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12 CULTURAL HERITAGE ASSESSMENT

12.1 INTRODUCTION

This section presents the results of the cultural heritage impact assessment (CHIA) for the construction and operation of the proposed an LNG terminal at Black Point. It summarises information gathered from a literature review and field surveys to establish the baseline cultural heritage and marine archaeological conditions. The detailed field survey findings are presented in *Annex 12*. Potential impacts have been evaluated and measures have been recommended to mitigate potentially adverse impacts, where appropriate.

The study area for terrestrial archaeological investigation included areas within 100 m from the Project Site boundary and works areas that were considered to potentially have adverse impacts on known and unknown archaeological sites. The Study Area for the marine archaeological investigation included the seabed that will be affected by the marine works on the Project. These areas are shown on *Figure 12.1*.

12.2 LEGISLATIVE REQUIREMENTS AND EVALUATION CRITERIA

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

- *Environmental Impact Assessment Ordinance (EIAO) (Cap. 499.S16)*;
- *Environmental Impact Assessment Ordinance (Cap. 499.S16). Technical Memorandum on the EIA Process (EIAO TM)*;
- *Antiquities and Monuments Ordinance (Cap. 53)(AM Ordinance)*;
- *Land (Miscellaneous Provisions) Ordinance (Cap. 28)*;
- *Hong Kong Planning Standards and Guidelines*;
- *Criteria for Cultural Heritage Impact Assessment (CHIA)*; and
- *Guidelines for Marine Archaeological Investigation (MAI)*.

12.2.1 *Environmental Impact Assessment Ordinance*

According to the *EIAO, Schedule 1 Interpretation*, “Sites of Cultural Heritage” are defined as:

“an antiquity or monument, whether being a place, building, site or structure or a relic, as defined in the Antiquities and Monuments Ordinance (Cap. 53) and any place, building, site, or structure or a relic identified by the Antiquities and Monuments Office to be of archaeological, historical or palaeontological significance”.

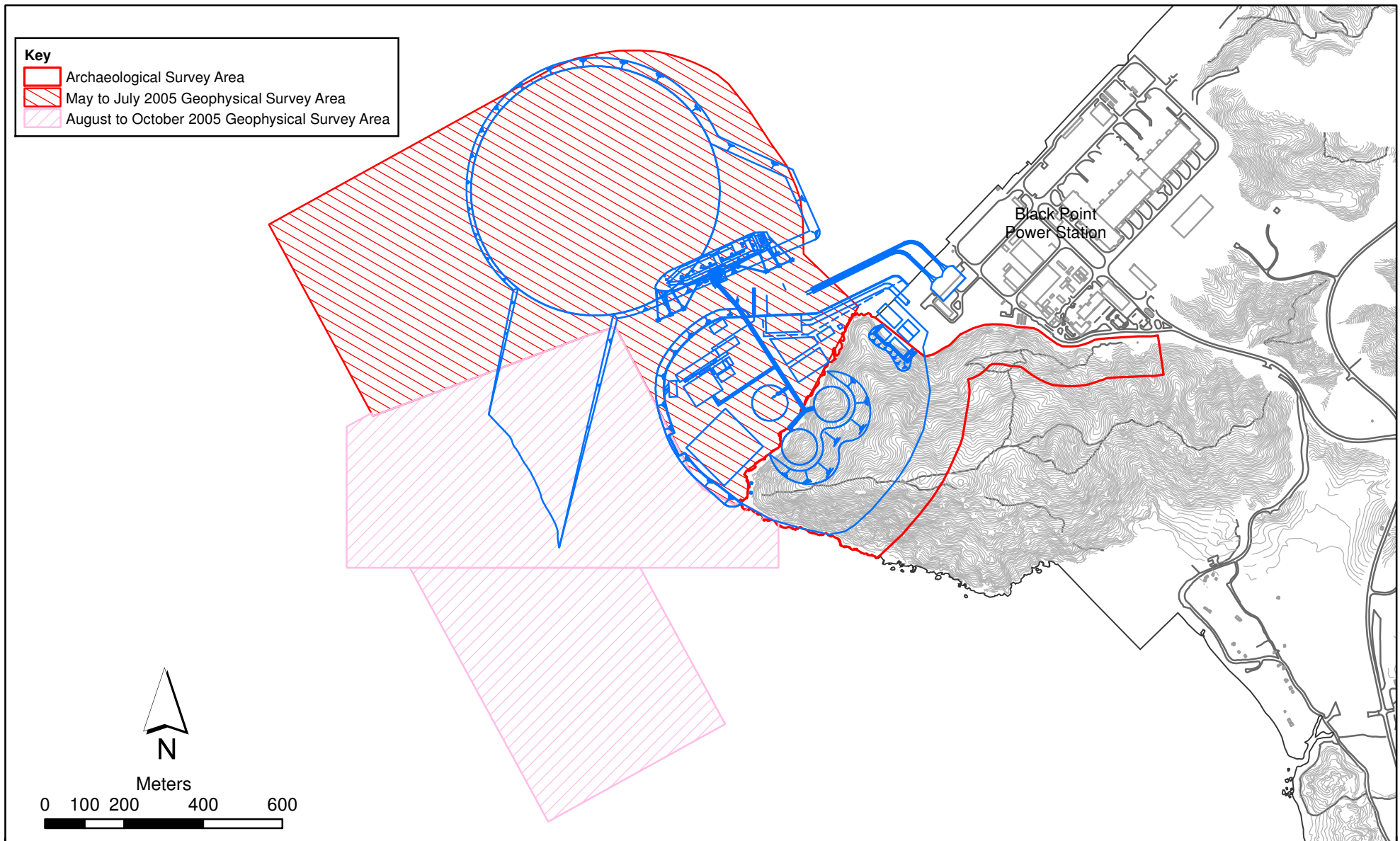


Figure 12.1

Study Area and Survey Coverage for LNG Terminal at Black Point

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12.2.2 *Technical Memorandum on the EIA Process*

The technical scope for evaluating and assessing cultural heritage impacts is defined in *Annexes 10, 18 and 19* of the *EIAO TM*. The approach recommended by the guidelines can be summarized as follows.

- *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; and*
- *Adverse impacts on sites of cultural heritage shall be kept to an absolute minimum.*

12.2.3 *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 archaeological sites to enable their preservation for posterity. The *AM Ordinance* also establishes the statutory procedures to be followed in making such a declaration.

In practice, the Antiquities and Monuments Office (AMO) also identifies Deemed Monuments⁽¹⁾ and then seeks to reach agreements with the owners of the monuments to provide for specific measures that will ensure preservation. Deemed Monuments have the potential to be upgraded to statutory Declared Monuments under the *AM Ordinance*.

A large range of potential sites of cultural heritage, among which are historical buildings and structures and archaeological sites, have been identified and recorded by AMO in addition to those for which a declaration has been made under the *AM Ordinance*.

Historic buildings and structures are recorded by AMO according to the grading system summarised in *Table 12.1*.

Table 12.1 *The Grading of Historical Buildings*

Grade	Description
I	Buildings of outstanding merit; every effort should be made to preserve if possible
II	Buildings of special merit; effort should be made to selectively preserve
III	Buildings of some merit, but not yet qualified for consideration as possible monuments. These are to be recorded and used as a pool for future selection

It should be noted that the grading of historical buildings is intended for AMO's internal reference only and has no statutory standing. Although there are no statutory provisions for the protection of recorded archaeological

(1) Deemed Monument – a building that has been identified by AMO as historically significant. The owner of the building has entered an agreement with AMO to allow restoration work to take place and reasonable access for the public. This designation provides no legal protection over the building under the *AM Ordinance*.

sites and historical buildings and features (including deemed, graded and recorded), the Government has established a set of administrative procedures⁽¹⁾ for giving consideration to the protection of these resources.

Over the years, surveys have been undertaken to identify archaeological sites in Hong Kong. The AMO has established boundaries for the identified sites and a set of administrative procedures for the protection of the known archaeological sites. However, the present record of archaeological sites is known to be incomplete as many areas have not yet been surveyed. Therefore procedures and mechanisms, which enable the preservation and formal notification of previously unknown archaeological resources that may be revealed or discovered during project assessment or construction, must be 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)⁽²⁾, is formally notified of archaeological resources which are discovered during the assessment or construction of a project.

12.2.4 *Land (Miscellaneous Provisions) Ordinance (Cap. 28)*

Under this *Ordinance*, it is required that a permit be obtained for any excavation within government land prior to commencement of any excavation work commencing.

12.2.5 *Hong Kong Planning Standards and Guidelines*

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

12.2.6 *Criteria for Cultural Heritage Impact Assessment(CHIA)*

The criteria as stated in *EIA Study Brief No. ESB-126/2005* details the criteria for the CHIA which include a baseline study, field evaluation and impact assessment.

12.2.7 *Marine Archaeological Investigation (MAI) Guidelines*

Guidelines for MAI outlined in *Appendix D* of the *EIA Study Brief No. ESB-126/2005* provide details on the standard practice, procedures and methodology that must be undertaken in determining the marine

- (1) Administrative procedures are adopted by AMO with the intention to protect sites of archaeological and historical interests that not protected under the provisions of AM Ordinance. For example, reserve area may be imposed on a particular area or building consultation with AMO for advice when development within the reserve area is proposed. These AMO measures are referred to as administrative procedures.
- (2) 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.

archaeological potential, presence of archaeological artefacts and establishing suitable mitigation measures. The first step, a Stage 1 MAI involves a baseline review, geophysical survey and establishing archaeological potential. Subject to the results of the Stage 1 MAI, a Stage 2 MAI investigation may or may not be required.

12.3 EXISTING CONDITIONS

12.3.1 Terrestrial Cultural Heritage Resources

A comprehensive inventory of cultural heritage resources has been prepared from a desktop review supplemented by field surveys and identified the following:

- No declared monuments or graded buildings identified;
- Built Heritage – two building structures at Terraces 1 and 3, a WWII cave at Terrace 2 (see *Figures 12.2 to 12.5*) and a grave site(G001)(see *Figure 12.2*); and
- Former Yung Long and existing Lung Kwu Sheung Tan archaeological sites (see *Figure 12.6*).

The sites are described below.

Built Heritage - Building Structure 1 at Terrace 1

Two separate building structures were identified and were named Structure 1a and 1b (see *Figures 12.2 and 12.3*). The two structures are located at the northern tip of the Project Area facing northeast at approximately +22mPD.

Structure 1a is a dilapidated building measuring approximately 2m x 2m. It has a pitch roof with mostly broken roof tiles. The foundations of the gable walls were built with granite blocks with lime plastered with grey and reddish bricks built on top of the foundations. The structure measures about 1.6 m high. No decorative features or datable artefacts were identified and therefore, it is not known when the structure was built. Based on the material used for the building, it is considered to have been built in the late 19th century to early middle 20th century. Since buildings of similar material can still commonly be found in most of the New Territory areas, the structure is considered to have little architectural value.

Structure 1b is a stone wall measuring approximately 2m x 4m, a terraced platform with stone wall supports and a circle shaped stone structure likely to have been used for cooking. Based on the material used for the building, it is likely to have been built in the late 19th century to early 20th century. The structure is considered to have little architectural value.

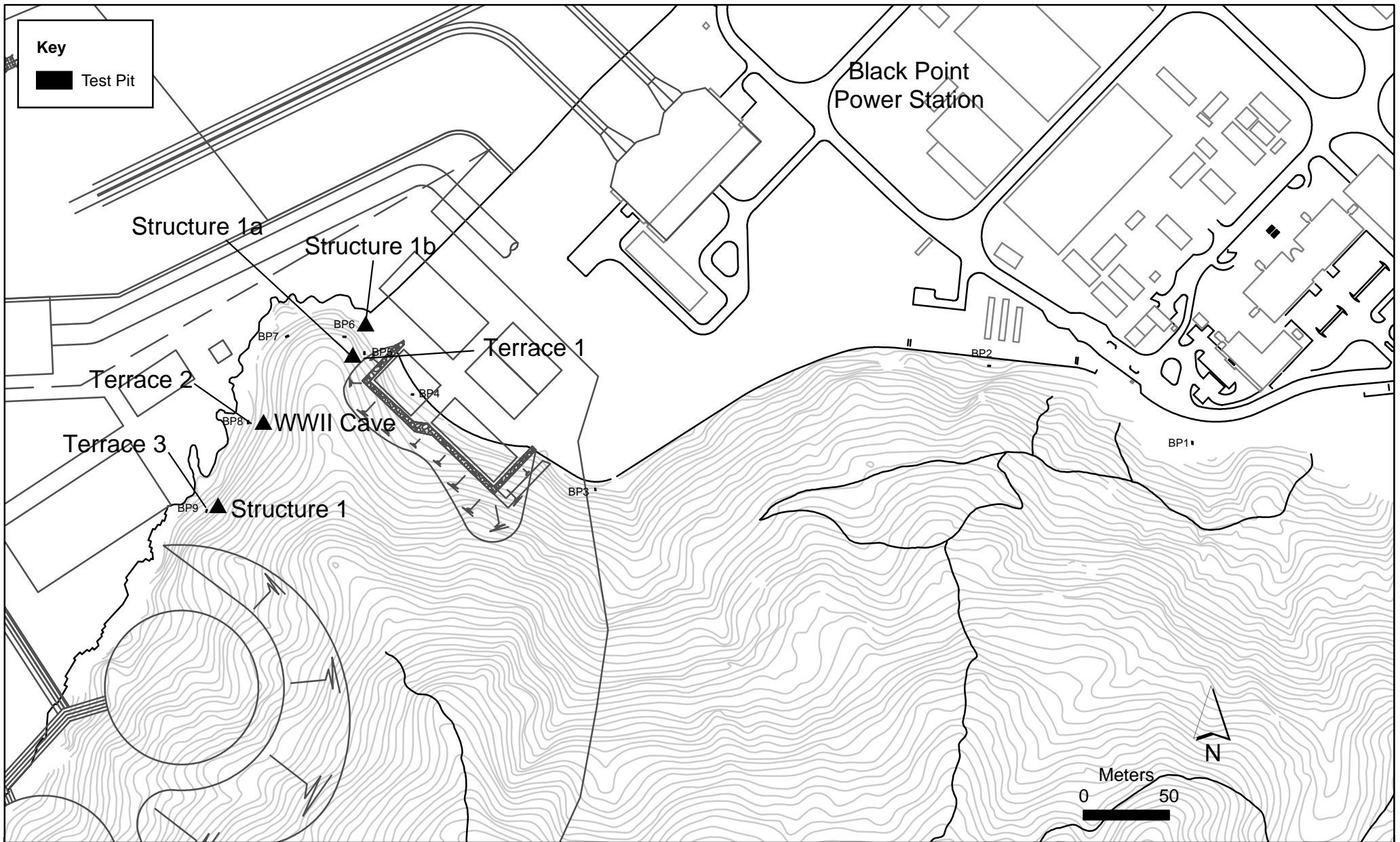
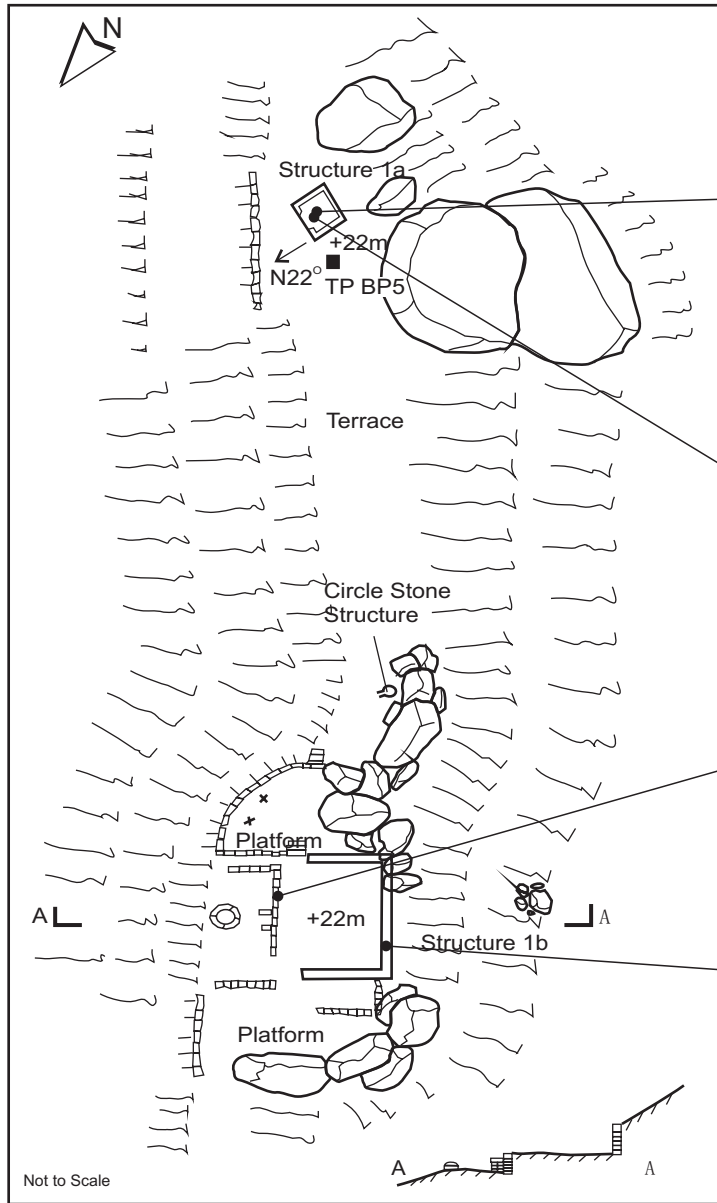


Figure 12.2

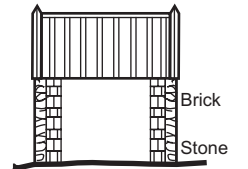
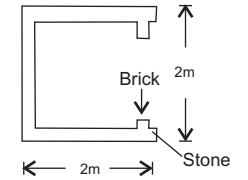
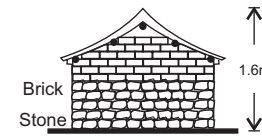
Location Plan of Test Pits and Terrace Platforms at Black Point



Gable of Building Structure 1a



Facade of Building Structure 1a



Reconstruction of Building Structure 1a



Platform of Structure 1b



Stone Wall Structure of Structure 1b

- ✕ Modern Iron Pipe
- ▬ Stone Wall
- ▬▬ Platform Stone
- ⬭ Rock
- ▨ Stairs

Figure 12.3

Building Structure 1 at Terrace 1



Cave Near Terrace 2



Cave Near Terrace 2



Granite Built Retaining Wall



Granite Built Retaining Wall

Figure 12.4

WWII Cave and Retaining Wall at Terrace 2



Stone Wall Structure



Platform

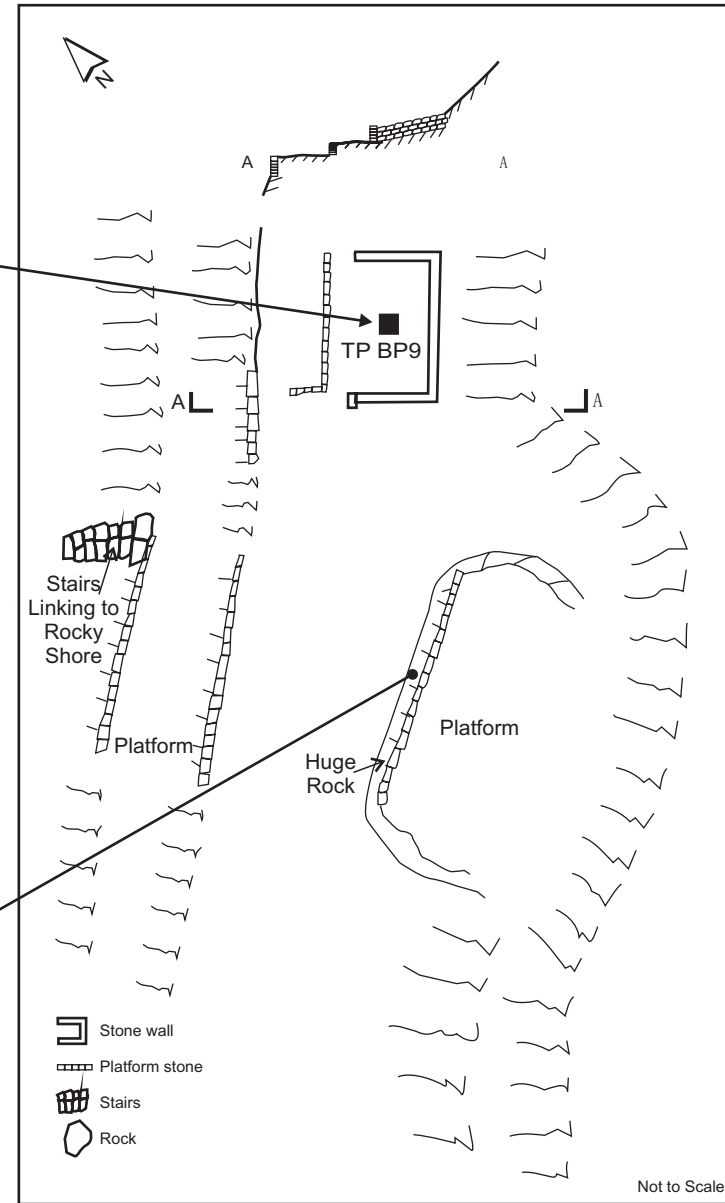


Figure 12.5

Building Structure at Terrace 3

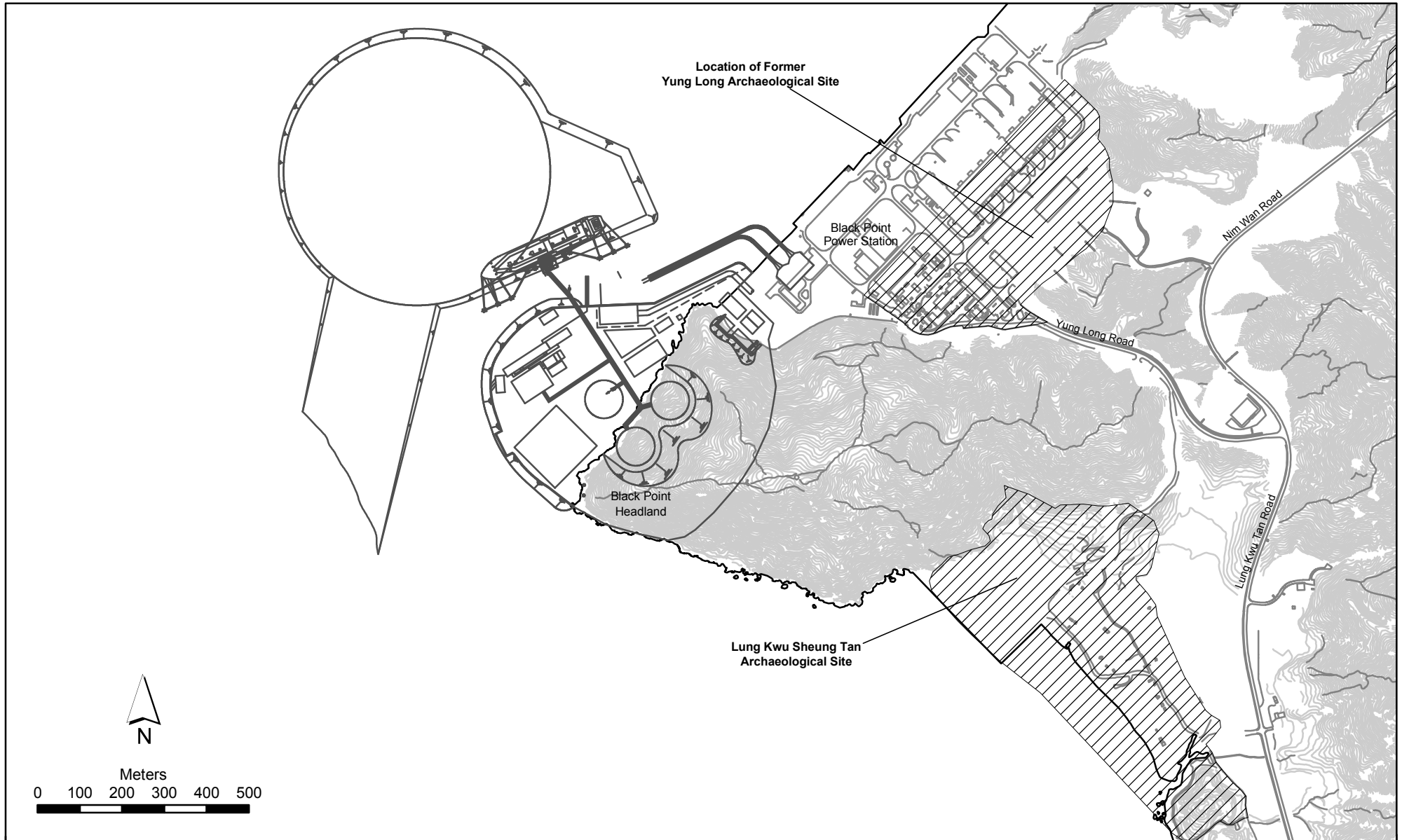


Figure 12.6

Location of Lung Kwu Sheung Tan Archaeological Site and Lung Kwu Sheung Tan Archaeological Site

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Built Heritage – WWII Cave at Terrace 2

A terrace area with granite block built retaining walls was identified (see *Figures 12.2 and 12.4*). However, no artefacts were identified. On the slope from the terrace towards the rocky shore, a 1.5 m high cave was identified. The cave is approximately 2.3 m deep facing northwest towards the Urmston Road. It is expected that the cave was constructed during the Japanese occupation for military purposes⁽¹⁾.

Built Heritage - Building Structure at Terrace 3

A stone built rectangular structure measuring approximately 2 m x 4 m is located by the coast at approximately +20mPD facing the sea (see *Figures 12.2 and 12.5*) on a terraced platform. The structure is unroofed with stone built stairs were constructed linking the terraced platform to the rocky shore. No datable artefacts were identified around the structure, and thus, it is not known when the structure was built. Based on the construction materials, it is estimated that the structure was built in the late 19th to early 20th century. The structure is considered to have little architectural value as similar structures can commonly be found in most areas of the New Territories.

Grave Site

A grave site was identified within the project area (see *Figures 12.7 and 12.8*). It is facing the south and generally in good condition. It is not know which clan group the grave belongs to.



Figure 12.7 *Grave of Unknown Person*

(1) Ko, TK 1996 *Ruins of War : A Guide to Hong Kong's Battlefields and Wartime Sites*. Hong Kong : Joint Publishing (H.K.) Co., Ltd.

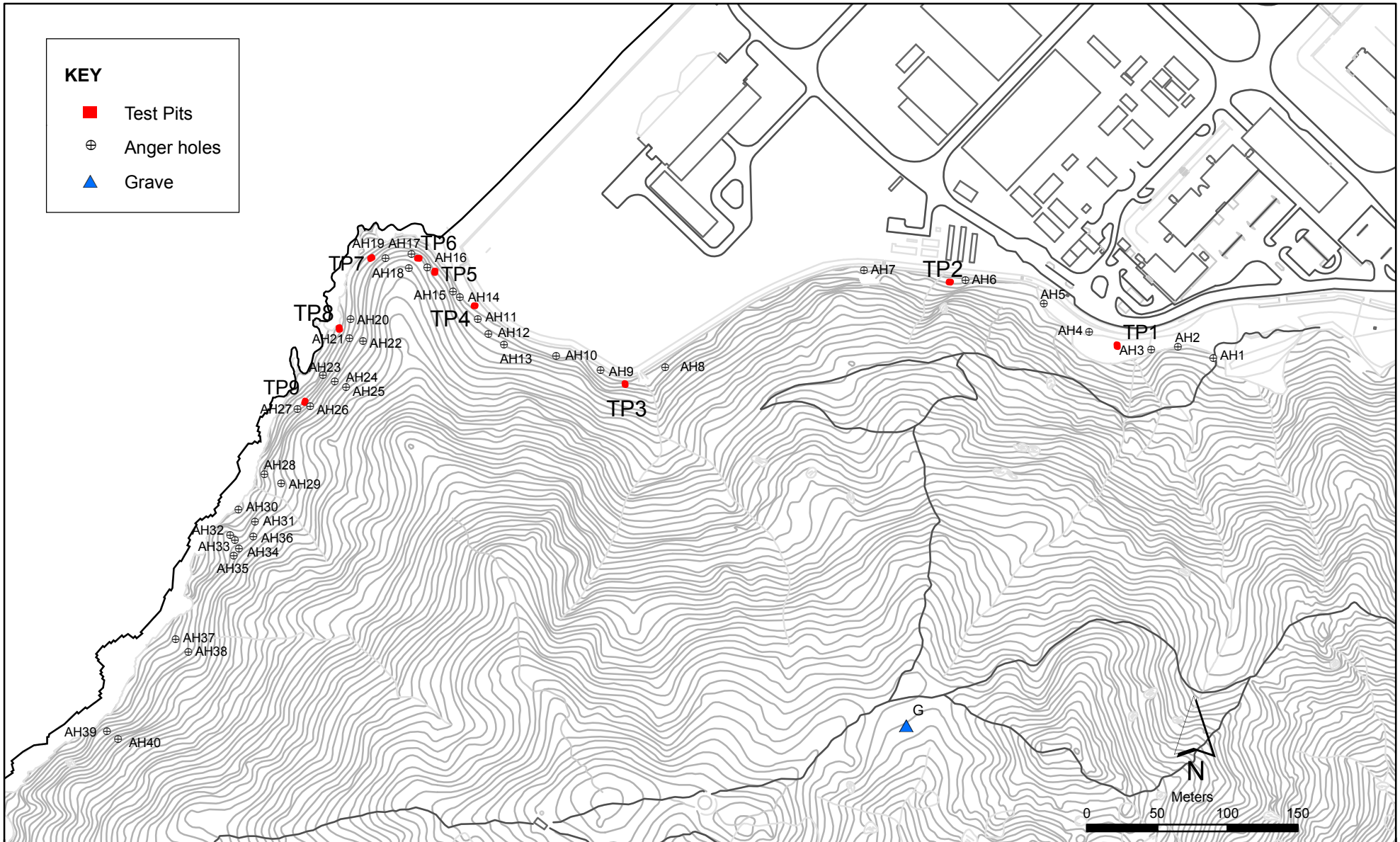


Figure 12.8

Location Plan of Auger Holes and Test Pits at Black Point

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Former Yung Long Archaeological Site

The Project Site is located next to the former Yung Long archaeological site (at the beach area beneath the existing Black Point Power Station) (see *Figure 12.7*). The archaeological site was identified by the Hong Kong Archaeological Society in 1974 and listed as an archaeological site in 1981. In 1983 two test pits were excavated and kiln furniture such as kiln bars, kiln brick, kiln cover, fire grille and pot-stands were identified that identified the site as a Neolithic pottery kiln complex⁽¹⁾. During 1992 and 1993, due to the construction of the Black Point Power Station, a full rescue excavation was conducted to preserve the site by record. The findings included archaeological features such as a house foundation, post holes, firing stove, burials, workshop areas and artefacts such as stone tools and stone rings, stone weights, pottery shards and bone tools dated to the early phase of the Late Neolithic Age⁽²⁾ (2,900 BC to 2,400 BC).

Lung Kwu Sheung Tan Archaeological Site

The site was first recorded by the Hong Kong Archaeological Society in 1976 where a small excavation was conducted and identified finds which included coarseware, chalk pottery and quartz discs. It was again then visited by AMO in 1978 during which celadon and prehistoric shards were identified. In the 1980s, Peacock and Nixon undertook investigations at the site and prehistoric artefacts and Song dynasty artefacts were identified⁽³⁾.

Archaeological Survey Result

As the Project Area is located relatively close to the former Yung Long Archaeological Site where Neolithic Age artefacts have been unearthed, the archaeological potential could not be ruled out.

To obtain field data for the CHIA, an archaeological survey at Black Point as part of the EIA was therefore undertaken between 12 and 15 October 2005.

A total of 40 auger holes and 9 test pits were conducted for the archaeological survey (see *Figure 12.8*). Some late 19th to early 20th century common village ware pottery shards and roof tiles fragments were identified. However, as these artefacts can still be commonly found in the New Territories, they are considered to have low cultural heritage significance. No earlier period finds were discovered from the survey. Thus, it is considered that the Project Area is of negligible to low archaeological potential.

- (1) Peacock and Nixon 1985 "Yung Long", *The Hong Kong Archaeological Survey: Subsurface Investigation Reports*, Hong Kong, Antiquities and Monuments Office, p25-36.
- (2) 香港古物古蹟辦事處 1997 《湧浪新石器時代遺址發掘簡報》，考古1997年第六期，科學出版社，p35-53.
- (3) Peacock and Nixon 1986 *Report of the Hong Kong Archaeological Survey Hong Kong*, Antiquities and Monuments Office.

12.3.2 Marine Archaeological Resources

The waters between Shekou (situated in Shenzhen) and Black Point were used as a war junk anchorage from the 8th century. In the 8th century (Tang Dynasty), Black Point was within the military division area of Tunmen Bing Zhen (屯門兵鎮) whose 2,000 soldiers were under the command of one Defence Commissioner. The headquarters of this division was situated in the present Nantou (南頭) walled city of Shenzhen and its military division area also covered the HKSAR, as well as the Huizhou (惠州) and Chaozhou (潮州) areas ⁽¹⁾. The military division was serving the same area until the Yuan Dynasty (A.D.1279-1368).

In the late 16th century (Ming Dynasty), China was facing frequent disturbance from coastal invaders and more forts and beacon towers were set up to protect the key locations from Japanese pirates. The Nantou Military Division (南頭寨) was established in 1565 and commanded 53 war junks and 1,486 soldiers ⁽²⁾. The military force was increased to 1,659 soldiers in 1645.

During this period, the Portuguese explorer, Jorge Alvares was permitted to land on Lintin Island (Neilingding 內伶仃) in 1513 ⁽³⁾. He then built a fort and erected a stone column with a carving of the Portuguese national symbol. The Chinese navy attacked and demolished the Portuguese fort in 1518 ⁽⁴⁾. In 1522, it was recorded that a sea battle between the Chinese navy and Portuguese ships was fought in the water between Lantau Island and Tuen Mun. The Chinese navy won the battle.

A review of a historical chart of the mouth of the Pearl River dated 1658 ⁽⁵⁾, also indicated that the waters between Black Point and Lintin Island were part of the main shipping route from the West to the East.

During the Ming to Qing Dynasties (A.D.1368 -1911), Imperial Junks sailing from Guangdong to Southeast Asian countries were required to anchor at a bay known as Chiwan (赤灣) on the Nantou peninsula, located to the west of Shenzhen City (located some 9 km north of Black Point). The Nantou area used to zone as the Nantou Military Division. During the early Qing Dynasty in the 1660s, although the Nantou Military Division was replaced by Xin'an Camp (新安營), it was still situated within the Nantou Walled City ⁽⁶⁾. A Tin Hau Temple was established in this Chiwan Bay, probably in 1410

- (1) Siu, K.K 1997 *Forts and Batteries: Coastal Defence in Guangdong During Ming to Qing Dynasties*, Hong Kong, Urban Council.
- (2) 蕭國健 1994 〈明代粵東海防中路之南頭頭寨〉,《香港歷史與社會》,香港教育圖書公司。
- (3) Brage, J.M. 1965 *China Landfall 1513, Jorge Alvares Voyage to China*, Macau, Imprensa Nacional.
- (4) Cortesão, A 1944, *The Suma Oriental of Tome Pires and the Book of Francisco Rodrigues*. London, Hakluyt Society. 龍思泰 (Anders Ljungstedt) 1832, 1997 《早期澳門史》,北京,東方出版社。
- (5) Nessel, Johan 1658 Tngqvin, in 格斯·冉福立 (Kees Zenvliet) 江樹生 譯 1997 《十七世紀荷蘭人繪製的台灣老地圖》,台北,漢聲出版社。
- (6) 靳文謨 1688 《新安縣志》,新安縣衙。

according to an inscription of the Temple where sailors worshipped Tin Hau seeking protection from mishaps at sea⁽¹⁾. Two stone forts were also built near the Tin Hau Temple during the Qing Dynasty and the remains of the forts can still be found.

Based on this historical review, it is considered that Black Point is located in the vicinity of a historically busy marine sea route. The waters at Black Point, Deep Bay and Neilingding Island have provided the main shipping channel between Guangdong and the Southern China Sea and Southeast Asian countries as well as East and West for centuries. On this basis, the waters at Black Point are considered to have marine archaeological potential.

A review of the *Study on the Potential, Assessment, Management and Preservation of Maritime Archaeological Sites in Hong Kong* undertaken in 1998⁽²⁾ identified a number of shipwrecks recorded some 3.5 km Northwest outside the proposed project area but no shipwrecks were identified within the proposed project area. A review of the wreck files kept by the United Kingdom Hydrographic Office identified no shipwrecks were found to be within 1km of the Project Area.

Geophysical Survey Data Review

Geophysical surveys were undertaken by CAPCO's geophysical contractor EGS(Asia) Limited (EGS), covering the proposed LNG marine facilities associated with Black Point site (see *Figure 12.1*). The objective of the geophysical survey was to define the areas/sites of greatest archaeological potential, assess the depth and nature of the seabed sediments and map any seabed and sub-bottom anomalies which may have archaeological material. The survey data obtained by EGS were reviewed by a qualified marine archaeologist and a summary of the findings are described below and detailed in *Annex 12-B*.

The geophysical survey using multi beam system, side scan sonar system and sub-bottom profiler system showed that the surveyed area has been impacted by anchoring, trawling and the dumping of materials. A site was identified as possible wrecks on the seabed (*Figures 12.9 and 12.10, and Table 12.2*).

(1) 王應華 1660年代，2000〈赤灣天后廟記〉，《明清兩朝深圳檔案文獻演繹》，廣州，花城出版社；蔡學元 1814，2000〈重修赤灣天后廟記〉，《明清兩朝深圳檔案文獻演繹》，廣州，花城出版社。

(2) Ali, Sarah 1998 *Study on the Potential, Assessment, Management and Preservation of Maritime Archaeological Sites in Hong Kong*. Hong Kong: Lord Wilson Heritage Trust

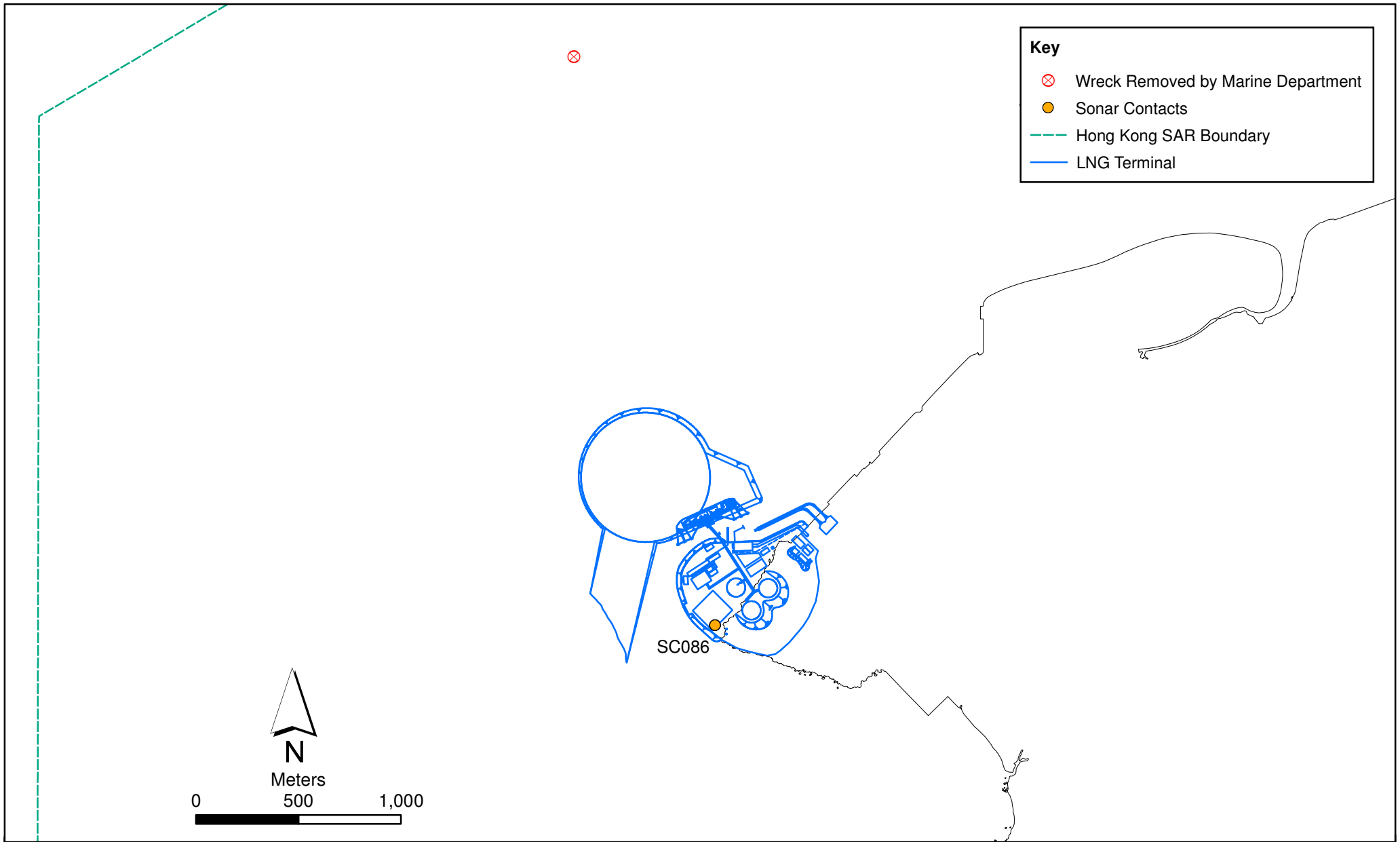


Figure 12.9

Location of the SC086 and Wreck Removed by the Marine Department Adjacent to the Study Area

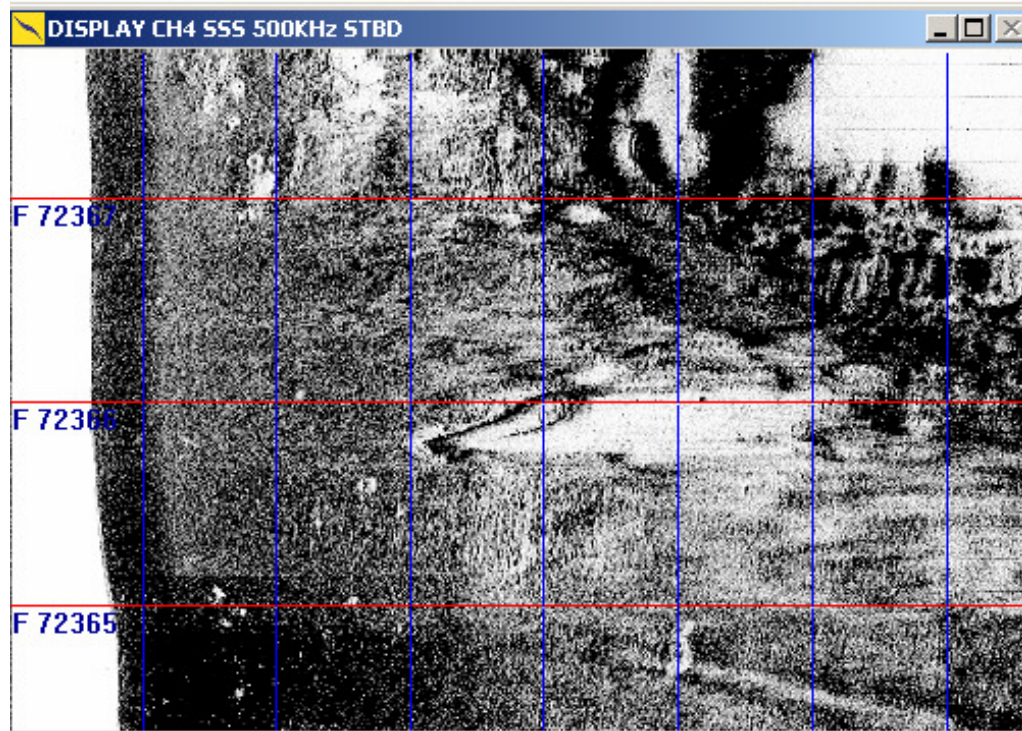


Figure 12.10 Possible Wreck (SC086)

Table 12.2 Sonar Contact SC086

Contact number	Latitude Longitude	Easting Northing	KP RPL offset	Dimensions (m)	Description
SC086	22° 24.388' N 113° 54.072' E	798693.9E 2480702.4N	39.148 1572m SW	10.77m x 3.31m x 2.03m	Possible wreck

Based on the side scan sonar image SC086 was considered to be a possible wreck. In order to address the doubt as well as the possibility that the recognizable shipwreck could be modern sites, (i.e., post-1800 the date which *AM Ordinance* defines an antiquity as a relic) a magnetic survey was conducted to ascertain how much ferrous material remained on the anomalies. While pre-1800 ships would have carried ferrous equipment and used ferrous material in their construction, it was considered that the amount of ferrous material detected during a magnetic survey could provide an indication on the age of the vessel.

Magnetic Survey

EGS performed the magnetic survey and conducted a measurement of turbidity from 2 to 4 September 2005 at 14 Sonar Contacts of archaeological potential between South Soko and Black Point. Sonar Contact SC086 is located within the Black Point Study Area.

The magnetometer survey confirmed the presence of ferrous material at SC086 to contain in excess of 1,000nt more than the surrounding area. This was estimated to be in excess of 2-3 tons of ferrous material and given the size of SC086, this site was interpreted as a wooden vessel containing a reasonable amount of iron/steel.

Remote Operated Vehicle (ROV)

In order to investigate the age and nature of SC086, an ROV survey was undertaken on 15 February 2006 by EGS under the marine archaeologist's supervision. The finding is summarized in *Table 12.3* and detailed in *Annex 12-B*.

Table 12.3 *ROV Survey Findings*

Contact number	Latitude Longitude	Easting Northing	KP RPL offset	Dimensions (m)	Survey Findings
SC086	22° 24.388' N 113° 54.072' E	798693.9E 2480702.4N	39.148 1572m SW	10.77m x 3.31m x 2.03m	Nature of the feature cannot be ascertained due to poor visibility (0 cm) with very muddy water condition.

Because of the poor (nil) visibility, the nature and ages of SC086 could not be determined. The presence of fishing nets found on SC086 also made a diver survey too hazardous due to the prominence of the nets on the seabed and the likelihood of trapping nets. Therefore, a more detailed sonar survey was carried out in an attempt to further define SC086.

Side Scan Sonar and Multi Beam Sonar Survey

A further detailed side scan sonar and multi beam sonar survey was undertaken by EGS in April 2006 for Sonar Contact SC086. An analysis of this new data in context with the earlier survey work (side scan sonar survey and magnetometer data) was carried out by the marine archaeologist. The summary result is presented below and detailed findings are presented in *Annex 12-B*.

The result indicated that the vessel and its location has the appearance of a 'recent' motorised wooden sampan. Located close to the rocks at Black Point and effected by the swells breaking over it, and the continual sea traffic, the vessel could not be expected to maintain its integrity for very long (perhaps months or just a year or so). Seats can be seen in the vessel and it shows damage to its hull which is considered to have been caused from its continual movement/sinking. A vessel of pre-1800 age would not be in this condition at this location.

The Marine Department salvaged a similar looking sampan on the 22 March 2006 which they reported was about 30 years old. SC086 is probably of a

similar vintage. Based on the survey data, SC086 is considered to be a motorised sampan and is therefore not an antiquity or relic of archaeological value according to the *Antiquities and Monuments Ordinance (Cap. 53)*.

12.4 ASSESSMENT METHODOLOGY FOR CULTURAL HERITAGE IMPACT ASSESSMENT

The CHIA methodology follows the criteria and guidelines in *Annexes 10 and 19* of the *EIAO TM* and the criteria for Cultural Heritage Impact Assessment (CHIA) and Guidelines for Marine Archaeological Investigation (MAI) as stated EIA Study Brief No. *ESB-126/2005*.

12.4.1 *Baseline Study for Terminal Site*

A comprehensive inventory of cultural heritage resources within the project area was compiled and includes:

- All declared monuments or graded historical buildings listed by AMO;
- All sites of archaeological interest (including marine archaeological sites);
- All pre-1950 buildings and structures;
- Selected post-1950 buildings and structures of high architectural and historical significance and interest; and
- Landscape features including sites of historical events or providing a significant historical record or a setting for buildings or monuments of architectural or archaeological importance, historic field patterns, tracks and fish ponds and cultural elements such as fung shui woodlands and clan graves.

Information sources included the AMO, Hydrographic Office of Marine Department, the Royal Naval Hydrographic Department in UK, Lands Department, Public Records Office, tertiary libraries and the internet.

12.4.2 *Field Surveys*

Historical Buildings and Features Survey

The Project Area (defined as the area within and up to 100 m from the terminal site boundary) was field scanned to identify all historical buildings and structures. Photographic records of each building or structure, (exterior and interior where possible) as well as the surroundings were taken. Architectural and historical appraisals of identified sites were also developed. Three building structure sites located at three Terrace areas were identified. They are detailed in *Section 12.3.1* above.

Terrestrial Archaeological Survey

Prior to fieldwork commencement, a desktop review was undertaken through the review of old maps, aerial photographs, topography, geological background and previous archaeological survey findings to establish the fieldwork scope for agreement with AMO. Relevant licences and permits were obtained from DLO/Tuen Mun and AMO. The fieldwork was undertaken between 12 and 15 October 2006. A total of 40 auger holes and 9 test pits were conducted within the surveyed area (see *Figure 12.8*). The detailed findings are presented in *Annex 12-A* and summarised in *Section 12.3.1*

Marine Archaeological Investigation

Following a baseline review including review of literature and old maps, consultation with UK Hydrographic Office and Hong Kong Hydrographic Office on their database of shipwrecks, comprehensive geophysical survey comprising the use of side scan sonar system, multi-beam system, magnetometer system, sub-bottom profiler system and Remote Operated Video (ROV) system were undertaken in various stages covering the proposed submarine Project Area. *Table 12.4* summarised the systems adopted and survey period undertaken for the Geophysical Survey. The survey data obtained by EGS were reviewed and interpreted by the marine archaeologist to identify features of possible archaeological potential. The detailed methodology and findings are presented in *Annex 12-B* and summarised in *Section 12.3.2*.

Table 12.4 *Geophysical Survey Conducted for MAI*

Stages	Survey System Adopted	Survey Period	Remarks ⁽¹⁾
1	Side Scan Sonar System, multi-beam system, sub-bottom profiler system	May to July and August to September 2005	Covers the submarine project area
2	Magnetometer system	1-4 September 2005	For 14 Sonar Contacts only
3	Remote Operated Video	15 February 2006	For 6 Sonar Contacts only
4	Side Scan Sonar System, multi-beam system	6-7 April 2006	For 6 Sonar Contacts only

12.5 POTENTIAL SOURCES OF IMPACT

12.5.1 Construction Phase

The construction phase of a development may have direct or indirect impacts to sites of potential sites of cultural heritage. Such impacts may arise from the following activities:

(1) This includes both submarine project areas for Black Point and South Soko

- Direct loss of historical buildings or structures due to temporary or permanent landtake for development;
- Indirect impact on access for future archaeological surveys due to temporary or permanent landtake for development where the archaeological deposits are preserved *in situ* within the development site but in instances where no soil excavation work is required at the archaeologically sensitive area;
- Temporary or permanent change of cultural landscape around standing heritage that indirectly reduces the associated cultural landscape value;
- Construction vibration impacts on standing heritage;
- Temporary or permanent access disturbance to standing heritage due to construction work near standing heritage.
- Direct loss of potential marine archaeological deposits due to seabed construction works such as dredging and piling; and
- Direct loss of archaeological deposits due to soil excavation in archaeological deposits area.

12.5.2 *Operation Phase*

The operation phase of a development may have direct or indirect impacts to sites of potential sites of cultural heritage from the following activities:

- Indirect impact on access for future archaeological surveys; and
- Permanent access disturbance to standing heritage if the standing heritage are conserved within the developed area.

12.6 *IMPACT ASSESSMENT*

As there are no Declared Monuments or Deemed Monuments located within the Project Area and no sites of cultural heritage protected under the *AM Ordinance* have been identified, construction and operational impacts to sites of cultural heritage are not expected.

Direct loss of two building structures at Terrace 1, a WWII cave at Terrace 2 and a stone structure at Terrace 3 is expected due to the site formation works for the development within the Project Boundary. As these features are considered to have low heritage value their loss is acceptable.

Impact to the grave is not expected as it is located outside the project boundary.

One potential marine archaeological site (SC086) was identified from a review of geophysical data and magnetometer data review. A ROV survey and

further detailed side scan sonar and multi beam survey was undertaken to inspect the nature and age of the site. The surveys indicated that SC086 is a modern motorized sampan and is therefore considered to have no archaeological value. Since no marine archaeological resources were identified within the marine area of the proposed development, no impact is expected.

At present there are no planned projects on Black Point that could have cumulative cultural heritage impacts with the construction of the LNG terminal.

12.7

MITIGATION MEASURES

Although the direct loss of two building structures at Terrace 1, a WWII cave at Terrace 2 and a stone structure at Terrace 3 is expected due to the site formation works for the development, these cultural heritage resources are considered to have low cultural heritage value. Thus, the impact is considered acceptable provided that a photographic and cartographic recording is undertaken for the sites following AMO's requirements.

As no impact on the grave is expected, no mitigation measure is required.

As no marine archaeological interest sites have been identified, no impact is expected. Thus, no mitigation measures are considered necessary.

12.8

CONCLUSIONS

A literature review supplemented by a field survey has identified four terrestrial sites of cultural heritage comprising two building structures at Terrace 1, a WWII cave at Terrace 2, a stone structure at Terrace 3 and a grave site. Construction activities will impact the three building structures, but they are considered to have little cultural heritage value. Appropriate mitigation measures comprising the preparation of photographic and cartographic records prior to their removal will be undertaken to preserve these structures by record.

No impact to the identified grave is expected as it is located outside the project boundary.

No marine archaeological sites have been identified, thus, the proposed development imposes no marine archaeological impact and no mitigation measures are considered necessary.

With the implementation of the mitigation measures as detailed in *Section 12.7*, no residual impact is expected.

Annex 12-A

Archaeological Survey Report

ENGLISH ABSTRACT

ERM-Hong Kong, Limited (ERM) has been commissioned by the Castle Peak Power Company Limited (CAPCO) to undertake the EIA for a proposed Liquefied Natural Gas (LNG) terminal development at Black Point. A Cultural Heritage Impact Assessment (CHIA) has been included in the EIA Study Brief as one of the requirements. To obtain field data for the CHIA, an Archaeological Survey at Black Point was undertaken between 12 and 15 October 2005.

A total of 40 auger holes and 9 test pits were conducted. Three terraces considered to have archaeological potential were identified. Some late 19th to early 20th century common village ware pottery shards and roof tile fragments were identified at one of the terraces. No artefacts were identified at the other two terraces. In addition, a cave for military use during WWII was also found.

As the artefacts identified are late 19th to early 20th century common village ware pottery and are still used by local people in the New Territory area, they are considered to have low cultural heritage significance.

With regard to the cave, similar caves can be found on Lamma Island with a complex network of tunnels. This cave is considered to have some value in understanding the military history of Tuen Mun area but with low architectural value due to its simple design.

中文摘要

香港環境資源管理有限公司受青山發電有限公司委托，為興建液化天然氣接收站及相關設施之工程進行了環境影響評估。文化遺產影響評估為環境影響評估其中一項要求。為了搜集所需田野資料，以進行環境影響評估之中的文化遺產影響評估，在2005年10月12至15日期間，在爛角咀進行了考古調查。

是次考古調查一共鑽探了40個鑽孔及挖掘了九個探方，並發現具考古潛質的三個階地。其中一個階地發現一些19世紀末至20世紀初期日用鄉村器物之陶片及瓦片。另外兩個階地均無任何文物發現。此外，亦發現一個可能是二次大戰的軍事用途洞穴。

在第一個階地所發現之文物的年代為19世紀晚期至20世紀初期，這些文物屬於目前新界原居民仍然使用的普通鄉間陶器，因此，它們的文化遺產價值甚低。

至於那軍用洞穴，同類形而網絡複雜的洞穴可在南丫島找到，此洞穴有助於了解屯門的軍事歷史的價值，但由於其簡單設計，其建築價值為低。

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ANNEXES

<i>Annex 12-A-A</i>	<i>Soil Profile of Auger Holes</i>
<i>Annex 12-A-B</i>	<i>Stratigraphy of Test Pits</i>
<i>Annex 12-A-C</i>	<i>Land Survey of Test Pits Positions</i>

1 INTRODUCTION

1.1 BACKGROUND TO THE SURVEY

ERM-Hong Kong, Limited (ERM) has been commissioned by the Castle Peak Power Company Limited (CAPCO) to undertake the EIA for a proposed LNG terminal at Black Point. A Cultural Heritage Impact Assessment (CHIA) is one of the components of the EIA study. To obtain field data for the CHIA, an Archaeological Survey at Black Point has been undertaken.

The purpose of the archaeological survey is to investigate the presence of any archaeological deposits within 100 m from the boundary of the proposed development as shown in *Figure 1.1*. Where archaeological remains are identified, their nature, horizontal and vertical extent have been determined.

Prior to archaeological survey commencement, a *Licence* to conduct the archaeological survey and an *Excavation Permit* were obtained from the Antiquities and Monuments Office (AMO) under the *Antiquities and Monuments Ordinance (Cap. 53)* and the District Land Office (Islands) under the *Land (Miscellaneous Provisions) Ordinance (Cap. 28)* respectively. The fieldwork was undertaken between 12 and 15 October 2005.

This Report presents the findings for the archaeological survey.

1.2 ARCHAEOLOGICAL SURVEY TEAM MEMBERS

The following individuals participated in the archaeological survey:

<i>Mr Steven Ng</i> of ERM	Project Field Director, Licensed Archaeologist;
<i>Ms Peggy Wong</i> of ERM	Trained Field Archaeologist;
<i>Mr Wong Fu</i>	Trained Field Archaeologist; and
<i>Ms Zoe Chan</i> of ERM	Trained Assistant Field Archaeologist.

In addition to the above team members, eight trained labourers were employed to assist in the survey and a team of qualified Land Surveyors from Land Marker (1980) HK Company Limited assisted with the land surveying work.

Mr Steven Ng, Ms Peggy Wong, Ms Zoe Chan and Mr Wong Fu undertook post-excavation processing and analysis of fieldwork records, artefact assessment, preparation of rubbing, drawings, video recording and photographic records of artefacts.

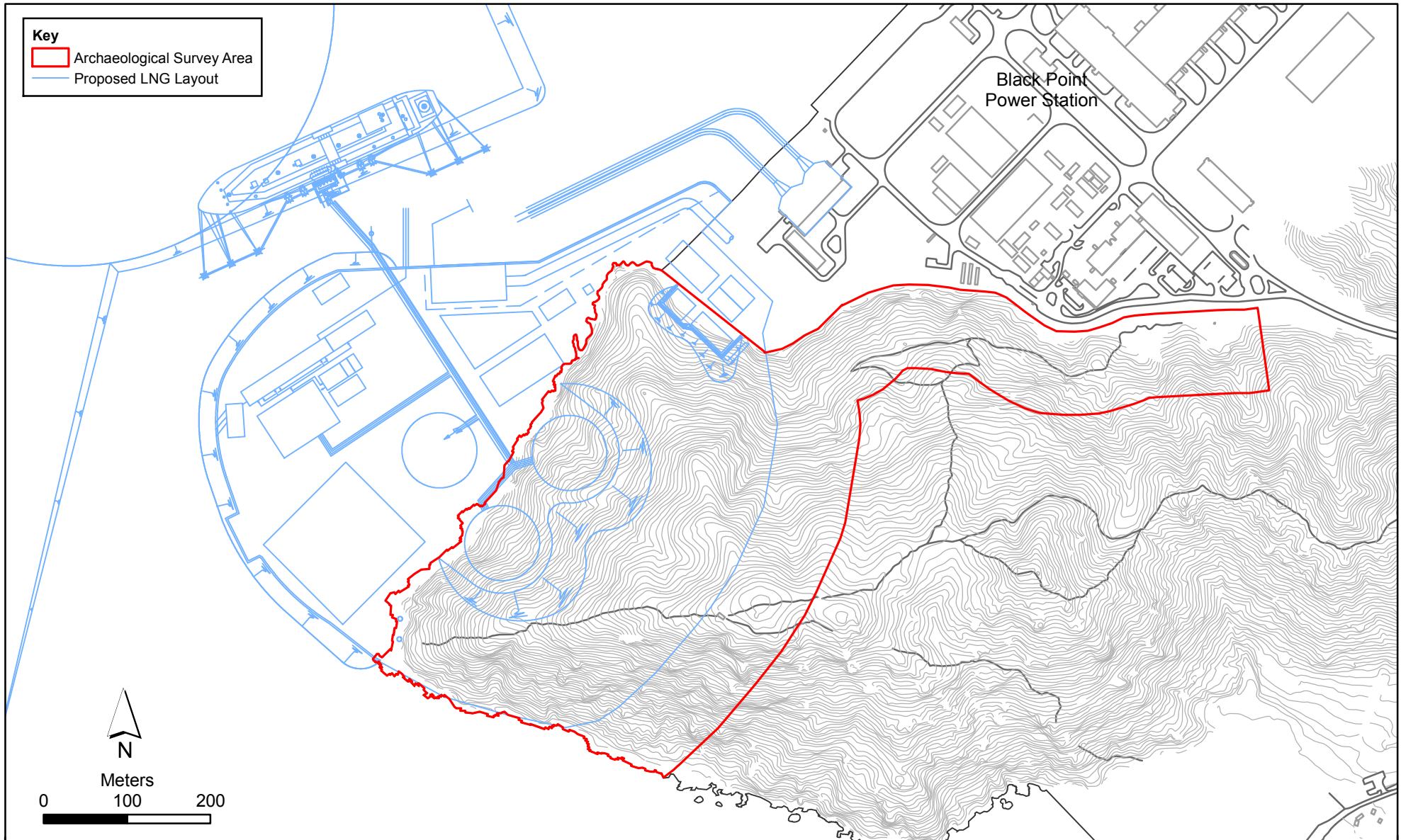


Figure 1.1

Indicative Layout for LNG Terminal at Black Point

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Date: 30/09/2006

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1.3

STRUCTURE OF THE REPORT

Following this introductory section, the remainder of this report comprises the following sections:

- Section 2* describes the objectives and methodology for the archaeological survey;
- Section 3* presents the site background (including information on the geology, topography, hydrology, historical, ethnological and archaeological backgrounds);
- Section 4* presents the archaeological survey findings;
- Section 5* presents the preliminary finds assessment; and
- Section 6* presents the conclusions.

The following annexes have also been included:

- Annex 12-A-A* Soil Profile of Auger Holes;
- Annex 12-A-B* Stratigraphy of Test Pits; and
- Annex 12-A-C* Land Survey of Test Pits Positions.

2 OBJECTIVES AND METHODOLOGY

2.1 OBJECTIVES

The objectives of the archaeological survey were to obtain adequate data to determine the presence, extent, depth, chronology, character and survival condition of identified archaeological deposits, if any.

2.2 METHODOLOGY

2.2.1 Desktop Study

Prior to commencement of the fieldwork, a desktop review and document research were undertaken to establish the fieldwork scope and strategy to obtain adequate field data, following Sections 1.4.3 and 1.5.3 of *Criteria for Cultural Heritage Impact Assessment* established by AMO. This included the review of site condition, past land use, vegetation cover, landform, hydrogeology, annual wind direction and sea currents, previous archaeological fieldwork findings, historical and geological maps and aerial photographs from the 1950s to 1990s. The fieldwork scope and strategy were then agreed with AMO of Leisure and Culture Services Department (LCSD) prior to fieldwork commencement.

2.2.2 Field Walking

Field walking was conducted within the Project Area to record artefacts on the ground surface and assess the archaeological potential based on these finds. During field walking, the extent, quantity and chronology of special and general artefacts are recorded. In addition, the position of any special artefacts found was precisely recorded.

2.2.3 Hand Augering

An augering was undertaken to examine the presence of any cultural layers through the investigation of the vertical soil profile according to the soil colour or texture. Comparison of the stratigraphy of different auger holes assists in determining the extent of an archaeological deposit area. A total of 40 auger holes were bored (see Section 4.2 for details).

2.2.4 Test Pits Excavation

The purpose of test pit excavation is to investigate the vertical and horizontal extent of any identified cultural layers. A total of 9 test pits were excavated (see Section 4.3 for details).

The size of the test pits measured either 1 m x 1.5 m or 2 m x 1 m subject to site conditions, and were excavated to a depth of between 0.8 m to 3.5 m below

ground level subject to site conditions. All test pits were excavated to the sterile layer. All test pits were excavated manually by trained labourers under the supervision of the project field director or archaeologists. After the excavation works were complete, all test pits were backfilled and reinstated to their original state.

2.2.5 *Recording, Reporting and Processing of Finds*

The site code of the archaeological survey was designated as **BP05** representing "Black Point" and the year of the survey.

Positions of the test pits were recorded according to the Hong Kong metric grid system. A team of qualified land surveyors established the test pit locations (see *Annex 12-A-C*). The site benchmark was tied to Hong Kong Principal Datum (mPD).

The stratum of each test pit or auger hole was distinguished by natural deposits in terms of soil colour, soil texture and any human activities or cultural remains. All auger holes, test pits and deposits were recorded using ERM's recording system which is compliant with AMO's standard.

Stratigraphic drawings and photographic records of at least one section of each test pit were undertaken whenever site conditions allowed.

The formation of the soil layers is influenced by both natural and human factors. A soil layer without human or artificial remains is generally classified as a "natural layer". A soil layer with man-made features or remains is regarded as a "cultural layer".

All artefacts identified were carefully washed, cleaned, labelled, bagged and boxed. Their functions and chronology were preliminarily assessed, and when possible, sorted typologically. Special or datable finds were registered, drawn and photographed.

The chronology of artefacts in this investigation adopted a "cross-dating method ⁽¹⁾" i.e. the finds are dated by referencing datable findings recorded in published archaeological reports.

(1) Cross-dating refers to "Artefacts from an archaeological site are often dated by correlation with typologies of similar artefacts in the surrounding area. This method is based on the assumption that typologies evolved at the same area". From Whitehouse, R.D. ed 1983 *Macmillan Dictionary of Archaeology*, London: Macmillan Press.

3 SITE BACKGROUND

3.1 GEOLOGY, TOPOGRAPHY AND HYDROLOGY

The solid geology of Black Point is dominated by Mesozoic granite rock with a medium grain size. Northeast-Southwest running faults can commonly be found. The superficial deposit of Black Point is mainly composed of colluvial debris flow deposits. Two seasonal streams run to the sea ⁽¹⁾ (see *Figure 3.1*).

The Project Area is mainly comprised of a headland with an elevation of 135 mPD. There is no natural terrace or flat area within the Project Area. Granite boulders are commonly found exposed on the hill slope.

3.2 ARCHAEOLOGICAL BACKGROUND

The Project Site is located next to the former Yung Long archaeological site (at the beach area beneath the existing Black Point Power Station). The archaeological site was identified by the Hong Kong Archaeological Society in 1974 and was listed as an archaeological site in 1981. In 1983, a survey was conducted and two test pits were excavated. Kiln furniture such as kiln bars, kiln brick, kiln cover, fire grille, pot-stands was identified. Based on these finds, the site was considered to be a “Neolithic pottery kiln complex ⁽²⁾”. During 1992 and 1993, a full rescue excavation was conducted to preserve the site by record due to the construction of the Black Point Power Station at the site. The findings included archaeological features such as house foundation post holes, firing stove, burials, workshop areas and artefacts such as stone tools and stone rings, stone weights, pottery shards and bone tools dated to the early phase of the Late Neolithic Age⁽³⁾ (BC 2,900 to BC 2,400).

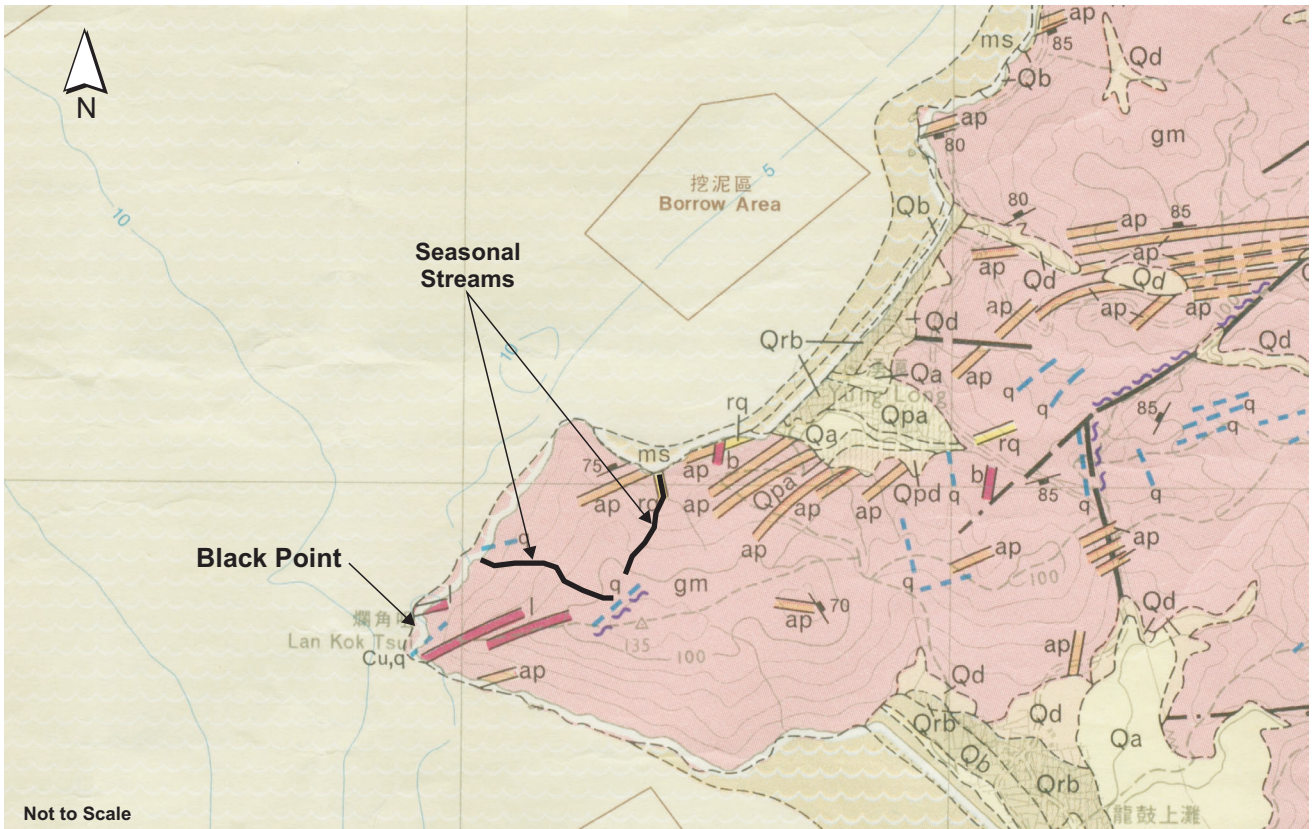
3.3 HISTORICAL AND ETHNOLOGICAL BACKGROUND

The Project Area is mainly a hilly area that is not favourable for human settlement. No record of permanent settlement has been identified within the Project Site.

(1) Langford, R.L and others 1989 *Geology of the Western New Territories*, Hong Kong, Civil Engineering Services Department.

(2) Peacock and Nixon 1985 “Yung Long”, *The Hong Kong Archaeological Survey: Subsurface Investigation Reports*, Hong Kong, Antiquities and Monuments Office, p25-36.

(3) 香港古物古蹟辦事處 1997 “湧浪新石器時代遺址發掘簡報”，考古1997年第六期，科學出版社，p35-53.



Superficial Deposits

Qa Colluvial

Solid Geology

Qpa Debris Flow Deposit

Major Intrusive Igneous Rocks

gf Fine - grained granite, 0.06-2mm

gfm Fine - to grained granite

gm Medium - grained granite, 2-6mm

Minor Intrusive Igneous Rocks

b Basalt

l Lamprophyre

rq Quartzphyric rhyolite

rf Feldsparphyric rhyolite

ap Aplite

q Quartz

Metamorphic Rocks

Schist

Cu = Chalcopyrite

Figure 3.1

Geology of Black Point

4

ARCHAEOLOGICAL SURVEY FINDINGS

Although the Project Site itself was not favourable for ancient human settlement, it is noted that quartz can be easily identified in the surrounding hill areas which would have provided raw materials for stone tools. Thus, the beach areas to the north at Black Point and south at Lung Kwu Tan favoured the establishment of ancient settlement such as the former Yung Long archaeological site and the Lung Kwu Sheung Tan archaeological site (see *Figure 4.1*). As the Lung Kwu Sheung Tan archaeological site is outside the proposed development boundary, it was not necessary to survey this site.

4.1

FIELD WALKING

The slope angle at most of Project Site is between 40 degrees to 55 degrees (see *Figure 4.2*). Consequently, field walking was only undertaken at accessible areas.



Figure 4.2 Steep Slope at Black Point

Three terrace platforms with granite block retaining wall structures were identified at the rocky shore as shown in *Figure 4.3*. They are detailed below.

4.1.1

Terrace 1

Two separate building structures were identified, termed Structure 2a and 2b (see *Figure 4.4*). The two structures are located at the northern tip of the Project Site facing northeast at approximately +22 mPD.

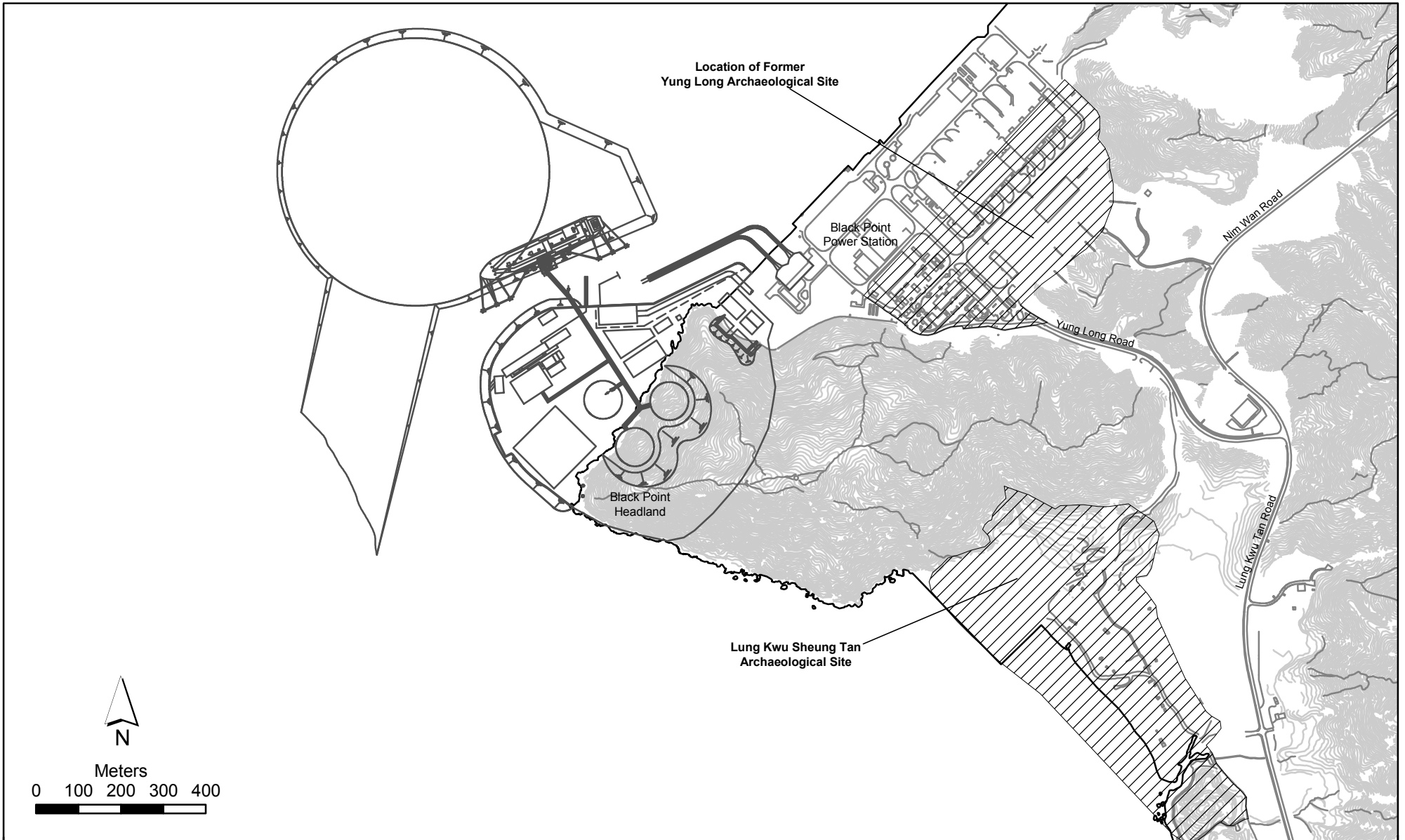


Figure 4.1

Location of Lung Kwu Sheung Tan Archaeological Site

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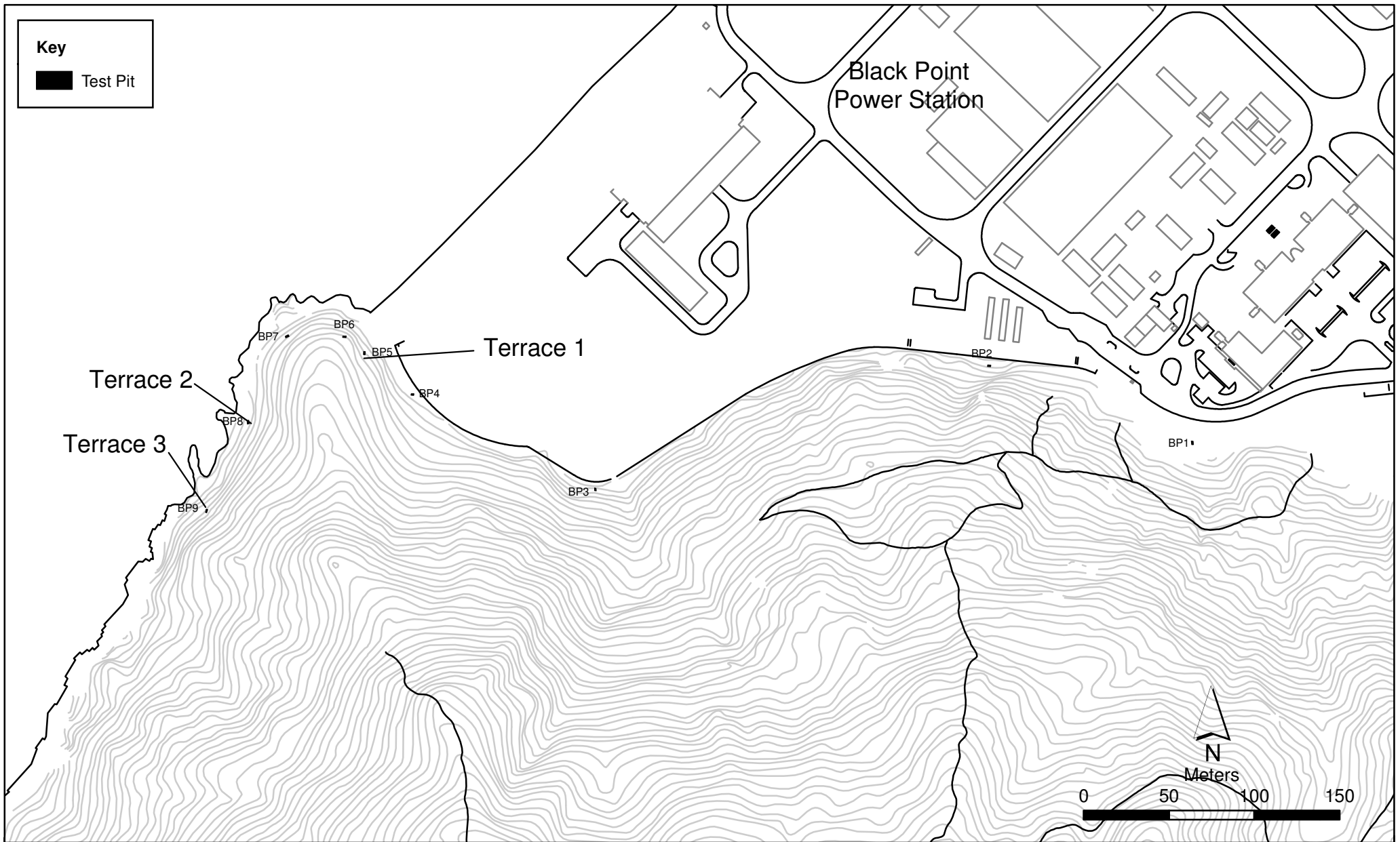
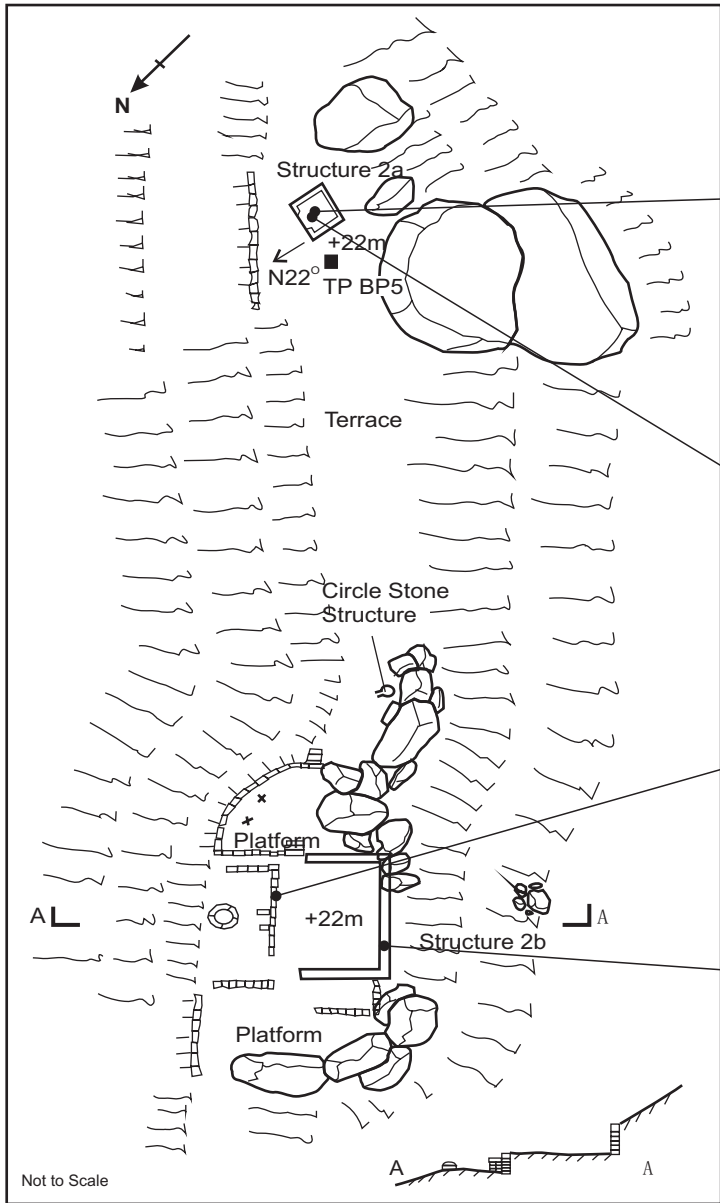


Figure 4.3

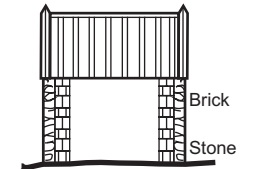
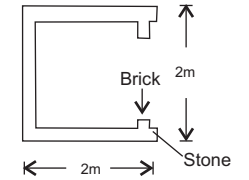
Location Plan of Test Pits and Terrace Platforms at Black Point



Gable of Building Structure 2a



Facade of Building Structure 2a



Reconstruction of Building Structure 2a



Platform of Structure 2b



Stone Wall Structure of Structure 2b

Figure 4.4

Terrace 1 at Black Point

Structure 2a is a dilapidated building measuring approximately 2 m x 2 m. It has a pitch roof but the roof tiles were mostly broken. The foundations of the gable walls were built with granite blocks, lime plastered with grey and reddish bricks built on top of the foundations. The structure measures about 1.6 m high. No decorative features or datable artefacts were identified. It is not known when the structure was built. Based on the material used for the building, it was built in the late 19th century to early to middle 20th century. As buildings built with similar material can still commonly be found in most of the New Territory areas, the structure is considered to have little architectural value.

Structure 2b is a stone wall measuring approximately 2 m x 4 m, a terraced platform with stone wall supports and a circle shaped stone structure likely to have been used for cooking purposes. Based on the material used for the building, it is likely to have been built in late 19th century to early 20th century. The structure is considered to have little architectural value.

4.1.2 *Terrace 2*

A terrace area with built granite block retaining walls (see *Figure 4.5*) was identified. However, no artefacts were identified. At the slope from the terrace towards the rocky shore, a cave measuring 1.5m in height was identified (see *Figure 4.5*). The cave is approximately 2.3m deep and faces northwest towards the Urmston Road. It is expected that the cave was constructed during the Japanese occupation for military use⁽¹⁾.

4.1.3 *Terrace 3*

Terrace 3 is located by the coast at approximately +20 mPD facing the sea (see *Figures 4.3* and *4.6*). It is a stone built rectangular structure measuring approximately 2 m x 4 m. The structure is unroofed and has steps built of stone linking the terraced platform to the rocky shore. No datable artefacts were identified around the Structure. Therefore, it is not known when the structure was built. Based on the materials of construction, it is likely to have been built in the late 19th century to early to 20th century. The structure is considered to have little architectural value as similar structures are commonly found in most areas of the New Territories.

4.2 *AUGERING*

A total of 40 auger holes were bored within the Project Area (see *Figure 4.7*). No artefacts were found from augering, confirming that the area is of no or low archaeological potential. For details of auger hole results, please see *Annex 12-A-A*.

(1) Ko, TK 1996 *Ruins of War : A Guide to Hong Kong's Battlefields and Wartime Sites*. Hong Kong : Joint Publishing (H.K.) Co., Ltd.



Cave Near Terrace 2



Cave Near Terrace 2



Granite Built Retaining Wall



Granite Built Retaining Wall

Figure 4.5

Terrace 2 Identified at Black Point



Stone Wall Structure



Platform

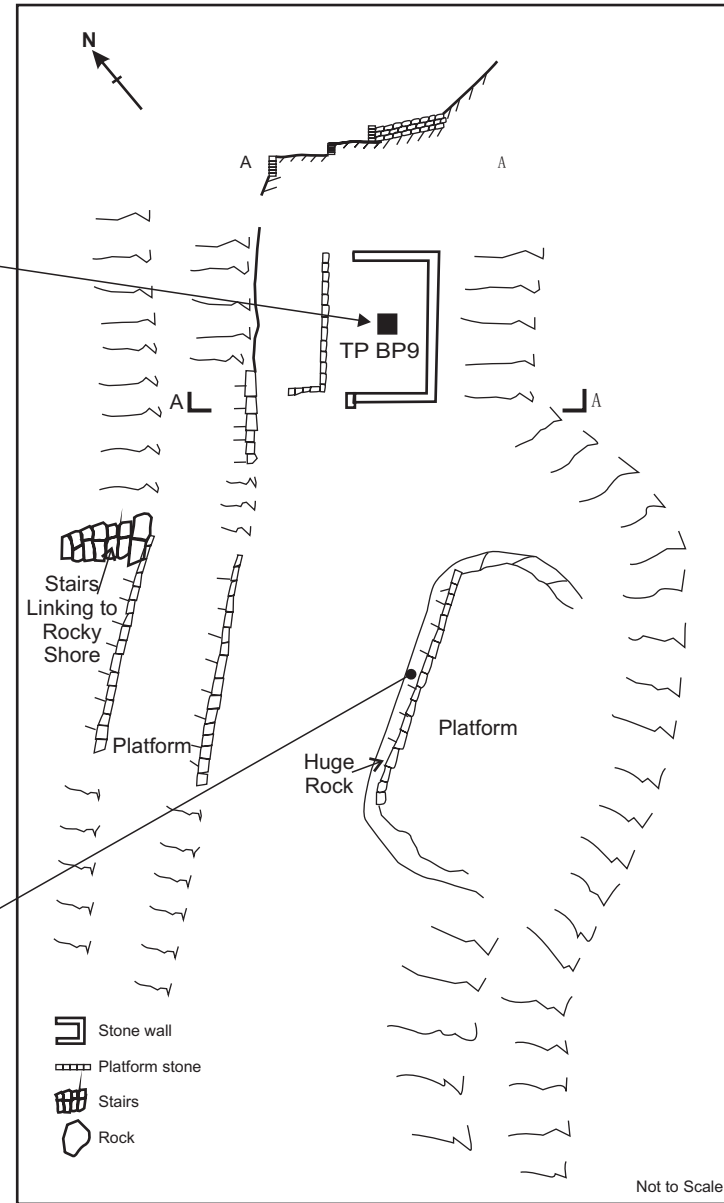


Figure 4.6

Terrace 3 Identified at Black Point

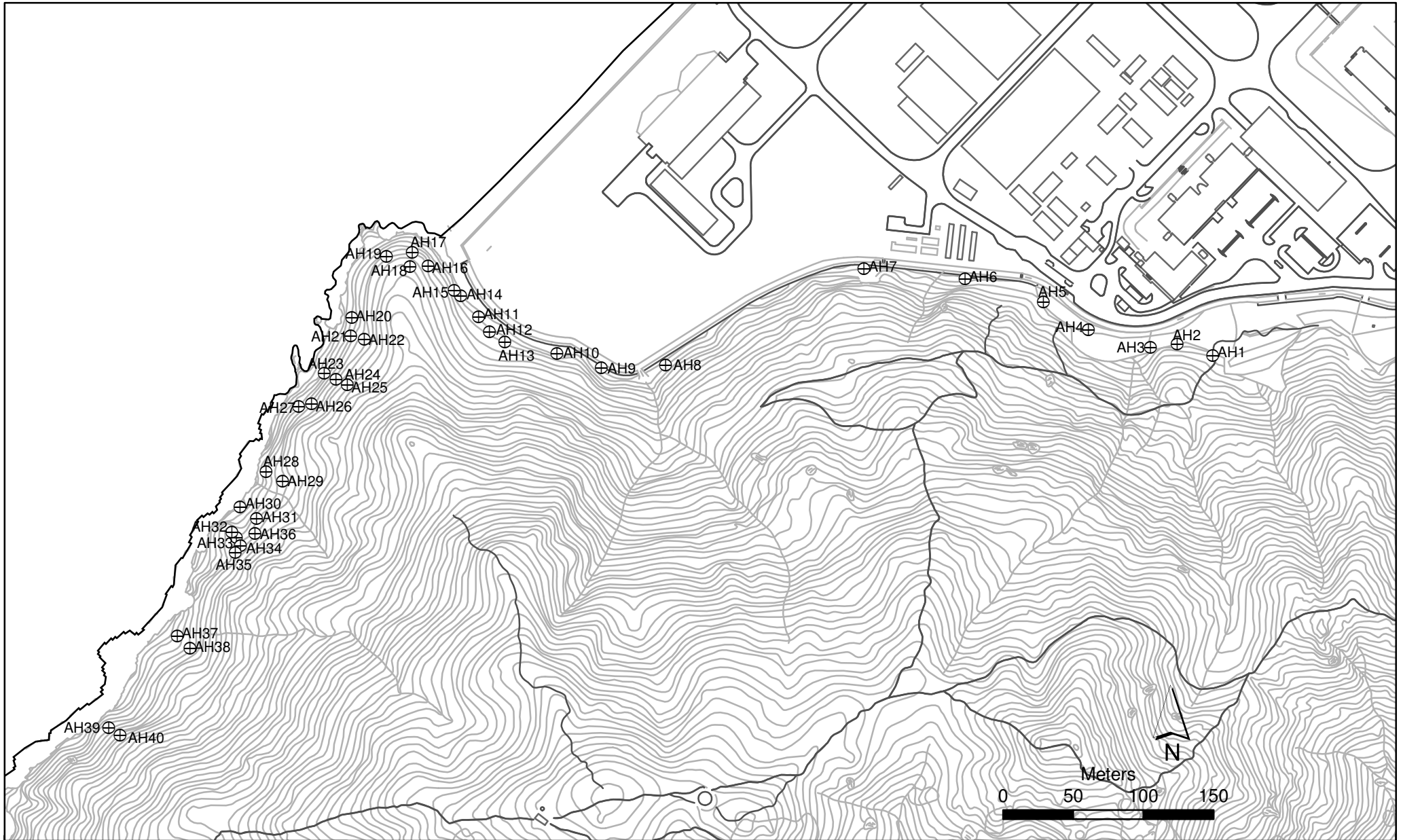


Figure 4.7

Location Plan of Auger Holes at Black Point

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4.3

TEST PITTING

A total of 9 test pits were excavated within the Project Area (see *Figure 4.3*). Only one of these pits, TP B5, was found to contain artefacts. In this pit, a large number of roof tile fragments and pot shards were identified. No remains were found in the rest of the pits. For full details of the test pit findings see *Annex 12-A-B*. A summary of key findings are presented below, and in *Table 4.1*.

Two test pits (TPs BP5 and BP9) were allocated at two of the terraces, Terrace 1 and Terrace 3 respectively (see *Figure 4.3*). A large number of roof tile fragments, black glazed pot shards and reddish slip pot shards (see *Figure 4.8*) were identified in L1 of TP BP5. According to the typology of the shards, they are common village wares dated to the late 19th century to middle 20th centuries. The roof tiles found in L1 of TP BP5 are yellowish in colour the same as those on the roof of the ruined building structure. The roof tiles are common construction material used in the late 19th to early 20th centuries for Chinese buildings.

Table 4.1 Summary of Test Pits Findings

Test Pit	Findings Result			
	Prehistoric Age	Historic Period (late 19 th to early 20 th centuries)	Others	No Finds
TP BP1				✓
TP BP2				✓
TP BP3				✓
TP SP4				✓
TP BP5		✓		
TP BP6				✓
TP BP7			✓ ⁽¹⁾	
TP BP8			✓ ⁽¹⁾	
TP BP9				✓

Note: (1) Natural quartz/quartz flakes



Roof tiles



Pottery shards
(exterior)



Pottery shards
(interior)

Figure 4.8

Recent finds Identified in TP BP5

5 PRELIMINARY FINDS ASSESSMENT

5.1 ARTEFACTS

5.1.1 Roof Tiles

A total of 83 pieces of broken yellow roof tiles (selected samples are shown in *Figure 4.8*) were identified in L1 of TP BP5. According to the colour and fabric of the roof tiles, they are identical to the roof tiles of the abandoned building structure which is dated to late 19th to early 20th centuries.

5.1.2 Pot Shards

A total of 36 broken pottery shards were identified including the rims and body. They were discovered in association with the broken roof tiles in L1 of TP BP5. They are mainly darkbrown glaze pots and basin shards (selected samples are shown in *Figure 4.8*) commonly used in villages in the late 19th to early 20th centuries.

6

CONCLUSIONS

Although some late 19th to early 20th century artefacts were identified at Terrace 1, they are common village wares that are still commonly used and found in the New Territory areas. Thus, it is considered to have low cultural heritage significance. The function of the dilapidated building structure identified at Terrace 1 is not known. The construction materials for the building structure were commonly used in the late 19th to early 20th century. Based on the low height of the building, it was not used for habitation. However, no further artefacts could be identified to ascertain its use. It is considered that the building is of low cultural heritage significance.

No finds were identified at Terrace 2 from the field walking and building structures appeared to be used for agricultural purposes during the late 19th to early 20th centuries. These building structures are also considered to be of low cultural heritage significance.

The cave feature identified at Black Point was believed to have been constructed for military purposes in WWII but no artefacts related to military uses were discovered. Similar caves that have a more complex network of tunnels have been found elsewhere in Hong Kong such as on Lamma Island. The cave at Black Point is therefore considered to be of low architectural and historic value. It is considered that this cave is of low cultural heritage significance.

On Terrace 3, some simple wall structures were found. No artefacts were located to aid the investigation of their function. The structures are considered to have no special architectural value.

Annex 12-A-A

Soil Profile of Auger Holes

AUGER HOLE RECORDS

LOCATION	BP	SITE		AUGER HOLE NO.	BP / AH1
LANDFORM	HILL SLOPE			DATE	14/10/2005

SOIL PROFILE	DEPTH (CM)	STRATUM	SOIL COLOUR	SOIL TEXTURE	FINDS	REMARKS
Ground Surface ▼	0					
43cm	0 4 8 12 16 20	1	7.5YR 7/3 Pink	Sandy Soil	NONE	
70cm	40	2	7.5YR 7/6 Reddish Yellow	Sandy Soil	NONE	
75cm	60	3		Weathered Bed Rock	NONE	
	80					
	100					
	120					
	140					
	160					
	180					
	200					
	220					
	240					

<p>LEGEND</p> <table style="width: 100%;"> <tr> <td> = CONCRETE</td> <td> = LOAMY SOIL</td> <td> = WEATHERED BED ROCK</td> </tr> <tr> <td> = GRAVEL</td> <td> = CLAYEY SOIL</td> <td></td> </tr> <tr> <td> = SAND</td> <td> = CLAYEY SAND</td> <td></td> </tr> <tr> <td> = SANDY SOIL</td> <td> = COBBLES AND PEBBLES</td> <td></td> </tr> </table>	= CONCRETE	= LOAMY SOIL	= WEATHERED BED ROCK	= GRAVEL	= CLAYEY SOIL		= SAND	= CLAYEY SAND		= SANDY SOIL	= COBBLES AND PEBBLES		<p style="text-align: center;"><i>INTERPRETATION</i></p> <div style="text-align: center;"> <p>ERM</p> </div>
= CONCRETE	= LOAMY SOIL	= WEATHERED BED ROCK											
= GRAVEL	= CLAYEY SOIL												
= SAND	= CLAYEY SAND												
= SANDY SOIL	= COBBLES AND PEBBLES												

AUGER HOLE RECORDS

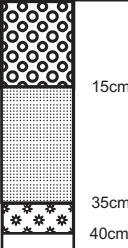
LOCATION	BP	SITE		AUGER HOLE NO.	BP / AH2
LANDFORM	HILL SLOPE			DATE	14/10/2005

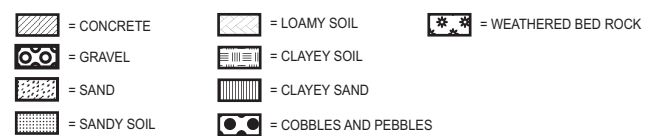

SOIL PROFILE	DEPTH (CM)	STRATUM	SOIL COLOUR	SOIL TEXTURE	FINDS	REMARKS
<p>Ground Surface</p> <p>30cm</p> <p>40cm</p>	<p>0</p> <p>4</p> <p>8</p> <p>12</p> <p>16</p> <p>20</p> <p>40</p> <p>60</p> <p>80</p> <p>100</p> <p>120</p> <p>140</p> <p>160</p> <p>180</p> <p>200</p> <p>220</p> <p>240</p>	<p>1</p> <p>2</p>	<p>2.5Y 7/4 Pale Yellow</p>	<p>Sandy Soil</p> <p>Weathered Bed Rock</p>	<p>NONE</p> <p>NONE</p>	

LEGEND	INTERPRETATION													
<table style="width: 100%;"> <tr> <td> = CONCRETE</td> <td> = LOAMY SOIL</td> <td> = WEATHERED BED ROCK</td> </tr> <tr> <td> = GRAVEL</td> <td> = CLAYEY SOIL</td> <td></td> </tr> <tr> <td> = SAND</td> <td> = CLAYEY SAND</td> <td></td> </tr> <tr> <td> = SANDY SOIL</td> <td> = COBBLES AND PEBBLES</td> <td></td> </tr> </table>	= CONCRETE	= LOAMY SOIL	= WEATHERED BED ROCK	= GRAVEL	= CLAYEY SOIL		= SAND	= CLAYEY SAND		= SANDY SOIL	= COBBLES AND PEBBLES			
= CONCRETE	= LOAMY SOIL	= WEATHERED BED ROCK												
= GRAVEL	= CLAYEY SOIL													
= SAND	= CLAYEY SAND													
= SANDY SOIL	= COBBLES AND PEBBLES													

AUGER HOLE RECORDS


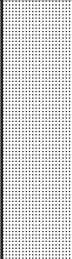

LOCATION	BP	SITE		AUGER HOLE NO.	BP / AH3
LANDFORM	HILL SLOPE			DATE	14/10/2005





























SOIL PROFILE	DEPTH (CM)	STRATUM	SOIL COLOUR	SOIL TEXTURE	FINDS	REMARKS
<div style="text-align: right; margin-bottom: 5px;">Ground Surface ▼</div> 	0 4 8 12 16 20 40 60 80 100 120 140 160 180 200 220 240	1 2 3	7.5Y 6/1 Gray 7.5Y 7/6 Reddish Yellow	Coarse Sand and Gravel Sandy Soil Weathered Bed Rock	NONE NONE NONE	

LEGEND 	INTERPRETATION 
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AUGER HOLE RECORDS

LOCATION	BP	SITE		AUGER HOLE NO.	BP / AH4
LANDFORM	HILL SLOPE			DATE	14/10/2005

SOIL PROFILE	DEPTH (CM)	STRATUM	SOIL COLOUR	SOIL TEXTURE	FINDS	REMARKS
Ground Surface ▼						
 10cm	0 4 8	1	10YR 5/6 Yellowish Brown	Sandy Soil	NONE	
 55cm	12 16 20 40	2	10YR 5/8 Yellowish Brown	Sandy Soil	NONE	
 60cm	60	3		Weathered Bed Rock	NONE	
	80 100 120 140 160 180 200 220 240					

<p>LEGEND</p> <table style="width: 100%;"> <tr> <td> = CONCRETE</td> <td> = LOAMY SOIL</td> <td> = WEATHERED BED ROCK</td> </tr> <tr> <td> = GRAVEL</td> <td> = CLAYEY SOIL</td> <td></td> </tr> <tr> <td> = SAND</td> <td> = CLAYEY SAND</td> <td></td> </tr> <tr> <td> = SANDY SOIL</td> <td> = COBBLES AND PEBBLES</td> <td></td> </tr> </table>	 = CONCRETE	 = LOAMY SOIL	 = WEATHERED BED ROCK	 = GRAVEL	 = CLAYEY SOIL		 = SAND	 = CLAYEY SAND		 = SANDY SOIL	 = COBBLES AND PEBBLES		<p style="text-align: center;"><i>INTERPRETATION</i></p> <div style="text-align: right;">  </div>
 = CONCRETE	 = LOAMY SOIL	 = WEATHERED BED ROCK											
 = GRAVEL	 = CLAYEY SOIL												
 = SAND	 = CLAYEY SAND												
 = SANDY SOIL	 = COBBLES AND PEBBLES												

AUGER HOLE RECORDS

LOCATION	BP	SITE		AUGER HOLE NO.	BP / AH5
LANDFORM	HILL SLOPE			DATE	14/10/2005

SOIL PROFILE	DEPTH (CM)	STRATUM	SOIL COLOUR	SOIL TEXTURE	FINDS	REMARKS
<div style="text-align: right; margin-bottom: 5px;">Ground Surface ▼</div>	0 4 8 12 16 20 40 60 80 100 120 140 160 180 200 220 240	1 2	7.5YR 7/6 Reddish Yellow 10YR 5/8 Reddish Yellow	Coarse Sandy Soil Gravel and Some Rocks	NONE NONE	

LEGEND 	INTERPRETATION
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AUGER HOLE RECORDS

LOCATION	BP	SITE		AUGER HOLE NO.	BP / AH6
LANDFORM	HILL SLOPE			DATE	14/10/2005

SOIL PROFILE	DEPTH (CM)	STRATUM	SOIL COLOUR	SOIL TEXTURE	FINDS	REMARKS
Ground Surface 	0					
	0 4 8 12 16 20	1	10YR 4/3 Brown	Sandy Soil	NONE	
	33cm 40cm 40	2		Weathered Bed Rock	NONE	
	60 80 100 120 140 160 180 200 220 240					

LEGEND <ul style="list-style-type: none"> <li style="width: 30%;"> = CONCRETE <li style="width: 30%;"> = LOAMY SOIL <li style="width: 30%;"> = WEATHERED BED ROCK <li style="width: 30%;"> = GRAVEL <li style="width: 30%;"> = CLAYEY SOIL <li style="width: 30%;"> = SANDY SOIL <li style="width: 30%;"> = CLAYEY SAND <li style="width: 30%;"> = COBBLES AND PEBBLES <li style="width: 30%;"> = SAND 	INTERPRETATION
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AUGER HOLE RECORDS

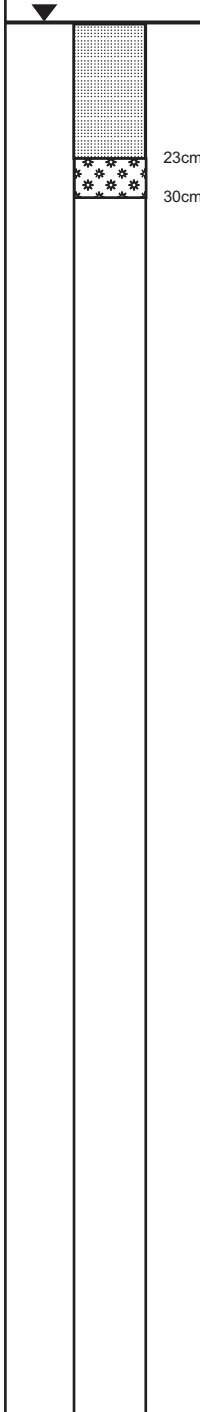
LOCATION	BP	SITE		AUGER HOLE NO.	BP / AH7
LANDFORM	HILL SLOPE			DATE	14/10/2005

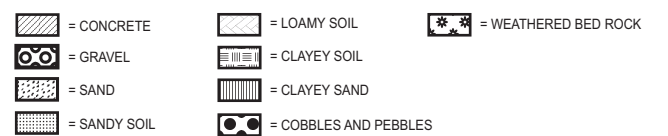

SOIL PROFILE	DEPTH (CM)	STRATUM	SOIL COLOUR	SOIL TEXTURE	FINDS	REMARKS
<div style="text-align: right; margin-bottom: 5px;">Ground Surface ▼</div>	0 4 8 12 16 20 40 60 80 100 120 140 160 180 200 220 240	1 2 3	7.5YR 7/4 Pink 7.5YR 6/3 Light Brown	Sandy Soil Sandy Soil Weathered Bed Rock	NONE NONE NONE	

LEGEND 	INTERPRETATION
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AUGER HOLE RECORDS

LOCATION	BP	SITE		AUGER HOLE NO.	BP / AH8
LANDFORM	HILL SLOPE			DATE	15/10/2005

SOIL PROFILE	DEPTH (CM)	STRATUM	SOIL COLOUR	SOIL TEXTURE	FINDS	REMARKS
<div style="text-align: right; margin-bottom: 5px;">Ground Surface ▼</div> 	0 4 8 12 16 20 40 60 80 100 120 140 160 180 200 220 240	1 2	10YR 4/3 Brown	Sandy Soil Weathered Bed Rock	NONE NONE	

LEGEND 	INTERPRETATION 
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AUGER HOLE RECORDS

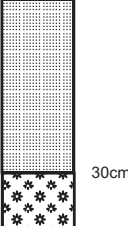
LOCATION	BP	SITE		AUGER HOLE NO.	BP / AH9
LANDFORM	HILL SLOPE			DATE	14/10/2005


SOIL PROFILE	DEPTH (CM)	STRATUM	SOIL COLOUR	SOIL TEXTURE	FINDS	REMARKS
<div style="text-align: right; margin-bottom: 5px;">Ground Surface ▼</div>	0 4 8 12 16 20 40 60 80 100 120 140 160 180 200 220 240	1 2 3	7.5YR 5/3 Brown 7.5YR 4/2 Brown	Sandy Soil Sandy Soil with Gravel Weathered Bed Rock	NONE NONE NONE	

LEGEND 	INTERPRETATION
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AUGER HOLE RECORDS

LOCATION	BP	SITE	AUGER HOLE NO.	BP / AH10
LANDFORM	HILL SLOPE			DATE
				14/10/2005

SOIL PROFILE	DEPTH (CM)	STRATUM	SOIL COLOUR	SOIL TEXTURE	FINDS	REMARKS
Ground Surface ▼	0					
 <div style="position: absolute; left: 150px; top: 30px;">30cm</div> <div style="position: absolute; left: 150px; top: 340px;">40cm</div>	4 8 12 16 20 40 60 80 100 120 140 160 180 200 220 240	1	2.5YR 5/4 Light Olive brown	Sandy Soil	NONE	
		2		Weathered Bed Rock	NONE	

LEGEND	INTERPRETATION	
<div style="display: flex; flex-wrap: wrap; justify-content: space-between;"> <div style="width: 30%;"> <p> = CONCRETE</p> <p> = GRAVEL</p> <p> = SAND</p> <p> = SANDY SOIL</p> </div> <div style="width: 30%;"> <p> = LOAMY SOIL</p> <p> = CLAYEY SOIL</p> <p> = CLAYEY SAND</p> <p> = COBBLES AND PEBBLES</p> </div> <div style="width: 30%;"> <p> = WEATHERED BED ROCK</p> </div> </div>		

AUGER HOLE RECORDS

LOCATION	BP	SITE		AUGER HOLE NO.	BP / AH11
LANDFORM	HILL SLOPE			DATE	13/10/2005

SOIL PROFILE	DEPTH (CM)	STRATUM	SOIL COLOUR	SOIL TEXTURE	FINDS	REMARKS
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<p>Ground Surface</p> <p>37cm 45cm</p>	<p>0</p> <p>4</p> <p>8</p> <p>12</p> <p>16</p> <p>20</p> <p>40</p> <p>60</p> <p>80</p> <p>100</p> <p>120</p> <p>140</p> <p>160</p> <p>180</p> <p>200</p> <p>220</p> <p>240</p>	<p>1</p> <p>2</p>	<p>2.5YR 5/4 Light Olive Brown</p> <p>Weathered Bed Rock</p>	<p>Sandy Soil</p> <p>Weathered Bed Rock</p>	<p>NONE</p> <p>NONE</p>	
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LEGEND	INTERPRETATION	
= CONCRETE = LOAMY SOIL = WEATHERED BED ROCK = GRAVEL = CLAYEY SOIL = SAND = CLAYEY SAND = SANDY SOIL = COBBLES AND PEBBLES		

AUGER HOLE RECORDS

LOCATION	BP	SITE		AUGER HOLE NO.	BP / AH12
LANDFORM	HILL SLOPE			DATE	13/10/2005

SOIL PROFILE	DEPTH (CM)	STRATUM	SOIL COLOUR	SOIL TEXTURE	FINDS	REMARKS
<div style="text-align: right; margin-bottom: 5px;">Ground Surface ▼</div>	0 4 8 12 16 20 40 60 80 100 120 140 160 180 200 220 240	1 2	2.5YR 5/4 Light Olive Brown 2.5YR 7/6 Light Olive Brown	Sandy Soil Sandy Soil	NONE NONE	

LEGEND <table style="width: 100%; border: none;"> <tr> <td style="width: 33%;"> = CONCRETE</td> <td style="width: 33%;"> = LOAMY SOIL</td> <td style="width: 33%;"> = WEATHERED BED ROCK</td> </tr> <tr> <td> = GRAVEL</td> <td> = CLAYEY SOIL</td> <td></td> </tr> <tr> <td> = SAND</td> <td> = CLAYEY SAND</td> <td></td> </tr> <tr> <td> = SANDY SOIL</td> <td> = COBBLES AND PEBBLES</td> <td></td> </tr> </table>	= CONCRETE	= LOAMY SOIL	= WEATHERED BED ROCK	= GRAVEL	= CLAYEY SOIL		= SAND	= CLAYEY SAND		= SANDY SOIL	= COBBLES AND PEBBLES		INTERPRETATION <div style="text-align: right; margin-top: 20px;"> </div>
= CONCRETE	= LOAMY SOIL	= WEATHERED BED ROCK											
= GRAVEL	= CLAYEY SOIL												
= SAND	= CLAYEY SAND												
= SANDY SOIL	= COBBLES AND PEBBLES												

AUGER HOLE RECORDS

LOCATION	BP	SITE		AUGER HOLE NO.	BP / AH13
LANDFORM	HILL SLOPE			DATE	13/10/2005

SOIL PROFILE	DEPTH (CM)	STRATUM	SOIL COLOUR	SOIL TEXTURE	FINDS	REMARKS
<div style="text-align: right; margin-bottom: 5px;">Ground Surface ▼</div>	0 4 8 12 16 20 40 60 80 100 120 140 160 180 200 220 240	1 2 3	2.5YR 5/4 Light Olive Brown 2.5YR 6/6 Olive Yellow	Sandy Soil Weathered Bed Rock	NONE NONE NONE	

LEGEND 	INTERPRETATION
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AUGER HOLE RECORDS

LOCATION	BP	SITE		AUGER HOLE NO.	BP / AH14
LANDFORM	HILL SLOPE			DATE	12/10/2005

SOIL PROFILE	DEPTH (CM)	STRATUM	SOIL COLOUR	SOIL TEXTURE	FINDS	REMARKS	
<div style="text-align: right; margin-bottom: 5px;">Ground Surface ▼</div>	0						
	4						
	8						
	12	1		2.5YR 4/2 Dark Brown	Coarse Sandy Soil	NONE	
	16						
20							
40	2		10 YR 4/3 Brown	Fine Sandy Soil	NONE		
45	3		7.5YR 6/1 Gray	Sandy loam	NONE		
51							
60							
80	4		10YR 5/6 Yellow Brown	Weathered Bed Rock	NONE		
100							
120	5			Weathered Bed Rock	NONE		
130							
140							
160							
180							
200							
220							
240							

LEGEND 	INTERPRETATION
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AUGER HOLE RECORDS

LOCATION	BP	SITE		AUGER HOLE NO.	BP / AH15
LANDFORM	HILL SLOPE			DATE	12/10/2005

SOIL PROFILE	DEPTH (CM)	STRATUM	SOIL COLOUR	SOIL TEXTURE	FINDS	REMARKS
Ground Surface ▼	0					
50cm	4 8 12 16 20	1	10YR 4/3 Brown	Coarse Sandy Soil	NONE	
64cm	40	2	10YR 5/6 Yellowish Brown	Coarse Sandy Soil	NONE	
70cm	60	3		Weathered Bed Rock	NONE	
	80					
	100					
	120					
	140					
	160					
	180					
	200					
	220					
	240					

<p>LEGEND</p> <table style="width: 100%;"> <tr> <td></td> <td>= CONCRETE</td> <td></td> <td>= LOAMY SOIL</td> <td></td> <td>= WEATHERED BED ROCK</td> </tr> <tr> <td></td> <td>= GRAVEL</td> <td></td> <td>= CLAYEY SOIL</td> <td></td> <td>= CLAYEY SAND</td> </tr> <tr> <td></td> <td>= SAND</td> <td></td> <td>= COBBLES AND PEBBLES</td> <td></td> <td></td> </tr> <tr> <td></td> <td>= SANDY SOIL</td> <td></td> <td></td> <td></td> <td></td> </tr> </table>		= CONCRETE		= LOAMY SOIL		= WEATHERED BED ROCK		= GRAVEL		= CLAYEY SOIL		= CLAYEY SAND		= SAND		= COBBLES AND PEBBLES				= SANDY SOIL					<p style="text-align: center;"><i>INTERPRETATION</i></p> <div style="text-align: right; margin-top: 20px;"> </div>
	= CONCRETE		= LOAMY SOIL		= WEATHERED BED ROCK																				
	= GRAVEL		= CLAYEY SOIL		= CLAYEY SAND																				
	= SAND		= COBBLES AND PEBBLES																						
	= SANDY SOIL																								

AUGER HOLE RECORDS

LOCATION	BP	SITE		AUGER HOLE NO.	BP / AH16
LANDFORM	HILL SLOPE			DATE	14/10/2005

SOIL PROFILE	DEPTH (CM)	STRATUM	SOIL COLOUR	SOIL TEXTURE	FINDS	REMARKS
Ground Surface ▼	0					
20cm	4	1	10YR 4/1 Dark Gray	Sandy Soil	NONE	
43cm	8	2	10YR 3/6 Dark Yellowish Brown	Sandy Soil	NONE	
76cm	12	3	10YR 4/6 Dark Yellowish Brown	Loamy Soil	NONE	
85cm	16	4	10YR 8/6 Yellow	Loamy Soil	NONE	
90cm	20	5		Weathered Bed Rock	NONE	
	24					
	28					
	32					
	36					
	40					
	44					
	48					
	52					
	56					
	60					
	64					
	68					
	72					
	76					
	80					
	84					
	88					
	92					
	96					
	100					
	104					
	108					
	112					
	116					
	120					
	124					
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	212					
	216					
	220					
	224					
	228					
	232					
	236					
	240					

<p>LEGEND</p> <table style="width: 100%;"> <tr> <td> = CONCRETE</td> <td> = LOAMY SOIL</td> <td> = WEATHERED BED ROCK</td> </tr> <tr> <td> = GRAVEL</td> <td> = CLAYEY SOIL</td> <td></td> </tr> <tr> <td> = SAND</td> <td> = CLAYEY SAND</td> <td></td> </tr> <tr> <td> = SANDY SOIL</td> <td> = COBBLES AND PEBBLES</td> <td></td> </tr> </table>	= CONCRETE	= LOAMY SOIL	= WEATHERED BED ROCK	= GRAVEL	= CLAYEY SOIL		= SAND	= CLAYEY SAND		= SANDY SOIL	= COBBLES AND PEBBLES		<p style="text-align: center;"><i>INTERPRETATION</i></p> <div style="text-align: right; padding-right: 20px;"> </div>
= CONCRETE	= LOAMY SOIL	= WEATHERED BED ROCK											
= GRAVEL	= CLAYEY SOIL												
= SAND	= CLAYEY SAND												
= SANDY SOIL	= COBBLES AND PEBBLES												

AUGER HOLE RECORDS

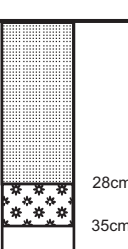
LOCATION	BP	SITE		AUGER HOLE NO.	BP / AH17
LANDFORM	HILL SLOPE			DATE	11/2005


SOIL PROFILE	DEPTH (CM)	STRATUM	SOIL COLOUR	SOIL TEXTURE	FINDS	REMARKS
Ground Surface ▼	0					
15cm	4	1	7.5YR 6/2 Pinish Gray	Sandy Soil	NONE	
30cm	8	2	7.5YR 5/4 Brown	Sandy Soil	NONE	
35cm	12	3	7.5YR 5/2 Brown	Sandy Soil	NONE	
45cm	16	4	7.5YR 7/6 Reddish Yellow	Sandy Soil	NONE	
50cm	20	5		Weathered Bed Rock	NONE	
	24					

<p>LEGEND</p> <table style="width: 100%;"> <tr> <td> = CONCRETE</td> <td> = LOAMY SOIL</td> <td> = WEATHERED BED ROCK</td> </tr> <tr> <td> = GRAVEL</td> <td> = CLAYEY SOIL</td> <td></td> </tr> <tr> <td> = SAND</td> <td> = CLAYEY SAND</td> <td></td> </tr> <tr> <td> = SANDY SOIL</td> <td> = COBBLES AND PEBBLES</td> <td></td> </tr> </table>	= CONCRETE	= LOAMY SOIL	= WEATHERED BED ROCK	= GRAVEL	= CLAYEY SOIL		= SAND	= CLAYEY SAND		= SANDY SOIL	= COBBLES AND PEBBLES		<p style="text-align: center;"><i>INTERPRETATION</i></p> <div style="text-align: right; padding-right: 20px;"> </div>
= CONCRETE	= LOAMY SOIL	= WEATHERED BED ROCK											
= GRAVEL	= CLAYEY SOIL												
= SAND	= CLAYEY SAND												
= SANDY SOIL	= COBBLES AND PEBBLES												

AUGER HOLE RECORDS

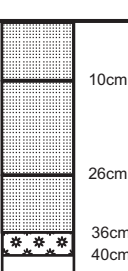
LOCATION	BP	SITE		AUGER HOLE NO.	BP / AH18
LANDFORM	HILL SLOPE			DATE	14/10/2005

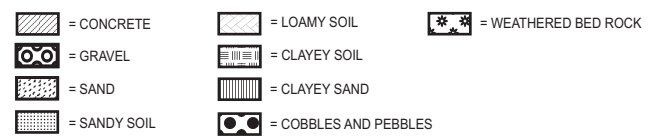

SOIL PROFILE	DEPTH (CM)	STRATUM	SOIL COLOUR	SOIL TEXTURE	FINDS	REMARKS
<p>Ground Surface</p>  <p>28cm 35cm</p>	<p>0</p> <p>4</p> <p>8</p> <p>12</p> <p>16</p> <p>20</p> <p>40</p> <p>60</p> <p>80</p> <p>100</p> <p>120</p> <p>140</p> <p>160</p> <p>180</p> <p>200</p> <p>220</p> <p>240</p>	<p>1</p> <p>2</p>	<p>2.5YR 4/3 Olive Brown</p>	<p>Sandy Soil</p> <p>Weathered Bed Rock</p>	<p>NONE</p> <p>NONE</p>	

<p>LEGEND</p> <table style="width: 100%;"> <tr> <td> = CONCRETE</td> <td> = LOAMY SOIL</td> <td> = WEATHERED BED ROCK</td> </tr> <tr> <td> = GRAVEL</td> <td> = CLAYEY SOIL</td> <td></td> </tr> <tr> <td> = SAND</td> <td> = CLAYEY SAND</td> <td></td> </tr> <tr> <td> = SANDY SOIL</td> <td> = COBBLES AND PEBBLES</td> <td></td> </tr> </table>	= CONCRETE	= LOAMY SOIL	= WEATHERED BED ROCK	= GRAVEL	= CLAYEY SOIL		= SAND	= CLAYEY SAND		= SANDY SOIL	= COBBLES AND PEBBLES		<p>INTERPRETATION</p> <div style="text-align: right;">  </div>
= CONCRETE	= LOAMY SOIL	= WEATHERED BED ROCK											
= GRAVEL	= CLAYEY SOIL												
= SAND	= CLAYEY SAND												
= SANDY SOIL	= COBBLES AND PEBBLES												

AUGER HOLE RECORDS

LOCATION	BP	SITE		AUGER HOLE NO.	BP / AH19
LANDFORM	HILL SLOPE			DATE	14/10/2005











SOIL PROFILE	DEPTH (CM)	STRATUM	SOIL COLOUR	SOIL TEXTURE	FINDS	REMARKS
<div style="text-align: right; margin-bottom: 5px;">Ground Surface ▼</div> 	0 4 8 12 16 20 40 60 80 100 120 140 160 180 200 220 240	1 2 3 4	7.5YR 6/3 Light Brown 7.5YR 6/4 Light Brown 7.5YR 7/6 Reddish Yellow 	Coarse Sandy Soil Sandy Soil Sandy Soil Weathered Bed Rock	NONE NONE NONE NONE	

LEGEND 	INTERPRETATION <div style="text-align: right; margin-top: 20px;">  </div>
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AUGER HOLE RECORDS

LOCATION	BP	SITE		AUGER HOLE NO.	BP / AH20
LANDFORM	HILL SLOPE			DATE	14/10/2005

SOIL PROFILE	DEPTH (CM)	STRATUM	SOIL COLOUR	SOIL TEXTURE	FINDS	REMARKS
Ground Surface ▼	0					
33cm 37cm	4 8 12 16 20	1	2.5YR 6/6 Olive Yellow	Sandy Soil	NONE	
* * *	20 40	2		Weathered Bed Rock	NONE	
	60 80 100 120 140 160 180 200 220 240					

LEGEND  = CONCRETE  = GRAVEL  = SAND  = SANDY SOIL  = LOAMY SOIL  = CLAYEY SOIL  = CLAYEY SAND  = COBBLES AND PEBBLES  = WEATHERED BED ROCK	INTERPRETATION 
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AUGER HOLE RECORDS

LOCATION	BP	SITE		AUGER HOLE NO.	BP / AH21
LANDFORM	HILL SLOPE			DATE	14/10/2005

SOIL PROFILE	DEPTH (CM)	STRATUM	SOIL COLOUR	SOIL TEXTURE	FINDS	REMARKS
Ground Surface ▼	0					
10cm	4	1	7.5YR 5/3 Pink	Sandy Soil	NONE	
25cm	8	2	7.5YR 7/4 Pink	Sandy Soil	NONE	
65cm	12	3	7.5YR 6/4 Light Brown	Sandy Soil	NONE	
80cm	16	4	7.5YR 7/6 Reddish Yellow	Weathered Bed Rock	NONE	
	20					
	24					
	28					
	32					
	36					
	40					
	44					
	48					
	52					
	56					
	60					
	64					
	68					
	72					
	76					
	80					
	84					
	88					
	92					
	96					
	100					
	104					
	108					
	112					
	116					
	120					
	124					
	128					
	132					
	136					
	140					
	144					
	148					
	152					
	156					
	160					
	164					
	168					
	172					
	176					
	180					
	184					
	188					
	192					
	196					
	200					
	204					
	208					
	212					
	216					
	220					
	224					
	228					
	232					
	236					
	240					

<p>LEGEND</p> <table style="width: 100%;"> <tr> <td> = CONCRETE</td> <td> = LOAMY SOIL</td> <td> = WEATHERED BED ROCK</td> </tr> <tr> <td> = GRAVEL</td> <td> = CLAYEY SOIL</td> <td></td> </tr> <tr> <td> = SAND</td> <td> = CLAYEY SAND</td> <td></td> </tr> <tr> <td> = SANDY SOIL</td> <td> = COBBLES AND PEBBLES</td> <td></td> </tr> </table>	= CONCRETE	= LOAMY SOIL	= WEATHERED BED ROCK	= GRAVEL	= CLAYEY SOIL		= SAND	= CLAYEY SAND		= SANDY SOIL	= COBBLES AND PEBBLES		<p style="text-align: center;"><i>INTERPRETATION</i></p> <div style="text-align: right; padding-top: 20px;"> </div>
= CONCRETE	= LOAMY SOIL	= WEATHERED BED ROCK											
= GRAVEL	= CLAYEY SOIL												
= SAND	= CLAYEY SAND												
= SANDY SOIL	= COBBLES AND PEBBLES												

AUGER HOLE RECORDS

LOCATION	BP	SITE		AUGER HOLE NO.	BP / AH22
LANDFORM	HILL SLOPE			DATE	14/10/2005

SOIL PROFILE	DEPTH (CM)	STRATUM	SOIL COLOUR	SOIL TEXTURE	FINDS	REMARKS
<div style="text-align: right; margin-bottom: 5px;">Ground Surface ▼</div>	0 4 8 12 16 20 40 60 80 100 120 140 160 180 200 220 240	1 2 3	2.5YR 5/4 Light Olive Brown 2.5YR 7/6 Yellow	Sandy Soil Sandy Soil Weathered Bed Rock	NONE NONE NONE	

LEGEND 	INTERPRETATION
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AUGER HOLE RECORDS

LOCATION	BP	SITE		AUGER HOLE NO.	BP / AH23
LANDFORM	HILL SLOPE			DATE	14/10/2005

SOIL PROFILE	DEPTH (CM)	STRATUM	SOIL COLOUR	SOIL TEXTURE	FINDS	REMARKS
<div style="text-align: right; margin-bottom: 5px;">Ground Surface ▼</div>	0 4 8 12 16 20 40 60 80 100 120 140 160 180 200 220 240	1 2 3	7.5YR 8/4 Pink 7.5YR 7/6 Reddish Yellow	Sandy Soil Sandy Soil Weathered Bed Rock	NONE NONE NONE	

LEGEND <ul style="list-style-type: none"> = CONCRETE = LOAMY SOIL = WEATHERED BED ROCK = GRAVEL = CLAYEY SOIL = SANDY SOIL = CLAYEY SAND = COBBLES AND PEBBLES = SAND 	INTERPRETATION <div style="text-align: right; margin-top: 20px;"> </div>
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AUGER HOLE RECORDS

LOCATION	BP	SITE		AUGER HOLE NO.	BP / AH24
LANDFORM	HILL SLOPE			DATE	14/10/2005

SOIL PROFILE	DEPTH (CM)	STRATUM	SOIL COLOUR	SOIL TEXTURE	FINDS	REMARKS
<div style="text-align: right; margin-bottom: 5px;">Ground Surface ▼</div>	0 4 8 12 16 20 40 60 80 100 120 140 160 180 200 220 240	1 2 3	2.5Y 5/3 Light Olive Brown 2.5Y 8/4 Pale Yellow	Sandy Soil Coarse Sandy Soil Weathered Bed Rock	NONE NONE NONE	

LEGEND 	INTERPRETATION
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AUGER HOLE RECORDS


LOCATION	BP	SITE		AUGER HOLE NO.	BP / AH25
LANDFORM	HILL SLOPE			DATE	14/10/2005


SOIL PROFILE	DEPTH (CM)	STRATUM	SOIL COLOUR	SOIL TEXTURE	FINDS	REMARKS
<div style="text-align: right; margin-bottom: 5px;">Ground Surface ▼</div>	0 4 8 12 16 20 40 60 80 100 120 140 160 180 200 220 240	1 2 3	7.5YR 8/3 Pink 7.5YR 7/4 Pink	Sandy Soil Coarse Sandy Soil Weathered Bed Rock	NONE NONE NONE	

LEGEND 	INTERPRETATION
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AUGER HOLE RECORDS

LOCATION	BP	SITE		AUGER HOLE NO.	BP / AH26
LANDFORM	HILL SLOPE			DATE	14/10/2005

SOIL PROFILE	DEPTH (CM)	STRATUM	SOIL COLOUR	SOIL TEXTURE	FINDS	REMARKS
<div style="text-align: right;">Ground Surface ▼</div> 	0 4 8 12 16 20 40 60 80 100 120 140 160 180 200 220 240	1	2.5Y 4/2 Dark Grayish Brown	Sandy Soil	NONE	
		2	Weathered Bed Rock		NONE	

LEGEND	INTERPRETATION	
= CONCRETE = LOAMY SOIL = WEATHERED BED ROCK = GRAVEL = CLAYEY SOIL = SAND = CLAYEY SAND = SANDY SOIL = COBBLES AND PEBBLES		

AUGER HOLE RECORDS

LOCATION	BP	SITE		AUGER HOLE NO.	BP / AH27
LANDFORM	HILL SLOPE			DATE	14/10/2005

SOIL PROFILE	DEPTH (CM)	STRATUM	SOIL COLOUR	SOIL TEXTURE	FINDS	REMARKS
<div style="text-align: right; margin-bottom: 5px;">Ground Surface ▼</div>	0 4 8 12 16 20 40 60 80 100 120 140 160 180 200 220 240	1 2 3	7.5YR 7/8 Reddish Yellow 7.5YR 6/6 Reddish Yellow	Sandy Soil Sandy Soil with some Weathered Bed Rock Weathered Bed Rock	NONE NONE NONE	

LEGEND 	INTERPRETATION
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AUGER HOLE RECORDS

LOCATION	BP	SITE		AUGER HOLE NO.	BP / AH28
LANDFORM	HILL SLOPE			DATE	14/10/2005

SOIL PROFILE	DEPTH (CM)	STRATUM	SOIL COLOUR	SOIL TEXTURE	FINDS	REMARKS
<p>Ground Surface</p>	<p>0</p> <p>4</p> <p>8</p> <p>12</p> <p>16</p> <p>20</p> <p>40</p> <p>60</p> <p>80</p> <p>100</p> <p>120</p> <p>140</p> <p>160</p> <p>180</p> <p>200</p> <p>220</p> <p>240</p>	<p>1</p> <p>2</p>	<p>2.5Y 5/2 Grayish Brown</p>	<p>Sandy Soil</p> <p>Weathered Bed Rock</p>	<p>NONE</p> <p>NONE</p>	

<p>LEGEND</p> <table style="width: 100%;"> <tr> <td> = CONCRETE</td> <td> = LOAMY SOIL</td> <td> = WEATHERED BED ROCK</td> </tr> <tr> <td> = GRAVEL</td> <td> = CLAYEY SOIL</td> <td></td> </tr> <tr> <td> = SAND</td> <td> = CLAYEY SAND</td> <td></td> </tr> <tr> <td> = SANDY SOIL</td> <td> = COBBLES AND PEBBLES</td> <td></td> </tr> </table>	= CONCRETE	= LOAMY SOIL	= WEATHERED BED ROCK	= GRAVEL	= CLAYEY SOIL		= SAND	= CLAYEY SAND		= SANDY SOIL	= COBBLES AND PEBBLES		<p>INTERPRETATION</p> <div style="text-align: right;"> </div>
= CONCRETE	= LOAMY SOIL	= WEATHERED BED ROCK											
= GRAVEL	= CLAYEY SOIL												
= SAND	= CLAYEY SAND												
= SANDY SOIL	= COBBLES AND PEBBLES												

AUGER HOLE RECORDS

LOCATION	BP	SITE		AUGER HOLE NO.	BP / AH29
LANDFORM	HILL SLOPE			DATE	14/10/2005

SOIL PROFILE	DEPTH (CM)	STRATUM	SOIL COLOUR	SOIL TEXTURE	FINDS	REMARKS
Ground Surface ▼	0					
20cm	4 8 12 16 20	1	7.5YR 7/8 Reddish Yellow	Sandy Soil	NONE	
36cm	20	2	7.5YR 7/6 Reddish Yellow	Sandy Soil	NONE	
56cm	40	3	7.5YR 6/6 Reddish Yellow	Sandy Soil	NONE	
60cm	60	4		Weathered Bed Rock	NONE	
	80					
	100					
	120					
	140					
	160					
	180					
	200					
	220					
	240					

<p>LEGEND</p> <table style="width: 100%;"> <tr> <td> = CONCRETE</td> <td> = LOAMY SOIL</td> <td> = WEATHERED BED ROCK</td> </tr> <tr> <td> = GRAVEL</td> <td> = CLAYEY SOIL</td> <td></td> </tr> <tr> <td> = SAND</td> <td> = CLAYEY SAND</td> <td></td> </tr> <tr> <td> = SANDY SOIL</td> <td> = COBBLES AND PEBBLES</td> <td></td> </tr> </table>	= CONCRETE	= LOAMY SOIL	= WEATHERED BED ROCK	= GRAVEL	= CLAYEY SOIL		= SAND	= CLAYEY SAND		= SANDY SOIL	= COBBLES AND PEBBLES		<p style="text-align: center;"><i>INTERPRETATION</i></p> <div style="text-align: right; padding-right: 10px;"> </div>
= CONCRETE	= LOAMY SOIL	= WEATHERED BED ROCK											
= GRAVEL	= CLAYEY SOIL												
= SAND	= CLAYEY SAND												
= SANDY SOIL	= COBBLES AND PEBBLES												

AUGER HOLE RECORDS

LOCATION	BP	SITE		AUGER HOLE NO.	BP / AH30
LANDFORM	HILL SLOPE			DATE	14/10/2005

SOIL PROFILE	DEPTH (CM)	STRATUM	SOIL COLOUR	SOIL TEXTURE	FINDS	REMARKS
<div style="text-align: right; margin-bottom: 5px;">Ground Surface ▼</div>	0					
	20	1	2.5Y 6/3 Light Yellowish Brown	Sandy Soil	NONE	
	40	2	2.5Y 8/2 Pale Yellow	Sandy Soil	NONE	
	60	3	2.5Y 7/2 Light Gray	Sandy Soil	NONE	
75	4		Weathered Bed Rock	NONE		
	80					
	100					
	120					
	140					
	160					
	180					
	200					
	220					
	240					

LEGEND 	INTERPRETATION <div style="text-align: right; margin-top: 20px;"> </div>
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AUGER HOLE RECORDS

LOCATION	BP	SITE		AUGER HOLE NO.	BP / AH31
LANDFORM	HILL SLOPE			DATE	14/10/2005

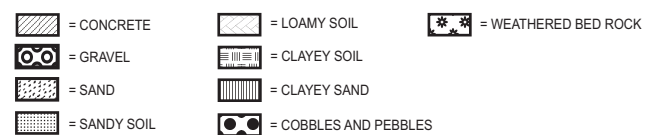

SOIL PROFILE	DEPTH (CM)	STRATUM	SOIL COLOUR	SOIL TEXTURE	FINDS	REMARKS
<div style="text-align: right; margin-bottom: 5px;">Ground Surface ▼</div>	0 4 8 12 16 20 40 60 80 100 120 140 160 180 200 220 240	1 2 3	7.5YR 7/6 Reddish Yellow 7.5YR 7/4 Pink	Sandy Soil Sandy Soil Weathered Bed Rock	NONE NONE NONE	

LEGEND 	INTERPRETATION
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AUGER HOLE RECORDS

LOCATION	BP	SITE		AUGER HOLE NO.	BP / AH32
LANDFORM	HILL SLOPE			DATE	14/10/2005

SOIL PROFILE	DEPTH (CM)	STRATUM	SOIL COLOUR	SOIL TEXTURE	FINDS	REMARKS
Ground Surface ▼	0					
35cm	4 8 12 16 20	1	2.5Y 6/2 Light Brownish Gray	Sandy Soil	NONE	
40cm	20 40	2		Weathered Bed Rock	NONE	
	60 80 100 120 140 160 180 200 220 240					

LEGEND 	INTERPRETATION 
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AUGER HOLE RECORDS

LOCATION	BP	SITE		AUGER HOLE NO.	BP / AH33
LANDFORM	HILL SLOPE			DATE	14/10/2005

SOIL PROFILE	DEPTH (CM)	STRATUM	SOIL COLOUR	SOIL TEXTURE	FINDS	REMARKS
Ground Surface ▼	0					
10cm	4 8	1	7.5YR 8/4 Pink	Sandy Soil	NONE	
30cm	12 16 20	2	7.5YR 6/6 Reddish Yellow	Coarse Sandy Soil	NONE	
	40 60 80 100 120 140 160 180 200 220 240					

<p>LEGEND</p> <table style="width: 100%;"> <tr> <td> = CONCRETE</td> <td> = LOAMY SOIL</td> <td> = WEATHERED BED ROCK</td> </tr> <tr> <td> = GRAVEL</td> <td> = CLAYEY SOIL</td> <td></td> </tr> <tr> <td> = SAND</td> <td> = CLAYEY SAND</td> <td></td> </tr> <tr> <td> = SANDY SOIL</td> <td> = COBBLES AND PEBBLES</td> <td></td> </tr> </table>	= CONCRETE	= LOAMY SOIL	= WEATHERED BED ROCK	= GRAVEL	= CLAYEY SOIL		= SAND	= CLAYEY SAND		= SANDY SOIL	= COBBLES AND PEBBLES		<p style="text-align: center;"><i>INTERPRETATION</i></p> <div style="text-align: right; padding-right: 10px;"> </div>
= CONCRETE	= LOAMY SOIL	= WEATHERED BED ROCK											
= GRAVEL	= CLAYEY SOIL												
= SAND	= CLAYEY SAND												
= SANDY SOIL	= COBBLES AND PEBBLES												

AUGER HOLE RECORDS

LOCATION	BP	SITE		AUGER HOLE NO.	BP / AH34
LANDFORM	HILL SLOPE			DATE	14/10/2005

SOIL PROFILE	DEPTH (CM)	STRATUM	SOIL COLOUR	SOIL TEXTURE	FINDS	REMARKS
<div style="text-align: right; margin-bottom: 5px;">Ground Surface ▼</div>	0 4 8 12 16 20 40 60 80 100 120 140 160 180 200 220 240	1 2 3	2.5Y 3/1 Very Dark Gray 2.5Y 6/1 Gray	Sandy Soil Sandy Soil Weathered Bed Rock	NONE NONE NONE	

LEGEND 	INTERPRETATION
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AUGER HOLE RECORDS

LOCATION	BP	SITE		AUGER HOLE NO.	BP / AH35
LANDFORM	HILL SLOPE			DATE	14/10/2005

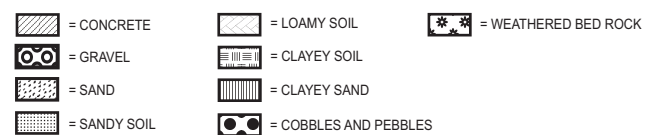

SOIL PROFILE	DEPTH (CM)	STRATUM	SOIL COLOUR	SOIL TEXTURE	FINDS	REMARKS
<div style="text-align: right; margin-bottom: 5px;">Ground Surface ▼</div>	0 4 8 12 16 20 40 60 80 100 120 140 160 180 200 220 240	1 2 3 4	7.5YR 7/8 Reddish Yellow 7.5YR 8/6 Reddish Yellow 7.5YR 7/6 Reddish Yellow 7.5YR 8/4 Red Pink	Coarse Sandy Soil Coarse Sandy Soil Coarse Sandy Soil Weathered Bed Rock	NONE NONE NONE NONE	

LEGEND 	INTERPRETATION
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AUGER HOLE RECORDS

LOCATION	BP	SITE		AUGER HOLE NO.	BP / AH36
LANDFORM	HILL SLOPE			DATE	14/10/2005

SOIL PROFILE	DEPTH (CM)	STRATUM	SOIL COLOUR	SOIL TEXTURE	FINDS	REMARKS
Ground Surface ▼	0					
30cm	4 8 12 16 20	1	10YR 3/1 Very Dark Gray	Sandy Soil	NONE	
50cm	40	2	10YR 5/2 Grayish Brown	Sandy Soil	NONE	
90cm	60 80	3	2.5YR 7/6 Yellow	Sandy Soil	NONE	
105cm	100	4	7.5YR 8/4 Red Pink	Weathered Bed Rock	NONE	
	120 140 160 180 200 220 240					

LEGEND  <ul style="list-style-type: none"> = CONCRETE = GRAVEL = SAND = SANDY SOIL = LOAMY SOIL = CLAYEY SOIL = CLAYEY SAND = COBBLES AND PEBBLES = WEATHERED BED ROCK 	INTERPRETATION <div style="text-align: right; padding-top: 20px;">  </div>
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AUGER HOLE RECORDS

LOCATION	BP	SITE		AUGER HOLE NO.	BP / AH37
LANDFORM	HILL SLOPE			DATE	14/10/2005

SOIL PROFILE	DEPTH (CM)	STRATUM	SOIL COLOUR	SOIL TEXTURE	FINDS	REMARKS
<div style="text-align: right; margin-bottom: 5px;">Ground Surface ▼</div>	0 4 8 12 16 20 40 60 80 100 120 140 160 180 200 220 240	1 2 3	2.5Y 5/3 Light Olive Brown 2.5Y 6/4 Light Yellowish Brown	Sandy Soil Sandy Soil Weathered Bed Rock	NONE NONE NONE	

LEGEND 	INTERPRETATION
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AUGER HOLE RECORDS

LOCATION	BP	SITE		AUGER HOLE NO.	BP / AH38
LANDFORM	HILL SLOPE			DATE	14/10/2005

SOIL PROFILE	DEPTH (CM)	STRATUM	SOIL COLOUR	SOIL TEXTURE	FINDS	REMARKS
<div style="text-align: right; margin-bottom: 5px;">Ground Surface ▼</div>	0 4 8 12 16 20 40 60 80 100 120 140 160 180 200 220 240	1 2 3 4	2.5Y 6/4 Light Yellowish Brown 2.5Y 7/6 Yellow 2.5Y 5/3 Light Olive Brown 	Sandy Soil Sandy Soil Sandy Soil Weathered Bed Rock	NONE NONE NONE NONE	

LEGEND 	INTERPRETATION
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AUGER HOLE RECORDS

LOCATION	BP	SITE		AUGER HOLE NO.	BP / AH39
LANDFORM	HILL SLOPE			DATE	14/10/2005

SOIL PROFILE	DEPTH (CM)	STRATUM	SOIL COLOUR	SOIL TEXTURE	FINDS	REMARKS
Ground Surface ▼	0					
30cm	4 8 12 16 20	1	2.5Y 4/3 Olive Brown	Sandy Soil	NONE	
50cm	40	2	2.5Y 5/6 Light Olive Brown	Sandy Soil	NONE	
55cm	60	3		Weathered Bed Rock	NONE	
	80					
	100					
	120					
	140					
	160					
	180					
	200					
	220					
	240					

<p>LEGEND</p> <table style="width: 100%;"> <tr> <td> = CONCRETE</td> <td> = LOAMY SOIL</td> <td> = WEATHERED BED ROCK</td> </tr> <tr> <td> = GRAVEL</td> <td> = CLAYEY SOIL</td> <td></td> </tr> <tr> <td> = SAND</td> <td> = CLAYEY SAND</td> <td></td> </tr> <tr> <td> = SANDY SOIL</td> <td> = COBBLES AND PEBBLES</td> <td></td> </tr> </table>	= CONCRETE	= LOAMY SOIL	= WEATHERED BED ROCK	= GRAVEL	= CLAYEY SOIL		= SAND	= CLAYEY SAND		= SANDY SOIL	= COBBLES AND PEBBLES		<p style="text-align: center;"><i>INTERPRETATION</i></p> <div style="text-align: right; padding-right: 20px;"> </div>
= CONCRETE	= LOAMY SOIL	= WEATHERED BED ROCK											
= GRAVEL	= CLAYEY SOIL												
= SAND	= CLAYEY SAND												
= SANDY SOIL	= COBBLES AND PEBBLES												

AUGER HOLE RECORDS

LOCATION	BP	SITE		AUGER HOLE NO.	BP / AH40
LANDFORM	HILL SLOPE			DATE	14/10/2005

SOIL PROFILE	DEPTH (CM)	STRATUM	SOIL COLOUR	SOIL TEXTURE	FINDS	REMARKS
<div style="text-align: right; margin-bottom: 5px;">Ground Surface ▼</div>	0 4 8 12 16 20 40 60 80 100 120 140 160 180 200 220 240	1 2 3	2.5Y 5/4 Light Olive Brown 2.5Y 6/6 Olive Yellow	Sandy Soil Sandy Soil Weathered	NONE NONE NONE	

LEGEND 	INTERPRETATION
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Annex 12-A-B

Stratigraphy of Test Pits

Test Pit Record

Location	Black Point	Site Code	BP05	Test Pit No.	BP1
Test Pit Coordinate	830037.954	808732.614	Test Pit Measurement	2 m x 1 m	
	Northing	Easting			
Digging Method	Hand Digging		Ground Level	8.645	mPD

Stratigraphy and Finds

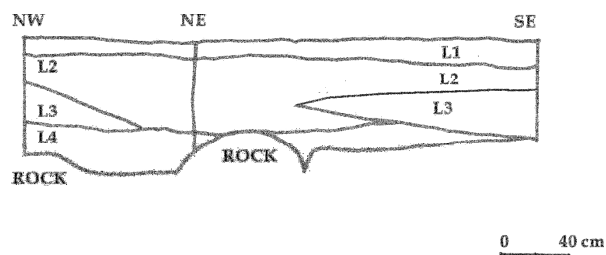
Layer	Soil Texture	Soil Colour	Finds	Chronology
L1	Sandy soil	Pink 7.5YR 7/3	None	
L2	Sandy soil	Reddish yellow 7.5YR 7/6	None	
L3	Sandy soil	Yellow brown 10YR 6/4 light	None	
L4	Coal Debris (煤灰)	Gray 10YR5/1	None	

Test Pit Wall Photography



Northern Wall Section

Test Pit Wall Drawing



Representative Artefacts

Nil

<i>Date</i>	12 Oct 2005	<i>Log by</i>	SNG
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Test Pit Record

Location	Black Point	Site Code	BP05	Test Pit No.	BP2
Test Pit Coordinate	830083.622	808613.047	Test Pit Measurement	2 m x 1 m	
	Northing	Easting			
Digging Method	Hand Digging		Ground Level	5.973 mPD	

Stratigraphy and Finds

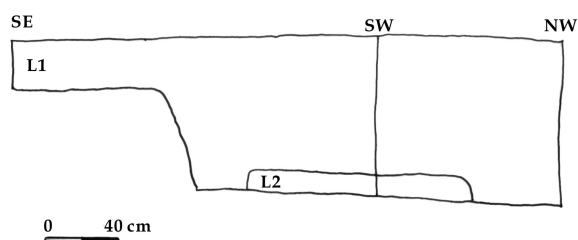
Layer	Soil Texture	Soil Colour	Finds	Chronology
L1	Sandy soil	Olive yellow 2.5Y6/6	None – With many cobbles	
L2	Sandy soil	Olive brown 2.5Y4/3	None – With many cobbles	

Test Pit Wall Photography



Western Wall Section

Test Pit Wall Drawing



Representative Artefacts

Nil

<i>Date</i>	12 Oct 2005	<i>Log by</i>	WF
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Test Pit Record

Location	Black Point	Site Code	BP05	Test Pit No.	BP3
Test Pit Coordinate	830011.050	808382.876	Test Pit Measurement	1 m x 1.5 m	
	Northing	Easting			
Digging Method	Hand Digging		Ground Level	7.774	mPD

Stratigraphy and Finds

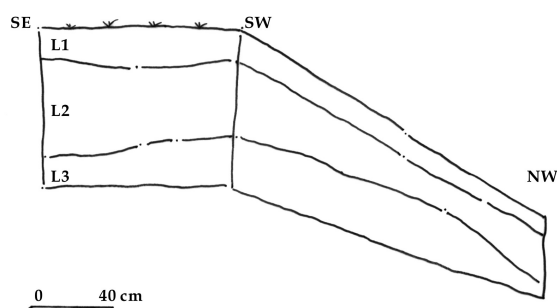
Layer	Soil Texture	Soil Colour	Finds	Chronology
L1	Loamy soil	Yellowish brown 7.5YR5/6	None	
L2	Loamy soil	Light yellowish brown 7.5YR6/4	None	
L3	Sandy soil – coarse sand	Very pale brown 7.5YR7/3	None	

Test Pit Wall Photography



Southern Wall Section

Test Pit Wall Drawing


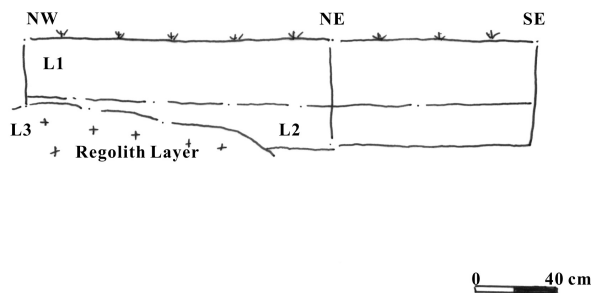


Representative Artefacts

Nil

<i>Date</i>	12 Oct 2005	<i>Log by</i>	PKW
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Test Pit Record

Location	Black Point	Site Code	BP05	Test Pit No.	BP4
Test Pit Coordinate	830067.755	808275.564	Test Pit Measurement	1 m x 1.5 m	
	Northing	Easting			
Digging Method	Hand Digging		Ground Level	8.989 mPD	
Stratigraphy and Finds					
Layer	Soil Texture	Soil Colour	Finds	Chronology	
L1	Sandy soil	Reddish brown 5YR5/3	None		
L2	Sandy soil	Light reddish brown 5YR6/4	None		
L3	Bed Rock and associated weathered bed rock soil	Reddish yellow 7.5YR7/6	None		
Test Pit Wall Photography			Test Pit Wall Drawing		
					
Eastern Wall Section					
Representative Artefacts					
Nil					
<i>Date</i>	12 Oct 2005	<i>Log by</i>	SNG		

Test Pit Record

Location	Black Point	Site Code	BP05	Test Pit No.	BP5
Test Pit Coordinate	830092.351 Northing	808247.562 Easting	Test Pit Measurement	2 m x 1 m	
Digging Method	Hand Digging		Ground Level	11.218	mPD

Stratigraphy and Finds

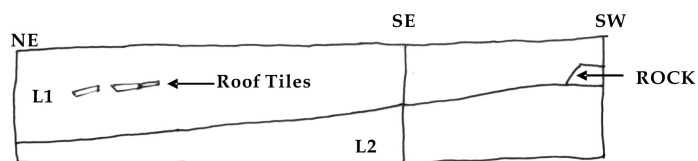
Layer	Soil Texture	Soil Colour	Finds	Chronology
L1	Sandy soil	Dark grayish brown 2.5Y4/2	Modern roof tiles and pottery shards	
L2	Sandy soil	Yellow 2.5Y8/6	None	

Test Pit Wall Photography



Eastern Wall Section

Test Pit Wall Drawing



Representative Artefacts

N/A

<i>Date</i>	13 Oct 2005	<i>Log by</i>	WF
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Test Pit Record

Location	Black Point	Site Code	BP05	Test Pit No.	BP6
Test Pit Coordinate	830100.491	808235.311	Test Pit Measurement	2 m x 1 m	
	Northing	Easting			
Digging Method	Hand Digging		Ground Level	17.260 mPD	

Stratigraphy and Finds

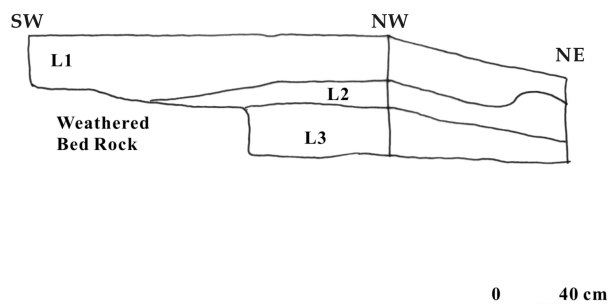
Layer	Soil Texture	Soil Colour	Finds	Chronology
L1	Loamy soil	Very dark grayish brown 2.5Y3/2	None	
L2	Sandy soil	Pale yellow 2.5Y8/3	None	
L3	Sandy soil	Yellow 2.5YR7/6	None (Regolith layer)	

Test Pit Wall Photography



Western Wall Section

Test Pit Wall Drawing


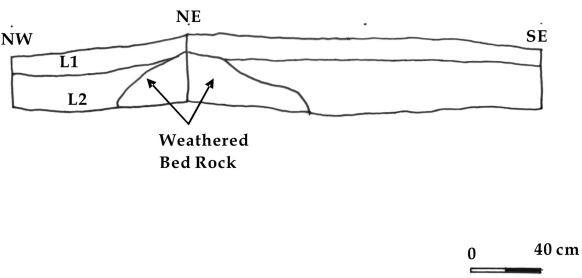


Representative Artefacts


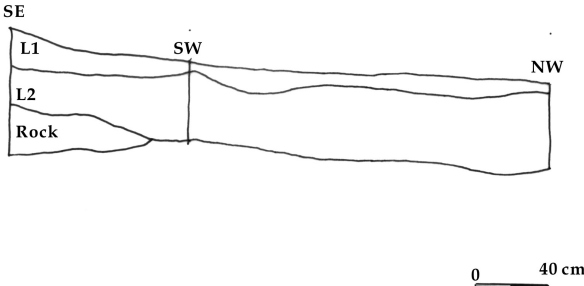
Nil

<i>Date</i>	12 Oct 2005	<i>Log by</i>	PKW
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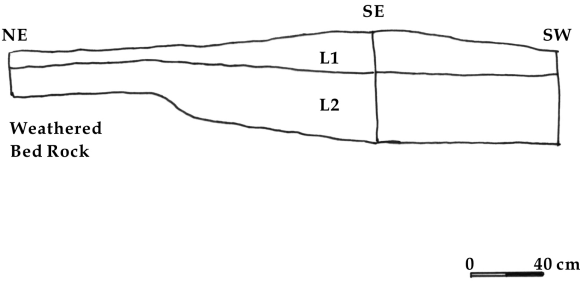
Test Pit Record

Location	Black Point	Site Code	BP05	Test Pit No.	BP7
Test Pit Coordinate	830101.195	808204.012	Test Pit Measurement	2 m x 1 m	
	Northing	Easting			
Digging Method	Hand Digging		Ground Level	12.263 mPD	
Stratigraphy and Finds					
Layer	Soil Texture	Soil Colour	Finds	Chronology	
L1	Sandy soil	Yellowish brown 10YR5/4	None		
L2	Sandy soil	Yellowish brown 10YR5/6	Lots of Quartz		
Test Pit Wall Photography			Test Pit Wall Drawing		
					
Northern Wall Section					
Representative Artefacts					
Nil					
<i>Date</i>	13 Oct 2005		<i>Log by</i>	SNG	

Test Pit Record

Location	Black Point	Site Code	BP05	Test Pit No.	BP8
Test Pit Coordinate	830050.190	808180.827	Test Pit Measurement	2 m x 1 m	
	Northing	Easting			
Digging Method	Hand Digging		Ground Level	5.726 mPD	
Stratigraphy and Finds					
Layer	Soil Texture	Soil Colour	Finds	Chronology	
L1	Sandy soil	Dark grayish brown 10YR4/2			
L2	Sandy soil	Brown 10YR5/3	Lots of Quartz flakes		
Test Pit Wall Photography			Test Pit Wall Drawing		
					
Southern Wall Section					
Representative Artefacts					
Nil					
<i>Date</i>	13 Oct 2005	<i>Log by</i>	WF		

Test Pit Record

Location	Black Point	Site Code	BP05	Test Pit No.	BP9
Test Pit Coordinate	829998.412	808154.969	Test Pit Measurement	2 m x 1 m	
	Northing	Easting			
Digging Method	Hand Digging		Ground Level	11.291	mPD
Stratigraphy and Finds					
Layer	Soil Texture	Soil Colour	Finds		Chronology
L1	Sandy soil	Dark grayish brown 2.5Y4/2	None		
L2	Sandy soil	Yellow 2.5Y8/6	None		
Test Pit Wall Photography			Test Pit Wall Drawing		
					
Southern Wall Section					
Representative Artefacts					
Nil					
<i>Date</i>	13 Oct 2005	<i>Log by</i>	PKW		

Annex 12-A-C

Land Survey Positions of Test Pits

YUNG LONG

ERM

File Name = 9474P3

Date 18 OCT 05

POINT	DESCRIPTIONS	EASTING	NORTHING	R.L.	PLACE	SOURCE
BP1-1	FINAL	808732.614	830037.954	8.645	1	25.760
BP1-2	FINAL	808732.433	830040.035	8.661	2	25.760
BP1-3	FINAL	808733.471	830039.932	8.633	3	25.760
BP1-4	FINAL	808733.713	830037.874	8.633	4	25.760
BP2-1	FINAL	808613.047	830083.622	5.973	5	25.760
BP2-2	FINAL	808613.112	830084.699	5.934	6	25.760
BP2-3	FINAL	808615.033	830084.513	5.911	7	25.760
BP2-4	FINAL	808614.860	830083.504	5.966	8	25.760
BP3-1	FINAL	808382.876	830011.050	7.774	9	25.760
BP3-2	FINAL	808382.815	830012.701	6.826	10	
BP3-3	FINAL	808383.755	830012.543	6.861	11	25.760
BP3-4	FINAL	808383.902	830010.929	7.859	12	25.760
BP4-1	FINAL	808275.564	830067.755	8.989	13	25.760
BP4-2	FINAL	808277.223	830067.696	8.970	14	25.760
BP4-3	FINAL	808277.116	830066.753	8.956	15	25.760
BP4-4	FINAL	808275.482	830066.833	9.007	16	25.760
BP5-1	FINAL	808247.562	830092.351	11.218	17	25.760
BP5-2	FINAL	808248.683	830092.268	11.159	18	25.760
BP5-3	FINAL	808248.536	830090.340	11.246	19	25.760
BP5-4	FINAL	808247.516	830090.464	11.279	20	25.760
BP6-1	FINAL	808235.311	830100.491	17.260	21	25.760
BP6-2	FINAL	808235.373	830101.460	16.927	22	25.760
BP6-3	FINAL	808237.425	830101.385	17.042	23	25.760
BP6-4	FINAL	808237.319	830100.413	17.237	24	25.760
BP7-1	FINAL	808204.012	830101.195	12.263	25	25.760
BP7-2	FINAL	808202.006	830100.252	12.242	26	25.760
BP7-3	FINAL	808201.780	830101.252	12.024	27	25.760
BP7-4	FINAL	808203.593	830102.168	12.152	28	25.760
BP8-1	FINAL	808180.827	830050.190	5.726	29	25.760
BP8-2	FINAL	808179.540	830049.965	5.447	30	25.760
BP8-3	FINAL	808179.473	830052.014	5.309	31	25.760
BP8-4	FINAL	808180.402	830052.245	5.226	32	25.760
BP9-1	FINAL	808154.969	829998.412	11.291	33	25.760
BP9-2	FINAL	808155.553	830000.324	11.350	34	
BP9-3	FINAL	808156.424	830000.001	11.391	35	
BP9-4	FINAL	808155.834	829998.156	11.401	36	

Surveyed by : SAI YW

Checked by: [Signature]

Annex 12-B

Marine Archaeological Investigation

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ANNEXES

Annex 12-B-A	Vertical Profile of Turbidity Measurements and The Secchi Disc Depths
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1 INTRODUCTION

1.1 INTRODUCTION

In May 2005, the Castle Peak Power Company Limited submitted an application for an Environmental Impact Assessment (EIA) Study Brief (No. ESB-126/2005) to be undertaken on a Liquefied Natural Gas (LNG) Terminal and Associated Facilities at Black Point (*Figure 1.1*). As the proposed development involves marine works (see *Part 2 – Section 3.2.1, 3.2.2, 3.2.4, 3.2.5, 3.2.6 and 3.3.3* for details of marine works required), potential impact on marine archaeological resources would be a concern. Thus, a Marine Archaeological Investigation (MAI), in accordance with *Clause 3.7.8.2(ii)* of the Study Brief, a Marine Archaeological Investigation (MAI) was required during the Review Phase of the Project. This report was prepared by Bill Jeffery, a qualified marine archaeologist, detailing the MAI findings.

1.2 OBJECTIVES OF THE MARINE ARCHAEOLOGICAL INVESTIGATION

The objectives of the MAI were to include a phased review/investigation of the Study Areas in accordance with the MAI Guidelines as stated in ESB-126/2005, which should include the following:

- Baseline Review on known sources of archive data as stated in Section 1.2 of the MAI Guideline;
- Review of Geophysical Survey Raw Data prepared by CAPCO's Geophysical Contractor EGS (Asia) Limited (EGS);
- Review of Magnetic Survey Data prepared by CAPCO's Geophysical Contractor EGS (Asia) Limited (EGS);
- Remote Operated Vehicle Survey prepared by CAPCO's Geophysical Contractor EGS (Asia) Limited (EGS);
- Establish Archaeological Potential; and
- Provide a Report on these aspects.

This report represents the MAI results.

1.3 REPORT STRUCTURE

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

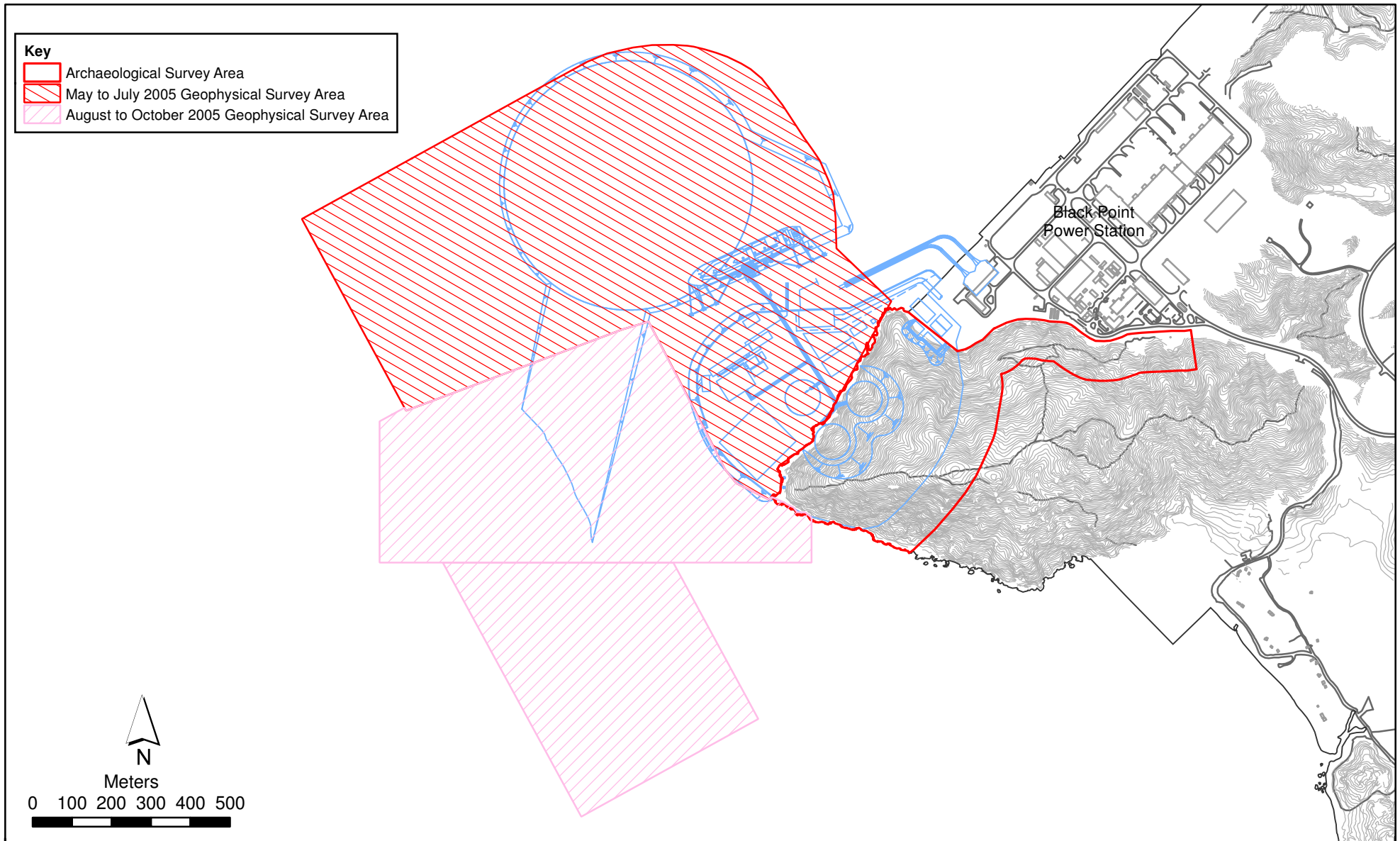


Figure 1.1

Survey Areas for LNG Terminal at Black Point

File: 0018180/Report_August/Geographical_Survey_BP_3.mxd
Date: 09/11/2006

Environmental
Resources
Management



- 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 Study Areas;
- Section 5* Establish archaeological potential of the Study Areas; and
- Section 6* Assessment of the impact on the archaeological resources and recommendations.

2

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) (AM Ordinance);*
- *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 archaeological sites 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 Home Affairs); 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 archaeological sites in Hong Kong. The AMO has established boundaries for the identified sites and a set of administrative procedures for the protection of the known archaeological sites. However, the present record of archaeological sites 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.

(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.

2.3 *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.

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, archaeological sites 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 were provided in *Appendix D* of the *EIA Study Brief No. ESB-126/2005*. Baseline review, geophysical survey and establishing archaeological potential are considered the first stage of a MAI. Subject to the results of the first stage MAI, further investigation may or may not be required.

3 ASSESSMENT METHODOLOGY & SCOPE OF WORK

3.1 METHODOLOGY

The methodology used in this assessment followed the Guidelines for MAIs as prepared by AMO and comprised the following tasks.

3.1.1 *Establish Baseline Conditions*

- Implement Desktop Research, comprising a review of geotechnical survey data, historical documents and United Kingdom Hydrographic Office ‘Wreck’ files to establish the potential for marine archaeological sites in the Study Area (Black Point terminal, gas pipeline, watermain and submarine cable);
- Examination of the seabed and below seabed using geophysical survey equipment in order to locate and define any sites of archaeological potential in the Study Areas.

3.1.2 *Establish Archaeological Potential*

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

3.1.3 *Impact Assessment*

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 CONDITIONS

4.1 DESKTOP RESEARCH

4.1.1 Geotechnical Data

Generally, 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. 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.

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 subcrops beneath the Hang Hau Formation ⁽¹⁾.

More modern sediments are related to the discharge from the Pearl River, (and which would have an effect on the project area, being located down stream from the mouth of the Pearl River) having a seasonal discharge of about 370,000 million cubic metres each year⁽²⁾. They consist of sand, mud and some gravel.

Fyfe⁽³⁾ further explains the rate of sedimentation:

“In general, present day sedimentation rates in Hong Kong waters are low, though they were undoubtedly greater earlier in the Holocene when sea level was rising rapidly. ... Without tidal flushing, the sediment entering Victoria Harbour from the Pearl River, sewage solids and losses from dredging and reclamation might be expected to raise the seabed level by 40mm per year. However, comparison of Hydrographic charts of Victoria Harbour from 1903 to 1980 revealed no conclusive evidence of net sedimentation, implying that the seabed is a state of dynamic equilibrium. Assuming that sedimentation in Hong Kong waters began about 8 000 years ago, deposition of the 10 to 20 m of marine mud must have occurred at an average sedimentation rate of between 1.25 and 2.5 mm per year. Available evidence indicates that the rate of Holocene sedimentation has not been steady. Radiocarbon

(1) Fyfe, J.A., R. Shaw *et al.* 2002. *The Quaternary Geology of Hong Kong*, Hong Kong: Civil Engineering Department.

(2) Ibid.

(3) Ibid..

dating suggests that the majority of sedimentation has taken place over the past 4 000 to 5 000 years.”

During the late Pleistocene period (18,000BP) sea levels began to rise until about 6,000 years BP to levels similar to the present day. “The extent of the rise could be as great as perhaps 140 metres in parts”(1).

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 to include well preserved remains associated with the occupation and use of the islands in Hong Kong waters. This is in contrast to the surface of the seabed, which is often found to have been disturbed by fishing and other shipping related activities. These remains could include shipwrecks.

4.1.2 *Review of Historical Documents*

The water between Shekou (situated in Shenzhen) and Black Point was in use as a war junk anchorage since the 8th century. In the 8th century (Tang Dynasty), Black Point was within the military division area of Tunmen Bing Zhen (屯門兵鎮) where 2,000 soldiers were under the command of one Defence Commissioner. The headquarters of this division was situated in the present Nantou (南頭) walled city of Shenzhen and its military division area also covered the HKSAR, as well as the Huizhou (惠州) and Chaozhou (潮州) areas (2). The military division was serving the same area until the Yuan Dynasty (A.D.1279-1368).

In the late 16th century (Ming Dynasty), China was facing more frequent disturbance from coastal invaders and more forts and beacon towers were set up to protect the key locations from Japanese pirates. The Nantou Military Division (南頭寨) was set up in 1565. It commanded 53 war junks and 1,486 soldiers (3). The military force was increased to 1,659 soldiers in 1645.

During this period, the Portuguese explorer, Jorge Alvares was permitted to land on Lintin Island (Neilingding 內伶仃) in 1513 (4), he then built a fort and erected a stone column with a carving of the Portuguese national symbol. The Chinese navy attacked and demolished the Portuguese fort in 1518 (5). In 1522, it was also recorded that a sea battle between the Chinese navy and Portuguese ships was fought in the water between Lantau Island and Tuen Mun. The Chinese navy won the battle.

(1) Fyfe, J.A., R. Shaw and et al. 2002. *The Quaternary Geology of Hong Kong*, Hong Kong: Civil Engineering Department.

(2) Siu, K.K 1997 *Forts and Batteries: Coastal Defence in Guangdong During Ming to Qing Dynasties*, Hong Kong, Urban Council.

(3) 蕭國健 1994 〈明代粵東海防中路之南頭寨〉，《香港歷史與社會》，香港教育圖書公司。

(4) Brage, J.M. 1965 *China Landfall 1513, Jorge Alvares Voyage to China*, Macau, Imprensa Nacional.

(5) Cortesão, A 1944, *The Suma Oriental of Tome Pires and the Book of Francisco Rodrigues*. London, Hakluyt Society. 龍思泰 (Anders Ljungstedt) 1832, 1997 〈早期澳門史〉，北京，東方出版社。

A review of a historical chart of the mouth of the Pearl River dated 1658 ⁽¹⁾, also indicated that the waters between Black Point and Lintin Island were part of the main voyaging route from the East to the West of the river.

During the Ming to Qing Dynasties (A.D.1368 -1911), Imperial Junks sailing from Guangdong to Southeast Asian countries were required to anchor at a bay known as Chiwan (赤灣) of Nantou peninsula, located to the west of Shenzhen City (located some 9km north of Black Point). A Tin Hau Temple was established in this Bay, probably in 1410 according to an inscription of the Temple where sailors worshipped Tin Hau for sea travelling safety ⁽²⁾. During the early Qing dynasty in the 1660s, although the Nantou Military Division was replaced by Xin'an Camp (新安營), it was still situated in the Nantou Walled City ⁽³⁾. Two stone forts were also built near the Tin Hau Temple during the Qing Dynasty and the remains of the forts can still be found.

Based on the historical development review, it is considered that Black Point is located in the vicinity of a busy marine sea route. The water area at Black Point, Deep Bay and Neilingding Island was the main voyaging channel between Guangdong and the Southern China Sea and Southeast Asian countries as well as East and West for centuries. On this basis, the waters at Black Point are considered in general to have marine archaeological potential.

Marine archaeology is still a new area in Hong Kong. In 1998, a study was undertaken on the potential, assessment, management and preservation of maritime archaeological sites in Hong Kong and to explore all aspects of the subject to ensure that the scope of all future work is feasible. Review of the report identified a number of shipwrecks recorded some 3.5 km to the northwest outside the proposed project area but no shipwreck was identified within proposed marine works areas⁽⁴⁾.

4.1.3

United Kingdom Hydrographic Office "Wreck" Files

The United Kingdom Hydrographic Office (UKHO) in Taunton maintains a database of known shipwrecks in the HKSAR. The aim of the UKHO in keeping the database is to maintain a list of shipwrecks/obstructions that could be navigation hazards, wrecks through deterioration/corrosion over time become less of a navigation hazard but still remain on their database and if not removed could potentially become significant archaeological sites. The UKHO database is only one source of data, albeit an important source of historical data on shipwrecks, that combined with other historical sources on other types of sites (as well as some types of shipwrecks) and the geophysical

- (1) Nessel, Johan 1658 Tngqvin, in 格斯·冉福立 (Kees Zenlvliet) 江樹生 譯 1997 《十七世紀荷蘭人繪製的台灣老地圖》，台北，漢聲出版社。
- (2) 王應華 1660年代，2000〈赤灣天后廟記〉，《明清兩朝深圳檔案文獻演繹》，廣州，花城出版社；蔡學元 1814，2000〈重修赤灣天后廟記〉，《明清兩朝深圳檔案文獻演繹》，廣州，花城出版社。
- (3) 靳文謨 1688 《新安縣志》，新安縣衙。
- (4) Ali, Sarah 1998 *Study on the Potential, Assessment, Management and Preservation of Maritime Archaeological Sites in Hong Kong*. Hong Kong: Lord Wilson Heritage Trust

surveys, it provides a significant contribution in ascertaining if a region encompasses submerged archaeological deposits. The review indicated that no shipwrecks were found to be within 1 km of the proposed Black Point facilities.

The Hong Kong Marine Department could not provide any additional information beyond what was provided by the UKHO. However, discussion with the Marine Department noted that a wreck adjacent to Sha Chau/Lung Kwu Cha had been lifted in March 2006. The wreck is a Chinese engineering vessel mostly damaged and approximately 10 m x 3 m x 2 m in size. It is estimated that the wreck was about 30 years old (see *Figure 4.10* for location and *Figure 4.19* for a description).

4.2 GEOPHYSICAL SURVEYS

4.2.1 Introduction

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

4.2.2 Survey Scope

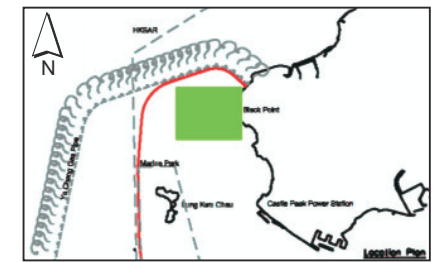
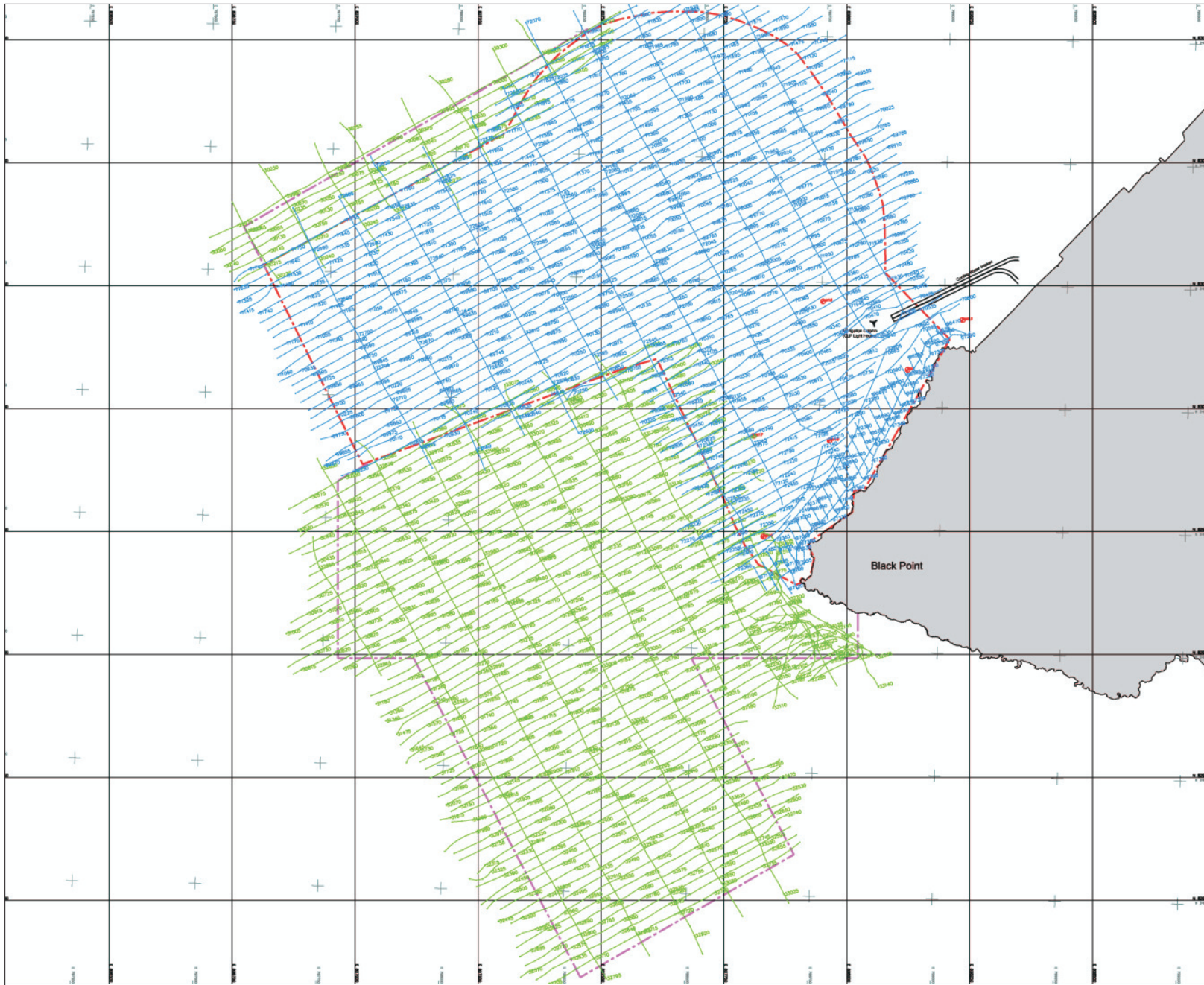
The survey scope (see *Figure 1.1*) of the Geophysical Survey covers the proposed Approach Channel, Turning Circle and Reclamation Area and additional areas at Black Point covering a survey line length of 167 km.

4.2.3 Survey Methodology

Geophysical Surveys were undertaken by CAPCO contractor, EGS (Asia) Limited (EGS), between May and September 2005; February 2006; April 2006. Side Scan Sonar and Boomer surveys were implemented of all the potentially impacted areas off Black Point. The data were collected from either 20 m or 25 m traverses. The vessel track plots of the surveys are presented *Figure 4.1*. Later, multi-beam and magnetometer surveys were implemented on some specific sonar contacts. These surveys allowed for a comprehensive investigation of the seabed, and below the seabed.

4.2.4 Equipment Used

- Multi-Beam EchoSounder (Seabeam 1180 multi-beam system, 180 kHz transducer and cable, Anschutz Raytheon Gyrostar II gyrocompass, Seatronix MRU 5, Valeport Model 600 temperature/salinity profiler)
- Single-Beam EchoSounder (Knudsen Model 320 survey echo sounder, Dual frequency transducer, Bar Check);



Key

- 53075 Vessel Track Plot
- 53075 Vessel Track Plot

Figure 4.1

Vessel Track Plots at Black Point

- Navigation & Positioning (C-Nav DGPS System w/ 50m cables, C-Nav Antenna Stand, Navigation PC, Navigation Monitor, Marine Radio, Hand Held Radio Set w/ Charger);
- Subbottom Profiler (C-Boom low voltage boomer system, EGS TVG Processor, C-Phone hydrophone system, 120/138 Waverley Recorder);
- Side Scan Sonar System (Klein 3000 side scan sonar system);
- Measurement of Currents (RD Instruments acoustic Doppler current profiler (ADCP))
- Magnetometer ("SeaSPY", manufactured by Marine Magnetic Ltd); and
- Other Computer facilities (C-View Logging System & monitors, C-View Int. System, Printers (B/W), UPS for computer systems).

4.2.5 *Review of Geophysical Survey Results*

The geophysical survey data obtained by EGS were processed by in house geophysicists and reviewed by the marine archaeologist. The geophysical survey showed how the seabed in the Survey Area had been impacted by anchoring, trawling (*Figure 4.2*) and the dumping of materials (*Figure 4.3*). Anchoring and trawling will reduce the archaeological potential of the seabed in these areas as will the dumping of materials, although this activity can also enhance the archaeological potential by providing a protective covering over sites (it can also interfere/damage sites through this activity). It makes it very difficult, potentially impossible to assess the archaeological potential of these parts of the seabed. In addition, it located Sonar Contacts comprising natural features, dumped materials, shipwrecks, linear debris, anchor marks and fishing devices. In a further review of the Sonar Contacts identified a site (*Figure 4.4*) as possible wrecks off Black Point area (*Table 4.1*). The Sonar Contact discounted as possible wreck based on a combination of factors, which included the interpretation and a comparison of the geophysical signatures with those signatures that were clearly wrecks (and possibly wrecks), debris and dumped materials. Wrecks as seen in the side scan sonar images have identifiable relief (as seen in the shadows they develop on the side scan sonar images) and features that could be considered not-natural, such as straight lines delineating its boundaries. In comparison debris could show relief but it is characterised by natural, rounded features and boundaries. Dumped materials and some debris were characterised by areas of a darker/black section of the seabed on the side scan sonar images consisting of coarser materials/sediments with little or no relief. The assessment also included the context of the Sonar Contact with its surrounding seabed environment, where identifiable dumped materials/debris was found to be in the very near vicinity. The raw data for all the Sonar Contacts was reviewed by the marine archaeologist using the above criteria.

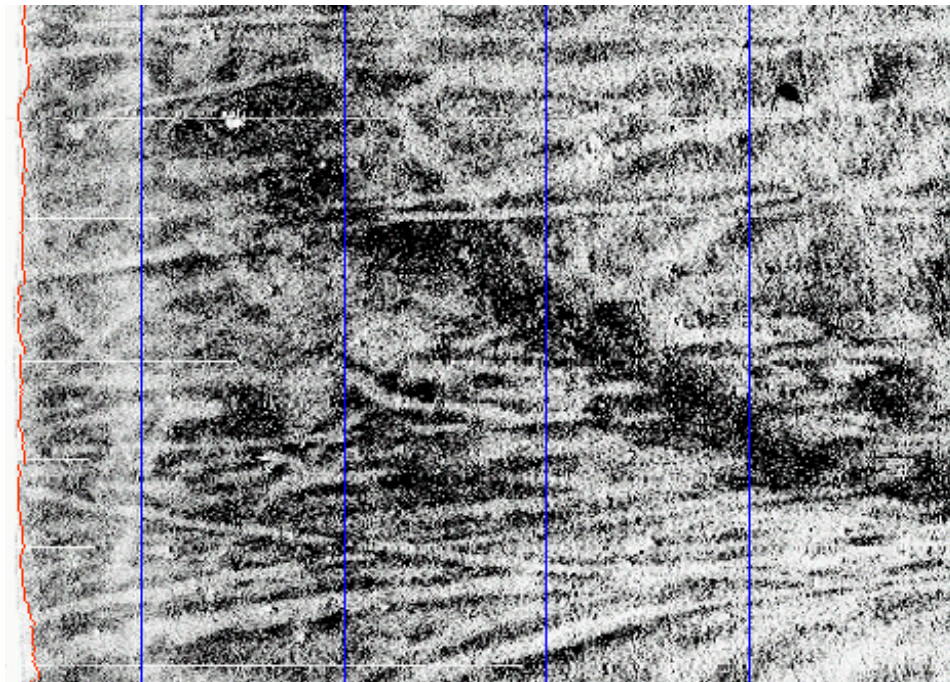


Figure 4.2 Geophysical Survey Showing How the Seabed Was Impacted By Anchoring & Trawling

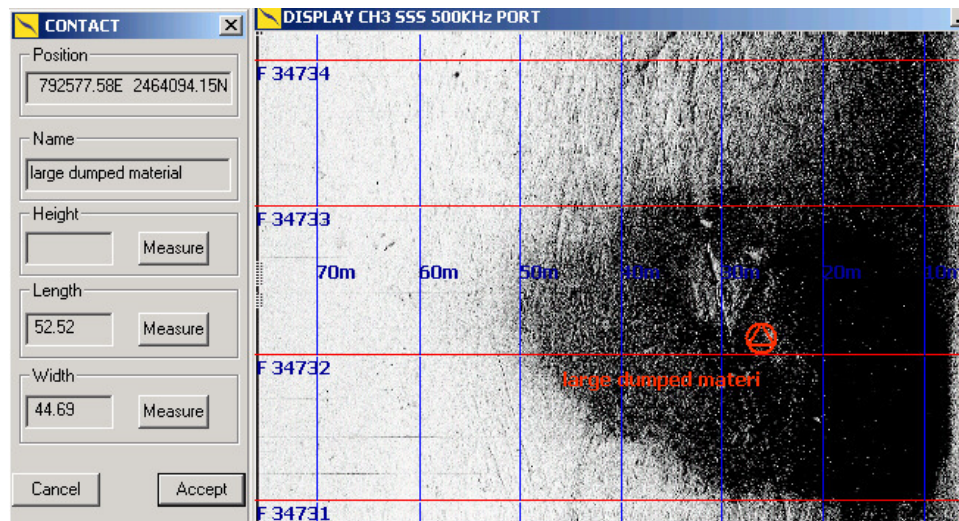


Figure 4.3 Geophysical Survey Showing How the Seabed Was Impacted By The Dumping Of Materials

Table 4.1 Sonar Contact Located off Black Point

Contact number	Latitude Longitude	Easting Northing	KP RPL offset	Dimensions (m)	Description
SC086	22° 24.388' N 113° 54.072' E	798693.9E 2480702.4N	39.148 1572m SW	10.77m x 3.31m x 2.03m	Possible wreck

The above anomaly is sitting on the seabed. A review of the boomer data failed to identify any sub-bottom anomalies.

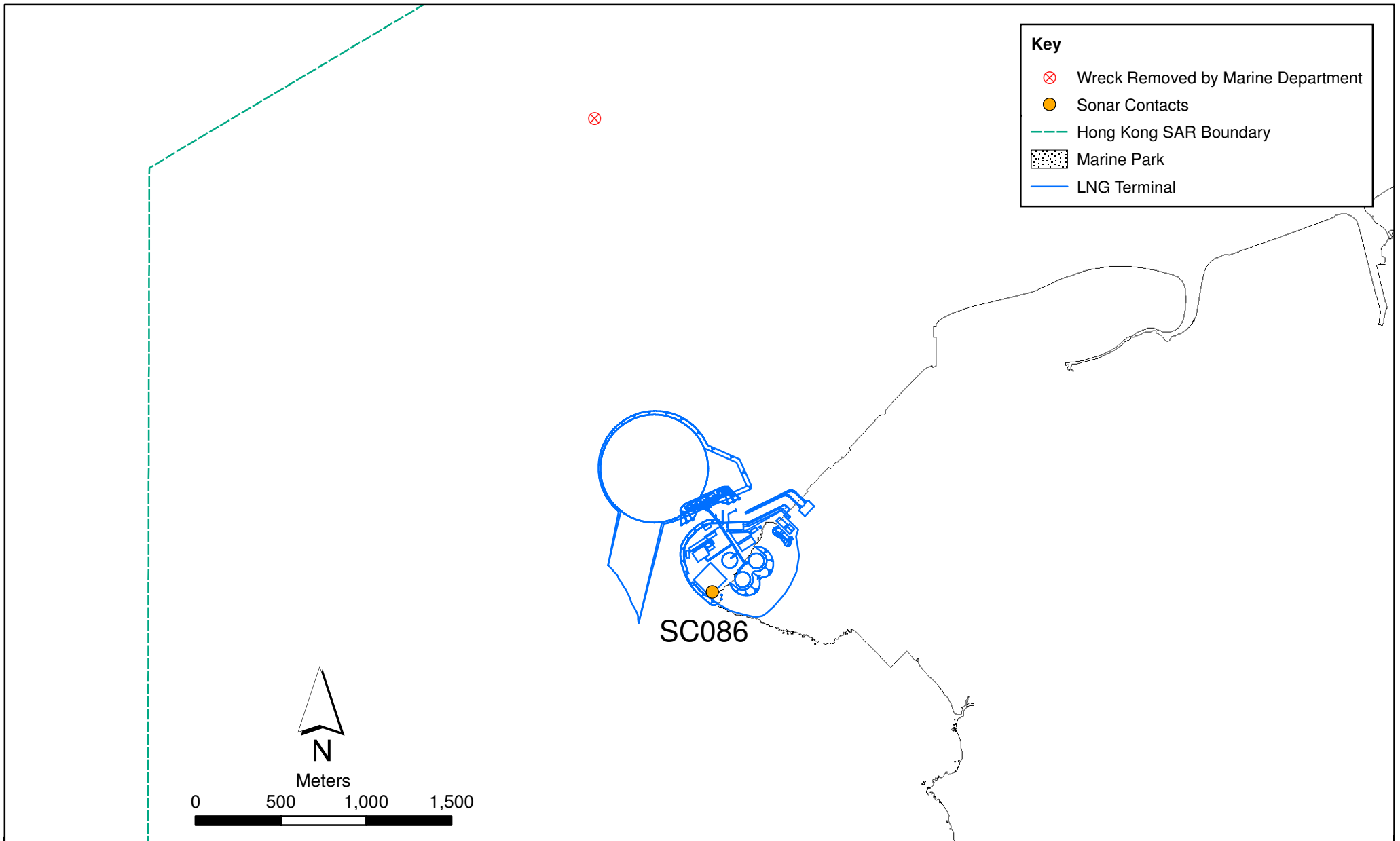


Figure 4.4

Location of the SC086 and Wreck Removed by the Marine Department Adjacent to the Study Area

Based on the side scan sonar image there was a degree of doubt if SC086 was a shipwrecks (see *Figures 4.4 and 4.5*).

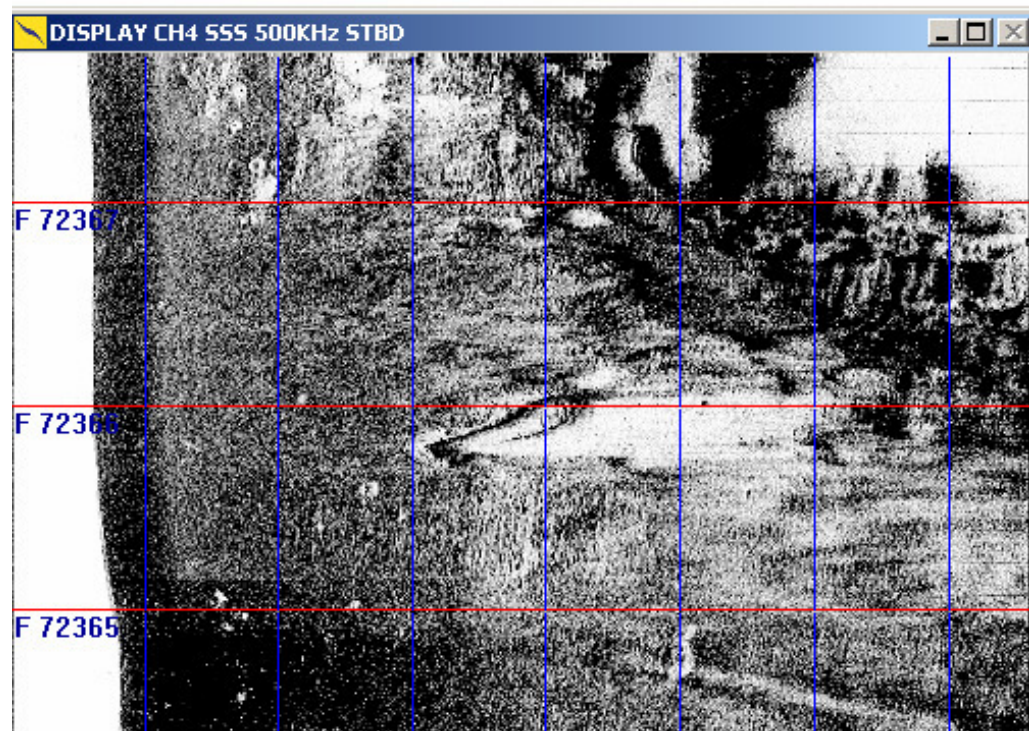


Figure 4.5 Possible Wreck (SC086)

It was this degree of doubt in some of the sites as well as the possibility that the recognisable shipwrecks could be modern sites, i.e., post-1800 (the date which Antiquities and Monuments Ordinance defines an antiquity as a relic) that prompted the recommendation that a Magnetic Survey be conducted on the above sites to ascertain how much ferrous material remains on the anomalies. While pre-1800 ships would have carried ferrous equipment and used ferrous material in their construction, later ships could potentially be modern ferrous barges or timber vessels with larger amounts of ferrous material and used today in and around Hong Kong. It was considered that the amount of ferrous material detected during a Magnetic Survey and in association with the site descriptions already obtained during the side scan sonar survey, an indication on the age (through the nature of the remains) of the sites could be obtained.

4.3 MAGNETIC SURVEY

4.3.1 Survey Scope and Methodology

For the purpose of the MAI, a Magnetic Survey covering the 3 Sonar Contacts as presented in *Table 4.1* was undertaken by EGS from 2 to 4 September 2005⁽¹⁾. Survey lines around 100m long were surveyed for the Contact, with a line

(1) The numbering in the plans do not reflect the numbers shown in the above table

spacing of 5 m (see *Figure 4.6*). The 100m line lengths were selected to allow time for the magnetic sensor to be deployed close to the seabed and moving smoothly at a fixed level by the time it passed across the feature. The line interval of 5m was selected as magnetic anomalies decay rapidly with distance from the ferrous material (usually an inverse cube relationship), and a wider spacing risked completely missing a magnetic anomaly.

Magnetometers have been used in maritime archaeology for about 40 years to locate and map shipwrecks, both iron shipwrecks and non-ferrous shipwrecks (Green, 2004: 62-73)¹. Ferrous material (such as anchors, cannons, nails, chain, etc.) contained in a shipwreck will change the intensity of the earth's magnetic field and this change in intensity can be measured with a magnetometer sensor towed behind a boat. For a typical object (such as a shipwreck) the intensity of the magnetic anomaly varies as the inverse of the cube of the distance from the anomaly and the unit of measurements is known as a nano Tesla (nT). The SeaSPY magnetometer used in this survey can detect changes in intensity of less than 1 nT. A 5 nT change in intensity will detect a 10 tonne shipwreck at 45 metres, a 10kg cannon ball at 3 m and a 2 tonne cannon at 27 m (Green, 2004: 63). Conversely, a 10kg cannon ball will produce a change in intensity of c.2-3 nT at 5 m (distance from sensor to seabed in this survey) and a 2 tonne cannon will be produce a change in intensity of c.600 nT at 5 m.

When searching for shipwrecks, magnetometers use wide search lanes, perhaps 50, 100 or hundreds of metres depending on the size of the anomaly to provide an exact location, with little detailed information about the nature of the anomaly. In this survey, the SeaSPY magnetometer was used to implement close-plot surveys over small areas of a number of sites, using a maximum of 5 m search lanes and with the instrument capable of taking a reading every 0.25 second. This enabled detailed magnetic contour plans to be developed which in association with other surveys, such as other remote sensing surveys can assist in ascertaining the nature of a site. These accurate contour plans can help to locate discreet anomalies such as cannons, anchors, even iron fittings used in wooden hull construction.² Large intensity anomalies without many discreet anomalies could be single objects, such as a cannon, an anchor, an engine, dumped materials and the ship itself if constructed of ferrous material.

It is highly unlikely that timber vessels of any size from small sampans to large junks would not contain some ferrous material. Iron nails have been found in use on Chinese ships dating back to 220BC, together with the use of iron adzes and chisels used in their construction and maintenance⁽³⁾. Some pieces of iron equipment in the form of anchors, grapnels, guns, machinery have also been used on Chinese junks for over 1000 years. The quantity and distribution of the ferrous material (found through an analysis of the intensity

¹ Green, J.G., 2004, *Maritime Archaeology: A Technical Handbook* Elsevier Academic Press California

² See Green, 2004:159-162 for details of a close-plot survey of the Dutch shipwreck *Amsterdam* and which provides, amongst other things a good outline of the timber hull shape.

(3) Maitland, D., 1981, *Setting Sails. A tribute to the Chinese Junks*. South China Morning Post. Hong Kong

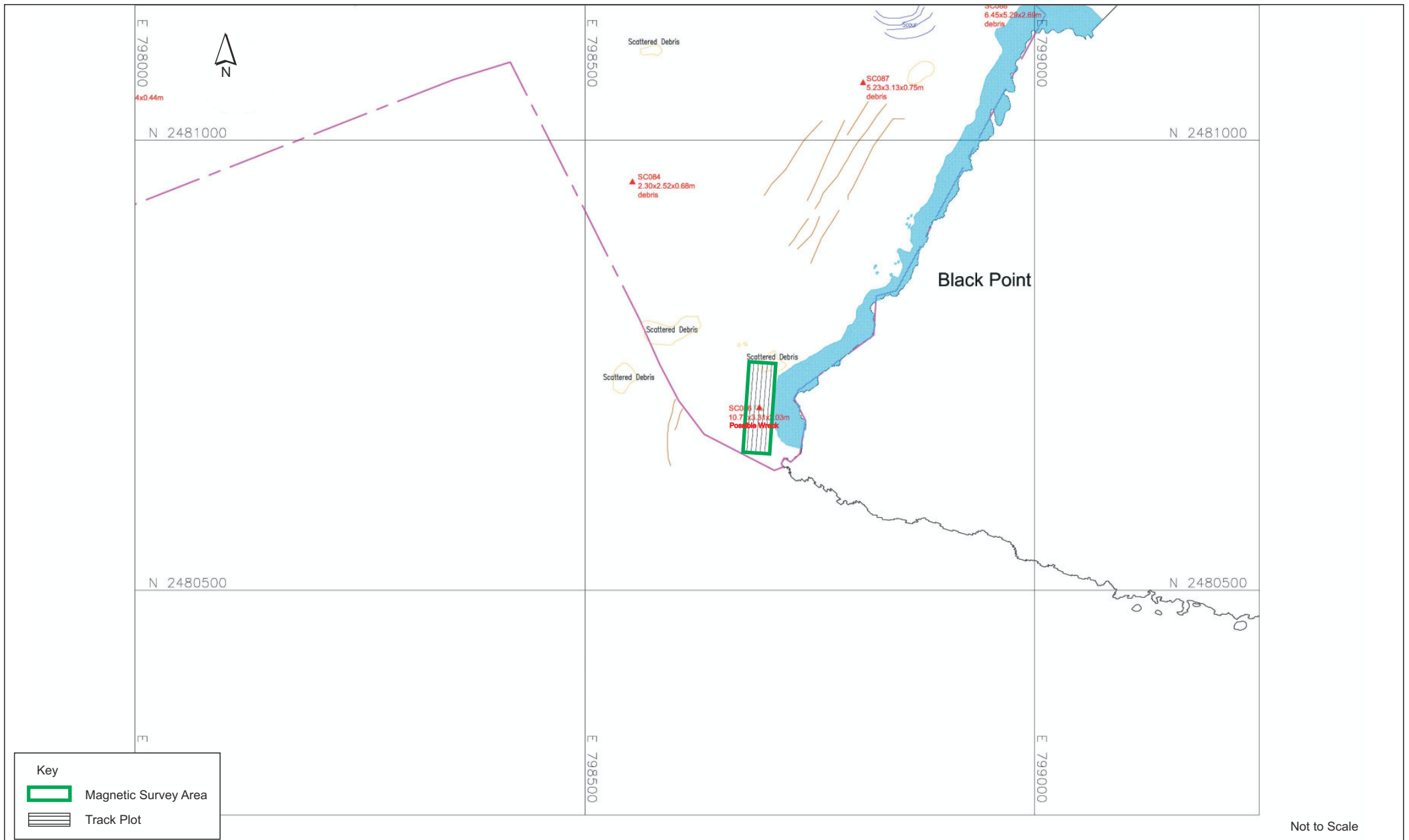


Figure 4.6

Magnetic Survey Track Plot for SC086

of the anomaly and an examination of the close-plot contour plans) will in association with the other surveys help to identify the nature of the site and was the major objective of the magnetic survey.

4.3.2 *Turbidity and Visibility Readings*

A vertical profile of turbidity was recorded for the Sonar Contact, with closely spaced readings close to the seabed and wider spacing close to the sea surface. The turbidity sensor was attached to a Secchi disc, so that the greatest depth that visible objects could be seen from the survey boat was also recorded.

4.3.3 *Magnetometer*

The magnetometer was deployed 15m behind the survey vessel, to separate the magnetometer sensor from the magnetic effect of the vessel's steel engine. In shallow water close to coastlines, in less than around 5m of water, the sensor and cable were buoyed with floatation material to keep them close to the sea surface. In deeper waters away from the shore, non magnetic (brass) weights were attached to the sensor so that it would sink down close to the seabed. The position and quantity of these weights was adjusted until the pressure sensor attached to the magnetometer showed that the magnetometer sensor was within 5m of the seabed, without striking the seabed.

The magnetic field strength measured in the sensor was transmitted up the towing cable to the survey vessel, where the values were logged together with the navigation information on a computer logging system.

4.3.4 *Positioning and Navigation*

Surface positioning was provided by GcGPS during all of the work: C-Nav provided primary positioning with a one sigma standard deviation of 0.5m for this project. A C-Nav antenna provides the GcGPS position of the vessel on a C-Nav decoder. For each position update, an NMEA string (GGA, VTG) was sent from the C-Nav decoder directly to the computer logging the navigation and magnetometer information.

4.3.5 *Magnetic Survey Results*

The regional gradient and diurnal variability was subtracted from the measured values using proprietary EGS software, leaving the background geological magnetic field; in Hong Kong, this is mostly around 44,500nT to 45,000nT. The remaining magnetic anomalies associated with ferrous material at the seabed or buried at shallow depth were contoured at a scale of 1:500. The drawing also show the location of seabed features (see *Figure 4.7*).

The results are summarised in *Section 4.3.6* below in the description of the magnetic surveys and in *Figures 4.8* and *4.9*.

The vertical profile of turbidity measurements and the Secchi disc depths are presented in *Annex 12-B-A*.

KEY :

44718 MAGNETIC ANOMALY

CONTOUR AT 50NT INTERVALS

▲ SONAR CONTACT (LXWXH)

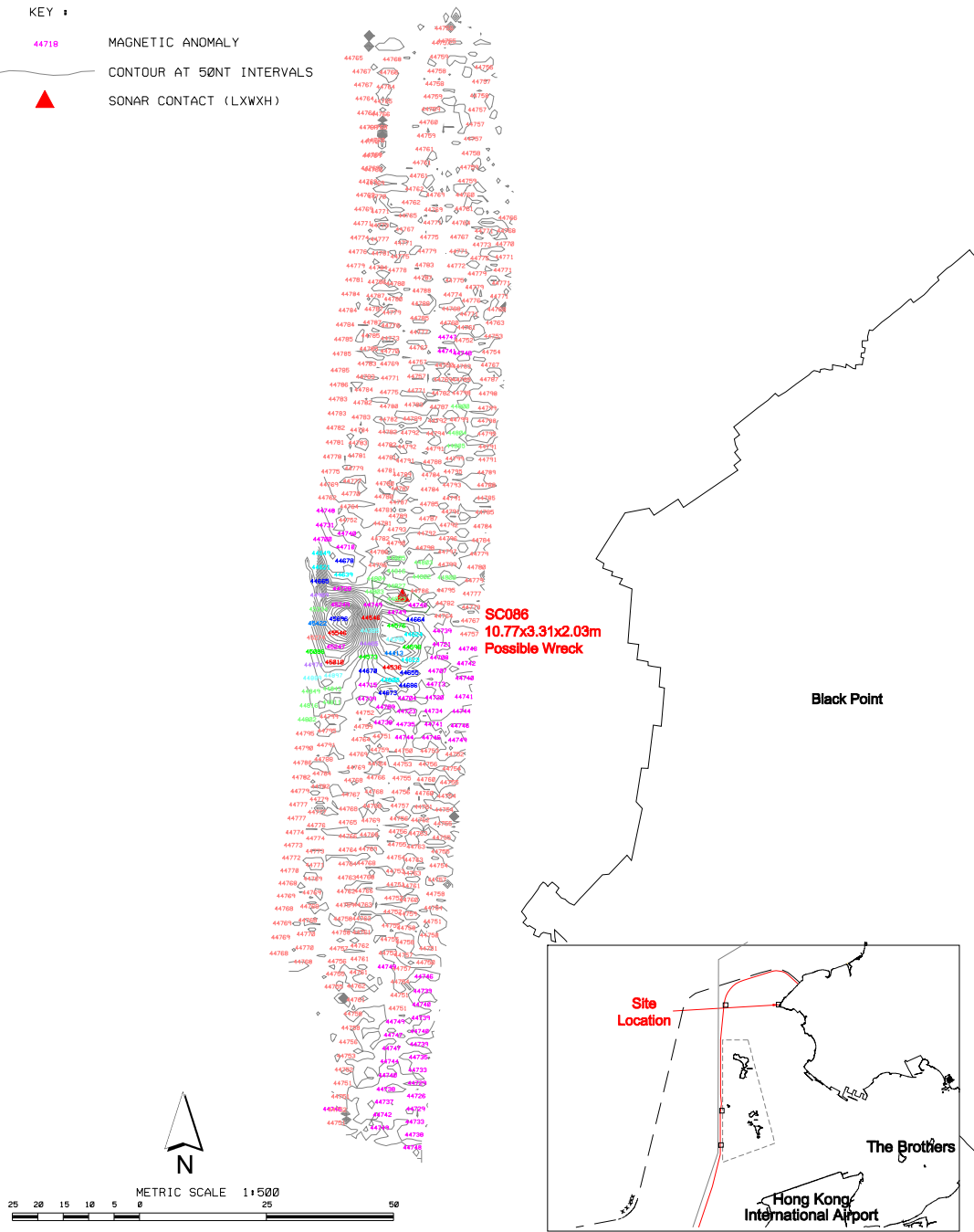


FIGURE 4.7

Contoured Plan for SC086

Environmental Resources Management





i) ROV



ii) Computer ROV Operation



iii) ROV Deployed from Boat



iv) ROV Deployed from Sampan

Figure 4.8

ROV Operation

The turbidity readings and Secchi disc depths suggest that visibility near the seabed will be less than 1m for much of the route, so it is likely to be difficult for divers to make a visual inspection of these features.

4.3.6 *Description of the Magnetic Surveys*

M11 West of Black Point. >1,000nT anomaly associated with sonar contact SC086 (11m long wreck) confirms presence of ferrous material.

4.3.7 *Interpretation of the Magnetic Anomalies*

The magnetic sensor was within 5 m of the seabed/sonar contact. If a Sonar Contact was timber vessel with no or little ferrous fastenings, equipment, stores or cargo then they may not produce any addition to the 1-2nT variation. However, it is considered that a vessel of pre-1800 would contain some ferrous fittings, equipment, stores or cargo that would provide a significant change (greater than 1-2nT) in the earth's magnetic field given the magnetic sensor was within 5 metres of the Sonar Contact. Another possibility is that these anomalies are very old, pre Iron Age vessels, but given their location, i.e., exposed on the seabed, this is not realistic. SC086 is considered to be a vessel of some sort. Given the relatively low magnetic signals for the size of the anomaly and at the distance of the magnetic sensor to the anomaly that it is not solely made of iron, but is of a composite material, possibly timber and iron/steel.

4.4 *REMOTE OPERATED VIDEO (ROV)*

One possible wreck (SC086) was identified and has been presented in *Table 4.2* and *Figure 4.4*. In order to identify its nature and age, an inspection of the sites was undertaken on the 15th February 2006, carried out by EGS using their Remote Operated Vehicle (ROV) from their work-boat and employing EGS staff (six in total) to operate the ROV, the positioning equipment (DGPS) and boats. The ROV is a small piece of equipment that contains a video with lights and is controlled by an operator on the boat. It can be propelled (using a surface generator attached with a cable to the ROV) to move about in the water. However this model (Titan) cannot operate against much current and needs to be used as a 'drop camera', i.e. to be simply dropped onto the site to be inspected and to be moved by operators with ropes from the *Figures 4.8(i)* and *4.8(ii)*. The ROV was dropped on some of the sites from the work-boat (*Figure 4.8(iii)*) and the sampan depending on current and site location (*Figures 4.8(iv)*).

Table 4.2 Identified Archaeological Potential Site

Contact number	Latitude Longitude	Easting Northing	KP RPL offset	Dimensions (m)	Description
SC086	22° 24.388' N 113° 54.072' E	798693.9E 2480702.4N	39.148 1572m SW	10.77m x 3.31m x 2.03m	Possible wreck

Most videos will work in low lux (amount of luminosity) values of 5-15 lux (10 lux is early twilight or light from 60 watt bulb from 3 metres away; 1 lux is late twilight; and 0.1 lux is light from a full moon). It was anticipated that the water in the vicinity of the sites would be turbid (from suspended sediments) and most likely with a very low lux value.

Tides during the day were 0.5m at 0505; 1.5m at 1117; 1.0m at 1607; and 2.1m at 2239. The weather was overcast, either fog, pollution or a combination and which would have only contributed slightly to the underwater visibility.

4.4.1 ROV Results

SC086 (5:35pm) (Figure 4.9)

This site is located about 20m from the rocks at Black Point in 7 m of water and was not found during the ROV survey. The visibility was zero, the water had a very muddy appearance on the surface. There was a slight breeze and given the busy shipping activity in the vicinity, there was at times a choppy sea. The ROV Video camera did show what was most likely rocks (or possibly wreckage) and the remains of some fishing nets (see Figure 4.10 for the clip of video record).

Due to the lack of visibility, the nature and age of SC086 could not be determined. The presence of fishing nets found on SC086 also makes diver surveys hazardous for this and the other sites that could contain nets, given their prominence on the seabed and the likelihood of entrapment.

It was recommended that more detailed remote sensing work incorporating multibeam sonar and side scan sonar data be undertaken for the site so that the sonar data can be used to develop three dimensional models that can be rotated and viewed at different angles. These very accurate virtual models are the closest thing to viewing the real site and are currently the best system that can be used in nil visibility situations. In combination with more detailed side scan sonar surveys and the existing magnetometer data (or closer plot magnetometer survey data) it may be possible to identify rope or other modern artefact/equipment that will confirm the nature and age of the sites.

It is problematic if diver surveys would be more useful in determining the nature of the sites. The ROV with its low lux values can 'see' better than human eyes and while a diver can feel objects, he/she may not be able to produce objective results in the form of drawings as they would be reliant on

their memory or the translation of their surface, diving supervisor when noting their descriptions. It was considered more useful to implement a multi beam survey which produces objective and recordable results and in combination with the other remote sensing surveys provides for more comprehensive and independent assessments.



Figure 4.9 Area at SC086

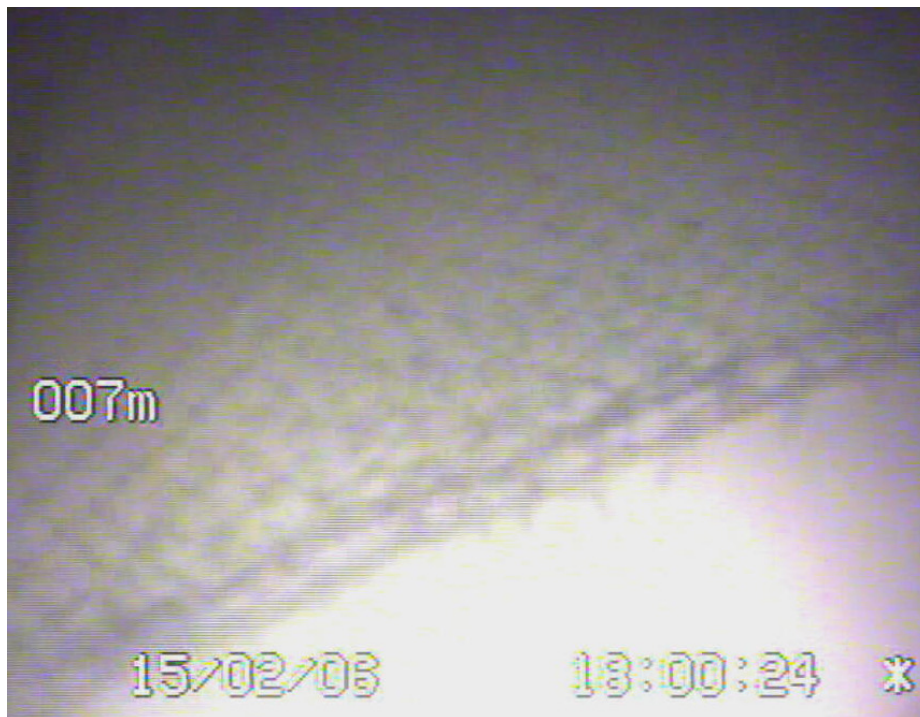


Figure 4.10 Video Clips Showing SC086

4.5 SIDE SCAN SONAR AND MULTI BEAM SONAR SURVEY

Further to the ROV result, a further detailed Side Scan Sonar and Multi Beam Sonar Surveys was undertaken by EGS in April 2006 for the Sonar Contact SC086. The survey track plot is shown in *Figures 4.11*.

4.5.1 Survey Methodology

The main equipment used for the survey is shown in *Table 4.3*.

Table 4.3 *Equipment Used for the Side Scan Sonar and Multi Beam Sonar Surveys*

Survey System	Manufacturer	Model Number
Swath Bathymetry	Reson A.s.	400 kHz 8125
Side Scan Sonar	Klein Associates Inc	System 3000
Positioning	C&C Technologies Inc	C-Nav GcDGPS
Navigation	C-Products Ltd	C-View Nav

4.5.2 Swath Bathymetry

The navigation receiver was placed vertically above the swath transducer mounted on the side of the survey vessel. As the vessel travelled along the survey traverses, the system transmitted a fan of echo sounder beams down into the water column to map the shape of the sea bed in great detail. The geometry is illustrated in *Figure 4.12*.

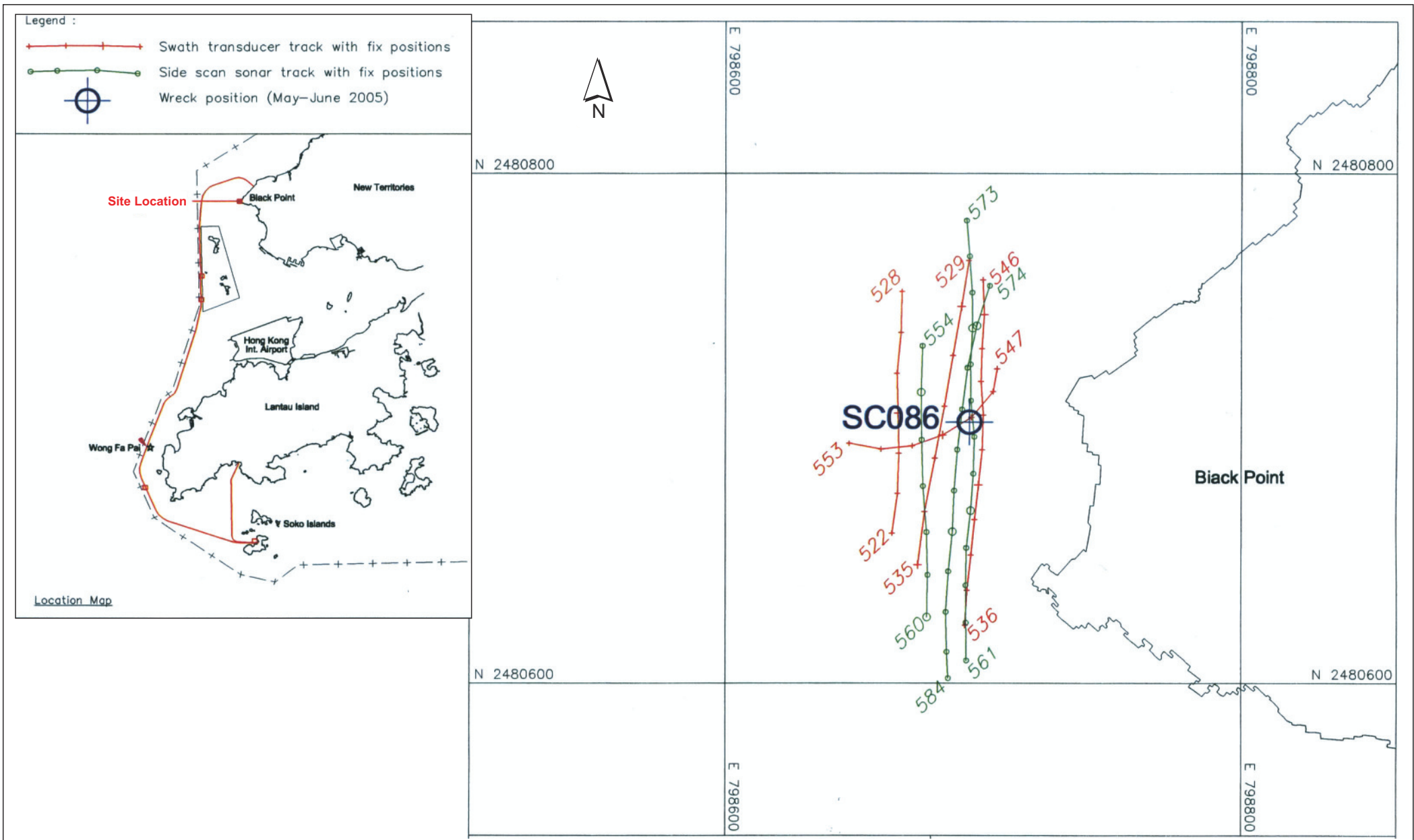


Figure 4.11

Track Plot Location of SC086

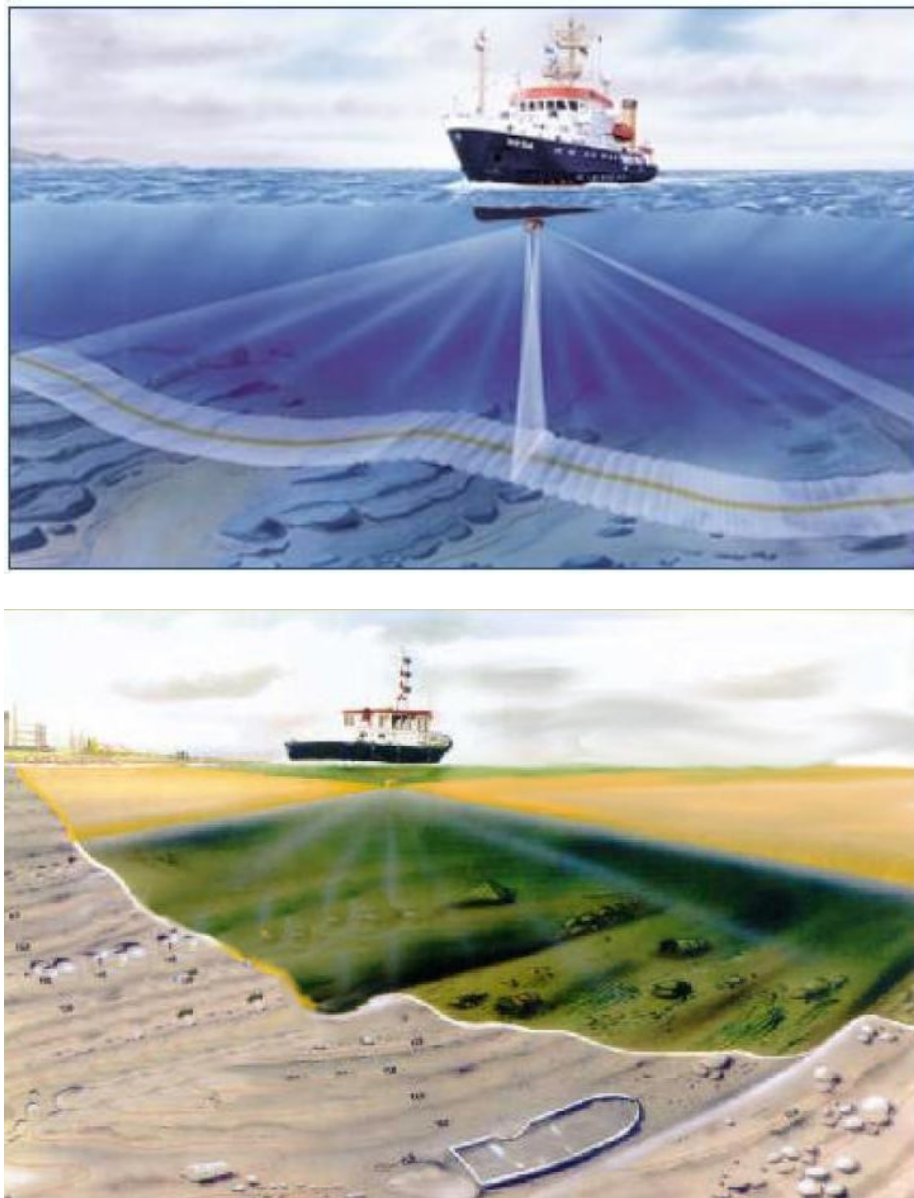


Figure 4.12 Illustrations of Swath Bathymetry Systems

At each location, the survey vessel sailed along four traverses around the artefact, “boxing in” and isonifying the sonar contact from each side. The measurements from each side were combined into a single image using the QinSys processing software supplied with the swath system. The level of each sounding has been colour coded, using a spectrum of colours to represent the range of levels found at each location. To give the impression of looking at the sonar contact from different directions, the image has been rotated in three dimensions before capturing the image. The images are presented in the results.

4.5.3 *Side Scan Sonar*

At each location, the survey boat sailed along four traverses to box in the sonar contact and isonify it from each direction, as for the swath measurements. The side scan sonar fish was towed behind the survey vessel

a few metres above the sea bed. As it travelled along the survey traverse, the transducers emitted sound pulses to either side and measured the echoes from features on the sea bed. The arrangement is illustrated in *Figure 4.13*.

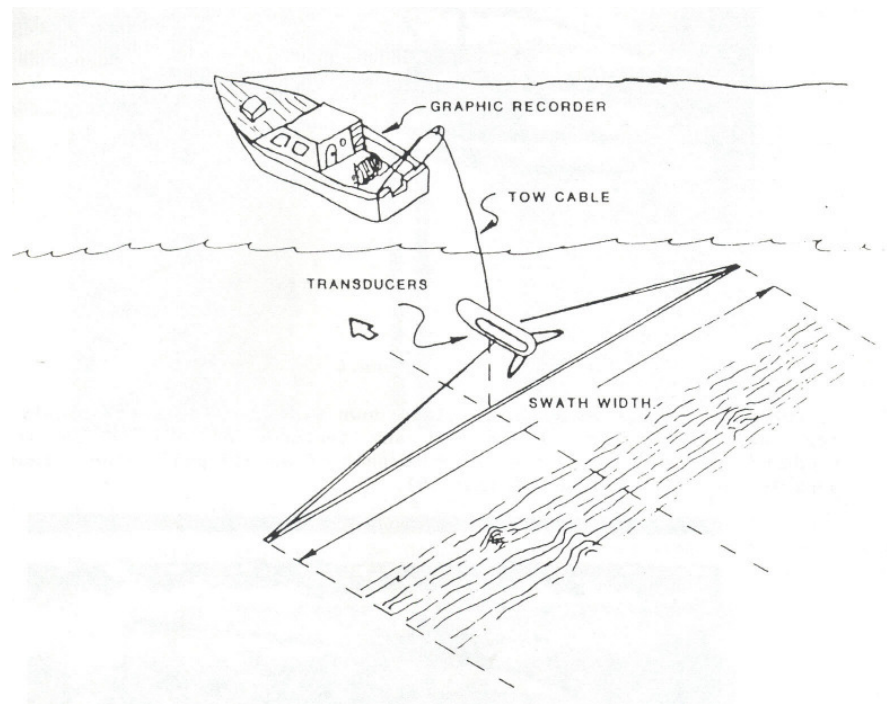


Figure 4.13 *Schematic Illustration of Side Scan Sonar System Operation*

A dual frequency (100 kHz and 500 kHz) system was used. The echoes for each frequency were recorded separately using the C-View acquisition system. Amplifier gains were applied to compensate for geometrical dispersion of the wave intensity with distance: no other processing was applied.

The images for each pass were examined and the clearest images for each contact were selected for printing in the results.

4.5.4 *Side Scan Sonar and Multi Beam Sonar Surveys Findings*

After EGS completed the Side Scan Sonar and Multi Beam Sonar Surveys, an analysis of this new data in context with the earlier survey work (side scan sonar survey and magnetometer data) was carried out by the marine archaeologist. The result is presented below.

SC086

In the side scan sonar survey in 2005, the following assessment was made of this anomaly. A vessel 10.77m x 3.31m x 2.03m in dimensions and located at 798694E, 2480702N (see *Figure 4.5*).

The magnetometer survey found this anomaly to contain in excess of 1,000nt more than the surrounding area. This was estimated to be in excess of 2-3 tons

of ferrous material and given the size of the anomaly, this site was interpreted as a wooden vessel containing a reasonable amount of iron/steel.

On the 6th and 7th April 2006 the area was surveyed with the multi beam sonar and the side scan sonar and better images of the vessel were obtained (See *Figure 4.14*).

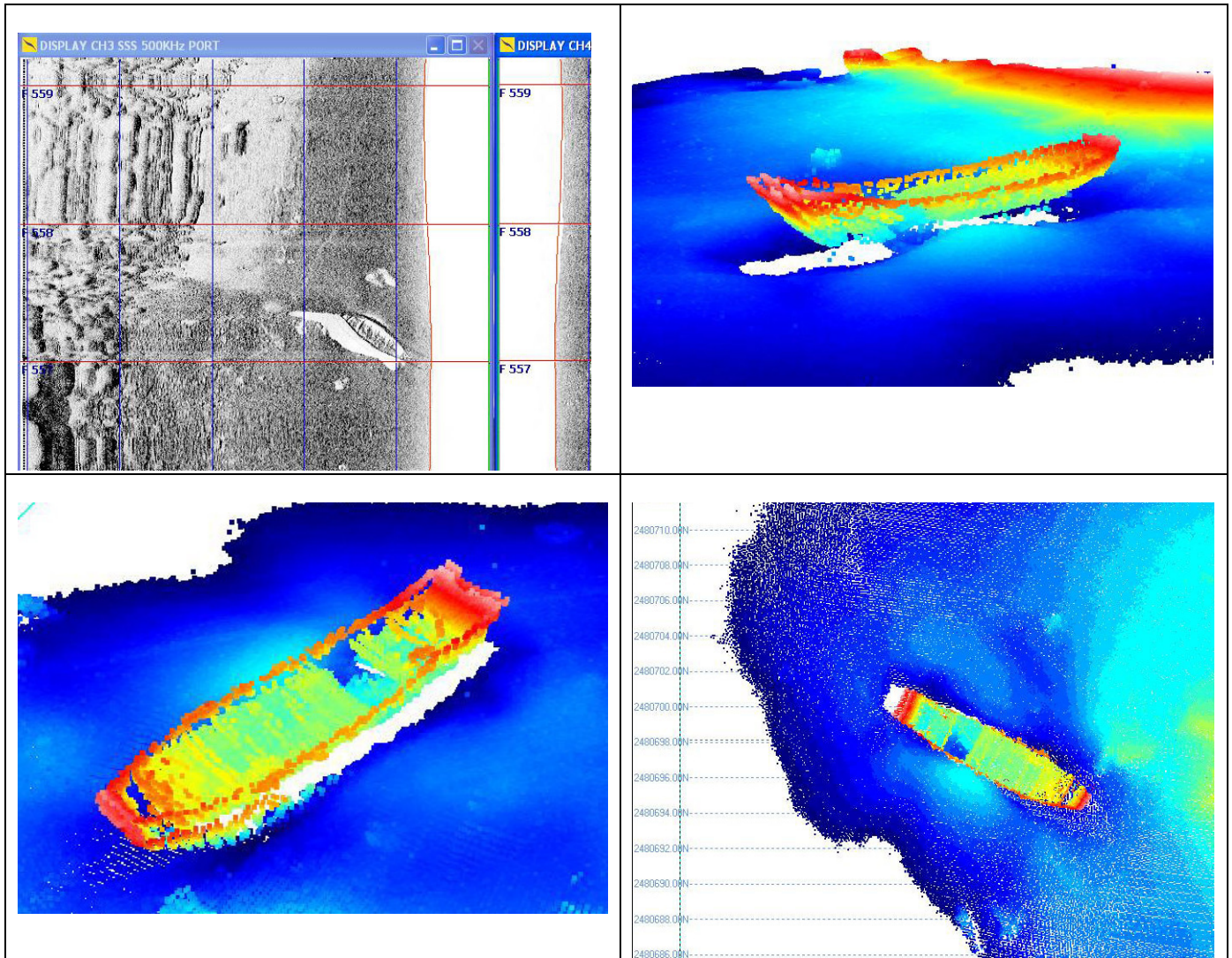


Figure 4.14 *Top Left: Side Scan Sonar Image of SC086 UNDERTAKEN in April 2006 (Centre)*

Top Right :General View of the Vessel by the Multi Beam Sonar

Bottom Left: Sampan with what looks like a hole towards one end of the vessel

Bottom Right: Plan View of Sampan confirming damage in the hull

The vessel and its location has all the appearances of a ‘recent’ motorised wooden sampan (see *Figure 4.15*). Located close to the rocks at Black Point and effected by the swells breaking over it, and the continual sea traffic, the vessel could not be expected to maintain its integrity for very long (perhaps months or just a year or so). Seats can be seen in the vessel and it shows

damage to its hull which is considered to have been caused from its continual movement. A vessel of pre-1800 age would not be in this condition in this location. The Marine Department salvaged a similar looking sampan on the 22 March 2006 (see *Figures 4.4 and 16*) which they reported was about 30 years old. SC086 is probably of a similar vintage.



Figure 4.15 A Motorised Sampan of about the Size of SC086



Figure 4.16 Recently Recovered by Marine Department with Dimensions Similar to SC086 (Source: Marine Department)

IMPACT ASSESSMENT

Literature review supplemented by Geophysical Survey, Magnetic Survey and further detailed side scan sonar and multi beam sonar survey identified one shipwreck (SC086) within the Study area. However, based on the survey data, the result indicated that SC086 is considered to be a motorised sampan. In the context with the *AM Ordinance (Cap. 53)*, the site is not an antiquity or relic and of no archaeological value. Thus, due to the lack of archaeological value of the site, impact to it is considered acceptable.

6

CONCLUSIONS AND RECOMMENDATIONS

Literature review supplemented by Geophysical Survey, Magnetic Survey and further detailed side scan sonar and multi beam sonar survey identified one shipwreck (SC086) within the Study area. However, based on the survey data, the result indicated that SC086 is considered to be a motorised sampan. In the context with the *A M Ordinance (Cap. 53)*, the site is not an antiquity or relic and of no archaeological value. Thus, due to the lack of archaeological value of the site, impact to it is considered acceptable. No mitigation measure is considered necessary.

Annex 12-B-A

Vertical Profile of Turbidity Measurements and The Secchi Disc Depths



TURBIDITY PROFILES AND SECCHI DISC DEPTHS

<i>Group</i>	<i>L</i>
<i>Form No</i>	<i>App_2</i>
<i>Revision</i>	<i>0</i>
<i>Approved by</i>	<i>R E Hale</i>

Job No. : HK196705 Job Name: Hydrographic and Geophysical Survey from Black Point Location : Black Point to Soko Group Instrument: OBS Infra-red turbidity sensor EGS black and white Secchi disc on calibrated chain	Date: 4th September 2005 Survey Team : Sin Wai On Survey Vessel: Sampan
---	--

Profile:	M11 Black Point	798,702 E	2,480,691 N
	Water Depth (m)	10m	Secchi Disc Depth
	Time	Depth (m)	Turbidity (ftu)
	10:19	9	26.8
		8	27.9
		7	16.6
		6	15.0
		5	13.9
		4	12.9
		3	11.7
		2	11.6
		1	11.3