# ITEM FOR PUBLIC WORKS SUBCOMMITTEE OF FINANCE COMMITTEE

HEAD 709 – WATERWORKS Water Supplies – Fresh water supplies 350WF – Improvement of water supply to Sheung Shui and Fanling

Water Supplies – Salt water supplies 53WS – Uprating of Chai Wan salt water supply system

Water Supplies – Combined fresh/salt water supplies 196WC – Implementation of Water Intelligent Network

> Members are invited to recommend to the Finance Committee the upgrading of **350WF**, **53WS** and part of **196WC** to Category A at estimated costs of \$521.3 million, \$379.1 million and \$239.7 million in money-of-the-day prices respectively.

#### PROBLEM

We need to improve the water supply systems in Sheung Shui, Fanling, Chai Wan and Siu Sai Wan to meet the rising water demand in these areas. We also need to continuously monitor the performance of the existing water distribution network and determine the most cost-effective means to maintain the healthiness of the network.

/PROPOSAL .....

#### 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) 350WF at an estimated cost of \$521.3 million in money-of-the-day (MOD) prices for the improvement of water supply to Sheung Shui and Fanling;
- (b) **53WS** at an estimated cost of \$379.1 million in MOD prices for the uprating of the Chai Wan salt water supply system; and
- (c) part of **196WC** at an estimated cost of \$239.7 million in MOD prices for the implementation of the first stage of the Water Intelligent Network.
- 3. Details of the above proposals are at Enclosures 1 to 3 respectively.

4. On 15 April 2016, we issued PWSC(2016-17)13 to invite Members to recommend to the Finance Committee (FC) the upgrading of **350WF** to Category A. The paper is yet to be discussed by the Public Works Subcommittee (PWSC). This paper supersedes PWSC(2016-17)13. The details of **350WF** are at Enclosure 1 to this paper.

5. We consulted the Legislative Council Panel on Development on **350WF** on 15 March 2016, **53WS** on 24 May 2016, and **196WC** on 26 April and 24 May 2016. Members supported the submission of these funding proposals to the PWSC of FC for consideration.

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Development Bureau June 2016

## **350WF – Improvement of water supply to Sheung Shui and Fanling**

#### PROJECT SCOPE AND NATURE

The scope of the proposed works comprises –

- (a) construction of a service reservoir at Table Hill with a capacity of 24 000 cubic metres  $(m^3)$ ;
- (b) laying of two trunk mains of about 1 000 metres (m) in total, with a diameter of 700 and 600 millimetres (mm) connecting respectively the existing Sheung Shui water treatment works and Table Hill fresh water service reservoir with the new service reservoir; and
- (c) laying of about 1 700 m twin distribution mains of 600 mm in diameter connecting the new service reservoir with the existing fresh water distribution network at Tin Ping Road.

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

3. Subject to the funding approval of the Finance Committee, we plan to commence the construction of the proposed works in end 2016 for completion in early 2020.

#### JUSTIFICATION

4. The existing fresh water service reservoirs supplying to Sheung Shui and Fanling (SSF) supply zone have a total storage capacity of 88 000 m<sup>3</sup>. In order to cope with the increasing water demand arising from planned new housing developments within the supply zone and to enhance the reliability of water supply to the areas, we propose to construct a new service reservoir of a storage capacity of 24 000 m<sup>3</sup> and associated water mains. The total storage capacity of the fresh water service reservoirs within the supply zone will reach 112 000 m<sup>3</sup> upon completion of the works and would be able to meet the projected daily demand of 145 000 m<sup>3</sup> per day.

5. SSF areas are presently using fresh water for flushing. The proposed service reservoir and twin mains system will be designed with flexibility for conversion in stages to a flushing water system using other flushing medium in the future.

#### FINANCIAL IMPLICATIONS

6. We estimate the cost of the proposed works to be \$521.3 million in MOD prices (please see paragraph 8 below), broken down as follows –

			\$ millio	n
(a)	Construction of service reservoir		181.1	
(b)	Laying of fresh water mains (i) conventional method <sup>1</sup> (ii) trenchless method <sup>2</sup>	137.0 56.6	193.6	
(c)	Environmental mitigation measures	5	4.2	
(d)	Consultants' fees for advisory ser for New Engineering Contract (N Administration	vices EC) <sup>3</sup>	4.9	
(e)	Contingencies		38.4	
		Sub-total	422.2	(in September 2015 prices)
(1)	Provision for price adjustment		99.1	
		Total	521.3	(in MOD prices)
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<sup>1</sup> Conventional method refers to laying pipelines in trench. It involves opening up the road surface for laying of pipelines. We estimate that around 87% of the fresh water mains under this project will be laid by conventional method. The actual percentage will depend on the site conditions.

<sup>2</sup> Trenchless method (sometimes referred to as 'minimum dig' or 'reduced dig' method) refers to the use of 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 presences of river or unfavourable traffic conditions. We estimate that around 13% of the fresh water mains under this project will be laid by trenchless method. The actual percentage will depend on the site conditions.

<sup>3</sup> 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.

#### Enclosure 1 to PWSC(2016-17)29

7. 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.

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

Year	\$ million (Sept 2015)	Price adjustment factor	\$ million (MOD)
2016 - 2017	3.8	1.05775	4.0
2017 - 2018	82.3	1.12122	92.3
2018 - 2019	107.7	1.18849	128.0
2019 - 2020	120.2	1.25980	151.4
2020 - 2021	92.3	1.33539	123.3
2021 - 2022	15.9	1.40549	22.3
_	422.2		521.3

9. 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 2016 to 2022. We will deliver the proposed works under an NEC form of contract with provision for price adjustment.

10. We estimate the additional annual recurrent expenditure arising from this project to be \$540,000.

11. The project will lead to an increase in the production cost of water by 0.11% in real terms by  $2020^4$ .

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The increase in production cost of water is calculated at the present price level and on the assumption that the water demand remains static during the period from 2016 to 2020.

## PUBLIC CONSULTATION

12. We consulted the District Minor Works and Environmental Improvement Committee of the North District Council on 14 September 2015. The Committee supported the proposed works.

13. We consulted the Legislative Council Panel on Development on 15 March 2016 and Members supported the proposed works.

#### ENVIRONMENTAL IMPLICATIONS

14. This is not a designated project under the Environmental Impact Assessment Ordinance (Cap 499). We have carried out a Preliminary Environmental Review which concluded that the proposed works would not cause long-term environmental impact. We have included in paragraph 6(c) above a sum of \$4.2 million (in September 2015 prices) in the project estimate for the implementation of standard pollution control measures to mitigate short term environmental impacts during construction. These measures include frequent watering of the site, provision of wheel-washing facilities, covering of materials on trucks and use of silenced construction plant.

15. 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<sup>5</sup>. 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.

16. 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.

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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.

17. We estimate that the proposed works will generate in total 142 840 tonnes of construction waste. Of these, we will reuse 9 220 tonnes (6%) of inert construction waste on site and deliver 132 750 tonnes (93%) of inert construction waste to public fill reception facilities for subsequent reuse. We will dispose of the remaining 870 tonnes (1%) of non-inert construction waste at landfills. The total cost for accommodating construction waste at public fill reception facilities and landfill is estimated to be \$3.7 million for this project (based on a unit charge rate of \$27 per tonne for disposal at public fill reception facilities and \$125 per tonne at landfills as stipulated in the Waste Disposal (Charges for Disposal of Construction

### HERITAGE IMPLICATIONS

Waste) Regulation).

18. 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

19. The proposed works do not involve resumption of private land, but clearance of about 64 900 square metres  $(m^2)$  government land is required. We will charge the cost of land clearance estimated at \$0.1 million to **Head 701 – Land Acquisition**. A breakdown of the clearance cost is at Annex 3 to Enclosure 1.

#### TRAFFIC IMPLICATIONS

20. We have carried out a Traffic Impact Assessment (TIA) for the proposed works. The TIA concluded that the construction of the proposed service reservoir and mainlaying works through implementation of appropriate temporary traffic management schemes would not cause any significant impact on the traffic.

#### BACKGROUND

21. We upgraded **350WF** to Category B in September 2013 and deployed in-house staff for the detailed design works.

22. In April 2015, we engaged contractors to carry out site investigation and consultants to undertake the traffic impact assessment, plant survey, and advisory services for preparation of NEC for the project at an estimated cost of \$11.1 million. 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 substantially completed the detailed design of the proposed works.

23. Of the 217 trees within the project boundary, 124 trees will be preserved and 93 trees will be felled. All trees to be removed are not important trees<sup>6</sup>. We will incorporate planting proposals as part of the project, including estimated quantities of 93 trees and 3 400 m<sup>2</sup> of grassed area.

24. We estimate that the proposed works will create 150 jobs (130 for labourers and another 20 for professional or technical staff) providing a total employment of 5 000 man-months.

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"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;

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- (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

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



#### 350WF - Improvement of water supply to Sheung Shui and Fanling

Consultant's staff costs	Estimated man- months	Average MPS* salary point	Multiplier	Estimated fee (\$ million)
(a) Consultants' fees Professions for advisory services for Technical NEC administration (Note 2 & 3)	al 20 38	38 14	2.0 2.0	3.0 1.9
			Total	4.9

#### Breakdown of the estimates for consultants' fees (in September 2015 prices)

\*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 = \$74,210 per month and MPS point 14 = \$25,505 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.

## **350WF – Improvement of water supply to Sheung Shui and Fanling**

Bre	akdown of the estimated land clearance cost		\$ million
<b>(I</b> )	Estimated clearance cost		0.05
(a)	Ex-gratia allowance for crop compensation	0.01	
(b)	Ex-gratia allowances for miscellaneous indigenous villager matters	0.04	
( <b>II</b> )	Contingency payment		0.01
(a)	Contingency on the above costs	0.01	
		Total cost	0.06 (say 0.1)

### 53WS – Uprating of Chai Wan salt water supply system

#### PROJECT SCOPE AND NATURE

The scope of the proposed works comprises –

- (a) uprating the output capacity of Siu Sai Wan salt water pumping station (SWPS) from 30 000 cubic metres  $(m^3)$ per day to 41 700 m<sup>3</sup> per day, including –
  - (i) replacement of existing pumpsets with new and higher output capacity pumpsets;
  - (ii) replacement of the existing electro-chlorination system by a sodium hypochlorite solution dosing system with associated electrical and mechanical (E&M) plant and equipment; and
  - (iii) modification works<sup>1</sup> to the pumping station;
- (b) laying of about 3.8 kilometres (km) salt water mains ranging from 150 millimetres (mm) to 600 mm in diameter; and
- (c) laying of about 0.3 km fresh water mains of 450 mm in diameter for providing contingent augmentation to salt water supply.

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

3. The design of the proposed works has been completed. Subject to the funding approval of the Finance Committee, we plan to commence the proposed works in December 2016 for completion in early 2020.

#### /JUSTIFICATION .....

<sup>&</sup>lt;sup>1</sup> Modification works include the construction of cable trench, construction of openings in switchgear room, modification of pump plinths, replacement of bellmouth and puddle pipe, etc.

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#### JUSTIFICATION

4. The Siu Sai Wan SWPS supplies salt water to the Chai Wan and Siu Sai Wan areas. In early 2016, the population and salt water demand of the areas are about 170 000 and 29 000  $m^3$  per day respectively. The population and salt water demand of the areas are expected to increase to about 179 000 and 30 000  $m^3$  per day respectively in early 2020 and further to about 196 000 and 35 300  $m^3$  per day respectively in 2024. It is therefore necessary to uprate the output capacity of the Siu Sai Wan SWPS to 41 700  $m^3$  per day to cater for peak demand and implement the associated mainlaying works to cope with the increasing water demand arising from planned developments in the areas. As part of the uprating works, the existing electro-chlorination system of the Siu Sai Wan SWPS will be replaced by a sodium hypochlorite solution dosing system for better cost effectiveness<sup>2</sup>.

5. The existing salt water supply system for the Chai Wan and Siu Sai Wan areas is operated on a single-line configuration of the trunk mains. Shutting down the trunk mains will lead to widespread suspension of salt water supply to the majority area. To improve the reliability of the salt water supply system to the area, we propose to change the single-line configuration of the trunk mains to a ring mains system by laying a new leg of salt water trunk mains. The ring mains system will ensure uninterrupted water supply to the majority of supply zone even when a section of the ring mains needs to be shut down. To further enhance the reliability of the supply system, we propose to lay a section of about 0.3 km fresh water mains of 450 mm in diameter for providing augmentation to salt water supply in case of emergency situations when the Siu Sai Wan SWPS needs to be shut down.

## FINANCIAL IMPLICATIONS

6. We estimate the cost of the proposed works to be \$379.1 million in MOD prices (see paragraph 7 below), broken down as follows –

		\$ million	
<ul> <li>(a) Uprating of Siu Sai Wan SWPS</li> <li>(i) Uprating of pumpsets, uprating of chlorine dosing system and associated E&amp;M plant and equipment</li> </ul>	75.4	92.4	/(ii)

<sup>&</sup>lt;sup>2</sup> The electro-chlorination plant generates sodium hypochlorite solution by electrolysis of seawater through the electrolytic cells. The sodium hypochlorite will help prevent degradation of seawater quality after abstraction and suppress the growth of marine organisms in the supply system. The sodium hypochlorite dosing system primarily consists of hypochlorite solution storage tanks with associated pipework and dosing pumps. The latter has the advantages of reduced operation and maintenance costs.

			\$ millior	1
	(ii) civil and E&M modification works	17.0		
(b)	Laying of salt water mains (i) conventional method <sup>3</sup> (ii) trenchless method <sup>4</sup>	141.8 32.4	174.2	
(c)	Laying of fresh water mains by conventional method		7.2	
(d)	Environmental mitigation measures		4.5	
(e)	Contingencies	Sub-total	<u>27.8</u> 306.1	(in September 2015 prices)
(f)	Provision for price adjustment	Total	73.0 379.1	(in MOD prices)

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

Year	\$ million (Sept 2015)	Price adjustment factor	\$ million (MOD)
2016 - 2017	2.7	1.05775	2.9
2017 - 2018	56.6	1.12122	63.5
2018 - 2019	79.6	1.18849	94.6
			/Year

<sup>&</sup>lt;sup>3</sup> The conventional method refers to laying pipelines in trench. It involves opening up the road surface for laying of pipelines. We estimate that about 92% of the salt water mains under this project will be laid by the conventional method. The actual percentage will depend on the site conditions.

<sup>&</sup>lt;sup>4</sup> The trenchless method (sometimes referred to as 'minimum dig' or 'reduced dig' method) refers to the use of pipe jacking, micro-tunneling or boring techniques to construct underground pipelines without opening up the road surface for laying of the pipelines. This method will be employed when the conventional method is not feasible due to site constraints such as unacceptable traffic conditions. We estimate that around 8% of the salt water mains under this project will be laid by the trenchless method. The actual percentage will depend on the site conditions.

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Year	\$ million (Sept 2015)	Price adjustment factor	\$ million (MOD)
2019 - 2020	87.3	1.25980	110.0
2020 - 2021	59.7	1.33539	79.7
2021 - 2022	20.2	1.40549	28.4
	306.1		379.1

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 for public sector building and construction output for the period from 2016 to 2022. We will deliver the works under a re-measurement contract because the quantities of works are subject to variation during construction to suit the actual site conditions. The contract will provide for price adjustment.

9. We estimate the additional annual recurrent expenditure arising from this project to be \$1.9 million.

10. The project will lead to an increase in the production cost of water by 0.16% in real terms by  $2022^5$ .

#### PUBLIC CONSULTATION

11. We consulted the Planning, Works and Housing Committee of the Eastern District Council on 1 February 2016. The Committee generally supported the proposed works with relevant mitigation measures which would enhance the reliability of the water supply system in Chai Wan.

12. We consulted the Legislative Council Panel on Development on 24 May 2016 and Members supported the proposed works. Supplementary information on the sewage system in Chai Wan and Siu Sai Wan areas was provided to Members on 31 May 2016.

#### /ENVIRONMENTAL .....

<sup>&</sup>lt;sup>5</sup> The increase in production cost of water is calculated at the present price level and on the assumption that the water demand remains static during the period from 2016 to 2022.

## ENVIRONMENTAL IMPLICATIONS

13. The proposed works is not a designated project under Schedule 2 of the Environmental Impact Assessment Ordinance (Cap 499). We have completed the Preliminary Environmental Review (PER) for the project. The PER has concluded and the Director of Environmental Protection agreed that the project would not have any long-term environmental impacts. 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, provision of wheel-washing facilities, covering of materials on trucks and use of silenced construction plant. We have included in paragraph 6(d) above a sum of \$4.5 million (in September 2015 prices) in the project estimate for the implementation of the 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<sup>6</sup>. 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 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.

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<sup>&</sup>lt;sup>6</sup> 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 25 300 tonnes of construction waste. Of these, we will reuse 18 200 tonnes (72%) of inert construction waste on site and deliver 6 000 tonnes (24%) of inert construction waste to public fill reception facilities for subsequent reuse. We will dispose of the remaining 1 100 tonnes (4%) 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 \$0.3 million for this project (based on a unit charge rate of \$27 per tonne for disposal at public fill reception facilities and \$125 per tonne at landfills as stipulated in the Waste Disposal (Charges for Disposal of Construction Waste) Regulation).

## 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 Impact Assessment (TIA) for the proposed works. The TIA concluded that the proposed works through implementation of appropriate temporary traffic management schemes would not cause any significant impact on the traffic.

## BACKGROUND INFORMATION

20. We upgraded **53WS** to Category B in September 2012.

21. In May 2013, we engaged contractors to carry out ground investigation and engaged consultants to undertake the traffic impact assessment study and the landscape design and tree felling proposal for the proposed works at an estimated cost of \$2.6 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 substantially completed the ground investigation and consultancy in April 2016.

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

23. Of the 840 trees within the project boundary of the proposed works, 822 trees will be preserved and 18 trees will be felled. All trees to be removed are not important trees<sup>7</sup>. We will incorporate planting proposals as part of the project, including estimated quantities of 18 trees.

24. We estimate that the proposed works will create about 110 jobs (95 for labourers and 15 for professional or technical staff) providing a total employment of 3 840 man-months.

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"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;

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



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#### **196WC – Implementation of Water Intelligent Network**

#### PROJECT SCOPE AND NATURE

The part of 196WC which we propose to upgrade to Category A comprises –

- (a) construction of chambers, pipeworks and other associated works for the establishment of about 85 District Metering Areas (DMAs) and Pressure Management Areas (PMAs)<sup>1</sup> in Kwun Tong, Sha Tin and Tai Po districts<sup>2</sup> with the installation of monitoring and sensing equipment in the respective parts of the water distribution network;
- (b) procurement and establishment of an intelligent network management system and development of associated analytical tools; and
- (c) investigation and detailed design for the remaining about 515 DMAs and PMAs in the territory.

2. Plans showing the locations of the proposed DMAs and PMAs mentioned in paragraphs 1(a) and 1(c) above are at Annex 1 and Annex 2 to Enclosure 3 respectively. A schematic diagram of DMA and PMA and typical details of the associated chambers are shown at Annex 3 to Enclosure 3.

3. Subject to funding approval of the Finance Committee (FC), we plan to commence the proposed works stated in paragraph 1(a) and 1(b) above in end 2016 and early 2017 for completion in end 2019 and end 2018 respectively. We will also engage consultants to carry out the proposed investigation and detailed design stated in paragraph 1(c) above in end 2016 for completion in end 2017. To meet the programme, we invited tenders for the investigation and detailed design of the proposed works stated in paragraph 1(c) in April 2016. We will also invite tenders for the proposed works stated in paragraph 1(a) in June 2016 and that stated in paragraph 1(b) by end 2016. All tenders will only be awarded after obtaining FC's funding approval.

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<sup>&</sup>lt;sup>1</sup> A DMA is defined as a discrete area of a water distribution network established by the closure of district boundary valve(s) or complete disconnection of water mains, with the quantity of water supplied to the area metered. Some of the DMAs will also serve as PMAs where there is room for pressure management without affecting the minimum supply pressure to sustain normal supply. The monitoring and sensing equipment includes among others flowmeters and pressure loggers to collect water flow and pressure data.

<sup>&</sup>lt;sup>2</sup> The DMAs and PMAs in Tai Po district mentioned in paragraph 1(a) are under the coverage of Sha Tin major water supply zone.

4. We will retain the remainder of **196WC** in Category B, which mainly comprises establishment of the remaining 515 DMAs and PMAs stated in paragraph 1(c) above and reprovisioning for about 325 kilometres (km) of water mains which will become aged and susceptible to bursting or leakage before the full implementation of WIN. We will seek funding for the remainder of **196WC** at a later stage.

## JUSTIFICATION

5. In the 1990s, maintenance of a considerable length of water mains approaching the end of their service life became increasingly difficult and costly. Given the poor condition of the water distribution network, replacement and rehabilitation (R&R) of the aged water mains was the most effective solution to rejuvenate the water distribution network to arrest the rapidly rising trend of main bursting and leakage. The R&R programme of water mains was launched in 2000, covering around 3 000 km of aged water mains in Hong Kong. The R&R programme has been substantially completed. At present, the total length of water mains in Hong Kong is about 8 000 km.

6. Following the substantial completion of the R&R programme, the condition of the water distribution network has been largely improved. The annual number of water main bursts has been reduced from the peak of about 2 500 in 2000 to 145 in 2015. The leakage rate has also been reduced from exceeding 25% in 2000 to 15% in 2015.

7. However, the water mains not covered in the R&R programme will continue to age and deteriorate. Riding on the technological advancement of sensors, telemetry, network management software and data analysis in recent years, we consider it an opportune time to implement WIN to maintain the healthiness of the water distribution network through analysing the condition of the water distribution network and determining the most cost-effective means to maintain its healthiness.

8. The essence of WIN is continuous monitoring of network performance in a holistic manner by utilising advanced technologies. Under WIN, the water distribution network will be divided into discrete DMAs and PMAs of manageable size with high-technology monitoring and sensing equipment installed in each DMA and PMA network. Implementation of WIN enables the effective execution of measures under the four pillars of network management in an integrated and coordinated manner. These four pillars include –

- (a) active leakage detection and control using monitoring and sensing equipment installed in the network;
- (b) pressure management to reduce pressure in the PMAs network;
- (c) quality and speedy repairs to water main leaks and bursts; and
- (d) asset management by reprovisioning of aged water mains which are beyond economic repair.

9. WIN also enables detection of probable unauthorised consumption from the network.

10. A tremendous amount of flow and pressure data as well as other associated network data will be collected from the monitoring and sensing equipment of the DMAs and PMAs. Under WIN, an intelligent network management computer system will be established for analysing the data collected for continuous (and where necessary real-time) monitoring of the condition of the network so as to assess the level of leakage and unauthorised consumption, and to enable timely determination of the priorities and the most effective network management measures for the DMAs and PMAs. In addition, associated analytical tools such as predictive model of water main bursts will also be developed to enhance the function of WIN.

11. In addition to the 600 DMAs and PMAs mentioned in paragraphs 1(a) and 1(c) we plan to establish and link to the intelligent network management system, there are about 1 400 DMAs and PMAs<sup>3</sup> which have either been established or are being established under other projects. These 1 400 DMAs and PMAs were originally planned to be operated and managed on an individual basis. For full implementation of WIN to cover the entire water distribution network in the territory, we will link up these 1 400 DMAs and PMAs and PMAs to the intelligent network management system. By incorporating all the DMAs and PMAs into the proposed intelligent network management system, will enable efficient network management to cover the water distribution network in the territory.

#### /FINANCIAL .....

<sup>&</sup>lt;sup>3</sup> There are 17 major water supply zones in the territory. The 600 DMAs and PMAs to be established under **196WC** belong to five major water supply zones, including Kowloon East, Sha Tin, Yuen Long, Sheung Shui & Fanling and Islands major water supply zones. The 1400 DMAs and PMAs which either have been established or are being established under other projects fully cover the remaining major water supply zones.

## FINANCIAL IMPLICATIONS

12. We estimate the cost of the proposed works to be \$239.7 million in MOD prices (please see paragraph 14 below), broken down as follows –

				\$ million	
(a)	Estal PMA	blishment of the 85 DMAs and As		131.8	
	(i)	Construction works with installation of monitoring and sensing equipment	108.7		
	(ii)	Environmental mitigation measures	1.7		
	(iii)	Consultants' fees for contract administration	2.7		
	(iv)	Consultants' fees for management of resident site staff (RSS)	1.1		
	(v)	Remuneration of RSS	17.6		
(b)	Proc the in mana deve analy	urement and establishment of ntelligent network agement system and lopment of associated ytical tools		23.7	
(c)	Inve for the PMA	stigation and detailed design he remaining 515 DMAs and As		26.3	
	(i)	Site investigation works	15.3		
	(ii)	Consultants' fees for investigation and detailed design	8.7		
	(iii)	Consultants' fees for supervision of site investigation works	2.3		
(d)	Cont	tingencies	-	18.2	_
	_	Sub-total		200.0	(in September 2015 prices)
(e)	Prov	ision for price adjustment Total	-	<u>39.7</u> 239.7	(in MOD
			-		prices)

13. Due to the lack of adequate in-house resources, we propose to engage consultants to undertake contract administration and site supervision of the proposed works stated in paragraph 1(a). A breakdown of the estimates for the consultants' fees and RSS costs by man-months is at Annex 4 to Enclosure 3. We propose to also engage consultants to conduct the proposed investigation and detailed design of the proposed works stated in paragraph 1(c) above. A breakdown of the estimates for the consultants' fees by man-months is at Annex 5 to Enclosure 3. The proposed procurement and establishment of the intelligent network management system and development of associated analytical tools stated in paragraph 1(b) above will be arranged and overseen by in-house resources.

14. Subject to funding approval, we will phase the expenditure as follows-

Year	<pre>\$ million (Sept 2015)</pre>	Price adjustment factor	\$ million (MOD)	
2016 - 2017	15.0	1.05775	15.9	
2017 - 2018	55.0	1.12122	61.7	
2018 - 2019	57.0	1.18849	67.7	
2019 - 2020	44.0	1.25980	55.4	
2020 - 2021	25.0	1.33539	33.4	
2021 - 2022	4.0	1.40549	5.6	
	200.0		239.7	

We have derived the MOD estimate on the basis of the 15. 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 2016 to 2022. We will deliver the works stated in paragraph 1(a) for establishment of the 85 DMAs and PMAs under a re-measurement contract because the quantities of works involved may vary depending on the actual underground conditions. The contract will provide for price adjustment. We will procure and establish the proposed intelligent network management system stated in paragraph 1(b) under a lump sum contract as the requirements of the system can be well defined. We will deliver the proposed consultancy agreement stated in paragraph 1(c) for the investigation and detailed design for the remaining 515 DMAs and PMAs under a lump sum contract as the scope of the consultancy agreement can be well defined. The consultancy agreement will provide for price adjustment.

16. We estimate the additional annual recurrent expenditure arising from proposed works to be \$47 million.

17. The project by itself will lead to an increase in the production cost of water by 0.66% in real terms by  $2022^4$ .

## PUBLIC CONSULTATION

18. We consulted the Environment, Housing and Works Committee of the Tai Po District Council, the Traffic and Transport Committee of the Kwun Tong District Council and the Development and Housing Committee of the Sha Tin District Council on 13 January 2016, 26 January 2016 and 3 March 2016 respectively on the proposed establishment of the 85 DMAs and PMAs in these districts and they all endorsed the project. We will implement suitable traffic and environmental mitigation measures under the works contracts to minimise inconvenience brought to the public during the works period. We will also closely monitor the implementation of these mitigation measures and the interfacing of the proposed works with works in the proximity.

19. We consulted the Legislative Council Panel on Development (the Panel) on 26 April and 24 May 2016. Members generally supported our submission of the funding proposal to the Public Works Subcommittee for consideration. Supplementary information related to measures taken to alleviate the frequent occurrences of water mains burst and leakage on Hong Kong Island as requested by Members was submitted to the Panel on 11 May 2016.

#### ENVIRONMENTAL IMPLICATIONS

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20. The proposed works to be upgraded is not a designated project under the Environmental Impact Assessment Ordinance (Cap 499). The project will not cause any long-term environmental impact. We have included in paragraph 12(a)(ii) above a sum of \$1.7 million (in September 2015 prices) in the project estimate the cost to implement suitable mitigation measures to control short term environmental impacts.

/21. .....

The increase in production cost of water is calculated at the present price level and on the assumption that the water demand remains static during the period from 2016 to 2022.

21. During construction of the 85 DMAs and PMAs, we will control noise, dust and site run-off nuisances to meet established standards and guidelines through the implementation of mitigation measures in the relevant works contracts. These include the use of silencers, mufflers, acoustics lining or shields for noisy construction activities, frequent cleaning and watering of the site, and provision of wheel-washing facilities.

22. At the planning and design stages for the 85 DMAs and PMAs, we have considered various locations for chambers of the proposed network monitoring and sensing equipment to reduce construction waste where possible. In addition, we will require the contractors 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<sup>5</sup>. We will require the contractors 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.

23. At the construction stage for the 85 DMAs and PMAs, we will require the contractors to submit for approval a plan setting out waste management measures, which will include appropriate mitigation means to avoid, reduce, reuse and recycle inert construction waste. We will ensure that day-to-day operations on site comply with the approved plan. We will require the contractors to separate 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.

24. We estimate that the proposed works for establishment of the 85 DMAs and PMAs will generate in total 1 750 tonnes of construction waste. Of these, we will reuse about 260 tonnes (15%) of inert construction waste on site and deliver 1 400 tonnes (80%) of inert construction waste to public fill reception facilities for subsequent reuse. We will dispose of the remaining 90 tonnes (5%) 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 \$50,000 for this project (based on a unit charge rate of \$27 per tonne for disposal at public fill reception facilities and \$125 per tonne for disposal at landfills as stipulated in the Waste Disposal (Charges for Disposal of Construction Waste) Regulation).

/25. .....

<sup>&</sup>lt;sup>5</sup> 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.

25. The proposed site investigation works for establishment of the remaining 515 DMAs and PMAs will only generate a minimal amount of construction waste. We will require the consultant to fully consider measures to minimise the generation of construction waste and to reuse or recycle construction waste as much as possible at the construction stage.

## HERITAGE IMPLICATIONS

26. The proposed works for establishment of the 85 DMAs and PMAs and the proposed investigation and detailed design for the remaining 515 DMAs and PMAs in the territory will not affect any heritage sites, 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.

#### TRAFFIC IMPLICATIONS

27. We have carried out traffic impact assessments (TIAs) for the proposed construction works for the 85 DMAs and PMAs. The cumulative effects of traffic generated by projects at adjacent sites are also covered in the TIAs. The TIAs have concluded that the proposed works would not cause any significant traffic impact on the surrounding road network. In any case, we will implement temporary traffic arrangements to minimise the impact on traffic during construction and will display notice boards on site to explain the reason for the temporary traffic arrangement and the expected completion dates of individual sections of works. In addition, we will set up telephone hotlines for public enquiries or complaints.

28. We will carry out TIAs for the proposed site investigation works for the remaining 515 DMAs and PMAs if necessary.

#### LAND ACQUISITION

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

#### BACKGROUND INFORMATION

30. We upgraded **196WC** to Category B in September 2014.

31. In August 2015, we engaged a consultant to undertake the investigation and detailed design for establishment of the 85 DMAs and PMAs mentioned in paragraph 1(a) above and reprovisioning for about 21 km of water mains at an estimated cost of \$4.5 million in MOD prices. We charged this amount under block allocation **Subhead 9100WX** "Waterworks, studies and investigation for items in Category D of the Public Works Programme". The investigation and detailed design for establishment of the 85 DMAs and PMAs commenced in August 2015 for completion in June 2016.

32. The establishment of the 85 DMAs and PMAs will not involve any tree removal or planting proposals. We will require the consultant to take into consideration the need for tree preservation during the site investigation and detailed design for the remaining 515 DMAs and PMAs.

33. We estimate that the proposed works will create 80 jobs (50 for labourer and another 30 for professional or technical staff) providing a total employment of 1 900 man-months.

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REF. 62015-106 REV03.DWG



附錄 Annex 2 to Enclosure 3

REF. 62015-107 REV03.DWG



REF. 62015-108 REV02 DWG

附件 三

附錄

三(兩張中的第一張)

Annex 3 to Enclosure 3 (Page 1 of 2)

註:流量錶用於量度供應到監測區域的水量 NOTE: FLOWMETER USED TO METER WATER SUPPLIED TO DMA



附件 三 附錄 三 (兩張中的第二張) Annex 3 to Enclosure 3 (Page 2 of 2)

REF. 62015-109\_REV01.DWG

#### **196WC – Implementation of Water Intelligent Network**

# Breakdown of the estimates for consultants' fees and resident site staff costs for the establishment of the 85 DMAs and PMAs (in September 2015 prices)

	Estimated man-mont hs	Average MPS* salary point	Multiplier (Note 1)	Estimated fee (\$ million)
(a) Consultants' fee for Professiona	al —	_	_	1.9
contract administration Technical (Note 2)	_	—	_	0.8
			Sub-total	2.7
(b) Resident site staff Professiona	al 70	38	1.6	8.3
(RSS) costs <sup>(Note 3)</sup> Technical	255	14	1.6	10.4
Comprising –			Sub-total	18.7
(i) Consultants' fees for management of RSS			1.1	
(ii) Remuneration of RSS			17.6	
			Total	21.4

\*MPS = Master Pay Scale

#### Notes

- 1. 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 point 38 = \$74,210 per month and MPS point 14 = \$25,505 per month).
- 2. The consultants' staff cost for contract administration is calculated in accordance with the existing consultancy agreement. The tender and construction phases of the 85 DMAs and PMAs will only be executed subject to Finance Committee's approval to upgrade part of **196WC** to Category A.
- 3. The actual man-months and actual costs will only be known after completion of the construction works.

#### **196WC – Implementation of Water Intelligent Network**

Breakdown of the estimates for consultants' fee for investigation and detailed design and supervision of site investigation works for the remaining 515 DMAs and PMAs (in September 2015 prices)

Consultants' staff costs <sup>(Note 2)</sup>			Estimated man-mon ths	Average MPS* salary point	Multiplier (Note 1)	Estimated fee (\$ million)
(c) In	nvestigation and	Professional	51	38	2.0	7.6
d	etailed design	Technical	22	14	2.0	1.1
(d) S	supervision of site	Professional	9	38	2.0	1.3
iı	nvestigation works	Technical	19	14	2.0	1.0
					Total	11.0

\*MPS = Master Pay Scale

#### Notes

- 1. A multiplier of 2.0 is applied to the average MPS point to arrive at the full staff costs including the consultants' office overhead and profit, as the staff will be employed in the consultants' office (as at now, MPS point 38 = \$74,210 per month and MPS point 14 = \$25,505 per month).
- 2. The actual man-month and fees will only be known when the consultants through the usual competitive bidding system are selected.