

## **Real Time Data Acquisition, Inflow** forecasting and flood management system



Presented By Mechatronics Systems Private Limited, Pune



 Management of Water / Flows in Rivers in a Safe and Regulated manner based on Scientific Flood Forecasting; and Controlled Releases of Water from Dams & Reservoirs to Avoid/ Minimize likely Damages to lives & properties during Excess Rainfall/ Heavy Snow Melting;

(or)

 Avoiding Artificial Droughts resultant of Unnecessary excess releases of Water from Dams, with fear of wrongly anticipated heavy water inflows based on Un-scientific Flood Forecasting and several assumptions, on account of very poor data input from Rain & River Gauging stations of catchment area; also coupled with human errors in computations under many physical & psychological constraints



- Water Basic requirement in the daily routine of human life.
- Water Natural everlasting resource unlike coal, oil etc.
- Hydropower Generation Clean, environment friendly and simple but also much more economical compared to other methods of power generation.
- Principal duty and responsibility of the Irrigation Department conserve every drop of water and judiciously utilize the water stored.
- Irregular monsoon In some bad years there are no rains, one has to face paucity of water and in some years it rains heavily creating flood havoc, damaging huge landed property including human life.
- This necessitates perfect water management a must.
- Water Utilized for the purpose of drinking, irrigation & generation of power.



• During rainy season, if the gates are kept open, lake level remain low, causing avoidable storage loss.

• Maintain optimum level as per reservoir scheduling and safely routing the flood through the spillway gates, it is necessary to operate gates in such a manner that the maximum water level (MWL) in lake is not crossed and optimum power generation is achieved.

• This requires close monitoring of the water level in lake.

• Natural tendency of the project engineer is to keep the water level in dam lower by safe margin for accommodating the replenishment likely to be received. This results in avoidable loss of storage.

• During the irrigation period, water is released through canals. Presently the canals are operated and monitored manually.



- At present gates are being operated manually.
- This necessitates an operator to be stationed permanently at the site.
- Operator is provided with charts, correlating the amount of rainfall occurring at various rain gauge stations & the consequent inflow likely to impinge on the lake and the resulting rise in water level, canal flows, canal levels, and discharges required.
- It is assumed that whenever gates are operated, they are operated according to the schedule or order of operation fixed by authorities.



This mode of operations has following limitations:

• During the rainy season the weather conditions at the dam site are adverse. Fogs, high humidity, inaccessibly are some of the reasons.

• Maintaining control manually for a long time is very rigorous, tedious, making the job very difficult.

• Negligence of person on duty can create serious situation during heavy rainfall periods.

• The dam sites and canal sites are remotely located, operators stationed at these sites required to take many readings like, lake levels, canal levels, canal flows, gate positions manually.

• In adverse conditions, operator is likely to make mistakes.



• The operator has to take the permissions from the authorities, before making any modifications as per the site conditions as he is not competent to take the decision.

• Lack of communication may cause the delay in decision and in turn havoc during emergencies.

• As there is no feedback link it is very difficult to know the actual operations/ happenings at site.

• It is difficult for the operator to transmit the information / data about the happenings at dam site, command and catchment area.

• This makes handicap situation when- main power supply fails, mechanical failure of gates, sudden downpour in the catchment, rainfall in command and so on.

• The gate operations are always done in anticipation and approximate keeping safe margins for manual and communication errors effecting in avoidable loss of usable precious water or may cause serious havoc during floods.



- For real time flood forecasting, automation of the spillway gates is not the complete solution.
- The knowledge of incoming floods in advance, through river level, rain gauge, AWS through telemetry system is most important.
- Advance knowledge of flood will help in pre depletion of reservoirs and maintain the Rule Level.
- The main function of a dam, is flood control, and to save the downstream areas from floods, and also the dam security during floods is important.
- By maintaining the rule level at Dam, by advance intimation of incoming floods, operation of spillway gates at the last moment, threatening the safety of dams and downstream areas is avoided



- The basic benefit of a local flood warning program is an increased lead time for watches and warnings at locations subject to flood risk.
- The information can be used to predict whether a flood is about to occur, when it will arrive, and how severe it will be.
- Organizations and individuals are given notice by the system so they can protect themselves and their property.
- The entire system should be capable of running on solar power at remote locations, as there is no power availability at these locations, and very high instances of load shedding.



- Most of us have the luxury of taking our data for granted. Without the experience of what would happen if we didn't have data to inform our decisions we lack appreciation for the difference it makes in our lives.
- The need for water resource management backed by timely accurate data is highlighted in these situations.
- The combination of accurate meteorological and hydrometric data can allow for informed decision making, design, flood warnings and resource allocation in situations like this. After the fact the data needs to managed, interpreted, finalized and communicated to all stakeholders.
- Having the right tools in the office is just as important as having the right tools in the field.



## **Inputs for real time Flood Management**

- Rainfall Data from Rain Gauging stations in Catchment Area
- Water Level/Discharges Data of River in U/S & D/S of Dam from River Gauging Stations
- Reservoir Levels at the Dam site
- Spillway / Head regulators of Gate Positions



#### MECHATRONICS SYSTEMS PVT. LTD. RESOURCE MANAGEMENT





- Real Time Data Recording & Self-Transmitting Rain Gauge Stations (in Catchment Area) with un-interrupted solar Power Supply
- Real time River Gauzing Sensors on U/S & D/S of Dam
- Reservoir Level Sensors at Dam Site
- Spillway Gate Position Sensors
- Control stations having Control system at Dam Site & Sub-Divisional Offices
- Master Control Room (DATA CENTER) with entire infrastructure at Decision makers Offices;
- Efficient Voice/Data Communication System for Data Transfer and Program Implementation Instructions





**Real Time Flood Forecasting** 



#### Integrated Disaster Management





#### **Smart Phone Application**









#### **Typical SMS Facility**

SMS Facility:

- Registered user gets SMS of real time data on his cell phone.
- SMS will be send on predefined time which is settable, it varies from 1, 2, 3, 4, 6, 8, 12 and 24 hour.
- User can get updated information on his cell at any time by sending request to Data center.
- User can easily add or delete his number for GSM facility .

|  | SAMSUNG   |
|--|---|
| A<br>2:<br>W<br>C<br>D<br>Y<br>C<br>Re | L.P. Goa<br>2/08/2013 08:03<br>7.L. = 92.07 mtr<br>nt= 4177.5 Ham<br>charge= 13.76 Cu<br>day Rain = 16 mm<br>um Rain = 3690 mm<br>ceved: 8:06AM |
|  | Enter message Send  |
|  |   |

# Early Warnings Notification

- Advance knowledge about an impending flood can be used to:
- Warn low-lying areas to evacuate

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- Schedule closure of schools and transportation of students
- Curtail electric and gas service to prevent fire and explosions
- Provide evacuation assistance to invalids, convalescents and others requiring help;
- Establish traffic controls to facilitate evacuation and Commissioner Office prevent inadvertent travel into hazardous areas
- Deploy fire and rescue services for continued protection

#### Alarms would be generated to the government bodies

- The Commissioner Office,
- The Collectorate and
- The local bodies like municipalities, corporations
- Alarms also, ambulance, rescue operation agencies, police fire brigades













### SCOPE OF RTDAS FOR KRISHNA & BHIMA BASIN

• Project comprises of real time data acquisition from 248 designated remote stations which include:

| * | 42  | Automatic Weather stations (AWS),               |
|---|-----|---|
| * | 189 | Automatic Rain Gauge Stations (ARG),            |
| * | 36  | Gauge discharge (GD) stations,                  |
| * | 46  | <b>Reservoir level &amp; Discharge stations</b> |
| * | 37  | Gate position sensor on 5 reservoirs.           |

- Data Centre:
  - Establishment of Data centre.
- Co-operator stations:
  - IMD, ISRO, CWC are the government entities who have established their own ARG, AWS and GD Stations in the project area with real time data dissemination facilities to their respective Data Centers. It is proposed to have the data of these 29 co-operator stations through internet from the co-operator data centers.

**Current installation Status of RTDAS FOR KRISHNA & BHIMA BASIN** 

- **\*** 38 Automatic Weather stations (AWS),
- **\*** 155 Automatic Rain Gauge Stations (ARG),
- **\*** 34 Gauge discharge (GD) stations,
- 41 Reservoir level & Discharge stations
- **\*** 31 Gate position sensor on 4 reservoirs.

• Data Centre:

- Established of Data centre.
- Co-operator stations:
  - Collected data from 25 exiting co-operator station of ISRO.



#### Typical Data collection system- GSM/GPRS



**Data Collection Platform** 

Data Centre at Sinchan Bhavan



### Typical Data collection system-Satellite Communication



**Data Collection Platform** 

Data Centre at Sinchan Bhavan



- The positions of the gates of the dams should be measured to calculate the discharge through gates. It could be spillway gates, irrigation/power outlets
- Gate positions would correspond to the discharge of water, and concerned authorities would operate the gates depending on the flood forecast.
- In case of notification of incoming flood in advance, the dam lake is emptied through dam gates, so that the incoming flood can be accommodated in the reservoir.
- Also if there are a series of cascade of dams on a river, gate positions and discharge of one dam would be communicated to the next dam.
- MECH-GMS is specially designed measurement system for radial, vertical and screw type gates. This can be interfaced with variety of sensors like leaner encoders, rotary encoders, absolute encoders and optical encoders. Special function for conversion of radial gate opening to vertical opening









- For the centralized operation of the spillway radial gates from the control room, centralized hoist motor control cubicle with automatic and manual interlocking is provided in the control room.
- The Gate Control system can be operated from the master control station through the VSAT network, which is a two way communication media. The Gates can be operated to manage the water outflow
- The Gates can be also be operated manually from the Dam control station, using the control system.





#### **Application Software- Screen Shots**





#### **Application Software- FCS Screen Shots**









#### Application Software- Rainfall Screen Shots





#### Application Software- River Guage Screen Shots





#### Application Software- Reservoir Screen Shots





#### Application Software- Reservoir Summary Reports

#### Real Time Data Acquisition System for Krishna and Bhima Basin

#### Name of Basin : Krishna

#### Automated Reservoir Water Level and Outflow Discharge Stations

|            |  |                | Hydraulic Details |              |                            | Current Data |       |                |                           |                   |
|------------|--|----------------|-------------------|--------------|----------------------------|--------------|-------|----------------|---------------------------|-------------------|
| Sr.<br>No. | Name of Automated Reservoir<br>Water Level and Outflow<br>Discharge Stations | River<br>Basin | RBL<br>(mtr)      | FRL<br>(mtr) | Live<br>Capacity<br>(McuM) | Date         | Time  | Level<br>(mtr) | Live<br>Storage<br>(McuM) | % Live<br>Storage |
| 1          | Dhom   | Krishna        | 725.40            | 747.70       | 331.05                     | 01/09/2013   | 16:45 | 746.42         | 301.85                    | 91.15             |
| 2          | Dhom Balkawadi   | Krishna        | 768.54            | 814.00       | 112.13                     | 01/09/2013   | 16:45 | 811.97         | 103.45                    | 92.23             |
| 3          | Kanher   | Venna          | 659.10            | 690.78       | 271.68                     | 31/08/2013   | 09:00 | 689.92         | 262.84                    | 94.41             |
| 4          | Urmodi   | Krishna        | 665.65            | 696.00       | 273.27                     | 01/09/2013   | 16:30 | 695.02         | 257.94                    | 94.39             |
| 5          | Koyna  | Koyna          | 611.12            | 659.43       | 2835.68                    | 01/09/2013   | 16:45 | 658.89         | 2769.70                   | 104.43            |
| 6          | Uttarmand  | Uttarmand      | 658.00            | 687.50       | 24.59                      | 01/09/2013   | 16:45 | 683.21         | 15.76                     | 64.18             |
| 7          | Morna (Gureghar)   | Morna          | 632.00            | 660.40       | 36.99                      | 01/09/2013   | 16:45 | 655.55         | 24.18                     | 65.30             |
| 8          | Warna  | Warna          | 588.20            | 626.90       | 779.35                     | 01/09/2013   | 16:45 | 626.70         | 772.65                    | 99.14             |
| 9          | Kadvi  | Kadvi          | 574.60            | 601.25       | 70.56                      | 01/09/2013   | 16:00 | 601.19         | 70.15                     | 99.42             |
| 10         | Kumbhi   | Kumbhi         | 580.50            | 612.20       | 76.50                      | 01/09/2013   | 16:45 | 611.67         | 74.55                     | 97.46             |
| 11         | Radhanagari  | Bhogawati      | 566.14            | 590.98       | 219.97                     | 01/09/2013   | 16:45 | 590.09         | 204.33                    | 92.90             |
| 12         | Dudhganga  | Dudhganga      | 607.16            | 646.00       | 679.66                     | 01/09/2013   | 16:45 | 645.24         | 653.36                    | 96.21             |
| 13         | Tembhu Barrage   | Krishna        | 552.50            | 558.50       | N/A                        | 01/09/2013   | 16:00 | 554.60         | NA                        | NA                |
| 14         | Satpewadi Barrage  | Krishna        | 539.00            | 541.50       | N/A                        | 01/09/2013   | 16:00 | 542.24         | NA                        | NA                |

# CASE STUDY OF UPPER WAR HA PROJECT



- The Wardha River, across which the Upper Wardha Dam is built, is a tributary of the Godavari River.
- From its origin, at an altitude of 785 m (2,575 ft) in Satpura Range from the Multai Plateau in Betul District of Madya Pradesh, the river flows 32 km (20 mi) in Madhya Pradesh and then enters into Maharashtra near the Multai plateau of the Satpuda range
- It flows along the entire northern and western border of the Wardha district. After traversing 528 km (328 mi), it joins Wainganga River and together it is called the Pranhita, which ultimately flows into the Godavari River.



- Kar, Wena, Jam and Erai are its left-bank tributaries whereas Madu, Bembla and Penganga are the right-bank tributaries.
- The catchment area is hilly and forested in its upper reaches from its source and the lower reaches are flat wide valleys.
- The project is located near Morshi, about 8 km (5.0 mi) towards to the east of Morshi and 56 km (35 mi) from the Amaravati town, in the Godavari River Basin.
- The river drains a catchment area of 4,302 km2 (1,661 sq mi) up to the dam site.



# FEATURES

- CATCHMENT
- TOTAL STORAGE
- Gate size
- Design Flood
- Storage against gates

4302 SQKM
786 Mm3
18 x12 Mtr. – 13 nos.
19457 Cumecs
663 Mm3



- Mowad Dam Breach in 1992 -- Effects at Upper Wardha Project.
- Heavy floods in 1994 and endanger to the dam due to loss of communication, power failure at Dam site, Regulation of flood during adverse Conditions
- In critical because major storage is against Gates
- Any mistake in flood computation, anticipation or gate operation may lead to heavy floods on D/s along with loss of precious storage.
- Experiences during the flood regulation without the Real-time System.



- D/S floods
- D/S communication due to bridge
- Submergence of substantial area, villages
- Storage loss
- Loss to property and life


### **Present Practice**

- Manual rainfall measurement
- Manual River stage gauging
- No communication means
- Reservoir Level from gauges
- Gate Measurement very crude methods
- Calculations manually based on historical data



- To avoid error arising out of human element
- Perfect and Real time Measurement
- Real time data communication
- Decision Support based on Real time data
- Automatic Calculations
- Real time automatic control
- Operational Ease



Automation system of Upper wardha project is completed in 1997. This is first fully Automated indigenous project. This Automation Project Monitor & Control following:

- Monitor Reservoir Level, Gate opening
- Control Gate operation as per ROS following gate operation schedule.
- Calculate Discharge rate, Inflow rate, contents, % contents etc.
- Calculate expected inflow.
- Monitor rainfall data from 9 field station at catchment area
- Monitor River guage levels from 4 River guage stations
- Monitor & control LBHR & RBHR Canal gates
- Monitor Flow & Bill generation of MIDC, MJP & Morshi Town.
- Monitor & Control area lighting with gallery lighting.
- Monitor & Control dewatering pump.
- Remote monitoring from sub Division, Division & Circle for monitoring.



### **Installed System – Upper Wardha**





### **Upper Wardha System Schematic**





### **Installed System – Upper Wardha**





### **Selection of Rain Gauge Locations:**

9 nos. of automatic rain gauges installed in total CA so as to represent approximately equal area for each station. Area represented by each station is verified by "Theisson's Polygon" method.

### **Rain Guage Stations**

- Bhaipur Rain gauge station
- Sahur Rain Gauge station
- Wai Rain Gauge station
- Narkhed Rain Gauge station
- Katol Rain Gauge station
- Benoda Rain Gauge Station
- Nara Rain Gauge station
- Jalalkheda Rain Gauge station
- Etava Rain Gauge station



### **River Gauge Stations:**

- Jalalkheda River Gauge station
- Chargadh River Gauge station
- Salbardi River Gauge station
- Barshingi River Gauge station

### Flow Measurement Station:

- MJP Amravati
- MIDC Morshi
- Morshi City Water Supply



- Real-time inflow forecasting based on rainfall data and river levels
- Automatic control of Spillway gates for Flood Routing as per ROS & Gate operation Schedule
- Automatic Remote control of Canal Head Regulator gates from control room as per the Rotation Planning
- Event Logging and Responsibility Assignment



## **Reservoir level station**

- Instruments Used
  - Level sensor
  - Solar/mains power supply
  - Data logger
  - Telemetry system
  - Battery backup









Gauge Room



Data Logger

- Data logger measures reservoir level and send data to the data center after every 15 minutes.
- Level sensor is used as per site condition such as radar, shaft encoder, bubbler sensor.
- All data is stored locally after every 15 minutes.
- User can view all data locally



## **Reservoir level station**

- This unit is designed for collection, storage and transmission of water level from remote Stations to control room.
- This is Micro controller based Digital Water Level Recorder reflect state of the art in micro controller based instrumentation design. The micro controller has its internal memory along, a real time clock with an LCD to display the instrument status. Digital Water Level Recorder consist of a weatherproof enclosure which contains the data logger and power supply, and comes complete with a solar panel / mains supply. Level sensor also consists of a weatherproof enclosure. This system comes with four different sensor input combinations as per user requirement, Ultrasonic / Radar Shaft Encoder / Bubbler type Level Sensor.



- The system is powered by rechargeable sealed maintenance free batteries with integral solar panel, which will easily keep the batteries charged throughout the year.
- Operate in harsh environment. Local data is stored for one year on predefined time period with facility for local retrieval of data using RS-232 serial interface.



# River /Stage Discharge station

- Instruments Used
  - Level sensor
  - Solar power supply
  - Data logger
  - Telemetry system
  - Battery backup



Data logger measures river level, calculate stage discharge and send data to the data center after

- every 15 minutes.
- Level sensor is used as per site condition such as radar, shaft encoder, bubbler sensor.
- All data is stored locally after every 15 minutes.
- User can view all data locally.



### **Rainfall Station**

- Instruments Used
  - Tipping Bucket
  - Solar power supply
  - Data logger
  - > Telemetry system
  - Battery backup











Rain Bucket

- Data logger measures rainfall & send data to the data center after every 15 minutes.
- Rainfall is stored locally after every 15 minutes.
- Data logger shows data such as today's rainfall, total rainfall on local HMI screen.
- Total rainfall automatically reset on 1<sup>st</sup> june.





### **Weather Station**

- This unit is designed for collection, storage and transmission of Weather data such as Rainfall data, Air temperature, Relative Humidity, Wind Speed, Wind Direction, Air pressure, Solar radiation from remote Stations to control room.
- Rainfall for current hour, Today's, Yesterday's and cumulative rainfall from defined date of start of mansoon (Generally 1<sup>st</sup> of June), Air temperature, Relative Humidity, Wind speed, Wind direction, Air pressure & Solar radiation, water level are continuously displayed.
- Operate in harsh environment. Local data is stored for one year on predefined time period with facility for local retrieval of data using RS-232 serial interface.
- It powered with 12 VDC Hybrid (mains & Solar) power source.





### **Weather Station**

### Instruments Used

- Weather Sensor
- Tipping Bucket
- Solar power supply
- Data logger
- Telemetry system
- Battery backup







Tipping Bucket



Full Climate Station



Data Logger

- Data logger measures rainfall, wind speed, wind direction, temperature, solar radiation, atmospheric pressure & send data to the data center after every 15 minutes.
- All data is stored locally after every 15 minutes.
- User can view all data locally.



- The positions of the gates of the dams should be measured to calculate he discharge through gates. It could be spillway gates, irrigation/power outlets
- Gate positions would correspond to the discharge of water, and concerned authorities would operate the gates depending on the flood forecast.
- In case of notification of incoming flood in advance, the dam lake is emptied through dam gates, so that the incoming flood can be accommodated in the reservoir.
- Also if there are a series of cascade of dams on a river, gate positions and discharge of one dam would be communicated to the next dam.
- MECH-GMS is specially designed measurement system for radial, vertical and screw type gates. This can be interfaced with variety of sensors like leaner encoders, rotary encoders, absolute encoders and optical encoders. Special function for conversion of radial gate opening to vertical opening









- For the centralized operation of the spillway radial gates from the control room, centralized hoist motor control cubicle with automatic and manual interlocking is provided in the control room.
- The Gate Control system can be operated from the master control station through the VSAT network, which is a two way communication media. The Gates can be operated to manage the water outflow
- The Gates can be also be operated manually from the Dam control station, using the control system.







Water supply Measurement System for Jeevan Pradhikaran, MIDC and Morshi.

- Remote Real time Data collection, Computerized Water Billing
- Water Savings and Revenue rise by about 25 to 30%
- Losses due to human negligence are stopped



- Automatic Control System for Area-Lighting
- Computerized Control System for Gallery Dewatering Pumps
- Low voltage Galley Illumination System
- 140 KVA DG sets with Auto Mains Failure panels as back-up Power Source



### Real time Data Acquisition, Monitoring & Control Software

- The MECH SCADA /MMI Software is a complete automation solution providing graphical visualization, Data acquisition and Supervisory Control for field instrumentation program.
- The MECH SCADA system is comprises of host software automation solutions including remote telemetry systems, remote terminal units (RTU), programmable logic controllers (PLCs) which are typically installed in remote areas. Communication is over long distances to the host system.
- Objects in the picture are linked to specific measurement or control data in the database to allow viewing of real time data. The objects are also animated to show, for example, the level of water in a Reservoir, Weir, Canal level or flow, Tank or the position of gate or valve. In addition, multiple colors are used to show whether the parameter is in or out of alarm condition.
- In addition to providing real time data, several tools are included for viewing historical data and generating Maintenance & Management reports.
- An event scheduler is provided for performing tasks at specific times, such as generating & printing reports.
- Facility for Exporting reports in PDF, Excel or Access formats.





### Real time Data Acquisition, Monitoring & Control Software

- MECH SCADA systems provides solution to all of your needs, suitable for a simple low cost single station with just a few I/O points, or a complex multiple screen, redundant close loop control system with unlimited of I/O points
- Distant monitoring and control achieved by MECH SCADA through the use of VHF / VSAT / INSAT / GSM / GPRS/ Microwave / Fiber Optic or normal telephone line,





- The function of the DAS is to interface with all the sensors and store the data with time stamping. It has GPS clock to synchronize events between different stations. It will log data for long periods for e.g. 365 days.
- It is capable of running in remote environments and runs on solar power.
- It can interface with various wireless networks like VSAT, INSAT, GPS/GPRS, VHF. It will be able to transmit the information at regular programmable intervals







### Data Acquisition Storage & Transmission System

- The model *DASTU-6000i* is designed for collection, storage and transmission of data from field instruments to control room and MCS
- It will operate in harsh environment also having facility for local retrieval of data using RS-232 serial interface
- It can be powered with 12Vdc Hybrid (mains and Solar) power source
- *DASTU-6000i* offers 4 AI, 8 DI, 8 DO, 1 AO further can be extended using IO expansion module *EM-4880*





### • VHF

- System installed in way back 1998, that time VSAT technology was very new, that's why VHF technology has adopted.
- GSM / GPRS
  - Subsequently, to inform emergencies to concern officers, the GSM/GPRS connectivity is provided.



- Computerized remote control system for Flood routing will utilize the parameters / data received from the monitoring system.
- Control the power outlet gates and spillway gates in such a fashion that the flood passing through river will be moderated without affecting dam safety.
- While routing the flood all parameters like rainfall in the catchment area, likely inflow, travel time, levels in the dams on u/s and d/s, etc., will be taken into account.
- The Decision Support Software (DSS) will automatically adjust the gate openings of spillway radial gates.
- The gate positions will be periodically modified on the basis of received / calculated data in close loop fashion.
- The Decision Support Software will operate the spillway gates taking into account gate operation schedule.
- While calculating the discharges reservoir operation schedule will be taken into account.



This module is designed to control the reservoir operation and is brain of the SCADA system for the flood routing. This module provides following modes of operations

- •Fully automatic mode
- •Semi-automatic mode or operator override with password security

In full automatic mode software makes all decisions. Based on the inputs received from the monitoring equipments and pre-programmed conditions and algorithm for reservoir operation schedule and gate operation schedule it calculates the discharge rate to be let out after a pre-programmed time interval.

The software continuously –

- Calculates actual inflow using change in reservoir level, expected inflow based on the rainfall and provided rainfall run-off relationship.
- Displays received / calculated data on the monitor along with the graphical representation of spillway gates.



- Calculates the time to reach MWL and FRL considering inflow rate.
- Calculates discharge required to be let out and accordingly repositions the gate taking into considerations gate operation schedule..
- Annunciates to the system operator in the abnormal event such asheavy rainfall, heavy inflow, crossing of pre-set downstream constrains, failure of any gate etc.
- Based on expected inflow and travel time to reach to reservoir, system takes decision considering down stream conditions, reservoir operation schedule, and gate operation schedule, so as not to cause any damage to lives or properties.
- For creating accommodation capacity for impinging flood, the system will activate switchgear to adjust the extent of gate opening to release the water at moderate rate.



In semi automatic mode software provides operator override after checking security password and confirmation from central control station at Dam. In this mode following options are available-

- •Gate opening against time option
- •Discharge rate / quantum against time option
- •Level to be maintained option
- •Anticipatory option

The software provides access to all these options only after the confirmation of security password.

In gate opening option operator can open the gates for a particular time interval. In this option gate operation schedule override is also provided for the higher password levels.



### Gate Based Operation:

✤In gate opening option operator can open the gates for a particular time interval.

✤In this option gate operation schedule override is also provided for the higher password levels.

#### **Discharge Based Operation:**

◆In the discharge / quantum option operator can enter the required discharge rate or a quantum of water to be released within a time interval.

Accordingly, extent of gate opening is decided by the computer, taking into consideration gate operation schedule.

◆Discharge rate higher than the downstream constrain is allowed to higher password levels.



### Level Based Mode:

✤In level to be maintained option operator can enter the level to be maintained and entered level will be maintained.

This is override to the reservoir schedule.

\*Extent of gate opening is decided by the computer, taking into consideration gate operation schedule.

This option is available with higher password levels only.

#### **Anticipatory Mode:**

✤In anticipatory option calculations of expected inflow after a predetermined time interval is done based on rainfall in the catchment and the provided rainfall run-off relationship.



- Computer system calculate and simulate the status of the reservoir after particular time interval.
- Based on these calculations operator can operate the gates manually to create accommodation capacity by releasing the water at moderate rate.
- The relevant data is stored after a pre-programmed time interval.
- This data can be used for further analysis like generation of hydrographs, inflow discharge analysis etc.
- The software provides the facility to print the data in different formats. The data related to the events occurring at dam site along with the password level of the operator is logged.
- This data is not editable and can form a black box.

Login Get Data Inflow Forecasting Gate Operation Password Sailent Features Logou



Login Ret Data Inflow Forecasting Gate Operation Password Sailent Features Logo



#### 😸 UPPER WARDHA DAM AUTOMATION



Login Get Data Inflow Forecasting Gate Operation Password Sailent Features Logout





Rain River Response XXX Gate Opening ToolStripStatusLabel3 **GMS Response** 




### 😸 UPPER WARDHA DAM AUTOMATION









Rain River Response XXX Gate Opening ToolStripStatusLabel3 **GMS Response** 

😸 UPPER WARDHA DAM AUTOMATION



Lougin Get Data Inflow Forecasting Gate Operation Password Sailent Features Logout







Rain River Response XXX Gate Opening ToolStripStatusLabel3 **GMS Response** 







GMS Response Rain River Response XXX Gate Opening ToolStripStatusLabel3



Rain River Response XXX Gate Opening ToolStripStatusLabel3 **GMS Response** 

# 🔜 UPPER WARDHA DAM AUTOMATION



Rain River Response XXX Gate Opening ToolStripStatusLabel3 **GMS Response** 

| Hour | Excess<br>Rainfall | Ordinate1 | Ordinate2 | Ordinate3 | Ordinate4 | Ordinate5 | Ordinate6 | Ordinate7 | Ordinate |
|------|--------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|
| 1    | 0.000              | 0.000     |           |           |           |           |           |           |          |
| 2    | 0.000              | 0.000     | 0.000     |           |           |           |           |           |          |
| 3    | 0.000              | 0.000     | 0.000     | 0.000     |           |           |           |           |          |
| 4    | 0.000              | 0.000     | 0.000     | 0.000     | 0.000     |           |           |           |          |
| 5    | 0.000              | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     |           |           |          |
| 6    | 0.000              | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     |           |          |
| 7    | 0.000              | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     |          |
| 8    | 0.000              | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000    |
| 9    | 0.000              | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000    |
| 10   | 0.000              | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000    |
| 11   | 0.000              | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000    |
| 12   | 0.000              | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000    |
| 13   | 0.000              | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000    |
| 14   | 0.000              | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000    |
| 15   | 0.000              | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000    |
| 16   | 0.000              | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000    |
| 17   | 0.000              | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000    |
| 18   | 0.000              | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000    |
| 19   | 0.000              | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000    |
| 20   | 0.000              | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000    |
| 21   | 0.000              | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000    |
| 22   | 0.000              | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000    |
| 23   | 0.000              | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000    |
| 24   | 0.000              | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000    |
| 25   | 0.000              | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000    |
| 26   | 0.000              | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000    |
| 27   | 0.000              | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000    |
| 28   | 0.000              | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000    |
| 29   | 0.000              | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000    |
| 30   | 0.000              | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000    |
| 31   | 0.000              | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000     | 0.000    |

| ilient Features                                       |  |                      |                           |                  |                  |                           |               |          |                 |
|---|--|----------------------|---------------------------|------------------|------------------|---------------------------|---------------|----------|-----------------|
| SALIENT FEATURE                                       | S CROP PATTE                                       | RN APPROVED          |                           |                  |                  |                           |               |          |                 |
| LOCATION  | Controlling I                                      | evels of Dam         | SUBMERGEN                 | CE               | Intigation Do    | tential                   | Expected      | l date d | of Completion   |
| Village Simbhora                                      | River Bed Level                                    | 308.30 M             | Area (in Ha.)             | 9748             | GCA              | 116978 Ha                 | Dam           | I        | n June-1993     |
| District Amravati                                     | Outlet sill Level                                  | (L.S.L) 328.50 M     | Houses<br>Amravati Dis    | 1201             | CCA              | 93603 Ha                  | Canals        | E        | y June 2011     |
| Taluka Morshi   | M.D.D.L  | 332.50 M             | Wardha Dist               | 1495             | Irrigable Comma  | and Area 78169 Ha         | Gurukuni L.)  | IS.      | y June 2013     |
| River Wardha Biver                                    | F.R.L.   | 342.50 M             | Total                     | 2696             | Irrigation Poter | itial 75020 Ha            | Pathergaon    | LIS      | v June 2013     |
| Top Sheet 20 /K/3                                     | MWL  | 343.50 M             | Population Afflecte       | d Kaan           |                  |                           |               |          |                 |
| Longitude 78 03 27"                                   | ЕТВІ   | 346.50 M             | Amravati Dist             | . 0004<br>(2152  |                  | Village benefitter        | d in Comma    | nd Are   | a               |
| CATCHMENT AREA  | STORAGE  |                      | / VV ardha Disi           | . 0100           |                  | a) Right Bank Canal       |               | 16       | Villages        |
| Maharashtra 2957 Sa                                   | Km Gross   | 78.27 Mm3            | *10ta                     | 11817            |                  | Tisa                      |               | 59       | Villages        |
| M.P. 1345 Sq.   | Km. Live   | 64.05 Mm3            | Irrigable C               | ommand Ar        | ea (Taluka) —    | Chandur Railway           |               | 22       | Villages        |
| Total 4302 Sq.  | Km. Dead Storage                                   | 14.22 Mm3            | Amravati Dis              | t.               | Ha               | Dhamangaon Riy.           |               | 86       | Villages        |
| YIELD   |  |                      | a) Morshi                 | 2770             | Ha               |                           | Total         | 183      | Villages        |
| A) 75% dependable yield                               | 1  | 500.72               | 500.72 Mm3 b) Chandur Rly |                  |                  | Gurukunj L.I.S. in Tio    | isa Ta.       | 16       | Villages        |
| 3) Deduct Upstream rese                               | ervation   | 368.152              | Mm3 d) Tiwsa              | 12358            | Ha               | Pathergaon L.I.S. in (    | handur Riv. T | a 5      | Villages        |
| ) Available yield after d                             | educting upstream                                  | 132.568              | Mm3 Mm3                   | Total 54077      | Ha               |                           | Total         | 204      | Villages        |
| D) Add for regeneration f                             | flow at 10% os U/S res                             | ervation 6,628       | Mm3 Wardha Dist           | 2521             | На               | b) Left Bank Canal        | Total         | 41       | , mages         |
| E) Add for balance stora;<br>wears as nor working tob | ge avaliable from previ<br>les prepared in serires | ous 188.271          | Mm3 a) Arvi               | 7511             | Ha               | Ashti                     |               | 55       | Villages        |
| years as per working tab<br>Net V                     | Vater avaliable for use                            | (c+d+e) 327.467      | Mm3                       | Total 16003      |                  | Arvi                      | 7.4.1         | 04       | Villages        |
| UTILISATION   |  | Masonary             | Dam                       | 10092            | па               |                           | Total         | 90       | villages        |
| Irrigation 2  | 00.203 Mm3   | Type of Spill        | way Ogee type gated       | central spillway | y                | 4                         | Total         | 300      | Villages        |
| Drinking water supply 🛽                               | 7.329 Mm3  | Length of spi        | 11way 240.50              | 10 M             | Project Eco      | nomics ( including G      | urukunj and   | l Patha  | rgaon L.I.S.) - |
| Industrial Use 2                                      | 4.735 Mm3  |                      | O.F. 91.00                | M                | a) Total antici  | ipated cost of the projed | et 137663.61  | Lakl     | 15              |
| Evaporation losses 6                                  | 8.535 Mm3  |                      | Total 2214                | 0 M              | b) Cost per H    | a. Of Area Irrigated (IC) | A) 1.9619     | Lakl     | w/Ha            |
| Total 3   | 70.802 Mm3   | May haight of        | Spilliour Sea A6:20       |                  | c) Cost per M    | m3 Gross-storage          | 200.41        | Lakl     | 15 / Mm3        |
| Rehabilitation  |  | max neight of        | 40.20                     | IVI              | d) Benefite as   | net ratio                 | 2.37          | - 10     |                 |
| Dist. Villages Affete                                 | ected Villeges Rehabil                             | tated Discharge cape | icity 19457               | M3/Sec           | u) Denemis cu    | /39-1 dillo               |               |          |                 |
| Amravati Dist. 13                                     | 12   | Crest Control        | 13                        |                  | Cancal           |                           | -             |          |                 |
| Wardha Dist. 1  | 1.5  | Length of non        | overflow portion શ 👔      | M                | a) Length of I   | Main Canal                |               |          |                 |
| Total 24  | 27   | Water Sup            | nlv                       |                  | Right Bank Ca    | anal 95.00 Km             | 0             |          |                 |
| Earthen Dam   |  | Dention              | r-J<br>r cumula to Morabi |                  | Left Bank Car    | nal 12.40 Km              |               |          | ][              |
| Type of Dam Roll filled                               | Earthen Dam  | Warud, Nand          | gaon Peth, Amravati       |                  | b) Discharge     | at Head                   | Update        | Clo      | se View         |
| Length 5588.58  | М  | Badnera, Badı        | nera Riy, Hiwarkhed       |                  | Right Bank C     | anal 37,00 Km             | 2             |          | 1947 B          |
| Man Halana 20.00                                      | м  | & 11 villages,       | Loni & 14 villages,       |                  | Left Bank Car    | aal 10.42 Km              |               |          |                 |



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Mm3

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MODE

WATER LEVEL IN GALLERY (Mtr) LAST UPDATED DATE AND TIME 26/09/2013 18:29:03

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1.04000

41.533

09/08/2013 09:25

| WIRELESS ROOM | CS                | GALLERY LIGHT1        |
|---------------|-------------------|-----------------------|
| 5 H.P PUMP    | 📕 GOLIATH CRANE   | GALLERY LIGHT2        |
| SPILLWAY      | 📕 FOCUS LIGHT 🛛 📕 |                       |
| E-DAM LEFT    | E-DAM RIGHT       |                       |
| AIR PLANT     | 📕 LIFT LIGHT 🛛 📕  |                       |
| ON STATE      | DAM LIGHT         | GALLERY LIGHT<br>MODE |



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**GALLERY LIGHT** 

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WATER LEVEL IN GALLERY (Mtr)

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WATER LEVEL IN GALLERY (Mtr) LAST UPDATED DATE AND TIME

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WATER LEVEL IN GALLERY (Mtr)

**TOTAL RELEASE FROM 1ST JUNE (LLtrs)** 

LAST UPDATED DATE AND TIME

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WATER LEVEL IN GALLERY (Mtr)

LAST UPDATED DATE AND TIME



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LAST UPDATED DATE AND TIME

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| Login       |        |
|-------------|--------|
| User Name : | user1  |
| Password :  | *****  |
|             | Cancel |

| Date :27/09/201 | 3 Time :14:21:15  |                   |                 |                   |              |               |                |              |                   |
|-----------------|-------------------|-------------------|-----------------|-------------------|--------------|---------------|----------------|--------------|-------------------|
| 🐉 start         | 🔞 Mysore City Cor | 🔯 Microsoft Excel | My Network Plac | 🗢 Local Disk (D:) | 🖙 WPKEY (G:) | SERVER WARDHA | 🐼 Upper_wardha | UPPER WARDHA | 🔦 🏯 🦀 🏝 👼 2121 PM |



|          | \$          | Spillway De  | etails    |              |
|----------|-------------|--------------|-----------|--------------|
| • Daily  | From Date : | 27/09/2012 🛩 | To Date : | 27/09/2012 🛩 |
| OMonthly | Month :     | September 🗙  | Year: [   | 2013 🛟       |
|          | Sho         | )w           |           | Close        |

| Date :27/09/201 | 13 Time :14:45:40        |                        |                      |                        |                 |                      |                     |
|-----------------|--------------------------|------------------------|----------------------|------------------------|-----------------|----------------------|---------------------|
| 🛃 start         | 🛛 💩 Mysore City Corporat | Microsoft Excel - Latl | 🔁 4 Windows Explorer | • 🧐 Upper_wardha_serve | UPPER WARDHA DA | 📲 River Gauge Yearly | 🤹 🖧 🐲 🏝 🖏 😰 2:45 PM |

#### JPPER WARDHA DAM AUTOMATION

Main Report

|            |       |              |          |          |          |                 |                   |                | FRO   | OM 03/0 | 9/2012 T      | 0 04/09/2        | 2012             |      |      |      |      |      |      |       |      |      | DATE  | 27/0 | 19/20 | 13  |
|------------|-------|--------------|----------|----------|----------|-----------------|-------------------|----------------|-------|---------|---------------|------------------|------------------|------|------|------|------|------|------|-------|------|------|-------|------|-------|-----|
|            |       |              |          | Contents |          | Inflow          | e -               | Exp.<br>Inflow | Dis   | scharge | Total<br>Flow | Time to<br>Reach | Time to<br>Reach | •    |      |      |      |      | G    | ATE ( | OPEN | ling | IN MI | TEF  | ł     |     |
| Date       | Time  | Dam<br>Level | Live     | %        | Total    | Rate            | Cum               | 9 9            | Rate  | Cum     |               | FRL              | MWL              | 1    | 2    | 3    | 4    | 5    | б    | 7     | 8    | 9    | 10    | 11   | 12    | 13  |
| 03/09/2012 | 08:00 | 341.72       | 495.3805 | 87.8300  | 609.5961 | 233.327         | 1,178.560         | 0.012          | 0.000 | 0.000   | 0.000         | 81.45            | 81.45            | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00  | 0.00 | 0.00 | 0.00  | 0.00 | 0.00  | 0.0 |
| 03/09/2012 | 13:00 | 341.75       | 497,9067 | 88.2700  | 612.1223 | 699 <i>9</i> 80 | 1,181.080         | 0.010          | 0.000 | 0.000   | 0.000         | 26:15            | 26:15            | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00  | 0.00 | 0.00 | 0.00  | 0.00 | 0.00  | 0.0 |
| 03/09/2012 | 14:00 | 341.76       | 498.7403 | 88.4200  | 612.9559 | 233.327         | 1,181920          | 0.010          | 0.000 | 0.000   | 0.000         | 77:45            | 77:45            | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00  | 0.00 | 0.00 | 0.00  | 0.00 | 0.00  | 0.0 |
| 03/09/2012 | 15:00 | 341.77       | 499.5947 | 88.5700  | 613.8103 | 236.105         | 1,182.770         | 0.011          | 0.000 | 0.000   | 0.000         | 75:50            | 75:50            | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00  | 0.00 | 0.00 | 0.00  | 0.00 | 0.00  | 0.0 |
| 03/09/2012 | 16:00 | 341.78       | 500.4398 | 88.7200  | 614,6554 | 236.105         | 1,183.620         | 0.011          | 0.000 | 0.000   | 0.000         | 74:50            | 74:50            | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00  | 0.00 | 0.00 | 0.00  | 0.00 | 0.00  | 0.  |
| 03/09/2012 | 17:00 | 341.78       | 500.4398 | 88.7200  | 614.6554 | 0.000           | 1,183.620         | 0.012          | 0.000 | 0.000   | 0.000         | 999999           | 999.99           | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00  | 0.00 | 0.00 | 0.00  | 0.00 | 0.00  | 0.0 |
| 03/09/2012 | 18:00 | 341.78       | 500.4398 | 88.7200  | 614.6554 | 0.000           | 1,183.620         | 0.013          | 0.000 | 0.000   | 0.000         | 999999           | 999999           | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00  | 0.00 | 0.00 | 0.00  | 0.00 | 0.00  | 0.0 |
| 03/09/2012 | 19:00 | 341.79       | 501.2856 | 88.8700  | 615.5012 | 233.327         | 1,184.460         | 0.014          | 0.000 | 0.000   | 0.000         | 74.43            | 74:43            | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00  | 0.00 | 0.00 | 0.00  | 0.00 | 0.00  | 0.0 |
| 03/09/2012 | 20:00 | 341.80       | 502.1323 | 89.0200  | 6163479  | 236.105         | 1,185310          | 0.015          | 0.000 | 0.000   | 0.000         | 72:50            | 72:50            | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00  | 0.00 | 0.00 | 0.00  | 0.00 | 0.00  | 0.0 |
| 03/09/2012 | 21:00 | 341.82       | 503.8278 | 89.3200  | 618.0434 | 469.431         | 1,187.000         | 0.017          | 0.000 | 0.000   | 0.000         | 3538             | 35:38            | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00  | 0.00 | 0.00 | 0.00  | 0.00 | 0.00  | 0.0 |
| 03/09/2012 | 22:00 | 341.84       | 505.5263 | 89.6200  | 619.7419 | 472.209         | 1,188.700         | 0.018          | 0.000 | 0.000   | 0.000         | 34:25            | 34:25            | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00  | 0.00 | 0.00 | 0.00  | 0.00 | 0.00  | 0.0 |
| 03/09/2012 | 23:00 | 341.87       | 508.0798 | 90.0800  | 622.2954 | 711.091         | 1,191.260         | 0.020          | 0.000 | 0.000   | 0.000         | 21:51            | 21:51            | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00  | 0.00 | 0.00 | 0.00  | 0.00 | 0.00  | 0.0 |
| 04/09/2012 | 00:00 | 341.88       | 508,9325 | 90.2300  | 623.1481 | 236.105         | 1,192.110         | 0.022          | 0.000 | 0.000   | 0.000         | 64:50            | 64:50            | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00  | 0.00 | 0.00 | 0.00  | 0.00 | 0.00  | 0.0 |
| 04/09/2012 | 01:00 | 341.89       | 509.7880 | 90.3800  | 624.0016 | 236.105         | 1,192960          | 0.025          | 0.000 | 0.000   | 0.000         | 63:50            | 63:50            | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00  | 0.00 | 0.00 | 0.00  | 0.00 | 0.00  | 0.0 |
| 04/09/2012 | 02:00 | 341.90       | 510.6402 | 90.5300  | 624.8558 | 238.882         | 1,193.820         | 0.028          | 0.000 | 0.000   | 0.000         | 62:6             | 62.6             | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00  | 0.00 | 0.00 | 0.00  | 0.00 | 0.00  | 0.0 |
| 04/09/2012 | 03:00 | 341.91       | 511.4952 | 90.6800  | 625.7108 | 236.105         | 1,194 <i>6</i> 70 | 0.032          | 0.000 | 0.000   | 0.000         | 61.50            | 61:50            | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00  | 0.00 | 0.00 | 0.00  | 0.00 | 0.00  | 0.0 |

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### UPPER WARDHA DAM AUTOMATION

Main Report

|            |       | ₽ <sup>7</sup> |               | 4              |               | 4              |               | FROI           | M 27/08       | /2012 TO       | D 27/08/2     | 2012           |               | 101            |               | Da             | i <b>te</b> 27/09 | /2013          |             |
|------------|-------|----------------|---------------|----------------|---------------|----------------|---------------|----------------|---------------|----------------|---------------|----------------|---------------|----------------|---------------|----------------|-------------------|----------------|-------------|
| Date       | Time  | BH             | LAIPUR        | SAHU           | R             | 2              | WAI           | NAF            | KHED          | KA             | TOL           | N              | IARA          | BENO           | DA            | JALALK         | HEDA RAIN         | ETAW           | A (M.P.     |
|            |       | Todays<br>Rain | Total<br>Rain     | Todays<br>Rain | To t<br>Rai |
| 27/08/2012 | 08:00 | 0.00           | 314.50        | 0.50           | 246.00        | 0.00           | 603.50        | 0.00           | 522.00        | 0.00           | 0.00          | 0.00           | 468.00        | 0.00           | 260.50        | 0.00           | 280.50            | 0.00           | 310         |
| 27/08/2012 | 09:00 | 0.00           | 314.50        | 0.00           | 246.00        | 0.00           | 603.50        | 0.00           | 522.00        | 0.00           | 0.00          | 0.00           | 468.00        | 0.00           | 260.50        | 0.00           | 280.50            | J.00           | 310         |
| 27/08/2012 | 10.00 | 0.00           | 314.50        | 0.00           | 246.00        | 0.00           | 603.50        | 0.00           | 522.00        | 0.00           | 0.00          | 0.00           | 468.00        | 0.00           | 260.50        | 0.00           | 280.50            | D.00           | 310         |
| 27/08/2012 | 11.00 | 0.00           | 314.50        | 0.00           | 246.00        | 0.00           | 603.50        | 0.00           | 522.00        | 0.00           | 0.00          | 0.00           | 468.00        | 0.00           | 260.50        | 0.00           | 280.50            | 0.00           | 310         |
| 27/08/2012 | 12:00 | 0.00           | 314.50        | 0.00           | 246.00        | 0.00           | 603.50        | 0.00           | 522.00        | 0.00           | 0.00          | 0.00           | 468.00        | 0.00           | 260.50        | 1.50           | 282.00            | 0.00           | 310         |
| 27/08/2012 | 13:00 | 0.00           | 314.50        | 0.00           | 246.00        | 2.00           | 605.50        | 0.00           | 522.00        | 0.00           | 0.00          | 0.00           | 468.00        | 0.00           | 260.50        | 3.50           | 284.00            | 0.00           | 310         |
| 27/08/2012 | 14:00 | 0.00           | 314.50        | 0.00           | 246.00        | 2.00           | 605.50        | 0.00           | 522.00        | 0.00           | 0.00          | 0.00           | 468.00        | 0.00           | 260.50        | 3.50           | 284.00            | 0.00           | 310         |
| 27/08/2012 | 15:00 | 0.00           | 314.50        | 0.00           | 246.00        | 2.00           | 605.50        | 0.00           | 522.00        | 0.00           | 0.00          | 0.00           | 468.00        | 0.00           | 260.50        | 3.50           | 284.00            | 0.00           | 310         |
| 27/08/2012 | 16:00 | 0.00           | 314.50        | 2.00           | 248.00        | 2.00           | 605.50        | 0.00           | 522.00        | 0.00           | 0.00          | 0.00           | 468.00        | 0.00           | 260.50        | 3.50           | 284.00            | 0.00           | 310         |
| 27/08/2012 | 17:00 | 0.00           | 314.50        | 2.00           | 248.00        | 2.00           | 605.50        | 0.00           | 522.00        | 0.00           | 0.00          | 0.00           | 468.00        | 0.00           | 260.50        | 4.00           | 284.50            | 0.00           | 310         |
| 27/08/2012 | 18:00 | 0.00           | 314.50        | 2.00           | 248.00        | 2.00           | 605.50        | 0.00           | 522.00        | 0.00           | 0.00          | 0.00           | 468.00        | 0.00           | 260.50        | 4.00           | 284.50            | 0.00           | 310         |
| 27/08/2012 | 19:00 | 0.00           | 314.50        | 2.00           | 248.00        | 2.00           | 605.50        | 0.00           | 522.00        | 0.00           | 0.00          | 0.00           | 468.00        | 0.00           | 260.50        | 4.00           | 284.50            | 0.00           | 310         |
| 27/08/2012 | 20:00 | 0.00           | 314.50        | 2.00           | 248.00        | 2.00           | 605.50        | 0.00           | 522.00        | 0.00           | 0.00          | 0.00           | 468.00        | 0.00           | 260.50        | 4.00           | 284.50            | 0.00           | 310         |
| 27/08/2012 | 21:00 | 0.00           | 314.50        | 2.00           | 248.00        | 2.00           | 605.50        | 0.00           | 522.00        | 0.00           | 0.00          | 0.00           | 468.00        | 0.00           | 260.50        | 4.00           | 284.50            | 0.00           | 310         |
| 27/08/2012 | 22:00 | 0.00           | 314.50        | 2.00           | 248.00        | 2.00           | 605.50        | 0.00           | 522.00        | 0.00           | 0.00          | 0.00           | 468.00        | 0.00           | 260.50        | 4.00           | 284.50            | 0.00           | 310         |
| 27/08/2012 | 23:00 | 0.00           | 314.50        | 2.00           | 248.00        | 2.00           | 605.50        | 0.00           | 522.00        | 0.00           | 0.00          | 0.00           | 468.00        | 0.00           | 260.50        | 4.00           | 284.50            | 00.C           | 310         |
| 28/08/2012 | 00.00 | 0.00           | 314.50        | 2.00           | 248.00        | 2.00           | 605.50        | 0.00           | 52200         | 0.00           | 0.00          | 0.00           | 468.00        | 0.00           | 260.50        | 4.00           | 284.50            | 00.C           | 310         |
| 28/08/2012 | 01.00 | 0.00           | 314.50        | 2.00           | 248.00        | 2.00           | 605.50        | 0.00           | 52200         | 0.00           | 0.00          | 0.00           | 468.00        | 0.00           | 260.50        | 4.00           | 284.50            | 00.C           | 310         |
| 28/08/2012 | 02:00 | 0.00           | 314.50        | 2.00           | 248.00        | 2.00           | 605.50        | 0.00           | 522.00        | 0.00           | 0.00          | 0.00           | 468.00        | 0.00           | 260.50        | 4.00           | 284.50            | J.00           | 310         |
| 28/08/2012 | 03.00 | 0.00           | 314.50        | 2.00           | 248.00        | 2.00           | 605.50        | 0.00           | 522.00        | 0.00           | 0.00          | 0.00           | 468.00        | 0.00           | 260.50        | 4.00           | 284.50            | 0.00           | 310         |

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| DATE       | QTY OF WATER<br>UNITS | DATE       | QTY OF WATER<br>UNITS | DATE       | OTY OF WATER<br>UNITS |
|------------|-----------------------|------------|-----------------------|------------|-----------------------|
| 01/09/2012 | 332.00                | 02/09/2012 | 332.08                | 03/09/2012 | 332.00                |
| 64/09/2012 | 332.00                | 05/09/2012 | 332.00                | 06/09/2012 | 332.00                |
| 07/09/2012 | 332.00                | 08/09/2012 | 332.00                | 09/09/2012 | 332.00                |
| 10.09/2012 | 332.00                | 11.09/2012 | 632.00                | 12/09/2012 | 332.00                |
| 13/09/2012 | 158.00                | 14/09/2012 | 925.00                | 15/09/2012 | 682.00                |
| 16/09/2012 | 701.00                | 17/09/2012 | 11,237.00             | 18/09/2012 | 566.00                |
| 19/09/2012 | 386.00                | 20/09/2012 | 1,000.000             | 21/08/2012 | 961.00                |
| 22/09/2012 | 575.00                | 23/09/2012 | 425.00                | 24/05/2012 | 451.00                |
| 25/09/2012 | 396.00                | 25.05/2012 | 447.00                | 27/08/2012 | 835.00                |
| 29/09/2012 | 682.00                | 29.09/2012 | 751.00                | 30/09/2012 | 1,215.00              |

TOTAL CONSUMPTION OF WATER 2655L00

UNITS (1 UNIT = 10,000 LTRS )

Sub Divisional Engineer Upper Wardha Dam Sub Div. II., Morshi

DATE 27/09/2013

#### VIDHARBHA IRRIGATION DEVELOPMENT CORPORATION (V.I.D.C.), NAGPUR UPPER WARDHA PROJECT DIVISION, AMRAWATI

#### WATER SUPPLY BILL

|    | ND                          | /UWDD(AED/ |  |
|----|-----------------------------|------------|--|
| 1  | CUSTOMER                    | 1          | MARARASHTRA INDUSTRIAL DEVELOPMENT CORPORATION |
| 2  | SOURCE OF WATER             | +          | UPPER WARDHA DAM                               |
| 3  | DATE OF AGGRIMENT           | 38<br>1    | 19/11/2000                                     |
| 4  | MONTH & YEAR OF CONSUMPTION |            | 9 - 2012                                       |
| 5  | TOTAL CONSUMPTION OF WATER  |            | 26550.00 UNITS (1 UNIT = 10,000 LTRS.)         |
| 6  | UNIT RATE                   | -          | RS. 38.00 PER UNIT (1 UNIT = 10,000 LTRS. )    |
| 7. | AMOUNT                      | 24         | RS 1,008,900.00                                |
| θ. | LOCAL TAXES (20 PERCENT)    | +          | RS 201,780.00                                  |
| 9  | GRAND TOTAL                 | ÷.         | R5 1,210,680.00                                |
|    |                             |            |  |

#### IN WORDS RS. Rupees Twelve Lakh Ten Thousand Six Hundred Eighty Only

C.C.TO : 1) Executive Engineer , Maharashtra Jeevan Prachikaran Div. No. 2 , Amrawati for payment 2) T.S. -3 , Divisional Office .

Sub Divisional Engineer Upper Wardha Dam Sub Div. 11, Morshi Executive Engineer Upper Wardha Dam Division, AMRAWATI

#### UPPER WARDHA DAM AUTOMATION

Main Report

~ **Pumps Report: Daily** FROM 27/09/2012 TO 27/09/2012 Date: 27/09/2013 Pump 2 Pump 3 Pump 4 Pump 5 Pump 1 Total Sump Cummulative Cumulative Cumulative Cumulative Cumulative Cumulative Date Time Level Discharge Discharge Discharge Discharge Discharge Discharge (Mtr) (LLtr) (LLtr) (LLtr) (LLtr) (LLtr) (LLtr) 27/09/2012 08:00 2.55 0.00 356.47 432.05 0.00 0.00 788.52 27/09/2012 09:00 2.55 0.00 358.06 436.19 0.00 0.00 794.25 2.55 27/09/2012 10:00 440.91 0.00 0.00 0.00 359.15 800.06 27/09/2012 11:00 2.55 0.00 363.46 445.13 0.00 0.00 808.59 27/09/2012 12:00 2.55 0.00 367.80 445.80 0.00 0.00 813.59 27/09/2012 13:00 2.55 0.00 369.88 450.87 0.00 0.00 820.76 2.55 27/09/2012 14:00 0.00 372.98 455.59 0.00 0.00 828.58 27/09/2012 15:00 2.55 0.00 376.88 460.31 0.00 0.00 837.19 27/09/2012 16:00 2.55 0.00 381.42 460.48 0.00 0.00 841.90 27/09/2012 17:00 2.55 0.00 383.51 465.56 0.00 0.00 849.07 2.55 27/09/2012 18:00 0.00 386.47 470.28 0.00 0.00 856.74 27/09/2012 19:00 2.55 0.00 390.30 475.52 0.00 0.00 865.82 27/09/2012 20:00 2.55 0.00 395.05 475.55 0.00 0.00 870.60 27/09/2012 21:00 2.55 0.00 397.14 480.24 0.00 0.00 877.38 27/09/2012 22:00 2.55 0.00 400.03 484.96 0.00 0.00 884.99 27/09/2012 23:00 2.55 404.13 489.18 0.00 0.00 893.31 0.00 28/09/2012 00:00 2.35 0.00 408.47 489.76 0.00 0.00 898.23 2 35 28/09/2012 01:00 0.00 410.70 493 90 0.00 0.00 904 60 Total Page No.: 1 Zoom Factor: 100% Current Page No.: 1 💩 Mysore City Corpor. 🔀 Microsoft Excel - Lat... a Windows Explorer 🍻 Upper\_wardha\_serv... 🧏 UPPER WARDHA DA. 🔛 UPPER WARDHA DA.. 👹 Pum Daily Window - . . 🔍 ) 🏯 🐲 🏝 🐌 🛃 - 2:48 PM -🛃 start

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#### UPPER WARDHA DAM AUTOMATION

Main Report

|  |            |       |                        |                     |                    | 3                   |  |
|--|------------|-------|------------------------|---------------------|--------------------|---------------------|--|
|  | Date       | Time  | WARDHA<br>(JALALKHEDA) | CHARGAD<br>(YEWATI) | MALU<br>(SALBARDI) | JAM<br>(BHARSHINGI) |  |
|  | 26/00/2012 | 08.00 | River Level            | River Level         | River Level        | River Level         |  |
|  | 26/00/2012 | 00.00 | 0.48                   | 0.00                | 0.92               | 0.75                |  |
|  | 26/09/2012 | 10.00 | 0.41                   | 0.00                | 0.91               | 0.00                |  |
|  | 26/09/2012 | 11:00 | 0.35                   | 0.00                | 0.20               | 0.01                |  |
|  | 26/09/2012 | 12:00 | 0.20                   | 0.00                | 0.20               | 0.70                |  |
|  | 26/09/2012 | 12:00 | 0.21                   | 0.00                | 0.00               | 0.75                |  |
|  | 26/09/2012 | 14:00 | 0.15                   | 0.00                | 0.80               | 0.71                |  |
|  | 26/09/2012 | 15:00 | 0.21                   | 0.00                | 0.84               | 0.73                |  |
|  | 26/09/2012 | 16:00 | 0.22                   | 0.00<br>0.00        | 0.86               | 0.78                |  |
|  | 26/09/2012 | 17:00 | 0.52                   | 0.00                | 0.84               | 0.91                |  |
|  | 26/09/2012 | 18:00 | 0.38                   | 0.00                | 0.87               | 0.99                |  |
|  | 26/09/2012 | 19:00 | 0.39                   | 0.00                | 0.89               | 1.18                |  |
|  | 26/09/2012 | 20:00 | 0.39                   | 0.00                | 0.88               | 1.41                |  |
|  | 26/09/2012 | 21:00 | 0.38                   | 0.00                | 0.90               | 1.56                |  |
|  | 26/09/2012 | 22:00 | 0.39                   | 0.00                | 0.91               | 1.91                |  |
|  | 26/09/2012 | 23:00 | 0.38                   | 0.00                | 0.91               | 2.07                |  |
|  | 27/09/2012 | 00:00 | 0.38                   | 0.00                | 0.91               | 2.07                |  |
|  | 27/09/2012 | 01:00 | 0.38                   | 0.00                | 0.92               | 1.98                |  |
|  | 27/09/2012 | 02.00 | 0.38                   | 0.00                | 0.02               | 1.02                |  |

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W UPPER UPPER WARDHA DAM AUTOMATION



Date :27/0

🐴 start





## Comparison for 2006

### Duration

1<sup>St</sup> June 2006 to 10<sup>th</sup> June 2006 11<sup>th</sup> June 2006 to 20<sup>th</sup> June 2006 21<sup>st</sup> June 2006 to 30<sup>th</sup> June 2006 1<sup>st</sup> July 2006 to 10<sup>th</sup> July 2006 11<sup>th</sup> July 2006 to 20<sup>th</sup> July 2006 21<sup>st</sup> July 2006 to 30<sup>st</sup> July 2006 31<sup>st</sup> July 2006 to 9<sup>th</sup> Aug 2006 10<sup>th</sup> Aug 2006 to 19<sup>th</sup> Aug 2006 20<sup>th</sup> Aug 2006 to 29<sup>th</sup> Aug 2006 30<sup>th</sup> Aug 2006 to 29<sup>th</sup> Aug 2006 9<sup>th</sup> Sept 2006 to 18<sup>th</sup> Sept 2006 19<sup>th</sup> Sept 2006 to 28<sup>th</sup> Sept 2006 29<sup>th</sup> Sept 2006 to 30<sup>th</sup> Sept 2009 **Total** 

| Per 10 days<br>yield(Expected) | Per 10 days<br>yield(Actual) |
|--------------------------------|------------------------------|
| 30125                          | 30250.5                      |
| 63147.37219                    | 45087.3                      |
| 44941.51269                    | 31436                        |
| 107103.1842                    | 42499.2                      |
| 38346.31076                    | 24072.1                      |
| 51794.97769                    | 33219.1                      |
| 37639.33949                    | 50422                        |
| 58364.26653                    | 64145.8                      |
| 35302.48052                    | 50393.5                      |
| 30123.45847                    | 129701                       |
| 56719.84401                    | 156451.3                     |
| 43116.77061                    | 105291.6                     |
| 13290.50621                    | 19999                        |
| 610015.0234                    | 782968.4                     |

## Accuracy of the Result is :- 77.027 %

# Trends Showing 10 days Yield from 1<sup>st</sup> June 2006 to 30<sup>th</sup> Sept 2006



## **Trends Showing Hourly Inflow from 1<sup>st</sup> June** 2006 to 30<sup>th</sup> Sept 2006





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# MECHATRONICS SYSTEMS PVT. LTD.

- Optimisation of water storage
- Real time remote reservoir monitoring and control
- Instantaneous Decision making
- Well advanced flood forecasting
- Efficient flood routing
- Increase in power generation
- Safety of dam structures
- Reduction / Elimination of man-made errors
- Easy and efficient model analysis for further use
- Single room control for reservoir operation.
- Reduction in operational costs.
- Increased crop production,
- Better service to the water users,
- Labour savings,
- Easy management of the water system,
- Reduced maintenance requirements,
- Fish and wildlife enhancement,
- Decreased flood damage,
- Better response to emergencies



# MECHATRONICS SYSTEMS PVT. LTD.

# Conclusion

- Flood warning is a crucial part of the flood management system, but it can only be useful if integrated in pre and post flood activities.
- Early flood warning systems are essential for the protection of the population against flood hazards as it allows people to get prepared.
- However, early flood warning systems will not prevent flooding. Increased public awareness of floods and a high level of community preparedness can be achieved and maintained by educational programs.
- The public must be involved through government organizations and local government initiatives to assess flood risk and make the necessary actions to mitigate as best as possible.

