For discussion **PWSC(2019-20)1**
on 9 April 2019

ITEM FOR PUBLIC WORKS SUBCOMMITTEE OF FINANCE COMMITTEE

HEAD 705 – CIVIL ENGINEERING
Civil Engineering – Multi-purpose
50CG – Provision of an Additional District Cooling System at the Kai Tak Development

Members are invited to recommend to the Finance Committee the upgrading of **50CG** entitled "Provision of an Additional District Cooling System at the Kai Tak Development" to Category A at an estimated cost of $4,269.3 million in money-of-the-day prices.

PROBLEM

There is a need to provide an additional District Cooling System (DCS) at the Kai Tak Development (KTD) to meet a significant increase in the projected cooling demand.

PROPOSAL

2. The Director of Electrical and Mechanical Services, with the support of the Secretary for the Environment, proposes to upgrade **50CG** to Category A at an estimated cost of $4,269.3 million in money-of-the-day (MOD) prices for the provision of an additional DCS to meet the increase in cooling demand.

/PROJECT …..

PROJECT SCOPE AND NATURE

3. The proposed scope of the project comprises -

(a) a chiller plant cum seawater pump room;

(b) seawater pipework;

(c) chilled water pipework; and

(d) connection facilities at user buildings including the New Acute Hospital (NAH), adjacent commercial areas at Area 3 at the KTD, the Kai Tak Sports Park (KTSP), as well as the Animal Management and Animal Welfare Building Complex.

4. The estimated cooling capacity of the proposed additional DCS is about 178 megawatt of refrigeration (MW) which can serve an estimated total additional public and private non-domestic air-conditioned floor areas of about 811 000 m^2.

5. Subject to funding approval of the Finance Committee (FC), we plan to commence construction of the proposed works in the fourth quarter of 2019. Operation of the additional DCS is planned to commence in 2022-23 to tie in with the commissioning of the developments, and the entire project is planned for completion by end 2028. A layout plan showing the main construction works and pipe network of the proposed project is at Enclosure 1, and a preliminary schedule for the provision of district cooling services is at Enclosure 2.

JUSTIFICATION

Need for an additional DCS

6. The cooling capacity of the existing DCS was designed during the initial development of KTD in 2008. Since then, the Electrical and Mechanical Services Department (EMSD) has been monitoring closely new developments, and decided in 2017 that the existing DCS would not be able to meet the growth in projected cooling demand of user buildings including the NAH; the addition of total commercial floor area of about 400 000 m^2 arising from the increase in development intensity of KTD as announced in the 2017 Policy Address; and the KTSP.

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7. From an energy efficiency perspective, it will not be desirable if each of these developments has to develop its own air-conditioning system to meet the shortfall. EMSD therefore proceeded with the planning and preliminary design of an additional DCS, and confirmed that the proposed project was technically and financially viable.

Environmental and other benefits

8. A DCS is an energy-efficient air-conditioning system, consuming 35% and 20% less electricity as compared with traditional air-cooled air-conditioning systems and individual water-cooled air-conditioning systems using cooling towers (WACS) respectively. It is more cost-effective to develop a DCS in a new development or redeveloped area, as its pipe network may be laid without disrupting existing road and building users. For these reasons, the use of DCS was adopted for the KTD at the early stage of its development.

9. The additional DCS at the KTD will bring about significant environmental benefits. Upon full utilisation, the project is estimated to save about 53 million kilowatt-hour of electricity a year, corresponding to an annual reduction of about 37 000 tonnes of carbon dioxide emission.

10. Apart from energy saving, the additional DCS will also bring about the following benefits –

(a) reduction in users' upfront capital cost, as chiller plants are not required at user buildings. The reduction is about 5% to 10% of the total building cost;

(b) more flexible building designs for user buildings;

(c) reduced heat island effects at KTD, and no noise and vibration arising from the operation of heat rejection equipment and chillers of air-conditioning plants, as such equipment will not be required in user buildings; and

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(d) a more adaptable air-conditioning system as compared to individual air-conditioning systems. Individual buildings can adjust their cooling capacity to meet air-conditioning demands without having to carry out extensive modification or retrofitting works.

11. DCS requires water for heat rejection and should better be located near a water source. The proposed additional DCS plant will be located adjacent to the Kai Tak Nullah next to the Desilting Compound at Site 1P1 as shown at Enclosure 1. The DCS plant will draw water from the Desilting Compound for heat rejection, which will help reduce the construction cost of the project.

Ensuring timely implementation

12. We need to proceed with the proposed works in order to provide timely cooling service to facilities in the KTD that will be in operation from 2022-23. Having regard to the experience of the existing DCS, we will tender the core works for the additional DCS under a "Design, Build and Operate" (DBO) contract. Tasking the selected contractor with the detailed design and construction works will help expedite the project to tie in with the commissioning of the developments. Incorporating the operating requirements into the design of the DCS will also facilitate smooth commissioning and operations as well as subsequent management and maintenance of the facilities.

13. To tie-in with the programme of upcoming road construction works and to avoid having to re-open newly completed roads for pipe laying works of the additional DCS, EMSD will entrust the works for pipe laying at Trunk Road T2, Road L9 and Road D1 to the Civil Engineering and Development Department (CEDD), which is responsible for building those roads.

FINANCIAL IMPLICATIONS

14. We estimate the capital cost of the proposed works to be $4,269.3 million in MOD prices, broken down as follows –

			$ million (in MOD Prices)
(a)	DCS plant buildings		713.8
(b)	Civil and pipe laying works		744.5
(c)	Electrical and mechanical installation and associated plant equipment		1,609.2
(d)	Connection facilities at user buildings		397.8
(e)	Environmental mitigation measures		42.5
(f)	Additional energy conservation measures		5.3
(g)	Consultants' fees		19
	made up of fees for -		
	(i) contract administration	*8.4*	
	(ii) management of resident site staff (RSS)	*10.6*	
(h)	Remuneration of RSS		349.1
(i)	Contingencies		388.1
	Total		4,269.3

A detailed breakdown of the estimates for the consultants' fees and RSS costs by man-month is at Enclosure 3.

15. Subject to approval, we plan to phase the expenditure of the works as follows –

Year	**$ million (MOD)**
2019 – 2020	59.1
2020 – 2021	465.2
2021 – 2022	843.2
2022 – 2023	603.3

/**Year** …..

Year	$ million (MOD)
2023 – 2024	766.4
2024 – 2025	466.2
2025 – 2026	401.7
2026 – 2027	259.8
2027 – 2028	174.7
2028 – 2029	158.9
2029 – 2030	70.8
	4,269.3

16. We have derived the MOD estimates on the basis of the Government's latest set of assumptions on the trend rate of change in the prices of public sector building and construction output for the period from 2019 to 2030. The contract will provide adjustments for price fluctuations as appropriate.

17. The estimates of the recurrent costs arising from this project are at Enclosure 4. The District Cooling Services Ordinance (Cap. 624), which came into force in March 2015, provides that the recurrent costs arising from this project, including the operation and maintenance fees for engaging a contractor and utility charges for operating the DCS plants, be offset by the district cooling services charges collected. The Ordinance also sets out the tariff level and the adjustment mechanism.

18. The tariff for using the existing DCS at KTD has been set at a competitive level, comparable to the cost of using WACS, and WACS is one of the most cost-effective air-conditioning systems available in the market. EMSD's preliminary assessment shows that the additional DCS is financially viable, as the capital and operating costs for the additional DCS can be recovered through charges collected from its consumers, which would include notional costs payable by the Government bureaux or departments concerned, over the project life of 30 years. The estimated unit cost of air-conditioning provided by the additional DCS for all types of buildings is lower than that of WACS.

PUBLIC CONSULTATION

19. We have consulted the following parties. They all supported the provision of the additional DCS at the KTD –

(a) the Wong Tai Sin District Council on 6 November 2018;

(b) the Housing and Infrastructure Committee of the Kowloon City District Council on 8 November 2018;

(c) the Environment and Hygiene Committee of the Kwun Tong District Council on 27 November 2018; and

(d) the Subcommittee on Energy Efficiency and Conservation and Renewable Energy under the Energy Advisory Committee on 1 February 2019.

20. EMSD briefed the Task Force on Kai Tak Harbourfront Development (the Task Force) on the additional DCS project on 15 January 2019. The Task Force acknowledged the operational need and environmental merits of the additional DCS. It also proposed improving the façade design of the plant building, minimising the building footprint and housing multiple uses on the same site. EMSD will take into account their views in preparing the tender document. It will consult the Task Force again when a more detailed design is available.

21. We consulted the Legislative Council Panel on Development on 26 February 2019. The Panel had no objection to our submitting the funding proposal to the Public Works Subcommittee (PWSC) for consideration. There were enquiries from some Members on the project cost and charges to be collected. In response to the enquiries, we provided supplementary information to the Panel on 1 April 2019.

22. We gazetted the proposed works for the seawater intake and outfalls for the additional DCS under the Foreshore and Seabed (Reclamations) Ordinance (Cap. 127) on 4 January 2019. Upon expiry of the two-month gazette notification period on 4 March 2019, no objection was received. The notice on the authorisation of the proposed works under section 7 of Foreshore and Seabed (Reclamations) Ordinance was gazetted on 22 March 2019.

ENVIRONMENTAL IMPLICATIONS

23. The project is not a designated project under Schedule 2 of the Environmental Impact Assessment Ordinance (Cap. 499). We have completed the Preliminary Environment Review (PER) for the project. The PER has concluded, and the Director of Environmental Protection has agreed, that the project would not cause adverse environmental impacts with the implementation of the recommended environmental mitigation measures which include acoustic louvres and silencers to mitigate operational fixed plant noise.

24. For mitigating short-term construction impacts, we will implement measures recommended in the PER to control noise, dust and site run-off nuisances, in order to comply with established standards and guidelines. These measures include the use of quality powered mechanical equipment, movable noise barriers, noise enclosure and acoustic mats for noisy construction activities, frequent cleansing and watering of the site, and provision of wheel-washing facilities. We will also carry out site inspections to ensure that these mitigation measures and good site practices are properly followed and implemented. We have included in the project estimates the cost for the implementation of these mitigation measures.

25. At the planning and design stages, we will consider the piping alignment, design level and construction method of the proposed works to avoid generating construction waste where possible. In addition, we will require the contractor to reuse inert construction waste (e.g. excavated soil) on site or in other suitable construction sites as far as possible, in order to minimise the disposal of inert construction waste at public fill reception facilities[1]. We will encourage the contractor to maximise the use of recycled or recyclable inert construction waste, and the use of non-timber formwork to avoid generating construction waste.

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[1] Public fill reception facilities are specified in Schedule 4 of the Waste Disposal (Charges for Disposal of Construction Waste) Regulation (Cap. 354N). Disposal of inert construction waste in public fill reception facilities requires a licence issued by the Director of Civil Engineering and Development.

26. At the construction stage, we will require the contractor to submit for approval a plan setting out the waste management measures, which will include appropriate mitigation means to avoid, reduce, reuse and recycle inert construction waste. We will ensure that the operations on site comply with the approved plan. We will require the contractor to separate inert and non-inert construction wastes on site for disposal at appropriate facilities. We will control the disposal of inert construction waste and non-inert construction waste at public fill reception facilities and landfills respectively through a trip-ticket system.

27. We estimate that the proposed works will generate about 306 000 tonnes of construction waste. Of this, we will reuse about 216 810 tonnes (70.8 %) of inert construction waste on site and deliver about 88 380 tonnes (28.9%) of inert construction waste to public fill reception facilities for subsequent reuse. We will dispose of the remaining 810 tonnes (0.3%) of non-inert construction waste at landfills. The total cost for disposal of construction waste at public fill reception facilities and landfill sites is estimated to be about $6.4 million for the proposed works (based on a unit charge rate of $71 per tonne for disposal at public fill reception facilities and $200 per tonne at landfills, as stipulated in the Waste Disposal (Charges for Disposal of Construction Waste) Regulation (Cap. 354N)).

28. The Government will continue to take the lead in promoting green building. We target to achieve the second highest rating under BEAM Plus for the DCS plant building which will also incorporate green features and renewable energy systems such as photovoltaic panel systems. In addition, we have considered the adoption of greenery. The proposed plant building roof greening ratio will be over 20% of the roof area and the overall greening ratio will be over 30% of the overall site area.

ENERGY CONSERVATION MEASURES

29. Apart from being an energy-efficient air-conditioning system itself, the additional DCS is designed to include various forms of energy efficient features and renewable energy technologies, including –

(a) light-emitting diode (LED) general lighting and occupancy sensors for lighting control;
(b) LED type exit signs; and
(c) a photovoltaic system.

30. Regarding greening features, there will be landscaping, roof greening and vertical greening in appropriate areas for environmental and amenity benefits.

31. The estimated additional cost for adopting the above features is around $5.3 million, including $0.7 million for energy efficient features. The total cost has been included in the cost estimate of the project. The energy efficient features will achieve 5% energy saving in the annual energy consumption of building services in the plantrooms, with a payback period of about seven years.

HERITAGE IMPLICATIONS

32. The project will not affect any heritage site, i.e. all declared monuments, proposed monuments, graded historic sites/buildings, sites of archaeological interest and government historic sites identified by the Antiquities and Monuments Office (AMO). As part of the alignment of DCS pipes is located within the area of relatively low archaeological potential that was identified in the Archaeological Field Investigation conducted by CEDD in 2015, we will consult AMO to formulate and implement necessary mitigation measures to minimise any adverse archaeological impact.

LAND ACQUISITION

33. The proposed works do not require any resumption of private land.

BACKGROUND INFORMATION

34. We upgraded **50CG** to Category B in September 2017.

35. The proposed works will involve tree preservation and removal proposals. The proposed construction of the project will require the removal of seven trees. None of the trees to be removed are important trees[2]. To compensate the number of tree to be removed, we will incorporate planting proposals of the same number of removed trees as part of the project.

36. We estimate that the proposed project as a whole will create about 335 jobs (285 for labourers and another 50 for professional or technical staff) providing a total employment of 20 300 man-months.

Environment Bureau
April 2019

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[2] "Important trees" refer to trees in the Register of Old and Valuable Trees, or any other trees that meet one or more of the following criteria –

(a) trees of 100 years old or above;

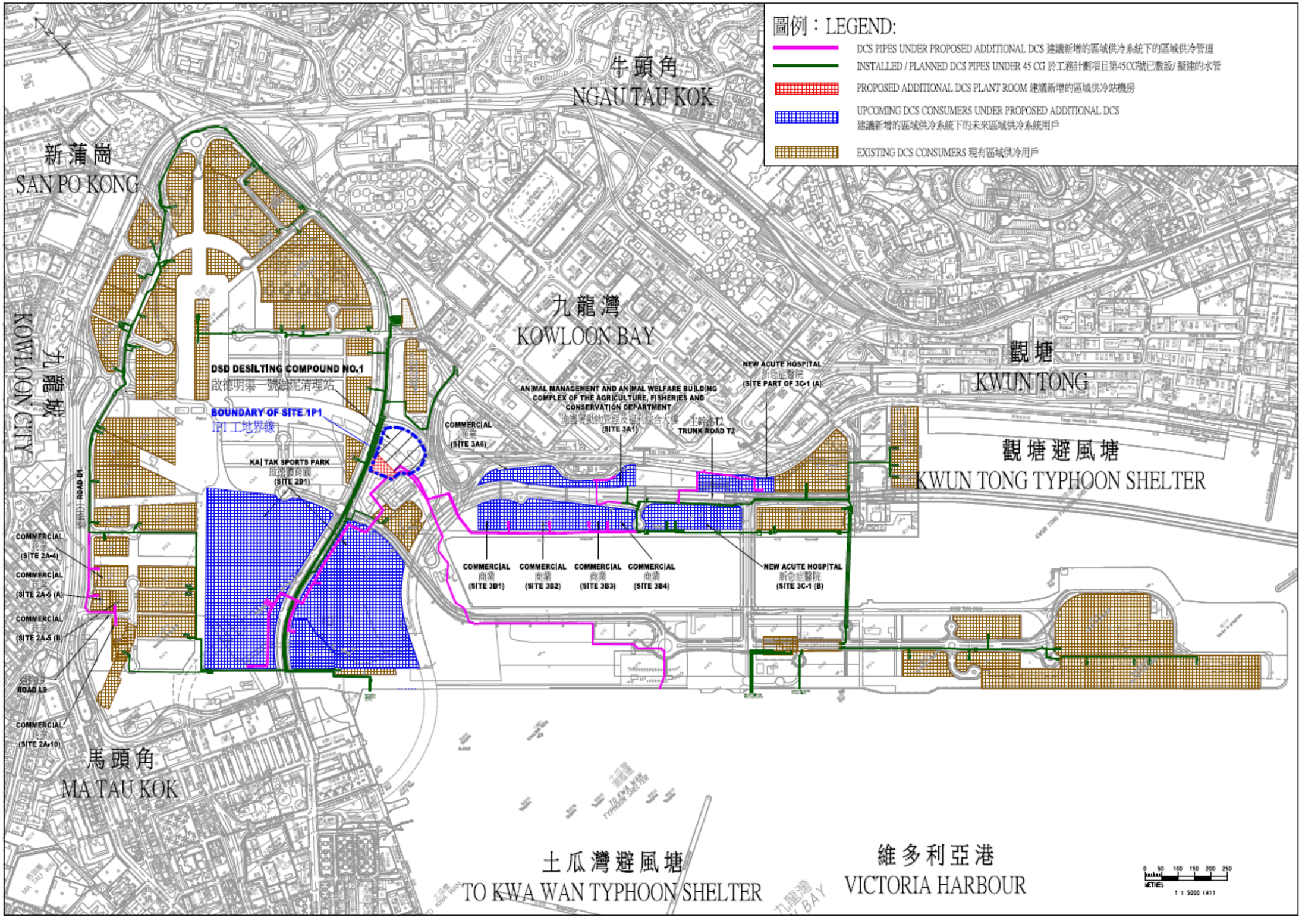
(b) trees of cultural, historical or memorable significance e.g. Fung Shui tree, tree as landmark of monastery or heritage monument, and trees in memory of an important person or event;

(c) trees of precious or rare species;

(d) trees of outstanding form (taking account of overall tree sizes, shape and any special features) e.g. trees with curtain like aerial roots, trees growing in unusual habitat; or

(e) trees with trunk diameter equal or exceeding 1.0 metre (m) (measured at 1.3 m above ground level), or with height/canopy spread equal or exceeding 25 m.

Common trees refer to trees not classified as "important trees".


圖例：LEGEND:
DCS PIPES UNDER PROPOSED ADDITIONAL DCS 建議新增的區域供冷系統下的區域供冷管道
INSTALLED / PLANNED DCS PIPES UNDER 45 CG 於工務計劃項目第45CG號已敷設/ 擬建的水管
PROPOSED ADDITIONAL DCS PLANT ROOM 建議新增的區域供冷站機房
UPCOMING DCS CONSUMERS UNDER PROPOSED ADDITIONAL DCS
建議新增的區域供冷系統下的未來區域供冷系統用戶
EXISTING DCS CONSUMERS 現有區域供冷用戶
新蒲崗
SAN PO KONG
牛頭角
NGAU TAU KOK
九龍灣
KOWLOON BAY
觀塘
KWUN TONG
觀塘避風塘
KWUN TONG TYPHOON SHELTER
九龍城
KOWLOON CITY
馬頭角
MA TAU KOK
土瓜灣避風塘
TO KWA WAN TYPHOON SHELTER
維多利亞港
VICTORIA HARBOUR
DSD DESILTING COMPOUND NO.1
啟德明渠一號總淤清理站
BOUNDARY OF SITE 1P1
1P1 工地界線
KAI TAK SPORTS PARK
啟德體育園
(SITE 2D1)
ANIMAL MANAGEMENT AND ANIMAL WELFARE BUILDING COMPLEX OF THE AGRICULTURE, FISHERIES AND CONSERVATION DEPARTMENT
漁護署動物管理及福利綜合大樓
(SITE 3A1)
COMMERCIAL
商業
(SITE 3A5)
TRUNK ROAD T2
NEW ACUTE HOSPITAL
(SITE PART OF 3C-1 (A)
COMMERCIAL
商業
(SITE 3B1)
COMMERCIAL
商業
(SITE 3B2)
COMMERCIAL
商業
(SITE 3B3)
COMMERCIAL
商業
(SITE 3B4)
NEW ACUTE HOSPITAL
新急症醫院
(SITE 3C-1 (B)
COMMERCIAL
(SITE 2A-4)
COMMERCIAL
(SITE 2A-5 (A)
COMMERCIAL
(SITE 2A-5 (B)
ROAD L9
COMMERCIAL
(SITE 2A-10)
ROAD D1
1 : 5000 (A1)

Provision of an Additional District Cooling System (DCS)
at the Kai Tak Development (KTD)

Schedule of Provision of DCS

Site	Usage	Year of DCS Provision
2A-4, 2A-5(A), 2A-5(B), 2A-10	Commercial	2023
2D1	Kai Tak Sports Park	2022
3A1	Animal Management and Animal Welfare Building Complex of the Agriculture, Fisheries and Conservation Department	2022
3A6, 3B1, 3B2, 3B3, 3B4	Commercial	2025-2028
Part of 3C-1 (A)	New Acute Hospital	2024
3C-1 (B)	New Acute Hospital	2024

[Note:
Year of DCS provision to commercial sites is subject to the development schedule of the sites.]

50CG – Provision of an Additional District Cooling System at the Kai Tak Development

Breakdown of the estimates for consultants' fees and resident site staff costs for 50CG (in September 2018 prices)

			Estimated man-months	Average MPS* salary point	Multiplier (Note 1)	Estimated fee ($million)
(a)	Consultants' fees for contract administration	Professional	24	38	2.0	3.9
		Technical	48	14	2.0	2.8
					Sub-total:	6.7#
(b)	Resident site staff (RSS) costs (Note 2)	Professional	829	38	1.6	108.7
		Technical	3840	14	1.6	176.5
					Sub-total:	285.2
	– Comprising –					
	(i) Consultant's fees for management of RSS			8.4#		
	(ii) Remuneration of RSS			276.8#		
					Total:	**291.9**

* MPS = Master Pay Scale

Notes

1. A multiplier of 2.0 is applied to the average MPS salary point to estimate the cost of staff to be employed in the consultants' offices. A multiplier of 1.6 is applied to the average MPS salary point to estimate the cost of RSS supplied by the consultants (as at now, MPS salary point 38 = $81,975 per month, and MPS salary point 14 = $28,725 per month).
2. The actual man-months and actual costs will only be known after the completion of the construction works.

Remarks

The cost figures in this Enclosure are shown in constant prices to correlate with the MPS salary point of the same year. The figures marked with # are shown in money-of-the-day prices in paragraph 14 of the main paper.

50CG – Provision of an Additional District Cooling at the Kai Tak Development

Estimated recurrent costs (in MOD prices)

Year	Estimated recurrent costs* $ million
2022 – 2023	18.3
2023 – 2024	39.1
2024 – 2025	37.7
2025 – 2026	22.7

* As provided in the District Cooling Services Ordinance (Cap. 624), charges and fees received for the provision of district cooling services are used to settle the operation and maintenance fees for a DCS operator as well as utility costs for operating the DCS plants. Therefore, the estimated recurrent cost shown in the table above is the shortfall in income to meet the operating expenses incurred, taking into account the charges and fees received in that particular year. The price adjustment factor adopted for converting charges/fees received and operating expenses incurred in September 2019 prices to MOD price is based on the assumption of a 2% increase per annum from 2019 to 2026. It is estimated that starting from 2026-27, the charges and fees received would be sufficient to settle all the operation and maintenance fees for the DCS operator as well as utility costs for operating the DCS plants. Referring to the planned schedule to provide DCS to user buildings as shown at Enclosure 2, the investment cost for the additional district cooling system can be paid back in 30 years.