2007-08

Field Training Report

Report submitted to-

Chief Engineer,

Hydrology Project, Nashik

(09/06/2008-15/06/2008)

जलविज्ञान प्रकल्प, नाशिक

Hydrology Project, Nashik

सरळ सेवा भरतीने सहाय्यक कार्यकारी अभियंता या पदावर नियुक्ती दिलेल्या अधिकाऱ्यांसाठी
क्षेत्रीय प्रशिक्षण कार्यक्रम, जलसंपदा विभाग

Field Training for Direct Recruits as Assistant Executive Engineer of Water Resource Department.

कालावधी: ०९ जुन ते १५ जुन २००८
Duration: 09-15 June 2008 (1 week)

"क्षेत्रीय प्रशिक्षण अहवाल"

"FIELD TRAINING REPORT"

सादरकर्ता–
Submitted by-

सहाय्यक कार्यकारी अभियंता,
जलसंपदा विभाग, महाराष्ट्र शासन

Assistant Executive Engineer,
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महाराष्ट्र अभियांत्रिकी प्रशिक्षण प्रबोधिनी, नाशिक.
Maharashtra Engineering Training Academy, Nashik

Executive Summary

Maharashtra Engineering Training Academy (META), Nashik organized training program for direct recruits - Assistant Executive Engineer of Water Resource Department (WRD), in accordance with Maharashtra Engineering Service Examination-2004.

As per schedule of training program, we were directed to undergo training at **Hydrology Project, Nashik** from 9th to 15th June 2008.We joined Hydrology Project office on 9th June 2008 and contacted to the Shri. R.N. Sonawane, Executive Engineer, Data Center Division. On the occasion of general presentation and lecture of hydrology projects, Shri. M.K. Pokale Saheb introduced us the objective and mission of Hydrology Project. The schedule for the training was as follows for Group A:-

09/06/2008	Session I: (Morning) General Presentation and lecture on Hydrology Projects
	Session II (Afternoon): Lecture on: Water Availability and Yield Calculation By: Shri. V.G Kulkarni, Asst. Chief Engineer Hydrology Project
10/06/2008	Session I (Morning): Data Centre Division, Shri. R.N. Sonawane, Executive Engineer, Hydrology Project
	Session II (Afternoon): Water Planning Division, Shri. V.G Kulkarni, Asst. Chief Engineer Hydrology Project
11/06/2008	Data Storage
12/06/2008	Water Resources, Sub-division, Nashik
13/06/2008	Water Quality Laboratory

It was nice experience to interact with the dynamic officers and staff and grasp maximum knowledge from their experience.

This report includes the brief of all these studies performed and understood by me. It was very nice experience to get in depth knowledge through this training session. It will serve as a foundation for my life. I am thankful to the officer and staff of the office, for providing us the necessary information.

Acknowledgement

I take this opportunity to express my gratitude to those whose active help and support makes field training and this report possible in the present form.

First of all, I express my sincere gratitude to hon'ble Chief Engineer of Hydrology Project **Shri. H.T. Mendhegiri Saheb**, for insisting in me the drive to work hard and for inculcating in me the discipline to think clearly.

It is the endless guidance and constant encouragement of Superintending Engineer- **Shri. M.K. Pokale saheb**, Asst. Chief Engineer**- Shri. V.G. Kulkarni saheb** and Executive Engineer of Data Center Division- **Shri. R.N. Sonawane saheb.** They shared valuable experiences with us and it was the most enjoyable part of training. I express my heartfelt gratitude for their active help.

I would like to express my gratitude to the Executive Engineer of Water Planning Division- **Shri. Avinash Wani saheb**, Shri. Madhav Hase, Shri. Nandanwar, Shri. Kshirsagar, Smt. Chitra Deshpande, Shri. Subhash Pagare, Shri. Patil, Shri. Nannaware, Shri. Dhananjay Jadhav, Shri. Bacchav for providing us necessary assistance during the training.

Definitely the knowledge, I received during this training session was a lifetime experience and it will serve as a foundation for my career.

Last, but not least, I wish to express my gratitude towards my parents and friends.

Date: /06/2008
Place: Nashik

(Assistant Executive Engineer)
Water Resources Department,
Government of Maharashtra.

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Chapter 1. About Hydrology Project

1.1 About Training at Hydrology Project

As per directions of Chief Engineer, Maharashtra Engineering Training Academy, Nasik, we submitted arrival report to Executive Engineer, Data Centre division, Hydrology Project Nashik.
One week training at Hydrology project includes-

09/06/2008	Session I: (Morning) General Presentation and lecture on Hydrology Projects
	Session II (Afternoon): Lecture on: Water Availability and Yield Calculation By: Shri. V.G Kulkarni, Asst. Chief Engineer Hydrology Project
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Interaction with Superintending Engineer: Shri. M.K. Pokale

By: Shri. V.G Kulkarni, Asst. Chief Engineer Hydrology Project

It was our pleasure to have an interaction with Superintending Engineer: Shri. **M.K. Pokale** who introduced us the objectives of Hydrology Project.
Smt. Chita Deshpande explained the organizational setup and work culture of hydrology project. Then Shri. S.H. Kshirsagar explained about water quality aspect.

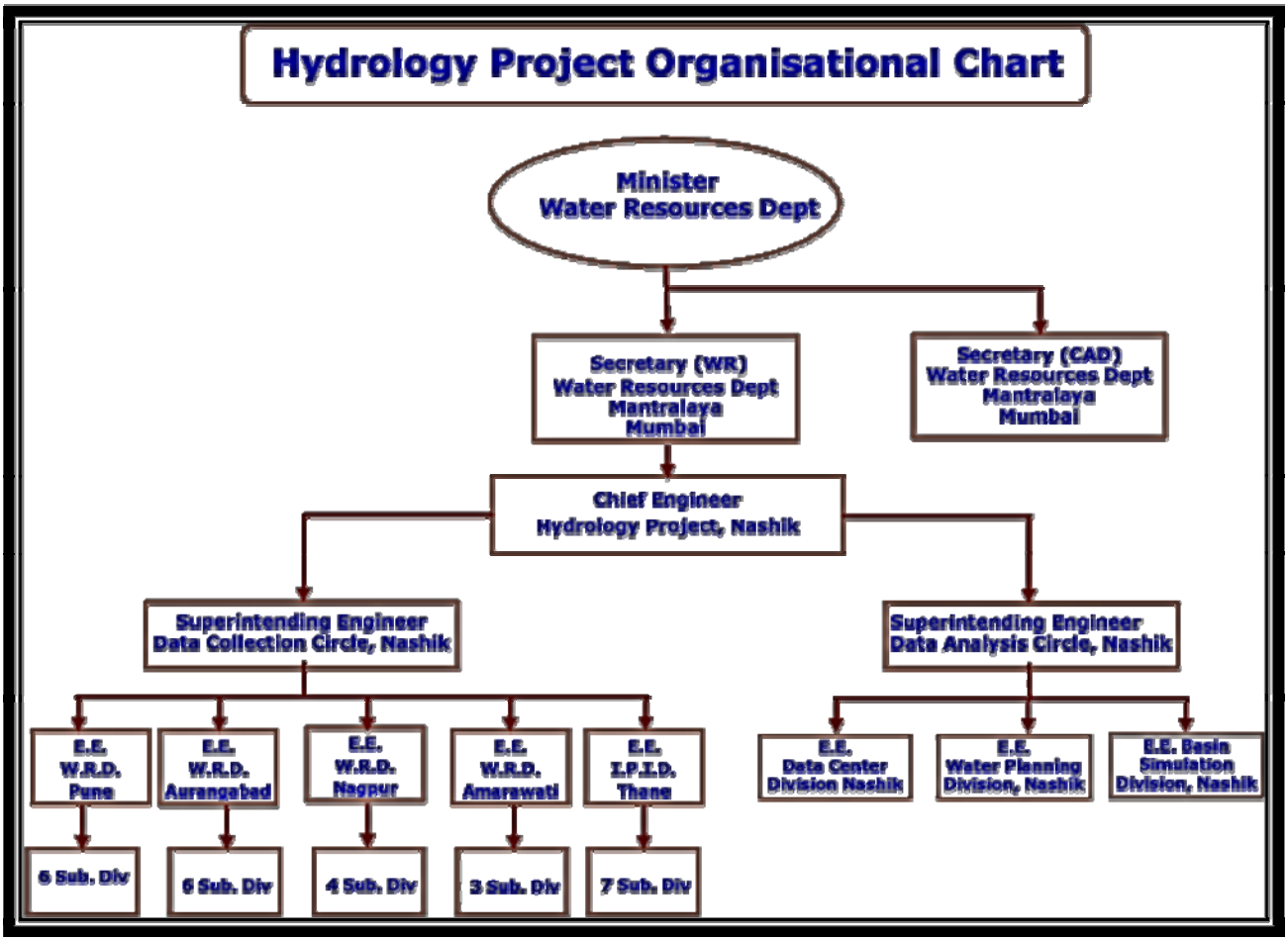
1.2 About Hydrology Project

Hydrology project is taken up with the help of World Bank under credit No. 2774-IN. The prime objective is to develop sustainable Hydrological Information System (HIS) for the participating 22 agencies including Maharashtra state in India. The Hydrological Information System comprises hydro meteorological monitoring infrastructure and a set of easily assessable comprehensive and friendly user database for data validation, processing, storage, dissemination etc.

The development of hydrological database supports major aspects of India's Water Policy particularly in allocation, planning and management of water resources. The information provided by the system is being tuned to the requirements of decision / policy makers, designers and researchers. It will be useful to take decision, to study the water resources for long term planning's or to design.

1.3 Organizational Setup

The Government authorities working for hydrology project (surface water) in the state of Maharashtra are shown in the organization chart.



1.4 Prime Objectives

The prime objective of Hydrology Project is to develop and implement a sustainable Hydrological Information System (HIS) through improvement and strengthening the infrastructure of Hydro-meteorological stations, training extensively the personnel involved and computerization of the data for meaningful analysis and dissemination to the users. The use of SW-DES and HYMOS software's in data entry and processing has resulted in giving out quality data.

The phase I of Hydrology Project with achievement of objectives cited above is completed on 31st Dec 2003.

The next phase i.e. Hydrology Project Phase II is under sanctioned by World Bank providing assistance to the tune of Rs 9.60 Crores over a period of six years and is started from July 1, 2006. The Phase II focuses basically on

demand driven dissemination and use of HIS data though HDUG and purpose driven studies based on HP data and development of decision support system.

- **Database:**

  Development of hydrological database is supporting major aspects of State and Central level Water Policy particularly in: Water Allocation, Water Planning, Water Management and Water Quality Monitoring

- **Data Centre**

  In Maharashtra State 22 sub-divisional data processing centers, 6 Divisional Data Processing Centers, main State Data Processing Center and State Data Storage Center are involved in hydrological surface water data processing and dissemination.

- **Water Availability Certificate**

  Based on the database created under HP- Phase I, Govt. of Maharashtra has authorized Hydrology Project organization to assess the yield for any project to be taken up and certify the Water Availability. The project can be sanctioned by any organization only if water availability is certified by this organization.

1.5 Hydrology Project: Phase II

Part A : Institutional strengthening

- To consolidate HP I activities.
- To extend training in HIS data processing and associated software provided under HP I and training in the use of specialized water quality equipment.
- To upgrade information technology hardware and software, and hydrometric equipments.

Part B : Vertical extension

- Creation or development of hydrological design aids for SW & WQ using well established internationally accepted methodologies.
- Development of decision support system, consisting of information system linked to appropriate models, to promote the use of the data generated under HIS in HP-I states.
- Implementation of purpose driven studies to be financed in HP I states.
  - PDS-Subjects taken are as follows.
  - Optimization of GD Stations network of HP
  - Urban hydrology of Thane metropolitan city
  - Effect of changing water allocation of Paithan (Nath sagar) irrigation project.

Various comities are formed at state and national level by MOWR, New Delhi, for selection of purpose driven studies. These studies will be completed under the guidance of National Institute of Hydrology, Roorkee.

Part C : Horizontal extension:
This component is for new participating States and Agencies.

1.6 Participating Central Agencies

- Ministry Of Water Resources (MOWR)
- Central Water Commission (CWC)
- Central Ground Water Board (CGWB)
- National Institute of Hydrology (NIH)
- Central Water & Power Research Station (CWPRS)
- Indian Meteorological Department (IMD)

Chapter 2. Data Centre Division

2.1 Introduction

The prime objective of Hydrology Project is to develop and implement a sustainable Hydrological Information (HIS) System. The chain of activities from data collection to data storage and dissemination is covered under HIS.

2.2 HIS Structure:

A HIS comprises the physical infra structure and human resources for data collection, data processing, data storage and data dissemination on hydrological, geo-hydrological and hydro-meteorological quantity and quality variables. HIS is structured to provide the information on water resources / water use system.

2.3 Data Collection

At Stations: Field data and water quality samples are collected in the surface water observation networks at the stations. The water samples are brought to the water quality laboratories. The field data is submitted to the Sub-divisional / Divisional Data Processing Center at regular intervals (monthly / quarterly).

In Water quality laboratories: The analysis of the samples is done and the analysis results are entered in the computer and are subjected to the primary validation. At regular intervals, the laboratory passes the information to the nearest Divisional Data Processing Center.

2.4 Data Processing

All the field data entry and primary validation takes place in the sub-divisional data processing center. More advanced, secondary validation is carried out in the Divisional Data Processing Center. After validation the data is transferred to the State Data Processing Center at Nashik.

The main activity of the State Data Processing Center is final data validation, compilation, analysis and reporting. At the end of hydrological year, the processed data is transferred to the State Data Storage Center at Nashik (MS).

2.5 Data Storage and Dissemination

The State Data Storage Center Nashik.

- Maintains a database system for permanent storage of hydrological data
- Administrates the storage of all field and processed hydrological data collected in the Stat.
- Makes the data available to authorized Hydrological Data Users.
- Maintains a catalogue of all data stored in its own database and those stored in the databases at the other states / Central agencies

All available data sets are being maintained in well defined computerized databases using the Oracle database management system.

2.6 The types of data stored in the database include:

- Geographical and space oriented data on catchments and hydraulic infrastructure.
- Location oriented data of observation stations and laboratories.
- Relation oriented (derived) data on two or more variables / parameters used with respect to climatic, water quantity and quality data.
- Processing results held in objects.

2.7 Hydrological Data User's Group (HDUG):

To encourage use of data banks, separate Hydrological Data User Group (HDUGs) is constituted at State Level. Purpose of HDUG is:

1. To provide a Common platform for discussions between HDUG and data providers.
2. To create awareness amongst users about HIS data and educate them on the potentials and limitations of HIS.
3. To understand, analyze and update information on the changing needs of data users from a macro level perspective.
4. To review recommended additions/ deletions in the data collection networks and related HIS, if appropriate.

Chapter 3. Water Planning Division

3.1 Methodology for Water Availability Study:

1. Marking of the project location with the help of latitude and longitude on map.
2. Identification of gauge discharge (GD) station near to project location.
3. Identification of rain gauge stations available in and around the catchment's area of GD site.
4. Monthly / yearly data availability for rain gauge and GD sites (Estimate missing rainfall data by using the standard statistical methods)
5. Formation of Thiessen Polygons to calculate average rainfall series over the catchment.
6. Computation of average rainfall series over the catchment with the help of relation developed during formation of Thiessen polygons.
7. Computation and aggregation of computed discharge to daily as it is available in hourly /twice daily / thrice daily / four times daily format.
8. Conversion of daily computed discharge in cum / sec. to daily runoff depth in mm by multiplying it by conversion factor (86.4 / catchment area in sq. km)
9. Aggregation of daily runoff depth, daily rainfall of individual station and daily average rainfall of catchment to monthly as well as yearly time interval for the available data period.
10. Compilation of the existing surface water utilization including of evaporation losses, export and import if any upstream of the river gauge discharge site for each year during the period (This data is generally available in tank gauge data format).
11. Computation of gross monsoon yields by adding the upstream utilizations to the computed monsoon yields at the river gauge site and subtracting the regeneration from net Kharif utilizations from major and medium projects (generally at 10% of utilization)
12. Conversion of gross monsoon yield to runoff depth over the catchment.
13. Using the monsoon runoff depth and corresponding average monsoon rainfall over the catchment during the period, the rainfall – runoff relationships to be developed at the river gauge discharge site based on regression analysis considering both linear and non-linear forms of equation.

Some trials are required to obtain good correlation ($0.6 < r < 1.0$). The best-fit equation is to be considered based on the least standard error for the water availability study. (Minimum 10 years rainfall and runoff data required for regression analysis).

14. The R – R correlation so developed at river gauge discharge site, is to be assumed to hold good for the entire sub basin or part catchment thereof, depending on the range of catchment, climate and precipitation characteristics. This R-R equation is also to be used for the water availability studies of projects in the basin / sub basin catchment.
15. From the non-monsoon observed yields, the average percentage of non-monsoon yield to the gross-monsoon yield at the river gauge discharge is to be worked out.
16. Using the R-R equation, the monsoon yield series for the sub basin / project site is generated. Adopting the non-monsoon yield percentage, the non-monsoon yield and then annual yield series is generated.

Generally 30 years yield series are used for the project planning (40 years series if carry over provided in project planning). Since rainfall data of longer duration than the runoff data are normally available, the regression equation can be used to generate runoff series of required period. Based on this series, the 75% and 50% dependable annual yields are obtained.

Water availability at project site: (a-b+c)

(a) 50% / 75% dependable annual yield

(b) Deduct upstream utilizations

(c) Add for regeneration:

(i) 80% of domestic and industrial use (non-irrigation use)

(ii) 10% of the net water utilization for irrigation by existing, ongoing and proposed major and medium projects.

3.2 General guidelines for the water availability studies of irrigation projects:

1. The water resources planning are required to be done for a hydrological unit such as basin as a whole or for a sub basin. The master plan of the basin / sub basin development is necessary.
2. The various interstate aspects and tribunal awards are required to be considered
3. The effect of the proposed project on the existing and ongoing projects in the sub basin / basin & upstream reservations is required to be studied.
4. Dependable yield for planning:

(a) Major and medium projects at 75 % dependability

(b) Minor irrigation projects at 50% dependability including K.T. Weirs

(c) In drought prone areas, the existing major and medium irrigation projects are to be considered as planned at 50% dependable yield and balance yield to be made available to new projects (GOM earlier guidelines, not acceptable to CWC)

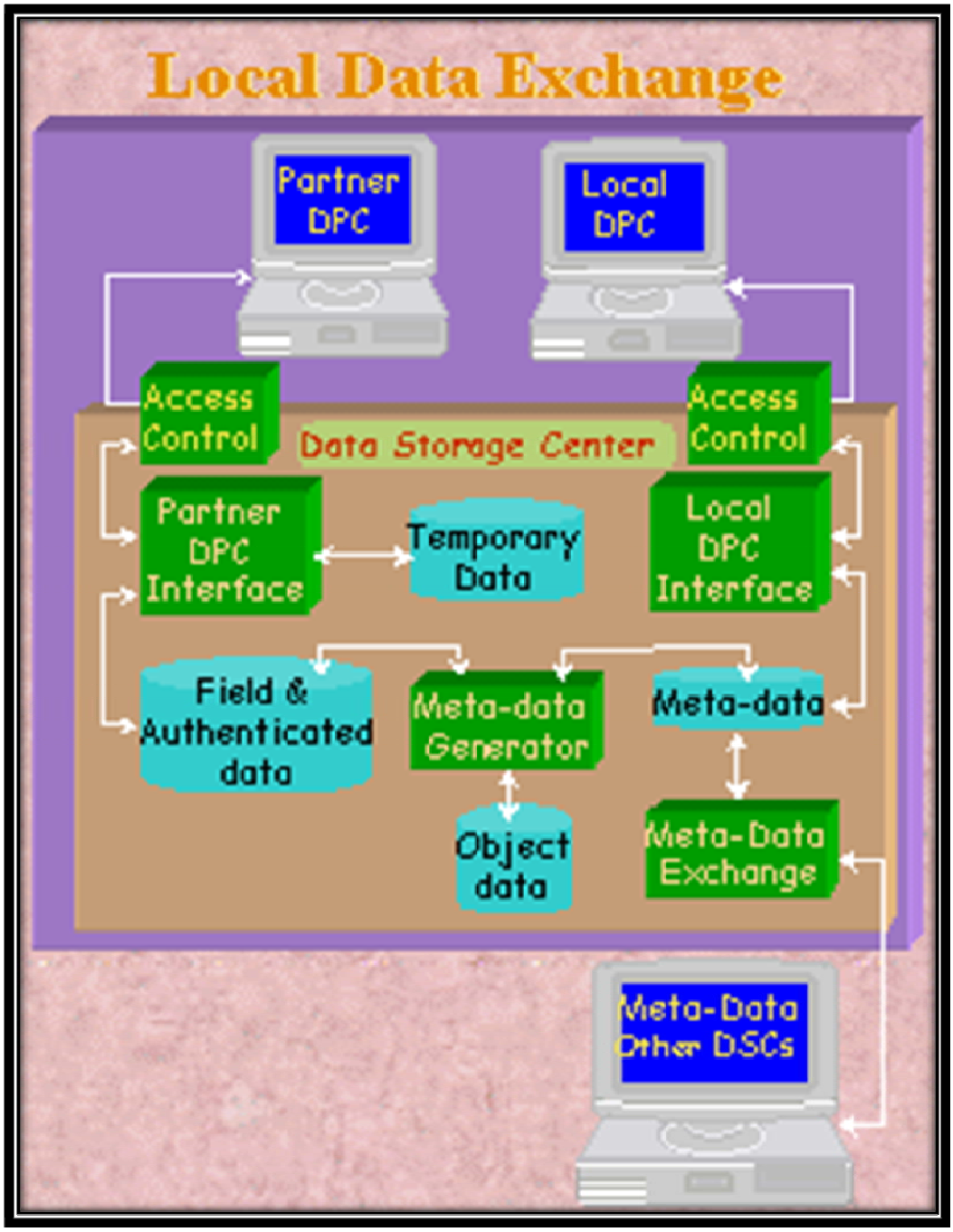
(d) Hydro power projects at 90% dependability

(e) Drinking water supply projects at 95% dependability.

5. In Konkan Bandhara, water is generally stored after flood period i.e. after September. So the yield available in streams after September shall be sufficient to fill the bandhara at least two times.
6. Monthly R-R correlation is required for water availability studies of K.T. weirs. As the needles are lowered down at the later period of the monsoon, the yield in later period shall be sufficient to meet the requirement.
7. While proposing the new projects in the upper catchment and at lower dependable yield, it is required to be seen that the dependability of existing major and medium irrigation projects will not be less than 75%.

Chapter 4 Data Storage

4.1 Architecture of Data Storage Center



Input Data Flow

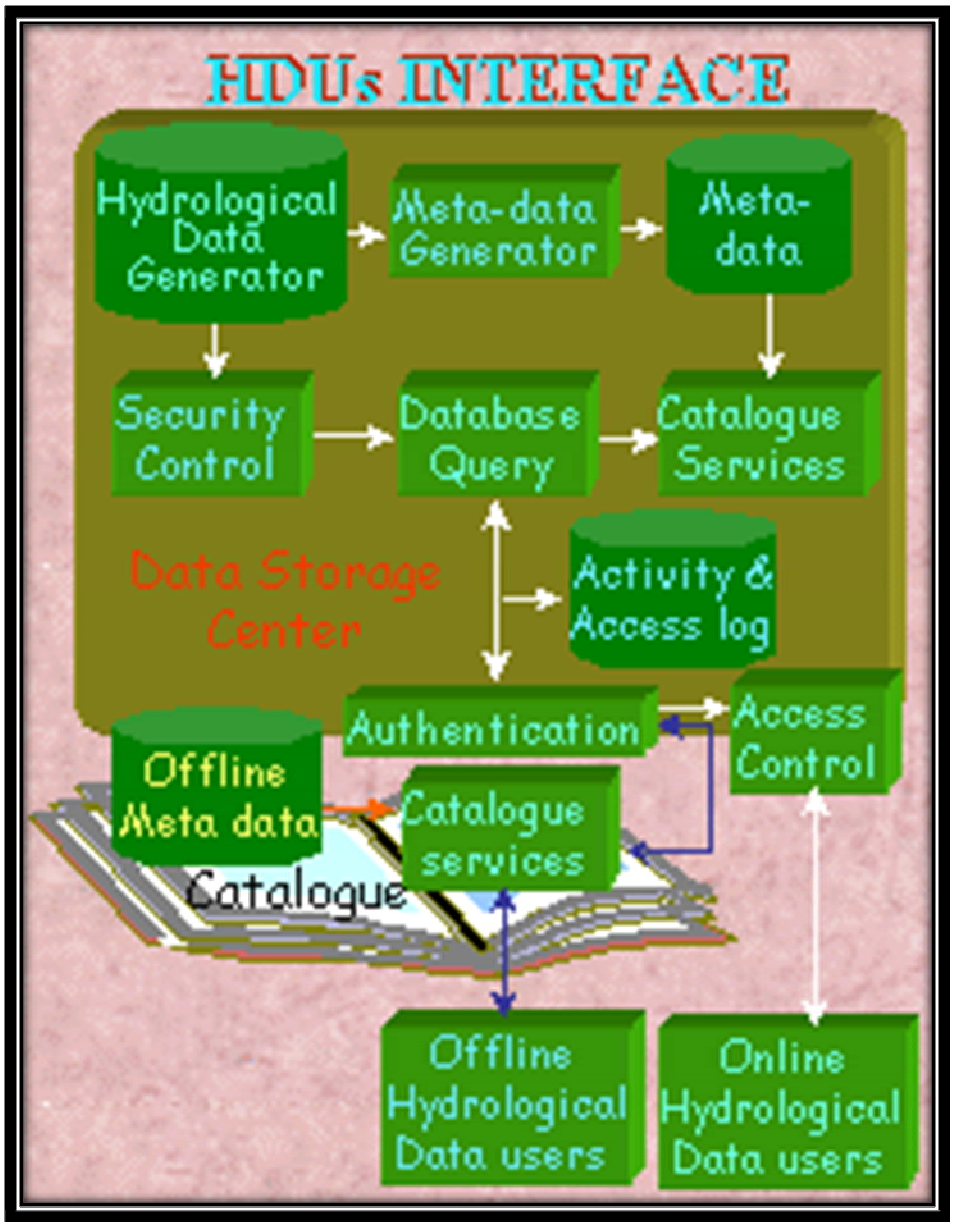
- From owner Data Processing Centers
  - Field data
  - Authenticated data
  - Object data for storage.
- From local data processing centers.
  - Temporary data
- From other data storage centers
  - Meta-data

Output Data Flow

- Requested data
  - To authenticated data users only.
- Meta data
  - To other HIS participating data storage centers.

4.2 Hydrological Data Users:

- Hydrological data users will request the Data Storage Center to supply specific hydrological data.
- The hydrological data users will have only access to the authenticated hydrological data.
- For search and selection of the required data a Catalogue will be made available.
- The Data Storage Center will verify the hydrological data user's authorization level.
- For authorized hydrological data users, the data request may run on the database and the results will be made available to the hydrological data users.



4.3 DSC Functions

Internal Functions

- Hydrological database creation & maintenance.
- Translation of data files into HIS database system..
- Maintenance and safeguarding of the stored data.
- Operation of an archive and backup system.
- Creation and maintenance of local meta-database.
- Data flow & amount monitoring.
- Preparation of reports.

External Functions

- Data import
- Data Conversion
- Data formatting
- HUB service
- Meta database replication & synchronization.
- Dissemination of the catalogue.
- Processing of requests for data.
- Export of hydrological data.
- Security on data access.
- Data Processing Center information
- User support
- Communication with other DSCs

4.4 Hydrological Data Users

- ✓ Government and state decision makers
- ✓ Authenticated Hydrological Data Users (HDUGs) and hydrology professionals.
- ✓ Ministry of water resources (MOWR)
- ✓ Central water commission (CWC)
- ✓ Central Ground Water Board (CGWB)
- ✓ State Ground Water authorities (SGW)
- ✓ Indian Meteorological Department (IMD)
- ✓ Government offices and departments like:
  - Water Resource Department
  - State Electricity Board
  - Pollution Control Boards
  - Geology and Mines Department
  - Water supply bodies,
  - Public Health
  - Agricultural
  - Industry
  - Fishery
  - Public Works Department
  - Roads and Railway departments
- ✓ Private organizations.

Chapter 5. Rain Gauge and River Gauge Stations visit

Water Resources subdivision, Nashik is situated at DGP Nagar, Nashik. The jurisdiction of this subdivision is as below:

Sr. No.	Parameters	HP	Non HP	Total
01.	Rain Gauge Station			
	1) SRG	26	33	59
	2) ARG	12	--	12
02.	Gauge Discharge Station	08	04	12
03.	Full Climatologically Station	04	02	06

The subdivision collects data of hydrological parameters like Rain fall, Max. & Min. Temperature, Humidity, Wind direction, Wind Velocity, Sunshine Hours, River Discharge and Stream velocity with various instruments.

5.1 Rainfall Measurements (Standard rain gauge and automatic rain gauge):

Standard rain gauge station gives daily rainfall whereas automatic rain gauge station gives hourly rainfall. The graph of rainfall versus time is obtained automatically plotted in ARG.

5.2 Temperature Measurement: (Minimum Temp. Thermometer, Maximum Temp. Thermometer)

These thermometers are installed to measure respective temperature. Also, the maximum & minimum temperature is recorded at 08.30 hrs & 17.30 hrs.

Thermograph: This is also a temperature recording instrument consists of daily or weekly clock driven drum. The temperature is recorded continuously and marked on graph automatically.

5.3 Humidity Measurement:

This is measured with the help of dry & wet bulb thermometer. The difference of these two temperatures is used to calculate humidity.

5.4 Pan Evaporimeter:

The important aspect of evaporation is measured using Pan Evaporimeter. The quantity of water required maintaining particular level of water in the pan every day is measured. This value is called as evaporation of that day.

5.5 Wind Vane:

This shows direction of wind. There is an instrument, which gives the wind speed. The speed is calculated on average daily basis or instantly as and when needed. The unit is m/ sec.

5.6 Sunshine Recorder:

This is the instrument, which measures the hours of sun on every day. This record is maintained daily and is useful for calculation of evapotranspiration.

5.7 Current meter:

This is mechanical device used to measure stream velocity. The number of revolutions is measured automatically and the velocity is calculated as,

$v = a \times m + b$ where, m= number of revolutions.

5.8 Floating Gauge:

Automatic stage records overcome the basic objection of manual staff gauge and find considerable use in stream flow measurement practice. In floating gauge a float operates in a stilling well connected by means of a counterweight over the pulley of recorder. Displacement of the float due to rising or lowering the float due to water level automatically recorded and gives continuous data of stage versus time.

Chapter 6. Water Quality Laboratory

6.1 Water Quality

The water quality monitoring is being carried out under hydrology project. Hydrology project (SW) Maharashtra takes care of surface water monitoring through 127 sampling locations throughout the state from last 3 to 4 years.
In accordance with decision taken in first meeting of water quality review committee of govt. of Maharashtra "The uniform protocol" water monitoring finalized by the water quality assessment authority formulated by the Ministry of Water Resources is made available to the HP, Maharashtra.
Hydrology Project (SW), Maharashtra has gone through the recommendations given in protocol and considering needs of HP (SW), Maharashtra guidelines are decided, designed and circulated to the field officers. On the basis of the protocol it is suggested to finalize criteria for classification of locations as 'Base line, TREND, Flux' etc. After collection of data for three years so that further water quality monitoring also be uniform all over and classification of location should be finalized on the basis of uniform method.
The basic objectives of water quality monitoring in HP are:

a) Monitoring and establishing the base line water quality.
b) Observing trend in water quality changes.
c) Calculating flux of water constituents of interest.
d) Control and management of water pollution.

Planning of water resource development involves ensuring the availability of water in the required quantity and appropriate quality. Biological water quality is particularly important because of potential health problems related to water borne diseases. In addition, the water quality needs for agriculture and industrial use, for preservation of environmental systems.

Water quality of some Indian rivers is now deteriorating, mainly due to discharge of chemical wastes from industrial processing and untreated or partially treated sewage.
The chemical parameters commonly determined are the ions of Calcium, magnesium, Sodium, Potassium, Iron, Manganese carbonates, Chloride, Sulfate and Nitrate, together with total dissolved solids, electrical conductivity Ec and Ph. Pollution with toxic metals and organic micro-pollutants has received a little attention.

6.2 Establishment of Water Quality Laboratory in Maharashtra

Level I Laboratories

Level II Laboratories

Level - I Laboratories:

Level I laboratories are located at surface water flow gauging sites and are equipped to measure in-situ certain parameters such as Ec, Ph, DO, BOD and TDS, which needs to be determined in 24 hours. 2-3 adjacent gauging sites can be covered from one level I laboratory. Total 38 level I laboratories are established in the state.

Level II laboratories

To perform chemical analysis for basic parameters, 5 level II well equipped laboratories are established.

6.3 Basic Parameters For Analysis in Level II Laboratories

A: Field Determination	**PH**	**EC**
	DO	TEMP
	Colour	ODOUR
B: General	PH	EC
	TDS	TSS
C: Nutrients	NH_3	NO_2 + NO_3
	TOTAL P	
D: Organic Matter	BOD	COD
E: Alkalinity	PHEN $CaCO_3$	TOTAL $CaCO_3$
F: Hardness	TOTAL	Ca^{++}
G: Major Ions	Ca	Mg
	Na	K
	Cl	SO_4
	CO_3	HCO_3
H: Other Inorganic	Si	F
	B	
I: Coliforms	TOTAL MPN/100	FECAL MPN/100
G: Biological	CHLOROPHYLL - A	

The samples collected and analyzed at the laboratory are further validated using following criteria:

A	Cations	i) Ca^{++} ii) Mg^{++}
		iii) Na^{+} iv) K^{+}
B	Anions	i) Cl^{-} ii) SO_4^{-}
		iii) CO_2 iv) HCO_3
		v) NO_2 v) NO_3
C	Total Cations	
D	Total Anions	
Data Validation:		
E	ION BALANCE	C-D/C+D
F	ION BALANCE	Na^{+}/Cl^{-}
G	EC BALANCE	TDS/EC
H	CARBON BALANCE	COD/BOD
I	CO2 BALANCE	If PH< 8.3 PHEN Alkilinity =0

6.4 Water Quality Data Processing and Management

The water quality information should be easily accessible at state and national level for planning and management purpose. Under HP, computerized data management system for storing and processing of water quality information is set up in the data centers. The state and central WQ data management systems is fully compatible and complimentary.

6.5 The water quality data systems store:

- ✓ Results of analysis
- ✓ Datum-references
- ✓ Station type
- ✓ Sampling position
- ✓ Sampling methods
- ✓ Quantity of samples
- ✓ Remarks
- ✓ Data which can be obtained from other monitoring agencies.

6.6 Dissemination of Water Quality Data

The basic water quality data stored in the state level data bank at Nashik(MS) would be easily accessible and readily available to all authorized users in an appropriate format. In addition, consolidated overviews of the current state of water quality in the state would be published regularly and relevant result of research would be disseminated widely.