For discussion **FCR(2005-06)9**
on 27 May 2005

ITEM FOR FINANCE COMMITTEE

CAPITAL WORKS RESERVE FUND
HEAD 710 – COMPUTERISATION
Lands Department
New Subhead "Replacement of Computerised Land Information System"

Members are invited to approve a new commitment of $42,841,000 for replacing the Computerised Land Information System.

PROBLEM

The Computerised Land Information System (CLIS) in the Survey and Mapping Office (SMO) of Lands Department (LandsD), which was set up in 1989, has become incapable of meeting the existing and new operational needs, as well as the contemporary data requirements of government bureaux, departments, consultants firms, private companies and the general public.

PROPOSAL

2. The Director of Lands, with the support of the Secretary for Housing, Planning and Lands, proposes to create a new commitment of $42,841,000 to replace the obsolescent hardware, upgrade the retired software, enrich the geographical database, improve the workflow, and enhance the functionality of CLIS so as to increase the efficiency and productivity of SMO of LandsD.

JUSTIFICATION

Background

3. Since the implementation of CLIS in 1989, digital mapping and land boundary information maintained by SMO has become the geographical data in support of the business functions and activities of more than 40 government departments and numerous consultants firms and private companies.

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4. In recent years, a growing number of government departments have experienced the benefits of using geographical information as a valuable management and analysis tool by setting up their own Geographical Information Systems (GIS). As SMO is Government's sole supplier of digital maps which have constituted the basis of all GIS, the data maintained by CLIS has actually become the cornerstone of all these systems. Below are a few examples where the digital geographical information in CLIS is being intensively used -

(a) the Third Generation Mobilisation System (TGMS) of the Fire Services Department (FSD);

(b) the Command and Control System of the Hong Kong Police Force (HKPF);

(c) the Slope Information System of the Civil Engineering and Development Department;

(d) the Transportation Information System of the Transport Department (TD);

(e) the Town Planning Information System of the Planning Department;

(f) the Road Data Management System of the Highways Department;

(g) the Building Records Management System of the Buildings Department; and

(h) the Property Master System and the Interim Valuation System of the Rating and Valuation Department.

5. In 2004, the Food and Environmental Hygiene Department requested SMO to develop a web-map system to record and monitor the Dengue Fever Ovitrap Index and the spatial dispersion of chicken farms and pig husbandries. The Treasury also requested SMO to report on the up-to-date information and status of the Government Land Allocation for preparing the stewardship statement, which is to be published together with the accrual-based consolidated financial statements by Government. Again, the digital mapping and land boundary information of LandsD has proven to be a common information reference framework across government departments. It is therefore vital for CLIS to maintain a comprehensive data model, an efficient system architecture and the ability to provide up-to-date information in appropriate formats.

/**Current** .....

Current Problems

6. The hardware vendor of CLIS has informed SMO that a significant part of the critical hardware of CLIS has passed the end-of-service life while many others are approaching the same. After the end-of-service life, the hardware supplier will not be able to provide full technical support for the products. In the event of hardware failure, SMO will fail to maintain and provide the required digital geographical information products and services to support the operations of LandsD, other government departments and the general public.

7. In the meantime, the software vendor has also advised SMO that the current software version of CLIS has retired. A new version of the software has been developed using the latest design method and modern computer programming paradigms which are completely different from those adopted in the retired version of the software. The software revolution renders the retired software impossible to be upgradeable onto new hardware environment. This means that the software vendor will no longer provide technical support of the retired software version through direct phone, fax, or email. No patches or hot fixes will be available for existing and new software bugs and security loopholes. Moreover, the retired software environment has rendered the whole system vulnerable to security threats and system failure.

8. As mentioned in paragraph 4 above, the digital mapping and land boundary data maintained by CLIS was essential to many other GIS. However, the database model of CLIS, which was designed some 15 years ago, can no longer meet the modern requirements for an enterprise database. Below are some of its deficiencies -

(a) The current database cannot handle more complex data structures such as digital orthophoto [1] images, digital terrain model and seamless geographical database model.

(b) The current database cannot support present-day and advanced geographical applications such as 3D spatial data processing, real time location-based applications, version control, as well as wireless applications.

(c) The legacy database management system hinders efficient data storage, data retrieval, data conversion, information analysis and prompt generation of system statistics. It also makes the database updating and data sales transaction processes very tedious, inflexible, labour intensive and time consuming.

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[1] Orthophoto is an aerial photograph with a uniform scale and can be used as an ordinary map.

9. As a result, many departments have to deploy resources to convert, re-organise, or even modify the data received from SMO to suit their own needs.

10. The storage capacity of CLIS has become insufficient to store and maintain new data, such as digital Land Boundary Plan, digital terrain model, point of interest, road network and digital orthophoto. This adversely affects the efficiency and productivity of daily activities of SMO. The data processing capacity of CLIS has also proven to be insufficient in handling automatic data conversion and dissemination of large amount of geographical information between CLIS and other survey and mapping systems in SMO.

11. The existing CLIS lacks adequate uninterrupted power supply, a resilience system, speedy system recovery solutions to sustain and restore itself within a reasonable period of time. In case the headquarters system fails, the data supply services will have to be halted. It will gravely affect other GIS which are relying on on-line data access through direct linkage, such as the Slope Maintenance Responsibility Information System of LandsD, the TGMS of FSD, the Geographical Information Retrieval System of the Government Property Agency, and many other departments that rely on CLIS data to support their applications. In the absence of a reliable system, LandsD will also run the risk of not meeting the obligation to supply digital map data on a regular basis imposed by the contracts with the web-map services contractors and the business partners.

Improvement Areas

12. A feasibility study completed in March 2001 concluded that LandsD should enhance or replace the existing CLIS in order to meet the contemporary user requirements and provide higher service level with better data quality. Some identified areas to be improved are as follows –

(a) Replacement of the existing hardware is required. In view of the lack of serviceable parts and the high cost incurred in maintenance contract renewal, the most cost-effective solution is to replace the end-of-service-life hardware before the system deteriorates. It is also necessary to expand the current storage capacity to cater for new data types required by both public and private users, and improve the capacity of the current uninterrupted power supply system to ensure system availability.

/(b) .....

(b) Upgrading of the existing software is required to improve the existing data processing workflow. Moreover, the existing CLIS does not cover the land boundary survey activities in the District Survey Offices (DSOs) of SMO. Additional software licenses are therefore required to enhance the land boundary survey operation of SMO, such that all data capture, processing and plan production activities are under a unified platform thus resolving the internal data inconsistency problems. Additional software licenses are also required to produce new orthophoto maps in the DSOs to facilitate land resumption, land clearance and land control activities of LandsD.

(c) An object-oriented data model[2] for the development of geographical database in CLIS is required to capture, store, maintain, manipulate and visualise the historical and existing data, as well as new data types to satisfy the new user requirements. In particular, it will facilitate the speedy updating and delivery of data in support of real time and mission critical applications of other government departments, such as emergency rescue of FSD, epidemic control of Hospital Authority, and traffic management applications of HKPF and TD.

(d) An optimised system architecture is required to enhance the system capacity and performance to manage the object-relational enterprise geographical database and to implement new functionalities of CLIS. In addition, resilience measures, disaster recovery requirements, and adequate uninterrupted power supply system are required to ensure system availability. Moreover, the security measures of the system will have to be strengthened. The latest security technologies in intrusion detection, anti-virus and anti-spy software measures will be incorporated as necessary. Physical security such as access and environmental controls of the main server room and resilience site will also be upgraded.

13. The new CLIS will have no adverse effects on existing users. The user departments can continue to use their present computer systems to retrieve the digital map data from the new CLIS through the on-line linkage connection.

14. The open architecture design adopted in the new CLIS will allow the system to be upgraded in the future when new hardware and software technology emerges.

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[2] Object-oriented is a state-of-the-art data modeling technique, in which data records in a database are treated as real-world items that can have their individual status and behaviours, and can interact with other items.

15. As mentioned in paragraphs 6 to 11 above, the obsolescent system components have started to undermine the ability of SMO in providing necessary digital map and land boundary data to support GIS and location-based applications in both the public and private sectors. It is imperative to replace the system so as to continue smooth delivery of services.

Intangible Benefits

16. The following intangible benefits can also be achieved upon the replacement of CLIS -

(a) Improved business process

The replacement of CLIS provides an opportunity to revisit the entire system design and to re-engineer the existing workflow with a view to improving the productivity and reducing the operation cost of the system using the latest information and telecommunication technologies. It is expected that after the implementation of the new system, geographical information can be supplied to other government departments and the general public in a more efficient manner.

(b) Improved data model and database structure

The replacement of CLIS requires a redesign of the data model and the database structure using object-oriented database analysis and design methodology. This allows more efficient concurrent data updating, version control and data integrity checking so that the quality, accessibility, usability and serviceability of the geographical information can be improved.

(c) New data types to meet contemporary user requirements

The new database can facilitate the production and storage of new data types required by many government departments and the general public. This will also create new business opportunities with existing business partners, generate new sources of revenue for the government and improve the quality of life of the community.

(d) Better data sharing potential

The de facto data format adopted by the new system will minimise the data conversion effort and further enhance the usability and interoperability of the data. This will eliminate the duplicated data conversion and restructure efforts currently engaged by different data receivers.

/**Cost .....**

Cost and Benefit Analysis

17. A cost and benefit analysis of the replacement of CLIS is at Enclosure.

Encl.

FINANCIAL IMPLICATIONS

Non-recurrent Expenditure

18. We estimate that the total non-recurrent expenditure of the proposed replacement is $42,841,000 over a three-year period from 2005-06 to 2007-08, broken down as follows -

		2005-06 $'000	2006-07 $'000	2007-08 $'000	Total $'000
(a)	Hardware	-	10,885	231	11,116
(b)	Software	-	15,090	2,715	17,805
(c)	Implementation services	-	1,785	1,785	3,570
(d)	Contract staff	-	1,499	1,499	2,998
(e)	Site preparation	412	412	-	824
(f)	Training	-	-	2,202	2,202
(g)	Start-up consumables	-	-	431	431
(h)	Contingency	41	2,967	887	3,895
	Total	**453**	**32,638**	**9,750**	**42,841**

19. On paragraph 18(a) above, the estimate of $11,116,000, including $339,225 for disaster recovery services, is to meet the costs for the acquisition of computer hardware including database servers, backup servers, workstations, uninterrupted power supply system and other computing peripherals.

20. On paragraph 18(b) above, the estimate of $17,805,000 is for the acquisition of the GIS software and the database management systems, including $1,170,000 for disaster recovery services.

21. On paragraph 18(c) above, the estimate of $3,570,000 is for the acquisition of services for system analysis and design, data modeling and database re-engineering, application programmes development and deployment, database conversion and migration, etc.

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22. On paragraph 18(d) above, the estimate of $2,998,000 is for the hiring of contract staff for preparation of tender, giving technical advice and contract monitoring during the implementation period of the project to supplement the in-house project management team.

23. On paragraph 18(e) above, the estimate of $824,000 is for the equipment and site preparation work, including the installation of conduit facilities, network nodes and power points for computer equipment.

24. On paragraph 18(f) above, the estimate of $2,202,000 is for the training of system administrators and support staff on the use of the proposed software and related development tools.

25. On paragraph 18(g) above, the estimate of $431,000 is for the acquisition of computer consumables for the proposed system such as printer cartridges, printing paper and storage media.

26. On paragraph 18(h) above, the estimate of $3,895,000 represents a 10% contingency on the cost items set out in paragraphs 18(a) to (g) above.

Recurrent Expenditure

27. We estimate that the recurrent expenditure is $10,084,000 per annum as from 2008-09 and onwards. A breakdown is as follows -

		2008-09 and onwards
		$'000
(a)	Hardware maintenance and support	231
(b)	Software maintenance and support	7,336
(c)	Data lines	518
(d)	Consumables	1,999
	Total	**10,084**

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28. On paragraph 27(a) above, the estimated annual expenditure of $231,000 is for hire of services to support the operation of the new system and maintenance for computer hardware.

29. On paragraph 27(b) above, the estimated annual expenditure of $7,336,000 is for the software licence maintenance for the new system. It includes software maintenance cost and related support services.

30. On paragraph 27(c) above, the estimated annual expenditure of $518,000 is for the maintenance of data lines to support the higher traffic arising from transmission of spatial objects, images and other Intranet applications. This figure includes the annual maintenance cost required for both the expanded bandwidth and the existing data lines.

31. On paragraph 27(d) above, the estimated annual expenditure of $1,999,000 is for the purchase of consumables such as printer cartridges, printing paper and storage media.

32. The estimated recurrent expenditure of $10,084,000 will be partly offset by the annual savings of $9,506,000 being the running costs currently incurred in the existing system. This represents $2,621,000 for hardware maintenance and support, $4,621,000 for software maintenance and support, and $2,264,000 for data lines and consumables. The estimated additional recurrent expenditure arising from the proposed system is therefore $578,000 per annum and will be absorbed within existing resources.

Implementation Plan

33. We estimate that the proposed CLIS can commence operation in March 2008 with full implementation in August 2008. The proposed implementation plan is as follows -

Activities	**Target completion date**
Site preparation	March 2006
Tendering	June 2006
System analysis and design	February 2007
Data conversion	January 2008
Roll out of headquarters system	March 2008
Full implementation of the new CLIS	August 2008

/**BACKGROUND** .....

BACKGROUND INFORMATION

34. We circulated a paper to the Legislative Council Panel on Planning, Lands and Works on 26 April 2005 to inform Members of the funding proposal for the replacement of CLIS. Members noted the paper and did not raise any comments on the funding proposal.

Housing, Planning and Lands Bureau
May 2005

Enclosure to FCR(2005-06)9

Cost and Benefit Analysis for the Replacement of Computerised Land Information System

	Cash flow ($'000)							
	2005-06	**2006-07**	**2007-08**	**2008-09**	**2009-10**	**2010-11**	**2011-12**	**Total**
Cost								
Non-Recurrent								
Expenditure	453	32,638	9,750	-	-	-	-	42,841
Sub-total	453	32,638	9,750	-	-	-	-	42,841
Recurrent								
Expenditure [Note 1]	-	-	-	10,084	10,084	10,084	10,084	40,336
Sub-total	-	-	-	10,084	10,084	10,084	10,084	40,336
Total cost	**453**	**32,638**	**9,750**	**10,084**	**10,084**	**10,084**	**10,084**	**83,177**
Savings								
Realisable savings [Note 1]	-	-	-	9,506	9,506	9,506	9,506	38,024
Total savings	**-**	**-**	**-**	**9,506**	**9,506**	**9,506**	**9,506**	**38,024**
Net Shortfall	**453**	**32,638**	**9,750**	**578**	**578**	**578**	**578**	**45,153**
Net Cumulative Shortfall [Notes 2 & 3]	**453**	**33,091**	**42,841**	**43,419**	**43,997**	**44,575**	**45,153**	

Note 1 The proposed replacement system is meant to be cost-neutral in terms of staffing requirements. Hence, the analysis does not cover these cost items.

Note 2 The project is recommended despite the net cumulative shortfall for the following reasons –

(a) Upon the end-of-service life of the obsolescent system, LandsD will not be able to maintain and provide the required digital geographical information products and services to support the operations of LandsD and other government departments.

(b) In the absence of a reliable system, LandsD will run the risk of not meeting the obligation to supply digital map data on a regular basis imposed by the contracts with the web-map services contractors and the business partners.

(c) The proposed replacement will have a number of benefits/improvement as stated in paragraphs 12 - 16 of FCR(2005-06)9.

Note 3 About $5.65M was generated as revenue in 2004-05 under the existing system. LandsD will explore opportunities for generating revenue under the new system.
