

## **CHAPTER 4**

### **Water Supplies Department**

#### **Construction of Tai Po Water Treatment Works**

**Audit Commission  
Hong Kong  
25 October 2007**

*This audit review was carried out under a set of guidelines tabled in the Provisional Legislative Council by the Chairman of the Public Accounts Committee on 11 February 1998. The guidelines were agreed between the Public Accounts Committee and the Director of Audit and accepted by the Government of the Hong Kong Special Administrative Region.*

Report No. 49 of the Director of Audit contains 12 Chapters which are available on our website at <http://www.aud.gov.hk>.

Audit Commission  
26th floor, Immigration Tower  
7 Gloucester Road  
Wan Chai  
Hong Kong

Tel : (852) 2829 4210  
Fax : (852) 2824 2087  
E-mail : [enquiry@aud.gov.hk](mailto:enquiry@aud.gov.hk)

# CONSTRUCTION OF TAI PO WATER TREATMENT WORKS

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## **PART 1: INTRODUCTION**

1.1 This PART describes the background to the audit and outlines the audit objectives and scope.

### **Tai Po Water Treatment Works Project**

1.2 In 1994, the Water Supplies Department (WSD) forecasted that the capacity of the Shatin Group of Water Treatment Works of supplying 1,700,000 cubic metres (m<sup>3</sup>) of treated water daily to Hong Kong Island, Kowloon and north-eastern New Territories would be inadequate to meet the projected demand by 2000. Therefore, the WSD planned to implement the Tai Po Water Treatment Works Project for supplying additional 250,000 m<sup>3</sup> of treated water daily to the areas. The capacity of this new water treatment facility could be expanded to meet the future increase in demand.

1.3 Between 1994 and 1996, the Finance Committee (FC) of the Legislative Council approved total funding of \$4.6 billion for implementing the Tai Po Water Treatment Works Project. In October 1994 and November 1995, the WSD employed a consultant (the Consultant) under two consultancies, one for carrying out an investigation study (**Investigation Study Consultancy**) in the sum of \$8.9 million, and the other for carrying out the design and supervision of construction works (**Design and Construction Consultancy**) in the sum of \$72.2 million. Between May 1997 and February 1998, the construction works commenced under three capital works contracts (see Table 1 and Figure 1). The Tai Po Water Treatment Works commenced operation in June 2003.

Table 1

## The three capital works contracts

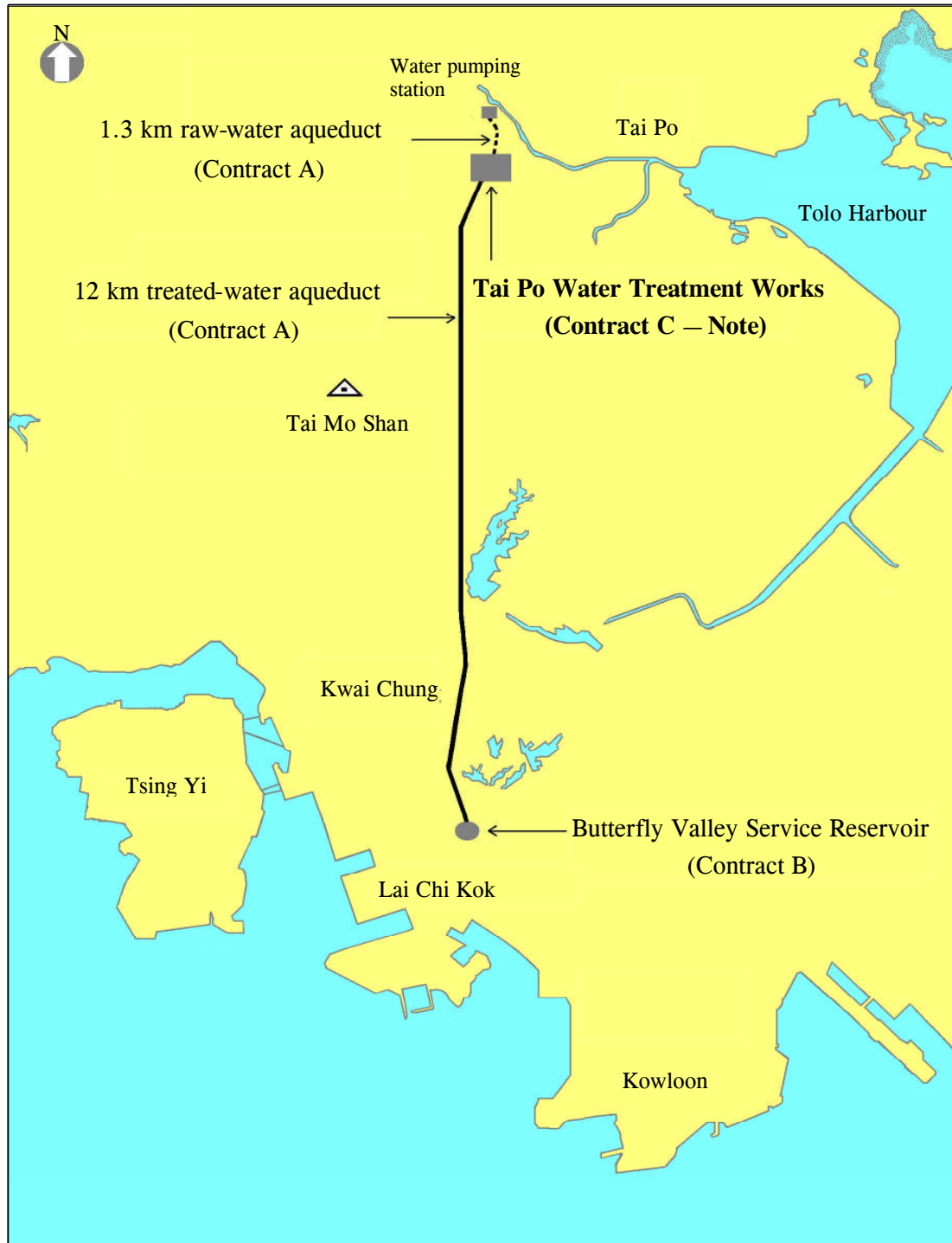
<b>Contract</b>	<b>Major works</b>	<b>Commencement date (Month)</b>	<b>Substantial completion date (Month)</b>	<b>Final contract sum (\$ million)</b>
Contract A	Construction of two aqueducts for carrying raw water and treated water between Tai Po and the Butterfly Valley	June 1997	March 2001	1,016
Contract B	Construction of a primary service reservoir, with site formation and ancillary works at the Butterfly Valley	May 1997	August 2001	325
<b>Contract C</b>	<b>Construction of water treatment works and a treated water pumping station in Tai Po</b>	<b>February 1998</b>	<b>September 2003</b>	<b>2,155</b>
Total				3,496

Source: WSD records

Remarks: This audit review only covered Contract C. The results of the audit review of Contracts A and B were included in Chapter 9 "Tai Po Water Treatment Works Project: contract administration" of the Director of Audit's Report No. 46 of March 2006.

Figure 1

## Major works under the three capital works contracts



Source: WSD records

Note: See remarks in Table 1

**Design and construction**

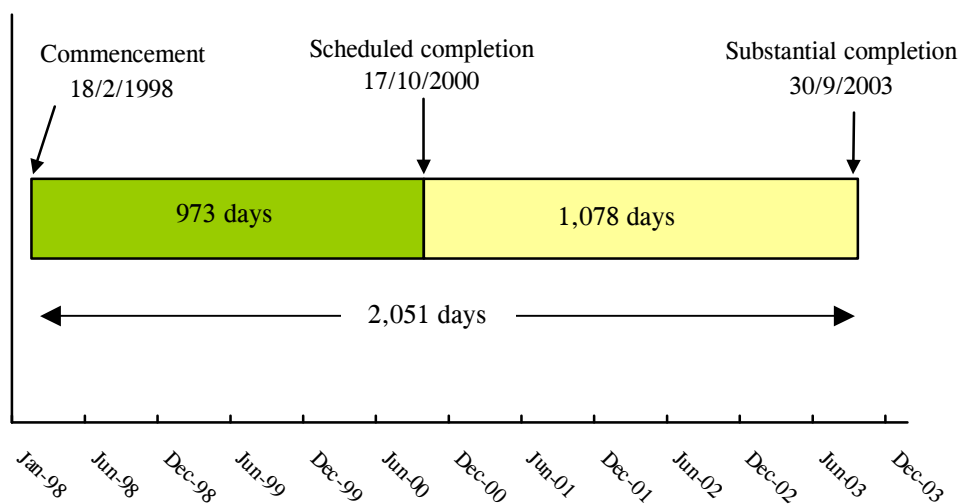
1.4 Under the Design and Construction Consultancy, the Consultant was responsible for the design and supervision of the construction of the Tai Po Water Treatment Works. In December 1996, the FC approved funding of \$2,227 million for the construction of the water treatment works and a pumping station in Tai Po. In January 1998, the WSD awarded Contract C (the Contract) to a contractor (the Contractor) in the sum of \$1,941 million for the works. The WSD also appointed the Consultant as the Engineer of the Contract.

**Final contract sum**

1.5 The major works under the Contract were substantially completed in September 2003, nearly three years behind schedule (see Figure 2). There were disputes between the WSD and the Contractor over the Contractor’s claims. In October 2006, after mediation, the WSD and the Contractor signed a supplemental agreement, under which the WSD paid the Contractor an additional sum to settle all the contractual disputes under the Contract. The settlement sum accounted for part of the difference between the original contract sum of \$1,941 million and the final contract sum of \$2,155 million.

**Figure 2**

**Duration of the Contract (major works)**



Source: WSD records and Audit’s analysis

Remarks: Major works referred to those works which, if delayed, could affect the commencement of operation of the Tai Po Water Treatment Works.



## **Audit review**

1.6 In 2005, the Audit Commission (Audit) conducted an audit review of the Tai Po Water Treatment Works Project, covering only Contracts A and B (Contract C was excluded at that time because contractual disputes had not yet been resolved). The review results were included in Chapter 9 “Tai Po Water Treatment Works Project: contract administration” of the Director of Audit’s Report No. 46 of March 2006.

1.7 In October 2006, the WSD signed a supplemental agreement with the Contractor to settle the disputes (see para. 1.5). Audit has recently conducted a review to examine the WSD’s administration of the Contract and the two related consultancies. The audit review focused on the following areas:

- (a) changes to works layout (PART 2);
- (b) increase in rock excavation quantities (PART 3);
- (c) changes to the electricity distribution system (PART 4); and
- (d) management of contract variations (PART 5).

Audit has found that there are areas where improvements can be made by the WSD in the administration of consultancies and works contracts.

## **Acknowledgement**

1.8 Audit would like to acknowledge with gratitude the full cooperation of the staff of the WSD during the course of the audit review.

## **PART 2: CHANGES TO WORKS LAYOUT**

2.1 This PART examines the WSD's administration of the changes to the works layout of the Tai Po Water Treatment Works.

### **Investigation Study Consultancy**

#### *Terms of reference*

2.2 In July 1994, the FC approved funding of \$22.4 million for the Investigation Study Consultancy. In October 1994, the WSD employed the Consultant to carry out an investigation study. The terms of reference of the study included:

- (a) identifying the relevant constraints relating to land and environment, and ensuring the practicality of the project;
- (b) producing a layout for the staged development of the treatment works and the associated water transfer facilities;
- (c) producing an optimum preliminary design for the project, taking into account all relevant constraints; and
- (d) giving early advice on and making the best effort in taking action to address all relevant constraints to ensure the scheduled completion of the project.

2.3 The consultancy agreement included the following milestones:

- (a) **by 31 January 1995, the Consultant should finalise the land requirements and site boundary of the water treatment works.** The Consultant should liaise with the District Lands Offices, the District Offices and all relevant bodies to seek their agreement on the proposed site for the treatment works and the transfer facilities, and other land requirements;
- (b) **by 31 January 1995, the Consultant should submit the draft preliminary project feasibility report to the WSD.** This report should include a statement confirming that:
  - (i) a site had been earmarked by the Lands Department (with defined key boundaries); and
  - (ii) major resumption or clearance problems had been identified; and

- (c) **by 31 July 1995, the Consultant should submit the final project feasibility report to the WSD.**

*Public consultations*

2.4 On 6 December 1994, the WSD informed the Consultant that:

- (a) public consultations formed an essential part of the consultancy; and
- (b) once there was a clear idea of land requirements, the consultation process should commence as soon as possible.

On 8 February 1995, the Consultant submitted the draft preliminary project feasibility report to the WSD.

2.5 In mid-May 1995, the Consultant submitted a draft consultation paper with a proposed works layout plan to the WSD. On 13 and 27 June 1995, the WSD presented the project and the layout plan to the Tai Po Rural Committee and the Tai Po District Council respectively.

2.6 On 11 July 1995, the WSD received a letter (dated 8 July 1995) from a solicitor representing the villagers of She Shan Village, Lam Tsuen. In the letter, it was pointed out that the villagers:

- (a) opposed to any plans to proceed with the proposed water treatment works on Fung Shui (Note 1) grounds, as the proposed works site would cover the ridge line of the hills (called the “dragon’s vein” by the villagers); and
- (b) suggested shifting the works site to obviate any adverse impact.

*Actions to address objection after Investigation Study Consultancy*

2.7 In August 1995, the Consultant submitted to the WSD the final project feasibility report, together with a proposed works layout plan. In August and September 1995, the WSD, the Consultant and the District Office/Tai Po (DO/TP) took actions (see Table 2) to address the villagers’ objection.

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**Note 1:** *Fung Shui is a discrete Chinese belief system involving a mix of geographical, religious, philosophical, mathematical, aesthetic, and astrological ideas.*

**Table 2**  
**Actions to address villagers' objection**  
**(August and September 1995)**

Date (1995)	Action taken by	Action
11 August	DO/TP	Advised the WSD that the villagers' concerns should be addressed before finalising the project plan
7 September	Consultant	Wrote to the WSD:  (a) saying that the villagers' proposal of shifting the site was <b>not</b> recommended because it would require more excavation works and would have greater impact on the environment; and  (b) suggesting alternative measures (such as carrying out treatment of affected slopes, and planting and landscaping works) to mitigate the impact claimed by the villagers
18 September	WSD	Forwarded the Consultant's comments of 7 September 1995 to the DO/TP
21 September	WSD	Forwarded the Consultant's comments of 7 September 1995 to the solicitor representing the villagers

Source: WSD records

## Design and Construction Consultancy

### *Guidelines on consultations*

2.8 As laid down in Financial Circular No. 11/94 on “Public Works Subcommittee of Finance Committee” of May 1994 (Note 2):

- (a) government bureaux and departments should undertake consultations prior to the finalisation of the Public Works Subcommittee (PWSC) papers (for seeking funds for projects); and
- (b) where there was public or sectoral opposition to the proposals, the PWSC papers should set out clearly the grounds, together with remedial measures.

2.9 In 2004, the then Secretary for the Environment, Transport and Works issued the following guidelines to strengthen consultations with the public for implementing public works projects:

- (a) thorough consultations must be conducted for proposed public works projects;
- (b) there should be more direct consultations with the affected residents; and
- (c) greater details on the outcome of consultations should be provided in the PWSC papers.

2.10 As laid down in Environment, Transport and Works Bureau (ETWB) Technical Circular (Works) No. 4/2006 of August 2006, works departments:

- (a) should aim to complete the resolution of all public objections within four months from the expiry of the objection period;
- (b) where objections cannot be fully resolved within four months, may extend the resolution period to seven months; and
- (c) should seek the Head of Department’s agreement before further extending the resolution period to nine months.

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**Note 2:** *This circular was subsequently superseded. Financial Circular No. 2/2006 on “User Guide on the Finance Committee, Establishment Subcommittee and Public Works Subcommittee” of February 2006 (which is currently in force) contains similar guidelines.*

### ***Funding approval for Design and Construction Consultancy***

2.11 Before the PWSC meeting on 12 July 1995, the Administration submitted a paper to the PWSC to seek its endorsement of a funding application for the Design and Construction Consultancy. In the paper, the Administration said that:

- (a) as part of the investigation study, the WSD was conducting the consultation with the relevant District Councils; and
- (b) during the detailed design stage of the project, the WSD would take into account the results of the consultation.

The PWSC endorsed funding of \$52.6 million for the Design and Construction Consultancy. On 29 July 1995, the FC approved the funding application.

### ***Appointment of Consultant***

2.12 On 13 November 1995, the WSD employed the Consultant to take up the Design and Construction Consultancy (see para. 1.3). The WSD attached to the Consultancy Brief the proposed works layout plan (included in the final project feasibility report submitted in August 1995 by the Consultant — see para. 2.7). As laid down in the Design and Construction Consultancy Agreement, the Consultant should:

- (a) review the land requirements for the detailed design of the project, refine the site boundary and propose additional land requirements, taking into account the objection from the villagers of She Shan Village and the results of public consultations carried out during the Design and Construction Consultancy;
- (b) liaise and follow up with the District Lands Offices, the District Offices and all relevant parties to seek their agreement on land matters associated with the project; and
- (c) review the Fung Shui impact arising from the project, in particular the objection raised by the villagers, and seek agreement from the concerned parties on the proposed mitigation measures.

### ***Actions to address objection during Design and Construction Consultancy***

2.13 In early November 1995, the WSD received another letter from the solicitor representing the villagers of She Shan Village, in which he reiterated their objection to the works layout and their request to shift the site. Between January and May 1996, the WSD, the Consultant and the DO/TP took actions to address the villagers' objection (see Table 3).

Table 3

**Actions to address villagers' objection  
(January to May 1996)**

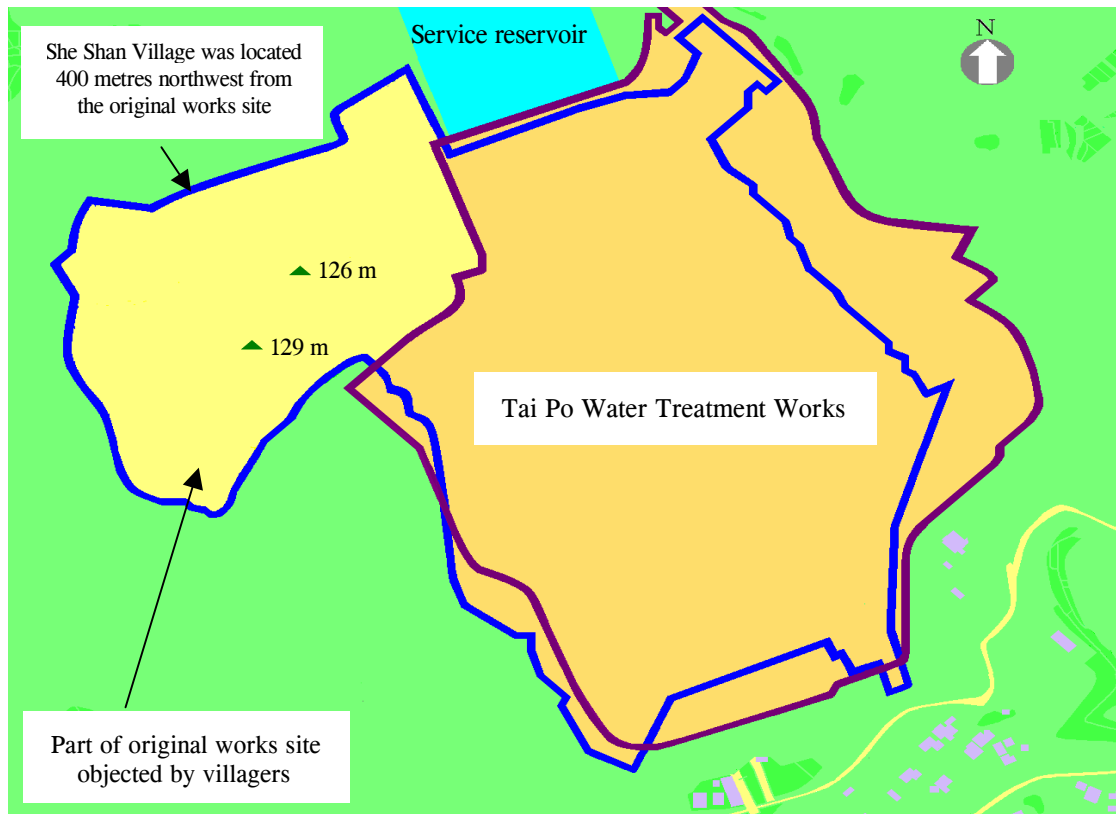
Date (1996)	Action taken by	Action
12 January	DO/TP	Forwarded to the WSD a complaint letter of 29 December 1995 written by the She Shan Village representatives, stating the villagers' objection to the proposed works layout
18 January	WSD	Instructed the Consultant to change the works layout and adjust the site boundary
1 March	Consultant	In a review report submitted to the WSD, proposed to:  (a) shift the works site to avoid cutting into the ridge line (this was in line with the suggestion of the villagers); and  (b) change the works layout with the site area reduced
8 March	WSD	Instructed the Consultant to develop a revised works layout plan based on his proposal of 1 March 1996
13 May	Consultant	Submitted the revised works layout plan to the WSD

Source: WSD records

2.14 In July 1996, the villagers agreed with the revised works layout plan. The original and revised site boundaries are shown in Figure 3.

Figure 3

Site boundaries



- Legends:
- Original site boundary of May 1995
  - Revised site boundary of July 1996
  - ▲ 129 m Height (in metres)

Source: *Audit's drawing based on WSD records*



## **Additional costs of works layout changes**

2.15 Owing to the additional work associated with the revision of the works layout plan, the completion date of the design was extended from October 1996 by eight months to June 1997. As a result, the Consultant claimed additional costs for the preparation of the revised works layout plan and the longer time required for completing the design. **In July 2003, after negotiations, the WSD agreed with the Consultant to pay him an additional fee of \$9.4 million for full and final settlement of the claims arising from the changes to the layout.**

## **Audit observations**

### *Need to carry out public consultations at an early stage*

2.16 As laid down in the Investigation Study Consultancy Agreement, the Consultant should, by 31 January 1995:

- (a) finalise the land requirements and site boundary of the water treatment works (see para. 2.3(a)); and
- (b) submit the draft preliminary project feasibility study report (see para. 2.3(b)).

2.17 In December 1994, the WSD informed the Consultant that once there was a clear idea of land requirements, the consultation process should commence as soon as possible. In June 1995, the WSD conducted consultations with the Tai Po Rural Committee and the Tai Po District Council. In July 1995, the villagers of She Shan Village objected to the proposed works site on Fung Shui grounds. In January 1996, the WSD instructed the Consultant to revise the works layout, and the completion of the works design was extended by eight months at an additional cost of \$9.4 million. **Audit considers that the WSD (with the Consultant's assistance) should have conducted consultations with the affected villagers soon after the completion of the preliminary project feasibility study in early 1995.**

2.18 Earlier consultations with the affected villagers could have:

- (a) enabled the WSD to receive the villagers' objection to the original works site sooner;
- (b) facilitated preparation of the works layout plan taking into account the villagers' objection; and
- (c) obviated the subsequent revision of the works layout plan at an additional cost.

- 2.19 In August 2007, the WSD informed Audit that:
- (a) at the time when the preliminary project feasibility study report was under preparation, most of the technical assessments were still in the early stage, and there would be insufficient information to support public consultations at that stage. It would therefore not be practicable to consult the villagers before finalising the preliminary project feasibility study report;
  - (b) it was only appropriate to conduct public consultations when more information on other technical assessments was available and a preliminary layout design of the treatment works was completed; and
  - (c) the conduct of public consultations in June 1995 had been carefully worked out with the District Office, after considering the progress of the investigation study.

*Need to promptly address villagers' objection*

2.20 In July 1995, the She Shan villagers objected to the works layout on Fung Shui grounds. In January 1996, the WSD instructed the Consultant to revise the works layout. In the event, the revised works layout was agreed by the villagers in July 1996, twelve months after the objection was first raised. **Audit considers that the WSD should in future make concerted efforts to address public objections as soon as possible (see paras. 2.8 to 2.10).**

*Need to allow adequate time for consultations*

2.21 For the project, the WSD consulted the Tai Po Rural Committee and the Tai Po District Council for the first time on 13 and 27 June 1995 respectively. These two consultations were conducted less than one month before the PWSC meeting on 12 July 1995 to consider the funding application for the Design and Construction Consultancy. The Administration did not inform the PWSC at its meeting on 12 July 1995 of the villagers' objection received on 11 July 1995 (nor the FC at its meeting on 29 July 1995). **Audit considers that the WSD should have allowed adequate time for consultations before submitting the application paper to the PWSC.**

- 2.22 In August 2007, the WSD informed Audit that:
- (a) the purpose of the PWSC paper submitted in July 1995 was to secure funding for the design aspect of the project;

- (b) it was the WSD's intention to address public concerns in the design stage; and
- (c) the project was implemented under a very tight schedule. It was considered necessary to conduct public consultations in parallel with the funding application for the Design and Construction Consultancy.

*Need to inform the PWSC and the FC of villagers' objections received*

2.23 As laid down in Financial Circular No. 11/94, where there was public or sectoral opposition to a project, the PWSC paper should set out clearly the grounds, together with remedial measures (see para. 2.8(b)). For this project, the Administration did not inform the PWSC of the villagers' objection (received on 11 July 1995) at its meeting on 12 July 1995, nor inform the FC at its meeting on 29 July 1995.

**Audit recommendations**

2.24 **With a view to minimising programme delays, abortive design work and additional costs in implementing a works project, Audit has *recommended* that the Director of Water Supplies should:**

- (a) **conduct consultations with the parties affected at an early stage (see para. 2.17);**
- (b) **make concerted efforts to address objections as soon as possible in accordance with the guidelines in ETWB Technical Circular (Works) No. 4/2006 (see para. 2.20);**
- (c) **take into account views expressed by the parties affected in carrying out design work, where appropriate (see para. 2.20); and**
- (d) **allow adequate time for public consultations before seeking the PWSC's endorsement of funding, so that information about objections to the project can be included in the submission (see para. 2.21).**

2.25 **Audit has *recommended* that the Secretary for Development should consider notifying all works departments of the audit recommendations mentioned in paragraph 2.24(a) and (d) to facilitate effective project implementation and contract administration.**

2.26 **Audit has recommended that the Secretary for Financial Services and the Treasury should, in consultation with the Secretary for Development, consider incorporating into Financial Circular No. 2/2006 the following requirements:**

- (a) **allowing adequate time for public consultations before seeking the PWSC's endorsement of funding (see para. 2.21); and**
- (b) **informing the PWSC and the FC of objections received during the intervening period between the submission of a PWSC paper and the FC's funding approval, such as by providing them with a supplementary paper at the PWSC or the FC meetings (see para. 2.23).**

### **Response from the Administration**

2.27 The **Director of Water Supplies** agrees with the audit recommendations in paragraph 2.24.

2.28 The **Secretary for Development** agrees with the audit recommendation in paragraph 2.25. She has said that:

- (a) public consultations should be planned in advance and be concluded prior to PWSC submissions. As required under ETWB Technical Circular (Works) No. 4/2006, public consultations are required to be completed before making a submission to the PWSC; and
- (b) adequate time should be allowed for public consultations before seeking the PWSC's endorsement of a funding application. The Government has to strike a balance between the need to expedite public works projects in the public interest and the necessity to address the concerns of individuals whose interests may be affected.

2.29 The **Secretary for Financial Services and the Treasury** agrees with the audit recommendation in paragraph 2.26.

2.30 The **Director of Home Affairs** agrees with the audit recommendation in paragraph 2.24(d). She has said that relevant government departments should allow more time for the Home Affairs Department to conduct public consultations.

### **PART 3: INCREASE IN ROCK EXCAVATION QUANTITIES**

3.1 This PART examines the WSD's administration of a claim arising from an increase in rock excavation quantities.

#### **Excavation works**

3.2 The Contract involved excavation works for:

- (a) site formation;
- (b) construction of the foundation of plant buildings; and
- (c) construction of a drainage culvert and pipe galleries.

3.3 Between December 1995 and July 1996, the Consultant conducted the site investigation. Based on the results of the site investigation, the Consultant prepared the Bills of Quantities (BQ) for the works contract tender documents. In June 1997, the WSD invited tenders for the Contract. In January 1998, the WSD awarded the Contract to the Contractor in the sum of \$1,941 million. **Among the BQ items included in the Contract, there were provisional quantities of rock excavation totalling 23,547 m<sup>3</sup>. Upon the substantial completion of the excavation works, in July 2000, the Engineer certified that the actual quantities of rock excavation were 81,729 m<sup>3</sup> (347% of the BQ quantities).**

#### **Claim for increase in rock excavation quantities**

3.4 Since July 1998, the Contractor had claimed extensions of time (EOTs) and additional costs for mitigating delays due to the substantial increase in rock excavation quantities. In January 2002, the Engineer informed the WSD of the increase in rock excavation quantities. He classified the increase into the following three categories:

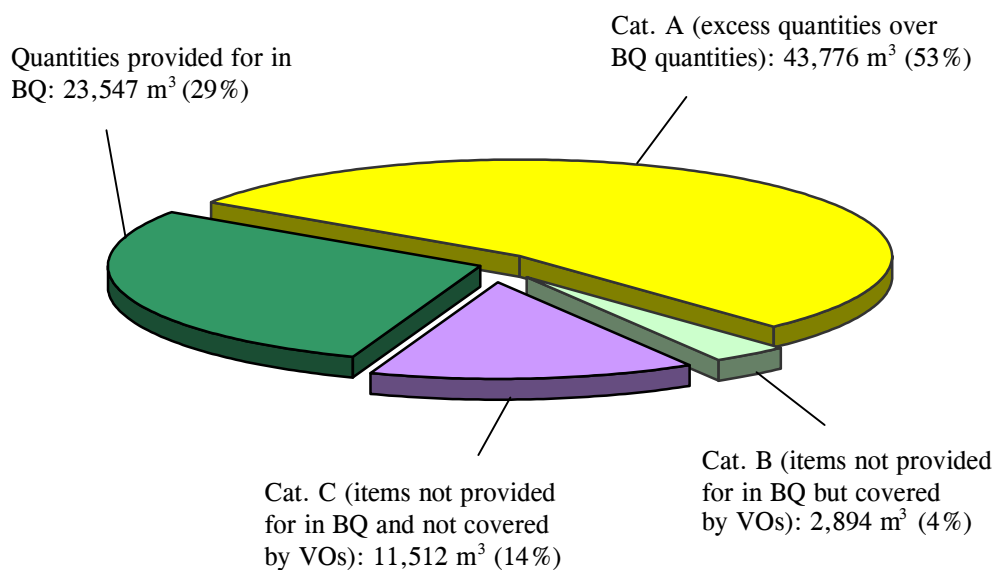
- (a) *Category A: items provided for in the BQ (but the quantities were exceeded).* When compared with those quantities provided for in the BQ, the actual rock excavation increased from 23,547 m<sup>3</sup> by 43,776 m<sup>3</sup> to 67,323 m<sup>3</sup>;
- (b) *Category B: items not provided for in the BQ but subsequently covered by Variation Orders (VOs).* There were 2,894 m<sup>3</sup> of rock excavations in this category. These rock excavations were mainly carried out for constructing the foundations of plant buildings; and

- (c) **Category C: items not provided for in the BQ and not covered by VOs.** There were 11,512 m<sup>3</sup> of rock excavations in this category. These works items mainly related to the construction of the central pipe gallery and the water pumping station. The Engineer (who was also the Consultant — see para. 1.4) considered that such rock excavation had been included in other BQ items.

The total increase in rock excavation quantities was 58,182 m<sup>3</sup> (43,776 m<sup>3</sup> + 2,894 m<sup>3</sup> + 11,512 m<sup>3</sup>). Figure 4 shows the different categories of rock excavation quantities under the Contract.

**Figure 4**

**Rock excavation quantities (81,729 m<sup>3</sup>)**



Source: WSD records and Audit's analysis

3.5 The Contractor claimed EOTs for the three categories of increased rock excavation quantities. The Contractor also submitted claims for prolongation costs and costs for mitigating the delays.

***Reasons for substantial increase in rock excavation quantities***

3.6 In September 2002, in response to the WSD's enquiry about the reasons for the increase in rock excavation quantities, the Engineer said that:

- (a) the design stage site investigation (involving drilling of boreholes) was planned based on the "pre-Fung Shui works layout" of May 1995 (i.e. before taking into account the villagers' objection to the original site boundary — see Figure 3 in para. 2.14);
- (b) the site investigation started in December 1995. It was partially adjusted during the first half of 1996 to suit the revised works layout. At the time of making the changes, the revised works layout was being developed at a rapid pace and the designs for some structures (such as the drainage culvert and central pipe gallery) were at an early stage. The changes to the site investigation were made within the scope and budgets of two site investigation contracts (Note 3);
- (c) the site investigation was planned and implemented during a period when significant changes were being made to the works layout. The interpretation of the site geology and the estimation of the provisional BQ rock excavation quantities were based on the site investigation results;
- (d) during construction, larger rock excavation quantities than those in the BQ were identified; and
- (e) a design decision was made during construction to avoid founding some large structures partly on rock and partly on decomposed/fill materials. Consequently, four VOs were issued instructing the Contractor to remove a layer of rock for constructing the structures.

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**Note 3:** *These two contracts were administered by the Geotechnical Engineering Office of the Civil Engineering and Development Department.*

### *Engineer's assessment*

3.7 The Engineer considered that, among the three categories of increased rock excavation quantities mentioned in paragraph 3.4, the Contractor should be awarded an EOT and prolongation costs for Category B items only. For Categories A and C items, the Engineer considered that the Contractor should only be awarded an EOT without prolongation costs. In April 2004, the Engineer assessed an EOT of 300.5 days for the three categories of increased rock excavation quantities and a prolongation cost of \$16.7 million for Category B items.

### *Settlement of dispute*

3.8 In May 2005, the Contractor raised a dispute over the Engineer's assessment. In June 2005, the Contractor requested mediation to settle the dispute, which was agreed by the WSD. Upon conclusion of the mediation, the WSD agreed to pay the Contractor an additional sum to settle the dispute. This formed part of the sum payable to the Contractor under the Supplemental Agreement signed in October 2006 (see para. 1.5).

### **Audit observations**

#### *Need to provide better estimation of rock excavation quantities in BQ*

3.9 As shown in Figure 4, there were 23,547 m<sup>3</sup> of rock excavation quantities provided for in the BQ. However, the actual rock excavation quantities were 81,729 m<sup>3</sup>, representing 347% of the original provision. In August 2007, the WSD informed Audit that:

- (a) the site investigation had taken into account the revised site layout; and
- (b) the actual rock profile turned out to be far more variable than what could have been reasonably interpreted from the site investigation results.

3.10 According to the Engineer, the site investigation was partially adjusted during the first half of 1996 to suit the revised works layout (see para. 3.6(b)). The site investigation was completed in July 1996 (see para. 3.3). At that time, the revised works layout plan had just been finalised (the villagers agreed with the revised works layout plan on 15 July 1996), and the designs for some structures (such as the drainage culvert and the central pipe gallery) were at an early stage. The interpretation of the site geology and the estimation of the BQ rock excavation quantities were based on the site investigation results. The actual quantities of rock excavation for constructing two major structures significantly exceeded the BQ quantities, as follows:



- (a) the actual rock excavation quantities for constructing the drainage culvert were 11,889 m<sup>3</sup>, representing 290 % of the BQ quantities of 4,100 m<sup>3</sup>; and
- (b) the actual rock excavation quantities for constructing the central pipe gallery were 9,180 m<sup>3</sup>. There was no provision for such quantities in the BQ.

3.11 There were eleven months between the completion of the site investigation in July 1996 and the tender invitation in June 1997. As laid down in Works Branch Technical Circular No. 17/95 of August 1995 (which is currently in force):

*“Before any tender document is finalised, the project engineer shall aim to ensure that the design is sufficiently completed so that there is no necessity for substantial post contract design changes/additional information.”*

**In view of the fact that both the revised works layout plan and the site investigation were completed in the same month (July 1996), additional site investigations could have provided more information for facilitating the estimation of the rock excavation quantities in the BQ. This would have helped minimise the prolongation and disruption costs.**

3.12 **Audit considers that BQ quantities should be estimated as accurately as possible.** This is because:

- (a) tenderers submit tenders based on the quantities provided for in the BQ. Significant increases in the actual quantities over those provided for in the BQ invariably cause delay to the completion of works and result in additional costs; and
- (b) in the event of dispute over the assessment of EOT and prolongation cost claims, the WSD needs to incur resources in settling the dispute.

***Need to inform the WSD of significant variation works***

3.13 Between March and July 1999, the Engineer issued four VOs to the Contractor instructing him to remove a layer of rock involving 2,894 m<sup>3</sup> of excavation quantities (see para. 3.6(e)). Subsequently, the Engineer granted an EOT of 176.5 days and a prolongation cost of \$16.7 million to the Contractor for the additional works.

3.14 In August 2007, the WSD informed Audit that:

- (a) the removal of the layer of rock was due to a decision which required some structures to be founded on homogeneous strata of rock (this was the design intention); and
- (b) such a decision could only be reached in the course of excavation.

3.15 As laid down in the Design and Construction Consultancy Agreement, the Consultant should, in respect of any work done, report to the WSD any errors, omissions and shortcomings of whatsoever nature of which the Consultant became aware of in the performance of the services. As far as Audit could ascertain, before instructing the Contractor to carry out the excavation works under the revised design, the WSD had not been informed of:

- (a) the decision in 1999 to remove the layer of rock involving 2,894 m<sup>3</sup> of excavation quantities; and
- (b) the implications of the variation works on the cost and works programme.

**Audit considers that there is room for improvement in the WSD's monitoring of significant variation works in works projects.**

*Need to ensure prompt submission of design documents*

3.16 As laid down in the Design and Construction Consultancy Brief, on completion of the works design, the following documents should be submitted to the WSD:

- (a) a full set of design calculations, including a statement of the standards, procedures and codes of practice adopted; and
- (b) a certificate certifying that the design calculations had been checked by a qualified independent designer, and that the drawings had been prepared in accordance with the calculations.

3.17 Audit noted that the required documents were only submitted to the WSD 43 months after the completion of the works design (see Table 4).

**Table 4**

**Submission of required documents to the WSD**

<b>Date</b>	<b>Event</b>
June 1997	Works design was completed.
April 2000	The WSD sent a reminder to the Consultant requesting the submission of the required design calculations and certificate.
January 2001	The Consultant submitted the required design calculations and certificate to the WSD.

*Source: WSD records*

3.18 In August 2007, the WSD informed Audit that:

- (a) not all design calculations and certificates could be submitted in June 1997; and
- (b) three major structures were re-designed by the Contractor, and the electrical and mechanical works were subject to the Contractor's detailed design and independent checking. These documents could only be submitted to the WSD at a late stage.

3.19 **Audit considers that the WSD should have taken more effective action to ensure compliance with the Consultancy Brief requirements on the prompt submission of design calculations and certificate.**

### **Audit recommendations**

3.20 With a view to minimising delays and additional costs in implementing a works project, Audit has *recommended* that the Director of Water Supplies should:

- (a) conduct additional site investigations before tendering of a works contract if there are significant layout changes (see para. 3.11);
- (b) take measures to ensure that BQ quantities in the works contract are estimated as accurately as possible (see para. 3.12);
- (c) require the Engineer of the contract to promptly inform the WSD of significant variation works (and the implications on cost and the works programme) before carrying out the works (see para. 3.15); and
- (d) take measures to ensure that the consultants comply with the consultancy brief requirements (such as prompt submission of design calculations and certificates — see para. 3.19).

### **Response from the Administration**

3.21 The Director of Water Supplies agrees with the audit recommendations in paragraph 3.20.

## **PART 4: CHANGES TO THE ELECTRICITY DISTRIBUTION SYSTEM**

4.1 This PART examines the WSD's administration of the changes to the design of the electricity distribution system.

### **Re-design of the electricity distribution system**

4.2 Under the Contract, the Contractor should design, supply, install and commission electrical and mechanical systems for the Tai Po Water Treatment Works, including an electricity distribution system. The Consultant's pre-contract estimate of electrical loading of the load centres (plants or buildings requiring power supply) was 17,300 kilovoltampere (kVA — Note 4).

4.3 On 16 September 1998, the Contractor issued a Request for Information (RFI — Note 5) to the Engineer in which he requested the Engineer's comments on the power supply arrangements for one of the load centres within 14 days (see paras. 4.22 to 4.25). In early December 1998, the Contractor submitted to the Engineer his calculations of power requirements for the load centres.

4.4 On 4 January 1999, the Contractor informed the Engineer that:

- (a) he had not received the Engineer's response to his RFI of 16 September 1998;
- (b) as a consequence, the progress of the cabling and associated works had been delayed; and
- (c) he intended to claim EOTs and additional costs incurred.

4.5 On 23 February 1999, the Engineer informed the WSD of the increase in the loading requirements and the need to revise the electricity distribution system. On 25 February 1999, the Engineer informed the WSD that:

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**Note 4:** *kVA is the unit for measuring electrical power.*

**Note 5:** *Under the Contract, if the Contractor found design details missing, ambiguous, or unclear, he might issue RFIs to seek clarifications from the Engineer. In July 2007, the WSD informed Audit that the Engineer would bring up a matter to the WSD for information only when necessary.*

- (a) the Contractor's power-requirement calculations for some load centres were generally higher than the pre-contract estimates; and
- (b) the increased power requirements for three load centres were due to the acceptance of the alternative arrangement proposed by the Contractor during the tender stage.

The Engineer proposed to the WSD that, in view of the increase in power requirements, there was a need to re-design the electricity distribution system. On 5 March 1999, the WSD discussed the issue with the Engineer. On 19 March 1999, the WSD requested the Engineer to put up a prompt solution to the issue.

4.6 On 12 April 1999, the WSD agreed with the need to re-design the electricity distribution system. The WSD also agreed to:

- (a) increase the number of transformers from 11 to 14;
- (b) provide two extra sub-stations;
- (c) carry out civil modification works to the related buildings; and
- (d) provide extra cabling and associated accessories.

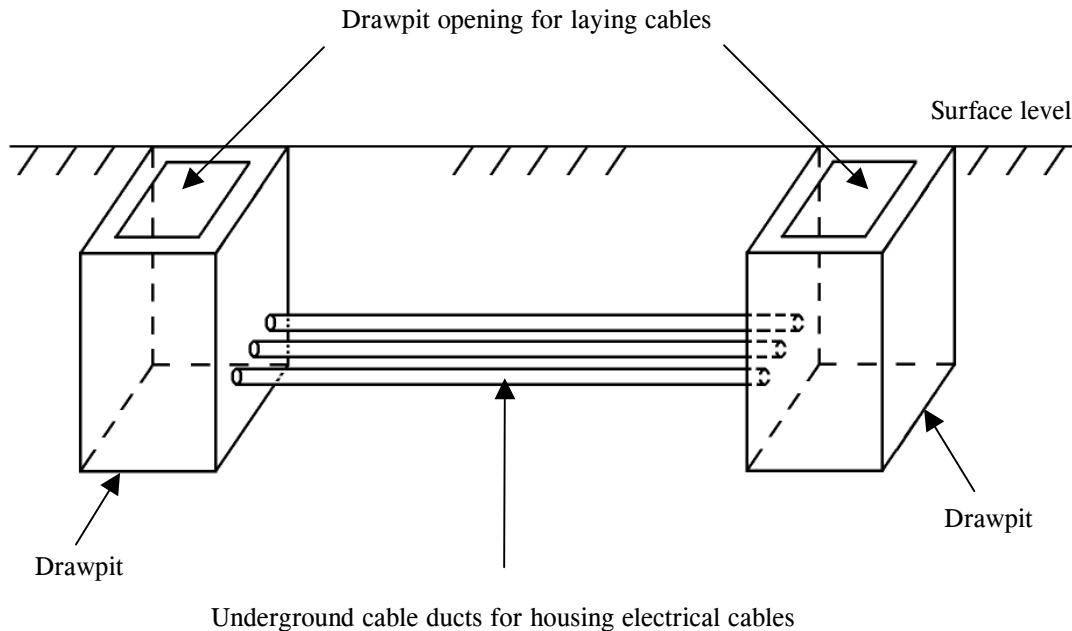
4.7 On 22 April 1999, the Engineer responded to the Contractor's RFI of 16 September 1998 and provided information on the additional works. On 5 May 1999, the Engineer requested the Contractor to proceed with the detailed design of the revised electricity distribution system and the associated works according to the information provided. The Engineer subsequently issued a VO on 9 June 1999 and another on 23 June 1999 for the revised works.

### **Change from cable drawpits to cable galleries**

4.8 Under the Contract, the Contractor should construct a system of drawpits and ducts to accommodate electrical cables. The system was designed by the Engineer (see Figure 5). On 24 January 2000, the Contractor issued an RFI requesting the Engineer to provide details of the drawpits and duct layouts. On 11 April 2000, the Engineer responded to this RFI and provided information on the system. Later, on 26 May 2000, the Contractor issued another RFI requesting information on the civil design of some drawpits, to which the Engineer responded on 31 July 2000. In July 2000, the Contractor informed the Engineer that he intended to claim EOTs and additional costs owing to the Engineer's late response to his RFIs of January and May 2000.

Figure 5

## Cable drawpits and ducts



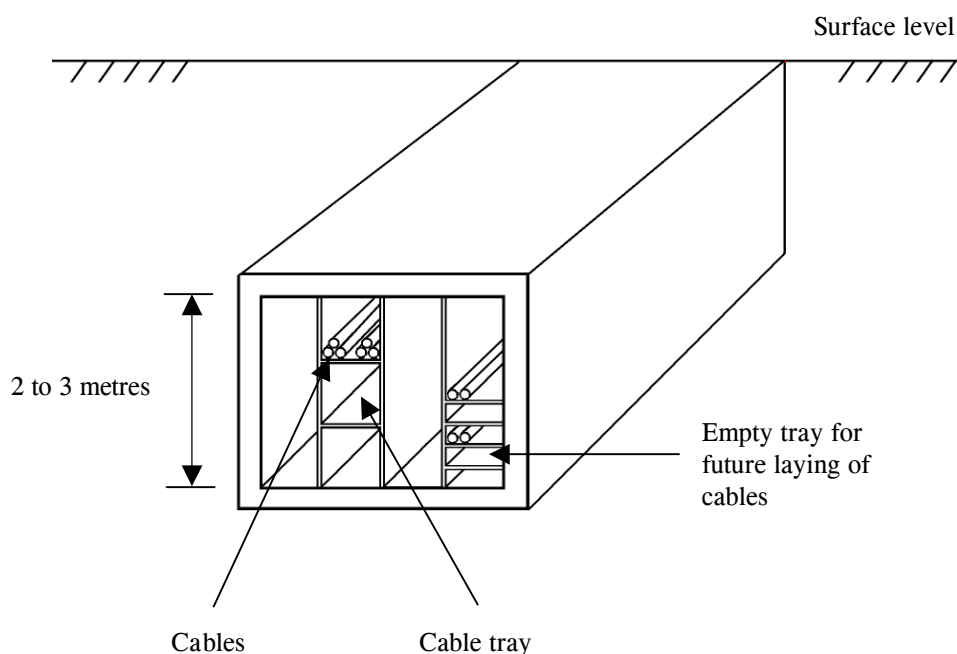
Source: Audit's drawing based on WSD records

4.9 On 30 August 2000, the Engineer gave a verbal instruction (followed by a written instruction dated 4 September 2000) to the Contractor that he should cease constructing the cable drawpits and ducts at some locations, and that these drawpits and ducts would be replaced by cable galleries (see Figure 6). On 8 September 2000, the Contractor informed the Engineer that he intended to claim EOTs and additional costs due to the late receipt of design information of the cable galleries. In January 2001, the Engineer issued an instruction to the Contractor that he should construct two cable galleries (Cable Galleries A and B) to replace some cable drawpits and ducts. In February 2001, the Engineer issued a VO for the replacement works. The Engineer said that the construction of the two cable galleries would:

- (a) simplify the cable installation and maintenance; and
- (b) cater for the cabling requirements for future phases of development.

**Figure 6**

**A cable gallery**



*Source: Audit's drawing based on WSD records*

***Construction of cable galleries***

4.10 For Cable Gallery A, the construction works commenced in December 2000 and were completed in June 2001. For Cable Gallery B, the construction works commenced in May 2001 and were completed in October 2001. During construction, the Contractor undertook works to resolve the problems associated with the underground electrical services and civil works (such as water mains and sewage). The construction of the cable galleries was delayed.

**Contractor's claims**

4.11 Between August 2002 and February 2003, the Contractor submitted claims for EOTs and prolongation costs due to delays arising from:



- (a) the re-design and installation of the electricity distribution system;
- (b) the construction of the two cable galleries to replace some cable drawpits and ducts; and
- (c) the resolution of problems associated with the underground electrical services and the civil works.

4.12 In response to the Contractor's claims, the Engineer assessed that the completion of the civil works had been delayed by the construction of the cable galleries. The Engineer assessed an EOT of 179 days and a prolongation cost of \$22.1 million.

4.13 The Contractor disagreed with the Engineer's assessment. In May 2005, the Contractor served a notification of dispute. In June 2005, the Contractor requested mediation. Upon completion of the mediation, the WSD agreed to pay the Contractor an additional sum to settle the dispute. This formed part of the sum payable to the Contractor under the Supplemental Agreement signed in October 2006 (see para. 1.5).

### **Audit observations**

#### *Need to inform the WSD of major design changes*

4.14 As laid down in the Design and Construction Consultancy Agreement, the Engineer should report to the WSD errors, omissions and shortcomings in the course of the consultancy (see para. 3.15). For this contract, the WSD was only informed of the need to revise the electricity distribution system on 23 February 1999, five months after the Contractor raised the issue with the Engineer on 16 September 1998. **Audit considers that the WSD should make improvement in this area by implementing the audit recommendation in paragraph 3.20(c).**

#### *Need to provide better estimation of power requirements*

4.15 The overall electrical loading of the load centres, as constructed, was 22,100 kVA. This was 28% higher than the pre-contract estimate. According to the Engineer, the power-requirement calculations for some load centres were generally higher than the pre-contract estimates (see para. 4.5(a)). For example:

- (a) for the administration building, the power requirement was 340% of the pre-contract estimate; and

- (b) for the secondary rapid gravity filter building, the power requirement was 227% of the pre-contract estimate.

Owing to the increase in power requirements for the load centres, there was a need to re-design the electricity distribution system (see para. 4.6).

4.16 In August 2007, the WSD informed Audit that:

- (a) the Consultant provided the design for the civil works. Before letting the Contract, he only provided an outline design for the electrical and mechanical works. The Contractor was required to carry out the electrical and mechanical works design so that the plants to be installed could be accommodated within the civil works; and
- (b) under such contractual arrangements, it was difficult to estimate the power requirements to a higher level of accuracy until the Contractor had specified the plants to be installed.

**Audit considers that, to minimise the need to re-design the electricity distribution system in similar projects in future, the WSD should take measures to ensure that the power requirements are estimated as accurately as possible.**

*Need to assess works implications of design changes during tender stage*

4.17 According to the Engineer, one of the reasons for the increased power requirements was the acceptance of the alternative arrangement proposed by the Contractor during the tender stage (see para. 4.5(b)). In July 2007, the WSD informed Audit that:

- (a) the alternative arrangement proposed by the Contractor during the tender stage involved minor changes only, which might not necessarily give rise to a change to the power-system design. If such a change was required, the costs of the additional equipment would be absorbed by the Contractor, because the Contract (on the electrical and mechanical part) was a design-and-build contract;
- (b) it would be impossible for the Contractor to provide accurate loading requirements during the tender stage, as such requirements would only be available after the completion of the detailed design and selection of the equipment during the construction stage; and
- (c) the increase in power requirements due to the acceptance of the alternative arrangement accounted for about 25% of the total increase in power requirements.

4.18 As it transpired, the Contractor's alternative arrangement gave rise to increased power requirements and, as a consequence, the need to re-design the electricity distribution system. **Audit considers that there is room for improvement in assessing the implications of accepting an alternative arrangement proposed by a contractor in future projects.**

*Need to promptly respond to Contractor's submissions*

4.19 The Contractor stated in his claims that the Engineer's late response to his submissions (of designs, drawings and documents) and RFIs was one of the reasons for his claims for delays and prolongation costs. Audit noted that, as laid down in the Contract:

- (a) the Contractor should check all designs, drawings and documents before submitting them to the Engineer for consent. In the case of first submissions and re-submissions involving a substantial amount of redesign, each design, drawing and document should reach the Engineer's office in time to allow **at least 28 working days** (Note 6) for the Engineer's review before returning it to the Contractor;
- (b) a re-submission by the Contractor to the Engineer of the same design, drawing or document involving only minor revisions should reach the Engineer's office in time to allow **at least 14 working days** (Note 7) for the Engineer's review before returning it to the Contractor; and
- (c) in case of ambiguities or discrepancies found in the contract document, the Engineer should clarify such ambiguities or discrepancies **within 14 days** of receipt of such requests from the Contractor.

4.20 Audit examination revealed that, of the 39,688 submissions put up by the Contractor, only 20,223 (51%) were responded to within 39 days (i.e. 28 working days) of receipt of the submissions (see Figure 7). **Audit considers that there is room for improvement in the WSD's monitoring of the response to the Contractor's submissions.**

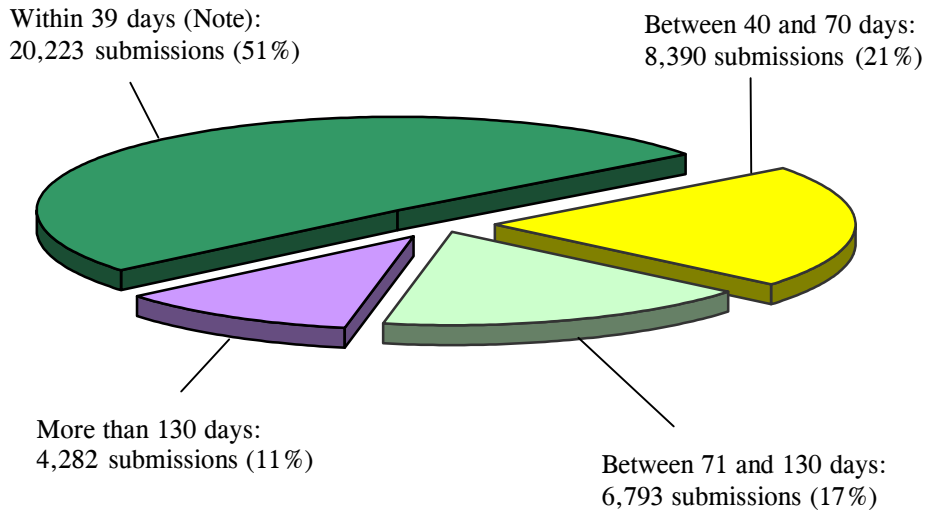
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**Note 6:** *In this report, all days refer to calendar days, unless otherwise specified. On average, there are 28 working days in 39 calendar days.*

**Note 7:** *On average, there are 14 working days in 19 calendar days.*

**Figure 7**

**Response to Contractor's submissions**



*Source:* WSD records and Audit's analysis

*Note:* As laid down in the Contract, the Contractor's submissions involving a substantial amount of redesign should reach the Engineer's office to allow at least 28 working days (i.e. 39 calendar days) for the Engineer's review.

4.21 In August 2007, the WSD informed Audit that, to handle the large volume of submissions with limited resources, an urgency rating was assigned to each submission to ensure that the more pressing submissions were handled with priority.

***Need to specify response time for RFIs***

4.22 The Contract did not contain provisions specifying the Engineer's response time for the Contractor's RFIs. The Engineer considered that it was reasonable to apply the following response time regarding the RFIs:

- (a) 28 working days for RFIs involving a substantial amount of redesign (see para. 4.19(a)); and
- (b) 14 working days for RFIs involving minor revisions (see para. 4.19(b)).

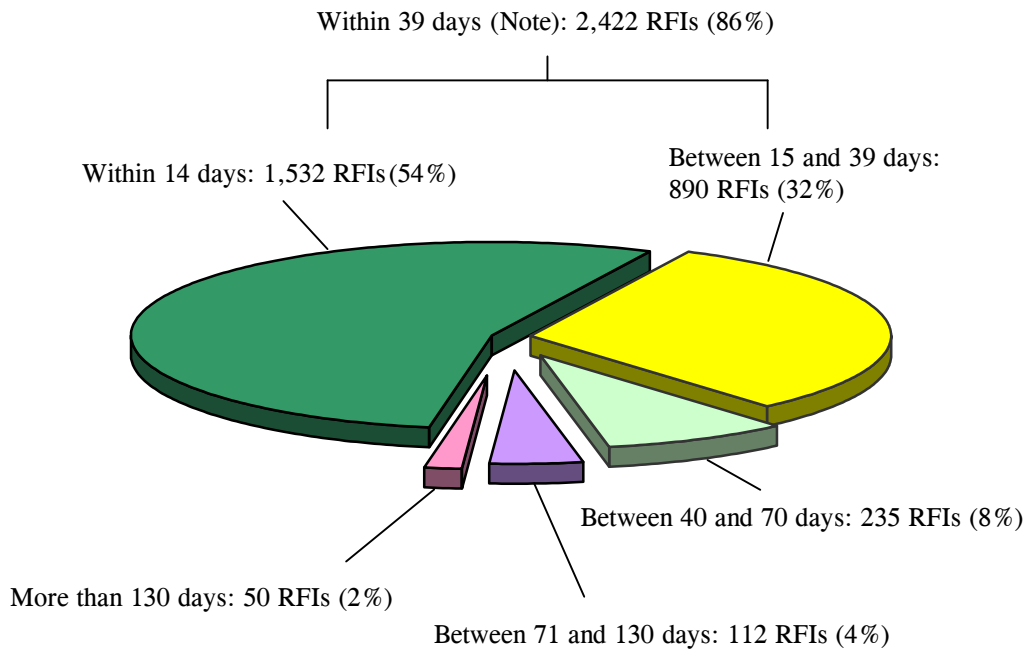
4.23 The Contractor had different views on the response time for RFIs. Audit examination revealed that the Contractor had specified in each RFI the expected response time (14, 7 or 3 days depending on the nature of the RFI) since the commencement of the Contract. **Audit considers that the time for responding to the Contractor’s RFIs should have been specified in the Contract. This would have helped obviate the dispute between the Contractor and the Engineer. Furthermore, the dispute should have been resolved at an earlier date.**

*Need to promptly respond to Contractor’s RFIs*

4.24 Taking 14 days as the longest acceptable response time (as per the Contractor — see para. 4.23), Audit examination revealed that 1,532 RFIs (54% of the total 2,819 RFIs) were responded to within this period. On the other hand, if 39 days (i.e. 28 working days) were taken as the longest acceptable response time (as per the Engineer — see para. 4.22), 2,422 RFIs (86% of the total 2,819 RFIs) were responded to within this period. **Audit considers that the WSD should have taken effective action to ensure that the Contractor’s RFIs were promptly responded to.** An analysis of the response time is shown in Figure 8.

**Figure 8**

**Response to Contractor’s RFIs**



Source: WSD records and Audit’s analysis

Note: On average, there are 28 working days in 39 calendar days.

4.25 For illustration, the following two events during construction showed that the Contractor's RFIs had not been responded to promptly:

- (a) on 16 September 1998, the Contractor issued an RFI to the Engineer requesting him to comment on the power supply arrangements for one of the load centres **within 14 days** (see para. 4.3). In the event, the Contractor's RFI was only responded to on 22 April 1999 (see para. 4.7), seven months after the submission of the RFI; and
- (b) the Engineer took about two months to respond to the Contractor's RFIs of January and May 2000 on the details of the drawpits. The responses were issued in April and July 2000 respectively (see para. 4.8).

*Need to minimise conflicts of works on site*

4.26 The Contractor submitted claims for the resolution of problems associated with the underground electrical services designed by the Contractor and the civil works designed by the Engineer (see para. 4.11(c)). Under the Contract, the Contractor was responsible for the design of electrical services for the load centres whereas the Engineer was responsible for the design of the related civil works. Owing to site constraints, some areas were congested with underground utilities, and there were design conflicts between the two types of works. **Audit considers that, with a view to minimising the conflicts, the WSD should have made better arrangements to accommodate the two types of design on the site with space constraints.**

**Audit recommendations**

4.27 **Audit has recommended that, in administering a works contract, the Director of Water Supplies should:**

- (a) **take measures to ensure that electrical power requirements are estimated as accurately as possible (see para. 4.16);**
- (b) **before accepting a contractor's proposed alternatives, thoroughly assess the implications (see para. 4.18);**
- (c) **take measures to ensure that the contractor's submissions are responded to within the time specified in the contract (see para. 4.20);**

- (d) **specify in the contract the number of days within which the Engineer should respond to the contractor's RFIs (see para. 4.23);**
- (e) **take measures to address promptly the different views on any significant issue between the Engineer and the contractor (see para. 4.23);**
- (f) **take measures to ensure that the contractor's RFIs are promptly responded to (see para. 4.24); and**
- (g) **take measures to minimise conflicts between designs of underground utilities and related civil works on a site with space constraints (see para. 4.26).**

### **Response from the Administration**

4.28 The **Director of Water Supplies** agrees with the audit recommendations in paragraph 4.27.

## **PART 5: MANAGEMENT OF CONTRACT VARIATIONS**

5.1 This PART examines the WSD's management of variations under the Contract.

### **Issue of variation orders**

5.2 During the course of a construction contract, the Engineer sometimes orders variations to the works. A variation may have a disruption effect to a part or the whole of the works which may entitle the contractor to claim EOTs and other costs. As laid down in the WSD Project Administration Manual (Note 8):

- (a) the Engineer should assess the cost of the variation works, its programme implications and possible disruption/prolongation costs; and
- (b) if the estimated cost of a variation exceeds \$300,000, the Engineer should obtain the WSD's prior approval in writing for the issue of the VO.

5.3 For the execution of works under the Contract, the Engineer issued a total of 491 VOs to the Contractor. The final valuation of the works under these VOs amounted to \$85.3 million (4% of the final contract sum of \$2,155 million).

5.4 The Contract stipulated that:

- (a) the Engineer should order variations to any part of the works that were necessary for the completion of the works; and
- (b) **no variation should be made by the Contractor without an order in writing by the Engineer.**

5.5 According to the Development Bureau's Project Administration Handbook for Civil Engineering Works (Note 9):

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**Note 8:** *Under the Design and Construction Consultancy Agreement, the Consultant (who was also the Engineer) should comply with the requirements laid down in this Manual.*

**Note 9:** *This Handbook (which is currently in force) provides guidance on matters commonly encountered by works departments in the administration of works projects. Under the Design and Construction Consultancy Agreement, the Consultant should comply with the requirements laid down in this Handbook.*



- (a) there is no provision in the General Conditions of Contract for issuing VOs verbally for later confirmation in writing; and
- (b) all VOs are to be made in writing and signed by the Engineer.

### **Audit observations**

#### *Need to issue VOs before execution of variation works*

5.6 Audit examination revealed that, of the 491 VOs issued under the Contract, 93 (19%) were issued **after the completion of the whole works in January 2005** (no works were carried out thereafter). The value of these 93 VOs amounted to \$9.4 million. Furthermore, the WSD Contract Advisory Unit identified during technical audits of the Contract that some variation works had been carried out without the issue of VOs, as follows:

- (a) some variation works had been ordered through the issue of site instructions (Note 10) instead of VOs (observation included in WSD Technical Audit Report of November 1998); and
- (b) some variation works executed on a daywork basis (Note 11) had not been ordered in the form of VOs (observation included in WSD Technical Audit Report of September 2001).

**Audit considers that the WSD should monitor closely the issue of VOs to ensure that the contractual requirement is complied with (see para. 5.4(b)).**

5.7 In August 2007, the WSD informed Audit that:

- (a) most of the VOs issued after the substantial completion of the Contract were related to matters which the Consultant originally considered as the Contractor's obligation, but the Consultant subsequently agreed with the Contractor's arguments and claims that these matters were variations to the Contract; and

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**Note 10:** *A site instruction is a written instruction issued by the Engineer to the contractor stating the works to be done or precautions to be taken. A site instruction may be in the form of a VO.*

**Note 11:** *Works executed on a daywork basis refer to works that are valued and paid for on the basis of time, and materials and/or plants used.*

- (b) it was not unreasonable in some instances to issue VOs after the execution of some variation works. As long as a written order was issued, the contractual requirement was deemed to have been complied with.

*Need to closely monitor programme implications*

5.8 As laid down in the WSD Project Administration Manual, before the issue of a VO, the Engineer should assess the cost of the variation works, its programme implications and possible disruption/prolongation costs. Furthermore, as laid down in the Design and Construction Consultancy Agreement, as soon as a VO was issued, the Engineer was required to provide the estimated value and justifications for the VO to the WSD. During construction, the Engineer submitted standard forms to the WSD stating:

- (a) the estimated value and justifications for the VOs; and
- (b) whether the variation works would have any programme implications (by making a tick mark beside the relevant statement provided in the standard form).

5.9 Of the total 491 VOs issued under the Contract, as far as Audit could ascertain, the Engineer submitted 259 VO forms to the WSD. Audit examination of the 259 VO forms revealed that the Engineer had indicated that these VOs would not have programme implications. However, Audit found that some VOs had caused delays to the works programme and resulted in prolongation/disruption costs (see paras. 3.13 and 4.12). For illustration, the events about the issue of four VOs for the additional rock excavation works (see para. 3.13) are shown below.

### Issue of four VOs and delays to the works programme

1. Since July 1998, the Contractor had claimed EOTs and additional costs incurred for mitigating delays due to the substantial increase in rock excavation quantities (see para. 3.4).
2. Between March and July 1999, the Engineer issued four VOs to the Contractor instructing him to remove a layer of rock (see para. 3.13).
3. In the VO forms forwarded to the WSD, the Engineer informed the WSD that:
  - (a) the estimated costs of the works for the four VOs were \$170,000, \$500,000, \$70,000 and \$50,000 respectively; and
  - (b) the variation works had “no impact” on the works programme.

### Outcome

The final values of these four VOs were \$222,000, \$755,000, \$245,000 and \$549,000 respectively. Owing to the programme delay arising from the increased rock excavation quantities, the variation works resulted in the assessment of an EOT of 176.5 days and a prolongation cost of \$16.7 million (see para. 3.13).

In view of the Contractor’s claims for EOTs and additional costs relating to rock excavation since July 1998, there was a high possibility that the Contractor would claim for EOTs and additional costs for the four VOs issued between March and July 1999 involving similar works. **Audit considers that there is room for improvement in monitoring the programme implications of VOs in future.**

5.10 In August 2007, the WSD informed Audit that:

- (a) VOs were normally copied to the WSD when issued. There were works which were not considered as variations at the time of giving instructions but were later accepted as variations when more information/justifications were provided by the Contractor. The decisions on such changes were recorded in correspondence, instead of the VO forms. The details of each VO were included in the monthly progress reports; and

- (b) in a complex and multi-disciplinary contract like this one, there would be on-going activities taking place in parallel and the critical path might change from time to time. Some of the programme implications could only be assessed at the end of the contract when the effects on the works across different disciplines became apparent.

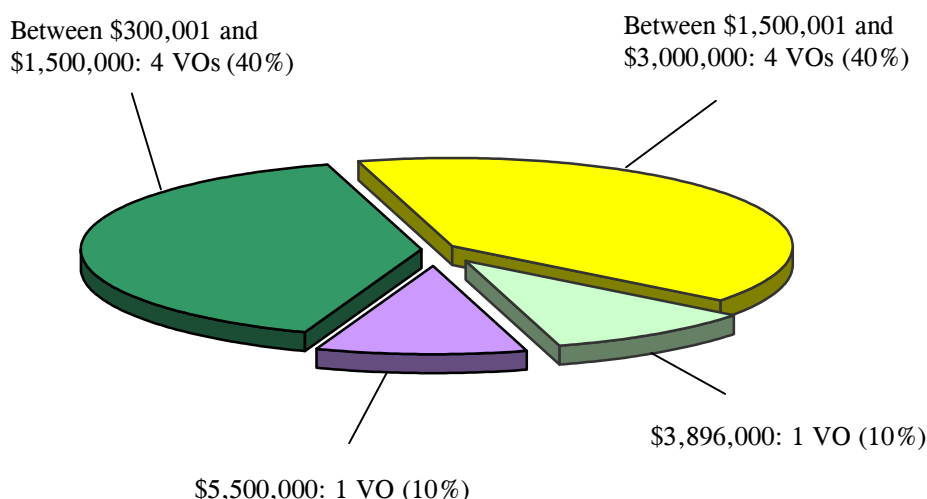
***Need to seek WSD’s prior approval for a variation exceeding \$300,000***

5.11 As laid down in the Design and Construction Consultancy Agreement (and also the WSD Project Administration Manual — see para. 5.2), the Engineer should obtain the WSD’s prior approval in writing for a VO exceeding \$300,000. Audit examination revealed that:

- (a) of the 491 VOs issued under the Contract, 20 (4%) were each having an estimated value exceeding \$300,000; and
- (b) of these 20 VOs, 10 (50%) had been issued without the WSD’s prior approval (see Figure 9).

**Figure 9**

**Value of 10 VOs issued without WSD’s prior approval**



Source: WSD records and Audit’s analysis

5.12 For illustration, the events of the issue of a VO exceeding \$300,000 without the WSD's prior approval are shown below.

**Issue of a VO (exceeding \$300,000)  
without the WSD's prior approval**

1. In June 1999, after noting that the Engineer had not sought the WSD's prior approval before issuing three VOs (each with a value exceeding \$300,000), the WSD informed the Engineer in writing that he should comply with the requirement of seeking the WSD's prior approval.
2. However, in February 2001, the Engineer issued a VO to the Contractor for constructing the cable galleries (see para. 4.9) without seeking the WSD's prior approval.
3. In August 2001, the Engineer informed the WSD that:
  - (a) the estimated value of the VO was \$1.84 million; and
  - (b) the variation had no impact on the programme of works.
4. In June 2005, in response to the WSD's enquiry, the Engineer said that the background information about the variation had been provided to the WSD before the issue of the VO.

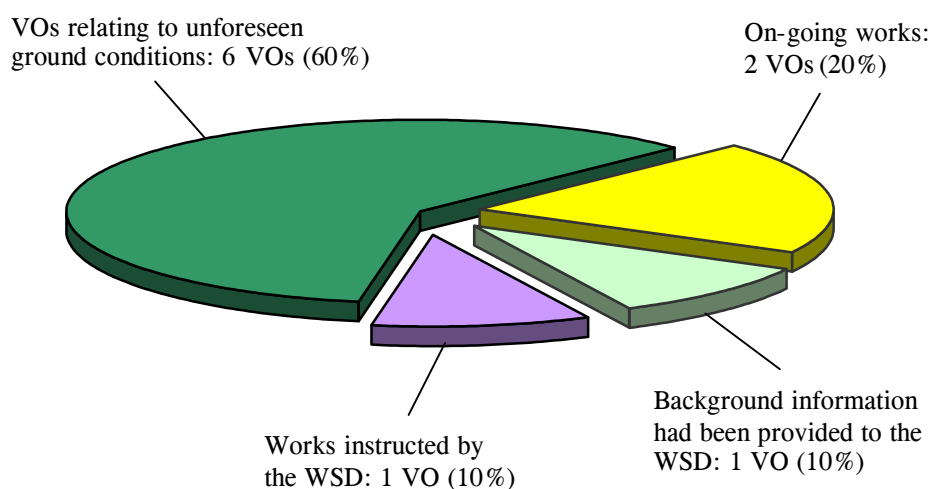
**Outcome**

The final value of this VO was \$4.1 million. The variation works led to the grant of an EOT of 179 days and associated prolongation cost (see para. 4.12).

5.13 In June 2005 and August 2006, in response to the WSD's enquiries, the Engineer provided the WSD with reasons for not seeking the WSD's prior approval for the 10 VOs (see Figure 10).

**Figure 10**

**Reasons for not seeking WSD's prior approval for the 10 VOs**



*Source: WSD records and Audit's analysis*

**Audit considers that the WSD should have ensured that the Engineer sought the WSD's prior approval before issuing VOs exceeding \$300,000 each.**

***Need to provide feedback to the Engineer on compliance with requirements***

5.14 Under the Consultants' Performance Information System of the Development Bureau (used for consultants selection and management), in managing a consultant's performance, a works department should compile the following two types of appraisal reports:

- (a) quarterly performance reports; and

- (b) a final performance report upon completion of the consultancy. This report would provide an overall assessment of the consultant's performance and provide the consultant with feedback in order to help him seek continuous improvements.

5.15 Audit noted that the Consultant's performance on "Appreciation of government requirements and procedures" was assessed by the WSD as acceptable in the quarterly performance reports compiled during the Consultancy. In July 2007, the WSD informed Audit that the Consultancy would be completed in late 2007. **Audit considers that, when compiling the final performance report, there is a need for the WSD to provide the Consultant with feedback on his compliance with some essential requirements under the Consultancy Agreement, having regard to the pertinent audit observations mentioned in this report.**

### **Audit recommendations**

5.16 **Audit has recommended that the Director of Water Supplies should:**

- (a) **in administering a works contract:**
  - (i) **take measures to ensure that VOs are issued before the execution of variation works (see para. 5.6);**
  - (ii) **closely monitor the implications of VOs on the works programme if there have been claims arising from similar works items under the contract (see para. 5.9); and**
  - (iii) **take measures to ensure that a VO exceeding \$300,000 is submitted to the WSD for prior approval as required by the WSD Project Administration Manual (see para. 5.13); and**
- (b) **provide the Consultant with feedback on his compliance with some essential requirements under the Design and Construction Consultancy Agreement when compiling the final report on the Consultant's performance (see para. 5.15).**

### **Response from the Administration**

5.17 The **Director of Water Supplies** agrees with the audit recommendations in paragraph 5.16. He has said that the WSD fully acknowledges the need to order variations in writing and that it is desirable to issue written instructions at an early date.

**Acronyms and abbreviations**

Audit	Audit Commission
BQ	Bills of Quantities
DO/TP	District Office/Tai Po
EOT	Extension of time
ETWB	Environment, Transport and Works Bureau
FC	Finance Committee
kVA	Kilovoltampere
m <sup>3</sup>	Cubic metres
PWSC	Public Works Subcommittee
RFI	Request for Information
VO	Variation order
WSD	Water Supplies Department