IIC TECHNOLOGIES™

Final Feasibility Report
National Waterway-78
Region V – Penganga-Wardha
Ranvalli to Chimata (261.51km)

SURVEY PERIOD: 10 JUN 2016 TO 05 AUG 2016

Volume - I

Prepared for:

Inland Waterways Authority of India
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IIC Technologies Ltd. expresses its sincere gratitude to IWAI for awarding the work of carrying out detailed hydrographic surveys in the New National Waterways in NW-78 in Region V – from confluence of Adan and Penganga Rivers near Chimata village to the confluence of Wardha and Pranhita Rivers near Ranvalli village.

We would like to use this opportunity to pen down our profound gratitude and appreciations **to Shri Pravir Pandey, IA&AS, Chairman IWAI** for spending his valuable time and guidance for completing this Project. IIC Technologies Ltd., would also like to thank, **Shri Alok Ranjan, ICAS, Member (Finance), Shri Shashi Bhushan Shukla, Member (Traffic), Shri S.K. Gangwar, Member (Technical)** for their valuable support during the execution of project**.**

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List of Abbreviations

CD	Chart Datum
DGPS	Differential Global Positioning Systems
ETS	Electronic Total Station
GPS	Global Positioning Systems
PNG	Penganga
LBM	Local Bench Mark
MSL	Mean Sea Level
RL	Reference Level
SD	Sounding Datum
SBAS	Satellite-Based Augmentation System
TBC	Trimble Business Center
PIA	Project Influence Area
NH	National Highway
SH	State Highway

SALIENT FEATURES AT A GLANCE

<table>
<tr><th>#</th><th>Particulars</th><th>Details</th></tr>
<tr><td>1.</td><td>Name of Consultant</td><td>IIC Technologies Limited, Hyderabad</td></tr>
<tr><td>2.</td><td>Region number & State(s)</td><td>Region – V, Maharashtra & Telangana</td></tr>
<tr><td>3.</td><td>Waterway stretch, NW # (from…. to; total length)</td><td>National Waterway No – 78
From confluence of Adan and Penganga rivers near Bridge near Chimata village to confluence with Wardha river to confluence of Wardha and Pranhita rivers near Ranvalli village. (261.51 km).</td></tr>
<tr><td>4.</td><td>Navigability status</td><td>At present river is fully dried – No Navigable</td></tr>
<tr><td>a)</td><td>Tidal & non tidal portions (from… to, length, average tidal variation)</td><td>The river is non-tidal</td></tr>
<tr><td>b)</td><td>Least Spot Height status (w.r.t. CD)
i) Survey period (... to ...)
ii) < 1.2 m (km)
iii) 1.2 m to 1.4 m (km)
iv) 1.5 m to 1.7 m (km)
v) 1.8 m to 2.0 m (km)
vi) > 2.0 m (km)</td><td>Penganga-Wardha River is dry and the survey was conducted by topographic method.
<table>
<tr><th>LAD (m)</th><th>0 - 30 km</th><th>30 - 60 km</th><th>60 - 90 km</th><th>90 - 120 km</th><th>120 - 150 km</th><th>150 - 180 km</th><th>180 - 210 km</th><th>210 - 240 km</th><th>240 - 261.51 km</th><th>Total</th></tr>
<tr><td>< 1.2</td><td>30</td><td>30</td><td>30</td><td>30</td><td>30</td><td>30</td><td>30</td><td>30</td><td>21.51</td><td>261.51</td></tr>
<tr><td>1.2 - 1.4</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>1.5 - 1.7</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>1.8 - 2.0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>> 2</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Total</td><td>30</td><td>30</td><td>30</td><td>30</td><td>30</td><td>30</td><td>30</td><td>30</td><td>21.51</td><td>261.51</td></tr>
</table></td></tr>
<tr><td>c)</td><td>Cross structures
i) Dams, weirs, barrages etc. (total number; with navigation locks or not)

ii) Bridges, Power cables etc. [total number; range of horizontal and vertical clearances]</td><td>Cross structures
i) Bridges – 17 Nos
Horizontal Clearance – 9.21 to 60.657m
Vertical Clearance w.r.t. HFL – 3.918 to 11.719m
ii) Power Cables – 01 No
Vertical Clearance w.r.t. HFL – 18.603m
iii) High Tension Lines – 07 Nos
Vertical Clearance w.r.t. HFL – 14.238 to 18.627m</td></tr>
<tr><td>d)</td><td>Avg. discharge & no. of days</td><td>As the river is dried so Avg. Discharge cannot be calculated.</td></tr>
</table>

<table>
<tr><th>#</th><th>Particulars</th><th>Details</th></tr>
<tr><td>e)</td><td>Slope (1 in ….)</td><td>
<table>
<tr><th colspan="2">Chainage (km)</th><th rowspan="2">Slope (A/B)</th></tr>
<tr><th>From</th><th>To</th></tr>
<tr><td>0.0</td><td>30.0</td><td>1 : 0.385</td></tr>
<tr><td>30.0</td><td>60.0</td><td>1 : 0.097</td></tr>
<tr><td>60.0</td><td>90.0</td><td>1 : 0.180</td></tr>
<tr><td>90.0</td><td>120.0</td><td>1 : 0.333</td></tr>
<tr><td>120.0</td><td>150.0</td><td>1 : 0.596</td></tr>
<tr><td>150.0</td><td>180.0</td><td>1 : 0.302</td></tr>
<tr><td>180.0</td><td>210.0</td><td>1 : 0.501</td></tr>
<tr><td>210.0</td><td>240.0</td><td>1 : 0.316</td></tr>
<tr><td>240.0</td><td>261.51</td><td>1 : 0.675</td></tr>
</table>
Average slope is 1: 0.366 for entire river stretch
</td></tr>
<tr><td>5.</td><td>Traffic potential</td><td>Non Navigable at present condition.</td></tr>
<tr><td>a)</td><td>Present IWT operations, ferry services, tourism, cargo, if any</td><td>No IWT operations had been found. Local Ferry Service by small boats and operation of tourism boats are also not available in the survey stretch.</td></tr>
<tr><td>b)</td><td>Important industries within 50 km</td><td>

Western Coalfields Limited (WCL), a subsidiary of Coal India, has many mines around Ballarpur is 0.90km away from Penganga River
Ballarpur Industries Limited (BILT) is a flagship and India's largest manufacturer of writing and printing (W&P) paper is 0.67km away from Penganga River
Lime Stone mines industry, Awarpur is7.91km away from Penganga River.
Manikgarh cement industry at Chandur is 17.53km away from Penganga River
Murli Industries Ltd - Cement Plant at Naranda is 3.78km away from Penganga River
Chandrapur Super Thermal Power Station at Neri is 13.70km away from Penganga River
Chandrapur Ferro Alloy Plant at Chauhan colony is 11.50km away from Penganga River
ACC Limited-Chanda Cement Works at Nakoda is 4.32km away from Penganga River

</td></tr>
<tr><td>c)</td><td>Distance of Rail & Road from Industry</td><td>

Western Coalfields Limited (WCL), 1.70km away from Balharshah Railway station.
Ballarpur Industries Limited (BILT) is 1.47km away from Balharshah Railway station.
Lime Stone mines industry, Awarpur is 26.16km away from Manikgarh Railway station
Manikgarh cement industry at Chandur is 23.09km away from Balharshah Railway station.
Murli Industries Ltd - Cement Plant at Naranda is 30.58km away from Balharshah Railway station
Chandrapur Super Thermal Power Station at Neri is 5.63km away from Chandrapur Railway station

</td></tr>
</table>

#	Particulars	Details
		• Chandrapur Ferro Alloy Plant at Chauhan colony is 3.66km away from Chandrapur Railway station • ACC Limited-Chanda Cement Works at Nakoda is 3.78km away from Ghugus Railway Station.
6.	Consultant's recommendation for going ahead with TEF / DPR preparation	No scope of TEF/DPR can be provided for the Penganga-Wardha River since the river is dry. This River Stretch is not-viable for navigable channel.
7.	Any other information/ comment	Nil

(Signature)

Date: Name of Consultant

1 Introduction

1.1 Background

The stretch of about 261.51km of Penganga-Wardha River, from confluence of Adan and Penganga River near Chimata village to confluence of Wardha and Pranhita River near Ranvalli village. This area of interest was identified for the Inland Water transport facility as per a study carried out earlier. To assess the feasibility of water transportation, over this stretch of river a bathymetric survey and topographic survey were carried out by IIC Technologies Ltd. on behalf of IWAI.

The Penganga-Wardha River is the chief river of the Yavatmal, Chandrapur and Washim district in the Maharashtra and flows along the south east boundaries of the district in a winding, meandering course. The Penganga or Painganga River originates in the Ajantha ranges in Aurangabad district in Maharashtra. It then flows through Buldhana and Washim district. It flows through Risod Tehsil of Washim district. The River before converging into the Wardha River near a small village called Wadha in Chandrapur Taluka of Chandrapur district. The River gets flooded during rainy and winter season and partially flooded in summer. The total length of the river is 676km (420 mi). Penganga is an interstate river and is a tributary of river Wardha in Godavari river basin. Its catchment area lies mostly in Maharashtra (93%) and part in Telangana (7%).

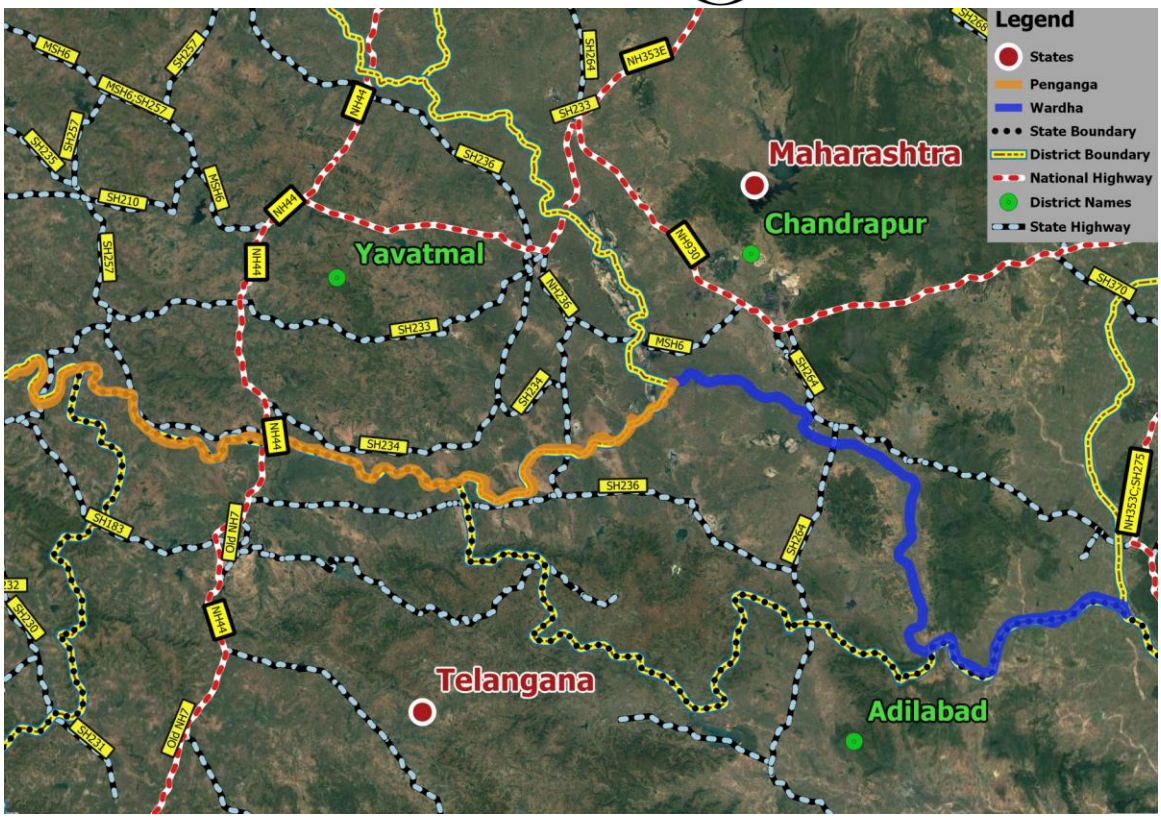


Figure 1 - Location around the survey stretch

1.2 Tributaries / Network of Rivers / Basin

The major tributaries of Penganga River are Adan River, Kas River, Arunawati River, Kayadhu River and Pus River. The tributaries joining Wardha River are Sari, Khadakia, Dabha, Andhari ,Kar, Wena, Jam, Erai Madu and Bembla.

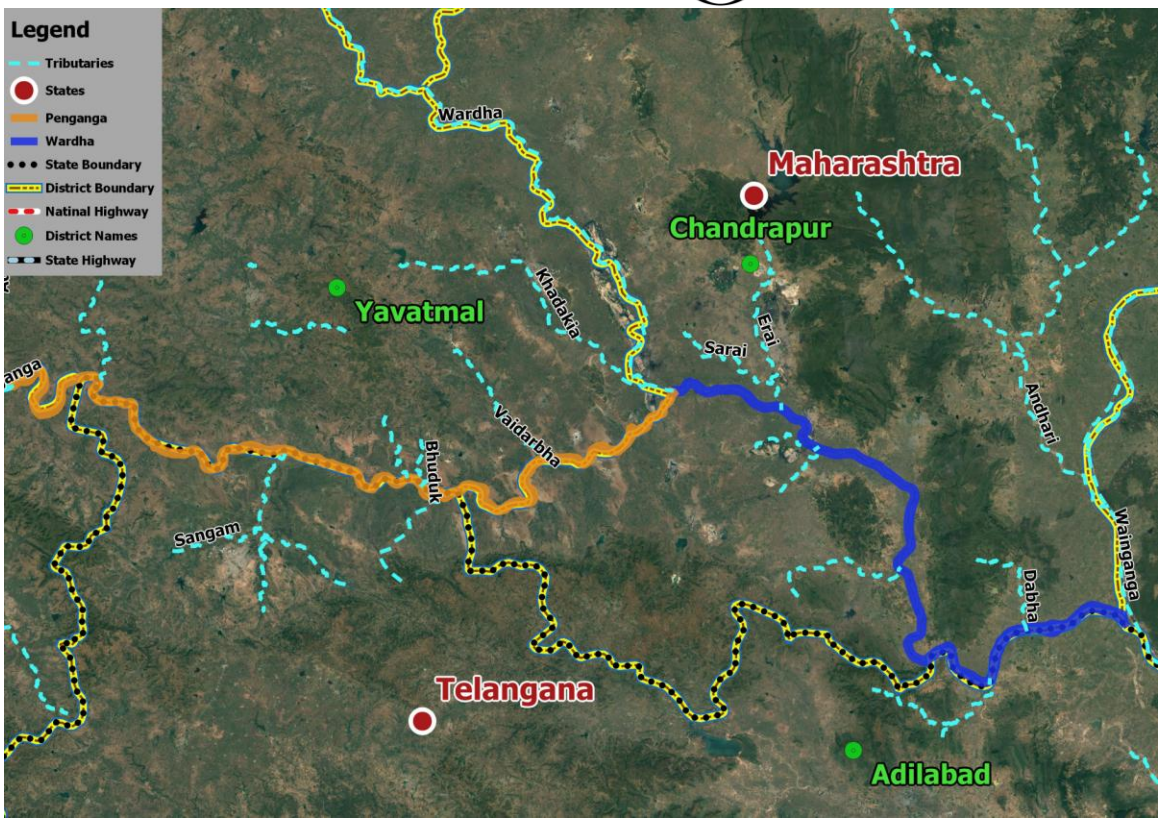


Figure 2 - Tributaries of Penganga-Wardha River

1.3 State/ District through which river passes

The Penganga-Wardha River flows through Buldhana, Washim and Hingoli districts. Then it acts as boundary between Yavatmal and Nanded districts of Maharashtra. The river flows along state border between Maharashtra and Telangana before converging into the Wardha River near a small village called Wadha in Chandrapur Taluka of Chandrapur District in Maharashtra.

State Name	Chainage (km)		Length in km
	From	To	
Maharashtra	42.4	166.3	145.41
	240.0	261.51	
Telangana & Maharashtra	0.0	42.40	116.10
	166.3	240.0	

Table 1 - State wise waterway

1.4 Maps

1.4.1 Full course of the waterway

The map displaying the state boundary with road and rail network for the course of water way is represented as below:-

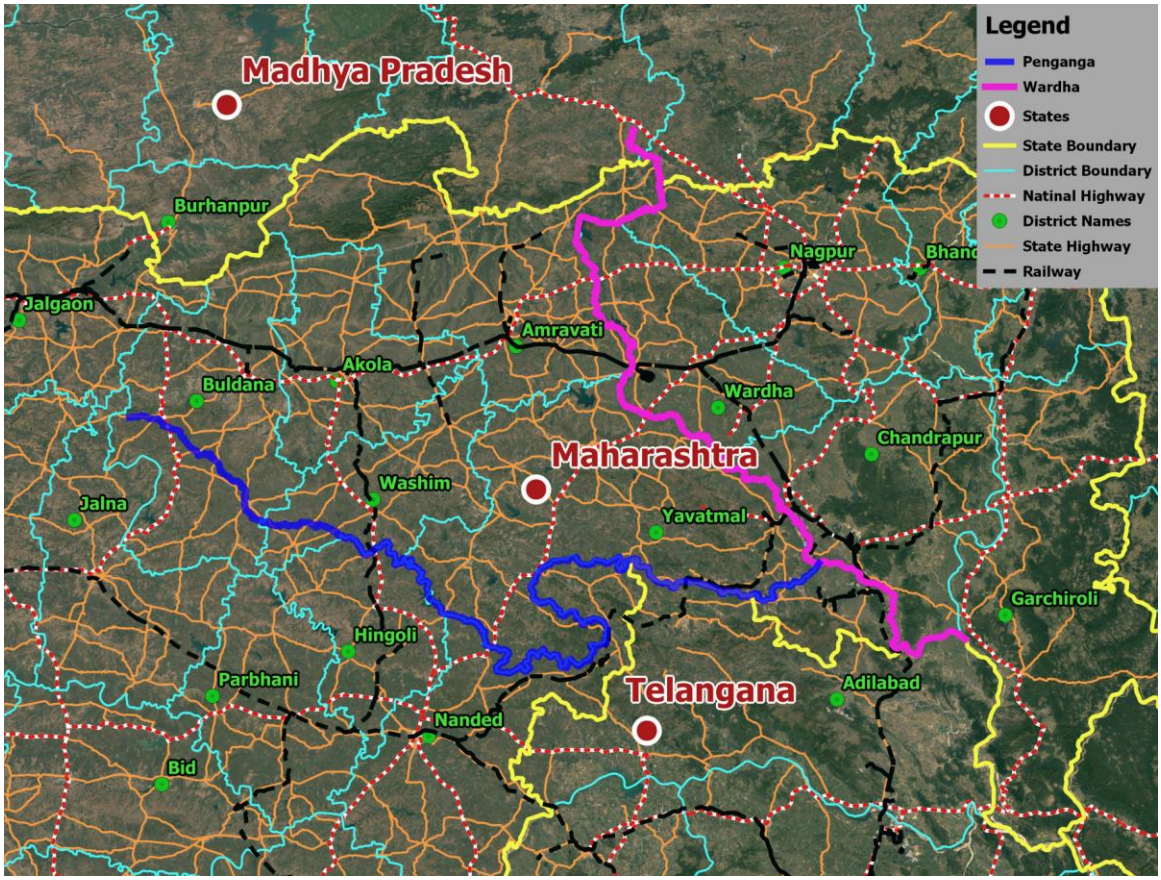


Figure 3 - Full Course of Penganga-Wardha River

1.4.2 Course of the waterway under study

The map displaying the state boundary with road and rail network for the course of water way is represented as below:

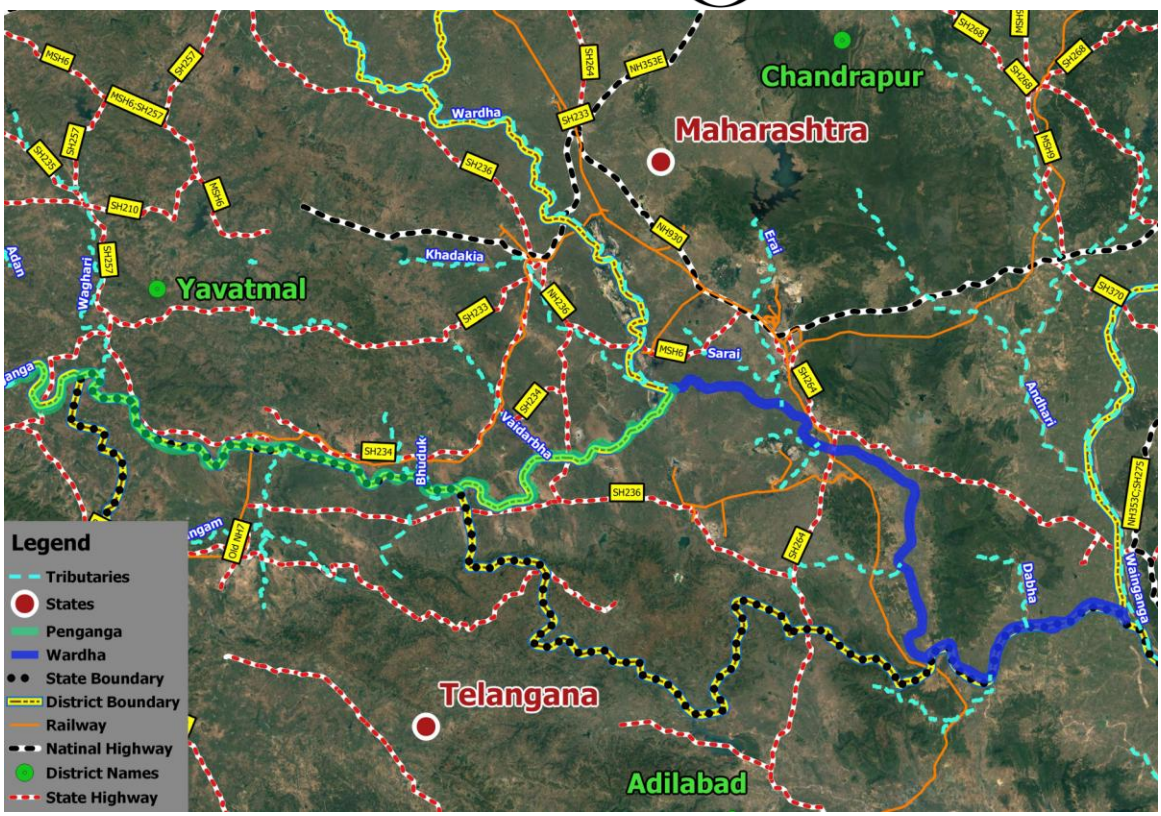


Figure 4 - Course of Penganga-Wardha River

1.5 Scope of work

IIC Technologies Ltd. conducted a topographic survey of the Penganga-Wardha River from the confluence of Adan and Penganga rivers near Chimata village at Lat 19°54'8.32"N, Long 78°12'36.43"E to the confluence with the Wardha river to the confluence of Wardha and Pranhita rivers near Ranvalli village at Lat 19°33'59.30"N, Long 79°49’0.39"E. Bathy survey is unable to conduct due to the insufficient of water depth throughout the Stretch.

The scope of the work for the conduct of survey of Penganga-Wardha River includes:

- Undertake bathymetric and topographic survey of proposed waterway.
- Establishing horizontal and vertical control stations
- Construction of benchmark pillars and establishing its reduced level w.r.to Mean Sea Level
- Setting up and deployment of water level gauges
- Current velocity and discharge measurements
- Collection and analysis of water and bottom samples.

- A collection of topographic features including existing cross structures.
- Preparation of inventory of industries in the project influence area (PIA)
- Analysis of survey data, including assessment of water availability for navigation.
- Preparation of survey charts and feasibility report

2 Methodology Adopted to undertake Study

2.1 Recce

Advance recce of the survey area was undertaken in early 17th Mar 2016 by a detach survey party. The recce was started from Panora village, Chandrapur Dist. to Chimata Village, Yavatmal Dist of Maharashtra State. The survey stretch of Penganga-Wardha was examined at five places, namely villages Panora a place where Penganga confluence with Wainganga, a Dhudholi village near a bridge where SH-264 crossing Penganga, near a bridge National Highway-7 crossing Penganga in Dollara village, another place near a bridge crossing Penganga in Unkeshwar village,were area found fully rocky and bushes growth both side of the banks.

The following observation has been made.

- The survey area is 261.51km, from the Chimata village towards downstream.
- River width varied between 100 mtr to 300 mtr.
- The Topography Survey work is challenging due to rocks and thick vegetation growth and cliffs on both sides of the banks.

It was observed that most of the River stretch was dry and preliminary queries revealed that the River remains dry for most of the year. Hence a decision was taken to undertake topographic survey initially for the complete River stretch, the hydrographic survey would be undertaken depending on the field conditions and availability of water in limited pockets of the River stretch under consideration.

2.2 Survey Resources and Methodology

The survey was commenced on 10th Jun 2016 and completed on 05th Aug 2016. The survey was undertaken on a scale of 1:5000 and 1:10000, with a sounding line spacing kept at 200 m and plotted on UTM Projection (Zone 44^{o} N) as directed by the contract specifications.

2.2.1 Survey Launch

The bathymetric survey was unable to conduct due to the unavailability of sufficient water in the River stretch.

2.2.2 Survey Equipment

Following equipment was employed in the topographic survey.

Equipment	Make	Equipment. Serial No.	Qty. Employed
DGPS Sets	Trimble R3/R4	-	5
Auto Level	Sokkia Auto level & Accessories	-	2
ETS	Electronic Total Station	120595, 120840	2
Software	TBC	Version 12	1
Software	AUTOCAD	2012	1
Software	Microsoft Office	2013	1

Table 2 - Survey Equipment Used

2.2.3 Topography Survey

The survey commenced on 10th Jun 2016 and completed on 5th Aug 2016. The weather was sunny throughout the period during survey operations. The weather was favorable with moderate hot climate for the conduct of the survey and the weather condition remains same for the entire duration of the survey.

The survey was undertaken as per the line plan provided and the spot level points in the cross line were spaced at 20m interval. The Plotting of the chart was done on UTM Projection at Zone 44N as directed in the contract specifications. The spot levels along the river were obtained by using Trimble DGPS. The data was post processed using Trimble Business Center to get the precise position and MSL height values of the rover locations. The topographic survey for the entire survey stretch was conducted to collect the following data:-

- Spot levels
- Delineation of Islands
- Fixing of bridges and marks
- Assess the type of river bank
- Extending the vertical and horizontal control throughout the survey area
- Collection of local information along the river Banks

The details on all spot levels are provided in the respective sheets being presented along-with this report. Additionally, a soft copy of the same in XYZ format is being handed over as deliverable data.

Figure 5 - Spot levelling by DGPS

2.2.4 Bathymetric Survey and Survey Launch

The bathymetric survey by survey launch for the Penganga-Wardha River was not able to be conducted due to non-availability of sufficient water depth throughout the river.

2.2.5 Calibration

The equipment used for the survey was calibrated by the equipment supplier. The equipment calibration certificates are placed at Annexure-14 to this report.

2.3 Description of Bench Marks (B.M.) / Authentic Reference Level

Twenty five Benchmark Pillars (IWAI BM Pillars) were constructed (25 no's) as per specification and erected at an average interval of 10 km along the river stretch from starting to end chainage of the river. The value of these benchmarks w.r.t. MSL was obtained by leveling them to the Local benchmarks established earlier.

The value of these marks w.r.t. MSL was obtained by leveling them to the IWAI BM Pillar from Wainganga BM Pillar namely IWAI BM WNG-11 and thereafter one pillar to another.

IWAI BM GDV-21 Benchmark is located on the road side of Godavari River near the Village–Ramjapur, District–Gadchiroli. State – Maharashtra with MSL height of 100.110m. IWAI BM WNG-11 is located on the road side of the Waingangā River near Village– Chaparala, District–Gadchiroli. State–Maharashtra with MSL height of 147.025m. Through Baseline processing method the values from GDV-21 are transferred to WNG-11 and then to IWAI BM PNG-01.

The final accepted co-ordinates and reduced level (R.L) values of these Bench Marks and other station established for setting up of reference DGPS base stations are as below:

Sl. No.	Station	Latitude	Longitude	Height above MSL (m)	Chainage (km)	Source/ Type
1	IWAI BM WNG-11	N19°35'28.46679"	E79°48'29.67892"	147.025	2.512	BL Processed
2	IWAI BM PNG-01	N19°35'18.23632"	E79°41'56.14118"	156.507	14.928	BL Processed
3	IWAI BM PNG-02	N19°33'49.46042"	E79°36'35.78507"	167.95	24.517	BL Processed
4	IWAI BM PNG-03	N19°30'43.13894"	E79°35'25.20356"	162.066	31.500	BL Processed
5	IWAI BM PNG-04	N19°33'44.66839"	E79°30'04.30286"	170.154	49.774	BL Processed
6	IWAI BM PNG-05	N19°36'49.61088"	E79°30'10.95869"	170.908	54.648	BL Processed
7	IWAI BM PNG-06	N19°41'05.43354"	E79°29'53.38666"	167.825	64.974	BL Processed
8	IWAI BM PNG-07	N19°47'12.60138"	E79°28'17.39628"	174.026	76.668	BL Processed
9	IWAI BM PNG-08	N19°48'55.62322"	E79°22'39.40361"	173.618	87.023	BL Processed
10	IWAI BM PNG-09	N19°51'54.69933"	E79°19'10.43410"	177.620	97.185	BL Processed
11	IWAI BM PNG-10	N19°53'58.97910"	E79°14'44.99976"	176.995	106.152	BL Processed
12	IWAI BM PNG-11	N19°53'56.14170"	E79°08'54.09427"	180.125	117.182	BL Processed
13	IWAI BM PNG-12	N19°50'43.43035"	E79°05'00.63455"	189.302	126.716	BL Processed
14	IWAI BM PNG-13	N19°48'36.39317"	E79°00'45.46913"	190.856	138.206	BL Processed
15	IWAI BM PNG-14	N19°46'05.44655"	E78°56'13.27790"	198.466	148.429	BL Processed
16	IWAI BM PNG-15	N19°46'08.91113"	E78°52'55.88501"	206.675	161.394	BL Processed
17	IWAI BM PNG-16	N19°45'44.29082"	E78°49'15.57843"	209.674	168.553	BL Processed
18	IWAI BM PNG-17	N19°46'46.40919"	E78°45'01.29892"	215.263	177.955	BL Processed
19	IWAI BM PNG-18	N19°47'44.90733"	E78°40'41.95386"	210.208	187.806	BL Processed
20	IWAI BM PNG-19	N19°49'11.45678"	E78°34'36.23851"	215.308	198.908	BL Processed
21	IWAI BM PNG-20	N19°48'32.14211"	E78°30'25.82755"	224.413	207.008	BL Processed
22	IWAI BM PNG-21	N19°50'10.56920"	E78°24'03.32186"	229.156	222.138	BL Processed
23	IWAI BM PNG-22	N19°53'06.76245"	E78°21'55.38244"	240.708	229.679	BL Processed
24	IWAI BM PNG-23	N19°55'02.20582"	E78°18'34.79247"	244.6	239.355	BL Processed
25	IWAI BM PNG-24	N19°52'02.61632"	E78°15'04.61181"	246.444	248.731	BL Processed
26	IWAI BM PNG-25	N19°55'00.90749"	E78°12'56.19793"	259.291	260.447	BL Processed

Table 3 - Accepted station coordinates (WGS-84)

2.4 Tidal Influence Zone and Tidal Variation

The survey stretch of Penganga-Wardha River is non-tidal water body and no influence of tidal force was observed throughout the survey period.

2.5 Methodology to fix Chart Datum / Sounding Datum

The Penganga River is to 261.51km stretch which is between Ranvalli to Chimata. There are no dams and barrages present in the survey stretch of the Penganga-Wardha River.

The water depth by an average of 0.1 to 0.2mtr is available in small pockets. The water level is recorded as Dry (dead level) in the records held by the CWC Gauge authorities. The least MSL Value obtained during the conduct of a Topographic survey for the stretch is considered as Chart Datum.

2.5.1 Sounding Datum

The Penganga-Wardha River is to 261.51km stretch between Ranvalli to Chimata. The entire River stretch is divided into per-km stretches and the least MSL Value obtained during the conduct of a Topographic survey for the stretch is considered as Chart Datum for the Dredging Volume calculations.

2.5.2 Datum Calculation

The datum for calculation of dredge volume needs to be adopted as per the gradient of the River and the average water level of the River. The datum for calculation of dredge volume was accepted as the least spot height in the stretch for the entire River. The newly established sounding datum is established by assuming the least value of the Spot height for every 01km of the River stretch.

KM Stretch	Least Level w.r.t. MSL (m)	Established CD (m)	KM Stretch	Least Level w.r.t. MSL (m)	Established CD (m)	KM Stretch	Least Level w.r.t. MSL (m)	Established CD (m)
0 - 1	140.170	140.170	87 - 88	160.657	160.657	174 - 175	195.625	195.625
1 - 2	140.537	140.537	88 - 89	160.963	160.963	175 - 176	195.754	195.754
2 - 3	141.026	141.026	89 - 90	161.125	161.125	176 - 177	196.625	196.625
3 - 4	139.000	139.000	90 - 91	161.053	161.053	177 - 178	196.956	196.956
4 - 5	138.620	138.620	91 - 92	161.125	161.125	178 - 179	197.147	197.147
5 - 6	138.669	138.669	92 - 93	161.147	161.147	179 - 180	197.735	197.735
6 - 7	140.220	140.220	93 - 94	161.158	161.158	180 - 181	197.869	197.869
7 - 8	140.720	140.720	94 - 95	161.214	161.214	181 - 182	198.324	198.324
8 - 9	141.358	141.358	95 - 96	162.356	162.356	182 - 183	198.920	198.920
9 - 10	141.736	141.736	96 - 97	163.156	163.156	183 - 184	199.147	199.147
10 - 11	142.414	142.414	97 - 98	163.256	163.256	184 - 185	199.347	199.347
11 - 12	142.214	142.214	98 - 99	163.236	163.236	185 - 186	199.514	199.514
12 - 13	142.757	142.757	99 - 100	163.644	163.644	186 - 187	199.814	199.814

KM Stretch	Least Level w.r.t. MSL (m)	Established CD (m)	KM Stretch	Least Level w.r.t. MSL (m)	Established CD (m)	KM Stretch	Least Level w.r.t. MSL (m)	Established CD (m)
13 - 14	143.251	143.251	100 - 101	164.125	164.125	187 - 188	199.925	199.925
14 - 15	143.854	143.854	101 - 102	164.235	164.235	188 - 189	199.957	199.957
15 - 16	144.963	144.963	102 - 103	164.835	164.835	189 - 190	200.820	200.820
16 - 17	145.458	145.458	103 - 104	165.125	165.125	190 - 191	200.420	200.420
17 - 18	145.863	145.863	104 - 105	165.255	165.255	191 - 192	200.612	200.612
18 - 19	146.260	146.260	105 - 106	165.525	165.525	192 - 193	200.825	200.825
19 - 20	146.857	146.857	106 - 107	166.058	166.058	193 - 194	200.847	200.847
20 - 21	147.314	147.314	107 - 108	166.156	166.156	194 - 195	200.958	200.958
21 - 22	147.547	147.547	108 - 109	166.354	166.354	195 - 196	203.151	203.151
22 - 23	148.053	148.053	109 - 110	166.547	166.547	196 - 197	201.044	201.044
23 - 24	148.214	148.214	110 - 111	166.647	166.647	197 - 198	201.147	201.147
24 - 25	148.327	148.327	111 - 112	166.851	166.851	198 - 199	201.223	201.223
25 - 26	148.796	148.796	112 - 113	167.125	167.125	199 - 200	201.247	201.247
26 - 27	148.829	148.829	113 - 114	167.253	167.253	200 - 201	201.658	201.658
27 - 28	149.358	149.358	114 - 115	167.624	167.624	201 - 202	201.654	201.654
28 - 29	149.557	149.557	115 - 116	168.158	168.158	202 - 203	202.214	202.214
29 - 30	149.820	149.820	116 - 117	168.514	168.514	203 - 204	202.814	202.814
30 - 31	149.824	149.824	117 - 118	169.147	169.147	204 - 205	205.457	205.457
31 - 32	150.225	150.225	118 - 119	169.625	169.625	205 - 206	203.658	203.658
32 - 33	150.453	150.453	119 - 120	170.147	170.147	206 - 207	204.644	204.644
33 - 34	150.457	150.457	120 - 121	170.616	170.616	207 - 208	206.158	206.158
34 - 35	150.658	150.658	121 - 122	171.125	171.125	208 - 209	205.147	205.147
35 - 36	150.817	150.817	122 - 123	171.156	171.156	209 - 210	208.214	208.214
36 - 37	151.144	151.144	123 - 124	171.647	171.647	210 - 211	206.156	206.156
37 - 38	151.447	151.447	124 - 125	172.614	172.614	211 - 212	206.935	206.935
38 - 39	151.614	151.614	125 - 126	172.854	172.854	212 - 213	207.214	207.214
39 - 40	151.614	151.614	126 - 127	173.235	173.235	213 - 214	208.257	208.257
40 - 41	151.935	151.935	127 - 128	173.697	173.697	214 - 215	208.457	208.457
41 - 42	152.151	152.151	128 - 129	175.158	175.158	215 - 216	208.858	208.858
42 - 43	152.223	152.223	129 - 130	174.857	174.857	216 - 217	210.147	210.147
43 - 44	152.436	152.436	130 - 131	176.214	176.214	217 - 218	209.963	209.963
44 - 45	152.520	152.520	131 - 132	175.947	175.947	218 - 219	210.123	210.123
45 - 46	152.547	152.547	132 - 133	176.853	176.853	219 - 220	210.458	210.458
46 - 47	152.714	152.714	133 - 134	177.347	177.347	220 - 221	210.856	210.856
47 - 48	152.847	152.847	134 - 135	177.247	177.247	221 - 222	211.356	211.356
48 - 49	153.120	153.120	135 - 136	178.156	178.156	222 - 223	211.854	211.854
49 - 50	153.247	153.247	136 - 137	178.125	178.125	223 - 224	213.147	213.147
50 - 51	153.454	153.454	137 - 138	178.654	178.654	224 - 225	212.814	212.814
51 - 52	153.657	153.657	138 - 139	179.397	179.397	225 - 226	213.125	213.125
52 - 53	153.844	153.844	139 - 140	180.147	180.147	226 - 227	213.854	213.854

KM Stretch	Least Level w.r.t. MSL (m)	Established CD (m)	KM Stretch	Least Level w.r.t. MSL (m)	Established CD (m)	KM Stretch	Least Level w.r.t. MSL (m)	Established CD (m)
53 - 54	154.157	154.157	140 - 141	180.356	180.356	227 - 228	215.214	215.214
54 - 55	154.256	154.256	141 - 142	181.147	181.147	228 - 229	215.244	215.244
55 - 56	154.425	154.425	142 - 143	181.147	181.147	229 - 230	215.857	215.857
56 - 57	154.414	154.414	143 - 144	181.456	181.456	230 - 231	216.957	216.957
57 - 58	154.747	154.747	144 - 145	181.758	181.758	231 - 232	216.851	216.851
58 - 59	154.827	154.827	145 - 146	182.214	182.214	232 - 233	217.253	217.253
59 - 60	155.047	155.047	146 - 147	183.247	183.247	233 - 234	217.858	217.858
60 - 61	155.235	155.235	147 - 148	184.147	184.147	234 - 235	218.247	218.247
61 - 62	155.453	155.453	148 - 149	183.725	183.725	235 - 236	218.814	218.814
62 - 63	155.757	155.757	149 - 150	185.369	185.369	236 - 237	219.151	219.151
63 - 64	155.925	155.925	150 - 151	184.856	184.856	237 - 238	219.825	219.825
64 - 65	156.125	156.125	151 - 152	186.147	186.147	238 - 239	220.247	220.247
65 - 66	156.128	156.128	152 - 153	185.556	185.556	239 - 240	220.829	220.829
66 - 67	156.147	156.147	153 - 154	187.158	187.158	240 - 241	223.147	223.147
67 - 68	156.225	156.225	154 - 155	186.214	186.214	241 - 242	221.747	221.747
68 - 69	156.654	156.654	155 - 156	188.147	188.147	242 - 243	222.047	222.047
69 - 70	156.457	156.457	156 - 157	187.147	187.147	243 - 244	222.957	222.957
70 - 71	156.854	156.854	157 - 158	187.658	187.658	244 - 245	223.069	223.069
71 - 72	157.079	157.079	158 - 159	188.820	188.820	245 - 246	224.147	224.147
72 - 73	157.147	157.147	159 - 160	189.354	189.354	246 - 247	224.157	224.157
73 - 74	157.314	157.314	160 - 161	189.751	189.751	247 - 248	224.814	224.814
74 - 75	157.325	157.325	161 - 162	190.248	190.248	248 - 249	225.214	225.214
75 - 76	157.821	157.821	162 - 163	190.847	190.847	249 - 250	225.712	225.712
76 - 77	157.921	157.921	163 - 164	192.147	192.147	250 - 251	226.257	226.257
77 - 78	158.147	158.147	164 - 165	191.355	191.355	251 - 252	226.953	226.953
78 - 79	158.247	158.247	165 - 166	191.720	191.720	252 - 253	227.935	227.935
79 - 80	158.658	158.658	166 - 167	192.758	192.758	253 - 254	227.856	227.856
80 - 81	159.054	159.054	167 - 168	193.147	193.147	254 - 255	228.154	228.154
81 - 82	159.245	159.245	168 - 169	193.654	193.654	255 - 256	228.714	228.714
82 - 83	159.325	159.325	169 - 170	193.920	193.920	256 - 257	229.365	229.365
83 - 84	159.347	159.347	170 - 171	193.914	193.914	257 - 258	230.520	230.520
84 - 85	160.125	160.125	171 - 172	194.556	194.556	258 - 259	231.325	231.325
85 - 86	159.786	159.786	172 - 173	194.929	194.929	259 - 260	233.147	233.147
86 - 87	160.647	160.647	173 - 174	194.920	194.920	260 - 261	232.156	232.156
						261 - 261.51	235.147	235.147

Table 4 - Established CD for per kilometer stretch

2.6 Average of 06 years minimum Water Levels to arrive at CD

The chart datum is calculated for the erected benchmarks with the provided tide gauge details from IWAI. It has been observed that there are CWC gauge data available on this stretch, hence, we have calculated with CWC gauges of Sirpur, Bamini and P.G Bridge value for this river stretch. The CD value is calculated for the years of span i.e. from 2009 to 2015. The tide poles were not erected as the river was having only small pockets of water and boat survey could not be possible for the river stretches.

SIRPUR CWC GAUGE 2009-15							
WL values in m.							
Min/Max	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Jan Min.	150.260	150.130	150.680	150.600	150.720	150.810	150.440
Jan Max.	150.480	150.540	150.820	150.790	150.940	151.050	150.960
Feb Min.	150.190	150.150	150.630	150.530	150.630	150.770	150.410
Feb Max.	150.410	151.050	150.940	150.680	150.930	150.930	150.830
Mar Min.	150.090	150.080	150.500	150.240	150.480	150.670	150.380
Mar Max.	150.310	150.500	150.860	150.620	150.780	151.520	150.670
Apr Min.	149.970	149.810	150.400	149.880	150.180	150.300	150.200
Apr Max.	150.090	150.080	150.850	150.230	150.600	150.630	150.600
May Min.	149.830	149.610	150.330	149.700	150.070	150.180	150.000
May Max.	149.970	149.800	150.980	149.900	150.230	150.320	151.120
Jun Min.	149.770	149.570	150.600	149.670	150.060	150.190	
Jun Max.	151.870	151.080	151.260	152.940	157.750	150.740	
Jul Min.	150.910	151.270	150.870	150.720	151.850	150.300	
Jul Max.	152.210	156.300	153.790	158.020	160.300	155.650	
Aug Min.	150.550	152.380	151.610	151.550	152.810	150.860	
Aug Max.	152.110	158.600	155.630	155.860	161.300	153.480	
Sep Min.	150.480	152.220	151.740	152.220	151.800	151.340	
Sep Max.	152.850	157.850	156.460	158.340	154.350	156.950	
Oct Min.	150.200	151.340	150.820	151.080	151.720	150.940	
Oct Max.	150.600	152.150	151.680	152.750	156.400	151.300	
Nov Min.	150.090	151.130	150.550	150.800	151.090	150.630	
Nov Max.	150.530	151.700	150.770	151.190	151.900	151.010	
Dec Min.	150.230	150.770	150.520	150.800	150.940	150.390	
Dec Max.	150.540	151.140	150.790	151.020	151.090	151.230	
Yearly Min.	149.770	149.570	150.330	149.670	150.060	150.180	150.000
Yearly Max.	152.850	158.600	156.460	158.340	161.300	156.950	151.120
6yr. Min.	**149.570**						
6yr. Max.	**161.300**						
6yr. Ave. Min.	**149.968**						
6yr. Ave. Max.	**157.417**						
Value of Chart Datum (CD) adopted	**149.968**						

Table 5 - Sirpur Gauge Data from 2009 to 2015

BAMINI CWC GAUGE 2009-15							
WL values in m.							
Min/Max	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Jan Min.	158.430	158.400	159.150	159.060	159.050	159.170	158.760
Jan Max.	158.640	158.610	159.190	159.120	159.150	159.310	159.050
Feb Min.	158.390	158.490	159.110	159.110	158.990	159.110	158.770
Feb Max.	158.550	159.350	159.250	159.190	159.220	159.200	158.940
Mar Min.	158.340	158.380	158.950	159.010	158.990	158.970	158.740
Mar Max.	158.490	158.800	159.200	159.200	159.100	159.660	158.960
Apr Min.	158.300	158.140	158.860	158.850	158.850	158.720	158.600
Apr Max.	158.360	158.370	159.060	159.040	159.080	158.960	158.760
May Min.	158.210	158.120	158.820	158.750	158.750	158.500	158.510
May Max.	158.310	158.140	159.300	158.910	158.860	158.720	159.240
Jun Min.	158.210	158.130	158.950	158.730	158.750	158.390	
Jun Max.	160.770	159.240	159.430	161.220	169.810	159.150	
Jul Min.	158.850	159.280	159.110	159.080	159.940	158.490	
Jul Max.	160.400	169.470	163.120	170.490	174.210	166.070	
Aug Min.	158.670	160.840	159.490	159.640	161.810	158.930	
Aug Max.	159.920	172.250	167.080	166.540	175.680	162.970	
Sep Min.	158.650	160.640	159.800	160.400	160.210	159.420	
Sep Max.	161.440	170.470	168.410	171.450	164.400	169.130	
Oct Min.	158.410	159.600	159.150	159.280	160.070	159.020	
Oct Max.	158.760	160.860	159.830	161.710	167.520	159.370	
Nov Min.	158.330	159.370	159.050	159.080	159.490	158.920	
Nov Max.	158.780	160.010	159.130	159.350	160.160	159.030	
Dec Min.	158.430	159.180	159.060	159.080	159.320	158.720	
Dec Max.	158.720	159.330	159.150	159.220	159.510	159.270	
Yearly Min.	158.210	158.120	158.820	158.730	158.750	158.390	158.510
Yearly Max.	161.440	172.250	168.410	171.450	175.680	169.130	159.240
6yr. Min.	**158.120**						
6yr. Max.	**175.680**						
6yr. Ave. Min.	**158.553**						
6yr. Ave. Max.	**169.727**						
Value of Chart Datum (CD) adopted	**158.553**						

Table 6 - Bamini Gauge Data from 2009-2015

P.G. BRIDGE CWC GAUGE 2009-15							
WL values in m.							
Min/Max	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Jan Min.	199.620	199.590	199.930	199.820	199.830	199.810	199.620
Jan Max.	199.715	199.610	200.150	200.130	200.070	200.200	199.930
Feb Min.	199.590	199.570	199.870	199.740	199.880	199.730	199.620
Feb Max.	199.620	199.590	200.060	200.080	200.060	200.170	199.700
Mar Min.	199.580	199.480	199.780	199.760	199.790	200.100	199.650
Mar Max.	199.580	199.570	199.950	200.040	200.050	200.880	199.970
Apr Min.	199.500	199.340	199.800	199.630	199.520	199.910	199.630
Apr Max.	199.580	199.470	199.950	199.820	199.820	200.170	199.750
May Min.	199.430	199.200	199.750	199.550	199.430	199.750	199.590
May Max.	199.500	199.340	199.920	199.670	199.860	200.090	199.750
Jun Min.	199.380	199.150	199.720	199.520	199.740	199.670	
Jun Max.	203.750	199.400	200.490	203.140	208.610	199.970	
Jul Min.	200.140	200.480	200.060	200.050	201.300	199.640	
Jul Max.	201.630	210.070	205.080	213.500	213.630	201.130	
Aug Min.	199.760	201.590	200.870	200.810	202.100	199.790	
Aug Max.	201.020	211.390	205.880	204.190	214.650	203.500	
Sep Min.	199.890	201.790	200.930	201.270	201.370	200.480	
Sep Max.	203.400	207.890	204.110	204.980	205.030	206.380	
Oct Min.	199.620	200.800	200.240	200.290	201.050	200.060	
Oct Max.	200.050	201.800	200.880	202.540	206.350	200.440	
Nov Min.	199.620	200.480	199.940	200.050	200.280	199.720	
Nov Max.	200.260	201.070	200.230	200.320	200.980	200.080	
Dec Min.	199.610	200.060	199.860	199.920	200.110	199.620	
Dec Max.	199.800	200.460	200.110	200.170	200.310	199.700	
Yearly Min.	199.380	199.150	199.720	199.520	199.430	199.620	199.590
Yearly Max.	203.750	211.390	205.880	213.500	214.650	206.380	199.970
6yr. Min.	**199.150**						
6yr. Max.	**214.650**						
6yr. Ave. Min.	**199.505**						
6yr. Ave. Max.	**209.258**						
Value of Chart Datum (CD) adopted	**199.505**						

Table 7 - P.G. Bridge Gauge Data from 2009-2015

2.7 Transfer of Sounding Datum

The Penganga-Wardha River is non-tidal and Dry River, the lowest MSL level of per-km stretch is considered as the chart datum value at different stretches.

2.8 Table indicating tidal variation at Different Observation Points

The survey stretch of the Penganga-Wardha River is non-tidal river and the river dries fully during the summer season.

2.9 Salient features of Dam, Barrages, Weirs, etc.

There are no Dam, Barrages and Anicut, locks and Aqueducts in the survey stretch of the Penganga-Wardha River.

2.10 Erected IWAI Bench Mark Pillars

New bench Mark Pillars were constructed as per specification at suitable locations as specified in the contract. The extension of horizontal control was made by the baseline processing of 06 hourly DGPS observations carried out with the nearest reference station. The value of these benchmarks w.r.t. MSL was obtained by Auto leveling from the IWAI BM WNG-11 as Reference Bench Mark to IWAI BM PNG-01 and thereafter one pillar to another. The final accepted co-ordinates and a Reference Level value of IWAI BM Pillars are as below:

Sl. No	Station	Chainage (km)	Location	Latitude (N) / Longitude (E)	Easting (E) / Northing (N)	BM Height above MSL (m)	CD w.r.t. MSL (m)	BM Height w.r.t. Established CD (m)
1	IWAI BM PNG-01	14.928	Darur	N19°35'18.23632" E79°41'56.14118"	363541.676 2166454.085	156.507	143.854	12.653
2	IWAI BM PNG-02	24.517	Chamur	N19°33'49.46042" E79°36'35.78507"	354184.930 2163798.223	167.95	148.327	19.623
3	IWAI BM PNG-03	31.5	Juna Polsa	N19°30'43.13894" E79°35'25.20356"	352080.829 2158086.680	162.066	150.225	11.841
4	IWAI BM PNG-04	49.774	Lathi	N19°33'44.66839" E79°30'04.30286"	342774.495 2163747.223	170.154	153.247	16.907
5	IWAI BM PNG-05	54.648	Weggaon	N19°36'49.61088" E79°30'10.95869"	343018.292 2169431.704	170.908	154.256	16.652
6	IWAI BM PNG-06	64.974	Pachgaon	N19°41'05.43354" E79°29'53.38666"	342575.674 2177301.704	167.825	156.125	11.7
7	IWAI BM PNG-07	76.668	Kothari	N19°47'12.60138" E79°28'17.39628"	339881.935 2188615.731	174.026	157.921	16.105
8	IWAI BM PNG-08	87.023	Dudholi	N19°48'55.62322" E79°22'39.40361"	330075.233 2191875.012	173.618	160.657	12.961
9	IWAI BM PNG-09	97.185	Kalegaon	N19°51'54.69933" E79°19'10.43410"	324049.029 2197440.781	177.62	163.256	14.364
10	IWAI BM PNG-10	106.152	Marada	N19°53'58.97910" E79°14'44.99976"	316366.874 2201341.010	176.995	166.058	10.937
11	IWAI BM PNG-11	117.182	Wadha	N19°53'56.14170" E79°08'54.09427"	306159.300 2201363.112	180.125	169.147	10.978
12	IWAI BM PNG-12	126.716	Paramdoh	N19°50'43.43035" E79°05'00.63455"	299301.093 2195512.929	189.302	173.235	16.067
13	IWAI BM PNG-13	138.206	Murti	N19°48'36.39317" E79°00'45.46913"	291830.217 2191692.107	190.856	179.397	11.459

Sl. No	Station	Chainage (km)	Location	Latitude (N) / Longitude (E)	Easting (E) / Northing (N)	BM Height above MSL (m)	CD w.r.t. MSL (m)	BM Height w.r.t. Established CD (m)
14	IWAI BM PNG-14	148.429	Gadeghat	N19°46'05.44655" E78°56'13.27790"	283851.263 2187144.891	198.466	183.725	14.741
15	IWAI BM PNG-15	161.394	Yedash	N19°46'08.91113" E78°52'55.88501"	278105.629 2187322.389	206.675	190.248	16.427
16	IWAI BM PNG-16	168.553	Gota Ka Rajur	N19°45'44.29082" E78°49'15.57843"	271681.654 2186646.571	209.674	193.654	16.02
17	IWAI BM PNG-17	177.955	Dhanora	N19°46'46.40919" E78°45'01.29892"	264303.120 2188653.913	215.263	196.956	18.307
18	IWAI BM PNG-18	187.806	Patan Digras	N19°47'44.90733" E78°40'41.95386"	256776.926 2190555.174	210.208	199.925	10.283
19	IWAI BM PNG-19	198.908	Pimpalkhuti	N19°49'11.45678" E78°34'36.23851"	246167.794 2193366.795	215.308	201.223	14.085
20	IWAI BM PNG-20	207.008	Chanakha	N19°48'32.14211" E78°30'25.82755"	238860.312 2192263.546	224.413	206.158	18.255
21	IWAI BM PNG-21	222.138	Arti	N19°50'10.56920" E78°24'03.32186"	227770.577 2195459.248	229.156	211.854	17.302
22	IWAI BM PNG-22	229.679	Sagda	N19°53'06.76245" E78°21'55.38244"	224130.939 2200937.347	240.708	215.857	24.851
23	IWAI BM PNG-23	239.355	Naren Pet	N19°55'02.20582" E78°18'34.79247"	218350.115 2204581.272	244.6	220.829	23.771
24	IWAI BM PNG-24	248.731	Unkeshwar	N19°52'02.61632" E78°15'04.61181"	212144.124 2199155.003	246.444	225.214	21.23
25	IWAI BM PNG-25	260.447	Khadaka	N19°55'00.90749" E78°12'56.19793"	208497.088 2204701.803	259.291	232.156	27.135

Table 8 - Accepted Benchmark coordinates with established Chart Datum

2.11 Chart Datum / Sounding Datum and Reductions Details

The water availability in Penganga-Wardha River is very less and the spot leveling by topographic method was attempted for the entire survey stretch of Penganga-Wardha River. The least MSL level for the per-kilometer stretch was obtained as the established chart Datum. The details of Topo level converted as Depth for volume calculation are forwarded as soft copy along with the report.

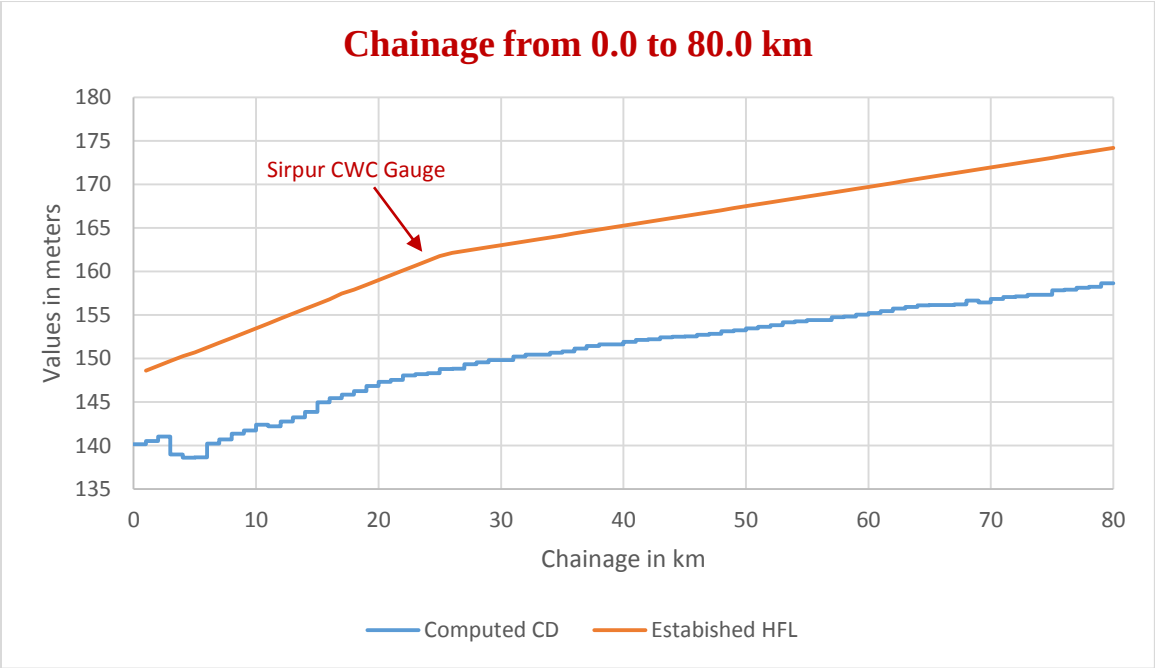
2.12 HFL/MHWS values of Bridges/Cross Structures

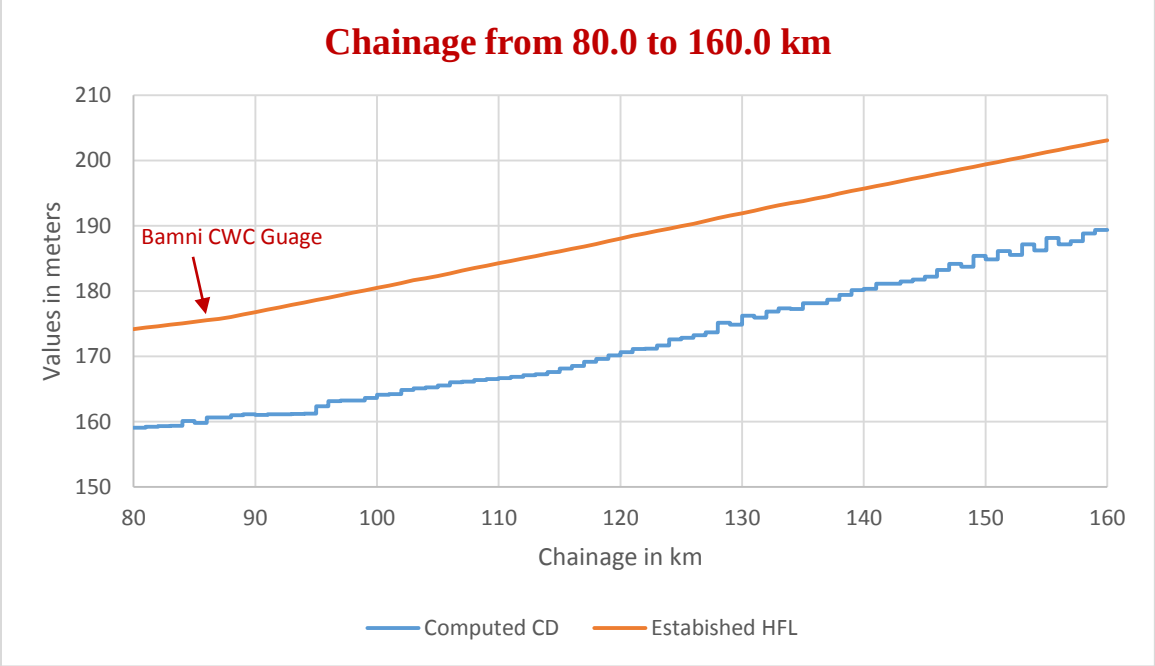
The established HFL value of the Sirpur CWC gauge, Bamini CWC gauge and PG Bridge w.r.t MSL in the last 20 years was provided by IWAI. The HFL value for the remaining survey stretch is computed for the Penganga-Wardha River. The details of established and computed HFL values for the entire stretch are as follows:

Sl. No.	Location and description of CWC gauge Barrages / Weirs / Anicut / Barrages / Aqueducts	Cross-structure details	Chainage (km)	Established HFL / FRL w.r.t. MSL (m)	Computed HFL at Cross-Structures w.r.t. MSL (m)
	A	B	C	D	E
1	Sirpur CWC gauge	Gauge	24.502	161.950	-
2	Venkatrapet to Polsa Bridge	Bridge	31.619	-	163.468
3	Tohogaon-Wirur Road Bridge	Bridge	57.235	-	169.271
4	Bamini CWC gauge	Gauge	86.804	175.890	-
5	Mancherial- Nagpur Road Bridge (NH-264)	Bridge	87.054	-	176.038
6	Balharshah Railway Bridge (New)	Bridge	87.680	-	176.038
7	Balharshah Railway Bridge (Old)	Bridge	87.802	-	176.038
8	Manoli-Balharshah Road Bridge	Bridge	92.039	-	177.886
9	Wardha-Hadasti Road Bridge	Bridge	100.763	-	180.843
10	Penganga Road Bridge	Bridge	112.899	-	185.352
11	Relegaon-Dewada Road Bridge (SH-236)	Bridge	130.944	-	192.301
12	Bori Road Bridge	Bridge	139.488	-	195.702
13	Kura Road Bridge	Bridge	187.823	-	213.592
14	P. G Bridge CWC gauge	Gauge	198.870	217.920	-
15	Dollara Road Bridge (NH-44)	Bridge	198.884	-	217.731
16	Dollara Road Bridge (NH-44)	Bridge	198.910	-	217.731
17	Kodari Railway Bridge	Bridge	201.841	-	219.173
18	Unkeshwar Road Bridge (SH-257)	Bridge	248.753	-	243.817

Table 9 - HFL values of Bridges/Cross structures

2.13 Graph: Sounding Datum and HFL vs Chainage





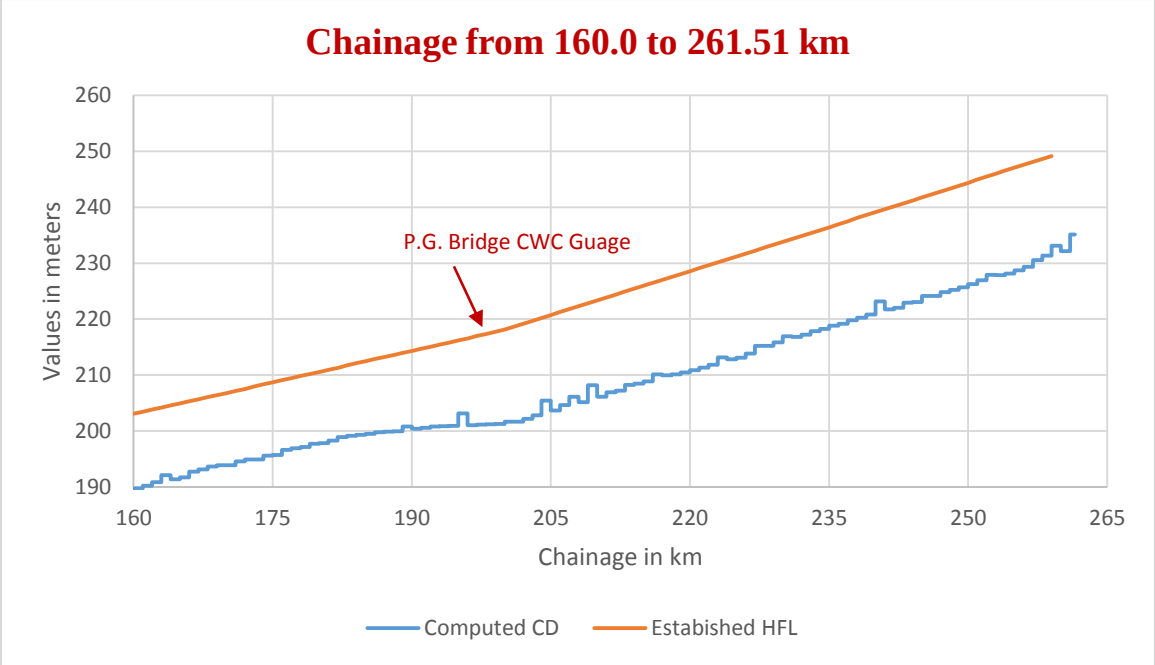


Figure 6 - Sounding Datum and HFL vs Chainage

2.14 Average Bed Slope

The average bed slope for the Penganga-Wardha River is as follows:

Reach and River-bed Level (RBL)		River-bed Level Change (m) (A)	Distance (km) (B)	Slope (A/B)
From	To			
Ch. 0 - RBL_141.403	Ch. 30 - RBL_152.958	11.555	30	1 : 0.385
Ch. 30 - RBL_152.958	Ch. 60 - RBL_155.854	2.896	30	1 : 0.097
Ch. 60 - RBL_155.854	Ch. 90 - RBL_161.257	5.403	30	1 : 0.180
Ch. 90 - RBL_161.257	Ch. 120 - RBL_171.235	9.978	30	1 : 0.333
Ch. 120 - RBL_171.235	Ch. 150 - RBL_189.125	17.890	30	1 : 0.596
Ch. 150 - RBL_189.125	Ch. 180 - RBL_198.179	9.054	30	1 : 0.302
Ch. 180 - RBL_198.179	Ch. 210 - RBL_213.214	15.035	30	1 : 0.501
Ch. 210 - RBL_213.214	Ch. 240 - RBL_222.697	9.483	30	1 : 0.316
Ch. 240 - RBL_222.697	Ch. 261.51 - RBL_237.147	14.450	21.51	1 : 0.675

Reach and River-bed Level (RBL)		River-bed Level Change (m) (A)	Distance (km) (B)	Slope (A/B)
From	To			

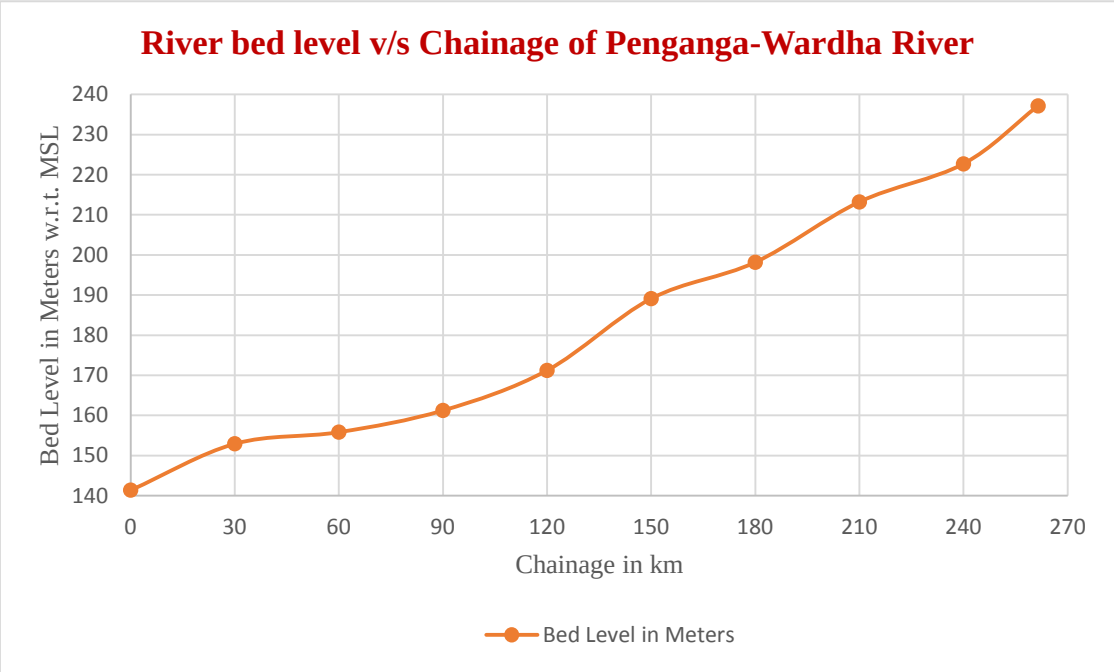


Table 10 - Average Bed Slope

2.15 Details of Dam, Barrages, Weirs, Anicut, etc.

There are no Dams, Barrages, Weirs and Anicut present in the entire survey stretch of Penganga-Wardha River.

2.16 Details of Locks

There are no Locks present in the entire survey stretch of Penganga-Wardha River.

2.17 Details of Aqueducts

There are no Aqueducts present in the survey stretch of Penganga-Wardha River.

2.18 Details of existing Bridges and Crossings over waterway

S. No	Structure Name and for road / rail	Chainage (km)	Type of Structure (RCC / Iron / Wooden)	Location	Position (Lat Long)	Position (UTM)	Length (m)	Width (m)	No of Piers	HC (clear distance Between piers) (m)	Vertical clearance w.r.t. HFL (m)	Remarks (complete / under - construction), in use or not, condition
					Left Bank Right Bank	Left Bank Right Bank						
1	Vennkatraopet to Polsa Bridge	31.619	RCC	Venkatrapet	**Left Bank:** 19°30'24.0311"N 79°35'17.7266"E **Right Bank:** 19°30'36.1601"N 79°35'21.6711"E	**Left Bank:** 351858.023 2157501.012 **Right Bank:** 351976.085 2157872.966	390	10.039	11	30.011	3.918	Completed and in use
2	Tohogaon-wirur Road Bridge	57.235	RCC	Arvi	**Left Bank:** 19°38'0.0582"N 79°29'14.9346"E **Right Bank:** 19°38'2.4059"N 79°29'26.6156"E	**Left Bank:** 341405.234 2171612.067 **Right Bank:** 341746.160 2171681.234	350	6.084	11	28.817	4.002	Completed and in use
3	Mancherial-Nagpur Road Bridge NH-264	87.054	RCC	Dudholi	**Left Bank:** 19°48'43.3918"N 79°22'35.4323"E **Right Bank:** 19°48'54.7090"N 79°22'38.9249"E	**Left Bank:** 329956.056 2191500.032 **Right Bank:** 330061.033 2191847.036	360	6.756	10	29.75	6.892	Completed and in use
4	Balharsha Railway Bridge New	87.680	RCC	Dudholi	**Left Bank:** 19°48'47.0154"N 79°22'14.3685"E **Right Bank:** 19°49'1.0982"N 79°22'18.4152"E	**Left Bank:** 329344.164 2191617.350 **Right Bank:** 329466.097 2192049.231	450	5.53	6	60.657	6.892	Completed and in use
5	Balharsha Railway Bridge Old	87.802	RCC	Dudholi	**Left Bank:** 19°48'49.5078"N 79°22'10.6689"E **Right Bank:** 19°49'1.5227"N 79°22'14.3224"E	**Left Bank:** 329237.244 2191695.024 **Right Bank:** 329347.124 2192063.431	380	2.81	14	22.213	6.892	Completed and in use
6	Manoli Balharsha Road Bridge	92.039	RCC	Manoli Bk (Near Coal Mine)	**Left Bank:** 19°49'52.4439"N 79°20'0.7014"E **Right Bank:** 19°50'5.7789"N 79°20'10.7975"E	**Left Bank:** 325474.235 2193667.100 **Right Bank:** 325772.045 2194074.232	503	6.663	10	45.121	5.739	Completed and in use
7	Wardha-Hadasti Road Bridge	100.763	RCC	Hadasti	**Left Bank:** 19°52'25.4158"N 79°17'17.9436"E **Right Bank:** 19°52'40.9547"N 79°17'13.7580"E	**Left Bank:** 320786.101 2198418.212 **Right Bank:** 320669.199 2198897.256	490	7.11	10	45.102	6.874	Completed and in use
8	Penganga Road Bridge	112.899	RCC	Erai	**Left Bank:** 19°54'7.5512"N 79°10'59.4503"E **Right Bank:** 19°54'17.3544"N 79°11'4.5214"E	**Left Bank:** 309809.324 2201674.216 **Right Bank:** 309960.076 2201974.077	335	6.708	12	24.671	11.719	Completed and in use
9	Virur Gadegaon Bridge	121.522	RCC	Virur Gadegaon	**Left Bank:** 19°52'1.61"N 79°7'34.19"E	**Left Bank:** 303796.4 2197867.33	450.5	12.18	13	33.61	--	Under Construction

S. No	Structure Name and for road / rail	Chainage (km)	Type of Structure (RCC / Iron / Wooden)	Location	Position (Lat Long)	Position (UTM)	Length (m)	Width (m)	No of Piers	HC (clear distance Between piers) (m)	Vertical clearance w.r.t. HFL (m)	Remarks (complete / under - construction), in use or not, condition
					Left Bank Right Bank	Left Bank Right Bank						
					Right Bank: 19°51'49.61"N 79°7'43.06"E	**Right Bank:** 304050.69 2197495.36						
10	Relegaon-Dewada Road Bridge (SH-236)	130.944	RCC	Wanoja	**Left Bank:** 19°48'52.4161"N 79°03'53.9649"E **Right Bank:** 19°49'7.7349"N 79°03'54.4693"E	**Left Bank:** 297322.013 2192121.175 **Right Bank:** 297342.088 2192592.088	470	8.02	9	46.012	7.497	Completed and in use
11	Bori Road Bridge (SH-236)	139.488	RCC	Bori	**Left Bank:** 19°48'31.0345"N 78°59'56.8779"E **Right Bank:** 19°48'20.2750"N 78°59'57.2186"E	**Left Bank:** 290414.001 2191544.001 **Right Bank:** 290420.000 2191213.000	332	6.02	8	30.129	11.088	Completed and in use
12	Kura Road Bridge	187.823	RCC	Kura	**Left Bank:** 19°47'37.2329"N 78°40'39.4919"E **Right Bank:** 19°47'44.6369"N 78°40'41.3454"E	**Left Bank:** 256702.010 2190320.110 **Right Bank:** 256759.098 2190547.099	235	6.06	8	23.15	9.663	Completed and in use
13	Dollara Road Bridge (NH-44) -1	198.884	RCC	Dollara	**Left Bank:** 19°48'58.1439"N 78°34'41.6035"E **Right Bank:** 19°49'6.8060"N 78°34'37.7170"E	**Left Bank:** 246318.098 2192955.057 **Right Bank:** 246208.781 2193223.122	287	7.99	12	30.114	10.740	Completed and in use
14	Dollara Road Bridge (NH-44)-2	198.910	RCC	Dollara	**Left Bank:** 19°48'57.8376"N 78°34'40.7163"E **Right Bank:** 19°49'6.4991"N 78°34'36.9051"E	**Left Bank:** 246292.136 2192946.005 **Right Bank:** 246185.011 2193214.021	287	10.86	12	30.101	10.740	Completed and in use
15	Kodari Railway Bridge	201.841	RCC	Kodari	**Left Bank:** 19°49'17.3147"N 78°33'3.3033"E **Right Bank:** 19°49'33.4945"N 78°33'4.4981"E	**Left Bank:** 243465.034 2193586.012 **Right Bank:** 243507.033 2194083.199	500	3.879	23	20.212	10.820	Completed and in use
16	Chyas Bridge	248.368	RCC	Chyas	**Left Bank:** 19°51'56.51"N 78°15'17.49"E **Right Bank:** 19°52'3.39"N 78°15'15.36"E	**Left Bank:** 212515.91 2198961.03 **Right Bank:** 212457.36 2199173.70	226.98	15.18	16	9.21	-	Under Construction /Abandoned
17	Unkeshwar Road Bridge	248.753	RCC	Unkeshwar	**Left Bank:** 19°51'54.5489"N 78°15'2.0398"E **Right Bank:** 19°52'1.4669"N 78°15'3.8032"E	**Left Bank:** 212065.209 2198908.024 **Right Bank:** 212120.011 2199120.024	220	6.26	11	15.215	9.594	Completed and in use

Table 11 - Bridges crossing over waterway

2.19 Details of other Cross structures, pipe-lines, underwater cables

There is numerous small pipeline connections between the Drinking water well and shore Pump houses in the Penganga-Wardha River, however, no major Pipelines or under water cables cross-through the Penganga-Wardha River.

2.20 High Tension Lines / Electric lines / Tele-communication lines

Sl. No.	Type of Line	Chainage (km)	Location	Position (Lat/Lon) (left Bank/ Right Bank)	Position (UTM) (left Bank/ Right Bank)	No of Piers	Horizontal Clearance (m)	Vertical clearance w.r.t. HFL (m)	Remark (complete/ under – construction)
1	HTL	49.625	Polsa	**Left Bank:** 19°34'19.3108"N 79°29'45.7799"E **Right Bank:** 19°34'3.6927"N 79°29'52.7214"E	**Left Bank:** 342244.023 2164817.065 **Right Bank:** 342442.098 2164335.098	-	-	14.238	Completed
2	HTL	57.151	Dhanora	**Left Bank:** 19°37'59.5277"N 79°29'10.1257"E **Right Bank:** 19°38'3.3233"N 79°29'27.9437"E	**Left Bank:** 341265.000 2171597.000 **Right Bank:** 341785.099 2171709.098	-	-	-	Under Construction
3	HTL	87.097	Dudholi	**Left Bank:** 19°48'42.5598"N 79°22'33.8246"E **Right Bank:** 19°48'55.9653"N 79°22'37.6070"E	**Left Bank:** 329909.025 2191474.900 **Right Bank:** 330023.053 2191886.032	-	-	15.381	Completed
4	HTL	91.826	Ravindra Nagar	**Left Bank:** 19°49'47.1194"N 79°20'2.0205"E **Right Bank:** 19°49'59.4585"N 79°20'17.3917"E	**Left Bank:** 325511.000 2193503.000 **Right Bank:** 325962.000 2193878.000	-	-	16.391	Completed
5	HTL	97.471	Dharmashala	**Left Bank:** 19°51'47.9626"N 79°18'47.9906"E **Right Bank:** 19°51'58.3365"N 79°19'1.4252"E	**Left Bank:** 323394.043 2197240.156 **Right Bank:** 323788.064 2197555.234	-	-	16.478	Completed
6	HTL	114.386	Dhanora	**Left Bank:** 19°54'18.3698"N 79°10'20.9135"E **Right Bank:** 19°54'31.5914"N 79°10'9.9150"E	**Left Bank:** 308692.044 2202019.034 **Right Bank:** 308376.568 2202429.086	-	-	18.468	Completed
7	EP	248.846	Unkeshwar	**Left Bank:** 19°51'55.37"N 78°14'58.65"E **Right Bank:** 19°52'6.2483"N 78°15'1.9682"E	**Left Bank:** 211967.00 2198935.00 **Right Bank:** 212069.000 2199268.000	-	-	18.603	Completed
8	HTL	249.817	Hatola	**Left Bank:** 19°52'17.5882"N 78°14'30.1989"E	**Left Bank:** 211150.000 2199632.000	-	-	18.627	Completed

Sl. No.	Type of Line	Chainage (km)	Location	Position (Lat/Lon) (left Bank/ Right Bank)	Position (UTM) (left Bank/ Right Bank)	No of Piers	Horizontal Clearance (m)	Vertical clearance w.r.t. HFL (m)	Remark (complete/ under – construction)
				Right Bank: 19°52'28.7325"N 78°14'42.5120"E	**Right Bank:** 211514.000 2199969.000				

Table 12- High Tension Lines

2.21 Current Meter and Discharge details

Current meter observation is not done in Penganga-Wardha River due to non-availability of water.

2.22 Water Samples

Water Samples were not collected in Penganga-Wardha River due to non-availability of water.

3 Description of waterway

The Waterway of Penganga-Wardha River coming within survey limits is divided into nine stretches in accordance with the topographic feature and nature of river stream. The details are as follows:

3.1 Sub Stretch 1: Ranvalli to Polsa (Chainage 0.00km to 30.00km)

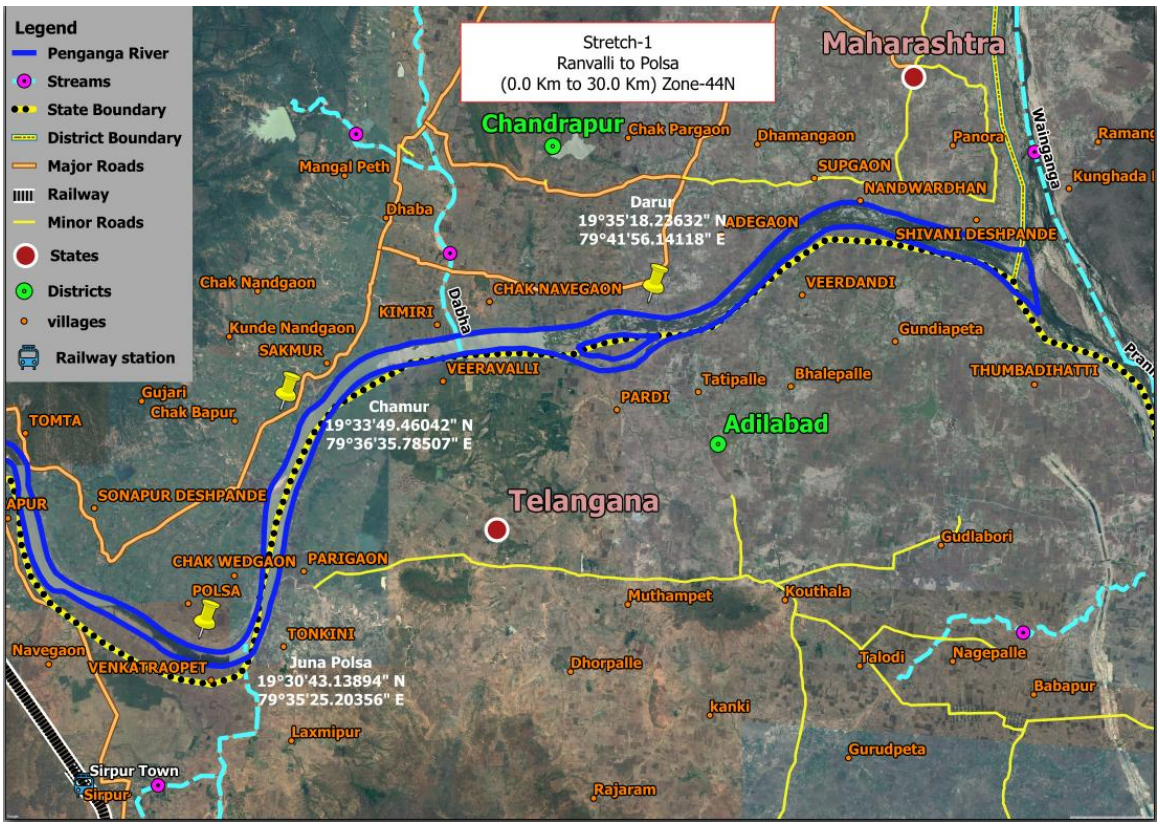


Figure 7 - Stretch-1 Ranvalli to Polsa

- **Bathymetry Survey**
  a) No bathymetric survey is conducted due to the unavailability of water
- **Topographic Survey**
  b) 30km of the length of the stretch for which the Topographic survey has been carried out.

Stretch-1 is covered 30.00km i.e. from 0.0km to 30.00km from Ranvalli to Polsa Village.

Ranvalli is a Village in Kouthala Mandal in Adilabad District of Telangana State, It is located 156km towards East from District headquarters Adilabad 8km from Kouthala.

Gudlabori (5km), Ravindranagar (7km), Talodi (8km), Gundaipeta (8km), Balaji Ankoda (9km) are the nearby Villages to Ranvalli. Ranvalli is surrounded by Mulchera Mandal towards the East, Bejjur Mandal towards the South, Gondpipri Mandal towards the North and Sirpur (T) Mandal towards west.

Kagaznagar is the Nearest Town to Ranvalli. Kagaznagar is 50km from Ranvalli. Road connectivity is there from Kagaznagar to Ranvalli. There is no railway station near to Ranvalli in less than 10km. There are railway Stations from Near By town Kagaznagar. The Warangal Rail Way Station is a major railway station 196km near to Ranvalli. The confluence Penganga River and Wainganga River is locate near to Shivani Deshpande village of Gondpipri Block in Chandrapur district of Maharashtra state.

In this stretch along the right bank of the rivers Supgaon, Adegaon, Darur, Chak Navegaon, Sakmur, Kirmiri and Wadegaon, villages are located in Chandarpur District, Maharashtra and left bank of the rivers Veerdandi, Tatipella, Pardi, Veervalli, Lonavelly, Parigaon, Tonkini and Venkatraopet villages are located in Adilabad District Telangana. The river in this stretch acts as a natural boundary between two states. Both sides of river banks having good cultivable land. Rice, Jowar, Bajra, Wheat, Tur, Mung, Urad is cultivated mostly in the area.

In this river's stretch area found full rock and scattered flow of water. The area between BM PNG-01 to PNG-03 River in this stretch having a partial flow of water non navigable streams. The river bed is fine sandy in nature and the stretch is covered by topographic survey method. There are features like Irrigation lift and Temples along the river.

Figure 8 - Water Plant (17.811 km chainage) and Temple (14.926 km chainage)

Class	Chainage (km)		Observed					Reduced w.r.t. Sounding Datum				
	From	To	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Accumulated Qty.	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Accumulated Qty.
I	0	30	0.000	0.000	30000	1,293,263.76	1,293,263.76	-0.300	0.000	30000	1,646,305.27	1,646,305.27
II	0	30	0.000	0.000	30000	1,971,004.19	1,971,004.19	-0.300	0.000	30000	2,427,565.06	2,427,565.06
III	0	30	0.000	0.000	30000	2,970,638.39	2,970,638.39	-0.300	0.000	30000	3,532,924.96	3,532,924.96
IV	0	30	0.000	0.000	30000	3,593,604.13	3,593,604.13	-0.300	0.000	30000	4,182,706.58	4,182,706.58

Table 13 - Dredging Quantity Details

3.1.1 Observed and reduced Bed Profile of the stretch

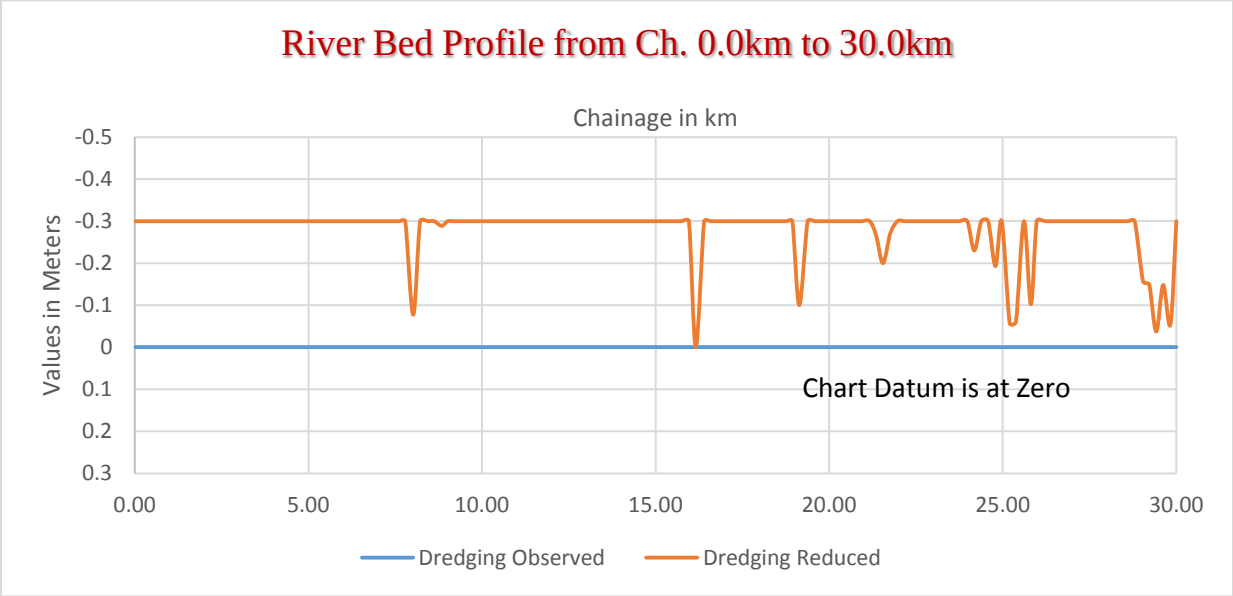


Figure 9 - River Bed Profile

3.2 Sub-Stretch-2: Polsa to Panchgaon (30.0km to 60.0km)

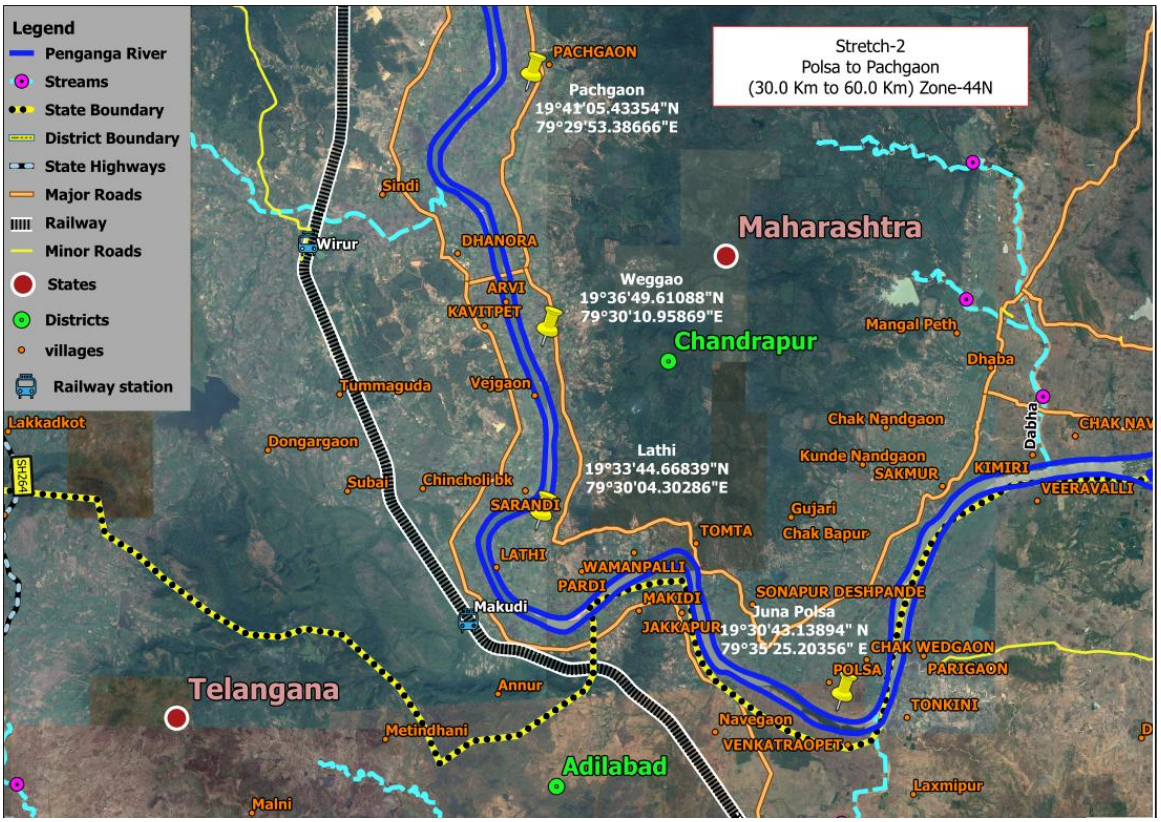


Figure 10 - Polsa to Panchgaon

- **Bathymetry Survey**
  a) No bathymetric survey is conducted due to the unavailability of water
- **Topographic Survey**
  b) 30km of the length of the stretch for which the Topographic survey has been carried out.

Stretch-2 has covered 30.00 km, i.e. from 30.00 to 60.00 km from Polsa to Panchgaon village.

In this stretch of river only scattered flow of water is observed and is there is no sufficient water for navigation and hydrographic survey using a survey boat could not be carried out. The spot levels by topographic survey method were measured using Trimble R4 GPS.

In this stretch, the river bed is fine sandy in nature and between stretches right on the river bank are having big hills and hillocks with bush's growth are found. Along the right bank of the river Sonapur Deshpande, Tomta, Wamanpalli, Pardi, Lathi, Tohogaon, and Panchgaon villages are located and on left bank of the river Jakkarpur, Makadi,

Chincholi B.K, Sarandi, Wejgaon, Kavipet, Dhanora and Nalphadi villages are located. Both side of river banks having well cultivable land.

In this stretch along the river Railway line is passing from Sirpur to Wirur on the left bank of the river. There are 02 Bridge, 01 Anemometer station, 02 High transmission power lines are crossing the river in this stretch. At chainage 31.619km Venkatraopet Road Bridge is constructed across the Penganga River. It is connecting Venkatraopet and Polsa village. At Chainage 57.235km Thogaon-Wirur Road Bridge is passing across Penganga River. It is connecting between Thogaon and Wirur villages.

Figure 11 - Venkatraopet Road Bridge and Anemometer Station at Polsa *(31.619 km chainage)*

Figure 12 - Thogaon-Wirur Road Bridge (57.235 km chainage)

Figure 13 - Power Transmission Line under constructions (57.151 Km chainage)

Class	Chainage (km)		Observed					Reduced w.r.t. Sounding Datum				
	From	To	Min. depth (m)	Max. depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Accumulated Qty.	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Accumulated Qty.
I	30	60	0.000	0.000	30000	1,293,530.73	2,586,794.49	-0.300	0.000	30000	1,630,213.13	3,276,518.40
II	30	60	0.000	0.000	30000	1,970,242.15	3,941,246.34	-0.300	0.000	30000	2,401,874.98	4,829,440.04
III	30	60	0.000	0.000	30000	2,977,811.01	5,948,449.40	-0.300	0.000	30000	3,511,855.80	7,044,780.76
IV	30	60	0.000	0.000	30000	3,593,127.95	7,186,732.08	-0.300	0.000	30000	4,150,950.46	8,333,657.04

Table 14 - Dredging Quantity Details

3.2.1 Observed and reduced Bed Profile of the stretch

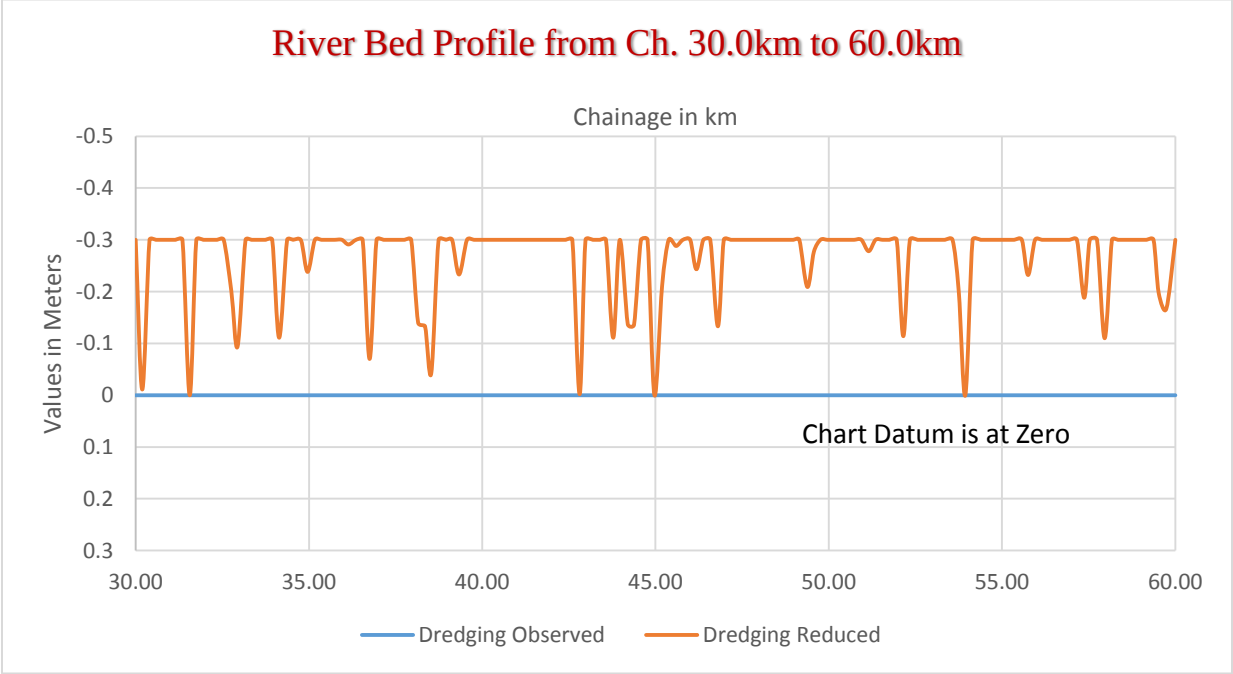


Figure 14 - River bed Profile

3.3 Sub-Stretch-3: Pachgaon to Balharsha (60.0km to 90.0km)

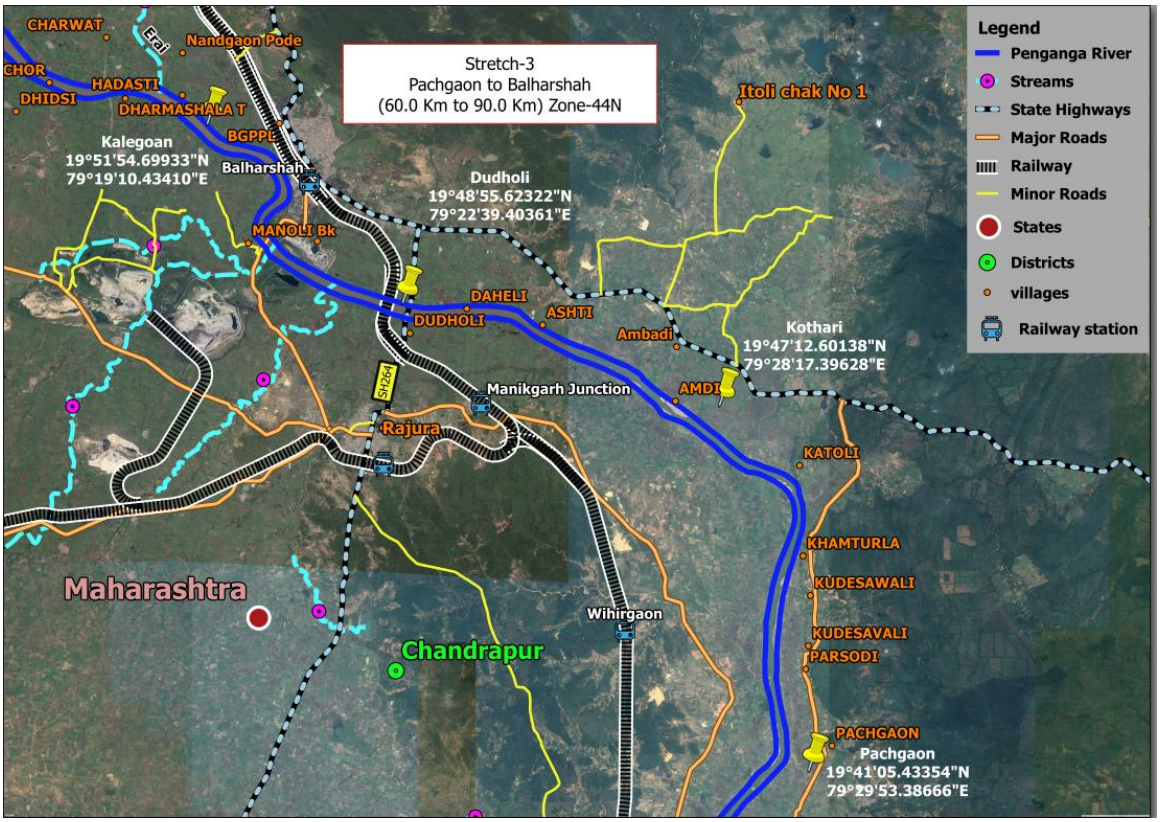


Figure 15 - Stretch-03 Pachgaon to Balharsha

- **Bathymetry Survey**
  a) No bathymetric survey is conducted due to the unavailability of water
- **Topographic Survey**
  b) 30km of the length of the stretch for which the Topographic survey has been carried out.

Sub-Stretch-3 has covered 30.0 km i.e. from 60.0 to 90.0km from Panchgaon to Balharsha in Chandrapur District, in Maharashtra state. In this river stretch, very shallow and small pocket of water is available and hydrographic survey by survey boat could not be conducted. The spot leveling for the entire area was conducted by topographic survey method.

In this stretch along the right bank of the rivers Parsodi, Kudesawali, Khamturla, Katoli, Ambadi, Ashti, Lawari and Balharsha villages are located and left bank of the rivers Murti, Kohapara, Mangaon, Panchala, Chunala, Dudholi, and Manali B.K villages are located.

Both sides of river banks are having good cultivable land. Rice, Jowar, Bajra, Wheat, Tur, Mung, Urad, Gram, Pulses, Oilseeds. Groundnut, Sunflower, Soyabean, Cotton, Sugarcane, Turmeric, Mango, Banana, Orange, Grape, Cashew nut is the major crops that are cultivated mostly in the area.

Balharsha also called Ballarpur it is the city in Chandrapur district, this is one of the industrial areas of the region also it is known as wood city. Balharsha has 9 coal mines nearby owned by the public sector company western coal-fields Limited also has India's largest Paper mills like BILT Graphic Paper Products Limited, Sabah Forest Industries (SFI). Ballarpur has a good road and rail connectivity to Nagpur, Hyderabad and Chandrapur.

In this stretch, Railway line is along the river and crossing the river near Dudholi village and going towards Visapur and Chandarpur. Near the Balharsha city along the river number of coal mine deports are found.

There are 01 Road Bridge, 02 Railway Bridge and 01 High transmission power lines are crossing to the river in this stretch. In addition to this, an irrigation plant and 01 Paper mill is found along the river. At Chainage 87.054km Mancherial- Nagpur Road Bridge is constructed across Penganga River near to Dudholi village.

Figure 16 - Mancherial- Nagpur Road Bridge (87.054 km chainage)

Figure 17 - New and Old Railway line (87.6 km chainage)

Figure 18 - Irrigation Plant under construction (83.348 km chainage)

Class	Chainage (km)		Observed					Reduced w.r.t. Sounding Datum				
	From	To	Min. depth (m)	Max. depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Accumulated Qty.	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Accumulated Qty.
I	60	90	0.000	0.000	30000	1,294,378.21	3,881,172.70	-0.300	0.000	30000	1,645,183.46	4,921,701.86
II	60	90	0.000	0.000	30000	1,971,529.38	5,912,775.72	-0.300	0.000	30000	2,423,125.49	7,252,565.53
III	60	90	0.000	0.000	30000	2,979,769.81	8,928,219.21	-0.300	0.000	30000	3,540,653.56	10,585,434.32
IV	60	90	0.000	0.000	30000	3,595,503.14	10,782,235.22	-0.300	0.000	30000	4,181,571.00	12,515,228.04

Table 15 - Dredging Quantity Details

3.3.1 Observed and reduced Bed Profile of the stretch

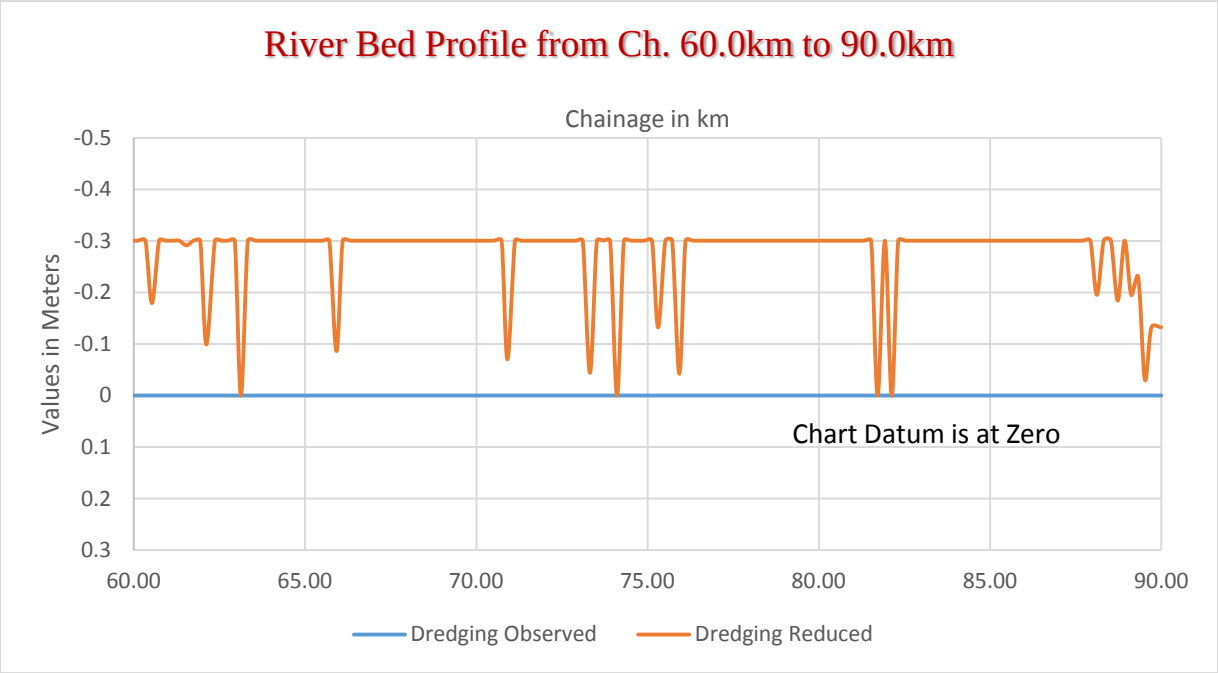


Figure 19 - River bed Profile

3.4 Sub-Stretch-4: Balharsha to Virur Gadegaon (90.0km to 120.0km)

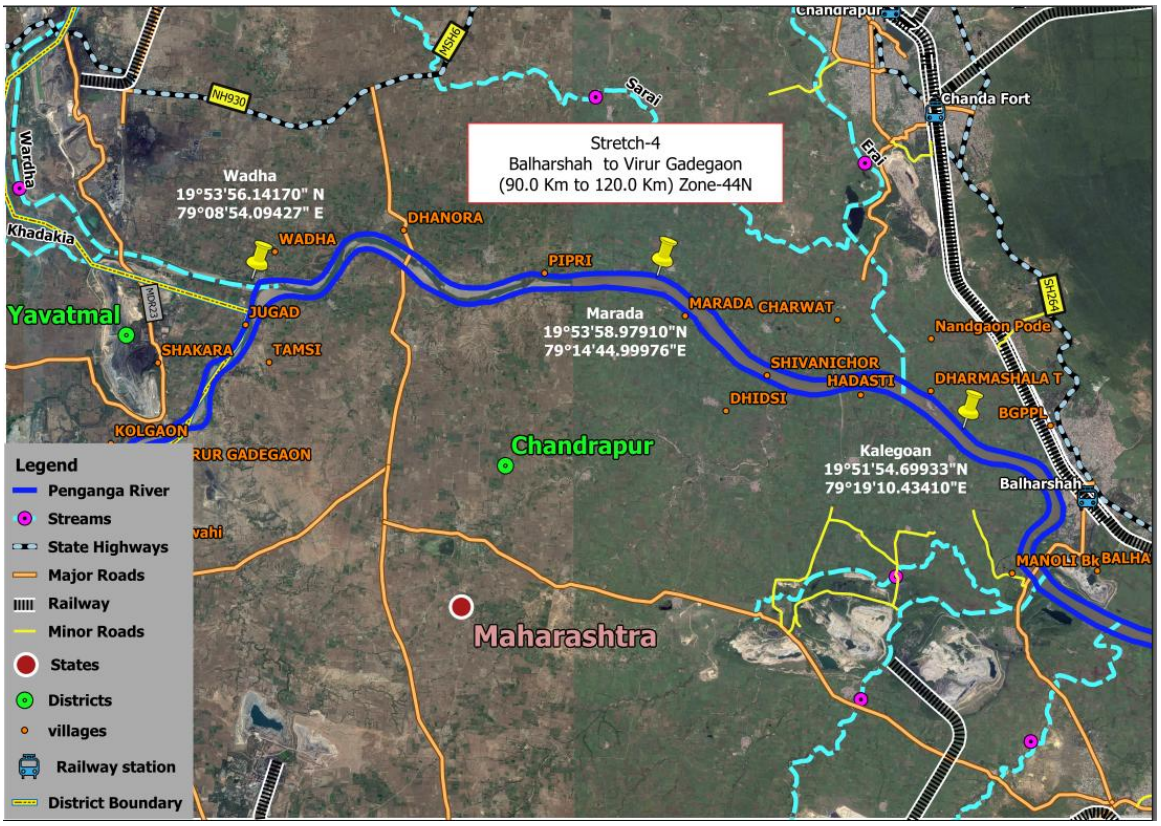


Figure 20 - Balharsha to Virur Gadegaon

- **Bathymetry Survey**
  a) No bathymetric survey is conducted due to the unavailability of water.
- **Topographic Survey**
  b) 30km of the length of the stretch for which the Topographic survey has been carried out.

Stretch-4 has covered 30.00 km i.e. from 90.00 to 120.00 km from Balharsha to Virur Gadegaon village Chandrapur District, Maharastra. In this river stretch, very shallow and small pocket of water is available and hydrographic survey by survey boat could not be conducted. The spot leveling for the entire area was conducted by topographic survey method.

In this stretch along the right bank of the rivers Dharmasala T, Charwat, Marada, Pipri, Dhanora, Wadha and Jugad villages are located and left bank of the rivers Hadasti, Dhidsi, Kurli, Bharosa, Tamsi and Viru Gadegaon villages are located. Both side of river banks having good cultivable land. Rice, Jowar, Bajra, Wheat, Tur, Mung, Urad, Gram, Pulses, Oilseeds. Groundnut, sunflower, soyabean, cotton, sugarcane is the major crops that are cultivated mostly in the area.

In this stretch scattered flow of water was there between the stretch ground water is found in the basal portion containing fine sand. In this stretch at Wadha village it is the place where Wardha river confluence with Penganga River. It is also called confluence or Sangam of Wardha and Penganga River.

There are features 03 bridges, 02 High Transmission Lines are crossing to the river, also in this stretch 12 Nos. of pump, 06 Temples house and 01 Water Tank found along the river, In addition to this a coal mine deport along the right side of river at Sakhara village was found.

At Chainage 92.039km Manoli Road Bridge is crossing over the Penganga Village. It is connecting Manoli and Balharshah. At Chainage 100.763km Wardha Hadasti Road Bridge is constructed across the river. It is connecting Hadasti and Charwat villages. At Chainage 112.899km Penganga Road Bridge is constructed across the river. It is connecting Bharosa and Dhanora Villages.

Figure 21 - Manoli Road Bridge (92.039km chainage)

Figure 22 - Wardha Hadasti Road Bridge-MDR -41(100.763 km chainage)

Figure 23 - Penganga Road Bridge (112.899 km chainage)

Figure 24 - Features in Stretch 4 (HTL at 114.386 km Chainage and water tank at 98.249 km chainage)

Class	Chainage (km)		Observed					Reduced w.r.t. Sounding Datum				
	From	To	Min. depth (m)	Max. depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Accumulated Qty.	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Accumulated Qty.
I	90	120	0.000	0.000	30000	1,292,884.81	5,174,057.51	-0.300	0.000	30000	1,634,048.81	6,555,750.67
II	90	120	0.000	0.000	30000	1,969,244.02	7,882,019.74	-0.300	0.000	30000	2,408,308.28	9,660,873.81
III	90	120	0.000	0.000	30000	2,976,321.55	11,904,540.76	-0.300	0.000	30000	3,521,503.37	14,106,937.69
IV	90	120	0.000	0.000	30000	3,591,341.38	14,373,576.60	-0.300	0.000	30000	4,161,036.29	16,676,264.33

Table 16 - Dredging Quantity Details

3.4.1 Observed and reduced Bed Profile of the stretch

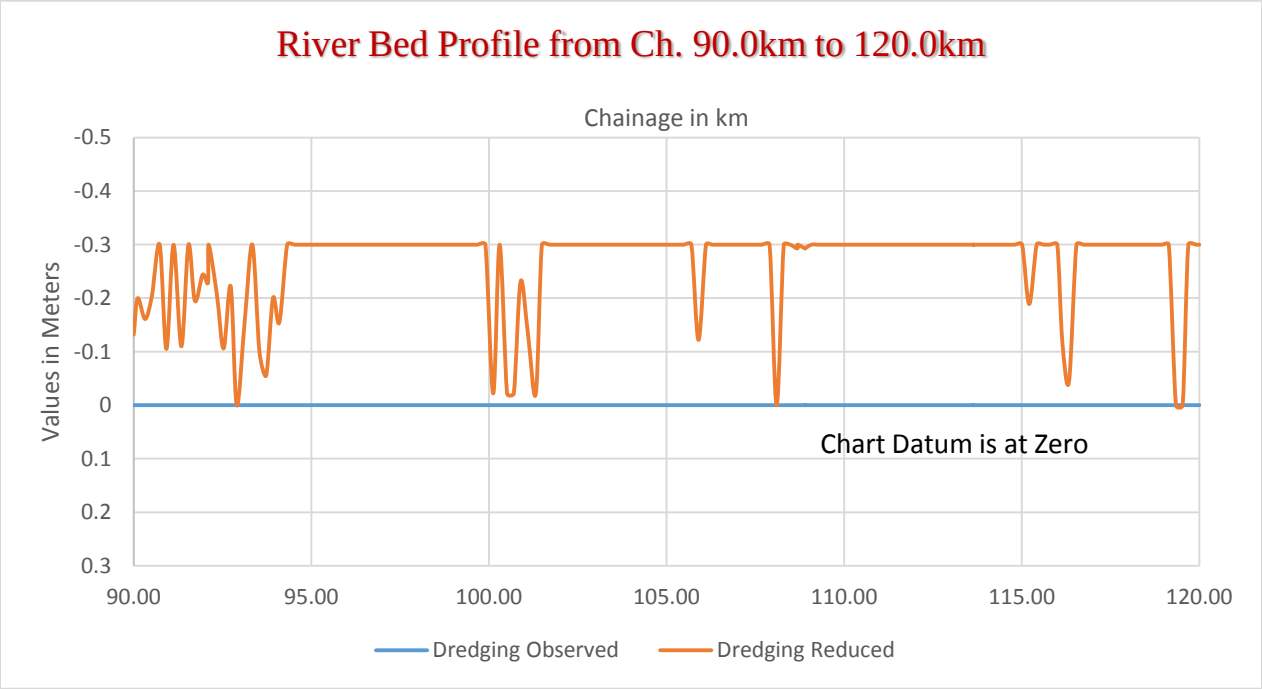


Figure 25 - River bed Profile

3.5 Sub-Stretch-5: Virur Gadegaon to Weded (120.0km to 150.0km)

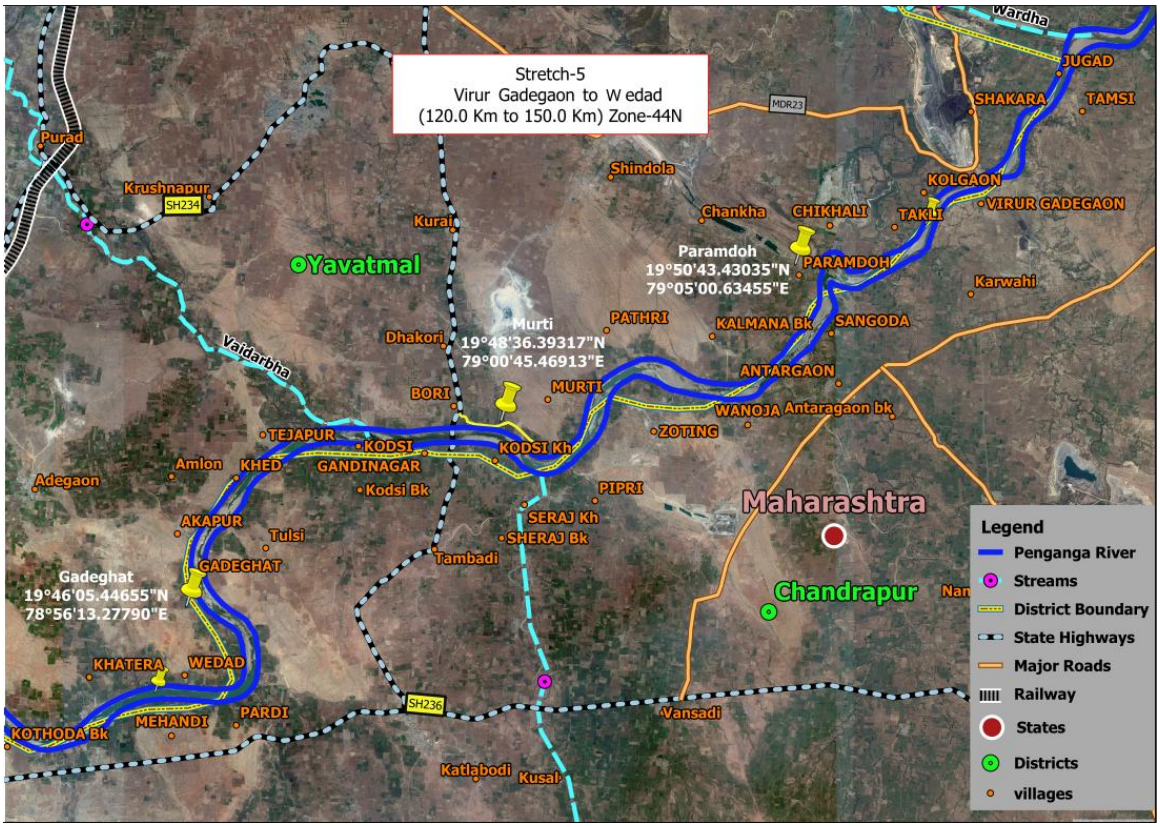


Figure 26 - Virur Gadegaon to Weded

- **Bathymetry Survey**
  a) No bathymetric survey is conducted due to the unavailability of water
- **Topographic Survey**
  b) 30km of the length of the stretch for which the Topographic survey has been carried out.

Stretch-5 has covered 30.00 km i.e. from 120.00 km to 150.00 km from the Virur Gadegaon village to Wedad village in Yawatmal District in Maharashtra State.

In this stretch along the right bank of the rivers Takti, Paramdoh, Kalmana B.K, Pathri, Murti, Bori, Deurwada, Tejapur, Gadeghat and Wedad villages are located and left bank of the rivers Karwahi, Sangoda, Wanoja, Pipri, Gandhinagar, Kodsi, Tulsi, Akola and Pardi villages are located. Both sides of river banks are having good cultivable land. Rice, Jowar, Bajra, Wheat, Tur, Mung, Urad Gram, Pulses, Oilseeds, Groundnut, Sunflower, Soybean, Cotton, Sugarcane is the major crops that are cultivated mostly in the area.

In this stretch river was completely dry and bush's growth both bank of the river. There are features 02 Bridges are crossing the river. In addition 02 Temples and 01 Pump House found along the river.

At Chainage 130.944km Relegaon- Dewada Road Bridge is constructed across the river. It is connecting Wanjo and Kalmana Villages.At Chainage 139.488km Bori Road Bridge is constructed across the river. It is connecting Gandhinagar and Bori Villages.

Figure 27 - Relegaon- Dewada Road Bridge (130.944 km Chainage)

Figure 28 - Bori Road Bridge (139.488 km chainage)


Figure 29 – Temple (138.252 k m chainage) and Pump House (139.458 km chainage)

Class	Chainage (km)		Observed					Reduced w.r.t. Sounding Datum				
	From	To	Min. depth (m)	Max. depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Accumulated Qty.	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Accumulated Qty.
I	120	150	0.000	0.000	30000	1,291,906.02	6,465,963.53	-0.300	0.000	30000	1,625,775.28	8,181,525.95
II	120	150	0.000	0.000	30000	1,967,729.94	9,849,749.68	-0.300	0.000	30000	2,397,546.12	12,058,419.93
III	120	150	0.000	0.000	30000	2,973,989.96	14,878,530.72	-0.300	0.000	30000	3,508,297.17	17,615,234.86
IV	120	150	0.000	0.000	30000	3,588,506.89	17,962,083.49	-0.300	0.000	30000	4,147,007.53	20,823,271.86

Table 17 - Dredging Quantity Details

3.5.1 Observed and reduced Bed Profile of the stretch

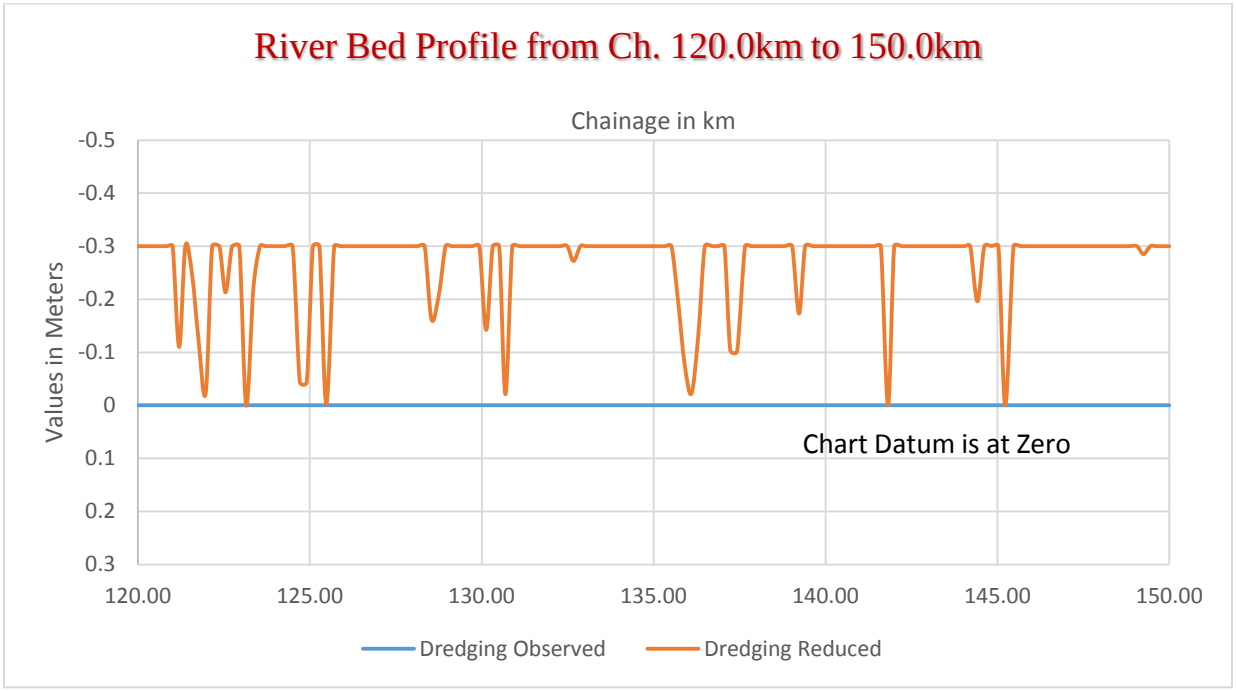


Figure 30 - River bed Profile

3.6 Sub-Stretch-6: Weded to Durbha (150.0km to 180.0km)

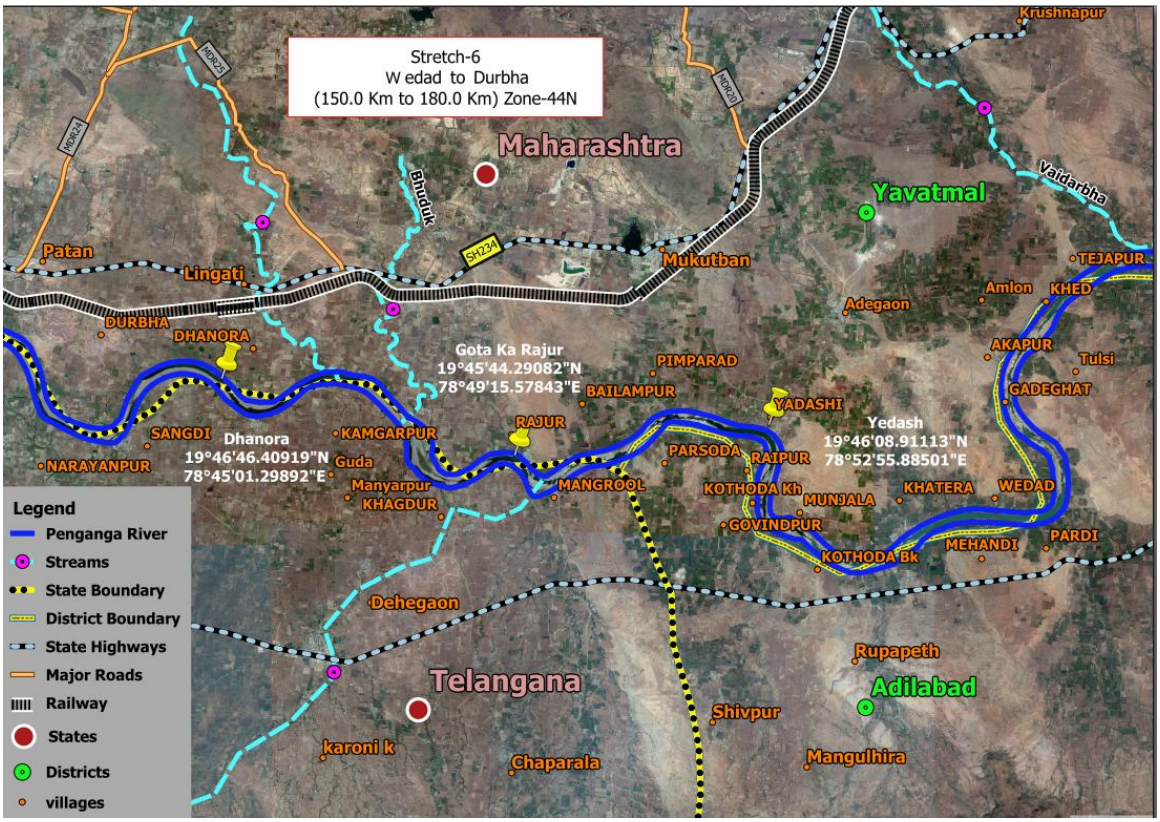


Figure 31 - Weded to Durbha

- **Bathymetry Survey**
  a) No bathymetric survey is conducted due to the unavailability of water
- **Topographic Survey**
  b) 30km of the length of the stretch for which the Topographic survey has been carried out.

Stretch-6 has covered 30.00 km i.e. from 150.0km to 180.0km from Wedad village to Durbha village in Yawatmal District in Maharashtra State.

In this stretch along the right bank of the rivers Khatera, Yedashi, Bailampur, Rajpur and Dhanora villages are located and left bank of the rivers Mehendi, Kathoda B.K, Parsoda, Mangool, Khagdur, Kamgapur, Bhiloda and Sangdi villages are located.

Both sides of river banks having cultivable land. Rice, Jowar, Bajra, Wheat, Tur, Mung, Urad Gram, Pulses, Oilseeds, Groundnut, Sunflower, Soya bean, Cotton, Sugarcane is the major crops that are cultivated mostly in the area.

Dhanora is a village is located in the Dhanora Taluk/Mandal/Tehsil Gadchiroli district, in the state of Maharashtra in India.

In this stretch river was completely dry with lithic sand. There are no features crossing of the river in this stretch. 02 Temples, 01 Water Tank and 01 Pump House found along the river.

Class	Chainage (km)		Observed					Reduced w.r.t. Sounding Datum				
	From	To	Min. depth (m)	Max. depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Accumulated Qty.	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Accumulated Qty.
I	150	180	0.000	0.000	30000	1,291,314.61	7,757,278.14	-0.300	0.000	30000	1,636,298.07	9,817,824.02
II	150	180	0.000	0.000	30000	1,966,851.74	11,816,601.42	-0.300	0.000	30000	2,411,089.62	14,469,509.55
III	150	180	0.000	0.000	30000	2,972,690.56	17,851,221.28	-0.300	0.000	30000	3,525,432.80	21,140,667.66
IV	150	180	0.000	0.000	30000	3,586,958.81	21,549,042.30	-0.300	0.000	30000	4,164,876.80	24,988,148.66

Table 18 - Dredging Quantity Details

3.6.1 Observed and reduced Bed Profile of the stretch

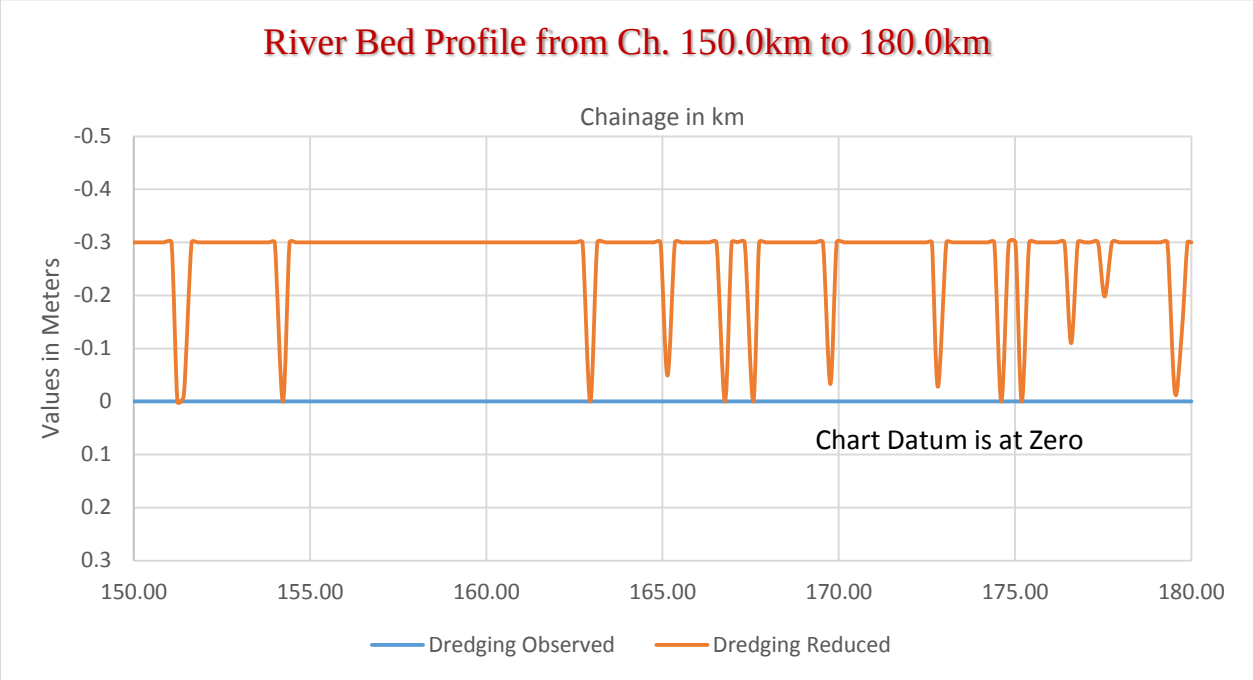


Figure 32 - River bed Profile

3.7 Sub-Stretch-7: Durbha to Chanakha (180.0km to 210.0km)

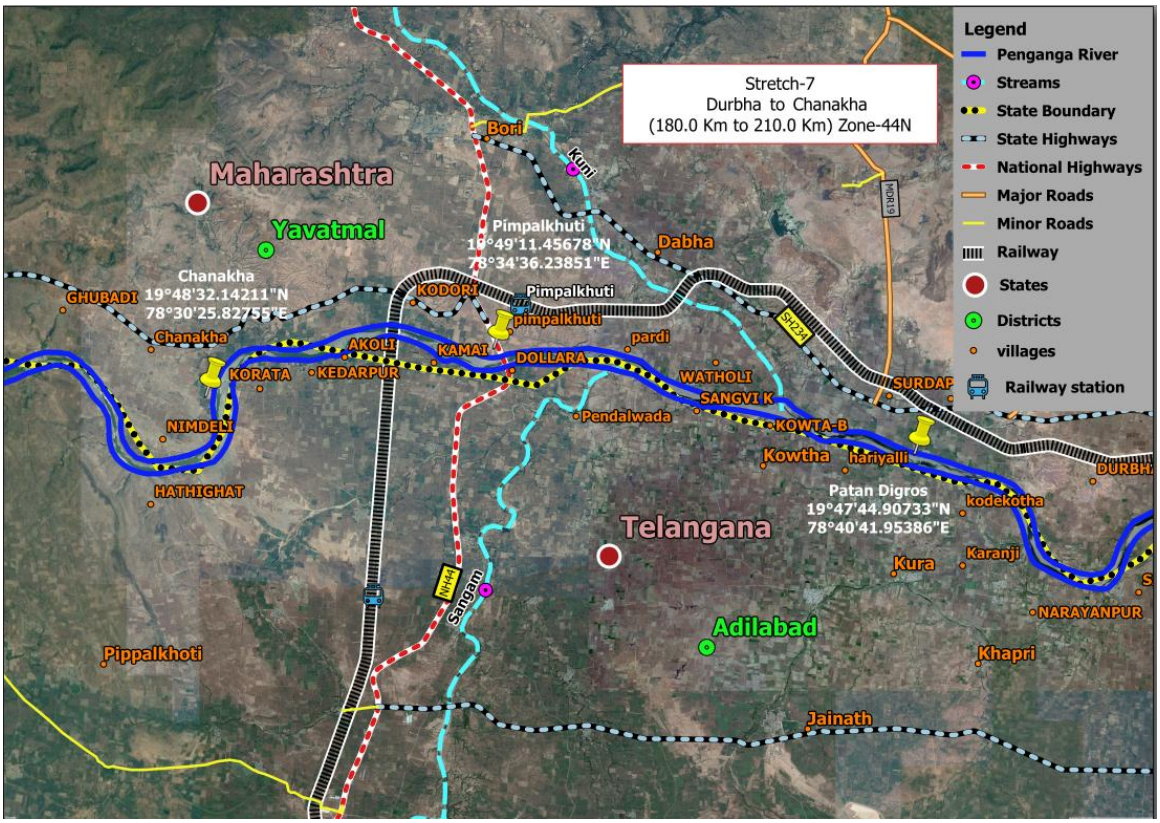


Figure 33 - Durbha to Chanakha

- **Bathymetry Survey**
  a) No bathymetric survey is conducted due to the unavailability of water
- **Topographic Survey**
  b) 30km of the length of the stretch for which the Topographic survey has been carried out.

Stretch-7 has covered 30.00 km i.e. from 180.0 km to 210.0 km from Durbha village to Chanakha village in Yawatmal District in Maharashtra State.

In this stretch along the right bank of the rivers Surdapur, Watholi, Pimpalkhuti, Kodori, Rudha, Chankha and Nimdeli villages are located and left bank of the rivers Narayanapur, Karanji, Kedokotha, Hariyali, Kotwa B, Pendalwada, Dollara Akoli, Kedarpur, Korata and Tamsi K villages are located.

Both sides of river banks having good cultivable land. Rice, Jowar, Bajra, Wheat, Tur, Mung, Urad, Gram, Pulses, Oilseeds. Groundnut, Sunflower, Soya bean, Cotton, Sugarcane is the major crops that are cultivated mostly in the area.

In this stretch river was completely dry and slate rocky with Lithic sand and bush's growth both bank of the river within the stretch small Kotar/Canal are divided by the river at the villages Karanji, Kotwa B, and Satpalli.

In this stretch Railway lines are passing along the river and crossing through Penganga River near Kodori village and nearest railway station as Pimpalkhuti. The features across the river are 02 Road Bridge, 01 Railway Bridge. In addition 05 Temples, 01 Well, 01 Pump House and 01 House found along the river.

At Chainage 187.823km Kura Road Bridge is crossing through Penganga River near Kodekotha village and at Chainage 198.884km and 198.910km Dollara Road Bridges are constructed over the Penganga River near Dollar Village connecting Dollora and Pimpalkuti village.

Figure 34 - Kura Road Bridge (187.823 km chainage)

Figure 35 - Dollara Road Bridges (198.910 km chainage)

Figure 36 - Kodari Railway line Bridge (201.841 km chainage)

Figure 37 – Temples at 201.365 km and 207.023 km chainage)

Class	Chainage (km)		Observed					Reduced w.r.t. Sounding Datum				
	From	To	Min. depth (m)	Max. depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Accumulated Qty.	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Accumulated Qty.
I	180	210	0.000	0.000	30000	1,293,241.89	9,050,520.03	-0.300	0.000	30000	1,641,837.32	11,459,661.34
II	180	210	0.000	0.000	30000	1,969,795.75	13,786,397.17	-0.300	0.000	30000	2,417,660.26	16,887,169.81
III	180	210	0.000	0.000	30000	2,977,135.92	20,828,357.20	-0.300	0.000	30000	3,532,606.23	24,673,273.89
IV	180	210	0.000	0.000	30000	3,592,317.89	25,141,360.19	-0.300	0.000	30000	4,172,724.64	29,160,873.30

Table 19 - Dredging Quantity Details

3.7.1 Observed and reduced Bed Profile of the stretch

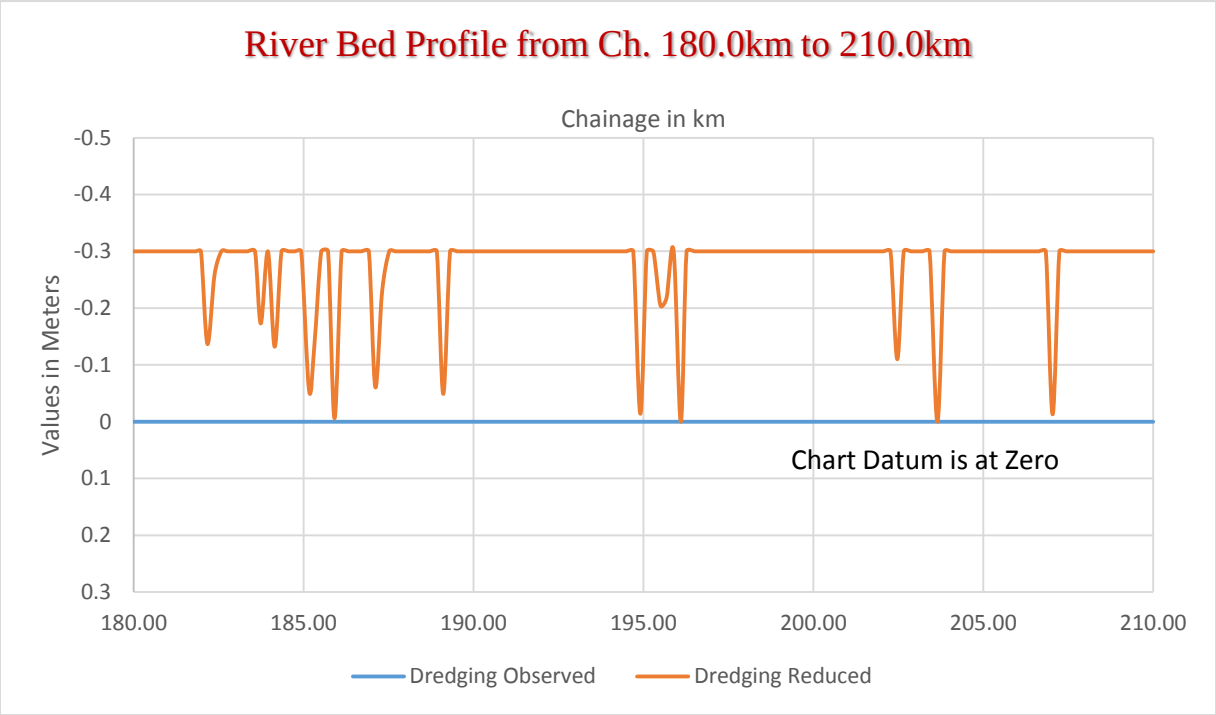


Figure 38 - River bed Profile

3.8 Sub-Stretch-8: Chanakha to Govindpur (210.0km to 240.0km)

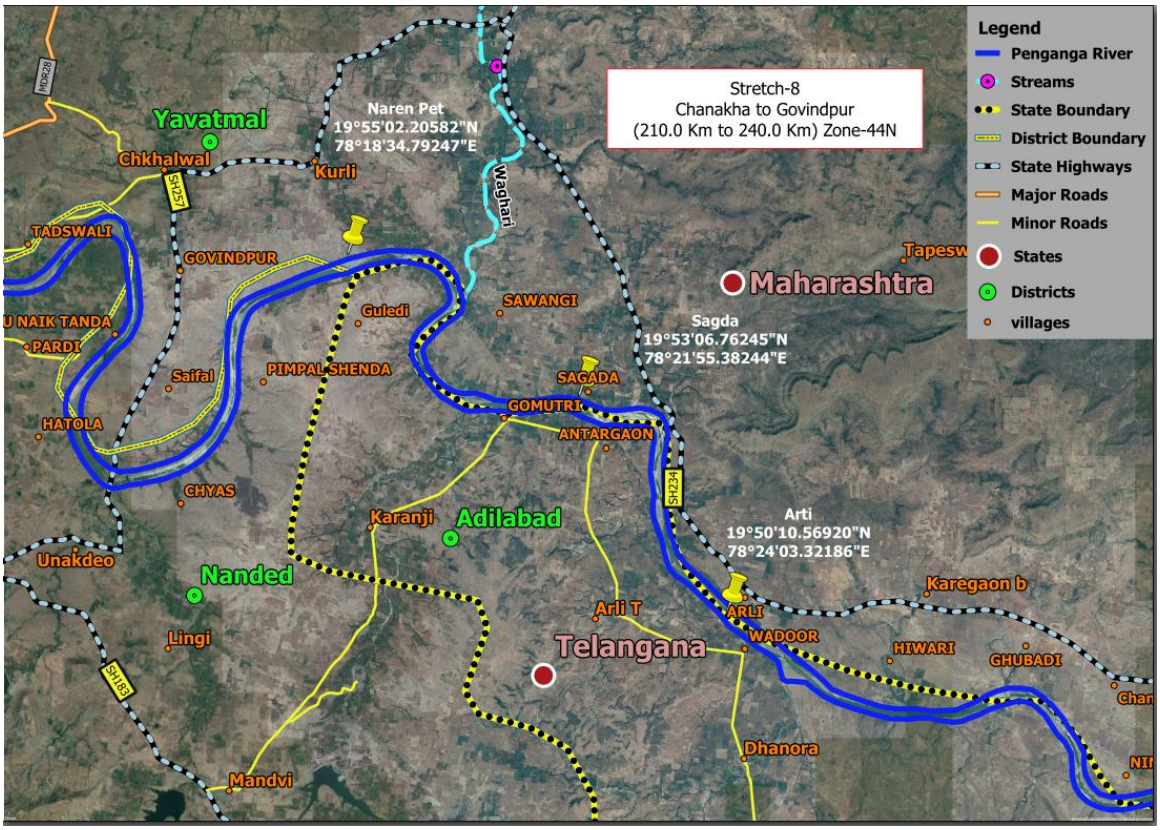


Figure 39 - Chanakha to Govindpur

- **Bathymetry Survey**
  a) No bathymetric survey is conducted due to the unavailability of water
- **Topographic Survey**
  b) 30km of the length of the stretch for which the Topographic survey has been carried out.

Stretch-8 has covered 30.00 km i.e. from 210.00 km to 240.00 km from the Chankha village to Govindpur village in Yavatmal District in Maharashtra State.

In this stretch along the right bank of the rivers Ghubadi, Hiwari, Arli, Ganeri, Sagada, Sawangi, Rajupeeth and Govindpur villages are located and left bank of the rivers Gollaghat, Dhanora, Wadoor, Antargaon, Gomurti, Guledi, and Pimpal Snenda villages are located.

Both side of river banks having good cultivable land. Rice, Jowar, Bajra, Wheat, Tur, Mung, Urad, Gram, Pulses, Oilseeds. Groundnut, Sunflower, Soyabean, Cotton, Sugarcane are the major crops that are cultivated mostly in the area.

Arli is located in Kelapur tehsil, Yavatmal district of Maharashtra. It is one of 140 villages in kelapur Block along with villages like Pimpalshenda and Hiwari. Nearby railway station of Arli is Yavatmal.

In this stretch river is completely dry and having is full of rocks scattered flow of water in small non navigable streams and the basal portion containing fine Lithic sand and bush's growth both bank of the river. There are no features along and across the river found in the stretch.

Class	Chainage (km)		Observed					Reduced w.r.t. Sounding Datum				
	From	To	Min. depth (m)	Max. depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Accumulated Qty.	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Accumulated Qty.
I	210	240	0.000	0.000	30000	1,292,720.03	10,343,240.06	-0.300	0.000	30000	1,646,018.21	13,105,679.55
II	210	240	0.000	0.000	30000	1,968,985.77	15,755,382.94	-0.300	0.000	30000	2,424,392.59	19,311,562.40
III	210	240	0.000	0.000	30000	2,975,928.14	23,804,285.34	-0.300	0.000	30000	3,542,530.79	28,215,804.68
IV	210	240	0.000	0.000	30000	3,590,860.66	28,732,220.85	-0.300	0.000	30000	4,183,111.51	33,343,984.81

Table 20 - Dredging Quantity Details

3.8.1 Observed and reduced Bed Profile of the stretch

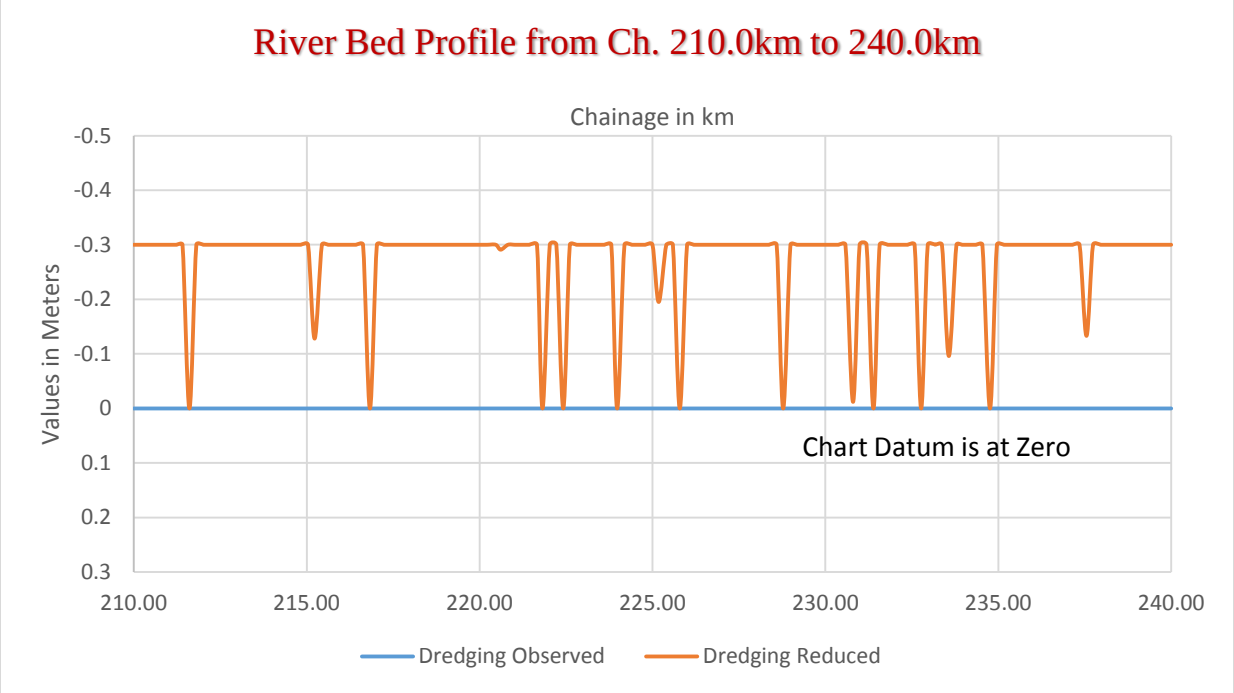


Figure 40 - River bed Profile

3.9 Sub-Stretch-9: Govindpur to Chimata (240.0km to 261.51km)

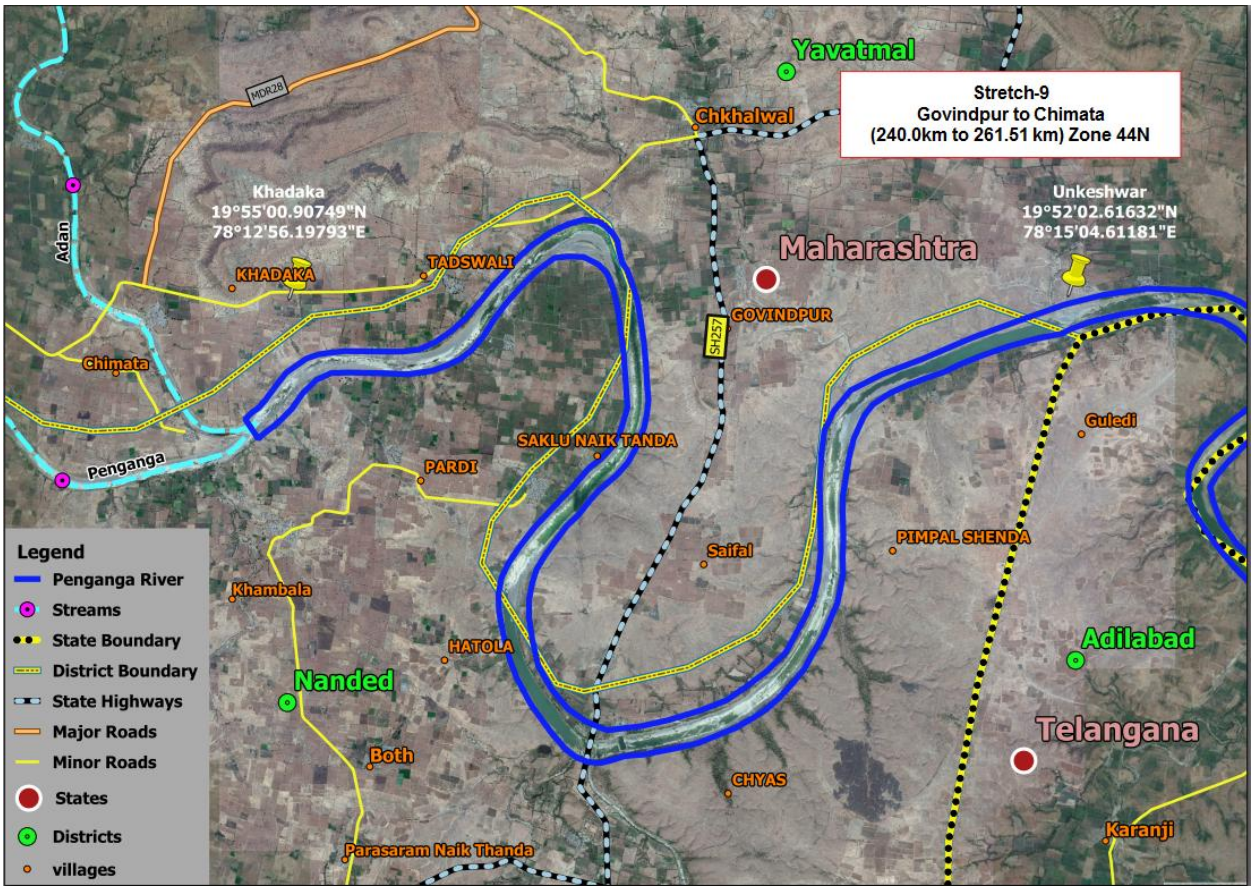


Figure 41 - Govindpur to Chimata

- **Bathymetry Survey**
  a) No bathymetric survey is conducted due to the unavailability of water
- **Topographic Survey**
  b) 21.51km of the length of the stretch for which the Topographic survey has been carried out.

Stretch-9 has covered 21.51 km i.e. from 240.0km to 261.51km from Govindpur village to Chimata village in Yavatmal District in Maharashtra State.

In this stretch along the right bank of the rivers Saifal, Tadsawali and Khadaka villages are located and left bank of the rivers Pimpal Shenda, Chayas, Unkeshwar, Hatota, Pardi and Chimata villages are located.

Both sides of river banks having cultivable land. Rice, Jowar, Bajra, Wheat, Tur, Mung, Urad, Gram, Pulses,Oilseeds. Groundnut, Sunflower, Soyabean, Cotton, Sugarcane are the major crops that are cultivated mostly in the area.

In this stretch river full of rocks scattered flow of water in small non navigable streams and the basal portion containing fine Lithic sand and bush's growth both bank of the river within the stretch there is a small Kotar/Canal is merging at Govindpur village.There are features 01 Road Bridges, 01 Under Construction Bands, 01 High Transmission Line and 01 Electric Line are crossing to the river. In addition to this 01 Temple, 02 Pump House and 01 Burial Ground/Shamshan found along the river.

At Chainage 248.753km Unkeswar Road Bridge is crossing through Penganga River near Unkeswar village.

Figure 42 - Unkeswar Road Bridge (248.753 km chainage)

Figure 43 - Shamshan (248.708 km chainage)

Class	Chainage (km)		Observed					Reduced w.r.t. Sounding Datum				
	From	To	Min. depth (m)	Max. depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Accumulated Qty.	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Accumulated Qty.
I	240	261.51	0.000	0.000	21510	913,742.70	11,256,982.76	-0.300	0.000	21510	1,160,917.21	14,266,596.76
II	240	261.51	0.000	0.000	21510	1,391,765.25	17,147,148.19	-0.300	0.000	21510	1,709,871.27	21,021,433.67
III	240	261.51	0.000	0.000	21510	2,103,521.22	25,907,806.56	-0.300	0.000	21510	2,498,752.72	30,714,557.40
IV	240	261.51	0.000	0.000	21510	2,538,188.08	31,270,408.93	-0.300	0.000	21510	2,951,266.91	36,295,251.72

Table 21 - Dredging Quantity Details

3.9.1 Observed and reduced Bed Profile of the stretch

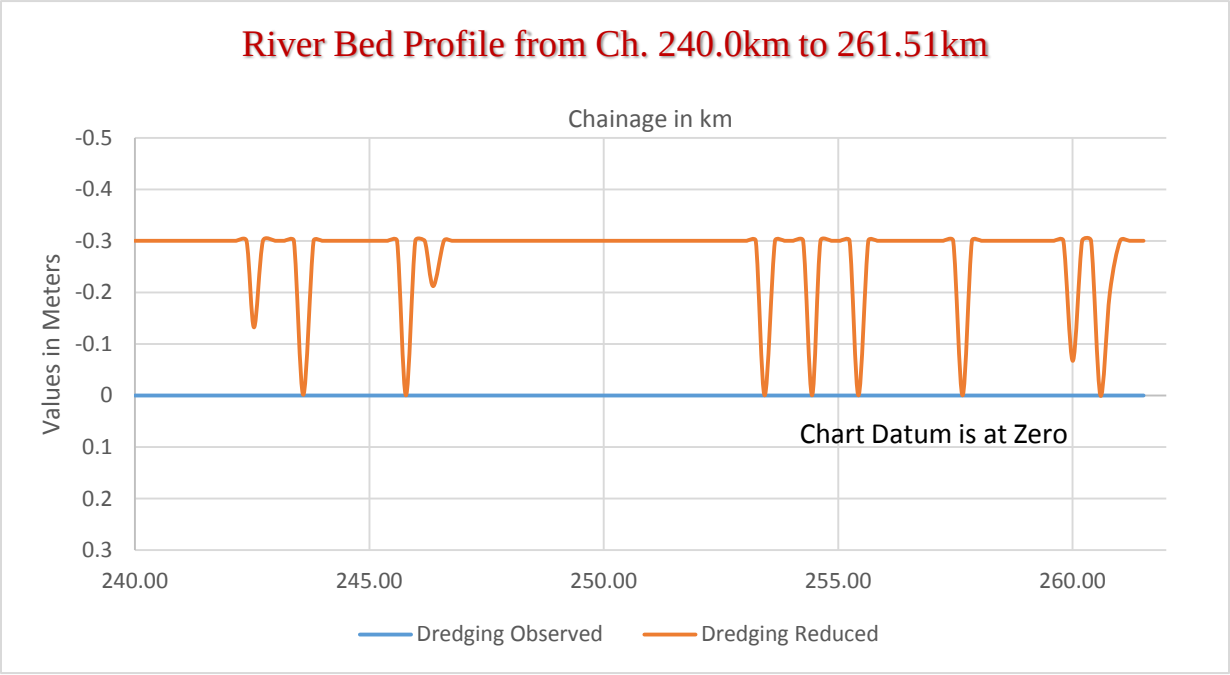


Figure 44 - River bed Profile

3.10 Other aspects of Waterway

3.10.1 Details of Irrigation Canals and outlets

No special Irrigation canals in Penganga-Wardha River survey area's stretches, but some kotars/canals are present in the Penganga-Wardha River throughout the stretches. They are utilized by farmers for irrigation through their own pump sets/ lift. The Penganga is accompanied with a Wainganga River basin at Godavari.

3.10.2 Industries

Major Industries and factory found along the Penganga-Wardha Rivers Survey Stretch is in a Balharsha/Ballarpur city in Chandrapur District.

Balharshah/Ballarpur is a city and a municipal council in Chandrapur district in the state of Maharashtra, India which is having Coal mine. Western Coalfields Limited (WCL), a subsidiary of Coal India, has many mines around Ballarpur.

Many people call this city as mini India due to large a number of people from all over India. Reason behind these much diversity in people is BILT (Ballarpur Industries Ltd) which is a famous paper industry, which created a huge employment opportunity for people from all around in its early days. However, now they have started to cut down

their employee strength. The city is also one of the largest industrial areas of the region, making it second largest city in the district & also called as wood city of India.

3.10.3 Crops

The crops cultivated in Yavatmal districts are Cotton, Jawar, Wheat, Sugarcane betel leaves, Bajra, Gram, Tur, Groundnut, orange and Sunflower.

The Chandrapur district is a Soyabean, Jawar, Tur, Moog, and gram mostly places cultivating of the state. Cotton and Soya bean are the major crops grown in the Chandrapur district.

3.10.4 Irrigation/Drinking water

The Penganga-Wardha River provides water for irrigation to the Washim and Yavatmal districts in Maharashtra. 88.0 km upstream. There are two dams being constructed on the river, namely Upper Penganga and Lower Penganga also this dam is known as 'Isapur Dam'. This dam is administered by the 'Pusad' Taluka. Nearby talukas are Kalamnuri, Pusad, Umarkhed and Hadgaon.

3.10.5 Important cities/towns

The Major town situated along the bank of Penganga-Wardha River is Balharsha. Balharsha is city it is famous for its industries Paper Mills, Coal Mining, Thermal Plants etc.

3.10.6 Road Network

3.10.6.1 National Highway

One National Highway NH-44 is passing through the Penganga-Wardha River at Dollara village to Pimpalkhuti village in Chandrapur district.

3.10.6.2 State Highway

Two State Highways are crossing through Penganga-Wardha River at Ghandhinagar to Bori village SH-236 in Chandrapur District and other State Highway 264 passing at Dudholi to Bamni village in Chandrapur district.

3.10.6.3 Major District Roads

Chandrapur and Yavatmal districts had a good road network. The major district road route numbers are MSH 41.

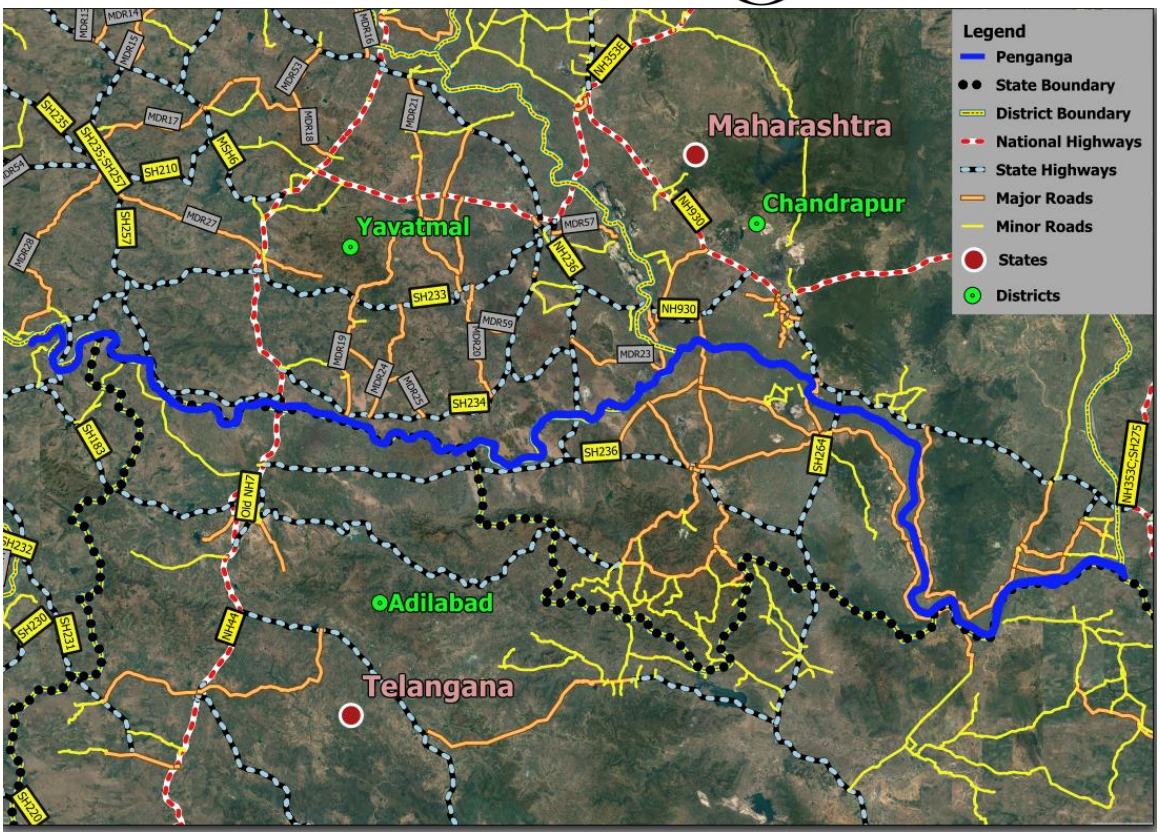


Figure 45 - Road Network

3.10.7 Railway Network

The railway line follows the river parallel along the left bank from Makudi Railway station till Manikgarh railway station. It crosses the river from Manikgarh Railway station to Balharsha Railway Station. It is parallel along the right bank from Balharsha Railway station to Visapur Railway Station leaving the river. It follows the river parallel along from Kayar Railway station to Pimpalkhuti Railway station, it crosses the river from the Pimpalkhuti Railway station to Adilabad Railway station.

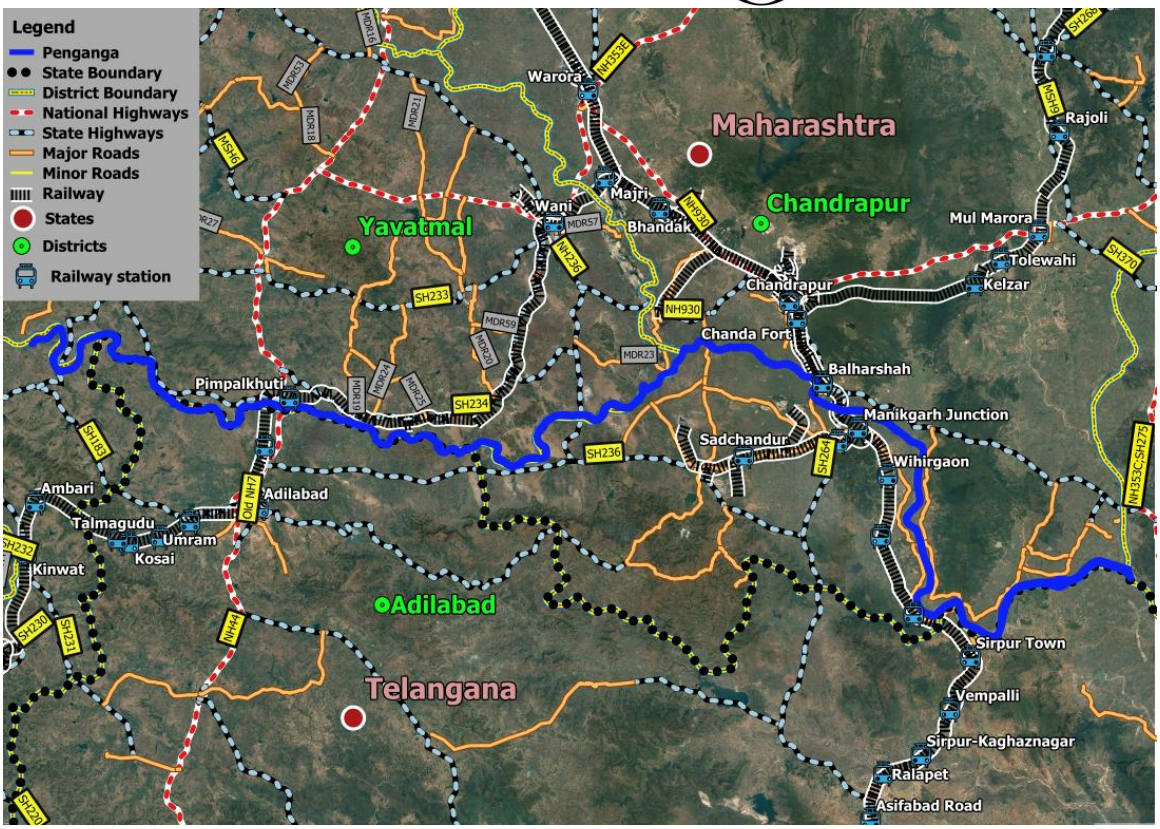


Figure 46 - Railway Stations

3.10.8 Land Use

In Chandrapur and Yavatmal District the land use is divided into Forest area, Cultivation area and Net area Shown.

In Chandrapur the land info as follows:

- Inhabited area 880 Sq. Kms.
- Agricultural area 4870 Sq. Kms.
- Industrial area 32.34 Sq. Kms.
- Forest cover 3810 Sq. Kms
- Waste Land 550 Sq. Kms.
- Drought Prone area 2890 Sq. Kms

In Yavatmal District the land use is as follows:

- Geographical Area 1351900
- Area Under Forest 25430
- Barren and uncultrable land 39400

- Land put to non-agri uses 41600
- Culturable waste 25400
- Permanent pastures and other grazing 60800
- Land under Miscellaneous tree crop 60800
- Current follows 299900
- Other fallows 28700
- Net are sworn 857900
- Area sown more than once 79000
- Gross cropped area 936900

3.10.9 Construction Material

The area being near to Balharsha city, all types of modern construction materials like cement, Iron etc. are available in bulk quantity. Balharsha city having number of coal mines and it is the city also known as wood city.

3.10.10 Condition of Banks

Bank is unprotected along the River.

3.10.11 Jetties and Terminals

Lack of the jetties and Terminals along the River.

3.10.12 Cargo Movement

Lack of the cargo movements along the River.

3.10.13 Passenger Ferry Services

Passenger ferry services are not available in the survey stretch of the Penganga-Wardha River.

3.10.14 Historic importance

Mahakali Mandir in Chandrapur is an icon for Chandrapur. It is symbolic to Chandrapur City and it has a prominent place in the heart of the people of Chandrapur. Devotes visit Mahakali Mandir every day, but Tuesdays are special days to visit Mahakali Mandir. There is a small Ganesha temple and Hannuman temple inside the Mahakali Mandir premises. There are two entrances to the temple. The rear entrance has Ganesh and Hanuman temple. Both the entrances have small shops for puja supplies like coconut, flowers and cloth.

There are two idols (Murthys) in the Mahakali Mandir. One standing Murthy is the main idol decorated with red, yellow and orange color cloths. The main idol also associated

with Shiv Ling. The second Murthy is reclining position. The second idol is actually below the ground level and to reach there, devotes need to walk in kind of a tunnel.

Inside the temple the priest will be always there to assist you with Puja and offerings. Every year there is a fair during the month of April, during that period all devotees from different parts of state visit the Mahankali Mandir. Now there is a trust formed to take care of temple administration. There were lots of improvements to the amenities of the temple in the last decade. Temple authority has made Dharmashalas for devotees to help them stay near the temple for free who travels from distant places of the Chandrapur district.

The annual fair that used to happen in the month of April used to be a big festival for the devotees of Mahakali and also for Chandrapur people. There used to be lots of activities and events for all the ages and used to be a time for joy and fun for all the people. There used to be shops selling kitchen gadgets, toys, bangles, imitation jewelry and clothes. Entertainers used to come from different parts of Chandrapur district and various parts of Maharashtra state to show entertain the people and show their skills. There used to be small magic shows and circus. The kids used to wait for all the year for this event and which makes it a memorable festival for the family and kids.

Figure 47 - Mahakali Temple, Chandrapur (105.0 km change)

3.10.15 Tourism

Chandrapur District of Maharashtra is situated between Wainganga and Wardha river basins. It is situated on the banks of the Irai River. It is also known as the City of Black Gold because it has numerous coal mines. It draws a fair number of tourists from all over the country due to its closeness to the wildlife park and many ancient temples. Half a dozen rivers flowing through the town has been the strength of its economy. More than

ten dams have been constructed in and around Chandrapur in the past few decades to meet its irrigation and power needs. The temples and forts are the major tourist attractions of Chandrapur. The town is an important camping ground as well for those interested in wildlife expeditions in the neighboring Tiger Park.

Mahakali Temple-Mahakali Temple is one of the famous temples in Chandrapur, and can be called the representation of the city. There are two main entrances to the temple, a back entrance featuring a Ganesh temple and a Shani temple, which is a common place of worship on Saturdays, and the front entrance featuring Lord Hanuman.

Gond Raja Fort-This Fort was built by the Gond kings between the late 15th century and early 16th century. The main purpose of constructing this fort was to protect the king and the army from enemy attacks. The construction of this fort was started by Babji Ballal Sah, after his death in 1597; the work was carried further by Dhundya Ram Sah. Although the construction was completed by Dhundya Ram Sah, the building originated under Khandkya Ballal Sah (1470-1495). The fort measures around 15 to 20ft of height, and covers a massive area of around 7.5 miles.

Anandvan Ashram-This ashram is located in the town of Warora, which is just a few kilometers from Chandrapur city. It is basically an ashram; this center mostly serves as a community rehabilitation center for patients suffering from leprosy. It also serves the disabled, from downtrodden sections of society.

Ancient Caves-The Ancient Caves are located very close to the city of Chandrapur. These caves were constructed during the 8th century; these caves house about nine smaller caves that were engraved for Buddhist monks. These were basically used by the monks for meditation and thus feature a large number of carved Buddhist sculptures.

Jugad Temple- Jugad Temple is a Lord Shiva temple at Wani where the river alliance as an island. Every year at Gurupornima thousands of devotees are coming for worship. Jugad is a small Village/hamlet in Wani Taluka in Yavatmal District of Maharashtra State, India. It comes under Jugad Panchayath. It belongs to Vidarbha region and Amravati Division. It is located 110 KM towards East from District headquarters Yavatmal. Jugad is surrounded by Maregaon Taluka towards west, Bhadrawati Taluka towards East, Warora Taluka toward North, and Zari Jamni Taluka towards west. Wani, Warora, Durgapur, Chandrapur are the nearby Cities. This Place is in the border of the Yavatmal District and Chandrapur District. Chandrapur District Bhadrawati is east towards this place.

4 Terminals

4.1 Details of Terminal survey carried out

In this River stretch could not find any adequate proposed terminal, due to the unavailability of water in this stretch.

5 Fairway Development

5.1 Fairway Dimensions

As per the specification of the survey, dredging quantity was required to be estimated for a channel dimension of 50m x 2m with Side slope of 1:5, along with the deepest route.

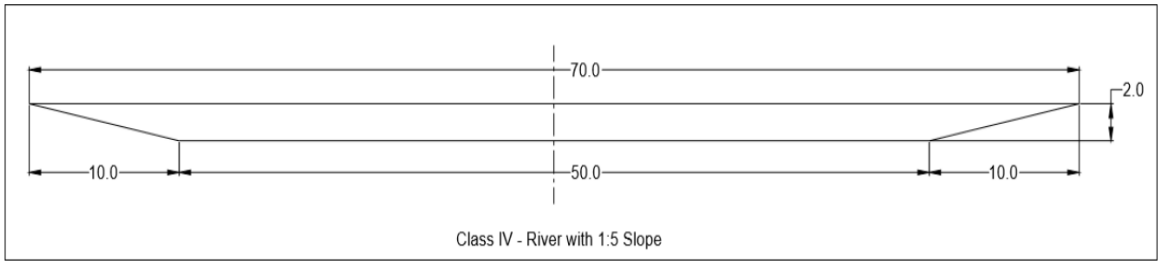
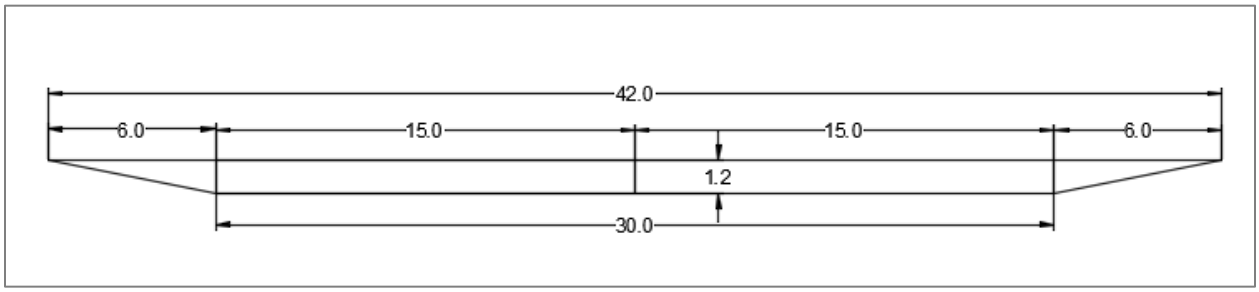


Figure 48 - Fairway Channel Dimensions 50m X 2m

5.2 Calculation of Dredging Quantity

The dredge volume calculations were accomplished using the HYPACK dredge volume computation utility. The channel template was created as per the different classification and kilometer wise dredging calculation was carried out. (Enclosed at Annexure-3) The Hypack Standard volume algorithm was used to calculate the dredge volume in each segment. The stretch wise summary of the dredge volume for different class of fairway is as follows:-

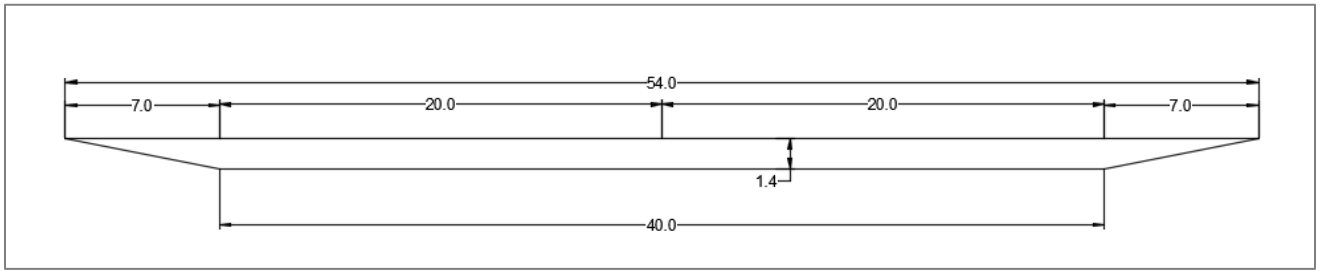
Class I



Class I														
Location		Chainage (km)		Observed					Reduced w.r.t. Sounding Datum					
From	To	From	To	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Accumulated Qty.	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Accumulated Qty.	
Ranavlli	Polsa	0	30	0.000	0.000	30000	1,293,263.76	1,293,263.76	-0.300	0.000	30000	1,646,305.27	1,646,305.27	
Polsa	Pachgaon	30	60	0.000	0.000	30000	1,293,530.73	2,586,794.49	-0.300	0.000	30000	1,630,213.13	3,276,518.40	
Pachgaon	Balharshah	60	90	0.000	0.000	30000	1,294,378.21	3,881,172.70	-0.300	0.000	30000	1,645,183.46	4,921,701.86	
Balharshah	Virur Gadegaon	90	120	0.000	0.000	30000	1,292,884.81	5,174,057.51	-0.300	0.000	30000	1,634,048.81	6,555,750.67	
Virur Gadegaon	Wedad	120	150	0.000	0.000	30000	1,291,906.02	6,465,963.53	-0.300	0.000	30000	1,625,775.28	8,181,525.95	
Wedad	Durba	150	180	0.000	0.000	30000	1,291,314.61	7,757,278.14	-0.300	0.000	30000	1,636,298.07	9,817,824.02	
Durba	Chanakha	180	210	0.000	0.000	30000	1,293,241.89	9,050,520.03	-0.300	0.000	30000	1,641,837.32	11,459,661.34	
Chanakha	Govindpur	210	240	0.000	0.000	30000	1,292,720.03	10,343,240.06	-0.300	0.000	30000	1,646,018.21	13,105,679.55	
Govindpur	Chimata	240	261.51	0.000	0.000	21510	913,742.70	11,256,982.76	-0.300	0.000	21510	1,160,917.21	14,266,596.76	
Total						**261510**	**11,256,982.76**	**11,256,982.76**	**Total**		**261510**	**14,266,596.76**	**14,266,596.76**	

Table 22 - Dredge Volumes-Class I

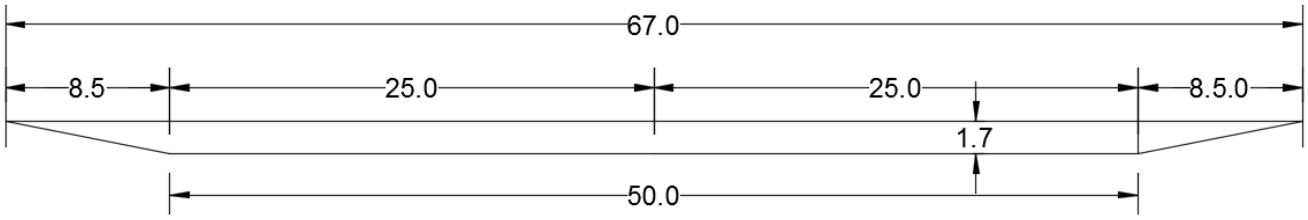
Class II



Class II														
Location		Chainage (km)		Observed					Reduced w.r.t. Sounding Datum					
From	To	From	To	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Accumulated Qty.	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Accumulated Qty.	
Ranvalli	Polsa	0	30	0.000	0.000	30000	1,971,004.19	1,971,004.19	-0.300	0.000	30000	2,427,565.06	2,427,565.06	
Polsa	Pachgaon	30	60	0.000	0.000	30000	1,970,242.15	3,941,246.34	-0.300	0.000	30000	2,401,874.98	4,829,440.04	
Pachgaon	Balharshah	60	90	0.000	0.000	30000	1,971,529.38	5,912,775.72	-0.300	0.000	30000	2,423,125.49	7,252,565.53	
Balharshah	Virur Gadegaon	90	120	0.000	0.000	30000	1,969,244.02	7,882,019.74	-0.300	0.000	30000	2,408,308.28	9,660,873.81	
Virur Gadegaon	Wedad	120	150	0.000	0.000	30000	1,967,729.94	9,849,749.68	-0.300	0.000	30000	2,397,546.12	12,058,419.93	
Wedad	Durba	150	180	0.000	0.000	30000	1,966,851.74	11,816,601.42	-0.300	0.000	30000	2,411,089.62	14,469,509.55	
Durba	Chanakha	180	210	0.000	0.000	30000	1,969,795.75	13,786,397.17	-0.300	0.000	30000	2,417,660.26	16,887,169.81	
Chanakha	Govindpur	210	240	0.000	0.000	30000	1,968,985.77	15,755,382.94	-0.300	0.000	30000	2,424,392.59	19,311,562.40	
Govindpur	Chimata	240	261.51	0.000	0.000	21510	1,391,765.25	17,147,148.19	-0.300	0.000	21510	1,709,871.27	21,021,433.67	
Total						**261510**	**17,147,148.19**	**17,147,148.19**	**Total**		**261510**	**21,021,433.67**	**21,021,433.67**	

Table 23 - Dredge Volumes-Class II

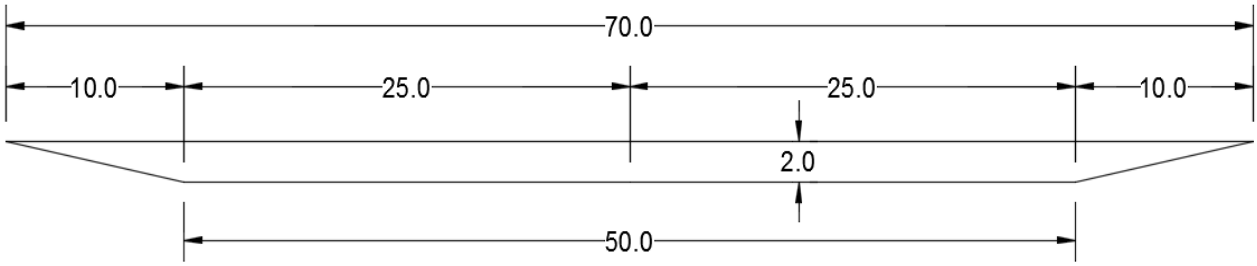
Class III



Class III													
Location		Chainage (km)		Observed					Reduced w.r.t. Sounding Datum				
From	To	From	To	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Accumulated Qty.	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Accumulated Qty.
Ranvalli	Polsa	0	30	0.000	0.000	30000	2,970,638.39	2,970,638.39	-0.300	0.000	30000	3,532,924.96	3,532,924.96
Polsa	Pachgaon	30	60	0.000	0.000	30000	2,977,811.01	5,948,449.40	-0.300	0.000	30000	3,511,855.80	7,044,780.76
Pachgaon	Balharshah	60	90	0.000	0.000	30000	2,979,769.81	8,928,219.21	-0.300	0.000	30000	3,540,653.56	10,585,434.32
Balharshah	Virur Gadegaon	90	120	0.000	0.000	30000	2,976,321.55	11,904,540.76	-0.300	0.000	30000	3,521,503.37	14,106,937.69
Virur Gadegaon	Wedad	120	150	0.000	0.000	30000	2,973,989.96	14,878,530.72	-0.300	0.000	30000	3,508,297.17	17,615,234.86
Wedad	Durba	150	180	0.000	0.000	30000	2,972,690.56	17,851,221.28	-0.300	0.000	30000	3,525,432.80	21,140,667.66
Durba	Chanakha	180	210	0.000	0.000	30000	2,977,135.92	20,828,357.20	-0.300	0.000	30000	3,532,606.23	24,673,273.89
Chanakha	Govindpur	210	240	0.000	0.000	30000	2,975,928.14	23,804,285.34	-0.300	0.000	30000	3,542,530.79	28,215,804.68
Govindpur	Chimata	240	261.51	0.000	0.000	21510	2,103,521.22	25,907,806.56	-0.300	0.000	21510	2,498,752.72	30,714,557.40
Total						**261510**	**25,907,806.56**	**25,907,806.56**	**Total**		**261510**	**30,714,557.40**	**30,714,557.40**

Table 24 - Dredge Volumes-Class III

Class IV



Class IV														
Location		Chainage (km)		Observed					Reduced w.r.t. Sounding Datum					
From	To	From	To	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Accumulated Qty.	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Accumulated Qty.	
Ranvalli	Polsa	0	30	0.000	0.000	30000	3,593,604.13	3,593,604.13	-0.300	0.000	30000	4,182,706.58	4,182,706.58	
Polsa	Pachgaon	30	60	0.000	0.000	30000	3,593,127.95	7,186,732.08	-0.300	0.000	30000	4,150,950.46	8,333,657.04	
Pachgaon	Balharshah	60	90	0.000	0.000	30000	3,595,503.14	10,782,235.22	-0.300	0.000	30000	4,181,571.00	12,515,228.04	
Balharshah	Virur Gadegaon	90	120	0.000	0.000	30000	3,591,341.38	14,373,576.60	-0.300	0.000	30000	4,161,036.29	16,676,264.33	
Virur Gadegaon	Wedad	120	150	0.000	0.000	30000	3,588,506.89	17,962,083.49	-0.300	0.000	30000	4,147,007.53	20,823,271.86	
Wedad	Durba	150	180	0.000	0.000	30000	3,586,958.81	21,549,042.30	-0.300	0.000	30000	4,164,876.80	24,988,148.66	
Durba	Chanakha	180	210	0.000	0.000	30000	3,592,317.89	25,141,360.19	-0.300	0.000	30000	4,172,724.64	29,160,873.30	
Chanakha	Govindpur	210	240	0.000	0.000	30000	3,590,860.66	28,732,220.85	-0.300	0.000	30000	4,183,111.51	33,343,984.81	
Govindpur	Chimata	240	261.51	0.000	0.000	21510	2,538,188.08	31,270,408.93	-0.300	0.000	21510	2,951,266.91	36,295,251.72	
					Total	261510	31,270,408.93	31,270,408.93		Total	261510	36,295,251.72	36,295,251.72	

Table 25 - Dredge Volumes-Class IV

6 Conclusion

The aim is to undertake bathymetric survey, topographic survey, collection of data on cargo movement, industry survey, tourism facilities etc., in the project area; preparation of detailed hydrographic survey charts, topographic survey charts, and feasibility report.

6.1 Description of Waterways

The surveyed stretch of the Penganga-Wardha River is 261.51km in length and is not being explored for any navigational possibility. This survey stretch starts from the confluence of Wardha and Pranhita River near the Ranvalli village to Chimata village. The stretch wise minimum and maximum width range, average width and average slope of the waterway are as below:-

Sl. No.	Location		Chainage (km)		Width Range of the waterway		Average Width	Average slope (in m/km)
	From	To	From	To	Min	Max		
1	Ranavalli	Polsa	0	30	287.79	1859.00	1073.40	1 : 0.385
2	Polsa	Pachgaon	30	60	242.33	457.13	349.73	1 : 0.097
3	Pachgaon	Balharshah	60	90	196.69	510.33	353.51	1 : 0.180
4	Balharshah	Virur Gadegaon	90	120	207.49	599.49	403.49	1 : 0.333
5	Virur Gadegaon	Wedad	120	150	231.35	730.89	481.12	1 : 0.596
6	Wedad	Durba	150	180	205.21	707.61	456.41	1 : 0.302
7	Durba	Chanakha	180	210	233.89	600.12	417.00	1 : 0.501
8	Chanakha	Govindpur	210	240	179.09	632.29	405.69	1 : 0.316
9	Govindpur	Chimata	240	261.51	234.55	600.21	417.38	1 : 0.675

Table 26 - Stretch wise Average width and slope of waterway

6.2 Methods for making waterway feasible

The waterway may be developed as a Class IV navigational River by carrying out dredging to achieve the navigability. The class-wise details of reduced dredging quantities of the waterways are as tabulated below:-

Reduced w.r.t. CD Dredging Values				
Class	**I**	**II**	**III**	**IV**
0 – 30 (km)	1,646,305.27	2,427,565.06	3,532,924.96	4,182,706.58
30 – 60 (km)	1,630,213.13	2,401,874.98	3,511,855.80	4,150,950.46
60 – 90 (km)	1,645,183.46	2,423,125.49	3,540,653.56	4,181,571.00
90 – 120 (km)	1,634,048.81	2,408,308.28	3,521,503.37	4,161,036.29
120 – 150 (km)	1,625,775.28	2,397,546.12	3,508,297.17	4,147,007.53
150 – 180 (km)	1,636,298.07	2,411,089.62	3,525,432.80	4,164,876.80
180 – 210 (km)	1,641,837.32	2,417,660.26	3,532,606.23	4,172,724.64
210 – 240 (km)	1,646,018.21	2,424,392.59	3,542,530.79	4,183,111.51
240 - 261.51 (km)	1,160,917.21	1,709,871.27	2,498,752.72	2,951,266.91
Total	**14,266,596.76**	**21,021,433.67**	**30,714,557.40**	**36,295,251.72**

Table 27 - Class-wise Reduced Dredging quantity

Due to the continuous gradient of the river and the water level will not be available during the summer season the navigation aspect will not be fulfilled throughout the year. The Barrage/Navigational lock is required to maintain the minimum depth required for navigation and regulate the water level in the river. The class-wise details of reduced depth at different stretches of the waterways are as tabulated below:-

Sl. No.	**Chainage (km)**		**< 1.2**		**1.2 - 1.4**		**1.5 - 1.7**		**1.8 - 2.0**		**> 2.0**	
	From	**To**	**Availability of Depth (km)**	**% of availability**	**Availability of Depth (km)**	**% of availability**	**Availability of Depth (km)**	**% of availability**	**Availability of Depth (km)**	**% of availability**	**Availability of Depth (km)**	**% of availability**
1	0	30	30	100%	0	0 %	0	0 %	0	0 %	0	0 %
2	30	60	30	100%	0	0 %	0	0 %	0	0 %	0	0 %
3	60	90	30	100%	0	0 %	0	0 %	0	0 %	0	0 %
4	90	120	30	100%	0	0 %	0	0 %	0	0 %	0	0 %
5	120	150	30	100%	0	0 %	0	0 %	0	0 %	0	0 %
6	150	180	30	100%	0	0 %	0	0 %	0	0 %	0	0 %
7	180	210	30	100%	0	0 %	0	0 %	0	0 %	0	0 %
8	210	240	30	100%	0	0 %	0	0 %	0	0 %	0	0 %
9	240	261.51	21.51	100%	0	0 %	0	0 %	0	0 %	0	0 %
Total			**261.51**	**100%**	**0**	**0 %**	**0**	**0 %**	**0**	**0 %**	**0**	**0 %**

Table 28 - Class-wise availability of reduced depth of the waterway

6.3 Modifications/ improvement measures

Improvement measures for design and depth improvement are required for the first phase of the development. River banks being not prominent and no signs of erosion of River banks are found in the entire stretch of the Penganga-Wardha River. The limitation for improvement of navigational aspects includes the gradient of the River, non-availability of the water throughout the period. The class-wise modification details of cross structure and high tension line clearance are as tabulated below:-

Bridges Clearances less than Class			High Tension lines Clearances less than Class	
Class	**Horizontal**	**Vertical**	**Horizontal**	**Vertical**
I	8	1	0	06
II	13	2		
III	16	7		
IV	16	10		

Table 29 - Bridges and HTL Clearances less than Class no.

6.4 Recommendation

There is no major scope for a navigational aspect of the waterway due to its geographic condition and non-availability of water throughout the region. The River banks are well connected with the road network and major distribution of settlements is there near to Chandrapur and Yavatmal Cities. There is only one major industry that is Paper mill Industry present in the area near Balharshah. The road is a near parallel on both sides throughout the River stretch. No scope for the future development of the River was recommended for navigational purpose and the survey Stretch is not-viable for developing as navigable channel.

The purpose of the survey was for assessing the River stretch from the Ranvalli village to Chimata village for the development of water transport facilities in the new National Waterway (NW-67). All conspicuous objects within and in the vicinity of the survey area have been fixed. The deliverable sheets contain mean sea level values of elevation information, important landmarks with the state of the River banks. The survey is considered complete in all respects.

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