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12 CULTURAL HERITAGE IMPACT

12.1 Introduction

12.1.1 Clause 3.4.8 of the EIA Study Brief (ref ESB-110/2003) for HKLR (previously called the Hong Kong - Zhuhai - Macao Bridge Hong Kong Section and North Lantau Highways Connection) requires a Cultural Heritage Impact Assessment (CHIA) to be conducted. This should include terrestrial and marine archaeological investigation as well as built heritage investigation to evaluate the impacts on known or potential cultural heritage. The guideline of CHIA is appended in Appendix 12A

12.1.2 The CHIA includes a Marine Archaeological Investigation (MAI). The MAI guidelines set by the Antiquities and Monuments Office (AMO) are the standard procedures within Hong Kong for assessing and identifying submerged cultural heritage (see **Appendix 12B**).

12.2 Legislation and Standards

12.2.1 The assessment and protection of cultural heritage within HKSAR is governed by the following legislative standards and guidelines:-

- Environmental Impact Assessment Ordinance (Cap 499);
- Antiquities and Monument Ordinance (Cap 53); and
- Hong Kong Planning Standards and Guidelines.

12.2.2 Environmental Impact Assessment Ordinance

12.2.2.1 The Environmental Impact Assessment Ordinance (EIAO) stipulates that consideration shall be given to cultural heritage and archaeological issues as part of the EIAO process. Annexes 10 and 19 of the TM-EIAO (see **Appendix 12C**) cite the following:-

- criteria for evaluating the impacts on sites of cultural heritage;
- guidelines for impact assessment;
- 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 the absolute minimum.

12.2.2.2 The Guidance Note on Assessment of Impact on Site of Cultural Heritage in Environmental Impact Assessment Studies (http://www.epd.gov.hk/eia/english/guid/cultural/basis.html) serves as a reference to facilitate an understanding of the requirements set out in Annex 10 and Annex 19 of the TM-EIAO for assessing impacts on sites of cultural heritage in EIA studies.

12.2.3 Antiquities and Monuments Ordinance

12.2.3.1 The Antiquities and Monuments Ordinance was enacted in 1976. It prescribes the regulation over the discovery, excavation and protection of antiquities in HKSAR.

12.2.3.2 Under this Ordinance, the Secretary for Development is the Antiquities Authority. The statutory Antiquities Advisory Board (AAB) consists of members with expertise in various relevant fields to advise the Antiquities Authority on any

matters relating to antiquities and monuments. The Antiquities and Monuments Office (AMO), as the executive arm of the Antiquities Authority, provides secretarial and executive support to the AAB in conserving places of historical and archaeological interest.

12.2.3.3 The Antiquities Authority may, after consulting AAB and with the approval of the Chief Executive as well as the publication of the notice in government gazette, legally declare a place to be protected. The Antiquities Authority is empowered to prevent alterations, or to impose conditions upon any proposed alterations as appropriate to protect the monument.

12.2.3.4 In addition to declared monuments, a large number and variety of sites of cultural heritage are identified and recorded by AMO. Recorded historic buildings and structures are graded as Grades I, II or III by the AAB to indicate their relative importance, as defined below:-

Grade I	Buildings of outstanding merit, which every effort should be made to preserve if possible.
Grade II	Buildings of special merit, efforts should be made to selectively preserve.
Grade III	Buildings of some merit, preservation in some form would be desirable and alternative means could be considered if preservation is not practicable.

12.2.3.5 Guidelines on the approach, methodologies and criteria to be used in conducting a CHIA are included under *Annex 10* and *19* of the EIAO TM, and the assessment criteria are explained in the Guidance Note on Assessment of Impact on Site of Cultural Heritage in EIA Studies. The criteria in EIAO-TM *Annex 10* for evaluating impacts to sites of cultural heritage include:

- 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.

12.2.3.6 Although graded buildings and structures, and deemed monuments carry no statutory protection, the Government has administrative procedures that require conservation be given to those historic buildings and sites of cultural heritage.

12.2.3.7 For archaeological sites, relics (defined under the Antiquities and Monuments Ordinance as fossils and objects/artefacts created, modified, etc. by human agency before 1800 AD) discovered after 1976 are, by law, properties of the government. All discoveries of antiquities or supposed antiquities must also be reported.

12.2.3.8 Archaeological sites are administratively classified into two categories, namely:-

- Declared Monument – those that have been gazetted in accordance with Cap. 53 by the Antiquities Authority; and
- Recorded Archaeological Sites – those which have not been declared but recorded by the AMO under administrative protection.

12.2.4 Hong Kong Planning Standards and Guidelines

12.2.4.1 Chapter 10 of the HKPSG provides guidelines relating to the conservation of historic buildings, archaeological sites and other antiquities. The guidelines detail the methods for the conservation and preservation of protected monuments, the method of identifying and recording antiquities, particularly

buildings which should be conserved and the recording and grading of such buildings and archaeological sites.

12.3 Scope and Study Area

12.3.1 General

12.3.1.1 As stipulated in Section 3.4.8 of the EIA Study Brief (ESB-110/2003), the CHIA will follow the criteria and guidelines as stated in Annexes 10 and 19 of the TM-EIAO. The key stages for CHIA include the following:-

- Baseline study (including both desktop study and field survey);
- Impact evaluation; and
- Recommendation of mitigation measures.

12.3.2 Alignment

12.3.2.1 **Section 3** has provided a detailed description of the preferred alignment of HKLR from the HZMB Main Section at HKSAR boundary to Sha Lo Wan, along Airport Channel and eventually connecting to the HKBCF.

12.3.2.2 Most of the sections would be in the form of a viaduct except at 2 sections, including a 1.1km long short tunnel underneath Scenic Hill and a 1.5km long at-grade road along the east coast of CLK Island.

12.3.2.3 There would be some reclamation of about 23ha along the eastern coast of CLK Island to reclaim minimum land required for the Scenic Hill tunnel portal and the associated at-grade road **Figure 12.1**.

12.3.3 Study Area

12.3.3.1 According to the EIA Study Brief, the study area for field survey and impact evaluation includes the area of potential impact that would be caused by the preferred HKLR alignment. The alignment and the study area are shown in **Figure 12.1** and are summarised below:

Terrestrial archaeology	A 50m buffer distance on both sides of the proposed alignment.
Built heritage	A 300m buffer distance on both sides of the proposed alignment.
Marine archaeology	A 100m buffer distance on both sides of the proposed alignment.

12.4 Terrestrial Archaeology

12.4.1 Desk-top Research

12.4.1.1 The baseline study will include any areas impacted by the project as well as direct and indirect impact of ancillary works areas, access sites etc. The desktop study of known cultural heritage resources within the study area is given below.

12.4.1.2 AMO maintains a list of archaeological sites which is updated from time to time. This list can be consulted at the AMO. However, the list is not meant to be exhaustive, nor is the information contained therein comprehensive.

12.4.1.3 Other useful sources of relevant information include the tertiary institutions (e.g. the Hong Kong Collection at the University of Hong Kong Library, Departments

of History and Architecture at the University of Hong Kong and the Chinese University of Hong Kong), public libraries and archives (e.g. Public Records Office), District Offices, District Lands Offices and Land Registries, etc.

12.4.1.4 There are 3 main archaeological surveys (see the first 3 items in **Table 12-1**) conducted in the study area of the Hong Kong Link Road between 1982 and 1998, including:-

- those by Peacock and Nixon in 1982 - 1985;
- Chinese University of Hong Kong in 1991; and
- the Guangzhou Institute of Cultural Relics and Archaeology in 1997-1998.

12.4.1.5 These archaeological surveys present data from successive archaeological surveys across the North Lantau region. These surveys summarise the location and extent of archaeological remains and for the most part provide a cumulative record, which elaborate on the results of each previous study. A summary of these 3 archaeological surveys and other relevant sources of information is given in **Table 12-1**.

Table 12-1 Relevant Previous Studies for Terrestrial Archaeology

Report	Relevance to this Study
Report of the Hong Kong Archaeological Survey, volumes I-III [12-1]	This report presents the results of the first territory-wide archaeological survey in Hong Kong which included field visits and field evaluation of known and potential archaeological sites across the North Lantau region. Those sites recorded which are relevant to the current study include San Shek Wan (磡石灣), Sha Lo Wan (West) (沙螺灣西), San Tau (磡頭), Sha Tsui Tau (沙咀頭) and Pak Mong (白芒) (archaeological summaries below).
Report of the Archaeological Survey of North Lantau 北大嶼山考古調查報告 [12-2]	An archaeological survey of North Lantau was commissioned by the AMO in 1991 and included survey and fieldwork at San Shek Wan, Sha Lo Wan (West), Sha Lo Wan, San Tau , Sha Tsui Tau and Pak Mong. This survey provides additional site information and follow-up data which elaborates and extends the field results obtained during the 1982-1985 survey (Peacock and Nixon, above). Notable additional Tang (唐) and Song (宋) period remains were found at Sha Lo Wan including stone spear and arrow heads, a stone axe mould and bronze knife.
Second Territory-wide archaeological survey of North Lantau [12-3]	As part of the second territory-wide archaeological survey of Hong Kong, a team from the Guangzhou Institute of Cultural Relics and Archaeology conducted a program of field evaluation throughout the North Lantau region during 1997-8. Archaeological sites relevant to the present study surveyed during 1997-1998 include San Shek Wan, Sha Lo Wan (West), Sha Lo Wan and San Tau. Notable finds included remains of a Han (漢) period mirror at San Shek Wan and 2 graves of Song period at San Tau.
WP12 – Historical, Archaeological and Cultural Heritage Impact Assessment, (CE 1/97)[12-4]	A Cultural Heritage Impact Assessment for a study area between Tung Chung and Tai Ho (occupying the eastern half of the HZMB study area) was conducted for TDD in 1999 in advance of New Town development at Tung Chung. This included archaeological field survey of sites at San Tau, Sha Tsui Tau, Ma Wan Chung, Pak Mong and Tai Ho Wan. No new sites were found though a cache of Tang period coins was discovered at San Tau.
Archaeological Investigations on Chek Lap Kok Island [12-5]	An archaeological survey of Chek Lap Kok was conducted in 1990 in advance of reclamation works and airport construction. Seven archaeological sites were surveyed and recorded over a 9-month period. These included remains of middle Neolithic pottery, Bronze Age burials and Tang period lime kilns which – following excavation and recording – were removed during

Report	Relevance to this Study
	airport works. The only archaeological site of relevance to the current study is at Ha Law Wan (蝦螺灣) on the southern part of Chek Lap Kok Island. A complex of Yuan (元) period kilns was discovered during the 1990 archaeological program and these have been preserved by the Airport Authority on the northern lower slope of Scenic Hill.
New Airport Master Plan – Environmental Impact Assessment [12-6]	An EIA study conducted in 1990-1993 for the new airport development at Chek Lap Kok documented 7 archaeological sites. All of these have been removed with the exception of the Yuan period kiln complex at Ha Law Wan which has been preserved near Scenic Hill. A Neolithic and Bronze Age archaeological site at Sha Lo Wan (West) was excavated in 1993 prior to removal of the headland for airport works. Operational impacts of the new airport on archaeological sites along the North Lantau coast were restricted to visual and noise intrusion.

12.4.1.6 Reports and publications have also been reviewed for individual archaeological sites within the study area. Where relevant these have been cited in the archaeological summaries in **Table 12-2**. It is emphasised that the boundary of each archaeological site delimits an area within each region of both proven and potential archaeology. In effect the "archaeological site" has been defined by AMO to include areas where archaeological remains have been found and areas of potential. The location of these known archaeological sites are illustrated in **Figure 12.2**.

Table 12-2 Description of Terrestrial Archaeological Sites

Terrestrial Archaeological Site	Description
San Shek Wan (磡石灣) archaeological site [12-3]	This site occupies the beach, rear beach and hinterland on the west coast of North Lantau. There are no recorded in situ archaeological structures though a deposit of Late Neolithic period, Bronze Age, Han, Tang and Song artefacts exist within a coastal sandbar/rear beach setting. The inclusion of the rear beach and lower hill slopes within the San Shek Wan archaeological site suggest potential for archaeological material behind the beach.
Sha Lo Wan (W) (沙螺灣西) archaeological site [12-7]	This truncated promontory (removed in 1995 before airport construction) was formerly the site of a Late Neolithic promontory site with a rich assemblage of artefacts, pottery and evidence of domestic structures which was excavated in 1993. The remaining headland has traces of Tang and Neolithic period artefacts and proximity to the excavated site (described above) suggests further archaeological potential at this site.
Sha Lo Wan (沙螺灣) archaeological site [12-2] & [12-3]	The Sha Lo Wan archaeological site occupies an expansive open beach, a wide former estuary (now infilled) and a hinterland of low slopes which includes the village of Sha Lo Wan Tsuen. Archaeological remains by way of Late Neolithic period artefacts, Tang period kiln debris and Song period pottery have been recorded during surveys (1991 and 1998) within a coastal rear beach setting. The fact that the boundary of the archaeological site at Sha Lo Wan includes both the beach and hinterland suggests that further archaeological potential exists on the lower slopes and infilled valley.
San Tau (磡頭) archaeological site [12-4]	The San Tau archaeological site lies on the western end of Tung Chung Bay on a large outwash alluvial fan of coarse gravels. The San Tau site encompasses two archaeological sites - Tin Sam (west of San Tau village) and that of San Tau proper. Tin Sam is represented by Tang and Song period artefacts and San Tau by Tang period burials as well as Late

Terrestrial Archaeological Site	Description
	Neolithic, Six Dynasties, Tang (唐), Song (宋) and Qing (清) period artefacts. The boundary of this site includes both the alluvial plain and adjoining lower slopes which holds the prospect of further archaeological material.
Ha Law Wan (蝦螺灣) archaeological site [12-5]	Ha Law Wan is located on the western side of Scenic Hill on Chek Lap Kok Island. During archaeological excavation prior to airport development, a complex of 13 Yuan (元) period iron smelting kilns were found. These have been preserved in situ and the area set aside as a visitor area managed by the Airport Authority. This site has been excavated and the prospect of further archaeological potential here is limited.
Sha Tsui Tau (沙咀頭) archaeological site [12-8 and 12-9]	The Sha Tsui Tau archaeological site lies at the head of Tung Chung Bay immediately east of the river outlet. The Hau Wong temple (1765) occupies part of the site. The area yielded two Tang period kiln structures, some surface Tang (唐), Song (宋) and Ming (明) ware and traces of Neolithic period artefacts. A Qing (清) period burial was found during excavation in 1995.
Ma Wan Chung (馬灣涌) archaeological site [12-4]	The Ma Wan Chung archaeological site is located on the eastern side of Tung Chung Bay. Two Tang period lime kilns as well as kiln debris were found near Ma Wan Chung village as well as a few fragments of Neolithic pottery. The boundary of the archaeological site includes the alluvial plain to the rear of the archaeological findspots described above and is considered to have further archaeological potential.
Pak Mong (白芒) archaeological site [12-10] *	The Pak Mong archaeological site lies to the east of Tung Chung Bay and occupies both the beach and hinterland which includes the 18th Century village of Pak Mong. This site is an extensive and important archaeological site represented by 4 clear cultural horizons and rich assemblage of Jin (晉) / Tang (唐) / Song (宋), Han (漢), Bronze Age and Late Neolithic period artifacts.
Tai Ho (大蠔) archaeological site [12-4] *	The Tai Ho archaeological site occupies a large valley and hinterland which surround a relatively deep embayment (Tai Ho Bay) to the east of Tung Chung. Two small archaeological deposits of Tang and Song period artefacts from a coastal setting and a promontory site to the east were recorded during surveys in 1991 and 1998.
Tung Chung Game Board Carving [12-4]	A rock carving of game board design and unknown date is located some 200m to the rear of the Tung Chung Battery.
Fu Tei Wan Kiln [12-5]	A Tang dynasty (A.D. 618-907) lime kiln was found at Fu Tei Wan, which was relocated to New Tung Chung Development Area. The site was destroyed by construction of the airport island.

Notes : * These archaeological sites are stated in the EIA Study Brief for HZMB which has been renamed to HKLR. The latest HKLR alignment would now terminates at HKBCF which is more than 3 km from Pak Mong and Tai Ho. The description on Pak Mong and Tai Ho Archaeological Sites are therefore included for information only.

12.4.2 Terrestrial Archaeological Investigation

12.4.2.1 The preferred alignment would span over part of the Sha Lo Wan (West) Archaeological site. All the viaduct structure would not encroach into this archaeological site.

12.4.2.2 This will be the only area of archaeological potential impacted by the alignment. According to the EIA Study Brief ESB-110/2003, an archaeological survey was conducted in this area from Sept 6th – 15th 2004 within an area 50m on either side of the proposed alignment. The Archaeological Survey Report at Sha Lo Wan (West) Southern Headland (March 2007) is appended in Appendix 12D.

12.4.2.3 Sha Lo Wan (West) lies on the northern coast of Lantau Island and opposite the south-western corner of the Chek Lap Kok airport. Much of the promontory here was removed in 1995 before airport construction together with the remains of a prominent Late Neolithic archaeological site, excavated in 1993 [12-7]. Though some 150m south of the archaeological site described above, the remaining headland has traces of Tang and Neolithic period artefacts, found during a limited field survey and test pit program in this area in 1985 [12-1] 1991 [12-2] and 1998 [12-3]. The geology of the Sha Lo West headland is granite with mapped colluvial deposits occupying the central small valley toward the east of the study area.

Method

12.4.2.4 The field survey strategy included a desktop review of previous studies, air photo interpretation and an interpretation of local geomorphology. A field scan and sampling program (test pit and auger survey) was planned on both elevated and lower slope sites within the survey area with the aim of investigating the prospect of archaeology associated with the former promontory site and on the gentler slopes to the east. The area was overgrown with scrubby vegetation and a grid sampling method proved impractical.

Ground Survey Results

12.4.2.5 The field scanning program found nothing across the southern and western part of the study area, with the exception of a fragment (top half) of a large polished stone hammer found on the hilltop to the west of the study area.

12.4.2.6 On the eastern beach however, to the north of a small stream outlet in the centre of the beach, sparse Prehistoric and Tang Dynasty artefacts were found along an approximate 40m sector of the beach, eroded from a dark sandy horizon some 30 cm thick above the weathered bedrock at the head of the beach. This discovery drew attention to a probable source area behind the beach where prehistoric and historic period sherds were found along an abandoned and eroded trackway behind the beach. Further survey revealed the presence of an extensive and previously unmapped sand deposit some 50m x 70m in dimensions and at an elevation of between 3-7m PD - somewhat unexpected given the relatively small embayment and hinterland. The results of the ground survey implied that this area held considerable archaeological potential and it became a prominent focus of the test pit and auger program.

Test Pit Surveys

12.4.2.7 A total of 6 test pits and 22 auger holes and shovel tests were excavated across the study area to investigate both the extent and archaeological potential of the sand deposit to the rear of the eastern beach as well as previously unsurveyed areas throughout the study area including the hilltop.

12.4.2.8 Test Pits 2, 3, 4 and 5 were sited within the sand body proper. TP3 produced an assemblage (95 sherds) of both Tang Dynasty ribbed plain ware and several crackled glaze fragments above a layer of Late Neolithic soft geometric stamped pottery, coarse-corded ware and well-fired geometric ware. TP2 and TP4 also produced Tang Dynasty sherds while auger holes 3, 7 and 17 yielded Late Neolithic and Tang Dynasty sherds.

12.4.2.9 An additional test pit and auger hole located on the main hillcrest failed to find any archaeological material to the west of the study area. While in a less prominent position, when compared with the headland site excavated in 1993, the presence of archaeological remains on this hilltop should not be ruled out. A test pit and auger hole was also located on the western beach where the hinterland rises steeply behind the beach. Sampling here and within mid and lower slope positions along the southern and northern margin a of the study area also failed to find archaeological remains.

12.4.2.10 The sand body on the eastern side of the remaining Sha Lo Wan (W) headland occupies much of the small valley and gentle hinterland in two broad lobes of variable thickness, some 200m2 in area.

12.4.2.11 Based on the amount and distribution of both Tang Dynasty and Late Neolithic pottery from sample sites TP2, TP3, A3 and A7 there is a concentration of archaeological remains from these periods at the northern half of this feature. The archaeological finds described above and the identification of a sand deposit on the eastern side of the Sha Lo Wan (W) headland suggest that this area holds further archaeological potential.

12.4.2.12 **Figure 12.3** shows the locations of the test pits and auger holes excavated at Sha Lo Wan (West) Archaeological Site.

Discussion of Survey Results

12.4.2.13 It would seem reasonable to speculate that the age and proximity of these finds to the rich Late Neolithic site excavated in 1993 - on the (now removed) promontory to the north – that both sites would have been connected. Indeed contemporary occupation of both areas might be strongly argued on the basis that the beach and rear-beach site found during this survey offers a more sheltered setting and beach access not offered by the hilltop site. There must have been transit between the promontory and the nearby beach and likely habitation of the rear beach – at the same time and likely by the same people who were engaged in a range of activities on the promontory.

12.4.2.14 If this is the case and the entire promontory might be considered as a Late Neolithic archaeological complex - with the northern part of this complex gone- the southern part may yet provide evidence of contemporary and varied activity.

12.4.3 Impacts Evaluation

12.4.3.1 All the bridge structure would totally avoid the Sha Lo Wan (West Archaeological Site) during both the construction and operational phases. Hence, there will be no direct impacts. Indirect impacts such as traffic noise would also be insignificant since the deck structure would have provided significant screening effect.

12.4.4 Recommendations

12.4.4.1 Since there are no significant direct and indirect impacts during the construction and operational phases, mitigation measures are not required and there are no residual impacts.

12.4.4.2 As a precautionary measure, periodic monitoring of construction works should be conducted to ensure the avoidance of any impacts on the Sha Lo Wan (West) Archaeological Site. Access to the said archaeological site for works area and storage of construction equipment is not allowed.

12.5 Built Heritage

12.5.1 Desk-top Research

12.5.1.1 There are no declared monuments within the HKLR study area. However, there are 2 declared monuments (ie the Tung Chung Battery and Tung Chung Fort) lying at beyond 500m from the preferred alignment.

12.5.1.2 Further references include the Tung Chung Fort [12-11], Forts and Batteries, Coastal defence in Guangdong during the Ming and Qing Dynasties [12-12] and Forts and Pirates [12-13].

12.5.1.3 A summary of built heritage for the Tung Chung – Tai Ho region is also provided within the Historical chapter of the TDD 1999 report [12-4] on Tung Chung redevelopment.

12.5.1.4 **Table 12-3** summarises localities within the study area based on a review of available data on built heritage, which has been supplemented by limited field survey. These include villages/districts of Kau Liu, San Tau, Tin Sum, Sha Lo Wan and San Shek Wan cited within the Study Brief.

Table 12-3 Summary of Built Heritage

Built Heritage	Approximate distance from HKLR	Description
San Shek Wan (磡石灣) [12-4]	600m	San Shek Wan has few buildings, which are over 50 years old. Most are of single storey stone construction. A temple – one hall type – was originally a shrine, which was developed as a temple in the mid 20th century. A Qing period inscription (renovated 1933) exists on the path toward Nam Tin - south of San Shek Wan.
Sha Lo Wan Tsuen (沙螺灣村) [12-4]	150m – temples; 300m - villages	Sha Lo Wan Tsuen is a notable historic village with a Pa Kong (harbour guarding) Hung Shing temple - with a bronze bell dating to 1774 – and a two-hall Tin Hau temple built in the early 18th century. Both temples are near the beach, with the main village about a kilometre inland. The entrance to Sha Lo Wan Tsuen is through the remains a village wall and stone gateway. There are three ancestral halls, two of modern construction, the third (Man Ancestral Hall) is currently being rebuilt. There are 5 rows of Hakka village houses of stone, mud and green brick construction.
San Tau (磡頭) [12-4]	300m	The San Tau region includes the, villages of San Tau, Tin Sam (田心) and Kau Liu (較寮). San Tau is a small village with ancestral halls of the Ho and Tse families. There are 3 rows of old stone and green brick houses, many in ruin. Tin Sam is a small hamlet about 150m north of Kau Liu with 2 rows of old stone houses and stone well. Kau Liu is a small hamlet some 250m north –west of San Tau with a notable row of 3 green brick buildings and house ruins. There are two prominent Fung Shui elements in the San Tau area - the elephants trunk Fung Shui element which extends north-south, following the course of the main river through San Tau and the dragons back element follows the ridgeline to the immediate west of the village.
Tung Chung Fort (東涌炮台) [12-4]	1.5km	Tung Chung Fort lies at the head of Tung Chung Bay and is a declared monument of early 19th Century date with substantial stone walls, 3 prominent gates and 6

Built Heritage	Approximate distance from HKLR	Description
		cannons facing toward Tung Chung Bay.
Tung Chung Battery (東涌小炮台) [12-4]	1.2km	Tung Chung Battery is an early 19th century fortification located on an elevated setting on the eastern side of Tung Chung Bay. It is a declared monument.
Kau Liu	400m	Kau Liu is a small hamlet some 250m north–west of San Tau and contains a notable row of three green brick Hakka style buildings and scattered house ruins. The typical design of these buildings is of a one-hall-one room type, built of green bricks with timber framed pitched ceramic tiled roof. Cocklofts are common above the back room. These houses are not graded historical buildings. A small earth god lies opposite the school at Kau Liu. The school was built in 1959.
Tin Sam	300m	Tin Sam is a small hamlet about 150m north of Kau Liu with two rows of stone houses and an old stone well. The houses are not of traditional Hakka design and have been abandoned.

12.5.1.5 **Figure 12.2** shows built heritage in the surroundings of the preferred alignment. Field survey method of this area was in general accordance with BHIA guidelines issued by the AMO and Annex 10 and 19 of the EIAO - Technical memoranda. It should also be noted that other than Sha Lo Wan, all built heritage shown in **Figure 12.2** are beyond 300m from the alignment. They are included in the above **Table 12-3** for reference only. For Pak Mong and Tai Ho, although they are mentioned in the Study Brief, they are located more than 3 km from the project and hence are not included in the assessment.

Sha Lo Wan Areas

12.5.1.6 As discussed above, there are 2 temples and a shrine fall in Sha Lo Wan that are within 150m of the preferred alignment. The main village complex of Sha Lo Wan Tsuen is some 500m from the coast and hence there is large buffer distance in between. At this distance, there will be no direct impacts to any of the structures and any adverse indirect impacts will be minimal.

12.5.1.7 A location map of the temples at Sha Lo Wan is provided in **Image 1 of Appendix 12E**. Both temples face Northeast and the Hung Shing Temple and Tin Hau Temple are situated side by side, with a separate and smaller earth shrine to the north of the Tin Hau Temple.. A report of the description and condition of these temples and shrine is shown below and photographs are provided from **Images 2 to 6 of Appendix 12E**.

(1) Hung Shing Temple (refer item 1 on location plan and images of Appendix 12E)

12.5.1.8 The Hung Shing Temple is a three-roomed temple with twin-pitched roof, datable – with reference to an inscription on a cast iron bell within the temple - to at least 1774. The temple was renovated in 1852, 1883, 1968, 1977, 1980 and 1998 and is made of stone, concrete rendered construction facing the sea. The Temple bears the name “Ba Gong Gu Miao” (把港古廟).

12.5.1.9 Hung Shing is one of the popular sea gods within southern China, worshipped for protection by fishermen and to prevent flooding. The Hung Shing festival is held at the temple and forecourt at Sha Lo Wan on the first weekend of August.

12.5.1.10 The name Ba Gong means “guarding the bay”. This suggests that the purpose of the temple is to guard the bay, prevent strong tides and provide protection from bad weather. Sha Lo Wan village faces north east in a topographic setting prone to strong tides and storms - particularly during typhoons. To protect the village, legend has it that the village chief hundreds of years ago asked a Fung Shui master for advices about the location of a temple. He proposed to build a temple in guarding the bay. Then they invited the Ba Gong Da Wang (the king of bay guarding) Hong Sheng stayed into this temple. After that, there were no flooding in Sha Lo Wan village.

Architectural detail : The Door and Roof Motifs

12.5.1.11 There are dragon motifs on each of the front doors of the Hung Shing Temple to guard the temple and two dragons on the ridge of the roof between a pearl – a common feature of ridge decoration in temples throughout Hong Kong.

(2) Tin Hau Temple (refer item 2 on location plan and images of Appendix 12E)

12.5.1.12 The Tin Hau Temple (天后宮) in Sha Lo Wan was built at 1819. Tin Hau is one of the main gods, worshipped by fishermen throughout Hong Kong. The temple is a twin pitched design with single chambered room. The temple was renovated most recently in 2000 with donation from the Association of Chinese Temples and the Village Committee. Condition of the building is generally good with some minor damp on the interior west wall.

Architectural detail : The Door Gods and Chi Wen (鴟吻)

12.5.1.13 There are two groups of door gods on the front of the temple’s doors. The duties of door gods are guarding the temples and keeping the bad spirits away from the temple. The god on the left door with a black face is called Qu-Chi Jing De (屈遲敬德) and the one on the right with a white face who called Qin Shu Bao (秦叔寶).

12.5.1.14 There are two fish-like figures located on the two sides of the main ridge of the Tin Hau temple called Chi Wen (Image 6). These figures are common on temples throughout Hong Kong.

12.5.1.15 Chi Wen is one of the nine sons of dragon. Chi Wen stays always at the top temple and two side of main ridge. Because Chi Wen is spirit of water, it can prevent conflagration; it likes looking into the distance from a high place.

(3) Earth Shrine (refer item 3 on location plan and images of Appendix 12E)

12.5.1.16 A small earth shrine lies about 5m to the north of the Tin Hau temple. The condition of the shrine is good.

12.5.2 Impact Evaluation

12.5.2.1 There will be no direct impacts associated with either the construction or operational phase of the project as there were no recorded heritage resources in either of the alignment or works areas along the alignment. The following indirect impacts were assessed for both the construction and operational phases for the temples and shrine at Sha Lo Wan.

- Visual and aesthetic impacts on heritage resources; and
- Noise impact.

Construction Phase

12.5.2.2 The evaluation of impacts during the construction phase is given below.

Table 12-4 Evaluation of Impacts – Construction Phase

Resource	Separation to Works Area	Impact Assessment - visual	Impact Assessment - noise
Hung Shing Temple, Tin Hau Temple and Earth Shrine	150 m	There will be some visual or aesthetic impacts associated with the proposed viaduct which lies within clear view and 150m to the north of the temples and shrine. The construction works areas would be about 100m from the temple and hence visual impact would not be significant.	There will be some construction noise impacts on worship and observance at festival time. Construction noise impacts (see Section 6) has revealed that the noise level would comply with the criteria and hence mitigation measure is not required.

Operational Phase

12.5.2.3 The evaluation of impacts during the operational phase is given below.

Table 12-5 Evaluation of Impacts – Operational Phase

Resource	Separation to Alignment	Impact Assessment - visual	Impact Assessment - noise
Hung Shing Temple, Tin Hau Temple and Earth Shrine	150m	There will be some visual or aesthetic impacts associated with the proposed project as the HKLR route lies within clear view and 150m to the north of the temples and shrine. Aesthetic design on HKLR will be provided in the detailed design stage to minimise the visual impacts.	There will be some traffic noise impacts on worship and observance at festival time for the same reason. Operational noise impact (see Section 6) has revealed that the noise level would comply with the criteria and hence mitigation measure is not required.

12.5.3 Historical Land Use Patterns and Cultural Landscape Features

12.5.3.1 These resources include historical terracing, for both agricultural and slope management functions, field patterns and traditional track ways as well as fung shui features, such as ponds, woods and lines. There are no historical land use patterns were identified in the field scan of the works area.

12.5.4 Pre-War / Clan Graves

Introduction

12.5.4.1 Field investigations were undertaken to identify the presence of any pre World War II / Clan graves in the Study area. A grave survey was conducted which is described below.

Methodology

12.5.4.2 Information on graves was collected in the field through on-site surveys and interviews with local informants. Aerial photographs and topographical maps were used to identify the presence of graves.

Results of Grave Survey

12.5.4.3 No pre-war graves were recorded during the survey. Several remains of graves lie on the hill to the east of the Sha Lo Wan headland although these are in complete disrepair and do not appear to have been visited for decades. A small multi-pot graves lies on the eastern side of the headland which does indeed appear to be visited. This grave does not appear to be pre-war.

12.5.5 Recommendations

12.5.5.1 As the alignment will span over the Sha Lo Wan west headland there will be no direct impacts on any graves within the area. As no pre-war graves were located and there are no indirect impacts. Mitigation measures are therefore not required.

12.6 Marine Archaeology

12.6.1 The primary focus of the marine archaeology study follows a 4 stage process as outlined in the EIA Study Brief and AMO's requirements. This includes:-

(a) A baseline review, which includes both a summary of historical sources and geological maps and texts.

(b) A review which contributes to the design and interpretation of results from a submarine geophysical survey of the study area. The geophysical survey will deploy high resolution seismic (boomer), side scan sonar and an echo sounder.

(c) Data examined from desktop information and the geophysical survey has been analyzed to provide an indication of the character and extent of marine archaeological resources within the study area. This would facilitate formulation of a strategy for investigation. **Image 8 of Appendix 12E** shows the extent of geophysical surveys.

(d) Where necessary, remote Operated Vehicle (ROV)/Visual Diver Survey/Watching Brief will be conducted subject to the outcome of the above tasks to evaluate areas of archaeological potential. These areas can be inspected by ROV or divers. ROV or a team of divers with both still and video cameras would be used to record all seabed features of archaeological interest. A watching brief may be undertaken in the event of heavy marine traffic.

12.6.2 If archaeological material is found, AMO will be contacted immediately to seek guidance on its significance and appropriate mitigation measures would be designed and implemented by the project proponent.

Environment, Geology and Setting

12.6.3 The study area is dominated by the CLK Airport. This reclamation project, completed in 1997, incorporated the island of CLK, as well as the smaller Lam Chau to the west (**Image 9 of Appendix 12E**). The waters surrounding these offshore islands were very shallow, probably less than 3m.

12.6.4 To the east of CLK is an expanse of shallow water, less than 2.5m, where the seabed composes of fine black sandy mud, mixed in some areas with patches of shell [12-14] as shown in **Image 10 of Appendix 12E**. Similar conditions are found in the narrow stretch of water between CLK and Lantau. The seabed in this area is also composed of black sandy mud with shell patches, and pebbles within the matrix as well.

12.6.5 To the west of CLK and Lantau, the water depths increase gradually to 10m where the study area meets the HKSAR Boundary [12-15]. However a chart of the area made in 1780 shows shoal waters to the west of CLK (**Image 11 of Appendix 12E**). This could possibly indicate that the area was shallower over 200 years ago or that the captain of the vessel undertaking the survey thought that the area was too shallow to be considered worth navigating for European vessels and therefore did not bother conducting the survey there. The seabed is similar that currently known elsewhere within the study area that is, it is composed of fine sand black mud with shell.

12.6.6 The shore line bounding the study area is a mixture of reclaimed shoreline and unreclaimed rocky shore. For the most part, the shoreline of CLK is man-made however remnants of the rocky shoreline of original island is visible in the south east corner the airport. On Lantau the eastern shore is composed of reclaimed land up to eastern end of Tung Chung Wan. From Tung Chung Wan to the south western edge of the study area the shore line is pebbly with occasional sections of low cliffs. The seabed immediately adjacent to the shoreline is rocky, some parts of which are exposed at low tide.

12.6.7 A large volume of borehole data for North Lantau and Tung Chung exists from previous site investigations including those for the airport project (**Image 12 of Appendix 12E**). This large dataset was compiled as part of a computerized database [12-16]. The nature and distribution of offshore superficial sediments have been mapped using borehole logs, shallow seismic profiles and CPT traces carried out initially for the Port and Airport Development Strategy, offshore sand resource exploration and site investigation for reclamation. Borehole ESC 17 located off North-west Lantau provides a summary of the three main formations within the study area (**Image 13 of Appendix 12E**).

12.6.8 The CLK formation is 15-20m thick and represents the old Pleistocene sediments, which indicate a predominantly fluvial with fluctuating estuarine environment. Deep incised channels imply phases of erosion and palaeo-drainage to the north (Urmston Road) and west into the Lantau Channel [12-17]. The date range of these sediments is from 16,420 B.P. to 80,000 B.P.

12.6.9 The Sham Wat formation was recognized relatively recently, 1995, and overlies the Chek Lap Kok formation with a maximum thickness of 17 metres and occurs both north and south of Lantau Island. The total subcrop area is small however (some 96 km2) and is not exposed at the seabed. This formation is composed of soft to firm grey clayey silts with abundant peaty debris and sand near the top of the formation. These sediments have been accumulated rapidly and within an estuarine to marine environment with rising sea-levels and increasing salinity with time. Above -22.8 mPD these sediments were deposited in fully marine conditions and slightly deeper water. Dating of these sediments has yielded incomplete results.

12.6.10 The Hang Hau formation is the most widely developed offshore superficial deposits in the North Lantau area some 5-10 metres thick to the west of CLK and to 15m east of the airport. It forms a blanket of muddy sediment covering

all older superficial deposits. It is composed of soft olive-grey clayey silt with shell debris scattered throughout or in lenses and has been deposited in a wholly marine environment. The Hang Hau formation has been dated from 7,960 B.P. to 2,170 B.P. It is at the interface of the CLK and Hang Hau formations that evidence related to the early human occupation of the Hong Kong area are to be found.

12.6.11 The area is protected from winds from the south and eastern quadrants. The exception to this is the extreme western end of the study area which is exposed to winds from the south west. The present day CLK airport protects the northern shore of Lantau, but prior to reclamation, the smaller islands would have provided more limited protection from northern winds. The island of Chek Lap Kok would have protected the entrance to Tung Chung Wan.

12.6.12 No wind data for the study area was available at the time of writing. From published sources the predominant wind directions for the Hong Kong area west of Lantau are from the northern through to eastern quadrants, with the strongest winds emanating from the east [12-18] and **Image 14 of Appendix 12E**. Another source states that 80% of Hong Kong's typhoons come from the southeast [12-4].

Baseline Review

12.6.13 Desktop sources for marine archaeology are summarised in **Table 12-6**:

Table 12-6 Information Sources for Marine Archaeology

Location	Information
(a) Geotechnical Engineering Office	Extensive seabed survey data collected from previous geological research.
(b) Marine Department, Hydrographic Office	Substantial archive of hydrographic data and charts.
(c) The Royal Naval Hydrographic Department in the UK	An archive of all survey data collected by naval hydrographers.

12.6.14 The above data sources provide historical records and more detailed geological analysis of submarine features which may have been subsequently masked by more recent sediment deposits and accumulated debris. A marine geophysical survey has been conducted to identify the targets for visual diver survey.

12.6.15 It is understood that there have been no previous marine archaeological investigations within the HZMB study area.

Historical and Potential Inundated Terrestrial Sites

12.6.16 The earliest known archaeological sites in Hong Kong, such as those at Yim Tin Tsam, Kiu Tsui Chau, Pa Tau Kwu, Stonecutters Island, Tai A Chau, Cheung Sha, Yung Shue Wan, are littoral sites and all post date 6,000 yBP [12-19]. There are no recorded archaeological sites in Hong Kong which pre-date this period – while earlier cave sites exist in Guangdong [12-20] there is no evidence for sites of Early Neolithic or earlier (Mesolithic/Pleistocene) date in and around Hong Kong.

12.6.17 However, it is likely that human occupation occurred in Hong Kong during these earlier phases – and given the pattern of Neolithic occupation and its maritime focus in Hong Kong, it is likely that earlier sites too were coastal and that watercraft use was also prevalent for fishing, transport and local trade from this early period. Yet due to the last post-glacial rise in global sea levels,

commencing around 18,000 yBP and stabilising around 6,000 yBP [12-21 and 12-22], human habitation sites on the earlier exposed coastal and estuarine areas have become inundated, with occupation shifting towards higher ground. In light of these changes in sea level in the last 12,000 years, the earliest evidence of human habitation within Hong Kong could be expected to be found underwater.

12.6.18 The prospect that submerged prehistoric sites might be preserved and detectable in the present setting is negligible. It is however possible to reconstruct the landscape of this period using offshore geophysical data and provide a conceptual notion of the environmental setting and possible occupation sites:-

(a) Immediately following the end of the last Glacial Period coastal sites would have been focused at the margin of the continental shelf – as far as 120km south-east of Hong Kong at about 18000 yBP. The landscape north of Lantau Island at this time would have been relatively undulating – under the influence of N-S trending geological structural control – and draining toward a main W-E valley between present day Tuen Mun and Ma Wan Island.

(b) With sea-level rise at about 10m per 500 years and a relatively rapid shift of the coastline from the Continental shelf toward Hong Kong, coastal sites are still likely to have been focused on the south-east margin of Hong Kong.

(c) The palaeo-drainage to the north of Lantau Island during this period of sea-level rise indicates a main river/channel coincident with what is presently Urmston Road which extends west – east from Tuen Mun through Ma Wan Island. It would be easy to imagine such a valley as a focus of terrestrial occupation – and while terrestrial sites should not be ruled out - it is not until the early Holocene that the landscape north of Lantau became flooded from the north (**Image 15 of Appendix 12E**) and therefore a focus for coastal occupation and activity.

(d) The palaeo-drainage of this area suggests that, particularly east of Chek Lap Kok – valleys trend N-S and were rather narrow. This implies that embayments and estuaries at the coast of these valleys would have been relatively small and perhaps not ideal occupation sites. Further to the west, the Tung Chung and Sham Wat valleys appear less structurally controlled, rather more open and therefore offering more attractive beach and estuarine sites for occupation in the period 8000 – 6000 yBP.

(e) It is also notable that during this period of the marine transgression was advancing at some 4-5m per year or 150m in a generation, a factor which would have prevented long periods of continuous coastal occupation.

(f) As sea-levels stabilized at about 6000 yBP the attraction of the northern coast of Lantau Island including Chek Lap Kok Island for prehistoric settlement is supported by the discovery of prominent coastal sites at Sha Lo Wan, Ha Law Wan, Sham Wan and Pak Mong which variably suggest occupation from Late Neolithic to Han period.

(g) While sea-levels have been relatively stable over the past 6000 years, small fluctuations of a few metres have been argued [12-23, 12-24, 12-25], which allied with periods of deforestation – have altered erosion regimes and modified the coastal environment across North Lantau. What were former navigable estuaries – such as at Sha Lo Wan and Tung Chung Bay - have since silted up and been reclaimed for agriculture. The archaeological consequences of coastal sediment supply and progradation is that earlier sites may be buried and beyond common survey or prospecting methods.

12.6.19 Several Late Neolithic (post 6,000 yBP) sites have been identified along coastal and estuarine areas of Hong Kong. Of particular relevance to the current study is the Late Neolithic archaeological site previously identified at Sha Lo Wan, northern shore of Lantau. This site was identified in the early 1990s as part of archaeological assessments associated with the then proposed truncation of the Sha Lo Wan promontory to allow larger vessels to pass through the channel between Lantau and CLK. An archaeological excavation, covering 340m^2 was conducted on the Sha Lo Wan promontory in 1993 [12-26]. Numerous cultural features and artefacts were revealed, including burials, pottery, stone tools, polished rings, stone weights and evidence of domestic structures. The promontory was truncated in 1995, however, the remaining headland also has traces of Tang and Neolithic period artefacts and the proximity to the Sha Lo Wan sites suggests further archaeological potential in this area.

12.6.20 Archaeological investigations on the island of Chek Lap Kok have also yielded further evidence of prehistoric occupation. Prehistoric stone adzes have been identified at the site of Ha Law Wan on the south-west coast – however, these finds were encountered in disturbed deposits and thus could not be accurately dated.

12.6.21 Sandy deposits at the base of the hill at Sham Wan Tseun, on the northern coast, have revealed painted and incised pottery dating to the Middle Neolithic, the earliest known phase of Hong Kong's prehistory (red painted pottery oc c. 7,000 – 6,000 yBP) as well as Late Neolithic materials.

12.6.22 Fu Tei wan, on a coastal plateau on the SW coast, revealed evidence of Middle Neolithic occupation – C14 dates of 6,000 – 5,300 yBP – including numerous polished stone tools, pottery and a few complete pots found in pits, probably burial offerings.

12.6.23 Two sites at Kwo Lo Wan on the south-east coast, on the hillslope above the beach, also yielded Middle Neolithic occupation with large amounts of unique, incised pottery and five groups of burial offerings. Six Bronze Age burials were also discovered, with C-14 dates of 3,400 – 2,800 yBP. Bronze bivalve casting moulds, several sets of polished stone rings and a piece of fine textile stuck to and preserved by a corroded bronze object were also found.

International Trade, Defence and Salt - Qin (221-206 B.C.E.) to Late Ming (1500-1644 C.E.)

12.6.24 The early maritime history in the region is linked with international trade, defence and salt – as early as the Qin Dynasty (221-206 B.C.E.) to Late Ming (1500-1644 C.E.). The intensity of shipping in the Lantau area increased dramatically from the time of the Qin Dynasty (221-206 B.C.E.), centred on Guangzhou.

12.6.25 Around this time Guangzhou became the starting point of the maritime trade route over the South China Sea as well as a meeting place for the exchange of goods, a position, which it has maintained up to today. The northern shore of Lantau overlooks a part of one of the world's most popular shipping routes. From around 200 B.C.E. until the advent of steam power, monsoon winds brought trading vessels from South East Asia toward the region. Strong currents bought the vessels past the north west coast of Lantau before turning northwards to follow close to the eastern coast of the Pearl River. Vessels also made their way to and from the Pearl River from the east, that is, towards northern China, via the waterway that separates Lantau and the mainland.

12.6.26 The destination for these trading vessels has always seen the rich merchant port of Guangzhou. During the Tang (618-907 C.E.) and Song (960-1279 C.E.) Dynasties, Guangzhou had grown into the largest commercial port in China. It was the first Chinese city to have a government office to administer foreign

trade [12-27]. The importance of this centre and the volume of foreign shipping in the Pearl River delta was always a concern for the Imperial Government. From as early as 411 C.E. a pirate band named the Lo Ting had established itself on Lantau and harassed shipping in the area. To safeguard the seaward approaches to Guangzhou and minimise piracy, the Government established war junk patrols and forts at suitable anchorages (**Image 16 of Appendix 12E**). The initial base for the war junk patrols was situated at Tuen Mun. It had been established sometime prior to the mid-8th century as in 743 C.E. troops were transported from Tuen Mun to the Yangtse River to combat a pirate fleet. The war junk patrols were not always successful as in 758 C.E., Guangzhou was sacked by an Arab fleet.

12.6.27 Lantau at this time was of interest to the Government through its salt producing capabilities. An Assistant to the Imperial Salt Commissioner based in Guangzhou was responsible for salt production on Lantau. His responsibilities included clamping down on illicit salt-working, preventing salt smuggling and to protect the ships conveying salt to Guangzhou. Salt pans and works may have been established around Tung Chung at this time as there is archaeological evidence of settlement at Tung Chung during the Tang Dynasty. Tung Chung may have also served as an auxiliary anchorage for the war junks based at Tuen Mun due to that harbour's exposure to the south, the direction from which most of Hong Kong's typhoons originate (**Image 17 of Appendix 12E**).

12.6.28 During the 12th century C.E. the Southern Song Dynsaty established its capital at Hangzhou. As a result Government interest and presence in Lantau increased. This resulted in a 50 year rebellion on Lantau as the Government sought to control fishing and salt-working activities. It is recorded in the 1819 gazetteer of Xin'an that there was an attempt in 1197 C.E. to stop private trading in salt on Lantau. The islanders successfully repulsed a government invasion force by mining their harbours with wooden stakes and engaging them in a sea battle (**Image 18 of Appendix 12E**). They captured merchant ships, and killed more than three hundred people. Tung Chung is very likely to have been one of the harbours involved in the rebellion.

12.6.29 In the second half of the 13th century, as the lands of the Southern Song were being overrun by the Mongols, the fleeing Imperial court on several occasions took refuge on Lantau. Before finally leaving Lantau, the young Emperor, Tak Yau (德祐) died and his half brother, Prince Ping (帝昺) was enthroned. These events took place in north Lantau and most likely at Tung Chung [12-4].

12.6.30 Of particular interest to the current study is the archaeological site of Ha Law Wan, on the western side of Scenic Hill, Chek Lap Kok, dating to the Yuan period (1271-1368 C.E.). Archaeological excavations conducted at this site in 1990 and 1991 (prior to airport development) revealed a complex of thirteen Yuan period kilns, thought to be used for smelting the iron-rich sands. Ha Law Wan was originally a west facing bay located on the western side of Chek Lap Kok Island with a narrow sandy beach and cultivated hinterland – the construction of the Chek Lap Kok airport has significantly altered the landscape however and only part of the original island at Scenic Hill (including the Ha Law Wan site) remains.

12.6.31 Each of the thirteen kilns identified at Ha Law Wan had been dug into the surrounding slope and were found in various states of preservation. Their construction included a lining of baked mortar with stone-lined outlets and chimney structures - evident wherever the kiln roof remained intact. All were roughly oval in shape and 1.5 - 2m in diameter, usually less than 1m high and filled with silt. Kiln No. 6 was completely filled which is certain to have led to its complete preservation (with roof in tact and four chimney structures). Sparse Tang and Song period pottery fragments were also found during excavation of the kiln structures. The Ha Law Wan site was dated by C-14 to c. 1250-1400 C.E., roughly corresponding to the Yuan Dynasty. This kiln complex at Ha Law

Wan is unlike any described in historical sources or reported from China and is certainly the only one of its kind in Hong Kong

12.6.32 A second kiln complex – Tang culture – of very different construction to Ha Law Wan, has also been identified on Chek Lap Kok on a sand bar at Sham Wan Tsuen. Archaeological investigations at this site have revealed a total of twelve kilns and three clay structures, probably slaking pits, along with a large quantity of Tang pottery and over one hundred coins.

The Age of Piracy – Middle to Late Ming (1500-1644) to Qing (1644-1911)

12.6.33 In 1513 the first Europeans, the Portuguese, arrived in their vessels at the Pearl River [12-28]. The Portuguese realisation of the importance of Guangzhou as a lucrative trade centre and shipping spurred them to make an attempt to seize an area on the coast at the entrance of the Pearl River. In 1514, the Portuguese reached Tuen Mun Bay and were not expelled until 1521 after a sea battle during which Ming forces under Wang Hung achieved a decisive victory. The Portuguese subsequently retreated to Macau [12-29], there is a strong argument, however, to suggest that the Portuguese may have seized Lantau and may have constructed a fortified settlement at Tung Chung or Tai O. The sea battle itself seems to have taken place between Lantau (Tung Chung?) and Sha Chau - possibly at Sai Tso Wan. The Portuguese lost possibly up to one warship and three unarmed sailing vessels [12-30].

12.6.34 No doubt influenced by the Portuguese attack, six guard stations were established in the Hong Kong region during the mid 1530s, with one station located at Tai O [12-31]. These stations were tasked not only to prevent further European incursions but also to try and control piracy. As the 16th century wore on pirate attacks were becoming more frequent. During the 17th century the Ming (1368-1644 C.E.) Government proved incapable in dealing with the threat and in 1662 C.E., the Qing (1644-1911 C.E.) Government took the extreme measure of expelling all coastal inhabitants to the hinterland. Until rescinded in 1668 C.E., Lantau was effectively uninhabited except for pirates and smugglers.

12.6.35 The present villages around Tai O were founded from the mid 18th century onwards, with the earliest recorded village, Pak Mong, being settled in 1740. The presence of two small cannons (jingals) at Tin Liu, a small hamlet adjacent to Tai O, suggests continued concerns regarding defence against pirates.

12.6.36 The troubles with piracy and the anti-trade tendencies in the Ming and Qing periods affected trade out of Guangzhou but did not stop it. When China enforced a policy, which closed ports to foreign trade, an exemption was made for Guangzhou for a large part of that period.

12.6.37 Piracy continued to be endemic in the waters around Lantau well into the 19th century. One of the most notorious pirates was Cheung Po Tsai（張保仔）from XinHui (Jiangmen Prefecture, Guandong Province), who became one chief of one of Cheung Yet's branches [12-32]. In 1808-1809, Chang Po Tsai bested the Qing Government navy on several occasions. At one time Chang Po Tsai had over 270 boats and 15,000 men under his command with hideouts in Tung Chung and Stanley on Hong Kong Island. In 1810 he was finally surrounded by the combined naval Chinese and Macao naval forces, near Chek Lap Kok, where, he gave himself up on the promise of a pardon [12-33].

12.6.38 Of particular importance to the current study is a battle between Chang Po Tsai and his "Ladrones" (Portuguese for pirates) and a Chinese Government funded fleet – Portuguese and Chinese vessels known as the "Invincible Squadron" – in a bay off Lantau in 1809. The exact location of the battle is not known, however, it is widely interpreted that the bay referred to in historical accounts of the battle is Tung Chung as the Ladrones were known to have a base there.

12.6.39 Early in November 1809, Chang Po Tsai and his wife, “pirate queen” Zhang Yisao, were in Tung Chung with only two ships when they were threatened by three Portuguese ships and a brig. Chang Po Tsai directed two fleets of Ladrone vessels (Red Flag Fleet & Black Flag Fleet), who were raiding the Pearl River, to come to their aid. The Ladrone fleets reached Lantau on the 5th of November, having been chased by the Portuguese vessels upon passing the island of Lintin. The fleets split into two squadrons, one anchoring in the bay and the other standing to the east – and a number of vessels were also apparently hauled onto shore for repairs. On the 8th of November, four Portuguese ships, a brig and a schooner entered the mouth of the bay. The Ladrones, with only seven junks active, hauled their vessels out, mooring them head to stern across the bay and manned approximately 200 rowboats ready for boarding. There seems to have been a standstill for many days, however, as historical sources indicate that the first shots in the battle did not occur until the 20th of November, when an immense fleet of Chinese vessels – consisting of 93 war junks – arrived in Tung Chung to reinforce the Portuguese vessels (**Image 19 of Appendix 12E**). The combined Chinese and Portuguese fleet then made sail towards the Ladrones, forming a line close in and firing broadsides for several hours until one of the largest Chinese vessels was “blown up” by a firebrand thrown from a Ladrone junk. The combined fleet then retreated slightly yet continued a heavy cannonading almost continuously for another nine days. The Ladrones apparently returned very little fire but managed to capture a twenty-two gun Chinese vessel under the cover of dark on the 23rd of November. On the night of the 28th of November, the Portuguese sent eight small fire-vessels into the centre of the Landrone fleet. These vessels apparently did very little damage, however, and the Ladrones eventually towed them on shore, extinguished the fires and broke them up for timber. The following day, the Ladrones, having completed vessel repairs and being ready for sea, weighed up and prepared to sail. The Portuguese and Chinese fleet saw these actions and made sail, being chased – ultimately unsuccessfully – by the Ladrones for several hours, thus ending the nine-day blockade [12-34]. A canonball reportedly recovered off Kwo Lo Wan – before the reclamation of Chek Lap Kok – may have been associated with this battle.

12.6.40 Historical sources regarding the battle – including official Qing and Portuguese accounts and an eyewitness account by British East Indiamen Officer Richard Glasspoole, a captive of the Ladrones – are rather varied; the offical records state that 1,4000 pirates were killed and many pirate ships sunk or damaged, whereas Glasspoole’s account records that only 30-40 pirates were killed and not a single Ladrone vessel destroyed. Nonetheless, while it is impossible to determine the true details, it is almost certain that by the end of the battle, the strength of the pirate fleet was very little affected [12-35].

12.6.41 The pirate tradition in Lantau was so prevalent that the Tanka people of Tai O have a song, which celebrates the exploits of the female pirate, Lady Cheng I Sao. She and her confederate Chang Po Tsai, held off an attack of government vessels for a week in Tung Chung Wan. The date of this event is not known at present.

12.6.42 In the 19th century the Qing Government had given the task of protecting the coastal area of Hong Kong to the Tai Pang Battalion, which in 1831 was elevated to status of a Brigade. The Brigade was divided into a Left and Right Battalion. The Right Battalion was composed of 482 soldiers and 5 patrol boats with a Headquarters at Tung Chung Walled City. In 1847 there were 30 soldiers at Tung Chung, 5 at Sha Lo Wan to the west and 5 at Tai O [12-36].

12.6.43 The garrison could not have been that effective as in November 1854, an expedition was sent to Tai O to deal with pirate junks that had fired on the Queen, an American naval steamer. After shelling and an assault by hastily collected squadron of European vessels, the pirate junks and storehouses were destroyed. Additional naval encounters were recorded in the area 1809, 1857

and 1864. Two of these encounters took place in Tung Chung Wan. By the end of the 19th century piracy in Hong Kong waters had been suppressed.

The Modern Period - 1900 to the Present

12.6.44 The modern period saw the northern part of Lantau remain poorly developed and rather neglected by the ever-expanding Hong Kong metropolis. The advent of steam power and larger draft of modern vessels meant that fewer trading vessels took refuge in the safe and shallow anchorages along northern Lantau. In 1898 when Lantau became part of the New Territories, the garrison and the seven or eight war junks departed.

12.6.45 Of profound influence to the landscape of North Lantau in the past 20 years has been the construction of the new Chek Lap Kok airport development between Chek Lap Kok and Lam Chau islands. In the 1990s it had become evident that the Kai Tak airport was too small for Hong Kong's needs. The new airport was constructed on an artificially created island, which incorporated the islands of Chek Lap Kok and Lam Chau, with much of CLK being leveled and materials utilised for land reclamation. It can be imagined that any shipwrecks which would have been present in the area now covered by CLK Airport would have been buried or destroyed during reclamation operations.

12.6.46 The construction of CLK airport also involved various infrastructure works around the artificial Island. Most obvious is the land reclamation that took place along northern shore of Lantau to the east of Tung Chung (**Image 20 of Appendix 12E**), enabling the construction of the North Lantau Highway and the MTR railway and depot.

12.6.47 From current hydrographic charts it appears that a channel, 5 metres in depth, has been dredged through the shallow waters to the east of CLK, most likely for the purposes of allowing larger vessels to access Tung Chung. A dredged channel seems also to be maintained in the narrow stretch of water between Lantau and CLK to depth of 7m (**Image 10 of Appendix 12E**). A promontory on the northern shore of Lantau, opposite the SW extent of CLK, was also truncated in 1995 to allow passage for larger vessels.

Dredging History

12.6.48 A search of the CEO library, Port Works Authority, CEDD and Marine Department revealed no information about dredging of fill management within study area. However, dredging activity has taken place in the last 15 years as can be shown on the Hydrographic Chart.

Shipwreck Records

12.6.49 Available shipwreck data for Hong Kong waters shows no wrecks in the vicinity of the study area. **Image 21 of Appendix 12E** has been complied from data collected by the UK Naval Hydrographic Office prior to 1997 [12-37].

12.6.50 It should be noted that marine surveys by the UK Hydrographic Office were only interested in recording the location of shipwrecks, which could be a hazard to navigation. Therefore wrecks that may be hundreds of years old, which have a low profile on the seabed or may be partially buried, would not have been recorded as they did not necessarily pose a threat to shipping.

12.6.51 The closest known shipwreck to the study area appears in a 1990 chart of the Outer Approaches to Hong Kong (**Image 22 of Appendix 12E**). This site lies just to the west of the HKSAR boundary. Its position is approximate though it is unlikely to be situated within the study area.

12.6.52 Enquires at the Hong Kong Hydrographic Office and the Civil Engineering Office did not reveal any additional information on the locations of any shipwrecks within the study area. It should be noted that in recent years the HKSAR boundary in the vicinity of Lantau has been moved further to the west. These waters are not as well surveyed as the rest of HKSAR.

Summary of Maritime Archaeological Potential from Baseline Review

12.6.53 From the historical and archaeological summary presented above, a review of known cultural activities relevant to local maritime archaeology includes: transportation, and trade, military activity; fishing, piracy, anchorages (along major trade route and for war junks), customs and policing. As a result, the following archaeological site types might be expected within the study area:-

- shipwrecks;
- anchors;
- moorings;
- anti-ship stakes;
- remnant salt pans;
- maritime related structures such as jetties and navigation aids; and
- submerged terrestrial sites.

12.6.54 The potential for the extent and frequency of the submerged cultural heritage is summerised as follows (**Image 22 of Appendix 12E**):-

- There is potential for shipwrecks to be present across the study area, with the exception of areas that have been dredged.
- The likelihood for the presence of shipwrecks increases closer to the northern shoreline of Lantau west of Tung Chung Wan, in Tung Chung Wan and the eastern shore of Chek Lap Kok Airport.
- Anchors can be expected to be found on the rocky seabeds adjacent to the northern shore of Lantau and the eastern shore of Chek Lap Kok Airport.
- Moorings are more likely to be present in, and near to, the bays within the study area, in particular Tung Chun Wan.
- It is unlikely that the anti-ship stakes from 1179 C.E. would be in situ. If they are any remains of such devices they would be situated in the mud seabed in the peripheral corners of Tung Chung Wan.
- Jetties and other maritime related structures are expected to be found within the bays of the study area with a greater frequency of such remains being present in Tung Chung Wan.
- The remains of salt pans are most likely expected to be found along the shores of Tung Chung Wan.
- Evidence of submerged remains of prehistoric settlements can be expected to be found throughout the study area. It appears that dredging that has been conducted to the south and the east of Chek Lap Kok Airport has been sufficiently deep so as to remove such remains.

Geophysical Survey

12.6.55 In compliance with Stage 2 of the MAI guidelines three marine geophysical surveys are relevant for this study (**Image 23 of Appendix 12E**). The first and

most extensive survey was conducted by EGS between May and June 2004 [12-38]. The later surveys were conducted in reaction to changes to the proposed bridge alignment and cover previously unsurveyed areas. IGGE surveyed a relatively small area to the west of CLK on the HKSAR border in late 2005 while in late 2008 EGS surveyed the seabed off the north east corner of CLK as part of HKBCF component of the project [12-39 and 12-40].

12.6.56 The main EGS marine geophysical survey was carried out during the period 9th May to 14th June 2004. The survey was conducted using primarily a marine seismic profiler and a dual side scan sonar. Because of the variable water depths throughout the survey area, three vessels of varying drafts were used. The main survey vessel, MV *Wing Hung 8*, was used in the deeper waters. In the shallow waters a sampan was deployed. A fibre glass speed boat was used in the very shallow waters in the Airport Channel (situated between Lantau and CLK) and Tung Chung Bay for echo sounding only.

12.6.57 The IGGE survey took place between the 29th November and 5th December 2005. It was conducted aboard the MV Hung Kuk using a marine seismic profiler and dual channel side scan sonar.

12.6.58 The EGS 2008 survey used side scan sonar, multi-beam sonar and marine seismic profiling was carried out. Some magnetometer survey work was conducted to the north of CLK, which was outside the assessment scope for this EIA.

12.6.59 The scope and objectives of the three marine geophysical surveys are described in **Table 12-7**:

Table 12-7 Objectives of marine geophysical surveys relevant to this EIA

EGS (2004)	IGGE (Late 2005)	EGS (Late 2008)
* To map the sea bed and underlying significance geological horizons, and to provide this data in a form suitable for use during the bridge design. * To record sea bed features such as wrecks and rock outcrops. * To determine the extent of present and past fishing activities.	* To determine underlying significant geological horizons. * To map seabed features. * To locate man made objects, wrecks, rock outcrops and 'main' anomalies. * To map seabed topography in the survey area.	* Identify the geological succession at and beneath the study area. * Identify objects at or above the sea bed, such as rock outcrops, dumped materials and other artefacts. * To measure seabed levels in detail. * To locate the alignment of existing cables.

12.6.60 The marine geophysical survey covered the whole of the nominated, and expanded marine geophysical survey area, with the exception of the immediate shorelines of both the Airport, the North Lantau coast and part of southern Tung Chung Bay, where water depth was too shallow for survey boat access. An area of approximately 750 x 750 m was also not recorded in the vicinity of aeronautical lights and landfall of the Hutchison cable on the eastern shore of CLK (see **Image 24 of Appendix 12E**).

12.6.61 For the side scan sonar survey, the distances between the survey tracks (or transects) were set to ensure that 100% of the seabed was recorded. The distance between the tracks for side scan sonar work is dependent on water depth. This is due to the design of side scan sonar where the greater the water depth, the greater the coverage and therefore the greater the distance between tracks. The reverse is the case with shallow water. For the majority of the waters east of the CLK and all of waters between CLK and Lantau, the distances between the tracks were approximately 20m. For the extreme

eastern part of the marine geophysical survey area and all of the waters west of CLK and Lantau, the distances between the tracks were approximately 40 metres.

12.6.62 For the marine seismic profiling the distance between the survey tracks was 40 metres, which was deemed – within the scope of the project – an appropriate coverage of the sub-seabed.

12.6.63 The shorelines of both north Lantau and CLK Island are rocky. Therefore it is not possible to conclusively determine the presence, or absence, of cultural material within these areas using the side scan sonar data. Furthermore because of the extremely shallow waters and submerged rocks, which made navigation hazardous, the marine geophysical survey did not extend up to the shoreline in all places. With regards to cultural remains of potential archaeological significance, none should be anticipated along the shoreline of CLK Island, with the exception of the unreclaimed shoreline in the south east corner, near Scenic Hill as the 'island' is less than 20 years old. The situation is the reverse along the unreclaimed shoreline of North Lantau, especially near areas of known cultural activity such as settlements, both past and present. Cultural remains of potential archaeological significance, such as shipwreck remains, maritime infrastructure (jetties) or ancient rubbish dumps, may be found close to shore near these localities.

12.6.64 Particular physical constraints were identified across the marine geophysical survey area, which influenced the conduct of the survey and the degree of confidence in the interpretation of the marine seismic data obtained. Data quality was adversely affected by masking within, and close to, the base of the Marine Deposits. EGS interpreted this phenomenon as being caused by anaerobic decomposition of organic plant material trapped during a recent inundation. The gas bubbles so generated absorb the seismic energy, thereby preventing reflections from deeper horizons. In such localities no marine seismic data could be collected. Such areas are not uncommon around Hong Kong and limit the collection of marine seismic data. These localities have been marked up on the appropriate figures presented in the EGS report and are delineated in **Image 25 of Appendix 12E**.

12.6.65 It should be expected that cultural objects such as shipwrecks present within the masked Marine Deposits would lay closer to the surface of the stratum rather than the base, and therefore may not have been affected by this phenomenon. In masked areas, therefore the seismic assessment sub-seabed archaeological potential may be limited. The bridge alignment crosses over these 'masked' areas only for a few hundred metres off the western shore of Lantau and a very short section off the east coast of CLK.

12.6.66 Close to the old village of Tung Chung on Lantau raw sewerage is being discharged untreated into the river flowing into the southern part of the bay. The presence of this effluent in effect reflects the seismic signals and thereby only multiple seabed reflections are present on the marine seismic records. As the route options do not pass through the southern half of Tung Chung Bay no recommendations regarding further investigation of the archaeological potential have been made.

12.6.67 In both the above "masked" areas side scan data was available which provided an indication of both surface and shallow submerged objects. However, the impact assessment may include scope to include a Watching Brief programme aimed at mitigating any potential impact from pile construction on any deeper cultural objects.

12.6.68 The spatial accuracy of the surveys varied and are summarised in **Table 12-8**:

Table 12-8 Survey accuracies of marine geophysical surveys

Accuracies	EGS 2004	IGGE 2007	EGS 2009
Vertical	+/- 0.15 m	+/- 0.10 m	+/- 0.15 m .
Horizontal	+/- 0.30 m	+/- 2.0 m	+/- 1.0 m

12.6.69 Assessment of Marine Archaeological Potential

Assessment of Geophysical Data

12.6.69.1 Task 3 of the MAI includes an interpretation of the geophysical survey data as well as baseline sources and an establishment of the nature and extent of marine archaeological potential along the proposed alignment for the HZMB and where limited reclamation is to take place along the eastern edge of CLK.

12.6.69.2 For ease of understanding detailed descriptions of the bathymetry, seabed and stratigraphy have been separated into the following three sections (see **Image 26 of Appendix 12E**).

- East of CLK Island
- Channel between Lantau and CLK Island and Tung Chung Bay
- Waters west of Lantau and CLK Island

Relevant marine geophysics charts for this assessment are presented in **Appendix 12F**.

Bathymetry

12.6.69.3 The bathymetry in the vicinity of the seabed has been reviewed and is summarised below.

Area	Bathymetry
East of Chek Lap Kok Island	• At the eastern part of this area the water depth close to the north coast of Lantau is –2.1 mPD. This can be expected, as this is a reclaimed shoreline. Close to the eastern shore of CLK Island, where there has been limited reclamation, the water depth is –1.0 mPD, though dredging around the berths of the CLK Ferry Terminal has increased depths to around –6 to –7 mPD. The water depth increases only gradually with distance from shore to a depth of around –4.0 mPD. The exception to this is the channel leading into Tung Chung Bay, where the maximum water depth is –9.7 mPD. Water depth in the dredged approach to the ferry terminal reaches –5.5 mPD. • The seabed is generally flat except in the channels. There is evidence of scouring, only slight, along the Lantau coast and along the channels.
Channel Between Lantau and Chek Lap Kok Isalnd and Tung Chung Bay	• Water depth in this area varies from the extremely shallow waters of southern Tung Chung Bay and the northern shore of Lantau (+1.1 to + +1.2 mPD). The

Area	Bathymetry
	waters adjacent to the CLK Island seawall are also shallow. The deepest water is in the channel, dredged, which runs east-west, parallel with the southern shore of CLK Island. Maximum water depth at this location is –9.1 mPD. • Both shorelines are characterised by boulders, colluvium and rock outcrops along the southern shore and deposited as fill along the northern shore. For the remainder of the seabed in this area it is smooth in shape with the exception of the channel.
West of Lantau and Chek Lap Kok Island	• As can be expected the shallowest part, minimum of –1.4 mPD recorded, of this survey area is along the shores of CLK Island and Lantau. Water depth gradually increased to a maximum depth of –10.2 mPD at the extreme western end of the marine geophysical survey area. A maximum depth of –9.2 mPD was recorded at the dredged western end of the Airport Channel. This channel runs along the southern edge of CLK and is up to 100 m wide in places. • The seabed in this area is generally smooth with the exception of boulders and rock outcrops close to the Lantau shoreline.

Interpretation of Seabed

12.6.69.4 The seabed information in the vicinity has been reviewed and is summarised below.

Area	Interpretation of Seabed
East of Chek Lap Kok Island	• The seabed composition in this area is a mix of cohesive (silty) and granular sediments. A band of silty sediment in the centre of the area roughly corresponds with the dredged channel. This possibly indicates that the channel is silting up. • Extensive trawling has been observed in areas where the seabed is a mix of cohesive/granular to granular sediments. Along the north east coast of CLK the seabed is composed mostly of finer sediments. There are some relatively large debris fields to the east of the CLK Ferry Terminal, through which passes a Hutchison telecommunications cable. • A dredged channel runs approximately through the centre of the area from the north east to the south west. There is a higher density of dumped material close to the reclaimed shore of Lantau. In the eastern half of the area there are numerous sonar contacts of individual objects. Some have been interpreted as ‘blocks’. These may be moorings.

Area	Interpretation of Seabed
Channel Between Lantau and Chek Lap Kok Isalnd and Tung Chung Bay	• The composition of the seabed in Tung Chung Bay is a mix of silty/granular to granular sediments with extensive rock outcropping and boulders along the southern and western shore of Tung Chung Bay. West of Tung Chung Bay the seabed is mostly silty. A band of granular sediments runs close, and parallel, to CLK Island. This band of sediment corresponds with the dimensions of the dredged Airport Channel. It is likely that these sediments are part of the alluvial stratum that has been exposed by the dredging of the channel. • The seabed in this area is littered with debris, most of which may have been deposited during the construction of CLK Island. This would be more the case for debris identified between the Airport Channel and CLK Island. Debris identified south of the Airport Channel, in particular within Tung Chung Bay is most likely associated with the cultural activities that have been taking place along the northern shoreline of Lantau for the last 8,000 years. A number of sonar contacts in the Bay, south of the Airport Channel were identified, some of which were tentatively described as being potentially shipwrecks.
Waters West of Lantau and Chek Lap Kok Island	• The seabed composition in this Survey Area is overwhelmingly silty with patches of granular sediments close to the western shore of Lantau and off the north west tip of CLK Island. The seabed has been extensively trawled. Close to the HKSAR border in the northern half of the area surveyed by IGGE in 2005, there is a scatter of debris, one cluster appearing to be that of a wreck.

Interpretation of Stratigraphy

12.6.69.5 EGS identified four broad geological successions in their 2004 survey. Of these, the two uppermost strata are relevant for this study. They are:-

- *Marine deposits (deposited during Holocene, forming the seabed and immediate subsurface strata).* Very soft to soft silty clay. Sometimes sandy at the base or near the shorelines. These deposits are between 8,000 to 10,000 years old. Immediately prior to this time the mean sea level was approximately 80 to 100m lower than the present level.
- *Alluvium (Strata beneath the marine deposits, derived from terrestrial conditions during the late Pleistocene).* Soft to firm silty, sandy clay to compact dense silty fine sand sometimes with gravel.

Area	Interpretation of Stratigraphy
East of CLK Island	At the interface between the marine deposits and the alluvium – the pre-inundation palaeo-topography – there are 4 drainage channels where surface run-off from Lantau drained down to the main river channel in Urmston Road to

Area	Interpretation of Stratigraphy
	the north. The base of these channels is about 5m below the level of the surrounds.
Channel between Lantau and CLK Island and Tung Chung Bay	Marine deposits dip gently northwards across the airport channel towards CLK Island.
Waters west of Lantau and CLK Island	Marine deposits thicken, -20.0 to -25.0m to the north and est. A pattern of palaeo-drainage has been cut into this surface, flowing generally to the north and west.

Process of Evaluating Material and Anomalies of Marine Archaeological Potential

12.6.69.6 The areas and anomalies assessed to be of archaeological potential were determined by a combination of the following:-

Step 1 : The predicted type, extent and frequency of submerged cultural heritage within the study area (carried out in the *Review*).

Step 2 : 'Targets' or areas identified by the marine geophysical survey

Step 3 : Examination of aerial photographs

12.6.69.7 All three marine geophysical surveys supplied charts depicting seabed features interpreted from the side scan sonar data in .dgn, .dxf and .dwg formats. These files were opened in AutoCAD 2008. The EGS 2004 and IGGE 2005 reports were also accompanied by raw side scan sonar data. This data was presented in file formats particular to each company. EGS had supplied the programme with which to view the data. The IGGE raw side scan sonar data could not be viewed.

12.6.69.8 This situation was acceptable with respect to the assessment of archaeological potential as the proposed bridge alignment passes over a section of seabed where there was an overlap with EGS 2004 survey. With respect to the absence of the raw side scan sonar data from the EGS 2008 survey, no anomalies of archaeological potential were noted within the vicinity of the proposed bridge alignment as discerned from the relevant seabed features chart.

12.6.69.9 With respect to the EGS 2004 survey, records collected in the field were interpreted using the C-View system. The process was as follows:-

- Records were scrolled on the PC screen in 'waterfall' mode,
- The interpretation option allowed the following operations to be carried out:
  - The screen could be stopped and started.
  - Features can be defined and marked up in shaped or lined form.
  - Features can be annotated.
  - Interpreted records can be saved for subsequent plotting.
- On completion, the file was passed directly to the AutoCAD 2008 system for plotting.

12.6.69.10 The raw data collected using side scan sonar and seismic profiling was provided along with the C-View programme. Accompanying this information were maps of the interpreted seabed features and track plots of the side scan sonar and seismic profiling survey.

12.6.69.11 The selection of targets was carried out in the following process:-

- Using the detailed seabed feature plots provided, single objects, potential shipwrecks and small scatters of debris/dumped material within the study area were listed.
- The coordinates of the targets, in Hong Kong Metric Grid, were obtained from the AutoCAD files
- The seabed features were then overlaid with the side scan sonar track plots.
- Where the tracks passed over the listed anomalies, the track and fix numbers were noted.
- The track and fix numbers were matched with the corresponding .CVD files.
- These files were examined using C-View. Images were then obtained of the anomalies that appeared to have archaeological potential.

12.6.69.12 For this assessment it has been assumed that 'dumped material' is cultural in nature and represents relatively large areas of seabed which are covered with demolition material resulting from construction and the like, which has been deliberately discarded on the seabed from barges. 'Debris' represents a localised area of material, which may be cultural or possibly natural. If the former is the case, such material could have been accidentally (i.e shipwreck) or deliberately (ballast, rubbish from a single vessel), deposited.

12.6.69.13 The process outlined above was the same for buried anomalies. Such targets or anomalies as were found were to be presented in the seabed features plans.

12.6.69.14 In addition to viewing data collected by EGS, aerial photographs of the study area were also examined. The reasoning for this was that it may have been possible, in the right conditions, to view submerged cultural features in the very shallow waters east of CLK Island and in Tung Chung Bay. Two aerial photo-mosaics covering the study area were examined. The mosaics were based on 1973 and 2001 aerial photographs (Lands Department, Hong Kong Government). It was however not possible to discern the presence of any submerged cultural features because of a number of reasons such as the angle of the sun shining on the water, wind waves, and water clarity. While a potentially useful technique for shallow water archaeological mapping, it would have required exceptional conditions for photographs taken in the last 50 years for water clarity to be at a sufficient level to allow for a successful examination and interpretation of the seabed to the east of CLK Island.

Targets and Areas of Archaeological Potential

12.6.69.15 The surface anomalies – targets - represents identified potential cultural material requiring further evaluation (dive inspection). The targets presented in this section will be accompanied by their position, in HKMG, the closest track and fix numbers, the corresponding .CVD file and approximate water depths and additional comments (**Table 12-9**). **Appendix 12G** also provides additional information of these anomalies in the form of descriptions and side scan sonar images. The notation of the track and fix numbers were necessary for locating

the image of the target in the C-View system. The water depths were estimated from the seabed contour maps from the EGS report.

Table 12-9 Surface Anomalies (Targets)

No.	Type	Easting	Northing	Track	Fix	.CVD file	Depth (m)
1	debris	803013.0	815690.0	E35	42235	559	8.1
2	debris	806470.44	815987.83	E119	31704	418	4-5
3	debris	806483.94	816084.56	E120	31928	420	4-5
4	debris	806549.6	816074.51	E121	32206	424	4-5
5	debris	806560.9	816244.5	E123	32250	425	4-5
6	debris	806576.4	816246.3	E123	32250	425	4-5
7	debris	806494.7	816440.2	E123	32260	425	5-6
8	debris	806476.6	816488.7	E123	32282	425	5-6
9	debris	807600.5	817016.4	N83A	16951	255	5
10	debris	807600.4	817030.5	N83A	16951	255	5
11	debris	807621.4	817029.5	N18b	16310	230	1-3
12	debris	807679.7	817044.6	N18b	16314	230	1-3
13	debris	807701.5	817009.7	N18b	16315	230	1-2
14	debris	807735.7	817084.1	N24b or c	14634	199	1-3
15	debris	807801.9	817109.3	N24b or c	14628	199	1-3
16	Unidentified object	807841.8	817110.1	N24b or c	14626	199	1-3
17	debris	807978.4	817136.4	N83b or c	16976	255	1-3
18	debris	807983.5	817171.9	N84b or c	21572	292	1-3
19	debris	808076.76	817088.82	N17B	16289	229	0-1
20	debris	808756.7	817228.6	N24F	14560	198	2-3
21	debris	808950.4	817224.8	N24F	14546	198	2-3
22	debris	809003.5	817228.4	N24F	14543	198	2-3
23	debris	811642.8	817896.0	N103	8699	136	1-2
24	dumped material	811906.3	817824.1	N38	6454	104	2
25	'block'	811823.2	818000. 5	N106	9065	139	1-2
26	'Unknown object'	811899.8	818366.0	N52	4845	87	0-1

12.6.69.16 The majority of the anomalies of archaeological potential are located in the western section of the bridge alignment (see **Image 27 of Appendix 12E**). They are mostly that of discrete patches of debris up to 40 m across.

12.6.69.17 The proposed bridge alignment enters HKSAR approximately 500 m to the south of a debris field composed of discrete relatively small patches of debris, one of which appears to be a recent wreck. Target 1 is a small patch of debris an otherwise 'clean' expanse of seabed. As can be expected the frequency of debris on the seabed off the west coast of Lantau decreases with distance from shore and the proposed bridge alignment passes through a small debris field about 700 m from shore.

12.6.69.18 At the western entrance to the Airport Channel the frequency of debris increases. Debris located on the southern shores of CLK, within the dredged channel or the lower slopes of the batters were not assessed as anomalies of archaeological potential as they were considered to have been deposited recently.

12.6.69.19 Though within the 300 m of the proposed bridge alignment, there was no examination for potential anomalies beyond the point where the bridge makes landfall on Lantau. This is because for the most part debris and other seabed objects are located on the southern shore of CLK or in the dredged Airport Channel. Those anomalies in the northern parts of Tung Chung Bay, south of the Airport Channel – where some possible recent wrecks were identified by

EGS – will not be impacted by the proposed bridge, even with slight changes to the alignment. The realignment of the bridge to a degree where it enters the northern un-dredged waters of Tung Chung Bay would represent a major change to the development proposal.

12.6.69.20 There are a number of seabed anomalies north of where the proposed bridge alignment enters the waters to the east of CLK. One of these is a relatively large object, up to 6m in length, which is located close to the shoreline (Target 26).

12.6.69.21 No buried anomalies, potentially cultural in origin, were shown on the seabed feature maps provided. An examination of the Isopach maps also revealed that no buried anomalies were identified by EGS within the marine deposits and alluvium. However, as noted in 12.6.66, interpretation may be limited due to natural accumulations of organic gases close to the base of the Marine Deposit stratum or emissions of raw sewerage. These masked areas have been taken into consideration when assessing the need for a watching brief program.

12.6.69.22 The proposed bridge alignment crosses unreclaimed shorelines on Lantau. The seabed close to these crossing points were not able to be surveyed because of the shallow waters and the dangers posed to expensive equipment from partially submerged rocks. Furthermore such seabed types make identification of cultural remains using side scan sonar images difficult. In the absence of geophysical data the following interpretation of marine archaeological potential is provided for the near-shore areas along the North Lantau coast.

12.6.69.23 Seabeds close to shorelines are a rich source of archaeological information. Evidence associated with littoral activities such as, habitation (fishing villages) and industry are often found in the first 50 m offshore. Remains of maritime related structures such as jetties can also be found. Vessels striking hard objects such as shorelines mostly cause shipwrecks as a general rule. Shipwrecks can be found in the intertidal zone and in the first 50 m from shore.

12.6.69.24 The alignment also crosses a promontory at the north west corner of Lantau. This promontory was longer but was truncated in 1995 during the construction of CLK Airport. On the removed section of the promontory was a Late Neolithic archaeological site, Sha Lo Wan (West), excavated in 1993. The excavation covered some 340 sq m and produced burials and an assemblage of artefacts such as pottery, stone tools, polished rings, stone weights and evidence of domestic structures. The remaining headland has traces of Tang and Neolithic period artefacts and proximity to the excavated site (described above) suggests further archaeological potential at this site. It is understood that the route alignment will span over this truncated promontory.

12.6.69.25 The eastern side of the promontory forms a shallow embayment, which would have been more pronounced prior to 1995. This embayment would have been relatively well protected from all winds except those blowing from the northeast. It was well suited as an anchorage for small vessels. Vessels could have also been dragged ashore onto the beach on the southern part of the embayment. Cultural remains, such as jetties and material deposited from shore, associated with the Tang period could possibly be present close to the eastern and southern shores. Artefacts from the Neolithic period could also be present. Shipwrecks may also be present, the likelihood of their presence being more likely the result of piracy or warfare rather than adverse weather or poor navigation.

12.6.69.26 The proposed alignment also skirts around some of the unreclaimed shoreline of CLK. Archaeological evidence relating to occupation and industrial activities on the former island CLK dates back to Middle Neolithic period (7,000 B.P.). In later periods there was evidence of a Tang Dynasty lime kiln in the northern part of the island (Sham Wan Tsuen) and Yuan Dynasty kilns on the slopes of the

sole surviving original hill landscape (Ha Law Wan) in the south east of the Island. Archaeological evidence associated with activities that have taken place on and in the immediate vicinity of CLK may be present along the rocky shoreline.

12.6.69.27 The archaeological potential of the unsurveyed near-shore areas described above suggest further "target" areas for field evaluation. These are identified in **Image 27 of Appendix 12E** as Transects.

12.6.69.28 The archaeological potential of submerged terrestrial sites appears most favourable in Sha Lo Wan and Tung Chung Bay. It is also plausible that the phenomenon of acoustic turbidity or methane blanketing – the product of accumulation of buried organic material - common, particularly east of CLK might be part of concentrated swamp or estuarine material, If this were the case, it could be speculated that human occupation may have been associated with such a setting.

12.6.70 Impacts Evaluation

12.6.70.1 From the available information the most immediately obvious impacts of the proposed development would be the driving in of the footings into the seabed for the bridge. This will have the effect of destroying any sites or objects of cultural heritage, in the location where the footings will be placed.

12.6.70.2 The proposed reclamation on the east coast of CLK, between the shoreline and the bridge alignment. It is assumed that this reclamation will require the removal of Holocene sediments, at least, and their replacement with compacted fill. It is therefore expected that any archaeological resources within the reclamation envelope would be removed.

12.6.71 Review and Requirement for Further Evaluation of Marine Archaeological Potential

12.6.71.1 In accordance with EIAO Technical Memorandum Annex 19 Clauses 2.6 to 2.9, an impact assessment is required to measure the effects of the development on sites of cultural heritage. The Baseline Review and the analysis of the marine geophyiscal survey data did not identify any sites of cultural heritage as defined by EIAO Technical Memorandum Annex 19 Clause 2.1 (See **Appendix 12B**). It was identified as follows:-

(a) The study area has potential for both prehistoric and historic period sites of cultural heritage.

(b) The marine geophysical survey found a number of anomalies on the seabed surface, within the shadow of the proposed bridge alignment, which may be cultural in nature and could possibly be shipwrecks. It cannot be determined from the interpretation of the survey whether these anomalies are sites/objects of significant cultural heritage. A field evaluation is therefore required.

(c) There is a possibility that some of the identified anomalies may be impacted by the installation of the footings of the proposed bridge. Any final impact evaluation will clearly depend on both field evaluation of the anomalies (above) and detailed footing design.

(d) The seabed immediately adjacent to the northern shore of Lantau and east coast of CLK has potential for the presence of sites or objects of significant cultural heritage.

(e) The marine geophysical team, because of physical constraints, could not survey the seabed immediately adjacent to the northern shore of Lantau. In the absence of geophysical data, further interpretation of near-shore

archaeology identified potential target areas along the north Lantau coast – to be included in the field evaluation (dive) phase.

(f) The proposed bridge alignment for the most part traverses across areas, which are not optimum locations for settlement in a pre-inundation landscape. The exception to this is the ribbon of organic masking off the west coast of Lantau, which is suggestive of a possible former watercourse. There is a relatively higher likelihood of settlements having been formed close to such a feature.

(g) It is assessed that the narrowly confined and localised footprint of individual bridge piers will have a minimal likelihood of impacting a pre-inundation settlement buried under marine sediments.

(h) It is assessed that the relatively small parcels of reclamation proposed on the eastern shore of the CLK will have a minimal likelihood of impacting a pre-inundation settlement buried under marine sediments.

12.6.72 Results of Visual Diver Survey

12.6.72.1 To assess the cultural heritage significance of the surface anomalies identified from the marine geophysical survey and examine areas of archaeological potential a Visual Diver Survey (VDS) was undertaken.

12.6.72.2 All 26 targets listed in **Table 12-10** were inspected during the VDS conducted in April 2009. The methodology for the VDS complies with the Guidelines for Marine Archaeological Investigation. Key procedures of the survey are:-

Pre-VDS preparation:	Prior to the commencement of the VDS the coordinates of the targets were converted from Hong Kong Metric Grid (1980) to WGS 84.
Target location procedure:	Using a Garmin GPS 76, the sampan was directed to the target and a. buoy was dropped when the reading on the GPS it was less than 5 m from the target and the accuracy of the GPS position at the time the buoy was dropped was recorded.
Seabed circular search:	Once the buoy was dropped over the target a diver was sent down the buoy line. The diver attached one end of a 12 m reel to the anchor/weight at the base of the buoy. The purpose of the 12 m line was to snag or catch any objects protruding from the seabed. The diver visually examined objects snagged by the survey line.
Post search de-brief :	Upon regaining the surface the diver was questioned on what he saw. The approximate dimensions and composition of objects were provided as well as their distance from the anchor/weight. A description of the seabed and water visibility was also provided.

12.6.72.3 Most of the 26 targets inspected revealed only rock, modern brick and shell scatters. It was a feature of the targets inspected to the west and south of CLK that objects were encountered at about 0.15 m under soft silt. Water visibility did not exceed 0.5 m. Brief descriptions of the individual targets are presented in **Table 12-10**.

Table 12-10 Description of Surface Anomalies (Targets) from VDS

No.	Description
1	Scatter of shell
2	Scatter of shell and a timber fragment recently deposited – part of interior fitting of a vessel
3	Scatter of shell
4	Scatter of shell
5	Occasional shell
6	Occasional shell

No.	Description
7	Occasional shell
8	Occasional shell
9	Nothing found
10	Nothing found
11	Nothing found
12	Nothing found
13	Fishing line and small metal debris
14	Rock, shell and modern plywood fragment
15	Small concentrated scatter of rock
16	Two rock fragments protruding from the seabed
17	Nothing found
18	Scatter of rock
19	Irregular sand-waves
20	Rock and shell scatter
21	Dense concentration of shell and some rock
22	Dense concentration of shell and some rock
23	Large triton shell
24	Concentration of modern brick, stone and fishing line
25	1 x 2.5 x 1 m high steel 'box' or basin.
26	4 x 2 x 1 m high bedrock (granite) outcrop. Square ferrous frame nearby.

12.6.72.4 Nothing of interest was found in Targets 9 to 12 and 17 is likely due to the observation that low relief objects visible to side scan sonar may in fact not protrude above the seabed in areas where there is very fine silt. This would make the detection of such objects by divers difficult. It is also very likely that some of the objects detected by the side scan sonar may have been mobile, such as plastics and light fragments of wood and hence had disappeared by the time of the visual diver survey.

12.6.72.5 A diver following the shoreline at a depth of 1 to 2 m inspected the areas of archaeological potential along the unreclaimed eastern shore of CLK and the eastern side of the promontory upon which the archaeological site of Sha Lo Wan (W) was sited.

12.6.72.6 The transect along the shore of CLK was abandoned after a number of apparently abandoned fishing nets were encountered amongst rock outcrops in very low water visibility conditions. Nothing of cultural heritage significance was identified.

12.6.72.7 The seabed below the low tide mark along the eastern side of the promontory upon which the archaeological site of Sha Lo Wan (W) was sited was soft silt. This resulted in zero visibility conditions for the diver transect in this area. Nothing of cultural heritage significance was identified.

12.6.73 Assessment of Cultural Significance

12.6.73.1 The objects and artefacts identified during the VDS have no or minimal cultural significance.

12.6.74 Recommendations

12.6.74.1 Periodic monitoring at Sha Lo Wan (West) Archaeological Site is recommended. It is recommended to conduct inspection of the site every 3 months. Inspection record supplemented with site photos showing the condition of the overall archaeological site should be submitted to the AMO for record purpose.

12.7 Conclusions

Terrestrial Archaeology

12.7.1 All the bridge structure would totally avoid the Sha Lo Wan (West Archaeological Site) during both the construction and operational phases. Hence, there will be no direct impacts. Mitigation measures are not required and there are no residual impacts.

12.7.2 As a precautionary measure, periodic monitoring of construction works should be conducted to ensure the avoidance of any impacts on the Sha Lo Wan (West) Archaeological Site. Access to the said archaeological site for works area and storage of construction equipment is not allowed

Built Heritage

12.7.3 Two temples, namely Hung Shing Temple and Tin Hau Temple, and an Earth Shrine are indentified in the Sha Lo Wan area, as the alignment will span over the Sha Lo Wan west headland, there will be no direct impact to any historic buildings within the area. Indirect impacts by way of visual and noise will be within acceptable limits.

12.7.4 As the alignment will span over the Sha Lo Wan west headland there will be no direct impacts on any graves within the area. As no pre-war graves were located and there are no indirect impacts. Mitigation measures are therefore not required.

Marine Archaeology

12.7.5 Diver Survey was undertaken and nothing of cultural heritage significance was identified. There is no need for any further investigation or mitigation measures.

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APPENDIX 12A

Guidelines for Cultural Heritage Impact Assessment

Guidelines for Cultural Heritage Impact Assessment

(as at December 2008)

Introduction

The purpose of the guidelines is to assist the understanding of the requirements in assessing impact on archaeological and built heritage. The guidelines will be revised by the Antiquities and Monuments Office (AMO) of the Leisure and Cultural Services Department from time to time, where appropriate, and when required.

A comprehensive Cultural Heritage Impact Assessment (CHIA) includes a baseline study, an impact assessment study associated with the appropriate mitigation measures.

(1) Baseline Study

1.1 A baseline study shall be conducted:

a. to compile a comprehensive inventory of heritage sites within the proposed project area, which include:

(i) all archaeological sites (including marine archaeological sites);

(ii) all pre-1950 buildings and structures;

(iii) selected post-1950 buildings and structures of high architectural and historical significance and interest; and

(iv) cultural landscapes include places associated with historic event, activity, or person or exhibiting other cultural or aesthetic values, such as sacred religious sites, battlefields, a setting for buildings or structures of architectural or archaeological importance, historic field patterns, clan graves, old tracks, *fung shui* woodlands and ponds, and etc.

b. to identify the direct and indirect impacts on the heritage sites at the planning stage in order to avoid causing any negative effects. The impacts include the direct loss, destruction or disturbance of an element of cultural heritage, impact on its settings or impinging on its character through inappropriate sitting or design, potential damage to the physical fabric of archaeological remains, historic buildings or historic landscapes through air pollution, change of ground water level, vibration, ecological damage, new recreation or other daily needs to be caused by the new development. The impacts listed are merely to illustrate the range of potential impacts and not intended to be exhaustive.

1.2 The baseline study shall also include a desk-top research and a field evaluation.

1.3. Desk-top Research

1.3.1 Desk-top research should be conducted to analyse, collect and collate extant information. It shall include but not limited to:

a. List of declared monuments protected by the Antiquities and Monuments Ordinance (Chapter 53).

b. Graded historic buildings and sites.

c. Government historic sites identified by the Antiquities and Monuments Office (AMO).

d. Lists and archives kept in the Reference Library of the Antiquities and Monuments Office of the Leisure and Cultural Services Department including archaeological sites, declared monuments, proposed monuments, deemed monuments and recorded historical building & structures identified by the AMO.

e. Publications on local historical, architectural, anthropological, archaeological and other cultural studies, such as, Journals of the Royal Asiatic Society (Hong Kong Branch), Journals of the Hong Kong Archaeological society, Antiquities and Monuments Office Monograph Series and so forth.

f. Other unpublished papers, records, archival and historical documents through public libraries, archives, and the tertiary institutions, such as the Hong Kong Collection and libraries of the Department of Architecture of the University of Hong Kong and the Chinese University of Hong Kong, Public Records Office, photographic library of the Information Services Department and so forth.

g. Any other unpublished archaeological investigation and excavation reports kept by the AMO.

h. Historical documents in the Public Records Office, the Land Registry, District Lands Office, District Office and the Hong Kong Museum of History and so forth.

i. Cartographic and pictorial documents. Old and recent maps and aerial photos searched in the Maps and Aerial Photo Library of the Lands Department.

j. Existing geological information (for archaeological desk-top research).

k. Discussion with local informants.

1.4 Field Evaluation

1.4.1 General

The potential value of the project area with regard the cultural heritage could be established easily where the area is well-documented. However, it does not mean

that the area is devoid of interest if it lacks information. In these instances, a site visit and consultations with appropriate individuals or organisations should be conducted by those with expertise in local heritage to clarify the situation.

1.4.2 Field survey on historic buildings and structures

a. Field scan of all the historic buildings and structures within the project area.

b. Photographic recording of each historic building or structure including the exterior (the elevations of all faces of the building premises, the roof, close up for the special architectural details) and the interior (special architectural details), if possible, as well as the surroundings, the associated cultural landscape features and the associated intangible cultural heritage (if any) of each historic building or structure.

c. Interview with local elders and other informants on local historical, architectural, anthropological and other cultural information related to the historic buildings and structures.

d. Historical and architectural appraisal of the historic buildings and structures, their associated cultural landscape and intangible cultural elements.

1.4.3 Archaeological Survey

a. Appropriate methods for pricing and valuation of the archaeological survey, including by means of a Bill of Quantities or a Schedule of Rates should be considered in preparing specifications and relevant documents for calling tenders to carry out the archaeological survey. The specifications and relevant documents should be sent to the Antiquities and Monuments Office for agreement prior to calling tenders to conduct the archaeological survey.

b. A licence shall be obtained from the Antiquities Authority for conducting an archaeological survey. It takes at least two months to process the application.

c. A detailed archaeological survey programme should be designed to assess the archaeological potential of the project area. The programme should clearly elaborate the strategy and methodology adopted, including what particular question(s) can be resolved, how the archaeological data will be collected and recorded, how the evidence will be analyzed and interpreted and how the archaeological finds and results will be organized and made

available. Effective field techniques should also be demonstrated in the programme. The programme should be submitted to the Antiquities and Monuments Office for agreement prior to applying for a licence.

d. The following methods of archaeological survey (but not limited to) should be applied to assess the archaeological potential of the project area:

(i) Definition of areas of natural land undisturbed in the recent past.

(ii) Field scan of the natural land undisturbed in the recent past in detail with special attention paid to areas of exposed soil which were searched for artifacts.

(iii) Conduct systematic auger survey and test pitting. The data collected from auger survey and test pitting should be able to establish the horizontal spread of cultural materials deposits.

(iv) Excavation of test pits to establish the vertical sequence of cultural materials. The hand digging of 1 x 1 m or 1.5 x 1.5 m test pits to determine the presence or absence of deeper archaeological deposits and their cultural history.

(v) The quantity and location of auger holes and test pits should be agreed with the Antiquities and Monuments Office prior to applying for a licence.

(vi) A qualified land surveyor should be engaged to record reduced levels and coordinates as well as setting base points and reference lines in the course of the field survey.

e. A Marine Archaeological Investigation (MAI) following *Guidelines for MAI* may be required for projects involving disturbance of seabed.

1.4.4 If the field evaluation identifies any additional heritage sites within the study area which are of potential historic or archaeological importance and not recorded by AMO, the findings should be reported to the AMO as soon as possible.

1.5 The Report of Baseline Study

1.5.1 The study report should have concrete evidence to show that the process of the above desk-top and field survey has been satisfactorily completed. This should take the form of a detailed inventory of the heritage sites supported by full description of their significance. The description should contain detailed geographical, historical, archaeological, architectural, anthropological,

ethnographic and other relevant data supplemented with illustrations below and photographic and cartographic records, if required.

1.5.2 A master layout plan showing all the identified archaeological and built heritage within the study area should be provided in the report. All the identified heritage sites should be properly numbered with their locations indicated on the master layout plan.

1.5.3 Historic Buildings/ Structures/ Sites

a. A map in 1:1000 scale showing the boundary of each historic item.
b. Photographic records of each historic item.
c. Detailed recording form of each historic item including its construction year, previous and present uses, architectural characteristics, as well as legends, historic persons and events, cultural landscape features and cultural activities associated with the structure.
d. A cross-referenced checklist including the reference number of each historical item, their photo and drawing reference, as well as the page number of the detailed recording form of each identified historical item for easy cross-checking of individual records.

1.5.4 Archaeological Sites

a. A map showing the boundary of each archaeological site as supported and delineated by field walking, augering and test-pitting;
b. Drawing of stratigraphic section of test-pits excavated which shows the cultural sequence of a site.
c. Reduced levels, coordinates, base points and reference lines should be clearly defined and certified by a qualified land surveyor.
d. *Guidelines for Archaeological Reports* should be followed (Annex 1).

1.5.5 A full bibliography and the source of information consulted should be provided to assist the evaluation of the quality of the evidence. To facilitate verification of the accuracy, the AMO will reserve the right to examine the full details of the research materials collected under the baseline study.

1.6 Finds and Archives

1.6.1 Archaeological finds and archives should be handled following *Guidelines for Handling of Archaeological Finds and Archives (Annex 2)*.

1.7 Safety Issue

1.7.1 During the course of the CHIA Study, all participants shall comply with all Ordinances, Regulations and By-laws which may be relevant or applicable in safety aspect in connection with the carrying out of the CHIA Study, such as site safety, insurance for personal injuries, death and property damage as well as personal safety apparatuses, etc.

1.7.2 A Risk Assessment for the fieldwork shall be carried out with full consideration to all relevant Ordinances, Regulations and By-laws.

(2) Impact Assessment Study

2.1 Identification of impact on heritage

2.1.1 The impact assessment study must be undertaken to identify the impacts on the heritage sites which will be affected by the proposed development subject to the result of desktop research and field evaluation. The prediction of impacts and an evaluation of their significance must be undertaken by expert(s) in local heritage.

2.1.2 During the assessment, both the direct impacts such as loss or damage of important features as well as indirect impacts should be clearly stated, such as adverse visual impact on built heritage, landscape change to the associated cultural landscape features of the built heritage, temporary change of access to the heritage sites during the work period, change of ground level or water level which may affect the preservation of the archaeological and built heritage *in situ* during the implementation stage of the project.

2.1.3 The evaluation of heritage impact assessment may be classified into five levels of significance based on type and extent of the effects concluded in the CHIA study:

a. Beneficial impact: the impact is beneficial if the project will enhance the preservation of the heritage site(s) such as improving the flooding problem of the historic building after the sewerage project of the area;
b. Acceptable impact: if the assessment indicates that there will be no significant effects on the heritage site(s);
c. Acceptable impact with mitigation measures: if there will be some adverse effects, but these can be eliminated, reduced or offset to a large extent by specific measures, such as conduct a follow-up Conservation Proposal or Conservation Management Plan for the affected heritage site(s) before commencement of work in order to avoid any inappropriate and

unnecessary interventions to the building;

d. Unacceptable impact: if the adverse effects are considered to be too excessive and are unable to mitigate practically;

e. Undetermined impact: if the significant adverse effects are likely, but the extent to which they may occur or may be mitigated cannot be determined from the study. Further detailed study will be required for the specific effects in question.

2.1.4 Preservation in totality must be taken as the first priority as it will be a beneficial impact and will enhance the cultural and socio-economical environment if suitable measures to integrate the heritage site into the proposed project are carried out.

2.1.5 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.

2.1.6 Total destruction must be taken as the very last resort in all cases and shall only be recommended with a meticulous and careful analysis balancing the interest of preserving local heritage as against that of the community as a whole. Assessment of impacts on heritage sites shall also take full account of, and follow where appropriate, paragraph 4.3.1(c), item 2 of Annex 10, items 2.6 to 2.9 of Annex 19 and other relevant parts of the Technical Memorandum on Environmental Impact Assessment Process.

2.2 Mitigation Measures

2.2.1 It is always a good practice to recognize the heritage site early in the planning stage and site selection process, and to avoid it, i.e. preserve it in-situ, or leaving a buffer zone around the site.

2.2.2 Mitigation is not only concerned with minimizing adverse impact on the heritage site but also should give consideration of potential enhancement if possible (such as to improve the access to the built heritage or enhance the landscape and visual quality of built heritage).

2.2.3 Mitigation measures shall not be recommended or taken as *de facto* means to avoid preservation of heritage sites. They must be proved beyond all possibilities to be the only practical course of action. Heritage sites are to be in favour of preservation unless it can be demonstrated that there is a need for

a particular development which is of paramount importance and outweighs the significance of a heritage site.

2.2.4 If avoidance of the heritage site is not possible, amelioration can be achieved by minimizing the potential impacts and the preservation of the heritage site, such as physically relocating it. Measures like amendments of the sitting, screening and revision of the detailed design of the development are required to lessen its degree of exposure if it causes visual intrusion to the heritage site and affects the character and integrity of the heritage site.

2.2.5 A rescue programme, when required, may involve preservation of the historic building or structure together with the relics inside, and its historic environment through relocation, detailed cartographic and photographic survey or preservation of an archaeological site "by record", i.e. through excavation to extract the maximum data as the very last resort.

2.3 The Impact Assessment Report

2.3.1 A detailed description and plans should be provided to elaborate on the heritage site(s) to be affected. Besides, please also refer to paragraph 4.3.1(d), items 2.10 to 2.14 of Annex 19 and other relevant parts of the Technical Memorandum, other appropriate presentation methods for mitigation proposals like elevations, landscape plan and photomontage shall be used in the report extensively for illustrating the effectiveness of the measures.

2.3.2 To illustrate the landscape and visual impacts on built heritage, as well as effects of the mitigation measures, choice of appropriate presentation methods is important. These methods include perspective drawings, plans and section/ elevation diagrams, photographs on scaled physical models, photo-retouching and photomontage. These methods shall be used extensively to facilitate communication among the concerned parties.

2.3.3 The implementation programme for the agreed mitigation measures should be able to be executed and should be clearly set out in the report together with the funding proposal. These shall form an integral part of the overall redevelopment project programme and financing of the proposed redevelopment project. Competent professionals must be engaged to design and carry out the mitigation measures.

2.3.4 For contents of the implementation programme, reference can be made to

Annex 20 of the Technical Memorandum on Environmental Impact Assessment Process. In particular, item 6.7 of Annex 20 requires to define and list out clearly the proposed mitigation measures to be implemented, by whom, when, where, to what requirements and the various implementation responsibilities. A comprehensive plan and programme for the protection and conservation of the partially preserved heritage site, if any, during the planning and design stage of the proposed project must be addressed in details.

2.3.5 Supplementary information to facilitate the verification of the findings shall be provided in the report including but not limited to:

a. layout plan(s) in a proper scale illustrating the location of all heritage sites within the study area, the extent of the work area together with brief description of the proposed works;
b. all the heritage sites within the study area should be properly numbered, cross-reference to the relevant drawings and plans.
c. an impact assessment cross-referenced checklist of all the heritage sites within the study area including heritage site reference, distance between the heritage site and work area, summary of the possible impact(s), impact level, summary of the proposed mitigation measure(s), as well as references of the relevant plans, drawings and photos; and
d. a full implementation programme of the mitigation measures for all affected heritage sites to be implemented with details, such as by whom, when, where, to what requirements and the various implementation responsibilities of individual parties.

Annex 1

Guidelines for Archaeological Reports
(As at December 2008)

I. General

1. All reports should be written in a clear, concise and logical style.
2. The reports should be submitted in A4 size and accompanying drawings of convenient sizes.
3. Draft reports should be submitted to the Antiquities and Monuments Office (AMO) for comments within two months after completion of archaeological work unless otherwise approved by AMO.
4. The draft reports should be revised as required by AMO and relevant parties. The revised reports should be submitted to AMO within three weeks after receiving comments from AMO and relevant parties.
5. At least 5 hard copies of the final reports should be submitted to AMO for record purpose.
6. At least 2 digital copies of the final reports in both Microsoft Word format and Acrobat (.PDF) format without loss of data and change of appearance compared with the corresponding hard copy should be submitted to AMO. The digital copies should be saved in a convenient medium, such as compact discs with clear label on the surface and kept in protective pockets.

II. Suggested Format of Reports

1. Front page:
   - Project/Site name
   - Nature of the report
     - e.g. (Draft/Final)
       Archaeological Investigation/Survey Report
       Archaeological Impact Assessment Report
       Watching Brief Report
       Rescue Excavation Report
       Post-excavation Report
   - Organization
   - Date of report

2. Contents list
   Page number of each section should be given.

3. Non-technical summary (both in English and Chinese with approximate 150 - 300 words each)
   This should outline in plain, non-technical language, the principal reasons for the archaeological work, its aims and main results, and should include reference to authorship and commissioning body.

4. Introduction
   This should set out background leading to the commission of the reports. The location, area, scope and date of conducting the archaeological work must be

given. The location of archaeological work should be shown on maps in appropriate scales and with proper legends.

5. Aims of archaeological work
These should reflect the aims set in the project design.

6. Archaeological, historical, geological and topographical background of the site
Supporting aerial photos and maps (both old and present) in appropriate scales, with proper legends and with the site locations clearly marked on should be provided.

7. Methodology
The methods used including any variation to the agreed project design should be set out clearly and explained as appropriate.

8. Result
This should outline the findings, known and potential archaeological interests by period and/or type. Their significance and value with reference/inclusion of supporting evidence should be indicated. For impact assessment, the likely effect of the proposed development on the known or potential archaeological resource should be outlined.

9. Conclusion
This should include summarization and interpretation of the result.

10. Recommendation
Recommendations on further work and the responsible party as well as a brief planning framework should be outlined.

11. Reference and bibliography
A list of all primary and secondary sources including electronic sources used should be given in full detail.

12. Archaeological Team
The director and members of the archaeological team and the author of the report should be clearly specified.

13. Supporting illustrations
They should be clearly numbered and easily referenced to the text. They should be scanned and saved in TIFF or JPEG formats.

    A. Maps
    Archaeological work locations, such as auger hole and test pit locations (with relevant coordinates certified by a qualified land surveyor), should be clearly shown on maps in appropriate scales, with proper legends, grid references (in 8 digits) and captions.

    B. Drawings of test pits, archaeological features and finds
    The below scales should be followed:

Cross section and profile drawings of test pits	1:20
Archaeological feature drawings	1:10
Finds drawings	1:1

If drawings of the above stated scales are not appropriate to be incorporated into the report under certain occasions, reduced copy of the drawings with the same scales are acceptable. Proper captions, legends and indication of reduced size should be given.

C. Photos of site and finds
All photos should be at least in 3R size with proper captions and scales. They should be clearly numbered and easily referenced to the text. They should be scanned and saved in TIFF or JPEG formats.

14. Supporting data in appendices
These should consist of essential technical details to support the result. These may include stratigraphy record of test pits and auger holes, record of general and special finds discovered with description, quantity and context number/stratigraphical sequence, index of field archives.

15. Comment and Response
All comments and responses from AMO and relevant parties should be attached.

III. Green Measures

1. All reports should be of single line spacing and printed on both sides of the paper.

2. Excessive page margins should be avoided. A top/bottom margin of 2 cm and left/right margin of 2.5 cm are sufficient.

3. Use of blank paper should be avoided as far as possible.

4. Suitable font type of font size 12 should be used generally in balancing legibility and waste reduction objective.

Guidelines for Handling of Archaeological Finds and Archives

(As at Oct 2006)

General

1. Site Code
   The Licensee should contact the Central Archaeological Repository (CAR) of the Antiquities and Monuments Office (AMO) [Contact Person: Mr. Michael TANG, Tel: 2384 5446; Email: mkstang@lcsd.gov.hk] about the allocation of site code before the commencement of the project to avoid duplicate of site code assignment.

I. Archaeological Finds

2. Cleaning
   Every excavated finds should be properly cleaned before handing over to the CAR of the AMO.

3. Marking
   - All the excavated finds should be cleaned before marking object number.
   - "Sandwich" technique [1] should be adopted for marking permanent identification number on an object.
   - Every special finds should be marked with site code, context number and object number, etc.
   - All representative samples collected from general finds should be marked.
   - For the finds which is too small, has unstable surface, or leather, textiles or wood, it should not be marked/labeled directly and should be bagged separately or attached with tags by tying. The tag should contain information about the object number, context number and site code, etc.

4. Labeling and bagging
   - A label should be attached on each bag.
   - Information about the object number, context number, test-pit number, site code and bag number should be stated clearly on the label.
   - Finds excavated within the same context should be bagged together.

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[1] *Steps for "Sandwich" technique*

1. First of all, the object should be marked in appropriate area and size that does not impact important diagnostic or aesthetic parts of the object.
2. Clean the area to be marked.
3. Apply a thin coat of clear reversible lacquer on the area. Use white lacquer if the object is dark in colour. Let the base coat dry completely.
4. Use a permanent water-based ink to write the object number on top of the base coat. Let ink dry completely.
5. Apply a top coat of clear varnish.
6. Let the marking dry completely before packing.

However, if they have been categorized according to their types, materials or characteristics, separate bagging is required.

5. Conservation
   - To refit and reconstruct pottery vessels by appropriate adhesive. A heat and waterproof adhesive, e.g. product of H. Marcel Guest Ltd., is recommended.
   - Any adhesives which are not reversible or will damage artefacts, e.g. the pottery vessel should not be applied on the finds.

6. Finds register
   A clear finds register with information about the finds description, quantity, form, weight, dimensions and field data should be prepared for handover to the CAR.

II. Field Archives and Laboratory Records

7. Field archives include field dairy, context recording sheet, special finds recording sheet, soil sample/sample recording sheet, map, survey sheet and video/visual records etc. Laboratory records also form part of the archaeological archives, which include finds processing record, conservation record, finds drawings and photos, records of typological analysis and objects card etc.

8. All the aforesaid archives should be handed over to the CAR after the compilation of the excavation report. Attention should be drawn to the followings:

   - All the field archives should be submitted together with their indexes.
   - The video footage should be submitted together with a detailed script introducing the content of the video record.
   - All the slides, colour/black & white negatives and digital photographs should be submitted together with their contact prints and indexes.

Handover of Finds

9. Packing
   - Every special finds should be protected with tissue paper, bubble sheet or P.E. foam with shock-proofed packing. No packing material other than the aforesaid items should be used.
   - All the general finds should be stored in heavy duty plastic container with shock-proofed packing.
   - The heavy duty plastic container, e.g. product of the Star Industrial Co., Ltd. (No. 1849 or 1852), is recommended.
   - For oversized finds, prior advice on packing method should be sought from the AMO.

10. Handover procedure
    - The Licensee should arrange to transport the finds and archives to the CAR upon the completion of the finalized excavation report.
    - Separate handover forms for finds and archives should be signed by the representatives of the Licensee and the AMO.

APPENDIX 12B

Guidelines for Marine Archaeological Investigation (MAI)

GUIDELINES FOR MARINE ARCHAEOLOGICAL INVESTIGATION (MAI)

Standard practice for MAI should consist of separate tasks, i.e.

(1) Baseline Review

(2) Geophysical Survey

(3) Establishing Archaeological Potential

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

(1) Baseline Review

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

1.2 The baseline review will focus on known sources of archive data. It will include:

a. Geotechnical Engineering Office (GEO) – the Department holds extensive seabed survey data collected from previous geological research.

b. Marine Department, Hydrographic Office – the Department holds a substantial archive of hydrographic data and charts.

c. The Royal Naval Hydrographic Department in the UK – the Department maintains an archive of all survey data collected by naval hydrographers.

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

(2) Geophysical Survey

2.1 Extensive geophysical survey of the study area should deploy high resolution boomer, side scan sonar and an echo sounder. The data received from the survey would be analysed in detail to provide:

a. Exact definition of the areas of greatest archaeological potential.

b. Assessment of the depth and nature of the seabed sediments to define which areas consist of suitable material to bury and preserve archaeological material.

c. Detailed examination of the boomer and side scan sonar records to map anomalies on the seabed which may be archaeological material.

d. Detailed examination of the multi beam sonar data to assess the archaeological potential of the sonar contacts.

(3) Establishing Archaeological Potential

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

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

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

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

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

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

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

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

APPENDIX 12C

Environmental Impact Assessment Ordinance, Technical Memorandum – Annexes 10 and 19

EIAO-TM ANNEX 10: CRITERIA FOR EVALUATING IMPACT ON SITES OF CULTURAL HERITAGE

2. Criteria for Assessment of Impact on Sites of Cultural Heritage

2.1 The criteria for evaluating impact on sites of cultural heritage include:

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.

EIAO-TM ANNEX 19: GUIDELINES FOR ASSESSMENT OF IMPACT ON SITES OF CULTURAL HERITAGE AND OTHER IMPACTS

1. General

1.1 The annex describes the commonly adopted approaches and methodologies for assessment of impact on sites of cultural heritage and other environmental issues. The methodologies may vary from case to case, depending on the nature of the issues and the latest development in methods and techniques.

2. Impact on Sites of Cultural Heritage

2.1 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.

Baseline Study

2.2 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.

Methodology

2.3 The best information shall be assembled for the assessment of the identified sites of cultural heritage. The entry point shall be the Antiquities and Monuments Office, public libraries and archives and tertiary institutions.

2.4 The assessment shall provide detailed geographical, historical, archaeological, ethnographical and other cultural data. Published papers, records, archival and historical documents as well as oral legends shall also be consulted.

2.5 In cases where the above sources of information prove to be inadequate or where the proposed project area has not been adequately studied before, field surveys and site investigations shall be conducted to assemble the necessary data.

Impact Assessment

2.6 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.

2.7 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.

2.8 Total destruction must be taken as the very last resort in all cases and shall only be recommended with a meticulous and careful analysis balancing the interest of preserving the archaeological, historical, architectural and other cultural values as against that of the community as a whole.

2.9 Assessment of impacts on sites of cultural heritage shall also take full account of, and follow where appropriate, the Guidelines for Landscape and Visual Impact Assessment at Annex 18.

Mitigation Measures

2.10 Mitigation measures shall not be recommended or taken as *de facto* means to avoid conservation and preservation of sites of cultural heritage. They must be proved beyond all possibilities to be the only practical course of action.

2.11 Designs, layouts, external treatments, colour and texture of materials, but not limiting to such, shall be worked out for the integration of the sites of cultural heritage to be preserved in whole or in part into the proposed project.

2.12 For total destruction, a comprehensive and practical rescue plan must be worked out. This is also applicable to sites of cultural heritage where only partial preservation is proposed.

2.13 Annex 18 also applies.
A practical programme and funding proposal for the implementation of the recommended mitigation measures shall be included as part of the assessment. These shall form an integral part of the overall development programme and financing of the proposed project. Competent professionals must be engaged to design and carry out the mitigation measures.

APPENDIX 12D

Archaeological Survey Report at Sha Lo Wan (West) Southern Headland (march 2007)

SHA LO WAN (West)
Southern Headland

Archaeological Survey Report

March 2007

Conducted for CHIA
Agreement No. CE 26 / 2003
Hong Kong Section of Hong Kong - Zhuhai – Macao Bridge and Connection with North Lantau Highway - Investigation

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CONTENTS

APPENDIX

沙螺灣(西)南岬 – 陸上考古調查 – 總結

工程背景：

港珠澳大橋將香港、珠海及澳門連成一線。作為對香港、澳門與珠江的西部通道，她對香港的旅遊、物流、金融及貿易發展十分重要，不但可加强香港作爲國際航運及空運中心的地位，亦可促進香港與珠江西部之間的經濟融合。

跟據港珠澳大橋的環境研究概要 ESB110/2003 第 3.4.8 章，文化遺產影響評估包括進行水底考古調查、陸上考古調查及建築遺存調查。環境考古有限公司被委託進行此文化遺產影響評估之陸上考古調查部分。

背景：

跟據最新的路線走向，高架橋將橫跨部份沙螺灣（西）考古遺址。沙螺灣西位於大嶼山北岸及香港赤鱲角機場西南角對岸。沙螺灣以西的岬角由中部村莊至調查地帶以東的地質底部為花崗岩，其上覆蓋著積礫沈積。

該遺址於一九九三年(Drewett 1995)始被發現。另於一九八五年(Peacock and Nixon 1985)、一九九一年(CUHK 1991)及一九九八年(Guangzhou Institute 1998)，分別於上述遺址以南約一百五十米的範圍內，進行過有限度的田野考古調查及探方試掘，並發現新石器晚期器物及唐代遺存。大部分沙螺灣北岬角連同其新石器時代晚期考古遺址的遺物已於一九九五機場工程前一同移去。

按環境研究概要的要求，環境考古有限公司於二零零四年九月六日至十五日在大橋五十米範圍內的沙螺灣(西)考古遺址內進行考古調查。

調查方法：

田野調查策劃包括分析地段航空照相和進行地形詮釋研究。依據考古學調查的角度和岬角地形的走勢，田野調查和抽樣試掘的位置亦定於調查地段上較底的山坡上和向東的緩坡上。但由於以上地帶被矮小的植冠覆蓋，探方發掘並不可行，所以決定採用採坑探孔鑽探。

結果：

在研究地帶的南部和西部，除了在西部的山丘上發現一片磨光石鎚上半部的碎片外，考古踏查並沒有任何重大發現。但在東面沙灘的一條北流小溪，其出水口位於沙灘的中部，沿沙灘約四十米的範圍發現少量已被侵蝕的史前及唐代器物。器物位於一層約三十厘米黑色的沙層中，而沙層位於風化的岩層之上。

就上述發現，推測沙灘後面可能藏有考古遺存，沿沙灘後一條已經荒廢的小徑亦發現史前及歷史時期器物碎片。經進一步調查，一個延伸沙層堆積，其面積約五十米乘七十米，海拔約三至七米高，形成一相對較小的灣和海岸。就土表的調查，估計此地帶可能包含考古遺存，所以探坑試掘及探孔鑽探亦集中在此區域。

是次考古調查在上述地域共開探坑六個和探孔二十二個，目的在於確定這東部沙灘後的沙層堆積內的考古潛力及其延伸。TP2,3,4 及 5 正位於沙層堆積上。TP3 內發現合共九十五片陶瓷片，其中為無花紋的唐代製品、幾塊破裂的釉面碎片、幾片新石器時代晚期軟幾何印紋陶片、夾砂陶片及幾何硬陶片。TP2 和 TP4 內均發現唐代瓷片，而探孔 3,7,17 亦發現新石器時代晚期和唐代器物碎片。

此調查區以西的小山丘上亦置有一個探坑及探孔(TP6 及 A12)，但並沒有發現考古遺物。雖然這小山丘位於相比岬角較隱敝的地點，但不應排除在這小丘上發現考古遺物的可能性。在西部沙灘後的斜坡亦布置了一個探坑及探孔，但亦沒有發現考古遺物。最後，沿研究地帶南北邊緣的位置亦沒有發現考古遺物。

討論：

就北部岬角新石器晚期器物的年代和接近程度可合理地推測兩地點的關連。調查發現沙灘和灘後地帶可以提供一個掩蔽的佈局和高起的特點可避免沙灘的入侵。其中於岬角和就近沙灘之間可能有一個過渡的地帶，可能是一沙灘灘後棲地，亦可能代表曾經有人類活動。因此，整個沙螺灣(西)岬（包抬已移去的北岬及現時的南岬）可被視為一個新石器時代晚期的復合區。雖然北岬已被移去，但南岬卻可提供現代多樣化人類活動的證據。

由於高架橋將橫跨沙螺灣（西）岬角遺址上，而所有橋柱及相關設施(例：排水，電力)將會設於遺址以外，所以預期工程將不對遺址構成直接影響。但是，於施工期間應禁止施工設備及人員進入沙螺灣（西）遺址，亦應作定期監察，以避免對遺址構成影響。

1 INTRODUCTION

1.1 Project Background

The proposed Hong Kong - Zhuhai - Macao Bridge (HZMB) will be a dual 3-lane highway, providing a direct land crossing linking Hong Kong to Zhuhai and Macao. This link will shorten the travelling time between Hong Kong and western part of Pearl River Delta, which currently is linked mainly by water transport. The construction of the HZMB will promote the economic development of the western part of Pearl River Delta as well as boosting Hong Kong economy by fostering relationship in areas of tourism, logistics, finance and trade.

The Government of the Hong Kong Special Administrative Region (HKSAR) completed a Preliminary Environmental Review (PER) in October 2002 for the possible landing points of the Bridge and the alignments of the connecting infrastructure. The PER has recommended that the best landing point of the bridge should be at Northwest Lantau.

In March 2004, Arup was commissioned by Highways Department to carry out an investigation of the Hong Kong Section of the HZMB and its connection with the North Lantau Highway (NLHC). Option evaluation exercise is currently being conducted which has taken into consideration all key factors such as Engineering, Planning and Land matters, Environmental Issues, Implementation Programme, Cost, Traffic Planning and Impacts to Local Community. An alignment option WP has been circulated to various government departments. Out of the options identified, the alignment indicated in Figure 1A achieved the highest score and is the current preferred option.

1.1 EIA Study Brief and Project Scope

The proposed project is classified as a designated project under Schedule 2 of the Environmental Impact Assessment Ordinance (EIAO). In accordance with the requirements of Section 5(1) of the EIAO, a project profile was submitted to Environmental Protection Department (EPD) for the application of an EIA Study Brief on 8 October 2003. Pursuant to Section 5(7)(a) of the EIAO, EPD issued to the Project Proponent, namely Highways Department, a study brief (ref: EIA Study Brief No: ESB-110/2003 dated 15 November 2003) to carry out an EIA study.

According to Chapter 3.4.8 of ESB 110/2003, a Cultural Heritage Impact Assessment is to be carried out on marine archaeology, built heritage and terrestrial archaeology. The terrestrial archaeological component – which this report addresses is cited within the ESB – 110/2003 as follows:

> 3.4.8.2 The cultural heritage impact assessment shall include terrestrial and marine archaeological investigation as well as built heritage investigation. The Applicant shall refer to Appendix F for the detailed requirements.
>
> (i) <u>Terrestrial Archaeological Investigation</u>

The study areas for terrestrial archaeological investigation shall include areas within 50 metres from the recommended alignment of the Project and works areas that may have adverse impacts on known and unknown archaeological sites. Special attention shall be paid to the archaeological sites at San Shek Wan, San Tau, Sha Lo Wan, Sha Lo Wan (West), Ha Law Wan and Tai Ho. The Applicant shall engage a qualified archaeologist who shall obtain a License from the Antiquities Authority before undertaking the field evaluation under the provision of the Antiquities and Monuments Ordinance (Cap. 53).

1.2 Aim of the Study

According to the latest route proposal, part of the Sha Lo Wan (West) archaeological site will be traversed by the viaduct route. Under this proposal the other archaeological sites listed above would not appear to be at risk from direct or indirect impact of the viaduct.

It is proposed to span the area at Sha Lo Wan (West) by the viaduct – an area some 150m to the south of the (now removed) Late Neolithic promontory site which was excavated in 1993. Although impacts are expected to be negligible, this area has however not been extensively investigated and has unproven archaeological potential. According to the scope cited in ESB-110/2003 (summarised in section 1.1) an archaeological survey was conducted in this area from Sept 6th – 15th 2004 within 50m of the proposed viaduct.

1.3 Location

Sha Lo Wan (West) lies on the northern coast of Lantau Island and opposite the south-western corner of the Chek Lap Kok airport. The location and boundary of the Sha Lo Wan (West) Archaeological Site is shown in Figures 1A – 1D.

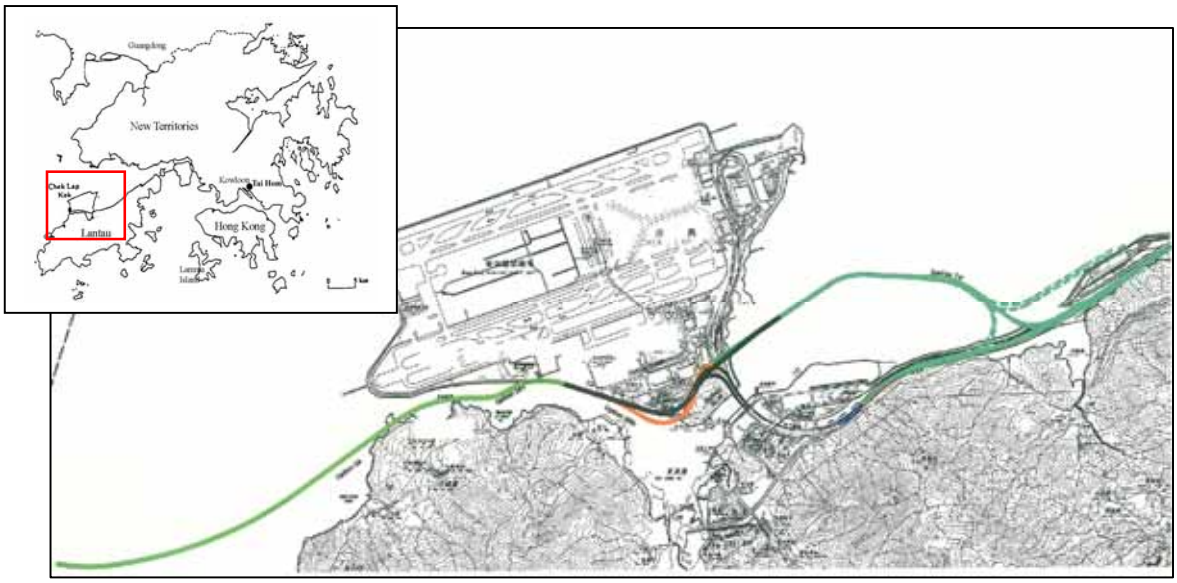


Figure 1A Location of Sha Lo Wan (west) and the latest route proposal (2A+, SR, TH)

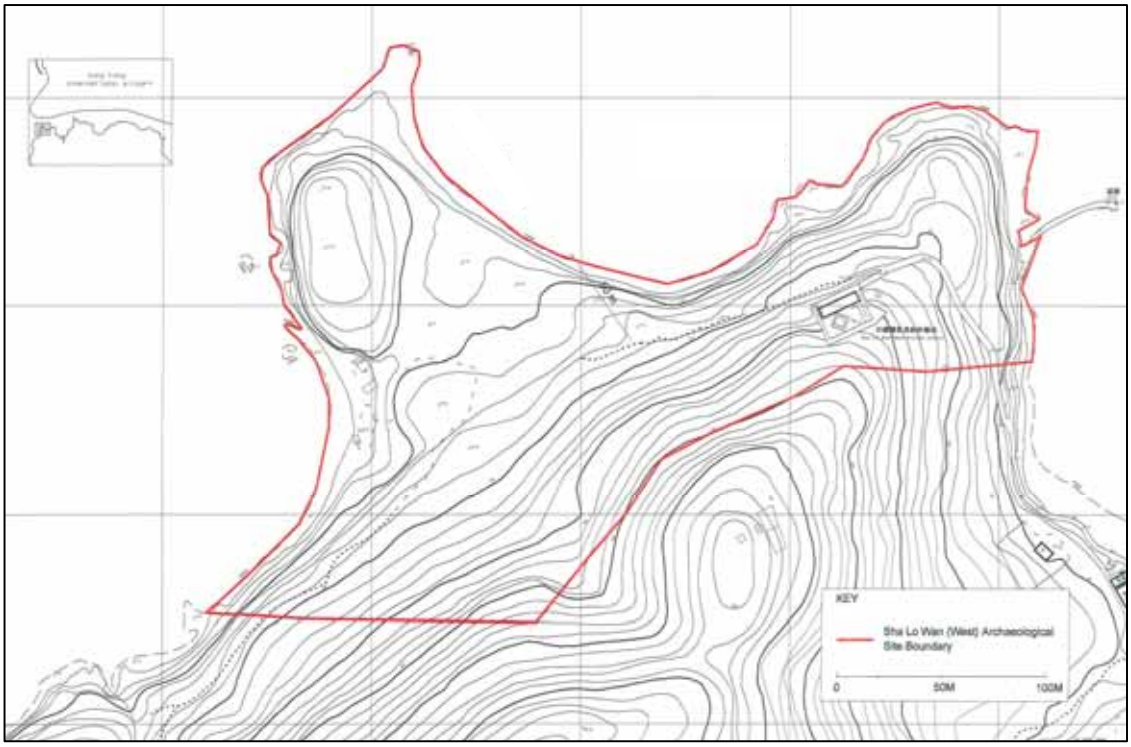


Figure 1B Sha Lo Wan (West) Archaeological Site

Figure 1C Sha Lo Wan (West) Headland – view toward east.

Figure 1D Aerial Photos of Sha Lo Wan (West) Archaeological Site

2 PREVIOUS WORK

2.1 The Sha Lo Wan (West) promontory site

The route alignment will span over a truncated promontory which forms a part of the Sha Lo Wan (West) Archaeological Site on the north-west coast of Lantau Island. Much of this promontory was removed in 1995 before airport construction together with the remains of a prominent Late Neolithic Archaeological Site, excavated in 1993 (Drewett 1995). The excavation covered some 340 sq m and produced a rich assemblage of artefacts such as pottery, stone tools, polished rings, stone weights and evidence of domestic structures as well as burials.

Though some 150m south of the archaeological site described above, the remaining headland has traces of Tang Dynasty (618 – 917 AD) and Neolithic period artefacts, found during a limited field survey and test pit program in this area in 1985 (Peacock and Nixon 1985) 1991 (CUHK 1991) and 1997 (Guangzhou Institute 1998). While it will be possible for the alignment to span over this promontory, an archaeological field survey was conducted to determine the archaeological potential within areas indirectly impacted by the limited piling or ancillary works.

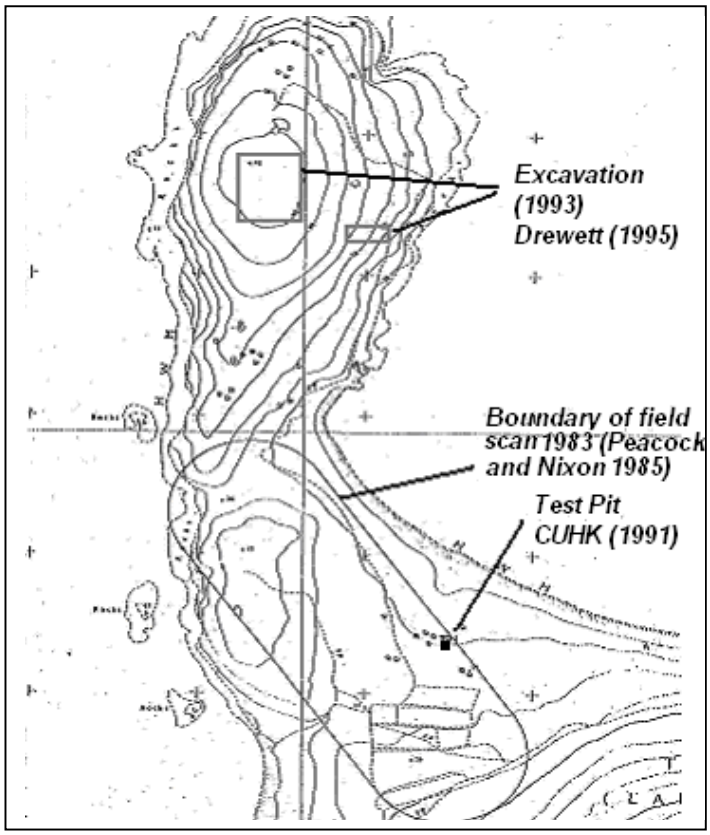


Figure 2 Previous archaeological investigation at Sha Lo Wan (West) prior to removal of promontory in 1995.

2.2 The Sha Lo Wan Site

The wide beach and valley to the east of the study area (Fig 3), at the head of which lies Sha Lo Wan village forms the Sha Lo Wan archaeological site. The Sha Lo Wan archaeological site occupies an expansive open beach, a wide former estuary (now infilled) and a hinterland of low slopes which includes the village of Sha Lo Wan Tsuen.

During archaeological investigation in 1991 (CUHK 1991), 2 long test trenches and 2 test pits were excavated at both the western beach and eastern end (near the present football pitch). The recorded artefacts included a stone axe, stone spear-head, stone core, stone arrow-head, stone adze, quartz ring, stone ring, stone axe-mould, a bronze knife, a pair of axe moulds, prehistoric geometric and coarse corded pottery as well as Tang (618 – 917AD) and Song (960 - 1279 AD) Dynasty pottery and Song Dynasty coins. Tang Dynasty kiln debris was also found.

As part of the 1997 Territory-wide archaeological survey an archaeological team from the Guangzhou Institute (Guangzhou Institute 1998) found over 200 Neolithic period sherds together with Tang and Song Dynasty pottery also within the beach at Sha Lo Wan. The fact that the boundary of the archaeological site at Sha Lo Wan includes both the beach and hinterland suggests that further archaeological potential exists on the lower slopes and infilled valley.

Figure 3 Sha Lo Wan Beach

3 ENVIRONMENTAL SETTING

The geology of the Sha Lo Wan (West) headland is granite with mapped colluvial deposits occupying the central small valley toward the east of the study area (Sewell et al 1995). The scale of geological mapping produced in Hong Kong – for the most part at 1:20000 scale – is however only indicative and often of insufficient resolution to identify superficial soils and deposits, many of which may have direct or indirect archaeological significance. The fieldwork at Sha Lo Wan (West) again proved this to be the case, with the presence of a prominent and unmapped rear-beach sand deposit - on what were otherwise mapped as colluvial deposits - on the eastern side of the promontory.

4 METHOD

4.1 Field Survey Approach

The archaeological field survey program at Sha Lo Wan (West) followed the specifications for field survey within EIAO Technical memorandum Annex 19 and relevant guidelines for CHIA issued by the AMO (http://www.epd.gov.hk/eia/english/guid/cultural/basis.html). Prior to commencement of field work formal approval for field work was sought from the District Lands Office. This field survey method included:

- A definition of undisturbed terrain within the study area.
- A field scan of these areas with attention paid to exposed soil and artefacts within these areas.
- The employment of an auger survey/shovel test program to establish the soil type and depth as well as the horizontal spread of any deposit of cultural material.
- Excavation of test pits and recording of stratigraphic and archaeological data to establish the vertical sequence of cultural materials. Test pits at Sha Lo Wan (West) were of dimensions 1.5m x 1.5m, 1.5m x 1m, 1m x 1m and 0.8 x 0.8m.
- The number and location of auger holes and test pits proposed with justification was agreed with the AMO before field work commenced.
- Liaison with the AMO during the field program about any identified and additional sites of cultural heritage within the Sha Lo Wan (West) area. The historic and archaeological value of the items will be assessed and reported during the field program and should a rescue excavation be necessary this will form part of the mitigation program.

The project was directed by Dr Chris Day, Director Archaeo-Environments Ltd and the licensee (Licence No. 203) for this project.

4.2 Sampling Strategy at Sha Lo Wan (West)

Figure 4 shows the proposed route alignment which will span over the truncated headland at Sha Lo Wan (West). A 50m wide study area boundary (impact area) is shown on either side of the proposed alignment according to the terms of the brief ESB 110/2003. Figure 4 also shows the eastern and western extremities of the study area. These parts of the study area occupy narrow rocky coastline, are thereby of low archaeological potential and have been trimmed from subsequent study area maps.

The area is characterised by low sloping terrain – slightly steeper to the west. The eastern half of the survey area has traces of abandoned agriculture. A test pit excavated by an archaeological team from Chinese University in 1991 on the eastern side of the headland (Figure 2) and in the direct alignment of the proposed viaduct revealed sparse Tang Dynasty pottery fragments over Neolithic period fragments to a depth of 80cm.
A summary of the sampling strategy at Sha Lo Wan (West) is summarised below.

- A program of field walking across both the survey area and the wider promontory was conducted to note the presence or otherwise of any surface artefacts,

undisturbed landscape and other terrain features relevant to subsurface sampling.

- Based on the above fieldwork and in conjunction with air photo interpretation and an interpretation of local geomorphology, a series of 22 auger holes/shovel tests was planned on both elevated and lower slope sites within the survey area to determine the presence of archaeological remains.

- The strategy of the sampling program would also be governed by field results, with an initial focus on both the saddle of the hill (3 test pits) with a further 3, on the eastern slope. The aim of these test pits is to search for the prospect of further archaeological remains which might be associated with the former promontory site and both primary and secondary (mapped colluvial) remains respectively on the gentler slopes to the east.

- As will be discussed in the following section (Section 5), results in the field necessitated an adjustment in the initial sampling strategy. The area was overgrown with thick scrubby vegetation and while a grid and transect sampling method was proposed this proved impractical. In addition, the discovery during field scanning of surface artefacts and exposure of a cultural horizon on the eastern beach meant that closer sampling was conducted within and around this area. The observation of an elevated sand deposit rather than colluvial slopes indicated on geological maps was also a product of the field phase, which influenced the sampling strategy.

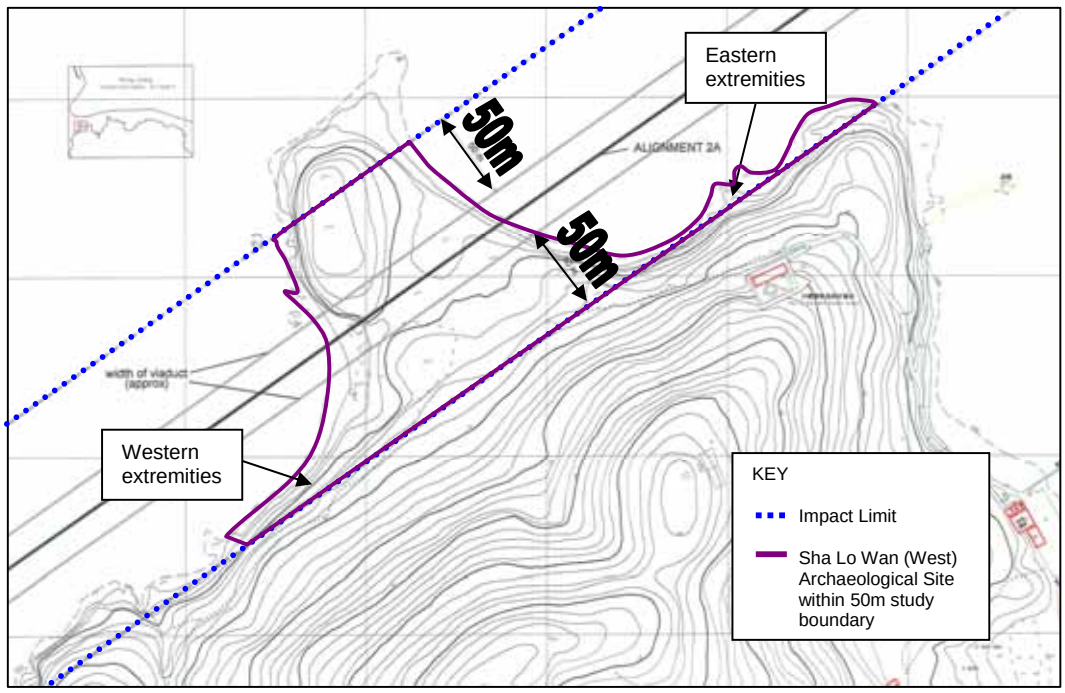


Figure 4 Map of study boundary showing route alignment and 50m buffer

5 RESULTS

5.1 Field scan

A field scan was conducted across the study area:

- where thick scrub allowed
- along existing and overgrown access tracks
- along the beaches on the east and western side of the headland.

Figure 5 shows a summary of field walking areas. Nothing was found across the southern and western part of the study area, with the exception of a fragment (top half) of a large polished stone adze with clear grooves presumably where it was attached to a handle (Ref photo 1 in Appendix 2 and Drawing 1 in Appendix 3). This fragment was found on the hilltop to the west of the study area.

On the eastern beach however, to the north of a small stream outlet in the centre of the beach, highly weathered Prehistoric and Tang Dynasty artefacts were found along an approximate 40m sector of the beach. On closer examination of the beach and surrounds it was observed that archaeological remains were being eroded from a dark sandy, cultural horizon some 30 cm thick which lay immediately above the mottled granitic bedrock shown in Figure 6 below. Although disturbed by overlying construction debris and refuse, thin layers of organic material and part indurated layers were preserved within this horizon. Sparse prehistoric and historic period plain ware sherds were observed within this layer.

After attention had been drawn to this archaeological exposure, the area behind the beach was surveyed and prehistoric and historic period sherds were also found along an abandoned and eroded trackway to some 30m behind the beach (Figure 7). This traverse revealed the presence of an extensive and previously unmapped sand deposit. The discovery of the archaeological horizon exposed at the beach and the presence of a previously unmapped sand body behind the beach with associated surface artefacts suggested an area highly prospective for further archaeological material. This area was therefore a prominent focus of the survey program.

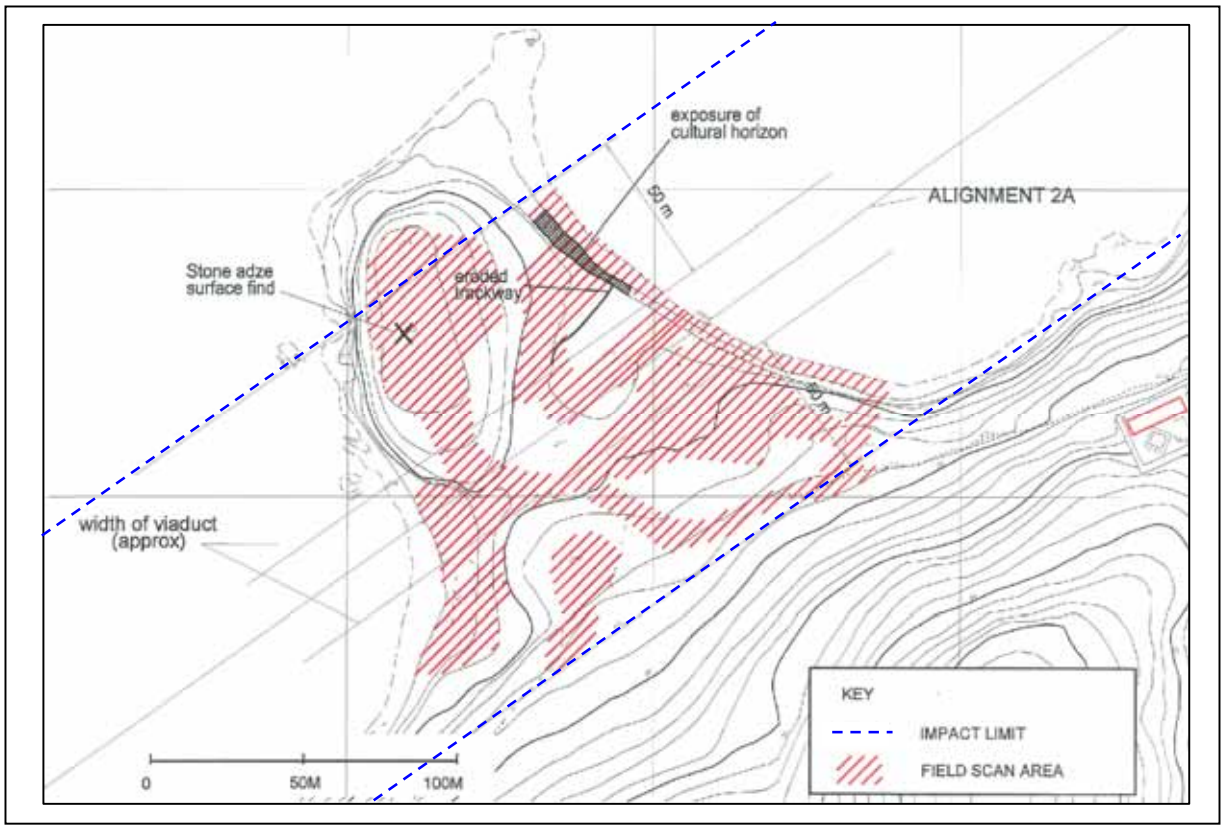


Figure 5 Map of field scan

Figure 6 Exposure of cultural horizon, Eastern beach.

Figure 7 Eroded trackway at rear of eastern beach (north).

5.2 Test Pit and auger- shovel test survey

A total of six test pits were excavated within the Sha Lo Wan (West) study area (Figure 8).

The location of test pits had 2 aims:

- To survey areas of prospective or predicted archaeological remains
- To ensure reasonable coverage of other areas – of lesser or unknown archaeological potential in order to optimise impact assessment within the area.

Each test pit was excavated to undisturbed bedrock (weathered granite) or superficial sterile material (colluvium). Stratigraphic data and archaeological artefacts were systematically recorded within each test pit.

A total of 22 auger hole and shovel tests were excavated across the study area to investigate the extent and archaeological potential of the sand deposit to the rear of the eastern beach. Auger holes were also excavated to investigate unproven and unknown areas throughout the study area.

Each shovel test was excavated with dimensions of approximately 50cm x 50cm and to a depth of approximately 80cm. The purpose of the shovel test was to maximise the prospect of recovering archaeological and stratigraphic data, particularly within the sand deposit. Thereafter an auger was used at each shovel test site to extend sampling to bedrock – up to 150cm. A 1:1000 scale location map for test pits and auger hole-shovel test sites is provided in Appendix 5.

All historic period artefacts recovered during both surface and subsurface sampling throughout the study area were submitted to Prof Peter Lam, Director, Museum of Art, Chinese University of Hong Kong and descriptions within the text for the historic period assemblage are based on his analysis of pottery type and age. The assemblage of prehistoric artefacts recovered during both surface and subsurface sampling throughout the study area was examined and corroborated by William Meacham, an archaeologist of 30 years experience in Hong Kong and Director of the adjacent Chek Lap Kok archaeological survey.

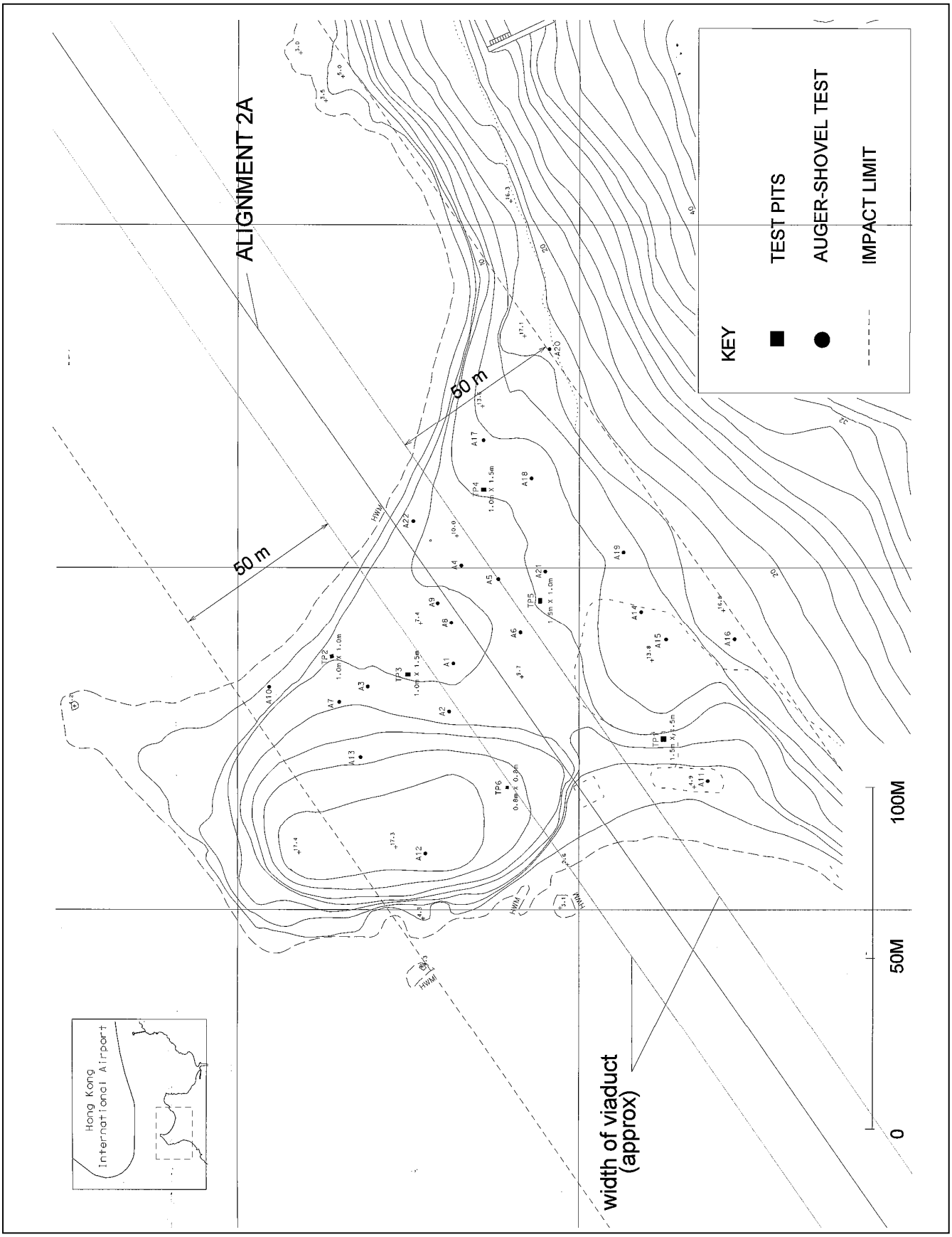


Figure 8 Location of Test pits and Auger holes at Sha Lo Wan (West)

5.2.1 TEST PIT RESULTS

TEST PIT 1

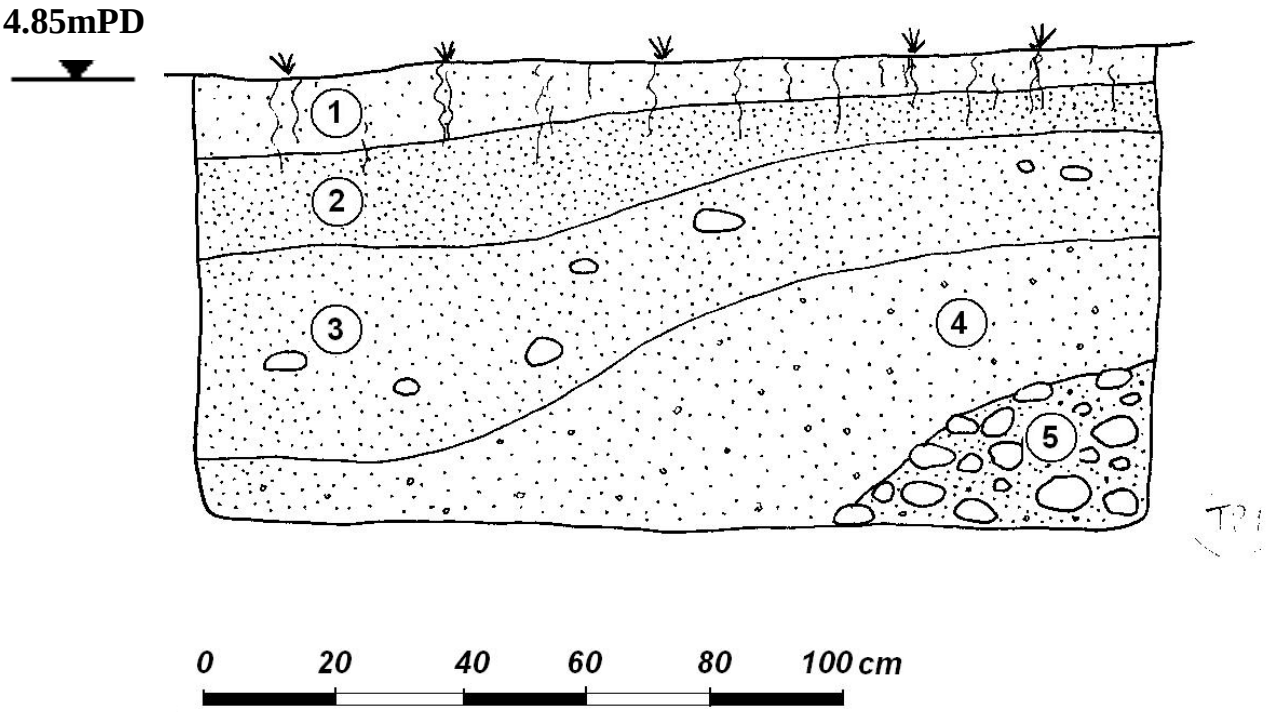
Test pit 1 is located within a cultivated area some 8m to the south of a small piggery on the western beach at Sha Lo Wan (West)(Figure 9). There have been no recorded archaeological finds in this area although the small beach and hinterland would appear to offer prospects for archaeological material. The area has been terraced for agriculture and three small dwellings and water tanks occupy the northern part of the beach.

SUMMARY

A test pit 1.5m x 1.5m in dimensions was excavated to a depth of about 70cm. 5 contexts were recorded and are summarised below. These included upper layers of sand and clayey sand above colluvial material and a basal cobble/pebble horizon deposited coincident with the hillslope and sloping from east to west. No archaeological material was observed within test pit1.

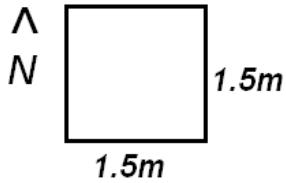
Figure 9 View of TP1 from east

Context	Depth (cm)	Description	Finds
1	0-13	Brown, fine-medium loamy sand	Nil
2	13-29	Mid Brown fine-medium clayey sand	Nil
3	29-60	(as above) with quartz pebbles to 3-4cm diam.	Nil
4	60-70	Orange-brown uniform medium clayey sand	Nil
5	45-70	Pebbles and cobble horizon 3-8cm diameter.	Nil



Project Sha Lo Wan West 2004
Date 10/9/2004
Test Pit No. 1
807410.1E 816847.9N (NW cnr)

North Section



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TEST PIT 2

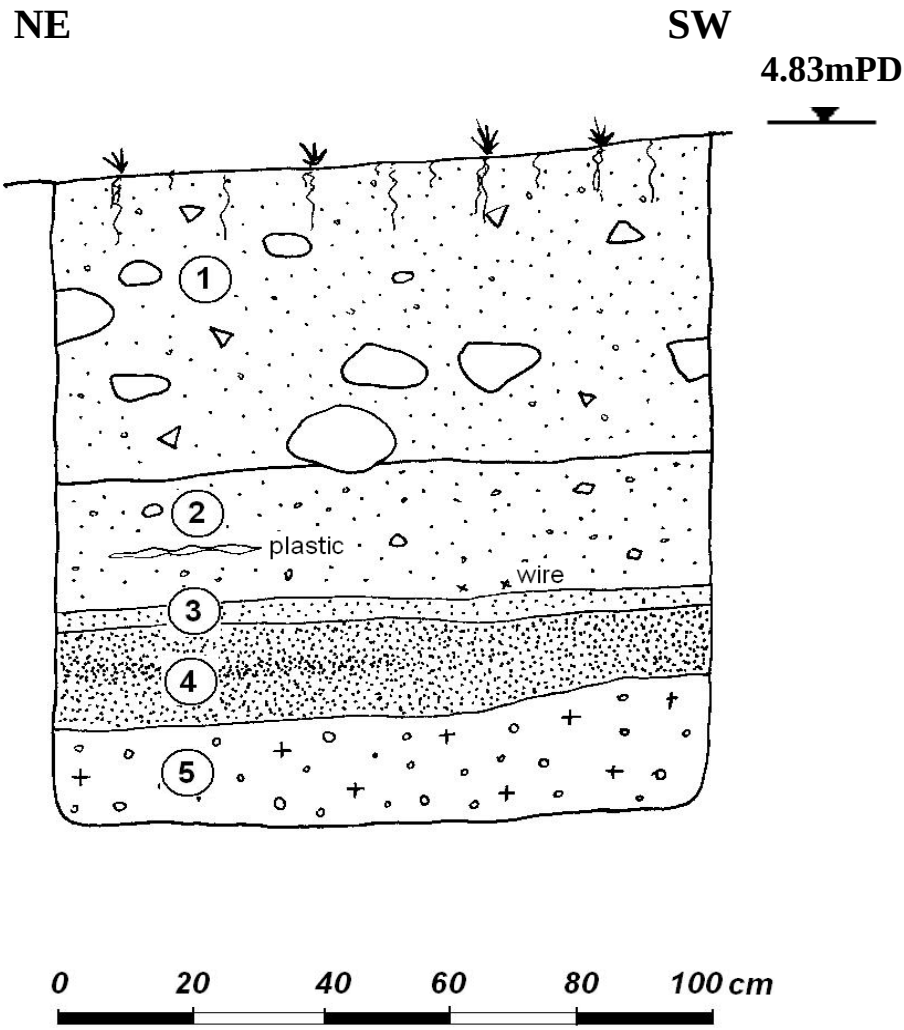
Test pit 2 was located some 5m to landward of the eastern beach at the Sha Lo Wan (West) southern headland. The site was chosen to investigate the presence of an *in situ* archaeological layer which was exposed above weathered bedrock at the upper beach and at about the high water mark.

SUMMARY

Test pit 2 revealed multiple layers of fill, rubble and building debris to a depth of about 74cm. The source of this material is unknown, though in the absence of any local development it may have been dumped during the removal of the former headland or construction of the airport.

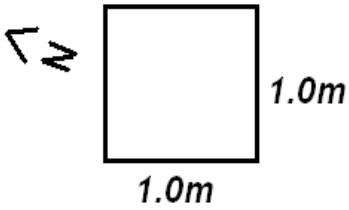
Beneath the fill layers at 74-89cm was a layer of dark brown sand, variably disturbed. A Tang Dynasty (618 – 917AD) plain-ware sherd (base fragment) was recovered from this layer (Photo 2 – Appendix 2). This relatively thin layer would appear to conform with the layer of brown sand and artifacts which outcrops at the rear of the beach. The test pit was concluded within mottled and weathered granite at a depth of 1.10m.

Context	Depth (cm)	Description	Finds
1	0 - 48	Fill – rubble and building debris	Nil
2	48-70	Fill – rubble, plastic, wire in brown and orange sandy clay matrix	Nil
3	70-74	Beige/light brown sand	Nil
4	74-89	Brown fine-medium sand	1 Tang Dynasty plain-ware sherd (base fragment)
5	89-105	Orange-brown weathered granitic sandy clay (Parent material)	Nil



Project Sha Lo Wan West 2004
Date 11/9/2004
Test Pit No. 2
817433.7E 816944.7N (S-SE cnr)

South-east section



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TEST PIT 3

Test pit 3 was located some 20m south of test pit 2 and within the sand deposit behind the eastern beach (Figure 10). The field scan had revealed sparse prehistoric and Tang Dynasty sherds particularly within a partly eroded track behind the beach. Test pit 3 was sited at the head of the eroded track with the purpose of proving whether this part of the sand bar was continuous with the archaeological material exposed at the beach.

Summary

Test pit 3 revealed a deposit of brown sand separated into 5 contexts, of total 95cm thickness above weathered granite. Finds are summarised below and in Appendix 4. Tang Dynasty artefacts were recovered within context 3 (dark brown sand 38 - 47cm). Notable among the 22 recovered Tang Dynasty sherds in context 3 were relatively large plain-ware rim and base fragments (Photos 3-5 – App2), as well as 3 small sherds of Tang Dynasty cracked glaze porcelain (Photo 6 – App2). Context 4 and 5 contained prehistoric (Late Neolithic) artefacts within slightly coarser textured sand at a depth of 47 – 60cm.

Among the 73 prehistoric artefacts found within context 4 were : soft geometric over-stamped fragments typical of the Late Neolithic period and ascribed to Phase 1V (Late Prehistoric Period), 2200-1500BC Chau (1994) (Photo 7 – App2, Drawing 3 App3). In addition to highly weathered coarse-corded ware sherds (Photo 10 -11 – App2) sherds of well-fired soft impressed geometric “leaf-vein” patterned ware were recovered (Photo 8 – App2, Drawing 4, App3) and decorated coarse-ware (Photo 9 - App2, Drawing 5, App3)). The latter sherds are of similar typology to those found at Sha Lo Wan (West) (Drewett 1995) and Yung Long (Meacham 1995) for which C14 dates of 2200-2900 BC were obtained. Context 5 included coarse-corded ware and a fragment of a polished stone adze (Photo 12 – App2, Drawing 6 & 7, App3).

The presence of 2 phases of later Neolithic pottery within context 4 (11cm) implies either post-depositional disturbance or a period of transition between the two periods. What is significant however from the assemblage at Test Pit 3 is evidence (whether disturbed or transitional) for later (LN Phase IV) occupation of this site - a phase otherwise absent from the assemblage the Sha Lo Wan (West) promontory site.

Figure10 Location of TP3

According to the principles of archaeology, artifacts of mixed periods (in this case a few hundred years apart) can exist in the same layer. Sham Wan is one of the best known, excavated and published sites in HK, and one of few sites in HK with a complete sequence of multi-period prehistoric occupation. For this reason it is a particularly relevant reference irrespective of when the site was excavated. However on p137 of the Chek Lap Kok monograph (Chek Lap Kok Island, Journal Monograph IV, Hong Kong Archaeological Society; 1994, Meacham, W (ed))the following reference is also made "*A few potsherds at the top of the Late Neolithic layer in Square FX might represent early Bronze Age, even though no hard geometric pottery was found. The coarse pieces with stamped geometric patterns and rather thin (3-4mm) bodies were found interspersed with Tang sherds; this type has been found on other sites with both Late Neolithic and*

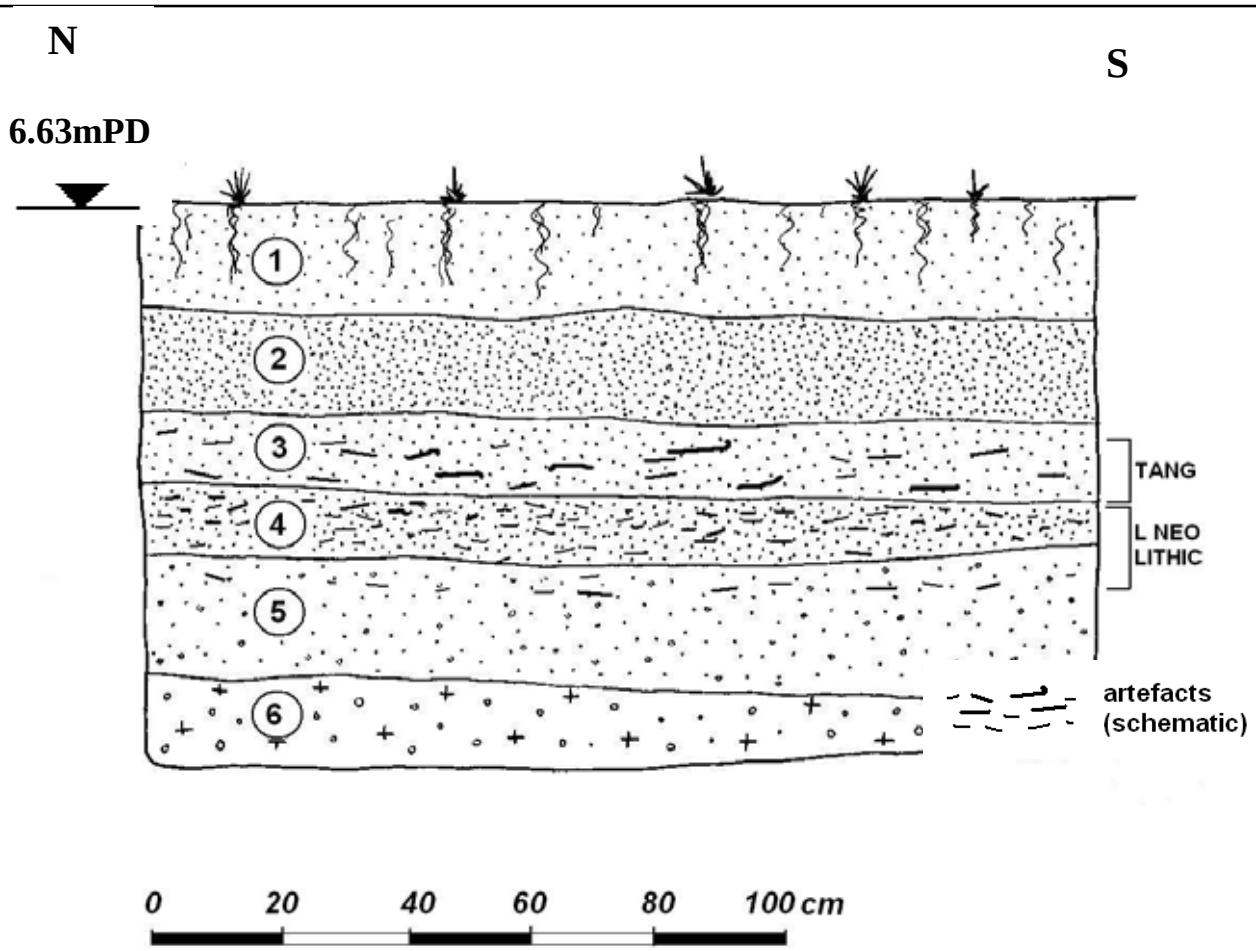
Bronze Age materials, and may be a transitional pottery type." Similar principles are also stated in reference such as "Techniques of Archaeological Excavation by Phillip Barker - Routledge 3rd ed(1999) (p137-138)" for a description of the type of layer and how mixing might occur.

Hence, the two possibilities occur because Context 4 represents a mixed layer of 2 types of pottery and which can be due to mixing caused by post-depositional processes such as agriculture, animal activity etc. This is also consistent with one of the main principles in archaeology that younger layers are deposited above older layers. This also supports the field method used during excavation of TP3 and that it was done carefully and with sufficient precision given the method common in archaeological test pit survey work. Due care was taken to investigate basic stratigraphy and stratigraphic relationships in each test pit.

In such circumstances a reinterpretation of simple stratigraphic principles is necessary. The fact that this mixed layer (Context 4) is thin (11cm) suggests it was identified with reasonable precision and not mixed during excavation.

Reference to similar transitional layers in Hong Kong can be found in W. Meacham (ed) (1978) Sham Wan, Lamma Island; An Archaeological Site Study, Journal Monograph III, Hong Kong Archaeological Society.

Context	**Depth (cm)**	**Description**	**Finds**
1	0-18	Brown organic loamy sand with common roots	Nil
2	18-35	Dark brown fine-medium sand	Nil
3	35-47	Mid brown fine-medium sand	Tang Dynasty plainware, crackled-glaze porcelain
4	47-58	Mid-dark brown fine-medium sand	Coarse-corded ware, Soft geometric. “Leaf vein” ware
5	58-77	Brown medium-coarse granticsand	Coarse corded ware, polished stone adze fragment
6	77-92	Orange-brown coarse granitic sandy clay (Parent Material).	Nil

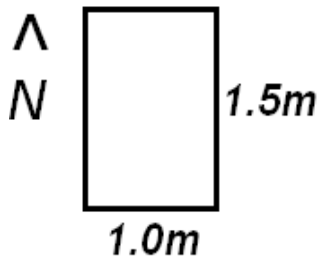


Date 11/9/2004

Test Pit No. 3

807423.4E 816923.8N
(NE cnr)

East section



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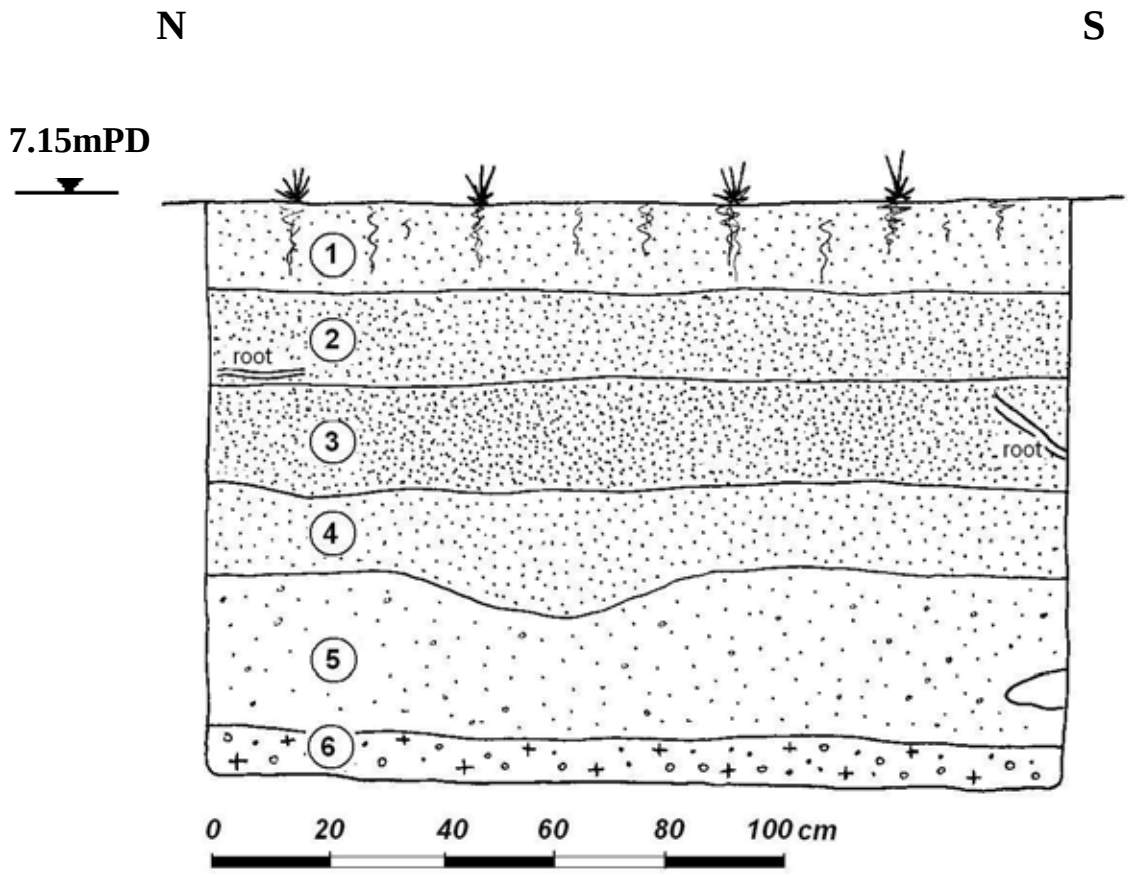
TEST PIT 4

Test pit 4 was sited on the southern side of the small valley some 25m from the beach and in the vicinity – and estimated approximately 20m south-east of the site of the test pit excavated by CUHK in 1991. Sparse Tang Dynasty and prehistoric pottery sherds were recorded within this test pit. Test pit 4 was therefore located in the vicinity to investigate the prospect of further archaeological remains on this side of the valley and whether the frequency of remains found in Test pit 3 might be replicated elsewhere within the sand deposit.

SUMMARY

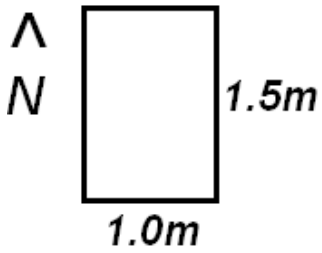
Test pit 4 confirmed that the sand deposit was relatively thick – almost a metre - in this part of the study area. 4 Tang Dynasty plain ware sherds were recovered within context 3 (Photo 13 - App2) at a depth of 40 - 48cm. Notably, no prehistoric remains were found within lower contexts of this test pit. In light of the earlier recovery of both Tang Dynasty and prehistoric remains in the area and the general thickness of the sand deposit proven within test pit 4, this part of the study area remains prospective for further archaeological remains.

Context	Depth (cm)	Description	Finds
1	0-16	Brown fine-medium sand with organic material and common roots	Nil
2	16-32	Mid-brown fine-medium sand	Nil
3	32-50	Dark brown fine-medium sand with some organic material	4x Tang Dynasty plain ware fragments
4	50-71	Mid brown clayey sand-sand	Nil
5	65-95	Orange-brown medium clayey sand	Nil
6	95-104	Orange-brown coarse granitic sandy clay (Parent Material)	Nil



Project Sha Lo Wan West 2004
Date 13/9/2004
Test Pit No. 4
807484.6E 816902.3N (NE cnr)

East section



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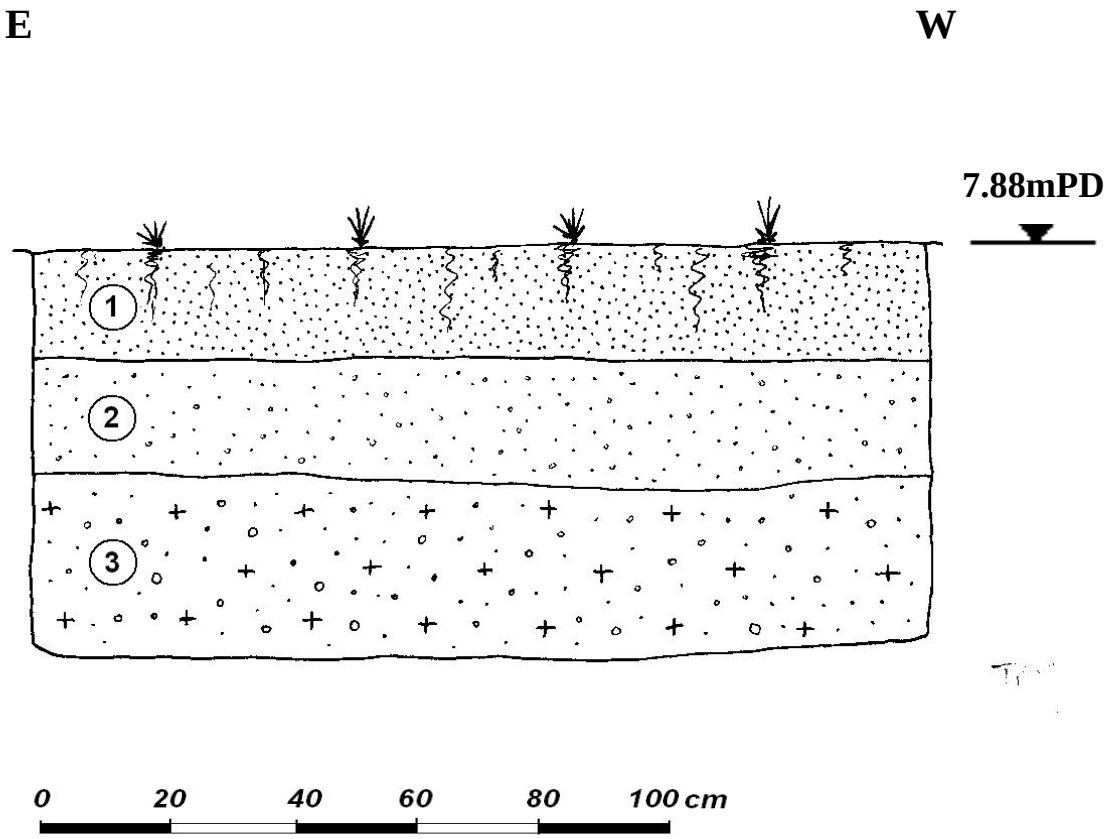
TEST PIT 5

Test pit 5 was sited in the topographic saddle/upper small valley and approximate midpoint between the eastern and western sides of the study area. It was located here particularly to delimit the sand deposit recorded throughout most of the eastern study area and to investigate whether the sand and/or associated archaeological remains extended to the west of earlier finds in test pit 3 and test pit 4.

SUMMARY

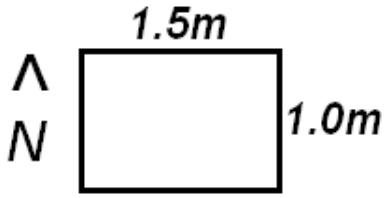
Test pit 5 revealed relatively shallow sand layers over weathered granite at about 40cm. There were no archaeological remains recovered within test pit 5. The shallow thickness of the brown sandy horizon within this test pit provides an indication of the western limit of the sand deposit and archaeological site at Sha Lo Wan (West).

Context	Depth (cm)	Description	Finds
1	0-19	Brown fine-medium organic sand	Nil
2	19-39	Light brown medium-coarse quartz sand	Nil
3	39-60	Orange-brown coarse granitic sandy clay (Parent Material)	Nil



Project Sha Lo Wan West 2004
Date 14/9/2004
Test Pit No. 5
817452.2E 816884.2N (SW cnr)

South section



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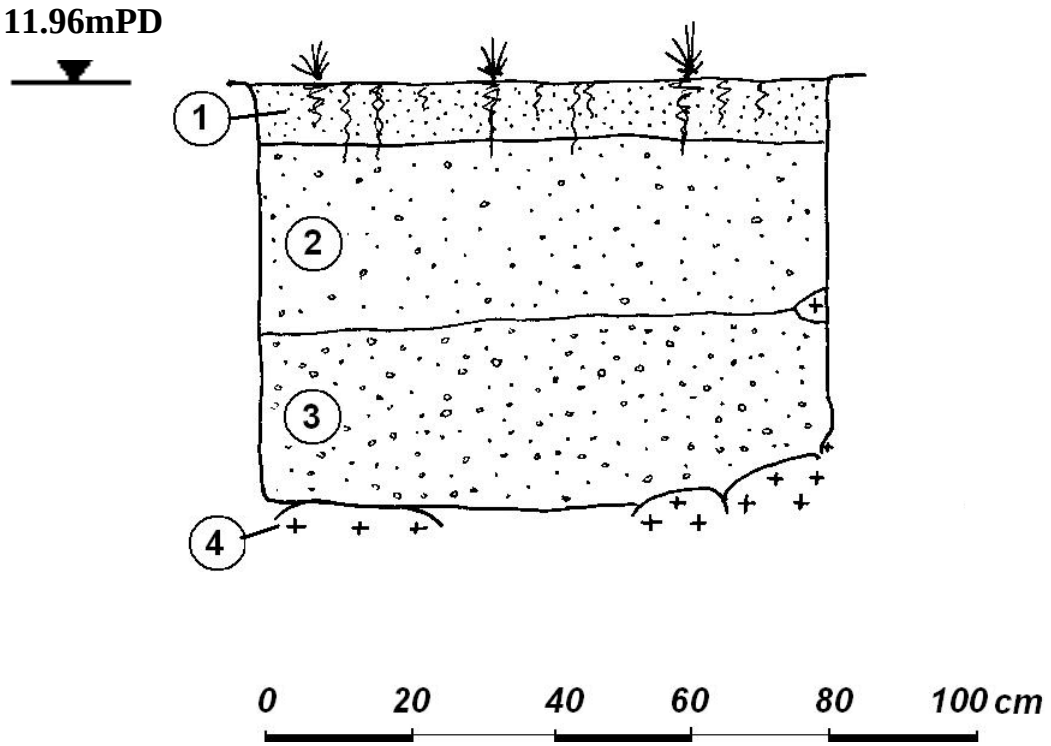
TEST PIT 6

Test pit 6 was sited on the crest of the prominent hill to the west of the study area with the aim of investigating whether this hilltop area contained any archaeological remain, particularly in light of it's similar topographic setting with the rich Sha Lo Wan (West) promontory site located some 150m to the north.

SUMMARY

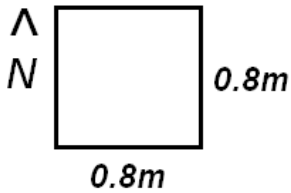
Test pit 6 revealed coarse skeletal soil and shallow bedrock – stratigraphically similar to that of the Sha Lo Wan (West) promontory site – although there was an absence of any archaeological remains. The hilltop was field scanned – during which a fragment of a polished a stone adze was found – and surveyed by excavation of a test pit and shovel test. In spite of the lack of archaeological remains found through sub-surface survey, the prospect of archaeological remains on this hill cannot be ruled out.

Context	Depth (cm)	Description	Finds
1	0-8	Dark brown loamy sand	Nil
2	8-34	Brown coarse sand-gravelly sand with common rock fragments	Nil
3	34-60	Light brown coarse gravelly granitic sand	Nil
4	60+	Bedrock – angular granitic rock fragments to 30cm.	Nil



Project Sha Lo Wan West 2004
Date 14/9/2004
Test Pit No. 6
807392.1E 816894.5N (SW cnr)

West section



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5.2.2 AUGER-SHOVEL TEST RESULTS

The location of all auger and shovel test sites are shown in Figure 8 and results are listed in Appendix 1. A summary of this sampling program is discussed below.

Auger-shovel test 1
A1 was located some 15m to the south of Test Pit 3 with the purpose of further investigating the lateral extent, depth and archaeological potential of the sand deposit proven in TP3. A shovel test was excavated to about 80cm and an auger was used to extend sampling to a depth of 163cm. This sampling site revealed the sand deposit to be 143cm deep – the thickest section of the deposit recorded within the study area - above weathered granite. No archaeological materials were recorded with A1.

Auger-shovel test 2
A2 was located 14m west of A1 and some 20m south-west of TP3 with the purpose of investigating the extent of the sand deposit and any archaeological materials behind TP 3 and A1. A shovel test revealed brown sand to 45cm over weathered granite with no archaeological material, proving that the sand deposit thins within 20m west and to landward of TP3. The results from A2 provide an indication of the western limit of the sand deposit in this part of the study area.

Auger-shovel test 3
A3 was located 12m north of Test Pit 3 and at the approximate midpoint between Test pit 3 and Test pit 2 on a prominent part of the sand deposit. A shovel test was excavated to a depth of 75cm through dark brown organic loamy sand and yellow-brown sand. Thereafter an auger hole extended sampling to a depth of 128cm and weathered granitic parent material. A coarse-corded sherd was recovered by the auger at a depth of 112cm within medium-coarse orange-brown sand and just above the weathered granite (Photo 14 – App2). The depth of sand deposit and the presence of artifacts at this site suggest that the area is highly prospective for further archaeological material.

Auger-shovel test 4

A4 was located about 18m west of Test Pit 4 on the southern side of the small valley/drainage line with the purpose of investigating the extent and archaeological potential of the sand deposit to the south of the prominent find-spots in TP3 and A3. A shovel test was excavated to a depth of 45cm within dark brown and brown sand and yellow-brown sand with occasional pebbles. Thereafter an auger extended the sampling to weathered granite at 64cm. A4 revealed that the sand deposit was only some 60cm thick – possibly slightly thinner on the margin of a small topographic rise which extends from west to east in this part of the study area. No archaeological remains were recovered in A4.

Auger-shovel test 5
A5 was located some 12m south of A4 on the southern side of the drainage line and on the same relatively broad and gentle slope/natural terrace sampled by TP4 and A5 – and indeed the general vicinity of Tang and prehistoric find-spots within a test pit excavated by CUHK in 1991. A shovel test was excavated which revealed brown sand and

weathered granite at 44cm. No archaeological remains were recorded. The depth of sand within A5 suggests that the sand deposit thins toward the north. A5 therefore provides an indication of the limit of the sandy body in this part of the study area.

Auger-shovel test 6

A6 was located some 12m to the east of Test Pit 5 and in the gentle saddle dividing the eastern and western beaches of the headland. Sited slightly further toward the estimated extent of the sand deposit in A1 and TP3, it was anticipated that A6 might prove the western extent of the deposit. A shovel test revealed brown sand and light brown sand above weathered granite at 56cm. While slightly deeper than the sand found within TP5, the results from A6 provide an indication that the sand deposit thins gradually toward the west in his part of the study area.

Auger-shovel test 7

A7 was located about 11m west of TP2 further to landward and within the sand deposit. Here the feature would appear to be limited in lateral extent confined by hillslopes which grade more steeply to the beach to the north of the study area. A shovel test was excavated to a depth of 70cm revealing dark brown and brown sand. A coarse-corded sherd was recovered at a depth of 65cm (Photo 15 – App2). Thereafter an auger was used to extend sampling to weathered granite at 90cm. The results from A7 indicate that the sand deposit and associated archaeological potential extend at least this far north within the study area.

Auger-shovel test 8

A8 was located near the centre-line (middle of proposed route alignment) and some 12m to the east of A1 and within the sand deposit. A shovel test revealed dark brown and brown sand to a depth of 56cm above weathered granite. No archaeological remains were recovered within A8. The results here show that the sandy body is rather thinner than at both A1 and TP3 to the west.

Auger-shovel test 9

A9 was located near the centre-line and 7m toward the beach from A8. A shovel test revealed dark brown sand and lighter brown sand above weathered granite at 65cm. No archaeological remains were recorded within this shovel test. As with A8, the depth of sand is rather thinner than might have been expected in this central part of the valley.

Auger-shovel test 10

A10 was located at the northern limit of the study area and some 15m west of the beach. This area is disturbed with building debris and rubbish throughout. An auger hole was attempted in 3 areas here but each was abandoned due to impenetrable rock/fill at about 10cm. This part of the study area would appear to covered in large part by debris – presumably accumulated during demolition of the promontory to the north.

Augerhole 11

A11 was located some 25m south of the piggery and small buildings on the western beach and some 15m south ot Test Pit 1. Auger sampling revealed brown and light brown coarse granitic sand over rock at 95cm. No archaeological remains were recovered.

Auger-shovel test 12

A12 was located on the hillcrest some 20m north of test pit 6 on the western side of the study area with the purpose of investigating the prospect of archaeological remains in an area of topgraphic similarity to that of the Sha Lo Wan (West) site some 150m to the north. A shovel test revealed coarse gravelly loam and rock abpve impenetrable rock at 50cm. No archaeological remains were recovered.

Augerhole 13

A13 was located 20m to the west of A7 to investigate the archaeological potential of the lower hillslope – north of the identified sand deposit. The area was covered in scrub and it was necessary to cut a path through the undergrowth for some 25m to access – and provide sampling – within this part of the study area. The augerhole revealed coarse granitic sands and rubble to 58cm above coarse weathered granitic parent material. Situated on the lower part of a hillslope A13 proved, as might be expected - the existence of shallow soil and colluvium. No archaeological remains were found.

Augerhole 14 – 16

A14 – A16 were located in the southwestern part of the study area above the eastern beach. The purpose of these 3 auger-holes was to investigate the archaeological potential of lower and mid-slope areas to the south and southwest of the study area. Soil depth was within the range 34-42cm above weathered granite and no archaeological remains were recorded.

Augerhole 17

A17 was located adjacent a small spur some 30m south of test pit 4. An auger hole in this part of the study area was necessary to provide some evidence of the southern extent of the sand deposit. A17 revealed brown sand and thereby presence of the sand body albeit thinning to the south, above weathered granite at about 50cm. A small Tang Dynasty crackled-glaze sherd was found at a depth of about 8cm (Photo 16 – App2)

Augerhole 18

A18 was located 15m southeast and slightly upslope from test pit 4. An auger hole here would provide an indication of the western limit of the sand body found within TP4. A18 revealed brown and light brown sand for a depth of 75cm above weathered granite. Although this augerhole was archaeologically sterile it is clear – as the sand deposit is relatively thick here – that it probably extends as far as lower hillslope to the west.

Augerhole 19

A19 was located in a lower slope position next to the main access trackway which leads from east-west across the southern part of the study area. Brown loamy sand was recorded above weathered granite at 41cm. No archaeological remains were noted within A19.

Augerhole 20

A20 was located above a gentle rocky spur at the far eastern corner of the study area. Several attempts were made to sample within this area but augering was abandoned at less than 20cm due to impenetrable rock.

Augerhole 21
A21 was sited some 15m to the east of TP5, to provide another indicator of the extent of the sand body across the relatively gentle terrace on the southern side of the lower valley. Brown sandy loam however was only 38cm thick above weathered granite. The limit of the sand deposit would therefore appear to lie to the north of A21. No archaeological remains were recorded within this augerhole.

Augerhole 22
A22 was located only a few metres south of the eastern beach and within primary beach sands. Light brown-beige sand and yellow-brown sand with some pebbles extends to a depth of 80cm above weathered granite. With the exception of a small layer of brown sand immediately above the parent material, this augerhole sampled material within primary and recent beach deposits. No archaeological remains were recovered from A22.

5.2.3 Surveying

The survey of test pit co-ordinates and relative levels was conducted by professional surveyors John Barrett and Associates on March 12th 2005. The relative topographic level (mPD) and co-ordinates (eastings and northings according to the HK Grid) are provided with each test pit description. Auger hole-shovel test co-ordinates were located with reference to digital GPS measurements provided for the tree inventory. The accuracy of this grid was plus/minus 1m and was deemed suitable accuracy for the purposes of the archaeological survey. A summary of auger hole -shovel test data and co-ordinates is provided in Appendix 1.

*The reader will note that some disparity between the surveyed levels and the contour data on the base map. It is acknowledged that 1 :1000 scale contour maps may not be accurate – especially in relatively remote parts of Hong Kong.

6 SUMMARY

Following the observation of surface Tang Dynasty and Prehistoric artifacts during field scanning on the eastern beach, and an exposure of a cultural horizon at the rear of this beach attention was drawn to rear beach area as a probably source of this material. A field scan of the rear beach area produced sparse prehistoric and early historic period sherds within what was clearly a remnant raised sand deposit which was partly exposed along an eroded pathway behind this part of the beach. Further inspection of the eastern beach and wider hinterland at Sha Lo Wan (West) revealed that this feature extends both to the west and to the south toward the edge of the hills in both directions for about 50m and 70m respectively. This sand body exists at an elevation of between 3-7m PD, is previously unmapped and is somewhat unexpected in this geomorphic setting - given the relatively small embayment and hinterland. In the light of this observation allied with the discovery of surface finds, *in situ* material along the beach and artefacts recovered during the Test pit and auger-shovel test survey, it would appear that this area holds considerable archaeological potential.

The focus sand deposit

TP 3 was located within the sand body proper and produced an assemblage of both Tang Dynasty ribbed plain-ware and several crackled glaze fragments above a prehistoric horizon which yielded a Late Neolithic assemblage of soft geometric stamped pottery, coarse-corded ware and well-fired soft geometric ware. The former - soft geometric pottery - is typical of a later phase (2200-1500BC) within the Late Neolithic, the latter well-fired soft geometric pottery and decorated coarse ware is typical of an earlier phase (2900-2200BC) found at the Sha Lo Wan (West) promontory site and at Yung Long for example. Following these observations and results, a prominent objective of the survey was to map the extent and assess the archaeological potential of this sand body. A total of four test pits and 13 auger holes were focused on the gentle valley and rear beach on the eastern side of the study area. In addition to the Tang Dynasty and Late Neolithic period assemblages found within TP3, Tang and/or Late Neolithic artefacts were also recovered from TP2, shovel test-augerholes A3 and A7 to the north of TP3 as well as from TP4 and A17 some 60m to the south. Figure 11 shows the interpreted extent of the sand body based on archaeological and stratigraphic data from the test pit and auger program in this area.

Hilltop

A program of 1 test pit and 1 shovel test failed to find any archaeological material on the hillcrest to the west of the study area. A stone hammer fragment was found within 3 metres of A12 during a surface scan. As a prominent Late Neolithic site was found on a similar feature only 150m to the north on the same headland some traces of similar activity might have been expected. While somewhat smaller and in a less prominent position, when compared with the headland site excavated in 1993, the presence of archaeological remains on this hilltop should not be ruled out.

Western beach

The western beach is of similar length to the eastern beach although the hinterland rises steeply behind the beach. A test pit (TP1) and auger hole (A11) just behind this beach and a series of auger-holes within mid and lower slope positions along the southern and northern margin of the study area also failed to find archaeological remains.

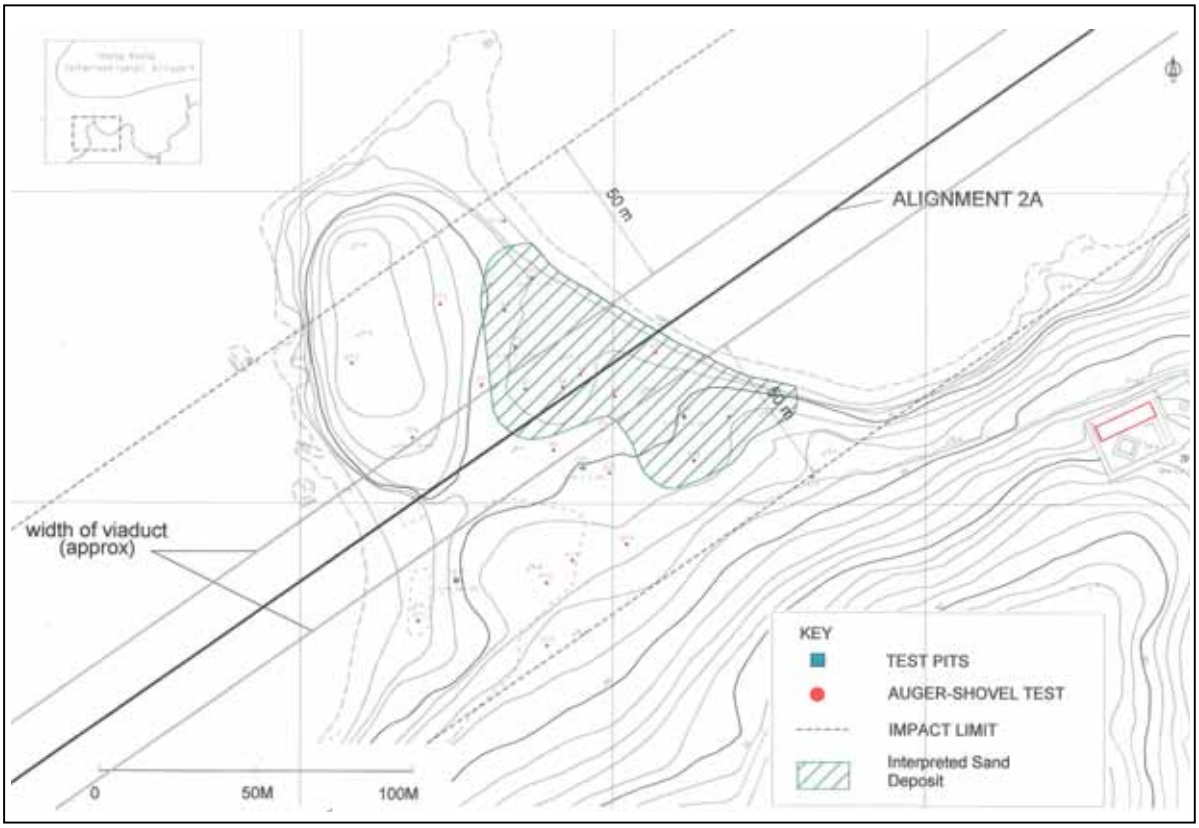

Figure 11 Map showing interpreted archaeologically prospective sand deposit at Sha Lo Wan (West).

Figure 12 Sand deposit near TP3

7 DISCUSSION

The sand body on the eastern side of the remaining Sha Lo Wan (West) headland occupies much of the small valley and gentle hinterland in two broad lobes, occupyinig some 200m^2 with variable thickness to 2 metres. Based on the amount and distribution of both Tang Dynasty and prehistoric pottery from both surface exposure and sample sites TP2, TP3, A3 and A7 there would seem to be a focus of archaeological material from these periods at the northern half of this feature.

The archaeological finds described above and the identification and mapping of what would appear to be an archaeologically prospective sand body on the eastern side of the Sha Lo Wan (West) headland suggest that this feature holds considerable further archaeological potential. While yielding fewer artefacts, the hilltop and slopes to the west of this sand body – by virtue of its physical similarity with the known (and removed) Late Neolithic promontory site to the north – is also considered to hold further archaeological potential. The beach to the west and the hillslopes to the south of the study area - on the basis of the results of the current survey – appear to be of less archaeologically prospective.

It would seem reasonable to speculate that the age and proximity of these finds to the rich Late Neolithic site, which once occupied the original promontory to the north, would suggest a connection between the two. Indeed contemporary occupation of both areas might be strongly argued, not only according to the typology of the respective artefacts, but also that the beach and rear-beach site found during this survey offers a more sheltered setting and (notably) beach access not offered by the rather inaccessible promontory site. There must have been transit between the promontory and the nearby beach during the Late Neolithic and it is difficult to conceive how the beach and rear beach to the south could have been avoided as an area of habitation – at the same time and likely by the same people who were occupied in a range of activities on the promontory.

Evidence however also exists from the present survey for a later phase of Neolithic occupation at the beach and rear beach site. If this is the case, then the area might be considered a Late Neolithic archaeological complex. With the northern part of this complex gone, the southern part may yet provide evidence of both contemporary and later occupation with perhaps varied activity. Both the beach and hilltop areas within the study area are therefore of considerable further archaeological potential.

8 RECOMMENDATIONS

A) As the proposed 2A viaduct will span the Sha Lo Wan (West) site there will be no direct impacts from the proposed construction, however the archaeological site should avoid any indirect impacts with particular attention to the defined sand bar and hilltop within the study area. No construction activities and personel should be allowed to enter the archaeological site.

B) Given the priority within EIA -TM Annex 10 and 19 for the preservation of archaeological remains *in-situ* and in totality - and the fact that there will be no physical encroachment on the site - then no further excavation works are deemed necessary.

C) If there are to be any direct or indirect impacts from the proposed viaduct, then *in situ* preservation / preservation in totality is preferred. If impacts are unavoidable, according to EIAO Annex 19, a rescue excavation will be required to recover data and record the site. Sufficient time and funding will be made available for conducting a rescue excavation to salvage the archaeological record at this site.

D) Periodic monitoring of construction works should be conducted to ensure avoidance of any impacts. Subsequent to construction, monitoring should be conducted to ensure maintenance of (natural) protective vegetation and mitigation of erosion, should any shadow effects of the viaduct become evident on the local vegetation and soil cover.

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APPENDIX 1

AUGER-SHOVEL TEST DATA

Auger No.	Location E	Location N	Depth (cm)	Description	Archaeological summary
1	807431.1	816910.4	0-12	Dark brown sand	**Nil**
			12-65	Lighter brown sand	
			65-110	Yellow-brown fine-medium sand	
			110-143	Orange-brown medium sand	
			143-163	Weathered granite	
2	807417.2	816911.6	0-16	Dark brown organic sand	
			16-45	Mid brown fine-medium sand	
			45-50	Weathered granite	**Nil**
3	807424.4	816935.4	0-28	Dark brown-black organic sand	
			28-52	Yellow-brown fine-medium sand	
			52-85	Mid brown fine-medium sand	
			85-128	Orange-brown medium-coarse sand	**Coarse corded ware sherd @ 112cm**
			128+	Weathered granite	
4	807459.9	816908.1	0-13	Dark brown sand	**Nil**
			13-45	Mid brown fine-medium sand	
			45-64	Yellow-brown coarse sand and occasional pebbles	
			64+	Weathered granite	
5	807455.9	816897.3	0-20	Brown fine-medium sand	**Nil**
			20-43	Mid brown quartz sand	
			43+	Weathered granite	
6	807440.2	816890.8	0-22	Brown fine-medium sand	
			22-33	Mid brown quartz sand	**Nil**
			33+	Weathered granite	
7	807419.9	816943.8	0-16	Dark brown organic sand	
			16-42	Mid brown sand	
			42-70	Yellow-brown medium-coarse sand	**Coarse corded sherd**
			70-90	Orange-brown coarse sand	
			90+	Weathered granite	

Auger No.	Location E	Location N	Depth (cm)	Description	Archaeological summary
8	807443.1	816911.0	0-12	Dark brown sand	
			12-33	Mid brown sand	
			33-56	Mid brown medium-coarse sand	
			56+	Weathered granite	**Nil**
9	807448.8	816915.0	0-11	Dark brown sand	
			11-45	Mid brown fine-medium sand	
			45-65	Brown slightly coarser sand	
			65+	Weathered granite	**Nil**
10	807424.2	816964.3	0-10	Dark brown sand and refuse	
			10+	Impenetrable rubble	**Nil**
11	807397.0	816835.9	0-34	Dark brown sand	
			34-68	Light brown fine sand	
			68-95	Orange-brown coarse gravelly sand	
			95+	Weathered granite	**Nil**
12	807375.6	816918.5	0-9	Brown organic sandy loam	
			9-25	Brown coarse gravelly loam	
			25-50	Yellow-brown stoney soil	
			50+	Bedrock - granite	**Nil**
13	807403.9	816937.5	0-26	Brown organic loamy topsoil	
			26-44	Light brown sandy loam with rubble (colluvium)	
			44-58	Brown organic horizon (colluvium)	
			58-88	Weathered granite	**Nil**
14	807446.4	816855.5	0-8	Dark brown loamy sand	
			8-42	Yellow-brown gritty loam	
			42-68	Orange-brown coarse gravelly clay	**Nil**

Auger No.	Location E	Location N	Depth (cm)	Description	Archaeological summary
15	807438.1	816848.1	0-10	Dark brown loamy sand	
			10-34	Yellow-brown gritty sand/loam	
			34-66	Orange sandy clay and gravel	**Nil**
16	807438.2	816828.0	0-14	Brown organic sandy loam	
			14-39	Mid brown coarse angular gravelly loam	
			39-55	Orange coarse sandy clay with weathered parent material	**Nil**
17	807496.3	816901.6	0-8	Brown fine loamy sand	**Small crackled glaze sherd (Tang)**
			8-28	Brown fine-medium sand	
			28-50	Mid brown medium sand	
			50-68	Orange coarse sandy clay (weathered parent material)	**Nil**
18	807485.3	816887.5	0-14	Dark brown fine sand	
			14-58	Light brown fine-medium sand	
			58-75	Mid brown clayey sand	
			75-84	Weathered granite	**Nil**
19	807463.7	816860.7	0-8	Brown loamy sand	
			8-41	Mid brown coarse sand	
			41-55	Weathered parent material	**Nil**
20	807523.1	816882.4	0-10	Brown loamy sand	
			10+	Impenetrable rock	**Nil**
21	807458.2	816883.5	0-9	Brown sandy loam	
			9-38	Mid brown coarse gritty sand	
			38-52	Weathered granite	**Nil**
22	807472.8	816922.2	0-38	Beige-light brown fine beach sand	
			38-67	Yellow-brown beach sand with minor small pebbles	
			67-80	Mid brown medium-coarse sand	
			80-85+	Weathered granite	**Nil**

APPENDIX 2

FINDS PHOTOGRAPHS

FIELD SCAN WEST HILLTOP

Photo 1 Polished stone hammer found on hilltop (west)

TEST PIT 2

Tang pottery context 4

Photo 2 Test Pit 2 Context 4 Tang Dynasty plain-ware base fragment

TEST PIT 3
Tang pottery (Context 3)

Photo 3 Test Pit 3 Context 3 Tang Dynasty ribbed plain ware.

Photo 4 Test Pit 3 Context 3 Tang Dynasty plain ware rim sherds

Photo 5 Test pit 3 Context 3 Tang Dynasty plain ware ribbed sherds and base.

TP3 Tang pottery Context 3 (contd)

Photo 6 Test Pit 3 Context 3 Tang Dynasty crackled glaze sherds

Test Pit 3
Late Neolithic pottery (Context 4)

Photo 7 Test Pit 3 Context 4
Soft geometric pottery sherds (L Neolithic, 2200-1500BC)

Photo 8 Test Pit 3 Context 4
Well-fired soft geometric leaf-vein design geometric sherds (L. Neolithic, 2900-2200BC)

Photo 9 Test Pit 3 Context 4
Wave design decorated coarse-ware sherd (L Neolithic, 2900-2200BC)
.

TEST PIT 3 Late Neolithic pottery (context 4)

Photo 10 Test Pit 3 Context 4
Weathered coarse-corded ware
(L Neolithic)

Photo 11 Test Pit 3 Context 4
Highly weathered coarse corded
ware (L Neolithic)

Test Pit 3 Late Neolithic pottery (Context 5)

Photo 12 Test Pit 3 Context 5
Coarse corded ware, soft
geometric (mid right) and
fragment of polished adze (lower
right) (L Neolithic).

TEST PIT 4
Tang pottery (Context 3)

Photo 13 Test Pit 4 Context 3
Tang Dynasty black-ware sherds

AUGER – SHOVEL TEST Finds

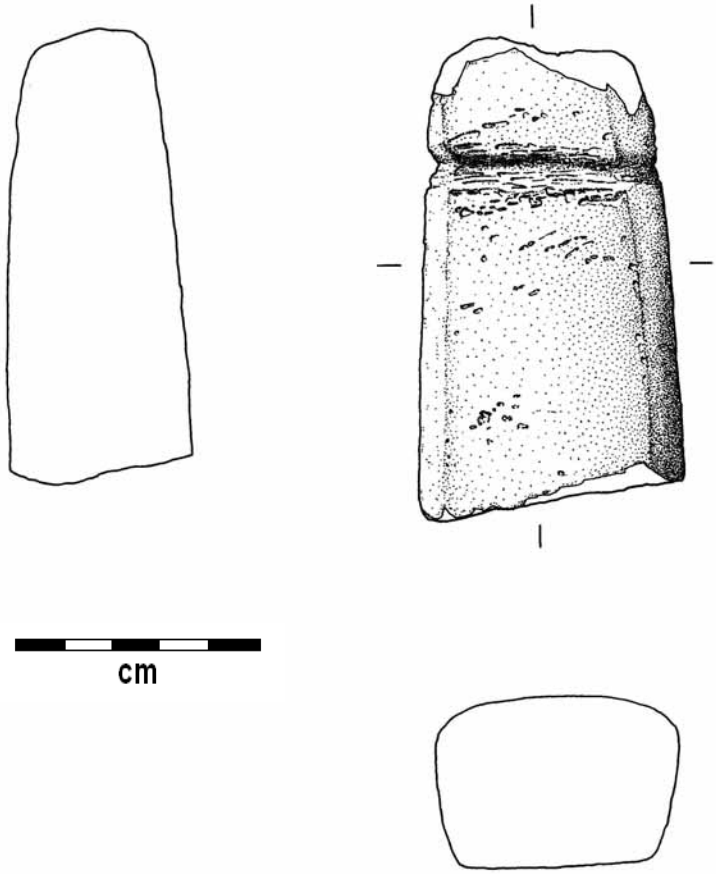
Photo 14 Shovel test-augerhole 3 Coarse – corded ware sherd found at 112cm depth

Photo 15 Shovel test-augerhole 7 Coarse –corded ware sherd found at 65cm depth

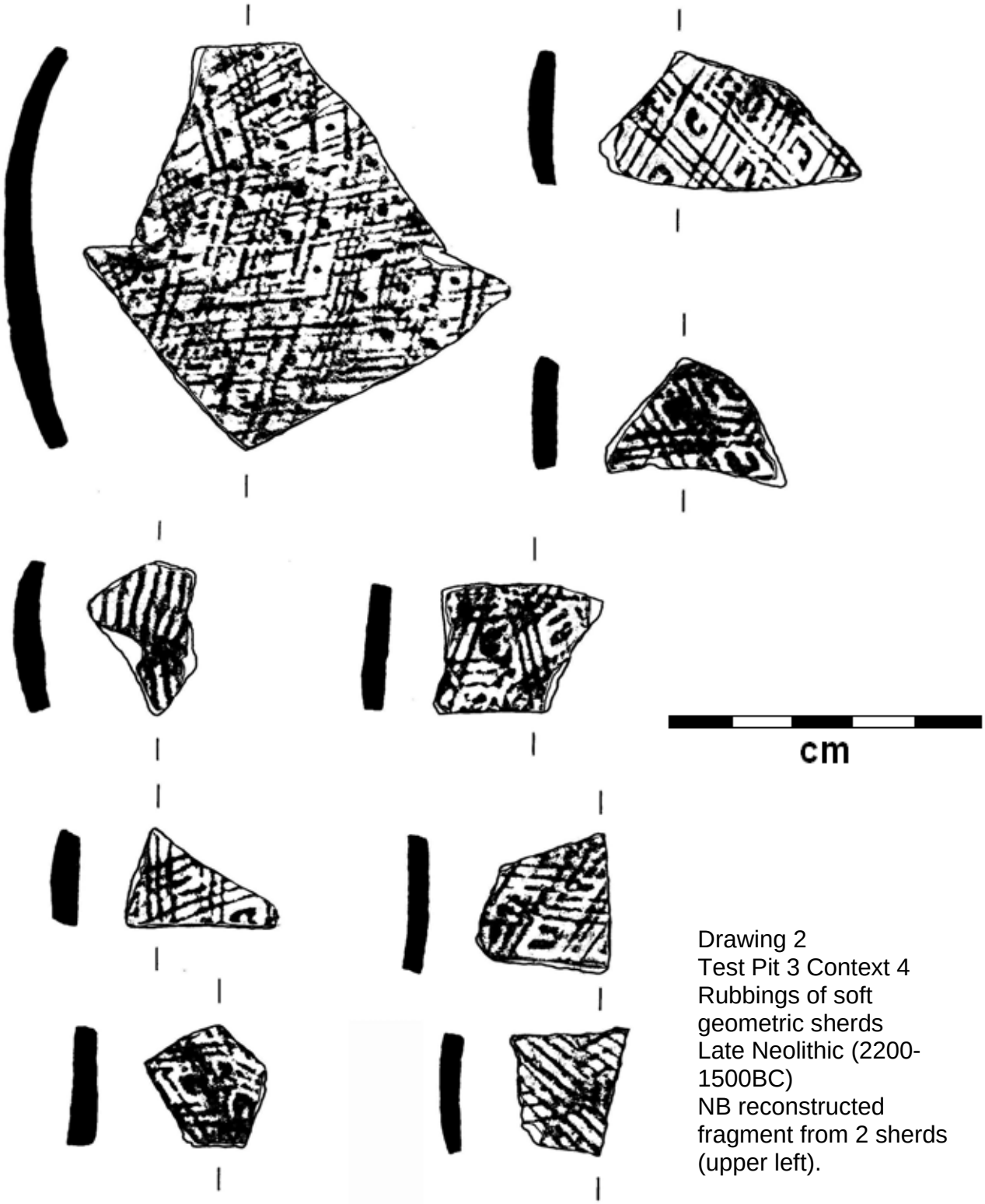
Photo 16 Auger hole 17 Tang Dynasty crackled glaze porcelain

APPENDIX 3

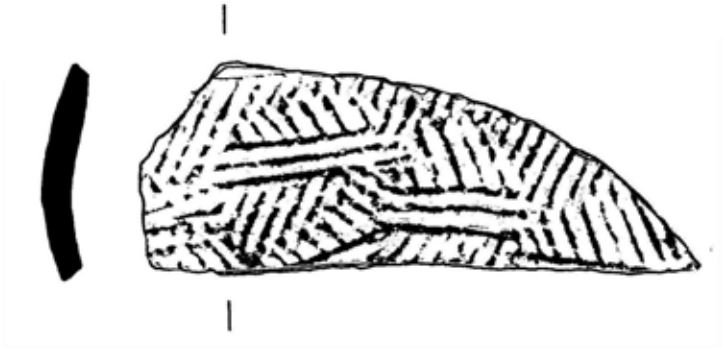
Drawings and pottery rubbings



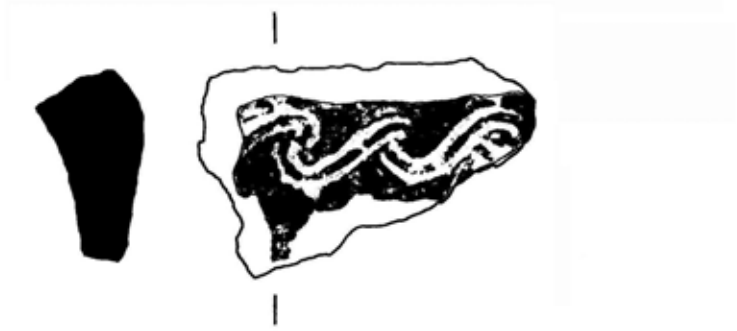
Drawing 1
Drawing and sections of polished stone hammer found during field scan on hilltop (west)



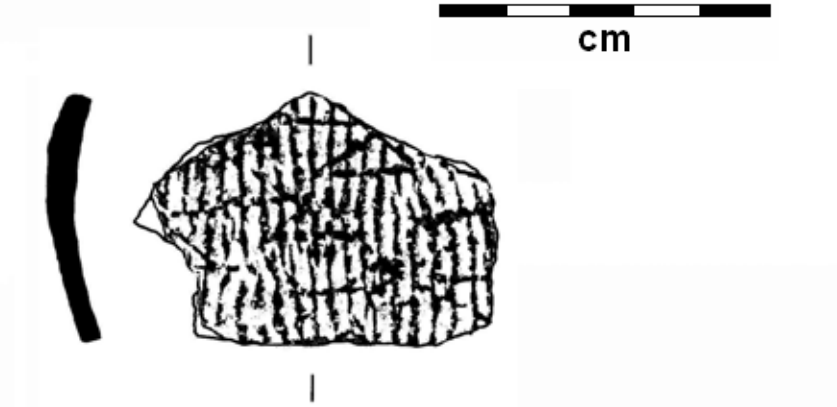
Drawing 2
Test Pit 3 Context 4
Rubbings of soft geometric sherds
Late Neolithic (2200-1500BC)
NB reconstructed fragment from 2 sherds (upper left).



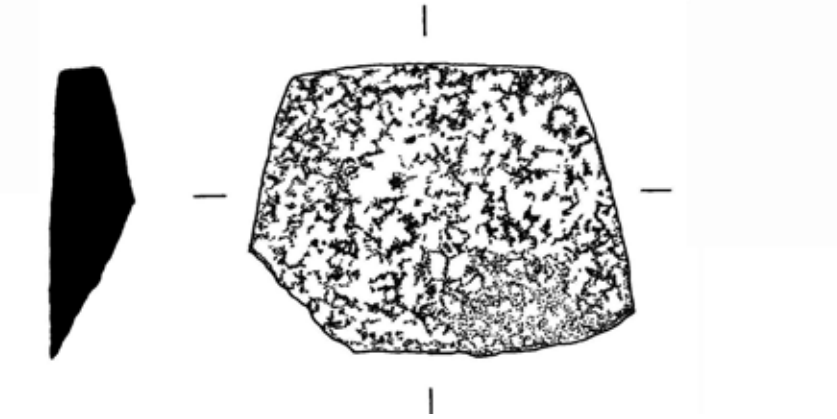
Drawing 3
Test pit 3 Context 4 Well-fired soft geometric (leaf-vein pattern) pottery fragment (Late Neolithic 2900-2200BC) – reconstructed from 3 sherds



Drawing 4
Test pit 3 Context 4 Decorated coarse-ware sherd (Late Neolithic 2900-2200BC).



Drawing 5
Test Pit 4 Context 5 Coarse-ware sherd



Drawing 6
Test Pit 4 Context 5 Polished stone adze

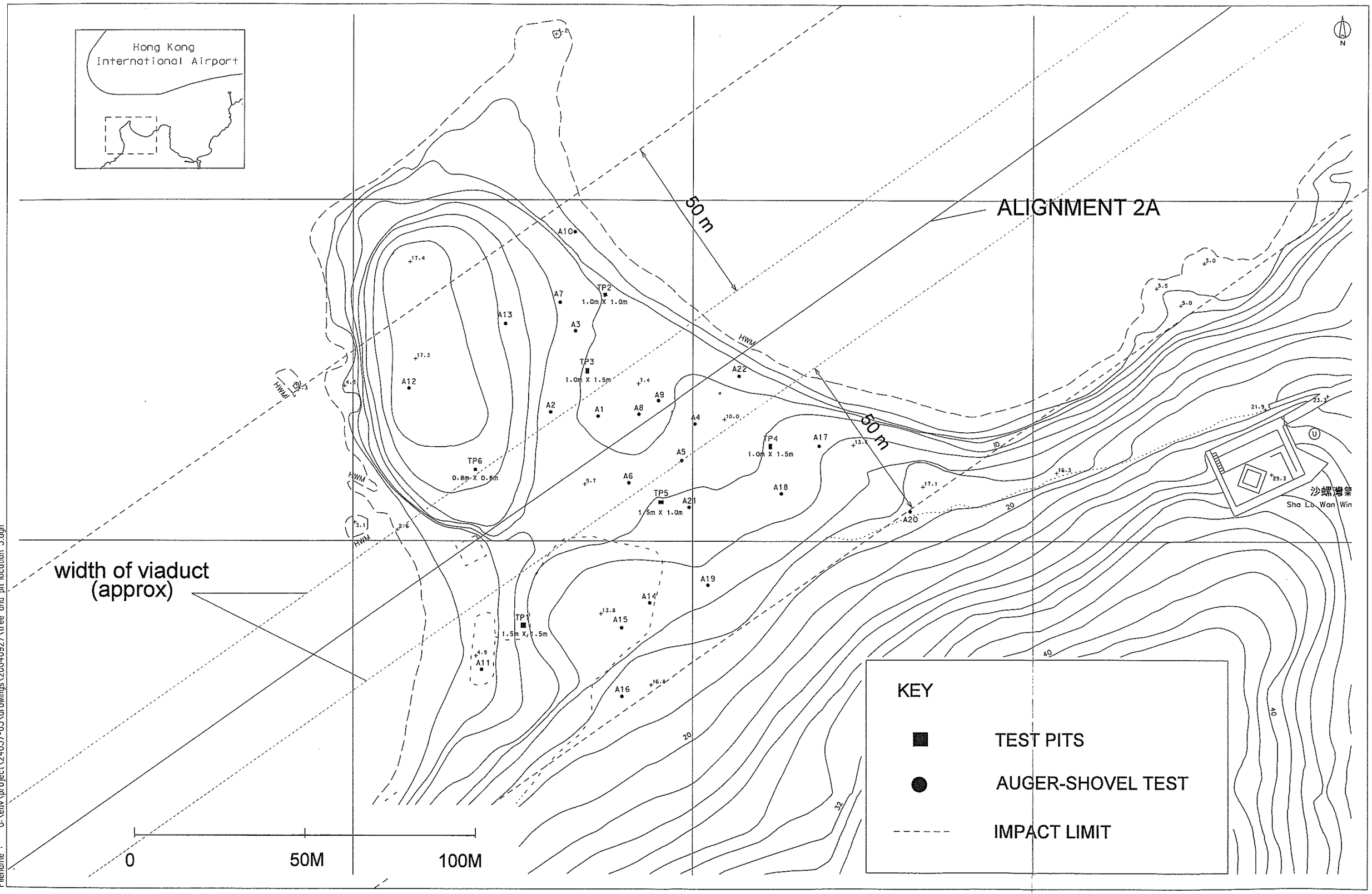
APPENDIX 4

ARCHAEOLOGICAL FINDS SUMMARY

Sample site	Context	No. Sherds	Period > Tang	Prehistoric			Other
TP2	4	1	1 Tang plain ware sherd				
TP3	3	22	19 Plain ware 3 Celadon				
	4	63		13 Soft geometric	7 well-fired soft geometric sherds	43 coarse corded	
	5	10		1 soft geometric		9 coarse corded	Polished adze fragment
TP4	3	4	4 Plain ware sherds				
A3		1				1 coarse corded	
A7		1				1 coarse corded	
A17		1	1 Tang porecelain				
Field Scan near A12							Polished stone adze fragment

APPENDIX 5

1:1000 sampling location map



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				Checked: FC	Approved: YWY
				Scale: 1:1000 (A3)	Drawing No. Appendix 5
					Rev. A

Rev	Description	Date
A	FIRST ISSUE	09/04

APPENDIX 12E

Images

Index

Image 1 Location Map of Sha Lo Wan Temples

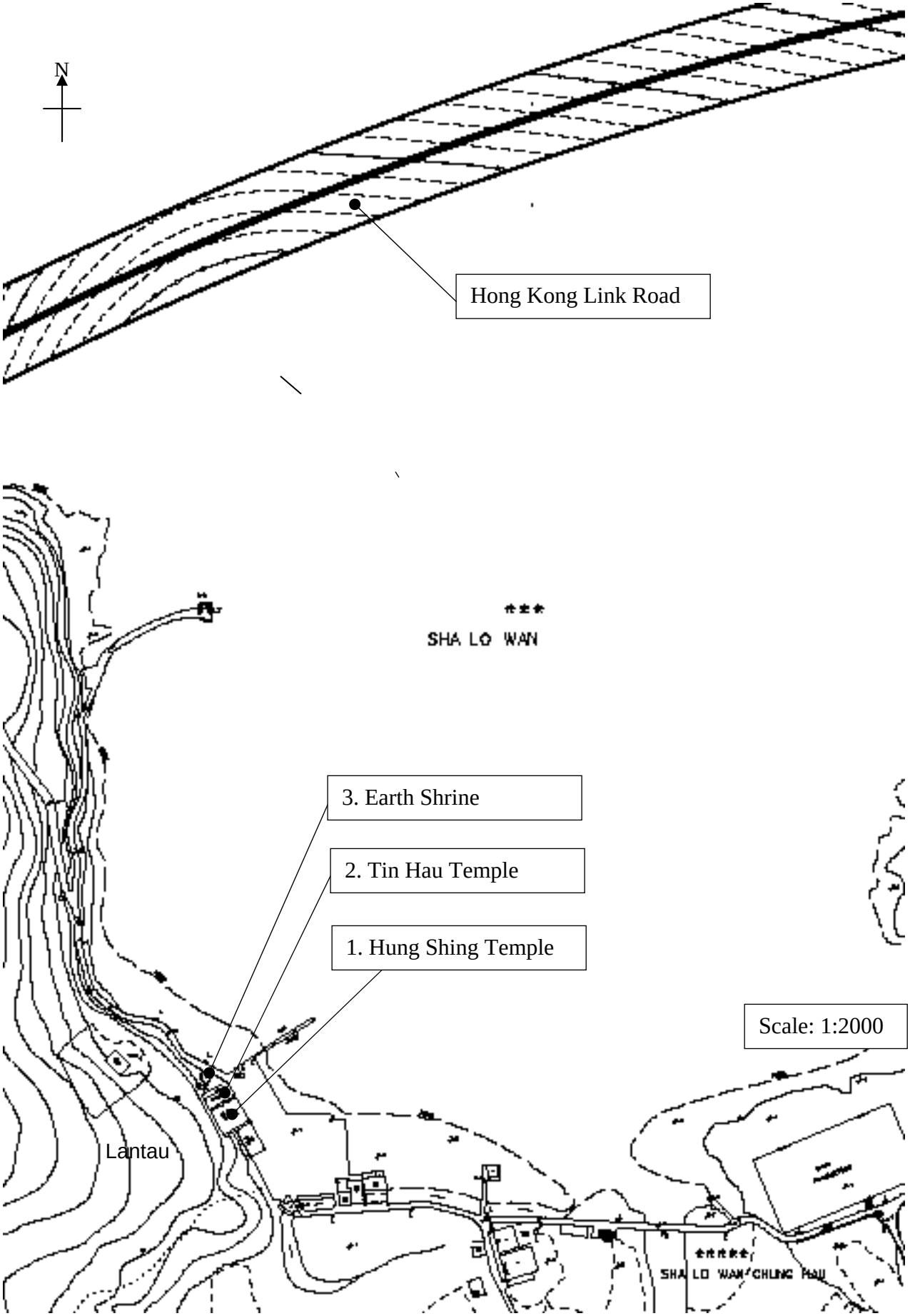


Image 2 Hung Shing Temple and Tin Hau Temple (Labelled as 1 and 2 respectively)

Image 3 The Door and Roof Motifs of Hung Shing Temple

Image 4 The Cast Iron Bell at Hung Shing Temple

Image 5 Earth Shrine (labelled as 3)

Image 6 Chi Wen in Tin Hau Temple

Image 7 Sha Lo Wan Grave

Image 8 Geophysical Surveys

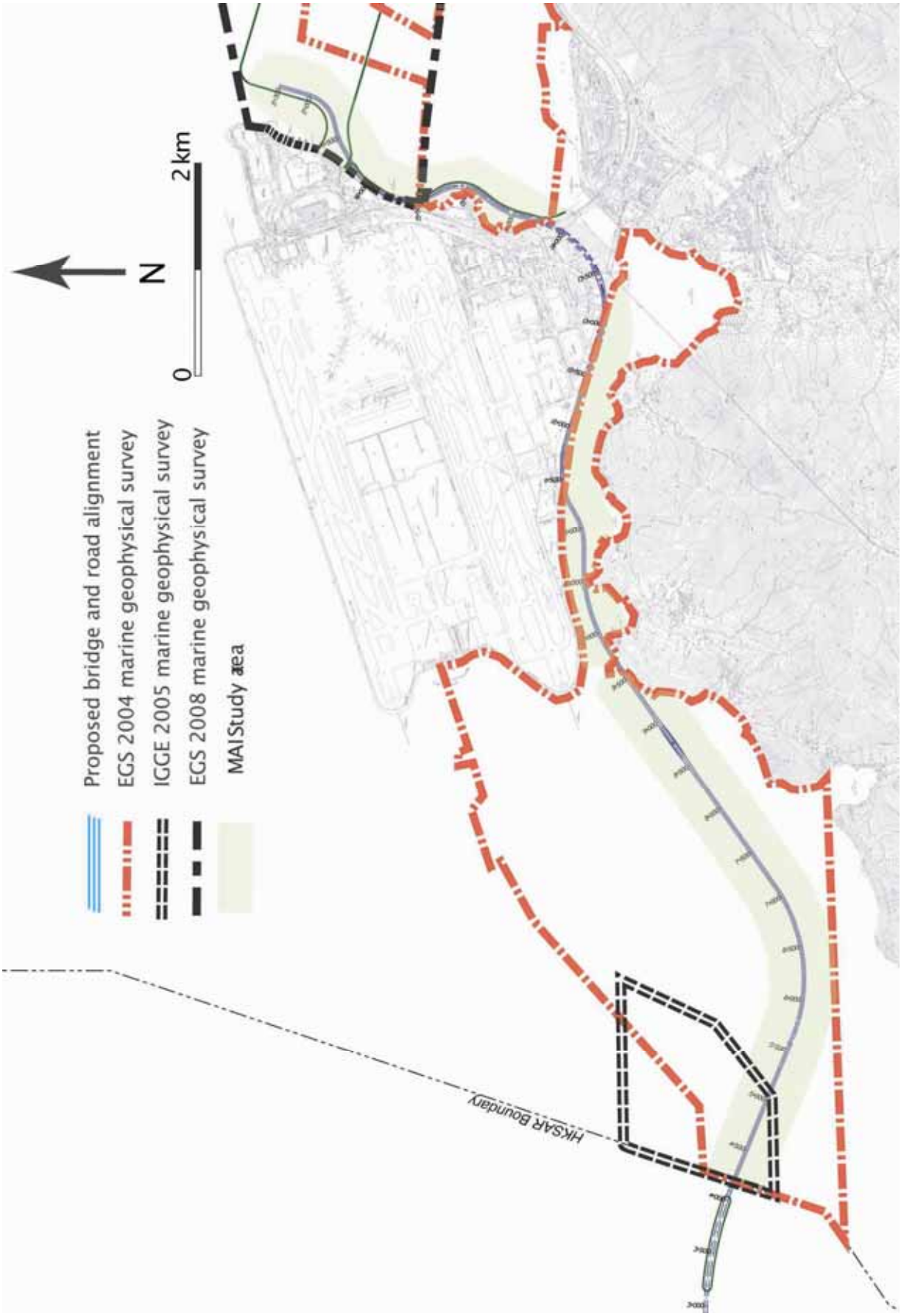


Image 9 Geology of the Study Area

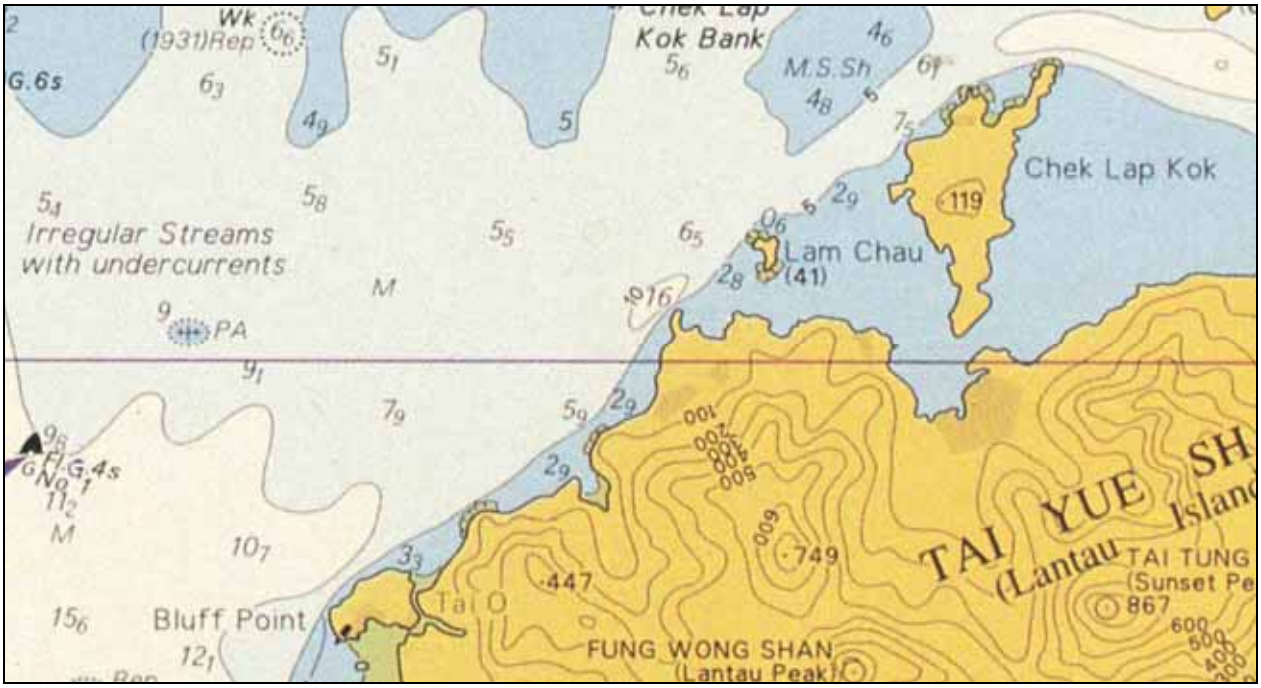


Image 10A Shallow Water of the Study Area (East of CLK Island)

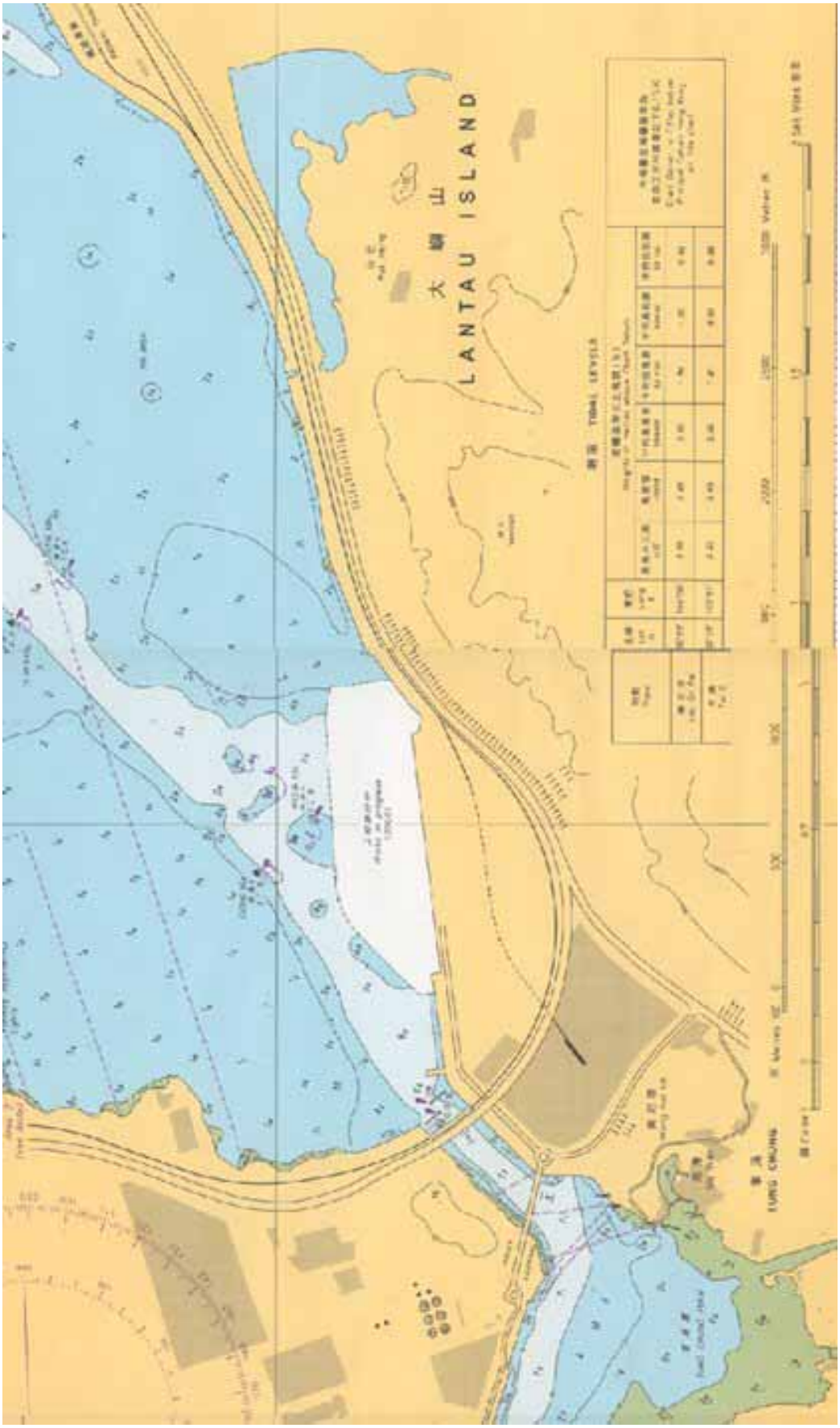


Image 10B Shallow Water of the Study Area (West of CLK Island)

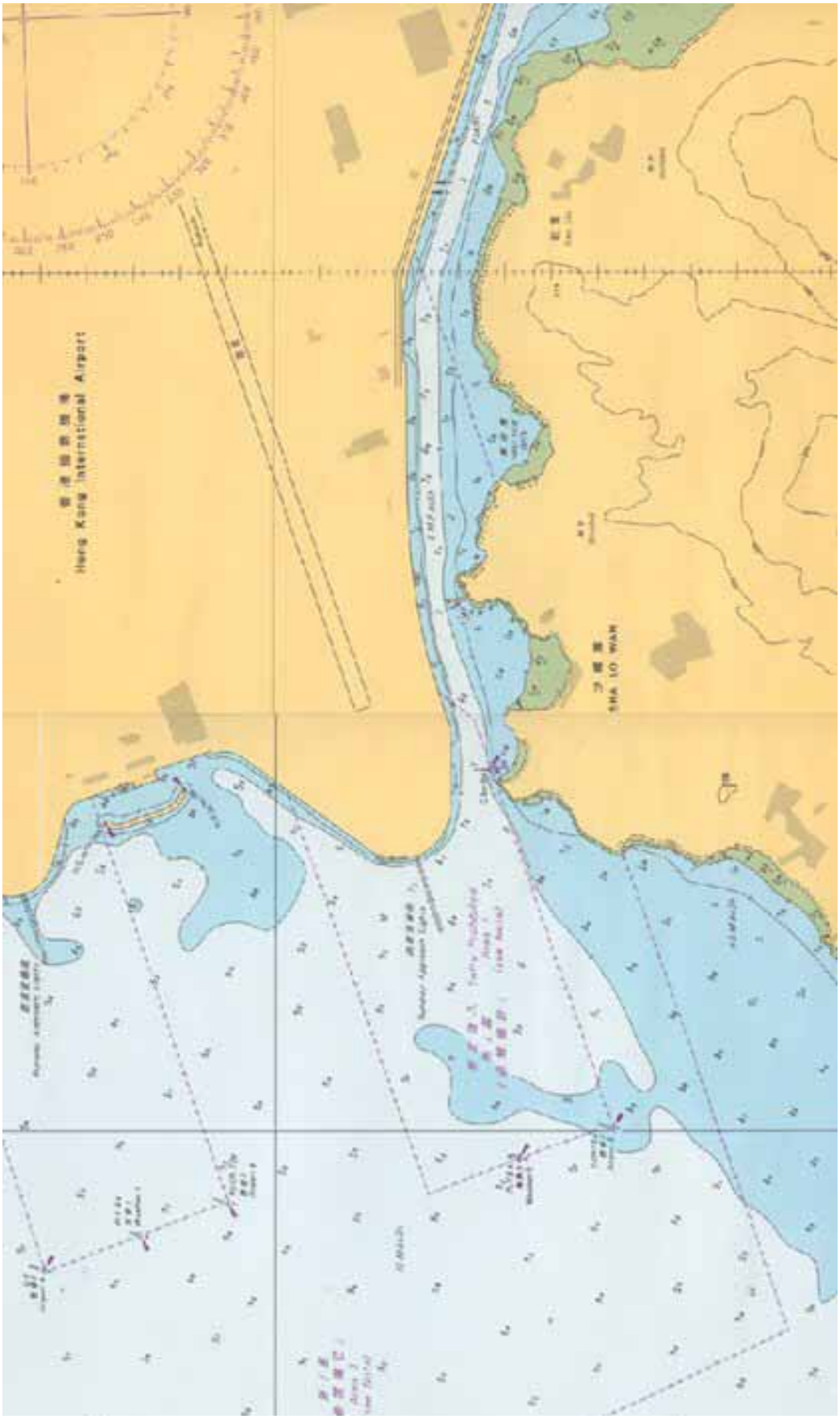


Image 11 Shoal Waters to the West of Chep Lap Kok

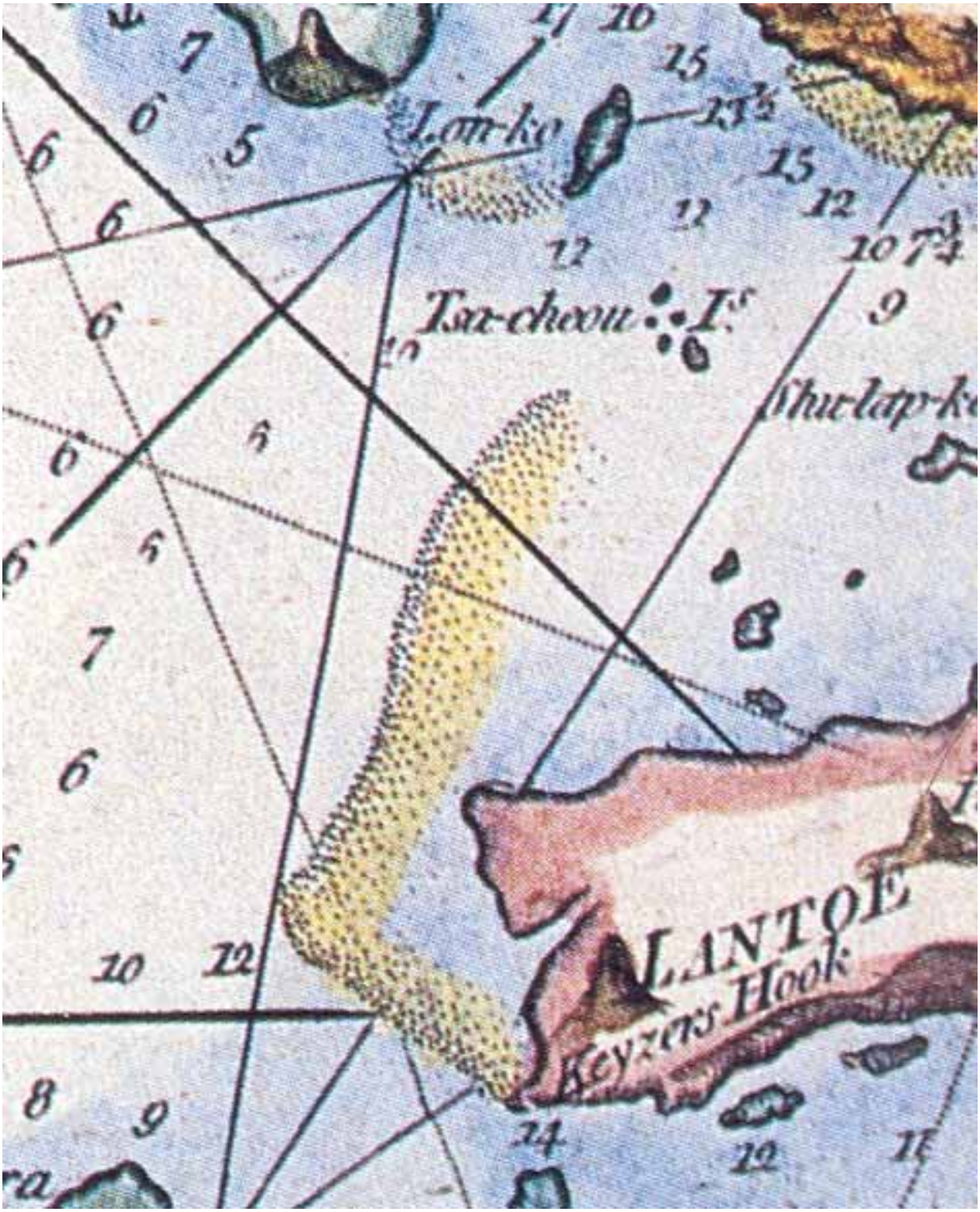


Image 12 Borehole Data for North Lantau and Tung Chung

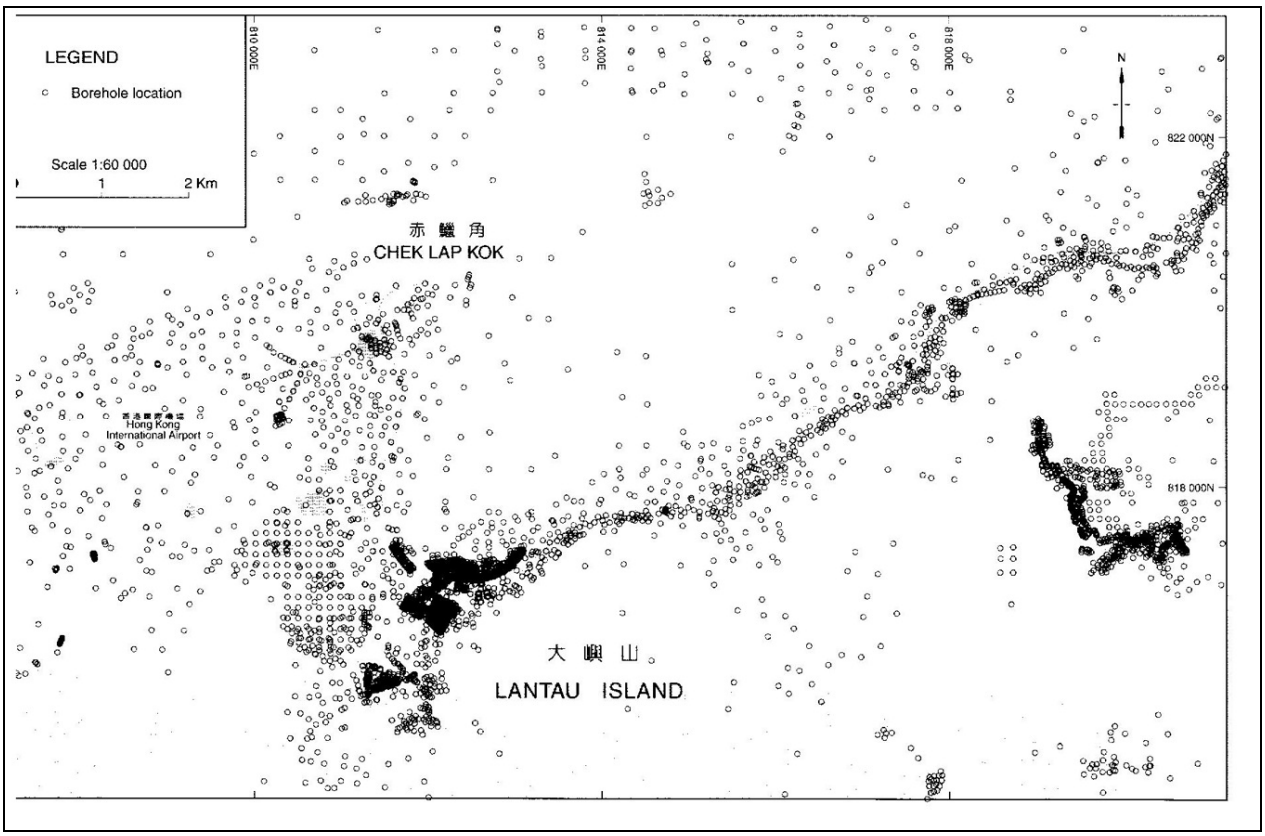


Image 13 Borehole ESC 17 located off North-west Lantau

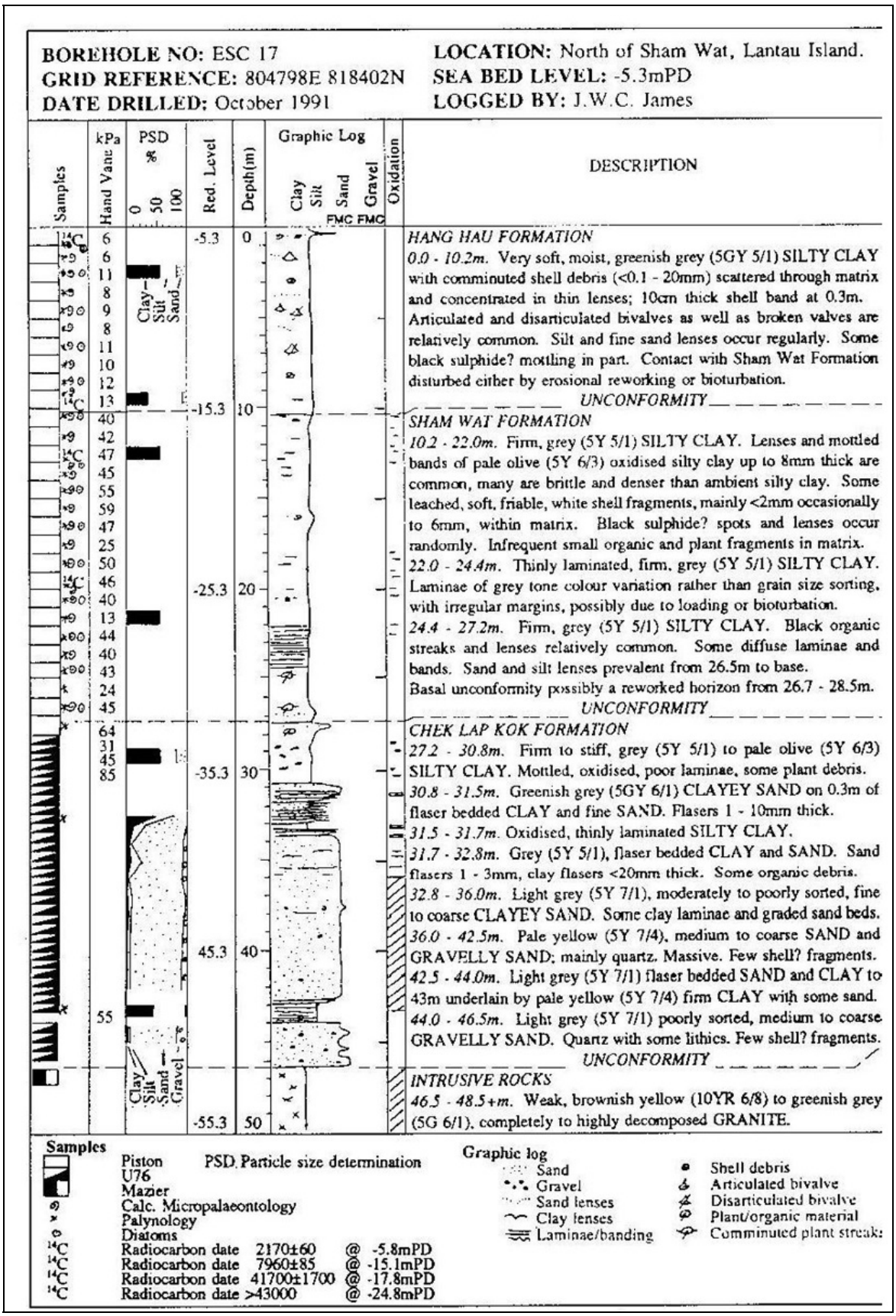


Image 14 Predominant Wind Directions for the Hong Kong Area West of Lantau

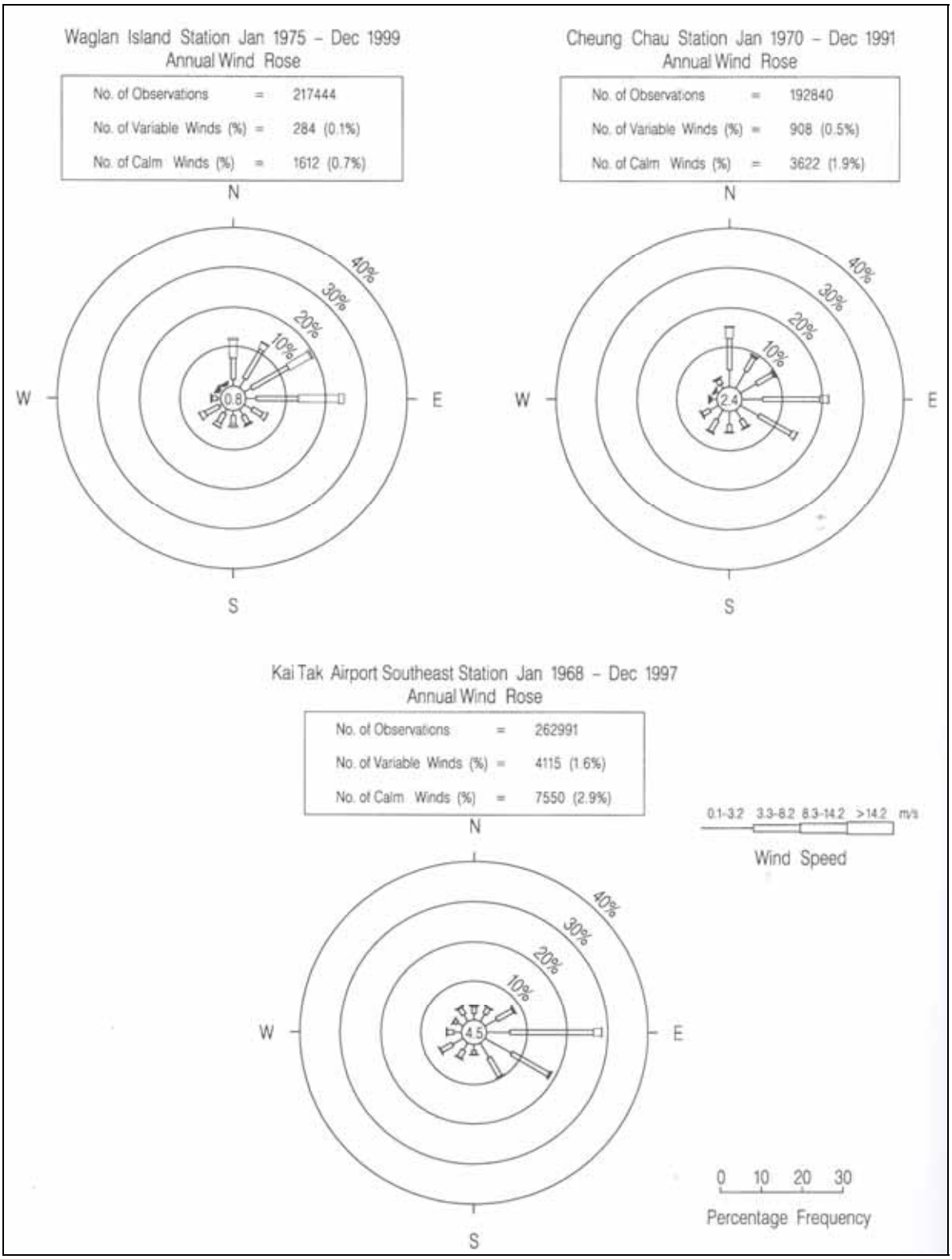


Image 15 The Early Holocene for the Landscape North of Lantau

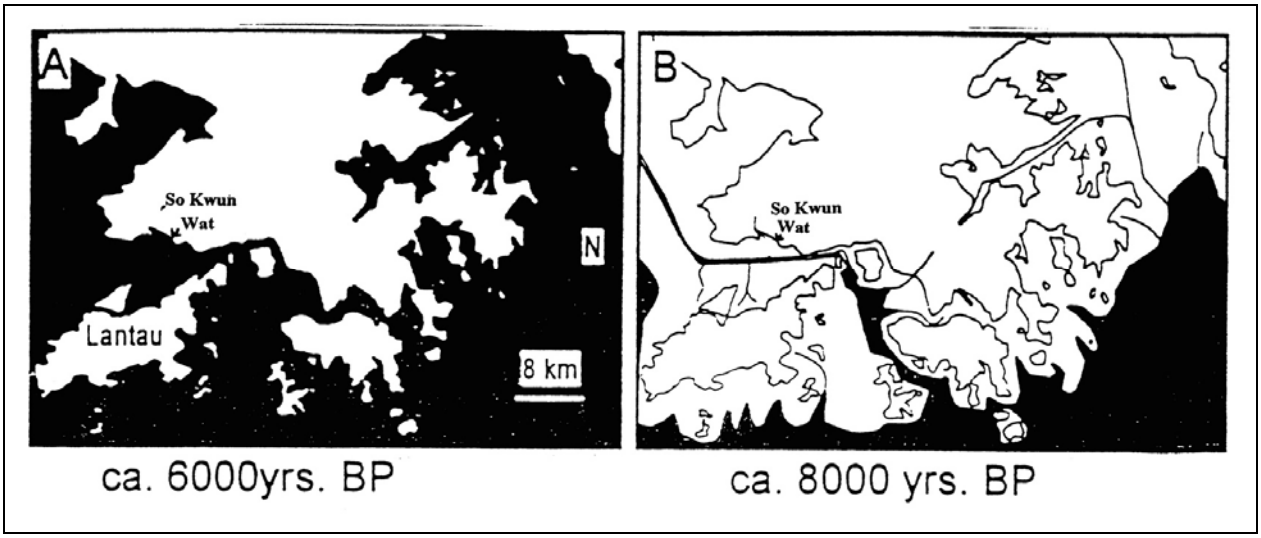


Image 16 Artist's representation of a Tang Dynasty tower ship (left) and Song Dynasty war junk

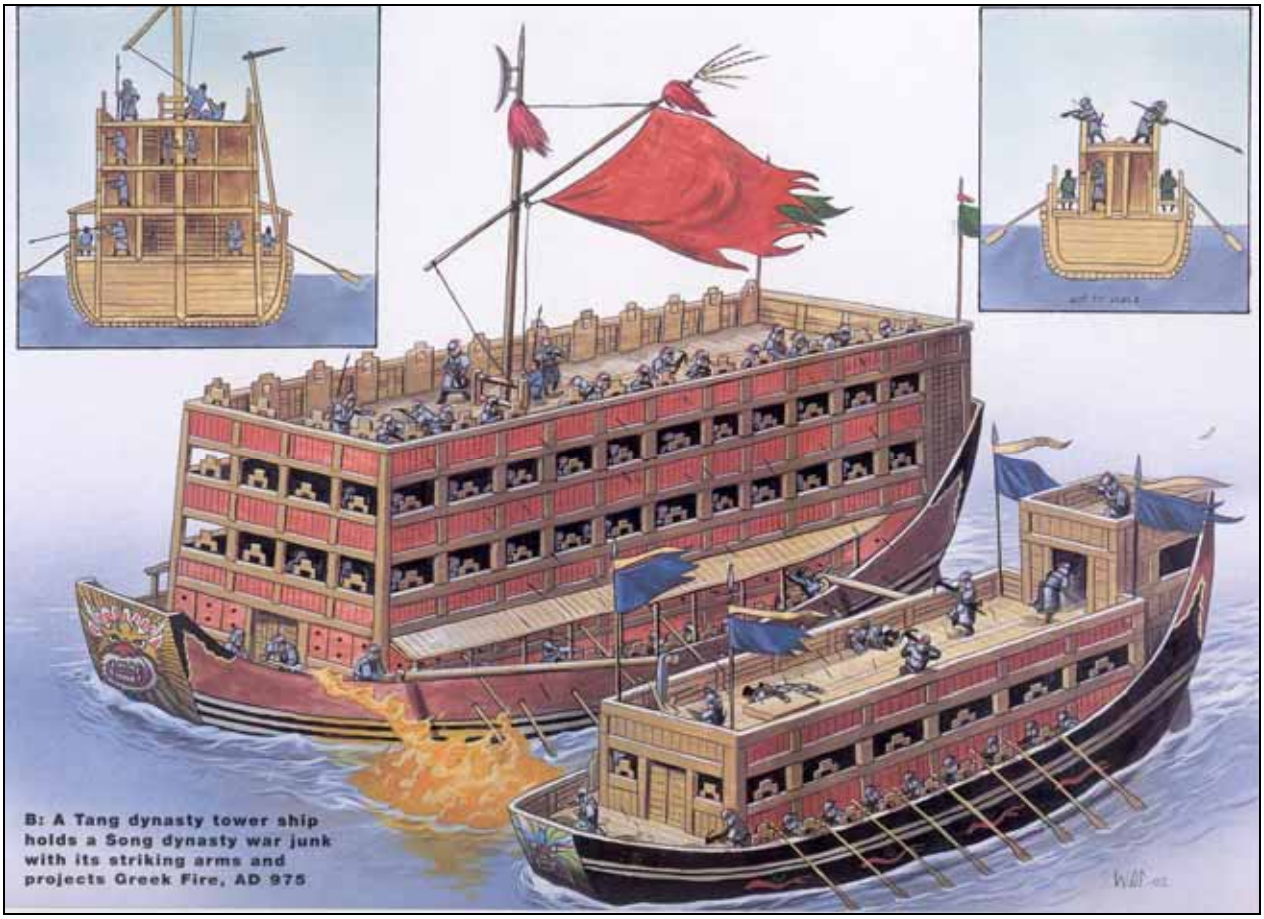


Image 17 Portion of 1856 French chart showing location of Tuen Muen in relation to the study area

Image 18 Artist's representation of a Yuan Dynasty war junk impaled on wooden stakes

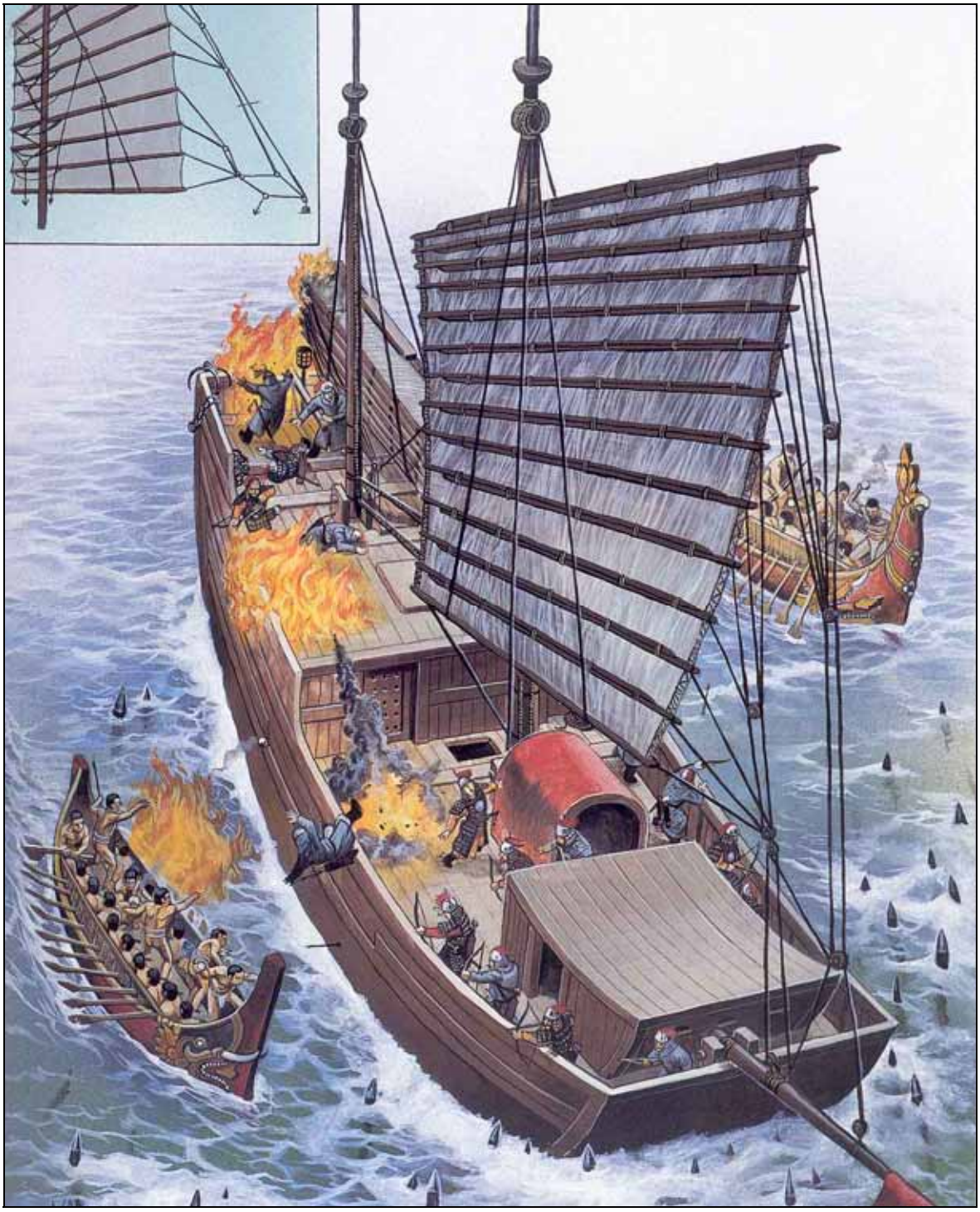


Image 19 Pirate war junks of the early 19th century C.E. in the Pearl River region

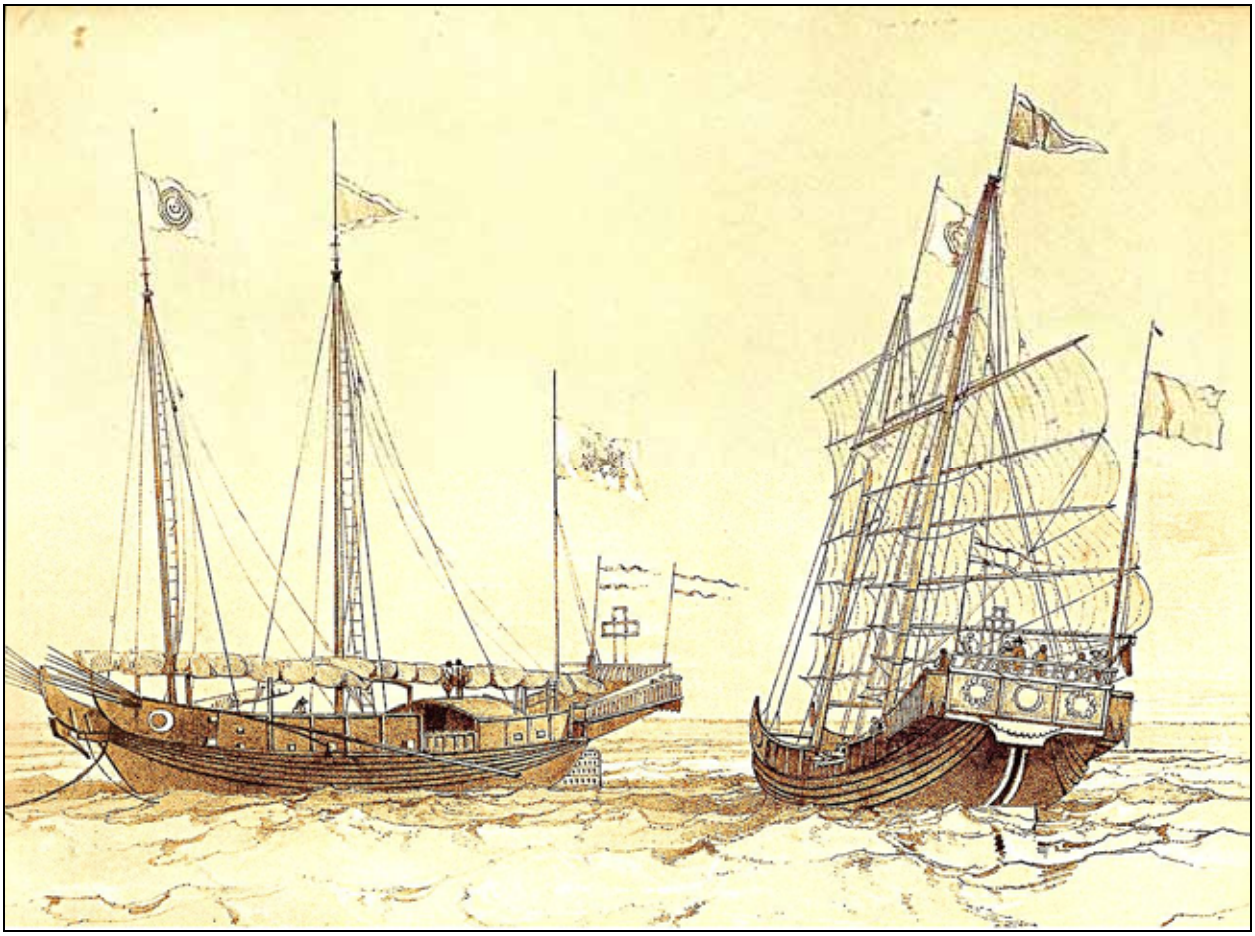


Image 20 Land Reclamation from Northern Chore of Lantau to East of Tung Chung

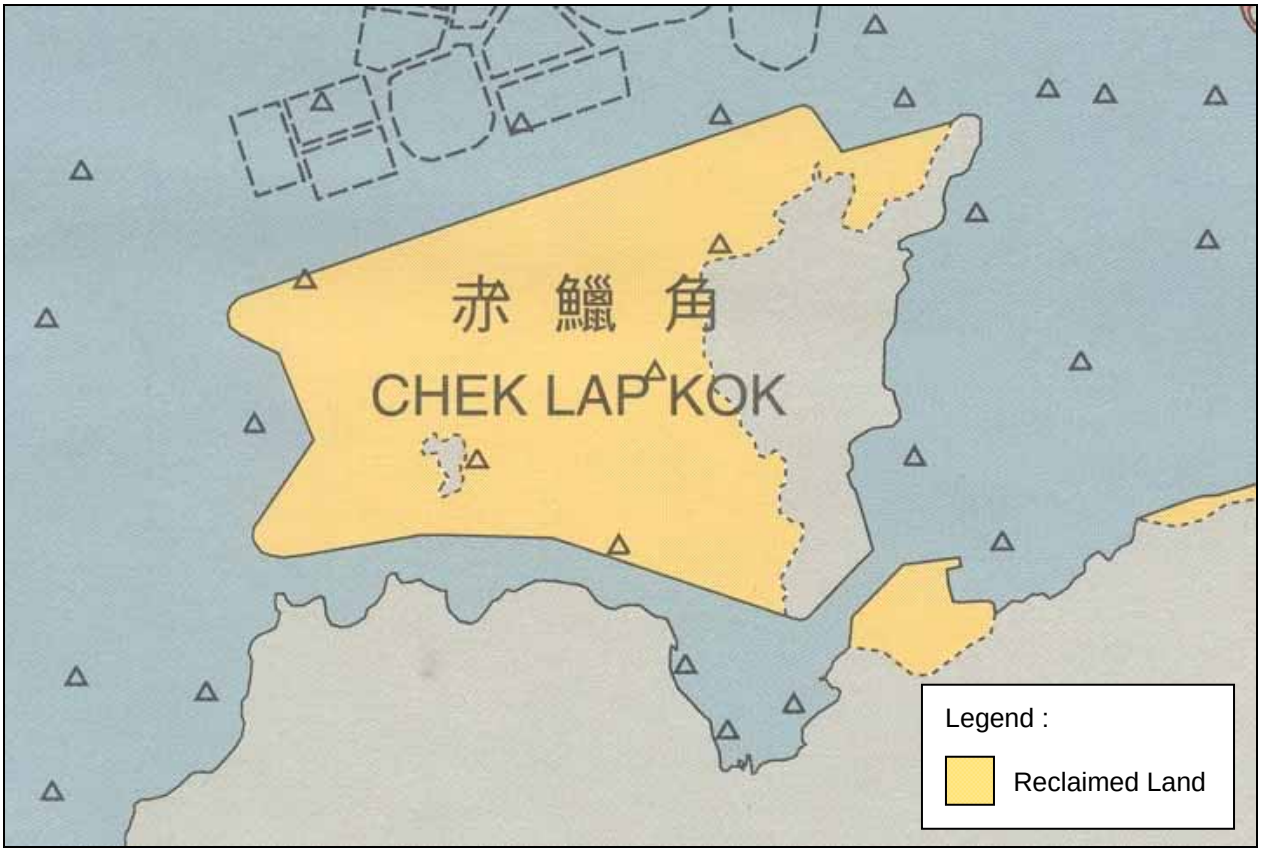


Image 21 Shipwreck Record of UK Naval Hydrographic Office prior to 1997

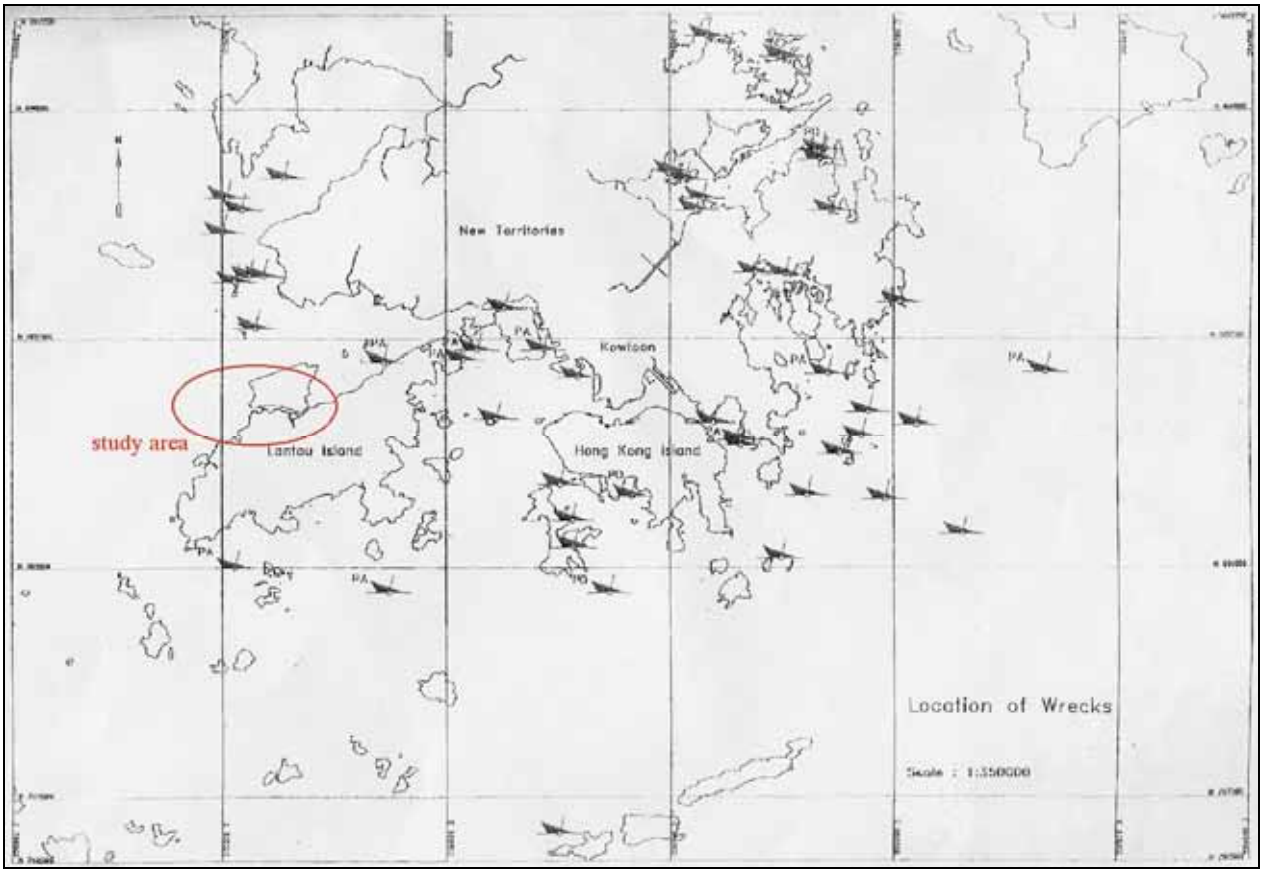


Image 22 Submerged Cultural Heritage in the 1990 Chart of the Outer Approaches to Hong Kong

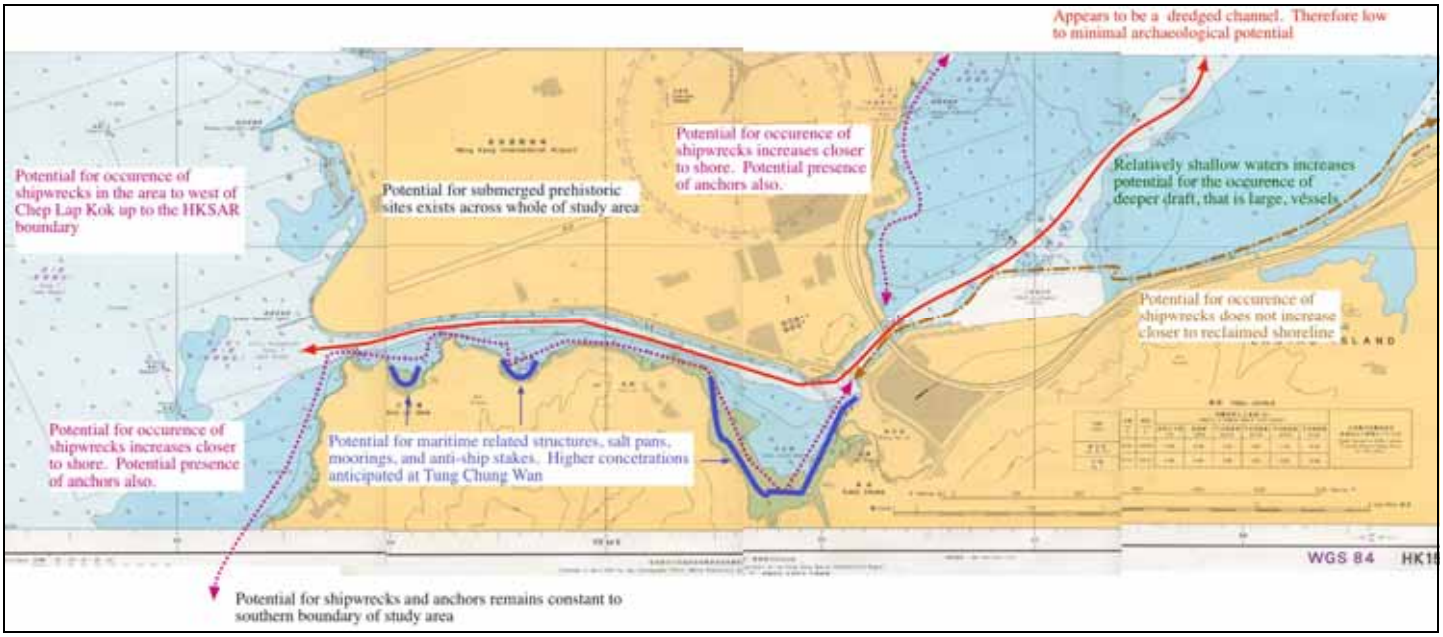


Image 23 Marine Geophysical Surveys

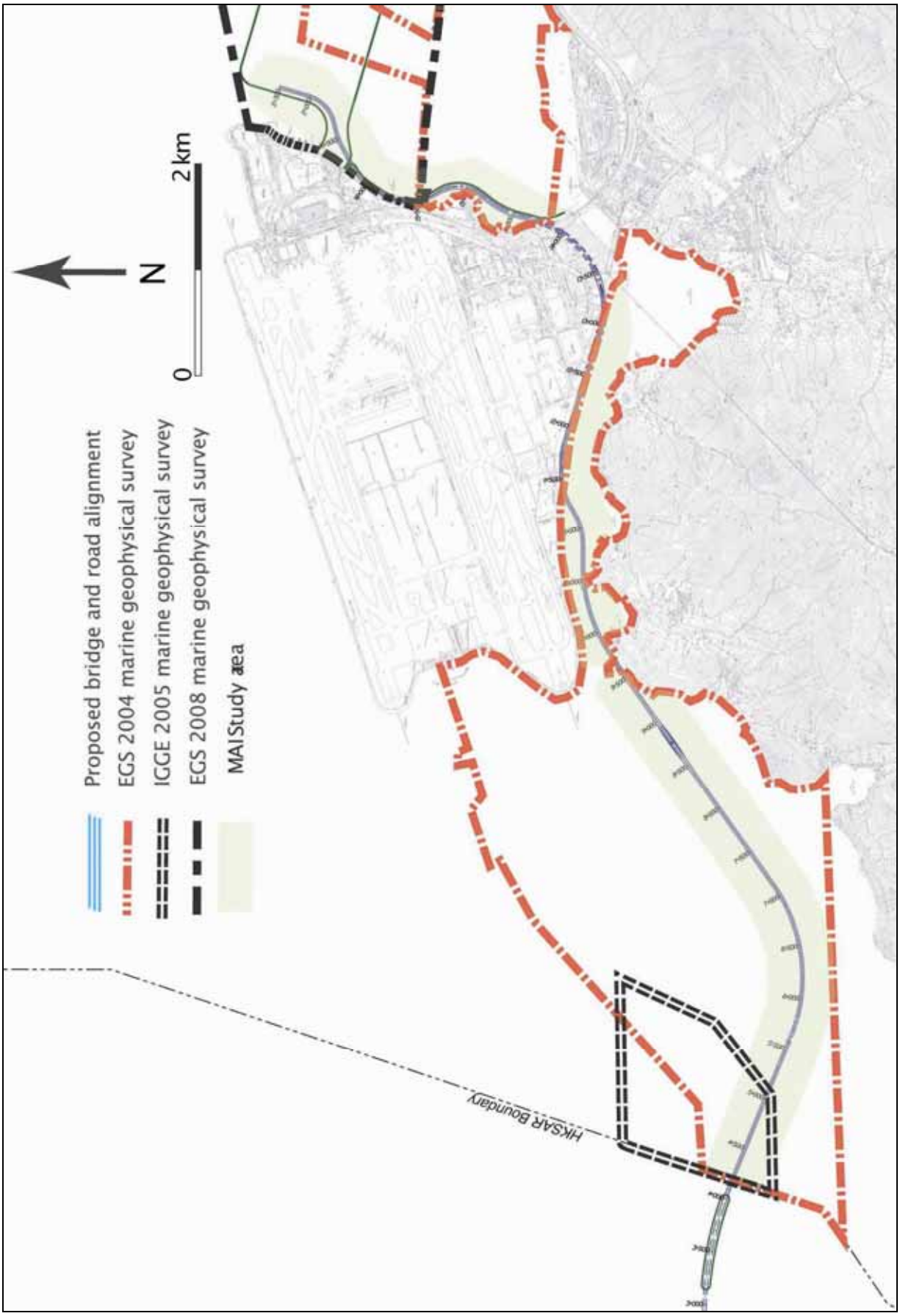


Image 24 Area not surveyed on the eastern shore of CLK Island, circled in red. [12-40]

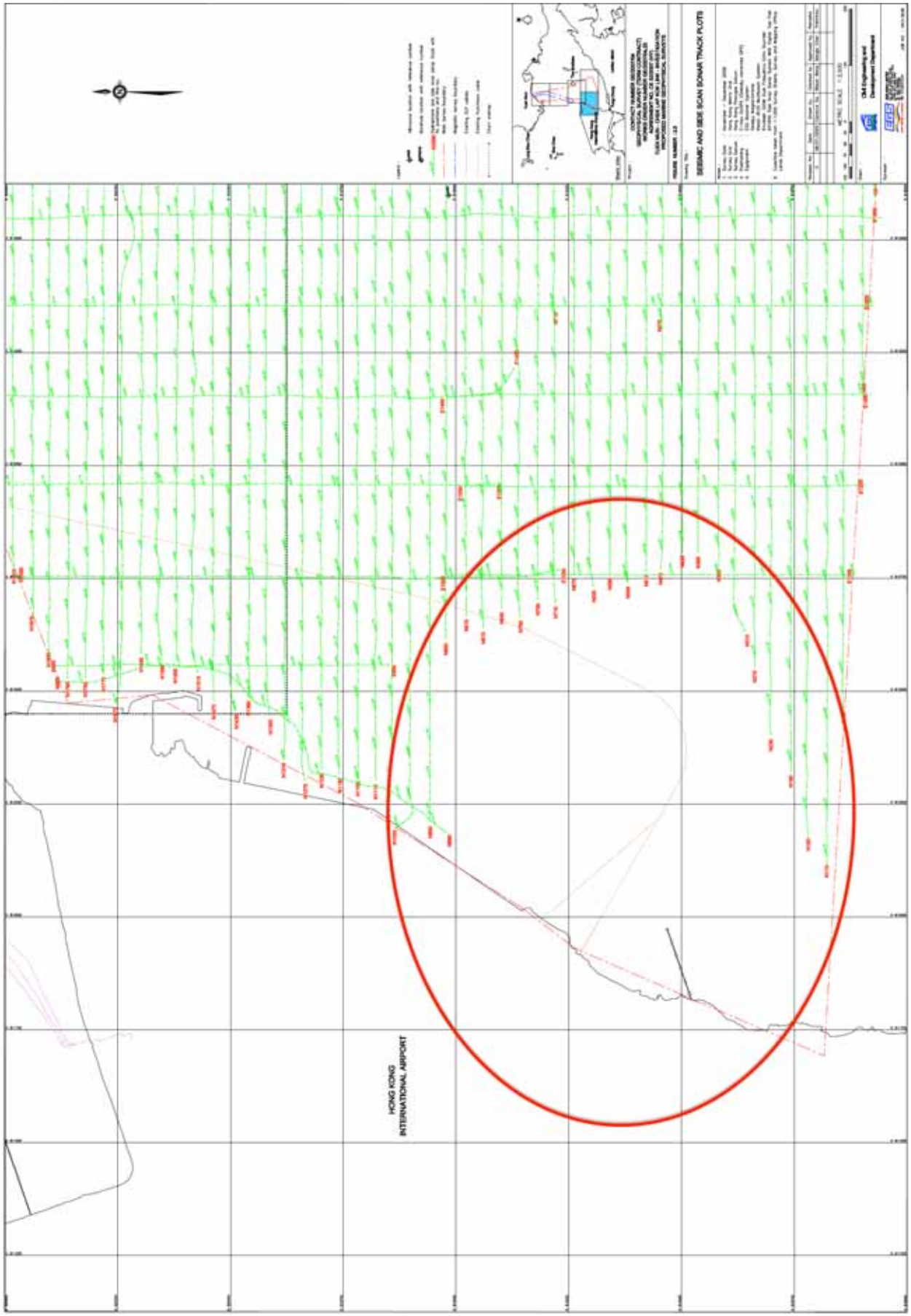


Image 25 Organic Masking for the Study Area

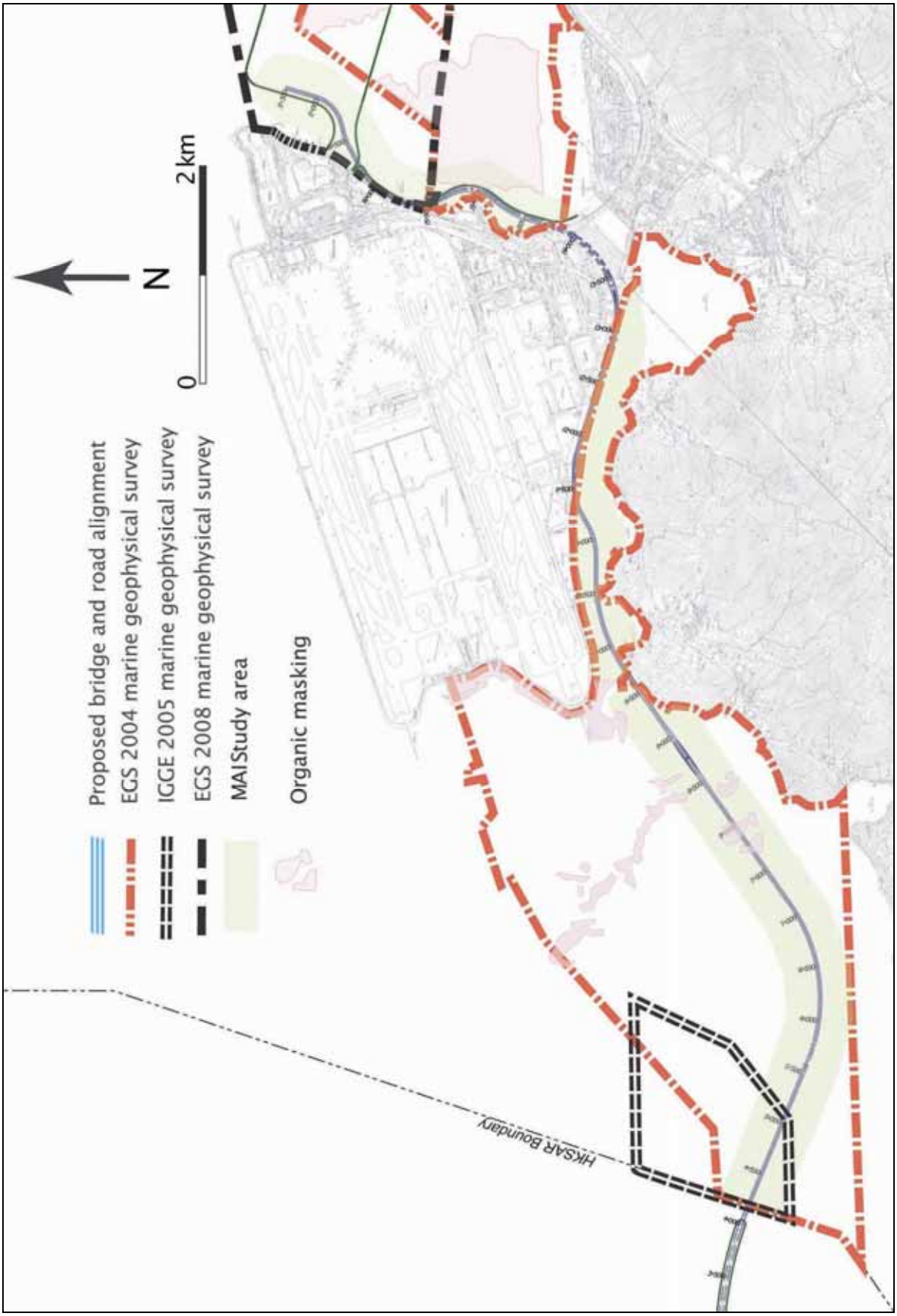


Image 26 Description of areas for results of Marine Geophysical Surveys

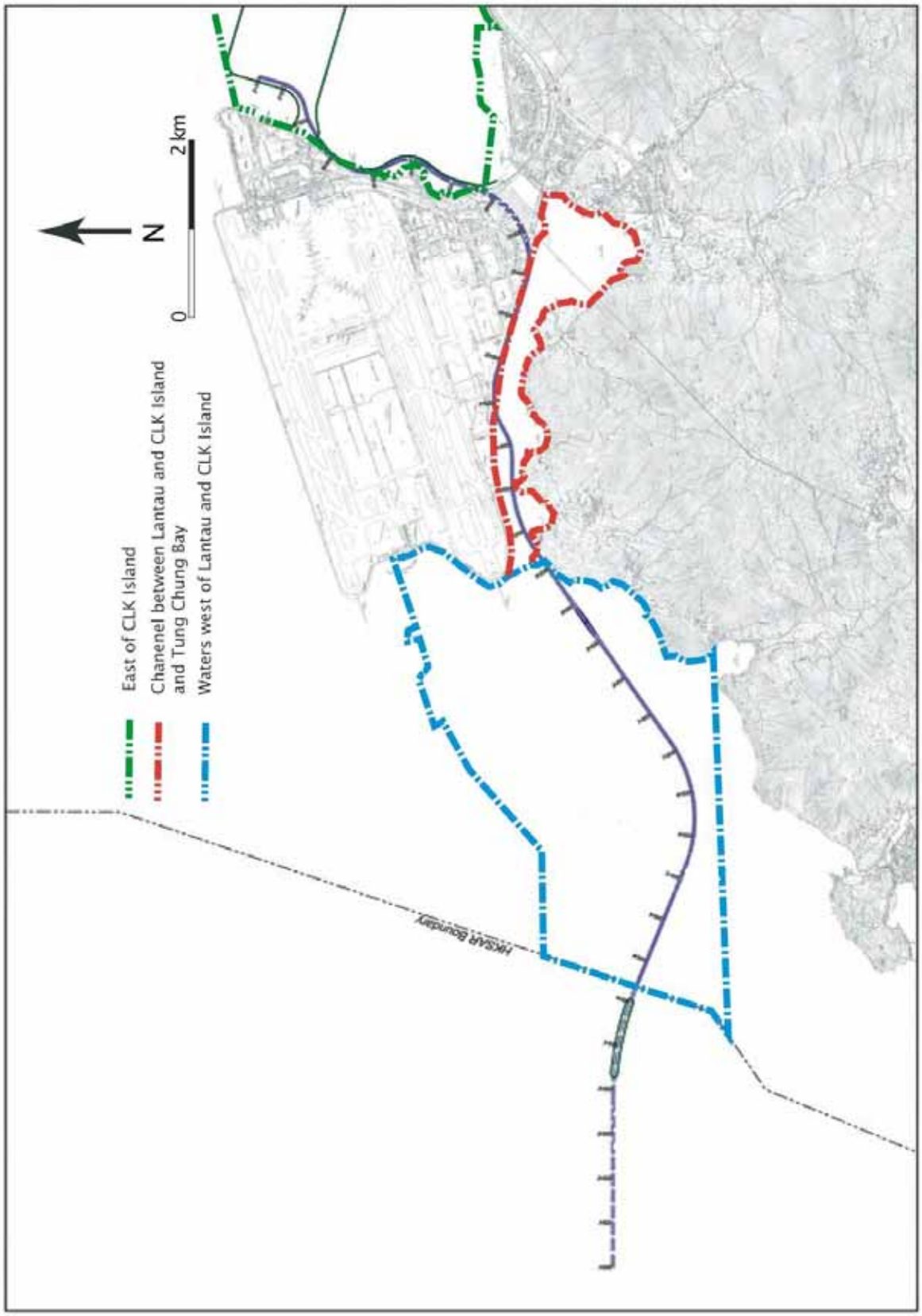
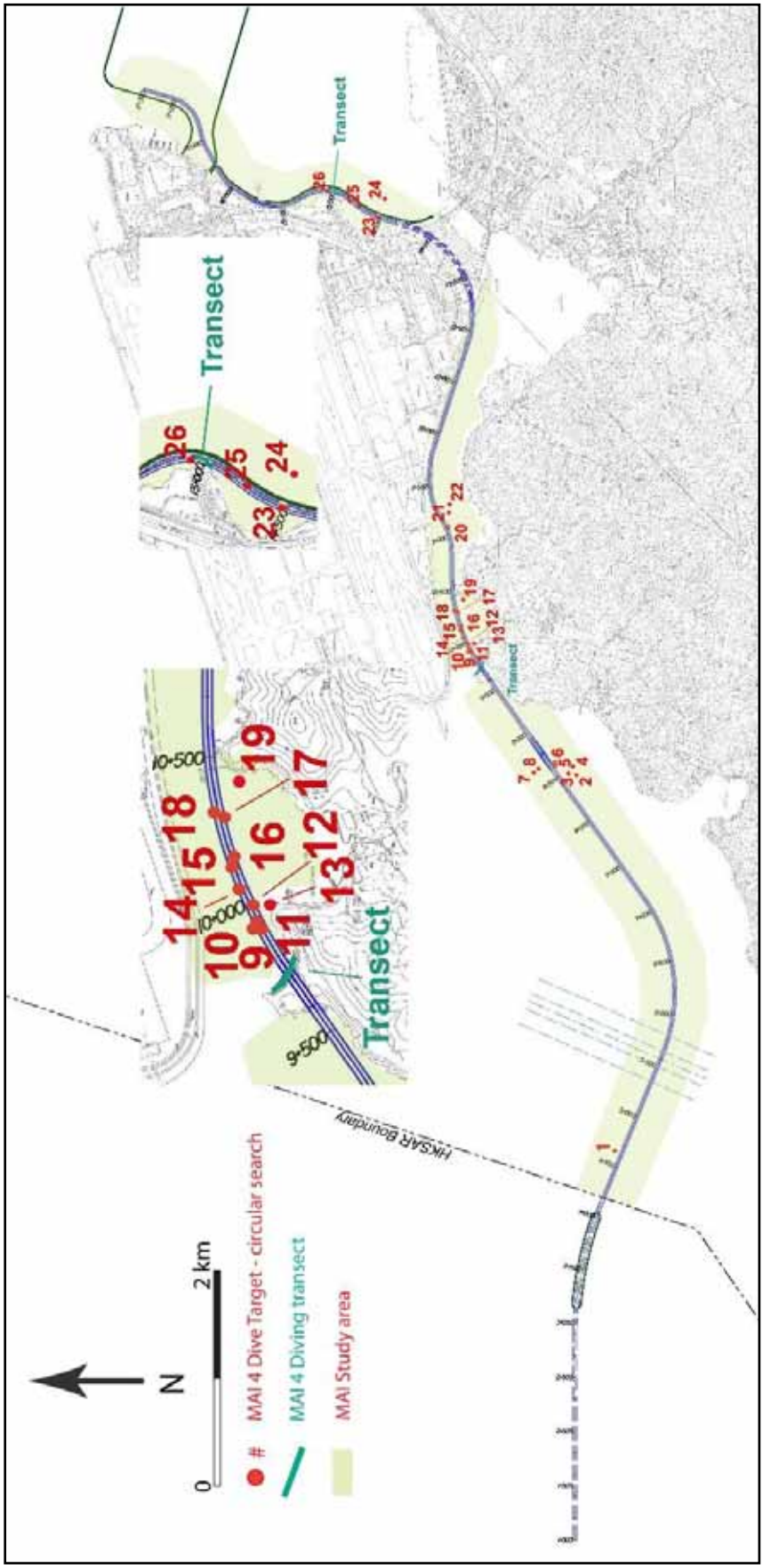


Image 27 Location of dive targets and transects



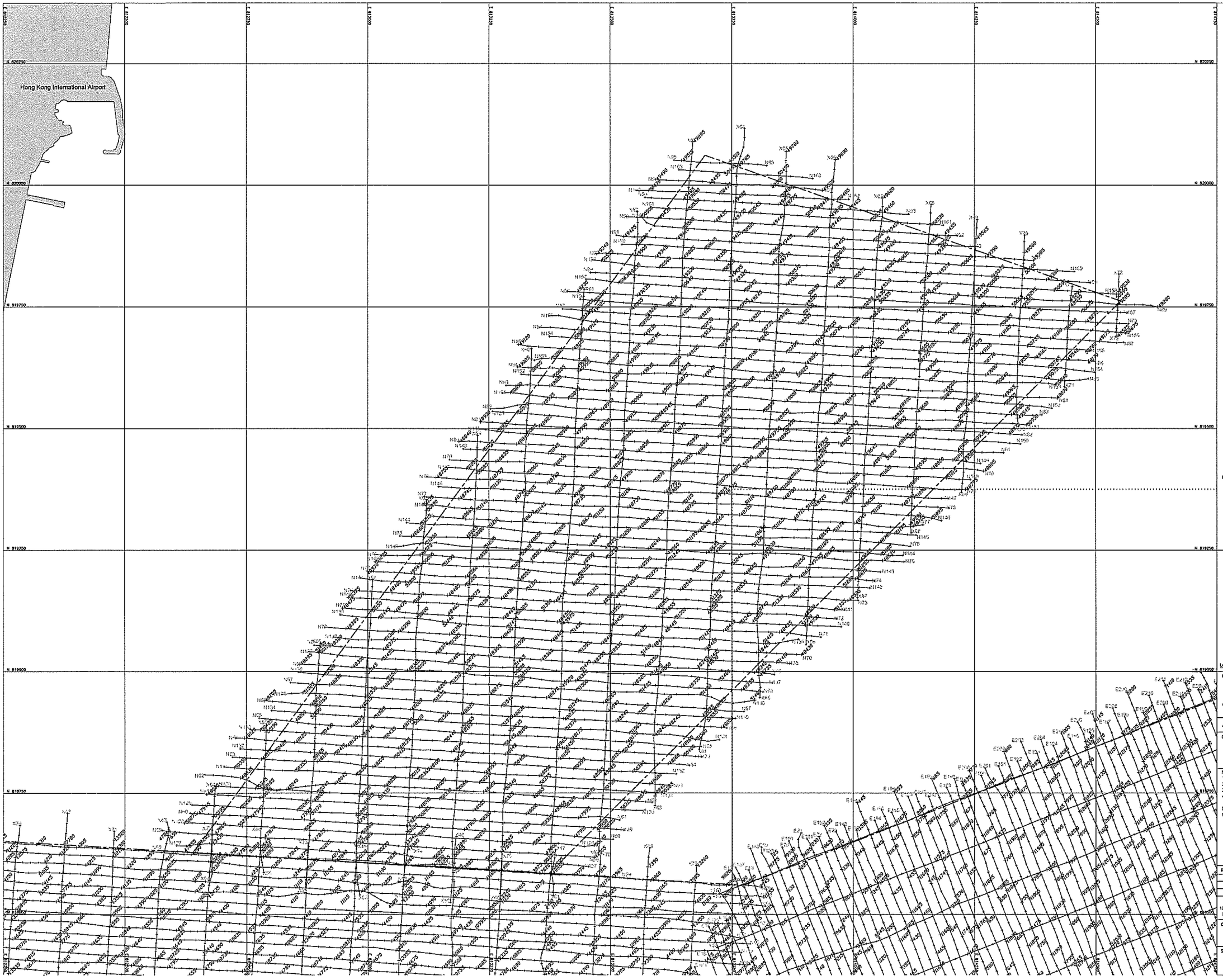
APPENDIX 12F

Relevant Marine Geophysical Charts

List of Figures

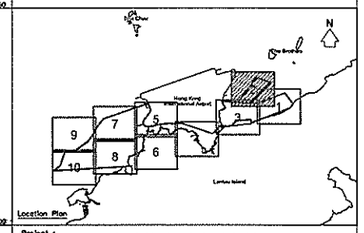
List of Figures

Marine Geophysical Survey Results 2008



Legend :

- Vessel track with fix positions
- Survey boundary
- Chart overlap
- Existing drillhole location
- MH14 Drillhole location (2004)



Location Plan

Project :

WORKS ORDER NO. GE/2003/18.24
AGREEMENT NO. CE 26/2003 (HY)
HONG KONG SECTION OF HONG KONG - ZHUHAI - MACAO BRIDGE AND CONNECTION WITH NORTH LANTAU HIGHWAY - INVESTIGATION
MARINE GEOPHYSICAL SURVEYS

AREA : NORTH OF TUNG CHUNG

FIGURE NUMBER : 1.2

Drawing Title :

VESSEL TRACK PLOTS

Notes :

1. Survey Date : 11/05/2004 – 14/06/2004
2. Survey Grid : Hong Kong Metric Grid
3. Survey Datum : Hong Kong Principal Datum
4. Survey Vessel : Wing Hung 8
   Yau Sampan
5. Equipment : C-Nav GeGPS System
6. Coastline taken from 1:1000 Survey Sheets, SMO,LD.

Revision No.	Date	Drawn by	Checked by	Approved by	Remarks
0	21/07/2004	Clarence Siu	Matthew Lai	WIRT	Preliminary
1	18/09/2004	Clarence Siu	Matthew Lai	WIRT	Final

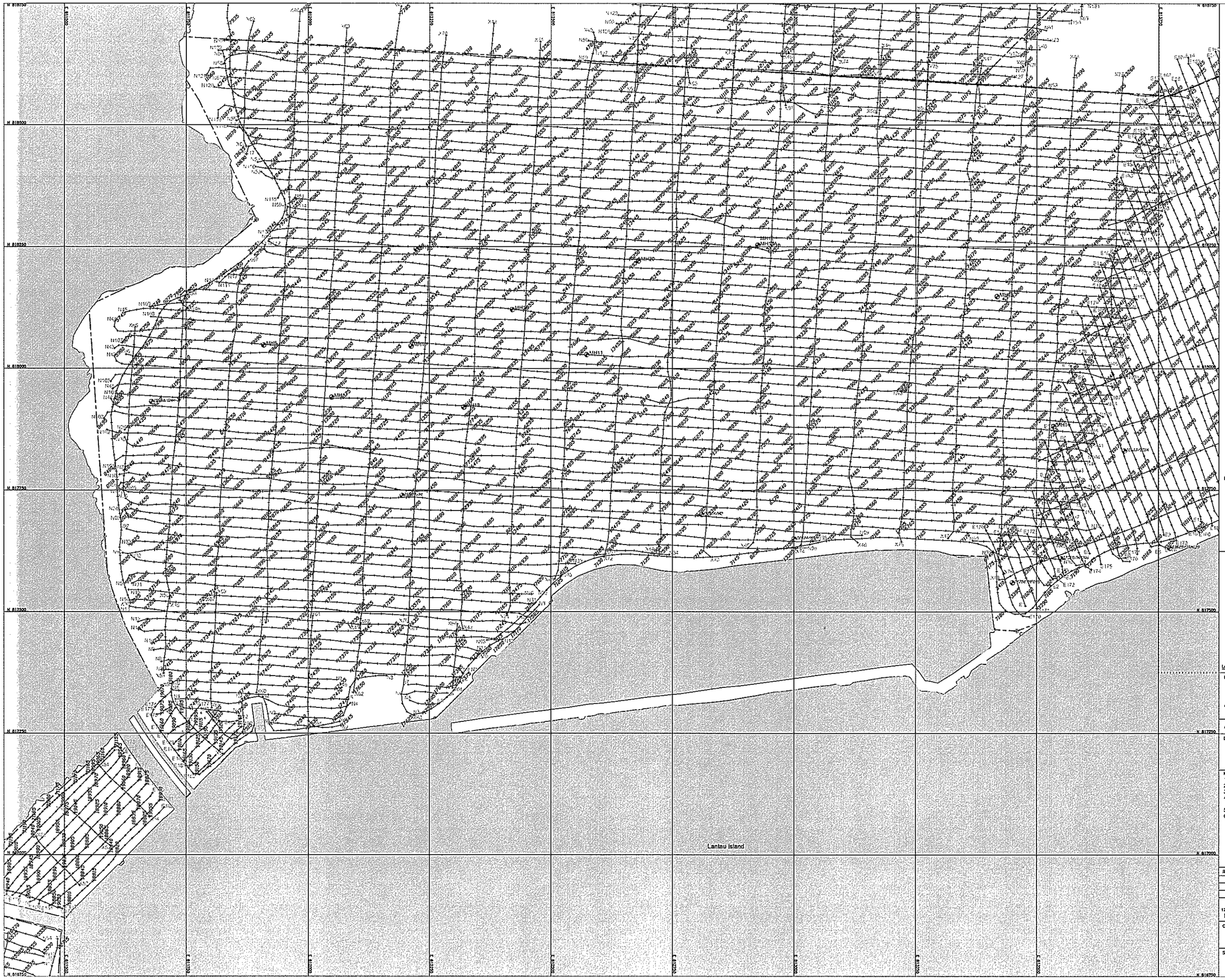
METRIC SCALE 1:2,500

125 100 75 50 25 0 125 250

Client : Civil Engineering And Development Department

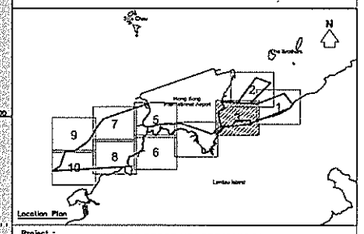
Surveyor : EGS ECA(ASIA) LIMITED

JOB NO. : HK186804



Legend :

- Vessel track with fix positions
- Survey boundary
- Chart overlap
- Existing drillhole location
- Drillhole location (2004)



Location Plan

Project :

WORKS ORDER NO. GE/2003/18.24
AGREEMENT NO. CE 25/2003 (HY)
HONG KONG SECTION OF HONG KONG - ZHUHAI - MACAO BRIDGE
AND CONNECTION WITH NORTH LANTAU HIGHWAY - INVESTIGATION
MARINE GEOPHYSICAL SURVEYS

AREA : NORTH OF TUNG CHUNG | FIGURE NUMBER : 1.3

Drawing Title :

VESSEL TRACK PLOTS

Notes :

1. Survey Date : 11/05/2004 – 14/06/2004
2. Survey Grid : Hong Kong Metric Grid
3. Survey Datum : Hong Kong Principal Datum
4. Survey Vessel : Wing Hung 8
   You Sampan
5. Equipment : C-Nav GcGPS System
6. Coastline taken from 1:1000 Survey Sheets, SWO,I.D.

Revision No.	Date	Drawn by	Checked by	Approved by	Remarks
0	21/07/2004	Clarence Siu	Matthew Lai	WART	Preliminary
1	18/09/2004	Clarence Siu	Matthew Lai	WART	Final

METRIC SCALE 1:2,500

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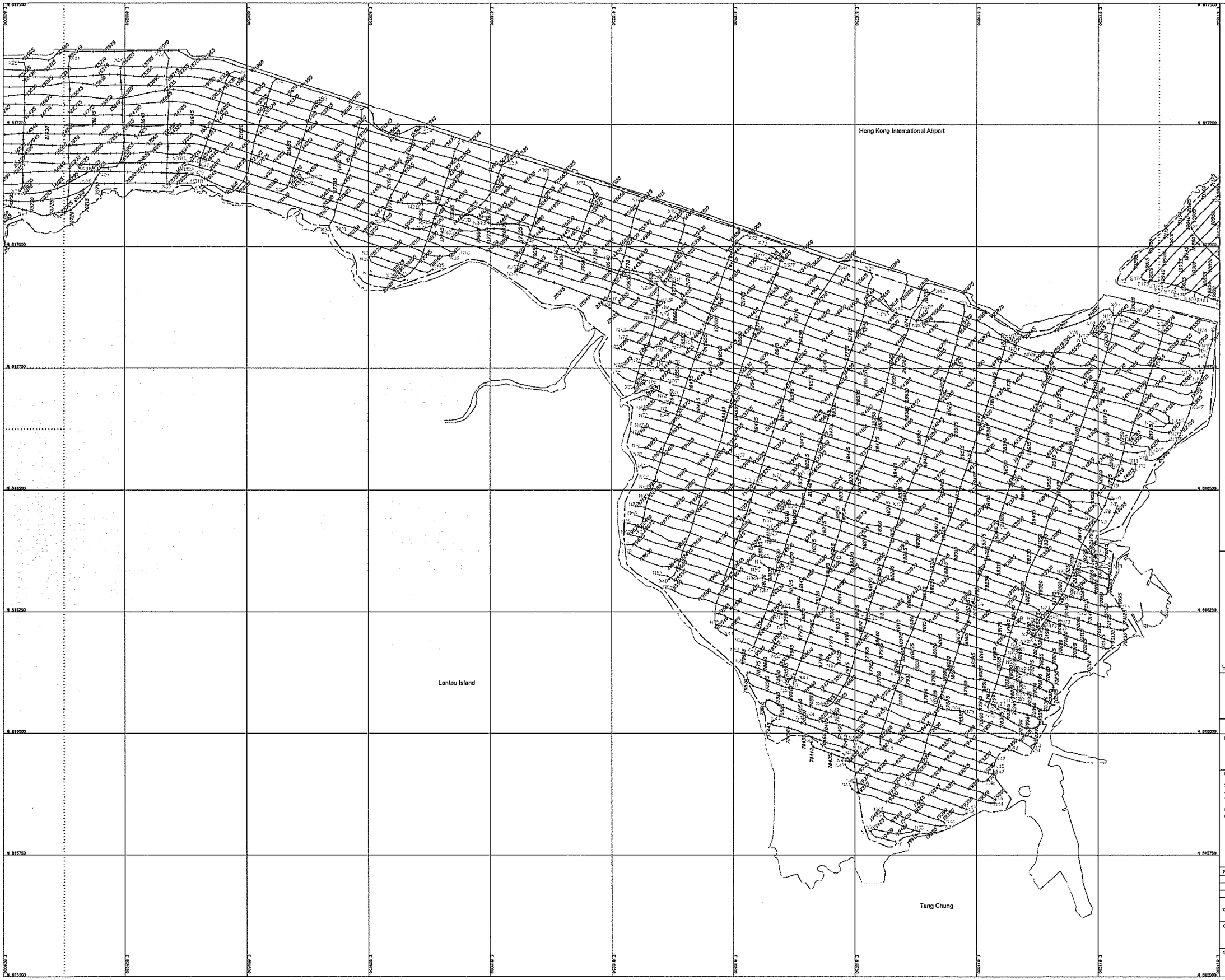
Client : Civil Engineering And Development Department

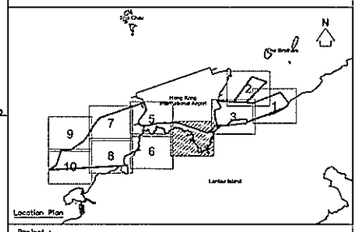
Surveyor : EGS (ASIA) LIMITED

JOB NO. : HK1868D4



Legend :

- Vessel track with fix positions
- Survey boundary
- Chart overlap
- 14429-DIGS Existing drillhole location
- MH14 Drillhole location (2004)



Location Plan

Project :

WORKS ORDER NO. GE/2003/18,24
AGREEMENT NO. CE 26/2003 (HY)
HONG KONG SECTION OF HONG KONG - ZHUHAI - MACAO BRIDGE AND CONNECTION WITH NORTH LANTAU HIGHWAY - INVESTIGATION
MARINE GEOPHYSICAL SURVEYS

AREA : CHEK LAP KOK CHANNEL

FIGURE NUMBER : 1.4

Drawing Title :

VESSEL TRACK PLOTS

Notes :

1. Survey Date : 11/05/2004 – 14/06/2004
2. Survey Grid : Hong Kong Metric Grid
3. Survey Datum : Hong Kong Principal Datum
4. Survey Vessel : Wing Hung 8
   You Sampan
5. Equipment : C-Nav GcDPS System
6. Coastline taken from 1:1000 Survey Sheets, SMO,LD.

Revision No.	Date	Drawn by	Checked by	Approved by	Remarks
0	21/07/2004	Clarence Siu	Matthew Lai	WNRT	Preliminary
1	18/09/2004	Clarence Siu	Matthew Lai	WNRT	Final

METRIC SCALE 1:2,500

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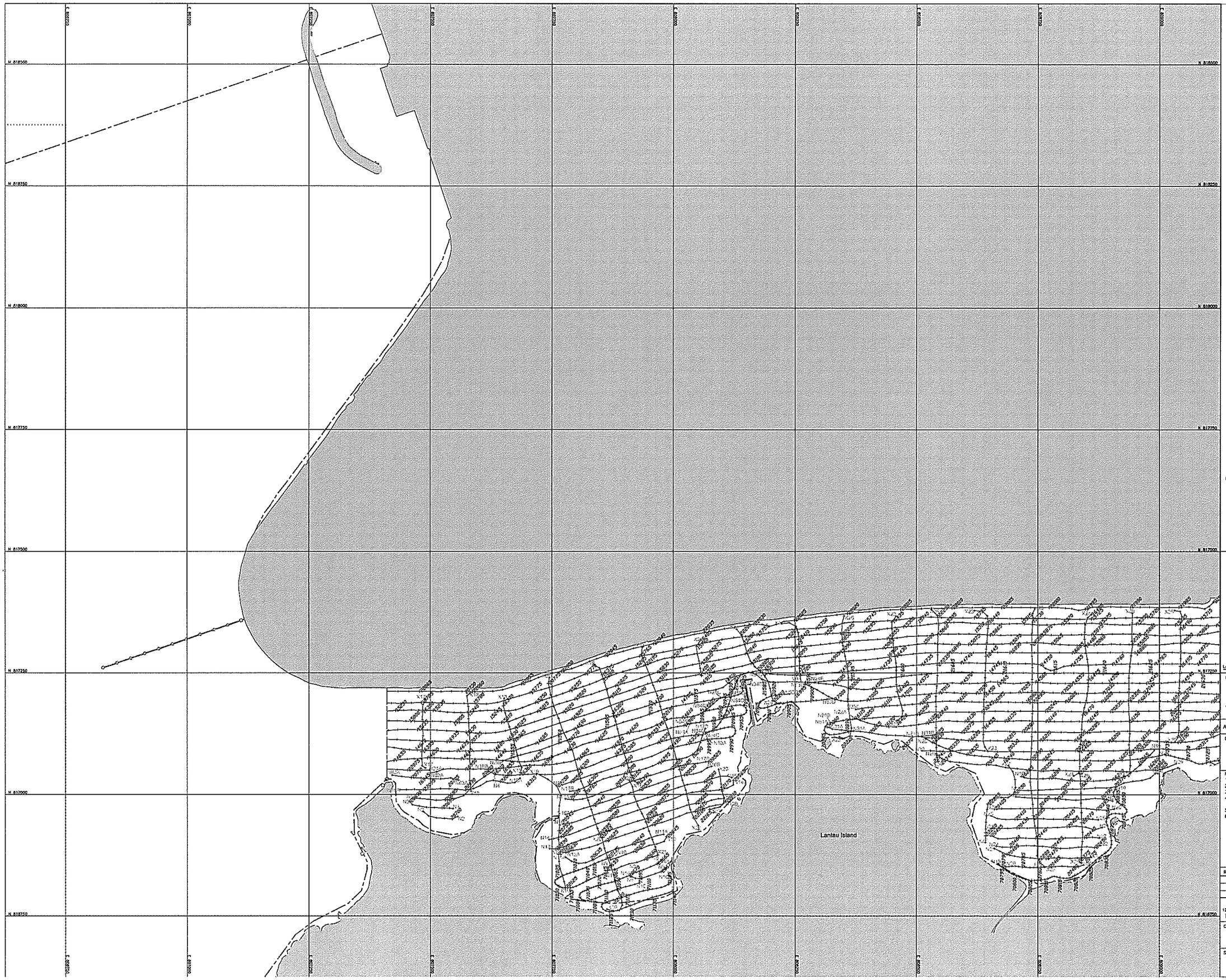
Client :

Civil Engineering
And Development Department

Surveyor :

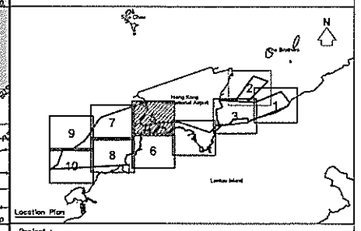
EGS (ASIA) LIMITED

JOB NO. : HK186804



Legend :

- Vessel track with fix positions
- Survey boundary
- Chart overlap
- 14429/EN33 Existing drillhole location
- MH14 Drillhole location (2004)



Location Plan

Project :

WORKS ORDER NO. GE/2003/18.24
AGREEMENT NO. CE 26/2003 (HY)
HONG KONG SECTION OF HONG KONG - ZHUHAI - MACAO BRIDGE
AND CONNECTION WITH NORTH LANTAU HIGHWAY - INVESTIGATION
MARINE GEOPHYSICAL SURVEYS

AREA : CHEK LAP KOK CHANNEL | FIGURE NUMBER : 1.5

Drawing Title :

VESSEL TRACK PLOTS

Notes :

1. Survey Date : 11/05/2004 – 14/06/2004
2. Survey Grid : Hong Kong Metric Grid
3. Survey Datum : Hong Kong Principal Datum
4. Survey Vessel : Wing Hung 8
   Yau Sampan
5. Equipment : C-Nav GcGPS System
6. Coastline taken from 1:1000 Survey Sheets, SMO,LD.

Revision No.	Date	Drawn by	Checked by	Approved by	Remarks
0	21/07/2004	Clarence Siu	Matthew Lai	WRT	Preliminary
1	19/09/2004	Clarence Siu	Matthew Lai	WRT	Final

METRIC SCALE 1:2,500

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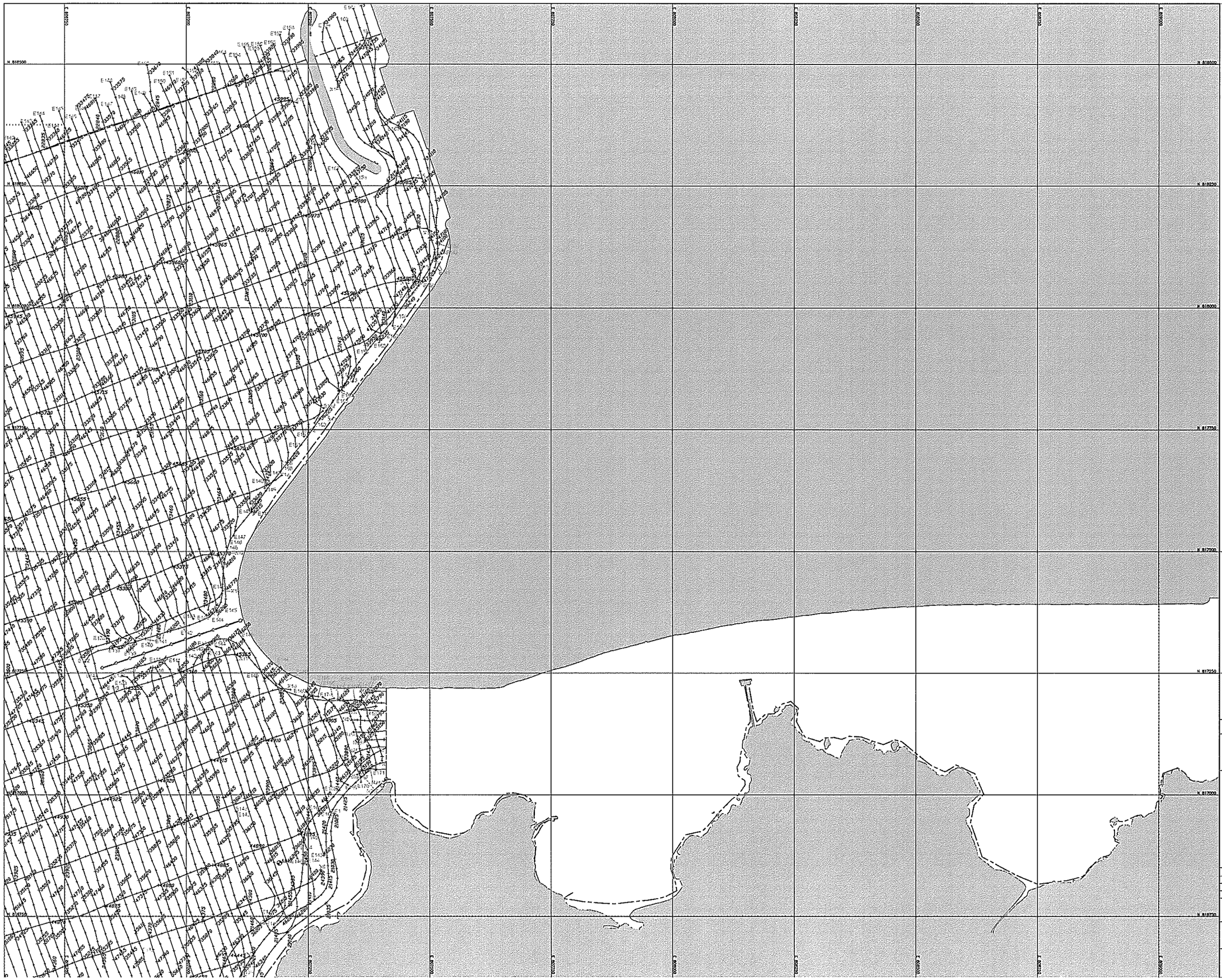
Client : Civil Engineering And Development Department

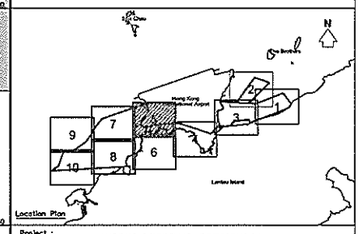
Surveyor : EGS EGS (M) LIMITED

JOB NO. : HK186804



Legend :

- Vessel track with fix positions
- Survey boundary
- Chart overlap
- MH14 Drillhole location (2004)



Location Plan

Project :

WORKS ORDER NO. GE/2003/18.24
AGREEMENT NO. CE 26/2003 (HY)
HONG KONG SECTION OF HONG KONG - ZHUHAI - MACAO BRIDGE
AND CONNECTION WITH NORTH LANTAU HIGHWAY - INVESTIGATION
MARINE GEOPHYSICAL SURVEYS

AREA : WEST OF CHEK LAP KOK | FIGURE NUMBER : 1.5

Drawing Title :

VESSEL TRACK PLOTS

Notes :

1. Survey Date : 11/05/2004 – 14/06/2004
2. Survey Grid : Hong Kong Metric Grid
3. Survey Datum : Hong Kong Principal Datum
4. Survey Vessel : Wing Hung 8
   Yau Sampan
5. Equipment : C-Nav GcGPS System
6. Coastline taken from 1:1000 Survey Sheets, SMO,LD.

Revision No.	Date	Drawn by	Checked by	Approved by	Remarks
0	21/07/2004	Clarence Siu	Matthew Lai	WART	Preliminary
1	05/10/2004	Clarence Siu	Matthew Lai	WART	Final

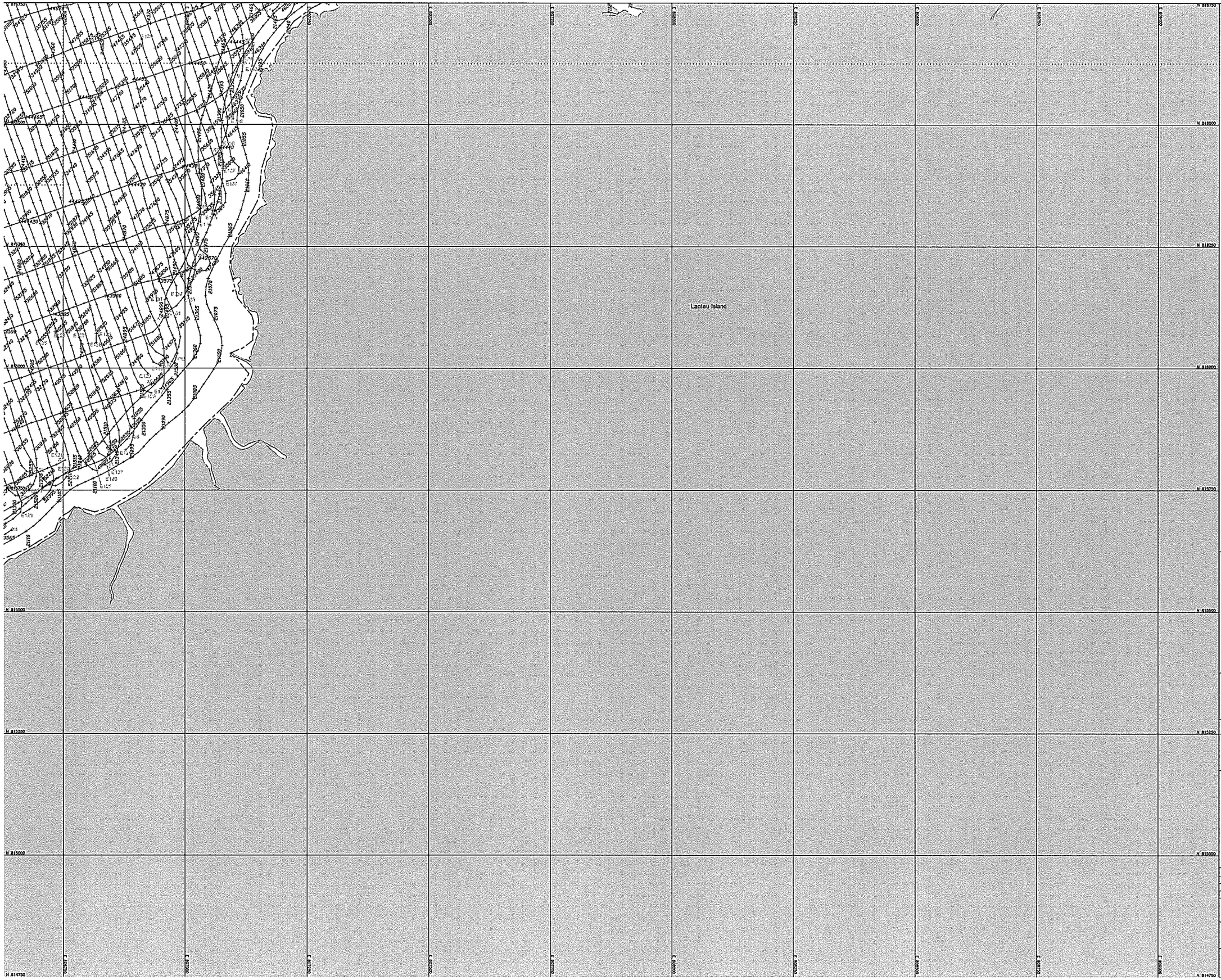
METRIC SCALE 1:2,500

125 100 75 50 25 0 125 250

Client : Civil Engineering And Development Department

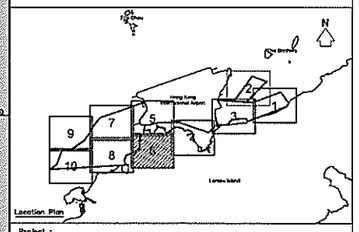
Surveyor : EGS EGS (ASIA) LIMITED

JOB NO. : HK186804



Legend :

- Vessel track with fix positions
- Survey boundary
- Chart overlap
- MH14 Drillhole location (2004)



Location Plan

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AGREEMENT NO. CE 26/2003 (HY)
HONG KONG SECTION OF HONG KONG - ZHUHAI - MACAO BRIDGE
AND CONNECTION WITH NORTH LANTAU HIGHWAY - INVESTIGATION
MARINE GEOPHYSICAL SURVEYS

AREA : WEST OF CHEK LAP KOK

FIGURE NUMBER : 1. 6

Drawing Title :

VESSEL TRACK PLOTS

Notes :

1. Survey Date : 11/05/2004 – 14/06/2004
2. Survey Grid : Hong Kong Metric Grid
3. Survey Datum : Hong Kong Principal Datum
4. Survey Vessel : Wing Hung 8
   You Sampan
5. Equipment : C-Nav GcGPS System
6. Coastline taken from 1:1000 Survey Sheets, SMO,LD.

Revision No.	Date	Drawn by	Checked by	Approved by	Remarks
0	21/07/2004	Clarence Siu	Matthew Lai	WNRT	Preliminary
1	05/10/2004	Clarence Siu	Matthew Lai	WNRT	Final

METRIC SCALE 1:2,500

125 100 75 50 25 0 125 250

Client :

Civil Engineering
And Development Department

Surveyor :

EGS (ASIA) LIMITED
14/F NEWS MANSION HOUSE,
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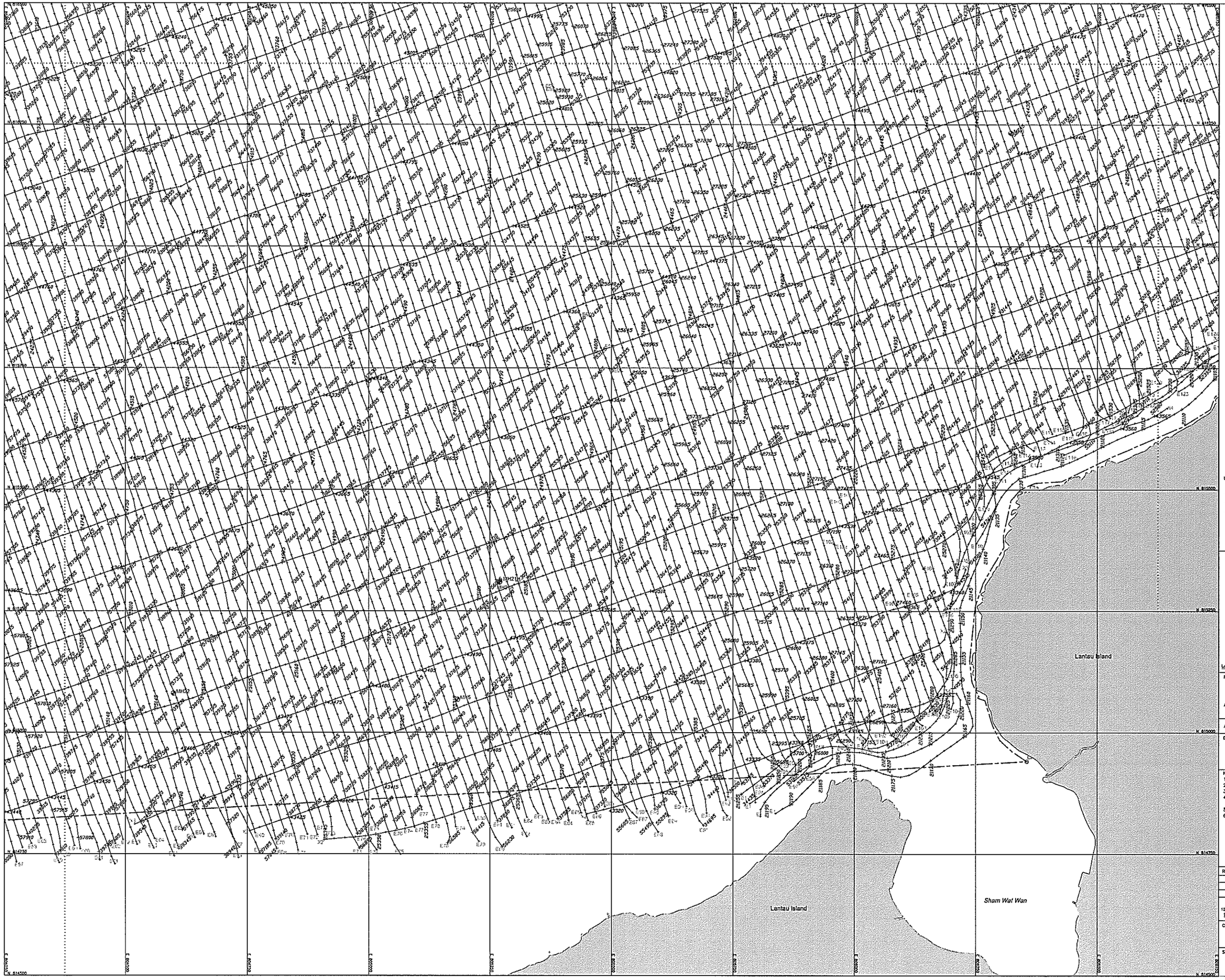
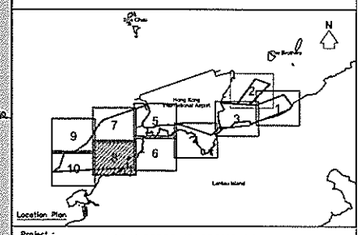
Earth Sciences & Surveying

JOB NO. : HK185904



Legend :

- Vessel track with fix positions
- Survey boundary
- Chart overlap
- MH14 Drillhole location (2004)



Project :

WORKS ORDER NO. GE/2003/18.24
AGREEMENT NO. CE 26/2003 (HY)
HONG KONG SECTION OF HONG KONG - ZHUHAI - MACAO BRIDGE AND CONNECTION WITH NORTH LANTAU HIGHWAY - INVESTIGATION
MARINE GEOPHYSICAL SURVEYS

AREA : WEST OF CHEK LAP KOK

FIGURE NUMBER : 1.8

Drawing Title :

VESSEL TRACK PLOTS

Notes :

1. Survey Date : 11/05/2004 – 14/06/2004
2. Survey Grid : Hong Kong Metric Grid
3. Survey Datum : Hong Kong Principal Datum
4. Survey Vessel : Wing Hung 8
   You Sampan
5. Equipment : C-Nav GcGPS System
6. Coastline taken from 1:1000 Survey Sheets, SWD,LD.

Revision No.	Date	Drawn by	Checked by	Approved by	Remarks
0	21/07/2004	Clarence Siu	Matthew Lai	WHRT	Preliminary
1	05/10/2004	Clarence Siu	Matthew Lai	WHRT	Final

METRIC SCALE 1:2,500

125 100 75 50 25 0 125 250

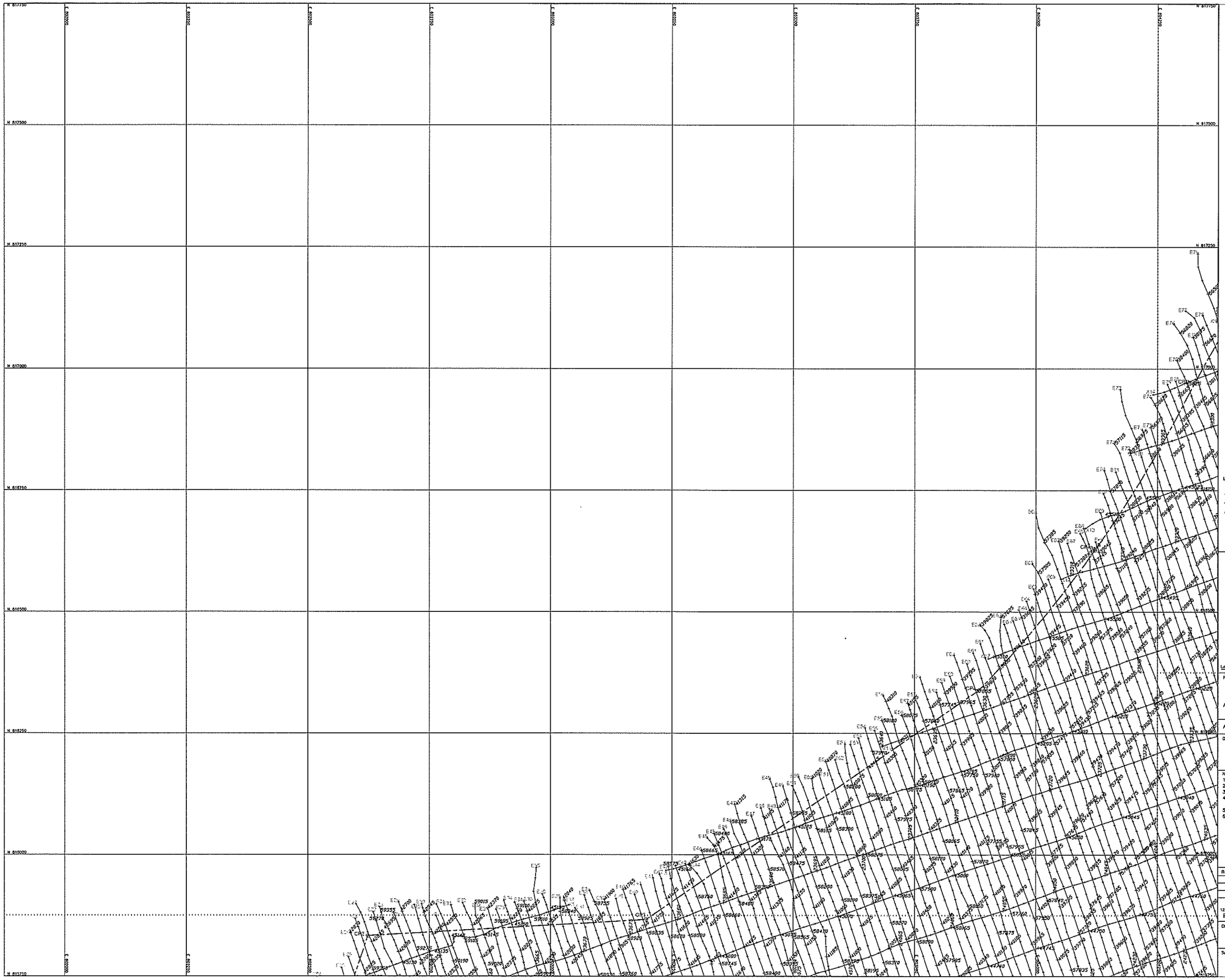
Client :

Civil Engineering
And Development Department

Surveyor :

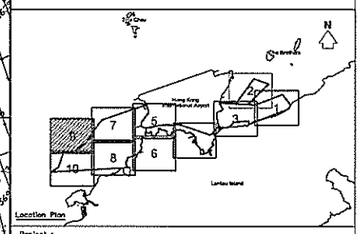
EGS (ASIA) LIMITED

JOB NO. : HK186604



Legend :

- Vessel track with fix positions
- Survey boundary
- Chart overlap
- MH14 Drillhole location (2004)



Location Plan

Project :

WORKS ORDER NO. GE/2003/18.24
AGREEMENT NO. CE 26/2003 (HY)
HONG KONG SECTION OF HONG KONG - ZHUHAI - MACAO BRIDGE AND CONNECTION WITH NORTH LANTAU HIGHWAY - INVESTIGATION
MARINE GEOPHYSICAL SURVEYS

AREA : WEST OF CHEK LAP KOK

FIGURE NUMBER : 1.9

Drawing Title :

VESSEL TRACK PLOTS

Notes :

1. Survey Date : 11/05/2004 – 14/06/2004
2. Survey Grid : Hong Kong Metric Grid
3. Survey Datum : Hong Kong Principal Datum
4. Survey Vessel : Wing Hung 8
   Yau Sampan
5. Equipment : C-Nav GcDPS System
6. Coastline taken from 1:1000 Survey Sheets, SMO,LD.

Revision No.	Date	Drawn by	Checked by	Approved by	Remarks
0	21/07/2004	Clarence Siu	Matthew Lai	WNRT	Preliminary
1	05/10/2004	Clarence Siu	Matthew Lai	WNRT	Final

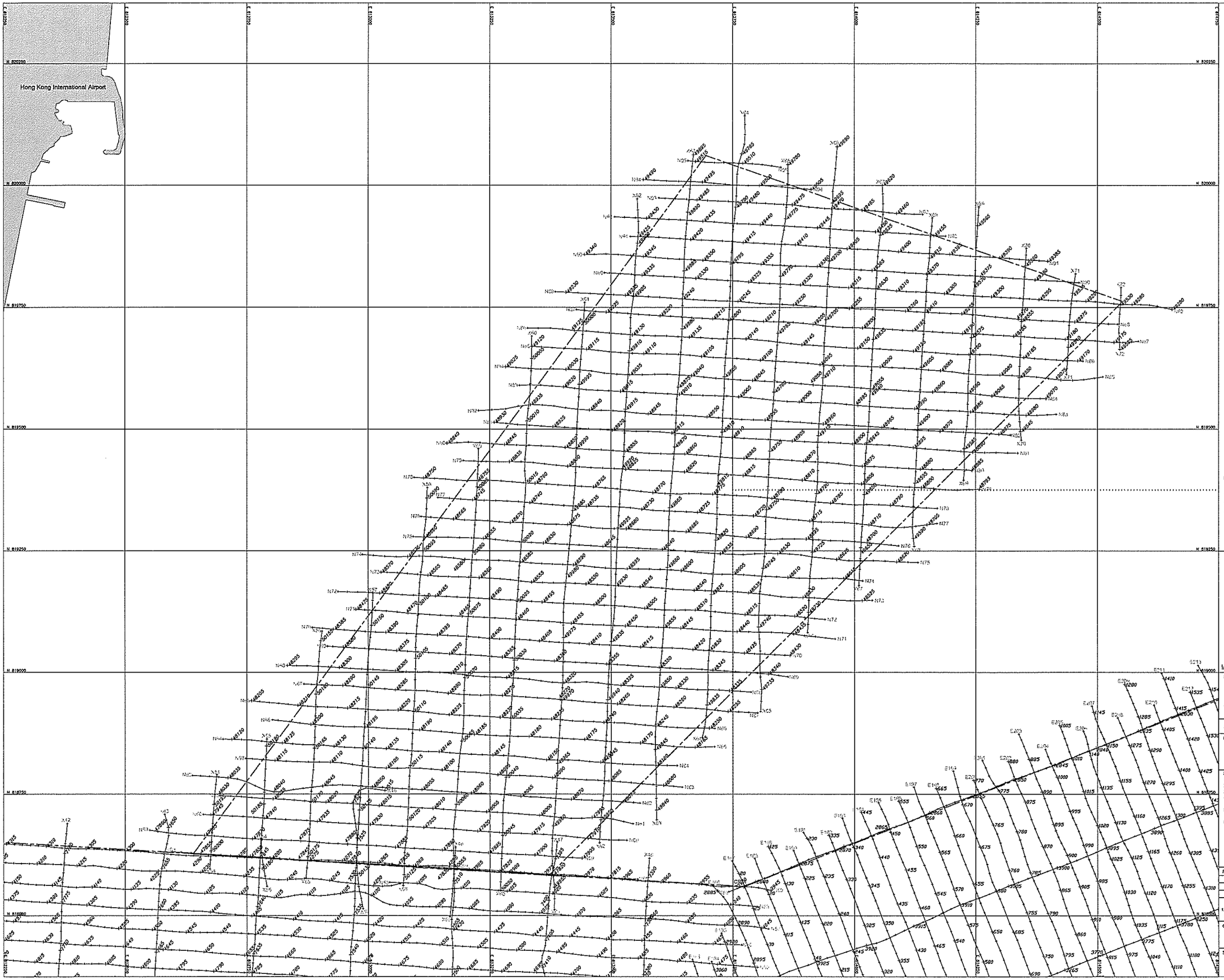
METRIC SCALE 1:2,500

125 100 75 50 25 0 125 250

Client : Civil Engineering And Development Department

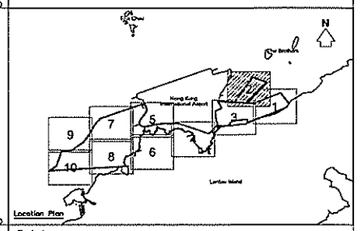
Surveyor : EGS (ASIA) LIMITED

JOB NO. : HK166804



Legend :

- Hydrophone track with fix positions
- Survey boundary
- Chart overlap
- Existing drillhole location
- MH14 Drillhole location (2004)



Project :

WORKS ORDER NO. GE/2003/18.24
AGREEMENT NO. CE 25/2003 (HY)
HONG KONG SECTION OF HONG KONG - ZHUHAI - MACAO BRIDGE AND CONNECTION WITH NORTH LANTAU HIGHWAY - INVESTIGATION
MARINE GEOPHYSICAL SURVEYS

AREA : NORTH OF TUNG CHUNG | FIGURE NUMBER : 2.2

Drawing Title :

HYDROPHONE TRACK PLOTS

Notes :
1. Survey Date : 11/05/2004 – 14/06/2004
2. Survey Grid : Hong Kong Metric Grid
3. Survey Datum : Hong Kong Principal Datum
4. Survey Vessel : Wing Hung 8
   You Samgan
5. Equipment : C-Nav GcGPS System
   C-Boom Low Voltage Boomer and Hydrophone
6. Coastline taken from 1:1000 Survey Sheets, SMO,LD.

Revision No.	Date	Drawn by	Checked by	Approved by	Remarks
0	21/07/2004	Clarence Siu	Matthew Lai	WIRT	Preliminary
1	18/09/2004	Clarence Siu	Matthew Lai	WIRT	Final

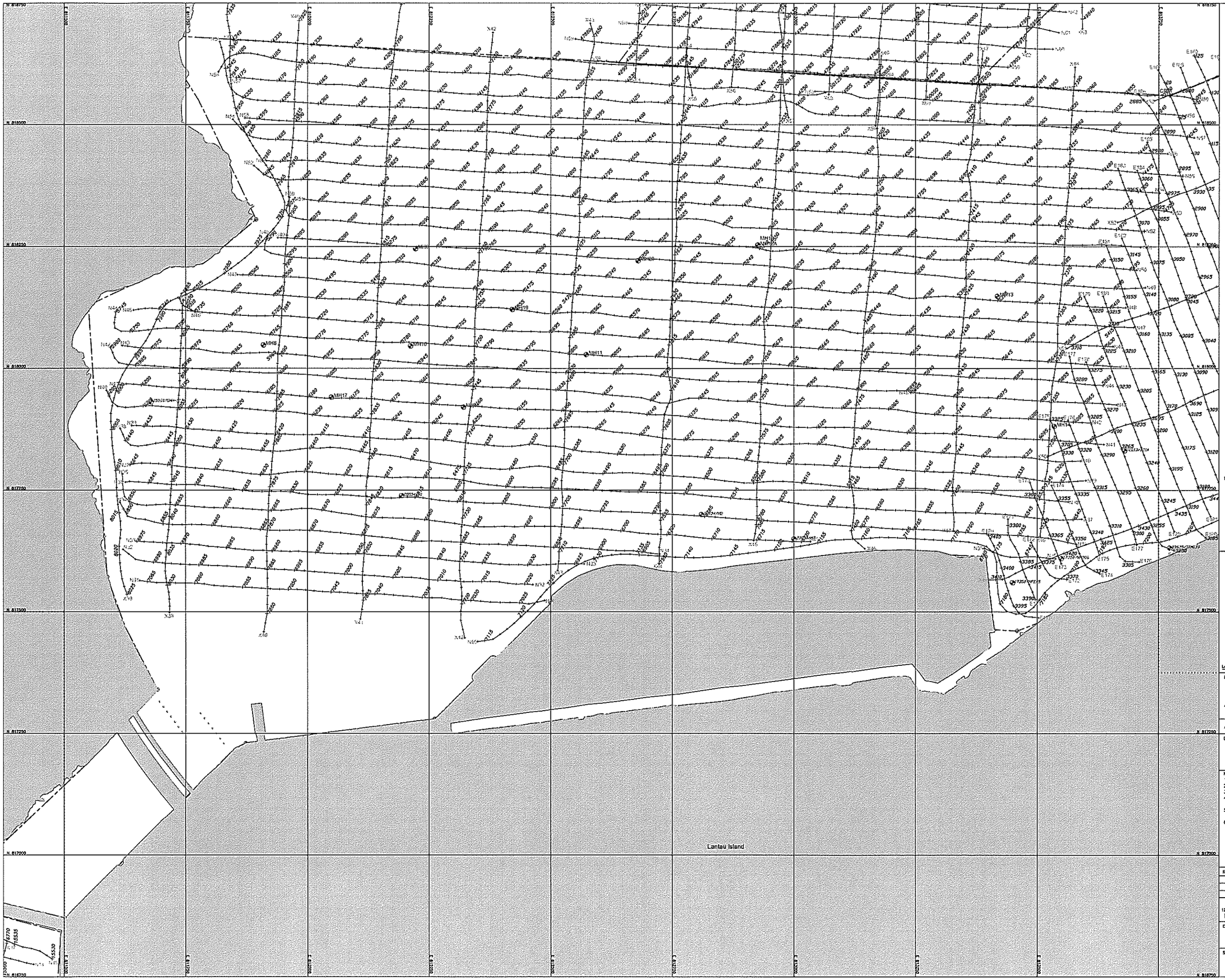
METRIC SCALE 1:2,500

125 100 75 50 25 0 125 250

Client : Civil Engineering And Development Department

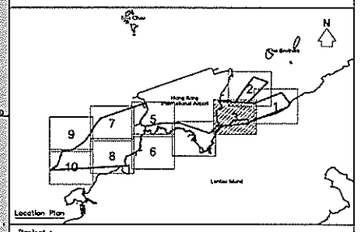
Surveyor : EGS (ASIA) LIMITED

JOB NO. : HK186804



Legend :

- Hydrophone track with fix positions
- Survey boundary
- Chart overlap
- Existing drillhole location
- MH14 Drillhole location (2004)



Location Plan

Project :

WORKS ORDER NO. GE/2003/18.24
AGREEMENT NO. CE 26/2003 (HY)
HONG KONG SECTION OF HONG KONG - ZHUHAI - MACAO BRIDGE AND CONNECTION WITH NORTH LANTAU HIGHWAY - INVESTIGATION
MARINE GEOPHYSICAL SURVEYS

AREA : NORTH OF TUNG CHUNG | FIGURE NUMBER : 2.3

Drawing Title :

HYDROPHONE TRACK PLOTS

Notes :

1. Survey Date : 11/05/2004 – 14/06/2004
2. Survey Grid : Hong Kong Metric Grid
3. Survey Datum : Hong Kong Principal Datum
4. Survey Vessel : Wing Hung 8
   Yau Sampan
5. Equipment : C-Nav GcGPS System
   C-Beam Low Voltage Boomer and Hydrophone
6. Coastline taken from 1:1000 Survey Sheets, SMO,LD.

Revision No.	Date	Drawn by	Checked by	Approved by	Remarks
0	21/07/2004	Clarence Siu	Matthew Lai	WIRT	Preliminary
1	18/09/2004	Clarence Siu	Matthew Lai	WIRT	Final

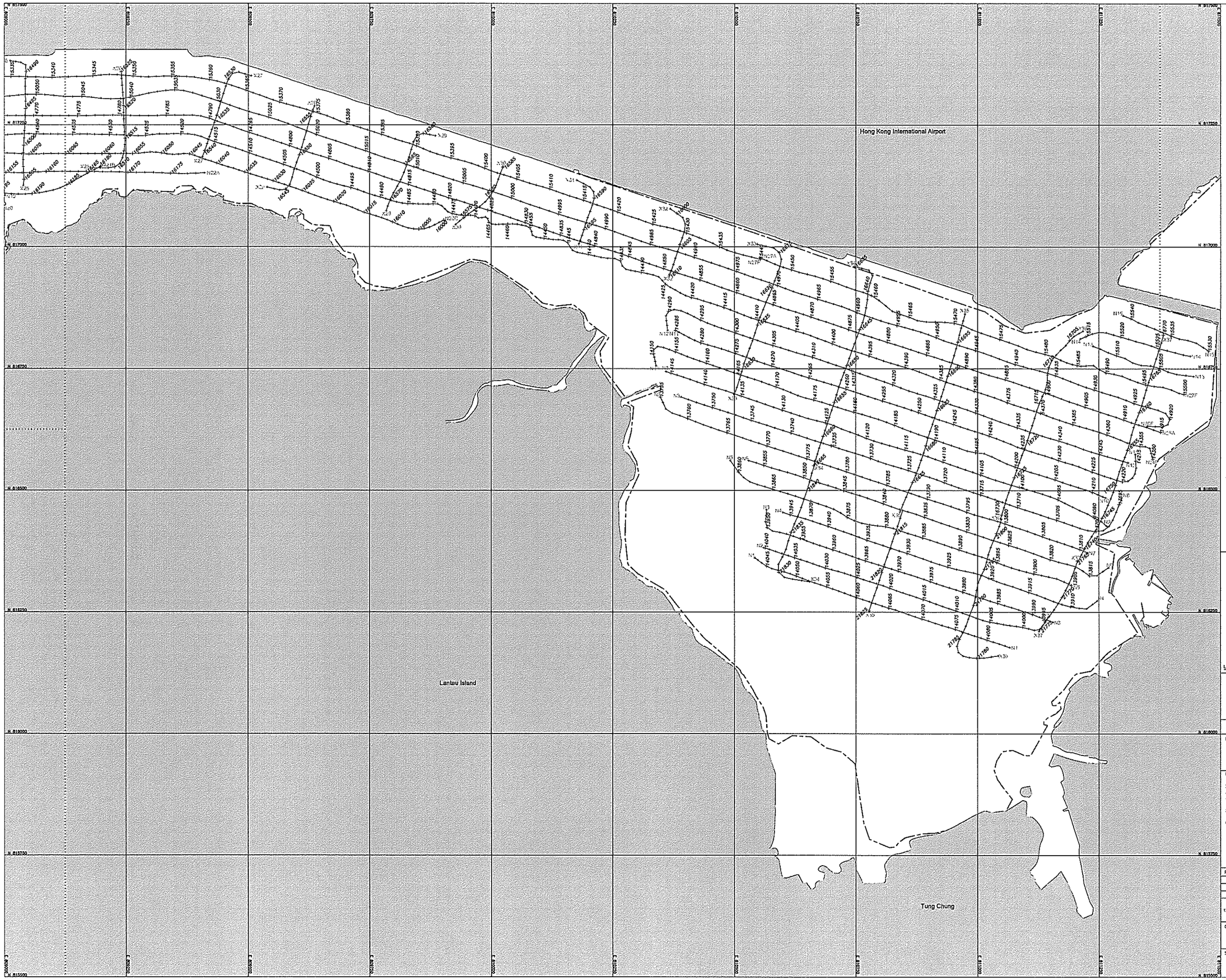
METRIC SCALE 1:2,500

125 100 75 50 25 0 125 0 250

Client : Civil Engineering And Development Department

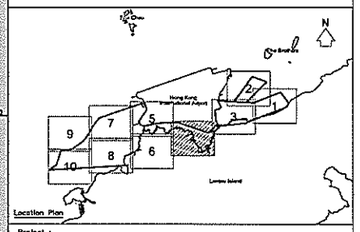
Surveyor : EGS (ASIA) LIMITED

JOB NO. : HK186804



Legend :

- Hydrophone track with fix positions
- Survey boundary
- Chart overlap
- Existing drillhole location
- Drillhole location (2004)



Location Plan

Project :

WORKS ORDER NO. GE/2003/18.24
AGREEMENT NO. CE 26/2003 (HY)
HONG KONG SECTION OF HONG KONG - ZHUHAI - MACAO BRIDGE AND CONNECTION WITH NORTH LANTAU HIGHWAY - INVESTIGATION
MARINE GEOPHYSICAL SURVEYS

AREA : CHEK LAP KOK CHANNEL | FIGURE NUMBER : 2.4

Drawing Title :

HYDROPHONE TRACK PLOTS

Notes :

1. Survey Date : 11/05/2004 – 14/06/2004
2. Survey Grid : Hong Kong Metric Grid
3. Survey Datum : Hong Kong Principal Datum
4. Survey Vessel : Wing Hung 8
   Yau Sampan
5. Equipment : C-Nav GcGPS System
   C-Boom Low Voltage Boomer and Hydrophone
6. Coastline taken from 1:1000 Survey Sheets, SMO,LD.

Revision No.	Date	Drawn by	Checked by	Approved by	Remarks
0	21/07/2004	Clarence Siu	Matthew Lai	WIRT	Preliminary
1	18/09/2004	Clarence Siu	Matthew Lai	WIRT	Final

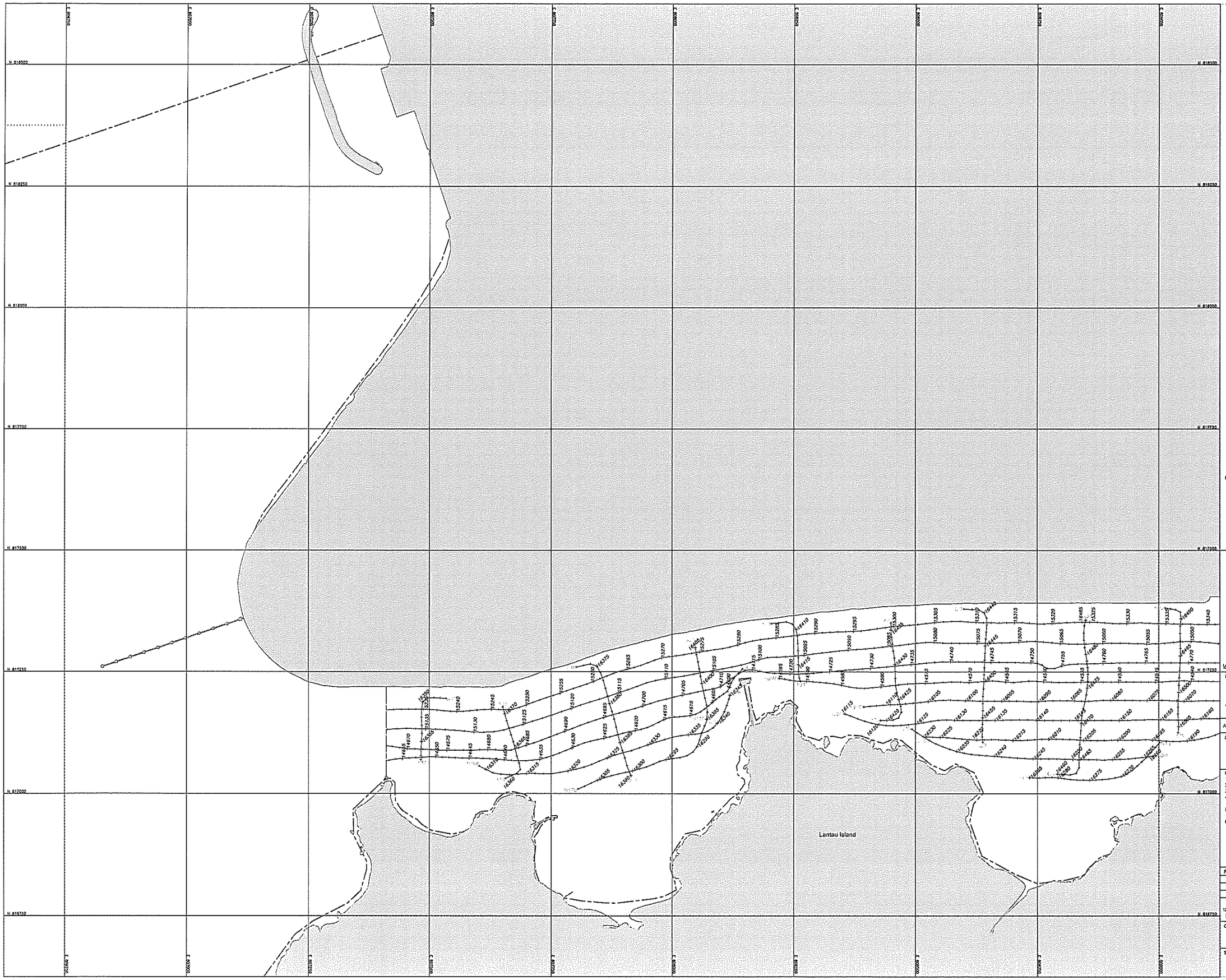
METRIC SCALE 1:2,500

125 100 75 50 25 0 125 250

Client : Civil Engineering And Development Department

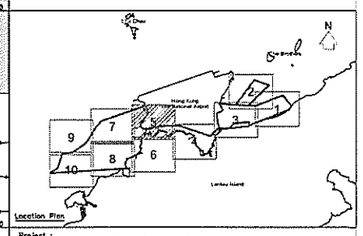
Surveyer : ECS ECS(ASIA) LIMITED

JOB NO. : HK185504



Legend :

- Hydrophone track with fix positions
- Survey boundary
- Chart overlap
- Existing drillhole location
- Drillhole location (2004)



Project :

WORKS ORDER NO. GE/2003/18.24
AGREEMENT NO. CE 26/2003 (HY)
HONG KONG SECTION OF HONG KONG - ZHUHAI - MACAO BRIDGE AND CONNECTION WITH NORTH LANTAU HIGHWAY - INVESTIGATION
MARINE GEOPHYSICAL SURVEYS

AREA : CHEK LAP KOK CHANNEL | FIGURE NUMBER : 2.5

Drawing Title :

HYDROPHONE TRACK PLOTS

Notes :
1. Survey Date : 11/05/2004 – 14/06/2004
2. Survey Grid : Hong Kong Metric Grid
3. Survey Datum : Hong Kong Principal Datum
4. Survey Vessel : Wing Hung 8
   Yau Sampan
5. Equipment : C-Nav GeGPS System
   C-Boom Low Voltage Boomer and Hydrophone
6. Coastline taken from 1:1000 Survey Sheets, SMO,LD.

Revision No.	Date	Drawn by	Checked by	Approved by	Remarks
0	21/07/2004	Clarence Siu	Matthew Lai	WNRT	Preliminary
1	18/09/2004	Clarence Siu	Matthew Lai	WNRT	Final

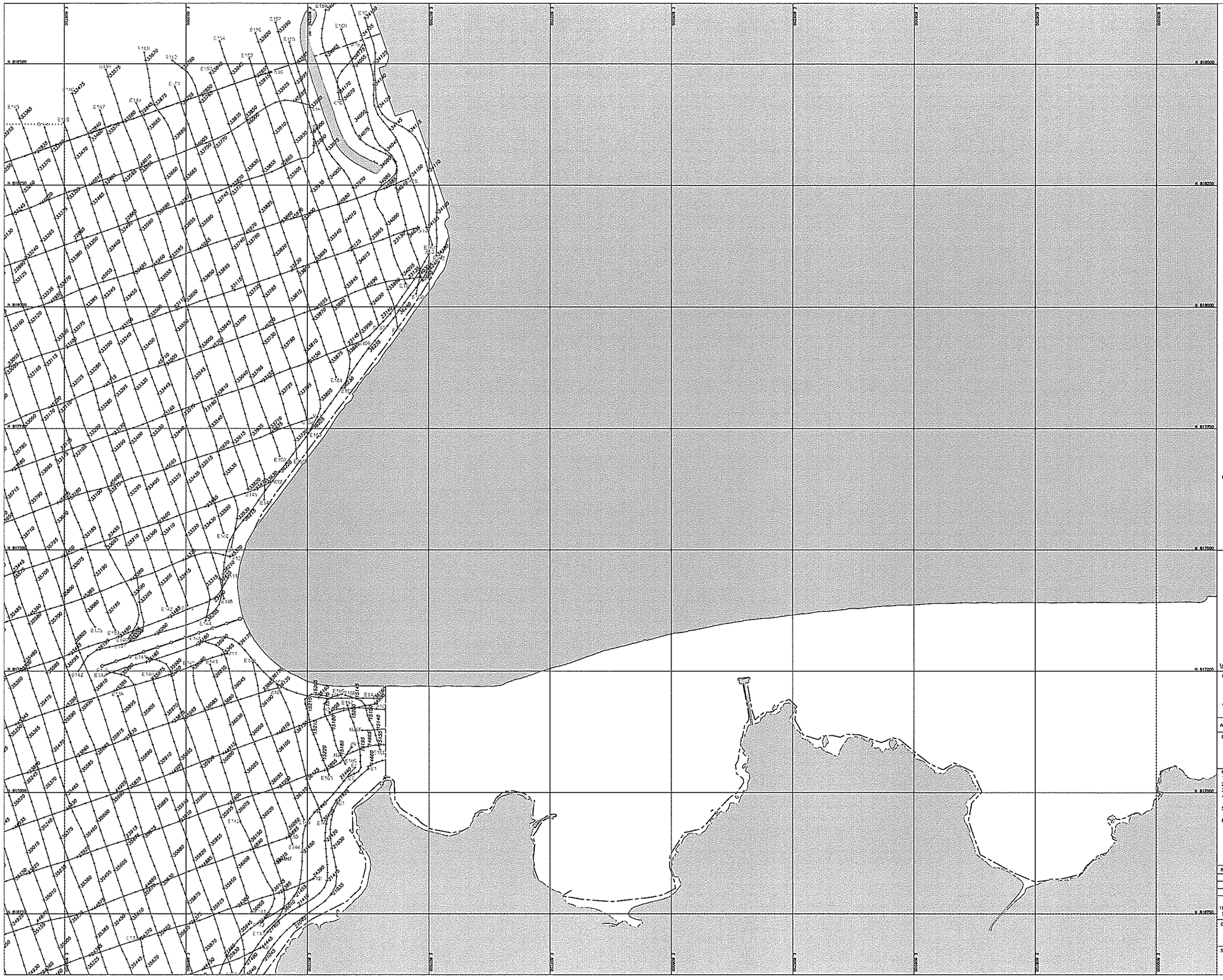
METRIC SCALE 1:2,500

125 100 75 50 25 0 125 250

Client : Civil Engineering And Development Department

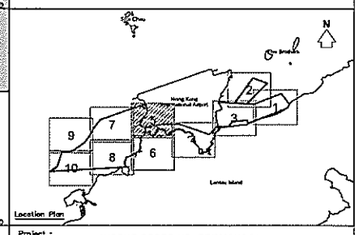
Surveyor : ECS (ASIA) LIMITED

JOB NO. : HK186604



Legend :

- Hydrophone track with fix positions
- Survey boundary
- Chart overlap
- MH14 Drillhole location (2004)



Project :

WORKS ORDER NO. GE/2003/18.24
AGREEMENT NO. CE 26/2003 (HY)
HONG KONG SECTION OF HONG KONG - ZHUHAI - MACAO BRIDGE
AND CONNECTION WITH NORTH LANTAU HIGHWAY - INVESTIGATION
MARINE GEOPHYSICAL SURVEYS

AREA : WEST OF CHEK LAP KOK | FIGURE NUMBER : 2.5

Drawing Title :

HYDROPHONE TRACK PLOTS

Notes :

1. Survey Date : 11/05/2004 – 14/06/2004
2. Survey Grid : Hong Kong Metric Grid
3. Survey Datum : Hong Kong Principal Datum
4. Survey Vessel : Wing Hung 8
   You Sampan
5. Equipment : C-Nav GCPS System
   C-Boom Low Voltage Boomer and Hydrophone
6. Coastline taken from 1:1000 Survey Sheets, SMO,LD.

Revision No.	Date	Drawn by	Checked by	Approved by	Remarks
0	21/07/2004	Clarence Siu	Matthew Lai	WHRT	Preliminary
1	05/10/2004	Clarence Siu	Matthew Lai	WHRT	Final

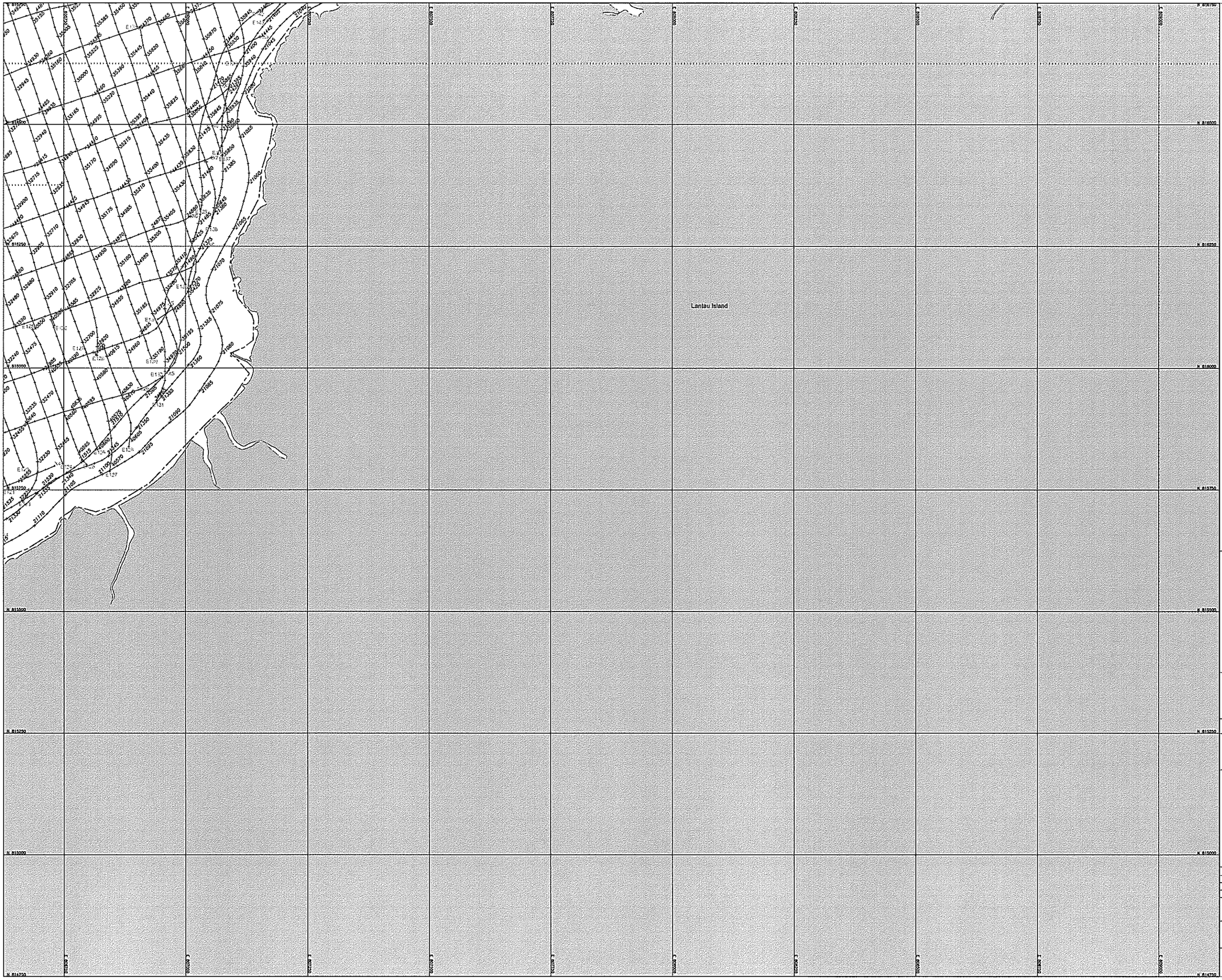
METRIC SCALE 1:2,500

125 100 75 50 25 0 125 250

Client : Civil Engineering And Development Department

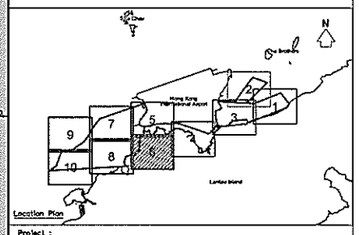
Surveyor : EGS (ASIA) LIMITED

JOB NO. : HK156804



Legend :

- Hydrophone track with fix positions
- Survey boundary
- Chart overlap
- MH14 Drillhole location (2004)



Location Plan

Project :

WORKS ORDER NO. GE/2003/18.24
AGREEMENT NO. CE 26/2003 (HY)
HONG KONG SECTION OF HONG KONG - ZHUHAI - MACAO BRIDGE
AND CONNECTION WITH NORTH LANTAU HIGHWAY - INVESTIGATION
MARINE GEOPHYSICAL SURVEYS

AREA : WEST OF CHEK LAP KOK

FIGURE NUMBER : 2.6

Drawing Title :

HYDROPHONE TRACK PLOTS

Notes :

1. Survey Date : 11/05/2004 – 14/06/2004
2. Survey Grid : Hong Kong Metric Grid
3. Survey Datum : Hong Kong Principal Datum
4. Survey Vessel : Wing Hung 8
   Yau Sampan
5. Equipment : C-Nav GcGPS System
   C-Boom Low Voltage Boomer and Hydrophone
6. Coastline taken from 1:1000 Survey Sheets, SMO,LD.

Revision No.	Date	Drawn by	Checked by	Approved by	Remarks
0	21/07/2004	Clarence Siu	Matthew Lai	WIRT	Preliminary
1	05/10/2004	Clarence Siu	Matthew Lai	WIRT	Final

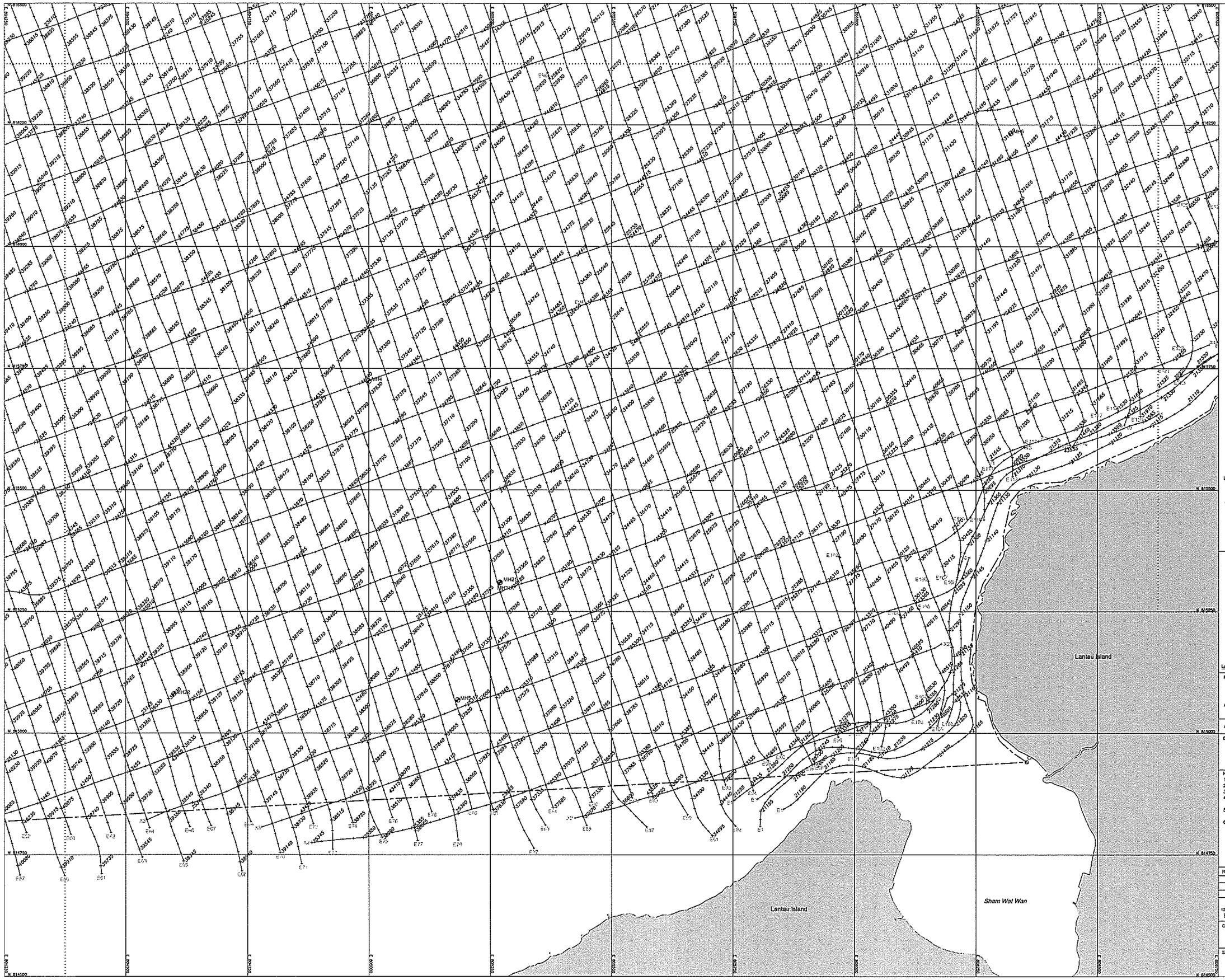
METRIC SCALE 1:2,500

125 100 75 50 25 0 125 250

Client : Civil Engineering And Development Department

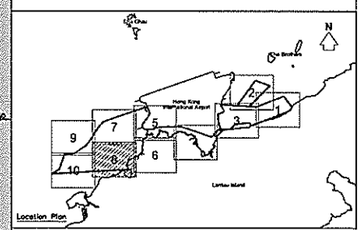
Surveyor : EGS EGS (ASIA) LIMITED

JOB NO. : HK185504



Legend :

- Hydrophone track with fix positions
- Survey boundary
- Chart overlap
- MH14 Drillhole location (2004)



Location Plan

Project :

WORKS ORDER NO. GE/2003/18.24
AGREEMENT NO. CE 26/2003 (HY)
HONG KONG SECTION OF HONG KONG - ZHUHAI - MACAO BRIDGE AND CONNECTION WITH NORTH LANTAU HIGHWAY - INVESTIGATION
MARINE GEOPHYSICAL SURVEYS

AREA : WEST OF CHEK LAP KOK

FIGURE NUMBER : 2.8

Drawing Title :

HYDROPHONE TRACK PLOTS

Notes :

1. Survey Date : 11/05/2004 – 14/06/2004
2. Survey Grid : Hong Kong Metric Grid
3. Survey Datum : Hong Kong Principal Datum
4. Survey Vessel : Wing Hung 8
   You Sampan
5. Equipment : C-Nav GcGPS System
   C-Boom Low Voltage Boomer and Hydrophone
6. Coastline taken from 1:1000 Survey Sheets, SMO,LD.

Revision No.	Date	Drawn by	Checked by	Approved by	Remarks
0	21/07/2004	Clarence Siu	Matthew Lai	WKRT	Preliminary
1	05/10/2004	Clarence Siu	Matthew Lai	WKRT	Final

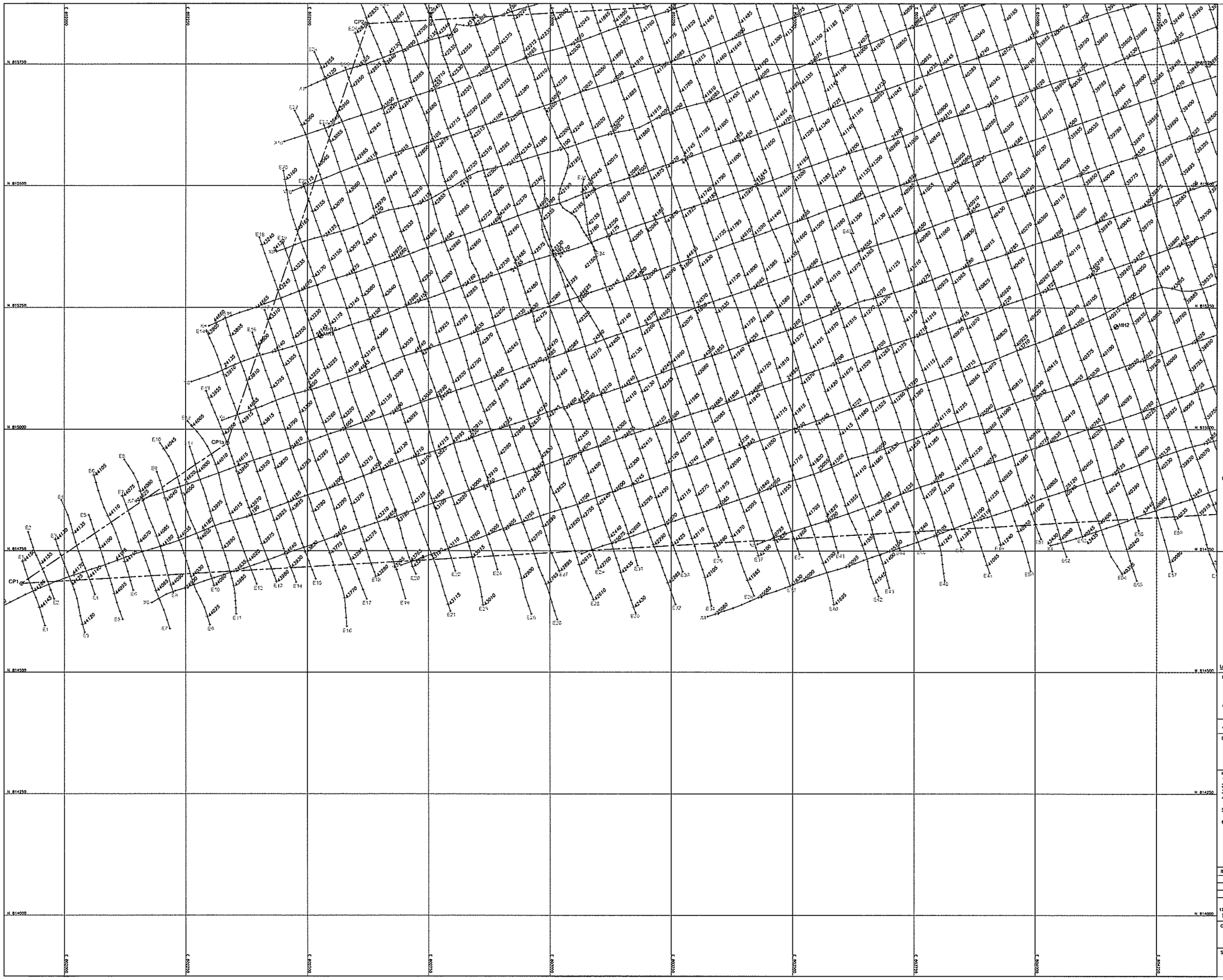
METRIC SCALE 1:2,500

125 100 75 50 25 0 125 250

Client : Civil Engineering And Development Department

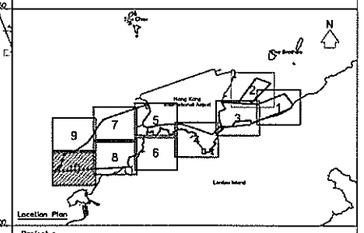
Surveyor : EGS (ASIA) LIMITED

JOB NO. : HK156604



Legend :

- Hydrophone track with fix positions
- Survey boundary
- Chart overlap
- MH14 Drillhole location (2004)



Location Plan

Project :

WORKS ORDER NO. GE/2003/18.24
AGREEMENT NO. CE 26/2003 (HY)
HONG KONG SECTION OF HONG KONG - ZHUHAI - MACAO BRIDGE
AND CONNECTION WITH NORTH LANTAU HIGHWAY - INVESTIGATION
MARINE GEOPHYSICAL SURVEYS

AREA : WEST OF CHEK LAP KOK | FIGURE NUMBER : 2.10

Drawing Title :

HYDROPHONE TRACK PLOTS

Notes :

1. Survey Date : 11/05/2004 – 14/06/2004
2. Survey Grid : Hong Kong Metric Grid
3. Survey Datum : Hong Kong Principal Datum
4. Survey Vessel : Wing Hung 8
   You Sampan
5. Equipment : C-Nav GcGPS System
   C-Boom Low Voltage Boomer and Hydrophone
6. Coastline taken from 1:1000 Survey Sheets, SMO,LD.

Revision No.	Date	Drawn by	Checked by	Approved by	Remarks
0	21/07/2004	Clarence Siu	Matthew Lai	WART	Preliminary
1	05/10/2004	Clarence Siu	Matthew Lai	WART	Final

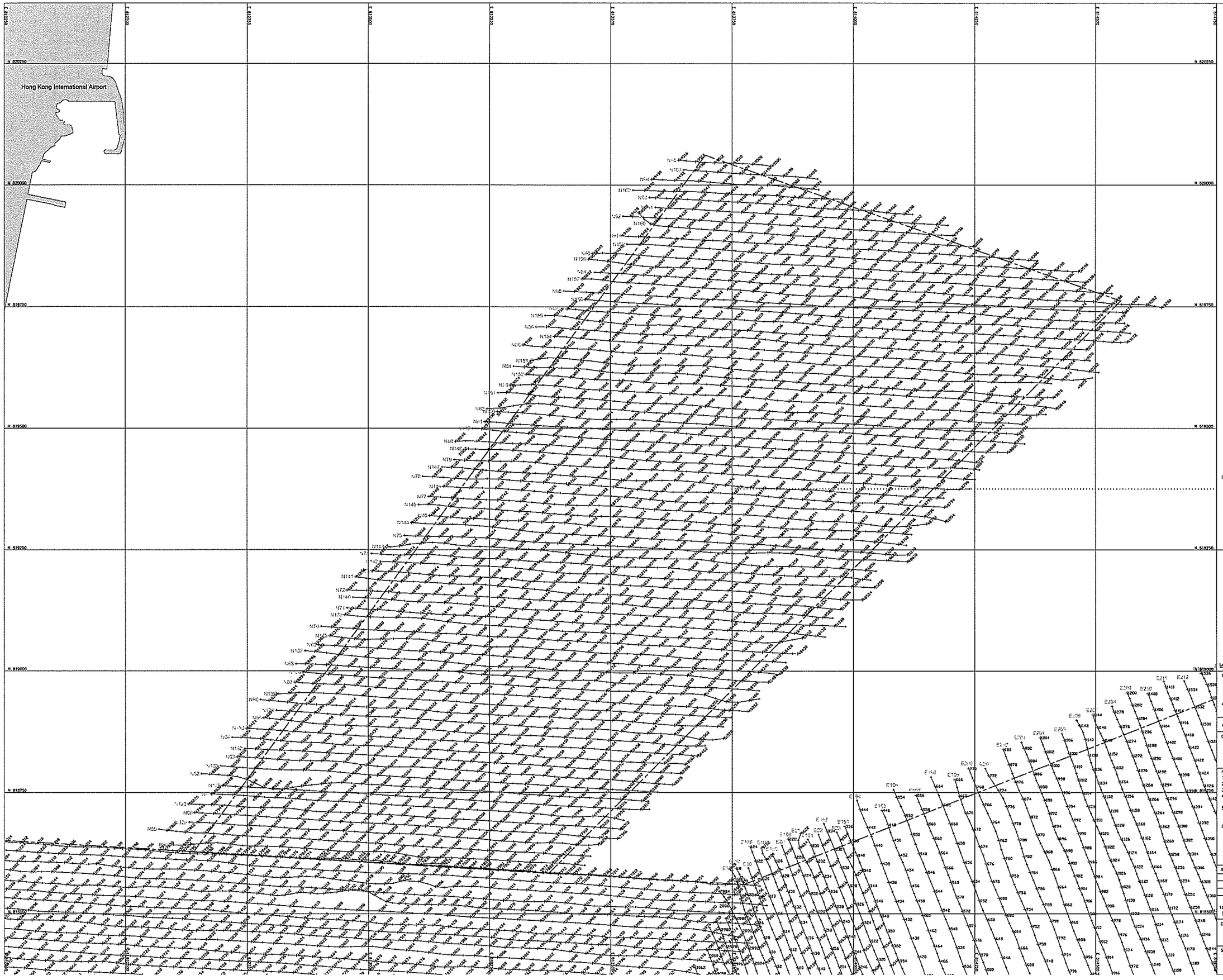
METRIC SCALE 1:2,500

125 100 75 50 25 0 125 250

Client : Civil Engineering And Development Department

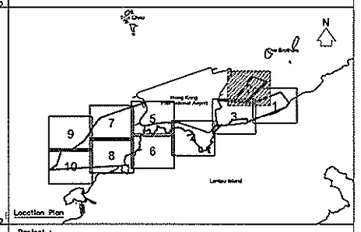
Surveyor : EGS (ASIA) LIMITED

JOB NO. : HK186804



Legend :

- Side scan sonar track with fix positions
- Survey boundary
- Chart overlap



Location Plan

Project :

WORKS ORDER NO. GE/2003/18.24
AGREEMENT NO. CE 25/2003 (HY)
HONG KONG SECTION OF HONG KONG - ZHUHAI - MACAO BRIDGE
AND CONNECTION WITH NORTH LANTAU HIGHWAY - INVESTIGATION
MARINE GEOPHYSICAL SURVEYS

AREA : NORTH OF TUNG CHUNG | FIGURE NUMBER : 3.2

Drawing Title :

SIDE SCAN SONAR TRACK PLOTS

Notes :

1. Survey Date : 11/05/2004 – 14/06/2004
2. Survey Grid : Hong Kong Metric Grid
3. Survey Datum : Hong Kong Principal Datum
4. Survey Vessel : Wing Hung 8
   Yau Sampan
5. Equipment : C-Nav GcOPS System
   Klein System 2000 Tow Fish
   C-view SDMP
6. Coastline taken from 1:1000 Survey Sheets, SMO,LD.

Revision No.	Date	Drawn by	Checked by	Approved by	Remarks
0	21/07/2004	Clarence Siu	Matthew Lai	WHRT	Preliminary
1	18/09/2004	Clarence Siu	Matthew Lai	WHRT	Final

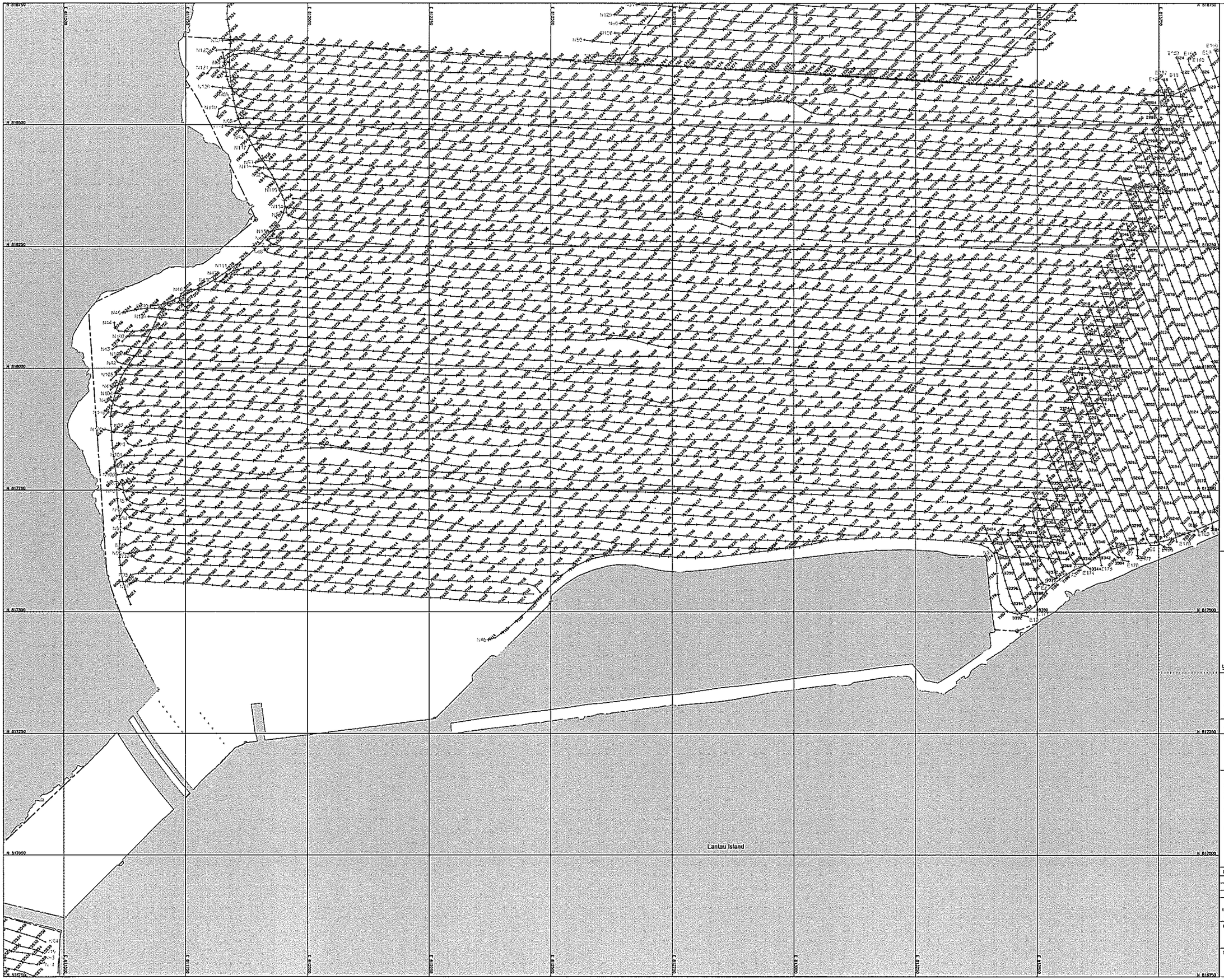
METRIC SCALE 1:2,500

125 100 75 50 25 0 125 250

Client : Civil Engineering And Development Department

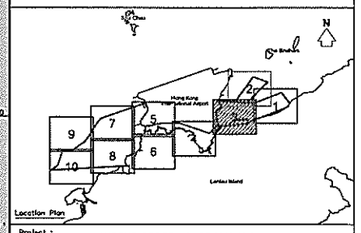
Surveyor : EGS (ASIA) LIMITED

JOB NO. : HK186804



Legend :

- Side scan sonar track with fix positions
- Survey boundary
- Chart overlap



Location Plan

Project :

WORKS ORDER NO. GE/2003/18.24
AGREEMENT NO. CE 26/2003 (HY)
HONG KONG SECTION OF HONG KONG - ZHUHAI - MACAO BRIDGE AND CONNECTION WITH NORTH LANTAU HIGHWAY - INVESTIGATION
MARINE GEOPHYSICAL SURVEYS

AREA : NORTH OF TUNG CHUNG | FIGURE NUMBER : 3.3

Drawing Title :

SIDE SCAN SONAR TRACK PLOTS

Notes :

1. Survey Date : 11/05/2004 – 14/06/2004
2. Survey Grid : Hong Kong Metric Grid
3. Survey Datum : Hong Kong Principal Datum
4. Survey Vessel : Wing Hung 8
   Yau Sampan
5. Equipment : C-Nav GcGPS System
   Klein System 2000 Tow Fish
   C-view SDMP
6. Coastline taken from 1:1000 Survey Sheets, SMO,LD.

Revision No.	Date	Drawn by	Checked by	Approved by	Remarks
0	21/07/2004	Clarence Siu	Matthew Lai	WHRT	Preliminary
1	16/09/2004	Clarence Siu	Matthew Lai	WHRT	Final

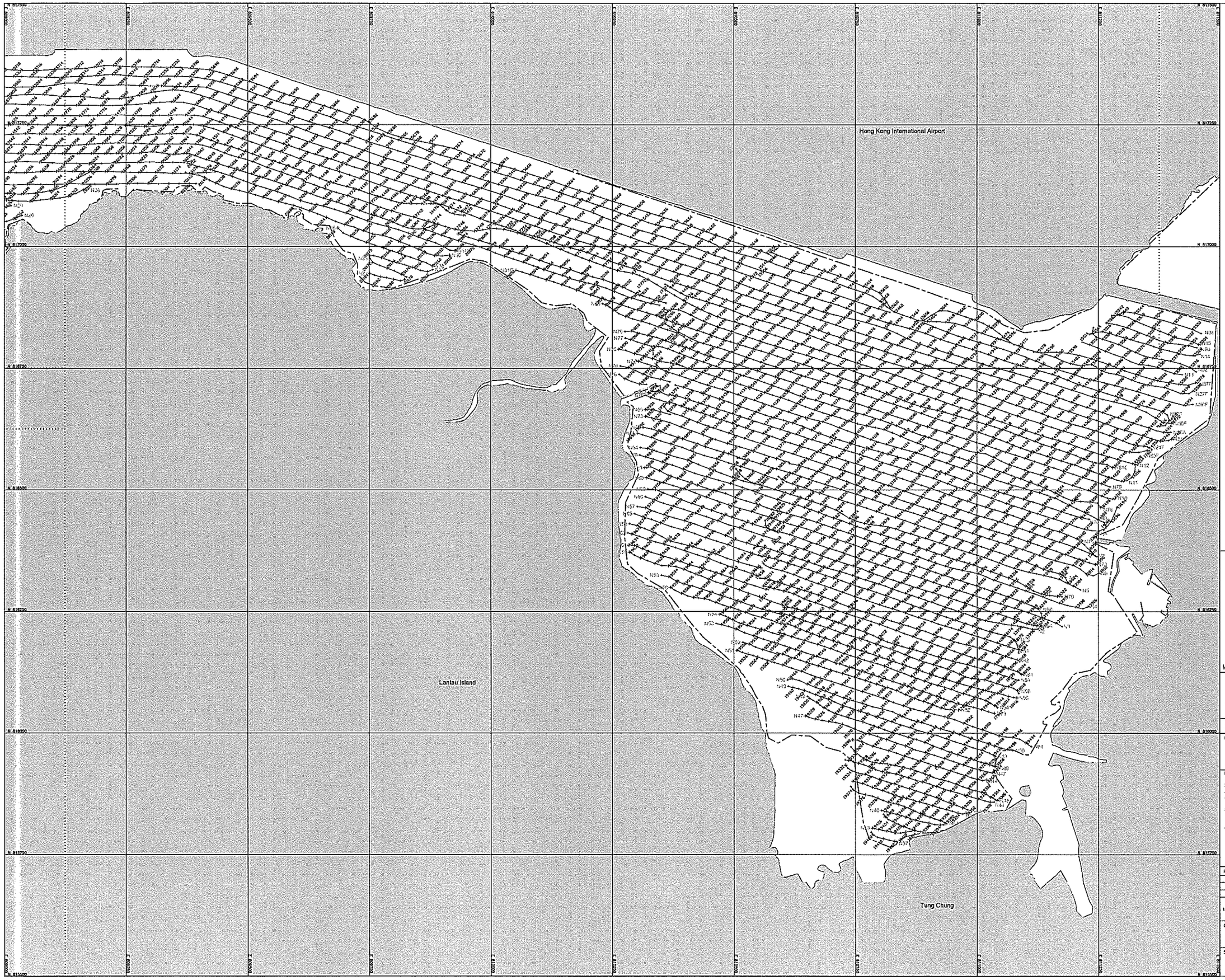
METRIC SCALE 1:2,500

125 100 75 50 25 0 125 250

Client : Civil Engineering And Development Department

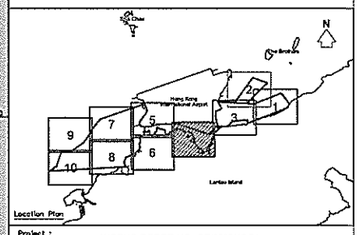
Surveyor : EGS (ASIA) LIMITED

JOB NO. : HK186804



Legend :

- Side scan sonar track with fix positions
- Survey boundary
- Chart overlap



Location Plan

Project :

WORKS ORDER NO. GE/2003/18.24
AGREEMENT NO. CE 26/2003 (HY)
HONG KONG SECTION OF HONG KONG - ZHUHAI - MACAO BRIDGE AND CONNECTION WITH NORTH LANTAU HIGHWAY - INVESTIGATION
MARINE GEOPHYSICAL SURVEYS

AREA : CHEK LAP KOK CHANNEL | FIGURE NUMBER : 3.4

Drawing Title :

SIDE SCAN SONAR TRACK PLOTS

Notes :

1. Survey Date : 11/05/2004 – 14/06/2004
2. Survey Grid : Hong Kong Metric Grid
3. Survey Datum : Hong Kong Principal Datum
4. Survey Vessel : Wing Hung 8
   Yau Sampan
5. Equipment : C-Nav GcGPS System
   Klein System 2000 Tow Fish
   C-view SDMP
6. Coastline taken from 1:1000 Survey Sheets, SMO,LD.

Revision No.	Date	Drawn by	Checked by	Approved by	Remarks
0	21/07/2004	Clarence Siu	Matthew Lai	WART	Preliminary
1	18/09/2004	Clarence Siu	Matthew Lai	WART	Final

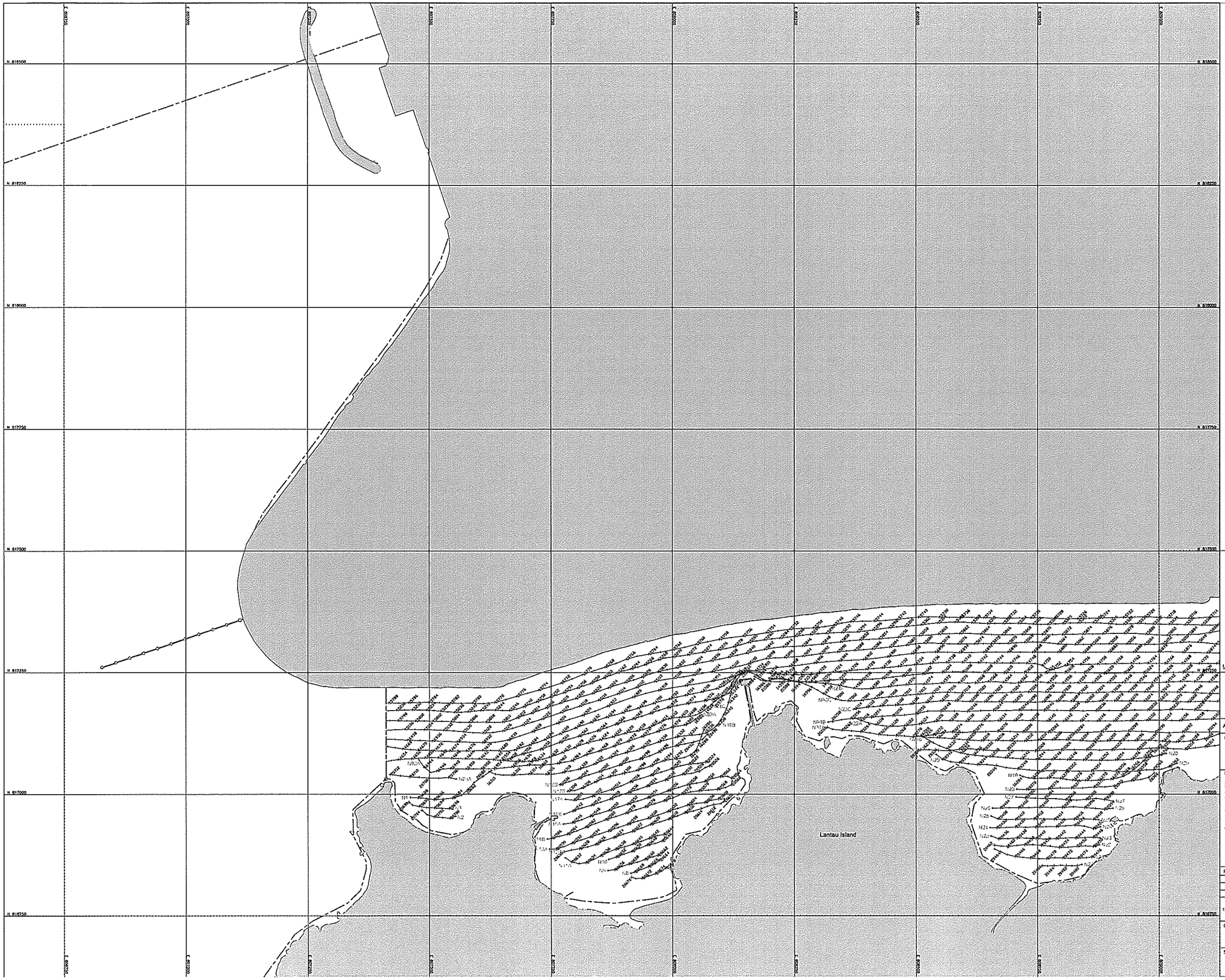
METRIC SCALE 1:2,500

125 100 75 50 25 0 125 250

Client : Civil Engineering And Development Department

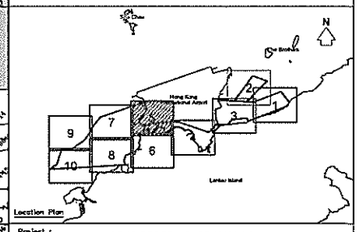
Surveyor : EGS (ASIA) LIMITED

JOB NO. : HK185504



Legend :

- Side scan sonar track with fix positions
- Survey boundary
- Chart overlap



Location Plan

Project :

WORKS ORDER NO. GE/2003/18.24
AGREEMENT NO. CE 26/2003 (HY)
HONG KONG SECTION OF HONG KONG - ZHUHAI - MACAO BRIDGE
AND CONNECTION WITH NORTH LANTAU HIGHWAY - INVESTIGATION
MARINE GEOPHYSICAL SURVEYS

AREA : CHEK LAP KOK CHANNEL

FIGURE NUMBER : 3.5

Drawing Title :

SIDE SCAN SONAR TRACK PLOTS

Notes :

1. Survey Date : 11/05/2004 – 14/06/2004
2. Survey Grid : Hong Kong Metric Grid
3. Survey Datum : Hong Kong Principal Datum
4. Survey Vessel : Wing Hung 8
   Yau Somoon
5. Equipment : C-Nav GcGPS System
   Klein System 2000 Tow Fish
   C-view SDMP
6. Coastline taken from 1:1000 Survey Sheets, SMO,LD.

Revision No.	Date	Drawn by	Checked by	Approved by	Remarks
0	21/07/2004	Clarence Siu	Matthew Lai	WNRT	Preliminary
1	18/09/2004	Clarence Siu	Matthew Lai	WNRT	Final

METRIC SCALE 1:2,500

125 100 75 50 25 0 125 250

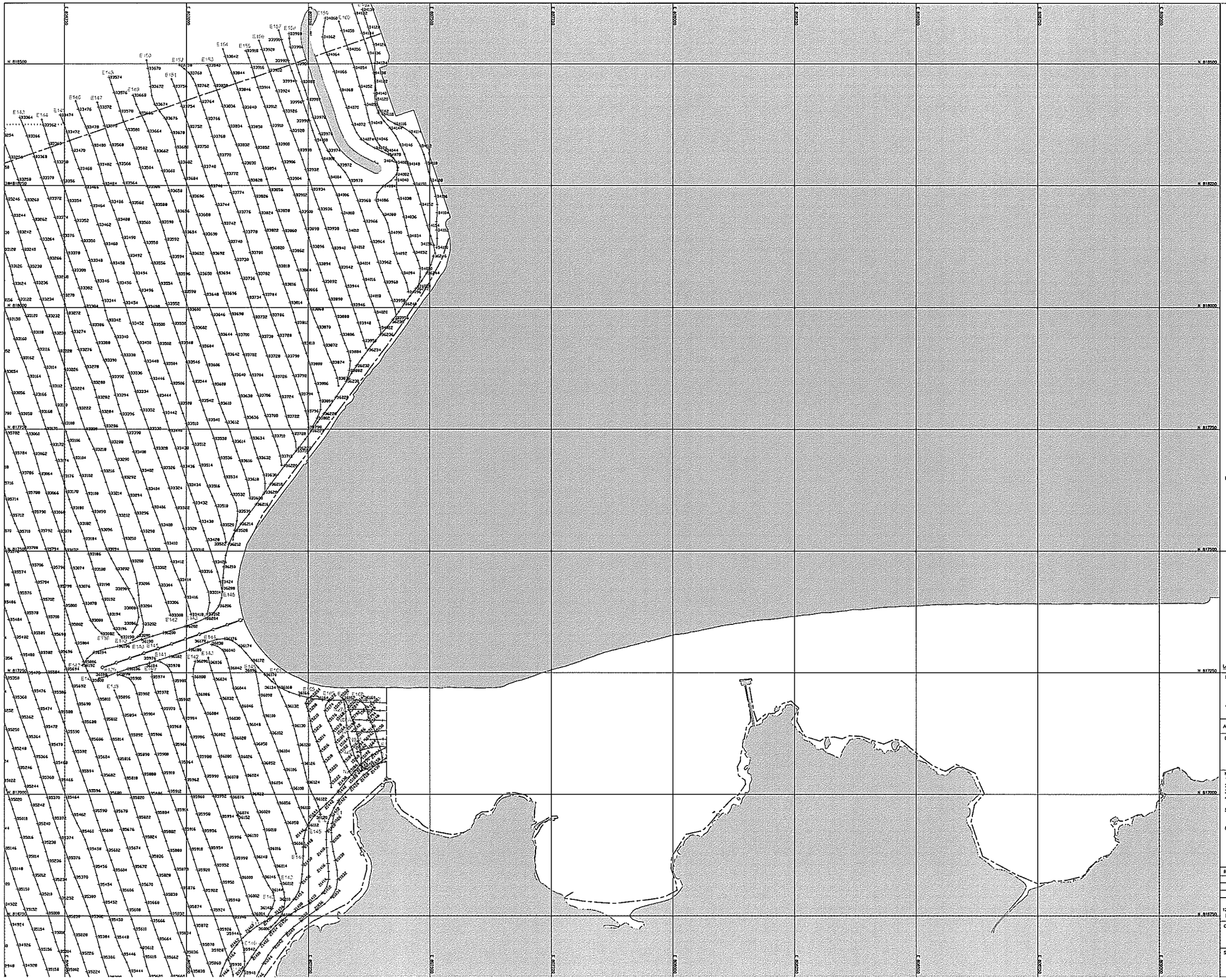
Client :

Civil Engineering
And Development Department

Surveyer :

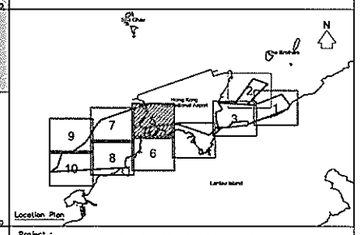
EGE (ASIA) LIMITED
Earth Science & Exploration

JOB NO. : HK186804



Legend :

- Side scan sonar track with fix positions
- Survey boundary
- Chart overlap



Project :

WORKS ORDER NO. GE/2003/18.24
AGREEMENT NO. CE 26/2003 (HY)
HONG KONG SECTION OF HONG KONG - ZHUHAI - MACAO BRIDGE AND CONNECTION WITH NORTH LANTAU HIGHWAY - INVESTIGATION
MARINE GEOPHYSICAL SURVEYS

AREA : WEST OF CHEK LAP KOK

FIGURE NUMBER : 3.5

Drawing Title :

SIDE SCAN SONAR TRACK PLOTS

Notes :

1. Survey Date : 11/05/2004 – 14/06/2004
2. Survey Grid : Hong Kong Metric Grid
3. Survey Datum : Hong Kong Principal Datum
4. Survey Vessel : Wing Hung 8
   Yau Sampan
5. Equipment : C-Nav GeoPS System
   Klein System 2000 Tow Fish
   C-view SDVR
6. Coastline taken from 1:1000 Survey Sheets, SMO,LD.

Revision No.	Date	Drawn by	Checked by	Approved by	Remarks
0	21/07/2004	Clarence Siu	Matthew Lai	WNRT	Preliminary
1	05/10/2004	Clarence Siu	Matthew Lai	WNRT	Final

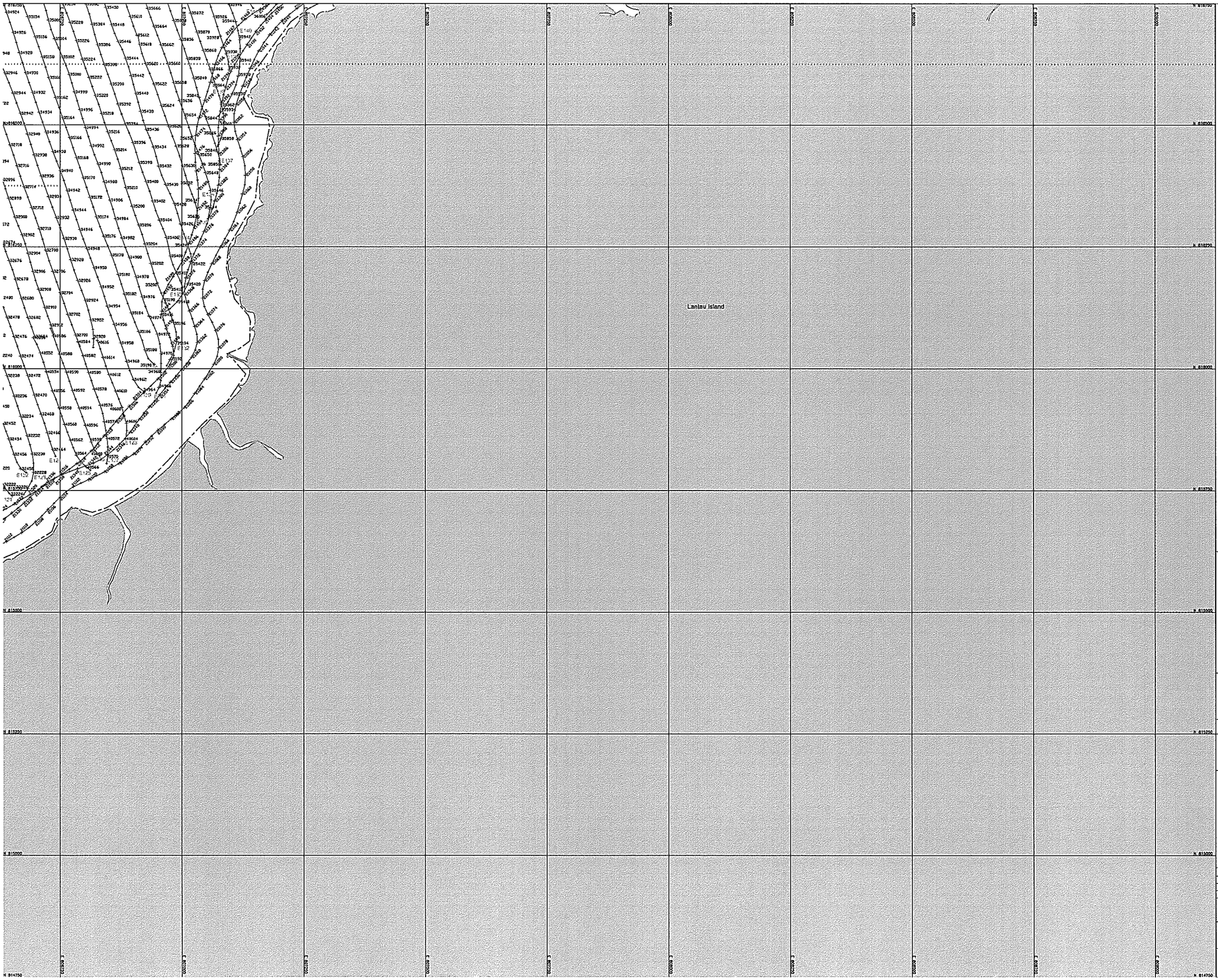
METRIC SCALE 1:2,500

125 100 75 50 25 0 125 250

Client : Civil Engineering And Development Department

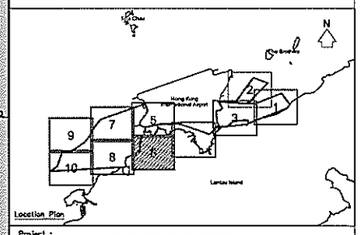
Surveyor : EGS (ASIA) LIMITED

JOB NO. : HK186804



Legend :

- Side scan sonar track with fix positions
- Survey boundary
- Chart overlap



Location Plan

Project :

WORKS ORDER NO. GE/2003/18.24
AGREEMENT NO. CE 26/2003 (HY)
HONG KONG SECTION OF HONG KONG - ZHUHAI - MACAO BRIDGE
AND CONNECTION WITH NORTH LANTAU HIGHWAY - INVESTIGATION
MARINE GEOPHYSICAL SURVEYS

AREA : WEST OF CHEK LAP KOK

FIGURE NUMBER : 3.6

Drawing Title :

SIDE SCAN SONAR TRACK PLOTS

Notes :

1. Survey Date : 11/05/2004 – 14/06/2004
2. Survey Grid : Hong Kong Metric Grid
3. Survey Datum : Hong Kong Principal Datum
4. Survey Vessel : Wing Hung 5
   You Sampan
5. Equipment : C-Nav GcGPS System
   Klein System 2000 Tow Fish
   C-view SDMP
6. Coastline taken from 1:1000 Survey Sheets, SMO,LD.

Revision No.	Date	Drawn by	Checked by	Approved by	Remarks
0	21/07/2004	Clarence Siu	Matthew Lai	WMRT	Preliminary
1	05/10/2004	Clarence Siu	Matthew Lai	WMRT	Final

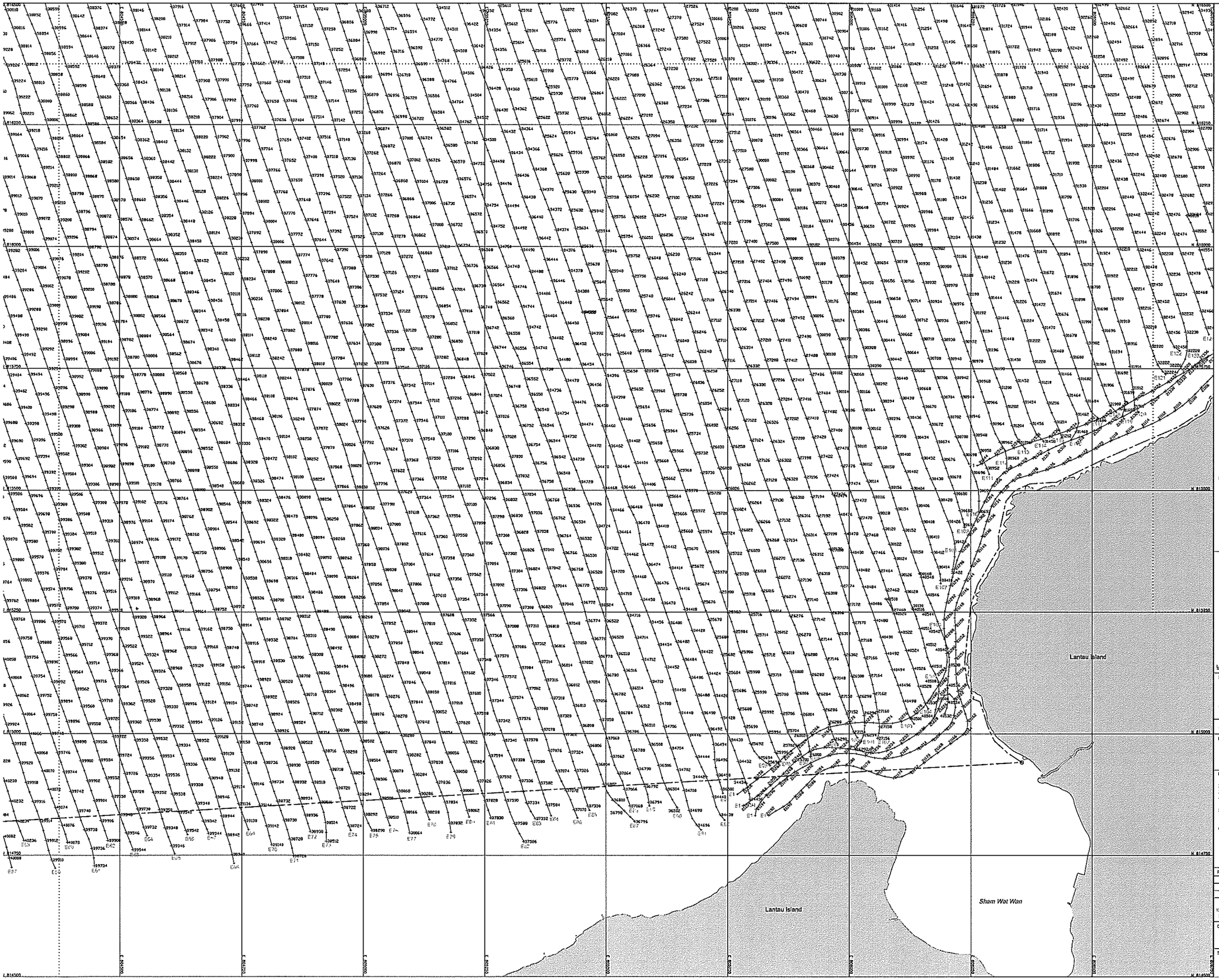
METRIC SCALE 1:2,500

125 100 75 50 25 0 125 250

Client : Civil Engineering And Development Department

Surveyor : EGS (ASIA) LIMITED

JOB NO. : HK186804

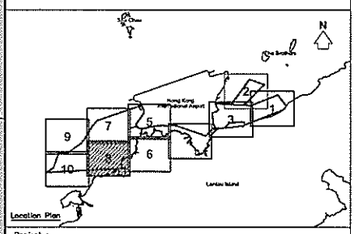


Legend :

105 — 100 Side scan sonar track with fix positions

Survey boundary

Chart overlap



Project :

WORKS ORDER NO. GE/2003/18.24
AGREEMENT NO. CE 26/2003 (HY)
HONG KONG SECTION OF HONG KONG - ZHUHAI - MACAO BRIDGE AND CONNECTION WITH NORTH LANTAU HIGHWAY - INVESTIGATION
MARINE GEOPHYSICAL SURVEYS

AREA : WEST OF CHEK LAP KOK | FIGURE NUMBER : 3.8

Drawing Title :

SIDE SCAN SONAR TRACK PLOTS

Notes :
1. Survey Date : 11/05/2004 – 14/06/2004
2. Survey Grid : Hong Kong Metric Grid
3. Survey Datum : Hong Kong Principal Datum
4. Survey Vessel : Wing Hung 8
   You Sampan
5. Equipment : C-Nav GcPS System
   Klein System 2000 Tow Fish
   C-view SDMP
6. Coastline taken from 1:1000 Survey Sheets, SMO,LD.

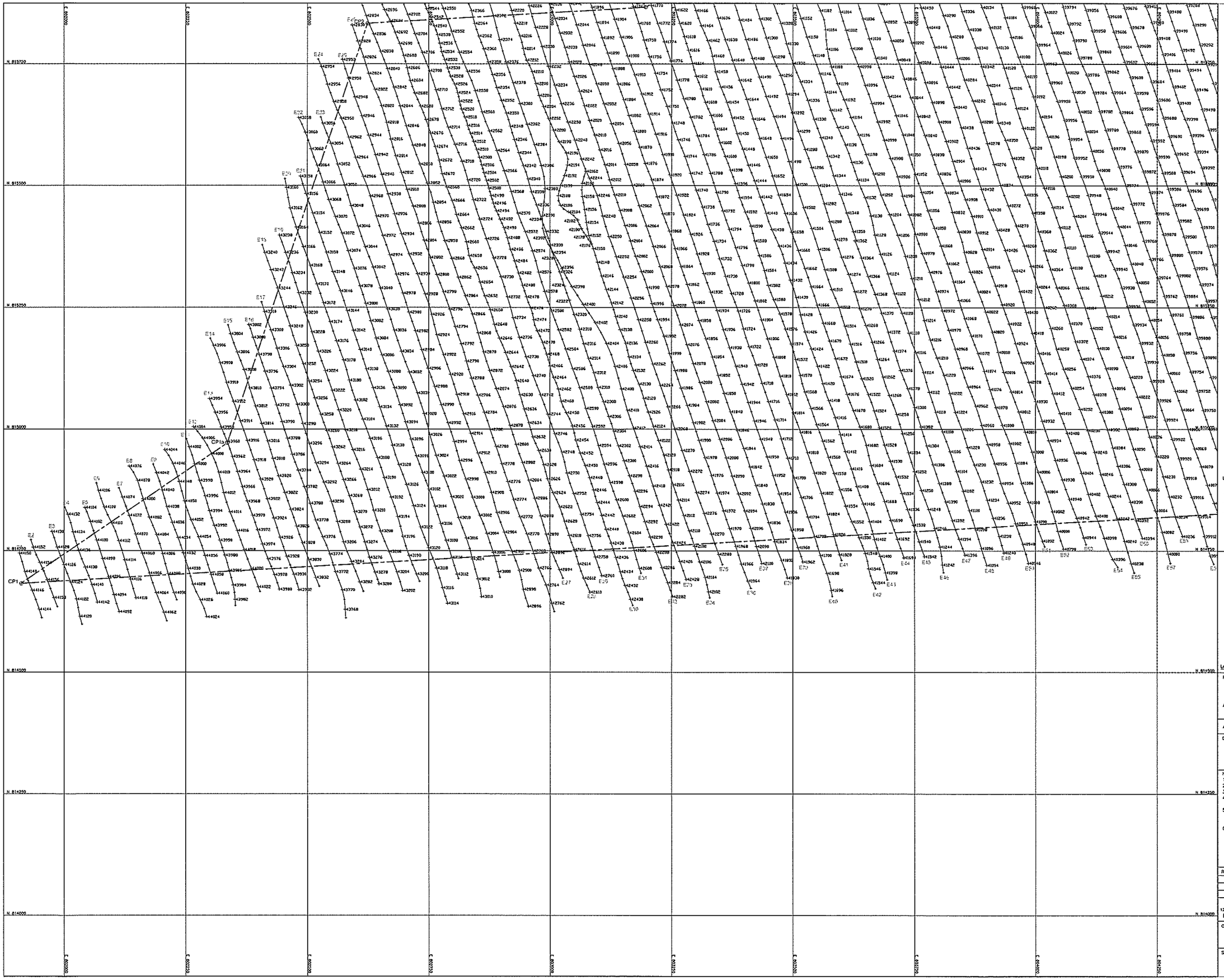
Revision No.	Date	Drawn by	Checked by	Approved by	Remarks
0	21/07/2004	Clarence Siu	Matthew Lai	WHRT	Preliminary
1	05/10/2004	Clarence Siu	Matthew Lai	WHRT	Final

METRIC SCALE 1:2,500
125 100 75 50 25 0 125 250

Client : Civil Engineering And Development Department

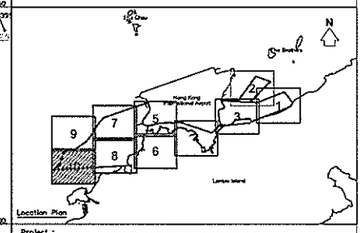
Surveyor : EGS (ASIA) LIMITED

JOB NO. : HK186804



Legend :

- Side scan sonar track with fix positions
- Survey boundary
- Chart overlap



Location Plan

Project :

WORKS ORDER NO. GE/2003/18.24
AGREEMENT NO. CE 26/2003 (HY)
HONG KONG SECTION OF HONG KONG - ZHUHAI - MACAO BRIDGE AND CONNECTION WITH NORTH LANTAU HIGHWAY - INVESTIGATION
MARINE GEOPHYSICAL SURVEYS

AREA : WEST OF CHEK LAP KOK | FIGURE NUMBER : 3.10

Drawing Title :

SIDE SCAN SONAR TRACK PLOTS

Notes :

1. Survey Date : 11/05/2004 – 14/06/2004
2. Survey Grid : Hong Kong Metric Grid
3. Survey Datum : Hong Kong Principal Datum
4. Survey Vessel : Wing Hung 8
   Yau Sampan
5. Equipment : C-Nav GcOPS System
   Klein System 2000 Tow Fish
   C-view SDMP
6. Coastline taken from 1:1000 Survey Sheets, SMO,LD.

Revision No.	Date	Drawn by	Checked by	Approved by	Remarks
0	21/07/2004	Clarence Siu	Matthew Lai	WNRT	Preliminary
1	05/10/2004	Clarence Siu	Matthew Lai	WNRT	Final

METRIC SCALE 1:2,500

125 100 75 50 25 0 125 250

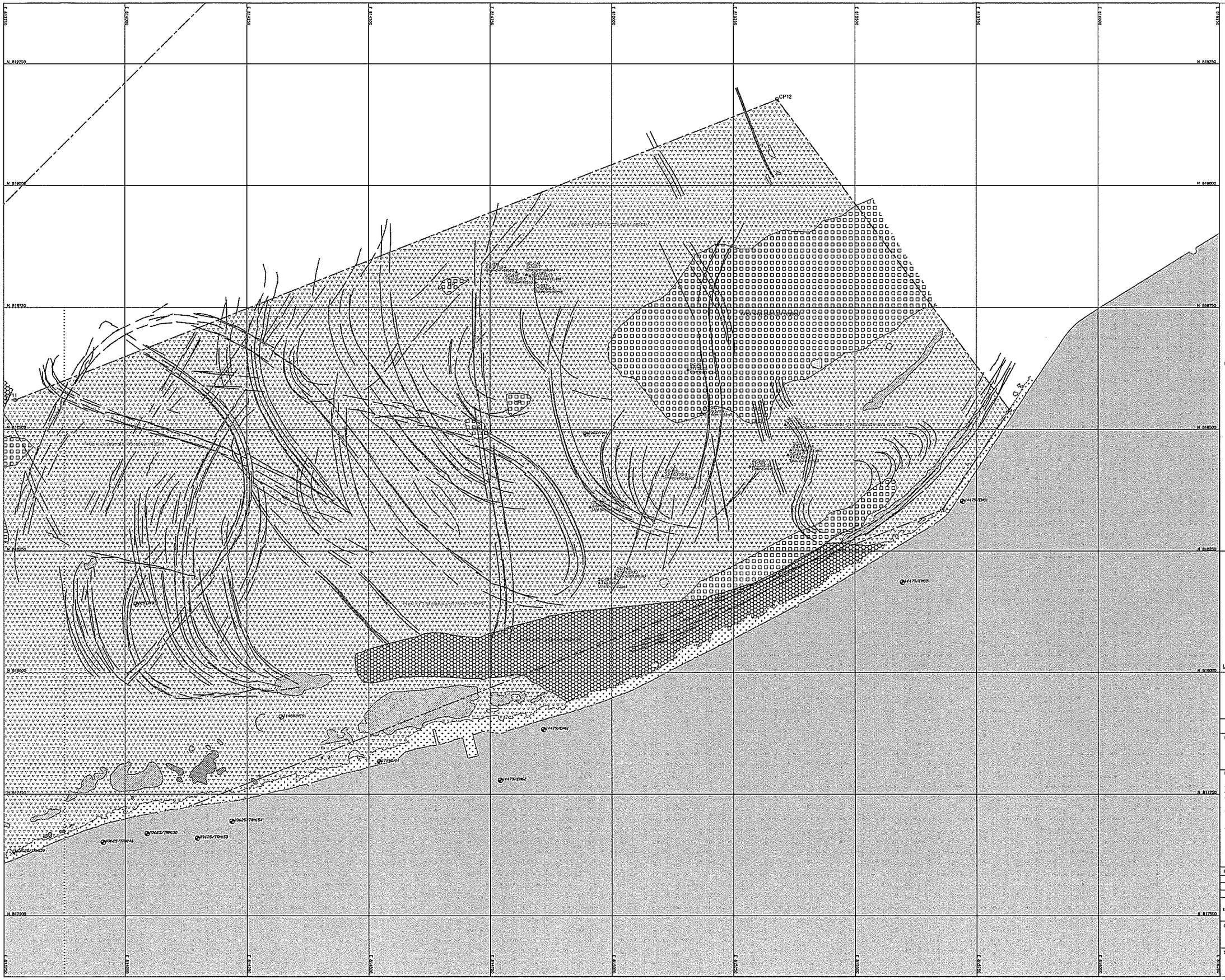
Client :

Civil Engineering
And Development Department

Surveyor :

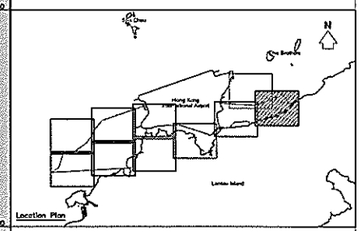
EGS (ASIA) LIMITED
5/F, DIGITAL INVENTORY HOUSE,
SUNNY PLACE, 175 SHATIN ROAD,
SHA TIN, NEW TERRITORIES,
HONG KONG
Tel: (852) 2576 6000
Fax: (852) 2576 6010
Web: www.egsasia.com

JOB NO. : HK186804



Legend :

- Area with granular seabed (HR– High Reflective)
- Area with granular/cohesive seabed (MR– Medium Reflective)
- Area with cohesive seabed (LR – Low Reflective)
- Dumped material
- Debris
- Rubble mound seawall
- Seabed with boulders, gravels and pebbles
- Trawl scars
- Survey boundary
- Chart overlap
- Sonar Contact (LxWxH) (nmh = non-measurable height)



Project :

WORKS ORDER NO. GE/2003/18.24
AGREEMENT NO. CE 26/2003 (HY)
HONG KONG SECTION OF HONG KONG - ZHUHAI - MACAO BRIDGE AND CONNECTION WITH NORTH LANTAU HIGHWAY - INVESTIGATION
MARINE GEOPHYSICAL SURVEYS

AREA : CHEK LAP KOK CHANNEL | FIGURE NUMBER : 11.1

Drawing Title :

SEABED FEATURES

Notes :

1. Survey Date : 11–24/05/2004
2. Survey Grid : Hong Kong Metric Grid
3. Survey Datum : Hong Kong Principal Datum
4. Survey Vessel : Wing Hung 5
   Yau Sampan
5. Equipment : C–Nav GcOps System
   Klein System 2000 Tow Fish
   C–view SDMP
6. Coastline taken from 1:1000 Survey Sheets, SMO,LD.

Revision No.	Date	Drawn by	Checked by	Approved by	Remarks
0	04/06/2004	Clarence Siu	Wilson Wong	Matthew Loi	Preliminary

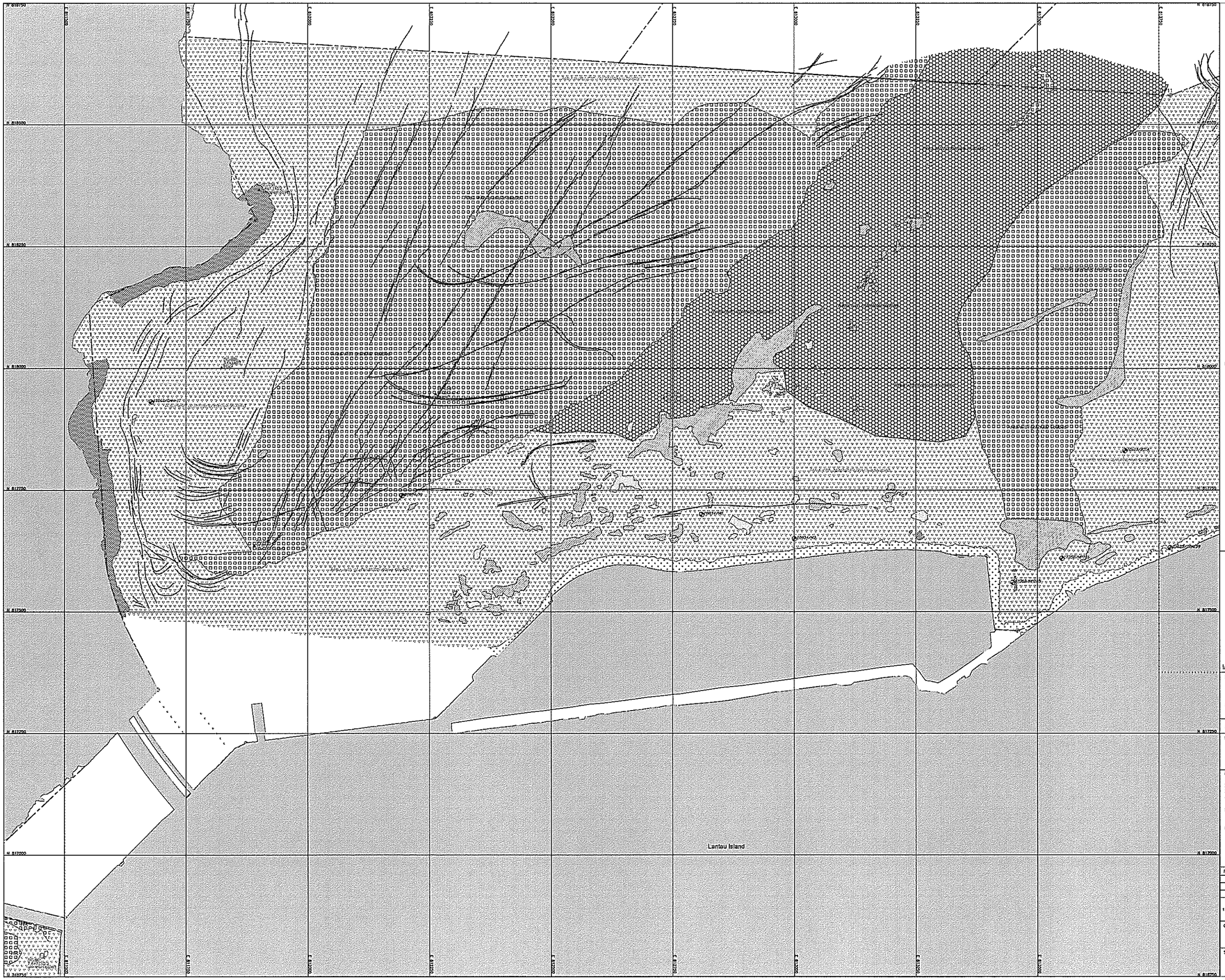
METRIC SCALE 1:2,500

125 100 75 50 25 0 125 250

Client : Civil Engineering Department Hong Kong

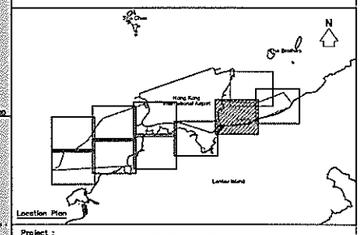
Surveyor : EGS (ASIA) LIMITED

JOB NO. : HK186804



Legend :

- Area with granular seabed (HR– High Reflective)
- Area with granular/cohesive seabed (MR– Medium Reflective)
- Area with cohesive seabed (LR– Low Reflective)
- Dumped material
- Debris
- Rubble mound seawall
- Seabed with boulders, gravels and pebbles
- Trawl scars
- Survey boundary
- Chart overlap
- A Sonar Contact (LxWxH) (nmh = non-measurable height)



Project :

WORKS ORDER NO. GE/2003/18.24
AGREEMENT NO. CE 26/2003 (HY)
HONG KONG SECTION OF HONG KONG - ZHUHAI - MACAO BRIDGE AND CONNECTION WITH NORTH LANTAU HIGHWAY - INVESTIGATION
MARINE GEOPHYSICAL SURVEYS

AREA : CHEK LAP KOK CHANNEL | FIGURE NUMBER : 11.2

Drawing Title :

SEABED FEATURES

Notes :

1. Survey Date : 11–24/05/2004
2. Survey Grid : Hong Kong Metric Grid
3. Survey Datum : Hong Kong Principal Datum
4. Survey Vessel : Wing Hung 8
   Yau Sampan
5. Equipment : C–Nav GcGps System
   Klein System 2000 Tow Fish
   C–view SBMP
6. Coastline taken from 1:1000 Survey Sheets, SMO,LD.

Revision No.	Date	Drawn by	Checked by	Approved by	Remarks
0	04/06/2004	Clarence Siu	Wilson Wong	Matthew Lai	Preliminary

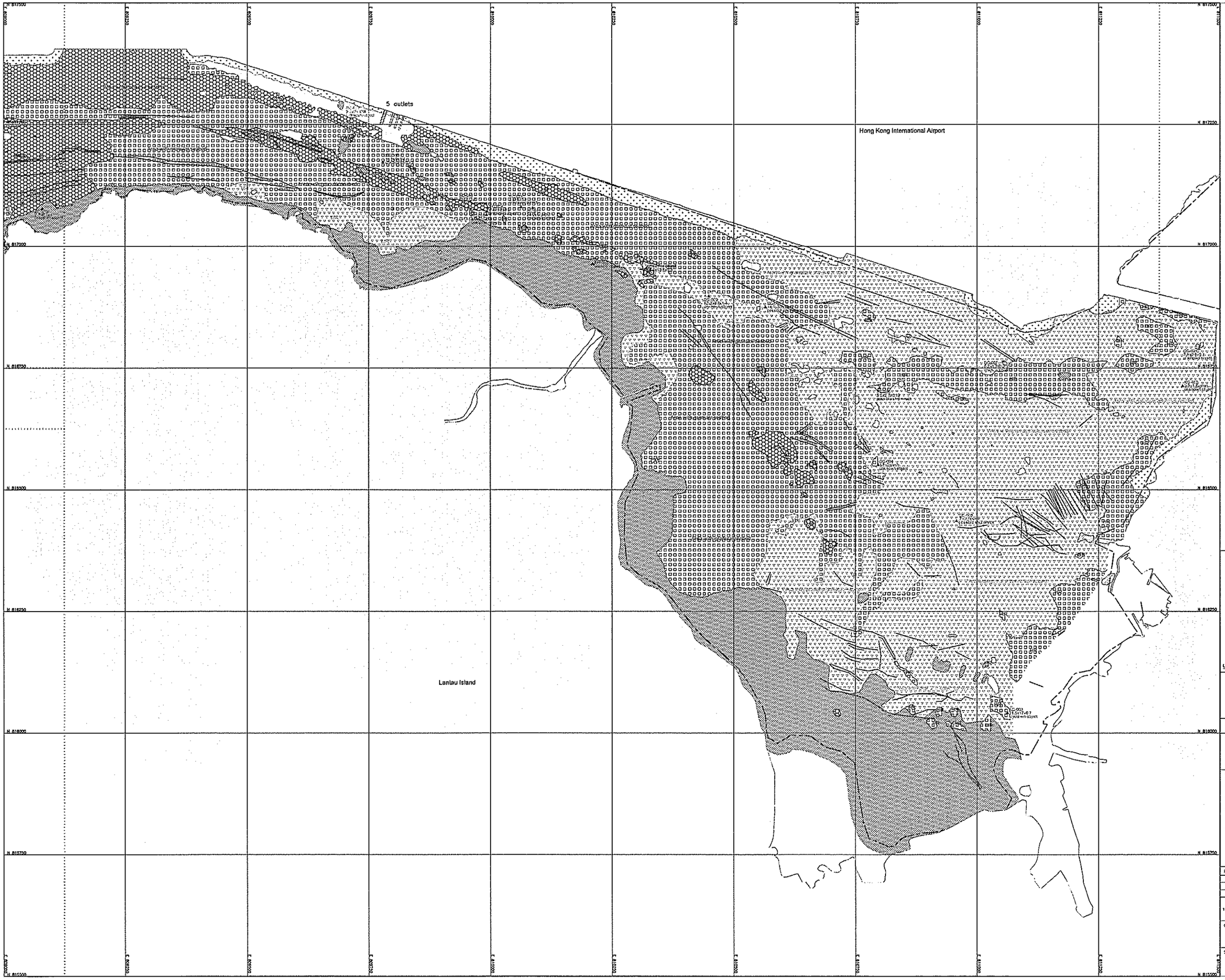
METRIC SCALE 1:2,500

125 100 75 50 25 0 125 250

Client : Civil Engineering Department Hong Kong

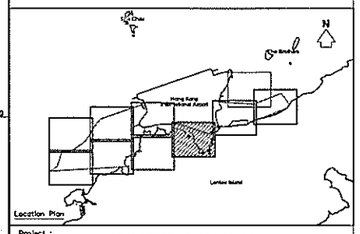
Surveyor : EGS (ASIA) LIMITED

JOB NO. : HK186804



Legend :

- Area with granular seabed (HR– High Reflective)
- Area with granular/cohesive seabed (MR– Medium Reflective)
- Area with cohesive seabed (LR – Low Reflective)
- Dumped material
- Debris
- Rubble mound seawall
- Seabed with boulders, gravels and pebbles
- Trawl scars
- Survey boundary
- Chart overlap
- Sonar Contact (LxWxH) (nmh = non-measurable height)



Project :

WORKS ORDER NO. GE/2003/18.24
AGREEMENT NO. CE 26/2003 (HY)
HONG KONG SECTION OF HONG KONG - ZHUHAI - MACAO BRIDGE AND CONNECTION WITH NORTH LANTAU HIGHWAY - INVESTIGATION
MARINE GEOPHYSICAL SURVEYS

AREA : CHEK LAP KOK CHANNEL | FIGURE NUMBER : 11.3

Drawing Title :

SEABED FEATURES

Notes :
1. Survey Date : 11–24/05/2004
2. Survey Grid : Hong Kong Metric Grid
3. Survey Datum : Hong Kong Principal Datum
4. Survey Vessel : Wing Hung 8
   Yau Sampan
5. Equipment : C–Nav GeOps System
   Klein System 2000 Tow Fish
   C–view SDMP
6. Coastline taken from 1:1000 Survey Sheets, SWO,LD.

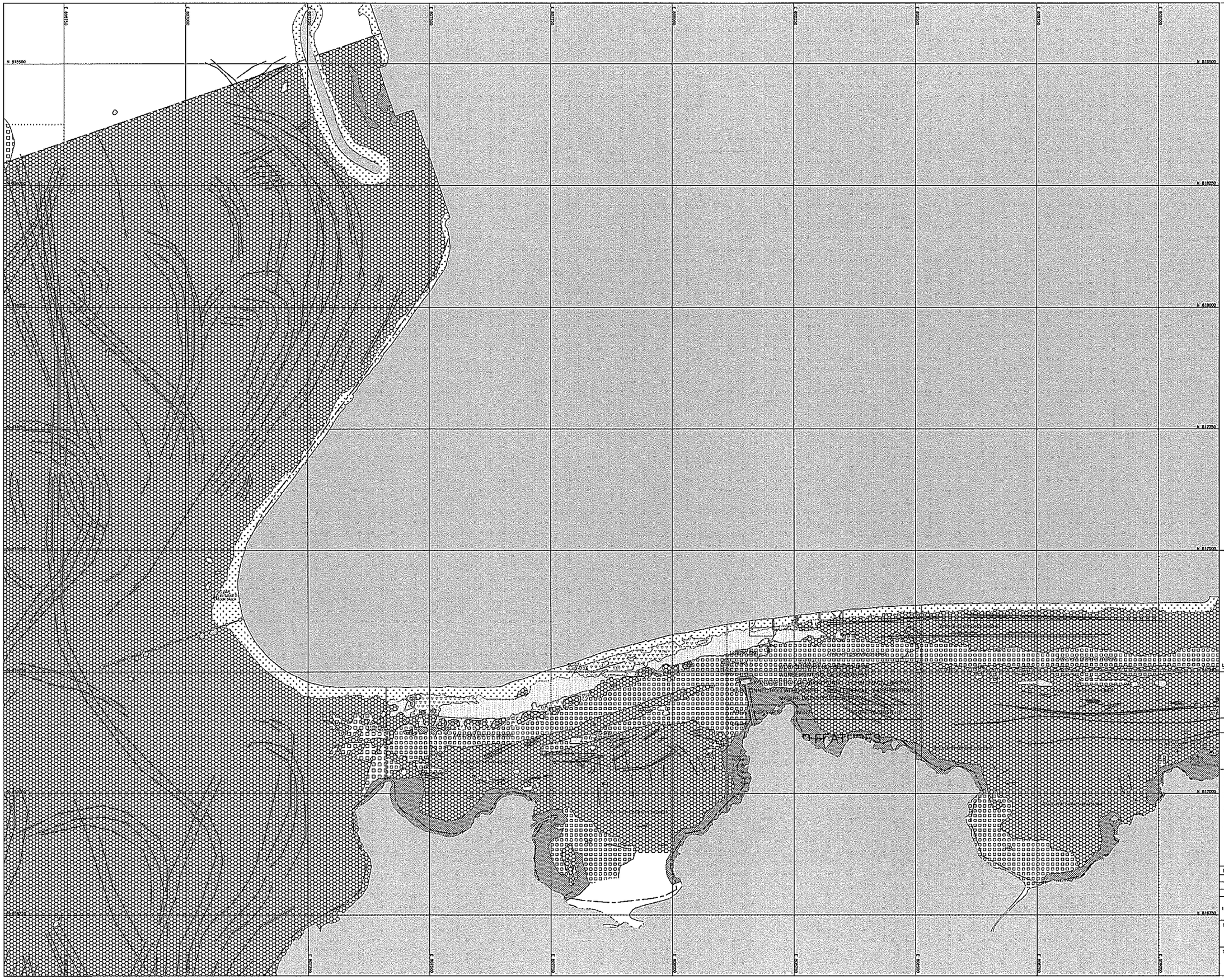
Revision No.	Date	Drawn by	Checked by	Approved by	Remarks
0	04/06/2004	Clarence Siu	Wason Wong	Matthew Lai	Preliminary

METRIC SCALE 1:2,500
125 100 75 50 25 0 125 250

Client : Civil Engineering Department Hong Kong

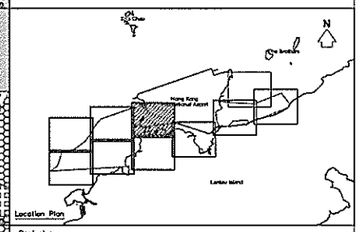
Surveyor : EGS (ASIA) LIMITED

JOB NO. : HK186804



Legend :

- Area with granular seabed (HR– High Reflective)
- Area with granular/cohesive seabed (MR– Medium Reflective)
- Area with cohesive seabed (LR – Low Reflective)
- Dumped material
- Debris
- Rubble mound seawall
- Seabed with boulders, gravels and pebbles
- Trawl scars
- Survey boundary
- Chart overlap
- Sonar Contact (LxWxH) (nmh = non-measurable height)



Location Plan

Project :

WORKS ORDER NO. GE/2003/18.24
AGREEMENT NO. CE 26/2003 (HY)
HONG KONG SECTION OF HONG KONG - ZHUHAI - MACAO BRIDGE AND CONNECTION WITH NORTH LANTAU HIGHWAY - INVESTIGATION
MARINE GEOPHYSICAL SURVEYS

AREA : CHEK LAP KOK CHANNEL | FIGURE NUMBER : 11.4

Drawing Title :

SEABED FEATURES

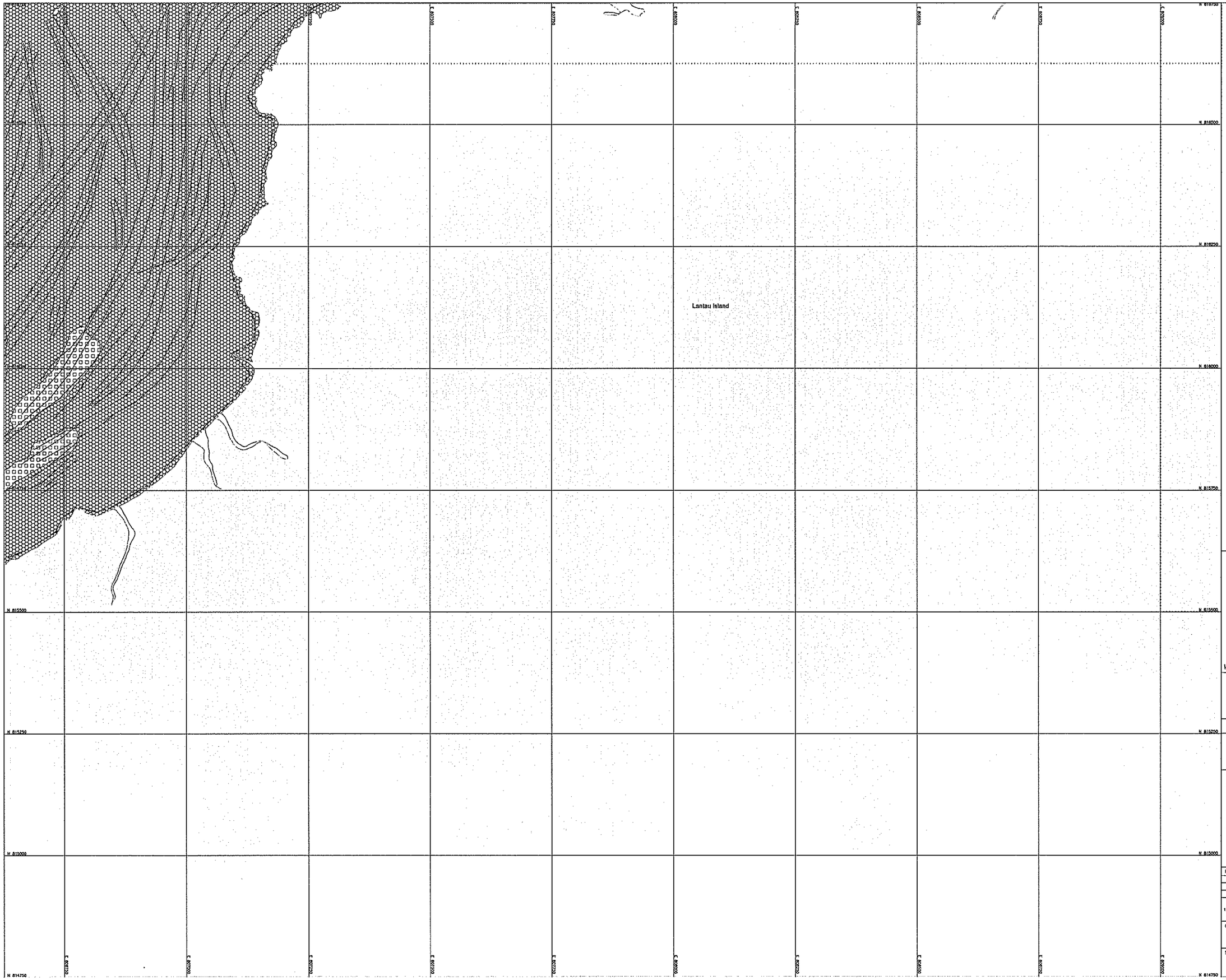
Notes :
1. Survey Date : 11–24/05/2004
2. Survey Grid : Hong Kong Metric Grid
3. Survey Datum : Hong Kong Principal Datum
4. Survey Vessel : Wing Hung 8
   Yau Sampan
5. Equipment : C–Nav GcGps System
   Klein System 2000 Tow Fish
   C–view SDMP
6. Coastline taken from 1:1000 Survey Sheets, SMO,LD.

Revision No.	Date	Drawn by	Checked by	Approved by	Remarks
0	12/07/2004	Clarence Siu	Wilson Wong	Matthew Lai	Preliminary

METRIC SCALE 1:2,500
125 100 75 50 25 0 125 250

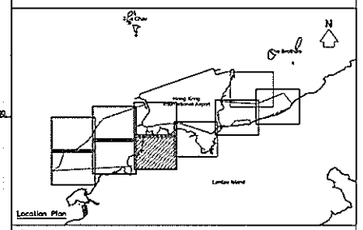
Client : Civil Engineering Department Hong Kong

Surveyor : EGS (ASIA) LIMITED
JOB NO. : HK186804



Legend :

- Area with granular seabed (HR – High Reflective)
- Area with granular/cohesive seabed (MR – Medium Reflective)
- Area with cohesive seabed (LR – Low Reflective)
- Dumped material
- Debris
- Rubble mound seawall
- Seabed with boulders, gravels and pebbles
- Trawl scars
- Survey boundary
- Chart overlap
- Sonar Contact (LatWell) (nmh = non-measurable height)



Location Plan

Project :

WORKS ORDER NO. GE/2003/15.24
AGREEMENT NO. CE 25/2003 (HY)
HONG KONG SECTION OF HONG KONG - ZHUHAI - MACAO BRIDGE
AND CONNECTION WITH NORTH LANTAU HIGHWAY - INVESTIGATION
MARINE GEOPHYSICAL SURVEYS

AREA : CHEK LAP KOK CHANNEL | FIGURE NUMBER : 11.5

Drawing Title :

SEABED FEATURES

Notes :

1. Survey Date : 11/05/2004 – 14/06/2004
2. Survey Grid : Hong Kong Metric Grid
3. Survey Datum : Hong Kong Principal Datum
4. Survey Vessel : Wing Hung 8
   You Sampan
5. Equipment : C-Nav GcOps System
   Klein System 2000 Tow Fish
   C-view SDWP
6. Coastline taken from 1:1000 Survey Sheets, SMO,LD.

Revision No.	Date	Drawn by	Checked by	Approved by	Remarks
0	21/07/2004	Clarence Siu	Matthew Lai	WART	Preliminary

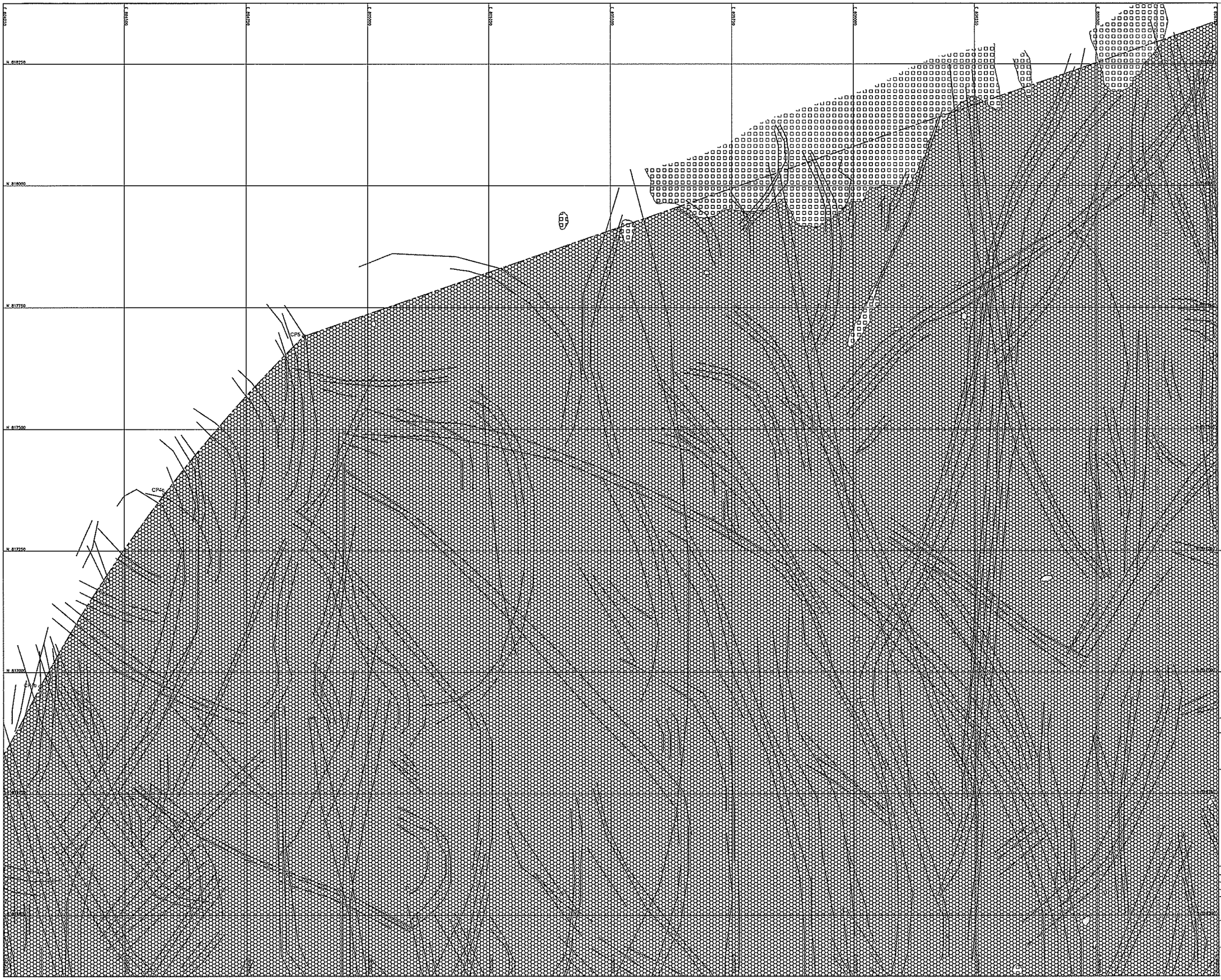
METRIC SCALE 1:2,500

125 100 75 50 25 0 125 250

Client : Civil Engineering Department Hong Kong

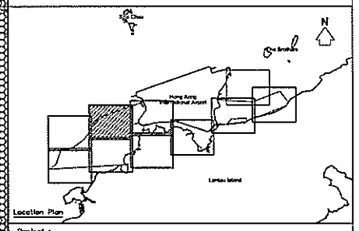
Surveyor : ECS ECO SYSTEMS LIMITED

JOB NO. : HK1555D4



Legend :

- Area with granular seabed (HR– High Reflective)
- Area with granular/cohesive seabed (MR– Medium Reflective)
- Area with cohesive seabed (LR – Low Reflective)
- Dumped material
- Debris
- Rubble mound seawall
- Seabed with boulders, gravels and pebbles
- Trawl scars
- Survey boundary
- Chart overlap
- Sonar Contact (LxWxH) (nmh = non–measurable height)



Location Plan

Project :

WORKS ORDER NO. GE/2003/18.24
AGREEMENT NO. CE 26/2003 (HY)
HONG KONG SECTION OF HONG KONG - ZHUHAI - MACAO BRIDGE
AND CONNECTION WITH NORTH LANTAU HIGHWAY - INVESTIGATION
MARINE GEOPHYSICAL SURVEYS

AREA : CHEK LAP KOK CHANNEL

FIGURE NUMBER : 11.6

Drawing Title :

SEABED FEATURES

Notes :

1. Survey Date : 11/05/2004 – 14/06/2004
2. Survey Grid : Hong Kong Metric Grid
3. Survey Datum : Hong Kong Principal Datum
4. Survey Vessel : Wing Hung 8
   Yau Somoon
5. Equipment : C–Nav GcGps System
   Klein System 2000 Tow Fish
   C–view SDMP
6. Coastline taken from 1:1000 Survey Sheets, SMO,LD.

Revision No.	Date	Drawn by	Checked by	Approved by	Remarks
0	21/07/2004	Clarence Siu	Matthew Lai	WRT	Preliminary

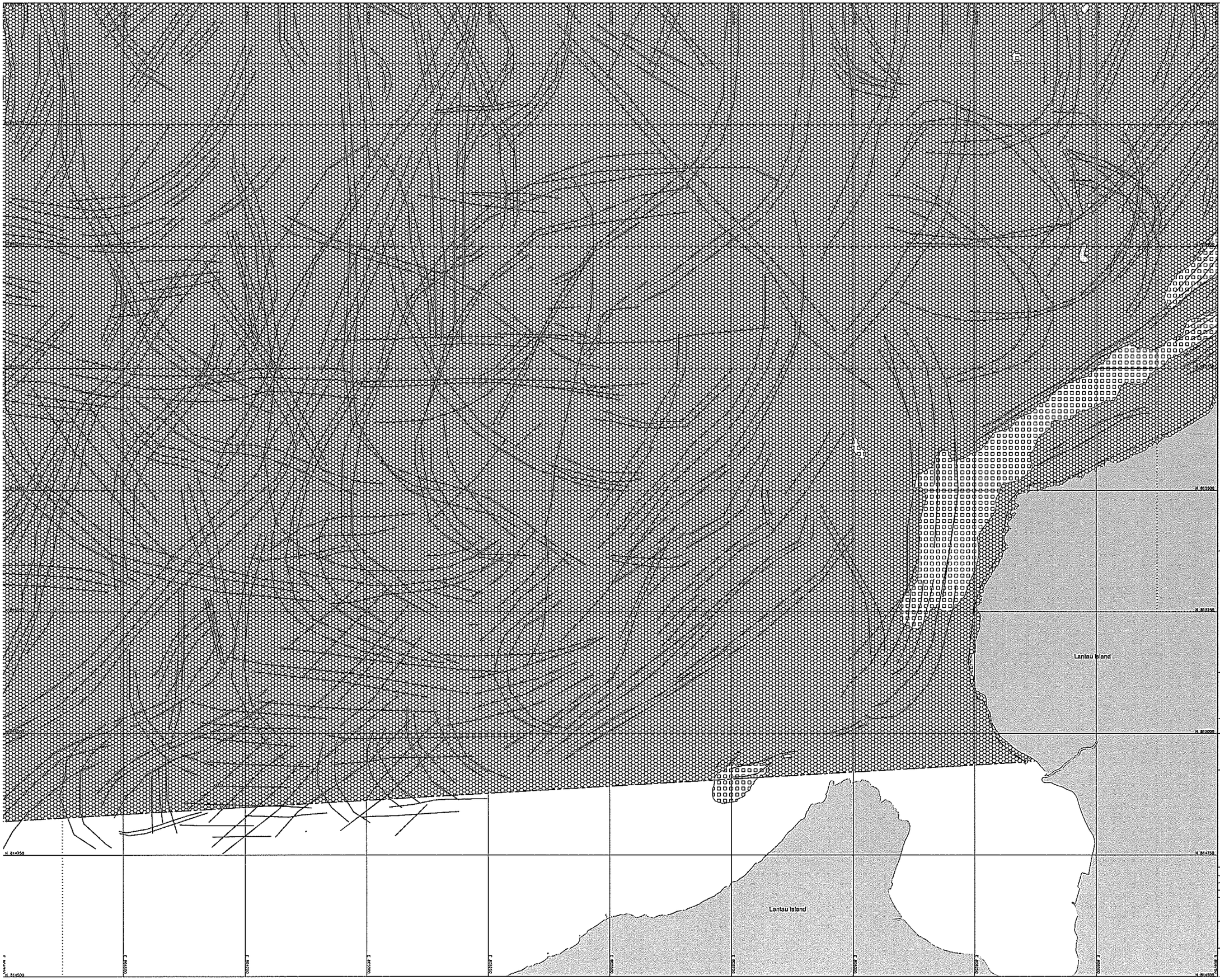
METRIC SCALE 1:2,500

125 100 75 50 25 0 125 250

Client : Civil Engineering Department Hong Kong

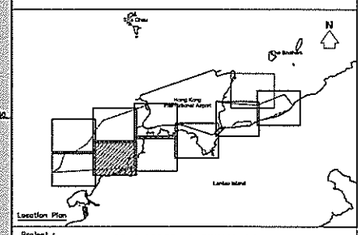
Surveyor : EGS (ASIA) LIMITED

JOB NO. : HK186504



Legend :

- Area with granular seabed (HR– High Reflective)
- Area with granular/cohesive seabed (MR– Medium Reflective)
- Area with cohesive seabed (LR– Low Reflective)
- Dumped material
- Debris
- Rubble mound seawall
- Seabed with boulders, gravels and pebbles
- Trawl scars
- Survey boundary
- Chart overlap
- Sonar Contact (LxWxH) (nmh = non-measurable height)



Location Plan

Project :

WORKS ORDER NO. GE/2003/18.24
AGREEMENT NO. CE 26/2003 (HY)
HONG KONG SECTION OF HONG KONG - ZHUHAI - MACAO BRIDGE AND CONNECTION WITH NORTH LANTAU HIGHWAY - INVESTIGATION
MARINE GEOPHYSICAL SURVEYS

AREA : CHEK LAP KOK CHANNEL | FIGURE NUMBER : 11.7

Drawing Title :

SEABED FEATURES

Notes :

1. Survey Date : 11/05/2004 – 14/06/2004
2. Survey Grid : Hong Kong Metric Grid
3. Survey Datum : Hong Kong Principal Datum
4. Survey Vessel : Wing Hung 8
   You Sampan
5. Equipment : C-Nav GcGps System
   Klein System 2000 Tow Fish
   C-view SDMP
6. Coastline taken from 1:1000 Survey Sheets, SMO,LD.

Revision No.	Date	Drawn by	Checked by	Approved by	Remarks
0	21/07/2004	Clarence Siu	Matthew Lai	WNRT	Preliminary

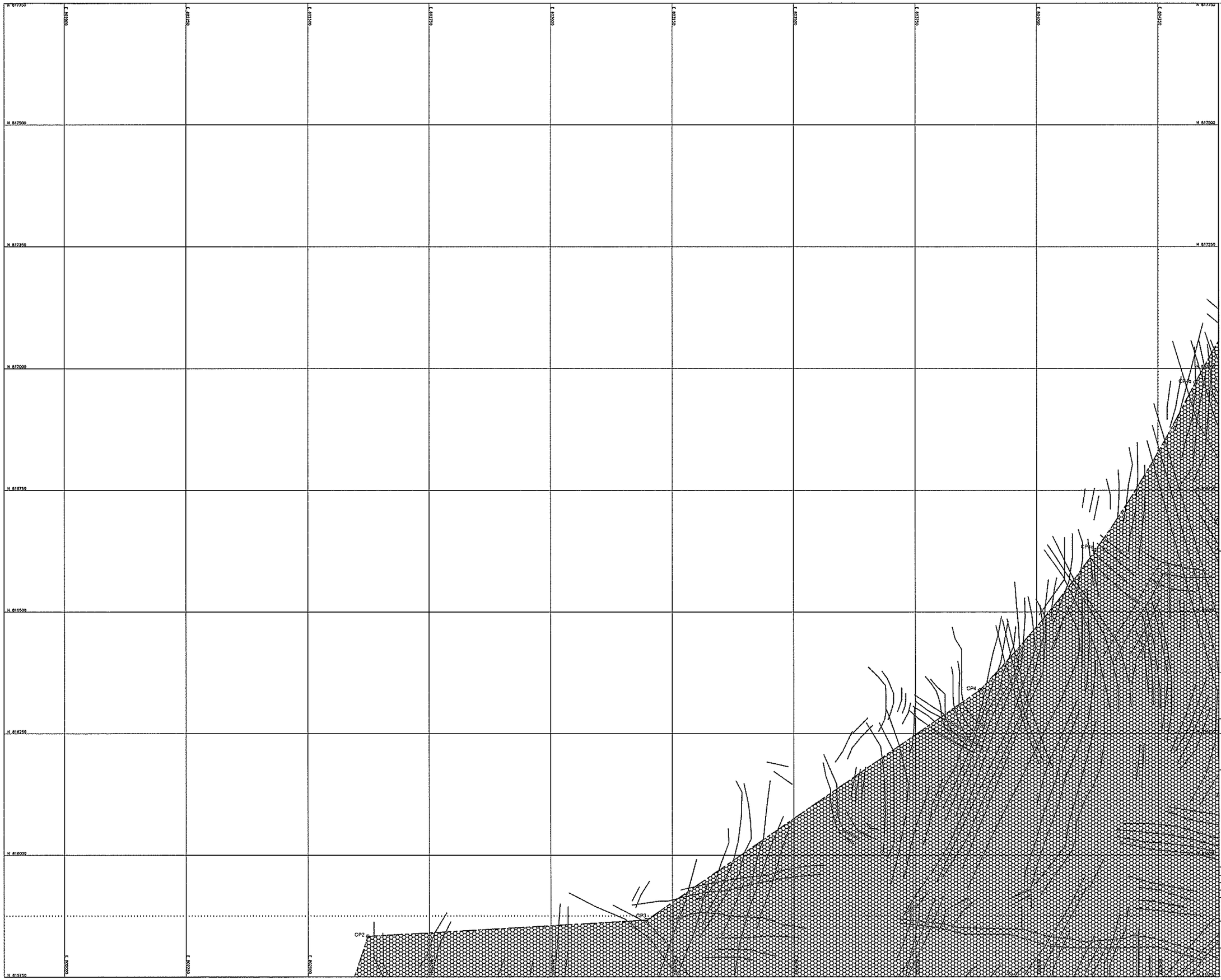
METRIC SCALE 1:2,500

125 100 75 50 25 0 125 250

Client : Civil Engineering Department Hong Kong

Surveyor : EGS (ASIA) LIMITED

JOB NO. : HK1868S04



Legend :

- Area with granular seabed (HR– High Reflective)
- Area with granular/cohesive seabed (MR– Medium Reflective)
- Area with cohesive seabed (LR– Low Reflective)
- Dumped material
- Debris
- Rubble mound seawall
- Seabed with boulders, gravels and pebbles
- Trawl scars
- Survey boundary
- Chart overlap
- Sonar Contact (LxWxH) (nmh = non–measurable height)

Location Plan

Project :

WORKS ORDER NO. GE/2003/18.24
AGREEMENT NO. CE 26/2003 (HY)
HONG KONG SECTION OF HONG KONG - ZHUHAI - MACAO BRIDGE AND CONNECTION WITH NORTH LANTAU HIGHWAY - INVESTIGATION
MARINE GEOPHYSICAL SURVEYS

AREA : CHEK LAP KOK CHANNEL | FIGURE NUMBER : 11.8

Drawing Title :

SEABED FEATURES

Notes :

1. Survey Date : 11/05/2004 – 14/06/2004
2. Survey Grid : Hong Kong Metric Grid
3. Survey Datum : Hong Kong Principal Datum
4. Survey Vessel : Wing Hung 8
   Yau Sampan
5. Equipment : C–Nav GeOps System
   Klein System 2000 Tow Fish
   C–view SDMP
6. Coastline taken from 1:1000 Survey Sheets, SMO,LD.

Revision No.	Date	Drawn by	Checked by	Approved by	Remarks
0	21/07/2004	Clarence Siu	Matthew Loi	WART	Preliminary

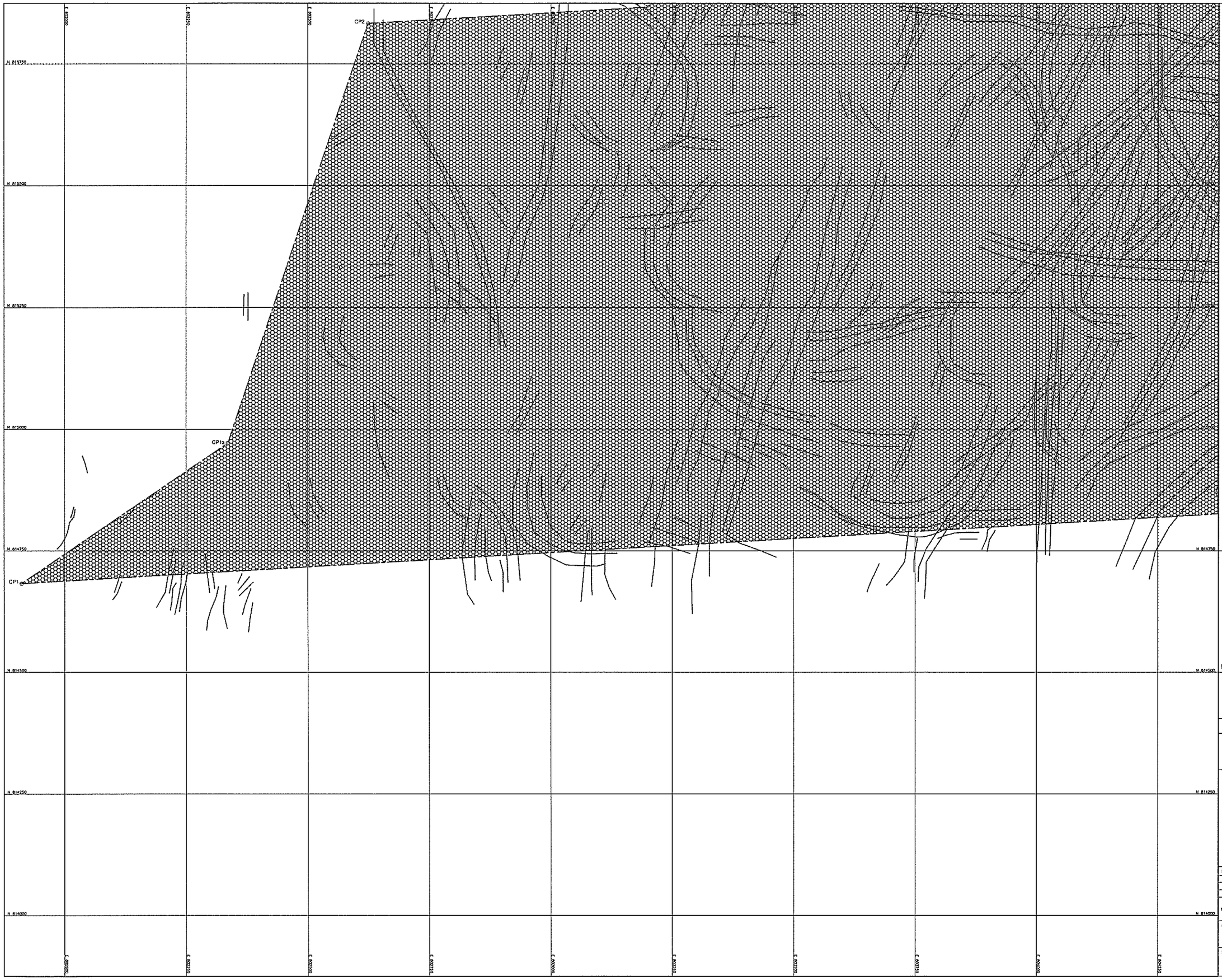
METRIC SCALE 1:2,500

125 100 75 50 25 0 125 250

Client : Civil Engineering Department Hong Kong

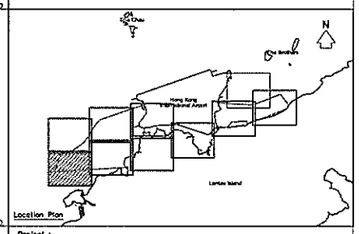
Surveyor : EGS (ASIA) LIMITED

JOB NO. : HK186604



Legend :

- Area with granular seabed (HR– High Reflective)
- Area with granular/cohesive seabed (MR– Medium Reflective)
- Area with cohesive seabed (LR – Low Reflective)
- Dumped material
- Debris
- Rubble mound seawall
- Seabed with boulders, gravels and pebbles
- Trawl scars
- Survey boundary
- Chart overlap
- Sonar Contact (LxWxH) (nmh = non-measurable height)



Location Plan

Project :

WORKS ORDER NO. GE/2003/18.24
AGREEMENT NO. CE 25/2003 (HY)
HONG KONG SECTION OF HONG KONG - ZHUHAI - MACAO BRIDGE AND CONNECTION WITH NORTH LANTAU HIGHWAY - INVESTIGATION
MARINE GEOPHYSICAL SURVEYS

AREA : CHEK LAP KOK CHANNEL

FIGURE NUMBER : 11.9

Drawing Title :

SEABED FEATURES

Notes :

1. Survey Date : 11–24/05/2004
2. Survey Grid : Hong Kong Metric Grid
3. Survey Datum : Hong Kong Principal Datum
4. Survey Vessel : Wing Hung 8
   Yau Sampan
5. Equipment : C–Nav GeOps System
   Klein System 2000 Tow Fish
   C–view SDVP
6. Coastline taken from 1:1000 Survey Sheets, SMO,LD.

Revision No.	Date	Drawn by	Checked by	Approved by	Remarks
0	12/07/2004	Clarence Siu	Wilson Wong	Matthew Lai	Preliminary

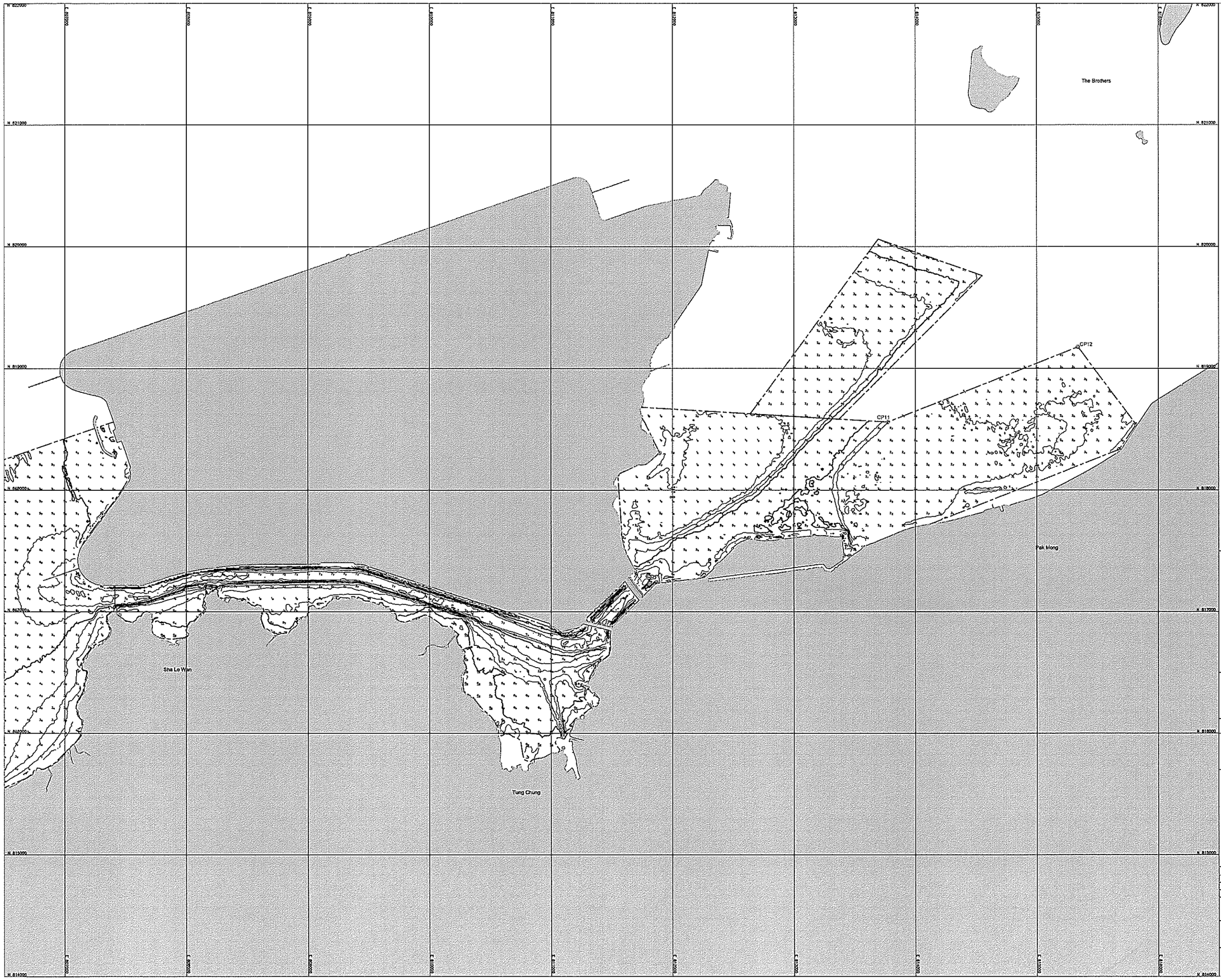
METRIC SCALE 1:2,500

125 100 75 50 25 0 125 250

Client : Civil Engineering Department Hong Kong

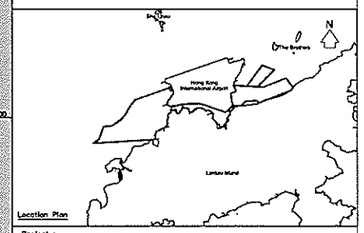
Surveyor : EGS (HK) LIMITED

JOB NO. : HK186804



Legend :

3.4	Sounding value in metres above/below HK Principal Datum
	Contour at 1 metre interval
	Survey boundary
	Chart overlap



Location Plan

Project :

WORKS ORDER NO. GE/2003/18.24
AGREEMENT NO. CE 26/2003 (HY)
HONG KONG SECTION OF HONG KONG - ZHUHAI - MACAO BRIDGE AND CONNECTION WITH NORTH LANTAU HIGHWAY - INVESTIGATION
MARINE GEOPHYSICAL SURVEYS

AREA : NORTH OF TUNG CHUNG AND CHEK LAP KOK CHANNEL

FIGURE NUMBER : RP2

Drawing Title :

SOUNDING PLAN

Notes :
1. Survey Date : 11/05/2004 – 14/06/2004
2. Survey Grid : Hong Kong Metric Grid
3. Survey Datum : Hong Kong Principal Datum
4. Survey Vessel : Wing Hung 8
   Yau Sampan
5. Equipment : C-Nav GcGPS System
   Knudsen 320M Echo Sounder
   Altos Deso 25 dual frequency Echo Sounder
6. Coastline taken from 1:1000 Survey Sheets, SMO,LD.

Revision No.	Date	Drawn by	Checked by	Approved by	Remarks
0	18/09/2004	Agnes Siu	Matthew Lai	MHRT	Final
			"		

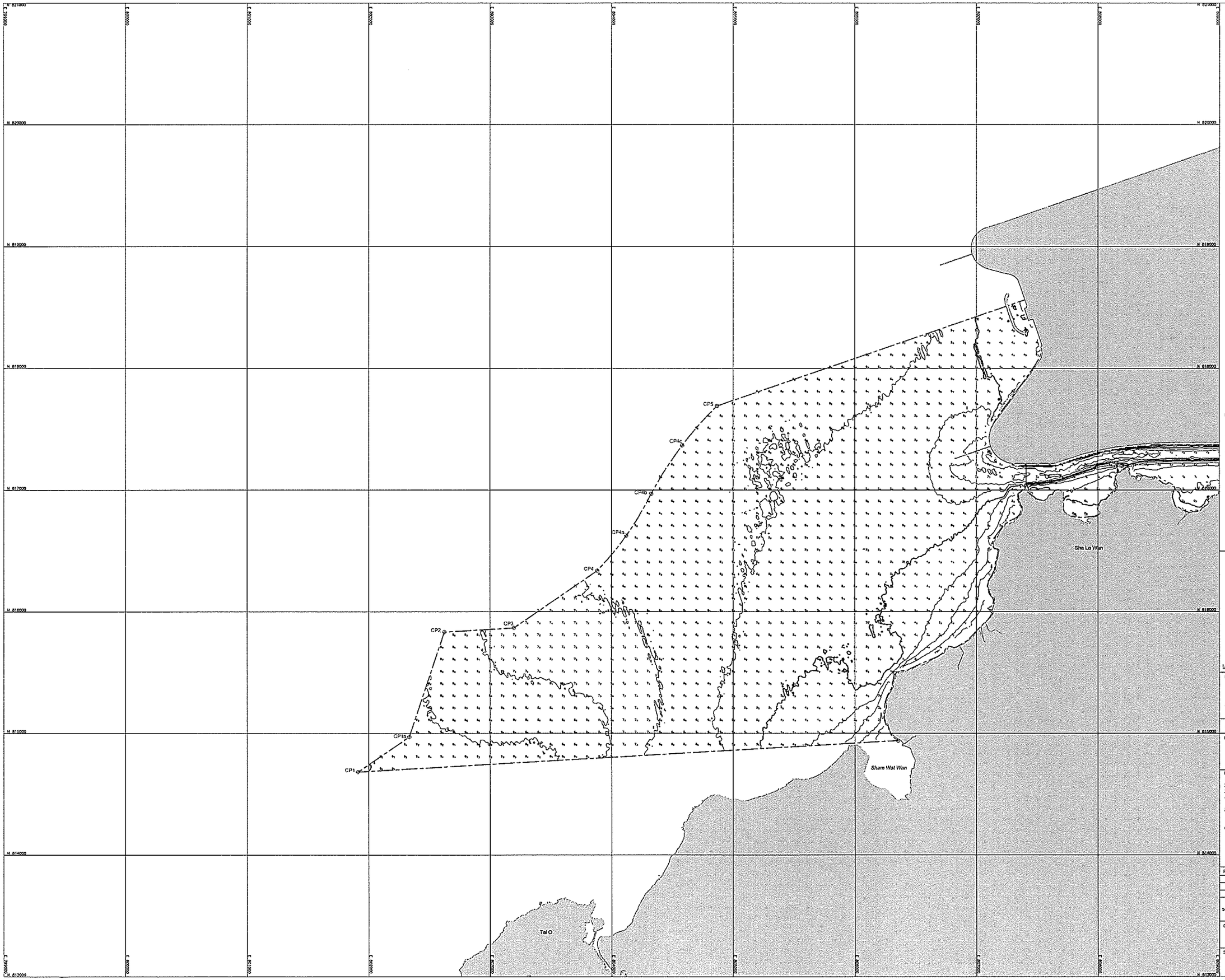
METRIC SCALE 1:10,000

500 400 300 200 100 0 500 1000

Client : Civil Engineering And Development Department

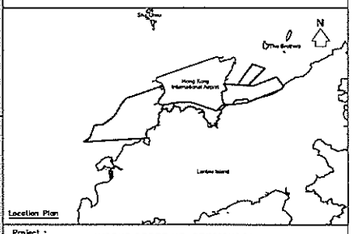
Surveyor : EGS (ASIA) LIMITED

JOB NO. : HK186804



Legend :

4	Sounding value in metres above/below HK Principal Datum
	Contour at 1 metre interval
	Survey boundary
	Chart overlap



Location Plan

Project :

WORKS ORDER NO. GE/2003/18.24
AGREEMENT NO. CE 26/2003 (HY)
HONG KONG SECTION OF HONG KONG - ZHUHAI - MACAO BRIDGE AND CONNECTION WITH NORTH LANTAU HIGHWAY - INVESTIGATION
MARINE GEOPHYSICAL SURVEYS

AREA : WEST OF CHEK LAP KOK

FIGURE NUMBER : RP7

Drawing Title :

SOUNDING PLANS

Notes :
1. Survey Date : 11/05/2004 – 14/06/2004
2. Survey Grid : Hong Kong Metric Grid
3. Survey Datum : Hong Kong Principal Datum
4. Survey Vessel : Wing Hung 8
   You Sampan
5. Equipment : C-Nav GcGPS System
   Knudsen 320M Echo Sounder
   Altos Deso 25 dual frequency Echo Sounder
6. Coastline taken from 1:1000 Survey Sheets, SMO,LD.

Revision No.	Date	Drawn by	Checked by	Approved by	Remarks
0	05/10/2004	Agnes Siu	Matthew Lai	WIRT	Final

METRIC SCALE 1:10,000

500 400 300 200 100 0 500 1000

Client :

Civil Engineering
And Development Department

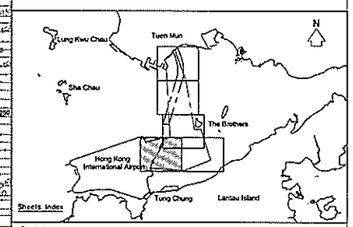
Surveyor :

ECS (UK) LIMITED
6/F, Block A, Kowloon Commercial Centre, 51 Lam Chuen Road, Kowloon, Hong Kong.
Tel: (852) 2366 6693
Fax: (852) 2366 6696
Email: info@ecs-uk.com
Land Surveyors & Engineers

JOB NO. : HK186604

Legend :

- Vibrocore location with reference number
- Borehole location with reference number
- Echo sounding and swath bathymetry track with fix positions
- Main survey boundary
- Magnetic survey boundary
- Existing CLP cables
- Existing Hutchison cable
- Chart overlap



Sheets Index

Project :

CONTACT NUMBER GE/2007/04
GEOPHYSICAL SURVEY (TERM CONTRACT)
WORKS ORDER NUMBER GE/2007/04.20
AGREEMENT NO. CE 52/2007 (HY)
TUEN MUN - CHEK LAP KOK LINK - INVESTIGATION
PROPOSED MARINE GEOPHYSICAL SURVEYS

FIGURE NUMBER : 1.5

Drawing Title :

ECHO SOUNDING AND SWATH BATHYMETRY TRACK PLOTS

Notes :

1. Survey Date : November – December 2008
2. Survey Grid : Hong Kong Metric Grid
3. Survey Datum : Hong Kong Principle Datum
4. Positioning : C-Nav GcGPS (Globally corrected GPS)
5. Equipment : EGS Boomer System
   Seapay Magnetometer
   Reson 8125 Multibeam System
   Knudsen 320M Dual Frequency Echo Sounder
   DF1000 Side Scan Sonar System With Digital Tow Fish
6. Coastline taken from 1:1,000 Survey Sheets, Survey and Mapping Office, Lands Department

Revision No.	Date	Drawn by	Checked by	Approved by	Remarks
0	08/01/2009	Clarence Siu	Wilson Wong	Margie Chan	Preliminary

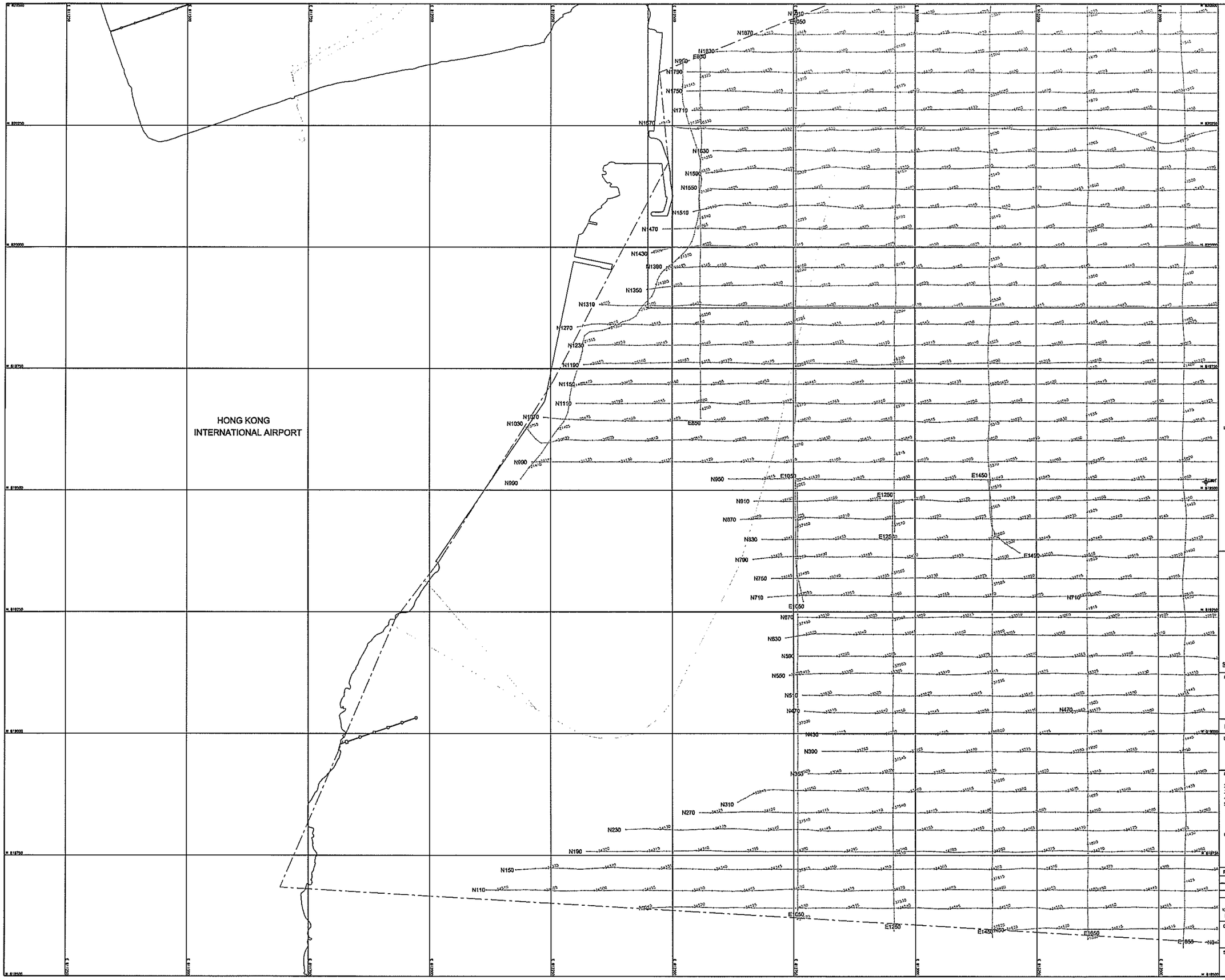
METRIC SCALE 1:2,500

125 100 75 50 25 0 125 250

Client : CEDD Civil Engineering and Development Department

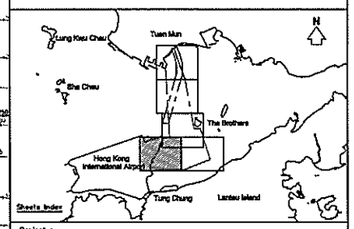
Surveyor : EGS (ASIA) LIMITED

JOB NO. : HK213608



Legend :

- Vibrocore location with reference number
- Borehole location with reference number
- N3600 Hydrophone and side scan sonar track with fix positions and line no.
- Main survey boundary
- Magnetic survey boundary
- Existing CLP cables
- Existing Hutchison cable
- Chart overlap



Sheets Index

Project :

CONTACT NUMBER GE/2007/04
GEOPHYSICAL SURVEY (TERM CONTRACT)
WORKS ORDER NUMBER GE/2007/04.20
AGREEMENT NO. CE 52/2007 (HY)
TUEN MUN - CHEK LAP KOK LINK - INVESTIGATION
PROPOSED MARINE GEOPHYSICAL SURVEYS

FIGURE NUMBER : 2.5

Drawing Title :

SEISMIC AND SIDE SCAN SONAR TRACK PLOTS

Notes :

1. Survey Date : November – December 2008
2. Survey Grid : Hong Kong Metric Grid
3. Survey Datum : Hong Kong Principle Datum
4. Positioning : C-Nav CcGPS (Globally corrected GPS)
5. Equipment : EGS Boomer System
   Seaspy Magnetometer
   Reson 8125 Multibeam System
   Knudsen 320M Dual Frequency Echo Sounder
   DF1000 Side Scan Sonar System With Digital Tow Fish
6. Coastline taken from 1:1,000 Survey Sheets, Survey and Mapping Office, Lands Department

Revision No.	Date	Drawn by	Checked by	Approved by	Remarks
0	08/01/2009	Clarence Siu	Wilson Wong	Margie Chan	Preliminary

METRIC SCALE 1:2,500

125 100 75 50 25 0 125 250

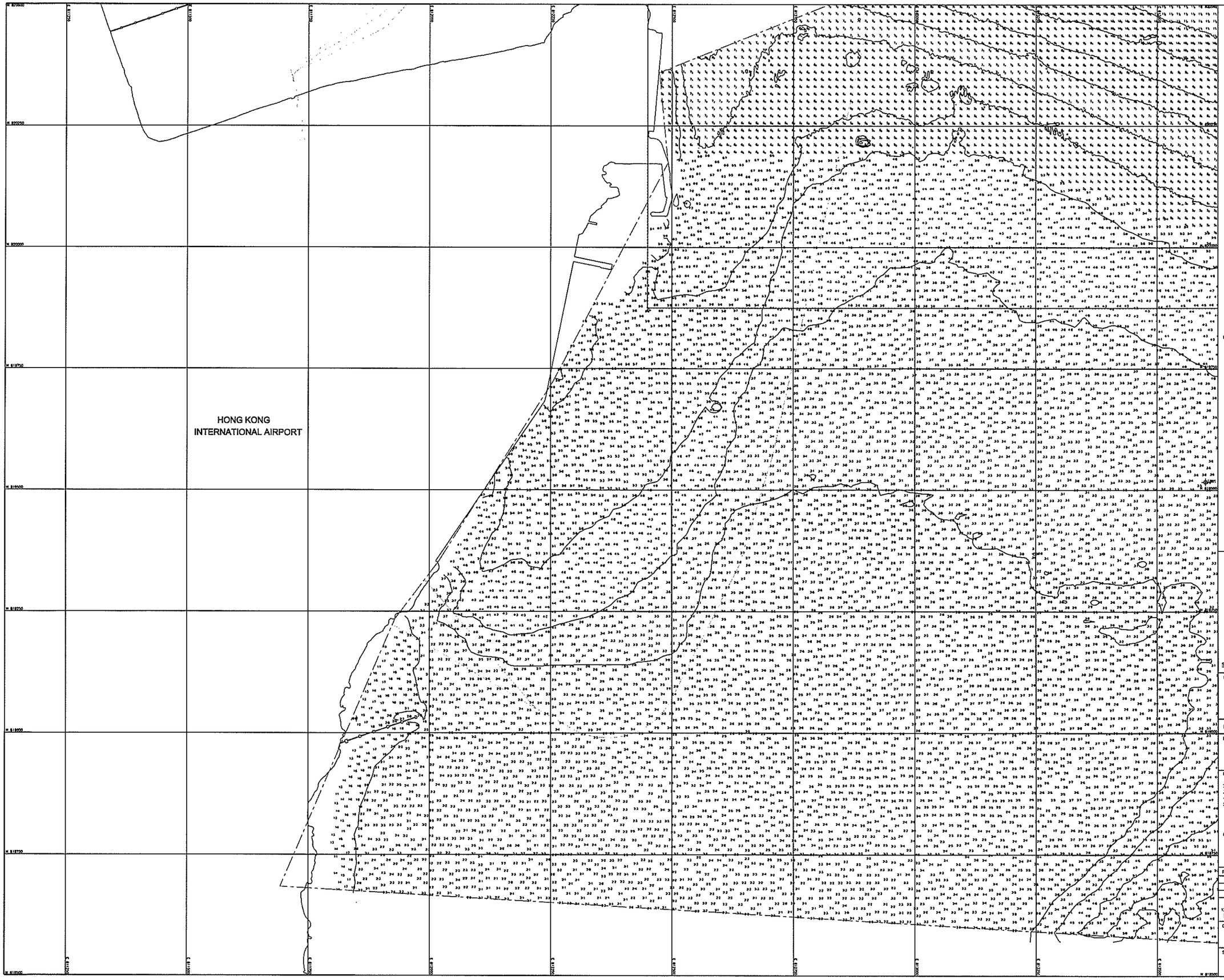
Client :

Civil Engineering and Development Department

Surveyor :

EGS (HK) LIMITED
Unit 2, 10/F., Sunning Plaza,
10 Hoi Ping Road,
Causeway Bay, Hong Kong
Tel: (852) 2576 6112
Fax: (852) 2576 6113
Email: egshk@egs.com.hk
Quality assured & turnkey solutions

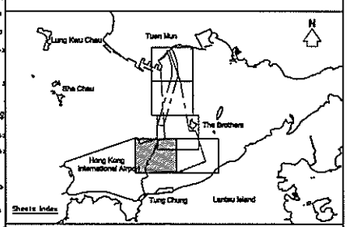
JOB NO. : HK213608



Legend :

- Vibrocore location with reference number
- Borehole location with reference number
- Gridded data in metres below HKPD
- Sounding data in metres above/below HKPD
- Contour at 1 metre interval
- Main survey boundary
- Magnetic survey boundary
- Existing CLP cables
- Existing Hutchison cable
- Chart overlap

Metres in HKPD



Project :

CONTACT NUMBER GE/2007/04
GEOPHYSICAL SURVEY (TERM CONTRACT)
WORKS ORDER NUMBER GE/2007/04.20
AGREEMENT NO. CE 52/2007 (HY)
TUEN MUN - CHEK LAP KOK LINK - INVESTIGATION
PROPOSED MARINE GEOPHYSICAL SURVEYS

FIGURE NUMBER : 4.6

Drawing Title :

COLOUR CONTOURED SWATH BATHYMETRY PLANS

Notes :

1. Survey Date : November – December 2008
2. Survey Grid : Hong Kong Metric Grid
3. Survey Datum : Hong Kong Principle Datum
4. Positioning : C-Nav GcGPS (Globally corrected GPS)
5. Equipment : EGS Boomer System
   Seapay Magnetometer
   Reson 8125 Multibeam System
   Knudsen 320M Dual Frequency Echo Sounder
   DF1000 Side Scan Sonar System With Digital Tow Fish
6. Coastline taken from 1:1,000 Survey Sheets, Survey and Mapping Office, Lands Department

Revision No.	Date	Drawn by	Checked by	Approved by	Remarks
0	08/01/2009	Clarence Siu	Wilson Wong	Margie Chan	Preliminary

METRIC SCALE 1:2,500

125 100 75 50 25 0 125 250

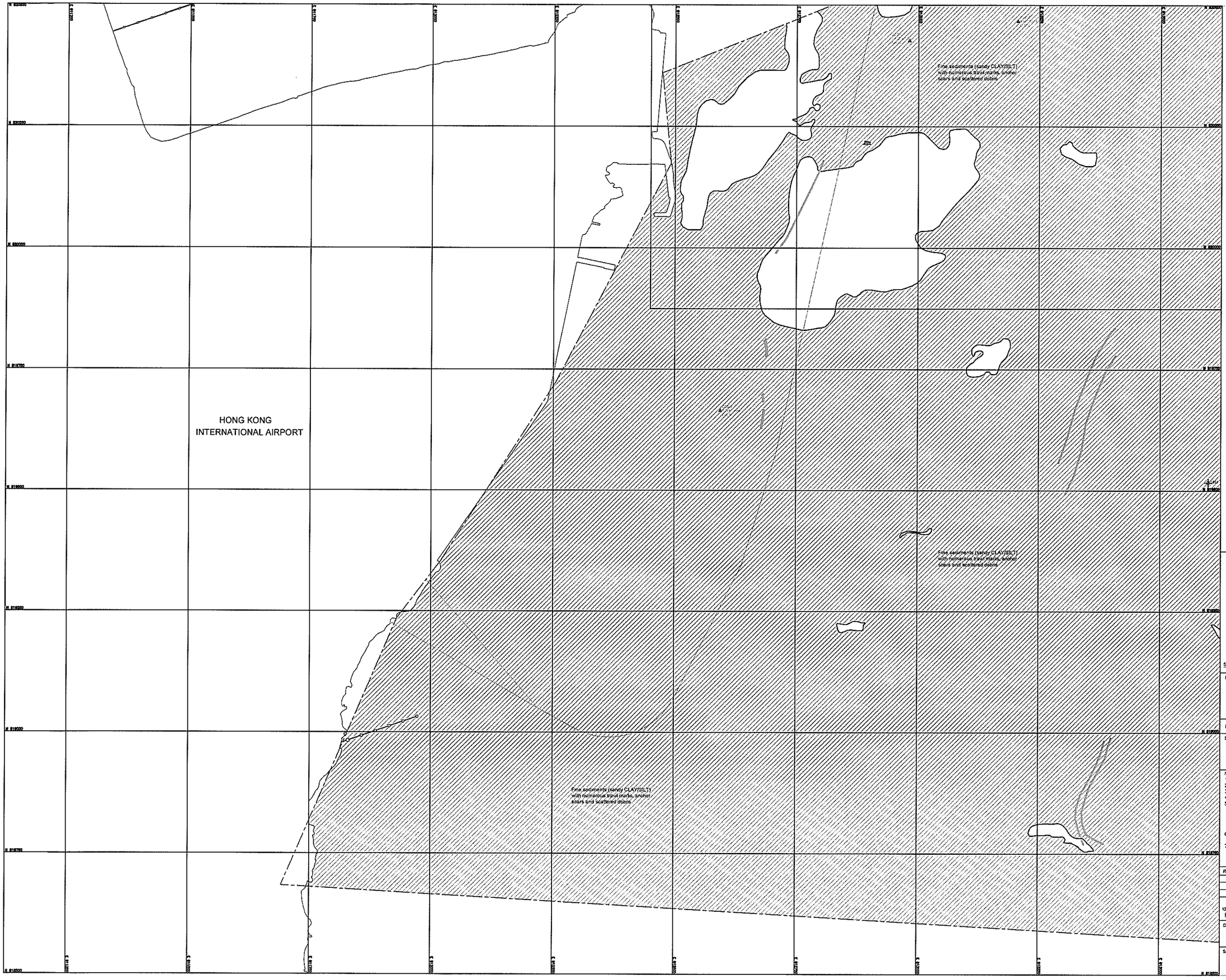
Client :

Civil Engineering and Development Department

Surveyor :

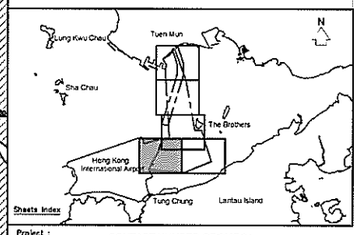
EGS (HK) LIMITED

JOB NO. : HK213608



Legend :

- Vibrocore location with reference number
- Borehole location with reference number
- Fine sediments (predominantly CLAY/SILT)
- Coarse sediments (predominantly SAND and GRAVEL)
- Rocky area
- Sonar contact
- Magnetic contact
- Seismic contact
- Echo sounding contact
- Buoy
- Scar/Trawl marks
- Megaripples
- Main survey boundary
- Magnetic survey boundary
- Existing CLP cables
- Existing Hutchison cable
- Chart overlap
- Interpreted cable/pipeline alignments based on magnetic, seismic and echo sounding data



Project :

CONTACT NUMBER GE/2007/04
GEOPHYSICAL SURVEY (TERM CONTRACT)
WORKS ORDER NUMBER GE/2007/04 20
AGREEMENT NO CE 52/2007 (HY)
TUEN MUN - CHEK LAP KOK LINK - INVESTIGATION
PROPOSED MARINE GEOPHYSICAL SURVEYS

FIGURE NUMBER : 11.5

Drawing Title :

SEA BED FEATURES AND CABLE ALIGNMENTS

Notes :

1. Survey Date : November – December 2008
2. Survey Grid : Hong Kong Metric Grid
3. Survey Datum : Hong Kong Principle Datum
4. Positioning : C-Nav GcGPS (Globally corrected GPS)
5. Equipment : EGS Boomer System
   Seaspy Magnetometer
   Reson 8125 Multibeam System
   Knudsen 320M Dual Frequency Echo Sounder
   DF1000 Side Scan Sonar System With Digital Tow Fish
6. Coastline taken from 1:1,000 Survey Sheets, Survey and Mapping Office, Lands Department
7. Please refer to Appendix E for details of magnetic contacts, seismic contacts and echo sounding contacts

Revision No.	Date	Drawn by	Checked by	Approved by	Remarks
0	05/01/2009	Clarence Siu	Wilson Wong	Margie Chen	Preliminary

METRIC SCALE 1:2,500

125 100 75 50 25 0 125 250

Client :

Civil Engineering and Development Department

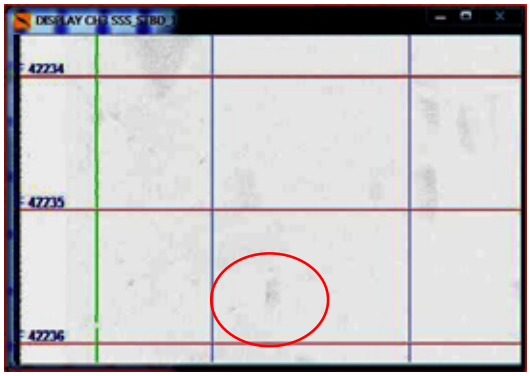
Surveyor :

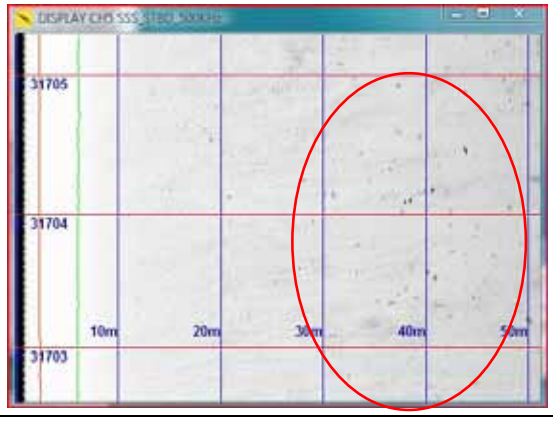
EGS (ASIA) LIMITED

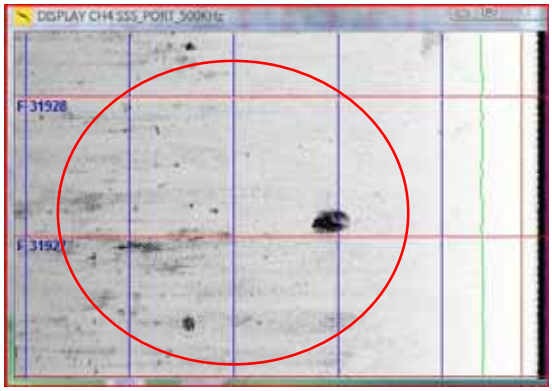
JOB NO. : HK213508

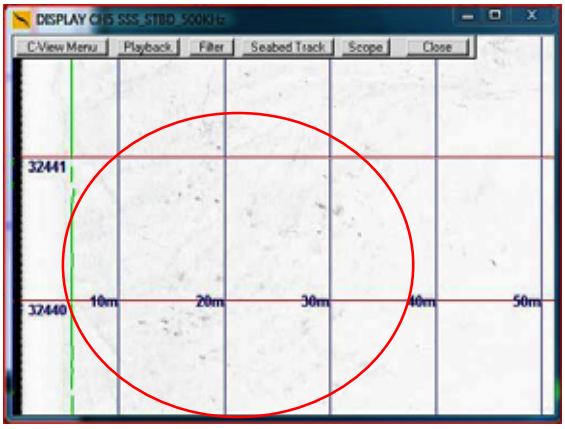
APPENDIX 12G

Seabed anomalies of possible cultural significance

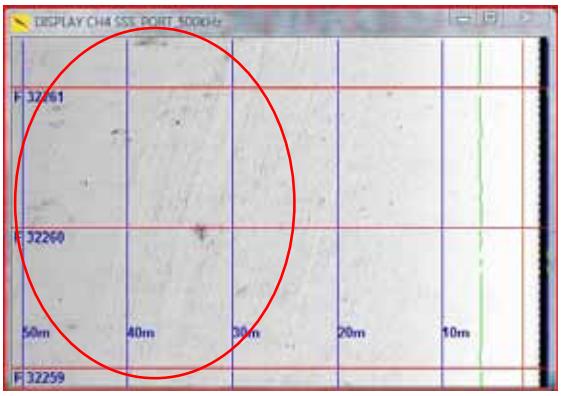
Target 1	803013.0E 815690.0N
Debris. Single object a few metres long with some smaller objects around it.	

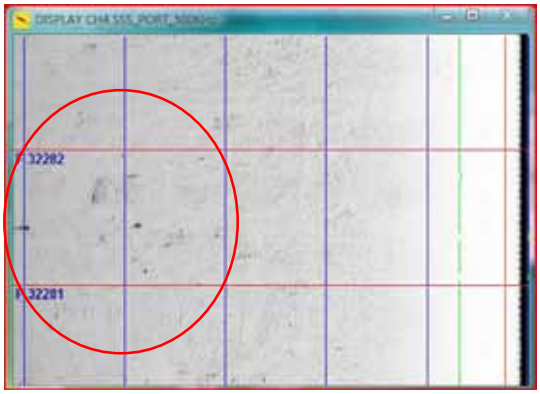
Target 2	806470.44E 815987.83N
Debris. Scatter of small objects across a 30 x 20 m area.	

Target 3	806483.94E 816084.56N
Debris. Scatter of small objects across a 30 x 30 m area with one object up to 4 m across.	

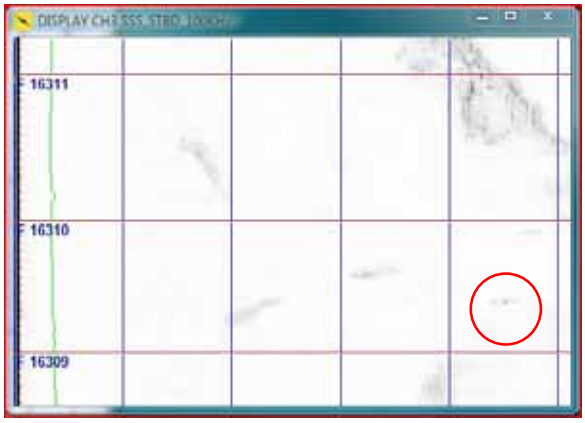
Target 4	806549.6E 816074.51N
Debris. Scatter of small objects across a 20 x 20 m area.	

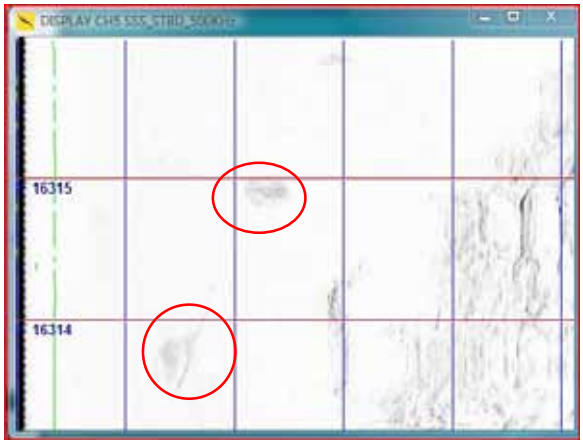
Targets 5 and 6	806560.9E 816244.5N 806576.4E 816246.3N
Debris. Scatter of objects up to 2 m in length across a 20 x 30 m area.	

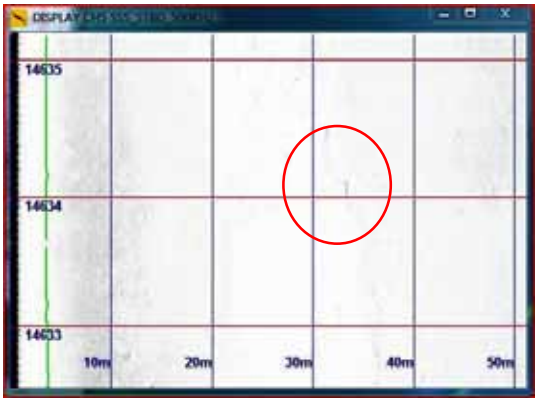
Targets 7	806494.7E 816440.2N
Debris. Scatter of objects up to 2 m in length across a 30 x 20 m area.	

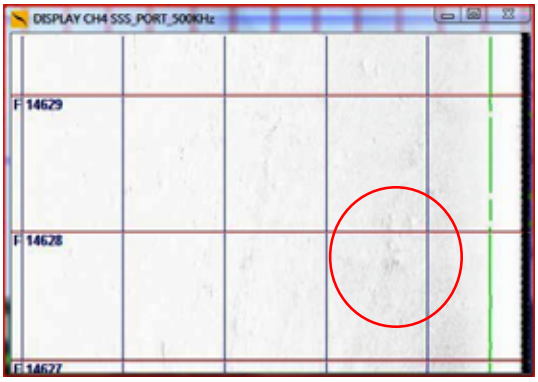
Targets 8	806476.6E 816488.7N
Debris. Discrete scatter of objects up to 3 m in length across a 10 x 10 m area.	

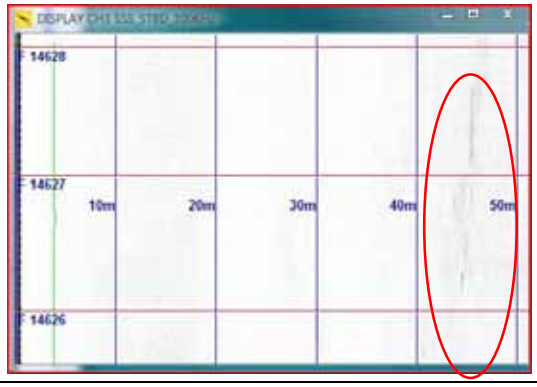
Targets 9 and 10	807600.5E 817016.4N 807600.4E 817030.5N
Two low relief objects up to 5 m in length.	

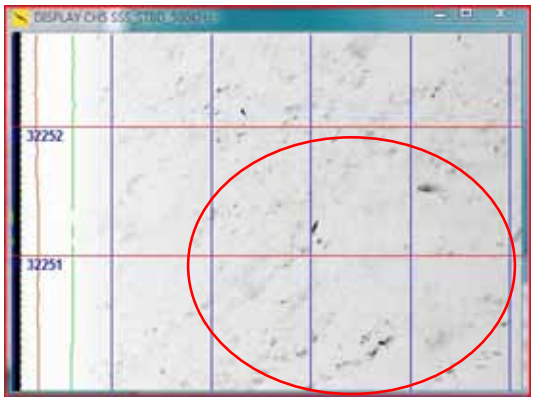
Target 11	807621.4E 817029.5N
Small object, which protrudes from the seabed. Debris or patches of coarser sediments around. Rock reef near shoreline in top right.	

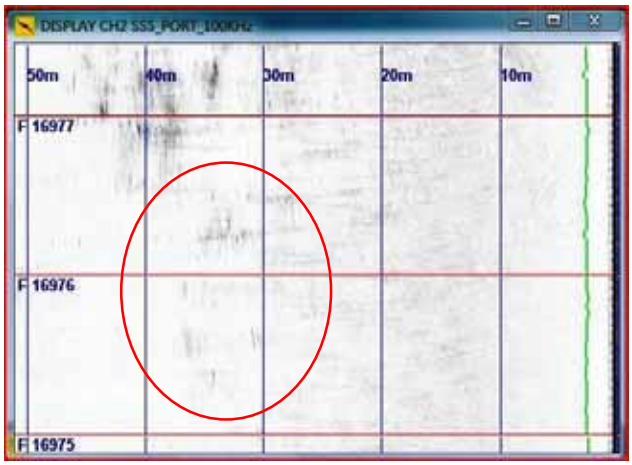
Targets 12 and 13	807679.7E 817044.6N 807701.5E 817009.7N
Possible chain and discrete small concentration of debris nearby and a 5 x 5 m patch of possible debris. Rock reef near shoreline on the right.	

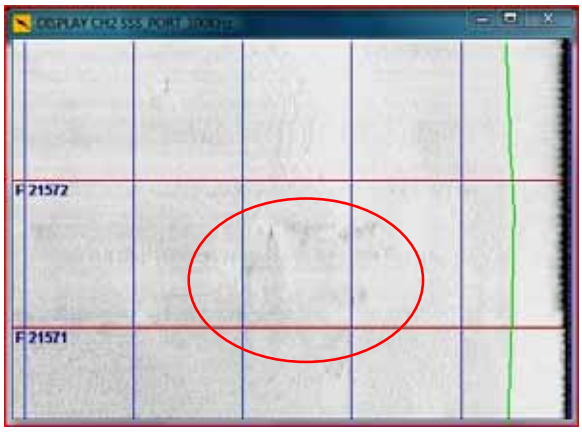
Target 14	807735.7E 817084.1N
Two objects up to 2 m in length around 5 m apart.	

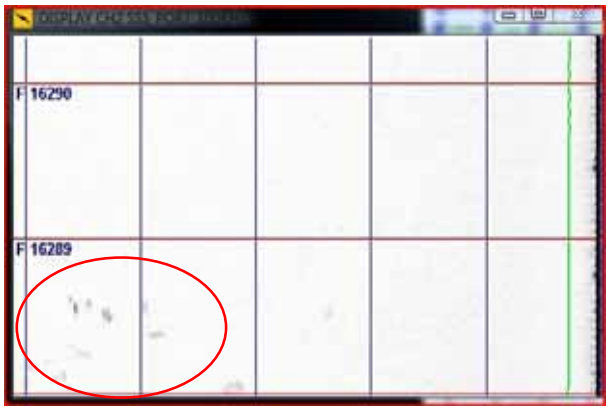
Target 15	807801.9E 817109.3N
Discrete scatter of objects, some of which appear to protrude up to 0.5 m above the seabed.	

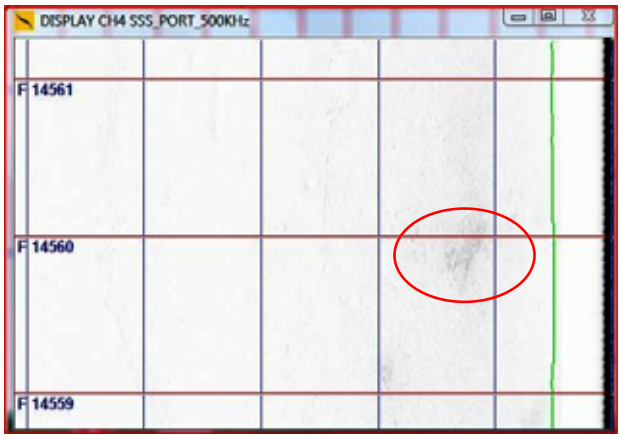
Target 16	807841.8E 817110.1N
Arrangement of linear objects up to 10 m in length. EGS has it described as an unidentified object - SC-024 15.2 x 5.4 x 0.5 m wide.	

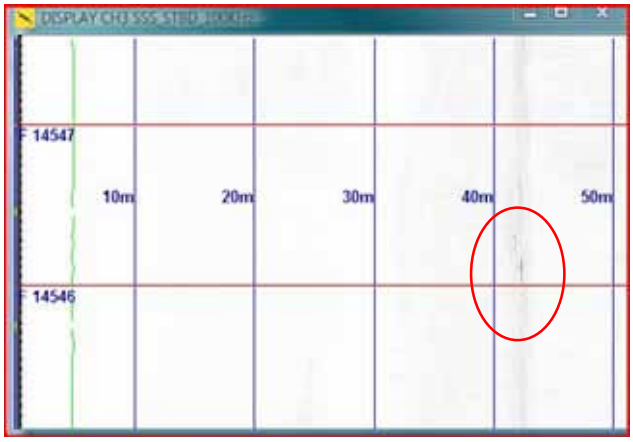
Targets 5 and 6 (Repeated? should be deleted)	806560.9E 816244.5N 806576.4E 816246.3N
Debris. Scatter of objects up to 2 m in length across a 20 x 30 m area.	

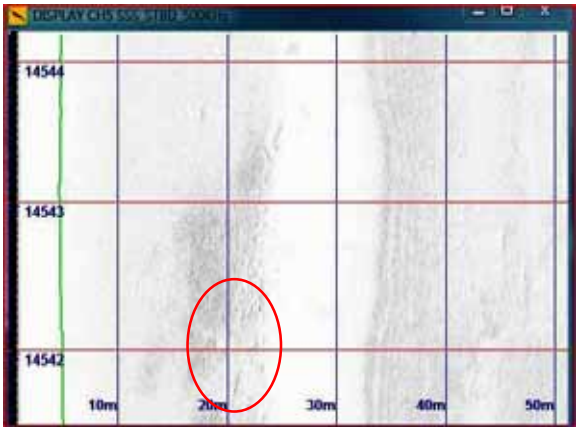
Target 17	807978.4E 817136.4N
Scatter of small objects over a 10 x 20 m area.	

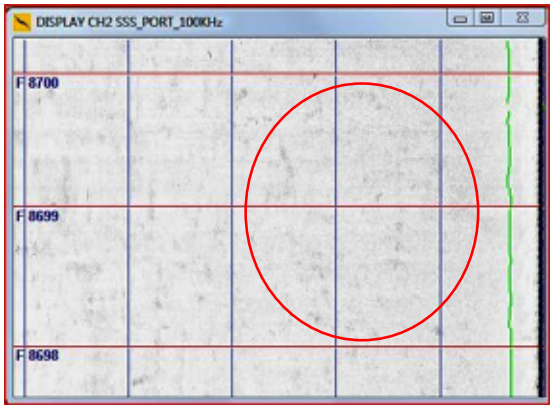
Target 18	807983.5E 817171.9N
Linear scatter of small objects over a 15 x 5 m area.	

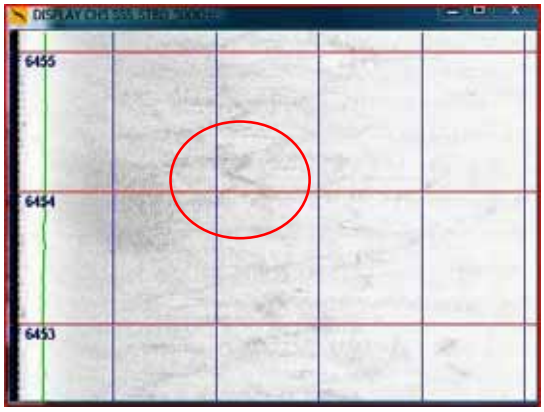
Target 19	808076.76E 817088.82N
Discrete scatter of objects up to 1m in size over a 10 x 5 m area.	

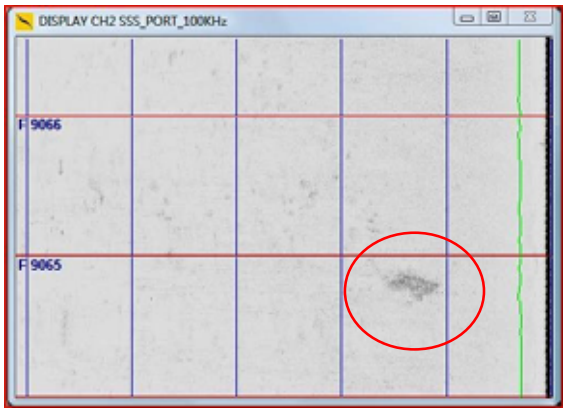
Target 20	808756.7E 817228.6N
Small dense scatter of objects over a 5 x 5 m area.	

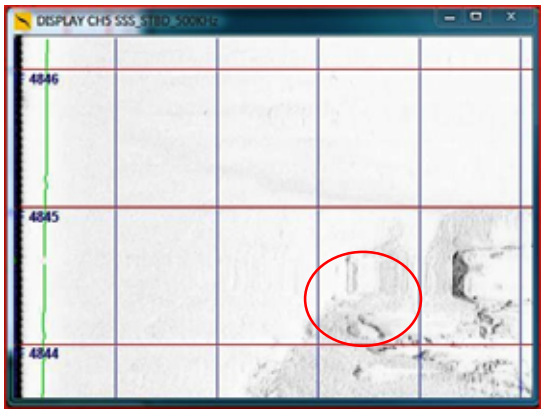
Target 21	808950.4E 817224.8N
2 m long and narrow object. Located within a linear feature over 40 m long.	

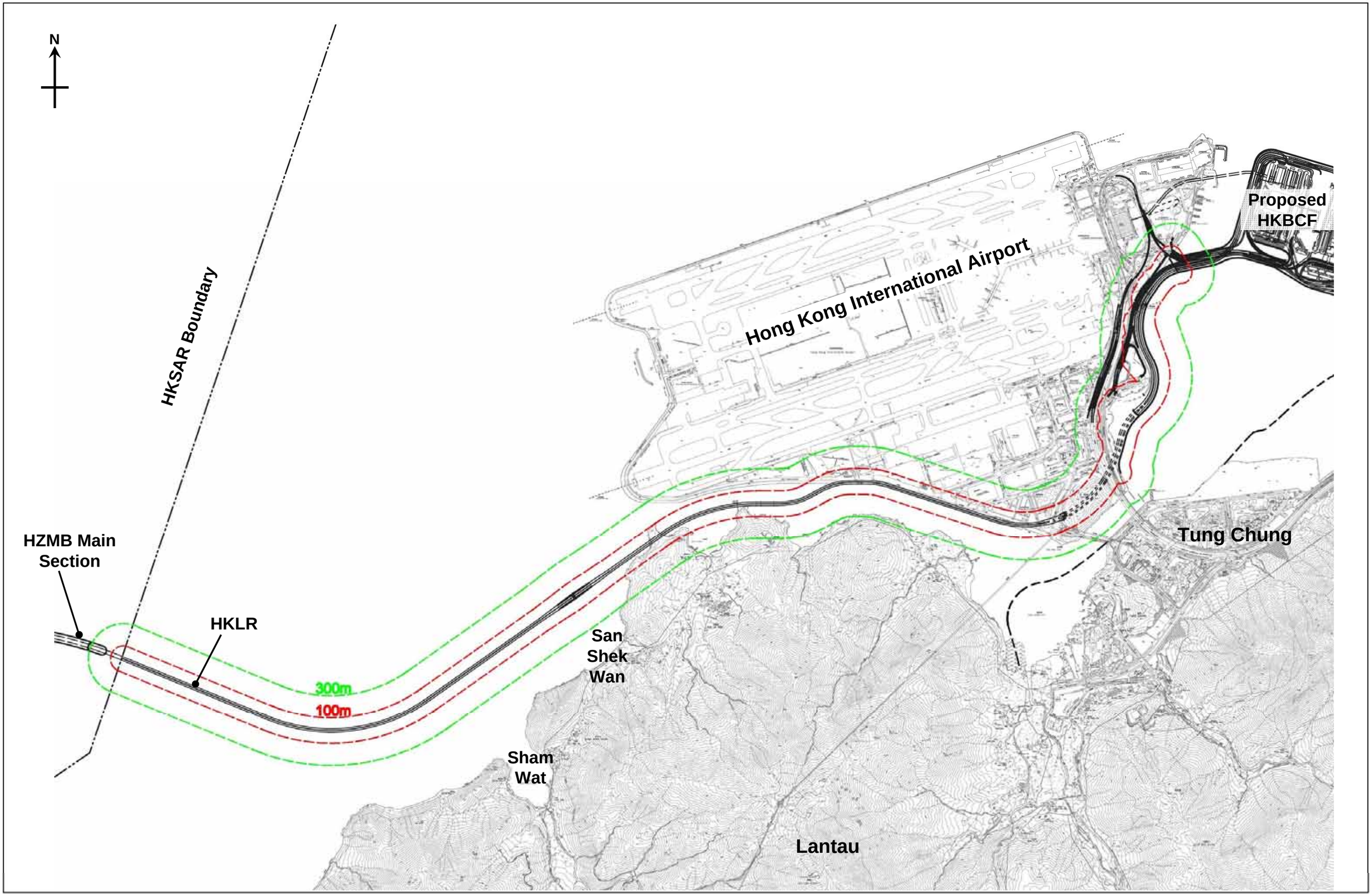
Target 22	809003.5E 817228.4N
Small objects within a wider debris field up to 30 m in length and around 10 m wide.	

Target 23	811642.8E 817896.0N
Scatter of debris. Some linear arrangement of debris, which may not be random but indicate buried structure.	

Target 24	811906.3E 817824.1N
Triangular feature near a patch of debris around 3 m across. EGS describes the area as 'dumped material'.	

Target 25	811823.2E 818000. 5N
Rectangular feature around 4 x 2 m across. EGS describes as a 'block' - SC-026 3.6 x 3 x 0.7 m.	

Target 26	811899.8E 818366.0N
Rectangular object on a rocky reef close to shore. EGS describes as an 'unidentified object' - SC-038 5.8 x 1.1 x 0.2.	



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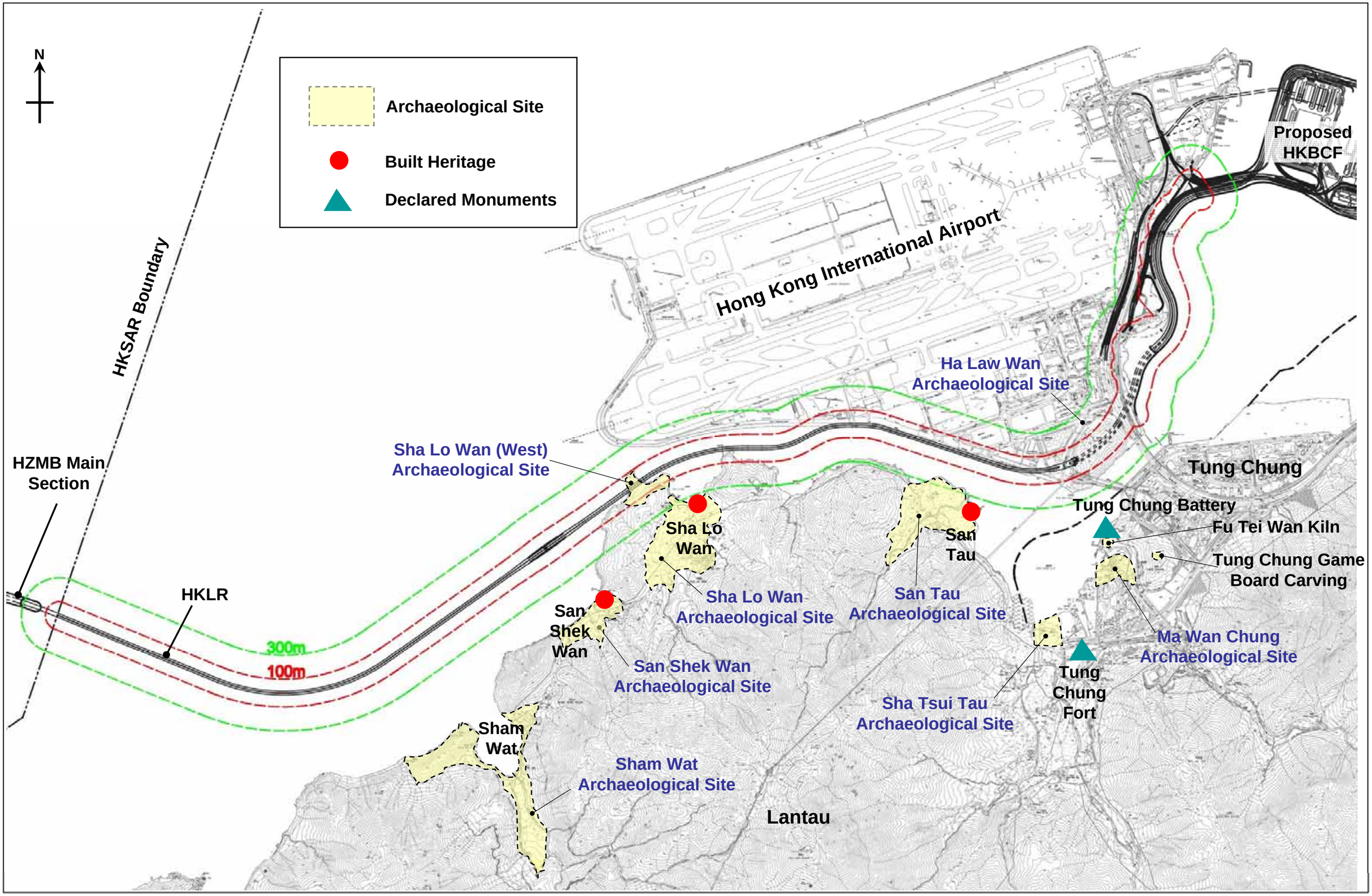

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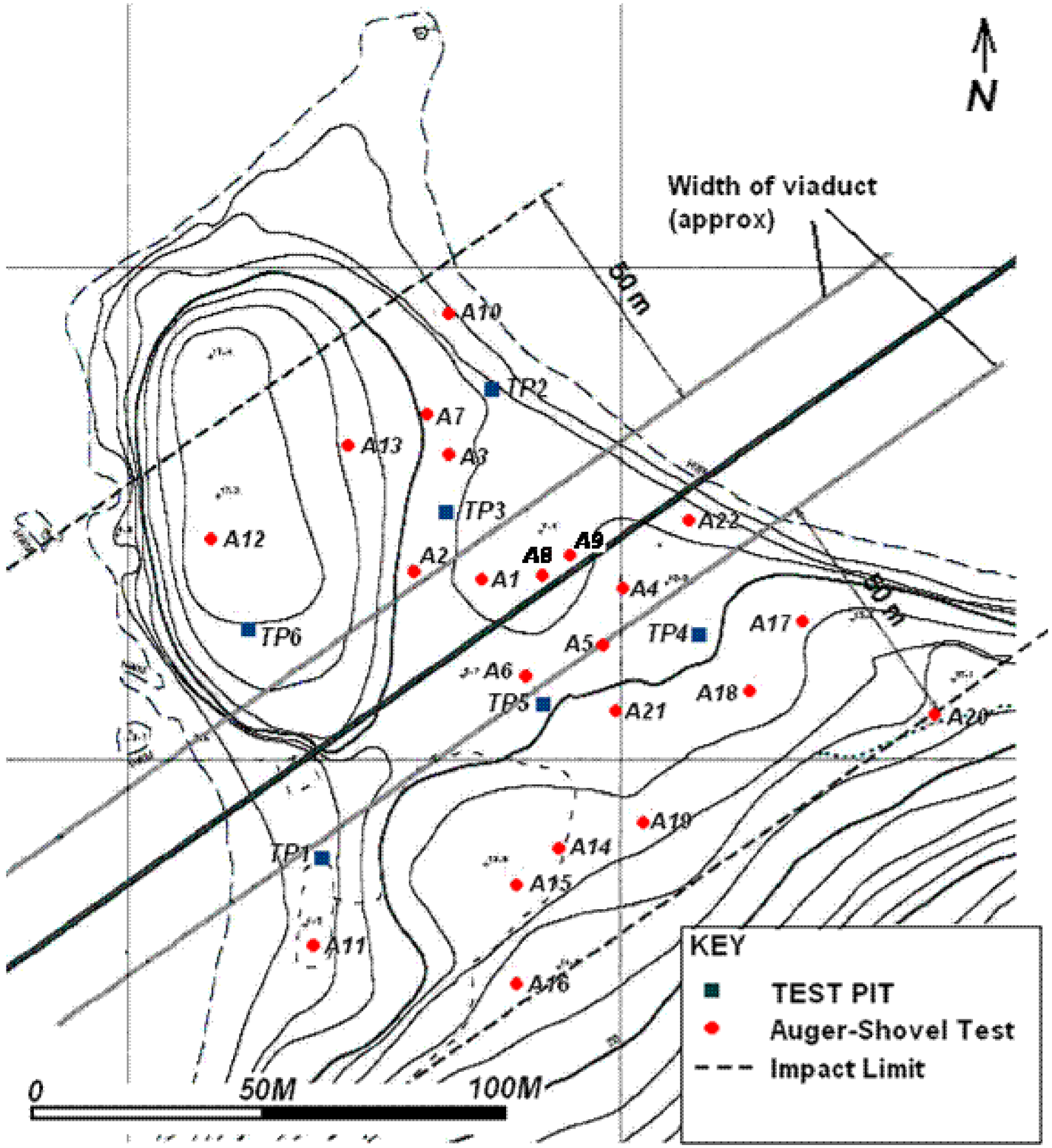
Drawing Title

Locations of Archaeological Sites, Built Heritage and Declared Monuments in the vicinity of HKLR

Drawing No.

Figure 12.2



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Drawing Title

Locations of Test Pits and Augur Holes Excavated at Sha Lo Wan Archaeological Site

Drawing No.

Figure 12.3