IIC TECHNOLOGIES™

Feasibility Report National Waterway-107, Region VI - Vaigai River Viragnoor Dam to Anai Patti (45.6km)

SURVEY PERIOD: 12 FEB 2016 TO 08 MAR 2016

Volume - I

Prepared for:

Inland Waterways Authority of India
(Ministry of Shipping, Govt. of India)
A-13, Sector – 1, NOIDA
Distt. Gautam Budh Nagar,
Uttar Pradesh – 201 301

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ACKNOWLEDGEMENT

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-107 in Region VI – Vaigai River from Viragnoor Dam to Anai Patti.

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**.**

IIC Technologies Ltd, wishes to express their gratitude to **Capt. Ashish Arya, Hydrographic Chief IWAI, Cdr. P.K. Srivastava ex-Hydrographic Chief and Shri SVK Reddy, Chief Engineer-I** for their guidance and inspiration for this project. IIC Technologies Ltd, would also like to thank **Sh. Rajiv Singhal, A.H.S., IWAI** for his invaluable support and suggestions provided throughout the survey period. IIC Technologies Ltd, is pleased to place on records its sincere thanks to other staff and officers of IWAI for their excellent support and cooperation throughout the survey period.

CONTENTS

List of Abbreviations

CD	Chart Datum
SD	Sounding Datum
DGPS	Differential Global Positioning Systems
ETS	Electronic Total Station
VAG	Vaigai
GPS	Global Positioning Systems
LBM	Local Bench Mark
MSL	Mean Sea Level
RL	Reference Level
SD	Sounding Datum
SBAS	Satellite-Based Augmentation System
TBC	Trimble Business Center

SALIENT FEATURES AT A GLANCE

<table>
<tr><th>Sl. No.</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 – VI, Tamilnadu State</td></tr>
<tr><td>3.</td><td>Waterway stretch, NW #
(from…. to; total length)</td><td>National Waterway No – 107
Anai Patti to Viragnoor Dam (45.6 km)</td></tr>
<tr><td>4.</td><td>Navigability Status</td><td>At present non navigable</td></tr>
<tr><td>a)</td><td>Tidal & non tidal portions (from… to, length, average tidal variation)</td><td>The survey Stretch of Vaigai River is non-tidal.</td></tr>
<tr><td>b)</td><td>LAD status (w.r.t. CD)
i) Survey period (12 Feb to 08 Mar, 2016.)
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>
<table>
<tr><th>LAD (m)</th><th>0-17.8</th><th>17.8-22.3</th><th>22.3-31.8</th><th>31.8-45.6</th><th>Total</th></tr>
<tr><td>< 1.2</td><td>17.8</td><td>4.5</td><td>9.5</td><td>13.8</td><td>45.6</td></tr>
<tr><td>1.2 - 1.4</td><td>0.0</td><td>0.0</td><td>0.0</td><td>0.0</td><td>0.0</td></tr>
<tr><td>1.5 - 1.7</td><td>0.0</td><td>0.0</td><td>0.0</td><td>0.0</td><td>0.0</td></tr>
<tr><td>1.8 - 2.0</td><td>0.0</td><td>0.0</td><td>0.0</td><td>0.0</td><td>0.0</td></tr>
<tr><td>> 2</td><td>0.0</td><td>0.0</td><td>0.0</td><td>0.0</td><td>0.0</td></tr>
<tr><td>Total</td><td>17.8</td><td>4.5</td><td>9.5</td><td>13.8</td><td>45.6</td></tr>
</table>
Vaigai River is dry and the survey was conducted by topographic method.</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>i) Dams etc. – 6 Nos.
ii) Bridges – 16 Nos
Horizontal Clearance – 5.657m – 23.813m
Vertical Clearance – 1.353 – 18.06m w.r.t. HFL
iii) High Tension Lines – 4 Nos
Vertical Clearance – 37m - 43m w.r.t. HFL</td></tr>
<tr><td>d)</td><td>Avg. discharge & no. of days</td><td>Discharge Data not available from Authorities.</td></tr>
<tr><td>e)</td><td>Slope (1 in ….)</td><td>Average Slope 1 : 7
<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>17.8</td><td>1 : 0.943</td></tr>
<tr><td>17.8</td><td>22.3</td><td>1 : 1.991</td></tr>
<tr><td>22.3</td><td>31.8</td><td>1 : 1.66</td></tr>
<tr><td>31.8</td><td>45.6</td><td>1 : 1.495</td></tr>
</table></td></tr>
</table>

Sl. No.	Particulars	Details
5.	Traffic potential	No Navigational traffic is present in the survey stretch of Vaigai River.
a)	Present IWT operations, ferry services, tourism, cargo, if any	No local boats or ferry services.
b)	Important industries within 50 km	No Large scale industries exist near to the survey area. Some small scale industries and cement factories are situated on the RBS of Vaigai River near to Madurai city. The LBS of Vaigai River near Madurai city is used mainly for residential purpose.
c)	Distance of Rail & Road from Industry	Both sides of Vaigai River is well connected with road network and frequent state transport buses runs from Madurai City to different areas. Local Taxis and Autos are also available along the entire River stretch. The details of National Highway present in the project influence area are NH-44, NH-85 and NH-38 which connects Madurai City. The state Highways SH-72A, SH-72 and SH-33 also connects Madurai city.
6.	Consultant's recommendation for going ahead with TEF / DPR preparation	Due to 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 navigational lock is required to maintain the minimum depth required for navigation and regulate the water level in the river. The waterway may be developed as a Class II navigational canal by carrying out capital dredging to achieve the navigability.
7.	Any other information/ comment	Nil

(Signature)

Date: Name of Consultant

1 Introduction

1.1 Background

The Vaigai River is the major river originated in the Periyar Plateau of the Western Ghats flows generally southeast, rising in the Varushanad Hills of western Tamil Nadu, it initially flows northeast through the Kambam and Varushanad valleys. In survey stretch, the Vaigai River flows south East near to Madurai City on its course to its mouth on Palk Strait. The Vaigai River usually dries on the summer season. To assess the feasibility of water transportation over this stretch of river a bathymetric survey and topographic survey was carried out by IIC Technologies Ltd. on behalf of IWAI.

1.2 Tributaries of Vaigai River

The main tributaries of the river Vaigai are the river Suruliyaru, the river Mullaiyaaru, the river Varaganadi and the river Manjalaru. All these rivers join with the great Vaigai River nearer to the places around the Vaigai Dam situated in Theni district. Vaigai gets major feed from the Periyar Dam in Kumuli, Kerala. In summers, the Vaigai River ends up dry very often. All the tributaries and canal are far away from the project influence area. Periyar main canal and Mullai Periyar Channel are near to the project influence area.

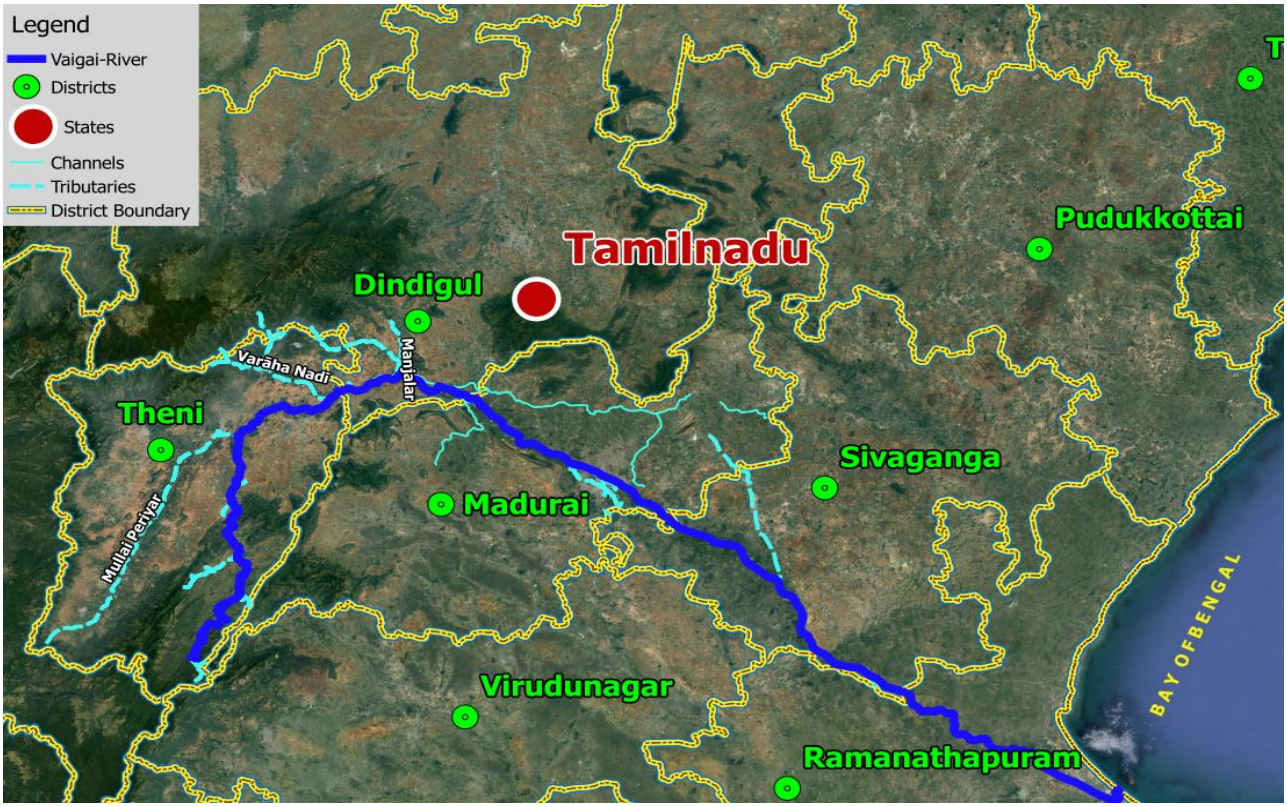


Figure 1 - Vaigai River Tributaries

1.3 State/District through which River passes

The Survey stretch of Vaigai River flows through the Madurai administrative district of Tamil Nadu.

States	Chainage (km)		Length in km
	From	To	
Tamilnadu	0.00	45.6	45.6

Table 1 - State wise waterway

1.4 Map

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:

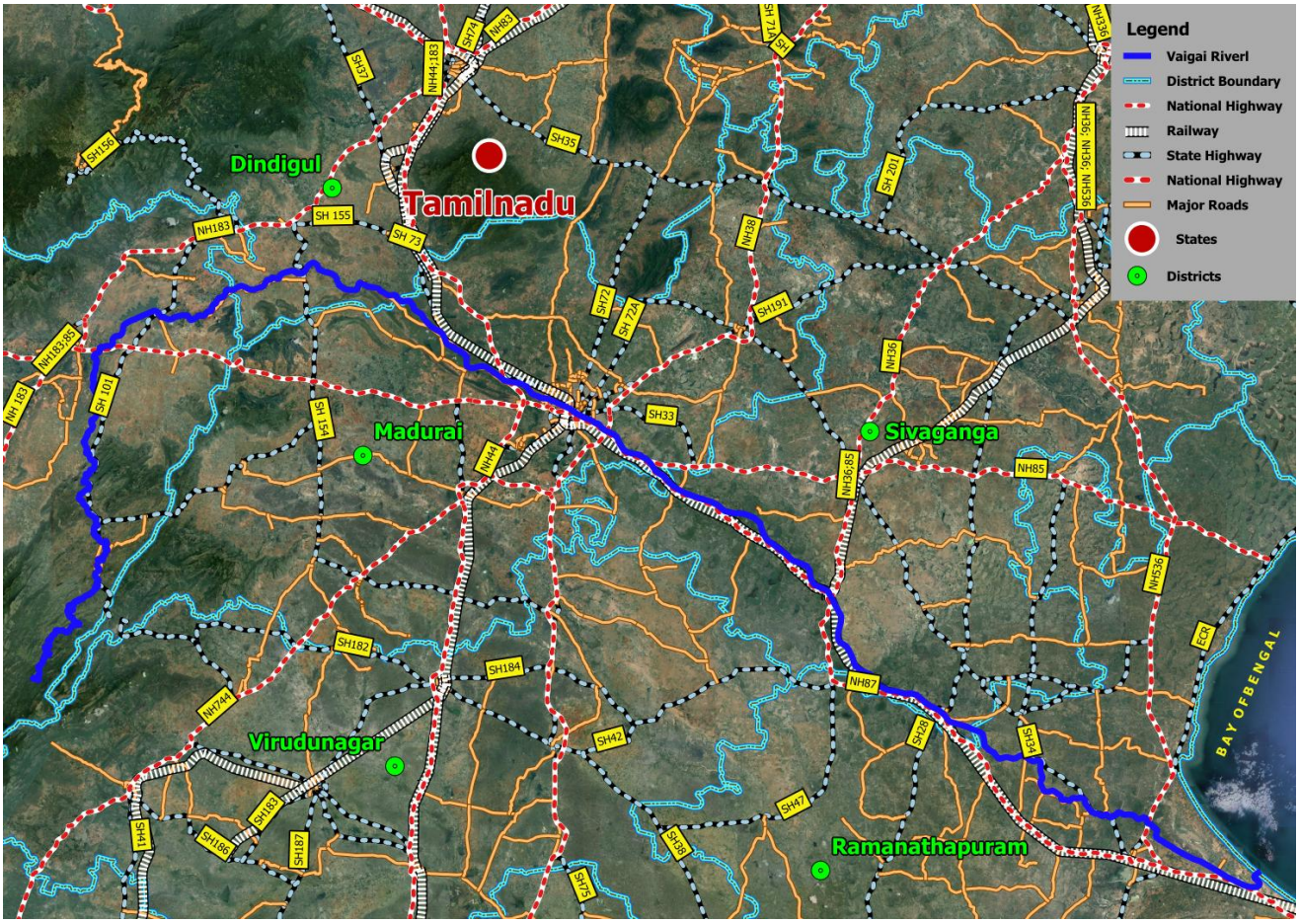


Figure 2 - Full Course of Vaigai River

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:

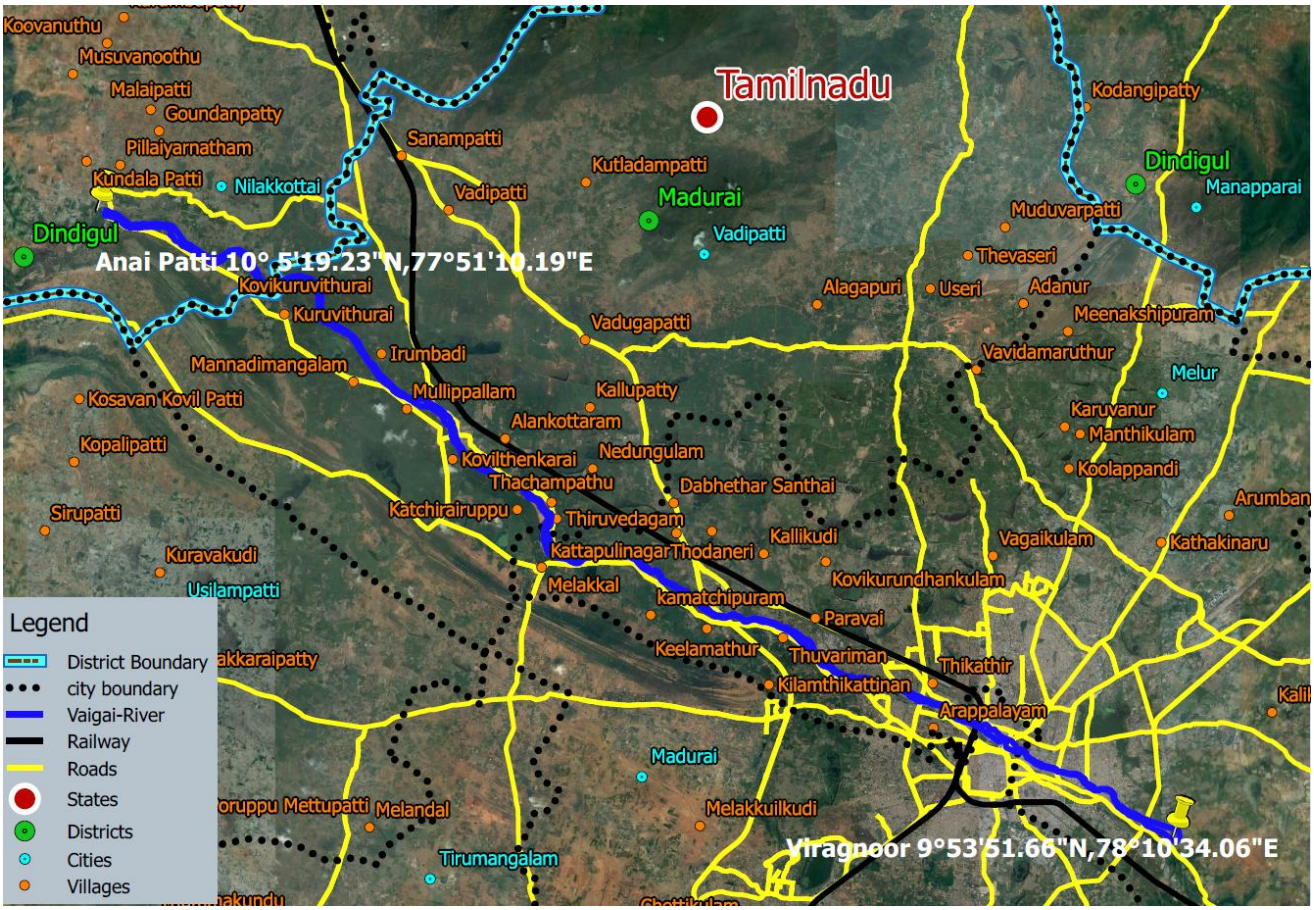


Figure 3 - Map of Vaigai River

1.5 Scope of Work

The major part of the work is, to conduct detailed hydrographic and topographic survey of 45.6 kms length of the Vaigai River from Viraganoor Dam at Lat 9°53'51.66"N, Long 78°10'34.06"E to Barrage near Anai Patti at Lat 10° 5'19.23"N, Long 77°51'10.19"E.

The scope of the work for the conduct of survey of Vaigai 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 on 10th Feb 2016. The Recee commenced form Viraganoor Dam (Downstream) to Barrage near Anai patti (Upstream). The MSL Value for the Sill level of the Viraganoor Dam was obtained from PWD Sub-section office near Viraganoor Dam.

The Upstream portion of the Vaigai River is sandy river bed with farm lands on the river banks and the downstream of the river is densely populated. The Madurai city is situated on the right bank side of the Vaigai River on downstream area. The water level in the river continued to be very less and operation of survey boat is found to be not possible through the entire stretch of the river.

Thick Vegetation and shrubs exists on the near river banks and beyond that the coconut and paddy cultivation is prominent for the entire area. The loss of lock for the DGPS is expected more on middle stretch of the river and observation time need to be selected cautiously by the DGPS operators according to the PDOP and Satellite availability. The auto leveling is also expected to be difficult due to the terrain of the area and non-availability of clear line of sight.

2.2 Survey Resources and Methodology

The actual survey was commenced on 12 Feb 2016 and completed on 08 March 2016. The survey was undertaken on a scale of 1:1000, with sounding line spacing, kept at 50 m and plotted on UTM Projection at Zone 43N and 44N as directed in the contract

2.2.1 Survey Equipment

Equipment	Make	Eqpt. Serial No.	Qty Employed
GPS Sets	Trimble R3/R4	-	06
Auto Level	Sokkia Auto level & Accessories	120775, 120799	02
ETS	Trimble M3	-	01
Current Meter	Valeport801	23447	1
Grab Sampler	Vanveen Grab	-	1
Water sampler	Naaskin Water sampler	-	1
DGPS	Trimble SPS 461Differential GPS	5516R80001	1
Software	HYPACK data acquisition	Version 15	1
Software	AUTOCAD	2012	1
Software	Microsoft Office	2013	1
Software	Trimble Business Center	Version 12	1

Table 2 - Survey Equipment Used

2.2.2 Topographic Survey

The survey was commenced on 12th Feb 2016 and completed on 8th Mar 2016. The weather was sunny throughout the period during survey operations. The weather was favorable with moderate hot climate for the conduct of 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 20 m interval. The plotting of the chart was done on UTM Projection at Zone 43N and 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 of 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 4 - Spot leveling by DGPS

2.2.3 Bathymetric Survey and Survey Launch

The bathymetric survey by survey launch for Vaigai River was unable to conduct, due to non-availability of sufficient water depth throughout the river.

2.2.4 Calibration

The equipment used for the survey was calibrated by the equipment supplier. The equipment calibration certificates are placed at Annexure - 15 to this report.

2.3 Description of Bench Marks/Authentic Reference Level Used

The established CWC gauges/benchmark of government organizations are not available for the entire survey stretch of the Vaigai River. The Sill level value of the Viraganoor Regulator was recovered as 119.170 mtr from MSL as mentioned in the Hydraulic Particulars of Viraganoor construction diagram provided by the Assistant Engineer, Tamilnadu state PWD Irrigation Department, Viraganoor.

The reference level value is used as the initial reference for vertical control and the Reference Level value of the same was transferred to station VAG-01 through Auto Level (optical leveling method). The leveling data for establishing the reference Level for the newly constructed benchmark pillars are placed at Annexure –10 to this report. The

final accepted WGS 84 coordinates and details of station & IWAI Benchmark established during the conduct of survey are as follows:-

Sl. No.	Station	Chainage (km)	Latitude	Longitude	Ht (above MSL)	Source/ Type
01	VAG_01	0.00	09°53'55.25390"N	78°10'37.87655"E	126.238	Online processed
02	VAG_02	10.22	09°56'20.29899"N	78°05'52.89219"E	136.118	Online processed
03	IWAI BM_VAG_01	3.89	09°54'52.64597"N	78°08'49.54129"E	124.862	Base line processed
04	IWAI BM_VAG_02	13.96	09°57'07.32611"N	78°04'01.29329"E	142.864	Base line processed
05	IWAI BM_VAG_03	24.37	09°59'04.71788"N	77°59'11.54283"E	154.405	Base line processed
06	IWAI BM_VAG_04	32.51	10°02'00.01107"N	77°56'25.28919"E	168.490	Base line processed
07	IWAI BM_VAG_05	44.35	10°05'01.39909"N	77°51'48.87805"E	187.581	Base line processed

Table 3 - Accepted Station coordinates (WGS-84)

2.4 Tidal influence Zone and Tidal Variation

The survey stretch of Vaigai 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 Vaigai River is 45.6 km stretch which is between Viraganoor Regulator and Peranai Regulator. There are many other various spillage & check dams present in the survey stretch of the Vaigai River. The water depth on an average of 0.1 to 0.2 mtr is available near the check dams and the water level are recoded as Dry (dead level) in the records held with the dam authorities.

2.5.1 Sounding Datum

The established CWC Chart Datum values are not available for the survey stretch of Vaigai River. On detailed observation and inputs from the Assistant Engineers of Viraganoor and Peranai Regulator, in summers the water level on entire survey stretch of Vaigai River ends up dry and the water will not be available for most of the drinking water pump house situated on the river beds. The Vaigai River being dry, it is divided as 01 km stretches according to the slope of the river and the least bed level value with respect to MSL, obtained during the conduct of 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 for the river. The slope of the Vaigai River is having symmetric gradient with variation of 64.8m for 45.6 km stretch. The datum for calculation of dredge volume was accepted as the least spot height in the 01 km stretch for the Vaigai River. The newly established Chart Datum for the stretches are as tabulated below:-

Km Stretch	Least level w.r.t. MSL (m)	Established CD (m)		Km Stretch	Least level w.r.t. MSL (m)	Established CD (m)
1	117.0	117.0		24	147.9	147.9
2	113.7	113.7		25	151.0	151.0
3	116.0	116.0		26	152.9	152.9
4	119.1	119.1		27	154.6	154.6
5	119.8	119.8		28	155.4	155.4
6	122.4	122.4		29	156.3	156.3
7	124.7	124.7		30	159.2	159.2
8	128.9	128.9		31	160.1	160.1
9	129.4	129.4		32	163.0	163.0
10	130.0	130.0		33	163.3	163.3
11	131.6	131.6		34	165.0	165.0
12	131.6	131.6		35	167.5	167.5
13	131.6	131.6		36	168.9	168.9
14	132.8	132.8		37	170.2	170.2
15	134.5	134.5		38	171.3	171.3
16	137.3	137.3		39	173.3	173.3
17	138.2	138.2		40	174.9	174.9
18	139.0	139.0		41	176.3	176.3
19	141.6	141.6		42	177.3	177.3
20	142.2	142.2		43	181.8	181.8
21	145.0	145.0		44	183.0	183.0
22	146.4	146.4		45	184.4	184.4
23	147.1	147.1		45.6	185.7	185.7

Table 4 - Established CD for per kilometer stretch

2.6 Average of 06 years min. Water Levels to arrive at Chart Datum (CD)

Vaigai River is non-tidal river body having the primary source of water receiving from Vaigai Dam and ends up in dry during summer. There is no CWC/state government gauge minimum water level data of Vaigai River for the average of last 06 years.

2.7 Transfer of Sounding Datum

The Vaigai River is non-tidal river and the least MSL level of the per-km stretch is considered as the datum value for computing sounding datum at different stretches.

2.8 Table indicating Tidal Variation at Different Observation Points

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

2.9 Salient features of Dam, Barrages etc.

The details of Viraganoor and Peranai Regulator were collected during the conduct of survey and the details are as follows:-

2.9.1 Salient features of Viraganoor Regulator

HYDRAULIC PARTICULARS OF VIRAGANOOR REGULATOR				
Year of construction 1971-75			REGULATOR	
01	Chainage from K. Peranai Regulator	43.0 Km	Sill Level	119.17
02	Catchment area at regulator site	1786 Sq. miles	No. of Vents	18
03	C value adopted	560	Size of Vents (Shutter)	12.9 X1.98
04	MFD Provided	108500 cusecs	Discharge	1,08,500
05	Length	260.90m		
06	Length between abutment	260.90m		
07	Level of foundation			
	U/S Cut off	113.84		
	D/S cut off	112.78		
08	Top of shutter FSL	121.15		
09	M.F.S U/S	123.59		
10	M.F.S D/S	122.64		
11	Level of water cushion	116.58		
12	Level of roadway	126.18		
13	Width of road way	3.65 m		
14	Level of operation Platform	130.21		
15	Ayacut	41,412		

Table 5 - Hydraulic particulars of Viraganoor Regulator

2.9.2 Salient features of Peranai Regulator

PERANAI REGULATOR HEAD WORKS			
HYDRAULIC PARTICULARS			
YEAR OF CONSTRUCTION - 1882			
REGULATOR		PERIYAR MAIN CANAL HEAD SLUICE	
Sill level	187.343	Sill Level	188.350
Number of shutters	10	Number of shutters	8
Size of shutter	40 X 14	Size of shutter	20 X 8.18
Top level of shutter	191.610	Discharge Capacity	19838 C/S
Discharging Capacity	70,000 c/s	Length	150
Length of regulator	138.37m	TIRUMANGALAM CANAL HEAD SLUICE	
Maximum flood discharge on 14.11.92	54834 cu secs	Sill level	189.890m
Maximum rain fall on 17.11.92	154 mm	Number of Shutter	02
Flood 11 .12.98	73401 c/s	Size of shutter	10X2
		Discharging capacity	228 c/s

FLOOD DISCHARGE OF PERANAI REGULATOR		
Date	Time	Discharge
19.11.79	11:45 AM	76160 c/s
07.03.84	09:00 AM	56929c/s
14.11.92	06:30AM	54835c/s
10.11.93	01:00AM	31195c/s
04.11.94	08:00AM	27760c/s
04.11.97	03:00AM	25517c/s
11.12.98	03:00AM	73401c/s

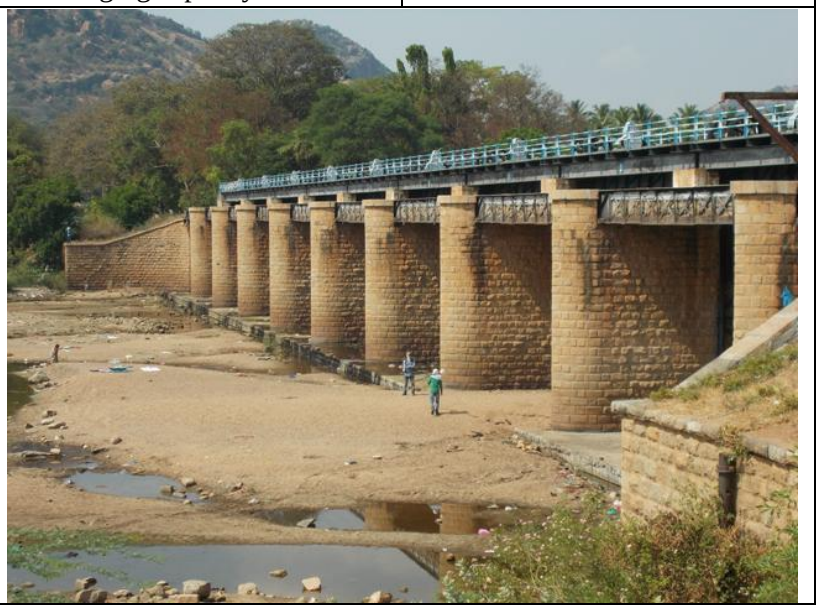


Table 6 - Hydraulic particulars of Peranai Regulator

2.10 Erected IWAI Benchmark 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 Sill level of Viraganoor dam {119.170 mtr from MSL, Source: - Tamilnadu state PWD (Irrigation) Department, Viraganoor}. The final accepted co-ordinates and a Reference Levelvalue of IWAI BM Pillars are as below:

Sl. No.	Station	Chainage (km)	Latitude (N) Longitude (E)	Easting Northing	Ellipsoidal Height (m)	Height above MSL (m)	BM Height w.r.t. Established CD (m)
01	IWAI BM_VAG_01	3.89	09°54'52.64597"N 78°08'49.54129"E	187130.674 1097315.022	29.275	124.862	5.762
02	IWAI BM_VAG_02	13.96	09°57'07.32611"N 78°04'01.29329"E	178379.198 1101532.917	47.354	142.864	8.364
03	IWAI BM_VAG_03	24.37	09°59'04.71788"N 77°59'11.54283"E	827467.028 1105195.429	58.927	154.405	3.405
04	IWAI BM_VAG_04	32.51	10°02'00.01107"N 77°56'25.28919"E	822350.965 1110540.275	73.501	168.490	5.190
05	IWAI BM_VAG_05	44.35	10°05'01.39909"N 77°51'48.87805"E	813878.043 1116043.282	92.711	187.581	3.181

Table 7 - Accepted BM coordinates w.r.t. established CD

2.11 Chart Datum / Sounding Datum and Reductions Details

The water availability in Vaigai River is very less and the spot leveling by topographic method was attempted for the entire survey stretch of Vaigai 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 is forwarded as soft copy along with the report.

2.12 HFL/MHWS values of Bridges/Cross Structures

The established HFL value of 123.590m w.r.t MSL for the Viraganoor dam was provided by Assistant Engineer, state PWD Irrigation department, Tamilnadu. The Estimated HFL Value of the Peranai Regulator was also obtained from the Assistant Engineer, Peranai Regulator as 191.6 m w.r.t MSL (Top Level of the shutter of Regulator). The HFL value for the remaining survey stretch is computed for the Vaigai River. The details of established and computed HFL values for the entire stretch is as follows:-

Sl. No.	Location and description of CWC gauge / Dam / Barrages / Weirs / Anicut / Locks / Aqueducts / BM	Cross-structure details	Chainage (km)	Established HFL / MHWS / FSL / MWL / FRL w.r.t. MSL (m)	Computed HFL at Cross-Structures w.r.t. MSL (m)
	A	B	C	D	E
1	Viraganoor dam	Regulator	0.00	123.59	-
2	Viraganoor	Bridge	1.26	-	125.55
3	Ananagar Bridge	Bridge	3.74	-	129.02
4	Anna Salai Bridge	Bridge	4.92	-	130.96
5	Ismail puram	Bridge	6.24	-	133.00
6	AV palam Bridge	Bridge	6.72	-	133.61
7	Victoria Bridge(Double Decker_lower)	Bridge	6.84	-	133.76
8	Victoria Bridge(Double Decker_upper)	Bridge	6.84	-	133.76
9	Under Construction BRIDGE	Bridge	7.11	-	134.32
10	Madurai bridge	Bridge	8.02	-	135.62
11	Madurai-railway bridge	Bridge	8.05	-	135.64
12	Aarapalayam-Aruidaspuram Bridge	Bridge	9.22	-	137.39
13	Nagu Nagar	Bridge	10.18	-	138.84
14	Vaigai River Byepass Bridge AH-43	Bridge	17.76	-	149.79
15	Melakkal Bridge	Bridge	23.93	-	159.19
16	Thiruvedagam Check dam	Check Dam	24.81		160.46
17	Sholavandan	Bridge	29.97	-	168.16
18	Sholavandan Check Dam	Check Dam	30.53	-	169.04
19	Mullippallam Dam	Check	31.63	-	170.65

Sl. No.	Location and description of CWC gauge / Dam / Barrages / Weirs / Anicut / Locks / Aqueducts / BM	Cross-structure details	Chainage (km)	Established HFL / MHWS / FSL / MWL / FRL w.r.t. MSL (m)	Computed HFL at Cross-Structures w.r.t. MSL (m)
		Dam			
20	Thenkarai spillage Dam	Check Dam	41.47	-	185.39
21	Anai Patti	Bridge	45.54	-	191.25
22	Peranai Regulator	Regulator	45.6	191.6	-

Table 8 - HFL values of Bridges/Cross Structures

2.13 Graph: Sounding Datum and HFL vs Chainage

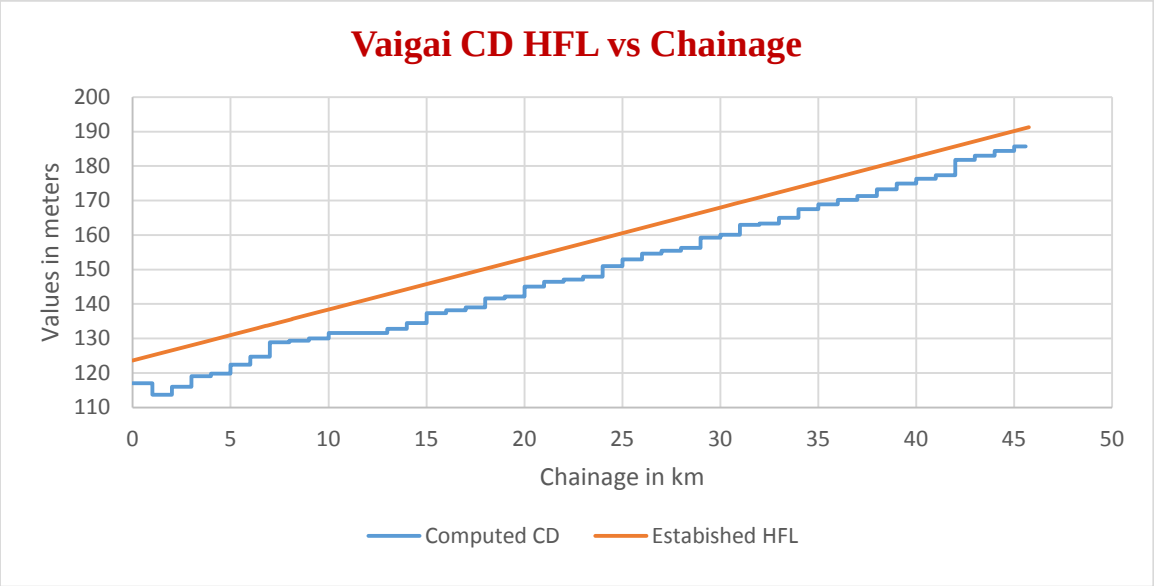


Figure 5 - CD and HFL vs Chainage

2.14 Average Bed Slope

The average bed slope for the Vaigai 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 - 124.756	Ch. 17.8 - RBL - 141.534	16.778	17.8	1 : 0.943
Ch. 17.8 - RBL - 141.534	Ch. 22.3 - RBL - 150.494	8.96	4.5	1 : 1.991
Ch. 22.3 - RBL - 150.494	Ch. 31.8 - RBL - 166.262	15.768	9.5	1 : 1.66
Ch. 31.8 - RBL - 166.262	Ch. 45.6 - RBL - 186.891	20.629	13.8	1 : 1.495

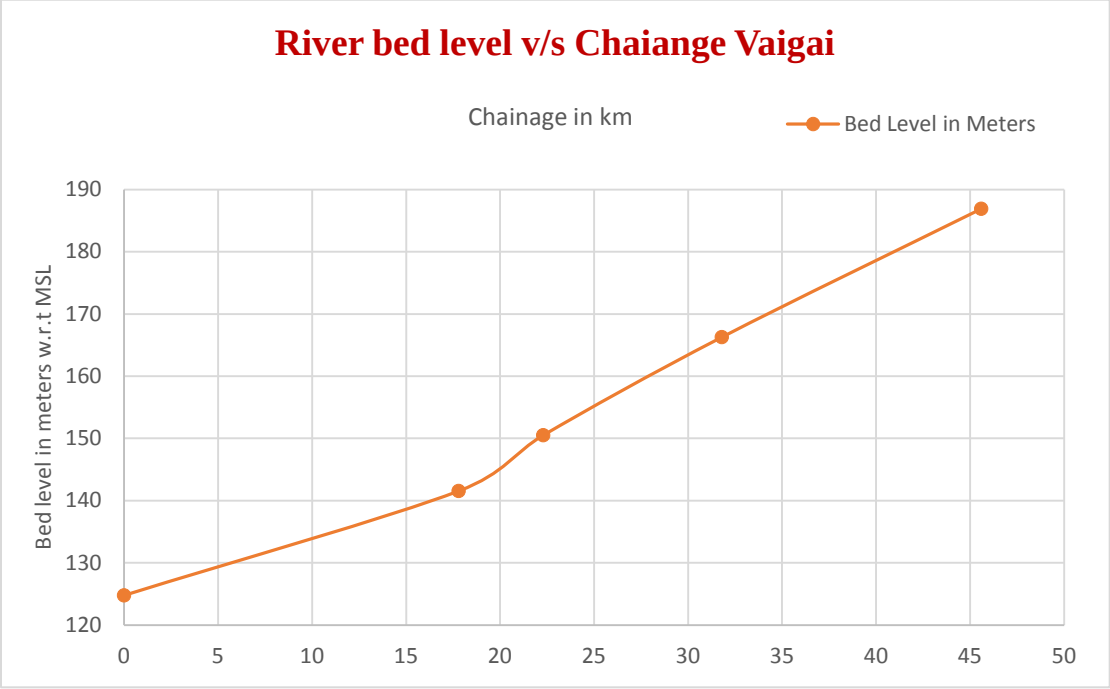


Table 9 - Average Bed Slope

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

Sl. No.	Structure Name	Chainage (km)	Location	Position (Lat Long)	Position (UTM)	Length (m)	Width (m)	Height w.r.t. MSL (m)	Present condition
1	Viraganoor Dam	0.01	Iravadanallur	**Left Bank:** 9°53'48.45"N 78°10'31.07"E **Right Bank:** 9°53'55.16"N 78°10'36.89"E	**Left Bank:** 1095314.742 190209.179 **Right Bank:** 1095519.551 190388.432	271.89	8.1	126.18	Operational
2	Kochadai Check Dam	12.11	Kochadai	**Left Bank:** 9°56'40.45"N 78° 4'55.62"E **Right Bank:** 9°56'48.24"N 78° 4'57.58"E	**Left Bank:** 1100691.86 180028.08 **Right Bank:** 1100931 180090	252.11	3.1	138.09	Operational
3	Thiruvedagam Check Dam	24.81	Thiruvedagam	**Left Bank:** 9°59'19.31"N 77°59'5.00"E **Right Bank:** 9°59'19.30"N 77°59'14.55"E	**Left Bank:** 1105642.355 827263.52 **Right Bank:** 1105644.681 827554.64	292.21	2.32	152.3	Operational
4	Sholavandan Check Dam	30.53	Sholavandan	**Left Bank:** 10°1'27.60"N 77°57'18.57"E **Right Bank:** 10°1'31.81"N 77°57'23.58"E	**Left Bank:** 1109558.176 823983.829 **Right Bank:** 1109689.010 824135.366	197.1	12.27	163.0	Operational
5	Mullippallam Dam	31.63	Mullippallam	**Left Bank:** 10° 1'46.35"N 77°56'51.14"E **Right Bank:** 10° 1'54.13"N 77°56'54.98"E	**Left Bank:** 1110127.247 823142.616 **Right Bank:** 1110367.54 823257.51	58.53	3.32	166.4	Operational
6	Thenkarai Spillage Dam	41.47	Thenkarai	**Left Bank:** 10°04'22.91"N 77°53'11.28"E **Right Bank:** 10°04'27.34"N 77°53'3.08"E	**Left Bank:** 816399.406 1114881.856 **Right Bank:** 816148.328 1115015.871	300	7.5	182.5	Operational
7	Peranai Regulator	45.6	Anai Patti	**Left Bank:** 10° 5'16.17"N 77°51'8.61"E **Right Bank:** 10° 5'20.64"N 77°51'10.51"E	**Left Bank:** 1116486.736 812647.064 **Right Bank:** 1116624.686 812703.758	137.27	8.46	195.1	Operational

Table 10 - Cross Structures w.r.t. MSL

2.16 Details of Locks

There are no Locks present in the entire survey stretch of Vaigai River.

2.17 Details of Aqueducts

There are no Aqueducts present in the survey stretch of Vaigai River.

2.18 Details of existing Bridges and Crossings over Waterway

Sl. 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)	VC w.r.t. HFL / MHWS (m)	Remarks (complete / under - construction), in use or not) condition
					Left Bank Right Bank	Left Bank Right Bank						
1	Viraganoor	1.26	RCC	Viraganoor	**Left Bank:** 9°54'4.55"N 78°9'55.45"E **Right Bank:** 9°54'13.14"N 78° 9'59.39"E	**Left Bank:** 189127.478 1095819.1 **Right Bank:** 189249.84 1096082.1	290.32	9.15	11	23.029	4.879	Completed and in use
2	Ananagar Bridge	3.74	RCC	Meenakshi Nagar	**Left Bank:** 9°54'45.89"N 78° 8'57.62"E **Right Bank:** 9°54'58.59"N 78° 8'54.96"E	**Left Bank:** 187375.25 1097105.17 **Right Bank:** 187297.509 1097496.37	397.71	13.05	18	21.756	7.183	Completed and in use
3	Anna Salai Bridge	4.92	RCC	Kuruvikaran Salai	**Left Bank:** 9°55'4.69"N 78° 8'22.23"E **Right Bank:** 9°55'11.89"N 78° 8'24.18"E	**Left Bank:** 186301.221 1097692.5 **Right Bank:** 186362.645 1097913.38	229.77	10.53	38	5.657	3.24	Completed and in use
4	Ismail puram	6.24	RCC	Ismail puram	**Left Bank:** 9°55'22.38"N 78°7'42.58"E **Right Bank:** 9°55'28.66"N 78°7'47.04"E	**Left Bank:** 185097.186 1098246.87 **Right Bank:** 185234.825 1098438.79	237.44	8.12	-	Near Ground Structure	1.353	Completed and in use
5	AV palam Bridge	6.72	RCC	Komathi puram	**Left Bank:** 9°55'29.65"N 78° 7'29.32"E **Right Bank:** 9°55'39.03"N 78° 7'34.78"E	**Left Bank:** 184694.798 1098473.91 **Right Bank:** 184863.821 1098760.89	332.07	12.41	14	21.573	9.089	Completed and in use
6	Victoria Bridge (Double Decker_ lower)	6.84	RCC	Komathi puram	**Left Bank:** 9°55'29.88"N 78° 7'24.36"E **Right Bank:** 9°55'41.02"N 78° 7'30.91"E	**Left Bank:** 184543.646 1098482.29 **Right Bank:** 184746.369 1098823.1	395.56	11.66	8	Near Ground Structure	1.369	Completed and in use
7	Victoria Bridge	6.84	RCC	Komathi puram	**Left Bank:** 9°55'29.88"N	**Left Bank:** 184543.646	395.56	11.66	8	21.004	6.417	Completed and in use

Sl. 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)	VC w.r.t. HFL / MHWS (m)	Remarks (complete / under - construction), in use or not) condition
					Left Bank Right Bank	Left Bank Right Bank						
	(Double Decker_ upper)				78° 7'24.36"E **Right Bank:** 9°55'41.02"N 78° 7'30.91"E	1098482.29 **Right Bank:** 184746.369 1098823.1						
8	Under Construction BRIDGE	7.11	RCC	Simmakkal	**Left Bank:** 9°55'37.46"N 78° 7'19.26"E **Right Bank:** 9°55'43.12"N 78° 7'22.88"E	**Left Bank:** 184390.256 1098716.71 **Right Bank:** 184502.124 1098889.79	208.74	8.84	10	19.373	3.823	Under Construction
9	Madurai bridge	8.02	RCC	Kela Kailasapuram	**Left Bank:** 9°55'53.86"N 78° 6'55.10"E **Right Bank:** 9°56'0.91"N 78° 6'58.09"E	**Left Bank:** 183658.086 1099227.38 **Right Bank:** 183751.123 1099443.37	238.35	10.27	19	11.644	4.383	Completed and in use
10	Madurai-railway bridge	8.05	RCC	Kela Kailasapuram	**Left Bank:** 9°55'51.06"N 78° 6'52.83"E **Right Bank:** 9°56'1.44"N 78° 6'56.88"E	**Left Bank:** 183588.134 1099141.89 **Right Bank:** 183714.377 1099459.99	342.27	6.07	7	23.275	5.84	Completed and in use
11	Aarapalayam-Aruidaspuram Bridge	9.22	RCC	West Ponnagaram	**Left Bank:** 9°56'7.44"N 78°6'20.01"E **Right Bank:** 9°56'16.65"N 78° 6'25.37"E	**Left Bank:** 182591.967 1099654.27 **Right Bank:** 182757.841 1099936.04	327.31	9.6	15	21.356	4.028	Completed and in use
12	Nagu Nagar	10.18	RCC	Manjalmattu Colony	**Left Bank:** 9°56'19.38"N 78° 5'53.24"E **Right Bank:** 9°56'27.68"N 78° 5'55.61"E	**Left Bank:** 181779.066 1100028.54 **Right Bank:** 181853.551 1100283.13	265.32	11.82	12	19.847	5.7	Completed and in use
13	Vaigai River Byepass Bridge AH-43	17.76	RCC	Meenakshi Mill Colony	**Left Bank:** 9°57'52.36"N 78° 2'24.41"E **Right Bank:** 9°58'2.89"N 78° 2'12.29"E	**Left Bank:** 175438.099 1102944.01 **Right Bank:** 175071.521 1103271.13	493.6	21.84	16	23.813	18.06	Completed and in use
14	Melakkal Bridge	23.93	RCC	Melakkal	**Left Bank:** 9°58'55.92"N 77°59'24.39"E **Right Bank:** 9°59'2.46"N 77°59'26.03"E	**Left Bank:** 827861.109 1104928.42 **Right Bank:** 827909.282 1105129.99	200.75	9.77	12	8.407	4.119	Completed and in use
15	Sholavandan	29.97	RCC	Sholavandan	**Left Bank:** 10°1'11.25"N 77°57'21.32"E	**Left Bank:** 824072.165 1109056.15	324.79	12.17	20	12.642	4.671	Completed and in use

Sl. 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)	VC w.r.t. HFL / MHWS (m)	Remarks (complete / under - construction), in use or not) condition
					Left Bank Right Bank	Left Bank Right Bank						
					Right Bank: 10°1'14.23"N 77°57'31.79"E	**Right Bank:** 824390.463 1109150.66						
16	Anai Patti	45.54	RCC	Anai Patti	**Left Bank:** 10° 5'14.31"N 77°51'12.93"E	**Left Bank:** 812779.196 1116430.69	219.24	12.79	15	16.842	6.582	Completed and in use
					Right Bank: 10° 5'21.19"N 77°51'14.75"E	**Right Bank:** 812832.806 1116642.72						

Table 11 - Details of Cross Structures

2.19 Details of other Cross structures, pipe-lines, under water cables

There are numerous small pipeline connection between drinking water well and shore Pump houses in the Vaigai River, however no major pipe lines or under water cables cross- through the Vaigai River. The most prominent details of water line across the river are as follows:-

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)	Horizontal clearance (clear distance Between piers) (m)	Remarks (complete / under - construction), in use or not, condition
					Left Bank Right Bank	Left Bank Right Bank				
1	Pipe line	1.86	Water pipe line	Viraganoor	**Left Bank:** 9° 54.289'N 78° 9.664'E	**Left Bank:** 188655.11 1096216.65	101.82	1.0	0	In use
					Right Bank: 9° 54.333'N 78° 9.695'E	**Right Bank:** 188713.14 1096297.67				
2	Pipe line	15.54	Water pipe line	Thivariman	**Left Bank:** 9° 57.691'N 78° 3.406'E	**Left Bank:** 177262.60 1102592.54	227.36	1.5	0	In use
					Right Bank: 9° 57.795'N 78° 3.471'E	**Right Bank:** 177383.19 1102783.36				

Table 12 - Details of other Cross structures, Pipelines

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

Total of 04 High Tension electrical lines were also present in the Vaigai River and the height of the high tension line were also measured by ETS. There are no piers for electrical lines constructed in the river bed of Vaigai River.

Sl. No.	Type of line	Chainage (km)	Location	Position (Lat Long)	Position (UTM)	No of Piers	Horizontal clearance (clear distance Between piers) (m)	Vertical clearance w.r.t. HFL / MHWS (m)	Remarks (complete / under - construction)
				Left Bank Right Bank	Left Bank Right Bank				
1	HTL	31.72	Mullippallam	**Left Bank:** 10°1'46.48"N 77°56'50.04"E **Right Bank:** 10°1'59.29"N 77°56'50.42"E	**Left Bank:** 823109.27 1110131.66 **Right Bank:** 823117.99 1110525.23	-	-	42	Complete
2	HTL	10.09	Theekkathir	**Left Bank:** 9°56'21.90"N 78°5'57.32"E **Right Bank:** 9°56'26.5”N 78°05'57.5”E	**Left Bank:** 181904.10 1100105.01 **Right Bank:** 181910.63 1100245.41	-	-	43	Complete
3	HTL	5.11	Kuruvikaran Salai	**Left Bank:** 9°55'6.86"N 78°8'15.74"E **Right Bank:** 9°55'15.1”N 78°08'17.8”E	**Left Bank:** 186104.81 1097761.65 **Right Bank:** 186169.00 1098012.27	-	-	37	Complete
4	HTL	2.59	Iravathanallur	**Left Bank:** 9°54'13.9”N 78°09'5.6”E **Right Bank:** 9°54'42.18"N 78°9'25.40"E	**Left Bank:** 187610.31 1096118.16 **Right Bank:** 188221.01 1096984.73	-	-	38	Complete

Table 13 - High Tension Lines Details

2.21 Current Meter and Discharge Details

Valeport801 Velocity meter was used to log the flow rates of the river. The locations of current meter deployment are as follows:

Stretch No.	Chainage (km)	Latitude Longitude	Easting Northing (m)	Obs. Depth (m) (D)	Velocity (m/sec.) 0.5 D	Avg. Vel. (m/sec.)	X-Sectional area (sq. m.)	Discharge (Cu.m)
1	9.24	09°56’15.52”N 78°06’23.32”E	182694.969 1099901.846	0.35	0.006	0.013	38.762	0.504
2	14.19	09°57’15.04”N 78°03’58.10”E	178283.951 1101770.983	0.75	0.014	0.018	40.37	0.727
3	24.35	09°59’06.70”N 77°59’13.10”E	827513.945 1105256.812	0.8	0.341	0.346	33.642	11.640

Stretch No.	Chainage (km)	Latitude Longitude	Easting Northing (m)	Obs. Depth (m) (D)	Velocity (m/sec.) 0.5 D	Avg. Vel. (m/sec.)	X-Sectional area (sq. m.)	Discharge (Cu.m)
4	32.51	10°02'01.61"N 77°56'26.31"E	822381.637 1110589.721	0.73	0.009	0.01	56.566	0.566
5	44.28	10°05'03.06"N 77°51'50.92"E	813939.816 1116094.898	0.65	0.553	0.557	56.105	31.250

Table 14 - Current Meter Deployment Locations

The collected data is forwarded as deliverable data along with this report.

2.22 Soil and Water Sample Locations

a) Soil Samples

River bed soil and water sampling was undertaken for the suitable locations evenly distributed throughout the Vaigai River Stretch. The Vanveen grab and Naskin water bottles were kept standby for the collections of samples. The depths are being very low; the samples were directly collected at assigned sampling locations. The details of soil and water sample locations are as follows:-

Sample No.	Chainage (km)	Latitude	Longitude	Easting (m)	Northing (m)	Depth (m)
1	9.24	09°56'15.52"N	78°06'23.32"E	182694.969	1099901.846	0.35
2	14.19	09°57'15.04"N	78°03'58.10"E	178283.951	1101770.983	0.75
3	24.35	09°59'06.70"N	77°59'13.10"E	827513.945	1105256.812	0.8
4	32.51	10°02'01.61"N	77°56'26.31"E	822381.637	1110589.721	0.73
5	44.28	10°05'03.06"N	77°51'50.92"E	813939.816	1116094.898	0.65

Table 15 - Soil Sampling Locations

b) Water Sample Locations

Sample No.	Chainage (km)	Latitude Longitude	Easting (m) Northing (m)	Total Depth (d) (m)	Mid-Depth (0.5d) (m)
VAG-01	9.24	09°56'15.52"N 78º06'23.32"E	182694.969 1099901.846	0.35	0.35
VAG-02	14.19	09°57'15.04"N 78º03'58.10"E	178283.951 1101770.983	0.7	0.75
VAG-03	24.35	09°59'06.70"N 77º59'13.10"E	827513.945 1105256.812	0.8	0.8
VAG-04	32.51	10°02'01.61"N 77º56'26.31"E	822381.637 1110589.721	0.7	0.73
VAG-05	44.28	10°05'03.06"N 77º51'50.92"E	813939.816 1116094.898	0.6	0.65

Table 16 - Water Sampling Locations

Figure 6 - Soil and Water Sampling

2.23 Analysis

The collected samples were analyzed for following properties:-

a) Soil Samples
   - Grain Size
   - Specific Gravity
   - PH Value
   - Cu, Cc
   - Clay Silt Percentage

b) Water Samples
   - Sediment Concentration

A detailed report on sample analysis is placed in Annexures -13 & 14 to this report.

3 Description of Waterway

The Waterway of Vaigai River coming within survey limits is divided in to four stretches in accordance with the topographic feature and nature of river stream. The details are as follows:

3.1 Viraganoor Regulator to Bridge near Keelamathur (0 km to 17.8 km)

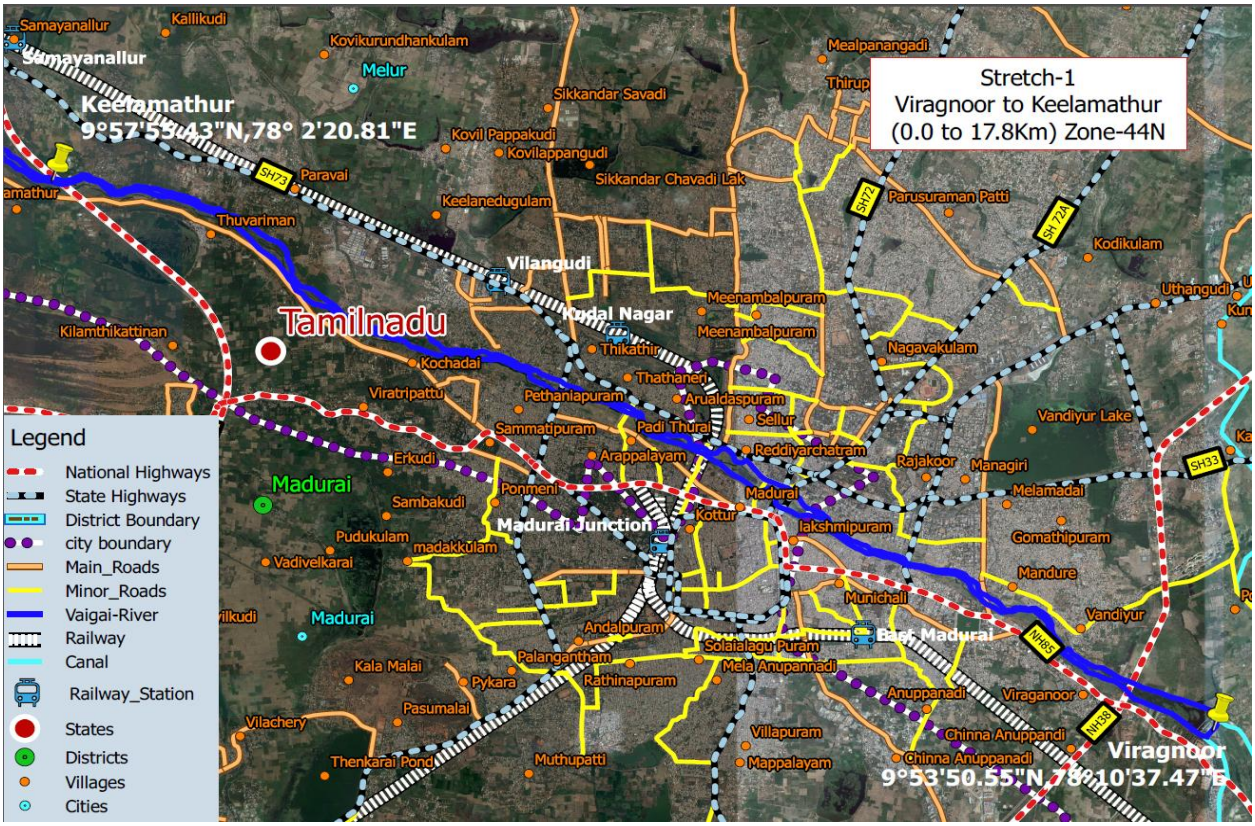


Figure 7 - Stretch-01 Viraganoor Regulator to Bridge near Keelamathur

- **Bathymetry Survey**
  a) No bathymetric survey is conducted due to the unavailability of water

- **Topographic Survey**
  b) 17.8km of the length of the stretch for which the topographic survey has been carried out.

This stretch is between 0 to 17.8km chainage of the survey stretch of Vaigai River. This stretch forms the upstream portion of the Viraganoor Regulator to the bridge across the AH-43 Service road near Keelamathur. This stretch consists of various spillage dams and over-head obstructions across the river. The river bed is flat and firm muddy in nature with open grass lands within the river stream. There exist some concrete constructions on

the center of the river bed. There is no ferry transport or any other local boat present in the river.

The river banks of this stretch are very densely populated on both sides and as a result these are widely used for the domestic purpose including drinking. The downstream of this stretch, near Viraganoor Regulator, there are many sewage outlets opening directly to the Vaigai River and the water in the area is not suitable for any domestic/drinking purposes.

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	17.8	0.000	0.000	17,800.00	756,018.96	756,018.96	-0.30	0.00	17,800.00	972,784.06	972,784.06
II	0	17.8	0.000	0.000	17,800.00	1,151,527.39	1,151,527.39	-0.30	0.00	17,800.00	1,430,456.68	1,430,456.68
III	0	17.8	0.000	0.000	17,800.00	1,740,323.34	1,740,323.34	-0.30	0.00	17,800.00	2,086,563.55	2,086,563.55
IV	0	17.8	0.000	0.000	17,800.00	2,099,830.93	2,099,830.93	-0.30	0.00	17,800.00	2,461,522.78	2,461,522.78

Table 17 - Stretch 1 Dredging Quantity

3.1.1 Stretch-1 River-bed Profile

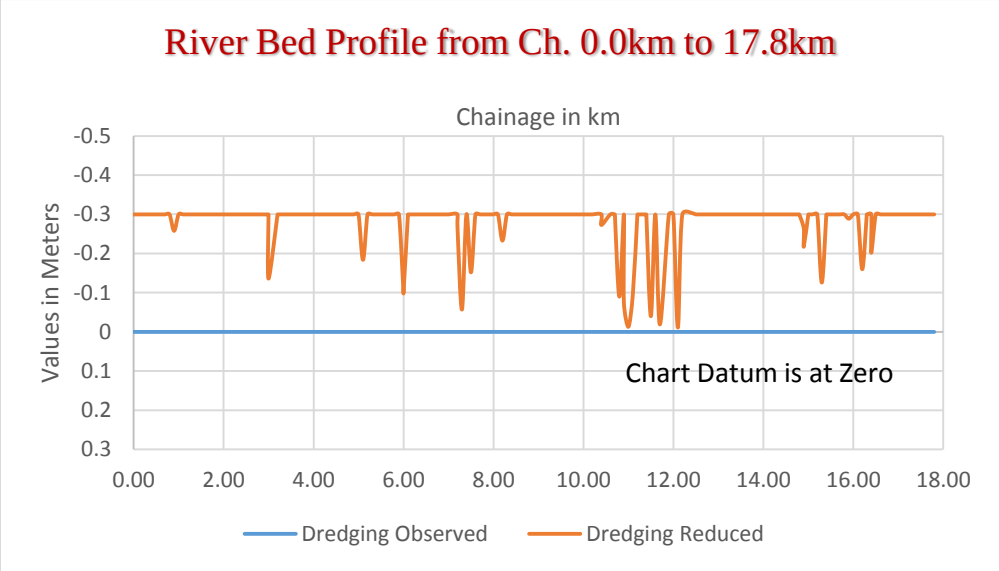


Figure 8 - Stretch 1 River-bed Profile

3.2 Bridge near Keelamathur to Thenur (17.8 km to 22.3 km)

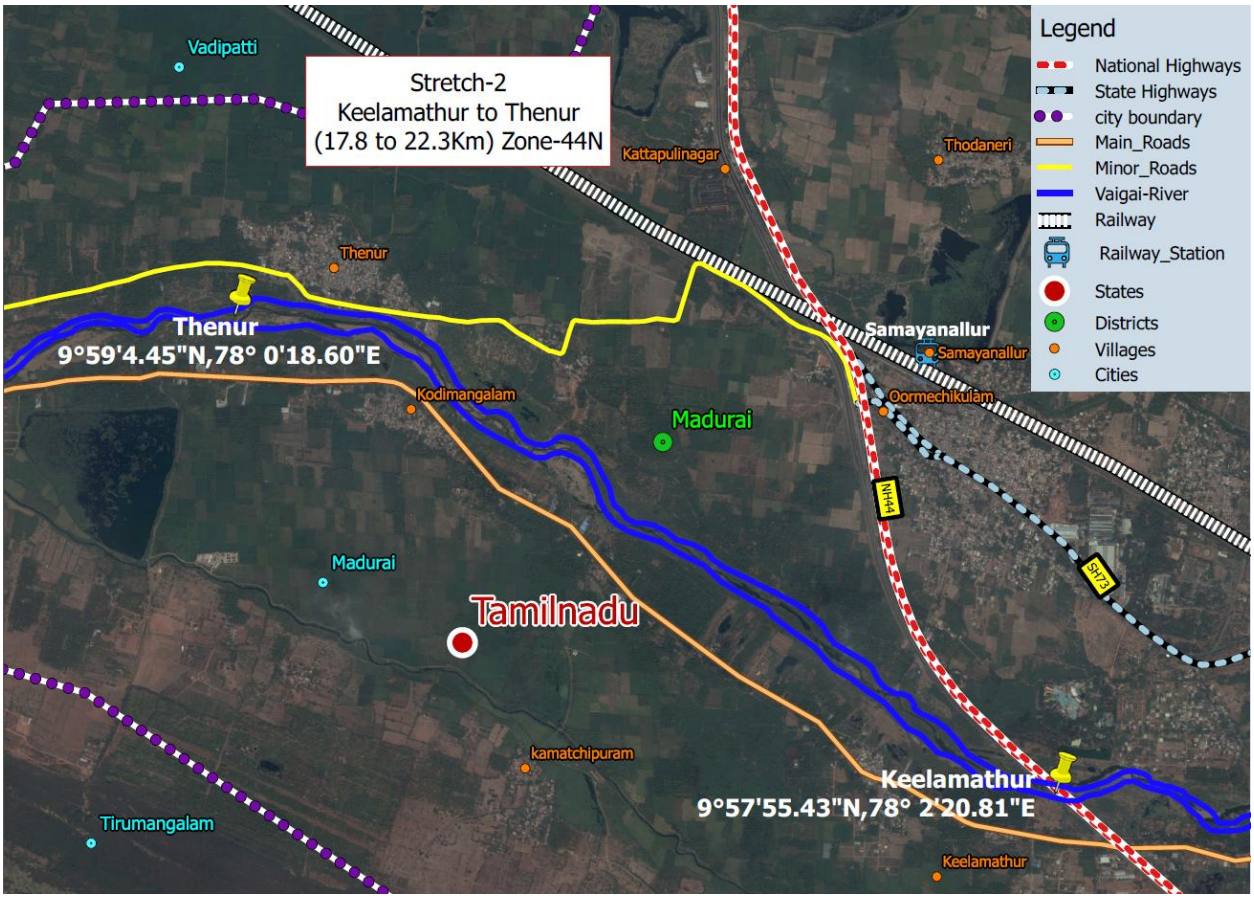


Figure 9 - Stretch-02 Bridge near Keelamathur to Thenur

- **Bathymetry Survey**
  a) No bathymetric survey is conducted due to the unavailability of water
- **Topographic Survey**
  b) 4.5 km of the length of the stretch for which the topographic survey has been carried out.

This stretch of Vaigai River is 17.8 to 22.3km chainage between the bridge across the AH-43 Service road near Keelamathur and Thenur Village. Isolated small towns are spread on the both river banks. The water streams follow very narrow pattern with dense vegetation on the river bed. The river banks of this stretch are un-protected in nature but the high rise riverbanks on both sides prevent the flood in the area. The coconut farms are distributed on the both sides of the river banks. Sighting of snakes are reported from the field during the conduct of survey at various occasions. The adequate safety measures and precautions were held during the conduct of survey.

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	17.8	22.3	0.000	0.000	4500	192,056.83	948,075.79	-0.300	0.000	4500	246,205.09	1,218,989.15
II	17.8	22.3	0.000	0.000	4500	292,531.06	1,444,058.45	-0.300	0.000	4500	362,287.87	1,792,744.55
III	17.8	22.3	0.000	0.000	4500	442,130.04	2,182,453.38	-0.300	0.000	4500	528,867.26	2,615,430.81
IV	17.8	22.3	0.000	0.000	4500	533,492.05	2,633,322.98	-0.300	0.000	4500	624,153.57	3,085,676.35

Table 18 - Stretch 2 Dredging Quantity

3.2.1 Stretch-2 River-bed Profile

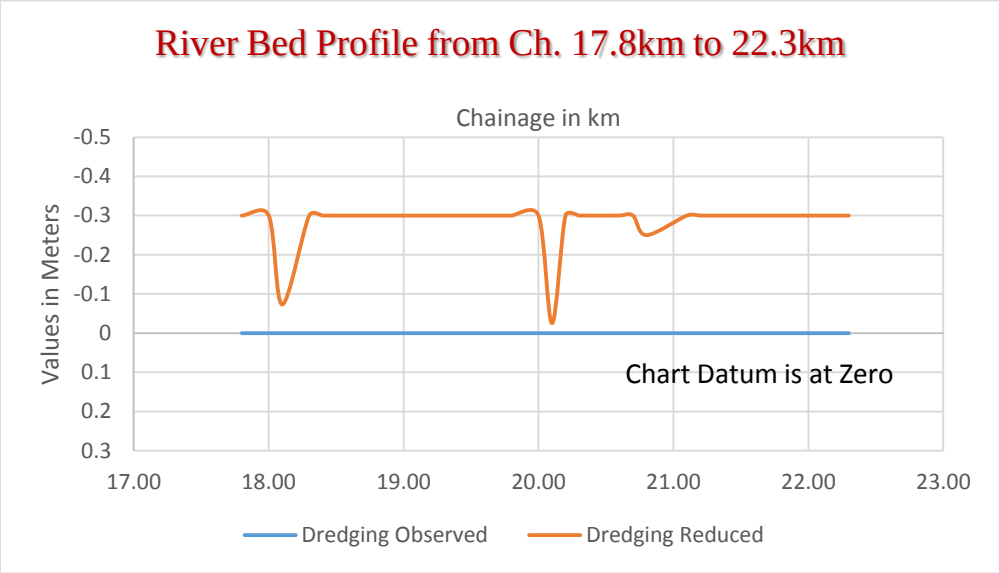


Figure 10 - Stretch 2 River-bed Profile

3.3 Thenur to Mullipalam Spillage Dam (22.3km to 31.8 km)

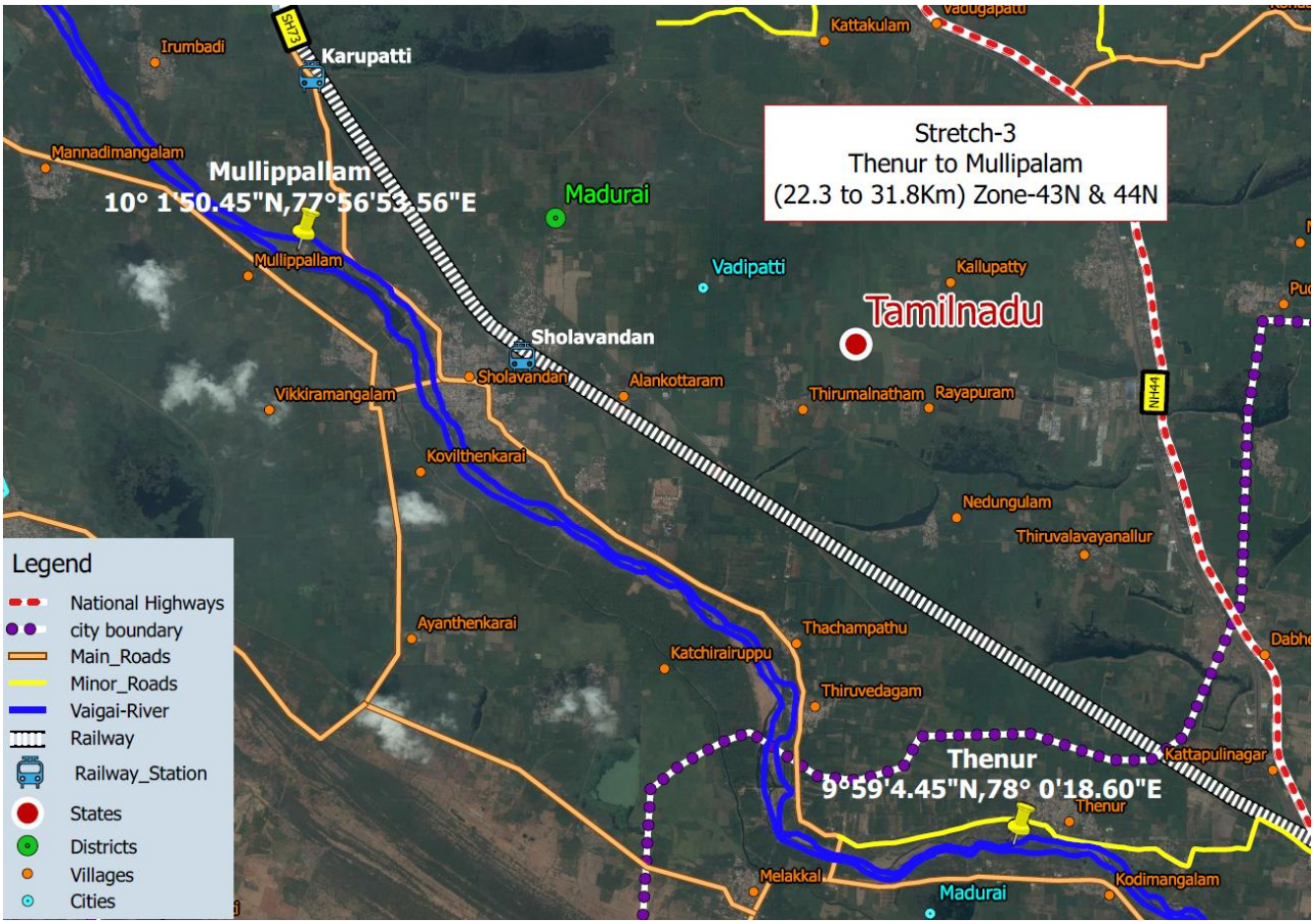


Figure 11 - Stretch-03 Thenur to Spillage dam near Mullipalam

- **Bathymetry Survey**
  a) No bathymetric survey is conducted due to the unavailability of water
- **Topographic Survey**
  b) 9.5 km of the length of the stretch for which the topographic survey has been carried out.

This stretch is between 22.3 to 31.8 km chainage of Vaigai River with sandy river bed. The water availability in this stretch is very less and the water quality is good in this stretch. Several pump houses for drinking water supply are present in this area. The major portions of the river banks are non-protected in nature with no sight of erosion and of Sholavandan Town is located on the left bank side of 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	22.3	22.7	0.000	0.000	400	16,013.94	964,089.73	-0.300	0.000	400	20,684.41	1,239,673.56
II	22.3	22.7	0.000	0.000	400	24,387.42	1,468,445.87	-0.300	0.000	400	30,391.81	1,823,136.36
III	22.3	22.7	0.000	0.000	400	36,863.90	2,219,317.28	-0.300	0.000	400	44,314.25	2,659,745.06
IV	22.3	22.7	0.000	0.000	400	44,482.86	2,677,805.84	-0.300	0.000	400	52,266.44	3,137,942.79

Zone 43N												
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	22.7	24.8	0.000	0.000	2100	85,092.70	85,092.70	-0.300	0.000	2100	109,048.20	109,048.20
I	24.8	30.5	0.000	0.000	5700	244,381.40	329,474.10	-0.300	0.000	5700	311,452.80	420,501.00
I	30.5	31.6	0.000	0.000	1100	47,358.60	376,832.70	-0.300	0.000	1100	59,461.00	479,962.00
I	31.6	31.8	0.000	0.000	200	8,638.80	385,471.50	-0.300	0.000	200	11,158.10	491,120.10
II	22.7	24.8	0.000	0.000	2100	129,601.70	129,601.70	-0.300	0.000	2100	160,452.70	160,452.70
II	24.8	30.5	0.000	0.000	5700	372,234.20	501,835.90	-0.300	0.000	5700	458,572.80	619,025.50
II	30.5	31.6	0.000	0.000	1100	72,130.30	573,966.20	-0.300	0.000	1100	87,823.50	706,849.00
II	31.6	31.8	0.000	0.000	200	13,158.50	587,124.70	-0.300	0.000	200	16,397.80	723,246.80
III	22.7	24.8	0.000	0.000	2100	200,888.60	200,888.60	-0.300	0.000	2100	240,307.40	240,307.40
III	24.8	30.5	0.000	0.000	5700	562,592.60	763,481.20	-0.300	0.000	5700	669,882.40	910,189.80
III	30.5	31.6	0.000	0.000	1100	109,014.60	872,495.80	-0.300	0.000	1100	128,589.80	1,038,779.60
III	31.6	31.8	0.000	0.000	200	19,887.20	892,383.00	-0.300	0.000	200	23,906.20	1,062,685.80
IV	22.7	24.8	0.000	0.000	2100	242,546.60	242,546.60	-0.300	0.000	2100	283,779.20	283,779.20
IV	24.8	30.5	0.000	0.000	5700	678,849.00	921,395.60	-0.300	0.000	5700	791,020.90	1,074,800.10
IV	30.5	31.6	0.000	0.000	1100	131,537.30	1,052,932.90	-0.300	0.000	1100	152,060.80	1,226,860.90
IV	31.6	31.8	0.000	0.000	200	23,996.40	1,076,929.30	-0.300	0.000	200	28,195.50	1,255,056.40

Table 19 - Stretch 3 Dredging Quantity

3.3.1 Stretch-3 River-bed Profile

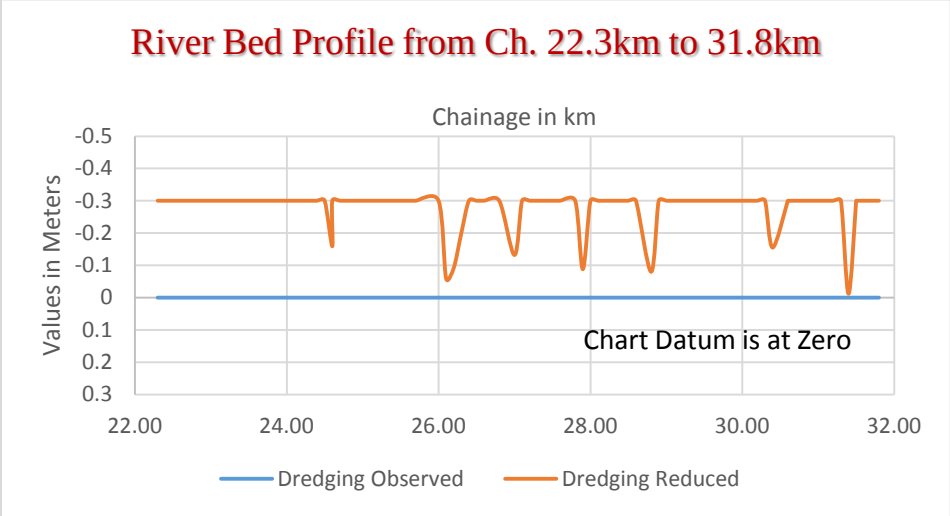


Figure 12 - Stretch 3 River-bed Profile

3.4 Spillage Dam near Mullipalam to Peranai Regulator (31.8km to 45.6 km)

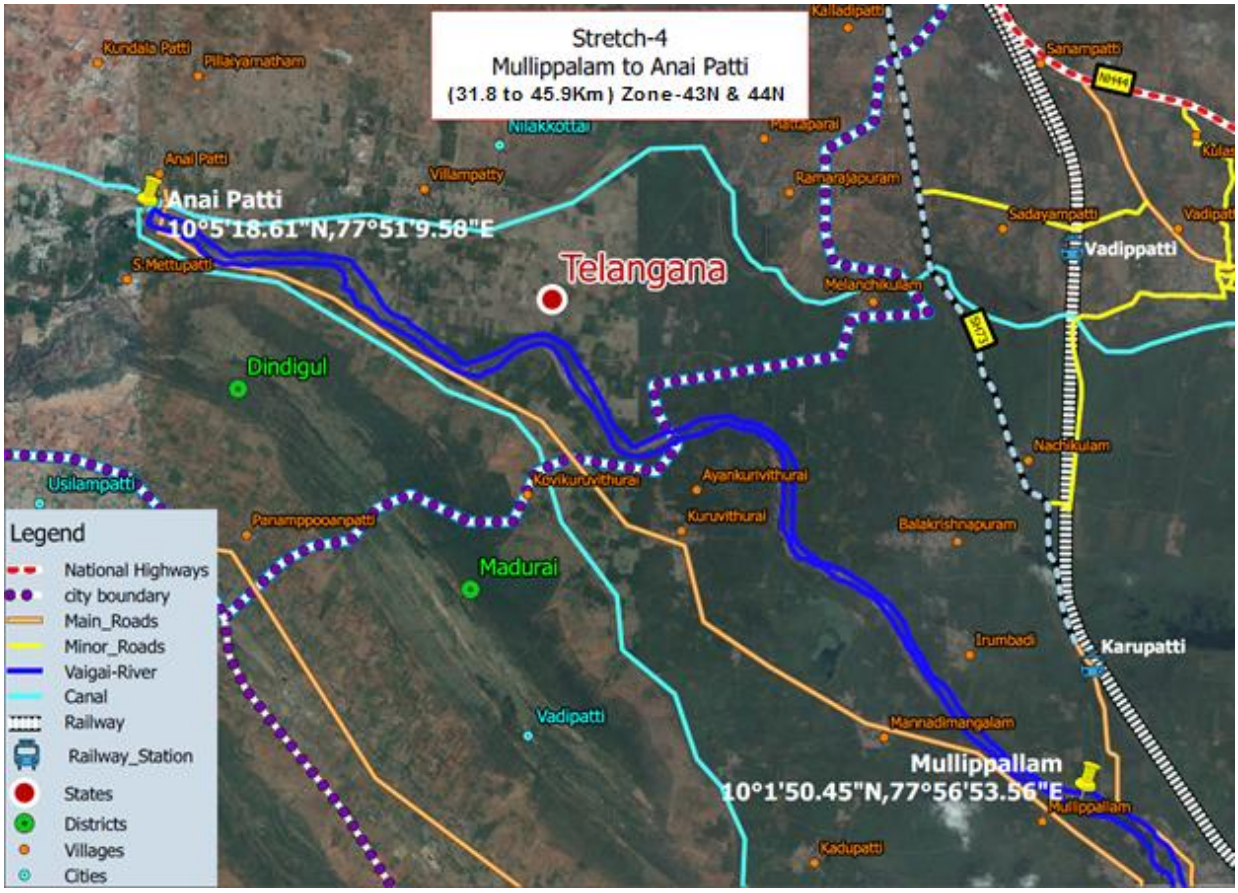


Figure 13 - View of Vaigai River – Stretch-04

- **Bathymetry Survey**
  a) No bathymetric survey is conducted due to the unavailability of water
- **Topographic Survey**
  b) 13.8 km of the length of the stretch for which the topographic survey has been carried out.

This stretch is between 31.8 to 45.6 km chainage of Vaigai River with sandy river bed. The water availability in this stretch is also very less and several pump house for drinking water supply are also present in this area. The river banks consist primarily of coconut farms and paddy fields. No major town/cities are present in the area. The major portions of the river banks are non-protected in nature and the river banks are prominently defined throughout 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	31.8	41.4	0.000	0.000	9600	412,410.70	797,882.20	-0.300	0.000	9600	526,441.50	1,017,561.60
I	41.4	45.6	0.000	0.000	4200	179,880.00	977,762.20	-0.300	0.000	4200	230,082.00	1,247,643.60
II	31.8	41.4	0.000	0.000	9600	628,152.10	1,215,276.80	-0.300	0.000	9600	775,269.10	1,498,515.90
II	41.4	45.6	0.000	0.000	4200	273,984.30	1,489,261.10	-0.300	0.000	4200	338,734.70	1,837,250.60
III	31.8	41.4	0.000	0.000	9600	949,351.60	1,841,734.60	-0.300	0.000	9600	1,132,574.20	2,195,260.00
III	41.4	45.6	0.000	0.000	4200	414,086.10	2,255,820.70	-0.300	0.000	4200	494,608.20	2,689,868.20
IV	31.8	41.4	0.000	0.000	9600	1,145,515.40	2,222,444.70	-0.300	0.000	9600	1,337,091.50	2,592,147.90
IV	41.4	45.6	0.000	0.000	4200	499,647.60	2,722,092.30	-0.300	0.000	4200	583,798.00	3,175,945.90

Table 20 - Stretch 4 Dredging Quantity

3.4.1 Stretch-4 River-bed Profile

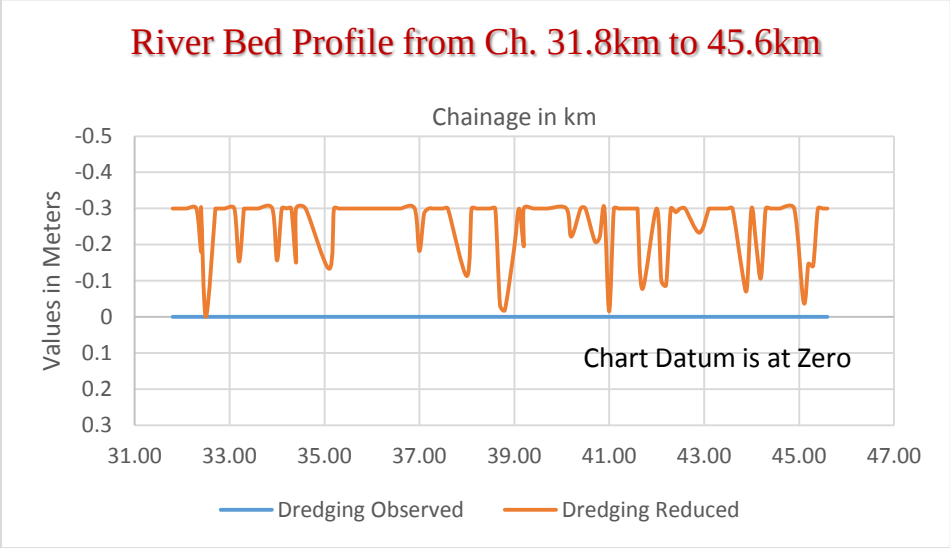


Figure 14 - Stretch 4 River-bed Profile

3.5 Other Aspects of Waterway

3.5.1 Fishing

No fishing activities exist on the entire survey stretch of the Vaigai River. No scope of fishing do exists in the river due to non-availability of water during summer season. The fishing boats/any other type country boats are also not available in the Vaigai River due to low depths.

3.5.2 Industries

No Large scale industries exist near to the survey area. Some small scale industries and cement factories are situated on the RBS of Vaigai River near to Madurai city. The LBS of Vaigai River near Madurai city is used mainly for residential purpose.

3.5.3 Crops

The river banks are spread with coconut trees along with other vegetation on the entire stretch of the river. The paddy cultivation is very prominent for the entire area. The irrigational canals from the Vaigai River support the paddy fields and coconut farms of the area. No other seasonal crops are found in the area. Thick Vegetation and shrubs in the river banks possess main hindrance for the topo survey.

Figure 15 - Thick shurbs and Coconut trees on river bank of Vaigai (28.3 km chainage)

3.5.4 Settlements

The overall River banks are moderately populated for the entire survey stretch. The Madurai city is located on the stretch-01 of the Vaigai River. The both river banks in the stretch-01 is densely populated. The small clusters of settlements and town are located on stretch 02 and stretch-03 of Vaigai River. The stretch-04 area are sparsely populated and coconut plantations are present in the area. All these stretches are well connected with the roads and state run public transport system.

3.5.5 Drinking Water

The water from Vaigai River is the primary source of Drinking water for the Madurai city and all other towns situated near by to the river. Several pumping stations are present in the Vaigai River for supply of drinking water and the water available in the river along with the ground water is extensively used to fulfil the water supply demand of the area. There are many spillage dams present in the river stretch to facilitate the water availability for the pump house in the area.

Figure 16 - Drinking Water Pump houses on Vaigai River (25.0 km chainage)

3.5.6 Important Cities/Towns

The towns situated near to Vaigai River are Madurai City. And various towns are also situated near to the river banks. These are small towns which are connected with frequent state transport buses runs from Madurai City. Local Taxis and Autos are also available occasionally along the entire River stretch, and these can be made available from the nearby towns.

3.5.7 Transportation

3.5.7.1 Road Network

The both sides of Vaigai River is well connected with road network and frequent state transport buses runs from Madurai City to different areas. Local Taxis and Autos are also available along the entire River stretch. All major road networks line national and state highway is limited to the Stretch-01 only. The details of National Highway present in the project influence area are NH-44, NH-85 and NH-38 which connects Madurai City. The state Highways SH-72A, SH-72 and SH-33 also connects Madurai city.

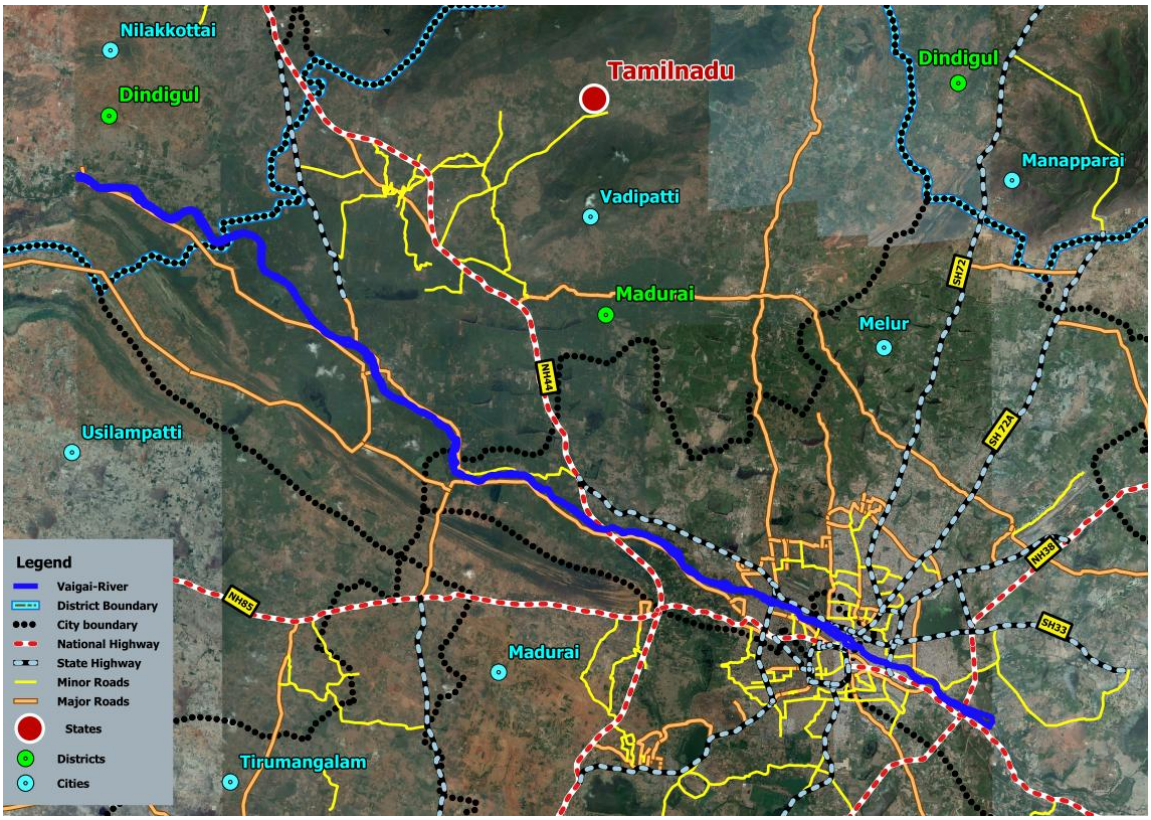


Figure 17 - Road Network

3.5.8 Rail Network

The Madurai- Dindigul railway network from Madurai City runs parallel to the Vaigai Left Bank Side up to Sholavandan and then diverts towards Vandipatti and leads to Dindigul. The stations are near and approachable from the area near Vaigai River. Madurai Junction is the important railway station near to the survey stretch of Vaigai River.

3.5.9 Land Use

The Madurai city is situated near to the river banks of Vaigai River. The land near Madurai city used for commercial and residential purpose. The small scale industries are situated on the Right bank side of Vaigai River near Viraganoor. The land on the remaining stretches of Vaigai River is utilized for agricultural purpose like coconut farms and paddy fields.

3.5.10 Construction Material

The area being near to Madurai city, all type of modern construction materials like cement, Iron etc. are available in bulk quantity. Vaigai River is sandy in nature but not type of sand mining activities are observed on the survey stretch of Vaigai River.

3.5.11 Cargo Movement

The cargo movement is not envisaged for the some small scale industries present near to the Viraganoor area. No cargo movement or passenger movement is expected to be there in this stretch of Vaigai River.

3.5.12 Passenger Ferry Services

No passenger ferry service is available in the survey stretch of the Vaigai River.

3.5.13 Historic importance

The Madurai City is the one of the Historical place situated near to the Vaigai River.

3.5.14 Tourism

The Madurai Meenakshi Temple is the prominent tourist spot situated near to the Vaigai River.

3.5.15 Irrigation Canals and Outlets

The water of Vaigai River is utilized exclusively for irrigation projects at various locations. The water supply for the coconut farms and paddy fields is facilitated through these canals from Vaigai River. The details of inlet and outlet canal present in the area are as follows:

Sl. No.	Canals	Chainage (km)	Type	Description
01	Iravadanalur Canal	0	Inlet Canal	The canal is situated near the Viraganoor Regulator. The canal originates from the Vandiyur lake and the excess water is flown from the Vandiyur lake to the Viraganoor Regulator.
02	Virangalur Canal	0.7	Outlet Canal	This irrigational canal is situated near to the Viraganoor Regulator. The Canal mouth is slightly elevated in nature so as the excess water from the Viraganoor regulator will only discharged to the canal.
03	Mullipalam Canal	31.8	Outlet Canal	This irrigational canal is situated near to the Mullipalam check dam. The canal run nearly parallel to the Vaigai River and diverts to Thanakkankulam. This is the prime

				source of water supply for the coconut farms and paddy fields of the area.
04	Thenkarai Canal	41.8	Outlet Canal	This irrigational canal is situated near to the Thenkarai spillage dam. The canal runs between the coconut plantation and paddy fields and finally joins the Thenkarai Pond.

Table 21 - Details of Canals

4 Terminals

The Vaigai River is 45.6 Km in length with various barrages and obstructions in the survey stretches. The water availability being very low on the river, there are no boats operation in the entire survey stretch of the Vaigai River.

4.1 Proposed Locations for Construction of New Terminals

The locations of the terminals can be considered on the upstream of Viraganoor barrage for tourism purpose only. The detail of the proposed location for construction of terminal is as follows:-

Sl. No.	Location	Lat	Long	Land Use	Owner
01	Viraganoor	09°53'49.08"N	78°10'29.45"E	Upstream of Viraganoor	Tamilnadu State PWD(Irrigation) Department
	The proposed location is on the upstream of Viraganoor Regulator and is 10 Km from Madurai City. The area is well connected with road network. The Depth in the area need to be improved for the berthing of boats throughout the period. There are some cement manufacturing industries situated near to the proposed location but the feasibility of cargo movement aspect is very less.				

Table 22 - Proposed Terminals

5 Fairway Development

The Vaigai River is south -Eastern flowing river with no major sharp curves or deviation of river stream

5.1 Fairway Dimensions

As per the specification of the survey, dredging quantity was required to be estimated for different channel classifications along the deepest route. Class-IV channel with dimension 50m width, 2m depth and side slop of 1:5 is shown below.

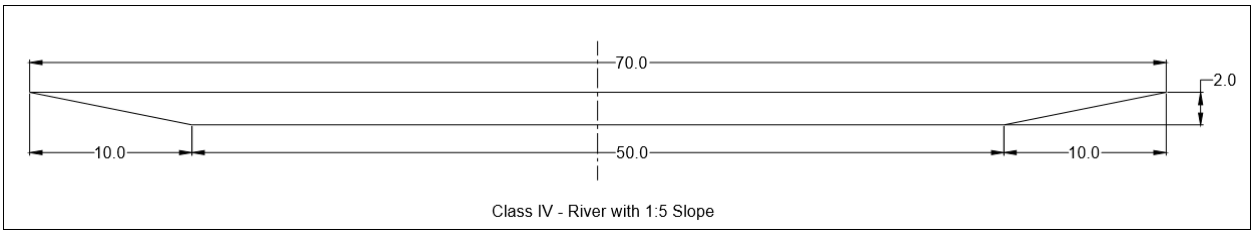
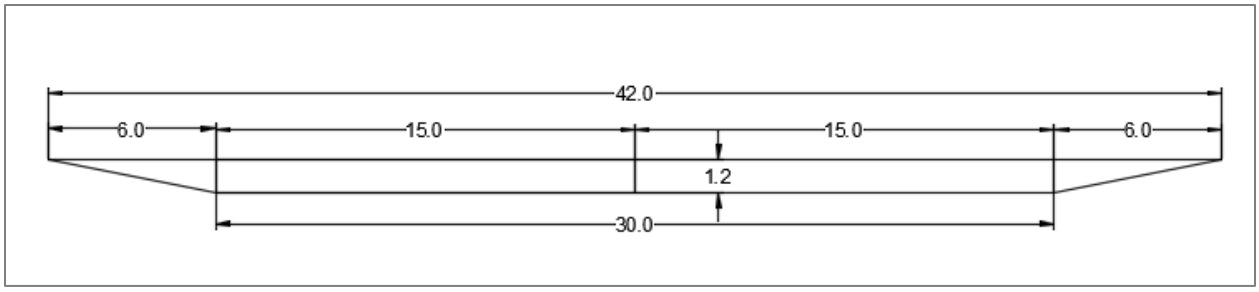


Figure 18 - Fairway Channel Dimensions

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 kilo meter wise dredging calculation was carried out. (Enclosed at Annexure-2) 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



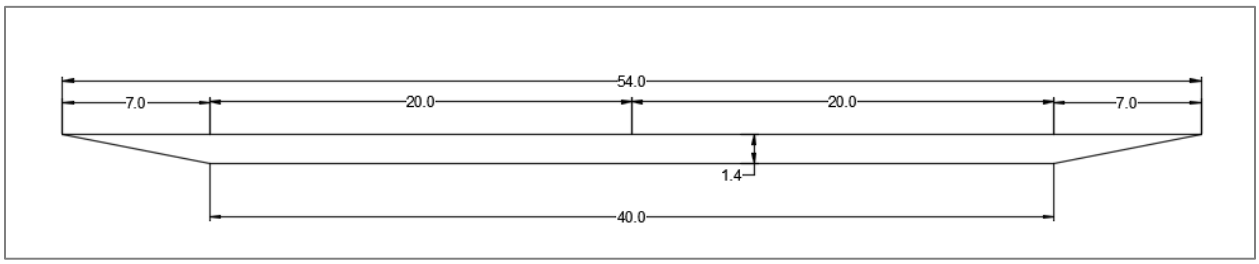
Class I-44N													
Location		Chainage (km)		Observed					Reduced w.r.t. Sounding Datum				
From	To	From	To	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Accumulated Qty.	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Accumulated Qty.
Viraganoor Regulator	Bridge near Keelamathur	0	17.8	0.000	0.000	17800	756,018.96	756,018.96	-0.300	0.000	17800	972,784.06	972,784.06

Class I-44N													
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.
Bridge near Keelamathur	Thenur	17.8	22.3	0.000	0.000	4500	192,056.83	948,075.79	-0.300	0.000	4500	246,205.09	1,218,989.15
Thenur	Thenur	22.3	22.7	0.000	0.000	400	16,013.94	964,089.73	-0.300	0.000	400	20,684.41	1,239,673.56
Total						**22700**	**964,089.73**	**964,089.73**	**Total**		**22700**	**1,239,673.56**	**1,239,673.56**

Class I-43N													
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.
Thenur	Mullipalam Spillage Dam	22.7	31.8	0.000	0.000	9100	385,471.50	1,349,561.23	-0.300	0.000	9100	491,120.10	1,730,793.66
Mullipalam Spillage Dam	Peranai Regulator	31.8	45.6	0.000	0.000	13800	592,290.70	1,941,851.93	-0.300	0.000	13800	756,523.50	2,487,317.16
				Total		**22900**	**977,762.20**	**1,941,851.93**	**Total**		**22900**	**1,247,643.60**	**2,487,317.16**

Table 23 - Dredge Volumes Class-I

Class II



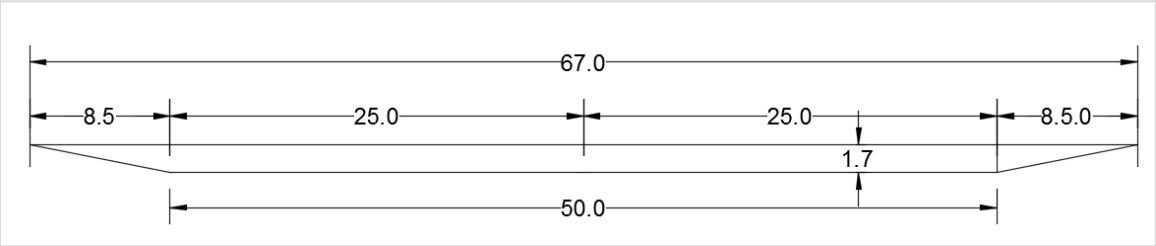
Class II-44N													
Location		Chainage (km)		Observed					Reduced w.r.t. Sounding Datum				
From	To	From	To	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Accumulated Qty.	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Accumulated Qty.
Viraganoor Regulator	Bridge near Keelamathur	0	17.8	0.000	0.000	17800	1,151,527.39	1,151,527.39	-0.300	0.000	17800	1,430,456.68	1,430,456.68
Bridge near Keelamathur	Thenur	17.8	22.3	0.000	0.000	4500	292,531.06	1,444,058.45	-0.300	0.000	4500	362,287.87	1,792,744.55
Thenur	Thenur	22.3	22.7	0.000	0.000	400	24,387.42	1,468,445.87	-0.300	0.000	400	30,391.81	1,823,136.36
					Total	**22700**	**1,468,445.87**	**1,468,445.87**		**Total**	**22700**	**1,823,136.36**	**1,823,136.36**

Class II-43N

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.
Thenur	Mullipalam Spillage Dam	22.8	31.8	0.000	0.000	9100	587,124.70	2,055,570.57	-0.300	0.000	9100	723,246.80	2,546,383.16
Mullipalam Spillage Dam	Peranai Regulator	31.8	45.6	0.000	0.000	13800	902,136.40	2,957,706.97	-0.300	0.000	13800	1,114,003.80	3,660,386.96
			Total			**22900**	**1,489,261.10**	**2,957,706.97**		**Total**	**22900**	**1,837,250.60**	**3,660,386.96**

Table 24 - Dredge Volumes Class-II

Class III

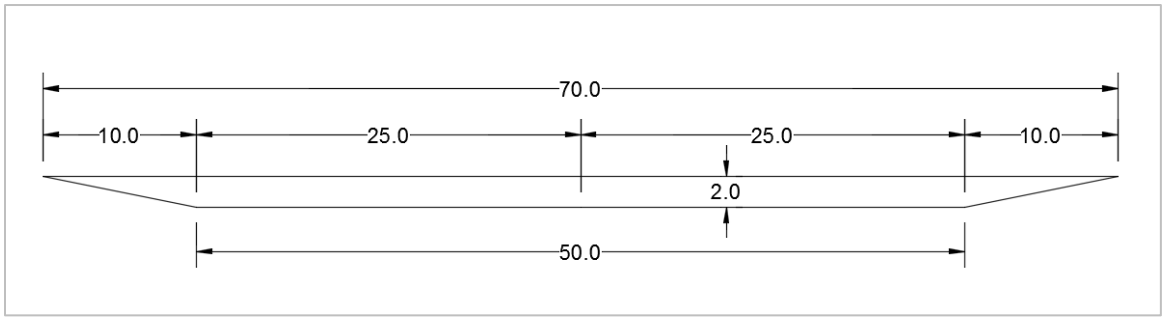


Class III-44N													
Location		Chainage (km)		Observed					Reduced w.r.t. Sounding Datum				
From	To	From	To	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Accumulated Qty.	Min. Depth (m)	Max. Depth (m)	Length of Shoal (m)	Dredging Qty. (cu.m.)	Accumulated Qty.
Viraganoor Regulator	Bridge near Keelamathur	0	17.8	0.000	0.000	17800	1,740,323.34	1,740,323.34	-0.300	0.000	17800	2,086,563.55	2,086,563.55
Bridge near Keelamathur	Thenur	17.8	22.3	0.000	0.000	4500	442,130.04	2,182,453.38	-0.300	0.000	4500	528,867.26	2,615,430.81
Thenur	Thenur	22.3	22.7	0.000	0.000	400	36,863.90	2,219,317.28	-0.300	0.000	400	44,314.25	2,659,745.06
			Total			**22700**	**2,219,317.28**	**2,219,317.28**		**Total**	**22700**	**2,659,745.06**	**2,659,745.06**

Class III-43N													
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.
Thenur	Mullipalam Spillage Dam	22.7	31.8	0.000	0.000	9100	892,383.00	3,111,700.28	-0.300	0.000	9100	1,062,685.80	3,722,430.86
Mullipalam Spillage Dam	Peranai Regulator	31.8	45.6	0.000	0.000	13800	1,363,437.70	4,475,137.98	-0.300	0.000	13800	1,627,182.40	5,349,613.26
			Total			**22900**	**2,255,820.70**	**4,475,137.98**		**Total**	**22900**	**2,689,868.20**	**5,349,613.26**

Table 25 - Dredge Volumes Class-III

Class IV



Class IV-44N													
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.
Viraganoor Regulator	Bridge near Keelamathur	0	17.8	0.000	0.000	17800	2,099,830.93	2,099,830.93	-0.300	0.000	17800	2,461,522.78	2,461,522.78
Bridge near Keelamathur	Thenur	17.8	22.3	0.000	0.000	4500	533,492.05	2,633,322.98	-0.300	0.000	4500	624,153.57	3,085,676.35
Thenur	Thenur	22.3	22.7	0.000	0.000	400	44,482.86	2,677,805.84	-0.300	0.000	400	52,266.44	3,137,942.79
					Total	**22700**	**2,677,805.84**	**2,677,805.84**		**Total**	**22700**	**3,137,942.79**	**3,137,942.79**

Class IV-43N													
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.
Thenur	Mullipalam Spillage Dam	22.7	31.8	0.000	0.000	9100	1,076,929.30	3,754,735.14	-0.300	0.000	9100	1,255,056.40	4,392,999.19
Mullipalam Spillage Dam	Peranai Regulator	31.8	45.6	0.000	0.000	13800	1,645,163.00	5,399,898.14	-0.300	0.000	13800	1,920,889.50	6,313,888.69
					Total	**22900**	**2,722,092.30**	**5,399,898.14**		**Total**	**22900**	**3,175,945.90**	**6,313,888.69**

Table 26 - Dredge Volumes Class-IV

6 Conclusion

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

6.1 Description of Waterways

The surveyed stretch of Vaigai River is 45.6 km in length and is not being explored for any navigational possibility. This survey stretch starts from the Peranai Regulator to Viraganoor Regulator. The stretch wise minimum and maximum width range, average width and average slope of the waterway are as below:-

S.No.	Location		Chaiange (km)		Width Range of the waterway		Average Width	Average slope (in m/km)
	From	To	From	To	Min	Max		
1	Viraganoor Regulator	Keelamathur	0.0	17.8	19.037	373.31	93.664	1 : 0.943
2	Keelamathur	Thenur	17.8	22.2	40.015	135.32	77.095	1 : 1.991
3	Thenur	Mullipalam Spillage Dam	22.2	31.8	24.239	242.6	93.985	1 : 1.66
4	Mullipalam Spillage Dam	Peranai Regulator	31.8	45.6	38.486	264.77	111.303	1 : 1.495

Table 27 - Stretch wise Average width and slope of waterway

6.2 Methods for making waterway feasible

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

Class	0-17.8km	17.8-22.3km	22.3-31.8km	31.8-45.6km	Total
I	972,784.06	246,205.09	511,804.51	756,523.50	**2,487,317.16**
II	1,430,456.68	362,287.87	753,638.61	1,114,003.80	**3,660,386.96**
III	2,086,563.55	528,867.26	1,107,000.05	1,627,182.40	**5,349,613.26**
IV	2,461,522.78	624,153.57	1,307,322.84	1,920,889.50	**6,313,888.69**

Table 28 - 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 waterway is used mainly for irrigation purpose and drinking water supply. The spillage dams are used for canal irrigation purpose and the water through the side way canals are used at large extent for coconut and paddy cultivation lands. A major capital dredging will not improve the depth of the channel as there is no facility to retain the water throughout the stretch. The construction of Barrage with Navigational channel & Navigational lock on the downstream of the required navigational waterway needs to be considered to maintain the water depth. However, the continuous gradient and motive of the river is also need to be considered for any alteration on the channel design. The class-wise details of reduced depth at different stretches of the waterways are as tabulated below:-

Sl.	Chaiange (km)	< 1.2	1.2 - 1.4	1.5 - 1.7	1.8 - 2.0	> 2.0

No	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	17.8	17.8	100%	0	0 %	0	0 %	0	0 %	0	0 %
2	17.8	22.3	4.5	100%	0	0 %	0	0 %	0	0 %	0	0 %
3	22.3	31.8	9.5	100%	0	0 %	0	0 %	0	0 %	0	0 %
4	31.8	45.6	13.8	100%	0	0 %	0	0 %	0	0 %	0	0 %
			45.6	**100%**	**0**	**0 %**	**0**	**0 %**	**0**	**0 %**	**0**	**0 %**

Table 29 - Class-wise availability of reduced depth of the waterway

6.3 Modifications/ improvement measures

Improvement measures for design and depth improvement is required on first phase of the development. River banks being very prominently structured and no signs of erosion of river banks are found in the entire stretch of Vaigai River. The limitation for improvement of navigational aspects includes the gradient of the river, non-availability of the water throughout the period and presence of various check dams. 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	16	4	0	0
II	16	9		
III	16	11		
IV	16	14		

Table 30 - Bridges and HTL Clearances less than Class no.

6.4 Recommendation

There is no major scope for navigational aspect of the waterway due to its geographic condition and non-availability of water throughout the season. The river banks are well connected with road network and major distribution of settlements are there near to Madurai City. The road is near parallel on both sides throughout the river stretch. On discussion with the Assistant engineers of both regulators, no scope for the future development of the river was recommended for navigational purpose. There are no major industries present in the area, the scope of cargo transportation is also very limited due to availability of good road transportation on both sides of the river. Boat jetties may be constructed at the upstream of Viraganoor Dam for tourism purpose only. No scope for the future development of the River was recommended for navigational purpose and the survey Stretch is not-viable for development as navigable channel.

The purpose of the survey was for assessing the river stretch from Viraganoor Dam to Anai Patti for development of water transport facilities in the new National Waterway (NW-107). 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.

7 Details of Annexures

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