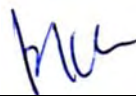


**Proposed Extension of Public Golf Course
at Kau Sai Chau Island, Sai Kung**

**Environmental Monitoring & Audit (EM&A)
Final EM&A Report**

(Report No. 382210/FIN/001)

Report Authorized For
Issue By:



For and on Behalf of
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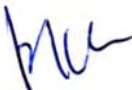
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Your ref : 40040032/CERT/03_08.doc
Our ref :

**Proposed Extension of Public Golf Course at Kau Sai Chau Island, Sai Kung
(Independent Environmental Checker)**

CHECK CERTIFICATE

1. We certify that professional skill and care have been used in checking of the Environmental Team's (ET) **Final EM&A Report** for the construction of Proposed Extension of Public Golf Course at Kau Sai Chau Island, Sai Kung.
2. We certify that the ET's EM&A programme for the reporting period has been satisfactorily executed and the **Final EM&A Report** has been verified.
3. We would comment that our evaluation of the ET's EM&A is based on a random audit process which cannot be guaranteed to have all non-conformities identified.

Signed



Independent Environmental Checker

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Date 18 February 2008

Executive Summary

This is the Final Environmental Monitoring and Audit (EM&A) Report prepared by Black & Veatch, the designated Environmental Team (ET), for the Project “Proposed Extension of Public Golf Course at Kau Sai Chau Island, Sai Kung”. The construction works of golf course was commenced on 16th January 2006. Major golf course construction was completed in December 2007. This final report presents the summary of EM&A monitoring results conducted for 24 months during construction phase (January 2006 to January 2008).

No dredging of the permanent intake and outfall pipelines for the desalination plant had been carried out during construction phase. Both pipelines were constructed along the KSC existing pier. The discharge licence application for the desalination plant is in progress. 89 numbers of corals located on the footprint of the pipelines were transplanted to at least 80m away from the KSC existing pier (near Site D2) in according to EIA report and EM&A manual.

All of the closed low flow drainage system was constructed and completed in November 2007 in order to collect all surface runoff from third golf course during operation phase. Filter system were installed at Holes 5 & 6 in according to the Environmental Permit (EP). All four permanent bridges were constructed by pre-cast method on site.

Exceedances on dust (24-hr TSP) and water quality (mainly suspended solids and turbidity) were recorded. However, all measured pesticides concentrations at all fresh water and marine monitoring stations were undetectable since turf establishment in February 2007.

Several incidents were occurred at buffer zone of streams during construction, they are (i) artificial rubble filling up downstream of Stream A after rain, (ii) additional vegetation clearance at Streams B & C and (iii) heavy silt deposit at the streambed of Stream C. All stream conditions are considered back to the baseline condition except Stream C. For Stream C, two species of Atyid shrimps, i.e. *Caridina fasciata* and *Cardina cantonensis*, which had been absent in June 2007, were found but still in very low density since November 2007.

The removal of the rock-filled pier at the temporary barging point will be commenced on 12th February 2008 for one month. Due to the coral damage incident occurred in March 2006 during the construction of the temporary barging point, additional coral monitoring are recommended by AFCD during the period of removal. If there is an extension of the removal programme due to any coral damage, further review on the coral monitoring frequency is required and will be submitted for AFCD and EPD for approval.

For air quality (dust nuisance), EPD issued two numbers of Record of Inspection (Pink Form) in January and May 2007 under Air Pollution Control Ordinance (APCO) to the Contractor (CHEC). In addition, two numbers of complaints issued by golfers due to dust nuisance were recorded in September 2006 and September 2007.

For water quality (silty runoff), EPD issued one number of Record of Inspection (Pink Form) under Water Pollution Control Ordinance (WPCO) to the CHEC in June 2006. In addition, two numbers of complaints issued by fish pond holder (Tiu Cham Wan) in March 2006 and Tai Tau Chau fish farmers were recorded. According to the EPD's record, CHEC was convicted for breaching the WPCO in November 2006.

Provision of buffer zone and pre-cast bridge construction are good successful examples to minimize the impact on sensitive stream. Works to be carried out in dry season within buffer zone as stated in EP can further minimize the potential impact.

Long-term water quality exceedances were found, in particular wet season, which was mainly due to the failure and insufficient of the temporary drainage implemented on site. It is important to note that a comprehensive, frequently update/review, highly maintain and effective temporary drainage system is the best management and practical tool to control silty runoff. Careful planning on bulky earthworks works programme is also the key success to control the silty runoff from construction site.

Temporary adverse impacts on air quality, water quality, terrestrial ecology and marine ecology were found after revealing two-year construction phase EM&A monitoring. It is also important to learn that the Contractor should follow all EIA recommendations, implemented mitigation measures before any work approach to environmental sensitive areas and modify/enhance mitigation measures due to the site constraints and conditions, if necessary in order to minimize and avoid any adverse impact to the environment.

According to the site inspection and site audit records, the Contractor was generally in compliance with environmental requirements except incidents causing buffer zone disturbance and coral damage at temporary barging point. However, the effectiveness and practicality of the mitigation measures provided by the Contractor were considered not sufficient during the construction phase.

1. Introduction

1.1 Background of the Project

- 1.1.1 Black & Veatch (hereinafter called the “ET”) was appointed by Hong Kong Jockey Club (hereinafter called the “Project Proponent”) to undertake Environmental Monitoring and Audit (EM&A) for “Proposed Extension of Public Golf Course at Kau Sai Chau Island, Sai Kung” (hereinafter called the “Project”). Under the requirements of Section 4 of Environmental Permit EP-224/2005, EM&A programme as set out in the EM&A Manual is required to be implemented. In accordance with the EM&A Manual, environmental monitoring of air quality, water quality, terrestrial and marine ecology, landscape and visual, archaeology (watching brief) and land contamination are required for the Project during the construction phase.

1.2 Purpose of the Report

- 1.2.1 This final EM&A review report summarises the environmental monitoring and audit reports for the Project after 24 months monitoring (January 2006 to December 2007) and one month post-Project monitoring (January 2008).

1.3 Scale and Scope of the Project

- 1.3.1 The scale and scope of the Project comprises the following major components:
- Construction of the third 18-hole public golf course on the east side of the island, south of the existing golfing area;
 - A new irrigation lake to collect surface runoff from the new 18-hole golf course. Water stored at the new irrigation lake can also be diverted to existing reservoir for tertiary treatment and recycling;
 - A new desalination plant adjacent to the existing pier to serve as an additional irrigation water supply for the new golf course during dry season; and
 - Expansion of existing administration and maintenance buildings.
- 1.3.2 The potential environmental impacts of the Project have been studied in the Environmental Impact Assessment (EIA) report (EIAO Register No. AEIAR- 091/2005). The EIA was approved on 14 November 2005 under the EIAO. An Environmental Permit (EP-224/2005) was granted on 28 November 2005. Application for Variation of an Environmental Permit by the Project Proponent on 2 August 2006 (Application No. VEP-222/2006) and the EP was superseded by EP-224/2005/A.

1.4 Site Description

- 1.4.1 A layout plan of the Project is provided in **Figure 1.1**.

1.5 Project Organization and Management Structure for EM&A Works

- 1.5.1 An environmental team (ET) has been established to investigate and audit the Contractor’s equipment and work methodologies, to monitor and to audit reports, and to provide recommendations and improvements. An Independent Environmental Checker (IEC) has been employed to review the EM&A works by the Project Proponent. The Engineer is generally responsible for supervising the contractor’s activities, reviewing the EM&A works and mitigations. The organization and lines of communication are shown in **Figure 1.2**.

1.6 Construction Programme

- 1.6.1 The construction works were commenced on 16 January 2006 and the major construction activities were completed by the end of December 2007.

1.7 Works under during the Construction Period

- 1.7.1 The major construction activities and works undertaken during the entire construction period where as follows:
- Construction of 18 hole of golf course;
 - Construction of close low flow drainage system including irrigation lakes, pumping stations and underground water tanks;
 - Construction of temporary barging point at east side of the KSC Island;
 - Construction of desalination plant located at the existing KSC pier;
 - Extension of existing administration and maintenance buildings;
 - Upgrading of existing sewage treatment plant;
 - Construction of bridges at Streams A, B, C and fresh water inland marsh; and
 - Turf establishment.

2. Summary of EM&A Requirements

2.1.1 The EM&A programme requires environmental monitoring for air quality, water quality, terrestrial and marine ecology, landscape and visual, archaeology (watching brief) and land contamination. The EM&A requirements for each parameter are described in subsequent sections, including:

- All monitoring parameters;
- Action and Limit Levels for all environmental parameters;
- Event and Action Plans; and
- Environmental mitigation measures, as recommended in the project EIA final report.

2.1.2 A summary of impact EM&A requirements during the construction phase is presented in **Annex A**.

2.1 Air Quality

2.1.3 The established Action/Limit Levels (AL levels) for the 1-hour and 24-hour TSP monitoring works are summarized in **Annex B**. The monitoring parameters and frequency are summarized in **Table 2.1**.

Table 2.1 TSP Monitoring Parameter and Frequency

Parameter	Frequency
24-hour TSP	Once every 6 days
1-hour TSP	3 times every 6 days (as required in case of complaints)

2.1.4 In accordance with the EM&A Manual, one monitoring station (GCA B1) was selected and shown in **Figure 2.1**. The Event and Action Plan (EAP) for air quality monitoring is presented in **Annex C**.

2.2 Water Quality

2.2.1 The established Action/Limit Levels for the water environmental monitoring parameters are shown in **Annex B**.

2.2.2 There are nine marine water monitoring stations include fish culture zones (TTC, K LW, KS), impact stations (M_RO1, M_Marsh, M_Coral and M_BP) and control (M_A and M_B). Seven fresh water monitoring stations include Streams A, B, C (F_UA, F_DA, F_UB, F_DB, F_UC and F_DC) and downstream of Fresh Water Inland Marsh (F_Inland M). Their respective locations are shown in **Figure 2.2**.

2.2.3 The monitoring parameters and frequency are summarized in **Table 2.2**. Additional marine and freshwater water quality monitoring parameters for the impact monitoring during construction include nitrate nitrogen (NO₃-N), nitrite nitrogen (NO₂-N), ammonia nitrogen (NH₃-N), total phosphate (TP) and selected pesticides.

2.2.4 Additional water quality monitoring at Tai Tau Chau FCZ (TTC), Kai Lung Wan FCZ (KLW), Kau Sai FCZ (KS), downstream of the existing marsh (M_Marsh), marine water of Port Shelter (M_Coral), existing reservoir (F_Inland M) and Control stations (M_A and M_B) shall be carried out after heavy rain storm or when there is an overflow event from the reservoir, irrigation buffer lake or detention ponds/tanks.

2.2.5 The Event and Action Plan (EAP) for water quality monitoring is presented in **Annex C**.

Table 2.2 Water Quality Monitoring Parameter, Frequency and Locations

Parameters	Frequency	Location
Dissolved Oxygen (mg/L)	3 days per week	<u>Marine Water</u> Fish culture zone stations: TTC, KLW, KS
Temperature (°C)		Control stations: M_A, M_B
Turbidity (NTU)		Impact stations: M_BP, M_RO1, M_Marsh, M_Coral
pH		
Salinity (ppt)		<u>Freshwater Water</u> Stream A (F_UA, F_DA) Stream B (F_UB, F_DB) Stream C (F_UC, F_DC) Inland Marsh (F_Inland_M)
Suspended Solids (mg/L)		

2.3 Ecology

- 2.3.1 The ecological monitoring survey for terrestrial ecology consists of aquatic fauna survey at Streams A, B, C & D (control station). Special attention was paid to ecologically sensitive streams to ensure minimum damage to existing vegetation and streams. The purpose of the monitoring survey was to check the conditions of the stream habitat and the associated aquatic fauna communities.
- 2.3.2 While the ecological monitoring survey for marine ecology includes coral monitoring at both the eastern (Site B2, Site C and Control Site) and western coasts (Site D2 and Site D3) of Kau Sai Chau Island. The coral monitoring at the western coast was not conducted because of the cancellation of dredging works for the desalination plant's submarine pipelines. The coral monitoring at the eastern Kau Sau Chau was conducted during construction phase. Monitoring survey consists of checking tagged corals at both impact sites and control site. The purpose of the monitoring survey was to check the conditions of the tagged corals and the impact sites. Although the dredging works for the desalination plant have yet to conduct, 89 natural corals near the plant were transplanted near to Site D2 in November 2006. The transplanted corals would be monitored quarterly for a year.
- 2.3.3 Monitoring locations for ecology are shown in **Figures 2.3 – 2.5**. The Event and Action Plan (EAP) for ecology monitoring is presented in **Annex C**.

2.4 Landscape and Visual

- 2.4.1 The EIA concluded that the landscape and visual impacts associated with the construction of the third golf course are anticipated to be acceptable with mitigation. In order to ensure that the effective management and implementation of landscape mitigation measures developed and defined in the EIA, the ET conducted regular site inspections of the construction work sites.
- 2.4.2 Auditing inspections and reporting are undertaken once every two weeks of the construction phase. The effectiveness of the mitigation works has been audited in order to ensure impact reduction levels are achieved as described in the EIA report.

2.5 Archaeology (Graves and Watching Brief)

- 2.5.1 The archeological impact assessment conducted in the EIA concluded that some potential for archaeological material remains at the Wan Chai Archaeological Site and a watching brief is recommended during the construction phase.
- 2.5.2 The monitoring locations include Hole 2, Hole 11, Hole 12, Hole 14, Hole 15 & Hole 16. The monitoring locations are present in **Figure 2.6**. A summary table for categories of archaeological find and recommended action is presented in **Annex C**.
- 2.5.3 The graves located within the Project area were identified in the EIA. According to the EM&A requirement, Grave #1 should be preserved in-situ with the provision of three meter buffer zone around the grave located at Hole 12 fairway, while Grave #5 and Grave #20 should be preserved by record

2.6 Land Contamination

- 2.6.1 Contamination Assessment Plan (CAP) was submitted to EPD for approval before site investigation. As land contamination at Hole 18 was confirmed by the site investigation, submission of a Contamination Assessment Report (CAR) including Remediation Assessment Plan (RAP) was required and both of them were approved during the construction phase. Potential five land contamination hotspots are presented in **Figure 2.7**.

2.7 Summary of implementation status

- 2.7.1 An implementation schedule of environmental mitigation measures is shown in **Annex D**.

3. Graphical Plots and Statistical Analysis of Monitored Parameters

3.1 Major activities being carried out on site

- 3.1.1 The major construction activities and approximate time frame being carried out during the construction phase is shown in **Table 3.1**. **Table 3.2** presents the summary of earthworks and turfing sequence.

Table 3.1 Summary of Construction Programme

Construction Activities	Approximate Time Frame
Construction of 18 hole of golf course	
(I) Earthworks and close low flow drainage systems	
<i>Northern Portion</i>	
Hole 1	January 2006 to October 2007 (21 months)
Hole 2	January 2006 to November 2007 (23 months)
Hole 3	May 2006 to June 2007 (14 months)
Hole 4	May 2006 to February 2007 (9 months)
Hole 5	May 2006 to March 2007 (10 months)
Hole 6	July 2006 to April 2007 (9 months)
Hole 7	July 2006 to May 2007 (10 months)
Hole 8	March 2006 to February 2007 (11 months)
<i>Central Portion</i>	
Hole 9	February 2006 to October 2007 (21 months)
Hole 10	July 2006 to September 2007 (14 months)
Hole 17	February 2006 to October 2007 (21 months)
Hole 18	April 2006 to July 2007 (15 months)
<i>Southern Portion</i>	
Hole 11	September 2006 to June 2007 (10 months)
Hole 12	September 2006 to August 2007 (11 months)
Hole 13	December 2006 to July 2007 (7 months)
Hole 14	October 2006 to July 2007 (10 months)
Hole 15	September 2006 to July 2007 (11 months)
Hole 16	September 2006 to July 2007 (10 months)
(II) Turf Establishment	
<i>Northern Portion</i>	
Hole 1	October to November 2007 (2 months)
Hole 2	November to December 2007 (1.5 month)
Hole 3	June to July 2007 (1 month)
Hole 4	April to July 2007 (3 months)
Hole 5	March to July 2007 (5 months)
Hole 6	May to July 2007 (3 months)
Hole 7	June to July 2007 (2 months)
Hole 8	February to July 2007 (6 months)
<i>Central Portion</i>	
Hole 9	October to December 2007 (3 months)
Hole 10	September to October 2007 (2 months)
Hole 17	October to December 2007 (3 months)
Hole 18	July to October 2007 (3 months)
<i>Southern Portion</i>	
Hole 11	June to August 2007 (3 months)
Hole 12	September to October 2007 (2 months)
Hole 13	August to October 2007 (3 months)
Hole 14	August to September 2007 (2 months)
Hole 15	July to August 2007 (2 months)
Hole 16	August to October 2007 (3 months)

Construction Activities	Approximate Time Frame
Construction of close low flow drainage system including irrigation lakes, pumping stations and underground water tanks	May 2006 to October 2007
Construction of temporary barging point at east side of the KSC Island	March 2006 to April 2006
Construction of desalination plant located at the existing KSC pier (no dredging activity being carried out for submarine pipelines)	June 2006 to December 2006
Extension of existing maintenance and administration buildings	March 2006 to June 2007 (maintenance) March 2006 to August 2007 (administration)
Construction of bridges at Streams A, B, C and fresh water inland marsh (VEP for bridge construction within wet season was approved in August 2006)	March 2006 (Stream A), September 2006 (Stream B), December 2006 (Stream C), August 2006 (Fresh Water Inland Marsh)

Table 3.2 Summary of Earthwork and Turfing Sequence of East Course

Date	Golf Hole																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
January 2006																		
February 2006	E	E																
March 2006	E	E							E								E	
April 2006	E	E						E	E								E	
May 2006	E	E	E		E			E	E								E	E
June 2006	E	E	E	E	E			E	E								E	E
July 2006	E	E	E	E	E	E	E	E	E	E							E	E
August 2006	E	E	E	E	E	E	E	E	E	E							E	E
September 2006	E	E	E	E	E	E	E	E	E	E							E	E
October 2006	E	E	E	E	E	E	E	E	E	E	E	E		E		E	E	E
November 2006	E	E	E	E	E	E	E	E	E	E	E	E		E	E	E	E	E
December 2006	E	E	E	E	E	E	E	E	E	E	E	E		E	E	E	E	E
January 2007	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
February 2007	E	E	E	S	E	S	E	t	E	E	E	E	E	E	E	E	E	E
March 2007	E	E	E	S	t	S	E	t	E	E	E	E	E	E	E	E	E	E
April 2007	E	E	E	t	t	S	E	t	E	E	E	E	E	E	E	E	E	E
May 2007	E	E	E	t	t	t	S	t	E	E	E	E	E	E	E	E	E	S
June 2007	E	E	E	t	t	t	t	t	E	E	S	E	E	E	E	E	E	S
July 2007	E	E	t	t	t	t	t	t	E	E	t	S	S	S	S	E	E	S
August 2007	E	E	t	t	t	t	t	t	E	S	t	S	t	t	t	S	E	t
September 2007	S	E	t	t	t	t	t	t	S	t	t	t	t	t	t	t	E	t
October 2007	t	E	t	t	t	t	t	t	S	t	t	t	t	t	t	t	S	t
November 2007	t	S	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t
December 2007	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t

Remarks:

E means earthworks (vulnerable to silty runoff and dust generation)

S means sand capping (less vulnerable to silty runoff and dust generation)

t means Planting with Turf

Air Quality

- 3.1.2 Summary of graphical presentation for 24-hr TSP measured at GCA B1 during the construction phase is presented in **Annex E**.

Water Quality

- 3.1.3 Summary of graphical presentation for water quality monitored at (i) nine marine water monitoring stations include fish culture zones (TTC, KLW, KS), impact stations (M_RO1, M_Marsh, M_Coral and M_BP) and control (M_A and M_B) and (ii) seven fresh water monitoring stations include Streams A, B, C (F_UA, F_DA, F_UB, F_DB, F_UC and F_DC) and downstream of Fresh Water Inland Marsh (F_Inland M) during the construction phase is presented in **Annex E**.

Ecology

- 3.1.4 Baseline conditions of (i) Streams A, B, C & D, (ii) tagged corals at Site B2, Site C and Control Site and (iii) transplanted corals recorded in December 2005 and after golf course / desalination plant construction are presented in **Annex E**.

Landscape and Visual

- 3.1.5 Summary of the site audit results for the landscape and visual is presented in **Annex E**. The compensatory tree planting is still on-going at East Course.

Archaeology

- 3.1.6 Summary of the (i) watching brief monitoring results at Hole 2, Hole 11, Hole 12, Hole 14, Hole 15 & Hole 16 and (ii) cartographic and photographic survey of Grave no.20 are summarized in **Annex E**.

Land Contamination

- 3.1.7 Summary of land contamination site investigation, assessment report and remediation action plan is presented in **Annex E**.

3.2 Weather conditions

- 3.2.1 According to the Hong Kong Observatory record, 19 days of rainstorm events were hoisted on 24 April 2006, 28 April 2006, 2 May 2006, 3 May 2006, 2 June 2006, 9 June 2006, 13 June 2006, 8 Jul 2006, 16 July 2006, 10 August 2006, 9 September 2006, 13 September 2006, 21 November 2006, 24 April 2007, 19 May 2007, 10 June 2007, 28 June 2007, 6 August 2007 and 22 August 2007 during the construction phase. There are 63% and 37% are dry days and wet days respectively. In most of the cases, the total daily rainfall records were less than 40 mm (88%).

3.3 Other factors might affect the monitoring results

- 3.3.1 The construction site is confined within Kau Sai Chau adjacent to the existing golf courses. There is no other major construction activity being carried out near to the construction site during the construction phase.

4. Summary of Environmental Quality Performance

- 4.1.1 Non-compliance (exceedances) for air quality and water quality are identified during the construction phase. Summary of action and limit levels exceedances are shown in this section.

Air Quality

- 4.1.2 There are 7 action levels (4 April 2006, 1 November 2006, 10 November 2006, 2 February 2007, 14 February 2007, 13 April 2007, 18 May 2007) and 1 limit level (2 April 2007) exceedances of 24-hour TSP recorded at the GCA B1.

Water Quality

- 4.1.3 The action and limit levels exceedances of dissolved oxygen (DO), pH, turbidity, suspended solids (SS) exceedances for marine and fresh water monitoring stations are summarized in **Tables 4.1 and 4.2.**

Table 4.1 Summary of Action and Limit Level Exceedance (Marine Water – In situ)

Monitoring Station	No. of Exceedances of Action Level (AL) and Limit Level (LL)								
	DO (Surface & Middle)		DO (Bottom)		pH	Turbidity		SS	
	AL	LL	AL	LL	AL/LL	AL	LL	AL	LL
Total no. of water sample taken during construction phase = 994									
M RO1	0	0	0	0	0	3	2	7	1
KLW	6	1	2	0	0	2	1	20	7
M Marsh	0	0	1	1	0	8	13	11	11
TTC	7	1	2	0	0	8	4	18	13
M BP	0	0	0	0	0	4	5	7	5
M Coral	0	0	0	0	0	6	0	8	0
KS	6	0	0	0	0	2	0	17	6
Sub-total	19	2	5	1	0	33	25	88	43
Project-related	0	0	0	0	0	10	22	13	26
Non Project-related	19	2	5	1	0	23	3	75	17

Table 4.2 Summary of Action and Limit Level Exceedance (Fresh Water – In situ)

Monitoring Station	No. of Exceedances of Action Level (AL) and Limit Level (LL)						
	DO		pH	Turbidity		SS	
Total no. of water sample taken during construction phase = 858							
	AL	LL	AL/LL	AL	LL	AL	LL
F_DA	1	0	1	19	60	26	43
F_UB	0	0	0	19	49	31	25
F_DB	0	0	0	9	62	40	36
F_UC	0	0	21	4	47	13	26
F_DC	0	0	0	7	43	21	26
F_Inland M	2	1	1	6	71	22	40
Sub-total	3	1	23	64	332	153	196
Project-related	1	1	2	32	263	84	170
Non Project-related	2	0	21	32	69	69	26

- 4.1.4 The action and limit levels exceedances of ammonia nitrogen (NH₃-N), nitrate nitrogen (NO₃-N), nitrite nitrogen (NO₂-N), total inorganic nitrogen (TIN), total phosphorus (TP) and chlorophyll a (Chl a) exceedances for marine and fresh water monitoring stations are summarized in **Tables 4.3 and 4.4**.

Table 4.3 Summary of Action and Limit Level Exceedance (Marine Water - Nutrient)

Monitoring Station	No. of Exceedances of Action Level (AL) and Limit Level (LL)										
	NH ₃ -N		NO ₃ -N		NO ₂ -N		TIN		TP	Chl a	
Total no. of water sample taken during construction phase = 278											
	AL	LL	AL	LL	AL	LL	AL	LL	LL	AL	LL
M Marsh	0	17	0	4	1	0	5	1	0	6	2
TTC	9	33	1	3	0	0	3	3	0	6	29
M BP	0	11	0	1	0	0	1	0	0	6	0
M Coral	0	2	0	1	0	0	0	0	0	2	0
KS	3	6	3	0	0	0	0	2	0	3	10
Sub-total	12	69	4	9	1	0	9	6	0	23	41
Project-related	0	0	0	2	0	0	1	1	0	0	0
Non Project-related	12	69	4	7	1	0	8	5	0	23	41

Table 4.4 Summary of Action and Limit Level Exceedance (Fresh Water - Nutrient)

Monitoring Station	No. of Exceedances of Action Level (AL) and Limit Level (LL)								
	NH ₃ -N	NO ₃ -N	NO ₂ -N	TIN		TP	Chl a		
Total no. of water sample taken during construction phase = 193									
	LL	AL	LL	LL	AL	LL	LL	AL	LL
F DA	5	4	8	1	2	8	1	4	6
F UB	6	2	17	2	0	18	2	0	6
F DB	8	2	23	2	2	22	2	1	9
F UC	6	4	10	3	1	11	2	3	8
F DC	4	2	16	0	1	16	2	1	7
F Inland M	52	2	68	23	1	69	1	3	41
Sub-total	81	16	142	31	7	144	10	12	77
Project-related	40	2	59	13	1	63	1	2	41
Non Project-related	41	14	83	18	6	81	9	10	36

Ecology

- 4.1.5 Apart from the accidental vegetation clearance of part of the buffer zone at Streams B and C, all of the identified sensitive streams are protected. Stream C was heavily silted after the wet season 2007 and extremely low abundance of Caridian shrimps was recorded since June 2007. Fortunately, the ecological surveys were observed a few of them since November 2007.
- 4.1.6 Most of the corals were recovered at Site B2, Site C and Control Site after two-year monitoring. Mortality from natural causes (such as bleaching, wave action damages and sediments from wave actions) is common in coral communities. Losses of tagged corals were recorded which could be due to the strong wave actions during typhoon weather. Wave actions could able to disturb seabed sediment covering some coral colonies, which might case mortality on isolated colonies at Site B2.

- 4.1.7 89 corals were identified at the footprint of desalination plant pipelines and transplanted to the bedrock near Site D2 (south of the existing KSC pier). Among the 89 transplanted corals, 86 colonies were recovered after one year quarterly monitoring (corals Nos. 68, 71, and 81 were found missing). Some transplanted colonies were found with a certain degree of mortality, but no sedimentation or bleaching was found. Mortality is not considered project-related. The corals remained similar with the baseline conditions during the transplantation survey.

4.1 Review of Reasons for the Non-compliance and Action Taken

- 4.1.1 Revised construction programme was submitted by the Contractor in January and February 2006. ET commented on the revised programme which indicated that major earthwork would be carried out during the wet season. Large proportion of area (cut-and-fill) would be exposed during the wet season and the area was significantly more than recommended in the EIA report (around one third of exposed area during construction). It was vulnerable to heavy rain and very likely to induce nuisance (e.g. silty runoff) to the fisherman and nearby marine sensitive receivers. It was also susceptible to wind erosion and causing dust nuisance to air sensitive receiver. In addition, turf establishment was concentrated within short period of time which might cause potential nutrients and pesticides runoff when the closed low flow drainage system was not yet completed.
- 4.1.2 Referring to **Tables 3.1 and 3.2**, actual exposed earth area was increased from 30% to more than 60% during April to September 2006 (wet season). Most of the construction areas were exposed during October 2006 to March 2007 (dry season). According to site record, mitigation measures provided on site were insufficient to control the dust generation and silty runoff. The exceedances records on air and water quality revealed that the open up areas were too extensive leading to implemented mitigation measures could not effectively minimize the impacts to the environment.

Air Quality

Dust Nuisance

- 4.1.3 Once the air quality monitoring result exceeded the action / limit level, additional 24-hr TSP sample was taken in according to the EM&A manual (Event and Action Plan). ET had further discussed with HKJC, RE and IEC in order to minimize the dust nuisance to the environment and nearby golfers. ET recommended the Contractor to provide more frequent watering at all major haul roads and during the rock breaking activities. In addition, ET also recommended the Contractor to pave the major haul roads with hard surface.
- 4.1.4 According to the weekly site audit report and monitoring results, the dust suppression measures provided on site during rock breaking, earth moving activities and major haul roads were considered insufficient leading to dust nuisance. There were two known available water sources for dust suppression, (i) downstream of fresh water inland marsh and (ii) water supply from existing golf course during night time. HKJC allowed the Contractor to use water from both water sources. The Contractor started to pump the water directly at downstream of the fresh water inland marsh since September 2006 to April 2007 for watering at haul road. However, there was no formal record regarding the quantity of water usage from existing golf course during night time. In addition, the Contractor reported that water supply from WSD could also be used for dust suppression during site progress meeting but no usage record was received. HKJC repeatedly reminded the Contractor to explore all possible water sources to minimize the dust nuisance during site progress meetings.

- 4.1.5 In order to minimize dust nuisance to the nearby golfers, hoarding were installed at some critical part of the site boundary in March 2006. Wheel wash facility was provided at the main entrance/exit in January 2007 after one year of construction phase commencement.

Water Quality

Silty Runoff

- 4.1.6 Exceedances on water quality were mainly recorded at fresh water and marine monitoring stations during the two wet seasons in 2006 and 2007. EPD had issued a letter dated 28th April 2006 to the Contractor regarding the water quality preliminary results on 24th April 2006 indicating exceedance on water quality on both fresh water and marine bodies. EPD concluded that the previous implemented measures by the Contractor were not sufficient to prevent silty runoff. There was a need to review the effectiveness of existing measures and further mitigation measures in order to prevent similar incident from occurring in the future.
- 4.1.7 EPD also advised the Contractor to take all necessary actions to rectify the situation so as not to contravene the statutory requirements under the EIAO. In relation to the potential adverse water quality impact, the Contractor should pay particular attention to the latter part of EP Condition 3.2 of the Project.
- 4.1.8 HKJC, RE and ET had urged the Contractor to submit the Temporary Drainage Management Plan (TDMP) for RE approval and implement the temporary drainage on site before wet season 2006 in order to minimize silty runoff to nearby sensitive receivers. After the silty runoff incident occurred in April 2006, enhancement of silty runoff mitigation measures including desilting basins, silt fence and silt curtains were provided on site.
- 4.1.9 ET repeatedly reminded the Contractor during every routine site audit to strengthen the silt fence along the site boundary, in particular low lying areas, with proper maintenance, provide cut-off drain to divert the natural runoff in order to minimize the mixing of contaminated water within the construction site, open up the construction area (vegetation clearance) only when construction work require, operate the desilting facilities during rain before discharge and cover up the soil stockpiles by tarpaulin or hydroseeds. However, the implementation of the mitigation measures was considered insufficient and ineffective to minimize the silty runoff and exceedances were still recorded at fresh water and marine water throughout the wet seasons in 2006 and 2007.

Contractor's Temporary Sewage Treatment Plant

- 4.1.10 Long-term nutrient exceedances was recorded at the downstream of fresh water inland marsh since February 2007. As agreed with HKJC, a joint sampling with ET and the Contractor was carried out on 16th April 2006 and water sample was collected at the effluent discharge outlet of the temporary sewage treatment plant near to the Contractor's site office. High level of ammonia nitrogen was recorded at 287 mg/L (exceeds the required standard of the discharge licence, 20 mg/L). Sight exceedance of suspended solids was recorded at 32 mg/L (exceeds the required standard of the discharge licence, 30 mg/L). The nitrate nitrogen and nitrite nitrogen were undetectable which indicated that there was neither nitrification nor de-nitrification process of the plant. RE immediately requested the Contractor to stop the plant to avoid any hazard to the public and environment (directly discharge to fresh water inland marsh) until the plant can perform according to the EPD's discharge licence.
- 4.1.11 High concentrations of ammonia nitrogen (286 mg/L), biochemical oxygen demand (134 mg/L) and *E. coli* (9,600,000 cfu/100mL) were still recorded on 12th May 2007 and all concentrations exceeded the EPD's discharge licence requirement. ET and IEC recommended the Contractor

to dispose the contaminated water properly offsite by a licenced Contractor offsite until the sewage treatment plant was rectified. Temporary storage tank was installed on 5th May 2007 in order to prevent direct discharge of contaminated water to the fresh water inland marsh as the interim mitigation measure until the Contractor repair and resume the sewage treatment plant.

- 4.1.12 It is, therefore, confirmed that the cause of the nutrient exceedances at the downstream of fresh water inland marsh since February 2007 was due to the poor performance of the Contractor's temporary sewage treatment plant.
- 4.1.13 HKJC, ET and IEC requested the Contractor to provide evidence to proof the performance of the STP and comply with the discharge licence before directly discharge to fresh water inland marsh. However, no information was submitted by the Contractor until the removal of the sewage treatment plant in December 2007.

Terrestrial Ecology

Stream A: Fill up with Rubble

- 4.1.14 During the monitoring survey carried out in June 2006, the main stream course of Stream A (the section downstream to the confluence of tributaries A1 and A2) was found to be filled up by rubble to the level of the weir at its downstream end. The rubble was reported to be washed down from the upper Tributary A2 which was under pipe culvert construction. Although the riparian vegetation was not affected by the rubbles, this section of stream channel was temporarily lost. HKJC required the Contractor to carry out remedial works in order to clear out all of the rubble and restore the channel as the baseline condition of Stream A.
- 4.1.15 Stream A was reinstated by the Contractor (without heavy equipment entering buffer zone) in November 2006. However, rubble from Hole 17 was washed into the downstream A again after the reinstatement. Downstream A was reinstated in December 2006.
- 4.1.16 The third incident of rubble filling at downstream of Stream A was occurred on 3rd July 2007 after rain. Downstream A was reinstated in August 2007. However, there was still some rubble sitting on the stream bed of the downstream of Stream A in December 2007.
- 4.1.17 A join site visit with HKJC, RE, ET and Contractor was carried out in 5th February 2008 and agreed that some minor works needed to be done underneath to the bridge section. Most of the Stream A is reinstated.

Stream A: Buffer Zone Intrusion

- 4.1.18 Regarding the site inspection carried out by EPD with the Contractor Representative on 19th May 2006 and 5th June 2006, EPD noted that some encroachment of personnel and equipment was found in the buffer zones of Stream A. EPD would like to draw particular attention to EP condition 3.4. IEC carried out site investigation with ET on 15th June 2006. Observation revealed that rock filling materials were found at downstream of Stream A. A portion of the rock filling material was lying within the buffer zone of Stream A and access roads were built in early June 2006. It was evidence that there had been site activities carried out within the buffer zone area of Stream A in wet season (April to October).
- 4.1.19 IEC held a meeting immediately with HKJC, Contractor and ET after the site investigation. It was learn that the concrete paved access road was constructed in order to connect to the temporary bridge at Stream A. The purpose of the paved haul road was to minimize the silty runoff to Stream A. HKJC, RE, ET and IEC reminded the Contractor to strictly follow the EP condition and avoid same incident occurred in future.

Stream B: Buffer Zone Intrusion

- 4.1.20 An environmental site audit was carried out on 7th November 2006, a backhoe was observed and working (vegetation clearance) within the buffer zone of Stream B2. ET notified the RE and Contractor once the incidence happened, the work was stopped by the Contractor immediately. According to the site investigation on 10th November 2006, the area of the vegetation clearance area was about 45 m² (3 m x 15 m) within the buffer zone of Stream B2. ET recommended the Contractor to post up warning signage along all three buffer zones to clearly demonstrate entries to buffer zones are prohibited to avoid similar incident occurred again.
- 4.1.21 A meeting was arranged with the HKJC, ET, Contractor, RE and IEC on 14th November 2006. The incident report, mitigation measures and proposed remediation work were prepared by the Contractor and submitted to EPD in November 2006.
- 4.1.22 A letter was issued by EPD to HKJC on 12th December 2006 and advised the HKJC to pay particular attention to the EP condition 3.4 and take all necessary actions so as not to contravene the statutory requirements under the EIAO. When there is any require work to be carried out with in the buffer zone, a variation of EP may be required. ET requested the Contractor to prepare a detail mitigation work programme for comments and get approval from RE and HKJC before carrying out any mitigation work within the buffer zone on site.
- 4.1.23 ET has commented on the mitigation work proposal in mid-December 2006 and the Contractor submitted the revised proposal in March 2007. Reinstatement work at Stream B2 buffer zone was carried out in March 2007 by planting native shrub (including *Gordonia axillaries*, *Melastoma candidum*, *Melastoma sanguineum*, *Rhaphiolepis indica*, *Rhodomyrtus tomentosa*) with approximate 400 mm height at four plots per metre square density. The Contractor was reminded to keep the reinstated area in good and healthy condition for the established plants.

Stream C: Buffer Zone Intrusion

- 4.1.24 Buffer zone intrusion at Stream C near Hole 16 tee was recorded during the construction of the permanent drainage in May 2007. Incident report (intrusion due to construction of permanent drainage system) was prepared and submitted by the Contractor in June 2007. Stream C buffer zone was reinstated by planting native shrub in June 2007 which was similar to Stream B2. The Contractor was reminded to water frequently at the reinstated areas of Streams B and C. The Contractor was reminded to keep the reinstated area in good and healthy condition for the established plants.

Streams B & C: Low Abundance of Caridian Shrimp

- 4.1.25 Heavy silty runoff was recorded on 22nd November 2006 at all Streams in particular Stream C (suspended solids of impact monitoring stations of Stream A, B and C were 130 mg/L, 49 mg/L & 836 mg/L respectively) and fresh water inland marsh (Suspended solids was 393 mg/L). Streams B & C were accumulated by sediment throughout the wet season of 2007.
- 4.1.26 Very low abundances of aquatic fauna, in particular Caridian shrimps, were recorded since June 2007. However, few of them were observed at Streams B & C since November 2007.

Marine Ecology

Coral Damage at Temporary Barging Point during Construction

- 4.1.27 Coral surveys were conducted on 23rd and 25th March 2006 at Site B2, Site C and Control Site during the construction of the rock-filled pier (temporary barging point) at East side of Kau Sai Chau). The survey results revealed that some boulders and sand were found outside the seawall block and some tagged corals were damaged due to the construction work. Among the 20 tagged corals, 6 of them had more obvious damages, while another two tagged corals had minor damages. Site C and the Control Site still remained similar conditions as during the Baseline Survey. No mortality, sedimentation or bleaching was found on the tagged corals in these two sites.
- 4.1.28 ET has informed and submitted the coral damage assessment report, incident report and proposed remedial work plan to EPD, AFCD, HKJC, RE and IEC. Additional coral monitoring at temporary barging point in terms of numbers, frequency and proposed remediation work are also proposed by ET after the incident for EPD and AFCD comments. Extension of three monthly coral surveys was required and carried out by ET in April, May and June 2006 in addition to the EM&A requirement. More corals were required to be monitored at Site B2 (temporary barging point), from 20 numbers to 50 numbers, throughout the construction phase of this Project.
- 4.1.29 The Contractor submitted the ecological remedial plan for the temporary barging point in July 2006 to EPD and AFCD for comments. The repaired corals were required to monitor on quarterly basis for a year in addition to the coral repair, boulder removal, sedimentation removal and site management. The one-year repair coral survey, coral repair work and boulder removal work were completed and submitted to EPD and AFCD for record.
- 4.1.30 As suggested by AFCD, additional coral surveys at the temporary barging point was required to avoid similar incident from occurring again as an addition protection measure to protect the coral along the shore during the removal period.
- 4.1.31 ET had provided comments on the proposed removal work in December 2007 and submitted to EPD and AFCD for further comments. They are summarized as follows:
- i. The flat barge will be berthed near to the pier for most of the time during the temporary barging point removal. We are concerned that the coral communities might be damaged during low-tide. ET suggested that the flat barge is not allowed to berth when low-tide. The Contractor should record and check the tide condition during whole period of removal.
 - ii. The flat barge should be properly enclosed along the three sides to prevent any object falling into the sea during loading of excavated material.
 - iii. ET recommended that silt curtain should also be provided during Stage 2 to prevent any silty water infiltrate through the seawall blocks to the nearby coral communities.
 - iv. ET concerned that the removal of all seawall blocks during Stage 3. Removal of all the seawall blocks at once would cause the unstable filling materials rolling/sliding by water current and lead to potential damage to the nearby coral communities. ET suggested that the Contractor to review the seawall blocks removal sequence and retain them until the final stage of the removal.

- v. ET suggested that Contractor should install the silt curtain away from the nearby coral communities. The silt curtain installed location should be checked by coral specialist in order to prevent any damage to the nearby coral communities.
- 4.1.32 The proposed temporary barging point removal programme is around one month. AFCD agreed the proposed coral monitoring (during the first, third and fifth weeks) at the temporary barging point removal in order to cover the whole removal period. If there is an extension of the removal programme due to any coral damage, further review on the coral monitoring frequency is required and will be submitted for AFCD and EPD approval.
- 4.1.33 In addition to ET's comments, AFCD requires the Contractor to submit event action plan including appropriate mitigation measures and remedial actions in case coral damage occurred during the removal period before commencement of the removal works.
- 4.1.34 AFCD commented on the revised removal programme and event and action plan submitted by the Contractor on 1st February 2008, they are (i) the Contractor should provide coral specialist during the installation of the silt curtain in order to avoid any damage to the nearby coral communities and (ii) the Contractor should clarify the removal work will be carried out during adverse weather or not. The Contractor agreed that coral specialist will be provided during silt curtain installation and no removal work will be carried out at the temporary barging point during adverse weather.
- 4.1.35 The original removal programme submitted by the Contractor was on 16th January 2008. According to the revised programme, the removal programme of temporary barging point will be delayed to 12th February 2008.
- 4.1.36 As the post construction phase impact monitoring was completed by the end of January 2008. ET and IEC responsibilities and duties will also be terminated in January 2008. Therefore, the removal progress and coral monitoring survey findings will NOT be included in this final report. However, all related reports will be submitted to EPD and AFCD separately for comments under this Project.

5. Summary of Complaints / Summon Notifications

Air Quality

- 5.1.1 For the construction dust generated from the construction site to nearby sensitive receivers (public/golfers), EPD formally issued "Yellow Form" to the Contractor on 30th March 2006 after the site inspection on 10th March 2006. EPD carried out routine site inspections and gave verbal warnings to the Contractor on (i) dust generation from dusty stockpiles and vehicles at major haul roads and (ii) insufficient installation of hoarding at the main exit/entrance according to the Air Pollution Control Ordinance (APCO) after the site inspection. However, the progress of the dust suppression mitigation measures provided on site was slow. EPD did the site investigation on 15th January 2007 and issued "Pink Form" to the Contractor on 17th January 2007 (Reference no. L/M to EP/AC/11/5000/40032) under the APCO. The non-compliance is due to carrying out notifiable work not in accordance with the Schedule of the APCO (Construction Dust) Regulation (Schedule no.14).
- 5.1.2 One environmental complaint was received from golfers to HKJC on 6th September 2006 regarding the dust generation from the construction site. A follow up site investigation report and further mitigation measures were submitted to EPD for comments. According to the air quality monitoring results (24-hour TSP) for September to early October 2006 indicated significant increasing trend of dust generated from the construction site. The monitoring results correlated with the weekly site observation. The site inspection revealed that haul road (vehicle movement) and rock breaking activities were major dust emission sources. The Contractor was repeatedly reminded to provide sufficient dust suppression mitigation measure to minimize the dust impacts such as provide more water trucks, watering haul road more frequently and pave the haul roads. HKJC and RE also repeatedly urged and requested the Contractor to provide more dust suppression mitigation measures to reduce dust nuisance to the nearby golfers and staffs.
- 5.1.3 A second "Pink Form" was issued by EPD to the Contractor on 7th May 2007 (Reference no. L/M to EP/AC/11/5000/40032(2)) under the APCO. The non-compliance is due to carrying out notifiable work not in accordance with the Schedule of the APCO (Construction Dust) Regulation (Schedule no.14 and 22).
- 5.1.4 A second environmental complaint was received from golfers to the HKJC on September 2007 regarding the dust generation from the construction site at Hole 1 to the existing golf course. The Contractor was reminded to provide dust suppression mitigation measures to prevent dust generation due to wind erosion from the dusty stockpiles. Three times (3rd, 9th and 12th October 2007) site investigation were carried out by ET. Additional mitigation measures (eg. watering sand stockpile and operation of irrigation system) were observed and no mentioned problem was found. The Contractor was reminded to provide sufficient watering or other equivalent measures to minimize dust nuisance from haul roads, stockpiles and other activities that may generate dust. It was concluded that the Contractor did not provided sufficient mitigation measures to avoid causing dust nuisance from the works area.

Water Quality

- 5.1.5 A compliant letter was issued from the fish pond holder (Tiu Cham Wan) to the Contractor on 11th March 2006. One of their concerns was on the water quality that the construction activities may potentially pollute the water quality within their fish pond area. ET reminded the Contractor to modify the haul road to minimize the potential silty runoff and progress had been made by the Contractor in April 2006 (provision of paved haul road with site drainage). ET further recommended the Contractor to install sufficient temporary drainage before wet season. Weekly site audit and water quality monitoring was routinely carried out in January and February 2006. No non-compliance was recorded. In addition, on-site observation revealed that no evidence of fish culture activity in the mentioned area.
- 5.1.6 One environmental complaint was received in June 2006. Tai Tau Chau fish farmers expressed their concern about the silty runoff from the construction site and fish death issues to HKJC on 2nd June 2006 afternoon after the rainstorm event. Site investigation was carried out on 2nd June 2006 at Tai Tau Chau fish farm with ET, HKJC and the Contractor in the afternoon. Further site investigations on the water quality and cause of fish death were carried out by AFCD, EPD and loss adjustor (Contractor) between 2nd and 5th June 2006. Kai Lung Wai fish farmers also raised their concern on the fish death on 3rd June 2006. Further site investigations on the water quality and fish death were carried out by AFCD, HKJC and loss adjustor (Contractor) between 3rd and 5th June 2006. The investigation report on the cause of the fish death was confirmed that silty runoff from the construction site to Tai Tau Chau fish farms after heavy rainstorm events was one of the major reasons.
- 5.1.7 According to the EPD's record, the Contractor was convicted for breaching the Water Pollution Control Ordinance (WPCO) and fined \$50,000 in November 2006. The main reason for the prosecution was due to the active pumping/discharge of silty water from the construction site of desalination plant directly into Port Shelter Water Control Zone (WCZ) without provision of proper water treatment facilities on site for treatment to ensure that the water quality complied within Water Quality Objectives (WQO) of Port Shelter before discharge on 12th June 2006.

6. Validity of EIA prediction, Shortcomings in EIA and Comments

6.1.1 The EIA report develops validity predictions/recommendations on different aspects including air quality, water quality, ecology, landscape and visual, archaeology and land contamination during the construction and operation phases of this Project. The implementation schedule is shown in **Annex D** and used as useful tools to monitor the construction site during site audit. However, some shortcomings in EIA recommendations were identified. A review of the effectiveness and efficiency of the mitigation measures and performance of the environmental management system (overall EM&A programme) are summarized in **Table 6.1**.

Table 6.1 Overall Performances of Mitigation Measures and EM&A Performance

EIA predictions / shortcomings / recommendations	Review of effectiveness and efficiency of mitigation measures	Performance of EM&A programme
<u>Air Quality</u> Appropriate dust control measures should be implemented during construction stage in accordance with the requirements in the <i>Air Pollution Control (Construction Dust) Regulation</i>. Dust control techniques should be considered to control dust to a level not exceeding the AQOs as well as the 1-hour TSP guideline level. These measures include: • Adoption of good site practices; • Avoid practices likely to raise dust level; • Frequent cleaning and damping down of stockpiles, dusty areas of the Site and the haul roads; • Reduce the speed of the vehicles (say 10 kph) on the haul road; • Reducing drop height during material handling; • Provision of wheel-washing facilities for Site vehicles leaving the Site; • Regular plant maintenance to minimize exhaust emission; • Sweep up dust and debris at the end of each shift; and • If concrete batching plant or rock crushing plant is planned to be used, a license from EPD may be required depending on the total silo capacity since they are specified processes under the APCO. Modern plant should be designed to limit emissions. EIA report assumes that all mitigation measures will be implemented on site before any impact arises. With the	According to the site observations and records throughout the construction phase, major dust suppression measures provided on site were watering and paving at the major haul roads. Due to the extensive exposure of bare earth during construction phase without provision of sufficient dust suppression measures, dust generation from dusty stockpiles, high traffic haul roads, earth moving activities and rock breaking activities were frequently observed. The Contractor did not implement effective dust suppression measures at early stage of the construction phase. The insufficient and ineffectively implemented mitigation measures which causing dust nuisance to the environment and nearby golfers. The dust impact from the construction site was confirmed by the air quality monitoring data and site audit records. Some dust suppression mitigation measures were provided even at very late stage of construction phase (hoarding, wheel wash facilities etc).	EM&A programme provide comprehensive air quality data (24-hr TSP) during the construction phase to evaluate the actual site condition. Exceedances were recorded during the construction phase. Once exceedance is found, event and action plan will be followed in order to notify all relevant parties, minimize the impacts, rectify the situation and avoid the incident occurred in future again. Due to the insufficient dust suppression measures provided on site, dust generation was still frequently observed to the environment and nearby golfers.

EIA predictions / shortcomings / recommendations	Review of effectiveness and efficiency of mitigation measures	Performance of EM&A programme
implementation of all recommended mitigation measures, it should be sufficient to maintain the air quality within acceptable impact level.		
<u>Water Quality</u> Key mitigation measures recommended during the construction phase are shown as follows: - Proposed 18-hole Golf Course Layout Design – buffer zone at streams; - Run-off and Drainage Management – silty and turf establishment run-off; - Concrete bridge construction; - Dredging during construction of desalination plant's intake and outfall; - General construction activities; - On-Site Sewage Effluents; and - Concrete batching plant. Key mitigation measures recommended during the operation phase are shown as follows: - Chemicals and Pesticides Run-off (closed low flow drainage system); and - Hole 5 and part of Hole 6 – Filter system and biopesticides. With the implementation of all recommended mitigation measures, it should be sufficient to maintain the water quality within acceptable impact level. EIA report assumes that all mitigation measures will be implemented on site before any impact arises. However, the Contractor did not implement at early stage.	It is stated clearly in EIA report that it is very critical to manage the stormwater run-off during the construction phase. In according to the EIA report, the golf holes are constructed sequentially into three groups (southernmost - Holes 11 to 16, northernmost - Holes 3 to 9 and central - Holes 1 to 2, 10, 17 to 18). Maximum two holes are recommended to be worked simultaneously for each group for cut-and-fill works. However, earthworks were conducted throughout the wet seasons of 2006 and 2007 due to the limitation of tight construction programme. More than 60% area was exposed without provision of sufficient silty runoff mitigation measures leading to silty runoff. In addition to the construction programme as one of management control to the silty runoff, proposed erosion control measures in the EIA report which will be accomplished through one or more several means, including (but not limit to): sedimentation tanks, silt fences, sand bags, porous pipe, hydroseeding; erosion control fabrics and mats; and temporary sedimentation basins. As recommended in the EIA report, a temporary drainage system have to fulfill the following purposes: (i) minimize the stormwater flow entering the works areas during construction; (ii) prevention of any polluted run-off to existing streams and marine waters; and (iii) recycle, reuse and recirculation of run-off for irrigation use. The Contractor implemented some recommended mitigation measures to prevent silty runoff but silty runoff was still observed and recorded	EM&A programme provide comprehensive water quality data during the construction phase to evaluate the actual condition at streams and marine water. Exceedances were recorded during the construction phase. Once exceedance is found, event and action plan will be followed in order to notify all relevant parties, minimize the impacts, rectify the situation and avoid the incident occurred in future again. Due to the slow progress of rectification work and improvement on the implemented temporary drainage system, silty runoff was still frequently recorded, in particular wet season.

EIA predictions / shortcomings / recommendations	Review of effectiveness and efficiency of mitigation measures	Performance of EM&A programme
	frequently at streams and marine water in particular wet season. Water quality monitoring data and site observation revealed that the implemented mitigation measures were ineffective and insufficient leading to silty runoff. Rectification and enhancement works at the vulnerable low lying areas was considered slow also leading to frequent silty runoff from construction site.	
<u>Terrestrial Ecology</u> Impacts to streams had been avoided during the design stage by designating buffer zones at all identified sensitive streams. Except at the crossings, there will be no direct disturbance to the stream bed. With the implementation of all recommended mitigation measures, all streams should remain intact during construction and operation phase.	There are several incidents occurred during the construction phase leading to different extend of stream disturbance. The Contractor has installed plastic orange fencing along the buffer zone at each stream when works approach. However, the site agent/worker did not acknowledge the importance of buffer zone and requirement in the EIA and EP which are prohibited and protected leading to stream disturbance incidents occurred. Provision of 20m buffer zone is an effectively mitigation measures to avoid disturbance to stream but the Contractor should also provide sufficient training and resources to their environmental and engineering teams in order to avoid the intrusion incident. Silty runoff to the Stream C leading to absent of the Caridina shrimp in June 2007 but were found but still in very low density since November 2007. The major cause was due to insufficient temporary drainage and cut off drains provided near to Stream C (Golf Hole 16).	EM&A programme provide comprehensive terrestrial ecology survey results during the construction phase to evaluate the actual condition at all protected streams and buffer zone. Exceedances were recorded during the construction phase. Once exceedance is found, event and action plan will be followed in order to notify all relevant parties, minimize the impacts, rectify the situation and avoid the incident occurred in future again. Repeated non-compliance records were due to the intrusion to the buffer zone and insufficient temporary drainage provided on site.
<u>Marine Ecology</u> Coral colonies within confined silt curtain area at Site D2 (79 colonies identified during the coral mapping survey) would be transplanted to the bedrock area about 80 m south of the existing KSC ferry pier during the EIA stage.	No dredging work for the desalination plant pipelines were carried out during the construction phase. The pipelines were constructed along the existing KSC pier (inland) in order to prevent the seabed disturbance and potential water quality impacts to the	EM&A programme provide comprehensive marine ecology survey results during the construction phase to evaluate the actual condition of coral communities and seagrass.

EIA predictions / shortcomings / recommendations	Review of effectiveness and efficiency of mitigation measures	Performance of EM&A programme
Dredging for the two pipelines (intake and discharge) for the desalination plant would require 50 days and would be scheduled to the extent possible from January to April 2006. This would avoid the flowering season for the seagrass <i>Halophila ovalis</i>, i.e. November and December (Fong <i>et al.</i> 2005) and the spawning season for corals, i.e. July to October (Lam 2000; Storlazzi, C. D. 2004). All anchoring points/structures of the floating pier would be located on the shore and/or at least 40m seaward to avoid the coral colonies at Site B2. The location of the floating pier would be shifted from the original location for barging point at Zone 2 and Zone 3 of the mapping area in Site B2 to Zone 5 which had the least corals (as specify in the EP).	environment. 89 coral colonies were identified and transplanted to the area about 80m away south of the existing KSC ferry pier before the commencement of testing and commissioning for the desalination plant. A rock-filled pier of the temporary barging point was constructed at Site B2. Coral damages were found during construction in March 2006. Frequent coral monitoring and more tagged corals at Site B2 were requested by AFCD in order to prevent further damage to the coral communities. AFCD also reminded the Contractor to pay attention during the operation and removal of the temporary barging point. The major cause for coral damage incident was due to the Contractor did not provide coral specialist / diver to identify the nearby coral communities during the design phase and construction of the temporary barging point.	Exceedances were recorded during the construction phase. Once exceedance is found, event and action plan will be followed in order to notify all relevant parties, minimize the impacts, rectify the situation and avoid the incident occurred in future again. The monitoring results revealed that no further coral damage was recorded after the coral damage incident occurred in March 2006.
<u>Landscape & Visual</u> In order to mitigate landscape and visual impacts, mitigation measures will be implemented. These can be categorised in the following groups: • Construction areas; • Tree planting; • Shrub and groundcover planting; • Engineering infrastructure: bridges, desalination plant, pumping stations and water tanks; and • Buildings: extensions of existing, halfway houses and rain shelters. To compensate loss of trees, a total of 42 trees will be transplanted and 967 trees (more than 3:1 ratio) will be planted on the new golf course (Appendix A12.1).	Major deficiencies on the implemented mitigation measures are shown as follows: Construction Areas - Vegetation: (i) <i>“Temporary construction sites shall be restored to standards as good as, or better than, the original condition. In this respect, areas that are not covered by golf course grassing works shall be hydro seeded”</i>. The site audit revealed that the quality of the hydroseedings was poor and insufficient water was provided. (ii) <i>“The potential for soil erosion shall be reduced at the construction stage by minimizing the extent of vegetation disturbance on site and providing a protective cover over exposed ground”</i>. The site audit revealed that hydroseedings were provided near to the completion of	EM&A programme provide comprehensive landscape and visual site audit during the construction phase to evaluate the actual condition of newly plants, transplanted trees, retained trees, constructed buildings and temporary structures conditions. Repeated non-compliance records were found during the construction phase. No rectification work had been carried out until the work completion. The following issues are still outstanding since June 2006: (i) Carry out surgery to damaged trees, (ii) Report the cause of death of tree T925, (iii) Re-fix the label of retained tree for easy identification, (iv) More frequent watering

EIA predictions / shortcomings / recommendations	Review of effectiveness and efficiency of mitigation measures	Performance of EM&A programme
	construction stage. (iii) <i>“No plant or building materials shall be stored under the dripline of retained trees and no vehicle movement or other construction activities like washing, concrete mixing etc shall be carried out under the dripline of trees”</i>. The site audit revealed that the Contractor did not rectify the situation and causing death and damage to the retain trees until completion of the adminstration building extension. Tree Preservation, Planting and Buffer Areas – Tree Preservation: (i) <i>“Transplant preparation works shall be carried as soon as possible after commencement of construction. Rootball and crown pruning shall be carried out over at least 1 month”</i>. The site audit revealed that transplantation preparation work is considered inappropriate.	for transplanted trees, planted vegetation and hydroseeded grass, (v) Rectify the mal-pruning practice of the transplanted trees; and (vi) Replace all trees and shrubs with poor quality.
<u>Archaeology</u> <i>Watching Brief</i> The project proponent should allow a flexibility to undertake the contingency arrangements. Should significant archaeological materials be discovered, appropriate mitigation measures will be designed and implemented by the project proponent. <i>Built Heritage</i> The following measures will be necessary to mitigate the adverse impacts arising from the proposed works during the construction phase; • A three metre fenced off buffer zone will be maintained around Grave #1 during the construction phase; • Graves #5 and #20 will be preserved by record. This will include a cartographic,	Watching Brief is carried out by ET which requires active communication with the Contractor regarding on the actual cut-and-fill progress at all concerned areas. All progress reports and final report were submitted to AMO and no further comment was received. No archaeological material was identified throughout the whole process. Grave #1 located at Hole 12 fairway was preserved and protected on site with three metre buffer zone. Grave #20 located at Hole 2 fairway was preserved by record. Cartographic, photographic and written record was submitted to AMO for approval. Grave #5 located at Hole 12 Tee was preserved on site instead of preserved	EM&A programme provide comprehensive watching brief programme during the construction. No non-compliance was recorded.

EIA predictions / shortcomings / recommendations	Review of effectiveness and efficiency of mitigation measures	Performance of EM&A programme
photographic and written record as well as a measured drawing to be undertaken prior to the commencement of site formation works. As well if AMO requires the retention of any historical structural elements associated with the grave, i.e. the plaque. The contractor will ensure the safe removal and transport of the material off the site; and For the northern coastal section of the Kap Lo Kok Study Area, it is recommended that if during the course of construction works, a grave is found that the AMO is contacted immediately and that works stop in the immediate vicinity of the grave until it can be inspected by AMO staff.	by record after revise golf course design.	
<u>Land contamination</u> Based on the preliminary site investigation results, the site area contains hotspots of contamination of lead and sulphur. The contamination levels of these hotspots should be further assessed during the construction stage with a proper implementation of the CAR and RAP. In addition, since the exact cut areas on site during construction by the Contractor have not been determined at this stage, the Contractor should implement the suitable precautions and preventive measures for the discovery of buried or abandoned ordnance during the construction. Moreover, it is recommended that standard good practice should be implemented during the construction phase in order to minimize any potential exposure to contaminated soils or groundwater.	CAP, CAR and RAP were submitted to EPD for approval before carrying out any on-site remedial work. Based on the further assessment, only Hotspots L3 (Hole 18) was found contaminated by lead. The contaminated soil was quantified and transferred from Hole 18 (cut area) to Hole 17 (fill area). The full scale remediation work was carried on 4th October 2006. A Final Site Remediation Report (FSRR) was submitted to EPD for approval. No further comment was received.	EM&A programme provide comprehensive assessment to identify the contaminated hotspots and provide effective method to remediate the contaminated soil during the construction. No non-compliance was recorded.

7. Recommendations and Conclusions

- 7.1.1 Apart from exceedances to the Action and Limit Levels on air quality and water quality, non-compliance on coral damage at temporary barging point and non-compliance on buffer zone intrusion and vegetation clearance, the environmental monitoring data collected during the construction period were generally in line with the prediction of the EIA Report.
- 7.1.2 Provision of buffer zone and pre-cast bridge construction are good successful examples to minimize the impact on sensitive stream. Works to be carried out in dry season within buffer zone as stated in EP can further minimize the potential impact. Long-term water quality exceedances were found, in particular wet season, which was mainly due to the failure and insufficiency of the temporary drainage implemented on site. It is important to note that a comprehensive, frequently update/review, highly maintain and effective temporary drainage system is the best management and practical tool to control silty runoff. Careful planning on bulky earthworks works programme is also the key success to control the silty runoff from construction site.
- 7.1.3 Kau Sai Chau is a relative remote Island, resources supply for environmental protection (such as desilting treatment plant, silt curtain, silt fences, tarpaulin etc) should be planned, implemented and properly stored on site during the construction phase. It is recommended that the Contractor should prepare and submit a comprehensive and site-specific environmental management plan to the client, RE and ET for comments before commencement of major earthwork for approval. This is an effective way to foresee the environmental problems and sort them out as soon as possible.
- 7.1.4 Temporary adverse impacts on air quality, water quality, terrestrial ecology and marine ecology were found after revealing two-year construction phase EM&A monitoring. It is also important to learn that the Contractor should follow all EIA recommendations, implemented mitigation measures before any work approach to environmental sensitive areas and modify/enhance mitigation measures due to the site constrain and conditions, if necessary in order to minimize and avoid any adverse impact to the environment.
- 7.1.5 According to the site inspection and site audit records, the Contractor was generally in compliance with environmental requirements except incidents causing buffer zone disturbance and coral damage at temporary barging point. However, the effectiveness and practicality of the mitigation measures provided by the Contractor were considered insufficient during the construction phase.
- 7.1.6 The original tentative construction programme for this Project was 18 months. Actual major golf course construction was completed in 24 months. Construction phase EM&A monitoring was terminated in December 2007. Post construction monitoring was completed in January 2008.