 22°11'13.4 E 114°08'04.0	2.7-4.6	1-2			
		End	N 22°11'12.9 E 114°08'05.4					
	T3	Start	N 22°11'12.9 E 114°08'05.4	3.5-4.5	1-2			
		End	N 22°11'12.4 E 114°08'07.0					

3.1.3 At the IMS, the substratum of the 3 transects were mainly composed of boulders (Table 3.2). Along the seawall, T1 was mainly composed of artificial boulders, the rock surface was bare or sparsely covered by coralline algae, and only 1 hard coral colony *Oulastrea crispate* was recorded. On the bell transect of T2, the substratum was covered with boulders of artificial and natural sources, rubbles, mud and silt. Abundance of hard coral in T2 was below 5%, composed of 7 species with *Favites pentagona* being the most common. T3 was mainly covered by boulders and sand and shell debris. Hard coral abundance was similar to T2, 7 species were observed in which *Favites pentagona* was most common. In site total, 10 species of hard coral and no soft coral were recorded at the IMS.

3.1.4 At the CMS, the 3 transects were dominated by natural boulders with different abundance of corals (Table 3.2). T1 was mainly boulders with scattered rubbles, bedrock and sand. The hard surface was covered by hard corals (6 to 10%) and encrusting algae (<5%). Ten species of hard corals were observed, in which *Leptastrea pruinosa*, *Leptastrea purpurea* and *Porites sp.* were the common taxa.

Substratum of T2 was mainly boulders with sand and shell debris. Abundance of hard corals were similar to T1 (6 to 10%), but only 6 species were observed in which *Leptastrea pruinosa*, *Leptastrea purpurea* and *Pavona decussata* were the common residents. T3 was a slope completely covered by boulders, the rock surface was mainly covered by encrusting algae and barnacles. Hard corals were scarce on the transect and only 2 species were recorded. In site total, 11 species of hard coral and no soft coral were observed at the CMS.

Table 3.2 IMS and CMS - Ecological, Substratum Attributes and Hard Coral Taxonomic Inventories in Initial (July 2007) and Final Coral Survey (August 2008).

Substratum attributes (0 – 6)	IMS						CMS					
	T1		T2		T3		T1		T2		T3	
	Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Final
Bedrock	0	0	1	1	0	0	2	2	0	0	0	0
Boulders	6	6	5	5	6	6	6	6	6	6	6	6
Rubble	2	2	3	3	2	2	2	2	2	0	0	0
Sand & Shell debris	0	0	2	2	3	3	2	2	3	3	0	0
Mud & Silt	0	0	3	3	0	0	0	0	0	0	0	0
Ecological attributes (0-6)												
Hard coral	1	1	2	2	2	2	3	3	3	3	1	1
Dead standing coral	0	0	0	0	0	0	1	1	0	1	0	0
Soft coral	0	0	0	0	0	0	0	0	0	0	0	0
Encrusting algae	0	0	0	0	0	0	2	2	1	1	3	2
Coralline algae	1	1	2	1	1	1	0	0	0	0	0	0
Macro algae	0	0	0	0	0	0	0	0	0	0	0	0
Sea anemone	0	0	0	0	0	0	0	0	1	1	0	0
Hard coral taxonomic inventories (0 – 5)												
<i>Oulastrea crispata</i>	1	1	3	3	0	0	0	0	0	0	0	0
<i>Cyphastrea serailia</i>	0	0	1	1	0	0	1	1	1	1	0	0
<i>Favia rotumana</i>	0	0	1	1	1	1	0	0	1	1	0	0
<i>Favia lizardensis</i>	0	0	0	0	0	0	1	1	0	0	0	0
<i>Favites pentagona</i>	0	0	3	3	3	3	1	1	0	0	0	0
<i>Favites abdita</i>	0	0	0	0	0	0	1	1	0	0	0	0
<i>Goniopora stutchburyi</i>	0	0	2	2	0	0	0	0	0	0	0	0
<i>Plesiastrea versipora</i>	0	0	2	2	1	1	0	0	0	0	0	0
<i>Porites sp.</i>	0	0	2	2	2	2	3	3	3	3	1	1
<i>Goniastrea aspera</i>	0	0	0	0	1	1	0	0	0	0	0	0
<i>Psammocora profundacella</i>	0	0	0	0	1	1	1	1	0	0	0	0
<i>Turbinaria peltata</i>	0	0	0	0	1	1	0	0	0	0	0	0
<i>Leptastrea pruinosa</i>	0	0	0	0	0	0	3	3	3	3	0	0
<i>Leptastrea purpurea</i>	0	0	0	0	0	0	3	3	3	3	1	1
<i>Pavona decussata</i>	0	0	0	0	0	0	1	1	3	3	0	0
<i>Platygyra acuta</i>	0	0	0	0	0	0	1	1	0	0	0	0
No. Species (by transect)	1	1	7	7	7	7	10	10	6	6	2	2
No. Specie (by site)	10						11					

3.1.5 Hard coral abundance and health status of the colonies at the IMS and CMS are presented in Appendix Ia and Ib, and summarized in Table 3.3. At the IMS, level of sedimentation was generally low (mean < 3%) and bleaching (< 1%) was scarcely observed. Mean partial mortality range from 0 to 6.57% for the 3 transects, but up to 70% mortality was recorded in selected colonies (Appendix Ia). At the CMS, sedimentation (< 3%) and bleaching (< 1%) was also low, while mean partial mortality for the 3 transects ranged from 2.50 to 6.24%, and selected colonies with up to 60% mortality (Appendix Ib).

Table 3.3 Summary of abundance and health status of hard coral at the IMS and CMS from Initial Coral Survey and Final Coral Survey.

Site	Parameter		Initial Coral Survey July 2007	Final Coral Survey August 2008
IMS	Total number of hard coral colonies	T1	1	1
		T2	30	27
		T3	17	14
	Number of hard coral species	T1	1	1
		T2	7	7
		T3	7	7
	Percentage cover (%) of sediment - Mean (range)	T1	0	0
		T2	3.10 (0 – 40)	2.10 (0 – 8)
		T3	1.50 (0 – 8)	2.20 (0 – 5)
	Percentage cover (%) of bleaching - Mean (range)	T1	0	0
		T2	0.03 (0 – 1)	0.04 (0 – 1)
		T3	0	0
	Percentage cover (%) of partial mortality - Mean (range)	T1	0	0
		T2	1.23 (0 – 8)	5.24 (0 – 70)
		T3	0.88 (0 – 5)	6.57 (0 – 40)
CMS	Total number of hard coral colonies	T1	59	45
		T2	50	44
		T3	4	4
	Number of hard coral species	T1	10	10
		T2	6	6
		T3	2	2
	Percentage cover (%) of sediment - Mean (range)	T1	2.83 (0 – 20)	2.71 (0 – 12)
		T2	2.80 (0 – 30)	3.00 (0 – 10)
		T3	1.30 (1 – 2)	1.8 (1 – 3)
	Percentage cover (%) of bleaching - Mean (range)	T1	0.15 (0 – 5)	0.05 (0 – 1)
		T2	0	0.07 (0 – 3)
		T3	0	0
	Percentage cover (%) of partial mortality - Mean (range)	T1	0.22 (0 – 10)	6.42 (0 – 55)
		T2	1.86 (0 – 40)	5.32 (0 – 60)
		T3	0	2.50 (0 – 10)

3.2 Tagged Coral Monitoring at the IMS and CMS in August 2008

- 3.2.1 The surveys were conducted on 30th and 31st August 2008.
- 3.2.2 The code, species name, area, and percentage covers of sediment, bleaching and mortality of the tagged coral colonies at each site were summarized in Tables 3.4. Photographs of the colonies were shown in Appendices IIa and IIb. 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.
- 3.2.3 At the IMS, sedimentation on the tagged coral colonies was low, varied from 0% to +2% when compared with the baseline level in July 2007. Increment in sedimentation level was observed in 4 colonies (A06, A08, A09 and A10). No bleaching was recorded. Partial mortality increased in 5 colonies (A02, A05, A06, A09 and A10) in June 2008 survey, had no further increase, varied from 5% to 80% (Table 3.4; Appendix IIa).
- 3.2.4 At the CMS, when compared with the baseline data in July 2007, level of sediment on the colonies increased in 2 colonies, varied from +2% to +3% (B02, B10), and decreased in 2 colonies (B01 and B07) by 1%. No bleaching was recorded. Partial mortality previously found in 5 colonies by 2-56% (B02, B03, B05, B06 and B09) in previous surveys had no further increase (Table 3.4; Appendix IIb).

3.3 Status of Coral Community: Initial Coral Survey vs. Final Coral Survey

- 3.3.1 Using the same sampling method, the ecological attributes and the health status of the coral communities was evaluated against the Initial Coral Survey.

Ecological Assessment of Coral Community

- 3.3.2 Comparing the ecological attributes between Initial and Final Coral Survey (Table 3.2), the level of hard coral cover, abundance and diversity of coral species was similar for all transects at the IMS and CMS.
- 3.3.3 At the IMS, cover of coralline algae decreased in T2 when compared with Initial Survey. At the CMS, an increase in dead standing coral was observed in T2, and decrease in encrusting algae in T3. The level of dead standing coral in CMS was low and scattered; identifiable dead coral species included *Favites pentagona* and *Leptastrea spp.*
- 3.3.4 In terms of coral species recorded and abundance level for each species, the values in this survey were the same those recorded in the Initial Coral Survey for all transects in both sites (Table 3.2). The results suggested no apparent change in both species composition and abundance level after the construction phase.

Abundance and Health Status of Coral Colonies

- 3.3.5 At both sites, the level of sedimentation and bleaching was similar to those recorded before the commencement of construction (Table 3.3). The number of colonies recorded in the transects generally decreased by ~10 to 15% at both IMS (T2 & T3) and CMS (T1 & T2). Level of sedimentation and bleaching was low (< 5%) for all transects, and there was no sign of increment over the Initial Coral Survey.
- 3.3.6 There was elevation in partial mortality, by ~5% mean value, at both sites. The increase was caused by large proportion of partial death in few colonies, particularly for *Favia pentagona* at the IMS and *Leptastrea spp.* at the CMS (Appendix Ia & b).

Table 3.4 IMS and CMS – Code, Species Name, Area, Percentage Covers of Sediment, Bleaching and Mortality of the Tagged Coral Colonies in Initial Coral Survey (21 July 2007), 2 previous (21 June and 09 August 2008) and 1 present (30-31 August 2008) monitoring surveys. “▲” and “▼” indicate increased and decreased in percentage, respectively, when compared with the Initial Coral Survey.

IMS (Yung Shue Wan)

Code	Coral Species	Area (cm ²)	Sediment (%)				Bleaching (%)				Mortality (%)			
			21 Jul 07 (Baseline)	21 June 08	09 Aug 08	30 Aug 08	21 Jul 07 (Baseline)	21 June 08	09 Aug 08	30 Aug 08	21 Jul 07 (Baseline)	21 June 08	09 Aug 08	30 Aug 08
A01	<i>Favites pentagona</i>	110	1	1	0	1	0	0	0	0	0	0	0	0
A02	<i>Favia rotumana</i>	220	0	2 ▲	0	0	0	0	0	0	0	5 ▲	5 ▲	5 ▲
A03	<i>Platygyra carnosus</i>	400	0	2 ▲	2 ▲	0	0	0	0	0	0	0	0	0
A04	<i>Favia rotumana</i>	570	0	0	4 ▲	0	0	0	0	0	0	0	0	0
A05	<i>Cyphastrea serailia</i>	330	3	0 ▼	3	3	0	0	0	0	0	10 ▲	10 ▲	10 ▲
A06	<i>Cyphastrea serailia</i>	190	0	0	3 ▲	2 ▲	0	0	0	0	0	0	0	0
A07	<i>Favites pentagona</i>	200	0	0	0	0	0	0	0	0	0	80 ▲	80 ▲	80 ▲
A08	<i>Favites pentagona</i>	400	0*	5 ▲	5 ▲	2 ▲	0	0	0	0	0	0	0	0
A09	<i>Favites pentagona</i>	300	0	0	3 ▲	2 ▲	0	0	0	0	0	5 ▲	5 ▲	5 ▲
A10*	<i>Favites pentagona</i>	1800	0*	0	0	2 ▲	0	0	0	0	0	20 ▲	20 ▲	20 ▲

CMS (Sham Wan)

Code	Coral Species	Area (cm ²)	Sediment (%)				Bleaching (%)				Mortality (%)			
			21 Jul 07 (Baseline)	21 June 08	09 Aug 08	31 Aug 08	21 Jul 07 (Baseline)	21 June 08	09 Aug 08	31 Aug 08	21 Jul 07 (Baseline)	21 June 08	09 Aug 08	31 Aug 08
B01	<i>Favia lizardensis</i>	360	1	2 ▲	1	0 ▼	0	0	0	0	0	0	0	0
B02*	<i>Favites pentagona</i>	750	0*	2 ▲	2 ▲	2 ▲	0	0	0	0	0	2 ▲	2 ▲	2 ▲
B03	<i>Psammocora profundacella</i>	440	2	5 ▲	3 ▲	2	0	10 ▲	0	0	0	60 ▲	60 ▲	60 ▲
B04	<i>Cyphastrea serailia</i>	220	0	0	0	0	0	0	0	0	0	0	0	0
B05	<i>Favites abdita</i>	650	2	5 ▲	2	2	0	0	0	0	0	2 ▲	2 ▲	2 ▲
B06	<i>Leptastrea pruinosa</i>	450	1	3 ▲	2 ▲	1	0	0	0	0	0	8 ▲	8 ▲	8 ▲
B07	<i>Platygyra acuta</i>	350	1	1	0 ▼	0 ▼	0	0	0	0	0	0	0	0
B08	<i>Leptastrea pruinosa</i>	690	2	4 ▲	2	2	0	0	0	0	0	0	0	0
B09	<i>Leptastrea pruinosa</i>	400	2	5 ▲	2	2	0	0	0	0	0	2 ▲	2 ▲	2 ▲
B10	<i>Favites pentagona</i>	130	0	5 ▲	3 ▲	3 ▲	0	0	0	0	0	0	0	0

*Newly tagged colony in 15 March 2008 survey as baseline

4 CONCLUSION

4.1 Summary

- 4.1.1 Upon the completion of the marine construction work in Yung Shue Wan, the Impact Monitoring Site (IMS) and Control Monitoring Site (CMS) were assessed for the status of coral communities using Rapid Ecological Assessment (REA) and tagged coral monitoring. The major findings of the survey include,
- There was no change in the general ecological attributes (algal cover, coral cover, coral species number and abundance level) when compared with Initial Coral Survey.
 - Level of sedimentation and bleaching was low for both IMS and CMS, and there was little or low increment when compared with Initial Coral Survey. Partial mortality increased by ~5% in average for both IMS and CMS, which was caused by large portion partial mortality in selected colonies.
 - Tagged coral colonies at the IMS and CMS showed low level of variation in sedimentation and bleaching over the course of monitoring. Partial mortality was recorded in 5 colonies in IMS, ranging from 5 to 80%; and 5 colonies in CMS, ranging from 2 to 60%.
- 4.1.2 At the IMS, coral colonies are mainly located along the rubble mount seawall near the construction site. One of the potential sources of impact by the construction work is the input of sedimentation to the standing corals. The Final Coral Survey showed that sedimentation level on the corals was kept at low level and showed little increase from the Initial Coral Survey, suggesting that the impact on sedimentation level was low. Moreover, regular monitoring on tagged coral colonies showed that the degree of sediment varied at similar range (~10%) at both IMS and CMS during the course of construction and no record of higher sedimentation rate in IMS has been reported. It is proposed that, rather than the potential sediment input from the construction work, the observed sedimentation rate is contributed by combined environmental factors such as monsoonal wind, tidal current, peripheral transports, etc.
- 4.1.3 At both IMS and CMS, the standing corals has been suffered from stressful events over the monitoring period, which may partly account for the lower number of colonies recorded in the bell transects, as well as the mortality of tagged corals in the two monitoring sites. In February 2008, a prolong period (~3 weeks) of abnormally low water temperature (13-15°C) was recorded in Hong Kong waters. Bleaching and partial mortality was recorded in some colonies and resulted in coral death in both sites. During May and June 2008, bleaching and mortality was observed and was likely to be associated with low salinity caused by heavy rainfall. In both cases, bleaching and mortality was recorded in comparable level at the IMS and CMS, which suggested the influence from the construction work is low.
- 4.1.4 In conclusion, the Final Coral Survey showed no evidence of adverse impact on the coral community on the rubble mount seawall at the IMS after the marine

construction work. The implemented mitigation measures to protect the corals is regarded effective.

4.2 Compliance / Event Action Plan

4.2.1 Overall, the healthy status of the tagged coral colonies was normal, with low to medium levels of sedimentation. Low levels of bleaching and mortality were observed in both Monitoring and Control Sites. Neither action/limit level of sedimentation, bleaching or mortality was exceeded in both monitoring survey conducted in August 2008.

Table 4.1 Evaluation of Monitoring Results against Action and Limit Level for Coral Monitoring Surveys. Note Definition of Action/Limit levels are listed in Table 2.1. “No” indicates NO exceedance.

30th - 31st August 2008

Site \ Exceedance	Sedimentation		Bleaching		Mortality	
	Action Level	Limit Level	Action Level	Limit Level	Action Level	Limit Level
IMS	No	No	No	No	No	No
CMS	No	No	No	No	No	No

5 REFERENCES

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Appendix

Appendix Ia List of Hard and Soft Coral Colonies, Percentage Covers of Sediment, Bleaching and Mortality on Bell Transects of Impact Monitoring Site (IMS) in the Initial Coral Survey (July 2007) and Final Coral Survey (August 2008).

Transect 1 (IMS)										
Initial Coral Survey						Final Coral Survey				
Coral no.	Species	Area (cm²)	Sed %	Bleach %	Mort %	Species	Area (cm²)	Sed %	Bleach %	Mort %
1	<i>Oulastrea crispata</i>	2	0	0	0	<i>Oulastrea crispata</i>	2	0	0	0

Transect 2 (IMS)										
Initial Coral Survey						Final Coral Survey				
Coral no.	Species	Area (cm²)	Sed %	Bleach %	Mort %	Species	Area (cm²)	Sed %	Bleach %	Mort %
1	<i>Oulastrea crispata</i>	1	0	0	0	<i>Oulastrea crispata</i>	1	0	0	0
2	<i>Oulastrea crispata</i>	1	0	0	0	<i>Oulastrea crispata</i>	2	0	0	0
3	<i>Oulastrea crispata</i>	2	0	0	0	<i>Oulastrea crispata</i>	3	0	0	0
4	<i>Oulastrea crispata</i>	3	0	0	0	<i>Oulastrea crispata</i>	2	0	0	0
5	<i>Oulastrea crispata</i>	2	0	0	0	<i>Oulastrea crispata</i>	1	0	0	0
6	<i>Oulastrea crispata</i>	1	0	0	0	<i>Oulastrea crispata</i>	1	0	0	0
7	<i>Oulastrea crispata</i>	1	0	0	0	<i>Goniopora stutchburyi</i>	180	5	0	3
8	<i>Oulastrea crispata</i>	1	0	0	0	<i>Plesiastrea versipora</i>	300	7	0	0
9	<i>Plesiastrea versipora</i>	220	40	0	0	<i>Cyphastrea serailia</i>	120	1	0	3
10	<i>Goniopora stutchburyi</i>	180	5	0	3	<i>Favites pentagona</i>	210	2	0	5
11	<i>Plesiastrea versipora</i>	300	7	0	0	<i>Favites pentagona</i>	30	0	0	0
12	<i>Cyphastrea serailia</i>	120	1	0	3	<i>Porites sp.</i>	250	5	1	0
13	<i>Favites pentagona</i>	210	5	0	5	<i>Goniopora stutchburyi</i>	190	8	0	20
14	<i>Favites pentagona</i>	30	0	0	0	<i>Favites pentagona</i>	110	3	0	0

Transect 2 (IMS)										
Initial Coral Survey						Final Coral Survey				
Coral no.	Species	Area (cm ²)	Sed %	Bleach %	Mort %	Species	Area (cm ²)	Sed %	Bleach %	Mort %
15	<i>Porites sp.</i>	250	4	1	0	<i>Goniopora stutchburyi</i>	100	3	0	0
16	<i>Favites pentagona</i>	50	0	0	0	<i>Favites pentagona</i>	100	0	0	0
17	<i>Goniopora stutchburyi</i>	190	8	0	5	<i>Favites pentagona</i>	200	2	0	70
18	<i>Favites pentagona</i>	110	1	0	0	<i>Porites sp.</i>	120	1	0	0
19	<i>Goniopora stutchburyi</i>	150	5	0	8	<i>Favites pentagona</i>	330	3	0	0
20	<i>Goniopora stutchburyi</i>	100	2	0	0	<i>Favia rotumana</i>	340	0	0	0
21	<i>Favites pentagona</i>	100	0	0	0	<i>Favites pentagona</i>	360	5	0	0
22	<i>Favites pentagona</i>	200	3	0	0	<i>Porites sp.</i>	300	1	0	0
23	<i>Porites sp.</i>	120	2	0	0	<i>Favites pentagona</i>	190	5	0	30
24	<i>Favites pentagona</i>	330	1	0	0	<i>Favites pentagona</i>	40	0	0	0
25	<i>Favia rotumana</i>	340	0	0	0	<i>Plesiastrea versipora</i>	450	1	0	0
26	<i>Favites pentagona</i>	360	2	0	0	<i>Favites pentagona</i>	200	0	0	0
27	<i>Porites sp.</i>	300	0	0	0	<i>Porites sp.</i>	290	2	0	0
28	<i>Favites pentagona</i>	190	3	0	5					
29	<i>Favites pentagona</i>	40	0	0	0					
30	<i>Plesiastrea versipora</i>	450	3	0	0					

Transect 3 (IMS)										
Initial Coral Survey						Final Coral Survey				
Coral no.	Species	Area (cm ²)	Sed %	Bleach %	Mort %	Species	Area (cm ²)	Sed %	Bleach %	Mort %
1	<i>Favia rotumana</i>	210	0	0	0	<i>Favia rotumana</i>	210	0	0	0
2	<i>Goniastrea aspera</i>	110	0	0	0	<i>Goniastrea aspera</i>	110	2	0	0
3	<i>Favites pentagona</i>	190	0	0	2	<i>Favites pentagona</i>	190	2	0	10

Transect 3 (IMS)										
Initial Coral Survey						Final Coral Survey				
Coral no.	Species	Area (cm ²)	Sed %	Bleach %	Mort %	Species	Area (cm ²)	Sed %	Bleach %	Mort %
4	<i>Favites pentagona</i>	390	0	0	0	<i>Favites pentagona</i>	390	3	0	40
5	<i>Porites sp.</i>	290	4	0	0	<i>Porites sp.</i>	290	5	0	0
6	<i>Turbinaria peltata</i>	180	0	0	0	<i>Turbinaria peltata</i>	180	1	0	0
7	<i>Porites sp.</i>	580	0	0	0	<i>Porites sp.</i>	580	3	0	2
8	<i>Porites sp.</i>	480	3	0	5	<i>Porites sp.</i>	480	2	0	5
9	<i>Plesiastrea versipora</i>	400	8	0	0	<i>Plesiastrea versipora</i>	400	5	0	5
10	<i>Porites sp.</i>	380	3	0	5	<i>Favites pentagona</i>	830	1	0	0
11	<i>Favites pentagona</i>	830	2	0	2	<i>Psammocora profundacella</i>	380	1	0	0
12	<i>Psammocora profundacella</i>	380	3	0	0	<i>Favites pentagona</i>	310	4	0	25
13	<i>Favites pentagona</i>	90	1	0	0	<i>Plesiastrea versipora</i>	1300	1	0	0
14	<i>Goniastrea aspera</i>	230	0	0	1	<i>Favites pentagona</i>	290	1	0	5
15	<i>Favites pentagona</i>	310	0	0	0					
16	<i>Plesiastrea versipora</i>	1300	1	0	0					
17	<i>Favites pentagona</i>	290	1	0	0					

Appendix Ib List of Hard and Soft Coral Colonies, Percentage Covers of Sediment, Bleaching and Mortality on Bell Transects of Control Monitoring Site (CMS) in the Initial Coral Survey (July 2007) and Final Coral Survey (August 2008).

Transect 1 (CMS)										
	Initial Coral Survey					Final Coral Survey				
Coral no.	Species	Area (cm²)	Sed %	Bleach %	Mort %	Species	Area (cm²)	Sed %	Bleach %	Mort %
1	<i>Leptastrea purinosa</i>	200	4	0	0	<i>Leptastrea purinosa</i>	200	2	0	3
2	<i>Porites sp.</i>	380	3	0	0	<i>Porites sp.</i>	380	3	0	0
3	<i>Favia lizardensis</i>	360	1	0	0	<i>Favia lizardensis</i>	360	1	0	0
4	<i>Cyphastrea serailia</i>	280	0	0	0	<i>Cyphastrea serailia</i>	280	0	0	0
5	<i>Favites abdita</i>	480	4	0	0	<i>Favites abdita</i>	480	8	0	0
6	<i>Porites sp.</i>	350	5	0	0	<i>Porites sp.</i>	350	8	0	0
7	<i>Porites sp.</i>	180	3	0	0	<i>Porites sp.</i>	280	3	1	4
8	<i>Porites sp.</i>	280	10	0	0	<i>Porites sp.</i>	180	2	0	1
9	<i>Porites sp.</i>	180	4	1	0	<i>Platygyra acuta</i>	250	0	0	0
10	<i>Platygyra acuta</i>	250	0	0	0	<i>Pavona decussata</i>	480	0	0	0
11	<i>Pavona decussata</i>	480	0	0	0	<i>Leptastrea purpurea</i>	180	3	0	45
12	<i>Pavona decussata</i>	380	0	0	0	<i>Leptastrea purinosa</i>	300	0	0	0
13	<i>Leptastrea purpurea</i>	180	0	0	0	<i>Leptastrea purinosa</i>	320	5	0	5
14	<i>Leptastrea purpurea</i>	250	0	0	0	<i>Leptastrea purinosa</i>	430	5	0	10
15	<i>Leptastrea purinosa</i>	300	5	0	0	<i>Cyphastrea serailia</i>	200	1	0	0
16	<i>Leptastrea purinosa</i>	320	4	0	0	<i>Leptastrea purpurea</i>	520	3	0	0
17	<i>Leptastrea purinosa</i>	210	1	0	0	<i>Porites sp.</i>	230	3	0	0
18	<i>Leptastrea purinosa</i>	430	3	0	0	<i>Porites sp.</i>	350	3	0	0
19	<i>Cyphastrea serailia</i>	200	0	0	0	<i>Leptastrea purpurea</i>	880	5	0	5
20	<i>Leptastrea purpurea</i>	520	3	0	0	<i>Porites sp.</i>	700	4	0	20

Transect 1 (CMS)										
Initial Coral Survey						Final Coral Survey				
Coral no.	Species	Area (cm ²)	Sed %	Bleach %	Mort %	Species	Area (cm ²)	Sed %	Bleach %	Mort %
21	<i>Porites sp.</i>	230	5	0	0	<i>Psammocora profundacella</i>	410	2	0	60
22	<i>Porites sp.</i>	350	3	0	0	<i>Favites pentagona</i>	500	2	0	15
23	<i>Leptastrea purpurea</i>	880	7	0	0	<i>Leptastrea purinosa</i>	400	1	0	0
24	<i>Porites sp.</i>	700	4	5	0	<i>Leptastrea purpurea</i>	1400	3	0	0
25	<i>Psammocora profundacella</i>	410	5	0	0	<i>Leptastrea purpurea</i>	320	3	0	0
26	<i>Favites pentagona</i>	500	6	0	0	<i>Leptastrea purinosa</i>	400	2	0	50
27	<i>Leptastrea purinosa</i>	380	2	0	0	<i>Leptastrea purpurea</i>	1100	1	0	0
28	<i>Leptastrea purinosa</i>	400	3	0	0	<i>Leptastrea purinosa</i>	520	12	0	0
29	<i>Leptastrea purpurea</i>	310	1	0	0	<i>Leptastrea purinosa</i>	2200	2	0	1
30	<i>Leptastrea purpurea</i>	1400	1	0	0	<i>Leptastrea purinosa</i>	380	1	0	10
31	<i>Leptastrea purpurea</i>	320	3	0	0	<i>Leptastrea purinosa</i>	290	0	0	0
32	<i>Leptastrea purinosa</i>	400	2	0	0	<i>Leptastrea purpurea</i>	3500	3	0	0
33	<i>Leptastrea purinosa</i>	210	1	0	0	<i>Leptastrea purinosa</i>	1900	3	0	5
34	<i>Porites sp.</i>	100	0	0	0	<i>Porites sp.</i>	430	2	0	5
35	<i>Leptastrea purpurea</i>	1100	2	0	0	<i>Porites sp.</i>	390	2	0	0
36	<i>Leptastrea purinosa</i>	520	8	0	0	<i>Porites sp.</i>	430	3	0	40
37	<i>Leptastrea purinosa</i>	210	0	0	0	<i>Leptastrea purinosa</i>	510	0	0	55
38	<i>Leptastrea purinosa</i>	2200	1	0	0	<i>Leptastrea purinosa</i>	670	1	0	5
39	<i>Leptastrea purinosa</i>	280	0	0	0	<i>Leptastrea purinosa</i>	450	0	0	0
40	<i>Leptastrea purinosa</i>	380	0	0	0	<i>Leptastrea purpurea</i>	900	4	0	0
41	<i>Leptastrea purinosa</i>	290	1	0	0	<i>Favites abdita</i>	330	2	0	0
42	<i>Leptastrea purinosa</i>	180	0	0	0	<i>Leptastrea purinosa</i>	700	3	0	0
43	<i>Leptastrea purpurea</i>	3500	4	0	0	<i>Leptastrea purinosa</i>	800	3	0	0

Transect 1 (CMS)										
Initial Coral Survey						Final Coral Survey				
Coral no.	Species	Area (cm ²)	Sed %	Bleach %	Mort %	Species	Area (cm ²)	Sed %	Bleach %	Mort %
44	<i>Leptastrea purinosa</i>	1900	2	0	0	<i>Leptastrea purinosa</i>	580	3	0	0
45	<i>Porites sp.</i>	430	9	0	0	<i>Porites sp.</i>	850	5	0	10
46	<i>Porites sp.</i>	390	2	0	0					
47	<i>Porites sp.</i>	430	3	2	10					
48	<i>Porites sp.</i>	230	4	0	0					
49	<i>Leptastrea purinosa</i>	510	0	0	0					
50	<i>Leptastrea purinosa</i>	670	1	0	0					
51	<i>Leptastrea purinosa</i>	450	0	0	0					
52	<i>Leptastrea purpurea</i>	900	2	0	0					
53	<i>Favites abdita</i>	330	5	0	0					
54	<i>Leptastrea purinosa</i>	700	4	0	0					
55	<i>Leptastrea purinosa</i>	800	1	0	0					
56	<i>Leptastrea purinosa</i>	580	2	0	0					
57	<i>Porites sp.</i>	450	20	1	0					
58	<i>Porites sp.</i>	850	3	0	3					
59	<i>Leptastrea purpurea</i>	10	0	0	0					

Transect 2 (CMS)										
Initial Coral Survey						Final Coral Survey				
Coral no.	Species	Area (cm ²)	Sed %	Bleach %	Mort %	Species	Area (cm ²)	Sed %	Bleach %	Mort %
1	<i>Pavona decussata</i>	390	0	0	0	<i>Pavona decussata</i>	390	2	0	0
2	<i>Porites sp.</i>	320	3	0	0	<i>Porites sp.</i>	320	8	0	0
3	<i>Leptastrea purinosa</i>	390	1	0	0	<i>Leptastrea purinosa</i>	390	1	0	0

Transect 2 (CMS)										
Initial Coral Survey						Final Coral Survey				
Coral no.	Species	Area (cm ²)	Sed %	Bleach %	Mort %	Species	Area (cm ²)	Sed %	Bleach %	Mort %
4	<i>Porites sp.</i>	600	30	0	40	<i>Leptastrea purinosa</i>	550	5	0	10
5	<i>Leptastrea purinosa</i>	550	5	0	0	<i>Porites sp.</i>	600	3	0	0
6	<i>Porites sp.</i>	600	5	0	0	<i>Porites sp.</i>	350	2	0	0
7	<i>Porites sp.</i>	350	0	0	0	<i>Porites sp.</i>	410	5	0	2
8	<i>Porites sp.</i>	290	0	0	0	<i>Leptastrea purpurea</i>	1200	3	0	3
9	<i>Porites sp.</i>	410	0	0	0	<i>Porites sp.</i>	430	3	0	5
10	<i>Leptastrea purpurea</i>	1200	3	0	0	<i>Porites sp.</i>	1000	8	0	20
11	<i>Porites sp.</i>	430	1	0	1	<i>Leptastrea purinosa</i>	1200	1	0	4
12	<i>Porites sp.</i>	1000	10	0	2	<i>Leptastrea purpurea</i>	250	5	0	50
13	<i>Porites sp.</i>	1400	7	0	40	<i>Porites sp.</i>	900	3	0	0
14	<i>Leptastrea purpurea</i>	200	0	0	0	<i>Leptastrea purpurea</i>	7000	5	0	2
15	<i>Leptastrea purinosa</i>	1200	5	0	0	<i>Porites sp.</i>	1100	2	0	5
16	<i>Leptastrea purpurea</i>	250	0	0	0	<i>Leptastrea purinosa</i>	700	4	0	0
17	<i>Porites sp.</i>	900	3	0	0	<i>Porites sp.</i>	500	5	3	8
18	<i>Leptastrea purpurea</i>	7000	7	0	0	<i>Leptastrea purinosa</i>	900	3	0	3
19	<i>Porites sp.</i>	1100	0	0	5	<i>Leptastrea purinosa</i>	1100	1	0	0
20	<i>Leptastrea purinosa</i>	700	3	0	0	<i>Leptastrea purpurea</i>	2400	2	0	0
21	<i>Porites sp.</i>	500	1	0	0	<i>Favia rotamana</i>	180	0	0	0
22	<i>Leptastrea purinosa</i>	900	3	0	0	<i>Leptastrea purpurea</i>	480	0	0	0
23	<i>Leptastrea purinosa</i>	1100	2	0	0	<i>Leptastrea purinosa</i>	1000	8	0	0
24	<i>Leptastrea purpurea</i>	2400	3	0	0	<i>Leptastrea purpurea</i>	1500	8	0	60
25	<i>Favia rotamana</i>	180	0	0	0	<i>Porites sp.</i>	600	2	0	0
26	<i>Leptastrea purpurea</i>	320	0	0	0	<i>Pavona decussata</i>	400	0	0	0
27	<i>Leptastrea purpurea</i>	480	0	0	0	<i>Pavona decussata</i>	1300	0	0	0

Transect 2 (CMS)										
Initial Coral Survey						Final Coral Survey				
Coral no.	Species	Area (cm ²)	Sed %	Bleach %	Mort %	Species	Area (cm ²)	Sed %	Bleach %	Mort %
28	<i>Leptastrea purinosa</i>	1000	4	0	0	<i>Porites sp.</i>	470	2	0	0
29	<i>Leptastrea purpurea</i>	1500	7	0	5	<i>Pavona decussata</i>	500	0	0	0
30	<i>Porites sp.</i>	600	1	0	0	<i>Pavona decussata</i>	270	0	0	0
31	<i>Pavona decussata</i>	400	0	0	0	<i>Cyphastrea serailia</i>	200	2	0	0
32	<i>Pavona decussata</i>	1300	0	0	0	<i>Cyphastrea serailia</i>	630	3	0	0
33	<i>Porites sp.</i>	470	3	0	0	<i>Porites sp.</i>	800	10	0	30
34	<i>Pavona decussata</i>	500	0	0	0	<i>Leptastrea purinosa</i>	1200	1	0	0
35	<i>Pavona decussata</i>	270	0	0	0	<i>Leptastrea purinosa</i>	1400	6	0	0
36	<i>Porites sp.</i>	300	0	0	0	<i>Porites sp.</i>	480	5	0	20
37	<i>Cyphastrea serailia</i>	200	0	0	0	<i>Leptastrea purinosa</i>	380	0	0	0
38	<i>Cyphastrea serailia</i>	630	3	0	0	<i>Porites sp.</i>	500	3	0	0
39	<i>Porites sp.</i>	800	10	0	0	<i>Pavona decussata</i>	500	0	0	0
40	<i>Leptastrea purinosa</i>	1200	1	0	0	<i>Pavona decussata</i>	600	0	0	0
41	<i>Leptastrea purinosa</i>	1400	6	0	0	<i>Porites sp.</i>	800	1	0	0
42	<i>Porites sp.</i>	480	4	0	0	<i>Leptastrea purinosa</i>	680	8	0	10
43	<i>Leptastrea purinosa</i>	380	0	0	0	<i>Leptastrea purpurea</i>	900	1	0	0
44	<i>Porites sp.</i>	500	3	0	0	<i>Porites sp.</i>	480	3	0	2
45	<i>Pavona decussata</i>	500	0	0	0					
46	<i>Pavona decussata</i>	600	0	0	0					
47	<i>Porites sp.</i>	800	1	0	0					
48	<i>Leptastrea purinosa</i>	680	3	0	0					
49	<i>Leptastrea purpurea</i>	900	1	0	0					
50	<i>Porites sp.</i>	480	3	0	0					

Transect 3 (CMS)										
Initial Coral Survey						Final Coral Survey				
Coral no.	Species	Area (cm ²)	Sed %	Bleach %	Mort %	Species	Area (cm ²)	Sed %	Bleach %	Mort %
1	<i>Leptastrea purpurea</i>	1000	2	0	0	<i>Leptastrea purpurea</i>	1000	3	0	0
2	<i>Porites sp.</i>	750	1	0	0	<i>Porites sp.</i>	750	1	0	0
3	<i>Porites sp.</i>	600	1	0	0	<i>Porites sp.</i>	600	1	0	10
4	<i>Porites sp.</i>	450	1	0	0	<i>Porites sp.</i>	450	2	0	0