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3.3 BUSINESS SYSTEM OPTIONS

3.3.1 INTRODUCTION

This section evaluates the Business System Options (BSO) for the integrated LandsD DDS which includes the Computerised Land Information System (CLIS) Data Dissemination System (DDS) and the Common Spatial Unit (CSU) DDS for LandsD.

The evaluation of the BSO is divided into two parts: BSO for the CLIS DDS and that for CSU DDS. It is assumed that there is no change to the business system options (for the CLIS DDS) discussed in the LandsD DDS FS Report and the same selected business system option is still valid for the CLIS DDS of the integrated DDS.

For completeness of the document, the relevant BSO content (for the CLIS DDS) in the LandsD DDS FS Report is included in this document for review and update.

3.3.1.1 CLIS DDS

Each BSO is assessed using a set of criteria to determine the degree to which the option meets these requirements. The user requirements for CLIS DDS are identified and listed in Table 3.3-7.

In conducting this assessment, numerous options are considered. Three basic options are identified in section 3.3.2.1, "Business System Options Considered" for evaluation as the recommended business system options. The suitability of these BSOs is evaluated according to the assessment criteria set out in section 3.3.2.2, "Assessment of Options". After assessing the BSOs using the criteria, Option 2(b) is hereby recommended as the selected BSO for the CLIS DDS and the recommendation is explained in section 3.3.2.3, "Recommendation". Options that have been considered but not further pursued for various reasons are described in Section 3.3.2.4, "Other Options Considered But Not Further Pursued".

3.3.1.2 CSU DDS

Each option represents a combination of different user requirements grouped by relevant requirement categories (see Table 3.3-5). The user requirements for CSU DDS selected by each option are described in Table 3.3-7.

Three options are suggested in section 3.3.2.1, "Business System Options Considered" and they are evaluated according to the assessment criteria set out in section 3.3.2.2, "Assessment Of Options". Among the three options, Option 3 is hereby recommended as the selected BSO for the CSU DDS and the details are explained in section 3.3.2.3, "Recommendation".

3.3.2 BSO FOR CLIS DDS

3.3.2.1 Business System Options Considered

Option 1 – Implementation of DDS with manual data conversion and dissemination

Manual data conversion: It requires LandsD users to activate the existing conversion routines manually to convert digital map data in various data formats, which is similar to the LandsD existing practice.

Manual dissemination: It requires LandsD users to manually prepare and copy the data on the dissemination media (i.e. CD) which is similar to the LandsD current practice.

This option focuses on the implementation of core functionality. It, therefore, concentrates on the implementation of user-friendly Internet based online ordering and payment facilities and the development of the Multi-format Spatial Data Hub. Direct connection access (through such means as leased lines) by other Government departments to LandsD digital map data will be established. These departments will be able to select and retrieve digital map data when appropriate connections are installed under this option. Internet connection will be provided to customers from other Government departments (i.e. those without direct connection access) and private sector. Private sector customers can select and download small volume of digital map data through Internet. Data conversion activities and preparation of dissemination media (CD-ROMs, tapes etc.) remain largely as manual processes. No attempt is made to satisfy requirements for enhanced select facilities and/or feature level updates / versioning as these are to be covered by the proposed Enhancement of Computerised Land Information System (ECLIS).

Option 2 – Implementation of DDS with automatic data conversion and dissemination

Automatic data conversion: It is a batch process, which can be activated automatically on the server to convert digital map data using the existing conversion routines.

Automatic dissemination: It is a batch process, which can be activated automatically on the server to allow the data to be downloaded by customer via GNET or Internet connection or copy the data on the dissemination media (i.e. CD).

This option focuses on automating the Data Conversion and Data Dissemination facility. The option incorporates all functions proposed by Option 1, and enhances them with the development of a more automated approach in data conversion and dissemination as well as Customer and Sales Record Subsystem. Functions enabling automated update and conversion of data within the Multi-format Spatial Data Hub are implemented. This option also develops tools that automate the completion of jobs and the preparation of distribution media. In this option, other Government departments and Private Sector customers are permitted to access LandsD digital map data through GNET and Internet connection, respectively. Automated routines are also provided to enable LandsD to send updated digital map data to customers via the direct connections on a regular basis. As with Option 1, complex selection facilities and feature level updates / versioning are not addressed as to prevent redundant effort in data model enhancement which is proposed to be introduced in ECLIS.

In order to provide flexibility and practical business options to LandsD, Option 2 was further

divided in two sub-options in the CLIS DDS FS Report. They are:

Option 2(a) – Online payment made using the facility provided within DDS: It provides all the functionality as specified above with electronic payment subsystem.

Option 2(b) – Payment made outside DDS: It provides all the functionality as specified above with offline payment facilities such as using existing LandsD payment procedure and/or Payment by Phone Service (PPS).

Since it is concluded in the Management Summary of the CLIS DDS FS Report that Electronic Payment Subsystem (i.e. option 2(a) payment made using the facility provided within DDS) would not be pursued at this stage, details of this option are not included in this document.

Option 3 – Implementation of DDS with all identified User Requirements

This option attempts to address all of the identified requirements in the User Requirements (UR) study. It expands the facilities, as established within Option 2, by developing the conversion routines and Customer and Sales Record Subsystem to allow selection and download of data based on enhanced spatial and textual selection criteria as well as feature level updates. Internet facilities are provided to allow preview of changes that have been made to a particular sheet since last purchase.

3.3.2.2 Assessment of Options

Selection of the most appropriate option, which will eventually be taken forward to the detailed analysis and design stage, must be based on the extent to which each option best meets user requirements, balances against the risks and incurs development effort in its implementation. Each of the options outlined in Section 3.3.2.3, "Recommendation" is assessed using the following criteria:

Item	Criteria	Description
1.	Meeting the Overall Requirements	Each option is evaluated based on its ability to meet the overall requirements of CLIS DDS. In conducting this assessment, user requirements are summarised into eight categories so that comparison between advantages and disadvantages of each option are readily apparent. Table 3.3-2 shows how these categories relate to User Requirements. These categories are: I. CLIS Data Management Activities II. Ordering and Payment Activities III. Customer Profile License and Sales Record Activities IV. Data Conversion Activities V. Data Dissemination Activities VI. License Renewal and Cessation Activities VII. Customer Supporting Activities VIII. Audit Control and Security
2.	Risk in Implementation	This is a measure of the difficulty in implementing the system as envisioned within the business option. Risk takes into account factors such as the complexity of the system, time to develop an operational system and (at a high level) expected costs.
3.	Development Effort	This is a measure of the development effort potentially involved in each option.

Table 3.3-1 - Assessment Criteria

Category		Requirement ID	Priority	Requirement Description
Item.	Description			
I.	CLIS Data Management Activities	REQ-SYS003	M	Provision of updated features
		REQ-D002	H	Minimise the disruption to LandsD digital map operational database
II.	Ordering and Payment Activities	REQ-SYS001	H	Provide efficient methods on online ordering of digital map data from LandsD
		REQ-SYS002	M	Expand the current selection criteria on selecting required digital map data
		REQ-SYS005	H	To generate demand note online
		REQ-D001	H	Offer a wide range of data formats to users
III.	Customer Profile, License and Sales Record Activities	REQ-SYS008	H	To maintain the customer and license details
IV.	Data Conversion Activities	REQ-SYS004	H	Provide enhanced range of data conversion tools for LandsD digital map data
		REQ-D003	H	Storage of LandsD digital map data in a number of commonly used formats
V.	Data Dissemination Activities	REQ-SYS006	H	Provide an efficient method in the automatic data conversion and extraction of required digital map data
		REQ-SYS007	H	Provide a range of effective digital map data delivery and dissemination methods
		REQ-SYS011	M	To provide regular updates to large private sector customers
		REQ-D004	L	Dissemination of digital data provided from other Government departments
		REQ-D005	L	Dissemination of historical digital map data
VI.	License Renewal and Cessation Activities	REQ-SYS010	H	Provide facilities to renew license and maintain cessation information
VII.	Customer Supporting Activities	REQ-SYS009	H	Provide technical support information to the customers
VIII.	Audit, Control and Security	REQ-ACS01	H	Track login, logout and system details information
		REQ-ACS02	H	Track activities of users
		REQ-ACS03	H	Verify conversion errors encountered during data conversion process
		REQ-ACS04	H	Manage user accounts and access rights
		REQ-ACS05	H	Physical access and system security
		REQ-ACS06	H	Provide secure measure on transmission of digital map data
		REQ-ACS07	H	Monitoring of system performance and usage
		REQ-ACS08	H	Perform system backup and archiving

Table 3.3-2 - Categorisation of Requirements

Table 3.3-3 presents the summary of assessment results, while Table 3.3-4 provides a comparison in terms of the extent to which each option fulfils detailed requirements.

Criteria Item (Category Item)	Criteria	Option 1 - Implementation of DDS with manual data conversion and dissemination	Option 2 – Implementation of DDS with automatic data conversion and dissemination (Payment made outside DDS)	Option 3 – Implementation of DDS with all identified User Requirements
1	Meeting Overall Requirements			
1(I)	CLIS Data Management Activities			
	Pros	<ul style="list-style-type: none"> Creation of Source Data hub within DDS to minimise disruption of CLIS. Routines to transfer updated layers from updated sheets from CLIS to Source Data hub Selection and purchase of digital map data remains on a sheet basis, and, therefore, enhancement of existing CLIS data structure to cater for feature level updating and/or selection is not needed 	<ul style="list-style-type: none"> As in Option 1 	<ul style="list-style-type: none"> As in Option 1, this provides a Source Data hub and transfer of layers from updated sheets from CLIS. Compares current data with those that have been updated to identify changed features, thus enabling feature level updating Converts data to facilitate flexible selection and download
	Cons	<ul style="list-style-type: none"> Does not cater for advanced selection criteria 	<ul style="list-style-type: none"> Does not cater for advanced selection criteria 	<ul style="list-style-type: none"> Enabling feature level update and flexible selection will require a series of processes to be run on data received from CLIS. These will modify the data structure such that the data held in Source Data Hub will be in a different format, and will include additional data from that held within CLIS

Criteria Item (Category Item)	Criteria	Option 1 - Implementation of DDS with manual data conversion and dissemination	Option 2 – Implementation of DDS with automatic data conversion and dissemination (Payment made outside DDS)	Option 3 – Implementation of DDS with all identified User Requirements
	Cons			<ul style="list-style-type: none"> This option will require establishing and publishing data structure and feature level date stamping formats before implementation of ECLIS which may compromise design decisions that can be taken in this system.
1(II)	Ordering and Payment Activities			
	Pros	<ul style="list-style-type: none"> Internet based online ordering is provided 	<ul style="list-style-type: none"> As in Option 1 	<ul style="list-style-type: none"> Internet based online ordering functions are provided. Online ordering facilities are provided to enable customers to: <ul style="list-style-type: none"> ➤ Identify features that have been updated in a preview window ➤ Select data for download by such criteria as feature type, geographic unit, attribute ➤ Select data for download by date since last update
	Pros			<ul style="list-style-type: none"> This meets all identified user requirements related to the online ordering issue This also permits customers to purchase selected data within a sheet and/or the entire sheet This decreases the amount of digital map data required to be transferred as the customers can better define their requirements

Criteria Item (Category Item)	Criteria	Option 1 - Implementation of DDS with manual data conversion and dissemination	Option 2 – Implementation of DDS with automatic data conversion and dissemination (Payment made outside DDS)	Option 3 – Implementation of DDS with all identified User Requirements
	<p>Cons</p>	<ul style="list-style-type: none"> • Selection and purchase of digital map data on a sheet by sheet basis only • Does not address user requirements on feature updates / versioning or enhanced selection criteria 	<ul style="list-style-type: none"> • As in Option 1 	<ul style="list-style-type: none"> • Expanding the range of selection criteria available to the customer beyond current sheet based selection could have a number implications including: • The calculation of payment charges, and recording of digital map data purchased by customers, and verification of deliverables become far more complicated as it is based on a feature level rather than on sheet level • Change in current policy is required to allow the customer to purchase digital map data on a non-sheet basis and management decision to devise a new sales strategy is also required • Feature level updates would require capturing the date on which features are added, edited and/or deleted in ECLIS database, Feature level date stamping is not captured by current CLIS. Though feature level date stamping could be introduced upon the update of the Source Spatial Data Hub, this would greatly complicate update processes and database design.

Criteria Item (Category Item)	Criteria	Option 1 - Implementation of DDS with manual data conversion and dissemination	Option 2 – Implementation of DDS with automatic data conversion and dissemination (Payment made outside DDS)	Option 3 – Implementation of DDS with all identified User Requirements
	Cons	<ul style="list-style-type: none"> • 		<ul style="list-style-type: none"> • Ability of customer’s systems to accept feature level updating is likely to be heavily dependent on the compatibility of their software with that used in CLIS/ECLIS • Incorporation of such feature level date stamping would introduce discrepancy between LandsD Operational and Source Spatial Data Hub • It is preferable that feature level change management be handled within the CLIS, in line with the recommendations of the ECLIS FS
1(III)	Customer Profile, License and Sales Record Activities			
	Pros	<ul style="list-style-type: none"> • Provision of Customer and Sales Record Subsystem • Customers can view and modify their own profile details through Internet Interface • Database maintains purchase order history and a list of digital map data that are currently being held by the customer • No requirement to develop new feature based purchase and licensing procedures 	<ul style="list-style-type: none"> • As in Option 1 • In addition, record of data held by customers can be updated automatically upon successful completion of conversion / dissemination process • Data stored in the Customer and Sales Record Subsystem is similar to those of the current system and is clearly defined 	<ul style="list-style-type: none"> • As in Option 2

Criteria Item (Category Item)	Criteria	Option 1 - Implementation of DDS with manual data conversion and dissemination	Option 2 – Implementation of DDS with automatic data conversion and dissemination (Payment made outside DDS)	Option 3 – Implementation of DDS with all identified User Requirements
	Cons	<ul style="list-style-type: none"> Update of Customer and Sales Record Subsystem must be undertaken manually by LandsD staff 	<ul style="list-style-type: none"> Not applicable 	<ul style="list-style-type: none"> Storage and tracking of feature level data held by customers will require the development and maintenance of a significantly more complex database Database structure is entirely different from either the current customer database or those required in Option 1 and 2 If customers are informed of changes when features held by them are updated rather than when sheets are updated, it will require a major change in the current update reminder procedures
1(IV)	Data Conversion Activities	<p>Pros</p> <ul style="list-style-type: none"> Conversion routines remain dependent on manual processing, and could make use of existing routines (i.e. conversion programs already developed and used by LandsD to convert digital map data in various data formats) and/or new Commercial Off The Shelf (COTS) packages (i.e. Package conversion tools available in the market such as FME) 	<ul style="list-style-type: none"> Facilities for manual conversion as in Option 1 This could make use of existing conversion routines and/or new COTS packages (e.g. FME). The existing conversion routines will require enhancement to improve stability, error handling/reporting and automation 	<ul style="list-style-type: none"> As in Option 2 In addition, this permits data format conversion of selected features within given sheet or feature layer

Criteria Item (Category Item)	Criteria	Option 1 - Implementation of DDS with manual data conversion and dissemination	Option 2 – Implementation of DDS with automatic data conversion and dissemination (Payment made outside DDS)	Option 3 – Implementation of DDS with all identified User Requirements
	Pros	<ul style="list-style-type: none"> • Use of existing routines would minimise development required, and enable staff to use conversion routines with which they are familiar 	<ul style="list-style-type: none"> • This provides additional automated processes that allow automatic conversion into Multi-format Spatial Data Hub and automatic fulfilment of dissemination requests from customers • Routines of automated conversion processes can be executed during off-peak hours, and processing of tasks within the Job Queue can be carried out during office hours 	
	Cons	<ul style="list-style-type: none"> • Conversion into Multi-format Spatial Data Hub and execution of ad hoc conversion requests will remain as manual processes • The conversion process will be <ul style="list-style-type: none"> ➢ labour intensive ➢ prone to human error ➢ limited in processing capacity that is largely tied to office hours ➢ leading to inefficient utilisation of computing resources • If existing routines are adopted, it will require investigation and correction of the conversion errors when dealing with large volume of digital map data 	<ul style="list-style-type: none"> • This will require extension of existing conversion routines and/or additional development based on COTS packages to ensure robust automated conversion • This does not, however, attempt to satisfy requirement for conversion of specific features within a layer 	<ul style="list-style-type: none"> • This will require extension of existing conversion routines and/or additional development based on COTS packages to provide robust automated conversion and feature level conversion • This, however, depends on enhancement of current data structures to achieve feature level conversion

Criteria Item (Category Item)	Criteria	Option 1 - Implementation of DDS with manual data conversion and dissemination	Option 2 – Implementation of DDS with automatic data conversion and dissemination (Payment made outside DDS)	Option 3 – Implementation of DDS with all identified User Requirements
	Cons	<ul style="list-style-type: none"> • If new COTS are used, it will require additional development based on COTS packages to ensure robustness of the conversion programs • This does not attempt to satisfy requirement for conversion of specific features within a layer 	<ul style="list-style-type: none"> • 	<ul style="list-style-type: none"> •
1(V)	Data Dissemination Activities Pros	<ul style="list-style-type: none"> • This provides direct data linkage to other Government departments to allow them to download digital map data from LandsD Multi-format Spatial Data Hub • Customers from other Government departments without direct data linkage and the private sector are allowed to download small volume of digital map data over the Internet 	<p>In addition to the advantages as described in Option 1, this also provides network and security facility to allow customers from private sector to access via leased line connections</p> <ul style="list-style-type: none"> • This enable updated digital map data to be automatically disseminated to customers (if they have routines to download the data). Alternatively, customers can manually download digital map data. This facility has a number of advantages including: <ul style="list-style-type: none"> ➤ Better security ➤ Better availability of data ➤ Easier control of licenses ➤ Greater confidence that customers hold most up-to-date data 	<ul style="list-style-type: none"> • As in Option 2

Criteria Item (Category Item)	Criteria	Option 1 - Implementation of DDS with manual data conversion and dissemination	Option 2 – Implementation of DDS with automatic data conversion and dissemination (Payment made outside DDS)	Option 3 – Implementation of DDS with all identified User Requirements
	<p>Pros</p>	<ul style="list-style-type: none"> • Preparation of dissemination media (checking Job Queue, copying files or ad hoc conversion and updating Customer and Sales Record Subsystem) remains as manual processes 	<ul style="list-style-type: none"> ➢ Better ability to control network load • Internet download permitted • In addition, automatic fulfilment of orders covers the following activities: <ul style="list-style-type: none"> ➢ Monitoring the Job Queue ➢ Selecting required data from Multi-format Spatial Data Hub ➢ Copying the selected data to the dissemination media ➢ Preparing the related documentation for the selected data ➢ Updating Customer and Sales Record Subsystem • Manual processing is only required to ensure that media writers are loaded with blank media and where Quality Assurance (QA) and packaging of orders are needed • This reduces staff involvement in routine dissemination and media preparation and, as a result, enables staff resources to spend more time on the verification process on the digital map data before distribution and provision of customer support • Order processing can be achieved 24 hours per day 7 days a week 	

Criteria Item (Category Item)	Criteria	Option 1 - Implementation of DDS with manual data conversion and dissemination	Option 2 – Implementation of DDS with automatic data conversion and dissemination (Payment made outside DDS)	Option 3 – Implementation of DDS with all identified User Requirements
	<p>Cons</p>	<ul style="list-style-type: none"> • Heavily reliant on manual processing for digital map data to be distributed on media • This diverts staff resources from customer support/sales activities to routine data conversion and file copying tasks • There is potential of human errors in processing large volume of conversion jobs • Orders for digital map data can only be processed during office hours • Direct data linkage can only be provided for other Government departments' customers to download data from LandsD. Large bandwidth linkage may be needed to cater for unexpected surge in demand for large volume of digital map data if the government departments do not download the digital map data on a regular basis • Direct data linkage facilities will not be provided to private sector 	<ul style="list-style-type: none"> • Not applicable 	<ul style="list-style-type: none"> • Not applicable
<p>1(VI)</p>	<p>License Renewal and Cessation Activities</p>			

Criteria Item (Category Item)	Criteria	Option 1 - Implementation of DDS with manual data conversion and dissemination	Option 2 – Implementation of DDS with automatic data conversion and dissemination (Payment made outside DDS)	Option 3 – Implementation of DDS with all identified User Requirements
	Pro	<ul style="list-style-type: none"> This provides the process to monitor the expiry of license and the cessation date. This also provides facility to issue of license renewals and cessation reminders 	<ul style="list-style-type: none"> As in Option 1 	<ul style="list-style-type: none"> This has the same facility as provided as in Option 1, but it will be enhanced to cater for new flexible licensing that will be required if feature level selection and updating are permitted
	Con	<ul style="list-style-type: none"> Not applicable 	<ul style="list-style-type: none"> Not applicable 	<ul style="list-style-type: none"> Storage and tracking of feature level data held by customers will require the development and maintenance of a much more complex database
1(VII)	Customer Supporting Activities			
	Pros	<ul style="list-style-type: none"> All Customer Supporting Activities are met 	<ul style="list-style-type: none"> All Customer Supporting Activities are met 	<ul style="list-style-type: none"> All Customer Supporting Activities are met
	Cons	<ul style="list-style-type: none"> Not applicable 	<ul style="list-style-type: none"> Not applicable 	<ul style="list-style-type: none"> Not applicable
1(VIII)	Audit Control and Security			
	Pros	<ul style="list-style-type: none"> All audit control and security requirements are met Restricting direct data linkage to other Government departments will simplify security procedures 	<ul style="list-style-type: none"> All audit control and security requirements are met 	<ul style="list-style-type: none"> As in Option 2
	Cons	<ul style="list-style-type: none"> Not applicable 	<ul style="list-style-type: none"> Not applicable 	<ul style="list-style-type: none"> Not applicable
2.	Risk in Implementation			

Criteria Item (Category Item)	Criteria	Option 1 - Implementation of DDS with manual data conversion and dissemination	Option 2 – Implementation of DDS with automatic data conversion and dissemination (Payment made outside DDS)	Option 3 – Implementation of DDS with all identified User Requirements
	Pros	<ul style="list-style-type: none"> • This maximises the use of existing practices, data structure and procedures • This maintains the purchase and distribution on a sheet basis • This can reduce the number of technical issues to be addressed in the area of automatic data conversion routines, dissemination routines and Customer and Sales Record Subsystem update 	<ul style="list-style-type: none"> • Existing CLIS data structure is leveraged • This can make use of the existing conversion routines (though enhancement will be required to ensure: stability, improved reporting / error handling and automation) • This maintains the purchase and distribution on a sheet basis • Data conversion and dissemination routines are automated • With the arrangement of payment made outside DDS (i.e. Option 2(b)), no extra security will be needed to apply 	<ul style="list-style-type: none"> • Not applicable
	Cons	<ul style="list-style-type: none"> • If new COTS conversion routines are used, the routines must be verified to ensure that the conversion of LandsD digital map data can be processed with accuracy 	<ul style="list-style-type: none"> • This poses a greater risk than Option 1 relying on development of new automated data format conversion processes • If existing conversion routines are to be used, these will require enhancement which may be limited by the technology in which they have been developed • If new COTS conversion routines are used, the routines must be verified to ensure the conversion of LandsD digital map data can be processed with accuracy 	<ul style="list-style-type: none"> • This involves considerably more risk than Option 2 as requires enhancement of current CLIS data model is required in order to fulfil feature level updates / versioning • Feature level dissemination requires far more complex processes to maintain an accurate detail of digital map data held by customers • If new COTS conversion routines are used, the routines must be verified to ensure the conversion of LandsD digital map data can be processed with accuracy

Criteria Item (Category Item)	Criteria	Option 1 - Implementation of DDS with manual data conversion and dissemination	Option 2 – Implementation of DDS with automatic data conversion and dissemination (Payment made outside DDS)	Option 3 – Implementation of DDS with all identified User Requirements
	Cons		<ul style="list-style-type: none"> • Additional security considerations need to be addressed in catering for on line download from private sector • Additional security measures will be required on Option 2(a) in the area of the monetary transaction between parties • 	<ul style="list-style-type: none"> • Development of enhanced data models to serve the requirements of DDS will need to be integrated with general enhancement work being undertaken on CLIS • This requires the implementation of new pricing and licensing policies • It is anticipated that the development effort involved in this option would be considerable. If development work is to take place based on the current CLIS data structure, the risk can be significant in that the development will be rendered redundant by changes in the data structure introduced by ECLIS
3.	Development Effort			
	Pros	<ul style="list-style-type: none"> • Efforts are focused on development of online ordering, payment facilities and Customer and Sales Record Subsystem in which it will minimise the development effort • Relatively minor development effort is required in the area of data conversion and dissemination technology • The system can be developed in less time than alternative options 	<ul style="list-style-type: none"> • Development effort will be focused in automating routine operations so as to divert human resources to customer service • Due to the arrangement of Payment made outside DDS (i.e. Option 2(b), maintain current payment procedure or PPS service), no extra development efforts will be required 	<ul style="list-style-type: none"> • Not applicable

Criteria Item (Category Item)	Criteria	Option 1 - Implementation of DDS with manual data conversion and dissemination	Option 2 – Implementation of DDS with automatic data conversion and dissemination (Payment made outside DDS)	Option 3 – Implementation of DDS with all identified User Requirements
	<p>Cons</p>	<ul style="list-style-type: none"> • There will be significant recurrent on-going effort and administrative overhead for LandsD in terms of data conversion and preparation of dissemination media 	<ul style="list-style-type: none"> • The development of the automatic data conversion and dissemination routines will require additional development effort as compared to Option 1 • Additional development effort will be required to cater for the implementation of additional security which is needed to control the access by the private sector • In comparison with Option 2(b), Option 2(a) is required to develop and test the following: <ul style="list-style-type: none"> ➤ The linkage and interface ➤ The security ➤ The account, payment and reconciliation management ➤ Any other areas related to the electronic payment. 	<ul style="list-style-type: none"> • Considerable effort will be required to set up the data structure and update and interface functions between the CLIS and the Source Spatial Data Hub if this option is to be adopted before the launch of ECLIS • Customer and Sales Record Subsystem design and license management procedures would be greatly complicated in comparison to alternative options • This will require significant additional effort in system design that will be inevitably revised once ECLIS is implemented

Table 3.3-3 - Assessment of BSO

Category		Requirement	Requirement Description	Option 1	Option 2	Option 3	Explanation	
Category Item	Description							
I.	CLIS Management Activities	Data	REQ-SYS003	Provision of updated features	✓	✓	✓	✓ - What is fulfilled: <ul style="list-style-type: none"> • Identification of updated layers since the last purchase is facilitated What is not fulfilled: <ul style="list-style-type: none"> • Identification of updated feature since the last purchase is not facilitated
			REQ-D002	Minimise the disruption to LandsD digital map operational database	✓	✓	✓	
II.	Ordering and Payment Activities		REQ-SYS001	Provide efficient methods on online ordering of digital map data from LandsD	✓	✓	✓	
			REQ-SYS002	Expand the current selection criteria on selecting required digital map data	✓	✓	✓	✓ - What is fulfilled: <ul style="list-style-type: none"> • Digital map data selection in sheet basis or layer basis is allowed What is not fulfilled: <ul style="list-style-type: none"> • Digital map data selection by features basis or customer defined Area of Interest (AOI) is not allowed
			REQ-SYS005	To generate demand note online	✓	✓	✓	
			REQ-D001	Offer a wide range of data formats to the users	✓	✓	✓	
III.	Customer Profile, License and Sales Record Activities		REQ-SYS008	To maintain the customer and license details	✓	✓	✓	✓ - What is fulfilled: <ul style="list-style-type: none"> • Customer and Sales Record Subsystem is established to store the customer, order, payment and license record What is not fulfilled: <ul style="list-style-type: none"> • Update of Customer and Sales Record Subsystem with data delivered is operated manually

Category		Requirement	Requirement Description	Option 1	Option 2	Option 3	Explanation
Category Item	Description						
IV.	Data Conversion Activities	REQ-SYS004	Provide enhanced range of data conversion tools for LandsD digital map data	✓	✓	✓	✓ - What are fulfilled: <ul style="list-style-type: none"> Data conversion tool is enhanced that increase the range of data formats supported COTS package and existing conversion routine are used Data conversion of specific layers or sheet is allowed What are not fulfilled: <ul style="list-style-type: none"> Data conversion process is still manually operated Data conversion of specific features within a layer is not allowed
		REQ-D003	Storage of LandsD digital map data in a number of commonly used formats	✓	✓	✓	✓ - What is fulfilled: <ul style="list-style-type: none"> Multi-format Spatial Data Hub is established to store digital map data in the most common data formats requested by the customer What is not fulfilled: <ul style="list-style-type: none"> The data conversion process which generates and updates the digital map data stored in the Multi-format Spatial Data Hub is operated manually
V.	Data Dissemination Activities	REQ-SYS006	Provide an efficient method in the automatic data conversion and extraction of required digital map data		✓	✓	

Category		Requirement	Requirement Description	Option 1	Option 2	Option 3	Explanation
Category Item	Description						
		REQ-SYS007	Provide a range of effective digital map data delivery and dissemination methods	✓	✓	✓	✓ - What are fulfilled: <ul style="list-style-type: none"> Digital map data in small quantity can be disseminated to general public via Internet Digital map data can be disseminated to other Government departments via direct data linkage What is not fulfilled: <ul style="list-style-type: none"> No direct data linkage is established to selected large private sector customers
		REQ-SYS011	To provide regular updates to large private sector customers	✓	✓	✓	✓ - What is fulfilled: <ul style="list-style-type: none"> Regular update can be provided by physical media (e.g. CDROM, tape) to selected private sector customers under a prior agreement between the customers and LandsD What is not fulfilled: <ul style="list-style-type: none"> Direct data linkage is not established for the private sector customers
		REQ-D004	Dissemination of digital data provided from other Government departments	✓	✓	✓	
		REQ-D005	Dissemination of historical digital map data	✓	✓	✓	
VI.	License Renewal and Cessation Activities	REQ-SYS010	Provide facilities to renew license and maintain cessation information	✓	✓	✓	
VII.	Customer Supporting Activities	REQ-SYS009	Provide technical support information to the customers	✓	✓	✓	
VIII.	Audit, Control and Security	REQ-ACS01	Track login, logout and system details information	✓	✓	✓	
		REQ-ACS02	Track activities of users	✓	✓	✓	
		REQ-ACS03	Verify conversion errors encountered during data conversion process	✓	✓	✓	
		REQ-ACS04	Manage user accounts and access rights	✓	✓	✓	
		REQ-ACS05	Physical access and system security	✓	✓	✓	
		REQ-ACS06	Provide secure measure on transmission of digital map data	✓	✓	✓	
		REQ-ACS07	Monitoring of system performance and usage	✓	✓	✓	
		REQ-ACS08	Perform system backup and archiving	✓	✓	✓	

Key:

- ✓ means complete fulfillment of the user requirement
- ✓ or ✓ mean partial fulfillment of the user requirement which is explained in details in the “Explanation” column

Table 3.3-4 - BSO compared to User Requirements

3.3.2.3 Recommendation

The following recommendations are made based on the assumption that the DDS will be implemented in the near future.

Option 1 represents the option with least risks, with data conversion and order processing being maintained on a manual basis. Apart from the enhanced ordering through the online facilities, payment through the online or offline facilities and Customer and Sales Record Subsystem features, the other major difference when compared to the existing situation would be the availability of the Multi-format Spatial Data Hub. This data hub will run conversion routines on a daily basis to update the digital map data, where required, to keep them up-to-date and readily available for quick access instead of having to make a conversion each time an individual order is received.

Dissemination of digital map data could be accessed:

- Via Internet by the private sector for small volume of digital map data
- Via the leased line by other Government departments
- By manually copying files to media

There is no requirement to enhance or modify existing CLIS data structures.

However, this option is not recommended as it will continue to rely entirely on the manual data conversion and dissemination procedures which will come under increasing strain in anticipation of a dramatic surge in the demand for LandsD spatial data. Whilst this option has the least risk and is likely to be the most simple to implement, the long-term benefits that can be derived from the system will be severely constrained by its manual nature.

Option 3 fully addresses the requirements identified in the User Requirement. It also carries the greatest risk with the need to develop complex Customer and Sales Record Subsystem, related processes to handle feature level data dissemination, and the adoption of feature level date stamping to cater for feature level updates/versioning.

This would involve considerable development effort. Given that a separate project, ECLIS, is likely to make changes to the CLIS data structure, there is a major risk of duplicated efforts once ECLIS is launched.

Option 3 is therefore not recommended. However, it is anticipated that the development effort and the risk involved would be significantly reduced if this option is implemented either in concurrence with the development of the proposed ECLIS or after.

Option 2 does not meet the requirements on feature level updates, but it will cater for all other identified user requirements. In summary, it would provide the following:

- Enhanced automatic facilities to extract and convert digital map data, for example:
 - Identify and copy updated digital map data from CLIS to Source Spatial Data Hub
 - Convert the updated digital map data into different data formats
- Automating the execution of order processing, for example:
 - Verifying payment status and putting order in a job queue
 - Monitoring the job queue for the orders

- Automating the dissemination of digital map data to customers (from both other Government departments and private sector) through Internet to ensure that customers can be updated on a regular basis, for example:
 - Allow access to customer to download ordered digital map data
 - Copying the ordered digital map data to dissemination media
- Keeping the customers' digital map data as up-to-date as those of LandsD

However, the following process will be still required to perform manually.

- To ensure that media writers are loaded with blank media
- To perform Quality Assurance (QA) and packaging of orders
- Manually reactivate the conversion process, if it fails due to unforeseen error while running automatically
- Data entry of customer order information for offline orders (i.e. Walk-in customer)

In comparison with Option 1, Option 2 will involve a bigger development overhead, and require enhancement or replacement of existing conversion routines so that they may be operated automatically. However, there are significant long-term advantages from Option 2 that would offset the greater development effort and risk. This option will reduce manual processing within the data dissemination tasks and enable greater emphasis on quality control, market development and sales support than are possible with Option 1.

In comparison with Option 3, the risks and development effort involved in Option 2 are far less if development is to take place in the near future, and before the implementation of ECLIS, as ECLIS will provide data modelling enhancement, feature level updating and versioning functionality. To avoid redundant effort and compatibility problems, Option 2 will not provide the above features. This will offer a shorter implementation period for LandsD to provide the required online ordering and automatic data conversion and dissemination functionality. Therefore **Option 2** is **recommended** in comparison with Option 1 and Option 3. However, in order to smoothly migrate DDS to support ECLIS from CLIS, certain enhancement will be required in the proposed system after ECLIS is implemented.

Though Option 2 is further divided in two sub-options for the purpose of providing flexibility and practical business options to LandsD. Online payment would not be pursued at this stage and only option 2(b) is considered.

3.3.2.4 Other Options Considered But Not Further Pursued

The following alternative options are also considered during the BSO selection process. They are not considered further based on the following reasons.

Option 4 – Status Quo

A “Status Quo” option, maintaining the way it is without any changes, has been considered. However, in the case of DDS, it has been clearly shown that the current problems, user requirements and the potential benefits that can be derived from enhancements warrant the development of a new system.

The current system, though involving considerable manual effort on the part of LandsD, is able to satisfy the current conversion and dissemination requirements. However, the current systems of payment and delivery do pose considerable inconvenience to the customers. In addition, over the last five years, the demand for LandsD digital map data has increased considerably and is expected to continue to accelerate in the near future. It is, therefore anticipated that pressure on LandsD resources and inconvenience for customers will continue to increase. Development of an enhanced DDS will facilitate delivery of better services to customers and increase access and usage of up-to-date LandsD digital map data. The “Status Quo” option is therefore eliminated from further consideration.

Option 5 – Implement DDS without Online Ordering and Payment System

This option considers enhancing conversion and dissemination processes without providing online ordering and payment functions. This would provide a suite of enhanced conversion tools, and establishment of Multi-format Spatial Data Hub. Data would be disseminated via leased line, traditional media and usage of standard electronic mail for small volume of digital map data. Development of online ordering and payment systems would not be considered under this option.

There is a strong demand for online ordering and payment facilities as expressed by both LandsD users and its customers. In addition, despite online payment is not considered at this stage, Internet based online ordering is considered to be the most efficient means of addressing these concerns. However, this option does not address this key requirement. Therefore, this option is also eliminated from further consideration.

Option 6 – Implement DDS without Source or Multi-Format Spatial Data Hubs

This option considers the introduction of online ordering, payment, conversion and dissemination facilities but without the development of additional Source or Multi-format Spatial Data Hubs. Digital map data would be extracted directly from LandsD operational databases for conversion as and when requested by customers. This is in effect similar to existing working practices and does not require investment in additional hardware or software for new Source or Multi-format Spatial Data Hubs. Digital map data would be converted on an as requested basis.

This approach is eliminated from further consideration for the following reasons:

- Direct extract of data for conversion from LandsD operational databases could impact the performance of the operational databases
- Conversion at the time of data delivery is:
 - Inefficient because the conversion routines are repeated for each customer
 - Increases the risk of conversion failure (failures occur more frequently when large batches are requested)
- In comparison, updating the Multi-format Spatial Data Hub on a daily basis will be less resource intensive requiring conversion of only relatively small amount of data (e.g. only updated layers in those sheets that have been modified)
- Facilities for direct download via leased lines will be harder to implement because they require additional levels of security when compared to the levels required for the Multi-format Spatial Data Hub

It is anticipated that the costs associated with establishing the Source or Multi-format Spatial Data Hubs will not be great given the relatively low price of disk space. No further investigation has been carried out for this option.

Option 7 – Establish Common Access Data Server

This option considers the possibility of serving the demands of some customers by providing digital map data on a data server integrated with their applications. In this type of set-up, no data is physically downloaded to customers' sites. The customers purchase the right to access LandsD digital map data mounted on a server maintained and managed by LandsD. Recent developments in Intranet and Internet based GIS technology are beginning to allow system to be constructed on the basis of such remote access to data stores.

Whilst it is believed this could in the long term be introduced as an efficient means of satisfying certain customer's requirements, the risks involved in this approach has precluded it from further analysis. Technology for serving and integrating remote datasets in this way is only emerged recently and not yet mature. In addition, current CLIS data structure will have difficulties in serving on an Internet platform under this technology. Therefore, Option 7 is eliminated for further consideration although it can be considered once again after the implementation of ECLIS or when this type of technology becomes mature and well proven.

3.3.3 BSO FOR CSU DDS

3.3.3.1 Business System Options Considered

Given the user requirements, there are three core requirements categories. They are:

- CSU Data Provision from DO
- CSU Data Manipulation
- CSU Data Dissemination to DU

To simplify the presentation of the non-core user requirements, relevant category requirements are grouped. Reporting and System Parameters Maintenance are included in the CSU Data Provision from DO requirement category whereas Metadata Maintenance is included in the CSU Data Manipulation requirement category.

Three options of CSU DDS are suggested as follows:

Requirement Category	Option 1	Option 2	Option 3
CSU Data Provision from DO		✓	✓
CSU Data Manipulation	✓	✓	✓
CSU Data Dissemination to DU			✓

Table 3.3-5 – Business System Options by Requirement Category

Option 1 – Implement only CSU Data Manipulation User Requirements

In this option, only the CSU Data Manipulation user requirements (together with metadata maintenance) specified in the User Requirements (UR) study would be included in the system supported. These user requirements are:

- CSU Data Manipulation
- Task Management for CSU Data Extraction
- Extract CSU Files to conform to file format standards
- Transaction log for CSU Data Manipulation
- Acknowledgement for CSU Data Manipulation
- Maintain Metadata of CSU

Other non CSU Data Manipulation related user requirements would be manually handled by users.

Option 2 – Implement only CSU Data Provision from DO and CSU Data Manipulation User Requirements

In this option, the following user requirements specified in the UR study would be fulfilled:

- the user requirements mentioned in Option 1
- CSU Data Provision from DO user requirements (together Reporting and System Parameters Maintenance)

Only CSU Data Dissemination to DU user requirements would be manually handled by

users.

Option 3 – Implement all CSU DDS User Requirements

In this option, all identified CSU DDS user requirements specified in the UR study, which include those user requirements mentioned in Option 2 and CSU Data Dissemination to DU user requirements would be totally supported.

The user requirements involved in each of the above 3 options could be referred in Table 3.3-7.

3.3.3.2 Assessment of Options

Selection of the most appropriate option would be a compromise between UR (what users need and what they can afford), development resources and the likely risks, if any, that will incur in the implementation stage. Each of the options outlined in Section 3.3.3.3, “Recommendation” is assessed using the following criteria:

Criteria Item	Criteria	Description
1.	Meeting the Overall Requirements	Each option is evaluated based on its ability to meet the overall user requirements of CSU DDS. In conducting this assessment, user requirements are summarised into six requirement categories so that comparison between Pros and Cons of each option are readily apparent. Table 3.3-7 shows how these requirement categories relate to user requirements. These categories are: I. CSU Provision from DO (together with Category IV Reports and Category VI System Parameters Maintenance) II. CSU Manipulation (together with Category V Metadata Maintenance) III. CSU Dissemination to DU
2.	Risk in Implementation	This is a measure of the difficulty in implementing the system as envisioned within the business option. Risk takes into account factors such as the complexity of the system, time to develop an operational system and (at a high level) expected costs.
3.	Development Effort	This is a measure of the relative development effort potentially among the options.

Table 3.3-6 - Assessment Criteria

Table 3.3-7 provides a comparison in terms of the extent to which each BSO fulfils detailed requirements and Table 3.3-8 presents the summary of assessment results of individual BSO.

Requirement Category		Requirement ID	Requirement Description	Option 1	Option 2	Option 3
Item	Description					
I.	CSU Data Provision from DO	REQ-DAM001	Interface for CSU Data Provision from DO	x	✓	✓
		REQ-DAM002	Validation for CSU Data Provision from DO	x	✓	✓
		REQ-DAM003	Transaction Log for CSU Data Provision from DO	x	✓	✓
		REQ-DAM004	Acknowledgement for CSU Data Provision from DO	x	✓	✓
II.	CSU Data Manipulation	REQ-DAM005	CSU Data Manipulation	✓	✓	✓
		REQ-DAM006	Task Management for CSU Data Extraction	✓	✓	✓
		REQ-DAM007	Extract CSU Files to conform to file format standards	✓	✓	✓
		REQ-DAM008	Transaction log for CSU Data Manipulation	✓	✓	✓
		REQ-DAM009	Acknowledgement on receipt of data from DAMin/DAMout	✓	✓	✓
III.	CSU Data Dissemination to DU	REQ-DAM010	Interface for CSU Data Dissemination to DU	x	x	✓
		REQ-DAM011	CSU Files Package	x	x	✓
		REQ-DAM012	Transaction log for CSU Data Dissemination to DU	x	x	✓
		REQ-DAM013	Acknowledgement for CSU Data Dissemination to DU	x	x	✓
IV.	Reports	REQ-DAM014	Generate Management Reports	x	✓	✓
		REQ-DAM015	Generate User Reports	x	✓	✓
V.	Metadata Maintenance	REQ-DAM016	Maintain Metadata of CSU	✓	✓	✓
VI.	System Parameters Maintenance	REQ-SYS012	Maintain code table and system parameters	x	✓	✓
		REQ-SYS013	Synchronization of system date and time	x	✓	✓

Key:

- ✓ means complete fulfillment of the user requirement
- x means partial fulfillment of the user requirement which is explained in details in the “Explanation” column

Table 3.3-7 - BSO compared to User Requirements

Criteria Item	Criteria	Option 1 - Implement only CSU Data Manipulation User Requirements	Option 2 – Implement only CSU Data Provision from DO and CSU Data Manipulation User Requirements	Option 3 – Implement all CSU DDS User Requirements
1	<p>Meeting Overall Requirements</p> <p>Pros</p>	<ul style="list-style-type: none"> • Provide a centralised database to keep all the 3 CSUs spatial data and textual data for CSU Data Dissemination to DU. • Automatically support the following CSU Data Manipulation activities: <ul style="list-style-type: none"> - matching data - validating data - updating data - scheduling data extraction - conversion data files to DAM defined formats - logging all CSU Data Manipulation transactions - sending acknowledgement for CSU Data Manipulation results. • Automatically maintain CSU metadata conforming to various international standards adopted by the Bureau. 	<ul style="list-style-type: none"> • As in Option 1. • Automatically support the following CSU Data Provision from DO activities: <ul style="list-style-type: none"> - capturing update CSU data via web-based user interface - validating data - generating report - logging all CSU Data Provision from DO transactions - displaying acknowledgement or error message and sending validation results. • Generate various management and user activities reports are automatically for easy monitoring different CSU activities. • Provide user-friendly interface for DA to maintain system code tables and parameters would make the system more efficient and feasible to adopt further business changes. • CSU Data Provision from DO processing can be achieved 24 hours per day 7 days a week. 	<ul style="list-style-type: none"> • As in Option 2. • Automatically support the following CSU Data Dissemination to DU activities: <ul style="list-style-type: none"> - providing web-based interface for DU to order available CSU delta data with searching or sorting features - keeping record for each order with transaction information. - generating report - packing files to reduce size for download - controlling file access security with user assigned password - logging all CSU Data Dissemination to DU transactions - sending acknowledgement for CSU Data Dissemination to DU orders information - allowing DU to download the ordered package again, in case of download failure. • CSU Data Provision from DO and CSU Data Dissemination to DU processing can be achieved 24 hours per day 7 days a week.

Criteria Item	Criteria	Option 1 - Implement only CSU Data Manipulation User Requirements	Option 2 – Implement only CSU Data Provision from DO and CSU Data Manipulation User Requirements	Option 3 – Implement all CSU DDS User Requirements
	<p>Cons</p>	<ul style="list-style-type: none"> • As in Option 2. • LandsD has to rely heavily on manual processing to support the following CSU Data Provision from DO activities: <ul style="list-style-type: none"> - manually receiving updated CSU information, e.g. via e-mail or diskette/CD-ROM from DO - uploading received data via simple import function - checking the file transmission result. - sending e-mails to inform DO on the file transmission result. • Risk to potential human errors in processing validation and large volume acknowledgement activities. • No management reports would be generated automatically and LandsD has to invest heavy manual effort to extract data from system files or transaction logs and calculate the figures based on the vast data extracted in order to produce useful statistical report. 	<ul style="list-style-type: none"> • LandsD has to rely heavily on manual processing to support the following CSU Data Dissemination to DU activities: <ul style="list-style-type: none"> - keeping track on the delta data to be disseminated to DU - packing delta data files - coping delta data files into diskette/CD-ROM or attaching them into e-mail - sending diskette/CD-ROM or e-mails to DU. • Risk to potential human errors in processing large volume acknowledgement activities. • CSU Data Dissemination to DU processing can only be operated within office hours. 	<ul style="list-style-type: none"> • Not applicable.

Criteria Item	Criteria	Option 1 - Implement only CSU Data Manipulation User Requirements	Option 2 – Implement only CSU Data Provision from DO and CSU Data Manipulation User Requirements	Option 3 – Implement all CSU DDS User Requirements
	<p>Cons</p>	<ul style="list-style-type: none"> • No user activities reports would be generated automatically and LandsD has to invest heavy manual effort to extract data from transaction logs and consolidate the details based on the vast data extracted into report. • Potential inaccuracy due to human errors in handling large volume of data for producing reports is unavoidable. • To cater certain minor business change, system administration may have to update data directly in the database with database tools which may create problem in data inconsistency as well as security concerns. • CSU data provision and CSU data dissemination processing can only be operated within office hours. 		

Criteria Item	Criteria	Option 1 - Implement only CSU Data Manipulation User Requirements	Option 2 – Implement only CSU Data Provision from DO and CSU Data Manipulation User Requirements	Option 3 – Implement all CSU DDS User Requirements
2.	Risk in Implementation Pros	<ul style="list-style-type: none"> Implementing DAM measures within 12 months is feasible. Cost incurred is comparatively low. Risky in technology limitation is comparatively low. 	<ul style="list-style-type: none"> Implementing DAM measures within 12 months is feasible. Most but not all CSU activities are automatically handled by the system. Cost incurred is comparatively higher, but the resources demand from LandsD would be very much reduced for validation etc. Risky in technology limitation is comparatively low. 	<ul style="list-style-type: none"> All CSU activities are automatically handled by the system. Efficient CSU Data Dissemination to DU. Cost incurred is comparatively high but not much different from Option 2 as LandsD has already included the data dissemination function in CLIS DDS. Relying manual procedures is comparatively minimal.
	Cons	<ul style="list-style-type: none"> Just core part of the CSU activities are automatically handled by the system. Not efficient mode of CSU Data Provisions from DO and CSU Data Dissemination to DU. Relying manual procedures is comparatively heavy. 	<ul style="list-style-type: none"> Relying manual procedures is comparatively fair. 	<ul style="list-style-type: none"> Implementing DAM measures within 12 months is tight.
3.	Development Effort			

Criteria Item	Criteria	Option 1 - Implement only CSU Data Manipulation User Requirements	Option 2 – Implement only CSU Data Provision from DO and CSU Data Manipulation User Requirements	Option 3 – Implement all CSU DDS User Requirements
	Pros	<ul style="list-style-type: none"> Development effort for core features of CSU data activities, i.e. CSU Data Manipulation is comparatively low. The time required to develop the system is comparatively short. 	<ul style="list-style-type: none"> Development effort for most features of CSU data activities except CSU Data Dissemination to DU is comparatively moderate. The time required to develop the system is comparative moderate. The recurrent on-going effort and administrative overhead for LandsD in terms of manual processing is comparatively less significant. 	<ul style="list-style-type: none"> The recurrent on-going effort and administrative overhead for LandsD in terms of manual processing is comparatively insignificant. Development effort required to cater for the implementation of additional security is comparatively low.
	Cons	<ul style="list-style-type: none"> The recurrent on-going effort and administrative overhead for LandsD in terms of manual processing is comparatively significant. Development effort required to cater for the implementation of additional security, such as logging queries activity for extracting statistic figures on data dissemination to DU, is comparatively high. 	<ul style="list-style-type: none"> Development effort required to cater for the implementation of additional security such as logging queries activity for extracting statistic figures on data dissemination to DU, is comparatively fair. 	<ul style="list-style-type: none"> Development effort for all features of CSU data activities is comparatively high. The time required to develop the system is comparatively long.

Table 3.3-8 - Assessment of BSO

3.3.3.3 Recommendation

Option 1 only includes the user requirements which support CSU Data Manipulation functions. The proposed solution is to provide a centralized database repository for keeping the 3 CSU data for LandsD. Activities related to CSU Data Provision from DO and CSU Data Dissemination to DU are to be handled manually, e.g. via diskette/CD-ROM delivery or e-mail communication channel. Report generation, metadata maintenance and code tables maintenance features are not provided.

In this option, CSU Data Provision from DO and CSU Data Dissemination to DU will be processed manually. These require manual procedures which will demand huge resources, in particular for the data validation.

This option is not recommended.

Option 2 includes the user requirements which support CSU Data Provision from DO and CSU Data Manipulation, but CSU Data Dissemination to DU would be handled manually by LandsD, e.g. via diskette/CD-ROM delivery or e-mail communication channel.

This option will automate the CSU Data Provision from DO process. This would greatly reduce the resources demand from LandsD for the CSU Data Provision from DO process. Although this option might cost a bit more than that of Option 1, it is likely that the saving from reducing recurrent effort for the data provisioning would offset the incremental cost. This option would be a better choice than Option 1.

When comparing with Option 3, since the infrastructure to be provided for the CLIS DDS could be shared for CSU Data Dissemination to DU, the likely incremental cost for this purpose would be very relatively small. On the contrary, LandsD, being the Data Agent of the three CSUs, could minimise the manual resources for CSU Data Dissemination to DU purpose. We would consider that Option 3 would be a cost effective option than Option 2.

This option is not recommended.

Option 3 meets all identified user requirements. All CSU activities would be automated and any unnecessary manual procedures would be eliminated. Given the reasons discussed above, we recommend Option 3 should be adopted as the preferred system option.

3.3.3.4 Way Forward – One-Stop Solution for LandsD

3.3.3.4.1 Brief Requirement

It is one of the requirements from the Brief that the feasibility and benefits of One-Stop CSU data query, request and download among participating departments (PD) with a view to extending to other government departments would be evaluated in the Supplementary Feasibility Study.

This discussion paper provides a high level overview of the feasibility of One-Stop Solution for the said purpose. Moreover, it proposes a roadmap for the possible migration from the integrated DDS (CLIS DDS and CSU DDS) to One-Stop Solution. It also highlights the possible features of the One-Stop Portal for Data Alignment Framework (DAF) and the issues that should be addressed prior to its implementation.

3.3.3.4.2 Background

Feasibility Study on Data Dissemination System (CLIS DDS)

Lands Department (LandsD) currently maintains the digital map and land record information in the Computerised Land Information System (CLIS). The different group of users currently uses this system. LandsD finished this study of Data Dissemination System (DDS) in 2000. The objectives of the CLIS DDS include:

- To provide facility to extract the up-to-date digital map data from CLIS and convert it into a number of commonly used formats for data dissemination
- To provide facility to maintain the customer profile, online order, undertaking and data license record information
- To provide facility to facilitate the handling of off-line payment process
- To provide facility to renew license and maintain cessation information
- To provide online/offline dissemination facilities of digital map data to customers
- To establish and provide technical support information to improve the customer support services of LandsD
- To provide facility to allow the user to perform ad-hoc analysis on customer and sales record information

Supplementary Feasibility Study on Data Dissemination System (CSU DDS)

The objective of the Supplementary FS is to identify, evaluate and determine the feasibility of using LandsD's Data Dissemination System for dissemination of the CSUs defined in the

Implementation of Data Alignment Measures (DAM) project, with respect to the recommended final solutions of DAM 1, DAM 2 and DAM 3.

CSU is a desired unit for storing spatial data that is shared with other PDs. Implementation of CSU includes development of system interfacing facility, data conversion and development of CSU Data Dissemination to DU facility. Upon completion of implementation, PDs have to prepare their data that need to be shared with other departments as stipulated in the CSU specifications.

It is anticipated that, with the implementation of CSUs, the post-processing efforts incurred in resolving data definition problems in the existing data exchange processes could be reduced.

LandsD was nominated as the Data Agent for Building, Lot and Road Centreline CSUs. In order to support the required data importing and dissemination functions, a data dissemination system is required.

Other GIS initiatives of government departments, including PDs and non PDs

While DAM is a joint initiative among all PDs, there are government departments (including PDs and non PDs) who have been initiating other GIS implementations on their own. In recent years, significant progress has been made in both ETWB and HPLB departments in employing geographic information systems (GIS) in capturing, updating, disseminating, performing query and analyzing geographic data. Some departments might have already implemented several GIS while at the same time there are quite a few GIS which are at different stages of development. These individual systems provide facilities which would serve the business needs of individual departments and/or service other departments and public. However, maintenance of GIS data could be a costly exercise as it would incur considerable cost to collect the data, in particular when the data are scattered among departments. Also departments need to maintain their own personnel to maintain the GIS data and systems. This is a particular problem for the departments who are minor GIS users (or non GIS users) and the GIS literacy within the departments is not high. The investment could have been better synergised if the resources could be shared, while at the same time, the data quality and the level of service are not compromised.

3.3.3.4.3 Benefit of One-Stop Solution in the context of DAM

The One-Stop Solution is a solution meant to provide a convenient, user-friendly and easily accessible centralized gateway or platform that can facilitate efficient CSU data searching, data request and data download by participating departments (PDs) with a view to further extending such service to more departments in the government. The One-Stop Solution would offer facilities that could facilitate collaboration among government departments (PDs and non PDs, when applicable), in particular non GIS users who are “enabled” to view the CLIS data and CSU data via facilities hosted by a designated agent and their investment on GIS personnel and own infrastructure for GIS applications can be kept to the minimum. When applicable, some of the LandsD systems can be consolidated together with this One-Stop Solution (e.g. the Metadata Catalogue Services MCS System) and such consolidation could bring synergised saving to the agent who will host the system. Multi level access to those geospatial data may be provided to government and the private sector, when required. Without compromising the requirements from the departments, departments can

also benefit from avoiding the costs of redundant data collection and repetitive development work on a similar initiative.

Spin off benefit from the One-Stop Solution

By implementing the One-Stop Solution, LandsD could be positioned as a GIS service provider, in particular for minor GIS users who could minimize their investment cost for their own GIS infrastructure and GIS personnel. HPLB could use the One-Stop solution as a pioneer project to advance DAM at an affordable cost and also a good marketing tools to sell DAM to the non PDs. On its successful implementation, departments would be motivated to advise how the One-Stop Solution could be expanded to include other value added services for the benefit of the other departments and the government as a whole. Investment could then be synergized. In this regard, the scope and requirements for its implementation should be well defined. Policy support for the implementation should be required for the implementation.

3.3.3.4.4 Migration from Current to One-Stop Solution

Roles of existing /planned systems in the One-Stop Solution

It has been recommended in the DAM project only data dissemination system for CSU would be implemented in DAM while the query and user analysis could be implemented later when considered appropriate by LandsD.

It is well defined that the integrated DDS is mainly for data dissemination purpose. There is a prototype GIH (Geospatial Information Hub) now available within LandsD that could perform query and analysis function. These two together could form a solution for the One-Stop Solution.

Possible Configuration

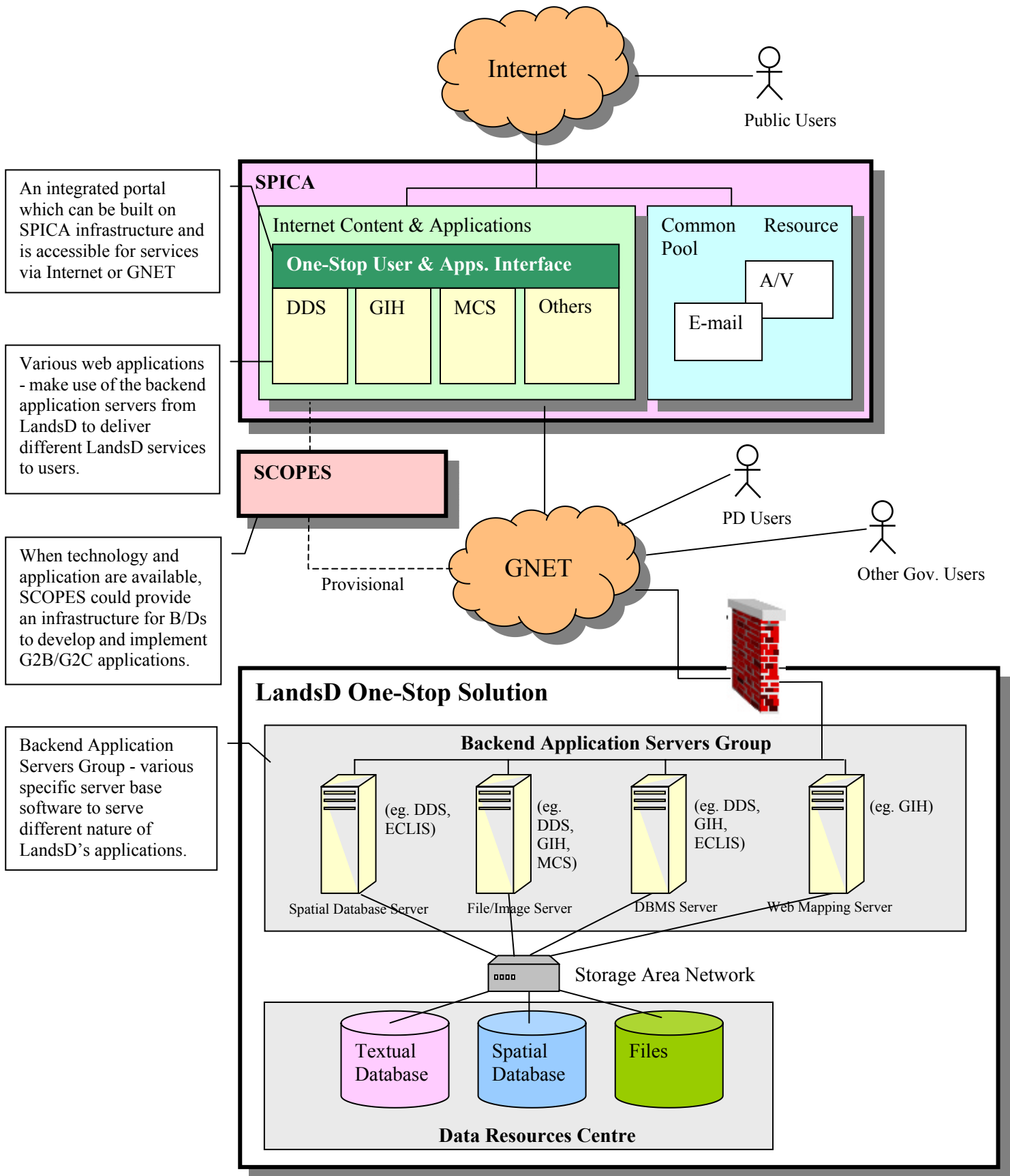
The goal of LandsD One-Stop Solution is to provide a GIS portal which could serve the public and business needs of government departments in different business domains. Given the current facilities now available with LandsD, one possible configuration is suggested below for future reference:

- One key component of the proposed LandsD One-Stop Solution is the GIH which is presently not accessible via Internet. The proposed LandsD One-Stop Solution should provide flexibility to users including public who could access the GIH and also the integrated DDS via a single portal.
- This LandsD One-Stop Solution could also consider including the metadata searching service and other existing GIS applications/systems to meet the needs from PDs and other Government departments according to the specification stated in DAM. MCS will also be considered to integrate with the LandsD One-Stop Solution.
- While in the planning of the ECLIS, LandsD should consider how the existing systems could be consolidated with the ECLIS that could be made to interface/ integrate with the One-Stop Solution.

The proposed configuration of LandsD One-Stop Solution shows as Figure 3.3-1. If considered appropriate, it will make use of Shared Platform for Internet Content and Applications (SPICA)¹ and/or the Shared COmmon Platform for Electronic Services (SCOPEs) to off-load network and security infrastructure from LandsD. The Backend Application Servers Group dividing the servers by their functions and services nature. The servers group retrieves appropriate data from different data storage through a Storage Area Network (SAN). This architecture forms an effective and efficient One-Stop Solution portal to serve inter-department and public.

¹ SPICA is a new service to be launched by ITSD in August 2004.

Figure 3.3-1 – Configuration example of One-Stop Solution for illustration purpose only



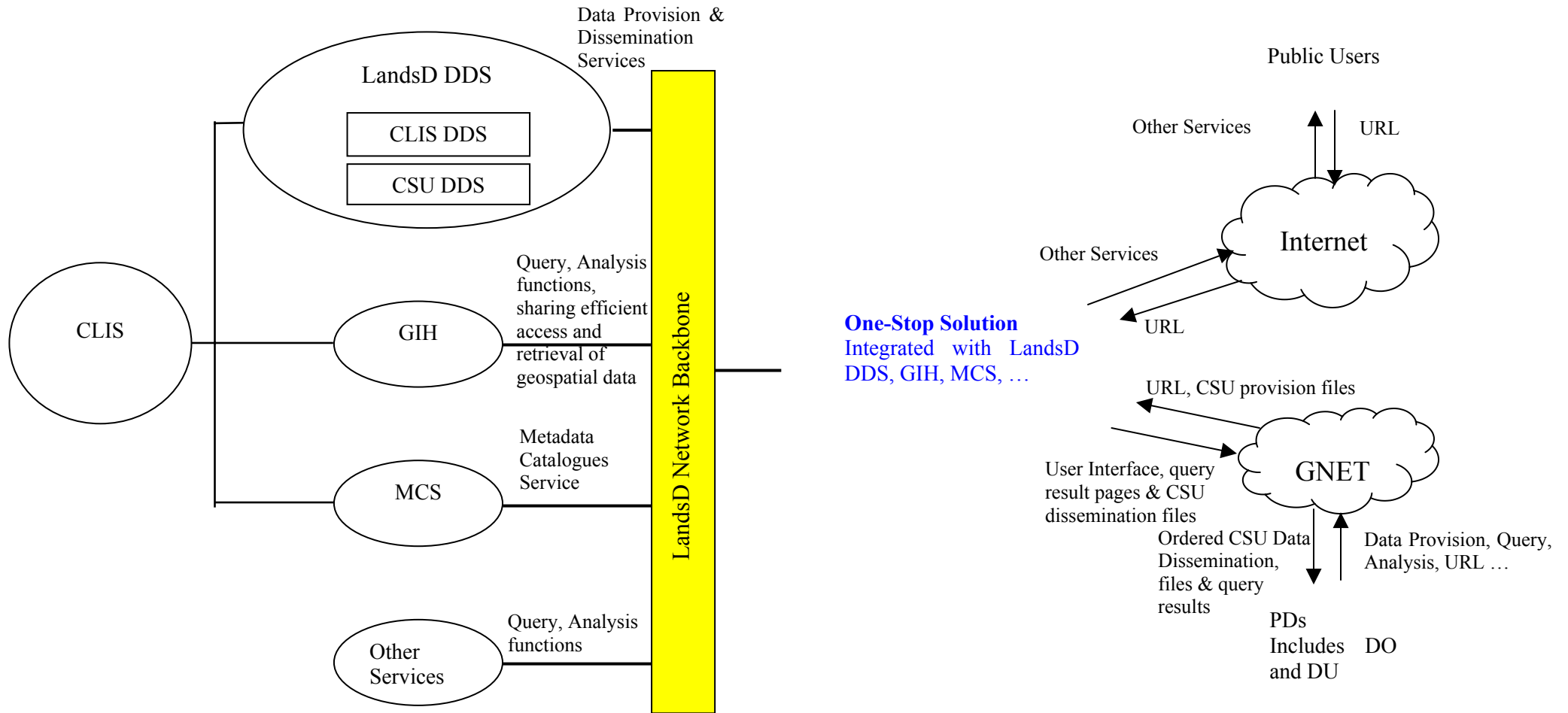
An integrated portal which can be built on SPICA infrastructure and is accessible for services via Internet or GNET

Various web applications - make use of the backend application servers from LandsD to deliver different LandsD services to users.

When technology and application are available, SCOPEs could provide an infrastructure for B/Ds to develop and implement G2B/G2C applications.

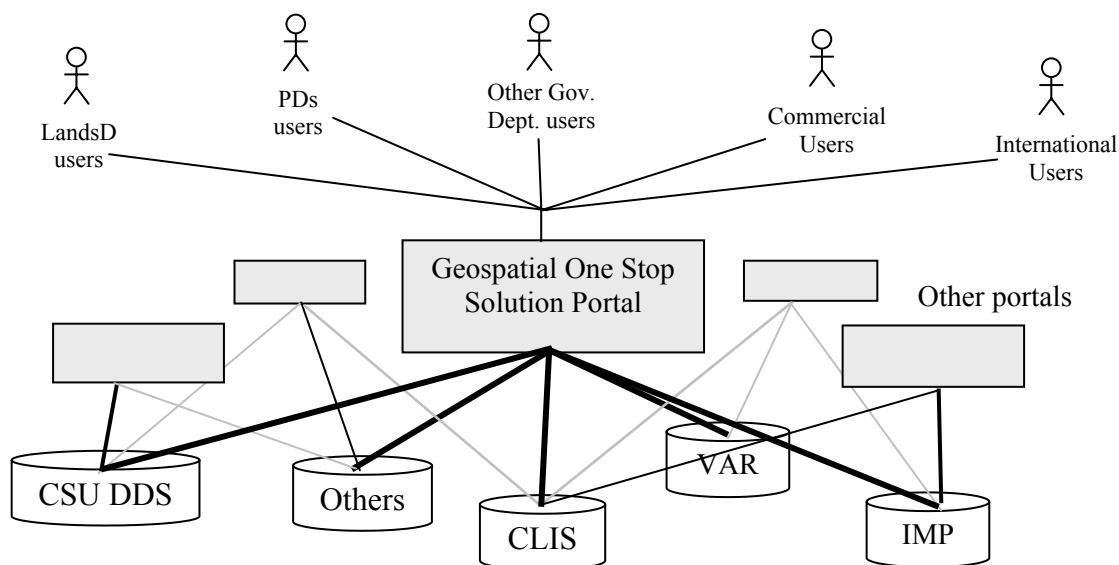
Backend Application Servers Group - various specific server base software to serve different nature of LandsD's applications.

Figure 3.3-2 – Concept Diagram of Proposed One-Stop Solution



3.3.3.4.5 DAF

As a longer term strategy, it is recommended that the DAF consolidate CSU datasets within a geospatial One-Stop portal which could cover a wider scope than the One-Stop Solution discussed above. This One-Stop portal could be based on a commercial enterprise relational database management system providing network access, security, sharing, and transactional control of CSU dataset updating. The strength of the One-Stop portal approach comes from users' ability to leverage the system to directly access non-redundant production ready CSU datasets stored within a data update transaction oriented, commercial spatially enabled, enterprise relational database management system. The geospatial data sharing community as the key views this geospatial One-Stop portal approach, to "true interoperability."



Subject to the need and requirements from the users, the One-Stop Portal can provide flexibility that can be extended to cover other services. Applications such as departmental GIS, Value Added Reseller (VAR) and Internet Map Permittee (IMP) services will be able to utilize the One-Stop Solution through published open software interfaces.

Other preparation work for One-Stop Portal

In the evolving technology environment, the enabling enterprise spatially enabled database, interoperable, GIS and web portal technologies are available. The ability to put in place shared IT infrastructure (i.e. GNET, SPICA) and technical resources (i.e. hardware, software, and staff) are key issues and success factors. Adequate budget, staff and administrative resources, and institutional will are all needed and must work in harmony to support integration of a common spatial Data Hub and Portal, make the system available, and keep the system working to meet day-to-day operational needs of the PDs.

Issues

Apart from the function requirements, there are a number of issues or non function requirements that need to be addressed prior to implementing the One-Stop Portal.

- Scope of CSU DDS – Currently, CED is the CSU Agent of the Slope CSU and they

will provide the Slope CSU data to the PDs while at the same time, they will provide slope data to other government departments and business partners. Technically, it might be feasible to include Slope CSU, or other new CSU in the CSU DDS for CSU Data Dissemination to DU purpose. Since DAM is confined to PDs only, the jurisdiction boundary and policy issues with respect to disseminating slope data (or other new CSU data) to business partners need to be reviewed if One-Stop Portal will proceed.

- Overlapping service - In the context of CSU DDS and CLIS DDS, the scope of the One-Stop Solution could be better perceived. There would be synergy if the One-Stop Portal can be implemented to include other services to be offered to other departments, business partners and public. HPLB (and ETWB) would then need to coordinate among PDs and accomplish true interoperability. Also it could help to avoid uncoordinated portals providing overlapping service to the public.
- Hosting Agent – The hosting agent of the One-Stop Agent should understand that there would be a high demand for GIS data maintenance skill and GIS literacy among personnel within the department and they can provide help desk services and answer queries from other departments and public.

3.3.3.4.6 References Sites of One-Stop Portal/One-Stop Solution in developed countries

The U.S. Government develops and publishes methodologies that were used in this study. For example, the “Geospatial One-Stop Portal Initiative” of Open GIS Consortium, Inc. and “US MAP & Data” are useful reference:

GOS-PI: <http://ip.opengis.org/gos-pi/>

US MAP & Data <http://www.geodata.gov/>

Geospatial One-Stop <http://www.geo-one-stop.gov/>

National Spatial Data Infrastructure <http://www.fgdc.gov/nsdi/nsdi.html>

The following websites also provide good reference for map data dissemination:

The Global Spatial Data Infrastructure Secretariat <http://www.gsdi.org/>

Digital Chart of the World <http://www.maproom.psu.edu/dcw/>