National Centre for Hydrology and Meteorology (NCHM)

(Revised Structure, Mandates and Functions)

2022

National Centre for Hydrology and Meteorology
Royal Government of Bhutan
Thimphu: Bhutan

National Centre for Hydrology and Meteorology
(Organisation Structure, Mandates and Functions)

This document was endorsed and launched during the 8th Governing Board meeting held on 28 June 2022

National Centre for Hydrology and Meteorology
Royal Government of Bhutan
2022

Acronyms

AMS	Aviation Meteorological Section
AWLS	Automatic Water Level Station
AWS	Automatic Weather Station
CIMS	Climate Information Management Section
CSD	Cryosphere Services Division
DDM	Department of Disaster Management
DGPC	Druk Green Power Corporation
DoE	Department of Energy
DOP	Department of Power
EWS	Early Warning System
EWS	Early Warning System
FWS	Flood Forecasting and Warning Section
GB	Governing Board
GLOF	Glacier Lake Outburst Flood
GoI	Government of India
GPMS	Government Performance Management System
GTS	Global Telecommunication system
HFWS	Hydrological Forecasting and Warning Section
HIMS	Hydrological Information Management Section
HMSD	Hydro-met Services Division
HOID	Hydro-met Operation and Infrastructure Division
HQ	Headquarter
HWRSD	Hydrology and Water Resources Services Division
ICT	Information Communication Technology
MOEA	Ministry of Economic Affairs
MTI	Ministry of Trade and Industry
NCFS	National Framework for Climate Services
NCHM	National Center for Hydrology and Meteorology
NCOF	National Climate Outlook Forum
NMHS	National Meteorological and Hydrological Services
NWFWC	National Weather Flood and Warning Centre
PR	Permanent Representative
R&D	Research and Development
RCSC	Royal Civil Service Commission
RGoB	Royal Government of Bhutan
SOP	Standard Operating Procedure
TMO	Technical Maintenance Officer
TOR	Terms of Reference
TSRD	Technical Standard and Research Division
WCSD	Weather and Climate Services Division
WFS	Weather Forecast Section
WMO	World Meteorological Organisation

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Brief History of Hydro-met Services in Bhutan

Chronology of organisational development of hydrology, meteorology and cryosphere sciences and services in Bhutan.

Year	Organisation
Prior 1990	Hydro-met data collection were done by respective line agencies based on their own need in a piecemeal basis through projects implemented by the respective agencies. Department of Agriculture was responsible for collection of meteorological data for agriculture and other RNR uses. Hydro-met Unit (Program funded by GoI) under the Department of Telecom was responsible for collection of river level and rainfall data for providing flood warning information to the Indian States of Assam and West Bengal.
1990-1993	The Hydrology Unit and Meteorology Unit were established under the Department of Power (DoP), Ministry of Trade and Industry (MTI) to collect hydrological and meteorological data. Under the Bhutan Power System Master Plan (PSMP) study, hydrological and meteorological network were designed and established covering whole Bhutan; Meteorology functions from the Department of Agriculture was transferred to DoP, MTI along with instrument and manpower.
2001	As a part of restructuring the energy sector and unbundling of the Department of Power (DOP), MTI the following agencies were created: a. Department of Energy, DoE (Policy and Coordination), b. Bhutan Power Corporation, BPC (transmission and distribution functions), c. Druk Green Power Corporation, DGPC, (generation functions) and d. Bhutan Electricity Authority, BEA (as regulator). The Hydro-met Services Division (HMSD) was one of the divisions created under the Department of Energy (DoE) with three sections, viz.: Hydrology, Meteorology and Flood Warning Section.
2002	When the Department of Telecom (DoT) was corporatized in 2002, the Hydro-met Unit with its observational network, functions and manpower were handed over to erstwhile the DoE. Hydro-met Unit was renamed as the Flood Warning Section under the HMSD, DoE.

2011	As per the decision of 67th Session of *Lhyengye Zhungtshog (LZ)* held on 30th March 2010 the Department of Energy (DoE) was restructured into three new departments, viz.: Department of Hydropower and Power Systems (DHPS), Department of Renewable Energy (DRE) and Department of Hydro-met Services (DHMS). The Department of Hydro-met Services (DHMS) operated with four functional divisions: Planning Coordination and Research Division (PCRD), Hydrology Division (HD), Meteorology Division (MD) and Snow and Glacier Division (SGD).
2016	As per the recommendation of the Organisation Development) Exercises (ODE)carried out by the Royal Civil Service Commission (RCSC), the Cabinet during its 92ndLhyengyeZhungtsog (LZ) Meeting held on 11th December 2015 approved the establishment of National Centre for Hydrology and Meteorology (NCHM) from erstwhile Department of Hydro-met Services, MoEA. The Centre was formally established in September, 2016 and was delinked from the Ministry of Economic Affairs in January 2017. Some of the mandates and functions from other agencies were also transferred NCHM to streamline and avoid duplication during the process of institutional reorganization. a. Glaciology Division was transfer from Department of Geology and Mines (DGM), MoEA to NCHM vide Office Order No. MOEA/HRD-01/2016/543 dated August 29, 2016. b. Aviation Meteorological Services from the Department of Air Transport (DoAT), MoIC to the NCHM vide Transfer Order No. MoIC/HRM-06/2017/1701, dated 01/02/2017.
2020	Internal reorganisation of NCHM was proposed in 2020 based on additional mandates on ambient water quality monitoring transferred from NECS, to streamline functions within the Center for effective utilization of manpower (resizing- do more with same number) with following objectives: a. To improve the center's capacity to handle its internal and external functioning and relationships; b. To ensure proper classification of position titles and categories through harmonisation of the position titles; c. To ensure clear career progression for existing employees and d. To align organisation structure with strategy and long-term goals for effective delivery of services. RCSC approved in following: a. Dissolution of HOID and creation of Technical Standard and Research Division vide order no. RCSC/HRMD/7/2021 dated 5 August 2022. b. Dissolve of Regional Office, East in Mongar. c. Entry Level of Hydro-met Technician with TTI graduate at S3A.

BACKGROUND, VISION, MISSION, ORGANISATION STRUCTURE, MANDATES AND FUNCTIONS OF NATIONAL CENTRE FOR HYDROLOGY AND METEOROLOGY

ABOUT ORGANISATION

1. Introduction

1.1 Background

As per the recommendation of the Organisation Development (OD) exercises carried out by the Royal Civil Service Commission (RCSC), the Cabinet during its 92nd Lhyengye Zhungtshog (LZ) Meeting held on 11th December 2015 approved the proposal for establishment of National Center for Hydrology and Meteorology (NCHM) by reorganizing the Department of Hydro-Met Services (DHMS) under the Ministry of Economic Affairs.

With approval of Royal Civil Services Commission (RCSC) vide letter RSCS/HRMD/26/2016/618 dated August 10, 2016, the **National Center for Hydrology and Meteorology (NCHM)** was established after reorganizing the Department of Hydro-met Services under the Ministry of Economic Affairs by transferring additional mandates on glaciology and aviation meteorology along with staff from the Department of Geology and Mines (DGM, MoEA) and the Department of Air Transports (DoAT, MoIC) respectively.

The Center was formally delinked from the Ministry of Economic Affairs vide letter no. MoEA/SEC/HRD/2017/06 dated January 24, 2017 with effect from 1 February 2017.

1.2 Objectives of Internal Re-organisation of NCHM

Internal re-organisation of NCHM was proposed in 2020 based on additional mandates on ambient water quality monitoring from NECS, to streamline functions within the Centre for effective utilization of manpower (resizing- do more with same number) with following objectives:

a. To improve the center's capacity/competency to handle its internal and external functioning and relationships;
b. To ensure proper classification of position titles and categories through harmonisation of the position titles;
c. To ensure clear career progression for existing employees and
d. To align organisation structure with strategy and long-term goals for effective delivery of services.

The following proposals for structural changes and staffing of the Centre were submitted to RCSC for review and considerations:

a. Proposal for Structural Changes, Division Creation, Position Title and Change in position directory submitted to RCSC in 6 April 2020
b. Upgrade Section to Division (Aviation Meteorological Services Division (AMSD)

c. Creation of Sediment and Water Quality Monitoring Section Submitted to RCSC in 14 April 2020
d. Dissolve Hydromet Operation and Infrastructure Division (HOID) and mandate and merge staff with respective Weather and Climate Services Division (WCSD) and HWRSD and
e. Create a new Technical Standard and Research Division

Accordingly, the RCSC approved the following:

a. Dissolution of HOID,
b. Dissolve of Regional Office, East in Mongar,
c. Approved creation of Technical Standard and Research Division (TSRD)
d. Entry Level of Meteorology/Hydrology Technician at S3A with certificate course from TTI.

2. Vision, Mission and Goals

2.1 Vision

Centre of Excellence in Hydrology, Meteorology and Cryosphere Science and Services.

2.2 Mission

Monitoring and understanding of hydrology, weather, climate and cryosphere, for timely provision of information and services to protect lives and property and support national needs for ecologically balanced sustainable development.

2.3 Core values

a. Commitment and loyalty in delivery of products and services
b. Integrity;
c. Professionalism in support of science, research, objectivity, impartiality, and excellence;
d. Mutual respect, cultural sensitivity and non-discrimination.

2.4 Goals

NCHM goals are to:

a. Improve result-based decision support service for weather incidents and events that threaten lives and livelihoods;
b. Enhance climate services to understand and adapt to climate-related risks;
c. Develop capacity to provide integrated and coupled monitoring, detection and forecast services to support assessment and management of water resources and hydro-meteorological hazards;

d. Build competence to provide sector-relevant information for socio-economic development, and support development of integrated environmental services to foster healthy communities and ecosystems;
e. Sustain highly skilled professional workforce equipped with training, tools and infrastructure to fulfil the mission.

2.5 Strategies

The following strategies would be used to achieve the above goals:

a. Modernising basic services and systems to enhance situational awareness through reliable, robust and integrated monitoring and observing system;
b. Focusing on need-based research, modelling and prediction to advance knowledge and understanding of the natural hydro-meteorological systems and related physical processes;
c. Improving data, ensemble & probabilistic forecasts and multi-hazard warning services from an operational framework for hydro-met services;
d. Seamless, integrated and interoperable information management system to guide planning, decision and action;
e. Developing result-oriented and impact-based decision-support systems for facilitating various sectors to support fulfilling their own missions;
f. Dynamic science/policy interface for effective decision-making in socio-economic development and disaster prevention & preparedness;
g. Enhancing competence and capacity of providers, users and partners in hydro-met activities;
h. Establishing collaboration and linkages with relevant national, regional and international organisations.

ORGANISATION STRUCTURE, MANDATES AND FUNCTIONS

3. Structure, Mandates and Functions

The National Centre for Hydrology and Meteorology (NCHM) is an autonomous scientific and technical agency of the Royal Government of Bhutan responsible for understanding the behaviors of atmosphere, its interaction with cryosphere and water bodies, the weather and climate and distribution of the country's water resources. It is the nodal agency responsible for generation of information and delivery of products and services on weather, climate, cryosphere and water resources in Bhutan.

3.1 Governing Board

As per the Agencification Framework for Civil Services developed by RCSC (April, 2015), the National Center shall constitute a Governing Board (GB) to provide strategic and policy direction for overall governance and management of the Centre. Therefore, the Center is governed by the GB and its members approved by the Cabinet. The Terms of References (ToR) of the Governing Board was approved during the 2nd Governing Board Meeting of the Center held on April 2, 2018 (Annexure -V).

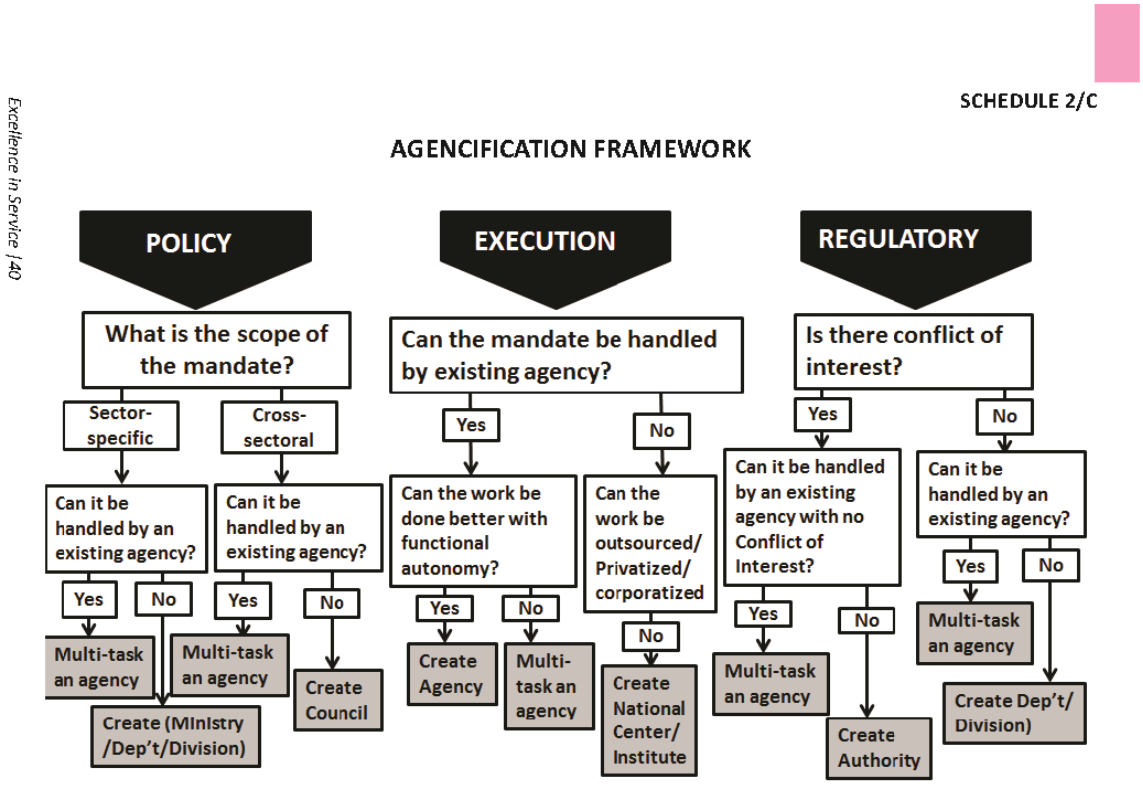

Figure 1: Agencification Framework (BCSR, 2018, RCSC)

3.2 Linkage to International Organisation

The Centre is the national designated focal point for the World Meteorological Organisation (WMO), the Intergovernmental Panel for Climate Change (IPCC) and other regional organisation dealing with weather, climate and flood. The Head of the Centre is designated as the Permanent Representative (PR) of Bhutan with the World Meteorological Organisation.

3.3 Existing Structure

Currently, the Centre is organized into Secretarial Services with four Technical Services Divisions head by Director;

a. Office of the Director General
b. Secretariat Services (Planning and Program, HR Services, Administration, Finance, Procurement/Store, ICT)
c. Technical Standard and Research Division (TSDR)
d. Cryosphere Services Division (CSD)
e. Weather and Climate Services Division (WCSD)
f. Hydrology and Water Resources Services Division (HWRSD)

Old and new approved organogram of Center is shown in *Figure 1* and *Figure 2*.

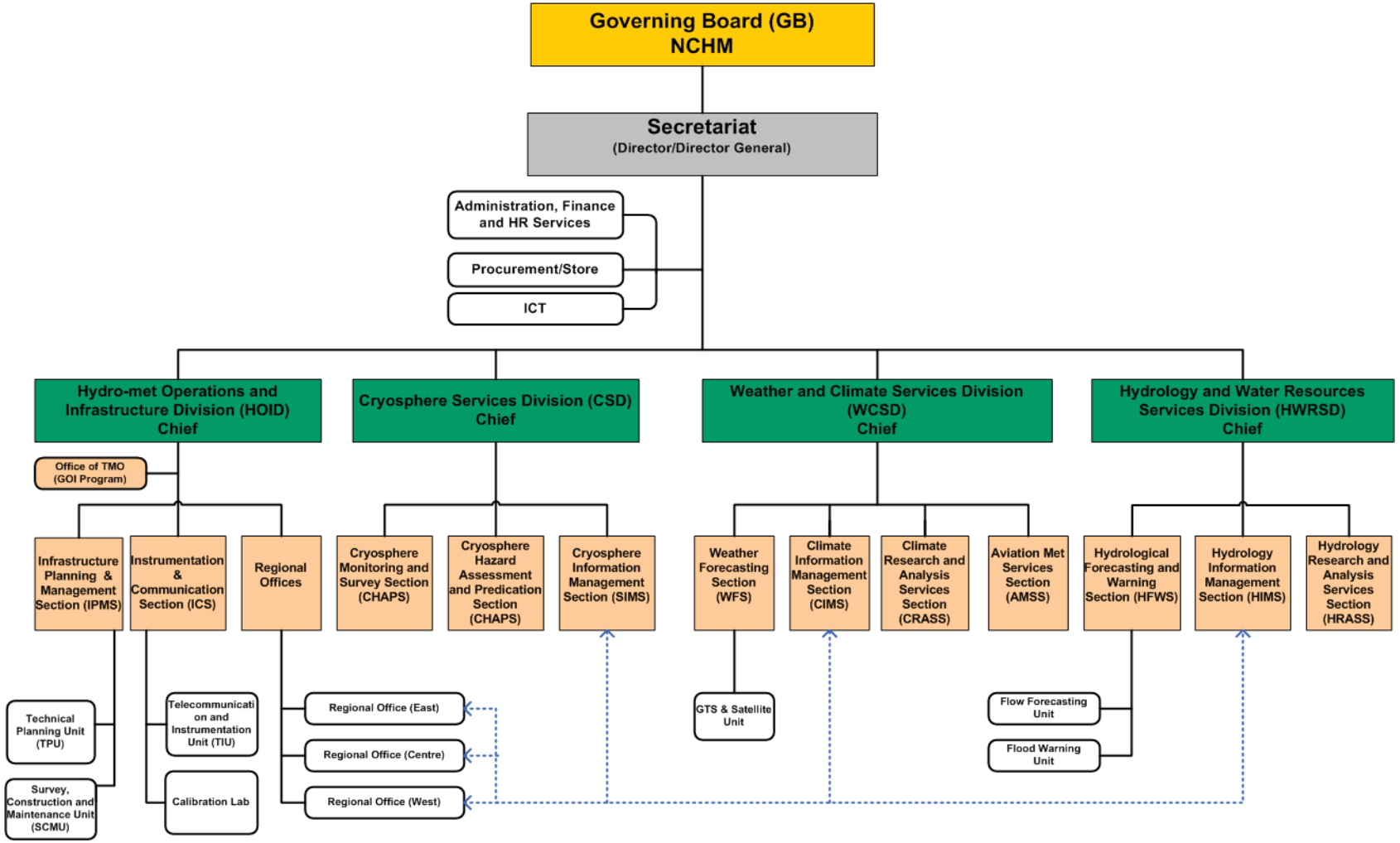

Figure 2: Approved Organogram of NCHM by RCSC (Vide Letter No. RCSC/HRM/26/2016/618 dated August 10, 2016)

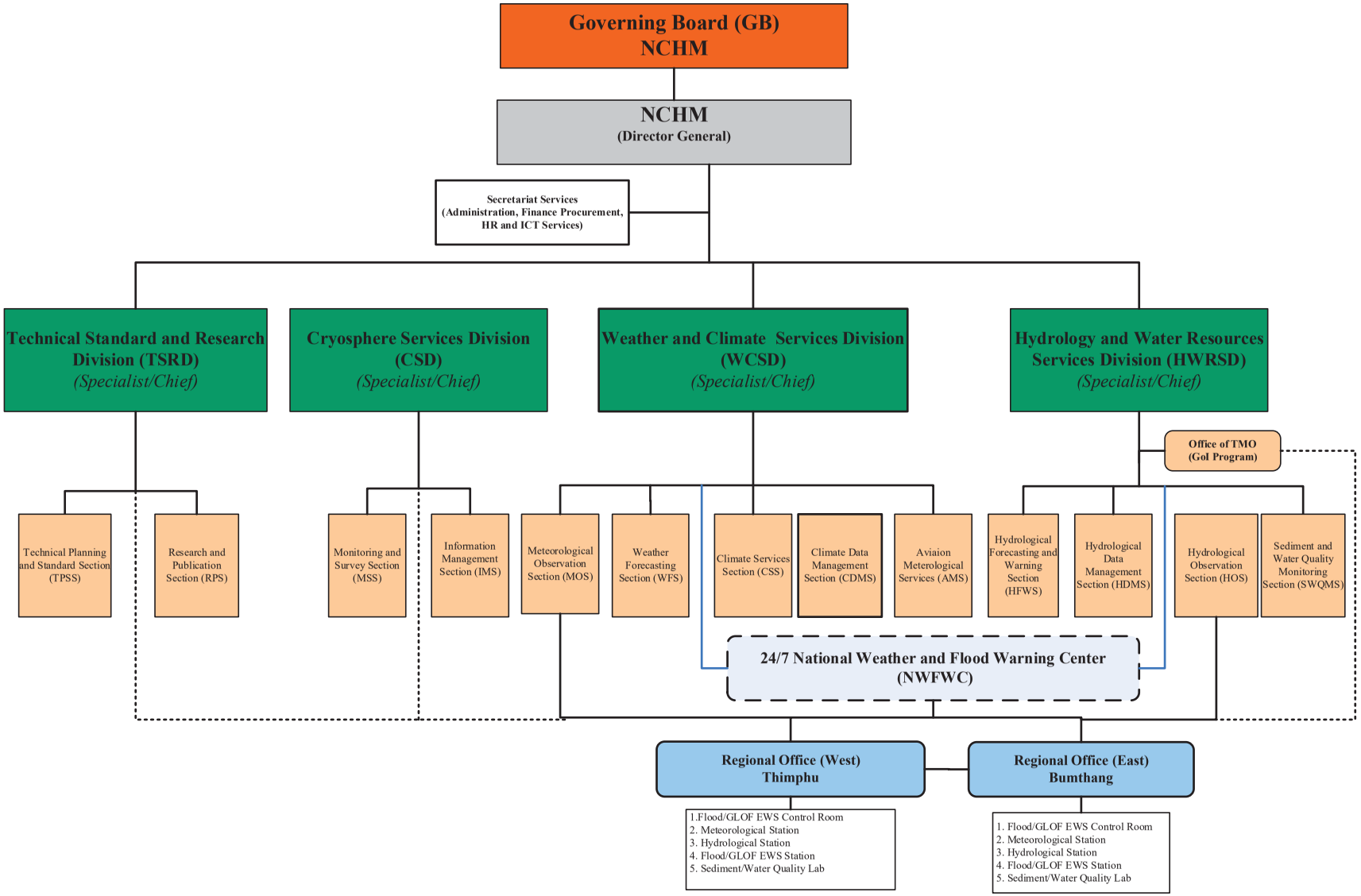

Figure 3:Approved Revised Organogram of NCHM (After Internal re-organisation, 2022)

3.4 Mandates

NCHM is mandated to provide scientific and technical services in hydrology, water resources, meteorology, climatology, and cryosphere to ensure the safety, socio-economic well-being of society and to support national and international needs.

The scope of the National Meteorological and Hydrological Service (NMHS) depends on its mandate, national arrangements and policies and geography. The diagram below shows the overall breadth of services that can be provided in an integrated end-to-end NMHS system (see Figure 3). It shows the flow of meteorological, hydrological and related information to produce services, but there is also a counterpart flow back from the users of information about requirements and the quality of the services. The observation, research and data management and modelling are core activities and functions to provide services.

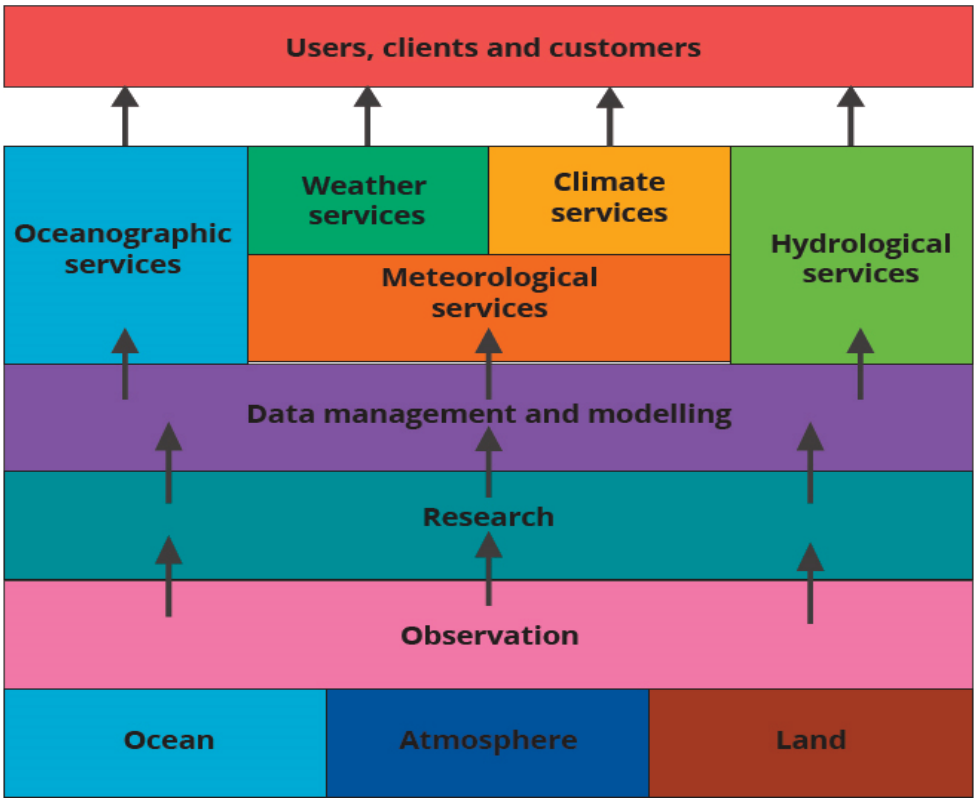

Figure 4: Range of services provided by NMHSs (WMO)

The mandates listed as:

a. Planning and operation of national hydrological (surface and subsurface) and meteorological (surface and upper air) observation network and its communications systems required for monitoring and data collection.
b. Study and monitor cryosphere (snow, glaciers, glacier lakes, permafrost), generate science-based information and provide to the relevant stakeholders for planning of resources and recommend appropriate mitigation and adaptation measures to address the associated hazards.

c. Study and provide public weather services, severe weather warnings, meteorological data management, aviation meteorological services, agro-meteorology and climate change information and services.
d. Aeronautical Meteorological Observation and provide forecast and warning services;
e. Carryout water resources assessment, inventories, hydrological forecasting, hydrological data management, dissemination of hydrological data and information and provide early warning services related to flood and GLOF.
f. Assessment and mapping of hydro-meteorological and GLOF hazards at the sub-basin and basin level.
g. Capacity and human resources development through training and education.
h. Research and application of science and technology in operational meteorology, hydrology and cryosphere for development of services and products.
i. Promote collaboration and institutional linkage with national, regional and international organisations related to weather, climate, hydrology, cryosphere, and water resources for exchange of data, research and technology transfer.

3.5 Functions

The following are the main functions of the Centre:

a. Establish and operate National Observation network and telemetry system for weather, climate, cryosphere, hydrology and water resources;
b. Maintain national database (repository) of hydrology, meteorology, cryosphere and related environmental data and information
c. Provide Public Weather Services (PWS), climate services, ago-meteorology, climate projection and
d. Aviation meteorological observation and provide aviation meteorological services.
e. Provide hydrological forecasting (flow and flood), water resource assessment and inventories.
f. Assessment and mapping of hydro-meteorological and GLOF hazards, and provide Early Warning Services.
g. Study and monitoring of snow, glaciers and glacial lakes in the country. Conduct scientific studies on cryosphere to make inventory and assess its potential in terms of water resources. Carry out hazard assessment and recommend suitable measures to address risk and hazard associated with this field.
h. Promote and conduct research on cryosphere, meteorology (weather and climate), hydrology and water resources;
i. Enhance human resources development and professional capacity in the field of hydro-meteorology and cryosphere services;
j. Promote and facilitate standardization of hydro-met instruments, methods of observation and recording.
k. Establish collaboration and linkage with national, regional and international organisations.

3.6 Structure and Functions of Secretariat

3.6.1 Structure of Secretariat Services

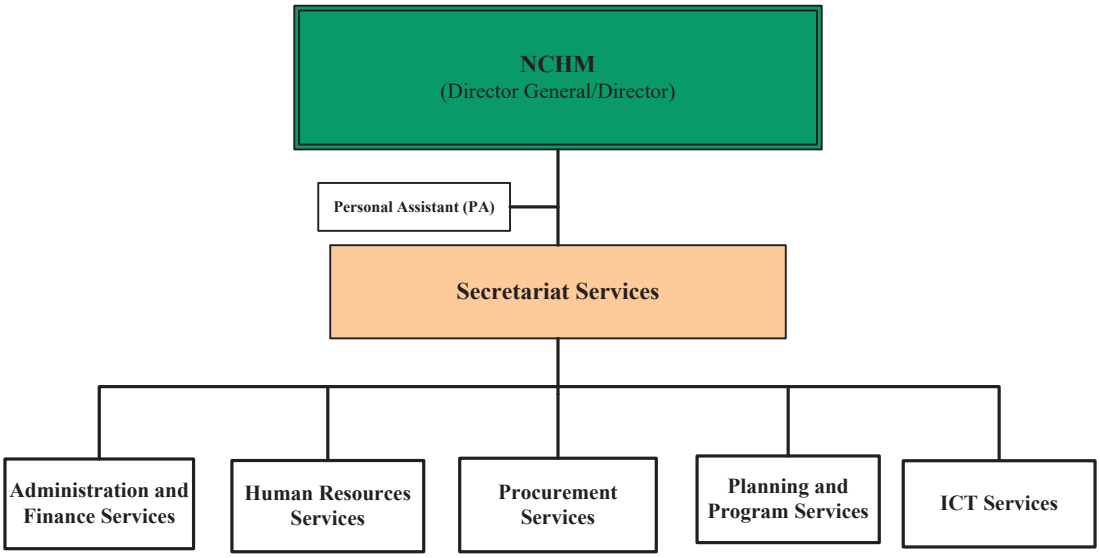

Figure 5: Organogram of Secretariat NCHM

3.6.2 Functions of Directorate

The following are main functions of Directorate:

a. Overall policy and administrative direction for leadership and management of NCHM and its divisions;
b. Liaise with the Governing Board (GB), line agencies and other stakeholders;
c. Facilitate formulation of policy and legal frameworks;
d. Facilitate in strategic planning and development of plans and programs of the Centre;
e. Facilitate mobilization of funds;
f. Monitoring and evaluation of programs/plans as per the requirement of the government procedures;
g. National focal point for World Meteorological Organisations (WMO) and International Panel on Climate Change (IPCC) as per the direction of the Ministry of Foreign Affairs;
h. Promote collaboration and institutional linkage with national, regional and international organisations;

3.6.3 Functions of Secretariat Services

Secretariat Services of the Centre includes, Administration and Finance, Human Resources and Procurement services. Secretariat services is responsible to provide the following functions to support the operation of main technical divisions;

a. Policy and planning services
b. Human resources management and development services
c. Finance and Accounts services
d. Administrative services
e. Procurement and assets management services
f. Pool vehicles services
g. Liaise with other agencies

3.6.3.1 Functions of Information, Communication and Technology (ICT) Services

a. Liaise with Department of IT and Telecom, MoIC;
b. Develop frameworks for implementation of standards for the development of software applications for hydro-met database management and information dissemination;
c. Planning and development of software solutions for effective delivery of service
d. Provide end-user training and support of implemented solutions.
e. Provide support in the development and maintenance of software solutions to other divisions of the Centre
f. Over all operation and management of NCHM systems, LAN and electronic security;
g. Provide ICT infrastructure related support to other divisions and field offices

Technical Standard and Research Division (TSRD)
(Structure, Mandate and Functions)

3.7 Technical Standard and Research Division

3.7.1 Mandate

The Technical Standard and Research Division (TSRD) is mandated to coordinate research and publications, calibration of instruments, standardization of hydro-meteorological data and related observations.

TSRD was created to oversee and develop necessary standards in line with regulatory requirements of WMO and ICAO for operation of hydrology, meteorological, aviation and cryosphere data collection and services. Use and adoption of standard hydro-meteorological equipment, method of measurements and standardization of data is very important for scientific works and investigation. The Centre needs to develop standard, technical regulation and methods and follow a number of regulatory requirements (Figure 4) including the quality of hydro-meteorological and related environment data that are shared with users and exchanged with international organisations.

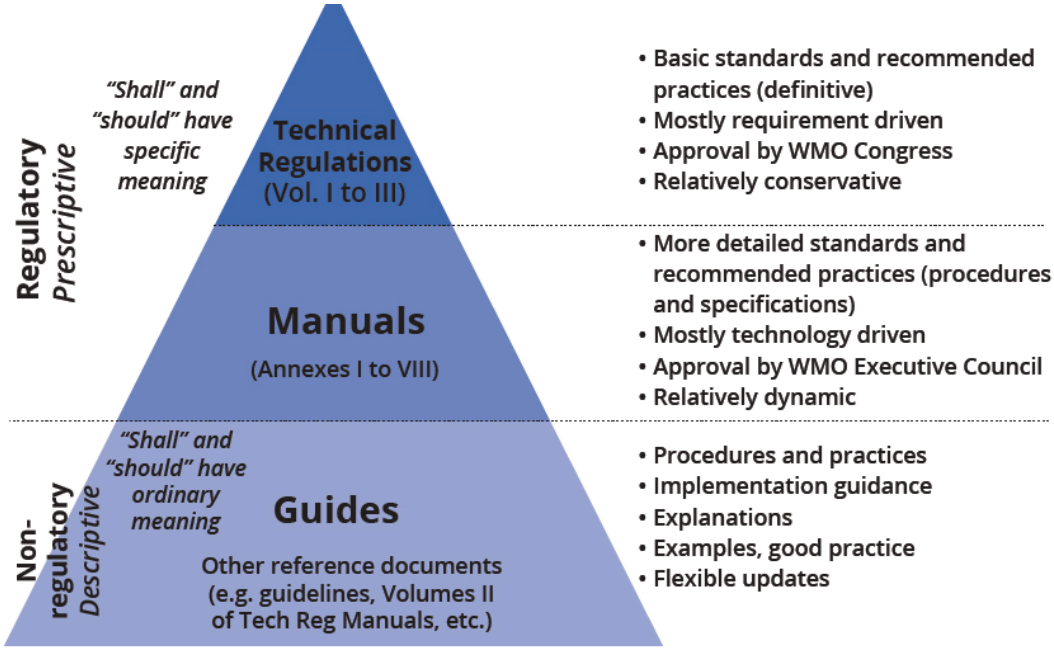

Figure 6: WMO Technical Regulations and other guidance material (Source WMO)

3.7.2 Functions of TSRD

a. Develop and establish operational policies, guidelines and other relevant standards pertaining to hydro-meteorological instruments, observations and statistics;
b. Develop and promote national standards for methods, procedures, techniques and practices in hydrology, meteorology and operational hydrology in coordination with relevant regulatory agencies and Technical Regulations, guidelines and manuals of WMO and ICAO;
c. Develop Technical Manuals for Operational Hydrology, Meteorology and Cryosphere observations;

d. Develop competency framework and training manuals for operational hydrology, meteorology and cryosphere in coordination with other divisions;
e. Carry out calibrations of hydro-met instruments and equipment;
f. Coordinate and conduct research improvements to existing standards, technical manuals and guidelines;
g. Coordinate research on new science and technologies with technical divisions and external agencies;
h. Provide research clearance on the field of hydrology, meteorology and cryosphere sciences;
i. Provide technical sanction for works and procurement of goods and services;
j. Publication of research journal, technical manual and related reports.
k. Compliance monitoring of standards and quality assurance for observation and data collection in the field of hydrology, meteorology and cryosphere.

3.7.3 TSRD Structure

Technical Standard and Research Division (TSRD) has two Sections as follows:

a. Technical Planning and Standard Section (TPSS)
b. Research Coordination and Publication Section (RCPS)

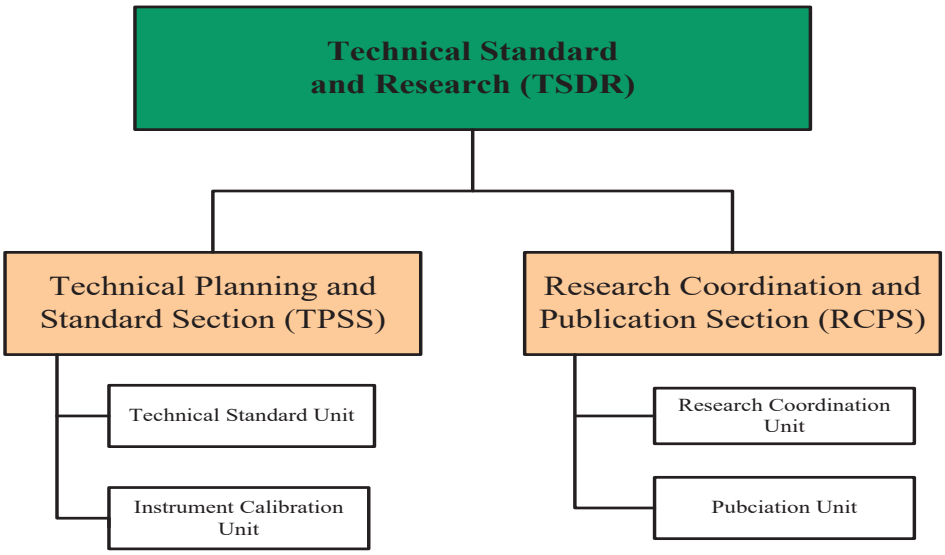

Figure 7: Organogram of Technical Standard and Research Division (TSRD)

3.7.3.1 Functions of Technical Planning and Standard Section (TPSS)

a. Review WMO, ICAO and other technical regulations, technical manuals, Guidelines and related documents pertaining to hydro-meteorological instrumentation, and observations and statistics;
b. Develop national technical regulations, manuals and guidelines and related cement in consolation with the regulatory agencies pertaining to hydro-meteorological instrumentation, and observations and statistics in Bhutan;

c. Promote and implement national standards for methods, procedures, techniques and practices in hydrology, meteorology and operational hydrology;
d. Provide technical sanction for the implementation of works and procurement of goods and services;
e. Develop technical manuals for operational hydrology, meteorology and cryosphere observations;
f. Develop training manuals for operational hydrology, meteorology and cryosphere;
g. Establish and carryout instrumentation and calibration of hydro-met instruments and accessories.
h. Compliance monitoring of the services for quality assurance.

3.7.3.2 Functions of Research Coordination and Publication Section (RCPS)

a. Coordinate and facilitate implementation of research works on hydrology, meteorology and cryosphere in collaboration with service divisions;
b. Review the research proposals and issue clearance pertaining to hydrology, meteorology and cryosphere sciences in Bhutan in coordination with service divisions;
c. Liaise with national and external universities and institutes for implementation of research on hydrology, meteorology and cryosphere and climate change issues.
d. Coordinate and carry out research and applications of new science and technologies in collaboration with technical divisions and external agencies/universities/institute;
e. Coordinate and plan research activities in consultation with service divisions;
f. Co-ordinate the publication of Hydro-meteorological Journals and other publications;
g. Manage and share knowledge and information on research and related studies.

Cryosphere Services Division (CSD)
(Structure, Mandate and Functions)

3.8 Cryosphere Services Division

The Glaciers are an indicator of climate change. It is the main source and storehouse (reserved) of water resources for Bhutan. It also maintains and regulates the ecosystem of alpine wetlands. Cryosphere conditions significantly influence the water resources availability and weather affecting, safety of life, economic development and management of important mountain resources. The cryosphere are sources of water resources in Bhutan and provide the fresh water reserved for water resources management downstream and environment sustenance. The update of glaciers and glacier lakes inventory and cryosphere observations and the monitoring can improve flood/GLOF forecasts and warnings. Past and present cryosphere information is necessary to enable better understating of water resources management and associated hazard and risk downstream. Cryosphere data and information are required to manage disaster preparedness.

3.8.1 Mandate

The Cryosphere Services Division (CSD) is mandated to monitor, carryout research and inventory on cryosphere (snow, glaciers, glacier lakes) and hazard assessment to generate science-based information for understanding of climate change, mitigation and adaptation planning.

3.8.2 Functions of CSD;

a. Prepare plans and programs related to cryosphere (snow, glaciers, glacier lakes) monitoring in Bhutan Himalayan;
b. Time series monitoring of glaciers and glacial lakes;
c. Operation and maintenance of cryosphere monitoring networks in coordination with other divisions of the Centre;
d. Maintain Inventory and National Cryosphere Database (Cryosphere Information Hub);
e. Assess hazards and risks of glaciers and glacier lakes and threat of Glacial Lake Outburst Flood (GLOF) and melt contribution from glacier and snow to the river runoff;
f. Research and publish scientific papers on cryosphere and related studies.
g. Coordinate with national agencies related to snow and glacier monitoring and data collection;
h. Foster collaboration with regional and international institutions/agencies involved in the field of cryosphere research and data sharing through the Centre;
i. Provide professional and technical services to the Centre/other agencies on conceptual and methodological aspects of cryosphere monitoring and related studies.

3.8.3 CSD Structure

Cryosphere Services Division (HSD) will organize two sections:

a. Monitoring and Survey Section (MSS)
b. Information Management Section (IMS)

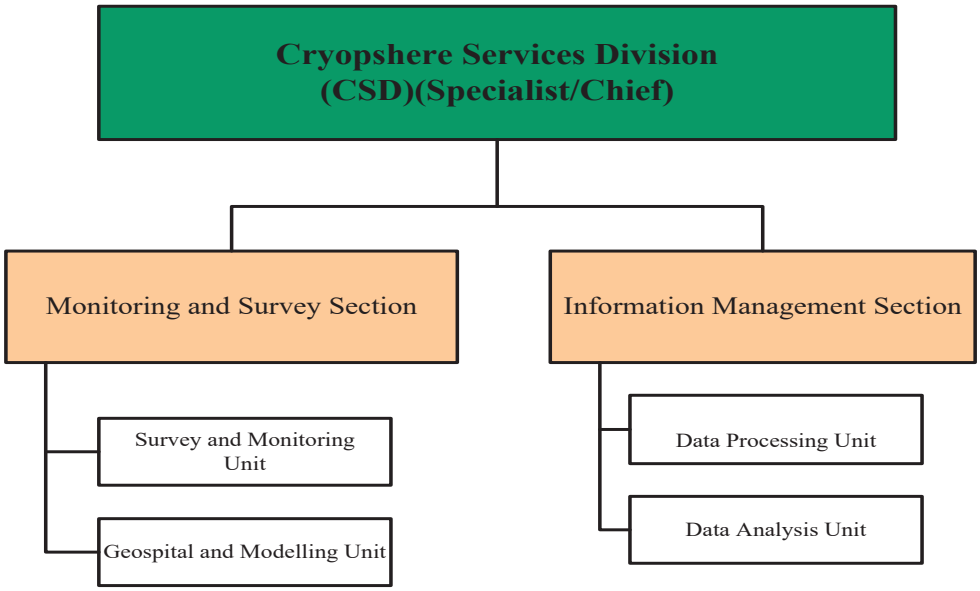

Figure 8: Organogram of CSD

3.8.3.1 Functions of Monitoring and Survey Section (CMSS)

a. Develop long term cryosphere monitoring program of Bhutan Himalayas;
b. Establish and operate long term benchmark glacier monitoring program to study status of the glaciers (mass balance, terminus activity, glacier surface activity, glacier dynamics including flow velocity and ice thickness), flow contribution and impact of climate change on water resources;
c. Establish and operate research based/time bound snow monitoring stations;
d. Preparing glaciers and glacier lakes inventory of Bhutan and updating;
e. Topographical and bathymetry survey of the glacier lakes for hazard assessment and modelling;
f. Conduct research activities on glaciers and snow melt and its contribution to surface runoff
g. Carry out Time Series Monitoring of glacial lakes, assess associated risk and implement appropriate mitigation/adaptation measures;
h. Coordinate with national stakeholders pertaining to snow, glacier and permafrost hazards and risk assessment;
i.. Breach scenerio modeling as input for hazard map preparation
j.. Carryout research activities pertaining to GLOF and related hazards/risk

k. Maintaining updated inventories on snow, glacier, and glacial lake and making making timely publications
l. Conduct research on permafrost.

3.8.3.2 Information Management Section (IMS)

a. Receive, compile raw cryosphere data (hard/soft copy) transmitted from all the manual cryosphere observation stations;
b. Entry of manual data into cryosphere database;
c. Ingest and extract data from automatic cryosphere monitoring stations into database;
d. Maintain meta-data of cryosphere monitoring network (Manual/automatic);
e. Perform data quality and validation of cryosphere and related environment data coordination with other divisions;
f. Process aı
g. Perform data search and rescue in collaboration with field staff and other divisions;
h. Operate and maintain national cryosphere database (Cryosphere hub) and archival system for data security;
i. Facilitate publication of annual cryosphere Databook and related reports;
j. Compile all the raw/primary Data Forms received from the sites in the library;
k. Digitization and archival of all the historical cryosphere raw data;
l. Dissemination of cryosphere data as per "Guidelines on the Exchange and Dissemination of Hydro-meteorological Data and Information".

Weather and Climate Services Division (WCSD)
(Structure, Mandate and Functions)

3.9 Weather and Climate Services Division

Weather and climate information services help individuals and organisations make climate smart decisions. Climate data and services helps decision makers and climate-sensitive sectors with better information to help society adapt to climate variability and change. Role of National Metrological and Climate Services involve systematic observation, monitoring and detection of climate change as a contribution to scientific basis in the understanding of the changing climate in order to build resilience of communities and the economy against the associated adverse impacts through adaptation and mitigation.

3.9.1 Mandate

The Weather and Climate Services Division (WCSD) is mandated to observe and provide public weather services, severe weather warnings, climate data management and services, long range forecasting, climate change information and services, agro-meteorology, and aviation meteorological services.

3.9.2 Functions of Weather and Climate Services Division (WCSD);

a. Operation of national meteorological observation network
b. Provide Public Weather Services (PWS);
c. Monitor extreme weather events and issue warnings/bulletins/advisories.
d. Operate and maintain national climate database management system;
e. Climate modelling, downscaling and climate change projections.
f. Provide climate services including agro-meteorological services.
g. Prepare and provide short, medium, extended range and seasonal forecasts.
h. Research and development in the field of weather and climate change.
i. Aviation meteorological service provider within Bhutan
j. Education, training and awareness programs on weather and climate

3.9.3 WCSD Structure

Weather and Climate Services Division (WCSD) is organized into five Sections (Figure 6):

a. Meteorological Observation Section (MOS)
b. Climate Data Management Section (CDMS)
c. Weather Forecasting Section (WFS)
d. Climate Services Section (CSS)
e. Aviation Meteorological Section (AMS)

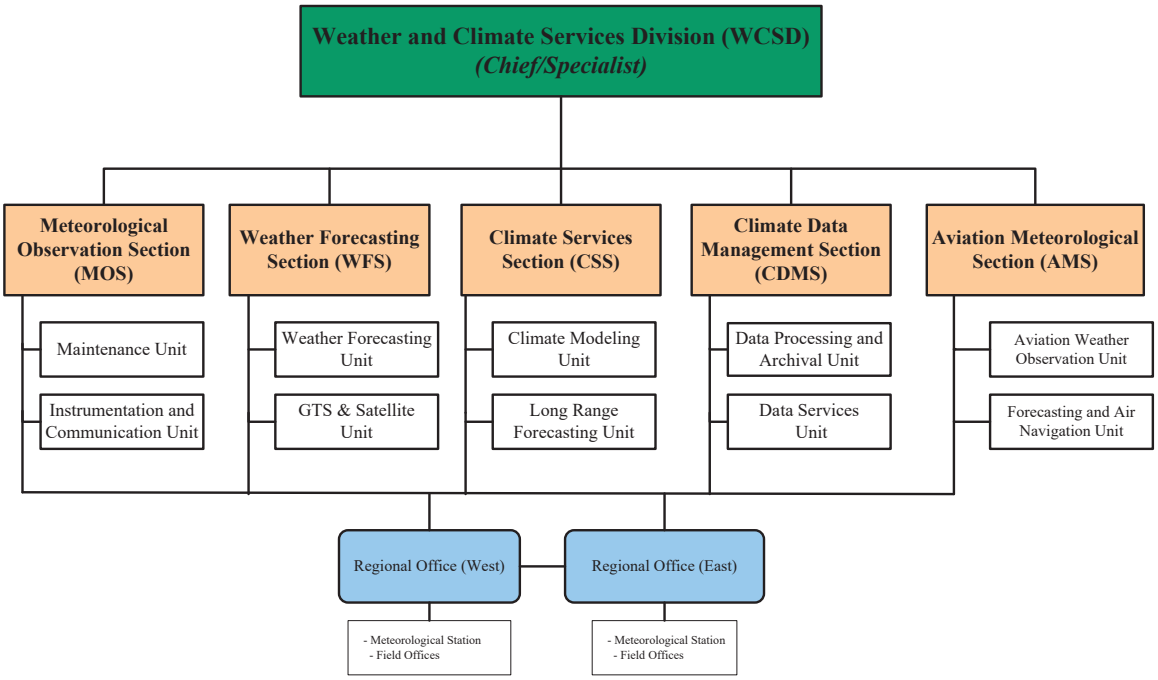

Figure 9: Structure of Weather and Climate Services Division (WCSD)

3.9.3.1 Functions of Meteorological Observation Section (MOS)

Meteorological observation and data collection are required to understand the patterns and trends of weather and climate to provide scientific evidence.

The functions of MOS shall include the following:

a. Planning and establishment of national meteorological network and air-quality monitoring network in consultation with the services divisions and line agencies;
b. Review meteorological and communication network and infrastructure development plans for implementation;
c. Operate and maintain national Synoptic, Climatological, Agro-meteorological and Automatic Weather Station (AWS) network
d. Operate and maintain Automatic Weather Observation System (AWOS) for Aviation
e. Operate and maintain Air Quality monitoring network
f. Prepare drawing, cost estimates, tendering and implementation of works related to establishment of meteorological stations and related infrastructures
g. Operation and maintenance of national meteorological observation networks including communication networks and related infrastructure
h. Inventory of meteorological observation network stations and infrastructures
i. Technical backstopping services to other agencies in meteorological observation and instrumentation.

3.9.3.2 Functions of Climate Data Management Section (CDMS)

The climate data provides the basis for weather forecasting in short-term, and aggregated over years and years, it shows how the climate is changing. It is therefore important to a good database management system to process, quality controlled and archive observation

data. The longer time series is required to study and understand patterns and trends to understand climate change. CDMS will be responsible for management of the National Climate Database Management System (CDMS).

The functions of CDMS includes the following;

a. Receive and compile meteorological data from manual stations
b. Data entry into database
c. Digitization of data
d. Extract data from Automatic Weather Stations (AWS)
e. Operate and maintain national Climate Database Management System
f. Archive historical synoptic, climatological, agrometeorological and AWS data
g. Carry out data processing and analysis
h. Carry out data backups and ensure data security
i. Carry out data quality control
j. Provide climatological data to government, private and users
k. Publish Climate data book
l. Publish monthly climate reports
m. Publish the state of climate report

3.9.3.3 Functions of Weather Forecasting Section (WFS)[1]

a. Provide public weather services, daily and three days' weather forecast
b. Monitor weather (24/7) attend to hotline and provide weather updates
c. Monitor extreme weather events (24/7)
d. Conduct weather briefings and media briefings
e. Issue extreme weather advisories and warnings
f. Provide aviation weather forecasts
g. Provide city forecast for World Meteorological Organisation (WMO)
h. Provide tailor made forecasts and information
i. Provide Impact Based Forecast (IBF)
j. Operate and maintain Weather Forecasting Control Room (WFCR)
k. Operate and maintain Weather Forecasting and Command Room (WFCR) of the National Weather and Flood Warning Center (NWFWC) 24/7 in coordination with the Flood Monitoring and Command Room (FMCR).
l. Operate and maintain Global Telecommunication System (GTS)
m. Operate and maintain satellite image reception and processing system (24/7)
n. Share local observation data to the Regional Telecommunications Hubs (RTH)
o. Monitor and archive meteorological and climatological events
p. Maintain and operate Common Operating Platform (COP) for weather forecasting (SMARTMET system)
q. Conduct Weather Research Forecast Modelling (WRF) and validation
r. Carry out verification of forecast
s. Carry out data assimilation

[1] *Weather Forecasting and Section (WFS) of WCSD shall work in close coordination with Hydrological Forecasting and Warning Section (HFWS) of HWRSD under the umbrella of National Weather and Flood Warning Centre (NWFWC) of the Center.*

3.9.3.4 Climate Services Section (CSS)

Climatology is the foundation of climate services. A climate service is the provision of climate information based on scientifically credible information and expertise to assist decision-making. Climate services equip decision makers in climate-sensitive sectors with better information to help society adapt to climate variability and change. Therefore, CSS will be responsible for climate and climate related services from data measurement to climate change.

The functions of CSS will include the followings;

a. Provide extended range forecasts (weekly forecasts)
a. Provide medium range weather forecasts (7-10 days' forecasts)
b. Carry out NWP modelling for long range forecasting
c. Issue seasonal monsoon forecasts
d. Issue monthly forecasts
e. Carry out forecast verification
f. Monsoon studies and provide monsoon outlook
g. Coordinate National Framework for Climate Services and WMO Climate Services activities
h. Carry out research on long range forecasting
i. Carry out research and provide agro-met services
j. Carry out climate studies, research, modelling and analysis
k. Carry out climate projection and downscaling
l. Produce climate maps and charts, publish climate normal and indices
m. Support climate change impact modelling and studies
n. Policy guidance on climate adaptation
o. Provide tailor made climate service
p. Provide policy guidance on climate change adaptation

3.9.3.5 Aviation Meteorological Section (AMS)

The Aviation Meteorological Office is mandated to provide aviation weather services to contribute to safety, regularity, and efficiency of air navigation. The Aviation Meteorological Office of NCHM in Bhutan operates in accordance to:

- Bhutan Civil Aviation Authority (BCAA requirement wherein NCHM is designated as the national Aeronautical Meteorological Service Provider (AMSP) within Bhutan vide letter ref. BCAA/ANS-MET/010/196 dated August 29, 2017 in pursuant to section 12(1)(e) & 57 of Civil Aviation Act of Bhutan 2016,
- ICAO Documents Annex 3 - Meteorological Services for International Air Navigation, DOC 8896-AN/893/4 - Manual of Aeronautical Meteorological Practices, DOC 7030 - Regional Supplementary Procedures.

Functions of AMS includes the followings;

a. Provide aviation met services for safe and regular operation of flights
b. Operate and Maintain the Aviation Met Station network
c. Collect and maintain the records of meteorological observations of all aerodromes

d. Collect weather information (MET REPORT/SPECIAL REPORT) at half hourly intervals;
e. Provide METAR/SPECI at half hourly intervals to Air Traffic Control, Airlines, Flight dispatchers and Pilots
f. Disseminate meteorological information (METAR/SPECI) to the originating aerodromes, Airlines, ATC and domestic airports through Automatic Message Handling System (AMHS);
g. Monitor aerodrome weather conditions and report to ATC for updating the pilots for landing and take-off;
h. Monitor and operate aviation met infrastructure in respective airports for safe operation of flights as per Bhutan Civil Aviation Authority (BCAA) and ICAO norms
i. Coordinate with Air Traffic Controllers and Air Traffic Services
j. Liaise with BCAA, ICAO, WMO, DoAT and Airlines
k. Provide aerodrome weather conditions for landing and take off
l. Provide Now casting
m. Provide SIGMET
n. Coordinate with Air Traffic controllers and Air Traffic Services

Hydrology and Water Resources Services Division (HWRSD)
(Structure, Mandate and Functions)

3.10 Hydrology and Water Resources Services Division

In broad terms, a hydrological service includes the provision of information about the water (or hydrological) cycle and the status and trends of a country's water resources.

The role of a National Hydrological Service (NHS) is to provide accurate information on the condition and trend of the country's water resources. This is required for economic and social development and for maintaining environmental quality. In general, the information is used for planning, development and management of water resources.

Understanding of Hydrology and Water Resources is very important for the effective use of hydrology in sustainable development to reduce the risk and impacts of water-related disasters and to support effective environmental management at national, river basin, Dzongkhag and Gewog and community levels.

3.10.1 Mandates

Hydrology and Water Resources Services Division (HWRSD) is mandated for water resources assessment, hydrological observation, forecasting, hydrological data management, dissemination of hydrological data and information and issue early warning services related to flood and GLOF.

3.10.2 Functions of HWRSD

a. Installation, operation and maintenance of national hydrological and flood observation networks including sediment and ambient water quality
b. Operation of flood/GLOF early warning systems
c. Provide hydrological forecast, issue flood/GLOF advisories and early warning services
d. Operation of National Hydrological Database Management System
e. Carry out national water resource assessment and maintain river information system
f. Carry out research and development in the field of hydrological science
g. Carryout flood/GLOF hazard assessment and mapping
h. Provide hydrological data and information
i. Conduct education, training and awareness programs on operation hydrology and GLOF EWS

3.10.3 HWRSD Structure

Hydrology and Water Resources Services Division (HWRSD) is organized into five Sections:

a. Hydrological Observation Section (HOS)
b. Sediment and Water Quality Monitoring Section (SWQMS)
c. Hydrological Forecasting and Warning Services (HFWS)

d. Hydrological Data Management Section (HDMS) and
e. Office of Technical Maintenance Officer (TMO) (GoI Program)

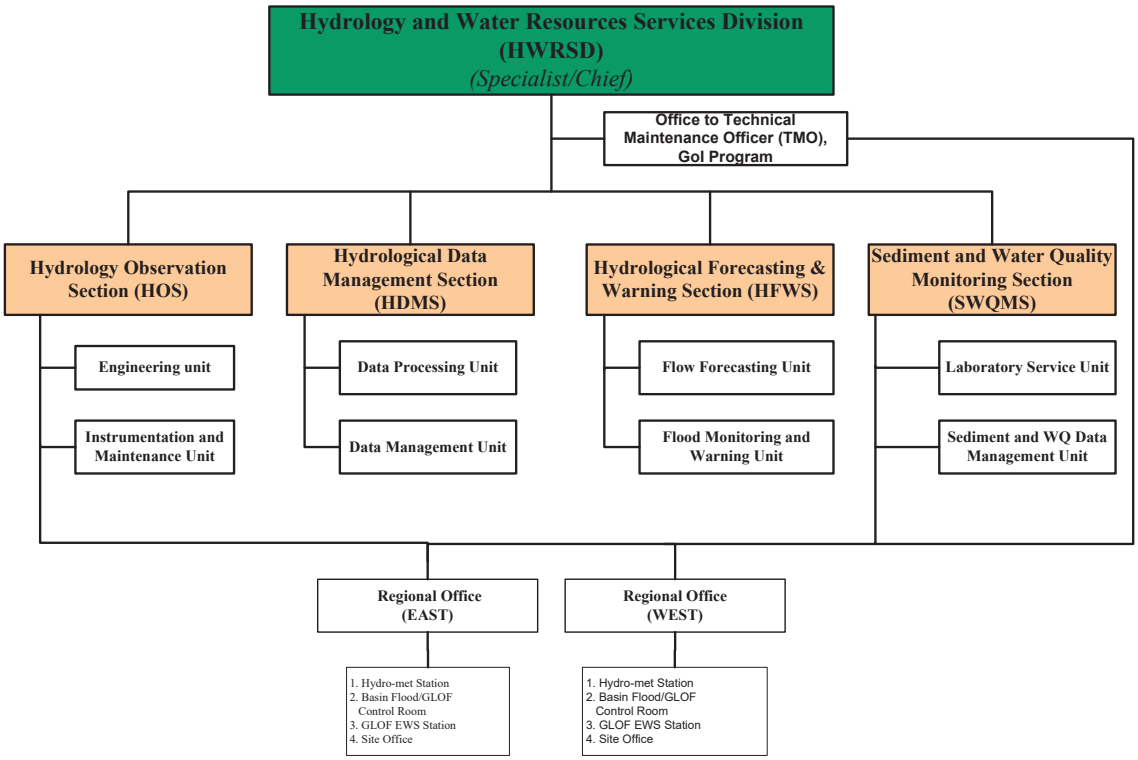

Figure 10: Proposed organogram of HWRSD

3.10.3.1 Functions of Hydrological Observation Section (HOS);

a. Planning, establish and operation of national hydrological observation and flood/GLOF Early Warning System (EWS) network along the river basins;
b. Establish and operate telecommunication networks for rapid exchange of observation, data and flood/GLOF warning services;
c. Install and operate additional water quality monitoring stations/sites based on requirement and needs;
d. Prepare annual plans and budget in consultation with the Division;
e. Prepare drawing, cost estimate of works related to establishment of hydrological stations, infrastructure and installation;
f. Tendering of works related to establishment/construction of hydro-met stations, related infrastructure and installation;
g. Construction and supervision of hydrological and flood warning network stations, field offices and related infrastructure;
h. Inventory of hydrological network and infrastructures;
i. Maintenance of hydrological, flood/GLOF EWS network and infrastructures;
j. Technical backstopping services to other agencies in operational hydrometry, establishment of hydrological stations and data collection;
k. Carryout low/lean flow and spot measurements;
l. Carry out the river cross section survey of hydrological stations;
m. GIS mapping of hydro-met network stations and infrastructures;
n. Carry out inspection and monitoring of hydro-meteorological stations.

3.10.3.2 Sediment and Water Quality Monitoring Section (SWQMS)

The Sediment Lab in Thimphu oversees the operation and management of all the sediment sampling networks and laboratories located in different river basins. Sediment and Water Quality Monitoring Unit was created after handing over of the ambient water quality functions by NECS vide letter no: NEC/WRCD/03/2020/495 dated April 6, 2020 to include additional responsibilities. Water quality laboratory facilities will be developed along with the existing Sediment Laboratories in Thimphu, Regional Office and other site offices in different river basins

The mandate of SWQMS is *"Monitor, assess and provide sediment and ambient water quality data and services to contribute to environment conservation and river ecosystem."*

Functions of Sediment and Water Quality Monitoring Section (SWQMS)

a. Selection of water quality monitoring methods and techniques;
b. Conduct ambient water quality monitoring (AWQM) of rivers and streams along with hydrological stations;
c. Provide technical support to the sectoral agencies in AWQM monitoring and related works;
d. Database Management (collect, process and archival) of Sediment and Ambient Water quality monitoring data and information,
e. Prepare annual Water Quality Report covering status and trends in water quality of rivers and streams;
f. Provide sediment and ambient water quality data and information services;
g. Any other related functions as and when assigned by NEC and the Centre;

3.10.3.3 Functions of Hydrology Forecasting and Warning Section (HFWS)[2]

a. Provide flood forecasting and early warning services to all the major river basins of the country through a network of flood/GLOF EWS facilities in the river basins;
b. Promote modern data collection techniques and hydrological modelling for water resources development through inflow and flood forecasting and warning services
c. Setup appropriate hydrological model for different basins for flood forecasting and inflow forecasting;
d. Operation of the Flood Monitoring and Command Room (FMCR) of National Weather and Flood Warning Centre (NWFWC) 24/7 in coordination with the basin flood warning Control Rooms;
e. Issue flood/GLOF advisories and warning services during the severe weather conditions;
f. Conduct education and awareness program on floods/GLOF EWS and post-flood investigation with concerned offices within and outside the agency;

[2] *Weather Forecasting and Section (WFS) of WCSD shall work in close coordination with Hydrological Forecasting and Warning Section (HFWS) of HWRSD under the umbrella of National Weather and Flood Warning Centre (NWFWC) of NCHM.*

g. Coordinate with the National Emergency Operation Center (NEOC)/DDM, Hydropower Plants (DGPC) and others regarding the inter-agencies Flood Forecasting and Warning Systems
h. Maintain linkages with national and local agencies related to flood/GLOF
i. Coordinate and conduct research in the field of hydrology and water resources such as flood forecasting, hazard mapping, climate change impacts on water resources
j. Coordinate and conduct water resources assessment
k. Carry out the flood frequency analysis from the timeseries hydrological information
l. Provide support and technical backstopping services to other divisions related to Flood/GLOF EWS, hydrological modeling and forecasting;

3.10.4 Functions of Hydrology Data Management Section (HDMS)

a. Receive raw data from the field stations and archive into hydrological database
b. Compile and analyze the hydrological data and water resources information relating to rivers and streams in the country
c. Perform data quality and validation of hydrological time series data collected in coordination with other divisions
d. Operate and maintain national hydrological database and archival system in respect of water resources
e. Prepare and maintain river basin and station network maps
f. Publish statistical data relating to surface water and information related to water resources
g. Provide hydrological data and information as per the data sharing guidelines
h. Publication on surface hydrological data, extreme flood events and flow status;
i. Carry out historical hydrological data analysis and publish statistical data on water resources;
j. Provide support and technical backstopping services to other divisions

3.10.5 Flood Warning Section (GoI Program)

A Hydro-meteorological and Flood Forecasting Network on Rivers System common to Bhutan and India started in 1955 with funding from the Government of India (GoI). The objective of the scheme is to share flood information with Indian States of Assam and West Bengal since all the rivers from Bhutan ultimately flow to India. This GoI scheme under the NCHM in Bhutan is looked after by the Technical Maintenance Officer (TMO) of the Flood Warning Program (GoI). TMO are deputed from GoI to Bhutan for a period of two years.

A Joint Experts Team (JET) constituted in 1979 is responsible *to "review and monitor the assigned work under the above scheme and to approve and release the funds by GoI to*

RGoB for this program". JET meetings are usually held twice a year, alternatively one in Bhutan and once in India. RGoB delegation to the JET meeting is led by Director General, National Centre for Hydrology and Meteorology (NCHM) and by the Chief Engineer, Brahmaputra & Barak Basin Organisation (BBO), Central Water Commission (CWC), Shillong, India from GoI side.

Hydro-met data from Bhutan are transmitted directly from the station via HF radio to the designated Center Water Commission (CWC) office in the Indian State of Assam and West Bengal, India as per the agreed transmission schedule. There are more than 44 regular staff (Bhutanese) working in Food Warning Stations under GoI funding.

The TMO directly reports to the Chief of Hydrology and Water Resources Services Division (HWRSD) of the Centre.

Functions of Flood Warning Section (GoI Program/TMO Office);

a. Overall administration and management of Flood Warning Program funded by GoI;
b. Timely transmission of flood warning data/information to designated contact points in India and HQ in Thimphu;
c. Up-gradation and modernization of Flood Warning Stations and required equipment for data collection and storage in coordination with the division;
d. Rehabilitation/renovation of existing infrastructure at various field stations as well as construction of new facilities in coordination with division;
e. Management of GoI budget as per the RGoB procedures;
f. Coordinate Joint Expert Team (JET) meeting between Bhutan and India on a comprehensive scheme for setting up flood forecasting (FF) systems on rivers common to India and Bhutan.

Hydromet Regional Office (HRO)
(Structure, Mandate and Functions)

3.11 Hydromet Regional Offices

For the effective administration and operation of national hydrological and meteorological observation network, two Regional Hydro-met Offices were approved under the Centre; a. Eastern Regional Office at Kurjey, Bumthang and b. Western Regional Officer, Thimphu, Headquarters.

a. Regional Office in East- Kurjey, Bumthang

Operate and look after all the hydro-meteorological network and facilities covering whole Manas River basin (Mangdechhu, Chamkharchhu, Kurichhu, Dangmechhu (Gongri and Kholongchhu), Neyra Amari and Jomori (Dhansari) sub-basins).

b. Regional Office (West)- located within Headquarter, Thimphu

Operate and look after all the hydro-meteorological network and facilities covering Jaldakha, Ammochhu, Wangchhu, Punatsangchhu, Aiechhu and Aiechhu (Maokhola) sub-basins.

The main functions of the regional offices are:

a. Administer hydrological, meteorological, sediment and water quality monitoring and flood monitoring stations and personnel in the region;
b. Prepare plan/program/activities related to hydro-met network installation, maintenance and associated facilities;
c. Carry out sediment and water quality monitoring and laboratory analysis data archival and transmitting to head office
d. Carry out timely repair and maintenance of stations under the region;
e. Ensure timely transmission of data to HQ in a desired format at predetermined time;
f. Transmit real time data from flood monitoring stations to National Weather and Flood Warning Centre (NWFWC) for weather and flood forecasting and warning.
g. Provide hydro-meteorological services and products to other agencies of the region in consultation HQ.
h. Represent Center in the Local Government (LG) meetings, workshops etc.
i. Oversee Operation and maintenance of GLOF EWS control room and field offices;
j. Cross check field data, compilation and filing;
k. Perform basic maintenance of the equipment and report any problems.
l. Liaise directly with Meteorological Observation Section (MOS) of WCSD and Hydrological Observation Section (HOS) of HWRSD and other divisions;

National Weather and Flood Warning Centre (NWFWC)
(Structure, Mandate and Functions)

3.12 National Weather and Flood Warning Centre (NWFWC)

The 24/7 National Weather and Flood Warning Center (NWFWC) was established in 2015. NWFWC is the main supervisory and command center of NCHM for monitoring hydro-met extreme and dissemination warnings to the stakeholders and general public. NWFWC is jointly operated by Weather Forecasting Section of WCSD and Hydrological Forecasting and Flood Warning Section of HWRSD. NWFWC oversee the operation of river basin control rooms (Punatsangchu, Mangdechhu and Chamkarchhu GLOF EWS Control Room and Ammochu Flood EWS Control Room currently).

NWFWC Building has following:

a. A dedicated Server room with ICT facilities
b. Weather Forecasting and Command Room (WFCR)
c. Flood Monitoring and Command Room (FMCR) Facilities

Server Room and ICT facilities are looked after by ICT Services.

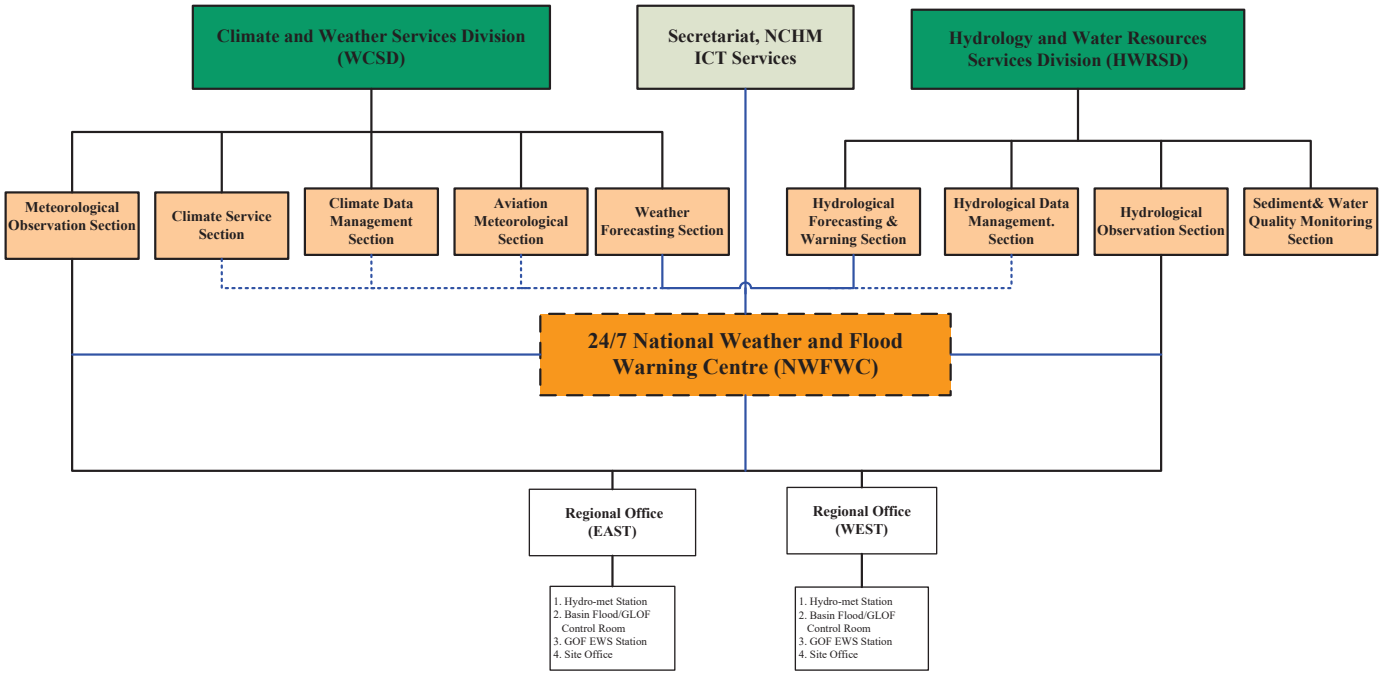

Figure 11: NWFWC Structure and Reporting

NWFWC is operated by regular staff on shift system for continuous monitoring and delivery of weather and flood warning services 24/7. NWFWC is responsible to collect data from manual hydro-met observation and Automatic Station (AWLS and AWS) and disseminate hydro-met extreme advisories and warning as per SOP for Flood/GLOF EWS and Weather Forecasting.

All the manual hydrological and flood warning stations shall transmit sub-daily data directly to Flood Monitoring and Command Room as per the SOP. Similarly, all the Class

A meteorological stations shall transmit sub-daily data directly to Weather Forecasting and Command Room as per the SOP.

4. Staffing

4.1 Existing Staffing

The Centre has 210 approved posts including 9 posts by standard. The Centre currently is manned by 197 existing employees including 13 ESP/GSP under FWS, GoI Program and 9 staff by standard.

Table 1: Staff Strength and Distribution

Division/Secretariat	Approved by RCSC	Existing	Gap	Remarks
Secretariat	21	18	-3	*Including 8 Drivers and 1 ESP (staffing by standard)*
Technical Standard and Research Division (TSRD)	7	5	-2	
Cryosphere Services Division (CSD)	8	7	-1	
Weather and Climate Services Division (WCSD)	57	55	-2	
Hydrology and Water Resources Services Division (HWRSD)	117	112	-5	*Including 13 ESP/GSP under GoI Program*
Total	**210**	**197**	**-13**	*Regular approved 201 and 9 by standard*

The detailed staff mapping to respective Division and Section is attached in the Annexure XII.

References

a. The Cabinet Secretariat Order No. C-3/92/169 dated 25 December, 2015 on Approvals on OD recommendation of RCSC;

b. The Royal Civil Service Commission Letter No. RCSC/PPD-40/2016/2246 dated, January 29, 2016 on Subject: Preparation of Operational and Staffing Plans to implement the OD Recommendations as approved by the Government;

c. RCSC (2015): Proposal on Agencification Framework of Civil Services, April 30, 2015;

d. DHMS, MoEA (March 2016): A proposal for NCHM Organisational Structure, Mandates and functions submitted to RCSC by DHMS, MoEA March 2016.

e. The Royal Civil Service Commission Letter No. RCSC/HRMD/26/2016/618 dated, August 10, 2016 on approval of proposed structure and staffing of NCHM.

f. The Cabinet Secretariat Order No. C-3/118/527 dated 25th November 2016 on "Composition of Board of National Center for Hydrology and Meteorology (NCHM).

g. Transfer Order from Ministry of Information and Communication (MOIC) No. MoIC/HRM/06/2017/1701 dated February 01,2017.

h. Office Order from Ministry of Economic Affairs No. MoEA/HRD-01/2016/543 dated August 29, 2016.

i. Certificate of Designation of NCHM as the Aviation Meteorological Services Provider of Bhutan by Bhutan Civil Aviation Authority (BCCA) No. BCAA/ANS-D&D/27/002, dated May 03, 2018.

j. The Prime Minister of Bhutan/Chairperson of NDMA designated NCHM as the Hydro-met Hazard Early Warning Service Provider vide Executive Order No.C-2/2019/369, dated December 05, 2019.

k. National Environment Commission letter no. NEC/WRCD/03/2020/495 date April 6, 2020 on Implementation of Water Quality Standards (WQS) 2018

l. WMO No. 1195: Guidelines on the Role, Operation and Management of National Meteorological and Hydrological Services (2017 edition)

Annexures

a. **Annexure I**: A letter from Cabinet Secretariat No. C-3/92/169 dated 25 December, 2015 on Approvals on OD recommendations of RCSC;

b. **Annexure II:** A letter from Royal Civil Service Commission No. RCSC/PPD-40/2016/2246 dated, January 29, 2016 on Subject: Preparation of Operational and Staffing Plans to implement the OD Recommendations as approved by the Government;

c. **Annexure III:** A letter from Royal Civil Service Commission No. RCSC/HRMD/26/2016/618 dated, August 10, 2016 on approval of proposed structure and staffing of NCHM

d. **Annexure IV:** An Office Order from Ministry of Economic Affairs No. MoEA/HRD-49/2016/71 dated September 20, 2016

e. **Annexure V:** A letter from Cabinet Secretariat No. C-3/118/527 dated 25th November 2016 on "Composition of Board of National Center for Hydrology and Meteorology (NCHM)

f. **Annexure VI:** An Office Order from Ministry of Economic Affairs No. MoEA/HRD-01/2016/543 dated August 29, 2016.

g. **Annexure VII:** Transfer Order from Ministry of Information and Communication (MOIC) No. MOIC/HRM/06/2017/1701 dated February 01,2017

h. **Annexure VIII:** Certificate of Designation of NCHM as the Aviation Meteorological Services Provider of Bhutan-by-Bhutan Civil Aviation Authority (BCCA) No. BCAA/ANS-D&D/27/002, dated May 03, 2018.

i. **Annexure IX:** The Prime Minister of Bhutan/Chairperson of NDMA designated NCHM as the Hydro-met Hazard Early Warning Service Provider vide Executive Order No.C-2/2019/369, dated December 05, 2019.

j. **Annexure X:** National Environment Commission letter no. NEC/WRCD/03/2020/495 date April 6, 2020 on Implementation of Water Quality Standards (WQS) 2018

k. **Annexure XI:** The Royal Civil Service Commission Letter No. RCSC/HRMD/7/2021/0411 dated 5 August 2022 Approved 12FYP Staffing of NCHM and approval of dissolve of HOID and creation of TSRD.

l. **Annexure XII:** The HRMD, Royal Civil Service Commission vide email dated 29 April 2022 has conveyed its approval for entry level of Meteorology/Hydrology Technician at S3A.

m. **Annexure XIII:** Detailed staff list and mapping of the employees against respective Divisions and Sections.