# COMPARISON BETWEEN CONVENTIONAL AND ANN-BASED FLOOD FORECASTING METHODS

A DISSERTATION

*Submitted in partial fulfillment of the requirements for the award of the degree*
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By

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# CANDIDATE'S DECLARATION

I hereby certify that the work, which is being presented in this Dissertation entitled "**COMPARISON BETWEEN CONVENTIONAL AND ANN-BASED FLOOD FORECASTING METHODS**" in partial fulfillment of the requirements for the award of the degree of MASTER OF TECHNOLOGY in Water Resources Development (Civil) and submitted to the Department of Water Resources Development and Management, Indian Institute of Technology, Roorkee, is an authentic record of my own work carried out during the period from July 2010 to June 2011 under the supervision and guidance of Dr. S.K. Mishra, Associate Professor, Department of Water Resources Development and Management, Indian Institute of Technology, Roorkee, India.

I have not submitted the matter embodied in this dissertation for the award of any other degree.

Dated: June, 2011
Place: Roorkee.

**(UMAKANT NAYAK)**

## CERTIFICATE

This is to certify that the above mentioned statement made by the candidate is correct to the best of my knowledge.

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Date: June, 2011 **(UMAKANT NAYAK)**

Place: Roorkee

## ABSTRACT

Flood forecasting models have been developed for many different large rivers. Traditionally they are based on regressions of downstream with upstream gages. Recently, more physically based models have been used which consist of an input like areal averaged rainfall, gauge levels or discharges at upstream gauges measured in real time and transferred to the regional forecasting centre, where they are converted by means of suitable hydrological and hydraulic models into future water levels and discharges at some critical points. Basis of most models is a numerical model for the rainfall - runoff process, whose parameters are fitted to meet local conditions. In the hydrological context, as in many other fields, artificial neural networks (ANN) are increasingly used as black-box, simplified models. For hydrological applications, ANN models can take advantage of their capability to reproduce the unknown relationship existing between a set of input variables descriptive of the system, for example, rainfall and set of output variables, for example, river flow rate.

Mahanadi is a major river basin of eastern India comprising a catchment of 141569 sq. km. Its major part is occupied by Chhatisgarh and Odisha States. The basin lying in the South-West monsoon tract is exposed to myriad hydro-climatic variations. The reservoir Hirakud which drains nearly 83000 sq. km. is the prime flood moderation structure in the basin, and the catchment of about 50000 sq. km. remains unregulated. Both the Hirakud release and intercepted catchment cause the flood damage to about 9000 sq. km of delta. As such there is not a serious flooding problem existing in the upstream of Hirakud. However, the Mahanadi delta is threatened by floods every 2 or 3 years. Out of the 19 rainfall-generated floods observed during the post-Hirakud period, 13 were due to intercepted catchment contribution and 6 due to Hirakud dam releases. During these floods five coastal districts were affected and a great loss to life and property occurred. The option for another flood moderation structure is not justifiable due to several socio reasons. Presently, inflows to Hirakud are forecast by Central Water Commission, Govt. of India, using MIKE-11, NAM, and HD (Hydrodynamic) models. To this end, data from Automatic Weather Stations and satellite images are used. These models however employ unit hydrograph and routing approaches, which may not be appropriate for deltaic regions, and therefore, may not be accurate.

In this study, three hourly stage data available for the monsoon period at the two gauge sites namely Khairmal and Naraj in Mahanadi basin have been used to develop an ANN-based forecasting model, and its performance evaluated. The performance criteria used are coefficient of determination (COD), Root Mean Square Error (RMSE), and Nash and Sutcliffe (1970) efficiency (NSE). Three cases were considered in model formulation. In Case-I which considers Khairmal stage only as input, ANN model is found to perform better than the conventional models. The former yielded NSE of 88%, RMSE = 0.47 m, and COD = 0.93 in calibration, and these values in validation are NSE=85%, RMSE = 0.46 m, and COD = 0.95. On the other hand, the latter exhibited NSE = 54%, RMSE = 0.94 m, and COD = 0.54 in calibration and NSE = 62%, RMSE = 0.76 m, and COD = 0.64 in validation. In Case-II which considers Naraj stage only as input, ANN model yielded NSE = 99%, RMSE = 0.11 m, and COD = 0.99 in calibration, and NSE= 99%, RMSE = 0.08 m, and COD = 0.99 in validation. The statistical model exhibited NSE = 99%, RMSE = 0.11 m, and COD = 0.99 in calibration and NSE = 99%, RMSE = 0.08 m, and COD = 0.99 in validation. In Case-III which considered both Khairmal and Naraj stages, the resulting ANN model yielded NSE = 99%, RMSE = 0.11 m, and COD = 0.99 in calibration, and NSE = 99%, RMSE = 0.08 m, and COD = 0.99 in validation. The counterpart statistical model exhibited NSE = 99%, RMSE = 0.12 m, and COD = 0.99 in calibration and NSE = 99%, RMSE = 0.09 m, and COD = 0.99 in validation. In Case-II and Case-III both ANN and statistical models have performed equally well, and therefore, statistical model can be opted instead of complex ANN model. In Case-I, the ANN model can be a better and more reliable option for forecasting the floods in deltaic situations.

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# ABBREVIATIONS AND SYMBOLS

| | | |
|---|---|---|
| E | = | Efficiency |
| etc. | = | Et cetera |
| e.g. | = | exempli gratia (=for example) |
| et al. | = | et alia (=and others) |
| Fig. | = | Figure |
| i.e. | = | id est ("that is") |
| $Km^2$ | = | Kilometer Square |
| m | = | metre |
| r | = | Correlation coefficient |
| $\sigma$ | = | Standard deviation |
| ANN | = | Artificial Neural Network |
| ARIMA | = | Auto Regressive Moving Average |
| ARMA | = | autoregressive moving average |
| ARS | = | Agricultural Research Service |
| ATRG | = | Automatic Transmission Rain Gauge |
| BP | = | Back Propagation |
| CORR | = | Correlation coefficient |
| CWC | = | Central Water Commission |
| CWCFF | = | Central Water Commission Flood Forecast |
| DHI | = | Danish Hydraulic Institute |
| FF | = | Flood Forecasting |

GIS = Geographical Information System

GUI = Graphical User Interface

HD = Hydrodynamic

HF = High Frequency

MLR = multiple- linear regression

MSE = Mean Square Error

NAM = Nedbor-Afstromnings-Model (*Rainfall-Runoff Model)*

NLP = Nonlinear Prediction

RMSE = Root Mean Square Error

SOFM = Self-Organizing Feature Map

SSARR = (Stream flow Synthesis and Reservoir Regulation

ST = Sediment Transport

SWAT= Soil and Water Assessment Tool

TD = Transport-Dispersion

USDA = United State Department of Agriculture

UK = United Kingdom

VHF = Very High Frequency

WFFS= Web-based flood forecasting system

WQ = Water Quality

*Chapter 1*

# INTRODUCTION

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Flooding has been a major concern for people inhabiting in the vicinity of rivers and water bodies since the dawn of civilization. Despite the fascinating developments achieved in many areas during the last three decades, the hazard of flooding has not yet been eradicated. In fact, recent floods seem to have been more abundant and more destructive in many regions of the globe than the earlier ones, and the projections for the future look gloomy. This calls for a need to re-think the strategy for flood preparedness. Traditionally, the strategy was to protect as far as was technically possible and affordable. However, since complete protection is never possible and an acceptable level of protection may be expensive, an alternative approach is to accommodate floods, i.e. to prepare to live with floods.

Floods are recurrent phenomena in India from time immemorial. Almost every year some or the other parts of the country are affected by floods of varying magnitudes. Different regions of the country have different climates and rainfall patterns and as such, it is also experienced that while some parts are suffering from devastating floods, another part is from droughts. With the increase in population and developmental activity, there has been a tendency to occupy the flood plains which has resulted in more and increasingly serious damages over the years. Because of the varying rainfall distribution, areas which are not traditionally prone to floods also often experience severe inundation. Thus, flood is the single most frequent disaster faced by the country.

A flood is an overflow of an expanse of water that submerges land. Flooding may result from the volume of water within a body of water, such as a river or lake, which overflows or breaks levees, with the result that some of the water escapes its usual boundaries. While the size of a lake or other body of water will vary with seasonal changes in precipitation and snow melt, it is not a significant flood unless such escapes of water endanger land areas used by man like a village, city or other inhabited area. Floods often cause damage to homes and businesses if they are placed in natural flood plains of rivers. While flood damage can be virtually eliminated by moving away from rivers and other bodies of water, since time out of mind, people have lived and worked by the water to seek sustenance and capitalize on the gains of cheap and easy travel and commerce by being near water. That humans continue to inhabit areas threatened by flood damage is evidenced by the fact that the perceived value of living near the water exceeds the cost of (repeated) periodic flooding. Floods can also occur in rivers, when flow exceeds the capacity of the river channel, particularly at bends or meanders. In India, billions of rupees are spent every year in flood control and flood forecasting. The hydrograph of extreme floods and stages corresponding to flood peaks provide valuable data for hydrologic design. Further, of various characteristics of the flood hydrograph, probably the most important and widely used parameter is the flood peak. At a given location in a stream, flood peaks vary from year to year and their magnitude constitutes a hydrologic series which enables one to assign a frequency to a given flood-peak value. In the design of hydraulic structures, the peak flow that can be expected with an assigned frequency (say 1 in 100 years or so) is of primary importance to adequately proportion the structure to accommodate its effect. The design of bridges, culvert, waterways, and spillways for dams and estimation of scour at a hydraulic structure are some examples where flood-peak values are required.

Total control of flood is not practicable from economic considerations and therefore flood management is essential. The flood management rationally refers a provision of reasonable degree of protection against floods by structural/non-structural measures to mitigate the recurring havoc caused by floods. Non-structural measures like flood forecasting and warning of incoming floods have also played a significant role in reducing the loss of life and movable property apart from alerting the civil and engineering authorities, in-charge of various works to take appropriate advance action to fight the onslaught of floods.

Flood forecasting for a river basically means estimating future discharges or water levels in the river at selected places along the river during the flood season. The aim is to forecast river stage and its time of occurrence at a place along the river. For formulating flood forecasts, it is necessary to have relevant hydrological data, such as physical and geographical characteristics of the river catchment and flood plains, such as current levels of water and flow in the river; and hydro-meteorological data, such as rainfall in the catchment and weather forecast. Forecasting river flow or stage after heavy rain is important for public safety, environment, and water management. An early warning system is a set of procedures designed to protect human lives and minimize damages to be expected from a flood which exceeds a certain critical level. It consists of a number of related and connected parts: forecasting, transformation of forecast into a warning, transmission of warning to local decision makers, conversion of warning into remedial action.

A forecasting model can be a black-box or a physically based, or a conceptual model. The black-box models are based on transfer functions which relate inputs with outputs. These models, as the name suggests, generally do not have any physical basis. Some commonly used black-box models include the unit hydrograph approaches, regression analysis, and time series models. The physically based models use the physical laws of various processes to model the catchments response. These laws are expressed through partial differential equations solved using numerical methods. The conceptual models fall intermediate to the physical and black-box models. Generally, the term 'conceptual' is used to describe models which rely on simple arrangement of a relatively small number of interlinked conceptual elements (such as storages), each representing a segment of land phase of hydrologic cycle.

### 1.1 Objective of the study

1. To propose an ANN-based flood forecasting method for deltaic region of Mahanadi basin.

2. To compare the forecasting results with those due to available conventional methods.

### 1.2 Organization of Work

The present thesis has been divided into six chapters including the present one. **Chapter 2** presents a review of the literature. **Chapter 3** contains methodology. **Chapter 4** presents the study area, data availability, and data processing. **Chapter 5** discusses the results, and finally, **Chapter 6** concludes the study.

The word "flood" comes from the Old English *flod*, a word common to Germanic languages (compare German *Flut*, Dutch *vloed* from the same root as is seen in *flow, float*; also compare with Latin *fluctus, flumen*). Deluge myths are mythical stories of a great flood sent by a deity or deities to destroy civilization as an act of divine retribution, and are featured in the mythology of many cultures. Flood forecasting is the use of real-time precipitation and stream flow data in rainfall-runoff and stream flow routing models to forecast flow rates and water levels for periods ranging from a few hours to days ahead, depending on the size of the watershed or river basin. Flood forecasting can also make use of forecasts of precipitation in an attempt to extend the lead-time available. It is an important component of flood warning distinguished in that the outcome of flood forecasting is a set of forecast time-profiles of channel flows or river levels at various locations, while "flood warning" is the task of making use of these forecasts to make decisions about whether flood warning should be issued to the general public or whether previous warnings should be rescinded or retracted.

## 2.1 DEFINITION OF FLOOD

General definition of flood in hydrology is "temporary covering by water of lands that are not normally covered by water". It is also defined as "an unusually high stage in a river – normally the level at which the river overflows its banks and inundates the adjoining area". Some definitions available on web in the context of water flow are quoted below:

- ✓ The rising of a body of water and its overflowing onto normally dry land; "plains fertilized by annual inundations" (wordnet.princeton.edu/perl/webwn).
- ✓ The temporary inundation of normally dry land areas resulting from the overflowing of the natural or artificial confines of a river or other body of water ( www.grid.unep.ch/product/publication/freshwater_europe/glos.php).
- ✓ The inundation of a normally dry area caused by high flow, or overflow of water in an established watercourse, such as a river, stream, or drainage ditch; or ponding of water at or near the point where the rain fell. This is a duration

type event with a slower onset than flash flooding, normally greater than 6 hours (www.srh.noaa.gov/jetstream/append/glossary_f.htm).

- ✓ High flow, overflow or inundation of a normally dry area which causes or threatens damage. (ggweather.com/glossary.htm).
- ✓ Stream flow greater than the channel capacity (www.pskf.ca/ publications/glossary.html).
- ✓ An event during which the volume of water in a stream becomes so great that it covers areas outside the stream's normal channel (www2.wwnorton.com/college/geo/earth2/glossary/f.htm).
- ✓ An overflowing of water beyond the channel's capacity (www.oas.org/cdmp/document/mitiplan/mitgloss.doc).
- ✓ Where a river overspills its banks and spreads out on the valley floor (www.swgfl.org.uk/rivers/waterwheel.htm).
- ✓ Any flow that exceeds the bank full capacity of a stream or channel and flows out of the floodplain; greater than bank full discharge (Buttecreekwatershed.org/ecr/new/glossary.htm).

## 2.2 CHARACTERISTICS OF FLOOD

The rise and fall of water level in river is called flood wave. Its highest point, or crest, travels progressively downstream. In the upstream portions of a river the flood crest passes quickly. Further downstream the greater volume of water causes slower passage of the flood crest, resulting in floods of longer duration. In many regions, annual foods follow the thaws and rains of spring: flooding may also occur because of thawing ice jamming narrower end shallower parts of a river. Less predictable are floods resulting from ocean waves, called storm surges, pushed onshore by an advancing hurricane, and from sudden torrential flows, called flash floods, following a brief, intense rainstorm or the bursting of a natural or man-made dam or levee. In addition to the duration and quantity of rainfall, the nature of the soil (permeability; state of saturation) of an area affects the frequency of floods. The following terms are frequently used to describe flood characteristics:

*Intensity of floods* is characterized by two methods (i) depth of inundation and (ii) area of inundation.

*Frequency of floods* represents the number of times an area is inundated during a particular time interval.

*Durations of flood* represent the length of time interval during which a particular area is inundated.

*Meandering* is due to changes its river because of siltation and erosion.

*Severity of flood* depends on damages caused by floods.

*Flood typology* also depends on types and magnitudes of damages caused.

River streams having velocity less than critical velocity have less silt carrying capacity and drops silts and sands and height of river bed is raised and surrounding areas are inundated. Such river stages are known as aggrading stage.

*Degrading river (Erosions):* River having velocity more than critical velocity erodes the river bed and known as eroding river.

## 2.3 CAUSES OF FLOOD

The major causes of flood are:

1. Due to heavy rainfall including cyclonic precipitation.
2. Inadequate capacity within banks of a river to contain high flows.
3. Poor natural drainage in an area or drainage congestion.
4. Synchronisation of high flows in main river and tributaries
5. Retardation of flow due to tidal and backwater effects, resulting in water stagnation and inundation, tsunamis.
6. Snowmelt and glacial outburst.
8. Heavy rainstorms/cloud-burst.

Apart from the overflow of rivers, the floods may also be caused by the failure of dams with sudden release of huge amount of water causing considerable damage to life and property.

## 2.4 FLOOD CONTROL MEASURES

The term 'flood control' is used to denote all efforts exercised to reduce damage to life and property caused by floods. From an extremely large flood occurring in a river the complete and strict control of the flood of negligible loss is neither physically possible nor economically feasible. However, there are ways by which to mitigate or minimize to some extent the impact of flood damage on people and property by adopting the following protective methods:

### 2.4.1 Structural measures

The structural measures comprise reservoirs and retarding structures which store peaks, channel improvements which increase flood carrying capacity, embankments and levees which keep the water away from flood prone areas, detention basins which absorb some flood water, flood ways which divert flood flows from one channel to another and overall improvement in the drainage system. In effect, the structural measures reduce the flood damage by restricting the movement of flood water in to the flood plains.

*2.4.1.1 Storage Reservoirs*

Flood control storage reservoirs have been built on many streams and rivers to store flood waters. A storage reservoir holds a portion of the flood waters when the flood is rising and releases it later when the flood is receding.

*2.4.1.2 Detention Reservoirs*

A detention reservoir stores excess water during floods and releases it after the flood. It is similar to a storage reservoir but it is provided with large gated spillways and sluiceways to release the stored water in a controlled way. In the earlier stages of a flood, the gates are left open and the water is released, subjected to the safe carrying capacity of the channel downstream. In the later stages of the flood, when the discharge downstream exceeds the maximum capacity of the downstream channel, the gates are kept partially closed. There is basically no difference between the detention reservoir and a storage reservoir, except that the former has a larger spillway capacity and sluiceway capacity to permit rapid downstream flow just before or after a flood. The reservoir is quickly emptied and thus the full reservoir capacity is made available again for moderating a subsequent flood after a short interval. In this manner, the available capacity is more effectively utilized.

*2.4.1.3 Levees*

Levees, also called dikes, are earthen walls which are constructed parallel to the river flow at some suitable distance from the river. Such walls or embankments may be raised either on both sides of the river or only on one side for some suitable distance, where the river is passing through towns and cities or other places of importance. These embankments retain and confine the flood water in between them, thereby preventing them from spreading into adjoining lands and towns. The levees being earthen walls require much care and maintenance. Although levees provide protection from some floods, they can, being earthen, be eroded by large floods and cause enormous damage.

*2.4.1.4 Flood Walls*

Flood walls are used in a developed area where it is rather difficult to obtain enough land for the construction of levees. Because of flat slopes, levees require a very large base width. If the land is limited, it is more economical to construct flood walls. A flood wall is a reinforced concrete and cement (RCC) or masonry wall.

*2.4.1.5 Channel Improvement*

The improvement of river channels involves straightening, widening or deepening of channels to increase their discharge carrying capacity.

*2.4.1.6 Flood ways*

Flood ways are bypass and diversion channels into which part of the flood would be diverted during high floods. A floodway can be a natural or manmade channel and its location is controlled essentially by topography. Generally, wherever they are feasible, flood ways offer an economical alternative to other structural flood control works.

**2.4.2 Non-structural measures**

The non-structural measures include flood plain management, flood forecasting and warning, flood plain zoning, flood proofing, flood insurance etc., which play significant role in reducing flood damages.

*2.4.2.1 Flood Plain Management*

The structural measures have been emphasizing on the attempts to modify the floods. The non-structural measures on the other hand lay stress on attempts to modify the susceptibility to flood damage and attempts to modify the loss burden. They strive to keep the people away from flood waters, bearing in mind the stark reality that the flood plains in fact, belong to the river and that the floods are not only a curse but also a blessing in disguise in some ways. It contemplates use of flood plains judiciously, simultaneously permitting vacating of the same for use of the river whenever the situation calls for. This technique allows the use of flood plains reducing the hazard, while retaining its beneficial effects. Flood plain management which would comprise of flood forecasting and warning, flood plain zoning and flood proofing.

*2.4.2.2 Flood Forecasting*

Flood forecasting for a river basically means estimating future stages or water levels in the river at selected places along the river during the flood season. The aim is to forecast river stage and its time of occurrence at a place along the river. For formulating flood forecasts, it is necessary to have relevant hydrological data, such as physical and geographical characteristics of the river catchment and flood plains, such as current levels of water and flow in the river; and hydro-meteorological data, such as rainfall in the catchment and weather forecast. These data are then the basic input to flood forecasting techniques, which may include graphical techniques, rainfall runoff models, unit hydrograph and computer models.

*2.4.2.3 Flood Plain Zoning*

Flood plain zoning means restricting any human activity in the flood plains of a river. The areas affected by floods are divided into different zones in flood plain zoning. The area affected by flood increases as the flood discharge increases. The flood discharge depends upon the recurrence interval. Therefore, the flood plain zoning can be done according to the recurrence interval. For example, flood zones can be demarcated as zones of 1, 2, 5, 10, 15, or 100 year floods. Evidently, the area under a 100-year flood will be much more than under a 5-year flood. The basic objective of flood plain zoning is to restrict encroachment of the zone which frequently comes under the influence of flood. The areas which are prone to yearly flood may be put to agricultural uses. However, crops and vegetables grown in these zones should be of such types that they are harvested well before the start of the next rainy season.

From the past experience it is learnt that, the structural measures can not altogether eliminate the residual hazard from rare flood events primarily due to high cost and topographical constraints. Therefore, along with the structural measures, adequate attention is needed for planning and implementation of non-structural measures, the urgent among these being flood forecasting and warning, so also flood plain zoning and management.

*2.4.2.4 Flood Proofing*

Any combination of structural and non-structural additions, changes, or adjustments to structures which reduce or eliminate flood damage to real estate or improved real property, water and sanitary facilities, structures and their contents. Flood Proofing is the provision of long term, non structural or minor structural measures to mitigate the effects of floods.

Non Structural Flood Proofing Measures are

- Institutional measures to coordinate development activities related to flood control and drainage;
- Planning developments in flood-prone areas to take account of prevailing hydrological conditions; and
- Ensuring hydrological data and analysis are available to those involved with design.

*2.4.2.5 Flood Insurance*

Though flood risk has been included in the list of items covered by General Insurance Companies, it is popular in urban areas only. The insurance companies have also not been able to arrive at different rates of insurance premiums for different areas. Therefore, there is a need to evaluate the risk associated with flooding of different areas and to modify the insurance schemes based on it.

## 2.5 WHAT IS FLOOD FORECASTING

Flood forecasting may be defined as "the process of estimating the future stages or flows and its time sequence at selected points along the river during floods". Flood forecasts are prediction of (i) the crest and its time of occurrence; and (ii) the stages expected at various points of time during the period of rising and falling stages of the river above or specified water level called the "Warning Level".

Some other relevant definitions are as follows:

§ *Forecasting:* estimation of some variable at a specific future time or over a specified future time interval.

§ *Prediction:* estimation of future conditions, without reference to a specific time.

§ *Real-time forecasting:* forecasts are made based on the current conditions.

§ *Lead time:* time (interval) over which a forecast is made.

Utility of the forecast depends on accuracy and timeliness. At the time of the event, the value of the forecast is zero. Hence, the entire operation of the flood forecasting service has to be planned around a time-factor keeping in view that the operational data being generally poor and incomplete; a compromise between the theoretically desirable complicities and computational details becomes necessary. This calls for use of appropriate techniques or methods to meet the requirements of accuracy and period of warning to different locations, and then there should be efficient arrangement for dissemination of forecasts/information. Attempts should be to convey the forecasts/warnings to the authorities concerned such that they get adequate time to organize necessary measures, if required in light of the forecasts issued.

## 2.6 WHY FLOOD FORECASTING

Most emergency measures during floods require prediction of incoming flood with the help of hydrological and hydro-meteorogical analysis, rapid warning to flood plain inhabitants and advance preparation involving provision of flood-fighting materials and a plan of action for intense activity immediately prior to, during and immediately following flooding. Once the flood forecasts are received by the Civil and Engineering authorities, the chain of activities start- warnings are issued, people and property are evacuated immediately prior to flood, patrolling of the affected area is organised, protection works including sealing off inlet points are affected and rescue operations are done during the flood and, after the flood recedes, rapid drainage, clean-up and rehabilitation follow.

Experience has shown that damage to movable property as well as loss of human and cattle lives etc., can be reduced to a considerable extent by forecasting flood with adequate warning time. On receipt of such advance warnings, the people can move to safer places in an organised manner with their movable property and cattle. Conversely, this may also, by providing appropriate reassurance, avoid costly and unnecessary evacuation. In the long-range plan of flood protection and prevention of flood damages, the flood forecasting services assumes considerable significance not only in the unprotected flood prone areas for organising rescue and relief operation but also in the area already protected by giving advance warning to the engineering authorities, for keeping desired vigil and safeguarding various structures. Short-term forecasts or flood forecasts of several hours and days provide flood warnings which can be used to operate reservoirs and emergency flood ways. It has now been universally recognised as an important component of flood-fighting and flood damage mitigation measures. As a matter of fact, in numerous situations when topographic (lack of potential dam sites) and or economic factors make the control of flood impractical and/or unjustifiable on economic consideration and in other cases until such times as the flood control measures to provide positive protection against flood damage are implemented, flood forecasting provides an alternative means of reducing flood damage including loss of life.

Flood forecasting also plays a very important role in reducing flood damages by helping in proper regulation of reservoirs because an ideal operating procedure requires perfect fore knowledge of the inflow and the hydrograph shape. A properly planned hydrologic forecasting system not only helps in moderation of floods but also in overall management of the available water resources for various purposes.

## 2.7 METHOD FOR DETERMINING THE PEAK FLOOD

The hydrograph of extreme floods and stages corresponding to flood peaks provide valuable data for purposes of hydrologic design. Further, of the various characteristics of the flood hydrograph, probably the most important and widely used parameter is the flood peak. At a given location in a stream, flood peaks vary from year to year and their magnitude constitutes a hydrologic series which enable one to assign a frequency to a given flood-peak value. In the design of practically all hydraulic structures the peak flow that can be expected with an assigned frequency (say 1 in 100 years) is of primary importance to adequately proportion the structure to accommodate its effect. The design of bridges, culvert waterways and spillways for dams and estimation of scour at a hydraulic structure are some examples wherein flood-peak values are required.

To estimate the magnitude of a flood peak the following alternative methods are available:

1. Rational method,
2. Empirical method,
3. Unit-hydrograph technique, and
4. Statistical or Frequency method.

The use of particular methods depends on (i) the desired objective, (ii) the available data, and (iii) the importance of the project. Further, the rational formula is only applicable to small size ($<50$ km$^2$) catchments and the unit hydrograph method is normally restricted to moderate-size catchments with areas less than 5000 km$^2$.

## 2.8 STEPS OF FLOOD FORECASTING

Flood forecasting for a river basically means estimating future stages or water levels in the river at selected places along the river during the flood season. The aim is to forecast river stage and its time of occurrence at a place along the river. For formulating flood forecasts, it is necessary to have relevant hydrological data, such as physical and geographical characteristics of the river catchment and flood plains, such as current levels of water and flow in the river; and hydro-meteorological data, such as rainfall in the catchment and weather forecast. These data are then the basic input to flood forecasting techniques, which may include graphical techniques, rainfall runoff models, unit hydrograph and computer models.

A flood forecasting system basically involves five steps. It begins from data collection to warning received by end user. The steps are (CWC, 1980),

(i) Data collection

(ii) Data dissemination

(iii) Data processing and Formulation of forecasting

(iv) Verification of forecast

(v) Dissemination of forecast

The above steps are shown in flow chart given in Fig. 2.1

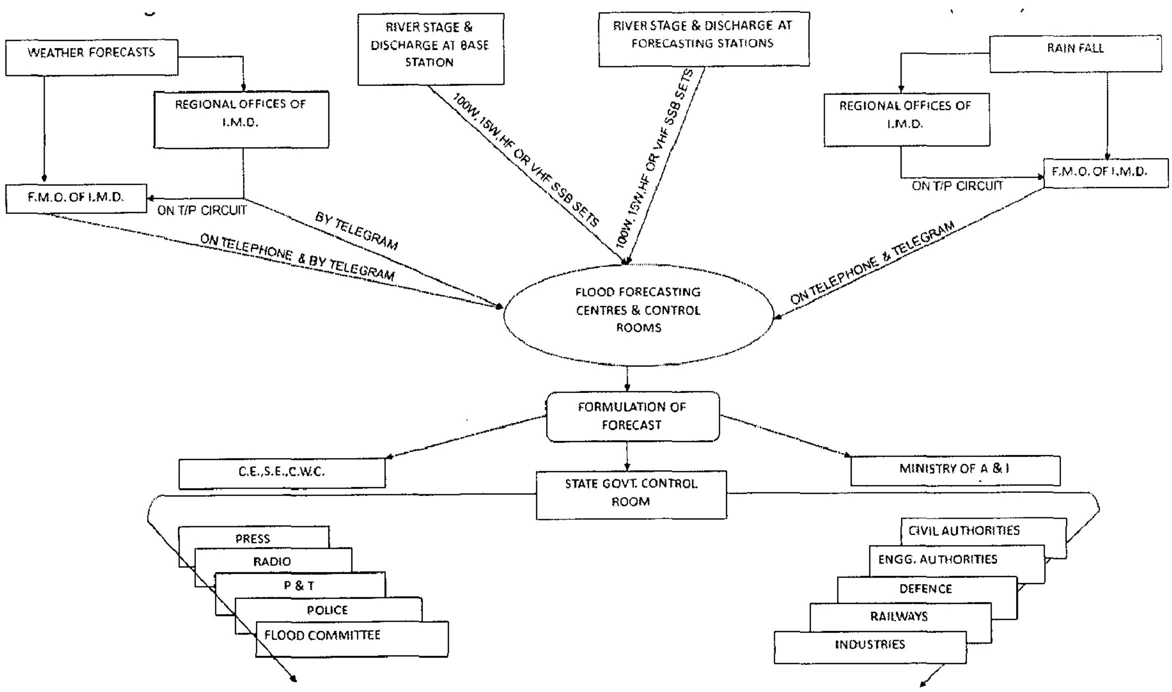


Fig 2.1: Schematic diagram of existing flood forecasting system in India.

### 2.8.1 Data Collection

A large number of hydrological and hydro-meteorological data are required for development of a river forecasting model and for operational forecast formulation. At the development stage of a flood forecasting model, all the available historical data can be utilised for identification of the various parameters of the model where as at the time of actual forecast formulation, only limited number of data may be available in time. Hence the term "Data Collection" in a broader sense means;

(a) Collection of all possible historical data from various sources for development of flood forecasting model; and
(b) Identification of representative or key data network where real time data transmission can be ensured with available resources.

*Data Required:*

i. Gauge/discharge and/or rainfall data are required for flood forecasting
ii. Interception, evaporation, evapo-transpiration, interflow, infiltration, ground water and percolation are also used as inputs to several conceptual models
iii. Number of reporting stations depend upon hydrologic need, availability of observers and communication;
iv. Density of rain gauge station required vary with basin topography and meteorological factors
v. 8 to 10 years of basic hydrological and meteorological data to develop a workable forecasting method.

### 2.8.2 Data Transmission

Transmission of data from the field stations to the flood forecasting centres plays a very vital role in flood forecasting. Transmission of data essentially refers to the transmission of limited number of data to be used for operational forecast formulation through a quickest possible channel. If a good deal of time is wasted in transmission of hydrological and hydro-meteorological data from the field stations, there will be hardly any sufficient time left for formulation of forecast and subsequent warning. Transmission of the observed data on real time basis is therefore, extremely necessary for efficient flood forecasting.

The essential requirements of a good transmission system are that it should be reliable, quick, and capable of transmitting data at desired frequency, expandable, cheap and computer compatible.

*Various systems of Data Transmission:*

Some of the most commonly used data transmission systems all over the world are:

a) Land line communication, i.e. telephone and telegraph

b) HF and VHF wireless network; and

c) Telemetry system including ATRG (Automatic Transmission Rain Gauge), satellite radar, mobiles, internet and FAX.

### 2.8.3 Data Processing and Formulation of Forecasting

The analysis of data and formulation of forecast is the most important stage in the process of flood forecast. Some model is used to estimate the forecast from the available hydrological and hydro-meteorological data. The model may be a simple gauge to gauge relation between upstream and downstream gauges or a very comprehensive catchment model like Stanford Watershed Model Mark IV incorporating a large number of hydrological, hydro-meteorological, and basin parameters. The use of appropriate model depends on the availability of data, forecast requirement, computational facilities, and the degree of accuracy desired etc.

The methods for formulating the real time flood forecast may be categorized under two groups: Statistical and deterministic methods.

#### 2.8.3.1 *Statistical Methods*

Methods based on statistical approach making use of statistical techniques can be presented either in the form of graphical relations or mathematical equations. A large number of data covering a wide range of conditions are analysed to derive the relationship which are inter-alia include gauge to gauge relationship with or without additional parameter and rainfall peak stage relationships. These methods are more commonly used by the Central Water Commission to issue real time forecast in India.

Method based on statistical approach makes use of the statistical techniques to analyse the historical data with an objective to develop methods for the formulation of flood forecasts. The methods thus developed can be presented either in the form of graphical relations or mathematical equations. A large number of data, covering a wide range conditions are analysed to derive the relationships which inter-alia include gauge to gauge relationship with or without additional parameter and rainfall peak stage relationship.

In the technique of gauge/discharge correlation the various variables which affect the stage at the forecasting point are:

i. Stage and discharge of the base station;
ii. Stage and discharge of the forecasting station;
iii. Change in stage and discharge of the base station;
iv. Travel time at various stages;
v. The rainfall (amount, intensity and duration) in the intercepting catchment;
vi. Topography, nature of vegetation, type of soil, land use, density of population, depth of ground water table, soil moisture efficiency etc. of the intercepted catchment;
vii. The atmospheric and climatic conditions; and
viii. Stage and discharge of any important tributary joining the main stream between the base station and forecasting station.

Factor (i) to (iv) are basic parameters used in developing the correlation curve. Factor (v) and (vi) are taken in to account by introducing the rainfall and API. Factor (vii) is a minor one and can be considered by introducing an additional parameter. The factor (viii) is very important and can be neglected if the contribution of the tributary is very small. In many hydrologic studies, regression methods like multiple-linear regression (MLR), autoregressive moving averaging (ARMA) and autoregressive integrated moving average (ARIMA) have been used extensively by various researchers for river flow and stage forecasting (Tingsanchali and Gautam 2000); Bruen and Yang, 2005).

**(a)** Direct correlation between gauge and discharge at U/S and D/S

In such case, only gauge and discharge data of the base stations and forecasting stations are utilised in different forms. The simplest of all is the correlations between the $N^{th}$ hour stage of base station and $(N+T)^{th}$ hour stage of forecasting stations; where T is the travel time of flood wave between the base station and the forecasting station.

This type of relations can be developed and used for a reach of the river where there is no major tributary with considerable discharge, catchment between the two stations is small so that the effect of rain is negligible and the travel time from base station to the forecasting stations is fairly constant for various stages.

However, in most of the cases the travel time is not constant and varies with water level. Apart from this such relations give considerable errors under different conditions. These relations can be considerable improved if the following aspects are taken into account

- The variation in travel time- This can be taken in to account by appropriately drawing a travel time-curve (U/S stage Vs travel time).
- Varying conditions during rising and falling stages of the flood- It is always desirable to draw separate curves for rising and falling conditions.
- Downstream boundary condition- This is also a very important factor, especially for the forecasting in the lower reaches of the river which falls in the sea or a larger river. When the outfall channel is in high stage or there is high tide in the sea, it will definitely have back water effect and the water level in the falling stream will be different than that normal conditions. Hence it is always desirable to take into account the tidal effect or the water level of outfall channel.
- Characteristic of flood wave- Generally the forecast at downstream stations are quite reliable when the storm results in the formation of single peak. But with one flood wave is immediately followed by another there is considerable effect in the water level at the downstream station in different conditions. For example when a smaller flood wave is followed by a comparatively larger flood wave with high peak, the two flood wave may overlap resulting in slight increase in the level at downstream station than the in normal case. On the contrary, if a larger flood wave is followed by a smaller flood wave, the same flood wave may not have any effect by the time it reaches the downstream station.

Finding correlation between stage and discharges between upstream and downstream gauging stations is one of the simplest methods. This gives better result when there is less influence of tributaries joining the main stream in between or the intercepted catchment is not influenced by heavy rainfall. Here correlation between upstream gauge and downstream gauge has been derived by simple mathematical equation with corresponding travel time.

Vieira et al. (1993) used the statistical model, which is based on a multiple regression technique, extends the forecasting range of the model from 3 hrs up to 24 hrs, and presents good accuracy (estimated mean absolute errors smaller than 10 cm) for short-term forecasts up to 9 hrs. Historically, researchers have relied on conventional modelling techniques, either deterministic, which consider the physics of the underlying process, or systems theoretic/black box (Jain et al., 2003). Jain et al., (2003) further investigated the suitability of some deterministic and statistical techniques along with the artificial neural networks (ANNs) technique to model an event-based rainfall-runoff process. Specifically, two unit hydrograph models, four regression models, and two ANN models were developed.

Abudu et al. (2010) used the application of partial least-squares regression (PLSR) in seasonal stream flow forecasting was investigated using snow water equivalent, precipitation, temperature from automatic Snow Telemetry sites, and previous flow conditions as input variables. The forecast performance of PLSR models was compared to principal components regression (PCR) models as well as to the Natural Resources Conservation Service (NRCS) official forecasts in three basins. The results indicated that using a correlation-weighted precipitation index is a relatively effective method in both improving forecast accuracy and developing relatively parsimonious regression models.

#### 2.8.3.2 *Deterministic methods*

SSARR (Stream flow Synthesis and Reservoir Regulation) model, Sacramento Model, NAM-System 11 FF model (MIKE-11), HEC-1D, CWCFF1 and SWAT are some of the conceptual watershed models for formulating the real time flood forecast.

*(i) SSARR (Stream flow Synthesis And Reservoir Regulation) Model*

The Stream flow Synthesis and Reservoir Regulation (SSARR) Model was developed to provide mathematical hydrologic simulations for systems analysis as required for the planning, design, and operation of water control works. The SSARR Model has been further developed for operational river forecasting and river management activities. As a general purpose mathematical model of a river system, the SSARR Model is a useful tool for stream flow and runoff forecasting, as well as for long term studies of the hydrology of a river system.

*(ii) The Rainfall-Runoff Model, NAM*

NAM is a deterministic rainfall-runoff model of the lumped conceptual type. NAM is an abbreviation of the Danish: "Nedbor-Afstromnings-Model", meaning precipitation-runoff-model. This model was originally developed by the Hydrologic Section of the Institute of Hydrodynamics and Hydraulic Engineering at the Technical University of Denmark (Nielsen and Hansen 1973). The NAM model has been further developed and extensively applied by DHI (Jonch-Clausen and Refsgaard 1984). NAM simulates the rainfall-runoff process in rural catchments. It operates by accounting continuously for the moisture content in five different and mutually interrelated storages representing physical elements in the catchment.

The data input requirements are precipitation, potential evapo-transpiration and (only if snow occurs) temperature data. The sampling interval of the input data can be given arbitrarily. Thus, typically, for flood modelling six-hourly or three hourly rainfall data would be appropriate, while daily rainfall data would be sufficient for most other purposes.

For the purpose of flood forecasting a hydrological model of the NAM-type and complexity is believed to be appropriate. It has been documented both by Kitandinis and Bras (1978) and by Jorgensen (1981), that conceptual models are superior to black box models (as e.g. the ARIMA type of models) for flood forecasting. A more complex conceptual model will probably not yield better stream flow simulations because the main uncertainty in the rainfall-runoff modelling of the flood situations usually pertains to the assessment of the rainfall input.

The NAM model is a well proven engineering tool which has been applied successfully to more than *50* catchments in different climatic regions throughout the World. Hence, in addition to numerous applications in Denmark, it has been applied for water supply studies in Borneo, Tanzania and Sri Lanka, irrigation and flood control studies in Thailand, flood forecasting and flood control studies in India, and for hydropower studies in Greenland and Tanzania.

*(iii) MIKE-11*

MIKE-11 is a menu-driven software package for the simulation of flows, sediment transport and water quality in rivers, estuaries, irrigation systems and similar water bodies. The simulation system is comprised of 4 modules:-(i)A hydrodynamic module(HD) which computes discharges and water level variations in rivers and flood plains, (ii) A sediment transport module(ST),(iii) A transport-dispersion module(TD), and (iv) A water quality module(WQ).

The MIKE-11 system also includes a rainfall-runoff model (NAM) which stimulates catchment runoff to the river composed of overland flow, interflow and base flow. For forecasting of discharge and water levels in real-time a special flood forecasting module has been added (FF). It streamlines and facilitates the data management, model simulations and updating required for operational flood forecasting in real-time.

The HD basis module has three options for solving the governing hydrodynamic equations (Saint Venant equations), namely fully dynamic wave, diffusive wave and kinematic wave approximation. Selection of wave approximation type depends on river topography and flow conditions.

*(iv) Unit Hydrograph based models*:

In India, the applications of unit hydrograph technique are restricted to the catchments of sizes less than 5000 Sq. Km. However, for the catchments of size more than 5000 sq. km., a network model is developed. In this model the catchment is divided in to sub-catchments and the main river is divided in to sub-reaches, considering the two consecutive nodes. The nodes are the points where the tributary of the sub-catchments join the main river. The principle of unit hydrograph is applied for converting the excess rainfall to direct surface runoff for each sub-catchment parameters as additional rainfall runoff data are reported and using these updated parameters the future flows are estimated for forecasting. Gosain (1984) has used a Unit Hydrograph based real-time flood forecast model on River Yamuna.

*(v) HEC-RAS*

It is an integrated package of hydraulic analysis programs, in which the user interacts with the system through the use of a Graphical User Interface (GUI). The system is capable of performing Steady and Unsteady Flow water surface profile calculations, and will include Sediment Transport and several hydraulic design computations in the future.

HEC-RAS has the ability to import three-dimensional (3D) river schematic and cross section data created in a GIS or CADD system. While the HEC-RAS software only utilizes two-dimensional data during the computations, the three-dimensional information is used in the program for display purposes. After the user has completed a hydraulic analysis, the computed water surface profiles can be exported back to the GIS or CADD system for development and display of a flood inundation map. The HEC has developed an Arc View GIS extension called GeoRAS that was specifically designed to process geospatial data for use with HEC-RAS. The Geo-RAS software allows a user to write geometric data to a file in the required format for HEC-RAS. HEC-RAS contains five optional methods for specifying floodplain encroachments. This is again a public domain model and shall be used for assessing flood inundation areas.

*(vi) CWCFF1 (Central Water Commission Flood Forecast 1)*

The fundamental of concept of the CWCFF1 (Central Water Commission Flood Forecast 1) model is based on the fact that fluid tends to maintain uniform levels under free conditions. When fluids of two different chambers with different levels are allowed to mix freely, their new levels after a certain time interval will depend on their levels at the beginning of the time interval and the time lapse.

In this model a river channel is visualized as comprising of a number of parallel slices. As water flows through these slices various processes take place simultaneously between each two adjoining slices; major processes are identified as follows:

1. Water flows from higher elevation to lower elevation;
2. Some of the water is absorbed and retained in the dry river banks;
3. Some of the water evaporates;
4. Some of the water spreads away from the river bank and returns to the main stream when the river stage falls;
5. Some of the spilled water crosses the river bank and is held up in pits and low-lying areas, never returning to the main stream;
6. At some places water takes a separate course and joins the river downstream.

The above processes are dependent on the following physical processes:

a) Process 1 depends on the difference of levels of water in the two adjoining slices and slope of the river bed;
b) process 2 depends on the dryness of river banks, which in turn depends on the previous maximum water level and the lapse of time since its occurrence;
c) process 3 depends on the dryness of the air and the air temperature;
d) Process 4, 5 and 6 depend on the slope of the river, bank conditions and river characteristics.

In this model, processes 1, 4, 5 and 6 are combined together as characteristics of a river channel at a particular location which remain almost unchanged.

*(vii) SWAT (Soil and Water Assessment Tool)*

SWAT is the acronym for Soil and Water Assessment Tool. a river basin. or watershed, scale model developed by Dr. Jeff Arnold for the USDA Agricultural Research Service (ARS). SWAT was developed to predict the water and sediment yield in large complex watersheds with varying soils, land use and management conditions. SWAT is a continuous time model. The model has a real-time flood forecasting component also. The present version of the model has a interface on ArcGIS. The model is a public domain model.

*(viii) Artificial Neural Network (ANN)*

ANN is a computational method inspired by the studies of the brain and nervous system in biological organisms (Schalkoff, 1997). One of the characteristics of the neural network is their ability to learn. A neural network is not programmed like a conventional computer program, but is presented with examples of the pattern, observations and concepts, or any type of data which it is supposed to learn. Through the process of learning (also called training) the neural network organizes itself to develop an internal set of features that it uses to classify information or data. Due to this massively parallel processing architecture the ANN is capable of efficiently handling complex computations, thus making it the most preferred technique today for high speed processing of huge data. ANN has been in existence since the 1940s, but since current algorithms have overcome the limitations of those early networks great interest in the practical applications of ANN has arisen in recent decades. ANN have been proven to provide better solution when applied to (1) complex system that may be poorly described or understood; (2) problem that deals with noise or involve pattern recognition, diagnosis, abstraction, and generalization; and (3) situations where input is incomplete or ambiguous by nature. It has been reported that an ANN has the ability to extract patterns in phenomena, which avoids the selection of a model form such as linear, power, or polynomial. ANN Model is another class of Black Box models introduced for modelling real time problems where the nonlinear relationship between the rainfall and runoff process exits. The use of ANN in real time flood forecasting is of very recent origin (Lekkas et al., 2004).

Artificial neural networks are a type of parallel computer structure, within which a number of processing units are linked together so that the computer's memory is distributed and information is passed in a parallel manner. A large number of ANN architectures and algorithms have been developed so far, multilayer feedforward networks (Rumelhart *et al.*,1986), self-organising feature maps (Kohonen, 1982), Hopfield networks (Hopfield, 1987), counter propagation networks (Hecht-Nielsen, 1987), radial basis function networks (Powell, 1987) and recurrent ANNs (Elman network; Elman, 1988). Of these networks, the most commonly used are feed forward networks and radial basis function networks (Karunanithi, *et al.*, 1994; Bishop, 1995). Multi-layer feed forward networks have been found to perform best when used in hydrological applications (Hsu *et al.*, 1995; Dawson and Wilby, 1999) and as such they are by far the most commonly used (Maier and Dandy, 2000). The attempt to choose between different methods and define which is the superior, is likely to fail as in most cases the choice should be "application oriented". It is preferable for every new application to test different types of ANNs rather than use a pre-selected one.

*Training:* To train an ANN, the following procedure is generally applied. Training data patterns are fed sequentially into the input layer, and this information is propagated through the network. The resulting output predictions $yj(t)$ are compared with a corresponding desired or actual output, $dj(t)$. The mean squared error at any time $t$, $E(t)$, may be calculated over the entire data set using Equation (2.1). The intermediate weights are adjusted using an appropriate learning rule until *E*(*t*) has decayed sufficiently.

$$MSE(t) = \frac{1}{2}\sum_{j=1}^{n}(y_j(t) - d_j(t))^2 \quad (2.1)$$

A wide range of training algorithms has been developed to achieve optimum model performance. For feed forward ANNs, the error back propagation algorithm with the gradient descent update rule (Rumelhart *et al.*, 1986) is most commonly employed. However, there are a number of inconvenient drawbacks associated with the use of this algorithm. For example, prior to ANN training it is necessary to specify the network architecture, that is, the number and configuration of its hidden units. The learning ability and performance of an ANN model depends on the suitability of its architecture. If the network is too small, it may have insufficient degrees of freedom to fully capture all the underlying relationships in the data. Conversely, if the network is too large, it may fail to generalise, memorising events in the training data that are not necessarily representative of the system under consideration.

For hydrological applications, ANN models can take advantage of their capability to reproduce the unknown relationship existing between a set of input variables descriptive of the system, for example, rainfall, and a set of output variables, for example, river flow rate (Chakraborty et al., 1992; Bishop, 1994). Cottrell and Girard (1995) and Yang (1996) stated that due to the ability of filling in gaps where information is missing, ANN provides a way of unravelling correlation complex systems. Therefore, we are encouraged further to examine its forecasting ability for no-ideal time series data. Using real hydrometric data, Dawson and Wilby (1998) used an ANN to forecast flow rates for 6-h lead time in two flood-prone catchments in the U.K. They also did forecasting at a gauging station for longer periods of time (about 6 months) using rainfall and flow discharge data measured at the same gauging station.

Methods to continuously forecast water levels at a site along a river are generally model based (Thirumalaiah et al., 1998). Physical processes influencing occurrence of a river stage are, however, highly complex and uncertain, which makes it difficult to capture them in some form of deterministic or statistical model. Neural networks provide model-free solutions and hence can be expected to be appropriate in these conditions. Built-in dynamism in forecasting, data-error tolerance, and lack of requirements of any exogenous input are additional attractive features of neural networks. Author highlights their use in real-time forecasting of water levels at a given site continuously throughout the year based on the same levels at some upstream gauging station and/or using the stage time history recorded at the same site. The network is trained by using three algorithms, namely, error back propagation, cascade correlation, and conjugate gradient.

Campolo et al (1999) developed a neural network model to analyze and forecast the behaviour of the river Tagliamento, during heavy rain periods. The makes use of distributed rainfall information coming from several rain gauges in the mountain district and predicts the water level of the river at the section closing the mountain district. The water level at the closing section in the hours preceding the event was used to characterize the behaviour of the river system subject to the rainfall perturbation.



ASCE (2000a) described the role of ANNs in hydrology. Apart from description of various aspects of ANN and some guidelines on their uses a brief comparison of ANNs and other modelling philosophies in hydrology were also presented. A discussion on the strengths and limitations of ANN brought out the similarities they have with other modelling approaches, such as physical model. ASCE (2000b) examined the role of ANN in various branches of hydrology presented an excellent critical review of published work. With identification of merits and demerits, it was found that ANNs are tools for modelling many of the non-linear hydrologic processes such as rainfall-runoff, stream flow, ground water management, water quality simulation and precipitation. A good physical understanding of the hydrologic process being modelled can help in selecting the input vectors and designing a more efficient neural network. However, artificial neural networks were found to be data intensive, and there appears to be no established methodology for their design and successful implementation. The merits and limitations of ANN applications were discussed and potential research avenues were explored. In brief, most of the ANN studies available are on training and testing of ANN rainfall-runoff studies provide enough evidences that ANN are highly capable in learning and extracting the behaviour of a system, when sufficient data is available for training of ANN model. The performance of the developed ANN has frequently been compared with other empirical, conceptual and statistical models. The comparison is normally input dependent and the ANNs resulted in superior performance. The use of artificial neural network for runoff and sediment yield simulation and forecasting is an area that is yet to be fully explored.

Wei et al. (2002) described a new approach to the flood disaster prediction problems. The results proved that the use of ANN with the capacity of mapping or function approximating on the flood disaster prediction problem is a valid approach, which is not only simple but also reliable. Since its mapping approximation process is independent of the types of variable relationships. Obviously, this method could also be extended to a wide variety of flood disaster problems such as danger forecasting. However, many further works are needed for the wide applications on flood disaster prediction problems such as the choice of proper ANN topology structures, and the improvement of its algorithm.

Chang and Chen (2003) presented a hybrid ANN including the fuzzy clustering scheme along with Radial Basis Functions for water stage forecasting in an estuary under high flood effects. They showed that ANN could be a powerful tool for solving such a poorly defined and complex problem. The primary goal of this paper was to investigate the applicability of hybrid structure of Artificial Neural Networks, Self Organizing Radial Basis (SORB), in streamflow forecasting. The architecture employed consists of Self-Organizing Feature Map (SOFM) as an unsupervised training scheme for data clustering, which correspondingly provides the parameters required for the Gaussian functions in RBF neural network. Spread of the Gaussian functions extracted from SOFM seemed to be tunable, and tuning was done in parallel to training the RBF network.

Laio et al (2003) compared performances of ANN and NLP (nonlinear prediction) for lead times of 1-, 3-, 6-, 12- and 24-hours using rainfall data in the input vector and the flow stage at a gauging station on Tanaro River in Alba in north-western Italy. According to Sudheer and Jain (2004), ANN model has various mathematical compositions capable of modelling extremely complex physical systems. It has the potential to be more flexible and less assumption-dependant approach to act as a simulation model for the hydrologic systems.

Moradkhani et al. (2004) improved stream flow forecasting using the self-organizing radial basis function ANN. Dawson et al. (2006) explored the potential of ANN in flood estimation in ungauged catchments and evaluated possible spatial biases in ANN model output error. Based on information at stations upstream of a river, a back-propagation neural network model was employed by Kerh (2006) to forecast flood discharge at station downstream of the river which lacks measurement. The performance of the neural network model was evaluated from the indices of root mean square error, coefficient of efficiency, error of peak discharge, and error of time to peak. The verification results showed that the neural network model is preferable, which performs relatively better than that of the conventional Muskingum method. Furthermore, the developed model with different input parameters was trained to check the sensitivity of physiographical factors. The results exhibited that flood discharge and water stage, are two factors to dominate the accuracy of estimation. Meanwhile, the physiographical factors had a slight and positive influence on the accuracy of the prediction. The time varied flood discharge forecasting at an unmeasured station might provide a valuable reference for designing an engineering project in the vicinity of the investigation region.

Li et al. (2006) introduced a Web-based flood forecasting system (WFFS), which includes five main modules: real-time rainfall data conversion, model-driven hydrologic forecasting, model calibration, precipitation forecasting, and flood analysis, is presented in this paper. The WFFS brings significant convenience to personnel engaged in flood forecasting and control and allows real-time contribution of a wide range of experts at other spatial locations in times of emergency. The conceptual framework and detailed components of the proposed WFFS, which employs a multi-tiered architecture, are illustrated. Multi-tiered architecture offers great flexibility, portability, reusability and reliability. The prototype WFFS has been developed in Java programming language and applied in Shuangpai region with a satisfactory result.

Yu et al. (2006) proposed the use of support vector machine, a novel artificial intelligence-based method derived from statistical learning theory, for real-time stage forecasting model. The lags associated with the input variables are determined by applying the hydrological concept of the time of response, and a two-step grid search method is applied to find the optimal parameters, and thus overcome the difficulties in constructing the learning machine. Two structures of models used to perform multiple-hour-ahead stage forecasts are developed.

Ren (2010) presented a new classified real-time flood forecasting framework by integrating a fuzzy clustering model and neural network with a conceptual hydrological model. A fuzzy clustering model was used to classify historical floods in terms of flood peak and runoff depth, and the conceptual hydrological model was calibrated for each class of floods. A back-propagation (BP) neural network was trained by using real-time rainfall data and outputs from the fuzzy clustering model. BP neural network provided a rapid on-line classification for real-time flood events. Based on the on-line classification, an appropriate parameter set of hydrological model was automatically chosen to produce real-time flood forecasting. Different parameter sets was continuously used in the flood forecasting process because of the changes of real-time rainfall data and on-line classification results. Chen et al. (2010) introduced a decision group Back-Propagation Neural Network for flood forecasting.

According to Panda (2010), simulation of water levels at different sections of a river using physically based flood routing models is quite cumbersome, because it requires many types of data such as hydrologic time series, river geometry, hydraulics of existing control structures and channel roughness coefficients. Normally in developing countries like India it is not easy to collect these data because of poor monitoring and record keeping. Therefore, ANN technique is used as an effective alternative in hydrologic simulation studies. The present study aims at comparing the performance of the ANN technique with a widely used physically based hydrodynamic model in the MIKE 11 environment. The MIKE 11 hydrodynamic model was calibrated and validated for the monsoon periods (June–September) of the years 2006 and 2001, respectively. Feed forward neural network architecture with Levenberg–Marquardt (LM) back propagation training algorithm was used to train the neural network model using hourly water level data of the period June–September 2006. The trained ANN model was tested using data for the same period of the year 2001. Simulated water levels by the MIKE 11HD were compared with the corresponding water levels predicted by the ANN model. The results obtained from the ANN model were found to be much better than that of the MIKE 11HD results as indicated by the values of the goodness of fit indices used in the study.

Kar et.al (2010) in their study described that downstream of Mahanadi basin is devoid of a sound flood forecasting system. They have compared both ANN and statistical methods using peak discharges in downstream catchment of Hirakud for flood forecasting at delta head.

### 2.8.4 Verification of forecasting

The following are the main purpose of forecast verification:

(i) To find the degree of accuracy and inaccuracy of the forecast;

(ii) To find out the possible reason for error and to suggest the possible improvement in the existing system;

(iii) To select the appropriate model parameter.

An accurate forecast means that the difference between the forecast level and the corresponding observed level is not considerable. In an ideal situation, the forecast and the corresponding observed values of water stage should be one and the same. However for all practical purposes, it has been assumed that a forecast may be called sufficiently correct if the difference between the forecast and the corresponding observed values of water stage is within +/- 15 cm and peak discharge of +/- 20% is accepted. Level forecast and Inflow forecast reliable to an extent of 95% (WMO, 1994).

### 2.8.5 Dissemination of forecast

The utility of flood forecast is dependent on both accuracy and timeliness. Under-prediction can lead to dangerous situation resulting in damage of life and property in the areas, victim of mistaken and misplaced confidence. On the other hand, over-prediction will result in avoidable and unnecessary evacuation, flood fighting measures including costly engineering and panic among the people. Timeliness is also equally important. It should be borne in mind that the value of the forecast is zero at the time of the event. Hence, longer the warning time, greater will be its utility. But here there is need for caution. The forecast of almost zero warning time will be hundred percent accurate while there is chance of the error increasing progressively upon various factors. Hence, there is need for some sort of a compromise between the accuracy and the warning time keeping in view that a warning period of less than 10 to 12 hours in our country will not mean much of a help in organizing flood fighting measures.

The organisations responsible for flood warning and flood fighting should be informed about the incoming flood as early as possible so that the required action is planned and activities set into operation with least possible delay. They should also be kept informed of the propagation of a flood wave and of any change in the present as well as anticipated flood situation with respect of time, these information which are supplied by the forecasting units in the form of Flood forecast Bulletin must be clear and include necessary details so that a very realistic picture of the incoming danger is depicted. There should be arrangement for double check with well defined responsibility in every office authorised to issue flood forecasts in order to avoid dissemination of wrong forecasts including even inadvertent mistakes because hardly any time is left for review between receipt of forecasts and start of chain of activities.

# METHODOLOGY

The present thesis work proposes an ANN-based flood forecasting model and compares its application results with those due to conventional techniques. Among the conventional techniques, simple regression approaches are used. These techniques are employed largely due to inapplicability of physically based models to the complex deltaic system.

## 3.1 STATISTICAL APPROACH

### 3.1.1 Multiple Linear Regression

The general purpose of multiple regression is to learn more about the relationship between several independent or predictor variables as a dependent or criterion variable. In general, multiple regression allows the researcher to ask (and hopefully answer) the general question "what is the best predictor of ......." The general computational problem that needs to be solved in multiple regression analysis is to fit a straight line to a number of points. In the simplest case- one dependent and one independent variable one- can be visualized in scatter plot.

#### 3.1.1.1 Method of Least Squares

In the scatter plot, we have an independent or X variable, and a dependent or Y variable. The goal of linear regression procedures is to fit a straight line through the points. Specifically, a line is computed so that the squared deviations of the observed points from that line are minimized. Thus, this general procedure is sometimes also referred to as least squares estimation.

#### 3.1.1.2 Regression Equation

A line in a two dimensional or two variable space is defined by the equation $Y = a + b*X_j$, the Y variable can be expressed in terms of a constant 'a' and a slope 'b' times the X variable. The constant is also referred to as the intercept, and the slope 'b' as the regression coefficient or b-coefficient. In the multivariate case, when there are more than one independent variable, the regression line cannot be visualized in the two dimensional space, that can be computed just as easily. In general, multiple regression procedures estimate a linear equation of the form:

$$Y = a + b_1 * X_1 + b_2 * X_2 + \ldots\ldots + b_n * X_n \quad (3.1)$$

### 3.1.1.3 Unique prediction and partial correlation

It may be noted from the above equation that the regression coefficients (or b-coefficients) represent the independent contributions of each independent variable to the prediction of the dependent variable. Another way to express this fact is to say that, for example, variable $X_1$is correlated with the Y variable, after controlling for all other independent variables. This type of correlation is also referred to as a partial correlation.

### 3.1.1.4 Predicted and residual scores

The regression line expresses the best prediction of the dependent variable (Y), given the independent variables (X). However, the nature is rarely (if ever) perfectly predictable, and usually there is substantial variation of the observed points around the fitted regression line. The deviation of a particular point from the regression line (its predicted value) is called the residual value. Residuals are calculated by working out 'expected' value of Y by applying the regression equal to the actual values of X and then subtracting each expected Y value from its corresponding actual Y value. Where the value of Y predicted by the equation is less than the actual value of Y, the residual is positive. Negative residuals result from cases where Y is predicted higher than it actually is.

### 3.1.1.5 Assumptions, limitations, and practical considerations

***(a) Assumption of linearity***

First of all, as is evident in the name multiple linear regression, it is assumed that the relationship between variables is linear. In practice this assumption can virtually never be confirmed. Fortunately, multiple regression procedures are not greatly affected by minor deviations from this assumption. However, as a rule it is prudent to always look at bivariate scatter plot of the variables of interest. If curvature in the relationships is evident, one may consider either transforming the variables, or explicitly allowing for non-linear components.

***(b) Limitations***

The major conceptual limitation of all regression techniques is that one only ascertains relationships, but never be sure about underlying causal mechanism.

***(c) Choice of the number of variables***

Multiple regression is a seductive technique: "Plug in" as many predictor variables as one can think of and usually at least a few of them will come out significant. This is because one is capitalizing on chance when simply including as many variables as one can think of as predictors of some other variables of interest. This problem is compounded when, in addition, the number of observations is relatively low. Most researchers recommend that there should be at least 10 to 20 times as many observations as one has variables, otherwise the estimates of the regression line are probably very unstable and unlikely to replicate if one were to do the study over.

***(d) Multi-co linearity and matrix Ill-conditioning***

This is a common problem in many correlation analyses. When there are many variables involved, it is often not immediately apparent that this problem exists, and it may only manifest itself after several variables have already been entered in to the regression equation. Nevertheless, when this problem occurs it means that at least one of the predictor variables is (practically) completely redundant with other predictors. There are many statistical indicators of this type of redundancy as well as some remedies (e.g., Ridge regression).

***(e) The importance of residual analysis***

Even though most assumptions of multiple regressions cannot be tested explicitly, gross violations can be detected and should be dealt with appropriately. In particular outliers (i.e., extreme cases) can seriously bias the results by "pulling" or "pushing" the regression line in a particular direction thereby leading to biased regression coefficients. Often, excluding just a single extreme case can yield a completely different set of results.

### 3.1.2 Formulation of Models

The general representation of statistical models may be given by

$$Y_i = \sum_{j=0}^{k} \beta_j X_{ij} + \varepsilon \qquad (3.2)$$

With $X_{io}=1$. Here, $X_{ij}$ is the independent variable for the i$^{th}$ observation (various water stages in the present study), $Y_i$ is the dependent variable for the i$^{th}$ observation, $\beta_j$ is unknown coefficients to be estimate, $k$ is the number of coefficient (to be estimated) in the model, and ε is the error in the determination of $Y_i$ which is generally assumed as having zero mean and constant standard deviation $\sigma$.

The unknown coefficients ($\beta$) are estimated by least squares method because here no assumption is necessary on the probability distribution data due to its simplicity. Initially preliminary analysis of data was carried out before starting actual statistical regression analysis.

#### *3.1.2.1 Preliminary analysis of data*

The preliminary analysis consists of

i. Initial filtration of data
ii. Partial visual inspection of the data files
iii. Creation of scatter plots

The outliers detected in the scatter plot were removed.

#### *3.1.2.2 Secondary analysis*

The filtered data for the data sets obtained after preliminary analysis is used to find correlation matrices predicting correlation of each flood forecasting parameters constituent stage at forecasting points. To enhance the visualization of the correlation matrix the square of correlation coefficient (COD) or coefficient of determination is calculated to indicate the contribution of individual flood forecasting parameters in explaining the variation in the dependent variable.

#### *3.1.2.3 Selection of independent variables for regression analysis*

If more number of independent variables as possible is used, the reliable fitted values can be determined and model prediction will be more accurate. Moreover, since COD gives the proportion of the variation in the dependent variables that is explained by the fitted regression model, one obviously wants COD to be large. But on the other hand, because of the costs involved in obtaining information on a large number of independent variables and subsequently monitoring them, there is interest in including as few independent variables as possible. Thus, one has to make compromise between these extremes, i.e. for selecting the best regression variables and thereby the best model. There is no unique statistical procedure for doing this (Draper and Smith, 1981). Different researchers suggested different statistical procedures namely: backward elimination, all possible regression, ridge regression, forward elimination in stepwise regression, principal component regression, and stage wise regression which may help information of optimum model. In the present study, the best subset regression approach has been used to select the best set of independent variables for dependent stage at forecasting points.

### *3.1.2.4 Best subset regression*

Using the coefficient of determination (COD) i.e., the proportion of variation explained in the dependent variable, different best subsets of independent variables could be selected. The regression was assessed for each subset according to

- The value of COD achieved,
- The number of observations used in developing the model.

The model obtained from large dataset and achieving high COD is preferred.

## 3.2 ARTIFICIAL NEURAL NETWORK

An artificial neural network (ANN) is a computing paradigm designed to mimic the human brain and nervous system. Neural network (NN) has a big role to play in the field of water sector where complex natural processes dominate. The high degree of empiricism and approximation in the analysis of water quality systems make the use of neural network highly suitable. In other words, when the possibility of representing the complex relationships between various aspects of the processes in terms of physical or conceptual modelling is very remote, the neural network plays an important role.

ANN is an information processing system that uses an approach entirely different from conventional algorithmic programming and roughly replicates the behaviour of a human brain by emulating the operations and connectivity of biological neurons. From a mathematical point of view, it is a complex non-linear function with many parameters that are trained in such a way that the ANN output becomes similar to the measured output on a known data set. ANNs are highly distributed interconnections of adaptive nonlinear processing-elements (PEs) (Figure 3.1). When implemented in digital hardware, the processing-element is a simple sum of products followed by non-linearity. The connection strengths, also called the network weights, can be adapted such that the network's output matches the desired response.

In multi-layered perception, hidden layer means third layer of processing elements or units in between the input and output layers that increases computational power. In principle, the hidden layer can be more than one layer. In practice, the number of neurons in this layer is evaluated by trial and error. Hornik et al (1989) proved that a single hidden layer containing a sufficient number of neurons could be used to approximate any measurable functional relationship between the input data and the output variable to any desired accuracy, in addition, De Viliars and Barnard (1993) showed that an ANN comprising of two hidden layers tends to be less accurate than its single hidden layer counterpart.

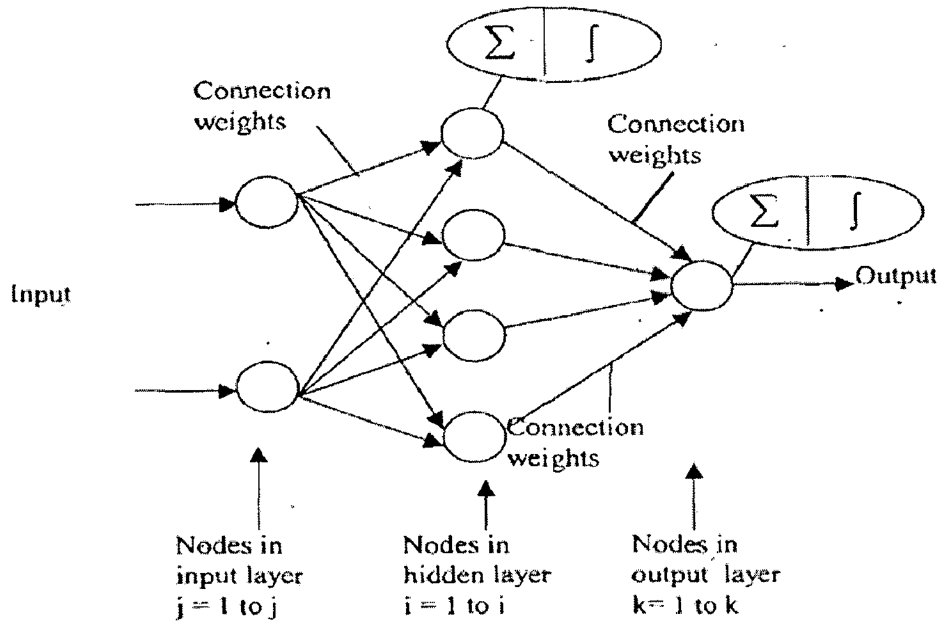


Fig. 3.1The Building Blocks of ANN

The ANNs are not exactly the substitute of regression. General regression cannot solve the problems where the input dimension space is high and there is restriction on the number of input data. Regression imposes a priori variable selection, with all the inherent pitfalls, where one is limited to a few inputs among hundreds available. Regressions are performed using simple dependency functions that are not very realistic. In regression there is only one dependency function over the whole data set, instead of many distinct niches, which is taken care of by ANNs. Where dependency between the input variables and the output are not well-defined, ANNs solve it better. The most important difference between ANN and regression is that the former maps the output by generalization whereas the later by memorization. Generalization refers to the neural network producing reasonable outputs for inputs not encountered during learning. To over-simplify, if an object is represented in a network as a pattern of activation of several units, and if a unit or two responds incorrectly, the overall patterns remain pretty well the same, and the network will still respond correctly to stimuli.

ANNs have been developed as a generalization of mathematical models of neural biology and are based on following rules:

(i) Information processing occurs at many single elements called nodes, also referred to as units of neurons.

(ii) Signals are passed between nodes through connection links.

(iii) Each connection link has an associated weight that represents its connection strength

(iv) Each node typically applies a nonlinear transformation called activation function to its net input to determine its output signal.

### 3.2.1 ANN Structure

#### 3.2.1.1 Biological neuron

A typical biological neuron comprises of Dendrites, Soma, Axon, and Synaptic Buttons, is shown in Figure (3.2). The dendrites form a very fine filamentary brush surrounding the body of the neuron. The information is picked up at the Dendrite. The Soma is cell body whereas the Axon is long transmission line like structure and the tail end of the Axon is called Synaptic Buttons. These neurons are so powerful in processing the information, that even a small earthworm with only 302 neuron has a computing power around one thousand times the power of Pentium-II Processor. Thus the computation power of parallel processing in neuro biological system is very high.

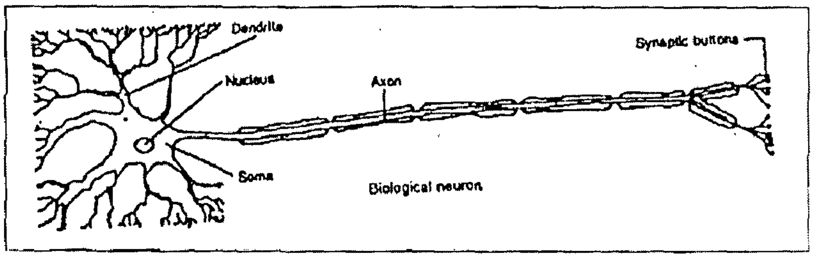


Fig. 3.2: Anatomy of Biological Neuron

#### 3.2.1.2 Artificial neuron

Let neuron has a set of n inputs $x_1$, $x_2$, $x_3$,.....$x_n$ and wt, $w_2$,$w_3$,....$w_n$ are weights attached to the input link. The inputs to the neuron may come from the environment in which it is embedded or outputs to the other neuron are located in. The signals are passed to the cell body through the synapse, which may accelerate or retard. This acceleration or retardation of the input signal is modelled by the weights.

Weights are multiplicative factors of the inputs to account for the strength of the synapse. The total output is

$$I = W1X1 + W_2X_2 + W3X3 + \ldots\ldots\ldots\ldots + w_n x_n$$

Or, $$I = \Sigma w_i x_i \qquad (3.4)$$

To generate the final output y, the sum is passed through a non-linear fitter $\Phi$ called activation function or transfer function, which releases the output y as

$$Y = \Phi(I) \qquad (3.5)$$

The error (E) is calculated at the output as

$$E = \frac{1}{2}\Sigma[(y_{obs} - y_{est})^2] \qquad (3.6)$$

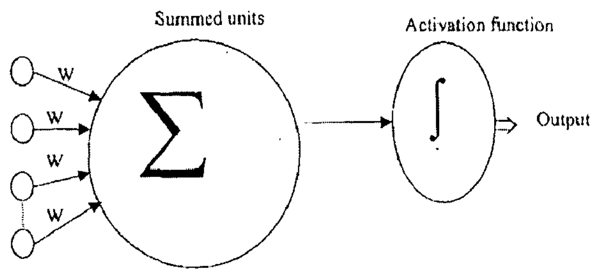


Fig. 3.3 Anatomy of artificial neuron

### 3.2.2 Gradient Descent Learning Algorithm

Gradient descent learning is the mostly used principle of ANN training. The reason is that trial computation is required to implement this method, and the fact that the gradient can be computed with local information. The principle of gradient descent learning is very simple. The weights are moved in a direction opposite to the direction of the gradient. The gradient of a surface indicates to the direction of the maximum rate of change. Therefore, if the weights are moved in the opposite direction of the gradient, the system state well approach points where the surface is flatter.

### 3.2.3 Neural Network Topology

The arrangement of the processing units, connections and pattern input / output in an ANN is referred to as topology. The processing units are arranged in three layers that are input, hidden and output. The units of a layer are similar in the sense that they all have the same activation dynamics and output function. The number of input and the number of output are problem specific. There are no fixed rules as to the how many units should be included in the hidden layer. If there are too less units in the hidden layer, the network may have difficulty in generalizing the problem. On the other hand, if there are too many units in the hidden layer, the network may take an unacceptably long time to learn. On the basis of direction of information flow and processing the ANNs are classified as feed forward and feed backward network.

#### 3.2.3.1 Feed forward network

The nodes are generally arranged in layers, starting from first input layer and ending at the final output layer. There can be several hidden layers with each layer having one or more nodes Information passes from the input to the output side. The neurons in one layer are connected to those in the next, but not to those in the same layer. Thus the output of a node in the one layer is only a dependent on the input it receives from previous layers and the corresponding weights.

#### 3.2.3.2 Feed backward network

Information flows through the nodes in both directions from the input to the output side and vice-versa. This is generally achieved by recycling previous network outputs as current inputs, thus allowing for feedback.

### 3.2.4 Activation Function

This function is the mostly used function for solving ANN problems.

#### 3.2.4.1 Sigmoid function

This function is a continuous function that varies gradually between asymptotic values 0 and 1 or -1 and +1 and is given by

$$\Phi(x) = \frac{1}{1 + e^{-\beta x}} \qquad (3.7)$$

Where, $\beta$ is the slope parameter, which adjusts the abruptness of the function as it changes between the two asymptotic values. Sigmoid functions are differentiate, which is an important feature of neural network theory. Experimental observations of biological neurons demonstrate that the firing is roughly sigmoid, when plotted(Fig.3.4).

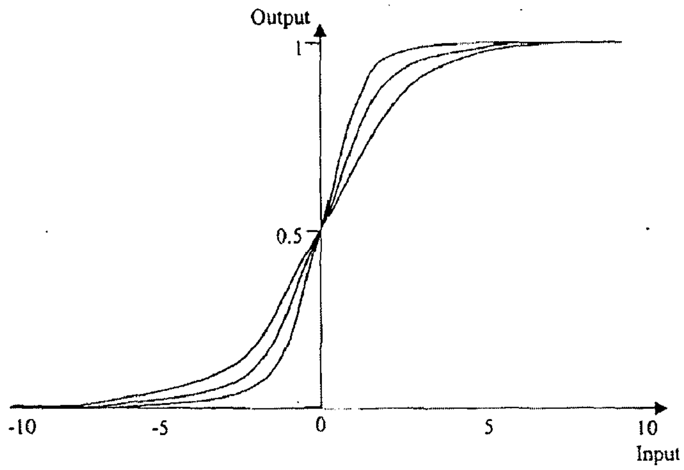


Fig 3.4: The Sigmoid Function

### 3.2.5 Architecture of ANN

The manner in which the neurons of a neural network are structurally and intimately linked with learning algorithm ceased to train the network. The optimal architecture is one, which yields the best performance in terms of error minimization, while training simple and compact structure. The numbers of input and output nodes are problem dependent. The flexibility lies in selecting number of hidden layers and in assigning the number of nodes to each of these layers.

### 3.2.6 Training of Artificial Neural Network

Once a network has been structured for a particular application, that network is ready to be trained. To start this process the initial weights are chosen randomly. Then, the training, or learning begins. Supervised and unsupervised are two methods used to train neural network.

#### 3.2.6.1 Supervised training

In supervised training, both the inputs and the outputs are provided, the networks then process the inputs and compare its resulting outputs against the desired outputs. Errors are then propagated back through the system, causing the system to adjust the weights, which control the network. This process occurs over and over as the weights are continually tweaked. The set of data, which enables the training, is called the 'training set'. During the training of a network the same set of data is processed many times as the connection weights are ever refined. Sometimes, some networks never learn because the input data does not contain the specific information.

If a network simply cannot solve the problem, the designer then has to review the input and outputs, the number of layers, the number of elements per layer, the connections between the layers, the summation, transfer and training functions, and even the initial weight themselves, those changes create a successful network.

#### 3.2.6.2 Unsupervised training

In unsupervised training, the network is provided with input but not with desired outputs. The system itself must then decide what features it will use to group the input data. At the present time, unsupervised learning is not well understood. Currently this field remains one that is still in the laboratory.

### 3.2.7 Back Propagation Algorithm

Back propagation is a system of method of training multi layer artificial neural networks. Scientist and Engineering community to the modelling has used it and processing of many quantitative phenomena using neural network has used it. This learning algorithm is applied to multi layer feed forwarded network consisting of neurons with continuous differentiate activation functions. Such networks associated with the back propagation-learning algorithm are called back propagation networks (Fig.3.5). The back propagation algorithm is a generalization of the least mean square algorithm that modifies network weights to minimize the mean squared error between the desired and actual outputs of the network. Back propagation uses supervised learning in which the network is trained using data for which inputs as well as desired outputs are known. Once trained, the network weights are frozen and can be used to compute output values for new input samples.

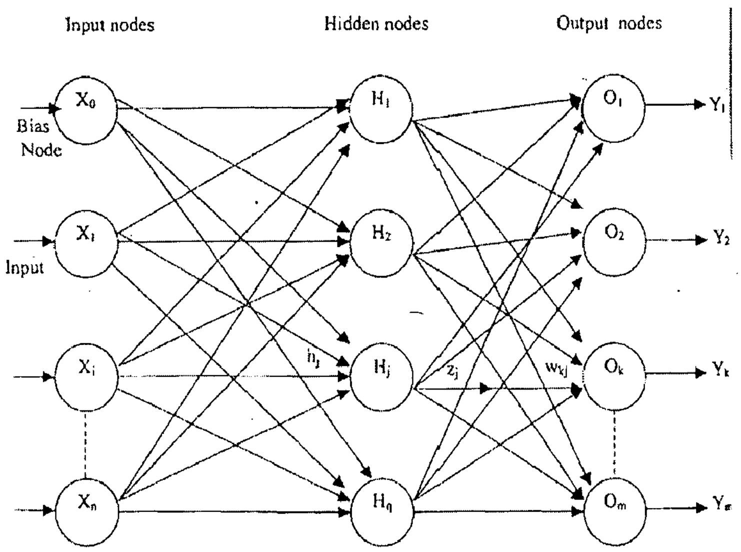


Fig 3.5 A typical three layered back propagation feed forward neural network

### 3.2.8 Learning Factors of Back Propagation

One of the major issues concerning back propagation algorithm is its convergence. The convergence of back propagation is based on some important learning factors such as the initial weights, the learning rate, the nature of training set and the architecture of the network.

#### 3.2.8.1 Initial weights

The initial weights of a multi layer feed forward network strongly affect the ultimate solution. They are typically initialized by small random values (between -1.0 and 1.0 or -0.5 to +0.5). Equal weights values cannot train the network properly if the solution requires unequal weights to be developed. The initial weights cannot be large, otherwise the sigmoid will saturate, from the beginning and the system will stuck at a local minimum. The saturation is avoided by choosing the initial values of the synoptic weights to be uniformly distributed inside a small range of values. The range should not be too small as it can cause the learning to be very small.

#### 3.2.8.2 Learning rate ($\eta$)

Weight vector change in back propagation are proportional to the negative gradient of the error, this guideline determines the relative changes that must occur in different weights when a training sample (or a set of samples) is presented, but does not fix the exact magnitudes of the desired weight changes. The magnitude change depends on the appropriate choice of the learning rate $\eta$. A large value of $\eta$ will lead to rapid learning but the weight may then oscillate, while low values imply slow learning. This is typical of all gradient descent methods. The right value of $\eta$ will depend on the application. Values between 0.1 and 0.9 have been used in many applications. The most efficient approach is to vary the learning rate as the training progresses, the effectiveness of learning rate may be checked as the training progresses and the value of the learning rate can be changed based on that.

#### 3.2.8.3 Momentum factor ($\alpha$)

Back propagation leads the weights in a neural network to a local minimum of the MSE, possibly substantially different from the global minimum that corresponds to the best choice of weights. This problem can be particularly bothersome if the "error surface" (plotting MSE against network weights) is highly uneven or jagged, with a large number of local minima.

We may prevent the network from getting stuck in some local minimum by making the weight changes depend on the average gradient of MSE in a small region rather than the precise gradient at a point average $\frac{\partial E}{\partial W}$ in a small neighbourhood can allow the network weights to be modified in the general direction of MSE decrease, without getting stuck in some local minima.

Calculating averages can be an expensive task. A shortcut, suggested by Rumelhart et. al (1986) is to make weight changes in the $i^{th}$ iteration of the back propagation algorithm depend on immediately preceding weight changes, made in the $(i-1)^{th}$ iteration. This has an averaging effect, and diminishes the drastic fluctuations in weight changes over consecutive iterations. The implementation of this method is straight- forward, and is accomplished by adding a momentum term to the weight update rule,

$$\Delta W_{kj}(t-1) = \eta \delta_k X_j + \alpha \Delta W_{kj}(t) \quad (3.8)$$

Where, $\Delta W_{kj}(t)$ is the weight required at time t, and

α is an additional parameter known as momentum factor.

Values for the momentum coefficient a can be obtained adaptively, as in the case of the learning rate parameter η. A well-chosen value of a can significantly reduce the number of iterations for convergence. A value close to 0 implies that the past history does not have much effect on the weight change, while a value closer to 1 suggests that the current error has little effect on the weight change.

**3.2.8.4 Data normalization**

The variables fall in the range of 0 to 1, because it smoothen the solution space and averages out some of the noise effects. Such process is called normalization or standardization.

**3.2.8.5 Training data and generalization**

The training data submitted to the network for it to learn and generalize the relation between input and output should be sufficient and proper. Networks with too many trainable parameters for a given amount of training data learn well but do not generalize well. This phenomenon is called over fitting with too few trainable parameters; the network fails to learn the training data. In estimation of parameter of a water quality model, the available data are divided into two parts. The first part is used to calibrate the model, and the second to validate it. This practice is known as 'Split-Sample' test. The length of calibration data depends upon the number of parameters to be estimated. The general practice is to use half to two-third of the data for calibration and the remaining for validation.

### 3.2.9 Steps in Development of ANN Model

The steps followed in the development of Artificial Neural Model are summarized as:

Step I: Identify parsimoniously all physically based input variables with their time memory that influence the output.

Step II: All inputs and output sets for the calibration and verification are normalized.

Step-III: Start with a three layered ANN model having only one hidden layer and the number of nodes in the hidden layer is approximately double of input models. The numbers of nodes in the input layer are equal to the number of input variables, whereas, the number of nodes in output layer is equal to the number of output variables.

Step-IV: All the interconnecting weights are assigned a small value between - 0.5 to +0.5 through a random numbers generation program.

Step-V: Select fixed or variable values of learning rate and / or momentum term depending upon the algorithm used for optimization.

Step-VI: Select the learning process that is either pattern learning or batch learning processes.

Step-VII: Execute the program, which performs:

(a) feed forward calculation,

(b) error back propagation in the network, and

(c) Finally change the weight.

Step-VIII: Estimate output for calibration and verification and apply performance evaluation criteria.

Step-IX: Perform whole operation for maximum desired iterations.

Step-X: Select the iteration that results in maximum generalization on the basis of performance evaluation criteria.

Step-XI: For required generalization repeat the learning process by assigning more numbers of nodes in the hidden layer or by increasing the numbers of hidden layers.

### 3.3 PERFORMANCE EVALUATION CRITERIA

The performance evaluation criteria used in the present study are described below

#### 3.3.1 Coefficient of determination (COD)

Coefficient of determination (COD) is used in the context of statistical models whose main purpose is the prediction of future outcomes on the basis of other related information. It is the proportion of variability in a data set that is accounted for by the statistical model (Steel and Torrie, 1960). It provides a measure of how well future outcomes are likely to be predicted by the model.

There are several different definitions of COD which are only sometimes equivalent. One class of such cases includes that of linear regression. In this case, if an intercept is included then COD is simply the square of the sample correlation coefficient between the outcomes and their predicted values, or in the case of simple linear regression, between the outcomes and the values of the single regressor being used for prediction. In such cases, the coefficient of determination ranges from 0 to 1. Important cases where the computational definition of COD can yield negative values, depending on the definition used, arise where the predictions which are being compared to the corresponding outcomes have not been derived from a model-fitting procedure using those data, and where linear regression is conducted without including an intercept. Additionally, negative values of COD may occur when fitting non-linear trends to data. (Cameron, 1997).In these instances, the mean of the data provide a fit to the data that is superior to that of the trend under this goodness of fit analysis.

The square of the multiple correlation coefficients COD or $R^2$ is defined as

$$COD = \frac{SSR}{SS_Y} = 1 - \frac{SSE}{SS_Y} \tag{3.9}$$

Where $SS_y$ = sum of square about the mean $=\Sigma(y-\bar{y})^2$

SSE = sum of square about the regression = $\Sigma(y-y_{est})^2$

SSR = sum of square due to regression = $\Sigma(y_{est}-\bar{y})^2$

i.e., $SS_y$ =SSE + SSR

y = the observed values of dependent variable,

$\bar{y}$ = the average value of dependent variable,

$y_{est}$ = the compute values of the dependent variable

The stronger the linear association between y and $y_{est}$, it will yield a large value of COD and vice-versa. Unfortunately, wherever comparing a subset model to a large model including the subset, COD value larger than that for the subset model. However, for fixed number of independent variables COD can be used to compare different models with a large value of COD indicating the preferred model.

COD is a statistic that will give some information about the goodness of fit of a model. In regression, the COD coefficient of determination is a statistical measure of how well the regression line approximates the real data points. An COD of 1.0 indicates that the regression line perfectly fits the data.

Values of COD outside the range 0 to 1 can occur where it is used to measure the agreement between observed and modelled values and where the "modelled" values are not obtained by linear regression and depending on which formulation of COD is used. If the first formula above is used, values can never be greater than one. If the second expression is used, there are no constraints on the values obtainable.

In many (but not all) instances where COD is used, the predictors are calculated by ordinary least-squares regression: that is, by minimizing SSE. In this case COD increases as we increase the number of variables in the model (COD) will not decrease). This illustrates a drawback to one possible use of COD, where one might try to include more variables in the model until "there is no more improvement". This leads to the alternative approach of looking at the adjusted COD. The explanation of this statistic is almost the same as COD but it penalizes the statistic as extra variables are included in the model. For cases other than fitting by ordinary least squares, the COD statistic can be calculated as above and may still be a useful measure. If fitting is by weighted least squares or generalized least squares, alternative versions of COD can be calculated appropriate to those statistical frameworks, while the "raw" COD may still be useful if it is more easily interpreted. Values for COD can be calculated for any type of predictive model, which need not have a statistical basis.

### 3.3.2 Nash-Sutcliffe Efficiency (NSE)

The Nash–Sutcliffe model efficiency coefficient is used to assess the predictive power of hydrological models. It is defined as:

$$NSE = 1 - \frac{\sum_{i=1}^{n}(O_i - P_i)^2}{\sum_{i=1}^{n}(O_i - \bar{O}_i)^2} \quad (3.10)$$

Where, n= total number of data sets;

$O_i$= Observed peak floods for $i^{th}$ data set,

$P_i$= Predicted peak flood for $i^{th}$ data set,

$\bar{O}_i$= Mean of observed peak flood for $i^{th}$ data set,

NSEs can range from $-\infty$ to 1. An efficiency of 1 (NSE = 1) corresponds to a perfect match of predicted to the observed data. An efficiency of 0 (NSE = 0) indicates that the model predictions are as accurate as the mean of the observed data, whereas an efficiency less than zero (NSE < 0) occurs when the observed mean is a better predictor than the model or, in other words, when the residual variance (described by the numerator in the expression above), is larger than the data variance (described by the denominator).

Essentially, the closer the model efficiency (NSE) is to 1, the more accurate the model is. This method can be used to describe the predictive accuracy of other models as long as there is observed data to compare the model results to.

### 3.3.3 Root Mean Square Error (RMSE)

The Root Mean Square Error (RMSE) is a frequently used measure of the differences between values predicted by a model or an estimator and the values actually observed from the thing being modelled or estimated. It is expressed as

$$RMSE = \sqrt{\frac{1}{n}\sum_{1}^{n}(O_i - P_i)^2} \tag{3.11}$$

Where, n= total number of data sets;

$O_i$= Observed peak floods for $i^{th}$ data set,

$P_i$= Predicted peak flood for $i^{th}$ data set,

RMSE indicates the discrepancy between the observed and predicted values. A RMSE value close to zero indicates better performance of the model. The best fit between observed and predicted values, which is unlikely to occur, would have RMSE as 0.

# STUDY AREA AND DATA AVAILABILITY

This chapter describes the study area and availability of data. The study area chosen for the present work is the deltaic region of Mahanadi River basin in India for application and testing of the proposed methodology. A brief of the Mahanadi basin is given as follows.

## 4.1 Mahanadi Basin

The Mahanadi basin extends over an area of 1,41,600 km$^2$ which is nearly 4.3% of the total geographical area of the country. It lies between east longitudes 80°30' to 86°50' and north latitudes 19°21' to 23°35'. It is bounded on the north by the Central India hills, on the south and east by the Eastern Ghats and on the west by the Maikala range. The upper basin is a saucer shaped and mostly lies in Chhattisgarh state. The basin lies in the States of Orissa, Bihar, Chhattisgarh, and Maharashtra. The basin is circular in shape with a diameter of about 400 km and an exit passage of about 160 km length and 60 km breadth. The state wise distribution of the drainage area is given in Table 1. Fig 4.1 depicts Mahanadi basin showing different zones.

**Table 4.1: State wise distribution of drainage area of Mahanadi River**

| State | Drainage area(km$^{2)}$ |
|---|---|
| Chhattisgarh | 74,970 |
| Odisha | 65,600 |
| Bihar | 650 |
| Maharashtra | 250 |
| Madhya Pradesh | 130 |
| Total | 141,600 |

*Source: Water Resources Department, Government of Odisha (2007).*

Physiographically, the basin can be divided into four regions, namely, the northern plateau, the Eastern Ghats, the coastal plain and the erosional plains of central table land. The first two are hilly regions. The coastal plain is the delta area which is highly fertile. The central table land is the central interior region of the basin, traversed by the river and its tributaries. The basin has a culturable area of about 79,900km$^2$ which is about 57% of the basin area and four percent of the total culturable area of the country.

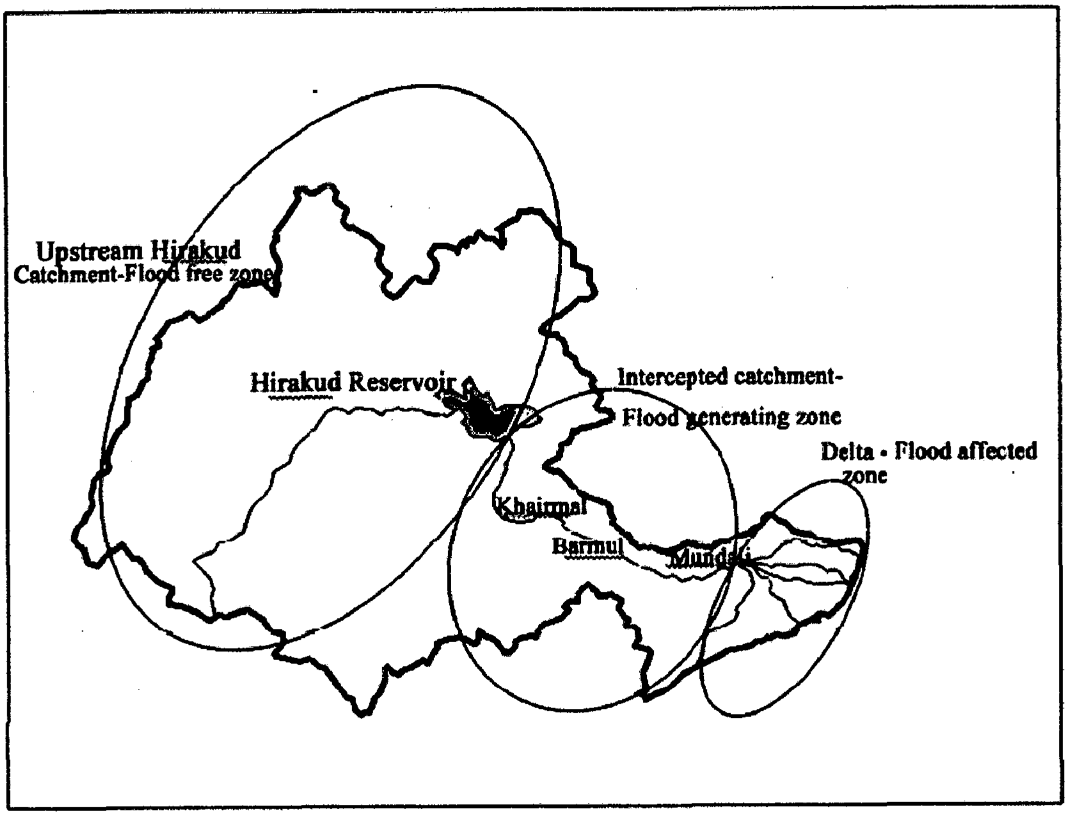


Fig 4.1: Mahanadi basin showing different zones (*Source:Kar et al.2010)*

It originates from the Amarkantak hills of the Bastar Plateau near Pharasiya village in Raipur district of Chhatisgarh. The river traverses a total distance of 851 km (in Orissa - 494 km.) and falls into the Bay of Bengal. Mahanadi is a major river basin of eastern India comprising a catchment of 141600 sq. km. Its major part is occupied by Chhatisgarh and Orissa States. The basin lying in the South West monsoon tract is exposed to myriad hydro-climatic variations. The reservoir Hirakud which drains nearly 83000 sq. km. is the prime flood moderation structure in the basin, and the catchment of about 50000 sq. km. remains unregulated. Both the Hirakud release and intercepted catchment cause the flood damage to about 9000 sq. km. of delta.

Mahanadi is a major east flowing river of India and known for its large water volume and flood havocs. Mahanadi is the sixth largest river of our country and is said to be the lifeline of two states like Odisha and Chhatisgarh. Simultaneously, it is dangerous for the disastrous floods it carried during different periods of time. Basin receives 1088 mm of rainfall during the South-West monsoon (mid June to mid-October). Due to heavy rainfall the delta of the basin (Fig.4.1) the river downstream of Mundali is subjected to annual floods, which are aggravated by high tides and heavy rainfall directly on the delta. Floods of recent time like those of 1980,1982,2001,2008 are still in the mind of the people of this basin. As the slope of basin is more flat on part of Odisha (carrying 46% of the total catchment) devastation due to floods are more here. Although, some reservoirs and storage structures are now planned or are to come up in both the states in order to control the flood as well as increase irrigation capacities.

**4.2 Climate of Mahanadi Basin**

To the north, in the region of the Mahanadi River the climate is predominantly sub-tropical with summer temperatures of around 29°C and winter temperatures of 21°C. The normal time of onset of monsoon over the basin is the first week of June. The bulk of the precipitation (800 to over 1,600 mm) over the basin falls in the period from July to September while during January to February, precipitation received is less than 50 mm.

The meteorology and climatology of the catchment are significantly influenced by the geographical location of the catchment with respect to the Bay of Bengal, where from most of the weather systems originate. Also, the orography of the Eastern Ghats, influence the rainfall pattern over the catchment to a great extent. The southwest monsoon normally sets over this area in the first week of June and withdraws in the first week of October. The south-west monsoon (June-October) accounts for nearly 91% of the annual rainfall. December is the driest month contributing less than 10% of annual rainfall.

***4.2.1 Rainfall***

The normal (1901-60) annual rainfall of the Mahanadi catchment is 141.7 cm. The average normal annual rainfall of the catchment above Hirakud is 139.6 cm and the corresponding value for catchment below Hirakud is 145.8 cm. Historical records show that the highest monthly and annual rainfalls were 1,405.9mm in June 1936 and 3,669.8mm in 1944 respectively at Bulandarpara. Besides the observatories maintained by IMD, about 200 rain gauge stations are maintained by the concerned States. Although distribution of the stations is fairly even, their number is not sufficient considering the hilly terrain which occupies the major part of the catchment. Rainfall data at some of the observatories and rain gauge stations are available from past 80 years.

*4.2.2 Temperature*

In the Mahanadi catchment, May is the hottest month and December the coldest. The diurnal range of temperature is the maximum during February and March; it is less during July and August. At Raipur and Sambalpur, the temperature varies from 12°C to 40°C while at Cuttack, it varies from 14 °C to 40°C. Temperature variation at Puri which is closer to sea is from 16 °C to 32°C.

*4.2.3 Evaporation*

Pan evaporation is being observed at four stations in the Mahanadi basin, namely, Labhandi, Hirakud, Bolangir and Cuttack. Out of these, long-term pan evaporation data is available for Labhandi and Cuttack stations. The average monthly pan evaporation of these stations is given in Table 4.2

Table 4.2 Pan Evaporation data (cm) of two stations in Mahanadi basin

| Month | Station | |
|---|---|---|
| | Labhandi | Cuttack |
| January | 3.0 | 3.3 |
| February | 4.9 | 4.4 |
| March | 6.8 | 5.3 |
| April | 10.9 | 6.6 |
| May | 14.6 | 7.5 |
| June | 11.8 | 5.6 |
| July | 5.7 | 3.9 |
| August | 4.9 | 3.4 |
| September | 4.1 | 3.9 |
| October | 3.7 | 3.6 |
| November | 3.0 | 3.3 |
| December | 2.4 | 3.0 |

*Source: Jain (2007)*

***4.2.4 Soils and Land Use***

The main soil types found in the basin are red and yellow soils. Mixed red and black soils occur in parts of the Bolangir, Sambalpur, and Sundargarh districts of Orissa. Laterite soil is found in the lower parts of Orissa. The deltaic soil is found in the coastal plains of the Mahanadi. Black soil and sandy soil with "Kankar" are the main soils found in the part of basin lying in Chhattisgarh. Except in the Chhattisgarh and coastal plains, the basin has an extensive area under forests. Forest and agriculture are the main stay of the people in the interior parts of the basin. The Chhattisgarh and coastal plains, with a high incidence of rainfall, are predominantly rice growing areas.

### 4.3 Mahanadi Delta Region

Delta region of Mahanadi River basin in India forms study area (Fig. 4.2 & 4.3). It is located in the north-eastern part of coastal Orissa in India and lies between the longitudes 85° 30' E and 86° 52' E and the latitudes 19° 40' N and 20° 45' N.

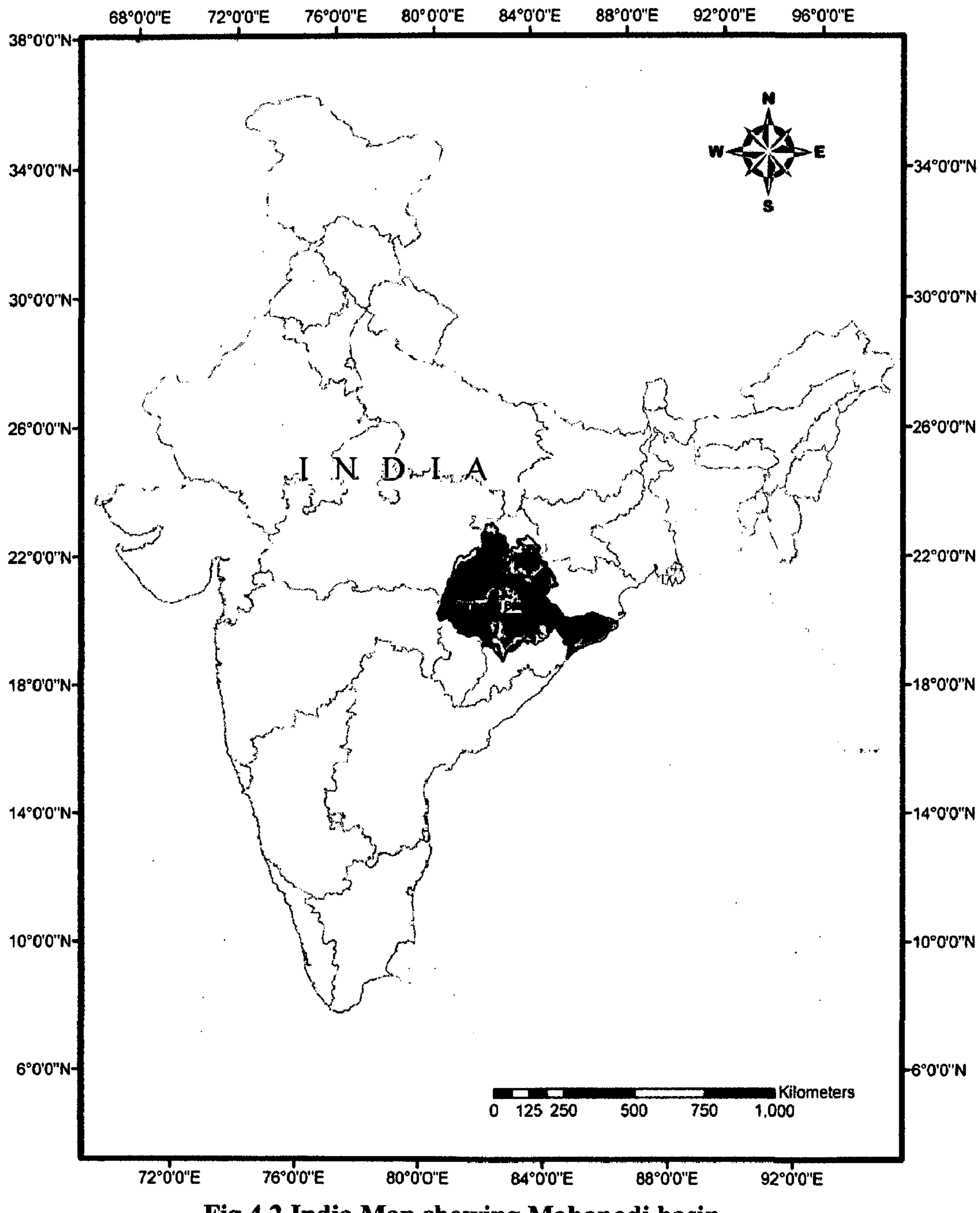


**Fig.4.2 India Map showing Mahanadi basin**

downstream end of the main course of the Mahanadi River as compared to others. The catchment area upstream of the delta receives heavy rainfall during the monsoon period as a result of which all the rivers in the delta flow full and flooding occurs.

Our study area lies between the longitudes 85° 30' E and 86° 25' E and the latitudes 19° 40' N and 20° 30' N of nearly 9000 $km^2$. Which includes the distributaries Kathjodi, Kuakhai, Serua, Bharagavi, Kushabhadra, Daya, Devi and Kelue.

**4.4 Data Acquisition**

Three hourly stage and discharge (Table I.1, Appendix-I) is available at base station and forecasting station for a period of 2004-2009. The data is collected from Department of Water Resources, Government of Odisha. Peaks at base station i.e. at Khairmal and corresponding peaks at forecast station i.e. at Naraj are collected, and their travel times determined from the corresponding time series. Out of these, 65 peaks are considered for our analysis; total four cases are taken for calibration and validation. Again using 3 hourly stage forecasting model has been developed taking three cases in to consideration, Case-I using data of base station(Khairmal) as input, Case-II using the data of forecasting station(Naraj) as input and Case-III using the combination of data of Khairmal stage and Naraj stage as input in the model.

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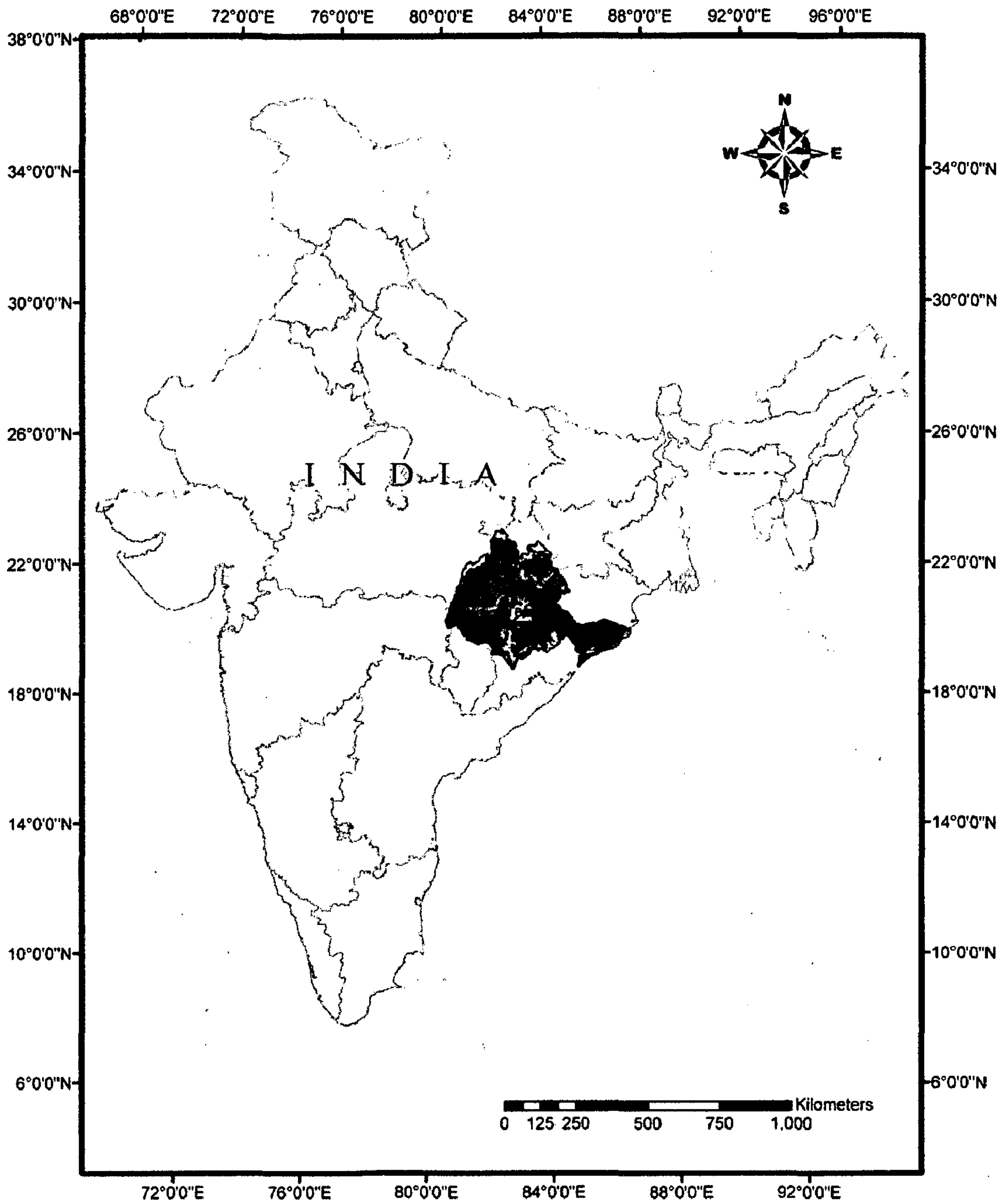


**Fig.4.2 India Map showing Mahanadi basin**

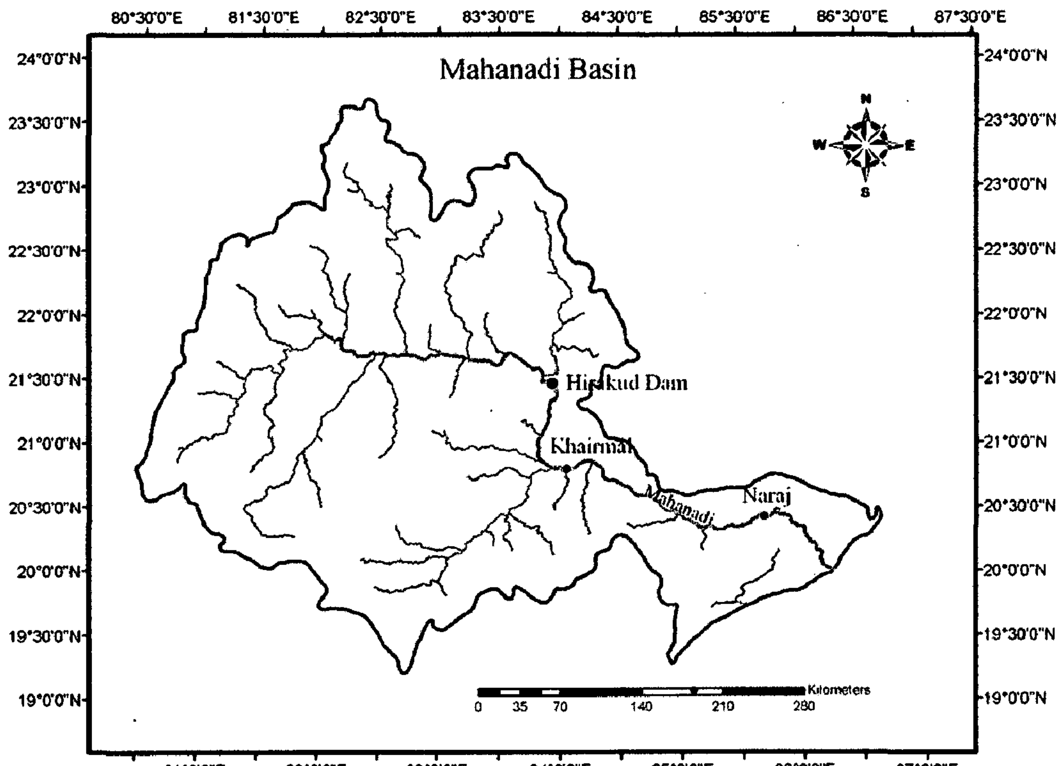


**Fig 4.3 Mahanadi basin**

The areal extent of the delta is about 6800 $km^2$ in which more than 80% of the total cropped area is affected by floods during the monsoon period. In the last five years, four severe floods have occurred in this region. The average surface elevation of the delta region ranges from 5m to 30m. The flooding in the delta region is due to the river Mahanadi and its distributaries. The downstream catchment has three main tributaries like Jeera, Ong and Tel with catchments 2383, 5128 and 25045 sq. km., respectively. So the contributions from the Tel catchment always remain predominant. Even the flood of 2008 is mainly due to the contribution of this tributary. It has produced a peak discharge of 33762 cumecs during 2008. The river Tel joins at Patharla to the main river Mahanadi and our base station Khairmal is at downstream of Patharla station. The other tributaries Ong and Jeera join also at the upstream of base station (Khairmal). The whole river from Khairmal is taken as one unit ignoring the contribution of further small tributaries.

The distributaries of the river Mahanadi include Kuakhai, Devi, Kathajodi, Kandal, Serua, Luna, Paika, Kushabhadra, Bhargavi, Chitrotpala, Daya and Biluakhai. The flooding problem is more severe in the rivers Devi, Kushabhadra and in the downstream end of the main course of the Mahanadi River as compared to others. The catchment area upstream of the delta receives heavy rainfall during the monsoon period as a result of which all the rivers in the delta flow full and flooding occurs.

Our study area lies between the longitudes 85° 30' E and 86° 25' E and the latitudes 19° 40' N and 20° 30' N of nearly 9000 $km^2$. Which includes the distributaries Kathjodi, Kuakhai, Serua, Bharagavi, Kushabhadra, Daya, Devi and Kelue.

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# CHAPTER 5
# RESULTS AND DISCUSSION

As discussed in the previous chapters, the present work aims at to develop (a) conventional (i.e. statistical) model and (b) ANN based model for flood forecasting using stage data of Khairmal and Naraj gauging stations located on River Mahanadi in Odisha State. The performance of these models is evaluated using the criteria of Coefficient of Determination (COD), Nash-Sutcliffe Efficiency (NSE), and Root Mean Square Error (RMSE) for comparison purpose. Thus, the following text discusses the results of both the proposed statistical and ANN-based models.

## 5.1 Statistical Model Development

The flood forecasting is based on the stage values of upstream stations as input data. Here, forecasting models are proposed for peak stages by establishing a peak to peak correlation at the two gauging sites. Secondly, three hourly stages are correlated through multiple-linear regression analysis.

### 5.1.1 Peak to peak correlation

The statistical approach is applied for development of a relationship between the peak stage values at Khairmal and Naraj gauging sites. Flood peaks have been derived by drawing time series of Khairmal and Naraj stage as shown in Figs 5.1-5.5. One peak of Naraj is taken corresponding to Khairmal peak stage, and thus, 65 peaks are derived from these time series graph. The whole available data are split into two sets, calibration and validation. Total four cases (Table 5.1) are considered as follows:

Table 5.1 Cases considered based on number of peaks in calibration and validation

| Case | Number of peaks considered | |
|---|---|---|
| | Calibration | Validation |
| I | 35 | 30 |
| II | 45 | 20 |
| III | 50 | 15 |
| IV | 55 | 10 |

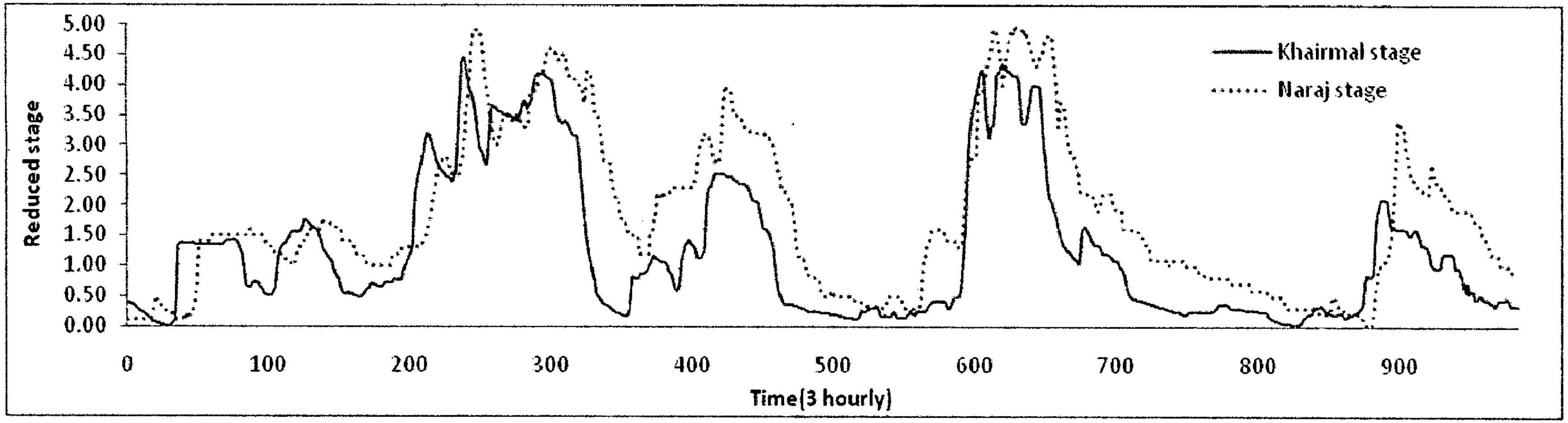


Fig. 5.1 Time series of Khairmal and Naraj stages for the year 2005

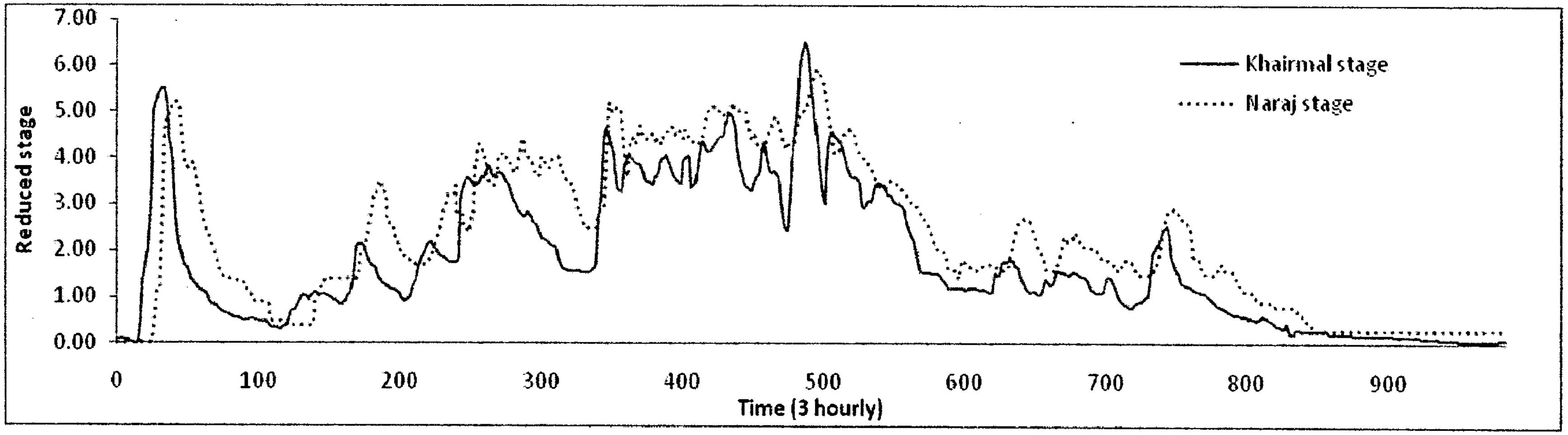


Fig. 5.2 Time series of Khairmal and Naraj stages for the year 2006

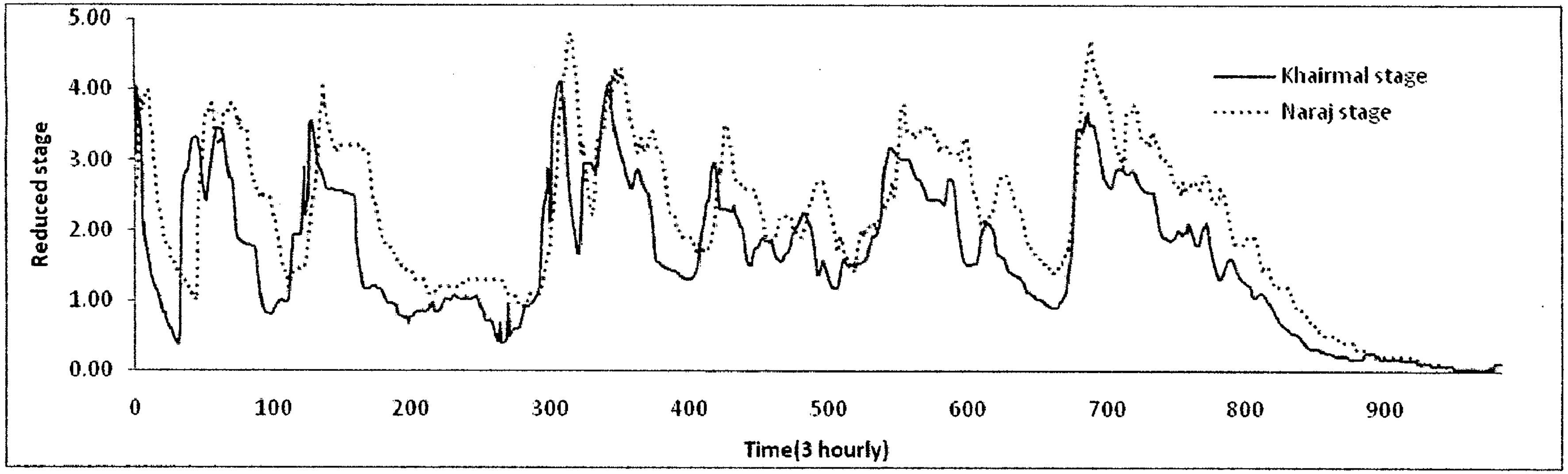


Fig. 5.3 Time series of Khairmal and Naraj stages for the year 2007

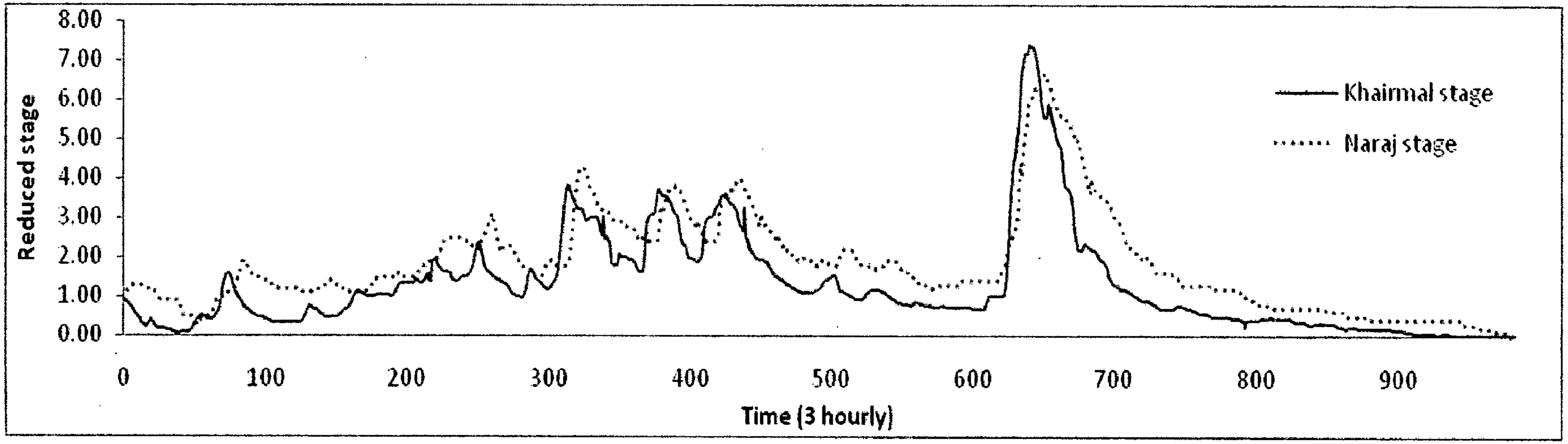


Fig. 5.4 Time series of Khairmal and Naraj stages for the year 2008

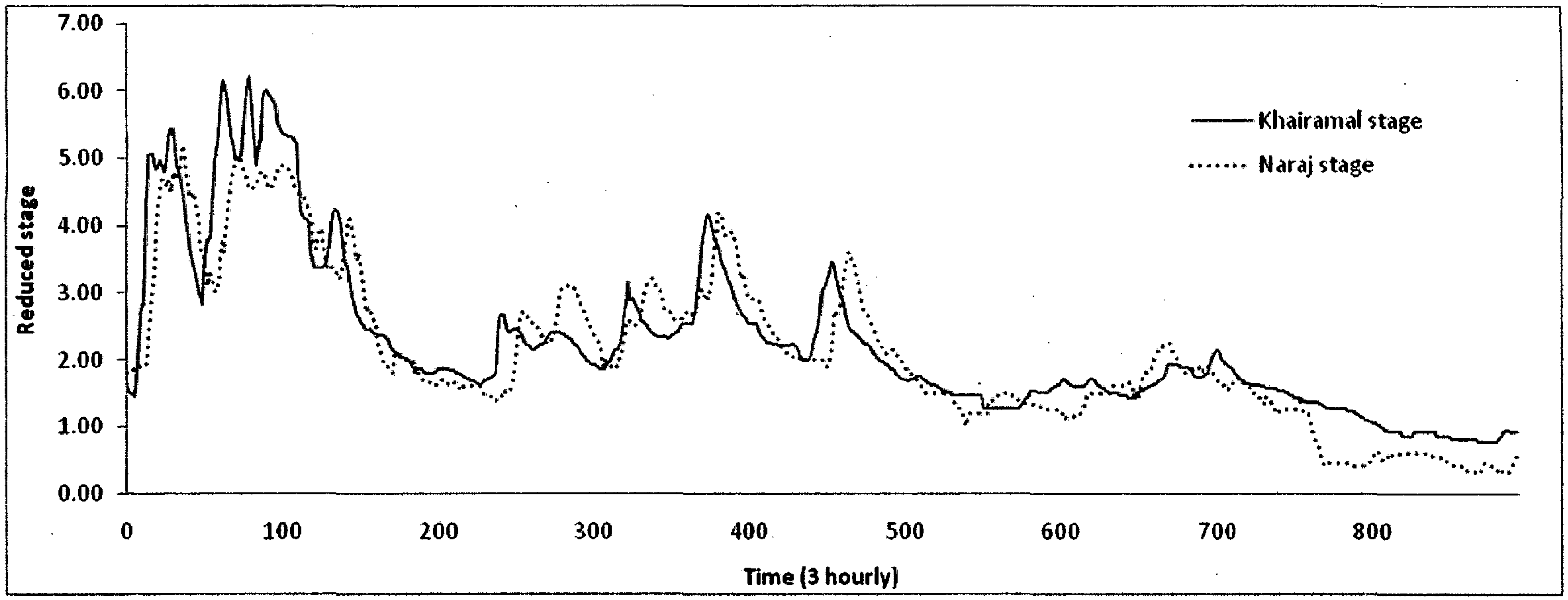


Fig. 5.5 Time series of Khairmal and Naraj stages for the year 2009

Table 5.2 Development of peak to peak stage (Khairmal to Naraj) linear relationship (statistical method)

| Case | Equation | COD | | RMSE (m) | | NSE | |
|---|---|---|---|---|---|---|---|
| | | Calibration | Validation | Calibration | Validation | Calibration | Validation |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| I | $H_N$=0.87*$H_K$-65.38 | 0.86 | 0.89 | 0.49 | 0.34 | 0.86 | 0.88 |
| II | $H_N$=0.86*$H_K$-65.03 | 0.86 | 0.90 | 0.45 | 0.39 | 0.86 | 0.89 |
| III | $H_N$=0.88*$H_K$-66.47 | 0.86 | 0.92 | 0.44 | 0.39 | 0.86 | 0.89 |
| IV | $H_N$=0.88*$H_K$-66.95 | 0.87 | 0.96 | 0.43 | 0.46 | 0.87 | 0.83 |

Notations: $H_N$ = Stage at Naraj (Forecasting Station) and $H_K$ = Stage at Khairmal (Base Station)

Table 5.2 describes the statistical results of Case-I to Case-IV, and these are depicted in Figs 5.6 - 5.9 showing the Line of Perfect Fit (LPF) between forecast and observed peak stages of Naraj. It is seen from these figures that for Case-III majority of the forecast peak stages are relatively close to the Line of Perfect Fit. The proposed peak to peak flood forecasting models for delta region of Mahanadi basin show the values of COD and NSE in the ranges of 0.86 to 0.87 and 0.86 to 0.87, respectively, in calibration. Values of COD and NSE vary in the ranges of 0.89 to 0.96 and 0.83 to 0.89 in validation. RMSE varies from 0.43 to 0.49 in calibration, and 0.34 to 0.46 in validation. Out of these four cases, model performance in Case-III is better than the others yielding COD, RMSE, and NSE as 0.86, 0.44, and 0.86, respectively, in calibration, and 0.92, 0.39, and 0.89 in validation. The performance of models in Case-I and Case-II is poorer than in Case-III, i.e their CODs are lower, and RMSEs higher, than those of Case-III. In Case-IV, model performance is better in calibration, but poor in validation, and therefore, it is not selected. Finally Case-III model is selected as the preferred model among all these models.

Column 2 of Table 5.2 describes the forecasting equation for each case. These simple equations although not so much accurate, but useful in emergency where lead time is very less for flood forecasting by other methods, as other methods require more data.

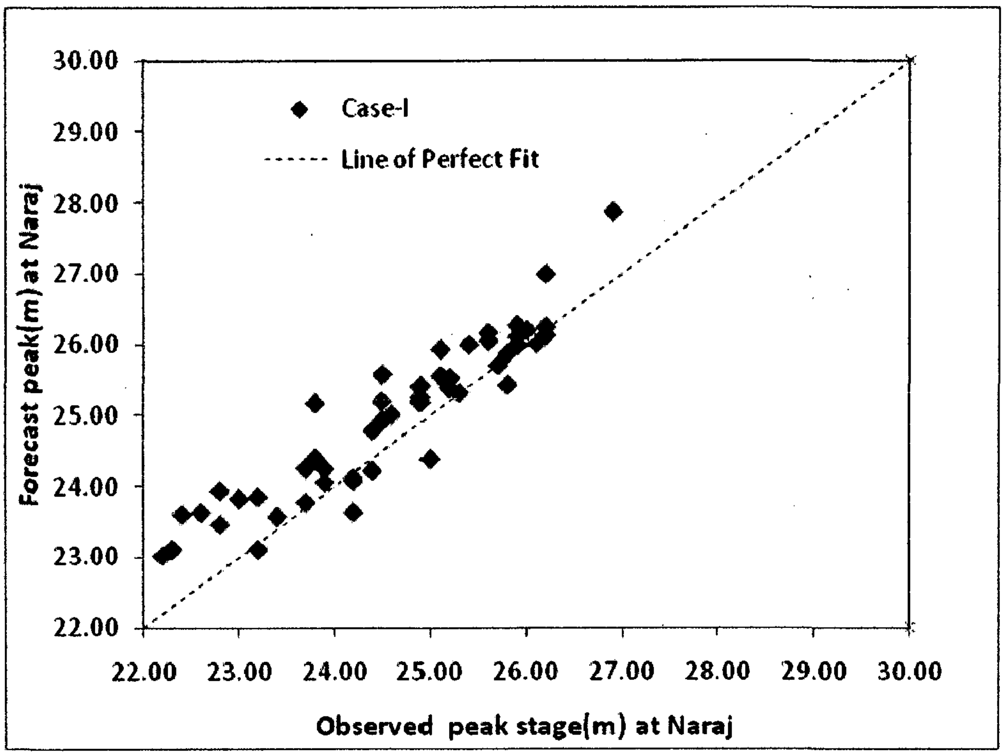


Fig. 5.6 (a) Forecast and observed peaks for Case-I in calibration

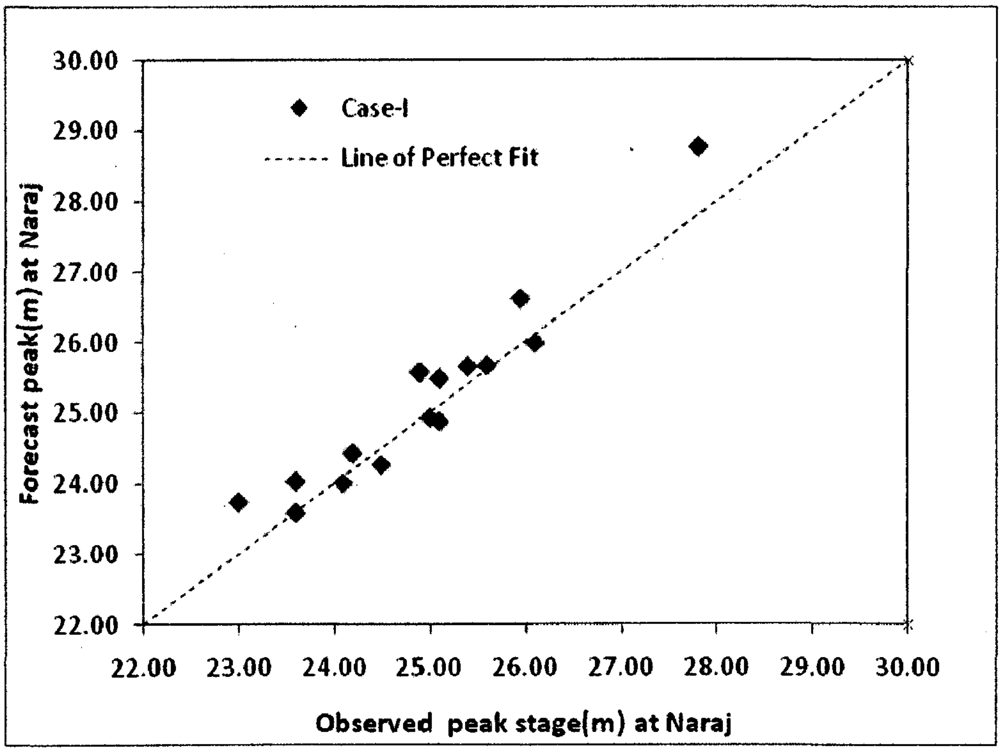


Fig. 5.6 (b) Forecast and observed peaks for Case-I in validation

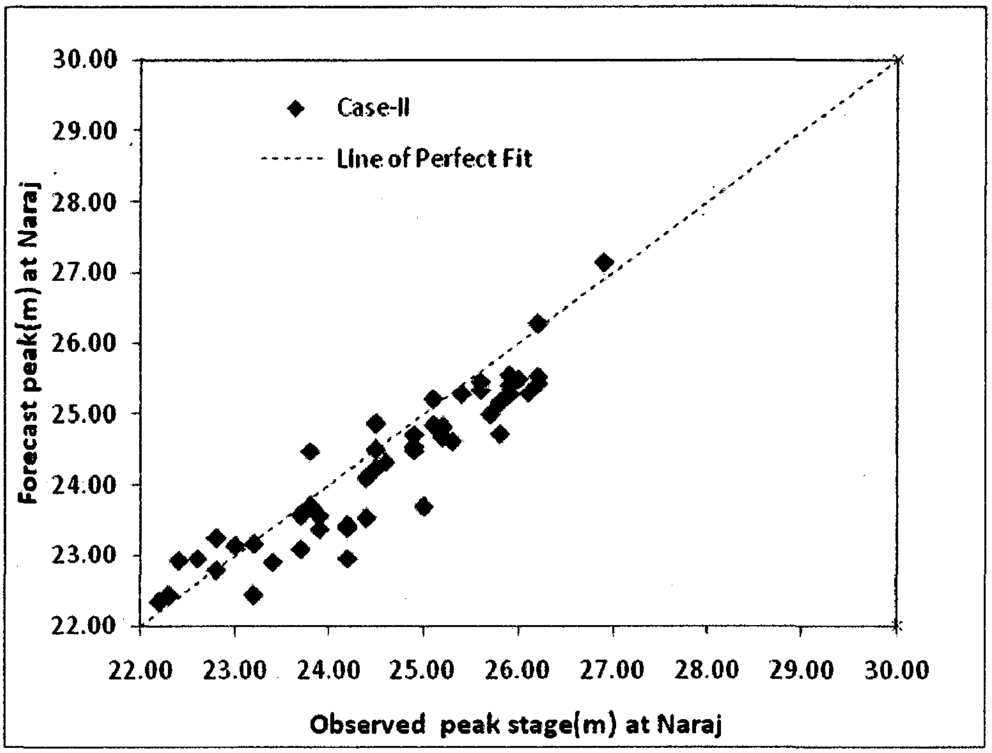


Fig. 5.7 (a) Forecast and observed peaks for Case-II in calibration

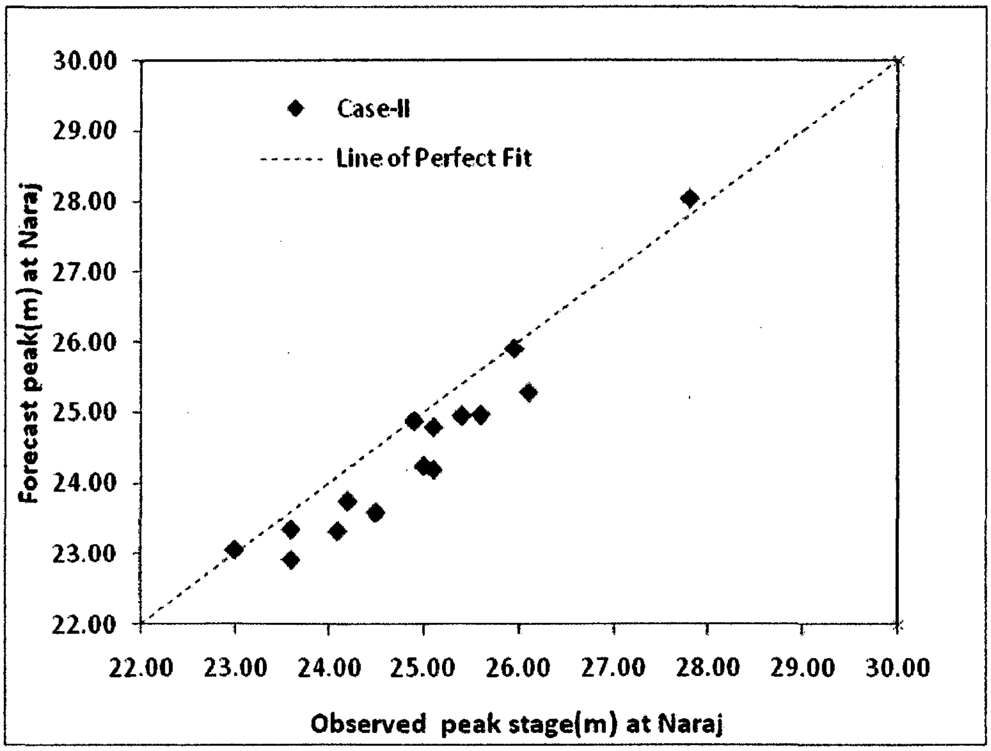


Fig. 5.7 (b) Forecast and observed peaks for Case-II in validation

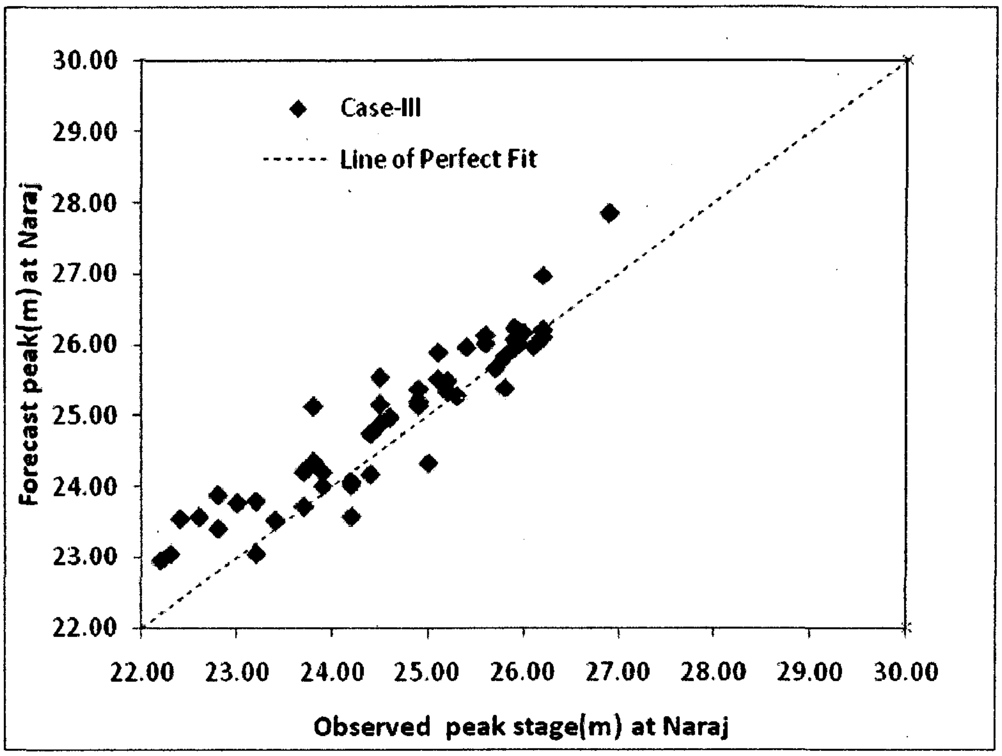


Fig. 5.8 (a) Forecast and observed peaks for Case-III in calibration

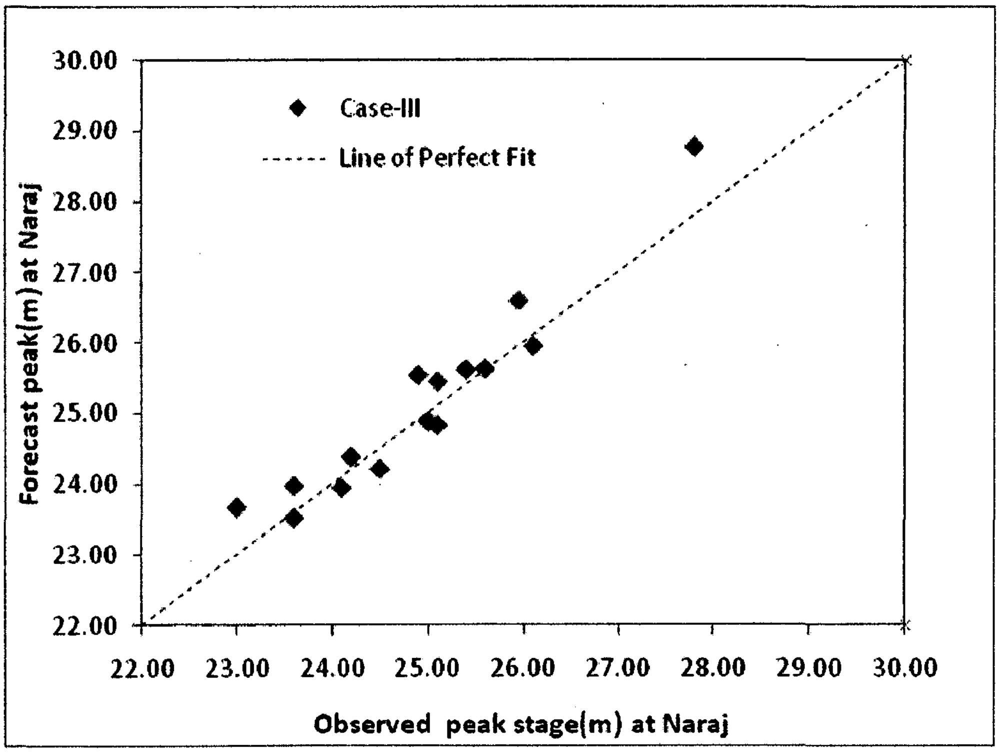


Fig. 5.8 (b) Forecast and observed peaks for Case-III in validation

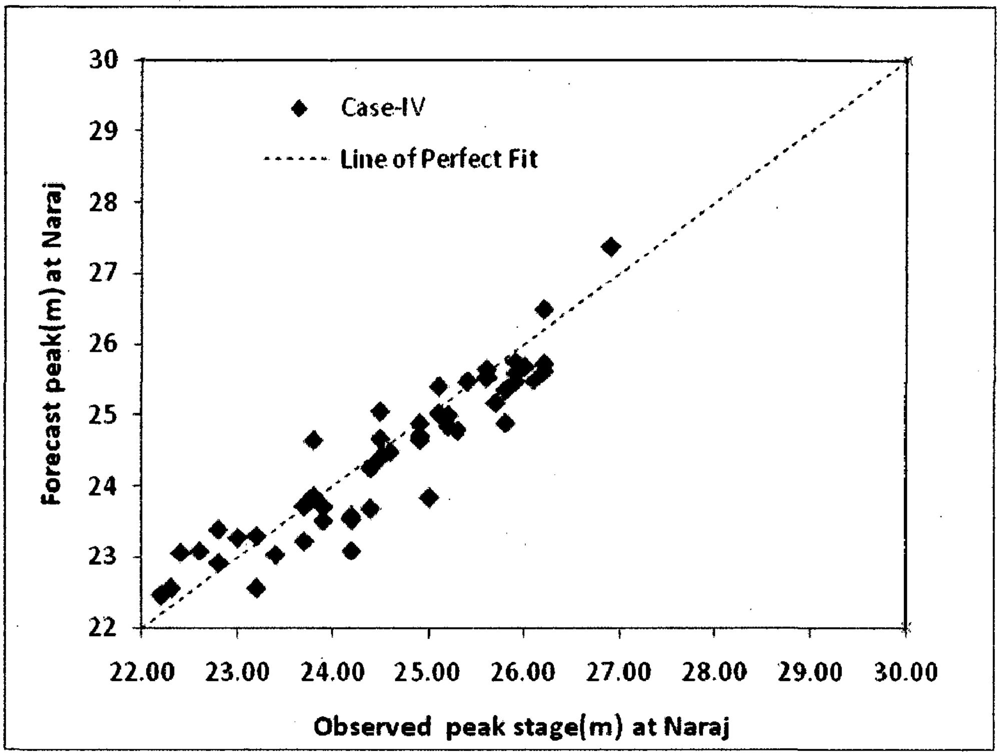


Fig. 5.9 (a) Forecast and observed peaks for Case-IV in calibration

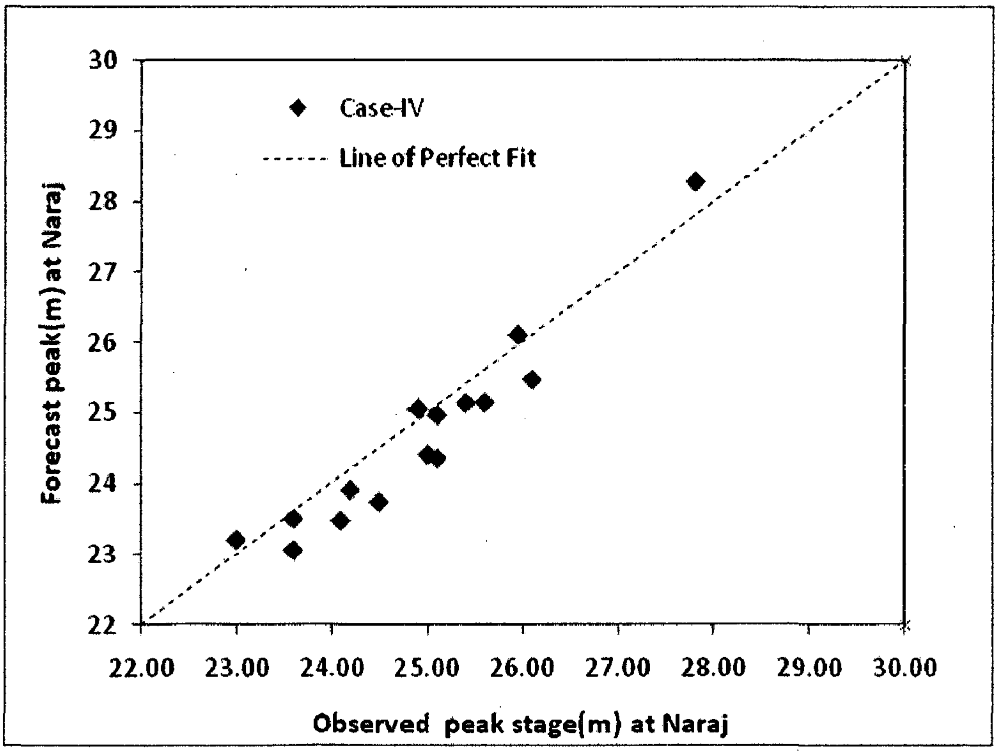


Fig. 5.9 (b) Forecast and observed peaks for Case-IV in validation

A major limitation of these equations is that these can be used in limited range of stage variation only. For example, if stage at Khairmal ($H_K$) is zero, the resulting stage at Naraj ($H_N$) is negative which is impossible and undesirable as well. Thus, these equations are valid only when $H_N$ is greater than or equal to zero.

In all the years, the computed peak stages were compared with the observed peak stages and these are given in Table 5.3. For performance evaluation, the relative error (%) was computed as:

$$\text{Relative error}(\%) = \frac{(H_o - H_c)}{H_o} * 100 \tag{5.1}$$

Where, $H_o$ and $H_c$ correspond to the observed and computed stage values, respectively.

Table 5.3 Observed and computed (annual) peak stages and relative errors (peak to peak)

| Year | Observed peak(m) | Computed peak(m) | Relative error(%) |
|---|---|---|---|
| 2005 | 26.00 | 25.83 | 0.66 |
| 2006 | 26.90 | 27.52 | -2.31 |
| 2007 | 25.90 | 25.63 | 1.05 |
| 2008 | 27.80 | 28.43 | -2.28 |
| 2009 | 26.10 | 25.63 | 1.81 |

It is apparent from Table 5.3 that the relative errors for five years range from -2.28 % to 1.81 %. The sufficiently low values of errors are indicative of the satisfactory model performance. Here '+' values indicate that the computed values are lower than the observed ones and vice versa for '-' values. It is also apparent from the table that the high stages yield relatively high relative errors.

**5.1.2 Three-hourly Continuous Stage Forecasting**

Here three hourly continuous stages are correlated through multiple-linear regression analysis. In this, the influencing values or predictor variables corresponding to different lags are considered for establishment of a statistical correlation using EXCEL 2007. The dataset from 2005 to 2007 was used for model formulation, and the dataset from 2008 to 2009 for model validation.

The input vector is selected generally by trial and error method (Maier and Dandy, 2000). Determination of the number of antecedent stage values involves the computation of lags of stage values that have significant influence on the forecasted stage. These influencing values corresponding to different lags can be identified through statistical analysis of the data series by avoiding the trial and error procedure. The statistical parameter such as cross correlation function (CCF) can be used for this purpose. Therefore, on the basis of cross correlation function of the data series, the input vector has been selected for the flood forecasting model in the present study.

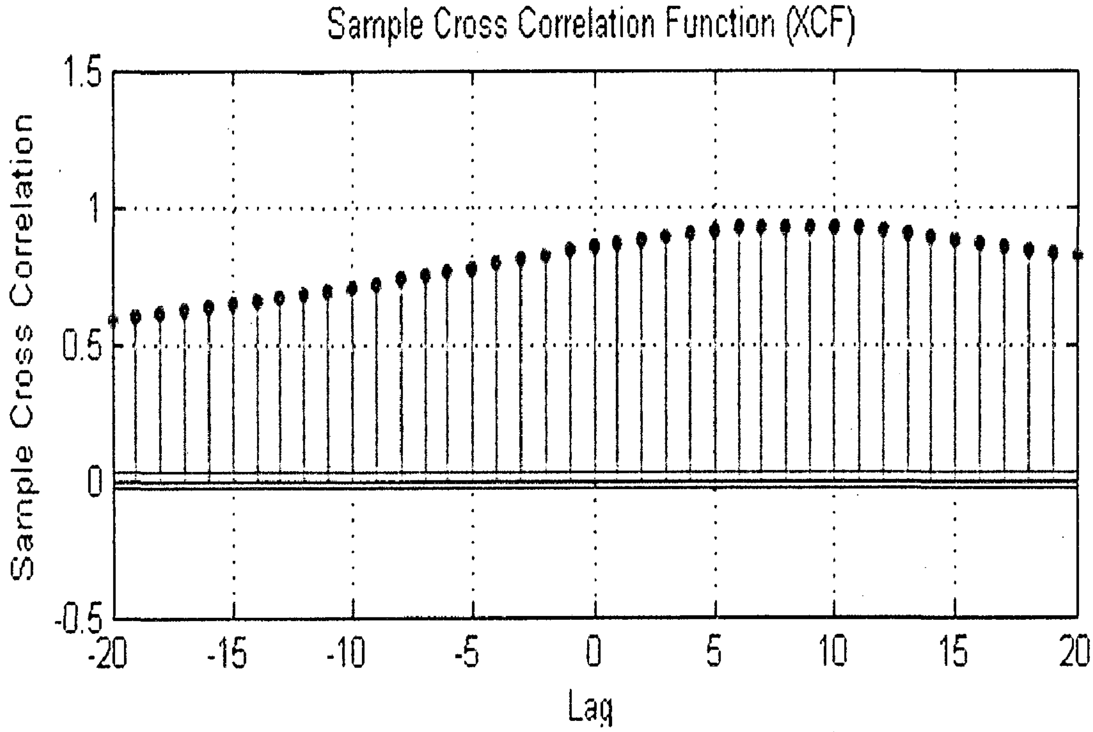


Fig 5.10: Sample cross correlation plot

Fig 5.10, the cross correlation plot between the three hourly stages at Khairmal site suggests the model input vector of stage series of Naraj site. This plot indicates the stage with 8(times 3) hr lag influences the stage at Naraj more than that due to any other lag time. To refine the model accordingly different model structures have been considered for forecasting the stage at Naraj. Total three cases were considered, Case-I: considers Khairmal stage only, Case-II: considers previous stage of Naraj only, and Case-III: considers combination of Khairmal and previous Naraj stages.

In the employment of statistical approach, different combination of relations between stages of Khairmal and Naraj were suggested and these are shown in Table 5.4.

Table 5.4 Model Formulations

| Model No | Model |
|---|---|
| Case I Forecasting by taking Khairmal stage only | |
| M1 | $H_N = f(H_{K(t-8)})$ |
| M2 | $H_N = f(H_{K(t-8)}, H_{K(t-7)})$ |
| M3 | $H_N = f(H_{K(t-9)}, H_{K(t-8)}, H_{K(t-7)})$ |
| M4 | $H_N = f(H_{K(t-9)}, H_{K(t-8)}, H_{K(t-7)}, H_{K(t-6)})$ |
| M5 | $H_N = f(H_{K(t-10)}, H_{K(t-9)}, H_{K(t-8)}, H_{K(t-7)}, H_{K(t-6)})$ |
| Case II Forecasting by taking previous Naraj stages only | |
| M6 | $H_N = f(H_{N(t-1)})$ |
| M7 | $H_N = f(H_{N(t-1)}, H_{N(t-2)})$ |
| M8 | $H_N = f(H_{N(t-1)}, H_{N(t-2)}, H_{N(t-3)})$ |
| M9 | $H_N = f(H_{N(t-1)}, H_{N(t-2)}, H_{N(t-3)}, H_{N(t-4)})$ |
| Case III Forecasting by taking Khairmal and previous Naraj stage | |
| M10 | $H_N = f(H_{K(t-8)}, H_{N(t-1)})$ |

In this Table, total ten models are taken in to consideration with three cases. Case-I forecasting by taking Khairmal stage only, under this case total five models are formulated with different combinations keeping 8(times 3) hr lag data as centre point derived from the sample cross correlation plot (Fig 5.10). Case-II forecasts by taking previous Naraj stage only. Under this case, four models are considered. Case-III forecasts by taking Khairmal stage and previous Naraj stage. While formulating these models number of input parameters is also taken into consideration, so that model with minimum number of input parameters could be recommended.

Table 5.5 Performance of Statistical Models

| Model | COD | | RMSE (m) | | NSE | |
|---|---|---|---|---|---|---|
| | Calibration | Validation | Calibration | Validation | Calibration | Validation |
| **Case-I** | | | | | | |
| M1 | 0.51 | 0.60 | 0.96 | 0.80 | 0.51 | 0.58 |
| M2 | 0.54 | 0.64 | 0.94 | 0.76 | 0.54 | 0.62 |
| M3 | 0.54 | 0.64 | 0.94 | 0.76 | 0.54 | 0.62 |
| M4 | 0.55 | 0.66 | 0.91 | 0.74 | 0.56 | 0.63 |
| M5 | 0.55 | 0.66 | 0.91 | 0.74 | 0.56 | 0.63 |
| **Case-II** | | | | | | |
| M6 | 0.99 | 0.99 | 0.12 | 0.09 | 0.99 | 0.99 |
| M7 | 0.99 | 0.99 | 0.11 | 0.08 | 0.99 | 0.99 |
| M8 | 0.99 | 0.99 | 0.11 | 0.08 | 0.99 | 0.99 |
| M9 | 0.99 | 0.99 | 0.11 | 0.08 | 0.99 | 0.99 |
| **Case-III** | | | | | | |
| M10 | 0.99 | 0.99 | 0.12 | 0.09 | 0.99 | 0.99 |

These models are calibrated using the three hourly stage data from 2005 to 2007, and validated on the dataset from 2008 to 2009. The model performance is evaluated using COD, RMSE, and NSE. It is seen in Table 5.5 that the values of COD and NSE vary in the range of 0.51 to 0.99 and 0.51 to 0.99, respectively, in calibration for the models suggested and these values vary in the range of 0.51 to 0.99 and 0.58 to 0.99 in model validation. RMSE varies from 0.11 to 0.96 in calibration, and from 0.09 to 0.80 in validation.

Model M2 is seen to have performed better than all other models with the values of COD , RMSE, and NSE resulting as 0.54, 0.94, and 0.54, respectively, in calibration, and 0.64, 0.76, and 0.62, respectively, in validation in Case I that considers Khairmal stage only. Model M1 performs poorer because it's COD and NSE are less than the M2 and RMSE is more, and thus, M1 is not a preferred model. Performance of M2 and M3 is almost same but the number of input parameters in M2 is two whereas three in case of M3, and therefore, to reduce the number of input parameters in the model, M2 is taken as the best model. Models M4 and M5 show slightly better performance than model M2 but the number of input parameters is four and five respectively whereas M2 has only two input parameters. To reduce the number of parameters, M2 is given preference over others.

Among Models M6 to M9 with Naraj stage as inputs, Model M7 performs better than the others. In model M6, though COD and NSE are same but RMSE is more than M7, and therefore, M7 is preferred. The performance of M7 to M9 does not vary much but the number of input parameters in the forecasting model is 2, 3 and 4 respectively and thus, to reduce the number of parameters M7 is taken as the best model. In general, Model M7 is considered as more suitable model yielding the COD, RMSE, and NSE as 0.99, 0.11, and 0.99, respectively, in calibration, and 0.99, 0.08, and 0.99 in validation. It is observed that the inclusion of 3-hour previous stage in Models M6 to M9 increases the model performance significantly.

Model M10 is the combination of models M1 and M6, considering the Khairmal stage and Naraj stage. It yields COD, RMSE, and NSE as 0.99, 0.12, and 0.99 respectively in calibration and 0.99, 0.09, and 0.99 in validation. The performance of

M10 is almost same as M6 and M7, and therefore, no further investigation was carried out because other models have larger number of input parameters.

As above M2, M7 and M10 are the best models of Case-I, Case-II and Case-III respectively. Out of these three models M2 has very low COD, NSE and high RMSE values, and therefore, its performance compared to M7 and M10 is not good. The value of COD, NSE and RMSE are almost the same for M7 and M10 with equal number of input parameters but M7 with less input parameters depends on a single station data whereas M10 depends on two stations data. It is easy to collect the data from a single station rather than collecting from two or more stations in case of emergency or flood time, and thus, M7 is preferred over others with COD, RMSE, and NSE as 0.99, 0.11, and 0.99, respectively, in calibration, and 0.99, 0.08, and 0.99 in validation.

**5.2 ANN Analysis**

The data used in statistical model development were further used in development of a model based on the artificial neural network (ANN) architecture using MATLAB 2008 codes. The 3 hourly stage data of monsoon period for the year 2005 to 2007 (2951 values) are used for calibration and data of 2008-2009 (1849 values) are used for validation. The trial has been taken with a 3-layer feed forward network with back propagation error algorithm. Different combinations of feed forward network with changing transfer function, number of neurons and epochs varying at an increment of 20 are trailed. The combinations which are mostly as per performance criteria are noted. In all cases 'tansing' neurons are used in the first layer, 'purelin' in second layer and 'trainbr' remains the training function. Both 'tansing' and 'purelin' are better compatible with feed forward networks. Again the two layer sigmoid/linear network can represent any functional relationship inputs and outputs if the sigmoid layer has enough neurons (WMO, 1994). The 'trainbr' function updates the weight and bias values as per Le-Venberg-Marquardt optimization. It minimizes the combination of squared errors and weights and then determines the correct combination to produce a network that generalizes well as per Bayesian regularization process. It reduces the difficulty of determining the optimum network architecture also over-fitting of training dataset is prevented, whereas in other networks, generalization and early stopping is required for reducing over-fitting. The performance functions are set as COD, RMSE, and NSE.

Table 5.6 Performance criteria of ANN Models

| Model | COD | | RMSE (m) | | NSE | |
|---|---|---|---|---|---|---|
| | Calibration | Validation | Calibration | Validation | Calibration | Validation |
| **Case I** | | | | | | |
| M1 | 0.93 | 0.95 | 0.48 | 0.47 | 0.87 | 0.85 |
| M2 | 0.93 | 0.95 | 0.47 | 0.46 | 0.88 | 0.85 |
| M3 | 0.94 | 0.95 | 0.46 | 0.47 | 0.88 | 0.85 |
| M4 | 0.94 | 0.95 | 0.45 | 0.47 | 0.89 | 0.85 |
| M5 | 0.94 | 0.95 | 0.44 | 0.47 | 0.89 | 0.85 |
| **Case II** | | | | | | |
| M6 | 0.99 | 0.99 | 0.12 | 0.09 | 0.99 | 0.99 |
| M7 | 0.99 | 0.99 | 0.11 | 0.08 | 0.99 | 0.99 |
| M8 | 0.99 | 0.99 | 0.18 | 0.13 | 0.98 | 0.98 |
| M9 | 0.99 | 0.99 | 0.18 | 0.13 | 0.98 | 0.98 |
| **Case III** | | | | | | |
| M10 | 0.99 | 0.99 | 0.11 | 0.08 | 0.99 | 0.99 |

Performance indices of the ANN models (M1 to M10) viz. COD, RMSE, and NSE are presented in Table 5.6 and these are used for model comparison. The values of COD and NSE are seen to vary in the range of 0.93 to 0.99 and 0.87 to 0.99, respectively, in calibration for the models suggested and these values vary in the range of 0.95 to 0.99 and 0.85 to 0.99 in model validation. RMSE varies from 0.11 to 0.48 in calibration, and from 0.08 to 0.47 in validation.

Model M2 is seen to have performed better than all other models with the values of COD, RMSE, and NSE resulting as 0.93, 0.47, and 0.88, respectively, in calibration, and 0.95, 0.46, and 0.85, respectively, in validation in Case I that considers Khairmal stage only. Model M1 performs poorer because its NSE is less than M2 in calibration and RMSE is more both in calibration and validation, and therefore, M1 is not a preferred model. Performance of M2 and M3 is almost the same, but the number input parameters in M2 is two whereas three in case of M3, and thus, to reduce number of input model parameters, M2 has been taken as the best model. Models M4 and M5 exhibit slightly better performance than model M2 but the number of input parameters is four and five respectively, whereas M2 has only two input parameters. For reasons of lesser number of parameters, M2 is taken as the best model.

Among Models M6 to M9 with Naraj stage as input, Model M7 performs better than the others; in model M6, though COD and NSE are the same but RMSE is more than

M7. The performance of M8 and M9 also deteriorates compared to M7 and the number of input parameters in the forecasting model is 3 and 4 respectively, and therefore, to reduce the number of parameters we select M7 as a more appropriate model. In general, Model M7 is considered as more suitable model yielding COD, RMSE, and NSE as 0.99, 0.11, and 0.99, respectively, in calibration, and 0.99, 0.08, and 0.99 in validation. It is observed that the inclusion of 3-hour previous stage of Naraj in Models M6 to M9 increases the model performance.

Model M10 is a combination of model M1 and M6, considering the Khairmal stage and Naraj stage. It yields COD, RMSE, and NSE as 0.99, 0.11, and 0.99, respectively, in calibration, and 0.99, 0.08, and 0.99 in validation. The performance of M10 is almost the same as M6 and M7, and therefore, further investigation was not desirable.

M2, M7 and M10 are the best models of Case-I, Case-II and Case-III respectively. Out of these three models M2 has very low COD, NSE and high RMSE values, and therefore, its performance as compared to M7 and M10 is not good. The value of COD, NSE and RMSE are almost same for M7 and M10 with equal number of input parameters but M7 input parameter depends on a single station data whereas M10 depends on two stations data. It is easy to collect the data from a single station rather than collecting from two or more stations in case of emergency flood time, and therefore, we select M7 as a preferable model over the other three cases with COD, RMSE, and NSE as 0.99, 0.11, and 0.99, respectively, in calibration, and 0.99, 0.08, and 0.99 in validation.

Optimal model structure decided on trial and error method. As per the inputs involved in the model, neurons in hidden layer kept varied from 1 to 6. The maximum performance obtained in M2, M7 and M10, with model structure 2-3-1, 2-2-1 and 2-2-1 respectively.

**5.3 Model Comparison**

Based on COD, RMSE and NSE the model performance is compared in both calibration and validation as shown in Tables 5.5 and 5.6. In Case-I, best statistical model yields COD, RMSE, and NSE as 0.54, 0.94, and 0.54 respectively in calibration, and 0.64, 0.76, and 0.62 in validation whereas the best ANN model yields COD, RMSE, and NSE as 0.93, 0.47, and 0.88 respectively in calibration, and 0.95, 0.46, and 0.88 in validation. The performance of ANN model has been better as it has larger number of parameters and considers the process as non-linear whereas in statistical model, the process is considered as linear.

In Mahanadi deltaic part Department of Water Resources, Government of Orissa is forecasting flood by using time lag method, in which they are able to forecast the travel time only i.e. time taken by the Khairmal flood to reach the next intermediate station or forecast station. A schematic presentation shows the distance and travel time from Hirakud to Mundali presently being used for the official purposes of Department of Water Resources, Government of Orissa (WR Dept. Govt. of Orissa).

Hirakud —115 km→ Khairmal —106 km→ Barmul —95 km→ Mundali (Naraj)
(12-18 hours) B.S (12-16 hrs.) I.S (12-16 hrs.) F.S

By adopting clustering method Kar et.al (2010) also proved that the travel time between the Khairmal and Munduli (u/s Naraj) stations varies from 24 to 37 hrs. By following the above travel time we can use the M2 ANN model for flood forecasting at Naraj site using the Khairmal stage only.

In Case-II, the performance of the statistical model and ANN model is almost the same, and therefore, in this case, the importance of the statistical model can't be ignored because it also gives encouraging results, and thus, the statistical model can also be used as a forecasting model instead of ANN model when model is formulated by considering previous stage of Naraj only. In Case-III also, the performance of statistical model is equivalent to ANN model, and therefore, we can use the statistical model instead of ANN model.

Figs. 5.11(a-c) and Figs. 5.12(a-b) show that ANN model M7 perform better than the counterpart statistical model requiring same input(s). Figs 5.11 (a-c) compares the stages for the year 2005, 2006 and 2007 respectively with observed stages, ANN forecasted stages and statistical forecasted stages in calibration. Figs 5.12 (a-b) compares the stages for the year 2008 and 2009 respectively with the observed stages, ANN forecasted stages and statistical forecasted stages in validation. It is observed in the above figs, ANN result are more close to the observed than the statistical ones, therefore, ANN-based models have better than others in forecasting peak floods.

Table 5.7 Observed and computed peak stages and relative errors (3-hr continuous flow)

| **Year** | **Observed peak(m)** | **ANN peak(m)** | **Relative error (%)** | **Statistical peak(m)** | **Relative error (%)** |
|---|---|---|---|---|---|
| 2005 | 26.00 | 25.84 | 0.62 | 25.88 | 0.45 |
| 2006 | 26.90 | 26.60 | 1.10 | 26.88 | 0.08 |
| 2007 | 25.90 | 25.87 | 0.11 | 25.96 | -0.25 |
| 2008 | 27.80 | 27.42 | 1.37 | 27.81 | -0.04 |
| 2009 | 26.10 | 25.76 | 1.30 | 26.06 | 0.15 |

It is apparent from Table 5.7 that the relative errors ANN and statistical models for five years range from 0.62 % to 1.37 % and -0.25% to 0.45%. These sufficiently low values are indicative of satisfactory model performance. Here '+' values indicate that the computed values are lower than the observed ones, and vice versa for '-' values. It is also apparent from the table that the high stage yield relatively high relative errors.

**5.4 Forecasting using the Recommended Model**

Flood forecasting using the recommended model for different lead times of maximum lag 8 (times 3=24 hr) is shown in Table 5.8.

Table 5.8 Performance of the recommended ANN model M7 under different lead times

Maximum lag= 8(times 3=24 hr).

| Lead Time | COD | | RMSE | | NSE | |
|---|---|---|---|---|---|---|
| | Calibration | Validation | Calibration | Validation | Calibration | Validation |
| 3 hours | 0.99 | 0.99 | 0.11 | 0.08 | 0.99 | 0.99 |
| 6 hours | 0.98 | 0.99 | 0.25 | 0.19 | 0.97 | 0.98 |
| 9 hours | 0.97 | 0.98 | 0.32 | 0.25 | 0.95 | 0.96 |
| 12 hours | 0.96 | 0.97 | 0.37 | 0.29 | 0.93 | 0.95 |
| 15 hours | 0.95 | 0.96 | 0.43 | 0.34 | 0.90 | 0.92 |
| 18 hours | 0.94 | 0.95 | 0.48 | 0.38 | 0.88 | 0.91 |
| 21 hours | 0.92 | 0.94 | 0.53 | 0.43 | 0.85 | 0.88 |
| 24 hours | 0.91 | 0.93 | 0.58 | 0.47 | 0.82 | 0.85 |

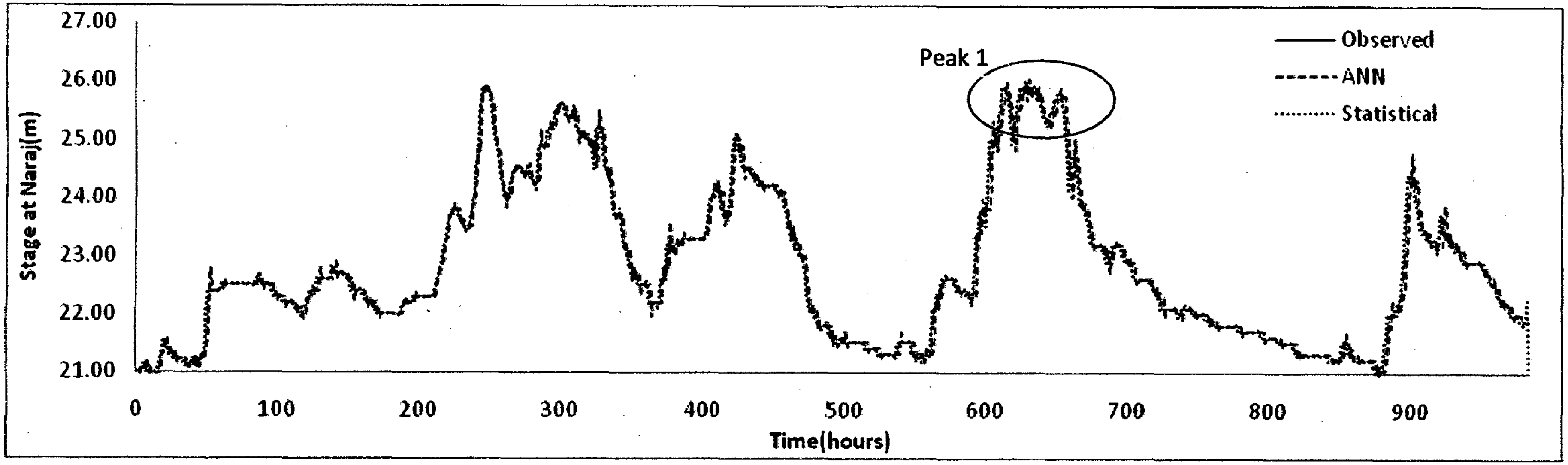


Fig. 5.11 (a) Comparison of stages in calibration for the year 2005 of M7

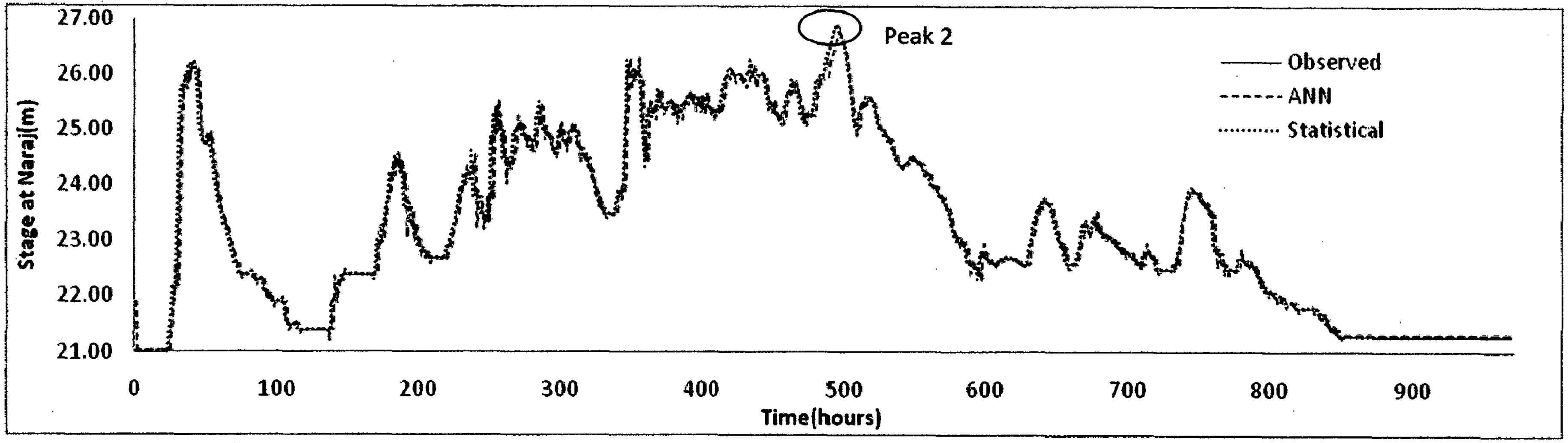


Fig. 5.11 (b) Comparison of stages in calibration for the year 2006 of M7

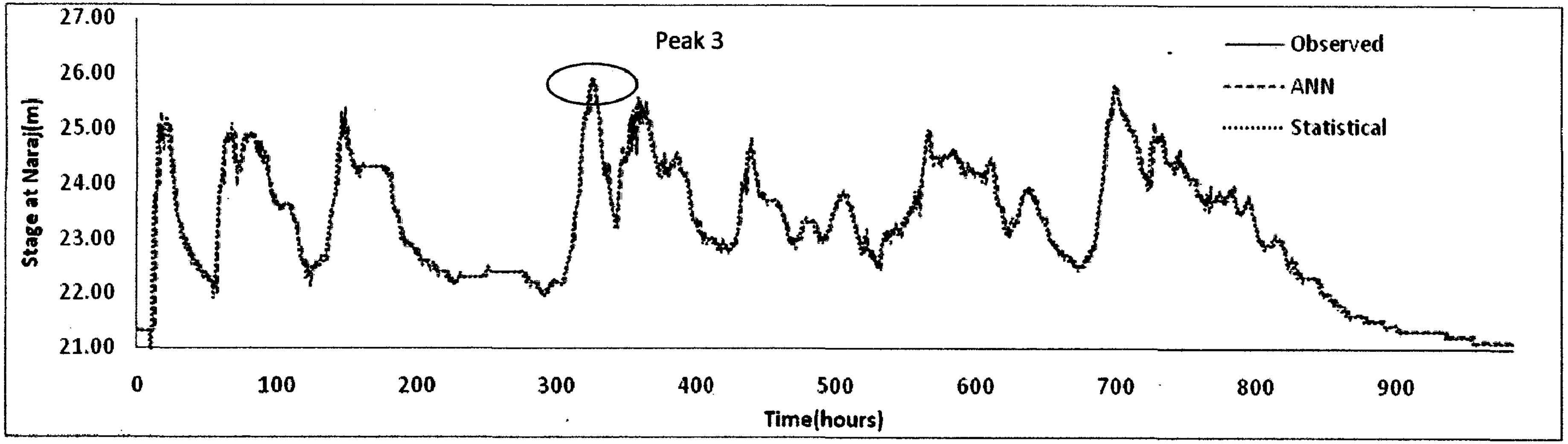


Fig. 5.11 (c) Comparison of stages in calibration for the year 2007 of M7

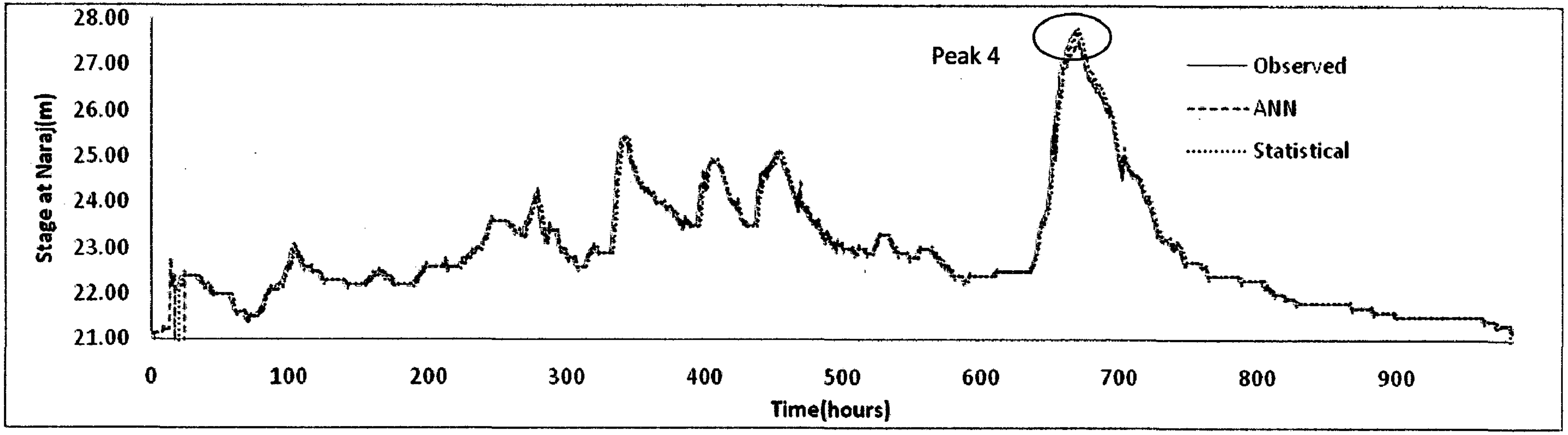


Fig. 5.12 (a) Comparison of stages in validation for the year 2008 of M7

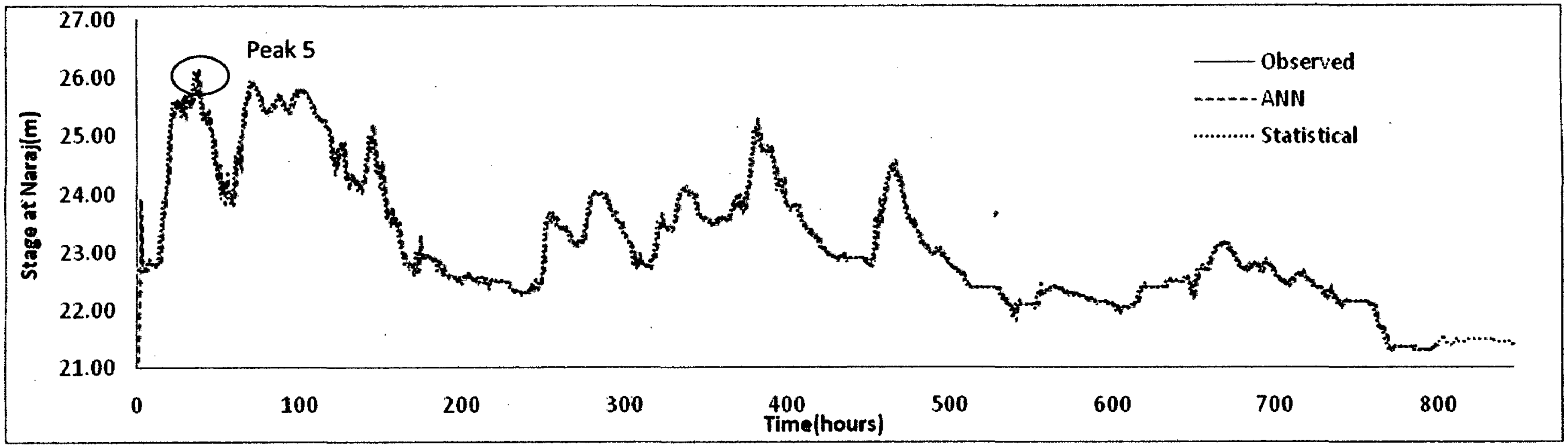


Fig. 5.12 (b) Comparison of stages in validation for the year 2009 of M7

In Table 5.8, the performance indices such as COD, RMSE and NSE values range from 0.91 to 0.99, 0.11 to 0.58 and 0.82 to 0.99 respectively in calibration and 0.93 to 0.99, 0.09 to 0.47 and 0.85 to 0.99 in validation. It is observed that as the lead time increases COD and NSE decrease and RMSE increases, and thus, the smaller the lead time the better the model results, and vice versa.

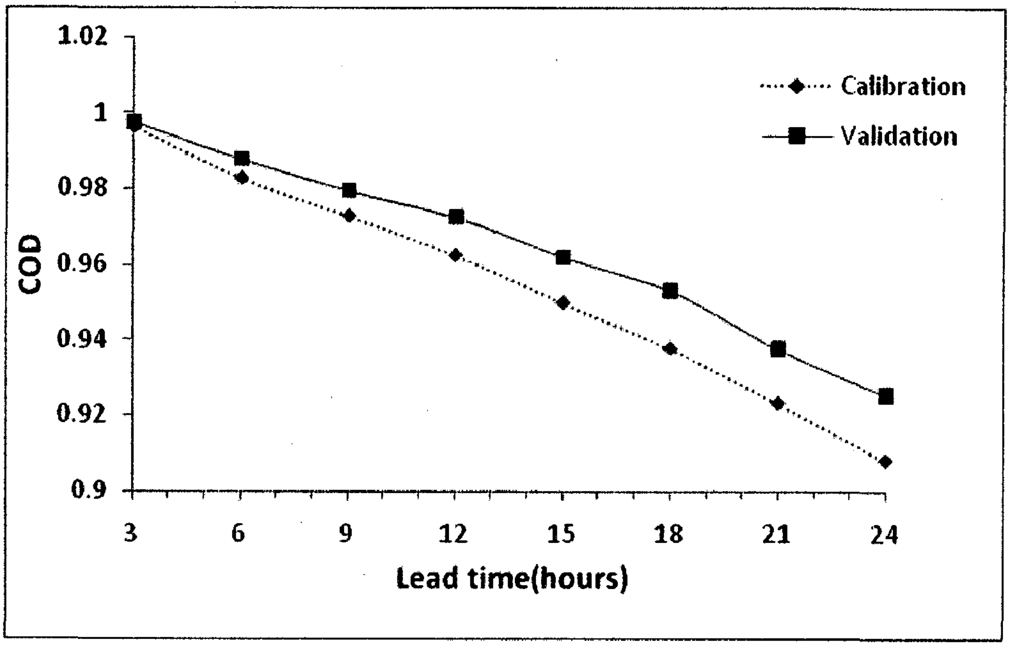


Fig. 5.13 Variation of COD with lead time in the recommended ANN model M7

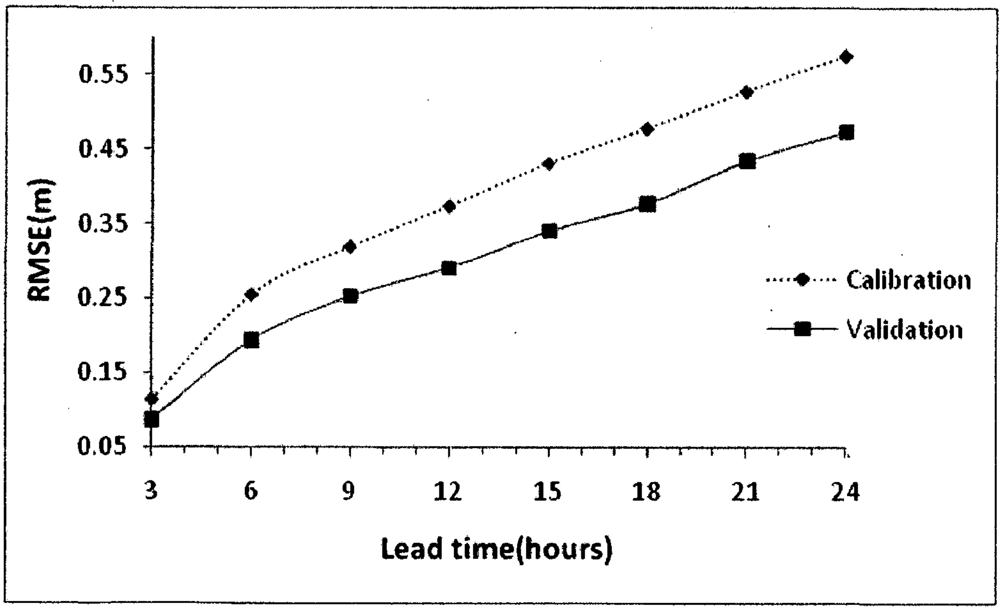


Fig. 5.14 Variation of RMSE with lead time in the recommended ANN model M7

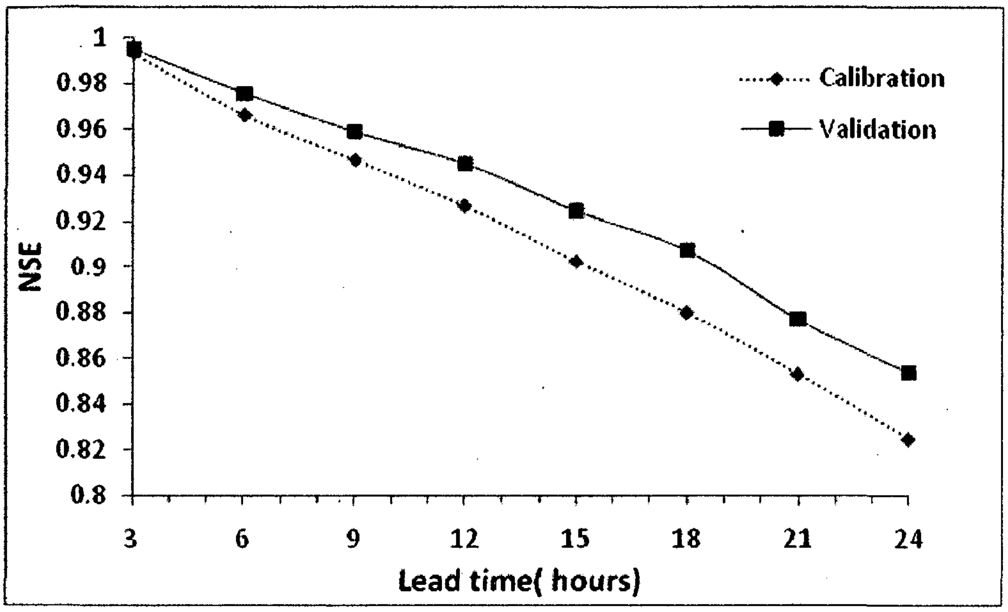

Fig. 5.15 Variation of NSE with lead time in the recommended ANN model M7

FigS 5.13 - 5.15 compare the calibration and validation performance results using COD, RMSE and NSE respectively of Case-II best ANN model. In Fig.5.13, it is seen that in calibration COD is less but in validation it is higher and as lead time increases, COD decreases. In Fig.5.14, it is observed that RMSE is almost the same in both calibration and validation. RMSE varies with lead time, as the latter increases then the former also increases. In Fig.5.15, it is observed that NSE in calibration is more than that in validation. NSE decreases with increasing lead time, and vice versa.

# SUMMARY AND CONCLUSIONS

Mahanadi is a flood prone basin, controlling flood through moderation structure other than Hirakud reservoir is nearly impossible at present time. Therefore to control flood require non-structural measures like flood risk mapping, flood plain zoning, flood forecasting, flood proofing, flood insurance etc. At present this basin is not adequately supported by an efficient flood forecasting model for downstream part of Hirakud. Establishment of a physical based model requires lot of hydro-meteorogical data. In this regard soft computing method like ANN application is a better alternative.

In this study attempt has been made to develop a flood forecasting model using stage of Khairmal site (base station) to forecast at Naraj site (forecast station). The main objectives of the study are to propose an ANN-based flood forecasting method for deltaic region of Mahanadi basin and to compare the forecasting results with those due to available conventional methods.

Drawing time series of Khairmal and Naraj stage total 65 peaks were derived. These 65 peaks were divided into two parts, one part for calibration and rest for validation. The best statistical model for peak to peak stage is derived by considering 50 peaks for calibration and 15 peaks for validation. This model yields COD, RMSE, and NSE as 0.86, 0.44, and 0.86, respectively, in calibration, and 0.92, 0.39, and 0.89 in validation.

The model is developed by basing on the criteria of cross correlation with the available 3 hourly continuous stage data for the period from 2005 to 2009. First three-year data were used for calibration, and rest two-year data for validation. Performance indices such as coefficient of determination (COD), root mean square (RMSE) and Nash-Sutcliffe Efficiency (NSE) were used for model selection. The forecasting obtained by both statistical and ANN methods is encouraging. The ANN method generally exhibits a better performance than the statistical method. The result at Naraj (Forecasting Station) with respect to Khairmal (Base Station) basing on the ANN network is best for taking the flood forecasting effectively because its NSE is 99% , RMSE is 0.11 m, and COD is 0.99.

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# APPENDIX-I

## Table I.1 Data used for study.

| Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 01.07.05 | 3 | 101.28 | 21.00 | 33 | 05.07.05 | 3 | 100.96 | 21.20 | 65 | 09.07.05 | 3 | 102.24 | 22.50 | 97 | 13.07.05 | 3 | 101.49 | 22.40 |
| 2 | | 6 | 101.28 | 21.00 | 34 | | 6 | 100.99 | 21.20 | 66 | | 6 | 102.24 | 22.50 | 98 | | 6 | 101.43 | 22.40 |
| 3 | | 9 | 101.27 | 21.00 | 35 | | 9 | 101.00 | 21.10 | 67 | | 9 | 102.24 | 22.50 | 99 | | 9 | 101.42 | 22.30 |
| 4 | | 12 | 101.26 | 21.00 | 36 | | 12 | 101.47 | 21.10 | 68 | | 12 | 102.24 | 22.50 | 100 | | 12 | 101.41 | 22.30 |
| 5 | | 15 | 101.25 | 21.00 | 37 | | 15 | 102.22 | 21.10 | 69 | | 15 | 102.26 | 22.50 | 101 | | 15 | 101.40 | 22.30 |
| 6 | | 18 | 101.24 | 21.10 | 38 | | 18 | 102.28 | 21.10 | 70 | | 18 | 102.29 | 22.50 | 102 | | 18 | 101.40 | 22.30 |
| 7 | | 21 | 101.21 | 21.10 | 39 | | 21 | 102.28 | 21.10 | 71 | | 21 | 102.31 | 22.50 | 103 | | 21 | 101.40 | 22.30 |
| 8 | | 24 | 101.18 | 21.00 | 40 | | 24 | 102.28 | 21.10 | 72 | | 24 | 102.31 | 22.50 | 104 | | 24 | 101.44 | 22.30 |
| 9 | 02.07.05 | 3 | 101.17 | 21.00 | 41 | 06.07.05 | 3 | 102.28 | 21.20 | 73 | 10.07.05 | 3 | 102.31 | 22.50 | 105 | 14.07.05 | 3 | 101.50 | 22.20 |
| 10 | | 6 | 101.14 | 21.00 | 42 | | 6 | 102.28 | 21.20 | 74 | | 6 | 102.31 | 22.50 | 106 | | 6 | 101.56 | 22.20 |
| 11 | | 9 | 101.13 | 21.00 | 43 | | 9 | 102.28 | 21.10 | 75 | | 9 | 102.31 | 22.50 | 107 | | 9 | 101.83 | 22.20 |
| 12 | | 12 | 101.12 | 21.00 | 44 | | 12 | 102.28 | 21.10 | 76 | | 12 | 102.31 | 22.50 | 108 | | 12 | 102.06 | 22.20 |
| 13 | | 15 | 101.11 | 20.90 | 45 | | 15 | 102.28 | 21.20 | 77 | | 15 | 102.31 | 22.50 | 109 | | 15 | 102.14 | 22.20 |
| 14 | | 18 | 101.10 | 20.90 | 46 | | 18 | 102.28 | 21.20 | 78 | | 18 | 102.31 | 22.50 | 110 | | 18 | 102.20 | 22.20 |
| 15 | | 21 | 100.07 | 20.90 | 47 | | 21 | 102.27 | 21.20 | 79 | | 21 | 102.28 | 22.50 | 111 | | 21 | 102.25 | 22.20 |
| 16 | | 24 | 100.04 | 20.90 | 48 | | 24 | 102.26 | 21.30 | 80 | | 24 | 102.22 | 22.50 | 112 | | 24 | 102.28 | 22.20 |
| 17 | 03.07.05 | 3 | 101.01 | 21.10 | 49 | 07.07.05 | 3 | 102.25 | 21.40 | 81 | 11.07.05 | 3 | 102.16 | 22.50 | 113 | 15.07.05 | 3 | 102.31 | 22.10 |
| 18 | | 6 | 100.99 | 21.20 | 50 | | 6 | 102.25 | 21.60 | 82 | | 6 | 102.10 | 22.50 | 114 | | 6 | 102.34 | 22.10 |
| 19 | | 9 | 100.98 | 21.30 | 51 | | 9 | 102.24 | 22.20 | 83 | | 9 | 101.96 | 22.50 | 115 | | 9 | 102.40 | 22.10 |
| 20 | | 12 | 100.98 | 21.40 | 52 | | 12 | 102.24 | 22.40 | 84 | | 12 | 101.76 | 22.50 | 116 | | 12 | 102.43 | 22.10 |
| 21 | | 15 | 100.97 | 21.50 | 53 | | 15 | 102.24 | 22.40 | 85 | | 15 | 101.58 | 22.50 | 117 | | 15 | 102.45 | 22.00 |
| 22 | | 18 | 100.96 | 21.40 | 54 | | 18 | 102.24 | 22.40 | 86 | | 18 | 101.54 | 22.60 | 118 | | 18 | 102.45 | 22.00 |
| 23 | | 21 | 100.95 | 21.40 | 55 | | 21 | 102.24 | 22.40 | 87 | | 21 | 101.54 | 22.60 | 119 | | 21 | 102.46 | 22.00 |
| 24 | | 24 | 100.94 | 21.40 | 56 | | 24 | 102.24 | 22.40 | 88 | | 24 | 101.56 | 22.60 | 120 | | 24 | 102.46 | 22.10 |
| 25 | 04.07.05 | 3 | 100.93 | 21.30 | 57 | 08.07.05 | 3 | 102.24 | 22.40 | 89 | 12.07.05 | 3 | 101.59 | 22.50 | 121 | 16.07.05 | 3 | 102.46 | 22.20 |
| 26 | | 6 | 100.93 | 21.30 | 58 | | 6 | 102.24 | 22.40 | 90 | | 6 | 101.62 | 22.50 | 122 | | 6 | 102.47 | 22.30 |
| 27 | | 9 | 100.92 | 21.30 | 59 | | 9 | 102.24 | 22.40 | 91 | | 9 | 101.64 | 22.50 | 123 | | 9 | 102.47 | 22.30 |
| 28 | | 12 | 100.91 | 21.20 | 60 | | 12 | 102.24 | 22.40 | 92 | | 12 | 101.63 | 22.50 | 124 | | 12 | 102.50 | 22.40 |
| 29 | | 15 | 100.90 | 21.20 | 61 | | 15 | 102.24 | 22.50 | 93 | | 15 | 101.62 | 22.50 | 125 | | 15 | 102.59 | 22.40 |
| 30 | | 18 | 100.90 | 21.20 | 62 | | 18 | 102.24 | 22.50 | 94 | | 18 | 101.59 | 22.50 | 126 | | 18 | 102.65 | 22.40 |
| 31 | | 21 | 100.90 | 21.20 | 63 | | 21 | 102.24 | 22.50 | 95 | | 21 | 101.56 | 22.50 | 127 | | 21 | 102.66 | 22.40 |
| 32 | | 24 | 100.93 | 21.20 | 64 | | 24 | 102.24 | 22.50 | 96 | | 24 | 101.53 | 22.50 | 128 | | 24 | 102.64 | 22.40 |

| Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 129 | 17.07.05 | 3 | 102.61 | 22.60 | 166 | | 18 | 101.38 | 22.20 | 203 | | 9 | 102.23 | 22.30 | 240 | | 24 | 105.33 | 24.20 |
| 130 | | 6 | 102.58 | 22.60 | 167 | | 21 | 101.38 | 22.20 | 204 | | 12 | 102.78 | 22.30 | 241 | 31.07.05 | 3 | 105.23 | 24.60 |
| 131 | | 9 | 102.55 | 22.60 | 168 | | 24 | 101.41 | 22.20 | 205 | | 15 | 103.14 | 22.30 | 242 | | 6 | 105.06 | 24.70 |
| 132 | | 12 | 102.54 | 22.60 | 169 | 22.07.05 | 3 | 101.44 | 22.10 | 206 | | 18 | 103.27 | 22.30 | 243 | | 9 | 104.93 | 24.90 |
| 133 | | 15 | 102.53 | 22.60 | 170 | | 6 | 101.47 | 22.10 | 207 | | 21 | 103.39 | 22.30 | 244 | | 12 | 104.81 | 25.50 |
| 134 | | 18 | 102.52 | 22.60 | 171 | | 9 | 101.50 | 22.00 | 208 | | 24 | 103.50 | 22.30 | 245 | | 15 | 104.72 | 25.70 |
| 135 | | 21 | 102.49 | 22.60 | 172 | | 12 | 101.53 | 22.00 | 209 | 27.07.05 | 3 | 103.59 | 22.30 | 246 | | 18 | 104.58 | 25.90 |
| 136 | | 24 | 102.43 | 22.60 | 173 | | 15 | 101.56 | 22.00 | 210 | | 6 | 103.68 | 22.30 | 247 | | 21 | 104.40 | 25.90 |
| 137 | 18.07.05 | 3 | 102.37 | 22.60 | 174 | | 18 | 101.59 | 22.00 | 211 | | 9 | 103.82 | 22.40 | 248 | | 24 | 104.19 | 25.90 |
| 138 | | 6 | 102.31 | 22.60 | 175 | | 21 | 101.60 | 22.00 | 212 | | 12 | 103.97 | 22.50 | 249 | 01.08.05 | 3 | 104.01 | 25.90 |
| 139 | | 9 | 102.23 | 22.70 | 176 | | 24 | 101.59 | 22.00 | 213 | | 15 | 104.08 | 22.60 | 250 | | 6 | 103.84 | 25.90 |
| 140 | | 12 | 102.16 | 22.80 | 177 | 23.07.05 | 3 | 101.58 | 22.00 | 214 | | 18 | 104.08 | 22.70 | 251 | | 9 | 103.81 | 25.80 |
| 141 | | 15 | 102.12 | 22.70 | 178 | | 6 | 101.57 | 22.00 | 215 | | 21 | 104.06 | 22.80 | 252 | | 12 | 103.78 | 25.70 |
| 142 | | 18 | 102.09 | 22.70 | 179 | | 9 | 101.56 | 22.00 | 216 | | 24 | 104.00 | 22.90 | 253 | | 15 | 103.69 | 25.40 |
| 143 | | 21 | 102.06 | 22.70 | 180 | | 12 | 101.55 | 22.00 | 217 | 28.07.05 | 3 | 103.92 | 23.10 | 254 | | 18 | 103.60 | 25.20 |
| 144 | | 24 | 102.03 | 22.70 | 181 | | 15 | 101.55 | 22.00 | 218 | | 6 | 103.83 | 23.20 | 255 | | 21 | 103.57 | 25.00 |
| 145 | 19.07.05 | 3 | 102.00 | 22.70 | 182 | | 18 | 101.58 | 22.00 | 219 | | 9 | 103.77 | 23.30 | 256 | | 24 | 103.74 | 24.90 |
| 146 | | 6 | 101.97 | 22.70 | 183 | | 21 | 101.61 | 22.00 | 220 | | 12 | 103.66 | 23.50 | 257 | 02.08.05 | 3 | 104.12 | 24.70 |
| 147 | | 9 | 101.88 | 22.70 | 184 | | 24 | 101.62 | 22.00 | 221 | | 15 | 103.60 | 23.60 | 258 | | 6 | 104.47 | 24.50 |
| 148 | | 12 | 101.79 | 22.70 | 185 | 24.07.05 | 3 | 101.62 | 22.00 | 222 | | 18 | 103.54 | 23.70 | 259 | | 9 | 104.54 | 24.30 |
| 149 | | 15 | 101.75 | 22.60 | 186 | | 6 | 101.62 | 22.00 | 223 | | 21 | 103.50 | 23.70 | 260 | | 12 | 104.54 | 24.20 |
| 150 | | 18 | 101.72 | 22.60 | 187 | | 9 | 101.62 | 22.00 | 224 | | 24 | 103.47 | 23.80 | 261 | | 15 | 104.52 | 24.00 |
| 151 | | 21 | 101.66 | 22.60 | 188 | | 12 | 101.63 | 22.10 | 225 | 29.07.05 | 3 | 103.44 | 23.80 | 262 | | 18 | 104.49 | 24.00 |
| 152 | | 24 | 101.57 | 22.60 | 189 | | 15 | 101.66 | 22.20 | 226 | | 6 | 103.41 | 23.80 | 263 | | 21 | 104.47 | 24.00 |
| 153 | 20.07.05 | 3 | 101.50 | 22.40 | 190 | | 18 | 101.69 | 22.20 | 227 | | 9 | 103.38 | 23.80 | 264 | | 24 | 104.46 | 24.00 |
| 154 | | 6 | 101.45 | 22.40 | 191 | | 21 | 101.68 | 22.20 | 228 | | 12 | 103.37 | 23.70 | 265 | 03.08.05 | 3 | 104.45 | 24.20 |
| 155 | | 9 | 101.44 | 22.40 | 192 | | 24 | 101.68 | 22.20 | 229 | | 15 | 103.37 | 23.60 | 266 | | 6 | 104.44 | 24.30 |
| 156 | | 12 | 101.43 | 22.40 | 193 | 25.07.05 | 3 | 101.67 | 22.20 | 230 | | 18 | 103.34 | 23.60 | 267 | | 9 | 104.41 | 24.40 |
| 157 | | 15 | 101.46 | 22.40 | 194 | | 6 | 101.66 | 22.20 | 231 | | 21 | 103.31 | 23.50 | 268 | | 12 | 104.41 | 24.50 |
| 158 | | 18 | 101.45 | 22.40 | 195 | | 9 | 101.66 | 22.20 | 232 | | 24 | 103.31 | 23.50 | 269 | | 15 | 104.41 | 24.50 |
| 159 | | 21 | 101.44 | 22.40 | 196 | | 12 | 101.77 | 22.30 | 233 | 30.07.05 | 3 | 103.38 | 23.50 | 270 | | 18 | 104.41 | 24.50 |
| 160 | | 24 | 101.43 | 22.40 | 197 | | 15 | 101.89 | 22.30 | 234 | | 6 | 103.45 | 23.50 | 271 | | 21 | 104.40 | 24.50 |
| 161 | 21.07.05 | 3 | 101.42 | 22.30 | 198 | | 18 | 101.91 | 22.30 | 235 | | 9 | 103.82 | 23.50 | 272 | | 24 | 104.38 | 24.50 |
| 162 | | 6 | 101.41 | 22.30 | 199 | | 21 | 101.97 | 22.30 | 236 | | 12 | 104.33 | 23.50 | 273 | 04.08.05 | 3 | 104.37 | 24.50 |
| 163 | | 9 | 101.41 | 22.20 | 200 | | 24 | 102.03 | 22.30 | 237 | | 15 | 104.81 | 23.70 | 274 | | 6 | 104.35 | 24.40 |
| 164 | | 12 | 101.40 | 22.20 | 201 | 26.07.05 | 3 | 102.09 | 22.30 | 238 | | 18 | 105.26 | 23.80 | 275 | | 9 | 104.34 | 24.40 |
| 165 | | 15 | 101.39 | 22.20 | 202 | | 6 | 102.15 | 22.30 | 239 | | 21 | 105.33 | 24.00 | 276 | | 12 | 104.32 | 24.40 |

| Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 277 | | 15 | 104.31 | 24.50 | 314 | | 6 | 104.17 | 25.10 | 351 | | 21 | 101.09 | 22.70 | 388 | | 12 | 101.55 | 23.30 |
| 278 | | 18 | 104.34 | 24.50 | 315 | | 9 | 104.09 | 25.10 | 352 | | 24 | 101.08 | 22.70 | 389 | | 15 | 101.51 | 23.30 |
| 279 | | 21 | 104.41 | 24.40 | 316 | | 12 | 104.06 | 25.10 | 353 | 14.08.05 | 3 | 101.07 | 22.70 | 390 | | 18 | 101.48 | 23.30 |
| 280 | | 24 | 104.50 | 24.30 | 317 | | 15 | 104.06 | 25.10 | 354 | | 6 | 101.07 | 22.70 | 391 | | 21 | 101.55 | 23.30 |
| 281 | 05.08.05 | 3 | 104.59 | 24.30 | 318 | | 18 | 104.06 | 25.10 | 355 | | 9 | 101.06 | 22.50 | 392 | | 24 | 101.66 | 23.30 |
| 282 | | 6 | 104.64 | 24.30 | 319 | | 21 | 104.01 | 25.00 | 356 | | 12 | 101.17 | 22.50 | 393 | 19.08.05 | 3 | 101.98 | 23.30 |
| 283 | | 9 | 104.58 | 24.30 | 320 | | 24 | 103.78 | 25.00 | 357 | | 15 | 101.46 | 22.50 | 394 | | 6 | 102.08 | 23.30 |
| 284 | | 12 | 104.49 | 24.30 | 321 | 10.08.05 | 3 | 103.48 | 25.00 | 358 | | 18 | 101.71 | 22.50 | 395 | | 9 | 102.17 | 23.30 |
| 285 | | 15 | 104.54 | 24.80 | 322 | | 6 | 103.24 | 24.90 | 359 | | 21 | 101.71 | 22.50 | 396 | | 12 | 102.26 | 23.30 |
| 286 | | 18 | 104.57 | 24.90 | 323 | | 9 | 102.97 | 24.90 | 360 | | 24 | 101.69 | 22.50 | 397 | | 15 | 102.28 | 23.30 |
| 287 | | 21 | 104.66 | 24.90 | 324 | | 12 | 102.70 | 24.70 | 361 | 15.08.05 | 3 | 101.69 | 22.50 | 398 | | 18 | 102.31 | 23.30 |
| 288 | | 24 | 104.81 | 24.90 | 325 | | 15 | 102.43 | 24.70 | 362 | | 6 | 101.69 | 22.50 | 399 | | 21 | 102.31 | 23.30 |
| 289 | 06.08.05 | 3 | 104.96 | 24.90 | 326 | | 18 | 102.25 | 25.20 | 363 | | 9 | 101.70 | 22.20 | 400 | | 24 | 102.28 | 23.30 |
| 290 | | 6 | 105.06 | 24.90 | 327 | | 21 | 102.13 | 25.20 | 364 | | 12 | 101.73 | 22.20 | 401 | 20.08.05 | 3 | 102.25 | 23.30 |
| 291 | | 9 | 105.08 | 25.00 | 328 | | 24 | 102.01 | 25.20 | 365 | | 15 | 101.76 | 22.20 | 402 | | 6 | 102.22 | 23.30 |
| 292 | | 12 | 105.08 | 25.20 | 329 | 11.08.05 | 3 | 101.89 | 25.20 | 366 | | 18 | 101.76 | 22.20 | 403 | | 9 | 102.14 | 23.40 |
| 293 | | 15 | 105.08 | 25.20 | 330 | | 6 | 101.77 | 25.00 | 367 | | 21 | 101.76 | 22.20 | 404 | | 12 | 102.06 | 23.50 |
| 294 | | 18 | 105.08 | 25.20 | 331 | | 9 | 101.65 | 24.70 | 368 | | 24 | 101.79 | 22.20 | 405 | | 15 | 102.04 | 23.70 |
| 295 | | 21 | 105.08 | 25.20 | 332 | | 12 | 101.47 | 24.50 | 369 | 16.08.05 | 3 | 101.82 | 22.20 | 406 | | 18 | 102.04 | 23.90 |
| 296 | | 24 | 105.08 | 25.30 | 333 | | 15 | 101.41 | 24.50 | 370 | | 6 | 101.85 | 22.20 | 407 | | 21 | 102.04 | 24.00 |
| 297 | 07.08.05 | 3 | 105.05 | 25.50 | 334 | | 18 | 101.38 | 24.50 | 371 | | 9 | 101.90 | 22.50 | 408 | | 24 | 102.07 | 24.00 |
| 298 | | 6 | 105.02 | 25.50 | 335 | | 21 | 101.35 | 24.40 | 372 | | 12 | 101.96 | 22.60 | 409 | 21.08.05 | 3 | 102.12 | 24.10 |
| 299 | | 9 | 105.01 | 25.60 | 336 | | 24 | 101.32 | 24.20 | 373 | | 15 | 102.00 | 22.60 | 410 | | 6 | 102.21 | 24.20 |
| 300 | | 12 | 105.00 | 25.60 | 337 | 12.08.05 | 3 | 101.29 | 24.00 | 374 | | 18 | 102.08 | 22.80 | 411 | | 9 | 102.86 | 24.10 |
| 301 | | 15 | 104.99 | 25.60 | 338 | | 6 | 101.26 | 23.80 | 375 | | 21 | 102.03 | 22.80 | 412 | | 12 | 103.10 | 24.10 |
| 302 | | 18 | 104.93 | 25.60 | 339 | | 9 | 101.26 | 23.70 | 376 | | 24 | 102.03 | 23.20 | 413 | | 15 | 103.17 | 24.10 |
| 303 | | 21 | 104.81 | 25.60 | 340 | | 12 | 101.24 | 23.70 | 377 | 17.08.05 | 3 | 102.00 | 23.20 | 414 | | 18 | 103.20 | 24.10 |
| 304 | | 24 | 104.61 | 25.50 | 341 | | 15 | 101.23 | 23.70 | 378 | | 6 | 101.97 | 23.20 | 415 | | 21 | 103.26 | 23.80 |
| 305 | 08.08.05 | 3 | 104.46 | 25.40 | 342 | | 18 | 101.22 | 23.70 | 379 | | 9 | 101.96 | 23.10 | 416 | | 24 | 103.35 | 23.80 |
| 306 | | 6 | 104.38 | 25.40 | 343 | | 21 | 101.19 | 23.70 | 380 | | 12 | 101.96 | 23.10 | 417 | 22.08.05 | 3 | 103.41 | 23.70 |
| 307 | | 9 | 104.30 | 25.40 | 344 | | 24 | 101.16 | 23.40 | 381 | | 15 | 101.96 | 23.20 | 418 | | 6 | 103.42 | 23.70 |
| 308 | | 12 | 104.29 | 25.40 | 345 | 13.08.05 | 3 | 101.14 | 23.20 | 382 | | 18 | 101.93 | 23.20 | 419 | | 9 | 103.42 | 23.70 |
| 309 | | 15 | 104.27 | 25.50 | 346 | | 6 | 101.14 | 23.10 | 383 | | 21 | 101.88 | 23.20 | 420 | | 12 | 103.42 | 23.80 |
| 310 | | 18 | 104.29 | 25.50 | 347 | | 9 | 101.12 | 23.10 | 384 | | 24 | 101.82 | 23.20 | 421 | | 15 | 103.42 | 24.10 |
| 311 | | 21 | 104.31 | 25.50 | 348 | | 12 | 101.11 | 23.10 | 385 | 18.08.05 | 3 | 101.79 | 23.20 | 422 | | 18 | 103.42 | 24.50 |
| 312 | | 24 | 104.27 | 25.20 | [illegible]9 | | 15 | 101.11 | 22.80 | 386 | | 6 | 101.76 | 23.30 | 423 | | 21 | 103.42 | 24.80 |
| 313 | 09.08.05 | 3 | 104.21 | 25.20 | 350 | | 18 | 101.10 | 22.80 | 387 | | 9 | 101.67 | 23.30 | 424 | | 24 | 103.42 | 25.00 |

| Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 425 | 23.08.05 | 3 | 103.39 | 24.90 | 462 | | 18 | 101.46 | 23.50 | 499 | | 9 | 101.10 | 21.60 | 536 | | 24 | 101.08 | 21.30 |
| 426 | | 6 | 103.36 | 24.90 | 463 | | 21 | 101.40 | 23.50 | 500 | | 12 | 101.09 | 21.60 | 537 | 06.09.05 | 3 | 101.08 | 21.30 |
| 427 | | 9 | 103.36 | 24.90 | 464 | | 24 | 101.34 | 23.30 | 501 | | 15 | 101.09 | 21.50 | 538 | | 6 | 101.08 | 21.30 |
| 428 | | 12 | 103.36 | 24.90 | 465 | 28.08.05 | 3 | 101.29 | 23.30 | 502 | | 18 | 101.09 | 21.50 | 539 | | 9 | 101.08 | 21.50 |
| 429 | | 15 | 103.36 | 24.60 | 466 | | 6 | 101.26 | 23.30 | 503 | | 21 | 101.09 | 21.50 | 540 | | 12 | 101.07 | 21.50 |
| 430 | | 18 | 103.34 | 24.50 | 467 | | 9 | 101.26 | 23.20 | 504 | | 24 | 101.09 | 21.50 | 541 | | 15 | 101.07 | 21.50 |
| 431 | | 21 | 103.33 | 24.50 | 468 | | 12 | 101.26 | 23.20 | 505 | 02.09.05 | 3 | 101.08 | 21.50 | 542 | | 18 | 101.12 | 21.50 |
| 432 | | 24 | 103.31 | 24.50 | 469 | | 15 | 101.25 | 23.10 | 506 | | 6 | 101.08 | 21.50 | 543 | | 21 | 101.13 | 21.50 |
| 433 | 24.08.05 | 3 | 103.30 | 24.50 | 470 | | 18 | 101.25 | 23.00 | 507 | | 9 | 101.07 | 21.50 | 544 | | 24 | 101.12 | 21.50 |
| 434 | | 6 | 103.28 | 24.50 | 471 | | 21 | 101.25 | 23.00 | 508 | | 12 | 101.06 | 21.50 | 545 | 07.09.05 | 3 | 101.08 | 21.50 |
| 435 | | 9 | 103.26 | 24.50 | 472 | | 24 | 101.25 | 23.00 | 509 | | 15 | 101.05 | 21.50 | 546 | | 6 | 101.05 | 21.50 |
| 436 | | 12 | 103.25 | 24.40 | 473 | 29.08.05 | 3 | 101.24 | 22.80 | 510 | | 18 | 101.05 | 21.50 | 547 | | 9 | 101.04 | 21.50 |
| 437 | | 15 | 103.26 | 24.40 | 474 | | 6 | 101.24 | 22.60 | 511 | | 21 | 101.05 | 21.50 | 548 | | 12 | 101.04 | 21.50 |
| 438 | | 18 | 103.26 | 24.30 | 475 | | 9 | 101.23 | 22.30 | 512 | | 24 | 101.04 | 21.50 | 549 | | 15 | 101.04 | 21.30 |
| 439 | | 21 | 103.26 | 24.30 | 476 | | 12 | 101.22 | 22.20 | 513 | 03.09.05 | 3 | 101.04 | 21.50 | 550 | | 18 | 101.04 | 21.30 |
| 440 | | 24 | 103.23 | 24.30 | 477 | | 15 | 101.21 | 22.10 | 514 | | 6 | 101.03 | 21.50 | 551 | | 21 | 101.04 | 21.30 |
| 441 | 25.08.05 | 3 | 103.19 | 24.30 | 478 | | 18 | 101.20 | 22.10 | 515 | | 9 | 101.03 | 21.50 | 552 | | 24 | 101.05 | 21.30 |
| 442 | | 6 | 103.13 | 24.20 | 479 | | 21 | 101.19 | 22.10 | 516 | | 12 | 101.02 | 21.40 | 553 | 08.09.05 | 3 | 101.09 | 21.30 |
| 443 | | 9 | 103.04 | 24.20 | 480 | | 24 | 101.18 | 22.10 | 517 | | 15 | 101.02 | 21.40 | 554 | | 6 | 101.12 | 21.30 |
| 444 | | 12 | 103.00 | 24.20 | 481 | 30.08.05 | 3 | 101.17 | 21.90 | 518 | | 18 | 101.05 | 21.40 | 555 | | 9 | 101.13 | 21.20 |
| 445 | | 15 | 102.97 | 24.20 | 482 | | 6 | 101.16 | 21.90 | 519 | | 21 | 101.09 | 21.40 | 556 | | 12 | 101.12 | 21.20 |
| 446 | | 18 | 102.97 | 24.20 | 483 | | 9 | 101.15 | 21.80 | 520 | | 24 | 101.15 | 21.40 | 557 | | 15 | 101.11 | 21.30 |
| 447 | | 21 | 102.93 | 24.20 | 484 | | 12 | 101.15 | 21.80 | 521 | 04.09.05 | 3 | 101.17 | 21.40 | 558 | | 18 | 101.10 | 21.30 |
| 448 | | 24 | 102.81 | 24.20 | 485 | | 15 | 101.14 | 21.80 | 522 | | 6 | 101.14 | 21.40 | 559 | | 21 | 101.11 | 21.30 |
| 449 | 26.08.05 | 3 | 102.70 | 24.20 | 486 | | 18 | 101.13 | 21.80 | 523 | | 9 | 101.15 | 21.40 | 560 | | 24 | 101.14 | 21.30 |
| 450 | | 6 | 102.58 | 24.20 | 487 | | 21 | 101.13 | 21.80 | 524 | | 12 | 101.16 | 21.40 | 561 | 09.09.05 | 3 | 101.15 | 21.30 |
| 451 | | 9 | 102.52 | 24.20 | 488 | | 24 | 101.13 | 21.80 | 525 | | 15 | 101.17 | 21.30 | 562 | | 6 | 101.15 | 21.40 |
| 452 | | 12 | 102.50 | 24.20 | 489 | 31.08.05 | 3 | 101.13 | 21.80 | 526 | | 18 | 101.18 | 21.30 | 563 | | 9 | 101.15 | 21.80 |
| 453 | | 15 | 102.49 | 24.10 | 490 | | 6 | 101.13 | 21.80 | 527 | | 21 | 101.18 | 21.30 | 564 | | 12 | 101.15 | 22.10 |
| 454 | | 18 | 102.47 | 24.10 | 491 | | 9 | 101.13 | 21.60 | 528 | | 24 | 101.18 | 21.30 | 565 | | 15 | 101.15 | 22.10 |
| 455 | | 21 | 102.42 | 24.10 | 492 | | 12 | 101.12 | 21.60 | 529 | 05.09.05 | 3 | 101.21 | 21.30 | 566 | | 18 | 101.15 | 22.30 |
| 456 | | 24 | 102.33 | 24.10 | 493 | | 15 | 101.12 | 21.60 | 530 | | 6 | 101.24 | 21.30 | 567 | | 21 | 101.19 | 22.30 |
| 457 | 27.08.05 | 3 | 102.24 | 24.10 | 494 | | 18 | 101.12 | 21.50 | 531 | | 9 | 101.24 | 21.30 | 568 | | 24 | 101.23 | 22.40 |
| 458 | | 6 | 102.17 | 24.00 | 495 | | 21 | 101.12 | 21.50 | 532 | | 12 | 101.20 | 21.30 | 569 | 10.09.05 | 3 | 101.26 | 22.50 |
| 459 | | 9 | 101.94 | 23.90 | 496 | | 24 | 101.12 | 21.50 | 533 | | 15 | 101.14 | 21.30 | 570 | | 6 | 101.29 | 22.60 |
| 460 | | 12 | 101.72 | 23.80 | 497 | 01.09.05 | 3 | 101.11 | 21.50 | 534 | | 18 | 101.08 | 21.30 | 571 | | 9 | 101.30 | 22.60 |
| 461 | | 15 | 101.56 | 23.70 | 498 | | 6 | 101.11 | 21.50 | 535 | | 21 | 101.08 | 21.30 | 572 | | 12 | 101.31 | 22.60 |

| Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 573 | | 15 | 101.31 | 22.60 | 610 | | 6 | 104.16 | 25.30 | 647 | | 21 | 104.56 | 25.50 | 684 | | 12 | 102.29 | 23.10 |
| 574 | | 18 | 101.31 | 22.60 | 611 | | 9 | 104.01 | 25.50 | 648 | | 24 | 104.16 | 25.50 | 685 | | 15 | 102.24 | 23.10 |
| 575 | | 21 | 101.31 | 22.60 | 612 | | 12 | 104.18 | 25.60 | 649 | 20.09.05 | 3 | 103.85 | 25.60 | 686 | | 18 | 102.24 | 22.90 |
| 576 | | 24 | 101.31 | 22.60 | 613 | | 15 | 104.24 | 25.90 | 650 | | 6 | 103.69 | 25.70 | 687 | | 21 | 102.24 | 22.90 |
| 577 | 11.09.05 | 3 | 101.31 | 22.60 | 614 | | 18 | 104.24 | 25.90 | 651 | | 9 | 103.36 | 25.70 | 688 | | 24 | 102.24 | 22.90 |
| 578 | | 6 | 101.31 | 22.60 | 615 | | 21 | 104.56 | 25.90 | 652 | | 12 | 103.18 | 25.80 | 689 | 25.09.05 | 3 | 102.22 | 23.00 |
| 579 | | 9 | 101.31 | 22.50 | 616 | | 24 | 105.06 | 25.80 | 653 | | 15 | 103.02 | 25.80 | 690 | | 6 | 102.19 | 23.10 |
| 580 | | 12 | 101.26 | 22.50 | 617 | 16.09.05 | 3 | 105.11 | 25.70 | 654 | | 18 | 102.99 | 25.80 | 691 | | 9 | 102.11 | 23.20 |
| 581 | | 15 | 101.20 | 22.40 | 618 | | 6 | 105.11 | 25.50 | 655 | | 21 | 102.94 | 25.80 | 692 | | 12 | 102.10 | 23.20 |
| 582 | | 18 | 101.20 | 22.40 | 619 | | 9 | 105.19 | 25.20 | 656 | | 24 | 102.85 | 25.50 | 693 | | 15 | 102.10 | 23.20 |
| 583 | | 21 | 101.23 | 22.40 | 620 | | 12 | 105.25 | 25.00 | 657 | 21.09.05 | 3 | 102.77 | 25.30 | 694 | | 18 | 102.10 | 23.20 |
| 584 | | 24 | 101.29 | 22.40 | 621 | | 15 | 105.25 | 25.20 | 658 | | 6 | 102.71 | 25.00 | 695 | | 21 | 102.10 | 23.20 |
| 585 | 12.09.05 | 3 | 101.35 | 22.40 | 622 | | 18 | 105.21 | 25.40 | 659 | | 9 | 102.58 | 24.60 | 696 | | 24 | 102.08 | 23.20 |
| 586 | | 6 | 101.38 | 22.40 | 623 | | 21 | 105.15 | 25.50 | 660 | | 12 | 102.46 | 24.30 | 697 | 26.09.05 | 3 | 102.05 | 23.10 |
| 587 | | 9 | 101.38 | 22.40 | 624 | | 24 | 105.12 | 25.70 | 661 | | 15 | 102.39 | 24.70 | 698 | | 6 | 102.02 | 23.00 |
| 588 | | 12 | 101.38 | 22.30 | 625 | 17.09.05 | 3 | 105.12 | 25.80 | 662 | | 18 | 102.31 | 24.70 | 699 | | 9 | 101.99 | 23.00 |
| 589 | | 15 | 101.38 | 22.30 | 626 | | 6 | 105.11 | 25.90 | 663 | | 21 | 102.25 | 24.70 | 700 | | 12 | 101.98 | 22.90 |
| 590 | | 18 | 101.41 | 22.30 | 627 | | 9 | 105.08 | 25.90 | 664 | | 24 | 102.21 | 24.60 | 701 | | 15 | 101.98 | 22.90 |
| 591 | | 21 | 101.56 | 22.30 | 628 | | 12 | 105.05 | 25.80 | 665 | 22.09.05 | 3 | 102.18 | 24.40 | 702 | | 18 | 101.98 | 22.90 |
| 592 | | 24 | 101.84 | 22.30 | 629 | | 15 | 105.05 | 26.00 | 666 | | 6 | 102.15 | 24.20 | 703 | | 21 | 101.94 | 22.90 |
| 593 | 13.09.05 | 3 | 102.18 | 22.70 | 630 | | 18 | 105.05 | 25.90 | 667 | | 9 | 102.15 | 24.00 | 704 | | 24 | 101.85 | 22.90 |
| 594 | | 6 | 102.49 | 23.00 | 631 | | 21 | 105.04 | 25.90 | 668 | | 12 | 102.12 | 23.90 | 705 | 27.09.05 | 3 | 101.85 | 22.70 |
| 595 | | 9 | 103.06 | 23.40 | 632 | | 24 | 104.96 | 25.90 | 669 | | 15 | 102.09 | 23.90 | 706 | | 6 | 101.82 | 22.60 |
| 596 | | 12 | 103.71 | 23.40 | 633 | 18.09.05 | 3 | 104.66 | 25.90 | 670 | | 18 | 102.06 | 23.80 | 707 | | 9 | 101.74 | 22.60 |
| 597 | | 15 | 104.09 | 23.70 | 634 | | 6 | 104.30 | 25.90 | 671 | | 21 | 102.03 | 23.80 | 708 | | 12 | 101.63 | 22.60 |
| 598 | | 18 | 104.31 | 23.70 | 635 | | 9 | 104.27 | 25.80 | 672 | | 24 | 102.00 | 23.70 | 709 | | 15 | 101.51 | 22.60 |
| 599 | | 21 | 104.46 | 23.80 | 636 | | 12 | 104.27 | 25.90 | 673 | 23.09.05 | 3 | 101.97 | 23.60 | 710 | | 18 | 101.42 | 22.60 |
| 600 | | 24 | 104.58 | 23.80 | 637 | | 15 | 104.27 | 25.80 | 674 | | 6 | 101.94 | 23.50 | 711 | | 21 | 101.38 | 22.60 |
| 601 | 14.09.05 | 3 | 104.71 | 23.80 | 638 | | 18 | 104.35 | 25.80 | 675 | | 9 | 101.93 | 23.30 | 712 | | 24 | 101.35 | 22.60 |
| 602 | | 6 | 104.81 | 23.80 | 639 | | 21 | 104.52 | 25.70 | 676 | | 12 | 102.38 | 23.20 | 713 | 28.09.05 | 3 | 101.35 | 22.60 |
| 603 | | 9 | 104.88 | 24.50 | 640 | | 24 | 104.61 | 25.60 | 677 | | 15 | 102.51 | 23.20 | 714 | | 6 | 101.35 | 22.60 |
| 604 | | 12 | 105.05 | 25.00 | 641 | 19.09.05 | 3 | 104.83 | 25.50 | 678 | | 18 | 102.56 | 23.20 | 715 | | 9 | 101.34 | 22.60 |
| 605 | | 15 | 105.12 | 25.00 | 642 | | 6 | 104.88 | 25.40 | 679 | | 21 | 102.54 | 23.20 | 716 | | 12 | 101.34 | 22.60 |
| 606 | | 18 | 105.15 | 25.00 | 643 | | 9 | 104.88 | 25.40 | 680 | | 24 | 102.49 | 23.20 | 717 | | 15 | 101.33 | 22.50 |
| 607 | | 21 | 105.04 | 24.90 | 644 | | 12 | 104.88 | 25.30 | 681 | 24.09.05 | 3 | 102.44 | 23.20 | 718 | | 18 | 101.33 | 22.50 |
| 608 | | 24 | 104.70 | 25.10 | 645 | | 15 | 104.88 | 25.30 | 682 | | 6 | 102.41 | 23.20 | 719 | | 21 | 101.32 | 22.50 |
| 609 | 15.09.05 | 3 | 104.38 | 25.10 | 646 | | 18 | 104.86 | 25.40 | 683 | | 9 | 102.35 | 23.20 | 720 | | 24 | 101.31 | 22.40 |

| Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 721 | 29.09.05 | 3 | 101.30 | 22.40 | 758 | | 18 | 101.14 | 21.90 | 795 | | 9 | 101.17 | 21.70 | 832 | | 24 | 100.98 | 21.30 |
| 722 | | 6 | 101.29 | • 2.30 | 759 | | 21 | 101.14 | 21.90 | 796 | | 12 | 101.17 | 21.60 | 833 | 13.10.05 | 3 | 101.01 | 21.30 |
| 723 | | 9 | 101.29 | 22.30 | 760 | | 24 | 101.14 | 21.90 | 797 | | 15 | 101.17 | 21.60 | 834 | | 6 | 101.04 | 21.30 |
| 724 | | 12 | 101.28 | 22.30 | 761 | 04.10.05 | 3 | 101.14 | 21.90 | 798 | | 18 | 101.17 | 21.60 | 835 | | 9 | 101.07 | 21.30 |
| 725 | | 15 | 101.27 | 22.10 | 762 | | 6 | 101.14 | 21.90 | 799 | | 21 | 101.16 | 21.60 | 836 | | 12 | 101.10 | 21.30 |
| 726 | | 18 | 101.26 | 22.10 | 763 | | 9 | 101.14 | 21.80 | 800 | | 24 | 101.16 | 21.60 | 837 | | 15 | 101.10 | 21.30 |
| 727 | | 21 | 101.25 | 22.10 | 764 | | 12 | 101.14 | 21.80 | 801 | 09.10.05 | 3 | 101.15 | 21.60 | 838 | | 18 | 101.10 | 21.30 |
| 728 | | 24 | 101.24 | 22.10 | 765 | | 15 | 101.14 | 21.80 | 802 | | 6 | 101.14 | 21.60 | 839 | | 21 | 101.12 | 21.30 |
| 729 | 30.09.05 | 3 | 101.23 | 22.10 | 766 | | 18 | 101.14 | 21.80 | 803 | | 9 | 101.14 | 21.60 | 840 | | 24 | 101.15 | 21.30 |
| 730 | | 6 | 101.23 | 22.10 | 767 | | 21 | 101.14 | 21.80 | 804 | | 12 | 101.14 | 21.60 | 841 | 14.10.05 | 3 | 101.18 | 21.30 |
| 731 | | 9 | 101.22 | 22.10 | 768 | | 24 | 101.14 | 21.80 | 805 | | 15 | 101.14 | 21.60 | 842 | | 6 | 101.21 | 21.30 |
| 732 | | 12 | 101.22 | 22.10 | 769 | 05.10.05 | 3 | 101.14 | 21.80 | 806 | | 18 | 101.14 | 21.60 | 843 | | 9 | 101.22 | 21.30 |
| 733 | | 15 | 101.21 | 22.10 | 770 | | 6 | 101.16 | 21.80 | 807 | | 21 | 101.11 | 21.60 | 844 | | 12 | 101.24 | 21.20 |
| 734 | | 18 | 101.21 | 22.10 | 771 | | 9 | 101.19 | 21.80 | 808 | | 24 | 101.08 | 21.50 | 845 | | 15 | 101.24 | 21.20 |
| 735 | | 21 | 101.20 | 22.10 | 772 | | 12 | 101.22 | 21.80 | 809 | 10.10.05 | 3 | 101.05 | 21.50 | 846 | | 18 | 101.21 | 21.20 |
| 736 | | 24 | 101.19 | 22.10 | 773 | | 15 | 101.25 | 21.80 | 810 | | 6 | 101.02 | 21.50 | 847 | | 21 | 101.18 | 21.20 |
| 737 | 01.10.05 | 3 | 101.18 | 22.00 | 774 | | 18 | 101.25 | 21.80 | 811 | | 9 | 101.01 | 21.50 | 848 | | 24 | 101.15 | 21.20 |
| 738 | | 6 | 101.17 | 22.00 | 775 | | 21 | 101.25 | 21.80 | 812 | | 12 | 101.01 | 21.50 | 849 | 15.10.05 | 3 | 101.15 | 21.20 |
| 739 | | 9 | 101.17 | 22.10 | 776 | | 24 | 101.25 | 21.80 | 813 | | 15 | 101.00 | 21.50 | 850 | | 6 | 101.15 | 21.20 |
| 740 | | 12 | 101.16 | 22.10 | 777 | 06.10.05 | 3 | 101.25 | 21.80 | 814 | | 18 | 101.00 | 21.50 | 851 | | 9 | 101.12 | 21.20 |
| 741 | | 15 | 101.15 | 22.10 | 778 | | 6 | 101.25 | 21.80 | 815 | | 21 | 100.99 | 21.50 | 852 | | 12 | 101.12 | 21.30 |
| 742 | | 18 | 101.15 | 22.10 | 779 | | 9 | 101.25 | 21.80 | 816 | | 24 | 100.98 | 21.50 | 853 | | 15 | 101.10 | 21.50 |
| 743 | | 21 | 101.14 | 22.10 | 780 | | 12 | 101.22 | 21.70 | 817 | 11.10.05 | 3 | 100.97 | 21.50 | 854 | | 18 | 101.10 | 21.50 |
| 744 | | 24 | 101.13 | 22.10 | 781 | | 15 | 101.19 | 21.70 | 818 | | 6 | 100.96 | 21.50 | 855 | | 21 | 101.10 | 21.50 |
| 745 | 02.10.05 | 3 | 101.13 | 22.10 | 782 | | 18 | 101.18 | 21.70 | 819 | | 9 | 100.95 | 21.40 | 856 | | 24 | 101.10 | 21.40 |
| 746 | | 6 | 101.12 | 22.10 | 783 | | 21 | 101.18 | 21.70 | 820 | | 12 | 100.95 | 21.40 | 857 | 16.10.05 | 3 | 101.12 | 21.40 |
| 747 | | 9 | 101.11 | 22.10 | 784 | | 24 | 101.18 | 21.70 | 821 | | 15 | 100.94 | 21.30 | 858 | | 6 | 101.12 | 21.30 |
| 748 | | 12 | 101.10 | 22.00 | 785 | 07.10.05 | 3 | 101.18 | 21.70 | 822 | | 18 | 100.94 | 21.30 | 859 | | 9 | 101.12 | 21.30 |
| 749 | | 15 | 101.10 | 22.00 | 786 | | 6 | 101.18 | 21.70 | 823 | | 21 | 100.94 | 21.30 | 860 | | 12 | 101.12 | 21.30 |
| 750 | | 18 | 101.10 | 22.00 | 787 | | 9 | 101.18 | 21.70 | 824 | | 24 | 100.94 | 21.30 | 861 | | 15 | 101.07 | 21.30 |
| 751 | | 21 | 101.12 | 22.00 | 788 | | 12 | 101.18 | 21.70 | 825 | 12.10.05 | 3 | 100.93 | 21.30 | 862 | | 18 | 101.04 | 21.20 |
| 752 | | 24 | 101.13 | 22.00 | 789 | | 15 | 101.18 | 21.70 | 826 | | 6 | 100.93 | 21.30 | 863 | | 21 | 101.04 | 21.20 |
| 753 | 03.10.05 | 3 | 101.14 | 22.00 | 790 | | 18 | 101.18 | 21.70 | 827 | | 9 | 100.93 | 21.30 | 864 | | 24 | 101.07 | 21.20 |
| 754 | | 6 | 101.14 | 22.00 | 791 | | 21 | 101.17 | 21.70 | 828 | | 12 | 100.92 | 21.30 | 865 | 17.10.05 | 3 | 101.07 | 21.20 |
| 755 | | 9 | 101.14 | 22.00 | 792 | | 24 | 101.17 | 21.70 | 829 | | 15 | 100.92 | 21.30 | 866 | | 6 | 101.10 | 21.20 |
| 756 | | 12 | 101.14 | 22.00 | 793 | 08.10.05 | 3 | 101.17 | 21.70 | 830 | | 18 | 100.92 | 21.30 | 867 | | 9 | 101.10 | 21.20 |
| 757 | | 15 | 101.14 | 21.90 | 794 | | 6 | 101.17 | 21.70 | 831 | | 21 | 100.95 | 21.30 | 868 | | 12 | 101.12 | 21.20 |

| Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 869 | | 15 | 101.12 | 21.20 | 906 | | 6 | 102.49 | 23.80 | 943 | | 21 | 101.76 | 22.90 | 980 | | 12 | 101.24 | 21.90 |
| 870 | | 18 | 101.15 | 21.20 | 907 | | 9 | 102.41 | 23.60 | 944 | | 24 | 101.72 | 22.90 | 981 | | 15 | 101.24 | 21.90 |
| 871 | | 21 | 101.15 | 21.20 | 908 | | 12 | 102.41 | 23.50 | 945 | 27.10.05 | 3 | 101.56 | 22.90 | 982 | | 18 | 101.24 | 21.90 |
| 872 | | 24 | 101.16 | 21.20 | 909 | | 15 | 102.41 | 23.50 | 946 | | 6 | 101.63 | 22.90 | 983 | | 21 | 101.24 | 21.90 |
| 873 | 18.10.05 | 3 | 101.21 | 21.20 | 910 | | 18 | 102.49 | 23.40 | 947 | | 9 | 101.47 | 22.90 | 984 | 01.07.06 | 3 | 100.76 | 21.00 |
| 874 | | 6 | 101.22 | 21.20 | 911 | | 21 | 102.51 | 23.40 | 948 | | 12 | 101.63 | 22.90 | 985 | | 6 | 100.77 | 21.00 |
| 875 | | 9 | 101.35 | 21.10 | 912 | | 24 | 102.49 | 23.40 | 949 | | 15 | 101.46 | 22.90 | 986 | | 9 | 100.78 | 21.00 |
| 876 | | 12 | 101.63 | 21.10 | 913 | 23.10.05 | 3 | 102.41 | 23.30 | 950 | | 18 | 101.48 | 22.90 | 987 | | 12 | 100.77 | 21.00 |
| 877 | | 15 | 101.74 | 21.00 | 914 | | 6 | 102.35 | 23.30 | 951 | | 21 | 101.48 | 22.80 | 988 | | 15 | 100.76 | 21.00 |
| 878 | | 18 | 101.74 | 21.00 | 915 | | 9 | 102.24 | 23.30 | 952 | | 24 | 101.48 | 22.80 | 989 | | 18 | 100.76 | 21.00 |
| 879 | | 21 | 101.72 | 21.00 | 916 | | 12 | 102.24 | 23.30 | 953 | 28.10.05 | 3 | 101.35 | 22.70 | 990 | | 21 | 100.76 | 21.00 |
| 880 | | 24 | 101.72 | 21.00 | 917 | | 15 | 102.24 | 23.20 | 954 | | 6 | 101.35 | 22.70 | 991 | | 24 | 100.73 | 21.00 |
| 881 | 19.10.05 | 3 | 101.74 | 21.10 | 918 | | 18 | 102.23 | 23.20 | 955 | | 9 | 101.35 | 22.70 | 992 | 02.07.06 | 3 | 100.70 | 21.00 |
| 882 | | 6 | 101.76 | 21.30 | 919 | | 21 | 102.22 | 23.20 | 956 | | 12 | 101.41 | 22.70 | 993 | | 6 | 100.69 | 21.00 |
| 883 | | 9 | 102.19 | 21.60 | 920 | | 24 | 102.15 | 23.20 | 957 | | 15 | 101.41 | 22.60 | 994 | | 9 | 100.69 | 21.00 |
| 884 | | 12 | 102.58 | 21.70 | 921 | 24.10.05 | 3 | 102.10 | 23.20 | 958 | | 18 | 101.41 | 22.50 | 995 | | 12 | 100.68 | 21.00 |
| 885 | | 15 | 102.77 | 22.00 | 922 | | 6 | 101.94 | 23.50 | 959 | | 21 | 101.35 | 22.50 | 996 | | 15 | 100.67 | 21.00 |
| 886 | | 18 | 102.85 | 22.00 | 923 | | 9 | 101.90 | 23.70 | 960 | | 24 | 101.35 | 22.50 | 997 | | 18 | 100.67 | 21.00 |
| 887 | | 21 | 102.99 | 22.00 | 924 | | 12 | 101.88 | 23.60 | 961 | 29.10.05 | 3 | 101.34 | 22.40 | 998 | | 21 | 100.70 | 21.00 |
| 888 | | 24 | 102.99 | 22.00 | 925 | | 15 | 101.85 | 23.40 | 962 | | 6 | 101.34 | 22.30 | 999 | | 24 | 100.93 | 21.00 |
| 889 | 20.10.05 | 3 | 102.99 | 22.00 | 926 | | 18 | 101.85 | 23.40 | 963 | | 9 | 101.34 | 22.30 | 1000 | 03.07.06 | 3 | 101.33 | 21.00 |
| 890 | | 6 | 102.99 | 22.10 | 927 | | 21 | 101.85 | 23.30 | 964 | | 12 | 101.29 | 22.20 | 1001 | | 6 | 102.03 | 21.00 |
| 891 | | 9 | 102.99 | 22.10 | 928 | | 24 | 101.85 | 23.30 | 965 | | 15 | 101.29 | 22.20 | 1002 | | 9 | 102.17 | 21.00 |
| 892 | | 12 | 102.97 | 22.20 | 929 | 25.10.05 | 3 | 101.90 | 23.30 | 966 | | 18 | 101.29 | 22.20 | 1003 | | 12 | 102.40 | 21.00 |
| 893 | | 15 | 102.77 | 22.30 | 930 | | 6 | 102.08 | 23.30 | 967 | | 21 | 101.24 | 22.20 | 1004 | | 15 | 102.52 | 21.00 |
| 894 | | 18 | 102.58 | 22.40 | 931 | | 9 | 102.10 | 23.20 | 968 | | 24 | 101.24 | 22.20 | 1005 | | 18 | 102.81 | 21.00 |
| 895 | | 21 | 102.55 | 22.70 | 932 | | 12 | 102.11 | 23.20 | 969 | 30.10.05 | 3 | 101.29 | 22.20 | 1006 | | 21 | 103.22 | 21.00 |
| 896 | | 24 | 102.56 | 23.00 | 933 | | 15 | 102.11 | 23.10 | 970 | | 6 | 101.34 | 22.10 | 1007 | | 24 | 103.64 | 21.00 |
| 897 | 21.10.05 | 3 | 102.53 | 23.50 | 934 | | 18 | 102.11 | 23.10 | 971 | | 9 | 101.34 | 22.00 | 1008 | 04.07.06 | 3 | 104.49 | 21.20 |
| 898 | | 6 | 102.51 | 23.90 | 935 | | 21 | 102.11 | 23.10 | 972 | | 12 | 101.34 | 22.00 | 1009 | | 6 | 105.73 | 21.50 |
| 899 | | 9 | 102.51 | 24.40 | 936 | | 24 | 102.10 | 23.10 | 973 | | 15 | 101.34 | 22.00 | 1010 | | 9 | 105.90 | 21.80 |
| 900 | | 12 | 102.51 | 24.40 | 937 | 26.10.05 | 3 | 102.10 | 23.00 | 974 | | 18 | 101.34 | 22.00 | 1011 | | 12 | 106.00 | 22.20 |
| 901 | | 15 | 102.51 | 24.30 | 938 | | 6 | 102.05 | 22.90 | 975 | | 21 | 101.35 | 22.00 | 1012 | | 15 | 106.08 | 22.20 |
| 902 | | 18 | 102.51 | 24.30 | 939 | | 9 | 101.85 | 22.90 | 976 | | 24 | 101.38 | 22.00 | 1013 | | 18 | 106.14 | 22.20 |
| 903 | | 21 | 102.51 | 24.30 | 940 | | 12 | 101.85 | 22.90 | 977 | 31.10.05 | 3 | 101.29 | 21.90 | 1014 | | 21 | 106.17 | 23.00 |
| 904 | | 24 | 102.50 | 24.00 | 941 | | 15 | 101.85 | 22.90 | 978 | | 6 | 101.24 | 21.90 | 1015 | | 24 | 106.17 | 24.10 |
| 905 | 22.10.05 | 3 | 102.49 | 23.90 | 942 | | 18 | 101.85 | 22.90 | 979 | | 9 | 101.24 | 21.90 | 1016 | 05.07.06 | 3 | 106.17 | 25.30 |

| Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1017 | | 6 | 105.96 | 25.80 | 1054 | | 21 | 101.46 | 22.70 | 1091 | | 12 | 101.04 | 21.50 | 1128 | 19.07.06 | 3 | 101.75 | 22.30 |
| 1018 | | 9 | 105.69 | 25.80 | 1055 | | 24 | 101.43 | 22.60 | 1092 | | 15 | 101.02 | 21.50 | 1129 | | 6 | 101.74 | 22.30 |
| 1019 | | 12 | 105.11 | 25.80 | 1056 | 10.07.06 | 3 | 101.40 | 22.60 | 1093 | | 18 | 101.02 | 21.50 | 1130 | | 9 | 101.74 | 22.40 |
| 1020 | | 15 | 104.94 | 26.00 | 1057 | | 6 | 101.37 | 22.50 | 1094 | | 21 | 101.02 | 21.50 | 1131 | | 12 | 101.72 | 22.40 |
| 1021 | | 18 | 104.81 | 26.00 | 1058 | | 9 | 101.35 | 22.40 | 1095 | | 24 | 101.01 | 21.50 | 1132 | | 15 | 101.70 | 22.40 |
| 1022 | | 21 | 104.42 | 26.20 | 1059 | | 12 | 101.33 | 22.40 | 1096 | 15.07.06 | 3 | 101.00 | 21.50 | 1133 | | 18 | 101.67 | 22.40 |
| 1023 | | 24 | 103.81 | 26.20 | 1060 | | 15 | 101.32 | 22.40 | 1097 | | 6 | 100.98 | 21.50 | 1134 | | 21 | 101.67 | 22.40 |
| 1024 | 06.07.06 | 3 | 103.40 | 26.20 | 1061 | | 18 | 101.30 | 22.40 | 1098 | | 9 | 100.98 | 21.50 | 1135 | | 24 | 101.64 | 22.40 |
| 1025 | | 6 | 103.02 | 26.20 | 1062 | | 21 | 101.29 | 22.40 | 1099 | | 12 | 100.98 | 21.40 | 1136 | 20.07.06 | 3 | 101.61 | 22.40 |
| 1026 | | 9 | 102.84 | 26.20 | 1063 | | 24 | 101.27 | 22.40 | 1100 | | 15 | 101.03 | 21.40 | 1137 | | 6 | 101.60 | 22.40 |
| 1027 | | 12 | 102.72 | 26.10 | 1064 | 11.07.06 | 3 | 101.24 | 22.40 | 1101 | | 18 | 101.03 | 21.40 | 1138 | | 9 | 101.57 | 22.40 |
| 1028 | | 15 | 102.62 | 25.80 | 1065 | | 6 | 101.23 | 22.40 | 1102 | | 21 | 101.06 | 21.40 | 1139 | | 12 | 101.54 | 22.40 |
| 1029 | | 18 | 102.48 | 25.40 | 1066 | | 9 | 101.23 | 22.40 | 1103 | | 24 | 101.12 | 21.40 | 1140 | | 15 | 101.53 | 22.40 |
| 1030 | | 21 | 102.38 | 25.10 | 1067 | | 12 | 101.22 | 22.40 | 1104 | 16.07.06 | 3 | 101.20 | 21.40 | 1141 | | 18 | 101.52 | 22.40 |
| 1031 | | 24 | 102.33 | 24.90 | 1068 | | 15 | 101.22 | 22.30 | 1105 | | 6 | 101.32 | 21.40 | 1142 | | 21 | 101.52 | 22.40 |
| 1032 | 07.07.06 | 3 | 102.30 | 24.80 | 1069 | | 18 | 101.21 | 22.30 | 1106 | | 9 | 101.38 | 21.40 | 1143 | | 24 | 101.55 | 22.40 |
| 1033 | | 6 | 102.24 | 24.80 | 1070 | | 21 | 101.20 | 22.30 | 1107 | | 12 | 101.38 | 21.40 | 1144 | 21.07.06 | 3 | 101.58 | 22.40 |
| 1034 | | 9 | 102.14 | 24.80 | 1071 | | 24 | 101.18 | 22.30 | 1108 | | 15 | 101.40 | 21.40 | 1145 | | 6 | 101.61 | 22.40 |
| 1035 | | 12 | 102.05 | 24.80 | 1072 | 12.07.06 | 3 | 101.17 | 22.30 | 1109 | | 18 | 101.41 | 21.40 | 1146 | | 9 | 101.69 | 22.40 |
| 1036 | | 15 | 102.02 | 24.90 | 1073 | | 6 | 101.17 | 22.30 | 1110 | | 21 | 101.46 | 21.40 | 1147 | | 12 | 101.75 | 22.40 |
| 1037 | | 18 | 101.99 | 24.80 | 1074 | | 9 | 101.16 | 22.30 | 1111 | | 24 | 101.50 | 21.40 | 1148 | | 15 | 101.81 | 22.40 |
| 1038 | | 21 | 101.96 | 24.60 | 1075 | | 12 | 101.16 | 22.10 | 1112 | 17.07.06 | 3 | 101.64 | 21.40 | 1149 | | 18 | 101.93 | 22.40 |
| 1039 | | 24 | 101.92 | 24.40 | 1076 | | 15 | 101.20 | 22.10 | 1113 | | 6 | 101.71 | 21.40 | 1150 | | 21 | 102.07 | 22.40 |
| 1040 | 08.07.06 | 3 | 101.86 | 24.30 | 1077 | | 18 | 101.20 | 22.10 | 1114 | | 9 | 101.71 | 21.40 | 1151 | | 24 | 102.41 | 22.40 |
| 1041 | | 6 | 101.83 | 24.00 | 1078 | | 21 | 101.20 | 22.00 | 1115 | | 12 | 101.71 | 21.40 | 1152 | 22.07.06 | 3 | 102.74 | 22.40 |
| 1042 | | 9 | 101.82 | 23.90 | 1079 | | 24 | 101.19 | 22.00 | 1116 | | 15 | 101.69 | 21.40 | 1153 | | 6 | 102.82 | 22.40 |
| 1043 | | 12 | 101.80 | 23.70 | 1080 | 13.07.06 | 3 | 101.18 | 21.90 | 1117 | | 18 | 101.67 | 21.40 | 1154 | | 9 | 102.81 | 22.70 |
| 1044 | | 15 | 101.79 | 23.60 | 1081 | | 6 | 101.17 | 21.90 | 1118 | | 21 | 101.60 | 21.40 | 1155 | | 12 | 102.79 | 23.00 |
| 1045 | | 18 | 101.78 | 23.50 | 1082 | | 9 | 101.16 | 21.90 | 1119 | | 24 | 101.67 | 21.40 | 1156 | | 15 | 102.79 | 23.00 |
| 1046 | | 21 | 101.76 | 23.40 | 1083 | | 12 | 101.15 | 21.90 | 1120 | 18.07.06 | 3 | 101.70 | 21.40 | 1157 | | 18 | 102.79 | 23.00 |
| 1047 | | 24 | 101.68 | 23.30 | 1084 | | 15 | 101.15 | 21.90 | 1121 | | 6 | 101.75 | 21.40 | 1158 | | 21 | 102.77 | 23.00 |
| 1048 | 09.07.06 | 3 | 101.59 | 23.30 | 1085 | | 18 | 101.15 | 21.90 | 1122 | | 9 | 101.77 | 21.40 | 1159 | | 24 | 102.66 | 23.20 |
| 1049 | | 6 | 101.54 | 23.20 | 1086 | | 21 | 101.14 | 21.90 | 1123 | | 12 | 101.77 | 21.90 | 1160 | 23.07.06 | 3 | 102.56 | 23.40 |
| 1050 | | 9 | 101.53 | 23.10 | 1087 | | 24 | 101.14 | 21.90 | 1124 | | 15 | 101.77 | 21.90 | 1161 | | 6 | 102.45 | 23.60 |
| 1051 | | 12 | 101.51 | 23.00 | 1088 | 14.07.06 | 3 | 101.13 | 21.90 | 1125 | | 18 | 101.75 | 22.00 | 1162 | | 9 | 102.36 | 23.75 |
| 1052 | | 15 | 101.50 | 22.90 | 1089 | | 6 | 101.10 | 21.90 | 1126 | | 21 | 101.75 | 22.10 | 1163 | | 12 | 102.34 | 23.90 |
| 1053 | | 18 | 101.48 | 22.80 | 1090 | | 9 | 101.07 | 21.60 | 1127 | | 24 | 101.75 | 22.20 | 1164 | | 15 | 102.33 | 24.20 |

| Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1165 | | 18 | 102.30 | 24.20 | 1202 | | 9 | 102.79 | 22.70 | 1239 | | 24 | 104.17 | 25.30 | 1276 | | 15 | 103.30 | 24.90 |
| 1166 | | 21 | 102.21 | 24.20 | 1203 | | 12 | 102.84 | 22.80 | 1240 | 02.08.06 | 3 | 104.24 | 25.30 | 1277 | | 18 | 103.28 | 24.80 |
| 1167 | | 24 | 102.12 | 24.40 | 1204 | | 15 | 102.87 | 22.90 | 1241 | | 6 | 104.24 | 25.00 | 1278 | | 21 | 103.24 | 24.70 |
| 1168 | 24.07.06 | 3 | 102.06 | 24.50 | 1205 | | 18 | 102.87 | 22.90 | 1242 | | 9 | 104.24 | 25.00 | 1279 | | 24 | 103.20 | 24.60 |
| 1169 | | 6 | 102.05 | 24.40 | 1206 | | 21 | 102.81 | 23.00 | 1243 | | 12 | 104.33 | 25.00 | 1280 | 07.08.06 | 3 | 103.14 | 24.60 |
| 1170 | | 9 | 101.97 | 24.40 | 1207 | | 24 | 102.75 | 23.10 | 1244 | | 15 | 104.42 | 24.50 | 1281 | | 6 | 103.06 | 24.60 |
| 1171 | | 12 | 101.97 | 24.40 | 1208 | 29.07.06 | 3 | 102.72 | 23.20 | 1245 | | 18 | 104.51 | 24.50 | 1282 | | 9 | 102.99 | 24.80 |
| 1172 | | 15 | 101.96 | 24.20 | 1209 | | 6 | 102.69 | 23.30 | 1246 | | 21 | 104.46 | 24.50 | 1283 | | 12 | 102.94 | 25.00 |
| 1173 | | 18 | 101.90 | 24.20 | 1210 | | 9 | 102.63 | 23.40 | 1247 | | 24 | 104.37 | 24.40 | 1284 | | 15 | 102.92 | 25.00 |
| 1174 | | 21 | 101.88 | 23.60 | 1211 | | 12 | 102.57 | 23.60 | 1248 | 03.08.06 | 3 | 104.28 | 24.40 | 1285 | | 18 | 102.90 | 25.00 |
| 1175 | | 24 | 101.86 | 23.60 | 1212 | | 15 | 102.54 | 23.70 | 1249 | | 6 | 104.25 | 24.40 | 1286 | | 21 | 102.89 | 24.80 |
| 1176 | 25.07.06 | 3 | 101.85 | 23.60 | 1213 | | 18 | 102.52 | 23.90 | 1250 | | 9 | 104.28 | 24.50 | 1287 | | 24 | 102.87 | 24.80 |
| 1177 | | 6 | 101.84 | 23.60 | 1214 | | 21 | 102.52 | 24.00 | 1251 | | 12 | 104.34 | 24.60 | 1288 | 08.08.06 | 3 | 102.84 | 24.80 |
| 1178 | | 9 | 101.83 | 23.60 | 1215 | | 24 | 102.48 | 24.00 | 1252 | | 15 | 104.34 | 25.00 | 1289 | | 6 | 102.79 | 24.80 |
| 1179 | | 12 | 101.82 | 23.30 | 1216 | 30.07.06 | 3 | 102.45 | 24.20 | 1253 | | 18 | 104.34 | 25.00 | 1290 | | 9 | 102.79 | 25.00 |
| 1180 | | 15 | 101.81 | 23.30 | 1217 | | 6 | 102.42 | 24.20 | 1254 | | 21 | 104.33 | 25.00 | 1291 | | 12 | 102.78 | 25.00 |
| 1181 | | 18 | 101.80 | 23.30 | 1218 | | 9 | 102.42 | 24.20 | 1255 | | 24 | 104.30 | 25.10 | 1292 | | 15 | 102.78 | 25.00 |
| 1182 | | 21 | 101.77 | 23.10 | 1219 | | 12 | 102.42 | 24.20 | 1256 | 04.08.06 | 3 | 104.27 | 25.10 | 1293 | | 18 | 102.75 | 25.00 |
| 1183 | | 24 | 101.71 | 23.10 | 1220 | | 15 | 102.42 | 24.20 | 1257 | | 6 | 104.18 | 25.10 | 1294 | | 21 | 102.62 | 25.00 |
| 1184 | 26.07.06 | 3 | 101.65 | 22.90 | 1221 | | 18 | 102.42 | 24.20 | 1258 | | 9 | 104.16 | 24.90 | 1295 | | 24 | 102.50 | 25.00 |
| 1185 | | 6 | 101.61 | 22.90 | 1222 | | 21 | 102.42 | 24.40 | 1259 | | 12 | 104.14 | 24.90 | 1296 | 09.08.06 | 3 | 102.40 | 24.70 |
| 1186 | | 9 | 101.59 | 22.90 | 1223 | | 24 | 102.47 | 23.80 | 1260 | | 15 | 104.05 | 24.90 | 1297 | | 6 | 102.33 | 24.70 |
| 1187 | | 12 | 101.60 | 22.80 | 1224 | 31.07.06 | 3 | 102.56 | 23.80 | 1261 | | 18 | 103.96 | 24.80 | 1298 | | 9 | 102.28 | 24.70 |
| 1188 | | 15 | 101.63 | 22.80 | 1225 | | 6 | 103.76 | 23.80 | 1262 | | 21 | 103.87 | 24.80 | 1299 | | 12 | 102.27 | 24.60 |
| 1189 | | 18 | 101.65 | 22.80 | 1226 | | 9 | 103.91 | 23.80 | 1263 | | 24 | 103.78 | 24.70 | 1300 | | 15 | 102.26 | 24.50 |
| 1190 | | 21 | 101.70 | 22.70 | 1227 | | 12 | 104.02 | 23.80 | 1264 | 05.08.06 | 3 | 103.69 | 24.70 | 1301 | | 18 | 102.25 | 24.50 |
| 1191 | | 24 | 101.84 | 22.70 | 1228 | | 15 | 104.13 | 23.50 | 1265 | | 6 | 103.58 | 24.70 | 1302 | | 21 | 102.25 | 24.50 |
| 1192 | 27.07.06 | 3 | 101.94 | 22.70 | 1229 | | 18 | 104.20 | 23.50 | 1266 | | 9 | 103.52 | 24.90 | 1303 | | 24 | 102.24 | 24.50 |
| 1193 | | 6 | 102.00 | 22.70 | 1230 | | 21 | 104.24 | 23.50 | 1267 | | 12 | 103.51 | 25.00 | 1304 | 10.08.06 | 3 | 102.24 | 24.30 |
| 1194 | | 9 | 102.06 | 22.70 | 1231 | | 24 | 104.21 | 23.40 | 1268 | | 15 | 103.46 | 25.30 | 1305 | | 6 | 102.24 | 24.30 |
| 1195 | | 12 | 102.21 | 22.70 | 1232 | 01.08.06 | 3 | 104.18 | 23.40 | 1269 | | 18 | 103.44 | 25.40 | 1306 | | 9 | 102.24 | 24.20 |
| 1196 | | 15 | 102.33 | 22.70 | 1233 | | 6 | 104.15 | 23.60 | 1270 | | 21 | 103.40 | 25.40 | 1307 | | 12 | 102.24 | 24.10 |
| 1197 | | 18 | 102.44 | 22.70 | 1234 | | 9 | 104.12 | 23.80 | 1271 | | 24 | 103.44 | 25.10 | 1308 | | 15 | 102.24 | 24.00 |
| 1198 | | 21 | 102.52 | 22.70 | 1235 | | 12 | 104.12 | 23.80 | 1272 | 06.08.06 | 3 | 103.53 | 25.10 | 1309 | | 18 | 102.23 | 23.80 |
| 1199 | | 24 | 102.58 | 22.70 | 1236 | | 15 | 104.11 | 24.90 | 1273 | | 6 | 103.50 | 25.00 | 1310 | | 21 | 102.23 | 23.80 |
| 1200 | 28.07.06 | 3 | 102.64 | 22.70 | 1237 | | 18 | 104.10 | 24.90 | 1274 | | 9 | 103.44 | 25.00 | 1311 | | 24 | 102.22 | 23.70 |
| 1201 | | 6 | 102.72 | 22.70 | 1238 | | 21 | 104.11 | 25.30 | 1275 | | 12 | 103.39 | 24.90 | 1312 | 11.08.06 | 3 | 102.22 | 23.60 |

| Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1313 | | 6 | 102.22 | 23.60 | 1350 | | 21 | 104.56 | 25.40 | 1387 | | 12 | 104.71 | 25.50 | 1424 | 25.08.06 | 3 | 104.42 | 26.00 |
| 1314 | | 9 | 102.22 | 23.50 | 1351 | | 24 | 104.54 | 25.50 | 1388 | | 15 | 104.65 | 25.40 | 1425 | | 6 | 104.30 | 26.00 |
| 1315 | | 12 | 102.21 | 23.50 | 1352 | 16.08.06 | 3 | 104.54 | 25.60 | 1389 | | 18 | 104.02 | 25.40 | 1426 | | 9 | 104.18 | 26.00 |
| 1316 | | 15 | 102.21 | 23.50 | 1353 | | 6 | 104.54 | 25.70 | 1390 | | 21 | 104.05 | 25.40 | 1427 | | 12 | 104.09 | 26.00 |
| 1317 | | 18 | 102.21 | 23.50 | 1354 | | 9 | 104.46 | 25.50 | 1391 | | 24 | 104.08 | 25.30 | 1428 | | 15 | 104.05 | 26.00 |
| 1318 | | 21 | 102.23 | 23.50 | 1355 | | 12 | 104.37 | 25.40 | 1392 | 21.08.06 | 3 | 104.11 | 25.30 | 1429 | | 18 | 104.02 | 25.80 |
| 1319 | | 24 | 102.26 | 23.50 | 1356 | | 15 | 104.28 | 25.40 | 1393 | | 6 | 104.26 | 25.30 | 1430 | | 21 | 103.99 | 25.60 |
| 1320 | 12.08.06 | 3 | 102.29 | 23.50 | 1357 | | 18 | 104.20 | 25.40 | 1394 | | 9 | 104.46 | 25.30 | 1431 | | 24 | 103.96 | 25.50 |
| 1321 | | 6 | 102.37 | 23.50 | 1358 | | 21 | 104.17 | 25.40 | 1395 | | 12 | 104.69 | 25.40 | 1432 | 26.08.06 | 3 | 103.96 | 25.40 |
| 1322 | | 9 | 102.80 | 23.50 | 1359 | | 24 | 104.17 | 25.40 | 1396 | | 15 | 104.89 | 25.40 | 1433 | | 6 | 104.12 | 25.50 |
| 1323 | | 12 | 103.39 | 23.70 | 1360 | 17.08.06 | 3 | 104.16 | 25.50 | 1397 | | 18 | 105.04 | 25.50 | 1434 | | 9 | 104.19 | 25.50 |
| 1324 | | 15 | 103.60 | 23.80 | 1361 | | 6 | 104.13 | 25.50 | 1398 | | 21 | 105.01 | 25.60 | 1435 | | 12 | 104.24 | 25.40 |
| 1325 | | 18 | 103.83 | 23.90 | 1362 | | 9 | 104.10 | 25.50 | 1399 | | 24 | 104.94 | 25.80 | 1436 | | 15 | 104.27 | 25.30 |
| 1326 | | 21 | 104.43 | 23.90 | 1363 | | 12 | 104.11 | 25.50 | 1400 | 22.08.06 | 3 | 104.85 | 25.90 | 1437 | | 18 | 104.30 | 25.30 |
| 1327 | | 24 | 105.03 | 23.90 | 1364 | | 15 | 104.28 | 25.30 | 1401 | | 6 | 104.83 | 26.00 | 1438 | | 21 | 104.41 | 25.30 |
| 1328 | 13.08.06 | 3 | 105.30 | 24.00 | 1365 | | 18 | 104.26 | 25.40 | 1402 | | 9 | 104.83 | 26.00 | 1439 | | 24 | 104.76 | 25.20 |
| 1329 | | 6 | 105.30 | 24.70 | 1366 | | 21 | 104.40 | 25.40 | 1403 | | 12 | 104.83 | 26.10 | 1440 | 27.08.06 | 3 | 105.01 | 25.20 |
| 1330 | | 9 | 105.21 | 25.40 | 1367 | | 24 | 104.59 | 25.40 | 1404 | | 15 | 104.86 | 26.10 | 1441 | | 6 | 104.95 | 25.20 |
| 1331 | | 12 | 105.11 | 26.20 | 1368 | 18.08.06 | 3 | 104.66 | 25.30 | 1405 | | 18 | 104.90 | 26.10 | 1442 | | 9 | 104.80 | 25.40 |
| 1332 | | 15 | 104.95 | 26.00 | 1369 | | 6 | 104.66 | 25.40 | 1406 | | 21 | 104.96 | 26.00 | 1443 | | 12 | 104.60 | 25.50 |
| 1333 | | 18 | 104.87 | 26.00 | 1370 | | 9 | 104.69 | 25.50 | 1407 | | 24 | 105.02 | 26.00 | 1444 | | 15 | 104.46 | 25.60 |
| 1334 | | 21 | 104.75 | 26.00 | 1371 | | 12 | 104.71 | 25.50 | 1408 | 23.08.06 | 3 | 105.08 | 26.00 | 1445 | | 18 | 104.38 | 25.70 |
| 1335 | | 24 | 104.41 | 26.00 | 1372 | | 15 | 104.65 | 25.50 | 1409 | | 6 | 105.11 | 26.00 | 1446 | | 21 | 104.36 | 25.70 |
| 1336 | 14.08.06 | 3 | 104.17 | 26.10 | 1373 | | 18 | 104.58 | 25.60 | 1410 | | 9 | 105.12 | 26.00 | 1447 | | 24 | 104.37 | 25.80 |
| 1337 | | 6 | 103.99 | 26.00 | 1374 | | 21 | 104.49 | 25.60 | 1411 | | 12 | 105.13 | 26.00 | 1448 | 28.08.06 | 3 | 104.40 | 25.90 |
| 1338 | | 9 | 103.97 | 26.00 | 1375 | | 24 | 104.41 | 25.60 | 1412 | | 15 | 105.13 | 26.00 | 1449 | | 6 | 104.36 | 25.80 |
| 1339 | | 12 | 103.96 | 26.00 | 1376 | 19.08.06 | 3 | 104.32 | 25.65 | 1413 | | 18 | 105.18 | 25.90 | 1450 | | 9 | 104.30 | 25.80 |
| 1340 | | 15 | 103.94 | 26.00 | 1377 | | 6 | 104.26 | 25.50 | 1414 | | 21 | 105.46 | 25.90 | 1451 | | 12 | 104.27 | 25.70 |
| 1341 | | 18 | 104.23 | 25.20 | 1378 | | 9 | 104.21 | 25.50 | 1415 | | 24 | 105.46 | 25.90 | 1452 | | 15 | 104.06 | 25.60 |
| 1342 | | 21 | 104.50 | 25.00 | 1379 | | 12 | 104.18 | 25.50 | 1416 | 24.08.06 | 3 | 105.64 | 26.00 | 1453 | | 18 | 103.75 | 25.50 |
| 1343 | | 24 | 104.60 | 24.70 | 1380 | | 15 | 104.16 | 25.50 | 1417 | | 6 | 105.60 | 26.10 | 1454 | | 21 | 103.47 | 25.30 |
| 1344 | 15.08.06 | 3 | 104.66 | 24.60 | 1381 | | 18 | 104.14 | 25.60 | 1418 | | 9 | 105.54 | 26.10 | 1455 | | 24 | 103.26 | 25.30 |
| 1345 | | 6 | 104.68 | 25.20 | 1382 | | 21 | 104.11 | 25.50 | 1419 | | 12 | 105.46 | 26.20 | 1456 | 29.08.06 | 3 | 103.15 | 25.20 |
| 1346 | | 9 | 104.68 | 25.40 | 1383 | | 24 | 104.59 | 25.50 | 1420 | | 15 | 105.32 | 26.00 | 1457 | | 6 | 103.12 | 25.30 |
| 1347 | | 12 | 104.66 | 25.40 | 1384 | 20.08.06 | 3 | 104.66 | 25.40 | 1421 | | 18 | 104.94 | 26.00 | 1458 | | 9 | 103.11 | 25.30 |
| 1348 | | 15 | 104.63 | 25.40 | 1385 | | 6 | 104.66 | 25.60 | 1422 | | 21 | 104.70 | 26.00 | 1459 | | 12 | 103.55 | 25.30 |
| 1349 | | 18 | 104.59 | 25.30 | 1386 | | 9 | 104.69 | 25.60 | 1423 | | 24 | 104.52 | 26.00 | 1460 | | 15 | 104.00 | 25.30 |

| Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1461 | | 18 | 104.55 | 25.30 | 1498 | | 9 | 104.70 | 25.60 | 1535 | | 24 | 103.70 | 24.45 | 1572 | | 15 | 101.87 | 22.60 |
| 1462 | | 21 | 104.97 | 25.30 | 1499 | | 12 | 104.58 | 25.60 | 1536 | 08.09.06 | 3 | 103.69 | 24.40 | 1573 | | 18 | 101.87 | 22.60 |
| 1463 | | 24 | 105.27 | 25.50 | 1500 | | 15 | 104.44 | 25.60 | 1537 | | 6 | 103.67 | 24.40 | 1574 | | 21 | 101.87 | 22.60 |
| 1464 | 30.08.06 | 3 | 105.47 | 25.70 | 1501 | | 18 | 104.38 | 25.60 | 1538 | | 9 | 103.65 | 24.40 | 1575 | | 24 | 101.87 | 22.60 |
| 1465 | | 6 | 105.86 | 25.90 | 1502 | | 21 | 104.29 | 25.60 | 1539 | | 12 | 103.63 | 24.30 | 1576 | 13.09.06 | 3 | 101.87 | 22.60 |
| 1466 | | 9 | 106.34 | 25.90 | 1503 | | 24 | 104.26 | 25.60 | 1540 | | 15 | 103.55 | 24.25 | 1577 | | 6 | 101.87 | 22.50 |
| 1467 | | 12 | 106.76 | 26.00 | 1504 | 04.09.06 | 3 | 104.26 | 25.50 | 1541 | | 18 | 103.41 | 24.20 | 1578 | | 9 | 101.87 | 22.50 |
| 1468 | | 15 | 107.02 | 26.00 | 1505 | | 6 | 104.26 | 25.40 | 1542 | | 21 | 103.26 | 24.20 | 1579 | | 12 | 101.87 | 22.40 |
| 1469 | | 18 | 107.18 | 26.00 | 1506 | | 9 | 104.26 | 25.30 | 1543 | | 24 | 103.17 | 24.20 | 1580 | | 15 | 101.86 | 22.60 |
| 1470 | | 21 | 107.15 | 26.00 | 1507 | | 12 | 104.22 | 25.20 | 1544 | 09.09.06 | 3 | 103.09 | 24.10 | 1581 | | 18 | 101.86 | 22.80 |
| 1471 | | 24 | 107.02 | 26.10 | 1508 | | 15 | 104.19 | 25.10 | 1545 | | 6 | 103.03 | 24.00 | 1582 | | 21 | 101.85 | 22.80 |
| 1472 | 31.08.06 | 3 | 106.80 | 26.30 | 1509 | | 18 | 104.13 | 25.05 | 1546 | | 9 | 102.97 | 24.00 | 1583 | | 24 | 101.84 | 22.80 |
| 1473 | | 6 | 106.46 | 26.40 | 1510 | | 21 | 103.80 | 25.05 | 1547 | | 12 | 102.91 | 24.00 | 1584 | 14.09.06 | 3 | 101.83 | 22.70 |
| 1474 | | 9 | 106.09 | 26.50 | 1511 | | 24 | 103.62 | 25.00 | 1548 | | 15 | 102.76 | 24.00 | 1585 | | 6 | 101.86 | 22.70 |
| 1475 | | 12 | 105.88 | 26.60 | 1512 | 05.09.06 | 3 | 103.59 | 24.90 | 1549 | | 18 | 102.61 | 23.90 | 1586 | | 9 | 101.87 | 22.70 |
| 1476 | | 15 | 105.58 | 26.70 | 1513 | | 6 | 103.63 | 24.90 | 1550 | | 21 | 102.46 | 23.90 | 1587 | | 12 | 101.87 | 22.65 |
| 1477 | | 18 | 105.32 | 26.80 | 1514 | | 9 | 103.72 | 24.90 | 1551 | | 24 | 102.34 | 23.80 | 1588 | | 15 | 101.86 | 22.65 |
| 1478 | | 21 | 105.12 | 26.90 | 1515 | | 12 | 103.75 | 24.85 | 1552 | 10.09.06 | 3 | 102.22 | 23.80 | 1589 | | 18 | 101.86 | 22.60 |
| 1479 | | 24 | 104.80 | 26.90 | 1516 | | 15 | 103.75 | 24.85 | 1553 | | 6 | 102.22 | 23.80 | 1590 | | 21 | 101.86 | 22.60 |
| 1480 | 01.09.06 | 3 | 104.44 | 26.90 | 1517 | | 18 | 103.71 | 24.75 | 1554 | | 9 | 102.22 | 23.70 | 1591 | | 24 | 101.86 | 22.60 |
| 1481 | | 6 | 104.17 | 26.80 | 1518 | | 21 | 103.84 | 24.65 | 1555 | | 12 | 102.22 | 23.65 | 1592 | 15.09.06 | 3 | 101.85 | 22.60 |
| 1482 | | 9 | 103.91 | 26.70 | 1519 | | 24 | 104.09 | 24.60 | 1556 | | 15 | 102.22 | 23.65 | 1593 | | 6 | 101.84 | 22.60 |
| 1483 | | 12 | 103.75 | 26.60 | 1520 | 06.09.06 | 3 | 104.11 | 24.50 | 1557 | | 18 | 102.22 | 23.55 | 1594 | | 9 | 101.84 | 22.65 |
| 1484 | | 15 | 103.69 | 26.50 | 1521 | | 6 | 104.11 | 24.45 | 1558 | | 21 | 102.21 | 23.50 | 1595 | | 12 | 101.83 | 22.65 |
| 1485 | | 18 | 104.49 | 26.30 | 1522 | | 9 | 104.11 | 24.40 | 1559 | | 24 | 102.20 | 23.40 | 1596 | | 15 | 101.83 | 22.70 |
| 1486 | | 21 | 104.89 | 26.10 | 1523 | | 12 | 104.11 | 24.35 | 1560 | 11.09.06 | 3 | 102.19 | 23.30 | 1597 | | 18 | 101.83 | 22.70 |
| 1487 | | 24 | 105.09 | 25.90 | 1524 | | 15 | 104.09 | 24.35 | 1561 | | 6 | 102.19 | 23.20 | 1598 | | 21 | 101.83 | 22.70 |
| 1488 | 02.09.06 | 3 | 105.21 | 25.70 | 1525 | | 18 | 104.07 | 24.35 | 1562 | | 9 | 102.19 | 23.10 | 1599 | | 24 | 101.80 | 22.70 |
| 1489 | | 6 | 105.21 | 25.50 | 1526 | | 21 | 104.05 | 24.35 | 1563 | | 12 | 102.19 | 23.10 | 1600 | 16.09.06 | 3 | 101.79 | 22.70 |
| 1490 | | 9 | 105.17 | 25.30 | 1527 | | 24 | 103.97 | 24.40 | 1564 | | 15 | 102.19 | 23.00 | 1601 | | 6 | 101.78 | 22.70 |
| 1491 | | 12 | 105.12 | 25.10 | 1528 | 07.09.06 | 3 | 103.88 | 24.40 | 1565 | | 18 | 102.18 | 23.00 | 1602 | | 9 | 101.78 | 22.70 |
| 1492 | | 15 | 105.10 | 25.10 | 1529 | | 6 | 103.87 | 24.45 | 1566 | | 21 | 102.14 | 23.00 | 1603 | | 12 | 101.82 | 22.70 |
| 1493 | | 18 | 105.08 | 25.10 | 1530 | | 9 | 103.87 | 24.50 | 1567 | | 24 | 102.09 | 23.00 | 1604 | | 15 | 102.08 | 22.70 |
| 1494 | | 21 | 105.00 | 25.30 | 1531 | | 12 | 103.85 | 24.50 | 1568 | 12.09.06 | 3 | 102.04 | 23.00 | 1605 | | 18 | 102.20 | 22.65 |
| 1495 | | 24 | 104.99 | 25.40 | 1532 | | 15 | 103.79 | 24.50 | 1569 | | 6 | 101.99 | 22.90 | 1606 | | 21 | 102.16 | 22.65 |
| 1496 | 03.09.06 | 3 | 104.93 | 25.50 | 1533 | | 18 | 103.73 | 24.45 | 1570 | | 9 | 101.93 | 22.90 | 1607 | | 24 | 102.13 | 22.65 |
| 1497 | | 6 | 104.78 | 25.50 | 1534 | | 21 | 103.72 | 24.45 | 1571 | | 12 | 101.87 | 22.65 | 1608 | 17.09.06 | 3 | 102.13 | 22.60 |

| Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1609 | | 6 | 102.34 | 22.60 | 1646 | | 21 | 102.00 | 22.60 | 1683 | | 12 | 102.07 | 22.80 | 1720 | 01.10.06 | 3 | 102.80 | 22.90 |
| 1610 | | 9 | 102.43 | 22.60 | 1647 | | 24 | 102.15 | 22.60 | 1684 | | 15 | 102.11 | 22.80 | 1721 | | 6 | 102.90 | 23.10 |
| 1611 | | 12 | 102.43 | 22.60 | 1648 | 22.09.06 | 3 | 102.25 | 22.70 | 1685 | | 18 | 102.12 | 22.80 | 1722 | | 9 | 103.08 | 23.30 |
| 1612 | | 15 | 102.43 | 22.60 | 1649 | | 6 | 102.25 | 22.80 | 1686 | | 21 | 102.08 | 22.80 | 1723 | | 12 | 103.16 | 23.50 |
| 1613 | | 18 | 102.44 | 22.60 | 1650 | | 9 | 102.24 | 22.90 | 1687 | | 24 | 102.02 | 22.70 | 1724 | | 15 | 103.19 | 23.60 |
| 1614 | | 21 | 102.47 | 22.70 | 1651 | | 12 | 102.22 | 23.00 | 1688 | 27.09.06 | 3 | 101.96 | 22.70 | 1725 | | 18 | 103.22 | 23.70 |
| 1615 | | 24 | 102.47 | 22.90 | 1652 | | 15 | 102.21 | 23.20 | 1689 | | 6 | 101.90 | 22.70 | 1726 | | 21 | 103.14 | 23.80 |
| 1616 | 18.09.06 | 3 | 102.47 | 23.00 | 1653 | | 18 | 102.20 | 23.30 | 1690 | | 9 | 101.81 | 22.70 | 1727 | | 24 | 102.99 | 23.90 |
| 1617 | | 6 | 102.47 | 23.10 | 1654 | | 21 | 102.19 | 23.30 | 1691 | | 12 | 101.72 | 22.60 | 1728 | 02.10.06 | 3 | 102.62 | 23.90 |
| 1618 | | 9 | 102.47 | 23.30 | 1655 | | 24 | 102.18 | 23.20 | 1692 | | 15 | 101.65 | 22.60 | 1729 | | 6 | 102.49 | 23.90 |
| 1619 | | 12 | 102.34 | 23.40 | 1656 | 23.09.06 | 3 | 102.17 | 23.20 | 1693 | | 18 | 101.60 | 22.60 | 1730 | | 9 | 102.40 | 23.90 |
| 1620 | | 15 | 102.32 | 23.50 | 1657 | | 6 | 102.16 | 23.20 | 1694 | | 21 | 101.57 | 22.60 | 1731 | | 12 | 102.31 | 23.90 |
| 1621 | | 18 | 102.28 | 23.60 | 1658 | | 9 | 102.18 | 23.20 | 1695 | | 24 | 101.54 | 22.80 | 1732 | | 15 | 102.24 | 23.90 |
| 1622 | | 21 | 102.16 | 23.60 | 1659 | | 12 | 102.20 | 23.20 | 1696 | 28.09.06 | 3 | 101.53 | 22.80 | 1733 | | 18 | 102.22 | 23.90 |
| 1623 | | 24 | 102.05 | 23.70 | 1660 | | 15 | 102.20 | 23.40 | 1697 | | 6 | 101.51 | 22.80 | 1734 | | 21 | 102.20 | 23.80 |
| 1624 | 19.09.06 | 3 | 101.98 | 23.70 | 1661 | | 18 | 102.20 | 23.40 | 1698 | | 9 | 101.48 | 22.80 | 1735 | | 24 | 102.06 | 23.80 |
| 1625 | | 6 | 101.92 | 23.70 | 1662 | | 21 | 102.20 | 23.30 | 1699 | | 12 | 101.45 | 22.80 | 1736 | 03.10.06 | 3 | 102.00 | 23.70 |
| 1626 | | 9 | 101.86 | 23.70 | 1663 | | 24 | 102.17 | 23.30 | 1700 | | 15 | 101.44 | 22.80 | 1737 | | 6 | 101.97 | 23.70 |
| 1627 | | 12 | 101.83 | 23.70 | 1664 | 24.09.06 | 3 | 102.14 | 23.20 | 1701 | | 18 | 101.45 | 22.70 | 1738 | | 9 | 101.96 | 23.70 |
| 1628 | | 15 | 101.81 | 23.70 | 1665 | | 6 | 102.13 | 23.20 | 1702 | | 21 | 101.48 | 22.70 | 1739 | | 12 | 101.94 | 23.70 |
| 1629 | | 18 | 101.77 | 23.70 | 1666 | | 9 | 102.12 | 23.20 | 1703 | | 24 | 101.51 | 22.60 | 1740 | | 15 | 101.92 | 23.60 |
| 1630 | | 21 | 101.79 | 23.60 | 1667 | | 12 | 102.11 | 23.10 | 1704 | 29.09.06 | 3 | 101.54 | 22.50 | 1741 | | 18 | 101.91 | 23.60 |
| 1631 | | 24 | 101.81 | 23.50 | 1668 | | 15 | 102.10 | 23.10 | 1705 | | 6 | 101.55 | 22.50 | 1742 | | 21 | 101.90 | 23.50 |
| 1632 | 20.09.06 | 3 | 101.81 | 23.40 | 1669 | | 18 | 102.09 | 23.10 | 1706 | | 9 | 101.57 | 22.50 | 1743 | | 24 | 101.88 | 23.50 |
| 1633 | | 6 | 101.81 | 23.30 | 1670 | | 21 | 102.06 | 23.10 | 1707 | | 12 | 101.58 | 22.50 | 1744 | 04.10.06 | 3 | 101.87 | 23.30 |
| 1634 | | 9 | 101.78 | 23.20 | 1671 | | 24 | 101.89 | 23.10 | 1708 | | 15 | 101.59 | 22.50 | 1745 | | 6 | 101.84 | 22.90 |
| 1635 | | 12 | 101.75 | 23.10 | 1672 | 25.09.06 | 3 | 101.83 | 23.10 | 1709 | | 18 | 101.61 | 22.50 | 1746 | | 9 | 101.82 | 22.80 |
| 1636 | | 15 | 101.74 | 23.00 | 1673 | | 6 | 101.82 | 23.00 | 1710 | | 21 | 101.64 | 22.50 | 1747 | | 12 | 101.81 | 22.80 |
| 1637 | | 18 | 101.76 | 23.00 | 1674 | | 9 | 101.80 | 23.00 | 1711 | | 24 | 101.67 | 22.50 | 1748 | | 15 | 101.80 | 22.80 |
| 1638 | | 21 | 101.86 | 22.90 | 1675 | | 12 | 101.78 | 23.00 | 1712 | 30.09.06 | 3 | 101.70 | 22.50 | 1749 | | 18 | 101.79 | 22.80 |
| 1639 | | 24 | 101.98 | 22.90 | 1676 | | 15 | 101.76 | 23.00 | 1713 | | 6 | 101.71 | 22.50 | 1750 | | 21 | 101.78 | 22.60 |
| 1640 | 21.09.06 | 3 | 102.04 | 22.70 | 1677 | | 18 | 101.76 | 23.00 | 1714 | | 9 | 102.02 | 22.50 | 1751 | | 24 | 101.78 | 22.60 |
| 1641 | | 6 | 102.04 | 22.60 | 1678 | | 21 | 101.76 | 22.90 | 1715 | | 12 | 102.29 | 22.50 | 1752 | 05.10.06 | 3 | 101.77 | 22.60 |
| 1642 | | 9 | 101.99 | 22.60 | 1679 | | 24 | 101.76 | 22.90 | 1716 | | 15 | 102.62 | 22.60 | 1753 | | 6 | 101.76 | 22.50 |
| 1643 | | 12 | 101.94 | 22.60 | 1680 | 26.09.06 | 3 | 101.76 | 22.80 | 1717 | | 18 | 102.67 | 22.60 | 1754 | | 9 | 101.73 | 22.50 |
| 1644 | | 15 | 101.94 | 22.60 | 1681 | | 6 | 101.84 | 22.80 | 1718 | | 21 | 102.70 | 22.60 | 1755 | | 12 | 101.70 | 22.50 |
| 1645 | | 18 | 101.95 | 22.60 | 1682 | | 9 | 101.95 | 22.80 | 1719 | | 24 | 102.80 | 22.80 | 1756 | | 15 | 101.67 | 22.50 |

| Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1757 | | 18 | 101.64 | 22.50 | 1794 | | 9 | 101.25 | 21.90 | 1831 | | 24 | 100.94 | 21.40 | 1868 | | 15 | 100.86 | 21.30 |
| 1758 | | 21 | 101.61 | 22.50 | 1795 | | 12 | 101.24 | 21.90 | 1832 | 15.10.06 | 3 | 100.94 | 21.30 | 1869 | | 18 | 100.86 | 21.30 |
| 1759 | | 24 | 101.58 | 22.50 | 1796 | | 15 | 101.24 | 21.90 | 1833 | | 6 | 100.94 | 21.30 | 1870 | | 21 | 100.86 | 21.30 |
| 1760 | 06.10.06 | 3 | 101.55 | 22.50 | 1797 | | 18 | 101.21 | 21.90 | 1834 | | 9 | 100.94 | 21.30 | 1871 | | 24 | 100.86 | 21.30 |
| 1761 | | 6 | 101.52 | 22.50 | 1798 | | 21 | 101.20 | 21.90 | 1835 | | 12 | 100.94 | 21.30 | 1872 | 20.10.06 | 3 | 100.86 | 21.30 |
| 1762 | | 9 | 101.49 | 22.70 | 1799 | | 24 | 101.18 | 21.90 | 1836 | | 15 | 100.94 | 21.30 | 1873 | | 6 | 100.86 | 21.30 |
| 1763 | | 12 | 101.47 | 22.70 | 1800 | 11.10.06 | 3 | 101.17 | 21.90 | 1837 | | 18 | 100.94 | 21.30 | 1874 | | 9 | 100.86 | 21.30 |
| 1764 | | 15 | 101.46 | 22.70 | 1801 | | 6 | 101.14 | 21.90 | 1838 | | 21 | 100.94 | 21.30 | 1875 | | 12 | 100.86 | 21.30 |
| 1765 | | 18 | 101.45 | 22.70 | 1802 | | 9 | 101.11 | 21.80 | 1839 | | 24 | 100.94 | 21.30 | 1876 | | 15 | 100.86 | 21.30 |
| 1766 | | 21 | 101.44 | 22.70 | 1803 | | 12 | 101.08 | 21.80 | 1840 | 16.10.06 | 3 | 100.90 | 21.30 | 1877 | | 18 | 100.86 | 21.30 |
| 1767 | | 24 | 101.43 | 22.60 | 1804 | | 15 | 101.06 | 21.80 | 1841 | | 6 | 100.90 | 21.30 | 1878 | | 21 | 100.86 | 21.30 |
| 1768 | 07.10.06 | 3 | 101.42 | 22.60 | 1805 | | 18 | 101.04 | 21.80 | 1842 | | 9 | 100.90 | 21.30 | 1879 | | 24 | 100.86 | 21.30 |
| 1769 | | 6 | 101.39 | 22.60 | 1806 | | 21 | 101.03 | 21.80 | 1843 | | 12 | 100.90 | 21.30 | 1880 | 21.10.06 | 3 | 100.86 | 21.30 |
| 1770 | | 9 | 101.36 | 22.60 | 1807 | | 24 | 101.02 | 21.80 | 1844 | | 15 | 100.90 | 21.30 | 1881 | | 6 | 100.86 | 21.30 |
| 1771 | | 12 | 101.35 | 22.60 | 1808 | 12.10.06 | 3 | 101.02 | 21.80 | 1845 | | 18 | 100.90 | 21.30 | 1882 | | 9 | 100.86 | 21.30 |
| 1772 | | 15 | 101.32 | 22.60 | 1809 | | 6 | 101.01 | 21.80 | 1846 | | 21 | 100.90 | 21.30 | 1883 | | 12 | 100.86 | 21.30 |
| 1773 | | 18 | 101.30 | 22.50 | 1810 | | 9 | 101.10 | 21.80 | 1847 | | 24 | 100.90 | 21.30 | 1884 | | 15 | 100.86 | 21.30 |
| 1774 | | 21 | 101.30 | 22.50 | 1811 | | 12 | 101.10 | 21.80 | 1848 | 17.10.06 | 3 | 100.90 | 21.30 | 1885 | | 18 | 100.86 | 21.30 |
| 1775 | | 24 | 101.29 | 22.40 | 1812 | | 15 | 100.99 | 21.80 | 1849 | | 6 | 100.90 | 21.30 | 1886 | | 21 | 100.83 | 21.30 |
| 1776 | 08.10.06 | 3 | 101.29 | 22.40 | 1813 | | 18 | 100.90 | 21.80 | 1850 | | 9 | 100.90 | 21.30 | 1887 | | 24 | 100.83 | 21.30 |
| 1777 | | 6 | 101.29 | 22.30 | 1814 | | 21 | 100.90 | 21.80 | 1851 | | 12 | 100.90 | 21.30 | 1888 | 22.10.06 | 3 | 100.83 | 21.30 |
| 1778 | | 9 | 101.28 | 22.20 | 1815 | | 24 | 100.90 | 21.80 | 1852 | | 15 | 100.90 | 21.30 | 1889 | | 6 | 100.83 | 21.30 |
| 1779 | | 12 | 101.27 | 22.20 | 1816 | 13.10.06 | 3 | 100.90 | 21.70 | 1853 | | 18 | 100.90 | 21.30 | 1890 | | 9 | 100.83 | 21.30 |
| 1780 | | 15 | 101.28 | 22.20 | 1817 | | 6 | 100.99 | 21.70 | 1854 | | 21 | 100.90 | 21.30 | 1891 | | 12 | 100.83 | 21.30 |
| 1781 | | 18 | 101.25 | 22.10 | 1818 | | 9 | 100.98 | 21.70 | 1855 | | 24 | 100.90 | 21.30 | 1892 | | 15 | 100.83 | 21.30 |
| 1782 | | 21 | 101.25 | 22.10 | 1819 | | 12 | 100.97 | 21.70 | 1856 | 18.10.06 | 3 | 100.90 | 21.30 | 1893 | | 18 | 100.83 | 21.30 |
| 1783 | | 24 | 101.21 | 22.10 | 1820 | | 15 | 100.97 | 21.70 | 1857 | | 6 | 100.86 | 21.30 | 1894 | | 21 | 100.83 | 21.30 |
| 1784 | 09.10.06 | 3 | 101.23 | 22.10 | 1821 | | 18 | 100.94 | 21.60 | 1858 | | 9 | 100.86 | 21.30 | 1895 | | 24 | 100.83 | 21.30 |
| 1785 | | 6 | 101.22 | 22.10 | 1822 | | 21 | 100.96 | 21.60 | 1859 | | 12 | 100.86 | 21.30 | 1896 | 23.10.06 | 3 | 100.83 | 21.30 |
| 1786 | | 9 | 101.21 | 22.10 | 1823 | | 24 | 100.96 | 21.60 | 1860 | | 15 | 100.86 | 21.30 | 1897 | | 6 | 100.83 | 21.30 |
| 1787 | | 12 | 101.20 | 22.00 | 1824 | 14.10.06 | 3 | 100.96 | 21.50 | 1861 | | 18 | 100.86 | 21.30 | 1898 | | 9 | 100.83 | 21.30 |
| 1788 | | 15 | 101.19 | 22.00 | 1825 | | 6 | 100.95 | 21.50 | 1862 | | 21 | 100.86 | 21.30 | 1899 | | 12 | 100.83 | 21.30 |
| 1789 | | 18 | 101.18 | 22.00 | 1826 | | 9 | 100.95 | 21.50 | 1863 | | 24 | 100.86 | 21.30 | 1900 | | 15 | 100.83 | 21.30 |
| 1790 | | 21 | 101.19 | 22.00 | 1827 | | 12 | 100.95 | 21.40 | 1864 | 19.10.06 | 3 | 100.86 | 21.30 | 1901 | | 18 | 100.83 | 21.30 |
| 1791 | | 24 | 101.21 | 22.00 | 1828 | | 15 | 100.95 | 21.40 | 1865 | | 6 | 100.86 | 21.30 | 1902 | | 21 | 100.83 | 21.30 |
| 1792 | 10.10.06 | 3 | 101.24 | 22.00 | 1829 | | 18 | 100.95 | 21.40 | 1866 | | 9 | 100.86 | 21.30 | 1903 | | 24 | 100.83 | 21.30 |
| 1793 | | 6 | 101.25 | 21.90 | 1830 | | 21 | 100.95 | 21.40 | 1867 | | 12 | 100.86 | 21.30 | 1904 | 24.10.06 | 3 | 100.83 | 21.30 |

| Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1905 | | 6 | 100.80 | 21.30 | 1942 | | 21 | 100.74 | 21.30 | 1979 | | 18 | 102.15 | 24.10 | 2016 | | 9 | 103.37 | 24.70 |
| 1906 | | 9 | 100.80 | 21.30 | 1943 | | 24 | 100.74 | 21.30 | 1980 | | 21 | 102.09 | 24.00 | 2017 | | 12 | 103.35 | 24.80 |
| 1907 | | 12 | 100.80 | 21.30 | 1944 | 29.10.06 | 3 | 100.74 | 21.30 | 1981 | | 24 | 102.06 | 23.70 | 2018 | | 15 | 103.52 | 24.80 |
| 1908 | | 15 | 100.80 | 21.30 | 1945 | | 6 | 100.74 | 21.30 | 1982 | 03.07.07 | 3 | 102.00 | 23.50 | 2019 | | 18 | 103.70 | 24.80 |
| 1909 | | 18 | 100.80 | 21.30 | 1946 | | 9 | 100.74 | 21.30 | 1983 | | 6 | 101.92 | 23.40 | 2020 | | 21 | 103.88 | 24.80 |
| 1910 | | 21 | 100.80 | 21.30 | 1947 | | 12 | 100.74 | 21.30 | 1984 | | 9 | 101.83 | 23.30 | 2021 | | 24 | 104.04 | 24.90 |
| 1911 | | 24 | 100.80 | 21.30 | 1948 | | 15 | 100.74 | 21.30 | 1985 | | 12 | 101.74 | 23.20 | 2022 | 08.07.07 | 3 | 104.16 | 24.90 |
| 1912 | 25.10.06 | 3 | 100.80 | 21.30 | 1949 | | 18 | 100.74 | 21.30 | 1986 | | 15 | 101.76 | 23.00 | 2023 | | 6 | 104.28 | 24.40 |
| 1913 | | 6 | 100.80 | 21.30 | 1950 | | 21 | 100.74 | 21.30 | 1987 | | 18 | 101.73 | 23.00 | 2024 | | 9 | 104.35 | 24.40 |
| 1914 | | 9 | 100.80 | 21.30 | 1951 | | 24 | 100.74 | 21.30 | 1988 | | 21 | 101.67 | 22.90 | 2025 | | 12 | 104.35 | 24.40 |
| 1915 | | 12 | 100.80 | 21.30 | 1952 | 30.10.06 | 3 | 100.74 | 21.30 | 1989 | | 24 | 101.61 | 22.90 | 2026 | | 15 | 104.35 | 24.30 |
| 1916 | | 15 | 100.80 | 21.30 | 1953 | | 6 | 100.74 | 21.30 | 1990 | 04.07.07 | 3 | 101.55 | 22.90 | 2027 | | 18 | 104.35 | 24.30 |
| 1917 | | 18 | 100.80 | 21.30 | 1954 | | 9 | 100.74 | 21.30 | 1991 | | 6 | 101.52 | 22.70 | 2028 | | 21 | 104.34 | 24.40 |
| 1918 | | 21 | 100.77 | 21.30 | 1955 | | 12 | 100.74 | 21.30 | 1992 | | 9 | 101.51 | 22.70 | 2029 | | 24 | 104.22 | 24.60 |
| 1919 | | 24 | 100.77 | 21.30 | 1956 | | 15 | 100.74 | 21.30 | 1993 | | 12 | 101.45 | 22.70 | 2030 | 09.07.07 | 3 | 104.07 | 24.80 |
| 1920 | 26.10.06 | 3 | 100.77 | 21.30 | 1957 | | 18 | 100.74 | 21.30 | 1994 | | 15 | 101.39 | 22.60 | 2031 | | 6 | 103.92 | 24.80 |
| 1921 | | 6 | 100.77 | 21.30 | 1958 | | 21 | 100.74 | 21.30 | 1995 | | 18 | 101.35 | 22.60 | 2032 | | 9 | 103.77 | 24.80 |
| 1922 | | 9 | 100.77 | 21.30 | 1959 | | 24 | 100.74 | 21.30 | 1996 | | 21 | 101.32 | 22.50 | 2033 | | 12 | 103.70 | 24.80 |
| 1923 | | 12 | 100.77 | 21.30 | 1960 | 31.10.06 | 3 | 100.77 | 21.30 | 1997 | | 24 | 101.30 | 22.50 | 2034 | | 15 | 103.67 | 24.90 |
| 1924 | | 15 | 100.77 | 21.30 | 1961 | | 6 | 100.77 | 21.30 | 1998 | 05.07.07 | 3 | 101.52 | 22.40 | 2035 | | 18 | 103.67 | 24.90 |
| 1925 | | 18 | 100.77 | 21.30 | 1962 | | 9 | 100.77 | 21.30 | 1999 | | 6 | 103.02 | 22.40 | 2036 | | 21 | 103.63 | 24.90 |
| 1926 | | 21 | 100.77 | 21.30 | 1963 | | 12 | 100.77 | 21.30 | 2000 | | 9 | 103.58 | 22.40 | 2037 | | 24 | 103.46 | 24.90 |
| 1927 | | 24 | 100.77 | 21.30 | 1964 | | 15 | 100.77 | 21.30 | 2001 | | 12 | 103.69 | 22.40 | 2038 | 10.07.07 | 3 | 103.18 | 24.80 |
| 1928 | 27.10.06 | 3 | 100.77 | 21.30 | 1965 | | 18 | 100.77 | 21.30 | 2002 | | 15 | 103.75 | 22.30 | 2039 | | 6 | 102.92 | 24.70 |
| 1929 | | 6 | 100.77 | 21.30 | 1966 | 01.07.07 | 3 | 104.00 | 23.60 | 2003 | | 18 | 103.75 | 22.30 | 2040 | | 9 | 102.82 | 24.60 |
| 1930 | | 9 | 100.77 | 21.30 | 1967 | | 6 | 104.94 | 23.80 | 2004 | | 21 | 103.81 | 22.30 | 2041 | | 12 | 102.79 | 24.70 |
| 1931 | | 12 | 100.74 | 21.30 | 1968 | | 9 | 104.74 | 23.90 | 2005 | | 24 | 104.00 | 22.30 | 2042 | | 15 | 102.78 | 24.50 |
| 1932 | | 15 | 100.74 | 21.30 | 1969 | | 12 | 104.47 | 24.80 | 2006 | 06.07.07 | 3 | 104.13 | 22.20 | 2043 | | 18 | 102.76 | 24.50 |
| 1933 | | 18 | 100.74 | 21.30 | 1970 | | 15 | 104.29 | 25.00 | 2007 | | 6 | 104.22 | 22.20 | 2044 | | 21 | 102.75 | 24.50 |
| 1934 | | 21 | 100.74 | 21.30 | 1971 | | 18 | 103.09 | 24.80 | 2008 | | 9 | 104.24 | 22.20 | 2045 | | 24 | 102.74 | 24.50 |
| 1935 | | 24 | 100.74 | 21.30 | 1972 | | 21 | 102.88 | 24.90 | 2009 | | 12 | 104.24 | 22.10 | 2046 | 11.07.07 | 3 | 102.72 | 24.50 |
| 1936 | 28.10.06 | 3 | 100.74 | 21.30 | 1973 | | 24 | 102.74 | 25.00 | 2010 | | 15 | 104.24 | 22.60 | 2047 | | 6 | 102.71 | 24.20 |
| 1937 | | 6 | 100.74 | 21.30 | 1974 | 02.07.07 | 3 | 102.62 | 25.05 | 2011 | | 18 | 104.16 | 23.20 | 2048 | | 9 | 102.71 | 24.10 |
| 1938 | | 9 | 100.74 | 21.30 | 1975 | | 6 | 102.50 | 25.10 | 2012 | | 21 | 104.05 | 23.70 | 2049 | | 12 | 102.71 | 24.00 |
| 1939 | | 12 | 100.74 | 21.30 | 1976 | | 9 | 102.38 | 25.05 | 2013 | | 24 | 103.82 | 24.00 | 2050 | | 15 | 102.70 | 23.80 |
| 1940 | | 15 | 100.74 | 21.30 | 1977 | | 12 | 102.27 | 24.60 | 2014 | 07.07.07 | 3 | 103.61 | 24.00 | 2051 | | 18 | 102.70 | 23.80 |
| 1941 | | 18 | 100.74 | 21.30 | 1978 | | 15 | 102.21 | 24.50 | 2015 | | 6 | 103.49 | 24.40 | 2052 | | 21 | 102.69 | 23.70 |

| Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2053 | | 24 | 102.61 | 23.70 | 2090 | | 15 | 103.30 | 22.90 | 2127 | | 6 | 102.62 | 24.30 | 2164 | | 21 | 101.68 | 22.50 |
| 2054 | 12.07.07 | 3 | 102.33 | 23.60 | 2091 | | 18 | 103.38 | 23.10 | 2128 | | 9 | 102.47 | 24.30 | 2165 | | 24 | 101.68 | 22.50 |
| 2055 | | 6 | 102.16 | 23.60 | 2092 | | 21 | 104.44 | 23.30 | 2129 | | 12 | 102.32 | 24.30 | 2166 | 26.07.07 | 3 | 101.70 | 22.50 |
| 2056 | | 9 | 102.00 | 23.60 | 2093 | | 24 | 104.48 | 23.50 | 2130 | | 15 | 102.18 | 24.30 | 2167 | | 6 | 101.73 | 22.40 |
| 2057 | | 12 | 101.89 | 23.55 | 2094 | 17.07.07 | 3 | 104.38 | 23.60 | 2131 | | 18 | 102.11 | 24.20 | 2168 | | 9 | 101.76 | 22.40 |
| 2058 | | 15 | 101.82 | 23.60 | 2095 | | 6 | 104.23 | 23.70 | 2132 | | 21 | 102.08 | 24.20 | 2169 | | 12 | 101.76 | 22.40 |
| 2059 | | 18 | 101.76 | 23.60 | 2096 | | 9 | 104.08 | 23.90 | 2133 | | 24 | 102.08 | 24.20 | 2170 | | 15 | 101.76 | 22.40 |
| 2060 | | 21 | 101.73 | 23.60 | 2097 | | 12 | 103.90 | 24.20 | 2134 | 22.07.07 | 3 | 102.08 | 24.20 | 2171 | | 18 | 101.76 | 22.40 |
| 2061 | | 24 | 101.73 | 23.60 | 2098 | | 15 | 103.83 | 24.60 | 2135 | | 6 | 102.08 | 24.00 | 2172 | | 21 | 101.76 | 22.40 |
| 2062 | 13.07.07 | 3 | 101.73 | 23.60 | 2099 | | 18 | 103.79 | 24.80 | 2136 | | 9 | 102.11 | 23.80 | 2173 | | 24 | 101.77 | 22.40 |
| 2063 | | 6 | 101.72 | 23.60 | 2100 | | 21 | 103.76 | 24.90 | 2137 | | 12 | 102.13 | 23.60 | 2174 | 27.07.07 | 3 | 101.76 | 22.40 |
| 2064 | | 9 | 101.72 | 23.50 | 2101 | | 24 | 103.71 | 25.20 | 2138 | | 15 | 102.13 | 23.50 | 2175 | | 6 | 101.76 | 22.30 |
| 2065 | | 12 | 101.76 | 23.40 | 2102 | 18.07.07 | 3 | 103.65 | 24.90 | 2139 | | 18 | 102.13 | 23.50 | 2176 | | 9 | 101.76 | 22.30 |
| 2066 | | 15 | 101.82 | 23.30 | 2103 | | 6 | 103.59 | 25.00 | 2140 | | 21 | 102.12 | 23.40 | 2177 | | 12 | 101.77 | 22.30 |
| 2067 | | 18 | 101.85 | 23.30 | 2104 | | 9 | 103.53 | 24.80 | 2141 | | 24 | 102.09 | 23.30 | 2178 | | 15 | 101.78 | 22.20 |
| 2068 | | 21 | 101.88 | 23.10 | 2105 | | 12 | 103.50 | 24.70 | 2142 | 23.07.07 | 3 | 102.09 | 23.20 | 2179 | | 18 | 101.84 | 22.20 |
| 2069 | | 24 | 101.90 | 23.00 | 2106 | | 15 | 103.50 | 24.60 | 2143 | | 6 | 102.09 | 23.00 | 2180 | | 21 | 101.88 | 22.20 |
| 2070 | 14.07.07 | 3 | 101.93 | 22.90 | 2107 | | 18 | 103.50 | 24.50 | 2144 | | 9 | 102.07 | 23.00 | 2181 | | 24 | 101.91 | 22.20 |
| 2071 | | 6 | 101.93 | 22.70 | 2108 | | 21 | 103.50 | 24.40 | 2145 | | 12 | 102.03 | 23.00 | 2182 | 28.07.07 | 3 | 101.76 | 22.20 |
| 2072 | | 9 | 101.93 | 22.60 | 2109 | | 24 | 103.50 | 24.30 | 2146 | | 15 | 101.97 | 22.90 | 2183 | | 6 | 101.76 | 22.30 |
| 2073 | | 12 | 101.91 | 22.60 | 2110 | 19.07.07 | 3 | 103.49 | 24.30 | 2147 | | 18 | 101.93 | 22.90 | 2184 | | 9 | 101.76 | 22.30 |
| 2074 | | 15 | 101.91 | 22.50 | 2111 | | 6 | 103.49 | 24.20 | 2148 | | 21 | 101.89 | 22.90 | 2185 | | 12 | 101.77 | 22.30 |
| 2075 | | 18 | 101.90 | 22.50 | 2112 | | 9 | 103.49 | 24.20 | 2149 | | 24 | 101.89 | 22.90 | 2186 | | 15 | 101.78 | 22.30 |
| 2076 | | 21 | 101.94 | 22.30 | 2113 | | 12 | 103.49 | 24.30 | 2150 | 24.07.07 | 3 | 101.89 | 22.90 | 2187 | | 18 | 101.84 | 22.30 |
| 2077 | | 24 | 102.18 | 22.30 | 2114 | | 15 | 103.49 | 24.30 | 2151 | | 6 | 101.89 | 22.80 | 2188 | | 21 | 101.88 | 22.30 |
| 2078 | 15.07.07 | 3 | 102.54 | 22.40 | 2115 | | 18 | 103.49 | 24.30 | 2152 | | 9 | 101.88 | 22.80 | 2189 | | 24 | 101.91 | 22.30 |
| 2079 | | 6 | 102.77 | 22.40 | 2116 | | 21 | 103.48 | 24.30 | 2153 | | 12 | 101.86 | 22.80 | 2190 | 29.07.07 | 3 | 101.97 | 22.30 |
| 2080 | | 9 | 102.85 | 22.50 | 2117 | | 24 | 103.45 | 24.30 | 2154 | | 15 | 101.86 | 22.70 | 2191 | | 6 | 101.95 | 22.30 |
| 2081 | | 12 | 102.86 | 22.50 | 2118 | 20.07.07 | 3 | 103.45 | 24.30 | 2155 | | 18 | 101.76 | 22.70 | 2192 | | 9 | 101.94 | 22.30 |
| 2082 | | 15 | 102.86 | 22.50 | 2119 | | 6 | 103.45 | 24.30 | 2156 | | 21 | 101.70 | 22.60 | 2193 | | 12 | 101.92 | 22.30 |
| 2083 | | 18 | 102.86 | 22.50 | 2120 | | 9 | 103.44 | 24.30 | 2157 | | 24 | 101.70 | 22.60 | 2194 | | 15 | 101.95 | 22.30 |
| 2084 | | 21 | 102.86 | 22.60 | 2121 | | 12 | 103.43 | 24.30 | 2158 | 25.07.07 | 3 | 101.69 | 22.60 | 2195 | | 18 | 101.98 | 22.30 |
| 2085 | | 24 | 102.86 | 22.60 | 2122 | | 15 | 103.43 | 24.30 | 2159 | | 6 | 101.68 | 22.60 | 2196 | | 21 | 102.00 | 22.30 |
| 2086 | 16.07.07 | 3 | 102.96 | 22.60 | 2123 | | 18 | 103.42 | 24.30 | 2160 | | 9 | 101.68 | 22.60 | 2197 | | 24 | 101.99 | 22.30 |
| 2087 | | 6 | 103.24 | 22.60 | 2124 | | 21 | 103.38 | 24.30 | 2161 | | 12 | 101.68 | 22.60 | 2198 | 30.07.07 | 3 | 101.97 | 22.30 |
| 2088 | | 9 | 103.81 | 22.60 | 2125 | | 24 | 103.11 | 24.30 | 2162 | | 15 | 101.68 | 22.50 | 2199 | | 6 | 101.96 | 22.30 |
| 2089 | | 12 | 103.14 | 22.70 | 2126 | 21.07.07 | 3 | 102.81 | 24.30 | 2163 | | 18 | 101.60 | 22.50 | 2200 | | 9 | 101.94 | 22.30 |

| Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2201 | | 12 | 101.94 | 22.30 | 2238 | 04.08.07 | 3 | 101.48 | 22.20 | 2275 | | 18 | 104.72 | 25.30 | 2312 | | 9 | 104.34 | 25.40 |
| 2202 | | 15 | 101.94 | 22.30 | 2239 | | 6 | 101.51 | 22.20 | 2276 | | 21 | 104.46 | 25.30 | 2313 | | 12 | 104.27 | 25.30 |
| 2203 | | 18 | 101.95 | 22.40 | 2240 | | 9 | 101.51 | 22.10 | 2277 | | 24 | 104.12 | 25.70 | 2314 | | 15 | 104.18 | 25.20 |
| 2204 | | 21 | 101.99 | 22.40 | 2241 | | 12 | 101.52 | 22.10 | 2278 | 09.08.07 | 3 | 103.79 | 25.80 | 2315 | | 18 | 104.09 | 25.20 |
| 2205 | | 24 | 101.95 | 22.40 | 2242 | | 15 | 101.53 | 22.10 | 2279 | | 6 | 103.49 | 25.90 | 2316 | | 21 | 104.01 | 25.40 |
| 2206 | 31.07.07 | 3 | 101.95 | 22.40 | 2243 | | 18 | 101.54 | 22.00 | 2280 | | 9 | 103.30 | 25.90 | 2317 | | 24 | 103.95 | 25.30 |
| 2207 | | 6 | 101.95 | 22.40 | 2244 | | 21 | 101.61 | 22.00 | 2281 | | 12 | 103.12 | 25.70 | 2318 | 14.08.07 | 3 | 103.89 | 25.20 |
| 2208 | | 9 | 101.95 | 22.40 | 2245 | | 24 | 101.70 | 22.00 | 2282 | | 15 | 102.98 | 25.50 | 2319 | | 6 | 103.83 | 25.20 |
| 2209 | | 12 | 101.97 | 22.40 | 2246 | 05.08.07 | 3 | 101.78 | 22.00 | 2283 | | 18 | 102.92 | 25.40 | 2320 | | 9 | 103.71 | 25.00 |
| 2210 | | 15 | 101.97 | 22.40 | 2247 | | 6 | 101.84 | 22.10 | 2284 | | 21 | 102.72 | 25.20 | 2321 | | 12 | 103.68 | 24.90 |
| 2211 | | 18 | 101.98 | 22.40 | 2248 | | 9 | 101.85 | 22.10 | 2285 | | 24 | 102.60 | 24.80 | 2322 | | 15 | 103.59 | 24.70 |
| 2212 | | 21 | 101.98 | 22.40 | 2249 | | 12 | 101.85 | 22.10 | 2286 | 10.08.07 | 3 | 102.60 | 24.60 | 2323 | | 18 | 103.53 | 24.60 |
| 2213 | | 24 | 101.92 | 22.40 | 2250 | | 15 | 101.85 | 22.20 | 2287 | | 6 | 102.90 | 24.40 | 2324 | | 21 | 103.53 | 24.50 |
| 2214 | 01.08.07 | 3 | 101.86 | 22.40 | 2251 | | 18 | 101.88 | 22.20 | 2288 | | 9 | 103.32 | 24.20 | 2325 | | 24 | 103.62 | 24.40 |
| 2215 | | 6 | 101.81 | 22.40 | 2252 | | 21 | 101.89 | 22.20 | 2289 | | 12 | 103.88 | 24.30 | 2326 | 15.08.07 | 3 | 103.72 | 24.30 |
| 2216 | | 9 | 101.78 | 22.40 | 2253 | | 24 | 101.93 | 22.20 | 2290 | | 15 | 103.88 | 24.20 | 2327 | | 6 | 103.78 | 24.20 |
| 2217 | | 12 | 101.74 | 22.40 | 2254 | 06.08.07 | 3 | 101.97 | 22.20 | 2291 | | 18 | 103.88 | 23.90 | 2328 | | 9 | 103.80 | 24.20 |
| 2218 | | 15 | 101.68 | 22.40 | 2255 | | 6 | 102.00 | 22.20 | 2292 | | 21 | 103.88 | 23.80 | 2329 | | 12 | 103.74 | 24.40 |
| 2219 | | 18 | 101.64 | 22.40 | 2256 | | 9 | 102.03 | 22.20 | 2293 | | 24 | 103.88 | 23.60 | 2330 | | 15 | 103.64 | 24.40 |
| 2220 | | 21 | 101.63 | 22.40 | 2257 | | 12 | 102.14 | 22.20 | 2294 | 11.08.07 | 3 | 103.88 | 23.50 | 2331 | | 18 | 103.60 | 24.30 |
| 2221 | | 24 | 101.63 | 22.40 | 2258 | | 15 | 102.46 | 22.20 | 2295 | | 6 | 103.88 | 23.40 | 2332 | | 21 | 103.55 | 24.20 |
| 2222 | 02.08.07 | 3 | 101.63 | 22.40 | 2259 | | 18 | 103.03 | 22.30 | 2296 | | 9 | 103.80 | 23.30 | 2333 | | 24 | 103.52 | 24.30 |
| 2223 | | 6 | 101.63 | 22.40 | 2260 | | 21 | 103.23 | 22.40 | 2297 | | 12 | 103.76 | 23.50 | 2334 | 16.08.07 | 3 | 103.49 | 24.30 |
| 2224 | | 9 | 101.60 | 22.40 | 2261 | | 24 | 103.35 | 22.50 | 2298 | | 15 | 103.75 | 23.80 | 2335 | | 6 | 103.46 | 24.30 |
| 2225 | | 12 | 101.52 | 22.40 | 2262 | 07.08.07 | 3 | 103.45 | 22.60 | 2299 | | 18 | 103.88 | 24.30 | 2336 | | 9 | 103.43 | 24.30 |
| 2226 | | 15 | 101.43 | 22.40 | 2263 | | 6 | 103.54 | 22.70 | 2300 | | 21 | 104.07 | 24.40 | 2337 | | 12 | 103.28 | 24.40 |
| 2227 | | 18 | 101.39 | 22.40 | 2264 | | 9 | 103.80 | 22.80 | 2301 | | 24 | 104.28 | 24.40 | 2338 | | 15 | 103.18 | 24.50 |
| 2228 | | 21 | 101.34 | 22.40 | 2265 | | 12 | 103.04 | 22.90 | 2302 | 12.08.07 | 3 | 104.49 | 24.50 | 2339 | | 18 | 102.96 | 24.50 |
| 2229 | | 24 | 101.62 | 22.40 | 2266 | | 15 | 103.23 | 23.20 | 2303 | | 6 | 104.67 | 24.50 | 2340 | | 21 | 102.69 | 24.50 |
| 2230 | 03.08.07 | 3 | 101.32 | 22.40 | 2267 | | 18 | 104.40 | 23.40 | 2304 | | 9 | 104.78 | 24.50 | 2341 | | 24 | 102.49 | 24.40 |
| 2231 | | 6 | 101.32 | 22.30 | 2268 | | 21 | 104.55 | 23.60 | 2305 | | 12 | 104.87 | 24.80 | 2342 | 17.08.07 | 3 | 102.46 | 24.30 |
| 2232 | | 9 | 101.32 | 22.30 | 2269 | | 24 | 104.70 | 23.70 | 2306 | | 15 | 104.96 | 25.10 | 2343 | | 6 | 102.46 | 24.20 |
| 2233 | | 12 | 101.34 | 22.20 | 2270 | 08.08.07 | 3 | 104.85 | 24.00 | 2307 | | 18 | 105.00 | 25.00 | 2344 | | 9 | 102.44 | 24.20 |
| 2234 | | 15 | 101.38 | 22.20 | 2271 | | 6 | 104.97 | 24.50 | 2308 | | 21 | 105.02 | 25.10 | 2345 | | 12 | 102.42 | 24.20 |
| 2235 | | 18 | 101.89 | 22.20 | 2272 | | 9 | 105.02 | 24.80 | 2309 | | 24 | 104.88 | 24.80 | 2346 | | 15 | 102.41 | 24.10 |
| 2236 | | 21 | 101.42 | 22.20 | 2273 | | 12 | 105.02 | 25.10 | 2310 | 13.08.07 | 3 | 104.67 | 25.30 | 2347 | | 18 | 102.40 | 24.00 |
| 2237 | | 24 | 101.45 | 22.20 | 2274 | | 15 | 104.90 | 25.30 | 2311 | | 6 | 104.49 | 25.20 | 2348 | | 21 | 102.39 | 23.90 |

| Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2349 | | 24 | 102.38 | 23.70 | 2386 | | 15 | 103.40 | 23.70 | 2423 | | 6 | 102.77 | 22.90 | 2460 | | 21 | 102.37 | 23.80 |
| 2350 | 18.08.07 | 3 | 102.37 | 23.50 | 2387 | | 18 | 103.23 | 24.00 | 2424 | | 9 | 102.77 | 22.90 | 2461 | | 24 | 102.49 | 23.80 |
| 2351 | | 6 | 102.36 | 23.40 | 2388 | | 21 | 103.23 | 23.90 | 2425 | | 12 | 102.74 | 23.00 | 2462 | 01.09.07 | 3 | 102.46 | 23.70 |
| 2352 | | 9 | 102.35 | 23.30 | 2389 | | 24 | 103.23 | 24.10 | 2426 | | 15 | 102.66 | 23.00 | 2463 | | 6 | 102.40 | 23.60 |
| 2353 | | 12 | 102.35 | 23.30 | 2390 | 23.08.07 | 3 | 103.23 | 24.30 | 2427 | | 18 | 102.57 | 23.00 | 2464 | | 9 | 102.34 | 23.60 |
| 2354 | | 15 | 102.35 | 23.30 | 2391 | | 6 | 103.23 | 24.60 | 2428 | | 21 | 102.54 | 23.00 | 2465 | | 12 | 102.28 | 23.50 |
| 2355 | | 18 | 102.34 | 23.30 | 2392 | | 9 | 103.23 | 24.60 | 2429 | | 24 | 102.51 | 23.10 | 2466 | | 15 | 102.20 | 23.40 |
| 2356 | | 21 | 102.33 | 23.10 | 2393 | | 12 | 103.22 | 24.60 | 2430 | 28.08.07 | 3 | 102.48 | 23.20 | 2467 | | 18 | 102.16 | 23.30 |
| 2357 | | 24 | 102.33 | 23.10 | 2394 | | 15 | 103.21 | 24.40 | 2431 | | 6 | 102.47 | 23.30 | 2468 | | 21 | 102.11 | 23.20 |
| 2358 | 19.08.07 | 3 | 102.30 | 23.10 | 2395 | | 18 | 103.20 | 24.30 | 2432 | | 9 | 102.49 | 23.30 | 2469 | | 24 | 102.11 | 23.10 |
| 2359 | | 6 | 102.27 | 23.00 | 2396 | | 21 | 103.20 | 24.20 | 2433 | | 12 | 102.54 | 23.30 | 2470 | 02.09.07 | 3 | 102.10 | 23.00 |
| 2360 | | 9 | 102.26 | 23.00 | 2397 | | 24 | 103.29 | 24.00 | 2434 | | 15 | 102.60 | 23.30 | 2471 | | 6 | 102.09 | 22.90 |
| 2361 | | 12 | 102.25 | 23.00 | 2398 | 24.08.07 | 3 | 103.16 | 23.90 | 2435 | | 18 | 102.62 | 23.30 | 2472 | | 9 | 102.11 | 22.80 |
| 2362 | | 15 | 102.24 | 23.00 | 2399 | | 6 | 103.13 | 23.80 | 2436 | | 21 | 102.62 | 23.30 | 2473 | | 12 | 102.20 | 22.80 |
| 2363 | | 18 | 102.23 | 23.00 | 2400 | | 9 | 103.07 | 23.80 | 2437 | | 24 | 102.65 | 23.30 | 2474 | | 15 | 102.35 | 23.00 |
| 2364 | | 21 | 102.23 | 23.00 | 2401 | | 12 | 103.01 | 23.80 | 2438 | 29.08.07 | 3 | 102.73 | 23.30 | 2475 | | 18 | 102.44 | 23.00 |
| 2365 | | 24 | 102.23 | 23.00 | 2402 | | 15 | 102.98 | 23.80 | 2439 | | 6 | 102.84 | 23.30 | 2476 | | 21 | 102.52 | 22.90 |
| 2366 | 20.08.07 | 3 | 102.23 | 23.00 | 2403 | | 18 | 102.97 | 23.70 | 2440 | | 9 | 102.90 | 23.10 | 2477 | | 24 | 102.48 | 22.80 |
| 2367 | | 6 | 102.23 | 22.90 | 2404 | | 21 | 102.95 | 23.70 | 2441 | | 12 | 102.94 | 23.10 | 2478 | 03.09.07 | 3 | 102.45 | 22.80 |
| 2368 | | 9 | 102.25 | 22.90 | 2405 | | 24 | 102.83 | 23.70 | 2442 | | 15 | 102.97 | 23.10 | 2479 | | 6 | 102.42 | 22.70 |
| 2369 | | 12 | 102.26 | 22.90 | 2406 | 25.08.07 | 3 | 102.66 | 23.70 | 2443 | | 18 | 103.00 | 23.00 | 2480 | | 9 | 102.41 | 22.70 |
| 2370 | | 15 | 102.31 | 22.80 | 2407 | | 6 | 102.51 | 23.70 | 2444 | | 21 | 103.04 | 23.00 | 2481 | | 12 | 102.42 | 22.60 |
| 2371 | | 18 | 102.37 | 22.90 | 2408 | | 9 | 102.44 | 23.70 | 2445 | | 24 | 103.10 | 23.00 | 2482 | | 15 | 102.43 | 22.60 |
| 2372 | | 21 | 102.45 | 22.90 | 2409 | | 12 | 102.43 | 23.70 | 2446 | 30.08.07 | 3 | 103.16 | 23.00 | 2483 | | 18 | 102.44 | 22.60 |
| 2373 | | 24 | 102.66 | 22.90 | 2410 | | 15 | 102.43 | 23.70 | 2447 | | 6 | 103.19 | 23.10 | 2484 | | 21 | 102.44 | 22.50 |
| 2374 | 21.08.07 | 3 | 102.85 | 22.90 | 2411 | | 18 | 102.53 | 23.70 | 2448 | | 9 | 103.19 | 23.10 | 2485 | | 24 | 102.44 | 22.60 |
| 2375 | | 6 | 102.96 | 22.80 | 2412 | | 21 | 102.64 | 23.60 | 2449 | | 12 | 103.16 | 23.20 | 2486 | 04.09.07 | 3 | 102.44 | 22.80 |
| 2376 | | 9 | 103.05 | 22.80 | 2413 | | 24 | 102.68 | 23.60 | 2450 | | 15 | 103.11 | 23.30 | 2487 | | 6 | 102.44 | 22.90 |
| 2377 | | 12 | 103.20 | 22.80 | 2414 | 26.08.07 | 3 | 102.68 | 23.50 | 2451 | | 18 | 103.05 | 23.40 | 2488 | | 9 | 102.44 | 23.00 |
| 2378 | | 15 | 103.35 | 22.80 | 2415 | | 6 | 102.68 | 23.50 | 2452 | | 21 | 103.02 | 23.50 | 2489 | | 12 | 102.46 | 23.10 |
| 2379 | | 18 | 103.35 | 22.80 | 2416 | | 9 | 102.74 | 23.40 | 2453 | | 24 | 102.98 | 23.50 | 2490 | | 15 | 102.47 | 23.10 |
| 2380 | | 21 | 103.43 | 22.90 | 2417 | | 12 | 102.79 | 23.30 | 2454 | 31.08.07 | 3 | 102.90 | 23.60 | 2491 | | 18 | 102.50 | 23.00 |
| 2381 | | 24 | 103.73 | 22.90 | 2418 | | 15 | 102.82 | 23.30 | 2455 | | 6 | 102.77 | 23.70 | 2492 | | 21 | 102.53 | 23.10 |
| 2382 | 22.08.07 | 3 | 103.84 | 23.00 | 2419 | | 18 | 102.80 | 23.10 | 2456 | | 9 | 102.60 | 23.70 | 2493 | | 24 | 102.56 | 23.10 |
| 2383 | | 6 | 103.90 | 23.10 | 2420 | | 21 | 102.77 | 23.00 | 2457 | | 12 | 102.42 | 23.80 | 2494 | 05.09.07 | 3 | 102.61 | 23.10 |
| 2384 | | 9 | 103.85 | 23.20 | 2421 | | 24 | 102.77 | 23.00 | 2458 | | 15 | 102.28 | 23.80 | 2495 | | 6 | 102.67 | 23.20 |
| 2385 | | 12 | 103.67 | 23.50 | 2422 | 27.08.07 | 3 | 102.77 | 23.00 | 2459 | | 18 | 102.28 | 23.80 | 2496 | | 9 | 102.75 | 23.20 |

| Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2497 | | 12 | 102.83 | 23.20 | 2534 | 10.09.07 | 3 | 103.49 | 24.50 | 2571 | | 18 | 102.44 | 23.60 | 2608 | | 9 | 102.04 | 23.00 |
| 2498 | | 15 | 102.84 | 23.20 | 2535 | | 6 | 103.43 | 24.50 | 2572 | | 21 | 102.45 | 23.60 | 2609 | | 12 | 102.04 | 22.90 |
| 2499 | | 18 | 102.84 | 23.10 | 2536 | | 9 | 103.36 | 24.60 | 2573 | | 24 | 102.54 | 23.50 | 2610 | | 15 | 102.04 | 22.90 |
| 2500 | | 21 | 102.86 | 23.20 | 2537 | | 12 | 103.36 | 24.60 | 2574 | 15.09.07 | 3 | 102.62 | 23.40 | 2611 | | 18 | 102.03 | 22.90 |
| 2501 | | 24 | 102.92 | 23.20 | 2538 | | 15 | 103.36 | 24.60 | 2575 | | 6 | 102.84 | 23.20 | 2612 | | 21 | 102.01 | 22.80 |
| 2502 | 06.09.07 | 3 | 102.98 | 23.30 | 2539 | | 18 | 103.36 | 24.50 | 2576 | | 9 | 102.90 | 23.20 | 2613 | | 24 | 102.00 | 22.80 |
| 2503 | | 6 | 103.04 | 23.30 | 2540 | | 21 | 103.36 | 24.50 | 2577 | | 12 | 102.96 | 23.10 | 2614 | 20.09.07 | 3 | 101.97 | 22.80 |
| 2504 | | 9 | 103.28 | 23.40 | 2541 | | 24 | 103.36 | 24.50 | 2578 | | 15 | 103.00 | 23.20 | 2615 | | 6 | 101.94 | 22.70 |
| 2505 | | 12 | 103.66 | 23.40 | 2542 | 11.09.07 | 3 | 103.36 | 24.40 | 2579 | | 18 | 103.02 | 23.30 | 2616 | | 9 | 101.94 | 22.70 |
| 2506 | | 15 | 103.82 | 23.50 | 2543 | | 6 | 103.36 | 24.40 | 2580 | | 21 | 103.02 | 23.30 | 2617 | | 12 | 101.94 | 22.70 |
| 2507 | | 18 | 103.91 | 23.50 | 2544 | | 9 | 103.36 | 24.30 | 2581 | | 24 | 103.01 | 23.30 | 2618 | | 15 | 101.92 | 22.70 |
| 2508 | | 21 | 103.98 | 23.60 | 2545 | | 12 | 103.36 | 24.20 | 2582 | 16.09.07 | 3 | 102.98 | 23.30 | 2619 | | 18 | 101.92 | 22.70 |
| 2509 | | 24 | 104.09 | 23.60 | 2546 | | 15 | 103.36 | 24.30 | 2583 | | 6 | 102.95 | 23.30 | 2620 | | 21 | 101.90 | 22.70 |
| 2510 | 07.09.07 | 3 | 104.09 | 23.70 | 2547 | | 18 | 103.33 | 24.30 | 2584 | | 9 | 102.90 | 23.40 | 2621 | | 24 | 101.89 | 22.60 |
| 2511 | | 6 | 104.09 | 23.80 | 2548 | | 21 | 103.30 | 24.30 | 2585 | | 12 | 102.82 | 23.50 | 2622 | 21.09.07 | 3 | 101.87 | 22.60 |
| 2512 | | 9 | 104.06 | 23.60 | 2549 | | 24 | 103.29 | 24.30 | 2586 | | 15 | 102.73 | 23.60 | 2623 | | 6 | 101.86 | 22.60 |
| 2513 | | 12 | 104.03 | 23.70 | 2550 | 12.09.07 | 3 | 103.39 | 24.30 | 2587 | | 18 | 102.64 | 23.70 | 2624 | | 9 | 101.85 | 22.60 |
| 2514 | | 15 | 104.00 | 24.00 | 2551 | | 6 | 103.54 | 24.20 | 2588 | | 21 | 102.58 | 23.80 | 2625 | | 12 | 101.83 | 22.50 |
| 2515 | | 18 | 103.97 | 24.20 | 2552 | | 9 | 103.64 | 24.20 | 2589 | | 24 | 102.57 | 23.80 | 2626 | | 15 | 101.82 | 22.50 |
| 2516 | | 21 | 103.96 | 24.40 | 2553 | | 12 | 103.64 | 24.20 | 2590 | 17.09.07 | 3 | 102.56 | 23.90 | 2627 | | 18 | 101.81 | 22.50 |
| 2517 | | 24 | 103.95 | 24.60 | 2554 | | 15 | 103.64 | 24.20 | 2591 | | 6 | 102.54 | 23.90 | 2628 | | 21 | 101.81 | 22.50 |
| 2518 | 08.09.07 | 3 | 103.94 | 24.80 | 2555 | | 18 | 103.61 | 24.20 | 2592 | | 9 | 102.53 | 23.90 | 2629 | | 24 | 101.82 | 22.50 |
| 2519 | | 6 | 103.93 | 24.90 | 2556 | | 21 | 103.46 | 24.20 | 2593 | | 12 | 102.47 | 23.90 | 2630 | 22.09.07 | 3 | 101.85 | 22.50 |
| 2520 | | 9 | 103.93 | 24.90 | 2557 | | 24 | 103.25 | 24.20 | 2594 | | 15 | 102.41 | 23.80 | 2631 | | 6 | 101.88 | 22.60 |
| 2521 | | 12 | 103.93 | 24.60 | 2558 | 13.09.07 | 3 | 103.05 | 24.20 | 2595 | | 18 | 102.35 | 23.80 | 2632 | | 9 | 101.91 | 22.60 |
| 2522 | | 15 | 103.93 | 24.50 | 2559 | | 6 | 102.88 | 24.10 | 2596 | | 21 | 102.33 | 23.70 | 2633 | | 12 | 101.91 | 22.60 |
| 2523 | | 18 | 103.93 | 24.50 | 2560 | | 9 | 102.76 | 24.10 | 2597 | | 24 | 102.32 | 23.70 | 2634 | | 15 | 101.92 | 22.70 |
| 2524 | | 21 | 103.90 | 24.50 | 2561 | | 12 | 102.64 | 24.20 | 2598 | 18.09.07 | 3 | 102.30 | 23.60 | 2635 | | 18 | 101.98 | 22.70 |
| 2525 | | 24 | 103.84 | 24.50 | 2562 | | 15 | 102.53 | 24.30 | 2599 | | 6 | 102.29 | 23.50 | 2636 | | 21 | 102.01 | 22.80 |
| 2526 | 09.09.07 | 3 | 103.78 | 24.50 | 2563 | | 18 | 102.46 | 24.40 | 2600 | | 9 | 102.29 | 23.40 | 2637 | | 24 | 102.07 | 22.80 |
| 2527 | | 6 | 103.72 | 24.40 | 2564 | | 21 | 102.44 | 24.40 | 2601 | | 12 | 102.27 | 23.40 | 2638 | 23.09.07 | 3 | 102.29 | 22.90 |
| 2528 | | 9 | 103.66 | 24.40 | 2565 | | 24 | 102.43 | 24.40 | 2602 | | 15 | 102.26 | 23.40 | 2639 | | 6 | 102.43 | 23.00 |
| 2529 | | 12 | 103.64 | 24.50 | 2566 | 14.09.07 | 3 | 102.42 | 24.30 | 2603 | | 18 | 102.25 | 23.40 | 2640 | | 9 | 102.56 | 23.20 |
| 2530 | | 15 | 103.64 | 24.50 | 2567 | | 6 | 102.42 | 24.20 | 2604 | | 21 | 102.23 | 23.30 | 2641 | | 12 | 102.83 | 23.40 |
| 2531 | | 18 | 103.62 | 24.50 | 2568 | | 9 | 102.42 | 24.00 | 2605 | | 24 | 102.20 | 23.20 | 2642 | | 15 | 103.35 | 23.60 |
| 2532 | | 21 | 103.59 | 24.50 | 2569 | | 12 | 102.44 | 23.80 | 2606 | 19.09.07 | 3 | 102.16 | 23.10 | 2643 | | 18 | 103.95 | 23.80 |
| 2533 | | 24 | 103.55 | 24.50 | 2570 | | 15 | 102.44 | 23.70 | 2607 | | 6 | 102.10 | 23.00 | 2644 | | 21 | 104.36 | 24.00 |

| Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2645 | | 24 | 104.36 | 24.30 | 2682 | | 15 | 103.73 | 24.80 | 2719 | | 6 | 102.86 | 23.60 | 2756 | | 21 | 102.48 | 23.00 |
| 2646 | 24.09.07 | 3 | 104.36 | 24.60 | 2683 | | 18 | 103.76 | 24.80 | 2720 | | 9 | 102.85 | 23.80 | 2757 | | 24 | 102.42 | 23.00 |
| 2647 | | 6 | 104.36 | 24.90 | 2684 | | 21 | 103.78 | 24.80 | 2721 | | 12 | 102.89 | 23.70 | 2758 | 08.10.07 | 3 | 102.36 | 22.90 |
| 2648 | | 9 | 104.30 | 25.20 | 2685 | | 24 | 103.78 | 24.90 | 2722 | | 15 | 102.89 | 23.70 | 2759 | | 6 | 102.30 | 22.90 |
| 2649 | | 12 | 104.36 | 25.20 | 2686 | 29.09.07 | 3 | 103.73 | 24.80 | 2723 | | 18 | 102.89 | 23.70 | 2760 | | 9 | 102.27 | 22.90 |
| 2650 | | 15 | 104.45 | 25.30 | 2687 | | 6 | 103.67 | 24.80 | 2724 | | 21 | 103.01 | 23.70 | 2761 | | 12 | 102.24 | 22.90 |
| 2651 | | 18 | 104.54 | 25.50 | 2688 | | 9 | 103.61 | 24.60 | 2725 | | 24 | 102.99 | 23.70 | 2762 | | 15 | 102.21 | 22.90 |
| 2652 | | 21 | 104.60 | 25.70 | 2689 | | 12 | 103.58 | 24.50 | 2726 | 04.10.07 | 3 | 102.93 | 23.80 | 2763 | | 18 | 102.20 | 22.90 |
| 2653 | | 24 | 104.41 | 25.80 | 2690 | | 15 | 103.55 | 24.40 | 2727 | | 6 | 102.87 | 23.80 | 2764 | | 21 | 102.18 | 22.90 |
| 2654 | 25.09.07 | 3 | 104.41 | 25.70 | 2691 | | 18 | 103.52 | 24.40 | 2728 | | 9 | 102.81 | 23.80 | 2765 | | 24 | 102.17 | 22.90 |
| 2655 | | 6 | 104.41 | 25.60 | 2692 | | 21 | 103.50 | 24.40 | 2729 | | 12 | 102.75 | 23.80 | 2766 | 09.10.07 | 3 | 102.15 | 23.00 |
| 2656 | | 9 | 104.41 | 25.50 | 2693 | | 24 | 103.49 | 24.40 | 2730 | | 15 | 102.72 | 23.70 | 2767 | | 6 | 102.14 | 23.00 |
| 2657 | | 12 | 104.33 | 25.40 | 2694 | 30.09.07 | 3 | 103.48 | 24.30 | 2731 | | 18 | 102.71 | 23.70 | 2768 | | 9 | 102.12 | 23.00 |
| 2658 | | 15 | 104.24 | 25.30 | 2695 | | 6 | 103.47 | 24.30 | 2732 | | 21 | 102.72 | 23.70 | 2769 | | 12 | 102.06 | 23.00 |
| 2659 | | 18 | 104.18 | 25.30 | 2696 | | 9 | 103.46 | 24.30 | 2733 | | 24 | 102.80 | 23.80 | 2770 | | 15 | 102.01 | 23.00 |
| 2660 | | 21 | 104.06 | 25.20 | 2697 | | 12 | 103.46 | 24.50 | 2734 | 05.10.07 | 3 | 102.89 | 23.80 | 2771 | | 18 | 101.98 | 23.00 |
| 2661 | | 24 | 103.91 | 25.20 | 2698 | | 15 | 103.46 | 24.50 | 2735 | | 6 | 102.96 | 23.80 | 2772 | | 21 | 101.96 | 22.90 |
| 2662 | 26.09.07 | 3 | 103.79 | 25.10 | 2699 | | 18 | 103.46 | 24.40 | 2736 | | 9 | 103.00 | 23.90 | 2773 | | 24 | 101.96 | 22.90 |
| 2663 | | 6 | 103.67 | 25.00 | 2700 | | 21 | 103.34 | 24.40 | 2737 | | 12 | 103.03 | 23.90 | 2774 | 10.10.07 | 3 | 102.00 | 22.80 |
| 2664 | | 9 | 103.63 | 25.00 | 2701 | | 24 | 103.22 | 24.30 | 2738 | | 15 | 102.93 | 23.80 | 2775 | | 6 | 102.03 | 22.70 |
| 2665 | | 12 | 103.60 | 25.00 | 2702 | 01.10.07 | 3 | 103.10 | 24.30 | 2739 | | 18 | 102.78 | 23.70 | 2776 | | 9 | 102.03 | 22.60 |
| 2666 | | 15 | 103.57 | 25.00 | 2703 | | 6 | 102.96 | 24.30 | 2740 | | 21 | 102.67 | 23.60 | 2777 | | 12 | 102.02 | 22.50 |
| 2667 | | 18 | 103.54 | 24.90 | 2704 | | 9 | 102.89 | 24.20 | 2741 | | 24 | 102.58 | 23.50 | 2778 | | 15 | 102.02 | 22.60 |
| 2668 | | 21 | 103.52 | 24.80 | 2705 | | 12 | 102.85 | 24.10 | 2742 | 06.10.07 | 3 | 102.49 | 23.50 | 2779 | | 18 | 101.99 | 22.60 |
| 2669 | | 24 | 103.55 | 24.70 | 2706 | | 15 | 102.82 | 24.10 | 2743 | | 6 | 102.40 | 23.50 | 2780 | | 21 | 101.96 | 22.60 |
| 2670 | 27.09.07 | 3 | 103.64 | 24.60 | 2707 | | 18 | 102.82 | 24.10 | 2744 | | 9 | 102.34 | 23.50 | 2781 | | 24 | 101.93 | 22.60 |
| 2671 | | 6 | 103.73 | 24.40 | 2708 | | 21 | 102.81 | 24.10 | 2745 | | 12 | 102.28 | 23.50 | 2782 | 11.10.07 | 3 | 101.90 | 22.50 |
| 2672 | | 9 | 103.79 | 24.30 | 2709 | | 24 | 102.80 | 24.10 | 2746 | | 15 | 102.22 | 23.60 | 2783 | | 6 | 101.87 | 22.40 |
| 2673 | | 12 | 103.79 | 24.20 | 2710 | 02.10.07 | 3 | 102.79 | 24.10 | 2747 | | 18 | 102.22 | 23.70 | 2784 | | 9 | 101.84 | 22.40 |
| 2674 | | 15 | 103.79 | 24.20 | 2711 | | 6 | 102.78 | 24.00 | 2748 | | 21 | 102.24 | 23.70 | 2785 | | 12 | 101.79 | 22.30 |
| 2675 | | 18 | 103.79 | 24.10 | 2712 | | 9 | 102.80 | 23.90 | 2749 | | 24 | 102.31 | 23.70 | 2786 | | 15 | 101.75 | 22.30 |
| 2676 | | 21 | 103.79 | 24.10 | 2713 | | 12 | 102.81 | 23.80 | 2750 | 07.10.07 | 3 | 102.38 | 23.60 | 2787 | | 18 | 101.70 | 22.30 |
| 2677 | | 24 | 103.79 | 24.00 | 2714 | | 15 | 102.82 | 23.80 | 2751 | | 6 | 102.42 | 23.50 | 2788 | | 21 | 101.70 | 22.30 |
| 2678 | 28.09.07 | 3 | 103.78 | 24.10 | 2715 | | 18 | 102.88 | 23.80 | 2752 | | 9 | 102.50 | 23.40 | 2789 | | 24 | 101.64 | 22.30 |
| 2679 | | 6 | 103.75 | 24.70 | 2716 | | 21 | 102.91 | 23.80 | 2753 | | 12 | 102.52 | 23.30 | 2790 | 12.10.07 | 3 | 101.61 | 22.30 |
| 2680 | | 9 | 103.73 | 24.80 | 2717 | | 24 | 102.91 | 23.70 | 2754 | | 15 | 102.53 | 23.20 | 2791 | | 6 | 101.58 | 22.30 |
| 2681 | | 12 | 103.73 | 24.80 | 2718 | 03.10.07 | 3 | 102.89 | 23.70 | 2755 | | 18 | 102.51 | 23.10 | 2792 | | 9 | 101.57 | 22.30 |

| Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2793 | | 12 | 101.56 | 22.30 | 2830 | 17.10.07 | 3 | 101.13 | 21.60 | 2867 | | 18 | 101.09 | 21.30 | 2904 | | 9 | 100.99 | 21.20 |
| 2794 | | 15 | 101.54 | 22.30 | 2831 | | 6 | 101.13 | 21.60 | 2868 | | 21 | 101.09 | 21.30 | 2905 | | 12 | 100.99 | 21.20 |
| 2795 | | 18 | 101.51 | 22.30 | 2832 | | 9 | 101.13 | 21.50 | 2869 | | 24 | 101.09 | 21.30 | 2906 | | 15 | 100.99 | 21.20 |
| 2796 | | 21 | 101.51 | 22.30 | 2833 | | 12 | 101.13 | 21.50 | 2870 | 22.10.07 | 3 | 101.09 | 21.30 | 2907 | | 18 | 100.99 | 21.20 |
| 2797 | | 24 | 101.48 | 22.30 | 2834 | | 15 | 101.13 | 21.50 | 2871 | | 6 | 101.09 | 21.30 | 2908 | | 21 | 100.99 | 21.20 |
| 2798 | 13.10.07 | 3 | 101.46 | 22.20 | 2835 | | 18 | 101.13 | 21.50 | 2872 | | 9 | 101.09 | 21.30 | 2909 | | 24 | 100.99 | 21.10 |
| 2799 | | 6 | 101.46 | 22.20 | 2836 | | 21 | 101.13 | 21.50 | 2873 | | 12 | 101.09 | 21.30 | 2910 | 27.10.07 | 3 | 100.99 | 21.10 |
| 2800 | | 9 | 101.45 | 22.10 | 2837 | | 24 | 101.13 | 21.50 | 2874 | | 15 | 101.09 | 21.30 | 2911 | | 6 | 100.99 | 21.10 |
| 2801 | | 12 | 101.45 | 22.00 | 2838 | 18.10.07 | 3 | 101.12 | 21.50 | 2875 | | 18 | 101.09 | 21.30 | 2912 | | 9 | 100.99 | 21.10 |
| 2802 | | 15 | 101.44 | 22.00 | 2839 | | 6 | 101.10 | 21.50 | 2876 | | 21 | 101.09 | 21.30 | 2913 | | 12 | 100.99 | 21.10 |
| 2803 | | 18 | 101.44 | 22.00 | 2840 | | 9 | 101.09 | 21.50 | 2877 | | 24 | 101.06 | 21.30 | 2914 | | 15 | 100.99 | 21.10 |
| 2804 | | 21 | 101.42 | 22.00 | 2841 | | 12 | 101.09 | 21.50 | 2878 | 23.10.07 | 3 | 101.06 | 21.30 | 2915 | | 18 | 100.95 | 21.10 |
| 2805 | | 24 | 101.39 | 22.00 | 2842 | | 15 | 101.09 | 21.50 | 2879 | | 6 | 101.06 | 21.30 | 2916 | | 21 | 100.95 | 21.10 |
| 2806 | 14.10.07 | 3 | 101.36 | 22.00 | 2843 | | 18 | 101.09 | 21.50 | 2880 | | 9 | 101.06 | 21.30 | 2917 | | 24 | 100.95 | 21.10 |
| 2807 | | 6 | 101.33 | 21.90 | 2844 | | 21 | 101.09 | 21.50 | 2881 | | 12 | 101.06 | 21.30 | 2918 | 28.10.07 | 3 | 100.95 | 21.10 |
| 2808 | | 9 | 101.30 | 21.90 | 2845 | | 24 | 101.09 | 21.40 | 2882 | | 15 | 101.06 | 21.30 | 2919 | | 6 | 100.95 | 21.10 |
| 2809 | | 12 | 101.27 | 21.90 | 2846 | 19.10.07 | 3 | 101.09 | 21.40 | 2883 | | 18 | 101.06 | 21.30 | 2920 | | 9 | 100.95 | 21.10 |
| 2810 | | 15 | 101.26 | 21.80 | 2847 | | 6 | 101.09 | 21.40 | 2884 | | 21 | 101.06 | 21.30 | 2921 | | 12 | 100.95 | 21.10 |
| 2811 | | 18 | 101.25 | 21.80 | 2848 | | 9 | 101.09 | 21.40 | 2885 | | 24 | 101.06 | 21.30 | 2922 | | 15 | 100.95 | 21.10 |
| 2812 | | 21 | 101.24 | 21.80 | 2849 | | 12 | 101.09 | 21.40 | 2886 | 24.10.07 | 3 | 101.06 | 21.30 | 2923 | | 18 | 100.95 | 21.10 |
| 2813 | | 24 | 101.24 | 21.80 | 2850 | | 15 | 101.13 | 21.40 | 2887 | | 6 | 101.06 | 21.30 | 2924 | | 21 | 100.95 | 21.10 |
| 2814 | 15.10.07 | 3 | 101.24 | 21.80 | 2851 | | 18 | 101.16 | 21.40 | 2888 | | 9 | 101.02 | 21.30 | 2925 | | 24 | 100.95 | 21.10 |
| 2815 | | 6 | 101.24 | 21.80 | 2852 | | 21 | 101.16 | 21.40 | 2889 | | 12 | 101.02 | 21.20 | 2926 | 29.10.07 | 3 | 100.95 | 21.10 |
| 2816 | | 9 | 101.24 | 21.70 | 2853 | | 24 | 101.16 | 21.40 | 2890 | | 15 | 101.02 | 21.20 | 2927 | | 6 | 100.95 | 21.10 |
| 2817 | | 12 | 101.23 | 21.70 | 2854 | 20.10.07 | 3 | 101.16 | 21.40 | 2891 | | 18 | 101.02 | 21.20 | 2928 | | 9 | 100.95 | 21.10 |
| 2818 | | 15 | 101.23 | 21.70 | 2855 | | 6 | 101.16 | 21.30 | 2892 | | 21 | 101.02 | 21.20 | 2929 | | 12 | 100.95 | 21.10 |
| 2819 | | 18 | 101.23 | 21.60 | 2856 | | 9 | 101.16 | 21.30 | 2893 | | 24 | 101.02 | 21.20 | 2930 | | 15 | 100.95 | 21.10 |
| 2820 | | 21 | 101.19 | 21.60 | 2857 | | 12 | 101.16 | 21.30 | 2894 | 25.10.07 | 3 | 101.02 | 21.20 | 2931 | | 18 | 100.92 | 21.10 |
| 2821 | | 24 | 101.20 | 21.60 | 2858 | | 15 | 101.13 | 21.30 | 2895 | | 6 | 101.02 | 21.20 | 2932 | | 21 | 100.92 | 21.10 |
| 2822 | 16.10.07 | 3 | 101.20 | 21.60 | 2859 | | 18 | 101.13 | 21.30 | 2896 | | 9 | 101.02 | 21.20 | 2933 | | 24 | 100.92 | 21.10 |
| 2823 | | 6 | 101.16 | 21.60 | 2860 | | 21 | 101.13 | 21.30 | 2897 | | 12 | 101.02 | 21.20 | 2934 | 30.10.07 | 3 | 100.92 | 21.10 |
| 2824 | | 9 | 101.16 | 21.60 | 2861 | | 24 | 101.13 | 21.30 | 2898 | | 15 | 100.99 | 21.20 | 2935 | | 6 | 100.92 | 21.10 |
| 2825 | | 12 | 101.16 | 21.60 | 2862 | 21.10.07 | 3 | 101.09 | 21.30 | 2899 | | 18 | 100.99 | 21.20 | 2936 | | 9 | 100.92 | 21.10 |
| 2826 | | 15 | 101.16 | 21.60 | 2863 | | 6 | 101.09 | 21.30 | 2900 | | 21 | 100.99 | 21.20 | 2937 | | 12 | 100.95 | 21.10 |
| 2827 | | 18 | 101.16 | 21.60 | 2864 | | 9 | 101.09 | 21.30 | 2901 | | 24 | 100.99 | 21.20 | 2938 | | 15 | 100.95 | 21.10 |
| 2828 | | 21 | 101.15 | 21.60 | 2865 | | 12 | 101.09 | 21.30 | 2902 | 26.10.07 | 3 | 100.99 | 21.20 | 2939 | | 18 | 100.95 | 21.10 |
| 2829 | | 24 | 101.14 | 21.60 | 2866 | | 15 | 101.09 | 21.30 | 2903 | | 6 | 100.99 | 21.20 | 2940 | | 21 | 100.99 | 21.10 |

| Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj □ m) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2941 | | 24 | 100.95 | 21.10 | 2978 | | 18 | 101.02 | 22.00 | 3015 | | 9 | 101.44 | 22.00 | 3052 | | 24 | 101.22 | 22.50 |
| 2942 | 31.10.07 | 3 | 100.95 | 21.10 | 2979 | | 21 | 100.98 | 22.00 | 3016 | | 12 | 101.55 | 22.10 | 3053 | 14.07.08 | 3 | 101.22 | 22.40 |
| 2943 | | 6 | 101.02 | 21.10 | 2980 | | 24 | 100.98 | 22.00 | 3017 | | 15 | 101.66 | 22.10 | 3054 | | 6 | 101.19 | 22.30 |
| 2944 | | 9 | 101.02 | 21.20 | 2981 | 05.07.08 | 3 | 100.98 | 22.00 | 3018 | | 18 | 101.93 | 22.10 | 3055 | | 9 | 101.19 | 22.30 |
| 2945 | | 12 | 101.02 | 21.20 | 2982 | | 6 | 100.98 | 22.00 | 3019 | | 21 | 102.19 | 22.10 | 3056 | | 12 | 101.19 | 22.30 |
| 2946 | | 15 | 101.02 | 21.20 | 2983 | | 9 | 100.95 | 22.00 | 3020 | | 24 | 102.30 | 22.10 | 3057 | | 15 | 101.19 | 22.30 |
| 2947 | | 18 | 101.02 | 21.20 | 2984 | | 12 | 100.95 | 22.00 | 3021 | 10.07.08 | 3 | 102.41 | 22.10 | 3058 | | 18 | 101.19 | 22.30 |
| 2948 | | 21 | 101.02 | 21.20 | 2985 | | 15 | 100.95 | 22.00 | 3022 | | 6 | 102.44 | 22.20 | 3059 | | 21 | 101.19 | 22.30 |
| 2949 | 01.07.08 | 3 | 101.77 | 22.00 | 2986 | | 18 | 100.92 | 22.00 | 3023 | | 9 | 102.44 | 22.20 | 3060 | | 24 | 101.19 | 22.30 |
| 2950 | | 6 | 101.73 | 22.10 | 2987 | | 21 | 100.92 | 22.00 | 3024 | | 12 | 102.38 | 22.20 | 3061 | 15.07.08 | 3 | 101.19 | 22.30 |
| 2951 | | 9 | □01.70 | 22.20 | 2988 | | 24 | 100.92 | 21.90 | 3025 | | 15 | 102.27 | 22.20 | 3062 | | 6 | 101.19 | 22.30 |
| 2952 | | 12 | 101.66 | 22.30 | 2989 | 06.07.08 | 3 | 100.95 | 21.80 | 3026 | | 18 | 102.12 | 22.30 | 3063 | | 9 | 101.19 | 22.30 |
| 2953 | | 15 | 101.62 | 22.40 | 2990 | | 6 | 100.95 | 21.70 | 3027 | | 21 | 102.00 | 22.40 | 3064 | | 12 | 101.19 | 22.30 |
| 2954 | | 18 | 101.59 | 22.40 | 2991 | | 9 | 100.95 | 21.60 | 3028 | | 24 | 101.93 | 22.50 | 3065 | | 15 | 101.19 | 22.30 |
| 2955 | | 21 | 101.52 | 22.40 | 2992 | | 12 | 100.95 | 21.60 | 3029 | 11.07.08 | 3 | 101.88 | 22.60 | 3066 | | 18 | 101.19 | 22.30 |
| 2956 | | 24 | 101.44 | 22.40 | 2993 | | 15 | 100.95 | 21.60 | 3030 | | 6 | 101.83 | 22.60 | 3067 | | 21 | 101.19 | 22.30 |
| 2957 | 02.07.08 | 3 | 101.39 | 22.40 | 2994 | | 18 | 100.95 | 21.60 | 3031 | | 9 | 101.77 | 22.70 | 3068 | | 24 | 101.19 | 22.30 |
| 2958 | | 6 | 101.34 | 22.40 | 2995 | | 21 | 100.95 | 21.60 | 3032 | | 12 | 101.70 | 22.90 | 3069 | 16.07.08 | 3 | 101.19 | 22.30 |
| 2959 | | 9 | 101.32 | 22.40 | 2996 | | 24 | 100.98 | 21.60 | 3033 | | 15 | 101.62 | 23.00 | 3070 | | 6 | 101.19 | 22.30 |
| 2960 | | 12 | 101.27 | 22.40 | 2997 | 07.07.08 | 3 | 101.05 | 21.60 | 3034 | | 18 | 101.59 | 23.00 | 3071 | | 9 | 101.19 | 22.20 |
| 2961 | | 15 | 101.22 | 22.40 | 2998 | | 6 | 101.16 | 21.60 | 3035 | | 21 | 101.55 | 22.90 | 3072 | | 12 | 101.19 | 22.20 |
| 2962 | | 18 | 101.16 | 22.40 | 2999 | | 9 | 101.24 | 21.50 | 3036 | | 24 | 101.52 | 22.90 | 3073 | | 15 | 101.19 | 22.20 |
| 2963 | | 21 | 101.12 | 22.40 | 3000 | | 12 | 101.29 | 21.40 | 3037 | 12.07.08 | 3 | 101.48 | 22.80 | 3074 | | 18 | 101.24 | 22.20 |
| 2964 | | 24 | 101.06 | 22.40 | 3001 | | 15 | 101.32 | 21.50 | 3038 | | 6 | 101.44 | 22.80 | 3075 | | 21 | 101.29 | 22.20 |
| 2965 | 03.07.08 | 3 | 101.16 | 22.30 | 3002 | | 18 | 101.34 | 21.50 | 3039 | | 9 | 101.42 | 22.70 | 3076 | | 24 | 101.37 | 22.20 |
| 2966 | | 6 | 101.22 | 22.30 | 3003 | | 21 | 101.39 | 21.50 | 3040 | | 12 | 101.39 | 22.60 | 3077 | 17.07.08 | 3 | 101.44 | 22.20 |
| 2967 | | 9 | 101.27 | 22.20 | 3004 | | 24 | 101.37 | 21.50 | 3041 | | 15 | 101.37 | 22.60 | 3078 | | 6 | 101.55 | 22.20 |
| 2968 | | 12 | 101.27 | 22.20 | 3005 | 08.07.08 | 3 | 101.34 | 21.50 | 3042 | | 18 | 101.37 | 22.60 | 3079 | | 9 | 101.62 | 22.20 |
| 2969 | | 15 | 101.24 | 22.20 | 3006 | | 6 | 101.32 | 21.50 | 3043 | | 21 | 101.34 | 22.60 | 3080 | | 12 | 101.62 | 22.20 |
| 2970 | | 18 | 101.19 | 22.20 | 3007 | | 9 | 101.29 | 21.50 | 3044 | | 24 | 101.33 | 22.60 | 3081 | | 15 | 101.59 | 22.20 |
| 2971 | | 21 | 101.12 | 22.20 | 3008 | | 12 | 101.27 | 21.60 | 3045 | 13.07.08 | 3 | 101.32 | 22.60 | 3082 | | 18 | 101.55 | 22.20 |
| 2972 | | 24 | 101.09 | 22.10 | 3009 | | 15 | 101.27 | 21.60 | 3046 | | 6 | 101.32 | 22.50 | 3083 | | 21 | 101.55 | 22.20 |
| 2973 | 04.07.08 | 3 | 101.05 | 22.10 | 3010 | | 18 | 101.27 | 21.60 | 3047 | | 9 | 101.29 | 22.50 | 3084 | | 24 | 101.52 | 22.20 |
| 2974 | | 6 | 101.05 | 22.00 | 3011 | | 21 | 101.27 | 21.70 | 3048 | | 12 | 101.29 | 22.50 | 3085 | 18.07.08 | 3 | 101.48 | 22.20 |
| 2975 | | 9 | 101.05 | 22.00 | 3012 | | 24 | 101.29 | 21.80 | 3049 | | 15 | 101.27 | 22.50 | 3086 | | 6 | 101.44 | 22.30 |
| 2976 | | 12 | 101.02 | 22.00 | 3013 | 09.07.08 | 3 | 101.34 | 21.90 | 3050 | | 18 | 101.24 | 22.50 | 3087 | | 9 | 101.42 | 22.30 |
| 2977 | | 15 | 101.02 | 22.00 | 3014 | | 6 | 101.39 | 22.00 | 3051 | | 21 | 101.24 | 22.50 | 3088 | | 12 | 101.39 | 22.30 |

| Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3089 | | 15 | 101.37 | 22.40 | 3126 | | 6 | 101.88 | 22.50 | 3163 | | 21 | 102.44 | 22.90 | 3200 | | 12 | 103.14 | 23.30 |
| 3090 | | 18 | 101.34 | 22.40 | 3127 | | 9 | 101.90 | 22.50 | 3164 | | 24 | 102.27 | 22.90 | 3201 | | 15 | 102.99 | 23.50 |
| 3091 | | 21 | 101.32 | 22.40 | 3128 | | 12 | 101.90 | 22.60 | 3165 | 28.07.08 | 3 | 102.23 | 23.00 | 3202 | | 18 | 102.81 | 23.60 |
| 3092 | | 24 | 101.32 | 22.40 | 3129 | | 15 | 101.90 | 22.60 | 3166 | | 6 | 102.72 | 23.00 | 3203 | | 21 | 102.63 | 23.60 |
| 3093 | 19.07.08 | 3 | 101.32 | 22.40 | 3130 | | 18 | 101.90 | 22.60 | 3167 | | 9 | 102.78 | 23.00 | 3204 | | 24 | 102.57 | 23.70 |
| 3094 | | 6 | 101.32 | 22.50 | 3131 | | 21 | 101.90 | 22.60 | 3168 | | 12 | 102.78 | 23.00 | 3205 | 02.08.08 | 3 | 102.50 | 23.80 |
| 3095 | | 9 | 101.32 | 22.50 | 3132 | | 24 | 101.90 | 22.60 | 3169 | | 15 | 102.72 | 23.00 | 3206 | | 6 | 102.47 | 23.90 |
| 3096 | | 12 | 101.32 | 22.50 | 3133 | 24.07.08 | 3 | 101.90 | 22.60 | 3170 | | 18 | 102.66 | 23.10 | 3207 | | 9 | 102.44 | 24.00 |
| 3097 | | 15 | 101.32 | 22.50 | 3134 | | 6 | 101.90 | 22.60 | 3171 | | 21 | 102.60 | 23.20 | 3208 | | 12 | 102.41 | 24.10 |
| 3098 | | 18 | 101.32 | 22.40 | 3135 | | 9 | 101.90 | 22.60 | 3172 | | 24 | 102.57 | 23.20 | 3209 | | 15 | 102.38 | 24.20 |
| 3099 | | 21 | 101.34 | 22.40 | 3136 | | 12 | 101.88 | 22.60 | 3173 | 29.07.08 | 3 | 102.53 | 23.30 | 3210 | | 18 | 102.38 | 24.00 |
| 3100 | | 24 | 101.37 | 22.40 | 3137 | | 15 | 101.88 | 22.60 | 3174 | | 6 | 102.50 | 23.40 | 3211 | | 21 | 102.34 | 23.90 |
| 3101 | 20.07.08 | 3 | 101.39 | 22.40 | 3138 | | 18 | 101.88 | 22.60 | 3175 | | 9 | 102.47 | 23.50 | 3212 | | 24 | 102.30 | 23.70 |
| 3102 | | 6 | 101.42 | 22.40 | 3139 | | 21 | 101.88 | 22.60 | 3176 | | 12 | 102.47 | 23.60 | 3213 | 03.08.08 | 3 | 102.27 | 23.50 |
| 3103 | | 9 | 101.44 | 22.30 | 3140 | | 24 | 101.93 | 22.60 | 3177 | | 15 | 102.47 | 23.60 | 3214 | | 6 | 102.23 | 23.30 |
| 3104 | | 12 | 101.48 | 22.30 | 3141 | 25.07.08 | 3 | 102.00 | 22.60 | 3178 | | 18 | 102.44 | 23.60 | 3215 | | 9 | 102.23 | 23.30 |
| 3105 | | 15 | 101.52 | 22.20 | 3142 | | 6 | 102.08 | 22.70 | 3179 | | 21 | 102.44 | 23.60 | 3216 | | 12 | 102.19 | 23.20 |
| 3106 | | 18 | 101.55 | 22.20 | 3143 | | 9 | 102.16 | 22.60 | 3180 | | 24 | 102.38 | 23.60 | 3217 | | 15 | 102.19 | 23.40 |
| 3107 | | 21 | 101.59 | 22.20 | 3144 | | 12 | 102.19 | 22.60 | 3181 | 30.07.08 | 3 | 102.30 | 23.60 | 3218 | | 18 | 102.16 | 23.40 |
| 3108 | | 24 | 101.62 | 22.20 | 3145 | | 15 | 102.19 | 22.60 | 3182 | | 6 | 102.27 | 23.60 | 3219 | | 21 | 102.16 | 23.40 |
| 3109 | 21.07.08 | 3 | 101.66 | 22.20 | 3146 | | 18 | 102.19 | 22.60 | 3183 | | 9 | 102.23 | 23.60 | 3220 | | 24 | 102.08 | 23.40 |
| 3110 | | 6 | 101.77 | 22.20 | 3147 | | 21 | 102.19 | 22.60 | 3184 | | 12 | 102.23 | 23.60 | 3221 | 04.08.08 | 3 | 102.02 | 23.40 |
| 3111 | | 9 | 101.85 | 22.20 | 3148 | | 24 | 102.19 | 22.60 | 3185 | | 15 | 102.27 | 23.60 | 3222 | | 6 | 101.97 | 23.40 |
| 3112 | | 12 | 101.93 | 22.20 | 3149 | 26.07.08 | 3 | 102.19 | 22.60 | 3186 | | 18 | 102.27 | 23.60 | 3223 | | 9 | 101.93 | 23.40 |
| 3113 | | 15 | 102.00 | 22.20 | 3150 | | 6 | 102.19 | 22.60 | 3187 | | 21 | 102.34 | 23.60 | 3224 | | 12 | 101.90 | 23.30 |
| 3114 | | 18 | 102.00 | 22.20 | 3151 | | 9 | 102.19 | 22.60 | 3188 | | 24 | 102.38 | 23.60 | 3225 | | 15 | 101.90 | 23.10 |
| 3115 | | 21 | 101.97 | 22.20 | 3152 | | 12 | 102.19 | 22.60 | 3189 | 31.07.08 | 3 | 102.38 | 23.50 | 3226 | | 18 | 101.88 | 23.00 |
| 3116 | | 24 | 101.95 | 22.20 | 3153 | | 15 | 102.19 | 22.60 | 3190 | | 6 | 102.38 | 23.50 | 3227 | | 21 | 101.85 | 23.00 |
| 3117 | 22.07.08 | 3 | 101.93 | 22.20 | 3154 | | 18 | 102.23 | 22.70 | 3191 | | 9 | 102.38 | 23.50 | 3228 | | 24 | 101.85 | 23.00 |
| 3118 | | 6 | 101.90 | 22.20 | 3155 | | 21 | 102.27 | 22.70 | 3192 | | 12 | 102.41 | 23.40 | 3229 | 05.08.08 | 3 | 101.83 | 23.00 |
| 3119 | | 9 | 101.90 | 22.20 | 3156 | | 24 | 102.27 | 22.70 | 3193 | | 15 | 102.44 | 23.40 | 3230 | | 6 | 101.83 | 22.90 |
| 3120 | | 12 | 101.88 | 22.20 | 3157 | 27.07.08 | 3 | 102.23 | 22.80 | 3194 | | 18 | 102.53 | 23.40 | 3231 | | 9 | 101.85 | 22.80 |
| 3121 | | 15 | 101.88 | 22.30 | 3158 | | 6 | 102.19 | 22.80 | 3195 | | 21 | 102.63 | 23.40 | 3232 | | 12 | 101.93 | 22.80 |
| 3122 | | 18 | 101.88 | 22.30 | 3159 | | 9 | 102.19 | 22.80 | 3196 | | 24 | 102.78 | 23.40 | 3233 | | 15 | 102.02 | 22.80 |
| 3123 | | 21 | 101.88 | 22.40 | 3160 | | 12 | 102.23 | 22.80 | 3197 | 01.08.08 | 3 | 102.99 | 23.30 | 3234 | | 18 | 102.27 | 22.80 |
| 3124 | | 24 | 101.88 | 22.40 | 3161 | | 15 | 102.27 | 22.90 | 3198 | | 6 | 103.17 | 23.30 | 3235 | | 21 | 102.50 | 22.80 |
| 3125 | 23.07.08 | 3 | 101.88 | 22.50 | 3162 | | 18 | 102.34 | 22.90 | 3199 | | 9 | 103.24 | 23.30 | 3236 | | 24 | 102.50 | 22.80 |

| Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3237 | 06.08.08 | 3 | 102.47 | 22.70 | 3274 | | 18 | 103.91 | 25.30 | 3311 | | 9 | 102.63 | 23.60 | 3348 | | 24 | 102.84 | 24.20 |
| 3238 | | 6 | 102.44 | 22.60 | 3275 | | 21 | 103.78 | 25.30 | 3312 | | 12 | 102.53 | 23.60 | 3349 | 20.08.08 | 3 | 102.81 | 24.10 |
| 3239 | | 9 | 102.34 | 22.60 | 3276 | | 24 | 103.78 | 25.10 | 3313 | | 15 | 102.47 | 23.50 | 3350 | | 6 | 102.81 | 24.00 |
| 3240 | | 12 | 102.30 | 22.60 | 3277 | 11.08.08 | 3 | 103.81 | 24.90 | 3314 | | 18 | 102.47 | 23.50 | 3351 | | 9 | 102.81 | 24.00 |
| 3241 | | 15 | 102.27 | 22.60 | 3278 | | 6 | 103.85 | 24.90 | 3315 | | 21 | 102.50 | 23.60 | 3352 | | 12 | 102.78 | 24.00 |
| 3242 | | 18 | 102.23 | 22.60 | 3279 | | 9 | 103.85 | 24.80 | 3316 | | 24 | 102.60 | 23.60 | 3353 | | 15 | 102.78 | 23.90 |
| 3243 | | 21 | 102.19 | 22.60 | 3280 | | 12 | 103.85 | 24.70 | 3317 | 16.08.08 | 3 | 103.05 | 23.60 | 3354 | | 18 | 102.75 | 24.00 |
| 3244 | | 24 | 102.16 | 22.60 | 3281 | | 15 | 103.85 | 24.60 | 3318 | | 6 | 103.66 | 23.60 | 3355 | | 21 | 102.75 | 23.90 |
| 3245 | 07.08.08 | 3 | 102.12 | 22.70 | 3282 | | 18 | 103.85 | 24.50 | 3319 | | 9 | 103.81 | 23.50 | 3356 | | 24 | 102.78 | 23.80 |
| 3246 | | 6 | 102.08 | 22.80 | 3283 | | 21 | 103.85 | 24.40 | 3320 | | 12 | 103.91 | 23.50 | 3357 | 21.08.08 | 3 | 102.87 | 23.70 |
| 3247 | | 9 | 102.05 | 22.90 | 3284 | | 24 | 103.72 | 24.40 | 3321 | | 15 | 103.94 | 23.50 | 3358 | | 6 | 102.99 | 23.60 |
| 3248 | | 12 | 102.05 | 22.90 | 3285 | 12.08.08 | 3 | 103.54 | 24.40 | 3322 | | 18 | 103.94 | 23.50 | 3359 | | 9 | 103.57 | 23.60 |
| 3249 | | 15 | 102.08 | 23.00 | 3286 | | 6 | 103.39 | 24.30 | 3323 | | 21 | 103.94 | 23.50 | 3360 | | 12 | 103.72 | 23.50 |
| 3250 | | 18 | 102.12 | 23.00 | 3287 | | 9 | 103.91 | 24.30 | 3324 | | 24 | 104.03 | 23.50 | 3361 | | 15 | 103.81 | 23.50 |
| 3251 | | 21 | 102.16 | 23.00 | 3288 | | 12 | 103.33 | 24.30 | 3325 | 17.08.08 | 3 | 104.33 | 23.50 | 3362 | | 18 | 103.85 | 23.50 |
| 3252 | | 24 | 102.23 | 23.00 | 3289 | | 15 | 103.39 | 24.30 | 3326 | | 6 | 104.55 | 23.70 | 3363 | | 21 | 103.85 | 23.50 |
| 3253 | 08.08.08 | 3 | 102.30 | 22.90 | 3290 | | 18 | 103.33 | 24.20 | 3327 | | 9 | 104.55 | 24.00 | 3364 | | 24 | 103.88 | 23.50 |
| 3254 | | 6 | 102.38 | 22.90 | 3291 | | 21 | 103.27 | 24.20 | 3328 | | 12 | 104.49 | 24.40 | 3365 | 22.08.08 | 3 | 103.91 | 23.50 |
| 3255 | | 9 | 102.53 | 22.90 | 3292 | | 24 | 103.21 | 24.20 | 3329 | | 15 | 104.42 | 24.40 | 3366 | | 6 | 103.94 | 23.50 |
| 3256 | | 12 | 102.87 | 22.90 | 3293 | 13.08.08 | 3 | 102.69 | 24.20 | 3330 | | 18 | 104.42 | 24.30 | 3367 | | 9 | 104.06 | 23.50 |
| 3257 | | 15 | 103.27 | 22.90 | 3294 | | 6 | 102.67 | 24.10 | 3331 | | 21 | 104.42 | 24.40 | 3368 | | 12 | 104.15 | 23.60 |
| 3258 | | 18 | 103.63 | 22.90 | 3295 | | 9 | 102.66 | 24.00 | 3332 | | 24 | 104.39 | 24.60 | 3369 | | 15 | 104.21 | 23.90 |
| 3259 | | 21 | 104.09 | 22.90 | 3296 | | 12 | 102.65 | 24.00 | 3333 | 18.08.08 | 3 | 104.33 | 24.70 | 3370 | | 18 | 104.30 | 24.30 |
| 3260 | | 24 | 104.42 | 22.90 | 3297 | | 15 | 102.64 | 24.00 | 3334 | | 6 | 104.27 | 24.80 | 3371 | | 21 | 104.39 | 24.30 |
| 3261 | 09.08.08 | 3 | 104.64 | 22.90 | 3298 | | 18 | 102.93 | 24.00 | 3335 | | 9 | 104.21 | 24.90 | 3372 | | 24 | 104.42 | 24.50 |
| 3262 | | 6 | 104.64 | 22.90 | 3299 | | 21 | 102.90 | 24.00 | 3336 | | 12 | 104.09 | 24.90 | 3373 | 23.08.08 | 3 | 104.45 | 24.60 |
| 3263 | | 9 | 104.64 | 23.00 | 3300 | | 24 | 102.87 | 24.00 | 3337 | | 15 | 103.97 | 24.90 | 3374 | | 6 | 104.49 | 24.70 |
| 3264 | | 12 | 104.58 | 23.30 | 3301 | 14.08.08 | 3 | 102.87 | 24.00 | 3338 | | 18 | 103.94 | 24.90 | 3375 | | 9 | 104.40 | 24.60 |
| 3265 | | 15 | 104.49 | 23.60 | 3302 | | 6 | 102.87 | 23.90 | 3339 | | 21 | 103.94 | 24.90 | 3376 | | 12 | 104.33 | 24.70 |
| 3266 | | 18 | 104.36 | 24.00 | 3303 | | 9 | 102.85 | 23.90 | 3340 | | 24 | 103.78 | 24.90 | 3377 | | 15 | 104.24 | 24.70 |
| 3267 | | 21 | 104.24 | 24.60 | 3304 | | 12 | 102.81 | 23.90 | 3341 | 19.08.08 | 3 | 103.51 | 24.80 | 3378 | | 18 | 104.21 | 24.80 |
| 3268 | | 24 | 104.18 | 24.80 | 3305 | | 15 | 102.78 | 23.90 | 3342 | | 6 | 103.33 | 24.80 | 3379 | | 21 | 104.18 | 24.80 |
| 3269 | 10.08.08 | 3 | 104.12 | 25.10 | 3306 | | 18 | 102.78 | 23.80 | 3343 | | 9 | 103.24 | 24.70 | 3380 | | 24 | 104.12 | 24.90 |
| 3270 | | 6 | 104.09 | 25.30 | 3307 | | 21 | 102.81 | 23.80 | 3344 | | 12 | 103.17 | 24.60 | 3381 | 24.08.08 | 3 | 104.06 | 24.90 |
| 3271 | | 9 | 104.09 | 25.40 | 3308 | | 24 | 102.78 | 23.80 | 3345 | | 15 | 103.14 | 24.50 | 3382 | | 6 | 104.00 | 25.00 |
| 3272 | | 12 | 104.09 | 25.40 | 3309 | 15.08.08 | 3 | 102.75 | 23.80 | 3346 | | 18 | 103.02 | 24.40 | 3383 | | 9 | 103.78 | 25.10 |
| 3273 | | 15 | 104.03 | 25.40 | 3310 | | 6 | 102.72 | 23.70 | 3347 | | 21 | 102.87 | 24.30 | 3384 | | 12 | 103.66 | 25.10 |

| Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3385 | | 15 | 103.60 | 25.10 | 3422 | | 6 | 102.08 | 23.10 | 3459 | | 21 | 101.93 | 23.30 | 3496 | | 12 | 101.70 | 22.90 |
| 3386 | | 18 | 103.54 | 25.00 | 3423 | | 9 | 102.05 | 23.10 | 3460 | | 24 | 101.90 | 23.30 | 3497 | | 15 | 101.70 | 22.90 |
| 3387 | | 21 | 104.10 | 24.90 | 3424 | | 12 | 102.02 | 23.10 | 3461 | 03.09.08 | 3 | 101.90 | 23.30 | 3498 | | 18 | 101.66 | 22.80 |
| 3388 | | 24 | 103.39 | 24.80 | 3425 | | 15 | 102.00 | 23.00 | 3462 | | 6 | 101.88 | 23.30 | 3499 | | 21 | 101.66 | 22.80 |
| 3389 | 25.08.08 | 3 | 103.30 | 24.70 | 3426 | | 18 | 101.97 | 23.10 | 3463 | | 9 | 101.85 | 23.30 | 3500 | | 24 | 101.66 | 22.80 |
| 3390 | | 6 | 103.21 | 24.70 | 3427 | | 21 | 101.95 | 23.10 | 3464 | | 12 | 101.83 | 23.20 | 3501 | 08.09.08 | 3 | 101.66 | 22.70 |
| 3391 | | 9 | 103.11 | 24.60 | 3428 | | 24 | 101.95 | 23.10 | 3465 | | 15 | 101.80 | 23.20 | 3502 | | 6 | 101.66 | 22.70 |
| 3392 | | 12 | 103.05 | 24.50 | 3429 | 30.08.08 | 3 | 101.95 | 23.10 | 3466 | | 18 | 101.80 | 23.10 | 3503 | | 9 | 101.66 | 22.70 |
| 3393 | | 15 | 102.99 | 24.40 | 3430 | | 6 | 101.95 | 23.00 | 3467 | | 21 | 101.80 | 23.00 | 3504 | | 12 | 101.62 | 22.60 |
| 3394 | | 18 | 102.93 | 24.30 | 3431 | | 9 | 101.93 | 23.00 | 3468 | | 24 | 101.80 | 23.00 | 3505 | | 15 | 101.62 | 22.60 |
| 3395 | | 21 | 102.87 | 24.20 | 3432 | | 12 | 101.93 | 23.00 | 3469 | 04.09.08 | 3 | 101.80 | 23.00 | 3506 | | 18 | 101.66 | 22.60 |
| 3396 | | 24 | 102.84 | 24.10 | 3433 | | 15 | 101.93 | 23.00 | 3470 | | 6 | 101.80 | 22.90 | 3507 | | 21 | 101.70 | 22.60 |
| 3397 | 26.08.08 | 3 | 102.81 | 24.00 | 3434 | | 18 | 101.93 | 23.00 | 3471 | | 9 | 101.83 | 22.90 | 3508 | | 24 | 101.70 | 22.50 |
| 3398 | | 6 | 102.78 | 23.90 | 3435 | | 21 | 101.93 | 23.00 | 3472 | | 12 | 101.88 | 22.90 | 3509 | 09.09.08 | 3 | 101.70 | 22.50 |
| 3399 | | 9 | 102.78 | 24.20 | 3436 | | 24 | 101.95 | 23.00 | 3473 | | 15 | 101.93 | 22.90 | 3510 | | 6 | 101.70 | 22.50 |
| 3400 | | 12 | 102.78 | 24.00 | 3437 | 31.08.08 | 3 | 101.97 | 23.00 | 3474 | | 18 | 101.95 | 22.90 | 3511 | | 9 | 101.66 | 22.40 |
| 3401 | | 15 | 102.78 | 24.00 | 3438 | | 6 | 102.00 | 22.90 | 3475 | | 21 | 101.97 | 22.90 | 3512 | | 12 | 101.66 | 22.40 |
| 3402 | | 18 | 102.75 | 23.90 | 3439 | | 9 | 102.02 | 22.90 | 3476 | | 24 | 102.00 | 22.90 | 3513 | | 15 | 101.66 | 22.40 |
| 3403 | | 21 | 102.75 | 23.90 | 3440 | | 12 | 102.05 | 22.90 | 3477 | 05.09.08 | 3 | 102.02 | 22.90 | 3514 | | 18 | 101.62 | 22.40 |
| 3404 | | 24 | 102.70 | 23.90 | 3441 | | 15 | 102.08 | 23.00 | 3478 | | 6 | 102.05 | 22.80 | 3515 | | 21 | 101.62 | 22.40 |
| 3405 | 27.08.08 | 3 | 102.63 | 23.80 | 3442 | | 18 | 102.12 | 23.00 | 3479 | | 9 | 102.05 | 22.80 | 3516 | | 24 | 101.62 | 22.40 |
| 3406 | | 6 | 102.57 | 23.70 | 3443 | | 21 | 102.19 | 23.00 | 3480 | | 12 | 102.05 | 22.80 | 3517 | 10.09.08 | 3 | 101.62 | 22.40 |
| 3407 | | 9 | 102.50 | 23.70 | 3444 | | 24 | 102.23 | 23.00 | 3481 | | 15 | 102.05 | 22.80 | 3518 | | 6 | 101.62 | 22.30 |
| 3408 | | 12 | 102.44 | 23.60 | 3445 | 01.09.08 | 3 | 102.27 | 23.00 | 3482 | | 18 | 102.02 | 22.80 | 3519 | | 9 | 101.62 | 22.30 |
| 3409 | | 15 | 102.38 | 23.60 | 3446 | | 6 | 102.27 | 23.00 | 3483 | | 21 | 102.02 | 22.80 | 3520 | | 12 | 101.62 | 22.30 |
| 3410 | | 18 | 102.38 | 23.60 | 3447 | | 9 | 102.30 | 22.90 | 3484 | | 24 | 102.00 | 22.80 | 3521 | | 15 | 101.59 | 22.30 |
| 3411 | | 21 | 102.38 | 23.50 | 3448 | | 12 | 102.34 | 22.90 | 3485 | 06.09.08 | 3 | 101.97 | 22.90 | 3522 | | 18 | 101.59 | 22.40 |
| 3412 | | 24 | 102.34 | 23.60 | 3449 | | 15 | 102.38 | 22.90 | 3486 | | 6 | 101.95 | 23.00 | 3523 | | 21 | 101.59 | 22.40 |
| 3413 | 28.08.08 | 3 | 102.30 | 23.50 | 3450 | | 18 | 102.41 | 22.90 | 3487 | | 9 | 101.93 | 23.00 | 3524 | | 24 | 101.59 | 22.40 |
| 3414 | | 6 | 102.27 | 23.40 | 3451 | | 21 | 102.41 | 22.90 | 3488 | | 12 | 101.90 | 23.00 | 3525 | 11.09.08 | 3 | 101.59 | 22.40 |
| 3415 | | 9 | 102.23 | 23.40 | 3452 | | 24 | 102.34 | 22.90 | 3489 | | 15 | 101.88 | 23.00 | 3526 | | 6 | 101.62 | 22.40 |
| 3416 | | 12 | 102.19 | 23.30 | 3453 | 02.09.08 | 3 | 102.23 | 23.00 | 3490 | | 18 | 101.85 | 23.00 | 3527 | | 9 | 101.62 | 22.40 |
| 3417 | | 15 | 102.16 | 23.20 | 3454 | | 6 | 102.08 | 23.10 | 3491 | | 21 | 101.83 | 23.00 | 3528 | | 12 | 101.62 | 22.40 |
| 3418 | | 18 | 102.16 | 23.30 | 3455 | | 9 | 102.00 | 23.10 | 3492 | | 24 | 101.80 | 23.00 | 3529 | | 15 | 101.62 | 22.40 |
| 3419 | | 21 | 102.14 | 23.30 | 3456 | | 12 | 102.00 | 23.20 | 3493 | 07.09.08 | 3 | 101.77 | 23.00 | 3530 | | 18 | 101.59 | 22.40 |
| 3420 | | 24 | 102.12 | 23.30 | 3457 | | 15 | 101.97 | 23.30 | 3494 | | 6 | 101.73 | 23.00 | 3531 | | 21 | 101.59 | 22.40 |
| 3421 | 29.08.08 | 3 | 102.08 | 23.20 | 3458 | | 18 | 101.95 | 23.30 | 3495 | | 9 | 101.70 | 22.90 | 3532 | | 24 | 101.59 | 22.40 |

| Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3533 | 12.09.08 | 3 | 101.59 | 22.40 | 3570 | | 18 | 101.88 | 22.80 | 3607 | | 9 | 106.13 | 27.00 | 3644 | | 24 | 102.50 | 24.50 |
| 3534 | | 6 | 101.59 | 22.40 | 3571 | | 21 | 101.90 | 22.90 | 3608 | | 12 | 105.95 | 26.90 | 3645 | 26.09.08 | 3 | 102.41 | 24.50 |
| 3535 | | 9 | 101.59 | 22.40 | 3572 | | 24 | 102.12 | 23.10 | 3609 | | 15 | 105.80 | 26.80 | 3646 | | 6 | 102.34 | 24.40 |
| 3536 | | 12 | 101.59 | 22.40 | 3573 | 17.09.08 | 3 | 102.57 | 23.30 | 3610 | | 18 | 105.70 | 26.80 | 3647 | | 9 | 102.27 | 24.30 |
| 3537 | | 15 | 101.59 | 22.40 | 3574 | | 6 | 103.02 | 23.50 | 3611 | | 21 | 105.70 | 26.70 | 3648 | | 12 | 102.19 | 24.20 |
| 3538 | | 18 | 101.59 | 22.40 | 3575 | | 9 | 103.88 | 23.50 | 3612 | | 24 | 105.52 | 26.70 | 3649 | | 15 | 102.16 | 24.10 |
| 3539 | | 21 | 101.59 | 22.40 | 3576 | | 12 | 104.49 | 23.60 | 3613 | 22.09.08 | 3 | 105.05 | 26.60 | 3650 | | 18 | 102.16 | 24.10 |
| 3540 | | 24 | 101.59 | 22.40 | 3577 | | 15 | 104.96 | 23.70 | 3614 | | 6 | 104.73 | 26.60 | 3651 | | 21 | 102.12 | 24.10 |
| 3541 | 13.09.08 | 3 | 101.59 | 22.50 | 3578 | | 18 | 105.30 | 23.80 | 3615 | | 9 | 104.61 | 26.60 | 3652 | | 24 | 102.12 | 24.00 |
| 3542 | | 6 | 101.59 | 22.50 | 3579 | | 21 | 105.46 | 23.90 | 3616 | | 12 | 104.61 | 26.50 | 3653 | 27.09.08 | 3 | 102.05 | 23.90 |
| 3543 | | 9 | 101.59 | 22.50 | 3580 | | 24 | 105.86 | 24.20 | 3617 | | 15 | 104.58 | 26.50 | 3654 | | 6 | 102.05 | 23.80 |
| 3544 | | 12 | 101.59 | 22.50 | 3581 | 18.09.08 | 3 | 106.10 | 24.40 | 3618 | | 18 | 104.49 | 26.40 | 3655 | | 9 | 102.05 | 23.70 |
| 3545 | | 15 | 101.59 | 22.50 | 3582 | | 6 | 106.59 | 25.00 | 3619 | | 21 | 104.30 | 26.30 | 3656 | | 12 | 102.05 | 23.60 |
| 3546 | | 18 | 101.59 | 22.50 | 3583 | | 9 | 107.29 | 25.50 | 3620 | | 24 | 104.03 | 26.20 | 3657 | | 15 | 102.02 | 23.40 |
| 3547 | | 21 | 101.59 | 22.50 | 3584 | | 12 | 107.61 | 25.20 | 3621 | 23.09.08 | 3 | 103.47 | 26.10 | 3658 | | 18 | 102.00 | 23.40 |
| 3548 | | 24 | 101.55 | 22.50 | 3585 | | 15 | 107.80 | 25.70 | 3622 | | 6 | 103.33 | 26.00 | 3659 | | 21 | 101.97 | 23.40 |
| 3549 | 14.09.08 | 3 | 101.55 | 22.50 | 3586 | | 18 | 108.04 | 26.10 | 3623 | | 9 | 103.08 | 26.10 | 3660 | | 24 | 101.95 | 23.30 |
| 3550 | | 6 | 101.55 | 22.50 | 3587 | | 21 | 108.04 | 26.40 | 3624 | | 12 | 103.02 | 26.00 | 3661 | 28.09.08 | 3 | 101.93 | 23.20 |
| 3551 | | 9 | 101.55 | 22.50 | 3588 | | 24 | 108.04 | 26.50 | 3625 | | 15 | 103.02 | 25.90 | 3662 | | 6 | 101.90 | 23.20 |
| 3552 | | 12 | 101.55 | 22.50 | 3589 | 19.09.08 | 3 | 108.22 | 27.00 | 3626 | | 18 | 103.05 | 25.80 | 3663 | | 9 | 101.88 | 23.20 |
| 3553 | | 15 | 101.55 | 22.50 | 3590 | | 6 | 108.22 | 27.10 | 3627 | | 21 | 103.17 | 25.60 | 3664 | | 12 | 101.85 | 23.20 |
| 3554 | | 18 | 101.55 | 22.50 | 3591 | | 9 | 108.18 | 27.10 | 3628 | | 24 | 103.21 | 25.40 | 3665 | | 15 | 101.83 | 23.20 |
| 3555 | | 21 | 101.52 | 22.50 | 3592 | | 12 | 108.18 | 27.20 | 3629 | 24.09.08 | 3 | 103.14 | 25.20 | 3666 | | 18 | 101.80 | 23.20 |
| 3556 | | 24 | 101.55 | 22.50 | 3593 | | 15 | 108.01 | 27.40 | 3630 | | 6 | 103.11 | 25.00 | 3667 | | 21 | 101.77 | 23.10 |
| 3557 | 15.09.08 | 3 | 101.62 | 22.50 | 3594 | | 18 | 107.84 | 27.40 | 3631 | | 9 | 103.11 | 24.90 | 3668 | | 24 | 101.73 | 23.10 |
| 3558 | | 6 | 101.73 | 22.50 | 3595 | | 21 | 107.58 | 27.50 | 3632 | | 12 | 103.08 | 24.70 | 3669 | 29.09.08 | 3 | 101.73 | 23.00 |
| 3559 | | 9 | 101.84 | 22.50 | 3596 | | 24 | 107.32 | 27.60 | 3633 | | 15 | 103.05 | 25.00 | 3670 | | 6 | 101.73 | 23.00 |
| 3560 | | 12 | 101.85 | 22.50 | 3597 | 20.09.08 | 3 | 106.80 | 27.60 | 3634 | | 18 | 103.05 | 25.00 | 3671 | | 9 | 101.73 | 23.10 |
| 3561 | | 15 | 101.88 | 22.50 | 3598 | | 6 | 106.59 | 27.70 | 3635 | | 21 | 103.05 | 24.90 | 3672 | | 12 | 101.73 | 23.10 |
| 3562 | | 18 | 101.88 | 22.50 | 3599 | | 9 | 106.39 | 27.70 | 3636 | | 24 | 102.99 | 24.80 | 3673 | | 15 | 101.73 | 23.10 |
| 3563 | | 21 | 101.88 | 22.50 | 3600 | | 12 | 106.39 | 27.80 | 3637 | 25.09.08 | 3 | 102.90 | 24.80 | 3674 | | 18 | 101.70 | 23.00 |
| 3564 | | 24 | 101.88 | 22.50 | 3601 | | 15 | 106.39 | 27.70 | 3638 | | 6 | 102.84 | 24.70 | 3675 | | 21 | 101.70 | 23.00 |
| 3565 | 16.09.08 | 3 | 101.88 | 22.50 | 3602 | | 18 | 106.68 | 27.60 | 3639 | | 9 | 102.78 | 24.70 | 3676 | | 24 | 101.66 | 22.90 |
| 3566 | | 6 | 101.88 | 22.50 | 3603 | | 21 | 106.74 | 27.50 | 3640 | | 12 | 102.75 | 24.60 | 3677 | 30.09.08 | 3 | 101.66 | 22.80 |
| 3567 | | 9 | 101.88 | 22.60 | 3604 | | 24 | 106.68 | 27.40 | 3641 | | 15 | 102.72 | 24.60 | 3678 | | 6 | 101.62 | 22.70 |
| 3568 | | 12 | 101.85 | 22.60 | 3605 | 21.09.08 | 3 | 106.45 | 27.20 | 3642 | | 18 | 102.66 | 24.60 | 3679 | | 9 | 101.59 | 22.70 |
| 3569 | | 15 | 101.85 | 22.70 | 3606 | | 6 | 106.26 | 27.10 | 3643 | | 21 | 102.60 | 24.60 | 3680 | | 12 | 101.59 | 22.70 |

| Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3681 | | 15 | 101.55 | 22.70 | 3718 | | 6 | 101.34 | 22.30 | 3755 | | 21 | 101.27 | 21.90 | 3792 | | 12 | 101.16 | 21.80 |
| 3682 | | 18 | 101.55 | 22.70 | 3719 | | 9 | 101.34 | 22.30 | 3756 | | 24 | 101.29 | 21.90 | 3793 | | 15 | 101.16 | 21.80 |
| 3683 | | 21 | 101.55 | 22.70 | 3720 | | 12 | 101.32 | 22.30 | 3757 | 10.10.08 | 3 | 101.29 | 21.90 | 3794 | | 18 | 101.16 | 21.80 |
| 3684 | | 24 | 101.55 | 22.70 | 3721 | | 15 | 101.32 | 22.30 | 3758 | | 6 | 101.32 | 21.80 | 3795 | | 21 | 101.16 | 21.80 |
| 3685 | 01.10.08 | 3 | 101.55 | 22.70 | 3722 | | 18 | 101.32 | 22.30 | 3759 | | 9 | 101.32 | 21.80 | 3796 | | 24 | 101.16 | 21.80 |
| 3686 | | 6 | 101.55 | 22.70 | 3723 | | 21 | 101.32 | 22.30 | 3760 | | 12 | 101.29 | 21.80 | 3797 | 15.10.08 | 3 | 101.16 | 21.80 |
| 3687 | | 9 | 101.55 | 22.70 | 3724 | | 24 | 101.32 | 22.30 | 3761 | | 15 | 101.29 | 21.80 | 3798 | | 6 | 101.16 | 21.70 |
| 3688 | | 12 | 101.52 | 22.70 | 3725 | 06.10.08 | 3 | 101.32 | 22.30 | 3762 | | 18 | 101.27 | 21.80 | 3799 | | 9 | 101.16 | 21.70 |
| 3689 | | 15 | 101.52 | 22.70 | 3726 | | 6 | 101.32 | 22.30 | 3763 | | 21 | 101.27 | 21.80 | 3800 | | 12 | 101.16 | 21.70 |
| 3690 | | 18 | 101.52 | 22.60 | 3727 | | 9 | 101.32 | 22.30 | 3764 | | 24 | 101.27 | 21.80 | 3801 | | 15 | 101.16 | 21.70 |
| 3691 | | 21 | 101.55 | 22.60 | 3728 | | 12 | 101.32 | 22.30 | 3765 | 11.10.08 | 3 | 101.27 | 21.80 | 3802 | | 18 | 101.16 | 21.70 |
| 3692 | | 24 | 101.59 | 22.60 | 3729 | | 15 | 101.32 | 22.30 | 3766 | | 6 | 101.27 | 21.80 | 3803 | | 21 | 101.16 | 21.70 |
| 3693 | 02.10.08 | 3 | 101.62 | 22.60 | 3730 | | 18 | 101.32 | 22.30 | 3767 | | 9 | 101.27 | 21.80 | 3804 | | 24 | 101.12 | 21.70 |
| 3694 | | 6 | 101.62 | 22.50 | 3731 | | 21 | 101.32 | 22.30 | 3768 | | 12 | 101.27 | 21.80 | 3805 | 16.10.08 | 3 | 101.12 | 21.70 |
| 3695 | | 9 | 101.62 | 22.40 | 3732 | | 24 | 101.29 | 22.30 | 3769 | | 15 | 101.29 | 21.80 | 3806 | | 6 | 101.09 | 21.70 |
| 3696 | | 12 | 101.62 | 22.40 | 3733 | 07.10.08 | 3 | 101.29 | 22.30 | 3770 | | 18 | 101.29 | 21.80 | 3807 | | 9 | 101.09 | 21.70 |
| 3697 | | 15 | 101.62 | 22.40 | 3734 | | 6 | 101.29 | 22.30 | 3771 | | 21 | 101.29 | 21.80 | 3808 | | 12 | 101.09 | 21.70 |
| 3698 | | 18 | 101.59 | 22.40 | 3735 | | 9 | 101.27 | 22.20 | 3772 | | 24 | 101.27 | 21.80 | 3809 | | 15 | 101.09 | 21.70 |
| 3699 | | 21 | 101.59 | 22.40 | 3736 | | 12 | 101.27 | 22.20 | 3773 | 12.10.08 | 3 | 101.27 | 21.80 | 3810 | | 18 | 101.05 | 21.70 |
| 3700 | | 24 | 101.55 | 22.40 | 3737 | | 15 | 101.27 | 22.20 | 3774 | | 6 | 101.24 | 21.80 | 3811 | | 21 | 101.05 | 21.70 |
| 3701 | 03.10.08 | 3 | 101.55 | 22.40 | 3738 | | 18 | 101.27 | 22.20 | 3775 | | 9 | 101.24 | 21.80 | 3812 | | 24 | 101.05 | 21.70 |
| 3702 | | 6 | 101.52 | 22.40 | 3739 | | 21 | 101.24 | 22.10 | 3776 | | 12 | 101.22 | 21.80 | 3813 | 17.10.08 | 3 | 101.09 | 21.60 |
| 3703 | | 9 | 101.52 | 22.40 | 3740 | | 24 | 101.24 | 22.10 | 3777 | | 15 | 101.22 | 21.80 | 3814 | | 6 | 101.09 | 21.60 |
| 3704 | | 12 | 101.48 | 22.40 | 3741 | 08.10.08 | 3 | 101.06 | 22.10 | 3778 | | 18 | 101.19 | 21.80 | 3815 | | 9 | 101.09 | 21.60 |
| 3705 | | 15 | 101.48 | 22.40 | 3742 | | 6 | 101.24 | 22.00 | 3779 | | 21 | 101.19 | 21.80 | 3816 | | 12 | 101.09 | 21.60 |
| 3706 | | 18 | 101.48 | 22.40 | 3743 | | 9 | 101.24 | 22.00 | 3780 | | 24 | 101.19 | 21.80 | 3817 | | 15 | 101.09 | 21.60 |
| 3707 | | 21 | 101.44 | 22.40 | 3744 | | 12 | 101.24 | 22.00 | 3781 | 13.10.08 | 3 | 101.19 | 21.80 | 3818 | | 18 | 101.09 | 21.60 |
| 3708 | | 24 | 101.44 | 22.40 | 3745 | | 15 | 101.24 | 22.00 | 3782 | | 6 | 101.19 | 21.80 | 3819 | | 21 | 101.09 | 21.60 |
| 3709 | 04.10.08 | 3 | 101.42 | 22.40 | 3746 | | 18 | 101.24 | 22.00 | 3783 | | 9 | 101.19 | 21.80 | 3820 | | 24 | 101.05 | 21.60 |
| 3710 | | 6 | 101.39 | 22.40 | 3747 | | 21 | 101.24 | 22.00 | 3784 | | 12 | 101.16 | 21.80 | 3821 | 18.10.08 | 3 | 101.05 | 21.60 |
| 3711 | | 9 | 101.39 | 22.40 | 3748 | | 24 | 101.24 | 22.00 | 3785 | | 15 | 101.16 | 21.80 | 3822 | | 6 | 101.05 | 21.60 |
| 3712 | | 12 | 101.39 | 22.40 | 3749 | 09.10.08 | 3 | 101.24 | 22.00 | 3786 | | 18 | 101.12 | 21.80 | 3823 | | 9 | 101.05 | 21.60 |
| 3713 | | 15 | 101.39 | 22.40 | 3750 | | 6 | 101.24 | 21.90 | 3787 | | 21 | 101.12 | 21.80 | 3824 | | 12 | 101.05 | 21.60 |
| 3714 | | 18 | 101.39 | 22.40 | 3751 | | 9 | 101.27 | 21.90 | 3788 | | 24 | 101.12 | 21.80 | 3825 | | 15 | 101.05 | 21.60 |
| 3715 | | 21 | 101.37 | 22.40 | 3752 | | 12 | 101.27 | 21.90 | 3789 | 14.10.08 | 3 | 101.16 | 21.80 | 3826 | | 18 | 101.05 | 21.60 |
| 3716 | | 24 | 101.37 | 22.40 | 3753 | | 15 | 101.27 | 21.90 | 3790 | | 6 | 101.16 | 21.80 | 3827 | | 21 | 101.05 | 21.60 |
| 3717 | 05.10.08 | 3 | 101.34 | 22.40 | 3754 | | 18 | 101.27 | 21.90 | 3791 | | 9 | 101.16 | 21.80 | 3828 | | 24 | 101.05 | 21.60 |

| Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3829 | 19.10.08 | 3 | 101.05 | 21.50 | 3866 | | 18 | 100.92 | 21.50 | 3903 | | 9 | 100.85 | 21.30 | 3940 | | 6 | 101.93 | 22.80 |
| 3830 | | 6 | 101.05 | 21.50 | 3867 | | 21 | 100.92 | 21.50 | 3904 | | 12 | 100.85 | 21.30 | 3941 | | 9 | 102.30 | 22.80 |
| 3831 | | 9 | 101.05 | 21.50 | 3868 | | 24 | 100.92 | 21.50 | 3905 | | 15 | 100.85 | 21.30 | 3942 | | 12 | 102.41 | 22.80 |
| 3832 | | 12 | 101.02 | 21.50 | 3869 | 24.10.08 | 3 | 100.92 | 21.50 | 3906 | | 18 | 100.85 | 21.30 | 3943 | | 15 | 102.41 | 22.80 |
| 3833 | | 15 | 101.02 | 21.50 | 3870 | | 6 | 100.92 | 21.50 | 3907 | | 21 | 100.85 | 21.30 | 3944 | | 18 | 103.06 | 22.80 |
| 3834 | | 18 | 101.02 | 21.50 | 3871 | | 9 | 100.92 | 21.50 | 3908 | | 24 | 100.85 | 21.30 | 3945 | | 21 | 103.94 | 23.00 |
| 3835 | | 21 | 101.02 | 21.50 | 3872 | | 12 | 100.92 | 21.50 | 3909 | 29.10.08 | 3 | 100.85 | 21.30 | 3946 | | 24 | 104.65 | 23.30 |
| 3836 | | 24 | 101.02 | 21.50 | 3873 | | 15 | 100.92 | 21.50 | 3910 | | 6 | 100.85 | 21.30 | 3947 | 14.07.09 | 3 | 104.65 | 23.50 |
| 3837 | 20.10.08 | 3 | 101.02 | 21.50 | 3874 | | 18 | 100.92 | 21.50 | 3911 | | 9 | 100.85 | 21.30 | 3948 | | 6 | 104.65 | 23.80 |
| 3838 | | 6 | 101.02 | 21.50 | 3875 | | 21 | 100.92 | 21.50 | 3912 | | 12 | 100.85 | 21.30 | 3949 | | 9 | 104.52 | 24.00 |
| 3839 | | 9 | 101.02 | 21.50 | 3876 | | 24 | 100.88 | 21.50 | 3913 | | 15 | 100.85 | 21.20 | 3950 | | 12 | 104.42 | 24.20 |
| 3840 | | 12 | 101.02 | 21.50 | 3877 | 25.10.08 | 3 | 100.88 | 21.50 | 3914 | | 18 | 100.85 | 21.20 | 3951 | | 15 | 104.45 | 24.80 |
| 3841 | | 15 | 101.02 | 21.50 | 3878 | | 6 | 100.88 | 21.50 | 3915 | | 21 | 100.85 | 21.20 | 3952 | | 18 | 104.52 | 25.10 |
| 3842 | | 18 | 101.02 | 21.50 | 3879 | | 9 | 100.92 | 21.50 | 3916 | | 24 | 100.85 | 21.20 | 3953 | | 21 | 104.55 | 25.30 |
| 3843 | | 21 | 101.02 | 21.50 | 3880 | | 12 | 100.92 | 21.50 | 3917 | 30.10.08 | 3 | 100.85 | 21.20 | 3954 | | 24 | 104.52 | 25.50 |
| 3844 | | 24 | 100.98 | 21.50 | 3881 | | 15 | 100.92 | 21.50 | 3918 | | 6 | 100.85 | 21.20 | 3955 | 15.07.09 | 3 | 104.45 | 25.60 |
| 3845 | 21.10.08 | 3 | 100.98 | 21.50 | 3882 | | 18 | 100.92 | 21.50 | 3919 | | 9 | 100.85 | 21.20 | 3956 | | 6 | 104.39 | 25.60 |
| 3846 | | 6 | 100.98 | 21.50 | 3883 | | 21 | 100.92 | 21.50 | 3920 | | 12 | 100.85 | 21.20 | 3957 | | 9 | 104.49 | 25.50 |
| 3847 | | 9 | 100.98 | 21.50 | 3884 | | 24 | 100.92 | 21.50 | 3921 | | 15 | 100.85 | 21.20 | 3958 | | 12 | 104.70 | 25.60 |
| 3848 | | 12 | 100.98 | 21.50 | 3885 | 26.10.08 | 3 | 100.92 | 21.50 | 3922 | | 18 | 100.85 | 21.20 | 3959 | | 15 | 104.91 | 25.50 |
| 3849 | | 15 | 100.98 | 21.50 | 3886 | | 6 | 100.88 | 21.50 | 3923 | | 21 | 100.85 | 21.20 | 3960 | | 18 | 105.02 | 25.40 |
| 3850 | | 18 | 100.98 | 21.50 | 3887 | | 9 | 100.88 | 21.50 | 3924 | | 24 | 100.85 | 21.20 | 3961 | | 21 | 105.02 | 25.60 |
| 3851 | | 21 | 100.98 | 21.50 | 3888 | | 12 | 100.88 | 21.50 | 3925 | 31.10.08 | 3 | 100.85 | 21.10 | 3962 | | 24 | 105.02 | 25.70 |
| 3852 | | 24 | 100.98 | 21.50 | 3889 | | 15 | 100.88 | 21.50 | 3926 | | 6 | 100.85 | 21.10 | 3963 | 16.07.09 | 3 | 104.73 | 25.60 |
| 3853 | 22.10.08 | 3 | 100.95 | 21.50 | 3890 | | 18 | 100.88 | 21.50 | 3927 | | 9 | 100.85 | 21.10 | 3964 | | 6 | 104.52 | 25.60 |
| 3854 | | 6 | 100.95 | 21.50 | 3891 | | 21 | 100.88 | 21.50 | 3928 | | 12 | 100.85 | 21.10 | 3965 | | 9 | 104.36 | 25.65 |
| 3855 | | 9 | 100.95 | 21.50 | 3892 | | 24 | 100.88 | 21.50 | 3929 | | 15 | 100.85 | 21.10 | 3966 | | 12 | 104.27 | 25.75 |
| 3856 | | 12 | 100.95 | 21.50 | 3893 | 27.10.08 | 3 | 100.88 | 21.40 | 3930 | | 18 | 100.85 | 21.10 | 3967 | | 15 | 104.15 | 25.90 |
| 3857 | | 15 | 100.95 | 21.50 | 3894 | | 6 | 100.88 | 21.40 | 3931 | | 21 | 100.85 | 21.10 | 3968 | | 18 | 104.03 | 26.10 |
| 3858 | | 18 | 100.95 | 21.50 | 3895 | | 9 | 100.85 | 21.40 | 3932 | | 6 | 101.21 | 22.70 | 3969 | | 21 | 103.88 | 26.00 |
| 3859 | | 21 | 100.95 | 21.50 | 3896 | | 12 | 100.85 | 21.40 | 3933 | | 9 | 101.11 | 22.70 | 3970 | | 24 | 103.69 | 25.80 |
| 3860 | | 24 | 100.92 | 21.50 | 3897 | | 15 | 100.85 | 21.40 | 3934 | | 12 | 101.11 | 22.70 | 3971 | 17.07.09 | 3 | 103.50 | 25.60 |
| 3861 | 23.10.08 | 3 | 100.92 | 21.50 | 3898 | | 18 | 100.85 | 21.40 | 3935 | | 15 | 101.08 | 22.70 | 3972 | | 6 | 103.33 | 25.40 |
| 3862 | | 6 | 100.92 | 21.50 | 3899 | | 21 | 100.85 | 21.40 | 3936 | | 18 | 101.08 | 22.70 | 3973 | | 9 | 103.17 | 25.30 |
| 3863 | | 9 | 100.92 | 21.50 | 3900 | | 24 | 100.85 | 21.40 | 3937 | | 21 | 101.04 | 22.80 | 3974 | | 12 | 103.05 | 25.40 |
| 3864 | | 12 | 100.92 | 21.50 | 3901 | 28.10.08 | 3 | 100.85 | 21.40 | 3938 | | 24 | 101.27 | 22.80 | 3975 | | 15 | 102.99 | 25.35 |
| 3865 | | 15 | 100.92 | 21.50 | 3902 | | 6 | 100.85 | 21.30 | 3939 | 13.07.09 | 3 | 101.62 | 22.80 | 3976 | | 18 | 102.90 | 25.20 |

| Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3977 | | 21 | 102.78 | 25.10 | 4014 | | 12 | 104.99 | 25.50 | 4051 | 27.07.09 | 3 | 103.17 | 24.90 | 4088 | | 18 | 102.05 | 23.65 |
| 3978 | | 24 | 102.66 | 25.00 | 4015 | | 15 | 104.70 | 25.50 | 4052 | | 6 | 102.99 | 24.60 | 4089 | | 21 | 102.02 | 23.60 |
| 3979 | 18.07.09 | 3 | 102.57 | 24.60 | 4016 | | 18 | 104.49 | 25.55 | 4053 | | 9 | 102.96 | 24.60 | 4090 | | 24 | 102.00 | 23.50 |
| 3980 | | 6 | 102.47 | 24.50 | 4017 | | 21 | 104.85 | 25.60 | 4054 | | 12 | 102.96 | 24.55 | 4091 | 01.08.09 | 3 | 101.97 | 23.50 |
| 3981 | | 9 | 102.41 | 24.50 | 4018 | | 24 | 104.85 | 25.65 | 4055 | | 15 | 102.96 | 24.70 | 4092 | | 6 | 101.97 | 23.50 |
| 3982 | | 12 | 102.90 | 24.25 | 4019 | 23.07.09 | 3 | 105.46 | 25.70 | 4056 | | 18 | 102.96 | 24.80 | 4093 | | 9 | 101.95 | 23.20 |
| 3983 | | 15 | 103.33 | 24.20 | 4020 | | 6 | 105.55 | 25.70 | 4057 | | 21 | 102.96 | 24.80 | 4094 | | 12 | 101.95 | 23.10 |
| 3984 | | 18 | 103.39 | 24.00 | 4021 | | 9 | 105.58 | 25.65 | 4058 | | 24 | 102.96 | 24.85 | 4095 | | 15 | 101.95 | 23.00 |
| 3985 | | 21 | 103.39 | 24.20 | 4022 | | 12 | 105.61 | 25.55 | 4059 | 28.07.09 | 3 | 102.99 | 24.65 | 4096 | | 18 | 101.95 | 22.90 |
| 3986 | | 24 | 103.69 | 24.15 | 4023 | | 15 | 105.55 | 25.50 | 4060 | | 6 | 103.02 | 24.45 | 4097 | | 21 | 101.95 | 22.80 |
| 3987 | 19.07.09 | 3 | 104.15 | 24.10 | 4024 | | 18 | 105.52 | 25.45 | 4061 | | 9 | 103.08 | 24.25 | 4098 | | 24 | 101.93 | 22.80 |
| 3988 | | 6 | 104.55 | 24.00 | 4025 | | 21 | 105.49 | 25.45 | 4062 | | 12 | 103.21 | 24.30 | 4099 | 02.08.09 | 3 | 101.90 | 22.80 |
| 3989 | | 9 | 104.70 | 23.90 | 4026 | | 24 | 105.46 | 25.50 | 4063 | | 15 | 103.39 | 24.30 | 4100 | | 6 | 101.88 | 22.80 |
| 3990 | | 12 | 104.82 | 23.90 | 4027 | 24.07.09 | 3 | 105.43 | 25.55 | 4064 | | 18 | 103.60 | 24.25 | 4101 | | 9 | 101.83 | 22.75 |
| 3991 | | 15 | 104.99 | 24.10 | 4028 | | 6 | 105.36 | 25.70 | 4065 | | 21 | 103.78 | 24.25 | 4102 | | 12 | 101.77 | 22.70 |
| 3992 | | 18 | 105.30 | 24.50 | 4029 | | 9 | 105.17 | 25.70 | 4066 | | 24 | 103.81 | 24.20 | 4103 | | 15 | 101.73 | 22.70 |
| 3993 | | 21 | 105.61 | 24.65 | 4030 | | 12 | 105.08 | 25.80 | 4067 | 29.07.09 | 3 | 103.81 | 24.20 | 4104 | | 18 | 101.70 | 23.00 |
| 3994 | | 24 | 105.74 | 24.50 | 4031 | | 15 | 105.02 | 25.80 | 4068 | | 6 | 103.81 | 24.10 | 4105 | | 21 | 101.70 | 22.95 |
| 3995 | 20.07.09 | 3 | 105.64 | 24.80 | 4032 | | 18 | 104.99 | 25.80 | 4069 | | 9 | 103.69 | 24.10 | 4106 | | 24 | 101.66 | 22.95 |
| 3996 | | 6 | 105.55 | 25.00 | 4033 | | 21 | 104.96 | 25.80 | 4070 | | 12 | 103.48 | 24.15 | 4107 | 03.08.09 | 3 | 101.66 | 22.95 |
| 3997 | | 9 | 105.36 | 25.20 | 4034 | | 24 | 104.96 | 25.80 | 4071 | | 15 | 103.30 | 24.25 | 4108 | | 6 | 101.62 | 22.95 |
| 3998 | | 12 | 105.13 | 25.50 | 4035 | 25.07.09 | 3 | 104.94 | 25.80 | 4072 | | 18 | 103.12 | 24.40 | 4109 | | 9 | 101.62 | 22.95 |
| 3999 | | 15 | 104.94 | 25.60 | 4036 | | 6 | 104.91 | 25.75 | 4073 | | 21 | 103.02 | 24.65 | 4110 | | 12 | 101.62 | 22.90 |
| 4000 | | 18 | 104.76 | 25.70 | 4037 | | 9 | 104.91 | 25.70 | 4074 | | 24 | 102.97 | 24.70 | 4111 | | 15 | 101.59 | 22.90 |
| 4001 | | 21 | 104.58 | 25.80 | 4038 | | 12 | 104.91 | 25.65 | 4075 | 30.07.09 | 3 | 102.78 | 25.00 | 4112 | | 18 | 101.59 | 22.90 |
| 4002 | | 24 | 104.58 | 25.90 | 4039 | | 15 | 104.88 | 25.60 | 4076 | | 6 | 102.66 | 25.00 | 4113 | | 21 | 101.59 | 22.90 |
| 4003 | 21.07.09 | 3 | 104.58 | 25.95 | 4040 | | 18 | 104.85 | 25.50 | 4077 | | 9 | 102.53 | 24.90 | 4114 | | 24 | 101.55 | 22.85 |
| 4004 | | 6 | 104.58 | 25.90 | 4041 | | 21 | 104.82 | 25.45 | 4078 | | 12 | 102.44 | 24.70 | 4115 | 04.08.09 | 3 | 101.52 | 22.85 |
| 4005 | | 9 | 104.64 | 25.85 | 4042 | | 24 | 104.33 | 25.40 | 4079 | | 15 | 102.34 | 24.40 | 4116 | | 6 | 101.48 | 22.85 |
| 4006 | | 12 | 104.82 | 25.80 | 4043 | 26.07.09 | 3 | 104.15 | 25.35 | 4080 | | 18 | 102.27 | 24.40 | 4117 | | 9 | 101.48 | 22.70 |
| 4007 | | 15 | 105.11 | 25.75 | 4044 | | 6 | 103.81 | 25.35 | 4081 | | 21 | 102.23 | 24.50 | 4118 | | 12 | 101.48 | 22.75 |
| 4008 | | 18 | 105.40 | 25.65 | 4045 | | 9 | 103.75 | 25.30 | 4082 | | 24 | 102.19 | 24.40 | 4119 | | 15 | 101.44 | 22.70 |
| 4009 | | 21 | 105.61 | 25.55 | 4046 | | 12 | 103.72 | 25.30 | 4083 | 31.07.09 | 3 | 102.16 | 24.20 | 4120 | | 18 | 101.44 | 22.65 |
| 4010 | | 24 | 105.74 | 25.45 | 4047 | | 15 | 103.69 | 25.25 | 4084 | | 6 | 102.12 | 24.00 | 4121 | | 21 | 101.44 | 22.60 |
| 4011 | 22.07.09 | 3 | 105.80 | 25.45 | 4048 | | 18 | 103.69 | 25.20 | 4085 | | 9 | 102.08 | 23.80 | 4122 | | 24 | 101.41 | 22.60 |
| 4012 | | 6 | 105.55 | 25.45 | 4049 | | 21 | 103.69 | 25.15 | 4086 | | 12 | 102.05 | 23.60 | 4123 | 05.08.09 | 3 | 101.41 | 22.60 |
| 4013 | | 9 | 105.27 | 25.45 | 4050 | | 24 | 103.51 | 25.10 | 4087 | | 15 | 102.05 | 23.70 | 4124 | | 6 | 101.39 | 22.60 |

| Sl No | Date | Time (hrs) | Stage at Khairmal (m) | Stage at Naraj (m) | Sl No | Date | Time (hrs) | Stage at Khairmal (m) | Stage at Naraj (m) | Sl No | Date | Time (hrs) | Stage at Khairmal (m) | Stage at Naraj (m) | Sl No | Date | Time (hrs) | Stage at Khairmal (m) | Stage at Naraj (m) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4125 | | 9 | 101.39 | 22.60 | 4162 | | 24 | 101.27 | 22.35 | 4199 | | 15 | 101.83 | 23.20 | 4236 | | 6 | 101.44 | 23.10 |
| 4126 | | 12 | 101.39 | 22.55 | 4163 | 10.08.09 | 3 | 101.29 | 22.35 | 4200 | | 18 | 101.85 | 23.20 | 4237 | | 9 | 101.44 | 22.90 |
| 4127 | | 15 | 101.39 | 22.55 | 4164 | | 6 | 101.29 | 22.35 | 4201 | | 21 | 101.88 | 23.15 | 4238 | | 12 | 101.44 | 22.80 |
| 4128 | | 18 | 101.39 | 22.55 | 4165 | | 9 | 101.32 | 22.35 | 4202 | | 24 | 101.90 | 23.15 | 4239 | | 15 | 101.44 | 22.90 |
| 4129 | | 21 | 101.39 | 22.50 | 4166 | | 12 | 101.32 | 22.30 | 4203 | 15.08.09 | 3 | 101.93 | 23.15 | 4240 | | 18 | 101.48 | 22.85 |
| 4130 | | 24 | 101.41 | 22.50 | 4167 | | 15 | 101.34 | 22.30 | 4204 | | 6 | 101.97 | 23.15 | 4241 | | 21 | 101.52 | 22.85 |
| 4131 | 06.08.09 | 3 | 101.42 | 22.55 | 4168 | | 18 | 101.37 | 22.30 | 4205 | | 9 | 102.00 | 23.20 | 4242 | | 24 | 101.55 | 22.85 |
| 4132 | | 6 | 101.44 | 22.55 | 4169 | | 21 | 101.39 | 22.30 | 4206 | | 12 | 102.00 | 23.20 | 4243 | 20.08.09 | 3 | 101.62 | 22.80 |
| 4133 | | 9 | 101.44 | 22.60 | 4170 | | 24 | 101.59 | 22.30 | 4207 | | 15 | 102.00 | 23.35 | 4244 | | 6 | 101.66 | 22.80 |
| 4134 | | 12 | 101.44 | 22.60 | 4171 | 11.08.09 | 3 | 101.95 | 22.30 | 4208 | | 18 | 102.00 | 23.50 | 4245 | | 9 | 101.73 | 22.80 |
| 4135 | | 15 | 101.44 | 22.55 | 4172 | | 6 | 102.23 | 22.35 | 4209 | | 21 | 102.00 | 23.60 | 4246 | | 12 | 101.73 | 22.75 |
| 4136 | | 18 | 101.44 | 22.55 | 4173 | | 9 | 102.27 | 22.35 | 4210 | | 24 | 102.00 | 23.80 | 4247 | | 15 | 101.73 | 22.80 |
| 4137 | | 21 | 101.44 | 22.55 | 4174 | | 12 | 102.23 | 22.35 | 4211 | 16.08.09 | 3 | 101.97 | 23.90 | 4248 | | 18 | 101.80 | 22.90 |
| 4138 | | 24 | 101.44 | 22.55 | 4175 | | 15 | 102.16 | 22.45 | 4212 | | 6 | 101.97 | 24.00 | 4249 | | 21 | 101.85 | 22.90 |
| 4139 | 07.08.09 | 3 | 101.42 | 22.50 | 4176 | | 18 | 102.05 | 22.40 | 4213 | | 9 | 101.95 | 24.00 | 4250 | | 24 | 101.97 | 23.00 |
| 4140 | | 6 | 101.42 | 22.50 | 4177 | | 21 | 102.00 | 22.40 | 4214 | | 12 | 101.93 | 24.00 | 4251 | 21.08.09 | 3 | 102.16 | 23.20 |
| 4141 | | 9 | 101.42 | 22.50 | 4178 | | 24 | 102.00 | 22.40 | 4215 | | 15 | 101.93 | 24.00 | 4252 | | 6 | 102.34 | 23.30 |
| 4142 | | 12 | 101.42 | 22.55 | 4179 | 12.08.09 | 3 | 102.02 | 22.45 | 4216 | | 18 | 101.90 | 24.00 | 4253 | | 9 | 102.41 | 23.50 |
| 4143 | | 15 | 101.39 | 22.55 | 4180 | | 6 | 102.05 | 22.55 | 4217 | | 21 | 101.90 | 24.00 | 4254 | | 12 | 102.75 | 23.50 |
| 4144 | | 18 | 101.39 | 22.55 | 4181 | | 9 | 102.05 | 22.65 | 4218 | | 24 | 101.88 | 24.00 | 4255 | | 15 | 102.47 | 23.45 |
| 4145 | | 21 | 101.39 | 22.55 | 4182 | | 12 | 102.05 | 23.00 | 4219 | 17.08.09 | 3 | 101.85 | 24.00 | 4256 | | 18 | 102.47 | 23.45 |
| 4146 | | 24 | 101.37 | 22.45 | 4183 | | 15 | 102.05 | 23.30 | 4220 | | 6 | 101.83 | 23.90 | 4257 | | 21 | 102.50 | 23.45 |
| 4147 | 08.08.09 | 3 | 101.37 | 22.45 | 4184 | | 18 | 102.02 | 23.50 | 4221 | | 9 | 101.80 | 23.90 | 4258 | | 24 | 102.47 | 23.45 |
| 4148 | | 6 | 101.34 | 22.50 | 4185 | | 21 | 102.00 | 23.50 | 4222 | | 12 | 101.77 | 23.80 | 4259 | 22.08.09 | 3 | 102.41 | 23.40 |
| 4149 | | 9 | 101.32 | 22.50 | 4186 | | 24 | 101.95 | 23.60 | 4223 | | 15 | 101.73 | 23.75 | 4260 | | 6 | 102.34 | 23.40 |
| 4150 | | 12 | 101.32 | 22.50 | 4187 | 13.08.09 | 3 | 101.90 | 23.60 | 4224 | | 18 | 101.70 | 23.70 | 4261 | | 9 | 102.27 | 23.45 |
| 4151 | | 15 | 101.29 | 22.50 | 4188 | | 6 | 101.85 | 23.60 | 4225 | | 21 | 101.64 | 23.70 | 4262 | | 12 | 102.23 | 23.50 |
| 4152 | | 18 | 101.29 | 22.50 | 4189 | | 9 | 101.83 | 23.60 | 4226 | | 24 | 101.62 | 23.60 | 4263 | | 15 | 102.16 | 23.60 |
| 4153 | | 21 | 101.27 | 22.50 | 4190 | | 12 | 101.80 | 23.50 | 4227 | 18.08.09 | 3 | 101.59 | 23.55 | 4264 | | 18 | 102.16 | 23.80 |
| 4154 | | 24 | 101.27 | 22.50 | 4191 | | 15 | 101.77 | 23.45 | 4228 | | 6 | 101.55 | 23.50 | 4265 | | 21 | 102.12 | 23.90 |
| 4155 | 09.08.09 | 3 | 101.27 | 22.50 | 4192 | | 18 | 101.73 | 23.45 | 4229 | | 9 | 101.55 | 23.50 | 4266 | | 24 | 102.08 | 24.00 |
| 4156 | | 6 | 101.24 | 22.50 | 4193 | | 21 | 101.73 | 23.45 | 4230 | | 12 | 101.52 | 23.40 | 4267 | 23.08.09 | 3 | 102.05 | 24.05 |
| 4157 | | 9 | 101.24 | 22.50 | 4194 | | 24 | 101.73 | 23.45 | 4231 | | 15 | 101.52 | 23.35 | 4268 | | 6 | 102.02 | 24.10 |
| 4158 | | 12 | 101.22 | 22.50 | 4195 | 14.08.09 | 3 | 101.77 | 23.40 | 4232 | | 18 | 101.52 | 23.30 | 4269 | | 9 | 102.00 | 24.10 |
| 4159 | | 15 | 101.22 | 22.50 | 4196 | | 6 | 101.77 | 23.40 | 4233 | | 21 | 101.52 | 23.25 | 4270 | | 12 | 101.97 | 24.05 |
| 4160 | | 18 | 101.24 | 22.45 | 4197 | | 9 | 101.80 | 23.35 | 4234 | | 24 | 101.48 | 23.20 | 4271 | | 15 | 101.95 | 24.00 |
| 4161 | | 21 | 101.27 | 22.40 | 4198 | | 12 | 101.83 | 23.30 | 4235 | 19.08.09 | 3 | 101.48 | 23.15 | 4272 | | 18 | 101.95 | 24.00 |

| Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4273 | | 21 | 101.93 | 24.00 | 4310 | | 12 | 103.42 | 24.70 | 4347 | 02.09.09 | 3 | 101.83 | 23.30 | 4384 | | 18 | 102.96 | 22.90 |
| 4274 | | 24 | 101.93 | 24.00 | 4311 | | 15 | 103.36 | 24.80 | 4348 | | 6 | 101.83 | 23.30 | 4385 | | 21 | 103.05 | 23.00 |
| 4275 | 24.08.09 | 3 | 101.93 | 23.90 | 4312 | | 18 | 103.24 | 25.10 | 4349 | | 9 | 101.83 | 23.25 | 4386 | | 24 | 103.02 | 23.20 |
| 4276 | | 6 | 101.93 | 23.80 | 4313 | | 21 | 103.09 | 25.10 | 4350 | | 12 | 101.83 | 23.25 | 4387 | 07.09.09 | 3 | 102.93 | 23.60 |
| 4277 | | 9 | 101.93 | 23.70 | 4314 | | 24 | 103.02 | 25.10 | 4351 | | 15 | 101.80 | 23.20 | 4388 | | 6 | 102.81 | 23.55 |
| 4278 | | 12 | 101.93 | 23.60 | 4315 | 29.08.09 | 3 | 102.96 | 24.90 | 4352 | | 18 | 101.80 | 23.15 | 4389 | | 9 | 102.72 | 23.65 |
| 4279 | | 15 | 101.90 | 23.60 | 4316 | | 6 | 102.93 | 24.80 | 4353 | | 21 | 101.80 | 23.10 | 4390 | | 12 | 102.63 | 23.70 |
| 4280 | | 18 | 101.90 | 23.60 | 4317 | | 9 | 102.87 | 24.75 | 4354 | | 24 | 101.80 | 23.10 | 4391 | | 15 | 102.57 | 23.85 |
| 4281 | | 21 | 101.93 | 23.60 | 4318 | | 12 | 102.81 | 24.75 | 4355 | 03.09.09 | 3 | 101.80 | 23.05 | 4392 | | 18 | 102.47 | 24.00 |
| 4282 | | 24 | 101.95 | 23.60 | 4319 | | 15 | 102.75 | 24.75 | 4356 | | 6 | 101.80 | 23.00 | 4393 | | 21 | 102.41 | 24.20 |
| 4283 | 25.08.09 | 3 | 101.95 | 23.55 | 4320 | | 18 | 102.69 | 24.80 | 4357 | | 9 | 101.80 | 23.00 | 4394 | | 24 | 102.30 | 24.30 |
| 4284 | | 6 | 101.97 | 23.50 | 4321 | | 21 | 102.63 | 24.80 | 4358 | | 12 | 101.80 | 22.95 | 4395 | 08.09.09 | 3 | 102.19 | 24.40 |
| 4285 | | 9 | 102.00 | 23.50 | 4322 | | 24 | 102.53 | 24.70 | 4359 | | 15 | 101.83 | 22.95 | 4396 | | 6 | 102.12 | 24.50 |
| 4286 | | 12 | 102.00 | 23.50 | 4323 | 30.08.09 | 3 | 102.47 | 24.60 | 4360 | | 18 | 101.83 | 22.95 | 4397 | | 9 | 102.05 | 24.50 |
| 4287 | | 15 | 102.05 | 23.50 | 4324 | | 6 | 102.41 | 24.50 | 4361 | | 21 | 101.83 | 22.90 | 4398 | | 12 | 102.02 | 24.40 |
| 4288 | | 18 | 102.08 | 23.50 | 4325 | | 9 | 102.38 | 24.30 | 4362 | | 24 | 101.80 | 22.90 | 4399 | | 15 | 102.00 | 24.30 |
| 4289 | | 21 | 102.12 | 23.55 | 4326 | | 12 | 102.34 | 24.20 | 4363 | 04.09.09 | 3 | 101.73 | 22.90 | 4400 | | 18 | 101.97 | 24.30 |
| 4290 | | 24 | 102.12 | 23.55 | 4327 | | 15 | 102.30 | 24.10 | 4364 | | 6 | 101.66 | 22.90 | 4401 | | 21 | 101.95 | 24.20 |
| 4291 | 26.08.09 | 3 | 102.12 | 23.60 | 4328 | | 18 | 102.27 | 24.20 | 4365 | | 9 | 101.62 | 22.95 | 4402 | | 24 | 101.93 | 24.10 |
| 4292 | | 6 | 102.12 | 23.60 | 4329 | | 21 | 102.23 | 24.20 | 4366 | | 12 | 101.59 | 22.90 | 4403 | 09.09.09 | 3 | 101.90 | 23.95 |
| 4293 | | 9 | 102.12 | 23.60 | 4330 | | 24 | 102.19 | 24.00 | 4367 | | 15 | 101.59 | 22.90 | 4404 | | 6 | 101.88 | 23.85 |
| 4294 | | 12 | 102.12 | 23.55 | 4331 | 31.08.09 | 3 | 102.16 | 23.90 | 4368 | | 18 | 101.59 | 22.90 | 4405 | | 9 | 101.85 | 23.70 |
| 4295 | | 15 | 102.12 | 23.55 | 4332 | | 6 | 102.12 | 23.80 | 4369 | | 21 | 101.59 | 22.90 | 4406 | | 12 | 101.83 | 23.65 |
| 4296 | | 18 | 102.21 | 23.60 | 4333 | | 9 | 102.12 | 23.80 | 4370 | | 24 | 101.59 | 22.90 | 4407 | | 15 | 101.83 | 23.55 |
| 4297 | | 21 | 102.30 | 23.65 | 4334 | | 12 | 102.12 | 23.80 | 4371 | 05.09.09 | 3 | 101.62 | 22.90 | 4408 | | 18 | 101.83 | 23.55 |
| 4298 | | 24 | 102.53 | 23.70 | 4335 | | 15 | 102.12 | 23.80 | 4372 | | 6 | 101.66 | 22.90 | 4409 | | 21 | 101.80 | 23.50 |
| 4299 | 27.08.09 | 3 | 102.75 | 23.80 | 4336 | | 18 | 102.12 | 23.80 | 4373 | | 9 | 101.80 | 22.90 | 4410 | | 24 | 101.77 | 23.45 |
| 4300 | | 6 | 102.96 | 23.90 | 4337 | | 21 | 102.12 | 23.80 | 4374 | | 12 | 101.88 | 22.90 | 4411 | 10.09.09 | 3 | 101.73 | 23.40 |
| 4301 | | 9 | 103.24 | 23.90 | 4338 | | 24 | 102.05 | 23.80 | 4375 | | 15 | 101.95 | 22.90 | 4412 | | 6 | 101.70 | 23.35 |
| 4302 | | 12 | 103.42 | 23.95 | 4339 | 01.09.09 | 3 | 102.00 | 23.70 | 4376 | | 18 | 102.02 | 22.90 | 4413 | | 9 | 101.66 | 23.30 |
| 4303 | | 15 | 103.54 | 23.80 | 4340 | | 6 | 101.95 | 23.60 | 4377 | | 21 | 102.16 | 22.90 | 4414 | | 12 | 101.62 | 23.20 |
| 4304 | | 18 | 103.66 | 23.85 | 4341 | | 9 | 101.93 | 23.55 | 4378 | | 24 | 102.34 | 22.90 | 4415 | | 15 | 101.59 | 23.15 |
| 4305 | | 21 | 103.75 | 23.80 | 4342 | | 12 | 101.90 | 23.50 | 4379 | 06.09.09 | 3 | 102.50 | 22.90 | 4416 | | 18 | 101.55 | 23.15 |
| 4306 | | 24 | 103.75 | 23.90 | 4343 | | 15 | 101.88 | 23.45 | 4380 | | 6 | 102.63 | 22.85 | 4417 | | 21 | 101.55 | 23.10 |
| 4307 | 28.08.09 | 3 | 103.69 | 24.00 | 4344 | | 18 | 101.85 | 23.40 | 4381 | | 9 | 102.72 | 22.85 | 4418 | | 24 | 101.55 | 23.05 |
| 4308 | | 6 | 103.60 | 24.20 | 4345 | | 21 | 101.85 | 23.40 | 4382 | | 12 | 102.81 | 22.80 | 4419 | 11.09.09 | 3 | 101.52 | 23.00 |
| 4309 | | 9 | 103.51 | 24.45 | 4346 | | 24 | 101.85 | 23.35 | 4383 | | 15 | 102.87 | 22.80 | 4420 | | 6 | 101.52 | 23.00 |

| Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4421 | | 9 | 101.52 | 23.00 | 4458 | | 24 | 101.12 | 22.40 | 4495 | | 15 | 100.85 | 22.40 | 4532 | | 6 | 101.24 | 22.10 |
| 4422 | | 12 | 101.48 | 23.00 | 4459 | 16.09.09 | 3 | 101.09 | 22.40 | 4496 | | 18 | 100.85 | 22.40 | 4533 | | 9 | 101.27 | 22.10 |
| 4423 | | 15 | 101.44 | 23.00 | 4460 | | 6 | 101.09 | 22.40 | 4497 | | 21 | 100.85 | 22.40 | 4534 | | 12 | 101.29 | 22.00 |
| 4424 | | 18 | 101.44 | 23.05 | 4461 | | 9 | 101.09 | 22.40 | 4498 | | 24 | 100.85 | 22.40 | 4535 | | 15 | 101.29 | 22.00 |
| 4425 | | 21 | 101.42 | 23.00 | 4462 | | 12 | 101.09 | 22.35 | 4499 | 21.09.09 | 3 | 100.85 | 22.40 | 4536 | | 18 | 101.27 | 22.05 |
| 4426 | | 24 | 101.39 | 23.00 | 4463 | | 15 | 101.05 | 22.30 | 4500 | | 6 | 100.85 | 22.35 | 4537 | | 21 | 101.24 | 22.05 |
| 4427 | 12.09.09 | 3 | 101.37 | 22.95 | 4464 | | 18 | 101.05 | 22.20 | 4501 | | 9 | 100.85 | 22.35 | 4538 | | 24 | 101.22 | 22.05 |
| 4428 | | 6 | 101.34 | 22.90 | 4465 | | 21 | 101.05 | 22.20 | 4502 | | 12 | 100.85 | 22.35 | 4539 | 26.09.09 | 3 | 101.22 | 22.05 |
| 4429 | | 9 | 101.32 | 22.90 | 4466 | | 24 | 101.05 | 22.20 | 4503 | | 15 | 100.85 | 22.30 | 4540 | | 6 | 101.19 | 22.05 |
| 4430 | | 12 | 101.29 | 22.85 | 4467 | 17.09.09 | 3 | 101.05 | 22.15 | 4504 | | 18 | 100.85 | 22.30 | 4541 | | 9 | 101.19 | 22.05 |
| 4431 | | 15 | 101.29 | 22.80 | 4468 | | 6 | 101.05 | 22.10 | 4505 | | 21 | 100.85 | 22.30 | 4542 | | 12 | 101.19 | 22.05 |
| 4432 | | 18 | 101.29 | 22.80 | 4469 | | 9 | 101.05 | 22.10 | 4506 | | 24 | 100.88 | 22.30 | 4543 | | 15 | 101.19 | 22.05 |
| 4433 | | 21 | 101.27 | 22.75 | 4470 | | 12 | 101.05 | 22.00 | 4507 | 22.09.09 | 3 | 100.92 | 22.30 | 4544 | | 18 | 101.19 | 22.10 |
| 4434 | | 24 | 101.27 | 22.75 | 4471 | | 15 | 101.05 | 21.90 | 4508 | | 6 | 100.95 | 22.30 | 4545 | | 21 | 101.19 | 22.10 |
| 4435 | 13.09.09 | 3 | 101.29 | 22.70 | 4472 | | 18 | 101.05 | 22.00 | 4509 | | 9 | 100.98 | 22.25 | 4546 | | 24 | 101.19 | 22.15 |
| 4436 | | 6 | 101.29 | 22.70 | 4473 | | 21 | 101.05 | 22.10 | 4510 | | 12 | 101.02 | 22.25 | 4547 | 27.09.09 | 3 | 101.19 | 22.20 |
| 4437 | | 9 | 101.29 | 22.65 | 4474 | | 24 | 101.05 | 22.10 | 4511 | | 15 | 101.02 | 22.25 | 4548 | | 6 | 101.22 | 22.30 |
| 4438 | | 12 | 101.32 | 22.65 | 4475 | 18.09.09 | 3 | 101.05 | 22.10 | 4512 | | 18 | 101.05 | 22.25 | 4549 | | 9 | 101.24 | 22.40 |
| 4439 | | 15 | 101.32 | 22.65 | 4476 | | 6 | 101.05 | 22.10 | 4513 | | 21 | 101.12 | 22.25 | 4550 | | 12 | 101.27 | 22.40 |
| 4440 | | 18 | 101.34 | 22.60 | 4477 | | 9 | 101.05 | 22.10 | 4514 | | 24 | 101.12 | 22.25 | 4551 | | 15 | 101.29 | 22.40 |
| 4441 | | 21 | 101.34 | 22.55 | 4478 | | 12 | 101.05 | 22.10 | 4515 | 23.09.09 | 3 | 101.12 | 22.20 | 4552 | | 18 | 101.29 | 22.40 |
| 4442 | | 24 | 101.34 | 22.50 | 4479 | | 15 | 101.05 | 22.10 | 4516 | | 6 | 101.12 | 22.20 | 4553 | | 21 | 101.29 | 22.40 |
| 4443 | 14.09.09 | 3 | 101.32 | 22.45 | 4480 | | 18 | 101.05 | 22.10 | 4517 | | 9 | 101.12 | 22.20 | 4554 | | 24 | 101.27 | 22.40 |
| 4444 | | 6 | 101.29 | 22.40 | 4481 | | 21 | 101.05 | 22.10 | 4518 | | 12 | 101.09 | 22.20 | 4555 | 28.09.09 | 3 | 101.24 | 22.40 |
| 4445 | | 9 | 101.27 | 22.40 | 4482 | | 24 | 100.88 | 22.10 | 4519 | | 15 | 101.09 | 22.20 | 4556 | | 6 | 101.22 | 22.40 |
| 4446 | | 12 | 101.27 | 22.40 | 4483 | 19.09.09 | 3 | 100.85 | 22.10 | 4520 | | 18 | 101.09 | 22.15 | 4557 | | 9 | 101.19 | 22.40 |
| 4447 | | 15 | 101.24 | 22.40 | 4484 | | 6 | 100.85 | 22.10 | 4521 | | 21 | 101.09 | 22.15 | 4558 | | 12 | 101.19 | 22.40 |
| 4448 | | 18 | 101.24 | 22.40 | 4485 | | 9 | 100.85 | 22.10 | 4522 | | 24 | 101.09 | 22.15 | 4559 | | 15 | 101.16 | 22.40 |
| 4449 | | 21 | 101.22 | 22.40 | 4486 | | 12 | 100.85 | 22.30 | 4523 | 24.09.09 | 3 | 101.09 | 22.15 | 4560 | | 18 | 101.16 | 22.40 |
| 4450 | | 24 | 101.22 | 22.40 | 4487 | | 15 | 100.85 | 22.30 | 4524 | | 6 | 101.09 | 22.15 | 4561 | | 21 | 101.12 | 22.40 |
| 4451 | 15.09.09 | 3 | 101.22 | 22.40 | 4488 | | 18 | 100.85 | 22.30 | 4525 | | 9 | 101.12 | 22.15 | 4562 | | 24 | 101.12 | 22.40 |
| 4452 | | 6 | 101.19 | 22.40 | 4489 | | 21 | 100.85 | 22.30 | 4526 | | 12 | 101.16 | 22.15 | 4563 | 29.09.09 | 3 | 101.09 | 22.40 |
| 4453 | | 9 | 101.19 | 22.40 | 4490 | | 24 | 100.85 | 22.30 | 4527 | | 15 | 101.16 | 22.15 | 4564 | | 6 | 101.09 | 22.45 |
| 4454 | | 12 | 101.16 | 22.40 | 4491 | 20.09.09 | 3 | 100.85 | 22.35 | 4528 | | 18 | 101.19 | 22.15 | 4565 | | 9 | 101.09 | 22.50 |
| 4455 | | 15 | 101.16 | 22.40 | 4492 | | 6 | 100.85 | 22.35 | 4529 | | 21 | 101.19 | 22.15 | 4566 | | 12 | 101.09 | 22.50 |
| 4456 | | 18 | 101.12 | 22.40 | 4493 | | 9 | 100.85 | 22.35 | 4530 | | 24 | 101.22 | 22.10 | 4567 | | 15 | 101.09 | 22.50 |
| 4457 | | 21 | 101.12 | 22.40 | 4494 | | 12 | 100.85 | 22.40 | 4531 | 25.09.09 | 3 | 101.22 | 22.10 | 4568 | | 18 | 101.09 | 22.50 |

| Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4569 | | 21 | 101.09 | 22.50 | 4606 | | 12 | 101.52 | 22.95 | 4643 | 09.10.09 | 3 | 101.42 | 22.55 | 4680 | | 18 | 101.05 | 22.15 |
| 4570 | | 24 | 101.05 | 22.50 | 4607 | | 15 | 101.52 | 22.90 | 4644 | | 6 | 101.39 | 22.60 | 4681 | | 21 | 101.05 | 22.15 |
| 4571 | 30.09.09 | 3 | 101.05 | 22.50 | 4608 | | 18 | 101.48 | 22.85 | 4645 | | 9 | 101.37 | 22.60 | 4682 | | 24 | 101.02 | 22.15 |
| 4572 | | 6 | 101.05 | 22.50 | 4609 | | 21 | 101.48 | 22.80 | 4646 | | 12 | 101.34 | 22.60 | 4683 | 14.10.09 | 3 | 101.02 | 22.15 |
| 4573 | | 9 | 101.05 | 22.50 | 4610 | | 24 | 101.48 | 22.75 | 4647 | | 15 | 101.32 | 22.65 | 4684 | | 6 | 101.02 | 22.15 |
| 4574 | | 12 | 101.05 | 22.50 | 4611 | 05.10.09 | 3 | 101.48 | 22.75 | 4648 | | 18 | 101.29 | 22.60 | 4685 | | 9 | 101.02 | 22.15 |
| 4575 | | 15 | 101.02 | 22.50 | 4612 | | 6 | 101.48 | 22.70 | 4649 | | 21 | 101.27 | 22.55 | 4686 | | 12 | 100.95 | 22.15 |
| 4576 | | 18 | 101.02 | 22.55 | 4613 | | 9 | 101.48 | 22.70 | 4650 | | 24 | 101.27 | 22.55 | 4687 | | 15 | 101.02 | 22.15 |
| 4577 | | 21 | 101.02 | 22.55 | 4614 | | 12 | 101.48 | 22.70 | 4651 | 10.10.09 | 3 | 101.24 | 22.55 | 4688 | | 18 | 100.98 | 22.10 |
| 4578 | | 24 | 101.02 | 22.55 | 4615 | | 15 | 101.44 | 22.75 | 4652 | | 6 | 101.24 | 22.55 | 4689 | | 21 | 100.98 | 22.10 |
| 4579 | 01.10.09 | 3 | 101.05 | 22.45 | 4616 | | 18 | 101.42 | 22.75 | 4653 | | 9 | 101.24 | 22.50 | 4690 | | 24 | 100.98 | 22.10 |
| 4580 | | 6 | 101.09 | 22.30 | 4617 | | 21 | 101.37 | 22.80 | 4654 | | 12 | 101.24 | 22.45 | 4691 | 15.10.09 | 3 | 100.95 | 22.10 |
| 4581 | | 9 | 101.09 | 22.30 | 4618 | | 24 | 101.34 | 22.80 | 4655 | | 15 | 101.22 | 22.40 | 4692 | | 6 | 100.95 | 22.05 |
| 4582 | | 12 | 101.09 | 22.45 | 4619 | 06.10.09 | 3 | 101.34 | 22.80 | 4656 | | 18 | 101.22 | 22.40 | 4693 | | 9 | 100.95 | 21.90 |
| 4583 | | 15 | 101.12 | 22.50 | 4620 | | 6 | 101.32 | 22.80 | 4657 | | 21 | 101.22 | 22.40 | 4694 | | 12 | 100.95 | 21.80 |
| 4584 | | 18 | 101.12 | 22.60 | 4621 | | 9 | 101.32 | 22.75 | 4658 | | 24 | 101.22 | 22.40 | 4695 | | 15 | 100.95 | 21.70 |
| 4585 | | 21 | 101.12 | 22.70 | 4622 | | 12 | 101.32 | 22.70 | 4659 | 11.10.09 | 3 | 101.22 | 22.40 | 4696 | | 18 | 100.95 | 21.70 |
| 4586 | | 24 | 101.16 | 22.70 | 4623 | | 15 | 101.34 | 22.70 | 4660 | | 6 | 101.22 | 22.35 | 4697 | | 21 | 100.95 | 21.65 |
| 4587 | 02.10.09 | 3 | 101.16 | 22.70 | 4624 | | 18 | 101.37 | 22.80 | 4661 | | 9 | 101.19 | 22.25 | 4698 | | 24 | 100.92 | 21.60 |
| 4588 | | 6 | 101.19 | 22.70 | 4625 | | 21 | 101.37 | 22.80 | 4662 | | 12 | 101.19 | 22.25 | 4699 | 16.10.09 | 3 | 100.92 | 21.50 |
| 4589 | | 9 | 101.19 | 22.70 | 4626 | | 24 | 101.39 | 22.80 | 4663 | | 15 | 101.19 | 22.25 | 4700 | | 6 | 100.92 | 21.40 |
| 4590 | | 12 | 101.22 | 22.75 | 4627 | 07.10.09 | 3 | 101.48 | 22.80 | 4664 | | 18 | 101.16 | 22.35 | 4701 | | 9 | 100.88 | 21.30 |
| 4591 | | 15 | 101.22 | 22.80 | 4628 | | 6 | 101.55 | 22.75 | 4665 | | 21 | 101.16 | 22.30 | 4702 | | 12 | 100.88 | 21.30 |
| 4592 | | 18 | 101.24 | 22.90 | 4629 | | 9 | 101.62 | 22.75 | 4666 | | 24 | 101.16 | 22.30 | 4703 | | 15 | 100.85 | 21.35 |
| 4593 | | 21 | 101.24 | 22.95 | 4630 | | 12 | 101.66 | 22.70 | 4667 | 12.10.09 | 3 | 101.16 | 22.25 | 4704 | | 18 | 100.85 | 21.35 |
| 4594 | | 24 | 101.27 | 23.00 | 4631 | | 15 | 101.70 | 22.65 | 4668 | | 6 | 101.16 | 22.20 | 4705 | | 21 | 100.85 | 21.35 |
| 4595 | 03.10.09 | 3 | 101.27 | 23.05 | 4632 | | 18 | 101.73 | 22.60 | 4669 | | 9 | 101.16 | 22.20 | 4706 | | 24 | 100.85 | 21.35 |
| 4596 | | 6 | 101.29 | 23.10 | 4633 | | 21 | 101.73 | 22.55 | 4670 | | 12 | 101.16 | 22.10 | 4707 | 17.10.09 | 3 | 100.85 | 21.35 |
| 4597 | | 9 | 101.29 | 23.10 | 4634 | | 24 | 101.70 | 22.55 | 4671 | | 15 | 101.16 | 22.10 | 4708 | | 6 | 100.85 | 21.35 |
| 4598 | | 12 | 101.32 | 23.15 | 4635 | 08.10.09 | 3 | 101.62 | 22.55 | 4672 | | 18 | 101.12 | 22.10 | 4709 | | 9 | 100.85 | 21.35 |
| 4599 | | 15 | 101.37 | 23.15 | 4636 | | 6 | 101.59 | 22.50 | 4673 | | 21 | 101.12 | 22.15 | 4710 | | 12 | 100.85 | 21.35 |
| 4600 | | 18 | 101.42 | 23.15 | 4637 | | 9 | 101.55 | 22.50 | 4674 | | 24 | 101.12 | 22.15 | 4711 | | 15 | 100.85 | 21.35 |
| 4601 | | 21 | 101.52 | 23.15 | 4638 | | 12 | 101.52 | 22.45 | 4675 | 13.10.09 | 3 | 101.12 | 22.15 | 4712 | | 18 | 100.85 | 21.35 |
| 4602 | | 24 | 101.52 | 23.15 | 4639 | | 15 | 101.52 | 22.45 | 4676 | | 6 | 101.09 | 22.15 | 4713 | | 21 | 100.85 | 21.35 |
| 4603 | 04.10.09 | 3 | 101.52 | 23.10 | 4640 | | 18 | 101.48 | 22.50 | 4677 | | 9 | 101.09 | 22.15 | 4714 | | 24 | 100.85 | 21.35 |
| 4604 | | 6 | 101.52 | 23.00 | 4641 | | 21 | 101.48 | 22.50 | 4678 | | 12 | 101.09 | 22.15 | 4715 | 18.10.09 | 3 | 100.85 | 21.35 |
| 4605 | | 9 | 101.52 | 23.00 | 4642 | | 24 | 101.44 | 22.50 | 4679 | | 15 | 101.05 | 22.15 | 4716 | | 6 | 100.82 | 21.35 |

| Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) | Sl No | Date | Time ( hrs) | Stage at Khairmal ( m) | Stage at Naraj ( m) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4717 | | 9 | 100.82 | 21.30 | 4745 | | 21 | 100.50 | 21.45 | 4773 | | 9 | 100.45 | 21.45 | 4801 | | 21 | 100.36 | 21.20 |
| 4718 | | 12 | 100.82 | 21.30 | 4746 | | 24 | 100.50 | 21.45 | 4774 | | 12 | 100.45 | 21.45 | 4802 | | 24 | 100.36 | 21.25 |
| 4719 | | 15 | 100.82 | 21.30 | 4747 | 22.10.09 | 3 | 100.50 | 21.45 | 4775 | | 15 | 100.45 | 21.45 | 4803 | 29.10.09 | 3 | 100.36 | 21.30 |
| 4720 | | 18 | 100.82 | 21.30 | 4748 | | 6 | 100.50 | 21.45 | 4776 | | 18 | 100.45 | 21.40 | 4804 | | 6 | 100.36 | 21.35 |
| 4721 | | 21 | 100.79 | 21.30 | 4749 | | 9 | 100.50 | 21.45 | 4777 | | 21 | 100.45 | 21.40 | 4805 | | 9 | 100.36 | 22.00 |
| 4722 | | 24 | 100.77 | 21.30 | 4750 | | 12 | 100.50 | 21.50 | 4778 | | 24 | 100.45 | 21.40 | 4806 | | 12 | 100.36 | 21.70 |
| 4723 | 19.10.09 | 3 | 100.77 | 21.30 | 4751 | | 15 | 100.45 | 21.50 | 4779 | 26.10.09 | 3 | 100.45 | 21.40 | 4807 | | 15 | 100.36 | 21.30 |
| 4724 | | 6 | 100.74 | 21.30 | 4752 | | 18 | 100.45 | 21.50 | 4780 | | 6 | 100.45 | 21.35 | 4808 | | 18 | 100.36 | 21.30 |
| 4725 | | 9 | 100.72 | 21.30 | 4753 | | 21 | 100.45 | 21.50 | 4781 | | 9 | 100.45 | 21.35 | 4809 | | 21 | 100.36 | 21.30 |
| 4726 | | 12 | 100.72 | 21.30 | 4754 | | 24 | 100.45 | 21.50 | 4782 | | 12 | 100.41 | 21.35 | 4810 | | 24 | 100.36 | 21.30 |
| 4727 | | 15 | 100.69 | 21.30 | 4755 | 23.10.09 | 3 | 100.45 | 21.50 | 4783 | | 15 | 100.41 | 21.35 | 4811 | 30.10.09 | 3 | 100.36 | 21.30 |
| 4728 | | 18 | 100.69 | 21.35 | 4756 | | 6 | 100.45 | 21.50 | 4784 | | 18 | 100.41 | 21.30 | 4812 | | 6 | 100.36 | 21.25 |
| 4729 | | 21 | 100.69 | 21.35 | 4757 | | 9 | 100.45 | 21.50 | 4785 | | 21 | 100.41 | 21.30 | 4813 | | 9 | 100.41 | 21.20 |
| 4730 | | 24 | 100.66 | 21.35 | 4758 | | 12 | 100.45 | 21.50 | 4786 | | 24 | 100.41 | 21.30 | 4814 | | 12 | 100.45 | 21.25 |
| 4731 | 20.10.09 | 3 | 100.66 | 21.40 | 4759 | | 15 | 100.50 | 21.50 | 4787 | 27.10.09 | 3 | 100.41 | 21.30 | 4815 | | 15 | 100.50 | 21.25 |
| 4732 | | 6 | 100.64 | 21.40 | 4760 | | 18 | 100.50 | 21.50 | 4788 | | 6 | 100.41 | 21.30 | 4816 | | 18 | 100.50 | 21.20 |
| 4733 | | 9 | 100.64 | 21.45 | 4761 | | 21 | 100.50 | 21.50 | 4789 | | 9 | 100.41 | 21.30 | 4817 | | 21 | 100.54 | 21.20 |
| 4734 | | 12 | 100.64 | 21.50 | 4762 | | 24 | 100.50 | 21.50 | 4790 | | 12 | 100.41 | 21.25 | 4818 | | 24 | 100.54 | 21.20 |
| 4735 | | 15 | 100.61 | 21.55 | 4763 | 24.10.09 | 3 | 100.50 | 21.50 | 4791 | | 15 | 100.41 | 21.25 | 4819 | 31.10.09 | 3 | 100.54 | 21.20 |
| 4736 | | 18 | 100.61 | 21.50 | 4764 | | 6 | 100.50 | 21.50 | 4792 | | 18 | 100.41 | 21.25 | 4820 | | 6 | 100.50 | 21.25 |
| 4737 | | 21 | 100.61 | 21.45 | 4765 | | 9 | 100.50 | 21.50 | 4793 | | 21 | 100.41 | 21.25 | 4821 | | 9 | 100.50 | 21.30 |
| 4738 | | 24 | 100.58 | 21.40 | 4766 | | 12 | 100.50 | 21.50 | 4794 | | 24 | 100.41 | 21.25 | 4822 | | 12 | 100.50 | 21.35 |
| 4739 | 21.10.09 | 3 | 100.58 | 21.40 | 4767 | | 15 | 100.50 | 21.45 | 4795 | 28.10.09 | 3 | 100.41 | 21.25 | 4823 | | 15 | 100.50 | 21.40 |
| 4740 | | 6 | 100.54 | 21.40 | 4768 | | 18 | 100.50 | 21.45 | 4796 | | 6 | 100.41 | 21.25 | 4824 | | 18 | 99.59 | 21.45 |
| 4741 | | 9 | 100.54 | 21.40 | 4769 | | 21 | 100.50 | 21.45 | 4797 | | 9 | 100.41 | 21.25 | 4825 | | 21 | 99.59 | 21.50 |
| 4742 | | 12 | 100.54 | 21.50 | 4770 | | 24 | 100.50 | 21.45 | 4798 | | 12 | 100.41 | 21.20 | | | | | |
| 4743 | | 15 | 100.50 | 21.50 | 4771 | 25.10.09 | 3 | 100.50 | 21.45 | 4799 | | 15 | 100.36 | 21.20 | | | | | |
| 4744 | | 18 | 100.50 | 21.50 | 4772 | | 6 | 100.50 | 21.45 | 4800 | | 18 | 100.36 | 21.20 | | | | | |