Annex 11A
Marine Archaeological Investigation Report
INTRODUCTION

1.1 THE PROJECT BACKGROUND

The Drainage Services Department (DSD) has commissioned Black & Veatch (B&V) to undertake the consultancy Outlying Islands Sewerage Stage 2 - South Lantau Sewerage Works – Investigation under Agreement No. CE 55/2009 (DS) (the Project). B&V has sub-contracted ERM-Hong Kong Limited (ERM) to provide the environmental support services for this consultancy.

In accordance with Clause 3.4.8.2 of the EIA Study Brief (EIA Study Brief No. ESB-209/2009) (ESB), the Cultural Impact Assessment (CIA) shall include Marine Archaeological Investigation (MAI) for construction and operation of the Project and shall follow the detailed technical requirements given in Appendix I to the ESB. This Marine Archaeological Investigation Report is prepared to satisfy the requirement.

1.2 DESCRIPTION OF THE PROJECT

The Environmental Protection Department (EPD) completed the Outlying Islands Sewerage Master Plan (SMP) Study in 1994 and drew up a SMP for Lantau Island and other outlying islands. The SMP was subsequently reviewed by EPD under the Outlying Islands Sewerage Master Plan Stage 2 Review Study (SMP Review Study) in 2001. After the SMP Review Study, the proposed sewerage scheme for South Lantau was further reviewed under the Review of Sewerage Scheme for South Lantau (Review Study) in 2008.

According to the Review Study, the proposed sewerage works of the Project would serve the unsewered areas of Shui Hau, Tong Fuk, Cheung Sha, San Shek Wan, Pui O and Ham Tin in South Lantau. This would be implemented in three packages as follows:

(1) Package 1 – Village sewerage works;

(2) Package 2 – Trunk sewers and Sewage Pumping Stations (SPSs) along South Lantau Road; and

(3) Package 3 – San Shek Wan Sewage Treatment Works (STW) and associated effluent pumping facilities and submarine outfall.

The proposed works are to be implemented under Public Works Programme Item No. 331DS – “Outlying Islands Sewerage Stage 2 – South Lantau Sewerage Works”.

Package 1 comprises the provision of village sewerage to unsewered areas of Shui Hau, Tong Fuk, Cheung Sha, San Shek Wan, Pui O and Ham Tin in South Lantau. The works will involve construction of sewers inside villages’ alleys, two village SPSs, two beach SPSs and the associated twin rising mains, which are then connected into the trunk sewerage system under Package 2.
Package 2 comprises the construction of trunk sewer, a total of seven trunk SPSs and the associated twin rising mains along South Lantau Road for collection and conveyance of sewage from unsewered areas under Package 1 to the proposed San Shek Wan STW.

Package 3 comprises a STW at San Shek Wan and associated effluent pumping facilities and submarine outfall.

1.3 OBJECTIVES OF THE MARINE ARCHAEOLOGICAL INVESTIGATION

The objectives of the MAI are to include a phased review/investigation for marine works area in accordance with the MAI Guidelines and which should include, but not limited to the following (see Appendix 11A-1):

Phase I
- Desktop review of the marine works area;
- Review of Geophysical Survey data;
- Establish marine archaeological potential;
- Conduct marine archaeological impact assessment; and
- Prepare MAI report to present on the above findings, assessment results and provide necessary recommendations.

Phase II
- Remote Operated Vehicle/Visual Diver Survey/Watching Brief if potential sites are identified during Phase I work;
- Provide a Report on these aspects.

This Report represents the results of Phase I.

1.4 REPORT STRUCTURE

Following this introductory section, the remainder of this Report has been structured as follows:

Section 2 The legislative framework for the marine archaeological assessments in Hong Kong;

Section 3 The methodology used in this survey;

Section 4 The findings of the baseline conditions (desktop and geophysical surveys) for the marine works area;

Section 5 Establish archaeological potential of the marine works area; and

Section 6 Assessment of the impact on the archaeological resources and recommendations.

The following annex is also included:
Appendix 11A-1  Appendixes I and I-1 extracted from the EIA Study Brief; and

Appendix 11A-2  Figures 2 and 3 extracted from the Final Report for the Investigation Request for Ground Investigation Works under the Project.
LEGISLATIVE REQUIREMENTS AND EVALUATION CRITERIA

The following legislation and guidelines are applicable to the assessment of marine archaeological sites in Hong Kong:

- Environmental Impact Assessment Ordinance (Cap. 499) and the associated Technical Memorandum on the EIA Process (EIAO-TM);
- Antiquities and Monuments Ordinance (Cap. 53);
- Land (Miscellaneous Provisions) Ordinance (Cap. 28);
- Hong Kong Planning Standards and Guidelines; and
- Guidelines for Marine Archaeological Investigation prepared by AMO.

2.1 ENVIRONMENTAL IMPACT ASSESSMENT ORDINANCE TECHNICAL MEMORANDUM ON THE EIA PROCESS

The EIAO-TM outlines the approaches required in investigating and assessing the impacts on marine archaeological sites. The following sections of the EIAO – TM are applicable:

Annex 19: “There is no quantitative standard in deciding the relative importance of these sites, but in general, sites of unique archaeological, historical or architectural value will be considered as highly significant. A baseline study shall be conducted: (a) to compile a comprehensive inventory of places, buildings, sites and structures of architectural, archaeological and historical value within the proposed project area; and (b) to identify possible threats of, and their physical extent, destruction in whole or in part of sites of cultural heritage arising from the proposed project.”

The EIAO – TM also outlines the criteria for assessment of impact on sites of cultural heritage as follows:

Annex 10: “The criteria for evaluating impact on sites of cultural heritage includes: (a) The general presumption in favour of the protection and conservation of all sites of cultural heritage because they provide an essential, finite and irreplaceable link between the past and the future and are points of reference and identity for culture and tradition; (b) Adverse impacts on sites of cultural heritage shall be kept to the absolute minimum.”

The EIAO – TM also outlines the approach in regard to the preservation in totality; and in part to cultural resources:

Annex 19: “Preservation in totality will be a beneficial impact and will enhance the cultural and socio-economical environment if suitable measures to integrate the sites of cultural heritage into the proposed project are carried out. If, due to site constraints and other factors, only preservation in part is possible, this must be fully justified with alternative proposals or layout designs, which confirm the impracticability of total preservation.”
2.2 **ANTIQUITIES AND MONUMENTS ORDINANCE, CAP. 53**

The *Antiquities and Monuments Ordinance* (Cap. 53) (*AM Ordinance*) provides statutory protection against the threat of development on Declared Monuments, historical buildings and sites of archaeological interest to enable their preservation for posterity. The *AM Ordinance* also establishes the statutory procedures to be followed in making such a declaration.

“This Ordinance provides for the preservation of objects of historical, archaeological and palaeontological interest…”

The Ordinance defines an antiquity as a relic (a movable object made before 1800) and a place, building, site or structure erected, formed or built by human agency before the year 1800. The Ordinance also states, amongst other things, that the discovery of an antiquity shall be reported to the Authority (Secretary for Development); that ownership of all relics discovered after 1976 shall be vested in the Government; that the Authority can declare a place, building, site or structure to be a monument, historical building or archaeological or palaeontological site or structure (and therefore introducing certain additional controls for these sites); and that licences and permits can be granted for excavation and for other work.

Over the years, surveys have been undertaken to identify sites of archaeological interest in Hong Kong. The AMO has established boundaries for the identified sites and a set of administrative procedures for the protection of the known sites of archaeological interest. However, the present record of sites of archaeological interest is known to be incomplete as many areas have not yet been surveyed. There is a need therefore to ensure that the procedures and mechanisms, which enable the preservation or formal notification of previously unknown archaeological resources that may be revealed or discovered during project assessment or construction, are identified and implemented at an early stage of the planning of a project.

*Section 11* of the *AM Ordinance* requires any person who discovers an antiquity, or supposed antiquity, to report the discovery to the Antiquities Authority. By implication, construction projects need to ensure that the Antiquities Authority, the Antiquities Advisory Board (AAB)(1), is formally notified of archaeological resource which are discovered during the assessment or construction of a project.

2.3 **LAND (MISCELLANEOUS PROVISIONS) ORDINANCE (CAP. 28)**

Under this *Ordinance*, it is required that a permit should be obtained for any excavation within the Government land prior to any excavation work commencing.

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(1) The Antiquities and Monuments Office is the entry point to pass information to the AAB. The AAB is a statutory body consisting of expertise in relevant fields to advise on any matters relating to antiquities and monuments.
2.4  HONG KONG PLANNING STANDARDS AND GUIDELINES

The Chapter 10, Conservation, of the HKPSG provides general guidelines and measures for the conservation of historical buildings, sites of archaeological interest and other antiquities.

2.5  MARINE ARCHAEOLOGICAL INVESTIGATION (MAI) GUIDELINES

Guidelines for MAI which detail the standard practice, procedures and methodology which must be undertaken in determining the marine archaeological potential, presence of archaeological artefacts and defining suitable mitigation measures can be found in Annex A. Baseline review, geophysical survey and establishing archaeological potential are considered the first stage (Phase I) of a MAI. Subject to the results of the first stage MAI, further investigation may or may not be required.
3

ASSESSMENT METHODOLOGY

The methodology used in this assessment followed the guidelines listed in Annex A and comprised the following tasks.

3.1 ESTABLISH BASELINE CONDITIONS

- Implement Desktop Research, comprising a review of geotechnical survey data, historical documents and United Kingdom Hydrographic Office’s (UKHO) ‘Wreck’ database to establish the potential for marine archaeological sites in the marine works area;

- Examination of the seabed and below seabed using geophysical survey equipment in order to locate and define any sites of archaeological potential in the marine works area.

3.2 ESTABLISH ARCHAEOLOGICAL POTENTIAL

The synthesis and analysis of the baseline conditions were used to establish if there were any marine archaeological sites in the marine works area.

3.3 ASSESS IMPACT AND MAKE RECOMMENDATIONS

Based on the findings and analysis of the baseline conditions, an assessment was made of the potential impact of the project on the marine archaeological sites, and recommendations made to mitigate any impact.
4 BASELINE REVIEW

4.1 DESKTOP RESEARCH

The desktop research reviewed the geotechnical data, historical documents, the United Kingdom Hydrographic Office’s (UKHO) ‘Wrecks’ files and dredging data of Hong Kong, of the marine works area.

4.1.1 Geotechnical data

The submarine deposits in the Hong Kong region are subdivided into two formations, Chek Lap Kok Formations and the overlying Hang Hau Formations.

The Chek Lap Kok Formations, the lowest part of the Quaternary succession are considered to be Middle to Late Pleistocene in age and consists of colluvium, alluvium and lacustrine sediments (Fyfe et al. 2000). The marine sediments on top of this formation are sediments related to the Holocene period (from about 13,000 BP to the present day) and referred to as the Hang Hau Formations consisting of clayey silt sediments and some sand (mud, sandy mud).

The Sham Wat Formation, found between Chek Lap Kok Formations and Hang Hau Formations is considered to be the Eemian deposit with uncertain age and consists of soft to firm silty clays with yellowish mottling. This formation is presently not widespread but only in subcrop beneath the Hang Hau Formation (Fyfe et al. 2000).

The sediments of the Late Holocene period, considered to be relatively homogenous very soft to soft silty clay and with high moisture content, offers the greatest potential (as compared to the surface of the seabed which is often found to have been disturbed by fishing and other shipping related activities) to include well preserved remains associated with the occupation and use of the islands in Hong Kong waters. These remains could include shipwrecks.

4.1.2 Historical documents

No known historical record and sites of archaeological interest identified in the marine works area. The adjacent sites of archaeological interest are the Cheung Sha Ha Tsuen Site of Archaeological Interest at the west and the Pui O Site of Archaeological Interest at the east. These sites collectively contain cultural material dating back to the Han Dynasty but much of the historic landscape dates back to the Qing Dynasty. Pui O Wan which contains the marine works area is an exposed bay to the southerly winds and the gentle sloping seabed and shallow water would not have lent itself to an area of any great maritime activity (fishing and other marine exploitive industries, and as a boat anchorage). The marine works area is also too close to the shore and shallow to have been on any regular trading routes.
4.1.3 United Kingdom’s Hydrographic Office ‘Wreck’ Files

A review of the United Kingdom Hydrographic Office’s (UKHO) ‘Wrecks’ files found no shipwrecks/obstructions or significant underwater features within 4 km of the marine works area.

4.1.4 Hong Kong Dredging Data

No dredging data was found for this area.

4.2 BASELINE REVIEW FINDINGS

The baseline review of the literature found the marine works area has limited potential to contain underwater cultural heritage sites, and the UKHO’s Wreck files revealed no shipwrecks or other potential cultural heritage sites in the marine works area.

4.3 GEOPHYSICAL SURVEYS

4.3.1 Introduction

The objective of the geophysical survey was to define the areas/sites of greatest archaeological potential and which would encompass an assessment of the depth and nature of the seabed sediments and map any seabed and sub-bottom anomalies which may be archaeological material. This information is provided below.

4.3.2 Survey Methodology

EGS (Asia) Limited (EGS) undertook a seismic profiler, echo sounder, magnetometer and side scan sonar survey of the marine works area on 20 October 2010, but it was suspended due to the approach of Megi, a strong typhoon. The survey resumed on 8 November 2010 and was completed on 10 November 2010.

The surveyed area was 1,050m in a north-east / south-west orientation and 100m wide. The echo sounder survey was implemented every 5m in the north-east / south-west orientation with cross tracks every 100m. The seismic and side scan sonar surveys were implemented every 20m with cross tracks every 100m, and the magnetic survey was implemented every 25m with similar 100m cross tracks. This provided for a comprehensive assessment of the seabed and below the seabed. Figure 2 in Appendix 11A-2 shows the seismic and side scan sonar tracks.

4.3.3 Equipment Used

The following equipment was employed during the geophysical surveys:

- C-Nav GcGPS (Globally corrected GPS)
- Knudsen 320M Echo Sounder
- Klein 3000 Side Scan Sonar System
• C-Boom Seismic Profiler
• SeaSPY Marine Magnetometer System

4.3.4 Review of Geophysical Survey Results

The geophysical survey data obtained by EGS were processed by in house geophysicists and reviewed by a marine archaeologist, Bill Jeffery.

Side Scan Sonar Survey

The seabed slopes off gradually from Lantau Island to a maximum depth of 5.3 m. It comprises marine deposits (clayey silt and some sand) with negligible amounts close to the island to a maximum of 7m thick at the south-western end of the marine works area. Below this is alluvium (mainly coarse sediments with gravel) which is similarly shallow in the north-east and about 18m thick in the south-west of the marine works area. Below the alluvium is rock in various states of decomposition.

Much of the survey area is covered with very soft silt/clay (marine deposits). Weathered rock with materials discharged from a nearby stream was exposed on the seabed in the northern part of the marine works area and some isolated rocks located in a few places.

The seabed shows little impact from fishing trawlers and anchoring and minimal dumping of materials, and no impact from any dredging.

No shipwrecks or other archaeological features were observed on the seabed, Figure 3 in Appendix 11A-2 shows the seabed features.

Seismic profiling survey

The comprehensive boomer survey revealed no sub-bottom features or contacts as indicated in the Figures 4.1 and 4.2.
Figure 4.1  The seabed of just soft silty mud
Figure 4.2  The seabed showing the silty mud and a rocky area with an isolated rock with some relief

Magnetometer Survey

The magnetic survey was carried out to locate the existence of any utilities in the marine works area, and none were located. Two magnetic contacts were located (see Table 4.1; and Figures 4.3 and 4.4). The locations of these contacts were investigated for any seabed and sub-bottom features but none could be discerned. Both contacts found by the magnetic survey did not show up on the side scan sonar survey or the seismic survey and therefore are not major features such as a shipwreck.

Two magnetic contacts are not related to each other. MC001 is found at the northern end of the study area, about 80 metres west of centre line. MC002 is on the edge of the southern part of the survey about 50 metres from the centre line. The survey area is of water that has a maximum depth of 5.3 metres
and therefore unsuitable for an anchorage of much maritime activity. Given the highly sensitive nature of the Magnetometer used in which 0.1 nT can be discerned, very small objects such as hammer or a rock with magnetic properties. These contacts are likely to be random pieces of debris.

In addition to it being an exposed bay, MC001 and MC002 is of no archaeological significance.

Table 4.1 Unknown Magnetic Contacts

<table>
<thead>
<tr>
<th>Contact number</th>
<th>Latitude</th>
<th>Longitude</th>
<th>Easting</th>
<th>Northing</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MC001</td>
<td>22° 14.288' N</td>
<td>113° 58.199' E</td>
<td>814940.0E</td>
<td>811059.7N</td>
<td>Unknown feature</td>
</tr>
<tr>
<td>MC002</td>
<td>22° 13.855' N</td>
<td>113° 57.983' E</td>
<td>814566.9E</td>
<td>810261.1N</td>
<td>Unknown feature</td>
</tr>
</tbody>
</table>

Figure 4.3 Magnetic Contact 001, no seabed or sub-bottom features were observed
Figure 4.4  Magnetic Contact 002, no seabed or sub-bottom features were observed
The review of the historical documents and literature indicate the marine works area has limited potential in containing underwater archaeological or cultural heritage sites. A review of the of the UKHO’s Wreck files revealed no shipwrecks or other potential cultural heritage sites in the marine works area.

The geophysical surveys did not locate any underwater archaeological or cultural heritage features on or below the seabed. While the geophysical survey did not employ a multi-beam sonar survey this is not seen as a limitation in this survey given the ‘no-site’ findings of the historical documents and literature survey, and the environmental conditions that do not support the seabed in the marine works area to contain archaeological sites. There is more potential for sub-bottom sites to be found but none were found which is not surprising given the shallow thickness of the marine deposits and the disturbance that they would be under from Pui O Wan being an exposed bay.
The findings of this Marine Archaeological Investigation are that there are no sites of archaeological interest or antiquities as defined under the *Antiquities and Monuments Ordinance (Cap. 53) (AM Ordinance)* in the marine works area.

No mitigation measures need to be put in place.
BIBLIOGRAPHY


Annex A

Appendixes I and I-1
Extracted form the EIA Study Brief
Appendix I

Requirements for Marine Archaeological Investigation, Built Heritage Impact Assessment and Archaeological Impact Assessment under Cultural Heritage Impact Assessment

1. Marine Archaeological Investigation (MAI) - The Applicant shall engage a qualified marine archaeologist to review available information to identify whether there is any possible existence of sites of objects of cultural heritage, for example shipwreck, within seabed that will be affected by the marine and dredging works of the Project. The information shall include the information as stipulated in Task 1 – Baseline Review and Task 2 – Geophysical Survey according to the Guidelines for Marine Archaeological Investigation at Appendix I-1 of this study brief. The result of the review shall be presented as a written report and charts. If sites or objects of cultural heritage are found, Task 4 – Remote Operated Vehicle/Visual Diver Survey/Watching Brief is required within the said area. The MAI shall be carried out by a qualified marine archaeologist who shall obtain a Licence from the Antiquities Authority under the provision of the Antiquities and Monuments Ordinance (Cap 53).

2. Built Heritage Impact Assessment (BHIA) – The applicant shall conduct a BHIA, taking the result of previous BHIA and other background of the site into account, to identify known and unknown built heritage items within the assessment area that may be affected by the Project and its associated works to assess the direct and indirect impacts on the built heritage items. Special attention shall be paid to address possible impact to the Built Heritages at Shui Hau Tsuen, Cheung Sha Ha Tsuen, Cheung Sha Sheung Tsuen, Pui O Lo Wai Tsuen, Pui O San Wai Tsuen, San Shek Wan and Ham Tin. The Applicant shall draw necessary reference to relevant sections of the Guidelines for Culture Heritage Impact Assessment in Appendix I-2 of this study brief.

3. Archaeological Impact Assessment (AIA) - The study area for AIA shall include the Project sites, including sites for STW, effluent pumping station, sewage pumping stations, village sewerage pumping stations, effluent pipe and sewers, that may have adverse impacts on known and unknown archaeological sites. Special attention shall be paid to address possible impact to the Archaeological Sites at Pui O, Cheung Sha Ha Tsuen, Tong Fuk and Tong Fuk Mui Wan. The Applicant shall engage a qualified archaeologist who shall obtain a License from the Antiquities Authority before undertaking field evaluation under the provision of the Antiques and Monuments Ordinance (Cap 53).
Ordinance (Cap.53). The Applicant shall draw necessary reference to relevant sections of the Guidelines for Cultural Heritage Impact Assessment in Appendix I-2 of this study brief.

4. The Applicant shall demonstrate that the disturbances to those sites of cultural heritage are avoided to the maximum practicable extent by modification of the design of the Project. For those identified sites of cultural heritage that may still be directly and indirectly affected by the Project, the Applicant shall recommend practicable mitigation measures and monitoring to avoid or minimise the adverse impacts on the sites of cultural heritage. A checklist including the affected sites of cultural heritage, identified impacts, recommended mitigation measures as well as the implementation agent and period shall be given in the EIA report.
Appendix I-1

Guidelines for Marine Archaeological Investigation (MAI)

The standard practice for MAI should consist of four separate tasks, i.e. (1) Baseline Review, (2) Geophysical Survey, (3) Establishing Archaeological Potential and (4) Remote Operated Vehicle (ROV)/Visual Diver Survey/Watching Brief.

1. Baseline Review

1.1 A baseline review should be conducted to collate the existing information in order to identify the potential for archaeological resources and, if identified, their likely character, extent, quality and value.

1.2 The baseline review will focus on known sources of archive data. It will include:
   a. Geotechnical Engineering Office (GEO) – the Department holds extensive seabed survey data collected from previous geological research.
   b. Marine Department, Hydrographic Office - the Department holds a substantial archive of hydrographic data and charts.
   c. The Royal Naval Hydrographic Department in the UK - the Department maintains an archive of all survey data collected by naval hydrographers.
   d. Relevant government departments should be consulted in order to obtain the information of dredging history (if any) on the proposed project area. Area for sand dredging, mud disposal and allocated marine borrow area within Hong Kong should also be considered during the review.

1.3 The above data sources will provide historical records and more detailed geological analysis of submarine features which may have been subsequently masked by more recent sediment deposits and accumulated debris.

2. Geophysical Survey

2.1 Extensive geophysical survey of the study area should deploy high resolution boomer, side scan sonar, an echo sounder and high resolution multi beam sonar. The multi beam data must be presented as processed digital terrain models to facilitate the archaeological analysis. The data received from the survey would be analysed in detail to provide:
   a. Exact definition of the areas of greatest archaeological potential.
   b. Assessment of the depth and nature of the seabed sediments to define which areas consist of suitable material to bury and preserve archaeological material.
   c. Detailed examination of the boomer and side scan sonar records to map anomalies in and on the seabed which may be archaeological material.
   d. Detailed examination of the multi beam sonar data to assess the archaeological potential of the sonar contacts.
3. **Establishing Archaeological Potential**

3.1 The data examined during Task 1 and 2 will be analysed to provide an indication of the likely character and extent of archaeological resources within the study area. This would facilitate formulation of a strategy for investigation.

3.2 The results would be presented as a written report and charts. If there is no indication of archaeological material there would be no need for further work.

3.3 Charts should be presented at 1:500 scale and show each survey contact. Its dimensions and exact location should also be shown.

4. **Remote Operated Vehicle (ROV)/Visual Diver Survey/Watching Brief**

4.1 Subject to the outcome of Task 1, 2 and 3, accepted marine archaeological practice would be to plan a field evaluation programme to acquire more detailed data on areas identified as having archaeological potential. The areas of archaeological interest can be inspected by ROV or divers. ROV or a team of divers with both still and video cameras would be used to record all seabed features of archaeological interest.

4.2 Owing to the heavy marine traffic in Hong Kong, the ROV/visual diver survey may not be feasible to achieve the target. If that is the case, an archaeological watching brief is the most appropriate way to monitor the dredging operations in areas of identified high potential to obtain physical archaeological information.

4.3 A sampling strategy for an archaeological watching brief would be prepared based on the results of Task 1, 2 and 3 to focus work on the areas of greatest archaeological potential. Careful monitoring of the dredging operations would enable immediate identification and salvage of archaeological material. If archaeological material is found, the AMO should be contacted immediately to seek guidance on its significance and appropriate mitigation measures would be prepared.

4.4 If Task 4 is undertaken, the results would be presented in a written report with charts.

5. **Report**

Five copies of the final report should be submitted to the AMO for record.
Annex B

*Figures 2 and 3 extracted from the Final Report for the Investigation Request for Ground Investigation Works under the Project*