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# APPRAISAL REPORT-2019

## FLOOD FORECASTING

## NARMADA BASIN


GOVERNMENT OF INDIA

CENTRAL WATER COMMISSION

NARMADA BASIN ORGANISATION

NARMADA DIVISION, BHOPAL

*November-2019*

# प्रस्तावना

भारत में प्रतिवर्ष मानसून की अवधि के दौरान आमतौर पर सभी प्रमुख नदियों में बाढ़ आ जाती हैं, जिसके कारण जान माल आदि का नुकसान होता हैं | हालाँकि बाढ़ जैसी प्राकृतिक आपदाओं की घटना को रोका नहीं जा सकता, लेकिन उचित समय पर दिए गए बाढ़ के सही पूर्वानुमान से होने वाले नुकसान को कम किया जा सकता है | बाढ़ के पूर्वानुमान की सूचना से सम्बंधित विभागों के द्वारा आवश्यक कार्यवाही से बाढ़ से होने वाली जानमाल की हानि को कम किया जा सकता है |

बाढ़ से होने वाली क्षति को कम करने तथा जलाशय और विभिन्न प्रयोजनों के लिए उपलब्ध जल संसाधनों के समय प्रबंधन हेतु बाढ़ पूर्वानुमान प्रमुख गैर संरचानात्मक उपायों में से एक है | केंद्रीय जल आयोग द्वारा जल स्तर/अंतर प्रवाह पूर्वानुमान के लिए सभी प्रमुख अंतर्राज्यीय नदी, कछारों में बाढ़ पूर्वानुमान के स्थलों का संजाल विकसित किया गया है |

नर्मदा मंडल, केन्द्रीय जल आयोग, भोपाल की स्थापना सन 1976 में नर्मदा, तापी और उनकी सहायक नदियों पर गेज निस्सारण तथा मौसम संबंधी आंकड़ों के मापन हेतु 80 प्रमुख स्थल, योजना के अंतर्गत हुई थी | मानसून वर्ष 2000 से ऊपरी नर्मदा यानी डिंडोरी से होशंगाबाद के बाढ़ पूर्वानुमान का कार्य नर्मदा मंडल, भोपाल जबकि निचली नर्मदा यानी होशंगाबाद से भरूच के बाढ़ पूर्वानुमान का कार्य तापी मंडल, सूरत द्वारा किया जा रहा है |

इस प्रतिवेदन में मानसून 2019 के दौरान मंडल कार्यालय द्वारा जारी किये गए बाढ़ पूर्वानुमान, वर्षा के आकड़े एवं उनका पिछले दस वर्षों के आकड़ों के साथ तुलनात्मक मूल्यांकन प्रस्तुत किया गया है | मानसून 2019 के दौरान मंडला जिले के लिए 36 एवं स्थल होशंगाबाद के लिए 26 बाढ़ पूर्वानुमान जारी किये गए | लगभग सभी स्थलों पर सामान्य से अत्यधिक वर्षा दर्ज की गई | नर्मदा मंडल बाढ़ पूर्वानुमान के प्रदर्शन और उपयोगिता में सुधार करने के लिए सतत प्रयासरत है |

मैं, मुख्य अभियंता, नर्मदा बेसिन संगठन, केन्द्रीय जल आयोग, भोपाल और अधीक्षण अभियंता (सं), नर्मदा बेसिन संगठन का समय- समय पर उचित मार्गदर्शन के लिए आभारी हूँ | मैं, मंडल और उपमंडलों में कार्यरत सभी अधिकारयों एवं कर्मचारियों का भी आभारी हूँ जिनकी सतत एवं उत्कृष्ट सेवाओं द्वारा बाढ़ पूर्वानुमान के कार्य को सफलतापूर्वक संपन्न किया गया है |

भोपाल
नवम्बर 2019

(संजय कुमार मालवीय)
अधिशासी अभियंता
नर्मदा मंडल, भोपाल

## विशेष टिप्पणी

नर्मदा मंडल ,केन्द्रीय जल आयोग ,भोपाल की स्थापना सन 1967 में नर्मदा ,तापी और उनकी सहायक नदियों पर गेज, निस्सारण तथा मौसम संबंधी आकड़ों के मापन हेतु 80 key station (Plan) के अंतर्गत हुई थी |मानसून वर्ष 2000से ऊपरी नर्मदा यानी डिंडोरी से होशंगाबाद के बाढ़ का पूर्वानुमान का कार्य नर्मदा मंडल ,भोपाल जबकि निचली नर्मदा यानी होशंगाबाद से भरूच के बाढ़ पूर्वानुमान का कार्य तापी मंडल ,सूरत द्वारा किया जा रहा हैं |

विगत मानसून 2019में लगभग पूरे मध्यप्रदेश में भारी से अत्यधिक भारी बारिश हुई थी , जिसमे कि इस कार्यालय के अंतर्गत नर्मदा बेसिन में स्थित सभी स्थलों पर भी भारी वर्षा रिकॉर्ड की गई है जिसमे कि सबसे ज्यादा बारिश नर्मदा नदी पर स्थित स्थल मनोट में कुल 2202मिलीमीटर एवं सबसे कम स्थल मोरटक्का पर 920मिलीमीटर दर्ज हुई |इस कार्यालय के द्वारा नर्मदा नदी के किनारे पर स्थित दो शहरों क्रमशः मंडला एवं होशंगाबाद के लिए स्तर बाढ़ पूर्वानुमान का कार्य किया जाता हैं |इस मानसून में बारिश जुलाई 2019के अंत में प्रारंभ होकर 10नवम्बर 2019तक लगभग लगातार जारी रही एवं इस दौरान इस कार्यालय के अंतर्गत कार्य करने वाले सभी कर्मचारियों के सहयोग से 24x 7 वर्षा मापन एवं गेज प्रेक्षण का कार्य अनवरत किया गया जिसके आधार पर बाढ़ नियंत्रण कक्ष ,नर्मदा मंडल, भोपाल, ऊ.न.उ.म., जबलपुर एवं म.न.उ.म.-1, होशंगाबाद में कार्यरत अधिकारयों के द्वारा स्तर बाढ़ पूर्वानुमान का कार्य सफलतापूर्वक किया गया | गत मानसून में स्थल होशंगाबाद के लिए 36एवं स्थल मंडला के लिए 26स्तर बाढ़ पूर्वानुमान सभी यूजर एजेंसी को समय पर जारी किये गए जिससे कि उक्त स्थलों पर किसी भी प्रकार की जान-माल की क्षति नही हो सकी | इस कार्यालय के द्वारा स्तर बाढ़ पूर्वानुमान का कार्य करने के लिए स्थानीय प्रशासन ,जिला - होशंगाबाद एवं मंडला के द्वारा स्थल पर कार्यरत कर्मचारियों की मौखिक रूप से सराहना एवं उत्साहवर्धन किया गया |स्थल होशंगाबाद के लिए जारी किये गए सभी 36स्तर बाढ़ पूर्वानुमान 100 प्रतिशत सही हुए एवं स्थल मंडला के लिए जारी किये गए सभी 26स्तर बाढ़ पूर्वानुमान 97प्रतिशत सही हुए |उक्त कार्य इस कार्यालय के अंतर्गत मानसून में कार्य करने वाले सभी अधिकारियों एवं कर्मचारियों के अद्वितीय सहयोग एवं कर्मठता के द्वारा ही संभव हो पाया हैं जिसके लिए अधोहस्ताक्षरकर्ता के द्वारा ह्रदय से धन्यवाद एवं आभार ज्ञापित किया जाता हैं साथ ही भविष्य में इस कार्यालय के अंतर्गत कार्यरत सभी अधिकारयों/कर्मचारियों से आगामी मानसून में इसी तरह सहयोग की अपेक्षा की जाती हैं |

संजय कुमार मालवीय
(अधिशासी अभियंता )

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**Abbreviation and Symbols Used**

| | | |
|---|---|---|
| CWC | : | Central Water Commission |
| IMD | : | India Meteorological Department |
| WRD of GoMP | : | Water Resources Department of Government of Madhya Pradesh |
| NCA | : | Narmada Control Authority |
| MCM | : | Million Cubic Metres |
| Cumec | : | Cubic Metre per Second |
| ha | : | Hectare |
| $ha^2$ | : | Square hectare |
| $ha^3$ | : | Cubic hectare (Million cubic metres) |
| M.S.L. | : | Mean sea level |
| F | : | Float Observation |
| FF | : | Flood forecasting |
| G | : | Gauge |
| GTS | : | Great Trigonometrical Survey |
| hrs | : | Hours |
| IWYB | : | Integrated Water Year Book |
| $Hm^3$ | : | Hectometre cube = Million cubic metre |
| mm | : | millimetre |
| m | : | Metre |
| $m^3/s$ | : | Cubic metre per second |
| $^o$ | : | Degree ($00^o$) |
| ’ | : | Minute (00’) |
| ” | : | Second (00”) |
| 80 key | : | 80 key Hydrological Station Scheme |
| 67 key | : | 67 key Hydrological Station Scheme |

# Chapter- 1

## INTRODUCTION

During monsoon, every year all major rivers in India get flooded. These floods cause severe loss of property, human lives, cattle etc. and also these floods render thousands of acres of cultivated land useless for further cultivation due to sand deposit and silting. No one can stop the natural phenomenon like floods in the rivers but issuing correct and timely warnings of the incoming floods to the Central /State Authorities can minimize flood damages. Such warnings with adequate warning time are helpful in reducing the damages to property, loss of human lives, cattle lives etc. to a considerable extent. Flood forecasting thus plays a vital role in reducing damages and also in proper regulation of reservoirs and as such in overall management of the available water resources for various purposes.

The work of developing scientific technique of flood forecasting and issue flood warnings in different river basins was entrusted to Central Water Commission. Initially, a small Cell was created in late fifties to issue flood warnings in the Yamuna catchment and this Cell has now been expanded into Central Flood Forecasting Organization of the Central Water Commission to cover almost all the important inter-state rivers.

## 1.1FLOOD FORECASTING SETUP

Narmada Division, Bhopal was established in February-1976, previously known as Bhopal Gauging Division, Bhopal under 80 Key-station scheme for gauge and Discharge observation on various G&D sites on Narmada and Tapi river and their tributaries. The flood forecasting work of Narmada was entrusted with Tapi Division, Surat along with G&D observations up to 1999-2000.From 2000-2001 the flood forecasting works of Narmada Basin is reallocated as follows.

| Sr. No. | City | Flood Forecast Division |
|---|---|---|
| 1 | Mandla | Narmada Division, Bhopal |
| 2 | Hoshangabad | Narmada Division, Bhopal |
| 3 | Garudeshwar | Tapi Division, Surat |
| 4 | Bharuch | Tapi Division, Surat |

Narmada Division has one Control Room at Bhopal for issuing Flood-Forecast to the State Authorities concerned for Mandla and Hoshangabad cities.

Under the Hydrological Observations (H.O.) setup Gauge, Discharge and Water Quality are being observed at 16 stations of CWC. Out of above, silt observation is also being made at 9 stations of CWC. Under Flood Forecasting set up, Gauge-Rainfall at 4 sites, Gauge-Discharge-Rainfall at 5 sites and Rainfall at 2 sites are being observed and transmitted through wireless on real time basis. The data of these 11 sites of Gauge/Gauge Discharge/ Rainfall sites is being utilized for formulation of flood forecasts.

At present one Sub-Division namely Middle Narmada Sub-Division-I, Hoshangabad under Narmada Division Bhopal is carrying out the Flood-Forecasting activities.

The location of Division office, Sub Division and field Stations are indicated in Annexure -1 and details of Communication Network and River Gauge Network & Annexure 3 respectively are shown in Annexure -2. Plate-1 shows the map of Narmada basin. Plate -2 shows the location of all the Gauge/ Gauge-Discharge, Wireless and Rainfall stations under F.F Net work in Narmada basin. Plate -3 shows the Communication Diagram of wireless network of Narmada Division. Line diagram of Narmada basin is shown in Plate -4.

Flood level forecast, even if 100% accurate is of no use until it is disseminated in time to the users/ beneficiaries. Hence dissemination of forecasts should be quick without loss of time. Dissemination is, therefore, done on top priority by wireless/ telephone or by sending Fax or by sending special messenger to the State Authorities as per the guidelines given in flood memorandum of state Government or by the State District Collectors.

Based on our forecasts received on real time, the user agencies take immediate action for regulation of reservoirs or for precautionary measures against the onslaught of coming floods and as such flood damages are minimized. In addition to dissemination of forecast to the user agencies, message is conveyed to newspapers also, if required. Based on our forecasts State Government arranges to broadcast the flood messages over Radio and T.V. so as to inform the public well in advance.

METHODOLOGY

The methodology used for issuing forecast is as per the C.W.C. manual on flood forecast for level forecasts. Mainly graphical technique is used for most of the sites. In graphical techniques various co-relation diagrams depicting the effect of basin parameters are prepared and tested for accuracy. This Division is having a number of co-relation diagrams, stage discharge curve/ tables, travel time curves for both the forecasting sites based on 10 to 15 years data.

### 1.2.1 MANDLA FORECASTING SITE

**(A) G& D CURVES**

Average Gauge Discharge curves for Dindori, Manot, Mohgaon and Mandla have been developed by incorporating the data for 5 to 10 years.

**(B) CORRELATION CURVES**

Different type of correlation with different parameters between different sites from Dindori to Mandla has been developed i.e.

(i) Dindori to Manot on Narmada

(ii) Mohgaon to Mandla on Burhner & Narmada

(iii) Manot to Mandla on Narmada

**(C) TRAVEL TIME STUDIES**

Considering the related floods carried out peak-to-peak travel time between various fixed points on Narmada River. It had been seen that points were widely scattered in most of the cases. However, most suitable time lag cure was drawn and average travel time had been calculated and is being used in flood forecasting for Mandla.

### (D) PROCEDURE ADOPTED FOR ISSUING THE FLOOD LEVEL FORECAST FOR MANDLA

Whenever appreciable rain occurs in the upper catchment of Narmada and Banjar river, the water level of Dindori on Narmada and Mukki on Banjar starts rising and if it is felt that water level at Mandla is expected to reach warning level 437.200 m, the Flood-forecast is issued.

In such situation Water levels of these two sites are observed, initial forecast for Mandla is formulated and issued about 8 to 12 hrs in advance by using the correlations of Dindori to Manot and then final forecast of Mandla is issued using stage discharge curves of Manot, Mohgaon & Mandla sites. Subsequent revised forecast or a fresh forecast, about 3 to 4 hrs in advance, based on peak levels at Manot and Mohgaon, effect of local rain falls and contribution from Banjar river, is also formulated and issued, if required.

## 1.2.2 HOSHANGABAD G-D SITE

### (A) G-D CURVES

Average gauge discharge curves for Barmanghat and Hoshangabad have been established by incorporating the data of last 10 to 15 years.

### (B) CORRELTATION CURVES

Different types of correlation with different parameter between sites from Barmanghat to Hoshangabad have been developed i.e.

1. Barmanghat to Sandia
2. Sandia to Hoshangabad
3. Tawa to Hoshangabad

### (C) TRAVEL TIME STUDIES

Peak to peak travel time between various fixed points on the Narmada River had been carried out by considering the related floods. It had been seen that the points were widely scattered in most of the cases. However, the time lag curves had been drawn but when tested their results were not found satisfactory and hence average travel time had been calculated and used in flood forecasting for each site.

### (D) PROCEDURE ADOPTED FOR ISSUING THE FLOOD LEVEL FORECAST FOR HOSHANGABAD

Whenever water level at Hoshangabad is expected to reach warning level 292.830 m due to heavy rainfall in upstream catchment, or heavy releases from Bargi or Tawa reservoirs, Flood forecast is issued.

Flood level forecast based on Bargi release with the use of co-relations of Barmanghat to Hoshangabad, Gauge Discharge curves of Barmanghat and Hoshangabad sites, is formulated and issued about 30 to 40 hrs in advance.

Subsequent revised forecast or fresh forecast for about 20 to 40 hrs in advance based on Barmanghat peak with the use of different curves and available rain fall data / weather forecast, level forecast is formulated and issued. Advance information (if any) of Tawa release is also considered while issuing this forecast.

The forecasts issued as stated above are sometimes revised (if necessary) due to appreciable contribution of Tawa river (release from Tawa Dam) and heavy rainfall information on the interim catchment between Barmanghat to Hoshangabad (if received on real time) only 6 to 8 hrs in advance.

Sometimes main river Narmada is flooded due to heavy rains in Tawa dam catchment, forcing heavy releases from Tawa. In such cases, forecast (if found necessary) for about 6 to 8 hrs in advance is formulated and issued taking in to consideration the affect of local rain, if any.

### 1.3 Uploading of Flood Forecasts data on e- SWIS Platform via internet

CWC (HQ), Delhi has taken an initiative in getting all the flood forecasts related data uploaded on e-SWIS platform via internet for General public use. This data was also successfully uploaded during Monsoon period.

# Chapter- 2

**BASIN PHYSIOGRAPHY, RIVER SYSTEM AND BASIN RAIN FALL**

## 2.1 NARMADA BASIN

Narmada Basin extends over an area of about 98796 sq km and lies between East Longitude $81^0$ 45' to $72^0$ 32' and North latitude $23^0$ 45' to $21^0$ 20' lying in Northern extremity of Deccan plateau. The Basin covers the large area in the states of Madhya Pradesh and Gujarat and comparatively smaller area in Maharashtra & Chhattisgarh. The State wise distribution of drainage area is as under:

**Table 2.1 State wise Distribution of Drainage Area**

| S.I. No | Name of States | Drainage area in Sq km | Percentage area |
|---|---|---|---|
| 1 | Madhya Pradesh | 85,149 | 86.2 |
| 2 | Chhattisgarh | 710 | 0.7 |
| 3 | Maharashtra | 1,538 | 1.5 |
| 4 | Gujarat | 11,399 | 11.6 |
| | Total | 98,796 | 100.0 |

The Narmada Basin is bounded on the North by the Vindhya range, on the East by Maikal range, on the South by the Satpura and on the West by Arabian Sea. The Basin has an elongated or fern leaf shape with maximum length of 953 km from the East to West and maximum width of 234 km North to South. The basin has five well-defined Physiographic regions as under

**Table 2.2 Physiographic Regions**

| Sl. no. | Region | Length (km) | Fall (m) | Average Bed slope | Name of District. Covered fully or partially |
|---|---|---|---|---|---|
| 1. | Upper Hills | 378 | 690 | 1 in 548 | 1. Shahdol<br>2. Mandla<br>3. Kavardha<br>4. Balaghat<br>5. Seoni<br>6. Dindori |

| Sl. no. | Region | Length (km) | Fall (m) | Average Bed slope | Name of District. Covered fully or partially |
|---|---|---|---|---|---|
| 2. | Upper Plains | 462 | 190 | 1 in 2430 | 1. Jabalpur<br>2. Narsingpur<br>3. Sagar<br>4. Chindwara<br>5. Hoshangabad<br>6. Betul<br>7. Raisen<br>8. Sehore<br>9. Damoh |
| 3. | Middle Plain | 206 | 72 | 1 in 2860 | 1. Khandwa<br>2. Khargaon<br>3. Dewas<br>4. Indore<br>5. Dhar<br>6. Harda |
| 4. | Lower Hills | 105 | 86 | 1 in 1221 | 1. Khargaon<br>2. Barwani<br>3. Narmada<br>4. Baroda<br>5. Dhulia<br>6. Nandurbar |
| 5. | Gujarat | 161 | 19 | 1 in 6315 | 1. Bharuch<br>2. Baroda<br>3. Surat<br>4. Pachmahal |
| | Total | 1312 | 1057 | | |

The hilly regions are well forested. The upper Middle and lower plains are broad and fertile areas well suited for cultivation.

In general the soil are red, yellow, shallow black and skeletal in upper Narmada, medium black in middle Narmada and medium and deep Black in lower reaches of the basin.A plate of soil formation of Narmada basin as shown in data book.

### 2.1.1 RIVER SYSTEM

River Narmada is the fifth largest river of India. It originates at Amarkantak (M.P.) in Maikal Hills of Vindhya range at an elevation of 1057m. It flows from East to West between Vindhyan and Satpura ranges in long and narrow catchment. It falls in to Gulf of Cambay down-stream of Bharuch (Gujarat) and has a total length of 1312 kms. For the first 1079 Km, it runs in Madhya Pradesh and then forms the common boundary for Madhya Pradesh and Maharashtra for 35 Km. and Maharashtra and Gujarat for 39 Km. In Gujarat state it stretches for 159 km.

There are 41 important tributaries of Narmada River. Major tributaries joining from left are Burhner, the Banjar, the Sher, the Shakkar, the Dudhi, the Tawa, the Ganjal, the Chhota Tawa, the Kundi, the Goi and the Karjan.

Major tributaries joining from right are Gour, the Hiran, the Barna, the Tenduni, the Kolar, the Chankeshwar, the Kanar, the Man, the Uri and the Orsang.

The Narmada basin has been divided in to 4 (four) sub-basins. Salient features of the sub basins are furnished in the Annexure -4.

### 1.2.2 RAIN FALL

The South West Monsoon sets in by the middle of June and withdraws by middle of October. As per IMD the normal Monsoon rainfall (June–Oct) of Mandla & Hoshangabad stations are 1596.0 mm and 1650.0 mm respectively. Station wise (Dindori to Hoshangabad) comparison between normal rainfall and actual rainfall occurred (Monsoon-2019) is shown in the form of bar chart in Plate -5.

# Chapter- 3

**METEOROLOGICAL DATA**

## 3.1 ROLE OF METEOROLOGICAL DATA

In flood forecasting both, weather forecast and actual rainfalls received in the basin play vital role in the formulation of correct forecast. Although weather forecast does not indicate the magnitude of flood, yet it is useful to anticipate the probability of floods in their respective areas. Actual rainfall received in the basin helps in assessing the correct magnitude of floods. Hence, an adequate network of rain gauge with arrangements to transmit rainfall data on real time and the arrangements for obtaining weather forecasts like QPF/ Inference etc. are the basic need of flood forecasting network.

## 3.2 ARRANGEMENT FOR RECEIVING WEATHER FORECAST

Flood Met Office, Ahmadabad is helping this office in the field of weather forecast. F.M.O., Ahmadabad and Tapi Division are connected by Telephone/ Fax for communication of weather warning, storm movements QPF/ WAR daily rainfall etc. Tapi Division is connected to Narmada Division, through wireless network also.

Heavy rainfall warnings are also received through e-mail from I.M.D. Bombay/ Nagpur/ Bhopal/ Ahmadabad. As such this office is getting following weather information from I.M.D.

1. Heavy rainfall warnings
2. Regional weather summary
3. Weight age average rainfall of sub basins
4. Q.P.F for next 12/24/48 hrs
5. Inference information about the movement of depression/storm formed in Bay of Bengal/ Arabian Sea.
6. Satellite images and weather reports available in Website of Indian Meteorological Department also helped a lot in monitoring the movement of storm/ depression zone over the basin during the flood.

## 3.3 RAIN GAUGE NET WORK IN NARMADA BASIN

At present up to Hoshangabad 4 nos. SRRG and ORG had been installed in Narmada basin by I.M.D. and 1no. SRRG and 12nos.ORG by the CWC. The Location of all these rain gauge stations is shown in the Index map of Basin (Plate -2).

Daily rainfall data recorded at all the wireless stations are transmitted to controlling Sub Division/ Division on real time twice a day or even at shorter intervals like hourly/ 3 hourly, if required. Arrangements for rainfall by Telegram to our nearest wireless stations are also made by I.M.D. for some key Rain gauge stations. The flood forecast is formulated more accurately and well in advance for both forecasting sites by giving the weight age to heavy rainfall warnings, QPF, movement of depression and rainfall data received on real time.

# Chapter- 4

## BRIEF DESCRIPTION OF HYDROLOGICAL & METEOROLOGICAL EVENTS RESPONSIBLE FOR FLOODS DURING 2018

In the Narmada Basin monsoon started in mid July and showered up to the 2nd week of October. In all catchments the monsoon rainfall was Highest rainfall. The major rainfall spells in the basin were as follows:

Mandla

| Spell | Duration |
|---|---|
| I Spell | 03.08.2019 to 10.08.2019 |
| II Spell | 12.08.2019 to 19.08.2019 |
| III Spell | 07.09.2019 to 14.09.2019 |

Hoshangabad

| Spell | Duration |
|---|---|
| I Spell | 03.08.2019 to 10.08.2019 |
| II Spell | 12.08.2019 to 19.08.2019 |
| III Spell | 07.09.2019 to 14.09.2019 |

**Hoshangabad**: The maximum level Peak 294.700 Mtr. Dated 11.09.2019 at Hoshangabad remained above danger level 292.83 mt. throughout the monsoon season. There was 26 nos forecast issued during this monsoon as there was high flood at the site.

**Mandla:** During the third spell which occurred between 07.09.2019 to 14.09.2019 heavy rains took place in upstream of FF Station Mandla. The maximum water level at Mandla was 438.880 Mtr. Dated 08.09.2019 (Danger Level level 437.800 m). A total 36 Nos. forecasts were issued for Mandla Station.

# Chapter- 5

## FORECAST FORMULATION

**This year on an rainfall was highest rainfall occurred in Narmada Basin. However, the rainfall was uniform over the basin.**

### 5.1 STATIONS FROM ORIGIN TO MANDLA

Out line of the catchment area

| Stations | Catchment area |
|---|---|
| At Dindori | 2292 Sq km |
| At Manot | 4667 Sq km |
| At Mohgaon | 4090 Sq km |
| At Mukki | 968 Sq km |
| At Mandla | 13000 Sq km |

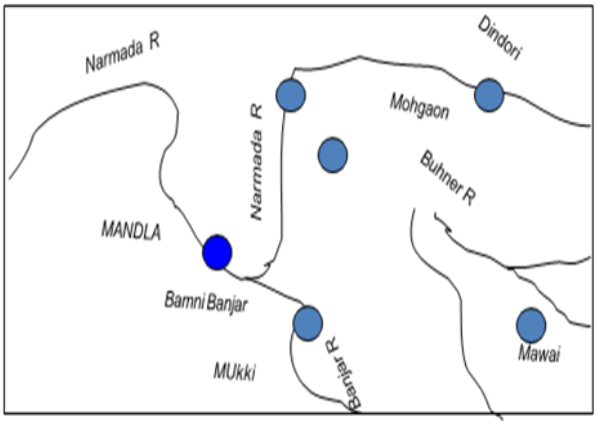


**Table 5.1 Real Time Data Availability from origin to Mandla**

| Stations | Data |
|---|---|
| Dindori | Hourly gauge, discharge and daily rainfall |
| Manot | Hourly Gauge, Discharge, daily rainfall and three hourly rainfalls (if required) |
| Mohgaon | Hourly gauge, discharge daily rainfall and 3 hourly rainfalls |
| Mukki | Hourly gauge, daily/3 hourly rainfall. |
| Mawai | Daily / 3 hourly rainfalls. |
| Mandla | Hourly gauge, daily discharge and daily/3 hourly. |

As per existing arrangement, forecast for Mandla site is being issued based on discharge method. First preliminary forecast for Mandla site can be issued about 10 to 12 hours in advance based on the data of Dindori on Narmada, Mukki on Banjar and rainfall data of Mawai in Burhner Catchment. As Mukki is not a Discharge site and Mawai is only rainfall reporting station, contribution from Banjar and Burhner cannot be assessed accurately so preliminary forecasts cannot be issued. Only final forecasts based on the data of Manot and Mohgaon and judgment about the contribution from Banjar catchment are issued about 4 to 5 hours in advance for Mandla.

## 5.2 STATIONS FROM BARGI TO HOSHANGABAD

Outline of the Catchment area

| Stations | Catchment area |
|---|---|
| At Barmanghat | 26453 Sq km |
| At Tawa Dam | 6060 Sq km |
| At Hoshangabad | 44548 Sq km |
| At Sandia | 33954 Sq.Km |

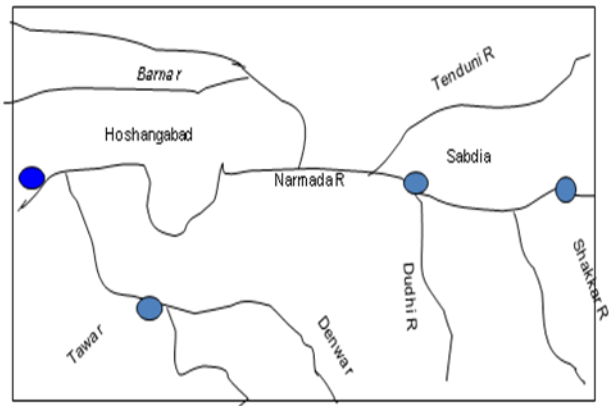


**Table 5.2 Real Time Data Availability from Bargi to Hoshangabad**

| Stations | Data |
|---|---|
| Bargi | Hourly Gauge daily and three hourly rainfall |
| Barman | Hourly gauge, daily discharge and three hourly rainfall |
| Sandia | Hourly gauge, daily discharge and three hourly rainfall |
| Tawa dam | Hourly gauge daily and three hourly rainfall, releases from Dam |
| Hoshangabad. | Hourly gauge, daily discharge and three hourly rainfall |

Forecast for Hoshangabad is issued based on stage at Barmanghat and releases from Tawa Dam. Forecast is further revised based on stage and discharge at Sandia G&D Site & corresponding releases from Tawa, if necessary.

The Catchment area between Barmanghat to Hoshangabad excluding Tawa catchment (12035 $km^2$) is very large and lies in the heavy rainfall zone. Gauge to gauge correlation is giving desired results thus discharge method and judgment are used for forecasting of Hoshangabad. At present there is no arrangement to get any information on real time for the above said catchment, d/s of Sandia although some temporary arrangement had been made to receive release information from Barna Dam , but the information is generally not received in time and hence affect the forecast performance of Hoshangabad site. There is no wireless station at site Sandia .Permanent telephone has been installed at site Sandia. This facility is very helpful for assessing correct forecast of Hoshangabad.

In the existing practice basic flood forecast is to be formulated at Hoshangabad Sub Division and analysed and approved by Divisional office.

# Chapter-6

## FORECAST PERFORMANCE DURING THE SEASON 2019

In Year 2019, actual rainfall was below normal rainfall in Narmada basin and the rainfall was uniform over the basin. During this year 07 Nos. forecasts were issued for Mandla town and no forecasts was issued for Hoshangabad town.

### 6.1 MANDLA - River Narmada

| | |
|---|---|
| Total forecast issued during Monsoon 2018 | 36 |
| Revised | Nil |
| Forecast with in limits (±15 cm) | 35 |
| Beyond limits | 01 |

### 6.2 HOSHANGABAD - River Narmada

| | |
|---|---|
| Total forecast issued during Monsoon 2018 | 26 |
| Revised | Nil |
| Forecast with in (±15cm)permissible limit | 26 |
| Beyond the permissible Limits | Nil |

# Chapter-7

## COMPARISION OF PERFOMANCE WITH PREVIOUS PERFORMANCE

The flood forecasting work for Mandla & Hoshangabad was allocated to this Division in the year 2000.

This year monsoon remained active throughout the season. However, the rainfall was not uniformly distribution over the basin, 36 Nos. forecasts were issued for Mandla town and 26 Nos forecast was issued for Hoshangabad town.

Average forecast performance including 2019 remained stable for both the sites as compared to the 10 years average performance from 2009 to 2019 as indicated in Annexure -8.

# Chapter-8

## PROBLEMS FACED AND DIFFICULTIES NOTICED IN THE NET WORK DURING THE MONSOON 2019

The catchments area between Dindori to Mandla and Barmanghat to Hoshangabad are very large and also rain fed. Gauge to Gauge co-relation for this reach is not giving desired results and thus discharge method is being used for flood forecasting of Mandla and Hoshangabad. Due to above problem, performance for these sites are affected. Communication system at Barna Dam for release may be made to improve the performance of forecast for Hoshangabad. For this purpose one gauge site opened at Barna dam under DWRIS plan Scheme in this year. The performance of Network was excellent and Telephones at vital sites has provided valuable information during this Monsoon and every official in FF work has performed his duties excellently with full sincerity.

Though Narmada Division is entrusted with the various types of works like flood forecasting, conducting hydrological observations, carrying out various deposit works undertaken by Narmada Basin Organisation etc and has a wide jurisdiction in state of Madhya Pradesh yet the staff strength provided is inadequate, even the sanctioned posts are not filled.

1 Key posts like post of P.A. Met in Division office is required for flood forecasting. Posting of E.A.D. / P.A. Met is very essential for proper assessment of floods during Monsoon and for up gradation/ updating of Flood forecast formulations during Non monsoon season.

2 In order to make the staff involved in flood forecast work well conversant with Meteorological aspects and its applications in flood forecasting, it is suggested that the staff should imparted training at regular intervals in meteorology and other aspects of flood forecast.

3. During the beginning of this Monsoon the Junior Engineer (Communication) posted at the Division Office, Bhopal has retired. Therefore, suitable skilled staff is urgently required for round the clock monitoring the Flood Forecasting activity and also for on line data entry through http://180.92.171.80/eSWDES/eswdes

4. A TV set (LCD/LED) had installed in the office of Executive Engineer and Hoshangabad FF Control room for live news coverage of FF related events to take necessary steps for smooth functioning of FF related work and one more TV set (LCD/LED) is to be installed at U.N.S.D., CWC, Jabalpur for the same.

# Chapter-9

## SPECIFIC MODERNISATION EFFORTS

**Presently, conventional methods of flood level forecast are being used for both the sites for flood forecast. Most of the work is being done manually and performance is satisfactory. A mathematical model for flood forcasting by using software like MIKE-11 etc.Shall be attempted and be revalidated by actual hydrological condition during floods at site.**

Satellite images and weather reports available at website of Indian Meteorological Department also helped a lot in monitoring the movement of storm/ depression zone over basin during monsoon.

Efforts for providing and using communication facilities like Telephone/ mobile phone to all sites are on.

Internet facility at Sub division level particularly at Hoshangabad has been installed to download Weather reports and Satellite images available at different Web sites proved more helpful to formulate accurate forecast.The Facility at Mandla site is also required for better communication to be set up.

The Flood Forecast are being uploaded on http://180.92.171.80/eSWDES/eswdes for general public use.

# Chapter-10

## APPRECIATION OF FORECAST

Narmada Division has started the work of issuing flood level forecasts for two stations in Narmada Basin since 2000.The performance of the Division during last ten years is very fruitful and encouraging as indicated in Annexure -9. During Monsoon 2019, total 36 Nos forecasts were issued for Mandla with 97 % accuracy (forecast lying within +/- 15cm. of the actual level reached) and for Hoshangabad with 100 % accuracy (forecast lying within +/- 15cm of the actual level reached).

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## CONCLUSIONS

Flood forecasting plays a vital role in minimizing flood damages. Existing methods are giving fairly good results. The coordination between Bargi and Tawa Project Authorities to release water can be even more helpful in appreciably reducing severity of flood at Hoshangabad.

This year Monsoon was abnormal & uniform in the Monsoon season in Narmada basin. Rains were evenly distributed all over the catchment. During monsoon period 36 Nos. forecasts for Mandla town and 26 nos. forecasts for Hoshangabad were issued .

Although traditional wireless network performs well except some minor failures, alternative arrangements like mobile or fixed line phone may be made available to sites as standby arrangement, in case of failure of conventional/ traditional wireless network.

Junior Engineer (Comm.) and P.A.Met at Bhopal Division may be posted to avoid any chance of error in Flood Forecast and to upgrade Flood Forecast formulation.

In order to modernize the flood forecasting system at least two/ three officials from Division should be imparted proper training in Basin/ Flood simulation using computers.

The Mobile Phone facility to all sites and the Sub Division & Divisional office involved in FF activity should be made available for timely dissemination of flood warnings in case of emergent situation arising due to failure of wireless communication & normal telephone services.

**Annexure 1 LOCATION OF DIVISION OFFICE, SUB DIVISION OFFICES AND FIELD STATIONS IN NARMADA BASIN.**

| S.No. | Code No | Name of Station | Zero of Gauge | Location | | River/ tributary | District/ State |
|---|---|---|---|---|---|---|---|
| | | | | Lat | Long | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| I | Head Quarters of Division office | | | | | | |
| 1 | Narmada Division, CWC, Bhopal | | | $23^0$14'16" | $77^0$25'36" | | Bhopal / M.P. |
| II | Head Quarters of Sub Div. offices | | | | | | |
| 1 | Upper Narmada Sub Division, CWC, Jabalpur | | | $23^0$ 09'25" | $79^0$ 52'31" | | Jabalpur/ M.P |
| 2 | Middle Narmada Sub Divn. No.1, Hoshangabad | | | $22^0$45'20" | $77^0$43'25" | | Hoshangabad |
| III | Field Stations | | | | | | |
| | 010215001 | Dindori | 660.000 | $22^0$56'52" | $81^0$04'34" | Narmada | Dindori/ M.P. |
| | 010215002 | Manot | 442.000 | $22^0$44'09" | $80^0$30'44" | Narmada | Mandla/ M.P. |
| | 010215003 | Mawai | - | $22^0$30'00" | $81^0$04'15" | | Mandla/ M.P. |
| | 010215004 | Mohgaon | 447.000 | $22^0$ 45'57" | $80^0$ 37'22" | Burhner | Mandla/ M.P. |
| | 010215005 | Mukki | 89.000 | $22^0$ 8'59" | $80^0$ 39'54" | Banjar | Balaghat/ M.P |
| | 010215007 | Mandla | 432.130 | $22^0$ 35'57" | $80^0$ 21'50" | Narmada | Mandla/ M.P. |
| | - | Bargi Dam | -- | $22^0$56'25" | $79^0$55'23" | Narmada | Jabalpur/M.P |
| | 010215011 | Barmanghat | 306.000 | $23^0$ 01'51" | $79^0$ 00'56" | Narmada | Narsingpur/ M.P. |
| | 010215016 | Pachmarhi | - | $22^0$ 27'45" | $78^0$ 25'29" | - | Hoshangabad/M.P |
| | 010215017 | Tawa Nagar | 308.762 | $22^0$ 33'48" | $77^0$ 58'34" | Tawa | Hoshangabad/M.P |
| | 010215019 | Hoshangabad | 282.000 | $22^0$ 45'22" | $77^0$ 43'58" | Narmada | Hoshangabad/M.P |

**Annexure 2 COMMUNICATION NET WORK**

| Sl. No. | River/ Station | No and Type of Wireless Set |
|---|---|---|
| 1. | Narmada / Dindori | LHP228,15Watts |
| 2. | Burhner/ Mohgaon | KENWOOD T.K.90, 100W/VHF-MOTOROLA |
| 3. | Burhner/Mawai | LHP 228,15 Watts |
| 4. | Narmada/ Manot | VHF-MOTOROLLA |
| 5. | Banjar / Mukki | ECIL-C-5211,15 Watts |
| 6. | Narmada/Mandla | Barrett 530 100 Watts |
| 7. | Narmada / Bargi Dam | BARRETT-530 100Watt |
| 8. | Narmada/Barmanghat | BARRETT-530 |
| 9. | Tawa/Tawa | KENWOOD T.K- 90, 100 W |
| 10. | Denwa/ Pachmarhi | Barrett 530, 100 Watts. |
| 11. | Narmada / Hoshangabad | Barrett 530 100 Watts |
| 12. | Mortakka | ECIL C-5211, 15 Watts |
| 13. | Bhopal control Room | Barrett 530 100 watts |

**Annexure 3 RIVER GAUGING NETWORK IN NARMADA BASIN UP TO HOSHANGABAD**

| Sl.No. | River/ site | Length of River to site in km | Catchment Area up to site in Sqkm | Bank of Station Gauge | Type of Observation/ Site | Commencement year |
|---|---|---|---|---|---|---|
| 1. | Narmada at Dindori | 97 | 2292 | Left | WGDR | 1987 |
| 2. | Banjar at Mukki | 64 | 968 | Right | WGR | 1988 |
| 3. | Narmada at Manot | 265 | 4667 | Right | WGDRSWQ | 1976 |
| 4 | Burhner at Mohgaon | 160 | 4090 | Right | WGDRSWQ | 1977 |
| 5. | Narmada at Mandla | 295 | 13000 | Right | WGRFF | 1974 |
| 6. | Narmada at Bargi Dam | 350 | 14561 | Left | WGR | 2001 |
| 7. | Narmada at Barmanghat | 526 | 26453 | Right | WGDRSWQ | 1970 |
| 8. | Tawa at Tawa D/S | 126 | 6060 | Left | WGR | 1974 |
| 9 | Narmada at Hoshangabad | 676 | 44548 | Left | WGDRSWQFF | 1970 |

**Annexure 4 SALIENT FEATURES OF NARMADA BASIN**

| SI. No. | Name of Sub Basin/ Sub Division | Bank | Length in km | Catchment in Sq km | % area with reference to total area |
|---|---|---|---|---|---|
| 1 | Upper Narmada up to Mandla | Main | 295 | 13000 | 13.2 |
| 2 | Middle Narmada Mandla to Hoshangabad | Main | 381 | 25210 | 25.5 |
| 3. | Tawa | Left | 172 | 6338 | 6.4 |
| 4. | Lower Narmada from Hoshangabad to confluence to sea near Bharuch | Main | 636 | 54248 | 54.9 |

**Annexure 5 DAILY RAINFALL ASSOCIATED WITH FLOOD SPELL, 2019**

| S.No. | Name of site | First Spell | | | | Second Spell | | | | | Third Spell | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **03/08/19** | **04/08/19** | **05/08/19** | **06/08/19** | **12/08/19** | **13/08/19** | **14/08/19** | **15/08/19** | **16/08/19** | **07/09/19** | **08/09/19** | **09/09/19** | **10/09/19** | **11/09/19** |
| 1 | Dindori | 34.0 | 25.0 | 0.0 | 4.8 | 0.0 | 2.2 | 67.2 | 30.6 | 10.0 | 42.6 | 4.6 | 21.0 | 1.2 | 107.2 |
| 2 | Mohgaon | 83.2 | 12.8 | 0.0 | 1.8 | 0.0 | 0.0 | 11.4 | 107.4 | 15.6 | 0.0 | 80.4 | 58.2 | 11.6 | 48.6 |
| 3 | Manot | 39.2 | 25.6 | 1.2 | 0.0 | 0.0 | 0.0 | 10.6 | 121.0 | 11.6 | 1.6 | 103.8 | 69.0 | 20.0 | 79.0 |
| 4 | Mukki | 28.2 | 37.4 | 0.4 | 0.4 | 0.0 | 0.0 | 37.6 | 14.8 | 10.6 | 12.4 | 80.8 | 4.0 | 3.2 | 0.0 |
| 5 | Mawai | 21.4 | 99.4 | 1.0 | 1.0 | 0.4 | 1.2 | 60.8 | 50.2 | 3.8 | 0.4 | 133.8 | 6.2 | 2.2 | 2.0 |
| 6 | Mandla | 6.0 | 22.4 | 0.0 | 0.0 | 0.0 | 0.0 | 20.85 | 78.0 | 8.0 | 0.8 | 0.8 | 57.8 | 14.6 | 2.4 |
| 7 | Bargi Nagar | 2.8 | 23.8 | 2.6 | 2.6 | 0.0 | 0.0 | 27.2 | 96.4 | 0.6 | 2.0 | 2.0 | 84.4 | 2.4 | 7.2 |
| 8 | Barman | 4.2 | 10.8 | 0.0 | 0.0 | 0.0 | 0.0 | 37.0 | 45.2 | 2.0 | 42.6 | 42.6 | 92.4 | 10.2 | 20.4 |
| 9 | Tawa Dam | 33.4 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 9.6 | 38.8 | 1.0 | 2.8 | 2.8 | 79.4 | 13.2 | 40.2 |
| 10 | Pachmarhi | 22.0 | 6.4 | 0.0 | 0.0 | 0.0 | 0.0 | 70.2 | 80.0 | 15.0 | 31.4 | 31.4 | 71.6 | 7.2 | 59.2 |
| 11 | Hoshangabad | 61.4 | 39.6 | 0.0 | 0.0 | 0.0 | 0.0 | 14.6 | 40.6 | 17.8 | 2.8 | 2.8 | 50.8 | 24.2 | 49.8 |

Note:-Other spell not associated with flood forecast

**Annexure 6 FORECAST PERFORMANCE DURING 2019**

| SL.No | Forecasting Station | Total No. Forecast Issued | Variation in Forecast with Actual | |
|---|---|---|---|---|
| | | | Within +/- 0.15m | Beyond Limit +/- 0.15m |
| 1 | Mandla | 36 | 35 | 01 |
| 2 | Hoshangabad | 26 | 26 | Nil |

**Annexure 7 FORECAST PERFORMANCE FOR LAST TEN YEARS (NARMADA BASIN)**

| Narmada at Mandla (Flood level) Commencement year 1989 | | | |
|---|---|---|---|
| Year | Total Forecast | Within +/- 15 cm | % |
| 2010 | 0 | 0 | - |
| 2011 | 7 | 7 | 100 |
| 2012 | 0 | 0 | - |
| 2013 | 0 | 0 | - |
| 2014 | 13 | 13 | 100 |
| 2015 | 02 | 02 | 100 |
| 2016 | 09 | 09 | 100 |
| 2017 | 0 | 0 | - |
| 2018 | 07 | 06 | 85 |
| 2019 | 36 | 35 | 97 |

| Narmada at Hoshangabad (Flood level) Commencement year 1973 | | | |
|---|---|---|---|
| Year | Total Forecast | *Within +/- 15 cm* | *%* |
| 2010 | 0 | *0* | - |
| 2011 | 0 | *0* | - |
| 2012 | 15 | *15* | *100* |
| 2013 | 47 | 46 | 97.9 |
| 2014 | 0 | 0 | - |
| 2015 | 0 | 0 | - |
| 2016 | 05 | 05 | 100 |
| 2017 | 0 | 0 | - |
| 2018 | 0 | 0 | - |
| 2019 | 26 | 26 | 100 |

**Annexure 8 COMPARISION OF FORECAST PERFORMANCE OF 2018 WITH LAST 10 YEARS UP TO 2019**

| River | Station | Percentage Accuracy from 2010 to 2018 | Percentage Accuracy 2019 |
|---|---|---|---|
| Narmada | Mandla | 97 % | 97 % |
| Narmada | Hoshangabad | 99.47 % | 100 % |

**Annexure 9 OVER ALL PERFORMANCE FOR THE LAST10 YEARS**

| Year | Total forecast issued | Forecast within admissible limit | Overall performance of the Division in % | Forecasting Division |
|---|---|---|---|---|
| 2010 | 0 | 0 | 0 | Narmada Division, CWC, Bhopal |
| 2011 | 7 | 7 | 100 | -do- |
| 2012 | 15 | 15 | 100 | -do- |
| 2013 | 47 | 46 | 97.9 | -do- |
| 2014 | 13 | 13 | 100 | -do- |
| 2015 | 02 | 02 | 100 | -do- |
| 2016 | 14 | 14 | 100 | -do- |
| 2017 | 0 | 0 | 0 | -do- |
| 2018 | 07 | 06 | 85 | -do- |
| 2019 | 62 | 61 | 98 | -do- |

**Annexure 10 DURATION AND PEAK OF FLOOD WAVES OF NARMADA BASIN DURING MONSOON 2019**

| SI.No | **Forecast** | **Flood wave** |
|---|---|---|
| 1. | MANDLA | 1 |
| | I) Peak(m) | 438.880 Meter 21.00 hrs dated 08.09.2019 |
| | II) Duration | 16 hrs. |
| | a) Above warning Level 437.2 m . | 16 hrs |
| | Total hours | 16 hrs |
| | b) Above danger Level 437.8 m | 12 hrs |
| | Total hours | 16 hrs |
| | c) Forecast issued | 36 |
| | d) Forecast with in limit | 35 |
| 2. | HOSHNAGABAD | |
| | I) Peak(m) | 294.700 meter, 00.00 hrs. dated 11.09.2019 |
| | II) Duration | 65 |
| | **a) Above warning Level 292.83 mt** | 65 |
| | **b) Above danger Level 293.83** | 19 |
| | c) Forecast issued | 26 |
| | d) Forecast with in limit | 26 |

**Annexure 11 Flood/ Heavy Rain Fall Damage-2019**

| SL. No. | Name of District | Area affected/Village | Population affected (in lakh) | Damage to crops | | Damage to Houses/Huts | | Cattle lost | | Human lives lost | Damage to public utilizes in Rs Crores | Total Damage to crops, House & public utilizes etc Col. 5(b)+6(b) +7(b)-9 | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Area in M.Ha | Value in Rs. crore | Nos | Value in Rs. crore | Nos | Value in Rs. crore | | Value in Rs. crore | Value in Rs.crore | |
| 1 | 2 | 3 | 4 | 5(a) | 5(b) | 6(a) | 6(b) | 7(a) | 7(b) | 8 | 9 | 10 | 11 |
| 1 | Mandla* | | | | | | | | | | | | - |
| 2 | Hoshangabad* | | | | | | | | | | | | |

***Note: The flood damage report for Mandla and Hoshangabad have not been received from Revenue Department, Govt. of M.P.**

**Annexure 12 Weather Reports received from IMD during the flood days**

Statement showing heavy rainfall warnings and QPF received from IMD during floods waves 2019

| Sl.No. | E-mail received from | Time and Date | Heavy rainfall warning | QPF Range mm |
|---|---|---|---|---|
| 1. | FMO, AHMEDABAD | 09:20 hrs/ 08.08.2019 | Heavy to very heavy rain would occur likely at many places in upper Narmada Basi and Narmada Hoshangabad to Sardar Sarovar | 51-100 |
| 2. | FMO, AHMEDABAD | 09.20 hrs/ 09.08.2019 | Heavy to very heavy rain would occur likely at many places in lower Narmada Basi and Narmada Hoshangabad to Sardar Sarovar | 51-100 |
| 3. | FMO, AHMEDABAD | 09.20 hrs/ 14.08.2019 | Heavy to very heavy rain would occur likely at many places in upper Narmada Basi and Narmada Hoshangabad to Sardar Sarovar | 51-100 |
| 4. | FMO, AHMEDABAD | 09:10 hrs/ 15.08.2019 | Heavy to very heavy rain would occur likely at many places in middle Narmada Basi and Narmada Hoshangabad to Sardar Sarovar | 51-100 |
| 5. | FMO, AHMEDABAD | 09:15 hrs/ 09.09.2019 | Heavy to very heavy rain would occur likely at many places in Narmada Hoshangabad to Sardar Sarovar | 51-100 |
| 6. | FMO, AHMEDABAD | 13.20 hrs./ 10.09.2019 | Heavy to very heavy rain would occur likely at many places in Narmada Hoshangabad to Sardar Sarovar and lower Narmada | 51-100 |
| 7. | FMO, AHMEDABAD | 09.20 hrs/ 11.09.2019 | Heavy to very heavy rain would occur likely at many places in Narmada Hoshangabad to Sardar Sarovar | 51-100 |
| 8. | FMO, AHMEDABAD | 13.30 hrs/ 12.09.2019 | Heavy to very heavy rain would occur likely at many places in Narmada Hoshangabad to Sardar Sarovar | 51-100 |
| 9. | FMO, AHMEDABAD | 13.30 hrs/ 13.09.2019 | Heavy to very heavy rain would occur likely at many places in Narmada Hoshangabad to Sardar Sarovar | 51-100 |

**Sitewise Photographs**

**Barginagar**

नई दुनिया

नई सोच, नया अंदाज

जबलपुर, इंदौर, भोपाल (नवदुनिया), ग्वालियर, रायपुर और बिलासपुर से एक साथ प्रकाशित

जबलपुर, सोमवार 09 सितंबर 2019

आंद्रस्कू ग्रैंड स्लैम जीतने वाली पहली कनाडाई : खेल पेज

मूसलाधार बारिश से बरगी बांध हुआ लबालब, सभी 21 गेट खोले गए

जबलपुर में बारिश का 52 इंच का कोटा पूरा

नरसिंहपुर, सिवनी व मंडला में कई मार्ग बंद

लगातार बारिश के बाद रविवार को बरगी के सभी गेट खोल दिए गए। ● नईदुनिया

21 गेट बरगी बांध के रविवार को खोले गए। गेटों की ऊंचाई 2 से 5 मीटर तक रखी गई है। इससे ग्वारीघाट, तिलवारा घाट, भेड़ाघाट के तट डूब गए। सायरन बजाकर लोगों को अलर्ट किया गया।

320 किमी लंबाई वाले नर्मदा के जबलपुर से लेकर होशंगाबाद वाले क्षेत्र में बांध प्रबंधन ने अलर्ट जारी किया गया है। सभी गेटों से प्रति सेकंड 10645 क्यूमेक पानी छोड़ा जा रहा है।

422.95 मीटर बांध का जलस्तर रविवार शाम पहुंच गया। जिसे नियंत्रित करते हुए 422.76 मीटर पर स्थिर किया गया। बारिश का 52 इंच का कोटा पूरा हो चुका है।

स्कूलों में आज अवकाश घोषित

जबलपुर जिले के सभी सरकारी व निजी स्कूलों में सोमवार को अवकाश रहेगा। भारी बारिश के अलर्ट के बाद कलेक्टर भरत यादव ने रविवार शाम आदेश जारी कर दिए। महाकोशल के बालाघाट, नरसिंहपुर, सिवनी और मंडला जिलों में भी स्कूलों में अवकाश रहेगा। अन्य जिलों में भी अवकाश घोषित किया गया है।

-पेज 02, 10 व 12 भी पढ़ें।



मंडला। रपटा घाट पर छोटा पुल डूब गया। बड़े पुल पर से नदी को निहारते लोग। ● नईदुनिया

■ महाकोशल-विंध्य के जिलों में शनिवार रात से शुरू हुई बारिश का सिलसिला रविवार को भी दिनभर चलता रहा। इससे नदी-नाले उफान पर आ गए।

■ नरसिंहपुर में तेंदूखेड़ा-डोभी, मुंगवानी-बरहटा व मलाहपिपरिया, धमना-तिंदनी मार्ग बंद हो गए। दमोह, शाहडोल में भी जमकर बारिश हुई

■ सिवनी में भीमगढ़ बांध के 9 गेट खुलने से केवलारी, बालाघाट, गोंदिया, भंडारा में अलर्ट जारी किया गया है। मंडला में नर्मदा खतरे के निशान से ऊपर है

उम्मीद कायम : चांद का चक्कर लगा रहे ऑर्बिटर ने खींची लैंडर की थर्मल इमेज

मिला विक्रम, संपर्क साधने की कोशिश

बेंगलुरु। एजेंसी

## Hoshangabad


## Mandla

**Mandla**

# Manot

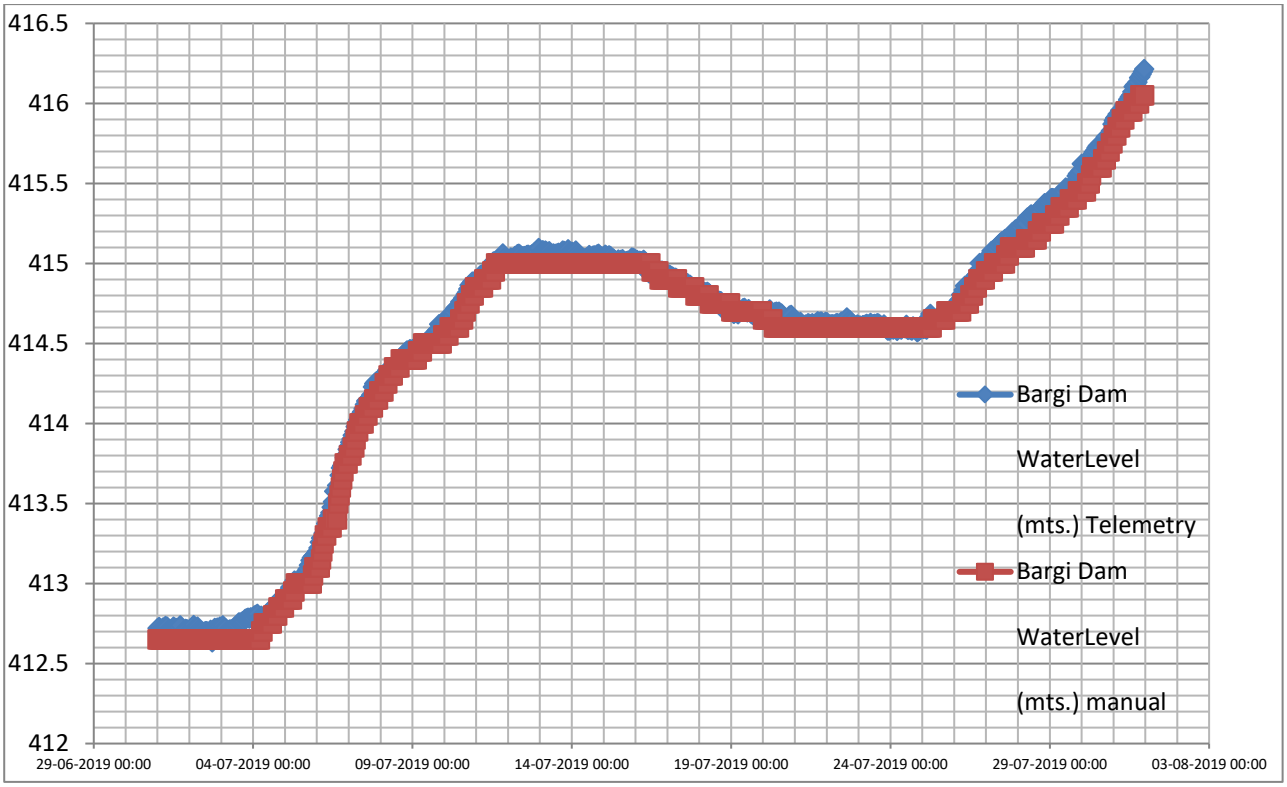

# Mohgaon


## Mukki

## List of User Agencies along with their contact numbers and e-mail addresses.

| Name (Shri/Smt./Ms…) | Designation | Mobile | Mail ID |
|---|---|---|---|
| Chanchal Chakraborty | Sr. Software Developer | 919871356330 | chanchalchakrabortykol@gmail.com |
| Aditya Sharma | CE, NBO, CWC, Bhopal | 919717200563 | cenbo-cwc@nic.in |
| Pardeep Kumar Thakur | SE(C), NBO, Bhopal | 919868565712 | secobhopal-cwc@nic.in |
| Sanjay Kumar Malviya | EE, Narmada Division, Bhopal | 919425079252 | eendb-cwc@nic.in |
| Karan Raghuvanshi | AEE, M.N.S.D.-3, Indore | 919718081172 | mnsd3@yahoo.com |
| Kiran Pramanik | Director(Mon.), NBO, Bhopal | 919711051441 | dirmonbpl@gmail.com |
| CWC, HQ, New Delhi | FMDTE | 011-26182836 | fmdte@nic.in |
| Delhi | FFM | 011-26182836 | ffmcwc@gmail.com |
| FMO, Ahmedabad | Ahmedabad | 079-22858020 | fmoahmedabad@rediffmail.com |
| Sudhi Ranjan Mohanty | Vallabh Bhawan (CS), M.P. | 0755-2441370 | cs@mp.nic.in |
| Pramod Kumar Jhabak | SDE (HQ), ND, Bhopal | 919425004681 | Pramodjhabak-cwc@gov.in |
| Manish Rastogi | Principal Secretary Revenue | 919425469444 | reliefcom@mp.nic.in |
| Vipul Kumar Verma | SDE, M.N.S.D.-1, Hoshangabad | 919425609349 | sdocwchbad@rediffmail.com |
| District Commandant Mandla | DC | 917049163513 | eocmdl@gmail.com |
| N. Ram | AEE, M.N.S.D.-2, Bhopal | 919893179791 | ee_ndb@yahoo.co.in |
| A.K. Shrivastava | A.D.-ll,NBO | 917987447791 | |
| R.S. Bachhav | W/l, ND, Bhopal | 919893693105 | rsbachhav65@gmail.com |
| Jyoti Kushwaha | Senior Computer (NDB) | 918989856208 | kushwaha293jyoti@gmail.com |
| M.P. Raguvanshi | Flood Incharge NVDA MP | 919826317454 | nvdfc11@gmail.com |
| Doorshan Kendra Bhopal | Doorshan Kendra, M.P. | | rnuddkbpl@gmail.com |
| Mahesh Gupta | DD, NBO, CWC, Bhopal | 919460523193 | dirpdbhopal-cwc@nic.in |
| Dr. Jagdish Chandra Jatiya | District Collector Mandla | 919425164003 | dmmandla@nic.in |
| R.S. Parihar | Supdt.of Police Mandla | 917049100446 | sp_mandla@mppolice.gov.in |
| InchargeFF room Revenue Mandla | ff room Revenue mandla | 919826459119 | |
| Incharge Tashildar Mandla | Incharge tashildar Mandla | 919893414794 | |
| Dinesh Waghmare | Nagar Palika mandla CMO | 919424359147 | cmomandla@mpurban.gov.in |
| N.K.Rohit | JE, M.N.S.D.-1, Hoshangabad | 918517007578 | |
| Sanjiv Das | Flood Cell, M.P. | 919425358635 | |
| R.K.Jain | Flood Cell, M.P. | 919406956348 | |
| Sheelendra Singh | District Collector, Hoshangabad | 919425818855 | dmhoshangabad@mp.gov.in |
| M.L. Chhari | SP Hoshangabad | 919425922993 | sp_hoshangabad@mppolice.gov.in |
| K.D Tripathi | ADM | 919981175612 | krishna.d.tripathi@mp.gov.in |
| Aditya Richhariya | SDM(Hoshangabad) | 919425367188 | sdmhoshangabad@gmail.com |
| Rajesh Borasi | Tehsildar | 919425445806 | hoshangabadtehsildar@gmail.com |
| Lalit Kumar | Home Gaurd C.Room Mandla | 919926329866 | eocmdl@gmail.com |
| C.S. Ghatole | SE Tawa Circle | 919425819410 | setawa67@yahoo.com |
| I.D. Kumare | E.E.Tawa | 919425304226 | |
| Arvind Yadav | S.D.O.TawaC.Room | 919424483070 | |
| Rohan Raikwar | Home Gaurd C.Room | 917049163513 | dchgmla15@gmail.com |
| Bharat Kumar Chaurasia | Junior Engineer | 918605998826 | bharatchaurasia1389@gmail.com |
| S.C. Tripathi | EE, Irrigation,Mandla | | eemandla@gmail.com |
| N.D. Jaiswal | SDE | 919643257751 | sde_cwcjabalpur@rediffmail.com |
| NDRF Varanashi | NDRF | 918004931410 | ndrf11up@gmail.com |

**Bargi Dam July 2019**

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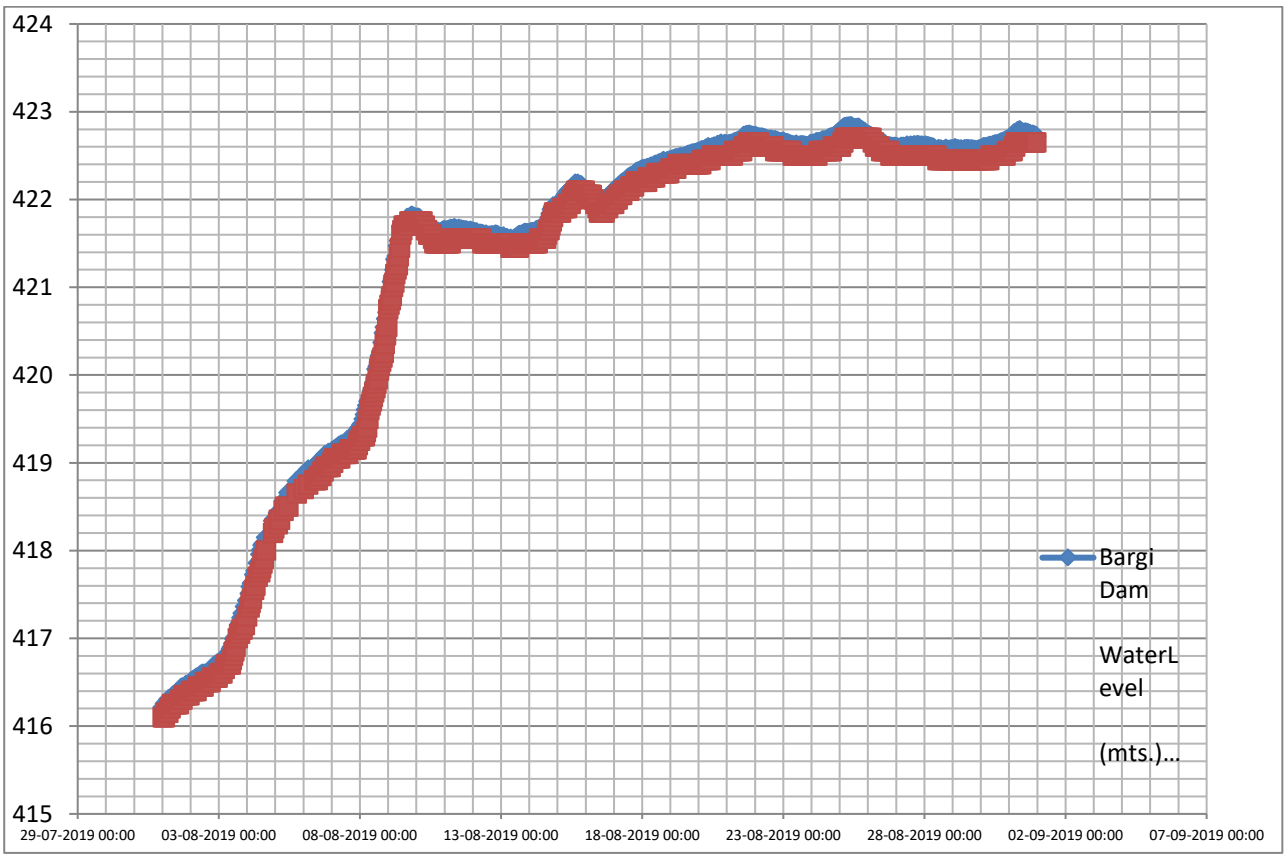

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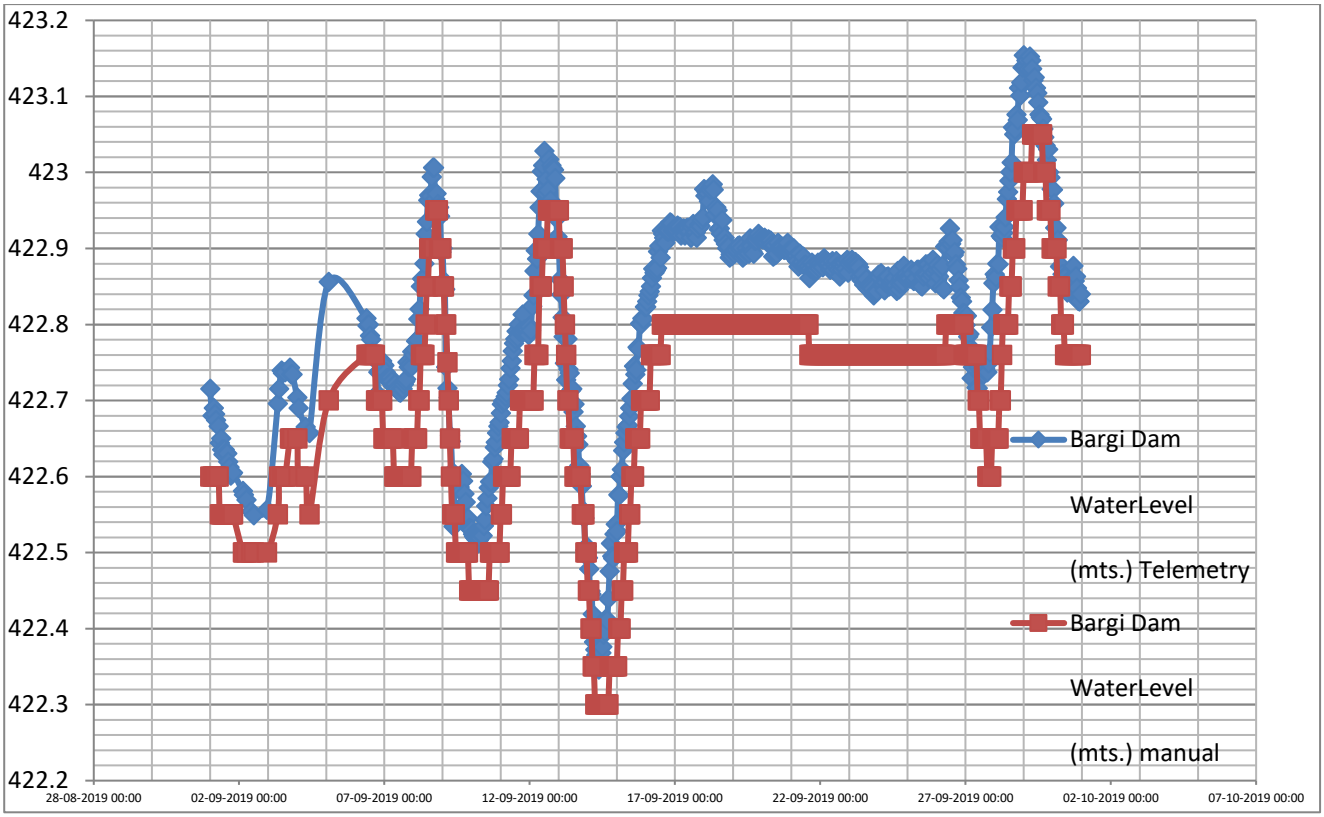


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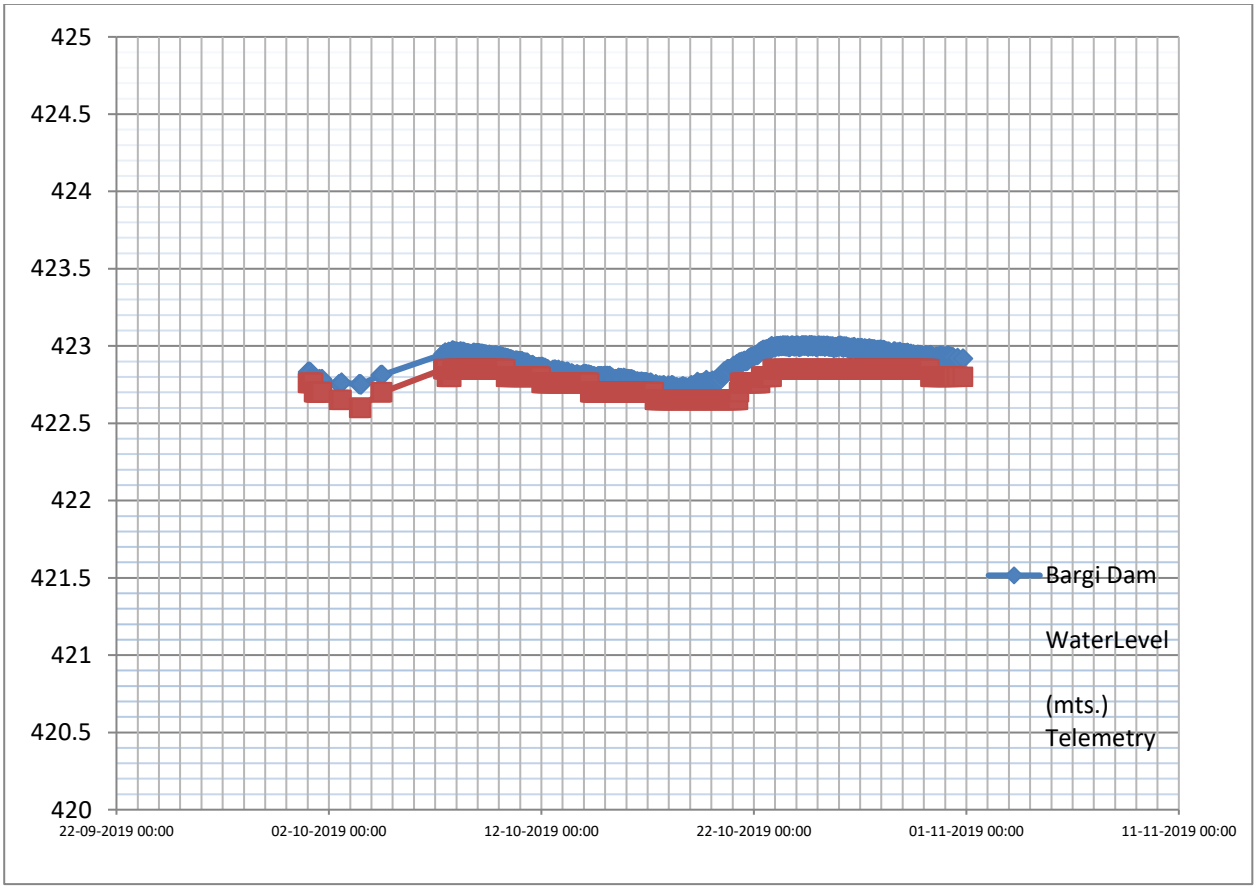

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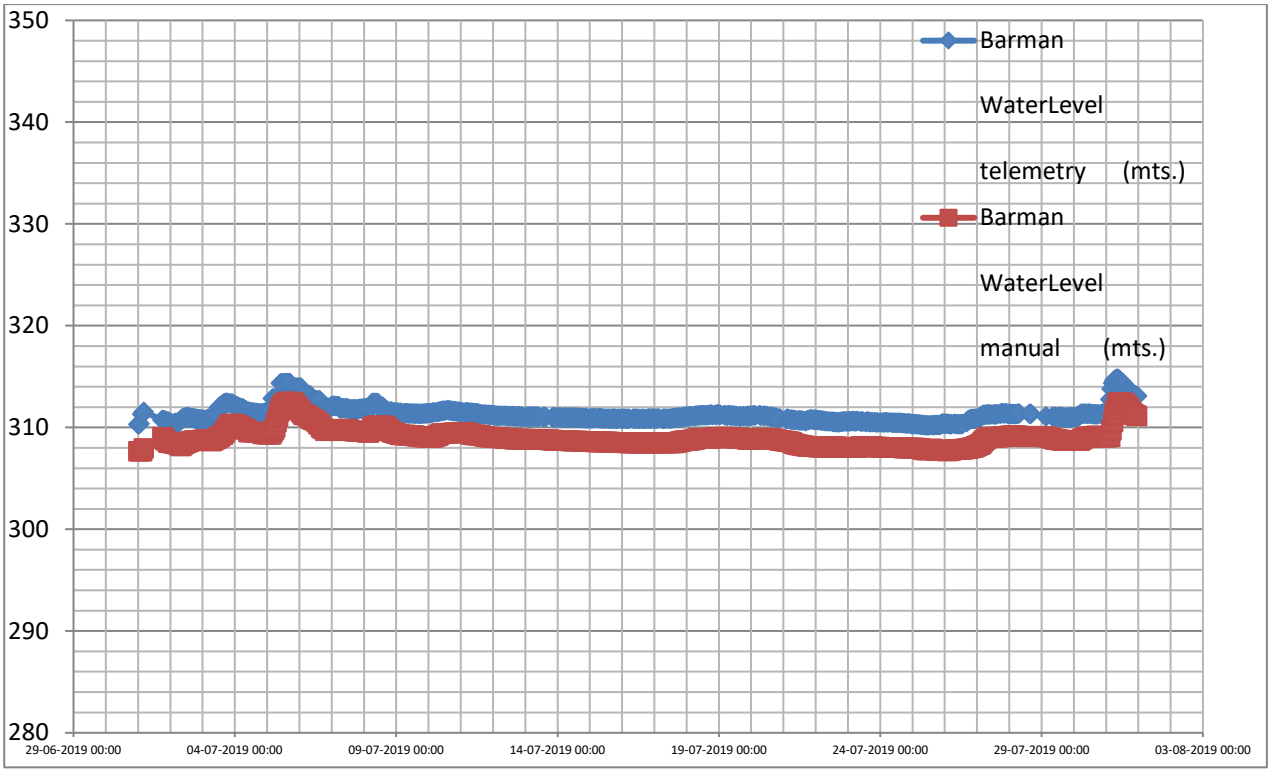


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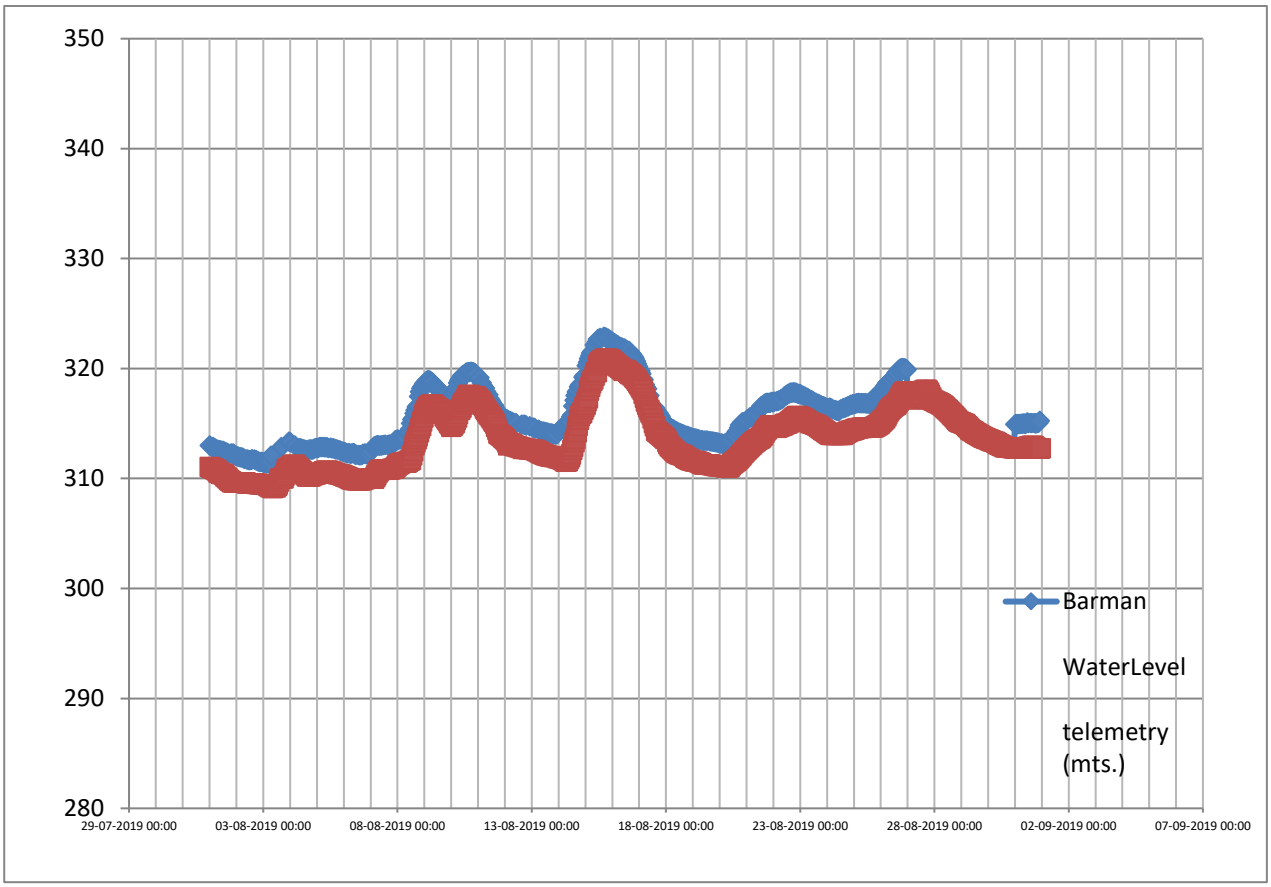

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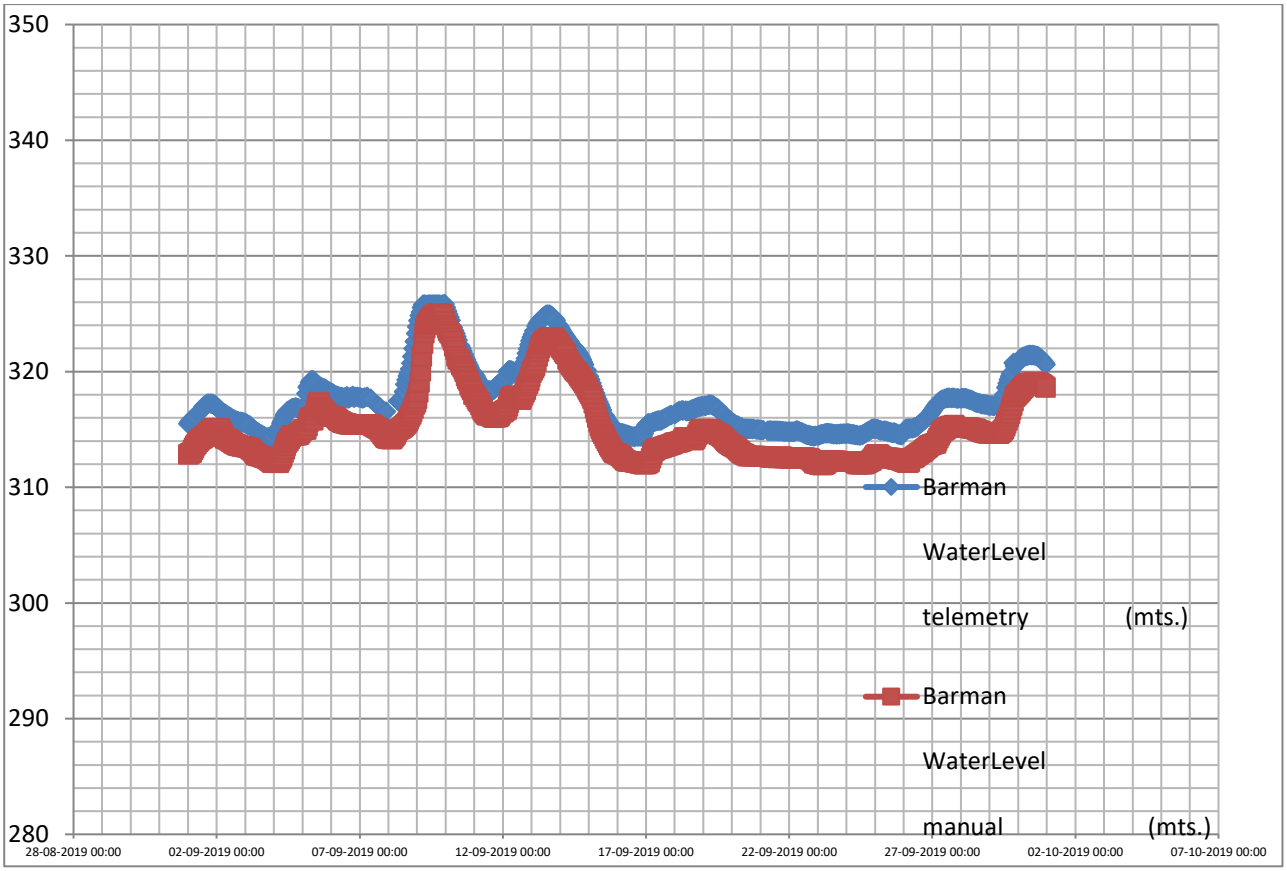


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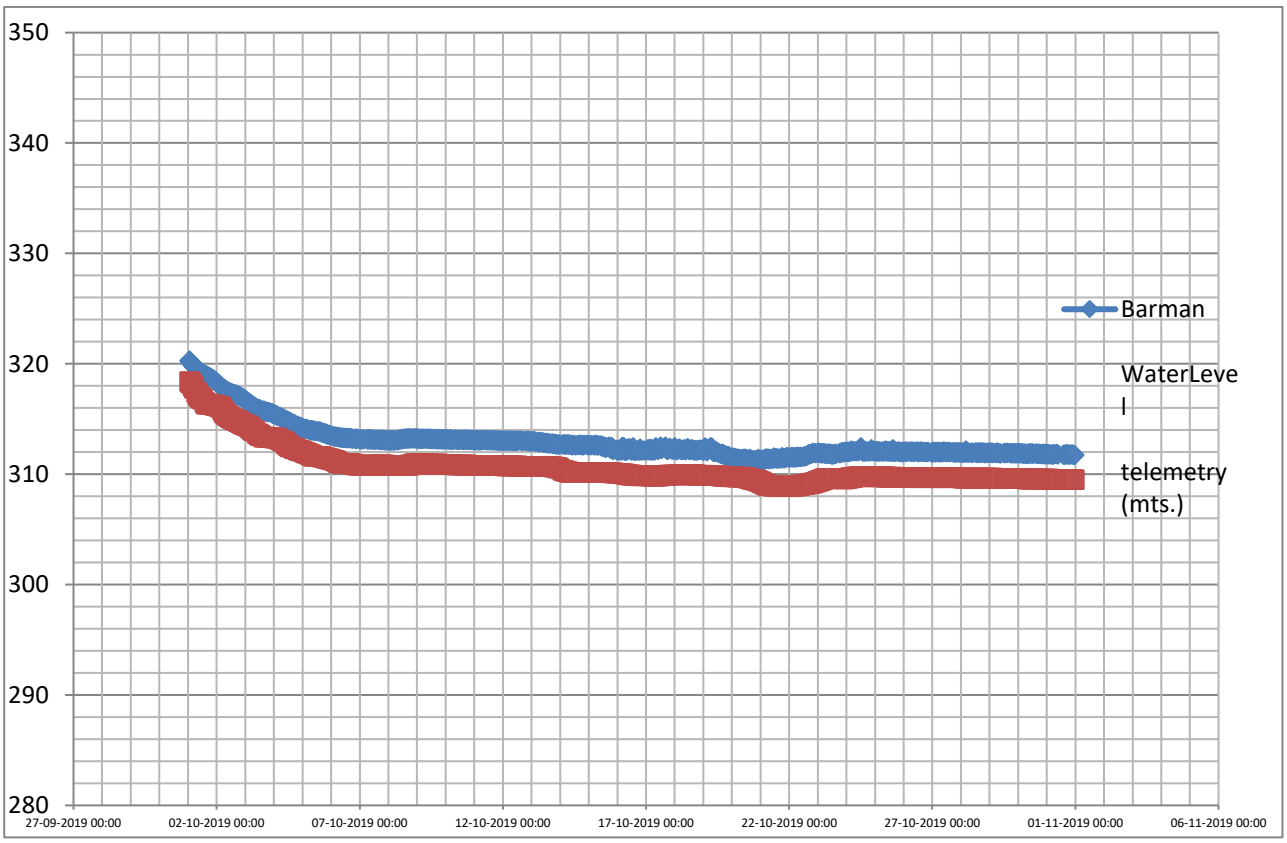

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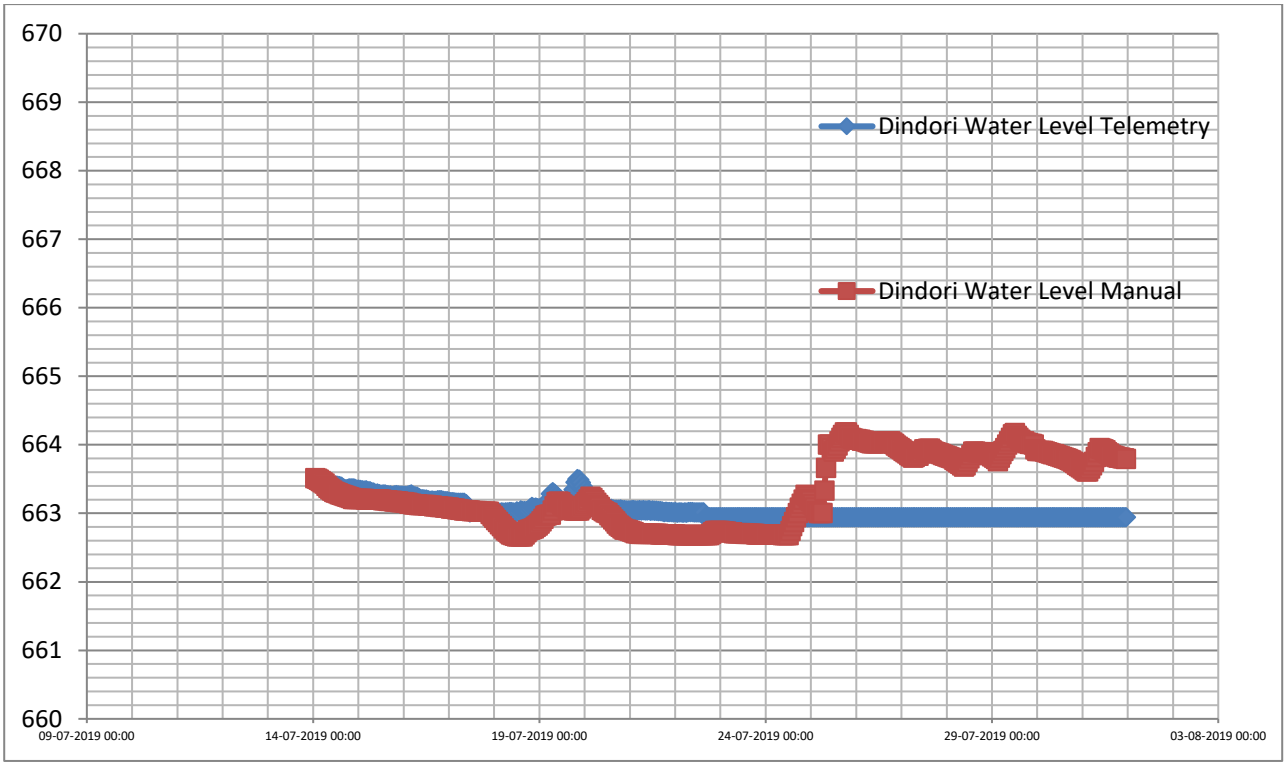


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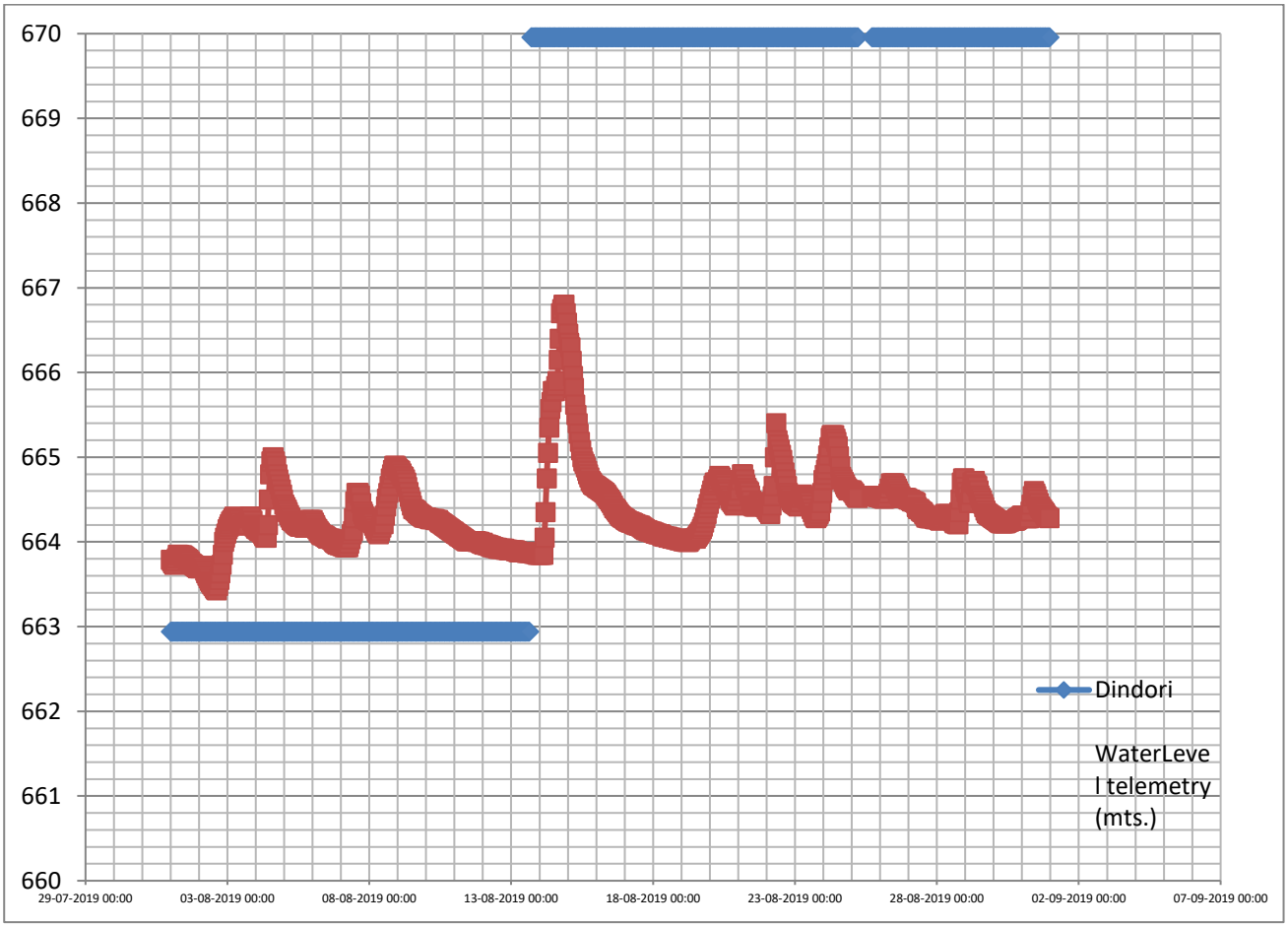

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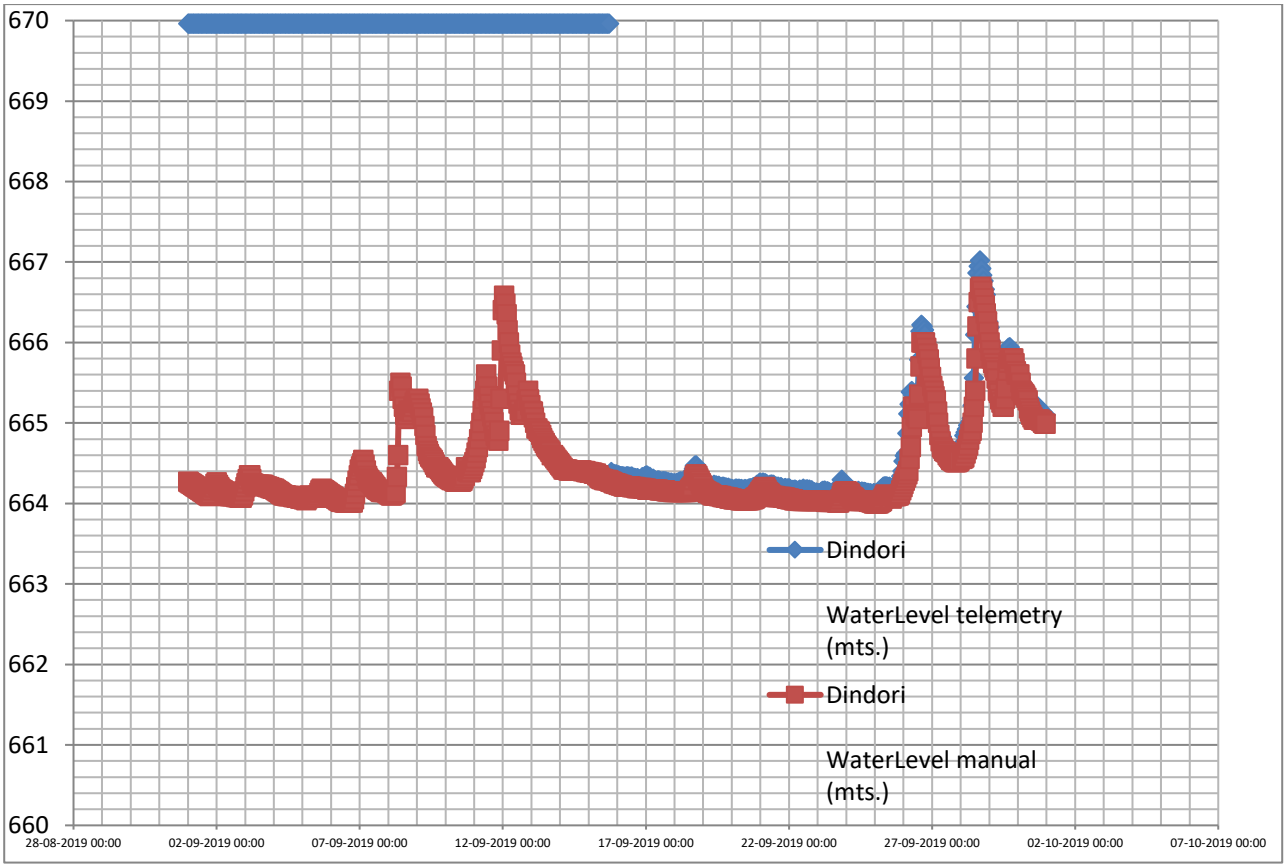


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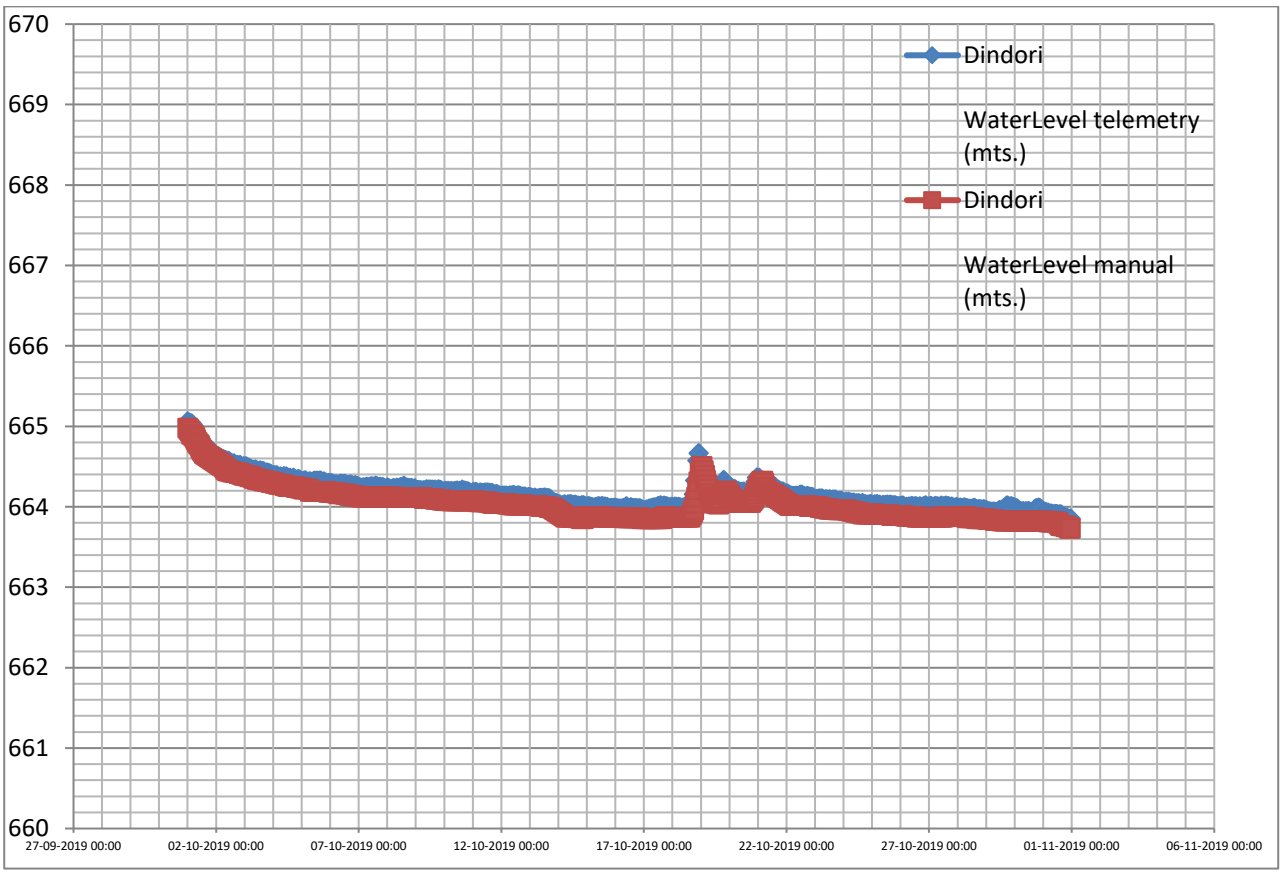

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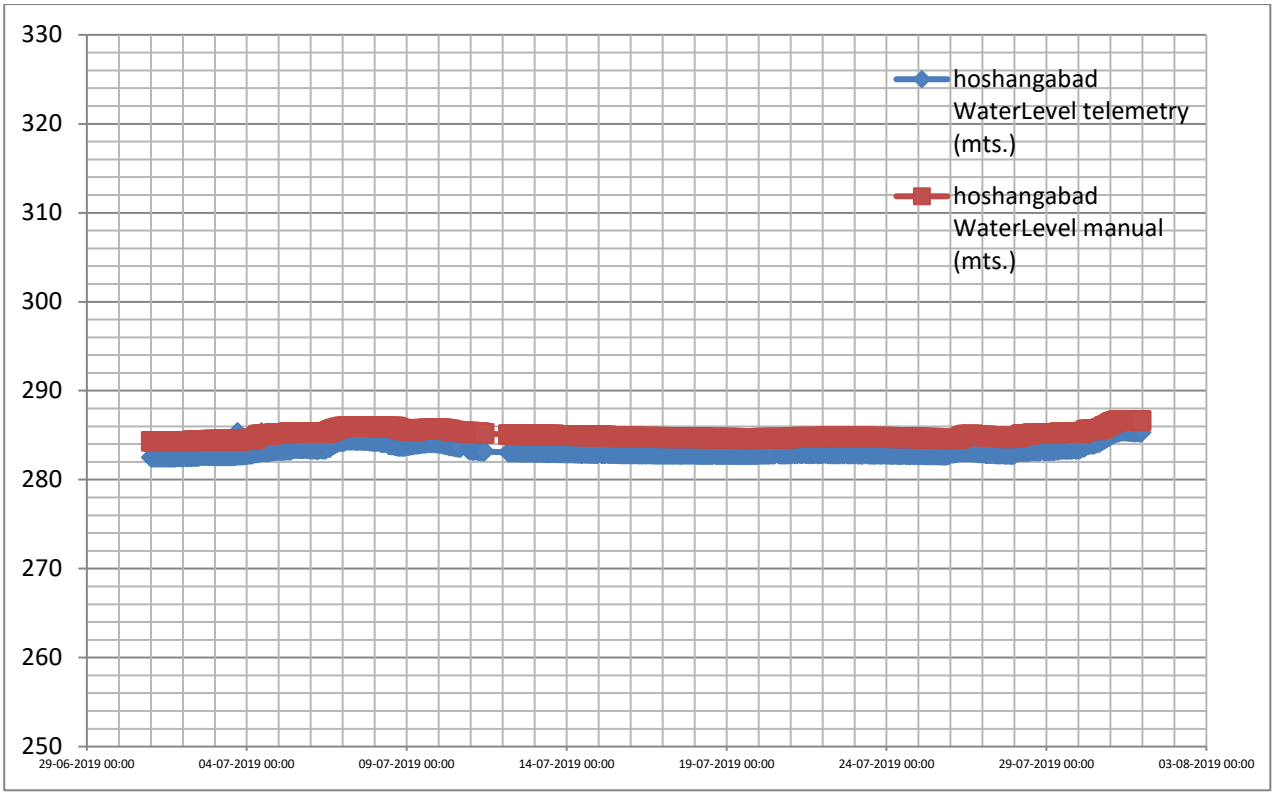


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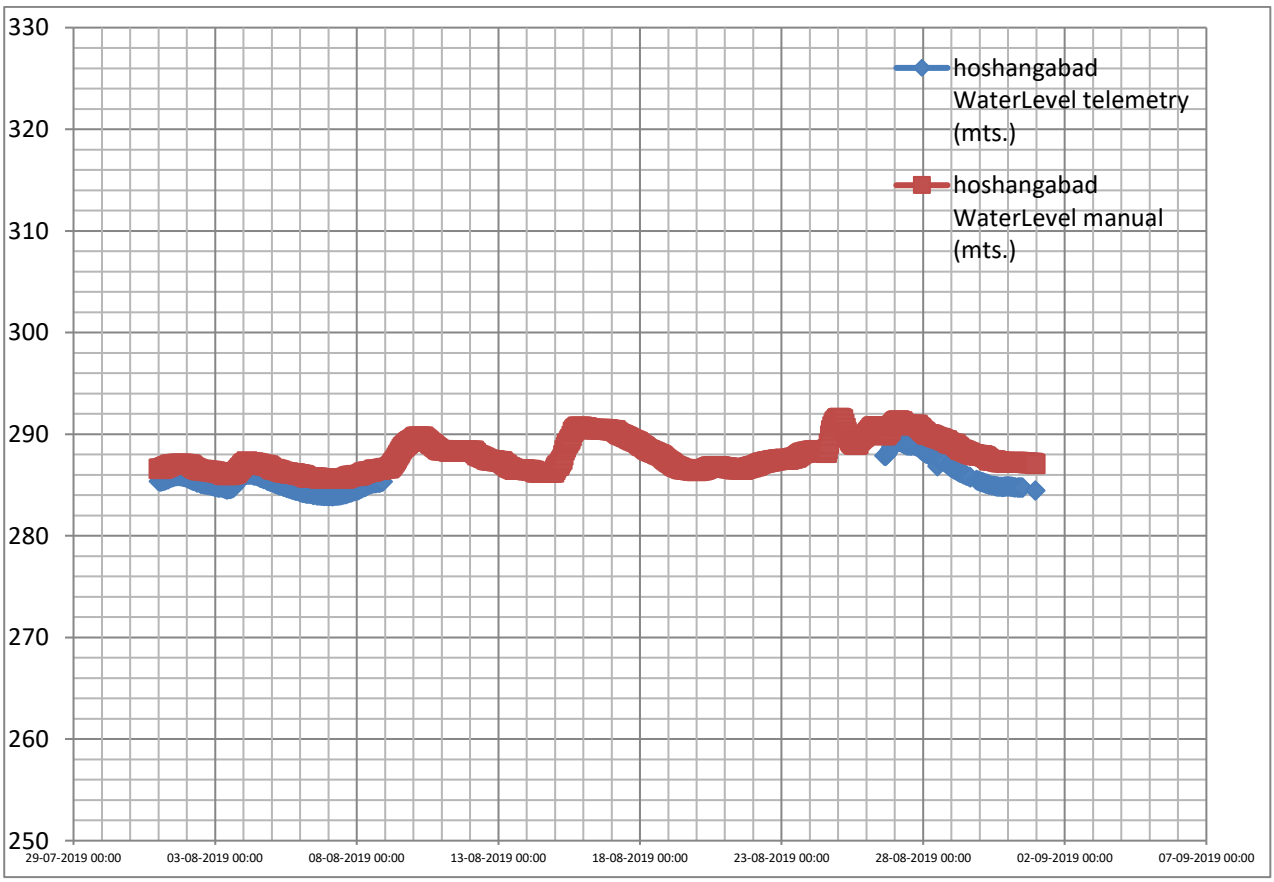

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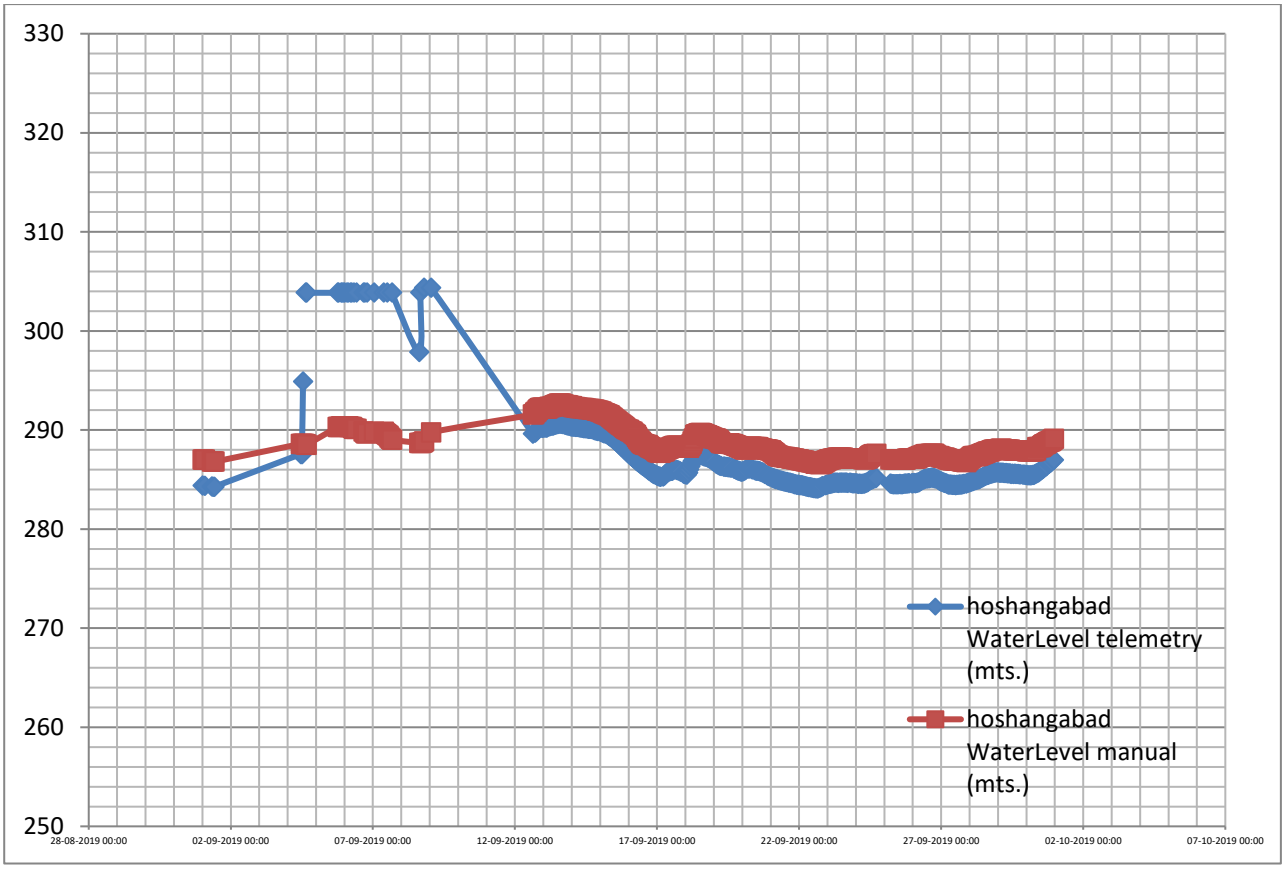


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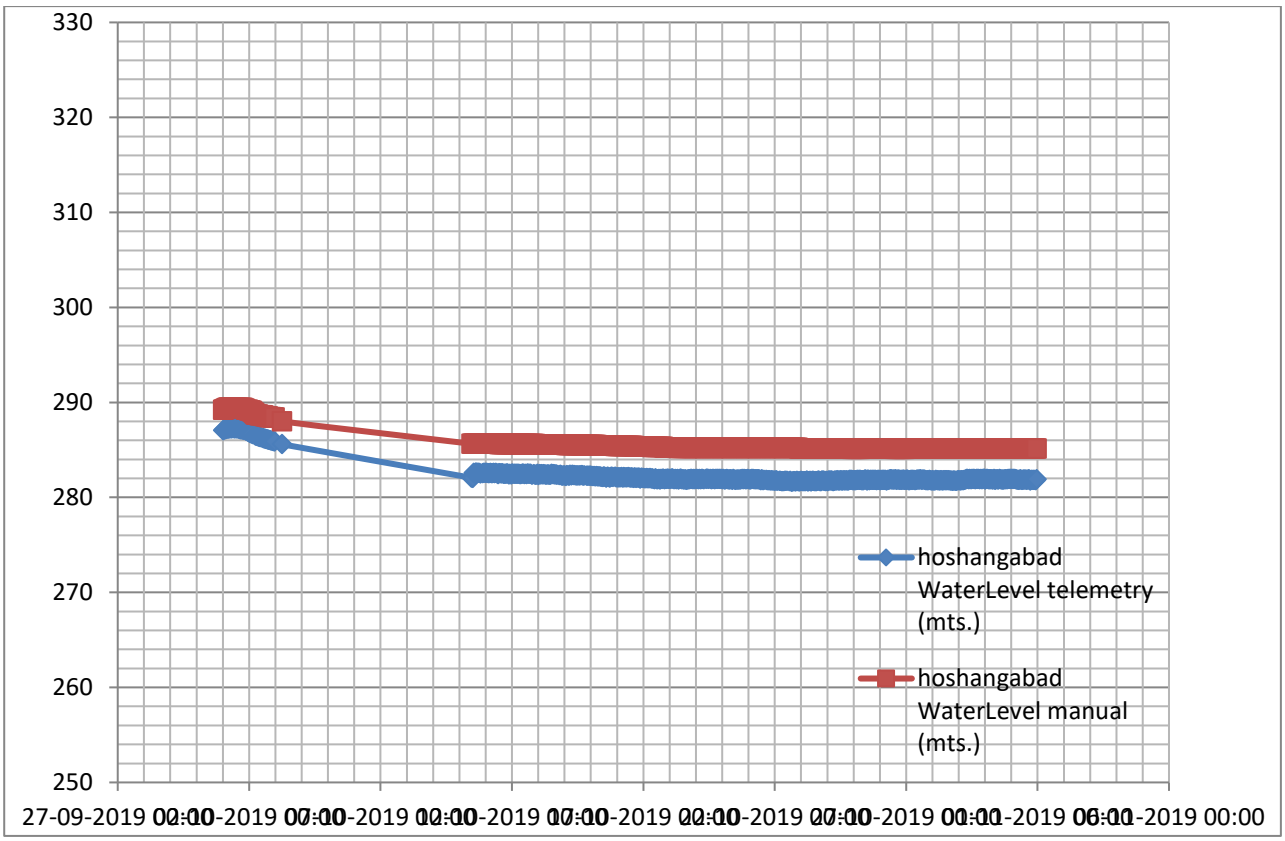
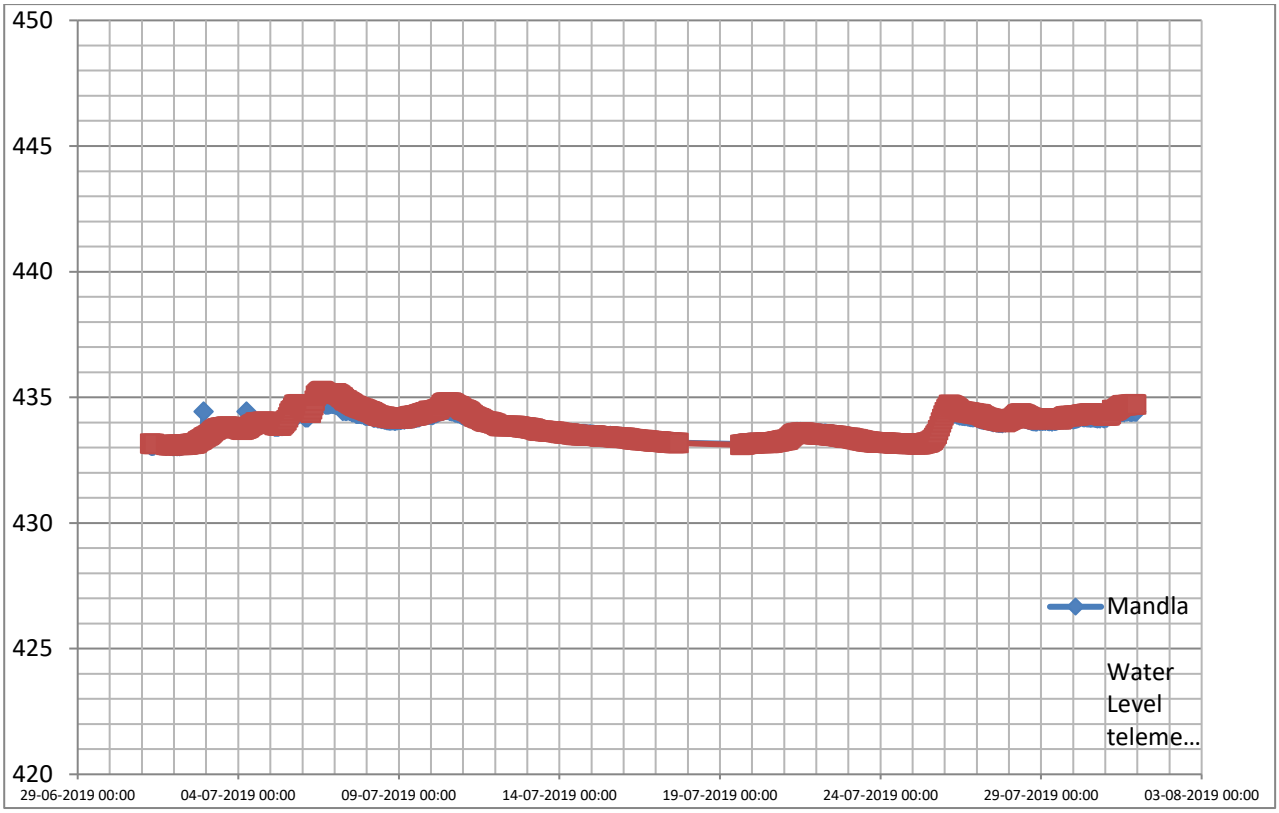


**Mandla July 2019**

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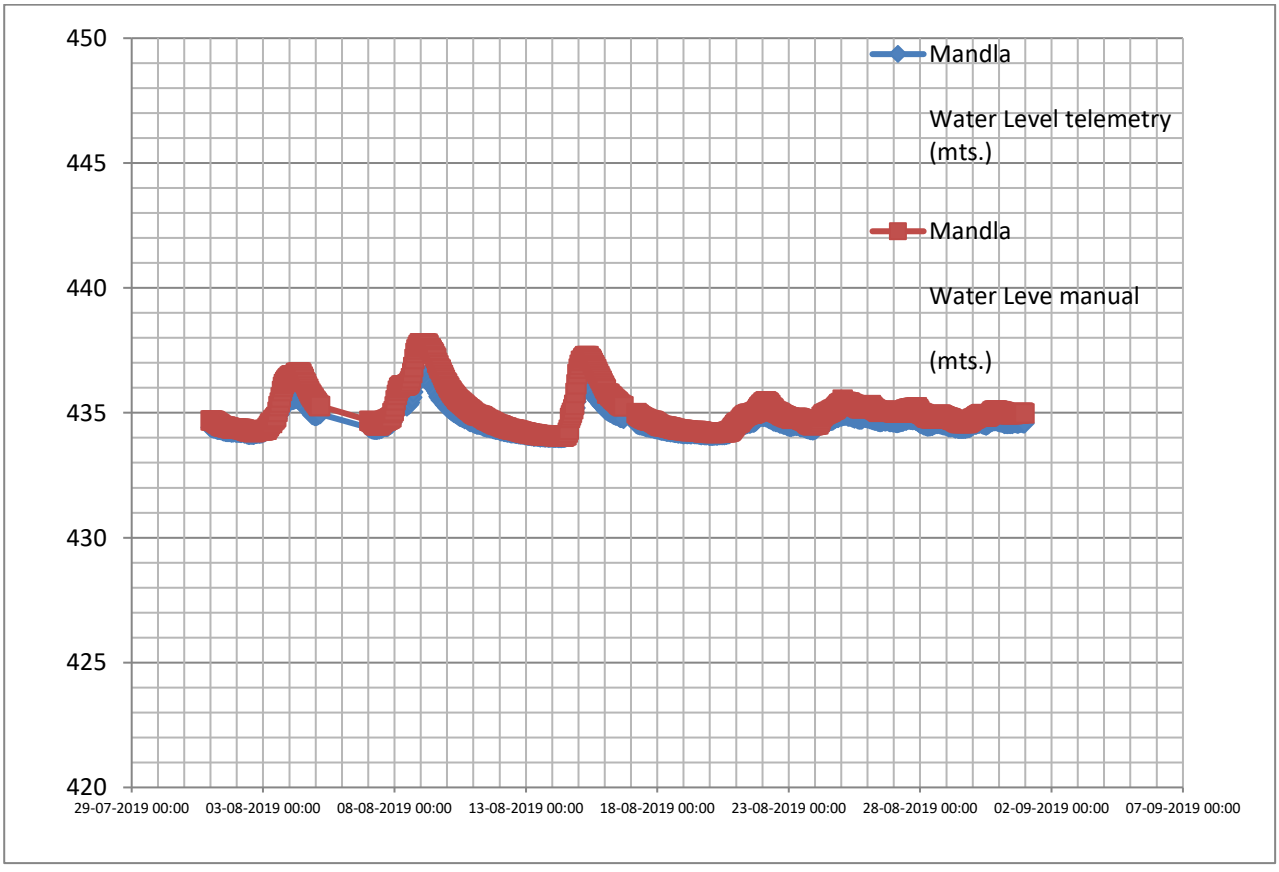

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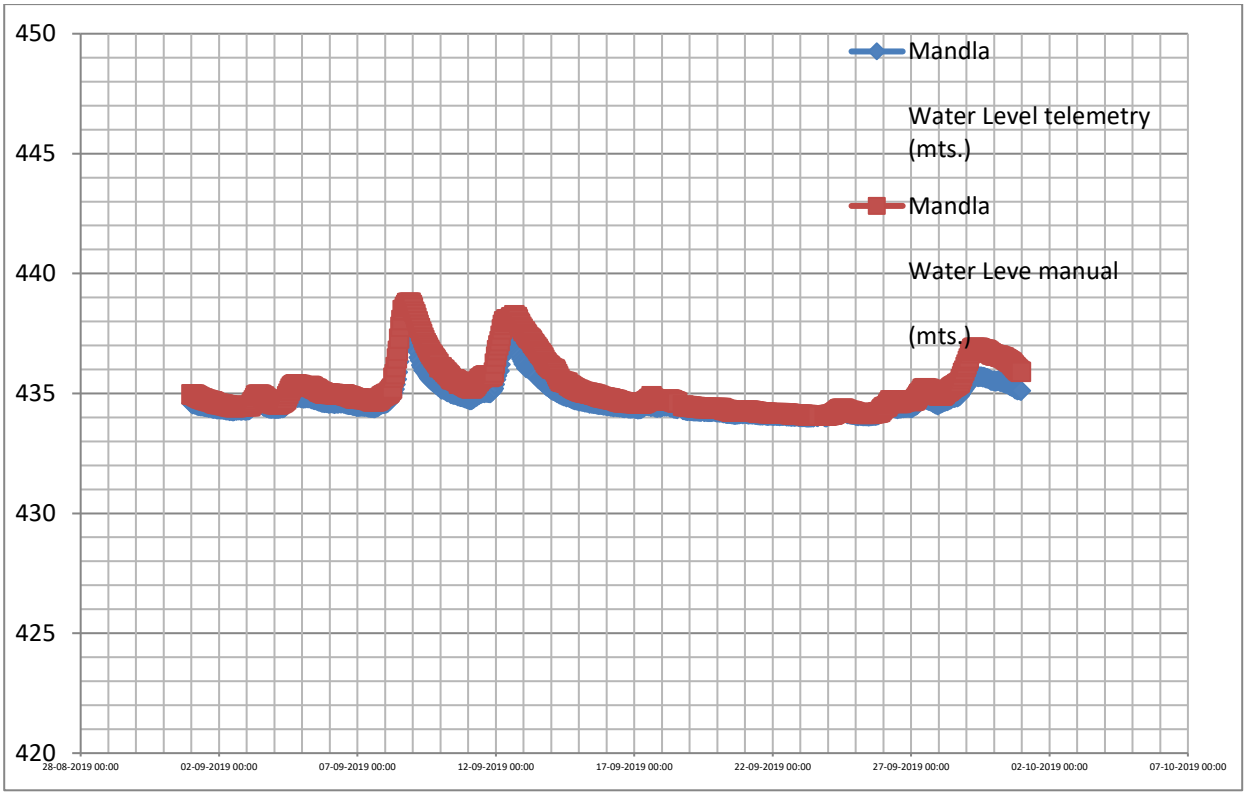


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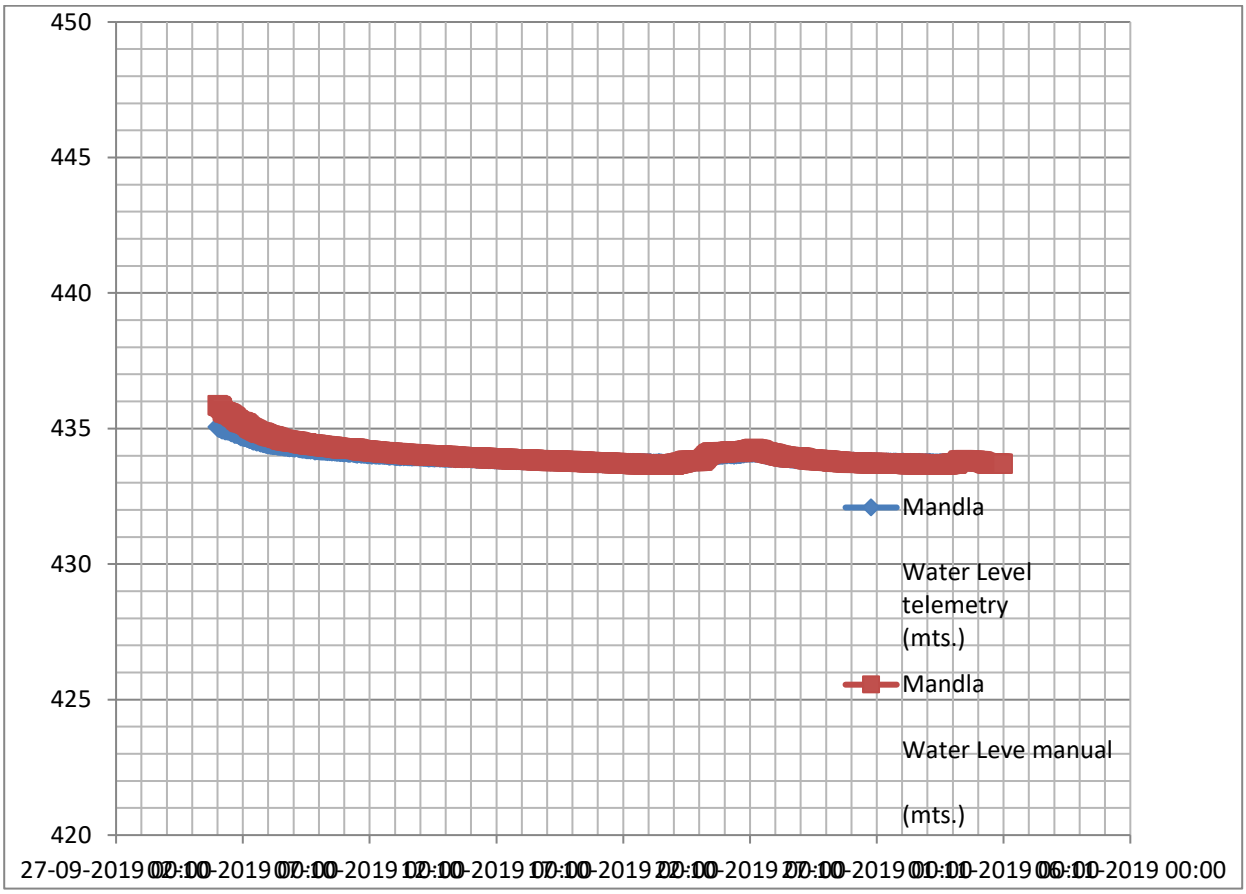
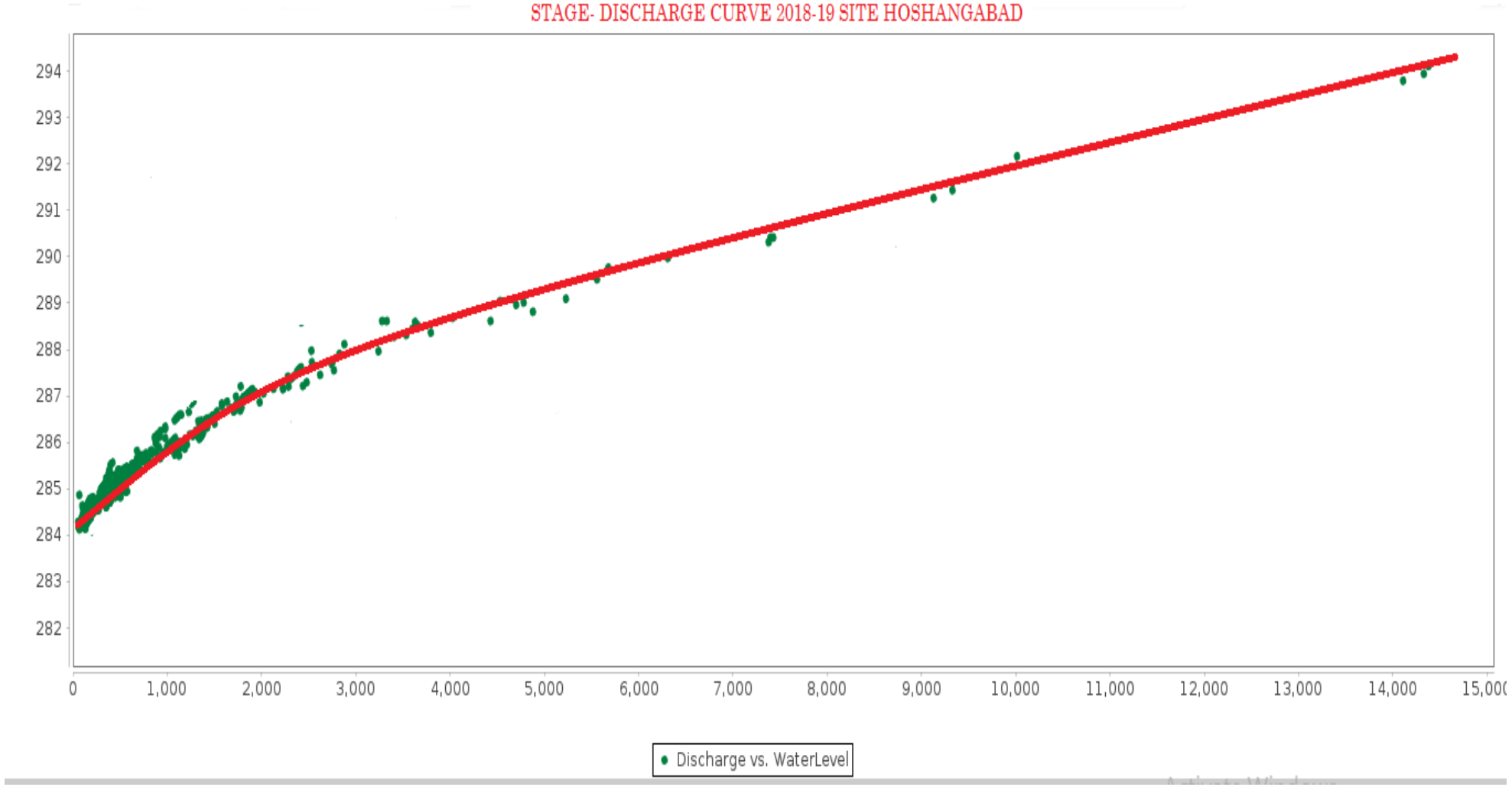
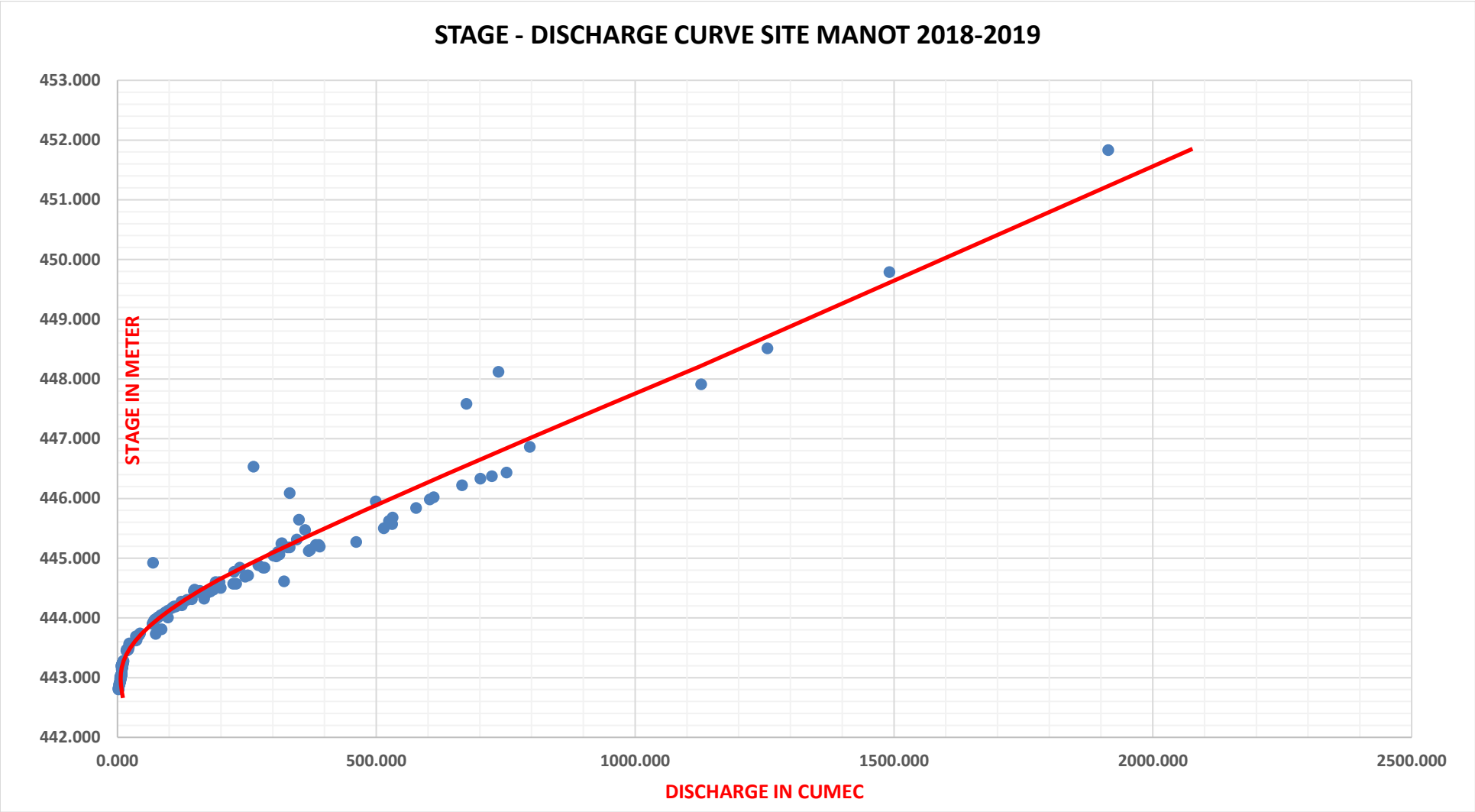
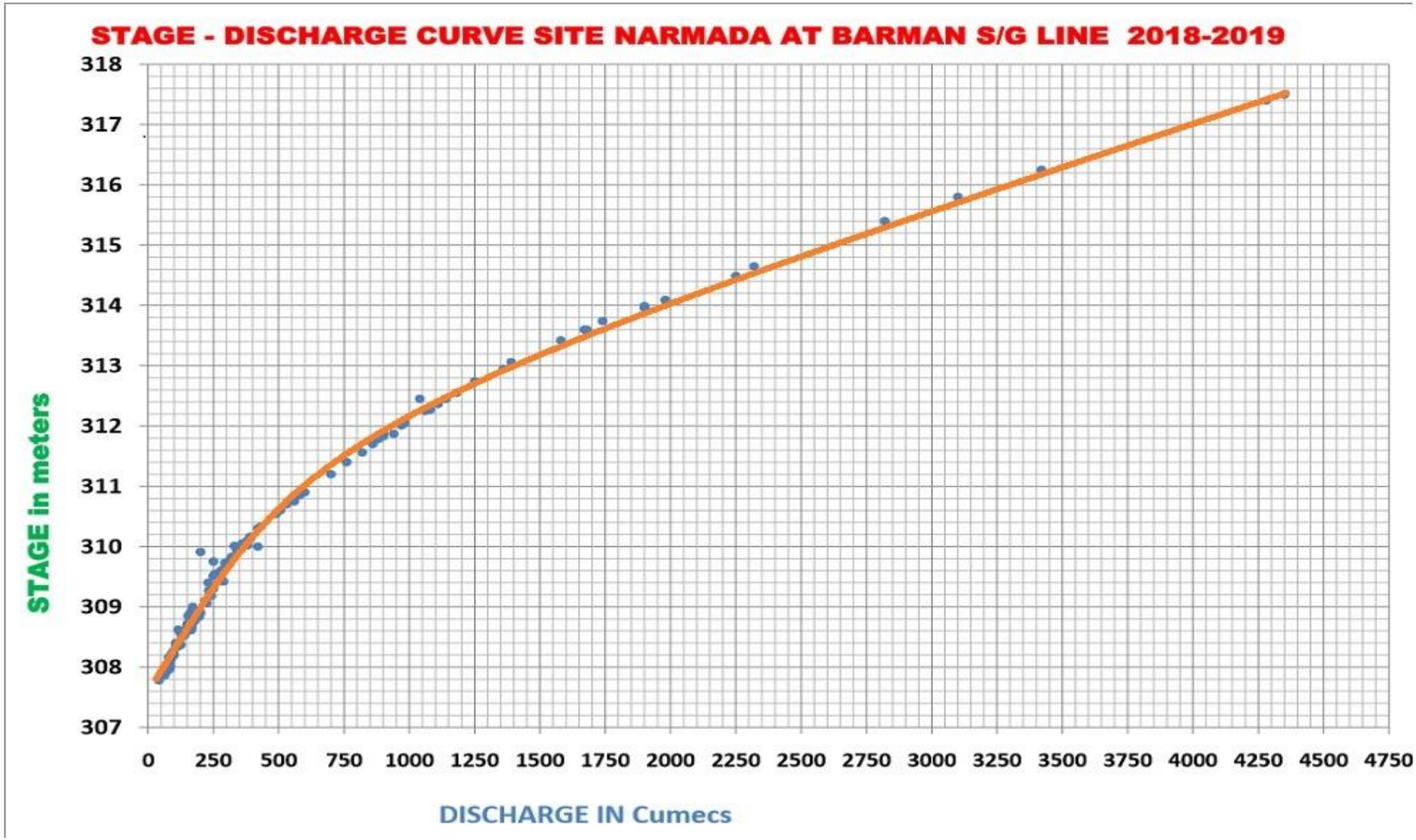


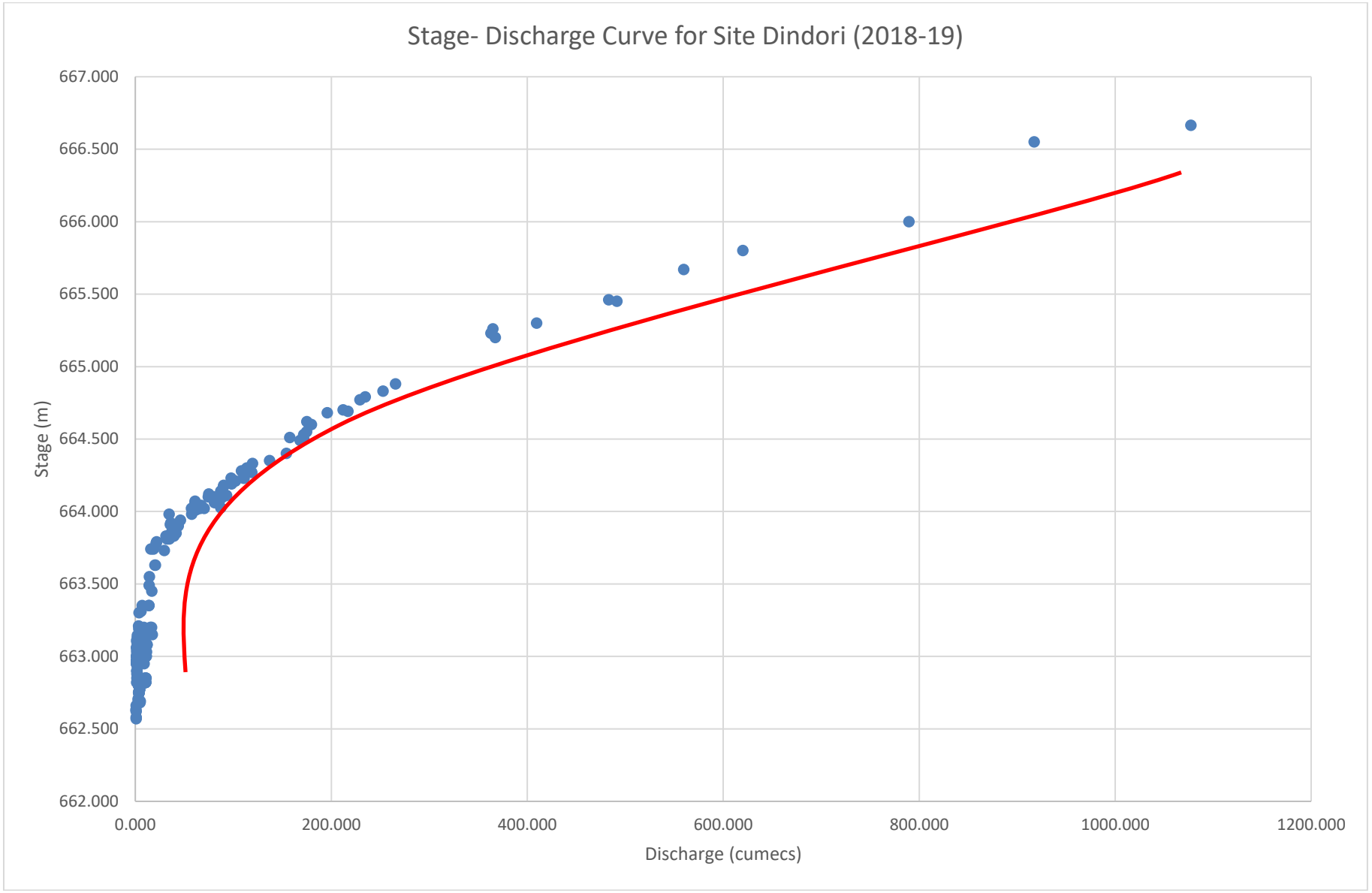
| S.N. | Name of Station | River/Tributary | State | District | Type |
|---|---|---|---|---|---|
| 1. | Dindori | Narmada | M.P. | Dindori | Raingauge and Rainfall |
| 2. | Mohgaon | Burhner | M.P. | Mandla | Raingauge and Rainfall |
| 3. | Manot | Narmada | M.P. | Mandla | Raingauge and Rainfall |
| 4. | Mandla | Narmada | M.P. | Mandla | Raingauge and Rainfall |
| 5. | Mawai | | M.P. | Mandla | Rainfall |
| 6. | Hoshangabad | Narmada | M.P. | Hoshangabad | Raingauge and Rainfall |
| 7. | Bargi | Narmada | M.P. | Jabalpur | Raingauge and Rainfall |
| 8. | Mukki | Banjar | M.P. | Balaghat | Raingauge and Rainfall |
| 9. | Patan | Hran | M.P. | Jabalpur | Raingauge and Rainfall |
| 10. | Sandia | Narmada | M.P. | Hoshnagabad | Raingauge and Rainfall |
| 11. | Barmanghat | Narmada | M.P. | Narsinghpur | Raingauge and Rainfall |
| 12. | Pachmarhi | | M.P. | Hoshnagabad | Rainfall |
| 13. | Tawanagar | Tawa | M.P. | Hoshangabad | Raingauge and Rainfall |

**Stage Discharge Curve Hoshangabad 2019**




STAGE - DISCHARGE CURVE SITE MANOT 2018-2019
453.000
452.000
451.000
450.000
449.000
448.000
447.000
446.000
445.000
444.000
443.000
442.000
STAGE IN METER
0.000
500.000
1000.000
1500.000
2000.000
2500.000
DISCHARGE IN CUMEC


STAGE - DISCHARGE CURVE SITE NARMADA AT BARMAN S/G LINE 2018-2019
STAGE in meters
318
317
316
315
314
313
312
311
310
309
308
307
0
250
500
750
1000
1250
1500
1750
2000
2250
2500
2750
3000
3250
3500
3750
4000
4250
4500
4750
DISCHARGE IN Cumecs


Stage- Discharge Curve for Site Dindori (2018-19)
667.000
666.500
666.000
665.500
665.000
664.500
664.000
663.500
663.000
662.500
662.000
Stage (m)
0.000
200.000
400.000
600.000
800.000
1000.000
1200.000
Discharge (cumecs)

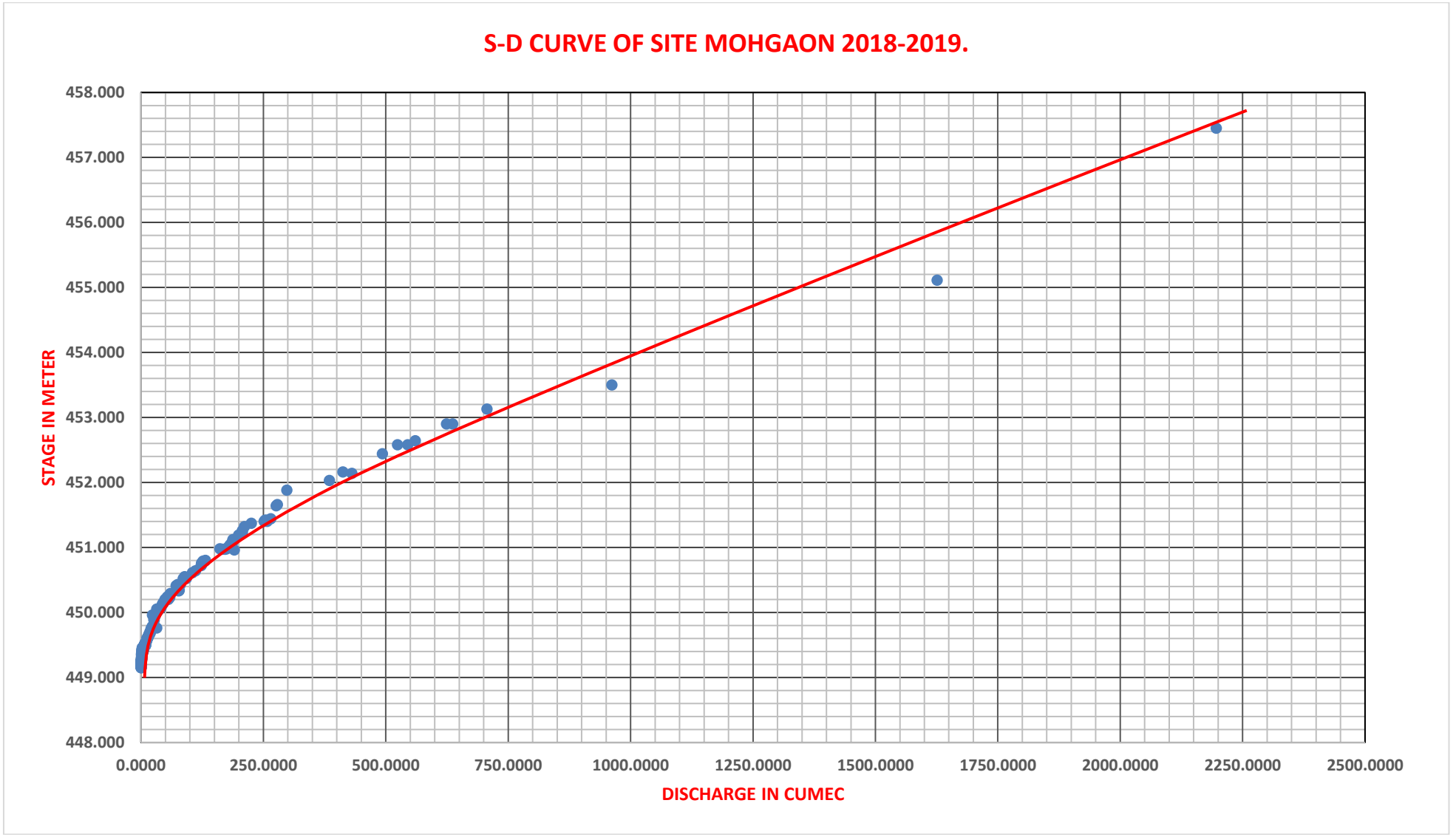

S-D CURVE OF SITE MOHGAON 2018-2019.
458.000
457.000
456.000
455.000
454.000
453.000
452.000
451.000
450.000
449.000
448.000
STAGE IN METER
0.0000
250.0000
500.0000
750.0000
1000.0000
1250.0000
1500.0000
1750.0000
2000.0000
2250.0000
2500.0000
DISCHARGE IN CUMEC

**Plate 1 Map of Narmada Basin**

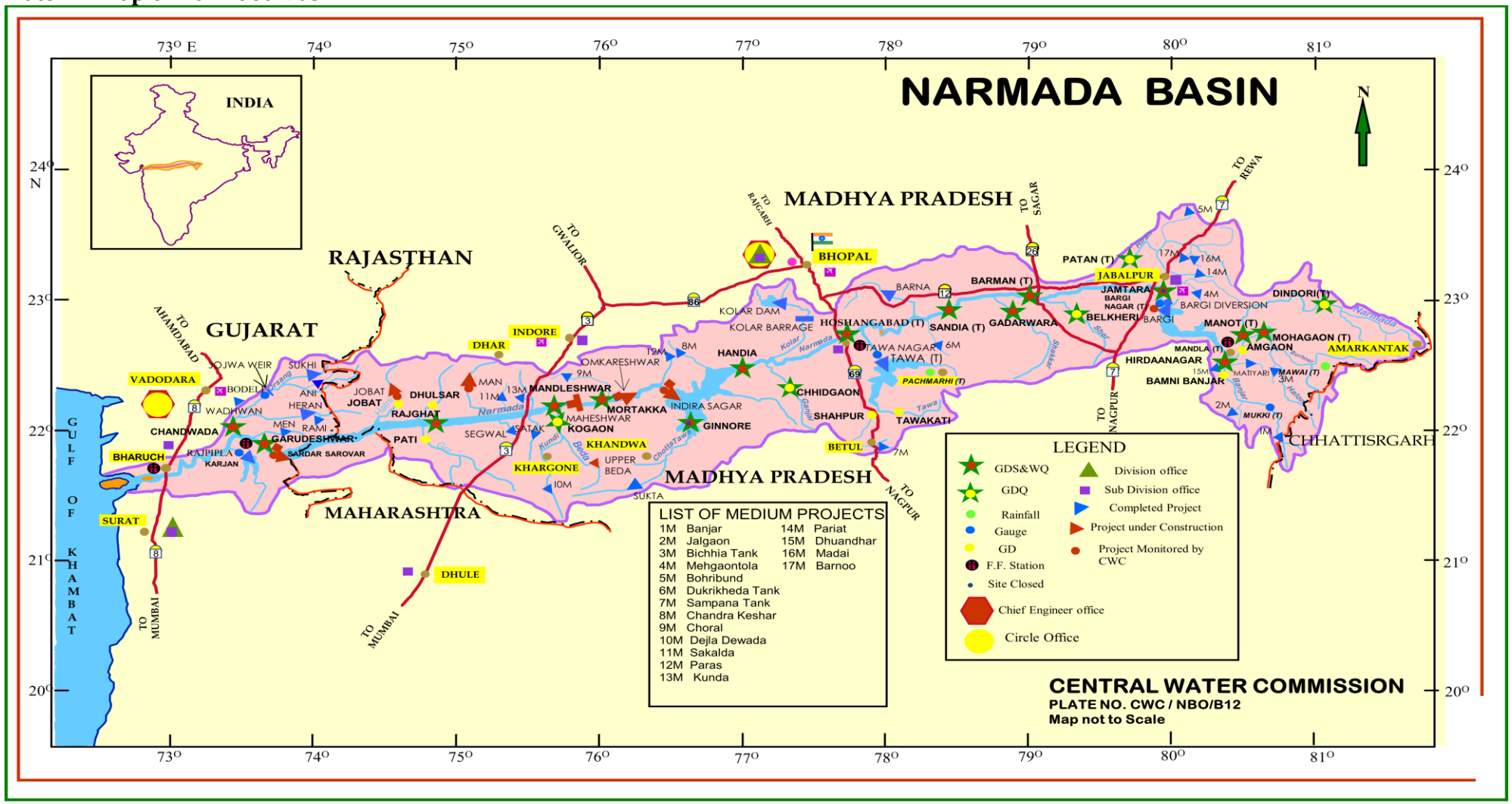


Plate 2 Wireless and S.R.R.G Stations in Narmada Basin

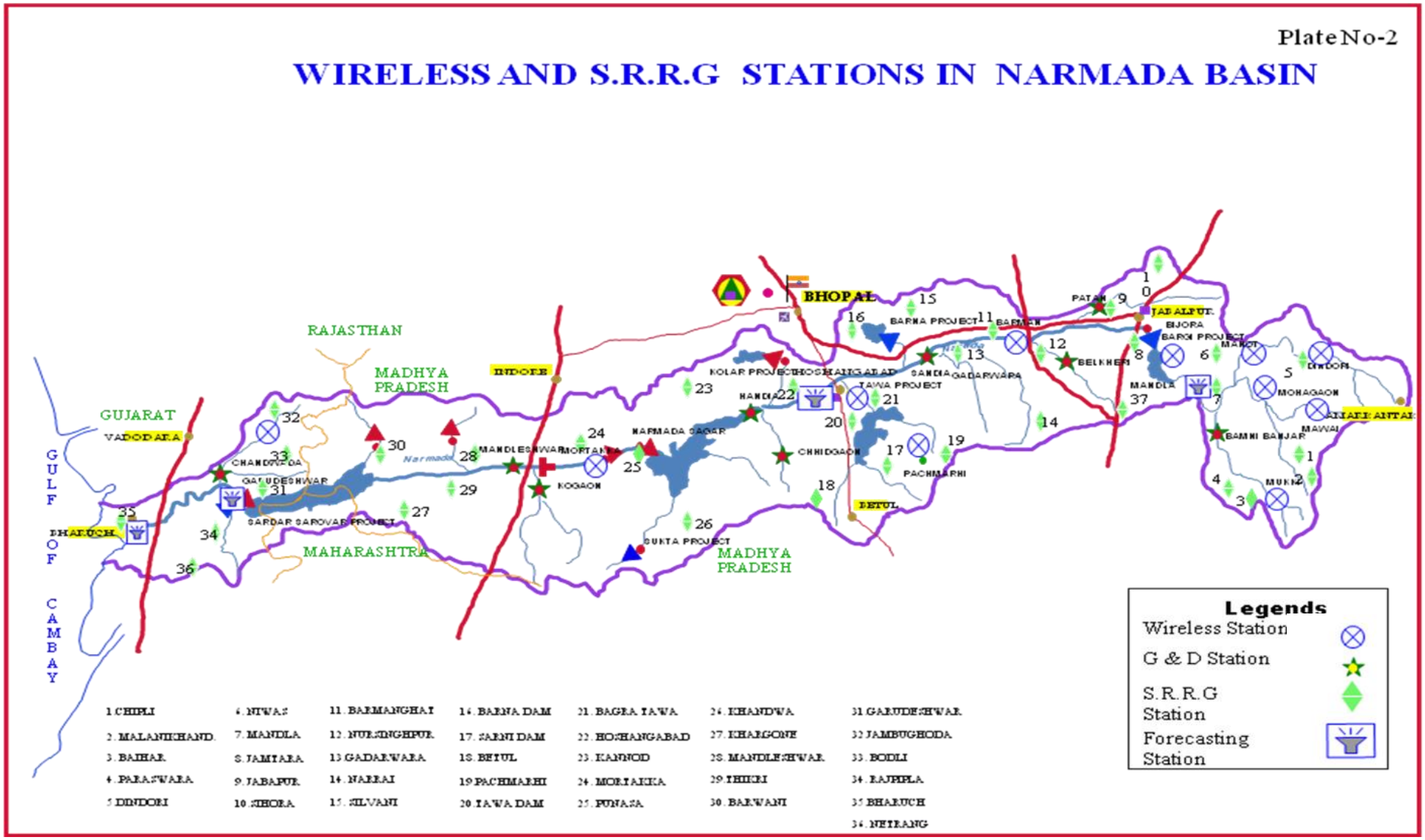


Plate 3 COMMUNICATION NET WORK OF NARMADA DIVISION

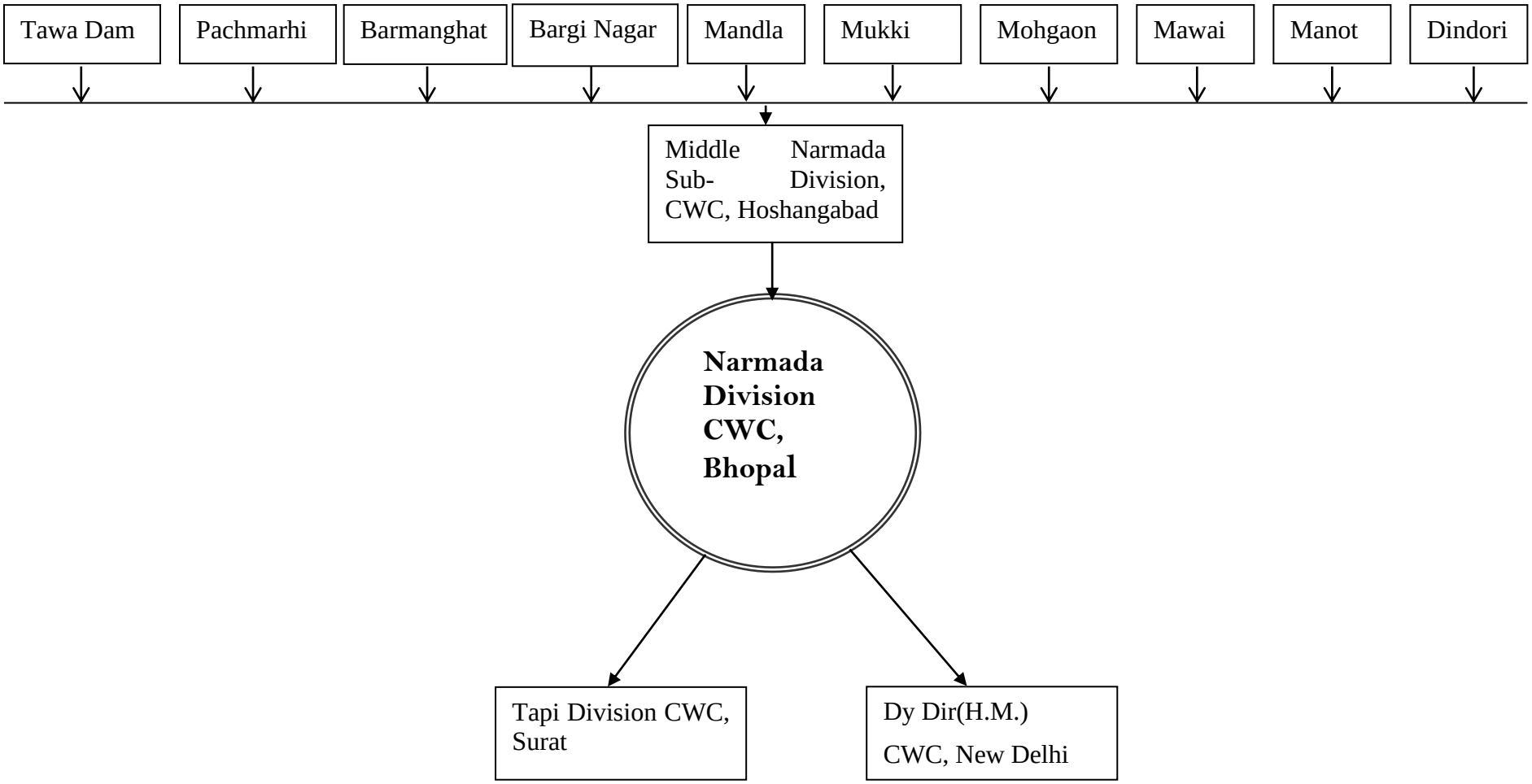


**Plate 4 Line Diagram of Narmada Basin**

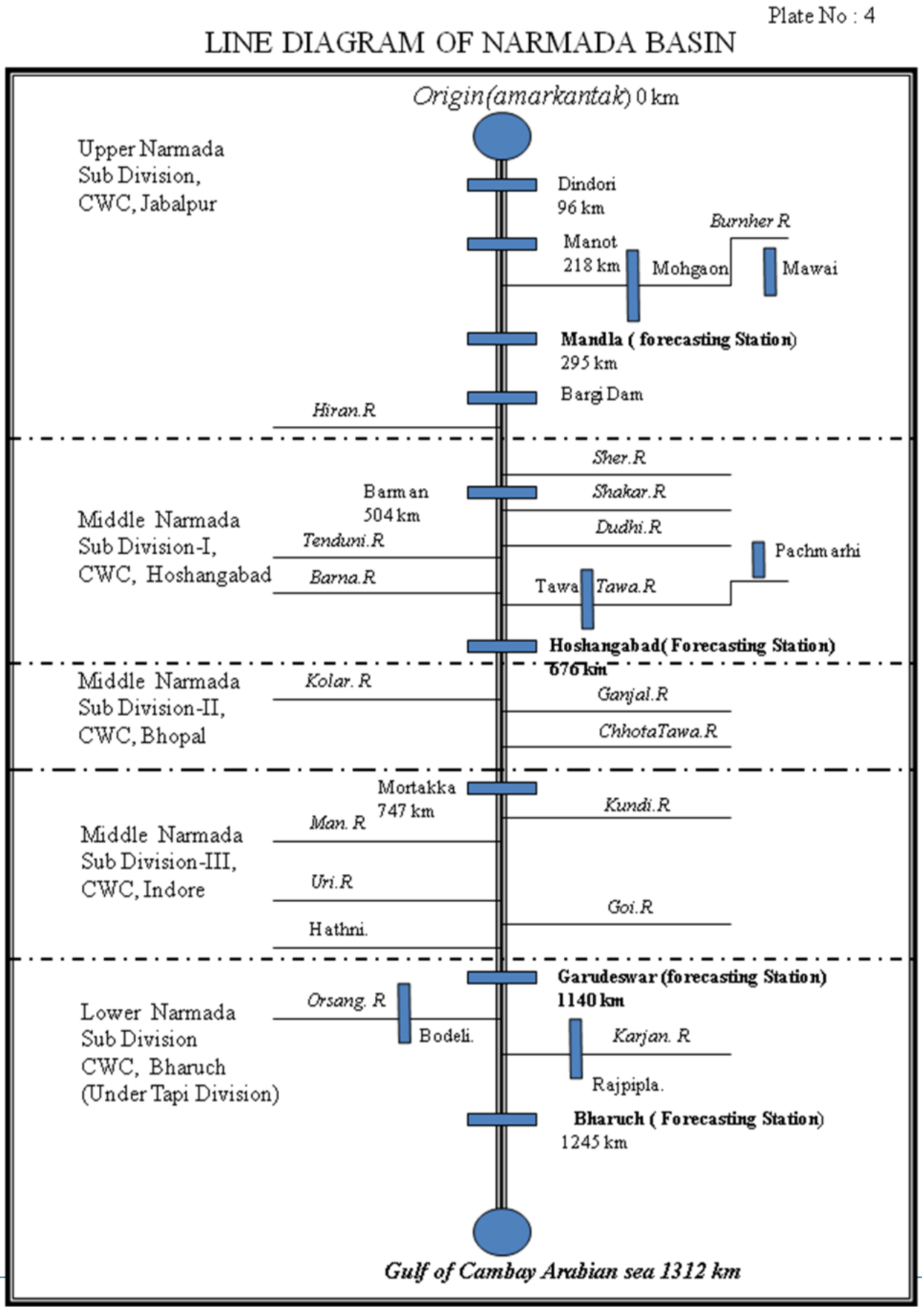


**Plate 5 Comparison of site wise Normal Monsoon and Actual Monsoon 2019 Rainfall**

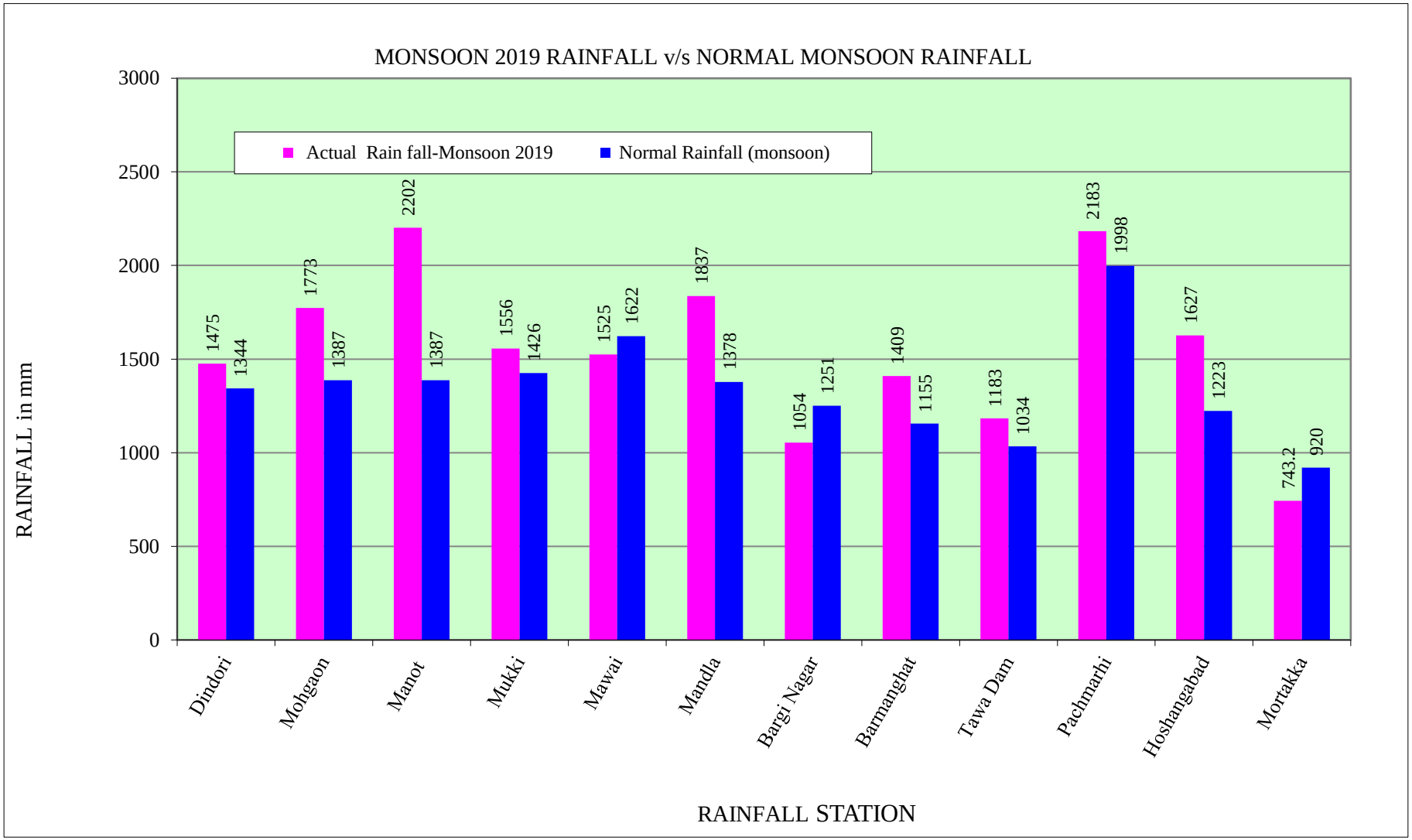


**Plate 6 Bar Chart showing the Flood Forecast performance for last 10 years of Mandla**

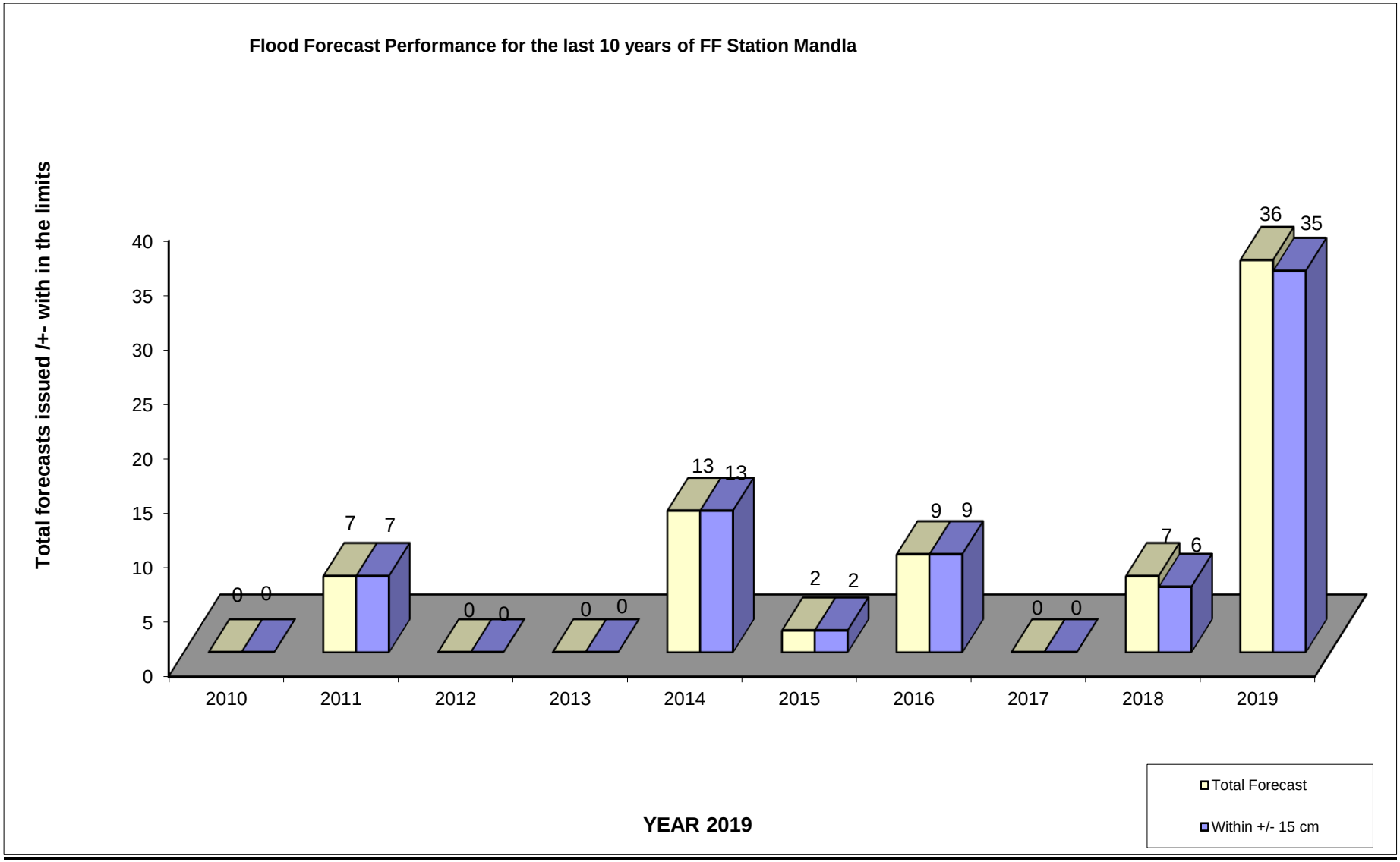


**Plate 7 Bar Chart showing the Flood Forecast performance for last 10 years of Hoshangabad**

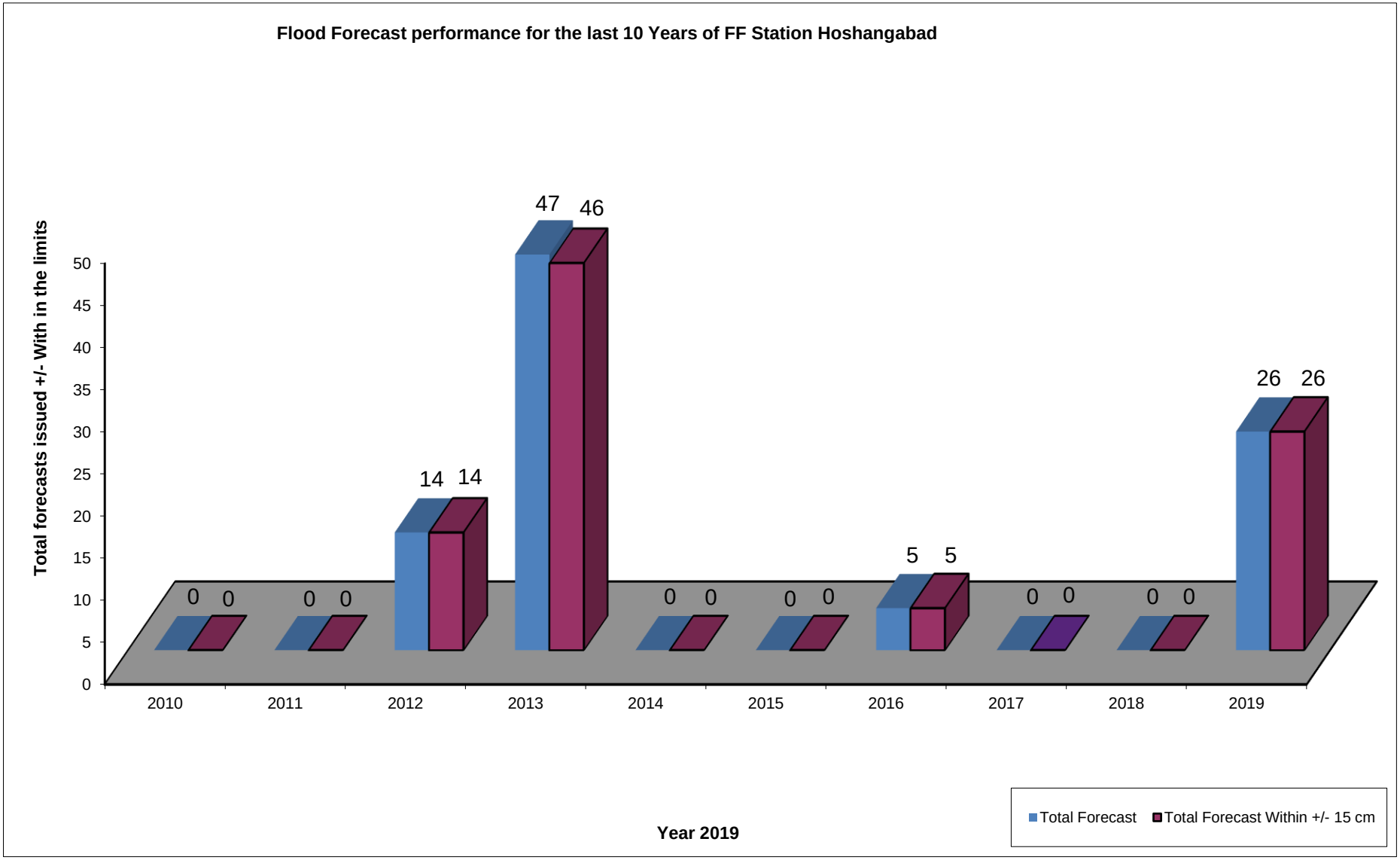


**Plate 8 Forecast Diagram for Mandla**

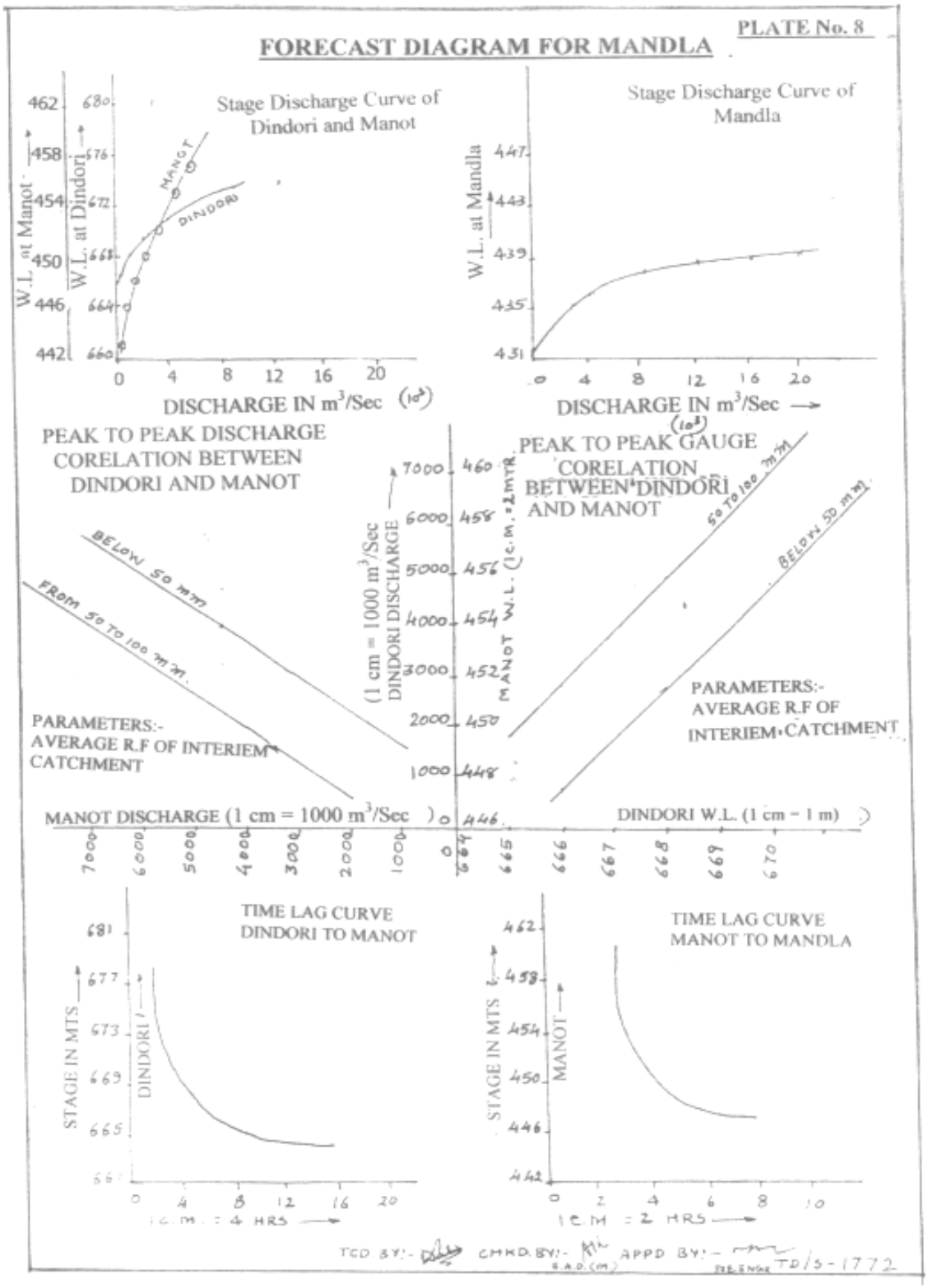


**Plate 9 Forecast Diagram for Hoshangabad**

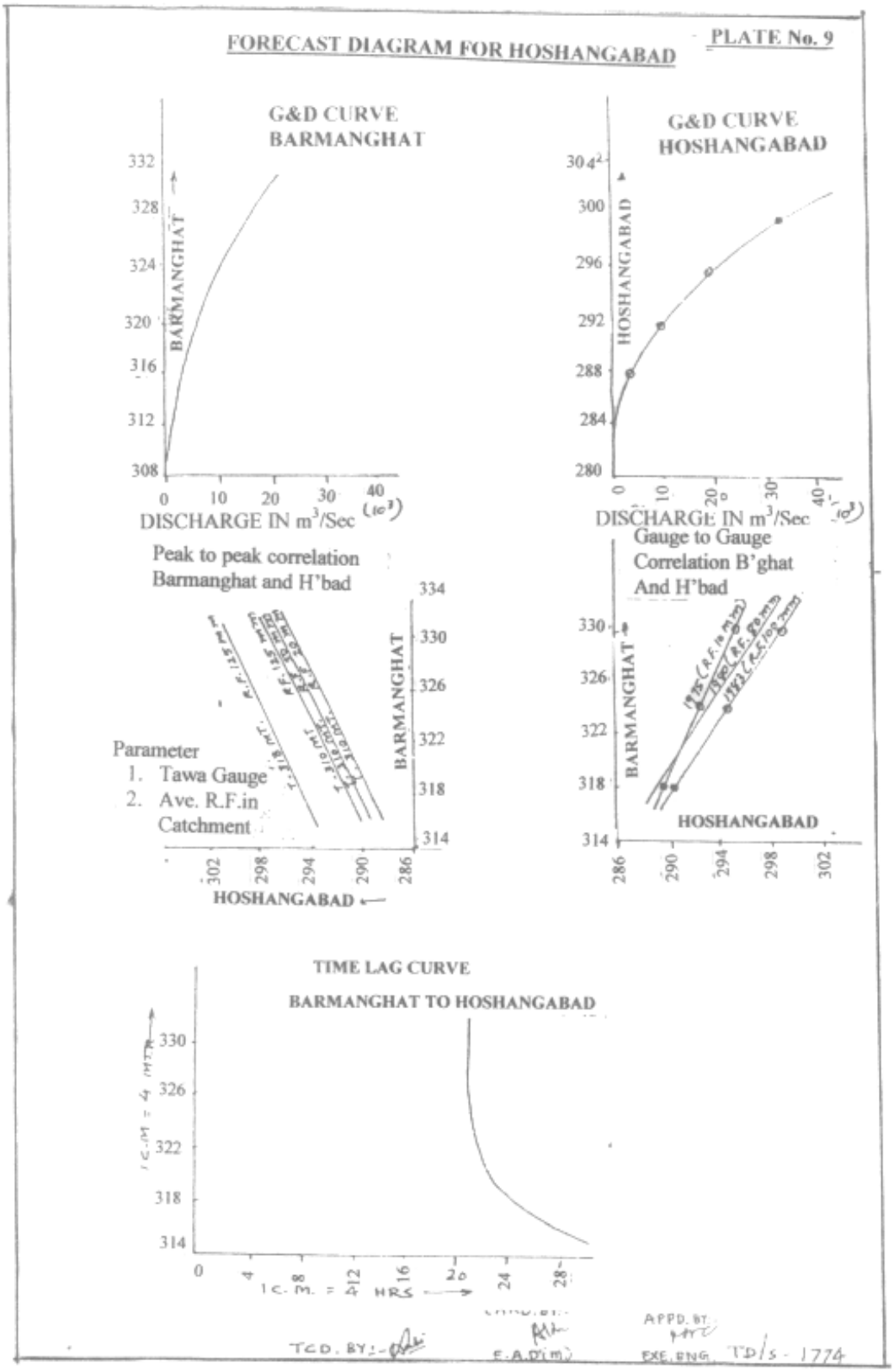


**Plate 10 Line Diagram from Dindori to Mandla**

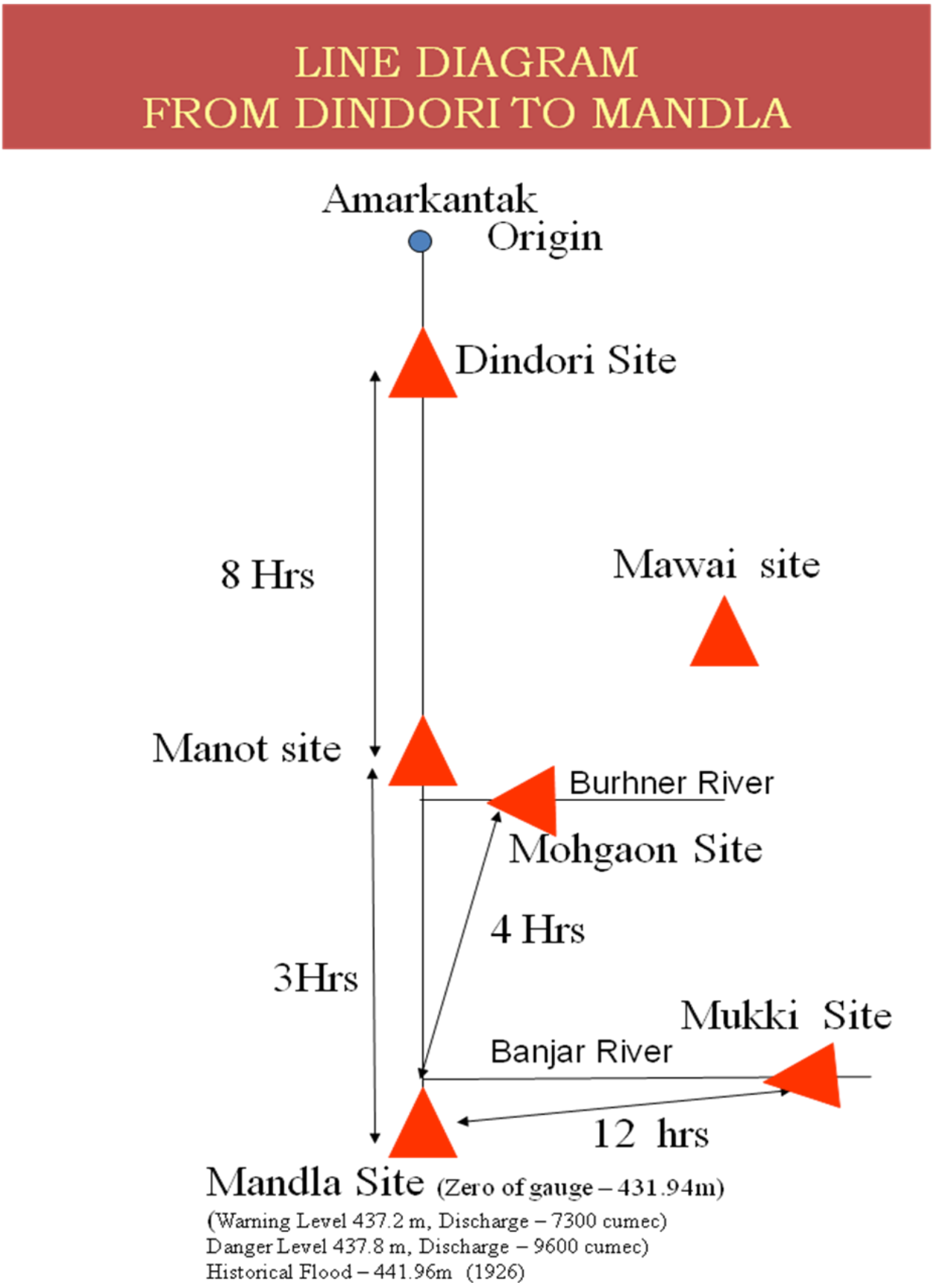


**Plate 11 Line Diagram from Bargi to Hoshangabad**

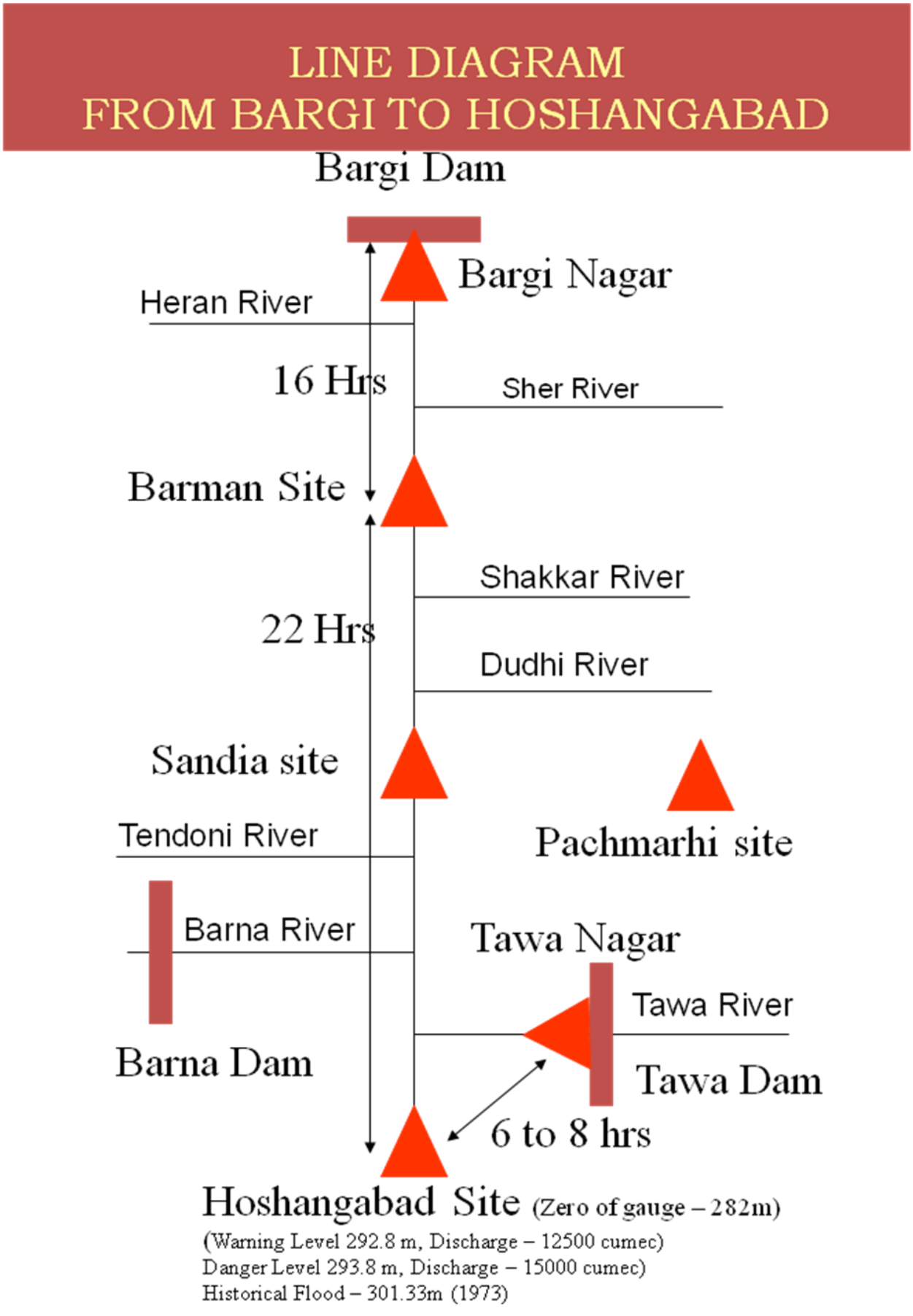
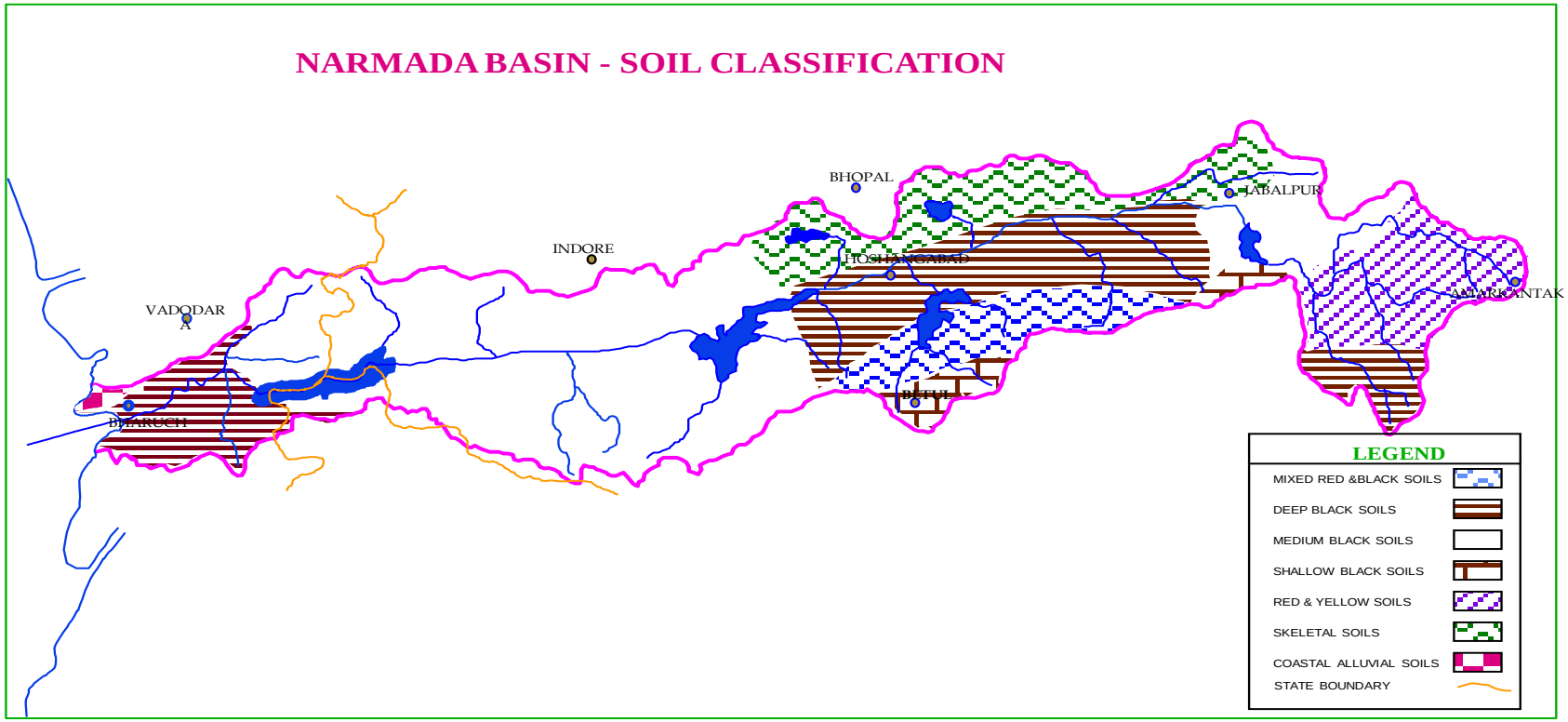


Plate-12 Narmada Basin – Soil Classification Narmada Basin – Soil Classification



## :धन्यवाद एवं विशेष आभार:

| क्र. | अधिकारी/कर्मचारी का नाम | पदनाम | कार्यालय का नाम |
|---|---|---|---|
| 1. | श्री संजय कुमार मालवीय | अधिशासी अभियंता | नर्मदा मंडल ,भोपाल |
| 2. | श्री प्रमोद कुमार झाबक | अनुविभागीय अभियंता | नर्मदा मंडल ,भोपाल |
| 3. | श्री विपुल कुमार वर्मा | अनुविभागीय अभियंता | म.न.ऊ.म-.1 ,होशंगाबाद |
| 4. | श्री एन .डी .जैसवाल | अनुविभागीय अभियंता | ऊ.न.ऊ.म., जबलपुर |
| 5. | श्री भरत कुमार चौरसिया | कनिष्ठ अभियंता | नर्मदा मंडल ,भोपाल |
| 6. | श्री नरेश कुमार रोहित | कनिष्ठ अभियंता | म.न.ऊ.म-.1 ,होशंगाबाद |
| 7. | श्री अंकित शर्मा | कनिष्ठ अभियंता | ऊ.न.ऊ.म., जबलपुर |
| 8. | श्री सुनील शर्मा | कनिष्ठ अभियंता | ऊ.न.ऊ.म., जबलपुर |
| 9. | श्री संतोष कुमार | कनिष्ठ अभियंता | ऊ.न.ऊ.म., जबलपुर |
| 10. | सुश्री ज्योति कुशवाहा | कनिष्ठ अभियंता | नर्मदा मंडल ,भोपाल |
| 11. | श्री राजू बच्छाव | बिजली मिस्त्री | नर्मदा मंडल ,भोपाल |