

Section 12A Application

**To amend Discovery Bay Outline Zoning Plan
For optimising the land uses**

At Area 10b, Discovery Bay

Planning Statement

January 2016

Applicant

Hong Kong Resort Company Limited

Section 12A Application

To Amend Discovery Bay Outline Zoning Plan for optimising the land use at Area 10b,
Discovery Bay

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Consultants

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Executive summary

- S1 Hong Kong Resort Company Limited has a long term vision to better utilise the existing land resources at Discovery Bay to serve a larger population while retaining the character of the development. It has conducted site analysis, and subsequently identified development potentials at Area 10b which is the subject site of this application, and Area 6f for which a separate application is made concurrently. The Concept Plan for the two areas will create about 1,601 units for 4,003 persons in total.
- S2 This application seeks to amend the Discovery Bay Outline Zoning Plan No.S/I-DB/4 at Area 10b around Marina Avenue, to enable a Concept Plan pertaining the following:
- Extended Outline Zoning Plan boundary,
 - Removal of the existing redundant or inappropriate service uses, and rationalisation of the existing servicing facilities within a podium,
 - Increase residential development of about 1,125 units for 2,813 persons, and
 - Improvement to the foreshore promenade and open space.
- S3 This Concept Plan is considered responsive to the Chief Executive's Policy Address 2015 advocating for housing supply, and development at Lantau Island where Discovery Bay is located. It has identified Area 10b, given its current mix of unsightly uses with minimal natural conservation value, representing opportunities for redevelopment and upgrade. The proposal is supported by engineering studies quantifying the infrastructure requirement to accommodate the population increase. It has given due regard for the waterfront setting. In summary, the proposed optimisation of land use at Area 10b is considered satisfactory in addressing the general planning intention of the area.
- S4 Accordingly, the Town Planning Board is invited to favourably consider this request to amend the OZP to enable the proposed Concept Plan at Area 10b.

行政摘要

- S1 香港興業有限公司有長遠計劃去運用現有愉景灣土地, 在保存現有的環境的同時增加當中的人口, 包括此規劃申請涉及的第 10b 區和另一申請涉及的第 6f 區。兩區計劃將會總共供應大約 1,601 單位容納 4,003 人口。
- S2 此第 12 條規劃申請地點位於愉景灣分區計劃大綱核准圖編號 S/I-DB/4 上第 10b 區遊艇徑附近的土地, 方案包括:
- 伸展分區計劃大綱核准圖的管轄範圍,
 - 移除現有不適用或不理想的附助用途, 並且重整現有的服務設施,
 - 增加住宅數量, 包括大約 1,125 單位容納 2,813 人口, 和
 - 增設海傍行人步道和休憩用地。

- S3 此擬議方案配合 2015 年行政長官施政報告所提倡的住宅供應和愉景灣所屬於的大嶼山的規劃發展。方案用意為利用第 10b 區的已發展環境，以重建和優化現在不適用或不理想的土地用途。方案包括影響評估報告以證實基礎設施足夠應付擬議的人口增長。其設計考慮到海旁的觀景。總括而言，此計劃附合大綱圖的整體規劃意向。
- S4 因此，懇請城市規劃委員會批准此更改分區計劃大綱核准圖的申請，容許擬議的發展方案。

Development Schedule 發展參數

Site Area 地盤面積 (approximately 大約)	62,875 m ² 平方米
Total GFA 總建築面積 (max 上限)	89,500 m ²
Domestic GFA 住用建築面積 (max 上限)	67,500 m ² 平方米
Non Domestic GFA 非住用建築面積 (max 上限)	22,000 m ²
Plot Ratio 地積比率	1.42
Domestic Plot Ratio 住用地積比率	1.07
Non Domestic Plot Ratio 非住用地積比率	0.35
Number of Storeys 樓宇層數 (max 最高)	<ul style="list-style-type: none"> • Low-rise 屋宇: 3-4 storeys 層 • Flat buildings on podium: 基座上分層住宅: 4-5 and 18 storeys 層 • Flat buildings 分層住宅: 6, 9- 12, 18 storeys 層
Building Height 建築物高度 (max 最高 including structure 包括構築物)	<ul style="list-style-type: none"> • Low-rise 屋宇: 21 mPD 主水平基準上 • Flat buildings on podium: 基座上分層住宅: 33- 35, 86 mPD 主水平基準上 • Flat buildings 分層住宅: 31, 47- 57, 77 mPD 主水平基準上
Number of flats 住宅單位數量 (approximately 大約)	1,125
Promenade 步道 (approximately 大約)	2500 m ²

Introduction

Hong Kong Resort Company Limited (HKR) has a long term vision to better utilise the existing land resources at Discovery Bay to serve a larger population, while retaining the existing character of the area.

- 2 HKR has conducted site analysis, taken into consideration of the topography and landscape around Discovery Bay, and recognised the value of the natural environment. It has subsequently identified development potentials at Area 10b and Area 6f around already disturbed sites or already approved development yet to be implemented. Their development is considered to reduce disturbances to the natural environment, as opposed to alternative pristine locations. Concept Plans have been prepared for the two areas, creating about 1,601 units for 4,003 persons in total.

The Application

- 2.1 This planning statement is prepared in support of an application made pursuant to Section 12A of the Town Planning Ordinance. The application seeks to amend the Discovery Bay Outline Zoning Plan No.S/I-DB/4 (the OZP), specifically referring to the land area in Area 10b around Marina Avenue. The application proposes to amend the OZP to enable implementation of a Concept Plan pertaining the following:
 - i. Extended OZP boundary,
 - ii. Removal of the existing redundant or inappropriate industrial uses, and rationalisation of the existing servicing facilities under a podium,
 - iii. Increase residential development of about 1125 units for 2813 persons, and
 - iv. Improvement to the foreshore promenade and marine access.
- 2.2 The proposals for Area 6f are made under a separate planning application concurrently.

3 Relevant Background

Chief Executive's Policy Address in 2015

- 3.1 Reference is made to the Chief Executive's Policy Address in 2015, which advocates increased housing supply, and future development at Lantau Island where Discovery Bay is located. Relevant paragraphs read as follows:

69. The Government will continue to maintain the stable and healthy development of the private property market through steady and sustained land supply...

72. What Hong Kong lacks is not land, but land that is developable... We also lowered the development intensity of land newly planned for development. These are causes of the serious shortage of housing supply that we have been facing in recent years.

74. We have to take into consideration more and more factors such as the impact on traffic, environment, conservation and even air ventilation in the

planning process. As a result, the supply of developable land has decreased or decelerated...

75. ...Increasing and expediting land supply is the fundamental solution to resolve the land and housing problems of Hong Kong.

85. At the same time, we will continue to actively explore with the MTRCL and the Kowloon-Canton Railway Corporation the development potential of stations and related sites along the existing and future rail lines, such as Siu Ho Wan in Lantau.

93. ...The Stage Three Public Engagement of the Tung Chung New Town Extension Study was also completed. The new town extension will provide about 48,000 residential units, and a commercial hub will be established in Tung Chung East.

100. ...In the medium term, we will continue with the development of the Tung Chung New Town Extension, and proceed to commence studies in connection with the reclamation in Sunny Bay and topside commercial development on the Hong Kong boundary crossing facilities of the Hong Kong-Zhuhai-Macao Bridge. In the long term, we will seek support of this Council for early commencement of the preliminary study on the East Lantau Metropolis to look into the development of artificial islands in the eastern waters off Lantau....

Preliminary Concept Plan Submission to the Government

- 3.2 HKR has submitted Preliminary Concept Plans to optimise the land use in Discovery Bay to the Government in July 2013 and July 2014, and received comments on them. This planning application is for a consolidated Concept Plan at Area 10b, which has taken account of the comments received.

Land Administration

- 3.3 Under the land lease, the immediately adjoining water to the south of Area 10b is granted to HKR. This water has been previously gazetted under Foreshores and Sea Bed Ordinance (G.N.710 of Gazette No.14 dated in 1976) and approved for reclamation. The reclamation of this area is proposed in this application.
- 3.4 Approved development at Discovery Bay is shown in a Master Plan under the lease. The current Master Plan No.6.0E1 has been in effect since February 2000, and the premium offer of the latest Master Plan No.6.0E7h(a) has been accepted by HKR.
- 3.5 Subsequent to the approval of this planning application, application to Lands Department will be made to amend the Master Plan to enable the proposed development at Area 10b.

4 The Application Site

- 4.1 The application site generally refers to the land area in Area 10b around Marina Avenue. It is located along the southern waterfront of the Tai Pak Tsui Peninsula. It is about 62,875 square metres in area, including the area of the approved reclamation. Its location plan is provided in **Figure 1**.



Figure 1. Location plan showing the general area of the application site at Area 10b. (Source: Google map)

- 4.2 Area 10b is generally segregated from the surrounding land uses, and is bound by the Nim Shue Wan water with an artificial waterfront to the south. Residential development to the north is located on an artificial slope. Marina Club to the east is set back from its entrance. Discovery Bay Road to the west separates the development across the road.
- 4.3 The area currently accommodates a mix of land uses (as shown in the photos in **Figure 2**), including:
- A telephone exchange, staff quarters, a refuse collection station, a liquefied petroleum gas storage, an overnight bus parking area, HKR's warehouse, a bus repair station and golf cart repair workshops, generally from east to west along the northern side of Marina Avenue.
 - Kai To Pier centrally located at the waterfront.

- iii. A boat servicing yard and a petrol filling station to the east, around the entrance of Marina Club.
 - iv. A decommissioned sewerage treatment plant and an existing sewage pump to the west, near the junction of Marina Avenue and Discovery Bay Road.
- 4.4 The locality functions as the service area for Discovery Bay. It is poorly utilised, unattractive and out of character with the high quality residential environment elsewhere in Discovery Bay. It represents opportunities for redevelopment and upgrade works.
- 4.5 Area 10b is traversed by the east-west running Marina Avenue, connecting Discovery Bay Road with the Marina Club.
- 4.6 There is vegetation, including scattered established tree groups, and slope greenery along the northwestern perimeter where the land rises towards Discovery Bay Road. Redevelopment of Area 10b will retain most of the trees in the northwestern part of the site.
- 4.7 The southern part of the area is reclaimed land. The adjoining water to the south has been approved for reclamation, which has never been implemented.



Figure 2a.

The Area 10b entrance is characterised by servicing facilities, including the golf cart repair workshop (to the left) and sewerage treatment plant (to the right).



Figure 2b.

The foreshore is generally void of design or structures intended for public amenity.

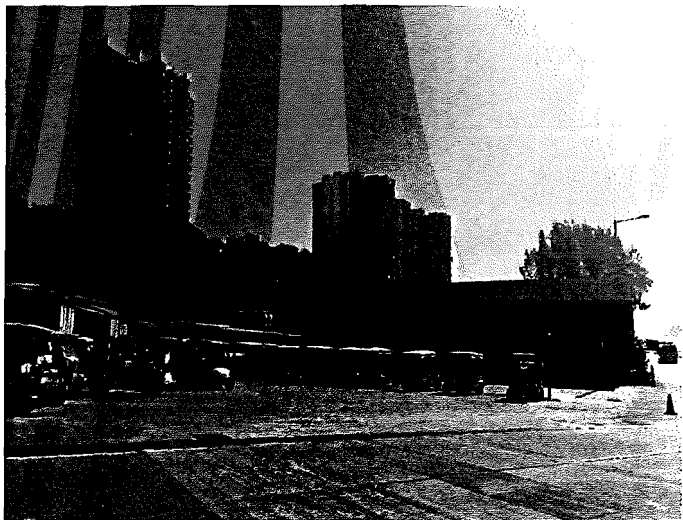


Figure 2c.

The golf cart repair workshop, with Peninsula Village on the backdrop.

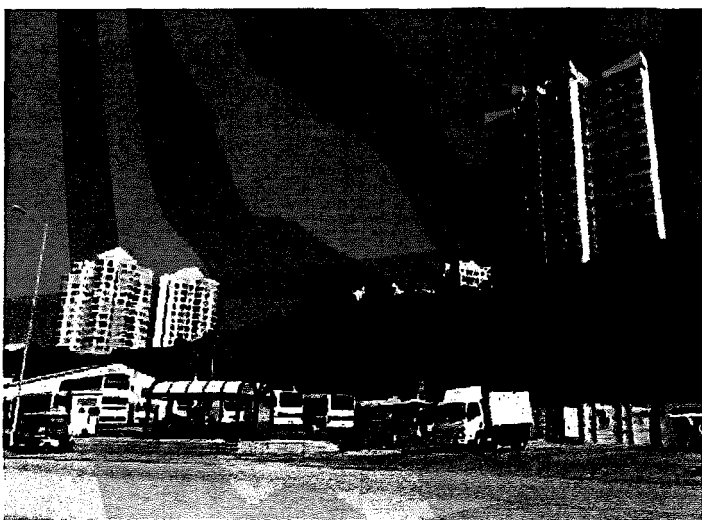


Figure 2d.

The bus parking area and repair workshop, with Peninsula Village on the backdrop.

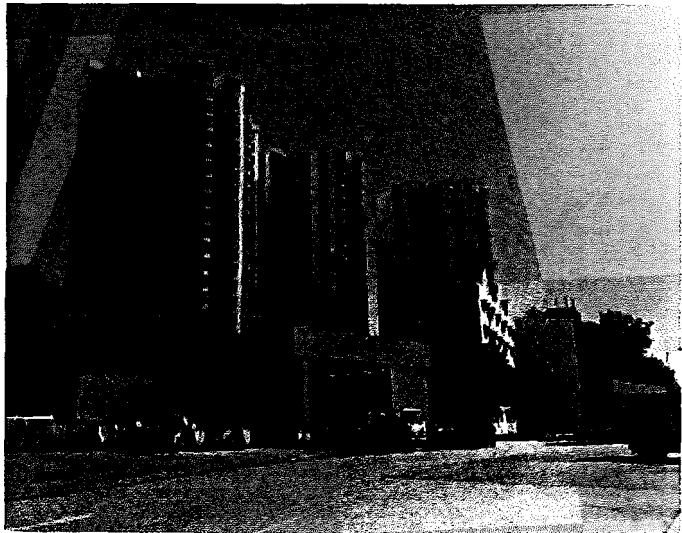


Figure 2e.

The refuse collection point and staff quarters, with Peninsula Village on the backdrop.

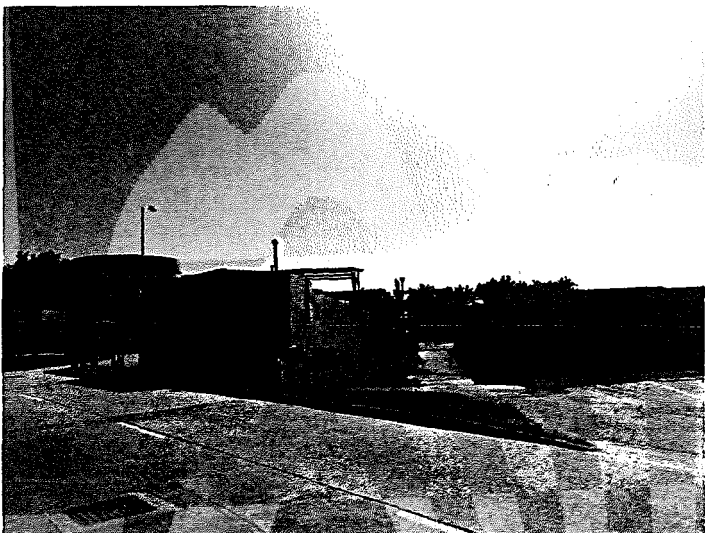


Figure 2f.

The petrol filling station, and service area behind the blank wall.

- 4.8 Under the current OZP, Area 10b is zoned for a range of "Government, Institution or Community" ("G/I/C") and "Other Specified Uses" ("OU") accommodating staff quarters and servicing facilities. An extract of the OZP is provided in Figure 3.

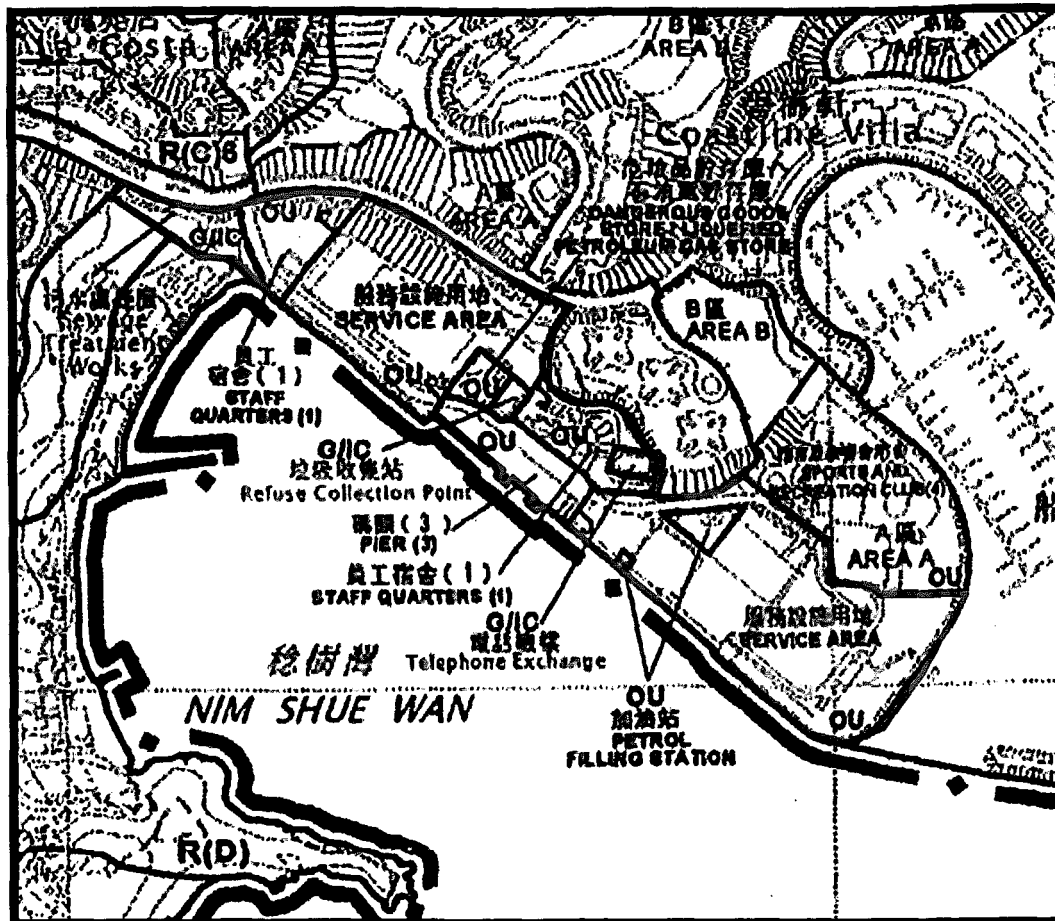
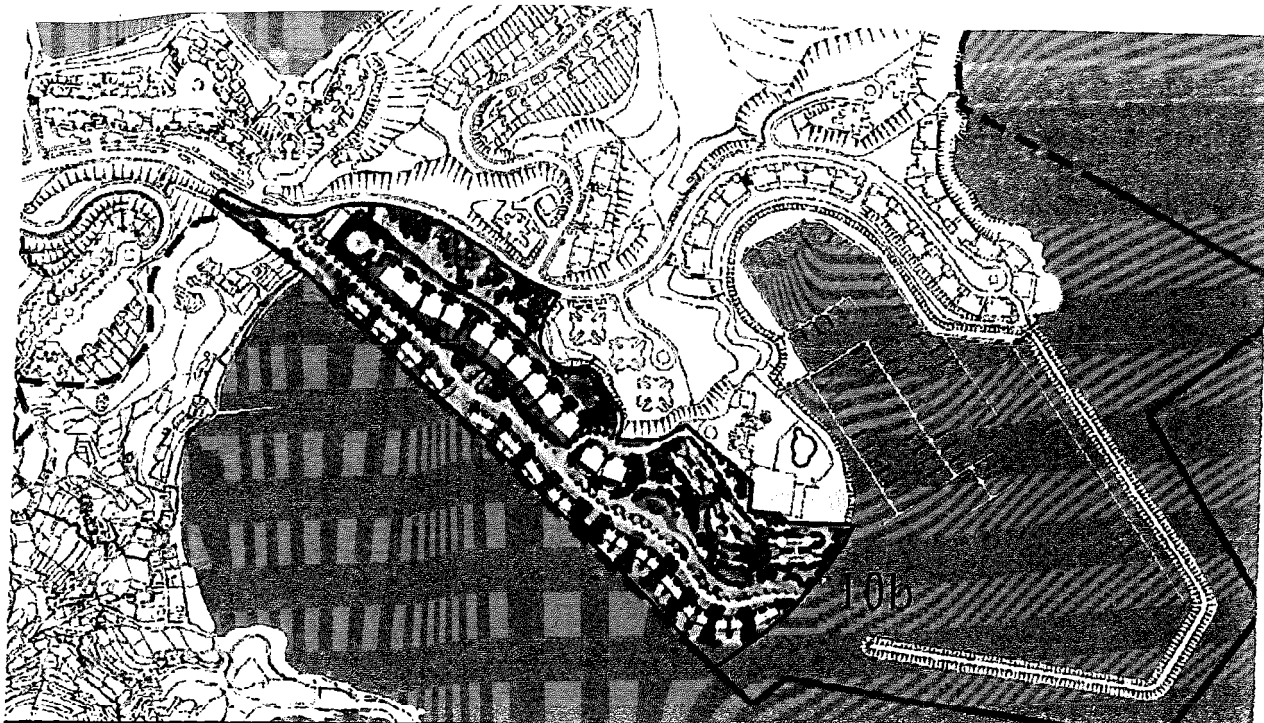


Figure 3 The land use zonings of Area 10b shown on an extract of the OZP.

5 The Concept Plan

- 5.1 Careful considerations have been given to the Concept Plan at Area 10b. Conceptual designs for various development intensity and building mass, the streetscape and pedestrian environment have been explored and discussed with Government Departments. Some of the alternative design schemes are included in Figure 4.
- 5.2 The current Concept Plan showing the proposed development at Area 10b is shown in Figure 5a. It has addressed the Government Departments' comments and the development intensity has been reduced. It pertains the followings, and each is discussed in details below:
- An extended OZP boundary,
 - Removal of the existing redundant or inappropriate uses, and rationalisation of the existing servicing facilities at a podium,
 - Increase residential development of about 1,125 units for 2,813 persons, and
 - Improvement to the foreshore promenade and open space.



Domestic plot ratio	Domestic GFA	Unit increase over the current OZP	Approximate population increase
1.10	69,590m ²	694	1,735

Figure 4. 2014 August design scheme .

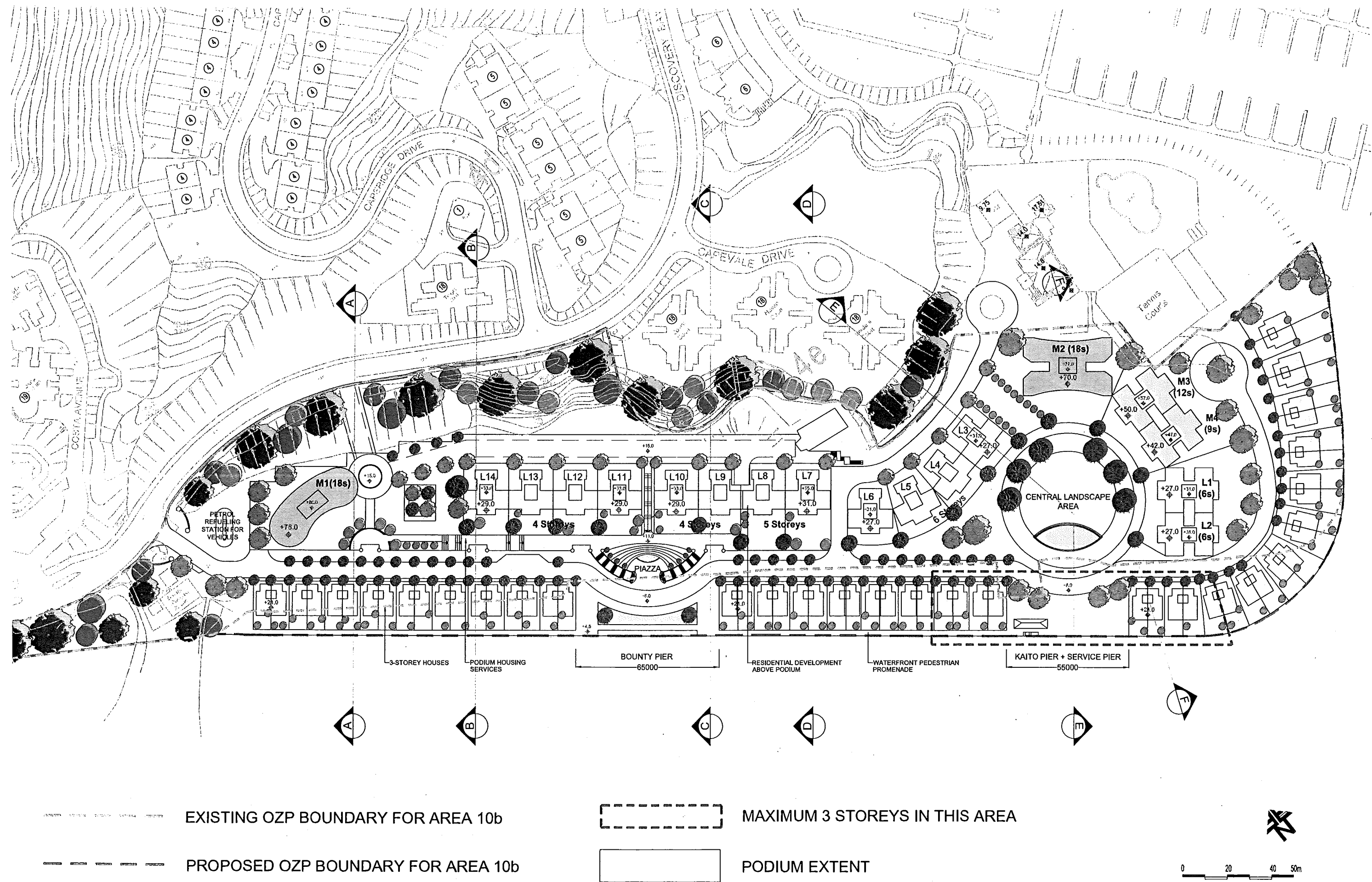


Figure 5a. The Concept Plan showing the current proposal at Area 10b.

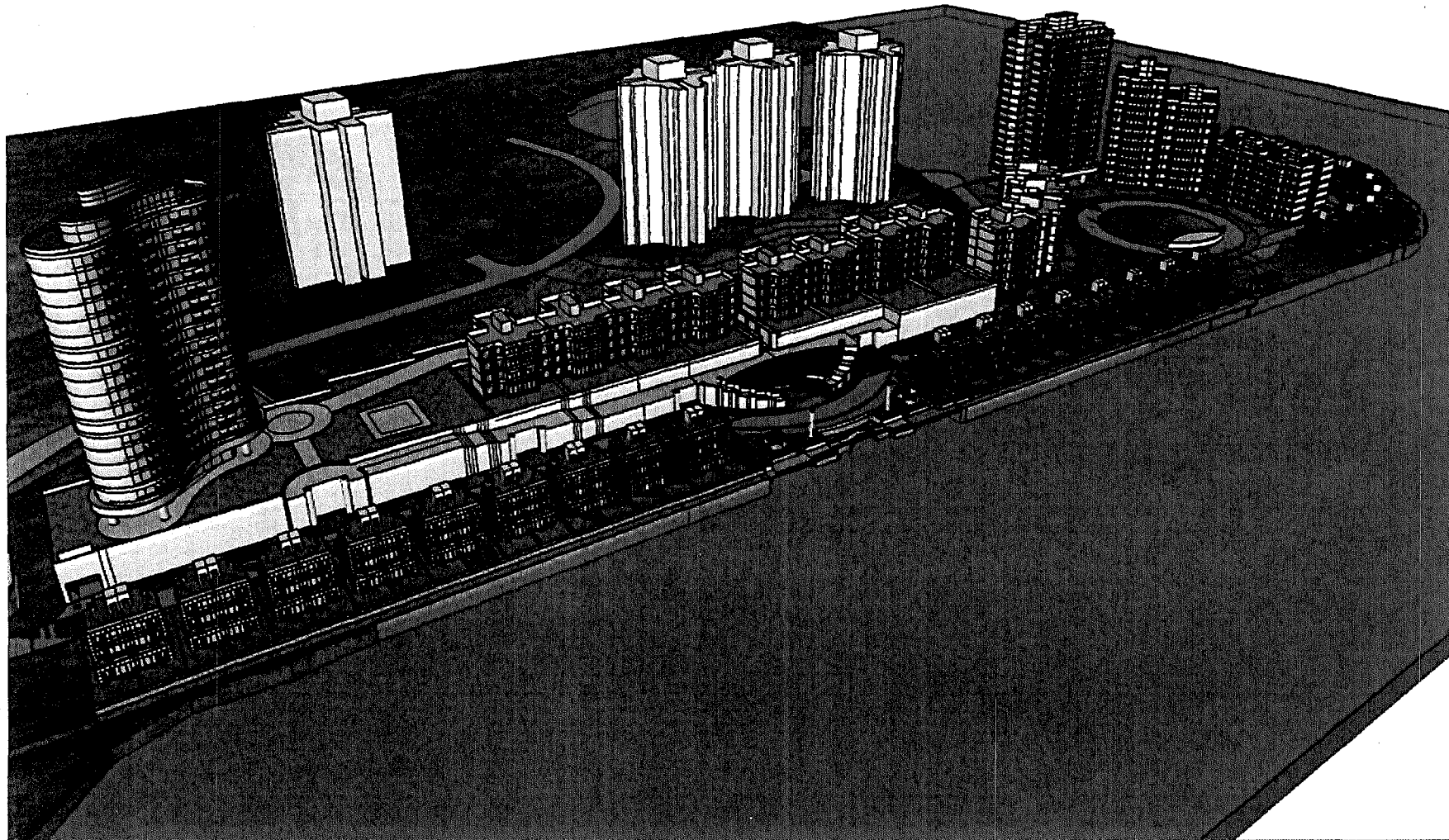


Figure 6. Illustration of the proposed building mass under the current design scheme.

Extending the OZP Boundary

- 5.3 The Concept Plan seeks to extend the foreshore boundary of Area 10b ranging from 9-34 metres beyond the existing seawall, which is outlined by the grey dotted line in **Figure 5a**. It is within the land lease boundary and the approved reclamation extent.
- 5.4 The Concept Plan designates land uses at the newly formed area. As such, an extended OZP boundary is required to cover this area to enable the proposed development.

Rationalising the Existing Service Area

- 5.5 The Concept Plan rectifies the existing poorly utilised and generally unattractive land use mix at Area 10b. It removes the existing redundant or inappropriate uses, and rationalises the servicing facilities, in the following manner:
- ii. The boat servicing yard will be out-sourced to outside Discovery Bay.
 - iii. The petrol filling station will be reprovided at the western part, around the junction of Marina Avenue and Discovery Bay Road. The liquefied petroleum gas storage will be removed.
 - iv. The overnight bus parking area, HKR's warehouse, bus repair station and golf cart repair workshops will be reprovided in an enclosed podium structure. The existing refuse collection station will be enlarged and integrated within the podium. A floor plan indicating these uses at the podium is shown in **Figure 5b**.
 - v. The telephone exchange and the sewage pumping station will remain in-situ.

Increasing Residential Development

- 5.6 Area 10b is currently limited in accommodation provision. There are two designated areas for staff quarters, one being realised with a 5 storeys building while the other has not been built. Meanwhile, staff quarters are no longer in need at Discovery Bay, as a result of the completion of Discovery Bay Tunnel facilitating connection with other districts at all times.
- 5.7 The Concept Plan for the area changes the form of the currently permissible accommodation and increases its density, to create the following:
- i. 3-4 storeys low-rise houses along the waterfront.
 - ii. A podium generally centrally located along the northern perimeter of the site. There will be 4-5 storeys residential buildings, and an 18 storeys residential building at the western part. There will be a vehicular access connecting the higher contour part of Discovery Bay Road with the podium roof. It will run above the existing slope greenery and minimise disturbance to the vegetation.
 - iii. 6 storeys residential buildings to the east of the podium.
 - iv. Stepped heights from 6 to 18 storeys residential buildings around the headland.
- 5.8 The building mass is illustrated in **Figure 6**.

- 5.9 There will be suitable provisions for parking and servicing vehicles, such as residential golf cart and loading/ unloading facilities. (Vehicle types and numbers are restricted in Discovery Bay, golf cart is the main form of vehicle ownership).

Improving the Promenade and Open Space

- 5.10 The Concept Plan designates promenade and open space at the newly formed waterfront, to create the following:
- i. A promenade connecting Discovery Bay Road with the Kai To Pier, and is about two thirds the length of the headland.
 - ii. A plaza generally centrally located along the foreshore, around the berthing of the tall ship (known as "the Bounty"). There will be small structures serving the maintenance of the Bounty. The plaza extends across the road, with a pedestrian access leading to the uphill area to the north. The Concept Plan envisages a design theme relevant to the Bounty, by including a bridge structure and grand steps, to create a focal point around its berthing.
 - iii. A plaza located towards the eastern part of the foreshore, around the Kai To Pier. There will be shelters serving the weather protection for the passengers. The plaza extends to a large park across the road. It forms a node of the area for the people arriving by sea.
 - iv. Section plans showing the stepped design from the foreshore promenade and the waterfront development are provided in **Figure 7**.
- 5.11 Detail considerations will be given to the urban design of the foreshore promenade, plazas and Marina Avenue, to provide for an integrated design and a pleasant amenity for the people using the area. A landscape proposal and section plans is shown in **Figure 8**.
- 5.12 The intersection of Marina Avenue and Discovery Bay Road will be modified to cater for the surrounding proposed developments. Detail considerations will be given to its urban design to form a gateway at the entrance to the proposed Area 10b.

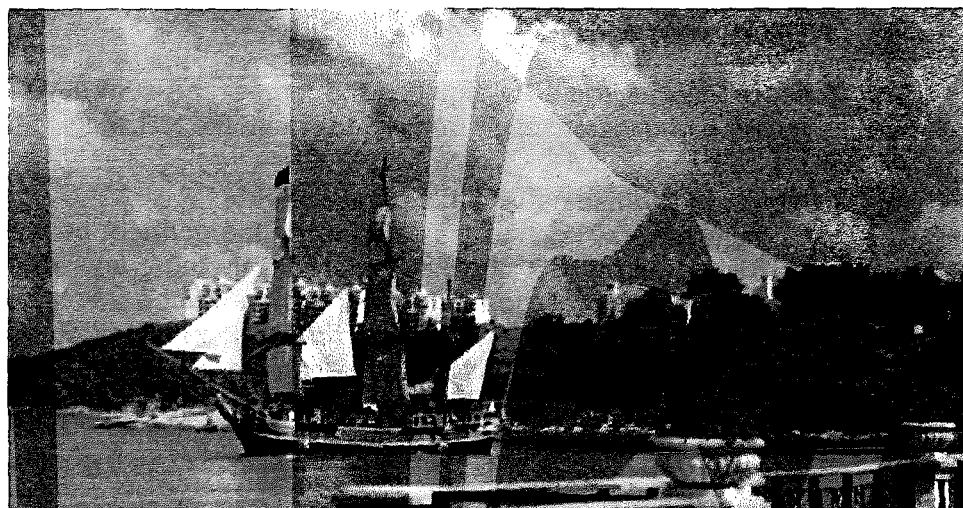


Image: The Bounty

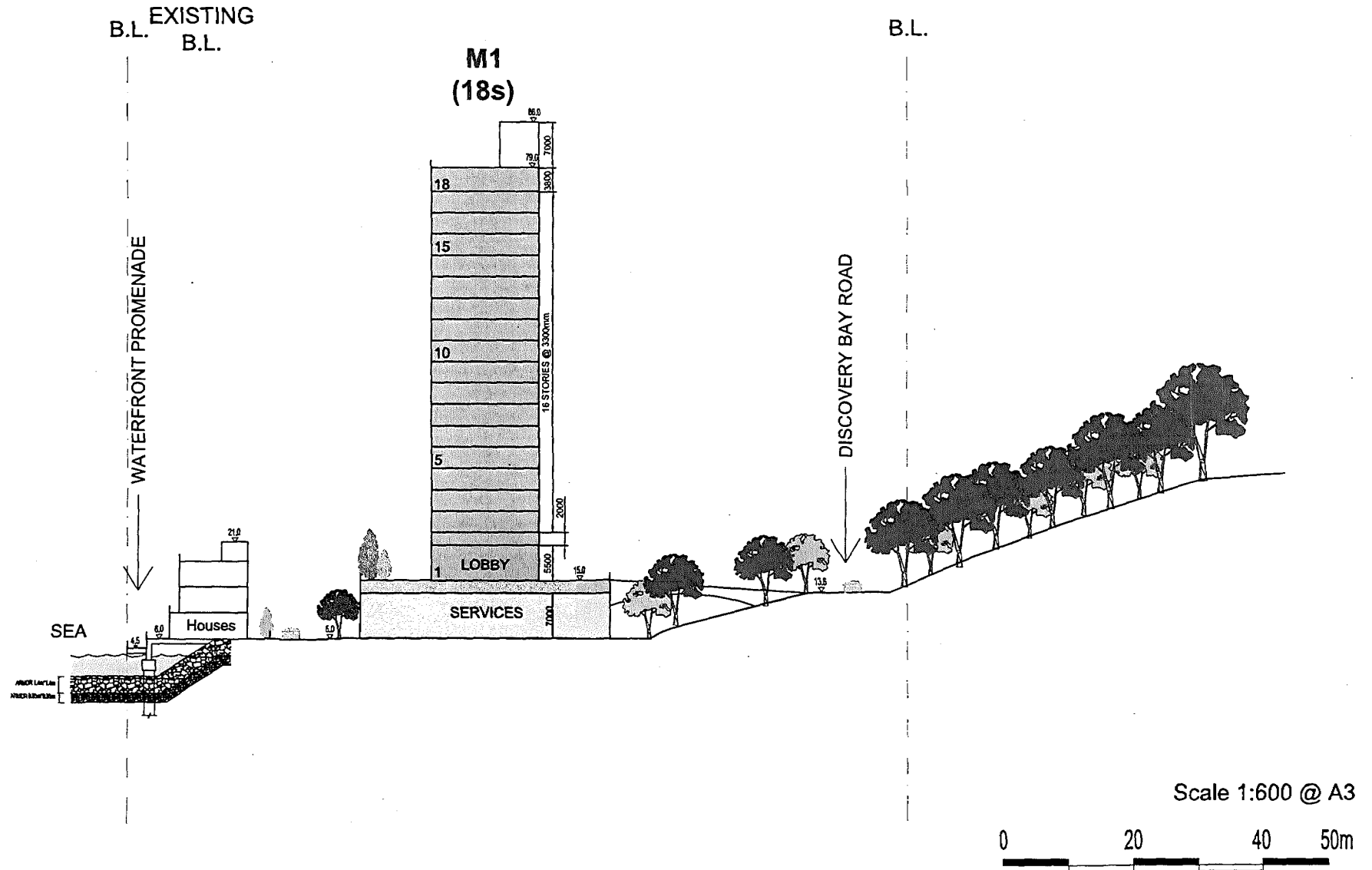


Figure 7a. Section plan showing the stepped design of Area 10b, from the foreshore promenade, the waterfront development, to the existing development uphill.

SECTION A-A

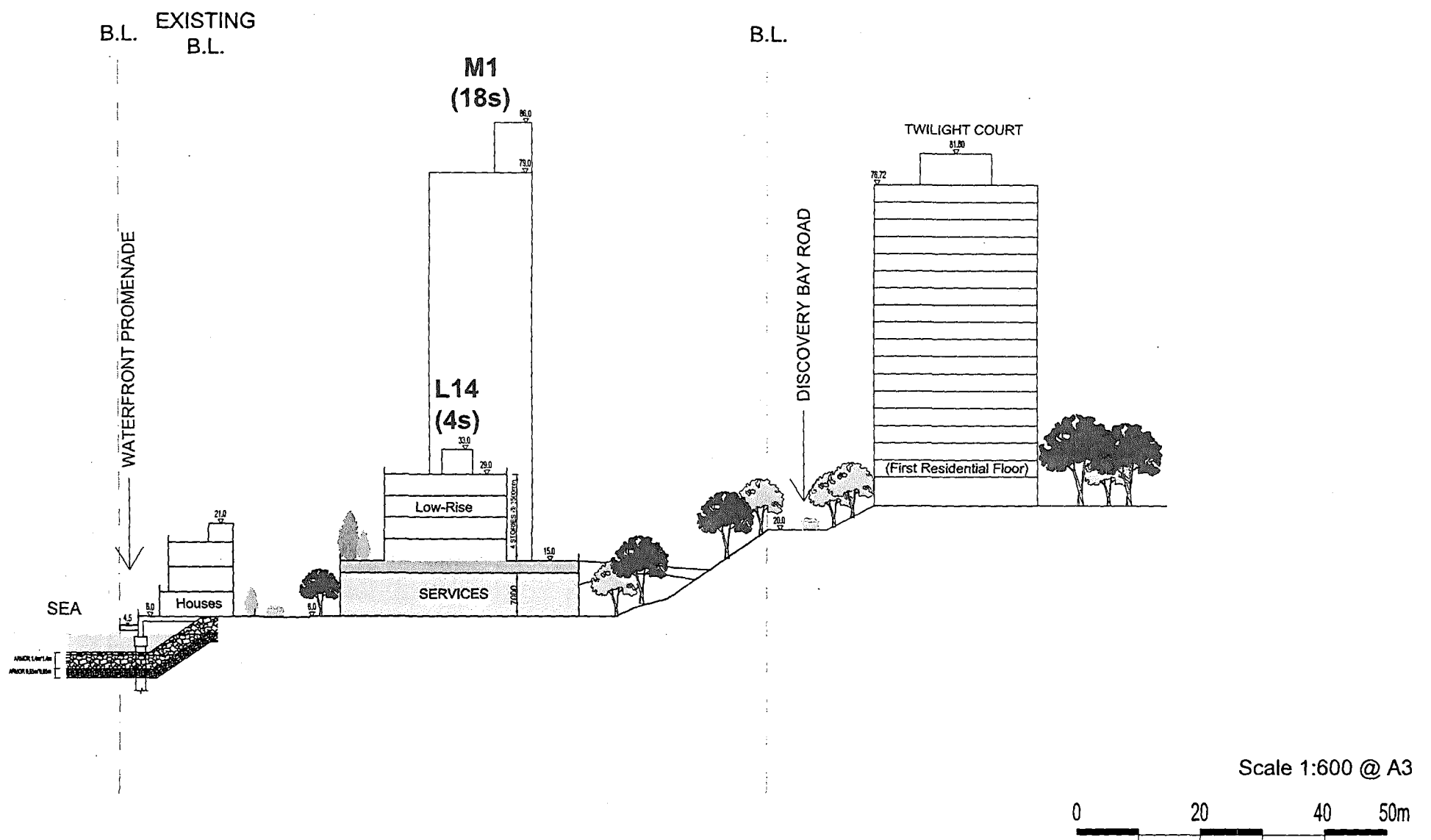


Figure 7b. Section plan showing the stepped design of Area 10b, from the foreshore promenade, the waterfront development, to the existing development uphill.

SECTION B-B

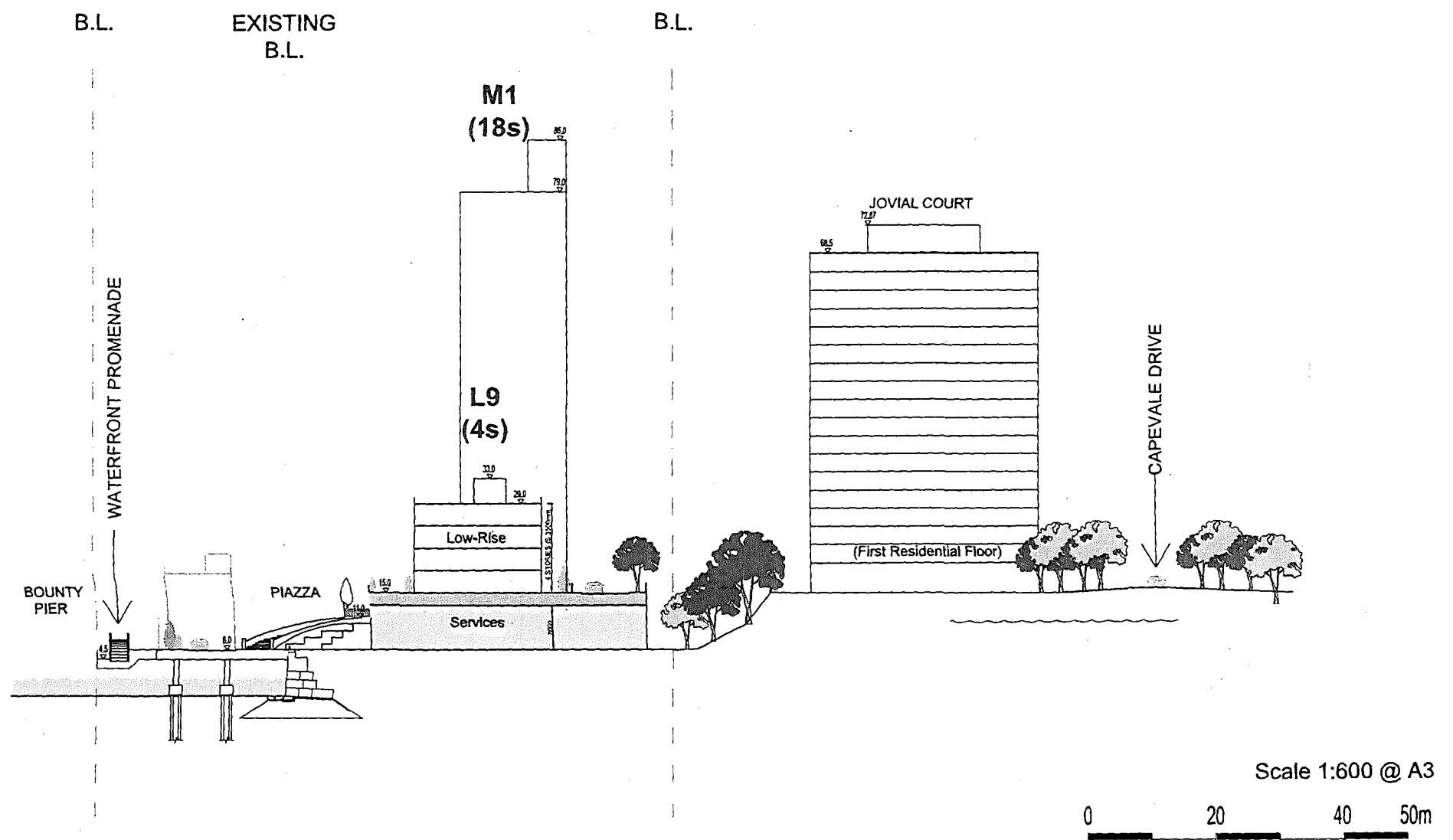


Figure 7c. Section plan showing the stepped design of Area 10b, from the foreshore promenade, the waterfront development, to the existing development uphill.

SECTION C-C

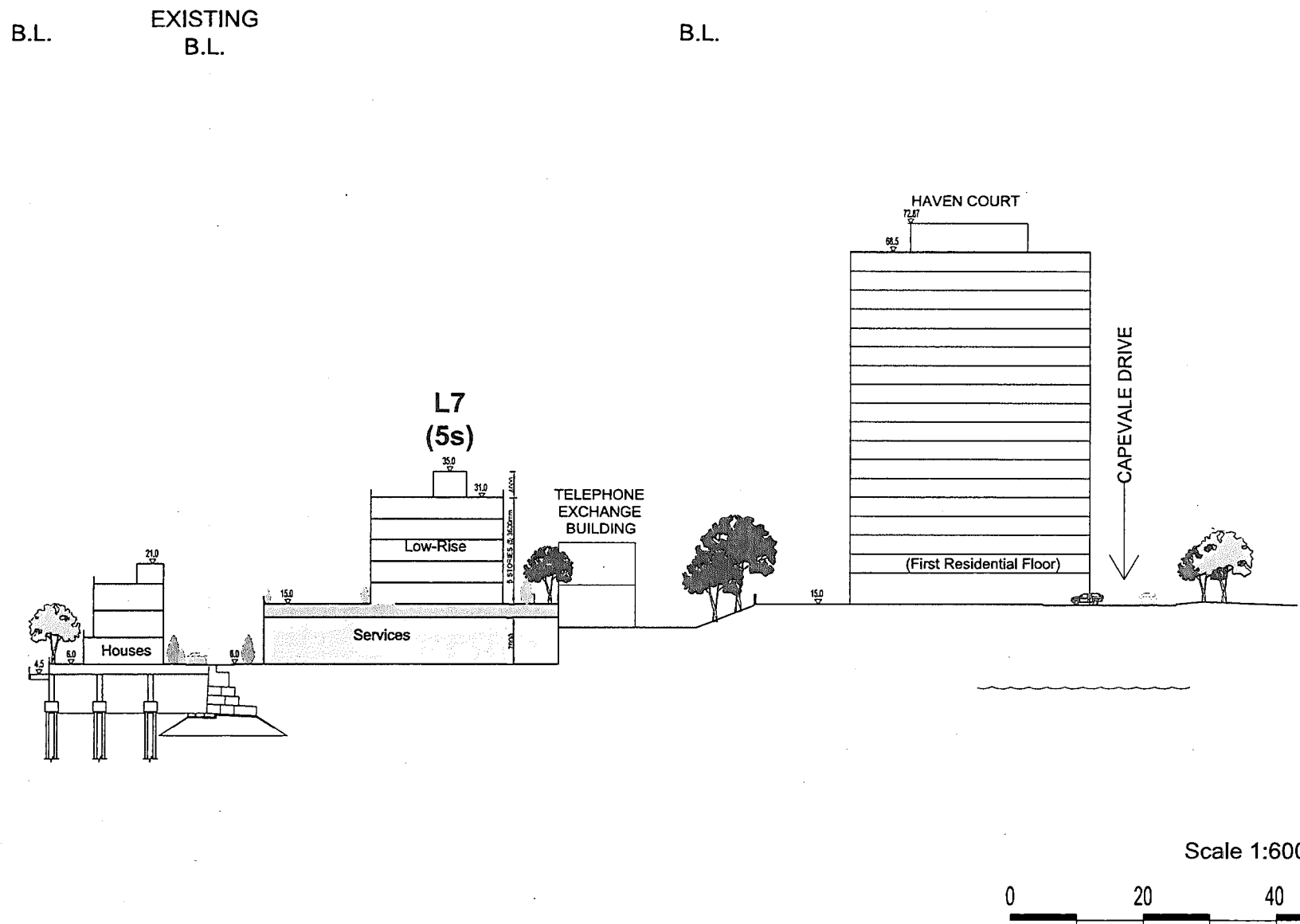


Figure 7d. Section plan showing the stepped design of Area 10b, from the foreshore promenade, the waterfront development, to the existing development uphill.

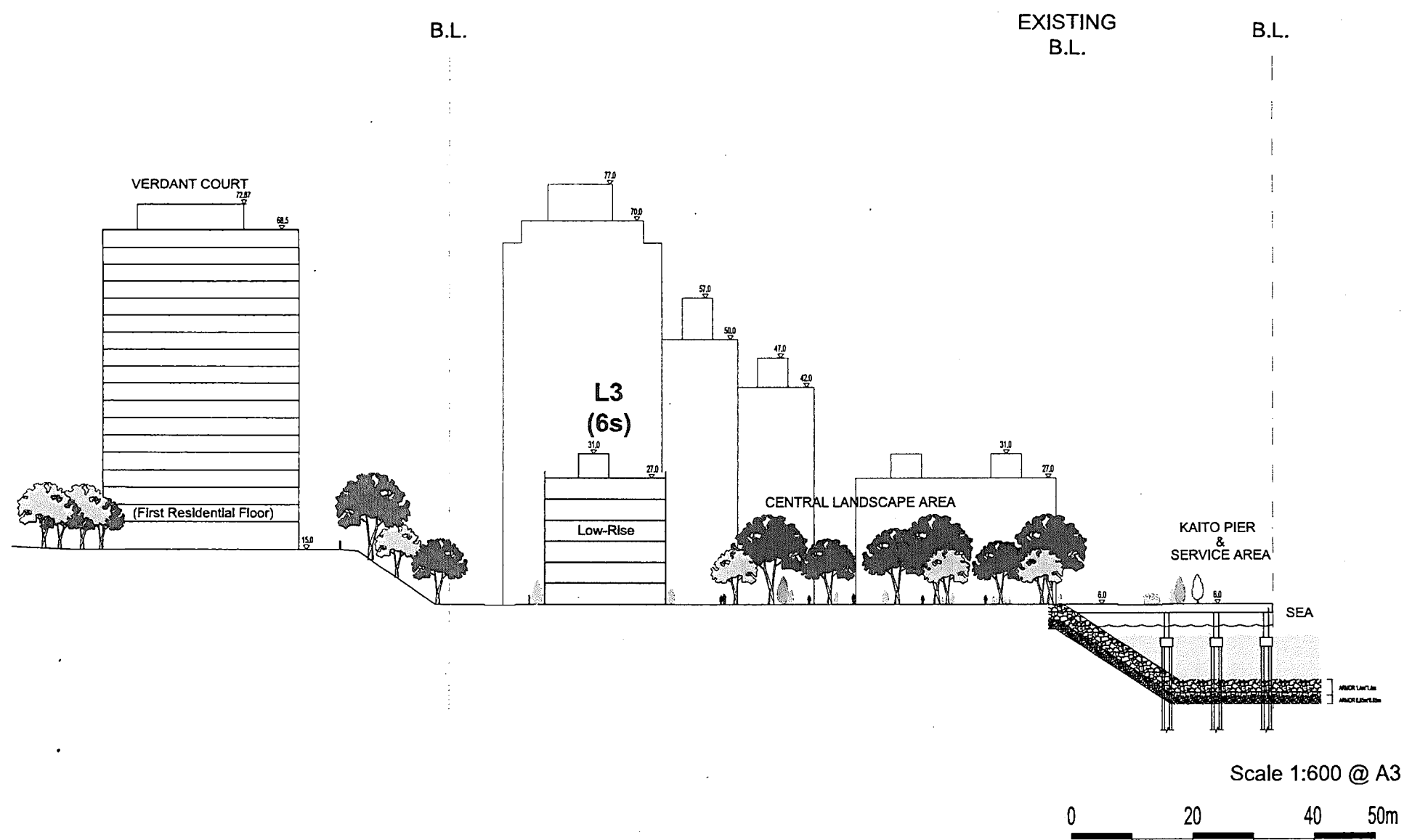


Figure 7e. Section plan showing the stepped design of Area 10b, from the foreshore promenade, the waterfront development, to the existing development uphill.

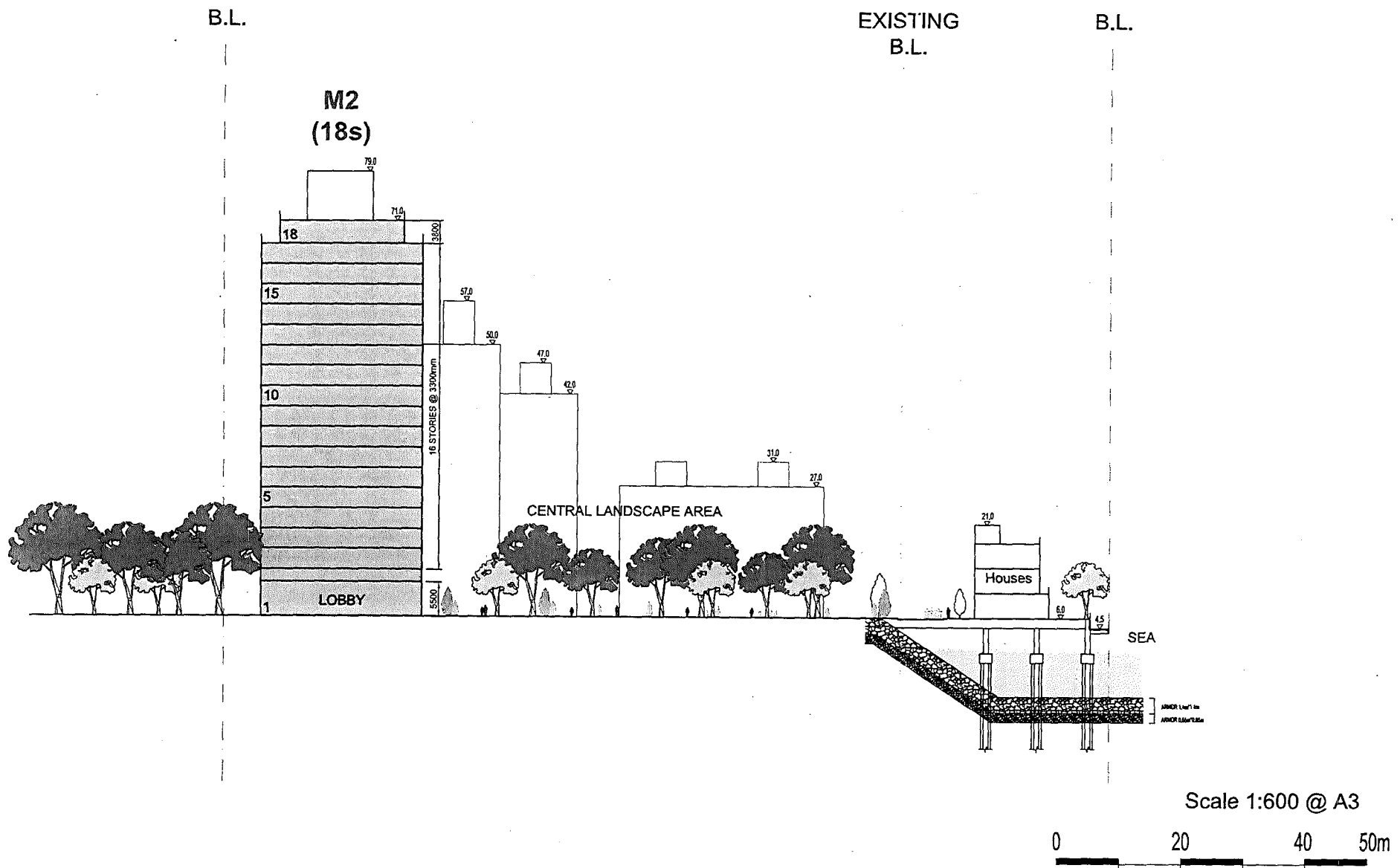


Figure 7f. Section plan showing the stepped design of Area 10b, from the foreshore promenade, the waterfront development, to the existing development uphill.

SECTION F-F

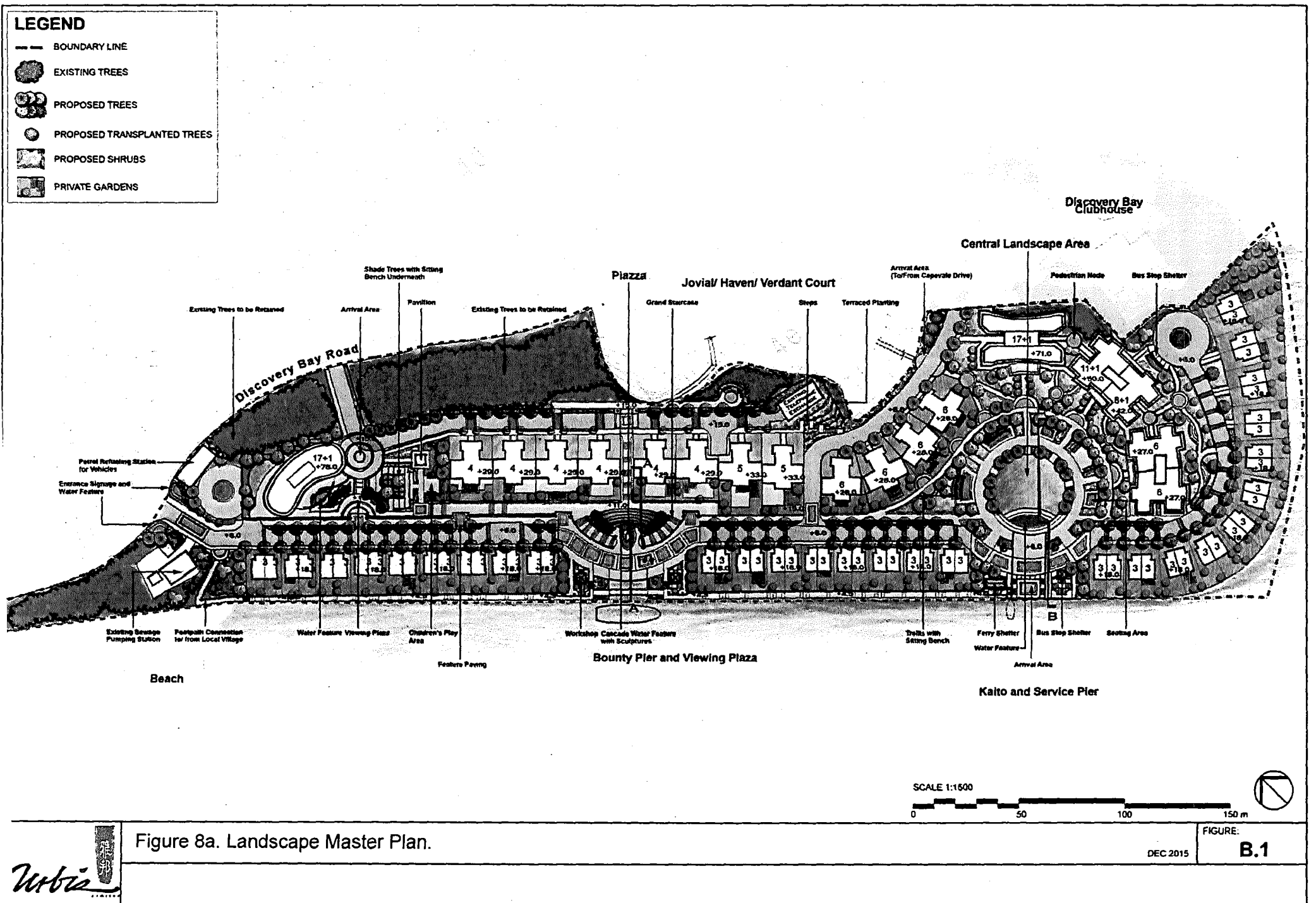


Figure 8a. Landscape Master Plan.

DEC 2015

FIGURE: B.1

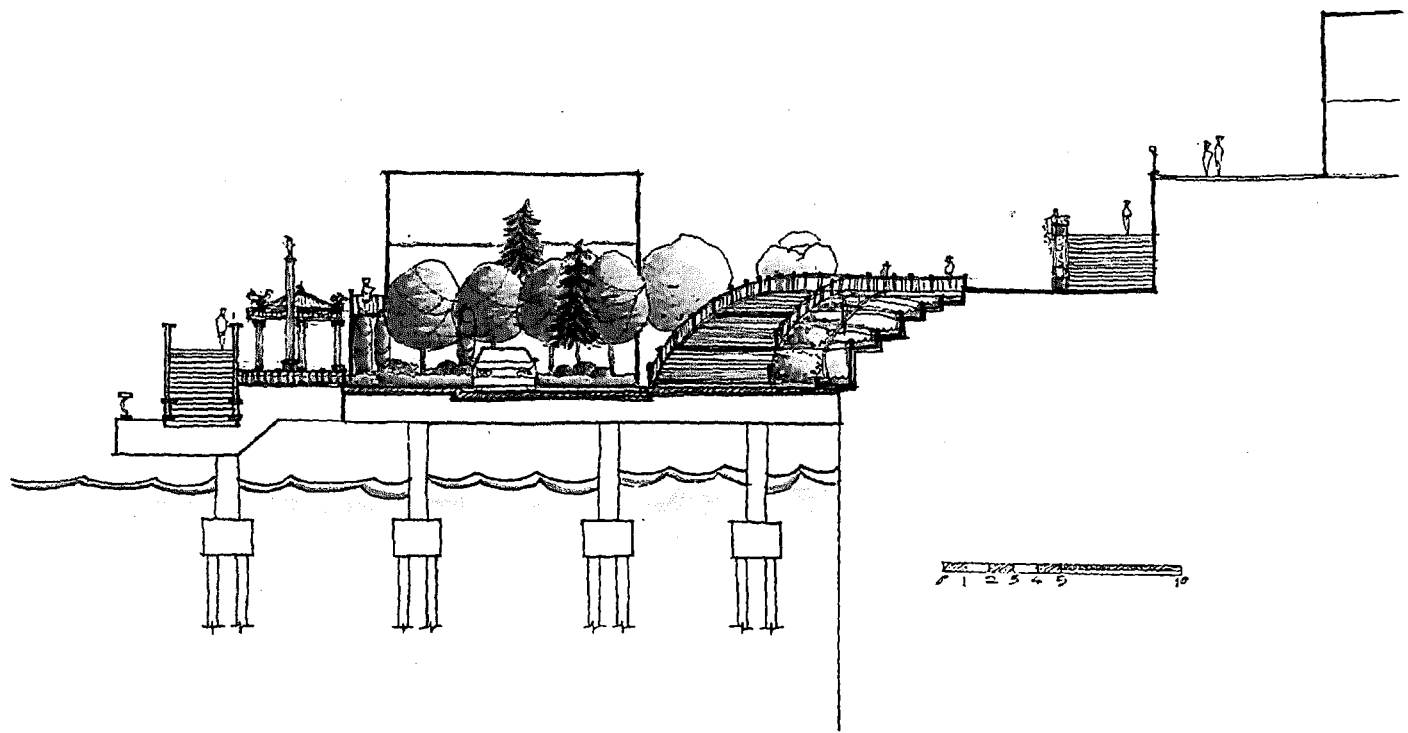


Figure 8b. Landscape Plan Section A-A.

FIGURE:
DEC 2015 **B.2**

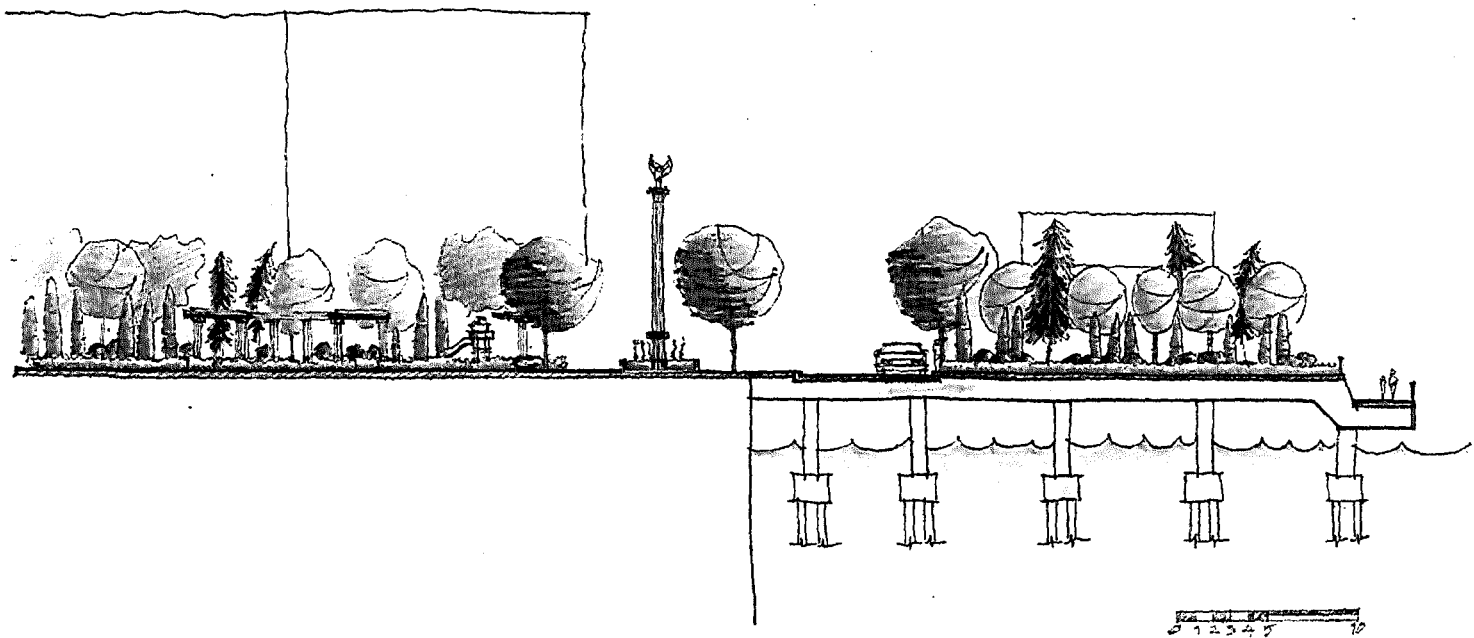


Figure 8c. Landscape Plan Section B-B.

FIGURE:
DEC 2015 **B.3**

5.13 A comparison of the currently permissible land uses and the proposal under the Concept Plan at Area 10b is described in **Table 1**.

Table 1 Comparison of the currently permissible and the proposed land uses at Area 10b.

Permissible development under the current OZP	Proposal under the Concept Plan
Site area: 50,950 m ²	Site area: 62,875 m ² (increased by reclamation)
Staff quarters: <ul style="list-style-type: none"> • Max 5 storeys or 15 metres in height (including structures) • Max 1,300m² gross floor area 	Residences: <ul style="list-style-type: none"> • 3-4 storeys low rise • 4-5 storeys and a 18 storey high building above a podium • 6, 9- 12 and 18 storeys high buildings • Domestic GFA: max 67,500m² • Domestic Plot ratio: 1.07
Supporting service: <ul style="list-style-type: none"> • service area (boat servicing yard, overnight bus parking area, HKR's warehouse, a bus repair station, and golf cart repair workshops) • petrol filling station • liquefied petroleum gas storage • refuse collection station • telephone exchange • decommissioned sewerage treatment plant, and a sewage pump 	Supporting service: <ul style="list-style-type: none"> • service area (overnight bus parking area, HKR's warehouse, bus and golf cart repair workshops) • petrol filling station • refuse collection station • telephone exchange • sewerage treatment plant, if necessary • sewage pump • Non domestic GFA: max 22,000m² • Non domestic Plot ratio: 0.35
Pier	Two piers

6 Engineering Studies

6.1 The Concept Plan is supported by engineering studies quantifying the infrastructure requirement. The Studies on Drainage, Sewerage and Water Supply Systems (**Appendix A**), and Traffic Impact Assessment (**Appendix B**) find that, subject to improvements works where required, the infrastructure is capable of accommodating the proposed population increase. The studies have been previously submitted to Government Departments for preliminary review, and have taken account of their comments.

Studies on Drainage, Sewerage and Water Supply Systems

6.2 Studies on Drainage, Sewerage and Water Supply Systems based on 4,003 population increase (also taking into account of the Concept Plan at Area 6f) conclude the following:

Stormwater

- i. The surface runoff at Area 10b will continue to be collected and discharged to the sea, there will be two new outfall pipes.

Sewage

- ii. Siu Ho Wan Sewerage Treatment Works (SHWSTW) requires upgrade works to cater for the existing and concurrent developments, irrespective of the proposed developments. The upgrade works could cater for the sewerage increase as a result of the proposal, which accounts around 0.8% of the treatment flow. There will be a sewerage pumping station and rising main serving Area 10b.
- iii. Should the government not upgrade SHWSTW in time for this proposal, an alternative on-site sewage treatment plant could be provided.

Water Supply

- iv. Siu Ho Wan Water Treatment Works (SHWWTW) and its planned expansion works will be able to cater for the increased water demand as a result of the proposal, accounting for only around 0.57% of the total upgraded capacity of SHWWTW. Siu Ho Wan Fresh Water Pumping Station (SHWFWPS) requires upgrade works to cater for the existing and concurrent developments, irrespective of the proposed developments.
- v. Should the government not upgrade SHWWTW and SHWFWPS in time for this proposal, alternative water supply include the existing Discovery Bay Reservoir, which has adequate storage for the increased fresh and flushing water demand, together with a new water treatment works, and new fresh water and flushing water mains.
- vi. Either source of water supply would require additional fresh water service reservoir storage capacity. The existing fresh water service reservoir storage volume is marginally below the required storage to cater for the fresh water demand of the proposed Area 10b additional population and the current OZP planned population. As such, the storage of the service reservoirs are to be expanded. Relevant approval procedures for a suitable site for expansion will be undertaken subsequent to the approval of this planning application and prior to the full occupation of the development.

Traffic Impact Assessment

- 6.3 The Traffic Impact Assessment forecasts the following as a result of the proposal:

- i. Minimal impact on the existing pedestrian and cycle track network.
- ii. There will be increase in internal bus trip, external bus trip and external taxi trip as a result of the proposal. Taking into account also the Concept Plan at Area 10b, The critical road links and key junctions in Discovery Bay, Tung Chung and Sunny Bay areas would operate with ample spare capacity during both AM and PM peak hour in year 2026 and 2031 (3 and 8 years subsequent to targeted occupation respectively).
- iii. The existing ferry services between Discovery Bay and Central would continue to operate with sufficient capacity.
- iv. The proposal is considered acceptable from traffic point of view.

7 Environmental Study

7.1 Area 10b is already developed, accommodating various servicing facilities. The land area has minimal natural environmental conservation value.

7.2 Land contamination investigations addressing the suitability of the site for the proposed use will be undertaken, subsequent to an approval of this planning application, prior to implementation.

7.3 The Environmental Study (**Appendix C**) concludes the following:

- i. The proposed development at the part of the existing land area and the proposed extension in form of decking and piling, subject to mitigation measures, is not anticipated to have adverse water quality impact during the construction (including site runoff and sewage from the workforce) or the operation (in terms of hydrology and water quality).
- ii. Large part of the development layout is set back from the local roads and complies with the Hong Kong Planning Standards and Guidelines. Given the forecasted insignificant traffic increase, it is unlikely to result in adverse vehicular emissions, air quality impact or road traffic noise impacts.
- iii. For the development along the southern side of Marina Avenue, quantitative study will be undertaken to determine the cumulative impact as part of the Environmental Impact Assessment to ensure compliance with the Air Quality Objectives stipulated in the Air Pollution Control Ordinance.
- iv. The marine vessels emission in the vicinity of Discovery Bay and the firework displays at the theme park are compliant with the Air Quality Objectives under Air Pollution Control Ordinance and non- Air Quality Objectives assessment criteria. They will not have adverse cumulative air quality impacts on the future residents at Area 10b.
- v. The marine noise and the firework displays do not cause adverse noise impact. Subject to careful design of the air sensitive receivers around the noise source and implementation of mitigation measures, the fixed noise, is not anticipated to have adverse impacts on the future residents at Area 10b.

7.4 Under the Environmental Impact Assessment Ordinance:

- i. Reclamation authorised under the Foreshore and Sea-bed (Reclamations) Ordinance before the Environmental Impact Assessment Ordinance comes into operation is exempt from the Ordinance so far as the construction and operation of the project is concerned. This is the case for the proposed extension of the land area at Area 10b, and is exempted.
- ii. The proposed bus depot in an enclosed podium underneath residences is designated development. Application in accordance with the Ordinance will be made, in due course.
- iii. Depending on the discussion with Drainage Services Department, should an on-site sewage treatment works be required, it would constitute a designated development. Application in accordance with the Ordinance will be made, where required.

- iv. Subject to detail design, dredging work outside the approved reclamation area for navigation channel may be required. It would constitute a designated development. Application in accordance with the Ordinance will be made, where required.

8 Trees and Landscaping

- 8.1 The Concept Plan will affect 11 scattered trees and tree groups. A Tree Preservation Scheme and Compensatory Planting Proposal is provided in **Appendix D**, as part of the Landscape Design Proposal. Considerations are given to the following:
 - i. The affected trees and tree groups are on reclaimed land.
 - ii. Removal of the scattered trees at the centre of the site has given with considerations in balance with the carefully designed building footprint, in relation to the headland waterfront context and the amenity of the surrounding development.
 - iii. The proposal does not extend excessively into the surrounding slope greenery. The alignment of the access road seeks to minimise its disturbance to the slope greenery. The balance of the greenery backdrop will continue to provide a pleasant landscape setting.
- 8.2 The landscape proposal as shown in **Figure 8** includes greenery at the open spaces throughout the site. It includes an upgraded gateway at the entrances to Area 10b, a tree lined waterfront promenade and Marina Avenue, and naturally shaded plazas around the berthings to form respective focal points of the locality. These are illustrated in the perspectives in **Figure 9**.
- 8.3 There will be open space, more than 1 square metre per person required under the Hong Kong Planning Standards and Guidelines.
- 8.4 The proposal is capable of meeting the Sustainable Building Design Guidelines, providing suitable building setback and building separation, and thereby the air ventilation for the amenity of the street environment, and greenery.

9 Visual Amenity

- 9.1 The Visual Impact Assessment (**Appendix E**) identifies visually sensitive receivers in relation to the Concept Plan at Area 10b, and concludes that visual impact as a result of the proposal will be partly enhanced/ partly adverse. There will be the replacement of the existing scene of low visual quality. The increase in development density and visual obstruction is highly compatible with the residential character and scale of the existing buildings in Peninsula Village.
- 9.2 Considerations are also given to the immediately adjoining private development's view sheds in this case, given the development typology in natural settings in Discovery Bay. Reference is made to the floor plans of Parkvale Village units in **Appendix F**:
 - i. The proposed tallest building at the headland (18 storeys) generally fronts the eastern elevation of the existing buildings that is solid walls or

some bedroom windows. Views obtained from bedrooms are generally given lesser weight, when compared with living rooms.

- ii. The remaining 6 to 12 storeys buildings at the headland are aligned in extension to the existing buildings, such that they are at an oblique angle outside the natural sightlines from the existing living areas. They step down in height towards the natural sightlines to reduce the interference with the existing views.
- iii. The 4-5 storeys buildings above the podium and the adjoining 6 storeys buildings will exceed above the lower levels of the existing buildings. However, the views of these existing units at lower levels currently look out to trees which will be mostly retained, the 5-storey staff quarters or the telephone exchange building. Further, the proposed buildings are set back from the affected windows by approximately 40 metres. Building height variations and building separations have been incorporated to allow view corridors, and future architectural modulations and façade finishes will be included to provide visual interest. The higher levels of the existing buildings will continue to have uninterrupted views to the south.

It is considered a reasonable sharing of views.



Figure 9a. Perspective illustrating the tree lined Marina Avenue.

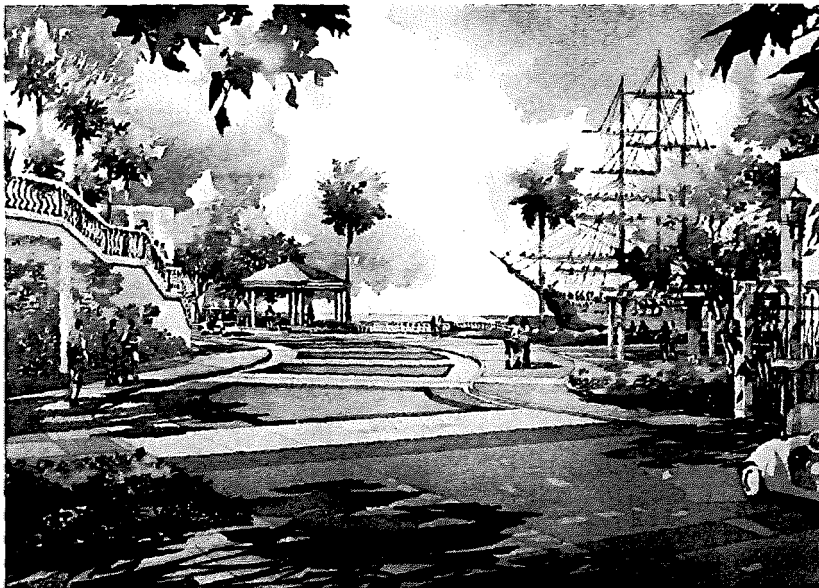


Figure 9b. Perspective illustrating the vista at Marina Avenue around the plaza.



Figure 9c. Perspective illustrating Marina Avenue around the open space with vast sense of openness.

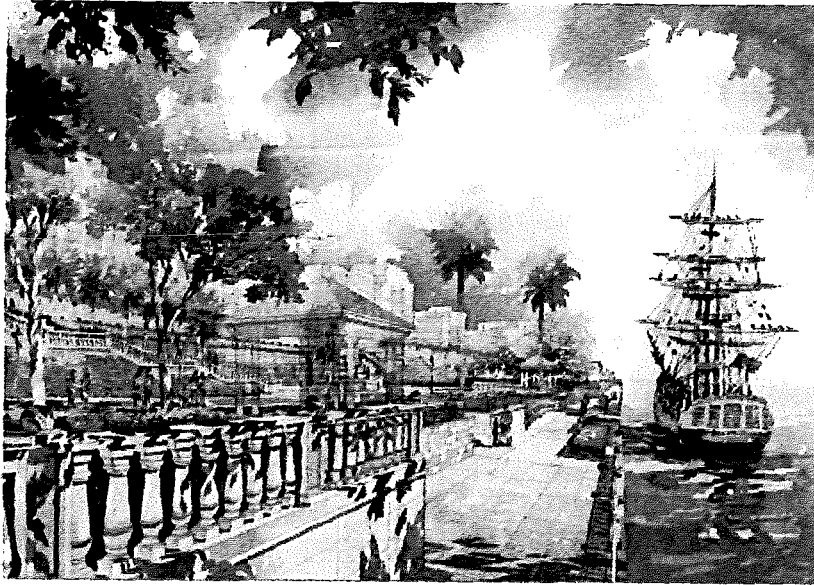


Figure 9d. Perspective illustrating the promenade for appreciation of the water body.

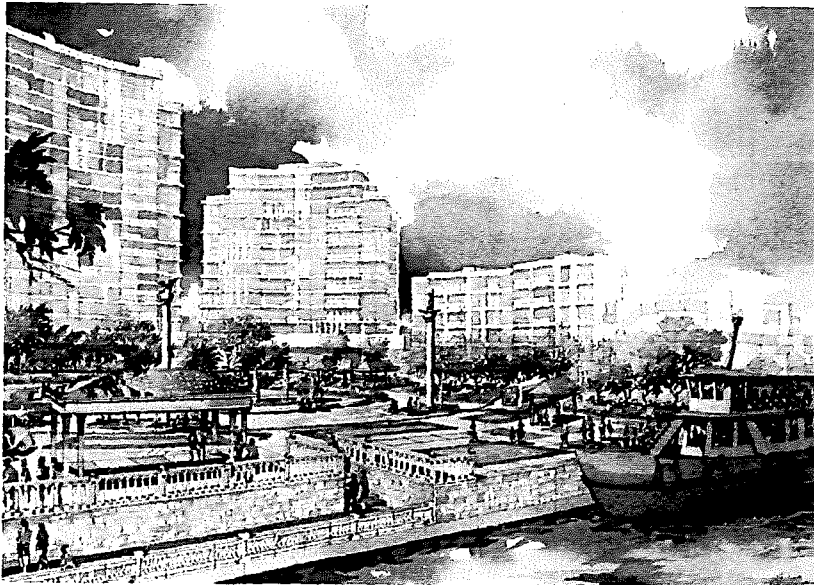


Figure 9e. Perspective illustrating landscape at Area 10b water front, including the pier, the adjoining plaza and open space, with the residential development on the backdrop.

10 Planning Assessment and Justifications

Consistent with Chief Executive's Policy Address and the Broader Strategic Planning for Lantau

- 10.1 The preparation of a site analysis and Concept Plan, followed by this planning application, together with the supporting technical studies are private sector initiatives for a sensitive long term increase in the residential capacity at Discovery Bay. It helps achieve the objective of the Chief Executive's Policy Address in increasing and expediting land supply to optimise residential development and to contribute to the housing supply.
- 10.2 The long term planning for Discovery Bay is consistent with the envisaged development at Siu Ho Wan, Sunny Bay and Tung Chung New Town Extension. It is also consistent with the considerations by the Lantau Development Advisory Committee for Lantau, where Discovery Bay is located and conveniently connected by a tunnel. It gives certainty to the infrastructure requirement and provision in the region, and expedites delivery of land and development.

Consistent with the General Planning Intention of the OZP

- 10.3 The Concept Plan has been prepared within the various components of the general planning intention for Discovery Bay, as stated in paragraph 7 of the Explanatory Statement of the OZP. In particular, consideration has been given to ensuring the proposals are of a high quality, with careful consideration given to compatibility with the natural setting and the existing forms of residential development. This is explained in the following paragraphs which include quotations from paragraph 7:
- 10.4 *"7.1 In line with the strategic planning context provided by the South West New Territories Development Strategy Review, the general planning intention of the Area is for conservation of natural environment and to provide for low density developments compatible with the surrounding natural setting. Existing natural features including the undisturbed backdrop of woodlands and slopes and the natural coastlines with inlets, bays, beaches at Tai Pak, Yi Pak, Sam Pak and Sze Pak should be conserved. Areas of high conservation value and natural habits including woodland, stream valleys, stream courses and stream/tidal lagoons should also be protected."*
- i. Reference is made to the Chief Executive's Policy Address setting a regional strategic planning context for housing supply and future Lantau Island development, as discussed in paragraphs 10.1 and 10.2 above.
 - ii. The Concept Plan has included site analysis and carefully identified Area 10b, which is already developed for various uses, as suitable for redevelopment. It has avoided areas with natural features, high conservation value and natural habitats.
- 10.5 *"7.2 Having regard to the character of the area, environmental considerations and the existing and planned infrastructure provision, in particular the limited capacity of external links, the plan provides for a planned total population of about 25,000 persons for the Discovery Bay development."*

Any further increase in population would have to be considered in the context of the general planning intention for the Area and subject to detailed feasibility investigations on infrastructure and environmental capacities."

- i. The accompanying technical studies of this application have quantified the infrastructure requirement and the potential environmental impact, and demonstrated the proposal to be feasible for the planned additional population.

10.6 *"7.2 In particular, the unique sub-urban low-density and car-free character of the development should be maintained in keeping with the surrounding natural setting. In line with the original concept as a holiday resort, a variety of recreation and leisure facilities are allowed for."*

"7.3 The general urban design concept is to maintain a car-free and low-density environment and to concentrate commercial and major community and open space facilities at more accessible locations."

- i. The Concept Plan will maintain the existing car-free character, given that the number of vehicles at Discovery Bay is restricted.
- ii. The marina is considered an element contributing to the concept as a holiday resort. The proposal at Area 10b seeks to maintain the existing marina, and will not affect its function or iconic significance.
- iii. Area 10b will provide community and landscape facilities along the waterfront, including a waterfront promenade
- iv. The future residents at Area 10b will be adequately served by recreation and leisure facilities.

10.7 *"7.2 Future development at Discovery Bay should also be in keeping with the theme park development and its adjoining uses at Penny's Bay to ensure compatibility in land use, height, visual and environmental terms."*

- i. With regards to the theme park development and its adjoining uses at Penny's Bay:
 - a. The accompanying environmental studies of this application demonstrate that the Concept Plan at Area 10b to be suitable in land use and environmental terms.
 - b. The proposal is compliant with the building height provision contained in the Deeds of Restrictive Covenant (between the HKSAR Government and Hong Kong International Theme Park Limited), and is appropriate in height and visual terms.

10.8 *"7.2 The existing rural settlements at Nim Shue Wan and Cheung Sha Lan would be retained with the planning intention of upgrading or redeveloping the existing temporary domestic structures with the provision of basic infrastructure."*

- i. The Concept Plan will not affect the existing rural settlements at Nim Shue Wan and Cheung Sha Lan.

10.9 *"7.3 A stepped height approach with low-rise on the headland and coastal lowland and high-rise further inland is adopted. This complements the visual presence of the mountain backdrop and maintains the prominent sea view."*

Variation in height is also adopted within individual neighbourhood to add variety in character and housing choice. The interplay of the natural and man-made landscape elements such as beaches, waterfront promenades, parks and golf courses helps integrate developments with the natural surroundings.

- i. The 4 to 18 storeys high buildings at the headland step up from the coast. The 18 storeys buildings will complement the existing built skyline, and will generally maintain the existing sightline to the mountain backdrop.
- ii. The low-rises along waterfront step up to the taller buildings to the rear. They will continue to provide for sea view to the upper floors of Peninsula Village.
- iii. There are variations in height amongst the buildings above and around the podium.
- iv. There will be a waterfront promenade along the headland.

10.10 In summary, the Concept Plan is considered to be consistent with the general planning intention for Discovery Bay stated in paragraph 7 of the Explanatory Statement of the OZP.

Adequate Infrastructure Provision

10.11 The accompanying engineering studies of this application quantify the infrastructure requirement of the proposed development. They consider that, where improvement works are necessary they would be feasible to support the planned population.

10.12 The Concept Plan is a rationalisation of the existing service area at Area 10b. There will continue to be adequate servicing facilities for Discovery Bay, such as refuse collection station, Kai To Pier and petrol filling station.

No Adverse Environmental Impact

10.13 Area 10b is identified as part of the Concept Plan as a result of a site analysis, having taken into consideration of the topography and landscape around Discovery Bay, and recognised the value of the natural environment. Being at an already disturbed site with minimal natural conservation value, its development will not have disturbances to the natural environment.

10.14 The accompanying engineering studies of this application demonstrate that the proposal will not have adverse environmental impacts during construction and operation. They also quantify the unlikely potential noise or air impact on the future residents. This includes the service facilities located within a podium that is considered major improvement to the existing environmental quality and compatible with the future proposed residential use in the area.

10.15 Should the planning of the Concept Plan be deemed appropriate and this application be approved, future land contamination investigations, and environmental impact assessment for the designated development will be carried out in accordance to the relevant regulations prior to implementation. This will further ensure the environmental suitability of the proposal.

Logical Location for Increased Development Intensity

- 10.16 Area 10b is currently served by public transport with accessible commercial and leisure activities in close proximity. The existing minimal accommodation provision and dominant service facilities in the area are a mis-use of the prime location, significantly underutilising the readily available land resources and the locational advantage of the locality for residential development.
- 10.17 The proposed land use mix and development intensities are considered optimal use of the land resources at Area 10b, for the following reasons.
- i. The proposed southern boundary extension within the lease boundary and the previously approved reclamation extent, is an implementation of a long existing approval.
 - ii. The redevelopment of Area 10b will cater for the existing servicing use, an increased housing supply and significant improvement of the amenity of the Discovery Bay residents at the readily available land resources.
 - iii. The 1,125 units and 2,813 population increase as a result of the proposal is considered of modest development intensities, having been planned in balance with the waterfront setting and the surrounding amenity. This makes optimal use of the available land resources, given the need to be compatible with the existing form and scale of development in the area.

Compatible Visual Form

- 10.18 The location, disposition and height of the proposed development has given careful consideration to the following design objectives:
- i. The distribution of the building heights is considered to generally follow the main design principle, by increasing in accordance with the distance from the waterfront and the topography of the site.
 - ii. The variation of the building heights above and around the podium is considered to meet the planning intention to provide visual interest.
 - iii. The buildings generally follow and relate to the existing skyline around Peninsula Village.
 - iv. There will be building separation and view corridor for the surrounding sensitive receivers and existing residents.
 - v. The curved road around the plaza helps to give interest and enhance experience along Marina Avenue. It also helps break the length of the podium structure.
 - vi. Detail considerations will be given to building setbacks, architectural modulations, façade finishes and screen planting to provide a sense of openness and visual relief at street levels.

Significantly Improved Amenity

- 10.19 The redevelopment of Area 10b will remove the existing unsightly mix of uses and activities, and significantly improve the general environment of the area. The proposed service facilities located within a podium will provide opportunity for improving the acoustic and visual amenity of the area. It will provide a high quality experience to the existing and future residents and pedestrians in and around the locality.

- 10.20 The new foreshore promenade and plazas will provide direct waterfront access. The existing north- south running pedestrian accesses will be reprovided and enhanced. There will also be a large park at the headland. This will serve the pedestrian experience in the area and the benefits of the Discovery Bay residents.
- 10.21 The proposed promenade and large open spaces are accessible to existing nearby residential development occupants, providing planning gain to this part of Discovery Bay where there is a general lack of amenities.

Significantly Improved Streetscape

- 10.22 The landscape proposal seeks to maintain the majority of the existing slope greenery and transplant any affected established mature trees in the area. There will be a landscape setting integral to the waterfront setting and lush greenery open spaces.
- 10.23 Detail consideration will be given to the architectural features and plantings at the open space in the area. The objectives are to form a gateway at the entrance to the area, tree lined foreshore promenade and Marina Avenue, natural shading and greenery at the focal points around the plazas and park. The existing service buildings remain in place will be suitably screened. The overall significantly improved landscaping will benefit the people using the area in future.

11. Request to Amend the OZP

- 11.1 This application requests to amend the OZP to enable the development in the Concept Plan for Area 10b to be implemented. It proposes the following, and each is discussed below:
- i. Expanded OZP boundary.
 - ii. New and modified land use zonings on the OZP.
 - iii. New and modified Notes to the OZP, including the Planning Intentions and Remarks.

OZP boundary

- 11.2 The proposed extension of the southern boundary for Area 10b is indicated in **Figure 10**. It does not exceed the land lease boundary, or the gazetted and approved reclamation extent.

Land Use Zonings on the OZP

- 11.3 The proposed zonings reflecting the proposed land uses and development intensity at the respective areas of Area 10b is indicated also in **Figure 10**. A summary of the new zonings is described in **Table 2**. The proposal follows the general form existing on the OZP, including use of sub- areas, and building height measured the top most structure.

Table 2. Summary of the proposed zonings at Area 10b.

Proposed zoning	Sub area	Number of storeys (max)	Building height (max, including structure)	GFA (max)
Residential (Group C)13	Sub area (A)	6	31 mPD	43,300m ²
	Sub area (B)	12	57 mPD	
	Sub area (C)	18	77 mPD	
	Sub area (D)	4	21 mPD	
Other Specified Uses (Residential Above Service Area)	Sub area (A)	18 storeys Residential above Service Area	86 mPD	Domestic 24,200m ²
	Sub area (B)	5 storeys Residential above Service Area	35 mPD	Non domestic 22,000 m ²
G/IC (Sewage Treatment Works and/ or Sewage Pumping Station)	-	-	-	-
Other Specified Uses (Promenade)	-	1	10mPD	200 m ²

- 11.4 The proposed building height refers to the maximum of the building height variations for the respective sub areas. The building height and variations will be considered in the detail design stage. In this regard, the maximum GFA is based on the Master Layout Plan and Building Mass Diagram so that its cap will allow suitable distribution of the building mass, without exceeding the overall building mass as shown.
- 11.5 It is proposed to relabel the existing "G/IC (Sewage Treatment Works)" as "G/IC (Sewage Treatment Works and/ or Sewage Pumping Station)". The existing Sewage Treatment Works in the area has been decommissioned, and there is a Sewage Pumping Station. However, the proposed Concept Plan may require a Treatment Works in addition to the Sewage Pumping Station, to cater for the population increase.

Notes to the OZP

- 11.6 The current Notes for "Residential (Group C)" and "G/IC" remain applicable.
- 11.7 The proposed Notes for the two new zones are included in **Table 3** and **Table 4** respectively.

Table 3. The proposed Notes for Other Specified Uses (Residential Above Service Area).

Other Specified Uses (Residential Above Service Area).

Column 1 Uses which are always permitted	Column 2 Uses that may be permitted on application to the Town Planning Board
<ul style="list-style-type: none">• Amenity Planting• Barbeque Spot• Bus Depot• Caretaker's Office or Quarters• Flat• Footpath• Government Refuse Collection Point• House• Park and Garden• Pedestrian Area• Petrol Filling Station• Picnic Area• Public Convenience• Public Utility Installation• Public Utility Pipeline• Recyclable Collection Centre• Road• Sewage Treatment Plant• Telephone Exchange• Utility Installation for Private Project• Vehicle and Golf Cart Depot• Vehicle and Golf Cart Repair Workshop• Warehouse (excluding Dangerous Goods Godown)	<ul style="list-style-type: none">• Eating Place• Educational Institution• Government Use• Institutional Use• Place of Entertainment• Place of Recreation, Sports or Culture• Private Club• Public Clinic• Public Utility Installation• Religious Institution• Residential Institution• School• Shop and Services (excluding Motor Vehicle Showroom)• Social Welfare Facility

Planning Intention

This zone is intended for residential developments, above a podium containing service area in support of the Discovery Bay development.

Table 4. The proposed Notes for Other Specified Uses (Promenade)

Other Specified Uses (Promenade)

Column 1 Uses which are always permitted	Column 2 Uses that may be permitted on application to the Town Planning Board
<ul style="list-style-type: none"> • Amenity Area • Amenity Planting • Barbeque Spot • Boat Servicing Facility • Caretaker's Office or Quarters • Eating Place • Field Study/ Education/ Visitor Centre • Footpath • Market • Park and Garden • Pavilion • Pedestrian Area • Picnic Area • Pier • Playground/ Playing Field • Promenade • Public Convenience • Public Utility Installation • Public Utility Pipeline • Road • Sitting Out Area • Utility Installation for Private Project 	<ul style="list-style-type: none"> • Government Use • Place of Entertainment • Place of Recreation, Sports or Culture • Shop and Services (excluding Motor Vehicle Showroom)

Planning Intention

This zone is intended primarily for the provision of outdoor open-air space at the foreshore promenade, for active and/ or passive recreational uses serving the needs of the local residents and visitors. It also includes land for piers to facilitate marine access to Discovery Bay, and boat servicing facility.

11.8 The Remarks in the Notes to the OZP for the land use zones, governing maximum gross floor area and building height, will generally reflect the proposal indicated in Table 2.

11.9 However, should the Town Planning Board consider that alternative amendments to the OZP would be more appropriate means for permitting the proposed development at any part of the area, then that may be acceptable to the Applicant.

12. Conclusion

12.1 HKR's long term vision is to develop a high quality residential area and to better utilise the existing land resources at Discovery Bay. This is responsive to the broader strategic planning objective of Hong Kong to provide additional housing capacity.

12.2 Area 10b is an already disturbed area together with the adjoining water already gazetted and approved for reclamation. It has minimal natural conservation area and has an unsightly mix of uses, and is considered a prime location for redevelopment. Its rationalisation, and the proposed residential development and open spaces are considered to achieve benefits for the Discovery Bay residents and visitors. The proposal is considered appropriate for the location, having balanced the waterfront setting and the amenity of the existing and future residents and pedestrians.

12.3 Accordingly, the Town Planning Board is invited to favourably consider this request to amend the OZP to facilitate implementation of the Concept Plan at Area 10b.

Appendix A
Study on Drainage, Sewerage and
Water Supply Systems

**Hong Kong Resort Company
Limited**

**Optimization of Land Use in
Discovery Bay**

**Study on Drainage, Sewerage and
Water Supply Systems for Area 10b**

235928-REP-003-02

Rev 02 | January 2016

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

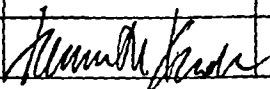
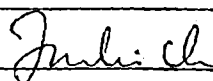
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APPENDIX B1

Calculations on Proposed Drainage System

APPENDIX B2

Calculations on Proposed Sewerage System

APPENDIX B3

Capacity Checking Calculations on existing Discovery Bay Reservoir, Fresh Water Service Reservoir and Proposed Water Supply System

Executive Summary

The Hong Kong Resort Company Limited (HKRCL) has been considering the feasibility of implementing additional development areas within the existing boundary of Discovery Bay to provide additional housing supply. A planning statement, titled “Optimisation of Land Use in Discovery Bay” was submitted to Planning Department (PlanD) in July 2013. A round of comments from various government departments was received on December 2013 (ref PlanD’s letter () L1/L/DBNC/352-17 dated 17 December 2013). Another round of submission was made in August 2014 and the corresponding set of comments was received from various Government departments in December 2014 (ref. PlanD’s letter () L1/L/DBNS/352-17(CR) dated 23 December 2014). In order to address those comments, the development proposal has been refined accordingly and a further round of submission was made in March 2015 and corresponding set of comments was received from Environmental Protection Department (EPD) in May 2015 (ref. PlanD’s letter L1/L/DBNS/352-17(CR) dated 19 May 2015). In order to address those comments, the report has been revised accordingly.

The latest current scheme only refers to Area 10b. The potential development area is included in the latest approved Discovery Bay Outline Zoning Plan as “Other Specified Uses” and “Government, Institution and Community”, despite the fact that some of their development parameters are proposed to be amended.

This report would address the issues relating to drainage, sewerage and water supply for the latest development proposal of Area 10b, while taking into account the cumulative impact of Area 6f. Those relating to noise, air quality, water quality, land contamination and ecology are separately presented in another report.

Drainage

Discovery Bay has a network of engineering drainage system that originates from the foot of the hills to convey the surface runoff east to the sea. The potential development is located at the catchment with total area of 6.3 ha.

The drainage catchment includes potential Area 10b with minor reclamation, where there is no existing drainage system. The surface runoff directly discharges to the sea under the existing condition.

The potential developments will generate increase in surface runoff due to land area partly changed from unpaved to paved condition. A new drainage system is proposed for discharge the runoff at potential Area 10b to the sea.

Sewerage

Sewage generated from existing Discovery Bay developments is collected by four existing sewage pumping stations at Discovery Bay and then lifted up to Drainage Services Department (DSD) Siu Ho Wan Sewage Treatment Works (SHWSTW) for further treatment and disposal via the internal rising mains between the sewage pumping stations and existing 450mm diameter twin rising mains laid along Discovery Bay Tunnel to SHWSTW. SHWSTW is a chemically enhanced primary treatment (CEPT) with design treatment capacity of 180,000 m³/d and a design peak flow of 3,750 l/s.

EPD commented in May 2015 that the current capacity of SHWSTW has been allocated for other existing and planned future developments so SHWSTW has no spare capacity to cater for the additional sewage from the potential development at Discovery Bay despite that additional flow due to potential developments for both 6f and 10b is only 0.8% of the current SHWSTW design treatment capacity. EPD also advised that there is currently no plan to increase the design capacity of the SHWSTW in the short and medium terms.

Nevertheless, the possibility of discharging additional sewage flows generated from the Discovery Bay potential development to SHWSTW in the long term should not be totally ruled out. For example, the Government is actively seeking cavern development as a new source of land supply. If in the future, it is deemed suitable that the existing SHWSTW can be relocated into a cavern site to vacate valuable land for development, the relocated SHWSTW can be such designed to accommodate the increased sewage flows from the Discovery Bay.

If SHWSTW will not be able to cater for the additional sewage generated from Discovery Bay potential developments, alternative sewerage option of discharging the sewage from the Area 10b to an on-site Discovery Bay Sewage Treatment Works (DBSTW) to be located at Area 10b are recommended.

Water Supply

Discovery Bay falls within supply zone of Siu Ho Wan Water Treatment Works (SHWWTW) via the Siu Ho Wan Fresh Water Pumping Station (FWPS). SHWWTW and Siu Ho Wan FWPS have a nominal capacity of 150,000 m³/d. Allowance has been made in SHWWTW for expansion to an ultimate capacity of 300,000 m³/d. An existing 1000mm / 1200 mm pumping main delivers fresh water from Siu Ho Wan FWPS to Tung Chung Fresh Water service reservoir. Fresh water is further pumped by Discovery Bay Fresh Water Booster Pumping Station via a 450mm branch-off pipe from the existing 1200 mm fresh water main. A 450 mm diameter outlet pumping main of Discovery Bay FWPS, laid along Discovery Bay Tunnel, delivers fresh water to Discovery Bay Fresh Water Service Reservoirs No. 1 and No. 2 for fresh water supply to Discovery Bay.

The existing capacity of the SHWWTW is already insufficient to supply the existing developments and other concurrent developments within the supply zone of SHWWTW. Therefore, SHWWTW and Siu Ho Wan FWPS are expected to be upgraded to a reported capacity of 300,000 m³/d irrespective of the Discovery Bay potential developments. Spare capacity of the upgraded SHWWTW and upgraded Siu Ho Wan FWPS with 300,000 m³/d capacity will then be adequate to supply additional fresh water to Discovery Bay potential development at Area 10b, which has estimated mean daily fresh water demand of 1,210 m³/d (equivalent to 0.4% of the total upgraded capacity of SHWWTW).

If the expanded SHWWTW still cannot provide fresh water supply to the potential development areas of Discovery Bay, an alternative fresh water supply scheme to extract raw water from Discovery Bay Reservoir, treat by a new water treatment plant and distribute by new water mains is recommended. An analysis has been carried out and confirmed that the existing reservoir has sufficient storage volume to supply the additional fresh water demand even during a drought year.

Additional flushing supply to the potential development area 10b will be provided from the existing Discovery Bay Reservoir. It has been checked that the existing reservoir has enough storage even during a drought year to meet this additional flushing water demand.

To facilitate the Discovery Bay potential developments, new water mains including fresh and flushing water mains are required for water supply to potential development Areas 10b.

1 Introduction

1.1 Background

- 1.1.1** The Hong Kong Resort Company Limited (HKRCL) has been considering the feasibility of implementing additional development areas within the existing boundary of Discovery Bay to provide additional housing supply. A planning statement, titled “Optimization of Land Use in Discovery Bay” was submitted to Planning Department (PlanD) in July 2013. A round of comments from various government departments was received on December 2013 (ref PlanD’s letter (L1/L/DBNC/352-17 dated 17 December 2013).
- 1.1.2** Another round of submission was made in August 2014 and the corresponding set of comments was received from various government departments in December 2014 (ref. PlanD’s letter () L1/L/DBNS/352-17(CR) dated 23 December 2014). A further round of submission was made in March 2015 and only comments from Environmental Protection Department (EPD) were received in May 2015 (ref. PlanD’s letter L1/L/DBNS/352-17(CR) dated 19 May 2015).
- 1.1.3** Ove Arup & Partners HK Ltd (Arup) has been appointed by HKRCL to conduct assessments to address those comments relating to environmental aspects including noise, air quality, water quality, land contamination, ecology, sewerage and drainage, and water supply.
- 1.1.4** This report addresses those comments relating to drainage, sewerage and water supply for Area 10b, taking into account the cumulative impact of the concurrent development at Area 6f. Those relating to noise, air quality, water quality, land contamination and ecology are separately presented in another report.

1.2 Overview of Potential Development Proposal

- 1.2.1** After receiving the comments from various government departments in December 2013, December 2014 and May 2015, HKRCL has been optimising the development proposal to address those comments. Under the current planning proposal, an estimated total population of 2,813 would be developed in Area 10b, which has a site area of 63,000 m².
- 1.2.2** Figure 1 illustrates the locations of the potential development area 10b and more relevant description on the details of the potential development area are given in Section 2.
- 1.2.3** It is noted that there is another potential development in Area 6f of Discovery Bay for residential development (site area of 8,300 m² and estimated total population of 1,190). For the purpose of the study on drainage, sewerage and water supply, the cumulative impacts from both potential developments at Area 6f and Area 10b have been considered.
- 1.2.4** It should also be noted that all the potential development areas are

included in the latest Discovery Bay Master Plan (some developments has already been implemented), despite the fact that some of their development parameters are proposed to be amended. The latest Discovery Bay Master Plan was approved in principle awaiting only revised land premium offer from Lands Department.

1.3 Key Objectives of this Study

1.3.1 The key objectives and scope of this study are given below:

- Obtain and examine existing drainage, sewerage and water supply records;
- Carry out site inspections;
- Estimate the surface runoff based on the proposed development scheme and determine capacity of existing drainage system immediately downstream of the potential developments;
- Assess the effect of the potential development on the existing drainage system and assess any mitigation measures are required;
- Describe in board terms the new sewerage infrastructure needed to serve the potential development;
- Conduct a detailed water demand assessment for the proposed development scheme and examine rainwater collection in existing catchment of the Discovery Bay Reservoir in the drought year as the worst scenario for flushing water supply;
- Recommend conceptual water supply to meet the demand of the additional development; and
- Describe in board terms the new water supply infrastructure and/or upgrading requirements of the existing reservoir and water treatment facilities are required.

2 Project Description

2.1 Background

- 2.1.1.1** The Discovery Bay development is a self-contained sub-urban residential development comprising mainly low-density private housing, situated in the eastern part of Lantau Island covering a total land area of about 650 hectares. There are currently around 8,300 nos. of residential flat with total population around 15,000.
- 2.1.1.2** Discovery Bay falls within the ambit of the Discovery Bay Outline Zoning Plan (Discovery Bay OZP) which was first approved on 21 March 2003. The current approved OZP limits the population to 25,000 (i.e. 10,000 nos. of residential flat), which is reflected in the latest Master Plan.

2.2 Development Area Description

- 2.2.1.1** Area 10b is located along the existing seafront along Marina Avenue leading to the existing Marina. Site observation reveals that the site is mainly occupied by a number of services facilities including the depot for vehicles, petrol / LPG filling station, ferry pier etc. It is also noted that the entire depot area is paved with concrete.
- 2.2.1.2** The current permissible land use for Area 10b in the OZP is "Government, Institution and Community" and "Other Specified Uses" for staff quarters and a variety of supporting services as shown in OZP S/I-DB/4 - Discovery Bay. Within Area 10b, it is proposed to have residential buildings, together with the necessary infrastructure and landscaping elements. Besides, some of the existing service would also be separated from the future housing by housing them in podium structure.
- 2.2.1.3** The existing seawall along Marina Avenue has adopted the configuration as a sloping seawall. In order to cater for the additional housing development, it is proposed include an additional narrow strip of reclamation, in the form as a decking with a width about 9-34m. The total area for this additional decking would be approximately 0.86ha.

2.3 Tentative Implementation Programme

- 2.3.1** According to the latest design, the tentative time for the occupation of the potential development areas would be beyond 2020 and this actual date would be reviewed throughout the design process.

3 Site Inspection

3.1 Several site visits were carried out in April – June 2014 to inspect existing public and Discovery Bay's private drainage, sewerage and water supply infrastructures. The following tables present the site photos for some major infrastructures components, which will be discussed in this study. Figure 1 illustrates respective location of these infrastructures.

Table 3.1a Existing Government and Private Sewerage Infrastructure

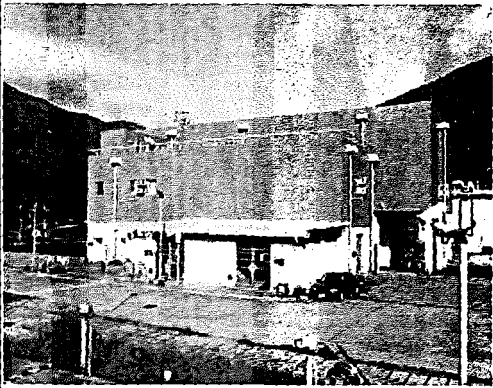
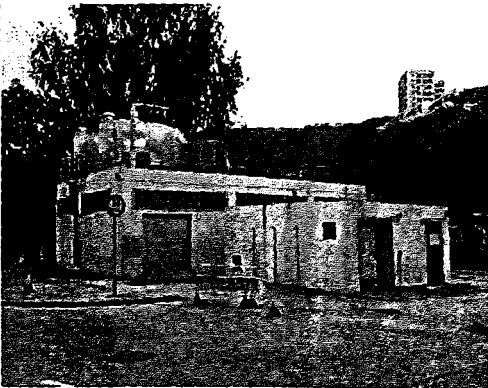
DSD Siu Ho Wan Sewage Treatment Works	Sewage Pumping Station No. 2 at Discovery Bay
	

Table 3.1b Existing Government Water Supply Infrastructure

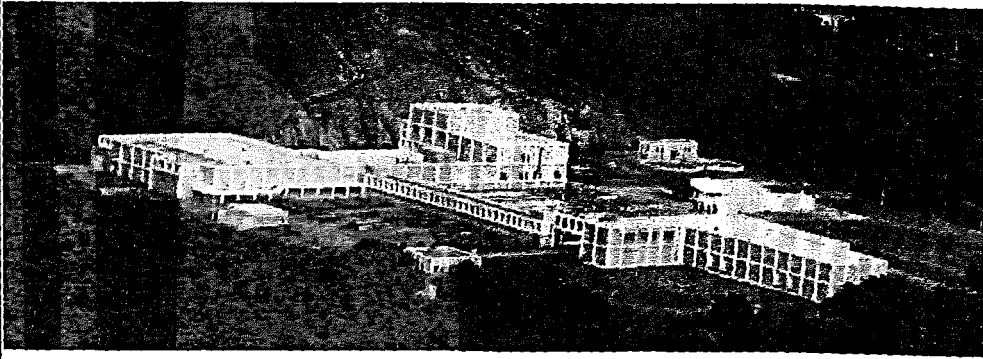
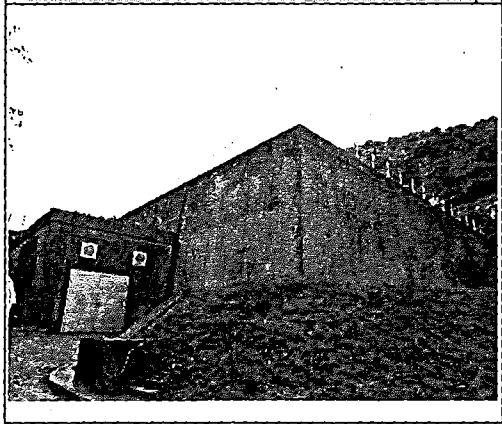
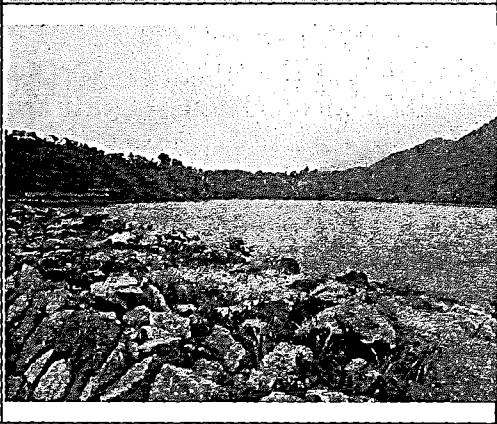
WSD Siu Ho Wan Water Treatment Works


Table 3.1c Existing Private Water Supply Infrastructure

Fresh Water Service Reservoir No. 1 at Discovery Bay	Discovery Bay Reservoir
	

4 Drainage Study

4.1 Methodology and Guidelines

4.1.1.1 The drainage study reviews the existing drainage catchment and systems at the Discovery Bay. It assesses the potential drainage impacts due to the potential development Area 10b and identifies the necessary drainage mitigation measures and proposed drainage system for Area 10b. This section presents the design method, parameters and criteria used for this drainage study.

4.1.2 Design Method

4.1.2.1 Stormwater drain capacity will be calculated based on the Continuity Equation:

$$Q = AV$$

Where Q = full flow capacity in m³/s

A = cross-sectional area in m²

V = velocity at full bore flow in m/s

4.1.2.2 Velocity at full-bore flow is based on the Colebrook-White equation:

$$V = -(32gRS)^{0.5} \log \left\{ \frac{(ks/14800R)}{(1.255v/R(32gRS)^{0.5})} \right\}$$

Where g = acceleration due to gravity in m/s²

R = hydraulic radius in m

S = gradient

ks = roughness in mm

v = kinematic viscosity of water in m²/s

4.1.2.3 Peak stormwater runoff rate will be calculated using Rational Method:

$$Q = 0.278 C i A$$

Where Q = peak stormwater runoff in m³/s

C = runoff coefficient

i = design mean intensity of rainfall (mm/hr)

A = area of catchment in km²

The design mean intensity of rainfall is based on Gumbel Solution in accordance with DSD Stormwater Design Manual, 4th Edition, 2013 (DSD SDM):

$$i = a / (t_c + b)^c$$

Where t_c = time of concentration in minutes

a, b, c = storm constants

4.1.3 Codes of Practice and Design Manuals

4.1.3.1 The assessment has been carried out in accordance with DSD SDM.

4.2 Design Parameters

4.2.1 Drainage System Capacity

4.2.1.1 Capacity of the proposed stormwater drainage system will be designed to cater for return period design peak flow as follows:

- 1 in 50 years return period design peak flow for urban drainage branch systems
- 1 in 200 years return period design peak flow for urban drainage trunk systems (equivalent to 1,800 mm diameter pipe or larger)

4.2.1.2 To account for the effect of materials deposited in the drainage systems between desilting cycles, the following reduction of flow area is assumed in accordance with DSD SDM:

- 5% reduction of flow area if the pipe gradient is greater than 1 in 25
- 10% reduction of flow area in other cases

4.2.1.3 Return period storm constants for calculation of rainfall intensities are obtained from DSD SDM and listed as follows:

- 1 in 50 years return period: $a = 687$; $b = 4.2$; and $c = 0.42$
- 1 in 200 years return period: $a = 766$; $b = 4.1$; and $c = 0.40$

4.2.2 Runoff Coefficient

Surface Characteristics	Runoff Coefficient, C
Paved Area	1.0
Unpaved Area	0.3

4.2.3 Time of Concentration

Time of concentration (t_c) is the shortest time in which all parts of the upstream catchment will contribute to the flow at the point of calculation. This is given by the equation:

$$t_c = t_e + t_f$$

Where t_e = time of entry
 t_f = time of flow

The time of entry, which is equivalent to time of concentration for a natural catchment, is calculated using the Brandsby William's Equation as follows:

$$t_o = \frac{0.14465L}{H^{0.2} A^{0.1}}$$

Where t_o = time of concentration of a natural catchment (min.)

A = catchment area (m^2)

H = average slope (m per 100m) of the natural flow

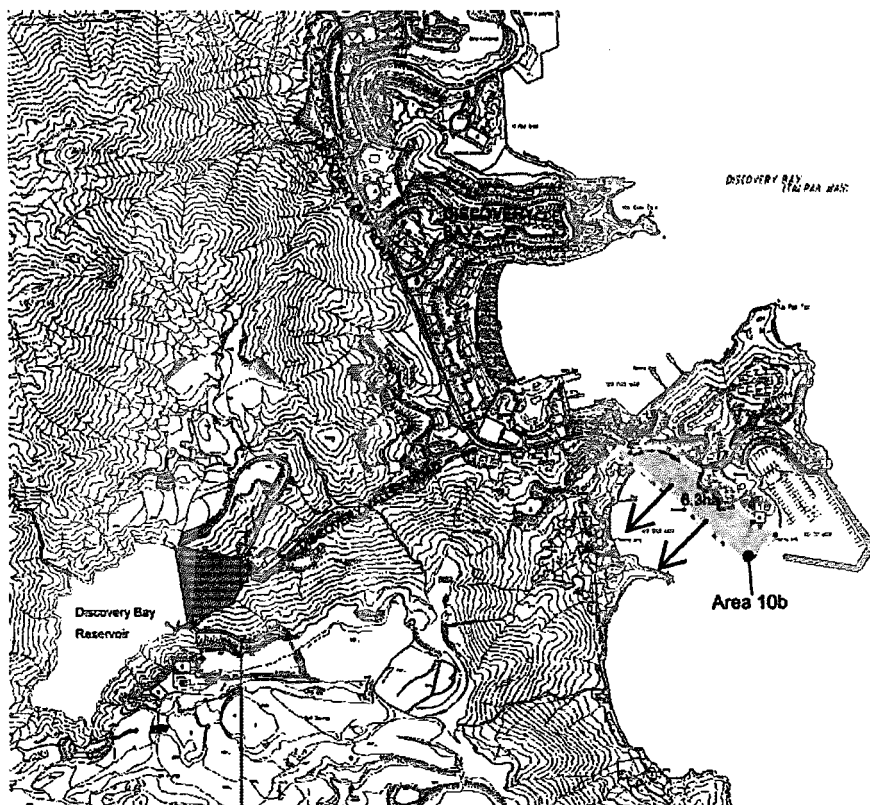
L = distance (m) of the natural flow

4.3 Existing Drainage System

4.3.1 Discovery Bay has a network of engineering drainage system that originates from the foot of the hills to convey the surface runoff east to

the sea. The existing drainage layout plan is illustrated in Figure 2. A description of this existing drainage system is provided below.

- 4.3.2 The potential development area is located in the catchment area of size 6.3 ha, shown as the yellow catchment in the following figure.



Drainage Catchment Plan for Site 10b

- 4.3.3 The catchment also comprises newly reclaimed land. The current site area has no existing drainage system. The surface runoff is discharged directly to the sea via overland flow.

4.4 Potential Drainage Impacts

- 4.4.1 The potential development scheme will generate increase in surface runoff due to land area partly changed from unpaved to paved surface. To be conservatively, it is assumed that the whole 6.3 ha site area at Area 10b is unpaved before development and will be changed to paved condition after development to estimate the worse drainage impact. The expected impact on the existing drainage system and the requirement for any measures to accommodate the increase of surface runoff are discussed below.

- 4.4.2 Table 4.1 summarizes the change in catchment area from existing to proposed conditions.

Table 4.1: Summary of Catchment Area Changes

Downstream Drainage System	Existing / Potential Development Area	Total Catchment Area (ha)	Paved Area (ha)		
			Existing	Proposed	Increase
N.A.	Area 10b	6.3	N.A.	6.3	6.3

4.5 Evaluation of Drainage Impacts, Mitigation Measures and Proposed Drainage

- 4.5.1.1** Potential development Area 10b will be developed on both existing area without drainage system and new reclaimed land. The surface runoff is currently discharged directly to the sea. New drainage system for this area is proposed to collect the surface runoff and discharge directly to the sea. The peak surface runoff from Area 10b has been estimated and two new 1500 mm diameter outfall pipes are proposed.
- 4.5.1.2** Figure 2 shows the proposed drainage scheme and calculations are attached in APPENDIX B1.
- 4.5.1.3** Area 6f is located at a different catchment, and no cumulative drainage impact is anticipated.

5 Sewerage Study

5.1 Methodology and Guidelines

5.1.1.1 The sewerage study estimates the sewage flows to be generated from potential development Area 10b and existing OZP approved 25,000 population at Discovery Bay. It reviews the existing sewerage system within the Discovery Bay and its discharge to the public sewerage and sewage treatment facilities at Siu Ho Wan. It recommends the sewerage collection, treatment and disposal scheme for the potential development Area 10b, with consideration of the accumulative effects of the concurrent development at Area 6f. This section presents the design method, parameters and criteria used for this sewerage study.

5.1.2 Design Method

5.1.2.1 Sewer capacity will be calculated based on the Continuity Equation:

$$Q = AV$$

Where Q = full flow capacity in m³/s

A = cross-sectional area in m²

V = velocity at full bore flow in m/s

5.1.2.2 Velocity at full-bore flow is based on the Colebrook-White equation:

$$V = -(32gRS)^{0.5} \log \left\{ \frac{(ks/14800R) + (1.255v/R(32gRS)^{0.5})}{1} \right\}$$

Where g = acceleration due to gravity in m/s²

R = hydraulic radius in m

S = gradient

ks = roughness in mm

v = kinematic viscosity of water in m²/s

5.1.3 Codes of Practice and Design Manuals

5.1.3.1 The assessment has been carried out in accordance with the guidelines set out in EPD Report No. EPD/TP1/05 Guidelines for Estimating Sewage Flows (GESF) for Sewage Infrastructure Planning Version 1.0 and in accordance with DSD Sewerage Manual (2013) [(Part 1: Key Planning Issues and Gravity Collection System (3rd Edition) and Part 2: Pumping Station and Rising Main (2nd Edition)]

5.2 Design Parameters

5.2.1 Unit Flow Factors

5.2.1.1 Unit flow factor is the average sewerage flow (average dry weather flow or ADWF) contributed by one unit of sewage source (person, employee or unit area) per day. According to Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning (GESF) published by EPD, the recommended unit flow factors are summarized in following Table 5.1:

Table 5.1: Unit Flow Factors

Type	Unit Flow Factor (m ³ /person/day)
Domestic	
Public Rental Housing	0.19
Private R1	0.19
Private R2	0.27
Private R3	0.37
Private R4	0.37
Traditional Village	0.15
Permanent Housing	0.23 ⁽¹⁾
Commercial	
Commercial Employee	0.08
Commercial activities:	
S1 (J7)	-
S2 (J1)	0.45
S3 (J2)	0.25
S4 (J9)	0.15
S5 (J5)	-
S6 (J4)	-
S7 (J4)	-
S8 (J3)	0.10
S9 (J10)	1.50
S10 (J10)	1.50
S11 (J3)	0.10
S12 (J6)	-
S13 (J6)	-
S14 (J6)	-
S15 (J12)	-
S16 (J11)	0.20
S17 (J11)	0.20
S18 (J11)	0.20
S19 (J11)	0.20
Industrial	
Industrial Employee	0.08
Industrial Activities	0.20
Institutional	
School Student	0.04

Note: ⁽¹⁾ Permanent housing for North Lantau catchment wide planning

5.2.2 Peaking Factors

5.2.2.1 Peaking factors cater for seasonal/diurnal fluctuation and normal amount of infiltration and inflow. The peaking factors shall be in accordance with GESF and are shown in Table 5.2.

Table 5.2: Peaking Factors for Various Population Ranges

Population Range	Peaking Factor (including stormwater allowance) for facility with existing upstream sewerage	Peaking Factor (excluding stormwater allowance) for facility with new upstream sewerage
Sewers		
< 1,000	8	6
1,000 – 5,000	6	5
5,000 – 10,000	5	4
10,000 – 50,000	4	3
> 50,000	Max (7.3/N ^{0.15} , 2.4)	Max (6/N ^{0.175} , 1.6)
Sewage Treatment Works, Preliminary Treatment Works and Pumping Stations		
< 10,000	4	3
10,000 – 25,000	3.5	2.5
25,000 – 50,000	3	2
> 50,000	Max (3.9/N ^{0.065} , 2.4)	Max (2.6/N ^{0.065} , 1.6)

Note:

N = Contributing population in thousands.

Contributing population = Calculated total average flow (m³/d) / 0.27 (m³/d)

5.3 Sewage Flow Estimation

5.3.1 The potential development at Area 10b will generate 1,041 m³/d as shown in Table 5.3 below.

Table 5.3: Sewage Flow Estimation Summary

Area	Proposed Uses	Population	Unit Flow Factor (UFF) (m ³ /person/d) ⁽¹⁾	ADWT (m ³ /d)
Area 10b	Residential	2,813	0.37	1,041

Note: ⁽¹⁾ R3 residential type is adopted for potential development

5.3.2 For the purpose of assessing the potential impact on the existing sewerage and sewage treatment facilities, sewage flow generated from another potential development at Area 6f will also be considered. With

a residential population of 1,190, the estimated sewage flow generation from potential development at Area 6f is 440 m³/day.

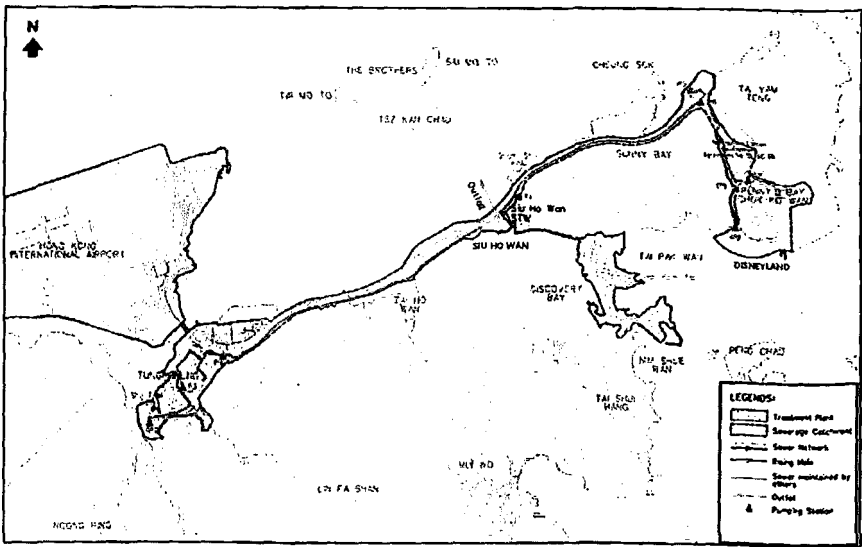
5.4 Existing Sewerage System

5.4.1 Sewage generated from existing Discovery Bay development is collected by three existing sewage pumping stations (i.e. Sewage Pumping Station No. 1, No. 2, No. 3 and No. 4) at Discovery Bay and then lifted up to DSD Siu Ho Wan Sewage Treatment Works (SHWSTW) for further treatment and disposal via internal rising mains between the sewage pumping stations and existing 450mm diameter twin rising mains laid along Discovery Bay Tunnel. Existing sewerage system is illustrated in Figure 3.

5.4.2 Siu Ho Wan Sewage Treatment Works

5.4.2.1 Siu Ho Wan Sewage Treatment Works (SHWSTW) was a preliminary sewage treatment works when it was commissioned in 1996. It was subsequently upgraded under the Project PWP Item 4224DS “Outlying Islands Sewerage Stage 1 Phase 1C - Upgrading of Siu Ho Wan Sewage Treatment Plant” to chemically enhanced primary treatment (CEPT). The scope of the project included increasing the treatment capacity of SHWSTW to 180,000 m³/d and a peak flow of 3,750 l/s so as to cater for the increase in sewage flow. Space was previously reserved for further extension to around 5,000 l/s.

5.4.2.2 Currently SHWSTW receives sewage from Hong Kong International Airport, Tung Chung, Disneyland, Penny’s Bay, Sunny Bay, Discovery Bay and Siu Ho Wan.. Catchment area of SHWSTW is shown as follows:



Siu Ho Wan Sewage Treatment Works Catchment Area

5.5 Evaluation of Sewerage Impacts and Mitigation Measures

5.5.1 Siu Ho Wan Sewage Treatment Works

- 5.5.1.1** EPD advised in May 2015 that the design capacity of the SHWSTW has been allocated for the treatment of the sewage arising from the development of the Expansion of Hong Kong International Airport into a Three Runway System, the new town development under Tung Chung New Town Expansion and the Penny's Bay Phase 2 development, etc. Therefore, SHWSTW has no spare capacity to cater for the sewage arising from any proposed Discovery Bay further development and the Sewerage Authority has no plan to increase the design capacity of the SHWSTW in the short and medium terms.

5.6 Proposed Sewerage System

5.6.1 Option 1 – Discharge to Siu Ho Wan Sewage Treatment Works

- 5.6.1.1** Although EPD has indicated that the SHWSTW has no spare capacity to cater for the sewage arising from any proposed Discovery Bay further development, the possibility of discharging additional sewage flows from the potential development Area 10b to SHWSTW in the long term should not be totally ruled out. For example, the Government is currently actively seeking cavern development as a new source of land supply. If in the future, it is deemed suitable that the existing SHWSTW can be relocated into a cavern site to vacate valuable land for development, the relocated SHWSTW can be such designed to accommodate the increased sewage flows from the Discovery Bay.

5.6.2 Option 2 – New Discovery Bay Sewage Treatment Works at Area 10b

- 5.6.2.1** Under option 2, a new small DBSTW at Area 10b will be proposed. The capacity of this proposed DBSTW will be dependent upon whether it will also be receiving the sewage flows generation from another potential development at Area 6f. If another development at Area 6f will construct its own on-site Sewage Treatment Works, the DBSTW at Area 10b will only need to support the development at Area 10b so the capacity of DBSTW shall be 1,041 m³/d. A new 225mm gravity

sewer is required to convey the sewage flow from Area 10b to the DBSTW (see APPENDIX B2 for calculation detail).

5.6.2.2 If the new proposed DBSTW will serve both potential developments at Area 6f and Area 10b, the treatment capacity of DBSTW shall be 1,481 m³/d.

5.6.2.3 The new DBSTW at Area 10b will be required to meet the Water Pollution Control Ordinance standards.

5.6.3 Septicity of Sewage due to New Sewage Pumping Station and Rising Main

5.6.3.1 Septicity becomes a problem when the retention time of sewage in the main is long and the temperature is high or the incoming sewage to the pumping station is already septic. If there is lack of oxygen during degradation process, septic conditions will occur which will result in the formation of hydrogen sulphide. This causes an offensive smell and is health hazard. Detailed study to examine necessary control measures of septicity will be carried out during detailed design. Example of septicity measures to be considered include:

- Pre-aeration in the wet well of the pumping station
- Adding controlled dosage of nitrate solution
- Frequent maintenance of wet well
- Injection of oxygen into rising main
- Twin or multiple rising mains with different size to suit for different flow conditions

6 Water Supply Study

6.1 Methodology and Guidelines

6.1.1.1 The water supply study reviews the existing water supply systems for Discovery Bay. It estimates the fresh and flushing water demands from potential development Area 10b and existing OZP approved 25,000 population at Discovery Bay. It also recommends water supply options to supply the new development area. This section presents the design method, parameters and criteria used for this water supply study.

6.1.2 Design Method

6.1.2.1 Water main capacity will be calculated based on the Continuity Equation:

$$Q = AV$$

Where Q = full flow capacity in m^3/s
 A = cross-sectional area in m^2
 V = velocity at full bore flow in m/s

6.1.3 Codes of Practice and Design Manuals

6.1.3.1 In accordance with WSD's DI No. 1309 "Design Criteria", the following design parameters and peak demand factors are adopted for the design of proposed fresh and salt water supply systems.

6.2 Design Parameters

6.2.1 Unit Demand

6.2.1.1 The unit water demands for the residential water demand estimate listed in WSD's DI 1309 are shown in Table 6.1 below. Since no detailed breakdown of zone types is available at this stage of Study, water unit demand for R3 has been adopted to suits the potential developments.

Table 6.1: Fresh and Flushing Water Unit Demand for Demand Estimate

Zone Type	Fresh Water		Flushing Water	Unit
	Residential	Service Trade		
Residential				
Public Rental Housing	140	40	70	Litre/head/day
R1	230	40	70	Litre/head/day

Zone Type	Fresh Water		Flushing Water	Unit
	Residential	Service Trade		
R2	300	40	70	Litre/head/day
R3	390	40	70	Litre/head/day
R4	390	40	70	Litre/head/day
Village	230	40	70	Litre/head/day
Commercial				
General	40	--	20	Litre/m ² GFA/day
Hotel	1200	--	140	Litre/room/day
Hospital	455	--	295	Litre/bed/day
School Student	25	--	25	Litre/head/day

6.2.2 Water Treatment Works Capacity:

- Fresh water system – 1.2 times mean daily demand

6.2.3 Service Reservoir Capacity:

- Fresh water system (Secondary) – 85% of mean daily demand for isolated supply zones.

6.2.4 Peak Flow Rates in Pumping Main:

- Fresh water system – 1.5 times mean daily demand
- Salt water system – 1.5 times mean daily demand

6.2.5 Peak Flow Rates in Distribution Main:

- Fresh water system – 3 times mean daily demand
- Salt water system – 2 times mean daily demand

6.2.6 Residual Head Requirement:

- Fresh water system – 20m
- Salt water system – 15m

6.2.7 Maximum Flow Velocity for Pumping Main:

- 3 m/s under peak flow, for pumping main

6.2.8 Maximum Flow Velocity for Distribution Main:

- $> \text{DN}700 \leq 3 \text{ m/s}$
- $\text{DN}700 \text{ to } \text{DN}525 \leq 2.5 \text{ m/s}$
- $\text{DN}450 \text{ to } \text{DN}375 \leq 2 \text{ m/s}$
- $\text{DN}300 \text{ to } \text{DN}200 \leq 1.5 \text{ m/s}$

6.3 Water Demand Estimation

6.3.1 The potential development at Area 10b will generate 1,210 m³/d (1,097+113) fresh water demand and 197 m³/d flushing water demand based on 2,813 residential populations, as shown in Table 6.2 below.

Table 6.2: Water Demand Estimation Summary

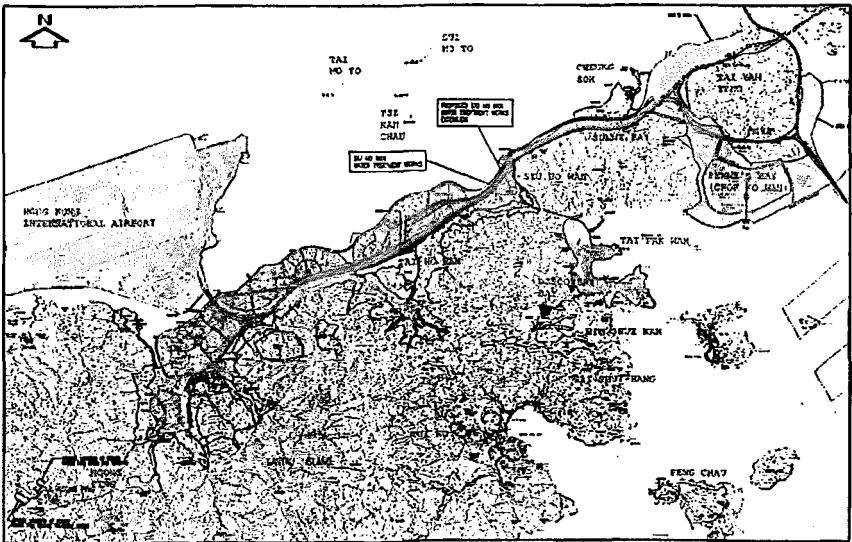
Areas	Proposed Uses	Population	Fresh Water Demand (m ³ /d) ⁽¹⁾		Flushing Water Demand (m ³ /d) ⁽¹⁾
			Fresh Water	Service Trades	
Area 6f	Residential	1,190	464.1	47.6	83.3
Area 10b	Residential	2,813	1,097.1	112.5	196.9
Total Resident =		4,003	1,721.3		280.2

Note: ⁽¹⁾ R3 residential type is adopted for potential development, i.e. fresh water unit demand = 0.390 m³/head/day; service trades unit demand = 0.040 m³/head/day; and flushing water unit demand = 0.070 m³/head/day.

6.3.2 For the purpose of assessing the potential impact on the existing water supply infrastructure, water demand from another potential development at Area 6f will also be considered. With a residential population of 1,190, the estimated fresh and flushing water demands from Area 6f are 512 m³/d and 83 m³/day respectively.

6.4 Existing Fresh Water Supply System

6.4.1 Discovery Bay falls within supply zone of Siu Ho Wan Water Treatment Works (SHWWTW) and the Siu Ho Wan FWPS. Supply zone of SHWWTW is shown below and the existing fresh water supply system is illustrated in Figure 4.



*Siu Ho Wan Water Treatment Works Supply Zone***6.4.2 Siu Ho Wan Water Treatment Works**

- 6.4.2.1** SHWWTW was commissioned in November 1996 and has a nominal capacity of 150,000 m³/d. Allowance has been made for expansion to an ultimate capacity of 300,000 m³/d. Currently, the average water supply is approximately 46,000 m³/d. This includes flushing water supply to Tung Chung, Siu Ho Wan, Tai Ho Wan and Ngong Ping.

6.4.3 Siu Ho Wan Fresh Water Pumping Station

- 6.4.3.1** Treated water from SHWWTW with capacity of 150,000 m³/d is delivered by Siu Ho Wan FWPS to Tung Chung Fresh Water Service Reservoir via existing 1000mm / 1200mm fresh water main.

6.4.4 Discovery Bay Fresh Water Booster Pumping Station

- 6.4.4.1** Discovery Bay Fresh Water Booster Pumping Station delivers fresh water to Discovery Bay via a 450mm branch-off pipe of the existing 1200 mm fresh water pumping main near SHWWTW. A 450 mm outlet pumping main of Discovery Bay Fresh Water Booster Pumping station, laid along Discovery Bay Tunnel, delivers fresh water to the Discovery Bay Fresh Water Service Reservoirs No. 1 and No. 2 for distribution to the Discovery Bay.

6.4.5 Discovery Bay Fresh Water Service Reservoir

- 6.4.5.1** There are two fresh water service reservoirs in Discovery Bay, namely Discovery Bay Fresh Water Service Reservoirs No. 1 and No. 2. They are interconnected and located at the same level of around +95 mPD with top water level of +101 mPD. Discovery Bay Fresh Water Service Reservoirs No. 1 and No. 2 have capacities of 7,250 m³ and 2,992 m³ respectively. Total capacity of these two service reservoirs is 10,242 m³.

6.5 Existing Flushing Water Supply System

- 6.5.1.1** Discovery Bay has its own flushing water supply system by intercepting existing hillside runoff by catchwater to the Discovery Bay Reservoir for flushing purpose. Existing flushing water supply system is illustrated in Figure 4.
- 6.5.1.2** The existing Discovery Bay Reservoir also provides both fresh and flushing water supply to the adjacent Nim Shue Wan Village.
- 6.5.1.3** Discovery Bay Reservoir collects and stores rainwater to supply flushing water to existing Discovery Bay developments and fresh and flushing water to Nim Shue Wan Village. It has a rainwater catchment area of around 138 ha, including 18 ha of the reservoir itself (at top

water level). Summary details of the Discovery Bay Reservoir are provided in **Table 6.3**.

Table 6.3: Description of Discovery Bay Reservoir

Name of Reservoir	Supply Zone	Capacity (m ³)	Invert Level (mPD)	Top Water Level (mPD)
Discovery Bay Reservoir	Discovery Bay and Nim Shue Wan Village	3,400,000	+125	+175

6.6 Evaluation of Fresh Water Supply Impacts and Mitigation Measures

6.6.1 Fresh Water Supply Option 1 – Supply from Siu Ho Wan Water Treatment Works

6.6.1.1 Siu Ho Wan Water Treatment Works and Siu Ho Wan Fresh Water Pumping Station

6.6.1.2 Fresh water to the potential development areas (both Areas 6f and 10b) is proposed to be supplied by the SHWWTW.

6.6.1.3 The existing capacity of the SHWWTW is already insufficient to supply the existing developments and other concurrent developments within the supply zone of SHWWTW. However, the future expansion works of SHWWTW and Siu Ho Wan FWPS to a capacity of 300,000 m³/d should be adequate to supply both its catchment and additional fresh water (1,721 m³/d) to Discovery Bay potential developments at both Area 6f and 10b (i.e. 0.57% of 300,000 m³/d ultimate upgraded treatment capacity of SHWWTW).

6.6.1.4 Existing capacity of Siu Ho Wan FWPS is same as SHWWTW (150,000 m³/d). Upgrading of Siu Ho Wan FWPS to 300,000 m³/d would be necessary.

6.6.1.5 Discovery Bay Fresh Water Booster Pumping Station

6.6.1.6 Existing Discovery Bay Fresh Water Booster Pumping Station has four pump bays and house three pump sets (2 duty and 1 standby) with a reliable output of about 15,120 m³/d (87.5 L/s each with 100.5m head) to deliver fresh water to Discovery Bay. It will be capable of delivering the total fresh water demand of Discovery Bay including the Discovery Bay potential developments at both Area 6f and 10b (12,574 m³/d) as shown in **Table 6.6**.

Table 6.6: Total Fresh Water Demand of Discovery Bay

Supply Zone	Population	Population Type	Unit Flow Factor (m ³ /person/d)	Fresh Water Demand (m ³ /d)
Existing Discovery Bay Development	25,000	Residential	0.390 + 0.04	10,750
	4,100	School	0.025	102.5
Discovery Bay potential development Areas 6f	1,190	Residential	0.390 + 0.04	512
Discovery Bay potential development Areas 10b	2,813	Residential	0.390 + 0.04	1,210

Total MDD = 12,574

6.6.1.7 The existing 450 mm pumping main from Discovery Bay Fresh Water Booster Pumping Station to Discovery Bay has been checked to be capable of meeting total fresh water demand of Discovery Bay and potential development. No upgrading of this trunk main would be envisaged. Detailed calculations are provided in APPENDIX B3.

6.6.1.8 Fresh Water Service Reservoirs at Discovery Bay

6.6.1.9 According to WSD's DI 1309, fresh water service reservoir requires total storage capacity of 0.85MDD (for isolated water supply zones), i.e. 12,062 m³/d x 0.85 = 10,253 m³ (to supply additional potential development at Area 10b only) and 12,574 x 0.85 = 10,688 m³ (to supply additional potential development at both Area 6f and 10b). Detailed calculations are provided in APPENDIX B3 and summary of total fresh water demand of Discovery Bay is provided in above Table 6.6.

6.6.1.10 Total capacity of existing Discovery Bay Fresh Water Service Reservoirs No. 1 and No. 2 is 10,242 m³ (7,250m³ + 2,992m³). The storage volume of the existing reservoirs is marginally below 0.85MDD of the ultimate fresh water demand from the existing Discovery Bay and the potential developments (total 10,253 m³ for Area 10b and total 10,688 m³ for Area 6f and 10b). The storage of the Service Reservoirs No. 1 and No. 2 are recommended to be expanded: additional fresh water storage of 11m³ will be required (to support for Area 10b only) or 446m³ will be required (to support both Area 6f and 10b). Detailed calculations are provided in APPENDIX B3.

6.6.2 Fresh Water Supply Option 2 – Supply from Discovery Bay Reservoir

6.6.2.1 If in the event that the SHWWTW and Siu Ho Wan FWPS cannot be expanded to match with the programme of the potential development at Discovery Bay, alternative fresh water supply proposal that does not rely on the expansion of SHWWTW will be required.

6.6.2.2 It is proposed that a new private fresh water supply system within Discovery Bay to supply the additional fresh water demands from the

potential developments Areas 6f and 10b. Fresh water is proposed to be supplied from the existing Discovery Bay Reservoir.

6.6.2.3 Discovery Bay Reservoir has an invert level of 125mPD, a top water level of 175mPD and total of 3,400,000 m³ storage. The existing Discovery Bay Reservoir supplies flushing water to Discovery Bay and both fresh and flushing water to the nearby Nim Shue Wan Village. Under this fresh water supply option 2, the existing Discovery Bay Reservoir will be extended to also supply fresh (and flushing) water supply for the potential development areas, as shown in Table 6.7 below.

Table 6.7: Total Water Demand from Discovery Bay Reservoir

Supply Zone	Population	Population Type	Unit Flow Factor (m ³ /person/d)	Flushing Water Demand (m ³ /d)
Flushing Demand from Existing Discovery Bay Development	25,000	Residential	0.07	1,750
	4,100	School	0.025	102.5
Fresh and Flushing Water Demand from Existing Nim Shue Wan Village	150	Residential + Service Trades	0.23+0.04+0.07	51
Fresh and Flushing Demand from Discovery Bay potential development Areas 6f and 10b	4,003	Residential	0.39+0.04+0.07	2,001.5
Total =				3,905

6.6.2.4 An analysis has been carried out to check the adequacy of water supply for the Discovery Bay Reservoir during a drought year. From the data collected from Hong Kong Observatory between year 2000 to 2014, the 12 month period from October 2010 to September 2011 has been selected as the drought year for assessment. Based on the lowest reservoir water level recorded between March 2008 and March 2014 (including the drought year), it has been conservatively estimated by taking into consideration all inflows and outflows to and from the reservoir that the remaining storage volume of Discovery Bay Reservoir after the drought year is around 0.36 million m³. This means after taken into account of the various water demands from the existing and proposed developments of Discovery Bay and Nim Shue Wan Village and the reservoir evaporation loss throughout the drought year, the remaining reservoir volume after the drought year still has more than equivalent of 3 months of total water demand of 0.35 million m³. (i.e. 3,905 m³/d x 90 days). It demonstrates the Discovery Bay Reservoir has adequate storage to provide additional fresh (and flushing) water supply to both the potential developments at Area 6f and 10b. The relevant calculations for checking the capacity of Discovery Bay Reservoir in drought year are provided in APPENDIX B3.

- 6.6.2.5** A new water treatment works will be needed to treat the abstracted water from the Discovery Bay Reservoir before distribution to the end users.

6.7 Evaluation of Flushing Water Supply Impacts and Mitigation Measures

6.7.1 Discovery Bay Reservoir

- 6.7.1.1** Discovery Bay Reservoir provides flushing water to existing Discovery Bay and both fresh and flushing water to Nim Shue Wan Village. Following the current flushing water supply arrangement, flushing water for the potential development Areas 6f and 10b is proposed to be supplied by the Discovery Bay Reservoir. Detailed calculations are provided in **APPENDIX B3** and a summary of total water supply from Discovery Bay Reservoir is provided in **Table 6.8**.

Table 6.8: Total Water Demand from Discovery Bay Reservoir

Supply Zone	Population	Population Type	Unit Flow Factor (m ³ /person/d)	Flushing Water Demand (m ³ /d)
Flushing Demand from Existing Discovery Bay Development	25,000	Residential	0.07	1,750
	4,100	School	0.025	102.5
Fresh and Flushing Water Demand from Existing Nim Shue Wan Village	150	Residential + Service Trades	0.23+0.04+0.07	51.0
Flushing Demand from Discovery Bay potential development Areas 6f and 10b	4,003	Residential	0.07	280.2
Total =				2,183.7

- 6.7.1.2** A similar analysis has been carried out to check the adequacy of water supply for the Discovery Bay Reservoir during a drought year. The assessment considered all inflows and outflows into and out of the reservoir during the drought year (12 months between October 2010 and September 2011). It estimated that after the drought year, the Discovery Bay Reservoir will still have around 0.99 million m³ storage volume, which is still more than total water demand for a whole year (2,184 m³/d x 365 = 0.80 million m³). It shows that it is feasible to provide flushing water supply for the new potential developments from the Discovery Bay Reservoir. Capacity checking calculations for Discovery Bay Reservoir in the drought year are provided in **APPENDIX B3**.
- 6.7.1.3** Since the Discovery Bay Reservoir is feasible to provide flushing water supply for developments at both Area 6f and Area 10b, the Discovery

Bay Reservoir is then adequate to provide flushing water supply for individual development at Area 10b.

6.7.2 Existing Flushing Water Main

- 6.7.2.1** The existing 300 mm diameter flushing water main from Discovery Bay Reservoir has been checked to be capable to supply flushing water to Discovery Bay as well as both fresh and flushing water to Nim Shue Wan Village. No upgrading of flushing water main would be envisaged. Checking calculations are attached in **APPENDIX B3**.

6.8 Proposed Fresh and Flushing Water Supply Systems

- 6.8.1** New 200 mm fresh water mains and new 80 mm flushing water mains are proposed for water supply to potential development Areas 10b. **Figure 4** shows the proposed water supply layout plan (based on fresh water supply option 1) and water main sizing calculations are attached in **APPENDIX B3**.

7 Conclusions

- 7.1.1** Sections 4 to 6 have provided a baseline review and preliminary impact assessments on drainage, sewerage and water supply systems. Mitigation measures to existing facilities and recommendation on new facilities to cater for the potential developments have also been proposed.

7.2 Drainage System

- 7.2.1** Preliminary drainage scheme has been proposed to discharge the surface runoff generated from potential development Area 10b to the sea nearby.

7.3 Sewerage System

- 7.3.1** Provision of new DBSTW at Area 10b are proposed to cater for the additional flow generated from the potential development at area 10b or from both area 10b. In case that the SHWSTW plans to upgrade its treatment capacity in the future, it is suggested to also include the additional 0.8% sewage flow from the Discovery Bay potential development at both 10b and 6f for efficient sewage treatment.

7.4 Water Supply System

7.4.1 Fresh Water Supply System

- 7.4.1.1** The existing capacity of the SHWWTW is already insufficient to supply the existing developments and other concurrent developments within the supply zone of SHWWTW irrespective of the Discovery Bay potential developments. However, the future expansion of SHWWTW and Siu Ho Wan FWPS to the capacity of 300,000 m³/d is expected to take into account the 0.57% fresh water demand of Discovery Bay potential developments at both Area 6f and 10b. Upgrading SHWWTW and Siu Ho Wan FWPS to the capacity of 300,000 m³/d would be adequate.
- 7.4.1.2** Existing Discovery Bay Fresh Water Booster Pumping station has four pump bays and house three pump sets (2 duty and 1 standby) with a reliable output of about 15,120 m³/d (87.5 L/s each with 100.5m head) to deliver fresh water to Discovery Bay including the potential developments. It will be capable to deliver total fresh water demand of Discovery Bay.
- 7.4.1.3** The two existing service reservoirs within Discovery Bay have been checked to have marginal inadequate storage volume due to the increased fresh water demands. Additional fresh water storage of 11m³ will be required for Area 10b development and additional fresh water

storage of 446m³ will be required if developments at both Area 6f and 10b are implemented.

- 7.4.1.4** In the event that the existing or planned SHWWTW cannot provide fresh water supply to the potential development areas, an alternative fresh water supply scheme has been developed. This will extract water from the Discovery Bay Reservoir. New water treatment facilities and water mains will be provided for water treatment and distribution of the treated fresh water.

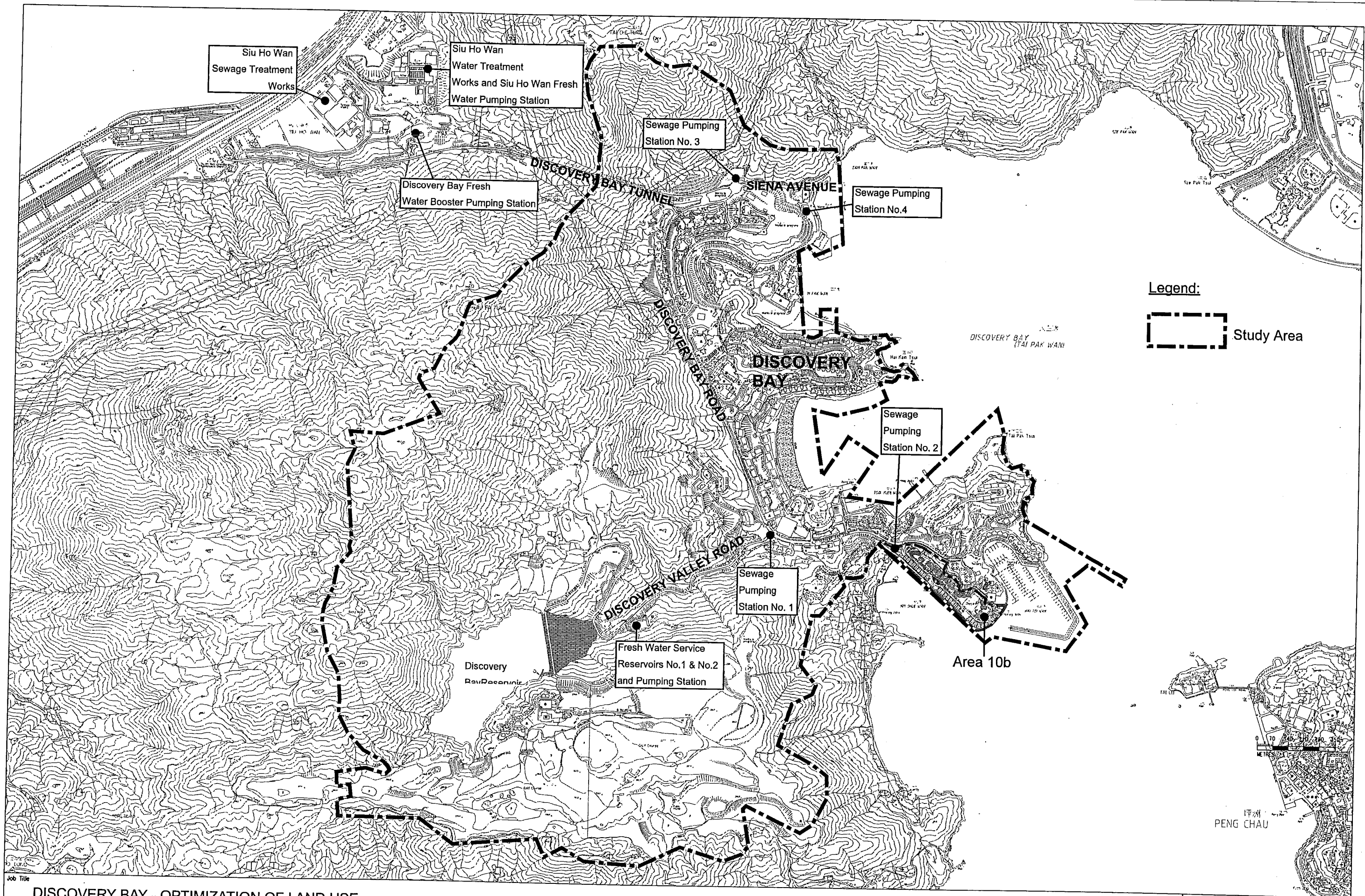
7.4.2 Flushing Water Supply System

- 7.4.2.1** Discovery Bay Reservoir, has been checked to be capable of flushing water supply to both the existing and potential developments including the existing water supply to Nim Shue Wan Village. No upgrading of Discovery Bay Reservoir would be envisaged.

7.4.3 Proposed Fresh and Flushing Water Supply Systems

- 7.4.3.1** New fresh and flushing water mains are proposed for water supply to potential development Areas 10b. The fresh water mains are proposed to have sizes of 200 mm and the flushing water mains are proposed to have sizes of 80 mm.

Figures



Legend:

Study Area

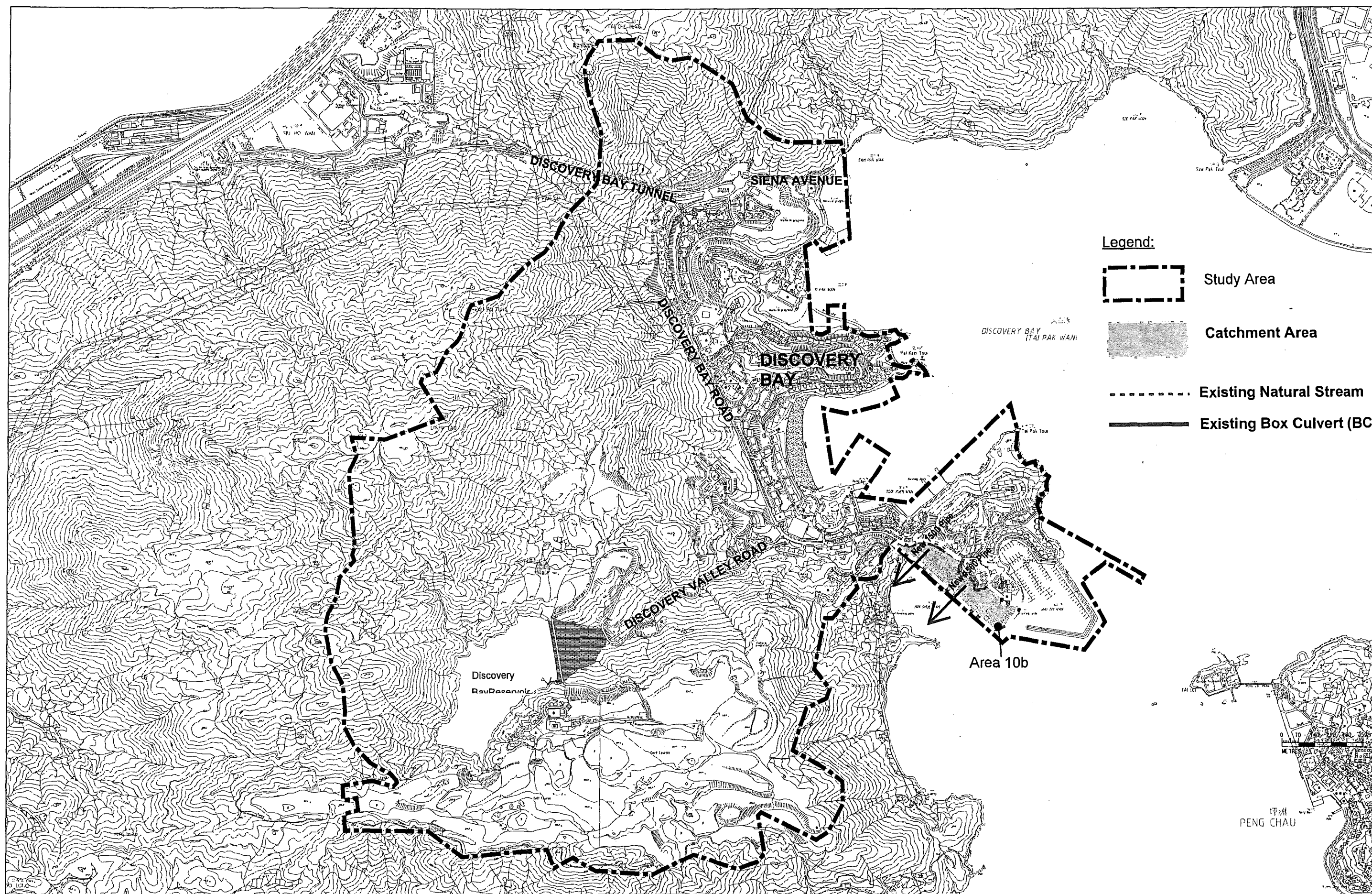
DISCOVERY BAY - OPTIMIZATION OF LAND USE

Date	Scale	Drawing Title
	1:15000	
Drawn	Job No.	
SY	736072	

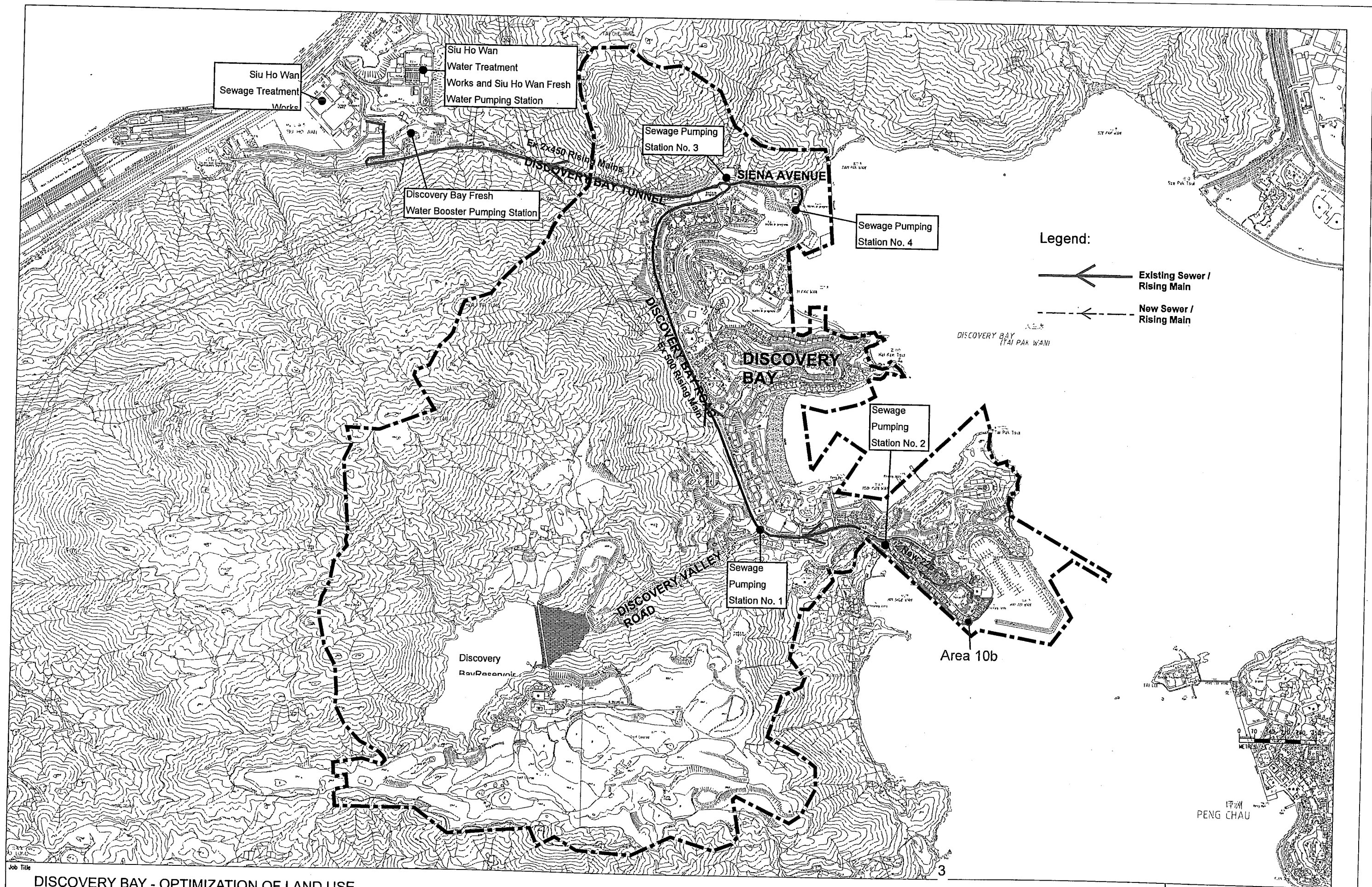
PROPOSED DEVELOPMENT AREAS IN DISCOVERY BAY

FIGURE 1

ARUP



Job Title			DISCOVERY BAY - OPTIMIZATION OF LAND USE		FIGURE 2
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Drawn	Job No.				
SY	236078	ARUP			

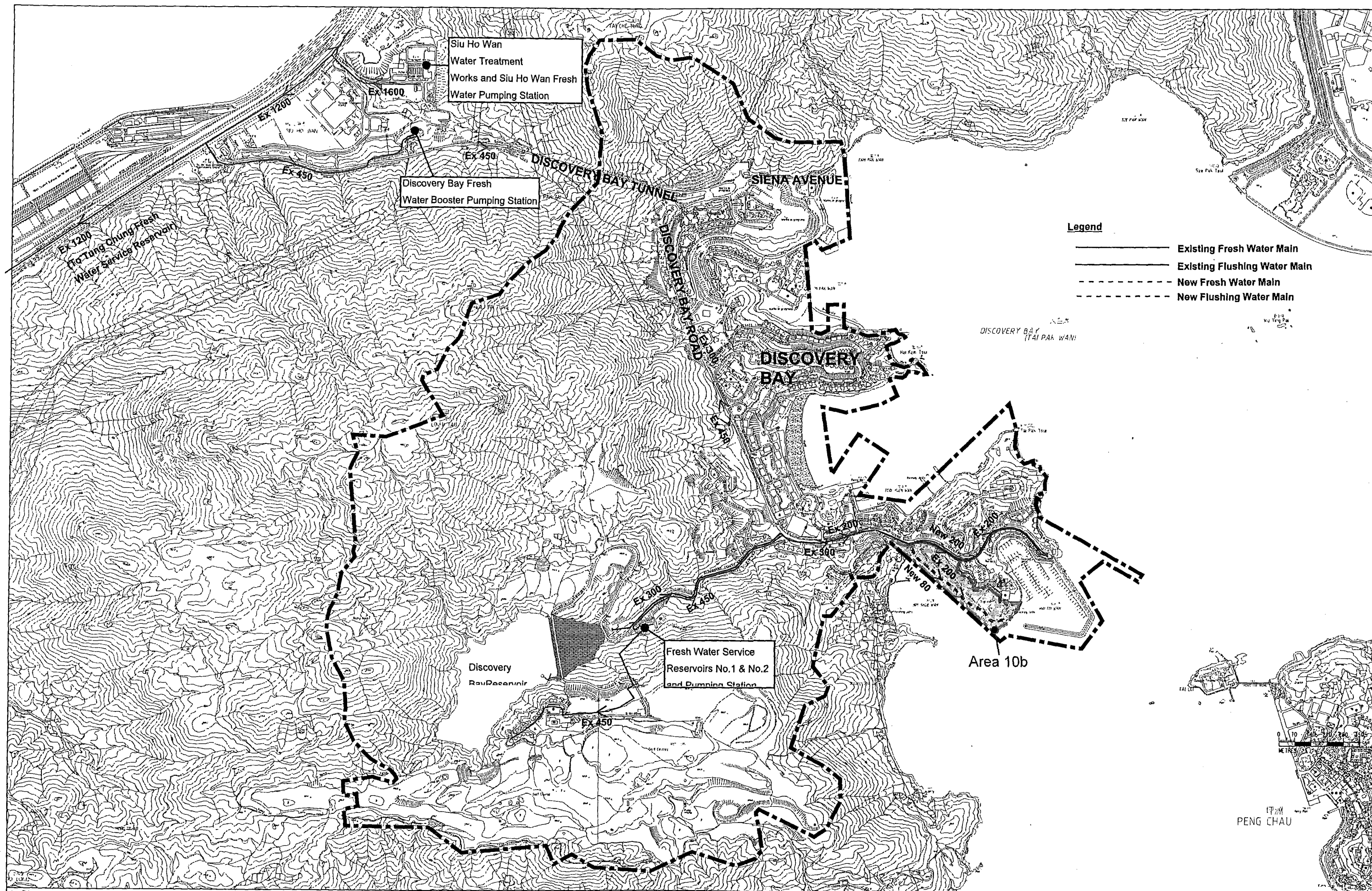


DISCOVERY BAY - OPTIMIZATION OF LAND USE

FIGURE 3

EXISTING AND PROPOSED SEWERAGE LAYOUT PLAN

ARUP



Job Title			DISCOVERY BAY - OPTIMIZATION OF LAND USE			FIGURE 4
Date	Scale	Drawing Title				ARUP
	1:15000	EXISTING AND PROPOSED WATER SUPPLY LAYOUT PLAN				
Drawn	Job No.					
	22607A					

APPENDIX B1

Calculations on Proposed Drainage System

ARUP

Job Title: Discovery Bay Optimization of Land Use

Prepared By: NY
Checked By: KK
Rev.: A

Rational method to estimate runoff and determination proposed drainage pipe / box culvert (BC) sizes

Use 1 in 200 year design event for sizing trunk system
1 in 50 year design event for sizing branch system

Design Assumption: $t_o = \text{time of concentration of a natural catchment (min)}$
 $t_o = 0.14465L$ where $A = \text{catchment area (m}^2\text{)} = 32.8 \times 10^3 \text{ m}^2$
 $H = \text{average slope (m per 100m) of the natural flow} = 72\text{m}$
 $L = \text{distance (m) of the natural flow} = 473\text{m}$
 $u = 1.0E-4$
 $R_x = 3$
 $C (\text{Paved}) = 1.00$
 $C (\text{unpaved}) = 0.30$

Potential Development Area	Pipe / BC Size	Length (m)	No. of Pipe / Cell	BC Width (m)	BC / Pipe Height (m)	Gradient (%)	Gradient (1 in X)	Area (m2)	Perimeter (m)	R = AP (m)	32QRS	Velocity (m/s)	Tt (min)	Tc (min)	Intensity (mm/hr)	Total Catchment Area (paved & unpaved) (m2)	Catchment Area (paved) (m2)	Cumulative Catchment Area (paved) (m2)	Catchment Area (unpaved) (m2)	Cumulative Catchment Area (unpaved) (m2)	Cumulative Runoff From Catchment (m3/s)	Pipe/BC Capacity (m3/s)	% Full Flow
Site 10b	1500 Dia.	10	2	1.50	1.50	0.5%	200	1,768	4,710	0.375	0.767	2.504	0.067	5.067	270	63,000	63,000	63,000		0	4.7	8.8	53%

APPENDIX B2

Calculations on Proposed
Sewerage System

ARUP

Job Title: Discovery Bay Optimization of Land Use

Prepared By: NY
Checked By: KK
Rev.: A

Sewer Sizing Calculation for Discovery Bay New Developments (10b)												
ks= 1.5												
Development	No. of Residential Unit	Population	Population Type	Unit Flow Factor (m ³ /person/day)	ADWF (m ³ /d)	Cum. ADWF (m ³ /d)	Peaking Factor for Sewer	Peak Flow (L/s)	Proposed Sewer Size (mm)	Proposed Sewer Gradient (1:xx)	Capacity of Proposed Sewer (L/s)	Occupied % of Proposed Sewer
10b	1125	2813	Residential	0.37	1040.8	1040.8	6	72.3	225	20	102.5	71%
Total ADWF (m ³ /d)					1040.8							

APPENDIX B3

Capacity Checking Calculations on existing Discovery Bay Reservoir, Fresh Water Service Reservoir and Proposed Water Supply System

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Calculation on Water Main, Service Reservoir and Reservoir

Table 1
Portable Water Consumption of Discovery Bay New Developments (10b)

Development	Population	Population Type	Unit Flow Factor (m ³ /person/day)	Water Demand (m ³ /d)
10b	2813	Residential + Service Trade	0.43	1209.6
Total Demand (m ³ /d)				1209.6 (14.0 L/s)

Table 2
Flushing Water Consumption of Discovery Bay New Developments (10b)

Development	Population	Population Type	Unit Flow Factor (m ³ /person/day)	Water Demand (m ³ /d)
10b	2813	Residential	0.07	196.9
Total Demand (m ³ /d)				196.9 (2.3 L/s)

Prepared By: NY
Checked By: KK
Rev.: A

Sizing for Fresh Water Distribution Main Supplying Discovery Bay New Developments (10b)

Total Water Demand (L/s)	Factor of Distribution Main	Total Peak Flow (L/s)	Proposed Distribution Main (mm)	Cross Section Area (mm ²)	Proposed Main Velocity (m/s)
14.0	3	42.0	200	31400	1.3

Sizing for Flushing Water Distribution Main Supplying Discovery Bay New Developments (10b)

Total Water Demand (L/s)	Factor of Distribution Main	Total Peak Flow (L/s)	Proposed Distribution Main (mm)	Cross Section Area (mm ²)	Proposed Main Velocity (m/s)
2.3	2	4.6	80	5024	0.9

Calculation on Water Main, Service Reservoir and Reservoir

Table 3

Total Fresh Water Consumption for Discovery Bay New Developments

Development	Population	Population Type	Unit Flow Factor (m ³ /person/day)	Water Demand (m ³ /d)
6f	1190	Residential + Service Trade	0.43	511.7
10b	2813	Residential + Service Trade	0.43	1209.6

Total Demand (m³/d) 1721.3 (19.9 L/s)

Table 4

Total Flushing Water Consumption for Discovery Bay New Developments

Development	Population	Population Type	Unit Flow Factor (m ³ /person/day)	Water Demand (m ³ /d)
6f	1190	Residential	0.07	83.3
10b	2813	Residential	0.07	196.9

Total Demand (m³/d) 280.2 (3.2 L/s)

Table 5

Capacity Checking of Existing Service Reservoirs No. 1 and No. 2

Existing Fresh Water Demand (241)	10853	(m ³ /d)
New Fresh Water Demand	1721	(m ³ /d)
Total Fresh Water Demand	12574	(m ³ /d)
Service Reservoir Capacity Required for Fresh Water System (85% of MOD)	10688	(m ³)
Capacity of Existing Service Reservoirs No. 1 (7,250m ³) & No. 2 (2,992m ³)	10242	(m ³)

(145.5 L/s)

The existing Service Reservoirs No. 1 and No.2 are marginally below capacity (96%). Additional 446m³ volume required to meet 0.85MOD storage suggested by WSD.

Table 6

Capacity Checking of Existing Reservoir Supply Flushing Water (Including both Portable and Flushing Water of Nim Shue Wan Village)

Development	Population	Population Type	Unit Flow Factor (m ³ /person/day)	Water Demand (m ³ /d)
Existing Discovery Bay Developments (241)	25000	Residential	0.07	1750.0
+ the OZP (DB)	4100	School	0.025	102.5
Existing Nim Shue Wan (244)	150	Residential + Service Trade	0.23+0.04+0.07	51.0
New Discovery Bay Development	4003	Residential	0.07	280.2

Total Demand (m³/d) 2183.7 (25.3 L/s)

Capacity Checking of Existing 450mm Dia. Fresh Water Pump Main to Service Reservoir

Total Water Demand (L/s)	Factor of Pump Main	Total Peak Flow (L/s)	Existing Pump Main (mm)	Cross Section Area (mm ²)	Proposed Main Velocity (m/s)
145.5	1.5	218.3	450	158963	1.4

Capacity Checking of Existing 300mm Dia. Water Main of Reservoir

Total Water Demand (L/s)	Factor of Distribution Main	Total Peak Flow (L/s)	Existing Distribution Main (mm)	Cross Section Area (mm ²)	Proposed Main Velocity (m/s)
25.3	2	50.5	300	70650	0.7

Summary of Historic Monthly Rainfall Data Collected from Hong Kong Observatory

Rainfall Data (In mm) for Discovery Bay (from Hong Kong Observatory, HKO)												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2014	0.0	40.0	165.5	139.5	547.0							
2013	1.5	1.0	95.0	223.0	434.5	502.5	329.5	309.0	297.0	0.5	46.0	114.0
2012	50.5	44.0	26.5	338.0	200.0	182.5	443.5	122.0	128.0	63.0	72.5	52.0
2011	7.5	27.0	29.0	47.0	193.5	379.5	182.0	219.5	120.5	115.0	97.5	1.0
2010	27.0	110.0	22.0	128.0	233.0	422.0	306.0	217.5	543.5	19.5	43.5	29.0
2009	0.0	2.5	119.0	143.5	257.5	342.5	321.0	238.0	248.0	10.5	31.5	48.5
2008	40.0	21.5	70.0	188.5	175.5	1204.5	546.0	266.5	165.5	110.5	1.0	8.5
2007	29.5	8.0	25.0	141.5	302.0	509.5	54.5	340.5	116.5	36.5	13.0	16.0
2006	16.5	44.0	58.5	171.5	394.5	382.0	377.0	266.5	230.0	32.5	93.5	15.5
2005	10.0	26.0	41.0	14.5	348.5	587.5	286.0	755.5	146.0	5.5	6.5	5.0
2004	33.5	45.5	77.5	105.0	257.0	184.5	347.5	411.5	79.5	3.5	0.5	0.0
2003	15.0	5.0	75.0	112.5	42.5	474.5	97.0	310.5	346.0	10.0	54.0	1.5
2002	22.5	4.0	111.0	10.5	252.0	162.5	292.5	431.0	446.0	82.5	29.5	70.5
2001	49.0	11.0	60.5	102.0	166.5	785.5	575.5	305.0	413.5	5.5	3.5	42.5
2000	48.5	31.0	45.5	515.0	153.0	279.5	265.0	374.0	88.5	130.5	89.0	51.0

* The driest year with minimum rainfall during a 12-month period is considered, i.e. Oct 2010 to Sep 2011

Summary of Discover Bay Reservoir Volume and Water Levels

Top water level of the Reservoir =	175	mPD	
Invert level of the Reservoir =	125	mPD	i.e. 50m water depth
Total Capacity of the Reservoir =	3,400,000	m ³	
Average surface area of the Reservoir =	68,000	m ²	
Lowest water level of the Reservoir =	168.6	mPD	i.e. 43.6m water depth
(from record data during March 2008 to March 2014)			(Assumed to be min. water level during the driest year in 2010/2011)
By pro-rata, storage volume of the Reservoir at lowest water level of +168.6 mPD =	2,964,800	m ³	
To be very conservative, assume only 50% of the Reservoir volume is available for water supply =	1,482,400	m ³	

Checking of Adequacy of Existing Discovery Bay Reservoir to Meet Existing and New Water Demand during Driest Year

Water Demand Case 1: Only Flushing Water of New DB Development (Areas 6f and 10b) to be Supplied by Discovery Bay Reservoir

Development	Population	Population	Fresh Water /	Unit Flow Factor	Water Demand
Existing Discovery Bay	25000	Residential	Flushing Water	0.07	1750.0
Developments	4100	School	Flushing Water	0.025	102.5
Existing Nim Shue Wan	150	Residential + Service	Fresh & Flush	0.23+0.04+0.07	51.0
New Discovery Bay	4003	Residential	Flushing Water	0.07	280.2
Total Water Demand Required =					2183.7 m ³ /d

(a) Inflow to Discovery Bay Reservoir					
a1.	Runoff collected by catchwater from catchment				
	Total rainfall depth	=	1,297.5	mm	
	Catchment Area	=	120	ha	
	(assume runoff coefficient 0.3)				
	Annual rainfall volume	=	467,100	m ³	
a2.	Direct Rainfall on Reservoir Area				
	Total rainfall depth	=	1,297.5	mm	
	Average surface area of Reservoir	=	68,000	m ²	
	Annual rainfall volume	=	88,230	m ³	
(b) Outflow from Discovery Bay Reservoir					
b1.	Evaporation from Reservoir Surface				
	Annual evaporation rate in 2010 / 2011	=	1380.7	mm	
	Reservoir top surface	=	18	ha	(very conservative assumption)
	Annual evaporation volume	=	248,526	m ³	
b2.	Water demand from Existing and Proposed New Development (Water Demand Case 1)				
	Daily total water demand	=	2,184	m ³	
	Annual water demand	=	797,054	m ³	

Remaining Volume of Discovery Bay Reservoir				
Reservoir Volume	+	Inflow volume	-	Outflow volume
1,482,400 m ³		555,330 m ³		1,045,580 m ³
				= 992,150 m ³
(Therefore Reservoir has adequate volume to meet water demand)				

Development	Population	Population	Fresh Water /	Unit Flow Factor	Water Demand
Existing Discovery Bay	25000	Residential	Flushing Water	0.07	1750.0
Developments	4100	School	Flushing Water	0.025	102.5
Existing Nim Shue Wan (244)	150	Residential + Service Trade	Fresh & Flushing Water	0.23+0.04+0.07	51.0
New Discovery Bay	4003	Residential + Service	Fresh &	0.39+0.04+0.07	2001.5

(a) Inflow to Discovery Bay Reservoir

- (b) Outflow from Discovery Bay Reservoir**

- ### Remaining Volume of Discovery Bay Reservoir

$$\begin{array}{rclcl} \text{Reservoir Volume} & + & \text{Inflow volume} & - & \text{Outflow volume} \\ 1,482,400 \text{ m}^3 & & 555,330 \text{ m}^3 & & 1,673,851 \text{ m}^3 \\ & & & & = 363,879 \text{ m}^3 \end{array}$$

(Therefore Reservoir has adequate volume to meet water demand)