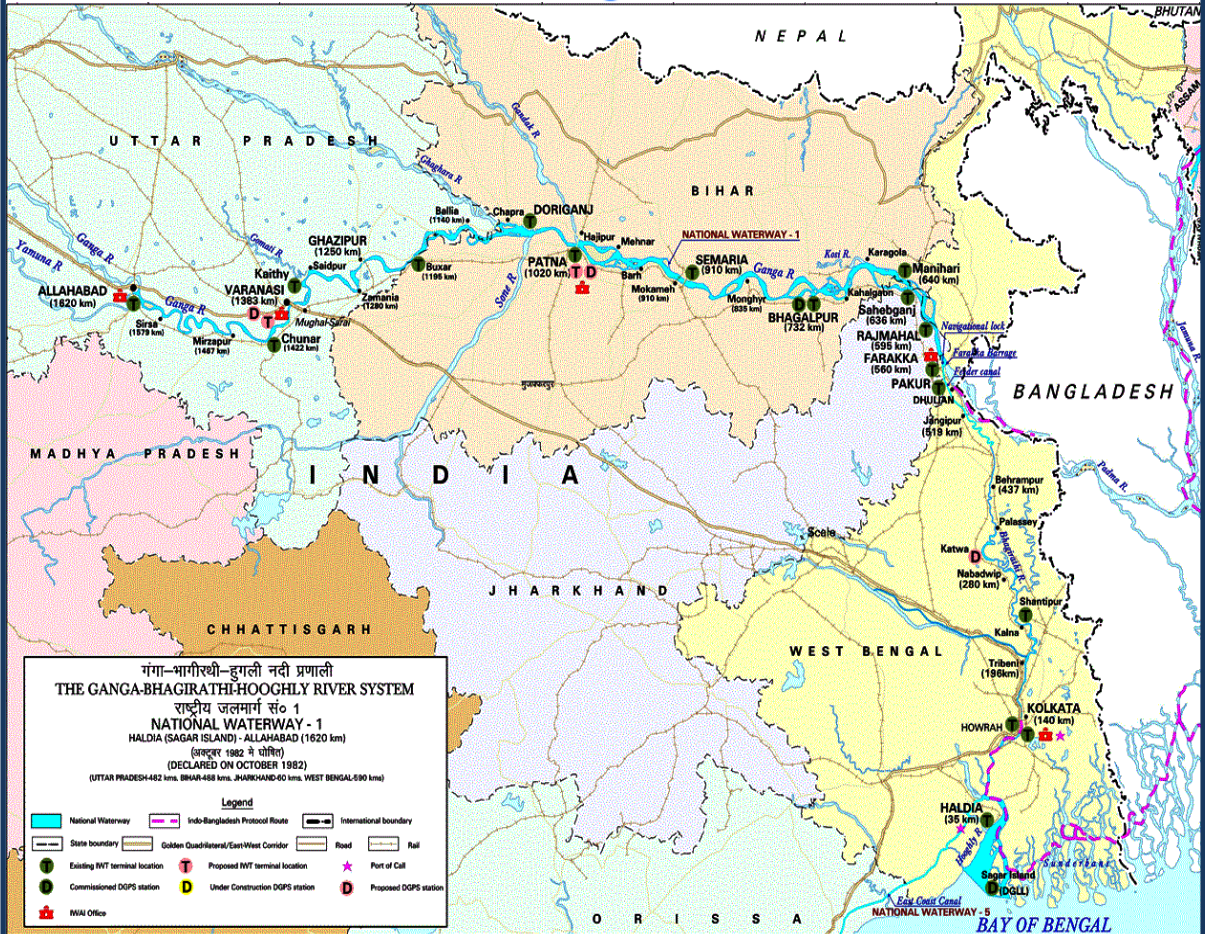


INLAND WATERWAYS AUTHORITY OF INDIA



Consulting Services for Risk Assessment and Disaster Management Plan for National Waterway-1 (River Ganga)

Final Report Volume I – Main Report



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ABBREVIATIONS

ALARP	As Low As Practically Reasonable
AIS	Automatic Identification System
BHD	Back Hoe Dredgers
BMP	Best Management Practices
BPCL	Bharat Petroleum Corporation Limited
BSDMA	Bihar State Disaster Management Authority
BOOT	Build Own Operate and Transfer
CCS	Cabinet Committee on Security
CAPF	Central Armed Police Forces
CCA	Central Coordinating Authority
CWC	Central Water Commission
CBRN	Chemical Biological Radiological and Nuclear
CIC	Chief Incident Controller
CIF	Chief Inspector of Factories and Boilers
CS	Chief Secretary
CRZ	Coastal Regulation Zone
CNG	Compressed Natural Gas
CMG	Crisis Management Group
CSA	Critical Section Analysis
CSD	Cutter Suction Dredger
DWT	Dead Weight Tonnage
DAE	Department of Atomic Energy
DGPS	Differential Global Positioning Systems
DGICG	Director General of Indian Coast Guard
DM Act	Disaster Management Act
DMA	Disaster Management Authority
DMD	Disaster Management Department
DMP	Disaster Management Plan
DRR	Disaster Risk Reduction
DC	District Collector
DDMA	District Disaster Management Authority
EDFC	Eastern Dedicated Freight Corridor
ENC	Electronic Navigational Chart
ECC	Emergency Control Centre
EOC	Emergency Operation Centre
ERV	Emergency Recovery Van
ESFs	Emergency Support Functionaries
EIA	Environmental Impact Assessment
FCP	Field Command Post
FAST	First Applied Sorbent Treatment against Chemical Threats
FGDs	Focus Group Discussions
FOCAL	Forum of Cargo Owners and Logistics Operators
FO	Furnace oil
GSI	Geological Survey of India
GST	Goods and Services Tax

GoI	Government of India
HDC	Haldia Dock Complex
HNS	Hazardous and Noxious Substances
HO	Head Office
HSD	High Speed Diesel
HTL	High Tension Line
ICR	Incident Control Room
IMT	Incident Management Team
IBP	India Bangladesh Protocol
IMD	India Meteorological Department
INCOIS	India National Centre for Oceanic Information Services
ICG	Indian Coast Guard
IRS	Indian Registry of Shipping
IV Act	Inland Vessel act
IWT	Inland Water Transport
IWAI	Inland Waterways Authority of India
IADC	International Association of Dredging Companies
IMDG	International Maritime Dangerous Goods
IMO	International Maritime Organization
IMSBC	International Maritime Solid Bulk Cargoes
ISGINTT	International Safety Guide for Inland Navigation Tank-barges and Terminals
IBRD	International Bank for Reconstruction and Development
JMVP	Jal Marg Vikas Project
JSDMA	Jharkhand State Disaster Management Authority
KAT	Key Assessment Team
KoPT	Kolkata Port Trust
LAD	Least Available Depth
LNG	Liquefied Natural Gas
LC-DMAF	London Convention- Dredged Material Assessment Framework
MSIHC	Manufacture, Storage and Import of Hazardous Chemical
MSDS	Material Safety Data Sheets
MTPA	Metric Tons Per Annum
MMT	Million Metric Tone
MoAFW	Ministry of Agriculture and Farmers Welfare
MoCA	Ministry of Civil Aviation
MoD	Ministry of Defence
MoES	Ministry of Earth Science
MoEF&CC	Ministry of Environment, Forest sand Climate Change
MoHFW	Ministry of Health and Family Welfare
MHA	Ministry of Home Affairs
MoM	Ministry of Mines
MoR	Ministry of Railways
MoRTH	Ministry of Road Transport and Highways
MoS	Ministry of Shipping
MoUD	Ministry of Urban Development

MoWR	Ministry of Water Resources
NCMC	National Crisis Management Committee
NDMA	National Disaster Management Authority
NDMP	National Disaster Management Plan
NDRF	National Disaster Response Force
NEC	National Executive Committee
NINI	National Inland Navigation Institute
NIDM	National Institute of Disaster Management
NOS-DCP	National Oil Spill Disaster Contingency Plan
NTPC	National Thermal Power Corporation
NW 1	National Waterway - 1
NWs	National Waterways
NGOs	Non-Government Organization
OMD	Operation, Maintenance and Development
OSCP	Oil Spill Contingency Plan
OSR	Oil Spill Response
O-D	Origin-Destination
ODC	Over Dimensional Cargo
PFD	Personal Flotation Devices
PPE	Personal protective equipment
PAC	Provincial Armed Constabulary
QHSE	Quality, Health, Safety & Environment
RO	Regional Office
RA	Risk Assessment
RIS	River Information System
RNA	River Navigation Atlas
Ro-Ro	Roll-on – Roll-off
SCBA	Self-Contained Breathing Apparatus
SIC	Site Incident Controller
SOC	Site Operation Centre
SASE	Snow and Avalanche Study Establishment
SOP	Standard Operating Procedure
SAP	State Armed Police
SDMA	State Disaster Management Authority
SDMP	State Disaster Management Plan
SDRF	State Disaster Response Force
SEOC	State Emergency Operation Centre
SEC	State Executive Committee
SIDM	State Institute of Disaster Management
ToR	Terms of Reference
TML	Transportable Moisture Limit
ULSD	Ultra-Low Sulphur Diesel
UPDMA	Uttar Pradesh Disaster Management Authority
UP	Uttar Pradesh
UPPCL	Uttar Pradesh Power Corporation Ltd.
VTMS	Vessel Traffic Management System

WS	Water Supply
WTMS	Water Traffic Management System
WB	West Bengal
WBDMA	West Bengal Disaster Management Authority
WODA	World Dredging Association

Executive Summary

National Waterway - 1 (NW 1) with an extend of 1620 km is the longest waterway which is essential part of Ganga - Bhageerathi - Hooghly river system falling within 4 major States of the Country i.e. Uttar Pradesh, Bihar, Jharkhand and West Bengal exiting to Bay of Bengal. Industrial developments along the project region, proximity with Eastern Dedicated Freight Corridor and connection with Port of Call, Kolkata and its Dock complex at Haldia offers great potential for intermodal and multimodal operability for NW-1. Towards developing NW 1 as an alternative mode of transport, Government of India is assisted by International Bank for Reconstruction and Development under the flagship project “Jal Marg Vikas Project” through developing fairway between Varanasi and Haldia.

*As part of JMVP, A fairway of 45 m bottom width with 3.0/2.5/2.2/1.5 m Least Available Depth (LAD) is proposed for the Varanasi to haldia stretch of waterway with provision of Multimodal Terminals at Varanasi, Sahibganj and Haldia with Intermodal terminals at Ghazipur and Kalughat and Tribeni. Ro-Ro terminals at 5 locations, construction of new navigational lock at Farakka, installation of RIS and VTMS facilities etc. are already integrated in the project. As per the standard design vessels for NW 1, the maximum vessel size allowed is 110*12*4.3 with a Dead Weight Tonnage around 2000 tonne requiring draft of 2.8m with an air draught of 9 m. 22 types of cargos are identified including hazardous and non-hazardous cargoes and total traffic expected in 5, 07,44,762 Tonnes by 2020 (Source: EIA Report, IWAI)*

The present study is targeted on identifying the risk associated with IWT operation in NW 1 and preparation of proposal for integration of IWT related risk with respective District Disaster Management Plans(DDMPs) of the 30 bordering districts with provision for escalation to involve national plan stakeholders based on the criticality of the incident. The study also includes preparation of onsite and offsite emergency plan for IWT related incidents and proposing emergency response equipments including cost estimation towards implementing the same.

Towards comprehensive risk assessment study, Consultants(KITCO) carried out detailed reconnaissance visit along the entire waterway and comprehensive database on salient features has been developed for NW 1.with support of extensive literature review with an interval of 2 km to delineate critical risk elements associated with waterway. As per the terms of reference, the study was focused on hazards associated with four risk elements i.e. related to channel, cargo, vessel and dredging for both offshore and onshore operations. Historical analysis shows that, hazards, which can develop into risky scenarios with respect to the four risk elements are grounding, collision, contact, fire and explosion. The consequence may include toxic contamination, toxic cloud, spillage of flammable liquid /gas. Vulnerability of project region to natural hazards i.e., cyclone, thunderstorm, flood, earthquake, tsunami, tidal bore were also assessed. Towards deriving the credible scenarios for detailed risk assessment, channel related risk were studied through critical section analysis, cargo related risk was assessed through intrinsic and inter compatibility issues, vessel related risk were assessed with causative factors and dredging related risk based on operation pattern. The major outcomes of the study are:

- *Out of the total 1620 km stretch of waterway, there are 325 sections along in NW 1 - 105 no between Prayagraj and Munger and 220 no between Munger and Haldia) due to presence of risk elements. There are **169 hotspots** identified all along the stretch studies.*
- *Total of 105 critical stretches identified for Prayagraj -Munger section, out of that, 38 are hotspots. The critical risk factors include critical bridge locations, pontoon bridges, mass gathering areas, environmentally sensitive stretches, high traffic areas, cargo handling terminal locations, multiple ferry crossings, sagging and eroding tower lines etc.*
- *There are 220 critical sections identified for Munger - Haldia section out of which 131 are hotspots. The critical risk factors within hotspots were sharp curves less than 200 , environmentally sensitive areas, high traffic areas such cargo jetties, multiple ferry crossings, presence of cross structures having low clearance, tower lines in eroding banks, lock gates and aqueducts etc.*
- *It is proposed that cautionary approach is to be adopted for the yellow sections, which are moderately critical and standard operating procedure, compliance with regulations, regular Thalweg surveys and dredging shall be adopted for the white sections including remaining sections. Also, in case of narrow stretches with thickly populated banks disaster management mechanism to be correctly aligned.*
- *The areas falling under Vikramshila Gangetic Dolphin Sanctuary and Kashi Turtle Sanctuary requires specific attention.*
- *The analysis of the intrinsic properties of cargo shows that, hazardous cargoes include liquefied ammonia, CNG, LNG, Petrol, High Speed Diesel, Furnace Oil, Coal, Ammonium Nitrate based Fertiliser (based on ammonium nitrate content) and Iron as Ferrous Metal Borings, shavings, turnings or cuttings or Iron Oxide, Spent or Iron Sponge, Spent (obtained from coal gas purification) which are to be transported as per the IMDG guidelines.*
- *Coal, Coke, Manganese Ore, and Iron in its various forms are attracting IMBC code require to follow the specific guidelines w r to the same and non-listed cargoes such as edible oil, food grains, plastic, paper, ODC etc. has to follow the best industry practice for safe transport through NW 1.*
- *Provision of RIS, VTMS facility, routine thalweg surveys, standardisation of cargo vessels for NW 1, implementation of FOCAL etc. would contribute for avoiding risks associated with vessels and manoeuvring. However, the risk associated with vessel malfunction, mis-communications, negligence of crew etc. cannot be ruled out and hence need close monitoring on operation and maintenance of vessels including the training and capacity building for the crew.*

A detailed disaster management plan has been prepared for inegration of the IWT related disaster operation for handling disasters onshore (terminal) and offshore (along waterway). The major aspects of DM Plan for NW-1 are

- *Being a continuous medium the emergency may easily transport from one location to another. As per the administrative system of India, the emergency within a State shall be routed through State and National Disaster Management Authority whereas*

incidents affecting multiple states the entire coordination shall be done through National Crisis Management Committee.

- *The onsite emergency plan has been prepared to deal the emergency Level 1 in a terminal with detailed proposal as Emergency Control Centre, Incident Management Team, Roles, Responsibilities, Training and Capacity Building including mock drills with provision of essential emergency equipment and facilities including the block cost estimate.*
- *For Level 2 /3 operation, proposal is made with suitable scaling up of intervention of IWAI-RO /HO in line with the DM Act, 2005 with provision of Incident Management Team at RO and HO with specific roles and responsibilities. A dedicated Crisis Management Group has been proposed at HO to handle the management decisions is and to coordinate with the apex authorities of country i.e. National Disaster Management Authority and National Crisis Management Committee. The proposal formulated has given the communication and operation flow and guideline suiting with both situations.*
- *Existing DM mechanism of each State was analysed in detail to understand the present nodal departments and specific roles assigned. The vulnerable resources along the project region of each State was listed out towards delineating the line departments / agencies who need to be integrated in the respective State Disaster Management Authority. Nodal departments who shall take care of the responsibility of coordination in each state as per the present operation plan was also delineated towards integrating the DM operations in case of an emergency. It is identified/proposed that*
- *For State of UP, Boat capsizing is the only IWT related disaster considered in the SDMP with Department of Revenue as Nodal Department. It is proposed to include IWT related disasters in SDMP with incremental cargo operation with suggesting Department of Revenue as nodal department. Vulnerable resources who may directly or indirectly affected include - Turtle Sanctuary, water supply Intake, Ferry services, Tourism vessels, Country boats, passenger vessels, fishing vessels, Jetties, HT line/Overhead Tower lines, Road bridge/ Rail bridge and human settlements, agriculture activities, common use of public. Since majority of respective line departments are already part of SDMA, it is proposed that Fisheries Department and Tourism Department to be integrated in the SDMA and integrate the same department in DDMA of bordering districts of NW 1. IWAI and Ministry of Railways will act as resource agencies.*
- *For the State of Bihar, inland water transport related disasters are not identified as disaster within the state and is to be added in the disasters list in SDMP. The Secretary, Department of Transport, who is already part of SDMA could be represent SDMA, same department shall act as nodal department in case of IWT related disasters within the State. Vulnerable resources who may directly or indirectly affected include – water supply intake, Gangetic Dolphin Sanctuary, ghats, rural/urban settlements, pilgrim centres, road cum railway bridge, Ro-Ro, Passenger Boats, Agriculture, HT Lines and fishing activities. Additionally, Department of Revenue and Land Forms and Dept. of*

Industries shall be added as additional stakeholder in SDMA and essentially in DDMA of bordering districts.

- In the State of Jharkhand, inland water transport related disasters are not listed in SDMP and is to be integrated. The Secretary, Department of Transport is already designated as one of the ESF in the SDMA, who could be represented for handling the IWT related disasters. The same department shall act as nodal department in case of IWT related disasters within the State. Vulnerable resources of project region who may directly or indirectly affected include fishing and agriculture activities, Ro-Ro facilities, country boat operations, municipal water supply, common property resources such as temple, burning ghats etc. It is required that Department of Environment and Department of Industries has to be added within SDMA to meet the requirement of emergency handling in IWT sector.*
- For the State of West Bengal, inland water transport related disasters are to be added to SDMP with proposed incremental cargo operation. The Secretary, Irrigation & Waterways Department is already part of SDMA could represent for handling the IWT related disasters. The same department shall act as nodal department in case of IWT related disasters within the State. Vulnerable resources of project region who may directly or indirectly affected include floating jetty, bank protection, irrigation water supply, fishing activities, vessels –tourism, ferry, passenger vessels, fishing harbour, H/T lines, agriculture activities, Port related traffic, Defence vessels/establishments road bridge, human settlements and public uses and drinking water supplies. It is proposed that Department of Land and Land Reform and Refugee Relief and Rehabilitation, Industry, Commerce and Enterprises, Department of Forest, Department of Environment with representation from State Pollution Control Board shall be added to SDMA. Kolkata Port Trust, IWAI, NTPC and Ministry of Railways would act as resource agencies within the project region.*
- It is required that necessary inclusion of provision for Inland oil spill incidents to be integrated in the National Oil Spill Disaster Contingency Plan, which presently deals with only marine oil spill contingencies. However, following the essential criteria and guidelines of NOS-DCP, proposal has been made for handling oil spill incidents within NW 1. It is concluded that*
- Only Furnace Oil is the persistent oil to be transported through NW 1 requiring specific Oil Spill Response (OSR) equipments. OSR equipments have been proposed for all terminals in line with NOS-DCP guidelines and it is proposed to have arrangement with Kolkata Port Trust and Indian Coast Guard for emergency operations in case of an offshore incidents.*
- Emergency response equipment's including OSR equipments has been proposed at each IWAI terminal along with facilities for setting up of an Emergency Control Centre in IWAI terminals, Ro and HO.*
- The block cost estimate for implementing the facilities at each terminal works out to **Rs. 6.66 Cr for an oil handling terminal and Rs. 1.49 Cr for a non-oil handling terminal.** The total cost for proposed 3 terminals works out to **Rs 19.98 Cr and Rs 4.5 Cr** respectively. The cost is inclusive of all tax except GST.*

- *RO and HO of IWAI shall be having a dedicated ECC facility to coordinate the response operations. The total cost estimate for setting up the facilities works out to **Rs. 20 Lakhs each totalling to Rs. 60 Lakhs** excluding GST.*
- *For handling the offshore emergencies associated with the vessels by respective DDMA's of the project region, it is proposed that additional facilities shall be ensured such as portable firefighting facilities and adequate PPEs etc. The total cost works out to **Rs.19.64 lakhs** for each DDMA and total of **Rs.5.892 crore** for 30 districts in case the facilities proposed are not available with them.*
- *Environmental Sensitive Areas of project region – Vikramshila Gangetic Dolphin Sanctuary and Kashi Turtle Sanctuary is proposed with specialised onshore oil spill containment facilities with provision of River Booms with accessories. The total cost works out to **Rs.78.85 Lakhs** excluding GST.*
- *IWAI shall have a dedicated provisioning for meeting with disaster management requirements with specific budgetary provisions to meet the expenses related with training, maintenance and upkeeping of the facilities and manpower to deal with any disaster situation.*

The best management practices that could be implemented at NW 1 for ensuring safe and sustainable IWT operation is proposed based on international practices and study has integrated the essential Standard Operating Procedure (SOPs) as per Inland Vessel act and specific protocols on speed control, monitoring, vessel tracking, waste management, incident reporting with aquatic mammals, hazardous chemicals handling etc. as part of the study. The final report incorporates all the findings of the study is submitted for approval.



INTRODUCTION

India is blessed with more than 18, 240 km of navigable or potentially navigable waterways through the extensive network of rivers, canals, creeks and back waters. It is with clear understanding on the potential and advantages of the inland waterways development for the country that Inland Waterways Authority of India (IWAI) was set up in October, 1986 vide IWAI Act, 1985 under the Ministry of Shipping (MoS) towards coordinating the task of developing, monitoring and administering Indian waterways. IWAI plays a key role in the expansion and maintenance of the waterways with development of infrastructure and regulations in National Waterways (NWs), taking up feasibility studies and advising Central Government and supporting State Governments in their initiatives to develop waterways. So far, 111 waterways of the country have been declared as NWs.

Ganga - Bhageerathi - Hooghly river system of 1620 km is the longest waterway in India, declared as national waterway with effect from 27th October, 1986. It spans from Central portion of North India till North –West Boundary of India, exiting to Bay of Bengal. The historical waterway is geographically, economically and strategically important and is serving as a lifeline of the country in all respects in terms of its multifaceted dependence stretching through four states, i.e. Uttar Pradesh, Bihar, Jharkhand and West Bengal, which have been marked with industry as a thrust area. The waterway is located in close proximity with Eastern Dedicated Freight Corridor (EDFC) and connectivity to Port of Call, Kolkata and Haldia make it apt for the establishment of vast network with ample opportunity for both intermodal and multimodal systems.

Understanding the potential of NW 1 to serve as an alternative mode of transport, the Government of India (GoI) has been assisted by the International Bank for Reconstruction and Development (IBRD) to develop the same as an alternative mode of transport under the flagship project “Jal Marg Vikas Project (JMVP)”. The project envisages developing fairway between Varanasi to Haldia covering a distance of 1620 km with many infrastructure interventions in between such as development of cargo terminals, Roll-on – Roll-off (Ro-Ro)

terminals, re-development of navigational lock etc. This would enable commercial navigation of vessels of around 2000 Dead Weight Tonnage (DWT).

River Ganga being a perennial river with industrial areas developed along its banks offers potential for commercial activities. However, it is to be noted that like any activity there are inherent risks as well as that posed by the hazardous commodities. Thus, it is necessary to undertake a detailed risk assessment study on safety and sustainability aspects. IWAI recognizes the need to preserve and protect human health and natural environment from the ever-present risk of oil and chemical spills, accidents and other natural hazards. In this context, the risk assessment study for the transport of existing and prospective cargo movement is highly relevant. The risk management measures would be integrated as mutually agreeable Disaster Management Plan (DMP) for NW 1, after due consultation with all the stakeholders including Disaster Management Authority (DMA) and integration of the same to the District Disaster Management Plan (DDMP). This proactive step will ensure integration of sustainability aspects to the planning as well as operational aspects of the IWT operations and maintenance of the same.

With present national policies focusing on the improvement of NWs, with several initiatives have been taken up by the government for enhancing the essential infrastructure facilities, establishing communication and navigation aids, ensuring regular maintenance of channels etc., the present study would be a leap in the sustainable management of IWT operations of cargo transport, especially hazardous cargo transport through prestigious inland waterways of India and a bench mark project for NW 1.

Through the national competitive bidding, M/s. KITCO Limited, Kochi, India's first state level public sector technical consultancy organisation was qualified as the Consultant towards undertaking the Risk Assessment study towards integration of IWT related risk in to DDMP and awarded the above work through Contract No.IWAI/WB/NW-1/10/3(4)/2016 dated 04th April 2018. The present report makes the Final Report of the study incorporating all scope of work as per the Terms of Reference (ToR) requirement. The report has been structured in to 2 Volumes including this introduction as below.

- Volume I –Final Report
 - Section 1 - Introduction
 - Section 2 - Salient Features of Waterway and its Operational Profile

- Section 3 - Risk Assessment
- Section 4 – Proposal on DM Plan for IWT Related Disasters for NW 1.
- Section 5 – Best Management Practices
- Volume II –Final Report – Protocols, SOPs and Annexures

SALIENT FEATURES OF NW 1 AND ITS OPERATIONAL PROFILE

NW 1 forms the part of the Ganga-Bhagirathi-Hooghly river system, extends between Allahabad in Uttar Pradesh to Sagar Island in West Bengal. The waterway connects four major states of the Country; Uttar Pradesh (UP), Bihar, Jharkhand and West Bengal (WB) and serves multi-stakeholder utilization pattern. It is fed by various tributaries along the entire stretch such as Tons, Gomti, Ghaghara, Sone, Gandak, Punpun and Kosi. A fairway of 45 m bottom width with 3.0/2.5/2.2/1.5 m Least Available Depth (LAD) is being provided for the entire waterway.

Most sacred river of India, the Ganges is mainstay of this system and has the status “living human entities” and first to receive the same in the country. It is the lifeline to millions of Indians who live along its course and depend on it for their daily needs. NW 1 passes through diverse cultural and socio-economic provinces having much of difference in language, geography, means and way of living for those who depend on this water body. With industrial developments picked up in the respective States, there are numerous industrial units set up along the riverbank and its hinterlands. The portion of the water body declared as NW 1 forms part of major important pilgrim centers and thus attracts tourist activities throughout the year.

NW 1 on its long course serves major cities and their industrial hinterlands like Haldia, Howrah, Kolkata, Sahibganj, Bhagalpur, Munger, Patna, Ghazipur, Varanasi and Allahabad, which are themselves the key promoters for the IWT operations in NW 1. Thus, JMVP aims at making it a full-fledged parallel transportation system to facilitate the commercial operations, with adequate connectivity with conventional transportation network including intermodal and multimodal aspects. **Figure 2.1.** presents the location map of the project region.

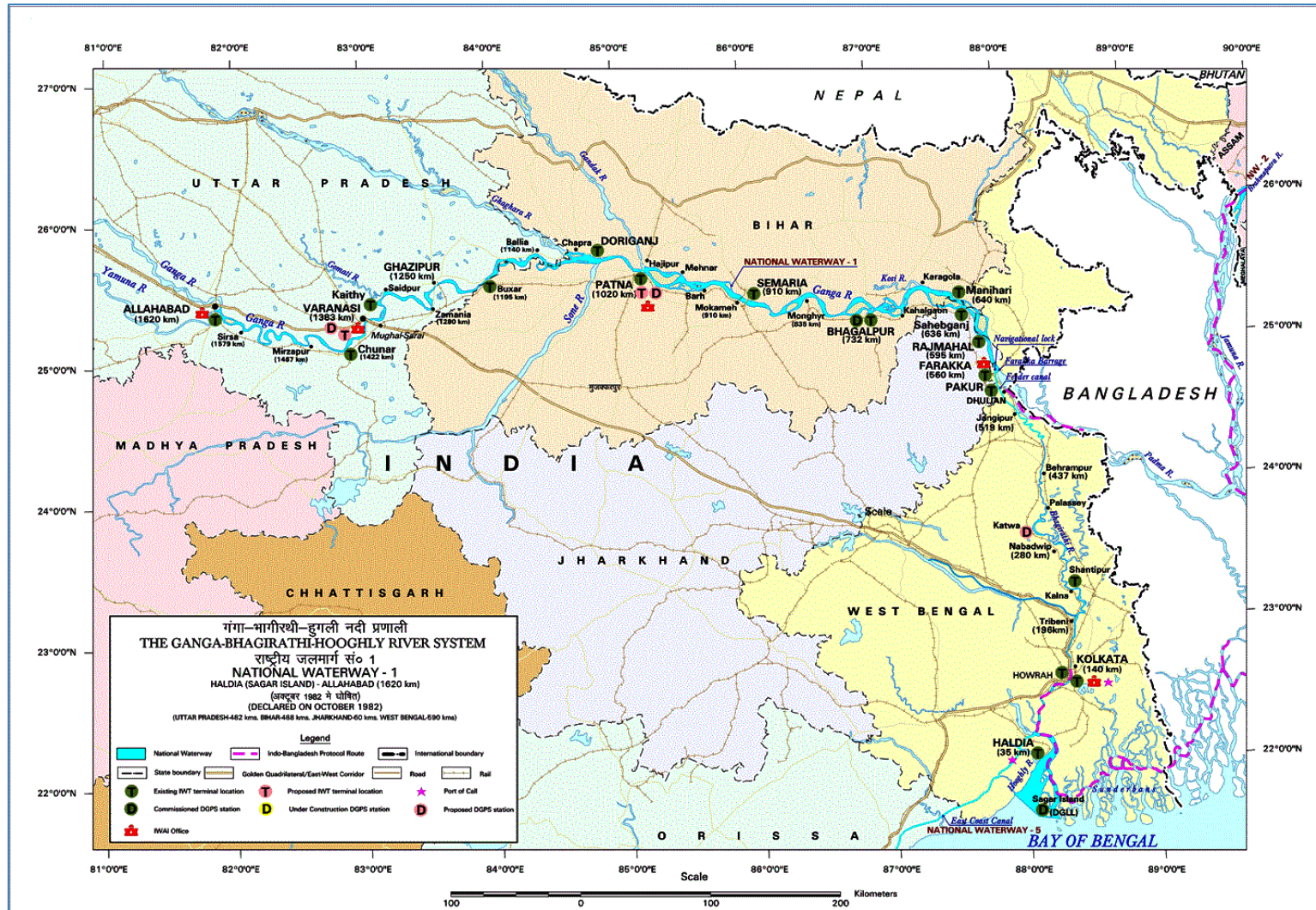


Figure 2.1. Location Map of NW 1

While considering the utilization of NW 1 as a cargo transport medium, it could be seen that the cargo includes wide variety of both solids and liquid commodities including hazardous ones. Also, at present, there have been extensive movement of Over Dimensional Cargo (ODC) especially related to Thermal Power projects by various power companies. Other common operators are tourism vessels, Inland Waterways Authority of India (IWAI) vessels and other traditionally operated vessels. Liquefied Natural Gas (LNG) is a prospective commodity under consideration in the near future. Operations of LNG operated vessels are also anticipated.

The present study targets on assessing the risk associated with cargo operation in NW 1 towards deriving a proposal for integration of risk into DDMPs of the project region.

2.1. Scope of the Study

The main objective of the present assignment is to prepare a detailed Disaster Management Plan for NW-1 in compliance with the existing DM structure of the country as the DM ACT 2005. The study will be conducted as two parts offshore and onshore. Offshore operations involve water activities with respect to the waterway, while onshore interventions for waterway activities which essentially requires activities/interventions with land –water interface such as Jetties, Terminals, Risk Information System(RIS)/ Differential Global Positioning Systems (DGPS) stations, ship repair facilities, lock gate, other assets etc.

Each aspect of NW-1 has been evaluated; independently based on its respective vulnerabilities to find and detail the declared “hotspots” along NW-1 and will make a recommendation to the IWAI to identify the more promising development of the DMP, which will include allocation and stockpile of resources at the designated hot spots.

For this project, the following activities will be done in brief:

- Review and adopt the international standards used in the DMP for inland waterways
- Analyse the IWT operational profile of NW - 1 with respect to all potential cargo movement.
- Risk Assessment
- Identify all “Hotspot” related risks under construction, operation and maintenance activities for NW-1
- Examine the vulnerability of the stakeholders affected by these risks

- Determine retained and transferable risk and quantify each risk using deterministic and probabilistic approaches for analysis as applicable.
- Identify practically possible safeguard options for integration to IWT operational procedure, ie., potential offshore & onshore emergencies during all phases of the project ie., construction, maintenance & operation phase of the waterway, river/marine accidents like grounding, collisions, capsizing etc., oil spill disaster contingency plan along NW-1, including plan for hazardous goods and vessels operating and/or carrying LNG/CNG as define by law in India.
- Develop an emergency preparedness and response strategy which shall outline the potential foreseeable emergency scenarios, classification, resources, incident command structure and a management plan encompassing prevention, control, recovery and remediation measures to deal with any emergency event that may occur within the project during construction, maintenance & operation phases.
- Preparation of Standard Operating Procedures (SOPs) in line with the Inland Vessels Acts, 1917 as amended from time to time.
 - Development and update of following protocols:
 - For speed control, monitoring, and vessel tracking
 - Waste management for barge operations and terminals
 - Biodiversity protection & accident reporting with aquatic mammals
 - Oil & Hazardous chemicals spills reporting and control and remediation as define by law in India.
 - Risk assessment procedures to assess and manage risks to personnel, vessels and the environment.
- Internal and external audit procedures and frequency.
- Delineate a methodology for integration of operational risk abetment measures to existing District Disaster Management Plan (DDMP) and coordinate with all nodal agencies on behalf of IWAI.
- Formulate capacity building and training strategy for effective implementation of comprehensive Disaster Management Plan.
- The Disaster Management Plan for NW-1 shall lay down clear guidelines for execution of mock drills of the plans.
- Validate the cost estimate for each segment of the DMP (i.e. infrastructure cost, equipment cost and training cost) based on the information collected for the NW-1. If

any relevant costs are missing in the studies, the Consultant is responsible to make the proper estimates. IWAI will facilitate the access of the Consultant to the relevant documentation;

- The DMP for NW-1 therefore will cover all phases of a disaster and therefore will have three plans - Mitigation Plan, Preparedness Plan and Response Plan and confirm that each part of the DMP substantially complies with local, state and national international safety, environmental and social requirements, and if not, what additional steps need to be taken in this regard.
- The DMP for NW -1 there for will cover all phases of a disaster and therefore will have three plans – mitigation plan, preparedness plan and response plan.
- Assistance of any statutory clearance/approvals for proposed Disaster Management Plan for NW-1.

2.2. Approach and Methodology

The present study targets on assessing the risk associated with the enhanced IWT operation with implementation of JMVP. In order to facilitate realistic view on the risk assessment study, the salient features of the waterway focusing to its key features w.r.to risk has been primarily delineated. IWT sector has 4 major components – channel, terminal, vessel and cargo. The salient features of channel, operation pattern of cargo transport and the properties of cargo are critical influential factors and multifaceted interaction between the activities/features or with operation, which will be emerged as a hazard, are analyzed in detail in the risk assessment study. Sequence of activities are presented in **Figure 2.2**.

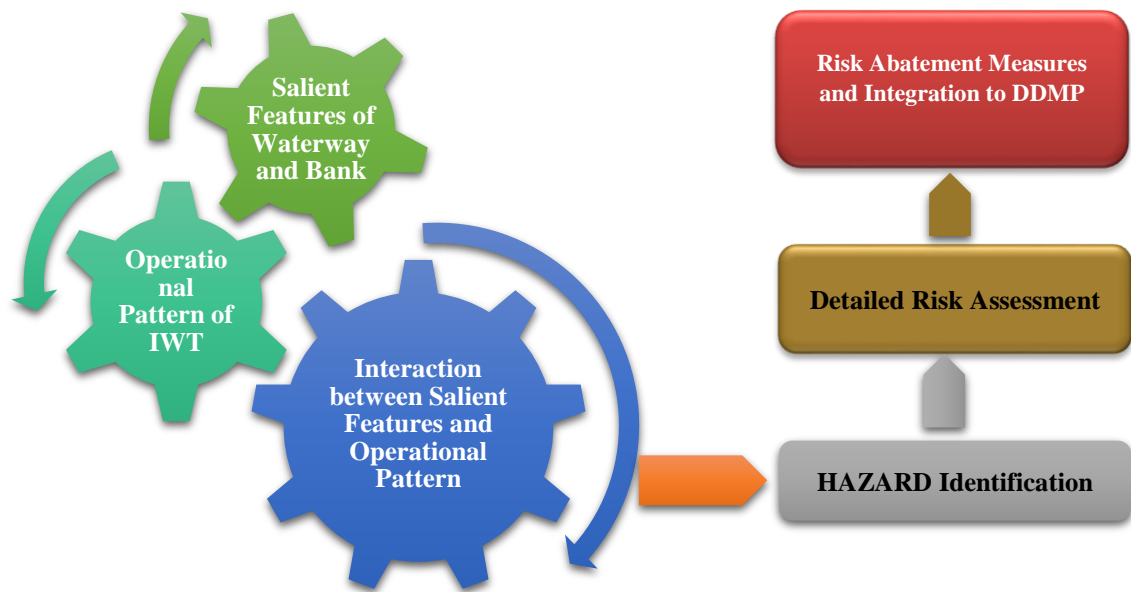


Figure 2.2. Sequence of Activities Leading to RA for NW 1

The salient features of the waterway has been studied in detail to understand its specific attributes and operational pattern, which are directly influencing the risk profile. The various components which become critical in risk include the features of the water body, the activities within the water body and the features along the bank in order to delineate the multifaceted interaction in between them which may derive as a risk element in the IWT operation.

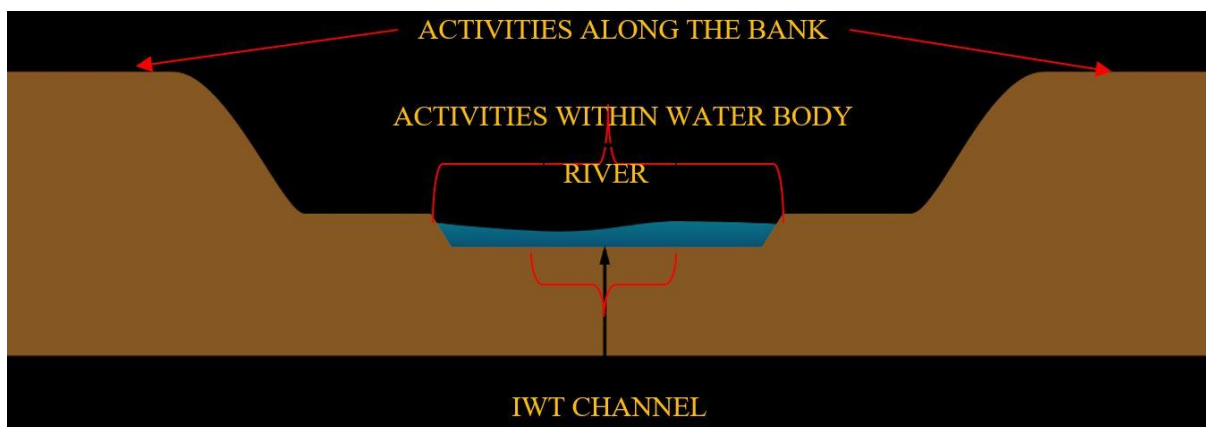


Figure 2.3. Schematic Representation of Salient Features of Waterway Influencing Risk

Thus, the salient features of the waterway could be assessed under three categories as below.

- Features of the river/fairway: Width of water body, Channel Morphology – Straight/meandering, alignment of fairway, proximity to bank, siltation areas, channel diversion areas, stream entering areas, environmental sensitivity of stretch, disaster prone areas etc.
- Activities within the water body: Transportation (ferry/cargo/passenger vessel/tourist vessels, fishing vessels), Jetty (Cargo/passenger/Ro-Ro), Recreation, Water Supply (WS) intake, agriculture Intake, navigation locks, industrial intake, country boat fishing, Net fishing, presence of vertical structures – road, railway, bridges, multiple bridges, electric line crossings, Common Public Utilities – Washing , bathing, Swimming, Cattle Rearing, cooling tower outfall etc.
- Bank Features– proximity of fairway to bank, bank characteristics – flat, gentle slope, steep slope, type of bank – clay/sand/soil, bank protection (rubble embankment/natural levees, grassy/open), sensitivity of Bank – Urban, town, rural, barren land, island, residential, agriculture, vegetated, educational institutions, industrial, historic monuments, temple/church/mosque, burning ghats, hospitals etc.

Risk due to IWT operation is a cumulative of probability of accident and the consequence on the receptors on various aspects. Through an extensive review of the features of the waterway, the critical elements, which may be a risk element, or the receptors, which could be critically impacted are delineated. A comprehensive five tier approach integrating the secondary and primary data collection through reconnaissance visits were followed as below towards establishing a well-defined project area profile towards delineating the critical aspects to be integrated in to the risk assessment study.

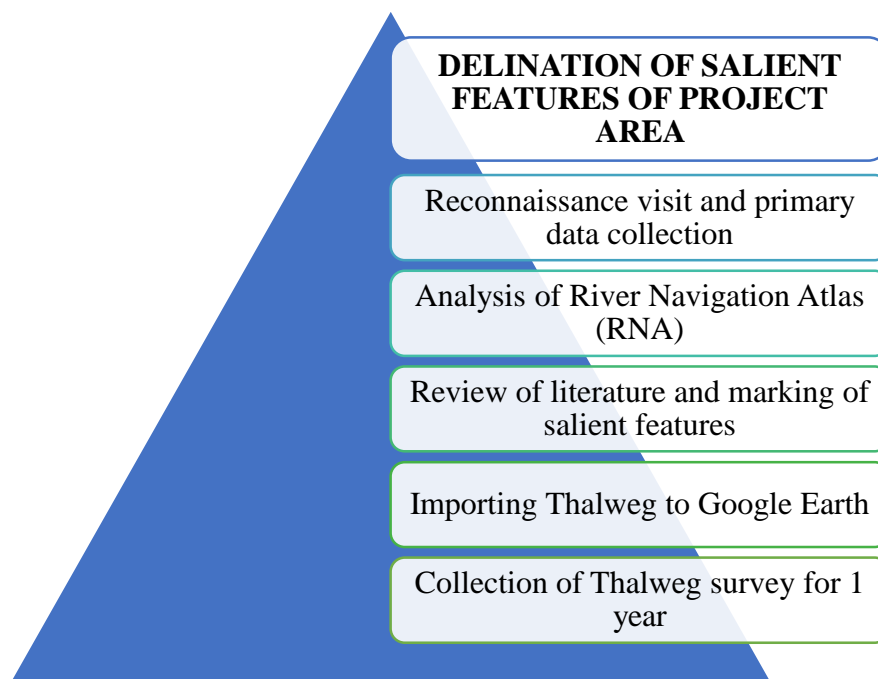


Figure 2.4. Five Tier Approach in Delineating Salient Features of Project Region

The details of Thalweg surveys conducted for the period from January 2017 to December 2017 has been analysed and it was observed that there is no major deviation in the survey route. The fairway has been demarcated at an interval of 2 km and the various sections has been further divided in to sub sections to ease the understanding and anlysis. Consultants including the Key Professionals with Supporting Key Professionals has carried out extensive reconnaissance visit through the entire stretch of waterway towards understanding the salient features between 17 May, 2018 to 10 June 2018 (Munger – Haldia Section) and 4 August, 2018 to 12 August, 2018 (Allahabad – Munger Section) under two schedules. A detailed inventory of the project region has been prepared for an interval of 2 km. The detailed analysis of the fairway alignment and sensitivity of activities has been carried out based on the literature review and reconnaissance visits, discussion with the officials in charge and Focus Group Discussions (FGDs) along the way. Detailed RA was followed towards preparation of DMP for IWT operation in NW - 1.

2.3. Salient Features of Waterway

The 1620 km waterway, reigning between Allahabad and Haldia forms part of a round the year operational waterway without any serious seasonal implications to navigability. The waterway section falls in 4 major states of the Country as presented in **Table 2.1**.

Table 2.1. State Wise Administrative Demarcation of NW 1

State	Section	Chainage (km)		Total Length (km)
		From	To	
Uttar Pradesh	Prayagraj – Rasulpur	1454	1092	362
Uttar Pradesh & Bihar	Rasulpur - Chappara	1092	982	110
Bihar	Chappara - Munger	982	762	220
Bihar	Munger – Rampur Ogairah	762	588	174
Jharkhand	Rampur Ogairah – Gadai Maharajpur	588	572	16
Bihar	Gadai Maharajpur – Naobarar Jaigir	572	558	14
West Bengal	Naobarar Jaigir – Nityanandapur	558	516	42
Jharkhand	Nityanandapur - Dogacchi	516	512	4
West Bengal	Dogacchi – Haldia	512	0	512

The entire waterway can be divided mainly into six stretches, viz.

- Prayagraj to Varanasi Multimodal Terminal- Medium wide stretch with total length of 204 km
- Varanasi Multimodal Terminal to Chappara- Medium wide stretch with total length of 268 km
- Chappara to Munger- Wider Stretch with total length of 220 km
- Munger to Farakka lock gate- Wider stretch with total length of 262 km
- Farakka lock Gate to Kolkata- Narrow stretch with total length of 400 km
- Kolkata to Haldia- Medium and wider stretch with total length of 100 km

A brief description of the project region is presented below and a detailed description along the alignment is presented in **Annexure I**.

2.3.1. Prayagraj - Varanasi Section

Prayagraj – Varanasi section starts at Ch. 1454 km and ends at Varanasi Multimodal Terminal in Ch. 1250 km. The entire riverine stretch is sufficiently wide with an average width of 600 m with elevated banks and sand beds within the river boundaries. The average LAD along this stretch is about 1.5 m. The entire stretch runs through the State of Uttar Pradesh and Prayagraj, Mirzapur, Sant Ravidas Nagar and Varanasi are the bordering districts. The location of Triveni Sangam, where three holy rivers Ganga, Yamuna and mythical Saraswathi confluences lies in this stretch. River Tons is the other major river joining this waterway. The major settlements along this stretch are Prayagraj, Mirzapur, Chunnar and Varanasi. Cultivation is the major

activity observed along the banks. Gyanpur lift irrigation project and other medium and small scale irrigation pumps are present within the river. Among the hotspots identified, critical bridge at Mirzapur and eroded tower lines at Paranipur are within this stretch.

2.3.2. Varanasi - Chappara Section

Varanasi – Chappara section starts from Ch. 1250 km near Varanasi Multimodal terminal at Varanasi, Uttar Pradesh and ends at Chappara in Bihar where river Ghaghara joins the waterway changing the profile of the river. Bordering districts along the stretch are Varanasi, Chandauli, Ghazipur, Ballia, Buxar, Saran and Bhojpur. The entire stretch are sufficiently wide with 1.5 to 2 m LAD. Major rivers joining the waterway are Varuna, Assi, Gomti, Karamnasa, Thora, Tamsa and Ghaghara. The declared Kashi Turtle Sanctuary at Varanasi also lies in this stretch. Major settlements include the famous Varanasi Municipal Corporation, Ghazipur, Buxar, Ballia and Chappara. Varanasi temple is a world famous pilgrimage centre and is a location of mass gathering along this stretch. The critical features identified includes the critical Rajghat Bridge at Varanasi and sagging tower line at Ghazipur. Other important features includes Multimodal Terminal of Ramnager, Proposed Intermodal terminal at Ghazipur and Ramnagar Fort. State boundaries of Bihar starts at Rasulpur from Ch. 1092 km and the river runs within the jurisdiction of state of Bihar along right bank and under the jurisdiction of state of Uttar Pradesh on the left bank upto Chappara near Ch. 982 km.

2.3.3. Chappara - Munger Section

Between Chappara (Ch. 982 km) – Munger (Ch. 762 km) stretch, the river is wide with an average width of 2 km and 2 to 2.5 m LAD in the channel. The bordering districts in this stretch are Saran, Bhojpur, Patna, Vaishali, Samastipur, Lakhisarai, Begusarai and Munger. The major rivers joining this stretch are Sone, Gandak and Punpun rivers. The major settlements includes the famous capital city of Patna, Chappara, Fatuha, Barh, and Munger. NTPC Barh, Thermal Power Station at Barauni, brick kilns at Lodipur are the major industrial unit along the stretch. Confluence point of Sone River with Ganga River is a high traffic area, where barges moves with sand across the river and Kothiya, near Patna is another location of high traffic. Critical features includes eroded tower lines at Kothiya, critical bridge at Simariya and temporary pontoon bridges connecting the banks at different locations in this stretch.

2.3.4. Munger – Farakka Lock Gate Section

Munger (Ch. 762 km) – Farakka lock (Ch. 500 km) gate are wider section with an average width of 2 km and 3 m LAD is maintained throughout the stretch. This stretch of waterway traverse through three main states namely Bihar, Jharkhand and West Bengal on reaching Farakka lock gate. NW 1 borders through the districts of Munger, Bhagalpur, Khagaria, Purnia, Katihar, Sahibganj, Malda and Murshidabad in this stretch. The declared Vikram-shila Dolphin Sanctuary from Sultanganj to Kahalgaon lies along this stretch. The other predominant feature along the waterway is the Farakka barrage across River Ganga. Major River Koshi joins the waterway downstream of Kahalgaon and before reaching Manihari. Major settlements include Munger, Sultanganj, Bhagalpur, Kahalgaon, Sahibganj, Rajmahal and Farakka. The Sahibganj Multimodal Terminal in the State of Jharkand lies in this stretch. Ro-Ro ferry service connecting the opposite banks of river can be seen at Manihari and Rajmahal. Critical aspects include eroding tower lines at Bakiasukhai near Manihari and Farakka Lock gate. This section is devoid of pontoon bridges and is continuously navigable throughout the year.

2.3.5. Farakka Lock Gate – Kolkata Section

The stretch between Farakka Lock Gate and Kolkata is a narrow stretch with an average width of 300 m and lies in the State of West Bengal. Feeder canal is runned for a length of 40 km from the Farakka Barrage and is the major source of water for navigation system. The assured depth of waterway in this stretch is about 3 m and this is the Bhagirathi- Hooghly river stretch of NW - 1. The bordering districts are Murshidabad, Purba Bardhfaman, Nadia, Hooghly, North Twenty Four Parganas, Kolkata and Howrah. Major rivers joining this stretch are Bhagirathi and Ajoy. Major settlements include Farakka township area, Jangipur, Behrampore, Katwa, Nabadwip, Kalna, Kalyani, Dakshineswar, Belur and the entire Kolkata Metropolitan area lies along this stretch. Critical features identified includes Pakur Bridge, Howrah Bridge, Vivekananda Setu, and eroded tower lines at Malopara. The banks are mainly utilited for cultivation in the upstream section and on reaching Kolkata land use pattern changes to industrial/urban use. The major industries includes NTPC Farakka, Bandel Thermal Power Plant, Jute mills and Paper mills. Water intake structures for municipal and irrigation application were seen all throughout the stretch and the prominent municipal supply units includes units at Barrackpore, Kalna, Nabadwip and Kalyani.

2.3.6. Kolkata – Haldia Section

Kolkata (Ch.100 km) – Haldia (Ch.0 km) stretch is a sufficiently wide stretch with a width varying from 400 – 5000 m near Haldia terminal. Average assured depth throughout the stretch is 3 m and the shipping channel of Kolkata Port Trust (KoPT) lies in this stretch. Bordering districts in the alignment are Kolkata, Howrah, Purba Medinipur and South Twenty Four Parganas. Rupnarayan River joins the waterway near Noorpur, where the width is about 2 km. The world's second tallest power transmission towers of height 236 m is located near Haldia between Ch.30 km and Ch.32 km. Major industrial areas include Falta Special Economic Zone, Budge Budge installation, Haldia industrial area and Kolkata Port Trust area. The entire stretch experiences heavy vessel traffic whole throughout the year. This stretch is also form part of declared Indo-Bangladesh protocol route, where cargo vessels moving with fly ash and food grains are predominant. Salient features of waterway has been assessed in detail in identification of critical sections and hotspots as part of Risk Assessment.

2.4. Infrastructure Facilities

The details of existing as well as proposed terminals/jetties are presented in **Table 2.2** followed by brief description of features around the terminals.

Table 2.2. Details of Existing and Proposed IWT Terminals in NW 1

Sl. No.	Name of Terminal with Chainage (in km)	Land Area (in ha)	Size of Berth, Water front (in m)	No. of Pontoon Barge & Gangway	Cargo Handling Equipment	Storage Area	Link Approach Road	Security (in each shift)	Water/Lighting Facility	Remarks
Existing Terminals										
1	Allahabad (Ch. 1535.00 km)	8.759	35 m berth and 300 WF	01- Pontoon Barge 01- Pontoon Gangway	Nil	To be stored on Pontoon and open space of IWAI land (0.5 ha)	Pucca Rasta (Concrete road) 500 m and metaled road 2 km connected with NH -76.	01 - armed 01 - unarmed	Drinking Water facility available.	Generator could be provided for lighting if required
2	Ramnagar (Varanasi) (Ch. 1315.00 km)	5.586 Hectare Land	35 m berth & 300 WF	01- Pontoon Barge 01 - Pontoon Gangway	Nil	To be stored on Pontoon and open space of IWAI land (0.2 ha)	Connecting with NH- 07.	01 - armed 01 - unarmed	-	Being developed under JMVP
3	Ghazipur (Ch. 1177.00 km) / Rajghat (Varanasi km)		35 m berth	01- Pontoon Barge 01- Pontoon Gangway	Nil	To be stored on Pontoon. Private land could be made available if required	Kachcha Rasta (Earthen Road) 100 m and Pucca road 100 m connected with NH 19.		Drinking Water facility available	Generator could be provided for lighting if required

Sl. No	Name of Terminal with Chainage (in km)	Land Area (in ha)	Size of Berth, Water front (in m)	No. of Pontoon Barge & Gangway	Cargo Handling Equipment	Storage Area	Link Approach Road	Security (in each shift)	Water/Lighting Facility	Remarks
4	Buxar (Ch. 1124 .00 km)		35 m berth	01- Pontoon Barge 01- Pontoon Gangway	Nil	To be stored on Pontoon. Private land could be made available if required	Kachcha Rasta 100 m and Pucca road 400 m connected with NH -84.		Drinking Water facility available and Street Lights available as provided by Local Administration	
5	Semaria (Ch. 850.00 km)		35 m berth	01- Pontoon Barge 01 - Pontoon Gangway	Crane on Pontoon available	To be stored on Pontoon. Private land could be made available if required.	Kachcha Rasta 200 m and Pucca road 300 m connected with NH -31.		Drinking Water facility available	
6	Munger (Ch. 793 .00 km)	1.37 ha Land	35 m berth	01- Pontoon Barge 01- Pontoon Gangway	Nil	To be stored on Pontoon and open space of IWAI land (0.1 ha)	Pucca Rasta 100 m and metaled road 5 km connected with NH- 80.	01 - armed 01 - unarmed	Drinking Water facility available and Street Lights available provided by Local Administration	Generator could be provided for lighting whenever required
7	Bhagalpur (Ch 715 .00 km)	1.56 ha Land	35 m berth	01- Pontoon Barge	Nil	To be stored on Pontoon	Pucca Rasta 300 m and metaled	01 - armed	Drinking Water Sodium Vapor	DGPS Station is operational and being

Sl. No.	Name of Terminal with Chainage (in km)	Land Area (in ha)	Size of Berth, Water front (in m)	No. of Pontoon Barge & Gangway	Cargo Handling Equipment	Storage Area	Link Approach Road	Security (in each shift)	Water/Lighting Facility	Remarks
				01- Pontoon Gangway		and open space of IWAI land (0.1 ha)	road 2 km connected with NH- 80.	02 - unarmed	Lamps (Full Illumination)	utilized since 2010.
8	Bateshwarsthan (Ch. 683.00 km)	-	35 m berth	01- Pontoon Barge 01- Pontoon Gangway	Nil	To be stored on Pontoon.	Kachcha Rasta 200 m and Pucca road 5 km connected with NH - 80.	-	Drinking Water facility available	Generator could be provided for lighting whenever required
9	Samdaghat (Sahebganj) (Ch.617.00 km)	-	35 m berth	01- Pontoon Barge 01- Pontoon Gangway	Crane on pontoon	To be stored on Pontoon. Private land could be made available if required	Kachcha Rasta 300 m and Pucca road 1 km connected with NH -80.	-	Drinking Water facility available	Generator could be provided for lighting whenever required
10	Manglahat (Rajmahal) (Ch.588.00 km.)	-	35 m berth	01- Pontoon Barge 01- Pontoon Gangway	Nil	To be stored on Pontoon. Private land could be made available if required	Kachcha Rasta 100 m and connected with NH -80	-	Drinking Water facility available	Generator could be provided for lighting whenever required

Sl. No	Name of Terminal with Chainage (in km)	Land Area (in ha)	Size of Berth, Water front (in m)	No. of Pontoon Barge & Gangway	Cargo Handling Equipment	Storage Area	Link Approach Road	Security (in each shift)	Water/Lighting Facility	Remarks
11	U/s Farakka (Ch. 545.00 km)	0.48 ha land	35 m berth	01- Pontoon 01- Bamboo Gangway	Nil	To be stored on Pontoon & land of FBP	100 m	01- armed 03- unarmed	Drinking Water Sodium Vapour Lamps	Land belongs to FBP being used by IWAI.
12	D/s Farakka (Ch. 542.00 km)	-	35 m berth	01- Pontoon 01 Bamboo Gangway	Nil	To be stored on Pontoon.	Along the road	Nil	Street Lights provided by Local Administration	Land not available pontoon placed on water front
13	Hazardwari (Ch.439.00 km)	-	35 m berth	01- Pontoon 01- Bamboo Gangway	Nil	To be stored on Pontoon.	100 m	Nil	Street Lights provided by Local Administration	Land not available pontoon placed on water front
14	Katwa (Ch. 334.50 km)	-	35 m berth	01- Pontoon 01- Bamboo Gangway	Nil	To be stored on Pontoon.	1.5 km	Nil	Nil	Land not available pontoon placed on water front
15	Swaroopganj (Ch.280.00 km)	0.23 ha land	35 m berth	01- Pontoon 01- Bamboo Gangway	Nil	One Godown of size 4.5 x 5 m and Open space (0.029 ha)	500 m	01 - armed 03 - unarmed	Drinking Water Sodium Vapour Lamps	Land taken from KoPT on lease basis

Sl. No	Name of Terminal with Chainage (in km)	Land Area (in ha)	Size of Berth, Water front (in m)	No. of Pontoon Barge & Gangway	Cargo Handling Equipment	Storage Area	Link Approach Road	Security (in each shift)	Water/Lighting Facility	Remarks
16	Shantipur (Ch. 241.00 km)	0.8 ha land	35 m berth & 100 WF	01 - Pontoon 06 - Modular Pontoons Gangway	Nil	To be stored on Pontoon and open space of IWAI land (0.2 ha)	3 km	03 - unarmed	NIL	Land belongs to State Govt. of W.B. being used by IWAI.
17	Tribeni (Ch. 196.00 km)	-	35 m berth	01 - Pontoon 01 - Bamboo Gangway	Nil	To be stored on Pontoon	Along the road	01 - armed 02 - unarmed	NIL	Land not available pontoon placed on water front
18	BISN Jetty & G.R. Jetty-1 (Ch. 135.00 km)	3.04 ha land	70 m berth & 100 WF	03 - Pontoons 01 - Steel Gangway	Nil	Open Space area (0.6 ha)	1 km	01 - armed 03 - unarmed	Sodium Vapour Lamps	Land taken from KoPT on lease basis
19	Botanical Garden Jetty (Ch. 134.50 km)	0.09 ha land	35 m berth & 50 m WF	01 - Pontoon 01 - Steel Gangway	Nil	To be stored on Pontoon	150 m	03 - unarmed	Sodium Vapour Lamps (Full Illumination)	Land belongs to KoPT being used by IWAI.
20	Haldia (Ch. 35.00 km)	1.09 ha land	70 m berth & 200 m WF	04 Pontoons 01 Gangway	Nil	One Godown of size 12 x 30 m and Open	3.5 km via HDC	01 - armed 03 - unarmed	Drinking Water Sodium Vapour Lamps	Land taken from Haldia Dock Complex (HDC) on lease basis.

Sl. No.	Name of Terminal with Chainage (in km)	Land Area (in ha)	Size of Berth, Water front (in m)	No. of Pontoon Barge & Gangway	Cargo Handling Equipment	Storage Area	Link Approach Road	Security (in each shift)	Water/Lighting Facility	Remarks
						space (0.163 ha)				
B) Fixed Terminals										
1	G.R.Jetty -2 (Ch. 134.50 km)	1,4 ha land	70 m berth	-	-	One Transit shed of size 25 x 46 m and Open space (0.4 ha)	500 m.	01 - armed 03 - unarmed	Drinking Water Sodium Vapour Lamps	Land taken from KoPT on long term lease basis. RCC Jetty completed and being operational since Nov., 2013.
2	Farakka RCC Jetty (Ch. 542 km)	-	115 m berth	-	-	-	Along the road	-	Drinking Water Sodium Vapour Lamps	Owned by FBP this can be used by the common users.
3	Pakur RCC Jetty (Ch. 522 km)	-	60 m berth	-	-	-	1 km	-	-	Owned by FBP this can be used by the common users.
Multimodal Terminals										
1	Varanasi	Multimodal								
2	Sahibganj	Multimodal								
3	Haldia	Multimodal								

Sl. No.	Name of Terminal with Chainage (in km)	Land Area (in ha)	Size of Berth, Water front (in m)	No. of Pontoon Barge & Gangway	Cargo Handling Equipment	Storage Area	Link Approach Road	Security (in each shift)	Water/Lighting Facility	Remarks
4	Ghazipur	Intermodal								
5	Kalughat	Intermodal								
6.	Tribeni (under consideration)	Intermodal								

Source: www.iwai.nic.in

2.5. Salient Features of Multimodal and Intermodal Terminal Areas

2.5.1. Varanasi Multimodal Terminal

Varanasi is the historical city of Kashi, which has got both the religious and architectural importance. Varanasi multimodal terminal is located at Ramnagar between Ch. 1250 to 1248 km, on the right banks of river Ganga (**Figure 2.5**). The terminal was inaugurated in November, 2018. Terminal location is within Varanasi municipal corporation limit, near Ramnagar Fort with residential area of Milkipur north. It is connected with NH 2 through a dedicated road at around 700 m. Downstream of terminal lies the Kashi Turtle Sanctuary Ghats of Varanasi are the important physical receptors in the locality. Also, the area is densely populated.

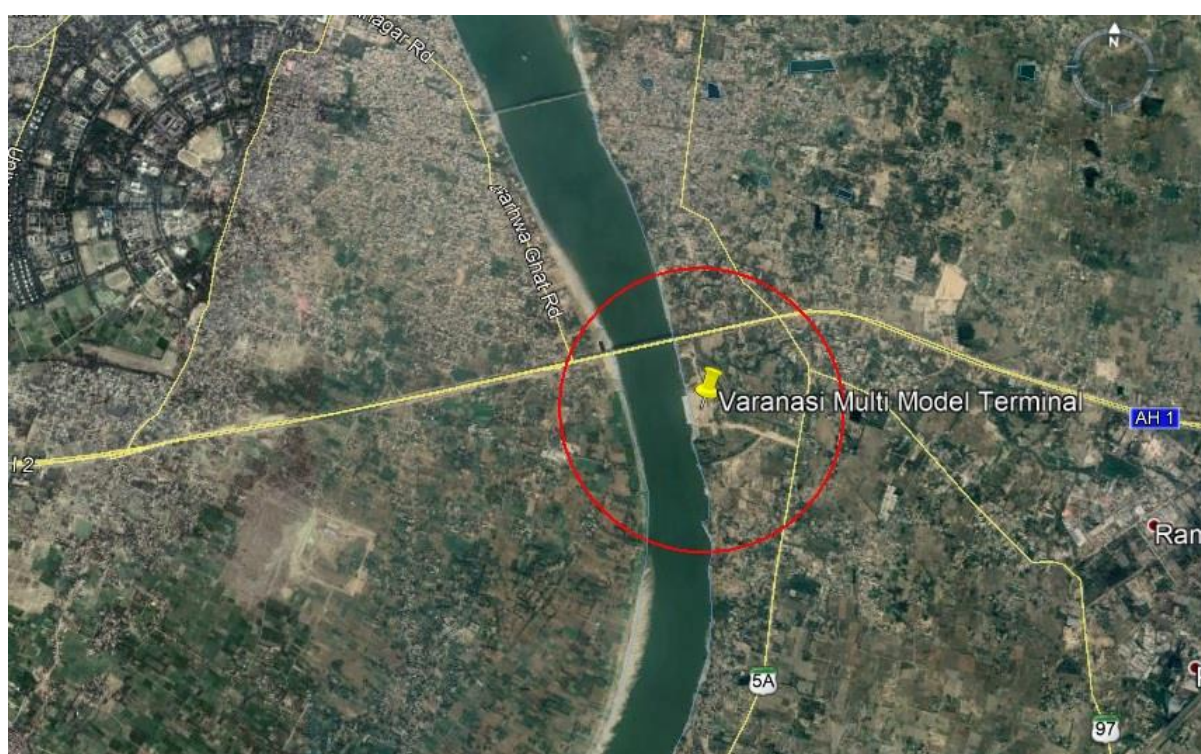


Figure 2.5. Varanasi Terminal and Immediate Surroundings of 1 km

2.5.2. Sahibganj Multimodal Terminal

The multimodal terminal is located on the RHS of river Ganga at Ch. 582 km with location close to Sakrigali railway station around 1.45 km and is also accessible through NH 80. The area is mainly rural, with scattered settlements. At this location, the channel is having a width of around 4 km, in which there are a number of Ghats namely, Dilram Yadav Ghat, Samda Nala Ghat and Kusum Ghat. Land use is mainly for vegetation and a small school is present at around 1 km, south of the terminal location. Shoals are present and hence relatively isolated. This is a shoal forming area.



Figure 2.6. Sahibganj Terminal and Immediate Surrounding of 1 km

2.5.3. Haldia Multimodal Terminal

A multimodal terminal is under construction on RHS bank of river Hooghly at Ch. 4 km. The Haldia terminal is located in East of Medinipur District of West Bengal. The landward side of the project belongs to Coastal Regulation Zone (CRZ) - II, which are part of already developed municipal areas of Durgachawk. Here the adjoining area is the industrial area viz., with immediate neighbors are the Bharat Petroleum Corporation Limited (BPCL), United Phosphorus Limited, Consolidated Fiber and Tata Chemicals Limited. Durgachack is the nearest railway station. There is a residential colony located towards the landward side further north. The area form part of an already developed industrial belt of Haldia.

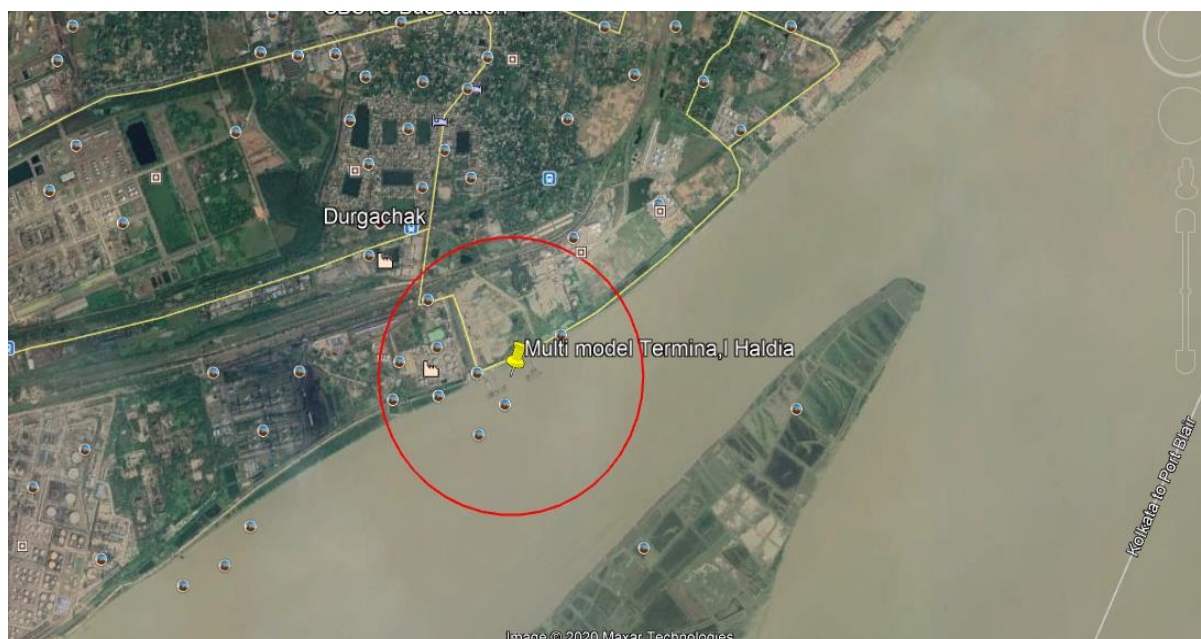


Figure 2.7. Haldia Terminal and Immediate Surrounding of 1 km

Designated capacity of terminals are is given as **Table 2.3** below.

Table 2.3. Designated Capacity of Multimodal Terminal

Sl. No.	Infrastructure Facility	Projected Cargo – 2015 (MTPA)	Projected Cargo – 2030 (MTPA)	Projected Cargo – 2045 (MTPA)
1	Varanasi Terminal	0.54	1.22	1.22
2	Sahibganj Terminal	2.24	4.39	9.00
3	Haldia Terminal	3.18	3.18	3.18

Source: IWAI

Note: MTPA- Million Tonnes Per Annum

The details of intermodal terminals proposed at Ghazipur, Kalughat and Tribeni are given below.

2.5.4. Ghazipur Intermodal Terminal

Ghazipur terminal is planned towards LHS of NW 1 i.e. the Northern bank of Ganges. It is located towards downstream of Ghazipur after Jamalpur bridge in NH 97, at around 4 km. It is located almost 3 km south of Ghazipur Ghat railway station and accessible from NH 17 through a dedicated road. The immediate premises are agricultural areas and there are rural area within 1km, further landward and north.



Figure 2.8. Ghazipur Terminal and Immediate Surrounding of 1 km

Here, the river is wide hence the 1km radial circle does not touch the opposite side of the bank.

2.5.5. Kalughat Intermodal Terminal

Kalughat is an important terminal location, which is currently proposed as an intermodal terminal, which can be used to access the land locked neighbouring country of Nepal. Here, the river stretch is narrow and also the channel beside is currently used on a seasonal basis.



Figure 2.9. Location Map of Kalughat Terminal and Immediate Surroundings

2.5.6. Tribeni Intermodal Terminal (Under consideration)

Tribeni terminal is planned towards the LHS of NW-1. The site is located on left bank of River Hooghly upstream of road bridge on SH-6 at Tribeni, West Bengal. Site is well connected with road & railways. Kalyani Samanta is nearest railway station. App. 40 ha of agricultural land is identified for development of terminal at this site. Some brick kilns also exist at the site. The opposite banks are thickly populated with a river joining the waterway just upstream to the proposed terminal. Kalyani residential area is on the same bank towards the landward side of the proposed terminal.



Figure 2.10. Tribeni Terminal and Immediate Surrounding of 1 km

Here, the river is narrow section and hence the 1km radial circle touch the opposite side of the bank.

2.6. Cargo Operational Pattern of NW 1

Total cargo handled and type of cargo handled are collected and analysed towards assessing the risk elements associated with it.

2.6.1. Existing and Projected Cargo Traffic

NW 1 is having cargo operation along various segments and also the international operation along India Bangladesh Protocol (IBP) route between KoPT limit to various destinations in Bangladesh. The vessels along IBP route has to obtain prior permission from IWAI Regional

Office (RO), Kolkata to operate along the route. The cargo transportation through both NW 1 including IBP routes are presented in **Table 2.4**.

Table 2.4. Cargo Statistics through both NW 1 and IBP Routes during 2013-18

Sl.No.	Year	Quantity of Cargo (in MMT)
1	2013-14	3.35
2	2014-15	5.05
3	2015-16	6.24
4	2016-17	4.62
5	2017-18	3.06

Source: IWAI

Note: MMT- Multimedia Terminal

The total projected cargo for the year 2020 for various stretches are given as **Table 2.5**.

Table 2.5. Total Projected Cargo for NW 1 for 2020

Sl.No.	Stretch	Name of the Stretch	Forecast Medium Augmentation Case (tons)
1	Stretch-1	Haldia-Varanasi	2,42,69,096
2	Stretch-2	Patna-Varanasi	38,11,763
3	Stretch-3	Haldia-Patna	2,26,63,903
Total			5,07,44,762

Source: HPC & HOWE Engineering Projects (India) Pvt. Ltd. (Design Consultant)

2.6.2. Type of Cargo

The existing and proposed cargo were collected from IWAI. Cargo to be transported on NW-1 includes Cement, Fly Ash, Iron Ore, Iron Ore Fines, Coal, Steel Shed, Tyres, Iron Fines, Iron Ingots, Galvanized Steel Plain Sheets, Stone Chips, Furnace Oil, High Speed Diesel, Lube Oil, Boulders, Pulses, Aluminum block, Sand chips, Ship Block, Food grains, Manganese ore, Petroleum, Coke, Cooking coal, Rock Phosphate, Timber, Peas, Slag oil, and Non-cooking coal.

2.7. Vessels to be used in NW 1

The vessels proposed in NW1 includes tankers, bulk carriers, container vessels, push boats, car carriers, Ro-Ro vessels, LNG carriers and dumb barges. The details of proposed vessels for using in NW1 is presented as **Table 2.6**. It is proposed to use vessels powered by LNG along the waterway.

Table 2.6. Details of Vessels to be used in NW - 1

Vessel Type	Length (m)	Breadth (m)	Depth Main Deck (m)	Draught max.(m)	Fuel Oil Capacity (T)
Tanker T1	110,00	12,00	3,70	2,80	30
Tanker T2	110,00	12,00	3,70	2,80	30
Bulk Carrier B1	110,00	12,00	3,70	2,80	30
Bulk Carrier B2	110,00	12,00	4,30	2,80	30
Bulk Carrier B3	92,00	12,00	3,70	2,80	
Bulk Carrier B LNG	110,00	12,00	3,70	2,80	LNG fuel - 17 T, Diesel Oil - 10 T
Container Vessel CO1	110,00	12,00	3,70	2,50	30
Container Vessel CO2	110,00	12,00	4,30	2,60	30
Push Boat PB	26,00	12,00	2,40	1,60	30
Car Carrier CC	90,00	14,50	3,10	1,80	24
Ro - Ro Vessel	70,00	14,50	2,80	1,70	30
LNG Carrier LNG1	90,00	14,50	4,20	2,30	30
LNG Carrier LNG2	92,00	12,00	3,70	2,10	30
Dumb Barge DB	42,00	8,00	2,80	2,50	--

Source: IWAI

RISK ASSESMENT

Risk Assessment is a systematic process of evaluating the potential risks that may be involved in an activity and assessing the negative consequences. Risk, by definition is a situation involving exposure to danger and the risk is determined as the probability of one entity to be exposed to a hazard and quantum of its negative consequence. During risk assessment, the level of risk involved in an operation is determined as low/medium/high through risk analysis with respect to a given situation and appropriate risk abatement measures are proposed to reduce the risk level to As Low As Practically Reasonable (ALARP).

Like any other activity, IWT is not an exception for hazards. They may turn out into disaster, if it occur in extreme intensity in a very vulnerable locality; due to natural or human induced factors. It is extremely important to have a detailed risk analysis covering the planning, design, implementation and operational phases. This helps in the preparation of an executable plan, with a road map for ensuring better preparedness as well as response in the case of a hazard scenario. This section presents the details of the RA conducted for NW 1 for the stretch from Allahabad to Haldia.

3.1. Risk Assessment (RA) Methodology

RA methodology adopted is a hybrid method that involves both qualitative and quantitative components. Different parameters involved in the risk assessment was initially identified and shortlisted in qualitative terms and wherever possible, their extent and impacts were expressed quantitatively. In addition, towards arriving at final risk posed by credible scenarios, a combination of probabilistic method as well as deterministic method was adopted. The probabilistic method was utilized to list out all possible credible scenario and to narrow down into the most probable and worst case scenarios while, deterministic method was used to establish their extent. The basic framework of RA process is summarized in the **Figure 3.1**.

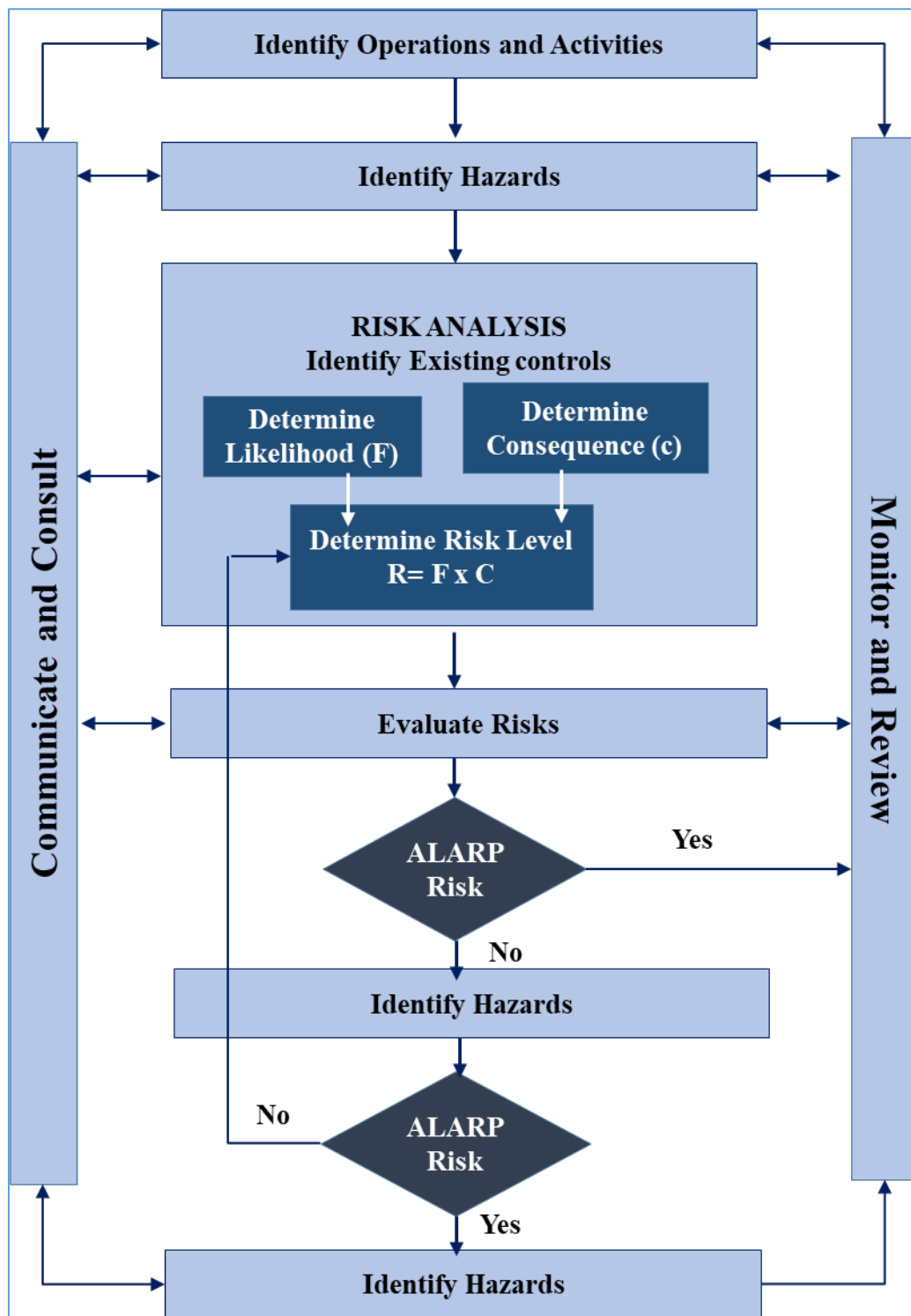


Figure 3.1. Risk Assessment Procedure

Important steps involved in the RA are:

- Identification of IWT operation and activities in NW 1.

- Hazard identification through detailed reconnaissance visit, literature review and stakeholder interaction. The existing waterway was analysed and the risk elements were identified. Critical Section Analysis (CSA) was carried out to delineate the stretches through multi criteria decision making.
- Analysis of existing/proposed control /precautions in development and maintenance of NW 1 which will reduce the risk of operation of waterway.
- Probabilistic risk analysis using historical frequency analysis, probability assessment, expert judgement to arrive at credible scenarios.
- Deterministic risk analysis for damage estimation for representative worst-case scenarios.
- Prioritization of areas and resources based on the risk level and proposing risk control or mitigation measures.
- Mitigation or re-prioritization of exposure category based on risk levels to ALARP principle.
- Reassess high-risk events by preparing and for monitoring and control plans.
- Monitoring and Improvement at the stage of operation, maintenance and shutdown phases.

As per the methodology outlined in the Terms of Reference (ToR), the cumulative risk is having the following components, four individual risks, i.e., with respect to channel, cargo, vessel and dredging. The cumulative risk levels were determined for credible scenarios including most probable and worst case ones. Risk abatement measures were also proposed. The studies executed in this regard is followed.

3.2. Review of IWT Operational Activities

IWT Operation activities proposed under JMVP were reviewed critically as a preliminary step towards initiating the RA study. The IWT operation in NW 1 include loading of cargo at terminals, transport of cargo through waterway, unloading and storage at terminal as presented in **Figure 3.2** below.

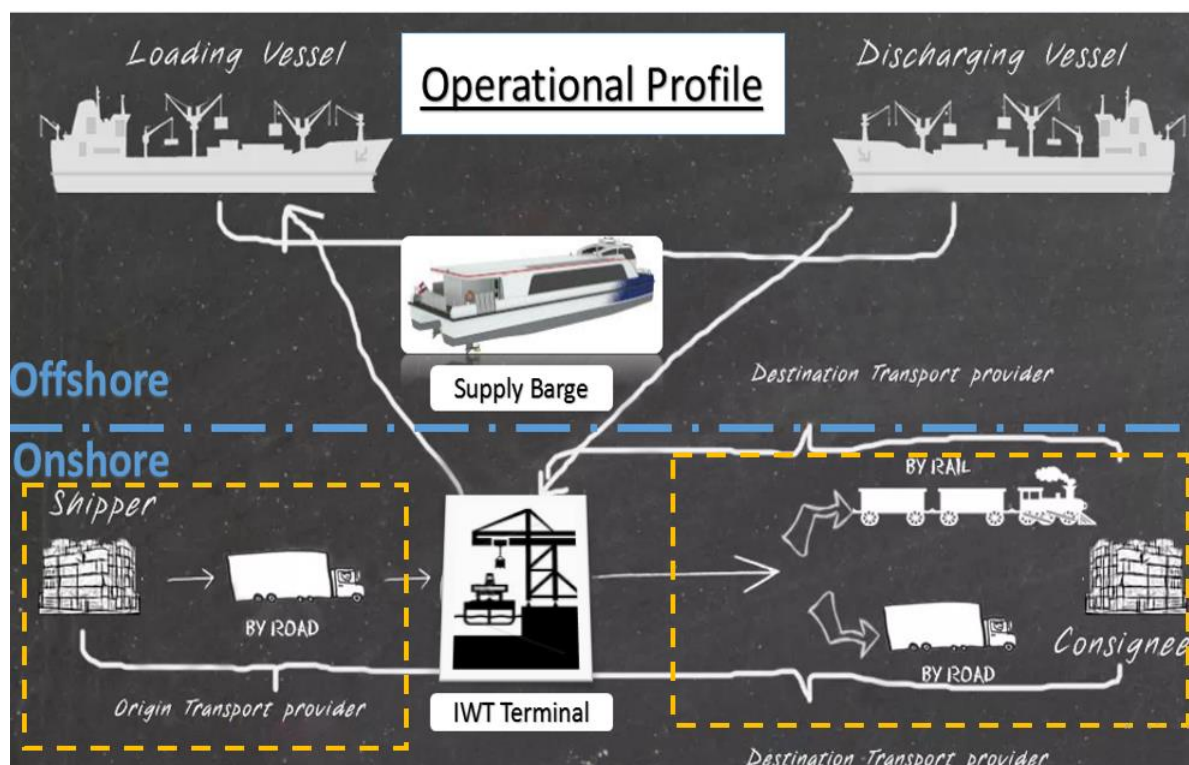


Figure 3.2. Mode Sharing in the Operational Profile of IWT through NW 1

In line with the ToR requirements, the risk assessment has been done under two broad categorization – **Off shore** and **Onshore** and the activities considered under each head is presented in **Figure 3.3**. For the present study, the scope of the risk assessment is restricted to the offshore operations through NW 1 and also, the onshore operations with NW 1 interface i.e., within the IWT Terminal.

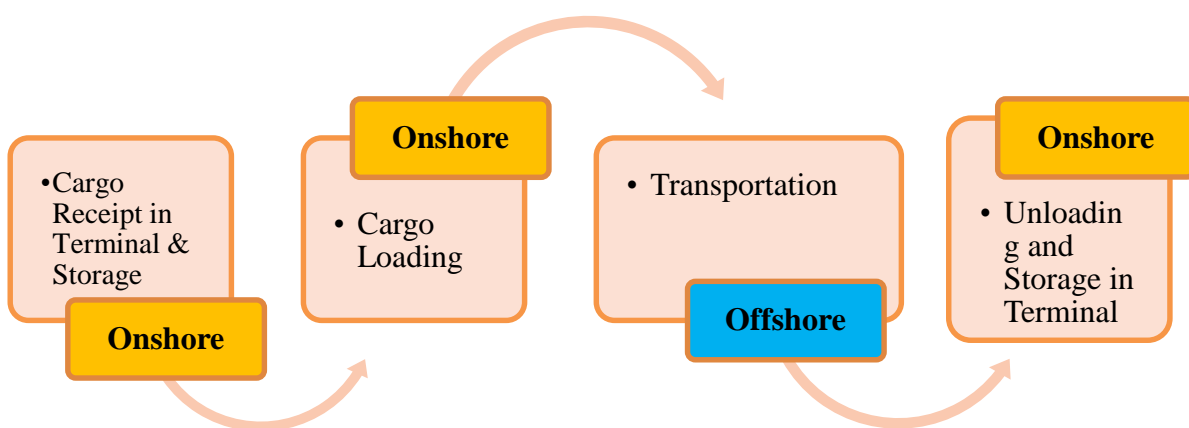


Figure 3.3. Offshore and Onshore Activities in IWT Operational Profile

Offshore and onshore risk locations are identified and summarized in **Table 3.1**.

Table 3.1. Offshore and Onshore Risks w r to Operations or Activities under JMVP

Risk Type	Risk Location	Operational/Activities related with IWT leading to risk.	Remarks
On shore	Along waterway	Cargo transport / /maintenance dredging	--
	Lock Gate	Cargo transport	--
	Other assets – All cross structures along channel	Cargo transport	Public and Private Assets and properties could be affected due to an incident while transport propagating to land masses.
Offshore	Jetties	Approaching of vessel/loading/unloading	--
	Terminals	Loading/Unloading/Storage	--
	RIS/DGPS Stations	NA	No risk expected due to IWT operation under development plan of JMVP
	Ship Repair Facilities	NA	

3.3. Identify Hazards & Analysis of Existing Control Measures

A hazard is defined as an agent, which has the potential to cause harm or damage to a vulnerable target i.e. people, property or environment. Historical analysis has been carried out based on the literature review to understand the hazards associated with IWT operation. The accident data were analysed to delineate the major hazard as well as the causes of hazard and further the same was analysed w. r. to their applicability for IWT operation in NW 1.

In the Indian context, there have been no reported major cargo accidents in inland waterways. In the recorded history of IWT operations through NW 1, no accidents associated with transportation of cargo occurred so far and few averted incidents such as hitting tower line near Ghazipur, collision of vessels especially within port limit etc. This may be mainly attributed to the fact that, there are very low cargo traffic in the inland waterways in the Indian context.

However, there have been accidents in connection with the movement of other vessels through the inland waterways of Ganga and immediate region w.r.to passenger vessels. They are mainly related to passenger vessels and are boat capsizes. The available statistics on analysis shows

that, total number of casualties reported during 2000-2013 were 9808 and the accident cases were 8903 for 28 States and Union Territories. i.e., more than 600 accidents on an average per year (T Kalyani et al, 2015). Bihar has reported the highest no. of accidents (836 no) in this regard. Accidents reported so far are mainly due to poor condition of the vessels, shoddy maintenance, absence of navigational aids & improper demarcation of channel, overloading, over speed, abnormalities in the design of the vessel, negligent conduct of crew and absence of life saving appliances. These aspects have been taken care while arriving at hazard scenarios for NW 1. However, there has been some incidents connected with the marine vessels in Hooghly river connected with KoPT operations as below:

- Nurpur (Diamond Harbour), March 22, 2008, a ship from Colombo got stuck in the Hooghly riverbed at Nurpur near Diamond Harbour after its steering jammed and it crashed through a jetty, while negotiating a sharp bend.
- Haldia Dock Complex, September, 2009, Collision of MV City carrying iron ore and a Dredger, while negotiating low draft areas in a zig zag course.
- 22 nautical miles south of Sagar Island, October 13, 2013 Chinese-owned Panama-flag freighter MV Bing, wrecked during Cyclone Philine which was loaded with Iron Ore from Haldia and Sagar.
- Near Sand heads, June 14, 2018, MV SSL Kolkata, a domestic merchant container vessel reported a fire on-board due to rough seas and strong winds, the fire spread rapidly and engulfed 70 per cent of the ship.



**Ship stuck on the Bank
Crashing the Jetty near
Noorpur, 2008**



**Fire on-board MV SSL Kolkata, a Domestic
Merchant Container Vessel, Sandheads, 2018**

Figure 3.4. Vessel Accidents within Kolkata Port Limit

International accident profile for IWT operation was reviewed to delineate the probable hazards as well as risk factors which have critical influence in leading to hazardous events. While International Maritime Organization (IMO) remains as the apex authority in marine vessel related incidents and have a unified operational guidelines, data assimilation and reporting and investigation aspects, IWT sector do not have a common platform of operation. While the IWT sector follows the guidelines on cargo issued by IMO, the accident data available are diverse by its nature – a few targeting to the type of incidents while others on the causes of incidents. IWT related accident analysis was carried out for US, Germany, Myanmar, Bangladesh and Rhine (for Europe as a whole) and the findings are followed. The accidents types are commonly represented as

- Grounding- striking underwater or banks.
- Fire and Explosion – if fire and explosion is the first event reported or fire / explosion results from hull/machinery damage.
- Collision - striking or being stricken by other vessels.
- Contact - striking an external object.

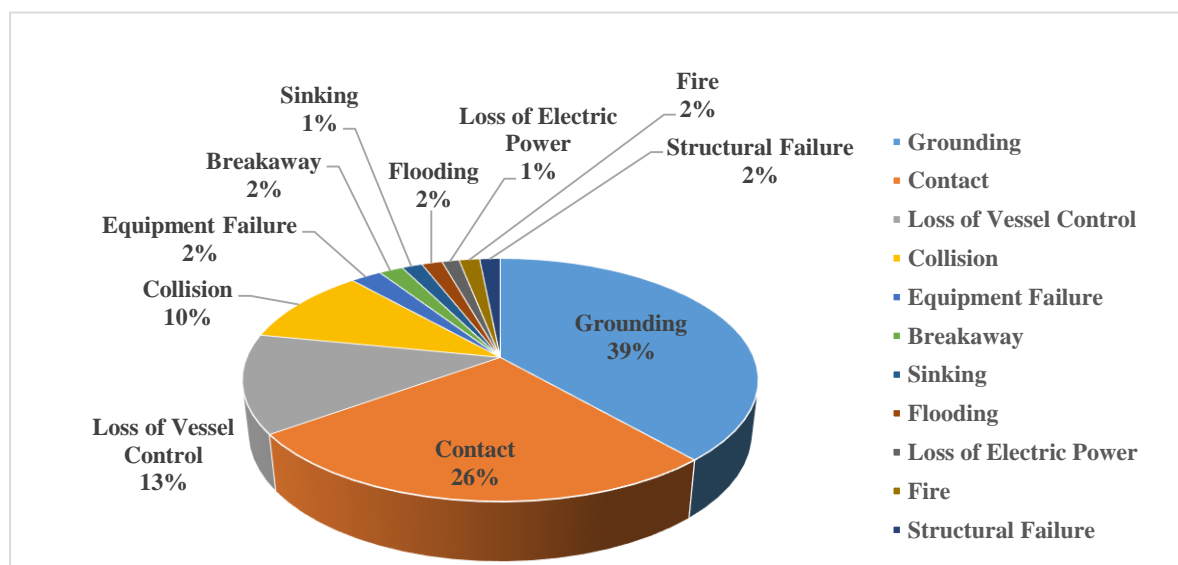


Figure 3.5. IWT Hazards and Causes of Hazards in U.S

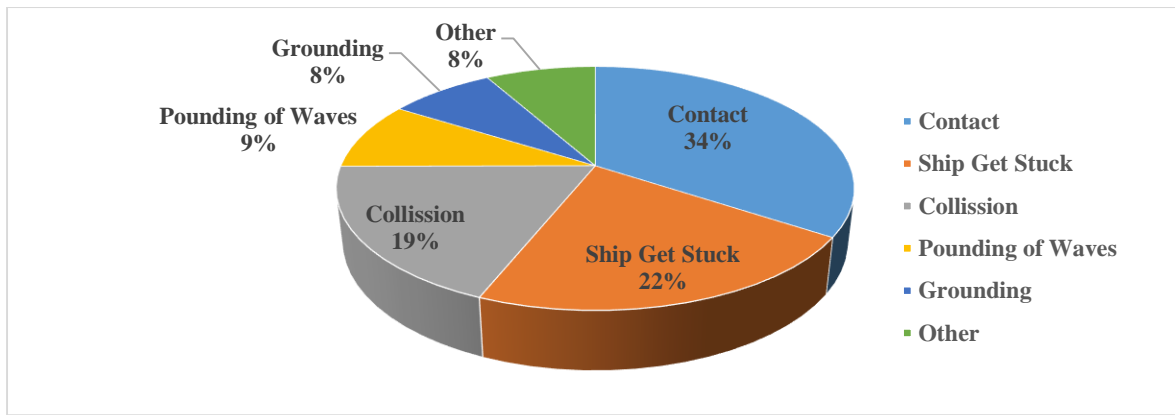


Figure 3.6. IWT Hazards and Causes for Germany

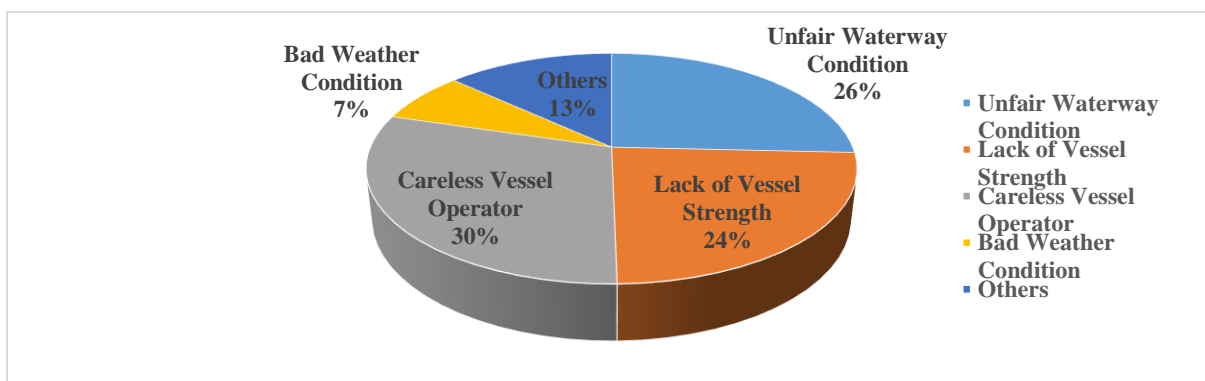


Figure 3.7. Causes of IWT Hazards in Myanmar

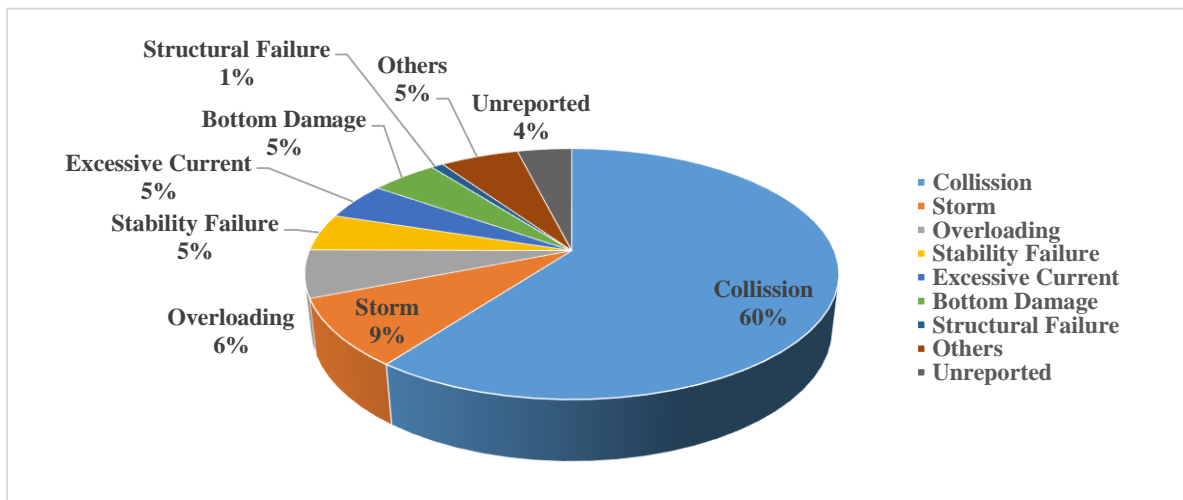


Figure 3.8. IWT Hazards and Causes of Hazards in Bangladesh

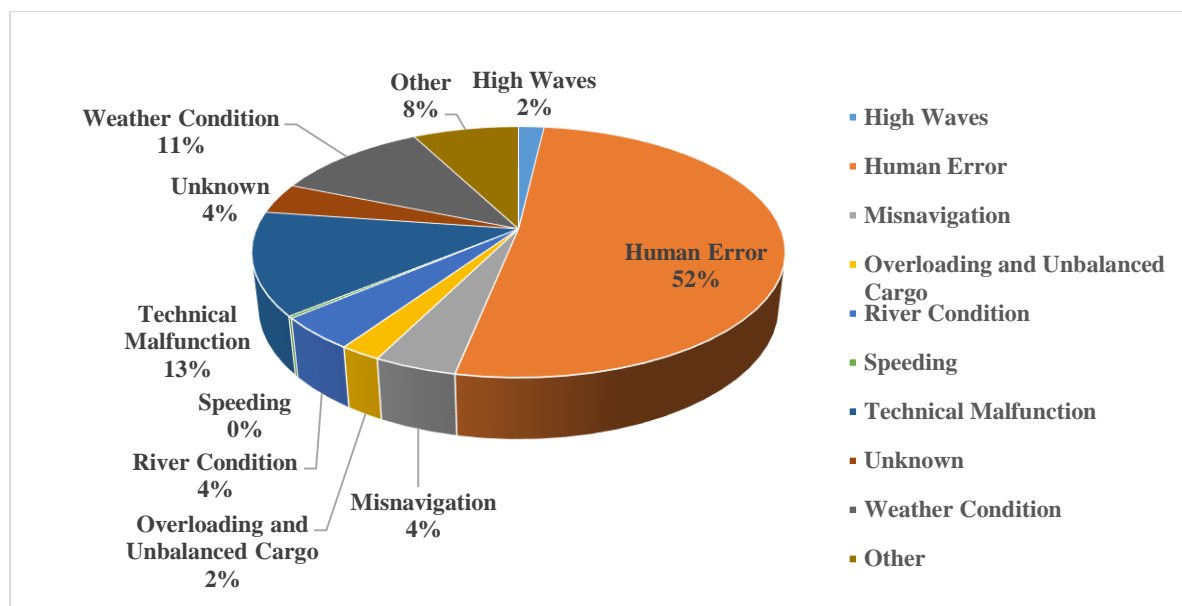


Figure 3.9. IWT Accidents and Causes in Rhine (Europe)

From the analysis it could be concluded that the major primary hazards include collision, contact, grounding, ship get stuck and fire. Considering the specific IWT operation for NW 1, involving transport of hazardous cargos explosion and spillage of cargo were also included as hazards since being very common in maritime industry. Sinking of ship is considered as a secondary hazard followed by a primary hazard.

Apart from listing the major hazards, the analysis reveals various factors which have critical role in IWT operation leading to hazard scenarios. Site specific factors of river Ganga as identified in detailed reconnaissance survey, which may have critical influence in risk profile of project region was also comparatively analysed towards further narrow down to credible scenarios.

Considering the existing control measures such as implementation of design vessel specifications, classification of vessels carrying cargo, availability of River Information System (RIS), LAD notices, dedicated portal - Forum of Cargo Owners and Logistics Operators (FOCAL) - to facilitate responses from the logistics operators against the requirement raised by cargo owners and vice-versa, information on regular thalweg survey and resultant regular maintenance dredging, implementation of Indian Vessel (IV) Act, the influence of risk factors w.r.to IWT operation in NW 1 was analysed towards factorizing into risk assessment. The factors and their influence w.r.to IWT operation in NW 1 is summarized in **Table 3.2**.

Table 3.2. Analysis of Causes of Hazards, Existing Control Measures and Resultant Influence of Risk factors on IWT Operation in NW 1

Sl. No	Risk Factor	Applicability w.r.to NW 1 Operation	Primary Hazard – Secondary Hazard	Primary Risk Element Involved
1	Careless Vessel Operation	Yes - The same factor is a critical factor in IWT related incidents. ¹	Collision/contact/grounding/vessel get stuck	Vessel/Channel related
2	Bad Weather Condition /Natural Hazard			
	Storm	Yes. Along influencing areas all along waterway especially during monsoon.	Collision, contact, grounding Vessel get stuck. The secondary hazard may include spillage/sinking	
	Flood			
	Earth Quake	The project region is falling in Zone III and IV.		
Pounding of wave, excessive current, high waves, cyclone, Tsunami, Tidal bore	Yes. Occur in the coastal stretches of NW 1 between Haldia and Tribeni.	Spillage of Cargo – Sinking		
3	Overloading/Un balanced cargo	Yes. For Coal transport, trimming is reported as an accident factor due to unbalanced cargo loading.	Spillage of Cargo- Sinking of vessel	Cargo related
4	River Piracy / Sabotage	Yes. Along the disturbed areas of project region.		
5	Vessel system malfunction, communication system failure etc. leading to mis navigation	Yes. Anywhere through waterway.	Collision, contact, grounding	Vessel/Channel related
6	Loss of Vessel Control	Yes. Anywhere through waterway especially curving areas, low depth areas, channel diversion areas, navigation lock, limiting bridges	Collision, contact, grounding	Vessel/Channel related

¹ 1] A considerable % of the accidents can be attributed to causes such as rough weather, structural failure due to contingencies, age of the vessels, overloading, human error etc. Also, it is important to note that more than 60 % of all accidents are caused by human error, which takes the lion share of all events (Source: ESMA, 2015).

Sl. No	Risk Factor	Applicability w.r.to NW 1 Operation	Primary Hazard – Secondary Hazard	Primary Risk Element Involved
7	Equipment failure	Yes. Anywhere through waterway.	Collision, contact, grounding	Vessel/Channel related
8	Loss of electric power	No. Not specific to NW 1 stretch. Additional source is available in vessel.	Collision, contact, grounding	Vessel/Channel related
9	Structural failure	No. Not specific to NW 1 and only as per the standard design issued by IWAI the vessels would be constructed and in compliance with the classification for inland vessels by Indian Registry of Shipping (IRS)	Spillage of Cargo	Vessel /Cargo related
10	Lack of Vessel Strength		Spillage of Cargo	Vessel related
11	Stability Failure		Spillage of Cargo	Vessel/Cargo related

3.4. Risk Assessment

Considering the operational pattern of IWT, as per the ToR, the various risk elements associated with the operation could be broadly classified as follows:

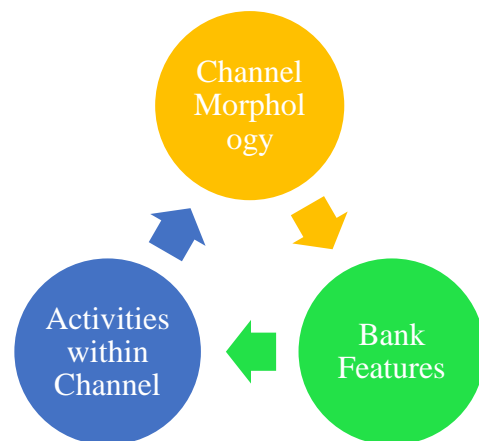
- Channel related risk.
- Cargo related risk.
- Vessel related risk.
- Dredging related risk.

The various risk elements are analysed in detail followed by cumulative interaction of risk elements.

3.4.1. Channel Related Risk Elements

The riverine feature and the channel running within it and the activities or interaction with the bank features pose critical importance in channel related risk. Part of the longest river system of NW 1 has diverse geographical features along its way. Towards delineating the areas having risk elements presence/features, critical stretches were identified through a Critical Section Analysis (CSA) as presented below.

CSA has been carried out to identify the stretches, which are critical by nature due to its inherent features, activities or interactions in between, which can be either a hazard causing or contributing factor and in due consideration of vulnerability and the resultant impact to the receptor. A detailed reconnaissance survey and data collection was carried out for 2 km interval along the entire reach of NW 1 and the river system was analyzed in detail for the presence of following elements:



- Channel Features: Channel morphology i.e., straight, meandering or curves, siltation areas, channel diversion areas, other stream entering areas, environmental sensitivity.

- Activities within Water Course: Jetty, recreation, drain inlets, water supply intake, agriculture intake, industrial intake, country boat fishing, net fishing, vessel traffic, vessel type- ferry, cargo, passenger, tourism and overlapping of activities.
- Bank Features – population density, public places, industrial clusters, accessibility, ecological and socio-economic resources, availability of response equipment.
- Cross Structures – Road, Railway bridges including multiple bridges, Lock Gates, High Tension Line Crossing and Syphon Aqueducts.

Detailed analysis of the data collected was carried out to identify Critical sections through conditional analysis of multi criteria decision-making based on Boolean. The important attributes which contributes to the channel related risk include limiting curving radius, siltation areas, environmentally sensitive stretches within the water body, limited width and close to bank alignment in densely populated areas, critical activities in water such as cargo jetties, high traffic areas, ferry crossings, bridges, aqueducts, lock gates and tower line crossings. The sections with presence of the above were identified as critical sections.

It was identified that there are 325 critical stretches along in NW 1 - (105 numbers between Prayagraj and Munger and 220 numbers between Munger and Haldia). Details of critical sections and attributes of criticality are presented in Annexure II.

While there are critical elements along the various sections above, it is possible that with implementation of control or precautionary measures, the risk level of such locations could be reduced or nullified. As presented before, the control measures and cautionary measures, which are in place or could be implemented were also identified for NW 1. Considering the same, critical sections were sub divided in to three categories – low, medium and high.

- Low (White) - Stretches which are safe enough to transport goods at favourable conditions. But important due to presence of one of the risk elements or the peculiarity of the locality.
- Medium (Yellow) - Precautions are to be taken prior to the transport. Certain hazard elements exists which may be turn out as high if left uncontrolled.
- High (Red) - designated as “hotspots” – Navigation limiting area for the transportation of goods in the present condition. Specific preventive measures are to be taken before

proceeding with cargo transport, which were evaluated in detail for arriving at credible hazard scenarios.

The categorization is made based on due consideration of the risk elements influencing the risk profile of IWT operation in NW 1 as presented in **Table 3.3**.

Table 3.3. Categorization of Critical Sections towards Determining the Hot Spots

Sl. No.	Risk Element	Categorization Criteria	Categorization of Stretch
Due to Presence of Risk Elements			
1.	Curve	Locations with curves <200 m – High	Red
		200 - 400 m – Medium	Yellow
		>400 m - Low	White
2.	Siltation Areas	Medium	Yellow
3.	Environmental Sensitivity	Protected Areas and Wild Life Sanctuaries - High	Red
4.	Sensitive Bank	Narrow Stretch (<250 m) – Alignment Close to the bank (<100 m)	Yellow
5.	Cargo Handling Jetties (Existing & Proposed)	High	Red
6.	High Traffic Areas	High	Red
7.	Ferry Crossing Locations	Multiple Ferry	Red
		Ferry	Yellow
8.	Cross Structures		
	Bridges	Critical bridges (i.e., having limitation on horizontal and vertical clearances) – High	Red
		Multiple bridges with sufficient clearance – Medium	Yellow
		Single bridge with sufficient clearance - Low	White
	Tower lines in Eroding Banks	High	Red
	Tower Line	Medium	Yellow
	Aqueduct	Medium	Yellow
	Pontoon Bridges (Seasonal)	High	Red
Lock Gate	High	Red	
Due to Channel Interaction with Activities of Channel and Bank Features			
9.	Narrow water body/water body with fairway	Medium	Yellow

	alignment close to bank.		
10.	Thickly populated area Close to the Bank	Medium	
11.	Highly eroding banks	Medium	

It is identified that there are 169 hotspots within NW 1 as presented in Table 3.4 and Map enclosed.

Table 3.4. Hotspot in NW 1

Sl. No.	Ch. Start	Ch. End	Start Location Name	End Location Name	Criteria for Hot Spot
1	0	2	Haldia	Nayachar Island	High traffic area, Cargo Jetty
2	2	4	Haldia	Nayachar Island	High traffic area, Cargo Jetty
3	4	6	DurgaChak	Balari Char	High traffic area
4	6	8	DurgaChak	Durga Nagar	High traffic area
5	8	10	DurgaChak	Durga Nagar	High traffic area
6	10	12	Banerwar Chak	Kulpi	High traffic area
7	12	14	Begunbere	Kulpi	High traffic area
8	14	16	Begunbere	Chakrupelsakar	High traffic area
9	16	18	Begunbere	Harinarayanpur	High traffic area
10	18	20	Begunbere	Bhishnurampur	High traffic area
11	20	22	Begunbere	Rabindra Nagar	High traffic area
12	22	24	Erakhali	Diamond Harbour	High traffic area, Passenger ferry
13	24	26	Erakhali	Diamond Harbour	High traffic area
14	26	28	Erakhali	Harinarayanpur	High traffic area
15	28	30	Kukrahati	Singal ganja Abad	High traffic area, Passenger ferry
16	30	32	Kukrahati	Roychak	High traffic area, Tower line crossing
17	32	34	Latpatia	Roychak	High traffic area
18	34	36	Thenul Bariya	Sukdebpur	High traffic area
19	36	38	Suklalpur	Sukdebpur	High traffic area, Passenger ferry
20	38	40	Gadiwara	Sukdebpur	High traffic area
21	40	42	Gurepol	Sriphalbaria	High traffic area
22	42	44	Kurchi Beria	Noorpur	High traffic area
23	44	46	Sibganga	Ramnagar	High traffic area
24	46	48	Dinga-Khola	Akalmegh	High traffic area
25	48	50	Alipur	Falta	High traffic area, Passenger ferry

Sl. No.	Ch. Start	Ch. End	Start Location Name	End Location Name	Criteria for Hot Spot
26	50	52	Barkalia	Shyamsunderpur	High traffic area
27	52	54	Kasipur	Ahmadpur	High traffic area
28	54	56	Chandipur	Padmapur	High traffic area, Passenger ferry
29	56	58	Belari	Burul	High traffic area
30	58	60	Baganda	Bahirkunji	High traffic area
31	60	62	Dakshin Ramachandrapur	Godakhali	High traffic area
32	62	64	Hirapur	Godakhali	High traffic area
33	64	66	Hiraganja	Dakshin Raypur	High traffic area
34	66	68	Kajiakhali	Birlapur	High traffic area
35	68	70	Kalinagar	Jagatballavpur	High traffic area
36	70	72	Uluberia	Achipur	High traffic area, Passenger ferry
37	72	74	Fuleswar	Pujali	High traffic area, Cargo Jetty
38	74	76	Sijberia	Pujali	High traffic area, Passenger ferry
39	76	78	Chakashi	Pujali M	High traffic area
40	78	80	Hat Bauria	Joychandipur	High traffic area, Passenger ferry, Cargo Jetty
41	80	82	Radhanagar	Shyampur	High traffic area
42	82	84	Raghudebatti	Chakchandul	High traffic area, Passenger ferry
43	84	86	Sarenga	Palpara	High traffic area
44	86	88	Manikpur	Uludanga	High traffic area
45	88	90	Osmanpur	Dakshini Housing Estate	High traffic area
46	90	92	Sankralijala	Badartala	High traffic area
47	92	94	Hatgacha	Badartala	High traffic area
48	94	96	Chunavati	Siraj Basti	High traffic area, Cargo Jetty
49	96	98	Gaubari	Bichali Ghat	High traffic area, Cargo Jetty
50	98	100	Botanical Garden	NSDock (KoPT)	High traffic area, Cargo Jetty, Narrow/dense settlement
51	100	102	Kazipara	Kidderpore (KoPT)	High traffic area, Cargo Jetty, Road Bridge
52	102	104	Naora	Fort William	High traffic area, Passenger ferry
53	104	106	Howra railway station	Fairley Palace	High traffic area, Passenger ferry, Critical Bridge
54	106	108	Mali Panchghara	Ahiritola	High traffic area, Passenger ferry

Sl. No.	Ch. Start	Ch. End	Start Location Name	End Location Name	Criteria for Hot Spot
55	108	110	Ghusur	Chitpur	High traffic area, Passenger ferry, Tower line crossing
56	110	112	Belur Math	Ratan Babu Ghat	High traffic area, Passenger ferry
57	112	114	Bally	Barahanagar	High traffic area, Passenger ferry, Critical Bridge
58	114	116	Kotrung	Jayasreenagar	High traffic area, Passenger ferry
59	116	118	Debaipukur	Nehabootnagar	High traffic area
60	118	120	Arabinda Pally	Angus Nagar Colony	High traffic area, Passenger ferry
61	120	122	Dharmadanga	Kulinpara	High traffic area, Passenger ferry
62	156	158	Tribeni	Kalyani	Passenger ferry, Cargo Jetty
63	168	170	Baneswarpur	Malopara	Passenger ferry, Eroding banks, Eroding tower line, Critical curve
64	202	204	Sultanpur	Char Sultanpur	Passenger ferry, Ro-Ro ferry
65	206	208	Kuledaha	Beltala	Passenger ferry, High traffic area, Ro-Ro ferry
66	208	210	Kalna	Nrisinghapur	Passenger ferry, High traffic area, Narrow/dense settlement
67	242	244	Nabadwip	Char Brahmanagar	Passenger ferry, High traffic area
68	252	254	Chupi	Kuturia	Highly critical curve
69	254	256	Sajiara	Kuturia	Highly critical curve
70	306	308	Mondalhat	Ballavpara	Passenger ferry, Ro-Ro ferry, Channel Siltation Area
71	308	310	Katwa	Ballavpara	Passenger ferry, High traffic area
72	318	320	Kalyanpur	Raghupur	Passenger ferry, Highly critical curve
73	330	332	Kadkhali	Char Palasi	Passenger ferry, Ro-Ro ferry
74	380	382	Ranibagan	Gora Bazar	Passenger ferry, High traffic area, Road bridge
75	382	384	Khagraghat	Khaghra	Passenger ferry, High traffic area
76	396	398	Mahinagar Diar	Azadhindbagh	Passenger ferry, High traffic area
77	398	400	Azimganj	Jiaganj	Passenger ferry, High traffic area
78	416	418	Singechwari	Bhatpara	Highly critical curve
79	418	420	Arijpur	Bhatpara	Highly critical curve

Sl. No.	Ch. Start	Ch. End	Start Location Name	End Location Name	Criteria for Hot Spot
80	442	444	Elasapur	Bahara	Highly critical curve
81	454	456	Basudebpur	Tantipara	High traffic area, Road bridge, Narrow/dense settlement
82	458	460	Khidirpur	Char Sekandara	Highly critical curve
83	480	482	Bhasaipaikar	Ghoramara	Critical Bridge, Tower line crossing
84	496	498	Chandipur	Chauki	Cargo Jetty, Narrow/dense settlement, Tower line crossing, Multiple bridge
85	498	500	Srimantapur	Farakka	Passenger ferry, Cargo Jetty
86	500	502	Bewa	Farakka	Lock gate, Critical curve, Cargo Jetty
87	502	504	Gobindarampur	Gobindarampur	Passenger ferry, Narrow/dense settlement, Highly critical curve
88	536	538	Raniganj	Narayanpur	High traffic area, Ro-Ro ferry,
89	538	540	Rajmahal	Paschim Narayanpur	High traffic area, Ro-Ro ferry
90	540	542	Rajmahal	Paschim Narayanpur	Passenger ferry, High traffic area
91	578	580	Sahibganj	Bhagwanpur	Passenger ferry, Ro-Ro ferry, Cargo Jetty
92	590	592	Lal Bathani Milk	Rampur Ogairah	High traffic area, Ro- Ro ferry
93	592	594	Lal Bathani Milk	Manihari	High traffic area
94	610	612	Hirdenagar Kant Nagar	Modi chak	Eroding tower line
95	644	646	Kahalgon	Tintanga	Passenger ferry, Vikramshila Gangetic Dolphin Sanctuary, High traffic area, Ro-Ro ferry
96	646	648	Kahalgon	Tintanga	Vikramshila Gangetic Dolphin Sanctuary, High traffic area
97	648	650	Kahalgon	Tintanga	Vikramshila Gangetic Dolphin Sanctuary
98	650	652	Kahalgon	Tintanga	Vikramshila Gangetic Dolphin Sanctuary
99	652	654	Rampur Gandharp Milik	Dimha	Vikramshila Gangetic Dolphin Sanctuary
100	654	656	Rampur Gandharp Milik	Dimha	Vikramshila Gangetic Dolphin Sanctuary
101	656	658	Rampur Gandharp Milik	Dimha	Vikramshila Gangetic Dolphin Sanctuary

Sl. No.	Ch. Start	Ch. End	Start Location Name	End Location Name	Criteria for Hot Spot
102	658	660	Rampur Gandharp Milik	Ismail pur	Vikramshila Gangetic Dolphin Sanctuary, Eroding banks
103	660	662	Kamlakund	Ismail pur	Vikramshila Gangetic Dolphin Sanctuary, Eroding banks
104	662	664	Budhuchak	Ismail pur	Vikramshila Gangetic Dolphin Sanctuary, Eroding banks
105	664	666	Budhuchak	Emadpur	Vikramshila Gangetic Dolphin Sanctuary, Eroding banks
106	666	668	Salarpur	Emadpur	Vikramshila Gangetic Dolphin Sanctuary
107	668	670	Pharka	Emadpur	Vikramshila Gangetic Dolphin Sanctuary
108	670	672	Pharka	Raziuddinpur	Vikramshila Gangetic Dolphin Sanctuary
109	672	674	Bhagalpur	Mahadeopur	Vikramshila Gangetic Dolphin Sanctuary
110	674	676	Bhagalpur	Mahadeopur	Vikramshila Gangetic Dolphin Sanctuary
111	676	678	Bhagalpur	Mahadeopur	Vikramshila Gangetic Dolphin Sanctuary, Road Bridge
112	678	680	Jalalpur	Raghopur	Vikramshila Gangetic Dolphin Sanctuary
113	680	682	Jalalpur	Raghopur	Vikramshila Gangetic Dolphin Sanctuary
114	682	684	Jalalpur	Raghopur	Vikramshila Gangetic Dolphin Sanctuary
115	684	686	Jhau	Kazi Koraia	Vikramshila Gangetic Dolphin Sanctuary
116	686	688	Jhau	Kazi Koraia	Vikramshila Gangetic Dolphin Sanctuary
117	688	690	Mohanpur	Faridpur	Vikramshila Gangetic Dolphin Sanctuary
118	690	692	Mohanpur	Faridpur	Vikramshila Gangetic Dolphin Sanctuary
119	692	694	Ajmeripur	Tekwazpur	Vikramshila Gangetic Dolphin Sanctuary
120	694	696	Mirzapur	Tekwazpur	Vikramshila Gangetic Dolphin Sanctuary
121	696	698	Mirzapur	Saiduddinpur	Vikramshila Gangetic Dolphin Sanctuary
122	698	700	Mirzapur	Saiduddinpur	Vikramshila Gangetic Dolphin Sanctuary

Sl. No.	Ch. Start	Ch. End	Start Location Name	End Location Name	Criteria for Hot Spot
123	700	702	Gangapur	Dudhaila	Vikramshila Gangetic Dolphin Sanctuary
124	702	704	Gangapur	Dudhaila	Vikramshila Gangetic Dolphin Sanctuary
125	704	706	Gangapur	Gaura	Vikramshila Gangetic Dolphin Sanctuary
126	706	708	Shahabad	Gaura	Vikramshila Gangetic Dolphin Sanctuary
127	708	710	Shahabad	Shahabad	Vikramshila Gangetic Dolphin Sanctuary
128	710	712	Shahabad	Shahabad	Vikramshila Gangetic Dolphin Sanctuary
129	712	714	Sultanganj	Madhopurpatpar	Vikramshila Gangetic Dolphin Sanctuary
130	714	716	Sultanganj	Madhopurpatpar	Passenger ferry, Vikramshila Gangetic Dolphin Sanctuary, Ro- Ro ferry, Road Bridge
131	716	718	Sultanganj	Madhopurpatpar	Vikramshila Gangetic Dolphin Sanctuary, High traffic area
132	820	822	Simariya	Hathida	High traffic area, Tower line crossing, Critical Bridge
133	892	894	Ghansurpur Diara	Ghanspur	Pontoon Bridge
134	910	912	Saidabad	Tilllak Nagar	High traffic area, Tower line crossing, Passenger ferry, Pontoon Bridge
135	914	916	Bidupur	Sabalpur	Eroding tower line, Road Bridge
136	922	924	Hajipur	Patna	High traffic area, Channel siltation area, Cargo Jetty, Pontoon Bridge, Road bridge, Narrow/dense settlement
137	936	938	Nakta Diyara	Mithila	Cargo Jetty
138	938	940	Panapur	Takiapur	Pontoon Bridge
139	958	960	Diara Singahi	Haldi Chhapra	High traffic area,
140	960	962	Diara Singahi	Haldi Chhapra	High traffic area, Channel siltation area, Passenger ferry
141	962	964	Jatia Bajidpur	Todarpur	High traffic area,
142	990	992	Kondarha Uparwar	Parasrampur	Pontoon Bridge
143	1016	1018	Shri Nagar	Gangawali	Pontoon Bridge
144	1028	1030	Dagarabad	Dangrabad	Tower line crossing, Pontoon Bridge

Sl. No.	Ch. Start	Ch. End	Start Location Name	End Location Name	Criteria for Hot Spot
145	1046	1048	Paikawali	Shivpur Diyar Saraju Khd	Passenger ferry, Pontoon Bridge, Road Bridge
146	1078	1080	Sarya	Ghola Ghat	High traffic area, Passenger ferry
147	1110	1112	Narainpur Urf Hariharpur	Andhi Tilwa	Pontoon Bridge
148	1120	1122	Nagwa Urf Nawapura	Gangbarar juvrajpur	Cargo Jetty
149	1126	1128	Foolpur	Gangbarar Mednipur	High traffic area, Channel siltation area, Tower line crossing, Multiple bridge
150	1128	1130	Barbarahana	Gangbarar Tari	High traffic area, Channel siltation area
151	1150	1152	Dharamarpur	Karbala	Channel siltation area, Eroding banks, Pontoon Bridge
152	1172	1174	Sarauli	Gangwara Nakanwa Medhw	Tower line crossing, Passenger ferry, Pontoon Bridge
153	1238	1240	Ganga Nagar	Suzabad	Channel siltation area, Critical Bridge
154	1240	1242	Ghasi Tola	Ratanpur	High traffic area, Kashi Turtle Sanctuary, Narrow/dense settlement
155	1242	1244	Gauriganj	Katesar	High traffic area, Kashi Turtle Sanctuary, Narrow/dense settlement
156	1244	1246	Nagwa Lanka	Ramnagar	High traffic area, Channel siltation area, Kashi Turtle Sanctuary
157	1246	1248	Rajghat	Susabad	High traffic area, Tower line crossing, Kashi Turtle Sanctuary, Road Bridge
158	1248	1250	Varanasi	Ramnagar	High traffic area, Eroding banks, Tower line crossing, Cargo Jetty, Road Bridge
159	1322	1324	Puranebada	Mirzapur	Passenger ferry, Critical Bridge
160	1340	1342	Pureraji	Babhani Mu. Parawa	Pontoon Bridge
161	1382	1384	Bhurra Tari	Mahewa Khurd	Eroding banks, Pontoon Bridge
162	1398	1400	Tela Khas	Chak Vishun Dutt	Tower line crossing, Pontoon Bridge
163	1404	1406	Kandala Mavaia	Paranipur Uparhar	Eroding tower line, Passenger ferry
164	1410	1412	Garhawa	Dubeypur	Tower line crossing, Passenger ferry

Sl. No.	Ch. Start	Ch. End	Start Location Name	End Location Name	Criteria for Hot Spot
165	1414	1416	Teliyatara	Sisra	Eroding banks, Passenger ferry, Pontoon Bridge
166	1446	1448	Dewrakh Ka Char	Mawaiya Ta. Javthan Ka Char	Tower line crossing, Pontoon Bridge
167	1448	1450	Jhusi	Chak Beniram, Naini	Channel siltation area, Tower line crossing, Pontoon Bridge, Mass Gathering location
168	1450	1452	Daraganj & Jhusi	Chak Hiranand, Naini	High traffic area, Channel siltation area, Mass Gathering location, Passenger ferry
169	1452	1454	Allahabad	Maheshwa Patti Purba Uparhar, Naini.	High traffic area, Tower line crossing, Mass gathering location, Narrow/dense settlement, Road bridge, Passenger ferry

Source: Analysis

These hotspots which are represented as red sections among the critical sections were taken for detailed risk analysis towards proposing risk management measures. Cautionary approach is to be adopted for the yellow sections, which are moderately critical and standard operating procedure, compliance with regulations, regular Thalweg surveys and dredging shall be adopted for the white sections including remaining sections. Also, in case of narrow stretches with thickly populated banks disaster management mechanism to be correctly aligned.

It is concluded that

- There are 220 critical sections identified for Haldia – Munger section out of which 131 are hotspots. The critical risk factors within hotspots were sharp curves less than 200 m, environmentally sensitive area, high traffic areas such cargo jetties, multiple ferry crossings, presence of cross structures having low clearance, tower lines in eroding banks, lock gates and aqueducts.
- There are 105 critical stretches identified for Munger - Prayagraj section out of which 38 are hotspots. The critical risk factors include critical bridge locations, pontoon bridges, mass gathering areas, environmentally sensitive stretches, high traffic areas, terminal locations, multiple ferry crossings, sagging and eroding tower lines etc.

- Out of the total 169 hotspots identified, 87 are falling within the state of West Bengal alone and rest 82 hotspot segments are falling under Jharkhand, Bihar and Uttar Pradesh.

3.4.2. Cargo Related Risk Elements

Cargo related risk in IWT operation are due to

- Intrinsic properties
- Inter-compatibility of various chemicals/ interaction with the medium – air/water
- Interaction with other activates – terminal operation/ vessel operation such as loading or unloading.

Towards delineating the cargo related risk, the listed cargos were analysed in detail to understand the properties above which may turn in to a disaster. International Maritime Dangerous Goods Code (IMDG) and International Maritime Solid Bulk Cargo (IMSBC) are the accepted international guideline for safe transportation or shipment which is followed for the IWT sector too. IMDG Code list out the Hazardous cargoes - those substance when mishandled will pose damage to people, property and environment because of their intrinsic properties such as flammability, corrosivity, reactivity and toxicity which are defined as below.

- Flammability - It is the ease with which a material ignites either naturally or through the presence of an ignition source. Flammable liquids are characterized by low boiling and flash point. Other flammable materials may catch fire spontaneously in contact with air or due to friction. In the fire event, a hazardous substance causes release of heat, solid particles and toxic gases.
- Corrosivity - It is the property of the chemical by which it destroy or irreversibly damage another surface or substance with which they come into contact including both living tissues skin, eyes, lungs and such as response equipment other cargos or packaging.
- Toxicity - Toxic chemicals are those chemicals that cause death or injury to the living organisms if inhaled, ingested or absorbed through the skin at low levels. It is often represented by the risk of a particular concentration to human health or the environment.

- Environmental Pollutant - Chemicals pose an immediate or delayed danger to one or more components of the environment and for which particular care should be exercised over their disposal.

IMSBC specifies the requirement for bulk solid cargos while handling and transport by classifying as follows.

- Group A – Cargos which may liquefy if shipped at a moisture content exceeding their Transportable Moisture Limit (TML).
- Group B – Cargos which possess a chemical hazard which could give rise to a dangerous situation on ship
- Group C – Cargos which are neither liable to liquefy (Group A) nor possess chemical hazard (Group B). Cargoes in this group can still be hazardous.

It is to be noted that classified cargoes under IMDG or IMSBC Group A/B has inherent hazards associated with it while carrying which are analyzed in detailed in the detailed risk assessment. For cargoes listed in Group C of IMSBC, the guidelines of the IMSBC shall be followed for avoiding risk and whereas for non-listed cargoes, the best industrial practice shall be followed for safe handling of cargo.

The detailed analysis of cargo for their applicability to IMDG and IMSBC are presented in **Annexure III**. The cargo classified in IMDG or IMSBC are presented in **Table 3.5**. For detailed features of hazardous cargo, Material Safety Data Sheets (MSDS) of the cargoes listed in IMDG are presented in **Annexure IX**.

Table 3.5. Cargo Classified in IMDG Code and or IMSCB

Sl.No	Cargo	Applicability		UN No	Physical State of Transport
		IMSBC	IMDG Code		
1	Liquid ammonia gas	NA	2.3	1005	Liquid
2	CNG	NA	2.1	1971	Gas
3	LNG	NA	2.1	1972	Gas
4	Petrol	NA	3	1203	Liquid
5	High Speed Diesel (HSD)	NA	3	1202	Liquid
6	Furnace oil	NA	9	1223	Liquid
7	Lube oil	NA			Liquid

Sl.No	Cargo	Applicability		UN No	Physical State of Transport
		IMSBC	IMDG Code		
8	Coal	Group A/B	4.1 - MHB	NA	Solid
9	Coke	Group C- Coke Breeze: Group A	NA		Solid
10	Manganese ore fines	Group a	NA		Solid
11	Ammonium based fertiliser				
	Ammonium nitrate based fertiliser	Group B	5.1	2067	Solid
	Ammonium nitrate based fertiliser	Group B	9	2071	Solid
12	Iron				
	Direct reduced iron (a) - briquettes, hot-moulded	Group B	MHB		Solid
	Direct reduced iron (b) - lumps, pellets, cold-moulded briquettes	Group B	MHB		Solid
	Direct reduced iron (c) - by- product fines	Group B	MHB		Solid
	Ferrous metal borings, shavings, turnings or cuttings	Group B	4.2	2793	Solid
	Iron and steel slag and its mixture	Group A	NA		Solid
	Iron ore fines	Group A	NA		Solid
	Iron oxide, spent or iron sponge, spent (obtained from coal gas purification)	Group B	4.2		Solid
	Iron oxide (technical)	Group A	NA		Solid
13	Concrete				
	Iron and steel slag and its mixture	Group A	NA		Solid
14	Wood		NA		
	Wood chips	Group B	MHB		Solid
	Wood products - logs, timber, saw logs, pulp wood, round wood	Group B	MHB		Solid
NA	Not applicable				
MHB	Materials hazardous only in bulk				

Hazardous cargoes attracting IMDG Code and IMSBC under Group A and B are considered in detailed risk assessment with specific inclusion of Group C cargo types having critical impact on aquatic organisms.

The inter compatibility of cargo was analysed towards understanding the probable scenarios onboard or at storage locations and the same is summarized in **Table 3.6**.

A cargo related incident can trigger various hazard scenarios such as spillage of cargo, fire or explosion. The primary release of cargo may trigger toxic cloud in air and on interaction with water lead to toxic contamination. Hence, cargo properties and immediate consequence were analysed and summarized in **Table 3.7** and the same were duly considered in identifying credible scenarios. The response of individual chemicals on release is presented in **Annexure VI**.

Table 3.6. Compatibility Matrix for Cargo to be Transported through NW1

Sl. No.	Cargo Transported/Medium of Interaction	Cargo Transported/Medium of Interaction																										
		Air (Medium)	Water (Medium)	Ammonia	LNG	Petrol	Diesel	Furnace Oil	Lube Oil	Edible Oil	Phosphoric Acid	Sulphur	Coal	Sponge Iron	Coke	Cement	Fly Ash	Rock Phosphate	Limestone	Manganese Ore	Ammo. Fertiliser	Food & Food	Plastic Granules	Textile	Paper	ODC and	Vehicles	General Cargo (non break bulk)
1.	Air (Medium)																											
2.	Water (Medium)																											
3.	Ammonia																											
4.	LNG																											
5.	Petrol																											
6.	High Speed Diesel																											
7.	Furnace Oil																											
8.	Lube Oil																											
9.	Edible Oil																											
10.	Phosphoric Acid																											
11.	Sulphur																											
12.	Coal																											
13.	Sponge Iron																											
14.	Coke																											
15.	Cement																											
16.	Fly Ash																											
17.	Rock Phosphate																											
18.	Limestone																											
19.	Manganese Ore																											
20.	Ammonium based Fertiliser																											
21.	Food & Food Stuff																											
22.	Plastic Granules																											
23.	Textile																											
24.	Paper																											
25.	ODC and similar (Iron, Steel, Concrete or Wood)																											
26.	Vehicles																											
27.	General Cargo (non break bulk)																											
	Legend :-																											
	Compatible																											Remarks
	Dilution with evolution of heat																											Non-Critical
	Dilution with evolution of heat																											Non-Critical
	Hydration with evolution of heat																											Non-Critical
	Neutralization with evolution of heat																											Non-Critical
	Reaction with evolution of hydrogen																											Critical
	Reaction with evolution of carbon dioxide																											Critical

Table 3.7. Properties of Cargo on Release

Sl.No	Cargo	Applicability		Risk of					Consequences
		IMSBC	IMDG Code	Toxic Contamination	Toxic Cloud	Emission of Flammable Liquid	Emission of Flammable Solid	Release of Flammable Gas	
1	Liquid Ammonia Gas	NA	2.3	√	√	×	×		Gas escapes - Heat evolution - changes to alkaline pH - threat to aquatic organism
2	Compressed Natural Gas (CNG)	NA	2.1	√	×		×	√	Gas escapes - Fire can spread on to banks
3	Liquefied Natural Gas (LNG)	NA	2.1	√	×		×	√	
4	Petrol	NA	3	√	×	√	×		Liquid Spill - Fire on surface can affect aquatic - can spread on to banks
5	High Speed Diesel (HSD)	NA	3	√	×	√	×		
6	Furnace Oil	NA	9	√	×	×	×		
7	Lube Oil	NA		√	×	×	×		
8	Coal	Group A/B	4.1 - MHB	√	×	×			Dust explosion in confined space, self-heating and fire at storage. Volatile release leads to health issues for public.
9	Coke	IMO Class :NA IMSBC :Group C - Coke Breeze: Group A	NA	√	×	×	√		Liquefaction
10	Cement	IMO Class :NA IMSBC :Group C	NA	√	×	×	×		Heat evolution with increase in pH. Toxic to aquatic organisms.
11	Fly Ash	IMO Class :NA IMSBC :Group C	NA	√	√	×	×		Fly ash dust is injurious to health
12	MANGANESE Ore fines	IMO Class :NA IMSBC :Group A	NA	×	×	×	√		Liquefaction
13	Ammonium based Fertiliser								
	Ammonium Nitrate based fertiliser	IMO Class: 5.1, IMSBC Group B	5.1	√	×	×	√		Ammonium Nitrate is flammable. Enhances eutrophication
	Ammonium Nitrate based fertiliser	IMO Class: 9, IMSBC Group B	9	√	×	×	√		
	Ammonium Nitrate based fertiliser (NON-HAZARDOUS)	IMO Class: NA, IMSBC Group C	NA	√	×	×	√		
	Urea	IMO Class: NA, IMSBC Group C	NA	√	×	×	×		Aid eutrophication
14	Iron								
	Direct Reduced Iron (A) - Briquettes, hot-moulded	IMO Class: MHB, IMSBC Group B	MHB	×	×	×	√		Liquefaction

Sl.No	Cargo	Applicability		Risk of					Consequences
		IMSBC	IMDG Code	Toxic Contamination	Toxic Cloud	Emission of Flammable Liquid	Emission of Flammable Solid	Release of Flammable Gas	
	Direct Reduced Iron (B) - Lumps, pellets, cold-moulded briquettes	IMO Class: MHB, IMSBC Group B	MHB	×	×	×	√		Self-heating
	Direct Reduced Iron (C) - By-product fines	IMO Class: MHB, IMSBC Group B	MHB	×	×	×	√		Self-heating
	Ferrous Metal Borings, shavings, turnings or cuttings	IMO Class :4.2, Group B	4.2	×	×	×	√		Self-heating
	Iron and Steel Slag and its mixture	IMO Class: NA, IMSBC Group A	NA	×	×	×	√		Self-heating
	Iron Ore Fines	IMO Class: NA, IMSBC Group A	NA	×	×	×	√		Liquefaction
	Iron Oxide, Spent or Iron Sponge, Spent (obtained from coal gas purification)	IMO Class: 4.2, IMSBC Group B	4.2	×	×	×	√		Self-heating
	Iron Oxide (Technical)	IMO Class: NA, IMSBC Group A	NA	×	×	×	√		Liquefaction
15	Concrete								
	Iron and Steel Slag and its mixture	IMO Class: NA, IMSBC Group A	NA	×	×	×	√		Self-heating
16	Wood								
	Wood Chips	IMO Class: MHB, IMSBC Group B	MHB	×	×	×	√		Self-heating
	Wood Products - Logs, Timber, Saw Logs, Pulp Wood, Round Wood	IMO Class: MHB, IMSBC Group B	MHB	×	×	×	√		Self-heating
	Flammable Solid								
	Flammable liquid								
	Flammable Gas								
	Toxic contamination								
	Toxic cloud								

3.4.2.1. Oil Spill Related Risks

Oil Spill associated risk was analysed as part of the proposed increased cargo movement along NW 1 towards ensuring oil spill emergency preparedness for NW 1 in line with the requirements set out as per National Oil Spill Disaster Contingency Plan (NOS-DCP) for responding to marine oil spill emergencies in Indian Waters.

The NOS-DCP stipulates the organizational and operational details to effectively combat a national oil spill contingency. NOS - DCP envisages the Director General of Indian Coast Guard (DGICG) as the Central Coordinating Authority (CCA) for enforcing the provisions of the NOS - DCP in the maritime zones of India and delineates the duties and responsibilities of each participating agency. Keeping the operational flexibility for effective response activities, escalation of activities are planned from facility level operation to regional level stakeholder operation through mutual aid activities and then further escalating to avail assistance from national plan or international plan stakeholders. The responsibility of combating with oil spills among the various stakeholders has been assigned as presented in **Figure 3.10** below.

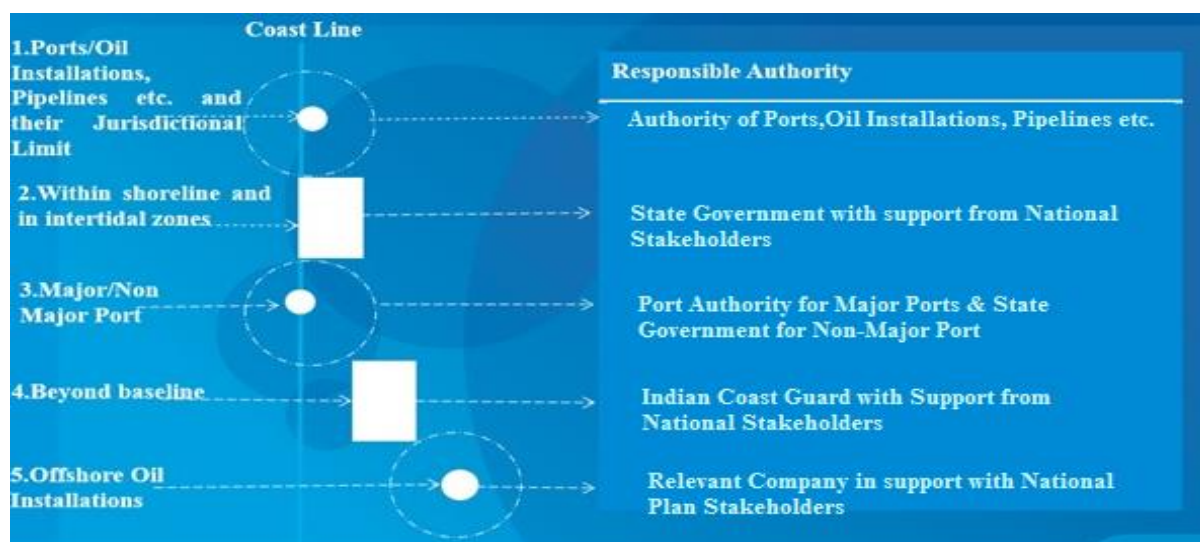


Figure 3.10. Responsibility for Combating to Oil Spill within Indian Waters

It is to be noted that the IWT Terminals/operation has not exclusively mentioned in NOS-DCP; however, in line with Port requirements and cargo operational profile, a proposal on oil spill contingency plan for cargo operation through NW 1 is formulated.

NOS-DCP guidelines defines oils and Hazardous and Noxious Substances (HNS) as below for which the Contingency Plan shall be prepared as per the ICG guidelines.

- “Oil” means petroleum in any form including crude oil, fuel oil, sludge, oil refuse and refined products, other than petrochemicals subject to the provisions of Annex II of MARPOL 73/78 and includes the substances listed in Appendix I to Annex I of MARPOL 73/78 as amended.
- “Hazardous and Noxious Substance” as defined in the IMO OPRC-HNS Protocol means any substance other than oil which, if introduced into the marine environment is likely to create hazards to human health, harm living resources and marine life, damage amenities or interfere with other legitimate uses of the sea.

When oil is spilled, it undergoes a number of physical and chemical changes, some of which lead to its removal from the sea surface, while others cause it to persist. Higher molecular fraction of oil products are persistent since considerable portion of heavy fractions of high boiling material which remain after spillage. While non-persistent oils are generally of a volatile nature and are composed of lighter hydrocarbon fractions which tend to dissipate rapidly through evaporation.

Considering the fate of spilled oil, distinction is frequently made between non persistent oils which tend to disappear rapidly from water surface and persistent oils which in contrast dissipate more slowly and usually require a clean-up response.

The detailed list of cargo proposed to be handled through NW 1 was reviewed for their applicability w.r.to the provision of MARPOL 73/78 and IMO OPRC-HNS towards its applicability with NOS-DCP guidelines. For the oil classified, persistency of the oil was analysed as it is critical in planning the response operation requirement and also for ensuring that appropriate equipments and facilities are procured for handling the oil or chemical emergencies expected. **Table 3.8** presents the analysis of oil types w r to persistency towards selecting the oil spill response system to be in place.

Table 3.8. Oil Classification for Cargo through NW 1

Sl.No	Commodity	Classification as per MARPOL	Persistency
1	Motor spirit	Oil	Non-persistent
2	High speed diesel / gas oil (HSD)	Oil	Non-persistent
3	Furnace oil (FO)	Oil	Persistent
4	Lube Oil	Oil	Non-persistent

Source: Analysis

The vessel to be moved include Tankers, Bulk Carriers, Container Vessel, Push boats, Car Carrier, Ro-Ro Vessel, LNG Carrier and Dumb barge along with the present operational vessels such as barges, dredgers, survey vessels, passenger ferries, fishing vessels, sand-carrying vessels etc. All the above vessels would be fueled either by High Speed Diesel (HSD) or by LNG /CNG as the case may be. So, it is to be concluded that the only persistent oil having probability for spill in NW 1 is Furnace Oil. As per the standard design specification for vessel proposed in IWAI, the maximum fuel stored in vessel would be HSD of 30 T and Furnace oil would be carried in tanker would be 1500 T. The same is duly considered in developing credible scenarios.

NOS-DCP has classified ports as Category A, B, C and D depending on the oil spill risk in due consideration of the oil spill probability based on vessel and cargo handled as presented in **Table 3.9**. The minimum Oil Spill Response (OSR) equipments to be in place for the facilities are also detailed out in NOS-DCP.

Table 3.9. Risk Categorization of Ports as per NOS-DCP

Risk Category	Description
A	Ports handling crude oil cargo Tankers (alongside/SBM/STS)
B	Ports handling Ships with other Cargos than crude oil cargo
	Ports handling Tankers with products only
C	Other than Cat 'A' and Cat 'B'
D	Ports handling ships using HSD only as bunker fuel and nil HFO onboard.

Source: EP/0720/Circular No 03/2018 dated 19.12.2018, Indian Coast Guard.

Considering the above, the minimum preparedness equivalent to Category C has been proposed for all terminals along NW 1 with specific requirements for protecting the environmental sensitive areas of Vikramshila Gangetic Dolphin Sanctuary and Kashi Turtle Sanctuary.

3.4.3. Vessel Related Risk

Vessel related risks are equally important as cargo related and channel related risk at the same time highly dependent on them. In the case of NW 1, the vessel to be moved include Tankers, Bulk Carriers, Container Vessel, Push boats, Car Carrier, Ro-Ro Vessel, LNG Carrier and Dumb barge along with the present operational vessels such as barges, dredgers, survey vessels, passenger ferries, fishing vessels, sand-carrying vessels etc. In the port areas of Haldia and Kolkata, there are marine going vessel operations ongoing and the areas are represented with highest traffic. Pure vessel related risks and consequences, other than those covered under

channel related and cargo related risk elements are given in **Table 3.10** below. These aspects were duly considered in development of credible scenarios.

Table 3.10. Vessel Related Risks and Consequences

Sl. No.	Activity	Scenarios	Consequences	
			Primary	Secondary
1	Mechanical	Main engine failure	Lube oil / fuel oil leaks & malfunctioning, overheating or breakdown of main engines.	Stranding/driftng of vessel, Collision with banks, Grounding, collision, fire and pollution of the surrounding environment
		Generators failure	Stranding of vessels	Collision with banks or grounding
2	Structural	Hull failure	Collision or grounding	Breakage of the hull
		Ballast tanks and or other tank structure failure	Damages to tanks and leakage of cargo	Pollution and contamination of cargo and ballast water
3	Electrical Equipment	Navigational equipment and or communication equipment failure	Cannot maintain safe navigation	Endangering crew, vessel, cargo and the environment and lead to possible navigation accidents
		Electrical installations and cables failure	Create sparks , fires or explosions	Personal Injury and damage to property
		Electrical equipment failure		
4	Crew	Lack of awareness and or training	Incorrect handling of dangerous goods, mistakes in the safe operation	Pollution, personal injury or fatalities, property damage, collision, grounding, fire and explosion.
		Lack of skills, experience and competence		
		Crewmembers not following proper rules/regulations/procedures.		
		Improper Communication and signage		
5	Lifesaving appliances & Fire fighting Equipment	Absence / Failure of Fire fighting equipment.	Consequences for safety, property and the environment as crewmembers will not be able to respond effectively in an emergency.	Pollution, personal injury or fatalities, property damage, collision, grounding, fire and explosion.
		Absence / Failure of Fire detection and alarm system		
		Absence / Failure of Emergency fire pump		
		Improper communication and signage		
		Absence of fire control plan		

Sl. No.	Activity	Scenarios	Consequences	
			Primary	Secondary
		Absence / failure of personal protective equipment		
		Absence / failure of lifesaving appliances		
	Other	Corrosion of storage tanks	Leakage of cargo	Pollution, lowering of water quality & damage to aquatic organism
		Failure of flexible pipe connecting bank and vessel	Leakage of flammable materials and vapours	Fire and explosion from ignition of flammable materials and vapours.
		Valves/flanges failure		
		Corrosion of storage tanks	Leakage of cargo	Pollution, lowering of water quality & damage to aquatic organism
		Welding defects	Leakage of cargo	Pollution, lowering of water quality & damage to aquatic organism
		Failure of tank-measurement devices	Tank overflow and leakage of cargo	Pollution incidents, lowering of water quality & damage to aquatic organism and, depending on the kind of dangerous goods being loaded or discharged, the release of flammable liquids or vapors which can lead to fire or explosion.
		Damage to Propeller, Entangling of Water hyacinth, wooden pieces, plastics, Hitting Fishing Nets	Navigational Failure	Grounding or Beaching

Source: Data Analysis

3.4.4. Dredging Related Risk

Dredging related risks are present in the form of channel related risks and is applicable during both construction and operation phases associated with capital and maintenance dredging respectively. It involves risk associated with dredging and allied activities. It is essential that minimum depth of the water is maintained in the river all the time of navigation, as per the notified LAD for each stretches. It cannot be stated that, this particular stretch has more dredging related risk since, LAD varies from each stretch.

Capital dredging location of proposed terminals i.e., Haldia (Operation of terminal would require dredging of 1,57,60,596 cum and also maintenance 8.5 lakh cum/year.), Sahibganj (1.5 lakh cum and also 30,000 cum for maintenance in lean season). Maintenance dredging within Navigation Channel - 14,850,000 cum/year is the tentative quantity, from Haldia to Varanasi (at present dredging is done only up to this point). Dredging activities are most prominent during the lean season between the November to May. All the terminals are important dredging locations in this regard.

Dredging as a fairway development or fairway conservation method in National Waterway No.1 is estimated to be a modest physical intervention. Modest because firstly it's required only in few and far places where the natural depth falls below minimum requirement for navigation. Secondly, required only during the lean season which ordinarily extends for maximum seven months from November to May. The dredging activity is confined only to the navigational channel which is 50-70 m. wide in comparison to the width of the river which is hundreds of meters or even kilometres.

Cutter suction dredging being the principal method of dredging NW.1, the dredged material can be disposed either by side casting away from the channel or to a farther distance through pipe lines. Transporting the dredged material out of the river to higher banks would involve huge technical challenges and unjustified costs. Further, it would amount to mining and permanently altering the bed profile of river. Hence, this option is ruled out.

It's recommended to dispose the dredged material within the river only away from the fairway in such a way that the disposed material do not cause substantial changes to the natural river characteristics. This is appropriate because dredging in a dynamic river environment is a temporary measure to conserve the fairway. The disposal areas which are appurtenant to the main navigational channel also shall be surveyed and mapped prior to commencement of

dredging and disposal. Deposition of dredged material at the disposal areas shall be continuously monitored with equal importance as assigned to the dredging area itself. Disposal shall be planned in such a way not to cause development of mounds on the river bed. It shall be uniform spread of dredged material over an area duly marked on the disposal area that has been initially mapped. The disposal areas shall be monitored continuously and ensured that at no place the disposal exceed a certain thickness which shall be decided specific to each shoal location.

Proper record of the disposal carried out according to above guidelines, ensuring least visible changes to the river bed profile outside of the fairway shall also form part of the dredging records at each shoal. Such records for individual shoals in successive lean seasons would also lead to a data base that will offer new insights into possible improvements in coming years to the methods of dredging and disposal in order to make the activity neutral in its environmental impacts.

The risk related with dredging activities includes disturbances in water column and bottom sediments which may affect aquatic organisms due to increased turbidity. The impact of the activity may be extended up to around 300m downstream depending on localized river hydraulics. Most common area where siltation is always a serious issue includes stretches downstream Ghazipur to Patna and at the feeder canal mouth. Highest no. of shoals being reported in the Farakka – Barh (60 no), followed by Barh – Ghazipur (43 no), Ghazipur - Allahabad (30 no) and Haldia (Sagar) – Farakka (15 no).

Type of dredgers used are Cutter Suction Dredger (CSD), Agitation dredgers/plough dredgers and Back Hoe Dredgers (BHD). Disposal of dredged material through CSDs will be done through pipeline into the free stream of the river in a way to avoid material working its way back to dredged channel. This can be achieved by disposing in faster flowing water, downstream and to the side of the working dredgers and disposal of material into secondary channels or redundant channels. Material dredged by BHD will need to be placed in a barge and disposed of away from the channel, as the reach of the BHD is unlikely to be sufficient to reach the faster flow for dispersion of the material.

Dredge disposal is done preferably offshore, onshore only if sediments are found to be contaminated. In general, dredging causes only temporary damage for the water quality i.e., 3 - 4 minutes as the plume passes. As per baseline study, riverbed sediments are non-toxic except

in Allahabad to Buxar stretch where Cadmium level is found marginally higher compared to US standard for offshore sediment disposal. However, this higher level is unlikely to have toxic effect on aquatic life considering the sensitivity level to cadmium exposure (short terms at Lethal Concentration (LC)-50 level) to aquatic life as per Canadian Guidelines (Source: Consolidated Environmental Impact Assessment Report of National Waterways-1: Volume – 3). Hence, the important hazardous events related to dredging are as follows:-

- Collisions with other vessels or structures while in operation.
- Failed cranes, which can cause the structure or its load to fall and injure/kill workers.
- Other individual risks related to pipeline breakages, high-pressure system failures, dropping objects injuring or killing a worker, falls into the water, where one can drown if they are not wearing a personal floatation device and long working hours, fatigue, and difficult working conditions.

It is empirical to note that due to interactions of various risk elements, the resultant risk and its impacts would be cumulative by nature on actual scenarios in a particular location, resulting in the escalation of incident. e.g. a section of channel with limiting radius can lead to vessel related risk of losing the vessel control and leading to an accident, where if the vulnerability is more, the area could be a high risk area or vice versa. Towards assessing the cumulative risk involved in the above hazards, their mutual implications are concluded as matrix and are presented in **Table 3.11**.

Table 3.11. Matrix on Cumulative Interaction of Risk Elements

	Risk Elements	Channel*	Vessel	Cargo
Risk Elements	Channel *	Escalation of emergency scenarios, i.e., a) lean season and low depth areas, b) natural disaster in an environmentally sensitive stretch.	Contact, Grounding, Collision.	Release of cargo effecting the sensitive waterway and bank features, activities in channel such as fishing.
	Vessel	Contact, Grounding.	Collision	Fire, Explosion.
	Cargo	Release of cargo effecting the sensitive bank features, activities in channel such as fishing, incompatibility of the cargo and the environment	Fire, Explosion. Trimming.	Incompatibility of Cargo resulting in Fire, Explosion and evolution of poisonous gases.

Source: Data Analysis

Note: Dredging related risk elements are confined to dredging areas which may interact with channel / vessel related risk elements.

From the above it can be concluded that, cumulative risks can emerge from the pair-to-pair combinations of all the three individual risk elements and the effects are accumulating and not nullifying. Also, the above matrix is indicative that, in addition to the above, the cumulative risk from the combination of all the three risk elements i.e., channel, cargo and vessel is also important and lead to worst case scenarios.

Other than human factor, the most important element causing or contributing or aggravating the incident are the natural disasters. The vulnerability of the project region for the natural disasters identified are summarized in **Table 3.12.**

Table 3.12. Vulnerability to Natural Disasters for NW 1

Sl. No.	Natural Disaster	Characteristics	Intensity and waterway stretch Effected.	Impacts Areas	Remarks
1	Cyclone	Cyclones emerging from Bay of Bengal which is characterized by fast winds, heavy rains and which results in flooding.	Velocity of the wind is the characteristic: Very High Damage Risk Zone, Vb = 50 m/s.	Terminal Infrastructure & vessels.	It can be a root cause and also many a times contribute or aggravate the effects of collision and contact.
			West Bengal- South 24- Parganas ,Medinipur, Howrah, Hooghly, Nadia, North 24 Pharanga.		
			High Damage Risk Zone, Vb= 47 m/s.		
			Bihar – Khagaria, Beggusarai, Samastipur, Vaishali, Buxar, Saran, Bhojpur, Patna, Nalanda, Lakhisarai, Sheikhpura, Munger, Bhagalpur, Kathihar.		
			Uttarpradesh - Gazhipur, Sant Ravidas Nagar		
			West Bengal- Murshidabad, Malda		
2	Thunderstorm	Similar to Cyclone.	Similar to Cyclone of lesser intensity.		

Sl. No.	Natural Disaster	Characteristics	Intensity and waterway stretch Effected.	Impacts Areas	Remarks
3	Flood	Mainly during monsoon rain or cyclones, it can also occur from flash flood or dam collapse.	<p>The entire waterway is prone to flooding. However, the river entering locations along the NW1 will be seriously affected due to the cumulative discharge from the upstream. District wise vulnerability to flood is given below:</p> <p>Uttar Pradesh- Ballia, Ghazipur, Chanduali, Mirzapur, Varanasi, Sant Ravidas nagar, Allahabad.</p> <p>Bihar- Most Vulnerable- Khagaria, Beggusarai, Samastipur, Vaishali.</p> <p>Vulnerable – Buxar, Saran, Bhojpur, Patna, Nalanda, Lakhisarai, Sheikhpura, Bhagalpur</p> <p>Less Vulnerable - Munger</p> <p>West Bengal – All districts along NW1 (Highly Vulnerable)</p> <p>Jharkhand- Most Vulnerable- Sahibganj</p>	Scouring of foundation of terminals, bridges and other infrastructure facilities, destruction of banks and formation of shoals thereby increasing chances as well as consequences of collision, contact, falling of structures etc.	It can be a root cause and also contribute or aggravate the effects of collision and contact.
4	Earthquake	Geological reason or	High Damage Risk Zone : Zone IV (MSK VIII)	Directly destructive to jetties,	It mainly emerge

Sl. No.	Natural Disaster	Characteristics	Intensity and stretch waterway affected.	Impacts Areas	Remarks
		triggered by Dam Break	<p>Bihar- Munger, Sheikpura, Lakhisarai, Khagaria, Begusarai, Samastipur, Vaishali, Patna, Saran, Bojpur, Bhagalpur and Buxar.</p> <p>West Bengal – South 24- Phargana</p> <p>Moderate Damage Risk Zone –III (MSK VII)</p> <p>West Bengal- Medinipur, Howrah, Hooghly, Nadia, Murshidabad. North 24 Pharanga</p> <p>Jharkhand- Sahibganj</p> <p>Uttarpradesh- Ballia, Ghazipur, Chanduali, Mirzapur, Varanasi, St. Ravidas Nagar, Allahabad</p>	terminals and other supporting infrastructure facilities.	as a root cause.
5	Tsunami	Origin is mainly associated with earthquake, it can also arise from Volcano or under water explosion.	Expected wave height - Around 1.5 to 2 m with a probability of 0.99 % per year. Tidal area of West Bengal.	It may damage/collapse the terminal infrastructure facilities and also cause a collision or contact hazard, beaching of vessels.	
6	Tidal Bore	Mainly associated with a cyclone or thunderstorm	Occur in the coastal stretches of NW 1 between Haldia and Tribeni. It occur around 100 days per year.	Will lead to siltation and shoaling in the area. It may damage/collapse the terminal infrastructure facilities and cause a	

Sl. No.	Natural Disaster	Characteristics	Intensity and stretch waterway affected.	Impacts Areas	Remarks
				collision or contact hazard.	
7	Man Made Disasters		Bihar- Vaisali, Samastipur, Patna, Khagaria, Bhagalpur, Begusari West Bengal -South Pharanga, Nadia, Malda Jharkand - Sahibganj	The common manmade disasters found are: chemical hazards fire communal riot	

Source: IMD, State Disaster Management Plan, Cumulative Impact Assessment Reports, CWC

3.5. Delineation of Credible Scenarios

A cumulative analysis was carried out based on all above studies - historical accident analysis in due comparison with the existing features of waterway with specific emphasis on the various risk elements associated with channel, vessel, cargo and dredging. Credible scenarios have been shortlisted for assessing the risk levels. Risk level for various shortlisted credible scenarios were determined based on the frequency of their occurrence i.e., likelihood that the event will occur and extent of threat to vulnerable features, i.e., consequences they could cause. Basis of probability and consequence and representative risk matrix considered in the study are as below.

Table 3.13. Basis of Probability and Consequences

Probability – Definitions	Assigned Value
Frequency - Likely to occur often in the life of an item.	5.
Probable - Will occur several times in the life of an item.	4.
Occasional - Likely to occur sometime in the life of an item.	3.
Remote - Unlikely but possible to occur in the life of an item.	2.
Improbable - So unlikely, it can be assumed occurrence may not be experienced	1
Consequences – Definitions	
Catastrophic - Operating conditions are such that human error, environment, design deficiencies, element, subsystem or component failure, or procedural deficiencies may commonly cause death or major system loss, thereby requiring immediate cessation of the unsafe activity or operation	4
Critical - Operating conditions are such that human error, environment, design deficiencies, element, subsystem or component failure or procedural deficiencies may commonly cause severe injury	3

or illness or major system damage thereby requiring immediate corrective action.	
Marginal - Operating conditions may commonly cause minor injury or illness or minor systems damage such that human error, environment, design deficiencies, subsystem or component failure or procedural deficiencies can be counteracted or controlled without severe injury, illness or major system damage	2
Negligible - Operating conditions are such that personnel error, environment, design deficiencies, subsystem or component failure or procedural deficiencies will result in no, or less than minor illness, injury or system damage	1

Table 3.14. Representative Risk Matrix

Basic Frequency Classes and Assigned Values	Consequences and Assigned Values			
	Catastrophic (5)	Critical (3)	Marginal (2)	Negligible (1)
Frequent (5)	High - 20	High - 15	High - 10	Medium - 5
Probable (4)	High - 16	High - 12	Serious - 8	Medium - 4
Occasional (3)	High - 12	Serious - 9	Medium - 6	Low - 3
Remote (2)	Serious - 8	Medium - 6	Medium - 4	Low - 2
Improbable (1)	Medium - 4	Low - 3	Low - 2	Low - 1

The risk levels assessed for the credible scenarios are as presented in **Table 3.15** below.

Table 3.15. Risk Levels for Credible Scenarios for NW 1

Sl. No	Hazard	Credible Scenario	Risk Type	Probability	Consequence	Risk Value	Risk Level	Response Operation
1	Grounding	Navigation failure near Sultanganj upstream of Vikramshila Gangetic Dolphin Sanctuary leading to grounding of vessel and spillage of Furance oil in water - Oil Spill contamination of watercourse	Offshore	1	4	4	Medium	IWAI and Vessel owners shall work on control of spillage /containment and also to deploy the protective boom and in case if required get assistance from Indian Coast Guard DDMA shall take action for restricting use of the contaminated water through respective nodal departments.
		Navigation failure near Khidderpur reach at Jangipur area leading to grounding of vessel and spillage of Urea in water - Toxic contamination of watercourse	Offshore	4	2	8	Serious	IWAI and Vessel owners shall work on control of spillage /containment and State Pollution Control Board in coordination with Drinking Supply intake downstream shall confirm the usability of water and should restrict use of water.
		Navigation failure in Kashi Turtle Sanctuary at Varanasi leading to grounding of vessel and spillage of Cement in water - Toxic contamination of watercourse	Offshore	1	4	4	Medium	IWAI and Vessel owners shall work on control of spillage /containment and State Pollution Control Board in coordination with Drinking Supply intake downstream shall confirm the usability of water and should restrict use of water.
2	Contact	Rupture of pipe lines during loading/unloading of liquid ammonia due to the contact between vessels and offshore structures resulting	Onshore	3	4	12	High	IWAI and Vessel owners shall work on control of spillage /containment with specific response facilities. Incident Management Team of Terminal shall be immediately activated for response

Sl. No	Hazard	Credible Scenario	Risk Type	Probability	Consequence	Risk Value	Risk Level	Response Operation
		in the release of liquid ammonia into waterway at Haldia terminal -Toxic cloud dispersion						operation with immediate evacuation of the area up to 100 m radius along prevailing wind direction. Depending on the intensity of release, evacuation up to 1 km depending on the weather condition or level 2 operation with support of DDMA would be warranted.
		Contact between vessel carrying petrol with tower lines near Ghazipur bridge resulting in electric arc and fire	Offshore	1	3	3	Medium	Response operation shall be initiated with in house facility of vessel supported by offsite emergency operation by DDMA.
3	Collision	Collission with passenger ferry at Dakshineswar resulting in spillage of fertilizer/urea into water causing impact to the aquatic life- Toxic contamination of watercourse	Offshore	2	2	4	Medium	IWAI and Vessel owners shall work on control of spillage /containment and State Pollution Control Board in coordination with Drinking Supply intake downstream shall confirm the usability of water and should restrict use of water if warranted.
		Collission with passenger ferry at Behrampore resulting in release of liquid ammonia into water- Toxic cloud dispersion	Offshore	1	3	3	Medium	Vessel owners shall work on control of spillage /containment and immediately request for offsite emergency operation through DDMA with emergency evacuation of 100m of aerial distance of project region in the prevailing wind direction. Depending on the intensity of release, evacuation upto 1 km

Sl. No	Hazard	Credible Scenario	Risk Type	Probability	Consequence	Risk Value	Risk Level	Response Operation
								depending on the weather condition would be warranted.
4	Explosion	Contact between vessel carrying CNG on the bridge piers at Mirzapur resulting to explosion with the release of CNG to atmosphere-	Offshore	1	4	4	Medium	DDMA has to take immediate response action with deployment of resource agencies.
5	Fire	Fire on storage location of Petrol/Diesel at Sahibganj terminal resulting in spreading of fire to the neighbourhoods	Onshore	2	4	8	Serious	Incident Management Team of terminal shall be put in to action at the earliest with support of site DDMA if required.
6	Piracy/ Sabotage	River piracy leading to theft of Petrol/HSD at Barh	Offshore	1	2	2	Low	IWAI/DDMA shall act with help of first responders.
7	Spillage	Loss of control of vessel near Katwa at the confluence location of Ajoy river and NW1 leading to spillage of coal into water- Toxic Contamination of water course	Offshore	2	2	4	Medium	IWAI and Vessel owners shall work on control of spillage /containment and State Pollution Control Board in coordination with Drinking Supply intake downstream shall confirm the usability of water and should restrict use of water .

3.6. Risk Abatement Measures

Historical analysis of accidents in IWT shows that the major primary hazards include collision, contact, grounding, ship get stuck and fire, spillage followed by explosion as an extremely negligible case. The probable areas for hazards above are identified under channel related risk and fire and explosion could be resulted as a consequence of primary hazards or due to cargo related or vessel related risk. Specific risk abatement measures has been proposed for handling channel related risk, vessel related risk, cargo related risk and dredging related risk. Considering that, 60% of the IWT related risks are caused by human error, risk abatement measures have been proposed for individual risk and crew. The following section presents the important risk abatement measures first followed by specific measures to handle channel, cargo and vessel related risk including risk abatement measures for avoiding human errors in IWT operations.

- Emergency Numbers to be displayed in vessel and at terminals where rescue facilities are available.
- ‘Do’s and ‘Don’ts details of hazardous cargo handling, transport emergency card, MSDS etc. should be available at vessel or jetty.
- If possible, develop a software and mobile app for hazardous cargo transportation.
- Modern first aid fire fighting facility should be made available in cargo vessels.
- Training on certified first aid, fire fighting, chemical spill handling etc. to be given to crew
- Minimum 4 fire drill shall be done an year for all members (in vessel and jetty)
- Equipments like Automated External Defibrillator (AED), first aid kit, Self - Contained Breathing Equipment (SCBA) etc. should be available in vessels.
- Hotline facility shall be developed for getting expert advice in case of emergency.
- Emergency Recovery Van (ERV) facility should be made available at major terminals handling hazardous cargos.

3.6.1. Channel Related Risk

- Channel shall be marked with navigational aids all along the way, which will be operational meeting the requirement of 24-hour navigation.
- Strictly monitor for the compliance of minimum LAD assured under JMVP to ensure smooth flow of traffic to avoid the grounding and related risks in areas identified as **Annexure IV** High siltation areas. The areas shall be marked with appropriate warning

signage and the routine Thalweg survey and dredging aspects to be kept on close monitoring while IWT traffic is allowed.

- Where the critical radius is <200 m as presented in Table 3.3 navigation shall be with extreme caution with regulated speed, prohibiting parallel navigation during the initial period with a long term plan to realign the curve as per the design standard. Vessel movement through this areas shall be closely tracked in VTMS and shall be provided with appropriate warning from the nearest terminal/RO. For areas where the curving radius between 200-400 m, navigation shall be with extreme caution prohibiting parallel navigation of large sized vessels. For areas where the curving radius >400 m, proper cautionary approach shall be followed.
- There are many channel diversion areas in NW 1 and Electronic Navigation Chart (ENC) shall have essential provision to guide the channel to be followed during the various seasons. Even during flood, since water level fluctuations of 8-10 m is experienced, rerouting the vessels in bridge locations would be warranted. Under JMVP, it shall be mandated to have seasonal navigation chart in place prior to accelerating IWT operation in NW 1.
- There are 44 bridges crossing the fairway including multiple bridges up to 3 no in single locations near Farakka, at Chauki (Ch. 496 to 498 km). All bridges shall be installed with fenders to avoid any collision impacts. As per RNA, 1 bridge location, at Bally, with a vertical clearance 8.8 m only (Ch. 112 to 114 km) is a limiting bridge. Also, Howrah bridge at Ch.104 to 106 is having a vertical clearance 9 m just meeting the requisite air draft for the design vessel. Specific cautionary approach has to be installed especially on these crossings while operating in monsoon seasons.
- Along all bridge locations, conscious approach shall be made to avoid contact. Along critical bridges (i.e., having limitation on horizontal and vertical clearances) speed regulation shall be followed with confirmation on vertical clearance according to the tidal/seasonal fluctuation in water level. Extreme caution shall be applied in case of multiple bridge crossings.
- Navigation of cargo vessel should be with caution along lock gate, tower line crossings, aqueduct crossing, narrow channels, water body with fairway alignment close to bank especially thickly populated banks.
- Sharp depth transition is observed in Kahalgaon area. The ENC shall include the location for precautionary approach for loaded vessels.

- Mass gathering occurs at Prayagraj (Allahabad) during Kumbh mela (February to May once in 9 years), at Ghats in Varanasi during Ganga Arati, Ganga Puja during the month of Shrawan (July- August), Ghats of Bihar during Chat Puja and Ghats of West Bengal during Durga Puja. Ajgaivinath Dham in Sultangaj and Batheshwer Dham in Kahalgaon area are important mass gathering location during the pilgrim season and is also characterised by large number of ferry crossings in this regard. This areas shall have specific traffic management with pass by permissions for IWT traffic avoid hitting the ferry crossings. Along the mass gathering areas, IWAI shall intimate the local self-governments on the NW1 about the Cargo movement, timings etc. to derive adequate traffic management mechanisms during the festive season.
- Dense settlements along the waterway have multiple ferry crossings as listed in **Annexure V**. Standard vessel operation guidelines for inland water transport shall be strictly mandated in those areas to avoid any mishap.
- Electric tower lines are crossing the fairway at 51 locations. The reported incidents where tower line has fallen to water body are at Srikrishnapur (Ch. 168 to 170 km), Bakiya Bishanpur (Ch. 610 to 612 km), Himatpur Diara (Ch. 914 to 916 km) and Kandala Mavaia (Ch.1404 to 1406 km). Sagging tower lines were observed at Ghazipur (Ch. 1126 to 1128 km). As per the mandate, the respective electricity boards are in charge of the safety of the tower lines. While all the tower lines crossing the waterway has been observed to have sufficient clearances w. r. to the vessels. As a precautionary approach, the routine fortnight Thalweg survey shall be mandated with a close observation of tower lines, especially following the floods and reporting the sagging if any and also IWAI shall have a formal arrangement with respective electricity board for confirmation based on the residual life studies executed by them.
- Speed regulation shall be mandated along the Farakka feeder canal stretch due to limited waterway width as well as concentration of human activities especially fishing using country boats at regular and multiple ferry crossing locations.
- Entry location of environmental sensitive areas such as Vikramshila Gangetic Dolphin Sanctuary and Kashi Turtle Sanctuary shall be provided with appropriate caution boards to enhance the consciousness of the vessel operator to avoid any mishap which will lead to huge ecological damages. Cautionary boards shall be installed stating important regulatory frameworks mandated for such areas including implications of violations if any.

- As per the various accident statistics, 60 % of the IWT related disasters have been happened due to human errors. IWAI as a proactive measure may foster the safety culture to the crew operating in NW 1 utilising the facilities at National Inland Navigation Institute (NINI), Patna and further scaling up the skill enhancement programme as per the requirements.
- IWAI shall implement the disaster management plan proposed for the terminal and at IWAI RO and HQ and ensure regular mock drills and updation of plan as per the operation pattern. This will include Incident management team, trained response personals and all facilities in an Emergency Control Room for responding in case of emergency with provision for escalating to the essential disaster management facilities of the respective districts.
- For the enhanced IWT operations, the vessel berthing points shall be allocated in designated areas along the waterway.
- Along aqueduct area at Ch.484-486 km, cautionary signs shall be installed to guide the Master of the vessel.
- IWAI need to have close coordination with Kolkata Port Trust and major industrial establishments to have direct support on Disaster Management. Major include NTPC Farakka, various other Thermal Power plants, Industrial Units of Haldia and Kolkata including BPCL, Hindustan Unilever, Indian Oil Corporation etc. A mutual aid association shall be in place towards emergency preparedness and response.
- Risk Assessment study for IWT sector whole over the world faces challenges due to reliable records on incidents w r to incident type, frequency of occurrence etc. Under JMVP, IWAI shall mandate to have a systematic accident record with investigation details compiled for futuristic planning.
- IWT related disasters shall be included in the respective DDMPs and regular mock drills shall be conducted in coordination with the DDMA. The frequency of the mock drill shall be 2 nos. per year. The same shall be schedule in during day and the other during night.
- Being a continuous medium, horizontal integration of DDMPs would be critical towards better response.

3.6.2. Cargo Related Risk

- It is to be noted that classified cargoes under IMDG or IMSBC Group A/B has inherent hazards associated with it while carrying which are analyzed in detailed in the detailed

risk assessment. The above goods shall be transported as per the IMDG or IMSBC and shall bear the tag and MSDS shall be made available on board.

- For cargoes listed in Group C of IMSBC, the transport and storage guidelines of the code shall be followed for avoiding risk and whereas for non-listed cargoes, the best industrial practice shall be followed for safe handling of cargo.
- All transfer or storage facilities of hazardous cargo shall have essential prior approval or permissions under the Manufacture, Storage and Import of Hazardous Chemical (MSIHC) (Amendment) Rules, 2016.
- The inter compatibility of cargoes (Table 3.6) shall be taken with due care while general cargo transport planning and also while assigning storage locations at terminals.
- Crew as well as the workers shall be trained with specific training requirements as per the cargo type handled.
- No source of ignition should be allowed into or near to a place where dangerous goods containers are stowed. Flame proof equipment shall be installed at all requisite locations.
- The deck and even the cargo holds should be free of oil or greasy material. If the deck is found in such a condition, it must be cleaned up immediately.
- Safety of the cargo involves the correct lashings & securing of the cargo.
- While handling the ongoing cargo operation, be careful not to come in the way or stand under any heavy load.
- On-board refrigerated cargo such as Liquefied Natural Gas (LNG) to be monitored and should be maintained at their required temperatures. Cargo holds containing dangerous cargo or fumigated containers should be well ventilated. Entry into such a hold with inadequate ventilation must not be allowed. Any kind of oil spill or leak must be prevented so as to avoid pollution of the water.
- Emergency response operations shall be done specific to the cargo and depending upon their inter compatibility.
- Emergency response measures related to individual cargo has been detailed in the section on DMP and the same has to be maintained at each terminal and the training shall be conducted as per the proposal.

3.6.3. Terminals & Jetties Related Risk

- Introduce specific infrastructure facilities for loading /unloading, shifting/storing of cargo at terminals as the situation demands.
- Regular maintenance of terminals and associated facilities.
- Appropriate safety measures to be installed at terminals and jetties.
- Implement the disaster management plan for Terminals and conduct regular mock drills once in 3 months.

3.6.4. Vessel Related Risk

- Vessels are to be constructed as per the design approved for IWAI complying with IRS Classification for inland vessels.
- Push Barges, which requires low draft can be adopted for certain areas. This will increase the cargo carrying capacity and at the same time reduce the risk of inland operations through narrow channel section to a great extent.
- In the case of vessels with external mounting for cargo special provisions for proper securement shall be provided.
- Safe manoeuvring for the vessels shall be ensured throughout the waterway.
- Fenders are to be provided to the vessels to ensure sufficient protection due to damages from hitting.
- Qualification of crew members and timely training are to be assured.
- All crew should be aware of the vessel contingency plan, which is kept in the deck office.
- First aid kit must always be present in the deck office.
- Unification and modernisation of Vessels Act and ensuring best practices.

3.6.5. Crew Related Risk

- Personal protective equipment must be worn during cargo operation, which includes the safety shoes, safety helmet, overall, gloves, etc.
- Correct lashing procedure have to be followed to avoid back injuries and sprains. One must never stand or walk under a working spreader.
- Safety signs should be posted at appropriate places e.g. 'No Smoking' signs.

With the implementation of various recommendation as above, risk for transportation of goods through NW 1 shall be greatly allineated.



DISASTER MANAGEMENT PLAN FOR NW 1

In the Indian context, National Disaster Management Act, 2005 (DM Act, 2005) is the basic legislation in the purview of Disaster Management (DM). DM Act defines disaster as “a catastrophe, mishap, calamity or grave occurrence in an area, arising from natural or manmade causes, by incidence or negligence which results in substantial loss of life or human suffering or damage to and destruction of property or damage to, or degradation of environment of such a nature or magnitude as to be beyond the coping capacity of the affected area”. They can be natural, manmade or hybrid based on the cause of their occurrence.

Disasters are result of a hazard’s impact on society. Disasters result in loss of life, livelihoods, infrastructure and property, thus pose serious disruptions to the normal functioning of the community resulting in widespread loss, pose immense hardships to them and results in the disruption of economic activity. Detailed risk assessment studies have showed the disaster vulnerability of the project region and the risk elements associated with the cargo transport through NW 1.

Towards developing a low risk cum risk resilient system for its developmental in NW 1, it was decided to take proactive measure under JMVP with deriving a detailed proposal for integration of IWT related disasters in to the District Disaster Management Plans (DDMPs). The present section details out the review of the existing disaster management system of the Country as per DM Act, 2005 and further leading to the development of proposal for integration of IWT related disasters in to existing DDMPs.

4.1. Approach towards Preparation of DMP for NW 1

The detailed risk assessment study w.r.to the IWT operations has revealed the critical hazards associated with the IWT operation include grounding, collision, contact, fire, explosion and spillage (flammable liquid, solid, chemicals leading to toxic contamination and or toxic cloud). The causes and contributing/aggravating factors include natural hazards, human error (while maneuvering, cargo handling – loading, unloading, storage) and technical issues associated with the vessels and intrinsic and inter compatibility issues of cargoes.

DM Act defines disaster management as a “continuous and integrated process of planning, organizing, coordinating and implementing measure which are necessary or expedient”. It can be divided into the following steps:

- **Prevention:** Preventing threat of any disaster which is possible to a great extent in the case of a manmade disaster.
- **Preparedness:** Contingency planning, stockpiling of equipments and supplies, arrangements for inter-agency coordination, preparation of evacuation plans and public awareness, capacity building and associated training and mock drills.
- **Response:** Prompt response to any threatening disaster situation or disaster including evacuation, rescue and immediate relief.
- **Recovery & Mitigation:** Assessing the severity or magnitude of effects of any disaster. Rehabilitation and Reconstruction and implementing measures for reduction of severity or consequences of a disaster

So, in case of disaster management, the phase wise activities required could be summarized as in **Figure 4.1** below.

Pre-Disaster	Disater	Post-Disaster
<ul style="list-style-type: none"> • Contingency Planning considering emergency scenario/classification/r esources/incident command structure/management plan • Early Warning of Emergency Conditions • Capacity building and Traning Strategy • Community Awareness • Mock drills 	<ul style="list-style-type: none"> • Effective Coordination of Response Activities - Evacuation, rescue and relief • Documentation 	<ul style="list-style-type: none"> • Robust recovery, rehabilitation and reconstruction

Figure 4.1. Various Phase of Disasters and Activities Involved – On a Broader Profile

The DM mechanism functional at national level and the 4 States – UP, Bihar, Jharkhand and West Bengal through which NW 1 is passing through was anlasyed in detail to understand the hazards identified in the project region and the legal, institutional and resource facilities

established for handling such emergency. Simultaneously, the vulnerability of project region w.r.to IWT related disasters, stakeholder involvement and resource requirement for handling the IWT related disaster in NW 1 was delineated and compared with the existing DM mechanism. A proposal on integration of IWT related disasters in to existing DDMPs was formulated with inclusion of additional stakeholders to handle the emergency with a route map for training and capacity building for handling such emergencies.

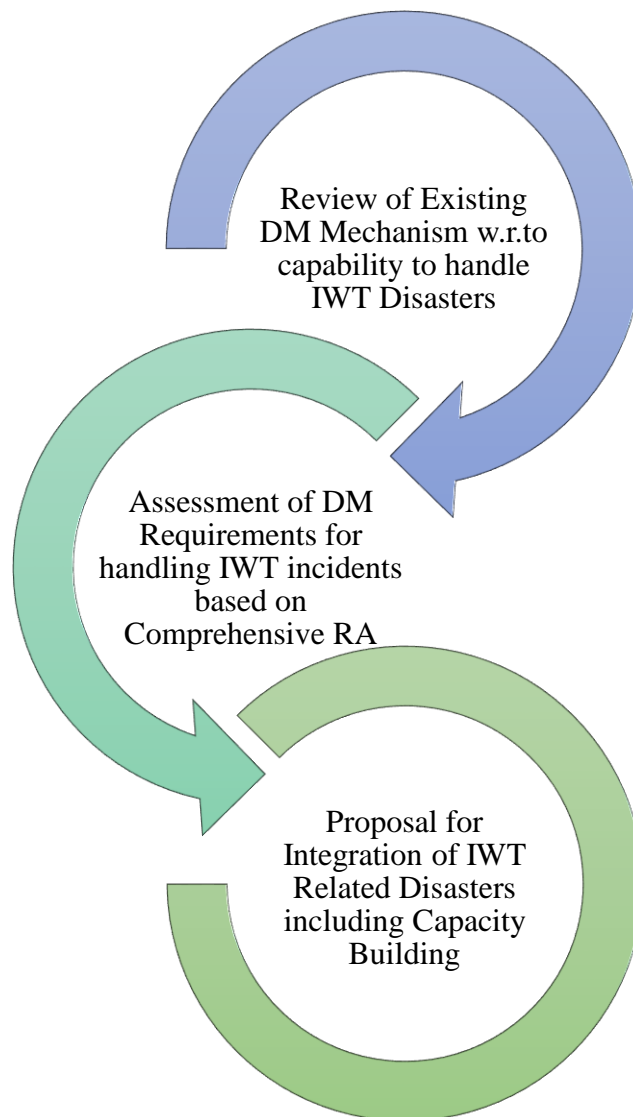


Figure 4.2. Steps Involved in Formulation of Proposal for Handling IWT Related Disasters in NW 1

4.2. Review of Institutional Mechanism for Disaster Management

DM Act, 2005 provides the legal and institutional framework for disaster management in India at the national, state and district and local levels. Before the enactment of DM Act, 2005, National level Cabinet Committee on Security (CCS) was dealing with the matters relating to nuclear, biological and chemical emergencies and National Crisis Management Committee (NCMC) under the Cabinet Secretary oversee the command, control and coordination of the disaster response. The DM Act promulgate establishment of National Disaster Management Authority (NDMA), State Disaster Management Authority (SDMA) and District Disaster Management Authority (DDMA) to combat with any disaster within the country.

DM Act mandates developing disaster management policies at the Central and State level along with preparation of Disaster Management Plan (DMP) delegating various nodal ministries/departments to effectively combat any disaster towards integrating the various manpower and infrastructure provisions available within the Country to combat with any disaster. The Central Government lays down policies and guidelines at the apex level and provides technical, financial and logistic support while the State and district administration through developing disaster management policies and plans make institutional and capacity building as per the vulnerability of the area to various disasters. Disaster management plans are integrated with various stakeholders specifying nodal agencies for early warning, coordination and mitigation or response of any operation. As an integrated approach the disaster response system of country will integrate involvement of various stakeholders i.e., academic institutions, scientific organizations, professional bodies, corporate sectors, Non-Government Organization (NGOs). National Institute of Disaster Management (NIDM) is involved in research and advisory support for the authorities in relevant policy interventions and for effective response operations and dedicated response forces have been established at Central and State levels including National Disaster Response Force (NDRF), Armed Forces and Central Armed Police Forces (CAPF). DM Act also mandates that the disaster management plans prepared at various levels shall be approved by the respective central and state authorities so as to ensure that the mechanism would function seamlessly in case of an event and also mandates for updation and revisions as per the schedules proposed.

National Disaster Management Plan (NDMP), 2016 classifies the disasters primarily as Natural Hazards or human induced hazard or result from a combination of both. Natural hazards are categorized as below.

- Geophysical – Earthquake, mass movement of earth material, volcano, Tsunami
- Hydrological – Flood, landslide, Wave action
- Meteorological – Cyclone, storm sure, Tornado, Convective storm, extra tropical storm, wind, cold wave, derecho², extreme temperature , fog, frost , freeze, hail, heat wave, lightning, heavy rain, sand storm, dust storm, snow , ice, winter storm, blizzard
- Climatological – drought, extreme hot/cold conditions, forest/wildlife fires, glacial lake outburst, subsidence
- Biological – epidemic: viral, bacterial, parasitic, fungal, or prion infections, insect infections, animal stampedes

Human induced hazards include accidents (industrial, road air, rail on river or sea, building collapse, fires mine flooding, oil spills), Chemical Biological radiological and Nuclear (CBRN) terrorists activities etc.

NDMP has identified the area of NW 1 under the section, ‘the Riverine Areas’ that spread over one or more states and also are the part of regions or areas involving multiple states requiring special attention i.e., ‘Ganga region’ drained by River Ganga of “Rivers of the Himalayan Region” (National Disaster Management Policy, 2016).

It is to be noted that RA study has identified that the causes and contributing factors of IWT related disasters, which include a few of the natural and human induced hazards listed above.

The basic institutional framework at national level to deal with the disaster is presented in.

Figure 4.3

² A derecho is a widespread, long-lived, straight-line wind storm that is associated with a fast-moving group of severe thunderstorms known as a mesoscale convective system, which can cause hurricane-force winds, tornadoes, heavy rains, and flash floods.

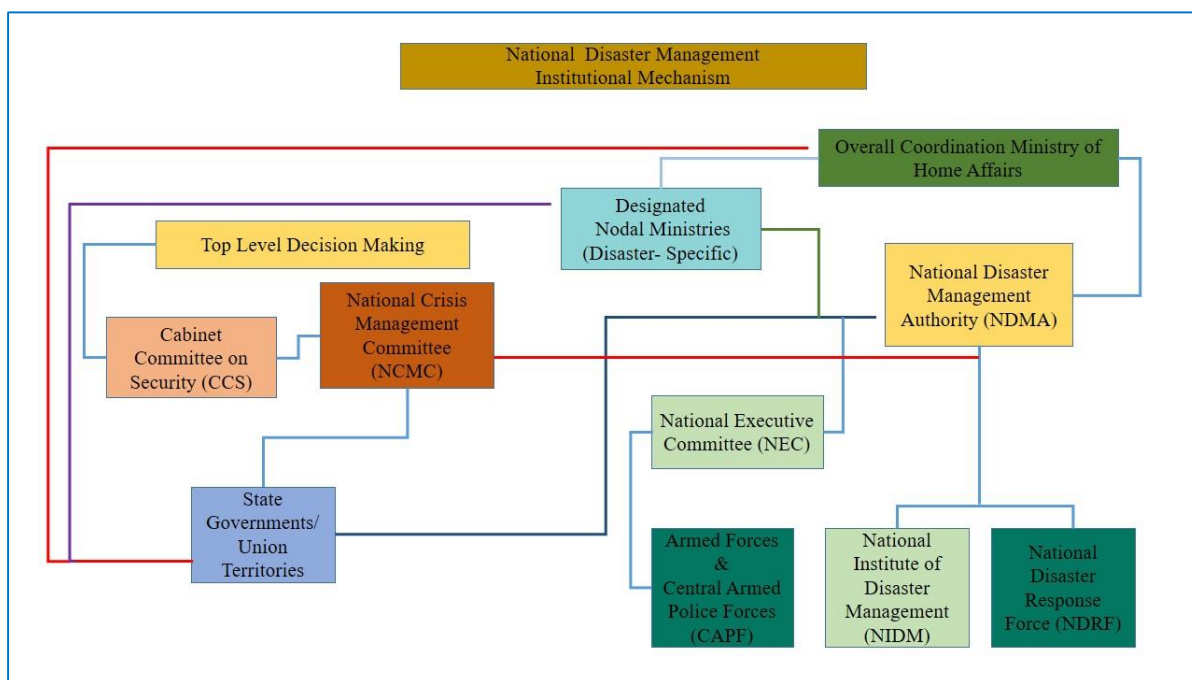


Figure 4.3. Basic Institutional Framework for Disaster Management in India

Note: This represents merely the institutional pathways for coordination, decision making and communication for disaster management and does not imply any chain of command.

Cabinet Committee on Security (CCS) and National Crisis Management Committee (NCMC) are the top level decision making authorities in the disaster management framework of the country. NDMA has the mandate to deal with all types of disasters – natural or human-induced. However, other emergencies such as terrorism (counter –insurgency), law and order situations hijacking, air accidents, CBRN weapon systems, which require the close involvement of the security forces and or intelligence agencies and other incidents such as mine disasters, ports and harbor emergencies, forest fires, oil field fires and oil spills will be handled by NCMC.

At times, the impact of disasters occurring in one State may spread over to the areas of other States. Similarly, preventive measures in respect of certain disasters, such as floods, etc. may be required to be taken in one State, as the impact of their occurrence may affect another. The administrative hierarchy of the Country is organized in to National, State and District level Administrations. This presents challenges in respect of disasters impacting more than one State. Management of such situations calls for a coordinated approach, which can respond to a range

of issues quite different from those that normally present themselves – before, during and after the event. The NCMC will play a major role in handling such multi-state disasters.

The disaster related with NW 1 extending through 4 major states of the country may require coordinated effort from two or more States where the present proposal need to have provision for involvement of NCMC to handle such disasters.

National Disaster Management Authority (NDMA) was established through the Disaster Management Act enacted by the Government of India in 30th May 2005. The agency is responsible for framing policies, laying down guidelines and best-practices and coordinating with the State Disaster Management Authorities (SDMAs) to ensure a holistic and distributed approach to disaster management.

NDMA has Prime Minister as Chairman with 3 members nominated by the Chairperson with Secretary, joint secretary (admin) and Additional secretary and Project Director (NCRMP) with operationally organized into 4 divisions - Policy & Plan, Mitigation, Operations & Communications and Finance headed by the Advisors of respective field. NDMA has the power to approve the National Plans and the Plans of the respective Ministries and Departments of Government of India. Ministry of Home Affairs (MHA) in the Central Government has the overall responsibility for disaster management in the country. NDMA is supported with National Executive Committee (NEC) consisting of the secretaries of nodal ministries or departments having responsibilities under DM Act, 2005. NEC is mandated to assist the NDMA in the discharge of its functions and further ensure compliance of the directions issued by the Central Government. NEC is responsible to prepare the National Plan and coordinate and monitor the implementation of the National Policy and the guidelines issued by NDMA. Responsibility allocation for the nodal ministries and departments are presented in **Table 4.1**.

Table 4.1. Institutional Arrangement for Management/Mitigation and Coordination of Disaster at National Level

Sl. No	Disaster	Nodal Ministry/Department/Agency for Operation at National Level	
		Management / Mitigation of Different Disasters	Coordination of Response
1	Biological Disasters	Min. of Health and Family Welfare (MoHFW)	
2	Chemical Disasters and Industrial Accidents	Min. of Environment, Forest sand Climate Change (MoEF&CC)	

Sl. No	Disaster	Nodal Ministry/Department/Agency for Operation at National Level	
		Management / Mitigation of Different Disasters	Coordination of Response
9	Forest Fire	Min. of Environment, Forests, and Climate Change (MoEF&CC)	
4	Cyclone, Tornado & Tsunami	Min. of Earth Sciences (MoES)	Min. of Home Affairs (MHA)
7	Earthquake		
8	Flood	Min. of Water Resources (MoWR)	Min. of Home Affairs (MHA)
3	Civil Aviation Accidents	Min. of Civil Aviation (MoCA)	
5	Disasters in Mines	Not listed	Min. of Coal; Min. of Mines
6	Drought, Hailstorm, Cold Wave & Frost, Pest Attack	Min. of Agriculture and Farmers Welfare (MoAFW)	
10	Landslides	Min. of Mines (MoM)	Min. of Home Affairs (MHA)
11	Avalanche	Min. of Defense (MoD)	Min. of Home Affairs (MHA)
12	Nuclear and Radiological Emergencies	Dept. of Atomic Energy (DAE)	Dept. of Atomic Energy, Min. of Home Affairs (DAE,MHA)
13	Oil Spills	Not listed	Min. of Defence/Indian Coast Guard
14	Rail Accidents	Min. of Railways (MoR)	Min. of Railways (MoR)
15	Road Accidents	Min. of Road Transport and Highways (MoRTH)	
16	Urban Floods	Min. of Urban Development (MoUD)	

Source: NDMP, 2016.

It is to be concluded that by the nature of risk associated with cargo operation in NW 1, support from the highlighted nodal ministries would be required depending on the response requirements.

NDMP has identified nodal agencies for early warning system for better preparedness in case of a disaster and the same is presented in **Table 4.2**.

Table 4.2. Central Agencies Designated for Natural Hazard-Specific Early Warnings

Sl.No	Hazard	Agencies
1	Avalanches	Snow and Avalanche Study Establishment (SASE)
2	Cyclone	India Meteorological Department (IMD)
3	Drought	Ministry of Agriculture and Farmers Welfare (MoAFW)
4	Earthquake	India Meteorological Department (IMD)
5	Epidemics	Ministry of Health and Family Welfare (MoHFW)
6	Floods	Central Water Commission (CWC)
7	Landslides	Geological Survey of India (GSI)
8	Tsunami	India National Centre for Oceanic Information Services (INCOIS)

National Disaster Response Force (NDRF) and National Institute for Disaster Management (NIDM) exclusively support and implements NDMA directions. NDRF headquartered at New Delhi has 3 units stationed close to the waterway, one at Kolkata (West Bengal), another at Patna (Bihar) and the third one at Varanasi (UP). Centre will be also, supporting the state by deploying Armed Forces (Army, Navy, Air Force and Coast Guard) and Central Armed Police Forces (CAPF).

NDMP identifies disaster management and its planning at various tiers must take into account the vulnerability of the disaster affected areas and the capacity of the authorities to deal with the situation as presented in **Table 4.3**.

Table 4.3. Disaster Planning at Various Levels and Responsibilities

Sl.No.	Level of Emergency	Definitions
1	Level 0	Normal working condition. Will be covered by operation and maintenance.
2	Level 1	The level of disaster that can be managed within the capabilities and resources at the District level. However, the state authorities will remain in readiness to provide assistance if needed.
3	Level 2	This signifies the disaster situations that require assistance and active mobilization of resources at the state level and deployment of state level agencies for disaster management. The central agencies must remain vigilant for immediate deployment if required by the state.
4	Level 3	This corresponds to a nearly catastrophic situation or a very large-scale disaster that overwhelms the State and District authorities.

For the project region falling along NW 1, State Disaster Management Authority (SDMA) of Uttar Pradesh, Bihar, Jharkhand and West Bengal shall be the state nodal agencies for coordinating any disaster in the region. Under SDMA, the DDMA's of the bordering districts shall be the first responders in case of a disaster, while IWAI being the owner of NW 1 shall take a key role in preparedness for avoiding any disaster and also to take up responsibility of coordination with NCMC, NEC, SDMA's, DDMA's and all stakeholders in case of a disaster.

The national and state level integrated institutional profile of Disaster Management applicable for NW 1 is presented in **Figure 4.4**. The state level mechanism operational in UP, Bihar, Jharkhand and West Bengal is described in detail in subsequent sections.

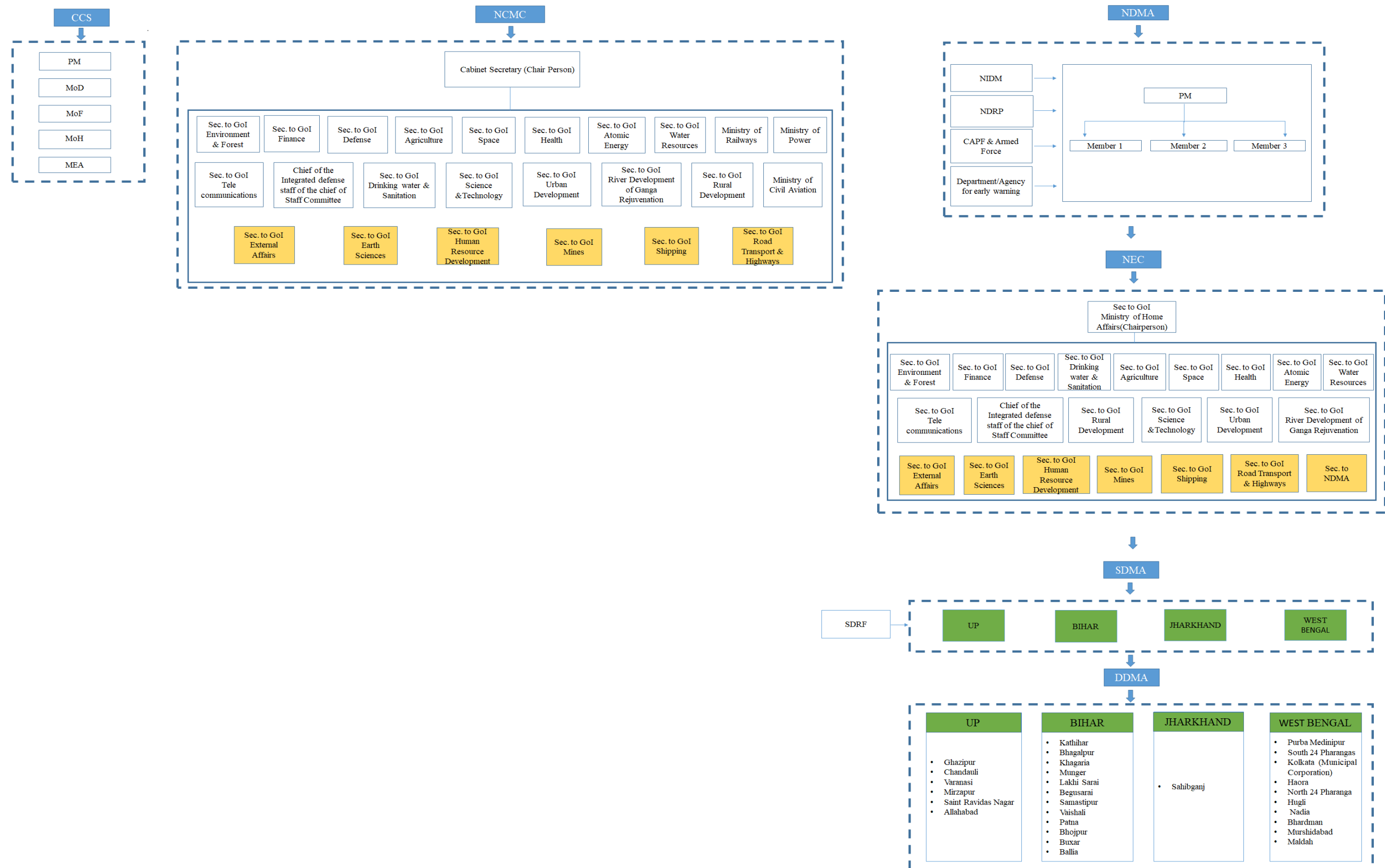


Figure 4.4. DM Institutional Framework in NW 1 Project Region

From the review of existing DM profile, it is to be concluded that

- IWT related disaster w.r.to the cargo movement has not been listed as a major hazard under NDMP. However, the port and harbor related disasters has been listed having responsibility for NCMC. With accelerated IWT related developments, the same need to be added in the NDMP.
- Secretary to Ministry of Shipping (MoS) is a special invitee to the NEC and also member of NCMC and shall be the nodal contact point with NCMC/NDMA in case of IWT related disasters.
- Disaster management Plan for NW 1 shall be prepared in line with DM Act, 2005 integrating to existing DDMPs of respective districts, while key coordination activities shall be handled by the owner – IWAI. Capacity building requirements for existing DDMAAs and IWAI shall be delineated.
- The DM proposal has to have the provision to handle Level 1 emergency with a provision for escalation to Level 2 and Level 3. In case of Level 2 incidents, DDMAAs would play a key role on response and for Level 3 incidents, the various national plan stakeholders such as resources from other states, national level shall be mobilized.
- It is required that the DMP proposal will involve essential provision to avail early warning from IMD (Cyclone and Earthquake), INCOISE (Tsunami) and CWC (Flood) for avoiding disasters which may be causative or contributive by nature in IWT.
- Since NW 1 is extending through 4 major states of India where the off shore hazard has high probability for getting transported to the neighboring state, the incident reporting requirements will be of two types considering the administrative system of the Country.
- DDMAAs of the State shall take lead on response operation with support from the respective SDMA for inter district operations if hazard is not transferable to neighboring districts.
- In case the hazards are transferable to the districts outside the State Limit, it is required that the matter need to be taken up at a higher level under NCMC to take a key role in coordination.

Incident reporting requirement for IWT related disasters in NW 1 is presented in **Figure 4.5**.

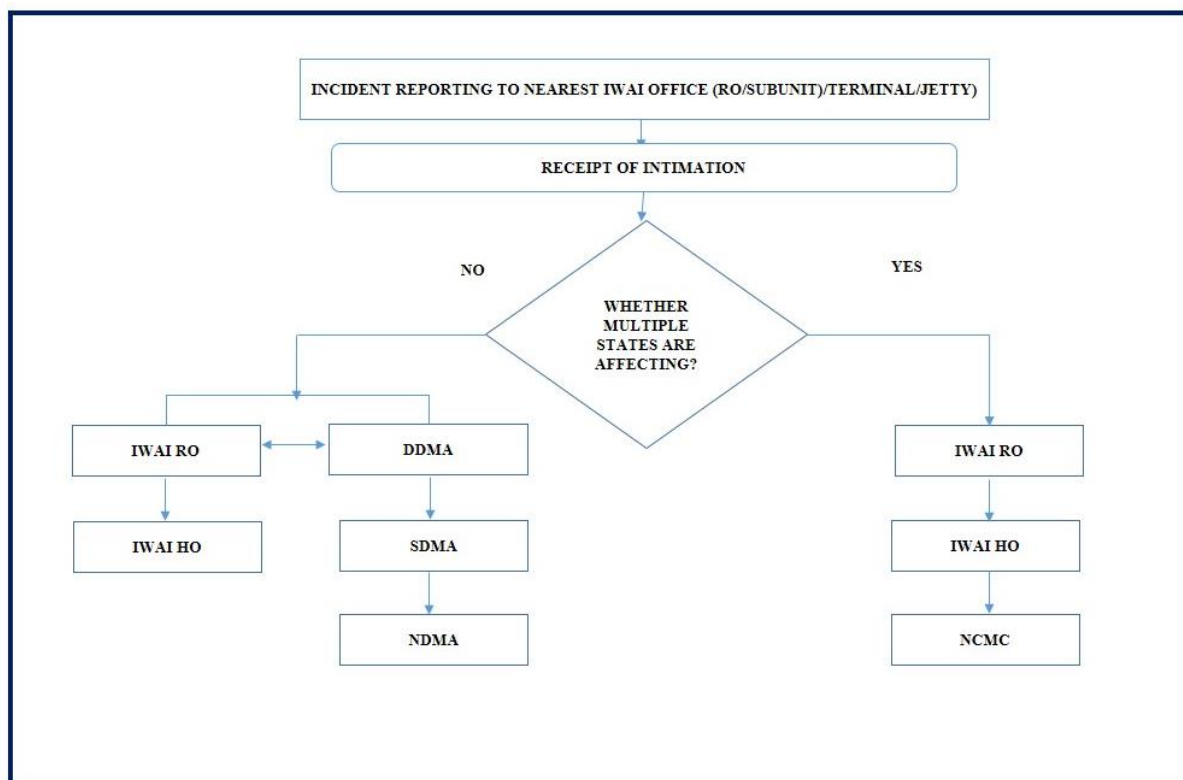


Figure 4.5. Incident Reporting for IWT Disasters in NW 1

Note: RO- Regional Office, HO – Head Office

4.3. Emergency Management Planning for NW 1

Comprehensive risk assessment study has revealed that an IWT related disaster could be resulted at off shore and onshore as presented in **Table 4.4**.

Table 4.4. Offshore and Onshore Activities and Related Hazards

Risk Location	Activities related with IWT leading to risk.	Emergency Operation Required
On shore - Along waterway , Lock gate	Cargo transport //Capital /maintenance dredging	Grounding / Collision/Contact/ Fire/Explosion/Spillage
Offshore - Terminals/Jetties	Approaching of Vessel/Loading/Unloading /Storage	Fire/Explosion/Spillage

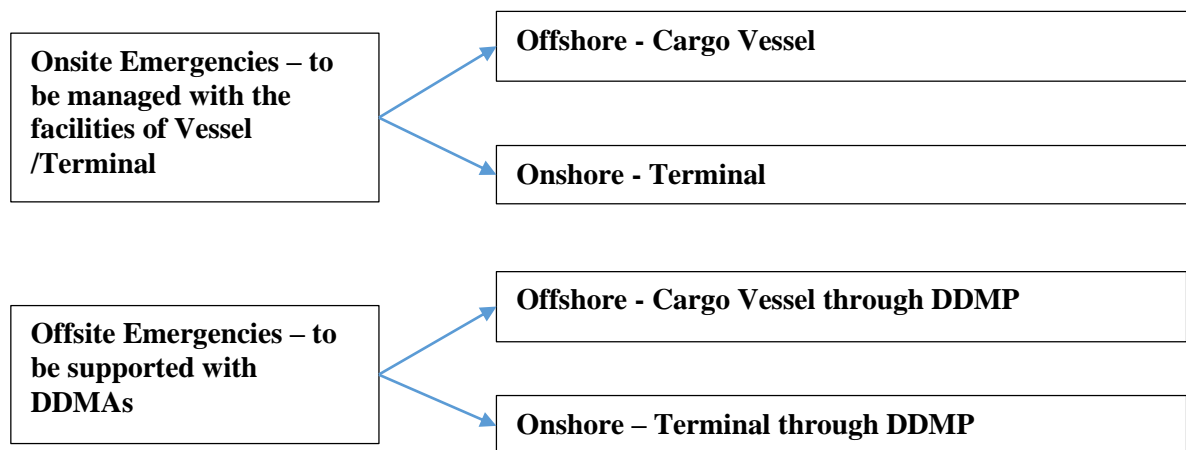
An emergency may be onsite or offsite which requires contingency planning at facility level as well as administrative level which are defined as follows.

- “Onsite emergency” means an emergency that takes place in an installation and the effects are confined to the Installation premise’s involving only the people working inside the plants and to deal with such eventualities is the responsibility of the occupier

and is mandatory. It may also require help of outside resources. Thus “onsite emergency plan” means a response plan to contain and minimize the effects due to emergencies within the installations which have a potential to cause damage to people and facilities within the installation premises;

- offsite emergency” means an emergency that takes place in an installation and the effects of emergency extends beyond the premises or the emergency created due to an incident , catastrophic incidents, natural calamities, etc. It no longer remains the concern of the installation management alone but also becomes a concern for the general public living outside and to deal with such eventualities shall be the responsibilities of district administration;

Thus offsite and onsite emergencies with respect to cargo operation in NW 1 is as follows.



Operating cargo vessels will be having the integrated plan for handling onsite emergencies whereas each IWAI Terminal shall have an onsite emergency plan with an Incident Management Team (IMT) to handle the emergencies within its capability. For both onshore and offshore operations, offsite emergency plan shall be prepared with provision for involvement of DDMPs for combat operations in case of any disaster.

4.4. Onsite Emergency Management Plan for IWAI Terminals

IWAI Terminals and Jetties (only where cargo is handled) would need to be equipped for handling the hazards related with spillage of cargo/fire/explosion within its premises with trained manpower and dedicated resources. An Incident Management Team (IMT) shall be formulated for each terminal with a Chief Incident Controller (CIC) and Site Incident Controller (SIC) with supporting staff as deemed necessary.

Considering that, IWAI terminals would be operational on Operation, Maintenance and Development (OMD) basis. The incident reporting shall be integrated with the IWAI operation hierarchy for higher level administrative involvement if deemed necessary.

During the onsite emergency requirements, the IMT of the terminal under the operator shall be put for combat operations. Head of Terminal shall be the Chief Incident Controller (CIC) supported by the Site Incident Controller (In Charge – Safety) and the supporting team for combat operations. The resident officer of IWAI at terminal shall be available for overall guidance and support for the terminal operator.

In case the situation warrants an operation of the offsite emergency plan supported by the District administration, the resident officer of the IWAI shall seek support from the Head (RO-IWAI) who shall be taking over the responsibility of CIC and coordinate with the DDMA of SDMA of the respective state for immediate response operation. Head (RO) shall be supported with the incident management team of RO for executing the responsibilities of coordination with various nodal departments of the respective state under direction of DDMA/SDMA as deemed necessary.

Emergency operation in a terminal would require a coordinated effort of various operational teams working in field supported by management, communication, logistic, technical and administrative support. In order to plan the Incident Management Team for each IWAI terminal, the emergency operational sequence was analysed in detail for delineating the requirement at each step in terms of the people, equipment and command and control mechanism to be in place to make the operation successful.

This detailed analysis has been followed with delineation of Emergency Control Centre (ECC) requirements delineating infrastructure facilities, manpower, resources and infrastructure facility requirement leading to the proposal on Incident Management Team (IMT) for IWAI Terminals specifying the roles and responsibilities of the IMT team members and command and control to be in place. The above analysis has been sequentially presented below.

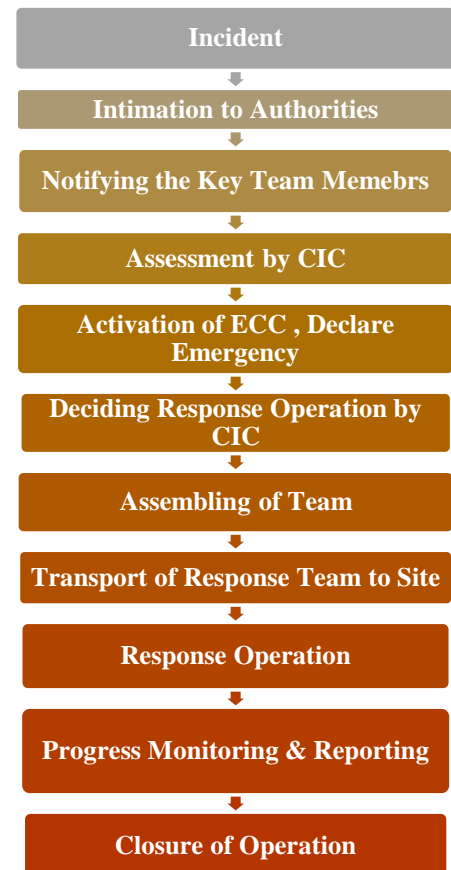
4.4.1. Emergency Control Centre/ Incident Control Room and Facilities

In case of an emergency operation requirement, the planning and response operation need to be coordinated from a single point called Incident Control Room (ICR) alternatively called as Emergency Control Centre (ECC) whereas response action may require to be directly overseen at a site close to the incident known as Field Command Post (FCP); response operation would require to be initiated simultaneously in Jetty and associated water course as well as the shoreline areas under risk. For each IWAI Terminal, ECC shall be established at Terminal Administrative Building. ECC shall be operated on 24*7 basis and would be activated on incident reporting.

ICR shall mandatorily have the various equipments for coordination with the activities of various operational units of Port as well as field operational team at the same remaining connected with the RO, HO, District Disaster Management Authority (DDMA) and stakeholders associated with terminal operation or stakeholders at risk, due to operational activities close to Terminal. ECC should mandatorily have the copy of the approved contingency plan, maps, charts, data formats to be used for operation. The facilities planned at ECC are followed.

4.4.2. Equipment

ECC shall be equipped with all equipments, communication and coordination facilities to act on emergency.



- Maps and display charts and diagrams showing buildings, roads, underground fire mains, important hazardous material and process lines, drainage trenches, and utilities such as steam, water, natural gas and electricity.
- A copy of the relevant disaster management plan.
- Situation boards (continuously updated to present a summary of the current situation and response actions being taken).
- Aerial photographs, if possible, and maps showing the site, adjacent industries, the surrounding community, highways, etc., to help determine how the disaster may affect the community so that the proper people can be notified, adequate roadblocks established, and the civil authorities advised.
- Sufficient telephone lines to enable full liaison with outside bodies.
- Names, addresses, and telephone numbers of employees, off-site groups and organizations that might have to be contacted; all telephone lists being reviewed for accuracy on a scheduled basis and updated, as necessary.
- Dedicated and reliable communication equipment; enough telephones and at least one fax line to serve the organization for calls both on and off-the-site.
- Fixed and portable two-way radio equipment to keep in contact with activities on-scene and to maintain continuity of communications when other means fail.
- Plan board, logbook, voice recorder, television, DVD and Video facilities for playing back records from aircraft and helicopters, as well as monitoring media coverage of the incident with a person assigned to record pertinent information and to assist in investigating cases, evaluating performance, and preparing reports.
- Emergency lights so that operations can continue in the event of power failure.
- Photocopy, fax and e-mail facilities.
- Dedicated computers with LAN/ internet facility to access the installation data and the latest and updated soft copies of all standard operating procedure (SOP) etc.
- Wireless Internet Facility.
- Video Conferencing Facility to have face to face communication/meetings between the stake holders.

4.4.3. Documents, Contact Details, Lists / Maps

ECC has to maintain documents on Terminal Level Disaster Management Plan, emergency contact details, maps, charts incident logs etc. The following details shall be available at ECC.

Contact Details

- ECC Key Personals, Trained Response Personals
- Emergency Contacts – Hospitals, Ambulance, Fire, Police, DDMA, Indian Coast Guard
- Stakeholders in and around terminal
- Contact List of Resource Agencies – IMD, CWC, INCOIS etc.
- Mutual Aid Partners
- Emergency Contact Details of Sub offices, RO and HQ, IWAI.
- Response Equipment Suppliers
- Specialists available on Call

4.4.4. Lists/Maps

- Emergency Response Equipment List
- Master Plan of Terminal showing ICR, equipment storage areas, FCPs, waste storage locations based on available terminal layout

4.4.5. Field Command Post (FCP) and Communications

Field Command Post is the point from where the response persons will be operating. FCP would be identified based on the location of incident in due consideration of the safety of the people to be deployed for emergency by SIC during an incident. FCP may be on land or in a vessel depending on the incident location and type of incident to be handled.

4.4.5.1 Field Communication Equipment's

SIC shall be directly overseeing the response operation and team would be deployed within terminal or shoreline adjacent to the terminal. The team should have seamless connectivity with dedicated field communication equipment for communicating in between during the operation. ECC shall have dedicated communication facilities in place to receipt, record and respond to the team under operation and also with the statutory authorities continuously.

The emergency response operation sequence and the facility requirements to handle emergency is compiled in **Figure 4.6** based on which, the Incident Management Team proposed for IWAI Terminal is presented in **Figure 4.7**.

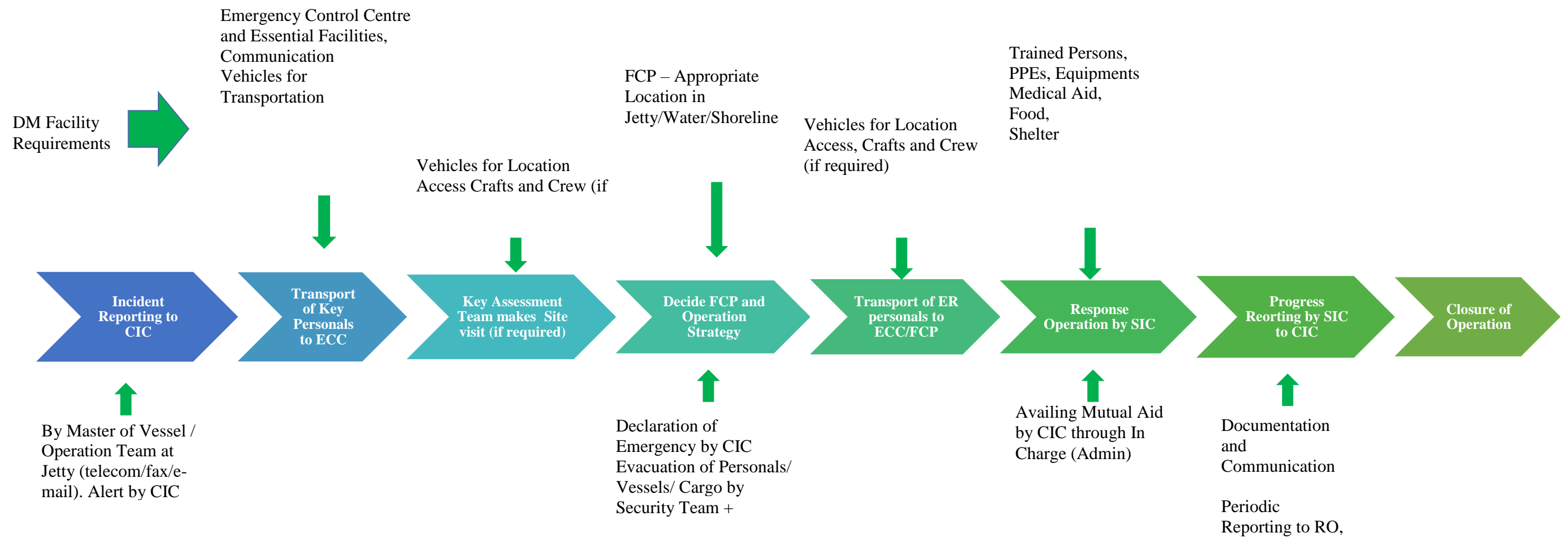


Figure 4.6. Emergency Operation Sequence and Infrastructure Provisions Required

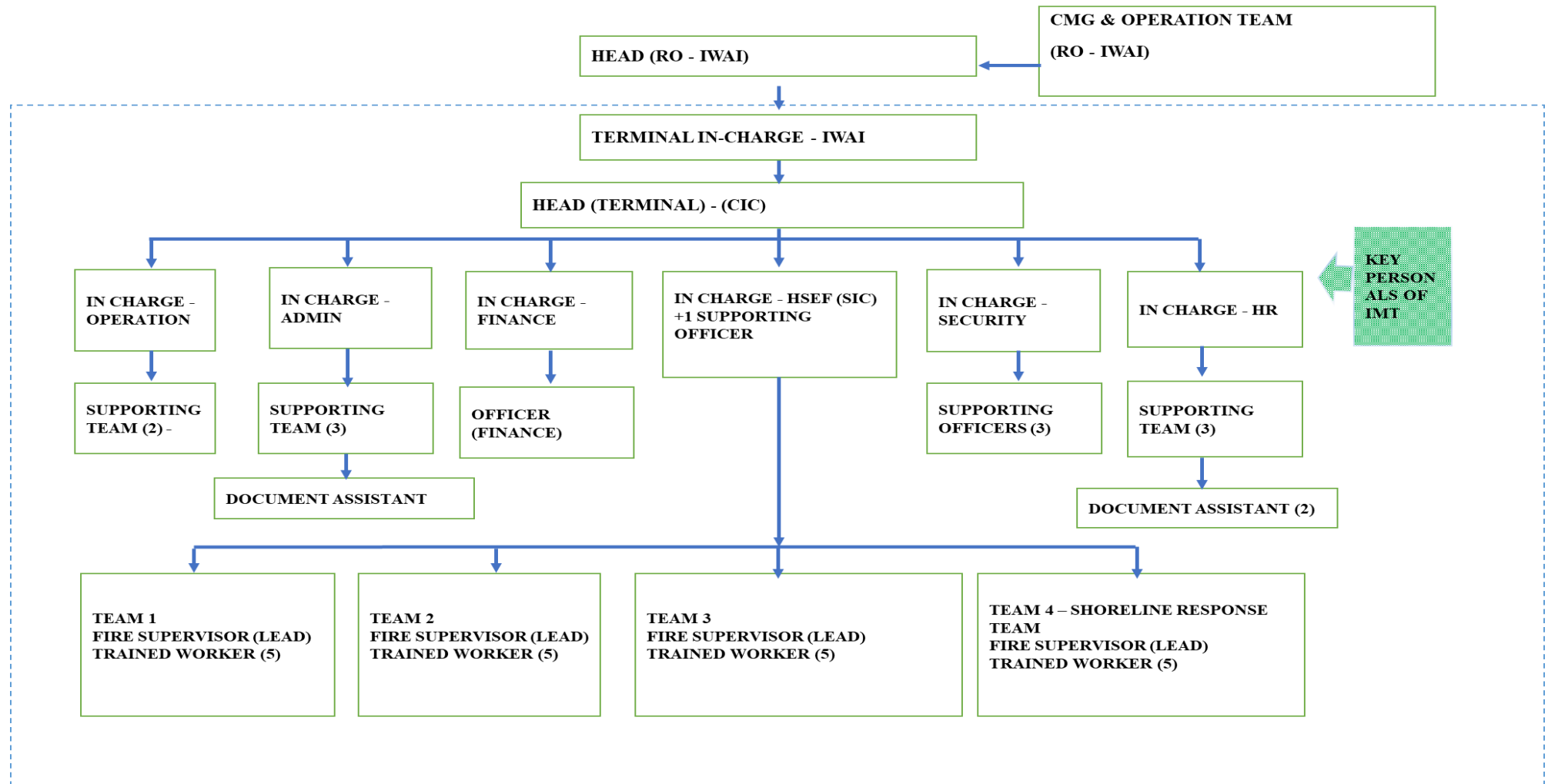


Figure 4.7. Incident Management Team for IWAI Terminal

Note: In case the water based operations are required, the Tug Operation team shall be joined with the operation team

4.4.6. Emergency Response Operation at Terminal

Head (Terminal) will act as the Chief Incident Controller and shall notify the key team members (all key officials of IMT) towards meeting up at ECC towards assessing the size and magnitude of incident. The members designated for making the preliminary assessment of the incident shall be the Key Assessment Team (KAT) whereas the other key team members shall remain available for supporting the assessment team and planning the immediate actions to be followed for response operation. The following are the key team members of the Incident Management Team.

- Head (Terminal) – Chief Incident Controller (CIC)
- In Charge - HSEF (SIC)
- In Charge – Operation
- In Charge - Security
- In charge - Admin
- In Charge - Finance
- In Charge - HR



Key Assessment Team will assess the magnitude of incident by connecting with the incident site / vessel and initiate the initial response operation. In case the connectivity couldn't be established, the Key Assessment Team shall be proceeding to the site seeking backup support from the neighboring health care facilities and assess the situation accordingly. On reporting the preliminary assessment by SIC to CIC, the CIC shall be declaring emergency and direct for safe transition from normal operation to emergency operation and systematic shut down as per the requirements.

On declaration of emergency, the operation team shall analyse the ongoing port operation pattern, ongoing cargo transfer operation, vessel positioning/ movements and which may interfere with the incident and will be controlling/re-planning or rescheduling the operations and would be intimating the various stakeholders associated with the operation. The Key personals of the ECC shall be taking the actions for initiating the response activities as per the direction of CIC towards mobilizing the response team within the least time frame.

4.4.7. Responsibility Allocation for Incident Management Team

The following section presents the roles and responsibilities of the emergency response personals and reporting requirements.

4.4.7.1. Chief Incident Controller (CIC) – Head (Terminal)

Head (Terminal) has been designated as the Chief Incident Controller for emergencies associated with the terminal Operations. CIC is responsible for the management and coordination of response operations at the scene of incident to achieve the most cost effective and least environmentally damaging resolution to the problem. During a major incident requiring operation of DDMA through offsite emergency plan, Head – RO (IWAI) shall take over the responsibility of the CIC where the Head (Terminal) shall be acting as SIC to execute the operational aspects of the response.

The Chief Incident Controller shall have overall responsibility to protect personnel, site facilities and the public before, during, and after an emergency or disaster. The CIC shall be present at the ECC for counsel and overall guidance. Responsibilities of the Chief Incident Controller shall include the following:-

- Preparation, review and updation of the Facility Level Disaster Contingency Plan for Terminal;
- Receive incident report; declaration of initial alert, preliminary reporting to RO.
- Mobilization of Key Personals to ECC, assessment of situation, declaration of emergency.
- Activation of ECC; intimation of various stakeholders on the emergency.
- Taking decision on seeking assistance from mutual aid members and external agencies;
- Arrange for medical aid for saving life; mobilize emergency response team for operation.
- Take decision and provide alternative arrangements coordinate with stakeholders on aspects related with changes in vessel operation plans, cargo handling plans, cargo /vessel shifting requirements etc.
- Support SIC through external assistance – technical, resources/equipment/medical support as deemed necessary.

- Coordinate with Head – RO, ensure that appropriate local and national government authorities are notified and various stakeholders are informed with regular and updated reports/information/guidance.
- Ensure round the clock operation; with shift personal being prepared to take charge of the emergency control function, emergency shutdown of system if needed.
- Taking stock of casualties and ensuring timely medical attention;
- Ensuring correct accounting and position of personnel after the emergency;
- Ordering evacuation of personnel as and when necessary;
- Support RO for taking decision of escalation of response operation with involvement of NDMA and NCMC.
- Remain for counselling at ECC for various stakeholders, releasing media and public statements.
- Planning and conducting mock drills and ensure the contingency plan is ready to execute.

4.4.7.2. Site Incident Controller (SIC) – In Charge (HSFE)

In Charge (HSFE) shall be the Site Incident Controller (SIC) who has overall responsibility for managing the response and will report directly to CIC. During lesser incidents, the SIC shall act as CIC and will have In Charge (Operation)/ In Charge (Security) as the resources who will assume the responsibility of SIC in absence of In Charge (HSFE). Three member team of - SIC, In Charge (Operation) and In Charge (Security) shall be the Key Assessment Team (KAT) on receipt of any incident reporting. The key personals shall be directly involved in response strategy formulation and revisions all throughout the emergency period.

Responsibilities of the Site Incident Controller shall include the following:-

- To maintain a workable emergency control plan, establish emergency control center, organize and equip the organization with trained personnel;
- On receipt of the intimation from CIC immediately proceed to ECC and play key role in assessing the situation by contacting vessel /In charge of incident area or proceeding to site.
- Assess the situation by contacting vessel or by leading the team to the incident assessment; report to CIC for emergency declaration, lifesaving requirements,

operation and response strategy. Support CIC in decision on availing support from mutual aid members and or DDMA.

- Ensure that essential HSE/Communication equipments are availed for the Key Assessment Team.
- Take quick decisions on priority of operation – life saving requirements/ response requirements, ideal location for field command post, response strategy to be adopted and take full charge of operational activities; coordinate all activities within Incident Management Team members.
- Plan both off shore and onshore operational strategy, revisit the strategy
- Ensure that medical aid has been made available as early as possible.
- Assess mutual aid requirements, intimate to CIC. Lead the response operation in case of smaller incidents assuming the power of CIC.
- Coordinate mutual aid activities if situation warrants. Support DDMA as Coordinator on behalf of Terminal with availing equipment, manpower and supporting facilities for response operation.
- Plan and deploy the available resources – equipment, firefighting facilities assess additional requirements with support from Key Assessment Team and avail with support of ECC.
- Lead response team to Field Command Post, brief the situation, lead operational activities; ensure that the response operations are least environmental damaging and best suited to the situation.
- Guide operational activities with appropriate response strategy, provide technical inputs (meteorological conditions, physical and chemical properties, environmental significance etc.) continuously monitor and report, revise the strategy as and when required.
- Ensure the maintenance requirements of the equipments and manpower (medical, transportation, food, shelter, change of shift etc.) is met with during the course of operation.
- Assess the additional requirements for response operation –equipments/ trained resources/ crafts/ crew/ communication devices / supply of food/ transportation, specialist support, weather forecasting requirements etc., ensure timely availing the support as desired.

- Ensure that the response operations are appropriately monitored, evidences are taken as per the guidelines and passed on to In Charge HR – Documentation in charge of ECC.
- Assess the immediate financial requirements, avail the same through CIC.
- Regularly report to CIC; support with in situ information on progress, terminal /vessel operational control requirements which need to be imposed.
- Provide technical support to CIC on coordinating with stakeholders, protecting the interest of the affected parties and ensuring factual information dissemination with the statutory/media/public.

4.4.7.3. In Charge – Operation

- On receipt of the intimation from CIC immediately proceed to ECC and play key role in assessing the situation by contacting vessel or proceeding to site.
- Support the response operation throughout the period with continued availability of Crafts (tug/pilot boats/survey launches etc.) and Crew & in case vessel operation is required, guide assessment team to the boarding point ensure the assessment team reaching the site of incident.
- Provide the Key assessment team with input on the vessel met with accident and the details available on the consignment, quantity etc.
- Support for the securing the wrecked vessel and or cargo arranged by the Ship Owner/Agent/Charterer.
- In absence of SIC, take over the complete responsibility of SIC as per the advice of CIC.
- Take decision on stopping the cargo handling activities/ evacuation of other vessels /operations if the incident site is close to the berth / anchorage. Coordinate and ensure immediate evacuation from the scene of incident.
- Take adequate action in consultation with the cargo handling team for securing the unloading cargo as well as the cargo received for dispatch.
- Take adequate action for informing the various stakeholders – with the change in vessel entry/exit to terminal areas, resultant cargo handling changes; ensure that the interest of the Terminal Owner as well as the Stakeholders are protected to the maximum. Ensure constant communications from ECC and remain available for the clarifications/decisions thereto.

- Supporting team under In Charge – Operation shall execute the changes required in vessel operation and cargo handling aspects as above.
- Immediately release the emergency operational people both for the response operation and ECC management requirements. Assess the additional manpower requirement for the ongoing operation pattern in Consultation with SIC and pass on emergency call people list to In Charge (Admin).
- Support with availing suitable cranes, vehicles and supporting crews for the transfer of spilled cargo collected to land and safe transfer to temporary disposal site.
- On behalf of Terminal, as per the advice of CIC, communicate with Vessel Owner/Agent/Charterer for the salvage operation requirements. Support for the salvage operation arranged by the Vessel Owner/Agent/Charterer with allotting operational accessibilities.
- Act as Specific In Charge for Jetty/Terminal based response operations.

4.4.7.4. In Charge – Security

- On receipt of the intimation from CIC immediately proceed to ECC; alert terminal users as per the direction of CIC.
- Assess the security requirements for immediately proceeding to the site of incidence; avail utility vehicles;
- Responsible for disbursing security directions for controlling entry/exit to Terminal premises.
- Assist the operation team for evacuation of personals/cargo if warranted. Operate public warning systems in emergency situations.
- Ensure the utility vehicles in place for accessing the site of incidence. Immediately plan and make available pathways for operation for medical team/fire team/response team etc. without compromising the security.
- In case of Level 2/3 operation, control on the entry /exit of vehicles, equipments and personals for the emergency operation; ensure ease of operation within the security regime.
- Quickly assess the security areas, requirement of additional resources if any from State Police/DDMA, report to CIC and coordinate with the additional resources.

-
- Support SIC in limiting the access of unauthorized persons/vehicle to the scene of incidence or response operation areas including the shore line response areas. Ensure tight security of the operational areas until normalcy is restored.
 - Oversee the shoreline response operations, regularly report the progress to SIC, ensure that the response operations are appropriately monitored, evidences are taken as per the guidelines.
 - In absence of SIC, take over the complete responsibility of SIC as per the advice of CIC.
 - Act as specific in charge for shoreline response operations.

4.4.7.5. In Charge - HR

- Core responsibility dealing with identifying manpower support for operations, handling communication with various agencies and central point of communication in ECC.
- On receipt of the intimation from CIC immediately proceed to ECC; alert terminal users per the direction of CIC.
- After primary assessment / as per the direction of SIC, immediately identify the primary responders and release intimation to In charge – Admin for necessary intimation and transport of personal to ECC.
- Support SIC in identifying additional manpower and requirement for the ongoing operation and pass on emergency call persons list to In Charge -Admin.
- Remain as the communication head of ECC, ensure that the communication from Site Incident Control is maintained uninterrupted. Support SIC in all communication aspects. Ensure that the information at ECC is continuously updated from the site.
- Responsible for all communication with all other agencies – DDMA, ICG, Government, mutual aid partners, various stakeholder – prepare the communication, get approval from CIC and release on behalf of CIC.
- Prepare response to all media/public queries, prepare press statements release responses/statements after approval from CIC.
- In case of additional support requirement, as per direction of CIC, contact mutual aid partners, collect information on the resources committed to be availed pass the information to SIC.
- Take full charge of the documentation of response operation. Direct /request the team in operation for documentary evidences, take full control on progress reports are

maintained, evidences are taken as per the DM guidelines. Get guidance from In charge (Finance) on the documentation aspects and support In charge (Finance) for financial closure of operation with providing various claims/reimbursements/disbursements etc. towards realization.

4.4.7.6. In Charge – Admin

- Responsible for core administration and logistic support for ECC and its operation.
- Responsible for the operation and maintenance for ECC. Over all coordination with the various operational unit for maintaining the ECC functional.
- After primary assessment / as per the direction of SIC, immediately coordinate with the primary responders and avail utility vehicle support for reaching ECC and further proceeding to FCP.
- Make necessary arrangements for the mutual aid partners for travel to project site, lead them to ECC and connect with the response team under SIC. Avail compliance with the security procedures of Terminal for the resources on call (internal as well as external) with a dedicated security personal for ease of operation.
- Maintain document on the resources deployment – details of the people/equipment on operation, period of deployment, comply with the financial requirements for arranging facilities for response personals through CIC.
- Avail transport and logistic arrangements for the personal on duty for emergency operation – ensure supply of food, shelter and travel requirement. Coordinate with the external facilities of terminal areas for making temporary arrangements.

4.4.7.7. In Charge – Finance

- Support CIC for preliminary estimate of the finance requirement for operations. Approve and avail the fund throughout operational period.
- Allot Officer (finance) round the clock in ECC for supporting the various team with guidance on collecting and recording the relevant supporting documents toward effecting payment directly/reimbursements.
- Support SIC on aspects of financial control of operations, after closure of operation, assume the charge of financial closure of operation with proceeding for the various claims/reimbursements/disbursements etc. until it is realized.

4.4.7.8. Technical Resource Person

- Lead coordinator for site specific support to ECC on cargo properties, weather forecasting and environmental and bathymetric aspects
- Provide technical guidance for the operation team on the chemical characteristics and fate of the cargo by analysing the incident report.
- Maintain updated contacts with the various resources agencies identified in Disaster Management Plan and avail ready to contact list in case of emergency. Identify resource persons to be utilised in case of emergency and maintain appropriate arrangements for availing services.
- Support In Charge - HR in communication with statutory agencies.
- Support response operation by connecting to the agencies such as INCOIS, CWC, IMD etc., early warning

4.4.7.9. Responsibilities of Supporting Teams of IMT

The most relevant roles of the key supporting members are listed below and being part of ECC additional responsibilities would be allotted to all members as per the requirement by CIC.

4.4.7.9.1. Supportive Team – under In Charge (Operations) – 2 Members

- Support In Charge - Operation for planning and execution of functional activities assigned to him.
- Analyse and re-plan ongoing and planned cargo operation, secure cargo unloaded or accepted for loading to vessels, securing of the vessels /facilities in incident proximity.
- Execution of the re plans as per the direction In Charge (Operation) which may include upto systematic shutting down.

4.4.7.9.2. Supportive Team – under In Charge (Admin) – 2 Members

- Support In charge – Admin to execute the role in managing ECC
- Support In charge – Admin for transportation of ECC Key members as per direction of CIC.
- Support In charge – Admin for providing logistic arrangements, catering facilities etc., for the incident response team.
- Support In charge – Admin for arranging any transfer facilities - arrangement of emergency vehicles, people etc.,

- Liaison with external facilities - hotels/resorts etc. for arranging accommodation for response personals.

4.4.7.9.3. Document Assistant– under In Charge - Admin

- Support In charge Admin to act as Centre point of communication at ECC.
- Take charge of preparation and custody of all documents w r to manpower and equipment requirements, logistic supports etc., for response operations.

4.4.7.9.4. Officer - Finance

- Complete the procedure for financial disbursement as per the direction of In Charge - Finance and ensure the disbursements.
- Keep on updating the reserve funds and additional requirements if any to In Charge - Finance.

4.4.7.9.5. Support Officer 1 – under In Charge- HR

- Support In Charge - HR for emergency call of response personals to ECC.
- Support In Charge - HR to ensure seamless communication to SIC and update to CIC.
- Support In Charge - HR for acting as the communication point at ECC, receiving and replying for the communication for all stakeholders.

4.4.7.9.6. Support Officer 2 – under In Charge- HR

- Analyse Media and PR queries, prepare replies and support In Charge - HR to get approved by CIC.

4.4.7.9.7. Supporting Officer 3 – under In Charge -HR

- Act as documentation in charge - take charge of preparation and custody of all documents - requests/orders/bills/claims etc.
- Support In Charge - HR for all documentation related aspects.
- Safe custody of progress reports of operation, ensure that essential supporting evidences are captured and documented towards claim on later stage.

4.4.7.9.8. Document Assistant for ECC – under In charge HR

- Meet the requirement of ECC on drafting, communications, printing, publishing, recording etc. throughout the operational period.

4.4.7.9.10. Supporting Officer – Under In Charge HSFE at FCP

- Support SIC executing his duties – managing FCP and coordinating the supporting units.

- Coordinate the various working units for response operation and supporting team such as medical units, equipment maintenance, communications, documentation etc. waste handling.
- Ensure that the response operations are supported with the requirements on timely basis.

4.4.8. Manpower Allocation for IMT - Training and Capacity Building Requirements

A total of 42 persons has been identified for IMT with responsibility allocation specific to the skill related with the present operation. The persons identified in IMT shall be given basic as well as specific training to handle the emergency situation. The training requirement identified in the Contingency planning phase is presented in **Table 4.5** below.

Table 4.5. Training and Capacity Building Requirements for IMT Personals

Sl.No	Training Modules	Type of Training	Duration and Frequency	Targeted Audience	Total Number of Persons
A.	Emergency Handling for IWT Terminal Operations				
1	IWT related risks in Terminals, Cargo Properties, Dos and Don'ts, Response Operation - Personal Safety, Equipment Usage, Incident Reporting, Incident Management Team, Responsibility allocation	Class room training followed by Table top exercise	3 hr	All members of IMT	42
B.	Specific Skill Development Training for Response Operations				
1	Management Training				
	Emergency Assessment, determination of level of response and development of strategy. Effective coordination of emergency. Legal aspects of handling emergency, documentation and communication requirement.	Class room Session	1.5 hr - Annually	Key Members of ECC	7
2	Supporting Team				

Sl.No	Training Modules	Type of Training	Duration and Frequency	Targeted Audience	Total Number of Persons
	Module I - Operation under emergency Requirement – Chemical properties of cargo and response planning, Planning and Execution of massive evacuation, cargo and vessel securing, cargo transfer and salvage operations	Classroom Interactive Session	1.5 hr - Annually	Technical resource person, Supporting Team - Operation, Admin, Finance, Security, HR	10
	Module II - Management of Emergency Control Centre, coordinating and arranging travel, logistics for mutual aid partners or external agencies, essential facility support for operational team. Statutory reporting, media handling and stakeholder communication during emergency.	Classroom Interactive Session	1.5 hr - Annually		10
C.	Emergency Response Personals				
	Emergency Response Operation at Terminal	Classroom followed by practical training in operation of response in riverine conditions	1.5 hr - every 3 months	All members of Response Team	24
	Shoreline Response Operation		1.5 hr - every 3 months		24

4.4.9. Conducting Mock drill

Mock drills shall be conducted at least once in every three months and a record shall be maintained of its conduct including the personnel participated, resources mobilized, etc. based on the experienced earned during mock drill, the disaster management plan shall be suitably updated.

4.4.10. Emergency Response Equipments to be availed at IWAI Terminal

Each terminal shall be provided with essential emergency response equipments along with oil spill response equipments equivalent to Category C of NOS-DCP in case of Furnace Oil handling or equivalent to Category D in case of non-oil cargo handling. The emergency

response equipments proposed at each terminal for both cases are presented in **Table 4.6** and **Table 4.7**.

Table 4.6. Emergency Response Equipments Proposed for Oil Handling Terminal

SI No.	Description	Quantity
1	River Booms with accessories (Material: Neoprene / rubber / Neoprene rubber)	600 with 2 Power Pack
2	Fence boom (Material : Neoprene/rubber/Neoprene rubber/ PU/ PV)	200
3	Skimmer (20TPH 50% weir type, 50% Brush type)	2
4	OSD Applicant or with Spray arms type along with 02 Nozzles system and 02 hand lancers (No.)	1
5	Oil Spill Dispersant (Chemical Dispersant) (litres)	1000
6	Bio-remediation (litres)	1000
7	Flex Barge 10 Tons (no.)	2
8	River Boom 100 metres with power pack and accessories (nos) or Integrated containment cum recovery system with power pack and accessories (nos)	2 1
9	Sorbent boom size min. 5 inch Dia, min. length 5 feet (no.)	100
10	Sorbent Pads min. 20 inch x 20 inch (no.)	500
11	Shoreline cleanup Equipment	Mini Vacuum pumps capacity 25m3
12		Portable Oil temporary storage facility capacity 10 m3
13	VOC Portable Monitor	2
	200 metres Shoreline sealing boom with power pack and accessories (material: Neoprene/rubber/Neoprene rubber) (nos.)	1
14	Level A protection: Positive pressure full face-piece self-contained breathing apparatus (SCBA) or positive pressure supplied air respirator with escape SCBA; Totally encapsulated chemical and vapor protective suit; Inner and outer chemical resistant gloves; and Disposable protective suit, gloves, and boots.	1
15	Level B protection: Positive pressure full face-piece self-contained breathing apparatus (SCBA) or positive pressure supplied air respirator with escape SCBA; Inner and outer chemical-resistant gloves; Face shield; Hooded chemical resistant clothing; Coveralls; and Outer chemical-resistant boots.	3
16	Level C protection: Full-face air purifying respirators; Inner and outer chemical-resistant gloves; Hard hat; Escape mask; and Disposable chemical-resistant outer boots.	5
17	Level D protection : Gloves; coveralls; safety glasses; Face shield; and Chemical resistant, steel-toe boots or shoes.	10

Sl No.	Description	Quantity
18	FAST ACT (First Applied Sorbent Treatment against Chemical Threats) Neutralization agent- 4kg Cylinder	5.00
19	Portable Inflatable Emergency Lighting System	5.00
20	High Pressure Water Mist &CAFS(10L)	1.00

Table 4.7. Emergency Response Equipments Proposed for No- Oil Handling Terminal

Sl.No.	Description	Quantity
1	Fence boom (Material : Neoprene/rubber/Neoprene rubber/ PU/ PV)	200
2	Bio-remediation (litres)	1000
3	Sorbent boom size min. 5 inch Dia, min. length 5 feet (no.)	500
4	Sorbent Pads min. 20 inch x 20 inch (no.)	2000
5	VOC Portable Monitor	2
6	Full-face air purifying respirators; Inner and outer chemical-resistant gloves; Hard hat; Escape mask; and Disposable chemical-resistant outer boots.	20
7	Gloves; coveralls; safety glasses; Face shield; and Chemical resistant, steel-toe boots or shoes.	30
8	FAST ACT (First Applied Sorbent Treatment against Chemical Threats) Neutralization agent- 4kg Cylinder	5.00
9	Portable Inflatable Emergency Lighting System	5.00
10	High Pressure Water Mist &CAFS(10L)	1.00

4.5. Offsite Emergency Plan for IWT Operation in NW 1

Incidents beyond the capacity of manpower and equipment at terminal/vessel requires operation of an offsite emergency plan with support from respective DDMA and further depending on the severity of incident, the additional support would be warranted with involvement of SDMA, NDMA or NCMC as the case may be. Thus a proposal for managing offsite emergency requirement has been formulated with an incident management team for IWAI RO and IWAI HQ with provision for escalation of involvement according to the level of emergency. Emergency Control Centre would be set up at IWAI RO and IWAI HQ, which will be activated on incident reporting as per the response level requirement.

In the case of an incident requiring offsite emergency operation with involvement of DDMA, respective Head (RO) shall take over the responsibilities of CIC from the IWAI side and coordinate with administrative authority for executing the emergency operation. Emergency Coordination Centre (ECC) shall be activated within the respective RO with a team supporting the coordination of response activities. Being the owner of the NW 1 and having the core

technical expertise in administering waterways, IWAI shall extend all technical assistance / advice to DDMA for responding to the incident.

The key responsibilities of IWAI in handling offsite emergencies of an IWT related disaster would be

- Assist DDMA by providing technical assistance on river hydrography, inland vessel operation, cargo type and its chemical characteristics, response requirements and supervising cargo transfer operations (if any).
- Execute a Mutual aid with the stakeholders along the region (under each RO) including major industrial units who may be able to assist to manage the incident with qualified persons and resources.
- Based on the Risk assessment study, provide inputs on stakeholders affected due to the incident actively involved in prioritising protection measures of the vulnerable resources.
- Be part of the DDMA to assess the situation, identifying additional resources for combat operations and help DDMA to take decision on escalation of emergency.
- RO – IWAI shall be the nodal officer from IWAI for coordinating with the disaster management system till Level 2 operation (confined within a state) with involvement of the respective SDMA.
- On escalation of an emergency to Level 3/ in case of any emergency which may be affecting more than one state requiring involvement of NCMC, Chairman IWAI shall be the CIC from the IWAI side for effective coordination with the respective disaster management mechanism. ECC shall be activated at IWAI – HQ and the ECC would be directly coordinating with the NDMA or NCMC for availing all possible support for the response operation and will act as a facility hub for extensive maximum support from the central institutions including armed forces, NDRF etc.
- IWAI shall play an active role in emergency response with specific intervention to avail support from central authorities in the least time frame through Secretary of Shipping, (MoS)
- IWAI shall take responsibility of coordinating with the respective Inland Vessel owner/Charterer/Agent and suitably support in securing cargo or vessel and supporting salvage operations, if any, initiated by the owner of vessel.

It is to be noted that, for major incidents or incidents involving multiple States, response operation would warrant critical management decisions at the top level to coordinate with NDMA/NCMC. Hence a Crisis Management Group (CMG) has been proposed at IWAI HO. Direction of the CMG shall be implemented by the IMT of HO where senior officials shall be involved in supporting CMG for coordinating with NDMA/NCMC through relevant information from field through the IMT of RO. CMG proposed for IWAI shall be normally involved in major incidents as above and shall be available for any specific incidents which require the involvement of top level management of IWAI. Thus the Incident Organogram proposed for IWAI for handling offshore emergencies are presented in **Figure 4.8**.

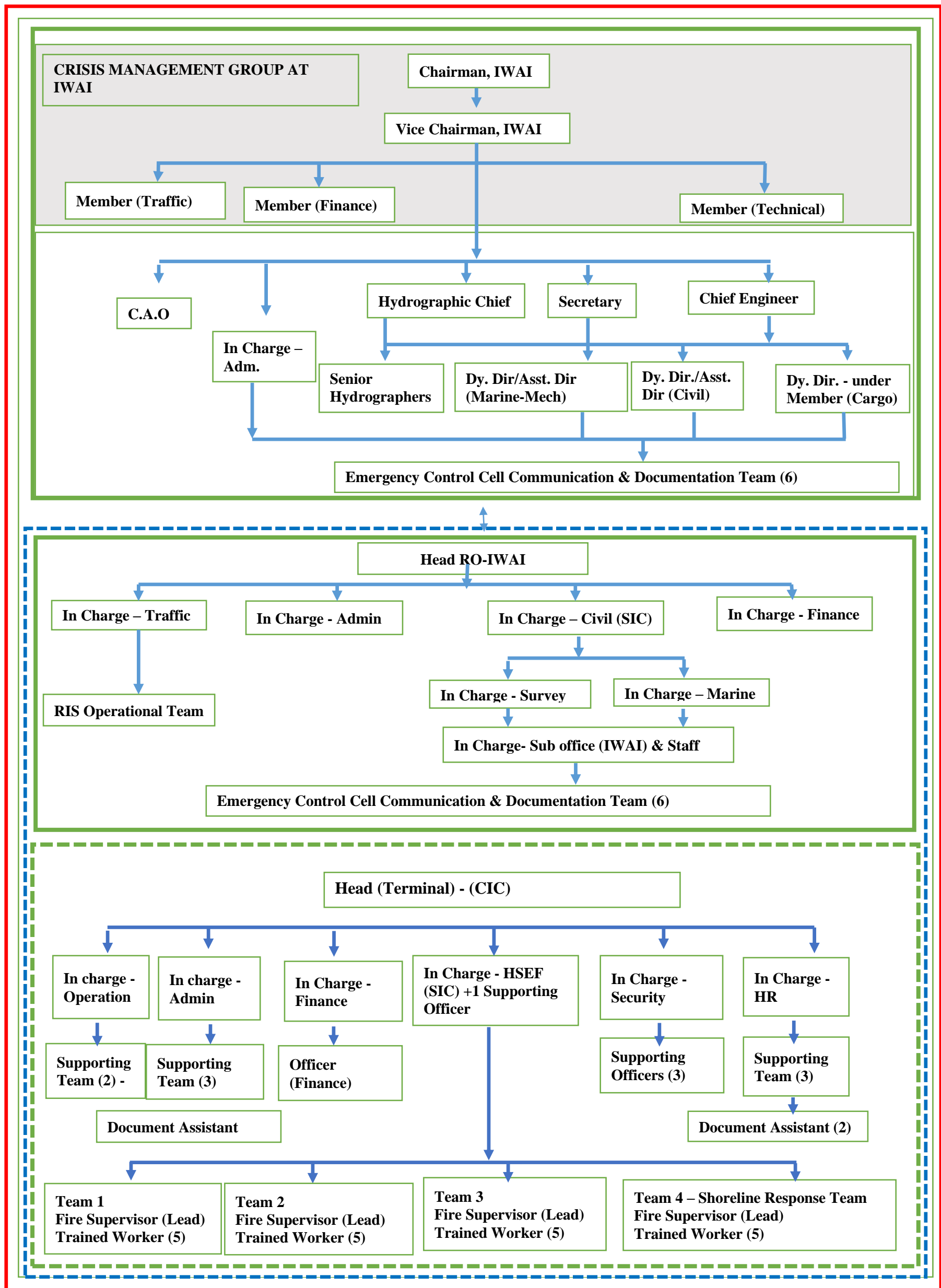
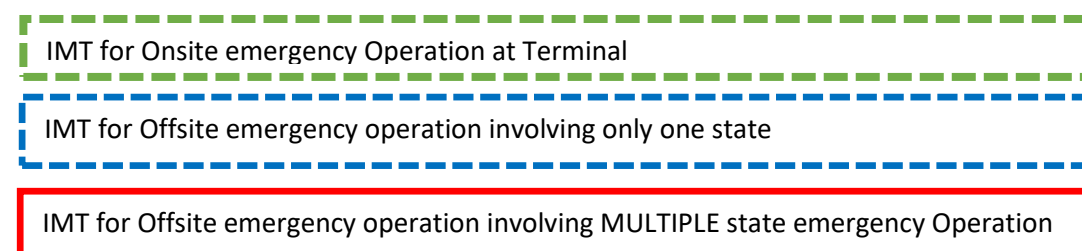


Figure 4.8. Incident Organization Chart for IWAI for Handling Operational Emergencies in NW 1



4.5.1. Responsibility of Emergency Response Personals at IWAI - RO

Responsibility allocation of IWAI officials at RO for handling emergencies confined within a State.

4.5.1.1. Head – RO

- Receive incident report from terminals, alert RO, activate ECC at RO and send an intimation to IWAI –HQ.
- Continuously receive update from terminal on response operation and additional support requirements if any and keep IWAI – HQ updated on the incident.
- Allot a member or entire team under In Charge (Civil) to scene of incident if situation demands.
- If escalation of emergency to Level 2 is required, take over the overall coordination responsibility with respective DDMA and avail technical support to DDMA's on river hydrography, inland vessel operation, cargo type and its chemical characteristics, response requirements and supervising cargo transfer operations (if any).
- Extend support to DDMA with available vessels, tugs and crew for combat operation.
- In case of an emergency of Level 3 or multiple State involvement, act as the site representative of IWAI for coordinating the involvement of various agencies / authorities/departments.
- Act as nodal contact point with IWAI –HQ for availing timely additional guidance or assistance from HQ/ NDMA/NCMC.
- Ensure that the ECC is functional throughout the response operation period and guide various team under to execute the specific responsibilities assigned and allot additional manpower or responsibilities for better management of the situation.
- Call for mutual aid as per the demand.
- Ensure that ECC members are provided with adequate training and all essential facilities are available at ECC at working conditions to handle any incident reported.
- Actively coordinate with DDMA's/SDMA in response operations.
- Avail counselling at RO for various stakeholders and decide on escalation of emergency and avail additional support through ECC at HQ.

4.5.1.2. In Charge (Civil) – SIC

- Core responsibility to act as a representative of IWAI at the scene / allot appropriate officer under him to coordinate with the response operation initiated by DDMA.
- Give input to DDMA on hydrographic aspects and vessel operational feasibilities through In-Charge (Survey)
- Give input to DDMA on vessel related risk, cargo related risk and support response operation through In-Charge (Marine)
- Avail report from field, analyse and update to CIC on additional support requirements for the ongoing field operations and make available the same to field team. e.g, support of Mutual aid members, additional vessels, experts, travel or accommodation arrangements for IWAI team in the field etc.
- As per the requirement, assess the emergency escalation requirement, support DDMA for escalation of emergency and also intimate RO on additional support requirement and intimation of IWAI HQ involvement.
- Be available at the site of incident in case of a critical situation and act as nodal person for coordination with authorities on behalf of IWAI when SDMA/NDMA/NCMC operation is initiated.
- Closely monitor the operation of the vessel owner in securing the vessel /cargo and ensure appropriate coordination between the vessels related operation and response operation of DDMA's.
- Ensure that minimum essential HSE/Communication equipment's are available at ECC and also at field offices to immediately act on emergency.
- Coordinate mutual aid activities if situation warrants. Support DDMA as Coordinator on behalf of IWAI with making available equipment, manpower and supporting facilities for response operation.
- Guide operational activities with appropriate response strategy, provide technical inputs continuously monitor and report revise the strategy as and when required.
- Ensure the maintenance requirements of the equipment and manpower (medical, transportation, food, shelter, change of shift etc.) is met with during the course of operation.
- Assess the additional requirements for response operation – equipment/ trained resources/ crafts/ crew/ communication devices / supply of food/ transportation,

specialist support, weather forecasting requirements etc., Assist DDMA for ensuring timely availability the support as desired.

- Ensure that the response operations are appropriately monitored, evidences are taken as per the guidelines and passed on to In-Charge Admin – Documentation in- charge of ECC.
- Assess the immediate financial requirements, avail the same through CIC.
- Regularly report to CIC; support with on site information on progress, terminal /vessel operational control requirements which need to be imposed.
- Provide technical support to CIC while coordinating with DDMA to handle the issues and interests of various stakeholders, affected parties and ensure factual information dissemination with statutory agencies media/public in all level of emergency operation.

4.5.1.3. In-Charge Traffic

- Core responsibility to support DDMA for technical matters related with cargo and traffic.
- On receipt of the intimation from Head RO, immediately proceed to ECC and play key role in assessing the situation and actively follow up /advice/direct w r to the vessel and cargo related aspects and get updated of the situation in case of a Level 1 Incident.
- In case of Level 2 Incident, support CIC with essential traffic re scheduling and advising on securing other vessels or cargos nearby the scene of incident.
- Appraise the ECC team members on meteorological conditions, type of consignment, physical and chemical properties, environmental significance etc. and the response operation methods towards appraisal of DDMA.
- Act as the nodal officer to deal with the vessel and cargo related matters and provide technical input to DDMA if deemed necessary.
- Execute the vessel rescheduling due to the incident along the scene of incident.
- If situation warrants, be available or allot additional resources for assistance at site for vessel or cargo related matters.
- Support for the securing the wrecked vessel and/or cargo arranged by the Ship Owner/Agent/Charterer.
- Support CIC in executing his/her responsibilities throughout the operational period of ECC.

- In the absence of SIC, take over the complete responsibility of SIC as per the advice of CIC.

4.5.1.4. In-Charge – Admin

- Core responsibility for administration and logistic support for ECC and its operation. Identifying additional manpower support for operations, handling communication with various agencies, complete documentation of operation of ECC and act as central point of communication in ECC.
- On receipt of the intimation from CIC immediately proceed to ECC; alert RO per the direction of CIC.
- After primary assessment / as per the direction of SIC, arrange for transport of IMT officials of RO to scene of incident
- Support SIC in identifying additional manpower and requirement for the ongoing operation and pass on emergency call to persons identified.
- Remain as the communication head of ECC, ensure that the communication from Site Incident Control is maintained uninterrupted. Support SIC in all communication aspects. Ensure that the information at ECC is continuously updated from the site.
- Responsible for all internal communication (within RO and with HQ) and with all other agencies – DDMA, ICG, Vessel owners, mutual aid partners and various stakeholders – prepare the communication, get approval from CIC and release on behalf of CIC.
- Prepare response to all media/public queries, prepare press statements and release responses/statements after approval from CIC.
- In case of additional support requirement, as per direction of CIC, contact mutual aid partners, support transport and logistic arrangements for mutual aid partners.
- Take full charge of the documentation of response operation. Direct /request the team in operation for documentary evidences, ensure that progress reports are maintained and evidences are taken as per the DM guidelines. Get guidance from In Charge (Finance) on the documentation aspects and support In Charge (Finance) for financial closure of operation by providing various claims/reimbursements/disbursements etc. towards realization in case of Level 2 incidents.
- In case of Level 3/ any multi state incidents, support CIC to communicate with ECC with site specific updates.

4.5.1.5. In Charge – Finance

- Support CIC to prepare preliminary estimate of the finance requirement for operations. Approve and avail the fund throughout operational period.
- Allot Officer (finance) round the clock in ECC for supporting the various team with guidance on collecting and recording the relevant supporting documents toward effecting payment directly/reimbursements.
- Support SIC on aspects of financial control of operations, after Closure of operation, assume the charge of financial closure of operation with proceeding for the various claims/reimbursements/disbursements etc. until it is realized in case of Level 2 operation. In case of Level 3 on multiple state exigencies support finance team of IWAI HQ with appropriate supporting documents as above towards financial closure of activities.

4.5.1.6. RIS Operational Team

- Receive the incident report within the area.
- Pass on the message to IWAI – RO&DDMAs in the region.
- Connect with other vessels on voyage and restrict sailing to scene of incidence.
- Sharing and retrieving details on vessels involved and movement in analysing the accident scenarios.

4.5.2. Manpower Allocation for IMT - Training and Capacity Building Requirements

A total of 38 persons has been identified for IMT with responsibility allocation specific to the skill related with the present operation. The persons identified in IMT shall be given basic as well as specific training to handle the emergency situation. The training requirement identified in the Contingency planning phase is presented in **Table 4.8** below.

Table 4.8. Training and Capacity Building Activities for IMT Personals

Sl. No	Training Module	Type of Training	Duration & Frequency	Targeted Audience	No. of Persons
A.	Basic Training				
1	IWT related risks in Terminals, Cargo Properties, Dos and Don'ts, Response Operation - Personal Safety, Equipment Usage, Incident Reporting,	Class room training followed by Table top exercise	3 hr - Annually	All members of IMT	38

Sl. No	Training Module	Type of Training	Duration & Frequency	Targeted Audience	No. of Persons
	Incident Management Team, Responsibility allocation				
B. Specific Skill Development Training for OSR Operations					
1.	Module I - Emergency Coordination, Managing ECC, Documentation and Statutory reporting - Equivalent to IMO Level 2 Course.	Class room Session	3 hr - Annually	Head - RO (CIC), In Charge - Civil (SIC), In Charge (Traffic)	3
2.	Module II - Management of ECC, Coordination and Communication in Emergency Situations, Travel, Logistic Arrangements, DM Documentation - Progress reports, evidences, claims, reimbursements/disbursements/financial closure.	Class room Session	3 hr - Annually	In Charge - Fin and In Charge Admin	2
3.	Module III - Emergency Operation Coordination and Communication. DM Documentation - Progress reports, evidences, claims, reimbursements/disbursements/financial closure.	Class room Session	3 hr - Annually	In Charge - Survey and In Charge Marine & In Charge of IWAI Sub offices and supporting Staff	33

4.5.3. Conducting Mock drill

Mock drills shall be conducted at least once in every six months internally and a record shall be maintained of its conduct including the personnel participated, resources mobilized, etc. based on the experiences earned during mock drill, the disaster management plan shall be suitably updated. RO - IWAI and all sub offices shall take part actively in the mock drills arranged by DDMA and Indian Coast Guard (ICG) on oil spill preparedness.

4.5.4. Facilities to be availed at ECC of IWAI – RO

Facilities to be made available at ECC of IWAI - RO is presented below.

- Maps and display charts and diagrams showing buildings, roads, underground fire mains, important hazardous material and process lines, drainage trenches, and utilities such as steam, water, natural gas and electricity.
- Electronic Navigational Chart (ENC) along with map of hotspots preferably superimposed on ENC and a copy of risk assessment and DMP report.
- A copy of the relevant Disaster Management Plan.
- Situation boards (continuously updated to present a summary of the current situation and response actions being taken).
- Aerial photographs, if possible, and maps showing the site, adjacent industries, the surrounding community, high-ways, etc., to help determine how the disaster may affect the community so that the proper people can be notified, adequate roadblocks established, and the civil authorities advised.
- Sufficient telephone lines to enable full liaison with outside bodies.
- Names, addresses, and telephone numbers of employees, off-site groups and organizations that might have to be contacted; all telephone lists being reviewed for accuracy on a scheduled basis and updated, as necessary.
- Dedicated and reliable communication equipment; enough telephones and at least one fax line to serve the organization for calls both on and off-the-site.
- Fixed and portable two-way radio equipment to keep in contact with activities on-scene and to maintain continuity of communications when other means fail.
- Plan board, logbook, voice recorder, television, DVD and Video facilities for playing back records from aircraft and helicopters, as well as monitoring media coverage of the incident with a person assigned to record pertinent information and to assist in investigating cases, evaluating performance, and preparing reports.
- Emergency lights so that operations can continue in the event of power failure.
- Photocopy, fax and e-mail facilities.
- Dedicated computers with LAN/ internet facility to access the installation data and the latest and updated soft copies of all standard operating procedure (SOP) etc.
- Wireless Internet Facility.
- Video Conferencing Facility to have face to face communication/meetings between the stake holders.

4.5.5. Responsibility of Emergency Response Personals at IWAI - HO

Responsibility allocation of IWAI officials at HO for handling Level 3 (through NDMA) /incidents involving more than one State (through NCMC).

4.4.5.1. Chairman – IWAI – CIC

- Receive report on any incident within terminal or waterway upto Level 2 stage (coordinated by IWAI RO) and regularly get updated from the CIC at RO and update to Secretary (MoS) as deemed necessary.
- With support of members of CMG and IMT, analyse additional support requirement for RO. Coordinate with NDMA or NCMC through MoS and extend support as far as possible.
- On Level 3 / multiple state emergency, act as CIC on behalf of IWAI and take over the overall coordination responsibility with NDMA/NCMC
- In Level 3 / multiple state emergency, on receipt of incident report from RO, activate ECC at HO and send an intimation to MoS for passing to NDMA/NCMC (if warranted).
- Deploy senior IMT members at site for coordinating the higher level response operation extend technical support on river hydrography, inland vessel operation, cargo type and its chemical characteristics, response requirements, supervising cargo transfer operations (if any).
- Update MoS on the progress, avail advice and execute at site.
- Allot additional staff for operational support for the field team as requested by CIC – RO.
- Coordinate with any specific institution at Central level for specific involvement on request of CIC-RO.
- Act as nodal contact point with IWAI –HQ for availing timely additional guidance or assistance from HQ/ NDMA/NCMC.
- Execute a mutual aid agreement with the various resource agencies who may be able to support response operations.
- Ensure that ECC members are provided with adequate training and all essential facilities are available at ECC at working conditions to handle any incident reported.

4.4.5.2. Vice Chairman, IWAI – SIC

- Support CIC to execute his / her responsibility.

- Specific responsibility to coordinate with the IMT of headquarters and actively following up or supporting the response operations and issuing essential management decision on approval of CIC.
- Support CIC for submission of regular updates to statutory authorities; MoS, NDMA or NCMC as deemed necessary.
- Over all control over operation of ECC. Ensure that minimum essential HSE/Communication equipment's are available at ECC and also at field offices to immediately act on emergency.
- Ensure that the response coordination team under Hydrographic Chief and Chief Engineer is extending technical support to the operations on hydrographic aspects and inland vessel operational feasibilities.
- Avail report from field, analyse and update CIC on additional support requirements for the ongoing field operations and avail the same to field team including intensifying the response operation with wider participation.

4.4.5.3. Member Technical /Finance/Traffic

- Key role in top level management decisions.
- Assist CIC in discharging his duties.
- Continuously analyse the progress reports from site and design strategy for efficient coordination of response operation from IWAI.
- Assist CIC for connecting with the Nodal Department of agencies and negotiate for availing specialised support if any.
- Member (Technical) and Member (Traffic) shall make key analysis on operational support requirement and coordination with resource agencies.
- Member (Finance) shall understand and analyse budgetary requirements and immediately make the same available for the field teams.

4.4.5.4. Chief Engineer, Secretary & Hydrographic Chief

- Overall responsibility for ensuring top level coordination of response operations with all resource agencies on behalf of IWAI supported with the resources at HQ an RO.
- As per the requirement assess the emergency escalation requirement support RO/HQ for escalation of emergency and extend additional support through SIC.

-
- Be available at site of incident in case of criticality of situation and act as nodal person for coordination with authorities on behalf of IWAI when SDMA/NDMA/NCMC operation is initiated.
 - Closely monitor the operation of the vessel owner in securing the vessel /cargo and ensure appropriate coordination between the vessels related operation and response operation of DM system.
 - Coordinate mutual aid activities if situation warrants. Support DDMA as Coordinator on behalf of IWAI with making available the equipment, manpower and supporting facilities for response operation.
 - Guide operational activities with appropriate response strategy, provide technical inputs continuously monitor and report, revise the strategy as and when required.
 - Ensure the maintenance requirements of the equipment and manpower (medical, transportation, food, shelter, change of shift etc.) is met with during the course of operation.
 - Assess the additional requirements for response operation—equipments/ trained resources/ crafts/ crew/ communication devices / supply of food/ transportation, specialist support, weather forecasting requirements etc.,. Ensure appropriate support from NDMA/NCMC through SIC.
 - Direct for appropriate monitoring of response operations, evidences are taken as per the guidelines and passed on to In Charge Establishment and Admin.
 - Assess the immediate financial requirements, avail the same through SIC.
 - Regularly report to SIC; support with in situ information on progress, terminal /vessel operational control requirements which need to be imposed.
 - Provide technical support to SIC while coordinating with top level decision making authorities and also guide/ advice Head – RO to handle the issues and interest of various stakeholders, affected parties and ensuring factual information dissemination with the statutory/media/public in all level of emergency operation.

4.4.5.5. In Charge – Admin

- Core responsibility for administration and logistic support for ECC and its operation, handling communication with various agencies, complete documentation of operation of ECC and central point of communication in ECC.

-
- On receipt of the intimation from CIC immediately proceed to ECC; alert HO as per the direction of CIC.
 - After primary assessment / as per the direction of SIC, arrange for transport of IMT officials of HO to scene of incident
 - Support SIC in identifying additional manpower and requirement for the ongoing operation and pass on emergency call to persons identified.
 - Remain as the communication head of ECC, ensure that the communication from site of incident/RO is maintained uninterrupted. Support SIC in all communication aspects. Ensure that the information at ECC is continuously updated from the site.
 - Responsible for all internal communication (within RO and with HQ) and with all other statutory or resource agencies.
 - Prepare response to all media/public queries, prepare press statements release responses/statements after approval from CIC.
 - Take full charge of the documentation of response operation. Direct /request the team in operation for documentary evidences, take full control on progress reports are maintained, evidences are taken as per the DM guidelines. Get guidance from In Charge (Finance) on the documentation aspects and support In Charge (Finance) for financial closure of operation with providing various claims/reimbursements/disbursements etc. towards realization in case of Level 3 incidents or incidents involving multiple States.

4.4.5.6. Chief Accounts Officer

- Support CIC for preliminary estimate of the finance requirement for operations. Approve and avail the fund throughout operational period.
- Remain available at ECC for the emergency financial approvals and disbursements throughout the operational period collecting and recording the relevant supporting documents toward effecting payment directly/reimbursements.
- Support SIC on aspects of financial control of operations, after Closure of operation, Assume the charge of financial closure of operation with proceeding for the various claims/reimbursements/disbursements etc. until it is realized in Level 3 or multiple state exigencies.

4.4.5.7. Dy Dir. /Asst. Dir (Marine – Mech) / Civil/Traffic/ Senior Hydrographers

- Extend technical assistance on vessel related, channel related and cargo related aspects by the area of expertise and support Chief Engineer / Hydrographic chief to take decision / advice the operational team of RO.
- Support Chief Engineer / Hydrographic Chief with specific input on vessel related aspects, active coordination with CIC of RO, visit the site of incident if warranted and support the respective heads in communication, advocacy etc.
- Act as representative of HQ at site, as per the direction of Chief Engineer / Hydrographic Chief and assist CIC of RO to connect to IMT of HQ and support response operation coordination between the RO and HQ.

4.5.6. Manpower Allocation for IMT - Training and Capacity Building Requirements

A total of 17 persons has been identified for IMT with responsibility allocation specific to the skill related with the present operation. The persons identified in IMT shall be given basic as well as specific training to handle the emergency situation. The training requirement identified in the Contingency planning phase is presented in **Table 4.9**.

Table 4.9. Training and Capacity Building Activities for IMT Personals

Sl. No	Training Module	Type of Training	Duration & Frequency	Targeted Audience	No of Persons
A.	Basic Training				
1.	IWT related risks in Terminals and Channels, Cargo Properties, Response Operation , Personal Safety, Incident Reporting, Incident Management Team, Responsibility allocation	Class room training followed by Table top exercise	Two 3 hr session- Annually	All members of IMT	16
B.	Specific Skill Development Training				
1.	Strategic Decision Making in IWT Emergencies - Equivalent to IMO Level 3 Course.	Chairman, Vice Chairman, Member (Cargo), Member (Technical), Member (Finance)	3 hr - Annually		5

Sl. No	Training Module	Type of Training	Duration & Frequency	Targeted Audience	No of Persons
2.	Module I - Emergency Coordination, Managing ECC, Documentation and Statutory reporting - Equivalent to IMO Level 2 Course.	Classroom Interactive Session	3 hr - Annually	CAO, Hydro. Chief and Chief Engineer	3
3.	Module II - Management of ECC, Coordination and Communication in Emergency Situations, Travel, Logistic Arrangements, DM Documentation - Progress reports, evidences, claims, reimbursements/disbursements/financial closure.	Classroom Interactive Session	3 hr - Annually	In Charge - Admin & Est.	1
4.	Module III - Emergency Operation Coordination and Communication. DM Documentation - Progress reports, evidences, claims, reimbursements/disbursements/financial closure.			Director (Marine – Mech), Civil and Cargo. Documentation Team - Middle Level Officers of IWAI	7

4.5.7. Conducting Mock drill

Mock drills shall be conducted at least once in every six months internally and a record shall be maintained of its conduct including the personnel participated, resources mobilized, etc. based on the experienced earned during mock drill, the disaster management plan shall be suitably updated. IMT of IWAI – HQ shall actively participate in the mock drills organized by NDMA / NCMC.

4.5.8. Emergency Response Facilities to be availed at ECC of IWAI - HO

ECC shall be equipped with all equipment, communication and coordination facilities to act on emergency.

- Maps and display charts and diagrams showing buildings, roads, underground fire mains, important hazardous material and process lines, drainage trenches, and utilities such as steam, water, natural gas and electricity.
- Electronic Navigational Chart (ENC) along with map of hotspots preferably superimposed on ENC and a copy of risk assessment and DMP report.
- A copy of the relevant Disaster Management Plan.
- Situation boards (continuously updated to present a summary of the current situation and response actions being taken).
- Sufficient telephone lines to enable full liaison with outside bodies.
- Names, addresses, and telephone numbers of employees, off-site groups and organizations that might have to be contacted; all telephone lists being reviewed for accuracy on a scheduled basis and updated, as necessary.
- Dedicated and reliable communication equipment; enough telephones and at least one fax line to serve the organization for calls both on and off-the-site.
- Fixed and portable two-way radio equipment to keep in contact with activities on-scene and to maintain continuity of communications when other means fail.
- Plan board, logbook, voice recorder, television, DVD and Video facilities for playing back records from aircraft and helicopters, as well as monitoring media coverage of the incident with a person assigned to record pertinent information and to assist in investigating cases, evaluating performance and preparing reports.
- Emergency lights so that operations can continue in the event of power failure.
- Photocopy, fax and e-mail facilities.
- Dedicated computers with LAN/ internet facility to access the installation data and the latest and updated soft copies of all standard operating procedure (SOP) etc.
- Wireless Internet Facility.
- Video Conferencing Facility to have face to face communication/meetings between the stake holders.

4.6. Block Cost Estimate for Developing Facilities within IWAI

4.6.1. Cargo Handling Terminals of IWAI

Block cost estimate for setting up of facilities for IWAI terminal in case of oil handling (Furnace Oil handling) i.e. equivalent to category B of NOS-DCP and no oil handling i.e. equivalent to Category D has been worked out. The cost towards setting up of ECC with

provision for video conferencing facility, WIFI, LAN and Computers, Telephone Line, Printer, FAX Machine, Copier and Miscellaneous has also been arrived at. The total cost works out to **Rs 6.66 Cr for an oil handling terminal** and **Rs. 1.49 Cr for non-oil handling terminal** as presented in **Table 4.10** and **Table 4.11**.

Table 4.10. Block Cost Estimate for Emergency Facilities at Oil Handling Terminals

SI No.	Description	Quantity	Amount (Rs.)	
1	Fence boom (Material : Neoprene/rubber/Neoprene rubber/ PU/ PV) - (m)	500	99,54,250.00	
2	Skimmer (20TPH 50% weir type, 50% Brush type) - (No)	4	1,10,32,666.00	
3	OSD Applicant or with Spray arms type along with 02 Nozzles system and 02 hand lancers (No)	3	49,54,500.00	
4	Oil Spill Dispersant (Chemical Dispersant) (litres)	2000	1,80,000.00	
5	Bio-remediation (litres)	1000	49,98,250.00	
6	Flex Barge 10 Tons (no.)	3	1,10,24,625.00	
7	River Boom 100 metres with power pack and accessories (no) or	3	39,42,550.00	
	Integrated containment cum recovery system with power pack and accessories (no)	1		
8	Sorbent boom size min. 5 inch Dia, min. length 5 feet (no)	200	1,94,600.00	
9	Sorbent Pads min. 20 inch x 20 inch (no.)	1000	69,750.00	
10	Shoreline cleanup	Mini Vacuum pumps capacity 25m ³	2	36,89,400.00
11	Equipment	Portable Oil temporary storage facility capacity 10 m ³	3	9,99,,600.00
12	VOC Portable Monitor	3	12,90,375.00	
13	200 metres Shoreline sealing boom with power pack and accessories (material: Neoprene/rubber/Neoprene rubber) (no)	2	88,18,333.33	
14	Level A protection: Positive pressure full face-piece self-contained breathing apparatus (SCBA) or positive pressure supplied air respirator with escape SCBA; Totally encapsulated chemical and vapor protective suit; Inner and outer chemical resistant gloves; and Disposable protective suit, gloves, and boots.	3	4,54,224.00	
15	Level B protection: Positive pressure full face-piece self-contained breathing apparatus (SCBA) or positive pressure supplied air respirator with escape SCBA; Inner and outer chemical-resistant gloves; Face shield;	6	9,09,960.00	

SI No.	Description	Quantity	Amount (Rs.)
	Hooded chemical resistant clothing; Coveralls; and Outer chemical-resistant boots.		
16	Level C protection: Full-face air purifying respirators; Inner and outer chemical-resistant gloves; Hard hat; Escape mask; and Disposable chemical-resistant outer boots.	10	3,30,400.00
17	Level D protection : Gloves; coveralls; safety glasses; Face shield; and Chemical resistant, steel-toe boots or shoes.	20	1,72,400.00
18	FAST ACT (First Applied Sorbent Treatment against Chemical Threats) Neutralization agent-4kg Cylinder	5	4,87,215.00
19	Portable Inflatable Emergency Lighting System	5	8,31,600.00
20	High Pressure Water Mist & CAFS(10L)	1	2,79,530.00
21	Facilities for ECC - ECC with provision for video conferencing facility, WIFI, LAN and Computers, Telephone Line, Printer, FAX Machine, Copier and Miscellaneous	LS	20,00,000.00
Block Cost for Each Oil Handling Terminal			6,66,14,228.33
Total Cost for 3 Multi Modal Terminal			19,98,42,685.00
Rounded as Rs 20 Cr			
Note: Cost is Inclusive of all taxes and Duties Except GST			

Table 4.11. Block Cost Estimate for Emergency Facilities at Non-Oil Handling Terminals

Sl.No.	Description	Quantity	Amount (Rs.)
1	Fence boom (Material : Neoprene/rubber/Neoprene rubber/ PU/ PV) - (m)	200	39,81,700.00
2	Bio-remediation (litres)	1000	49,98,250.00
3	Sorbent boom size min. 5 inch Dia, min. length 5 feet (no.)	500	4,86,500.00
4	Sorbent Pads min. 20 inch x 20 inch (no.)	2000	1,39,500.00
5	VOC Portable Monitor	2	8,60,250.00
6	Full-face air purifying respirators; Inner and outer chemical-resistant gloves; Hard hat; Escape mask; and Disposable chemical-resistant outer boots.	20	6,60,800.00
7	Gloves; coveralls; safety glasses; Face shield; and Chemical resistant, steel-toe boots or shoes.	30	2,58,600.00
8	FAST ACT (First Applied Sorbent Treatment against Chemical Threats) Neutralization agent-4kg Cylinder	5	4,87,215.00
9	Portable Inflatable Emergency Lighting System	5	8,31,600.00
10	High Pressure Water Mist & CAFS(10L)	1	2,79,530.00

Sl.No.	Description	Quantity	Amount (Rs.)
11	Facilities for ECC - ECC with provision for video conferencing facility, WIFI, LAN and Computers, Telephone Line, Printer, FAX Machine, Copier and Miscellaneous	LS	20,00,000.00
Block Cost for Each Non-Oil Handling Terminal			1,49,83,945.00
Total Cost for 3 Multi Modal Terminal			4,49,51,835.00
Rounded as Rs 4.5 Cr			
<i>Note: Cost is inclusive of all taxes and duties except GST</i>			

4.6.2. Regional Offices and Head Office of IWAI

RO and HO of IWAI shall be having a dedicated ECC facility to coordinate the response operations. The total cost estimate for setting up the facilities works out to **Rs.20 Lakhs each totaling to Rs. 60 Lakhs** as presented in **Table 4.12**.

Table 4.12. Block Cost Estimate for ECC Facilities at IWAI RO and IWAI HO

Sl.No	Facilities for ECC -	Amount (Rs.)
1.	Provision for video conferencing facility, WIFI, LAN and Computers, Telephone Line, Printer, FAX Machine, Copier and Miscellaneous	20,00,000.00
	Block Cost Estimate for IWAI - 2 Regional Offices, Head Office	60,00,000.00
Rupees Sixty Lakhs only		
<i>Note: Cost is inclusive of all taxes and duties except GST</i>		

4.4.9. Emergency Decision Making Process at IWAI

In case of facility level incidents, Head RO (IWAI) shall immediately convene a meeting at ECC – RO, assess the situation and Coordinator of Emergency Response Operation at RO through the supporting team of nearest sub unit of IWAI shall keep on availing the progress report from incident site and periodically update Head (RO).

In Level 1 or Level 2 operations, ECC shall be activated at RO – IWAI where the emergency coordination activities shall be initiated with respective DDMA/SDMAs. In Charge – Civil (SIC) with team at RO with support of the nearest sub unit of IWAI shall remain available at site of incident for coordination with the DDMA/SDMA as required. In Charge (Traffic) at RO shall connect with the In Charge – Civil for regular progress reporting and which shall periodically send to IWAI (HQ) by Head (RO) - CIC.

In case of Level 3 response operations or when the emergency requires interstate coordinated activities, ECC shall be activated at both RO and HQ and Chairman (IWAI) shall take over the responsibility of CIC with active coordination with the NDMA, NCMC as deemed necessary. All personals at the IMT shall be immediately taking over the responsibilities of active coordination and support CIC for executing his responsibility of coordination with NDMA or NCMC as deemed necessary. The team members of IMT at HQ, RO and Sub unit shall be operational under the overall guidance of CIC. CIC shall connect with NDMA /NCMC through Secretary (MoS) and the requirements from the site of incidents shall be submitted for essential top level intervention and support for effective response operation.

4.7. Deriving of Proposal for Integration of IWT Related Disasters in to DDMPs

The existing disaster management mechanism functional at each state was analysed in detail to understand its capability to handle the IWT related disasters within its jurisdictional limit. Proposal has been formulated for inclusion of IWT related disaster in to respective DDMPs of bordering districts in line with the SDMP of the respective State. The process involved in deriving proposal for integration of IWT related disaster is presented in **Figure 4.9**.

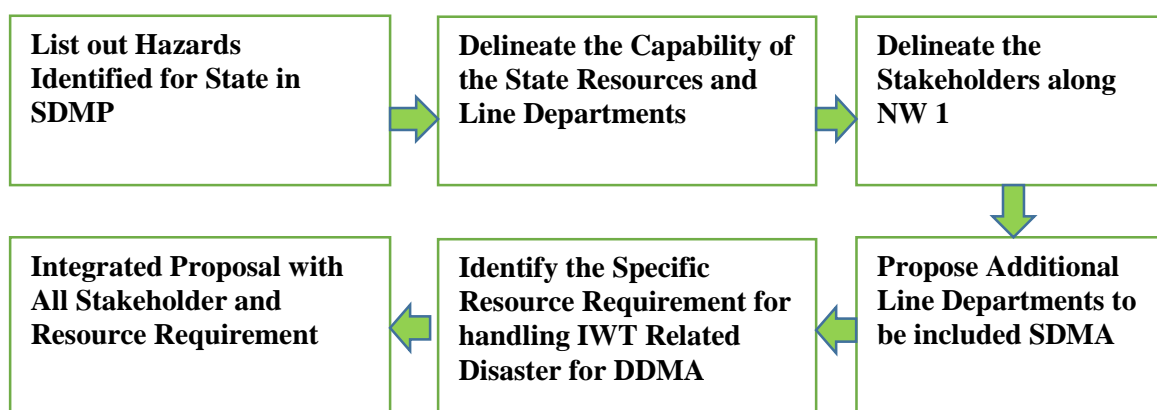


Figure 4.9. Process Involved in Integration of IWT Related Disasters to DDMPs

Considering that there are functional differences in DM structure operational in the States and the vulnerable resources of the project region are also diverse by nature, proposal has been formulated for individual States as presented below.

Considering the hazardous cargoes, response resource requirements and impact of disasters it is proposed that the following departments shall be included in the SDMAs for appropriate response.

- Department of Industries and Commerce – To support with technical resources on chemical characteristics and emergency handling persons, equipment and facilities.
- Chief Inspector of Factories and Boilers (CIF) – Regulatory authority in hazardous cargo handling.
- Department of Environment including specific representation from State/Central Pollution Control Board - CRZ authorities – Regulatory authority under Air and Water act, waste handling etc.
- Forest and Wildlife Department – Regulatory Authority in Protected Areas
- Fire and Emergency Services – Fire and Emergency support for IWT incidents
- Health and Family Welfare Department – Emergency medical support.
- Registered Vessel Owners – for handling water based emergency operations

The above departments shall be integrated in DM structure of all States to handle the requirements on IWT related incidents.

4.7.1. Integration of IWT Related Disasters in DDMA of Uttar Pradesh

State of Uttar Pradesh is a disaster prone State. The geo-climatic conditions and critical structures along the waterway of make it vulnerable to many hazards. As seen in **Section 2.3.1** and **2.3.2** of the salient features of NW1, the Prayagraj to Ballai stretch of NW 1 is falling in Uttar Pradesh for a total length of 472 km. NW 1 is bordering through 7 districts of the State – Prayagraj, Sant Ravidas Nagar, Mirzapur, Varanasi, Chandauli, Ghazipur and Ballai where DDMA are present.

State Disaster Management Authority (SDMA) has been constituted in Uttar Pradesh vide Notification in exercise of the powers conferred by sub section (1) of section 14 of DM Act, 2005. SDMA, headed by the Chief Minister as the Chairperson with 5 members from nodal departments, one member secretary and the Chief Secretary as the Chief Executive Officer.

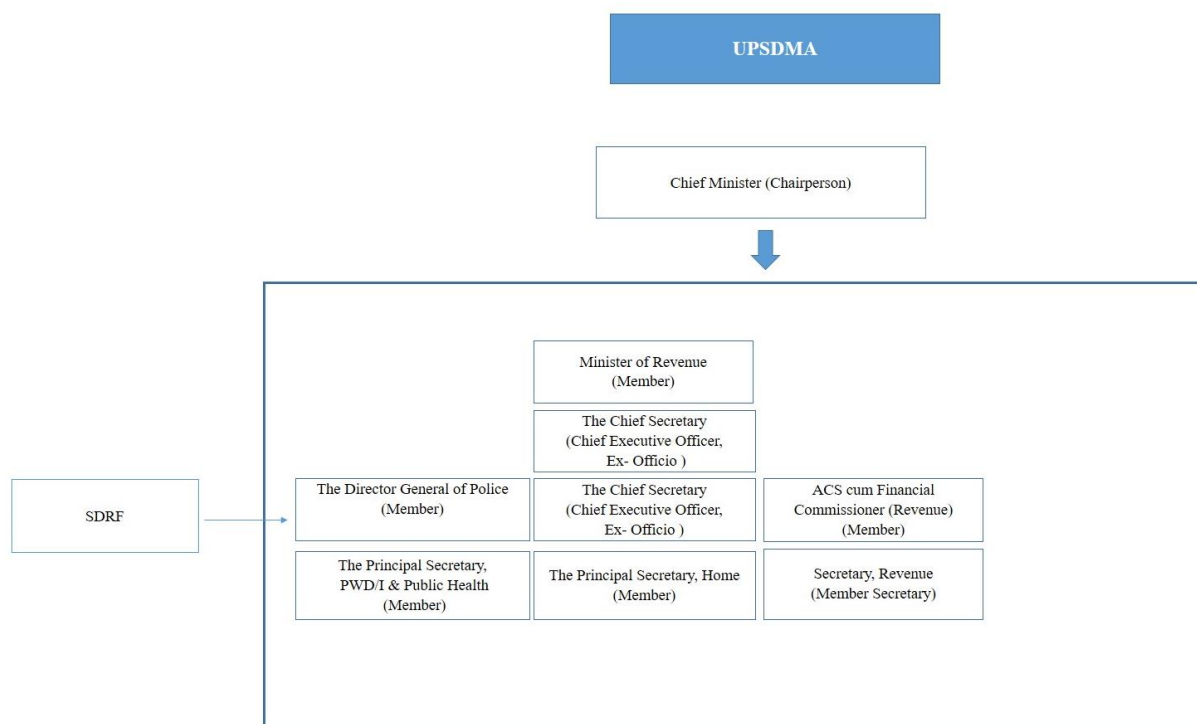


Figure 4.10. Uttar Pradesh State Disaster Management Authority

Powers and functions of State Authority are

- Promoting an integrated and coordinated system of disaster management including prevention or mitigation of disaster by the State, local authorities, stakeholders and communities.
- Collect/cause to be collected data on all aspects of disaster management and analyze it and further cause and conduct research and study relating to the potential effects of events that may result in disasters.
- Act as a repository of information concerning disaster management in the State. Lay down the policies and plans for disaster management in the State.
- Promote or cause to be promoted awareness and preparedness and advice and train the community, and stakeholders with a view to increasing capacity of the community and stakeholders to deal with potential disasters.

-
- On the expiry of a disaster declaration, the Authority shall, where necessary, act as an agency for facilitating and coordinating rehabilitation and reconstruction activities by departments of the Government

The SDMA and DDMA functional at State is presented in **Table 4.13**.

Table 4.13. SDMA and DDMA for Bordering Districts in Uttar Pradesh

Uttar Pradesh Disaster Management Authority (UPDMA)										
Chief Minister (Chairman)	Minister of Revenue (Member)	The Chief Secretary (Chief Executive Officer, Ex- Officio)	The Director general of Police (Member)	ACS cum Financial Commissioner (revenue) (Member)	Secretary, Revenue (member Secretary)	The Principal Secretary. Home (Member)	The principal secretary, PWD/I & Public Health (Member)			
State Executive Committee (SEC)										
Not Defined		Not Defined		Not Defined		Not Defined		Not Defined		
State Nodal Department										
Nodal State Departments for Disaster Coordination										
Department of Home	Dept. of Urban Developmen t	Dept. of Irrigation	Dept. of Fire	Dept. of Agricultur e	Department of Revenue	Dept. of Animal husbandry	Departmen t of Industry	Dept. of Financ e	Departmen t of Science and Technolog y	
Department of, District Administratio n	Dept. of Environment and Forest	Jal Nigam	Irrigation and water sources	Dept. of Planning	Dept. of Rural Developmen t	Dept. of Information and public relations	Departmen t of Informatio n technology	Dept. of Ground Water	Departmen t of Medical health and Family Welfare	
Department of Education	Department of Housing	Dept. of Horticultur e	Panchayat i Raj	Local Bodies	UP Pollution control Board					
District Disaster Management Authority (DDMA)										
Allahabad	Chandauli	Sant.Ravidas Nagar	Mirzapur		Ghazipur	Varanasi		Ballia		

The Relief Commissioner Organisation/ UPSDMA of the state is the nodal department for controlling, monitoring and directing measures for organizing rescue, relief and rehabilitation. All other concerned line departments should extend full cooperation in all matters pertaining to the response management of the disaster whenever it occurs. The State EOC and other control rooms at the state level as well as district control rooms should be activated with full strength. The existing arrangements therefore will be strengthened by the Relief Commissioner through Emergency Operations Centers (EOC), both at State Level and at the district levels. The DM Act 2005 empowers Relief Commissioner to be the Incident Commander in the State and District Collector in the respective districts.

State Emergency Operations Centre will be the hub of activity in a disaster situation. The EOC, the key organizational structure, is flexible to expand when demands increase, and contract when the situation slows down. The primary function of an EOC is to implement the Disaster Management Action Plan which includes the following:

- Coordination
- Policy-making
- Operations management
- Information gathering and record keeping.
- Public information
- Resource management.

DDMA has been formed in all the districts of the state. Chairperson of this authority is the district magistrate and it is co- chaired by the Zila Panchayant Chairman. DDMA acts as the planning, coordinating and implementing body for DM at District level and take all necessary measures for the purposes of DM in accordance with the Guidelines laid down by the NDMA and SDMA Plan. The DDMA will also ensure that the Guidelines for prevention, mitigation, preparedness and response measures laid down by NDMA and SDMA are followed by all Departments of the State Government, at the District level and the Local Authorities in the District.

District Emergency Operation Centre located in the office of deputy commissioner shall discharge the following functions:

-
- On receipt of information from SEOC/SEC or from any field office or Panchayat or from any other reliable source, DEOC will bring this in the notice of DDMA.
 - DEOC shall issue necessary alerts to all authorities in the district or at state level depending on the situation.
 - DEOC will send regular status and appraisal reports to SEOC.
 - DEOC shall maintain all records.
 - DEOC shall collate and synthesise information for consideration of DDMA.

The disaster management structure of the state is presented in the flow chart below.

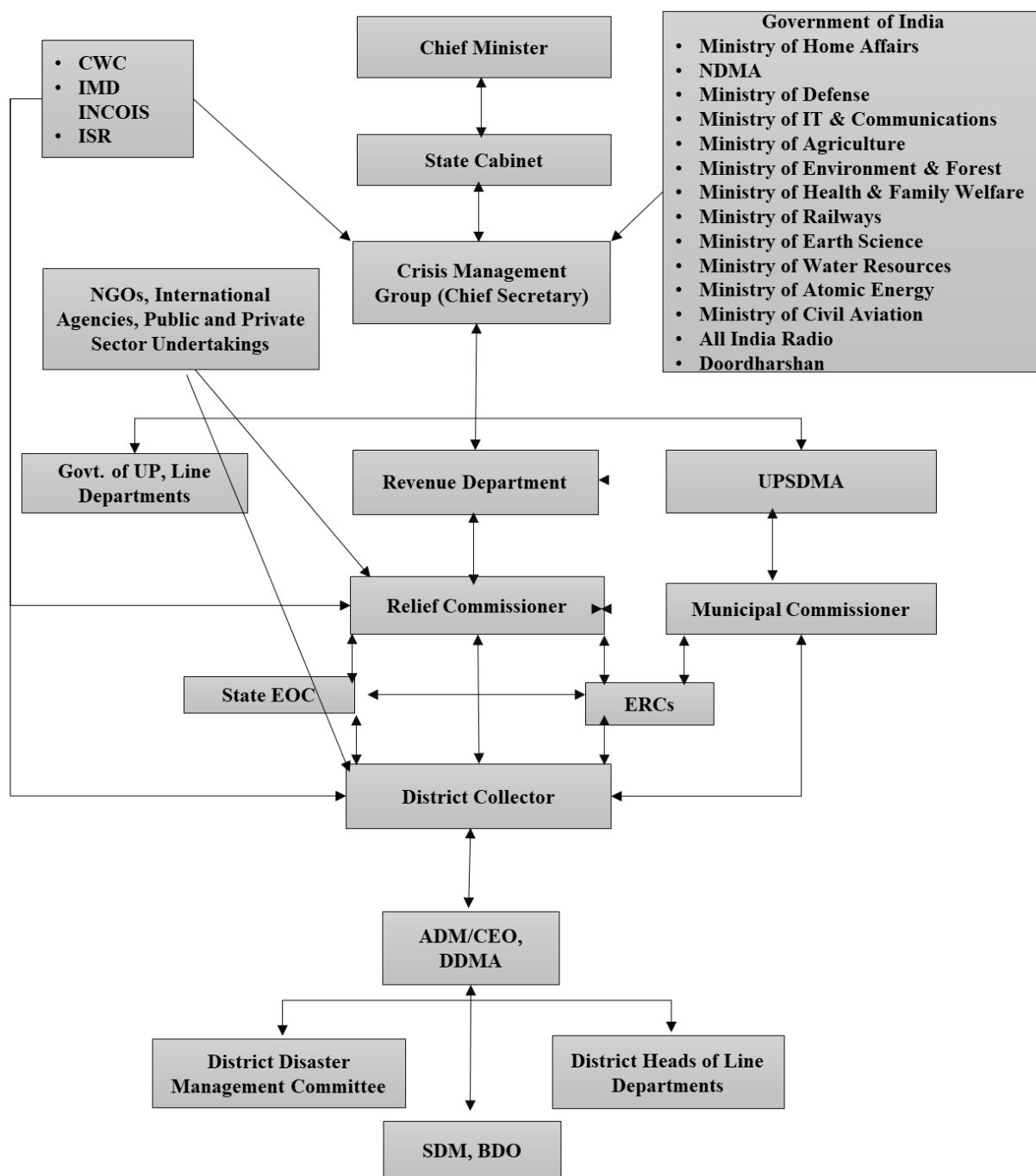


Figure 4.11. Uttar Pradesh Disaster Management Structure

Natural disasters that are of significance in Uttar Pradesh are – Floods, Droughts, Fires and Earthquakes. Loss of life and property from these disasters, especially the former three, are in terms of hundreds of Crores of rupees annually. UP is vulnerable from the aspect of man-made hazards too i.e. stampede, chemical, radiological and other hazards. The hazard threats in UP is classified and presented in **Table 4.14**.

Table 4.14. Vulnerability of State of Uttar Pradesh to Various Disasters

Classification Criteria	Disasters
Geological Disasters	Earthquakes
	Dam Bursts
	Dam Failures
Water & Climate Related Disasters	Floods
	Droughts
	Cloud burst
	Flash Floods
	Heat & Cold Waves
	Hailstorms
Chemical, Industrial & Nuclear Related Disasters	Chemical & Industrial Disasters,
	Forest Fires,
	Nuclear Disasters (Narora Power Plant)
Accident Related Disasters	Road
	Rail & Air Accidents
	Boat Capsizing,
	Major Building Collapse
	Bomb Blast
	Stampedes
	Rural & Urban Fires
Biological disasters	Biological Disasters
	Epidemics
	Cattle Epidemics
Other disasters	Other threatening events

Source:SDMP, 2016-2017

For the disasters identified, the DMP has designated nodal departments in the state with support agencies and departments for early warning systems. The same is presented in **Table 4.15**.

Table 4.15. Nodal Departments under State Disaster Management Authority

Sl No	Hazards specific	Nodal Departments	Supporting Agencies / Departments For Early Warning Systems
1	Earthquake	Dept. of Urban Development	IMD, Ministry of Earth sciences/Geological Survey of India, Remote Sensing Application Center, Dept. of Housing, Awas Bandhu, Health (Medical Care)
2	Floods/Flash Floods/Cloud Burst	Dept. of Irrigation	IMD,CWC, UP SDMA, Health (Medical Care & Epidemic Control)
3	Fire	Fire Department	IPH, Dept. of Health(Medical Care), Dept. of Home, UP SDMA,

Sl No	Hazards specific	Nodal Departments	Supporting Agencies / Departments For Early Warning Systems
4	Drought	Agriculture	IMD, Revenue, RD, DRDA, Horticulture, Ground water, Health (Medical Care & Epidemic Control)
5	Big/ Large Accidents	Department of Home	Transport, PWD, Health (Medical Care), District Administration
6	Boat capsizing	Department of Revenue	District DMA, Home, Health (Medical Care), Local Bodies
7	Stampede	Department of Home	Health (Medical Care)
8	Terrorism & Crisis events	Department of Home	Health (Medical Care), Fire
9	Industrial	Department of Industry	Labour, Home, Pollution Control Board, Health (Medical Care)
10	Chemical	Dept. of Environment	Industry/ Department Labour, Home, NDRF, Health (Medical Care)
11	Biological	Health (Medical Care)	Home, NDRF, Health (Medical Care)
12	Radiation	Environment and Science	Home, Health (Medical Care), Dept. of Science & Technology, NDRF,
13	Nuclear	Dept. of Environment, and Science & Tech.	Home, NDRF, Central Ministry of Atomic Energy and Defense, Health (Medical Care).
14	Wind Storms	Revenue	IMD, Agriculture and Horticulture, home, Health (Medical Care)
15	Extreme Cold	Department of Revenue, District Administration	IMD, Forest, Electricity, Health (Medical Care), Home
16	Dam / Reservoir Burst	Irrigation	PWD, Environment, Science and Technology, CWC and Administration, Health (Medical Care)
17	Communal Riots	Dept of Home	District Administration, Health (Medical Care), Fire
18	Epidemics	Dept. of Health & Family Welfare (In case of Human)/ Dept. o animal Husbandry (in case of Animals)	SDMA, DDMA, Local Bodies, panchayati Raj, Health (Medical Care)

The following agencies / departments have been identified as members for the emergency support functionaries to support various activities at the state level. They are as follows:-

- Communication -Department of IT
- Public Health and Sanitation - Department of health & family welfare
- Power-Department of power through UP State Electricity Board
- Transport-Department of Transport through UPSRTC
- Search and Rescue-Department of home through Police, Home Guard & Fire Brigade
- Donations, Relief supplies, Shelter- Department of Revenue
- Public works and Engineering-Department of public works, Irrigation & other engineering departments
- Information and Planning- Department of Information & Public relation
- Food-Department of Food & Civil Supplies
- Drinking water-Jal Nigam
- Media- Department of Information & public relations

State Disaster Response Force (SDRF) is operating under the Police Department under the Uttar Pradesh Provincial Armed Constabulary (PAC). There are 17 battalions earmarked as flood battalions. Three dedicated battalions of SDRF are being constituted under the home department.

From the review of existing DMP in the State of UP, it is concluded that:

- Boat capsizing is the only IWT related disaster considered in the DMP. Other IWT related disasters related with incremental cargo operation is to be added to the disasters list in the DMP.
- Department of Revenue is the Nodal department to handle boat capsizing. The same department shall act as nodal department in case of IWT related disasters within the State.

The activities along the NW 1 was studied and analysed for identifying the stakeholders and for each stakeholder, respective line departments were identified and the same is listed as **Table 4.16**.

Table 4.16. Vulnerable Users along NW 1 in Uttar Pradesh

Sl.No.	Vulnerable Users	Line Department/Agency
1	Ferry Jetties /any other non- commercial jetty	Local Bodies
2	Bank protection	Department of Irrigation
3	Water supply Intake	Jal Nigam
4	Fishing activities	Department of Fisheries
5	Rail Bridge	Ministry of Railway
6	Ferry services/Country Boats/Passenger vessels	Department of Transport
7	HT line/Overhead Tower lines	Uttar Pradesh Power Corporation Ltd. (UPPCL)
8	Agriculture activities/Transportation of agricultural goods/ Plantations	Department of Agriculture
9	Turtle Sanctuary	Department of Forest & Wild Life
10	Facilities at Tourism Jetty	Department Tourism
11	Survey Vessels, Cargo operations and IWT Operations, Maintenance of IWT jetties and terminals.	IWAI
12	Fishing vessels including fishing harbor	Fisheries Department
13	Road Bridge/ Pontoon Bridge	Public Works Department
14	Hospital	Department of Family and Healthcare
15	Human settlement & day to day activities – Bathing, Washing Cleaning, Burning Ghats, Crematorium	Department of Revenue and Relief.
16	Buffalo rearing	Department of Animal Husbandry
17	Sand mining	Department of Geology and Mining.

Considering the existing line departments which are already included in the DM Mechanism, it is understood that in order to protect the stake of the vulnerable resources of NW 1 the additional departments identified above shall be included as presented in **Figure 4.12**.

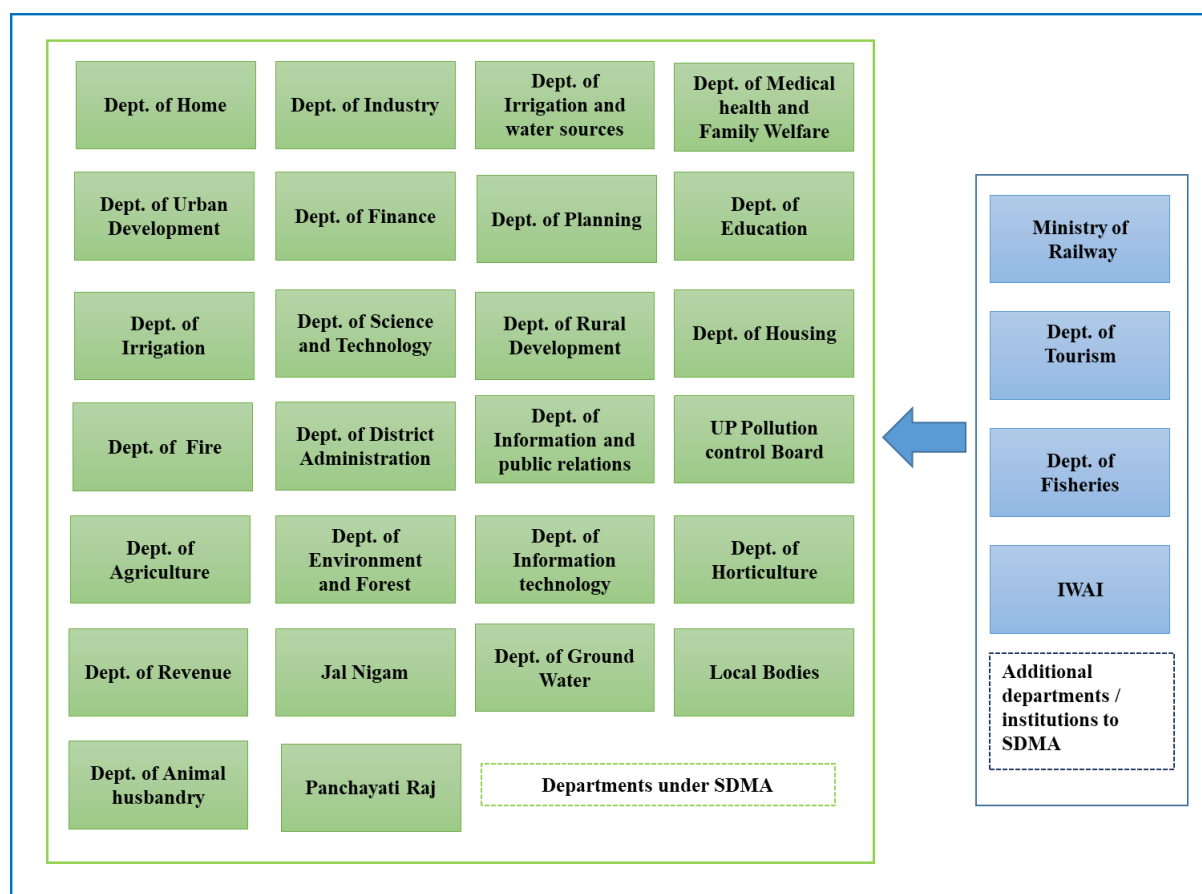


Figure 4.12. Existing and Proposed Departments and Agencies in SDMA

Note: Ministry of Railway and IWAI shall be acting as resource agencies and would not be part of DDMAAs.

4.7.2. Integration of IWT Related Disasters in DDMAAs of Bihar

The State of Bihar is a multi-disaster prone State. The geo-climatic conditions of Bihar make it vulnerable to many hazards. As seen in **Section 2.3.2, 2.3.3 and 2.3.4 of Salient features of NW1, the Buxar to Manihari stretch of NW 1 is falling in Bihar for a total length of 532 km.** NW 1 is bordering through 13 districts of the State - Kathihar, Purnea, Bhagalpur, Khagaria, Munger, Lakhii Sarai, Begusarai, Samastipur, Vaishali, Patna, Saran (Chappara), Bhojpur and Buxar.

Bihar State Disaster Management Authority (BSDMA) was set up vide notification No. 3449 on 6th November, 2007 under Section 14 (1) of the Disaster Management Act, 2005 passed by the Parliament. Government of Bihar, in compliance with the provisions of the Disaster Management Act 2005, has developed its State Disaster Management Plan (SDMP) through

Disaster Management Department, which has been approved by the State Cabinet in the year 2014.

BSDMA, the apex body in the disaster management system, is headed by Hon'ble Chief Minister of Bihar, a full time Vice Chairman (with Cabinet Minister Rank) and few experts as its Members (with Minister of State rank). BSDMA is undertaking a number of measures focused on Disaster Risk Reduction (DRR) and mitigation. Major divisions of BSDMA are;

- Natural Disaster
- Human Induced Disaster
- Human Resource Division , Capacity Building & Training
- Environment & Climate Change Adaptation
- Administration and Finance

Role and responsibilities of BSDMA are:-

- Lay down policies on disaster management.
- Approve the State Disaster Management Plan.
- Approve plans prepared by the Departments of the State Government in accordance with the State Disaster Management Plan.
- Lay down guidelines to be followed by the District Authorities in drawing up the District Disaster Management Plan.
- Lay down guidelines to be followed by the different State Departments for the Purpose of integrating the measures for prevention of disaster or the mitigation of it's effects in their development plans and projects.
- Coordinate the enforcement and implementation of the policy and plan for disaster management
- Recommend provision of funds for the purpose of mitigation.
- Take such other measures for the prevention of disaster, or the mitigation, or preparedness and capacity building for dealing with the threatening disaster situation or disaster as it may consider necessary.
- Lay down broad policies and guidelines for the functioning of the State Institute of Disaster Management.

The prime executive body for disaster management at the state level is State Executive Committee (SEC) headed by the Chief Secretary. The State Executive Committee shall function through Disaster Management Department (DMD) and other line departments. The organizational structure of BSDMA is presented in **Figure 4.13**.

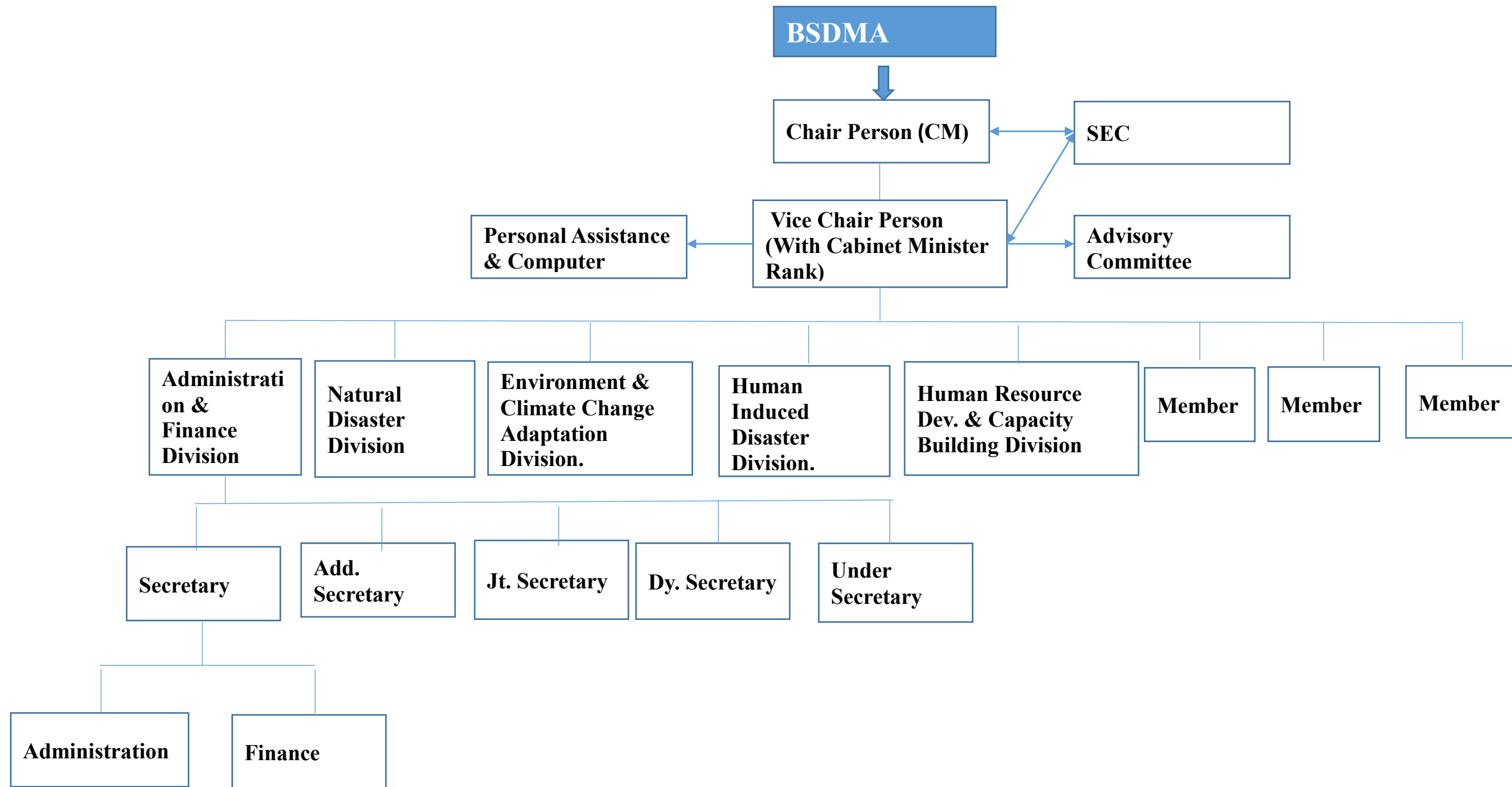


Figure 4.13. Organization Structure of Bihar State Disaster Management Authority

Out of 44 Govt. Depts. in the State, 26 departments play major role in the disaster management and have been included in the Plan. These departments are:

- Dept. of Disaster Management
- Dept. of Home
- Dept. of Water Resource
- Dept. of Minor Water Resources
- Dept. of Agriculture
- Dept. of Food & Consumer Protection
- Dept. of Panchayati Raj
- Dept. of Health
- Dept. of Education
- Dept. of Labour Resources
- Dept. of Public Health Engineering
- Dept. of Transport
- Dept. of Social Welfare/Backward Classes Welfare/SC & ST Welfare
- Dept. of Building Construction
- Dept. of Energy
- Dept. of Environment & Forest
- Dept. of Industries
- Dept. of Animal Husbandry
- Dept. of Finance
- Dept. of Road Construction
- Dept. of Rural Development
- Dept. of Urban Development
- Dept. of Cabinet Coordination (Civil Aviation)
- Dept. of Rural Works
- Dept. of Information and Public Relations
- Dept. of Planning & Development

Active integration of stakeholders have been planned with inclusion of multilateral agencies, corporate bodies and International and National level NGOs and Civil Societies. DDMA's are

present in various bordering districts and the combined institutional arrangement is presented in **Table 4.17**.

Table 4.17. SDMA and DDMA for Bordering Districts in Bihar

Bihar State Disaster Management Authority (BSDMA)													
Honourable Chief Minister (Chairperson)		Vice Chairman (with Cabinet Minister rank)		Few experts as its Members (with Minister of State rank).									
State Executive Committee (SEC) as Crisis Management Group (CMG)													
SEC is not defined in the State Disaster Management Plan of Bihar, however BSDMA have 5 divisions for working on Disaster Risk Reduction. Natural Disaster Human Induced Disaster Human Resource Division , Capacity Building & Training Environment & Climate Change Adaptation Administration and Finance													
State Nodal Department – Department of Disaster Management													
Nodal State Ministries/ Departments for Disaster Coordination													
Dept. of Disaster Management	Dept. of Home	Dept. of Water Resource	Dept. of Minor Water Resources	Dept. of Agriculture	Dept. of Food & Consumer Protection	Dept. of Panchayati Raj	Dept. of Health	Dept. of Education	Dept. of Labour Resources	Dept. of Public Health Engineering	Dept. of Transport	Dept. of Social Welfare/Backward Classes	Welfare/SC & ST Welfare
Dept. of Building Construction	Dept. of Energy	Dept. of Environment & Forest	Dept. of Industries	Dept. of Animal Husbandry	Dept. of Finance	Dept. of Road Construction	Dept. of Rural Development	Dept. of Urban Development	Dept. of Cabinet Coordination (Civil Aviation)	Dept. of Rural Works	Dept. of Information and Public Relations	Dept. of Planning & Development	
District Disaster Management Authority (DDMA)													

District Disaster Management Plan for districts of Bihar is under preparation.

Emergency Operation Center (EOC) is an essential part of disaster management system. EOCs are present in State level (SEOC), District level (DEOC) and Field level. The State Emergency Operation Centre (SEOC) shall operate on round the clock basis and be the Command Centre during disaster response period. It shall function as the data collection, programme monitoring and response providing centre for Disaster Management Department and cautioning and warning centre for the people at large. As a control room, SEOC shall be the seat of Incident Command for which it shall be suitably equipped and manned. As a monitoring cell, SEOC shall be an exchange of data collection, processing and dissemination. The Emergency Support Groups would be located in the SEOC and perform their functions under overall command and control of SEOC.

A shadow SEOC shall be located in the State Police Headquarter building which is being constructed in Patna. If the SEOC becomes dysfunctional, the shadow centre shall also function as SEOC for providing material support for relief and rehabilitation.

For the effective disaster management, BSDMA shall have the support of Bihar State Institute of Disaster Management (SIDM) for providing inputs to formulate guidelines on prevention, mitigation, preparedness, and research and development on vulnerability management related issues. The main objectives of BSIDM shall be:

- Hazard mapping and vulnerability studies.
- Strengthening of information technology for Natural Disaster Management.
- Monitoring and impact assessment of natural hazards.
- Human Resource Development mainly by imparting training.
- Early Warning System.

The Bihar State Govt. also constituted State Disaster Response Force (SDRF) as part of the disaster management. SDRF is hazard specific, i.e. separate force for Earthquake, Flood, Fire, Drought and Cyclonic Storm. SDRF, in association with NDRF, shall also prepare Civil Defence, Home Guard, Fire Brigade, Police, BMP and local youth in disaster response. They shall be trained to equip Gram Panchayat and communities with necessary skill of self-help which is the first help one is forced to bank upon at the time of disaster.

The District Disaster Management Authority (DDMA) consisting of District Magistrate as Chairman & 'Adhyaksa,' Zila Parisad as Co-Chairman shall be over all in-charge of response

to L1 level incident. It shall be an extended arm of Department of Disaster Management during responses to L2 & L3 level incidents. Since the Urban Local Bodies will play an equally important role, it is envisaged to make the Mayor/Chairman of the municipal bodies also as co-chairman of the Authority. DDMA shall associate Local Bodies and Local Voluntary Organizations both in mitigation and preparedness as well as in incident management.

Bihar is one of the most disaster prone States of the country. Floods, droughts, earthquakes, heat/cold waves, river erosions, fire incidence etc. are various forms of disasters prevalent in the state. Among natural disasters, flood is the most common and a regular annual phenomenon in Bihar resulting in enormous loss of life and property. In addition to floods, the seismic vulnerability of the State is another frequent disaster. (*Source: Disaster Management Plan 2015-16*)

From the review of existing DM system functional in the State of Bihar, it is to be concluded that

- Since, inland water transport related disasters are not listed in the disasters identified, with proposed incremental cargo operation, it is to be added in the disasters list in SDMP.
- The Secretary, Department of Transport is already part of SDMA. He could be represented for handling the IWT related disasters. The same department shall act as nodal department in case of IWT related disasters within the State.

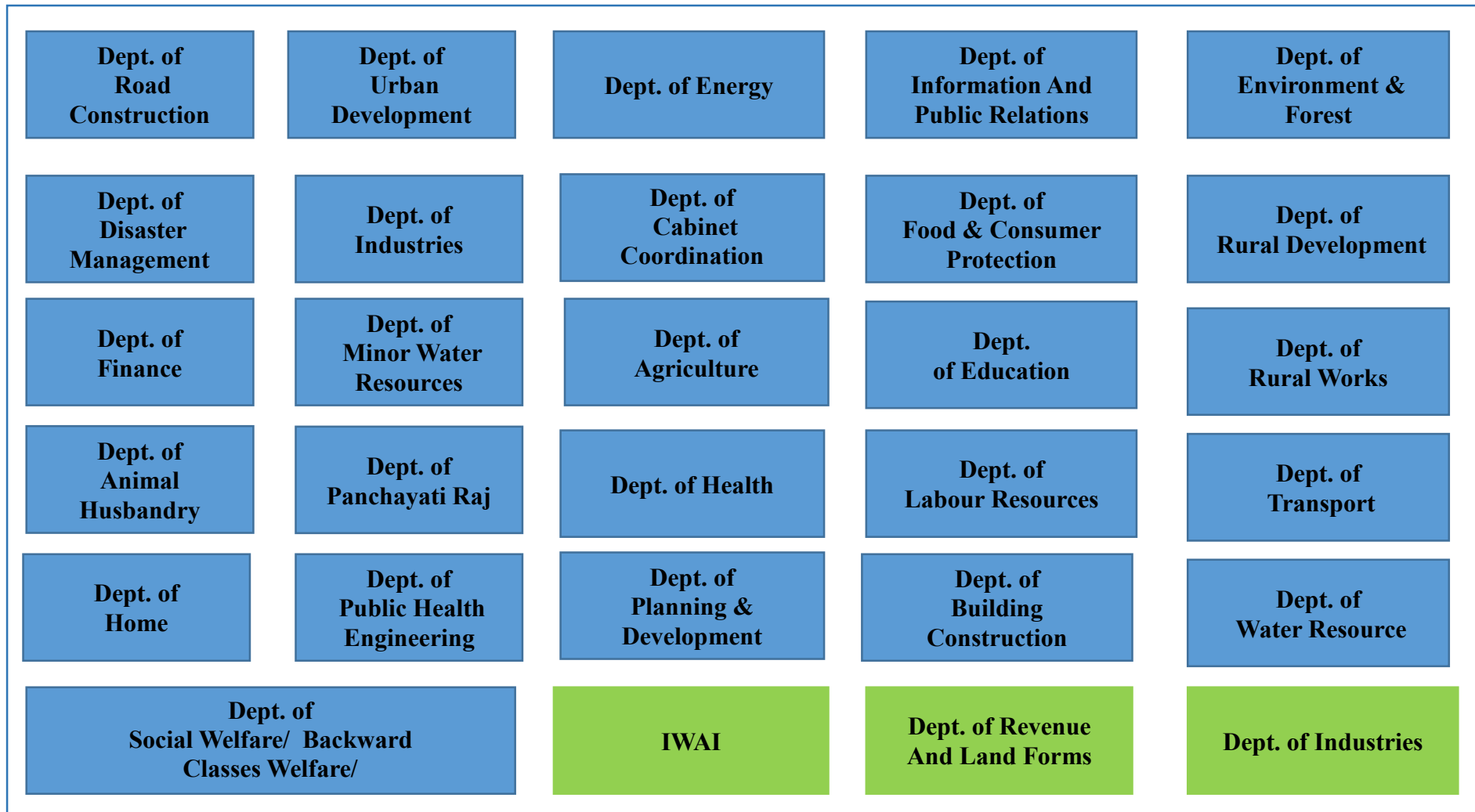
To integrate the proposal of IWT related risk to SDMP, the activities identified during the literature review and reconnaissance visit were analyzed towards identifying the vulnerable users. The State government operational profile was reviewed in detail to understand the line departments functional having responsibility over the resources which may be affected due to any incident. The vulnerable users of NW 1 in State of Bihar and the line departments are concluded in **Table 4.18**.

Table 4.18. Vulnerable Users along NW 1 in the State of Bihar

Sl. No	Users along NW1	Departments identified
1.	IWAI floating jetty	IWAI
2.	Water Supply (WS) intake	Dept. of Public Health Engineering
3.	Ghats, Rural and Urban settlements Pilgrim centre	Dept. of Revenue and Land forms & Dept. of Panchayati Raj

Sl. No	Users along NW1	Departments identified
4.	Road Cum Railway Bridge	Dept. of Road Construction & Ministry of railway
5.	Transportation through country boats including ferry crossing Passenger and Ro –Ro facilities Passenger boats Floating navigation lights	Dept. of Transport
6.	Agriculture fields	Dept. of Agriculture
7.	Gangetic Dolphin Sanctuary, Important Bird Areas	Dept. of Environment & Forest
8.	Fishing activities in country boats /with cage culture/Net Fishing	The Department of Animal Husbandry and Fisheries
9.	Road Bridge	Dept. of Road Construction
10.	Bank Protection	Dept. of Water Resource
11.	Bhagalpur College of Engineering	Dept. of Education
12.	Water supply scheme	Dept. of Public Health Engineering
13.	H T lines	Dept. of Energy

Considering the existing line departments which are already included in the DM Mechanism of State of Bihar, it is understood only very few departments has to be additionally added in the DM mechanism as presented in **Figure 4.14**.



 Additional Stakeholders

Note: IWAI is a central government Institutions and would act as resource agencies and would not be a permanent representative in DDMA.

Figure 4.14. Existing and Proposed Departments and Agencies in SDMA

The key role to be played by the line departments for managing any incidents are presented in **Table 4.19.**

Table 4.19. Key Role to be Played by Additional Stakeholders during IWT Related Disaster

SI No	Additional Stakeholders Identified	Role of Additional Stakeholders
1	Dept. of Industries	Extend support for response operation in coordination with the Industrial units in terms of Cargo related aspects as experts, rescue operational team, resources
2	Dept. of Revenue and Land Forms	Warning people living on banks of NW 1 during disaster- people engaged in cleaning, cremation, cattle rearing, agricultural activities etc.
3	IWAI	Response Coordination with availing the vessels / facilities available and coordination with DDMA and core responsibility in coordinating the cargo /vessel securing efforts of owner.

4.7.3. Integration of IWT Related Disasters in DDMA of Jharkhand

Jharkhand is a State in eastern India, carved out of the southern part of Bihar. The state shares its border with the States of Bihar to the north, Uttar Pradesh to the northwest, Chhattisgarh to the west, Odisha to the south and West Bengal to the east. The NW 1 passes through one district of Jharkhand – Sahibganj.

Jharkhand State Disaster Management Authority (JSDMA) has been constituted vide Notification # 425, dated 28 May, 2010 in exercise of the powers conferred by sub section (1) of section 14 of DM Act 2005 (Act no. 53 of 2005) by His Excellency, Governor of Jharkhand. The JSDMA has two distinct objectives viz.

- Development and updating of Plans and Strategies to handle any type of disaster at various levels
- Undertake projects for restoration and strengthening of infrastructure damaged by disasters.

JSDMA is mandated to develop disaster preparedness plans for the State to meet any eventuality arising out of all kinds of disasters such as cyclone, flood, drought, chemical explosion, etc.

SDMA headed by Chief Minister as the Chairperson and Minister-in-Charge, Department of Disaster Management as Vice Chairperson with 7 members from Nodal Departments and Chief Secretary as Chief Operating Officer. The State Authority is responsible for:

- Development of Multi-hazard response plan
- Establish and maintain a failsafe communication network interconnecting the State, district, block and GP Headquarters for dissemination and collection of information relating to disaster management.
- Institutional capacity building
- Capacity building of the communities and Community Based Organisations to handle emergencies
- Preparation of Geographic Information System (GIS) for disaster mitigation and development planning.
- Design and development of training programme for decision makers, elected representatives and the Civil Society groups.
- Coordination of NGO efforts

State Executive Committee (SEC) is proactively strategizing and functioning for the disaster management of the State. State Steering Committee has also been formed at the department level to govern the Govt. of India and UNDP sponsored disaster risk reduction program in the state.

SEC is headed by Chief Secretary as Chair person and Secretary to Disaster Management Department as member secretary and three members - Principal Secretary to Health department, Principal Secretary to Home department and Secretary to Finance department. Emergency Operation Centre (EOC) will act as nerve centre for coordination and management of disasters of all kind and magnitude. EOC will be a central command and control facility provider, responsible for carrying out the principles of disaster preparedness, response and management functions at a strategic level in emergency situation in their notified area. The present structure of SDMA and DDMA of Sahibganj in Jharkhand is presented in **Table 4.20**.

Table 4.20. Structure of SDMA, Jharkhand and DDMA, Sahibganj

Jharkhand Disaster Management Authority (JDMA)								
Chief Minister-Chairperson	Minister in charge Disaster Management Department-Vice president	Chief Minister) Home Affairs Department - (Member)	Minister in charge – Finance- (Member)	Minister in charge – Department of Health, Education, Family Welfare- (Member)	Minister in charge – Agriculture and Sugarcane Development Department- (Member)	Minister in charge – Water Resources- (Member)	Minister in charge – Road Construction- (Member)	Chief Secretary- Chief Operating Officer
State Executive Committee (SEC) as Crisis Management Group (CMG)								
Chief Secretary - Chairperson		Principal Secretary to Health Department - Member	Principal Secretary to Home Department - Member		Secretary to Finance Department - Member	Secretary to Disaster Management Department - Member Secretary		
State Nodal Department – Department of Disaster Management								
Nodal State Ministries/ Departments for Disaster Coordination								
Department of Disaster Management	Department of Home	Department of Health	Department of Agriculture	Department of Irrigation & Flood Control	Department of Urban Development	Department of Building construction	Department of Transport & Civil Aviation	
Department of Energy	Department of Road Construction	Department of Finance	Municipal Corporation of Ranchi & Dhanbad	Bomb Disposal Squad	BSNL	Department of Food and Civil Supply	Department of Drinking Water & Sanitation	
District Disaster Management Authority (DDMA)								
Sahibganj District								

Source: A draft on Jharkhand State Disaster Management Plan 2011, Prepared by Disaster Management Department

Disaster Management Department proposes comprehensive training program to build the capacity of functionaries of all the line departments at State, District and Block level to integrate and mainstream disaster management into development planning and programmes. Department proposes Knowledge cum Demonstration centers to be created for making aware the community and the common people about various types of probable disasters and their vulnerability to that, through technologies and tools and various ways to mitigate and cope up with the incumbent disaster.

An Incident Site Operation Centre (SOC) is also proposed as a complimentary unit to EOC, especially during disasters, which will operate close to the disaster site and will be linked directly with the State and District Emergency Operations Centre. The concerned Additional Collectors at District as Nodal Officer and CEO of DDMA will be the nodal officer from the district administration at this Centre. In the event of a serious disaster, the Chief Secretary will have sole right to appoint senior officers of any State Government Department, posted in the district as 'Field Relief Managers' for monitoring and co-ordinating the relief operations in the affected area.

The Chief Secretary is the official Incident Response Team Leader to activate the response system and to control and coordinate the resources required at the site of disaster. The Deputy Commissioner is the official Incident Response Team Leader to activate the command system and to control and coordinate the resources required at the site of disaster.

At the District level, DDMA's will act as the planning, coordinating and implementing body for DM and will take all measures for the purposes of DM in the respective Districts in accordance with the Guidelines laid down by NDMA and the concerned SDMA. Each DDMA is headed by the respective District Magistrate, District Collector (DC), Dy. Commissioner as the case may be with the elected representative of the Local Authority as the Co-Chairperson. DDMA will act as the planning, coordinating and implementing body for DM at District level and take all necessary measures for the purposes of DM in accordance with the guidelines laid down by the NDMA and SDMA.

Emergency Support Functionaries (ESFs) are identified for the state to be activated during a disaster. The list of function, nodal agency/officers and supporting agencies are listed in the **Table 4.21**.

Table 4.21. ESFs to be Activated during a Disaster in Jharkhand

ESFs	Function	Nodal Agency/ Officer	Supporting Agencies
ESF 1	Communication	BSNL	Private telecom service operators, mobile phone services operators
ESF 2	Evacuation	Department of Home	Jharkhand Police Force, Delhi fire Service, Directorate of Health Service and Civil Defence etc.
ESF 3	Search and Rescue	Jharkhand Fire Service	Department of Home, Jharkhand Police, Civil Defence and Directorate of Health Services..
ESF 4	Law & Order	Department of Home	
ESF 5	Medical Response and Trauma Counseling	State Health Department	CATS, MCD, DGHS (Central Govt), Indian Red Cross, Civil Defence, Delhi Fire Service
ESF 6	Water Supply	Drinking Water & Sanitation Department	MCs, CGWC, CWC, Irrigation and Flood Control.
ESF 7	Relief (Food and Shelter)	Department of Food and Civil Supplies	Department of Revenue, Urban Development, MCs, DWSD,
ESF 8	Equipment support, debris and road clearance	Department of Home	DWSD, Building department , MCs, Cant Board, Military Engineering Services
ESF 9	Help lines, warning dissemination	Department of Disaster Management	Department of Information and Publicity, BSNL, AIR, Doordarshan, UNI, Press Information Bureau, Press Trust of India, PTI
ESF 10	Electricity	Secy. Power	PTPC,DVC , NTPC JSEB
ESF 11	Transport	Secy. Transport	JTDC, Eastern railways, MCs, Civil Aviation, DWSD and Civil Defenceetc.
ESF 12	Bomb Disposal	Jharkhand Police	Bomb Squad, Dog Squad, Anti- Terrorist Squad, NSG

All ESFs have to assist the Incident Commander, i.e. Chief Secretary at state level and Deputy Commissioner (S) at District level. A detailed organisational setup of all ESFs and team leaders at state and district level has been given below.

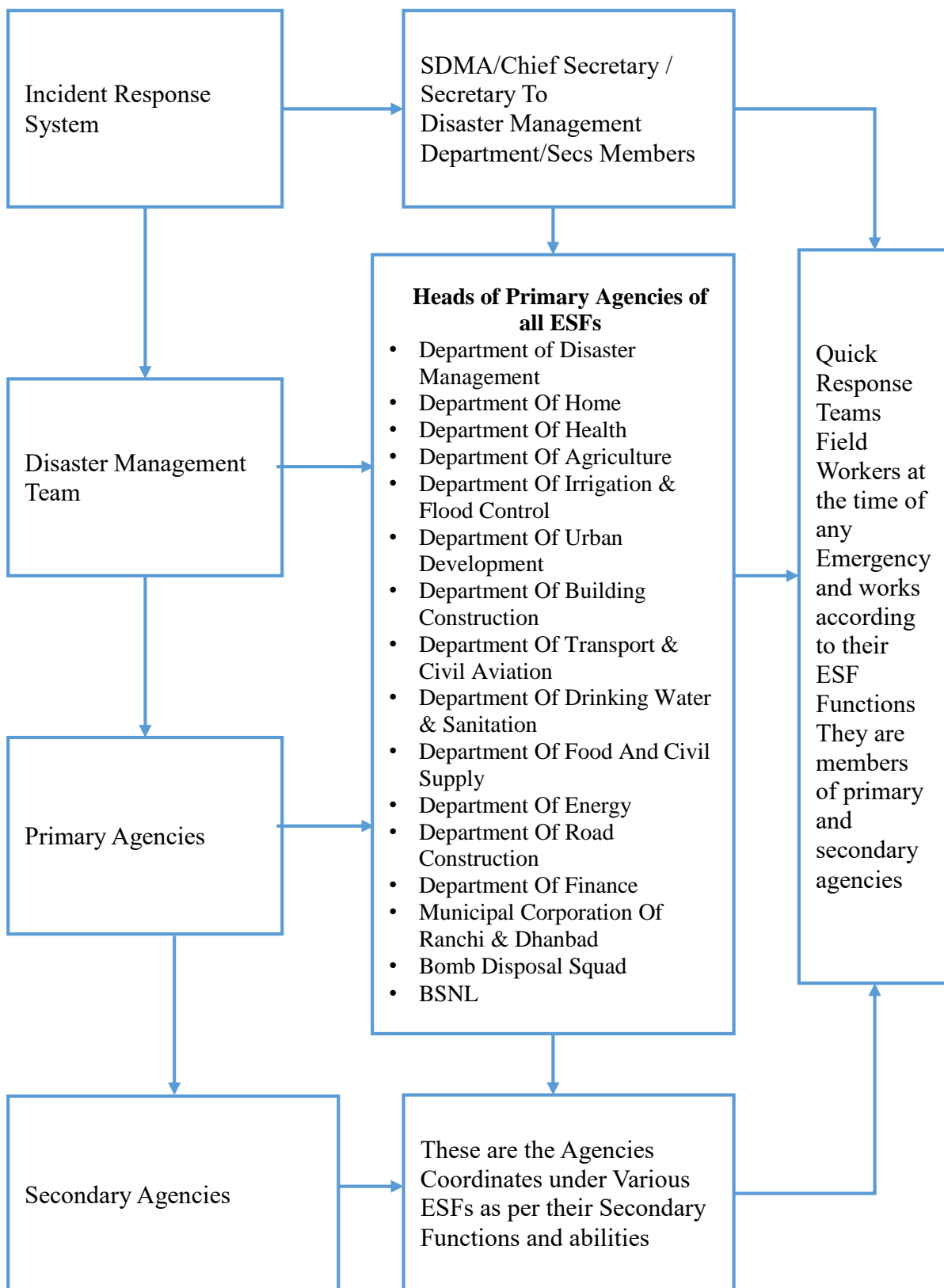


Figure 4.15. Organizational Set-up of the ESF at State Level

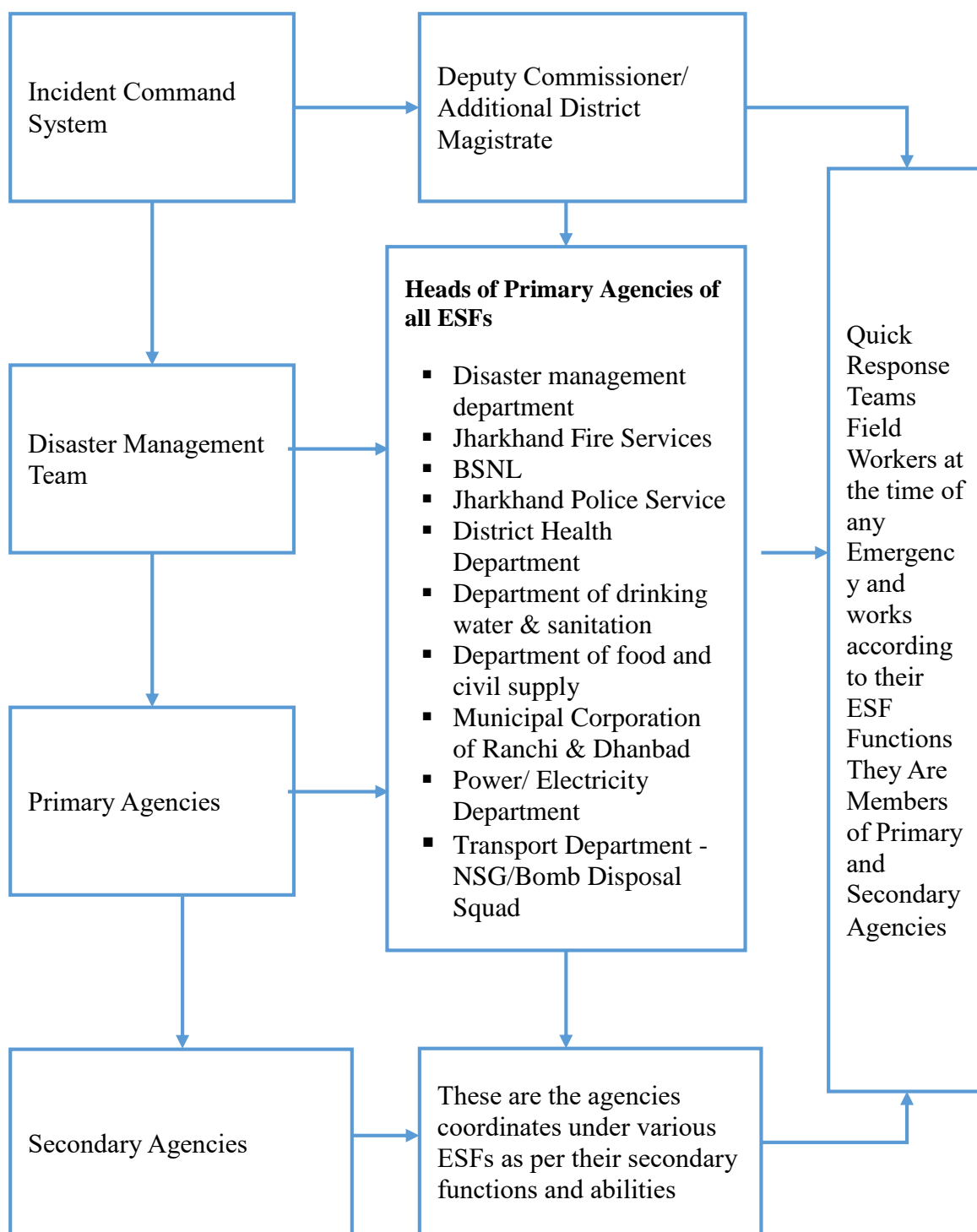


Figure 4.16. Organisational Set-Up of the ESF at District Level

Almost all the 24 districts in Jharkhand are affected by different kind of Disaster. The major disasters identified in the State are presented below.

Table 4.22. Disasters Identified in the State of Jharkhand

SI No	Disasters
1.	Drought
2.	Mining Accidents

Sl No	Disasters
3.	Chemical and Industrial Hazards
4.	Lightning
5.	Bird Flu
6.	Flood
7.	Earthquake
8.	Fire / Forest Fire
9.	Elephant Attacks
10.	Climate Change
11.	Biodiversity loss
12.	Naxalism/ Landmine Blasts

From the review of existing DM system functional in the State of Jhrkhand, it is to be concluded that

- Since, inland water transport related disasters are not listed in the disasters identified, with proposed incremental cargo operation, it is to be added in the disasters list in SDMP.
- The Secretary, Department of Transport is already designated as one of the ESF in the SDMA. Hence, the department can be represented for handling the IWT related disasters. The same department shall act as nodal department in case of IWT related disasters within the State.

To integrate the IWT related risk to DDMP, the activities identified during the reconnaissance visit were analysed towards identifying the vulnerable stakeholders. The State government operational profile was reviewed in detail to understand the line departments functional having responsibility over the resources which may be affected due to any incident. The vulnerable users of NW 1 in State of Jharkhand and the line departments are included in **Table 4.23**.

Table 4.23. Vulnerable Users along NW 1 in the State of Jharkhand

Sl. No	Vulnerable Users along NW1	Departments Identified
1	Fishing activities, Agricultural activities	Agriculture, animal husbandry & Fisheries Cooperative department
2	Ro - Ro facilities, Country Boat Operations, Passenger Boats, Stone Chips Carrying Boats	Transport
3	Terminal Construction	IWAI
4	Municipal Water Intake Structure	Drinking Water and Sanitation department
5	Burning Ghats, Temple, Cattle Rearing,	Revenue, Registration and Land Reforms Department

The respective line departments of vulnerable resources are already included in the state disaster management authority except Industries Department and Forest, Environment and Climate Change Department.

The institutional mechanism proposed for integration of IWT related disasters in existing DM structure of the State of Jharkhand is presented in **Figure 4.17**. The key role to be played by the line departments for managing any incidents are presented in **Table 4.18**.

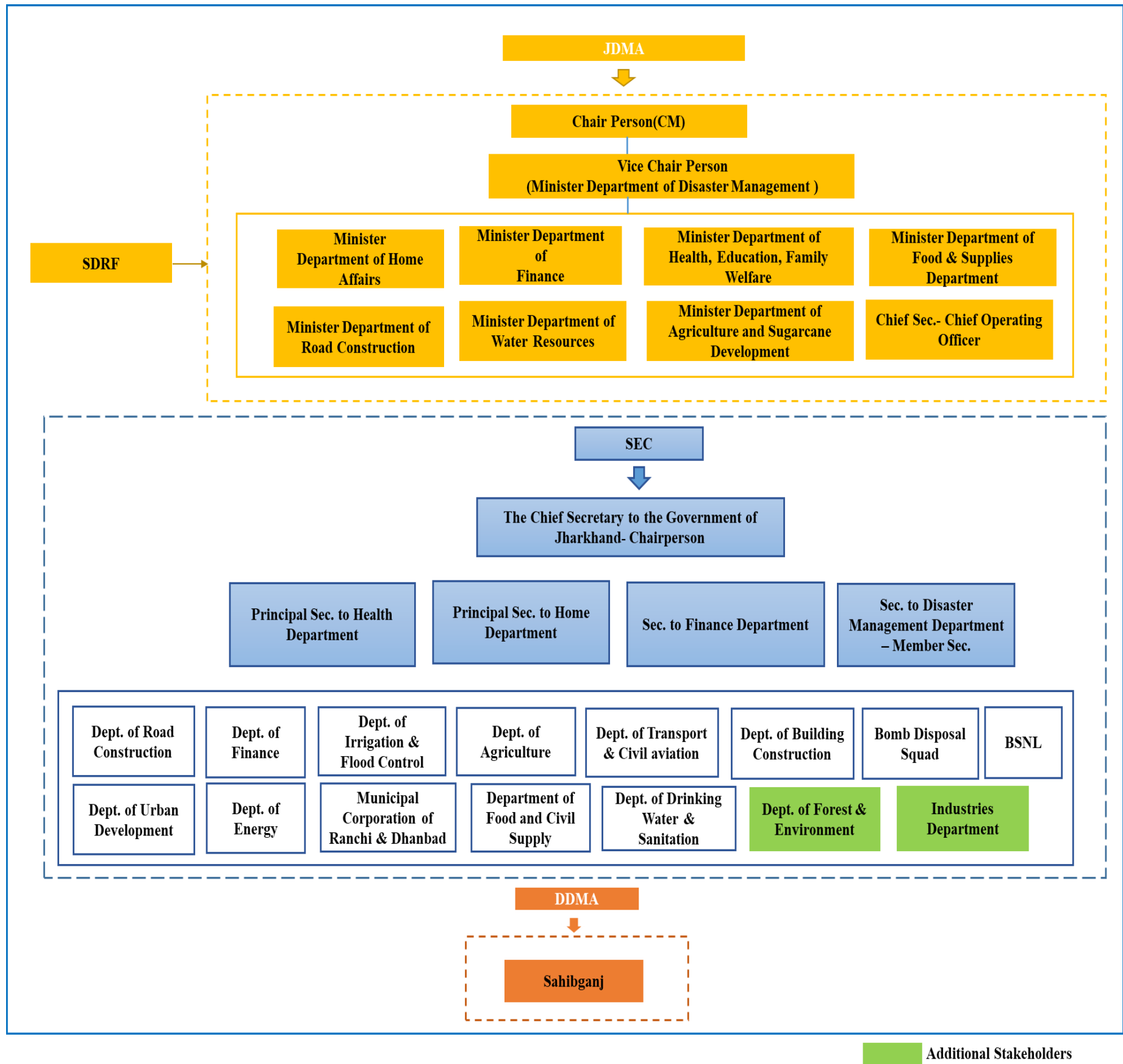


Figure 4.17. Existing and Proposed Departments in SDMA of Jharkhand

4.7.4. Integration of IWT Related Disasters in DDMA's of West Bengal

State of West Bengal is the state in eastern India, between the Himalayas and the Bay of Bengal. Ganga flows eastwards and its main distributary, the Hooghly River, flows south to reach the Bay of Bengal. As seen in **Section 2.3.5** and **Section 2.3.6** of report, the Farakka to Haldia stretch of NW 1 is falling in West Bengal for a total length of 500 km. NW 1 is bordering through 10 districts of the State- Burdwan, Hooghly, Howrah, Malda, Kolkata, Murshidabad, Nadia, North 24 Parganas, Purba Mednipur and South 24 Parganas.

Under Section 23(1) of the DM Act 2005, for the State of West Bengal, SDMA has been constituted. Disaster Management Department has prepared the Draft DMP in 2015-16 for the State. SDMA headed by Chief Minister as the Chairperson and Minister-in-Charge, Department of Disaster Management as Vice Chairperson with 7 members from Nodal Departments and Chief Secretary (CS) to the Government of West Bengal as Chief Executive Officer Ex-Officio. The State Executive Committee (SEC) under with State CS as Chairperson (ex officio) and four Secretaries to the Government of the State of such departments as the State Government may think fit, ex officio members. Powers and functions of State Authority are

- Lay down the State disaster management policy;
- Approve the State Plan in accordance with the guidelines laid down by the National Authority;
- Approve the disaster management plans prepared by the departments of the Government of the State;
- Lay down guidelines to be followed by the departments of the Government of the State for the purposes of integration of measures for prevention of disasters and mitigation in their development plans and projects and provide necessary technical assistance therefor;
- Coordinate the implementation of the State Plan
- Recommend provision of funds for mitigation and preparedness measures;
- Review the development plans of the different departments of the State and ensure that prevention and mitigation measures are integrated therein;
- Review the measures being taken for mitigation, capacity building and preparedness by the departments of the Government of the State and issue such guidelines as may be necessary.

The SDMA and DDMA functional at State is presented in **Table 4.24**.

Table 4.24. SDMA and DDMA of Bordering Districts in West Bengal

West Bengal Disaster Management Authority (WBDMA)									
Honorable Chief Minister (Chairperson)	Minister-in-Charge, Department of Disaster Management, (Vice Chairperson)	Minister-in-Charge, Finance Department (Member)	Minister-in-Charge, Department of Health and Family Welfare (Member)	Minister-in-Charge, Department of Irrigation & Waterways (Member)	Minister-in-Charge, Department of Public Works Department (Member)	Minister-in-Charge, Department of Agriculture (Member)	Minister-in-Charge, Food & Supplies Department (Member)	Minister-in-Charge, Department of Power (Member)	Chief Secretary to the Government of West Bengal & Chief Executive Officer Ex-Officio (Member)
State Executive Committee (SEC) as Crisis Management Group (CMG)									
The Chief Secretary to the Government of West Bengal (Ex-officio Chairperson)		The Secretary, Home Department.		The Secretary, Finance Department		The Secretary, Irrigation & Waterways Department		The Secretary, Disaster Management Department	
State Nodal Department – Department of Disaster Management									
Nodal State Departments for Disaster Coordination									
PWD	Health & Family welfare	Electricity Boards	Development Authority	Finance	Roads and Buildings	Water supply and Sanitation Department	Agriculture	Transport	Ports & Fisheries
District Disaster Management Authority (DDMA)									
Burdwan (Bardhaman)		Hooghly		Howrah		Malda District		Kolkata	
Murshidabad		Nadia		North 24 Parganas		Purba Mednipur		South 24 Parganas	

Source: Draft Disaster Management Plan 2015-16, West Bengal prepared by Department of Disaster Management

Emergency Operation Centers (EOC) are essential part of disaster management system. EOCs are present in State level (SEOC), District level (DEOC) and Field level. SEOC is an off-site facility functioning from State / District HQ. The SEOC will take stock of the emerging situation and assist the incident managers in mobilising the respective line department's resources, manpower and expertise along with appropriate delegated authorities for the on-scene actions / response. State EOC will keep the DEOC and field EOC informed of the changing situation and extend support. Emergency communication, SMS alert and warning system, decision support system and resources management system are few of critical components inbuilt into SEOC infrastructures.

Each DDMA will be headed by the respective District Magistrate, District Collector (DC), Dy. Commissioner as the case may be, with the elected representative of the Local Authority as the Co-Chairperson. DDMA will

- Act as the planning, coordinating and implementing body for DM at District level and take all necessary measures for the purposes of DM in accordance with the Guidelines laid down by the NDMA and SDMA.
- Prepare the District DM plan for the District and monitor the implementation of the National Policy, the State Policy, the National Plan, and the State Plan concerning its own District,
- Ensure that the guidelines for prevention, mitigation, preparedness and response measures lay down by NDMA and SDMA are followed by all departments of the State Government, at the District level and the Local Authorities in the District.

Various stakeholders identified in the Disaster Management System of the State include resource agencies, emergency service departments, corporates, volunteers as presented in **Figure 4.18**. Seven Companies from West Bengal SAP (State Armed Police) Battalion and three from Kolkata Police have been working as State Disaster Response Force (SDRF).

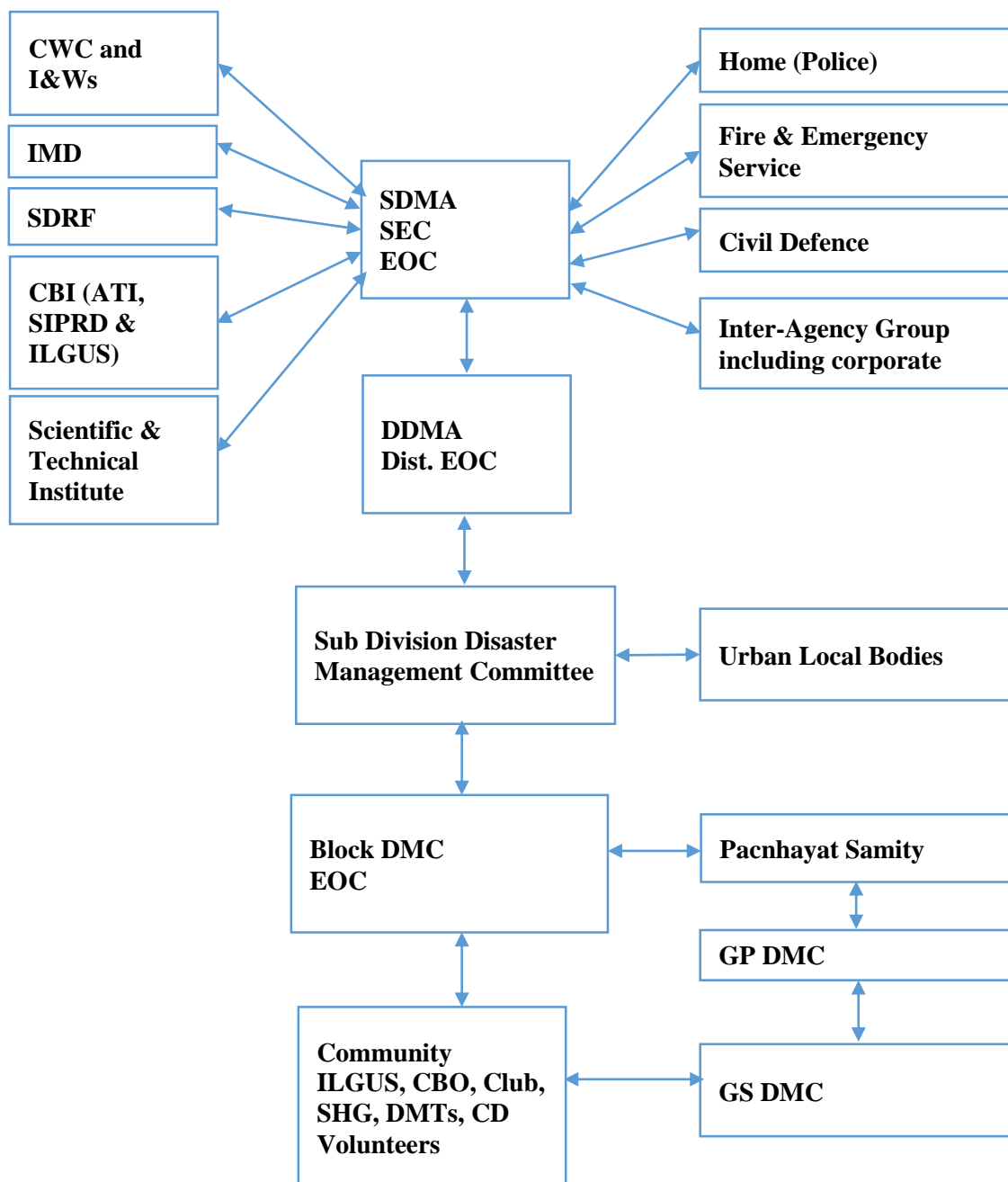


Figure 4.18. Stakeholder Integration in West Bengal Disaster Management System

Note: CWC- Central Water Commission; SIPRD- State Institute of Panchayats and Rural Development; SHG- Self-help Group and Self Employment, CBO-Community Based Organizations; I&Ws- Irrigation & Waterways dept.; ILGUS- Institute of Local Govt. And Urban Studies; CBO- Community Based Organizations; ATI- Administrative Training Institute; SDMA- State Disaster Management Authority; SEC- State Executive Committee; EOC- Emergency Centers; DMTs- Disaster Management Teams; DMC- Disaster Management Centers

Different parts of the State are vulnerable to the natural calamities like flood, cyclone, hailstorm - kalbaishakhi, earthquake, landslide, drought and erosion. In fact, there are multiple High Risk Multi Hazard Zones. Apart from these natural hazards, there are chances of man-made disasters

like major fire, industrial accidents, terrorist attacks etc. The major disasters identified in the state are as presented in **Table 4.25**.

Table 4.25. Vulnerability of State of West Bengal to Various Disasters

Classification Criteria	Disasters
Natural	Earthquake
	Flood
	Cyclone
	Storm Surge
	Tsunami
	Drought
	Land Slide
	Epidemics
Human Made Disasters	Fires
	Explosions
	Building or bridge collapses
	Transportation crashes
	Dam or levee failures,
	Nuclear reactor accidents
	Breaks in water lines
	Breaks in gas lines
	Breaks in sewer lines

Source: Disaster Management Plan 2015-16 West Bengal,

From the review of existing DM system functional in the State of West Bengal, it is to be concluded that

- Since, inland water transport related disasters are not listed in the disasters identified, with proposed incremental cargo operation, it is to be added in the disasters list in SDMP.
- The Secretary, Irrigation & Waterways Department is already part of SDMA. He could be represented for handling the IWT related disasters. The same department shall act as nodal department in case of IWT related disasters within the State.

To integrate the proposal of IWT related risk to DDMPs, the activities identified during the literature review and reconnaissance visit were analysed towards identifying the vulnerable stakeholders. The State government operational profile was reviewed in detail to understand the line departments functional having responsibility over the resources which may be affected due to any incident. The vulnerable users of NW 1 in State of WB and the line departments are included in **Table 4.26**.

Table 4.26. Vulnerable Users along NW 1.

Sl. No	Vulnerable Users along NW 1	Line Department/Agency
1.	Floating tetty, bank protection, irrigation water supply intake	Irrigation and Waterways
2.	NTPC water outlet from Industry	NTPC – Central Government Institution Department of Industries and Commerce – from State Government side.
3.	Fishing activities, Sea going fishing vessels, fishing harbour	Fisheries
4.	Railway line, railway station, rail bridge	Ministry of Railway – Central Government Institution
5.	Ferry services, country boats, passenger vessels	Transport
6.	H T lines	Power and Non-Conventional Energy Sources
7.	Agriculture activities	Agriculture
8.	Tourism jetty	Tourism
9.	Port related traffic	KoPT
10.	Defence vessels/establishments	Ministry of Defence
11.	Road Bridge	Public Works Department
12.	Hospital	Health and Family Welfare
13.	Human settlements and public uses	Land and Land Reforms & Refugee Relief and Rehabilitation
14.	Drinking Water Supplies	Water Supply and Sanitation

Considering the existing line departments which are already included in the DM Mechanism, it is understood that in order to protect the stake of the vulnerable resources of NW 1 the additional departments identified above shall be included as presented in **Figure 4.19**.

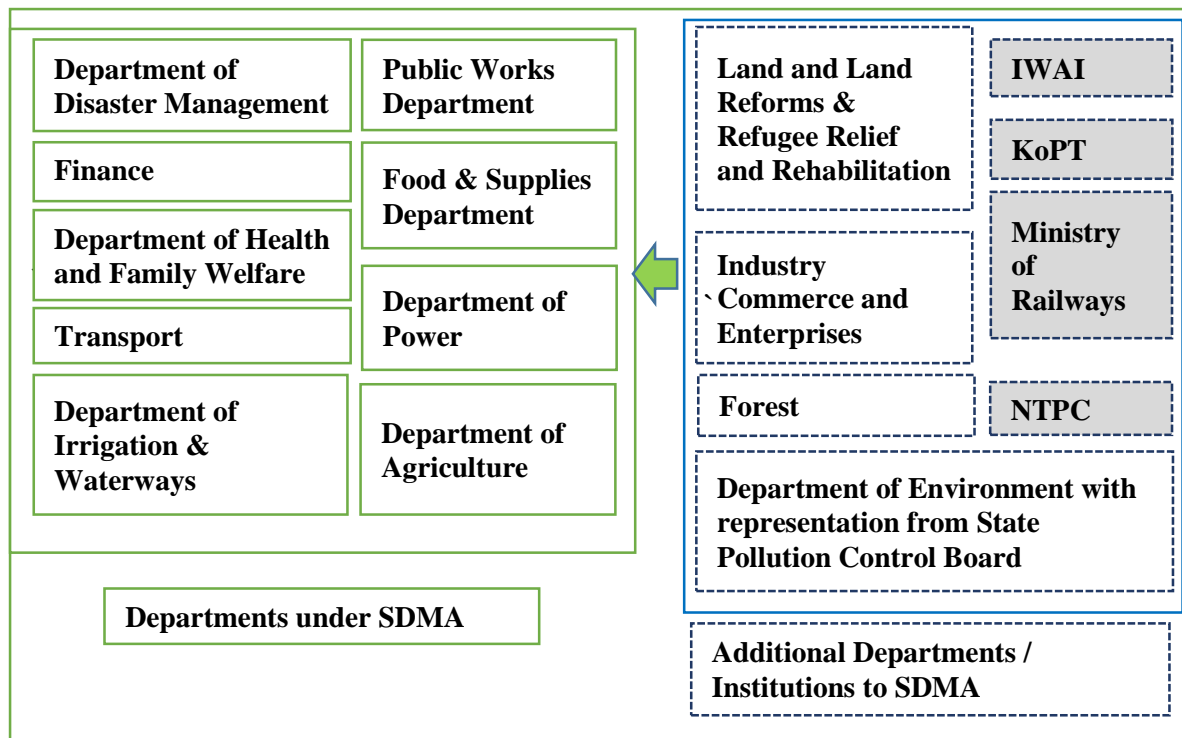


Figure 4.19 Existing and Proposed Departments and Agencies in SDMA

Note: IWAI, KoPT, NTPC and Ministry of Railways are Central Government Institutions and would act as resources agencies and would not be permanent representation in DDMA.

The institutional mechanism proposed for integration of IWT related disasters in existing DM structure of the State of West Bengal is presented in **Figure 4.20**. The key role to be played by the line departments for managing any incidents are presented in **Table 4.27**.

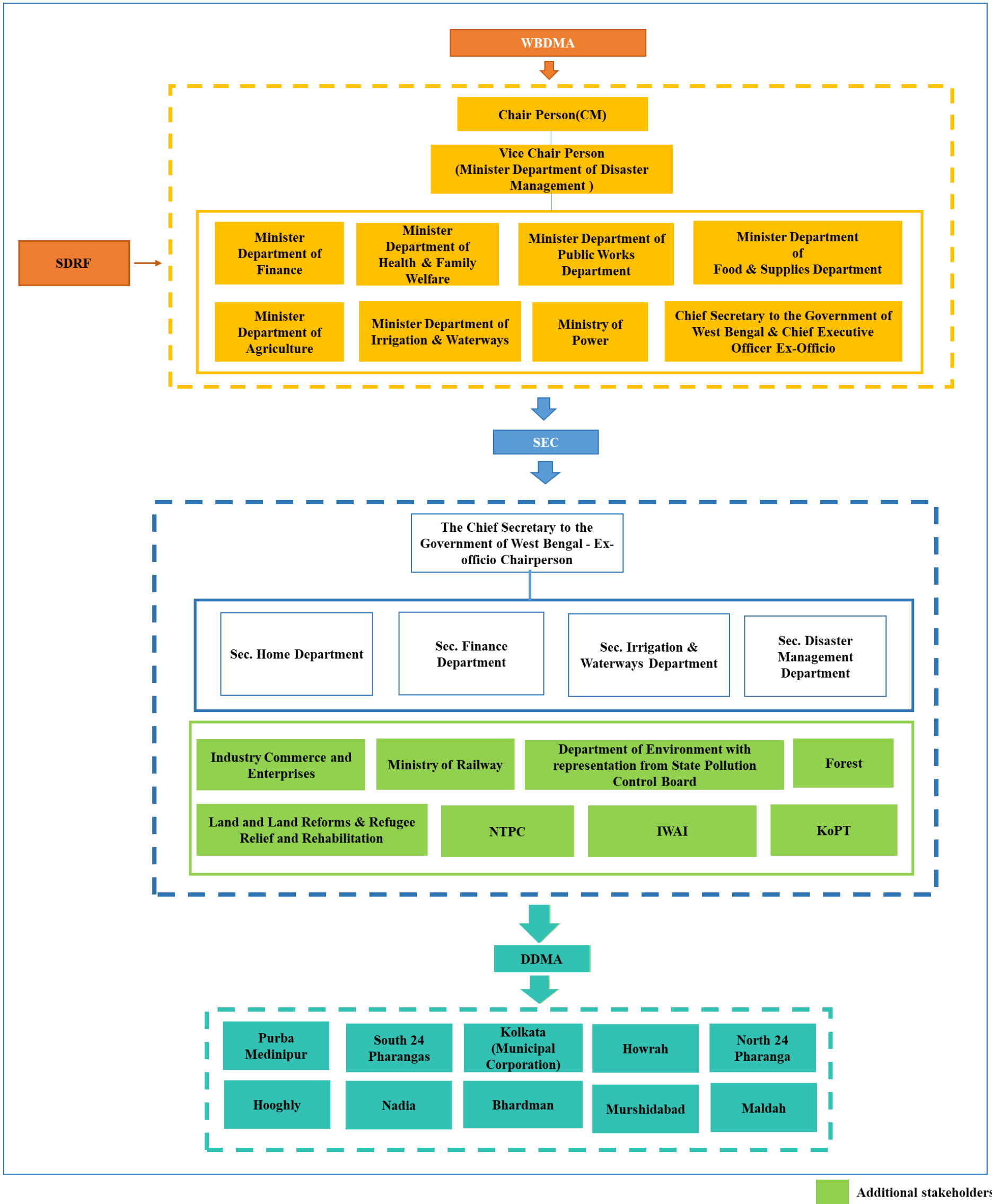


Figure 4.20. Existing DM structure of the State of West Bengal

Table 4.27. Key Role to be played by Additional Stakeholders during IWT Related Disaster

Sl No	Additional Stakeholders Identified	Role of Additional Stakeholders
1	Industry, commerce and enterprise	Extend support for response operation in coordination with the Industrial units in terms of Cargo related aspects as experts, rescue operational team, resources
2	Fisheries	Warning fishermen and local people engaged in fishing activities during disaster. Arranging quality checking of the affected area for fish consumption related aspects. Facilitating fisherman for losses if any.
3	Transport	Warning inland vessel operators during disaster Availing vessels or boats during disaster Support land side transport requirements for disaster management.
4	Forest	Guide response operation in protected areas with site specifying priority of protection and response strategy to be adopted.
5	Tourism	Alerting tourism establishments /tourists vessel in the impact zone and safe evacuation if needed.
6	Land and land reforms, refugee relief and rehabilitation	Warning people living on banks of NW 1 during disaster- people engaged in cleaning, cremation, cattle rearing, agricultural activities etc.
7.	Ministry of Railway	Resource agency.
8	IWAI	Response Coordination with availing the vessels / facilities available and coordination with DDMA and core responsibility in coordinating the cargo /vessel securing efforts of owner.
9.	KoPT	Support response efforts with availing the experienced staff, equipment and vessels as per the request from DDMA especially with utilising the sector specific experience.
10.	NTPC	Extend support for response operation in cargo related aspects as experts, rescue operational team, resources on request of DDMA.

4.8. Offsite Emergency Operation by DDMA of Bordering Districts of NW 1

The DDMA of the respective districts bordering NW 1 would required to act on emergency support requirement received from IWAI. The EOC of respective DDMA shall be immediately activated and the departments who has to get involved in IWT related as mentioned in section above of each state shall be shifted for the emergency operation requirement as deemed necessary. Head – IWAI RO shall play key role in coordinating with DDMA for operation.

In case of terminals where emergency is along the land mass, the existing facilities of DDMA shall be immediately mobilized with specific lead operation from the Fire and Emergency

services Department supported by the Health Department. In case the emergency require an offshore operation involving vessels, DDMA shall plan for operation from the nearest jetty /terminal with available vessels of locality – passenger/cargo/fishing etc.

4.9. Emergency Response Equipments for DDMA

Apart from the existing DM mechanism and land based response facilities part of each DDMA, it is proposed that additional facilities shall be ensured such as portable firefighting facilities and adequate PPEs to cater the specific response requirement for the IWT related disasters as presented below.

Table 4.28. Minimum Facilities Required at each DDMA and Block Cost Estimate

Gloves; coveralls; safety glasses; Face shield; and Chemical resistant, steel-toe boots or shoes.	10 Sets
FAST ACT (First Applied Sorbent Treatment against Chemical Threats) Neutralization agent - 4kg Cylinder	5 No
Portable Inflatable Emergency Lighting System	5 No
High Pressure Water Mist &CAFS (10L)	2 No
Block Cost for Procurement of Facilities above (Rs)	19,64,000.00
(Rupees Nineteen Lakh Sixty Four Thousand only)	

DDMA of each bordering district shall train the response personal specifically for operation in riverine situations taking extreme care on the personal safety to handle the IWT related disasters under their jurisdiction.

4.10. Specialized Protection for Environmental Sensitive Areas

Vikramshila Gangetic Dolphin sanctuary, being the most environmental sensitive area along the stretch warrants an additional precautionary measure in case of accelerated cargo transport as part of JMVP. Being under the complete jurisdictional limit of District of Bhagalpur in the state of Bihar, it is proposed to empower the respective DDMA with an additional provision of weir boom with supporting accessories to contain the oil spill if any within the least time possible. DDMA shall suitably locate the facilities at a near accessible point considering the priority of protection area in coordination with the Forest Department having control over the sanctuary limit for operational aspects in case of an emergency.

Similarly, Kashi Turtle Sanctuay also require specialized protection on account of the environmental sensitivity where an additional provision shall be given similar to the above. Since both Chandauli and Kashi districts are bordering the waterway, any of the DDMA shall

take hold of the responsibility of suitably locating the facility and IWAI may support any response operation with availing the terminal facilities, vessels and crews in case of an emergency.

The total cost for providing the above facilities works out to **Rs. 78.85 Lakhs**. The specification of the boom proposed including the cost provision is presented in **Table 4.29**.

Table 4.29. Provision for Gangetic Dolphin Sanctuary and Kashi Turtle Sanctuary

Description	Quantity (Rs.)	Amount (Rs.)
River Booms with accessories (Material: Neoprene / rubber / Neoprene rubber)	600 with 2 Power Pack	39,42,550.00
Total Cost towards setting up of facilities at two locations		78,85,100.00
(Rupees Seventy Eight Lakhs Eighty Five Thousand and One Hundred Only)		

The above facilities shall be provided on initiation of FO transport through NW 1.

4.11. Oil Spill Contingency Handling in Offshore Incidents in NW 1

As presented in Section – above, FO is the only persistent oil requiring dedicated clean up requirements in case of spillage in NW 1. Considering the response requirement in case of an offshore incident, it is proposed that IWAI shall have an administrative arrangement through MoS for availing the support from Kolkata Port Trust/Indian Coast Guard (ICG) in case of an emergency.

4.12. Project Implementation Plan

Based on the risk assessment study, disaster Management (DM) proposal the following implementation plan is proposed.

- IWAI shall ensure that the proposed disaster management plan for cargo terminals shall be implemented along with commissioning of the terminal including setting up of facilities, providing essential training and regular mock drills.
- All cargo handling terminals shall be provided with essential emergency management facilities proposed and the OSR equipment purchase could be planned on a phased manner considering the FO handling.
- The proposal towards integration of IWT related disasters with the respective DDMPs shall be submitted on due communication with SDMAs of respective States.

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- IWAI shall actively coordinate with DDMA's for mainstreaming mock drill to handle IWT related disasters and remain prepared for handling emergencies. The additional provisions for the DDMA's shall be allocated from the state /central reserves on mutual interactions.
 - IWAI shall ensure that the proposed ECC facilities are established at RO and HO and essential trainings are given for the personals identified as part of Incident Management Team.
 - Specialised protection for Vikramshila Gangetic Dolphin Sanctuary and Kashi Turtle Sanctuary to be implemented on initiation of FO transport through the respective regions.
 - For oil spill emergencies, each IWAI terminals shall be equipped with in built facilities and for offshore exigencies an administrative arrangement with KoPT and ICG shall be operationalized.

BEST MANAGEMENT PRACTICES

Best Management Practices (BMP) are essential prerequisites for an efficient and sustainable IWT system. BMP for transportation through waterways include different aspects related with waterways, vessels, terminals, cargo handling and storage, other users embedded in Quality Safety base. BMP of waterways have been adopted in the countries with extensive waterway system depending on the priority of the region. Countries of European Union, Myanmar are a few example. They are able to utilise the waterways efficiently by focusing on its benefits and introducing state of the art technical and managerial practices for better utilisation with improved performance. Major aims are to ease road congestion and the pollution by switching to greener transport modes away from residential areas.

NW 1 is a multi-user inland waterway where several development activities are underway at different planning and execution levels for enhancing the cargo transport and other uses of the waterway. Therefore, it is essential to initiate implementation of BMP for IWT in NW 1. This is more so in the backdrop of highly diverse uses and environmental sensitivity of the waterway, land use and socio-economic environment of the banks. Adoption of best practices will lead to achieve responsible IWT operations.

At present, the other countries extensively utilised for inland waterway navigation other than India are the North America, Europe, China, Thailand and Bangladesh.

- North America – Missouri- Mississippi and Inter Coastal Traffic in the Great Lake, which together accounts for over 630 million tonnes of cargo movement per annum.
- Europe – The Rivers Rhine and Danube are the major modes of transportation through European Union (EU). It is estimated that at around 7 % of the total freight traffic is supposed to be carried by the IWT operations. The modal share in EU by ton-kilometre percentages are 48 %.
- China - IWT accounts for almost 10 % of the total freight tonnage carried in the country and of the two- third is carried on the Yangtze river including the bulk commodities like coal, steel, cement, containers and LPG.

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- Thailand - IWT operations are having around 20 million tons of cargo handling annually, representing 4.5 % of the total inland cargo volume.
 - Bangladesh – IWT accounts for 14 percentage of countries annual passenger volume and 35 % of its annual freight volume.

After considering the peculiarities of NW 1 stress areas for implementing BMPs are identified as below:

- Waterway
- Vessels
- Operator/Tenant
- Terminals & Supporting Infrastructure Facilities
- Navigation & Traffic Management Systems
- Management of Dredged Material
- Environmental Protection & Sustainability
- Quality & Safety
- Administration
- Competing Uses
- Emergency Response
- Technology and Innovations
- Training
- Casualties and incidents

5.1. Waterway

- Giving more attention to hot spots area and critical sections like curves, sensitive banks, critical structures, high siltation area, high eroding banks etc. Check out the possibility of reducing the risk elements so that hotspots will be brought to critical sections and critical sections to non-critical sections.
- Identify parking, repair and halting areas along the waterway. Identify zones based on type of user and make arrangements for multiple user.
- Ensure proper visibility of signage at place throughout the waterway and provide additional signage were ever required for E.g. demarcation of channel diversions, accident prone areas etc.

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- Provide appropriate fender to all bridges and all other cross structures.
 - Provide lighting in areas with curvature, low width etc. to support night navigation through the waterway.
 - Impose speed restrictions, no turning etc. to prevent accidents at hotspot and critical sections.
 - Erosion control measures in the banks should be provided by planting erosion resisting plants.
 - Monitoring of Waterways to avoid dumping of municipal and industrial solid waste with the help of local people.
 - Removal of wrecks and other obstructions from time to time impeding navigation.

5.2. Vessels

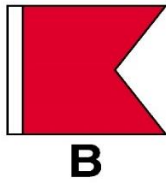
- Each Inland water vessel will have a unique identification number indicating its important features and its area of operation,
- Ensure Global Positioning System (GPS) and Automatic Identification System (AIS) facilities in each vessel.
- Barges having separate ballast and product tanks, as well as vapour return and efficient stripping facilities according to the latest technical standards are preferred so that not only will it minimise product residues by eliminating the need for cleaning and degassing, it will reduce the number of personnel along the supply chain who handle products thus allowing for greater levels of training.
- All the vessels should have on board all Life Saving Appliances, Light and Sound Signals and Fire Fighting Appliances required as per the Rules and regulations.
- Official log book shall be maintained at each vessel and any occurrence should be entered without fail.
- Double-hulled barges with diamond shaped tanks will help to minimise product residues.
- Barges equipped with deep well pumps or equivalents are preferred for self-priming purpose and for minimising pollution due to leakages.
- Efficient line draining should be available on the barge as recommended in the International Safety Guide for Inland Navigation Tank-barges and Terminals (ISGINTT guide.).
- Use of barges with a slop tanks for carrying loading residues should be ensured for better waste management.

- Barges with low-emission sampling points are preferred ideally by having a closed sampling system to avoid spillages as recommended in the ISGINTT.
- Use of Barge Trucks (Barges combined together with Push Boats) to utilise smaller waterways or to navigate smaller section of waterways and lock gates. This is feasible in the case of Dry & Liquid Cargo. They also help to modal shift in smaller waterways.
- Integrating Particulate Matter reduction and removal of noxious gases mechanisms such as selected catalytic reduction to the vessel. Use of low sulphur fuels.
- Implementing flow meters in fuel tank to determine the rate of fuel consumption so that real time monitoring is possible,
- Propeller shafts equipped with cutter to shred the entangling debris.
- Ensuring VHF Communication between Vessels.
- Implement Oil Filtration devices on bilge pumps.

5.3. Operator

- Checking vessel safety standards periodically and ensure proper operation and maintenance. Periodically check for the leakage of fuel storage facility. Quality of welding should be checked regularly.
- Training, appraisal and development schemes to be integrated as a part of Human Resource Development with specific orientation to current technology, regulation, disaster management, first aid, emergency response, interdepartmental operation and equipment usage. This will increase confidence and morale.
- Plan the activities and get together for enhancing interpersonal relationship and for developing a team culture among crew of different age, culture and experience.
- Training on the usage of appropriate Personal Protective Equipment (PPE) and Personal Flotation Devices (PFD) or Life Preservers are to be ensured.
- Appointing experienced vessel managers to make voyage efficient, safer, greener as well as economical.
- At least one employee of the vessel should have proficiency in regional language.
- Keep waste segregated and stored inside the vessel instead of throwing into waterway. They shall be transmitted to waste disposal facility on the land from time to time.
- Avoid overloading of cargo.
- MSDS of cargo carried shall be made available at each vessel
- All vessels should bare the International Flag B for marking that it is carrying a hazardous cargo and in night shall display all round red lights as shown in **Figure 5.1**.

Use of dedicated barges especially for the movement of hazardous cargo shipments will minimize product residues by eliminating the need for cleaning and degassing especially for liquid cargo.



International Alphabet Flag B

All Round Red Signal

Figure 5.1. Signages for HAZCHEM Vessel

- Every mechanically propelled inland vessel carrying goods of dangerous or hazardous nature shall be fitted with a spark arrester in all the ventilators and air pipes of the compartments carrying dangerous goods.
- Emergency information panel should be legible and conspicuously displayed on each side of the Upper Deck. Such panel shall contain details of cargo with label, contact details of emergency services, consigner and experts. All writing should be legible.
- Master of mechanically propelled inland vessel engaged in carriage of dangerous or hazardous goods shall, on the occurrence of an accident involving any dangerous or hazardous goods transported by his mechanically propelled inland vessel, report forthwith to the nearest IWAI office (RO/Sub unit), notify and report to the Administration and also inform the owner of the goods carriage or the transporter regarding the accident.
- Company and the master of the vessel shall be responsible for compliance with the applicable provisions of the Regulations and for management of the vessel so as to achieve safety in operations and protection of the environment.

5.4. Cargo

5.4.1. Dry Bulk Storage and Handling

- All the cargo are to be stored in closed ware house facilities to the possible extent, this will prevent the issues of ground water contamination and generation of dust particles.
- Warehouse should have impermeable surface, and there should be a dedicated storm water drain, which shall be routed through an ETP on requirement basis.

- In case of open storage, heaps shall be made steep to minimize the percolation pollution load and also, if possible a temporary barrier shall be kept in the most prominent direction to prevent the spillages.

5.4.2. Non-Bulk Chemical Storage and Handling

- Locate outdoor storage areas on impervious surfaces with no storm drains and within berms low enough to permit equipment access but capable of containing spills/releases;
- Outdoor storage areas can be constructed with a slightly sloping surface to a dead-end sump to collect precipitation. Sump pumps should be manually operated. Collected precipitation should be closely examined and tested, if necessary, to ensure there is no contamination from the contents of stored drums. If no contamination is observed or analyzed, collected precipitation can be pumped to the storm water collection system; If contamination is suspected or analyzed, the collected precipitation should be pumped to a drum or other container and managed as a hazardous waste
- For outdoor storage areas for containers of petroleum product, pumping the precipitation through an oil-water separator will then allow the water portion to be discharged to the storm water collection system [Note: oil-water separators will not remove chemical pollutants from water].
- Locate long-term storage areas under cover and within a secondary containment structure capable of holding the contents of the largest container plus at least 10 percent of its volume;
- Erect barriers at the perimeter of storage areas to prevent vehicle collisions, but that will permit access by loading/unloading equipment;
- Frequently inspect equipment used to unload/load containers off/on vessels, trains and trucks;
- Employees handling chemical containers should ensure labels, placards and other identification affixed to containers is not removed or defaced;
- Segregate chemicals and chemical products by compatibility; store flammables in a separate area and usually, per local codes, at a greater distance from the property line;
- Do not dispense product from containers in the storage area - - this should not be necessary or permitted for cargo in transit.
- Store drums upright (bungs-up), not horizontally, to prevent leaks from improperly closed or poorly fitted bungs and possible movement (rolling) on the storage area surface or from a horizontal storage rack;

- Forklifts equipped with drum grapplers should be used to move individual drums;
- Pallets of drums should be moved only when the drums are securely banded together;
- Move single drums only with a drum dolly, never roll drums on their side or bottom edge;
- Locate over pack drums (usually 80 gallons) with spill response equipment into which leaking drums can be placed and their contents contained.
- Other cargo handling structures such as restrict double-stacking plastic totes.
- Forklift drivers need to employ caution in lifting and moving totes and be particularly observant of the location and configuration of the top fill portal and (on some totes) a discharge valve near the bottom;
- Frequently inspect tote storage areas for leaking valves (if totes are equipped with these.

5.4.3. Liquid (Flammable/ Toxic Cargo) Bulk Storage and Transfer

- No leaky tank or container shall be used for transportation of HAZCHEM.
- Filled barrels and drums should be loaded with their bung upwards.
- No vessel shall carry the petroleum if passengers or any combustible cargo is present on board.
- Smoking, matchsticks, lighters or other fire inducing appliances should be strictly prohibited during loading/unloading and while transportation.
- Loading/unloading of petroleum after sunset shall be prohibited unless adequate lighting and firefighting facilities with trained personnel are available.
- Petroleum in bulk shall be necessarily carried in a vessel which is licensed for the stated purpose and stored in the standardised mandated manner approved by the licensing authority in water transportation.
- It should not be transported in a barge or flat-bottomed boat unless it is self-propelled or is in tow of, or attended by a steamer or tug and carries fire extinguishers.
- After complete discharge of petroleum from the vessel, its holds, tanks and bilges shall be rendered free from inflammable vapour.
- Gas free certificates for dock entry, man entry and hot work by the appointed officers are obligatory.
- Handling facilities in all cases shall be approved by the Terminal/Vessel Manager along with Terminal Safety Office rafter evaluating the various safety reports.
- Use of naked lights, fire or smoking on board in vessel are prohibited.

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- Fire-extinguishing appliances should always be kept ready
 - Prepare a spill prevention and emergency response plan for the facility and all storage/transfer operations and submit it to the federal and/or state/provincial environmental regulatory authority for approval;
 - Provide initial and follow-up training to employees responsible for facility operations and for emergency spill response;
 - Locate spill clean-up materials and equipment in known and convenient locations
 - Ensure that the loading/unloading area drains to a catchment basin or other similar containment structure; the capacity of the containment structure must be equivalent to the largest compartment of a tank car or truck loaded/unloaded;
 - Ensure that secondary containment holds the volume of the largest storage container plus sufficient freeboard for precipitation;
 - Regularly inspect fixed and mobile tanks, transfer equipment and piping for drip marks, tank discoloration, puddles of leaked liquid, puddles of water with a sheen (indicating petroleum product), corrosion, localized dead vegetation and stains on the ground, leaks/seepage from valves and seals, deformities (e.g., bulges, cracks, bends) in pipes and tanks.
 - Regularly inspect secondary containment structures for cracks, discoloration, corrosion, erosion (of inside walls and outside perimeter), valve leaks, loose mortar, sealer, sizing or grouting used to construct walls, presence of leaked or spilled material within the containment area, debris within the containment area and the operational status of drainage valves [closed] regularly inspect and test liquid level sensing devices and audible alarms on each storage tank to ensure proper operation.
 - Periodically conduct integrity testing of above ground storage tanks and leak testing of valves and piping;
 - Inspect and record inspection results of storm water released from any drainage system in the bulk tank storage area directly to waterways;
 - Regularly inspect and test liquid level sensing devices and audible alarms on each storage tank to ensure proper operation;
 - Inspect valves that permit the outward flow of tank or secondary containment contents to ensure that they will remain closed when not operating;
 - Inspect starter controls for pumps within secondary containment to ensure that they will remain locked in off position when not operating;

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- Inspect loading/unloading connections of pipelines to ensure that they are securely capped or blank flanged when not in service;
 - Inspect valves and valve operation, piping, flange joints, expansion joints, valve glands, catch pans, pipeline supports and metal surfaces;
 - Use physical barriers, warning signs, wheel chocks or vehicle brake interlock systems to prevent tank cars/trucks from departing before complete disconnection of transfer lines;
 - Inspect drains and outlets on tank cars/trucks prior to filling and departure and tighten, adjust or replace as necessary;
 - Use pans or containers to catch drips/spills when making or breaking connections with hoses, nozzles or other transfer equipment;
 - Ensure that buried piping has protective wrapping or coating and is cathodically protected or otherwise meets corrosion protection requirements;
 - Install and maintain vapor recovery systems for product transfer to bulk tanks;
 - Ensure that transfers are supervised by facility employees who are thoroughly familiar with normal and emergency operations procedures.

5.4.4. Gaseous Flammable/ Toxic Cargo

- No portion of the cylinder carrying gaseous HAZCHEM should project from the vessel and there should be no other flammable or corrosive articles in it.
- These cylinders need to be prevented from falling, rough handling, excessive shocks or local stresses.
- No lifting magnet shall be used in loading or unloading of filled cylinders.
- No person shall transport any leaky cylinder. In case of a leak during transport the same shall be removed to an isolated open place away from any source of ignition.
- Cylinders containing flammable gases should not be transported along with cylinders containing other type of compressed gas.
- Toxic or corrosive gas cylinders shall not be transported along with food-stuffs.

5.4.5. Loading & Unloading of Cargo

- Safety data sheet for each material should be available at the terminal as well as in each vessel and should be available before loading the cargo.
- Loading & Unloading operations should be carried out according to the Standard Operating Procedures (SOP).

- For liquid cargo, the loading lines are to be emptied into product tanks to avoid emissions or spillages. The loading location should be able to handle barge vapour residues. Closed loading systems are preferred, i.e. vapour return facilities, incineration or vapour absorbing systems should be considered.
- Sampling after loading of vessel's tank should be executed with lowest emission possible, ideally via a closed sampling system.
- When the previous cargo was incompatible, then the barge should be presented clean, dry and odourless and at atmospheric pressure. Any necessary cleaning should not result in a release of the substances in to the water. Contaminated water must be treated according to the regulations.
- Barges should either to be connected to a vapour return line of the land tank in to which the product is to be discharged or land tank to be connected to an off-gas handling system i.e. vapour return facilities, incineration or vapour absorbing system.
- Unloading facilities should always be provided with installations to use the efficient stripping system of barges to ensure that product tanks can be ensured liquid free.
- Arrangements for facilitating the draining of the barge's tanks can comprise of suction by a terminal's pump, Discharge by a barge's pump (stripping pump) and Purged by inert gas or air through a stripping line.
- When draining is complete, and before hoses or arms are disconnected, the barge's manifold valves and shore valves should be closed and the drain cocks at the barge's manifold should be opened to drain into fixed drain tanks or portable drip trays.
- Cargo manifolds and marine arms or hoses should be securely blanked off after being disconnected. The contents of portable or fixed drip trays should be transferred to a slop tank or other safe receptacle ashore.

5.4.6. Cargo Handling Equipment and Rail/Truck Operations

- Clean Fuel: change to advanced clean diesel fuel, such as low or ultra-low sulfur diesel (LSD) (ULSD), emulsified diesel, bio-diesel, compressed natural gas, liquefied natural gas, liquefied petroleum gas (propane, which requires a dedicated engine);
- Retrofit with essential equipments such as diesel particulate filters, oxidation catalysts, closed crankcase ventilation, selective catalytic reduction, lean NOx catalyst, exhaust gas recirculation, idle reduction devices;
- Rebuild and properly maintain engines;

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- Replace an older engine with a newer, cleaner engine, especially one that can use alternative fuels and/or has been manufactured to stricter on-road emission standards;
 - Replace older vehicles or machines with one built to stricter emissions standards;
 - Investigate the feasibility of using hydraulic hybrid vehicles as replacements for diesel engine equipment.
 - Conduct an emissions inventory to quantify air quality impacts of the current operations and assess potential impacts of port expansion and/or growth in port activities;
 - Implement an anti-idling policy and distribute information to tenants and transportation providers about idle reduction technologies;
 - Implement an educational program for tenants to inform them of strategies and options for reducing diesel emissions;
 - Include incentives for emissions reduction in leases and contracts with tenants, contractors and transportation service providers;
 - Expand operating hours to reduce truck queuing, idling and traffic congestion;

5.4.7. Hazardous Wastes

- Designate a permanent storage facility constructed and operated per regulatory requirements, including - covered area with impervious base and secondary containment;
- Signage designating Hazardous Waste Storage and restricting entry by unauthorized persons;
- Sufficient space to allow the segregation of non-compatible wastes and to permit movement of persons within the facility;
- Use of containers that are compatible with their waste contents; ensuring that containers are closed, except when adding waste;
- Required fire, emergency, communication and security measures implemented;
- Locate drums for the collection of hazardous waste in the operations areas where the waste is generated (satellite accumulation areas, per U.S. EPA regulations; drums must be moved to the permanent storage facility within three days of being filled);

5.4.8. Non-hazardous Waste

- Locate waste collection areas on impervious surfaces with a bermed perimeter;
- use covered dumpsters or roll-offs as the primary waste collection receptacles;

- Conduct a waste minimization study, to include alternatives to current practices for reducing the number and volume of wastes generated;
- Conduct a reduce/recycle/reuse (waste minimization) study to identify sources of current waste streams and alternatives to disposal; include a perimeter (and beyond) survey of trash to identify its origins;
- Place marked waste containers at locations convenient to visitors, truck operators, employees and vessels;
- Cover and berm trash collection areas and containers (e.g., roll-offs, barrels) to avoid dispersion by wind and storm water;
- Ensure that waste from vessel is received and managed properly;
- Publish a Used Materials Exchange for distribution to tenants and lessees advertising used materials that potentially could be re-used at another facility.

5.5 Navigation & Traffic Management

- Usage of Water Traffic Management System (WTMS) which will interface the voyage data and channel data to develop a geo-referenced data and helps in data analysis, interpretation and decision making.
- For IWAI, WTMS would serve as information system to optimize personnel at terminal, locks, and to provide higher safety due to traffic surveillance with exact vessel positions. This would reduce accidents and ensure quick and easy access to information to provide best possible help.
- The above communication infrastructure needs to be developed to provide better operating condition by ensuring safe and efficient traffic flow and the protection of the riverian environment.
- Implementation of Vessel Traffic Management System (VTMS), which is always a part of WTMS with Automated Identification System (AIS). AIS shall be at all RIS station and the informations collected at the stations need to be transmitted to IWAI terminals, regional office and sub offices. The collected informations need to be shared with district authorities from the nearest office. Electronic Navigational Chart (ENC) display with supporting facilities such as Radar, GPS etc. and integration with GPS facility of the vessel shall be provided at the RIS station.



Figure 5.2. Traffic Control System

5.6. Management of dredged material

- To prevent or limit the impacts from dredged materials, many national and international conventions have been developed. One component of the LC-DMAF (London Convention- Dredged Material Assessment Framework) is the conduct of a thorough Environmental Impact Assessment (EIA) to identify potential effects of a given dredging project prior to its execution and to reduce uncertainty about the scales of those impacts.
- PIANC has published, in close co-operation with the World Dredging Association (WODA) and International Association of Dredging Companies (IADC), a number of valuable reports about the environmentally sound handling and management of dredged material (see <http://www.pianc-aipcn.org/> and Bray 2008).
- Based on this knowledge, the most recent PIANC reports 'Dredging Management Practices for the Environment – A Structured Selection Approach' (PIANC, 2008b) and 'Dredged Material as a Resource – Options and Constraints' (PIANC, 2008c) provide up-to-date guidance and a number of recommendations including the benefits of relocating dredged material into aquatic systems, and of monitoring to minimize uncertainty about the interaction between dredged material and its receiving environment.
- A clear trend is to develop a better understanding of the sediment quantity and quality dynamics on a river basin scale and to set up sediment management plans for each single river.

5.7. Environmental Protection & Sustainability

An Environmental Management System should be in place for the IWT as a whole and for various departments as a part of BMP. This system shall be in accordance with prevailing environmental laws and rules along with statutory regulations such as Water Act, Air Act, etc.,

- ‘Polluter Pay’ principle should be adopted and channelize fund to protect important ecological areas such as notified sanctuary along the waterway.
- Prevent waterway activities that will create environmental problems such as scour damage, changes to the riverine regime.
- Promote habitat creation/enhancement at degraded areas.
- Declaration of valuable waterway sections as zero pollution areas, associate with NGOs & local people for achieving it.
- Prevention harmful emissions such as CO₂, NO_x and PM during activities related to IWT.

5.8. Quality & Safety

- Dedicated Quality, Health, Safety & Environment (QHSE) officers shall be appointed to consider the matters related to quality and safety at all terminals
- Quality manual should be made and followed for vessel operation by owner/operator of the vessel.
- Formal training schemes for improving the quality awareness of the employees especially in the operation side of IWT.
- Nurture a “no accusation / blame” culture while discussing matters in the areas of Quality & Safety among the employees.
- Use integrated Quality & Safety solution typically comprising of complete on board-onshore reporting for all findings and incidents, structured descriptions, conditions, root cause analysis functionality, fleet-wide action tracking etc. which shall be reviewed in a joint meeting of administrator & operators and proper corrective actions are to be taken.

5.9. Administration

- Focus on investment plans. Authority may invest for lands near Terminals and facilitate industries to invest on handling and storage facilities
- Develop Terminals-Establish CCTV Camera for Terminals. Ensure regular maintenance of Terminals, Vessels and allied facilities

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- Provision of pilotage facilities for River-Sea vessels entering the waterway may be extended.
 - Interact with prospective clients for inviting traffic to NW 1 and identify new Origin-Destination (O-D) Pairs. Organise O-D pairs to improve the channel performance. Schedule the vessel movements to avoid haphazard operation and reduce the probability of accident.
 - Intimate with lock gate operators on timing of passing.
 - Discuss with National Highway authorities for arriving at mutually amicable solutions in the expansion/development plans. Negotiate with responsible authorities for dismantling old bridges posing threat.
 - Implementation of risk abatement and management measures with coordination of district authorities and ensuring that the disaster management mechanisms are familiar and would effectively function in case of an emergency.
 - Provide Green Certification to less polluting vessels and provide fee exemptions for limited periods for them.
 - Contracts for various outsourced operations are to be provided and extended on performance base.
 - Registered users of inland waterways must be informed by the authorities on the day to day matters of waterway relevant to them which may include details related to fairway, traffic, restriction etc.
 - To provide Information Centre that will be providing information, advice and directions regarding vessel movements, timing etc. to users other interested personals. This will be very useful for new users. The users shall be also possible to deliver their grievance at this number.
 - Interactive Data bases which are accessible to the public through internet can be developed.
 - Conduct a public survey to understand their needs related to NW1. Concerns of Transit & Residential communities in and around NW1 shall be passed on to the respective departments/agencies/organization on identification.
 - Improving public awareness regarding various aspects of IWT through seminars/workshops and other media. This will attract more support and involvement of the public.

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- Conduct awareness classes and exhibitions on the waterway its importance and potential. Invite entries on Innovative ideas from academic/ research institutions.
 - Improvement of existing jetties along NW 1.
 - Provide loading and unloading facilities that does not require any land acquisition. Ro-Ro services can be effectively utilized for shorter distances of IWT operation.
 - Testing of the dredged material to identify the presence of undesirable elements.
 - Safe disposal of dredged material according to safe disposal plans.
 - Discussing with industries on prohibition of discharge of untreated effluent into the waterway.
 - Planning with local self-governments on diversion of municipal sewage from the waterway.
 - Introduction of private sector management for the IWT systems or a part there of in the initial stage. Implement project management agency to review the efficiency of implementation of project.

5.10. Competing Uses

- Scheduling of cargo movements by fixing time for channel crossing for other vessels like Ro-Ro ferries, Passenger ferries, Cargo ferries etc.
- Fixing of low speed areas, no parking areas in high traffic areas after having discussion with respective authorities.
- Determine the peak hours for high and medium traffic areas based on activities like tourism, port activities, passenger crossings etc.
- Patrolling/Sudden inspection in high risk areas
- Estimation of carriage capacity & augmentation planning
- Marking Buffer Zones between waterway & multiuser areas.
- Low speed zones near moored vessels, fixed objects, swimmers, anglers etc.
- Recommend control on issue of permit in areas already having high traffic density

5.11. Emergency Response

- Implement SOPs for responding to emergency
- Promote joint mock drill of different agencies
- Provide temporary diversions from spill scene

5.12. Technology &Innovations

- Efficiency improving measures such as Eco-speed coating on the hull to reduce the viscous resistance. Z-drive counter-rotating propeller systems
- Energy-efficient and environmentally friendly systems such as Diesel electric propulsion.

5.13. Training

- Purchase of Navigation Simulators for trainees and students which will be highly useful in navigating inland waterways which is much more restricted compared to open sea it will be helpful in safe manoeuvring, crossing etc.

5.14. Casualties and Incidents

- In the event of a casualty or incident involving the vessel resulting in loss of life or the vessel being materially damaged, stranded, abandoned or lost, the master or the Company shall inform the Administration immediately. If it is not possible to inform the Administration directly, information on the casualty or incident shall be provided to the nearest surveyor, registrar of vessels, police officer or harbour master, who shall immediately notify the Administration.
- In the case of the death or disappearance of any person on or from the vessel the information notified to the Administration shall include at least:
 - the date, time and location of the accident or occurrence;
 - the name of each person that died or disappeared;
 - the identification number and name of the vessel; and
 - the name and address of the Company.
- The Company shall submit a report to the Administration when as a result of a casualty or incident that involves the vessel or its equipment:
 - a person dies;
 - a person is injured and requires medical treatment beyond first aid;
 - a person disappears from a vessel in circumstances that indicate probable death or injury; or damage occurs to the vessel or other property.
- The report required shall be made:
 - within 48 hours of the casualty or incident if a person dies within 24 hours of the occurrence, requires medical treatment beyond first aid or disappears from a vessel; or within 10 days of the occurrence

- The report required shall be in writing, dated and signed on completion by the person or persons that prepared it. The administration should conduct an investigation into any occurrence meeting the criteria specified.

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