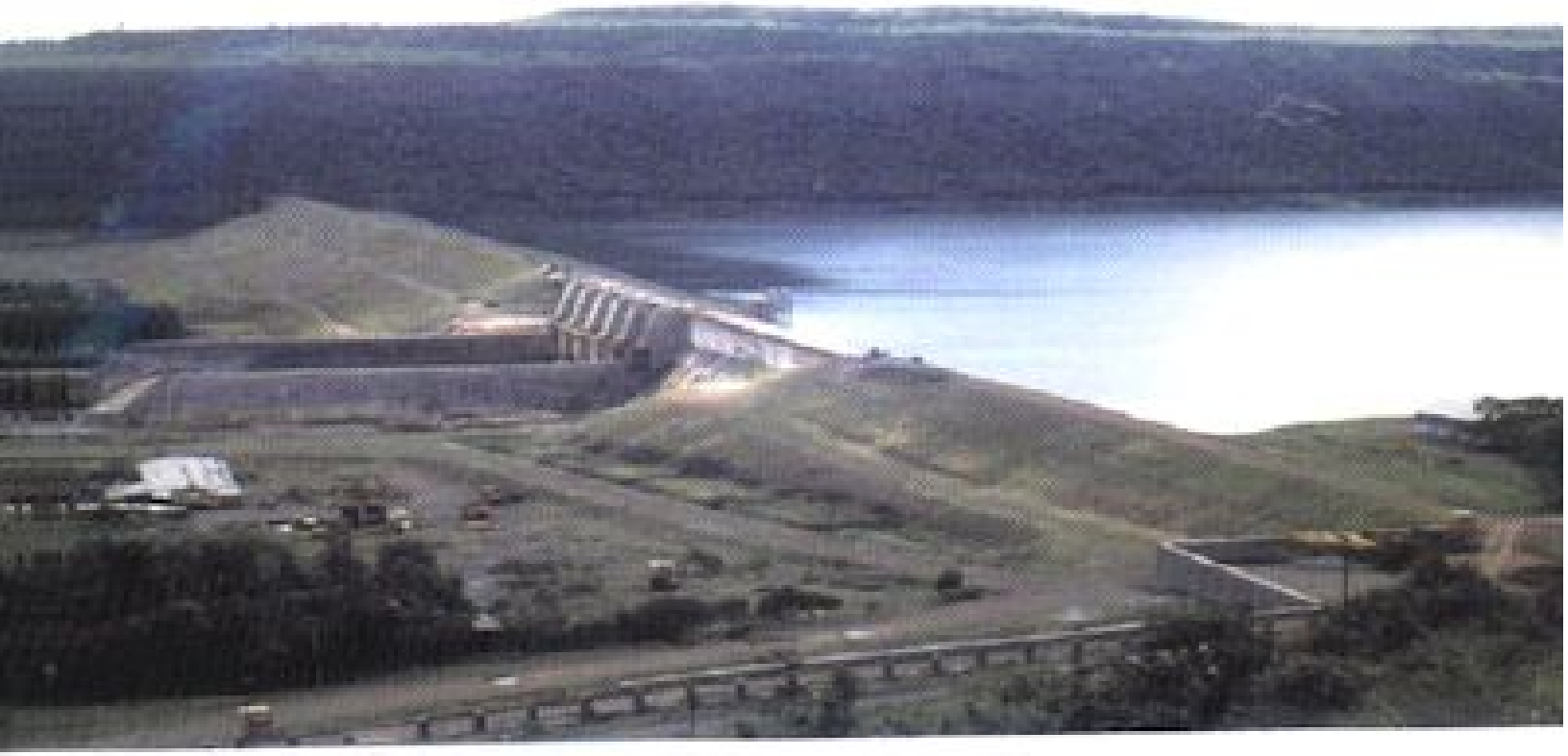
Report on
WATER AUDIT OF IRRIGATION PROJECTS
IN MAHARASHTRA
2003-04



WATER RESOURCES DEPARTMENT
GOVERNMENT OF MAHARASHTRA
MARCH 2005

REPORT
ON
WATER AUDIT
OF
IRRIGATION PROJECTS IN MAHARASHTRA
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WATER RESOURCES DEPARTMENT
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OREWORD

Water is a precious natural resource, basic human need & key element in development. The availability of surface water resources in the State from five major river basins is 164 km^3. Of the five river basin systems, four are interstate & therefore availability of water for use in the State is limited to 125 Km^3. State receives rainfall from monsoon winds in four months period. There is high variation in rainfall both with time & space. Rainfall varies from 400 to 6000 mm. About 40 percent of area of State is draught prone which necessitates storing the available water for use in the remaining period of year.

Many of the Water Resources Projects constructed by State are multipurpose projects. These water storages are now being considered as source for drinking water & industrial supply schemes for most of the cities, towns and even rural water supply schemes in the State. Therefore, a large quantity of water is being reserved for non-irrigation purposes. This has resulted in lesser availability of water for irrigation. As irrigation use entails about 80 to 85 percent of the quantity, a marginal improvement in the efficiency of water use in irrigation will result in saving substantial quantity resulting in enhanced food / fibre production. For achieving this goal, one of the methods is auditing of water use & its accounts.

In Maharashtra annual water auditing has been made mandatory as per the provisions made in State Water Policy for all major, medium and minor irrigation projects.

This is the first report being published by Government of Maharashtra. This report covers 1229 projects which include almost all major and medium projects contributing 80 percent of water resources of the State.

It would be worthwhile to mention the efforts taken by Shri S.M.Belsare, Under Secretary WRD GOM, G.V.Vyawahare & P.V.Mannikar Executive Engineer MWIC and their colleagues who have taken whole hearted efforts in preparing this report.

I would like to express thanks to Director General, WALMI, Aurangabad for getting this report printed at Aurangabad.

Comments & suggestions on this report would be highly appreciated.

(S. V. Sodal)

Secretary (CAD)

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ABBREVIATIONS

AI/DC	Area irrigated per day cusec
AIC Akola	Akola Irrigation Circle, Akola
AIC Aurangabad	Aurangabad Irrigation Circle, Aurangabad
Avg	Average
Avg Per	Average performance
BCM	Billion Cubic Metre
BIPC Buldhana	Buldhana Irrigation Project Circle, Buldhana
BIPC Parli	Beed Irrigation Project Circle, Parli Vaijanath
CAD	Command Area Development
CADA A'bad	Command Area Development Authority, Aurangabad
CBIP	Central Board of Irrigation & Power
CCA	Culturable Command Area
CIPC Chandrapur	Chandrapur Irrigation Project Circle, Chandrapur
CRT	Converted Regular Temporary
DIRD	Directorate of Irrigation Research & Development
GCA	Gross Command Area
GOI	Government of India
GOM	Government of Maharashtra
ha	Hectare
IMD	Indian Meteorological Department
KIC Kolhapur	Kolhapur Irrigation Circle, Kolhapur
KIC Ratnagiri	Konkan Irrigation Circle, Ratnagiri
Km^3	Cubic Kilometre
m	Metre
Mha	Million Hectare
mm	Millimetre
Mm^3	Million Cubic Metre
MWIC	Maharashtra Water and Irrigation Commission's office
NIC Nagpur	Nagpur Irrigation Circle, Nagpur
NIC Nanded	Nanded Irrigation Circle, Nanded
NIPC Dhule	Nashik Irrigation Project Circle, Dhule
NKIPC Thane	North Konkan Irrigation Project Circle, Thane
O & M	Operation & Maintenance
OIC Osmanabad	Osmanabad Irrigation Circle, Osmanabad
PIC Pune	Pune Irrigation Circle, Pune
PIM	Participatory Irrigation Management
PLBC	Paithan Left Bank Canal
PRBC	Paithan Right Bank Canal
SIC Sangli	Sangli Irrigation Circle, Sangli
TIC Thane	Thane Irrigation Circle, Thane
UWPC Amravati	Upper Wardha Project Circle, Amravati
WALMI	Water & Land Management Institute, Aurangabad
WRD	Water Resources Department
WUA	Water Users' Association
YIC Yavatmal	Yavatmal Irrigation Circle, Yavatmal

Chapter –1

Preface

1.0 National Scenario

Availability of natural resources, for people in India is inequitable at global level. Presently with 2.4 per cent of land and 4 per cent of water resources of the world, India has to support 16 percent of world population and 15 percent of livestock.

The availability of water on annual basis is almost fixed. India gets average precipitation of 4000 BCM per annum. Precipitation is highly, unevenly distributed with respect to time and space, all over the country. Nearly 75 % of total average annual precipitation occurs in 4 months of monsoon period. Even during the monsoon months, about 50% of total annual rainfall takes place only in 15 days and in less than 100 hours. The erratic nature of precipitation is further likely to be aggravated on account of large-scale urbanisation, deforestation and also due to impacts of global warming and climate changes on the water cycle. It is also feared that the present utilisable water resources may even go down due to unplanned human interventions. Even today regional chauvinism is creating severe water disputes among states, even in different parts of the same state and is posing threat in a big way in equitable distribution and optimum development of water resources in the country. Such problems are not showing any sign of abatement and are, in fact, likely to increase in days to come.

On the other hand, demand for fresh water is increasing with every passing day. It is not only due to rapid population growth alone, but also on account of many factors such as rise in per capita water need owing to continuous rising living standard, increased reliance on irrigated agriculture, massive urbanisation and industrialisation, etc.

As per the present indication, population of the country may stabilise by the year 2050 at around 1.6 billions. The available utilisable water resources of the country are considered less to meet all future needs. As far as Maharashtra is concerned population of Maharashtra has increased from 3.5 crores to 10 crores in last 50 years and urbanisation from 20% to 42% which has resulted into increase in drinking water requirement and industrial use. Under such a situation, in order to face the challenge of water shortage, apart from accelerating pace of development of available utilisable water resources, all out efforts, on the part of people from every walk of life, may need to be made to save every drop of water and increase efficiency of every water resources project.

2.0 State Scenario

Maharashtra is third largest state in India. The geographical area of the State is 30.80 million ha with culturable area of 22.50 million ha. The average annual rainfall of the State is 1360 mm. Nearly 88% of the total average rainfall occurs between June to September. There is large variation in the reliability of the rain in different parts of the State.

2.1 Climate

Maharashtra is having mostly a seasonal climate. Four distinct seasons are noticeable in a year viz. (1) Monsoon: The rains start with the south - west winds. Mainly it rains during the four months from June to September, but it often extends up to October. (2) Post-monsoon season: October to mid December is a fair weather season with meagre rains. These are the initial months of the post-monsoon *Rabi* crops and the condition of later depends upon the weather during these months. (3) Winter: It is generally a period of two or two-and-a-half months, from mid-December until end of February. Most of the *Rabi* crops are harvested during these months. (4) Summer: It lasts for at least three months, from March to May.

There is considerable variation in weather and rainfall among the five different geographical regions of Maharashtra.

1 The coastal districts of Konkan experience heavy rains but mild winter. The weather, however, is mostly humid throughout the year.

The maximum and minimum temperatures here range between 27^0C to 40^0C and 14^0C to 27^0C respectively. The relative humidity is 81% to 95% during June to August while 30% to 65% during January - February.

2 The western parts of Nashik, Pune, Satara and Kolhapur districts show a steep reduction in rainfall from the mountainous regions towards the East. The maximum temperature ranges between 26^0C to 39^0C and the minimum temperature between 8^0C to 23^0C. The relative humidity is 81% to 99% in August and only 20% to 39% in March.

3 The eastern part of the above four districts together with Ahmednagar, Sangli, Solapur, Aurangabad, Jalna, Beed and Osmanabad districts fall under the rain shadow of Sahyadri Mountains and therefore the beginning and end of the rainy season is quite uncertain in these parts. The rainfall is also meager. The climate is extreme. The summer temperature is high (maximum temperature 36^0C to 41^0C) but winter temperature is low (minimum temperature. 10^0C to 16^0C). The relative humidity in August is between 82% to 84% but only 19% to 26% in April. The rainfall increases as we go towards east viz. Parbhani, Nanded and Yavatmal. Many a times the eastern winds during the end of monsoon cause precipitation here.

4 Likewise the Tapi basin, the southern parts of Satpuda ranges and Dhule-Jalgaon districts towards west is low rainfall part like that of rain shadow region. But towards east, Buldhana, Akola, and Amravati districts experience a heavy rainfall. Summer temperature in this region is quite high (39^0C to 43^0C) and minimum winter temperature is found to be 12^0C to 15^0C. Relative humidity between May to August is 82% to 87% whereas in March & April it is 12% to 31%.

5 The Wainganga basin on east of Maharashtra and the hilly region still farther east is, on the whole, a zone having good rainfall, but as it is some what low lying area, the climate is even more extreme. The summer temperature is very high (39^0C to 45^0C) while it is cooler in winter as compared to other regions (12^0C to14^0C).

2.1.1 Rainfall

Maharashtra gets rain both from the south-west and the north-east monsoon winds. The proportion of the rainfall derived from the north-east monsoon increases towards east.

The average rainfall of the State is approximately 1360 mm. Nearly 88% of the total average rainfall occurs between June to September, while nearly 8% occurs between October to December and 4% after December. There is a considerable variation in the reliability of the rains in different parts of the State.

The steep decline in the rainfall to east of Sahyadri is strikingly noticeable. In the 30-50 km wide belt the average rainfall is observed to be less than 650 mm (as low as only 500 mm at some places). Thereafter the rainfall increases steadily towards east and the average rainfall in the easternmost districts is observed to be 1400 mm.

The pre-monsoon rain during March to May is maximum in Western Maharashtra (5%) while in Marathwada it is 4%, in Vidarbha it is 3% and the minimum is in Konkan (1%).

The number of average annual rainy days is maximum 95 in Konkan, 55 in Vidarbha, 51 in Western Maharashtra and the minimum 46 in Marathwada.

Out of the total cultivable land in Maharashtra about 53% is under *Kharif* and about 30% is under *Rabi* crops. These mostly comprise of food grains and oilseeds. The rainfall during June to September affects both the *Kharif* and the *Rabi* crops. That is why the regularity of rainfall during this period is of importance. But it is seen that there is considerable fluctuation in the number of rainy days as well as the amount of rainfall from year to year. The fluctuation in rainfall is observed to be 25%, 40% and between 20% to 30% in Konkan, Central Maharashtra and Vidarbha respectively. Crop management on fields during this period thereby becomes quite difficult.

2.1.2 Rainfall during 2003-04

The State received rains from South West monsoon from 16th June 2003, late by 9 days. The proportion of rainfall received during the period from 16th June to 31st October 2003 was as low as 90.3% of State's normal rainfall. As per IMD standards in 8 districts, it was deficient (41 to 80%) out of 33 districts in the State (excluding Mumbai city & Mumbai suburb). In 18 districts it was 81 to 100%, whereas in 7 districts it was above 100% of the normal. As per standards specified by IMD, out of 353 talukas in the State in 16 talukas the rainfall received was scanty (upto 40% of normal), in 127 talukas it was deficient (between 41% to 80%) whereas in 45 talukas it was excess - (i.e.20% or more above normal). The regionwise breakup of 143 talukas which received rainfall upto 80% of normal, is as follows:

Region	No. of talukas
Central Maharashtra (Nashik & Pune Divisions)	68
Vidarbha	36
Marathwada	29
Konkan	10
Source : Economic Survey of Maharashtra 2002-03	

The steep downfall in the rainfall of State since last three years, consequently affected the groundwater as well as surface water potential of the projects.

Thus, the overall picture of the rainfall received during this monsoon (2003-04) in the State was not at all satisfactory.

2.2 Agro-climatic zones

The Agriculture Department has divided the State into nine different agro-climatic zones depending upon the climate, foliage, topography, soil and cropping pattern in Maharashtra.(Map 1)

1. Very High Rainfall Zone with Lateritic Soils: This zone having lateritic soils situated between 0 to 500 m above the mean sea level and having very heavy rainfall, encompasses the South Konkan coastal region including Ratnagiri and the far-western parts of Satara and Kolhapur districts. The rainfall period in this zone exceeds 100 to 110 rainy days and the annual rainfall is between 2000 to 3000 mm. The soil is predominantly of lateritic type derived from Basalt. Small belts of saline soils are noticed to have been formed near the river mouths. Paddy is the main crop in the low lying areas while finger millet is cultivated on other areas. Horticulture is also practised on a large scale.

2. Very Heavy Rainfall Zone with Non-lateritic Soils: This is akin to the aforementioned lateritic soils and very high rainfall zone in respect of altitude from the sea level and incident rainfall. It encompasses Thane and northern part of Raigad districts and western-most parts of Nashik, Ahmednagar and Pune districts. Red to grey reddish loamy soils devoid of lateritic rocks occur predominantly in this area. Near the river deltas alluvium and saline soils occur. Paddy, finger millet and pulses are predominantly grown in this region. Similarly, this region is also conducive to horticulture and for growing mango, coconut, arecanut, sapota, banana etc. Movements on the Bay of Bengal lead to very intense rains in Konkan. While receding to west these cyclonic storms reach to South Maharashtra, resulting in good rains in winter up to Kolhapur and Sangli.

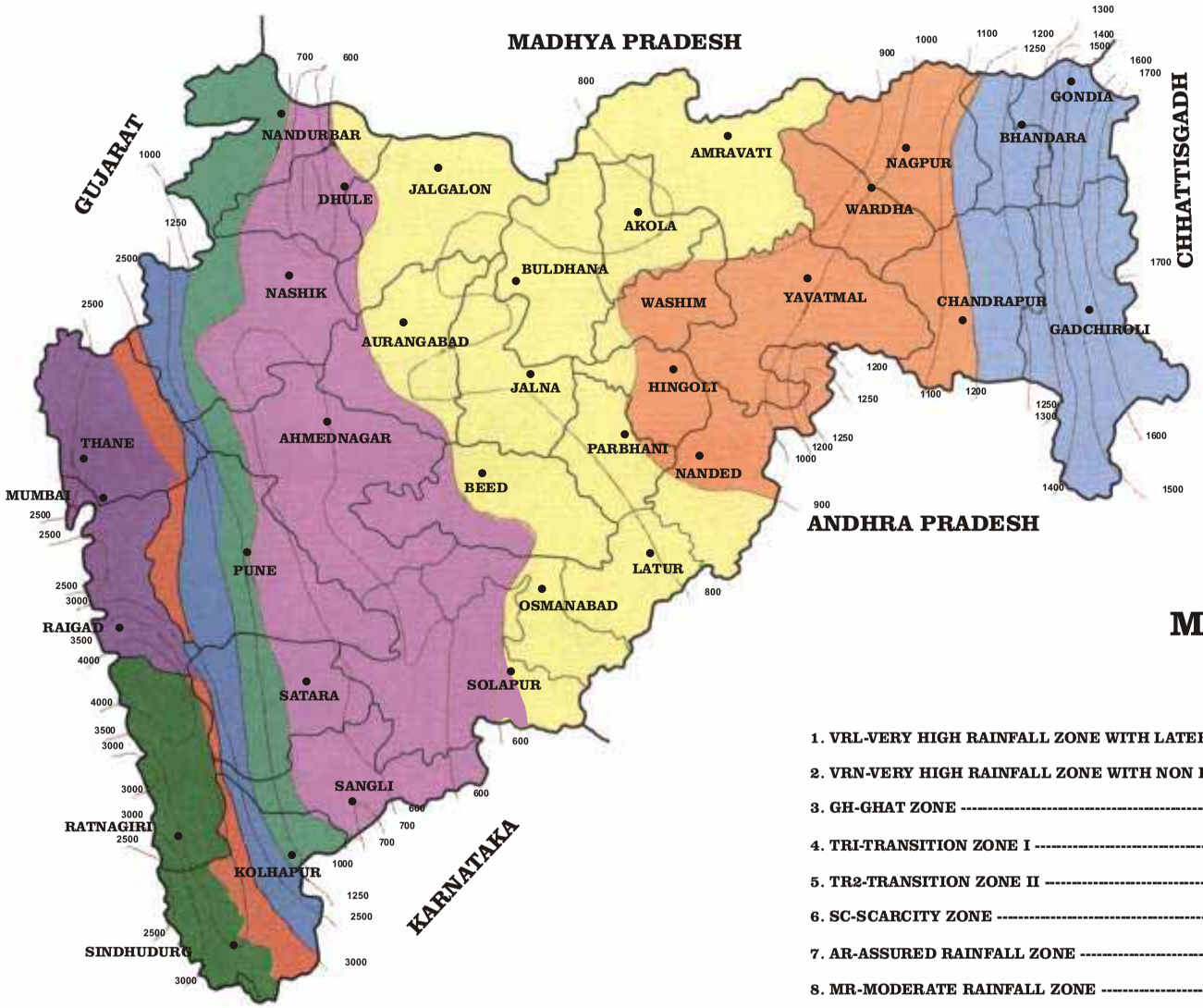
3. *Ghat Zone:* Sahyadri ranges and the region with slope 500 to 1500 m on its west extends to the west of Nashik, Ahmednagar, Pune, Sangli and Kolhapur districts. Average annual rainfall in this part is of the order of 2500 to 4000 mm. The soils on slope of hill ranges are shallow, pale grey to dark grey and laden with silty alluvium. Hilly ranges on west of this region exhibit red to red grey lateritic soils. The principal crop of this area is finger millet.

4. Transition Zone – I: The part of 500 to 1000 m altitude on eastern slope of Western *Ghat* belonging to Dhule, Nashik, Ahmednagar, Pune and Satara districts falls in Transition Zone-I. The rainfall of this zone ranges from 1250 to 2500mm. The reddish and black soil occurring in this area is derived from basaltic rocks. Heavy rains in winter are conducive to paddy growing. Pearl millet, sorghum and groundnut are the principal crops grown in low lying part.

5. Transition Zone - II: The undulating terrain of the plains comprises the Transition Zone – II. The central part of west (middle – west part) of Dhule, Nashik, Ahmednagar, Pune, Satara, Sangli districts and north-east part of Kolhapur district fall in this zone. The altitude of this zone from sea level varies from 300 to 1000 m and rainfall variation is of the order of 700 to 1200 mm The entire terrain is underlain by Deccan Trap. The soils are greyish to dark-greyish and varying in depth. The major *Kharif* crops are pearl millet, sorghum and groundnut while paddy is cultivated in scattered strips on small scale.

6. Scarcity Zone: This vast scarcity plains zone is situated at an average altitude of 600 m. The zone encompasses eastern parts of Dhule, Nashik, Ahmednagar, Pune, Satara, Sangli and western parts of Jalgaon, Solapur, Beed and

MAP SHOWING AGRO-CLIMATIC ZONES



MAHARASHTRA STATE

1. VRL-VERY HIGH RAINFALL ZONE WITH LATERITIC SOILS ----------
2. VRN-VERY HIGH RAINFALL ZONE WITH NON LATERITIC SOILS ---
3. GH-GHAT ZONE ----------
4. TRI-TRANSITION ZONE I ----------
5. TR2-TRANSITION ZONE II ----------
6. SC-SCARCITY ZONE ----------
7. AR-ASSURED RAINFALL ZONE ----------
8. MR-MODERATE RAINFALL ZONE ----------
9. HRM-HIGH RAINFALL ZONE WITH SOILS FROM MIXED PARENT MATERIAL ----------

Osmanabad districts. The zone is bounded between isohytes of 500 and 700 mm. Moreover, the rainfall is unevenly distributed. The terrain of this zone too is underlain by Deccan Trap. The soils are calcareous greyish black in colour and are of varying depths and textures. The cropping pattern is of *Kharif-cum-Rabi* type.

7. Assured Rainfall Zone: The terrain is situated at an altitude lesser than 600 m. Major parts of Jalgaon, Aurangabad and Osmanabad and eastern parts of Beed, Parbhani, Nanded, Akola and Amravati are bounded within this zone. Rainfall range is between 700 to 900 mm. The rains necessary for *Kharif* crops are assured in this zone. The *Kharif* crops mainly include sorghum, cotton and groundnut. Calcareous clay of dark greyish to black colour formed from Deccan Trap occurs in this zone.
8. Moderate Rainfall Zone: This zone, characterised by moderately assured rains and soft soils, is situated at an altitude the same as that of assured rainfall zone. Wardha, Nagpur, Yavatmal and part of Amravati fall in this zone. The rainfall ranges from 900 to 1250 mm and is evenly distributed in the south-west monsoon period. The depth and texture of soils formed of Deccan Trap vary in different parts of the zone. Alluvium occurs in Tapi, Wardha and Painganga river basins. *Kharif* crops are extensively grown in the very rich soils of these basins. Alongwith, *Rabi* crops are also harvested. The low pressure belt developed in the Bay of Bengal causes intense rains in this zone.
9. High Rainfall Zone with Soils from Mixed Parent Material: This zone of Wainganga Basin, soils of which are formed from the composite parent rocks and which is characterised with high rainfall, extends over Chandrapur, Bhandara, Gadchiroli and eastern part of Nagpur with an assured rainfall between 700 to 1250 mm on an average. The soils of this zone are derived from gneisses, granites and other Dharwad and Vindhyan period mountainous rocks. It is formed into red sandy loams or black clayeysoils. The predominant crop is paddy in *Kharif* season and wheat & sesame are main Rabi crops.

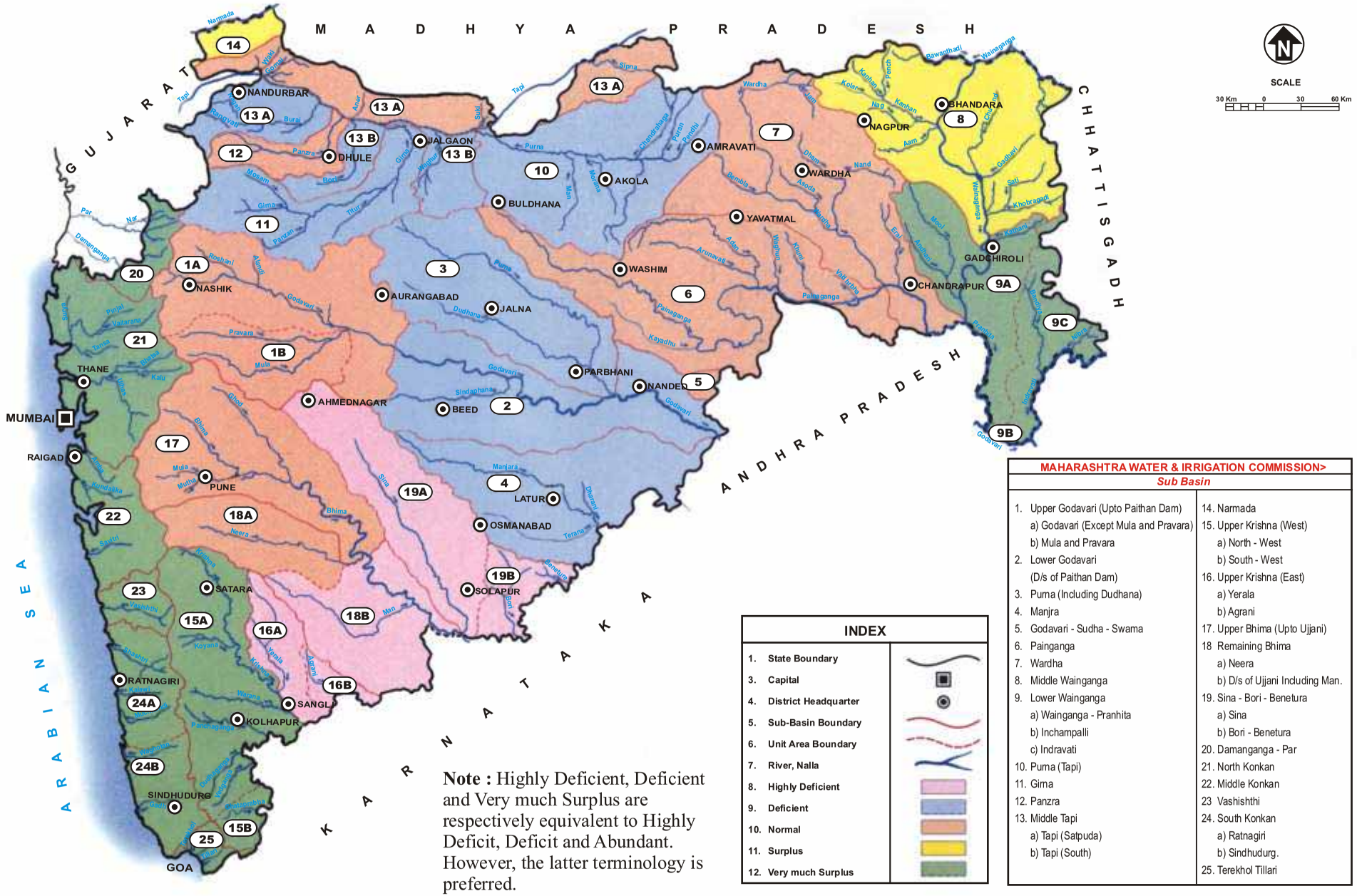
2.3 River basins in Maharashtra

Geographical area of the State is divided in five river basins viz Godavari, Tapi, Narmada, Krishna & West flowing rivers in Konkan region. Average surface water availability is 163820 Mcum. According to various river basin tribunal awards, utilisable water is 125936 Mcum. Water availability in Konkan region & Narmada basin is abundant and surplus respectively whereas Tapi basin is water deficit and Godavari and Krishna basins are normal. Ninety two percent of cultivable area of the State lies in Godavari and Krishna basins.

The sub basins in the State are as follows:

Sr. No.	River Basin	Sub basin	Abbreviated name	Categorisation for planning on the basis of availability of natural water
I	Godavari	1) Upper Godavari (Upto Paithan Dam)	Upper Godavari	Normal
		2) Lower Godavari (D/S of Paithan Dam)	Lower Godavari	Deficit
		3) Purna (including Dudhana)	Purna Dudhana	Deficit
		4) Manjra	Manjra	Deficit
		5) Godavari-Sudha-Swarna	Remaining Godavari	Normal
		6) Painganga	Painganga	Normal
		7) Wardha	Wardha	Normal
		8) Middle Wainganga	Middle Wainganga	Surplus
		9) Lower Wainganga	Lower Wainganga	Abundant
II	Tapi	10) Purna (Tapi)	Purna Tapi	Deficit
		11) Girna	Girna	Deficit
		12) Panzara	Panzara	Normal
		13) Middle Tapi	Middle Tapi	Deficit
III	Narmada	14) Narmada	Narmada	Surplus
IV	Krishna	15) Upper Krishna (West)	Upper Krishna (W)	Abundant
		16) Upper Krishna (East)	Upper Krishna (E)	Highly Deficit
		17) Upper.Bhima (Upto Ujjani)	Upper.Bhima	Normal
		18) Remaining Bhima	Remaining Bhima	Normal
		19) Sina-Bori-Benetura	Sina-Bori-Benetura	Highly Deficit
V	West Flowing	20) Damanganga-Par	Damanganga-Par	Abundant
	Rivers in	21) North Konkan	North Konkan	Abundant
	Konkan	22) Middle Konkan	Middle Konkan	Abundant
		23) Vashisthi	Vashisthi	Abundant
		24) South Konkan	South Konkan	Abundant
		25) Terekhol – Tillari	Terekhol – Tillari	Abundant

SUB - BESINS IN MAHARASHTRA AS PROPOSED BY THE COMMISSION & CATEGORIZATION THEREOF IN PLANNING GROUPS



Note : Highly Deficient, Deficient and Very much Surplus are respectively equivalent to Highly Deficit, Deficit and Abundant. However, the latter terminology is preferred.

INDEX

1. State Boundary
3. Capital
4. District Headquarter
5. Sub-Basin Boundary
6. Unit Area Boundary
7. River, Nalla
8. Highly Deficient
9. Deficient
10. Normal
11. Surplus
12. Very much Surplus

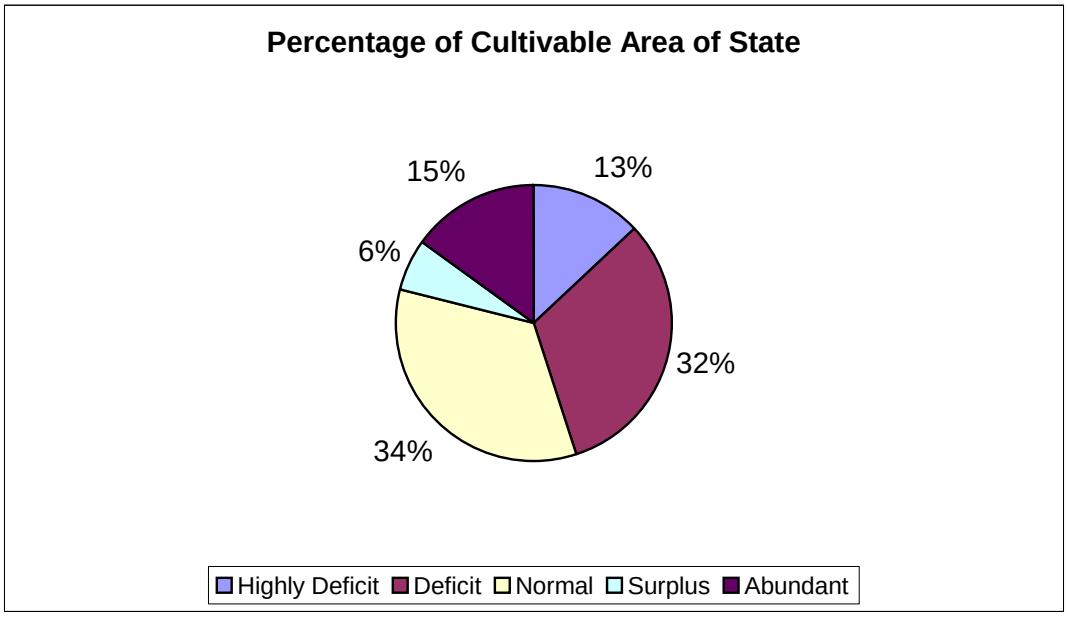
MAHARASHTRA WATER & IRRIGATION COMMISSION>

Sub Basin

1. Upper Godavari (Upto Paithan Dam)
   a) Godavari (Except Mula and Pravara)
   b) Mula and Pravara
2. Lower Godavari (D/s of Paithan Dam)
3. Purna (Including Dudhana)
4. Manjra
5. Godavari - Sudha - Swama
6. Painganga
7. Wardha
8. Middle Wainganga
9. Lower Wainganga
   a) Wainganga - Pranhita
   b) Inchampalli
   c) Indravati
10. Purna (Tapi)
11. Girna
12. Panzra
13. Middle Tapi
    a) Tapi (Satpuda)
    b) Tapi (South)
14. Narmada
15. Upper Krishna (West)
    a) North - West
    b) South - West
16. Upper Krishna (East)
    a) Yerala
    b) Agrani
17. Upper Bhima (Upto Ujjani)
18. Remaining Bhima
    a) Neera
    b) D/s of Ujjani Including Man.
19. Sina - Bori - Benetura
    a) Sina
    b) Bori - Benetura
20. Damanganga - Par
21. North Konkan
22. Middle Konkan
23. Vashishthi
24. South Konkan
    a) Ratnagiri
    b) Sindhudurg.
25. Terekhol Tillari

Categorisation of sub basins for planning, on the basis of naturally available quantum of water, is given below :

Sr. No.	Plan Group	Per ha availability (m^3)	Percentage of cultivable area of State
I	Highly Deficit Area	Below 1500	13
II	Deficit area	1501-3000	32
III	Normal area	3001-8000	34
IV	Surplus area	8001-12000	06
V	Abundant area	Above 12000	15



2.4 Irrigation development in Maharashtra

Agriculture sector plays an important role in the state economy. Irrigation facility is a key element of agriculture sector. Maharashtra Water and Irrigation Commission (1999) has estimated irrigation potential as 8.50 million ha through surface water. In pre plan period 0.274 million ha irrigation potential was created through investment of Rs. 16.60 crores. From first five year plan to 10^{th} five year plan (June 2003) i.e. during 52 years, irrigation potential is created on large scale. Total irrigation potential created at the end of June 2003 is 3.863 million ha through total investment of Rs. 30976 crores. There are 59 major, 128 medium, 885 minor irrigation projects and 22-lift irrigation schemes in progress. Balance cost of these projects on 1.4.2003 is 28,327 crores. After completion of these projects additional 3.00 million ha irrigation potential will be created.

3.0 Water Use Pattern

Designed water storage, available live storage, irrigation and non-irrigation water use of the irrigation projects in the State during last 7 years is given in Table 1.

Table 1: Designed water storage and water use (1997-98 to 2003-04)

Water in Mcum

Sr. No.	Year	Designed storage	Available storage as on 15th Oct.	Percentage of available water	Water Use			Percent-age of total water use to available storage
					Irrigation	Non Irrigation	Total	
1	2	3	4	5 = 4/3	6	7	8	9 = 8/4
1	1997-98	25528	16615	65	10639	3267	13906	84
2	1998-99	26712	23285	87	12347	3033	15380	66
3	1999-00	26716	25271	95	16037	3595	19632	78
4	2000-01	26748	18947	71	13575	3858	17433	92
5	2001-02	28062	17817	63	12346	3980	16326	92
6	2002-03	28715	18936	66	12965	4236	17201	91
7	2003-04	28840	16941	59	10569	4790	15359	91

Source: Irrigation Status Report 2003-04

From the above table it is revealed that non-irrigation water use is increasing with every passing day. It is also seen that about 75% water is used for irrigation.

Hence there is urgent need for paying special attention towards saving of water in irrigation sector which consumes more amount of water and where water use efficiency is relatively low. Any saving in irrigation sector would result into additional availability of water, which can be used for other sectors or can be used for bringing additional area under irrigation without much extra cost.

4.0 Water management practice

4.1 Pre independence period

The irrigation systems constructed through public funds in Maharashtra date back to pre-independence. Darna, Bhandardara, Chanakapur in North Maharashtra, Bhatghar, Radhanagari in Western Maharashtra and Asolamendha, Khindsi, Ghorazari & Naleshwar in Vidarbha are some such examples. The dam and canal system in pre-independence era, was constructed as scarcity work. It was with a view to provide irrigation facilities to low rainfall areas or where vagaries of rainfall are on major scale. Very good record of water use is maintained on these projects.

The State of Maharashtra came into being on 1 st May 1960. Prior to it, the geographical area was under the control of three different Governments, viz.

(1) North and Western Maharashtra under Bombay State;

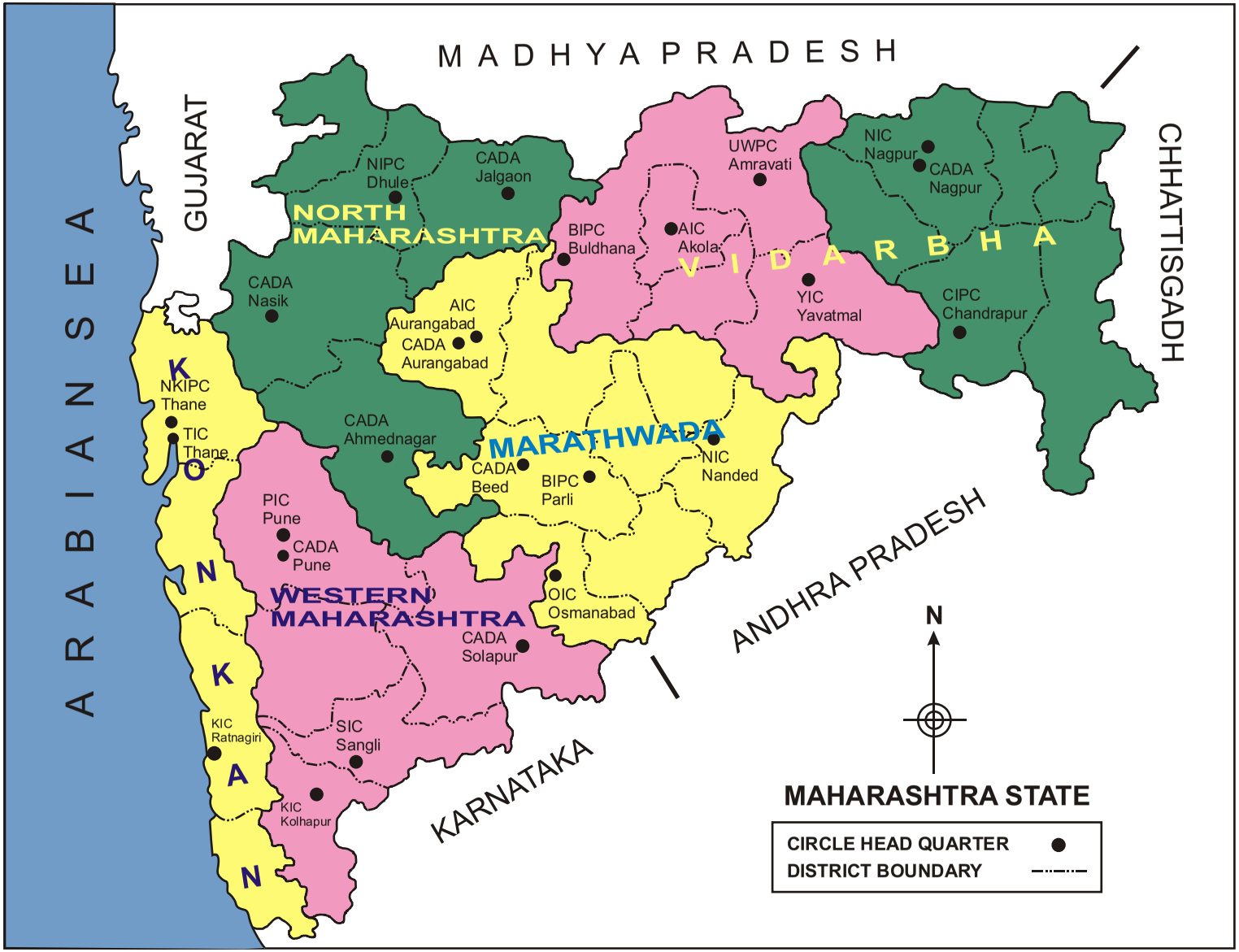
(2) Marathwada under Nizam Government;

(3) Vidarbha under Central Province & Berar.

4.2 Administrative Set Up for Irrigation Management

A chart detailing out the administrative set up for the irrigation management right from the level of Chief Engineer down to the lowest management staff on field is enclosed at **Appendix VI**. The Chief Engineer at regional level deals with the general administration and the development and utilisation of the irrigation projects. The Superintending Engineer assists the Chief Engineer. The Superintending Engineer is the administrative head at the circle level. He has full powers to sanction use of irrigation water for different activities in the region. The Superintending Engineer has to approve yearly utilisation of the storage in reservoirs and modify &

MAP SHOWING LOCATION OF IRRIGATION CIRCLES



approve irrigation programmes from year to year as per the availability of water. The Superintending Engineer has full administrative and financial control over the budget provisions allocated by Government. In addition to above, the Superintending Engineer has to certify the safety of major and medium dams by inspecting them during pre and post monsoon periods.

The Superintending Engineer being managerial head of the project approves water planning and monitors the same through Executive Engineer & Stakeholders. Executive Engineer is responsible for maintenance of irrigation works and management of its irrigation in the field. Apart from technical duties, the Executive Engineer has to perform duties under the Irrigation Act and rules thereunder. The management of irrigation is an important work assigned to the Executive Engineer and has to play a very important role in day-to-day sanction and distribution of canal water to each individual irrigator or WUA. Map - 2 showing location of irrigation circles is enclosed.

4.3 Irrigation Seasons

In Maharashtra, the Irrigation Year is reckoned from 1st July to 30 th June next year. The seasons are as under:-

Kharif Season	..	1 st July to 14 th October
Rabi Season	..	15 th October to 28 th February of next year.
Hot Weather Season	..	1 st March to 30 th June.

4.4 Preliminary Irrigation Programme (PIP)

Preliminary Irrigation Programme is prepared depending on the availability of water in the reservoir on 15 th October excluding quantity for non-irrigation uses and other commitments such as sanctioned blocks, etc. The preliminary irrigation programme, therefore, has to be very realistic and based on the probable demands of the cultivators in the command. The planning has to be such that all the available water in the storages as on 15th of October is fully utilised by the end of the irrigation year. It is also customary to prepare a supplementary irrigation programme by January every year so as to account for the actual utilisation of the water during the past 3 to 3 ½ months and to revise forecast of the utilisation of the balance of water completely during ensuing hot weather season.

4.5 Approval to Irrigation Programme

Yearly preliminary irrigation programme (PIP) prepared by the Executive Engineer is to be approved by the Superintending Engineer. On approval to the Programme, the Executive Engineer and the Superintending Engineer can have proper and timely control over the withdrawals of water in every rotation. In order to watch the day-to-day withdrawals as compared to the planned utilisation a chart is kept in the office of the Executive Engineer and the Superintending Engineer. This chart is known as “Tank Chart”. This chart gives the very valuable graphical representations of the overall usage from the storage.

4.6 Shejpali system of irrigation

Preparation of irrigation programme for the utilisation of stored water alongwith the river gains in the fair weather season has already been discussed in

above paras. Actual system of Irrigation known as 'Shejpali System of Irrigation' as practiced on irrigation systems in Maharashtra is described below.

Sub-divisionwise requirement of water for every rotation is calculated and distributed among the sub-divisions by the Executive Engineer in-charge of the management division. After the quota for each sub-division is fixed, it is further distributed among the various sections considering the sanctioned demands and duty normally obtained in each section based on the distributary wise duty registers. The Sectional officer who is in-charge of the section, further divides the quota of each rotation among the various canal inspectors in-charge of irrigation distributary wise and outlet wise.

4.7 Yearly Completion Report (CIR)

This report is prepared at the end of Irrigation year, when the water stored in the reservoir is fully consumed. The report gives comparative idea between irrigation programme as planned and as fulfilled.

5.0 Present System of water management

Rotation wise records of water use are maintained and submitted to the division office in form No. 126 since 1931. Keeping an account of water used in each rotation and monitoring the services is still in vogue.

Presently, monitoring of supply system during rotation is done as follows.

(1) Preliminary Irrigation Programme is prepared for every project & seasonwise use of water is planned.

(2) Wireless communication system is installed in commands of major projects. Daily lake levels, rainfall, inflow, outflow, discharges in canals etc. are communicated on wireless system.

(3) The management staff including sectional officer takes round the clock review of canal flows and discharges. The gates of distributaries are operated turn by turn and water loss is avoided by preventing over irrigation.

(4) Unauthorised irrigation, if any, observed during rotation by officers and staff is noted and charged at penal rates.

(5) How much area is irrigated in one unit of water is the basic question any officer will ask his subordinates during the rotation. Based on the values of Area Irrigated per Mcum of water performance of management is judged.

(6) Surprise checking of command area is carried out by Sectional officers, Subdivisional Engineers and Executive Engineers.

(7) Area irrigated is measured by the measurers, percentage cross checking of these measurements by Sectional officer, Sub-divisional Engineer and Executive Engineer helps in avoiding any area irrigated being left unassessed.

(8) Completion Irrigation Report (CIR) is prepared at the end of an irrigation year. It includes (a) season-wise water use for different purposes (b) transition and evaporation losses (c) Duty (d) Programmed and actual drawals (e) cropwise area irrigated, etc. The report is submitted to higher officers.

The performance is checked with PIP and the differences, if any, and the reasons for the same are also noted.

6.0 Weaknesses in Present System

Form No. 126 (e) was used for maintaining water account of every rotation particularly in major projects in the State. However the data compiled was not effecitively used for meaningful application in improving system performance. Also, water account was not audited. Because of loopholes and weaknesses in the present system of irrigation management, there was strong possibility of occurrence of following instances viz.

i) Unauthorised water use for irrigation

ii) Accounting less area for assessment.

iii) Accounting more water for transit losses

iv) Accounting less area under perennial crops

v) Release of water through escapes for trivial reasons

vi) No analysis of water account and accountability

The main weaknesses of the system were, there was no provision to workout water use efficiency at the end of season / year and analyse the performance of project i.e. whether objectives at the time of planning are achieved or otherwise. On above background government had appointed a committee for suggesting simplified, uniform water accounting & auditing procedure.

7.0 Maharashtra State Water Policy

Maharashtra State Water Policy underlines the importance of water audit as follows.

"For increasing utilisation of available potential, water audit is necessary. Water audit will be compulsory for all water resources projects. The service providers shall be accountable for providing measuring devices for volumetric supply and for giving the account of water use in various sectors."

8.0 Necessity of Water Auditing

The water available from storage dams is normally used for drinking water, industrial use, irrigation etc. With growing population & scarcity of water, there is growing demand from all sectors. Irrigation sector uses 75 to 80% of water, therefore, any saving in water use in irrigation sector would make available more water for other uses or bring additional area under irrigation. The water resources projects are planned with certain water use efficiency (area irrigated in ha per Mcum). But in reality planned water use efficiency could not be achieved for various reasons and tail-enders are deprived of getting full benefits of water resources project.

Hence it is essential to improve the performance of projects by way of increasing the water use efficiency which will increase area under irrigation with same quantity of available water in the reservoirs.

9.0 What is Water Auditing?

Water auditing is a systematic & scientific examination of water accounts of the projects. It is an intelligent & critical examination by independent organisation. It is a critical review of system of accounting. Water auditing is checking sector wise water use against planning, water use efficiency in irrigation and losses. As far as

irrigation sector is concerned, water audit should give comparison of planned water use efficiency (i.e. ha /Mcum) versus actual water use efficiency (i.e. ha/ Mcum). This will provide information about loss of water in the system. Efforts should be made to identify the causes for it and initiate action to minimise the losses to improve the water use efficiency.

Broadly water auditing involves checking the following parameters.

1) Actual water use in various sectors against planning,
2) Whether water use for irrigation in every season is as per planning & checking the water use efficiency (ha/Mcum)
3) Checking whether the prescribed procedure for irrigation management is followed or not.
4) Whether records as per requirements are maintained or not.

10.0 Benefits of Water Audit

Benefits of water audit include improved knowledge and documentation of the distribution system including problem and risk areas. Water auditing will lead to (a) efficient use of available water resources (b) reduced water losses (c) transparency in overall process (d) increased accountability of field officers (e) enhanced knowledge of the distribution system (f) improved financial performance and (g) improved level of service to customers.

Chapter: 2

New Water Accounting Procedure

2.1.0 The irrigation facilities created through public funds are not utilised to the fullest extent. The reasons for low utilisation can be listed as, more conveyance losses, poor field application methods, inadequate O & M, poor water accounting methods etc. Increase in demand of water for domestic and industrial use due to growth of urbanisation and industrialisation has resulted into lesser availability of water for irrigation. Hence water available for irrigation has to be used most judiciously & efficiently to achieve more irrigation and crop yield per unit of water.

In this context, Government of Maharashtra set up in September 2002, a committee under the chairmanship of Chief Engineer and Secretary, Maharashtra Water and Irrigation Commission, Aurangabad.

The committee after having detailed study of prevailing practices in irrigation management and discussions with field officers, prescribed proformae for use and submitted its report to Government in January 2003.

Based on the recommendations of the committee, Government issued Circular for water accounting and auditing of irrigation projects on 26-06-2003. Proformae for water accounting (I-A to V-A, I to V and VI & VII) are also issued. Checklists Part I & II are also issued vide proforma VIII & IX. These checklists give an exhaustive list of documents and items to be checked during inspections and auditing. These proformae are annexed as Appendix-VII

i) According to the above mentioned circular, Form No.126 (e) which was used till now for keeping account of water use in every rotation of irrigation is revised & keeping water account in the prescribed proformae has been made mandatory for every major, medium & minor irrigation project.

ii) Water account shall be maintained by each irrigation section in proforma I-A to V-A & by Sub division in proforma I to V. The proformae are to be submitted by the sectional officer to sub division within three days after completion of irrigation rotation. The responsibility of submitting the compiled information to division office within seven days shall lie with sub division.

iii) Annual water account of all major & medium projects shall be maintained in Proforma VI.

iv) Annual water account of all minor Irrigation projects shall be maintained in Proforma VII.

v) Annual water account of all projects (Proformae VI & VII) is required to be submitted by concerned Superintending Engineer, to Maharashtra Water and Irrigation Commission's office (proposed Water Resources Development Centre) within 45 days (before 14th August) after every irrigation year.

vi) Proformae VIII & IX (check lists) are prescribed for water auditing.

vii) Three water audit cells, each headed by an Executive Engineer are established under the administrative control of MWIC for six revenue regions of the State. They are :

Unit I	Amravati & Nagpur region
Unit II	Pune & Konkan region
Unit III	Aurangabad & Nashik region

viii) Water auditing of all irrigation projects in the State will be carried out once in a year or any time by MWIC Aurangabad with directives from Government in case of serious complaints.

ix) For assessing the efficiency of irrigation, criterion of ha/Mcum shall be adopted instead of the present practice of AI/DC (area irrigated per day cusec)

x) The data regarding rainfall & evaporation is required to be submitted to division regularly even if there is no irrigation rotation during a season.

xi) The compliance of the remarks raised by Maharashtra Water and Irrigation Commission office after scrutiny of water account reports be done by e-mail and paperless working procedure be followed hereafter.

For water auditing, additional establishment has been made available by Government of Maharashtra.

2.2 Salient features of Water Audit Proformae

The proformae I, II, III, IV & V are to be compiled by respective sub-divisions and submitted to the Executive Engineer. Similarly, the proformae I-A, II-A, III-A, IV-A and V-A are to be submitted to the respective sub-divisions by the irrigation sections looking after management of the project.

Proforma-I: Water Demand

This proforma (separately for various canals for each rotation of irrigation year) is to be submitted by the sub-division to the division office prior to starting of a rotation. It is compilation of demands (proforma I-A) received from various sections. This format is for indenting water for the forthcoming rotation. The requirement of water for various crops for a particular section shall be calculated as per directives issued by the Government from time to time or from projected ha/Mcum.

Proforma –I-A: Water Indent

This proforma is to be submitted by the respective sections to their sub-divisions. This is similar to proforma-I but it gives information of area expected to be irrigated by flow & lift separately. Lift irrigation includes canal lifts, river lifts and reservoir lifts within the jurisdiction of that section. This indent shall be submitted for each rotation one week before start of rotation.

Proforma-II: Daily Discharge drawn by Various Sections.

This proforma is for actual discharge drawn by the sections of a particular canal as against their water indent in proforma I-A. After completion of irrigation

rotation this proforma shall be compiled by the sub-division and submitted to the division office within a week.

Proforma-II-A: Discharge drawn at various locations of canal.

Proforma II-A shall be submitted by each section as soon as the rotation is over (within three days of completion of rotation). Discharges at various locations of canal, tail of canal, tail tank shall be fully considered while submitting this proforma.

Proforma-III and III-A: Water Used and Area Irrigated.

The proforma III relates to the water used and area irrigated in each rotation. This proforma gives the figures of areas under various heads as actually irrigated. This information is to be supplied by the sectional officer within three days after each irrigation rotation in proforma III-A.

The proforma III shall be compiled by sub-division and submitted to the division within a week's period after finishing the rotation of canal.

Proforma –IV-A & IV: Discharge let out through Scouring Sluices or Escapes.

Proforma IV-A & IV give information in connection with discharges let through the scouring sluices and escapes. It is important to watch that the water thus let out is the least possible mentioning reasons therefor.

Proforma – V-A & V: Rainfall & Evaporation

Details of rainfall & evaporation in the command area of the section are to be given in proforma V-A by the sectional officer. Compiled information of all the sections is to be submitted by the sub-division to the division in proforma V. Proforma V-A & V should be submitted after each rotation as well as at the end of each month irrespective of whether there is irrigation rotation or otherwise. The proformae are enclosed as Appendix VII

Chapter: 3

Water Audit 2003-04

The work of water auditing of all Major, Medium and Minor irrigation projects in the State is entrusted to Maharashtra Water & Irrigation Commission's Office, at Aurangabad. The circular to the effect was issued by Government of Maharashtra on 26.6.2003.

3.1.0 Methodology: Accordingly, three cells, each headed by an Executive Engineer and assisted by two Sub-Divisional Engineers, two Assistant Engineers-II and two Daftar Karkoons will carryout the work. Creation of additional posts in Maharashtra Water & Irrigation Commission's Office was under consideration of Government of Maharashtra. The work of auditing of water accounts of irrigation projects for 2003-04, in the State was carried out with the help of available staff. Field inspections and scrutiny of field records could not be taken up. There are 25 circles looking after management of irrigation projects in the State. Water accounts of major, medium and minor projects were received and scrutinised.

Number of Projects in Plangroup & Subbasin is as follows:

Plan Group	Subbasin	Major	Medium	Minor	Total
Highly Deficit	Upper Krishna (E)	-	3	-	3
	Sina-Bori -Benetura	-	18	-	18
	Total	**-**	**21**	**-**	**21**
Deficit	Lower Godavari	3	2	-	5
	Purna Dudhna	1	1	-	2
	Manjra	3	11	-	14
	Purna Tapi	2	9	-	11
	Girna	2	6	-	8
	Remaining Bhima	3	10	-	13
	Total	**14**	**39**	**-**	**53**
Normal	Upper Godavari	6	5	-	11
	Lower Godavari	1	-	-	1
	Upper Painganga	2	6	-	8
	Wardha	3	13	-	16
	Middle Tapi	1	8	-	9
	Upper Bhima	4	2	-	6
	Total	**17**	**34**	**-**	**51**
Surplus	Middle Wainganga	5	22	-	27
	Total	**5**	**22**	**-**	**27**
Abundant	Lower Wainganga	1	2	-	3
	Upper Krishna (W)	10	11	-	21
	North Konkan	2	2	-	4
	Middle Konkan	1	-	-	1
	Total	**14**	**15**	**-**	**29**
	Grand total	**50**	**131**	**1048**	**1229**
Note: For Minor projects total number of projects audited is given without referring to plangroup of subbasins.					

Some data about water accounts of major projects is enclosed as Appendix-VI.

The water accounts of major and medium projects (proforma VI) and minor projects (proforma VII) are checked in MWIC office. The water accounts were checked for following items.

(1) Availability of water in the reservoirs,
(2) Season-wise water use for irrigation (flow as well as lift) against projected use,
(3) Water use for non-irrigation purpose against projected,
(4) Evaporation from reservoir,
(5) Water lost through leakages,
(6) Season-wise area irrigated and water use efficiency.
(7) Area irrigated in influence area of project.

Some of the major observations are given in chapter 4.

After scrutiny, the remarks of audit are communicated to the field offices. Compliance of remarks is submitted by the respective Superintending Engineers. Some of the audit remarks are under correspondence with project authorities, which will be settled after due compliance & verification. However, the results & comments offered in the report are based on present status of analysis.

3.2.0 Training and Capacity Building

Training courses are conducted regularly by WALMI Aurangabad for senior & middle level officers and staff working in irrigation management. A State level workshop on this subject was held at WALMI, Aurangabad on 29 and 30 June 2004. Middle level officers of Irrigation Department participated and discussed the subject in detail. It was intended to have all out discussion on various aspects of irrigation management. Due cognizance of recommendations of workshop is taken in taking ahead water auditing. Another workshop on benchmarking and water auditing was held in WALMI, Aurangabad during 28 and 29 December 2004 wherein Superintending Engineers and Executive Engineers from all regions of State took part and detailed discussions and presentations on the important aspects of water auditing were made. The draft of Water Audit Report 2003-04 was discussed and finalised in the workshop.

3.3.0 Overview of Irrigation Projects

Construction of large number of major, medium and minor irrigation projects have been taken up by the water resources department of the State to bring maximum possible area under irrigation. By June 2003, irrigation potential of 3.863 Mha is created through 53 major, 212 medium and 2445 State sector minor irrigation projects.

3.4.0 Supply System

Generally supply of water for irrigation is through distribution network of canal offtaking either from dam or from pick-up-weir. The distribution network consists of main canal, branch canal, distributary, minor and field channels. The canals are either lined or unlined, but mostly the systems are unlined.

Water is supplied to irrigators via distribution network through outlets. In addition, there are individual, co-operative, Govt. owned lifts on reservoirs, rivers and canals. Normally there is major area under gravity irrigation and small part under lift

irrigation in most of the projects. Some projects are specially lift irrigation projects with storage reservoir or storage reservoir with series of Kolhapur type weirs downstream of reservoir. In every major and medium irrigation project, water reserved for domestic and industrial use is 15% and 10% respectively. Whenever there is more demand non-irrigation reservation goes even upto 50%.

The supply of water for domestic and industrial purpose is mostly made through pipeline either from reservoir or from river.

The projects are having major area under flow irrigation with small percent under lift irrigation. Most of the projects selected supply irrigation water for eight months i.e. Monsoon Kharif and Rabi and very small proportion for Hot Weather or for perennials. There is a practice to use water saved in Kharif and Rabi season for Hot weather or Perennial crops.

3.5.0 Crops Irrigated

The crops grown vary significantly between projects. The main crops grown in project commands are paddy, wheat, sorghum, gram, groundnut, maize, sunflower, safflower, L. S. cotton, vegetables & sugarcane.

3.6.0 Management of System

The irrigation systems are constructed and managed by government. Operation and maintenance of irrigation projects is looked after by irrigation divisions which are administratively controlled by circle office. GOM has taken policy decision to supply water for irrigation through Water Users' Associations only. Water Users' Associations are formed in command area of irrigation projects & irrigation management of area under their jurisdiction is transferred to them.

3.7.0 About This Report

The analysis of water account data received from various circles is carried out for following indicators.

i) Water Availability in Reservoirs
ii) Percentage of Evaporation to Maximum Live Storage.
iii) Water Use
iv) Water Use Efficiency.

Water accounts of major & medium projects are analysed considering grouping of projects in same sub basin. The analysis of water accounts of minor projects is carried out by grouping of projects in the circle.

Maharashtra Water & Irrigation Commission has recommended to consider sub-basin as a unit for water planning in future. The State & National Water Policies also advocate sub basin as unit for comparison. Therefore, the presentation of analysis for various indicators is carried out considering sub basin as a unit.

Chapter 4

Observations and Conclusions

4.1 Observations:

I) Water Availability in Reservoirs

Major Projects

Availability of water in projects in deficit sub basins varied from 0 to 78 percent. Bhima project in CADA Solapur did not receive any yield whereas availability of water in projects under CADA Aurangabad and CADA Beed was only 18 and 19 percent respectively. The overall availability in this plangroup was 31 %.

The availability of water in projects in normal sub basins was more than 60 percent except projects in YIC Yavatmal, where it was 22 percent only. The overall availability in this plangroup was 78 %.

The availability of water in projects in surplus and abundant sub basins was more than 70 percent. The overall availability in these sub basins was 92 and 86 percent respectively.

Medium Projects

Availability of water in reservoirs in highly deficit sub basins was negligible.

In deficit sub basins the variation in availability was very large. Only projects under five (CADA Jalgaon, CADA Aurangabad, NIC Nanded, CADA Nagpur and UWPC Amravati) out of eleven circles could receive yields more than 65%. The projects under SIC Sangli and CADA Solapur could not receive any yield.

In normal sub basins, projects under CADA Solapur could not receive any yield. Projects under 10 circles out of 12, received yield more than 55 % of designed values.

Projects in surplus and abundant sub basins received yields more than 84% of designed values.

The overall availability in highly deficit, deficit, normal, surplus and abundant sub basins was 15, 46, 76, 85 and 46 percent of designed storages respectively.

Minor Projects

The variation in availability of water ranges from 1 to 92 % of designed live storage. Projects under eight circles out of fourteen received yield more than 64%.

II) Evaporation from reservoirs

Major Projects

In deficit sub basins projects under CADA Solapur had no yield and therefore, live storage was nil hence the evaporation was from dead storage. The evaporation in CADA Aurangabad was as high as 52% of maximum live storage observed. The higher percentage of evaporation is mainly due to the storing water for industrial and drinking use throughout the year. The overall plan group wise evaporation observed was 22 %.

In normal sub basins the evaporation in YIC Yavatmal was as high as 62%. The overall evaporation for this plan group observed was 15 %. In surplus &

abundant sub basins the evaporation was within 20% of live storage available in the year. The overall evaporation observed for these plan groups was 13 % each.

Medium Projects

Evaporation in projects in highly deficit sub basins under CADA Solapur was observed to be as high as 66.9 percent. As the live storage availability was only 2 % water could not be used for irrigation and evaporation occurred partly from dead storage also.

Projects in deficit sub basins under SIC Sangli and CADA Solapur did not receive any yields and therefore the evaporation in these projects was partly from dead storage of reservoirs.

Evaporation in other projects in deficit sub basins was within 30 percent of live storage.

Evaporation in projects in normal sub basins varied from 14 to 41 percent of live storage.

Evaporation in projects in surplus and abundant sub basins was within 20 and 12 percent of live storage respectively.

Plan group wise figures of evaporation were 57, 24, 26, 20 & 10 percent for highly deficit, deficit, normal, surplus and abundant sub basins.

Minor Projects

In projects under NIC Nanded, the availability of water was 92%, out of which, only 16% is lost through evaporation. In CADA Beed, the availability of water was only 1% therefore, most of water (97% of available water) is lost through evaporation.

In NIC Nagpur the availability was 92% & evaporation was 25%.

III) Water Use

Major Projects

Non-irrigation use in case of projects under all circles in deficit sub basins is predominant compared to irrigation use except in projects under PIC Pune & NIC Nanded. The non-irrigation use figures for projects in CADA Aurangabad and CADA Jalgaon are 154 Mcum and 107 Mcum respectively, ie 38 & 36 % of available water.

In case of projects in CADA Beed and CADA Solapur, the non-irrigation use is predominantly for drinking purpose.

The use of available water for irrigation purpose in respect of CADA Jalgaon, PIC Pune and AIC Akola was judicious.

In normal sub basins, the non-irrigation use for projects in three circles (CADA Jalgaon, CADA Nashik & CADA Pune), out of nine is appreciable one.

Irrigation use in projects under NIC Nanded, PIC Pune, CADA Pune and CADA Nashik, is found justifiable and in good manner.

The use of available water for irrigation as well as non-irrigation in respect of CADA Nagpur in surplus sub basin was justifiable. The use in Hot weather is more due to peculiar cropping of paddy.

In abundant sub basins, the non-irrigation use in TIC Thane is very high on account of water supplied to Brihan Mumbai. In case of SIC Sangli, non irrigation use is high on account of water supplied for domestic use for Sangli & Kolhapur. The projects under CADA Pune and SIC Sangli, used available water for irrigation in all the three seasons.

Medium Projects

Water use for irrigation in projects in highly deficit sub basins was nil on account of non availability of sufficient storage. However, water use in projects under all the three circles was for non-irrigation purpose.

Water use in projects under SIC Sangli in deficit sub basin was nil owing to non availability of water in the reservoirs. Non-irrigation use is predominant in projects under AIC Akola, BIPC Buldhana and CADA Beed.

The projects under BIPC Buldhana, CADA A'bad, CADA Jalgaon and CADA Nagpur have used available water mostly in Rabi season and little in hot weather season. In NIC nanded & UWPC Amravati, use in hot weather nearly equals that in Rabi season owing to hot weather groundnut crop in the area.

In case of normal sub basins the non-irrigation use in case of CADA Nagpur, JIPC Jalgaon, AIC Akola and CADA Jalgaon was high. NIC Nagpur, CIPC Chandrapur and CADA Nashik used water for irrigation in all the three seasons.

In case of projects under CADA Nagpur in surplus plangroup, water use for irrigation in all the seasons was very good.

In projects under SIC Sangli in abundant plangroup, water use for irrigation and non-irrigation was good.

Minor Projects

The non irrigation use in projects under TIC Thane & NIC Nanded is remarkably high. Use for irrigation in all the three seasons is observed in projects under CADA Nagpur, CIPC Chandrapur & TIC Thane. The use in Kharif was due to paddy crop.

The principle of using most of the water in Rabi season to minimise evaporation is observed to be followed by all the circles.

It is observed that available water is being used for non irrigation purpose even from minor tanks also due to prevailing scarcity conditions in the State.

IV) Water Use Efficiency

Major projects

In deficit sub basins the water use efficiency in projects under CADA Jalgaon in *Rabi* season was found 193 ha/Mcum in projects under NIC Nanded, it was 192 ha/Mcum in Rabi and 163 ha/Mcum in hot weather season due to conjunctive use of flow irrigation & lift irrigation from wells in the command area of projects.

The projects under CADA Beed, CADA Aurangabad & CADA Solapur had no water for irrigation.

Projects under AIC Akola in deficit sub basins will have to improve their performance.

In normal sub basins CADA Jalgaon could perform well in hot weather but was below target in *Rabi*. Similarly performance of NIC Nanded was good in Rabi season but below State target in hot weather season.

Projects under SIC Sangli in abundant sub basins had very good performance in both the seasons.

Medium Projects

The water use efficiency of projects under UWPC Amravati in deficit sub basin have nearly achieved the targeted value of 150 ha/Mcum in Rabi season Projects under CADA Aurangabad and AIC Akola in this group will have to improve their performance.

In normal sub basin the water use efficiency in Rabi in projects under PIC Pune was 165 ha/Mcum.

In abundant sub basins the water use efficiency in projects under TIC Thane for Rabi was 51 ha/Mcum on account of existence of light soils, field to field irrigation and paddy crops.

Minor Projects

The water use efficiency in Rabi season in projects under PIC Pune is 322 ha/Mcum owing to protective irrigation given to standing crops. BIPC Buldhana and SIC Sangli could achieve the State Target for Rabi season.

CADA Nashik have achieved the State Target for HW season.

Due to non availability of water in projects under CADA Beed, no irrigation was done.

4.2 Conclusions

1) Systematic & comprehensive new water accounting method is established.

2) Third party auditing could be possible.

3) Water auditing has given an insight into the performance of water resources projects particularly in respect of water use, water use efficiency, losses, etc.

4) Training and capacity building of officers & staff has created awareness amongst the field officers and resulted into efficient use of existing supplies.

5) Water auditing has helped in identifying the areas of improvement for collection, maintenance and up keeping of data, leading to efficient irrigation management.

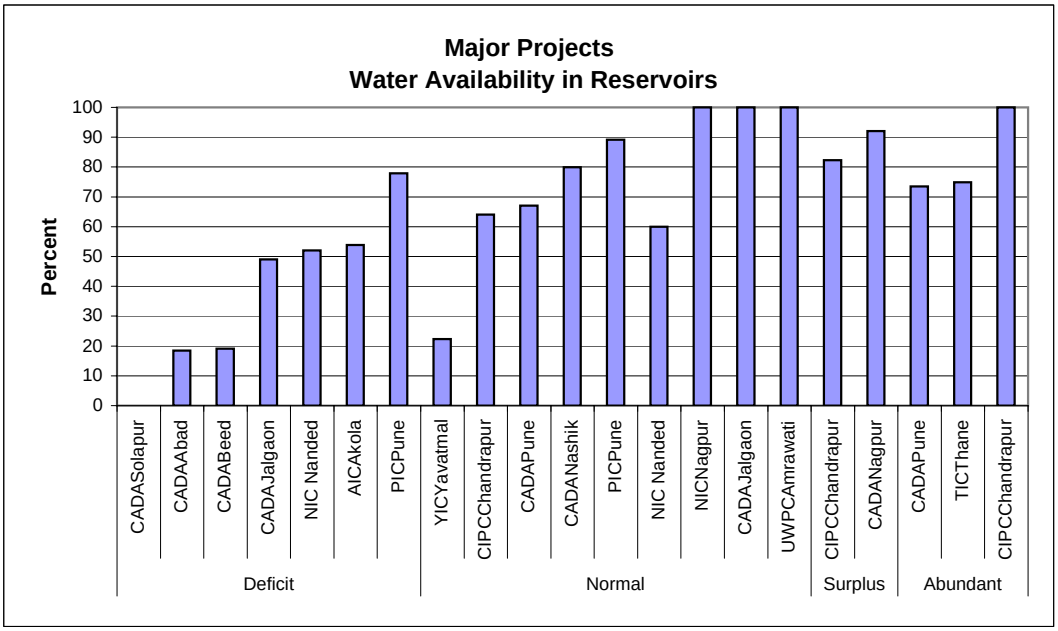
4.3 Way forward

Main thrust given in this report is on analysis of water use efficiency in irrigation. However analysis of water allocated to non irrigation use and actual use is not attempted. This has to be done in years to come.

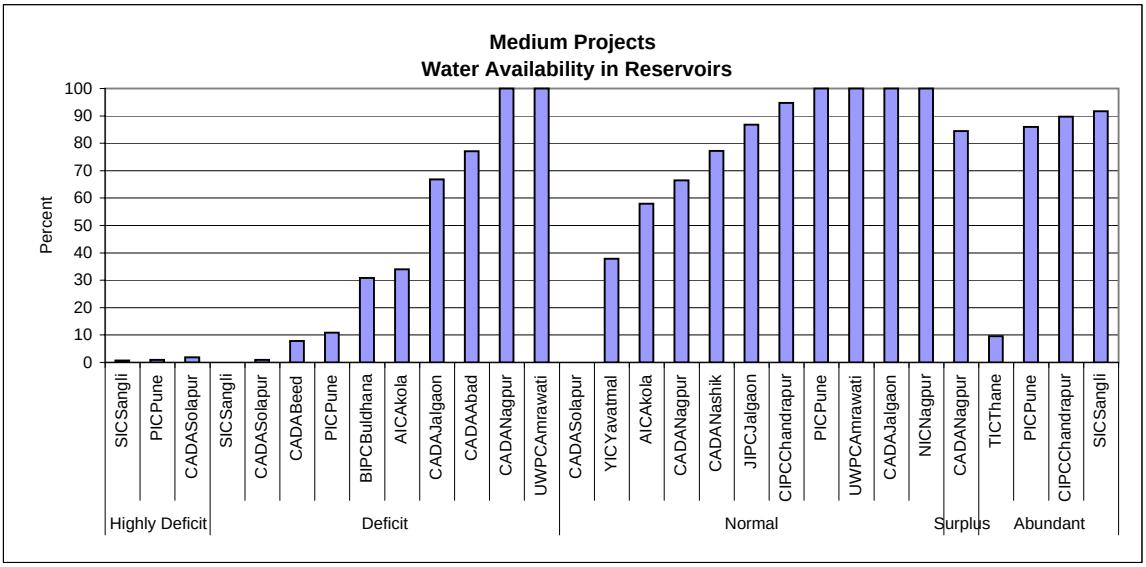
Auditing of water use mainly depends on collecting & keeping the data properly by the field officers. More stress is necessary on this aspect by way of adequate training to staff responsible for data collection. This will have to be properly cross checked by team members of audit cell during their annual inspection of irrigation divisions. This aspect will be carried out in coming years.

APPENDICES

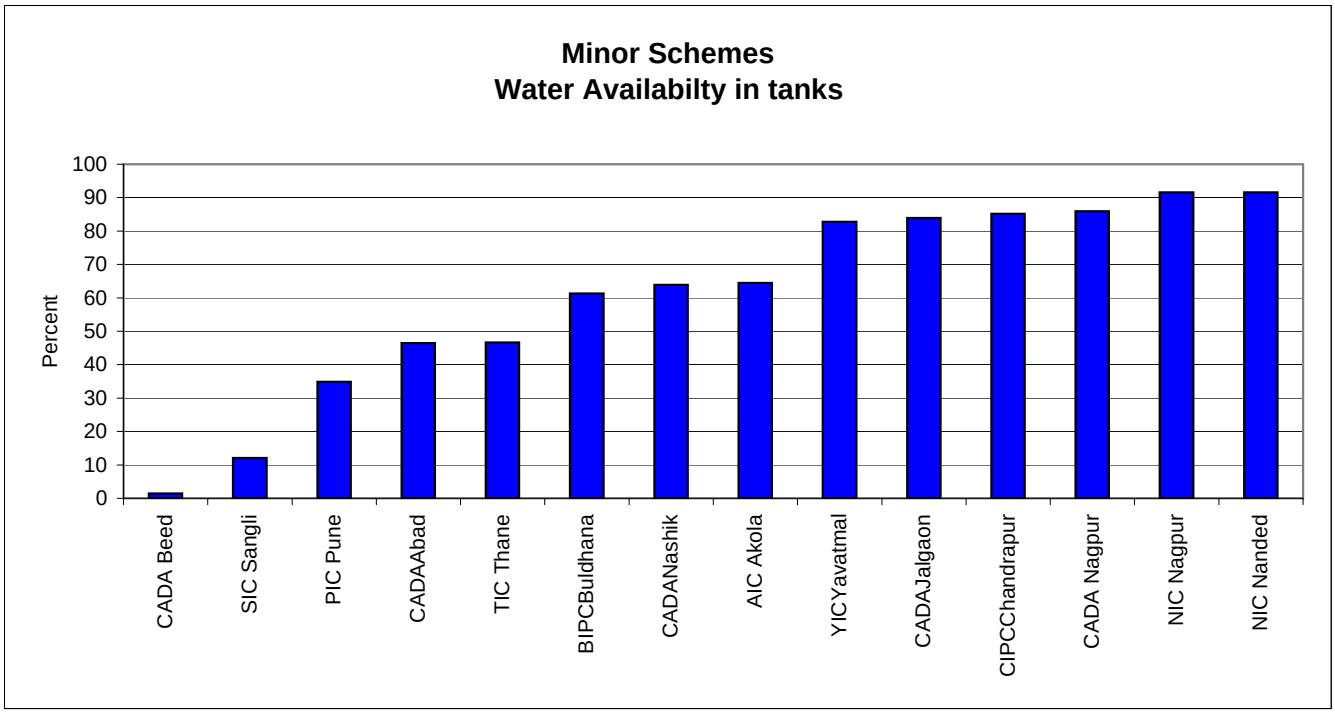
Appendix I



PlanGroup & Circles	Subbasins	Max. Live Storage	Designed Live Storage	Percent
Deficit				
CADASolapur	Remaining Bhima	0.00	1517.20	0
CADAAbad	Lower Godavari	400.07	2171.00	18
CADABeed	Lower Godavari & Manjra	114.50	599.32	19
CADAJalgaon	Girna & Middle Tapi	294.38	600.40	49
NICNanded	Purna Dudhana & Manjra	582.65	1101.25	52
AICAkola	Painganga & Purna Tapi	83.86	155.67	54
PICPune	Remaining Bhima	725.89	932.01	78
		2201.35	**7076.85**	**31**
Normal				
YIC Yavatmal	Painganga & Wardha	37.92	169.67	22
NIC Nanded	Lower Godavari &Painganga	636.77	1045.37	60
CIPCChandrapur	Wardha	81.64	127.42	64
CADAPune	Upper Bhima	683.38	1019.19	67
CADANashik	Upper Godavari	1524.92	1908.37	80
PICPune	Upper Bhima	879.28	986.00	89
NICNagpur	Wardha	189.18	189.18	100
CADAJalgaon	Middle Tapi	255.00	255.00	100
UWPCAmrawati	Wardha	614.80	614.80	100
		4902.89	**6315.00**	**78**
Surplus				
CIPCChandrapur	Middle Wainganga	46.37	56.38	82
CADANagpur	Middle Wainganga	1806.00	1961.85	92
		1852.37	**2018.23**	**92**
Abundant				
CADAPune	Upper Krishna (W)	443.02	602.73	74
TICThane	North Konkan & Middle Konkan	1316.05	1756.60	75
SICSangli	Upper Krishna (W)	1923.03	1928.17	100
CIPCChandrapur	Lower Wainganga	55.94	55.94	100
		3738.04	**4343.44**	**86**
Grand Total:		**12694.65**	**19753.52**	**64**

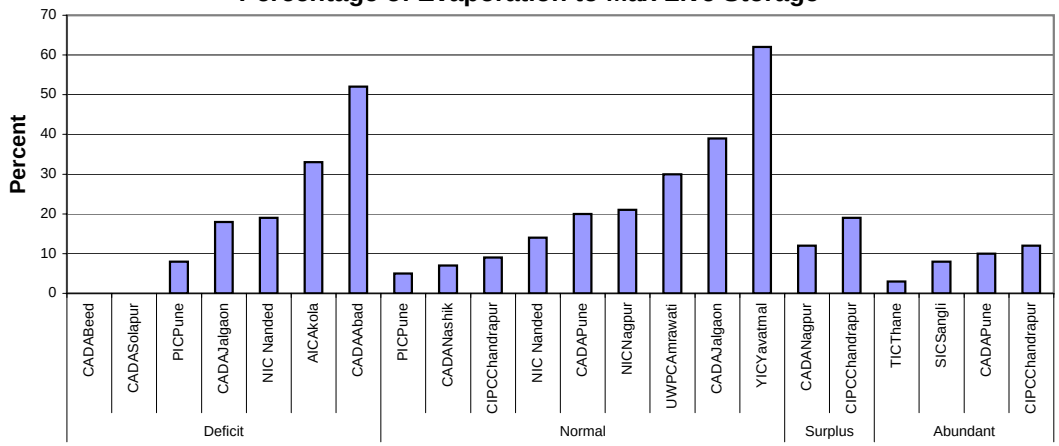


Plangroup & Circle	Subbasin	Max Live Storage	Designed Live Storage	Percentage
Highly Deficit				
SICSangli	Upper Krishna (E)	0.22	31.95	0.69
PICPune	Sina-Bori-Benetura	0.59	66.04	0.89
CADASolapur	Sina-Bori-Benetura	3.65	192.25	1.90
		4.46	**290.24**	**1.54**
Deficit				
SICSangli	Remaining Bhima	0.00	20.86	0.00
CADASolapur	Remaining Bhima	0.40	42.04	0.96
CADABeed	Lower Godavari & Manjra	4.79	61.31	7.81
PICPune	Remaining Bhima	12.29	112.97	10.88
BIPCBuldhana	Purna Tapi	32.29	104.70	30.84
AICAkola	Purna Tapi	28.15	82.69	34.04
CADAJalgaon	Girna	75.60	113.09	66.85
CADAAbad	Lower Godavari & Purna Dudhana	50.96	66.11	77.08
NIC Nanded	Manjra	46.15	46.70	99.00
CADANagpur	Purna Tapi	8.26	8.26	100.00
UWPCAmrawati	Purna Tapi	81.96	81.96	100.00
		340.85	**740.69**	**46.02**
Normal				
CADASolapur	Upper Bhima	0.00	31.96	0.00
YICYavatmal	Painganga & Wardha	30.20	79.72	37.88
AICAkola	Painganga	49.53	85.48	57.94
CADANagpur	Wardha	14.39	21.64	66.49
CADANashik	Upper Godavari	65.69	85.06	77.23
JIPCJalgaon	Middle Tapi	26.65	30.70	86.81
CIPCChandrapur	Wardha	102.99	108.66	94.78
NIC Nanded	Painganga	16.35	16.74	98.00
PICPune	Upper Bhima	30.39	30.39	100.00
UWPCAmrawati	Wardha	9.88	9.88	100.00
CADAJalgaon	Middle Tapi	82.20	82.20	100.00
NICNagpur	Wardha	57.80	57.80	100.00
		486.07	**640.23**	**75.92**
Surplus				
CADANagpur	Middle Tapi	220.18	260.65	84.47
		220.18	**260.65**	**84.47**
Abundant				
TICThane	North Konkan & Middle Konkan	35.94	375.08	9.58
PICPune	Upper Krishna (W)	16.38	19.04	86.03
CIPCChandrapur	Lower Wainganga	41.43	46.18	89.71
SICSangli	Upper Krishna (W)	220.56	240.48	91.72
		314.31	**680.78**	**46.17**
Grand Total:		**1,365.86**	**2,612.59**	**52.28**

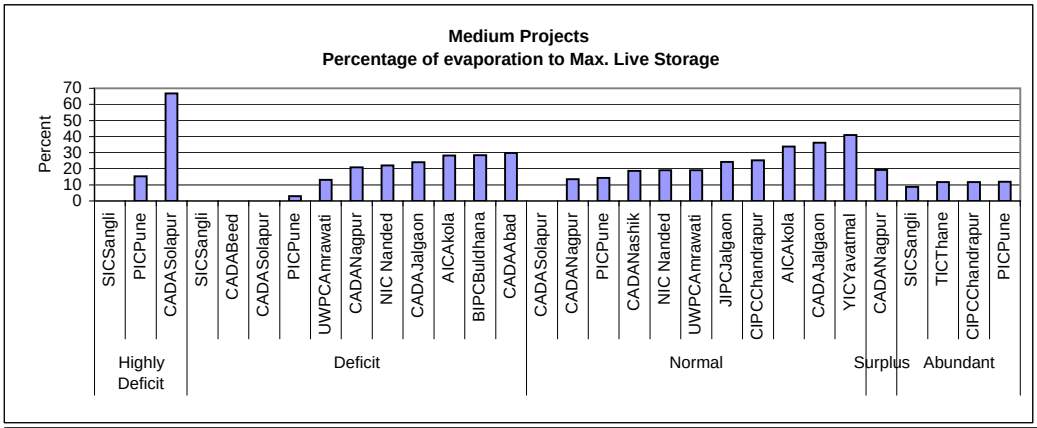


Circle	Max. Live Storage	Designed Live Storage	Percentage
CADA Beed	0.62	42.63	1
SIC Sangli	18.52	153.83	12
PIC Pune	113.29	325.37	35
CADAAbad	19.06	41.06	46
TIC Thane	93.54	200.71	47
BIPCBuldhana	43.83	71.50	61
CADANashik	101.10	158.27	64
AIC Akola	238.82	370.35	64
YICYavatmal	61.37	74.16	83
CADAJalgaon	189.20	225.39	84
CIPCChandrapur	130.76	153.49	85
CADA Nagpur	209.46	243.82	86
NIC Nagpur	37.80	41.28	92
NIC Nanded	248.63	271.49	92

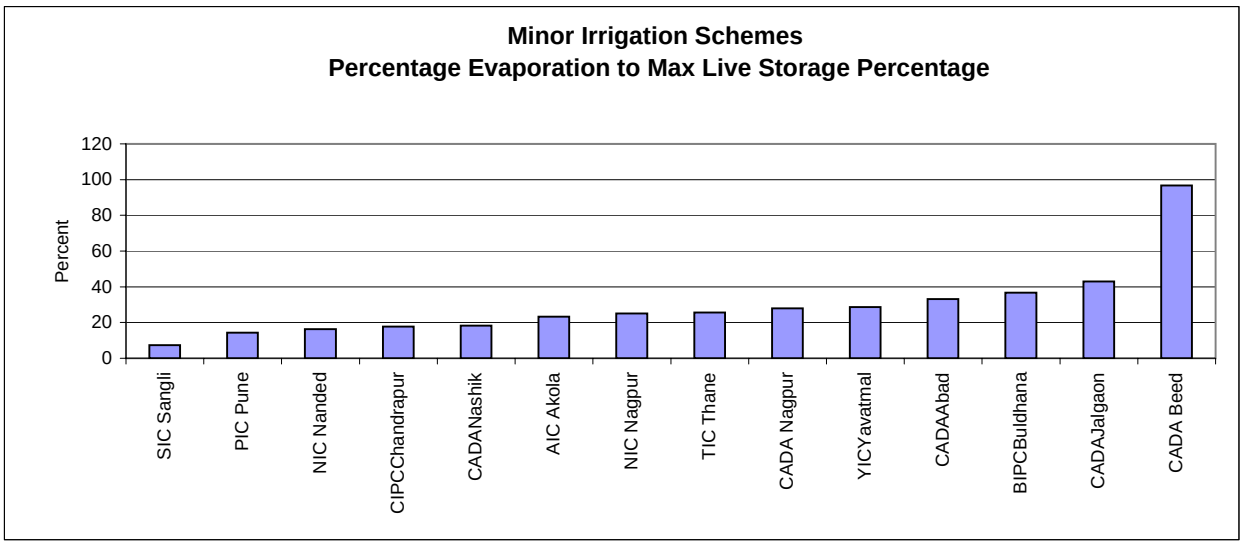
Appendix II
Major Projects
Percentage of Evaporation to Max Live Storage



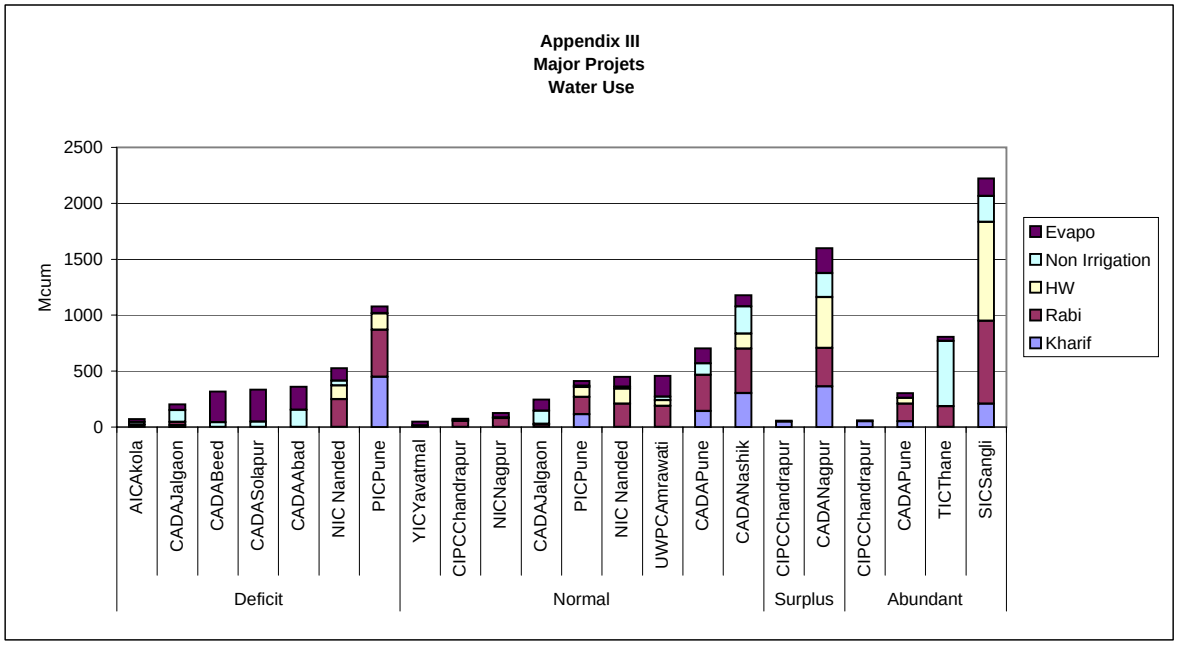
PlanGroup & Circles	Subbasins	Evaporation losses	Maximum Live Storage	Percent
Deficit				
CADABeed	Lower Godavari & Manjra	275.14	114.50	Evapo. from Dead Storage
CADASolapur	Remaining Bhima	287.74	0.00	Evapo. from Dead Storage
PICPune	Remaining Bhima	58.85	725.89	8
CADAJalgaon	Girna & Middle Tapi	52.31	294.38	18
NIC Nanded		112.59	582.62	19
AICAkola	Painganga & Purna Tapi	27.40	83.86	33
CADAAbad	Lower Godavari & Purna Dudhana	206.98	400.07	52
		458.13	**2,086.82**	**22**
Normal				
PICPune	Upper Bhima	45.40	879.28	5
CADANashik	Upper Godavari	99.34	1,524.92	7
CIPCChandrapur	Wardha	7.72	81.64	9
NIC Nanded		90.85	636.77	14
CADAPune	Upper Bhima	134.73	683.38	20
NICNagpur	Wardha	40.02	189.18	21
UWPCAmrawati	Wardha	185.87	614.80	30
CADAJalgaon	Middle Tapi	98.94	255.00	39
YICYavatmal	Painganga & Wardha	34.77	56.08	62
		737.64	**4,921.05**	**15**
Surplus				
CADANagpur	Middle Wainganga	224.00	1,806.00	12
CIPCChandrapur	Middle Wainganga	8.70	46.37	19
		232.70	**1,852.37**	**13**
Abundant				
TICThane	North Konkan & Middle Konkan	37.00	1,316.05	3
SICSangli	Upper Krishna (W)	159.21	1,923.03	8
CADAPune	Upper Krishna (W)	43.14	443.02	10
CIPCChandrapur	Lower Wainganga	6.63	55.94	12
		245.98	**3,738.04**	7
Grand Total:		**1,674.45**	**12,598.28**	**13**



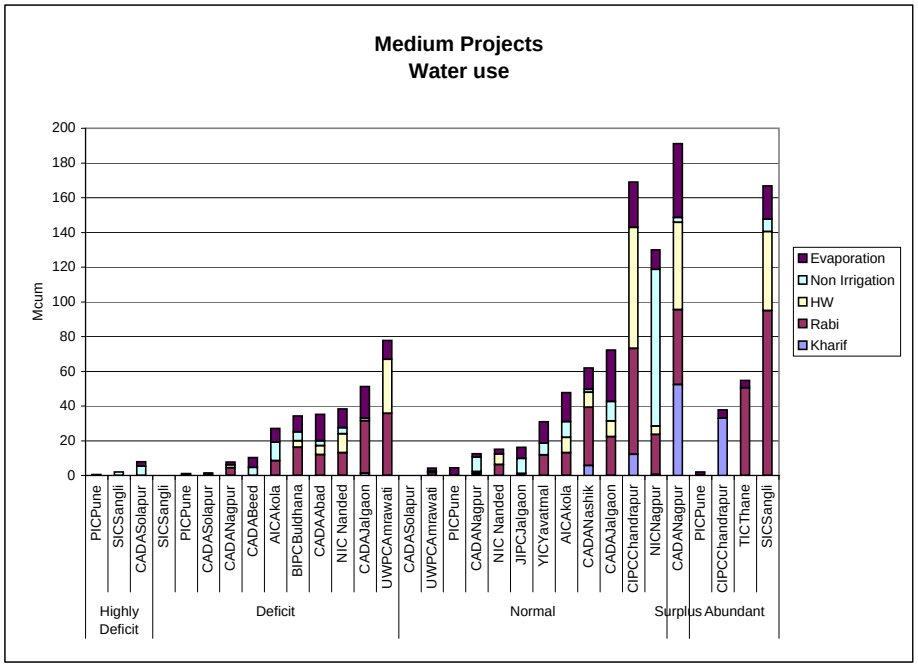
PlanGroup & Circle	Subbasin	Evaporation	Maximum Live Storage	Percent
Highly Deficit				
SICSangli	Upper Krishna (E)	0.00	0.22	0
PICPune	Sina-Bori-Benetura	0.09	0.59	15.25
CADASolapur	Sina-Bori-Benetura	2.44	3.65	66.90
		2.53	**4.46**	**56.76**
Deficit				
SICSangli	Remaining Bhima	0.00	0.00	0.00
PICPune	Remaining Bhima	0.36	12.29	2.93
UWPCAmrawati	Purna Tapi	10.77	81.96	13.14
CADANagpur	Purna Tapi	1.73	8.26	20.96
NIC Nanded		10.07	46.15	22.00
CADAJalgaon	Girna	18.25	75.60	24.14
AICAkola	Purna Tapi	7.93	28.15	28.17
BIPCBuldhana	Purna Tapi	9.19	32.29	28.46
CADAAbad	Lower Godavari & Purna Dudhana	15.22	50.96	29.87
CADABeed	Lower Godavari & Manjra	5.70	4.79	
CADASolapur	Remaining Bhima	0.68	0.40	Evapo. from Dead Storage
		79.90	**340.85**	**23.44**
Normal				
CADASolapur	Upper Bhima	0.00	0.00	0.00
CADANagpur	Wardha	1.95	14.39	13.55
PICPune	Upper Bhima	4.35	30.39	14.31
CADANashik	Upper Godavari	12.25	65.69	18.65
NIC Nanded		14.16	74.15	19.00
UWPCAmrawati	Wardha	1.88	9.88	19.03
NICNagpur	Wardha	11.27	57.80	19.49
JIPCJalgaon	Middle Tapi	6.47	26.65	24.28
CIPCChandrapur	Wardha	26.06	102.99	25.30
AICAkola	Painganga	16.76	49.53	33.84
CADAJalgaon	Middle Tapi	29.69	82.20	36.12
YICYavatmal	Painganga & Wardha	12.39	30.20	41.03
		137.23	**543.87**	**25.23**
Surplus				
CADANagpur	Middle Tapi	42.62	220.18	19.36
		42.62	**220.18**	**19.36**
Abundant				
SICSangli	Upper Krishna (W)	19.23	220.56	8.72
TICThane	North Konkan & Middle Konkan	4.22	35.94	11.74
CIPCChandrapur	Lower Wainganga	4.87	41.43	11.76
PICPune	Upper Krishna (W)	1.94	16.38	11.84
		30.26	**314.31**	**9.63**
Grand Total:		**292.54**	**1,423.44**	**20.55**



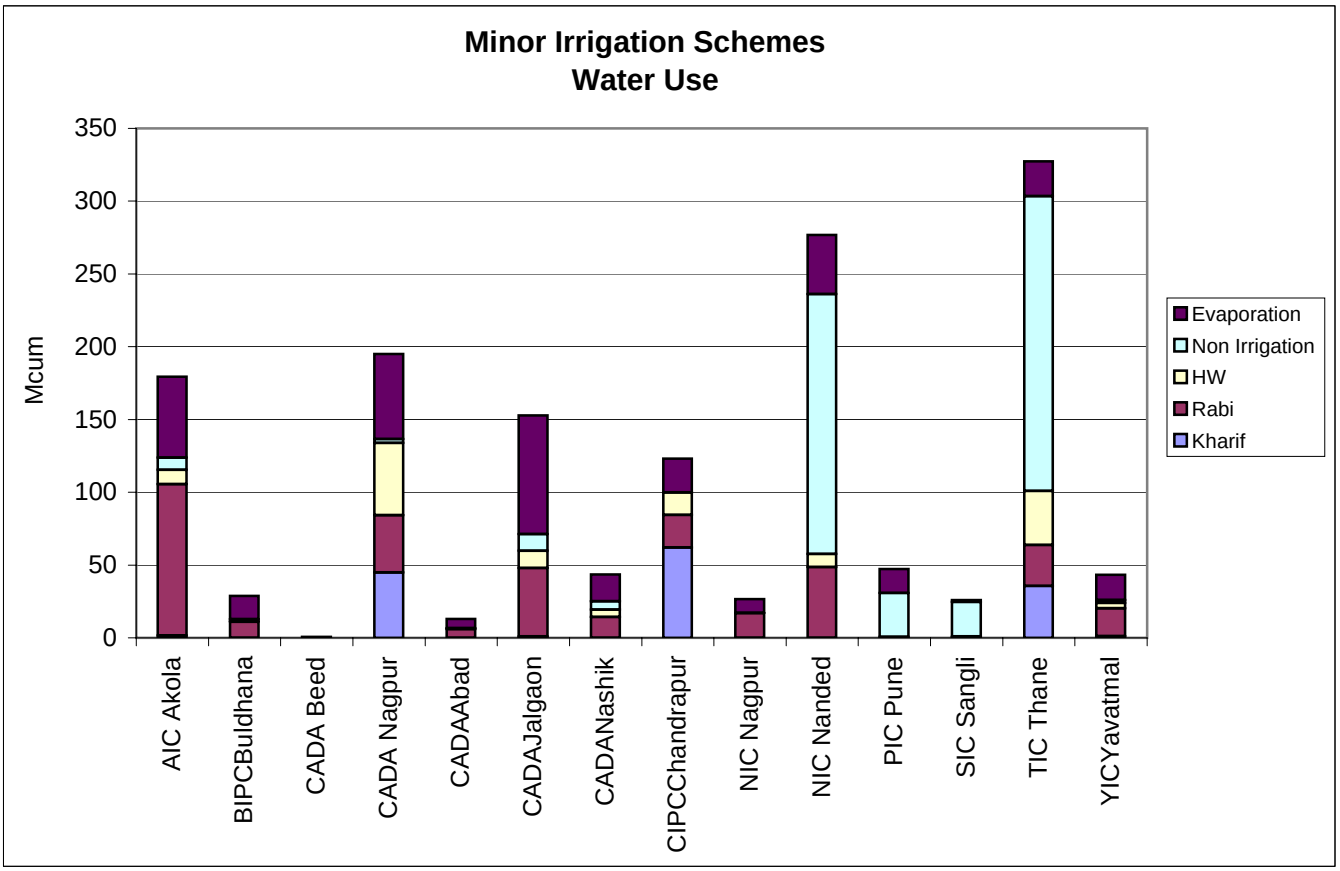
Circle	Evaporation	Max Live Storage	Percentage
SIC Sangli	1.37	18.52	7
PIC Pune	16.30	113.29	14
NIC Nanded	40.73	248.63	16
CIPCChandrapur	23.13	130.76	18
CADANashik	18.45	101.10	18
AIC Akola	55.61	238.82	23
NIC Nagpur	9.46	37.80	25
TIC Thane	24.01	93.54	26
CADA Nagpur	58.37	209.46	28
YICYavatmal	17.57	61.37	29
CADAAbad	6.30	19.06	33
BIPCBuldhana	16.11	43.83	37
CADAJalgaon	81.48	189.20	43
CADA Beed	0.60	0.62	97



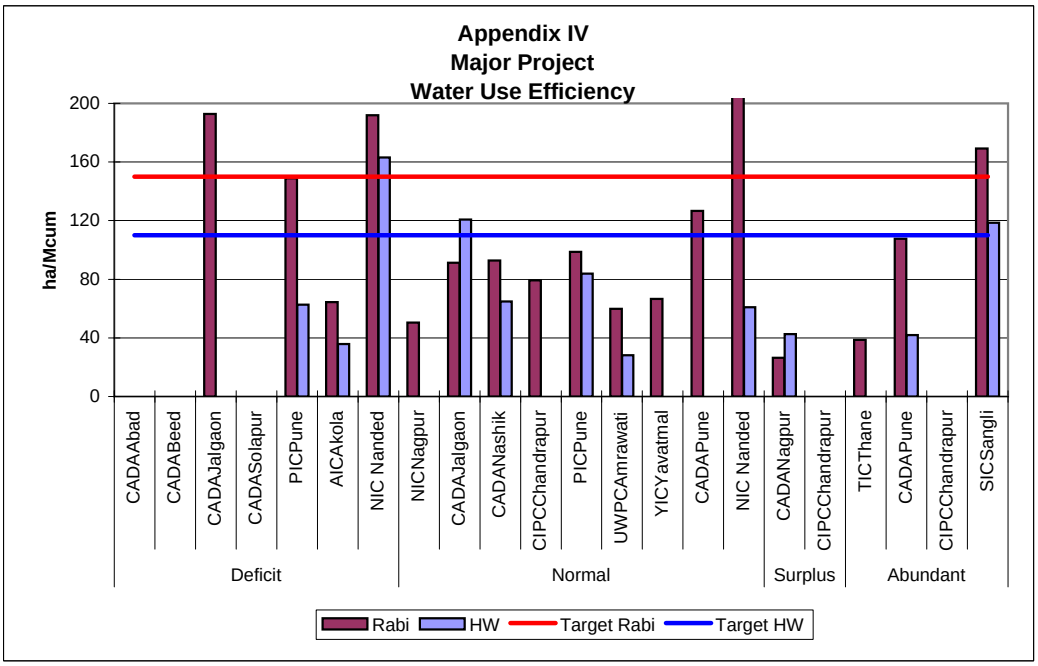
PlanGroup & Circles	Subbasins	Seasonal Use for Irrigation			Non Irrigation	Evaporation
		Kharif	Rabi	HW		
Deficit						
AICAkola	Painganga & Purna Tapi	0.00	19.14	4.65	20.81	27.40
CADAJalgaon	Girna & Middle Tapi	18.57	25.94	0.00	106.82	52.31
CADABeed	Lower Godavari & Manjra	0.00	0.00	0.00	42.07	275.14
CADASolapur	Remaining Bhima	0.00	0.00	0.00	47.95	287.74
CADAAbad	Lower Godavari & Purna Dudhana	0.00	0.00	0.00	153.96	206.98
NIC Nanded	Purna & Manjra	0.00	248.06	123.89	41.42	112.59
PICPune	Remaining Bhima	448.90	420.30	146.61	2.37	58.85
		467.47	**713.44**	**275.15**	**415.40**	**1,021.01**
Normal						
YICYavatmal	Painganga & Wardha	0.00	13.11	0.00	1.24	34.77
CIPCChandrapur	Wardha	0.00	55.59	11.47	0.00	7.72
NICNagpur	Wardha	0.00	78.84	0.00	7.80	40.02
CADAJalgaon	Middle Tapi	0.00	23.19	5.02	117.43	98.94
NIC Nanded	Lower Godavari & Painganga	0.00	21.19	133.00	16.45	90.84
PICPune	Upper Bhima	113.77	156.17	88.09	9.73	45.40
UWPCAmrawati	Wardha	0.00	188.46	52.38	30.94	185.87
CADAPune	Upper Bhima	144.19	322.78	0.00	101.60	134.73
CADANashik	Upper Godavari	304.20	397.94	134.05	243.51	99.34
		562.16	**1,257.27**	**424.01**	**528.71**	**737.63**
Surplus						
CIPCChandrapur	Middle Wainganga	49.12	0.00	0.00	0.00	8.70
CADANagpur	Middle Wainganga	363.00	343.00	455.00	214.00	224.00
		412.12	**343.00**	**455.00**	**214.00**	**232.70**
Abundant						
CIPCChandrapur	Lower Wainganga	52.34	0.00	0.00	0.00	6.63
CADAPune	Upper Krishna (W)	51.66	157.58	50.44	0.67	43.14
TICThane	North Konkan & Middle Konkan	0.00	187.25	0.00	583.00	37.00
SICSangli	Upper Krishna (W)	208.41	740.69	884.80	230.50	159.21
		312.41	**1,085.52**	**935.24**	**814.17**	**245.98**



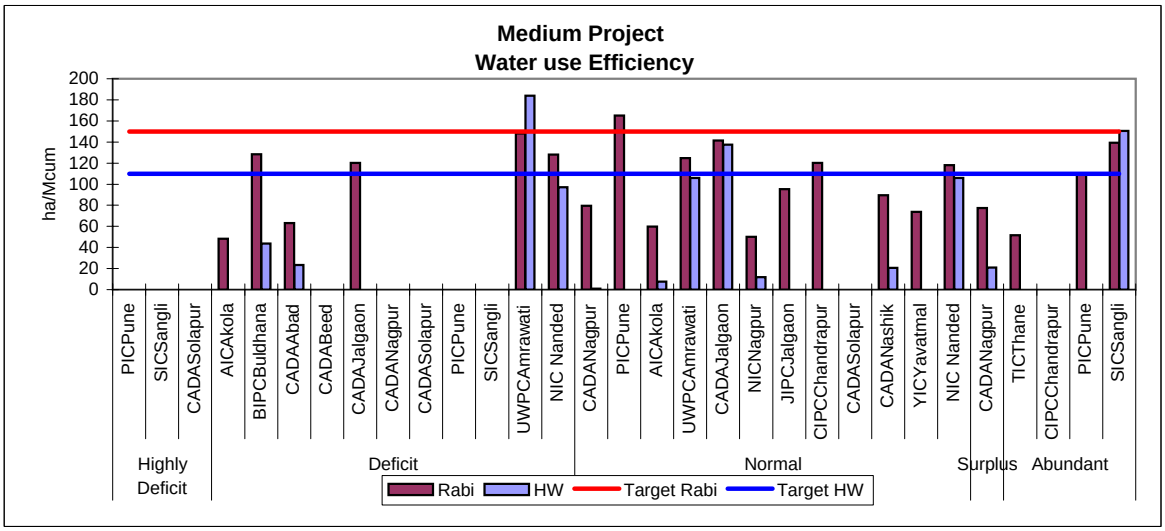
		Seasonal use for Irrigation7				
PlanGroup & Circle	**Subbasin**	**Kharif**	**Rabi**	**HW**	**Non Irrigation**	**Evaporation**
Highly Deficit						
PICPune	Sina-Bori-Benetura	0.00	0.00	0.00	0.49	0.09
SICSangli	Upper Krishna (E)	0.00	0.00	0.00	2.04	0.00
CADASolapur	Sina-Bori-Benetura	0.00	0.00	0.00	5.40	2.44
		0.00	**0.00**	**0.00**	**7.93**	**2.53**
Deficit						
SICSangli	Remaining Bhima	0.00	0.00	0.00	0.00	0.00
PICPune	Remaining Bhima	0.73	0.00	0.00	0.08	0.36
CADASolapur	Remaining Bhima	0.00	0.00	0.00	0.76	0.68
CADANagpur	Purna Tapi	0.00	4.36	1.72	0.02	1.73
CADABeed	Lower Godavari & Manjra	0.00	0.00	0.00	4.55	5.70
AICAkola	Purna Tapi	0.00	8.39	0.00	10.83	7.93
BIPCBuldhana	Purna Tapi	0.00	16.13	3.77	5.11	9.19
CADAAbad	Lower Godavari & Purna Dudhana	0.00	11.97	5.24	2.77	15.22
NIC Nanded	Manjra	0.00	13.02	10.86	3.54	10.87
CADAJalgaon	Girna	1.29	30.27	0.00	1.39	18.25
UWPCAmrawati	Purna Tapi	0.00	35.67	31.30	0.00	10.77
		2.02	**119.81**	**52.89**	**29.05**	**80.70**
Normal						
CADASolapur	Upper Bhima	0.00	0.00	0.00	0.00	0.00
UWPCAmrawati	Wardha	0.00	1.58	0.74	0.00	1.88
PICPune	Upper Bhima	0.00	0.02	0.00	0.13	4.35
CADANagpur	Wardha	0.00	1.02	1.10	8.39	1.95
NIC Nanded	painganga	0.00	6.18	6.10	0.00	2.89
JIPCJalgaon	Middle Tapi	0.00	1.02	0.00	8.80	6.47
YICYavatmal	Painganga & Wardha	0.00	11.75	0.00	6.84	12.39
AICAkola	Painganga	0.00	13.09	8.84	9.09	16.76
CADANashik	Upper Godavari	5.72	33.47	8.78	1.68	12.25
CADAJalgaon	Middle Tapi	0.00	22.38	8.93	11.25	29.69
CIPCChandrapur	Wardha	12.15	61.10	69.66	0.11	26.06
NICNagpur	Wardha	0.53	23.00	4.81	1.11	11.27
		18.40	**174.61**	**108.96**	**47.40**	**125.96**
Surplus						
CADANagpur	Middle Tapi	52.40	43.01	50.36	2.78	42.62
		52.40	**43.01**	**50.36**	**2.78**	**42.62**
Abundant						
PICPune	Upper Krishna (W)	0.00	0.16	0.00	0.00	1.94
CIPCChandrapur	Lower Wainganga	32.97	0.00	0.00	0.00	4.87
TICThane	North Konkan & Middle Konkan	0.00	50.59	0.00	0.00	4.22
SICSangli	Upper Krishna (W)	0.00	94.88	45.64	7.15	19.23
		32.97	**145.63**	**45.64**	**7.15**	**30.26**
Grand Total:		**105.78**	**483.06**	**257.83**	**86.38**	**282.07**



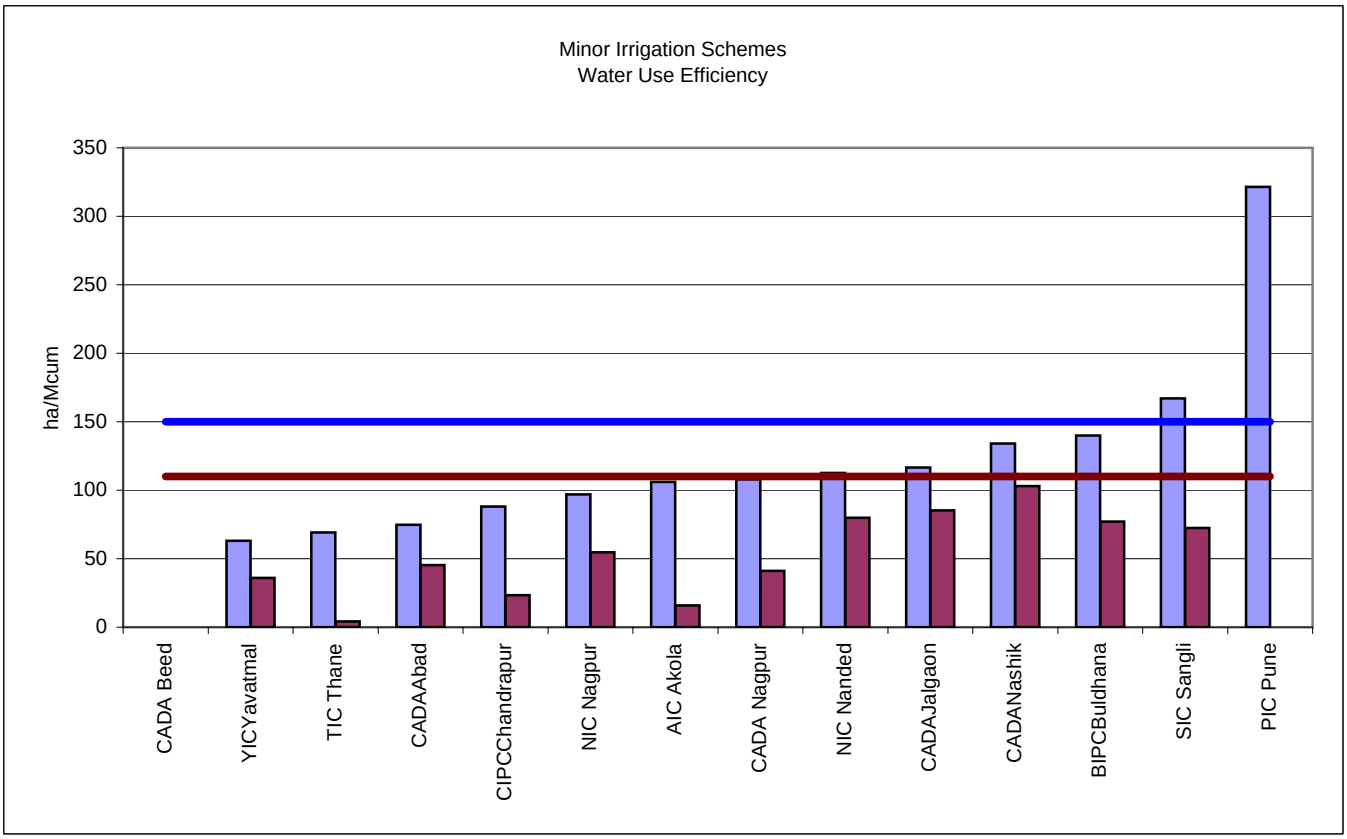
Circle	Kharif	Rabi	HW	Non Irrigation	Evaporation
AIC Akola	1.46	104.08	9.82	8.52	55.61
BIPCBuldhana	0.00	10.93	0.22	1.64	16.11
CADA Beed	0.00	0.00	0.00	0.00	0.60
CADA Nagpur	44.86	39.38	49.73	2.59	58.37
CADAAbad	0.00	6.04	0.64	0.00	6.30
CADAJalgaon	0.91	46.98	11.98	11.38	81.48
CADANashik	0.00	14.37	5.04	5.65	18.45
CIPCChandrapur	61.98	22.46	15.46	0.00	23.13
NIC Nagpur	0.00	16.87	0.33	0.00	9.46
NIC Nanded	0.06	48.50	8.94	178.54	40.73
PIC Pune	0.00	0.62	0.00	30.25	16.30
SIC Sangli	0.07	0.66	0.20	23.66	1.37
TIC Thane	35.68	28.17	36.98	202.46	24.01
YICYavatmal	1.18	19.05	3.68	1.94	17.57



PlanGroup & Circle	Subbasins	Rabi	HW	Target Rabi	Target HW
Deficit					
CADAAbad	Lower Godavari & Purna Dudhana	0.00	0.00		
CADABeed	Lower Godavari & Manjra	0.00	0.00		
CADAJalgaon	Girna & Middle Tapi	192.74	0.00		
CADASolapur	Remaining Bhima	0.00	0.00	150	110
PICPune	Remaining Bhima	148.88	62.61		
AICAkola	Painganga & Purna Tapi	64.34	35.81		
NIC Nanded	Purna & Manjra	192.00	163.00		
		85.42	**37.34**	**150**	**110**
Normal					
NICNagpur	Wardha	50.46	0.00		
CADAJalgaon	Middle Tapi	91.16	120.72		
CADANashik	Upper Godavari	92.77	64.95	150	110
CIPCChandrapur	Wardha	79.33	0.00		
PICPune	Upper Bhima	98.73	83.76		
UWPCAmrawati	Wardha	59.90	28.22		
YICYavatmal	Painganga & Wardha	66.67	0.00		
CADAPune	Upper Bhima	126.68	0.00		
NIC Nanded	Lower Godavari & Painganga	268.00	61.00		
		103.74	**39.85**	**150.00**	**110**
Surplus					
CADANagpur	Middle Wainganga	26.48	42.65	150	110
CIPCChandrapur	Middle Wainganga	0.00	0.00	150	
		13.24	**21.33**	**150**	**110**
Abundant					
TICThane	North Konkan & Middle Konkan	38.73	0.00		
CADAPune	Upper Krishna (W)	107.57	41.83		
CIPCChandrapur	Lower Wainganga	0.00	0.00	150	110
SICSangli	Upper Krishna (W)	169.12	118.59		
		78.85	**40.10**	**150**	**110**
Average		**85.16**	**37.41**	**150**	**110**



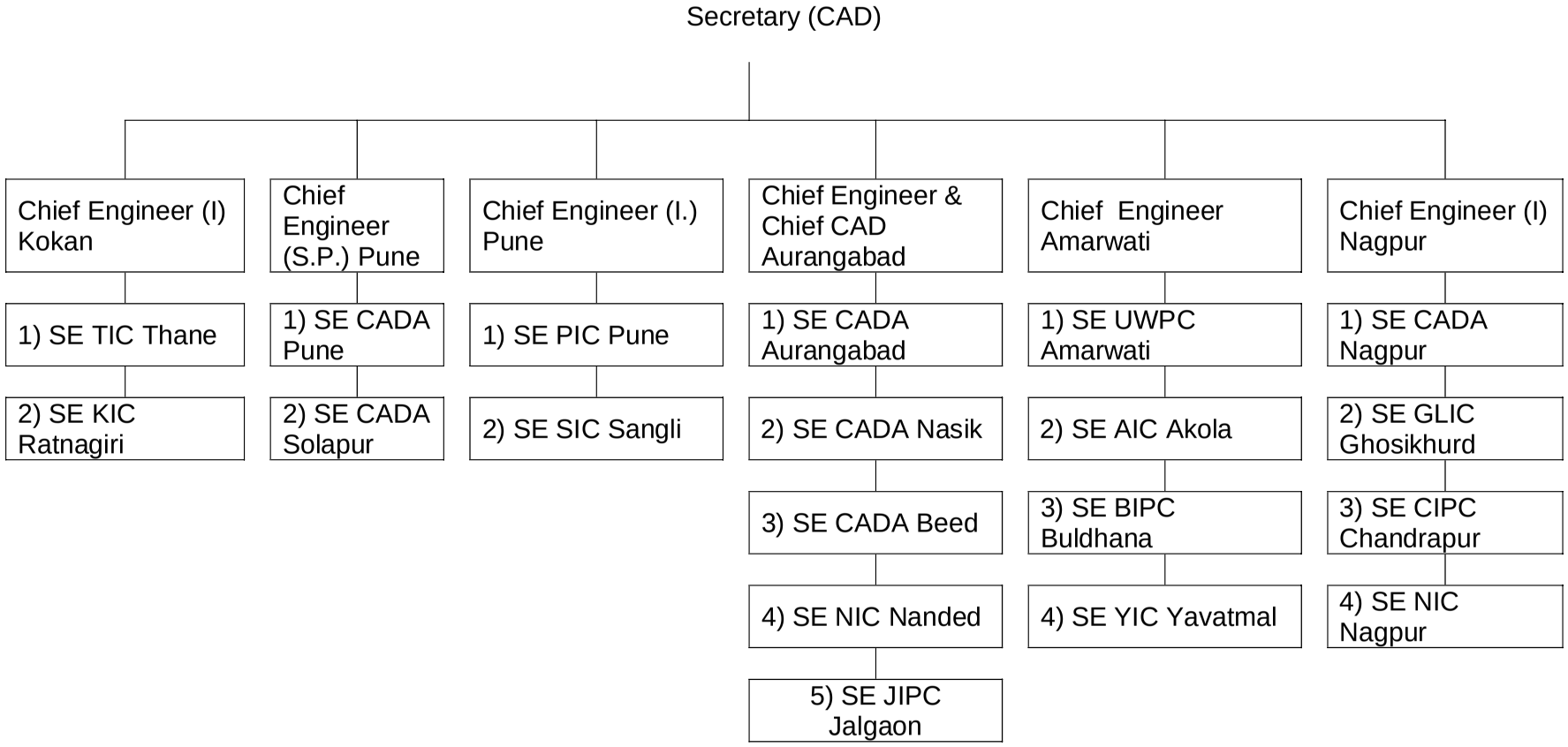
Plan Group & Circle	Subbasin	Rabi	HW	Target Rabi	Target HW
Highly Deficit					
PICPune	Sina-Bori-Benetura	0.00	0.00	150	110
SICSangli	Upper Krishna (E)	0.00	0.00	150	110
CADASolapur	Sina-Bori-Benetura	0.00	0.00	150	110
		0.00	**0.00**	**150.00**	**110.00**
Deficit					
AICAkola	Purna Tapi	48.19	0.00	150	110
BIPCBuldhana	Purna Tapi	128.48	43.81	150	110
CADAAbad	Lower Godavari & Purna Dudhana	63.10	23.41	150	110
CADABeed	Lower Godavari & Manjra	0.00	0.00	150	110
CADAJalgaon	Girna	120.26	0.00	150	110
CADANagpur	Purna Tapi	0.00	0.00	150	110
CADASolapur	Remaining Bhima	0.00	0.00	150	110
PICPune	Remaining Bhima	0.00	0.00	150	110
SICSangli	Remaining Bhima	0.00	0.00	150	110
UWPCAmrawati	Purna Tapi	148.14	183.86	150	110
NIC Nanded	Manjra	128.00	97.00	150	110
		57.83	**31.64**	**150.00**	**110.00**
Normal					
CADANagpur	Wardha	79.41	0.91	150	110
PICPune	Upper Bhima	165.00	0.00	150	110
AICAkola	Painganga	59.71	7.62	150	110
UWPCAmrawati	Wardha	124.68	105.83	150	110
CADAJalgaon	Middle Tapi	141.51	137.49	150	110
NICNagpur	Wardha	50.22	11.88	150	110
JIPCJalgaon	Middle Tapi	95.42	0.00	150	110
CIPCChandrapur	Wardha	120.30	0.00	150	110
CADASolapur	Upper Bhima	0.00	0.00	150	110
CADANashik	Upper Godavari	89.49	20.64	150	110
YICYavatmal	Painganga & Wardha	73.64	0.00	150	110
NIC Nanded	Painganga	118.00	106.00	150	110
		93.12	**32.53**	**150.00**	**110.00**
Surplus					
CADANagpur	Middle Tapi	77.51	20.92	150	110
		77.51	**20.92**	**150.00**	**110.00**
Abundant					
TICThane	North Konkan & Middle Konkan	51.49	0.00	150	110
CIPCChandrapur	Lower Wainganga	0.00	0.00	150	110
PICPune	Upper Krishna (W)	109.69	0.00	150	110
SICSangli	Upper Krishna (W)	139.27	150.41	150	110
		75.11	**37.60**	**150.00**	**110.00**
Grand Total:		**68.76**	**29.35**	**150.00**	**110.00**



Circle	Rabi	HW	Tar Rabi	Tar HW
CADA Beed	0	0	150	110
YICYavatmal	63	36	150	110
TIC Thane	69	4	150	110
CADAAbad	75	45	150	110
CIPCChandrapur	88	23	150	110
NIC Nagpur	97	55	150	110
AIC Akola	106	16	150	110
CADA Nagpur	108	41	150	110
NIC Nanded	113	80	150	110
CADAJalgaon	117	85	150	110
CADANashik	134	103	150	110
BIPCBuldhana	140	77	150	110
SIC Sangli	167	73	150	110
PIC Pune	322	0	150	110

Appendix V

Organisation Chart of Irrigation Management



Appendix VI

OVERVIEW OF MAJOR PROJECTS

									Mcum
			Live Storage		Water Use				
Subbasin	Circle	Project	Designed	Actual	Kharif	Rabi	HW	Non Irrigation	Evapo-ration
Upper Godavari	CADANashik	Bhandardara	304.10	304.10	79.00	131.47	23.34	0.00	5.68
		Darna/Gangapur	594.09	594.09	170.00	98.10	72.91	2.83	40.01
		Kadwa	52.91	52.91	24.04	26.57	1.73	0.60	10.28
		Mula	608.82	266.27	17.64	15.98	7.02	0.00	0.00
		Palkhad RBC			0.65	7.38	4.63	0.00	0.00
		Upper Godavari Project	348.45	307.55	12.87	118.44	24.42	20.31	43.37
Lower Godavari	CADAAbad	Jayakwadi PLBC	2171.00	400.07	0.00	0.00	0.00	0.00	206.98
	CADABeed	Jayawadi PRBC			0.00	0.00	0.00	0.00	206.98
		Majalgaon	312.00	114.50	0.00	0.00	0.00	0.00	48.40
	NICNanded	Vishnupuri	81.37	81.37	0.00	23.59	0.00	12.15	17.15
Purna Dudhna		Purna	890.22	471.59	0.00	192.85	104.97	0.00	96.93
Manjra	CADABeed	Lower Terna	114.00	0.00	0.00	0.00	0.00	0.00	3.53
		Manjra	173.32	0.00	0.00	0.00	0.00	0.00	16.23
	NICNanded	Manar	111.03	111.03	0.00	55.21	18.92	2.62	15.66
Penganga		Upper Pengaga	964.00	555.40	0.00	186.60	133.00	0.00	73.70
	YICYevatmal	Arunavati	169.67	37.92	0.00	13.11	0.00	15.65	22.94
Wardha	CIPCChandrapur	BOR	127.42	81.64	0.00	55.59	11.47	6.35	7.72
	NICNagpur	Lower Wunna	189.18	189.18	0.00	78.84	0.00	12.00	40.02
	UWPCAmrawati	Upper Wardha Project	614.80	614.80	0.00	188.46	52.38	89.72	185.87
Middle Wainganga	CADANagpur	Bagh	269.00	269.00	44.00	0.00	104.00	0.00	46.00
		Itiadoh	318.85	234.00	65.00	0.00	157.00	0.00	87.00
		Pench	1374.00	1303.00	254.00	343.00	194.00	179.00	91.00
	CIPCChandrapur	Asolamendha	56.38	46.37	49.12	0.00	0.00	0.00	8.70
Lower Wainganga	CIPCChandrapur	Dina	55.94	55.94	52.34	0.00	0.00	0.00	6.63
Purna-Tapi	AICAkola	Katepurna	86.35	23.48	0.00	0.00	0.00	32.65	13.16
		Nalganga	69.32	60.38	0.00	19.14	4.65	6.51	14.24
Girna	CADAJalgaon	Chankapur	76.85	76.85	18.57	8.39	0.00	0.00	9.63
		Girna+Panzan	523.55	217.53	0.00	17.55	0.00	0.00	42.68
Middle Tapi		Hatnur	255.00	255.00	0.00	23.19	5.02	90.53	98.94

			Live Storage		Water Use				
Subbasin	Circle	Project	Designed	Actual	Kharif	Rabi	HW	Non Irrigation	Evapo-ration
Upper Krishna (W)	CADAPune	Dhom	331.05	246.00	31.74	117.73	33.23	59.65	23.47
		Kanher	271.68	197.02	19.92	39.85	17.21	40.75	19.67
	SICSangli	Dudhaganga	679.11	675.03	0.00	60.54	64.86	57.00	56.00
		Kasari	77.96	76.90	0.00	19.94	39.81	0.00	3.04
		Krishna LIS	0.00	0.00	155.75	255.57	311.55	56.57	0.00
		Patgaon	79.86	79.86	0.00	20.17	19.01	2.61	14.26
		Radhanagari	219.97	219.97	0.00	159.38	169.00	24.15	31.57
		Tulshi	91.92	91.92	0.00	16.39	15.75	42.48	11.59
		Warana	779.35	779.35	0.00	119.17	149.92	0.00	42.75
		Warna LIS	0.00	0.00	52.66	89.53	114.90	29.70	0.00
Upper Bhima	CADAPune	Ghod	154.80	68.22	37.05	52.36	0.00	0.00	42.45
		Kukadi	864.39	615.16	107.14	270.42	0.00	0.00	92.28
	PICPune	Khadakwasla	712.00	646.74	103.90	145.67	84.55	203.91	29.68
		Pawana	274.00	232.54	9.87	10.50	3.54	168.32	15.72
Remaining Bhima	CADASolapur	Bhima	1517.20	0.00	0.00	0.00	0.00	150.95	287.74
	PICPune	NLBC	665.57	639.25	146.67	150.67	49.50	0.00	36.05
		NRBC	266.44	86.64	302.23	269.63	97.11	0.00	22.80
North Konkan	TICThane	Bhatsa	942.10	711.86	0.00	14.18	0.00	426.80	24.00
		Surya	286.31	176.48	0.00	57.67	0.00	0.00	13.00
Middle Konkan	TICThane	Kal	528.19	427.71	0.00	115.40	0.00	362.85	0.00

OVERVIEW OF MEDIUM PROJECTS

Mcum

Subbasin	Circle	Project	Live Storage		Water Use				
			Designed	Actual	Kharif	Rabi	HW	Non Irrigation	Evapo-ration
Upper Godavari	CADANashik	Alandi	27.46	27.46	0.00	6.88	8.78	0.00	4.95
		Bhojapur	10.21	9.54	5.72	5.82	0.00	0.00	1.36
		Ghatshil Pargaon	8.49	0.00	0.00	0.00	0.00	0.00	0.00
		Mandohol	11.30	1.09	0.00	0.00	0.00	0.00	0.31
Lower Godavari	CADAAbad	Galhati	13.84	0.00	0.00	0.00	0.00	0.00	0.00
		Masoli	27.37	27.37	0.00	4.68	5.24	0.00	4.74
Purna Dudhana		Karpara	24.90	23.59	0.00	7.29	0.00	0.00	10.48
Manjra	CADABeed	Raigavan	11.26	3.74	0.00	0.00	0.00	0.28	2.72
		Rui	8.61	0.00	0.00	0.00	0.00	1.72	0.00
		Sangameshwar	15.03	0.15	0.00	0.00	0.00	0.00	1.14
		Terna	19.66	0.91	0.00	0.00	0.00	4.81	1.34
		Wagholi	6.75	0.00	0.00	0.00	0.00	0.00	0.50
	NICNanded	Karadkhed	11.01	11.01	0.00	2.04	3.85	0.00	2.07
		Kudala	4.35	4.35	0.00	1.09	0.46	0.00	0.95
		Kundrala	10.41	10.16	0.00	2.09	2.76	0.00	1.85
		Mahalingi	4.79	4.51	0.00	1.20	0.47	0.00	1.21
		Nagzari	6.56	6.54	0.00	3.31	0.00	0.00	1.60
		Pethwadaj	9.58	9.58	0.00	3.29	3.32	0.00	2.39
Painganga	AICAkola	Dnyanganga	33.93	30.08	0.00	5.83	5.99	8.69	10.65
		Koradi	22.70	0.79	0.00	0.00	0.00	10.67	0.06
		Nirguna	28.85	18.66	0.00	7.26	2.85	0.00	6.05
	NICNanded	Dongargaon	8.36	7.97	0.00	3.22	3.35	0.00	1.40
		Loni	8.38	8.38	0.00	2.96	2.75	0.00	1.49
	YICYevatmal	Adan	67.25	17.73	0.00	4.85	0.00	11.76	8.29
Wardha	CADANagpur	Vena	21.64	14.39	0.00	1.02	1.10	11.55	1.95
	CIPCChandrapur	Amalnala	21.20	21.20	0.00	14.33	0.00	2.94	5.28
		Chandni	10.69	10.69	3.71	3.66	0.00	0.00	4.27
		Chargaon	19.87	19.87	8.44	7.92	0.00	0.00	7.63
		Dongargaon	4.44	2.96	0.00	1.87	65.00	0.00	0.47
		Labhansarad	7.35	7.35	0.00	6.52	0.00	0.00	2.28
		Panchadhara	10.39	6.20	0.00	3.38	0.29	0.00	1.44
		Pothra	34.72	34.72	0.00	23.42	4.37	0.00	4.69

Subbasin	Circle	Project	Live Storage		Water Use				
			Designed	Actual	Kharif	Rabi	HW	Non Irrigation	Evapo-ration
	NICNagpur	Kar nadi	21.06	21.06	0.00	9.32	1.85	0.00	3.13
		Dongargaon	12.44	12.44	0.53	4.72	0.00	0.00	3.06
		Jam River	24.30	24.30	0.00	8.96	2.96	0.00	5.08
	UWPCAmrawati	Chargad	9.88	9.88	0.00	1.58	0.74	0.00	1.88
	YICYevatmal	Nawargaon	12.47	12.47	0.00	6.90	0.00	2.71	4.10
Middle Wainganga	CADANagpur	Bagheda	4.54	4.04	1.51	0.00	0.00	0.00	0.78
		Beteker Bothli	3.67	3.67	1.31	0.55	0.00	0.00	1.14
		Bodalkasa	16.45	16.45	8.51	0.00	4.09	0.00	2.40
		Chandpur	28.88	16.22	8.41	0.00	0.00	0.00	1.37
		Chorkhamara	20.80	10.71	9.65	0.00	0.00	0.00	1.40
		Chulband	21.46	19.99	7.87	0.00	12.67	0.00	4.10
		Kesar nala	3.93	2.20	0.00	0.61	0.51	0.00	0.92
		Khairbanda	15.95	15.38	7.18	0.00	4.09	0.00	3.35
		Khanoli bara	20.49	18.15	0.00	6.99	7.59	0.00	3.03
		Khekranalla	23.81	19.64	0.00	3.98	3.89	0.00	5.30
		Kolar	30.32	24.45	0.00	7.25	5.46	0.00	4.60
		Makardhokda	19.93	19.05	0.00	10.51	2.29	0.00	3.10
		Managadh	7.05	7.05	1.45	0.00	3.83	0.00	1.52
		Mordham	4.95	4.95	0.00	1.98	1.24	0.00	1.18
		Pandhrabodi	13.14	13.14	1.23	4.13	0.53	2.16	3.35
		Rengepar	3.57	3.57	1.59	0.00	1.01	0.00	1.25
		Sangrampur	3.87	3.67	1.61	0.00	1.78	0.00	0.47
		Sayki	6.98	6.98	0.00	5.69	0.00	0.00	1.29
		Sorana	5.73	5.73	2.09	0.63	0.00	0.00	0.68
		Umri	5.14	5.14	0.00	0.70	1.39	0.00	1.42
Lower Wainganga	CIPCChandrapur	Ghorazari	38.00	33.25	20.07	0.00	0.00	0.00	4.23
		Naleshwar	8.18	8.18	12.90	0.00	0.00	0.00	0.64
Purna Tapi	AICAkola	Mas	22.04	7.35	0.00	1.42	0.00	8.09	1.88
		Morna	41.46	12.06	0.00	1.83	0.00	0.00	3.56
		Paldhag	7.51	7.51	0.00	5.14	0.00	0.37	1.41
		Uma	11.68	1.23	0.00	0.00	0.00	0.92	1.08
	BIPCBuldhana	Man	36.83	12.86	0.00	7.35	1.03	5.13	3.24
		Pen Takali	59.97	17.32	0.00	8.03	2.10	15.58	3.46
		Torna	7.90	2.11	0.00	0.75	0.64	0.12	2.49

Subbasin	Circle	Project	Live Storage		Water Use				
			Designed	Actual	Kharif	Rabi	HW	Non Irrigation	Evapo-ration
	CADANagpur	Chandrabhaga	8.26	8.26	0.00	4.36	1.72	0.00	1.73
	UWPCAmrawati	Wan	81.96	81.96	0.00	35.67	31.30	1.40	10.77
Girna	CADAJalgaon	Agnawati	2.76	2.76	0.00	0.58	0.00	0.68	1.87
		Haranbari	33.02	33.02	0.54	11.38	0.00	0.00	1.33
		Hivara	9.60	9.60	0.00	4.17	0.00	0.00	2.64
		Kelzar	16.20	16.20	0.75	7.65	0.00	0.00	2.07
		Manyad	40.27	11.68	0.00	5.42	0.00	0.00	8.02
		Nagya Sakya	11.24	2.34	0.00	1.07	0.00	0.00	2.32
Middle Tapi		Abhora	6.02	6.02	0.00	1.76	1.25	0.00	2.51
		Bhokarbari	6.54	6.54	0.00	1.45	0.22	0.00	2.92
		Bori	25.15	25.15	0.00	6.97	1.47	7.08	12.99
		Suki	39.85	39.85	0.00	11.62	5.99	0.00	8.20
		Tondapur	4.64	4.64	0.00	0.58	0.00	0.85	3.07
	JIPCJalgaon	Bahula	16.33	16.33	0.00	1.02	0.00	0.00	5.31
		Bhokar (Mangrul)	6.41	6.41	0.00	0.00	0.00	0.20	1.16
		Mor	7.96	3.91	0.00	0.00	0.00	0.00	0.00
Upper Krishna (W)	PICPune	Kasarsai	16.25	13.64	0.00	0.16	0.00	0.00	1.46
		Tarali	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Uttarmand	2.79	2.74	0.00	0.00	0.00	0.00	0.48
	SICSangli	Andur	5.70	5.70	0.00	0.11	0.06	0.00	0.80
		Chikotra	37.20	31.17	0.00	6.14	2.95	0.00	
		Chitri	52.36	40.66	0.00	16.28	19.47	0.00	5.18
		Jangamatti	26.15	26.15	0.00	8.44	11.86	0.00	3.88
		Kadvi	70.67	70.67	0.00	41.15	0.00	0.00	3.08
		Kumbhi	28.54	28.54	0.00	19.31	8.74	0.00	2.73
		Morna	16.54	14.35	0.00	3.10	2.18	0.00	3.10
		Vesaraf	3.32	3.32	0.00	0.35	0.38	0.00	0.46
Upper Krishna (E)		Basappawadi	6.27	0.00	0.00	0.00	0.00	0.00	0.00
		Sidhdhewadi	6.09	0.22	0.00	0.00	0.00	3.35	0.00
		Yeralwadi	19.59	0.00	0.00	0.00	0.00	2.04	0.00
Upper Bhima	CADASolapur	Hingani	31.96	0.00	0.00	0.00	0.00	1.49	0.00
	PICPune	Wadiwale	30.39	30.39	0.00	0.02	0.00	0.00	4.35
Remaining Bhima	CADASolapur	Ashti	23.01	0.00	0.00	0.00	0.00	0.00	0.68
		Budhihal	19.03	0.40	0.00	0.00	0.00	0.00	0.00

Subbasin	Circle	Project	Live Storage		Water Use				
			Designed	Actual	Kharif	Rabi	HW	Non Irrigation	Evapo-ration
	PICPune	Andhali	7.42	0.00	0.00	0.00	0.00	0.00	0.00
		Mhaswad	46.22	5.40	0.00	0.00	0.00	0.00	0.00
		Nazare	16.65	0.00	0.00	0.00	0.00	2.55	0.00
		Ner	11.79	1.83	0.00	0.00	0.00	0.00	0.08
		Ranand	6.42	3.85	0.73	0.00	0.00	0.00	0.28
		Tisangi	24.47	1.21	0.00	0.00	0.00	0.00	0.00
	SICSangli	Doddanala	6.00	0.00	0.00	0.00	0.00	0.00	0.00
		Sankh	14.86	0.00	0.00	0.00	0.00	0.00	0.00
Sina Bori Benetura	CADASolapur	Akrush	0.00	0.00	0.00	0.00	0.00	51.62	0.00
		Banganga	4.93	3.65	0.00	0.00	0.00	1.37	1.37
		Harani	11.18	0.00	0.00	0.00	0.00	0.00	0.00
		Jakapuri	32.28	0.00	0.00	0.00	0.00	6.52	0.00
		Jawalgaon	25.21	0.00	0.00	0.00	0.00	0.00	0.00
		Kada	8.56	0.00	0.00	0.00	0.00	0.18	0.00
		Kadi	5.47	0.00	0.00	0.00	0.00	0.00	0.00
		Khandala	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Khandeshwar	7.76	0.00	0.00	0.00	0.00	0.00	0.00
		Kurnur	32.28	0.00	0.00	0.00	0.00	6.52	1.07
		Mangi	30.53	0.00	0.00	0.00	0.00	0.51	0.00
		Mehekari	12.98	0.00	0.00	0.00	0.00	0.00	0.00
		Ramgamga	5.08	0.00	0.00	0.00	0.00	0.00	0.00
		Rooti	6.57	0.00	0.00	0.00	0.00	0.00	0.00
		Talwar	3.23	0.00	0.00	0.00	0.00	0.00	0.00
		Turori	6.20	0.00	0.00	0.00	0.00	0.00	0.00
	PICPune	Khairi	13.74	0.59	0.00	0.00	0.00	0.00	0.09
		Sina	52.30	0.00	0.00	0.00	0.00	0.00	0.00
North Konkan	TICThane	Rajanalla	339.14	0.00	0.00	31.28	0.00	0.00	0.00
		Wandri	35.94	35.94	0.00	19.31	0.00	0.00	4.22

Appendix VII
Proforma-I A
Water Indent

Name of Project/Canal — Section
Irrigation year — Sub division:
Season
Rotation No. & period

Type of irrigation	Area expected to be irrigated			Projected	Requirement of water for section		Remarks
	Seasonal	Perennial	Total				
	ha	ha	ha	ha/Mcum	Mcum	Day.cumecs	
1	2	3	4	5	6	7	8
A) Flow Irrigation 1. Direct Outlet 2. Minors 3. Distributories 4. Others							
Total (A)							
B) Lift Irrigation 1. Reservoir 2. Canal 3. River/Nalla 4. Well							
Total (B)							
Total (A+B)							

Notes: 1) The requirement of water shall be calculated from the projected values of ha/ Mcum (in Col. 5) or as per the directives issued by the Govt. time to time.

Sectional Officer
.....Section

Proforma-I
Water Demand

Name of Project/Canal Subdivision
Irrigation year
Season
Rotation No. and Period

Name of Section	Area expected to be irrigated			Projected Requirement of water ha/Mcum			Remarks
	Seasonal ha	Perenial ha	Total ha		for section		
					Mcum	Day.cumecs	
1	2	3	4	5	6	7	8

Note: 1) The requirement of water shall be calculated from the projected values of ha/ Mcum (in Col. 5) or as per the directives issued by the Govt. time to time.

Proforma II A

Discharges drawn at various locations of canal.

Name of Project/Canal **Section :**

Irrigation year

Season **Sub-Division :**

Rotation No. and Period **Division:**

Date	Time	Reservoir			Pickup weir		Discharge let out in Right/Left Bank canal		Discharge at various locations in cumecs				For non irrigation use	Tail /feeder tank			Discharge of Channel off-taking from tail /feeder tank
		R.L.	Contents	Discharge released	Gauge	Contents	Guage	Discharge	Gauge @ RD.	Gauge @ RD.	Gauge @ RD.	Gauge @ RD.		Discharge of Tail Canal	Depth	Contents	
		m	Mcum	cumecs	m	Mcum	m	Cumecs	Cumecs	Cumecs	Cumecs	Cumecs	Cumecs	Cumecs	m	Mcum	cumecs
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18

Note : Separate sheet for left or Right bank canal be used.

Sectional Officer

Proforma II

Daily Discharge Drawn by Various Sections

Name of Project/Canal Subdivision:

Irrigation year

Season Division :

Rotation No. and Period Discharge : Cumecs

Date	Discharge drawn at head of Sub	Discharge drawn by various sections of				Discharge				Remarks
		Sect. 1	Sect.2	Sect.3	Sect. 4	For irrigation use	For non irrigation use	Let into tail tank or escape	Total (Col. 7 to 9)	
1	2	3	4	5	6	7	8	9	10	11

Sub-Divisional Enginee
..... Sub-Division

Proforma III A
Water Used and Area Irrigated

Name of Project/Canal **Section :**
Irrigation year : **Sub Division :**
Season
Rotation No. and Period Area: ha

Type of Irrigation	Water used by Sectior		Area Irrigated				Area irrigated ha/Mcum (7/3)	Remarks
	Day cumecs	Mcum	Seasonal	Perenial	Unauthorised /Panchnama	Total		
1	2	3	4	5	6	7	8	9
A) Flow Irrigation								
1. Direct Outlet on main canal								
2. Distributaries/Branch								
3. Minors								
4. Others*								
Total (A)								
B) Lift Irrigation								
1. Reservoir/K.T.weir								
2. Canal								
3. River								
4. Well								
Total (B)								
Grand Total (A+B)								

* Includes irrigation on percolation

Section Officer
.....Section

Proforma I

Water Used and Area Irrigated

Name of Project/Canal: **Sub Division :**

Irrigation year : **Division**

Season:

Rotation No. and Period Area- ha

Name of Section	Type of Irrigation	Water used by Section		Area Irrigated				Area irrigated ha/Mcum (8/4)	Remarks
		Day cumecs	M. Cum	Seasonal	Perennial	Unauthorised /Panchanama	Total		
1	2	3	4	5	6	7	8	9	10
	A) Low Irrigation								
	1. Direct Outlet on main canal								
	2. Distributaries/Branch								
	3. Minors								
	4. Others*								
	Total (A)								
	B) Lift Irrigation								
	1. Reservoir/K.T.weir								
	2. Canal								
	3. River								
	4. Well								
	Total (B)								
	Grand Total (A+B)								

* Includes irrigation on percolation

Sub Divisional Engineer

.....Sub Division.

Proforma IX

Discharge letout through scouring sluices or escape

Nameof Project/Canal : **Section:**

Irrigation year : **Sub Division:**

Season :

Rotation No. and Period : Discharge : Day. cumecs

Item	Location of scouring sluice or escape			Remarks
	R.D.	R.D.	R.D.	
1	2	3	4	5
1) Date & time of opening				
2) Date & time of closing				
3) Duration in days				
4) Discharge in cumecs				
5) Day cumecs let out (3x4)				
6) Quantity in Mcum				
7) Total quantity let out from all sluices/escapes				
8) Total quantity used as obtained from 3A of III proforma				
9) Percentage of wastage (6*100/7)				

Section Officer

.....Section

Proforma V

Discharge letout through scouring sluices or escape

Nameof Project/Canal **Sub Division:**

Irrigation year : **Division:**

Season

Rotation No. and Period Discharge : Day. cumec

Item	Section 1	Section 2	Section 3	Section 4	Section 5	Remarks
1	2	3	4	5	6	7
1) Date & time of opening						
2) Date & time of closing						
3) Duration in days						
4) Discharge in cumecs						
5) Day cumecs let out (3x4)						
6) Quantity in Mcum						
7) Total quantity let out from all sluices/escapes						
8) Total quantity used as obtained from 3A of III proforma						
9) Percentage of wastage (6*100/7)						

Sub divisional Engineer

..... Sub division

Proforma VI

Rainfall Evaporation

Section :

Sub Division :

Unit: mm

Date	Recording Station					
	1		2		3	
1	Rainfall	Evaporation	Rainfall	Evaporation	Rainfall	Evaporation
Total						

Note: Rainfall data of nearest raingauge station or meteorological laboratory should be recorded.

Section Officer

.....Section

Proforma V

Rainfall Evaporation

Sub Division :

Section :

Unit: mm

Date	Recording Station					
	1		2		3	
1	Rainfall	Evaporation	Rainfall	Evaporation	Rainfall	Evaporation
Total						

Note: Rainfall data of nearest raingauge station or meteorological laboratory should be recorded.

Sub Divisional Engineer
..... Sub Division

Proforma 6 (e)

Annual Water Account for Major and Medium Projects

Year:-
Name of Circle:-
Name of Division -

	Project No. -----> 1
District Taluka Sub-basin No. Name of project Type of Project (Major/Medium)	
1. Designed storage a. Gross b. Live c. Designed carry over	
2. Maximum Live storage observed in the year 3. Actul live storage as on a. 1st July b. 15 th October c. 1 st March 4. Water remained unutilised by 30 th June 5. Replenishment received in June	
6. Reasons for unutilisation	
7. Projected Water Use in Mcum for…. **A. Irrigation** 1. Kharif 2. Rabi 3. Hot weather 4. Perennial **B. Non Irrigation** 1. Industries 2. Domestic **C Evaporation**	
D. Total (7a+7b+7c)	
8. Water drawn at head for irrigation in Mcum for… a. Kharif b. Rabi c. Hot weather	
d. Total (8a+8b+8c)	

9. Water lifted from reservior **A. Irrigation** **B. Non Irrigation** 1. Industries 2. Domestic	
C Total (9a+9b)	
10. Water released through escape 11.Evaporation from reservior 12. Water lost through leakages from dam a. Quantity b. Percentage	
13. Total utlisation + Losses (8d+9c+10+11+12a)	
14. Area Irrigated in ha. **A. By flow irrigation** **1. Kharif** i. Area ii. Equivalent Area iii. ha/Mcum (14a1(i) / 8a) **2.Rabi** i. Area ii. Equivalent Area iii. ha/Mcum (14a2(i) / 8b) **3. Hot Weather** i. Area ii. Equivalent Area iii. ha/Mcum (14a3(i) / 8c) **4. Total** i. Area (14a(I) +14a2(i) +14a3(i) ii. Equivalent Area (14a(ii) +14a2(ii) +14a3(ii) iii. ha/Mcum (14A4(i) / 8d)	
b. By lift Irrigation i. Area ii. Equivalent Area iii. ha/Mcum (14b(i) / 9a) 14.Area Irrigated on wells / Rivers/ Drains in influence area	
15 Remarks -	
Notes: 1) * Indicates projected utilisation by flow & lifts. 2) ** Wells on either sides of canal. 3) Equivalent Area = Area for Standard crop with 3 rotations ie Area /3 4) Area under perennial crops should be in remarks column.	

Proforma 7 (e)

Annual Water Account for Minor Irrigation Projects

Year:-
Name of Circle:-
Name of Division -

	Project No.---> 1
District Taluka Sub-basin No. Name of project Type Viz LMI, MI, KTW, LIS, ST, PT, VT etc	
1. Designed Storage in Mcum a. Gross b. Live 2. Maximum live storage observed in the year.	
3. Projected was use in Mcum for …. a. Kharif b. Rabi c. Hot weather d Non irrigation	
e.Total(3 a+3b+3c+3d)	
4. Water drawn at canal head for irrigation in Mcum for .. a. Kharif b. Rabi c. Hot weather	
d Total (4a+4b+4c)	
5. Lifts. 6. Evaporation Losses. 7. Leakages through dam	
8. Total (3e+4d+5+6+7)	
9. Actual Area Irrigated **a, Kharif** i) Area ii) Equivalent Area iii) Ha/Mcum (9a(i)/4a) **b. Rabi** i) Area ii) Equivalent Area iii) Ha/Mcum (9b(i)/4b) **c. Hot weather** i) Area ii) Equivalent Area iii) Ha/Mcum (9c(i)/4c)	

d. Total	
I) Area (9a(i)+9b(i)+9c(i) ii) Equivalent Area iii) Ha/Mcum (9d(i)/4d)	
e. Lifts. i) Area ii) Equivalent Area iii) Ha/Mcum (9e(i)/5)	
10. Non irrigation use 11. Water remained unutilised on 30 th June 12. Area Irrigated on wells/rivers/drains in influence area.	
13. Remarks.	
Notes: 1) Area = Area for standard crop with 3 rotations 2) Area under perennial crops should be mentioned in remarks column,.	