List of Goods and Delivery Schedule

Line Item& Sub-item N°	Description of Goods	Quantity	Physical unit	Final (Project Site) Destination as specified in BDS	Delivery (as per Incoterms) Date		
					Earliest Delivery Date	Latest Delivery Date	Bidder's offered Delivery date [*to be provided by the bidder*]
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
1.0	**Acquisition and supply of ICT hardware (Servers/ Devices) for all systems covering CDMS for BMD**			ABHAWA BHABAN, BMD, E-24, Agargaon, Dhaka-1207, Bangladesh		**8** (Eight) months from the date of signature of the contract	
1.1	Application Servers, 1U/2U Rack mounted	**2** (Two)	Units				
1.2	Set of Primary Data Storage System Hardware (Rack mounted device configuration)	**1** (One)	Set				
1.3	Set of Secondary Data Storage System Hardware (Rack mounted device configuration)	**1** (One)	Set				
2.0	**Licensed Software Package to support Climate Data Management System facility.**						
2.1	Licensed software for Servers *(Lcensed s shall be in perpetuity (preferable) or for a minimum of 10 (ten) years.*	**2** (Two)	Pack				
2.2	Licensed Software for all supporting CDMS underlying software *(Lcensed s shall be in perpetuity (preferable) or for a minimum of 10 (ten) years).*	**1** (One)	Pack				

List of Related Services and Completion Schedule

Service	Description of Service	Quantity[1] Physical Unit	Place where Services shall be performed	Final Completion Date(s) of Services
[insert Service No]	*[insert description of Related Services]*	*[insert quantity of items with physical quantity]*	*[insert name of the Place]*	*[insert required Completion Date(s)]*
1.0	**Assembly, fabricating, installation/ fitting-fixing/connecting all ICT goods, materials and installing/configuring, upgrading. customizing each system of hardware/devices with associated software for**			
1.1	Related services for achieving Climate Data Management System for BMD's offices shall include, but not limited to: *Completing related services for assembly, mounting, installation and commissioning of goods-servers and software, configuring, adjustment/ upgrading, testing of goods supplied undersubsection-1; and all related services/ works shall be completed in accordance with requirements of the Technical Specifications to meet project requirement. Item includes supply of necessary mounting and connecting/ interconnecting materials as would be required. After completion of installation and configuring of devices and software following functioning Systems must be achieved:* - *Integration of all the data held in the existing BMD Climate Data Management System, which is a CliSys system supplied by Meteo France International in 2012, into the new CDMS,* - *Integration of any other available and relevant data such as paper records, regional datasets etc.* - *Ongoing operational collection, storage and archiving of weather data from both the Integrated File and Message Switching System and the Archive System.* - *GUI for the discovery of data held in the CDMS and for providing all of the functionality specified under subsection-3 (Technical Specifications).*	**1- Lump Sum**	BMD's offices as mentioned in subsection-3.2 (Technical Specifications)	**12** (Twelve) months from the date of signature of the contract

2.0	**Providing services for developing bespoke software) and configurations as per requirement for system for**		Place of installation and use	**12** (Twelve) months from the date of signature of the contract
2.1	Climate Data Management System including supply of any software that would required to achieve the system	**1- Lump Sum**		
3.0	**Trial operation/functional testing and commissioning all system acceptable and to achieve SAT / UAT certification for**:			
3.1	After completion of installation/configuring of hardware & software providing services for functional trial operation of the installed Goods with achieved System of CDMS shall be completed and commissioned for acceptance by the Purchaser following successful Site Acceptance Test (SAT)/ User's Acceptance Test (UAT) as stated in subsection-3.3 and 5 under this Section –VII..	**1- Lump Sum**		
4.0	**Local hands-on training to Technical persons/Users of BMD for**			
4.1	Climate Data Management System operation at least for 10 (ten) technical staffs/users of BMD, so that they could be able to handle/operate the system independently the system. *Related services of training shall include system operation with trouble-shooting and solving functional problems of the Goods supplied & installed software in accordance with requirements of the Technical Specifications. In particular those who are operating the CDMS, and who may not have any specialized ICT background, will require adequate training to enable them to carry out all operator functions and to perform first-line fault diagnosis and maintenance. Item also refers subsection 3.4 of Section –VII of the bid document*	**1- Lump Sum**		
5.0	**Support services within the warranty period for:**			
5.1	Climate Data Management System within the warranty period. *Support services shall be provided as mentioned in Technical Specifications stated under Section-VII*	**1- Lump Sum**		
6.0	**Providing Service/work/supply etc. that has not been specifically mentioned in above, but would be essentially required for developing and achieving each system successful to requirement of the Purchaser for**			
6.1	Climate Data Management System for successful achievement as would be required by BMD (This is optional to bidder if any required)	**1- Lump Sum**		

1. If applicable

3. Technical Specifications

(Package No.: BMD-G32: Climate Data Management System for BMD)

3.1General Requirements

The Bangladesh Meteorological Department (BMD) requires an integrated ICT system that would provide a*Climate Data Management System (CDMS)* for weather and climate data. The Climate Data Management System is primarily to provide long-term (permanent) storage of meteorological information (data available in a wide variety of formats) and to allow the data held in the CDMS to be ingested, discovered, analysed and copied as required. The CDMS must incorporate a set of tools to allow the creation of standard climatological products in the form of Statistics, Time-Series, Graphs, Maps, Customized Tables, Reports, Wind Roses and similar. As this will be the permanent store of all weather data originating in Bangladesh, it is of the highest important that the system should facilitate the routine back-up of all files (including back-up to an off-site location to allow for Disaster Recovery) and the implementation of a high level of security protocol to guard against system malfunction or failure.

The Climate Data Management System is intended to provide functionality to facilitate the collection and storage of weather data in a wide variety of file formats, the application of Quality Control (QC) processes to the data and the flagging of the QC status of data, the discovery of the data held in the CDMS through an intuitive Graphical User Interface (GUI), the analysing of data in the archive through a series of standard and bespoke analysis tools, and the exporting or downloading of copies of selected data files by users on request. The Climate Data Management System is likely to be based on underlying database software, such as Oracle, SQL, and bidders should clearly identify any underlying DB software on which their systems rely and provide an estimate of annual licensing costs related to this underlying software.

The Climate Data Management System will collect data from both the Integrated File and Message Switching System (IFMSS) and the Archive System via both push and pull techniques. It will need to be capable of simultaneous use by at least 10 users (in Oracle DB, the Enterprise Edition requires a minimum of 25 named users plus per processor licenses or the total number of actual users). Access to the Climate Data Management System shall be through standard Windows-based office PCs or Ubuntu Linux PCs and shall not require any specialised hardware at the user end. The system should include a web-based GUI or appropriate PC-based client software to allow users to interact with the CDMS and to allow the discovery, browsing analysis and retrieval (both standard and scripting) of data. Retrieved data should be directed to one of a number of pre-defined specific locations.

The Climate Data Management System shall be able to ingest automatically AWS, ARG, BMD's Digital Barometer Network, WIS, MSS data sets and able to accept files will be in a wide variety of formats, many of them unique to meteorology, such as BUFR, SYNOP, GRIB, HDF5 and SIGMET, some very large file formats such as netCDF, and some more common formats such as XLS, XML, CSV, and MDB. The CDMS shall be able to ingest data from BMD's historical database.

The Climate Data Management System should be set up with an SQL database (or similar powerful relational database) to manage the data. There should be automatic management of the data, whereby incoming data is sorted, catalogued and stored according to type. It should also be supported for Application Programming Interface (API) facility, third party module support such as R, Python as well graphical output generators. CDMS should also be easily updatable for its newest version.

Approximately 5Tb – 10Tb of data per annum will require to be stored, and the archive should initially be capable of holding ten years' worth of data, with a total capacity of circa 100Tb. The system should allow for the easy addition of further storage capacity in the future.

A GUI to provide monitoring overview and management of the Climate Data Management System shall be provided. This shall provide managers with tools for classifying incoming data and configuring incoming folders. It shall allow managers to track use of the archive and record the detail of all uploads, copy requests and other downloads. The GUI shall provide tools for managing the taking of backups and restoring data from these backups. The system shall retain 90 days' of monitoring record for immediate examination, and shall package old monitoring records / log files etc. in a format suitable for transfer to an archive.

Detailed specifications of the functionality of the CDMS are provided below. These are largely derived from the guidance document of the World Meteorological Organisation WMO-No. 1131, which can be freely downloaded in PDF form from the WMO library at *https://library.wmo.int/index.php?lvl=notice_display&id=16300#.YD0j0JunyHs* or simply by using an internet search engine to search for "*WMO-No. 1131*".

The assignment is required to supply goods comprise all necessary hardware and software and provide related services to a developed and customized system as per requirements of the Purchaser. The system should be designed as far as possible with an open architecture that will allow for and facilitate future expansion and the addition of extra functionalities.

The Climate Data Management System will be a critical operational system in facilitating BMD to deliver weather and climatological services. Therefore a high degree of resilience and a guaranteed uptime of 99.5% is required, and a duplicate "hot standby" hardware suite or similar will be needed. For achievement of the desired system application Servers and database Software will be required. The system shall provide a Climate Data Management System that must be:

- Be based on two servers configured as:
    - Parallel operation with load balancing OR
    - Live/non-live configuration
- Switchover from live to non-live must be fast and easily implemented

The system shall incorporate the implementation of system security to guard against malfunction or failure and also unauthorised access to the system management functions. While broad access to the system for discovering and analysing data and requesting copies for download shall be granted to BMD staff (via a web-based link or PC-based client software), access to the management of the system (and especially to functionalities associated with setting retention / deletion policies, taking backups etc.) shall be strictly controlled to preserve system integrity.

Licensed Key or equivalent security code if any required for any product of software required for proper functioning and/or for security of the system shall be provided in favour of the Purchaser for operation, data acquisition and processing with the product.

Summary of descriptions, technical specifications, features, performance and standards required for each item by the Purchaser is furnished below. The bidder shall review the requirements and shall provide a **statement of compliances** of technical specifications of offered items of goods with the bid(s).

3.2 Descriptions, Technical Specifications and Features of Goods Required.

The Goods and Related Services for each of the items shall comply with following technical specifications, features, performances and standards:

***Item No. 1.0*: Acquisition and supply of ICT hardware (Servers/ Devices) for all systems covering CDMS for BMD**

Item/Sub-Item No.	*Technical Specifications, Features, Standards and Related Services required*	
1.1	**Application Servers, 1U/2U Rack mounted**	
1.1.1	***General***	*A minimum of two Application Servers (one live and one back-up with hot standby mode), 1U or 2U Rack mounted, are to be supplied for BMD to meet the requirements of their proposed Climate Data Management System. The servers are planned to be installed in a facility which will incorporate provision of three-phase power supply with dual single-phase supplies to each rack, back-up generators, surge protection, UPS, and air conditioning.*
	Make/Brand/Model	*Dell / Lenovo / Hewlett Packard / Fujitsu / Huawei or substantially equivalent international brands - to be mentioned by the bidder*
	Country of Origin of Product	*To be mentioned by the bidder*
	Country of Assemble/ Shipping	*To be mentioned by the bidder*
	Version/ Year of Production	*Latest- to be mentioned by the bidder*
1.1.2	**Technical Specifications**	Each Server shall be provided with: - CPU (not less than 2.9 GHz), RAM, disk must be sufficient for the proposed system and include at least a 50% margin of overcapacity. - Disk capacity: at least 1TB SSD drive in RAID 0 - Networking Capability: 10Gbps on at least 2 ports. - Embedded system management : Integrated Platform Management Interface (IPMI) - Server Rack: 1U or 2U Rack mounting Unit – same brand as of server equipment
1.1.3	**Fitting-Fixing Materials**	The Supplier shall supply all necessary fitting-fixing materials including electrical cables, sockets with plugs, cable connectors, etc. those will be specially required in mounting and operational functioning of the server unit.
1..1.4	**Brochures/ Catalogues**	The bidder shall provide printed brochures and technical catalogues available with the manufacturer(s)-that would support the bidder's specifications of goods offered with the bid(s).

1.1.5	**Others**	The bidder must provide a list of supported operating systems internationally accepted. The BMD's preferred Operating Systems are Ubuntu but Redhat or CentOS are also acceptable, as are Windows-based operating systems.
1.1.6	**Installation& Configuring /Testing/ Commissioning**	The Supplier must install and mounted on 1U/2U racks; and shall configure the servers in a manner that suits their software applying whatever modules and patches are required to the Operating System. Services of installation and configuring of the equipment/devices shall be done by experienced Engineer/Technical Personnel duly certified/accredited by the Manufacturer/ OEM/Principal Supplier of the products. Item includes all necessary installation/fitting-fixing and connecting materials as would be required to complete trial operation and commissioning of goods. *This item refers subsection -3.3 stated below*
1.1.7	**Warranty for Support Service**	Minimum**12** (Twelve) months from the date of acceptance of goods and system developed and services include support and maintenance as would be required.
1.2 & 1.3	**Primary and Secondary Data Storage System Hardware ((**Rack mounted device configuration)**) for Climate Data Management System:**	
(a)	***General***	*A Data Storage System is required to consist of data storage media, network devices, switches, controllers and any other such hardware as are required to support the storage functionality. The storage devices shall be rack mounted, and are to be supplied for BMD to meet the requirements of their proposed Climate Data Management System.* *Data Storage System Hardware shall be (a)1- set for primary data storage and (b) 1-set for back-up/secondary data storage system to meet requirement of BMD.* *The Data Storage System Hardware devices are planned to be installed in a facility which will incorporate provision of three-phase power supply, back-up generators, surge protection, UPS, and air conditioning.*
	Make/Brand/Model	*Internationally reputed –to be mentioned by the bidder*
	Country of Origin of Product	*To be mentioned by the bidder*
	Country of Assemble/ Shipping	*To be mentioned by the bidder*
	Version/ Year of Production	*Latest- to be mentioned by the bidder*

(b)	**Technical Specifications**	The Data Storage System shall be provided with functionality as follows: - The system should support the transfer of at least 20Gb/day in data volumes. - Disk capacity: at least 60TBwith high availability and no single point of failure, with the facility for future expansion - Back-up storage capacity, which may be by tape or equivalent data storage technology; - Networking Capability: 10Gbps on at least 2 ports. - Server Rack: Rack mounted units are required and rack shall be of same brand as of Servers.
(c)	**Fitting-Fixing Materials**	The Supplier shall supply all necessary fitting-fixing materials including electrical cables, sockets with plugs, cable connectors, etc. those will be specially required in mounting and operational functioning of the server unit.
(d)	**Brochures/ Catalogues**	The bidder shall provide printed brochures and technical catalogues available with the manufacturer(s)-that would support the bidder's specifications of goods offered with the bid(s).
(e)	**Installation & Configuring /Testing/ Commissioning**	The Supplier must install and mount all hardware on racks; and shall configure the Data Storage System in a manner that suits their software, applying whatever modules and patches are required to the Operating System. Services of installation and configuring of the equipment/devices shall be done by experienced Engineer/ Technical Personnel duly certified/ accredited by the Manufacturer/ Principal Supplier of the products. *This item refers subsection -3.3 stated below*
(f)	**Warranty for Support Service**	Minimum**12** (Twelve) months from the date of acceptance of goods and system developed and services include support and maintenance as would be required.

<u>Item No : 2.0</u>: Licensed Software Package to support Climate Data Management System facility for supporting Hardware & underlying Software

Item/Sub-Item No.	*Technical Specifications, Features, Standards and Related Services required*	
2.1 & 2.2	**Licensed Software Packages to support Servers and underlying software for Climate Data Management System facility**	
(a)	***General***	*Supply of software system (and/or development of bespoke software) and configurations as per requirement for CDMS system.* **1.1.a.i.1.1 Software shall be suitable and be employed to provide the Climate Data Management System functionality. The product must be an internationally**

		accepted brand of reputed manufacturer, and based on widely recognized and used underlying database software.
	Make/Brand/Model	*Internationally reputed –to be mentioned by the bidder*
	Country of Origin of Product	*To be mentioned by the bidder*
	Country of Shipping	*To be mentioned by the bidder*
	Version/ Year of development	*Latest- to be mentioned by the bidder*
(b)	**3rd Party Licence**	**3rd party licence** necessary for the proposed system **must** be provided in favour of the Purchaser's name. *License shall be in perpetuity (preferable) or for a minimum of 10 (ten) years*.
(c)	**Other Licenses**	If software programs, libraries or other elements requiring specific licenses are to be used in providing the service, the Supplier shall provide all relevant detailed information to BMD regarding such software elements, including the utility of the software elements and any ongoing or recurring license fee costs, and shall highlight any such recurring costs in their tender response.
(d)	**Installation/ Configuring**	Software shall be installed, configured and tested along with servers for generation of systems for achieving the Climate Data Management System. *This item refers subsection -3.3 stated below*
(e)	**Warranty**	At least 12 months from the date of acceptance of goods, or longer if provided by the Manufacturer of the product, with next Business Day Onsite Service at the Supplier's cost. This item includes installation of any available upgrades to the licensed software at Supplier's cost. *This also refers article of warranty stated below.*

Detailed General & Technical Specifications/Features as would be Required

	General – Climate Data Management System	
	The Climate Data Management System is primarily to facilitate the permanent storage of weather and climate data and products, with the facility to search this archive, analyse the data held therein, apply quality control procedures and develop a wide variety of products based on the data and any subsequent analysis. Data held in the CDMS will be managed in accordance with policies as decided by the BMD from time to time and implemented by the Climate Data Management System Manager. The detailed functionality of the software and system shall conform to the requirements as listed below.	
	Data Policies and Data Governance	
	WMO Resolutions	The CDMS shall be capable of flagging all data as either "Essential Data" or as "Additional Data" as defined by WMO Resolution 40 (Cg-XII) and Resolution 25 (Cg-XIII).
	WMO Technical Regulations	The definitions of data and the terminology used in the CDMS shall be consistent with the WMO Technical Regulations (WMO-No. 49) in all respects.
	National Policies	The CDMS shall be capable of providing data and services

		in such manner and in technical formats that are consistent with the national policies of the Government of Bangladesh with respect to open data and the exchange of national spatial data.
	Disaster Recovery	The CDMS shall facilitate the provision of regular, routine and secure data back-up procedures that guard against the loss of data during natural or man-made disasters.
	Access to Data	The CDMS shall provide for graduated levels of data access ranging from free access to open data through to specific access constraints related to security, contractual and commercial considerations.
	Archival Policy	The CDMS shall support the archiving of data in formats that will be accessible for the foreseeable future.
	Data Licensing	The CDMS shall facilitate the attachment of appropriate data licenses to all data provided to third-party (i.e. non-BMD) users.
	Usage Constraints	The CDMS shall facilitate the provision of clear usage constraint, where these are applicable, to all data provided via the CDMS to third parties.
	Attribution	The CDMS shall facilitate proper attribution, to the BMD or otherwise as necessary, of all data provided via the CDMS to third parties.
	Interoperability Standards	The CDMS shall facilitate data interoperability and data accessibility to a wide range of end-users.
	Quality of Delivered Data	The CDMS shall facilitate the clear identification and provision of the quality level of all data provided via the CDMS.
	Crowd sourced Data	The CDMS shall provide some facility for the assimilation of crowd-sourced data in non-standard meteorological formats.
	Other Agency Data	The CDMS shall provide the capability of assimilating climate-related data captured and maintained by official agencies external to the NMHS.
	Commercial use	The CDMS shall facilitate the provision of data to users on a commercial basis in line with policies agreed from time to time by the Government of Bangladesh.
	Climate Metadata	The CDMS shall facilitate policies that ensure that appropriate climate metadata are maintained to enable a better understanding of climate data. Climate metadata includes metadata on observations, discovery and data provenance.
	Data Lineage	The CDMS shall facilitate the discovery of the data lineage of all primary data back to the raw observations where this can be ascertained.
	Data Generation	The CDMS shall facilitate the identification of all definitions that are used in the generation and interpretation of observation variables. Examples include the definition of the climatological day, the time standard in use for applying a time to an observation, and the definition of a climatological hour.

	Sensor or Station Change	The CDMS shall facilitate the recording of all relevant information relating to changes in sensors, sensor calibration, changes in station position, parallel readings taken by manual and automated systems during periods of overlap, and all other material changes that may affect the use and interpretation of the primary data.
	Future Climate Data Framework	The CDMS shall have sufficient flexibility to allow for changes to definitions relating to dataset names, data quality, policies for the handling of missing data, policies for deriving data, changes to practices relating to data homogenization, and other such developments as may be established by a Future Climate Data Framework.
	Controlled Access to Data	The CDMS shall facilitate the provision of controlled access to data and systems, such that designated users have access to read, or read and write, privileges in accordance with their approved roles, and that any changes to the data shall be capable of being audited with respect to identifying the operator who made the change, the date and time of the change, the nature of the change, and other relevant matters.
	Approval to change Data	The CDMS shall facilitate the clear definition of the approval process required to modify data held within the database.
	IT change approvals	The CDMS shall be configured in such a way as to ensure that any IT change does not result in an unexpected change to, loss of, or corruption of the climate record.
	Managed Change	The CDMS shall facilitate the smooth application of managed changes in a manner that minimize the risk of loss or corruption to data, and in particular shall incorporate the capacity to roll-back the system to a previous state in the event that a change causes unexpected difficulties and issues.
	IT Architecture	The IT Architecture of the CDMS shall be such as to arrange the storage of all primary data, together with associated metadata, in formats and structures that facilitate the transfer of that data and metadata to another CDMS at a future date, should that become necessary for any reason. The IT architecture shall also support multiple languages, including at least English and Bangla.
	Documentation	The CDMS shall be supplied with all necessary documentation including an overview of the CDMS and its architecture, an overview of the data being managed, descriptions of the CDMS components and design, CDMS back-up and disaster recovery processes, and all relevant CDMS-related metrics.
	Backups	The CDMS shall facilitate the regular and routine preparation of backups, and in such a manner that there is no single point of failure that would disable access to both the live database and the backup database simultaneously. The backup database must be configured such that access and use of the backup can be conducted independently of the live CDMS.

	Climate Observations	
	Atmospheric Data Types	The CDMS shall make provision for the assimilation and storage of all atmospheric Essential Climate Variables (ECVs) including at least the following: **Surface:** - Air Temperature - Wind Speed and Direction - Water Vapour/Relative Humidity - Pressure - Precipitation - Surface Radiation Budget - Visibility - **Upper Air:** - Air Temperature - Wind Speed and Direction - Water Vapour - Cloud Properties - Earth Radiation Budget **Composition:** - Carbon Dioxide - Methane - Ozone - Aerosol - PM10 Particulate Matter - PM2.5 Particulate Matter
	Terrestrial Data Types	The CDMS shall make provision for the assimilation and storage of all terrestrial Essential Climate Variables (ECVs) including at least the following: - River Discharge - Water Use - Groundwater - Snow Cover - Ice Sheets - Albedo - Land Cover (incl. vegetation type) - Leaf-Area Index - Soil Moisture - Soil Temperature
	Oceanic Data Types	The CDMS shall make provision for the assimilation and storage of all oceanic Essential Climate Variables (ECVs) including at least the following: **Surface:** - Sea Surface Temperature - Sea-Surface Salinity - Sea Level - Sea State - Surface Current - Ocean Colour - Carbon Dioxide Partial Pressure

		- Ocean Acidity - Phytoplankton **Subsurface:** - Temperature - Salinity - Current - Nutrients - Carbon Dioxide Partial Pressure - Ocean Acidity - Oxygen - Tracers
	Station Identifier	The CDMS shall support the management of identifiers associated with an observation station or platform, including especially a globally-unique WMO identifier, a history of past identifiers, any other identifiers or aliases used for the station, and the beginning and end dates of each historical identifier used for the station.
	Station Overview	The CDMS shall facilitate the retention of information relating to an overview of each station, including information relating to the station owner, manager, maintenance authority, any relevant licence agreements, any station data usage constraints, station purpose, observation practices, observation schedule, identification of the datasets that provide the actual observation data for a given station, and details of station staff and station logistics.
	Station Status	The CDMS shall facilitate the identification of the status of a station over different time periods and especially whether it was operational or non-operational at any given time.
	Station Type	The CDMS shall facilitate the recording of the station type in accordance with the guideline provided in the WMO Manual on Codes (WMO-No. 306) Volume l.i, code 1860 and Volume l.2, code 0 02 001
	Location	The CDMS shall facilitate the recording of details relating to the location of the station, including at least the following: - Latitude - Longitude - Elevation - Spatial Reference System - Date/Time of the survey observation - Temporal reference system - Method used to determine location - Positional accuracy of location - Date/Time the station or sensor moved, together with previous locations - Administrative boundaries within which the station is located - Time Zones
	Local Environment	The CDMS shall facilitate the recording of details relating to the local environment surrounding the station, including at least the following:

		- Site Location Diagram - Site Plans - Site Skyline Diagram - Site photographs / videos - Station Exposure - Site Roughness - Soil Type - Vegetation Type - Surrounding Land Use - Date/Time of each visit The CDMS shall be capable of recording information on station siting and exposure in accordance with the WMO Guide to Meteorological Instruments and Methods of Observation (WMO-No. 8)
	Sensor	The CDMS shall make provision for the assimilation and storage of relevant information relating to the meteorological sensors and/or instruments used at the station or observation platform, including at least the following: **Sensor description, including:** - Name - Type - Serial number - Brand and model details - Photograph of sensor in situ - Supplier - Manufacturer - Location of manuals - Sensor firmware, version and dates during which each version was used - Length of time the observation data are stored locally on the sensor, prior to deletion **Sensor installation details, including:** - Technician and organization that installed the sensor - Date sensor was installed **Sensor status, including:** - Operational status (Sensor Health Parameters): • Operational • Not operational • Defective • Testing - Date/times applicable for each status **Sensor maintenance:** - Scheduled maintenance - Actual maintenance - Result - Replacement of consumables

		Sensor uncertainty: - System performance statistics claimed by manufacturer - Sensor calibration results - Observed sensor performance characteristics **Sensor siting details:** - Instrument height above ground - Station exposure description - As discussed in the Location component above, recording the location of each sensor is required. **Recommended sensor settings for optimal operations on site.** **Offset Values for Sensors.** **Details of what meteorological variable is being observed by the sensor (i.e. the observed property), including:** - Phenomena observed - Frequency of measurement - Frequency of acquisition - Units of measurement - Precision of measurement
	Data Processing	The CDMS shall record all relevant details relating to any data processing that has occurred to convert a sensor's signal into its recorded observation value, including at least the following: **Software, including:** - Version - Software language - Software name - Location of software source code - Description of processing applied (for example, whether values were calculated per minute, hour or other) - Formula/algorithm implemented - Processor details (the version, type of central processing unit and so forth) - Date/time covering the period of validity of the method **Input source (instrument, element and so forth)** **Data output, including:** - Data format and version of format
	Data Transmission	The CDMS shall record all relevant details relating to the

		transmission of data form station and/or observation platforms, including at least the following: **Sensor communications, including:** - Frequency of transmission - Time of transmission - Primary communication details - Method of transmission - Bit rate/ IP Address allocated (if any)
	Network	The CDMS shall make record all relevant information relating to the transmission of data from stations or observation platforms, including at least the following: Network name (such as Global Basic Observing Network, Regional Basic Climatological Network, Regional Basic Synoptic Network, GCOS, GCOS Upper-Air Network or National Climate Network) Network priority: - Critical - Essential - Not applicable Time of observations Reporting frequency Date/time of network membership The recording of when a station does not belong to a network.
	Dataset Identifier	The CDMS shall provide a unique identifier used to identify each dataset.
	Dataset overview	The CDMS shall provide an overview of each dataset, which may include a description of the dataset, the intended use of the dataset, its lineage and status.
	Dataset data quality	The CDMS shall provide scope for a general assessment of the quality of a dataset.
	Distribution	The CDMS shall provide information on the distributor of, and options for obtaining, the dataset
	Access constraints	The CDMS shall provide information on any access restrictions in place for a dataset
	Dataset maintenance	The CDMS shall provide information on the scope and frequency of updates and maintenance conducted on a dataset
	Spatial representation	The CDMS shall provide information on the mechanisms used to represent spatial information within a dataset.
	Reference Systems	The CDMS shall provide information on the reference systems used by a dataset. These include a horizontal spatial reference system, vertical spatial reference system, and a temporal reference system.
	Observation Data Products	

	Routine Messages	The CDMS shall facilitate the production of routine climatological messages as are typically transmitted internationally on the global meteorological telecommunications networks, such as daily maximum and minimum temperatures, evaporation, evapotranspiration etc.
	Climate Standard Normals	The CDMS shall facilitate the production of climatological monthly and annual standard normal, including the 30-yr normal updated every decade and the 1961-1990 Global Climate Normals as defined in WMO-No. 847.
	CLIMAT messages	The CDMS shall facilitate the production of routine CLIMAT messages in TDCF formats as are typically transmitted internationally on the global meteorological telecommunications networks.
	World Weather Records	The CDMS shall facilitate the storage of information relevant to the annual WMO World Weather Records
	Aeronautical Climatology	The CDMS shall facilitate the production of the routine monthly aerodrome climatological summary in tabular form, in compliance with the WMO Technical Regulations (WMO-No. 49), Volume ll, Section C.3.2
	Core Indices	The CDMS shall facilitate the production of core Climate Change indices as defined by WMO.
	Homogenised Data	The CDMS shall facilitate the production and storage of high-quality homogenized time-series datasets which aim to ensure that the only variability remaining in the time series is that resulting from actual climate variability.
	Computed	The CDMS shall facilitate the production and storage of derived data computed from observations for NMHS products, in accordance with the climatology policies in place.
	Normals and Averages	The CDMS shall facilitate the production and storage of any normals and averages used by the BMD that are in addition to climatological standard normals.
	Analyzed Data	The CDMS shall facilitate the production and storage of spatially distributed gridded data that has been derived from observational data as the result of an analytical process. Examples of such products include: **Singular variables such as:** - Normals - Observations for a given day or time - Averages - Percentiles - Cumulative data - Extremes - Homogenized data **Multi-variables such as:** - The generation of anomalies (difference between the normals data and a specific monthly variable) - More complex data such as potential evapotranspiration

	Topography	The CDMS shall facilitate the storage of relevant topographical data such as drainage, relief, cultural and nomenclatural features, in addition to digital elevation models.
	Emergency Management	The CDMS shall facilitate the storage of relevant data relevant to the provision of support to emergency management and related warning systems
	Administrative	The CDMS shall facilitate the storage of relevant administrative data such as administrative boundaries, transportation networks etc.
	Impacts	The CDMS shall facilitate the storage of spatial data relating to the impacts of weather and climate events. Among the impacts that shall be included are: - Deaths caused by heat waves, prolonged droughts, floods, cyclones, etc. - Infrastructure damage caused by a range of events such as floods, bush fires or cyclones. - Changing land use, such as agricultural adaptations due to a changing climate.
	Documentation	The CDMS shall facilitate the storage of textual data relating to various climate-related phenomena or that serve as documentation for the CDMS. Examples of data to be stored shall include: - CDMS technical and user documentation - Diagrams representing climate processes - Various climate forecasts and events - Climate processes such as El Niño-Southern Oscillation and the Madden-Julian Oscillation - NMHS policies and practices - Training documentation
	Various Media	The CDMS shall facilitate the use of a range of media used to support various climate-related services. Examples include: - Scanned hard copy climate records - Image portrayal of various climate data, such as an extract from a radar image stored in portable network graphics (PNG) format - Podcasts and video clips used to communicate various climate-related messages - Photographs of various climate-related phenomena
	Source Code Management	The CDMS shall facilitate the management of the source code used to process climate data. The following capabilities at least shall be provided: - Maintain a library of a variety of software source code. - Manage different versions (or branches) of the

		software concurrently, with the ability to maintain each version independently and to easily back port newer functionalities to an older version. - Easily detect the differences between software versions.
	Software Testing	The CDMS shall facilitate the testing of software that is to be deployed to manipulate climate data. This includes: - Details of test plans and individual test cases, including user-acceptance testing. - Details of the test data, database, etc. - Details of test systems and environment. - Details of test results and artifacts, particularly proof that the test data were not affected by the software or a change to the software.
	Climate Data Management	
	Business Rules	The CDMS shall support a wide range of business rules that govern how data are ingested into the climate database.
	WMO Messages	The CDMS shall facilitate the import of data from a range of WMO message formats, including the ability to work with a wide range of past, present and planned data formats. Examples of data formats that shall be supported are: **Binary:** - BUFR - GRIB **Alphanumeric:** - CREX - SYNOP - TEMP - SHIP - METAR - World Weather Records
	Vector	The CDMS shall support the import of a series of vector spatial formats, including Shape file and Geography Markup Language.
	Raster Array	The CDMS shall support the import of a series of raster array spatial formats, including CF-netCDF, Hierarchical Data Format, ArcInfo ASCII and GeoTIFF.
	Other Formats	The CDMS shall support the import of a range of other formats, which shall include at least: - Photographs (PNG, JPEG, TIFF, etc.) - Scanned documents - PDF files - ASCII generic formats such as CSV - Data managed in spreadsheets - Tabular formats, such as the import of data from a relational database management system

	Status Log	The CDMS shall maintain a record of each ingest activity and its status.
	Automated / Self Recovery	The CDMS shall support the automated ingest of a range of data types, particularly from Automatic Weather Stations, and shall allow for the automatic recovery of ingest tasks in the event that a task fails either wholly or partially during an ingest as a result of any technical fault.
	Transformation	The CDMS shall support the transformation of an ingest record. This shall include, as a minimum: - Transforming data from one format to another. - Transforming codes into formats more suitable for the destination climate database. - Correcting records that have been abbreviated in accordance with accepted local observation practice.
	Data Extraction	The CDMS shall support the extraction of data from the climate database in accordance with NMHS data policy and governance processes.
	Documents Imaging	The CDMS shall support the functionality required to digitally capture a physical document and store the resultant file and associated discovery metadata within the climate database as required. This functionality shall include the following types of document: - Scanned paper observation forms - Scanned microfiche/microfilm - Relevant observations metadata documents such as instrument calibration reports - Technical manuals - Site location plans and sections
	Data Rescue Metrics	The CDMS shall maintain metrics relating to the capture of observational data. These shall include: - Name and brief description of data rescue project - Location where activity is taking place - Types of data rescued - Summary and per cent digitized - Summary and per cent scanned - Summary and per cent scanned but not digitized - Summary and per cent undigitized
	Data Entry Forms	The CDMS shall provide the functionality for and facilitate the manual key-in of data through the provision of custom-designed user input forms, from which the fields are mapped to appropriate records and tables within the database. The Forms shall allow for the validation of keyed-in data before it is added to the database. The Forms shall support efficient and effective data entry processes that minimize operator fatigue and automatically calculate appropriate values. This component of the CDMS should support adequate support for monitoring the validity of data that are entered, in particular through the following: - Performing data quality consistency checks of the

		data to be entered. These checks and the appropriate values are to be customizable according to NMHS data policy and governance processes. - Ensuring that appropriate data types and context are entered for each field. - The component should alert the operator to any doubtful entries detected, providing appropriate advice as per NMHS data policy guidelines.
	Computation	The CDMS shall facilitate the automatic derivation of parameters at key-in, customizable according to the BMD data policies and governance processes. In particular, the CDMS shall facilitate: - The computation of a value for relative humidity after the values for dry-bulb temperature and dew point has been entered. - Decoding shorthand codes and replacing them with appropriate values.
	Consistency Checks	The CDMS shall provide a range of tests to ensure that inconsistent, unlikely or impossible records are either rejected or flagged as suspect. The CDMS shall facilitate investigation processes to then assess the validity of the suspect values.
	Data Comparison	The CDMS shall provide a range of tests to use and cross-reference data from a number of sources to validate suspect observations. Such sources may include: - Observations data showing daily precipitation at a station - Radar data covering the station - Synoptic forecast charts - Satellite imagery
	Statistical Checks	The CDMS shall be capable of facilitating a range of statistical tests which analyze historical data to detect inconsistent or unlikely data and declare it as suspect. Examples include: - Climate tests that highlight extreme climatic values, such as a record maximum air temperature. - Flat-line tests where a constant value exceeds the specified limit in a time series. - Spike tests conducted in a time series to identify data spikes exceeding a specified limit. - Rapid change tests conducted in a time series to identify rapid changes exceeding a specified limit. - Producing statistical reports
	Spatial Checks	The CDMS shall be capable of facilitating a range of spatial tests to detect inconsistent or unlikely data and declare it as suspect. Examples include: - Comparing the results of a time series of observations at a given station with those at nearby stations.

		- Using a Barnes or similar analysis to derive spatial patterns against which anomalous and possibly erroneous station values stand out.
	Data Recovery	The CDMS shall be capable of supporting processes to investigate anomalous observations, to accept or reject suspect data, and to recover and insert corrected data into the climate database, over-writing existing data if this is indicated.
	Data Monitoring	The CDMS shall be capable of providing data monitoring logs which provide metrics to assist with climate data management. Examples include: - Summary and per cent of data that have undergone quality control. - Percentage of data at each level of quality control. The CDMS shall also be able to identify derived datasets that may need to be reconstructed following the application of Quality Control and other processes that have resulted in modifications to the underlying data.
	Siting Classification	The CDMS shall facilitate the classification of sensors according to the rating scale as described in the *WMO Guide to Meteorological Instruments and Methods of Observation (WMO-No. 8) Annex 1.B Siting Classifications*.
	Multi-Layer Quality Flags	The CDMS shall facilitate the addition, to specific records of data, of multiple quality flags appropriate to different levels of quality from raw observation through various analysis and editing processes, that will allow examination of the true lineage of a record and the changes made to raw observations. The CDMS shall further facilitate: - Future analysis that requires data of a specific quality flag value. - Communication of the assessed quality of records.
	Quality assurance Metrics	The CDMS shall facilitate the production of metrics that can validate the performance of Quality Assurance software and processes. Examples include: - Summarizing observational errors detected by each quality assurance test. - Summarizing false positives and valid errors detected. - Comparing the performance of current quality assurance metrics with historical averages.
	Measurement Uncertainty	The CDMS shall facilitate data analysis used to understand and record the uncertainty inherent in observation measurements and processes.
	Creation of Metadata	The CDMS shall facilitate the effective and efficient creation of climate metadata.
	Maintenance of Metadata	The CDMS shall facilitate the effective and efficient maintenance of climate metadata.

	Quality Control of Metadata	The CDMS shall facilitate the effective and efficient assessment and quality control of climate metadata.
	Metadata Metrics	The CDMS shall facilitate the effective and efficient maintenance of metrics relevant to climate metadata.
	Climate Data Analysis	
	Spatial Analysis	The CDMS shall be able to handle a wide variety of raster and vector spatial analysis techniques. Some examples are: - Generating grids that show the spatial distribution of observations of a phenomenon such as precipitation. - Generating grids that represent the distribution of the average maximum temperature for a given month for climatological standard normals. - Generating grids that represent the distribution of the maximum temperature anomalies for a given month when compared to the climatological standard normal. - Selecting all meteorological stations located within a 10 km radius
	Time-Series Analysis	The CDMS shall be able to analyze time-series data using a very broad range of analysis techniques. Examples include the analyses required to produce: - WMO standard products such as extremes, standard normals, World Weather Records and climate change indices. - A variety of derived observations data.
	Data Homogenisation	The CDMS shall facilitate the analysis required to develop high-quality homogenised time-series datasets, which aim to ensure that the only variability remaining in a time series is that resulting from actual climate variability.
	Presentation of Climate Data	
	Tables	The CDMS shall facilitate the generation of a wide variety of tabular reports to effectively communicate issues relating to climate data.
	Graphs	The CDMS shall facilitate the generation of a wide variety of graphical products to effectively convey climate data issues. Graphs shall be capable of generation in a wide variety of formats including: - Scatter plots - Histograms - Windroses - Time-series graphs using one or more variables
	Manage Content	The CDMS shall facilitate the generation of a wide variety of content to effectively communicate issues relating to climate data. This shall include: - Preparing texts, documents and data for effective web presentation. - Using technology such as content management systems or similar to simplify web content presentation.
	Cartography	The CDMS shall facilitate the generation of a wide variety

		of cartographic output to effectively convey climate data issues. Examples include: - Spatial data preparation - Cartography - Simple point-and-click web maps
	Media Viewer	The CDMS shall facilitate the display of various media within the graphical user interface. Some examples are: - Photographs - Diagrams - Scanned documents such as scanned station records - Videos - Recorded audio media
	Spatial Intelligence	The CDMS shall support an effective and dynamic analysis of climate data within a web environment to facilitate understanding of climate matters and communicate issues relating to climate data. This dynamic analysis includes: - Geographical Information System (GIS) functionality, including the ability to perform spatial overlay analysis such as selecting points in a polygon. - The ability to search features by attribute, for example: • Conducting a search of all stations within the catchment of a specific river. • Filtering the resultant stations to view only those that observe precipitation. • Viewing summary observations data for each of those stations.
	Integrated Search of Observations	The CDMS shall provide functionality that allows an end-user to conduct an integrated search of the climate database and the observations metadata catalogue. Some examples are: - Determining what observations data are available based on a set of parameters and viewing the results in a table. - Reviewing observations metadata for selected stations. - Determining what datasets provide the actual observations data for a given station, sensor and phenomenon combination. An example could involve searching for stations that use both a tipping bucket rain-gauge and manual methods to observe rainfall.
	Search Discovery Metadata	The CDMS shall allow an end-user to search the CDMS discovery metadata catalogue to: - Determine what datasets are managed by the NMHS. This search may be limited to datasets that are available publicly or those that are only available for internal use. - Search for datasets in accordance with parameters, categories and keywords as defined in the WMO Information System. - Review discovery metadata records that adequately describe a dataset to enable searchers to determine whether it is suitable for their particular use.

		- Determine the URL that can be used to access online services that host the dataset for dynamic access and data download.
	Data Download	The CDMS shall support the functionality that enables end-users to download climate data.
	Climate Data Delivery Services	
	Web-Mapping Services	The CDMS shall support the provision and distribution of a wide range of climate data via a Web Mapping Service (WMS). WMS provides a map view of data distributed via a georeferenced image.
	Web Feature Services	The CDMS shall support the provision and distribution of a wide range of vector climate data via a Web Feature Service (WFS). WFS could provide vector and tabular climate data, which could be presented in a number of formats such as GML (see OGC GML web page) or Environmental Systems Research Institute (ESRI) shape file.
	Web-Coverage Services	The CDMS shall support the provision and distribution of a wide range of climate data via a Web Coverage Service (WCS) WCS provides the actual gridded or array data.
	CF-NetCDF	The CDMS shall support the provision of a wide variety of gridded or array scientific data written as netCDF files that supports the conventions for climate and forecast metadata.
	Discovery Metadata Catalogue	The CDMS shall support technology and processes that create a discovery metadata catalogue. This catalogue is used to publish an organization's data holdings as discovery metadata records, with corresponding records describing which online services may be used to access each dataset.
	WMO Formats	The CDMS shall support technology suitable for the distribution of a wide range of climate data via traditional WMO formats, including in particular FM94 BUFR Edition 4 and FM 92 GRIB Edition 2.
	Core Infrastructure	
	Directory	The CDMS shall provide directory services such as the Lightweight Directory Access Protocol or Active Directory to manage user credentials and details.
	Identity and Access Management	The CDMS shall support policies and functionalities that enable granular user access to the organization's IT resources and data.
	e-mail	The CDMS shall support the provision of secure e-mail access and include functionalities such as filtering for malware and spam where appropriate.
	FTP	The CDMS shall support the provision of secure services which allow exchange of climate data via the use of the File Transfer Protocol (FTP).

	Wiki	The CDMS shall support a collaborative web environment which allows any member of a team to easily edit content.
	Web Server	The CDMS shall support functionalities that deliver web content to web browsers.
	Proxy Server	The CDMS shall support functionality which routes web traffic, and acts as a load balancer and a reverse proxy server to contribute to secure connections to the web server.
	Tabular	The CDMS shall provide and/or support database technology suitable for the storage of a wide range of time-series climate data in tabular format.
	Spatial	The CDMS shall provide and/or support technology used to spatially enable time-series climate data. The component may consist of a functionality that spatially enables the tabular database component, or it could be a dedicated spatial database that is closely aligned to the climate data stored within the tabular database.
	Scheduling	The CDMS shall provide and/or support technology and processes used to ensure that software processes can be scheduled to run at specific times over a 24-hour basis. This functionality shall support activities such as regular data ingest, quality assurance operations, data analysis, derivation and backups.
	Service Desk	The CDMS shall provide functionalities required to provide support for service desk and service operations.
	Applications Management	The CDMS shall provide functionalities required to provide application administration tasks relevant to CDMS services.
	Systems Management	The CDMS shall provide functionalities required to provide systems management and systems administration tasks relevant to CDMS services.
	Internet	The CDMS shall provide all the functionalities necessary to support controlled access to the Internet.
	WMO WIS/GTS	The CDMS shall provide all the functionalities necessary to support access to the WMO Global Telecommunications System, which is essentially a private Wide Area Network.
	Internal Networks	The CDMS shall provide all the functionalities necessary to support access to all relevant internal networks and Local Area Networks.
	VPN	The CDMS shall provide all the functionalities necessary to support virtual private network (VPN), which allows a private network to be set up across the publicly available Internet making use of tunneling and security features.
	Hardware	The CMDS tender shall include all necessary computing hardware including servers and data storage systems, and also any necessary hardware to support routine data back-up and archiving. Desktop / personal computers from which access to the CDMS functionality can be gained are not included in this tender.
	Operating System	The preferred operating system for the BMD is Ubuntu but Redhat or CentOS are also acceptable or equivalent alternatives to be proposed by the supplier. The Operating

		system should be upgradeable using manufacturer's standard tools –internationally accepted such as 'yum' or 'apt-get'.
	Security	The CDMS software and systems shall be implemented with security in mind in order to protect the integrity of climate-related systems and data. This includes not just IT security but also to physical security, such as preventing the theft of a server. The system must provide security to: - Prevent unauthorized access to the computers - The proposed applications must only allow access to authorized personnel. - Different levels of access should be provided for at least 'operator' and 'administrators'. The applications and software must comply with industry best practice for security and operating standards. The system must be based on the principle of 'least privilege'. The system must synchronise time using NTP. The bidder must state in their bid(s) how this will be implemented.
	Storage Media	The CDMS shall provide sufficient storage media to cover operational activities, including the storage of climate data, systems, archives, backups and disaster recovery materials.
	Data Archival	The CDMS shall support and facilitate the secure archival of all historical data held in the database.
	Backups	The CDMS shall support and facilitate the regular operational backup and restoration of data and systems.
	Disaster Recovery	The CDMS shall support and facilitate resilient disaster recovery processes that include off-site storage of back-ups and efficient management of all back-up and disaster recovery procedures and practices.

Server topology

The system shall be implemented on at least 2 servers to provide redundancy. The servers may operate in:

- Live/ hot-standby non-live
- Live/ cold-standby non-live
- Load balancing

The Bidder must state in their bid(s) how they will implement the system that incorporates server resilience:

Failover method	Manual or automatic or both
Time taken to effect a failover	
Full description of the failover system	

Supported File Formats

Input	**Output**
Text	Text
CSV	CSV
JPEG	GIF
GIF	PDF
XLS(X)	XLS(X)

	MDB	MDB
	BUFR	XML
	TAC	
	GRIB	
	NetCDF	
	XML	
	Manual Input	
	Output requirements	
	General	The system shall download copies of all output files and products to a specified location from where they can be retrieved by the user.
	Output Types	Files in the formats mentioned above.
	File Downloading	
	General	Tools must be provided for downloading or receiving data from other servers on the BMD system, including the following: • XML and CSV files from the Integrated File and Message Switching System (IFMSS) • Graphics and tabular files from the IFMSS • Tool shall provide for 'pulling' data from other servers and moving new files to appropriate folders • The Tool shall provide for files being 'dropped' into folders and moving these files to the appropriate folders
	File Storage	
		Housekeeping tools shall be used to maintain data storage within configurable limits
	System Monitor	
	System Required	The system must have a central management system, access via a GUI. The GUI should ideally be web-based, however PC-based client software is also acceptable. The management system should allow: • Monitoring of all user logon / logoff activity; • User set-up (with different level of access privileges);

		• User authentication; • User deletion; • Identification of the date/time of each product created; • Any error messages or codes associated with delays or failures of transmission; • Warnings when the system storage capacities provided are close to being full (user-defined thresholds, e.g. 80%, 90%); • Facilities for routine and non-routine back-up procedures; • Monitoring of the security status of the system. • Access control shall be implemented either via folder/user permissions or via database rules.
	Logging	The system must record information in readable log-files including: • Record of all incoming and outgoing transactions • Record of status of incoming/outgoing transactions including success or failure • Recording information when failure occurs including as much information as practical on the failure • Record of configuration changes • Record of log on/off of administrators and operators • Statistics on all incoming/outgoing traffic • Record of file downloads • Record of file format conversions
	Log Viewer	A tool or tools must be provided for viewing log files as a UI and/or web tool. The tool should be able to select alerts of different level – information, warning, and error. A log viewer tool must be capable of displaying: • System error and warning messages • Configuration events
	Statistics	The system must be able to display statistics on: • Overall traffic in/out per hour/day • Optionally a graphical display of traffic over time. • Number of warnings and errors.
	System Configuration	
	General	A configuration system for all aspects of the software package is required.
	User Interface	A user interface (UI) must be provided for managing configuration for the majority of configurations,
	Web UI	It is desirable that a web enabled interface is provided.
	Logging	All configuration changes should be logged

	Access	Access to the configuration tools must be restricted to authorized users.
	File Configuration	Configuration tools based on a UI must be provided for managing the ingestion and the storage duration of file types. It should be possible to store different types of files for configurable time limits.
	Software Installation	
	General	The Supplier shall install the software package including any operating system modules that shall be required.
		The Supplier shall configure the disk system and install partitions that best suit the package
	Functional Test & Commissioning	
	General	The Supplier shall commission the software installed with the system.
	Data ingest	The Supplier shall configure the system to ingest the various existing data sources for files available through the IFMSS and on other systems.
	Output	The Supplier shall configure the output system for uploading output products to a specified location
	Acceptance and Commissioning	A Site Acceptance Test (SAT)/User's Acceptance Test (UAT) must be conducted and passed before the system can be accepted. A SAT/UAT protocol that includes tests on all aspects of the system must be developed by the Supplier and accepted by the contracting authority in advance. Any items that are not accepted must be addressed and pass a subsequent SAT/UAT. After successful SAT the Supplier shall commissioned the products and system before the representatives of the Purchaser.
	Local Training	
	Training course	A hands-on training course must be provided on-site, if possible, with regard to any COVID-19 restrictions (if required) for operators of the system. The course must cover: • Configuration • Monitoring • Trouble shooting • Operating system dependencies • Failover operation
	During installation	During installation and commissioning, on the job training shall be given to a selected number of BMD staffs.
	Materials	
	General	Full documentation of the system must be provided by the Supplier. Documentation must include: • System – full documentation on the Supplier's system • Customer specific documentation • Operator Guides, suitable for those with limited knowledge of ICT

		• Configuration guides • Trouble shooting guides
		At least 3 hardcopy versions of manuals must be provided
		Software copies and access to on-line manuals (if available) should also be provided by the Supplier
	Warranty	
	General	A warranty for the software system shall be provided for at least 12 months following a successful SAT/UAT.
		The Warranty must include bug fixes and support.
	Support and Maintenance	
	General	The Supplier must provide services for support and maintenance of the device and system during the warranty period with support service plan, on a next-working day basis.
	Support	The Supplier must provide support services that would provide support for the package and assistance for users during the warranty period. Support services shall include telephone, e-mail or an on-line reporting system. *The bidder **must** state in their bid(s) how they will provide services of support system for handling support issues.* At the end stage of the warranty period, the Supplier on basis of experience must provide to the Purchaser what levels of supports and response times of these levels would be required. They must state the operational hours and days of the support and the cost of different support plans – 9/5, 9/7 or 24/7.
	Maintenance	The Supplier must provide services of maintenance that would provide for regular updates and assistance for installing these updates and shall undertake to remedy issues arising from updates ensuring the system functioning correctly after updating during the warranty period. *The Supplier shall have to provide within the warranty period a maintenance guide/instruction manual at least for next five years' operation, updating system and trouble-shooting with solving techniques.*
	Access & delivery	The bidder shall state in their bid(s) what the plan to offer support and what access to the system will be required to provide remote support if offered.
	Period of support and maintenance	The Supplier shall provide within the warranty period annual basis cost estimation for support and maintenance services for five years next to warranty period.

	Mitigation against business failure and/or disaster recovery.	To mitigate against any future loss of capacity of the Supplier to support and maintain the software because of business failure or other Force Majeure, and/or to facilitate the capability of the BMD to recover from the impact of any disaster that may occur, the Supplier shall be required to enter into an arrangement to place the software source code and any other essential software elements, including passwords and access codes etc., into escrow or in some other secure facility from where BMD may recover the information to re-instate the software as required in the case of unforeseen events.

Installation, Functioning Trial and Commissioning

The Supplier shall deliver all the above items of Goods in anew and unused condition; and shall have them assembled, installed, mounted, fitted/connected/interconnected, adjusted, configured, developed for customization and put into operation by experienced Engineer/Technical Personnel/ duly certified/accredited from Manufacturers/ OEMs/Principal Suppliers and local Suppliers as well of the products including associated software as would be required; and subsequently shall carry out a complete trial operation with rectification if any defect or deficiency (including those notified by the Purchaser) until the functioning status of each item has achieved satisfactorily level of commissioning for acceptance- i.e. to have a successful Site Acceptance Test(SAT)/ User's Acceptance Test(UAT) to be carried out in presence of the representatives from the Purchaser. The Supplier shall provide all necessary items/materials for assembling, installation/fitting-fixing/mounting and connecting/ interconnecting for integrating the system as would be required to meet its functionality that would required complete the commissioning; and related costs to be incurred there for shall be included in the Bid/Contract Price.