

For discussion
On 25 October 2000

Legislative Council
Panel on Environmental Affairs

**Strategic Sewage Disposal Scheme Stage I : Completion of sewer tunnel
system from Kwai Chung to Stonecutters Island**

Purpose

This paper seeks Members' views on the Administration's proposal to seek Public Works Subcommittee's approval on 8 November 2000 to increase the approved project estimate for Public Works Project Item **320DS**, namely "Strategic Sewage Disposal Scheme Stage I: completion of sewer tunnel system from Kwai Chung to Stonecutters Island" from \$487.6 million by \$115.0 million to \$602.6 million in money-of-the-day (MOD) prices.

Background

2. The project **320DS** covers the completion of the western tunnels (Tunnels F and G) under Stage I of the Strategic Sewage Disposal Scheme (SSDS). The scope of works approved by the Finance Committee on 27 February 1998 is -

- (a) completion of a 3.6 kilometre-long sewer tunnel from Tsing Yi to Stonecutters Island (Tunnel F);
- (b) completion of a 0.8 kilometre-long sewer tunnel from Kwai Chung to Tsing Yi (Tunnel G); and
- (c) completion of shafts and ancillary site works including -
 - (i) works for the drop shaft at Kwai Chung Preliminary Treatment Works;
 - (ii) finishing works for the production/riser shaft at

Stonecutters Island and the production/drop shaft at Tsing Yi built under separate advance works contracts; and

(iii) ancillary site works at the above sites.

3. The project **320DS** is one of the 19 items making up the SSDS Stage I programme that were transferred to the Capital Works Reserve Fund in April 1998 after closure of the Sewage Services Trading Fund. The overall approved project estimate for the Stage I programme is \$8,323.7 million (including \$4,408.9 million spent during the existence of the Sewage Services Trading Fund). A location plan of the SSDS Stage I sewage tunnel system is at Annex A.

4. Tunnels F and G are designed to collect sewage from the Tsuen Wan, Kwai Chung and Tsing Yi areas. This area produces 25% of the sewage to be treated under SSDS Stage I.

5. The contract for constructing the two tunnels and associated works covered by **320DS** was originally let at the end of 1994. The contractor unilaterally suspended work in mid 1996 after excavating 0.5 kilometres of Tunnel F and 0.1 kilometres of Tunnel G. Government re-entered the sites in December 1996. Works for the western tunnels were subsequently re-tendered. The completion contract began in July 1997 with an original contract completion date of August 1999.

6. The excavation works for Tunnel G were successfully completed in January 1999 and the tunnel lining works were completed in June 2000. As at 15 October 2000, 93.0% of the excavation works for Tunnel F had been completed. We expect all the works to be substantially completed in the last quarter of 2001.

Problems encountered in excavation of Tunnels F and G

7. The progress of the tunnelling works under the completion contract encountered significant delays due to:

(a) replacement of a faulty mucking system (used for removing

spoil excavated from tunnels) in 1998; and

- (b) additional ground strengthening and stabilization works required to deal with the exceptionally poor ground conditions encountered.

The combined effect of these is expected to have delayed the completion of the western tunnels by about 26 months. Details are given in Annex B.

Justification for the Additional Funding

8. It is expected that the uncommitted funds under **320DS** will be reduced to \$8 million by December. To enable the continuation and completion of works under **320DS**, additional funding is urgently required to -

- (a) replenish the provision under the approved project estimate of **320DS** so that the shaft works at Stonecutters Island and other ancillary site works can be completed;
- (b) replenish the contingencies provision for **320DS** which has been consumed in dealing with the faulty mucking system and exceptionally poor ground conditions; and
- (c) cover the additional cost of undertaking tunnel lining works and ancillary works in Tunnel F.

Annex C sets out the detailed justifications for these expenses.

Urgency for the additional funding

9. The approved project estimate remaining under **Item 320DS** is now at a low level and the increase in approved project estimate is urgently required. If extra funding is not available by early December, we will not be able to settle payments for claims as they are certified by the Engineer. We will also not be able to proceed with the necessary additional works to

complete the lining of Tunnel F. The consequences of this would be that we would have to abandon the works under **320DS**. This would lead to claims from the contractor against Government for breach of contract.

10. Since one of the remaining works under **320DS** is to complete the riser shaft at the Stonecutters Island Sewage Treatment Works (SCISTW), which will serve the four eastern tunnels under SSDS as well as the two western tunnels, if works are abandoned under **320DS** sewage from the entire catchment of the six tunnels will not be treated even when the eastern tunnels are completed. The SCISTW, which have been completed, would then continue only to treat sewage generated in the West Kowloon area, which is already connected to the treatment works. This represents only 25% of the sewage in the SSDS Stage I catchment area.

Additional Information

11. As at 15th October 2000, excavation work on three of the four eastern tunnels (Tunnels AB, C, D and E) had been completed. Lining works and other finishing operations for these tunnels are in progress. Tunnel E, which connects the other three from To Kwa Wan to the SCISTW was 96.7% excavated. It is expected to be fully excavated within the next few weeks.

12. In April 2000, an International Review Panel (IRP) was set up to consider the future development of the sewage treatment system for the main urban area in the light of experience with Stage I of SSDS and developments in technology. The Panel was also asked to give early advice as to whether its likely recommendations might have any bearing on the works underway on Stage I. In September, the Panel advised that, having obtained information on tunnel progress and geological conditions it was satisfied that the works could be completed and would not be affected by recommendations it was likely to make on future development. [Note: We expect the IRP to present its full recommendations at the end of November].

Financial Implications

13. Following a review of the financial position of the project, we

consider it necessary to increase the approved project estimate of **320DS** from \$487.6 million by \$115.0 million to \$602.6 million in MOD prices in order to cover the cost of the works.

14. A summary of the disbursement of the proposed increase of \$115.0 million is at Annex D.

15. A comparison of the cost breakdown of the approved project estimate and the revised project estimate is at Annex E.

16. According to our current forecasts, if the proposed increase in the approved project estimate for **320DS** is approved, the overall estimate for the completion of SSDS Stage I will be \$8,252.0 million. This is \$72 million less than the total approved project estimate. This is due to reductions in the estimated costs of other projects under the SSDS Stage I programme.

17. Up to end September 2000, the total expenditure on the SSDS Stage I was \$6.8 billion.

18. The proposed increase in the approved project estimate will not give rise to additional recurrent expenditure. It will provide the necessary funding for completion of the western sewage tunnelling works, which will give rise to the continuation in the current employment of about 190 existing posts under this project (30 professional/technical staff and 160 labourers), totalling 4,560 man months. We expect this level of employment to be necessary until completion of the works in year 2001.

Public Consultation

19. The five then District Boards affected by the SSDS project were consulted in 1994. They supported the project. We have also kept the Legislative Council and its Panel on Planning, Lands and Works and Panel on Environmental Affairs updated on the progress of the project. The last progress report submitted was at the EA panel on 7 April 2000.

Environmental Implications

20. The proposed increase in the approved project estimate does not have any environmental implications.

Advice Sought

21. Subject to the views of Members, our proposal to increase the approved project estimate of **320DS** will be submitted to the Public Works Subcommittee for consideration on 8 November 2000 with a view to seeking the funding approval of Finance Committee on 1 December 2000.

Environment and Food Bureau
October 2000

Problems encountered in excavation of Tunnels F and G

The progress of the tunnelling works under the completion contract encountered significant delays due to:

- (a) replacement of a faulty mucking system (used for removing spoil excavated from tunnels) in 1998; and
- (b) additional ground strengthening and stabilization works required to deal with the exceptionally poor ground conditions encountered.

(a) Replacement of the faulty mucking system

2. The new contractor started excavation in Tunnels F & G in November and October 1997 respectively. The contractor later found that the mucking system, which was part of the forfeited plant from the previous tunnel contractor, could not operate effectively at full load. After receiving independent experts' recommendation, for the sake of safety and efficient operations we instructed the contractor to effect replacement works. These were completed in June 1998.

3. The works for replacing the mucking system could not have been foreseen when the tender was called for and were not budgeted for in our original estimate. Since the mucking system replacement works were very time-consuming and could not be foreseen when the tender was called for, we have received substantial claims from the contractor for the direct and prolongation costs. The cost arising from the additional works required, amounting to \$45.0 million had already been assessed by the Engineer and settled by the Government under the terms of the contract.

(b) Additional works to deal with weak grounds in Tunnel F

4. Before commencement of the project, best endeavours were made to assess the ground conditions of the works area. Boreholes were drilled along the tunnel alignments. As is the case with other tunnel excavation projects, such boreholes can only provide an indication of ground

conditions. Precise information on the actual ground conditions at each location can only be ascertained after works have commenced.

5. Actual geological conditions for constructing Tunnel G, the Stonecutters Island shaft and the Kwai Chung shaft were found to be better than expected from pre-excavation assessments. The excavation works for Tunnel G, the Stonecutters Island and Kwai Chung shaft were completed between May 1998 and March 1999, resulting in a saving of \$44.0 million from their original estimates.

6. Geological conditions for Tunnel F, however, were much worse than the pre-excavation investigation predicted. The major fault zones (Lead Mine Pass Fault, Tolo Channel Fault and an extensive zone of highly fractured rhyolite dykes) were more extensive than anticipated and were extremely difficult for tunnelling. To enable tunnel excavation to proceed safely in these areas, we instructed the contractor to undertake additional ground strengthening and stabilisation measures (including ground strengthening by grouting, as well as installation of reinforcement bars, steel casing tubes and steel support frames as ground supports). Since the additional ground strengthening and stabilisation measures were very time-consuming and could not be foreseen when the tender was called for, we have also received substantial claims from the contractor for the direct and prolongation costs involved. The cost of the above-mentioned additional works to deal with weak grounds, amounting to \$59.0 million, had been assessed by the Engineer and settled by the Government under the terms of the contract. The amount could only be fully identified during actual encounter with the poor ground.

Additional Funding Required

It is expected that the uncommitted funds under **320DS** will be reduced to \$8 million by December. To enable the continuation and completion of works under **320DS**, additional funding is urgently required to -

- (a) replenish the provision under the approved project estimate of **320DS** so that the shaft works at Stonecutters Island and other ancillary site works can be completed;
- (b) replenish the contingencies provision for **320DS** which has been consumed in dealing with the faulty mucking system and exceptionally poor ground conditions; and
- (c) cover the additional cost of undertaking tunnel lining works and ancillary works in Tunnel F.

(a) To complete the additional shaft works at Stonecutters Island and other ancillary site works

2. As mentioned in Annex B, the additional cost for replacement of the mucking system and the ground strengthening and stabilisation measures for traversing the weak grounds previously encountered in Tunnel F have far exceeded our savings on Tunnel G and the two shafts together with the amount we had allowed as contingencies. To maintain work progress and for the sake of safety and efficient operations of the contractors, we had directed these works to proceed at a cost of \$104.0 million. As an interim measure, funding earmarked for other purposes, notably for completing the additional shaft works at Stonecutters Island and other ancillary site works, has been redeployed within the approved project estimate. However, we have now almost fully committed our budget and therefore need to secure additional funding to replenish the project item to complete the riser shaft.

(b) To replenish the contingencies provision for dealing with additional claims

3. In addition to the additional payment which have been certified

by the Engineer and settled by the Government as mentioned in Annex B, we have received other substantial claims for additional payment from the contractor in relation to the prolonged construction period and the extensive difficult ground encountered. The Engineer has finished his assessment of some of these claims and would certify payment to them very soon. We will then be obliged to commit additional funding and settle such payments. Since we have almost depleted the contingencies provision under **320DS** which is used for handling claims, we consider it necessary to secure additional funding under the project by early December to cover the financial commitments that might arise imminently from claims settlement.

(c) To undertake additional tunnel lining works and ancillary works

4. Due to the poor ground conditions in Tunnel F, additional works for completing the tunnel linings in areas of weak grounds will be required. We estimated that additional funding of \$44.0 million will be required for effecting these measures.

**A summary of the disbursement of the proposed increase of
\$115.0 million in the approved project estimate of 320DS**

Factor	Increase/ (Decrease) in money-of- the-day(MOD) prices (\$ million)	%
(a) Cost already incurred for replacement of defective mucking system	45.0	39.1
(i) Direct cost	25.0	
(ii) Prolongation cost	20.0	
(b) Cost already incurred for additional works (including the ground strengthening and stabilisation works for weak grounds) in Tunnel F	59.0	51.3
(i) Direct cost	27.0	
(ii) Prolongation cost	32.0	
(c) Cost for additional works to deal with weak grounds (including the tunnel lining and ancillary works) incidental to remaining works of Tunnel F	44.0	38.3
(d) Reduction in cost for completion of Kwai Chung/ Stonecutters Island shaft, ancillary site works and Tunnel G due to better-than-expected ground conditions	(44.0)	(38.3)
(d) Contingencies	11.0	9.6
Total	115.0	100.0

in MOD
prices

Comparison of the cost breakdown of the approved project estimate and the revised project estimate of 320DS

Taking into account the actual expenditure of \$51.4 million under the SSTF, the total approved funds and latest project estimate in MOD prices become \$539.0 million and \$654.0 million respectively. A comparison of the approved project estimate and the revised project estimate is as follows -

	Approved Estimate (MOD) \$ million	Revised Estimate (MOD) \$ million	Difference \$ million
(a) Completion of sewer tunnel from Tsing Yi to Stonecutters Island (Tunnel F)	251.8 [267.0]	354.8 [370.0]	103.0
(b) Completion of sewer tunnel from Kwai Chung to Tsing Yi (Tunnel G)	60.3 [67.0]	31.8 [38.5]	(28.5)
(c) Completion of shafts in Kwai Chung, Tsing Yi and Stonecutters Island and ancillary site works	136.5 [166.0]	121.0 [150.5]	(15.5)
(d) Replacement of mucking system	0.0 [0.0]	45.0 [45.0]	45.0
(e) Contingencies	39.0 [39.0]	50.0 [50.0]	11.0
Total	<u>487.6 [539.0]</u>	<u>602.6 [654.0]</u>	<u>115.0</u>

[] - Total estimate including expenditure already incurred under the SSTF

2. As regards (a) (completion of sewer tunnel from Tsing Yi to Stonecutters Island (Tunnel F)), of the total increase of \$103.0 million -

- (a) \$22.0 million is for the cost (including prolongation cost) for additional ground stabilisation works to traverse through the fractured rhyolite dyke areas.
 - (i) \$12 million is for the contractor's prolongation cost due to the extended contract period for the additional works.
 - (ii) \$10 million is for the direct cost of these additional works.

- (b) \$37.0 million is for the cost (including prolongation cost) for additional ground stabilisation works to traverse through the Tolo Channel Fault zone.
 - (i) \$20 million is for the contractor's prolongation cost due to the extended contract period for the additional works.
 - (ii) \$17 million is for the direct cost of these additional works.

- (c) \$44.0 million is for the cost of additional works incidental to the remaining works (including both excavation and lining) for Tunnel F.
 - (i) \$21 million is for the contractor's prolongation cost due to the extended contract period for the additional works.
 - (ii) \$23 million is for the direct cost of these additional works.

3. As regards (b) (completion of sewer tunnel from Kwai Chung to Tsing Yi (Tunnel G)), we found that the ground condition of this tunnel had been better than expected. The sum of \$28.5 million previously allowed for additional ground stabilisation works in this tunnel is no longer required and has been utilised to offset the cost for additional ground stabilisation works in Tunnel F.

4. As regards (c) (completion of shafts and ancillary site works), we found that the ground condition for Kwai Chung drop shaft had been better than expected. The sum of \$15.5 million previously allowed for additional ground stabilisation works in this shaft is no longer required and has been utilised to offset the additional cost due to replacement of the defective

mucking system.

5. As regards (d) (replacement of defective mucking system), the increase of \$45.0 million is for the additional cost (including the prolongation cost) for replacement of the defective mucking system in Tsing Yi production shaft.

6. As regards (e) (contingencies), we retain \$50.0 million as the contingencies for the outstanding works, for settlement of the final accounts and for resolution of possible claims from the contractor.