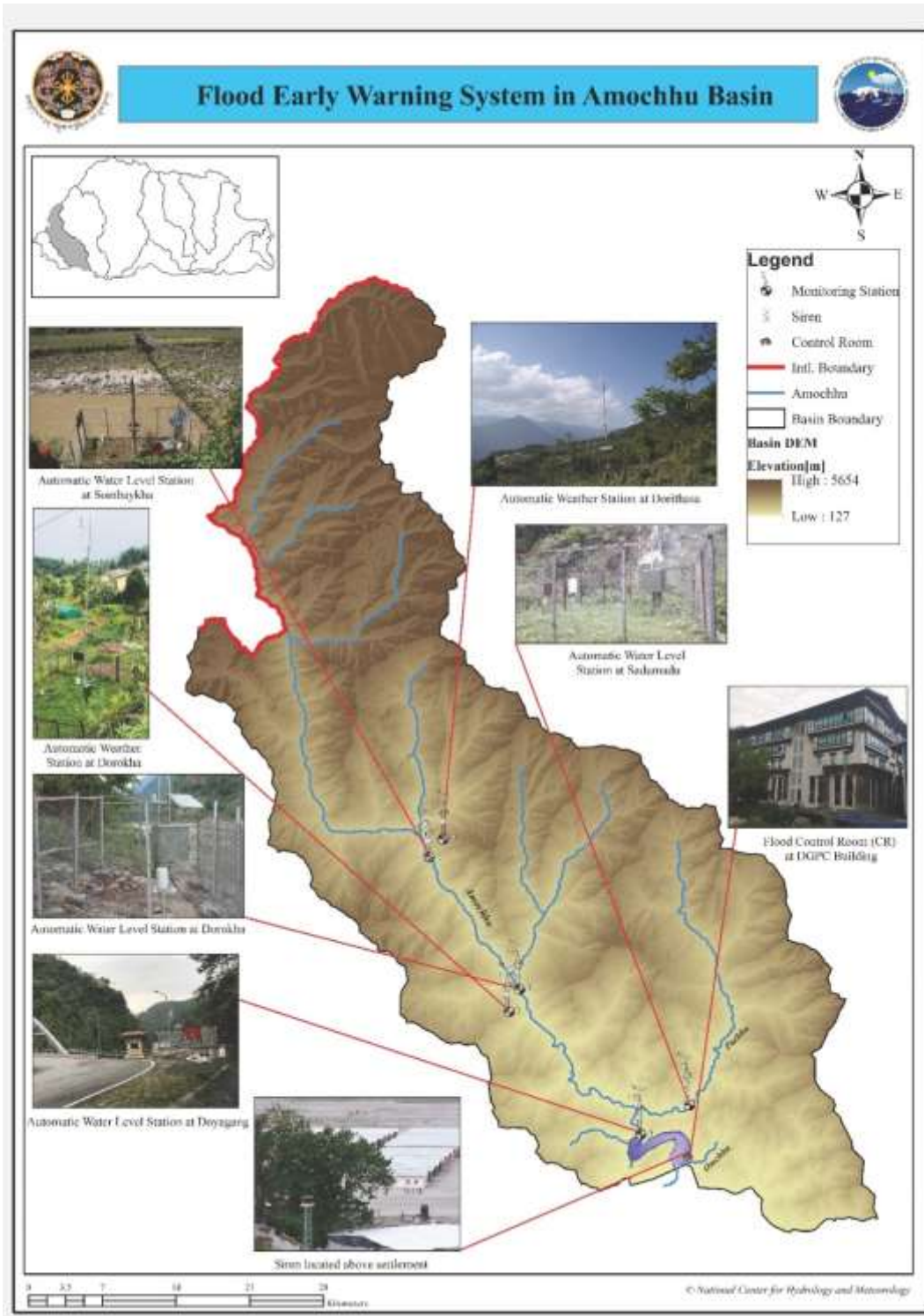




**STANDARD OPERATING PROCEDURE (SOP)
FOR
INTERIM COMMUNITY BASED FLOOD EARLY WARNING
SYSTEM FOR AMOCHHU SETTLEMENT,
PHUENTSHOLLING, BHUTAN
*(Version 1.0 May 2020)***

**National Center for Hydrology and Meteorology
Royal Government of Bhutan
Thimphu : Bhutan
2020**

TARGET AREA (Ammochhu Basin)



Standard Operating Procedure for Interim Community Based Flood Early Warning System for Amochhu Settlement, Phuentsholing, Bhutan

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ABBREVIATION

| | |
|----------|---|
| CBDRM | Community Based Disaster Risks Management |
| CBFFWS | Community Based Flood Forecasting and Warning System |
| CDCL | Construction Development Corporation Limited |
| CR | Flood Control Room |
| DCP | Data Collection Platform |
| DDM | Department of Disaster Management, Ministry of Home & Culture Affairs |
| DDMO | Dzongkhag Disaster Management Officer |
| DEOC | Dzongkhag Emergency Operation Center |
| DGPC | Druk Green Power Corporation |
| EWS | Early Warning System |
| FEWS | Flood Early Warning System |
| FMCR | Flood Monitoring and Command Room |
| GLOF | Glacial Lake Outburst Flood |
| HF Radio | High Frequency Radio |
| NCHM | National Center for Hydrology and Meteorology |
| NDMA | National Disaster Management Authority |
| NEOC | National Emergency Operation Center |
| NWFWC | National Weather & Flood Warning Center |
| O/M | Operation and Maintenance |
| PTDP | Phuentsholing Township Development Plan |
| RSF | Rain Storm Flood |
| SOP | Standard Operating Procedure |
| VHF | Very High Frequency |
| WFCR | Weather Forecasting Control Room |
| WFR | Weather Forecasting and Research model |

CHAPTER 1 Introduction

1.1 Background

The Interim Community Based Flood Early Warning System for Amochhu Settlement was setup to warn community (evacuated from Jaigoan) who were resettled in the shelters constructed at Phuentsholing Township Development Plan (PTDP) area on the Amochhu river bank at Phuentsholing.

This Standard Operating Procedure (SOP) was developed based on types of EWS system installed in consultation with local government, relevant stakeholders in and around the settlements in order to enhance capacity on flood forecasting and warning as well as emergency information sharing among relevant agencies and vulnerable communities. The SOP guides the basic communication flow and information sharing during emergency situation related to rainfall and floods in the central and local levels (Phuentsholing).

1.2 Institutional & Legal Background

Disaster Management Act of Bhutan was enforced in 2013, and “Disaster Management Rules and Regulations” was adopted in 2014.

The Disaster Management Rules and Regulations stipulates “Emergency Operation Center” in Chapter 5 as follow;

*Article 54: The Department of Disaster Management shall, in accordance with section 105 of the Act, establish the **National Emergency Operation Center (NEOC)** and **Dzongkhag Emergency Operation Center in each Dzongkhag.***

The Disaster Management Rules and Regulation also mentions as;

*Article 70: An agency maintaining an **emergency help center** shall collaborate and built linkages with the National Emergency Operation Center and Dzongkhag Emergency Operation Center.*

*Article 71: An **emergency help center** shall develop its **Standard Operation Procedures** for communicating and sharing information with the National Emergency Operation Center and Dzongkhag Emergency Operation Center.*

In accordance with Section 108 of the Disaster Management Act of Bhutan 2013, the National Disaster Management Authority (NDMA) designated NCHM as the National Hydro-met Early Warning Service Provider (EWS) within Country to notify all vulnerable populations and responding agencies of the threatening disaster situation or disaster in the country vide Government Executive Order C-2/2019/369 dated December 05, 2019.

The National Weather and Flood Warning Centre (NWFWC) is located Thimphu and Interim Community Based Flood Early Warning System Control Room (CR) was established at Phuentsholing to monitor and provide flood early warning services for Amochhu bank

settlements during monsoon. These Control Centre shall function as “*Emergency Help Center*” related to weather and flood. The SOP was developed for operation of Interim Community Based Flood Warning System for sharing information with NFWWC, Local Government (Chhukha Dzongkha and Phuentsholing Thromde) and vulnerable communities.

1.3 Scope of SOP

This SOP is guided by the basic principles and concepts of flood warning procedures and consists of logical steps to be followed by the responsible staff for monitoring, detection and issuance of warning.

This SOP only guides emergency communication on river/flood related information among relevant agencies and stakeholders, does not cover entire emergency response.

The emergency information sharing from the Department of Disaster Management (DDM)/National Emergency Operation Center (NEOC) is out of the objective of this SOP.

The basic concept of the SOP is as follows:

Concept of SOP

- *The SOP does not cover entire emergency response in Dzongkhag Disaster Management, but guides emergency communication on river/flood related information.*
- *The SOP may be used as reference while formulating the Dzongkhag/Thromde Contingency Plan stipulated in Disaster Management Act of Bhutan in future.*

Role of NFWWC, NCHM

- *Flood Monitoring and Command Room (FMCR) of NFWWC shall give instructions to the Flood Control Room (CR) at Phuentsholing, and provides river/flood related information to the central agencies. It doesn't have responsibility for disaster response and judgement.*
- *Weather Forecasting Control Room (WFCR) of NFWWC shall provide extreme weather information to the Flood Control Room (CR), Phuentsholing.*

Role of CR, Phuentsholing

- *The Flood Control Room (CR) is just an information provider, not a decision maker.*
- *To avoid confusion during emergency, information access to the Flood Control Room (CR) should be minimized and the CR shall disseminate the information only to the focal points as per the SOP.*

CHAPTER 2 Background Knowledge

2.1 Amochhu Basin Characteristics

2.1.1 Outline

The River Toorsa, known as the Amochhu in its northern reaches, flows out of Tibet into the Chumbi Valley through western Bhutan before broadening near Phuentsholing and then flowing into India (Figure 1). The river has its source on Mount Pauhunri (7,128 m) in China. The catchment area at Doyagang Hydrological Station at Amochhu bridge (Phuentsholing-Samtse highway) is around 3304 km².

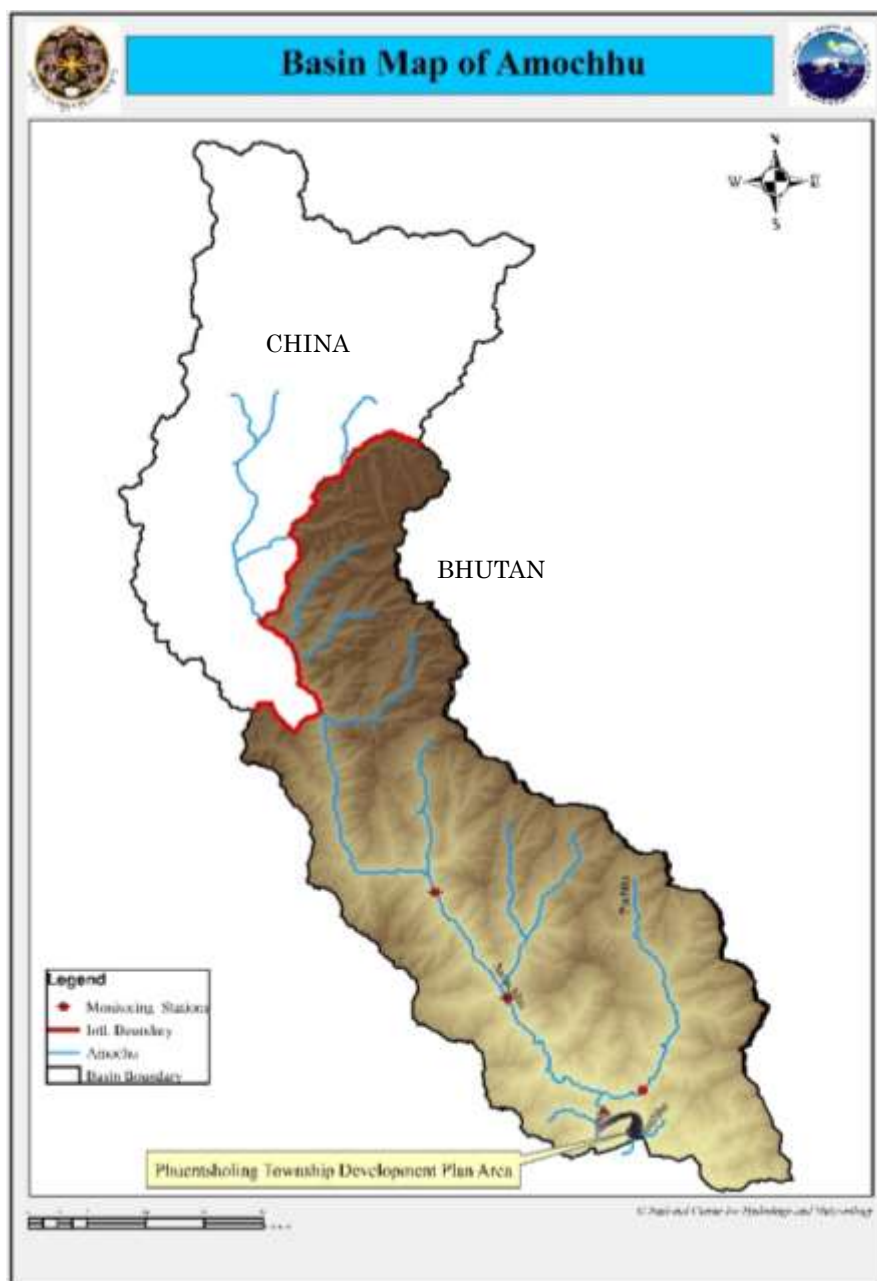


Figure 1: Amochhu river catchment area

2.2 Types of Flood in Bhutan

2.2.1 Glacial Lake Outburst Flood

Glacial lake is formed by a natural dam of glacial terminal moraine composed of debris and ice core. When the dam collapses because of some triggers such as overtopping water or ice core melting, large volume of water mass in the lake flow down as a Glacial Lake Outburst Flood (GLOF).

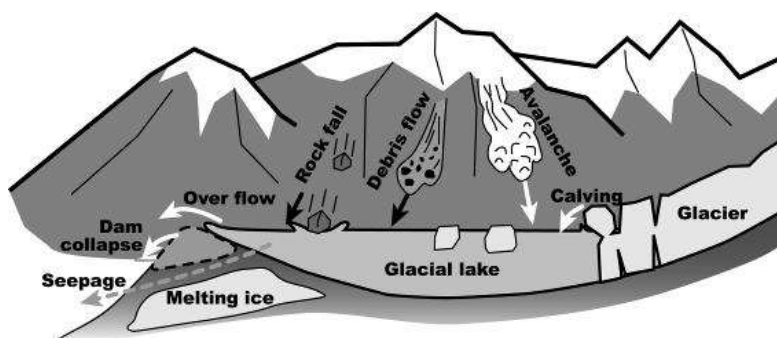


Figure 2: Mechanism of GLOF

Source: Fujita et al. (2012): Study on glacial lake outburst floods in the Bhutan Himalayas

2.2.2 Landslide Dam Outburst Flood (LDOF)

A landslide dam or barrier lake is a natural damming of a river by some kind of landslides, such as debris flows. It is more common in the high mountains with narrow valleys.



Figure 3: Tsatichhu Landslide Dam (2003)



Figure 4: Mochhu Landslide Dam (2012)

2.2.3 Rainstorm Flood

Rain storm flood (RSF) occurs when a river basin has heavy rain due to such as cyclone or other extreme weather phenomenon. During such event rainwater intensively drains into river and river water level, velocity and discharge increase unusually causing flood. May 2009, tropical cyclone Aila hit Bhutan and recorded the largest flood. The return period of the flood is estimated to be more than 50 to 100 years.

2.2.4 Difference between GLOF and Rainstorm Flood

According to the records of Luggy Tsho GLOF in 1999 and Cyclone Aila in 2009, the peak water levels of each flood were almost same at Wangdue gauging station (refer Figure 5). However, the water rising speed is extremely high in the GLOF comparing with the rainstorm flood. Whereas the time from starting water rising to peak water level was about 16 hours in the Cyclone Aila, it was only 2.5 hours in the Luggy GLOF. Furthermore, the maximum water rising speed in GLOF was more than 2.5 m in 30 min. Without any preparedness and precaution, safe evacuation will be often difficult during the GLOF event.

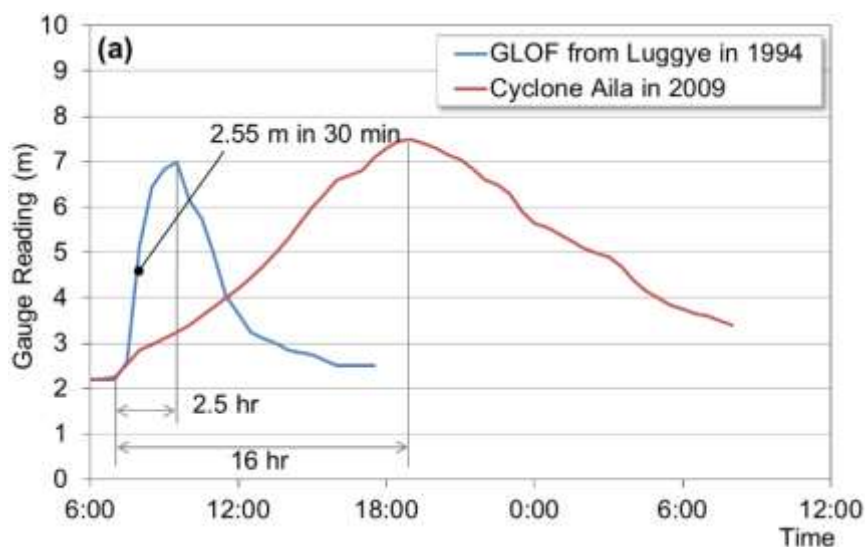


Figure 5: Typical Hydrograph of GLOF and RSF

2.2.5 Flooding Problems

Flooding in Southern Bhutan are regular phenomena during the monsoon due to heavy precipitation and fragile geology. Major flooding in Phuentsholing area occurred due to incessant rainfall in June 1990, Omchhu flood due to heavy rainfall on 2-5 July 1991, Omchhu and Barsachhu flood in August 2000, Cyclone Aila flood in May 2009 and heavy rainfall flood in July 2016. Flooding bring damages to infrastructure and industrial area as most of the settlements, infrastructure and industries are located in the flood plains.

The average annual rainfall is about 4000 mm at Phuentsholing. The annual rainfall decreases with the increase of the catchment elevation. The high amount of annual rainfall over the southern foothills causes numerous hydro-meteorological disasters due to flash flood and landslides.

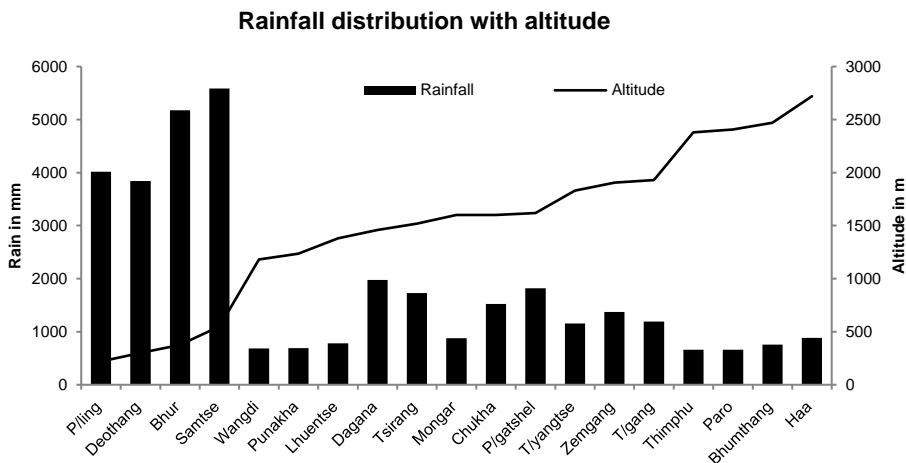


Figure 6: Annual rainfall distribution with altitude

2.2.6 Flood Discharge

Discharge is the amount of water volume flow down a river cross section per second. It is represented by “cubic meter per second (m^3/s)”. NCHM monitors water level and discharge of Amochhu at Doyagang, Phuentsholing. The Doyagang station has more than 11 years (2006-2019) of river level and flow data of Amochhu basin. The records are shown in Figure 7 and 8 respectively.

Average discharges at Doyagang station ranges between minimum of $18 m^3/s$ in winter and maximum of $988 m^3/s$ during the monsoon in summer season. Discharge of the Cyclone Aila on May 26, 2009 was extremely high and computed $2557.31 m^3/s$ at Doyagang station, which is equivalent to 50-years flood return period.

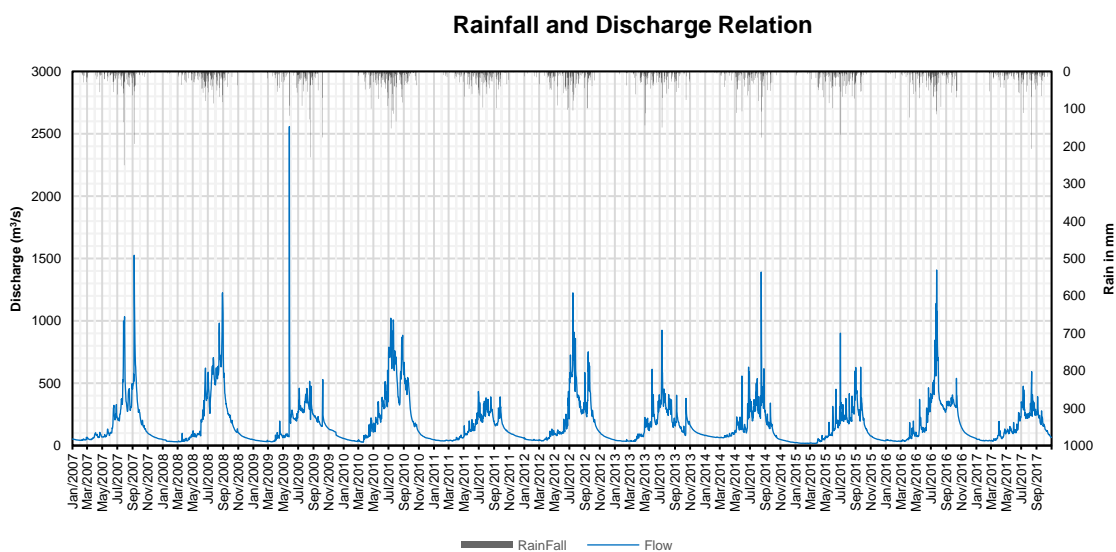


Figure 7: Precipitation (Dorokha) and Flow (Doyagang) pattern of Amochhu

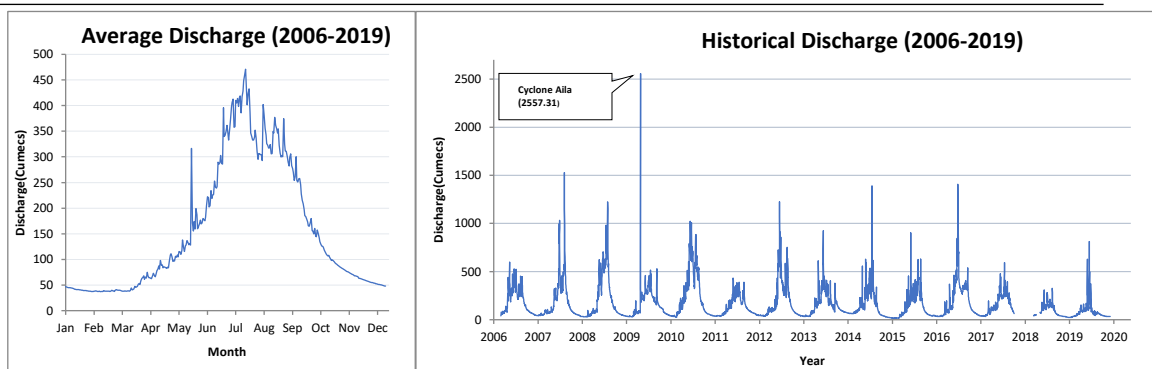


Figure 8: Average monthly flow and daily flow at Doyagang station with peak discharge during cyclone Aila

2.2.7 Flood Arrival Time

The flood arrival time is a lead time for the residents to evacuate to the safer area. Flood arrival time was estimated based on flood simulation result using hydrological model.

When a flood peak is detected at the Sombaykha station, it is estimated that flood may arrive at Amochhu settlements, Phuentsholing after 146 minutes (refer to Figure 9). Similarly, the flood travel time from Dorokha to Amochhu settlement is approximately 96 minutes. The flood travel time from Doyagang station to settlement area is approximately 21 minutes.

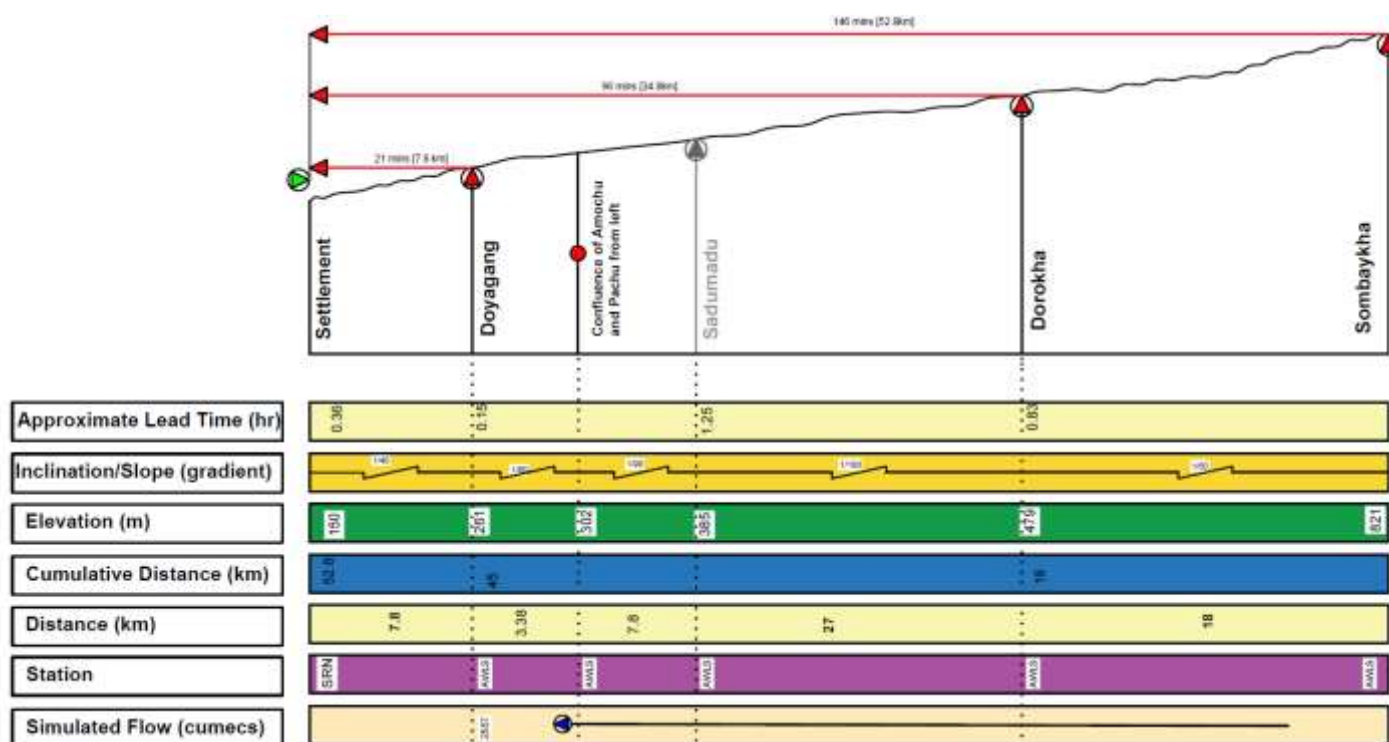


Figure 9: Distance and flood arrival time in Amochhu basin

2.3 Flood Hazard Map

Flood hazard maps in the Phuentsholing Township Development Plan (PTDP) area of Amochhu basin (Figure 10) were prepared based on Digital Elevation Model (DEM) generated from the rapid aerial drone survey and hydrological flood simulation from historical flood records. The hazard map shows simulated flood water depth, residential area and important land facilities. People can obtain information of flood vulnerable areas, evacuation route and evacuation sites developed by DDM and local government based on the hazard maps.

Omchhu flood hazard map was prepared based on the estimated flow from the extreme rainfall event of August 2000 and estimated flow for bank overtopping at 500 m³/s that corresponds to peak discharge of August 2000 (Hydrology Team, DOP, 2000).

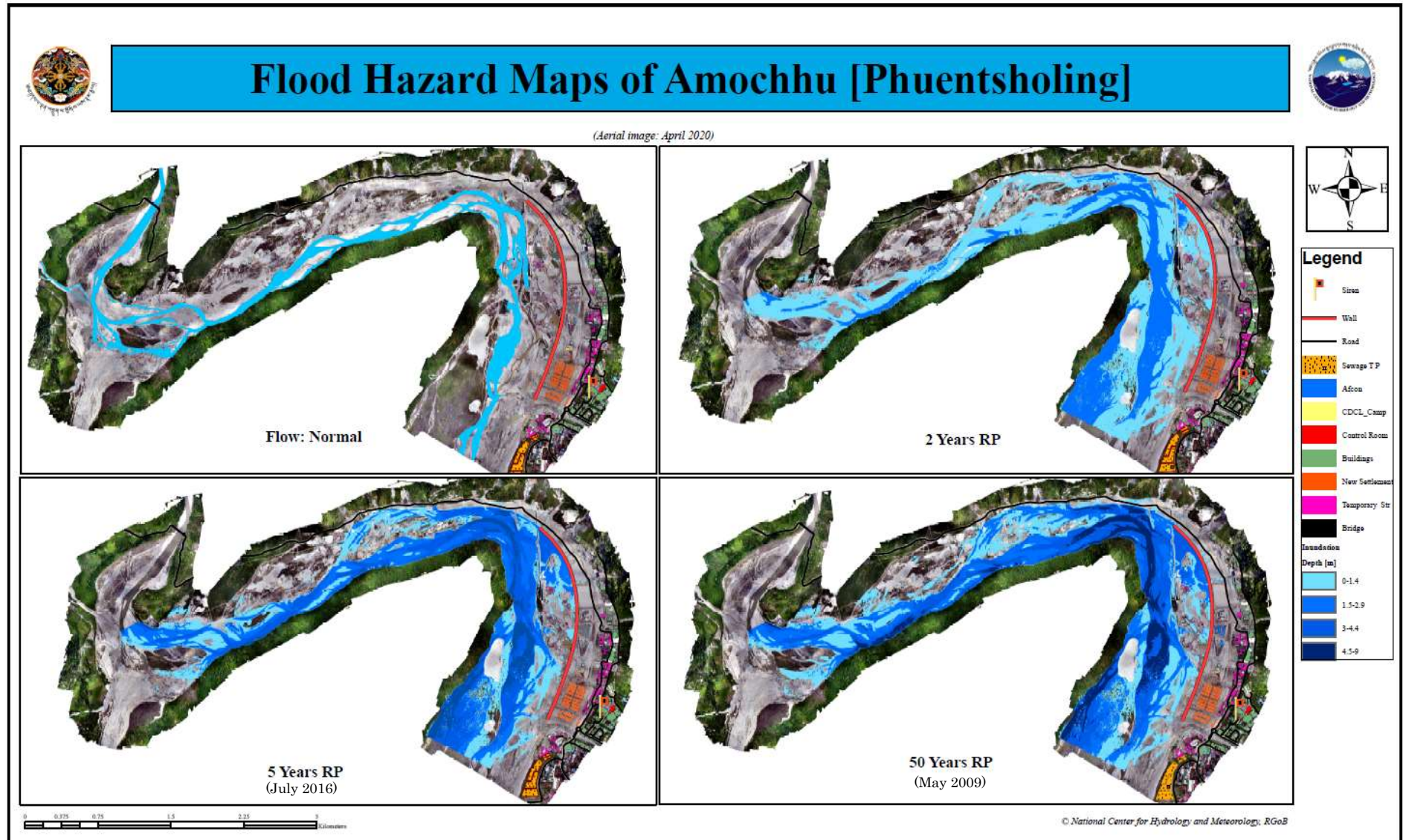


Figure 10 Flood hazard map of Phuentsholing Township Development Plan for 2, 5 and 50 years return period

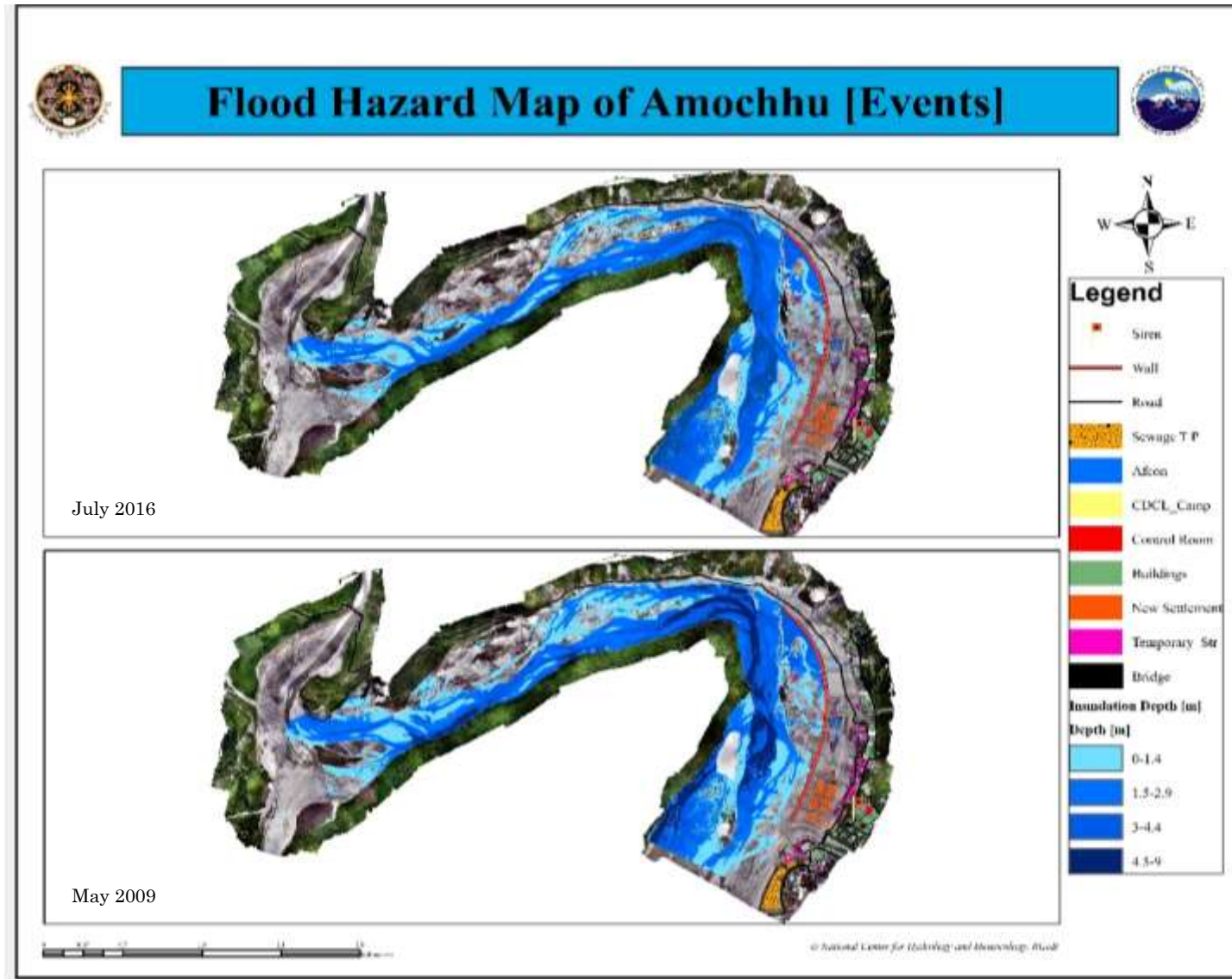


Figure 11: Flood hazard map of Amochhu based on the event of July 2016 and May 2009 respectively at Doyagang Station

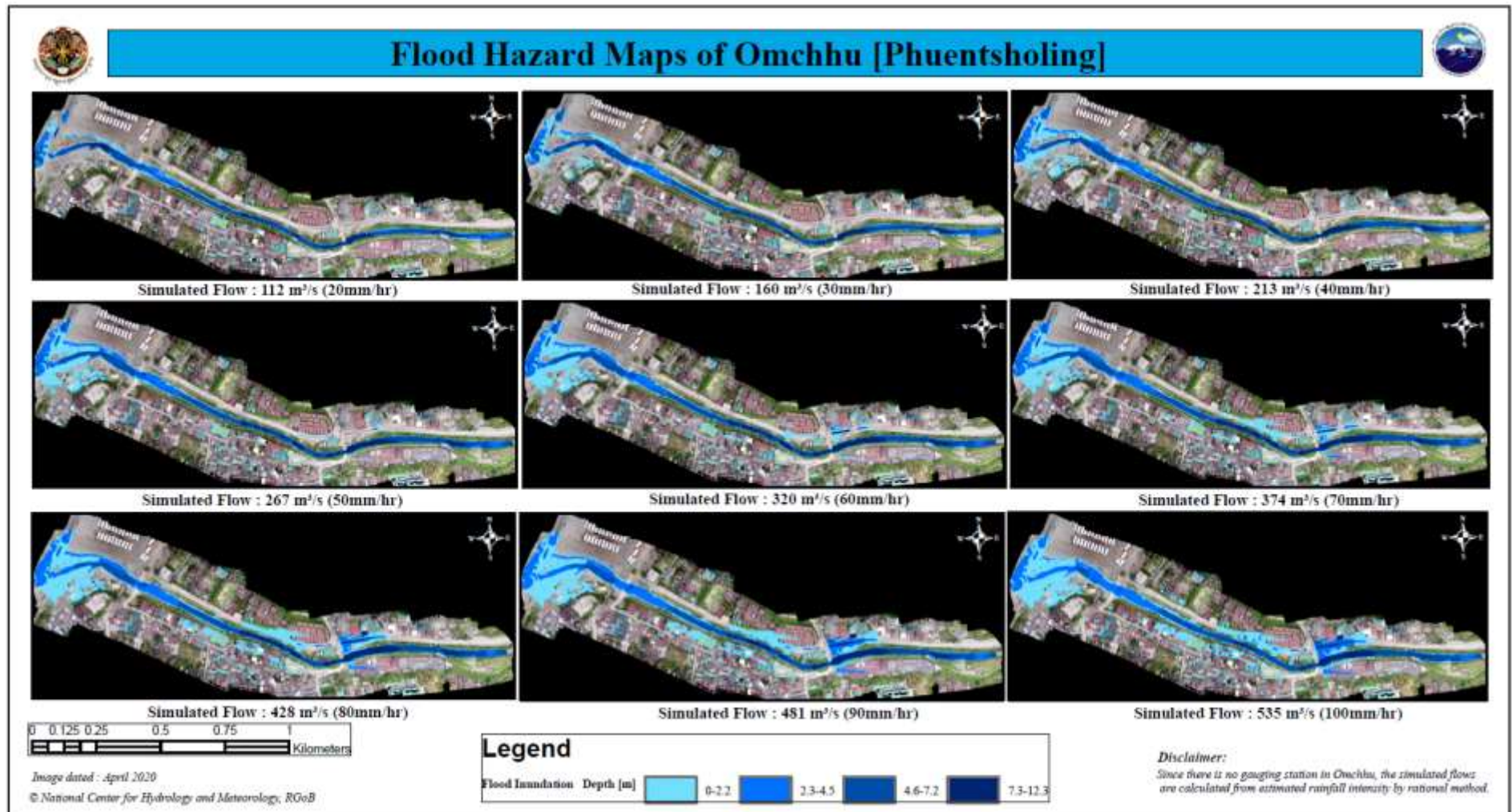


Figure 12: Omchhu flood hazard map for different flow simulation

CHAPTER 3 Interim Community Flood Early Warning System

3.1 Components of Flood Warning System

The Flood Early Warning System (FEWS) of Amochhu basin composed of following component:

- a. Flood Monitoring Stations
- b. Flood Control Room
- c. Communication system
- d. Flood information dissemination

3.1.1 Flood Monitoring Station

As an interim, rainfall and water level data from the 6-existing hydro-met stations located within upstream will be used as a guidance for flood warning purposes. New AWLS was installed at Dorokha and Doyayang at Amochhu to facilitate real time monitoring of water level and rainfall.

Table 1: List of hydro-met stations in the Amochhu basin

| Sl. No. | Station Name | Dungkhag/ Dzongkhag | Parameter to used |
|----------|---|------------------------|--|
| A | Meteorological Station | | |
| 1 | Dorithasa AWS, Sombaykha, Haa | Sombaykha/Haa | Rainfall, temperature, humidity |
| 2 | Dorokha AWS, Samtse | Dorokha/Samtse | Rainfall, temperature, humidity |
| B | Hydrological Station | | |
| 3 | Sombaykha AWLS on Amochhu | Sombaykha/Haa | Water level, rainfall, temperature. |
| 4 | Dorokha Flood Warning Station/AWLS | Dorokha/Samtse | Water level, rainfall, temperature |
| 5 | Sadumadu AWLS on Pachhu | Phuentsholing/ Chhukha | Water level, rainfall, temperature |
| 6 | Doyayang Principal Hydrological Station with AWLS | Phuentsholing/ Chhukha | Water level, flow, rainfall, temperature |

All the remote monitoring stations are powered by solar panel and battery. These stations are equipped with GSM/GPRS communication system.

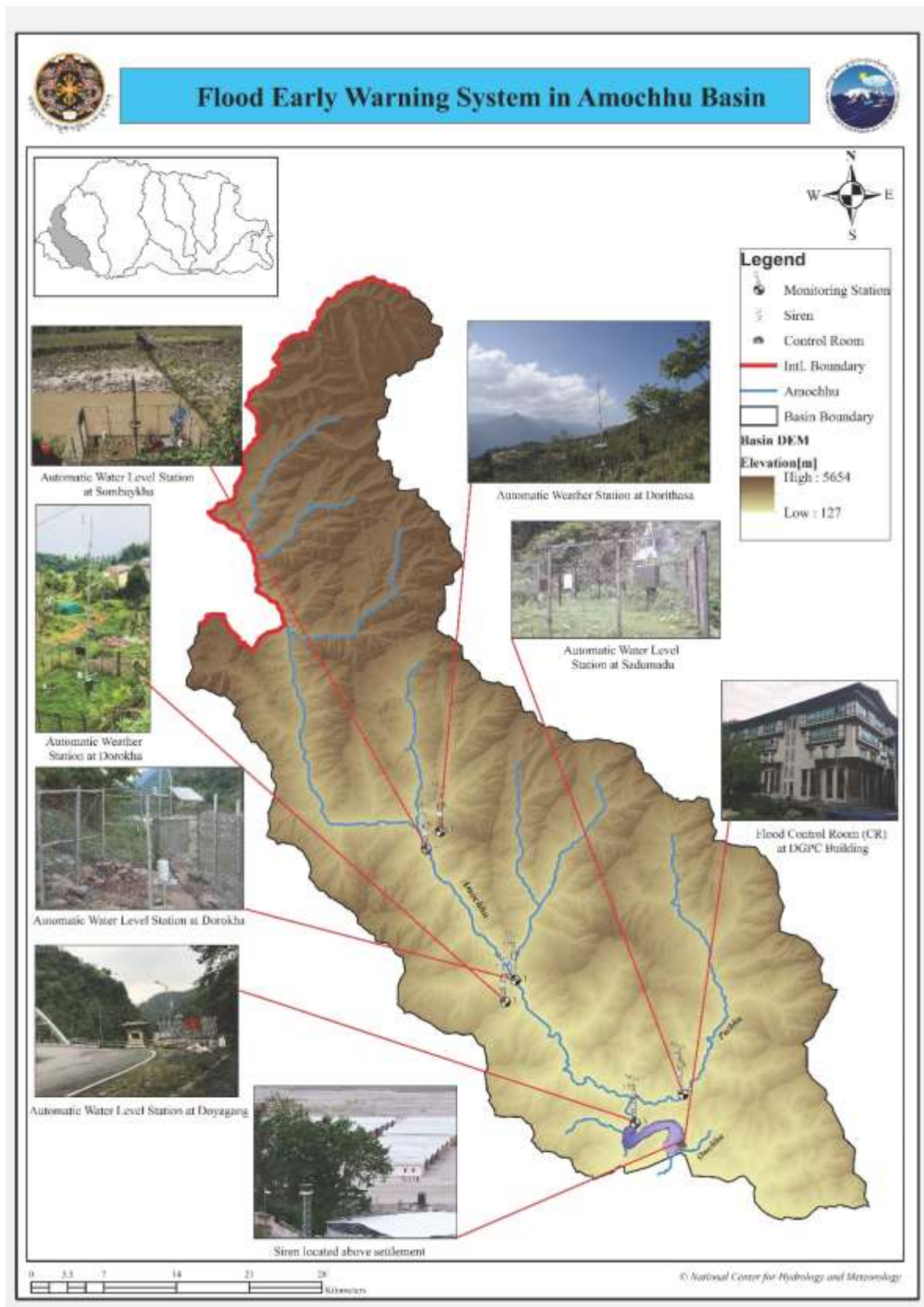


Figure 13: Interim Community Based Flood EWS in Amochhu Basin

3.1.2 Flood Control Room (CR) and NFWWC.

National Weather and Flood Warning Center (NFWWC)

The NFWWC is main supervisory and command center under NCHM for services related to extreme weather and flood. The NFWWC is operational for 24/7 with dedicated staff on shift to monitor and provide the information and services on hydrology and meteorology in the country using integrated database systems.

The status of real time data collected and transmitted from the remote monitoring stations are displayed and visualized in the Control Room of NFWWC, Thimphu.

NFWWC, Thimphu will provide specific and timely weather and flood advisories to CR for intensive monitoring.



Figure 14: Facilities of NFWWC (24/7), NCHM, Thimphu

Flood Control Room (CR), Phuentsholing

A Flood Control Room (CR) of the Amochhu Interim Community Flood Warning System is located at the DGPC building, Phuentsholing. The CR is operational 24/7 on shift duty (Figure 15) to monitor and provide flood information and services.

CR is equipped with various mode of communication facilities (HF radio, fix phone line and mobile phone), the operator can closely communicate with the FMCR of NFWWC and Thromdue Disaster focal point for the flood emergency operation.

CR will closely work with NFWWC, Thimphu for the information on weather and flood forecast.

The CR is equipped with a portable power backup generator for continuous operation during the power failure.



Figure 15: Interim Flood CR, DGPC Building, Phuentsholling

3.1.3 Communication System

Communication is the backbone for any Early Warning System. Therefore, FEWS at Amochhu is equipped with dedicated fixed telephone line, internet leased line, mobile phone and HF radio communication.

The scheduled data transmission from automatic monitoring stations are done via GSM/GPRS network to NWFWC, NCHM, Thimphu that can be visualized at the CR via internet.

The dedicated HF radio backup communication system will be used to communicate between CR and upstream monitoring station at Dorokha and Doyagang. VHF radio handset will be used to communicate with Thromde disaster focal point, CDCL and RBP post.

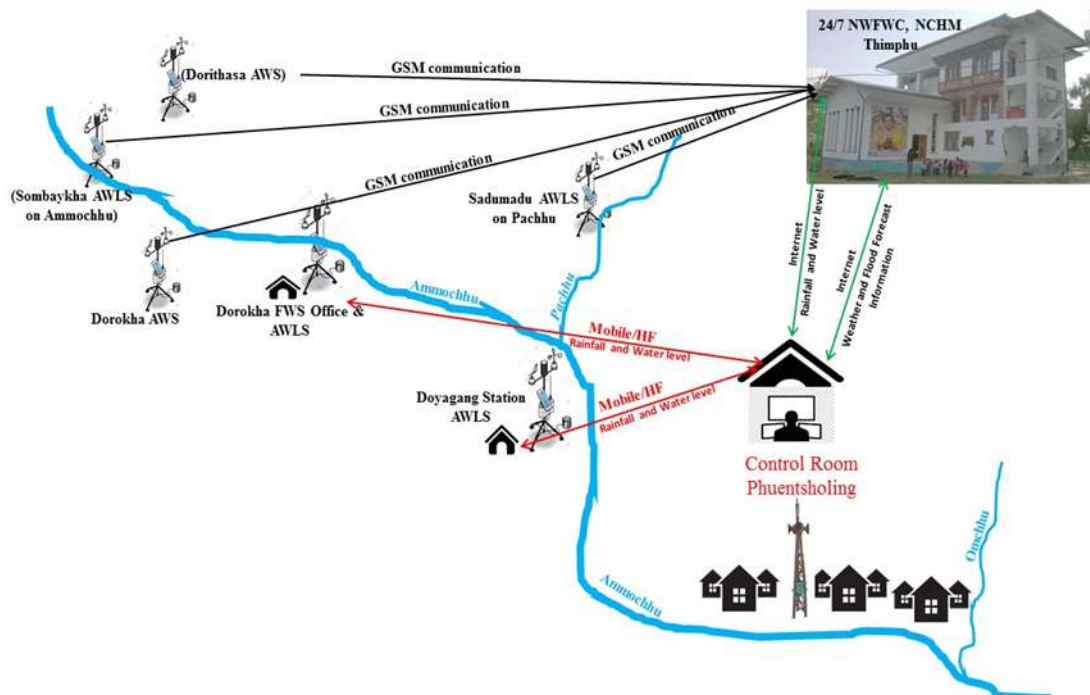


Figure 16: Design of FEWS and line of communication

3.1.4 Information Dissemination System

A manually operated outdoor sirens were installed close to community settlement for flood warning. The voice broadcasting system (trumpet horn) is will be used for further dissemination of information and warning.

Siren is manually activated when the water level reaches to **ALARM** level.



Figure 17: Warning Siren for Amochhu Settlement

3.2 Flood Thresholds

3.2.1 Principles

There are two thresholds of water level for the warning criteria, **ALERT** and **ALARM**.

In order to determine the flood, two water level thresholds (**ALERT** and **ALARM**) are set based on the flood modelling and historical maximum flood marks.

ALERT: When water level exceeds or equals to Alert level, CR operators will put staff in the state of readiness with more vigorous monitoring. No sirens will be activated during this situation.

ALARM: When water level of Doyayang monitoring stations exceeds or equals to ALARM level, the CR operator will immediately confirm with the monitoring station upstream (Dorokha and Doyayang) and activate siren manually. The CR will also monitor the rate of change of the water level.

3.2.2 Timing of ALERT and ALARM

Phuentsholing experiences frequent flood due to heavy rain, NFWFC, Thimphu shall provide the weather and flood forecast and advisories to the CR, Phuentsholing for preparedness and intensified monitoring. CR shall pay more attention on the water levels during the severe weather condition than in normal condition.

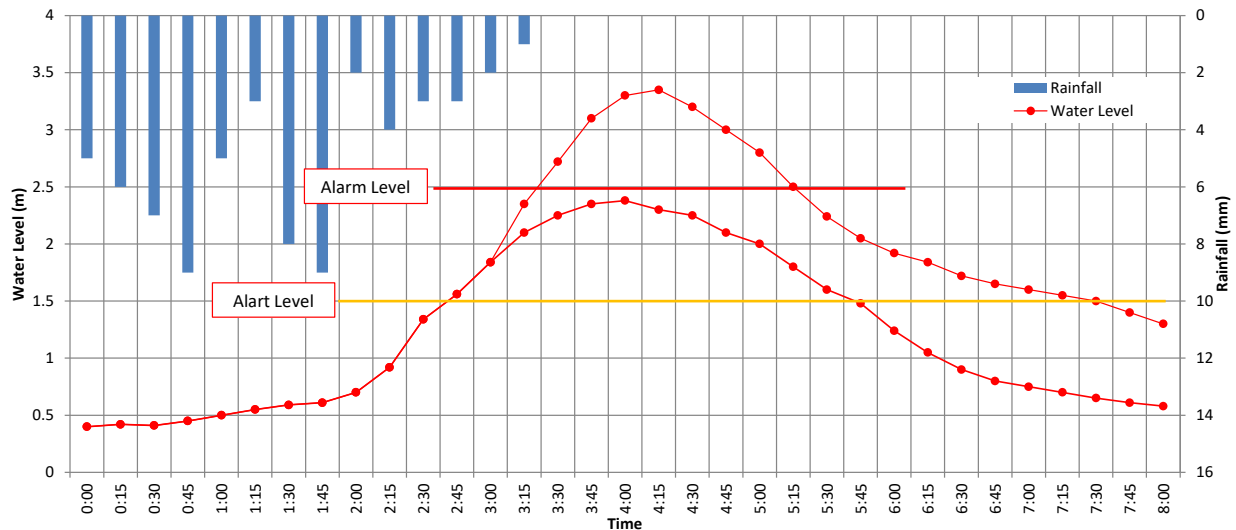


Figure 18: Example of water level trend for the rainstorm flood

3.2.3 Thresholds

Thresholds of ALERT and ALARM are the most important of FEWS. The thresholds should be reviewed and set based on the actual observed data and the physical condition at the monitoring sites.

ALERT Level

To maintain a sense of readiness to the operator, the CR shall be alerted when water level reached alert level. Therefore, the **ALERT** level is set up around water level in annual maximum flood which is nearly equal to above the 2 years return period flood considering flood mark at the Doyagang Hydrological Station.

ALARM Level

The **ALARM** level is set up in between the 20-years and 50-years return period flood. The flood inundation map of Cyclone Aila in 2009 flood event was used for determining the Alarm Level.

Table 2: Water level based on the flood event and hazard map at Doyagang monitoring station

| Return period (Years) | Flow (m ³ /s) | Water level (flood model) |
|-----------------------|--------------------------|---------------------------|
| 2 | 1055 | 4.91 |
| 5 | 1556 | 5.82 |
| 10 | 1886 | 6.38 |
| 20 | 2204 | 6.87 |
| 50 | 2557 | 7.29 |

Table 3: Thresholds of ALERT and ALARM at Doyagang Station defined as of May 2020

| Station | Alert Level | Alarm Level |
|----------|-------------|-------------|
| Doyagang | 5.0 m | 7.0 m |

Note: The above thresholds are subject to change depending on the physical changes at the monitoring station.

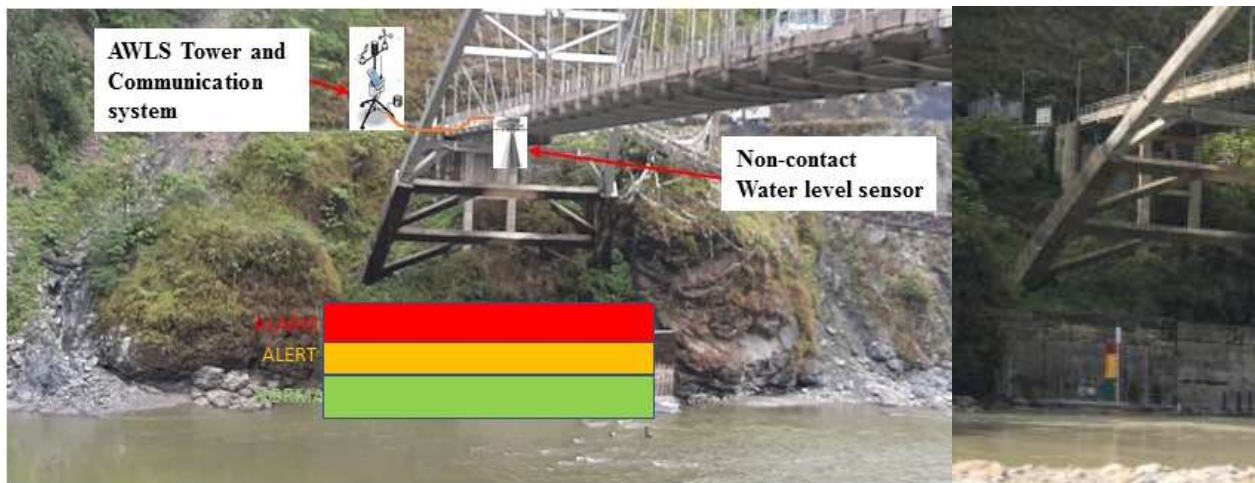


Figure 19: Water Level Gauge Mark on Amochhu Bridge

3.2.4 Thresholds based on rate of change of water levels

The CR Phuentsholing shall monitor the incremental rate of change of water level from the monitoring station once the water level exceeds the Alert level.

which needs immediate flood condition for the safe flood management.

- The CR shall not directly communicate to vulnerable communities. The CR provides only warning and broadcasting via the Siren Station. All the information and direction to the communities shall be provided by Thromde.

Communication Methods

- When **ALERT** /**ALARM** occurs, the CR shall use the best available communication methods (mobile/telephone/HF radio) to communicate with the FMCR of NWFWC and Thromde, RBP and CDCL/AFCONS (PTDP).
- Public communication tools such as mobile and telephone often shutdown during emergency. The CR shall keep HF radio communication with Dorokha and Doyagang Station open until threat are clear.

Decision Making

- For any requests to activate or stop the sirens from Thromde and other officials, the CR shall consult with the NWFWC for the decision.
- Only in case of continuous communication failure with the NWFWC, the CR shall follow the direction of the Thromde Disaster Management Committee or take independent decision based on the severity of the flooding situation.

4.3 Information Sharing in the Central Level

At the central level, the NWFWC, NCHM shall monitor and share rainfall and flood information with relevant central agencies by telephone, SMS or e-mail.

The NWFWC shall directly share the flood information with the following agencies:

- Department of Disaster Management (DDM), MoHCA / NEOC
- Prime Ministers' Office
- His Majesty Secretariat and
- Media (Bhutan Broadcasting Services (BBS TV and Radio) and others)

4.4 Warning Procedure

4.4.1 Basic Procedure

The CR will provide over all guidance and warning services. Therefore, the operator in CR will activate siren manually but monitors the process and keeps in communication with the FMCR of NWFWC, Thromde, RBP and CDLC/AFCONS.

The basic warning procedure is shown in Figure 21.

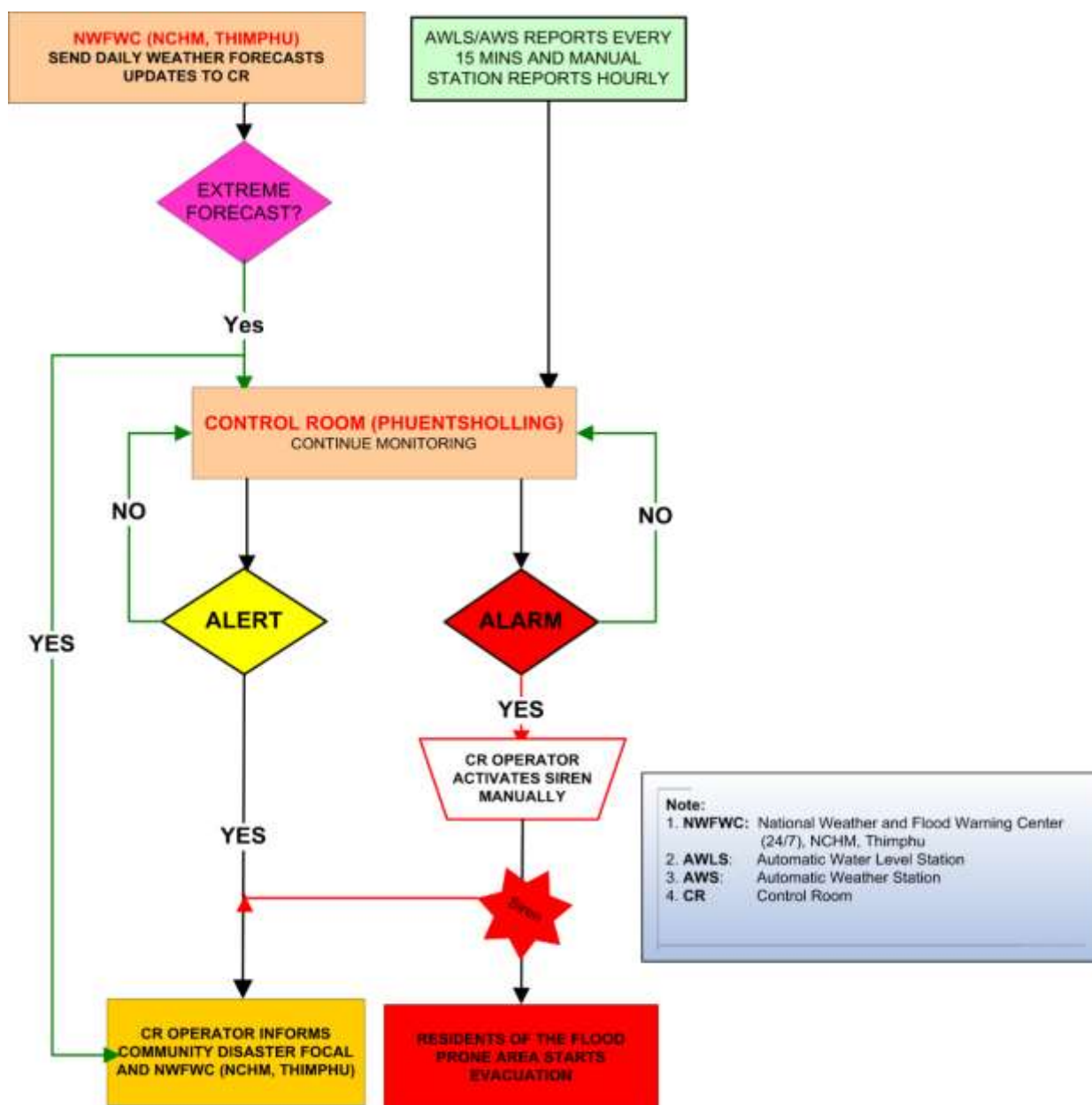


Figure 21: Basic Warning Procedure at Amochhu Flood EWS

4.4.2 False Alarm

In case of the false alarm, the CR operator will make a direct call to Thromde Disaster Focal Person and other focal point and NWFWC, Thimphu and followed by immediately announcement via broadcasting system (trumpet horn speaker) to the general public.

4.4.3 Duration of Siren Activation

The sirens shall be manually activated from CR for 5 to 10 minutes after which a voice announcement shall be broadcasted (trumpet horn speaker).

4.4.4 Termination of Emergency Situation

Termination of emergency situation by CR shall be based on the information provided by Thromde Disaster Management Committee or relevant authorities.

4.5 Contract List

4.5.1 Department of Disasters Management (DDM), MoHCA, Thimphu

The following contacts of DDM shall be available during emergency situation.

| No. | Name | Designation | Contact No. |
|-----|---------------------------|-----------------------|---------------------|
| 1 | Mr. Jigme Thinlye Namgyal | Director General | 17600584/ 02-327098 |
| 2 | Mr. Thinley Norbu | Chief Program Officer | 17333084/ 02-321004 |

4.5.2 Flood Monitoring and Command Room (FMCR), NWFWC, NCHM Thimphu

The CR is always connected with the FMCR of NWFWC, NCHM, Thimphu. However, the CR shall also use available public communication tools for effective communication.

| No. | Name | Designation | Contact No. |
|----------------------|-----------------------|---------------|---------------------|
| FMCR of NWFWC | | | 17128052/ 02-338442 |
| 1 | Mr. Jigme Wangdi | FMCR Operator | 17628951 |
| 2 | Mr. Aita Singh Tamang | FMCR Operator | 77396048 |
| 3 | Ms. Sangay Wangmo | FMCR Operator | 17474707 |
| 4 | Mr. Pema Dorji | FMCR Operator | 17980717 |
| 5 | Mr. Wangdi | FMCR Operator | 17588639 |

In case of no response from the FMCR of NWFWC, the CR shall communicate with below:

| No. | Name | Designation | Contact No. |
|-----|-------------------------|------------------------|-------------|
| 1 | Ms. Yeshe Choki | FMCR, In-charge, HWRSD | 17282553 |
| 2 | Mr. Sangay Tenzin | Asst. Engineer, HWRSD | 17711753 |
| 3 | Mr. Tayba Buddha Tamang | Chief, HWRSD | 17666639 |
| 4 | Mr. Tandin Wangchuk | Engineer, HWRSD | 17563060 |
| 5 | Mr. Karma Dupchu | Director, NCHM | 17629918 |

The following contacts of NWFWC and NCHM are available during emergency situation.

| No. | Name | Designation | Contact No. |
|--|---------------------|--------------|---------------------|
| Flood Monitoring and Control Room (FMCR) of NWFWC | | | 02-338442 /17128052 |
| 1 | Tayba Buddha Tamang | Chief, HWRSD | 02-323632 /17666639 |
| Weather Forecasting Room (WFCR) of NWFWC | | | 02-335578 /77452632 |
| 2 | Dr. Singay Dorji | Chief, WCSD | 02-324999 /17709253 |

The following contacts points of NCHM related to monitoring stations and ICT services.

| No. | Name | Designation | Contact No. |
|--|------------------------------|------------------------|-------------|
| Hydro-met Operation and Infrastructure Division | | | 02-330415 |
| 1 | Mr. Trashi Namgay | Dy. Executive Engineer | 17492942 |
| 2 | Mr. Jangchup Choephyel Dorji | Engineer | 17887396 |
| 3 | Mr. Kinzang Dorji | ICT officer | 17611407 |

4.5.3 Flood Control Room (CR), Phuentsholing

The CR is the 24/7 operation during summer season. The contacts of the CR are as follows:

| No. | Name | Designation | Contact No. |
|---|-------------------|-------------------------|---------------------|
| Flood Control Room, Amochhu, Phuentsholing | | | 05-250079/ 17123159 |
| 1 | Mr. Wangdi | CR Operator | 17588639 |
| 2 | Mr. Kunzang Dorji | Temporary (CR Operator) | 17825014 |
| 3 | Mr. Tashi Chopel | Temporary (CR Operator) | 17421445 |

4.5.4 Doyagang Flood Monitoring Station, Amochhu Bridge, Phuentsholing

The contacts of the staff are as follows:

| No. | Name | Designation | Contact No. |
|-----------------------------|-------------------------|--------------------|-------------|
| Doyagang Site Office | | | 17123161 |
| 1 | Mr. Indra Bdr. Ghalley | In charge | 17551029 |
| 2 | Ms. Budha Maya Raika | Technician | 17659057 |
| 3 | Mr. Paras Mani Sunwar | Technician | 17448834 |
| 4 | Mr. Tashi Wangchuk Doya | Temporary Observer | 17526036 |

4.5.5 Dorokha Flood Monitoring Station, Dorokha, Samtse

The contacts of the staff are as follows:

| No. | Name | Designation | Contact No. |
|--------------------------------------|--------------------------|-------------|-------------------|
| Dorokha Flood Warning Station | | | 77780438 |
| 1 | Mr. Ganesh Bdr. Pradhan | In-charge | 17684833/77452031 |
| 2 | Mr. K. N. Dhungyel | Observer | 17871482 |
| 3 | Mr. Shyam Nath Acharya | Observer | 77862173 |
| 4 | Ms. Sangay Zangmo Tamang | Observer | 17257192 |

4.5.6 Dzongkhag Administration, Chhukha

CR shall communicate the flood information based on need to the officials of Chhukha Dzongkhag Administration. The contacts are as follows:

| No. | Name | Designation | Contact No. |
|-----|--------------------|---------------|---------------------|
| 1 | Dasho Minjur Dorji | Dzongda | 08-478251/ 17984024 |
| 2 | Dasho Sherub Dorji | Dzongrab | 77103417 |
| 3 | Mr. Tshewang Dorji | Dzongkhag DMO | 77107843 |

4.5.7 Dungkhag Administration, Phuentsholing

CR shall communicate the flood information based on need to the officials of Dungkhag, Administration. Phuentsholing. The contacts are as follows:

| No. | Name | Designation | Contact No. |
|-----|---------------------|--------------|-----------------------------|
| 1 | Dasho Karma Rinchen | Drungpa | 05-251363/77105243/17117003 |
| 2 | Mr. Chhimi Tshewang | Dungkhag DMO | 17170133 |

4.5.8 Thromde, Phuentsholing

CR shall communicate the flood information to the officials of Phuentsholing Thromde. The contacts are as follows:

| No | Name | Designation | Contact No. |
|-----------|-----------------------|---------------------|---------------------|
| 1 | Dasho Uttar Kumar Rai | Thrompon | 17410281/ 05-252495 |
| 2 | Mr. Lungten Jamtsho | Executive Secretary | 17606945/ 05-254312 |
| 3 | Mr. Lhendup | Thromdue DMO | 17658514/ 05-254609 |
| 4 | Mr. Ashok Sunwar | Chief Engineer | 17447267 |

4.5.9 Royal Bhutan Police (RBP), Phuentsholing

CR shall communicate the flood information to the officials of Phuentsholing Thromde. The contacts are as follows:

| No. | Name | Designation | Contact No. |
|------------|----------------------|------------------------------|---------------------|
| 1 | Col. Namgay Dorji | SP | 17632027/ 05-252256 |
| 2 | Major Ugyen Tshewang | OC | 17131358 |
| 3 | Office Incharge | Phuentsholing Police Station | 05-252444 |

4.5.10 CDCL/AFCONS for PTDP Project

CR shall report flood information to the CDCL, PTDP, Phuentsholing. The contacts are as follows:

| No. | Name | Designation | Contact No. |
|------------|------------------|-----------------------------------|--------------------|
| 1 | Mr. Ashok Kumar | HSE In-charge, AFCONS Infra, PTDP | 17325971 |
| 2 | Mr. Pemchung | Health & Env. Manager, PTDP | 17867958 |
| 3 | Mr. Kamal Dhakal | Project Manager, PTDP | 77341447 |
| 4 | Mr. Lhendup | Dy. Project Manager, PTDP | 17463636 |

CHAPTER 5 Disaster Preparedness and Response

5.1 Mock Drill

Thromde in coordination with Department of Disaster Management (DDM, MoHCA) and NCHM shall conduct mock drill time to time (based on need) for the early warning and evacuation to be more efficient and effective.

5.2 Training of CR and Observers

The training program for CR operators and Observers is very important aspect of the effective operation of flood warning system in particularly water level and rainfall observations and use of communication equipment. NCHM to continuously provide training and refresher course for CR operators and field technicians and observers including the community volunteers, if any.