2021

River Information Service (RIS) Booklet & Standard Operation Procedures

Inland Waterways Authority of India
A-13, Sector-1, Noida (U.P)
6/21/2021

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1. Introduction

1.1 Inland Waterways Authority of India (IWAI) was established for development and regulation of National Waterways for shipping and navigation on 27th October 1986. The Authority primarily undertakes projects for development and maintenance of IWT infrastructure on national waterways through grant received from Ministry of Port Shipping and Waterways. The head office of the Authority is at Noida. The Authority also has its 4 regional offices at Patna, Kolkata, Guwahati and Kochi and 9 sub-offices at Allahabad, Varanasi, Bhagalpur, Farakka, Goa, Dibrugarh (Assam), Kollam, Chennai and Vijayawada (A.P.)

1.2 Vide National Waterways Act 2016, 106 additional waterways have been declared in addition to existing 05 NW's. IWAI has classified NW's in 03 categories: -

- Category A -23 Nos
- Category B -25 Nos
- Category C -63 Nos

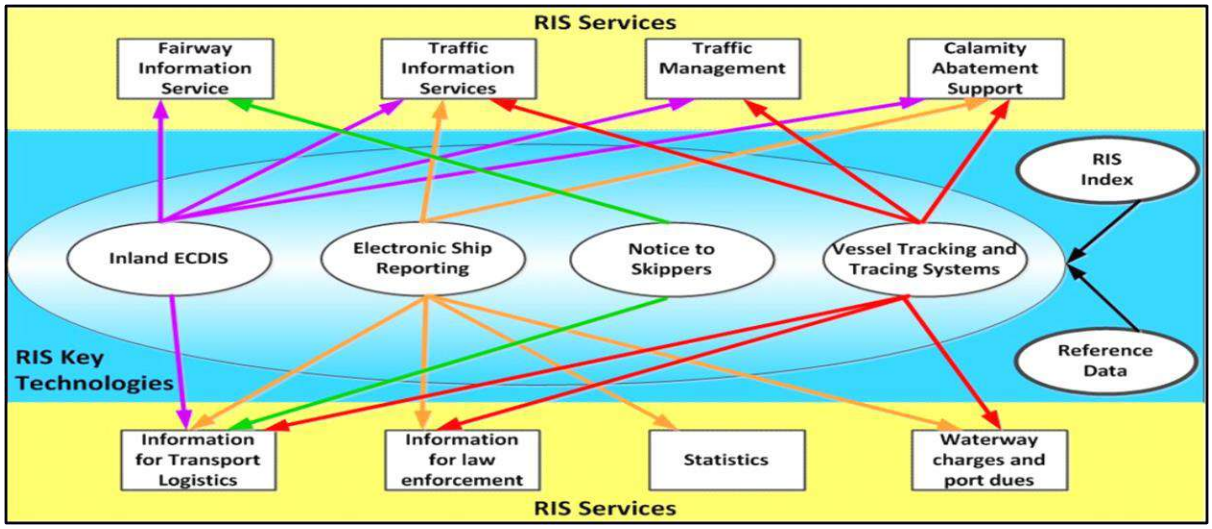
2. River Information Service (RIS).

2.1 IWAI established River Information System as per its mandate of disseminating navigational meteorological information about National waterways. RIS is akin to ATC in aviation and it is necessary for safe navigation along the Waterways. Tracking and tracing of inland navigation vessels is an important part of the "River Information Services" (RIS) for the improvement of safety and efficiency. It supports onboard navigation, shore-based traffic monitoring and other tasks such as calamity abatement. Inland AIS (Automatic Identification System) is a standardized procedure for the automatic exchange of nautical data between ships and between ships and shore installations.

2.2 IWAI planned RIS on lines of prevalent RIS Systems in Europe and USA. The Phase-I of the RIS, which is first of its kind in India, was implemented and launched by IWAI on the Sagar- Farakka stretch of National Waterway-1 on River Ganges to facilitate safe and accurate navigation in line with the recommendations of PIANC: Guidelines and Recommendations for River Information Services (2012).

2.3 After the successful implementation of RIS Phase-I, IWAI undertook setting up of another 2 phases of RIS viz RIS Phase-II (Farakka-Patna stretch) and RIS Phase-III (Patna-Varanasi stretch).

2.4 With its purposed utilization in NW-1, IWAI is mooting the idea of implementing RIS in NW-2, NW-16 and NW-97 and will float the tender for preparation of DPR for these Waterway and the RIS system will be fully operational in these NWs soon.



2.5 **Levels of RIS Information** RIS supports users in enhancing their efficiency at work. It works on the basis of different information levels. Fairway information contains the data of the waterway only. Traffic information has the information on vessels in the RIS area. Traffic information can be divided in tactical traffic information and strategic traffic information. Traffic information is provided by traffic images. The Guidelines and Recommendations for River Information Services (published by PIANC) define the following services:

(a) **Fairway information (FI)** contains geographical, hydrological and administrative information regarding the waterway (fairway) in the RIS area that is required by the RIS users to plan, execute and monitor a voyage. Fairway information is one-way information: shore to ship or shore to office (users' office).

(b) **Tactical traffic information (TTI)**is the information affecting the skipper's or the VTS operator's immediate decisions with respect to navigation in the actual traffic situation and the close geographic surroundings. A tactical traffic image contains position information and specific vessel information of all targets detected by a radar and presented on an electronic navigational chart and enhanced by external traffic information, such as the information delivered by AIS. TTI may be provided *on board* of a vessel or *on shore,* e.g. in a Control Centre.

(c) **Strategic Traffic Information (STI)**is the information affecting the medium and long term decisions of RIS users. A strategic traffic image contributes

to the planning decision capabilities regarding a safe and efficient voyage. A strategic traffic image contains all relevant vessels in the RIS area with their characteristics, cargoes and positions, stored in a database and presented in a table or on an electronic map. Strategic traffic information may be provided on board or in a RIS/VTS center.
The other support services which can effectively use RIS platforms are:

a) Calamity abatement support (CAS)
b) Information for transport logistics
c) Information for law enforcement
d) Statistics
e) Waterway charges and dues.

(d) **PIANC Definitions**: PIANC (Permanent International Association Navigation Congress) is the pioneer organization in the field of RIS. Following are important definitions, given in PIANC guidelines:

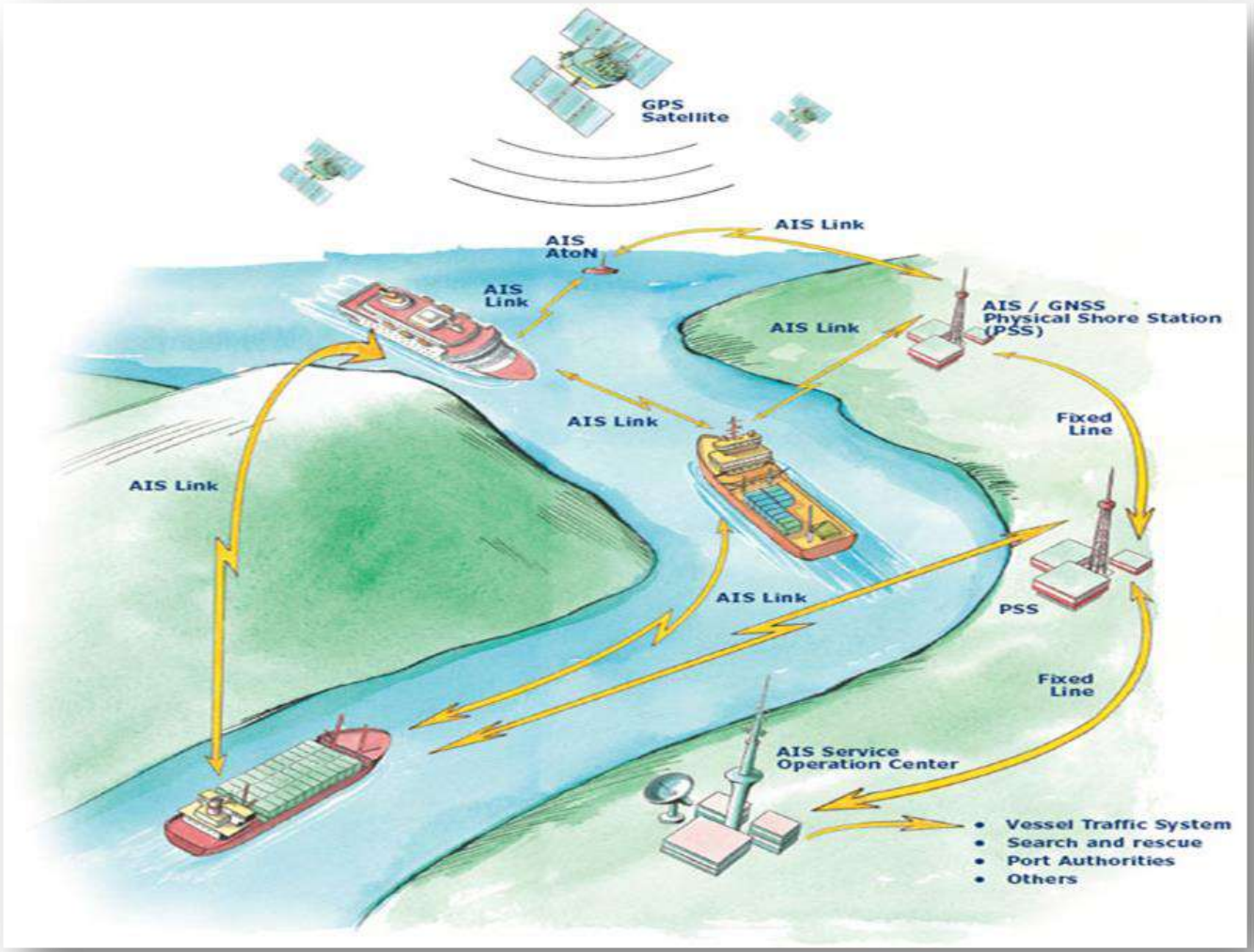
(i) **River Information Services (RIS):** River Information Services means the harmonized information services to support traffic and transport management including interfaces to other transport modes thus contributing to a safe and efficient transport process and utilizing the inland waterways RIS are already in operation in manifold ways.

(ii) **RIS system:** For the purpose of RIS, modern river information systems consist of one or more harmonized IT systems. An IT system (information technology system) is the totality of human resources, hardware, software, communication means and regulations in order to fulfil the task of processing information.

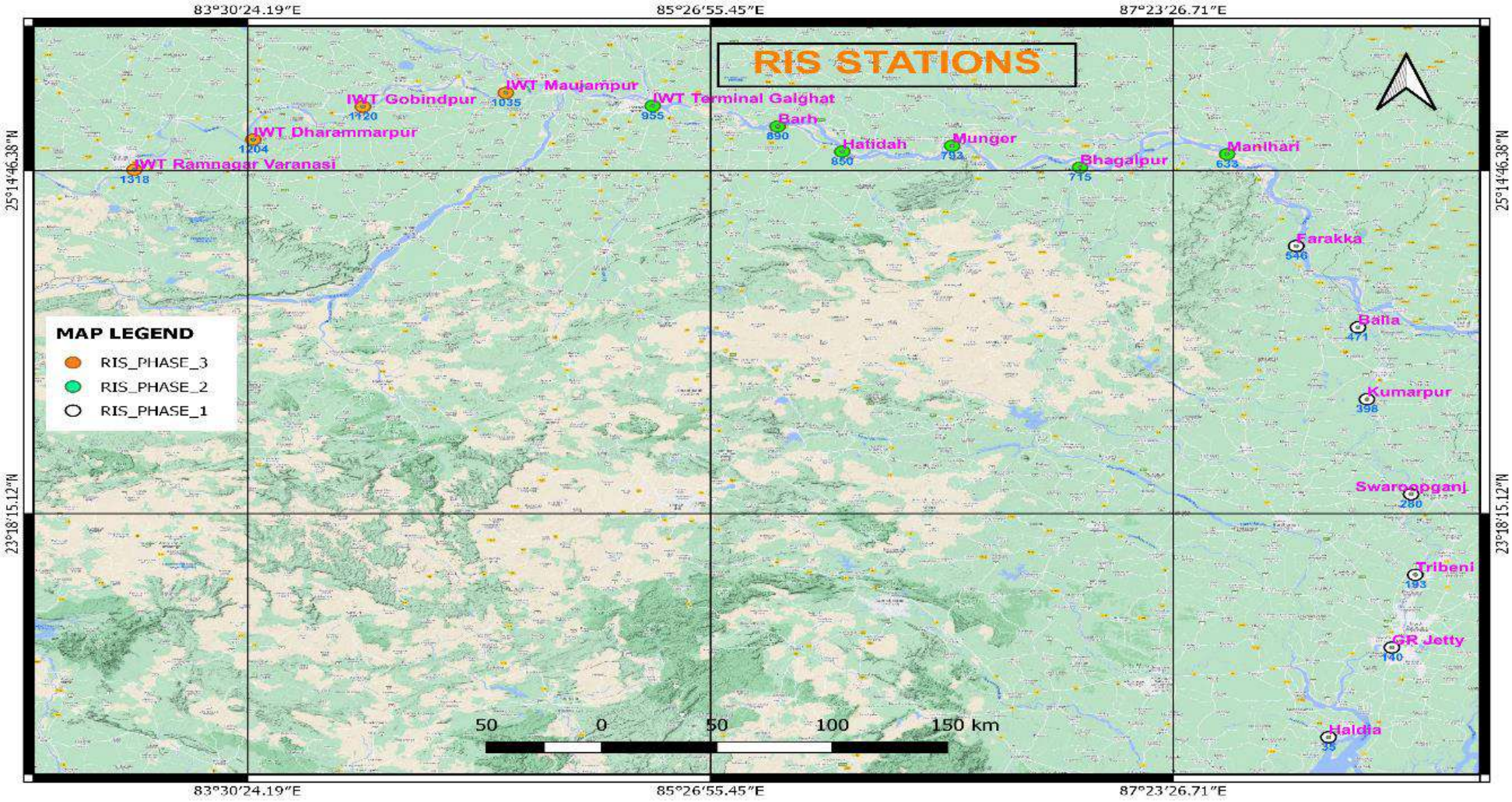
(iii) **RIS area: The** RIS area is the formally described area, where RIS are active. A RIS area may comprise the waterways in a geographical river basin, including the territories of one or more countries (e.g. in a situation where a waterway forms the borderline between two countries).

(iv) **RIS centre:** A RIS centre is the place, where the services are managed by operators. A RIS may exist without a RIS centre (e.g. service, a buoys service). When ship/shore interaction in both ways (e.g. by VHF service) is intended one or more RIS centre's are needed. If a VTS centre or a lock exists in a RIS area, they may also be used as RIS centre's. It is recommended to concentrate all services in a RIS area into one single RIS centre.

Schematic Diagram of River Information Service



RIS Stations in National Waterway-1



(v) **Inland VTS:** Inland VTS are a service, implemented by a competent authority, designed to Improve safety and efficiency of vessel traffic and to protect the environment. The service should have the capability to interact with the traffic and to respond to traffic situations developing in the VTS area.

(a) VTS should comprise at least an information service and may include others, such as navigational assistance service, or a traffic organization service, or both, defined as below:

(b) An information service is a service to ensure that essential information becomes available in time for onboard navigational decision-making.

(c) A navigational assistance service is a service to assist on-board navigational decision-making and to monitor its effects. Navigational assistance is especially of importance in reduced visibility, or difficult meteorological circumstances or in case of defects, or deficiencies affecting the radar, steering or propulsion. Navigational assistance is given in due form of position information at the request of the traffic participant or in special circumstances when deemed necessary by the VTS operator.

(d) A traffic organization service is a service to prevent the development of dangerous vessel traffic situations by managing of traffic movements and to provide for the safe and efficient movement of vessel traffic within the VTS area. Where present, Inland VTS are part of River Information Services. Within RIS, Inland VTS belongs to the group of traffic management services with the emphasis on information service and traffic organization.

(vi) **VTS area:** A VTS area is the delineated, formally declared service area of a VTS. A VTS area may be subdivided in sub-areas or sectors.

(vii) **VTS centre:** A VTS centre is the centre from where the VTS is operated. Each sub-area of the VTS may have its own sub-centre.

(viii) **Competent authority:** The competent authority is the authority made responsible for safety, in whole or in part, by the government, including environmental friendliness and efficiency of vessel traffic. The competent authority usually has the tasks of planning, arranging funding and of commissioning of RIS.

(ix) **RIS authority:** The RIS authority is the authority with the responsibility for the management, operation and coordination of RIS, the interaction with participating vessels, and safe and effective provision of the service.

(x) **RIS users:** The users of the services can be described in a number of different groups: skippers, RIS operators, lock/bridge operators, waterway authorities, terminal operators, operators in calamity fleet managers, cargo shippers, consignors, consignees, freight brokers, and supply forwarders.

(xi) **Vessel Tracking and Tracing:** Vessel tracking means the function of maintaining status information of the vessel, such as the current position and characteristics, and – if needed – combined with information on cargo and consignments. Vessel tracing means retrieving of information concerning the whereabouts of the vessel and – if needed – information on cargo, consignments and equipment.

3. Prevalent RIS Systems

3.1 European Union:

The most important proponent of RIS are European countries where number of RIS services like IRIS I and II, DoRIS, RIS equipment program in Serbia, BulRIS, etc. are in operation. This has resulted in number of directives and guidelines which are followed world over.

The potential of RIS to bring inland navigation to an improved position in the transport chain is also recognized by international organizations like the UNECE, several river commissions like the Rhine, Sava and Danube Commission and PIANC, the International Association for Waterborne Transport Infrastructure.

3.2 RIS in USA

The US Federally owned and operated system consists of about 12,000 miles of navigable waterways, 241 lock chambers and dams and reservoirs. Federal Initiative for Navigation Data Enhancement (FINDE): FINDE is a Federal effort to provide an integrated set of complete, precise and reliable navigation data for managing the Nation’s waterways utilizing the Automated Identification System (AIS), CBP"s Vessel Management System (VMS) and other currently available data sources.

3.3 In Asia, RIS Systems are in operation in China (Sections of Yangtze River & Pearl River) and in South Korea.

4. Objectives of RIS for IWAI:

The inland navigation sector includes many parties such as national authorities, port authorities, vessel owners, masters of the vessels, providers of nautical services, customs, etc. Achieving the objectives of RIS very much depends on interactions between these parties across national and organizational level. RIS objectives should strive to fulfill the aspiration of all the stakeholders, mainly the following three objectives:

a) Transport should be safe:
   (i) Minimise accidents
   (ii) Minimise fatalities
   (iii) Minimise voyage incidents

b) Transport should be efficient:
   (i) Maximise the capacity of waterways
   (ii) Maximise the carrying capacity of vessels
   (iii) Reduce travel time
   (iv) Reduce workload of RIS users
   (v) Reduce transport costs
   (vi) Reduce fuel consumption
   (vii) Provide efficient and economical link between transport modes
   (viii) Provide efficient operations in harbours and terminals

c) Transport should be environmentally friendly:
   (i) Reduce environmental hazard
   (ii) Reduce polluting emissions (in particular CO2) and spills due to accidents, illegal actions or normal operations

These objectives should be met under the constraints that RIS is supplied in a manner that is ***reliable, cost efficient and legally sound***.

5. National Waterway 1 (NW 1)

5.1 The Ganga-Bhagirathi-Hooghly river system from Allahabad to Haldia (1620 km), passing through four states – UP, Bihar Jharkhand and West Bengal, declared as national waterway in 1986. The Ganga is a typical alluvial river having characteristics of braiding, meandering and having sediment load and high water level fluctuation (both horizontal and vertical) during summer and monsoon months. On this river several shallow areas (shoals) come up during low water season and maintenance of 2 m least

available depth (LAD), particularly in upper reaches, becomes a difficult task. As the waterways are un-trained and therefore, open river navigation techniques (river conservancy works) namely dredging and Bandaling are employed for providing/maintaining targeted depth in the navigation channel. These river conservancy works are to be repeated every year.

5.2 **Limitations of channel:**

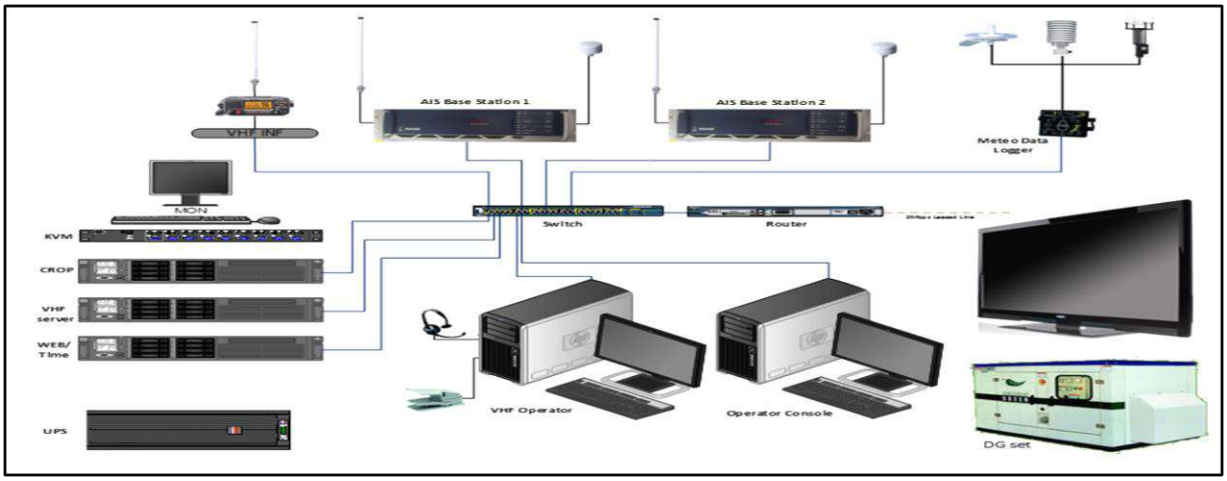
The large variation of discharge along with unstable morphological condition of bank and bed, heavy sediment load, continuous braiding and meandering makes maintenance of navigable channel a difficult proposition in NW-1. Careful navigation, therefore, is needed in the route with the help of state-of-the-art aids to navigation wherein better coordination measures ensures safe navigation.

5.3 **Night Navigation:**

The navigation in a channel during night time without the availability of reliable state of the art aids to navigation is practically difficult. The absence of this facility earlier had resulted in longer duration of voyage as the vessels had to anchor during night time. In order to optimize the cargo movement, IWAI took up the work to make the channels 24x7 navigable by providing night navigation facilities which included light beacons, lighted buoys and radio aids to navigation for better positional accuracy of vessels using GPS technology. IWAI has now ventured into an interactive system of Aids to Navigation like River Information Service where operator at control centre's established on the bank of the River interacts with vessels plying in the stretch of River and informs them on vital navigation information including proximity of vessels around.

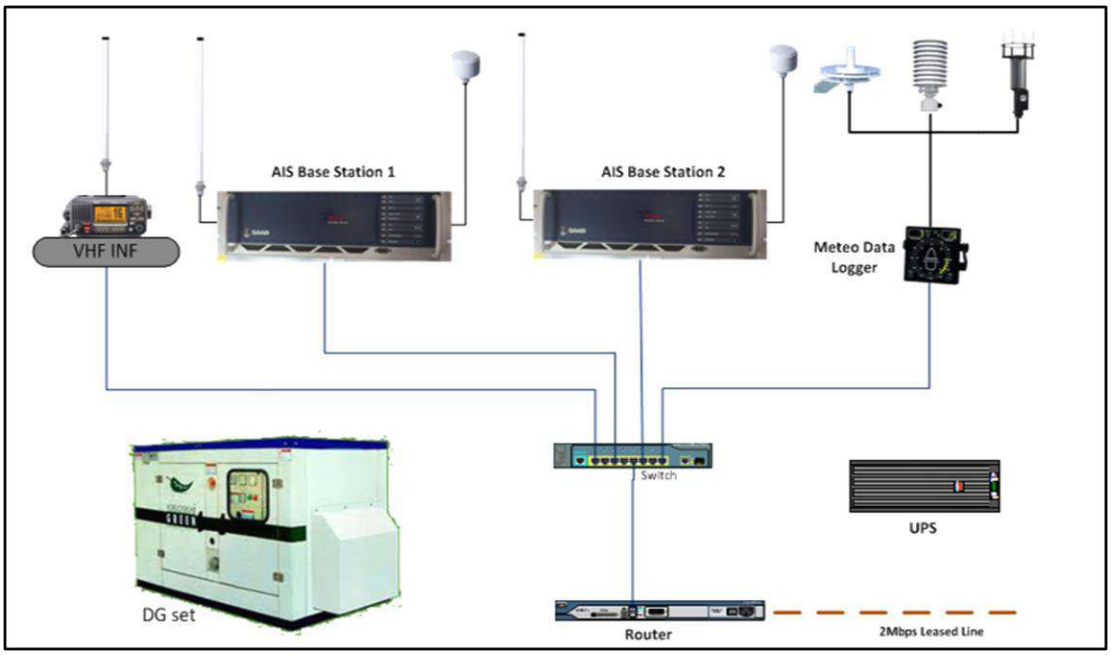
6. RIS Control and Base Stations on NW1

6.1 **RIS Area**: The entire stretch from Haldia to Varanasi is seamlessly covered by 17 Base Stations and 4 control stations at BISN Jetty, Farakka, Patna and Varanasi.



2 X AIS Base station,1 X VHF,1 X Met sensors, 3X Servers,1X Operator Console 1X 55" TV.

6. 2 **Base Station**: Base Stations are data collection centre through various sensors like AIS & Metrological. Vessels plying in the command area of a particular base stations are tracked and their relevant data are picked. The state of various weather components like wind speed, direction, humidity, pressure and temperature at the base station sites is also collected. All these data are then sent to control centre's where RIS operator issues suitable advises to the vessels through VHF.



The Components are2 X AIS Base station,1 X VHF,1 X MET sensors

6.3 **Control Station**: At control stations, data from base stations are received through dedicated leased lines. Based on these data, the duty operator transmits relevant and suitable information to vessels for safe navigation. The function of various sub-systems at control stations are as below:

(a) Central RIS Operating Processor – filter the duplicating messages, communicating all information to both ships and shore AIS units and provide feedback to monitoring units and web server.

(b) Central Monitoring and Storage Processor – the main functions are monitoring and storage of data.

(c) Web server – It is used to provide a traffic image to third party users. Third party can see the online information about the real time traffic movements and access the previous traffic records.

(d) Time server- control all above servers as well as it will keep the records of registration, display and reply data.

1 X Radar	1 X VHF	1 X Echo sounder
1 X DGPS receiver	1 X AIS	1 X ECDIS (MFD)

6.4 **On Board RIS Equipment**: The following compatible equipment for navigation are provided is equipped on board IWAI vessels. Some privately owned vessels may have part of these equipment.

(a) AIS Transponder (Class-A)

(b) VHF Communication system

(c) DGPS Receivers

(d) Radar

(e) Echo Sounder

(f) Hydro and metrological sensors

(g) Inland ECDIS (Navigational display software pre-loaded with ENC)

6.5 The location details of stations placed at **Annex-11**.

Level of Service: The level of service presently being provided by IWAI on NW1 shall fall under the category of “Fairway Information Service”.

6.6 **Participating Vessels**:

(a) Vessels navigating in a RIS area are recommended to make use as far as possible of the information provided by RIS and relevant services.

(b) Decisions concerning the actual navigation and the maneuvering of the vessel remain within the responsibility of the Master. Any information provided by the RIS cannot replace any decision made by the Master.

7. Operations at Control Station

The operations shall broadly be categorised into two parts as follows:

(a) Normal operation

(b) Emergency operation

7.1 Normal operation

Normal operation refers to the daily operation to be performed by the RIS operators present at Control center’s. Depending on the requirement, various alerts can be configured in Coast Watch/ Periskal[x]. The alerts are to be configured in consultation with the RIS system maintainer. The SOP for the operators at various locations is as follows.

(a) Login to Coast Watch/ Periskal[x] with the unique login credentials given to each operator.

(b) Check designated area in Coast watch/ Periskal[x].

(c) Ensure that there are no alerts pertaining to the ships.

(d) If there is a query about any particular ship from any authorised body, the operator should search for the ship in the field and give the details of that particular ship after obtaining permission from IWAI. The operator should also log this query in the logbook.

(e) Depending on requirement, send AIS binary messages to the ships. The operator should also log this event in log book.

(f) If there are any issues observed with regard to Coast Watch/ Periskal, the operator should notify the same to the system maintainer.

(g) Depending on requirement, request the maintainer to create virtual Atons.

(h) Monitor the virtual Atons periodically and notify the maintainer if any Aton information is missing.

(i) The operator should ensure that the Coast Watch/ Periskal operator session is logged out during end of shift.

(j) The operator should attend the VHF call received from vessel and assist the vessel through VHF communication.

(k) The operator should daily check weather data on weather station installed at site and if any discrepancy is found, the same is to be reported to the maintainer.

(l) Maintain the log book for operator login in system.

(m) Reporting of dangerous goods carried by the vessel

7.2 **Emergency Operation:**

Emergency operation refers to various operations to be performed by the operator during an incident/accident. The SOP for the operators at various locations is as follows:

(a) Login to Coast Watch/ Periskal with the unique login credentials given to each operator.

(b) Replay data on Coast Watch/ Periskal and search for the ships involved in the incident.

(c) Prepare a report with time stamp of incident.

(d) Create areas on Coast Watch/ Periskal map as per requirement.

(f) Obtain permission from IWAI and then share the incident details with third party.

(g) Ensure that the Coast Watch/ Periskal operator session is logged out during end of shift.

(h) In emergency condition assist vessel through VHF communication.

(i) Maintain the log book for operator login in system.

8**. Inspection Schedules**

All the inspection schedules, otherwise mentioned, shall be carried out by the personnel deployed by the contractor. In the event of Monthly, Half Yearly and Annual Inspection; consultation wherever required shall be carried out by the contractor's representative with the Director or his authorized representative.

8.1. **Daily Inspection (Di) Schedule**

Where available, the Daily inspection (DI) of all the equipment shall be carried out as per OEMs advice mentioned in the manuals. In addition, following works shall be carried out as detailed in Annex-1.

8.2. **Weekly Inspection (Wi) Schedules**

Where available, the weekly inspection (WI) of all the equipment shall be carried out as per OEMs advice mentioned in the manuals. In addition, following works shall be carried out by the staff as detailed in Annex-2.

8.3. **Monthly Inspection (Mi) Schedules**

Where available, the monthly inspection (MI) of all the equipment shall be carried out as per OEMs advice mentioned in the manuals. In addition, following works shall be carried out by the staff as detailed in Annex-3.

8.4. **Quarterly Inspection (Qi) Schedules**

Where available, the quarterly inspection (QI) of all the equipment shall be carried out as per OEMs advice mentioned in the manuals. In addition, following works shall be carried out by the staff detailed in Annex-4.

8.5. **Half Yearly (Hy) Inspection Schedules**

Where available, the Half Yearly inspection (HY) of all the equipment shall be carried out as per OEMs advice mentioned in the manuals. In addition, following works shall be carried out by the staff detailed in Annex-5.

8.6. **Yearly Inspection Schedules**

Where available, the Yearly inspection of all the equipment shall be carried out as per OEMs advice mentioned in the manuals. In addition, following works shall be carried out by the staff detailed in Annex-6.

9 Notices

9.1 **Notices to Skippers**: Fairway authorities have the obligation to inform users about the status of the waterway as far as that might influence safety and accessibility. Notices to Skippers communicate, for example, the status of the inland waterway infrastructure (i.e. bridges and locks), failures of aids to navigation, temporarily blockages of waterway sections or other types of infrastructure, works, water level and water depth information, and weather messages. The international standard for Notices to Skippers provides a standardised data format, which can be used both for publishing notices on the internet (pull-services) or for distribution by e-mail or SMS (push services).

9.2 **Notices to Mariners**: The notice to the Mariners will be issued by the Regional and field offices from time to time to inform the marines about any changes w.r.t safe Navigation. The format for the same is placed at **Annex 11**.

10. Duties and Responsibilities

10.1 Duties of Director

(a) Periodical visit – once in a six months/ his representative should visit every quarter

(b) VHF Range checks

(c) Validity of fire equipment as per certificate of testing agency

(d) Notices to mariners

(e) Contingencies work like maintenance, painting, etc.

(f) Nodal officers are to be nominated for periodical inspection, providing latest navigational rout, communication of warning message and checking broadcasting and web tracking.

10.2 Duties of System Maintainer

(a) He shall be responsible for satisfactory and efficient operation & maintenance of RIS Stations of the water way for which he is responsible.

(b) He shall visit various RIS Stations, once every quarter and submit a quarterly report on performance of the system to the Director

(c) He shall supervise and help station in charge in monthly, quarterly, half yearly and yearly inspections as per inspection schedule.

(d) He shall be responsible for scrutiny of various periodical returns and breakdown reports and take required remedial measures under intimation to the Director.

(e) He will also regularly update all the technical data, including software upgrades if any, at the stations under his control. He will also undertake training of the staff on such upgrades.

(f) In consultation with Director and Station in Charge, he shall ensure serviceability test of Fire Equipment from concerned agency.

(g) He shall also plan and carry out yearly VHF range checks of all the base stations under his command in consultation with Director,

(h) He shall periodically (every month) submit to the Director a true statement on any accidents if occurred during the said month.

(I) He shall also assist Director from time to time in any other relevant duty assigned by to him.

10.3 **Duties of RIS Operator**

(a) The contractor shall assign one of the operator as in-charge of the manpower unit who will be responsible to the system maintainer and Director IWAI or his representative in managing day to day operation of the station.

(b) The station in charge shall be responsible in all operational and maintenance matters relating to the station. He shall ensure that all the station personnel discharge their duties in efficient manner

(c) In discussion with System maintainer, the station in charge will prepare duty roster for 24 hours' operation in three shifts.

(d) The duty roster shall remain promptly displayed at a conspicuous location at the station.

(e) The station in charge shall carry out all routine maintenance

(f) He shall take up an equal share of the routine watch-keeping duties regularly at the Station along with other operator,

(g) He shall remain present during the routine inspection of by Engineer-in-Charge of IWAI or their authorized representative. In case of any shortfall/mishap he should promptly inform the concerned office and inform to the CAMC service provider on emergency basis and provide

such additional assistance as may be necessary during exigencies even if he is not on duty.

(h) He shall assist System maintainer in periodical maintenance schedule, during his routine visits.

10.4 Duties of Vessel Masters

(a) AIS equipment is to be always “switch on” mode. The relevant data on the AIS equipment about ships name, MMSI No, length, width, draught, tonnage, last port of call, next port of call, cargo etc to be updated prior any voyage.

(b) During sailing the Navigational safety is to be ensured with the help of periskal/ Coast Watch software.

(c) Monthly Navigational updated rout is to be used Navigation.

(d) Any operational problem is to be reported to nodal officer nominated by RO

(e) Daily it is to be ensure that required battery back is available with UPS installed with RIS equipment. The batteries are to be in fully charged condition.

(f) Separate log book is to be maintained for on board RIS equipment in which all records about visiting of nodal officer, CAMC service provider along with running hours

11. In The Event of Exigencies Duties of Various Staff

(a) In the event of emergencies, notwithstanding the duties and responsibilities contained, herein, all the staff shall follow the instructions of station in charge in tiding over the situation.

(b) In the event of fire at the station, parallel efforts to engage local authorities like fire station/municipal authorities shall be immediately made with due intimation to Concerned officer-In- Charge

(c) In the event of heavy storm and rain, the station shall be shut down after obtaining approval from Engineer in Charge / his authorized representative. The shifts shall be rotated on fortnightly basis by the Engineer in Charge representatives.

12. **Records to be Maintained**

(a) At Station Level– Annex-7
(b) At Director Office- Annex-8
(c) At Iwai Noida- Annex-9

13. Dos and Don'ts

Dos

(a) Do ensure all equipment is installed correctly and operating as intended
(b) Do diligently follow the standard operation procedures (SOP)
(c) Do follow the manufacturer's instructions for the installation, operation, storage, cleaning and maintenance of equipment.
(d) Do promote a safety culture to limit the chance of workplace accidents and injuries. Read the safety instructions before you work on the equipment.
(e) Ensure sufficient cooling & ventilation to the system.
(f) Ensure regular training of the staff
(g) Immediately report any minor problems observed with equipment.
(h) Do keep 'pest control' programs up to date. Remember rats and mice are good climbers and can easily chew through wires, cabling and the like.

Don'ts

(a) Smoking is strictly prohibited. Don't smoke.
(b) The sub-assemblies are not field repairable. Never attempt to repair a defective sub assembly. Contact the CAMC Contractor
(c) Don't carry out frequent measurements
(d) Turn off the power before opening the cabinet
(e) Don't override safety features mentioned on equipment/described by OEM.
(f) Never make any modifications to the original equipment manufacturers design
(g) Never place heat sources capable of producing combustion around equipment.
(h) Never use devices with open flames in confined spaces where oxygen could become depleted.
(i) Never use worn out or broken tools.
(j) Don't use hand tools with greasy or oily hands which can cause slippage.
(k) Don't overload power points and electrical circuitry. e.g. 'piggybacking' of double adapters, power boards and extension leads.

The location details of stations are as indicated below

PLACE	LAT (Degree)	LONG (Degree)	Lat (dms)	Long (dms)	CHAIN AGE KM	TYPE OF STN
Haldia	22.03870000	88.04123333	22° 02’19.32’”	88° 02’ 28.44	35.000	BASE STN
GR Jetty	22.54603333	88.30696667	22° 32’ 45.72	88° 18’ 25.08	140.000	CONTROL STN
Tribeni	22.95785000	88.40561667	22° 57’ 28.26	88° 24’ 20.22	193.000	BASE STN
Swaroopganj	23.41403333	88.38768333	23° 24’ 50.52	88° 23’ 15.66	280.000	BASE STN
Kumarpur	23.95170000	88.20266667	23° 57’ 06.12	88° 12’ 09.60	398.000	BASE STN
Balia	24.35855000	88.16478333	24° 21’ 30.78	88° 09’ 53.22	471.000	BASE STN
Farakka	24.81886667	87.90575000	24° 49’ 07.92	87° 54’ 20.70	546.000	CONTROL STN
Manihari	25.33842222	87.61582222	25° 20’ 18.32	87° 36’ 56.96	633.000	BASE STN
Bhagalpur	25.26345278	86.99863333	25° 15’ 48.43	86° 59’ 55.08	715.000	BASE STN
Munger	25.38595833	86.46207222	25° 23’ 09.45	86° 27’ 43.46	793.000	BASE STN
Hatidah	25.35334722	86.00108056	25° 21’ 12.05	86° 00’ 03.89	850.000	BASE STN
Barh	25.49604444	85.73023889	25° 29’ 45.76	85° 43’ 48.86	890.000	BASE STN
Gaighat	25.61165278	85.20569167	25° 36’ 41.95	85° 12’ 20.49	955.000	CONTROL STN
IWT Maujampur	25.68578333	84.58965000	25° 41’ 08.82	84° 35’ 22.74	1035.000	BASE STN
IWT Gobindpur	25.60755000	83.98995000	25° 36’ 27.18	83° 59’ 23.82	1120.000	BASE STN
IWT Dharammarpur	25.42120000	83.52973333	25° 25’ 16.32	83° 31’ 47.04	1204.000	BASE STN
IWT Ramnagar Varanasi	25.25069444	83.03128333	25° 15’ 02.50	83° 01’ 52.62	1318.000	CONTROL STN