

## **ITEM FOR PUBLIC WORKS SUBCOMMITTEE OF FINANCE COMMITTEE**

### **HEAD 705 – CIVIL ENGINEERING**

#### **Environmental Protection – Sewerage and Sewage Treatment 233DS – Sludge treatment facilities**

Members are invited to recommend to Finance Committee the upgrading of **233DS** to Category A at an estimated cost of \$5,154.4 million in money-of-the-day prices for the design and construction of the sludge treatment facilities.

### **PROBLEM**

At present, all dewatered sewage sludge (sludge) generated by sewage treatment works is disposed of at landfills. This current practice of sludge disposal at landfill is not sustainable from both environmental and technical perspectives. Without a dedicated sustainable sludge treatment facility, the planned sewage treatment projects including the Harbour Area Treatment Scheme (HATS) Stage 2A, upgraded Pillar Point Sewage Treatment Works (STW) and upgraded San Wai STW, which will generate a large quantity of sludge, cannot be commissioned.

### **PROPOSAL**

2. The Director of Environmental Protection (DEP), with the support of the Secretary for the Environment, proposes to upgrade **233DS** to Category A at an estimated cost of \$5,154.4 million in money-of-the-day (MOD) prices for the design and construction of the proposed sludge treatment facilities (STF).

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## PROJECT SCOPE AND NATURE

3. The scope of works for **233DS**, which is located in the eastern ash lagoon at Tsang Tsui, near Nim Wan, Tuen Mun, comprises –

- (a) design and construction of a sludge treatment facility of capacity of 2 000 tonnes per day;
- (b) provision of ancillary facilities<sup>1</sup>;
- (c) provision of environmental educational and associated facilities; and
- (d) environmental monitoring during the construction stage.

— A plan showing the location of the STF and a conceptual layout plan showing the proposed works are at Enclosure 1 and Enclosure 2 respectively.

4. We plan to commence the above design and construction works in February 2010 and commission the STF in two phases. Phase 1 with capacity of 1 600 tonnes per day will be commissioned in end 2012 while phase 2 to the full capacity of 2 000 tonnes per day will be commissioned in 2016.

## JUSTIFICATION

5. Since the cessation of marine disposal of sludge in 1996, all sludge generated by STW is disposed of at the three strategic landfills at present. However, despite the application of dewatering process prior to its disposal, sludge still retains approximately 70% by weight of water and is a very soft substance. In order to avoid causing operational and slope stability problem at the landfills, the sludge is mixed with municipal solid waste (MSW) and/or construction waste in a ratio of about one to ten (sludge-to-waste) before their co-disposal at the landfills.

6. While the commissioning of Stage 1 of HATS in 2001 has helped to improve the general water quality of Hong Kong, it has also produced a large quantity of sludge, around 70% of sludge produced daily. It is essential to have at the same time dedicated and appropriate treatment and disposal means to

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<sup>1</sup> Ancillary facilities include administration building, maintenance workshop, utility yard, gatehouse, chemical/fuel storage room, desalination plants, seawater pumping station and storage tank and sewage treatment plant.

handle the large amount of sludge generated on a daily basis. The planned progressive expansion of HATS together with the expansion and upgrading of other existing regional STW (including Pillar Point STW and San Wai STW), would result in further increase in the amount of sludge requiring disposal from the current quantity of about 800 tonnes per day to some 1 500 tonnes per day by 2014 and subsequently over 2 000 tonnes per day by 2020.

7. The current practice of sludge disposal at landfill is not sustainable from both environmental and technical perspectives. Landfilling of biodegradable waste such as sludge would generate other environmental impacts such as leachate and greenhouse gas which require further mitigation measures to deal with. Moreover, apart from the occupation of precious landfill space, the significant increase in quantity of sludge will undermine the assimilative capacity<sup>2</sup> of our landfills and could lead to slope failure at the landfills, thereby causing severe disruption to the safety and waste disposal operations at the landfills. With the current quantity of 800 tonnes per day of sludge, the sludge-to-waste ratio is already just meeting the one to ten<sup>3</sup> ratio. When Stage 2A of HATS is commissioned in 2014, the sludge-to-waste ratio of one to ten will not be met.

8. In view of the anticipated significant increase in sludge generation, we propose to build a dedicated STF at Tsang Tsui near Nim Wan, Tuen Mun. The STF location is selected for its remoteness and its compatibility with existing and planned developments in the area. With a designed capacity of 2 000 tonnes per day, the STF will provide treatment for sludge generated from HATS (i.e. Stonecutters Island STW) and ten other regional STWs, including the Pillar Point STW, San Wai STW, Sham Tsang STW, Siu Ho Wan STW, Sai Kung STW, Shatin STW, Shek Wu Hui STW, Stanley STW, Tai Po STW and Yuen Long STW, by means of high temperature incineration technology to substantially reduce the volume of sludge by 90%<sup>4</sup>. The much reduced volume of incineration ash produced would be disposed of at landfills.

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<sup>2</sup> Assimilative capacity refers to the capacity of landfills for safe disposal of sludge. Sludge is a very soft material. To avoid adversely affecting the stability of landfills, sludge needs to be mixed with solid waste at a sludge-to-waste ratio of not exceeding one to ten. The quantity of sludge that can be disposed of safely at landfills is therefore limited by the quantity of solid waste available to meet the mixing ratio.

<sup>3</sup> In 2008, total quantity of sludge and other types of wet/soft waste which required co-disposal (including waterworks sludge and livestock waste etc.) was 1 220 tonnes per day. To avoid affecting the stability of landfills, these wastes need to be mixed with MSW and construction waste in a ratio of one to ten. In the same year, the available quantity of MSW and construction waste was 12 072 tonnes per day.

<sup>4</sup> The remaining 10% dry and inert ash can be disposed of at landfills without causing the abovementioned landfill stability problem.

9. The STF is an essential and integral part of the HATS programme. It would not be technically or environmentally acceptable for HATS Stage 2A to proceed alone without a dedicated and sustainable outlet for the handling of the sludge arising from the Scheme. At the meeting of the Panel on Environmental Affairs on 15 December 2008, **341DS** “Harbour Area Treatment Scheme, Stage 2A – Construction of the Sewage Conveyance System and Upgrading of Stonecutters Island Sewage Treatment Works and Preliminary Treatment Works” was discussed. During the discussion, Members had expressed concerns about the treatment and disposal of the sludge generated by HATS Stage 2A and urged the Administration to expedite the implementation of the STF project.

## FINANCIAL IMPLICATIONS

10. We estimate the capital cost of the proposed works to be \$5,154.4 million in MOD prices (see paragraph 11 below), made up as follows –

	<b>\$ million</b>
(a) Civil and site formation works	79.0
(b) Building and architectural works <sup>5</sup>	705.5
(c) Incineration system	3,386.3
(i) Sludge receiving facilities <sup>6</sup>	706.9
(ii) Sludge incinerators <sup>7</sup>	795.8
(iii) Waste heat recovery system <sup>8</sup>	956.6
(iv) Flue gas treatment system <sup>9</sup>	795.8
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<sup>5</sup> Item (b) is the design, build and installation of the building works and architectural finishing works. The works include all foundation, structural works, utilities and architectural design and finishing.

<sup>6</sup> Item (c)(i) is for the design, build and installation of the sludge receiving facilities. The works include sludge discharge facilities, sludge hopper, sludge cake conveyor and sludge feeder.

<sup>7</sup> Item (c)(ii) is for the design, build and installation of the sludge incinerators. The works include incinerators, burner fan, fluidized air blower, compressor, sand transfer system and fuel supply system.

<sup>8</sup> Item (c)(iii) is for the design, build and installation of the waste heat recovery system. The works include air heater, waste heat boiler, and steam turbine generation system.

<sup>9</sup> Item (c)(iv) is for the design, build and installation of the flue gas treatment system. The works include primary gas filter, chemical dosing system, secondary bag filter, stacks and ashes and residues silos.

		<b>\$ million</b>	
(v)	Associated electrical and mechanical installations and pipeworks <sup>10</sup>	131.2	
(d)	Ancillary facilities	25.3	
(e)	Environmental educational and associated facilities	20.4	
(f)	Environmental monitoring during the construction stage	10.2	
(g)	Consultants' fees for contract administration	17.4	
(h)	Resident site staff costs	58.0	
(i)	Contingencies	428.7	
	Sub-total	4,730.8	(in September 2008 prices)
(j)	Provision for price adjustment	423.6	
	Total	5,154.4	(in MOD prices)

— A breakdown of the estimate for the consultants' fees and resident site staff costs by man-months is at Enclosure 3.

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

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<sup>10</sup> Item (c)(v) is for the design, build and installation of miscellaneous electrical and mechanical equipments and pipeworks. The works include process monitoring and control system, and all pipeworks for the incineration system.

Year	\$ million (Sept 2008)	Price adjustment factor	\$ million (MOD)
2009 – 2010	112.0	1.03500	115.9
2010 – 2011	1,221.5	1.05570	1,289.5
2011 – 2012	1,442.2	1.07681	1,553.0
2012 – 2013	1,245.3	1.09835	1,367.8
2013 – 2014	208.2	1.12032	233.3
2014 – 2015	167.2	1.15113	192.5
2015 – 2016	167.2	1.18566	198.2
2016 – 2017	167.2	1.22123	204.2
	4,730.8		5,154.4

12. We have derived the MOD estimate on the basis of the Government's latest forecast of trend rate of change in the prices of public sector building and construction output for the period 2009 to 2017. We intend to implement the proposed works and the follow-on operation of the STF under a Design-Build-and-Operate contract arrangement. The contractual operation period will be 15 years. The contract for the STF will provide for price adjustments.

13. We estimate that the annual recurrent expenditure arising from the proposed works to be about \$164.0 million per year upon full commissioning of the project. This has been taken into account in determining the sewage charges for the years 2008-09 to 2017-18 stipulated in the Sewage Services (Sewage Charge) Regulation (Cap. 463A).

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**PUBLIC CONSULTATION**

14. We have adopted a continuous public engagement process with the Tuen Mun District Council (TMDC) and other local representatives throughout the Environmental Impact Assessment (EIA) Study of the STF project. We consulted the Environment, Hygiene and District Development Committee and the Working Group on Development and Planning of Tuen Mun District of the TMDC, as well as all five Tuen Mun Area Committees from 2007 to 2008. In addition, we have organized roving exhibitions in the Tuen Mun district and arranged outreach programmes for schools in Tuen Mun to introduce the STF project to the local community.

15. We consulted the TMDC on 6 January 2009 on the findings of the EIA Study and the latest development of the STF project. The TMDC objected to the siting of too many perceivably unwelcomed public facilities in Tuen Mun and requested a joint meeting with the relevant Directors of Bureaux to discuss the overall planning and development of Tuen Mun. In response to the TMDC's request, the Environment Bureau has taken the lead to set up a working group with TMDC with representatives from relevant bureaux and departments. The first working group meeting was held on 27 March 2009, at which, TMDC representatives presented proposals for improving Tuen Mun's image and development. The Administration is assessing the feasibility of the proposals together with the TMDC with a view to taking forward measures to enhance the further development of the district.

16. The Administration is fully committed to forging a close working partnership with the TMDC to map out strategies and measures to promote the development of Tuen Mun. The issues concerning Tuen Mun's development and positioning would take time to resolve. We appeal for understanding that STF is an essential and integral part of the HATS programme, it is neither technically nor environmentally acceptable for HATS Stage 2A to proceed without a dedicated and sustainable outlet for the sludge arising from the HATS. We will continue to work with the TMDC and the relevant bureaux and departments on measures to promote the development of Tuen Mun.

17. Professional groups, including The Hong Kong Institution of Engineers and The Chartered Institution of Water and Environmental Management Hong Kong, submitted letters to the Legislative Council Panel on Environmental Affairs supporting the proposed STF, to handle the increase quantity of sewage sludge from HATS 2A.

18. We consulted the Legislative Council Panel on Environmental Affairs on the proposed project on 30 March 2009. Members noted our intention to submit the proposal to the Public Works Subcommittee for consideration in April 2009 and requested the Administration to provide the emission standard to be adopted for the STF, the arrangements for the marine transport of sludge for treatment at STF and the outcome of discussion of the working group mentioned in paragraph 15 above. We submitted an information note to the Panel on 9 April 2009.

## ENVIRONMENTL IMPLICATIONS

19. **233DS** is a designated project under the EIA Ordinance and an environmental permit is required for its construction and operation. The EIA report was approved under the EIA Ordinance on 19 February 2009. The EIA report concluded that, with the implementation of the recommended mitigation measures, the project would comply with the established standards stipulated under the EIA Ordinance.

20. For short term impacts during construction, we will control noise, dust and site run-off to levels within established standards and guidelines, through the implementation of mitigation measures such as the use of quiet construction plant to reduce noise generation, water-spraying to reduce dust emission and proper pre-treatment of site run-off. We will also carry out close site inspections to ensure that these recommended mitigation measures and good site practices are properly implemented.

21. We have considered the foundation design and use of precast concrete units in the planning and design stages to reduce the generation of construction waste where possible. In addition, we will require the contractor to reuse inert construction waste (e.g. excavated soil and demolished concrete) on site or in other suitable construction sites as far as possible, in order to minimize the disposal of inert construction waste to public fill reception facilities<sup>11</sup>. We will encourage the contractor to maximize the use of recycled or recyclable inert construction waste, as well as the use of non-timber formwork to further minimize the generation of construction waste.

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<sup>11</sup> Public fill reception facilities are specified in Schedule 4 of the Waste Disposal (Charges for Disposal of Construction Waste) Regulation. Disposal of inert construction waste in public fill reception facilities requires a licence issued by the Director of Civil Engineering and Development.



22. We will also 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 to public fill reception facilities and landfills respectively through a trip-ticket system.

23. We estimate that the project will generate in total about 125 600 tonnes of construction waste. Of these, we will reuse about 91 600 tonnes (73%) of inert construction waste on site. In addition, we will dispose of 34 000 tonnes (27%) of non-inert construction waste at landfills. The total cost for accommodating construction waste at landfill sites is estimated to be \$4.3 million for this project (based on a unit cost of \$125/tonne<sup>12</sup> for disposal at landfills).

## **HERITAGE IMPLICATIONS**

24. The project will not affect any heritage site, i.e. all declared monuments, proposed monuments, graded historic sites/ buildings, sites of archaeological interest and Government historic sites identified by the Antiquities and Monuments Office.

## **LAND ACQUISITION**

25. Land of about 11 hectares has been reserved by Lands Department for the project. The land at present is held by the Castle Peak Power Company Limited (CAPCO) for ash lagoon under a land license. A 12-month notice to surrender was issued to CAPCO on 27 February 2009 to take back the required site for the project.

## **BACKGROUND**

26. The “Sludge Treatment and Disposal Strategy Study”, completed in 1999, recommended that all sludge in Hong Kong be incinerated in a centralized treatment facility. This recommendation was endorsed by the Advisory Council

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<sup>12</sup> This estimate has taken into account the cost for developing, operation and restoring the landfills after they are filled and the aftercare required. It does not include the land opportunity cost for existing landfill sites (which is estimated at \$90/m<sup>3</sup>), nor the cost to provide new landfills, (which is likely to be more expensive) when the existing ones are filled.

on the Environment in January 2000. We then conducted a review in treatment technology in 2005. The review concluded that the incineration technology was still the preferred technology. This recommendation of adopting high temperature incineration was unanimously supported by an Independent Advisory Panel. This Panel was formed in 2005 and comprised four renowned academic members from the University of Hong Kong, Hong Kong University of Science and Technology and Hong Kong Baptist University to provide independent views on the technology options.

27. We then conducted a comprehensive site search with a view to identifying the most suitable site for the proposed STF. Nine potential sites were short-listed for detailed assessment based on various essential selection criteria including environmental implications (noise, air quality, water quality, ecology, visual and landscape), engineering feasibility (ease of construction, geotechnical conditions, water and power supply, wastewater treatment), transportation, town planning and financial considerations. In 2003, the eastern end of the ash lagoon at Tsang Tsui near Nim Wan, Tuen Mun, was identified as the most technically viable location for the STF because the site is remote from residential areas and there are no planned developments in the area. Besides, the site is accessible by both road and sea. Most importantly, the development of STF at the site would have no unacceptable impacts on air quality impact, water quality impact, marine ecology and fisheries impact, terrestrial ecology as well as landscape and visual aspects.

28. In 2004, we engaged a consultant under block allocation **Subhead 5101DX** “Environmental works, studies and investigations for items in Category D of the Public Works Programme” at a total estimated cost of \$13.0 million to carry out the feasibility study, environmental impact assessment and tendering exercise for the project.

29. We upgraded **233DS** to Category B in September 2006.

30. We plan to invite tenders for the project in June 2009 with a view to starting construction work in early 2010 for commissioning of phase 1 in end 2012.

31. The proposed construction of the STF will involve removal of 460 trees; including 46 trees to be transplanted and 414 trees will be replanted within the project site (subject to finalization of design). All trees to be removed are not important trees<sup>13</sup>. We will require the contractor to incorporate planting proposals as part of the project.

32. We estimate that the design and construction of the proposed works will create about 613 jobs (557 for labourers and another 56 for professional/technical staff) providing a total employment of 18 700 man-months. In addition, we estimate that the operation of the STF will create 60 permanent jobs (26 labourers and another 34 professional/ technical staff).

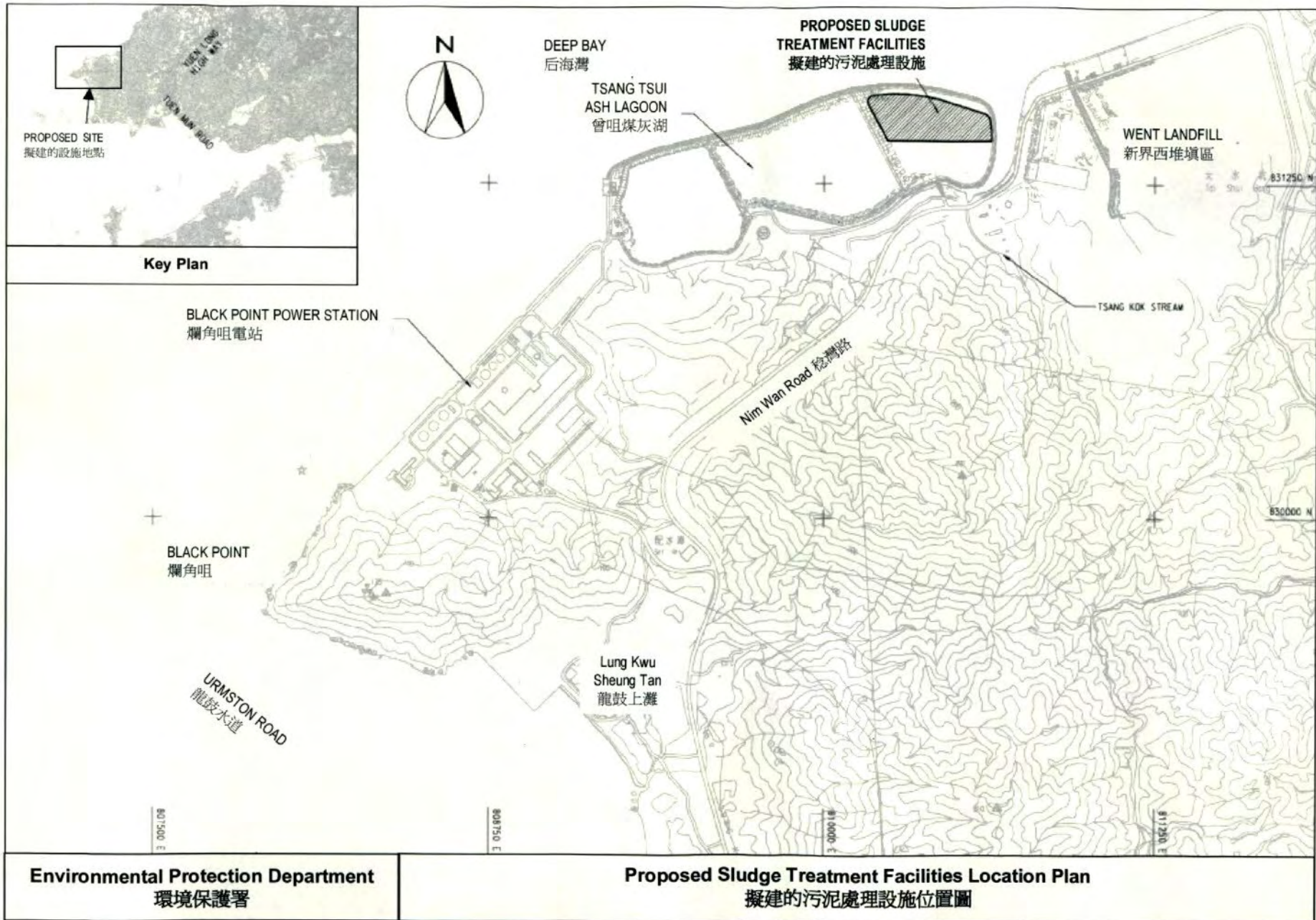
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Environment Bureau  
April 2009

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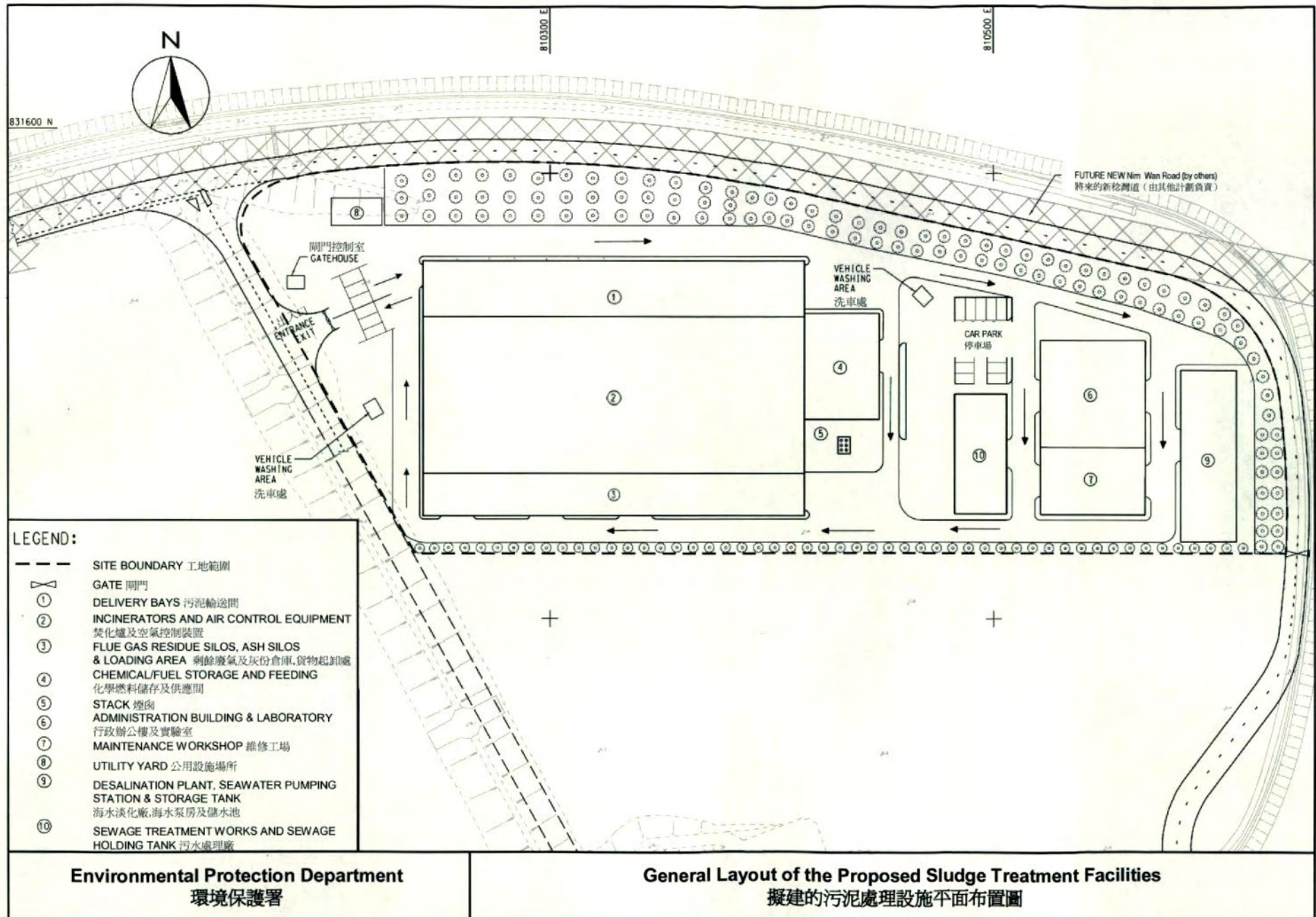
<sup>13</sup> An “important tree” refers to trees in the Register of Old and Valuable Trees, or any other trees that meet one or more of the following criteria –

- (a) trees of over 100 years old or above;
- (b) trees of cultural, historical or memorable significance e.g. Fung Shui tree, tree as landmark of monastery or heritage monument, and trees in memory of an important person or even;
- (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 (measured at 1.3 metres above ground level), or with height/ canopy spread equal or exceeding 25 metres.



Environmental Protection Department  
環境保護署

Proposed Sludge Treatment Facilities Location Plan  
擬建的污泥處理設施位置圖



**Enclosure 3 to PWSC(2009-10)16**

**233DS – Sludge treatment facilities**

**Breakdown of the estimates for consultants' fees and resident site staff costs  
(in September 2008 prices)**

			<b>Estimated man-months</b>	<b>Average MPS* salary point</b>	<b>Multiplier (Note 1)</b>	<b>Estimated fee (\$ million)</b>
(a)	Consultants' fees	Professional	140	38	1.6	13.6
	for contract	Technical	120	14	1.6	3.8
	administration (Note 2)					
(b)	Resident site staff	Professional	360	38	1.6	34.9
	costs (Note 3)	Technical	728	14	1.6	23.1
					<b>Total</b>	<hr/> <b>75.4</b> <hr/>

\* MPS = Master Pay Scale

**Notes**

1. A multiplier of 1.6 is applied to the average MPS point to arrive at the full staff costs, including the consultants' overheads and profit, for staff employed in the consultants' offices. MPS points 38 and 14 are used as the average MPS salary points for professionals and technical staff respectively. (As at 1 April 2008, MPS point 38 = \$60,535 per month and MPS point 14 = \$19,835 per month)
2. The figures given are based on estimates prepared by the Director of Environmental Protection. We will only know the actual man-months and actual fees when we have selected the consultant through the usual competitive lump sum fee bid system.
3. We will only know the actual man-months and actual costs after the completion of the construction works.