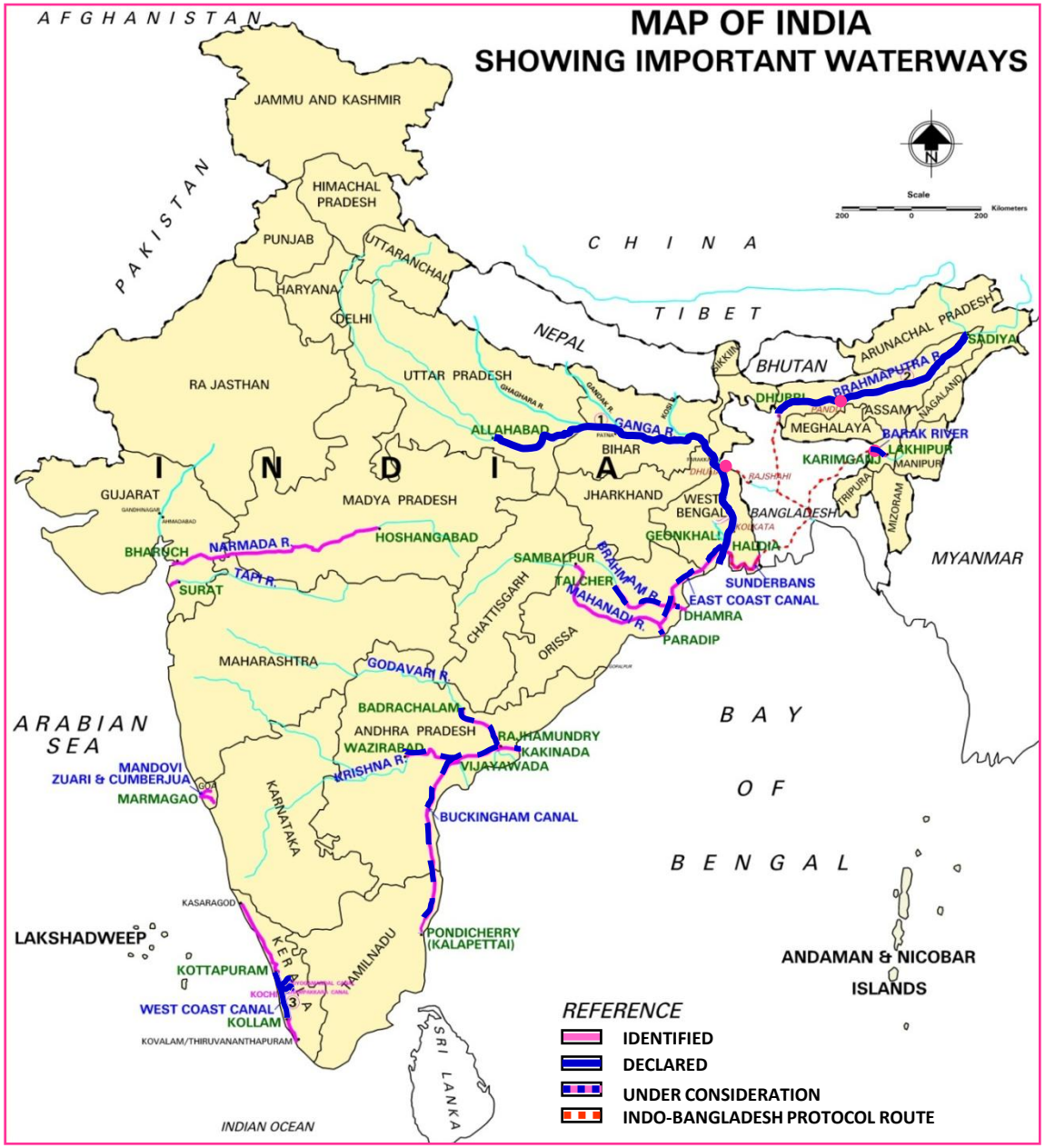
Cargo Movement on Ganga & Brahmaputra

Navigational Challenges & Solutions

Mumbai
16th March, 2010

Waterways of India

- Role of IWAI- Develop infrastructure and Regulate movement on National Waterways
- 3 National Waterways developed & operational - 2716 km
- GoI has notified two more waterways i.e. NW 4 and NW 5 in Nov. 2008 – 1718 km
- Other waterways to be developed by States



National Waterway - 1 Ganga

Distance

1620 km Haldia- Allahabad

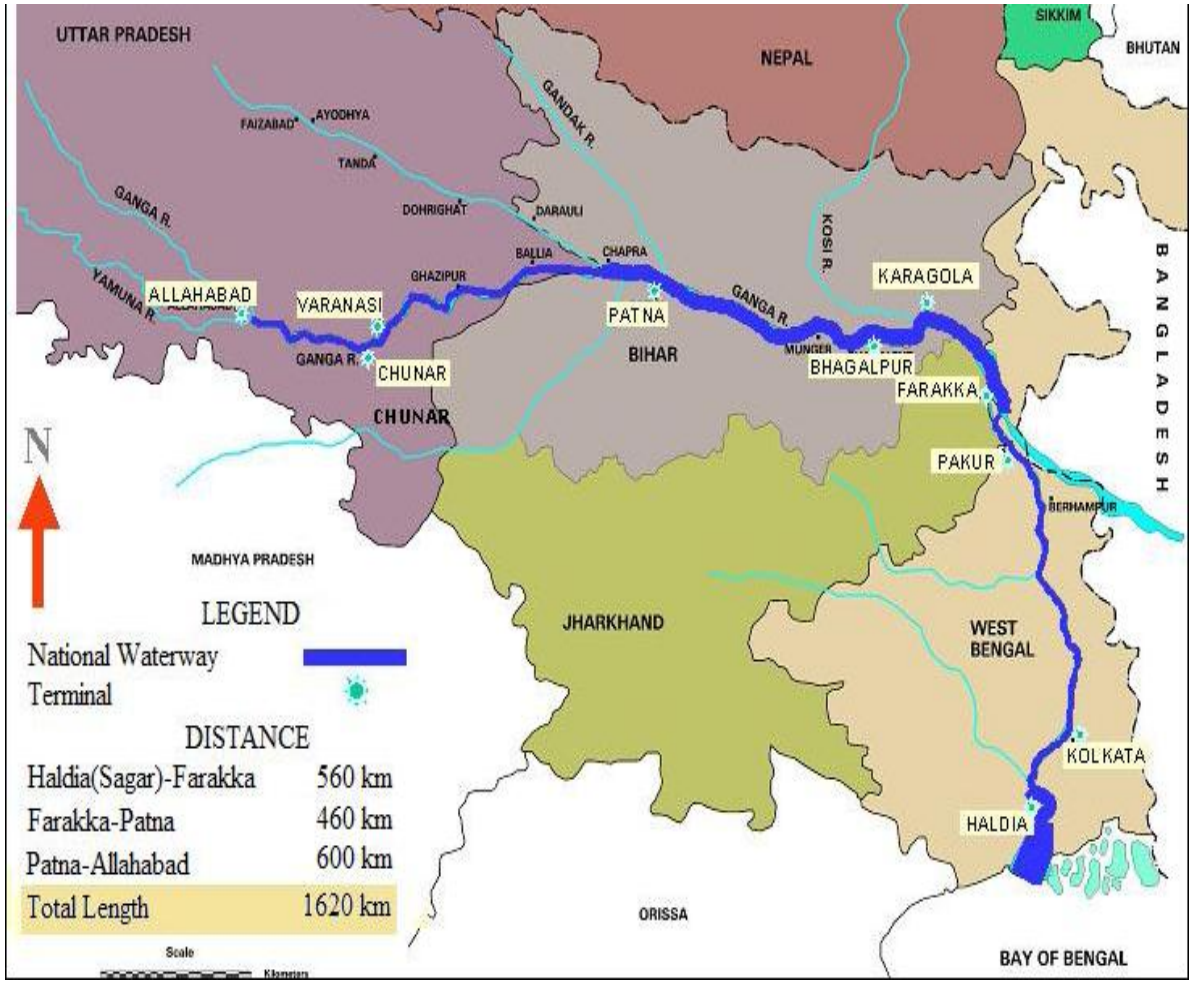
Fairway

Least available depth (LAD)

- 3 m Haldia-Farakka
- 2.5 m Farakka - Patna
- 2 m Patna - Varanasi
- 1.5m Varanasi-Allahabad

Navigational Aids

- Night navigation aids available between Tribeni and Varanasi
- Day navigational aids on entire stretch



Salient Features of Ganga

- Ganga – Bhagirathi – Hooghly river system
- Tidal reach from Haldia to Tribeni
- Wide variation in water discharge – during monsoons it is 70 to 80 times of lean season discharge
- Meandering nature of Ganga in major reaches of alluvial plain
- 1600 million tons is the annual silt load of Ganga
- Most of sediment load is extremely fine - less than 0.075 mm size
- Leads to rapid shoal formation
- Current velocity varies between 0.2m/s during lean season to 4.0 m/s during flood season in the stretch between Allahabad to Farakka
- Current velocity is 1.2 m/s in Feeder Canal & 1.7 m/s (max.) in Bhagirathi river stretch

Hydrological data NW-1

Water level variation (in m)

At Farakka	-	2.50
At Patna	-	10.00
At Varanasi	-	15.80
At Allahabad	-	16.50

Discharge (in cumec)

	At Allahabad		At Varanasi
Max	- 48000	-	43000
Min	- 96	-	116

Velocity (in m/sec)

	At Farakka	Feeder canal	Bhagirathi
Max	- 4.0	1.2 m/sec	3.5 m/ sec
Min	- 0.10		

Critical Bend Radius – NW 1

Location	Chainage (in km)	Bend radius(in m)
KoPT tidal stn	196	450
Rukespur	207	311
Kishoriganj	263	354
Mayapur cut off	283	400
Gopipur reach	292	375
Char Bishnupur cut off	331	465
Kalyanpur reach	357	316
Bhutghata reach	385	186
Kamnagar	394	201

Critical Bend Radius – NW-1
…contd

Location	Chainage (in km)	Bend radius (in m)
Katalia	406	459
Debipur	443	440
Maheshpur reach	450	304
Gadil reach	475	454
Khosalpur reach	487	345
Alampur	504	437
Farakka	545	410

Lock size NW-1

At Farakka

Lock chamber	-	149.35 x 25.15 m
Free board	-	2.13 m
Top of lock wall	-	R.L. 28.44 m
HFL	-	RL. 26.10 m

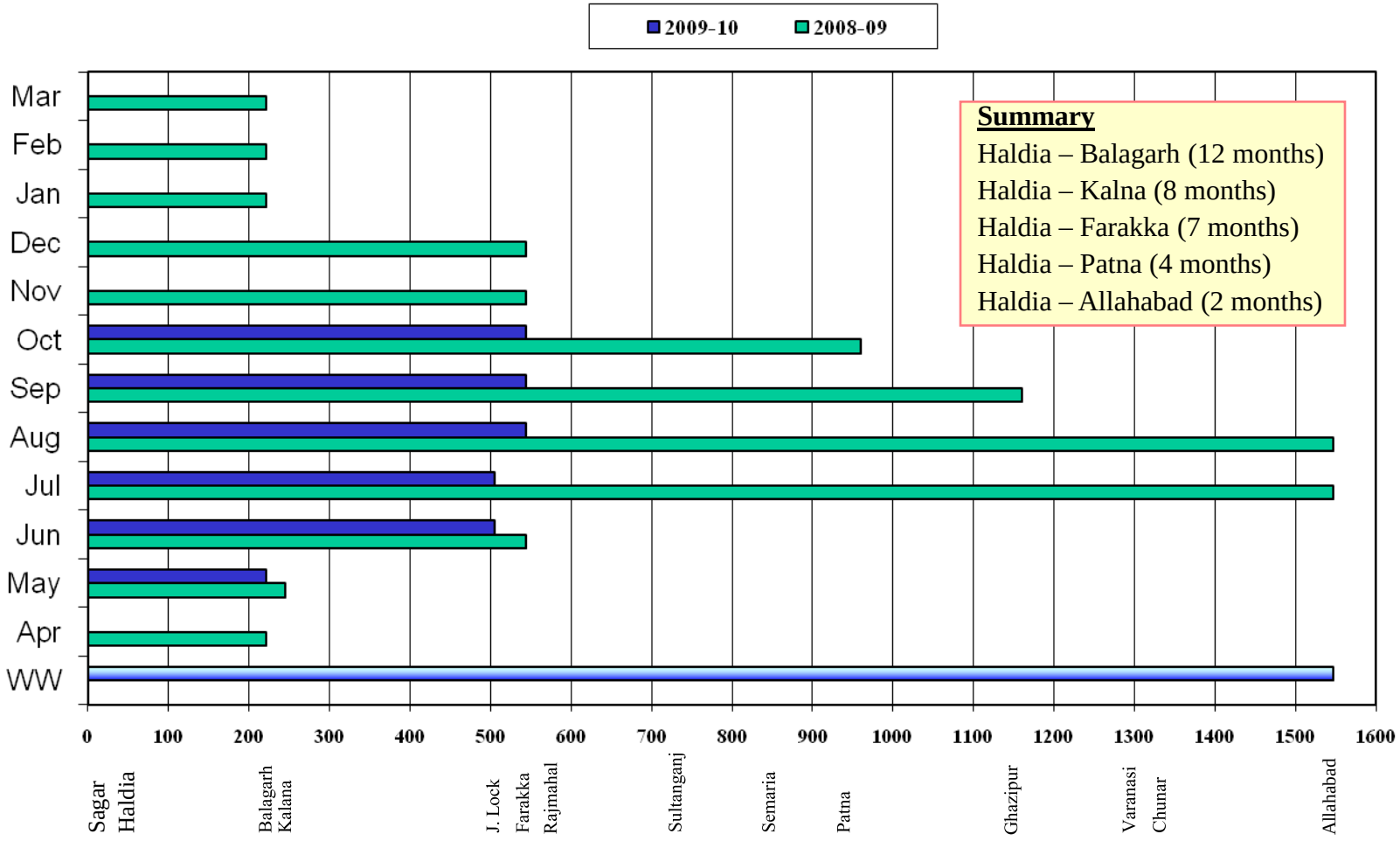
Steps taken

- IWAI has divided the waterway into seven stretches
  - Haldia to Katwa
  - Katwa to Rajmahal
  - Rajmahal to Munger
  - Munger to Patna
  - Patna to Ghazipur
  - Ghazipur to Chunar
  - Chunar to Allahabad
- Dredgers being deployed in each stretch
- Bandalling & dredging for providing requisite LAD
- 24 hr. navigation facilities provided
- DGPS station at Bhagalpur functional & three more at Katwa, Patna & Varanasi under construction
- Nodal Officers notified for each stretch

Dredging in river Ganga

Hydraulic surface dredger in Ganga

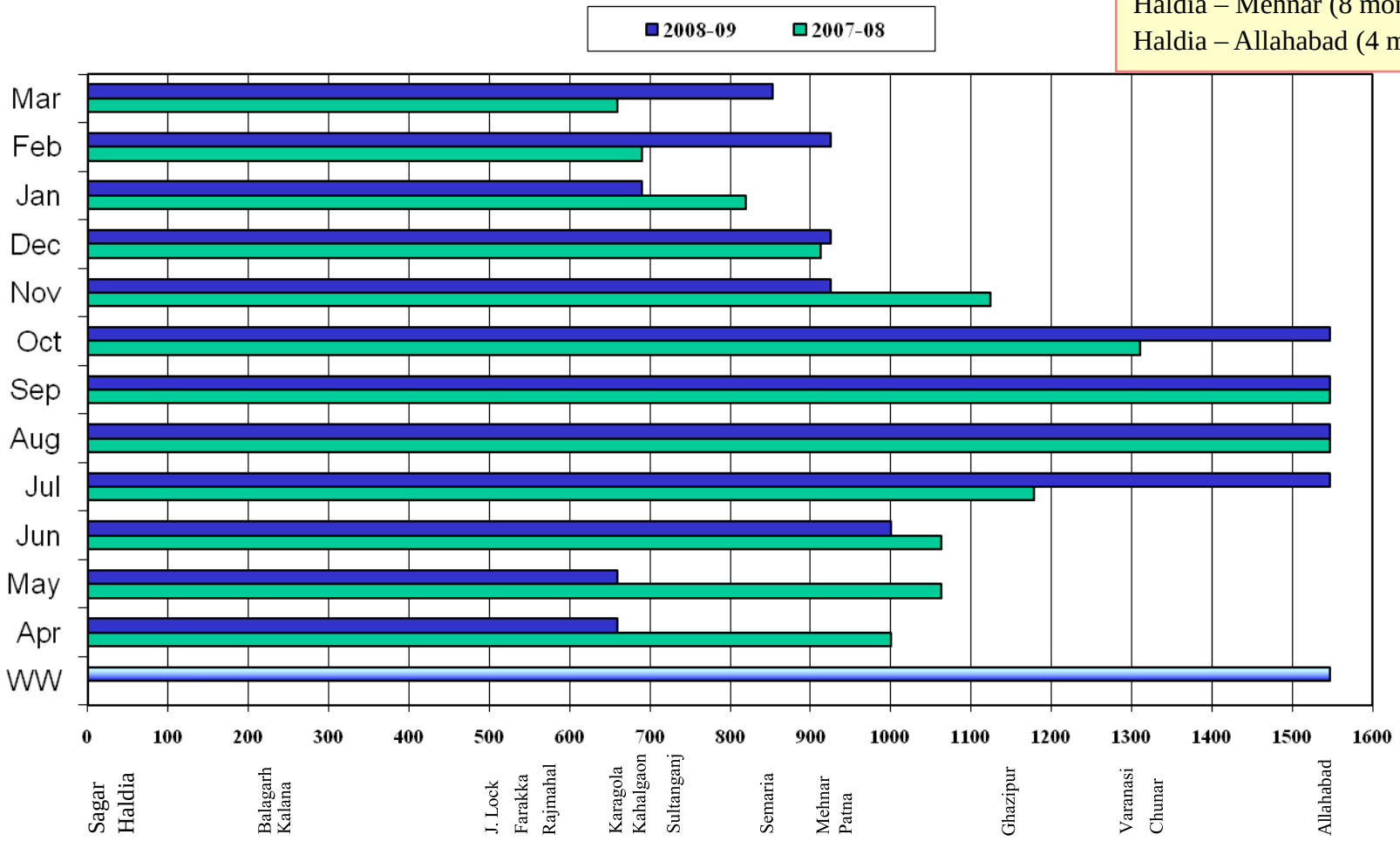
Stretch-wise availability of > 3m LAD on NW 1



Stretch-wise availability of > 2m LAD on NW 1

Summery

Haldia – Karagola (12 months)
Haldia – Kahalgoan (10 months)
Haldia – Semaria (9 months)
Haldia – Mehnar (8 months)
Haldia – Allahabad (4 months)



Present status of Ganga

Channel width	**45.0 m**
Channel depth at lowest WL	**3.0 m upto Farakka** **2.5 m Farakka – Patna** **2.0 m Patna – Varanasi** **1.5 m Varanasi - Allahabad**
Radius of curvature inside	**600 m**
Flattening at curves	**L sq./2R*** * Where L = vessel length in metres & R = radius of curvature of bend in metres
‘n’ ratio	**10**
Minimum vertical clearance above HFL under bridges	**10 m**
Minimum vertical clearance above HFL under high voltage transmission cables of 110 K.V.	**19 m + 1 cm. for each addl. 1 K.V. above 110 K.V.**

Critical bridge clearances- NW 1

Location	Chainage	HC (in m)	VC (in m)
Pakur bridge	525	49.07	12.15
Rajendra Setu- Semaria	853	40.00	10.00
Malaviya- Varanasi	1308	101.50	6.56
Mirzapur	1398	30.50	2.52

- However, vertical clearance below 10 m is for a few days only
- All other bridges are having more than 70 m HC and 9 m VC

Cargo potential on Ganga

- Ganga – **Dedicated Freight Corridor** for UP, Bihar & West Bengal
- Huge potential for cargo movement through IWT
- Coal movement for Thermal Power Plants alone could be in excess of 10 MTPA
- Market Study conducted by IFCI has identified a few origin - destination points along with cargo

Cargo potential …. contd.

(Source: Market Study –IFCI)

O-D pair	Expected Cargo	Cargo Volume	No. of barges required
Kolkata - Narayanganj	Fly Ash Foodgrains Steel	10,00,000 TPA 2,00,000 TPA 1,00,000 TPA	60
Chunar – Farakka **Chunar – Bhagalpur** **Chunar - Patna**	Cement Cement Cement	10,000 TPA 50,000 TPA 90,000 TPA	10
Farakka – Bhagalpur **Farakka – Patna** **Sahibganj - Patna**	Cement Cement Stone Chips	70,000 TPA 30,000 TPA 30,000 TPA	
Haldia - Varanasi	Edible Oil	2,16,000 TPA	13

National Waterway - 2 Brahmaputra

Distance

Dhubri to Sadiya – 891 km

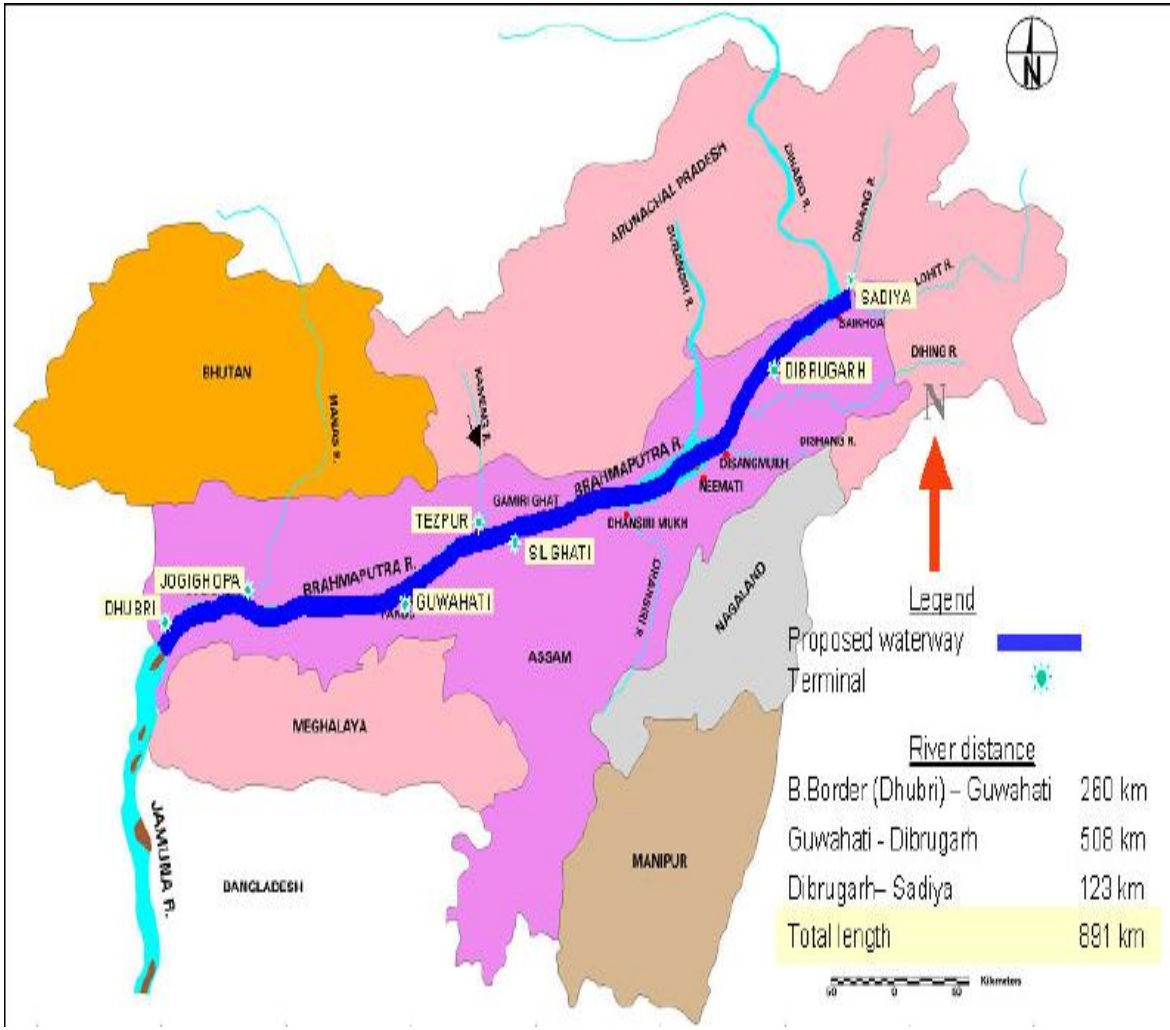
Fairway

Least available depth (LAD)

- 2.5m Dhubri - Neamati
- 2.0m Neamati - Dibrugarh
- 1.5m Dibrugarh - Sadiya

Navigational aids

- Night navigation aids available between Dhubri and Dibrugarh (768 km)
- Day navigation aids available in entire waterway



Salient Features of Brahmaputra

- Brahmaputra – life line for the North East
- Prior to 1950 earthquake, 5 m draft was available throughout Brahmaputra
- In 1951, 840,640 tonnes of cargo was carried
- Indo - Pak war of 1965 & 1971 adversely affected IWT on Brahmaputra
- 33% of country's water resources in Brahmaputra river basin
- Braided nature of Brahmaputra river – large load of medium sediment - 0.075 mm to 0.2 mm & coarse sediment of 0.2 mm +
- Maximum velocity -3.5 m/sec + during flood season
- **No critical bends in Brahmaputra**
- No critical bridges in Brahmaputra

Hydrological data NW-2

Water level variation (in m)

At **Dhubri** - **1.91**

At **Pandu** - **9.46**

At **Dibrugarh** - **8.71**

Discharge (in cumec)

At Jogighopa

Max - 78450

Min - 1001

Velocity (in m/sec)

At Pandu

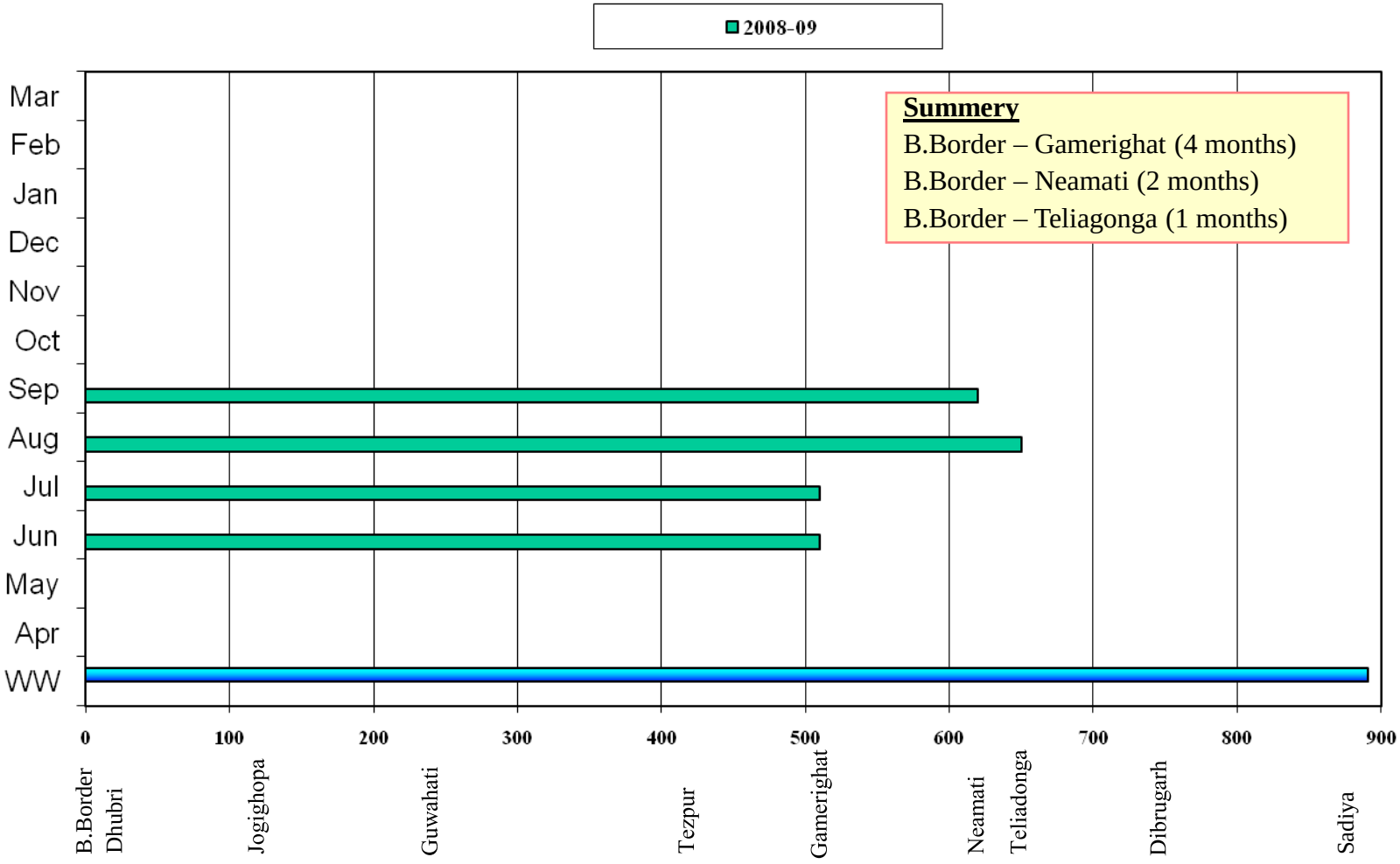
Max - 3.63

Min - 0.72

Steps Taken

- IWAI has divided the waterway into three stretches
  - Bangladesh border near Dhubri to Pandu
  - Pandu to Neamati
  - Neamati to Sadiya
- Dredgers being deployed in each stretch
- Bandalling & dredging for providing requisite LAD
- 24 hr. navigation facility provided
- DGPS station at Jogighopa functional – two more at Tezpur & Dibrugarh under construction
- Nodal officers notified for each stretch

Stretch-wise availability of > 3m LAD on NW 2



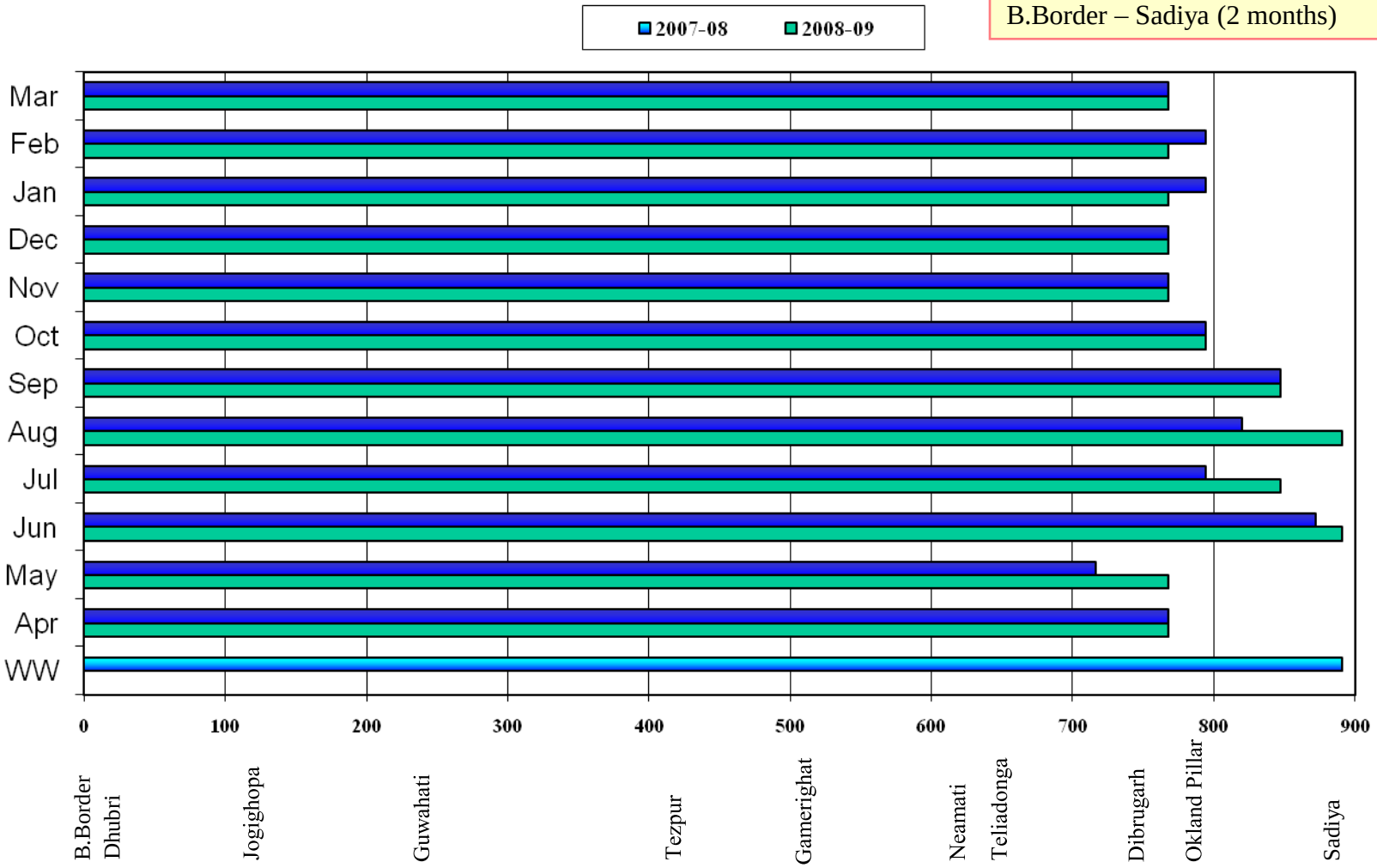
Stretch-wise availability of > 2m LAD on NW 2

Summary

B.Border – Dibrugarh (12 months)

B.Border – Okland Pillar (5 months)

B.Border – Sadiya (2 months)



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Cargo Potential on Brahmaputra

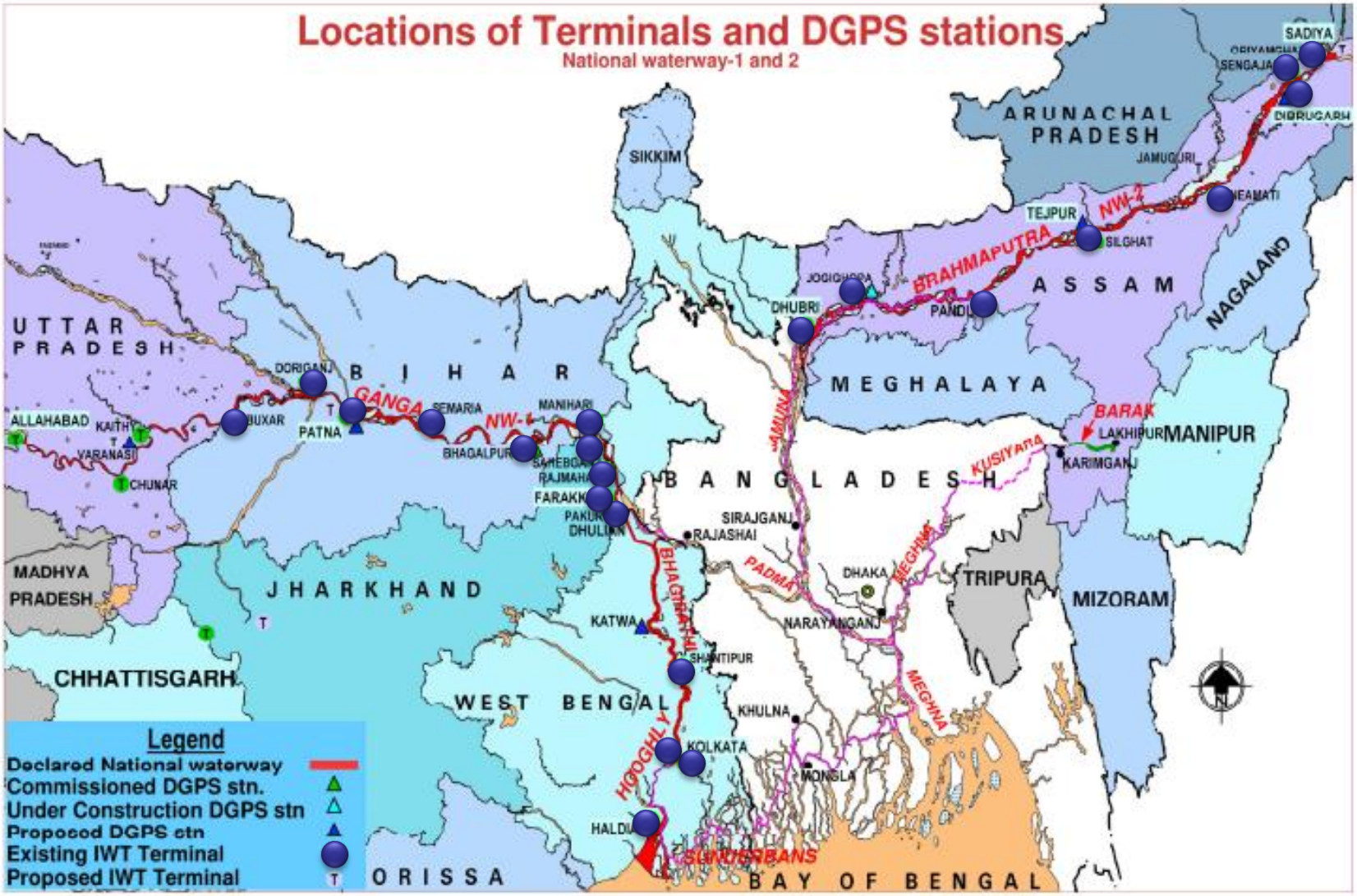
- Brahmaputra is the life line of North East
- Jute, Salt, Tea, Coal, Bitumen, HSD, Petro Coke & Fertilizers – potential cargo
- Huge potential for movement of ODC & Project cargo for upcoming hydro power plants in Arunachal Pradesh
- Market Study by IFCI has also identified potential cargo and certain origin-destination points

Cargo Potential

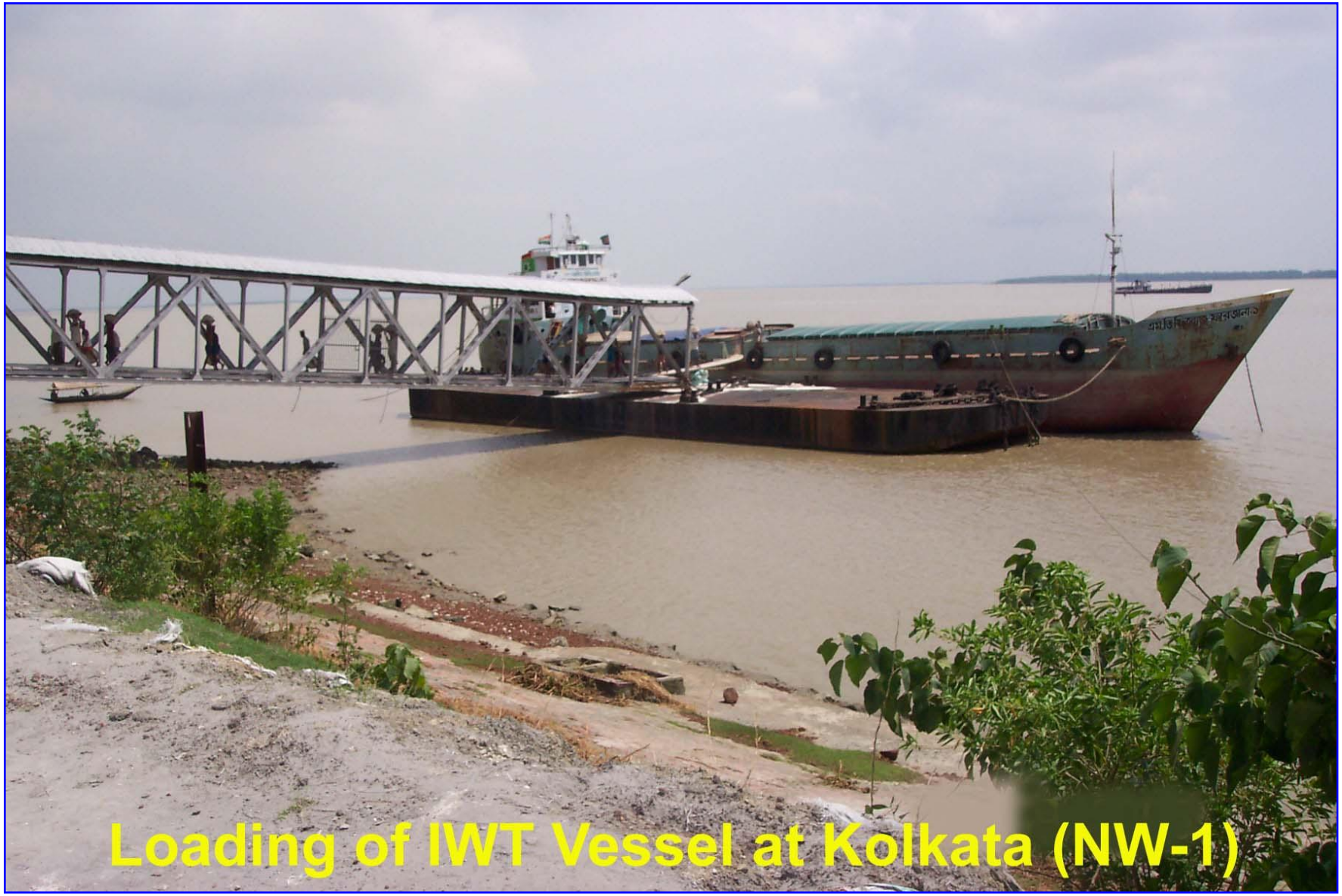
(Source: Market Study by IFCI)

O-D pair	Cargo	Quantity	No. of Barges
Jogighopa - Kolkata	Coal	1,50,000 TPA	**9**
Kolkata – Jogighopa	Salt, Bitumen & Petro-coke	40,000 TPA	
Silghat - Baghabari	High Speed Diesel	1,20,000 TPA	**5**

Inland Waterway Terminals on NW 1 & 2



Permanent IWT terminal at Gaighat, Patna


Loading of IWT Vessel at Kolkata (NW-1)

Mechanized cargo handling equipments

Equipments	NW-1	NW-2	NW-3
Container Crane	1	1	-
Shore Crane	2	2	8
Floating Crane	4	5	-

Factors impacting design parameters of cargo vessels

- Depth & width of navigable channel
- Water current velocity
- Turning Circles
- Navigational clearance – horizontal & vertical
- Ratio of wetted cross - sections of the channel & mid - ship form of the vessel (‘n” ratio)
- Whether two - way or one - way navigation is permitted
- Radius of curvature of channel bends
- Type of cargo – container; POL; dry bulk etc.
- Navigation Lock size

Vessel Design parameters

- Maximum length
- Maximum width
- Maximum draft (loaded)
- Maximum height above water line – (light condition)
- Full form of vessel & its mid-ship cross - section
- Speed while proceeding upstream
- Squat of vessel at full speed

Suitable IWT Vessels

- Ideal fleet suitable for operation on Ganga & Brahmaputra should be mix of **SPVs** & integrated **Tug - Barge combinations**
- Self Propelled Vessels (SPV) should be reduced to minimum
- Propelling barge should have twin screw propulsion
- Barges should have the facility of '**decoupling**' at critical 'S' bends on the river
- SPVs should be designed to carry 1500 tons +
- Tug – Barge combination should be able to carry 3000 tons +

Push Tow flotilla

- Push Tow flotilla – improves load & power ratio significantly
- Operational time of Push tug is more than SPV – no wait time for loading/unloading
- Greater flexibility in negotiating critical stretches
- Requires less man power
- Can be operated in variable draught with modern propulsion system
- Easy to construct & maintain – low investment

Opportunity Beckons

- Opportunity for Goa Barge Owners Association to deploy suitable vessels on NW 1 & 2
- IWAI officials will help them in undertaking survey of the river & assessing cargo
- IWAI will be willing to sign a MoU with Goa Barge Owners Association
- Scope for deployment of vessels on Indo-Bangladesh Protocol route too
- East coast could be the '**Growth Driver**' in this decade

See you on Ganga

Brahmaputra waits for you