

TERMS OF REFERENCE

for the

**Supply, Delivery, Installation, Testing, Commissioning and Training:
For the Establishment of an Integrated Hydrological
Data Management System (HDMS) - Phase III**

A. BACKGROUND

The hydrologic data of PAGASA is increasing in number, more so with the establishment of additional flood forecasting systems, from the existing 5 river basins to 18 river basins covering all major rivers. To safeguard the voluminous data which is vital in hydrologic analysis, a robust IT infrastructure will have to be in place.

The Integrated Data Management System to be established include the storing, editing and the retrieving of hydrometeorological data with ease and with utmost efficiency through the Time Series software to be procured. The visualization software, on the other hand, will immensely improve the dissemination of hydrologic information through various communication media (i.e., internet, GSM, etc.) to the concerned public, disaster risk reduction officers and planners, etc.

The first phase of the Project was implemented between May 2022 and March 2023. The main components of the HDMS were installed in two (2) pivotal sections of the Hydro-Meteorology Division (HMD) namely the Flood Forecasting and Warning Section (FFWS) and the Hydro-Meteorological Data Applications Sections (HMDAS). At the same time, four (4) river basins were covered namely: Pampanga, Agno, Bicol and Cagayan de Oro. While the second phase of the project was being implemented between January to October 2023 which covers the three (3) river basins, namely: Cagayan, Davao, and Pasig-Marikina-Tullahan-GMMA.

For the purpose of creating an efficient, effective and seamless overall database management system for HMD, pertinent provisions in the Phase I and Phase II project are carried over for Phase III. (and eventually for succeeding Phase).

B. APPROVED BUDGET FOR THE CONTRACT

The Approved Budget for the Contract (ABC) is in the total amount of **Thirty-Four Million Five Hundred Ninety-Four Thousand Pesos (Php34,594,000.00)**, inclusive of the Value Added Tax (VAT) and all other applicable government taxes.

C. PERIOD AND PLACE OF DELIVERY

The winning bidder shall Supply, Deliver, Install, Commission and Test the System in the identified onsite locations: **Three (3) PAGASA River Centers** namely 1) Abra 2) Agusan and 3) Buayan-Malungon, within **Three hundred (300) calendar days** commencing from the date of receipt of the **Notice to Proceed (NTP)**.

D. SCOPE OF WORKS

The following are the minimum specifications for the different components of the Hydrological Data Management System:

1. Software Packages

Software packages shall be installed in servers to be located in the following:

RIVER BASIN	LOCATION OF RIVER CENTER
a. Abra	Vigan City, Ilocos Sur
b. Agusan	Prosperidad, Agusan Del Sur
c. Buayan-Malungon	General Santos City, South Cotabato

As indicated, these software's shall come in packages with, but not limited to the following capabilities:

- Business logic, calculations and validation rules, interfaces to other systems;
- Application programming interface;
- Network configuration with PAGASA standard protocols
- Enables PAGASA to manage access rights to data and functionalities
- Ability to archive and analyse forecasts
- Ability to process and archive radar data
- Data transfer tasks (scheduled or triggered)
- Expert application of administration, configuration and advanced analytics
- Rating curve development
- Asynchronous data validation and consistency
- For uniformity, full and seamless compatibility in usage and implementation, as well as ease in the operation and maintenance, the system software should be similar to the HDMS-Phase 1 and Phase-2 Project.

The twenty (20) software licenses were acquired/ purchased during Phase I of the project. Of these, two (2) licenses were installed at HMD, and seven (7) were installed at the River Centers throughout Phases I and II. Three (3) licenses will be used for Phase III, while the remaining licenses will be allocated to the subsequent phase. To ensure optimal utilization of these licenses, the prospect bidder must be authorized to install and configure the software, ensuring that it meets the same system capabilities as implemented in Phases I and II.

2. Hardware Packages

The Hardware packages shall be composed of Servers, Workstations and Racks for Time Series Applications

Station	Module
RIVER CENTERS of three (3) river basins: 1. Abra 2. Agusan 3. Buayan-Malungon	Application Server
	Workstation and UPS
	Database Server
	Server Rack and UPS
	Network Switch

E. TECHNICAL ASPECTS

The winning bidder shall supply, deliver, configure, test and commission the three (3) new database systems and integrate to the Data Center at the HMD which was established under Phase I and Phase II of the same Project. The three (3) application servers from Phase 3 shall be installed and configured as database servers at the river centers established in Phase 2. Meanwhile, the three (3) database servers from the Phase 2 shall be installed and configured as application servers at the river centers for Phase 3.

The systems to be established shall conform to the following minimum specifications and requirements for both software and hardware.

1. Software – based on the Phase I and Phase II of the project the system’s software is capable/equipped with the following:

Item	Description	Specification
1.1	Commercial off- the-shelf solution	The overall architecture and software components must be a proven commercial off-the-shelf solutions with a minimum of custom developments and a strong support and maintenance program.
1.2	Architecture	In order to scale with the increasing amount of data, the overall architecture must be highly scalable. The scalability must be considered on the level of the storage as well as on the processing layer.
1.3	Flexibility	To ensure the system expansion, the proposed solution must be highly configurable and easy to extend. It must be possible for example to extend the solution by new <ul style="list-style-type: none"> - Observation stations - Data streams and data sources - Forecast data products - Derived data products by configuration (without programming or applying SQL statements).
1.4	Controlled Open access	The solution must provide controlled open access to all kind of data and data products stored. The data and data products must be exportable into human readable data formats as well as made accessible by application programming interfaces. To ensure the data consistency and integrity as well as to protect data from malicious intents backdoor access on storage level shall be not necessary.
2	Data Ingest	
2.1	Modular design	The system shall provide a modular design, that support the configuration and/or integration of new format conversions.
2.2	Data sources	The system must support the ingest from <ul style="list-style-type: none"> - web services - local directories - TCP/IP push - sFTP/FTP

		<ul style="list-style-type: none"> - HTTPS/HTTP - data collection platforms such as WMO GTS hubs - manual file upload - manual data entry
2.3	Automatic weather stations	The system must be able to import the data from the automatic weather stations
2.4	Automatic river level stations	The system must be able to import data from the river level stations
2.5	Automatic reservoir-related data	The system must be able to import data from the reservoirs and its related hydraulic structures
2.6	Manual data entry	<p>The system must be able to support data entry possibilities for</p> <ul style="list-style-type: none"> - river level check readings by field staff - reservoir structures entries by dam operators - manually read rain gauges
2.7	Radar data and composites	<p>The system must be able to build and import the radar composites from the</p> <ul style="list-style-type: none"> - BMFG C-Band (geotiff or Universal format UF) - Local X-Band radars (geotiff or Universal format UF)
2.8	GTS Data	Data collected directly via GTS global information system shall be imported. This includes the following data types: Synop, Ship, Buoy, METAR, Pilot, TEMP, Aircraft in structured text files following the TAC standard or the TDCF binary files.
2.9	Results from global numerical weather predictions	<p>The system must be able to import results from numerical weather predictions. The following model results shall be converted and imported:</p> <ul style="list-style-type: none"> - GSM (Japan) - GFS (USA) - ICON (Germany) - IFS (ECMWF) <p>both in its deterministic and probabilistic version, at the highest resolution and as often as available.</p>
2.10	Results from regional weather forecast	The system must be able to import results from the regional NWP's with a frequency in the range between one and three hours.
2.11	Source definitions	The system shall provide a user-friendly application to define additional sources and assign the appropriate Extract, Transform, Load (ETL) module.
2.12	Automation	The system shall process all data streams that delivers data to the ingest layer upon arrival. All data from sources, where data needs to be pulled from, must follow a definable schedule. The schedule must be configurable per data source.

2.13	Retry	Unprocessed files must automatically re-processed. The number of retries as well as the wait time between the retries must be configurable per data source. Only those data imports that could not be processed after the specific number of retries are classified as failed imports.
2.14	Logging	All steps from source access, conversion and import must be logged so that the users can easily analyse the reason for potentially failing imports. The solution shall offer a web frontend application that delivers continuously a statistic over the running import processes per source. The statistic shall show number of failed and successful imports accumulated over any time interval.
3	Data Storages	
3.1	River gaugings	Data from current meter gaugings must be stored with the associated observation station. The storage must include <ul style="list-style-type: none"> - Cross section geometry - Wet profile - Gauging verticals - Measuring points per vertical - Gauging device used - Gauging device calibration history Results from ADCP measurements must be stored with the associated observation station.
3.2	In-situ observations	All continuous observations from weather, river and reservoir stations needs to be stored as time series in a license free database backend (preferred PostGreSQL)
3.3	Raw and edited time series	The storage must support the differentiation of raw and processed/edited data points and must provide the storage of associated data qualities for each time stamp.
3.4	Data qualities	The system must allow the definition of data quality ranges (e.g. Good, Estimated, Suspect, Unchecked and Missing). The number of quality code definition shall be more than 50 codes. Each code must consist of number and print name.
3.5	Time stamps	All time stamps must be UTC, however the interpretation of the time stamp must be in the local time zone of the station location.
3.6	Units	The system shall provide a unit conversion feature to convert units to any other unit of the same unit group. Unit conversation needs to be considered at import time and calculation of derived data products.
3.7	Gridded data observation	Precipitation radar data, temperatures, soil moisture information is provided as gridded data, consisting of a series of cells with a geographic extent. The system shall provide a highly performing file based storage to store all incoming gridded data over time (gridded data time series). The storage must support different cell resolutions ranging from 25 by 25 m up to 0.1 or 1 degrees. The gridded data store must include the geographic projection as well as the classification of the cell values. Note: Each cell may contain more than a single value (e.g. rainfall intensity and precipitation type)
3.8		The storage must support the storage of derived data sets produced by the processing layer.

	Storage of derived data products	Examples for such derived data produces include fixed interval calculations such as e.g. aggregations to hourly, daily, monthly or annual statistics. In addition, it is necessary to store also sliding interval statistics such as hourly totals of the last 24 hours or 7-day mean calculated daily.
3.9	Photos and documents	The solution must provide the ability to store photos (as single information or as a time series) and documents (like pdf or word documents)
3.10	Meta data / Measuring Network information	The solution must provide the ability to store meta data about the network and the individual stations. The meta data must include <ul style="list-style-type: none"> - River branches - Catchment name and area - Station name and number - Station type (e.g. meteorological station) - Flexible set of attributes per station type - Location (latitude and longitude) - Observer parameter (such as precipitation, flow, stage) and associated unit
3.11	Storage Volumes	The system must provide a minimum storage capacity of 500 GB for time series data as well as 2 TB for gridded data. Data beyond this limit can be archived for later use. The gridded data processing component must allow a daily throughput of more than 100 GB per day originating from gridded observations and forecasts.
4	Processing layer	
4.1	Data validation	The system must provide a data validation framework that automatically scans the incoming data stream for erroneous data. The validation rules must be executed <ul style="list-style-type: none"> - primary validation for each observation point or single time series - secondary validation for a sets of time series at neighbouring stations and various parameters The primary data validation rules must be executed synchronously upon arrival of new data and on change of individual data values. The secondary data validation rules must be executed asynchronously on definable schedule for all or for a group of observation points. Validation rules must be extendable through configuration as well as through the deployment of new or amended validation scripts.
4.2		It is expected that the successful Supplier provides at minimum <ul style="list-style-type: none"> - Data consistency checks (such as checks for missing data, most recent data available) - Primary validation (range and rate-of-change checks, persistent reading etc.) - Secondary validation (inner consistency and spatial comparison of meteorological parameters, mass balance checks for reservoirs)
4.3		Both validation routines must be able to set data qualities in both situations: plausible or implausible data. With this approach, data qualities can be either up- or downgraded.

		Next to a possible downgrade in data quality, implausible data shall receive a remark explaining the reason for downgrading or optionally deleted.
4.4		<p>Where gaps have been set by the validation routines or data is missing, the validation routines should be configurable to close gaps of a definable duration.</p> <p>Gap closing should include</p> <ul style="list-style-type: none"> - fill gaps by block or linear interpolation - fill gaps with a constant - fill gaps from modelled data - fill gaps from gridded data sets
4.5	Quality codes	All derived data products shall include or exclude data due to their quality in the actual calculation
4.6	Stage discharge calculation	<p>The system must be able to provide various methods of stage to discharge calculations. The methods shall include</p> <ul style="list-style-type: none"> - standard discharge formula for geometric channels - rating curve calculation for natural cross sections
4.7		Computation of gauged flow velocities that is measured during the river discharge gauging
4.8	Rating curve development	<p>The system must provide a module to create and validate stage – discharge relationships in form of rating curves. The module must consider that the rating curve is not constant over time and is affected by changes in the hydraulic regime (e.g. through sediment or vegetation).</p> <p>In addition to stage-discharge other relationships such as sediment-velocity, reservoir volume- reservoir level must be supported by the same module.</p>
4.9	Standard statistics – fixed interval	Standard statistics include the aggregation to fixed higher intervals. Examples for such calculations are e.g. minimum, maximum, mean or totals for hour, day, month or year.
4.10	Standard statistics – moving intervals	Standard statistics include the aggregation to sliding higher intervals. Examples for such calculations are e.g. sliding minimum, maximum, mean, total over the last n hours, calculated for every hour, day, month or year
4.11	Long term statistics	<p>The long-term statistic calculation must support the calculation of a standard statistical profile (e.g. a standard year divided into monthly intervals). The long-term statistics calculates for each interval of the profile the average, mean, minimum, maximum or n- percentile value. The following statistics must be supported:</p> <ul style="list-style-type: none"> - Highest value for each month of a standard- year profile (e.g. highest monthly precipitation total for January, February, ... December) - Lowest value for each month of a standard- year profile (e.g. lowest monthly precipitation total for January, February, ... December) - Average value for each month of a standard- year profile (e.g. average monthly precipitation total for January, February, ... December) <p>The input period shall be configurable, so that the system can calculate the long term statistics over period of record, the last 10 years, the last 5 years etc.</p>
4.12		The system must support the determination of statistical independent

	Flood peak detection	flood peaks for later flood frequency statistics. Source data is the high-resolution river level time series. Two adjacent flood peaks are considered as statistically independent when the distance in time exceeds a configurable period and/or the distance to the local trough between two peaks exceeds a certain value.
4.13	Flood frequency statistics	<p>The flood frequency statistic uses the flood peaks to determine the relationship between the flood volume for return period. The flood peak points are fitted shall be fitted with one of the following distribution functions:</p> <ul style="list-style-type: none"> - Pearson 3 (P3) - Log. Pearson type 3 (LP3) - Gamma (G) - Extreme value 1 (Gumbel) (EV1) - Extreme value 2 (EV2) - Weibull 3 (WB3) - Normal (N) - Log. normal (LN) - General extreme (AE) - Log. general extreme (LAE) <p>For the calculation of the empirical probability the following plotting positions must be supported</p> <ul style="list-style-type: none"> - Pearson 3 (P3) - Log. Pearson type 3 (LP3) - Extreme value 1/Gumbel distribution (EV1, WB3) - General extreme (GEV) - Log. normal (LN3) - Weibull distribution with 3 parameters (WB3)
4.14	Return period flood calculation	The system must compute for a given return period (such as a 20 or 50-year event) the associated volume of river discharge. The calculation uses the flood as input and calculates with the distribution function the associated volume for the desired return period).
4.15	Catchment averages	<p>The system must calculate the catchment rainfall and other model forcing for the geographically extend of the catchment and from scalar time series (by interpolation) or gridded data products such as X-band radar composites* or the global or regional numerical weather predictions</p> <p>*the catchment rainfall shall be calculated from the observation as well as from the now cast.</p>
4.16	Raster calculation	<p>The processing layer must support raster time series calculations including the following:</p> <p>Raster to point extraction (extracts a series of values for a given pixel over time)</p> <p>Raster to polygon extraction (extracts a series of values of time for an area defined by a polygon)</p> <p>Raster to raster calculation (e.g. total, max, min and mean raster data for a particular event duration)</p>
5	Web Applications	

5.1	General	<p>The web application must support the latest version of the following browser:</p> <ul style="list-style-type: none"> - Microsoft Edge - Mozilla Firefox - Google Chrome
5.2		To find acceptance by the system operators, the system must provide professionally designed and easy to use web applications.
5.3		<p>The data visualisation shall be designed to the skillset of the user group:</p> <ul style="list-style-type: none"> - Non-technical (e.g. management level) - Technical (e.g. data managers) - Experts (e.g. hydrologist, flood operators) <p>The bidder must provide a description of the principle methodologies applied for UI-design and UI-development</p>
5.4		The web applications must be made available within a web application platform, where user needs to login. Depending on the user rights, the user has access to different applications.
5.5		Each registered user can create his own dashboards where he can store and arrange selected content elements (like maps, charts, graphics or tabular views). The content elements can be picked from any of the required web applications. The content elements shall not hold static information. It is required that the content element in the dashboard refreshes automatically with the arrival of new data sets.
5.6	Data Viewer	<p>The system must provide a real-time data viewer application that shows</p> <ul style="list-style-type: none"> - Topographic map of the catchments - The animated radar observations - The animated inundation maps - The forecasted precipitation and other parameters of the global and regional numerical weather predictions - The future alarm level exceedance as color- coded dots at the location of the individual stations - Catchment polygons - Available flood retention area per reservoir
5.7		The data viewer application must automatically refresh with the arrival of new data sets (observations and/or forecasts)
5.8		<p>The data viewer must provide the possibility to load and visualise data from the archive. This includes</p> <ul style="list-style-type: none"> - any gridded data from the gridded data store (observation and or forecasts) - any station type (e.g. weather and surface water station) with the classification - any time series data from the time series data store
6	Warnings and Alerts	
6.1		<p>The application "Warnings and Alerts" shall enable administrators to</p> <ul style="list-style-type: none"> - setup warning and alert thresholds based upon forecasted and observed parameters - setup recipient lists with names, email addresses and mobile numbers of the alarm receivers

6.2		The system must be able to send out warnings and alerts to the recipients be e-mail, Twitter, WhatsApp and by SMS
6.3		All alarms and visualization that the system has send out shall be archived and displayed in tabular format.
7	Web services/ dissemination	
7.1	General	All observations, derived data and forecast products shall be shared via web services (RESTful).
7.2	Supported formats	<p>The REST-Services shall return the requested data as</p> <ul style="list-style-type: none"> - netCDF4 and HDF5 for gridded data - GeoTIFF for gridded data - WaterML2.0 for time series data - JSON for time series and meta data - CSV for time series data - WKT Strings for polygon geometries
7.3	GIS Services	The proposed solution must support Web Mapping Services (WMS) and Web Feature Services (WFS) for sharing georeferenced information
8	User Management	
8.1	General	The solution must provide a user management on application level.
8.2	Authentication	The proposed solution shall support secure authentication services such as the OAuth standard.
8.3	Authorisation	<p>The proposed solution must provide a role-based authorisation. The authorisation shall consider Read only access to objects Create, Update & Delete (CRUD) of objects access to certain functional areas of the solution. The access rights shall be valid for the entire data sets but also for certain geographical areas and data types.</p> <p>For example, a user might be guest user for all data, but would have full administrative access to all weather stations of a specific river basin.</p>

2. Hardware

2.1 SERVERS (6 Units)
Must provide Six (6) units with the following specifications or better:
Must have two (2) units Intel Xeon with 8Cores, 16 Threads, 16GT/s UTI speed, 22.5M Cache, 3.7GHz to 4.1GHz frequency speed, with heat sink for two (2) CPU configuration
Must include two (2) units of memory module with 32GB RDIMM, 5600MT/s in dual rank
Must include the following storage: 6 x 960GB SSD SATA 6Gbps 2.5in Hot-plug AG Drive, 3.5in 4 x 4TB Hard Drive SAS, 12Gbps read speed, 3.5in Hot-Plug, AG Drive
Must include hardware RAID capability for mix storage components
Must include redundant, Hot-Plug, Power Supply with 1400W (100-240Vac) and two (2) meters power cable, C13 to C14 PDU style
Must include the following input and output ports: One (1) Dual port 10GbE BASE-T Adapter One (1) Dual port 1GbE BASE-T network adapter One (1) 2.0 USB port One (1) 3.0 USB port

One (1) management interface port One (1) VGA rear port One (1) VGA front port
Must have a form factor of 2U rack server
Must include Sliding Rails With Cable Management Arm
Must include support service: Onsite support, warranty, and keep hard drive enterprise for 84 Months
Cables, brackets, screws, bolts and enclosure that are not explicitly specified but are required for proper functionality of the solution should be included.
2.2 WORKSTATIONS
Must provide three (3) unit with the following specifications or better:
Must have a CPU of Intel Core i7 14th Gen processor with 36 MB cache, 20 cores, 28 threads, and 2.5 GHz up to 5.6 GHz frequency
Must have a atleast a memory module two (2) 16 GB, DDR5 with 4400 MT/s, non-ECC
Must include the following storage: 1x 512GB PCIe NVME™ Class 40 M.2 SSD 1x 4TB 5400rpm SATA 3.5" HDD
Must include a graphics card with the following specification: GPU Memory : 8GB GDDR6 Cuda cores: 896 Graphics Bus Interface : PCI Express 3.0 x 16 Ports : 4 mini Displayport 1.4a
Must have a tower form factor
Must include atleast the following input and output ports: One (1) RJ45 (1 GbE) Ethernet port Two (2) USB 3.2 Gen 2 (10 Gbps) ports Two (2) USB 2.0 (480 Mbps) One (1) USB 3.2 Gen 1 (5 Gbps) port with PowerShare One (1) Optical Drive with 8x DVD+/-RW/RAM 9.5mm Slimline
Must include 24" monitor with the following specification: Resolution : Atleast Full HD (1920 x 1080) Ports : HDMI, VGA, and Displayport
Must provide mini displayport to standard displayport cable
Must include a optical mouse and keyboard
Must include an operation system of Windows 11 Pro
Must include Microsoft Office Professional perpetual license software – latest version
Must have a 3 year warranty support for parts and services
Screws, cables and services that are not explicitly specified but are required for proper functionality of the system should be included
2.3 42U RACK Server Enclosure Cabinet
Must provide three (3) unit with the following specifications or better:
Must have the following standard dimension: Height : 42U

Width : 600mm Depth : 1100mm
Must have a maximum load capacity of 1600kg
Must include two (2) Vertical 3KW single phase PDU and cable management tray for dual PDU mounting
Must include the following panels : Single front mesh door with lock Double rear mesh doors with lock Side panels with lock Roof top with cable entry plates Integrated baying kit set
Must include four (4) fast deploying leveling feet and 4 casters
Must include four (4) (19") EIA-310 vertical mounting rails
Must include fifty (50) sets of captive M6 nuts and M6 screws
Must have a 3 year warranty support
Screws, cables and services that are not explicitly specified but are required for proper functionality of the system should be included
2.4 3000VA Rack Mount Backup UPS
Must provide three (3) unit with the following specifications or better:
Must have a rated power of 3000 VA
Must have a form factor of 2U rack mount
Must have a rated frequency range of 40Hz to 70Hz
Must have a rated input voltage of 220-230 volts
Must have a nominal output voltage of 200-240 volts
Must Have a battery type of lead acid or better
Must have an operating temperature of up to 40 °C
Must have a multifunction LCD status, control console and alarm
Screws, cables, railing kits and services that are not explicitly specified but are required for proper functionality of the system should be included
2.5 1100VA Backup UPS
Must provide three (3) unit with the following specifications or better:
Must have a rated power of 1100 VA
Must have a rated frequency range of 50Hz to 60Hz
Must have a rated input voltage of 230 volts

Must have a nominal output voltage of 230 volts
Must have a maximum input current of 5 Amperes
Must Have a battery type of lead acid or better
Must have an operating temperature of up to 40 °C
Must have a cable length of at least 1 meter
Must have a 3 year warranty support
Screws, cables, and services that are not explicitly specified but are required for proper functionality of the system should be included

2.6 SWITCH (3 Units)

Must provide three (3) unit with the following specifications or better:	
Standards	IEEE 802.3, IEEE 802.3u, IEEE 802.3ab, IEEE 802.3ad, IEEE 802.3ae, IEEE 802.3z, IEEE 802.3x, IEEE 802.1p, IEEE 802.1q, IEEE 802.1w, IEEE 802.1d, IEEE 802.1s
LED indicators	One Link/Act LED indicator for each port One Power LED indicator for each device One SYS LED indicator for each device
Interfaces	24 x 10/100/1000Base-T Ethernet ports 4 x 10G SFP+ ports 1 x Console port
Lightning protection	Port: 6kV Power: 6kV
Forwarding mode	Store-and-forward
Switching capability	128Gbps
Packet forwarding rate	95.2Mpps
Buffer	12Mbit
MAC address table	16K
Input voltage	100-240V~ 50/60Hz
Operating environment	Operating temperature: 0°C - 45°C Storage temperature: -40°C - 70°C Operating humidity: (10% - 90%)RH, non-condensing Storage humidity: (5% - 90%)RH, non-condensing
Certificates	CCC、FCC、CE、RoHS
Software Specifications	
Security features	Supports ARP receiving limit Supports discarding unknown MAC addresses Supports DoS attack defense Supports 802.1x security authentication Supports RADIUS authentication
VLAN	Supports IEEE 802.1Q VLAN Supports VLAN Layer-3 interfaces

	Supports three port modes: Access, Trunk and Hybrid
DHCP	Supports DHCP Server Supports DHCP Relay Supports DHCP Snooping Supports Option 82 policy configuration
L3 Routing	Supports inter-VLAN routing Supports IPv4 static routing Supports RIPv1/v2 dynamic routing protocol Supports OSPF dynamic routing protocol Supports dynamic ARP and static ARP Supports ARP aging configuration
IPv6	Supports IPv6 static routing Supports ICMPv6 Supports IPv6 ND Supports IPv6 Ping test and IPv6 Tracert test
Port aggregation	Supports static aggregation Supports LACP dynamic aggregation Supports a maximum of 32 aggregation groups and a maximum of 8 member ports in each group
Spanning tree	Supports IEEE 802.1d STP (Spanning Tree Protocol) Supports IEEE 802.1w RSTP (Rapid Spanning Tree Protocol) Supports IEEE 802.1s MSTP (Multiple Spanning Tree Protocol) Supports edge ports Supports BPDU statistics Supports BPDU Guard, BPDU Filter Supports Root Guard, Loop Guard Supports Loopback-detection
Multicast	Supports IGMP Snooping V1/V2/V3 Supports port fast leave
Port Mirroring	Supports N: 1 port mirroring
QoS	Supports SP (Strict Priority) Supports SWRR (Simple Weighted Round Robin) Supports WRR (Weighted Round Robin) Supports 802.1p port trust mode Supports DSCP port trust mode Supports a maximum of 8-queue service quality mapping Supports Tail Drop Supports storm suppression Supports port speed limit
ACL	Supports MAC ACL Supports IPv4 ACL Supports IPv6 ACL
Loading and upgrade	Supports FTP/TFTP/HTTP upgrade Supports configuration import and export

Cloud management	Supports configuration delivery from IMS cloud platform Supports log reporting and fault detection Supports remote maintenance: reboot, backup, upgrade
Local visualization management	Supports router, switch, AP, IP camera discovery Supports automatic generation of topology Supports online/offline status detection for devices Supports remotely rebooting the IP camera
Management and maintenance	Supports Telnet configuration Supports Console port configuration Supports SNMP V1/V2/V3 Supports WEB UI management and maintenance Supports Ping/Tracert Detection

3. Factory and On-site Training Services

The winning bidder shall conduct a 5-day Experts system training at the factory or facilities where the database system was developed to be attended by at least five (5) qualified PAGASA personnel. All related expenses, such as, but not limited to training materials, round trip airfare, local transportation, lodging / accommodation and daily allowances for each participant shall be borne by the winning bidder.

Further, a five-day on-site training shall also be conducted by the winning bidder at each of the three project sites. For each project site, ten (10) participants composed of river center personnel and those from nearby PAGASA stations, shall be invited. Training materials shall be provided to the participants.

The training sessions shall cover the following subject areas:

- installation, setup, monitoring and troubleshooting (IT Training)
- system administration and configuration (administrator training)
- validation, calculation and analytics (expert training)
- search, view and download (standard user training)
- network management (IT training)
- Arraystorage ETL, web configuration and troubleshooting (expert training)

The training sessions must be prepared in coordination with PAGASA and respective training hosts (abroad and local). The winning bidder shall describe the methodology and an example content for each of the training courses above.

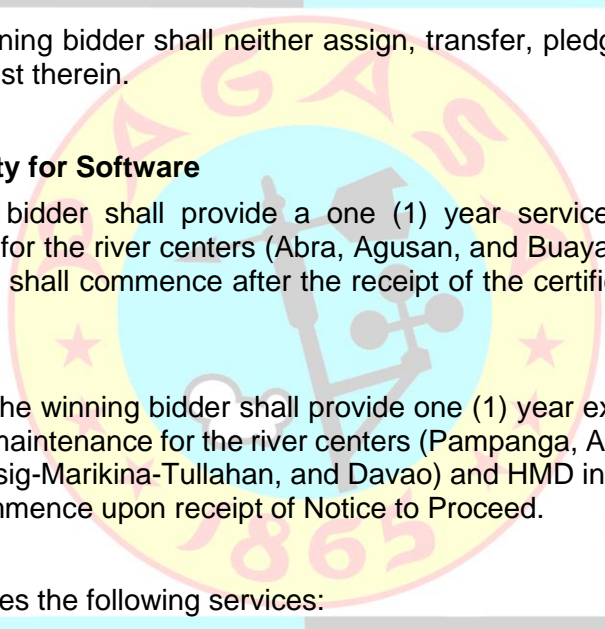
F. MISCELLANEOUS

a. System Documentations

The winning bidder must supply four (4) complete sets of as-built documents, schematic diagrams and current instruction books with fully keyed descriptive parts lists for each type of equipment supplied, including the network management software.

b. Warranties and After-Sales Support

- i. The bidder warrants that it shall strictly conform to all the Terms and Conditions of the Contract, including this Terms of Reference (TOR).

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- ii. All workmanship, materials and equipment shall be warranted by the supplier for a period of one year commencing from the date of final acceptance. The warranty shall include:
- Technical assistance when summoned to by the end-user regarding the delivered items.
 - Immediate replacement of the defective item/s, in any case of malfunction during the warranty period.
- iii. While the equipment is undergoing repair, a spare unit shall be made available to PAGASA to maintain the continuous operation of the system. Repair of the defective material or equipment shall be permitted provided that the repaired item meets original specifications.
- iv. Parts and materials must be readily available at the market for at least 5 years.
- v. The winning bidder shall neither assign, transfer, pledge nor sub-contract any part or interest therein.

c. Warranty for Software

The winning bidder shall provide a one (1) year service covering the support and maintenance for the river centers (Abra, Agusan, and Buayan-Malungon) included in the Phase III and shall commence after the receipt of the certificate of final acceptance and completion.

Additionally, the winning bidder shall provide one (1) year extended service covering the support and maintenance for the river centers (Pampanga, Agno, Bicol, Cagayan De Oro, Cagayan, Pasig-Marikina-Tullahan, and Davao) and HMD included in the Phases I and II and shall commence upon receipt of Notice to Proceed.

Which includes the following services:

- i. Provide services with the integration of further station and time series data into River Center's systems and the central system in HMD. This includes
- a. Development of required converters
 - b. Configuration of new mappings in the system (WISKI and KIDSM) for automated data import
 - c. Additional Templates
 - d. QA and documentation of the new additional data flows
 - e. Configuration of the data transport API Function
- ii. Comprehensive support and customers query to problems related to the listed products using the Jira software including:

- a. System existing configurations (meta data, time series and agents)
- b. System Web (Local and Public Web) {data collection from system and display configurations in GUI including radar, satellite, and NWP}
- c. Array Storage (including ETL scripts for data import and export)
- d. Operational systems
- iii. One WISKI Upgrade of the HMD (Manila) and River Center systems with the latest WISKI version including the analytics framework
- iv. Maintain specific PAGASA software functionalities, configurations and make new functions available which are implemented and developed for new WISKI product version
- v. Adjustments in data flow and further data integration by modifying the existing converters and scheduling
- vi. Access to any further developments of the software according to the scope of purchase
 - The software products purchased within this contract are further develop based on customer request and security requirements. These changes will be available for all customers if they are not a customer specific enhancement. For example, if a new importer or exporter is developed for WISKI, this development will be available for all customers
- vii. Access to comprehensive information of the products in the customer area of the customer portal including:
 - a. Information and release notes of the software
 - b. Technical information to system requirements, ports and software dependencies
 - c. Security and software patches
- viii. Documentation and online help videos for software tools and functions
- ix. Provide access to regular meetings and provide monthly report during the contract period.
- x. Availability of technical support on 24/7 via email, phone, or SMS during the duration of the support and maintenance agreement.
- xi. For severe or critical issues on the Security Module, Database and/ or, an SLA of 4 hours response time in 1 year term should be available.

d. Costs for Licenses, Permits, Training, etc.

The prospective bidder shall include in his financial proposal, the costs of all permits and licenses necessary to purchase, install, and operate the equipment to be supplied, including the cost for the conduct of the training.

e. Performance Testing

Prior to acceptance, the winning bidder shall provide actual equipment testing (table testing) wherein specifications will be clearly shown. A hard copy of the test results shall be provided together with the end-user approval and shall form part of the acceptance and completion certificate.

f. Payment Terms

The payment to the winning bidder will be processed upon submission of a billing statement accompanied by all necessary supporting documents. For progress billing, these documents include proof of completion of deliverables on-site, an inspection certificate, schematic diagrams or drawings (if applicable), photographs taken during the installation and testing phases, and any other related documentation required by accounting and auditing rules and regulations. The remaining payment of the Contract

Price shall be paid to the Supplier after the date of submission of the certificate of final acceptance and completion, and inspection certificate for the respective delivery issued by the Procuring Entity's authorized representative.

