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EXECUTIVE SUMMARY

This is the Final Sedimentation Rate Monitoring Report prepared by Gammon – Skanska – MBEC Joint Venture for the Project "Hong Kong-Shenzhen Western Corridor". Majority of construction works were completed since January 2007. According to the Engineer Instruction No. 72, the sedimentation rate monitoring continued to June 2007.

This report summarizes the sedimentation rate monitoring performed in the period of the whole EM&A programme from November 2003 to June 2007. Sedimentation Rate Monitoring for all stations were carried out in a monthly basis except there were temporarily suspension for the period between February 2004 and March 2004 and between February 2006 and August 2006 due to the threat of avian flu in Mai Po.

Referring to the monitoring data in seven monitoring stations, there were no significant changes in the elevation levels of the seabed during the monitoring periods.

1. INTRODUCTION

Background

1.1 StarVision Limited and Gammon – Skanska MBEC Joint Venture (GSMJV) carried out a mudflat sedimentation rate monitoring near Hong Kong - Shenzhen Western Corridor (HK-SWC) and Mai Po, Deep Bay, Hong Kong in accordance with the approved Sedimentation Rate Monitoring Plan submitted under Condition 2.4 of the Environmental Permit (No. EP-162/2003/B).

1.2 The purpose of the sedimentation rate monitoring in Deep Bay is aimed to assess the effect of sedimentation (or deposition) and erosion rates in Deep Bay due to the reduction in flushing capacity with the presence of the proposed Hong Kong - Shenzhen Western Corridor bridge piers. The major construction period of the Project was 41 months from October 2003 to January 2007 and the monitoring period for sedimentation rate covered from November 2003 to June 2007.

1.3 The projects works mainly comprises highway route linking the proposed Deep Bay Link (DBL) to the Mainland, together with the fourth boundary crossing providing relief to the traffic congestion at the existing boundary crossings. The highway within the HKSAR waters is about 3.2 km in length and was connected to the portion of about 2km in length provided by the Shenzhen authorities. The landing location of the bridge in Shenzhen was located at Dongjiaotou. The highway was connected to Deep Bay Link on the Hong Kong side at Ngau Hom Shek.

2. PROJECT CHARACTERISTICS

Project Organization

2.1 The Project Proponent was Highways Department (HyD); the Engineer Representative (ER) was Ove Arup & Partners Hong Kong Limited; the Contractor was Gammon-Skanska-MBEC Joint Venture; the Independent Environmental Checker (IEC) was CH2M HILL Hong Kong Limited, and the ET was Maunsell Environmental Management Consultants Limited.

2.2 The responsibilities of respective parties are detailed in Section 1.5 of the EM&A Manual.

Construction Activities

2.3 The major construction work was commenced on 14 October 2003 and completed in January 2007.

2.4 The major components of this Project are listed below:

Land Portion:

- Site Clearance
- Pre-drilling
- Erection of site run-off treatment tank
- Erections, operation and demolition of concrete batching plant at Lung Kwu Sheung Tan
- Fabrication, erection and demolition of Temporary Access Bridge (TAB)
- Cofferdam construction
- Pile-cap construction
- Bored piling
- Column construction
- Abutment construction
- Erection of false of work for Bridge C construction
- Ngau Hom Shek E&M plant room construction
- Temporary piles and platform construction at wetland
- Cable duct construction, telecom cable duct, storm drain, watermain installation and road paving along Fung Kung Tsuen Road
- Road widening works at Fung Kung Tsuen Road, Ping Ha Road and Tin Wah Road
- Drainage work along Fung Kung Tsuen Road, from Deep Bay Road to Ngau Hom Shek Plant Room
- Bridge C construction
- Scaffold erection and base slab & top slab formwork for Northbound and Southbound of bridge C
- Utilities diversion
- E&M installation
- Mastic asphalt plant construction, operation and demolition
- Landscaping works
- CRE and Contractor site offices construction and demolition
- Erection of fencing
- Mangrove replanting
- Hoarding erection and demolition
- Sign gantry erection
- Viaduct road paving, waterproofing, final friction course and movement join installation
- Installation of vehicle parapet post and rail installation

Marine Portion

- Installation of marker buoys
- Erection and demolition of staging platforms, wing platforms and barge loading platforms
- Pre-drilling and bored-piling in the shallow and deep water region
- Erection of TAB
- Pile cap excavation and construction
- Cofferdam construction and cofferdam construction for dolphin works
- Dolphin construction
- Column construction
- Segment Erection
- Piers construction along TAB
- Cable-stayed Bridge foundations, main tower construction, back-spans and main span
- Steel segment erection, welding & sliding work and cable stay final erection

- Viaduct road paving, waterproofing, final friction course and movement join installation
- E&M installation
- Installation of precast skin and edge beam
- Installation of vehicle parapet post and rail installation
- Emergence closet construction
- Installation of edge plate at CSB
- TAB dismantling
- Sign gantry erection
- Under bridge inspection platform

3. ENVIRONMENTAL MONITORING METHODOLOGY

Monitoring Frequency and Locations

3.1 Seven monitoring stations as specified in Particular Specification Appendix M9 at Tsim Bei Tsui, Mai Po mudflat and Sha Kiu Tsuen were monitored. The monitoring locations were stated in Figure 1 – Monitoring Location of SRM.

The survey points for seven monitoring stations.

Table 1 Survey points for monitoring stations

Station Name	Northing (m)	Easting (m)
P1	**838619.000**	**819250.000**
P2	**838601.000**	**819415.000**
P3	**838942.000**	**820630.000**
P4	**839528.000**	**820880.000**
P5	**840301.000**	**821115.000**
P6	**838897.000**	**817938.000**
P7	**838923.000**	**817923.000**

3.2 The monitoring works were took place every month during the construction period. The best time to undertake the monitoring work were during the ebb tide.

Methodology

3.3 The hydrographic field survey was carried out to measure the seabed levels of the Mai Po and Inner Deep Bay inter-tidal mudflat at the specified sampling points. The survey mainly applied on RTK GPS surveying technology. The RTK technology was using real time differential GPS technology to survey 3D coordinates (X, Y, Z) of a survey point. When real time differential signal was not available due to surveying and environmental conditions, static GPS surveying would be carried out with equivalent or better accuracy but of longer operation time.

The base station was a survey control point directly derived or established from Lands Department, HKSAR. The control station was established at the helipad of Mai Po area. The rover GPS instrument was used for surveying as standard DGPS operation. If there is any problem in using RTK GPS and using the proposed surveying control point, higher precision but longer surveying time static GPS surveying technology with nearby survey control point would be employed. As static GPS using much more observation to increase the observation result, the precision is higher than RTK GPS surveying but it takes much longer time to finish one point. It was a costly approach in term of time when comparing the RTK GPS. Sometimes, both digital data logging and written records were collected in the field. Both readings were checked twice after surveying to ensure no error was in data booking.

The base station was set up with double checking procedure to ensure the coordinates derived or provided by Lands Department was correctly input into the base station. The antenna height of the base station was also double checked for the essential input of the base station. The height of the antenna of the rover was measured and entered into the system with double checking procedure. The rover was used to measure known points such as benchmark of Lands Department to check the accuracy of the

whole system during the measurement in surveying days. On top of this procedure, more than one survey record was measured at each required location and the mean of at least three records was taken for the final survey result. The survey was also calibrated in the field at the base station and the nearby predefined checkpoint before and after the survey. This was to eliminate any systematic error during the survey at particular environment and particular date under international surveying methodology.

All survey point was approached by using real time GPS measurement to the nearest 5m. If the RTK signal is available, the surveying team will get to the nearest point using stake out procedure. If the RTK signal is not available, the surveying team will approach to the nearest position using non-RTK GPS approach within 30m. Should RTK or non-RTK GPS signal is not available within the specific surveying month, levelling, which has higher accuracy and precision, will be used if nearby known benchmark is available.

4. MONITORING RESULTS AND COMPARISION TO EIA PREDICTION

4.1 Tabulate Presentation and Graphic Presentations of SRM monitoring results were listed in Appendix A and B respectively.

4.2 Monitoring data from November 2003 were neglected as a RTK GPS operator failed to confirm the length of probe embedded into mudflat. In view of this, the methodology was reviewed due to the site constrains of the monitoring locations. Starting from December 2003, marking was provided in the probe so as to ensure the length of probe embedded into mudflat was controlled and therefore making the monitoring results comparable.

4.3 The predicted average sedimentation rates in EIA report for the baseline scenario before commencement of the HK-SWC bridge construction (with the latest HK-SWC reclamation layout and without HK-SWC bridge) (stated as scenario 2 in EIA report) and Operational scenario (with the latest HK-SWC reclamation layout and with HK-SWC bridge) (stated as scenario 3 in EIA report) were tabulated below.

Table 2 Predicted Average Sedimentation Rates (mm/yr) in EIA Report

Indicator Point	Scenario 2	Scenario 3
Tsim Bei Tsui SSSI	**11.3**	**11.6**
Ramsar Site (North)	**28.5**	**28.5**
Ramsar Site (South)	**13.4**	**13.5**

4.4 Construction Phase SRM locations, P1, P2, P6 and P7 were located near Tsim Bei Tsui SSSI. P4 and P5 were located near Ramsar Site (North) and P3 was located near Ramsar Site (South). Therefore, the actual measured sedimentation rates from seven SRM locations could be compared with three indicator points as stated in EIA report.

4.5 During the construction of Temporary Access Bridge, the cofferdam and the pier, the effect on the changes of sedimentation /erosion conditions would be more similar to scenario 3. Therefore, the construction phase sedimentation rates from seven monitoring locations would be compared with the predicted values in scenario 3.

4.6 Trend lines were used to represent the long-term movement in time series data after other components have been accounted for. They told whether particular data sets have increased or decreased over the period of time. Trend lines could be calculated using statistical techniques like linear regression**.**

4.7 Trend lines of seven monitoring locations were stated in Appendix C. The calculated sedimentation rates of seven monitoring stations were tabulated below.

Table 3 Calculated Sedimentation Rates (mm/yr)

Indicator Point	Calculated value	Predicted value
P1	**-16.39**	**11.6**
P2	**-1.13**	**11.6**

P3	**6.52**	**13.5**
P4	**6.85**	**28.5**
P5	**1.12**	**28.5**
P6	**-3.49**	**11.6**
P7	**8.85**	**11.6**

4.8 SRM did not conduct in the following months, Feb-04, Mar-04, Feb-06, Mar-06, Apr-06, May-06, Jun-06, Jul-06 and Aug-06, due to the threat of Avian Flu in Mai Po.

4.9 The changes in the elevation level of the seven monitoring stations at Tsim Bei Tsui, Mai Po mudflat and Sha Kiu Tsuen were less than the predicted value in EIA report.

5. COMMENTS, CONCLUSIONS AND RECOMMENDATIONS

5.1 StarVision Limited and GSMJV carried out sedimentation rate monitoring in accordance with the submitted sedimentation rate monitoring plan.

5.2 The changes in level of seabed recorded during the construction periods were found out to be less than the predicted values in EIA report.

5.3 With reference to monitoring data, it could be advised that there were no significant adverse impacts in the effect of sedimentation (or deposition) and erosion rates in Deep Bay due to the reduction in flushing capacity with the presence of the Hong Kong - Shenzhen Western Corridor bridge piers.