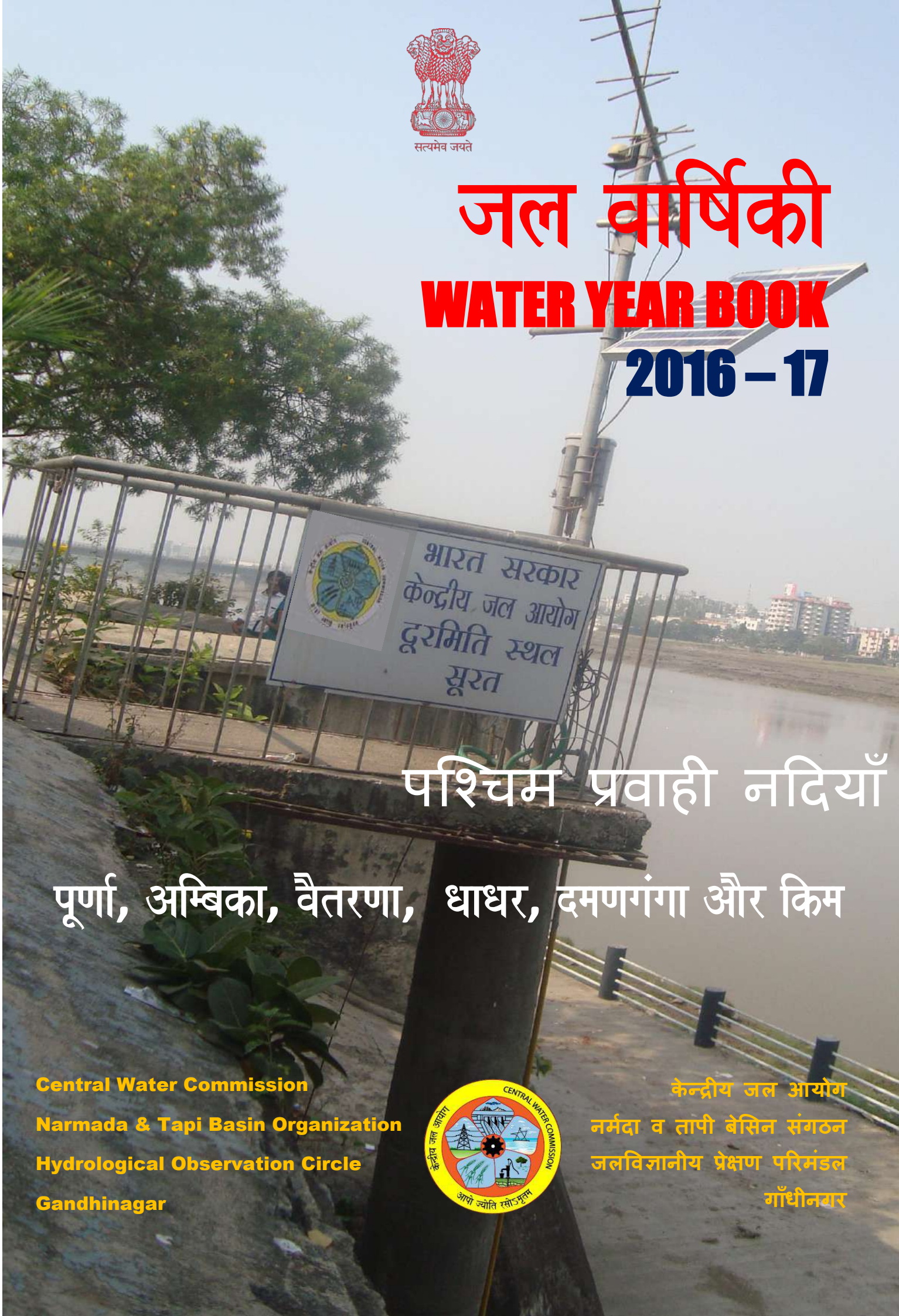
सत्यमेव जयते

जल वार्षिकी

WATER YEAR BOOK

2016 – 17



पश्चिम प्रवाही नदियाँ

पूर्णा, अम्बिका, वैतरणा, धाधर, दमणगंगा और किम

Central Water Commission

Narmada & Tapi Basin Organization

Hydrological Observation Circle

Gandhinagar

केन्द्रीय जल आयोग

नर्मदा व तापी बेसिन संगठन

जलविज्ञानीय प्रेक्षण परिमंडल

गाँधीनगर

आमुख

राष्ट्रीय जल नीति में मानकीकृत राष्ट्रीय सूचना प्रणाली डेटा वेस और डेटा वैंकों के एक नेटवर्क के साथ गुणवत्ता के आँकड़े उपलब्ध कराने और प्रसंस्करण क्षमताओं में सुधार के लिए मौजूदा केन्द्रीय और राज्य स्तरीय ऐजेन्सियों के एकीकरण की आवश्यकता पर वल दिया गया है। जल के वहु -उपयोगी स्वरूप एवं उसकी वढ़ती मांग को पूरा करने हेतु संसाधनों के अनुकूलतम नियोजन के संदर्भ में संवंधित आँकड़ों का संकलन अतिमहत्वपूर्ण है।

केन्द्रीय जल आयोग. जल संसाधनों के विकास में संलग्न भारत सरकार जल संसाधन मंत्रालय के अन्तर्गत देश की एक शीर्षस्थ तकनीकी संस्था है जो जल विज्ञानीय आँकड़ों के एकत्रीकरण से लेकर परियोजनाओं का मूल्यांकन,अभिकल्पन, प्रवोधन तथा परिचालन करती है।

जल विज्ञानीय प्रेक्षण परिमंडल गाँधीनगर नर्मदा तापी वेसिन संगठन के अन्तर्गत केन्द्रीय जल आयोग की एक क्षेत्रीय ईकाई है जिसके अन्तर्गत गुजरात, मध्य प्रदेश, महाराष्ट्र,राजस्थान, दमन एवं दीव एवं दादरा नगर हवेली (केन्द्र शासित प्रदेश) के भाग से होकर पश्चिम की ओर वहने वाली **17** नदियों के अधिसूचित महत्वपूर्ण स्थलों पर जल के सतही प्रवाह के आँकड़े एकत्रित किए जाते हैं।

तापी मंडल, सूरत द्वारा पश्चिम प्रवाही स्वतंत्र नदियों पूर्णा,अम्विका,वैतरणा, धाधर,दमणगंगा और किम पर वर्तमान में **7** स्थलों पर सतही प्रवाह का प्रेक्षण किया जा रहा है। इनके आँकडों इस वार्षिकी **2016-17** में संकलित किए गए हैं।

जल वर्ष **2005-06** से जल वार्षिकी का प्रकाशन केन्द्रीय जल आयोग द्वारा निर्धारित स्वरूप (SWDES) में किया जा रहा है। इस वार्षिकी में सतही प्रवाह के आँकड़ों के साथ - साथ वेसिन से संवंधित सूचनाएँ जैसे कि जलवायु भूगर्भ विज्ञान कृषि भूमि आदि भी दिये गए हैं।

इस वार्षिकी में दी गयी सूचना एवं संकलित आँकड़े उन सभी के लिये उपयोगी होंगे जो जल संसाधन से संवंधित किसी भी क्षेत्र में रूचि रखते हैं ऐसी आशा है। इसे और उपयोगी वनाने हेतु सुझाव आमंत्रित हैं।

वार्षिकी में प्रकाशित आँकड़ों के संकलन, विश्लेपण तथा प्रकाशन हेतु नर्मदा - तापी वेसिन संगठन के अधीनस्थ जल विज्ञानीय प्रेक्षण परिमंडल गांधीनगर एवं तापी मंण्डल, सूरत के अधिकारियों एवं कर्मचारियों ने जिस समर्पण एवं लगन से कार्य संपादित किया है, वह प्रशंसनीय है।

(विमल कुमार)
अधीक्षण अभियंता

गांधीनगर (गुजरात)
नवम्वर -2017

Preface

The National Water Policy stresses the need for a standardised national information system with a network of data base and data banks, integrating the existing Central and State agencies for providing quality data and improving the processing capabilities. Collection and compilation of data assumes greater importance in the context of optimal resource planning to meet the ever increasing demand for water in its multi-faceted use.

Central Water Commission is an apex organization of the country concerned with planning, development and monitoring in water resources sector. CWC has been maintaining Hydrological Observation & Flood forecasting network for a long time, which covers almost all the interstate rivers of India.

Hydrological Observation (HO) Circle, Gandhinagar, a field unit in Narmada Tapi Basin Organization of the Central Water Commission, is entrusted with the Hydrological Observation in 17 river basins of Gujarat, Madhya Pradesh, Maharashtra, Rajasthan, DNH (UT) and Daman & Diu (UT).

The Tapi Division, headquartered at Surat, under HO Circle, Gandhinagar is at present, carrying out hydrological observations at 7 sites on independent West flowing rivers viz. Purna, Ambica, Vaitarna, Dhadhar, Damanganga & Kim and its tributaries, which have been compiled in this Water Year Book 2016-17.

The publication of Water Year Book in SWDES format has been started since the water year 2005-06 as per guidelines issued by Central Water Commission, New Delhi. This Year Book not only provides the hydrological data but also provides general information about geology, climate, agriculture, soil, cities/towns, major and medium projects in the basin, etc.

It is hoped that the information and data compiled herein will be useful to all those concerned with any field related with water resources of the country. Comments and suggestions, if any, on the Water Year Book are most welcome.

The efforts put in by all the concerned officers and staffs of Tapi Division, Surat and Hydrological Observation Circle, Gandhinagar under NTBO, Central Water Commission is gratefully acknowledged.

Vimal Kumar

(Vimal Kumar)
Superintending Engineer

Gandhinagar (Gujarat)
November - 2017

C o n t e n t s

List of Plates and Figures

List of Tables

Abbreviations and symbols

Av	:	Average
Ann	:	Annual
A.G.R.	:	Automatic Gauge Recorder
C	:	Centigrate
Cum	:	Cubic meter
Cumec	:	Cubic meter per second
c/s	:	Cross section
C.W.C.	:	Central Water Commission
D	:	Days
Dis	:	Discharge
F	:	Float Observation
F.F.	:	Flood Forecasting
G	:	Gauge
GD	:	Gauge and Discharge
GDS	:	Gauge, Discharge and Sediment
GDWQ	:	Gauge, Discharge and Water Quality
GDSWQ	:	Gauge, Discharge, Sediment and Water Quality
GTS	:	Great Trigonometrical Survey
Hrs.	:	Hours
IWYB	:	Integrated Water Year Book
WYB	:	Water Year Book
km	:	Kilo meter
M	:	Million
m	:	Meter
mm	:	milli meter
m^3/s	:	Cubic meter per second
Mm3 / MCM	:	Million Cubic meter
Max.	:	Maximum
Min.	:	Minimum
m.s.l.	:	Mean sea level
MD	:	Mahi Division, CWC, Gandhinagar
neg.	:	Negligible
NNW	:	National Net Work
R.Days	:	Remaining days
R.L.	:	Reduced Level
R.D.	:	Reduced Distance
R.C.C.	:	Reinforced Cement Concrete
sq km	:	Square Kilometer
TD	:	Tapi Division, CWC, Surat
WQ	:	Water Quality
W.L.	:	Water Level
W.Year	:	Water Year
WRID	:	Water Resources Investigation Division, Ahmadabad
WRI C	:	Water Resources Investigation Circle, Ahmadabad
80 Key	:	80 Key Hydrological Station Scheme
163 Key	:	163 Key Hydrological Station Scheme
^{0}, ‘ . “	:	Degree (30^0) Minutes(56’) Seconds (35”)
*	:	Estimated Discharge
#	:	Discarded and estimated discharge

1.0 Introduction

1.1 General

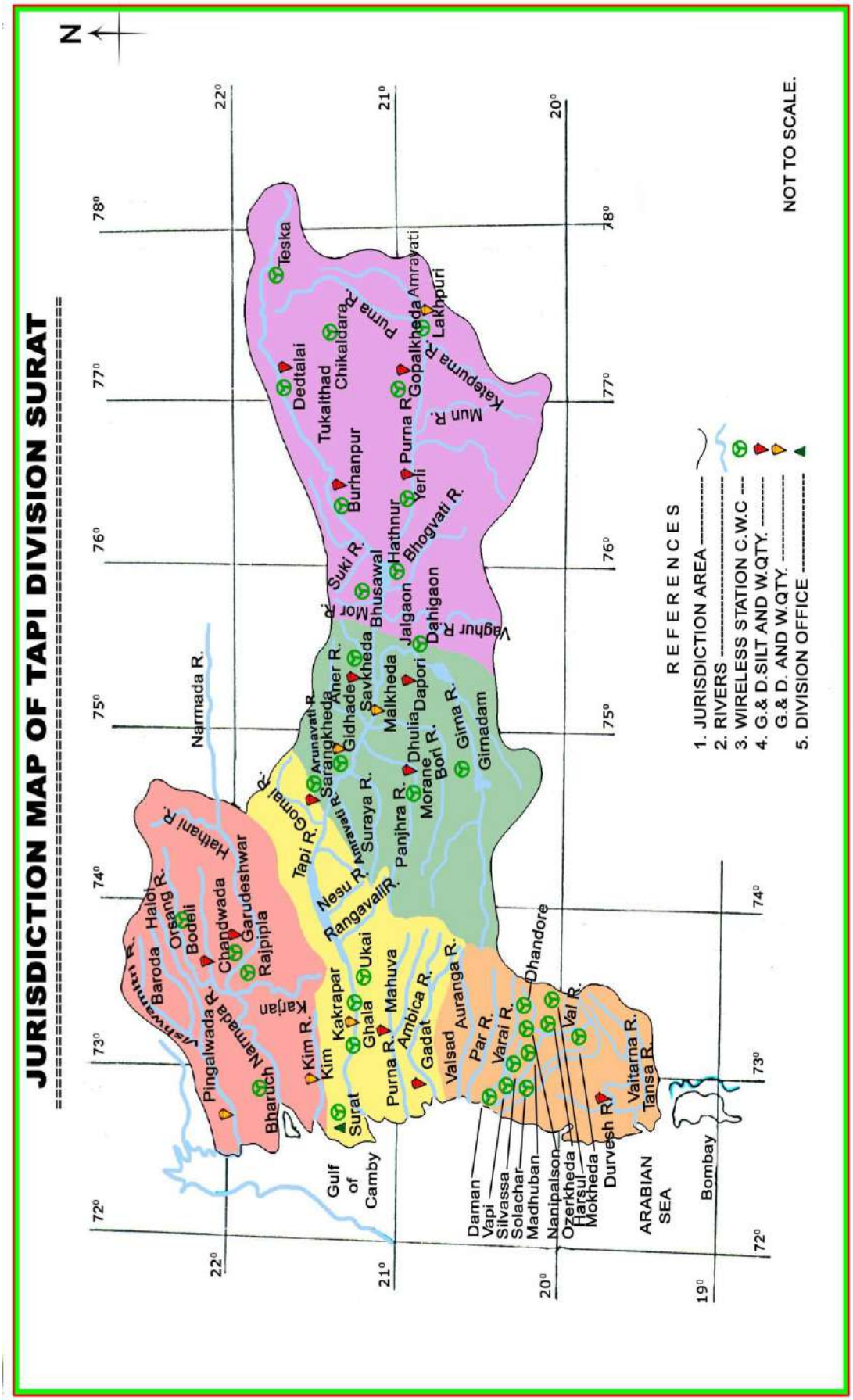
This water year book presents data of seven hydrological observation stations, along with general information about basins and trend analysis for annual runoff, for the water year 2016-17 in Purna, Vaitarna, Ambica, Dhadhar, Kim, Wagh and Damanganga rivers. The data of 07 sites which are included in this book are collected by Tapi division, Central Water Commission, Surat under Hydrological Observation Circle, Gandhinagar. Jurisdiction map of Tapi division, CWC, Surat is enclosed at **Plate-1**. Central Water commission is conducting hydrological observations on major west flowing river basins under various schemes viz. national network (NNW), 80-key stations, 163- key stations and flood forecasting (FF). The scheme wise distributions of sites are shown in the **table-1**.

Table-1: Scheme wise distributions of sites

Sl. No.	Name of Site	Station Code	Scheme	Type
1.	Purna at Mahuwa	01 02 19 001	NNW	GDS WQ
2.	Vaitarna At Durvesh	01 02 25 001	NNW	GDS WQ
3.	Ambica at Gadat	01 02 20 001	80 Key stations	GDSWQ
4.	Dhadhar At Pingalwada	01 02 14 001	163 Key stations	GD WQ
5.	Kim at Motinaroli	01 02 16 001	163 Key stations	GDWQ
6.	Wagh at Ozerkheda	01 02 24 002	FF	GD
7.	Damanganga at Nanipalsan	01 02 24 001	FF	GD

1.2 Jurisdiction Map of Tapi division, CWC, Surat.

Plate – 1



2.0 Description of River Basins

There are 6 independent river basins as given below under the jurisdiction of Tapi Division, Central Water Commission, Surat,

1. Purna Basin
2. Ambica Basin
3. Vaitarna Basin
4. Dhadhar Basin
5. Damanganga Basin
6. Kim Basin

Description of these river basins is given in subsequent sections of this year book.

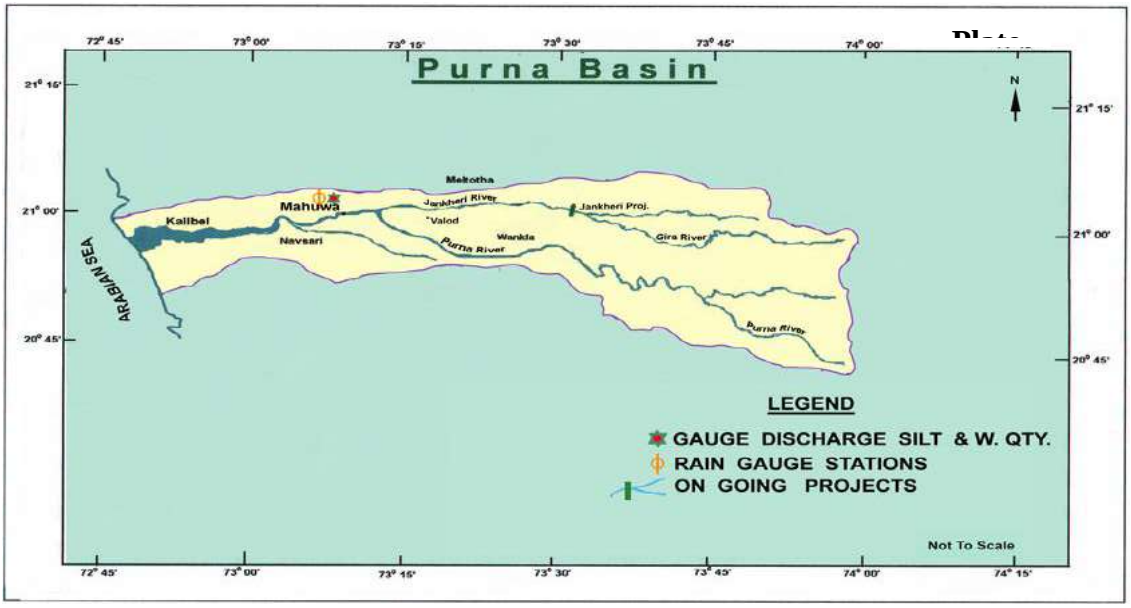
2.1 Purna Basin

2.1.1 Geographical setting of Purna Bain

Purna River is an important west flowing river with its catchment lying in Ahwaa, Valsad and Navsari districts of Gujarat and in Nasik district of Maharashtra. The Purna basin can be divided into three prominent physiographic regions, i.e.

i) Eastern parts, (ii) the middle reaches and (iii) the coastal zones.

The eastern parts of the basin cover a chain of rugged mountain ranges of the Western Ghats running at an elevation of above 1300 m and descending to an elevation of about 100 m at the edges of uplands of the Surat district. The middle reaches of the basin area are marked by high relief zone with ridges and valleys. The hilly zone then merges into the plains through an undulating piedmont coastal zone running parallel to the sea. Basin map of Purna River is shown in **Plate-2.1.1.**



2.1.2 River System

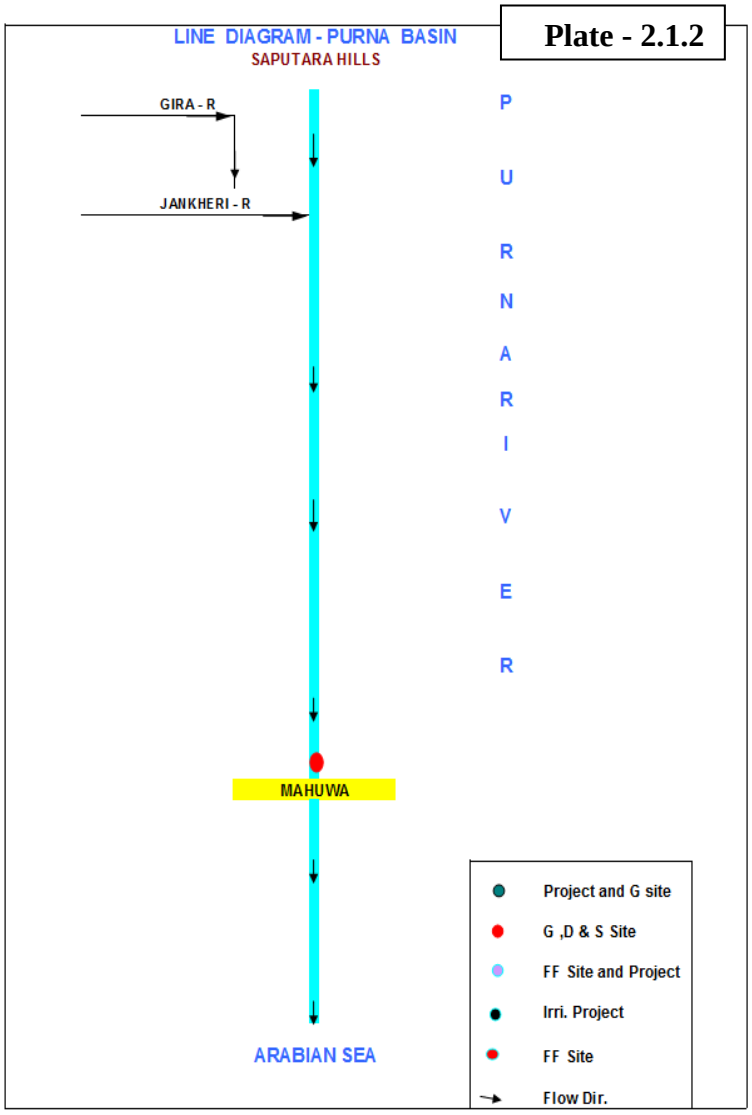
The river Purna rises in the Saputara hills of the Western Ghats near the village Chinchi in Maharashtra. The length of the river from its source to outflow in the Arabian Sea is about 180 km.

The important tributaries of the Purna River are Dhodar nala, Bardanala, Nagihpar nala, Girna River, Zankari River and Dumas khadi. The catchment area of the Purna basin is 2431 Sq. km. The basin lies between 72^0 45' to 74^0 00' East longitude and 20^0 41' to 21^0 05' North latitude. State wise distribution of drainage area is shown in **Table-2.1.1** and line diagram of Purna river system is shown in **Plate - 2.1.2**

Table -2.1.1**:** State wise distribution of catchments area of the Purna basin

Sl. No	State	C.A .in Sq. km.	% of the total C.A.
1	Maharashtra	58	2.39
2	Gujarat	2373	97.61
	Total	2431	100.00

Plate - 2.1.2



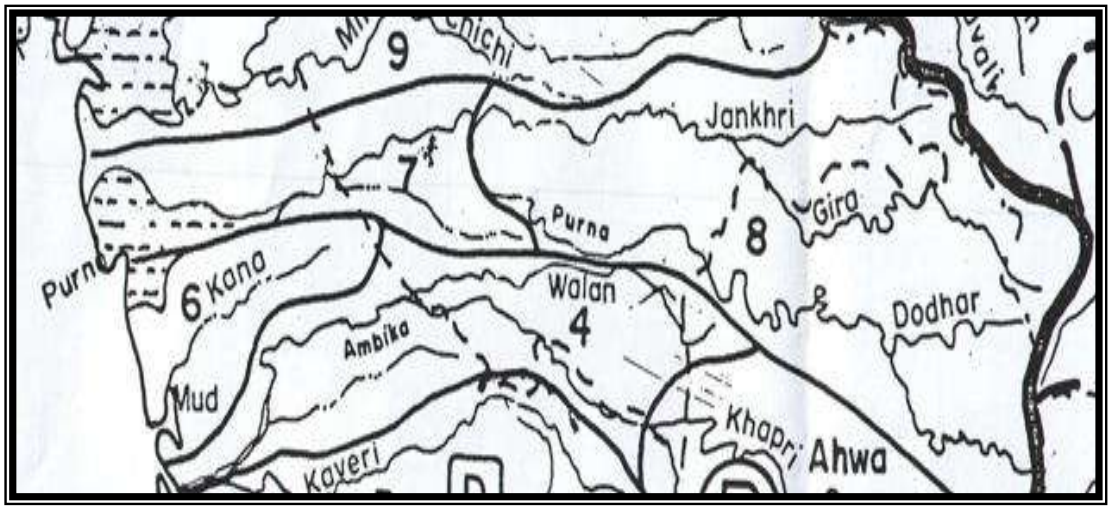
2.1.3 Purna Basin as per Watershed Atlas of India

As per Watershed Atlas of India, Published by Department of Agriculture and Cooperation, Ministry of agriculture, Krishi Bhavan New Delhi (1990), the sub catchments under 5B2D pertain to Purna Basin.

2.1.3.1 Sub-catchment -5B2D (5B2D7 & 5B2D8)

This Sub Catchment is situated in the plain and hilly region of Gujarat, and Maharashtra drained by Dhodar nala, Bardanala, Nagihpar nala, Girna River, Zankari River and Dumas khadi. The total area of this Sub-Catchment is 2431 Sqkm. Sub-catchment area of Purna Basin is shown in **Fig.-2.1.1**

Fig-2.1.1: Sub catchment area of Purna Basin as per water shed Atlas of India.



Source: Watershed Atlas of India, Published by Department of Agriculture and Cooperation, Ministry of agriculture, Krishi Bhavan New Delhi (1990)

2.1.4 Climate

Accordingly to Koeppan's Scheme, the climate of the basin is classified as AW-Tropical Savannah as most of the peninsular plateau, south of Tropic of Cancer is classified. In the initial reaches, the climate is influenced by the Western Ghats which becomes continued as the river reaches the coastal plains. The climatic variations are experienced in the patterns of temperature, rainfall & winds, rhythm of seasons and degree of wetness or dryness. These are described as follows:

2.1.4.1 Temperature

The Temperature is maximum in the month of May and Minimum in the month of December to January. The maximum, minimum temperatures observed at site Mahuwa varies from 27^0 C to 46^0 C and 30^0 C to 10^0 C respectively. The temperature profile in the basin is given in the **Table -2.1.2**

Table-2.1.2: Mean monthly Temperature (^{0}C) during water year at site Mahuwa

Month	Mean Monthly Maximum Temperature (^{o} C)	Mean Monthly Minimum Temperature (^{o} C)
Jun-16	33.7	27.9
Jul-16	29.1	25.4
Aug-16	29.0	25.5
Sep-16	29.9	24.5
Oct-16	30.5	21.9
Nov-16	30.2	17.2
Dec-16	28.9	15.7
Jan-17	28.3	14.8
Feb-17	32.8	16.8
Mar-17	35.7	20.2
Apr-17	36.8	23.8
May-17	37.0	26.8
Annual mean	31.8	21.7

2.1.4.2 Rainfall

The basin receives most of the rainfall from the South West monsoon from June to September. Average annual rainfall in the basin is 1545.6 mm. The rainfall at site Mahuwa in Purna Basin shown in **Table - 2.1.3.**

Table -2.1.3 Mean annual rainfall at site Mahuwa in Purna Basin

Sl. No	Name of Site	Data available (No of Years)	Average Annual Rainfall (mm)	Average no of rainy days	Rainfall in the year 2016-17	No of rainy days in 2016-17
1	Mahuwa	31	1545.6	73	1228.2	77

Table-2.1.4: Seasonal Rainfall during Water Year 2016 at Mahuwa in Purna basin

Sl No	Name of Site	Seasonal Rainfall (mm) in 2016				Total Annual Rainfall
		Winter monsoon	Pre monsoon	South-West monsoon	Post monsoon	
		(Jan-Feb)	(Mar-May)	(June-Sept)	(Oct-Dec)	
1	Mahuwa	0.0	0.0	1082.2	146.0	1228.2

2.1.4.3 Wind

The wind speed and direction profile at site Mahuwa, based on collected data is given in **table -2.1.5**. The average monthly wind speed varies from 2.9 km/h to 0.0 km/h .In

the pre and post-monsoon period; the wind speed is generally higher. The pre dominant wind direction is NE followed by SE and W.

Table 2.1.5: Wind Speed at site Mahuwa in Purna basin during Water Year 2016-17

Month	Mean monthly wind Speed (km/h)
June	0.9
July	0.4
August	0.8
September	0.2
October	0.1
November	0.0
December	0.1
January	0.0
February	0.1
March	0.1
April	0.3
May	0.6
Annual Mean	0.3

2.1.4.4 Humidity

The relative Humidity in Purna basin at site Mahuwa varies between 97.7% and 64.1% depending upon the season. It is naturally maximum in the monsoon period and is around 84.2 to 97.7%. In the winter months of November and December, the relative humidity decreases. The relative humidity profile at station Mahuwa in Purna Basin is given in **table -2.1.6**

Table 2.1.6: Mean monthly Relative Humidity at site Mahuwa in Purna Basin during Water Year 2016-17

Month	Relative Humidity (%)
June	79.3
July	82.8
August	80.3
September	80.0
October	75.6
November	59.3
December	57.2
January	66.6
February	66.3
March	75.2
April	75.7
May	81.3
Annual Mean	73.3

2.1.5 Geology

The whole basin can be divided in to three prominent physiographic zones viz. i) the Eastern zone ii) the middle zone and ii) the coastal zone. The Eastern zone of the basin covers a chain of rugged mountain ranges of the Western Ghats. The middle zone of the basin is marked by high relief zone with ridges and valleys. The hilly region then merges in to the plains through a coastal piedmont coastal zone running parallel to the sea. Deccan traps occupy the most parts of the basin. In the East there are high ridges and deep valleys and towards the west, they merge into the lower reach composed of recent and sub recent alluvium and blown sand. The straight graphical sequences of the rocks found in the basin are Neogene's, Palaeogene and early Palaeogene.

2.1.6 Soil

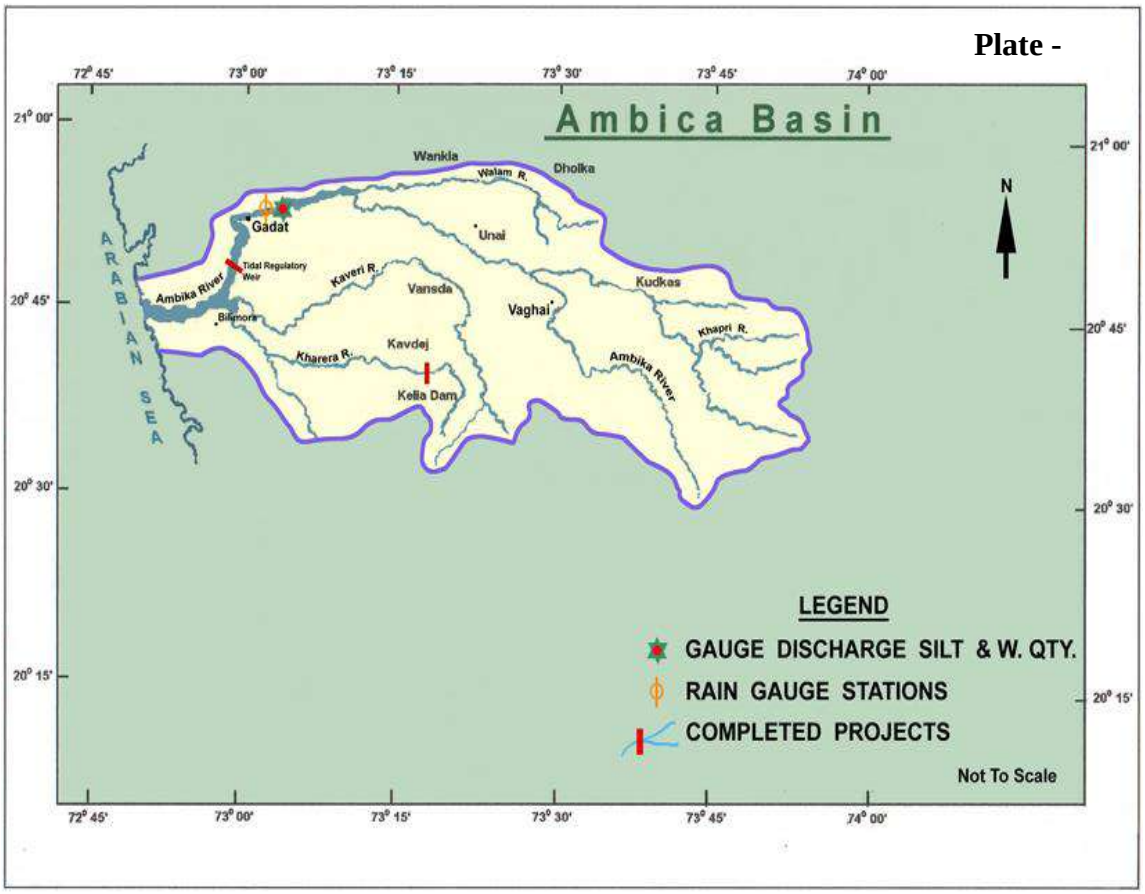
Soils of Purna basin can be classified into three groups viz lateritic soils, deep black soils and coastal alluvial soils.

2.2 Ambica Basin

2.2.1 Geographical setting of Ambica Basin

Ambica River is one of the important west flowing rivers with its catchment in Gujarat and Maharashtra. The Ambica basin which is adjacent to the Auranga basin can be divided in to two prominent physiographic zones. The eastern part comes under a rugged mountain chain of the Sahyadri Western Ghats and descending on the western side to the edge of the uplands of Surat district. This region is situated at general elevation ranging from 1050 m to 100 m. The western part consists of hills and valleys which generally lie below 100 m elevation. Its basin map is shown in **Plate -2.2.1.**

Plate -



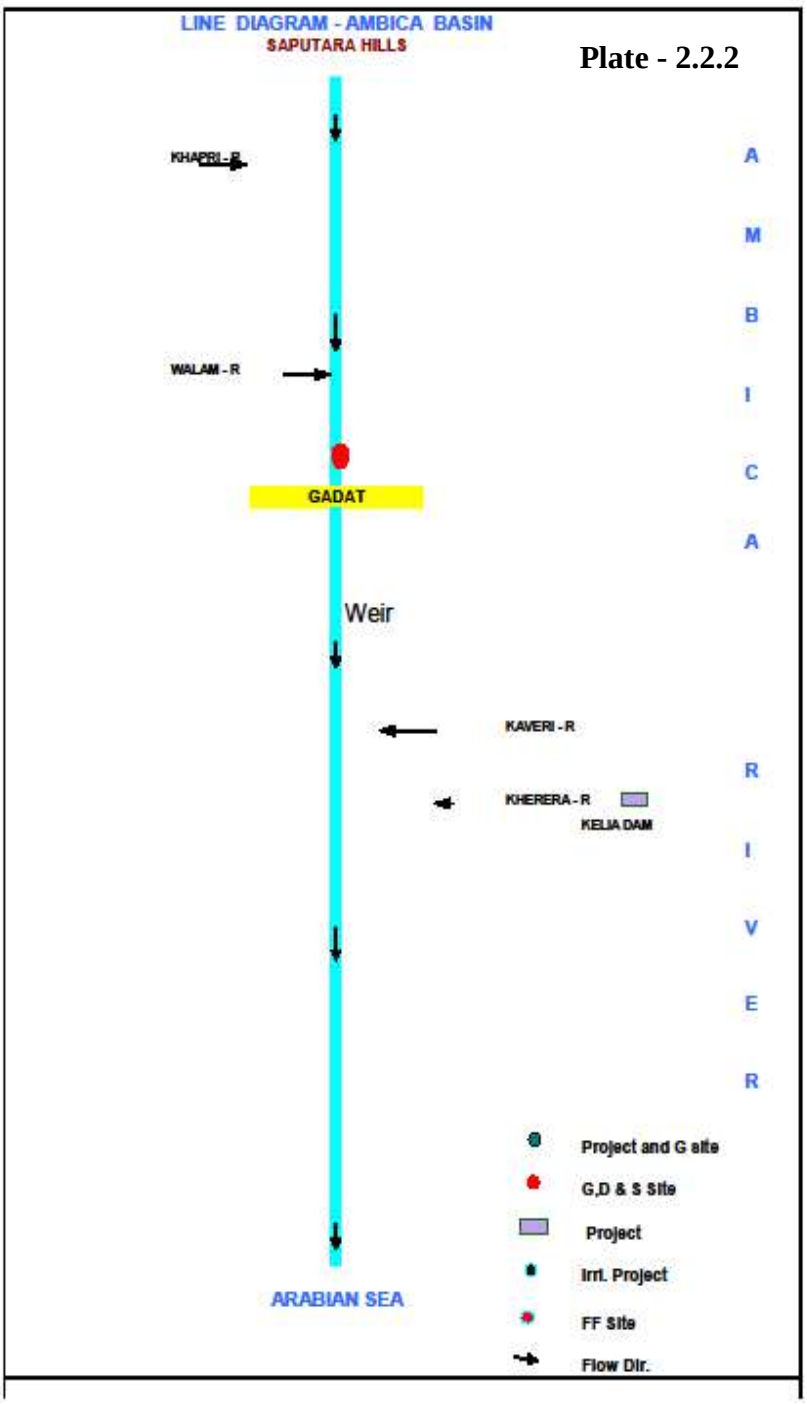
2.2.2 River System

It originates from Saputara Hill ranges near village Kotambi of Surgana taluka in the Nasik district of Maharashtra. After flowing for a length of 136 km it drains in to the Arabian Sea. The important tributaries of the Ambica River are Kapri, Wallan, Kaveri and Kharera. The river Ambica basin lies between 20° 31’ and 20° 57’ North latitude

and 72° 48’ and 73° 52’ East longitude with a drainage area of 2715 Sqkm. The Valsad, Dangs and Surat Districts of Gujarat and a small portion of the Nasik district of Maharashtra falls in the basin, drainage area of Ambica River basin is shown in **Table-2.2.1** and line diagram of Ambica river system is shown in **Plate - 2.2.2.**

Table -2.2.1: State wise distribution of catchments area of the Ambica basin

Sl.No	State	Catchment Area (sq km)	% Of the total C.A.
1	Maharashtra	102	3.76
2	Gujarat	2613	97.24
	Total	2715	100.00



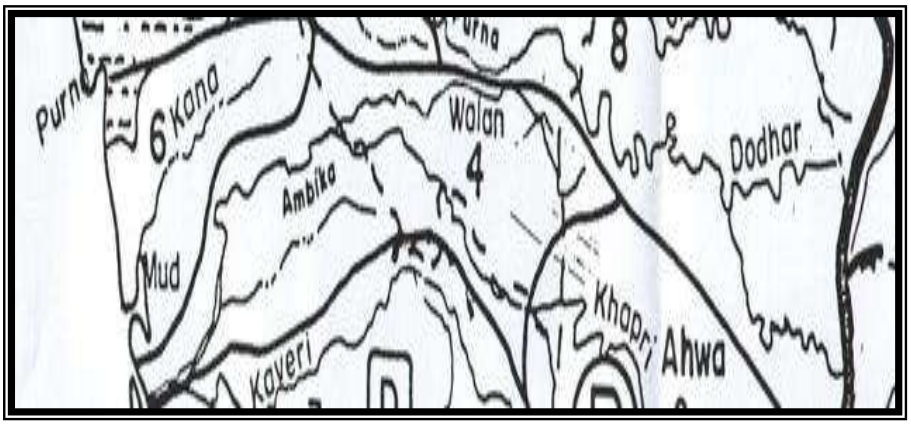
2.2.3 Ambica Basin as per Watershed Atlas of India

As per Watershed Atlas of India, Published by Department of Agriculture and Cooperation, Ministry of agriculture, Krishi Bhavan New Delhi (1990), the sub catchments from **5B2D** pertain to Ambica Basin, as shown in **Fig.-2.2.1.**

2.2.3.1 Sub-catchment -5B2D (5B2D3, 5B2D4 & 5B2D5)

This Sub Catchment is situated in the plain and hilly region of Gujarat, and Maharashtra drained by Kapri, Wallan, Kaveri and Kharera. The total area of this Sub-Catchment is 2715 Sqkm. Sub-catchment area of Ambica Basin is shown in **Fig. 2.2.1**

Fig-2.2.1: Sub- catchment area of Ambica Basin as per water shed Atlas of India.



Source: Watershed Atlas of India, Published by Department of Agriculture and Cooperation, Ministry of agriculture, Krishi Bhavan New Delhi (1990)

2.2.4 Climate

Accordingly to Koeppan's Scheme, the climate of the basin is classified as AW-Tropical Savannah, as most of the peninsular plateau, south of Tropic of Cancer, is classified. In the initial reaches, the climate is influenced by the Western Ghats which gradually changes as the river reaches the coastal plains. The climatic variations are experienced in the patterns of temperature, rainfall & winds, rhythm of seasons and degree of wetness or dryness. These are described as follows.

2.2.4.1 Temperature

The Temperature is maximum in the month of May and Minimum in the month of December to January. The maximum, minimum temperatures observed vary from 27.4^0C to 40^0C and 28.6^0C to 8^0 C respectively. The temperature profile in the basin is given in the **table 2.2.2**

Table-2.2.2: Mean monthly Temperature (^{0}C) during water year at site Gadat

Month	Mean Monthly Maximum Temperature (^{o} C)	Mean Monthly Minimum Temperature (^{o} C)
Jun-16	35.3	28.8
Jul-16	30.0	26.3
Aug-16	30.4	26.1
Sep-16	31.0	25.1
Oct-16	32.6	22.4
Nov-16	33.6	16.4
Dec-16	31.8	14.5
Jan-17	30.7	12.3
Feb-17	33.5	14.3
Mar-17	36.5	17.7
Apr-17	37.0	22.6
May-17	37.2	26.3
Annual mean	33.3	21.1

2.2.4.2 Rainfall

The basin receives most of the rainfall from the South West monsoon from June to September. Average annual rainfall in the basin is 1779.6 mm. The rainfall at site in Ambica Basin shown in **Table -2.2.3 & 2.2.4.**

Table -2.2.3: Mean annual rainfall of Ambica Basin at site Gadat

Sl. No	Name of Site	Data available (No of Years)	Average Rainfall (mm)	Average no of rainy days	Rainfall in the year 2016-17	No of rainy days in 2016-17
1	Gadat	34	1779.6	73	1735.0	79

Table-2.2.4: Seasonal Rainfall during Water Year 2016 at site Gadat in Ambica Basin

Sl No	Name of Site	Seasonal Rainfall (mm) in 2016				Total Annual Rainfall
		Winter monsoon	Pre monsoon	South-West monsoon	Post monsoon	
		(Jan-Feb)	(Mar-May)	(June-Sept)	(Oct-Dec)	
1	Gadat	0.0	0.0	1590.4	144.6	1735.0

2.2.4.3 Wind

The wind speed and direction profile at site Gadat based on collected data is given in T**able -2.2.5**.The average monthly wind speed varies from 0.3 km/h to 2.5 km/h .In the pre and post-monsoon period, the wind speed is generally higher. The pre dominant wind direction is NE.

Table 2.2.5: Wind Speed at site Gadat in Ambica basin during Water Year 2016-17

Month	Mean monthly wind Speed (km/h)
June	2.0
July	1.2
August	1.6
September	1.8
October	0.8
November	1.0
December	1.0
January	0.9
February	1.0
March	1.1
April	1.5
May	1.8
Annual Mean	1.3

2.2.4.4 Humidity

The relative Humidity in Ambica basin varies between 93.3 % to 74.0 % depending upon the season. The humidity is naturally maximum in the monsoon period and is around 93.3 to 89.9 %. In the winter months of November and December the relative humidity comes down. The relative humidity at station of CWC representative of Purna Basin is given in T**able- 2.2.6**

Table -2.2.6: Mean monthly Relative Humidity at site Gadat in Ambica Basin during Water Year 2016-17

Month	Relative Humidity (%)
June	92.6
July	91.9
August	91.9
September	97.7
October	91.1
November	89.5
December	88.8
January	87.8
February	89.2
March	89.2
April	91.5
May	91.6
Annual Mean	91.1

2.2.5 Geology

The basin can be divided into two prominent physiographic zones. The eastern part comes under rugged mountain chains of the Saputara Hills and descends on the western side to the edge of the uplands of Surat district. This region is placed at a general elevation of 1050 m to 100 m. The western part, barring the coastal plain, is essentially in the sub Sahyadrin zone of hills and valleys generally below 100 m elevation. Deccan traps and intermediate amphitheatres have developed out of the alluvial debris washed from the hills. The lower reaches of the basin upto the coastal margins are mainly alluvial plains

2.2.6 Soil

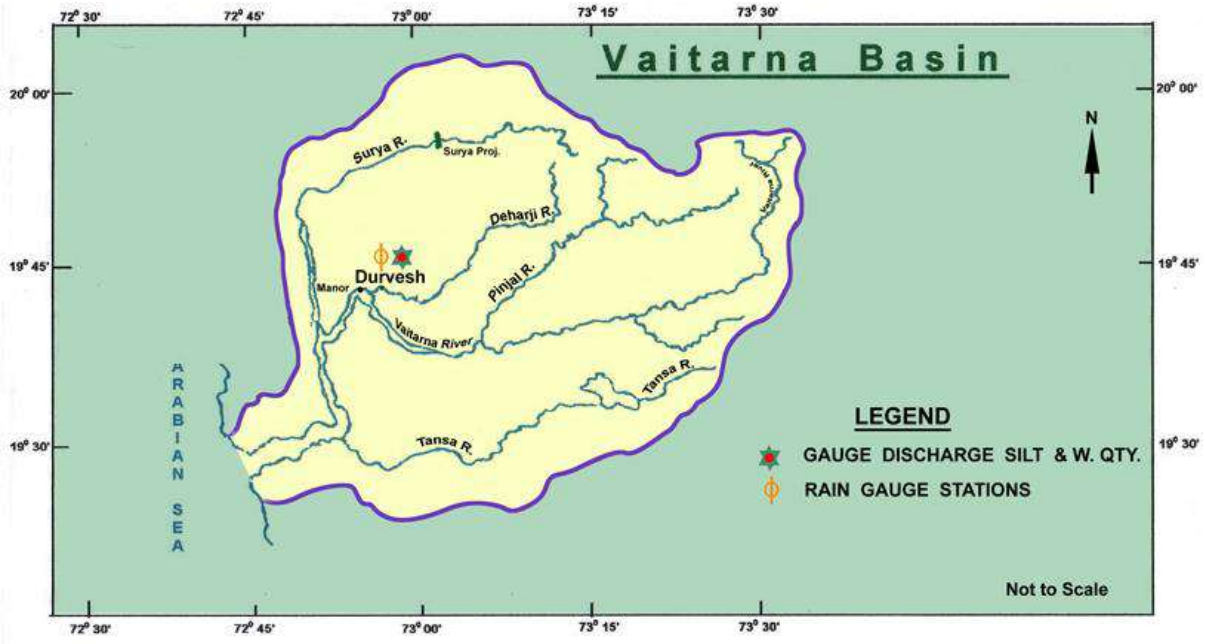
Soil of Ambica basin can be broadly classified into three group viz. Laterite soil, deep black soil and alluvial soil.

2.3 Vaitarna Basin

2.3.1 Geographical setting of Vaitarna Basin

The river Vaitarna is one of the west flowing rivers in the region North of Mumbai and South of the Tapi River. The river rises in the Sahyadri hill range in the Nasik district of Maharashtra State and after traversing a distance of about 120 km in Maharashtra joins the Arabian Sea. Basin map is shown in **Plate -2.3.1**. The Vaitarna basin lies between East longitude of 72^0 45' to 73^0 35' and North latitude of 19^0 25'to 20^0 20'.

Plate -2.3.1



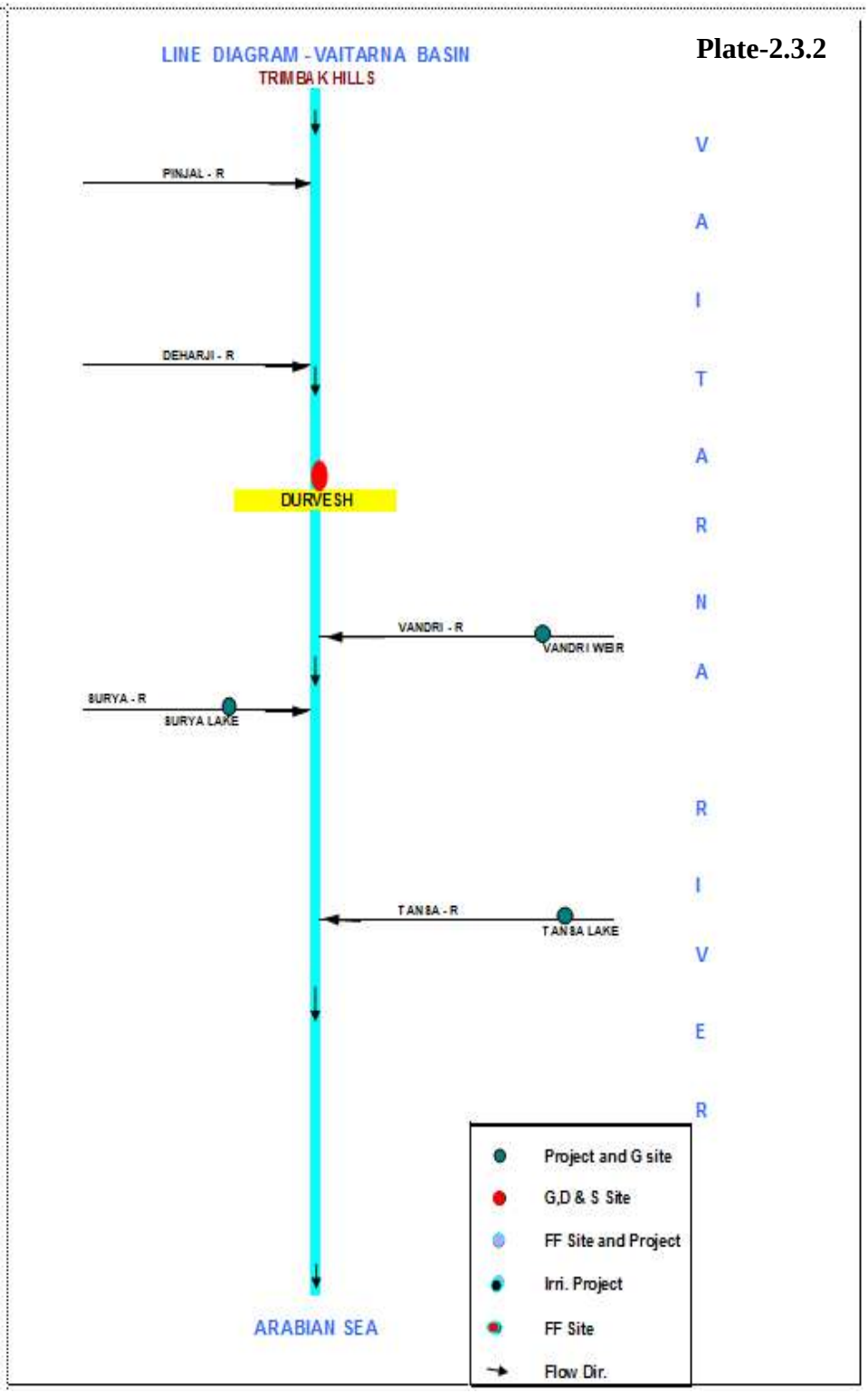
2.3.2 River System

The headstreams of the Vaitarna rise on the southern slopes of the Triambak-Anjaneri range and combine into three southward flowing streams which unite to form the Vaitarna a little north of Dapure. The Vaitarna from here has a very winding course southwards and goes round Zarwad (Jarwar) Budruk.

Due south of it, the river is joined by its tributary Alvand nadi, whose headstreams rise in the same Triambak Anjaneri range on the southern slopes of the Bhaskargad, Phani dongar and Harish dongar, which form the divide between these and those of the Val river flowing northwards. After the confluence with the Alvand river, the Vaitarna turns and flows nearly straight in a south-south-west direction cutting a deep gorge in the scarp of the Sahyadris. A small tributary from the northwest to south-east in a gorge continues the course of the Vaitarna in a remarkably deeply cut valley.

The main tributaries of Vaitarna river are Pinjal, Ganjai, Surya, Daharji, Tansa. The catchment area of Vaitarna basin completely lies in Thane and Nasik districts of Maharashtra. The Vaitarna drains an area of 2019 sq km before it falls in Gulf of Khambhat. A line diagram of Vaitarna river system is shown in **Plate -2.3.2**.

Plate-2.3.2



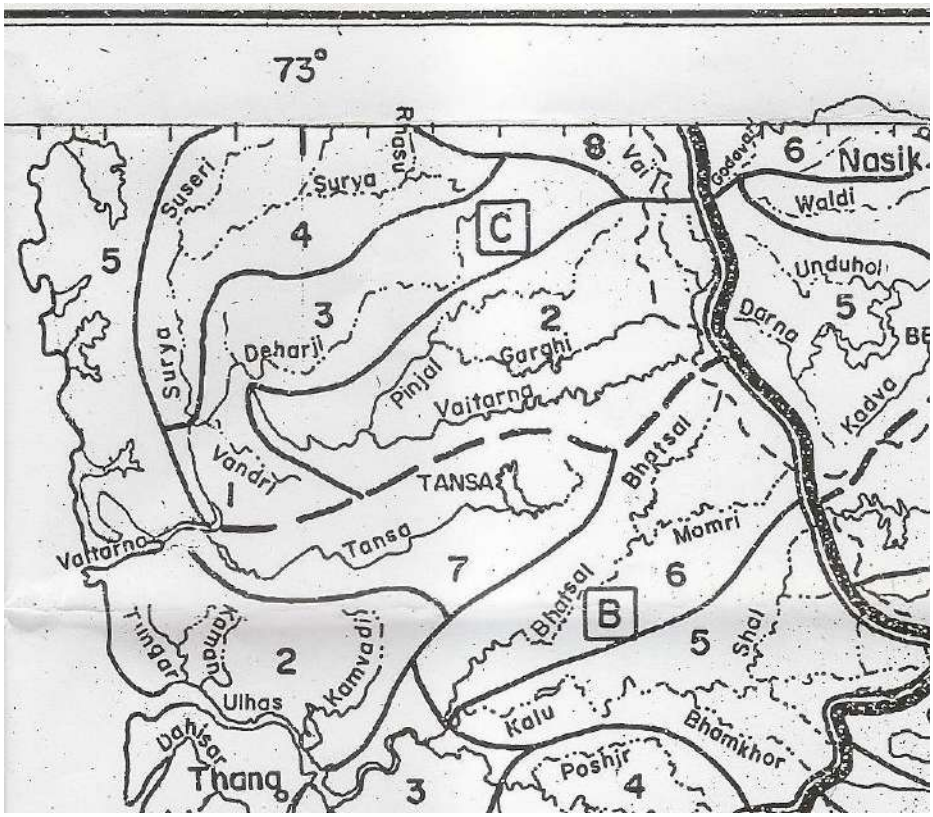
2.3.3 Vaitarna Basin as per Watershed Atlas of India

As per Watershed Atlas of India, Published by Department of Agriculture and Cooperation, Ministry of agriculture, Krishi Bhavan New Delhi (1990), the sub catchments from 5B2C pertain to Vaitarna Basin as shown in **Fig 2.3.1**.

2.3.3.1 Sub-catchment -5B2C (5B2C2 to 5B2C5)

This Sub Catchment is situated in the plain region of Maharashtra. Drained by main tributaries of Vaitarana River , Pinjal, Surya, Daharji, Tansa. The total area of this Sub-Catchment is 2019 sq km.

Fig 2.3.1 **Sub catchment area of Vaitarna Basin as per water shed Atlas of India.**



Source: Watershed Atlas of India, Published by Department of Agriculture and Cooperation, Ministry of agriculture, Krishi Bhavan New Delhi (1990)

2.3.4 Climate

Accordingly to Koeppan's Scheme, the climate of the basin is classified as AW-Tropical Savannah, as most of the peninsular plateau, south of Tropic of Cancer is classified. In the initial reaches, the climate is influenced by the Western Ghats that becomes coastal as the river reaches coastal plains. The climatic variations are

experienced in the patterns of temperature, rainfall & winds, rhythm of seasons and degree of wetness or dryness. These are described as follows.

2.3.4.1 Temperature

The Temperature is maximum in the month of May and Minimum in the month of December to January. The temperature profile in the basin is given in the Table-2.3.1.

Table-2.3.1: Mean monthly Temperature (^{0}C) during water year at site Durvesh

Month	Mean Monthly Maximum Temperature (^{o}C)	Mean Monthly Minimum Temperature (^{o}C)
Jun-16	35.6	28.5
Jul-16	28.7	25.7
Aug-16	29.2	25.7
Sep-16	30.7	24.6
Oct-16	32.7	22.9
Nov-16	34.9	16.9
Dec-16	34.4	15.5
Jan-17	33.8	14.4
Feb-17	36.5	16.8
Mar-17	37.6	19.5
Apr-17	39.4	23.8
May-17	39.5	27.2
Annual mean	34.4	21.8

2.3.4.2 Rainfall

The basin receives most of the rainfall from the South West monsoon during June to October. Almost 98% of the annual rainfall of the basin is received during this period. The rainfall at site in Vaitarna Basin shown in **Table-2.3.2** and **Table-2.3.3**.

Table-2.3.2 Mean annual rainfall of Vaitarna Basin at site Durvesh

Sl. No	Name of Site	Data available (No of Years)	Average Rainfall (mm)	Average no of rainy days	Rainfall in the year 2016-17	No of rainy days in 2016-17
1	Durvesh	35	2589.3	95	2939.4	97

Table-2.3.3: Seasonal Rainfall during Water Year 2016 at site Durvesh in Vaitarna basin

Sl No	Name of Site	Seasonal Rainfall (mm) in 2016				Total Annual Rainfall
		Winter monsoon	Pre monsoon	South-West monsoon	Post Monsoon	
		(Jan-Feb)	(Mar-May)	(June-Sept)	(Oct-Dec)	
1	Durvesh	0.0	2.6	2823.6	112.6	2938.8

2.3.4.3 Wind

The wind speed and direction profile at site Durvesh based on collected data is given in **Table-2.3.4**. The average wind speed in the Vaitarna basin varies about 1.7 km/h to 6.8 km/h. In the pre and post-monsoon period, the wind speed is generally higher. The predominant wind direction is SW.

Table-2.3.4: Wind Speed at site Durvesh inVaitarna basin during Water Year 2016-17

Month	Mean monthly wind Speed (km/h)
June	4.3
July	3.8
August	4.8
September	2.1
October	2.0
November	2.1
December	2.1
January	2.1
February	2.1
March	2.2
April	2.8
May	3.5
Annual Mean	2.8

2.3.4.4 Humidity

The relative Humidity in Vaitarna basin varies between 92.0 % and 70.0 % depending upon the season. Humidity is maximum in the monsoon period about 92.0 % to 87.9 %. In the winter months of November and December, it decreases. Relative humidity at Durvesh station of CWC is given in **Table-2.3.5**.

Table-2.3.5: Mean monthly Relative Humidity at site Durvesh in Vaitarna Basin during Water Year 2016-17

Month	Relative Humidity (%)
June	82.6
July	92.0
August	91.7
September	92.0
October	90.9
November	89.0
December	87.4
January	86.5
February	86.5
March	84.5
April	86.4
May	83.3
Annual Mean	87.7

2.3.5 Geology

The Great Trap region of the Deccan covers the maximum part of the Basin. It is entirely of volcanic formation. The volcanic portion consists of compact, stratified basalts, and an earthy trap. The basalts are the most conspicuous geological feature. To the west they lie in flat-topped ranges, separated by valleys, trending from west to east. In some flows the- basalt is columnar and then it weathers into the fantastic shapes. The formation at the base of the traps is chiefly amygdaloidal, containing quartz in vertical veins, crystals and zeolitic minerals, especially apophyllite weathering into a gray soil. The absence of laterite, which caps the summits of the hills to the south, is a curious feature in the geology of the area. The basalt is either fine textured or it is coarse and nodular.

2.3.6 Soil

The valleys are filled with disintegrated basalt of various shades from gray to black, washed down by rain. It is of argillaceous nature. This soil is not favorable to the growth of large trees but it is very fertile for cereals and pulses. The black soil contains high alumina and carbonates of calcium and magnesium with variable

amounts of potash, low nitrogen and phosphorus. There are broadly two groups of soils: 1) Red coarse soil & 2) Alluvial soil

The red soil is less common and is suitable for cultivation under a heavy and consistent rainfall. Red coarse soil derived from disintegration of basaltic rock fragments under heavy rainfall. The rock fragments have undergone intensive weathering and beaching with the surface weathered and fragmented materials being carried away with the heavy run off in the monsoon period. The residual soil left behind is usually reddish yellow in colour, shallow in depth, coarse sandy loam to sandy loam in texture, rapidly drained and low in fertility. Alluvial soil formed with the deposition of transported materials brought out by heavy run off. This soil is deep to very deep yellowish brown to grayish brown in colour and clay loam to salty loam in texture. This soil is normally free from salinity and alkalinity.

2.3.7 Major / Medium/ multipurpose/ irrigation projects

The major and medium projects completed / ongoing on Vaitarna river basin are as shown in **Table-2.3.6**

Table-2.3.6: List of major and medium projects completed / on going on Vaitarna river basin

Sl. No	Name of the project	River	Status	Capacity in Mcm		Utilisation
				Gross	Live	
1.	Vaitarn Hydro Electric Project. (upper Vaitarna)	Vaitarna	Major	301.60	295.80	Multipurpose
2.	Surya Project.	Surya	Major	285.31	276.35	Multipurpose
3.	Modak Sagar (Lower Vaitarna)	Vaitarna	Medium	N.A.	N.A.	Irrigation
4.	Wandra Project	Wandria	Medium	37.11	35.938	-do-
5.	Deharji River Project	Deharji	Medium	93.120	89.840	-do-
6.	Tansa Dam	Tansa	Medium	N.A.	N.A.	Multipurpose

2.3.7.1 Vaitarna hydropower project

Vaitarna hydropower project is located near Vaitarna and Alwandi masonry and earthen dam on Vaitarna and Alwandi Rivers, 30 km from Ghoti, in Nashik District, Maharashtra. The catchment area at the dam is 160.8 km2. The height and length of the dam is 47 m and 555 m respectively. The reservoir has a live storage capacity of 35 MCM at FRL 603.5 m and the MDDL is at 580 m. The power house has a unit of 60 MW. It has a firm power of 11 MW with mean annual inflow of 635 MCM. MSEB commissioned the project in 1976.

2.4 Dhadhar Basin

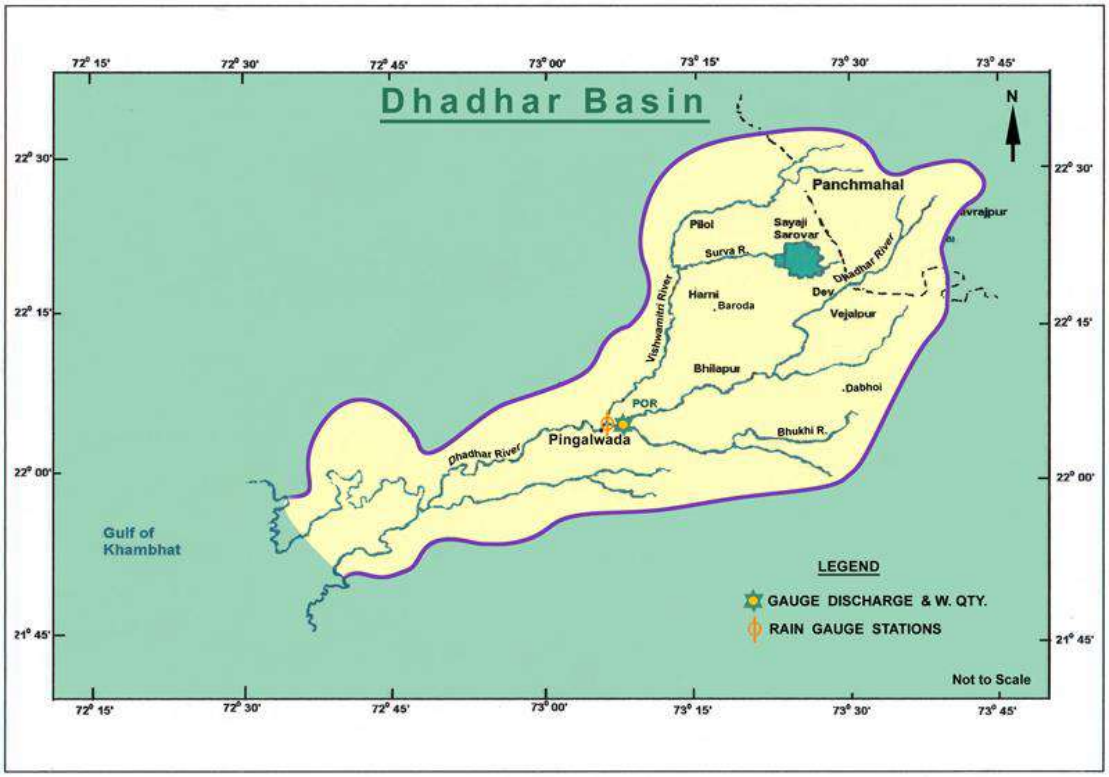
2.4.1 Geographical setting of Dhadhar Basin

The Dhadhar River is one of the west flowing rivers in Gujarat state. It originates from the Pavagadh Hills of Gujarat state and flows through Vadodara and Bharuch districts. The river Dhadhar after flowing 87 km receives Vishwamitri tributary from right bank at Pingalwada village 500 m upstream of Gauge and Discharge site. After flowing another 55 km it falls into the Gulf of Khambhat. The total length of the river from its source to outfall in the Gulf of Khambhat is about 142 km.

Basin map is shown in **Plate -2.4.1**.

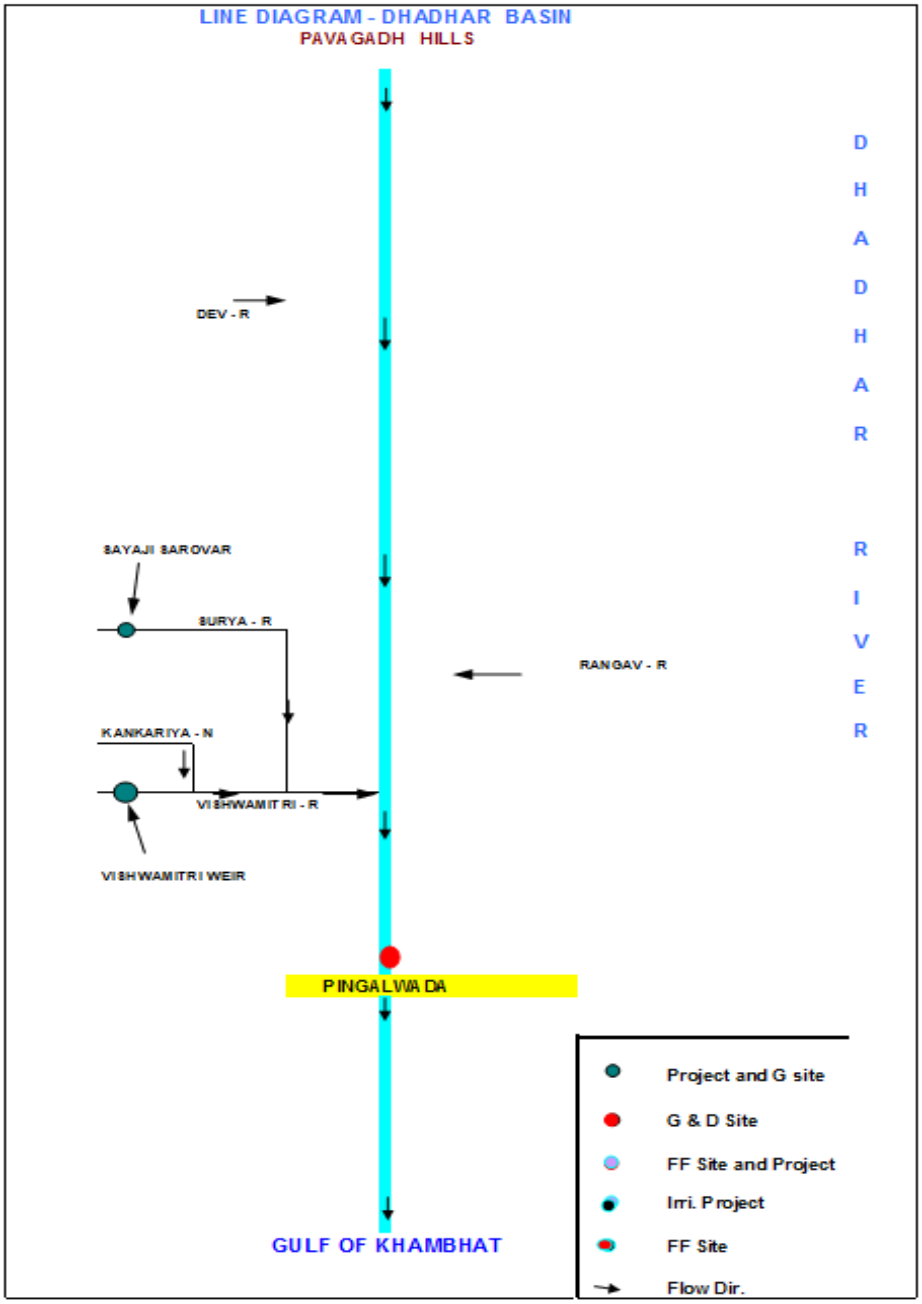
Plate- 2.4.1

2.4.2 River System



The important tributaries of the Dhadhar River are Vishwamitri, Jambuoriver, Dev and Surya River. The catchment area of the Dhadhar basin is 3423 Sq.km. and catchment area up to the site is 2400 Sq.km. It lies between east longitude 72° 30’ and 73° 45’ and North latitude 21° 45’ and 22° 45’. Line diagram of Dhadhar river system is shown in **Plate -2.4.2**.

Plate -2.4.2.



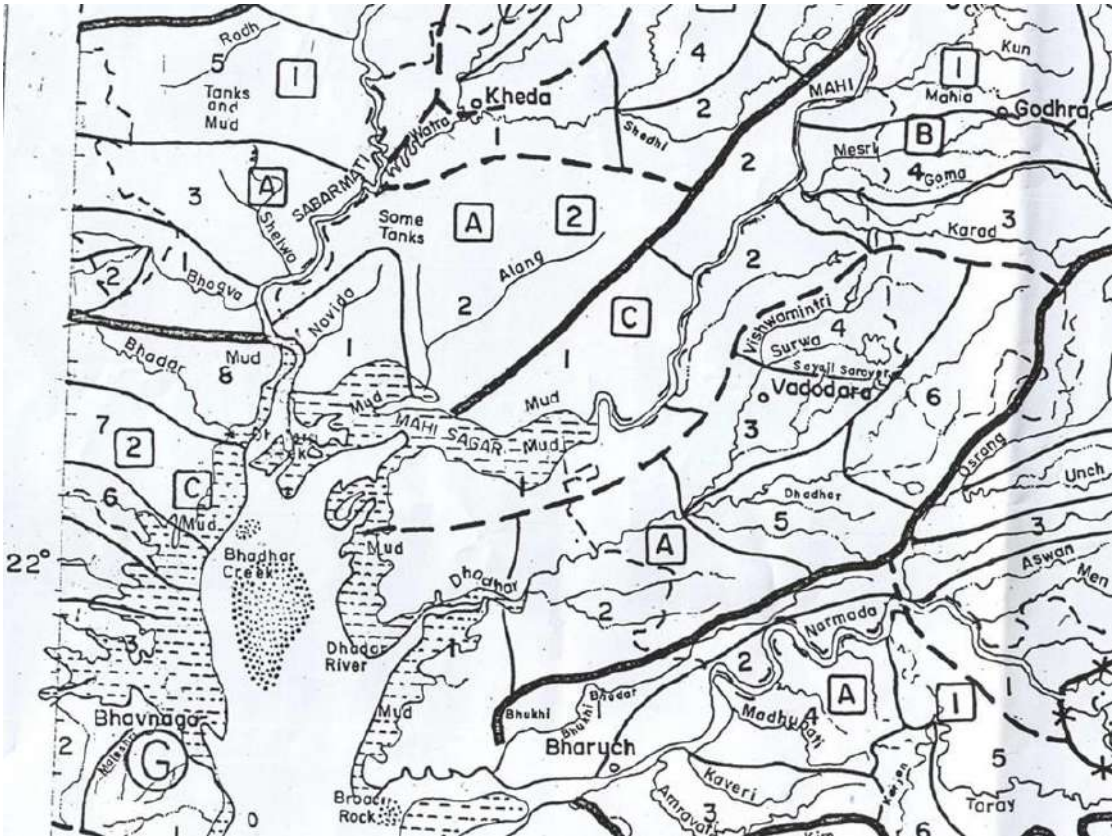
2.4.3 Dhadhar Basin as per Water Shed Atlas of India

As per Watershed Atlas of India, Published by Department of Agriculture and Cooperation, Ministry of agriculture, Krishi Bhavan New Delhi (1990), the sub catchments from 5E1A pertain to Dhadhar Basin as shown in **Fig 2.4.1**.

2.4.3.1 Subcatchment -5E1A (5E1A1 to 5E1A6)

This Sub Catchment is situated in the plain region of Gujarat, The important tributaries of the Dhadhar River are Vishwamitri, Jambuo river, Dev and Surya river. The total area of this Sub-Catchment is 3423 sqkm.

Fig 2.4.1: Sub catchment area of Dhadhar Basin as per water shed Atlas of India**.**



Source: Watershed Atlas of India, Published by Department of Agriculture and Cooperation, Ministry of Agriculture, Krishi Bhavan New Delhi (1990)

2.4.4 Climate

The Dhadar basin experiences seasons – summer (Mar-May), Monsoon (June-Sep) & winter (Oct-Feb). The major part of basin comprises tropical wet climate, caused mainly due to existence of the Western Ghats. Due to relatively high elevation in forest land, the area of the basin near the origin of the river experiences relatively cooler climate.

Accordingly to Koeppan's Scheme, the climate of the basin is classified as AW-Tropical Savannah as most of the peninsular plates, south of Tropic of Cancer are classified. The climatic variations are experienced in the patterns of temperature, rainfall & winds, whether of seasons and degree of wetness or dryness. These are described as follows.

2.4.4.1 Temperature

The Temperature is maximum in the month of May and Minimum in the month of December to January. The temperature profile in the basin is given in the **table -2.4.1**

Table-2.4.1: Mean monthly Temperature (^{0}C) during water year at site Pingalwada

Month	Mean Monthly Maximum Temperature (^{o}C)	Mean Monthly Minimum Temperature (^{o}C)
Jun-16	38.5	27.6
Jul-16	32.1	25.0
Aug-16	30.3	25.3
Sep-16	32.4	26.0
Oct-16	29.6	23.5
Nov-16	28.9	14.5
Dec-16	28.5	12.8
Jan-17	27.9	12.1
Feb-17	30.5	14.2
Mar-17	34.3	18.4
Apr-17	39.0	22.2
May-17	40.8	28.1
Annual mean	32.7	20.8

2.4.4.2 Rainfall

The basin receives most of the rainfall from the South West monsoon during June to October. Almost 98% of the annual rainfall of the basin is received during this period. The average annual rainfall in the Dhadar basin is 891.0 mm. The South - West monsoon sets in by the middle of June and withdraws by the first week of October. The rainfall is mainly influenced by the southwest monsoon. The effect is most pronounced in Vadodara lying on the windward side of the Western Ghats.

The rainfall at site Pingalwada in Dhadhar Basin is shown in **Table -2.4.2** and **Table-2.4.3.**

Table-2.4.2 Mean annual rainfall of Dhadhar Basin at site Pingalwada

Sl. No	Name of Site	Data available (No of Years)	Average Annual Rainfall (mm)	Average no of rainy days	Rainfall in the year 2016-17	No of rainy days in 2016-17
1	Pingalwada	26	891.0	43	472.4	45

Table-2.4.3 Seasonal Rainfall during Water Year 2016 at site Pingalwada

Sl No	Name of Site	Seasonal Rainfall (mm) in 2016				Total Annual Rainfall
		Winter monsoon	Pre monsoon	South-West monsoon	Post monsoon	
		(Jan-Feb)	(Mar-May)	(June-Sept)	(Oct-Dec)	
1	Pingalwada	0.0	00	371.8	100.6	472.4

2.4.4.3 Wind

The wind speed data of the Dhadhar basin is given in table -2.4.4. The monthly average wind speed in the Dhadhar basin varies about 1.7 km/h and 6.8 km/h. in the pre and post monsoon period. During monsoon the monthly average wind speed is generally higher than 4.2 km/h.

In general, wind speed is the lowest in post monsoon period (Oct-Nov) & the highest in June. The pre dominant wind direction is NE/SE. The wind direction remains uniform from post monsoon till early winter i.e. Oct – Feb. Change of direction takes place in March/April. It is observed at site that the dominant wind direction is from North east and east respectively during post monsoon and in winter changes to Westerly and South westerly.

Table-2.4.4: Wind Speed at site Pingalwada in Dhadhar basin during Water Year 2016-17

Month	Mean monthly wind Speed (km/h)
June	1.4
July	0.5
August	0.3
September	0.3
October	0.1
November	0.1
December	0.1
January	0.1
February	0.5
March	0.2
April	0.4
May	1.6
Annual Mean	0.5

2.4.4.4 Humidity

The relative Humidity in Dhadhar basin varies between 90.1 % to 66.8 % depending upon the season. Humidity is maximum in the monsoon period and is around 90.1 to 73.8 %. In the winter months of November and December, it decreases. Relative humidity at station Pingalwada in Dhadhar Basin is given in table -2.4.5.

Table-2.4.5: Mean monthly Relative Humidity at site Pingalwada in Dhadhar Basin during Water Year 2016-17

Month	Relative Humidity (%)
June	75.8
July	84.3
August	87.7
September	85.6
October	86.1
November	80.8
December	80.7
January	80.1
February	78.5
March	79.1
April	78.4
May	77.1
Annual Mean	81.2

2.4.5 Geology

The Late Pleistocene fluvial succession is exposed as 18–20 m high incised vertical cliffs all along the Dhadhar River basin in western India. The major fluvial sedimentary facies of the Late Pleistocene deposits in the Dhadhar River basin have preserved evidence of palaeo-drainage and could provide an important link between the sub-humid Narmada basin in the south and the semi-arid Mahi basin in the north. The sedimentary facies documented include overbank fines, which are associated with crevasse splays. Fine grained overbank sediments are interpreted as having formed by sheet flow of sediments over the banks of minor distributary channels during the flood stage. The overlying thinly stratified fluvial sands and silts, at the top of the exposed sediment succession show a thin cap of aeolian sediments suggesting less intense aeolian activity than that observed in Sabarmati, Mahi and Orsang basins, though a significant reduction in fluvial activity is suggested during the arid phase of the LGM.

However, the river may still have been perennial assuming that it retained the larger part of the catchment.

2.4.6 Major/Medium/Multipurpose/Irrigation projects

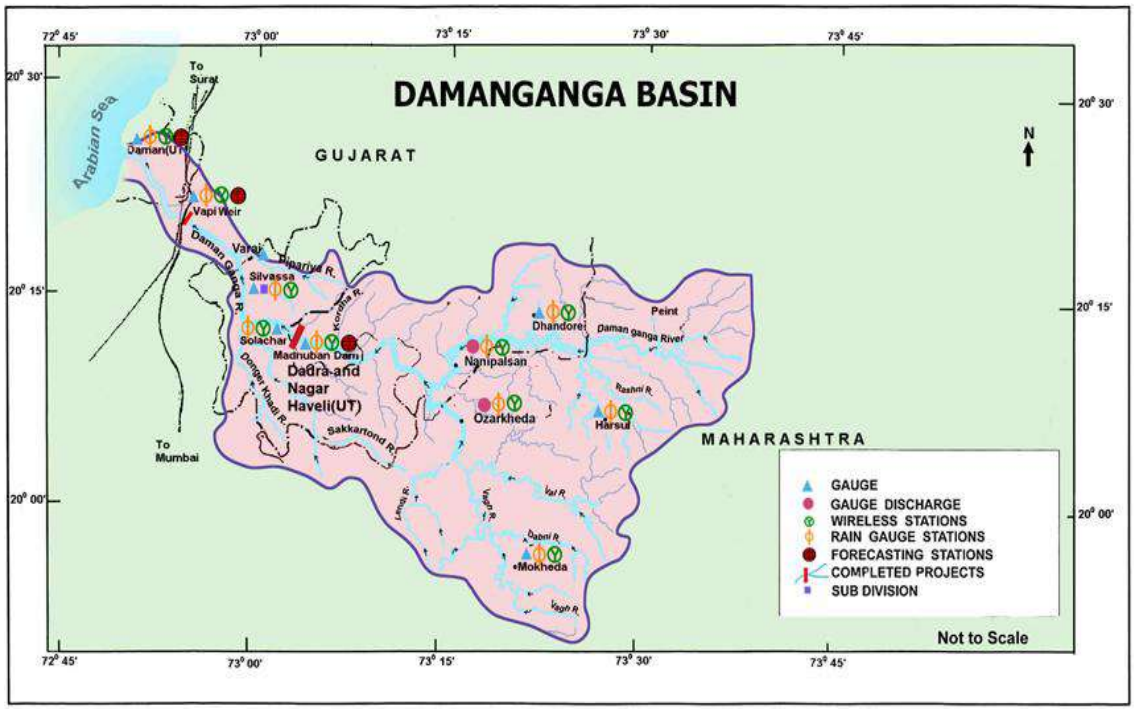
Ajwa tank, Pratap pura, Uma Bhariara, Dhanora, Ghansarva, Haripura, Vadodara, Deo Dam are the medium existing/ongoing projects in the basin.

2.5 Damanganga Basin

2.5.1 Geographical setting of Damanganga Basin

The Damanganga river rises in the Sahyadri hill ranges near village Ambegaon in Dindori taluka of Nasik district of Maharashtra State at an elevation of 950 m above MSL and traverses a total distance of about 131.30 km before it drains into the Arabian Sea at Daman. Damanganga along with its tributaries mainly flows through the hilly areas of Maharashtra, Gujarat and Union Territory Dadra and Nagar Haveli and Daman. Basin map is shown in **Plate-2.5.1**. It drains total area of 2318 sq km in Maharashtra State, Gujarat State and the Union Territories of Dadra, Nagar Haveli (DNH) and Daman & Diu before it drains into the Arabian Sea. The Damanganga River flows through Maharashtra State, Gujarat State and U.Ts. of DNH and Daman & Diu, while Vagh river up to Khargihill dam entirely lies in Maharashtra State.

Plate-2.5.1



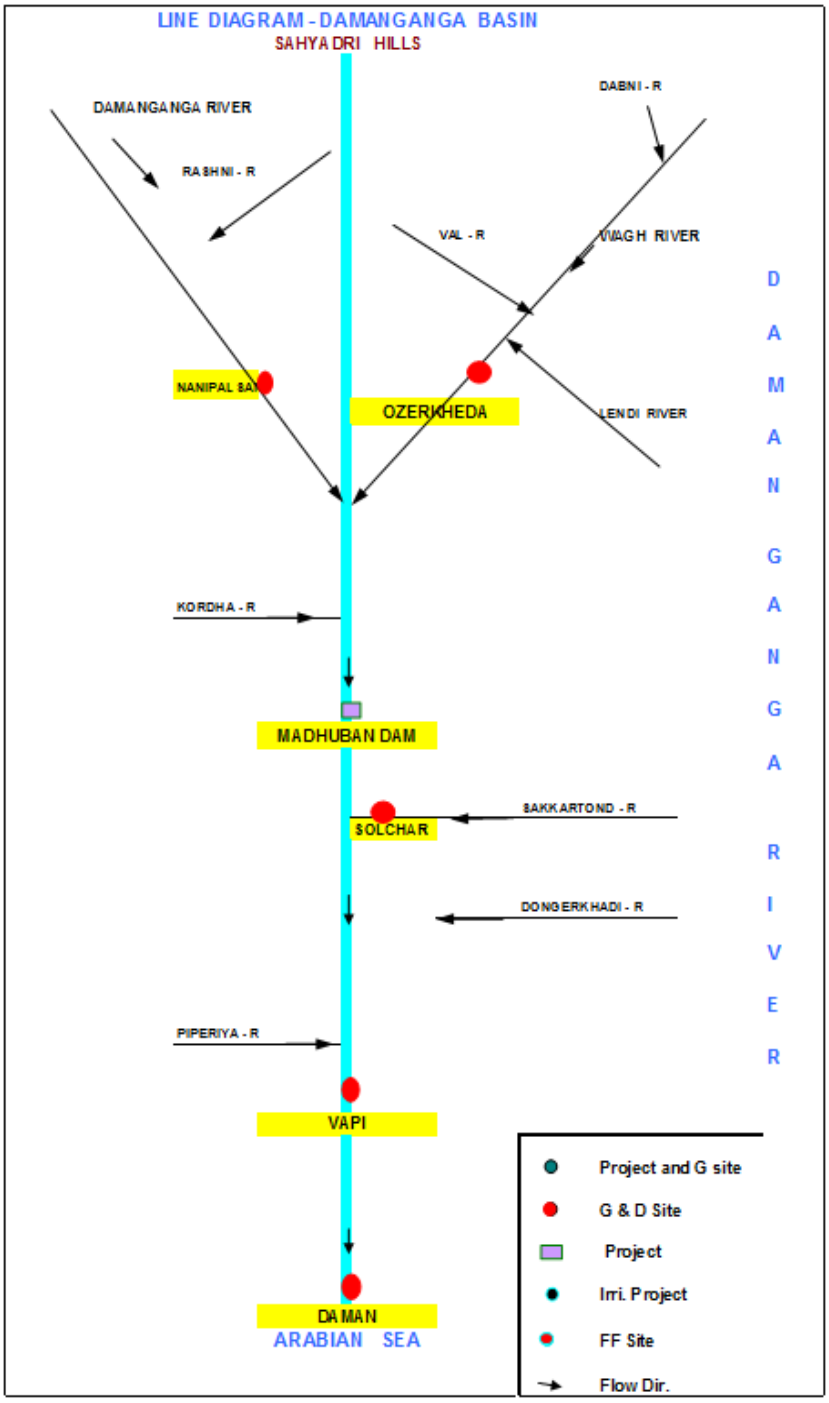
2.5.2 River System

The catchment of the river is fan shaped and the river is prone to severe flashy floods The important tributaries of the Damanganga river are Dawan, Shrimant, Val, Rayte, Lendi, Vagh, Sakartond, Dongarkhadi, Roshni and Dudhni. The Damanganga river drains total 2318 sq km. Drainage area of Damanganga River basin is shown in **Table-2.5.1** and line diagram of Damanganga river system is shown in **Plate-2.5.2**.

Table -2.5.1: State wise Distribution of drainage area of Damanganga River

Sl. No	Name of District / State	Catchment area (Sq km)	% of total catchment area
1	Nasik / Maharashtra	1408	60.74
2	Valsad / Gujarat	495	21.36
3	Dadara & Nagar Havali & Daman U.T.	415	17.90
	Total	2318	100.00

Plate-2.5.2



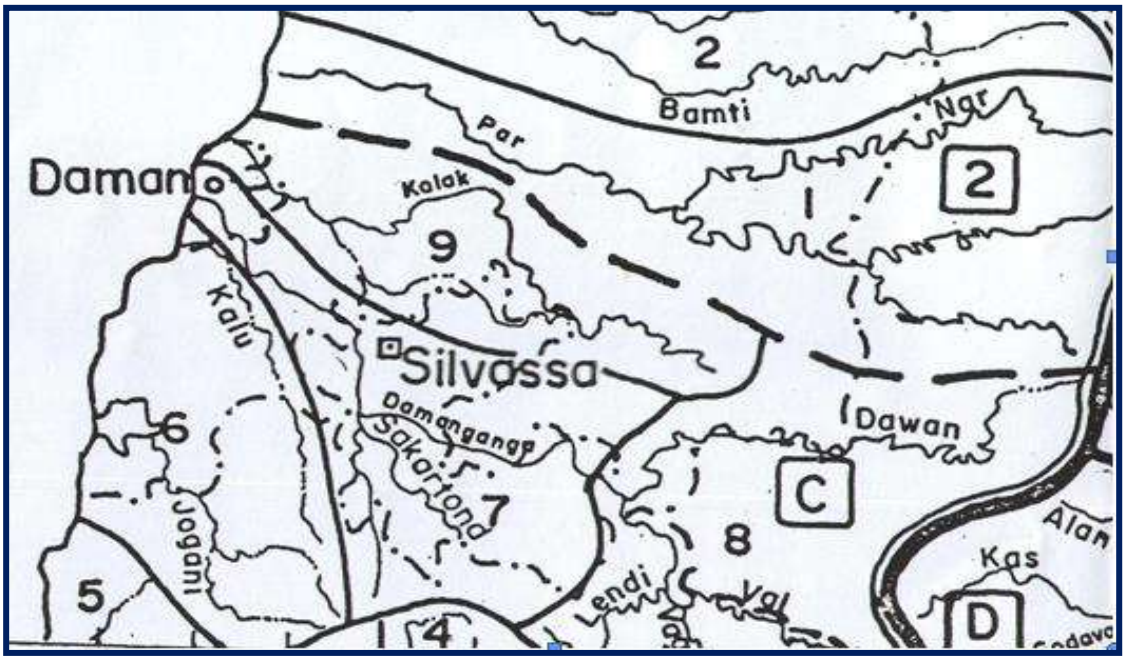
2.5.3 Damanganga Basin as per Watershed Atlas of India

As per Watershed Atlas of India, Published by Department of Agriculture and Cooperation, Ministry of agriculture, Krishi Bhavan New Delhi (1990), the sub catchments from 5B2C pertain to Damanganga Basin. Shown in **Fig-2.5.1**.

2.5.3.1 Sub catchment -5B2C (5B2C7 & 5B2C8)

This Sub Catchment is situated in the plain and hilly region of Gujarat, Maharashtra and Union territory (DNH) drained by Lendi, Sakkartond, Rashni, Val, Vagh, Donger Khadi, Pipariya, and Varai. The total area of this Sub-Catchment is 2318 sq km.

Fig-2.5.1: Sub-catchment area of Damanganga Basin as per watershed Atlas of India.



Source: Watershed Atlas of India, Published by Department of Agriculture and Cooperation, Ministry of agriculture, Krishi Bhavan New Delhi (1990)

2.5.4 The Climate

The entire Damanganga Basin lies in the Western Ghats region. It is bound on the west by Arabian Sea and on the east by Sahyadri ranges. The climate of the basin is characterised by a hot summer, which is generally dry except the southwest monsoon during June to September.

Accordingly to Koeppan's Scheme, the climate of the basin is classified as AW-Tropical Savannah as most of the peninsular plateau, south of Tropic of Cancer, is classified. The climatic variations are experienced in the patterns of temperature,

rainfall & winds, whether of seasons and degree of wetness or dryness. These are described as follows

2.5.4.1 Temperature

The Temperature is maximum in the month of May and Minimum in the month of December to January. The temperature profile in the basin is given in the Table-2.5.2

Table-2.5.2; Mean monthly Temperature (^{0}C) during water year at site Nanipalsan & Ozerkheda in Damanganga Basin

Name of Site	Nanipalsan		Ozerkheda	
Month	Mean Monthly Maximum Temperature (^{o}C)	Mean Monthly Minimum Temperature (^{o}C)	Mean Monthly Maximum Temperature (^{o}C)	Mean Monthly Minimum Temperature (^{o}C)
Jun-16	34.7	25.2	32.9	25.0
Jul-16	27.4	23.5	26.0	22.7
Aug-16	29.7	23.8	25.7	22.8
Sep-16	28.8	23.2	26.2	21.9
Oct-16	33.3	21.9	29.4	18.8
Nov-16	35.4	15.1	31.6	12.3
Dec-16	34.9	12.6	31.2	11.0
Jan-17	34.5	12.5	30.0	10.8
Feb-17	36.7	14.6	32.4	12.8
Mar-17	40.9	16.7	35.9	16.2
Apr-17	42.4	19.5	37.8	20.3
May-17	40.8	17.2	37.2	24.7
Annual mean	35.0	18.8	31.4	18.3

2.5.4.2 Rainfall

The basin receives most of the rainfall from the South West monsoon during June to October. Almost 98% of the annual rainfall of the basin is received during this period. The rainfall at site in Damanganga Basin as shown in Table -**2.5.3**. & table **2.5.4**

Table -2.5.3: Mean annual rainfall of Damanganga Basin

Sl. No	Name of Site	Data available (No of Years)	Average Rainfall (mm)	Average no of rainy days	Rainfall in the year 2016-17	No of rainy days in 2016-17
1	Ozerkheda	31	2082.4	90	2452.4	98
2	Nanipalsan	31	2147.7	91	2509.4	99

Table-2.5.4: Seasonal Rainfall during Water Year 2016 at site Nanipalsan & Ozerkheda in Damanganga Basin

Sl No	Name of Site	Seasonal Rainfall (mm) in 2016				Total Annual Rainfall
		Winter monsoon (Jan-Feb)	Pre monsoon (Mar-May)	South-West monsoon (June-Sept)	Post monsoon (Oct-Dec)	
1	Nanipalsan	0.0	1.0	2427.4	77.0	2505.4
2	Ozerkheda	0.0	1.2	2381.4	71.0	2453.6

2.5.4.3 Wind

The wind speed data of the Damanganga basin at two sites viz Ozerkheda and Nanipalsan are given in **Table -2.5.5**. The average wind speed in the Damanganga basin varies about 0.7 km/h to 4.3 km/h. in the pre and post monsoon period.

Table -2.5.5: Wind Speed at site Ozerkheda & Nanipalsan in Damanganga basin basin during Water Year 2016-17

Month	Mean monthly wind Speed (km/h)	
	Nanipalsan	Ozerkheda
June	4.2	3.7
July	1.6	0.9
August	2.3	1.3
September	1.5	0.6
October	1.2	0.3
November	1.1	0.4
December	1.3	0.7
January	1.6	1.1
February	2.1	1.6
March	2.8	2.4
April	3.3	2.7
May	2.3	3.2
Annual Mean	2.1	1.6

2.5.4.4 Humidity

The relative Humidity in Damanganga basin varies between 65.5 % and 91.9 %, depending upon the season. Humidity reaches maximum value during the monsoon period in the range of about 91.9 to 81.8 %. In the winter months of November and

December, it decreases. Relative humidity at Ozerkheda and Nanipalsan stations of CWC in Damanganga Basin is given in **Table-2.5.6**.

Table-2.5.6: Mean monthly Relative Humidity at site Ozerkheda & Nanipalsan in Damanganga Basin during Water Year 2016-17

Month	Relative Humidity (%)	
Name of Site	Nanipalsan	Ozerkheda
June	87.0	86.8
July	91.9	90.9
August	92.0	90.9
September	91.8	90.7
October	91.0	90.6
November	89.6	84.3
December	87.5	84.4
January	86.8	86.4
February	86.9	73.6
March	86.6	70.0
April	84.9	73.0
May	86.3	79.9
Annual Mean	88.5	83.5

2.5.5 Geology

The Great Trap region of the Deccan covers substantial part of the Basin. It is entirely of volcanic formation. The volcanic portion consists of compact, stratified basalts, and an earthy trap. The basalts are the most conspicuous geological feature. To the west they lie in flat-topped ranges, separated by valleys, trending from west to east. In some flows the basalt is columnar and then it weathers into the fantastic shapes. The formation at the base of the traps is chiefly amygdaloidal, containing quartz in vertical veins, crystals and zeolitic minerals, especially apophyllite weathering into a gray soil. The absence of laterite, which caps the summits of the hills to the south, is a curious feature in the geology of the area. The basalt is either fine textured or it is coarse and nodular.

2.5.6 Soil

Soils found in Damanganga basin can broadly be divided in three groups:

1) Red coarse soil
2) Coastal Alluvial soil
3) Black soil

The red soil is less common and is suitable for cultivation under a heavy and consistent rainfall. Red coarse soil is derived from disintegration of basaltic rock fragments under heavy rainfall. It is shallow in depth, coarse sandy loam to sandy loam in texture, rapidly drained and low in fertility. The alluvium is deep to very deep yellowish brown to grayish brown in colour and clay loam to salty loam in texture. This soil is normally free from salinity and alkalinity. The black soil is very fertile for cereals and pulses. The black soil contains high alumina and carbonates of calcium and magnesium with variable amounts of potash, low nitrogen and phosphorus.

2.5.7 Major / Medium/multipurpose/irrigation projects

The important project of this basin is Damanganga project. The salient features of the important components of Madhuban dam of Damanganga projects are as follows.

2.5.7.1 Madhuban Dam

This is a composite dam constructed across the river Damanganga near village Madhuban of Dharampur Taluka, Valsad district of Gujarat state. The main purpose of the project is irrigation, other being water supply for domestic and industrial use and for generation of 2.0 MW of power. The project has a network of canal system on either bank of the river to provide irrigation to an area of 56630-ha of land. The dam has height of 50 m above the deepest foundation to store 567 Mm^3 of water.

2.6 Kim Basin

2.6.1 Geographical setting of Kim Basin

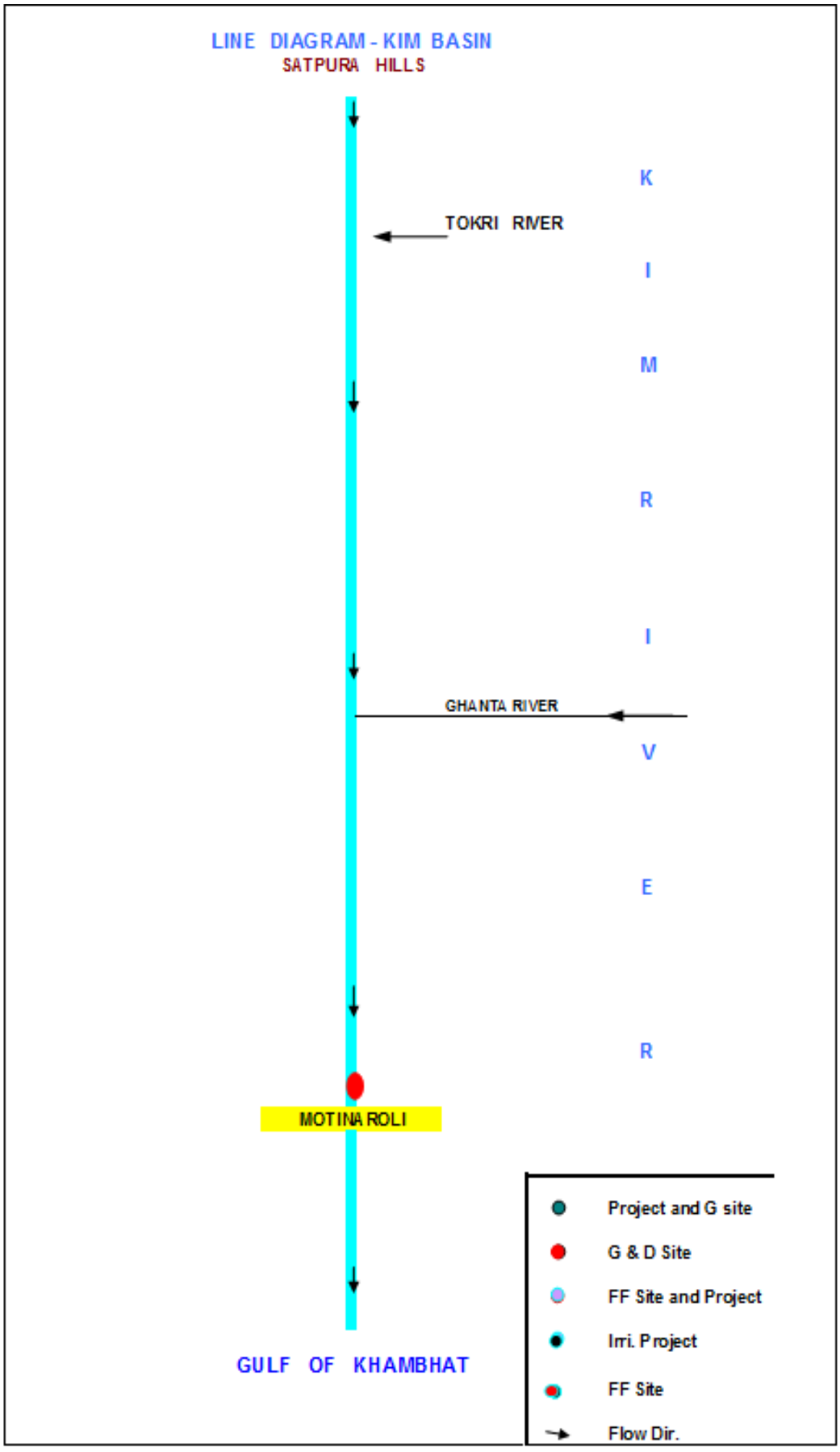
Kim River is one of the west flowing rivers in Gujarat state. It originates from Saputara Hill ranges in Bharuch district and falls in Gulf of Khambhat near village Kantiajal of Hansot taluka of Bharuch district after flowing south west direction for a length of 107 km. The river Kim, for the first 80 km of its course passes through Rajpipala and Valia talukas. For the remaining part, the river flows in a western direction between Ankleshwar and Olpad taluka of Surat District. Basin map is shown in **Plate -2.6.1**.

Plate -2.6.1

2.6.2 River System

The main tributaries of Kim river are Ghanta river and Tokri river. The river basin extends over an area of 1286 sq km of which the catchment area up to the site is 804 sq km. The river basin lies between21° 19’ to 21° 38’ North latitude and 72° 40’ to 73° 27’ East longitude. A line diagram of Kim basin is shown in **Plate -2.6.2**.

Plate -2.6.2


LINE DIAGRAM - KIM BASIN
SATPURA HILLS
K
TOKRI RIVER
I
M
R
I
GHANTA RIVER
V
E
R
MOTINA ROLI
GULF OF KHAMBHAT
Project and G site
G & D Site
FF Site and Project
Irri. Project
FF Site
Flow Dir.

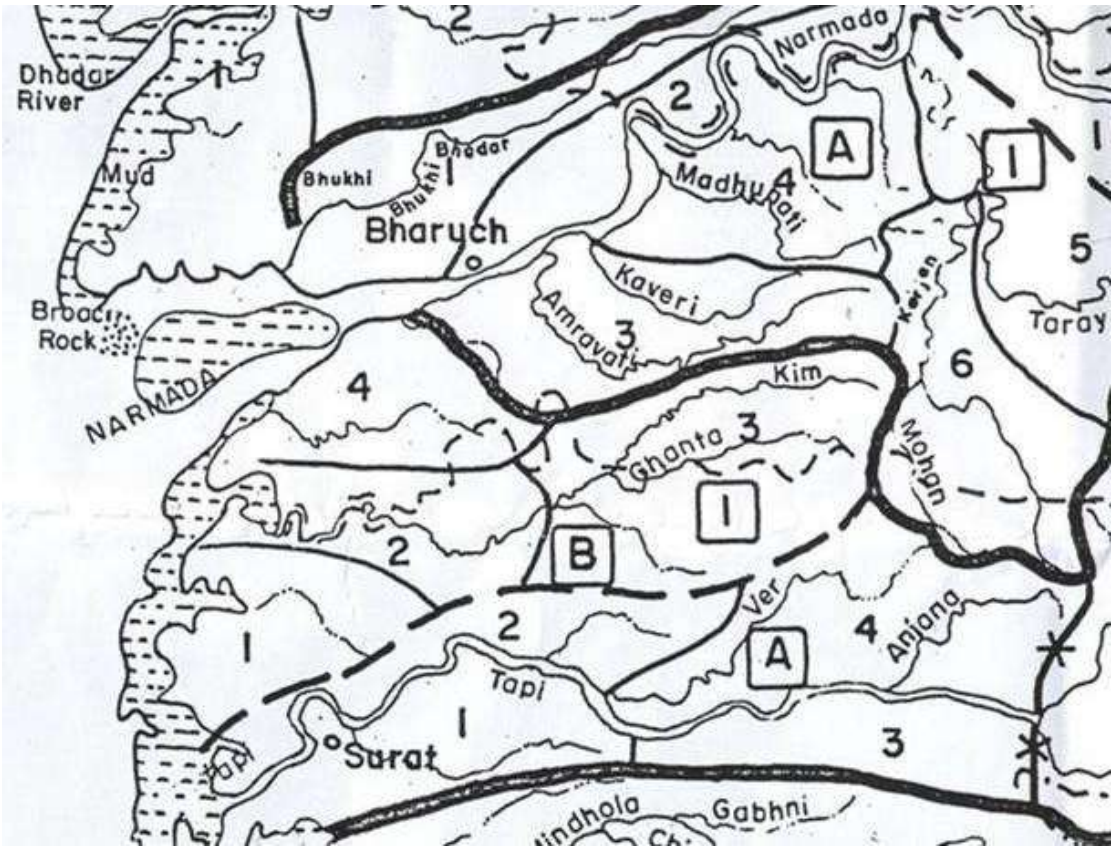
2.6.3 Kim Basin as per Water Shed Atlas of India

As per Watershed Atlas of India, Published by Department of Agriculture and Cooperation, Ministry of agriculture, Krishi Bhavan New Delhi (1990), the sub catchments from 5C1B pertain to Kim Basin as shown in **Fig.-2.6.1**.

2.6.3.1 Subcatchment -5C1B (5C1B2 & 5C1B3)

This Sub Catchment is situated in the plain region of Gujarat, drained by Ghanta and Tokri River. The total area of this Sub-Catchment is 1286 Sqkm.

Fig.-2.6.1: Kim Basin as per water shed Atlas of India**.**



Source: Watershed Atlas of India, Published by Department of Agriculture and Cooperation, Ministry of agriculture, Krishi Bhavan New Delhi (1990)

2.6.4 The Climate

Most of the Kim Basin lies in coastal plains near the sea, where the climate is moderate and humid. The month of May is the hottest and January is the generally coldest month of the Basin.

Accordingly to Kocppan's Scheme, the climate of the basin is classified as AW-Tropical Savannah, as most of the peninsular plateau, south of Tropic of Cancer, is classified. The climatic variations are experienced in the patterns of temperature,

rainfall & winds, rhythm of seasons and degree of wetness or dryness. These are described as follows

2.6.4.1 Temperature

Temperature is maximum in the month of May and Minimum in the month of December to January. The temperature profile in the basin is given in the **Table-2.6.1**.

Table-2.6.1: Mean monthly Temperature (^{0}C) during water year at site Kim at Motinaroli

Month	Mean Monthly Maximum Temperature	Mean Monthly Minimum Temperature
Jun-16	33.5	28.6
Jul-16	29.0	26.8
Aug-16	28.0	26.2
Sep-16	30.0	26.0
Oct-16	29.9	23.6
Nov-16	33.5	18.5
Dec-16	33.0	15.2
Jan-17	30.2	14.5
Feb-17	33.5	17.5
Mar-17	36.9	20.7
Apr-17	37.9	24.7
May-17	38.0	28.5
Annual mean	32.8	22.6

2.3.4.2 Rainfall

The basin receives most of the rainfall from the South West monsoon during June to October. Almost 98% of the annual rainfall of the basin is received during this period. The rainfall at site in Kim Basin shown in **Table-2.6.2** & **Table-2.6.3**.

Table-2.6.2: Mean annual rainfall of site Kim at Motinaroli

Sl. No	Name of Site	Data available (No of Years)	Average Annual Rainfall (mm)	Average no of rainy days	Rainfall in the year 2016-17	No of rainy days in 2016-17
1	Motinaroli	25	1223.6	54	627.3	50

Table-2.6.3: Seasonal Rainfall during Water Year 2016 at site Motinaroli

Sl No	Name of Site	Seasonal Rainfall (mm) in 2016				Total Annual Rainfall
		Winter monsoon	Pre monsoon	South-West monsoon	Post monsoon	
		(Jan-Feb)	(Mar-May)	(June-Sept)	(Oct-Dec)	
1	Motinaroli	0.0	8.0	473.9	153.4	653.3

2.6.4.3 Wind

The wind speed data of the Kim basin is given in Table-2.6.4. The average wind speed in the Kim basin varies about 0.3 km/h to 7.9 km/h. The pre dominant wind direction is NE

Table-2.6.4:Wind Speed at site Motinaroli in Kim basin during Water Year 2016-17

Month	Mean monthly wind Speed (km/h)
June	4.9
July	3.5
August	3.6
September	2.0
October	1.0
November	0.4
December	0.6
January	0.8
February	0.9
March	0.9
April	0.4
May	0.2
Annual Mean	1.6

2.6.4.4 Humidity

The relative Humidity in Kim basin varies between 97.1% to 78.7% depending upon the season. It is maximum in the monsoon period and is about 78.7 % to 97.1 %. In the winter months of November and December, relative humidity comes down. Relative humidity at station Motinaroli of CWC in the Kim Basin is given in Table-2.6.5.

Table-2.6.5: Mean monthly Relative Humidity at site Motinaroli in Kim Basin during Water Year 2016-17

Month	Relative Humidity (%)
June	82.1
July	91.8
August	92.0
September	88.3
October	87.7
November	81.6
December	88.5
January	87.3
February	86.4
March	80.7
April	78.1
May	85.5
Annual Mean	85.5

2.6.5 Soil

The soil found in Kim basin can be broadly classified into three groups i.e.Lateritic soils, deep black soils and coastal alluvial soils.

2.6.6 Major / Medium/multipurpose/irrigation projects

The major and medium projects completed / ongoing on Kim river basin are as shown in Table-2.6.6.

Table-2.6.6: Major and medium projects completed / ongoing in Kim basin

Sl.No.	Name of the project	River	Status	Capacity in Mm^3		Utilisation
				Gross	Live	Irrigation
1	Baldeva Irrigation Scheme	Tokri	Medium	8.15	7.84	Domestic
2	Pigut Irrigation S Scheme	Tokri	Medium	7.52	7.27	-do-

Hydrological observations by State government

Source of information

Apart from the sites maintained by central water commission the state government of Gujarat, Madhya Pradesh, Rajasthan and Maharashtra are also conducting gauge and discharge observations in among 14 Basins. The Basin wise list of sites and the authority maintaining the sites are listed in the following para.

Basin wise list of sites

1	Purna Basin	1 Purna 2 Purna 3 Purna 4 Zankhari 5 Zankhari 6 Zankhari	At Wankla At Navsari At Kalibel At Malotha At Ghat At ZanKhari	Sup. Engineer, WRI Circle LD Engg. College campus, near Gujarat university, Ahmedabad & Executive engineer WRI Divn., Bhadra fort, Laldarwaja, Ahmedabad
2	Ambica Basin	1 Ambica 2 Ambica 3 Khapri 4 Kharera 5 Kharera 6 Kaveri 7 Valam 8 Valam	At Unai At Bilimora At Kundkas At Kavdej At Lalia Dam At Vansda At Wankla At Dholka	Sup. Engineer, WRI Circle LD Engg. College campus, near Gujarat university, Ahmedabad & Executive engineer WRI Divn., Bhadra fort, Laldarwaja, Ahmedabad
3 Vaitarna Basin No state govt. Sites in this Basin				
4	Dhadhar Basin	1 Dhadhar 2 Dhadhar 3 Dhadhar 4 Deo 5 Deo 6 Vishwamitri 7 Vishwamitri 8 Surya	At Bhilapur At Por At Pingalwada At Vejalpur At Shivrajpur At Pilol At Harni At Bhaniyara	Sup. Engineer, WRI Circle LD Eengg. College campus, near Gujarat university, Ahmedabad & Executive engineer WRI Divn., Bhadra fort, Laldarwaja, Ahmedabad
5	Damanganga Basin	1 Damanganga 2 Sakertond	At Vapi Bridge At Khanvel	Water resources investigation Sub Division, Navsari
6	Kim Basin	1 Kim	At Vellachha	Water resources investigation Sub Division, Navsari

3.0 Methodology: Stream flow measurement

3.1 Gauge measurement

Water level or stage of the River is measured as its elevation above the g t s datum. Water level measurement was conducted by reading non-recording gauges. A series of vertical staff gauges as per the specifications laid down in is 4080-1977 have been fixed at three sections at each site i.e. Upstream, station gauge and downstream. The gauge posts are of RCC/wooden/ metallic with cut and edge waters and are fixed securely in position by installing them in m-150 concrete blocks of suitable size. Enameled gauge plate with marking in metric unit is fixed on the gauge posts with least count 0.005 m. Out of the three gauge lines the central line is used as station gauge line and readings of the other two lines are used for calculating the surface slope. The gauges were read hourly during Monsoon season and three hourly i.e. 0800, 1300 and 1800 Hrs during non Monsoon season at station gauge line.

3.2 Discharge observation

Discharge observation is conducted once a day at 0800 Hrs, at all the sites by area velocity method except on Sunday and holidays in non Monsoon period. However additional observations were conducted during floods to cover different stages, irrespective of holidays. The River width is generally divided into 15 to 25 segments based on the degree of accuracy as outlined in is: 1192-1981. The width of the River is measured by steel/metallic tape or wire rope stretched across the River with segment markings indicated thereon, when the River width is quite small and the flow depths permit wading. For larger width and deeper flow conditions and in unmanageable flood conditions segment points vertically are located by measuring the navigation craft with reference to pivot point and segment blocks constructed at sites.the depth measurement is carried out by using sounding rod for depths up to 3 meter and by using long bamboos for depths between 3 meter and 6 meter. For depths exceeding 6 meter sounding reel measurements at segment points are resorted to, and in Some cases, the depths are measured by echo sounder or are computed from the most recent x-sections of the River. The velocity is measured as per is 3918 - 1976 by using a cup type current meter conforming to is 3910 - 1976. The current meter is lowered to the requisite depth i.e. 0.6 of total depth down the vertical at every segment point by suspension equipment as specified in is 6064 - 1981 and where the depth is less than 0.3 meters, the velocity is observed just below the water surface. In

medium and high stages with significant flow velocities, boats fitted with power engines are used. Measurements of velocity are sometimes carried out from the bridges when the River flow condition does not permit the boat to be kept stable for velocity observation. When none of the above procedures are possible, the velocity is measured by float observations.

The data observed as above at the site is entered in the prescribed standard format to compute the total River discharge and it is further scrutinised at various levels before finalisation.

The daily observed/estimated discharge data is presented in this book.

Table-3.1.1 : Equipment used for observation

Sl. No	**Name of equipment**	**By wading**	**By boat**	**Bridge**	**By float**
1	Current meter	√	√	√	X
2	Pigmy current meter	√	X	X	X
3	Stop watch	√	√	√	√
4	Wading rod	√	X	X	X
5	Nylon rope & tag	√	X	X	X
6	Measuring tape	√	X	X	X
7	Protractor	√	√	√	X
8	Ranging rod	√	√	X	√
9	Sounding rod	√	√	X	X
10	Automatic battery counter	√	√	√	X
11	Thermometer	√	√	√	√
12	Prismatic compass	X	X	X	√
13	Balloon	X	X	X	√
14	Sounding cable with fish weight	X	√	X	X
15	Echo sounder	X	√	√	X
16	Bridge out fit	X	X	√	X
17	Boat out fit	X	√	X	X

3.3 Explanatory notes

Explanatory notes given here have been designed to assist in the data interpretation of hydrological parameters contained in the data presented. The notes are therefore, applicable in so far as the data presented in this book.

1. Water Year covers the period from June 1st of one calendar year to may 31st of next calendar year and includes one complete hydrological cycle.

2. Discharge is given in cubic meters per second.

3. Discharges given are daily observed / estimated discharges.

4. The zero of gauge is a datum level / RL Fixed for a given site, which is kept 1 or 2 m lower than the lowest water level recorded in a perennial stream. In a non - perennial stream, it is kept 1 or 2 m lower than the lowest bed level of the stream.

5. Maximum and minimum discharges are taken from the daily observed flows / estimated.

6. Runoff in "mm" is the notional depth of water in millimeters over the catchment area equivalent to annual runoff calculated at the discharge measurement station.

$$\textbf{Runoff (mm)} = \frac{\textbf{Annual runoff (Mm3)}}{\textbf{Catchment area (km}^2\textbf{)}} \times 1000$$

7. Peak and lowest flows correspond to the highest and lowest water levels recorded during the period of record.

8. Measuring authority refers to the field division responsible for the operation of the gauge station. The name of the division is abbreviated by taking first alphabet of the River name followed by alphabets "DN" for division. For example Mahi division is denoted by MDN and Tapi division is denoted as TDN. These abbreviations are given cross-reference in the list of abbreviations and symbols.

9. Gauging station code number is a unique nine-digit reference number, which facilitates retrieval of flow data in data bank. The first two digits denote the measuring authority. The third and fourth digits are the Basin/zone identifier and fifth and sixth digits are the independent River Basin identifier. The last three digits of the code number indicate gauging site no. which is given from origin to mouth.

11. The month and the year from which data are available in the data bank are indicated against the record available.

3.4 Method of presentation

The data presented in this book is processed discharge data obtained from application of SWDES/HYMOS software.

The station wise hydrological data is presented comprising history sheet, daily flow table and pictorial summary. The sequence of hydrological station arranged from its outfall to origin giving inter-priority to an intermediate tributary station.

4.0 Hydrological data

The hydrological data presented hereby mainly consist of the following

History sheet

Its manly consist of some salient features of particular site as Site name, state, district, River Basin, tributary, catchment area, latitude / longitude, opening / closing date for various types of data& maximum –minimum discharge values.

Data sheet

It consists of stage- discharge data (both observed & estimated from stage discharge curve for the season), for the current year with mean water level during the discharge observation and peak observed and computed discharge with corresponding water level with date during the year, Lowest discharge with corresponding water level with date during the year, Peak discharge with corresponding water level with date since inception, Lowest discharge with corresponding water level with date since inception.

Stage discharge curve

It gives a relationship between the stage of the river and the corresponding discharge.

Annual run-off

It gives the value of Annual run off in MCM for all the years from the opening of the site.

Water level v/s time graph

Hourly observed water level for one to three important highest peak flood events of current Water Year covering the period well before the start and upto well beyond the completion of these flood events.

Charts / Maps

Basin map showing sites / projects

The site-wise pre – Monsoon and post – Monsoon cross sections

The site-wise pie chart

Site-wise bar charts

The site-wise hydrographs (flood events)

Chapter-4: Hydrological data

4.1 Purna Basin

4.1.1 History sheet

HISTORY SHEET

			Water Year	**:**	**2016-17**
Site	**:**	**Purna at Mahuwa**	**Code**	**:**	**01 02 19 001**
State	:	Gujarat	District		Surat
Basin	:	WFR South of Tapi	Independent River	:	Purna
Tributary	:		Sub Tributary	:	
Sub-Sub Tributary	:		Local River	:	
Division	:	Tapi Division, Surat	Sub-Division	:	LTSD,CWC, Surat
Drainage Area	:	1995 Sq. Km.	Bank	:	Right
Latitude	:	21°00'52"	Longitude	:	73°08'25"
Zero of Gauge (m)	:	9 (m.s.l)	04/10/1970		
		Opening Date	Closing Date		
Gauge	:	04/10/1970			
Discharge	:	12/11/1970			
Sediment	:	18/06/1973			
Water Quality	:	15/06/1977			

Annual Maximum / Minimum discharge with corresponding water Level (m.s.l)

	Maximum			Minimum		
Year	Q (cumecs)	WL (m)	Date	Q (cumecs)	WL (m)	Date
1971-1972	682.3	13.655	13/08/1971	0.099	10.055	30/04/1972
1972-1973	454.6	12.800	19/08/1972	0.020	9.895	31/05/1973
1973-1974	1550	13.914	25/09/1973	0.026	9.930	09/06/1973
1974-1975	183.0	11.225	01/10/1974	0.071	10.095	31/05/1975
1975-1976	964.3	13.730	13/08/1975	0.030	10.055	12/06/1975
1976-1977	4380	20.550	31/07/1976	0.040	10.150	02/06/1976
1977-1978	4020	19.765	03/09/1977	0.100	10.060	07/06/1977
1978-1979	1692	15.252	09/07/1978	0.200	10.110	10/06/1978
1979-1980	3378	20.100	10/08/1979	0.200	10.110	13/06/1979
1980-1981	775.0	13.667	02/08/1980	0.480	10.190	15/05/1981
1981-1982	1572	16.430	10/07/1981	0.000	10.050	01/04/1982
1982-1983	2815	20.390	25/07/1982	0.100	10.065	09/05/1983
1983-1984	1818	15.666	20/07/1983	0.100	10.010	02/06/1983
1984-1985	846.3	13.955	13/09/1984	0.500	10.310	08/06/1984
1985-1986	3255	20.560	01/08/1985	0.300	10.060	13/04/1986
1986-1987	527.2	12.775	16/08/1986	0.300	10.125	08/03/1987
1987-1988	873.7	15.260	07/07/1987	0.100	10.035	29/01/1988
1988-1989	1526	15.700	27/07/1988	0.200	9.970	18/04/1989
1989-1990	2362	17.920	25/07/1989	0.600	10.020	07/06/1989
1990-1991	1396	17.625	17/08/1990	1.420	9.870	27/03/1991
1991-1992	300.8	10.970	24/07/1991	0.600	9.850	29/05/1992
1992-1993	1386	17.100	03/09/1992	0.280	9.720	30/05/1993
1993-1994	1254	15.250	10/07/1993	0.385	9.635	13/05/1994
1994-1995	3078	20.470	16/06/1994	0.286	9.755	19/04/1995
1995-1996	404.6	11.995	25/07/1995	0.100	9.720	09/06/1995
1996-1997	781.5	13.330	09/09/1996	0.600	9.720	10/06/1996
1997-1998	2174	17.410	25/08/1997	0.430	9.370	27/05/1998
1998-1999	2359	17.720	08/07/1998	0.350	9.355	08/06/1998
1999-2000	695.6	13.030	16/07/1999	0.598	9.320	17/02/2000
2000-2001	782.8	13.250	14/07/2000	0.061	9.160	27/04/2001
2001-2002	1233	14.400	16/08/2001	0.085	9.075	30/04/2002
2002-2003	2517	17.550	25/08/2002	0.089	9.150	05/06/2002
2003-2004	2946	18.365	28/07/2003	0.071	9.075	05/06/2003
2004-2005	8836	23.490	04/08/2004	0.779	9.230	31/01/2005
2005-2006	5437	21.280	29/06/2005	0.500	9.180	16/06/2005
2006-2007	3273	19.050	05/07/2006	0.827	9.140	26/05/2007
2007-2008	3058	18.350	02/07/2007	1.116	9.160	01/06/2007
2008-2009	1853	16.360	19/09/2008	2.163	9.170	06/06/2008
2009-2010	667.2	12.900	07/09/2009	0.000	9.050	01/06/2009
2010-2011	744.5	13.330	09/09/2010	0.007	9.010	27/03/2011
2011-2012	607.5	12.750	29/08/2011	0.000	9.010	10/06/2011
2012-2013	692.4	13.030	13/08/2012	0.000	9.020	01/06/2012
2013-2014	1508	15.500	24/09/2013	0.000	9.000	As per SD Curve
2014-2015	843.3	13.630	30/07/2014	0.000	9.010	01/06/2014
2015-2016	548.0	12.400	19/09/2015	0.000	8.690	01/06/2015
2016-2017	1048	14.020	09/08/2016	0.000	8.870	01/06/2016

4.1.2 Annual Maximum flood Peaks

Year	Annual Maximum flood Peaks (m)	Date	Hour
1970	9.780	13/10/1970	08:00:00
1971	13.655	13/08/1971	08:00:00
1972	14.805	06/07/1972	18:00:00
1973	18.215	25/09/1973	16:00:00
1974	12.035	15/07/1974	03:00:00
1975	18.680	12/08/1975	18:00:00
1976	21.200	12/07/1976	19:00:00
1977	20.550	03/09/1977	11:00:00
1978	17.700	29/08/1978	22:00:00
1979	20.210	10/08/1979	19:00:00
1980	15.330	02/08/1980	15:00:00
1981	16.440	10/07/1981	17:00:00
1982	20.710	25/07/1982	15:00:00
1983	17.130	13/08/1983	18:00:00
1984	22.550	18/07/1984	19:00:00
1985	21.050	01/08/1985	04:00:00
1986	13.120	19/07/1986	21:00:00
1987	15.680	07/07/1987	11:00:00
1988	18.185	29/07/1988	01:00:00
1989	19.890	24/07/1989	07:00:00
1990	19.500	17/08/1990	06:00:00
1991	13.670	24/07/1991	18:00:00
1992	17.810	03/09/1992	07:00:00
1993	19.400	14/07/1993	02:00:00
1994	24.800	16/06/1994	17:00:00
1995	13.660	28/07/1995	15:00:00
1996	17.500	23/07/1996	15:00:00
1997	18.000	31/07/1997	21:00:00
1998	17.840	08/07/1998	10:00:00
1999	13.500	19/07/1999	18:00:00
2000	14.640	14/07/2000	02:00:00
2001	19.300	17/06/2001	22:00:00
2002	19.500	26/06/2002	19:00:00
2003	19.880	28/07/2003	06:00:00
2004	23.900	04/08/2004	00:00:00
2005	21.280	29/06/2005	08:00:00
2006	20.300	05/07/2006	12:00:00
2007	20.500	02/07/2007	12:00:00
2008	18.800	19/09/2008	15:00:00
2009	14.740	22/07/2009	21:00:00
2010	14.400	07/08/2010	15:00:00
2011	14.140	14/08/2011	21:00:00
2012	13.800	13/08/2012	05:00:00
2013	19.700	23/09/2013	20:00:00
2014	14.200	30/07/2014	14:00:00
2015	15.800	18/09/2015	24:00:00
2016	14.500	06/08/2016	17:00:00

4.1.3 Summary of Discharge Data

Stage –Discharge data for the period 2016-17

Station Name: Purna at Mahuwa (010219001) Division : Tapi Division Surat Local River: Purna Sub -Division : LTSD, CWC, Surat

Day	Jun		Jul		Aug		Sep		Oct		Nov	
	W.L	Q	W.L	Q	W.L	Q	W.L	Q	W.L	Q	W.L	Q
1	8.870	0.000	8.770	0.000	10.580	135.5	9.660	21.29	9.760	27.76	9.200	2.989
2	8.870	0.000	8.870	0.000	11.960	405.9	9.640	20.20	9.760	29.55 *	9.180	2.715
3	8.850	0.000	8.900	0.000	11.440	283.0	9.620	18.78	11.180	250.5	9.150	0.000
4	8.840	0.000	9.000	0.000	11.220	261.9	9.600	18.40 *	10.740	163.6	9.140	0.000
5	8.810	0.000	8.940	0.000	11.120	243.4	9.540	11.69	10.660	139.7	9.140	0.000
6	8.760	0.000	8.930	0.000	11.980	414.5	9.520	10.61	10.380	100.3	9.140	0.000
7	8.750	0.000	8.920	0.000	14.000	1028	9.480	8.624	10.260	86.90	9.130	0.000
8	8.740	0.000	8.920	0.000	11.200	254.6	9.480	8.608	10.040	58.95	9.130	0.000
9	8.740	0.000	8.910	0.000	14.020	1048	9.680	22.99	9.840	36.00 *	9.130	0.000
10	8.720	0.000	8.910	0.000	11.960	408.4	9.600	16.71	9.960	52.93	9.120	0.000
11	8.720	0.000	12.400	498.8	11.720	355.8	9.500	12.66 *	9.820	34.34 *	9.120	0.000
12	8.710	0.000	9.980	54.34	11.120	243.1	9.500	9.694	9.760	29.55 *	9.110	0.000
13	8.700	0.000	10.980	208.1	10.680	142.4	9.500	12.66 *	9.700	24.97	9.110	0.000
14	8.690	0.000	10.060	63.44	10.540	116.0 *	9.420	7.855	9.640	18.14	9.110	0.000
15	8.690	0.000	9.680	23.22	10.460	104.8 *	9.380	7.598	9.620	18.58	9.100	0.000
16	8.690	0.000	9.580	12.71	10.220	82.66	9.380	7.151	9.580	17.17 *	9.090	0.000
17	8.690	0.000	9.500	12.66 *	10.000	54.95	9.980	50.68	9.570	13.02	9.080	0.000
18	8.680	0.000	9.460	9.873	9.880	45.27	10.920	176.0 *	9.520	10.83	9.080	0.000
19	8.680	0.000	9.540	10.67	10.000	54.75	11.300	275.7	9.480	8.913	9.070	0.000
20	8.670	0.000	10.060	63.70	9.820	34.86	11.720	338.2	9.480	9.108	9.070	0.000

21	8.670	0.000	9.740	25.94	9.900	41.22 *	10.400	101.3	9.440	8.580	9.070	0.000
22	8.680	0.000	9.700	25.11	9.780	29.80	10.560	131.1	9.420	8.229	9.060	0.000
23	8.680	0.000	9.680	22.81	9.700	24.65	10.220	82.67	9.360	6.290 *	9.050	0.000
24	8.680	0.000	9.640	20.96 *	9.780	29.73	10.730	159.9	9.350	5.920	9.050	0.000
25	8.690	0.000	9.580	12.57	10.480	107.5 *	10.620	127.7 *	9.330	5.687	9.040	0.000
26	8.690	0.000	9.520	8.606	10.020	56.47	10.420	103.1	9.310	5.314	9.040	0.000
27	8.690	0.000	9.520	8.611	9.960	53.13	10.200	80.09	9.310	5.302	9.040	0.000
28	8.710	0.000	9.480	8.103	9.860	37.71 *	10.000	55.97	9.290	5.072	9.030	0.000
29	8.720	0.000	9.420	7.499	9.780	29.07	9.920	49.68	9.250	3.815	9.020	0.000
30	8.730	0.000	9.400	7.226	9.720	25.79	9.820	37.91	9.230	2.230 *	9.020	0.000
31			9.740	28.02 *	9.700	25.14			9.200	2.998		
Ten-Daily Mean												
I Ten-Daily	8.795	0.000	8.907	0.000	11.948	448.4	9.582	15.79	10.258	94.62	9.146	0.570
II Ten-Daily	8.692	0.000	10.124	95.75	10.444	123.4	10.060	89.82	9.617	18.46	9.094	0.000
III Ten-Daily	8.694	0.000	9.584	15.95	9.880	41.84	10.289	92.95	9.317	5.403	9.042	0.000
Monthly												
Min.	8.670	0.000	8.770	0.000	9.700	24.65	9.380	7.151	9.200	2.230	9.020	0.000
Max.	8.870	0.000	12.400	498.8	14.020	1048	11.720	338.2	11.180	250.5	9.200	2.989
Mean	8.727	0.000	9.540	36.55	10.729	199.3	9.977	66.18	9.717	38.40	9.094	0.190

Annual Runoff in MCM = 907 **Annual Runoff in mm = 454**

Peak Observed Discharge = 1048.0 cumecs on 09-08-2016 **Corres. Water Level :14.020 m**

Lowest Observed Discharge = 0.000 cumecs on 01-06-2016 **Corres. Water Level :8.87 m**

Water Level(m.s.l) in m *:Computed Discharge #:Discarded Discharge (values changed as per rating curve)

Note: River remained in pooling/ no flow condition w.e.f. 01/06/16to 10/07/16 and from 03/11/16 to 31/05/17

Stage –Discharge data for the period 2016-17

Station Name: Purna at Mahuwa (010219001) Division: Tapi Division Surat Local River: Purna Sub -Division: LTSD, CWC, Surat

Day	Dec		Jan		Feb		Mar		Apr		May	
	W.L	Q	WL	Q	WL	Q	WL	Q	WL	Q	WL	Q
1	9.010	0.000	8.720	0.000	8.660	0.000	8.840	0.000	8.890	0.000	8.900	0.000
2	9.000	0.000	8.720	0.000	8.650	0.000	8.850	0.000	8.880	0.000	8.890	0.000
3	9.000	0.000	8.730	0.000	8.620	0.000	8.850	0.000	8.860	0.000	8.880	0.000
4	9.000	0.000	8.740	0.000	8.600	0.000	8.880	0.000	8.860	0.000	8.880	0.000
5	9.000	0.000	8.740	0.000	8.580	0.000	8.880	0.000	8.850	0.000	8.870	0.000
6	8.990	0.000	8.750	0.000	8.570	0.000	8.880	0.000	8.850	0.000	8.870	0.000
7	8.980	0.000	8.750	0.000	8.560	0.000	8.880	0.000	8.850	0.000	8.870	0.000
8	8.980	0.000	8.750	0.000	8.560	0.000	8.890	0.000	8.890	0.000	8.870	0.000
9	8.970	0.000	8.750	0.000	8.550	0.000	8.890	0.000	8.890	0.000	8.880	0.000
10	8.970	0.000	8.750	0.000	8.550	0.000	8.890	0.000	8.890	0.000	8.890	0.000
11	8.970	0.000	8.750	0.000	8.540	0.000	8.880	0.000	8.900	0.000	8.900	0.000
12	8.960	0.000	8.740	0.000	8.540	0.000	8.860	0.000	8.900	0.000	8.900	0.000
13	8.950	0.000	8.740	0.000	8.540	0.000	8.800	0.000	8.900	0.000	8.900	0.000
14	8.930	0.000	8.730	0.000	8.580	0.000	8.750	0.000	8.910	0.000	8.890	0.000
15	8.910	0.000	8.720	0.000	8.600	0.000	8.800	0.000	8.910	0.000	8.890	0.000
16	8.880	0.000	8.720	0.000	8.620	0.000	8.860	0.000	8.910	0.000	8.890	0.000
17	8.850	0.000	8.720	0.000	8.640	0.000	8.890	0.000	8.910	0.000	8.890	0.000
18	8.830	0.000	8.720	0.000	8.640	0.000	8.890	0.000	8.910	0.000	8.880	0.000
19	8.820	0.000	8.710	0.000	8.650	0.000	8.860	0.000	8.910	0.000	8.880	0.000
20	8.810	0.000	8.710	0.000	8.660	0.000	8.830	0.000	8.910	0.000	8.880	0.000

21	8.790	0.000	8.710	0.000	8.660	0.000	8.830	0.000	8.890	0.000	8.870	0.000
22	8.770	0.000	8.710	0.000	8.700	0.000	8.820	0.000	8.880	0.000	8.870	0.000
23	8.760	0.000	8.700	0.000	8.780	0.000	8.840	0.000	8.880	0.000	8.870	0.000
24	8.750	0.000	8.700	0.000	8.800	0.000	8.870	0.000	8.890	0.000	8.860	0.000
25	8.750	0.000	8.700	0.000	8.830	0.000	8.900	0.000	8.890	0.000	8.860	0.000
26	8.740	0.000	8.690	0.000	8.830	0.000	8.900	0.000	8.900	0.000	8.850	0.000
27	8.730	0.000	8.680	0.000	8.840	0.000	8.900	0.000	8.900	0.000	8.850	0.000
28	8.720	0.000	8.670	0.000	8.840	0.000	8.900	0.000	8.910	0.000	8.850	0.000
29	8.720	0.000	8.670	0.000			8.890	0.000	8.910	0.000	8.850	0.000
30	8.720	0.000	8.660	0.000			8.890	0.000	8.900	0.000	8.850	0.000
31	8.720	0.000	8.660	0.000			8.890	0.000			8.840	0.000
Ten-Daily Mean												
I Ten-Daily	8.990	0.000	8.740	0.000	8.590	0.000	8.873	0.000	8.871	0.000	8.880	0.000
II Ten-Daily	8.891	0.000	8.726	0.000	8.601	0.000	8.842	0.000	8.907	0.000	8.890	0.000
III Ten-Daily	8.743	0.000	8.686	0.000	8.785	0.000	8.875	0.000	8.895	0.000	8.856	0.000
Monthly												
Min.	8.720	0.000	8.660	0.000	8.540	0.000	8.750	0.000	8.850	0.000	8.840	0.000
Max.	9.010	0.000	8.750	0.000	8.840	0.000	8.900	0.000	8.910	0.000	8.900	0.000
Mean	8.870	0.000	8.716	0.000	8.650	0.000	8.864	0.000	8.891	0.000	8.875	0.000

Peak Computed Discharge = 176.0 cumecs on 18-09-2016 **Corres. Water Level :10.920 m**

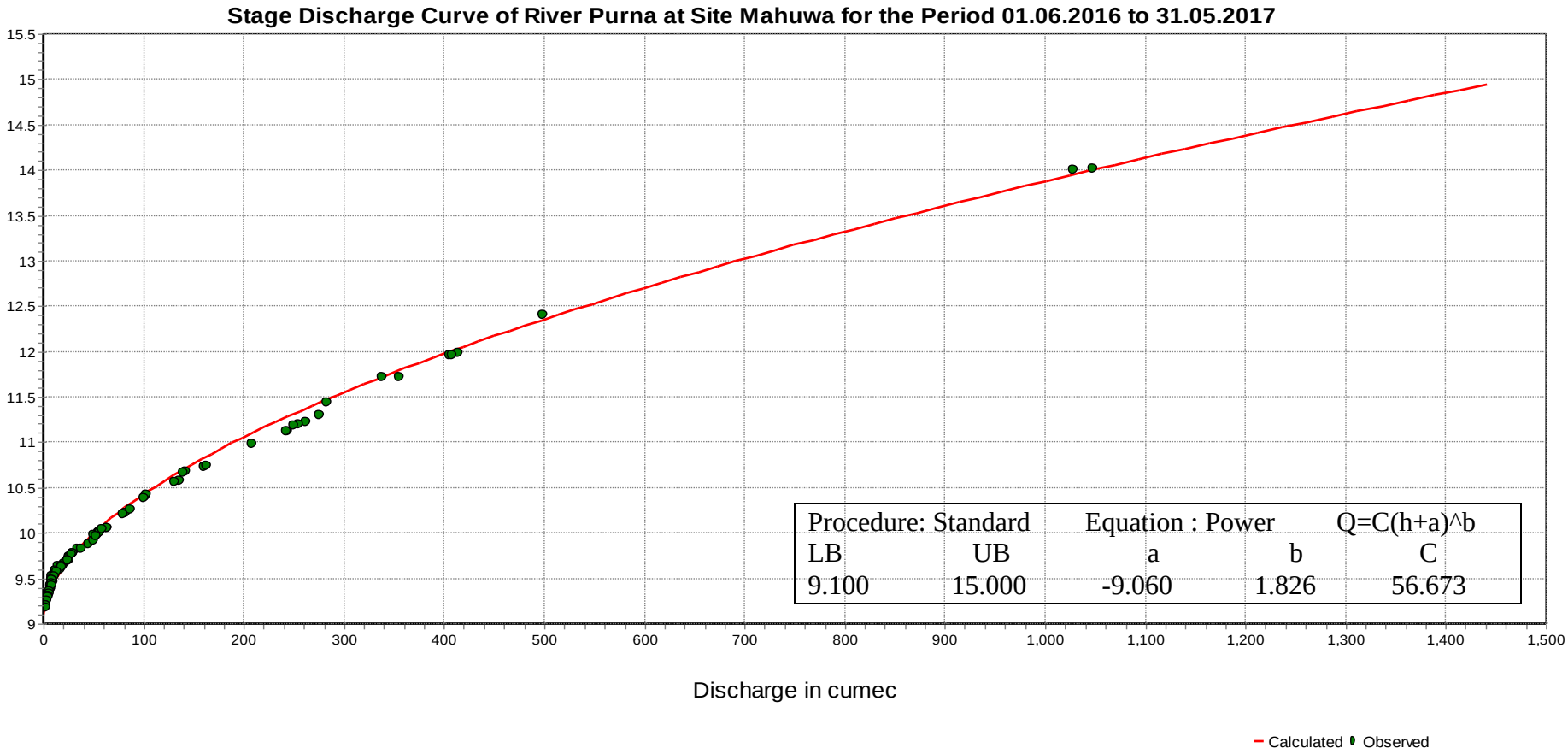
Lowest Computed Discharge = 2.230 cumecs on 30-10-2016 **Corres. Water Level : 9.230 m**

Water Level(m.s.l) in m *:Computed Discharge #:Discarded Discharge (values changed as per rating curve)

Note: River remained in pooling/ no flow condition w.e.f. 01/06/16to 10/07/16 and from 03/11/16 to 31/05/17

4.1.4 Stage Discharge Curve

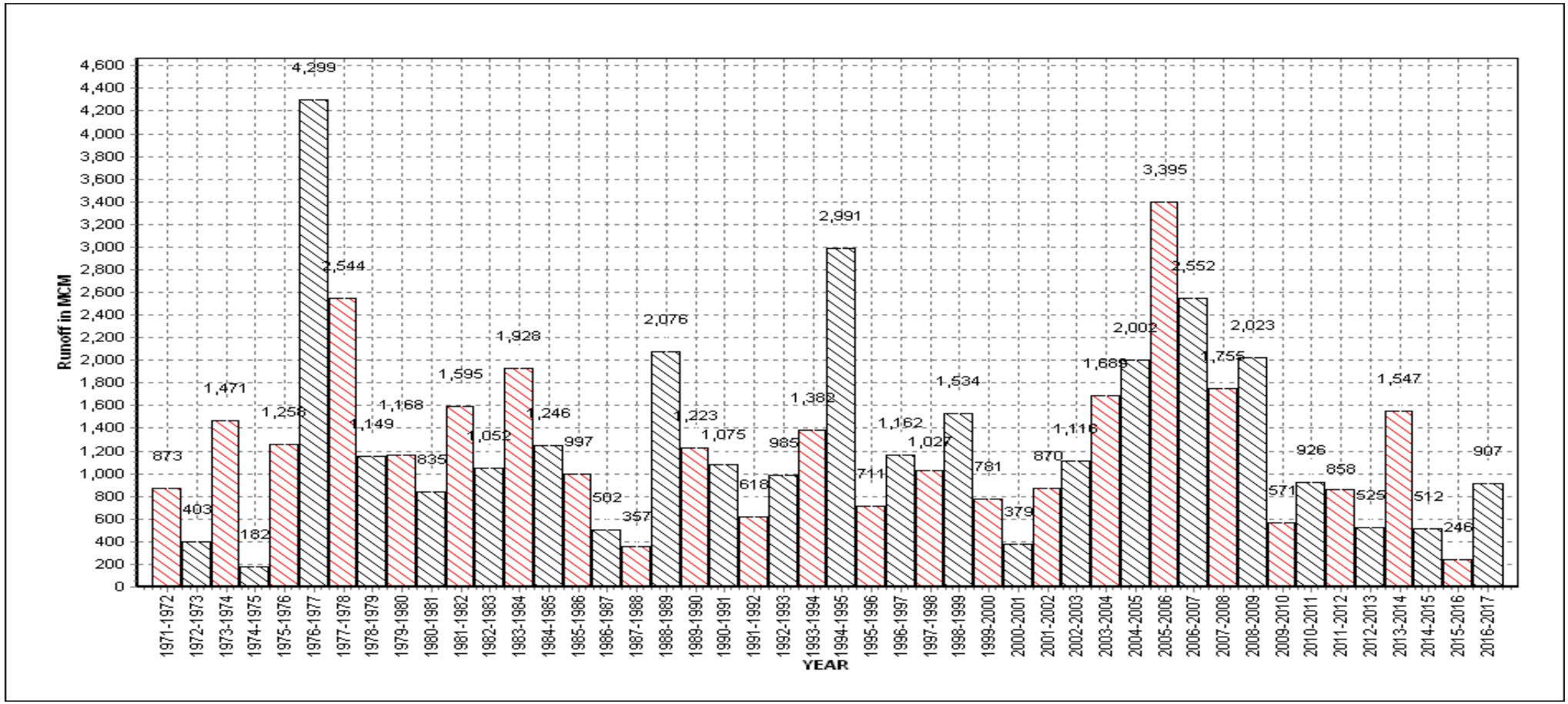
Station Name: Purna at Mahuwa (010219001) Division: Tapi Division Surat Local River: Purna Sub -Division: LTSD, CWC, Surat



4.1.5 Annual runoff

Annual Runoff Values Runoff Based on period 1971 to 2017

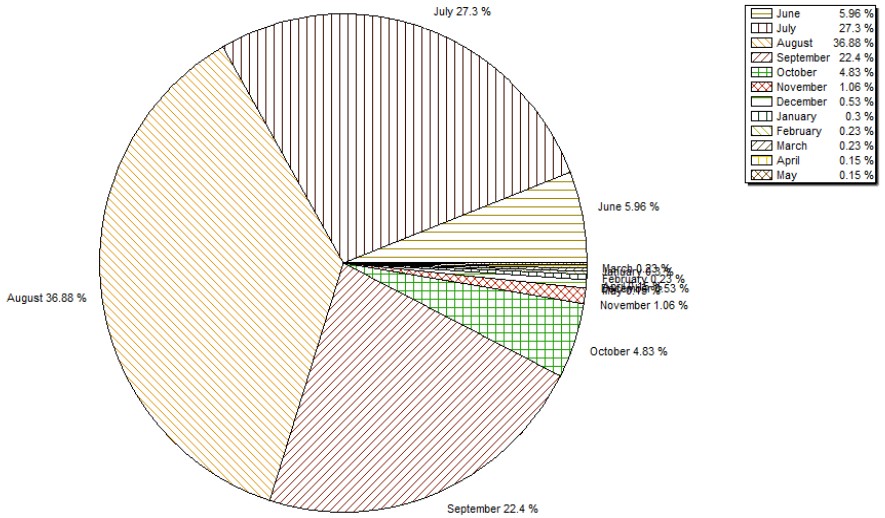
Station Name: Purna at Mahuwa (010219001) Division: Tapi Division Surat Local River: Purna Sub -Division: LTSD, CWC, Surat



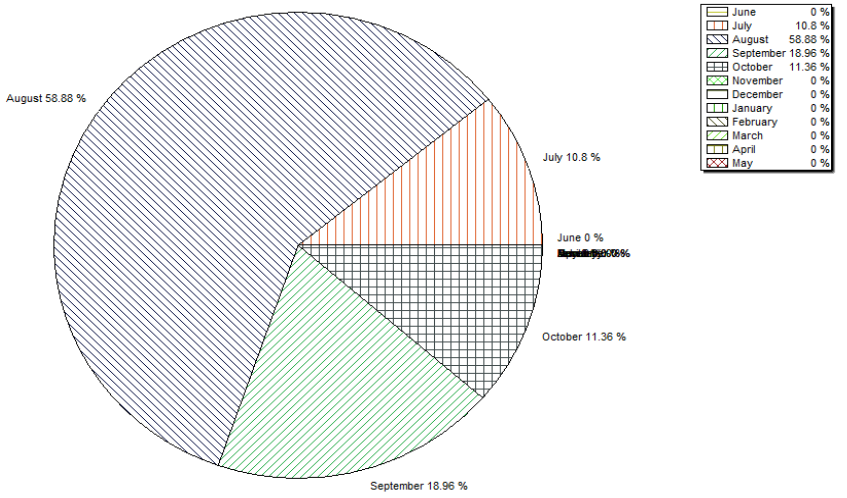
4.1.6 Monthly Average Runoff

Station Name: Purna at Mahuwa (010219001) Division: Tapi Division, Surat Local River: Purna Sub -Division: LTSD, CWC, Surat

Monthly Average Runoff Based on period: 1971 -2016



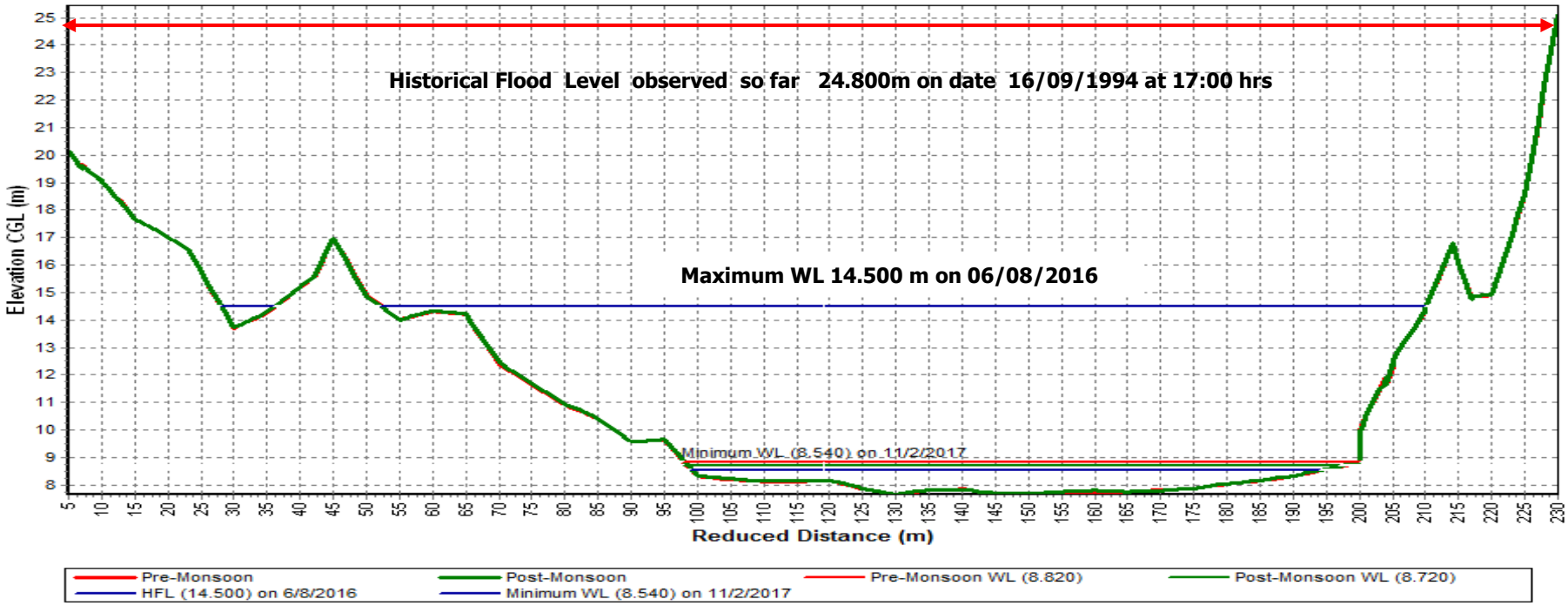
Monthly Average Runoff Based on period: 2016-17



4.1.7 Superimposed cross section

Station Name: Purna at Mahuwa (010219001) Division: Tapi Division Surat Local River: Purna Sub -Division: LTSD, CWC, Surat

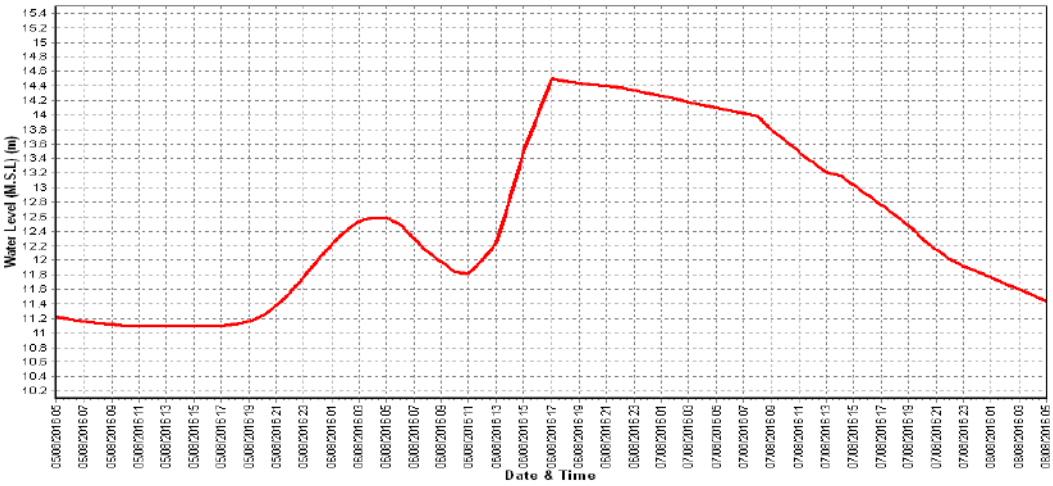
Superimposed cross section at SG line



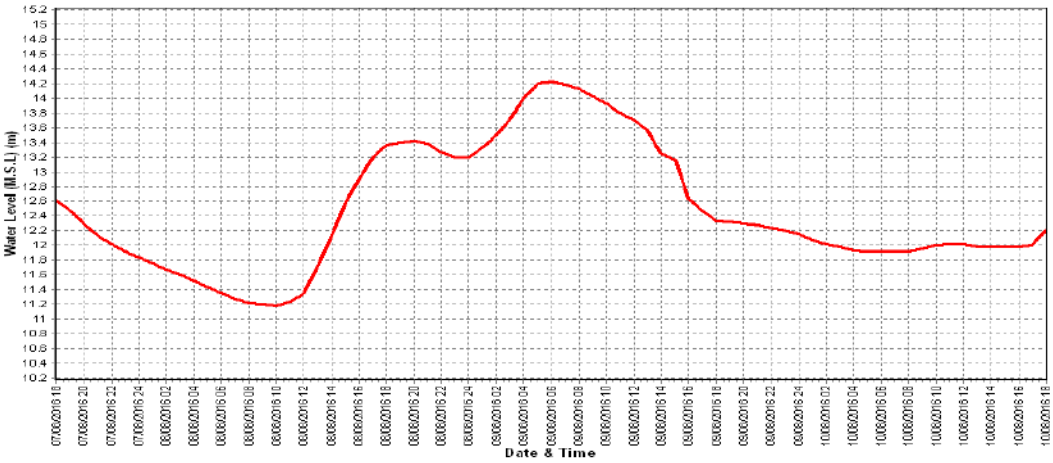
4.1.8 Water Level vs. Time- Graph of Highest Flood Peaks during 2016-17

Station Name: Purna at Mahuwa (010219001) Division : Tapi Division Surat
Local River : Purna Sub -Division : LTSD, CWC, Surat

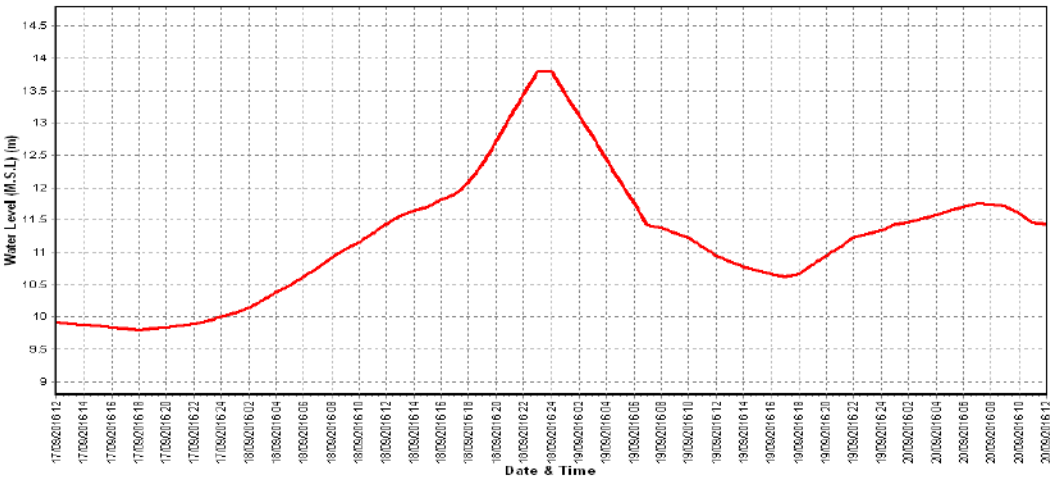
Water Level Vs. Time –Graph of I peak during the year 2016-17



Water Leel Vs. Time –Graph of II peak during the year 2016-17



Water Level Vs. Time –Graph of III peak during the year 2016-17



4.2 Ambica Basin

4.2.1 History sheet

HISTORY SHEET

			Water Year	**:**	**2016-17**
Site	**:**	**Ambica at Gadat**	**Code**	**:**	**01 02 20 001**
State	:	Gujarat	District		Valsad
Basin	:	WFR South of Tapi	Independent River	:	Ambika
Tributary	:		Sub Tributary	:	
Sub-Sub Tributary	:		Local River	:	
Division	:	Surat	Sub-Division	:	Surat
Drainage Area	:	1510 Sq. Km.	Bank	:	
Latitude	:	20°51’22”	Longitude	:	72°59’05”
Zero of Gauge (m)	:	1.5 (m.s.l)	14/01/1979		
		Opening Date	Closing Date		
Gauge	:	14/01/1979			
Discharge	:	12/03/1979			
Sediment	:	01/02/1985			
Water Quality	:	01/04/1980			

Annual Maximum / Minimum discharge with corresponding Water Level (m.s.l)

	Maximum			Minimum		
Year	Q (cumecs)	WL (m)	Date	Q (cumecs)	WL (m)	Date
1979-1980	1686	9.900	10/08/1979	0.180	3.350	16/06/1979
1980-1981	1492	9.160	02/08/1980	0.700	3.460	03/06/1980
1981-1982	1449	8.950	02/07/1981	0.000	3.500	13/06/1981
1982-1983	1537	9.400	25/07/1982	0.000	3.410	13/05/1983
1983-1984	1881	10.500	16/08/1983	0.000	1.500	07/06/1983
1984-1985	1551	9.430	06/07/1984	0.390	3.410	13/06/1984
1985-1986	1876	10.255	01/08/1985	0.100	3.315	17/04/1986
1986-1987	658.7	7.005	19/07/1986	0.100	3.315	13/06/1986
1987-1988	825.7	7.955	26/08/1987	0.000	3.200	05/04/1988
1988-1989	2308	10.110	27/07/1988	0.700	3.340	30/04/1989
1989-1990	2508	11.025	24/07/1989	0.456	3.285	08/06/1989
1990-1991	1385	10.220	17/08/1990	1.070	3.240	23/03/1991
1991-1992	450.7	6.440	28/07/1991	0.000	2.940	28/04/1992
1992-1993	1898	11.550	03/09/1992	0.000	3.020	14/06/1992
1993-1994	1245	5.185	25/06/1993	0.433	2.945	09/06/1993
1994-1995	2764	11.500	16/06/1994	0.364	2.940	03/05/1995
1995-1996	750.0	6.900	03/09/1995	0.091	2.810	16/04/1996
1996-1997	1255	8.425	24/07/1996	0.274	2.700	10/06/1996
1997-1998	1350	8.730	25/08/1997	0.465	2.200	30/05/1998
1998-1999	1200	8.800	08/07/1998	0.446	2.190	08/06/1998
1999-2000	2989	11.395	16/07/1999	0.783	2.130	26/04/2000
2000-2001	910.8	8.450	14/07/2000	0.748	2.425	13/01/2001
2001-2002	1873	9.810	20/07/2001	2.385	2.255	06/11/2001
2002-2003	1217	8.605	28/06/2002	2.210	3.955	21/10/2002
2003-2004	3650	10.075	28/07/2003	0.000	3.020	10/06/2003
2004-2005	2700	12.170	04/08/2004	1.812	3.700	30/10/2004
2005-2006	2894	13.010	29/06/2005	0.000	6.465	25/02/2006
2006-2007	1783	9.840	29/07/2006	0.000	6.460	02/03/2007
2007-2008	1601	9.400	02/07/2007	5.400	3.710	29/10/2007
2008-2009	1295	9.640	12/08/2008	40.43	3.840	30/08/2008
2009-2010	599	7.090	21/07/2009	0.000	4.820	01/06/2009
2010-2011	870.2	7.815	09/09/2010	0.000	4.590	01/06/2010
2011-2012	1594	9.67	29/08/2011	0.000	3.550	07/07/2011
2012-2013	548.7	6.930	13/08/2012	0.000	4.930	01/06/2012
2013-2014	1399	8.715	14/08/2013	0.000	3.750	As per SD curve
2014-2015	2086	10.120	30/07/2014	0.000	4.970	01/06/2014
2015-2016	1227	8.250	19/09/2015	0.000	4.830	01/06/2015
2016-2017	1362	7.600	09/08/2016	0.000	4.940	01/06/2016

4.2.2 Annual Maximum Flood Peak

Year	Annual Maximum flood Peaks (m)	Date	Hour
1979	12.180	11/08/1979	01:00:00
1980	10.690	02/08/1980	16:00:00
1981	9.980	10/07/1981	15:00:00
1982	10.950	25/07/1982	14:00:00
1983	11.070	16/08/1983	06:00:00
1984	13.470	18/07/1984	20:00:00
1985	13.020	01/08/1985	00:00:00
1986	7.780	19/07/1986	00:00:00
1987	9.870	26/08/1987	03:00:00
1988	11.650	27/07/1988	16:00:00
1989	11.490	24/07/1989	13:00:00
1990	10.270	17/08/1990	09:00:00
1991	6.710	28/07/1991	18:00:00
1992	11.950	03/09/1992	12:00:00
1993	11.710	25/06/1993	18:00:00
1994	13.985	16/06/1994	18:00:00
1995	7.970	20/07/1995	12:00:00
1996	10.400	23/07/1996	16:00:00
1997	12.400	31/07/1997	21:00:00
1998	10.760	08/07/1998	11:00:00
1999	12.760	16/07/1999	02:00:00
2000	10.550	14/07/2000	03:00:00
2001	11.570	20/07/2001	15:00:00
2002	12.360	26/06/2002	22:00:00
2003	13.520	28/07/2003	04:00:00
2004	13.980	04/08/2004	02:00:00
2005	13.450	29/06/2005	16:00:00
2006	12.900	05/07/2006	14:00:00
2007	10.200	02/07/2007	13:00:00
2008	11.420	12/08/2008	13:00:00
2009	9.300	21/07/2009	13:00:00
2010	7.980	09/09/2010	04:00:00
2011	11.800	29/08/2011	06:00:00
2012	8.100	10/08/2012	01:00:00
2013	12.460	23/09/2013	20:00:00
2014	10.400	30/07/2014	11:00:00
2015	8.600	19/09/2015	06:00:00
2016	9.980	02/08/2016	13:00:00

4.2.3 Summary of Data

Stage –Discharge data for the period 2016-17

Station Name: Ambica at Gadat (01 02 20 001) Division : Tapi Division Surat Local River: Ambica Sub -Division : LTSD, CWC, Surat

Day	Jun		Jul		Aug		Sep		Oct		Nov	
	W.L	Q	W.L	Q	W.L	Q	W.L	Q	W.L	Q	W.L	Q
1	4.940	0.000	4.470	0.000	5.310	302.4	4.070	49.89	4.090	51.45	5.100	0.000
2	4.940	0.000	4.500	0.000	6.950	793.1 #	4.060	45.73	4.080	45.32 *	5.080	0.000
3	4.940	0.000	4.660	0.000	6.365	827.6	4.050	40.64	4.160	74.61	5.040	0.000
4	4.900	0.000	5.100	0.000	5.670	460.3	4.030	37.67 *	4.810	245.5	5.030	0.000
5	4.900	0.000	5.060	0.000	5.560	371.4	3.995	35.47	4.455	119.3	5.010	0.000
6	4.890	0.000	5.000	0.000	7.025	979.7	3.970	33.22	4.300	91.99	5.010	0.000
7	4.880	0.000	5.000	0.000	6.970	799.7 *	3.980	32.23	4.310	90.56	5.000	0.000
8	4.880	0.000	5.000	0.000	5.805	535.6	4.250	59.71	4.205	60.69	5.030	0.000
9	4.800	0.000	4.190	0.000	7.600	1362	4.270	64.35	4.110	50.08 *	5.040	0.000
10	4.770	0.000	4.070	43.76 *	6.230	751.2	4.185	49.09	4.070	37.08	5.030	0.000
11	4.750	0.000	6.230	595.1	6.050	548.6	4.150	56.62 *	4.040	39.17 *	5.030	0.000
12	4.700	0.000	4.770	184.4	5.515	382.9	4.050	37.12	4.000	33.26 *	5.040	0.000
13	4.690	0.000	5.200	205.5	5.090	254.0	4.010	34.71 *	3.980	34.61	5.030	0.000
14	4.680	0.000	4.470	74.03	4.830	192.4 *	4.010	27.70	3.955	31.91	5.030	0.000
15	4.650	0.000	4.190	63.42	4.620	146.2 *	3.950	24.44	3.910	30.71	5.030	0.000
16	4.640	0.000	4.105	48.97	4.445	117.7	4.155	57.45 #	4.460	0.000	5.030	0.000
17	4.600	0.000	4.050	40.68 *	4.320	93.31	4.345	112.2	5.090	0.000	5.030	0.000
18	4.580	0.000	4.010	41.57	4.240	82.67	4.970	224.9 *	5.100	0.000	5.025	0.000
19	4.570	0.000	4.110	55.14	4.230	84.05	5.445	335.5	5.100	0.000	5.020	0.000
20	4.550	0.000	4.700	117.7	4.245	84.36	5.155	215.2	5.100	0.000	5.030	0.000

21	4.530	0.000	4.625	97.00	4.200	65.06 *	4.745	153.3	5.100	0.000	5.030	0.000
22	4.520	0.000	4.510	77.18	4.150	65.63	4.540	148.4	5.100	0.000	5.030	0.000
23	4.400	0.000	4.650	94.35	4.100	57.38	4.660	154.8 #	5.100	0.000	5.030	0.000
24	4.390	0.000	4.500	121.4 *	4.285	123.2	4.650	221.0	5.100	0.000	5.020	0.000
25	4.390	0.000	4.440	59.90	4.820	190.1 *	4.680	159.1 *	5.100	0.000	5.030	0.000
26	4.390	0.000	4.255	48.37	4.385	120.8	4.755	152.8	5.100	0.000	5.020	0.000
27	4.380	0.000	4.160	43.72	4.300	93.42	4.405	117.6	5.100	0.000	5.030	0.000
28	4.370	0.000	4.170	46.14	4.240	72.04 *	4.265	88.20	5.100	0.000	5.020	0.000
29	4.380	0.000	4.305	48.48	4.185	66.24	4.195	63.39	5.100	0.000	5.020	0.000
30	4.480	0.000	4.275	49.51	4.140	65.36	4.130	59.10	5.100	0.000	5.020	0.000
31			4.690	161.3 *	4.120	57.25			5.100	0.000		
Ten-Daily Mean												
I Ten-Daily	4.884	0.000	4.705	4.376	6.348	718.3	4.086	44.80	4.259	86.66	5.037	0.000
II Ten-Daily	4.641	0.000	4.584	142.7	4.759	198.6	4.424	112.6	4.473	16.97	5.030	0.000
III Ten-Daily	4.423	0.000	4.416	77.03	4.266	88.77	4.502	131.8	5.100	0.000	5.025	0.000
Monthly												
Min.	4.370	0.000	4.010	0.000	4.100	57.25	3.950	24.44	3.910	0.000	5.000	0.000
Max.	4.940	0.000	6.230	595.1	7.600	1362	5.445	335.5	5.100	245.5	5.100	0.000
Mean	4.649	0.000	4.563	74.76	5.097	327.3	4.337	96.38	4.627	33.43	5.030	0.000

Annual Runoff in MCM = 1416 **Annual Runoff in mm = 938**

Peak Observed Discharge = 1362 cumecs on 09-08-2016 **Corres. Water Level :7.600 m**

Lowest Observed Discharge = 0.000 cumecs on 01-06-2016 **Corres. Water Level :4.940 m**

Q: Observed/Computed discharge in cumecs WL: Corresponding Mean Water Level (m.s.l) in m * : Computed Discharge #:Discarded Discharge (values changed as per rating curve)

Note: River remained in pooling/ no flow condition w.e.f. 01/06/16 to 09/07/16 and from 16/10/2016 to 31/05/2017**. No flow,**Back water effect from Dewadha Dam exists at site during this period.

Stage –Discharge data for the period 2016-17

Station Name: Ambica at Gadat (01 02 20 001) Division : Tapi Division Surat Local River: Ambica Sub -Division : LTSD, CWC, Surat

Day	Dec		Jan		Feb		Mar		Apr		May	
	W.L	Q	WL	Q	WL	Q	WL	Q	WL	Q	WL	Q
1	3.520	0.000	3.450	0.000	3.270	0.000	3.040	0.000	3.240	0.000	2.990	0.000
2	3.520	0.000	3.450	0.000	3.270	0.000	3.040	0.000	3.240	0.000	3.000	0.000
3	3.520	0.000	3.450	0.000	3.270	0.000	3.040	0.000	3.280	0.000	3.000	0.000
4	3.520	0.000	3.450	0.000	3.220	0.000	3.040	0.000	3.290	0.000	3.000	0.000
5	3.520	0.000	3.450	0.000	3.210	0.000	3.040	0.000	3.300	0.000	3.000	0.000
6	3.520	0.000	3.450	0.000	3.210	0.000	3.040	0.000	3.260	0.000	3.000	0.000
7	3.520	0.000	3.450	0.000	3.210	0.000	3.090	0.000	3.250	0.000	3.000	0.000
8	3.520	0.000	3.440	0.000	3.210	0.000	3.090	0.000	3.250	0.000	3.000	0.000
9	3.510	0.000	3.440	0.000	3.160	0.000	3.090	0.000	3.240	0.000	3.000	0.000
10	3.510	0.000	3.440	0.000	3.140	0.000	3.100	0.000	3.210	0.000	3.000	0.000
11	3.510	0.000	3.440	0.000	3.130	0.000	3.110	0.000	3.220	0.000	3.000	0.000
12	3.510	0.000	3.440	0.000	3.130	0.000	3.110	0.000	3.200	0.000	3.000	0.000
13	3.510	0.000	3.440	0.000	3.110	0.000	3.110	0.000	3.200	0.000	3.000	0.000
14	3.500	0.000	3.440	0.000	3.110	0.000	3.130	0.000	3.190	0.000	2.990	0.000
15	3.500	0.000	3.440	0.000	3.100	0.000	3.140	0.000	3.180	0.000	3.050	0.000
16	3.500	0.000	3.440	0.000	3.090	0.000	3.140	0.000	3.200	0.000	3.050	0.000
17	3.500	0.000	3.400	0.000	3.080	0.000	3.160	0.000	3.200	0.000	3.080	0.000
18	3.490	0.000	3.400	0.000	3.070	0.000	3.190	0.000	3.210	0.000	3.090	0.000
19	3.490	0.000	3.400	0.000	3.060	0.000	3.220	0.000	3.210	0.000	3.090	0.000
20	3.490	0.000	3.400	0.000	3.050	0.000	3.230	0.000	3.220	0.000	3.110	0.000

21	3.480	0.000	3.390	0.000	3.040	0.000	3.230	0.000	3.220	0.000	3.110	0.000
22	3.480	0.000	3.380	0.000	3.040	0.000	3.230	0.000	3.200	0.000	3.130	0.000
23	3.480	0.000	3.380	0.000	3.040	0.000	3.210	0.000	3.190	0.000	3.150	0.000
24	3.480	0.000	3.380	0.000	3.040	0.000	3.200	0.000	3.150	0.000	3.160	0.000
25	3.450	0.000	3.380	0.000	3.040	0.000	3.200	0.000	3.140	0.000	3.150	0.000
26	3.450	0.000	3.370	0.000	3.040	0.000	3.210	0.000	3.100	0.000	3.150	0.000
27	3.450	0.000	3.350	0.000	3.040	0.000	3.210	0.000	3.070	0.000	3.150	0.000
28	3.450	0.000	3.350	0.000	3.040	0.000	3.210	0.000	3.050	0.000	3.150	0.000
29	3.450	0.000	3.350	0.000			3.220	0.000	3.020	0.000	3.150	0.000
30	3.450	0.000	3.280	0.000			3.220	0.000	3.000	0.000	3.130	0.000
31	3.450	0.000	3.270	0.000			3.220	0.000			3.130	0.000
Ten-Daily Mean												
I Ten-Daily	3.518	0.000	3.447	0.000	3.217	0.000	3.061	0.000	3.256	0.000	2.999	0.000
II Ten-Daily	3.500	0.000	3.424	0.000	3.093	0.000	3.154	0.000	3.203	0.000	3.046	0.000
III Ten-Daily	3.461	0.000	3.353	0.000	3.040	0.000	3.215	0.000	3.114	0.000	3.142	0.000
Monthly												
Min.	3.450	0.000	3.270	0.000	3.040	0.000	3.040	0.000	3.000	0.000	2.990	0.000
Max.	3.520	0.000	3.450	0.000	3.270	0.000	3.230	0.000	3.300	0.000	3.160	0.000
Mean	3.492	0.000	3.406	0.000	3.122	0.000	3.145	0.000	3.191	0.000	3.065	0.000

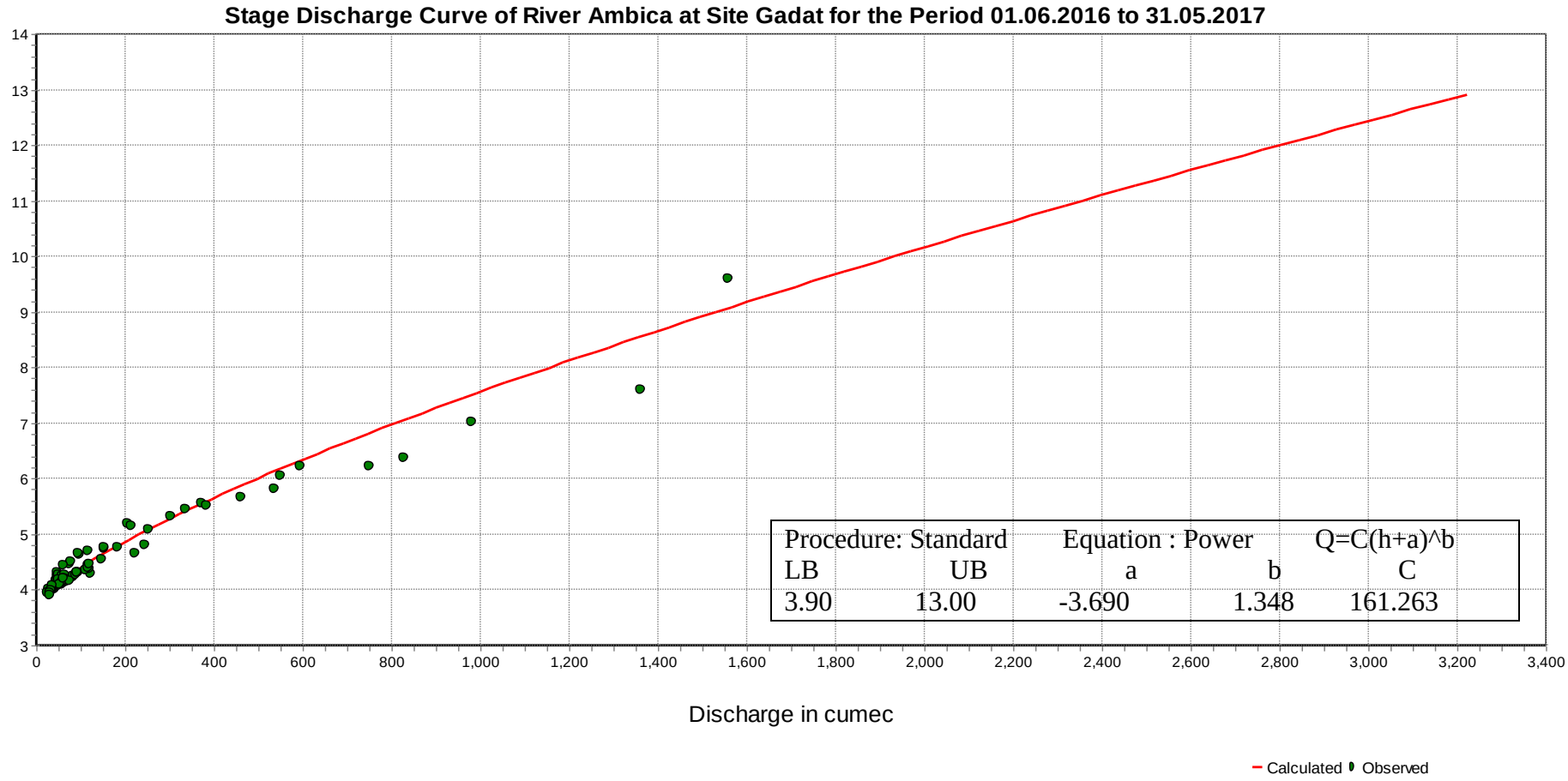
Peak Computed Discharge = 799.7 cumecs on 07-08-2016 Corres. Water Level :6.970 m
Lowest Computed Discharge = 33.26 cumecs on 12-10-2016 Corres. Water Level :4.00 m

Q: Observed/Computed discharge in cumecs WL: Corresponding Mean Water Level (m.s.l) in m * : Computed Discharge #:Discarded Discharge (values changed as per rating curve)

Note: River remained in pooling/ no flow condition w.e.f. 01/06/16 to 09/07/16 and from 16/10/2016 to 31/05/2017**. No flow,**Back water effect from Dewadha Dam exists at site during this period.

4.2.4 Stage Discharge Curve

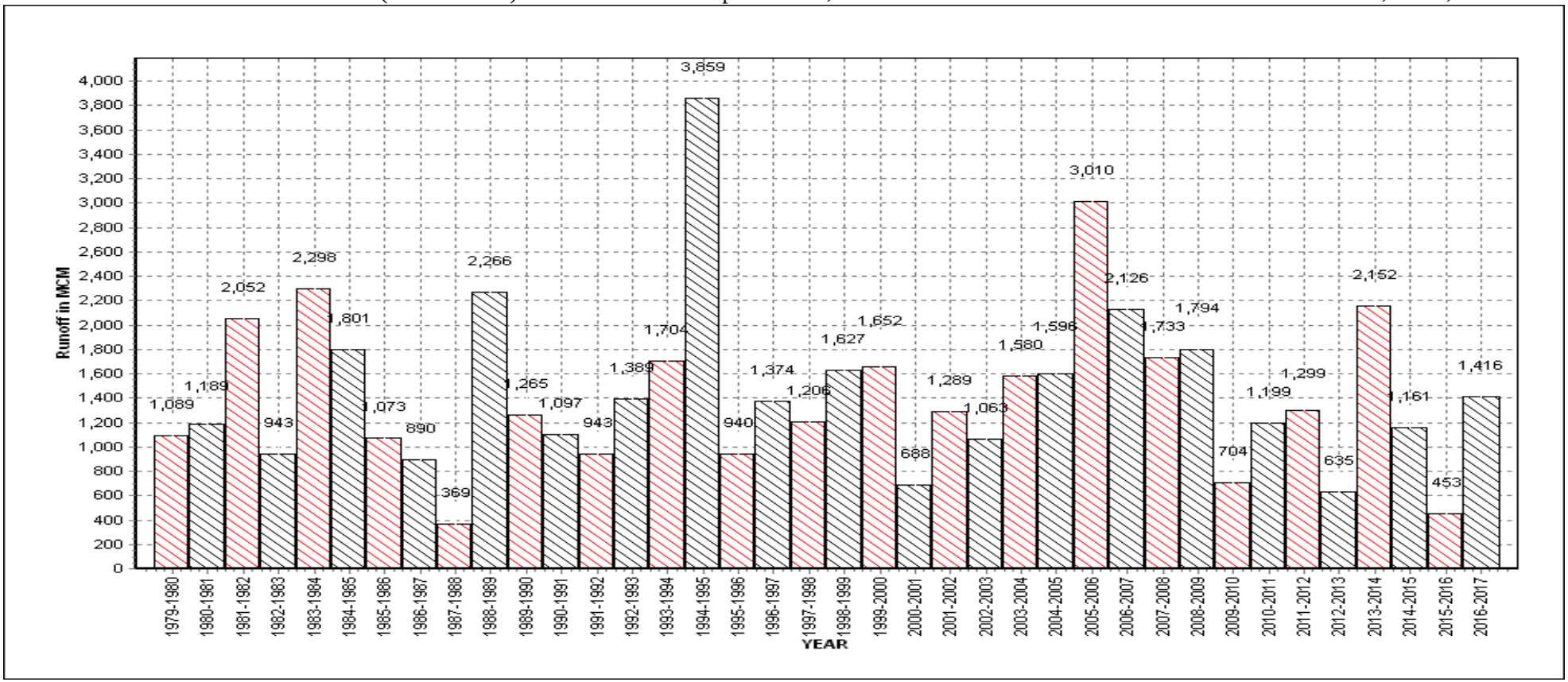
Station Name: Ambica at Gadat (01 02 20 001) Division : Tapi Division Surat Local River: Ambica Sub -Division : LTSD, CWC, Surat



4.2.5 Annual runoff

Annual Runoff Values Runoff Based on period 1979 to 2017

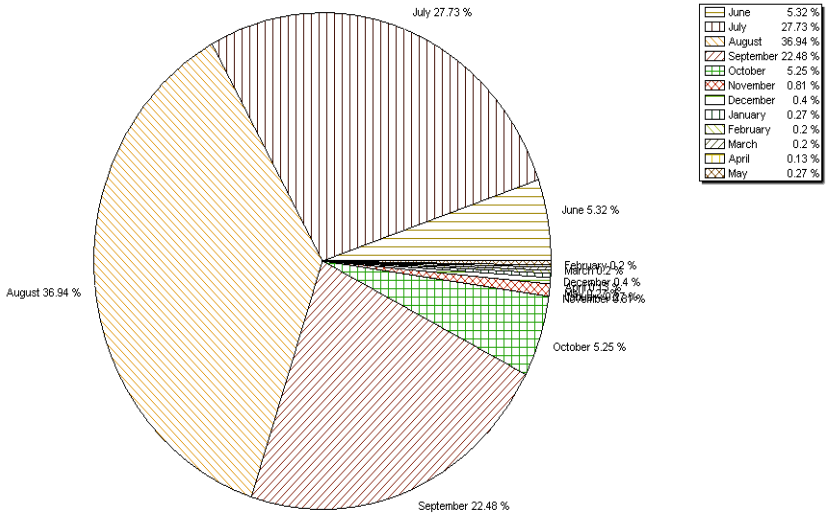
Station Name: Ambica at Gadat (01 02 20 001) Division : Tapi Division, Surat Local River: Ambica Sub -Division : LTSD, CWC, Surat



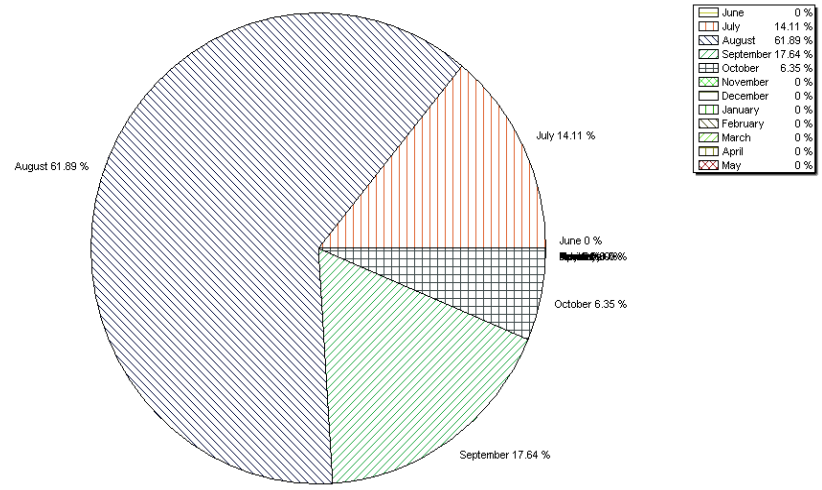
4.2.6 Monthly average Runoff

Station Name: Ambica at Gadat (01 02 20 001) Division : Tapi Division, Surat Local River: Ambica Sub -Division : LTSD, CWC, Surat

Monthly Average Runoff Based on period: 1979 -2016

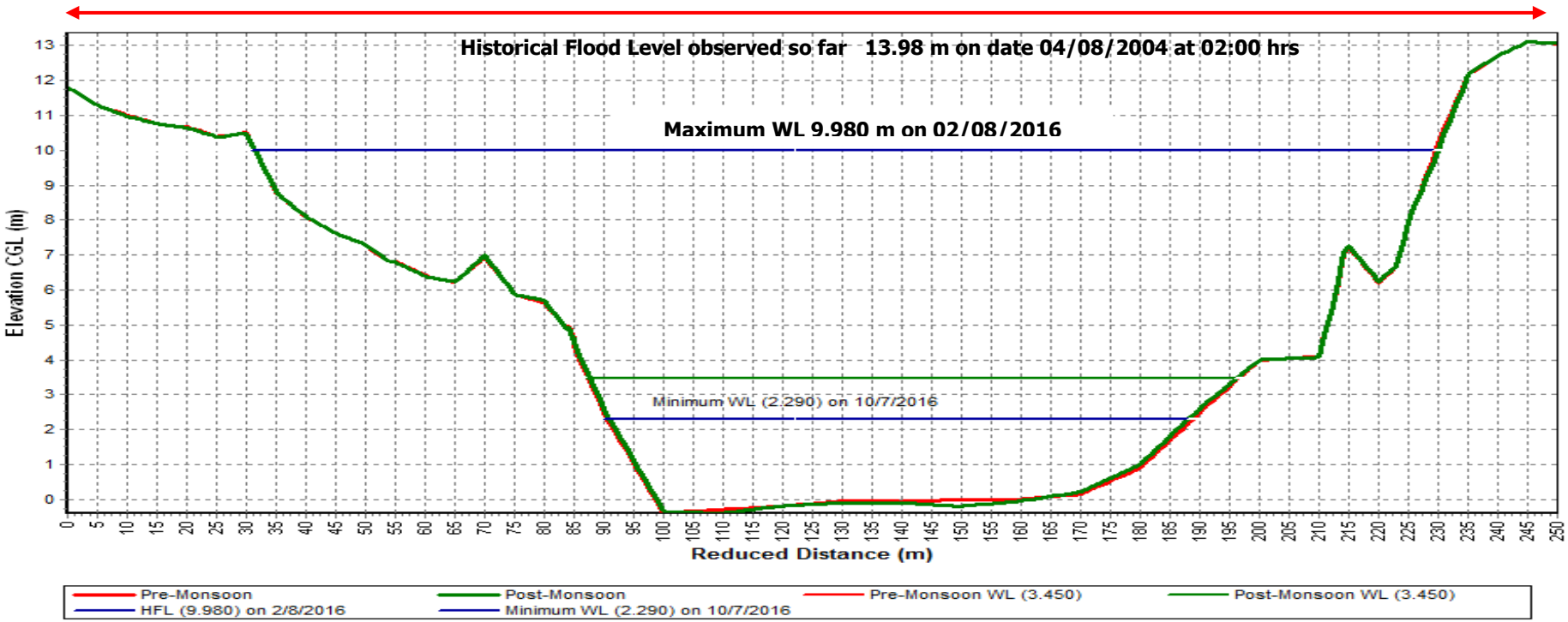


Monthly Average Runoff Based on period: 2016-17



4.2.7 Superimposed Cross section

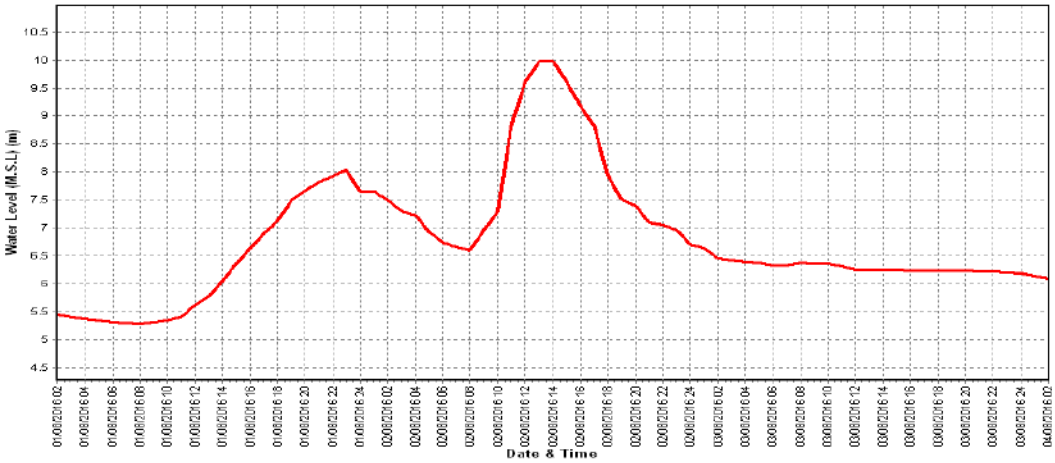
Station Name: Ambica at Gadat (01 02 20 001) Division: Tapi Division, Surat Local River: Ambica Sub -Division: LTSD, CWC, Surat



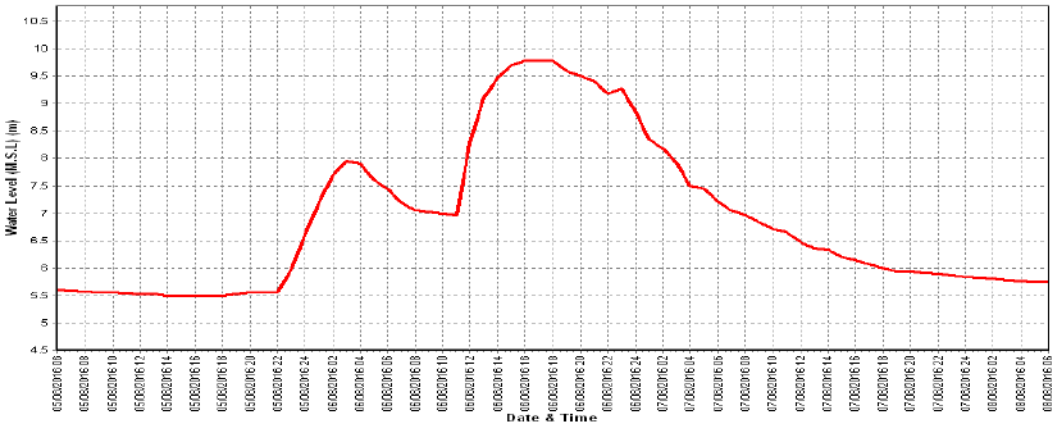
4.2.8 Water Level vs. Time- Graph of Highest Flood Peaks during 2016-17

Station Name: Ambica at Gadat (01 02 20 001) Division : Tapi Division Surat
Local River: Ambica Sub -Division : LTSD, CWC, Surat

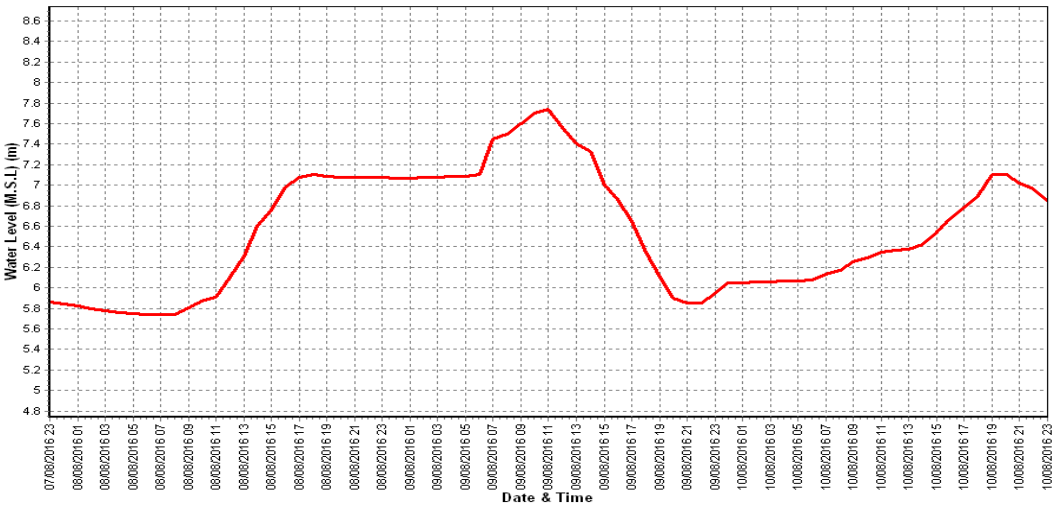
Water level vs. Time graph of 1st flood peak during the year 2016-17



Water level vs. Time graph of 2nd flood peak during the year 2016-17



Water level vs. Time graph of 3rd flood peak during the year 2016-17



4.3 Vaitarna at Durvesh

4.3.1 History sheet

HISTORY SHEET

Water Year : 2016-17

Site	**:**	**Vaitarna at Durvesh**	**Code**	**:**	**01 02 25 001**
State	:	Maharashtra	District		Thane
Basin	:	WFR South of Tapi	Independent River	:	Vaitarna
Tributary	:		Sub Tributary	:	
Sub-Sub Tributary	:		Local River	:	
Division	:	Tapi Division, Surat	Sub-Division	:	DGSD,CWC,Silvassa
Drainage Area	:	2019 Sq. Km.	Bank	:	
Latitude	:	19°42’45”	Longitude	:	72°55’50”

Zero of Gauge (m) : 0 (m.s.l) 26/10/1970

		Opening Date	Closing Date
Gauge	:	26/10/1970	
Discharge	:	26/01/1971	
Sediment	:	26/01/1971	
Water Quality	:	01/06/1977	

Annual Maximum / Minimum discharge with corresponding Water Level (m.s.l)

	Maximum			Minimum		
Year	Q (cumecs)	WL (m)	Date	Q (cumecs)	WL (m)	Date
1971-1972	4386	11.330	30/09/1971	0.000	1.975	21/06/1971
1972-1973	1543	6.463	02/07/1972	0.000	0.680	03/06/1972
1973-1974	3826	10.950	23/09/1973	0.000	0.890	09/05/1974
1974-1975	1655	6.743	04/07/1974	0.000	0.880	09/05/1975
1975-1976	3303	8.437	11/08/1975	0.000	0.855	29/04/1976
1976-1977	7744	14.250	31/07/1976	0.000	0.975	09/05/1977
1977-1978	4374	11.522	03/09/1977	0.020	0.825	14/06/1977
1978-1979	1796	7.277	21/06/1978	0.000	0.800	03/05/1979
1979-1980	5000	9.060	11/08/1979	0.000	1.045	19/06/1979
1980-1981	2460	9.025	04/08/1980	0.000	1.010	13/02/1981
1981-1982	1748	8.675	10/07/1981	0.000	1.400	17/12/1981
1982-1983	1140	8.900	22/08/1982	2.000	1.620	08/11/1982
1983-1984	2249	9.635	13/08/1983	0.000	0.920	14/06/1983
1984-1985	3180	12.900	19/07/1984	0.100	1.250	15/06/1984
1985-1986	1032	7.155	03/08/1985	0.000	1.440	05/07/1985
1986-1987	1293	7.850	19/07/1986	0.000	1.240	30/10/1986
1987-1988	1287	7.065	07/07/1987	0.000	1.954	02/07/1987
1988-1989	3396	11.000	16/07/1988	0.000	0.000	02/02/1989
1989-1990	1672	9.075	25/07/1989	0.000	1.610	30/06/1989
1990-1991	1761	7.690	18/08/1990	0.000	0.000	03/01/1991
1991-1992	1361	8.800	28/07/1991	0.000	0.000	26/01/1992
1992-1993	1405	8.675	12/08/1992	0.000	0.000	27/01/1993
1993-1994	1497	6.045	16/07/1993	0.000	0.000	15/02/1994
1994-1995	2340	12.550	13/07/1994	0.000	0.000	05/02/1995
1995-1996	1039	7.250	21/07/1995	0.000	0.000	02/02/1996
1996-1997	1611	7.380	23/07/1996	0.900	1.120	10/12/1996
1997-1998	4100	12.330	31/07/1997	0.000	1.200	14/06/1997
1998-1999	8000	15.220	17/09/1998	0.000	1.200	26/04/1999
1999-2000	4536	12.180	16/07/1999	0.000	1.190	14/05/2000
2000-2001	1749	8.440	13/07/2000	0.000	1.140	30/12/2000
2001-2002	1469	7.200	04/07/2001	0.000	1.140	31/12/2001
2002-2003	4400	10.830	27/06/2002	0.000	1.100	24/12/2002
2003-2004	6038	12.350	28/07/2003	0.000	1.090	28/12/2003
2004-2005	5080	12.050	03/08/2004	0.000	1.080	20/04/2005
2005-2006	4997	10.450	28/07/2005	0.000	1.030	13/04/2006
2006-2007	4086	10.680	07/08/2006	0.659	1.060	26/12/2006
2007-2008	2034	7.530	03/07/2007	0.853	1.070	24/12/2007
2008-2009	2941	9.830	20/09/2008	0.470	1.060	22/12/2008
2009-2010	1633	7.750	23/07/2009	0.000	1.000	01/06/2009
2010-2011	1422	7.060	02/08/2010	13.48	0.700	10/06/2010
2011-2012	3408	9.930	29/08/2011	0.000	0.950	03/06/2011
2012-2013	1394	6.460	04/09/2012	0.000	0.840	01/06/2012
2013-2014	2070	7.200	12/07/2013	0.000	0.780	01/06/2013
2014-2015	1942	7.040	01/09/2014	0.000	1.200	01/07/2014
2015-2016	1475	7.170	22/07/2015	0.000	0.960	01/06/2015
2016-2017	3850	10.250	02/08/2016	0.000	0.870	01/06/2016

4.3.2 Annual Maximum Flood Peak

Year	Annual Maximum flood Peaks (m)	Date	Hour
1974	7.690	04/07/1974	15:00:00
1975	9.860	30/07/1975	03:00:00
1976	14.700	31/07/1976	15:00:00
1977	12.075	03/09/1977	06:00:00
1978	7.720	21/06/1978	10:00:00
1979	9.510	11/08/1979	06:00:00
1980	10.830	04/08/1980	00:00:00
1981	10.500	10/07/1981	20:00:00
1982	9.200	22/08/1982	09:00:00
1983	12.000	15/08/1983	19:00:00
1984	14.460	18/07/1984	18:00:00
1985	8.050	03/08/1985	18:00:00
1986	8.300	15/07/1986	20:00:00
1987	10.800	20/08/1987	15:00:00
1988	13.800	16/07/1988	16:00:00
1989	11.540	25/07/1989	01:00:00
1990	10.250	03/07/1990	20:00:00
1991	10.500	28/07/1991	00:00:00
1992	10.500	03/09/1992	21:00:00
1993	11.900	17/07/1993	00:00:00
1994	12.800	13/07/1994	08:00:00
1995	8.100	21/07/1995	18:00:00
1996	8.220	23/07/1996	18:00:00
1997	12.920	31/07/1997	13:00:00
1998	16.130	17/09/1998	13:00:00
1999	12.500	16/07/1999	09:00:00
2000	8.670	13/07/2000	14:00:00
2001	8.300	09/07/2001	18:00:00
2002	14.500	26/06/2002	18:00:00
2003	12.400	28/07/2003	09:00:00
2004	15.120	02/08/2004	22:00:00
2005	11.340	02/08/2005	14:00:00
2006	11.300	08/08/2006	16:00:00
2007	9.680	05/08/2007	19:00:00
2008	14.220	11/08/2008	20:00:00
2009	9.600	22/07/2009	15:00:00
2010	8.160	31/08/2010	19:00:00
2011	12.720	28/08/2011	19:00:00
2012	7.480	04/09/2012	18:00:00
2013	8.260	02/08/2013	04:00:00
2014	11.950	29/07/2014	14:00:00
2015	7.480	22/07/2015	14:00:00
2016	10.550	02/08/2016	18:00:00

4.3.1 Summary of Data

Stage –Discharge data for the period 2016-2017

Station Name: Vaitarna at Durvesh (01 02 25 001) Division : Tapi Division Surat Sub -Division : DGSD, CWC, Silvasa

Local River: Vaitarna

Day	Jun		Jul		Aug		Sep		Oct		Nov	
	W.L	Q	W.L	Q	W.L	Q	W.L	Q	W.L	Q	W.L	Q
1	0.870	0.000	1.630	0.000	5.500	765.6	2.430	47.08	2.370	25.70	1.570	0.600 #
2	0.920	0.000	1.660	0.000	10.250	3850 #	2.610	29.96	2.380	27.67 *	1.580	0.670 #
3	1.090	0.000	3.860	216.9 *	6.440	1086 #	2.700	47.09	2.310	18.01	1.600	0.840 #
4	1.180	0.000	4.710	444.7	6.340	1038 #	2.620	45.11 *	2.180	17.95	1.600	0.840 #
5	1.300	0.000	3.280	142.5	6.695	1119	2.380	22.66	2.920	54.07	1.580	0.670 #
6	1.370	0.000	3.150	101.1 *	7.050	1399	2.240	15.33	2.960	59.42	1.560	0.520 *
7	1.250	0.000	2.610	52.77	5.110	545.4 *	2.280	16.73	2.680	39.50	1.430	0.020 #
8	1.220	0.000	2.425	30.85	4.010	305.5	2.670	56.52	2.580	37.64	1.360	0.000
9	1.230	0.000	2.500	41.35	4.360	383.9	2.620	50.66	2.300	22.89 *	1.350	0.000
10	1.140	0.000	4.280	308.9 *	4.080	262.8 #	2.580	37.92	2.180	13.58	1.320	0.000
11	0.990	0.000	5.085	598.4	4.560	402.4	2.360	26.43 *	2.120	13.93 *	1.340	0.000
12	0.950	0.000	4.720	464.8	3.990	303.0	2.250	25.03	2.060	11.49 *	1.310	0.000
13	0.910	0.000	4.575	409.1	3.010	74.48	2.200	17.61 *	2.010	8.939	1.280	0.000
14	0.860	0.000	3.840	281.6	3.110	95.99 *	2.110	11.55	2.020	9.468	1.240	0.000
15	0.890	0.000	3.230	120.3	2.560	40.31 *	2.100	10.84	2.000	8.959	1.310	0.000
16	0.940	0.000	2.890	76.16	2.670	55.96	2.360	25.13	1.950	7.670 *	1.340	0.000
17	0.970	0.000	3.020	85.05 *	2.320	33.25	2.635	38.17	1.830	5.198	1.360	0.000
18	0.960	0.000	3.190	104.5	2.275	32.99	2.460	32.96 *	1.830	5.268	1.330	0.000
19	0.920	0.000	4.780	499.7	2.240	20.56	2.680	39.15	1.810	4.906	1.350	0.000
20	0.940	0.000	5.360	679.7	2.140	15.66	2.530	29.17	1.810	4.891	1.370	0.000

21	1.020	0.000	4.350	360.0		2.180	16.65	*	4.780	489.9		1.800	4.680		1.360	0.000
22	1.120	0.000	3.570	165.7		2.220	19.54		3.430	142.1		1.800	4.706		1.340	0.000
23	1.150	0.000	3.380	130.6		2.260	32.64		3.110	85.44		1.780	3.400	*	1.310	0.000
24	1.160	0.000	4.080	262.8	*	2.410	33.38		3.750	244.4		1.800	4.592		1.260	0.000
25	1.180	0.000	3.190	104.1		2.430	30.92	*	2.920	73.75	*	1.700	14.42		1.280	0.000
26	1.640	0.000	3.080	82.96		2.490	39.14		2.780	45.22		1.660	11.95		1.270	0.000
27	1.430	0.000	2.800	58.87		2.930	65.35		2.640	38.69		1.650	10.81		1.300	0.000
28	1.600	0.000	3.060	77.53		2.660	48.48	*	2.580	37.58		1.640	10.69		1.320	0.000
29	1.680	0.000	3.220	114.0		3.010	72.43		2.350	24.14		1.620	8.425		1.340	0.000
30	1.620	0.000	4.490	398.7		2.880	43.42		2.220	16.69		1.620	1.030	*	1.360	0.000
31			5.260	596.2	*	2.900	59.12					1.580	6.102			
Ten-Daily Mean																
I Ten-Daily	1.157	0.000	3.011	133.9		5.984	1075		2.513	36.91		2.486	31.64		1.495	0.416
II Ten-Daily	0.933	0.000	4.069	331.9		2.887	107.5		2.368	25.60		1.944	8.072		1.323	0.000
III Ten-Daily	1.360	0.000	3.680	213.8		2.579	41.91		3.056	119.8		1.695	7.347		1.314	0.000
Monthly																
Min.	0.860	0.000	1.630	0.000		2.140	15.66		2.100	10.84		1.580	1.030		1.240	0.000
Max.	1.680	0.000	5.360	679.7		10.250	3850		4.780	489.9		2.960	59.42		1.600	0.840
Mean	1.150	0.000	3.590	226.1		3.777	396.4		2.646	60.77		2.031	15.42		1.377	0.139

Annual Runoff in MCM = 1867 **Annual Runoff in mm = 925**

Peak Observed Discharge = 3850 cumecs on 02-08-2016 **Corres. Water Level :10.250 m**

Lowest Observed Discharge = 0.000 cumecs on 01-06-2016 **Corres. Water Level :0.870 m**

Q: Observed/Computed discharge in cumec WL: Corresponding Mean Water Level (m.s.l) in m * : Computed Discharge

#:Discarded Discharge (values changed as per rating curve)

Note: River remained in pooling/ no flow condition w.e.f. 01/06/16 to 02/07/16 & from 08/11/16 to 31/05/17.

Stage –Discharge data for the period 2016-2017

Station Name: Vaitarna at Durvesh (01 02 25 001) Division : Tapi Division, Surat Sub -Division : DGSD, CWC, Silvassa Local River: Vaitarna

Day	Dec		Jan		Feb		Mar		Apr		May	
	W.L	Q	WL	Q	WL	Q	WL	Q	WL	Q	WL	Q
1	1.380	0.000	1.260	0.000	1.300	0.000	1.200	0.000	1.370	0.000	1.280	0.000
2	1.370	0.000	1.280	0.000	1.200	0.000	1.240	0.000	1.360	0.000	1.190	0.000
3	1.350	0.000	1.310	0.000	1.100	0.000	1.280	0.000	1.310	0.000	0.980	0.000
4	1.360	0.000	1.330	0.000	0.970	0.000	1.260	0.000	1.240	0.000	0.940	0.000
5	1.380	0.000	1.290	0.000	0.880	0.000	1.200	0.000	1.180	0.000	0.890	0.000
6	1.290	0.000	1.250	0.000	0.840	0.000	1.040	0.000	0.970	0.000	0.930	0.000
7	1.170	0.000	1.140	0.000	0.870	0.000	0.950	0.000	0.980	0.000	0.980	0.000
8	1.040	0.000	0.970	0.000	0.910	0.000	0.900	0.000	1.000	0.000	1.050	0.000
9	0.960	0.000	0.850	0.000	1.050	0.000	1.050	0.000	0.960	0.000	1.100	0.000
10	0.980	0.000	1.110	0.000	1.220	0.000	1.260	0.000	1.270	0.000	1.280	0.000
11	0.940	0.000	1.220	0.000	1.280	0.000	1.290	0.000	1.340	0.000	1.330	0.000
12	1.120	0.000	1.260	0.000	1.340	0.000	1.340	0.000	1.370	0.000	1.350	0.000
13	1.140	0.000	1.300	0.000	1.320	0.000	1.360	0.000	1.340	0.000	1.290	0.000
14	1.200	0.000	1.330	0.000	1.290	0.000	1.380	0.000	1.320	0.000	1.200	0.000
15	1.260	0.000	1.340	0.000	1.260	0.000	1.350	0.000	1.250	0.000	1.000	0.000
16	1.280	0.000	1.300	0.000	1.230	0.000	1.310	0.000	1.200	0.000	0.980	0.000
17	1.310	0.000	1.280	0.000	1.100	0.000	1.280	0.000	1.150	0.000	0.940	0.000
18	1.340	0.000	1.250	0.000	0.960	0.000	1.210	0.000	0.950	0.000	0.900	0.000
19	1.310	0.000	1.130	0.000	0.890	0.000	1.120	0.000	0.930	0.000	0.860	0.000
20	1.290	0.000	0.980	0.000	0.870	0.000	0.950	0.000	0.900	0.000	0.840	0.000

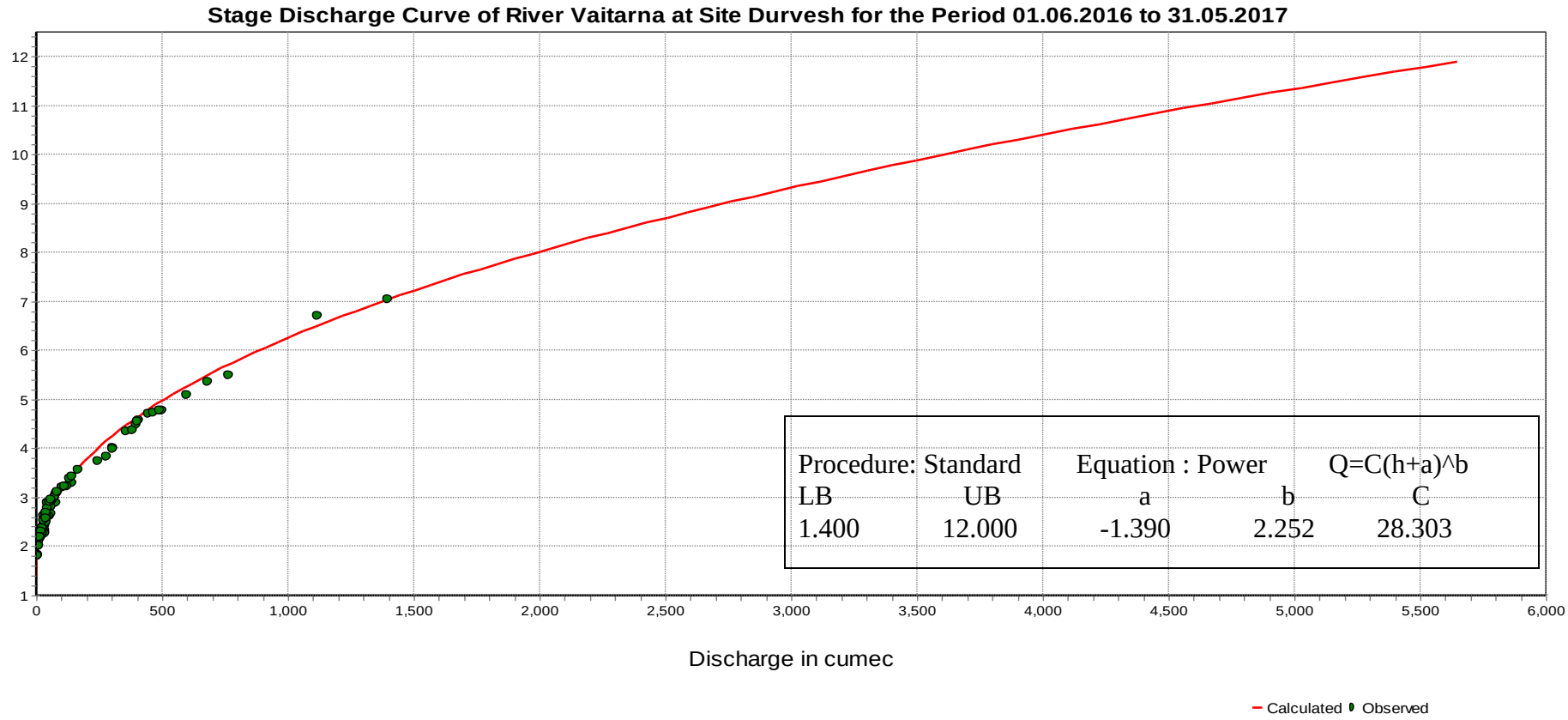
21	1.000	0.000	0.920	0.000	0.900	0.000	0.890	0.000	0.860	0.000	0.850	0.000
22	0.920	0.000	0.890	0.000	0.930	0.000	0.870	0.000	0.830	0.000	0.870	0.000
23	0.940	0.000	0.920	0.000	0.960	0.000	0.840	0.000	0.870	0.000	0.900	0.000
24	0.880	0.000	0.990	0.000	0.970	0.000	0.940	0.000	1.100	0.000	0.940	0.000
25	0.810	0.000	1.030	0.000	0.980	0.000	0.970	0.000	1.160	0.000	1.050	0.000
26	0.840	0.000	1.060	0.000	1.060	0.000	1.040	0.000	1.230	0.000	1.220	0.000
27	0.900	0.000	1.090	0.000	1.100	0.000	1.120	0.000	1.300	0.000	1.240	0.000
28	1.190	0.000	1.120	0.000	1.160	0.000	1.170	0.000	1.340	0.000	1.360	0.000
29	1.330	0.000	1.160	0.000			1.300	0.000	1.360	0.000	1.370	0.000
30	1.350	0.000	1.250	0.000			1.330	0.000	1.300	0.000	1.390	0.000
31	1.320	0.000	1.380	0.000			1.350	0.000			1.280	0.000
Ten-Daily Mean												
I Ten-Daily	1.228	0.000	1.179	0.000	1.034	0.000	1.138	0.000	1.164	0.000	1.062	0.000
II Ten-Daily	1.219	0.000	1.239	0.000	1.154	0.000	1.259	0.000	1.175	0.000	1.069	0.000
III Ten-Daily	1.044	0.000	1.074	0.000	1.007	0.000	1.075	0.000	1.135	0.000	1.134	0.000
Monthly												
Min.	0.810	0.000	0.850	0.000	0.840	0.000	0.840	0.000	0.830	0.000	0.840	0.000
Max.	1.380	0.000	1.380	0.000	1.340	0.000	1.380	0.000	1.370	0.000	1.390	0.000
Mean	1.160	0.000	1.161	0.000	1.069	0.000	1.155	0.000	1.158	0.000	1.090	0.000

Peak Computed Discharge = 596.2 cumecs on 31-07-2016 Corres. Water Level :5.260 m
Lowest Computed Discharge = 0.520 cumecs on 06-11-2016 Corres. Water Level :1.560 m

Q: Observed/Computed discharge in cumec WL: Corresponding Mean Water Level (m.s.l) in m * : Computed Discharge
#:Discarded Discharge (values changed as per rating curve)
Note: River remained in pooling/ no flow condition w.e.f. 01/06/16 to 02/07/16 & from 08/11/16 to 31/05/17.

4.3.4 Stage Discharge Curve

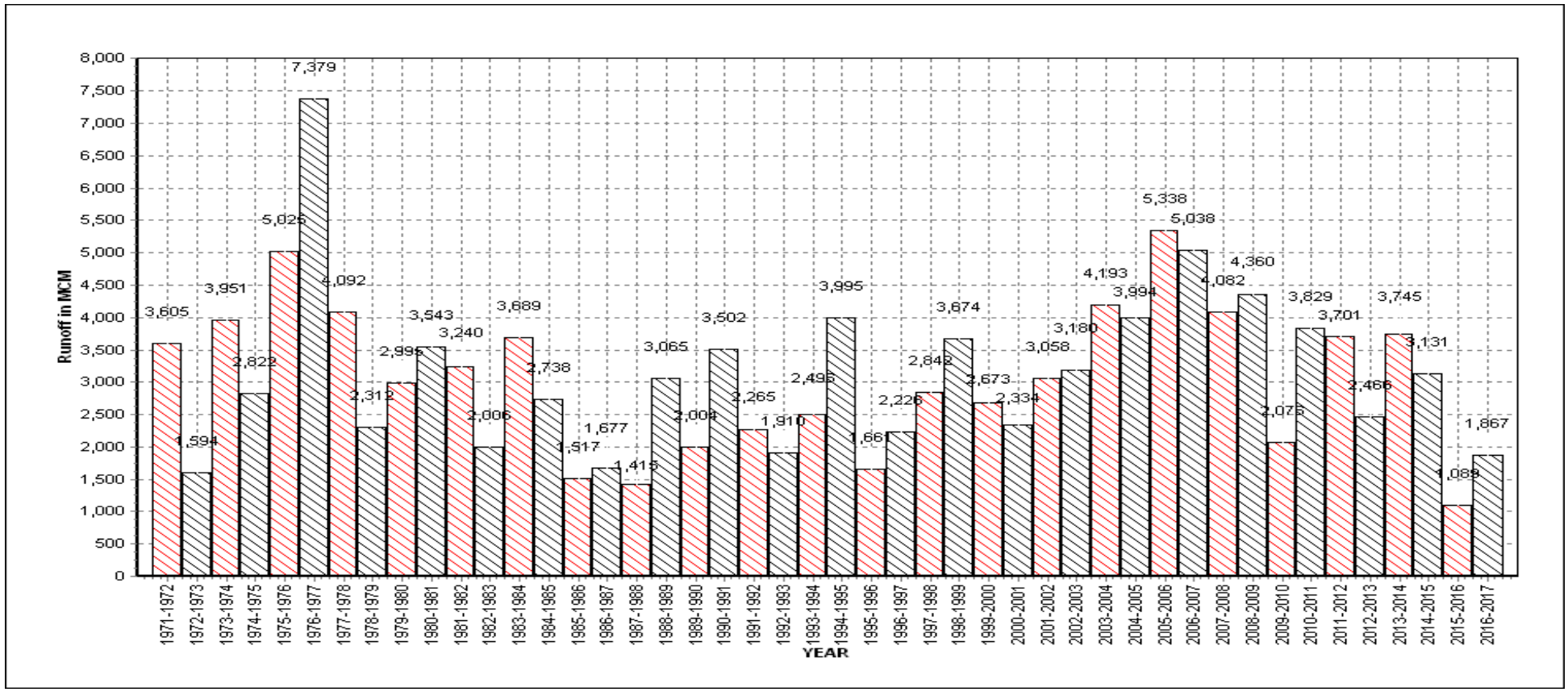
Station Name: Vaitarna at Durvesh (01 02 25 001) Division : Tapi Division Surat Local River: Vaitarna Sub -Division : DGSD, CWC, Silvassa



4.3.5 Annual Runoff

Annual Runoff Values- Runoff Based on period 1971 to 2017

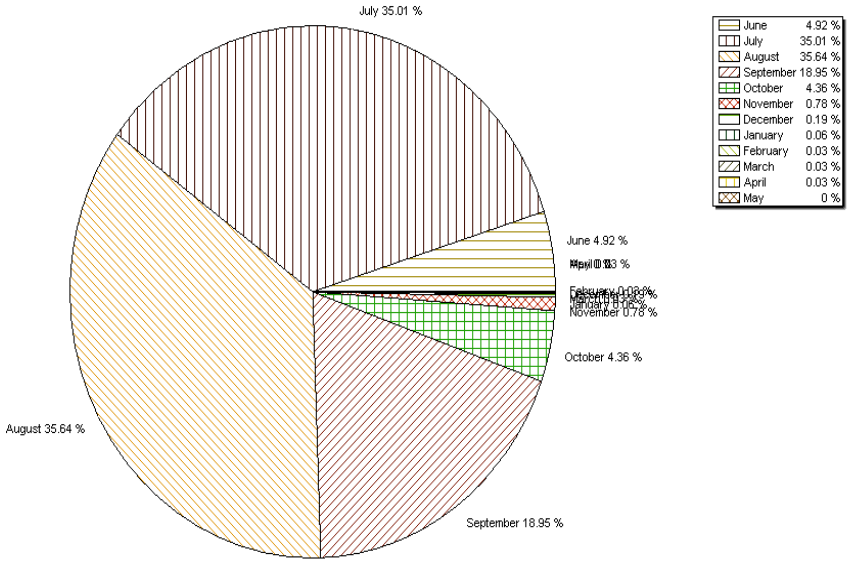
Station Name: Vaitarna at Durvesh (01 02 25 001) Division : Tapi Division Surat Local River: Vaitrana Sub -Division : DGSD, CWC, Silvassa



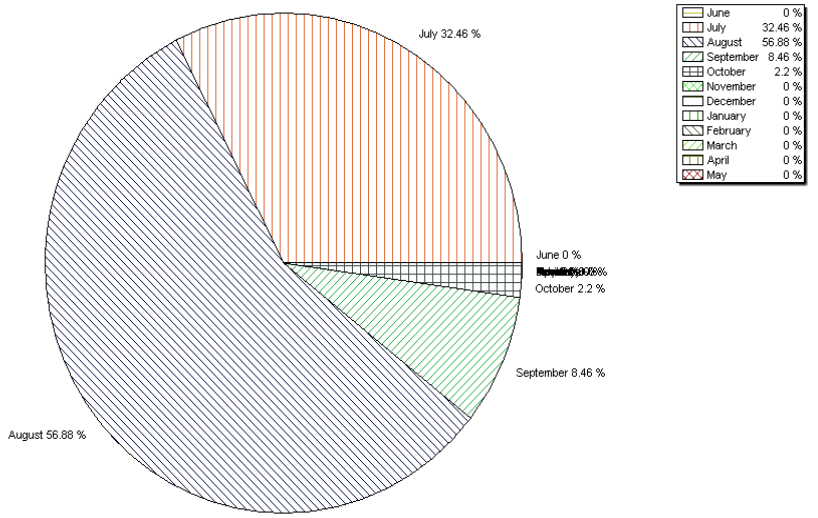
4.3.6 Monthly Average Runoff

Station Name: Vaitarna at Durvesh (01 02 25 001) Division : Tapi Division Surat Local River: Vaitarna Sub -Division : DGSD, CWC, Silvassa

Monthly Average Runoff Based on period: 1971 -2016



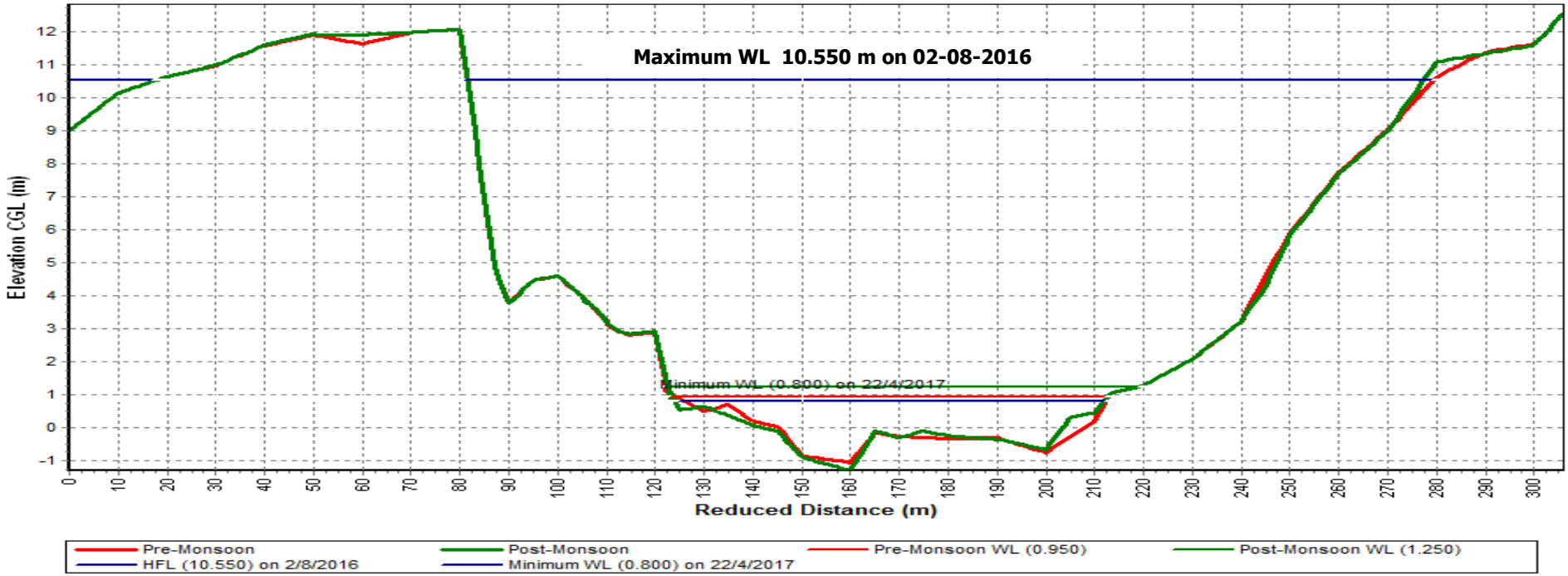
Monthly Average Runoff Based on period: 2016-17



4.3.7 Superimposed Cross section

Station Name: Vaitarna at Durvesh (01 02 25 001) Division : Tapi Division Surat Local River: Vaitarna Sub -Division : DGSD, CWC, Silvassa

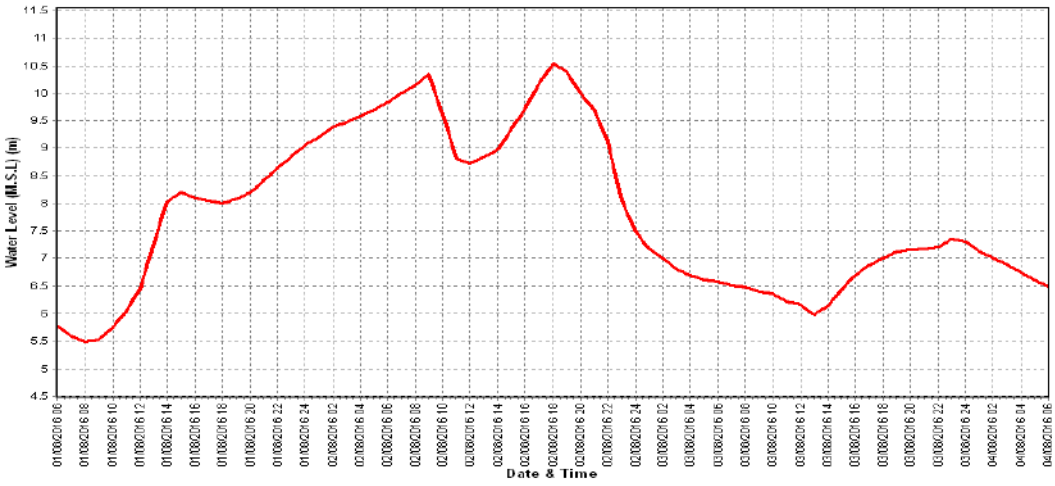
Historical Flood Level observed so far 16.130 m on date 17/09/1998 at 13:00 hrs



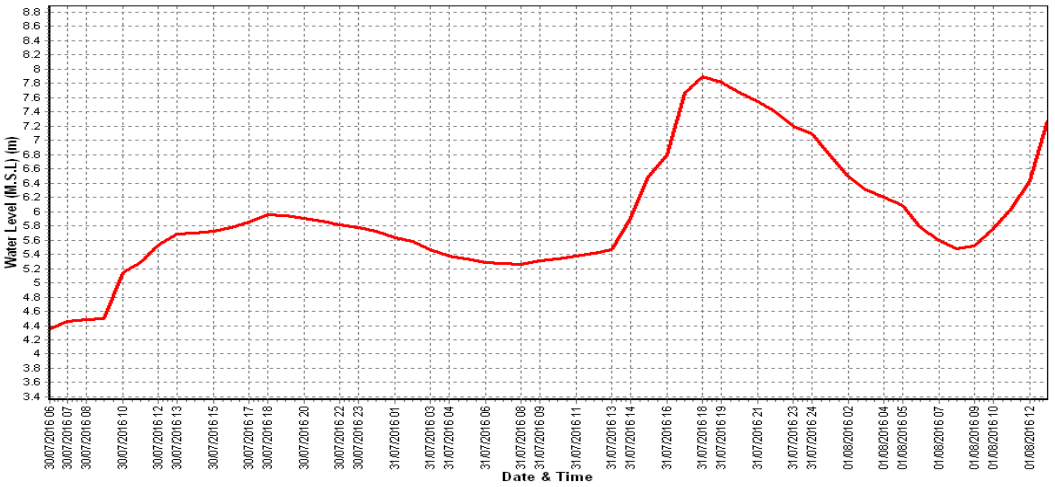
4.3.8 Water Level vs. Time- Graph of Highest Flood Peaks during 2016-17

Station Name: Vaitarna at Durvesh (01 02 25 001) Division : Tapi Division Surat
Local River: Vaitarna Sub -Division : DGSD, CWC, Silvassa

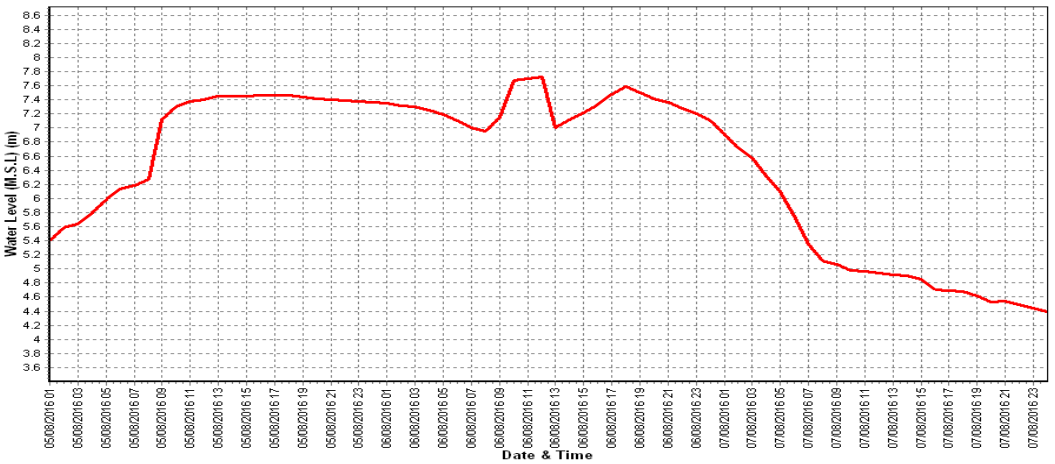
Water level vs. Time graph of I flood peak during the year 2016-17



Water level vs. Time graph of II flood peak during the year 2016-17



Water level vs. Time graph of III flood peak during the year 2016-17



4.4 Dhadhar Basin

4.4.1 History Sheet

HISTORY SHEET

			Water Year	**:**	**2016-17**
Site	**:**	**Pingalwada**	**Code**	**:**	**01 02 14 001**
State	:	Gujarat	District		Vadodara
Basin	:	Narmada	Independent River	:	Dhadhar
Tributary	:	-	Sub Tributary	:	-
Sub-Sub Tributary	:	-	Local River	:	Dhadhar
Division	:	Tapi Dvision, Surat	Sub-Division	:	LNSD Bharuch
Drainage Area	:	2400 Sq. Km.	Bank	:	Right
Latitude	:	22°06’37” N	Longitude	:	73°04’44” E
Zero of Gauge (m)	:	2 (m.s.l)	07/04/1989		
		Opening Date	Closing Date		
Gauge	:	07/04/1989			
Discharge	:	30/06/1989			
Sediment	:				
Water Quality	:	15/03/1990			

Annual Maximum / Minimum discharge with corresponding Water Level (m.s.l)

	Maximum			Minimum		
Year	**Q (cumecs)**	**WL (m)**	**Date**	**Q (cumecs)**	**WL (m)**	**Date**
1989-1990	334.9	10.768	21/08/1989	0.185	4.840	08/05/1990
1990-1991	985.4	18.200	25/08/1990	0.002	5.050	01/04/1991
1991-1992	424.3	13.025	25/07/1991	0.053	5.320	29/05/1992
1992-1993	197.7	10.368	04/09/1992	0.152	5.110	22/01/1993
1993-1994	674.5	15.300	18/07/1993	0.350	5.000	19/03/1994
1994-1995	1056	19.050	09/09/1994	0.280	5.040	12/06/1994
1995-1996	442.0	12.700	23/07/1995	0.650	5.000	30/05/1996
1996-1997	641.7	15.390	30/07/1996	0.500	5.000	25/11/1996
1997-1998	1014	17.400	26/08/1997	0.500	5.120	11/01/1998
1998-1999	602.0	16.835	18/09/1998	0.356	5.120	12/05/1999
1999-2000	23.02	6.500	14/10/1999	0.500	5.040	19/12/1999
2000-2001	503.1	15.425	15/07/2000	0.231	4.980	20/04/2001
2001-2002	418.2	13.500	12/08/2001	0.302	4.990	09/06/2001
2002-2003	427.1	13.700	05/09/2002	0.690	5.050	20/04/2003
2003-2004	839.9	15.710	26/08/2003	0.712	5.060	20/03/2004
2004-2005	681.5	15.260	16/08/2004	0.765	5.070	12/06/2004
2005-2006	807.5	18.450	02/07/2005	0.995	5.180	26/02/2006
2006-2007	759.0	18.245	31/07/2006	0.000	5.000	06/04/2007
2007-2008	586.9	15.250	03/07/2007	2.134	5.050	31/05/2008
2008-2009	682.7	15.750	13/08/2008	1.250	5.110	08/05/2009
2009-2010	21.98	6.745	31/08/2009	0.000	5.090	13/06/2009
2010-2011	655.0	15.850	09/08/2010	0.000	5.210	01/06/2010
2011-2012	250.1	13.200	14/08/2011	0.000	5.370	27/11/2011
2012-2013	148.2	12.090	12/09/2012	0.000	5.230	01/06/2012
2013-2014	593.6	15.700	24/09/2013	0.000	5.200	01/06/2013
2014-2015	301.8	12.500	28/07/2014	2.110	5.040	21/06/2014
2015-2016	40.57	7.270	30/07/2015	1.542	5.300	03/05/2016
2016-2017	124.3	9.510	06/10/2016	0.000	5.580	01/06/2016

4.4.2 Annual Maximum Flood Peak

Year	Annual Maximum flood Peaks (m)	Date	Hour
1989	7.860	01/09/1989	08:00:00
1990	18.870	25/08/1990	16:00:00
1991	13.250	25/07/1991	14:00:00
1992	10.500	04/09/1992	23:00:00
1993	15.300	18/07/1993	08:00:00
1994	19.700	08/09/1994	18:00:00
1995	13.300	22/07/1995	23:00:00
1996	15.750	29/07/1996	23:00:00
1997	17.400	26/08/1997	00:00:00
1998	16.950	18/09/1998	02:00:00
1999	7.000	21/07/1999	17:00:00
2000	15.430	15/07/2000	09:00:00
2001	13.500	11/08/2001	21:00:00
2002	13.850	05/09/2002	17:00:00
2003	15.840	26/08/2003	17:00:00
2004	15.260	15/08/2004	22:00:00
2005	18.450	02/07/2005	17:00:00
2006	18.500	31/07/2006	16:00:00
2007	15.350	02/07/2007	21:00:00
2008	17.700	14/08/2008	07:00:00
2009	7.000	29/08/2009	19:00:00
2010	16.300	09/08/2010	19:00:00
2011	13.200	14/08/2011	07:00:00
2012	12.800	12/09/2012	08:00:00
2013	19.300	26/09/2013	05:00:00
2014	19.400	11/09/2014	18:00:00
2015	7.500	29/07/2015	12:00:00
2016	9.510	06/10/2016	05:00:00

4.4.3 Summary of Data

Stage discharge data for the period of 2016-17

Station Name: Dhadar at Pingalwada(01 02 14 001) Division : Tapi Division, Surat Local River: Pingalwada Sub -Division : LNSD, CWC, Bharuch

Day	Jun		Jul		Aug		Sep		Oct		Nov	
	W.L	Q	W.L	Q	W.L	Q	W.L	Q	W.L	Q	W.L	Q
1	5.580	0.000	5.570	0.000	5.900	0.000	6.590	20.67	6.100	10.97	6.040	9.047
2	5.580	0.000	5.560	0.000	5.890	0.000	6.730	23.29	6.060	11.24 *	6.030	9.079
3	5.570	0.000	5.560	0.000	5.950	0.000	6.800	24.00	6.120	11.36	6.040	9.262
4	5.570	0.000	5.580	0.000	6.100	0.000	6.420	17.63 *	6.850	27.11 #	5.640	5.957
5	5.560	0.000	5.590	0.000	6.150	0.000	6.410	16.04	8.150	74.92	5.650	5.909
6	5.560	0.000	5.580	0.000	6.250	14.72	6.250	14.72	9.510	124.3	5.660	5.810 *
7	5.570	0.000	5.570	0.000	6.000	0.000	6.140	14.16	8.850	97.59	5.650	6.085
8	5.570	0.000	5.560	0.000	5.960	0.000	6.100	13.48	7.900	68.23	5.620	5.479
9	5.550	0.000	5.820	0.000	6.040	0.000	6.650	20.87	7.450	43.68 *	5.620	5.472
10	5.540	0.000	5.810	0.000	6.420	0.000	6.740	24.34	6.850	27.11 #	5.630	5.616
11	5.540	0.000	5.800	0.000	6.980	0.000	6.700	23.57 *	6.280	14.98 *	5.640	5.719
12	5.570	0.000	5.810	0.000	7.350	45.82	6.550	19.83	5.960	9.720 *	5.620	5.472
13	5.560	0.000	5.870	0.000	7.280	41.87	6.280	14.98 *	6.300	16.02	5.630	5.480 *
14	5.560	0.000	5.900	0.000	6.850	27.11 *	6.080	13.28	6.240	14.28	5.640	5.590 *
15	5.570	0.000	5.860	0.000	6.500	19.24 *	6.040	12.84	6.170	11.48	5.630	5.620
16	5.560	0.000	5.850	0.000	5.980	12.30	6.060	13.07	6.040	10.93 *	5.640	5.590 #
17	5.550	0.000	5.840	0.000	5.970	11.51	6.130	13.85	6.100	10.93	5.620	5.514
18	5.540	0.000	5.820	0.000	5.940	11.12	6.220	13.91 *	6.090	11.07	5.640	5.728
19	5.540	0.000	5.810	0.000	5.940	10.57	7.650	52.98	6.100	11.09	5.630	5.627
20	5.560	0.000	5.830	0.000	5.910	10.33	8.500	79.46	6.070	10.63	5.640	5.590 *

21	5.570	0.000	5.840	0.000	6.120	12.21 *	8.465	86.01	6.050	9.156	5.650	5.861
22	5.560	0.000	5.830	0.000	6.170	11.70	8.400	82.22	6.100	11.28	5.640	5.731
23	5.550	0.000	5.810	0.000	6.220	11.99	7.500	44.42	6.070	11.40 *	5.630	5.628
24	5.550	0.000	5.810	0.000	6.245	12.10	6.900	33.14	6.040	8.998	5.680	6.301
25	5.540	0.000	5.830	0.000	6.470	18.63 *	6.700	23.57 *	6.100	11.27	5.660	6.144
26	5.540	0.000	5.800	0.000	6.620	21.67	6.340	17.01	6.040	9.046	5.640	5.980
27	5.560	0.000	5.780	0.000	6.500	18.16	6.310	16.28	6.030	9.032	5.670	5.930 *
28	5.570	0.000	5.790	0.000	6.420	17.63 *	6.240	14.56	6.060	9.222	5.660	6.132
29	5.580	0.000	5.820	0.000	6.530	18.36	6.180	11.58	6.030	9.060	5.640	5.972
30	5.570	0.000	5.800	0.000	6.480	17.78	6.080	10.71	6.030	10.78 *	5.660	6.116
31			5.820	0.000	6.370	15.46			6.060	9.194		
Ten-Daily Mean												
I Ten-Daily	5.565	0.000	5.620	0.000	6.066	1.472	6.483	18.92	7.384	49.65	5.758	6.772
II Ten-Daily	5.555	0.000	5.839	0.000	6.470	18.99	6.621	25.78	6.135	12.11	5.633	5.593
III Ten-Daily	5.559	0.000	5.812	0.000	6.377	15.97	6.912	33.95	6.055	9.858	5.653	5.979
Monthly												
Min.	5.540	0.000	5.560	0.000	5.890	0.000	6.040	10.71	5.960	8.998	5.620	5.472
Max.	5.580	0.000	5.900	0.000	7.350	45.82	8.500	86.01	9.510	124.3	6.040	9.262
Mean	5.560	0.000	5.759	0.000	6.307	12.27	6.672	26.22	6.510	23.42	5.681	6.115

Annual Runoff in MCM = 241 **Annual Runoff in mm = 101**

Peak Observed Discharge = 124.3 cumecs on 06/10/2016 **Corres. Water Level :9.510 m**

Lowest Observed Discharge = 0.000 cumecs on 01/06/2016 **Corres. Water Level :5.580 m**

Q: Observed/Computed discharge in cumec WL: Corresponding Mean Water Level (m.s.l) in m * : Computed Discharge

#:Discarded Discharge (values changed as per rating curve)

Note: River remained in pooling/ no flow condition w.e.f. 01/06/2016 to 05/08/2016, 07/08/2016 to 11/08/2016 & 01/03/17 to 31/05/17.

Stage discharge data for the period of 2015-16

Station Name: Dhadar at Pingalwada (01 02 14 001) Division: Tapi Division, Surat Local River: Pingalwada Sub-Division:LNSD, CWC, Bharuch

Day	Dec		Jan		Feb		Mar		Apr		May	
	W.L	Q	WL	Q	WL	Q	WL	Q	WL	Q	WL	Q
1	5.640	5.979	5.780	7.260 *	5.900	10.45	5.850	0.000	5.440	0.000	6.450	0.000
2	5.650	6.117	5.780	7.150	5.920	9.828	5.840	0.000	5.400	0.000	6.500	0.000
3	5.680	6.278	5.760	6.884	5.880	10.28	5.830	0.000	5.420	0.000	6.460	0.000
4	5.660	5.810 *	5.780	7.120	5.890	10.43	5.840	0.000	5.400	0.000	6.500	0.000
5	5.780	7.361	5.800	7.945	5.880	8.580 *	5.850	0.000	5.420	0.000	6.460	0.000
6	5.800	7.526	5.780	7.603	5.920	10.75	5.850	0.000	5.440	0.000	6.450	0.000
7	5.810	7.627	5.800	7.876	5.940	9.997	5.860	0.000	6.400	0.000	6.450	0.000
8	5.780	7.313	5.790	7.390 *	5.950	10.35	5.850	0.000	6.800	0.000	6.400	0.000
9	5.800	7.522	5.810	7.772	5.900	9.290	5.860	0.000	6.790	0.000	6.460	0.000
10	5.680	6.388	5.880	6.171	5.860	8.710	5.860	0.000	6.400	0.000	6.450	0.000
11	5.700	6.280 *	6.000	11.59	5.880	9.040	5.850	0.000	6.200	0.000	6.500	0.000
12	5.740	6.760 *	5.990	11.39	5.840	8.040 *	5.860	0.000	6.500	0.000	6.530	0.000
13	5.760	6.983	5.980	11.11	5.730	5.681	5.840	0.000	6.400	0.000	6.550	0.000
14	5.740	6.749	5.960	10.94	5.760	6.200	5.850	0.000	6.400	0.000	6.540	0.000
15	5.750	6.922	5.940	9.430 *	5.840	7.506	5.840	0.000	6.500	0.000	6.530	0.000
16	5.760	6.957	5.870	9.905	5.860	7.795	5.860	0.000	6.400	0.000	6.550	0.000
17	5.740	6.785	5.940	10.22	5.900	8.625	5.850	0.000	6.500	0.000	6.480	0.000
18	5.760	7.010 *	5.910	9.806	5.880	8.033	5.840	0.000	6.400	0.000	6.500	0.000
19	5.750	6.916	5.880	9.474	5.860	8.310 *	5.850	0.000	6.520	0.000	6.500	0.000
20	5.760	6.948	5.860	9.086	5.840	6.691	5.800	0.000	6.500	0.000	6.480	0.000

21	5.780	7.274	5.870	9.138	5.840	5.080	5.580	0.000	6.440	0.000	6.500	0.000
22	5.760	7.074	5.880	8.580 *	5.850	5.247	5.520	0.000	6.500	0.000	6.540	0.000
23	5.780	7.220	5.910	9.745	5.860	5.457	5.540	0.000	6.500	0.000	6.550	0.000
24	5.740	6.779	5.900	9.863	5.860	8.310 *	5.500	0.000	6.520	0.000	6.500	0.000
25	5.780	7.260 *	5.880	9.567	5.850	5.104	5.500	0.000	6.550	0.000	6.560	0.000
26	5.750	6.896	5.890	8.720 *	5.860	8.310 *	5.520	0.000	6.500	0.000	6.540	0.000
27	5.760	7.023	5.920	9.861	5.850	8.170 *	5.540	0.000	6.550	0.000	6.560	0.000
28	5.740	6.748	5.910	9.724	5.820	7.770 *	5.500	0.000	6.500	0.000	6.550	0.000
29	5.760	7.033	5.900	10.00			5.480	0.000	6.450	0.000	6.540	0.000
30	5.740	6.682	5.900	10.51			5.500	0.000	6.400	0.000	6.200	0.000
31			5.920	9.525			5.420	0.000			6.100	0.000
Ten-Daily Mean												
I Ten-Daily	5.728	6.792	5.796	7.317	5.904	9.866	5.849	0.000	5.891	0.000	6.458	0.000
II Ten-Daily	5.746	6.831	5.933	10.30	5.839	7.592	5.844	0.000	6.432	0.000	6.516	0.000
III Ten-Daily	5.759	6.999	5.898	9.567	5.849	6.681	5.509	0.000	6.491	0.000	6.467	0.000
Monthly												
Min.	5.640	5.810	5.760	6.171	5.730	5.080	5.420	0.000	5.400	0.000	6.100	0.000
Max.	5.810	7.627	6.000	11.59	5.950	10.75	5.860	0.000	6.800	0.000	6.560	0.000
Mean	5.744	6.874	5.876	9.076	5.865	8.144	5.727	0.000	6.271	0.000	6.480	0.000

Peak Computed Discharge = 43.68 cumecs on 09/10/2016 Corres. Water Level :7.450 m

Lowest Computed Discharge = 5.480 cumecs on 13/11/2016 Corres. Water Level :5.63 m

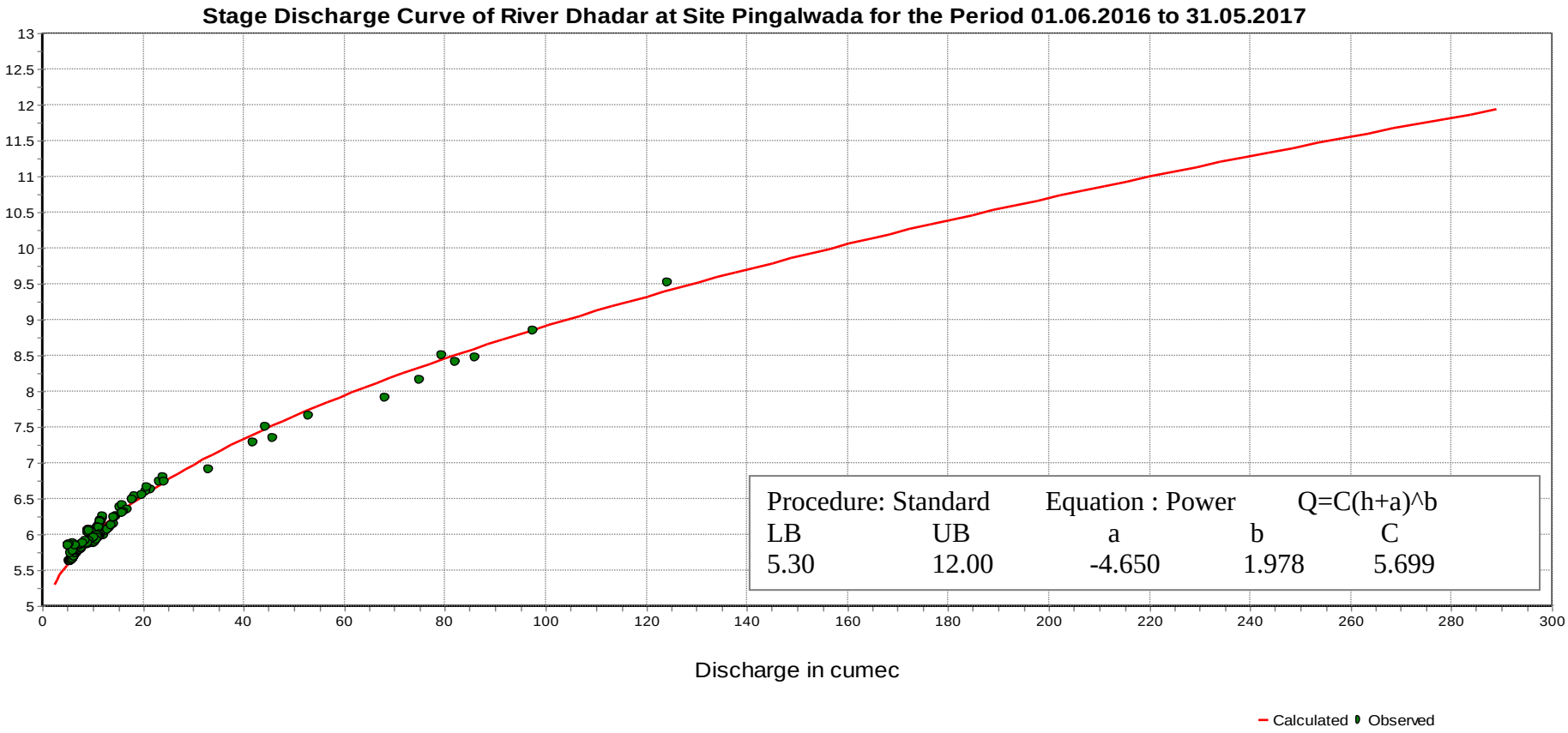
Q: Observed/Computed discharge in cumec WL: Corresponding Mean Water Level (m.s.l) in m * : Computed Discharge

#:Discarded Discharge (values changed as per rating curve)

Note: River remained in pooling/ no flow condition w.e.f. 01/06/2016 to 05/08/2016, 07/08/2016 to 11/08/2016 & 01/03/17 to 31/05/17.

4.4.4 Stage Discharge curve

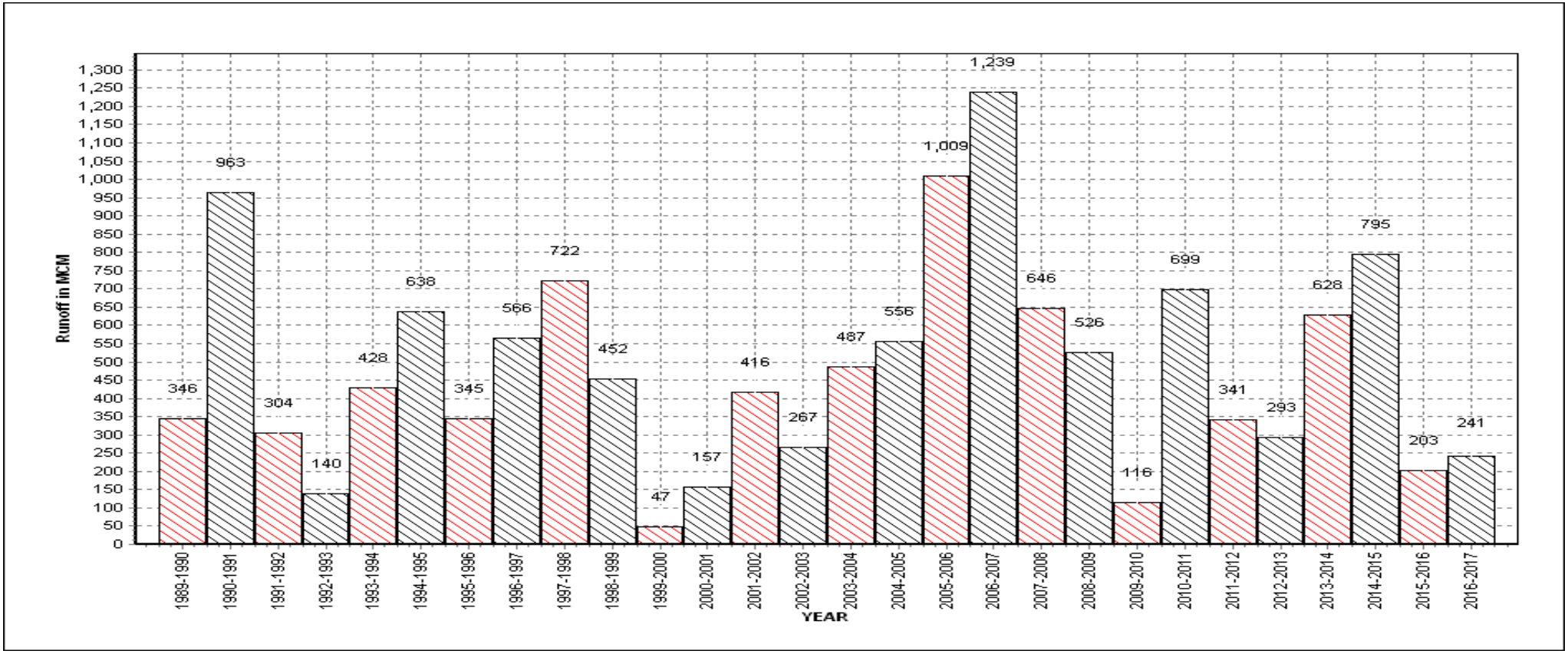
Station Name: Dhadar at Pingalwada(01 02 14 001) Division : Tapi Division, Surat Local River: Pingalwada Sub -Division : LNSD, CWC, Bharuch



4.4.5 Annual Runoff

Annual Runoff Values Runoff Based on period: 1989-2017

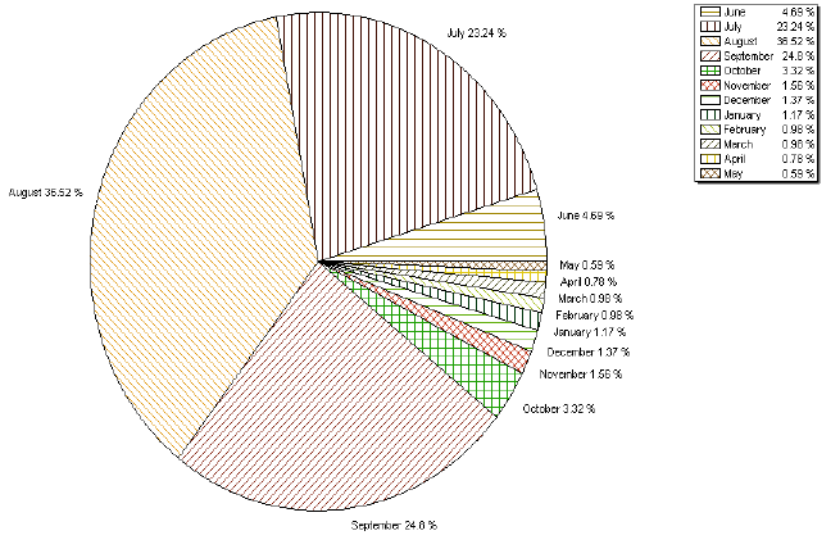
Station Name: Dhadhar at Pingalwada (01 02 14 001) Division : Tapi Division, Surat Local River: Pingalwada Sub -Division : LNSD, CWC, Bharuch



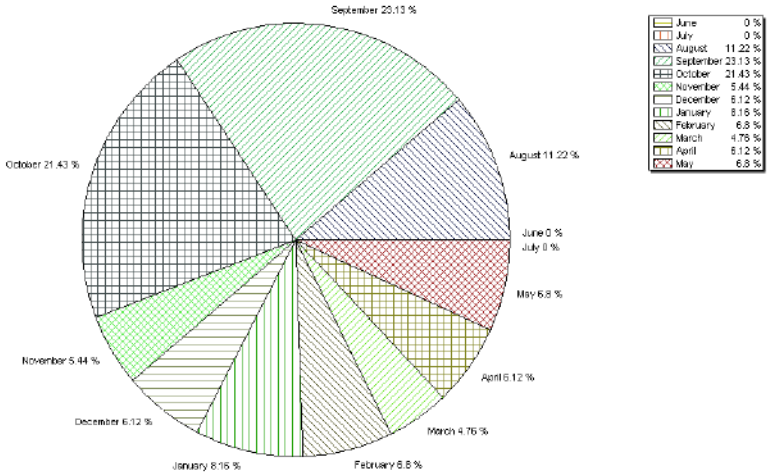
4.4.6 Monthly Average Runoff

Station Name: Dhadar at Pingalwada(01 02 14 001) Division : Tapi Division, Surat Local River: Pingalwada Sub -Division : LNSD, CWC, Bharuch

Monthly Average Runoff Based on period: 1989-2016



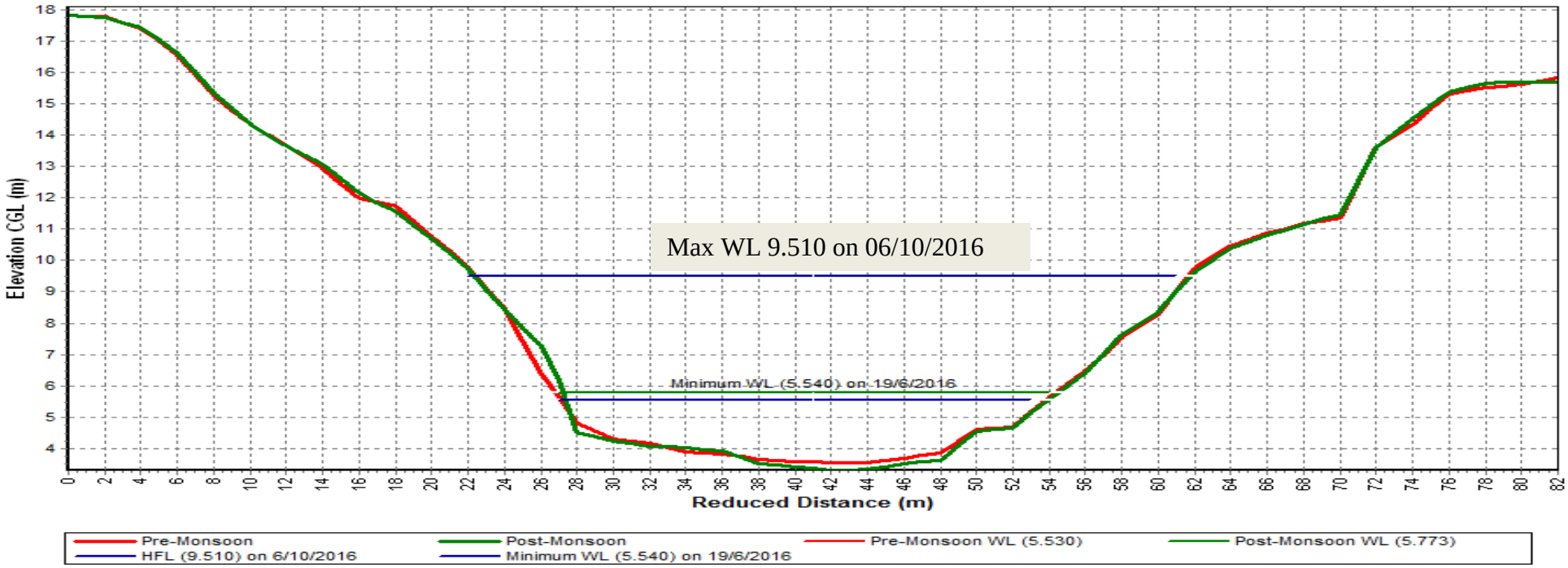
Monthly Average Runoff Based on period: 2016-2017



4.4.7 Superimposed Cross section

Station Name: Dhadar at Pingalwada (01 02 14 001) Division : Tapi Division, Surat Local River: Pingalwada Sub -Division : LNSD, CWC, Bharuch

Highest flood level observed so far 19.70 on dt 08-09-1994 at 1800hrs

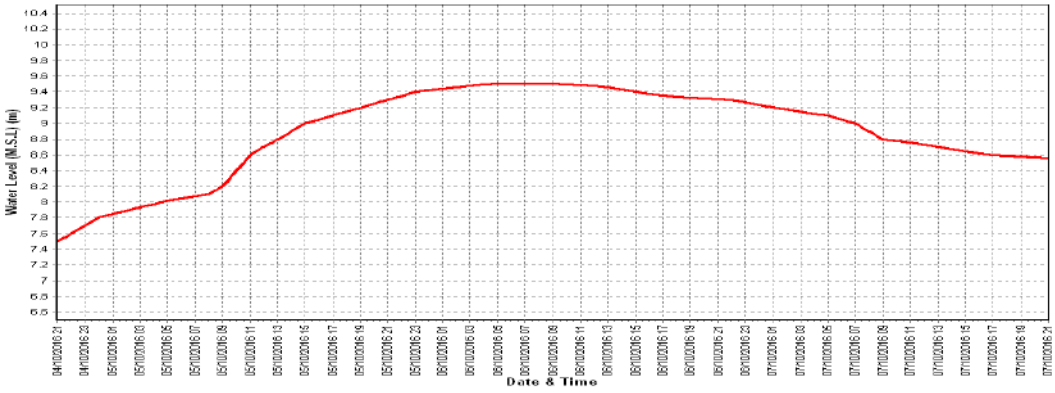


4.4.8 Water Level vs. Time- Graph of Highest Flood Peaks during 2016-17

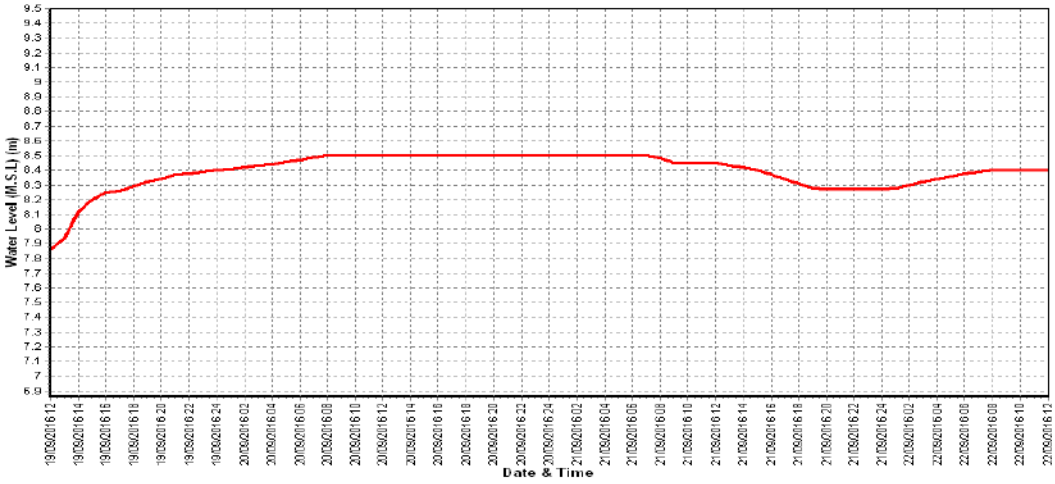
Station Name: Dhadar at Pingalwada
Local River: Pingalwada

Division : Tapi Division, Surat
Sub -Division : LNSD, CWC, Bharuch

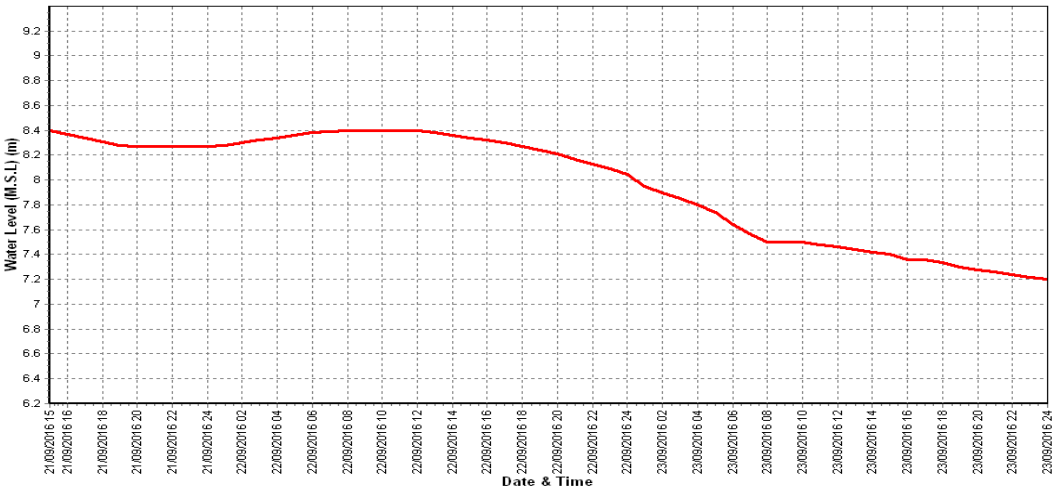
Water level vs. Time graph of I flood peak during the year 2016-17



Water level vs. Time graph of II flood peak during the year 2016-17



Water level vs. Time graph of III flood peak during the year 2016-17



4.5 Wagh Basin

4.5.1.1 History Sheet

HISTORY SHEET

			Water Year	**:**	**2016-17**
Site	**:**	**Wagh at Ozerkheda**	**Code**	**:**	**01 02 24 002**
State	:	Maharashtra	District		Nashik
Basin	:	WFR South of Tapi	Independent River	:	Daman Ganga
Tributary	:	Wagh	Sub Tributary	:	
Sub-Sub Tributary	:		Local River	:	
Division	:	Tapi Division, Surat	Sub-Division	:	DGSD,CWC,Silvassa
Drainage Area	:	640 Sq. Km.	Bank	:	
Latitude	:	20°06'01"	Longitude	:	73°16'16"
Zero of Gauge (m)	:	80.1 (m.s.l)	15/06/1983		
		Opening Date	Closing Date		
Gauge	:	28/06/1983			
Discharge	:	01/06/1984 Seasonal			
		01/06/1991 (Regular)			

Annual Maximum / Minimum discharge with corresponding Water Level (m.s.l)

	Maximum			Minimum		
Year	**Q (cumecs)**	**WL (m)**	**Date**	**Q (cumecs)**	**WL (m)**	**Date**
1991-1992	878.8	86.950	27/07/1991	0.000	81.400	17/05/1992
1992-1993	770.9	86.285	12/08/1992	0.000	81.080	22/05/1993
1993-1994	1117	87.100	13/07/1993	0.000	80.980	18/05/1994
1994-1995	1306	88.300	13/07/1994	0.000	81.340	10/02/1995
1995-1996	650.0	85.450	03/09/1995	0.000	80.610	04/03/1996
1996-1997	264.0	84.430	24/07/1996	0.000	80.410	04/02/1997
1997-1998	635.5	86.330	31/07/1997	0.000	80.860	18/03/1998
1998-1999	477.9	85.700	17/09/1998	0.000	80.650	05/05/1999
1999-2000	1144	87.175	16/07/1999	0.000	81.070	14/04/2000
2000-2001	774.8	85.750	13/07/2000	0.000	81.460	22/05/2001
2001-2002	284.0	84.620	16/08/2001	0.000	81.190	05/05/2002
2002-2003	1414	88.050	29/06/2002	0.000	81.110	07/05/2003
2003-2004	1145	87.200	28/07/2003	0.000	81.330	15/02/2004
2004-2005	2700	90.390	03/08/2004	0.000	81.670	20/04/2005
2005-2006	1660	88.550	29/06/2005	0.000	81.140	20/02/2006
2006-2007	1080	86.740	08/08/2006	0.042	81.210	13/01/2007
2007-2008	934.6	86.690	09/08/2007	0.100	81.130	09/01/2008
2008-2009	1421	87.855	12/08/2008	0.072	81.140	15/12/2008
2009-2010	1687	88.595	23/07/2009	0.000	81.090	01/06/2009
2010-2011	578.7	85.320	23/07/2010	0.000	81.080	01/06/2010
2011-2012	1289	87.200	29/08/2011	0.000	81.260	02/12/2011
2012-2013	1365	85.950	11/09/2012	0.000	81.140	01/06/2012
2013-2014	577.1	85.550	12/07/2013	0.000	81.300	01/06/2013
2014-2015	1267.0	87.100	31/07/2014	5.363	81.450	09/07/2014
2015-2016	251.7	84.000	28/07/2015	9.730	81.735	15/06/2015
2016-2017	1440	87.775	02/08/2016	0.000	81.210	01/06/2016

4.5.1.2 Annual Maximum Flood Peak

Year	Annual Maximum flood Peaks (m)	Date	Hour
1991	87.400	17/07/1991	11:00:00
1992	86.600	12/08/1992	13:00:00
1993	89.700	13/07/1993	16:00:00
1994	88.400	13/07/1994	07:00:00
1995	86.230	02/09/1995	16:00:00
1996	85.720	27/08/1996	19:00:00
1997	89.650	31/07/1997	18:00:00
1998	85.900	17/09/1998	09:00:00
1999	87.350	16/07/1999	07:00:00
2000	85.980	13/07/2000	18:00:00
2001	84.660	16/08/2001	12:00:00
2002	89.200	29/06/2002	13:00:00
2003	87.320	27/07/2003	12:00:00
2004	96.100	04/08/2004	01:00:00
2005	90.000	29/06/2005	05:00:00
2006	87.100	10/08/2006	16:00:00
2007	87.680	08/08/2007	16:00:00
2008	91.000	11/08/2008	17:00:00
2009	88.700	23/07/2009	09:00:00
2010	85.320	23/07/2010	08:00:00
2011	89.500	28/08/2011	16:00:00
2012	86.700	11/09/2012	12:00:00
2013	86.950	01/08/2013	11:00:00
2014	88.450	30/07/2014	20:00:00
2015	84.300	28/07/2015	18:00:00
2016	91.900	02/0/2016	19:00:00

4.5.1.3 Summary of Data

Stage Discharge Data for The period 2016-17

Station Name: Wagh at Ozerkheda (01 02 24 002) Division: Tapi Division, Surat Local River: Wagh Sub -Division: DGSD, CWC, Silvasssa

Day	Jun		Jul		Aug		Sep		Oct		Nov	
	W.L	Q	W.L	Q	W.L	Q	W.L	Q	W.L	Q	W.L	Q
1	81.210	0.000	81.140	0.000	84.500	339.8 *	82.300	40.45	82.430	46.43	81.660	5.444
2	81.210	0.000	81.150	0.000	87.775	1440	82.290	40.32	82.410	42.07 *	81.650	5.195
3	81.210	0.000	81.900	12.70 *	85.300	445.5	82.365	40.29	82.380	44.14	81.640	4.893
4	81.210	0.000	83.330	163.1	84.530	355.7	82.380	39.87 *	82.360	44.20	81.642	4.270
5	81.210	0.000	83.280	131.3	84.300	315.2	82.370	44.02	82.340	39.77	81.630	4.635
6	81.210	0.000	82.800	76.01 *	85.000	396.4	82.360	43.89	82.310	41.79	81.620	3.830 *
7	81.210	0.000	82.525	49.52	84.300	299.0 *	82.350	41.17	82.280	39.87	81.620	4.420
8	81.210	0.000	82.350	47.37	83.600	205.0	82.350	41.10	82.270	38.76	81.610	3.123
9	81.200	0.000	82.250	37.55	83.360	175.2	82.380	44.14	82.240	30.39 *	81.610	3.027
10	81.190	0.000	83.170	117.4 *	83.230	92.71	82.350	41.07	82.210	35.81	81.550	2.311
11	81.190	0.000	85.525	493.5	83.220	91.73	82.330	36.34 *	82.190	27.31 *	81.530	1.569
12	81.190	0.000	85.000	415.4	83.150	78.80	82.320	35.65 *	82.180	26.72 *	81.520	1.043
13	81.180	0.000	85.460	496.7	82.950	69.81	82.250	38.17	82.150	31.24	81.520	0.000
14	81.180	0.000	83.550	187.0	82.850	81.08 *	82.210	35.79	82.120	27.80	81.500	0.000
15	81.180	0.000	83.240	96.14	82.750	71.11 *	82.200	35.64	82.110	26.72	81.500	0.000
16	81.180	0.000	83.150	81.07	82.660	59.78	82.300	40.45	82.100	22.19 *	81.490	0.000
17	81.170	0.000	83.000	97.27 *	82.580	53.59	82.335	41.19	82.090	25.16	81.480	0.000
18	81.170	0.000	82.840	64.04	82.490	49.34	82.300	34.30 *	82.080	24.72	81.480	0.000
19	81.170	0.000	82.875	66.79	82.450	48.34	82.280	40.21	82.060	23.23	81.480	0.000
20	81.160	0.000	84.500	346.5	82.420	45.53	82.300	40.51	82.010	20.19	81.480	0.000

21	81.160	0.000	83.560	204.2	82.390	40.60 *	82.650	58.37	81.970	9.080	81.470	0.000
22	81.150	0.000	83.230	92.78	82.360	44.25	82.650	59.01	81.930	8.660	81.470	0.000
23	81.150	0.000	83.100	78.93	82.290	39.34	82.620	54.30	81.910	13.12 *	81.470	0.000
24	81.150	0.000	82.780	74.03 *	82.400	45.03	82.680	60.92	81.880	8.228	81.460	0.000
25	81.140	0.000	82.660	59.27	82.420	42.82 *	82.650	61.78 *	81.850	7.995	81.460	0.000
26	81.140	0.000	82.620	58.07	82.370	44.08	82.580	53.46	81.820	7.170	81.460	0.000
27	81.140	0.000	82.550	52.26	82.350	41.58	82.540	51.47	81.790	6.775	81.460	0.000
28	81.130	0.000	82.530	50.65	82.330	36.34 *	82.530	50.50	81.760	6.487	81.450	0.000
29	81.140	0.000	82.520	49.70	82.350	41.50	82.490	49.16	81.730	6.066	81.450	0.000
30	81.140	0.000	82.660	59.52	82.330	42.66	82.470	48.56	81.700	5.840 *	81.450	0.000
31			83.300	134.1 *	82.310	40.49			81.670	5.644		
Ten-Daily Mean												
I Ten-Daily	81.207	0.000	82.390	63.49	84.589	406.5	82.349	41.63	82.323	40.32	81.623	4.115
II Ten-Daily	81.177	0.000	83.914	234.4	82.752	64.91	82.283	37.83	82.109	25.53	81.498	0.261
III Ten-Daily	81.144	0.000	82.865	83.04	82.355	41.70	82.586	54.75	81.819	7.733	81.460	0.000
Monthly												
Min.	81.130	0.000	81.140	0.000	82.290	36.34	82.200	34.30	81.670	5.644	81.450	0.000
Max.	81.210	0.000	85.525	496.7	87.775	1440	82.680	61.78	82.430	46.43	81.660	5.444
Mean	81.176	0.000	83.050	125.6	83.204	166.9	82.406	44.74	82.075	23.99	81.527	1.459

Annual Runoff in MCM = 967 **Annual Runoff in mm 1511**

Peak Observed Discharge = 1440 cumecs on 02/08/2016 **Corres. Water Level :87.775 m**

Lowest Observed Discharge = 0.000 cumecs on 01/06/2016 **Corres. Water Level :81.210 m**

Q: Observed/Computed discharge in cumec WL: Corresponding Mean Water Level (m.s.l) in m * : Computed Discharge

#:Discarded Discharge (values changed as per rating curve)

Note: River remained in pooling/ no flow condition w.e.f. 01/06/2016 to 03/07/2016 & 13/11/16 to 31/05/17.

Stage Discharge Data for the period 2016-17

Station Name: Wagh at Ozerkheda (01 02 24 002) Division : Tapi Division, Surat Local River: Wagh Sub -Division : DGSD, CWC, Silvasa

Day	Dec		Jan		Feb		Mar			Apr		May	
	W.L	Q	WL	Q	WL	Q	WL	Q		WL	Q	WL	Q
1	81.440	0.000	81.420	0.000	81.400	0.000	81.380	0.000	*	81.350	0.000	81.321	0.000
2	81.440	0.000	81.420	0.000	81.400	0.000	81.380	0.000	*	81.350	0.000	81.321	0.000
3	81.440	0.000	81.420	0.000	81.400	0.000	81.380	0.000		81.350	0.000	81.321	0.000
4	81.440	0.000	81.420	0.000	81.400	0.000	81.380	0.000		81.350	0.000	81.321	0.000
5	81.440	0.000	81.420	0.000	81.400	0.000	81.380	0.000		81.350	0.000	81.310	0.000
6	81.440	0.000	81.420	0.000	81.400	0.000	81.370	0.000		81.350	0.000	81.310	0.000
7	81.440	0.000	81.420	0.000	81.400	0.000	81.370	0.000		81.350	0.000	81.310	0.000
8	81.440	0.000	81.420	0.000	81.400	0.000	81.370	0.000		81.350	0.000	81.310	0.000
9	81.440	0.000	81.420	0.000	81.400	0.000	81.370	0.000		81.350	0.000	81.310	0.000
10	81.440	0.000	81.410	0.000	81.400	0.000	81.370	0.000		81.340	0.000	81.310	0.000
11	81.440	0.000	81.410	0.000	81.390	0.000	81.370	0.000		81.340	0.000	81.310	0.000
12	81.440	0.000	81.410	0.000	81.390	0.000	81.370	0.000		81.340	0.000	81.310	0.000
13	81.440	0.000	81.410	0.000	81.390	0.000	81.370	0.000		81.340	0.000	81.310	0.000
14	81.430	0.000	81.410	0.000	81.390	0.000	81.370	0.000		81.340	0.000	81.310	0.000
15	81.430	0.000	81.410	0.000	81.390	0.000	81.370	0.000		81.340	0.000	81.310	0.000
16	81.430	0.000	81.410	0.000	81.390	0.000	81.360	0.000		81.340	0.000	81.300	0.000
17	81.430	0.000	81.410	0.000	81.390	0.000	81.360	0.000		81.340	0.000	81.300	0.000
18	81.430	0.000	81.410	0.000	81.390	0.000	81.360	0.000		81.340	0.000	81.300	0.000
19	81.430	0.000	81.410	0.000	81.390	0.000	81.360	0.000		81.340	0.000	81.300	0.000
20	81.430	0.000	81.410	0.000	81.390	0.000	81.360	0.000		81.340	0.000	81.300	0.000

21	81.430	0.000	81.410	0.000	81.390	0.000	81.360	0.000	81.330	0.000	81.300	0.000
22	81.430	0.000	81.410	0.000	81.390	0.000	81.360	0.000	81.330	0.000	81.290	0.000
23	81.430	0.000	81.410	0.000	81.390	0.000	81.360	0.000	81.330	0.000	81.290	0.000
24	81.430	0.000	81.410	0.000	81.390	0.000	81.360	0.000	81.330	0.000	81.290	0.000
25	81.430	0.000	81.410	0.000	81.390	0.000	81.360	0.000	81.330	0.000	81.290	0.000
26	81.420	0.000	81.410	0.000	81.390	0.000	81.360	0.000	81.330	0.000	81.290	0.000
27	81.420	0.000	81.410	0.000	81.390	0.000	81.360	0.000	81.330	0.000	81.290	0.000
28	81.420	0.000	81.410	0.000	81.390	0.000	81.360	0.000	81.330	0.000	81.290	0.000
29	81.420	0.000	81.410	0.000			81.360	0.000	81.320	0.000	81.280	0.000
30	81.420	0.000	81.410	0.000			81.360	0.000	81.320	0.000	81.280	0.000
31	81.420	0.000	81.410	0.000			81.360	0.000			81.280	0.000
Ten-Daily Mean												
I Ten-Daily	81.440	0.000	81.419	0.000	81.400	0.000	81.375	0.000	81.349	0.000	81.314	0.000
II Ten-Daily	81.433	0.000	81.410	0.000	81.390	0.000	81.365	0.000	81.340	0.000	81.305	0.000
III Ten-Daily	81.425	0.000	81.410	0.000	81.390	0.000	81.360	0.000	81.328	0.000	81.288	0.000
Monthly												
Min.	81.420	0.000	81.410	0.000	81.390	0.000	81.360	0.000	81.320	0.000	81.280	0.000
Max.	81.440	0.000	81.420	0.000	81.400	0.000	81.380	0.000	81.350	0.000	81.321	0.000
Mean	81.432	0.000	81.413	0.000	81.394	0.000	81.366	0.000	81.339	0.000	81.302	0.000

Peak Computed Discharge = 339.8 cumecs on 01/08/2016 Corres. Water Level :84.500 m

Lowest Computed Discharge = 0.000 cumecs on 01/03/2017 Corres. Water Level :81.380 m

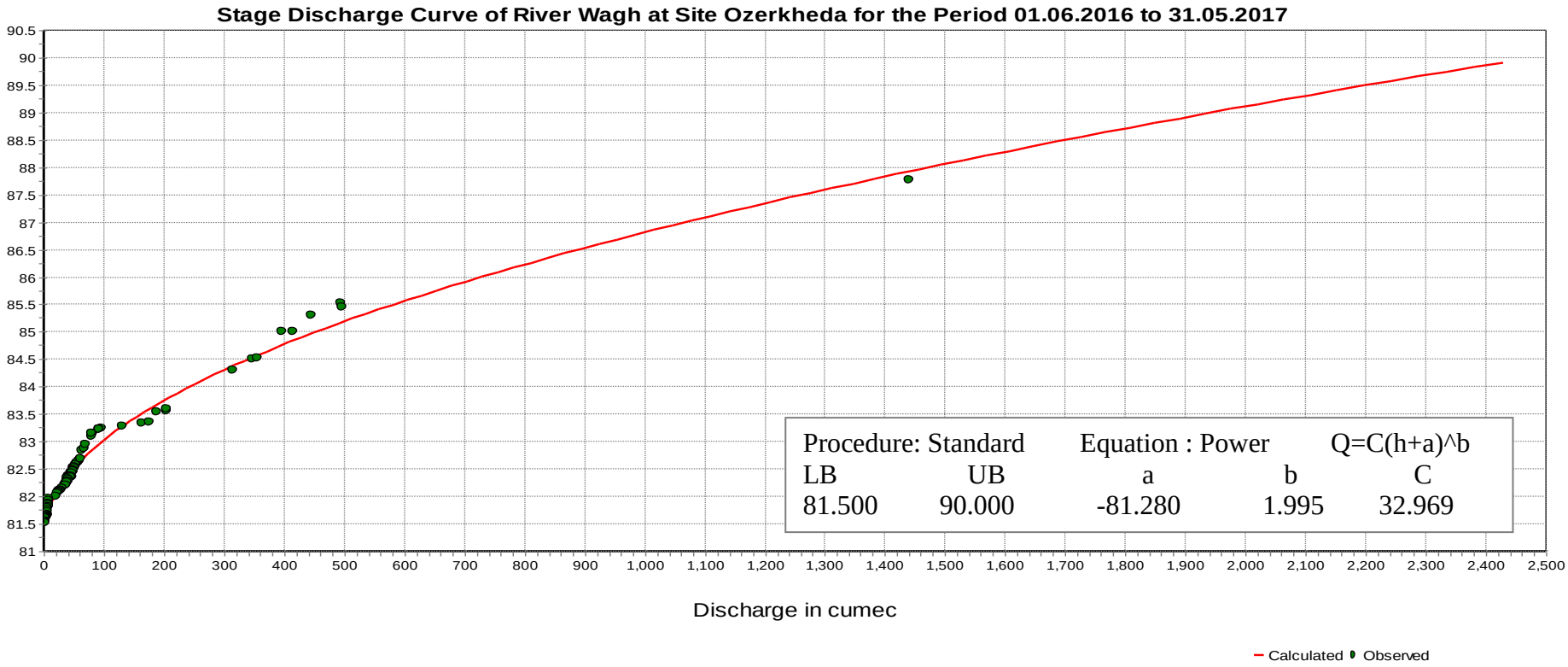
Q: Observed/Computed discharge in cumec WL: Corresponding Mean Water Level (m.s.l) in m * : Computed Discharge

#:Discarded Discharge (values changed as per rating curve)

Note: River remained in pooling/ no flow condition w.e.f. 01/06/2016 to 03/07/2016 & 13/11/16 to 31/05/17.

4.5.1.4 Stage Discharge Curve

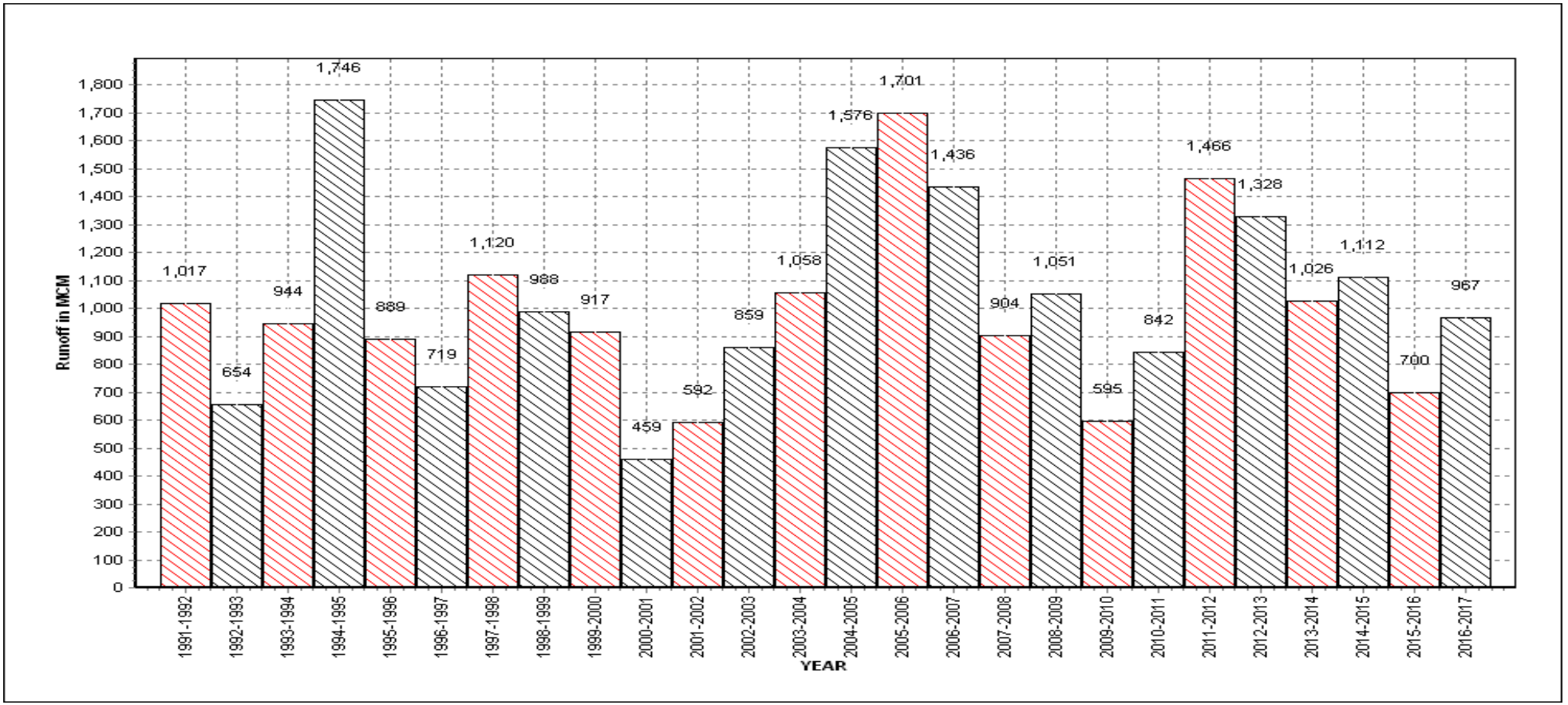
Station Name: Wagh at Ozerkheda (01 02 24 002) Division: Tapi Division, Surat Local River: Wagh Sub -Division: DGSD, CWC, Silvasssa



4.5.1.5 Annual Runoff

Annual Runoff Values Runoff Based on period 1991-2017

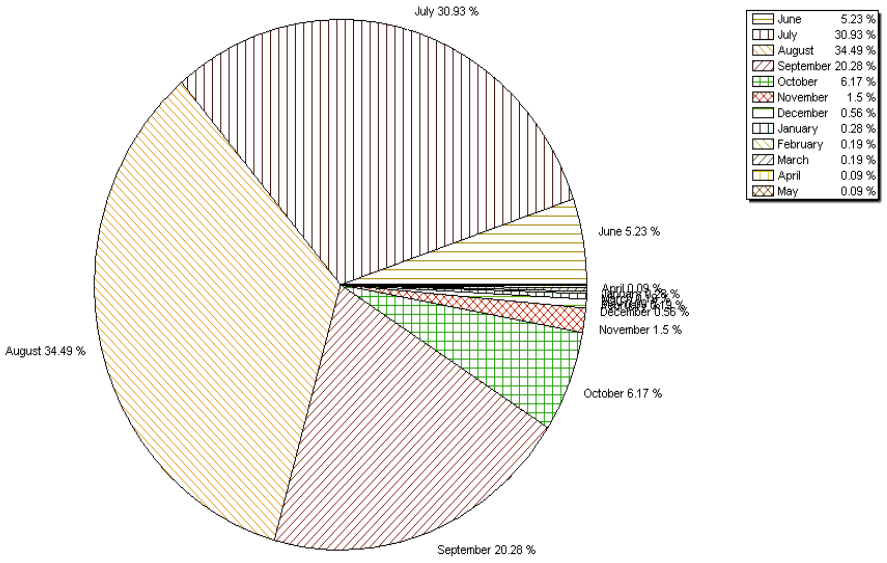
Station Name: Wagh at Ozerkheda (01 02 24 002) Division: Tapi Division, Surat Local River: Wagh Sub -Division: DGSD, CWC, Silvasssa



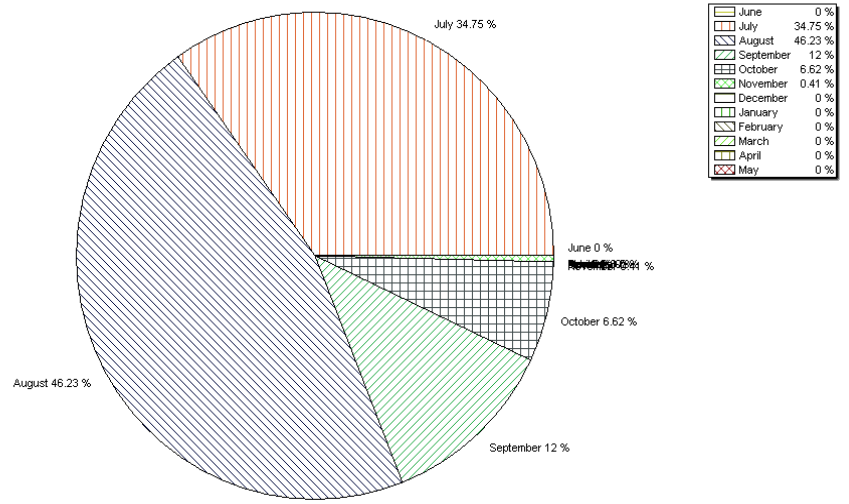
4.5.1.6 Monthly Average Runoff

Station Name: Wagh at Ozerkheda (01 02 24 002) Division: Tapi Division, Surat Local River: Wagh Sub -Division: DGSD, CWC, Silvasa

Monthly Average Runoff Based on period 1991-2016



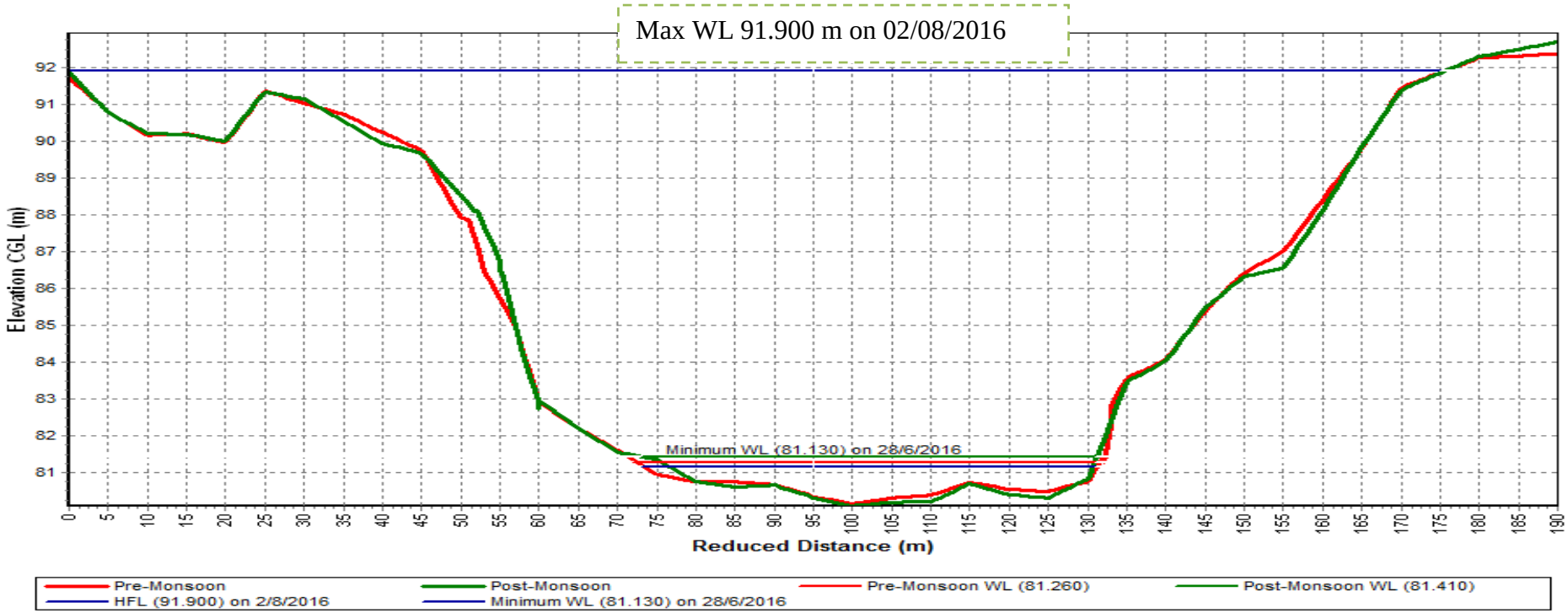
Monthly Average Runoff Based on period 2016-17



4.5.1.7 Superimposed cross section

Station Name: Wagh at Ozerkheda (01 02 24 002) Division: Tapi Division, Surat Local River: Wagh Sub -Division: DGSD, CWC, Silvasa

Highest flood level observed so far 96.100 on dt 04/08/2004 at 0100hrs

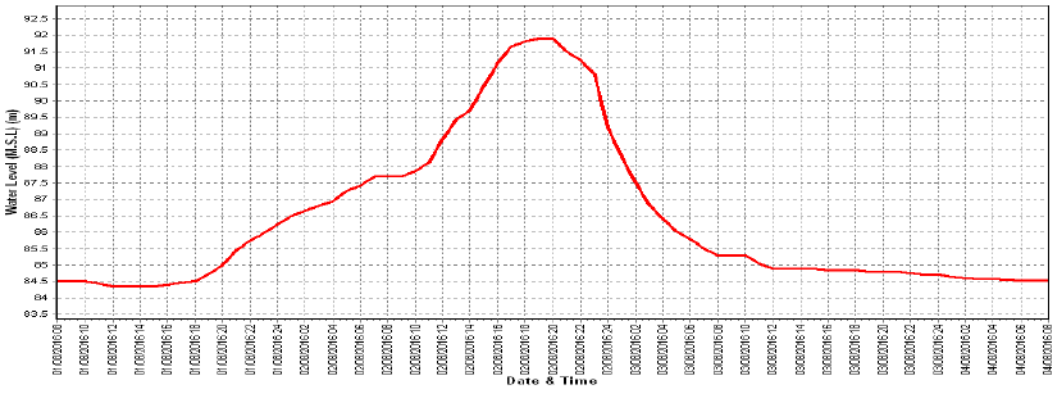


4. .5.1.8 Water Level vs. Time- Graph of Highest Flood Peaks during 2016-17

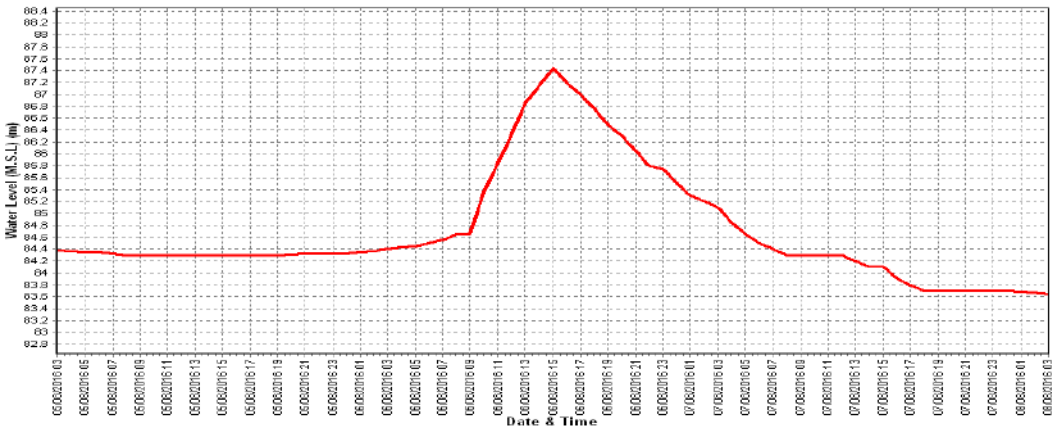
Station Name: Wagh at Ozerkheda
Local River: Wagh

Division : Tapi Division, Surat
Sub -Division : DGSD, CWC, Silvasssa

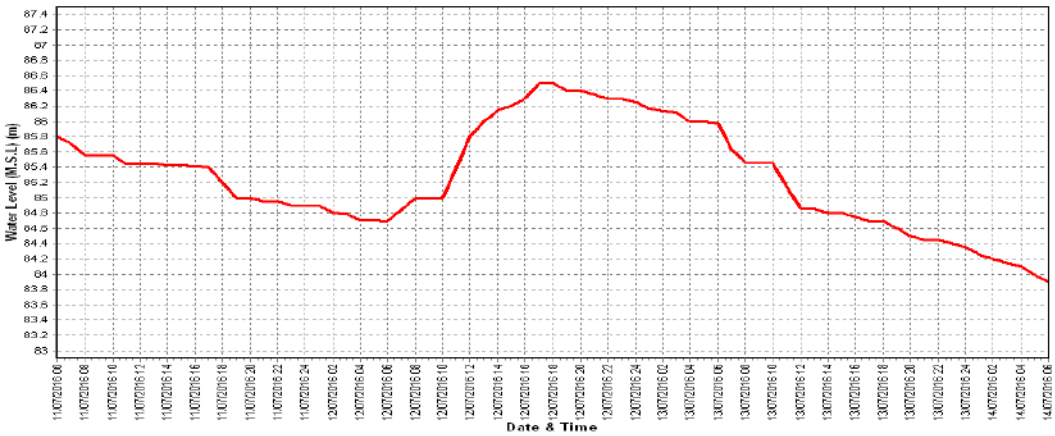
Water level vs. Time graph of I flood peak during the year 2016-17



Water level vs. Time graph of II flood peak during the year 2016-17



Water level vs. Time graph of III flood peak during the year 2016-17



4.5 Damanganga Basin

4.5.2.1 History sheet

History Sheet

			Water Year	**:**	**2016-17**
Site	**:**	**Damanganga at Nanipalsan**	**Code**	**:**	**01 02 24 001**
State	:	Gujarat	District		Valsad
Basin	:	WFR South of Tapi	Independent River	:	Daman Ganga
Tributary	:		Sub Tributary	:	
Sub-Sub Tributary	:		Local River	:	
Division	:	Tapi Division, Surat	Sub-Division	:	DGSD,CWC,Silvasa
Drainage Area	:	764 Sq. Km.	Bank	:	
Latitude	:	20°12'00" N	Longitude	:	73°17'00" E
Zero of Gauge (m)	:	95 (m.s.l)	6/15/1982		
		Opening Date	Closing Date		
Gauge	**:**	**15/06/1982**			
Discharge	**:**	**13/10/1983** **Seasonal**			
		01/06/1991 **regular**			

Annual Maximum / Minimum discharge with corresponding Water Level (m.s.l)

Year	Maximum			Minimum		
	Q (cumecs)	**WL (m)**	**Date**	**Q (cumecs)**	**WL (m)**	**Date**
1991-1992	1018	101.200	28/07/1991	0.000	96.120	26/01/1992
1992-1993	703.1	99.875	12/08/1992	0.000	96.340	22/02/1993
1993-1994	1393	101.485	13/07/1993	0.000	96.100	18/04/1994
1994-1995	1184	102.040	13/07/1994	0.000	96.020	27/04/1995
1995-1996	440.1	99.700	03/09/1995	0.000	96.070	09/03/1996
1996-1997	219.6	99.650	09/08/1996	0.000	96.320	13/03/1997
1997-1998	340.0	100.480	25/08/1997	0.000	96.260	12/03/1998
1998-1999	902.5	102.490	17/09/1998	0.000	96.230	27/06/1998
1999-2000	360.0	100.600	15/07/1999	0.000	96.250	13/06/1999
2000-2001	997.5	102.375	14/07/2000	0.000	96.250	03/03/2001
2001-2002	252.5	99.250	18/06/2001	0.000	96.580	19/02/2002
2002-2003	300.8	99.850	25/08/2002	0.521	96.670	30/11/2002
2003-2004	362.0	100.110	28/07/2003	0.716	96.710	10/12/2003
2004-2005	3173	103.925	03/08/2004	0.290	96.540	31/12/2004
2005-2006	1439	102.050	29/06/2005	0.000	96.420	28/02/2006
2006-2007	2728	103.590	09/08/2006	0.000	96.370	19/02/2007
2007-2008	895.1	100.900	09/08/2007	0.393	96.600	06/01/2008
2008-2009	1304	102.100	11/08/2008	0.000	96.400	25/04/2009
2009-2010	972.5	101.380	05/09/2009	0.000	96.460	19/02/2010
2010-2011	309.9	99.300	02/08/2010	0.000	96.320	01/06/2010
2011-2012	692.8	100.4	29/08/2011	0.000	96.580	24/12/2011
2012-2013	617.7	99.800	11/09/2012	0.000	96.300	01/06/2012
2013-2014	416.8	99.750	24/09/2013	0.000	96.400	01/06/2013
2014-2015	450.3	99.850	30/07/2014	0.000	96.460	01/06/2014
2015-2016	269.1	99.000	29/07/2015	0.000	96.400	01/06/2015
2016-2017	558.8	100.300	02/08/2016	0.000	96.370	01/06/2016

4.5.2.2 Annual Maximum Flood Peak

Year	Annual Maximum flood Peaks (m)	**Date**	**Hour**
1982	100.000	16/08/1982	07:00:00
1983	102.300	15/08/1983	10:00:00
1984	99.700	18/07/1984	13:00:00
1985	99.900	31/07/1985	15:00:00
1986	99.500	19/07/1986	06:00:00
1987	104.000	07/07/1987	13:00:00
1988	100.170	26/07/1988	14:00:00
1989	100.250	24/07/1989	06:00:00
1990	101.000	20/08/1990	03:00:00
1991	101.660	28/07/1991	00:00:00
1992	101.670	12/08/1992	16:00:00
1993	107.890	13/07/1993	13:00:00
1994	103.700	13/07/1994	06:00:00
1995	99.840	21/07/1995	21:00:00
1996	99.980	08/08/1996	19:00:00
1997	104.000	31/07/1997	14:00:00
1998	103.020	17/09/1998	13:00:00
1999	103.200	15/07/1999	13:00:00
2000	103.010	14/07/2000	01:00:00
2001	99.280	18/06/2001	03:00:00
2002	101.850	02/09/2002	18:00:00
2003	100.990	27/07/2003	17:00:00
2004	110.030	03/08/2004	18:00:00
2005	102.200	03/07/2005	15:00:00
2006	104.580	09/08/2006	12:00:00
2007	102.860	08/08/2007	23:00:00
2008	102.100	11/08/2008	08:00:00
2009	101.600	22/07/2009	18:00:00
2010	100.550	24/07/2010	23:00:00
2011	100.580	28/08/2011	01:00:00
2012	101.650	31/07/2012	13:00:00
2013	100.740	23/07/2013	24:00:00
2014	102.800	30/07/2014	17:00:00
2015	99.300	28/07/2015	16:00:00
2016	103.740	10/07/2016	20:00:00

4.5.2.3 Summary of Data

Stage Discharge Data for the period 2016-17

Station Name: Damanganga at Nanipalsan (01 02 24 001) Division : Tapi Division, Surat Local River: Damanganga Sub-Division:DGSD,CWC, Silvasssa

Day	Jun		Jul		Aug		Sep		Oct		Nov	
	W.L	Q	W.L	Q	W.L	Q	W.L	Q	W.L	Q	W.L	Q
1	96.370	0.000	96.250	0.000	99.950	455.9	97.600	63.58	97.620	67.74	96.990	6.251
2	96.370	0.000	96.250	0.000	100.300	558.8	97.480	35.68	97.590	53.81 *	96.980	5.755
3	96.370	0.000	96.260	0.000	98.780	210.7	97.460	35.18	97.600	70.56	96.980	5.577
4	96.370	0.000	97.150	22.06	99.270	313.6	97.540	48.82 *	97.720	74.88	96.970	4.860
5	96.370	0.000	97.400	31.16	98.760	203.9	97.510	35.82	98.060	112.8	96.970	4.637
6	96.370	0.000	97.350	31.56 *	100.120	486.4	97.490	35.72	98.060	112.7	96.960	5.970 *
7	96.360	0.000	97.320	24.99	100.540	587.0 *	97.470	35.55	97.940	106.5	96.960	4.454
8	96.350	0.000	97.300	24.92	99.480	312.9	97.550	58.28	97.900	100.6	96.950	3.911
9	96.320	0.000	97.290	24.55	99.020	264.3	97.610	66.01	97.870	84.92 *	96.950	4.199
10	96.310	0.000	98.500	172.3 *	98.850	195.5	97.580	64.87	97.850	92.14	96.940	3.581
11	96.310	0.000	99.000	264.0	99.480	313.5	97.570	51.79 *	97.840	81.34 *	96.940	3.498
12	96.310	0.000	98.560	181.8 #	99.000	263.4	97.550	49.80 *	97.840	81.34 *	96.930	3.486
13	96.310	0.000	99.370	329.6	98.400	162.3	97.540	57.82	97.820	90.19	96.930	4.680 *
14	96.310	0.000	98.850	223.1	98.300	142.2 *	97.510	35.89	97.810	89.72	96.920	4.270 *
15	96.300	0.000	98.160	127.2	97.850	82.52 *	97.490	35.80	97.810	89.19	96.920	3.168
16	96.300	0.000	98.080	115.1	97.780	86.13	97.480	35.49	97.800	76.65 *	96.920	3.437
17	96.290	0.000	98.050	107.6 *	97.700	74.84	97.610	63.46	97.790	87.73	96.900	2.970
18	96.290	0.000	98.222	133.4	97.630	65.42	97.580	52.79 *	97.750	78.24	96.900	2.897
19	96.280	0.000	98.240	133.6	97.600	65.36	97.570	64.45	97.670	76.52	96.890	2.585
20	96.280	0.000	98.560	181.8 #	97.580	64.91	98.760	203.9	97.560	64.33	96.890	3.140 *

21	96.270	0.000	98.450	168.9	97.570	51.79 *	98.060	113.5	97.200	10.49	96.890	2.749
22	96.270	0.000	98.350	151.1	97.560	64.38	97.750	77.42	97.160	8.278	96.880	2.607
23	96.270	0.000	98.300	145.0	97.550	58.23	97.720	76.24	97.140	15.94 *	96.880	2.731
24	96.270	0.000	98.250	135.0 *	97.540	57.76	98.290	142.8	97.120	7.581	96.870	2.596
25	96.260	0.000	98.200	130.8	97.720	67.60 *	97.980	98.52 *	97.110	7.297	96.870	2.550
26	96.260	0.000	97.860	100.2	97.680	73.93	98.430	164.3	97.080	7.081	96.870	2.472
27	96.260	0.000	97.740	75.54	97.670	73.36	98.200	131.5	97.060	6.390	96.850	1.840 *
28	96.250	0.000	97.670	73.74	97.660	61.09 *	97.740	77.33	97.040	6.198	96.850	2.180
29	96.250	0.000	97.600	65.07	97.650	65.56	97.680	74.00	97.020	6.721	96.850	2.129
30	96.250	0.000	97.650	65.69	97.630	64.24	97.650	65.81	97.010	8.380 *	96.850	2.087
31			98.050	107.6 *	97.620	63.84			97.000	6.493		
Ten-Daily Mean												
I Ten-Daily	96.356	0.000	97.107	33.16	99.507	358.9	97.529	47.95	97.821	87.65	96.965	4.919
II Ten-Daily	96.298	0.000	98.509	179.7	98.132	132.1	97.666	65.11	97.769	81.53	96.914	3.413
III Ten-Daily	96.261	0.000	98.011	110.8	97.623	63.80	97.950	102.1	97.085	8.259	96.866	2.394
Monthly												
Min.	96.250	0.000	96.250	0.000	97.540	51.79	97.460	35.18	97.000	6.198	96.850	1.840
Max.	96.370	0.000	99.370	329.6	100.540	587.0	98.760	203.9	98.060	112.8	96.990	6.251
Mean	96.305	0.000	97.880	108.0	98.395	181.0	97.715	71.74	97.543	57.51	96.915	3.575

Annual Runoff in MCM = 1125 **Annual Runoff in mm = 1472**

Peak Observed Discharge = 558.8 cumecs on 02-08-2016 Corres. Water Level :100.300 m

Lowest Observed Discharge = 0.000 cumecs on 01-06-2016 Corres. Water Level : 96.370 m

Q: Observed/Computed discharge in cumec WL: Corresponding Mean Water Level (m.s.l) in m * : Computed Discharge

#:Discarded Discharge (values changed as per rating curve)

Note: River remained in pooling/ no flow condition w.e.f. 01/06/16 to 03/07/16 & 06/01/2017 to 31/05/2017.

Stage Discharge Data for The period 2016-17

Station Name: Damanganga at Nanipalsan (01 02 24 001) Division : Tapi Division, Surat Local River: Damanganga Sub -Division: DGSD, CWC, Silvasssa

Day	Dec			Jan		Feb		Mar		Apr		May	
	W.L	Q		WL	Q	WL	Q	WL	Q	WL	Q	WL	Q
1	96.840	2.039		96.610		96.510	0.000	96.480	0.000	96.450	0.000	96.440	0.000
2	96.840	2.097		96.600	0.600	96.510	0.000	96.480	0.000	96.450	0.000	96.440	0.000
3	96.840	1.957		96.600	0.589	96.510	0.000	96.480	0.000	96.450	0.000	96.440	0.000
4	96.830	1.290	*	96.590	0.547	96.510	0.000	96.480	0.000	96.450	0.000	96.440	0.000
5	96.830	1.882		96.570	0.000	96.510	0.000	96.480	0.000	96.450	0.000	96.440	0.000
6	96.830	1.845		96.560	0.000	96.510	0.000	96.480	0.000	96.450	0.000	96.440	0.000
7	96.820	1.298		96.560	0.000	96.510	0.000	96.470	0.000	96.450	0.000	96.430	0.000
8	96.810	1.217		96.550	0.000	96.500	0.000	96.470	0.000	96.450	0.000	96.430	0.000
9	96.800	1.163		96.550	0.000	96.500	0.000	96.470	0.000	96.450	0.000	96.430	0.000
10	96.790	1.087		96.540	0.000	96.500	0.000	96.470	0.000	96.440	0.000	96.430	0.000
11	96.770	0.140	*	96.540	0.000	96.500	0.000	96.470	0.000	96.440	0.000	96.430	0.000
12	96.770	0.140	*	96.540	0.000	96.500	0.000	96.470	0.000	96.440	0.000	96.430	0.000
13	96.760	0.050	#	96.540	0.000	96.500	0.000	96.470	0.000	96.440	0.000	96.430	0.000
14	96.750	0.000	#	96.540	0.000	96.500	0.000	96.470	0.000	96.440	0.000	96.430	0.000
15	96.750	0.000	#	96.540	0.000	96.490	0.000	96.470	0.000	96.440	0.000	96.430	0.000
16	96.740	0.000	#	96.540	0.000	96.490	0.000	96.470	0.000	96.440	0.000	96.420	0.000
17	96.730	0.000	#	96.530	0.000	96.490	0.000	96.470	0.000	96.440	0.000	96.420	0.000
18	96.720	0.000	*	96.530	0.000	96.490	0.000	96.460	0.000	96.440	0.000	96.420	0.000
19	96.720	0.000	#	96.530	0.000	96.490	0.000	96.460	0.000	96.440	0.000	96.420	0.000
20	96.710	0.000	#	96.530	0.000	96.490	0.000	96.460	0.000	96.440	0.000	96.420	0.000

21	96.700	0.000	#	96.530	0.000	96.490	0.000	96.460	0.000	96.440	0.000	96.420	0.000
22	96.700	0.000	#	96.530	0.000	96.490	0.000	96.460	0.000	96.450	0.000	96.420	0.000
23	96.690	0.000	#	96.530	0.000	96.480	0.000	96.460	0.000	96.450	0.000	96.420	0.000
24	96.680	0.000	#	96.520	0.000	96.480	0.000	96.460	0.000	96.450	0.000	96.420	0.000
25	96.670	0.000	*	96.520	0.000	96.480	0.000	96.460	0.000	96.450	0.000	96.420	0.000
26	96.670	0.000	#	96.520	0.000	96.480	0.000	96.460	0.000	96.450	0.000	96.420	0.000
27	96.660	0.000	#	96.520	0.000	96.480	0.000	96.460	0.000	96.450	0.000	96.410	0.000
28	96.650	0.000	#	96.520	0.000	96.480	0.000	96.450	0.000	96.450	0.000	96.410	0.000
29	96.640	0.000	#	96.520	0.000			96.450	0.000	96.440	0.000	96.410	0.000
30	96.630	0.000	#	96.520	0.000			96.450	0.000	96.440	0.000	96.410	0.000
31	96.620	0.000	#	96.520	0.000			96.450	0.000			96.410	0.000
Ten-Daily Mean													
I Ten-Daily	96.823	1.588		96.573	0.193	96.507	0.000	96.476	0.000	96.449	0.000	96.436	0.000
II Ten-Daily	96.742	0.033		96.536	0.000	96.494	0.000	96.467	0.000	96.440	0.000	96.425	0.000
III Ten-Daily	96.665	0.000		96.523	0.000	96.482	0.000	96.456	0.000	96.447	0.000	96.415	0.000
Monthly													
Min.	96.620	0.000		96.520	0.000	96.480	0.000	96.450	0.000	96.440	0.000	96.410	0.000
Max.	96.840	2.097		96.610	0.600	96.510	0.000	96.480	0.000	96.450	0.000	96.440	0.000
Mean	96.741	0.523		96.543	0.058	96.495	0.000	96.466	0.000	96.445	0.000	96.425	0.000

Peak Computed Discharge = 587.0 cumecs on 07/08/2016 Corres. Water Level :100.540 m

Lowest Computed Discharge = 0.000 cumecs on 18/12/2016 Corres. Water Level :96.720 m

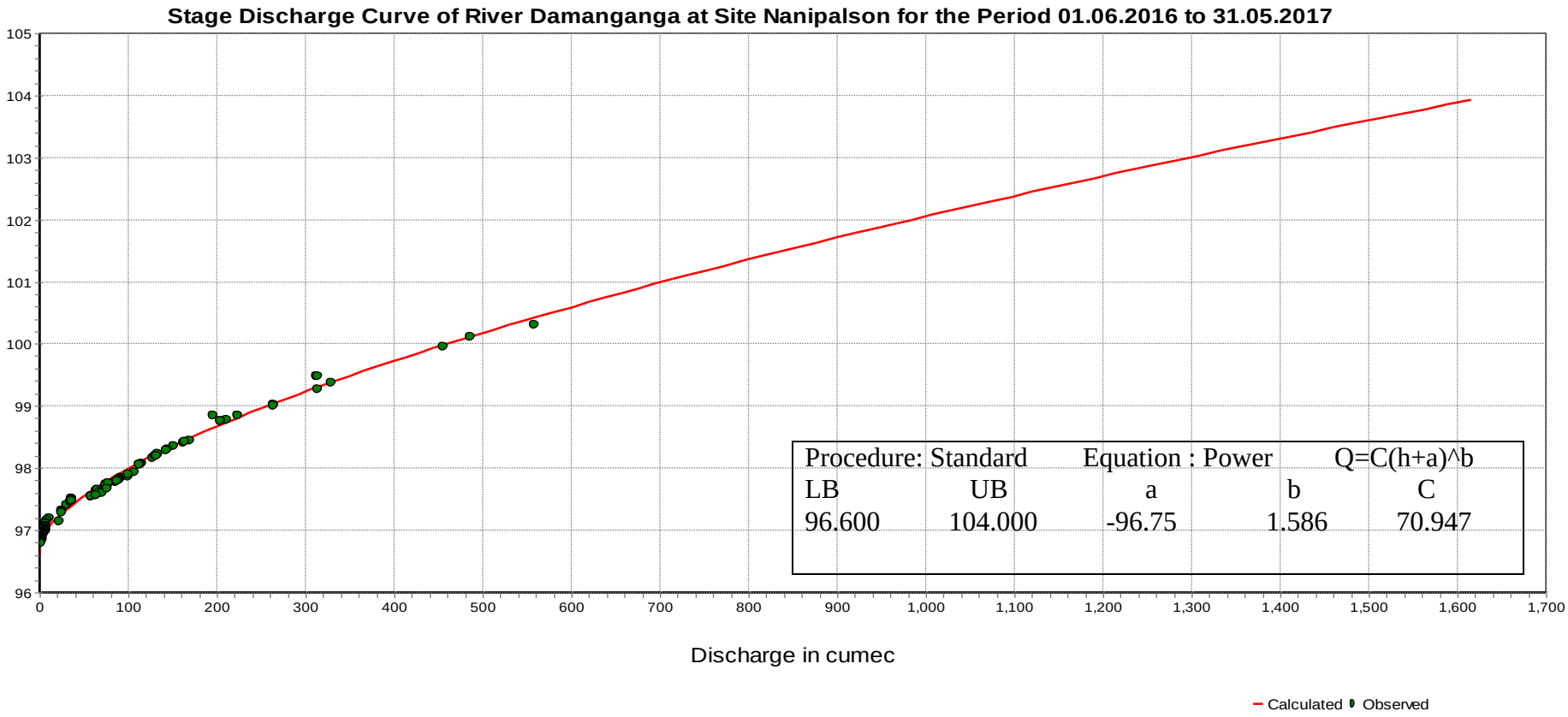
Q: Observed/Computed discharge in cumec WL: Corresponding Mean Water Level (m.s.l) in m * : Computed Discharge

#:Discarded Discharge (values changed as per rating curve)

Note: River remained in pooling/ no flow condition w.e.f. 01/06/16 to 03/07/16 & 06/01/2017 to 31/05/2017.

4.5.2.4 Stage Discharge Curve

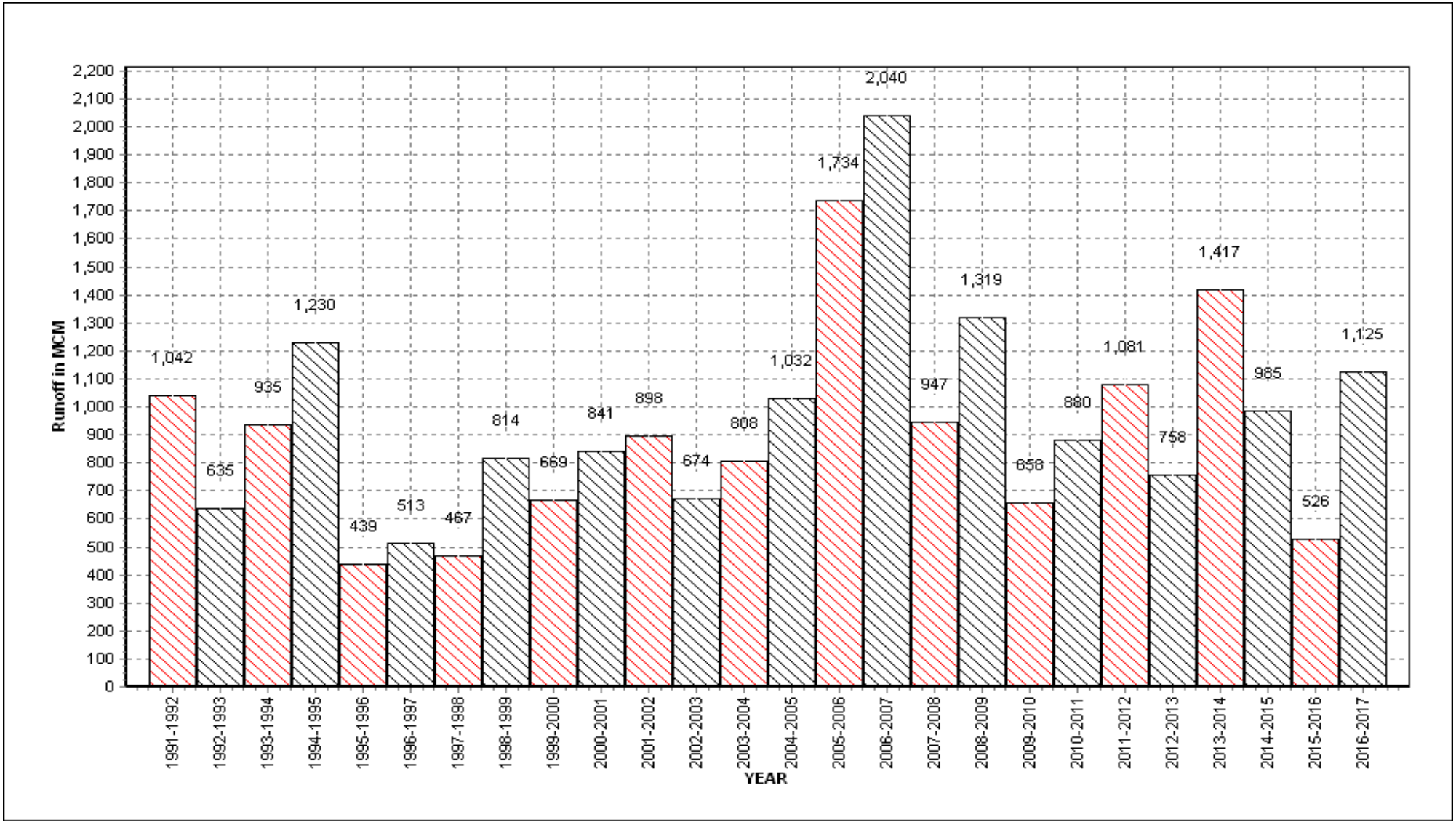
Station Name: Damanganga at Nanipalsan (01 02 24 001) Division : Tapi Division, Surat Local River: Damanganga Sub -Division: DGSD, CWC, Silvassa



4.5.2.5 Annual runoff

Annual Runoff values for the year 1991-2017

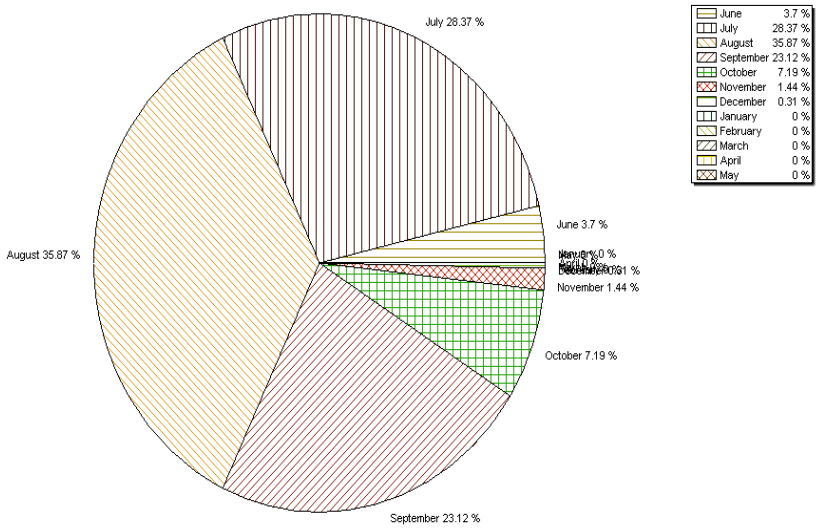
Station Name: Damanganga at Nanipalsan (01 02 24 001) Division : Tapi Division, Surat Local River: Damanganaga Sub -Division : DGSD, CWC, Silvassa



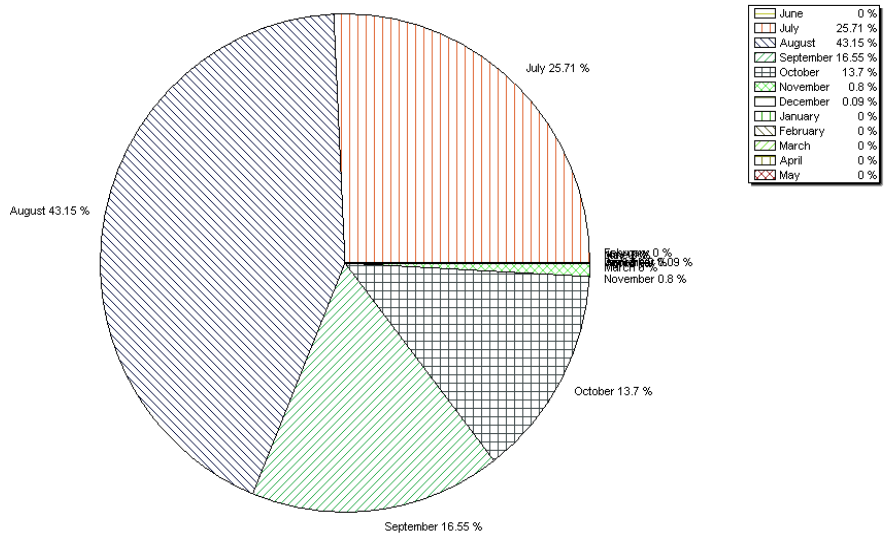
5.2.6 Monthly Average Runoff

Station Name: Damanganga at Nanipalsan (01 02 24 001) Division : Tapi Division, Surat Local River: Damanganga Sub -Division : DGSD, CWC, Silvasa

Monthly Average Runoff Based on period 1991-2016

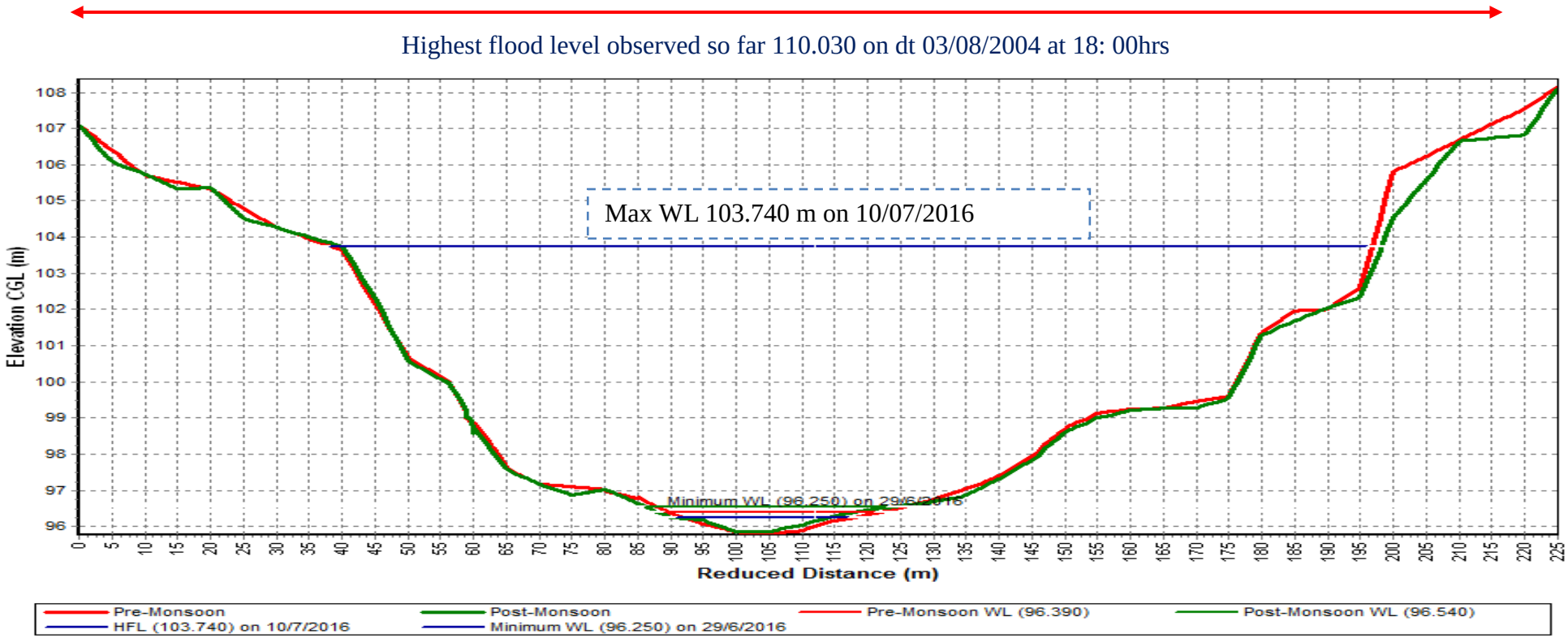


Monthly Average Runoff Based on period 2016-17



4.5.2.7 Superimposed cross section

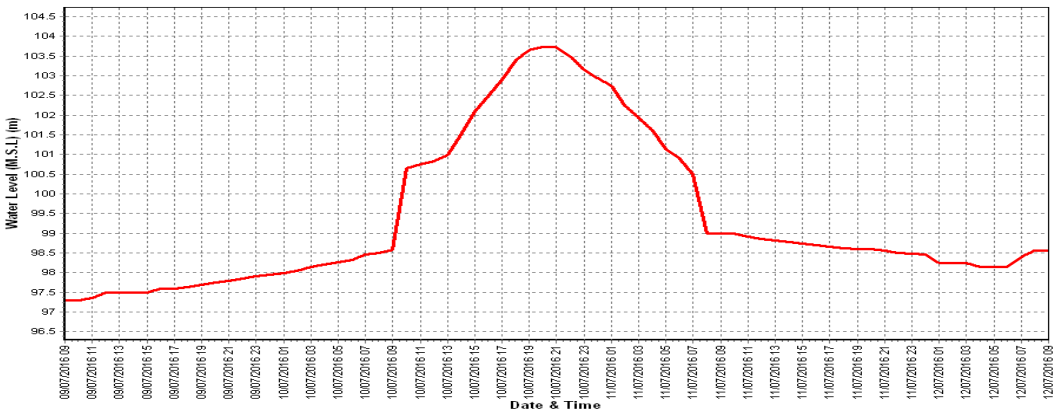
Station Name: Damanganga at Nanipalsan (01 02 24 001) Division : Tapi Division, Surat Local River: Damanganga Sub-Division:DGSD, CWC, Silvasa



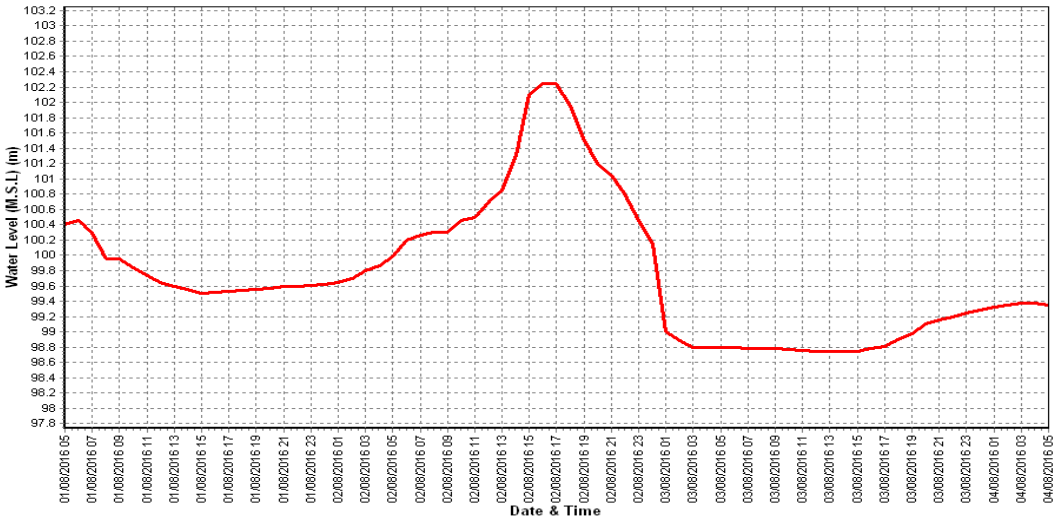
4.5.2.8 Water Level vs. Time- Graph of Highest Flood Peaks during 2016-17

Station Name: Damanganga at Nanipalsan (01 02 24 001) Division: Tapi Division, Surat
Local River: Damanganga Sub -Division: DGSD, CWC, Silvasa

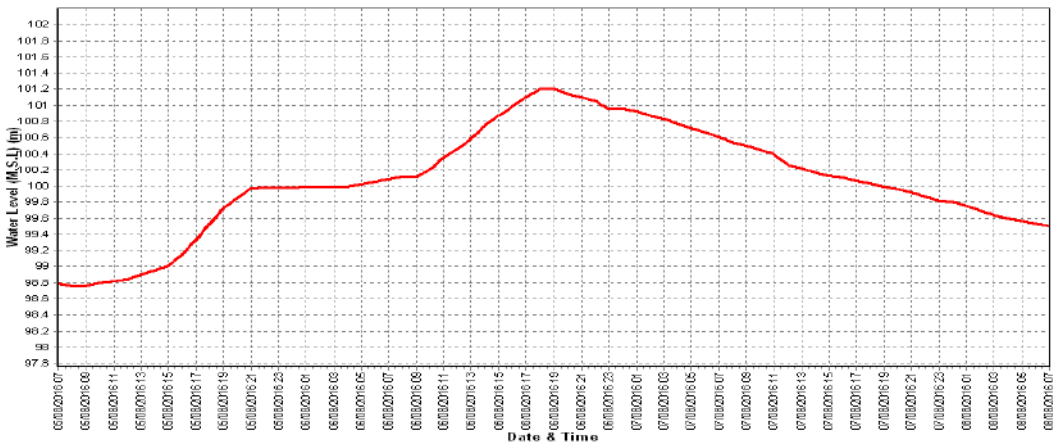
Water level vs. Time graph of I flood peak during the year 2016-17



Water level vs. Time graph of II flood peak during the year 2016-17



Water level vs. Time graph of III flood peak during the year 2016-17



4.6 Kim basin

4.6.1 History sheet

HISTORY SHEET

			Water Year	**:**	**2016-17**
Site	**:**	**Motinaroli**	**Code**	**:**	**01 02 16 001**
State	:	Gujarat	District		Surat
Basin	:	Narmada	Independent River	:	Kim
Tributary	:	-	Sub Tributary	:	-
Sub-Sub Tributary	:	-	Local River	:	Kim
Division	:	Tapi Dvision, Surat	Sub-Division	:	LNSD Bharuch
Drainage Area	:	804 Sq. Km.	Bank	:	Right
Latitude	:	21°24’16”	Longitude	:	72°57’48”
Zero of Gauge **m**	:	5 (m.s.l)	17/10/1990		

		Opening Date	Closing Date
Gauge	:	17/10/1990	
Discharge	:	17/10/1990	
Sediment	:		
Water Quality	:	1/7/1991	

Annual maximum/minimum discharge with corresponding Water level (above m.s.l)

Year	Maximum			Minimum		
	Q (cumecs)	**WL (m)**	**Date**	**Q (cumecs)**	**WL (m)**	**Date**
1991-1992	58.73	10.140	01/08/1991	0.000	6.245	06/05/1992
1992-1993	736.4	17.510	22/06/1992	0.191	7.515	30/03/1993
1993-1994	426.3	13.890	16/07/1993	0.170	7.520	17/05/1994
1994-1995	700.5	13.750	22/07/1994	0.000	7.350	04/04/1995
1995-1996	668.6	15.700	21/07/1995	0.240	7.280	05/04/1996
1996-1997	676.0	16.800	24/07/1996	0.112	7.470	23/04/1997
1997-1998	372.0	16.355	24/08/1997	0.080	7.300	10/03/1998
1998-1999	404.0	15.900	16/09/1998	0.099	7.230	26/03/1999
1999-2000	282.5	13.500	20/07/1999	0.170	7.360	26/03/2000
2000-2001	296.2	13.625	14/07/2000	0.041	7.200	28/05/2001
2001-2002	377.1	14.650	16/08/2001	0.000	7.220	07/05/2002
2002-2003	526.8	14.930	04/09/2002	0.000	7.100	13/04/2003
2003-2004	649.0	14.640	25/07/2003	0.000	7.190	29/05/2004
2004-2005	1288	17.200	04/08/2004	0.000	7.340	14/02/2005
2005-2006	720.2	16.380	30/06/2005	0.000	7.310	22/06/2005
2006-2007	923.2	17.650	29/07/2006	0.956	7.710	27/02/2007
2007-2008	851.7	16.815	02/07/2007	0.280	7.530	08/03/2008
2008-2009	735.6	15.985	12/08/2008	0.500	7.440	25/03/2009
2009-2010	206.8	13.660	07/09/2009	0.000	7.550	25/01/2010
2010-2011	384.2	14.625	10/09/2010	0.770	7.620	04/01/2011
2011-2012	497.8	14.425	26/08/2011	0.000	7.630	19/12/2012
2012-2013	47.64	13.480	04/09/2012	0.000	7.720	07/01/2013
2013-2014	399.3	15.150	23/09/2013	0.000	7.790	09/10/2014
2014-2015	498.0	13.740	01/08/2014	0.000	7.660	02/06/2014
2015-2016	538.4	15.000	28/07/2015	0.000	7.840	21/12/2015
2016-2017	33.46	10.480	19/09/2016	0.000	7.720	07/06/2016

4.6.2 Annual Maximum Flood peak

Year	Annual Maximum Flood peak (m)	Date	Hour
1990	7.320	20/11/1990	08:00:00
1991	10.160	01/08/1991	08:00:00
1992	17.660	22/06/1992	11:00:00
1993	15.480	18/07/1993	22:00:00
1994	18.150	16/06/1994	23:00:00
1995	15.850	21/07/1995	15:00:00
1996	16.800	24/07/1996	03:00:00
1997	16.550	24/08/1997	11:00:00
1998	16.600	16/09/1998	13:00:00
1999	16.480	20/07/1999	19:00:00
2000	14.000	14/07/2000	06:00:00
2001	14.800	16/08/2001	08:00:00
2002	15.080	04/09/2002	13:00:00
2003	16.630	25/07/2003	20:00:00
2004	17.400	04/08/2004	12:00:00
2005	17.500	29/06/2005	18:00:00
2006	18.225	29/07/2006	21:00:00
2007	18.090	02/07/2007	20:00:00
2008	16.400	12/08/2008	15:00:00
2009	18.000	19/02/2009	08:00:00
2010	16.130	10/09/2010	05:00:00
2011	14.630	26/08/2011	11:00:00
2012	13.500	04/09/2012	10:00:00
2013	18.710	25/09/2013	22:00:00
2014	14.780	01/08/2014	02:00:00
2015	17.240	21/07/2015	23:00:00
2016	11.700	19/09/2016	16:00:00

4.6.3 Summary of data

Stage Discharge Data for the period 2016-17

Station Name: Kim at Motinaroli (01 02 16 001) Division : Tapi Division, Surat Local River:Kim Sub -Division : LNSD, CWC, Bharuch

Day	Jun		Jul		Aug		Sep		Oct		Nov	
	W.L	Q	W.L	Q	W.L	Q	W.L	Q	W.L	Q	W.L	Q
1	8.400	7.300 #	7.480	0.000	8.360	6.685	8.500	7.748	8.620	9.841	8.225	8.355
2	8.320	6.560 #	7.590	0.000	8.560	7.956	8.380	6.775	8.560	8.850 *	8.190	7.864
3	8.100	4.372	7.610	0.000	8.530	8.095	8.320	5.552	9.050	18.29	8.190	7.333
4	8.050	4.308	7.680	0.000	8.495	7.836	8.280	6.210 *	9.225	19.31	8.200	8.404
5	8.300	6.390 *	8.175	5.320 #	8.420	6.933	8.285	4.832	9.755	27.92	8.180	7.103
6	7.860	2.970 #	8.190	5.440 *	8.450	7.122	8.300	4.687	9.125	18.89	8.130	6.170 *
7	7.720	0.000	8.040	5.077	8.590	9.160 *	8.330	5.193	9.450	19.88	8.180	7.074
8	7.700	0.000	7.950	4.580	8.570	8.255	8.500	7.736	9.390	18.69	8.190	7.143
9	7.620	0.000	7.910	4.470	9.145	14.44	8.660	8.365	9.200	16.17 *	8.170	6.935
10	7.510	0.000	8.030	4.170 *	9.035	14.58	8.610	8.102	8.445	9.241	8.230	7.905
11	7.450	0.000	8.220	5.690 #	9.875	28.24	8.650	9.780 *	8.610	9.360 *	8.240	8.030
12	7.430	0.000	8.230	5.780 #	8.890	10.62	8.690	8.693	8.500	8.250 *	8.240	8.036
13	7.420	0.000	8.350	7.550	8.750	9.736	8.670	9.990 *	8.355	8.579	8.240	8.010 *
14	7.400	0.000	8.470	10.17	8.620	9.460 *	8.650	8.534	8.270	6.737	8.270	8.500 *
15	7.390	0.000	8.500	10.30	8.470	7.960 *	8.630	8.256	8.270	6.621	8.350	10.21
16	7.380	0.000	8.480	10.25	8.365	6.777	8.650	8.489	8.270	8.500 *	8.300	9.807
17	7.360	0.000	8.460	7.870 *	8.295	6.644	9.680	22.87	8.230	8.740	8.250	9.452
18	7.340	0.000	8.430	9.996	8.330	6.763	10.050	28.36 *	8.240	8.107	8.290	8.764
19	7.340	0.000	8.550	8.750 #	8.450	7.107	10.480	33.46	8.190	7.536	8.270	8.449
20	7.330	0.000	8.490	10.20	8.445	7.022	9.850	23.32	8.160	7.586	8.300	8.980 *

21	7.320	0.000	8.500	10.23	8.390	7.200 *	9.440	18.66	8.220	8.097	8.280	8.535
22	7.320	0.000	8.500	7.361	8.480	7.445	9.300	18.66	8.200	7.701	8.290	8.752
23	7.310	0.000	8.410	7.380	8.430	7.059	9.200	18.86	8.200	7.350 *	8.280	8.587
24	7.310	0.000	8.380	7.110 *	8.410	6.692	8.730	10.63 #	8.170	6.768	8.320	9.091
25	7.300	0.000	8.370	6.618	8.550	8.750 *	8.950	13.11 *	8.200	7.197	8.300	8.192
26	7.320	0.000	8.520	8.298	8.500	7.647	9.695	23.46	8.190	7.544	8.280	8.364
27	7.330	0.000	8.540	8.377	8.565	8.226	9.605	20.96	8.180	7.608	8.310	9.140 *
28	7.340	0.000	8.570	9.169	8.650	9.780 *	9.175	18.12	8.220	8.314	8.320	9.190
29	7.340	0.000 *	8.500	7.804	8.750	10.17	8.845	11.32	8.180	7.784	8.290	8.360
30	7.340	0.000	8.540	8.440	8.715	9.581	8.735	12.45	8.170	6.850 *	8.270	8.209
31			8.430	7.580 *	8.570	8.557			8.180	7.601		
Ten-Daily Mean												
I Ten-Daily	7.958	3.190	7.865	2.906	8.615	9.106	8.416	6.520	9.082	16.71	8.188	7.428
II Ten-Daily	7.384	0.000	8.418	8.657	8.649	10.03	9.200	16.18	8.309	8.002	8.275	8.824
III Ten-Daily	7.323	0.000	8.478	8.033	8.546	8.283	9.168	16.62	8.192	7.529	8.294	8.642
Monthly												
Min.	7.300	0.000	7.480	0.000	8.295	6.644	8.280	4.687	8.160	6.621	8.130	6.170
Max.	8.400	7.300	8.570	10.30	9.875	28.24	10.480	33.46	9.755	27.92	8.350	10.21
Mean	7.555	1.063	8.261	6.58	8.602	9.113	8.928	13.11	8.517	10.64	8.252	8.298

Annual Runoff in MCM = 213 Annual Runoff in mm = 265

Peak Observed Discharge = 33.46 cumecs on 19/09/2016 Corres. Water Level :10.480 m

Lowest Observed Discharge = 0.000 cumecs on 07/06/2016 Corres. Water Level : 7.720 m

Q: Observed/Computed discharge in cumec WL: Corresponding Mean Water Level (m.s.l) in m * : Computed Discharge

#:Discarded Discharge (values changed as per rating curve)

Note: River remained in pooling/ no flow condition w.e.f. 07/06/16 to 04/07/16, 22/01/2016 to 30/01/2016, 04/02/2017 to 15/02/2017 & 23/03/2017 to 31/03/2017.

Stage Discharge Data for The period 2016-17

Station Name: Kim at Motinaroli (01 02 16 001) Division : Tapi Division, Surat Local River: Kim Sub -Division : LNSD, CWC, Bharuch

Day	Dec		Jan		Feb		Mar		Apr		May	
	W.L	Q	WL	Q	WL	Q	WL	Q	WL	Q	WL	Q
1	8.310	8.821	7.790	0.000	8.030	4.435	8.400	10.09	7.880	1.390 *	8.590	11.17
2	8.300	8.610	7.790	0.000	7.990	4.168	8.400	10.09	7.780	0.000 *	8.560	9.058
3	8.320	9.107	7.770	0.000	7.980	4.013	8.380	9.930	7.900	1.861	8.540	8.941
4	8.320	9.300 *	7.770	0.000	7.800	0.000	8.380	9.918	8.840	16.99 #	8.520	8.742
5	8.330	9.509	7.770	0.000	7.800	0.000	8.380	10.24 *	8.290	9.148	8.500	8.703
6	8.350	10.21	7.770	0.000	7.800	0.000	8.420	10.33	8.310	9.051	8.460	8.409
7	8.340	9.596	7.770	0.000	7.800	0.000	8.490	10.98	8.320	9.154	8.440	11.16 *
8	8.330	9.295	7.780	0.000	7.790	0.000	8.450	10.51	8.340	9.756	8.440	8.325
9	8.290	8.067	7.800	0.000	7.770	0.000	8.420	10.32	8.340	9.610 *	8.450	8.332
10	8.300	8.403	7.800	0.000	7.760	0.000	8.450	10.52	8.350	9.964	8.450	11.31 *
11	8.300	8.980 *	7.800	0.000	7.750	0.000	8.470	11.03	8.380	10.14	8.470	8.773
12	8.150	6.520 *	7.800	0.000	7.740	0.000	8.480	11.77 *	8.320	9.371	8.480	8.772
13	8.100	5.650 #	7.800	0.000	7.790	0.000	8.480	11.77 *	8.340	9.812	8.460	7.643
14	8.010	4.030 #	7.800	0.000	7.780	0.000	8.490	10.91	8.340	9.610 *	8.460	11.46 *
15	7.950	2.880 #	7.800	0.000	7.780	0.000	8.500	11.45	8.380	10.30	8.450	8.462
16	7.920	2.260 #	7.800	0.000	8.030	4.400 #	8.480	11.22	8.380	10.24 *	8.440	8.230
17	7.890	1.610 #	7.770	0.000	8.130	5.963	8.440	10.43	8.490	8.159	8.430	8.151
18	7.860	0.900 *	7.770	0.000	8.140	6.021	8.430	10.13	8.500	8.553	8.420	7.955
19	7.840	0.342	7.780	0.000	8.140	6.350 *	8.430	10.13 *	8.490	8.309	8.020	3.832
20	7.840	0.333	7.780	0.000	8.210	6.697	8.050	4.770 #	8.500	8.553	8.010	3.796

21	7.840	0.331	7.800	0.000	8.210	6.760	8.000	3.840 #	8.490	8.444	8.000	3.840 *
22	7.800	0.000	7.800	0.000	8.250	8.868	7.900	1.818	8.540	8.958	8.210	7.597
23	7.800	0.000	7.800	0.000	8.280	9.022	7.800	0.000	8.540	12.66 *	8.310	8.619
24	7.800	0.000	7.800	0.000	8.290	8.820 *	7.800	0.000	8.550	8.978	8.330	8.721
25	7.800	0.000	7.790	0.000	8.290	8.923	7.790	0.000	8.560	9.041	8.310	6.299
26	7.800	0.000	7.800	0.000	8.290	8.820 *	7.790	0.000	8.570	9.044	8.300	6.236
27	7.800	0.000	7.800	0.000	8.270	8.748	7.780	0.000	8.800	13.77	8.240	5.787
28	7.800	0.000	7.800	0.000	8.380	9.869	7.770	0.000	8.600	11.95	8.220	7.680 *
29	7.800	0.000	7.800	0.000			7.780	0.000	8.590	11.31	8.260	5.908
30	7.800	0.000	7.800	0.000			7.780	0.000	8.590	13.40 *	8.300	6.822
31			8.040	4.631			7.780	0.000			8.390	7.052
Ten-Daily Mean												
I Ten-Daily	8.319	9.092	7.781	0.000	7.852	1.262	8.417	10.29	8.235	7.692	8.495	9.415
II Ten-Daily	7.986	3.351	7.790	0.000	7.949	2.943	8.425	10.36	8.412	9.305	8.364	7.707
III Ten-Daily	7.804	0.033	7.821	0.421	8.283	8.729	7.815	0.514	8.583	10.76	8.261	6.778
Monthly												
Min.	7.800	0.000	7.770	0.000	7.740	0.000	7.770	0.000	7.780	0.000	8.000	3.796
Max.	8.350	10.21	8.040	4.631	8.380	9.869	8.500	11.77	8.840	16.99	8.590	11.46
Mean	8.036	4.158	7.798	0.149	8.010	3.996	8.206	6.845	8.410	9.251	8.370	7.928

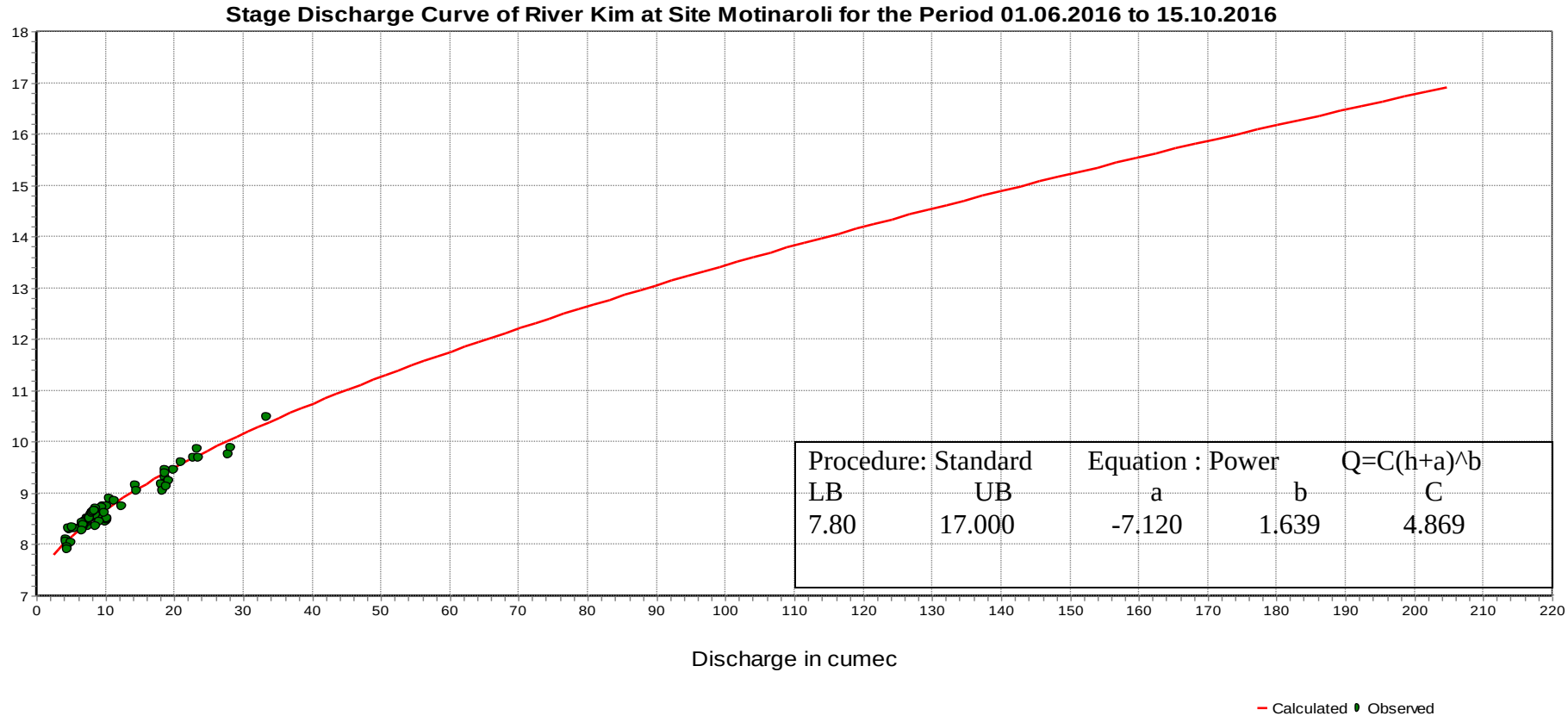
Peak Computed Discharge = 28.36 cumecs on 18/09/2016 Corres. Water Level :10.050 m
Lowest Computed Discharge = 0.000 cumecs on 29/06/2016 Corres. Water Level :7.340 m

Q: Observed/Computed discharge in cumec WL: Corresponding Mean Water Level (m.s.l) in m * : Computed Discharge
#:Discarded Discharge (values changed as per rating curve)

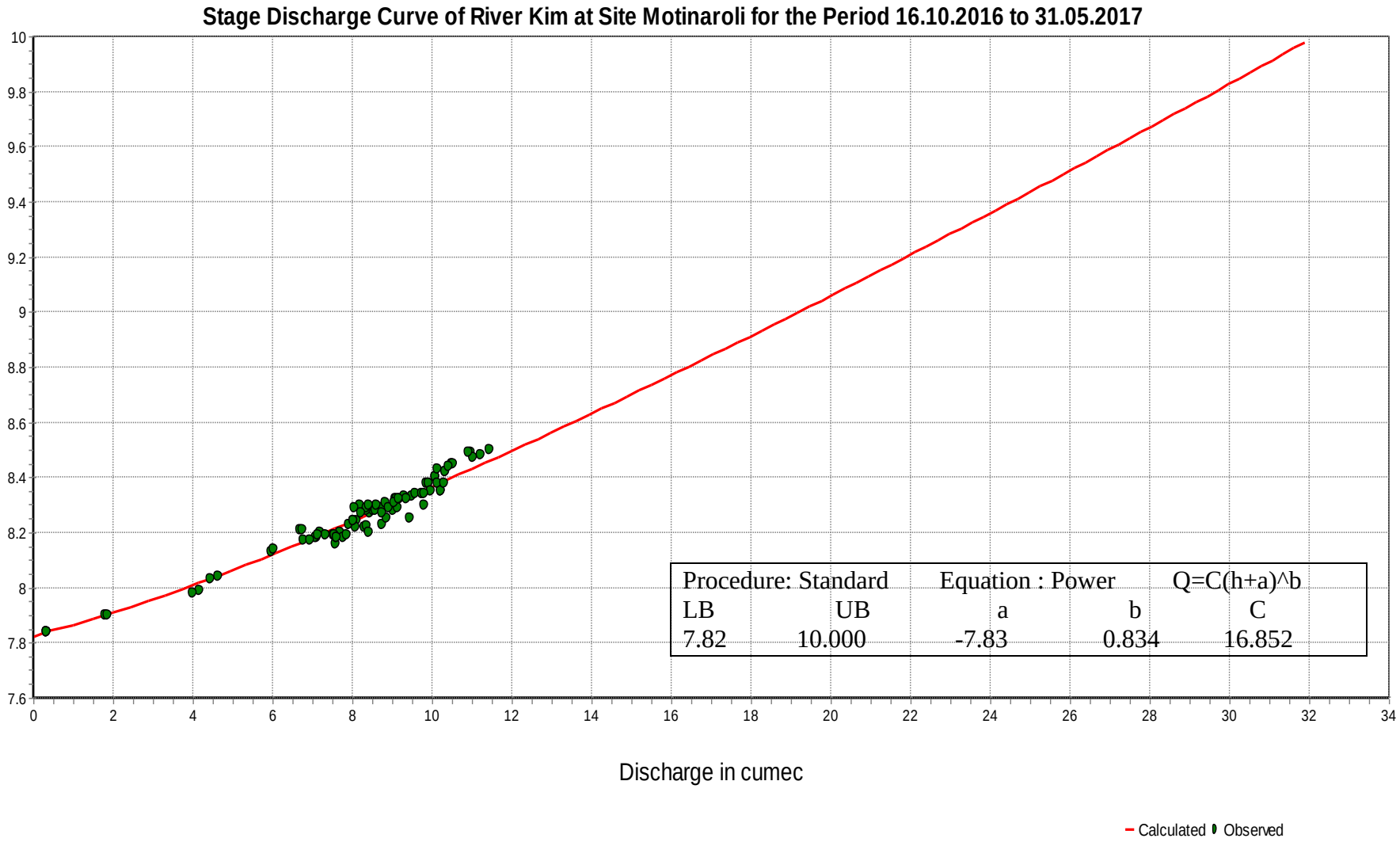
Note: River remained in pooling/ no flow condition w.e.f. 07/06/16 to 04/07/16, 22/01/2016 to 30/01/2016, 04/02/2017 to 15/02/2017 & 23/03/2017 to 31/03/2017.

4.6.4 Stage Discharge Curve

Station Name: Kim at Motinaroli (01 02 16 001) Division : Tapi Division, Surat Local River: Kim Sub -Division : LNSD, CWC, Bharuch



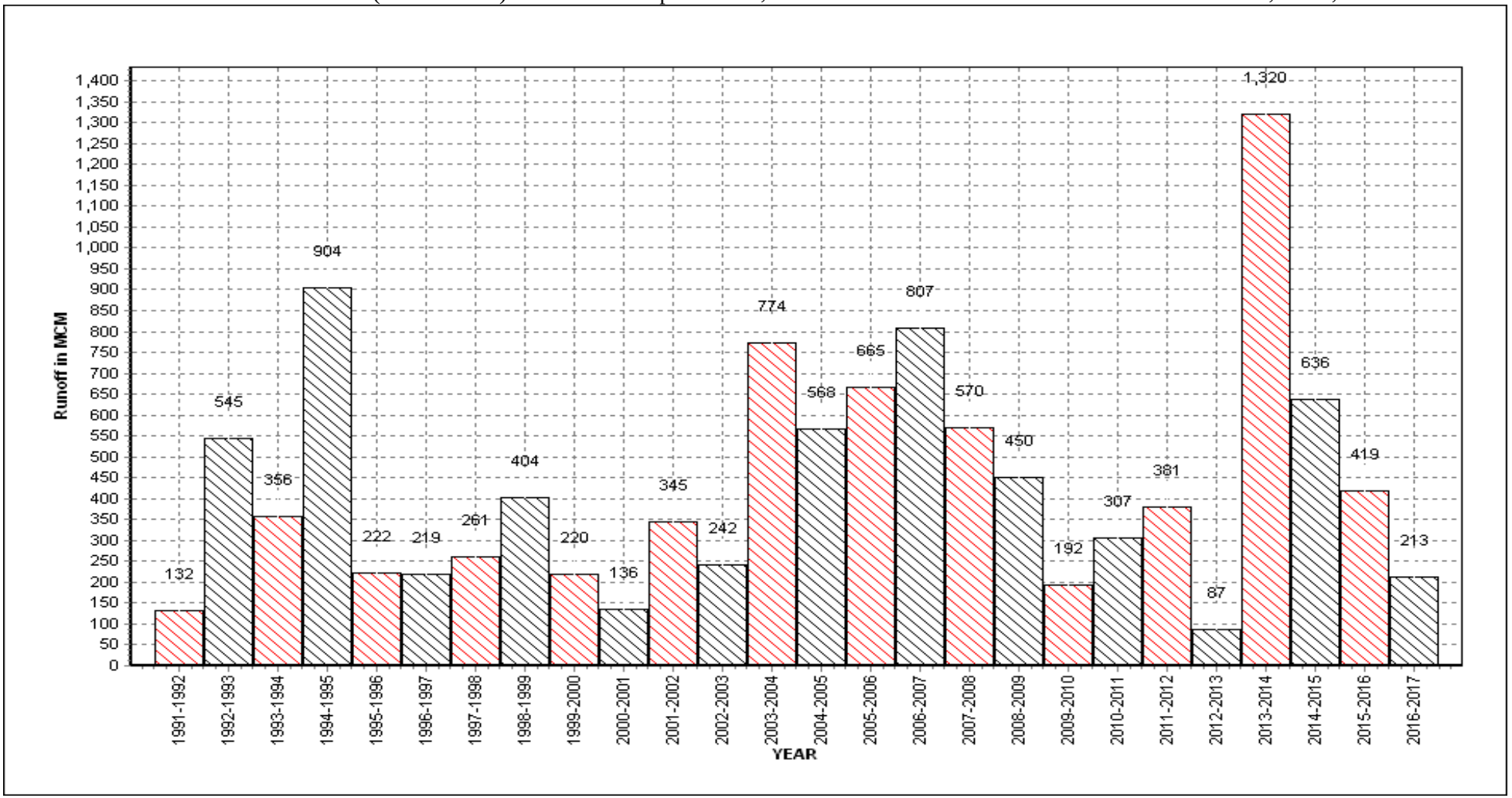
Station Name: Kim at Motinaroli (01 02 16 001) Division : Tapi Division, Surat Local River: Kim Sub -Division : LNSD, CWC, Bharuch



4.6.5 Annual runoff

Annual Runoff values for the period 1991-2017

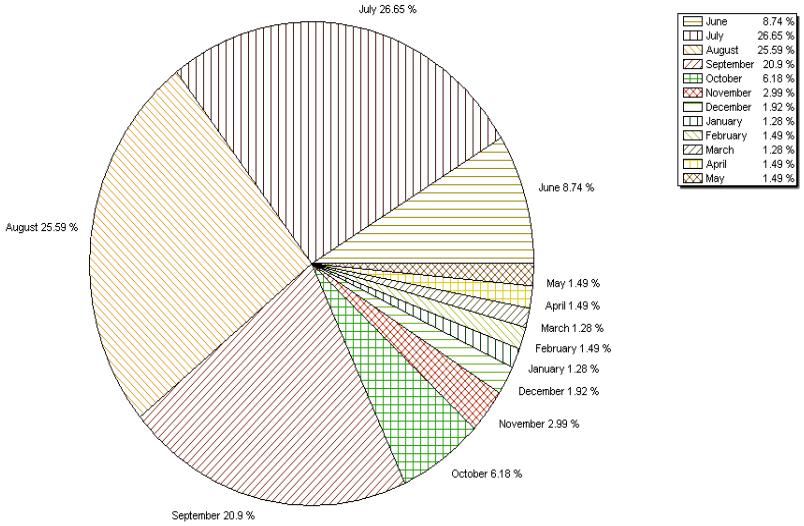
Station Name: Kim at Motinaroli (01 02 16 001) Division: Tapi Division, Surat Local River: Kim Sub -Division: LNSD, CWC, Bharuch



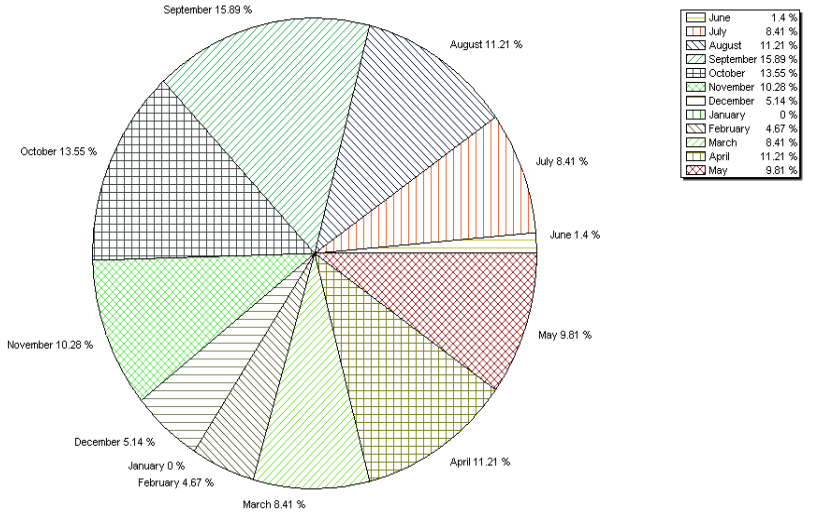
4.6.6 Monthly average Runoff

Station Name: Kim at Motinaroli (01 02 16 001) Division : Tapi Division, Surat Local River: Kim Sub -Division : LNSD, CWC, Bharuch

Monthly Average Runoff on period 1991-2016

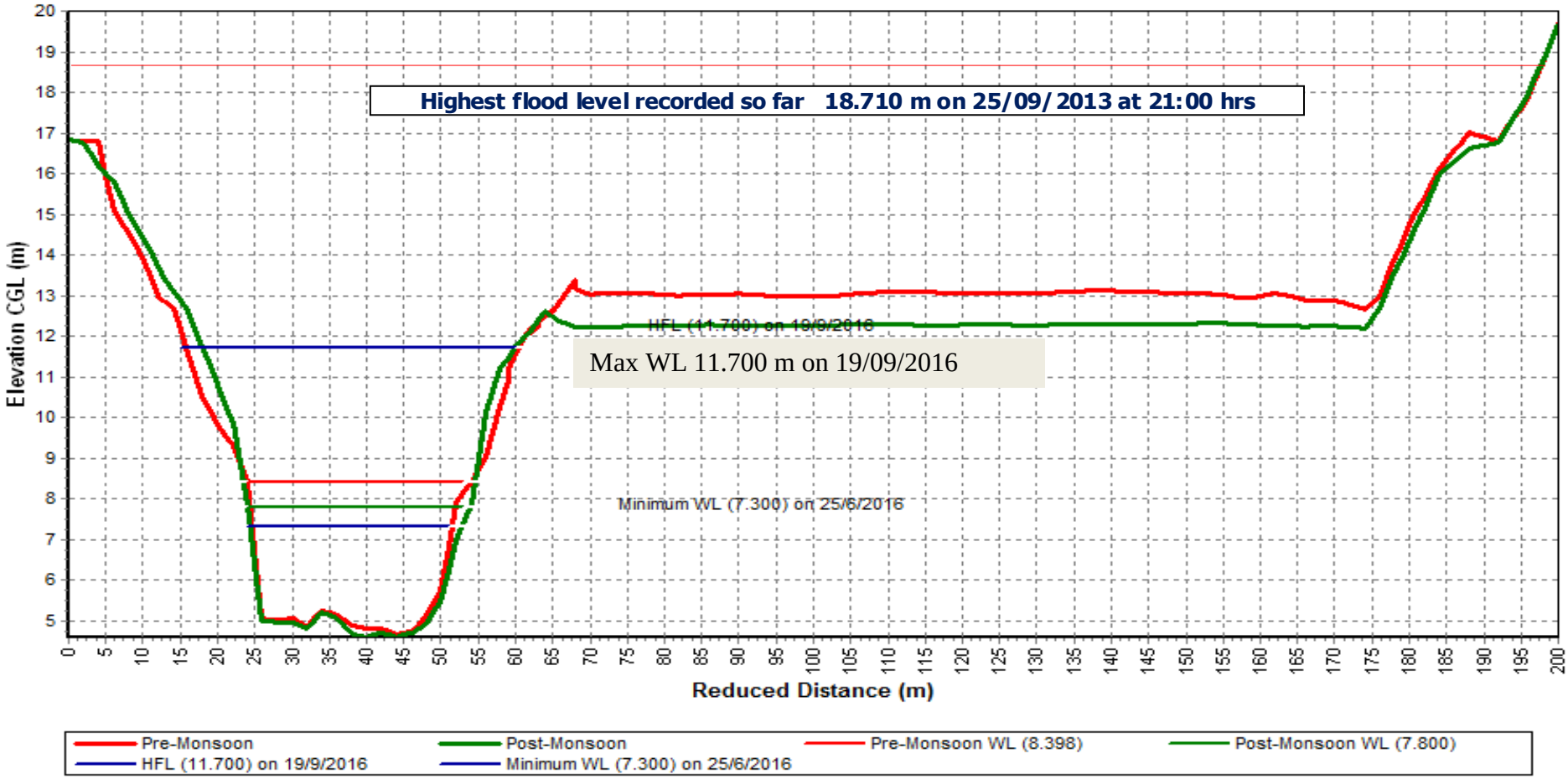


Monthly Average Runoff on period 2016-17



4.6.7 Superimposed cross section

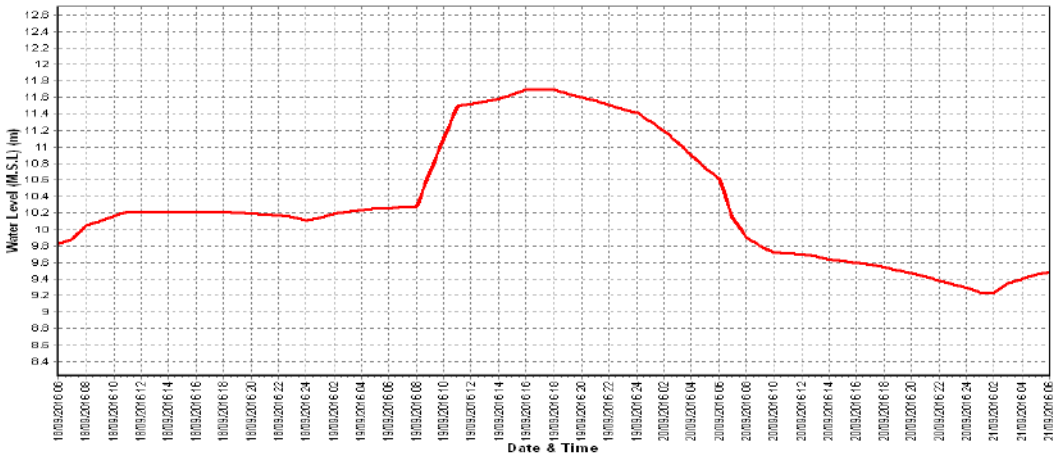
Station Name: Kim at Motinaroli (01 02 16 001) Division : Tapi Division, Surat Local River: Kim Sub -Division : LNSD, CWC, Bharuch



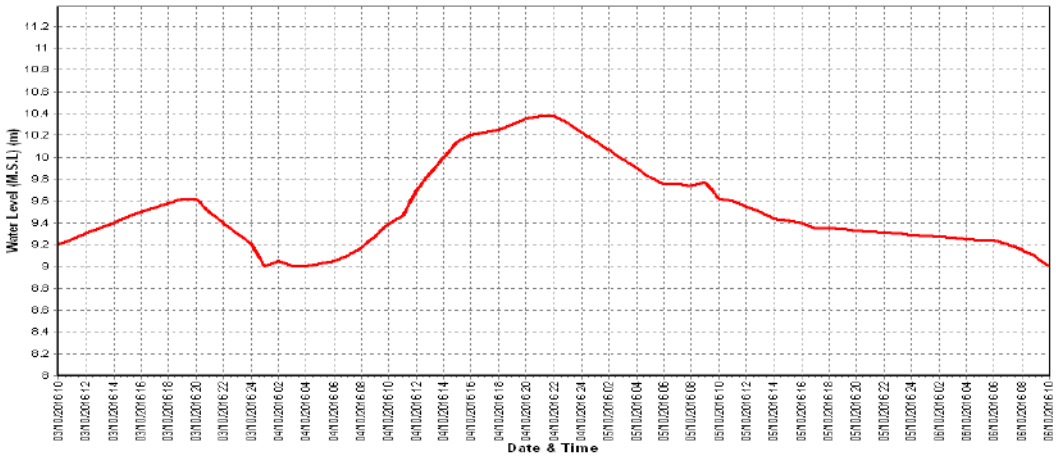
4.6.8 Water Level vs. Time Graph of highest flood peaks during 2016-17

Station Name: Kim at Motinaroli (01 02 16 001) Division : Tapi Division, Surat
Local River: Kim Sub -Division : LNSD, CWC, Bharuch

Water level vs. Time graph of 1st flood peak during the year 2016-17



Water level vs. Time graph of 2nd flood peak during the year 2016-17



Water level vs. Time graph of 3rd flood peak during the year 2016-17