For discussion **PWSC(2017-18)7**
on 31 May 2017

ITEM FOR PUBLIC WORKS SUBCOMMITTEE OF FINANCE COMMITTEE

HEAD 709 – WATERWORKS
Water Supplies – Fresh water supplies
356WF – Uprating of Tung Chung fresh water supply system
363WF – Upgrading of disinfection facilities in water treatment works
357WF – Design and construction for first stage of desalination plant at Tseung Kwan O

Members are invited to recommend to the Finance Committee –

(a) the upgrading of **356WF** and **363WF** to Category A at estimated costs of $300.2 million and $875.6 million in money-of-the-day (MOD) prices respectively;

(b) the upgrading of part of **357WF**, entitled "Design and construction for first stage of desalination plant at Tseung Kwan O – mainlaying", to Category A at estimated cost of $720.5 million in MOD prices; and

(c) the retention of the remainder of **357WF** in Category B.

PROBLEM

We need to carry out the following waterworks projects related to fresh water supplies –

/(a) …..

(a) **356WF** to carry out uprating works for the Tung Chung fresh water supply system to cope with the anticipated increase in fresh water demand in Tung Chung New Town and enhance the reliability of the existing system;

(b) **363WF** to upgrade the disinfection facilities in water treatment works (WTWs) to eliminate the risk of chlorine gas leakage associated with the transportation and storage of liquid chlorine, and hence resulting in enhancement of the safety of the disinfection operation; and

(c) Part of **357WF** to develop a strategic alternative water resource by seawater desalination which is not susceptible to climate change to safeguard water security in Hong Kong.

PROPOSAL

2. The Director of Water Supplies, with the support of the Secretary for Development, proposes to upgrade the following projects to Category A –

(a) **356WF** at an estimated cost of $300.2 million in MOD prices for the uprating of Tung Chung fresh water supply system;

(b) **363WF** at an estimated cost of $875.6 million in MOD prices for the upgrading of disinfection facilities in WTWs; and

(c) part of **357WF** at an estimated cost of $720.5 million in MOD prices for the laying of the water main to convey the fresh water produced at a proposed desalination plant at Tseung Kwan O (TKO) to the TKO fresh water primary service reservoir.

PROJECT SCOPE AND NATURE

3. Details of the above three projects are provided at Enclosures 1 to 3 respectively.

/4. …..

4. On 10 April 2017, we issued PWSC(2017-18)1 to invite Members to recommend to the Finance Committee the upgrading of the above three projects to Category A. This paper supersedes PWSC(2017-18)1 which has yet to be discussed by the Public Works Subcommittee. Details on the proposed upgrading of part of **357WF**, including the estimated cost, breakdown and phasing of expenditure of the project, are updated at Enclosure 3 to this paper.

Development Bureau
May 2017

356WF – Uprating of Tung Chung fresh water supply system

PROJECT SCOPE AND NATURE

The scope of the proposed works comprises –

(a) construction of Tung Chung No. 2 fresh water service reservoir with a capacity of 40 000 cubic metres (m^3); and

(b) associated geotechnical works, landscaping works and water main connection works[1].

2. The layout plan showing the proposed works is at Annex 1 to Enclosure 1.

3. Subject to the funding approval of the Finance Committee (FC), we plan to commence the proposed works in the third quarter of 2017 for completion in the second quarter of 2020. In order to meet the tight schedule, we will invite tenders in parallel to enable early commencement of the proposed works. Tender will only be awarded after obtaining FC's funding approval.

JUSTIFICATION

4. The existing Tung Chung fresh water service reservoir supplying fresh water to Tung Chung New Town and the Hong Kong International Airport has a storage capacity of 41 700 m^3. In order to cope with the increasing water demand arising from the proposed housing and commercial developments in Tung Chung New Town in 2020 and enhance the reliability of the existing system, we propose to construct a new service reservoir with a storage capacity of 40 000 m^3. Upon completion of the proposed works in 2020, the total storage capacity of Tung Chung and Tung Chung No. 2 fresh water service reservoirs will be increased to 81 700 m^3 and would be able to meet the projected daily demand of about 80 600 m^3 per day in 2020.

/FINANCIAL …..

---

[1] The water main connection works refer to the works for connecting the proposed Tung Chung No. 2 fresh water service reservoir to the inlet and outlet pipes of the existing Tung Chung fresh water service reservoir.

FINANCIAL IMPLICATIONS

5. We estimate the cost of the proposed works to be $300.2 million in MOD prices (please see paragraph 7 below), broken down as follows –

		$ million	
(a)	Construction of service reservoir	174.4	
(b)	Associated geotechnical works, landscaping works and water main connection works	39.6	
(c)	Mechanical and electrical works	4.9	
(d)	Environmental mitigation measures	3.0	
(e)	Consultants' fees for advisory services for New Engineering Contract (NEC) [2] Administration	3.5	
(f)	Contingencies	22.3	
	Sub-total	247.7	(in September 2016 prices)
(g)	Provision for price adjustment	52.5	
	Total	300.2	(in MOD prices)

6. While the construction of the proposed works will be supervised by in-house staff, we plan to engage consultants to provide advisory services for NEC administration for the project. A detailed breakdown of the estimate for the consultants' fees by man-months is at Annex 2 to Enclosure 1.

/7. …..

[2] NEC is a suite of contracts developed by the Institution of Civil Engineers, United Kingdom. It is a contract form that emphasises cooperation, mutual trust and collaborative risk management between contracting parties.

7. Subject to funding approval, we will phase the expenditure as follows –

Year	$ million (Sept 2016)	Price adjustment factor	$ million (MOD)
2017 – 2018	4.2	1.05750	4.4
2018 – 2019	50.1	1.12095	56.2
2019 – 2020	88.5	1.18821	105.2
2020 – 2021	70.5	1.25950	88.8
2021 – 2022	34.4	1.32562	45.6
	247.7		300.2

8. 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 2017 to 2022. We will deliver the proposed works under an NEC form of contract with provision for price adjustment.

9. We estimate the additional annual recurrent expenditure arising from this project to be $432,000.

10. The project will lead to an increase in the production cost of fresh water by 0.06% in real terms by 2022[3].

PUBLIC CONSULTATION

11. We consulted the Islands District Council on 20 February 2017. Members supported the proposed works.

/12 …..

[3] The increase in production cost of water is calculated at the 2017-18 price level and on the assumption that the water demand remains static and all other factors remain constant during the period from 2017 to 2022.

12. We consulted the Legislative Council Panel on Development (the Panel) on 28 March 2017. Members generally supported our submission of the funding proposal to the Public Works Subcommittee (PWSC) for consideration. Supplementary information on the usage of the proposed service reservoir rooftop, manpower planning and NEC was provided to the Panel on 7 April 2017.

ENVIRONMENTAL IMPLICATIONS

13. Although this is not a designated project under the Environmental Impact Assessment Ordinance (Cap. 499), we have carried out a Preliminary Environmental Review (PER) which concluded and the Director of Environmental Protection agreed that the project would not have any long-term environmental impacts. We will incorporate the mitigation measures recommended in the PER into the works contract to control the environmental impacts arising from the construction works to within established standards and guidelines. These measures include frequent watering of the site, provision of wheel-washing facilities, covering of materials on trucks and use of silenced construction plant. We have included in paragraph 5(d) above a sum of $3 million (in September 2016 prices) in the project estimate for the implementation of these environmental mitigation measures.

14. At the planning and design stages, we have optimised the design and layouts to reduce the generation of construction waste. In addition, we will require the contractor to reuse inert construction waste (e.g. demolished concrete and excavated soil and rock) on site or in other suitable construction sites as far as possible, in order to minimise the disposal of inert construction waste to public fill reception facilities[4]. We will encourage the contractor to maximise the use of recycled or recyclable inert construction waste, and the use of non-timber formwork to further reduce the generation of construction waste.

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

/16……

---

[4] 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.

16. We estimate that the proposed works will generate in total 86 700 tonnes of construction waste. Of these, we will reuse 8 500 tonnes (10%) of inert construction waste on site and deliver 73 560 tonnes (85%) of inert construction waste to public fill reception facilities for subsequent reuse. We will dispose of the remaining 4 640 tonnes (5%) of non-inert construction waste at landfills. The total cost for accommodating construction waste at public fill reception facilities and landfills is estimated to be $6.2 million for this project (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)).

HERITAGE IMPLICATIONS

17. The proposed works will not affect any heritage site, i.e. all declared monuments, proposed monuments, graded historic sites or buildings, sites of archaeological interest and government historic sites identified by the Antiquities and Monuments Office.

LAND ACQUISITION

18. The proposed works do not involve resumption of private land.

TRAFFIC IMPLICATIONS

19. We have carried out a traffic review for the proposed works. It concluded that the proposed works would not cause any significant impact on the traffic during the construction and operation stages.

BACKGROUND

20. We upgraded **356WF** to Category B in September 2014.

21. In September 2015, we engaged contractors to carry out ground investigation and engaged consultants to undertake the landscape design for the proposed works at an estimated cost of $2.5 million in MOD prices. We have charged this amount to block allocation **Subhead 9100WX** "Waterworks, studies and investigations for items in Category D of the Public Works Programme".

/22. ……

22. We have substantially completed the detailed design of the proposed works using in-house resources.

23. Of the 614 trees within the project boundary, 66 trees will be preserved and 548 trees will be felled. All trees to be removed are not important trees[5]. We will incorporate planting proposals as part of the project, including estimated quantities of 348 trees and 5 944 square metres of grassed area.

24. We estimate that the proposed works will create about 100 jobs (90 for labourers and 10 for professional or technical staff) providing a total employment of 3 000 man-months.

---

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

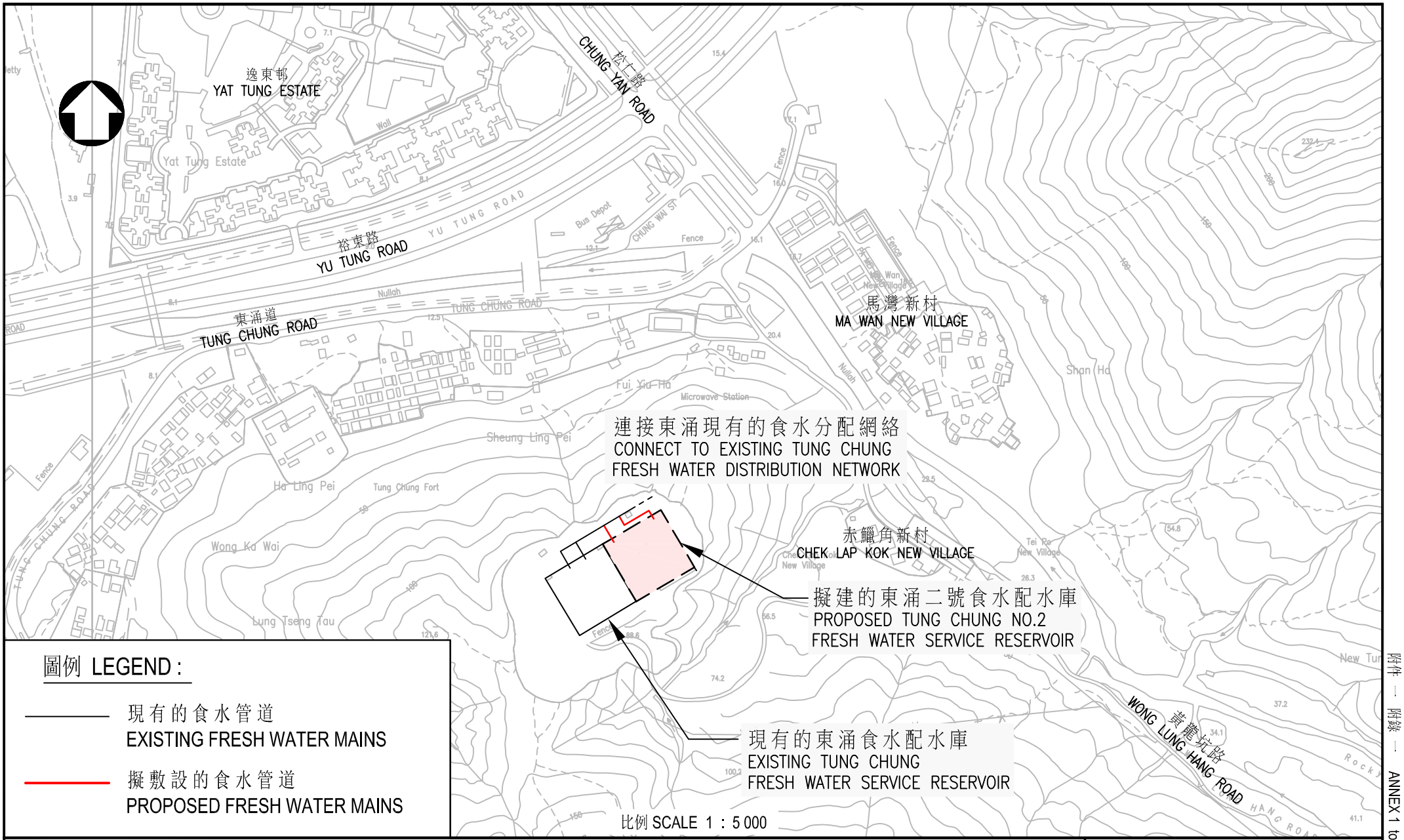
(a) trees of 100 years old or above;

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

(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 to or exceeding 1.0 metre (m) (measured at 1.3 m above ground level), or with height or canopy spread equal to or exceeding 25 m.



工務計劃項目第 356WF 號 -- 東涌食水系統提升工程

P.W.P. Item No. 356WF ---- Uprating of Tung Chung Fresh Water Supply System

水務署
WATER SUPPLIES DEPARTMENT

草圖編號 SKETCH NO. 62017 / 010

REF. 62017-010_REV04.DWG

附件一 附錄一 ANNEX 1 to ENCLOSURE 1

356WF – Uprating of Tung Chung fresh water supply system

Breakdown of the estimates for consultants' fees (in September 2016 prices)

Consultant's staff costs		Estimated man-months	Average MPS* salary point	Multiplier (Note 1)	Estimated fee ($ million)
(a) Consultants' fees for advisory services for NEC administration (Note 2 & 3)	Professional	16	38	2.0	2.5
	Technical	19	14	2.0	1.0
				Total	3.5

*MPS = Master Pay Scale

Notes

1. A multiplier of 2.0 is applied to the average MPS salary point to arrive at the full staff costs including the consultants' overheads and profit, as the staff will be employed in the consultants' offices (as at now, MPS point 38 = $77,320 per month and MPS point 14 = $26,700 per month).

2. The consultants' staff costs for advisory services for NEC administration are based on the estimates prepared by the Director of Water Supplies. The actual man-months and fees will only be known when we have selected the consultants through the usual competitive fee bidding system.

3. WSD will deploy in-house staff to supervise the construction of the proposed works. The fees in (a) above will be used for engaging consultants to provide advisory services for WSD's detailed arrangements for NEC administration.

363WF – Upgrading of disinfection facilities in water treatment works

PROJECT SCOPE AND NATURE

The scope of the proposed works comprises –

(a) supply and installation of chlorine generation plant in 11 major WTWs [1] and Tai Lam Chung No. 2 Chlorination Station[2]; and

(b) associated civil, geotechnical and electrical and mechanical (E&M) works[3].

2. A plan showing the locations of the WTWs and Tai Lam Chung No. 2 Chlorination Station is at Annex 1 to Enclosure 2.

3. Subject to funding approval of the FC, we plan to commence the proposed works in the third quarter of 2017 for completion in the fourth quarter of 2020. In order to meet the tight schedule, we will invite tenders in parallel to enable early commencement of the proposed works. Tender will only be awarded after obtaining FC's funding approval.

JUSTIFICATION

4. The use of chlorine gas for disinfection of drinking water has been proven internationally as effective, safe and reliable. Since there are no chlorine gas suppliers in Hong Kong, the Water Supplies Department (WSD) has been importing chlorine gas in liquid form from Guangdong Province, which is transported to WTWs for storage and use in order to sustain daily disinfection operation. The transportation and storage processes of liquid chlorine have been

/subject .....

[1] The 11 major WTWs, which are of nominal output capacity not less than 100 000 cubic metres per day, include Au Tau WTW, Ma On Shan WTW, Ngau Tam Mei WTW, Pak Kong WTW, Sha Tin WTW, Sheung Shui WTW, Silver Mine Bay WTW, Siu Ho Wan WTW, Yau Kom Tau WTW, Tsuen Wan WTW and Tuen Mun WTW.

[2] At the Tai Lam Chung No. 2 Chlorination Station, chlorine is dosed in the raw water supply from Tai Lam Chung Reservoir to effectively control the quality of the raw water before transferring to Tuen Mun WTW and Tsuen Wan WTW, and through a long submarine main to Siu Ho Wan WTW at the North Lantau.

[3] The associated E&M works include provision of raw material preparation systems, products treatment systems, and electricity supply and automatic control systems.

subject to a stringent quantitative risk assessment, and adequate safety measures have been adopted to ensure safety and reliability of the disinfection operation.

5. With advancement of technology, chlorine generation facilities have become more mature and reliable. The ever-improving membrane technology in recent years has rendered a chlorine generation plant to be accommodated in more compact space, and enhanced the cost-effectiveness of such facilities. WSD has carried out a study on generation of chlorine using the technology of membrane electrolysis. It has revealed that the chlorine generation facilities are suitable to be installed in the WTWs of Hong Kong and Tai Lam Chung No. 2 Chlorination Station to do away with transportation and storage arising from importation of liquid chlorine, and thus eliminating the risk of chlorine gas leakage associated with the transportation and storage of liquid chlorine, resulting in enhancement of the safety of the disinfection operation. The new system shall also be more cost-effective than the current system of using imported liquid chlorine.

6. The chlorine generation process proposed is to produce chlorine gas by electrolyzing brine through electrodes separated by a membrane. The production process is safe and reliable. Chlorine gas will be generated according to the demand and consumed immediately upon production. As storage of chlorine gas will no longer be required, upon completion of proposed works, the risk of storage will be eliminated. WSD has also conducted risk assessment on the operation of the chlorine generation facilities to ensure their reliability and safety. Therefore, WSD plans to upgrade the disinfection facilities by installing chlorine generation facilities in 11 major WTWs and Tai Lam Chung No. 2 Chlorination Station in stages with construction works commencing in 2017.

7. Apart from the 11 major WTWs, there are four small WTWs in operation in Hong Kong[4]. As the quantity of chlorine gas used at the four small WTWs is low and no chlorine generation facilities with such small production capacity are available in the market at present, WSD will make use of a simple and safe chemical process to convert the chlorine gas generated in the designated major WTWs to sodium hypochlorite solution which will then be transported to these small WTWs to replace chlorine for disinfection operation. The risk of the transportation of sodium hypochlorite solution is much lower than that of liquid chlorine. WSD will strictly follow the international safety standards in devising the transportation arrangement of the sodium hypochlorite solution. The disinfection performance of sodium hypochlorite solution is comparable to that of chlorine, and both disinfectants are widely used in different countries, and are safe and reliable conforming to the international standards.

/FINANCIAL …..

[4] The small WTWs include Cheung Sha WTW, Red Hill WTW, Tai O WTW and Tai Po Road WTW.

FINANCIAL IMPLICATIONS

8. We estimate that the cost of the proposed works to be $875.6 million in MOD prices (please see paragraph 9 below), broken down as follows –

			$ million	
(a)	Chlorine generation plant		427.1	
(b)	Associated civil, geotechnical and E&M works		258.9	
(c)	Environmental mitigation measures		3.3	
(d)	Contingencies		68.9	
		Sub-total	758.2	(in September 2016 prices)
(e)	Provision for price adjustment		117.4	
		Total	875.6	(in MOD prices)

9. Subject to funding approval, we will phase the expenditure as follows –

Year	**$ million (Sept 2016)**	**Price adjustment factor**	**$ million (MOD)**
2017 – 2018	98.5	1.05750	104.2
2018 – 2019	303.4	1.12095	340.1
2019 – 2020	265.3	1.18821	315.2
2020 – 2021	68.2	1.25950	85.9
2021 – 2022	22.8	1.32562	30.2
	758.2		875.6

10. We have derived the MOD estimates on the basis of the Government's latest forecast of the trend rate of change in the prices of public sector building and construction output for the period from 2017 to 2022. We will deliver the proposed E&M works under three lump-sum contracts because the scope of the works can be clearly defined in advance.

/11 .....

11. We estimate the additional annual recurrent expenditure arising from the proposed works to be $15 million.

12. The project will lead to an increase in the production cost of fresh water by 0.51% in real terms by 2022[5].

PUBLIC CONSULTATION

13. We consulted the relevant committees of nine concerned District Councils as listed in Annex 2 to Enclosure 2 between November 2016 and January 2017. Members generally supported the proposed works.

14. We consulted the Legislative Council Panel on Development on 28 March 2017 and Members supported the proposed works.

ENVIRONMENTAL IMPLICATIONS

15. Ten out of the total 11 major WTWs together with Tai Lam Chung No. 2 Chlorination Station are exempted designated projects under the Environmental Impact Assessment Ordinance (Cap. 499) for being in operation before April 1998. As for the remaining major WTW, Sha Tin WTW (South Works), an environmental permit was issued in January 2015. For the proposed works, we have completed the PER for the project. The PER has concluded and the Director of Environmental Protection agreed that the proposed works, with implementation of appropriate mitigation measures, would not cause adverse environmental impacts. The proposed works when completed will eliminate the need for transportation and storage of liquid chlorine, and hence the associated risk to the vicinity of the waterworks installations.

16. We will incorporate into the works contract the mitigation measures recommended in the PER to control the environmental impacts arising from the construction works to within established standards and guidelines. These measures include frequent watering of the site, covering of materials on trucks and use of silenced construction plant. We have included in paragraph 8(c) above $3.3 million (in September 2016 prices) in the project estimate for the implementation of the environmental mitigation measures.

/17. …..

[5] The increase in production cost of water is calculated at 2017-18 price level and on the assumption that the water demand remains static and all other factors remain constant during the period from 2017 to 2022.

17. At the planning and design stages, we have designed to minimise the generation of construction waste and will also require the contractor to reuse inert construction waste (e.g. excavated soil) on site or in other suitable construction projects as far as possible, in order to minimise the disposal of inert construction waste to public fill reception facilities[6]. We will encourage the contractor to maximise the use of recycled or recyclable inert construction waste, and the use of non-timber formwork to further reduce the generation of construction waste.

18. 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 day-to-day operations on site comply with the approved plan. We will require the contractor to separate the inert portion from non-inert construction waste 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.

19. We estimate that the proposed works will generate in total 16 900 tonnes of construction waste. Of these, we will reuse about 2 120 tonnes (13%) of inert construction waste on site and deliver 13 250 tonnes (78%) of inert construction waste to public fill reception facilities for subsequent reuse. We will dispose of the remaining 1 530 tonnes (9%) of non-inert construction waste at landfills. The total cost for accommodating construction waste at public fill reception facilities and landfill sites is estimated to be $1.2 million for the project (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)).

HERITAGE IMPLICATIONS

20. The proposed works will not affect any heritage site, i.e. all declared monuments, proposed monuments, graded historic sites or buildings, sites of archaeological interest and government historic sites identified by the Antiquities and Monuments Office.

LAND ACQUISITION

21. The proposed works do not require any land acquisition.

/TRAFFIC …..

[6] 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.

TRAFFIC IMPLICATIONS

22. We have completed the traffic review (TR) for the proposed works. The TR concluded that the traffic impact on the surrounding road network caused by the proposed works would be minimal in the construction and operation stages.

BACKGROUND

23. We upgraded **363WF** to Category B in September 2016.

24. In April 2016, we conducted an in-house review on the feasibility of local generation of chlorine for the use in all WTWs in Hong Kong.

25. We have substantially completed the detailed design for the proposed works using in-house resources.

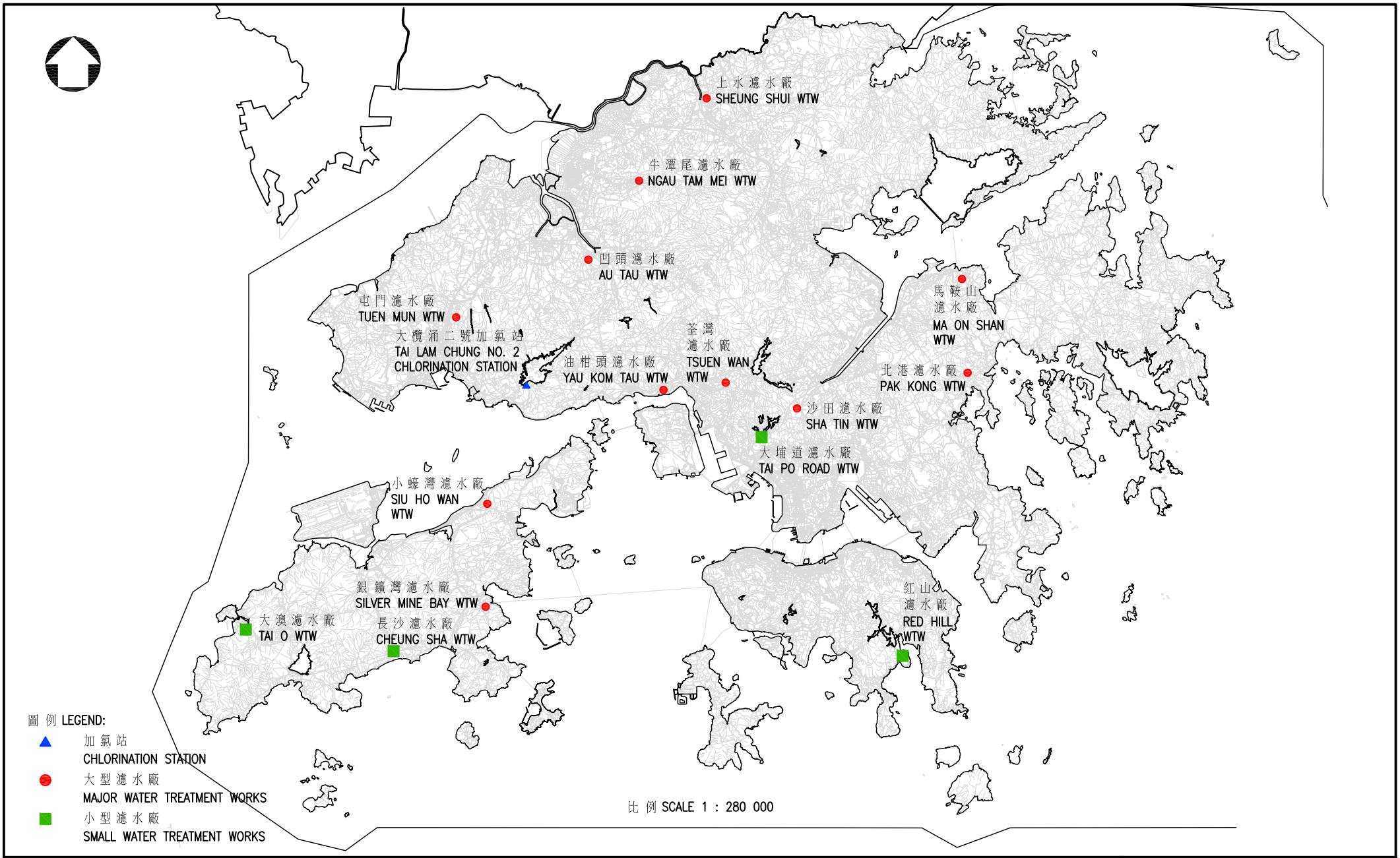
26. Of the 35 trees within the WTWs and affected by the proposed works, four trees will be preserved, six trees will be transplanted to Ping Che Fresh Water Service Reservoir of WSD and 25 trees will be felled. All trees to be removed are not important trees[7]. We will incorporate planting proposal as part of the project, including an estimated quantity of 25 trees.

27. We estimate that the proposed works will create about 220 jobs (190 for labourers and 30 for professional or technical staff) providing a total employment of 8 200 man-months.

---

[7] An "Important tree" refers 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 trees, trees as landmark of monastery or heritage monument, and trees in memory of important persons or events;
(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 to or exceeding 1.0 metre (m) (measured at 1.3 m above ground level), or with height or canopy spread equal to or exceeding 25 m.



工務計劃工程項目第363WF號— 改善濾水廠消毒設施

P.W.P. ITEM NO. 363WF — UPGRADING OF DISINFECTION FACILITIES IN WATER TREATMENT WORKS

水務署
Water Supplies Department

草圖編號 SKETCH NO. SK 52012/1

A4 297 x 210

CAD REF. SK52012-01_Encl2.dwg PLOT SCALE : 1 = 280

附件二 附錄一 ANNEX 1 to ENCLOSURE 2

363WF – Upgrading of disinfection facilities in water treatment works (WTW)
Consultation with District Councils

Date of Consultation	District Council	Committee	Waterworks Installations Involved
21 November 2016	North	District Minor Works and Environmental Improvement Committee	Sheung Shui WTW
25 November 2016	Tuen Mun	Environment, Hygiene and District Development Committee	Tuen Mun WTW and Tai Lam Chung No. 2 Chlorination Station
28 November 2016	Islands	Tourism, Agriculture, Fisheries and Environmental Hygiene Committee	Silver Mine Bay WTW, Siu Ho Wan WTW, Cheung Sha WTW and Tai O WTW
3 January 2017	Yuen Long	Culture, Recreation, Community Service and Housing Committee	Au Tau WTW and Ngau Tam Mei WTW
5 January 2017	Tsuen Wan	Environmental and Health Affairs Committee	Tsuen Wan WTW and Yau Kom Tau WTW
11 January 2017	Tai Po	Environment, Housing and Works Committee	Ma On Shan WTW
12 January 2017	Sai Kung	Housing and Environmental Hygiene Committee	Pak Kong WTW
12 January 2017	Sha Tin	Health and Environment Committee	Sha Tin WTW and Tai Po Road WTW
23 January 2017	Southern	District Development and Housing Committee	Red Hill WTW

357WF – Design and construction for first stage of desalination plant at Tseung Kwan O

PROJECT SCOPE AND NATURE

The part of **357WF** which we propose to upgrade to Category A comprises the laying of a 1 200 millimetres (mm) diameter fresh water main of about 10 kilometres (km) in length, connecting the proposed desalination plant at TKO to the existing TKO fresh water primary service reservoir, and associated works (the proposed mainlaying works).

2. The location of the proposed mainlaying works is shown on the plan at Annex 1 to Enclosure 3.

3. Subject to the funding approval of the FC, we plan to commence the proposed mainlaying works in the second quarter of 2017 for completion in the fourth quarter of 2021. In order to meet the tight schedule, we have invited tenders in February 2017. Tender will only be awarded after obtaining FC's funding approval.

4. We will retain the remainder of **357WF** in Category B and will seek funding for the works at a later stage. The scope of the remainder mainly comprises the site formation of a 10-hectare site in TKO Area 137, construction of the proposed desalination plant and associated works.

JUSTIFICATION

5. A reliable fresh water supply is of paramount importance in sustaining Hong Kong's development and economic growth. However, our fresh water resources, which come from the yield collected from local gathering ground and raw water imported from Dongjiang (DJ) in Guangdong Province, are both vulnerable to climate change. That aside, the reliability of fresh water supply to Hong Kong is also facing other challenges such as increasing water demand arising from population and economic growth and keen competition for DJ water resource due to the rapid economic development in the Pearl River Delta Region.

6. With the increasing water demand and the unforeseen extremely dry weather brought about by climate change, we need to develop seawater desalination as a strategic alternative water supply which is not susceptible to climate change to safeguard water security in Hong Kong.

/7. …..

7. A 10-hectare site in TKO Area 137 has been reserved for the construction of a medium-sized desalination plant. The planning and investigation study for the proposed desalination plant confirmed that TKO Area 137 is a suitable location for siting the proposed desalination plant in terms of the quality of nearby seawater. The use of the reverse osmosis technology[1] for the proposed desalination plant has also been proven technically feasible with an estimated unit water production cost at about $12 to $13 per m^3 at 2016 price level[2].

8. In order to convey the fresh water produced from the proposed desalination plant to the existing water distribution network, we propose to lay a fresh water main of about 10 km in length for connecting the proposed desalination plant to the existing TKO fresh water primary service reservoir. As the construction time required for the proposed mainlaying works will be longer than that for the proposed desalination plant, we propose to commence the proposed mainlaying works first to match with the programme for the commissioning of the desalination plant.

FINANCIAL IMPLICATIONS

9. We estimate the cost of the proposed mainlaying works to be $720.5 million in MOD prices (please see paragraph 11 below), broken down as follows –

		$ million	
(a)	Laying of fresh water mains		509.9
	(i) conventional method[3]	354.3	
	(ii) trenchless method[4]	155.6	

/(b) …..

---

[1] Reverses osmosis has become a mature technology and is used in most of overseas desalination plants in recent years. According to the International Desalination Association, there are over 17 000 desalination plants worldwide with a total water production capacity of more than 80 million m^3 per day and reverse osmosis accounts for approximately 60 per cent of the installed capacity. The number of desalination plant using reverse osmosis technology is on the increase.

[2] The estimated unit production cost of the proposed desalination plant in Hong Kong covers the energy cost, capital cost, treatment cost, distribution cost and customer service cost. The unit cost for producing fresh water by seawater desalination using reverse osmosis technology overseas ranges from $3.2 per m^3 to $46.2 per m^3 (at 2015 price level) according to the International Desalination Association. The unit water production costs in Hong Kong and other countries cannot be compared directly as they are affected by various factors such as energy cost, seawater quality and temperature, intake arrangement, environmental measures, financing details, and specific details of the water purchase agreement, etc.

[3] Conventional method refers to laying pipelines in trench. It involves opening up the road surface for laying of pipelines. We estimate that around 85% of the fresh water mains under this project will be laid by conventional method. The actual percentage will depend on the site conditions.

[4] Trenchless method (sometimes referred to as ‘minimum dig’ or ‘reduced dig’ method) refers to the use of heading, pipe jacking, micro-tunnelling or boring techniques to construct underground pipelines without opening up the road surface for laying of pipelines. This method will be employed when the conventional method is not feasible due to site constraints such as busy traffic conditions. We estimate that around 15% of the fresh water mains under this project will be laid by trenchless method. The actual percentage will depend on the site conditions.

		$ million	
(b)	Environmental mitigation measures	9.0	
(c)	Consultants' fees for advisory services for NEC[5] Administration	10.0	
(d)	Contingencies	52.9	
	Sub-total	581.8	(in September 2016 prices)
(e)	Provision for price adjustment	138.7	
	Total	720.5	(in MOD prices)

10. While the construction of the proposed mainlaying works will be supervised by in-house staff, we plan to engage consultants to provide advisory services for NEC administration. A detailed breakdown of the estimate for the consultants' fee by man-months is at Annex 2 to Enclosure 3.

11. Subject to funding approval, we will phase the expenditure as follows –

Year	**$ million (Sept 2016)**	**Price adjustment factor**	**$ million (MOD)**
2017 – 2018	36.8	1.05750	38.9
2018 – 2019	80.3	1.12095	90.0
2019 – 2020	150.1	1.18821	178.4
2020 – 2021	135.5	1.25950	170.7
2021 – 2022	101.7	1.32562	134.8
2022 – 2023	77.4	1.39190	107.7
	581.8		720.5

/12. …..

[5] NEC is a suite of contracts developed by the Institution of Civil Engineers, United Kingdom. It is a contract form that emphasises cooperation, mutual trust and collaborative risk management between contracting parties.

12. 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 2017 to 2023. We will deliver the proposed mainlaying works under an NEC form of contract with provision for price adjustment.

13. We estimate the additional annual recurrent expenditure arising from the proposed mainlaying works to be $0.8 million.

14. The proposed mainlaying works will lead to an increase in the production cost of fresh water by 0.14% in real terms by 2023[6].

PUBLIC CONSULTATION

15. We consulted the Sai Kung District Council on 6 January 2015 and 5 July 2016. Members supported the project for the proposed desalination plant in principle.

16. We consulted the Legislative Council Panel on Development (the Panel) on 24 January 2017 on the proposed mainlaying works. Members generally supported our submission of the funding proposal to the PWSC for consideration. Supplementary information related to full cost recovery and water leakage was provided to the Panel on 7 April 2017.

ENVIRONMENTAL IMPLICATIONS

17. The proposed mainlaying works are not classified as a designated project (DP) under Schedule 2 of the Environmental Impact Assessment (EIA) Ordinance (Cap. 499), but forms part of the project for the proposed desalination plant which is a DP requiring an environmental permit (EP) for its construction and operation. The Director of Environmental Protection approved the EIA report in November 2015 and issued an EP for the construction and operation of the project in December 2015. With implementation of the recommended pollution control measures, the approved EIA report concludes that the proposed mainlaying works would not cause any adverse environmental impacts. We shall implement these measures which include frequent watering of the site, covering of materials on trucks,

/use …..

---

[6] The increase in production cost of water is calculated at the 2017-18 price level and on the assumption that the water demand remains static, and all other factors remain constant during the period from 2017 to 2023.

use of silenced construction plant, temporary noise barriers and acoustic enclosures and environmental monitoring and audit programme recommended in the approved EIA report. We have included in paragraph 9(b) a sum of $9 million (in September 2016 prices) in the project estimate for the implementation of the environmental mitigation measures.

18. At the planning and design stages, we have considered the design of the proposed mainlaying works to reduce the generation of construction waste where possible. In addition, we will require the contractor to reuse inert construction waste (e.g. demolished concrete and excavated soil and rock) on site or in other suitable construction sites as far as possible, in order to minimise the disposal of inert construction waste to public fill reception facilities[7]. We will encourage the contractor to maximise the use of recycled or recyclable inert construction waste, and the use of non-timber formwork to further reduce the generation of construction waste.

19. 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 day-to-day operations on site comply with the approved plan. We will require the contractor to separate the inert portion from non-inert construction waste on site for disposal at appropriate facilities. We will control the disposal of inert and non-inert construction waste at public fill reception facilities and landfills respectively through a trip-ticket system.

20. We estimate that the proposed mainlaying works will generate in total 161 320 tonnes of construction waste. Of these, we will reuse about 118 930 tonnes (74%) of inert construction waste on site and deliver 38 100 tonnes (23%) of inert construction waste to public fill reception facilities for subsequent reuse. We will dispose of the remaining 4 290 tonnes (3%) of non-inert construction waste at landfills. The total cost for accommodating construction waste at public fill reception facilities and landfill sites is estimated to be $3.6 million for the proposed mainlaying 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)).

/HERITAGE …..

---

[7] 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.

HERITAGE IMPLICATIONS

21. The proposed mainlaying works will not affect any heritage site, i.e. all declared monuments, proposed monuments, graded historic sites or buildings, sites of archaeological interest and government historic sites identified by the Antiquities and Monuments Office.

LAND ACQUISITION

22. The proposed mainlaying works do not involve resumption of private land.

TRAFFIC IMPLICATIONS

23. We have carried out a Traffic Impact Assessment (TIA) for the proposed mainlaying works. The TIA concluded that the proposed mainlaying works would not cause any significant impact on the traffic through implementation of appropriate temporary traffic management schemes and by carrying out the proposed mainlaying works during night time as needed. We will adopt trenchless methods as needed for laying of water mains at busy road junctions and sections.

BACKGROUND

24. We upgraded **357WF** to Category B in September 2014.

25. Since November 2014, we had engaged contractors to carry out ground investigation and engaged consultants to undertake the TIA study, the tree preservation and removal proposal and the advisory services for preparation of NEC for the proposed mainlaying works at an estimated cost of $7.9 million in MOD prices. We have charged this amount to block allocation **Subhead 9100WX** "Waterworks, studies and investigations for items in Category D of the Public Works Programme". We have completed the detailed design of the proposed mainlaying works by in-house resources.

26. On 8 June 2012, we upgraded **345WF** "Planning and investigation study of desalination plant at TKO" (the Study) to Category A with an Approved Project Estimate of $34.3 million in MOD prices. In December 2012, we engaged consultants to commence a planning and investigation study for the proposed desalination plant in TKO Area 137. The study scope comprises detailed investigation of the feasibility and cost-effectiveness, preliminary design, formulation of the implementation strategy and programme, and impact assessments for the proposed desalination plant. We completed the Study in 2015.

/27. …..

27. On 26 June 2015, we upgraded part of **357WF** to Category A as **359WF** "Design and construction for first stage of desalination plant at TKO – investigation study review, design and site investigation" at an Approved Project Estimate of $154.5 million in MOD prices. In November 2015, we engaged consultants to carry out the investigation study review, design and associated site investigation works for the first stage of the proposed desalination plant. The consultants have completed the investigation study review and the field works of the ground investigation. The consultants are now preparing a reference design[8] for first stage of the proposed desalination plant and target for completion in 2017.

28. Of the 1 057 trees within the project boundary of the proposed mainlaying works, 1 022 trees will be preserved and 35 trees will be felled. All trees to be removed are not important trees[9]. We will incorporate planting proposal as part of the project, including estimated quantities of 35 trees.

29. We estimate that the proposed mainlaying works will create 130 jobs (110 for labourers and 20 for professional or technical staff) providing a total employment of 6 300 man-months.

30. We issued in April 2017 PWSC(2017-18)1 to invite Members to recommend to FC the upgrading of part of **357WF** to Category A at $1,111.8 million. Water Services Department, in consultation with the Development Bureau, has implemented various cost saving measures for the proposed mainlaying works. The cost saving measures include designing temporary traffic management schemes to suit the actual site conditions at specific locations; appropriately adopting the trenchless construction method; exempting non-essential contractual and design requirements; adopting the NEC target cost contract form[10], etc. As mentioned in

/paragraph …..

---

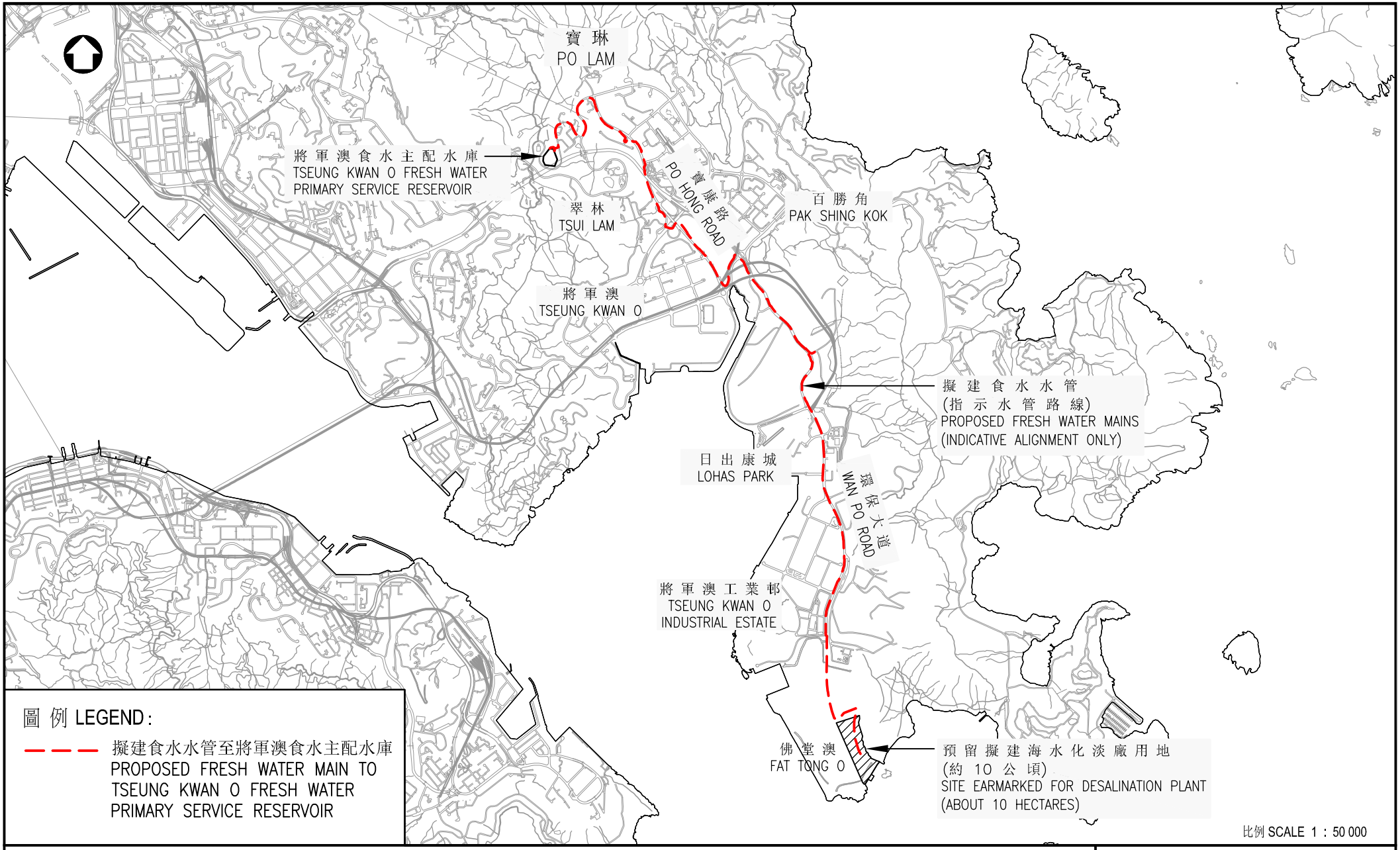
[8] We intend to implement the works for the first stage of the desalination plant via a "Design-Build-Operate" approach in which the contractor will be responsible for the detailed design of the proposed works. The reference design to be produced by the consultants will be used to establish the project requirements and as a reference for the detailed design.

[9] "Important trees" refers 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 trees, trees as landmark of monastery or heritage monument, and trees in memory of important persons or events;
(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 to or exceeding 1.0 metre (m) (measured at 1.3 m above ground level), or with height or canopy spread equal to or exceeding 25 m.

[10] It provides a pain-gain share mechanism and adopts an open book actual cost basis, providing more incentives for contractors to submit more competitive tenders with a lower premium.

paragraph 3 above, we invited tenders for the proposed mainlaying works in February 2017. After assessing the returned tender prices for the main contract, we have updated the project estimate. We consider that the latest estimate, which is 35% less than our earlier estimate, has reflected the prevailing market situation and the effectiveness of the cost saving measures, and that the latest estimate should be adequate to deliver the proposed mainlaying works. We will strive to effect further project cost savings during project implementation.



工務計劃項目第357WF號 – 將軍澳海水化淡廠第一階段設計及建造–
水管敷設工程

P.W.P. ITEM NO. 357WF – DESIGN AND CONSTRUCTION FOR FIRST STAGE OF DESALINATION PLANT
AT TSEUNG KWAN O – MAINLAYING

水務署
WATER SUPPLIES DEPARTMENT

草圖編號 SKETCH NO. G17-162

REF. G17-162_Rev02.DWG

附件三 附錄一 ANNEX 1 to ENCLOSURE 3

357WF – Design and construction for first stage of desalination plant at Tseung Kwan O

Breakdown of the estimates for consultants' fees (in September 2016 prices)

Consultant's staff costs		**Estimated man-months**	**Average MPS* salary point**	**Multiplier** (Note 1)	**Estimated fee ($ million)**
(a) Consultants' fees for advisory services for NEC administration (Note 2 & 3)	Professional	40	38	2.0	6.2
	Technical	72	14	2.0	3.8
				Total	10.0

*MPS = Master Pay Scale

Notes

1. A multiplier of 2.0 is applied to the average MPS salary point to arrive at the full staff costs including the consultants' overheads and profit, as the staff will be employed in the consultants' offices (as at now, MPS point 38 = $77,320 per month and MPS point 14 = $26,700 per month).

2. The consultants' staff costs for advisory services for NEC administration are based on the estimates prepared by the Director of Water Supplies. The actual man-months and fees will only be known when we have selected the consultants through the usual competitive fee bidding system.

3. WSD will deploy in-house staff to supervise the construction of the proposed mainlaying works. The fees in (a) above will be used for engaging consultants to provide advisory services for WSD's detailed arrangements for NEC administration.