



Hong Kong Government  
Environmental Protection Department

Agreement No. CE14/94

# Low-level Radioactive Waste Storage Facility Consultancy Study

Environmental Impact and Safety  
Assessment Report (EISA)  
Executive Summary

June 1995



MAUNSELL CONSULTANTS ASIA LTD

in association with

Consultants in Environmental Sciences (Asia) Ltd.  
Taylor Woodrow Management & Engineering Ltd.

EIA-0692/  
BC

EIA/021.2/95

Environmental Protection Department  
Waste Facilities Planning Group

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# 1 INTRODUCTION

## 1.1 Background to Project

The Government has decided that storage of low-level radioactive waste in Hong Kong requires a dedicated, purpose-designed facility. A feasibility study and an extensive site selection process have already been carried out by Government. Several inland and island potential sites were proposed and compared. Two islands to the south of Lantau (Siu A Chau and Shek Kwu Chau) were chosen to provide candidate sites.

The present consultancy study is being carried out on behalf of the Environmental Protection Department (EPD) by Maunsell Consultants Asia Ltd, in association with Consultants in Environmental Sciences (Asia) Ltd, and Taylor Woodrow Management and Engineering Ltd. The purpose of the study is to select, from the two short-listed islands, a suitable site for the proposed low-level radioactive waste storage facility (LRWF), to assess the feasibility of such a facility and recommend a suitable form of contract, and to produce an outline design for the facility.

The preferred site was selected using criteria designed by the consultants and took into account the views of the Client Department (EPD), as well as the Department of Health (the final operator of the facility and the regulatory authority under the Radiation Ordinance). The objective of the assessment was to identify an optimal site for a storage facility which would be safe, secure, cost-effective and with the least environmental impacts.

The preferred site is located on the island of Siu A Chau in the Soko islands (Figure 1), adjacent to the small bay of Sum Wan on the eastern side of the island (Figures 2 & 3).

The purpose of the Stage 1 Environmental Impact and Safety Assessment (EISA) study is to assess the suitability of the preferred site and to determine whether there are any over-riding environmental and safety constraints that cannot be overcome. It is proposed to undertake a Stage 2 EISA study following preparation of the final detailed design.

## 1.2 Need for the LRWF

Various industrial, educational and medical facilities in Hong Kong have, for a number of years, used radioactive materials and have generated waste. Most of the existing waste arisings are stored in disused air raid tunnels close to Queen's Road East in Wan Chai. Other arisings are stored temporarily (although in some cases for several years) at the point of use in educational institutions or hospitals.

The condition of the Queen's Road East tunnels has been found to be unsatisfactory and various parts of the tunnel system suffer from leakage and ingress of water. The condition of some of the waste packages has subsequently deteriorated and they are generally unsatisfactory for the safe long-term containment and storage of radioactive materials. In addition the existing facilities are located close to a high density of population, which makes access to, and management of, the waste more problematic.

As well as existing waste, there is also a continuing need to use radioactive materials in Hong Kong and a continuing predictable amount of future waste arisings. The volume

of repackaged existing waste is approximately 50m<sup>3</sup>. It is estimated that the volume of future waste arisings will be less than 1m<sup>3</sup> per annum. There is a need, therefore, for a dedicated, purpose-built facility capable of effective, economical and safe long-term storage of a variety of existing radioactive materials and a small amount of future arisings.

### 1.3 Scope of Stage 1 EISA Report

The Stage 1 EISA report, of which this is the Executive Summary, is an assessment based on the outline design of the LRWF developed by the consultants. The report addresses all potential environmental impacts arising from construction and operation of the proposed LRWF. In addition, it covers all relevant radiological safety aspects and presents a justified safety case for such a facility. The detail of the assessment is sufficient to identify possible impacts and to evaluate their scale and significance and whether they can be mitigated to allowable levels. It should be noted, however, that because the LRWF design is only at the outline stage and is therefore still to be finalised, the assessment of impacts is necessarily limited. An important function of the report is to identify areas where further study may be required and to specify terms of reference for the Stage 2 EISA study to be carried out following award of contract to the successful tenderer.

Extensive consultation was carried out with Government bodies and other organisations and specialists. Site visits were undertaken and relevant data were documented.

## 2 EXISTING ENVIRONMENT OF SITE ON SIU A CHAU

### 2.1 Location and Geographical Context

Siu A Chau is a small island to the south of Lantau and is the northernmost of the Soko Islands, which lie in the southwestern waters of Hong Kong. The island falls within an area identified by the Territorial Development Strategy as being a significant landscape and recreational asset, and is identified as being environmentally sensitive.

The island forms an hour-glass shape in plan form, with the western and eastern ends of the island dominated by hills rising to more than 120 metres and 77 metres, respectively. The central portion of the island is a thin strip of generally low-lying relief, formed in the main by a wide sand beach.

The proposed site on Siu A Chau is at the eastern side, adjacent to a small bay called Sum Wan. The bay is quite shallow with a generally rocky beach. The bay is enclosed by two south-easterly projecting promontories of up to 50 metres in height, which provide a degree of shelter and screening.

The proposed site is relatively low-lying at approximately 5 metres above Principal Datum. Behind the site the hill side rises to a saddle between hills of the two promontories.

### 2.2 Planning Context

There is at present no Outline Development Plan (ODP) or Layout Plan covering the site

at Siu A Chau. The Interim Recommended Strategy (IRS) of the South West New Territories Development Strategy Review (SWNT DSR) has been endorsed by the Development Progress Committee. The IRS acknowledged the strong countryside heritage of the SWNT and designated Siu A Chau as a Conservation Area, a Landscape Protection Area and a Coastal Protection Area. The IRS also recommended the Soko islands be designated as Inshore Recreation and Inshore Water Protection Areas, and the central part of the island as a potential area for tourist development.

The landscape and general recreational amenity of the area should thus be protected and design considerations must be compatible with the existing landscape.

### 2.3 Location of Sensitive Receivers

The island of Siu A Chau is not inhabited. The closest potential receiver is the refugee camp located on Tai A Chau, which is 1.7 km away. There will be no direct line of sight between the facility and the camp, which is sheltered behind hills.

The only other potential receiver is Shek Pik Prison on Lantau Island, which is 5.5 km from the proposed site and is not in direct line of sight.

There are no known existing mariculture sites or seawater intakes in the vicinity of Siu A Chau.

## 3 DESCRIPTION OF THE PROPOSED STORAGE FACILITY

### 3.1 Outline Design

The building will be designed for storage of, initially, 260 drums (340 litre capacity) unstacked. The overall plan dimensions including internal ancillary areas will thus be approximately 44 x 24 metres. The facility will allow for future double-stacking of drums, as well as limited expansion if required. With the use of an overhead travelling crane, the minimum ceiling height will need to be about 5 metres which leads to an overall building height of about 6.5 metres. A plan is attached in Figure 4. A helicopter landing pad and marine access jetty, together with landscaping and security requirements, bring the total site area to approximately 0.61 ha (shown in Figure 5).

The building will have a design capacity for about 20 years of arisings and a design life of about 50 years. The storage facility will only receive and store wastes in solid form.

The Contractor will be required to design the facility to operate as a 'dry facility', that is, producing no radioactive liquid effluent. If the Contractor can provide at the detailed design stage, recommendations on discharge limits to the satisfaction of Government, including EPD and the Radiation Board, then the facility may operate as a 'wet facility', that is producing liquid radioactive discharge of the minimum necessary radioactive loading. The source of the effluent would be limited to that produced as a by product of decontamination activities such as washing down of drums, floor etc. On that basis this EISA assesses the scenario of the facility being operated as a 'wet facility'.

### 3.2 Contract Options

The LRWF project will comprise a number of discrete but interdependent phases, including design, construction and commissioning, and operation and maintenance. It is currently envisaged that the most favourable option in terms of simplicity, assignment of responsibility and contingent liabilities, would be a design-build and operate (DBO) contract. The period of operation has yet to be determined, but should allow training of locally based staff, before transfer of the facility to the Department of Health for management. A relatively long period of approximately 10 years may be favoured by the Government.

Suitable contractual clauses will be drawn up to specify the responsibility of the selected contractor to install and maintain, for the duration of the contract, suitable pollution control equipment and to undertake recommended environmental and radiological monitoring. The contractor will also be obliged to respond to emergency situations at the facility.

### 3.3 Visual Aspects

Due to the location of the building, there is a potential for visual intrusion, especially considering the generally small scale of the island and natural features in the area. The physical requirements of the facility's operation, however, will not have notable visual impact implications. The facility will be accessed from the sea by means of a fixed jetty. The jetty will be 3 metres wide, widened to a 5 x 5 metres working area at the seaward end. The overall length will be approximately 85 metres, of which some 55 m will be constructed on piles in the bay and 30 m will be on a rock filled causeway across the intertidal zone. The pier will lead directly to a hard standing located adjacent to the building. The final layout, form and structure of the building will be finalised at the detailed design stage after award of contract and therefore the description in the EISA should not necessarily be adopted as the final design specification. The building design will be one of the parameters to be considered when assessing tenders.

Integration of the building into the natural landscape can be facilitated in various manners, recommended examples are keeping the building as low as possible, using a sloping, flat, tiled roof, using natural stone cladding as weatherproofing and erecting a stone canopy (trellis) in the front elevation to minimise the scale of the building.

### 3.4 Construction Schedule and Methods

The construction works would take an estimated twelve months to complete. In view of the remoteness of Siu A Chau, it is likely that the jetty would be constructed first so that the construction materials and labour required for the building and access road can be easily transported to the site. The site formation can proceed at the same time as the jetty construction. The excavation material can be stored temporarily at the site prior to use in the site landscaping or removal from the island after the jetty construction has been completed. On-site mixing of concrete for the construction of the works is likely to be adopted. The installation of electricity supply cabling and equipment will be concurrent with other construction works.

### 3.5 Operating Regime and Waste Transport Arrangements

Wastes from Queen's Road East (QRE) will be assayed and repackaged into storage drums at QRE by a Contractor under the supervision of the Radiation Health Unit of the Department of Health prior to commissioning of the LRWF. The DBO contractor will collect and transport both existing and future waste arisings to the LRWF. The storage drums and all the transport arrangements will be in accordance with the appropriate International Atomic Energy Authority (IAEA) Regulations.

Storage drums will be transferred to a sea-going vessel and on arrival at Siu A Chau will be off-loaded from the vessel onto a dedicated transport vehicle on the jetty in Sum Wan. This will be used to transfer the storage drum into the road bay of the LRWF.

On arrival at the LRWF the storage drums will be subjected to a further external radiation and contamination check to confirm acceptability before being placed directly into the storage vault. (Any drums showing signs of contamination would be routed through the processing area). The drum will then be transferred into the storage vault such that it is under the operating area of the crane. The crane will then be used to lift the storage drum into its storage location. The location of the drum, together with other appropriate information will be logged in a computerised Inventory System.

Future arisings of waste will be packaged by the waste consignors into a variety of packages which will meet the requirements of the IAEA Transport Regulations. The transportation arrangements for future arisings will be essentially the same as that for existing waste from QRE. On arrival at the LRWF packages will be subject to confirmatory radiation and contamination checks before being transferred into the waste processing area. If necessary a small number of packages may be stored in this area for operational reasons. Waste from packages, (or the complete package) will then be repackaged into the approved storage drum using suitable equipment. The storage drum will be 'quality checked' before being loaded with waste. Once full, the storage drum will be lidded, capped and monitored for external radiation and contamination. If necessary the drum will be decontaminated. The drum will then be passed into the storage vault and placed in its storage location using the crane. The location of the drum, together with the other appropriate information will be logged in an inventory system.

It is not considered feasible or economic to repackage certain sealed source arisings of waste which are known to have higher radioactive content. Such wastes will be placed directly into the storage vault within their 'original' packaging.

In order to minimise radiation dose uptake it is envisaged the crane will be automatic and capable of remote operation, although manual operation should also be provided. Potential radiation levels are too low to warrant remote recovery following failure of the crane; manual recovery is considered acceptable. A backup power supply will be provided sufficient to maintain emergency operations.

It is envisaged the waste processing area will be operated by qualified workers assisted by suitable installed and portable plant and equipment. This area will probably contain the following equipment:

- monorail for lifting waste from the road bay into the waste processing area.



- small shielded area for temporary storage of drums/packages.
- equipment for repackaging waste, such as fume cupboards/hoods, gloveboxes, tongs.
- equipment to assay waste.
- equipment to decontaminate drums/packages.
- handling equipment and trolleys for transporting packages/drums.
- radiological monitoring equipment.

The facility will not be permanently manned, although a 24 hour manned remote monitoring centre operated by the DBO Contractor will be provided. Visits to the LRWF will only be made to:

- undertake operations including waste handling
- carry out preventive or breakdown maintenance
- carry out inspection activities

## 4 ENVIRONMENTAL AND SAFETY ISSUES

### 4.1 Ecology

The impacts of the proposed LRWF on terrestrial ecology are considered to be low and of local nature. Mitigation measures, including slope restoration and grassland/shrub re-establishment are advised.

The rare Chinese White Dolphin and Black Finless Porpoise are known to utilise the waters around Siu A Chau, south Lantau and Tai A Chau. However, any impacts from the project are likely to be extremely localised. With regard to potential impacts on marine mammals, piling work for construction of the jetty is the most critical aspect. Construction of the jetty lasts only four and a half months. With careful planning, the use of the least disturbing construction methods and scheduling of the works programme to avoid critical seasons (for example, from October to December) for these mammals, potential impacts could be reduced to low levels.

The possible use of the island by Green Sea Turtles has not been confirmed, but the most sensitive area is likely to be the main sand beach, which is not affected by the proposal. The shoreline of the site is lined with cobbles and is not the type of habitat conducive to egg-laying by turtles.

Effect on benthic communities is short term and reversible. The area affected is localised and less than 0.03 ha. Benthic fauna inhabiting the sandy substrate are ubiquitous and have been known to recolonise rapidly upon completion of construction. The communities on rock and boulder in the bay have been surveyed along four transect lines and are typical of the location. As the species list is not extensive, loss of marine species would be minimal. Two species of coral were found, which occurred as isolated groups of small coral heads; these corals are not of particular conservation importance. Measures which have been specified to limit the amount of suspended sediment entering the water at the site and during jetty construction will protect these species.

Because the facility will be operated as a dry facility, and if discharge is permitted it will

be infrequent and within the limits allowed by EPD and the Radiation Board, and the short residence time of fish fry in shallow waters, the likelihood of fish fry being exposed to levels of radioactivity considerably higher than background is considered to be negligible. Potential for bioaccumulation and trophic transfer of radioactive substances is also considered to be negligible.

With careful control on jetty construction work, it is likely that any impacts would be minimal and localised to the piling itself. After construction, the pier piles would form a colonisation surface of benefit to marine life.

Siu A Chau Island is one of the few areas, both terrestrial and marine, where habitats are not already under pressure or threat. However, the nature and small scale of the LRWF indicates that with suitable mitigation measures, these concerns may not be justified.

Marine ecological impact is considered to be localised, short term, reversible and negligible with proper construction programming. No ecological survey is deemed necessary if the design features in this report are maintained.

#### 4.1.1 Proposed monitoring

A detailed inventory and abundance assessment of the plant species present on the site should be collected for the purposes of record and establishing replacement vegetation. Regular monitoring should take place on the stored topsoil/turf to ensure that it is in a reasonably healthy state for reuse at the end of construction.

#### 4.2 Water Quality

Although there is no surface fresh water at the proposed site, the water quality in Sum Wan and the surrounding marine areas is of generally high quality. This is to be expected in an area remote from the polluting influences of urbanised and industrialised or intensively farmed catchments.

Potential impacts arising during construction may include increased suspended solid matter in site run-off or organic pollution from foul effluent. As the scale of construction is not large, anticipated impacts are likely to be small. Nevertheless, some soil and rock excavation is required to create the site platform and concrete mixing and laying will occur on-site and therefore mechanisms have been recommended that will reduce the potential for impacts caused by site run-off. Similarly, means to reduce the potential for pollution from fuel spillage on site have been suggested.

During operation, there will be no adverse water quality impact from active effluent arisings when the LRWF is operated as a 'dry facility'. Discharge of active effluent is prohibited before agreement is reached with the Radiation Board and EPD on discharge limits; the discharge of active effluent arisings is regulated by the Radiation Ordinance with respect to public health and by the Water Pollution Control Ordinance with respect to the protection of water quality and the marine environment. If and when discharges of active liquid arisings are inevitable and permitted, there will be minimal water quality impacts as discharges will be of extremely small volume and will be infrequent. The routine arisings that have been identified as 'suspect' active include effluents from changerooms, cleaning waste from potentially contaminated areas, and liquor from

decontamination of drums or equipments. The quantity of such arising is estimated to be less than 1m<sup>3</sup>/yr. Calculation shows that total annual discharges would be 280MBq compared to a monthly limit of 500MBq (set in the Radiation Ordinance for the protection of human health). Even if all annual contamination were discharged in a single month, Hong Kong Government guidelines would not be exceeded.

Based on the assumption that dose uptake by a member of the public must not exceed 0.1 mSv/yr from liquid discharges, a swimmer or other individual has to ingest 75 litres of seawater in a year to reach this limit assuming that dispersion of the arisings is restricted to 100 m<sup>3</sup> of sea water. Ingesting 75 litres of seawater is not credible and dispersion being limited to 100 m<sup>3</sup> is conservative. Based on this and the fact that the nearest occupied area is 1.7 km away, dose to members of the public will be within limits and any effect would be negligible.

Effluent discharge will be contained within a tank for monitoring prior to discharge. Discharge limits should be assessed and set on a site-specific basis at the detailed design stage, based on the location of the discharge, the radionuclides likely to be present, possible food-chain pathways, accepted transfer factors and the dispersion characteristics of the area. Such limits should be agreed to by Government (including the Radiation Board) prior to any discharge of active effluents. Foul effluent (non-active) will be directed to a septic tank with a soakaway. The volume of dilution available in the open water off Siu A Chau is likely to be large and thus the effect of discharges of non-active effluent are unlikely to be measurable.

Small amounts of fuel, batteries, bottled gases and epoxy monomers are likely to be used during operations, but do not pose a significant risk to water quality if precautions are taken during handling and storage.

#### 4.3 Air Quality

As expected for this remote site, air quality would generally be of good quality. There are no known sensitive receivers for whom construction or operation of the LRWF may pose a problem. Nevertheless, given the pristine nature of the area, certain precautions have been recommended to minimise the discharges of materials, vapours and gases during construction and from the operational use of the facility.

Operational measures taken to protect workers in the LRWF, such as the negative pressure ventilation system (from less active to potentially most active areas), together with the use of control mechanisms including high efficiency particulate (HEPA) filters, will reduce the potential environmental impacts to negligible levels.

#### 4.4 Noise

Existing noise levels in the area are likely to be at very low background levels. Noise will be generated during construction work, particularly during the site preparation stage. However, due to distance and natural shielding, there are no sensitive receivers who could be affected.

#### 4.5 Transport

There is no existing transport infrastructure at the site. The small scale of the construction works and the consequently low volume and frequency of marine traffic employed for construction, should present no difficulties. Similarly, the operational need for delivery by sea will be very infrequent (perhaps daily visits in the initial month and a single visit per month thereafter) and thus effects on transport will be negligible.

Collection and delivery of waste to the LRWF is outside the scope of this assessment, however, initial collection of waste from QRE tunnels will probably require some traffic management. Delivery of future arisings will be from a variety of sources at infrequent intervals and will not require special arrangements.

#### 4.6 Historical and Cultural Heritage

There are no listed sites of archaeological importance at the site. Similarly, there are no known grave sites or Fung Shui interest in the area. Impacts during construction and operation are therefore not likely.

#### 4.7 Visual Amenity

The proposed site is within an area which is recognised as being a significant landscape and recreational asset and being environmentally sensitive. The area is particularly vulnerable to visual intrusion. However the site identified as the overall optimum by the site selection process on the basis of many criteria was also the site least suitable in terms of visual impact criteria. It is therefore inevitable that the proposal will have a local visual impact.

Notwithstanding the above, the specific topography of Siu A Chau will largely limit the visual intrusion to the Sum Wan area and to the sea views from the south-east.

The proposal is for quite a large facility, compared to the small scale of the island, although the operational characteristics of the facility should permit the incorporation of visual impact mitigation measures.

The mitigation strategy should be based upon minimising the impact by drawing on natural forms and materials. The mitigation measures should concentrate on minimising the visual impact of the facility itself, although screening may be a possibility. The mitigation strategy should be taken forward by means of the performance specification, which identifies the relevant mitigation criteria.

#### 4.8 Solid Waste

Mechanisms to prevent the unsightly accumulation or open burning of waste during the construction phase have been recommended. With suitable control, and given the small scale of the construction works, there should be minimal potential for impacts. Similarly, generation of solid waste during operation of the LRWF should be extremely low. All such wastes should be removed from the island for suitable disposal elsewhere whenever the workforce depart from the facility on their regular visits. Any Radioactive wastes generated as part of the operation of the LRWF may be stored within the facility.

#### 4.9 Radiological Assessment

The preliminary assessment for normal operation indicates that dose uptake (from external radiation and internal or external contamination with radioactive material) which is estimated to be less than 5% of the Ordinance limit, is likely to be minimal from Year 2 of operation onwards. Levels during Year 1 of operation, estimated to be around 80-90% of the allowable limits, are above investigation limits and therefore it is suggested that further analysis be undertaken by the DBO Contractor as part of the detailed EISA. A preliminary assessment of liquid and gaseous discharges indicates they will meet current Hong Kong Guidelines and dose limits for the public.

A preliminary assessment of unplanned events including a dropped load incident and road/sea accident involving either a storage drum or package external or internal to the LRWF suggests the consequences to be tolerable. It is also noted that transport will be in accordance with IAEA Regulations and that these are internationally accepted as providing safe methods of transport.

It is considered unlikely that storage drum containment will be breached within the LRWF due to a dropped load incident as the drum is always expected to be below the 'drop' height (the height to which standard drums have been drop tested). It is noted that due to the relatively low payload of the storage drum the potential exists to exceed its weight limits although a relatively simple method of protection has been identified.

Remote security monitoring of the LRWF will be undertaken on a 24-hour basis, the monitoring information being relayed to a suitable location to be agreed upon at the detailed design stage. The centre will be manned by a private security contractor or similar proposed by the DBO Contractor. The person manning the 24 hour monitoring centre is to be known as the DBO Contractor Emergency Representative (DBOER). The security monitoring will allow emergency action to be taken in the event of fire, security breach, or detection of activity by the radiological and/or stack monitors.

No significant hazards have been identified as a consequence of building services failure. The small risk of accident arising from the nearby helipad should be considered.

The facility should withstand extreme weather conditions. Hazards from fire should be further assessed, including the potential for, and consequences of, fire started outside the LRWF. It is noted that some components and stored materials, although not radioactive, are flammable. Prompt assistance will not be available at the site.

The consignors should be placed under an obligation to ensure only waste acceptable to the LRWF is delivered to the facility. The wrong type of waste could pose hazards during transportation and handling particularly if a liquid waste is sent. The consequences to an operator erroneously attempting to repack higher activity waste could be significant.

In the design of the facility the hazards from conventional operations should not be overlooked. For example the most serious consequences following a dropped load incident may be injury to a nearby operator due to the weight of the drum rather than a radiological hazard.

Detailed radiological monitoring has been proposed, including monitoring in the vicinity of the LRWF and for each area/room, process operations and personnel protection within the facility. Recommendations are given for the parameters to be monitored, the permanent and portable equipment to be used and the monitoring locations.

## 5 CONCLUSIONS AND RECOMMENDATIONS

The impacts of the proposed LRWF on terrestrial ecology are considered to be low and of local nature. Mitigation measures, including slope restoration and grassland/shrub re-establishment are advised.

Impacts on marine ecology from the project are likely to be extremely localised. During jetty construction, careful planning, the use of the least disturbing construction methods and scheduling of the works programme to avoid critical seasons can reduce potential impacts on marine mammals to low levels. It is recommended that the tender document specifies that construction of the jetty be curtailed from October through December.

As the scale of construction is not large, anticipated impacts on water and air quality are likely to be small. There will be some noise generated during construction, however there are no sensitive receivers in the locality. Operational impacts upon water quality, air quality, noise and transport will be negligible. Potential impacts can be avoided if the suggested mitigation measures are implemented.

Regarding visual amenity the proposal is for quite a large facility, compared to the small scale of the island. The operational characteristics of the facility will permit the incorporation of visual impact mitigation measures. These will be based upon minimising the impact by drawing on natural forms and materials.

A preliminary radiological assessment of liquid and gaseous discharges indicates that discharges will meet current Hong Kong Guidelines and dose limits for the public. An assessment has been made of potential radiological impacts due to unplanned events. Safety measures have been identified wherever possible, and a contingency plan outlined.

A Stage 2 EISA will need to be produced during the detailed design stage as the successful contractors will inevitably refine the outline design. Issues which require more detailed consideration are presented below.

- detailed justification and a safety case needs to be made for the particular design and operation of the LRWF which should include justification of radioactive dose uptake for both workers and members of the public under normal operation and unplanned incidents.
- recommendations, to the satisfaction of EPD, on discharge limits of radioactive liquid effluent, to enable the facility to operate as a 'wet facility'. Detailed justification and a safety case needs to be made for any discharges of radioactive effluent. Such discharge limits should be set on a site-specific basis with reference to the accepted annual limit of intake for each nuclide, the available dilution, major pathways and accepted transfer factors. It is anticipated that this could be achieved by a standard modelling approach. Discharges would be

licensed by the Radiation Board.

- assessment of internal worker dose.
- hazards from fire.
- environmental monitoring and audit during construction.
- radiological monitoring during operation.
- mitigation measures during construction:
  - jetty construction
  - slope restoration and grassland/shrub re-establishment
- as the visual aspects of the area are of critical importance, the detailed design should be pursued with sympathetic architectural consideration for integration of the LRWF into the surroundings.
- consideration should be given to detailed mechanisms, including the use of environmental performance clauses, for enforcing contract conditions during the construction and operational phases.

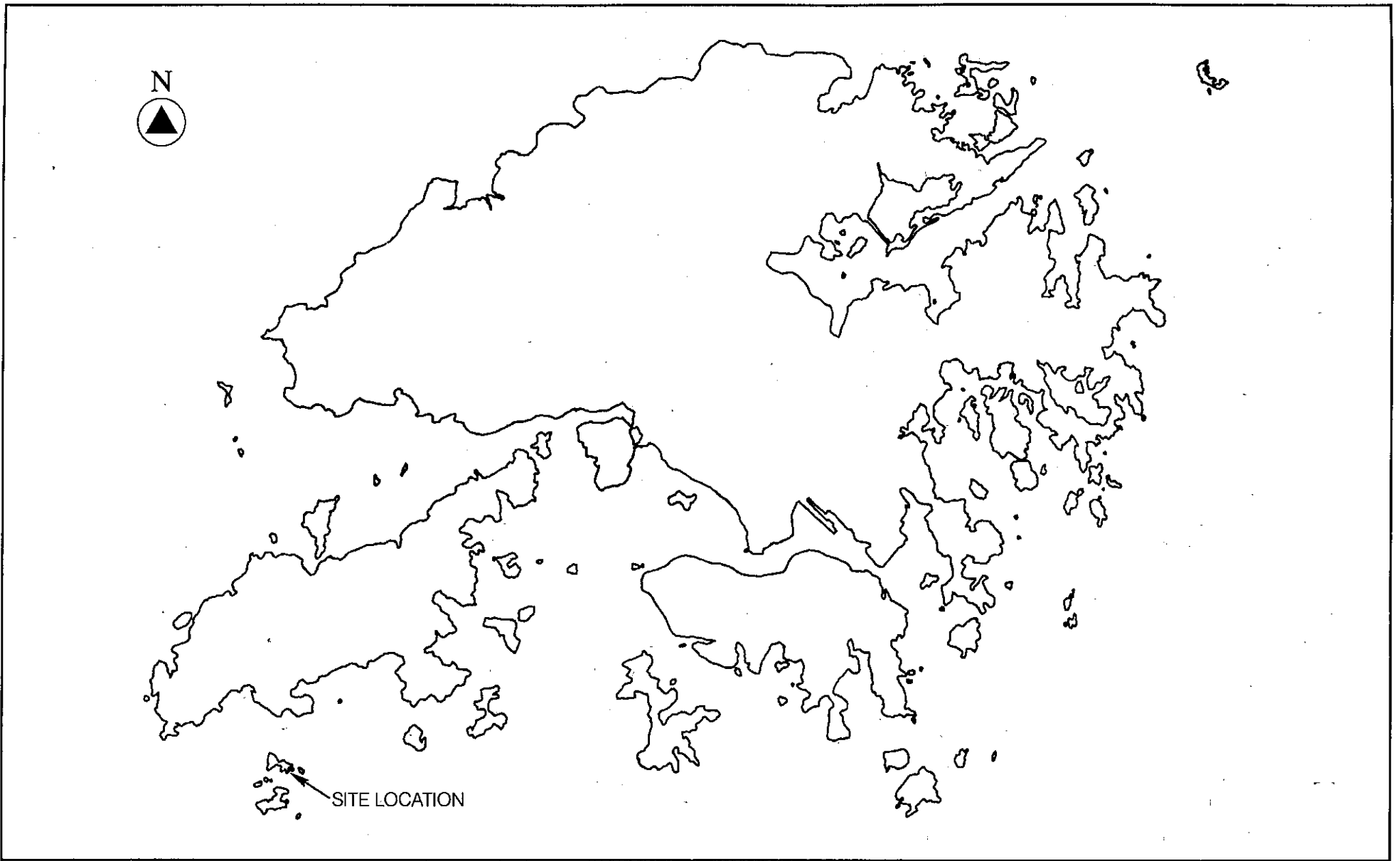


Figure 1 Site Location at Siu A Chau



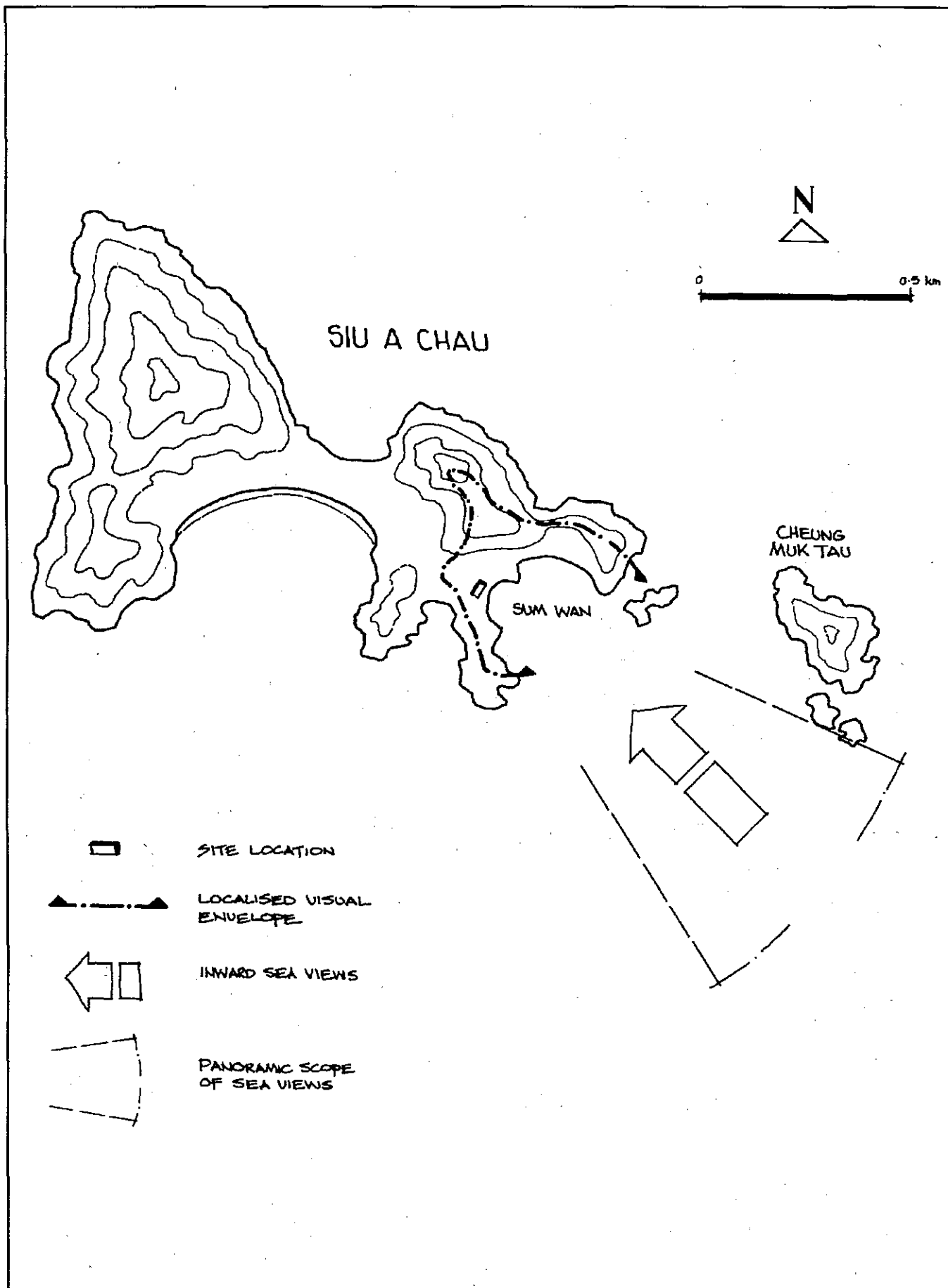


Figure 2 Proposed Site on Siu A Chau: Site Location & Local Viewsheds



Figure 3 Proposed Site: Site Photographs

**LEGEND:**

- L LOCKER
- BB BOOT BARRIER
- W WASH
- WC WATER CLOSET
- S SHOWER
- HM HAND MONITOR
- PM PERSONNEL MONITOR
- C WASH CUBICLE

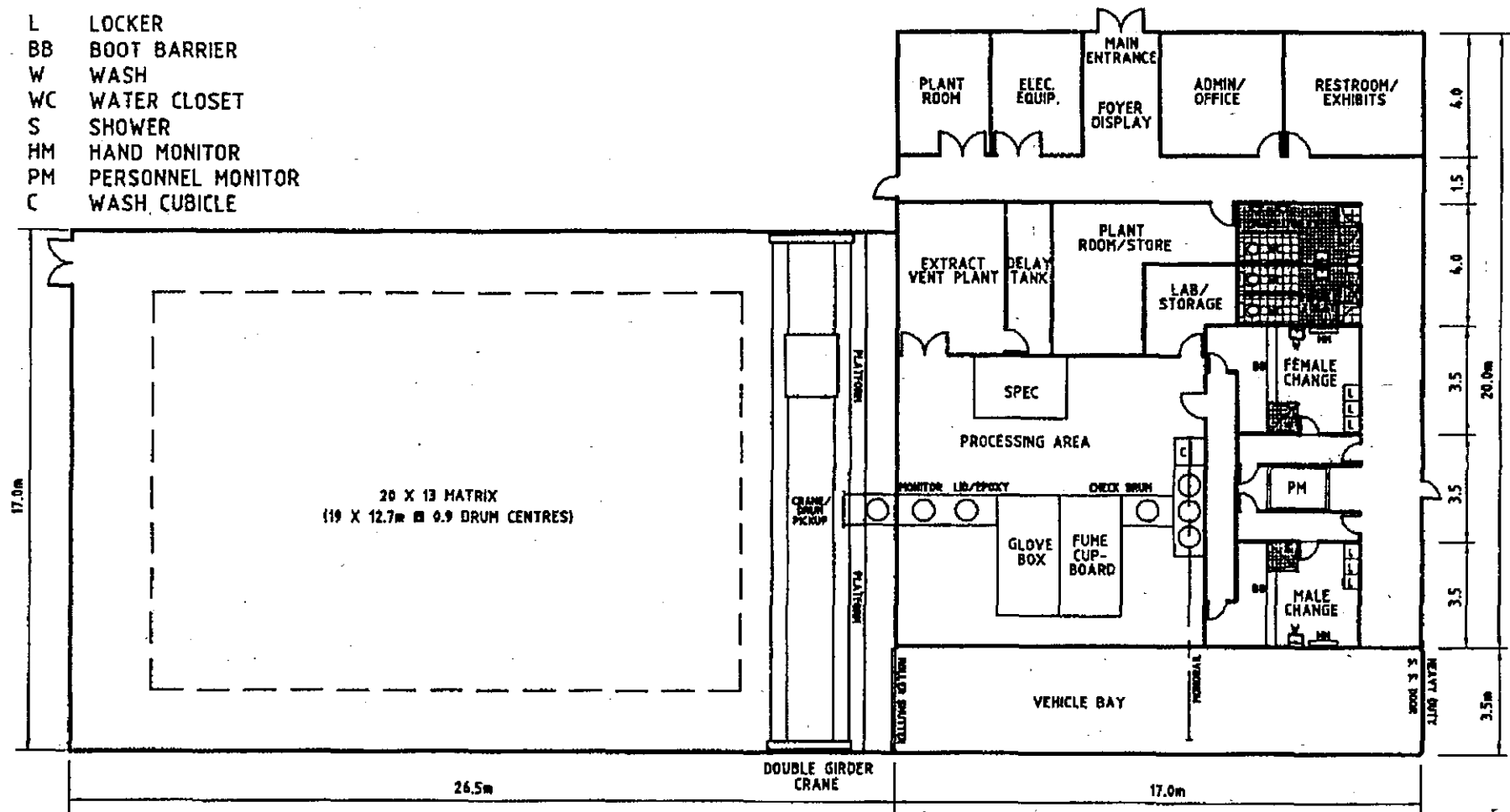


Figure 4 Diagram Illustrating Proposed Layout of LRWF

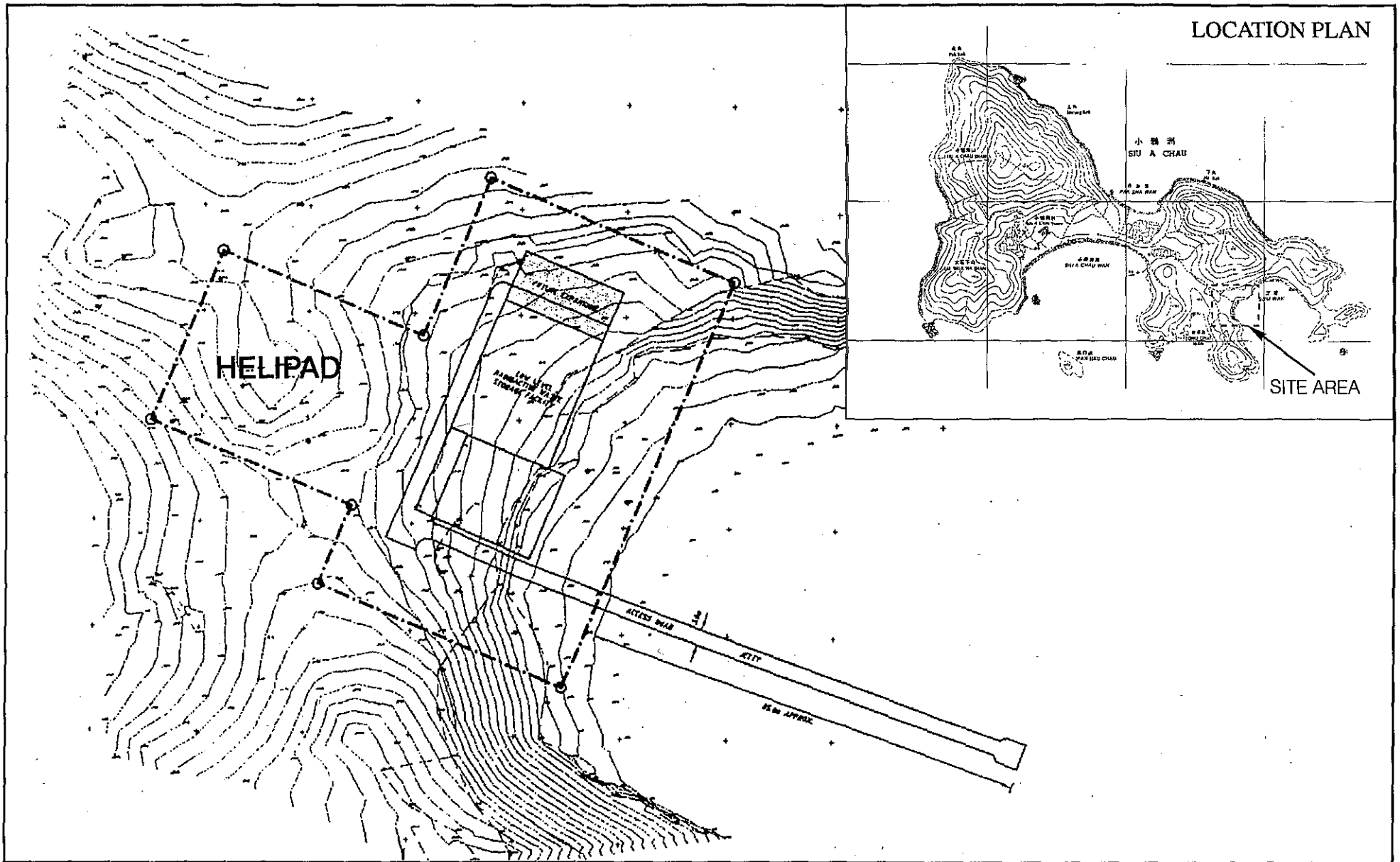


Figure 5 Site Area and Proposed Boundary of LRWF